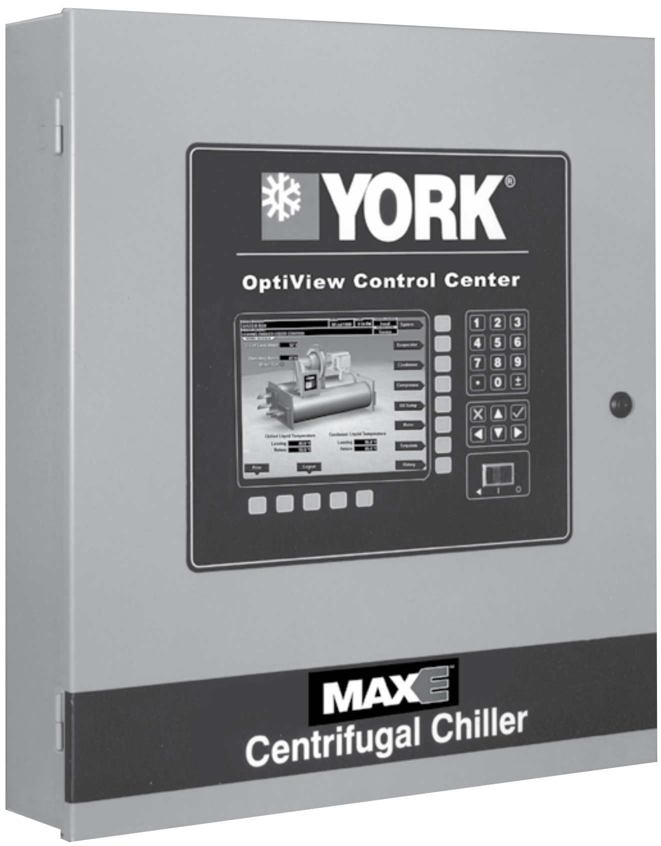
YORK	CENTRIFUGAL LIQUID CHILLERS WITH OPTIVIEW CONTROL CENTER	
SERVICE INSTRUCTIONS	Supersedes: 160.54-M1 (319)	Form 160.54-M1 (1019)

4/6/2020

OPTIVIEW CONTROL CENTER
MODEL YK (THROUGH STYLE G)



Issue Date:
October 25, 2019

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

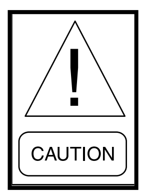
This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

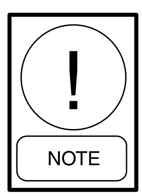
The following symbols are used in this document to alert the reader to specific situations:

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.



Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions and are not followed.

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



Highlights additional information useful to the technician in completing the work being performed properly.

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office or accessing the Johnson Controls QuickLIT website at http://cgproducts.johnsoncontrols.com.

It is the responsibility of rigging, lifting, and operating/service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

CHANGE BARS

Revisions made to this document are indicated with a line along the left or right hand column in the area the revision was made. These revisions are to technical information and any other changes in spelling, grammar or formatting are not included.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
Solid State Starter (Mod A) – Operation and Maintenance	160.46-OM3.1
Variable Speed Drive – Operation	160.00-O1
Variable Speed Drive – Service Instructions	160.00-M1
Solid State Starter (Mod B) – Operation and Maintenance	160.00-O2
Service - OptiSpeed Liquid Cooled Variable Speed Drive for Centrifugal Chillers	160.00-M4
Medium Voltage Solid State Starter – Service	160.00-M5
Medium Voltage Variable Speed Drive – Service	160.00-M6
Variable Speed Oil Pump Drive	160.52-M2
YK Style E MaxE Centrifugal Liquid Chillers Installation Instructions	160.54-N1
Operations Manual - OptiView Control Center, Model YK (through Style G), for EMS, SSS, and VSD	160.54-O1
Wiring Diagram – Unit (Style E) With Electromechanical Starter	160.54-PW1
Wiring Diagram – Unit (Style E) With Mod A Solid State Starter	160.54-PW2
Wiring Diagram – Unit (Style E) With Mod B Solid State Starter	160.54-PW2.1
Wiring Diagram – Unit (Style E) With Variable Speed Drive	160.54-PW3
Wiring Diagram – Unit (Style E) (P Compressors) With Electromechanical Starter	160.54-PW8
Wiring Diagram – Unit (Style E) (P Compressors) With Mod B Solid State Starter	160.54-PW9
Wiring Diagram – Unit (Style E) (P Compressors) Variable Speed Drive	160.54-PW10
Wiring Diagram – Field Control Modifications for YK Chiller (Style G)	160.75-PW4
Wiring Diagram – YK Chiller (Style G) OptiView Control Center with Remote Low or Medium Voltage EMS	160.75-PW5
Wiring Diagram – YK Chiller (Style G) OptiView Control Center with Unit Mounted Low or Medium Voltage SSS, Unit Mounted Low Voltage with Modbus, or Remote Medium Voltage VSD	160.75-PW6
Renewal Parts - OptiView Control Center, Model YK (through Style G)	160.54-RP1
Service Information - OptiView Panel Software Enhancement - OptiSave VSD Software Feature	SI0068

NOMENCLATURE

YK KC K4 H9 – CY G

- YK – MODEL*
- KC – EVAPORATOR CODE*
- K4 – CONDENSER CODE*
- H9 – COMPRESSOR CODE*
- – – POWER SUPPLY
  – for 60Hz
  5 for 50Hz
- CY – MOTOR CODE
- G – STYLE (Design Level)

* Refer to *YK Engineering Guide (Form 160.75-EG1)* for Shell/Motor/Compressor combinations.

TABLE 1 - CONTROL PANEL APPLICATIONS

PART NUMBER	DESCRIPTION
371-02264-101	Electromechanical Starter – NEMA 1
371-02486-101	Electromechanical Starter – CE
371-02448-101	Electromechanical Starter – NEMA 4/12
371-02264-102	Solid State Starter – NEMA 1
371-02486-102	Solid State Starter – CE
371-02448-102	Solid State Starter – NEMA 4/12
371-02264-103	Variable Speed Drive – NEMA 1
371-02486-103	Variable Speed Drive – CE
371-02448-103	Variable Speed Drive – NEMA 4/12
371-02778-101	Electromechanical Starter – NEMA 1 (P Compressors until 8/02)
371-02780-101	Electromechanical Starter – CE (P Compressors until 8/02)
371-02779-101	Electromechanical Starter – NEMA 4/12 (P Compressors until 8/02)
371-02778-102	MOD B Solid State Starter – NEMA 1 (P Compressors until 8/02)
371-02780-102	MOD B Solid State Starter – CE (P Compressors until 8/02)
371-02779-102	MOD B Solid State Starter – NEMA 4/12 (P Compressors until 8/02)
371-02778-103	Variable Speed Drive – NEMA 1-4 (P Compressors until 8/02)
371-02780-103	Variable Speed Drive – CE (P Compressors until 8/02)
371-02779-103	Variable Speed Drive – NEMA 4/12 (P Compressors until 8/02)
371-04118-101	Electromechanical Starter – NEMA 1 (Style F Chillers)
371-04118-102	Style B Solid State Starter – NEMA 1 (Style F Chillers)
371-04118-103	Variable Speed Drive – NEMA 1 (Style F Chillers)
371-04118-110 **-111** **-112**	Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications – no VGD – NEMA 1 Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications and VGD, no J7 compressor – NEMA 1 Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications and VGD, J7 compressor – NEMA 1
371-04119-101	Electromechanical Starter – NEMA 4/12 (Style F Chillers)
371-04119-102	Mod B Solid State Starter – NEMA 4/12 (Style F Chillers)
371-04119-103	Variable Speed Drive – NEMA 4/12 (Style F Chillers)
371-04119-110 **-111** **-112**	Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications – no VGD – NEMA 4-12 Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications and VGD, no J7 compressor – NEMA 4-12 Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications and VGD, J7 compressor – NEMA 4-12
371-04120-101	Electromechanical Starter – CE (Style F Chillers)
371-04120-102	Mod B Solid State Starter – CE (Style F Chillers)
371-04120-103	Variable Speed Drive – CE (Style F Chillers)
371-04120-110 **-111** **-112**	Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications – no VGD – CE Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications and VGD, no J7 compressor – CE Mod B Solid State Starter or Variable Speed Drive w/Modbus Communications and VGD, J7 compressor – NEMA 1

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SECTION 1 - INTRODUCTION

This document explains the operation of the printed circuit boards and major components of the OptiView™ Control Center to a level that allows a service technician to troubleshoot and locate the source of a problem.

The overall system architecture is described and illustrated with block diagrams, which describes the general function of each component and provides the system interface and signal flow, which must be understood before effective troubleshooting can begin.

The operation of each printed circuit board is described and illustrated with a block diagram that is a simplified representation of board circuitry. The expected voltage level at all inputs and outputs of each board for any operating condition is provided.

Included in this document are procedures that have to be performed at chiller commissioning or during service. They should not be performed by anyone other than a service technician. For example, calibration procedures have to be performed or verified at system commissioning or when a component is replaced. Certain safety shutdowns require special reset procedures to be performed before the chiller can be restarted. Since the operating program supplied in each OptiView Control Center is universal to all applications, special setpoints, program jumpers and program switches are required to configure the chiller for local operating conditions.

A system commissioning checklist is provided as a reference of items to be performed during chiller commissioning.

Chillers that are equipped with *P* compressors have certain component variances, which are noted in the appropriate sections of this manual.

In addition to this document, several supporting documents are required to service the system. *OptiView Control Panel – Operation (Form 160.54-O1)* explains the operation of the OptiView Control Center keypad, how to enter setpoints and explains all the messages displayed on the OptiView Control Center display. The appropriate diagrams for each chiller are shown in the associated literature table in the front of this manual. These wiring diagrams provide component interconnections within the OptiView Control Center and the connections between these components and the motor starter and chiller components.

When the chiller shuts down on a **SAFETY** or **CYCLING** shutdown or is being prevented from starting, a message is displayed providing the reason for the shutdown. This message, along with all the chiller operating conditions at the instant of the event are stored in the microboard battery-backed memory. This history data can be displayed or printed using an optional printer. The *OptiView Control Panel – Operation (Form 160.54-O1)* provides a detailed description of this message, including the conditions required to produce the message and conditions required to restart the chiller.

Diagnostic Routines allow service analysis of the following functions:

- Display
- Analog Inputs
- Digital inputs
- Digital Outputs
- Serial Data Ports

Before beginning any troubleshooting, observe the shutdown message and retrieve the **HISTORY** data of that event. Refer to the *OptiView Control Panel – Operation (Form 160.54-O1)* for an explanation of the message. The conditions required to produce the message must be clearly understood before proceeding. (If this is not needed, much time will be wasted). Armed with knowledge of the overall system architecture and the function of each printed circuit board and signal flow provided by this manual, proceed with the appropriate wiring diagram listed above to trace the problem through the system. Use the Diagnostic Routines where appropriate.

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SECTION 2 - SYSTEM ARCHITECTURE

The OptiView Control Center performs the following functions:

- Controls chiller capacity to chill liquid to the Chilled Liquid Temperature setpoint.
- Controls chiller solenoid valves, relays, actuators and motor contactors per the operating program.
- Displays chiller operating conditions, alarms, shutdown messages and history data.
- Accepts operator-programmed setpoints and controls the chiller accordingly.
- Allows manual control of chiller motor contactors and actuators.
- Monitors chiller operating conditions and shuts down chiller when Safety or Cycling thresholds are exceeded.
- Allows local manual start/stop and accepts start/stop commands from remote devices, via contact closures or serial communications.
- Allows setpoints to be changed from a remote location via 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA, 4 to 20mA, contact closures or serial communications.
- Provides chiller operating data and status to remote devices via serial communications and contact closures.
- Allows real-time data and history data to be printed on an optional printer.
- Controls the compressor motor starter and contains a printed circuit board logic that supports Electromechanical Starters, Solid State Starters and YORK Variable Speed Drives.

The OptiView Control Center is a microprocessor based control system that receives analog, digital and serial data inputs and controls analog, digital and serial data outputs per instructions in the operating program. A panel mounted display and touch-sensitive keypad permit local operation.

System pressures are sensed by pressure transducers. The output of each transducer is a DC voltage that is analogous to the pressure input. System temperatures are sensed by thermistors. The output of each thermistor is a DC voltage that is analogous to the temperature it is sensing. Typical output voltage range of both is 0.5 to 4.5 VDC. These are Analog Inputs to the OptiView Control Center.

Digital inputs are ON/OFF inputs to the OptiView Control Center in the form of switch and relay contacts. These inputs are 115 VAC when the contacts are closed and 0 VAC when open. These include flow switches, local start/stop switch, remote cycling and high pressure safety device, etc.

Digital Outputs are ON/OFF outputs from the OptiView Control Center in the form of relay contacts and triacs. The relay contacts typically switch 115 VAC and the triacs typically switch a nominal 30 VAC. Relay outputs include status/alarm, chiller solenoid valves, oil heater, oil pump starter and chilled and condenser water pump starters, etc. Triac outputs include pre-rotation vane control and variable orifice control.

Serial Data is transmitted to and received from devices in RS-232, RS-485 and TX/RX (opto-couple) form.

The OptiView Control Center supports three types of starters; Electromechanical Starter, Solid State Starter and Variable Speed Drive. However, all OptiView Control Centers contain the following standard components, regardless of the starter type applied:

- Microboard
- I/O (input/output) Board
- Keypad
- Display
- Power Supply

In addition to the standard components, the OptiView Control Center contains a printed circuit board that provides certain control and interface functions for the starter type applied. Each starter type requires a different board as follows:

- Electromechanical Starter – CM-2 Current Module.
- Solid State Starter (Style A) – Logic Board Solid State Starter (Style B) – None.
- Variable Speed Drive - Adaptive Capacity Control Board (except those VSDs that communicate with the microboard using Modbus protocol).
- *Figure 1 on page 22 through 4* are OptiView Control Center block diagrams of the three starter types. On each block diagram, the standard components are shown, along with the printed circuit board that supports the applied starter type. *Figure 8 on page 29 and Figure 9 on page 30* are Operation Sequence timing diagrams of the different starter applications.

The microprocessor and all supporting logic circuits, along with the memory devices containing the operating program, reside on the microboard. All chiller operating decisions are made here. It receives analog and digital inputs from the chiller and remote devices. The analog inputs are connected directly to the microboard. The Digital inputs are received via the I/O Board (see description below). Under Program control, the microboard operates the relays and triacs that are located on the I/O Board.

The control center will be equipped with one of the following Microboards:

- 031-01730-000 – Shipped in new production chillers until January 2004. The program resides in a replaceable Flash memory card. The software version is C.MLM.01.xx.yzz. It is printed on a label adhered to the card. The Program can be upgraded by replacing the card.
- 031-02430-000 – Shipped in new production chillers from January 2004 to June 2006. The program resides in non-removable onboard memory. The software version is C.OPT.01.xx.yzz, and is viewable on the DIAGNOSTICS Screen in SERVICE access level. The Program can be upgraded by downloading a new program from a Program card. Program cards are shirt-pocket-size portable memory storage devices. This board is backward compatible to YK chillers presently using the 031-01730-000 Microboard.
- 031-02430-001 – Shipped in new production chillers after June 2006. This is an upgraded version of the 031-02430-000 Microboard. The upgrade is necessary to operate with the Medium Voltage Solid State Starter, Medium Voltage Variable Speed Drive and those Variable Speed Drives and Style B Solid State Starters that serially communicate with the microboard using Modbus Protocol.
- 031-03630-001 – Shipped in new production chillers after June 2015. This new design microboard has additional features that will be enabled in future software revisions. It is a service replacement for all previous OptiView microboards.

Since the newer versions microboard are backward compatible to earlier vintage OptiView Control Centers, earlier chillers could be equipped with a later version microboard due to service replacement.

The software versions (C.MLM.01.xx.yzz, C.OPT.01.xx.yzz) or Y.OPT.01.xx.yzz are alphanumeric codes that are interpreted as follows. Each time the controls section or language section is revised, the respective revision level increments.

- Y or C – Commercial chiller
- MLM – Used on Microboard 031-01730-000
- OPT – Used on Microboard 031-02430-000/-001
- 01 – YK chiller
- xx – controls revision level (00, 01, etc)
- y – language package (0=English only, 1=NEMA, 2=CE, 3=NEMA/CE)
- zz – language package revision level (00, 01, etc)

Throughout this manual, reference is made to functions and features that are only available in certain flash memory card revision levels (C.MLM.01.xx.xxx). To cross reference C.MLM software to C.OPT software, refer to the controls revision level. Software version C.OPT.01.09.xxx is of the same controls revision level as C.MLM.01.09.xxx. From this starting point, both receive the same updates at each revision. However, beginning with the release of version C.OPT.01.15.011, C.MLM software will no longer be revised to include new features. Software upgrades should only be performed by a Service technician.

The **I/O Board** acts as an input/output device for the microboard. It conditions the digital input signals for the microboard and contains relays and triacs that are controlled by the microboard to control solenoids, motor contactors and actuators. The 115 VAC digital inputs from switch and relay contacts are converted to logic level voltages by optocouplers. The relays have +12 VDC coils that are energized and de-energized by the microboard. The contacts of these relays control the 115 VAC system solenoids, relays and motor contactors. The triacs are turned ON and OFF by the microboard. The outputs of these triacs control actuators.

Chillers equipped with the Variable Geometry Diffuser (VGD) are supplied with and require I/O Board 031-01743-002. This board is populated with the required Triacs Q3 and Q4 that apply the open and close signals to the Variable Geometry Diffuser ring actuator. See *SECTION 26 - VARIABLE GEOMETRY DIFFUSER.*

A front panel-mounted keypad allows operator and service technician user interface. Membrane keys are used to display chiller and system parameters, enter setpoints and perform chiller and OptiView Control Center diagnostics. It also contains a START-RUN-STOP/RESET switch that is used to locally start and stop the chiller and perform manual reset functions.

A front panel mounted liquid crystal display allows graphic animated display of the chiller, chiller subsystems and system parameters. The chiller and working components of the chiller are displayed, along with chiller operating pressures and temperatures. The keypad is used to select displays showing increasing levels of detail of chiller working components.

A self-contained power supply supplies the necessary DC voltages for all the components within the OptiView Control Center.

Chillers equipped with *P* compressors and Style F and later chillers have a different Condenser High Pressure Safety Cutout Switch (HPCO) than supplied on other applications. This switch is mounted on the condenser shell but has a different wiring interface to the I/O Board and Motor Controller circuit. For more information see *SECTION 6 - I/O BOARD* of this manual.

Also, P compressor applications and Style F and later chillers with G, Q and H5-8 compressors are equipped with a High Speed Thrust Bearing Limit Switch instead of the proximity probe supplied on other compressors. This device detects abnormal bearing position through probe contact instead of distance measurement as performed with the Proximity probe.

Style C (and earlier) chillers are equipped with fixed speed oil pumps. Style D (and later) chillers are equipped with variable speed oil pumps.

Style F (and later) chillers require flash memory card version C.MLM.01.07.xxx and later and are supplied with factory-mounted flow sensors on the evaporator and condenser. These are electronic thermal-type sensors.

The operating principle of the sensor is thermal conductivity. It uses the cooling effect of a flowing liquid to sense flow. The temperature of the heated sensor tip is sensed by a thermistor located in the tip. A second thermistor, located higher in the tip in a non-heated area, is only affected by changes in liquid temperature. The temperatures sensed by the thermistors are compared. Flowing liquid carries heat away from the heated sensor tip, lowering its temperature. The lower temperature differential between the two thermistors indicates the liquid is flowing. A higher differential indicates no flow.

These sensors are interfaced to microboard analog inputs. See the *SECTION 3 - MICROBOARD 031-01730-000* for a detailed explanation of this flow sensor and interface.

If equipped with flash memory card version C.MLM.01.07.xxx (and later), the chiller style/compressor combination must be entered using the Chiller Style/Compressor setpoint (See *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001*). Once the applicable chiller style/compressor combination is entered, the program automatically bundles the functionality and chiller control per the entered chiller style/compressor requirements. The various chiller style/compressor combinations are equipped differently and have different control requirements. The variables include:

- High Speed Thrust Bearing proximity sensing – Proximity probe or Limit Switch.
- Flow Sensor – Paddle type or factory mounted Thermal type. The paddle type applies 115 VAC to the I/O Board Digital inputs TB4-12 (evaporator) and TB4-11 (condenser) (See *Figure 34 on page 102*). The factory mounted thermal type available with Style F (and later) chillers, applies +5 VDC to the microboard Analog Inputs at J7-14 (evaporator) and J7-16 (condenser). For more information, see *Figure 15 on page 47*.

  Flash memory card version C.MLM.01.07.xxx and C.MLM.01.07A.xxx automatically selects the flow sensor input, either digital or analog per the chiller style/compressor setpoint selection.

Flash memory card version C.MLM.01.08.xxx and later allows use of either the Thermal-type or the Paddle-type flow sensors on Style "F" and later chillers. With these versions, the actual flow sensor type present must be entered using the Flow Switch Setpoint. For more information, see *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001*.

- Oil Heater Outputs – Either TB1-34 or TB1-64 on I/O Board.
- Refrigerant Level Control Default Period – Either 3.5 seconds or 10.0 seconds.
- "Oil – Variable Speed Pump-Pressure setpoint Not Achieved" safety shutdown threshold – Either 25 psid or 35 psid.
- Standard Coastdown Time (software version C.OPT.01.16.xxx (and later)) – defaults to either 150 seconds or 240 seconds.

When the compressor motor is driven by an Electromechanical Starter, the OptiView Control Center is equipped with a CM-2 current module. This printed circuit board provides current overload and power fault protection for the compressor motor. Current transformers, located in the compressor motor terminal box, along with rectifying and calibration circuitry, provide an analog voltage representing compressor motor current to the CM-2 module. This signal is further conditioned and provided to the microboard.

When the compressor motor is driven by a YORK solid state starter, one of three different starters could be applied. Later production chillers are equipped with either the Style B liquid cooled solid state starter (LCSSS) or the medium voltage solid state starter (MVSSS).

The Style B LCSSS (*Figure 3 on page 24*) contains a combination logic/trigger board in the starter cabinet that has a serial communications interface to the microboard. Early Style B LCSSS use an Opto-coupled interface with YORK proprietary protocol. Later Style B LCSSS (after mid 2008) use Modbus protocol (requires software version C.OPT.01.18.307 or later).

The medium voltage solid state starter (*Figure 4 on page 25*) serially communicates with the microboard using RS-485 Modbus Protocol. Earlier vintage chillers are equipped with the Style A Solid State Starter. This starter contains a trigger board that interfaces to a logic board that is installed inside the OptiView Control Center. The Logic board interfaces the microboard via a multiplexed data interface.

When the compressor motor is driven by a YORK Variable Speed Drive, there could be a Variable Speed Drive (VSD) or a Medium Voltage Variable Speed Drive (MV VSD) applied.

Early vintage VSDs (*Figure 5 on page 26*) contain an adaptive dapacity control (ACC) board that resides in the OptiView cabinet that interfaces the microboard using YORK proprietary protocol serial opto-coupled communications. The ACC board monitors system parameters and controls the VSD to drive the compressor at the slowest speed without surging, while maintaining required chiller capacity.

With the later vintage VSD (*Figure 6 on page 27*), the ACC functionality resides in the microboard, the ACC Board is not present and the VSD logic board directly interfaces the microboard using RS-485 Modbus protocol serial communications.

The MV VSD (*Figure 7 on page 28*) is also interfaced to the microboard with RS-485 Modbus serial communications. All Modbus protocol applications require software version C.OPT.01.16.xxx (or later).

Serial data interface to the Building Automation System (BAS) is through the optional E-Link Gateway. This printed circuit board monitors the required data from the microboard and makes it available for the BAS network. When BAS or ISN communications is selected as the control source, the microboard will follow the E-Link Gateway commands as well.

Certain compressors are equipped with a VGD, which is used to reduce rotating stall conditions and associated stall noise.

Stall may occur at low load conditions with high head. A mechanical ring, located in the compressor diffuser passage is operated to open or close the diffuser gap.

Stall noise is detected as gas pressure pulsations. A stall pressure transducer, mounted in the discharge scroll of the compressor, detects the gas pressure pulsations and outputs DC voltage pulsations to the **s**tall detector board, which converts the voltage pulsations into an analog voltage that represents the magnitude of the stall noise. This analog voltage is input to the microboard where it is compared to thresholds that determine if the stall noise is acceptable or unacceptable.

The VGD is pulsed toward the closed position in response to unacceptable stall noise. Otherwise, it is modulated to maintain the most open position possible without stall occurring. Software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later) and I/O board 031-01743-002 is required for this feature. A pre-rotation vanes position potentiometer is also required to support this feature.

If the chiller is provided with a compressor motor VSD or the optional hot gas bypass, the PRV potentiometer for those features is used. Otherwise, a PRV potentiometer is provided interfaced to the microboard.

After July 2009, chillers that are equipped for the hot gas bypass, heat recovery or head pressure control options are equipped with a Large Tonnage Chiller (LTC) I/O board. This board provides for analog and digital inputs and outputs for these features and it communicates with microboard (P/N 031-02430-00/001 COM3 RS-485 serial port using Modbus protocol.

After February 2010, chillers can be equipped with an optional motor monitoring feature. Motor winding temperature sensors and bearing temperature and vibration sensors are interfaced to the motor monitoring board (located in a separate box). The motor monitoring board communicates the winding and bearing temperatures and bearing vibration values to microboard (P/N 031-02430-000/001 COM3 RS-485) serial port using Modbus protocol. These parameters are displayed. Warning messages are displayed and safety shutdowns occur in response to high temperature and vibration conditions. Software version C.OPT.01.22.307 (and later) is required for this feature.

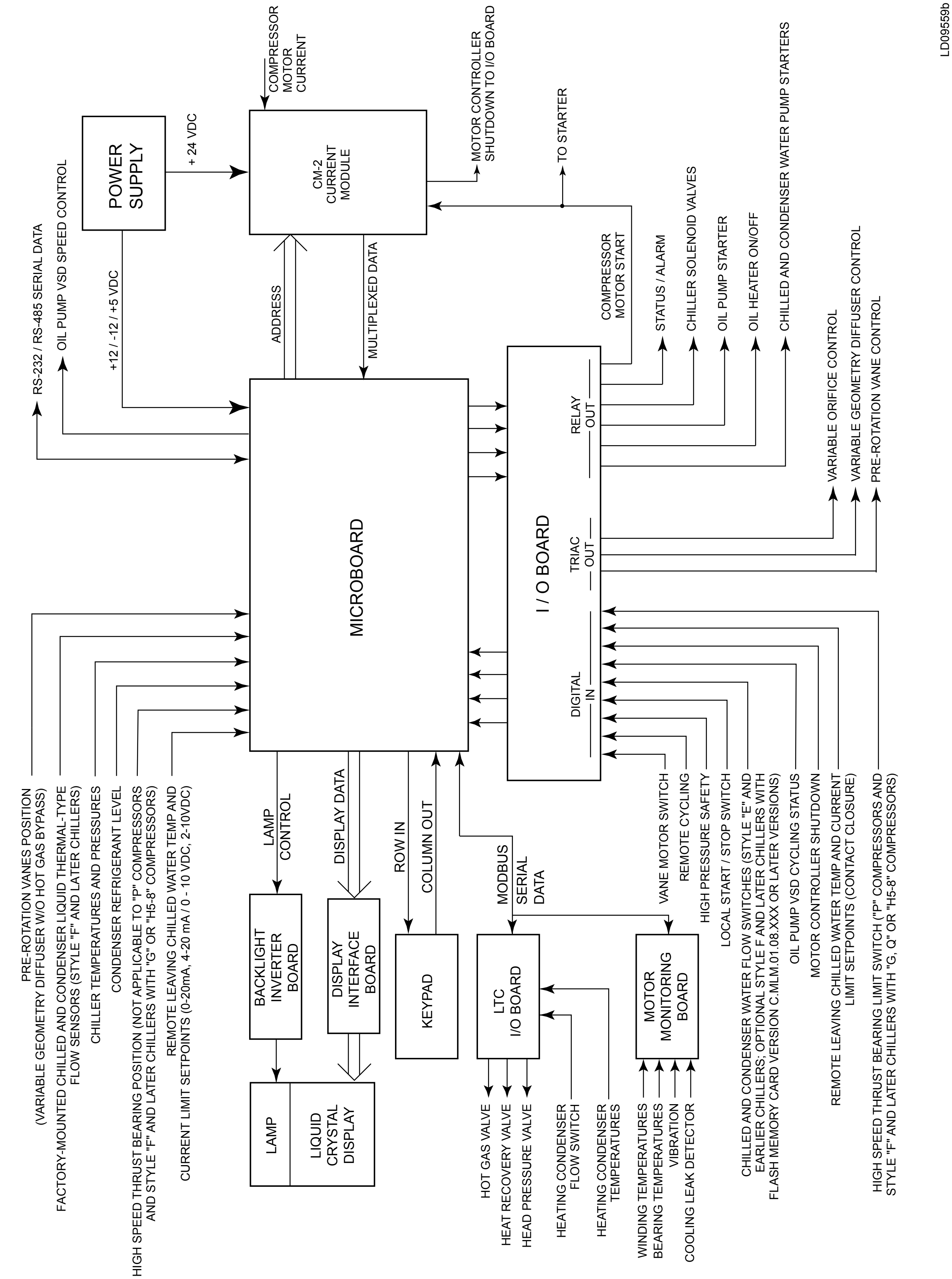


FIGURE 1 - OPTIVIEW CONTROL CENTER - ELECTROMECHANICAL STARTER APPLICATIONS

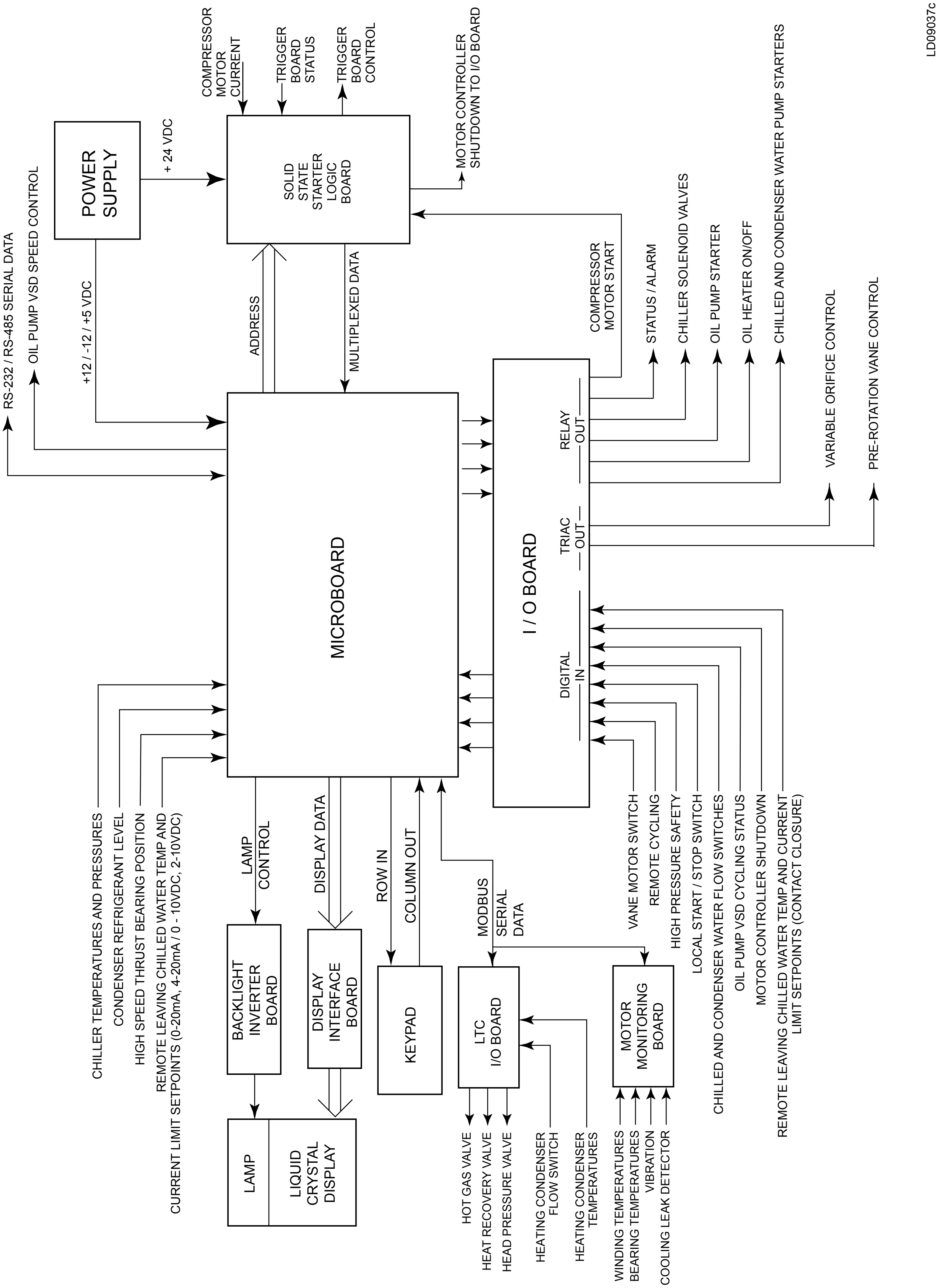


FIGURE 2 - OPTIVIEW CONTROL CENTER - MOD A SOLID STATE STARTER APPLICATIONS

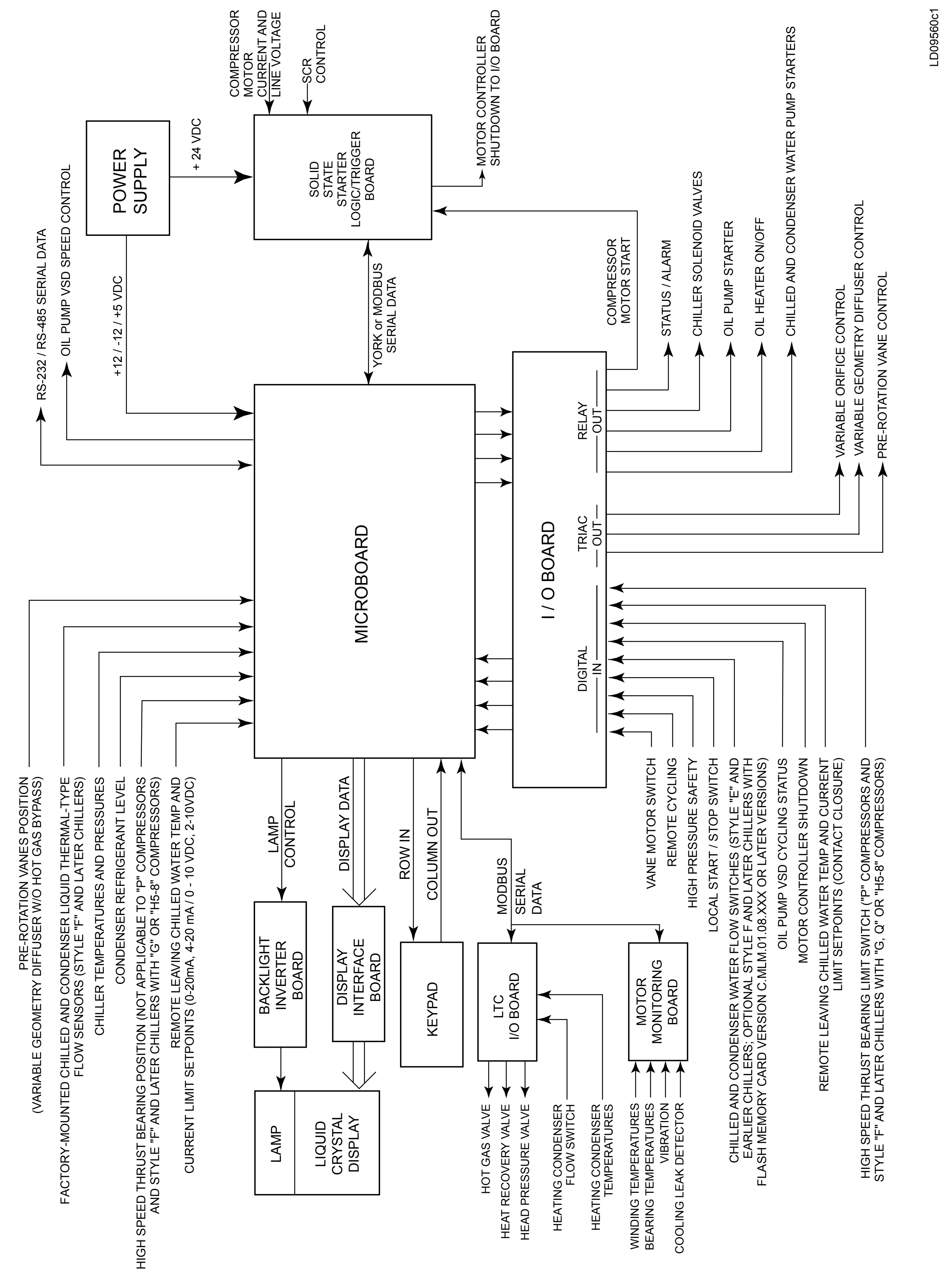


FIGURE 3 - OPTIVIEW CONTROL CENTER - MOD B SOLID STATE STARTER APPLICATIONS

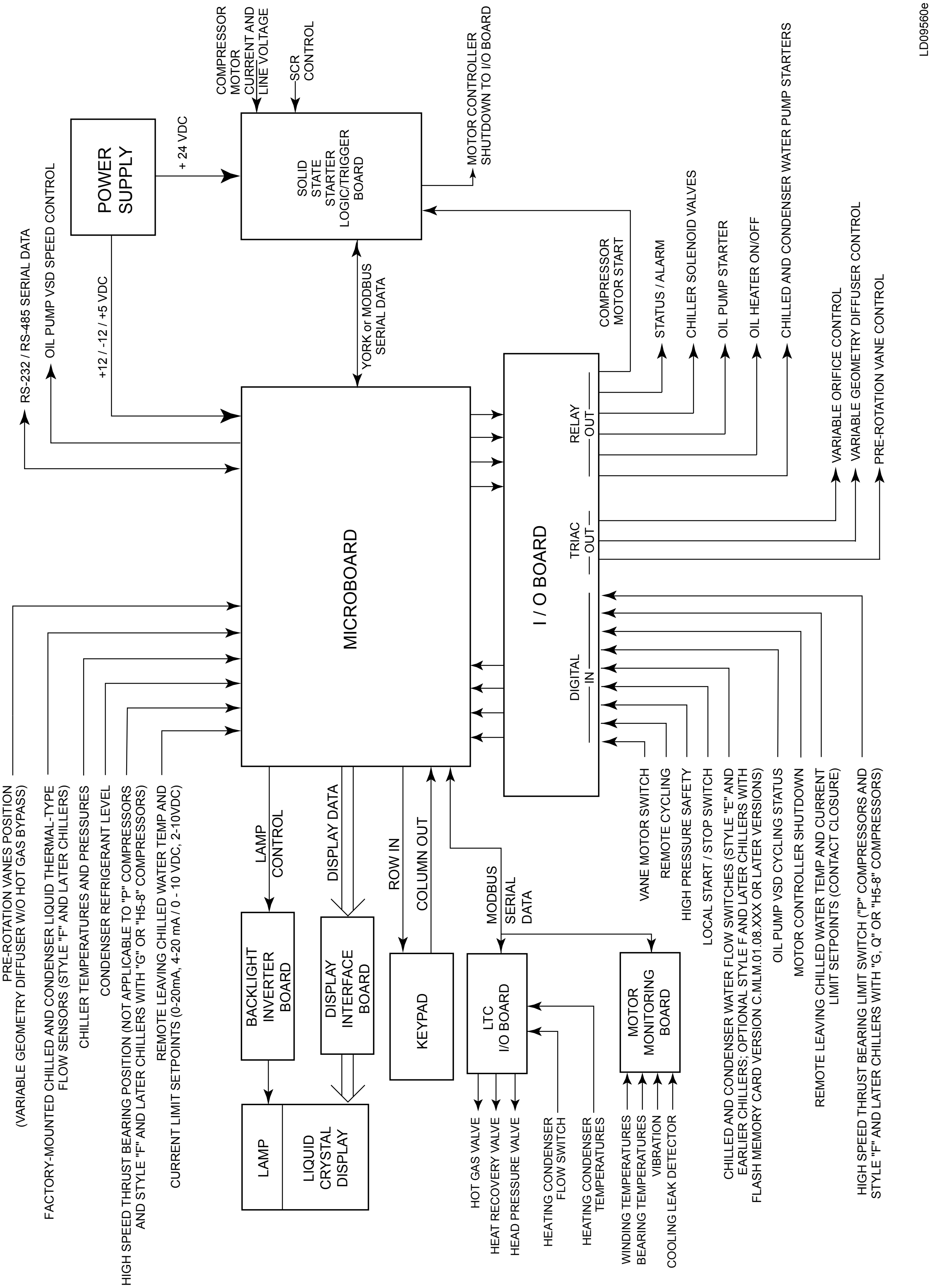


FIGURE 4 - OPTIVIEW CONTROL CENTER - MEDIUM VOLTAGE SOLID STATE STARTER APPLICATIONS

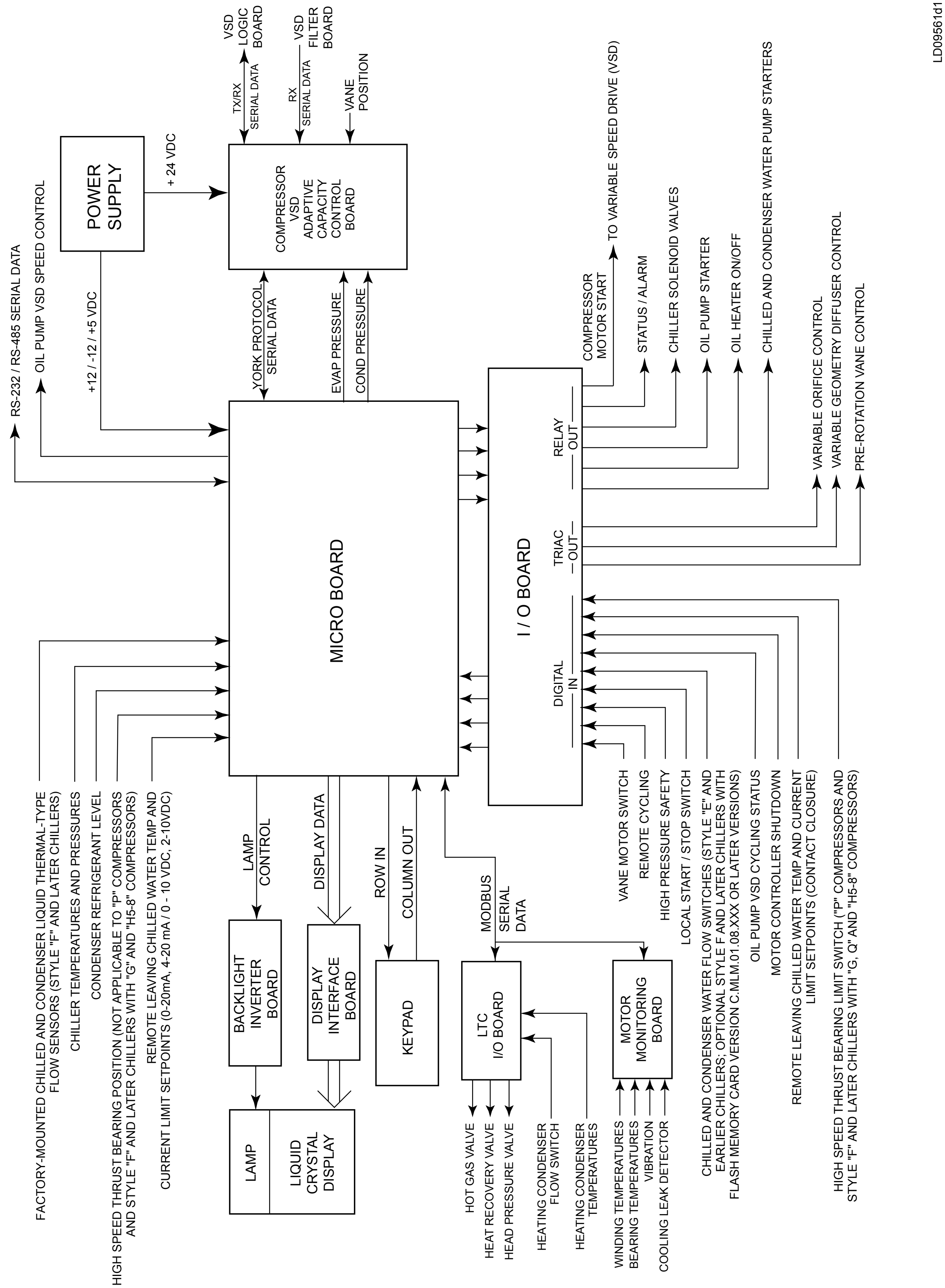


FIGURE 5 - OPTIVIEW CONTROL CENTER - COMPRESSOR MOTOR VARIABLE SPEED DRIVE (YORK SERIAL COMMUNICATIONS PROTOCOL)

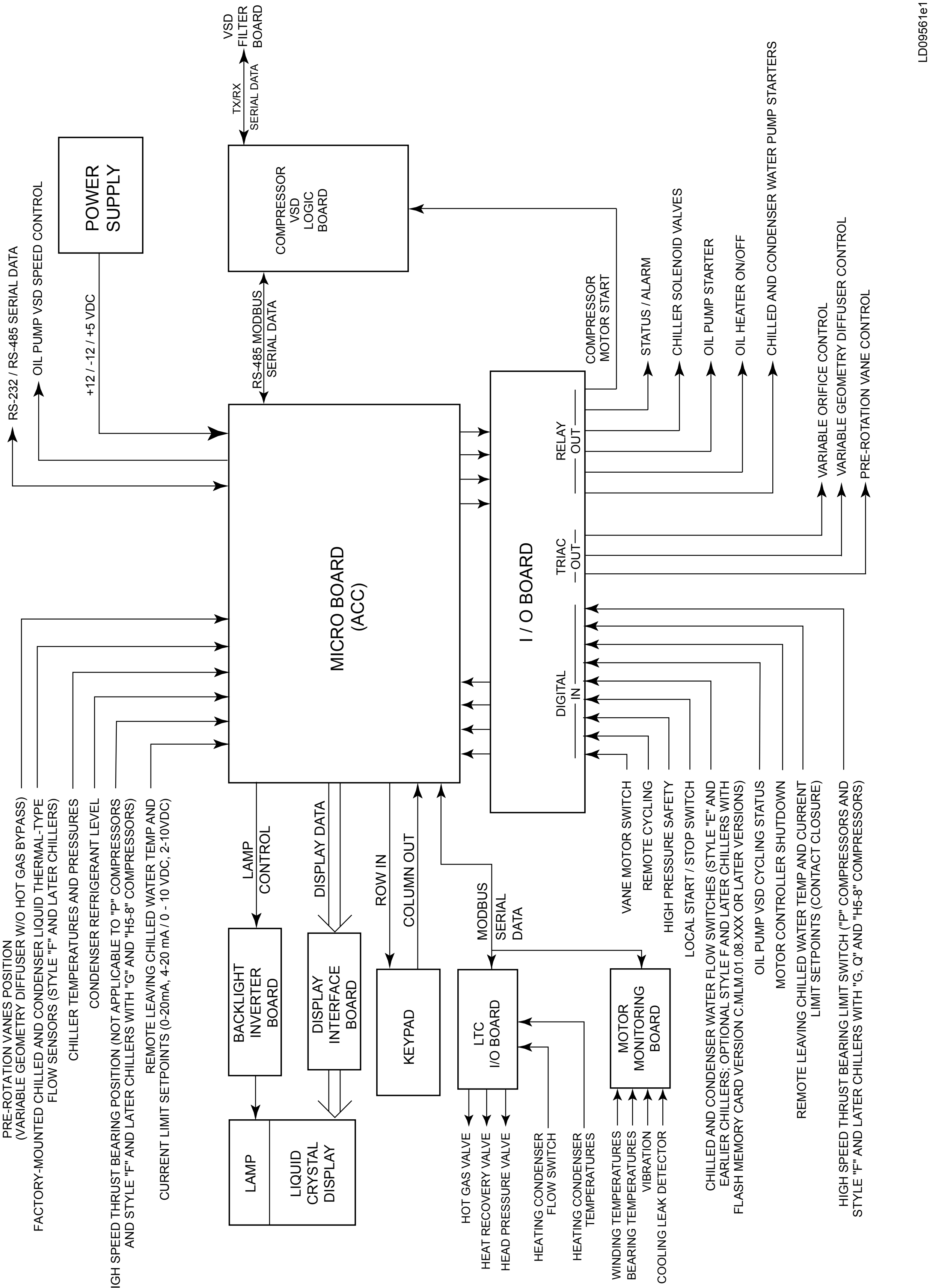


FIGURE 6 - OPTIVIEW CONTROL CENTER - COMPRESSOR MOTOR VARIABLE SPEED DRIVE (MODBUS SERIAL COMMUNICATIONS PROTOCOL)

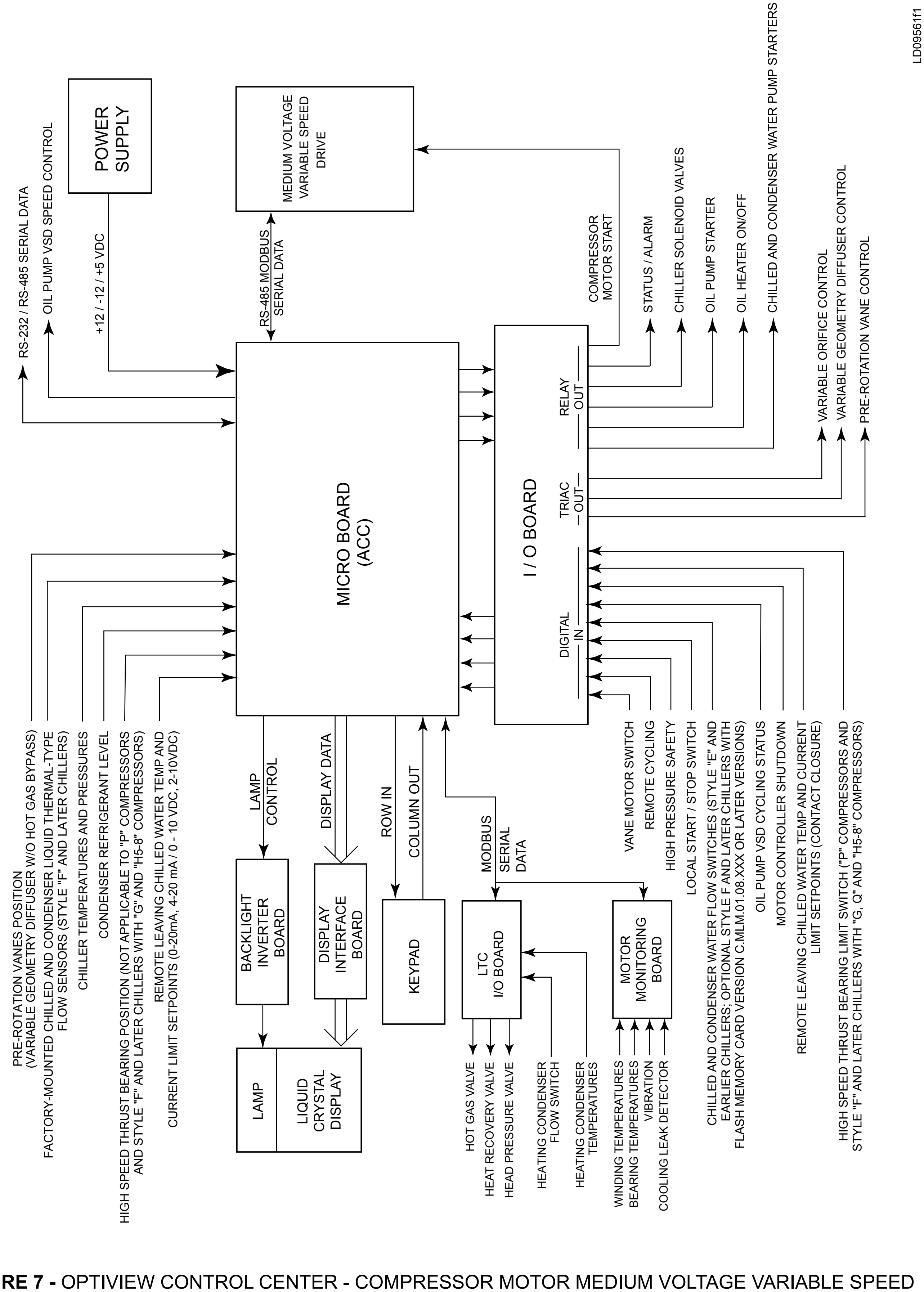
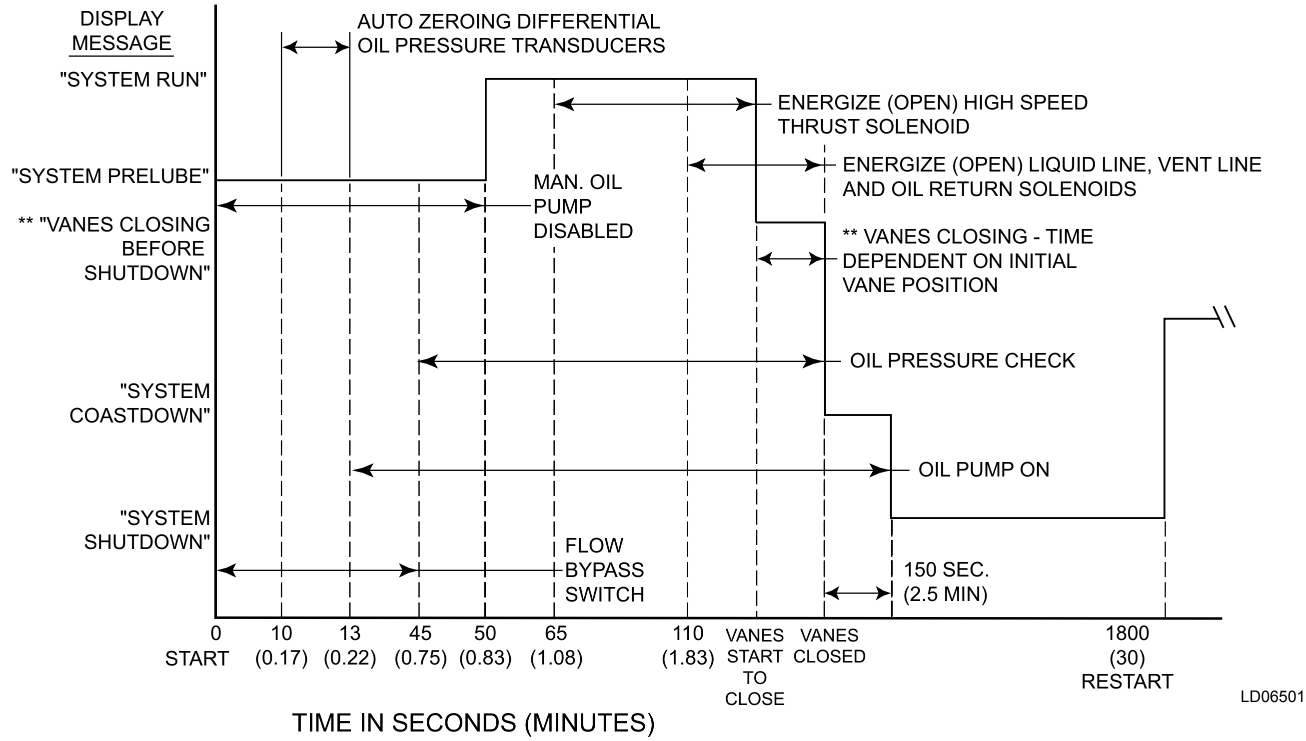


FIGURE 7 - OPTIVIEW CONTROL CENTER - COMPRESSOR MOTOR MEDIUM VOLTAGE VARIABLE SPEED DRIVE

TIMING DIAGRAM – CHILLERS EQUIPPED WITH FIXED SPEED OIL PUMP (STYLE C)



** Only applicable to the following shutdowns. When any of these shutdowns are performed, the vanes are driven fully closed before the starter is de-energized. When the vane motor switch closes (or 210 seconds from start of vane closure have elapsed), the starter is de-energized.
1. Low Water Temperature; 2. Multi-Unit Sequence (TB4-9); 3. Remote/ Local Cycling (TB4-13); 4. Internal Time Clock; 5. Remote Stop (TB4-8); 6. Remote Stop (ISN serial port). Operator initiated Soft Shutdown (Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx)

TIMING DIAGRAM – CHILLERS EQUIPPED WITH VARIABLE SPEED OIL PUMP (STYLE D/E/F)

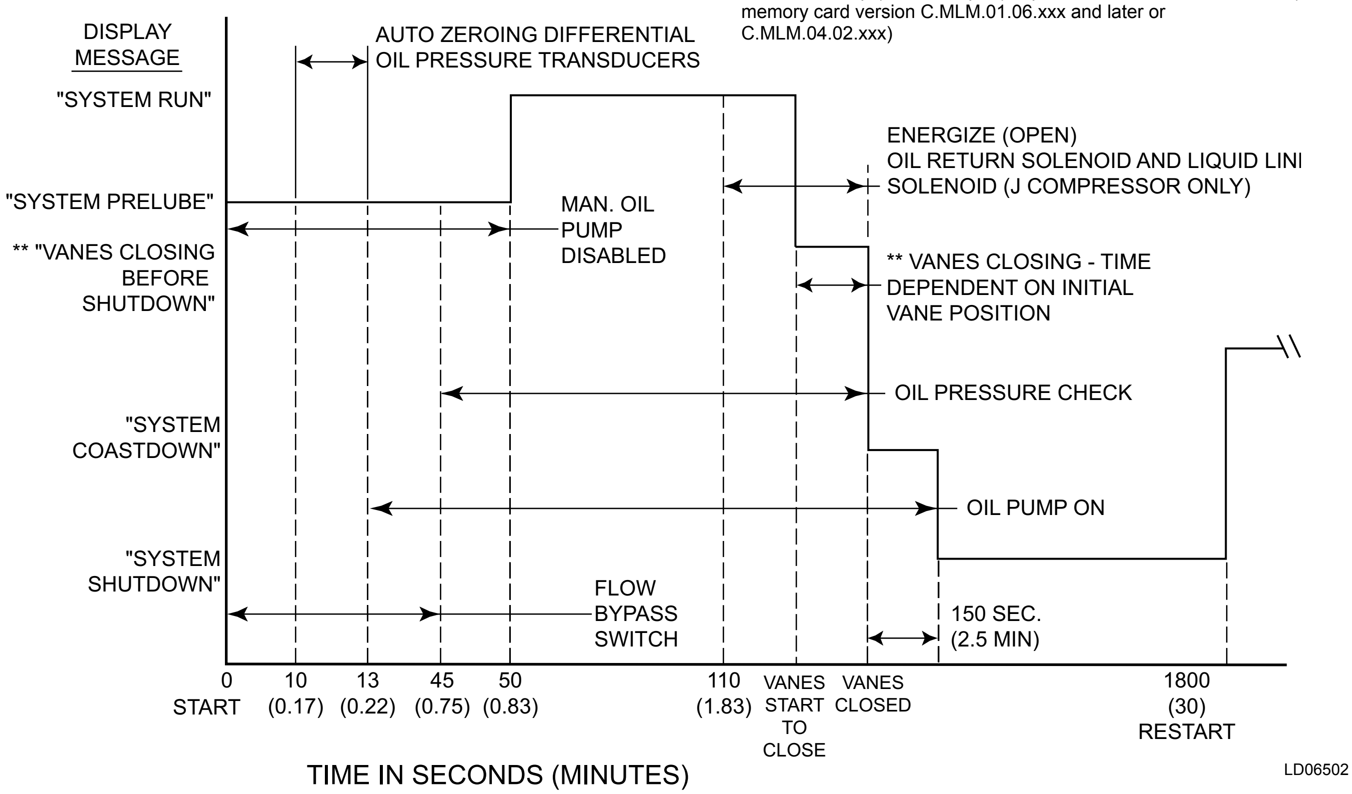
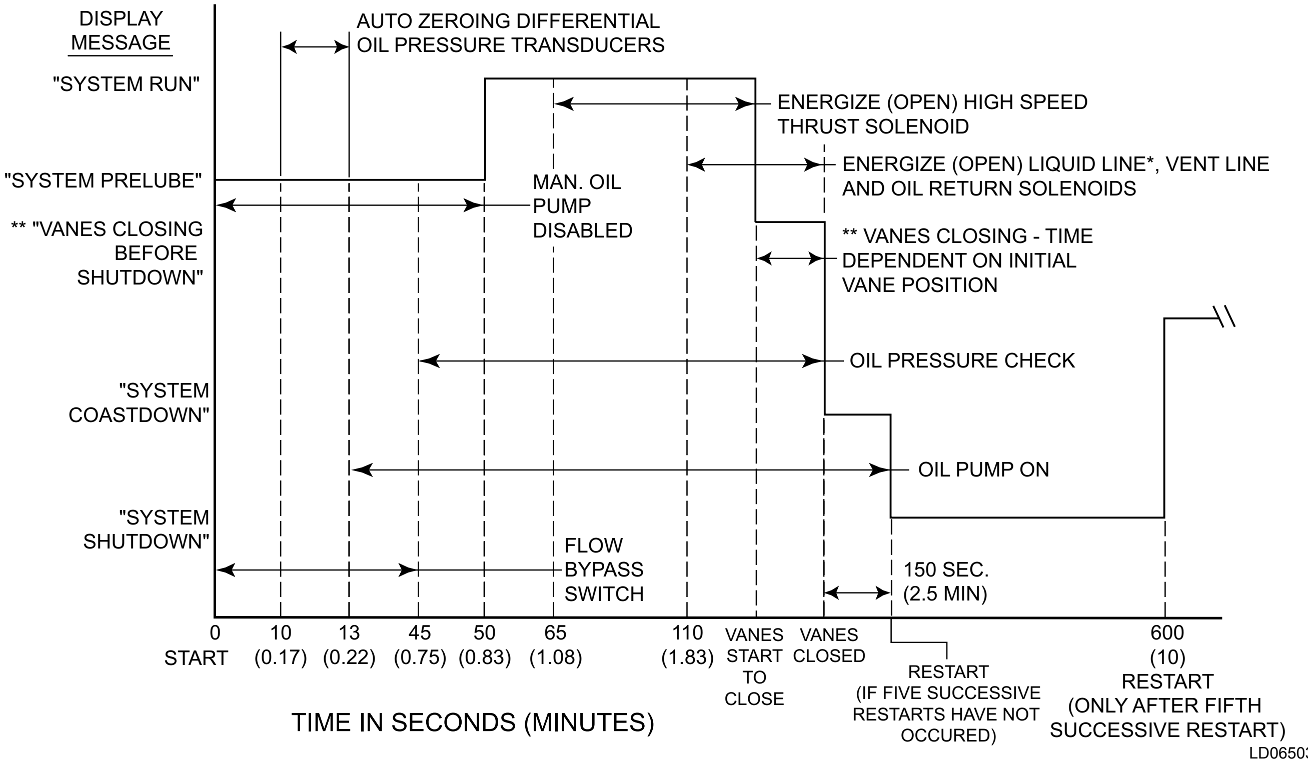


FIGURE 8 - OPERATION SEQUENCE TIMING DIAGRAM (ELECTROMECHANICAL AND SOLID STATE STARTER APPLICATIONS)

TIMING DIAGRAM – CHILLERS EQUIPPED WITH FIXED SPEED OIL PUMP (STYLE C)



* The Liquid Line solenoid will only be energized during this period when the oil temperature reaches > 140°F. It will then be de-energized when the temprature is less than 135°F.

** Only applicable to the following shutdowns. When any of these shutdowns are performed, the vanes are driven fully closed before the starter is de-energized. When the vane motor switch closes (or 210 seconds from start of vane closure have elapsed), the starter is de-energized. 1. Low Water Temperature; 2. Multi-Unit Sequence (TB4-9); 3. Remote/Local Cycling (TB4-13); 4. Internal Time Clock; 5. Remote Stop (TB4-8); 6. Remote Stop (ISN serial port). Operator initiated Soft Shutdown (Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx)

TIMING DIAGRAM – CHILLERS EQUIPPED WITH VARIABLE SPEED OIL PUMP (STYLE D/E/F)

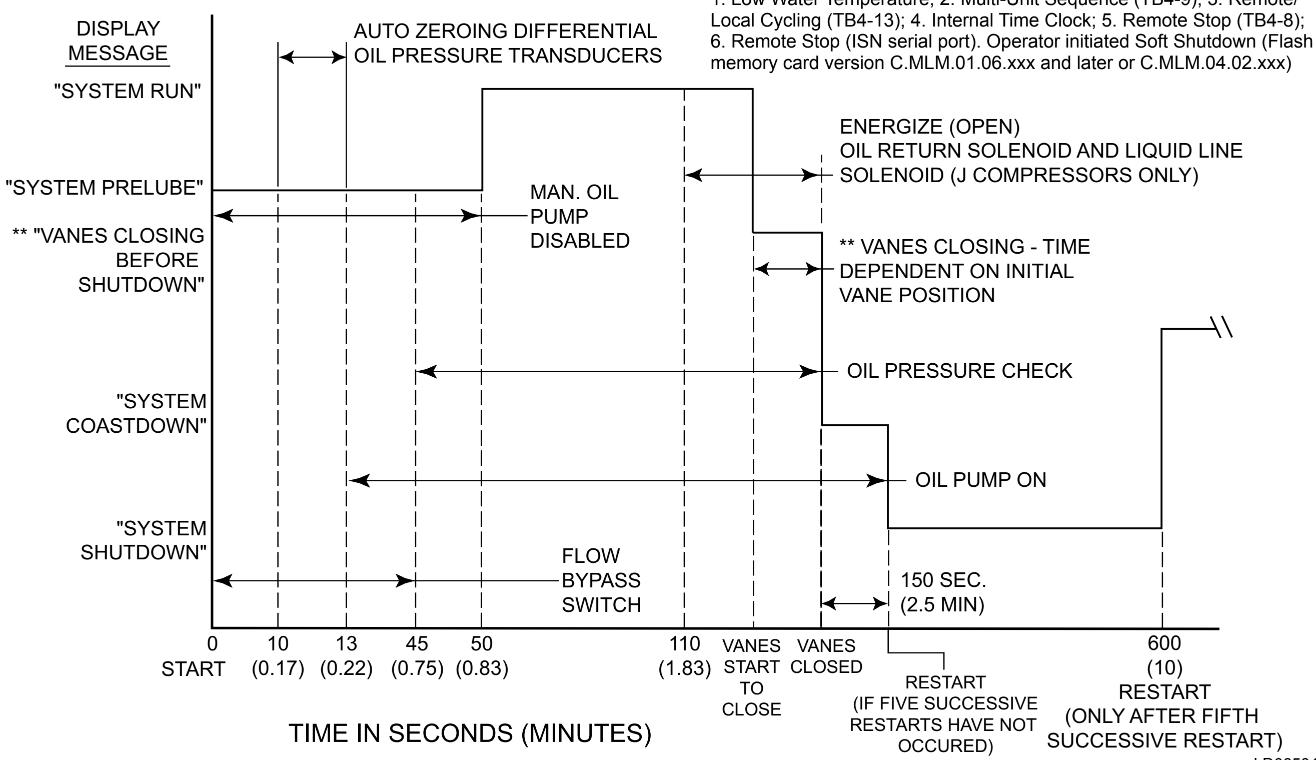


FIGURE 9 - OPERATION SEQUENCE TIMING DIAGRAM (COMPRESSOR MOTOR VARIABLE SPEED DRIVE APPLICATIONS)

SECTION 3 - MICROBOARD 031-01730-000

Microboard (P/N 031-01730-000) is supplied in new production chillers until January 2004.

The **microboard** contains the operating software (program), microprocessor, and supporting circuits for the microprocessor.

The **Program** is a set of instructions to control the chiller, the display and peripheral devices. It also contains the Safety and Cycling shutdown thresholds (non changeable) and display messages and screens. It is stored in a memory device called a **Flash Memory Card**, which is a type of non-volatile memory that can be read from or written to, but requires the locations to be erased before they are written to. With the exception of a write/read sequence that occurs during the boot-up process explained below, this device is used primarily as read-only in this application.

A write protect switch is located on the left edge of the card as shown in *Figure 11 on page 40*. It must be placed in the *Write Enabled* position to allow successful boot-up. The card is located in socket location U46 (See *Figure 10 on page 39*). It connects to the board via an elastomeric connector that is a silicon rubber strip embedded with silver conductors. The card can be removed from its socket by using the thumb to press down on the socket's plastic tension spring. The card is installed by inserting it into the socket/holder and pressing on the surface of the card until it snaps into place.

The memory card is a replaceable component. Refer to *YORK Renewal Parts - OptiView Control Center (Form 160.54-RP1)*. The version of the memory card is an alpha-numeric code that represents the application and revision level. The version is printed on a label adhered to the memory card's surface. The version code is as follows:

C.MLM.nn.nn.nnn

- Language Package Revision Level (00, 01, etc.)
- Language Package* (0=English only, 1=NEMA 1-4, 2=CE)
- Controls Revision Level (00, 01, etc.)
- Chiller Type (01=YK (all compressors after 8/02),02=YT, 03=YS, 04=YK (P compressors before 8/02), 05=YR)
- Centrifugal Chiller
- Commercial Chiller

* Refer to *YORK Renewal Parts List 160.54-RP1* for available languages.
1 = Supplied in new NEMA 1-4 OptiView Control Centers but can be retrofit to any OptiView Control Center.
2 = Supplied in new CE (European Community) OptiView Control Centers but can be retrofit to any OptiView Control Center.

There are two flash memory cards available. The difference between them is the different languages that can be displayed on the display screens. Language selection is performed on the USER screen following instructions in *OptiView Control Panel – Operation (Form 160.54-O1)*. Not all languages are available. Refer to *YORK Renewal Parts - OptiView Control Center (Form 160.54-RP1)* for list of available flash memory cards and display languages.

NOTE

IMPORTANT! – ***Not all versions of flash memory cards are compatible with revision E (and later) microboards or all BIOS EPROMs. If an incompatible version is used, the initialization (boot-up) process will not complete and the chiller will not run! Refer to YORK Renewal Parts - OptiView Control Center (Form 160.54-RP1) and Service Replacement paragraph in this manual.***

Flash memory cards are revised to add new features, enhancements and program corrections. Each time they are revised, the revision level of the affected portion of the program (controls or language) increments. Each time they are revised, a Service Information Bulletin is issued that describes the new features. Those bulletins that have been issued to date are located at the rear of this manual.

The microprocessor controls the chiller by reading and executing the Program instructions in a sequence determined by the Program. Under Program control, the microprocessor reads the Analog and Digital inputs to determine the operating conditions and controls Digital Outputs based upon these inputs. These inputs are compared to stored thresholds to determine if a Safety or Cycling shutdown is required. If a threshold has been exceeded, a shutdown is performed and the appropriate message is retrieved from the Program and displayed on the Liquid Crystal Display.

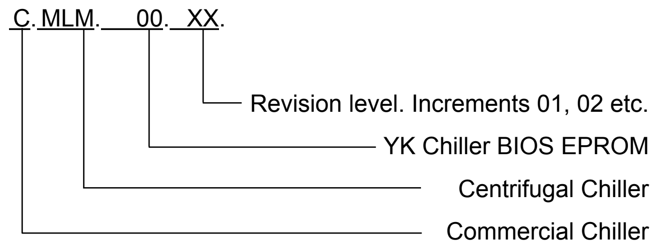
As operating conditions require, status messages are retrieved and displayed. The keypad is read as Digital inputs, when an operator presses a key to request a display; the microprocessor interprets the request, retrieves the display from the Program and displays it. The Program assembles data in the correct format for transmission through the serial data ports to peripheral devices. The Program also instructs the microprocessor to respond to requests from peripheral devices for serial data transmissions.

The **Watchdog** circuit monitors the +5 VDC supply from the external Power Supply to determine when a power failure is occurring. Just before the supply decreasing to a level where the microprocessor and supporting circuits can no longer operate, it applies a reset signal to the microprocessor.

The microprocessor responds by de-energizing the run digital output through the FPGA, shutting down the chiller and retrieving the POWER FAILURE message from the Program and sending it to the Display Controller for display. Similarly, when power is first applied after a power failure, it maintains the microprocessor in a reset state until the +5 VDC has returned to a sufficient level.

The watchdog circuit also ensures that all the program instructions are being performed and that the Program has not latched-up, bypassing important safety thresholds. If the Program has latched-up, the microprocessor initiates a safety shutdown and displays WATCHDOG – SOFTWARE REBOOT message.

The **BIOS EPROM** (basic input/output system erasable programmable read only memory) is a memory device that contains the bootstrap or power-up program. It is located in socket location U45. This EPROM is replaceable. Refer to *YORK Renewal Parts - OptiView Control Center (Form 160.54-RP1)*. The EPROM version is an alpha-numeric code that represents the application and revision level. The version is printed on a label adhered to the EPROM's surface. The version code is as follows:



Early vintage chillers were equipped with BIOS EPROM (P/N 031-01796-001). It is no longer used and was superseded by BIOS EPROM (P/N 031-01796-002).

NOTE

IMPORTANT! ***EPROM (P/N 031-01796-002) is not compatible with all versions of flash memory cards. Refer to Service Replacement on page 38 for more information.***

When power is applied to the OptiView Control Center following a power failure, the microprocessor executes the instructions in the BIOS EPROM program to initialize, configure and start operation of certain microboard components before the main program (stored in the flash memory card) is started.

Depending upon the application, the microboard could be equipped with an EPROM with 128K, 256K or 512K capacity. Microboard Program Jumper JP38 must be positioned according to the actual EPROM installed. See *Program Jumpers on page 42*.

There are five steps to the boot-up process. During the boot-up process, there is a visual indication as each step is performed, followed by a pass/fail status of the step. On the microboard, a green LED (CR17 - Pass) flashes to indicate the step was successful. If a step is unsuccessful, a red LED (CR18 - Fail) flashes and the boot-up process terminates. The execution and pass/fail status of Steps 3 through 5 are displayed on a white keypad display screen as they are performed. This white display screen also lists the BIOS EPROM version. The steps of the boot-up process are listed in the following heading along with the LED activity associated with each step.

BOOT-UP STEP AND DESCRIPTION

The steps of the boot-up process are as follows:

1. **First initiate table complete**

   Registers in the microprocessor are configured to allow it to perform basic memory read/write functions.

2. **FPGA configuration**

   The Field Programmable Gate Array (FPGA) is configured to process Digital inputs and Outputs.

3. **Mini-card signature test**

   A location in the Flash memory card that contains a code identifying the Manufacturer is compared to other locations that contain the manufacturer's name. If these values are the same, it is "pass". If they are different, it is "fail".

4. **Mini-card checksum**

   The Flash memory card checksum is calculated and compared to the checksum value that is stored in the Card at the time the Card was initially programmed at the YORK factory. If both values are the same, it is considered "pass". If the calculated value is different than the stored value, it is considered "fail".

5. **BRAM quick test**

   Test data is written to and then read from several memory locations to verify BRAM operation.

LED Indicators

When power is applied to the OptiView Control Center, both the red (CR18 - Fail) and green (CR17 - Pass) LED's simultaneously illuminate for 1 second, then the Boot-up process begins in the following sequence:

TABLE 2 - BOOT-UP LED INDICATORS

STEP	PASS	FAIL
1	Green on, Red off	Watchdog will initiate a re-boot.
2	Green flash once	Boot-up process halts. One red flash repeating.
3	Green flash once	Boot-up process halts. Two red flashes repeating.
4	Green flash once	Boot-up process halts. Three red flashes repeating.
5	Green flash once	Boot-up process halts. Four red flashes repeating.

When all steps have been completed, the LED's will then illuminate or extinguish, as long as power is applied, according to the settings of Microboard Program Switches 7 and 8 as follows:

Green (CR17)

Program SW 7 set to 50Hz – extinguishes
60Hz – illuminates

Red (CR18)
Program SW 8 set to Standard – illuminates
Enhanced – extinguishes

The **BRAM** (battery backed random access memory) is a memory device that contains a battery that preserves the data during power failures. It is a replaceable part. Refer to *YORK Renewal Parts - OptiView Control Center (Form 160.54-RP1)*. It is located in socket location U52. The microprocessor stores the setpoints programmed by the Operator or Service technician, History Data and other data that requires preservation, in this device. Also, the day of week, time of day and calendar date time-keeping are done here.

Program Jumpers/Program Switches

The Program Jumpers and Program Switches are used to alter the program operation or configure the microboard hardware for specific operation. This allows the Program and Microboard to be universal for all standard applications. See *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* for the function of each jumper and switch. The position of some jumpers can be determined by the Service technician to meet the desired operation. Others must be positioned according to the requirements of the size, type or style of components and thus are determined by the YORK factory. Some jumpers are plastic sleeves with metal inserts that are inserted over 2-prong or 3-prong conductors. Others are wire bridges that are either cut or left in place. The program switches are miniature switches that are placed in the ON or OFF position.

Keypad Interface

The keypad is read via J18. The keypad is a matrix of conductors arranged in rows and columns (See *Figure 50 on page 124 and Figure 51 on page 125*). There are 4 rows and 8 columns. When a key is pressed, the conductors are pressed together at that point, creating continuity between the row conductor and the column conductor. The keypad is read by applying a logic low to a row while leaving +5 VDC pull-up on all other rows. The microprocessor then reads the 8 columns. If any column has a logic low on it, the key corresponding to that coordinate (row, column) is being pressed. The microprocessor reads the entire keypad by repeating this routine beginning with row 1 and ending with row 4. The entire keypad is continually read while the Control Center is powered. See *SECTION 10 - KEYPAD* of this manual for details of the keypad.

CM-2 Board or Style A Solid State Starter Interface

The microboard retrieves certain operating parameters (via J10) from the compressor motor starter control board (CM-2 Current Board for Electromechanical starter or Style A Solid State Starter Logic Board). See the appropriate section of this manual for detailed explanation of each board.

Both boards contain an 8 channel multiplexer. The microprocessor sequentially and continually reads channels 0 through 7. It reads each channel by applying a 3-bit binary address to the multiplexer. A 0 to 5 VDC analog value is returned from each channel. The function of each is in the *Table 3 on page 34*. The microprocessor determines which board, and therefore which starter is present, by the value returned from channel 0. Since channels 0 through 6 are grounded, the CM-2 board returns a 0 VDC value. The Solid State Starter Logic Board returns a value more than 0.41 VDC to +5 VDC. If the value is less than 0.4 VDC, it indicates the starter is an Electromechanical (EM) starter and the microprocessor then reads channel 7 to retrieve the peak motor current value. A value more than 0.4 VDC indicates the starter is an A style Solid State Starter and the microprocessor reads channels 1 through 7.

In the solid state starter, channel 0 indicates the starter size (model) and voltmeter range (300 VAC or 600 VAC). Channel 1 is a hardware generated 100% FLA (prevents pre-rotation vanes from further opening) or 104% FLA (closes pre-rotation vanes until motor current is less than 102%) current limit override command that overrides normal pro-rotation vanes control. Channels 2 through 4 are analog voltages that represent phase A, B and C motor current. The highest phase Channels 5 through 7 are analog voltages that represent Phase A, B and C line voltage. The addresses and associated data are shown in the following table.

TABLE 3 - ADDRESSES AND ASSOCIATED DATA

<table>
<tr><th colspan="2">CM-2 Board</th><th colspan="2">MOD A SOLID STATE STARTER LOGIC Board</th></tr>
<tr><th>ADDRESS</th><th>DATA</th><th>ADDRESS</th><th>DATA</th></tr>
<tr><td rowspan="2">0–6</td><td rowspan="2">Grid</td><td>0</td><td>starter model / voltmeter range</td></tr>
<tr><td>1</td><td>currrent limit command</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Peak Motor Current</td><td>2–4</td><td>phase C, B, A motor current</td></tr>
<tr><td>5–7</td><td>phase A, B, C line voltage</td></tr>
</table>

Style B Solid State Starter or Variable Speed Drive Interface

If equipped with either of these drives, the drive is interfaced to the microboard via the Opto-Coupled COM 5 serial data port (J15). The serial data is represented by +5 VDC and 0 VDC logic levels. The TX data to the drive is located at J15-1 and J15-2 is RX data from the drive. See *SECTION 13 - SOLID STATE STARTERS* and *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* for details of this interface.

Printer Interface

An optional Printer can be connected to COM1 RS-232 serial data port (J2). TX data to the printer is located at J2-4 and J2-2 is the DSR (Data Set Ready or busy) signal from the printer. Signal levels are standard RS-232. The microboard sends data to the printer at the selected baud rate until the printer buffer becomes full, whereupon the printer asserts its Busy signal. The microboard suspends data transmission until the printer can accept more data. Each printer must be setup/configured to operate properly with the microboard. The Baud, Data Bits, Parity and Stop Bits must be programmed on the COMMS Screen. Other printer setup is performed on the Printer Screen. Refer to *OptiView Control Panel – Operation (Form 160.54-O1)* for details of available printers and printer setup instructions.

E-Link Gateway Interface

An optional E-Link Gateway printed circuit board can be connected to the COM 4B RS-232 serial data port (J2). J2-7 is TX data to the E-Link Gateway. The RX data is located at J2-6. Signal levels are standard RS-232. The E-Link Gateway polls system pressures, temperatures and status from the microboard. It holds it for retrieval by third-party devices. See *SECTION 18 - OIL PUMP VARIABLE SPEED DRIVE* of this manual.

Digital inputs

The I/O Board converts the 115 VAC inputs to logic level inputs for the microboard at J19. A 115 VAC input to the I/O Board is converted to a logic low (less than 1 VDC). A 0 VAC input to the I/O Board is converted to a logic high (more than 4 VDC). See *SECTION 6 - I/O BOARD* of this manual for details of the I/O Board.

Digital Outputs

The microboard controls 115 VAC relays and solenoids via the I/O Board (via J19). The I/O Board contains +12 VDC relays that isolate the microboard low voltage circuits from the 115 VAC device coils. Solid state switching devices are used to control the relays. The microboard energizes the +12 VDC relays by applying a ground to the coil input. They are de-energized by opening the ground path. The contacts of these relays switch 115 VAC to system relays and solenoids. The outputs that control the chilled liquid pump and compressor motor starter have anti-chatter (anti-recycle) timers associated with them. The output that controls relay K0 is not allowed to change at a rate greater than once every 10 seconds. The output that controls relay K13 is not allowed to change at a rate greater than once every 20 seconds.

The microboard controls actuator motors via triacs on the I/O board. Each actuator has an open winding and a close winding. Current flowing through a winding causes the actuator to rotate in the respective direction. Each winding is controlled by a triac. The triac is turned on to allow current to flow through a winding. The microboard turns on the triac by applying a logic low (less than 1 VDC) to the triac driver on the I/O board. It turns it OFF by applying a logic high (more than 4 VDC). See *SECTION 6 - I/O BOARD* of this manual for details of the I/O Board.

Analog Inputs

System pressures, in the form of analog DC voltages, are input from Pressure Transducers. See *SECTION 20 - PRESSURE TRANSDUCERS* of this manual. Formulas and graphs are included to calculate the expected transducer output voltage for a given pressure input.

System temperatures, in the form of analog DC voltages, are input from thermistors. See *SECTION 21 - TEMPERATURE THERMISTORS* of this manual. Included are tables to convert the expected output voltage for any temperature applied to the thermistor.

Style F (and later) chillers are supplied with factory-mounted flow sensors on the evaporator and condenser (Software version C.MLM.01.07.xxx (and later) is required for this feature. These are electronic thermal-type sensors. The operating principle of the sensor is thermal conductivity. It uses the cooling effect of a flowing liquid to sense flow. The temperature of the heated sensor tip is sensed by a thermistor located in the tip. A second thermistor, located higher in the tip in a non-heated area, is only affected by changes in liquid temperature. The temperatures sensed by the thermistors are compared. Flowing liquid carries heat away from the heated sensor tip, lowering its temperature. The higher the flow rate, the lower the tip temperature and therefore a lower differential between thermistors. Lower flow rates remove less heat from the tip allowing a higher tip temperature. The lower the flow, the greater the differential between thermistors.

The sensor is vendor-calibrated to turn ON its output at a flow rate of 20cm (0.6 ft.) / second, this is the setpoint. There are 11 LED's on the sensor that reflect the measured flow rate. The center located amber LED illuminates at the setpoint flow rate (and above). The 4 LED's to the left of the amber reflect flow rates below the setpoint. The 6 LED's to the right of the amber reflect flow rates above the setpoint. As the flow rate decreases from the setpoint, the LED display moves to the left. As the flow rate increases above the setpoint, the LED display moves to the right.

The sensor operates from a 24 VAC power source and has a solid state relay output. On each sensor, one side of the solid state relay output (pin 2) is connected to the microboard +5 VDC and the other side (pin 4) is connected to a Microboard Analog Input (See *Figure 15 on page 47*).

After power is applied, there is a thermal warm-up period of up to 20 seconds. During this time, the output could be unstable. When the setpoint (or greater) flow rate is sensed, the solid state relay output is turned ON causing it to conduct current through the 7.5K ohm Microboard load resistor to the +5 VDC. This applies more than +4 VDC to the microboard input evaporator J7-14; condenser J7-16). When a flow rate less than the setpoint is sensed, the solid state relay output is turned OFF, resulting in no conduction through the load resistor. This applies less than 1 VDC to the microboard input. To determine the state of the solid state relay, first confirm that +5 VDC is present at pin 2 of the flow sensor. Then connect a voltmeter from Microboard J7-14 (evaporator) or J7-16 (condenser) to Microboard TP1(ground).

Software version C.MLM.01.08.xxx (and later) allows either the Thermal-Type sensors connected to the microboard Analog Inputs or the Paddle-Type sensor connected to the I/O Board Digital inputs. (See the Flow Switch setpoint in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES*). To ensure that the program reads the correct input for the flow sensor type present, the Chiller Style/Compressor setpoint and Flow Switch setpoint must be set appropriately.

Serial Data Ports

The microboard is equipped with 5 serial data ports (See *Figure 14 on page 46*). Each port is dedicated for a specific function as follows:

A. COM1 (J2) – RS-232. Printer.

B. COM2 (J13) – RS-232. Not used.

C. COM3 (J12) – RS-485. Optional I/O.

D. COM4 (4A-J11), (4B-J2) – This port is actually two ports. However, they cannot be used simultaneously. The position of program jumper JP27 determines which port can be used. COM4A – RS485 Not used. COM4B – RS-232 E-Link Gateway.

E. COM5 (J15) – Opto-coupled transmit/receive. VSD Adaptive Capacity Control Board or Style B Solid State Starter.

Each port is equipped with two LED's. A red TX LED illuminates as data is transmitted to or requested from another device. A green RX LED illuminates as data is received from another device. The RS-232 voltages are industry standard +5 VDC to +25 VDC and -5 VDC to -25 VDC logic levels. The RS-485 voltages are industry standard 0 VDC and +1.5 VDC to +5 VDC logic levels. COM5 logic levels are 0 VDC and +5 VDC. A diagnostic test can be performed on each serial port to confirm proper operation. See Diagnostics *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

The LEDs and their functions are as follows:

- CR2 RX1 – COM1 serial port receive data.
- CR3 TX1 – COM1 serial port transmit data.
- CR12 TX4 – COM4 serial port transmit data.
- CR13 RX4 – COM4 serial port receive data.
- CR15 TX3 – COM3 serial port transmit data.
- CR14 RX3 – COM3 serial port receive data.

- CR11 RX2 – COM2 serial port receive data.
- CR16 TX2 – COM2 serial port transmit data.
- CR10 RX5 – COM5 serial port receive data.
- CR9 TX5 – COM5 serial port transmit data.

Display Interface

The graphic screens displayed on the Liquid Crystal Display are created from the program downloaded from the Program card and stored in the Flash Memory Chip. The data to form these screens is output from J5. This data is in the form of red, green and blue drive signals applied to each of the 303,200 the display pixels arranged in a matrix of 640 columns x 480 rows. Each pixel consists of 3 windows; red, green and blue, through which a variable amount of light from the Display Backlight, is permitted to pass to the front of the display. The drive signals determine the amount of light permitted to pass through each window. The overall pixel color is a result of the gradient of red, green and blue light allowed to pass. The drive signal for each pixel is an 18 bit binary word; 6 for each of the 3 colors. The greater the binary value, the more light is permitted to pass. The pixels are driven sequentially from left to right, beginning with the top row. To coordinate the drive signals and ensure that the pixels in each row are driven from left to right and the columns are driven from top to bottom, the drive signals are accompanied by a clock and horizontal and vertical sync signals.

During the boot-up, the program in the BIOS EPROM reads wire jumpers PID0 through PID3 on the Display Interface Board to determine the manufacturer of the display. Each display manufacturer requires a slightly different control. The program in the BIOS EPROM configures the microboard for correct operation for the actual display installed.

Different display manufacturers require different supply and control voltages for their displays and backlights. Program Jumpers JP2 through JP5 and JP7 and JP8 must be configured to provide the required supply and control voltages to the display and backlight control. *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* lists the required program jumper configuration for each display. Also, a label attached to the display mounting plate lists the required program jumper configuration for that display. The position of program jumper JP2 determines whether the supply voltage is +5 VDC or +3.3 VDC.

The microboard controls the Display Backlight via J6. The Display Backlight is the light source for the display. The Backlight Inverter Board provides a high voltage AC power source for the lamp. It converts low voltage DC via J6-1 (+12 VDC or +5 VDC, depending on position of Program Jumper JP5) to high voltage AC (500 to 1500 VAC). This high voltage AC is applied to the lamp to cause it to illuminate. The Backlight is turned ON and OFF with the BACKLIGHT ENABLE signal (J6-5).

The position of Program Jumper JP4 determines whether this is a +12 VDC or +5 VDC signal. In some displays, the backlight turns ON when this signal transitions from low to high; others turn OFF when it transitions from high to low.

The position of Program Jumper JP3 determines the transition that will occur when the microboard outputs the Backlight Enable signal. Program Jumper JP3 must be positioned according to the display manufacturer's requirement.

Under Program control, the microboard controls the backlight brightness via the Lamp Dimmer circuit output at J6-7. In order to extend the life of the Backlight lamp, the brightness is driven to 50% after 10 minutes of Keypad inactivity. At this brightness level, the graphics are still visible.

When Keypad activity is detected (a key is pressed), the lamp is driven back to full (100%) brightness. Some display manufacturers require a variable voltage to vary the brightness; others require a variable resistance. Program Jumpers JP7 and JP8 must be configured to enable the appropriate technique.

The Lamp Dimmer is an integrated circuit that is the electrical equivalent of a 10K ohm potentiometer with 100 positions or steps (See *Figure 20 on page 68*). The Lamp Dimmer controls the position of the potentiometer. The Lamp Dimmer varies the brightness of the backlight by applying a variable voltage (0 to 5.0 VDC) or a variable resistance (0 to 10K ohms) to the Backlight Inverter Board. If Program Jumpers JP7 and JP8 are installed, the Lamp Dimmer output is a variable voltage; if both are removed, the output is a variable resistance. The Lamp Dimmer outputs Brightness Control Wiper (J6-7) to the Backlight Inverter Board. If configured for variable voltage output, the voltage between J6-7 and J6-8 can be varied from 0 VDC (100% brightness) to 5.0 VDC (0% brightness). If configured for variable resistance, the resistance between J6-6 and J6-7 varies from 0 ohms (0% brightness) to 10K ohms (100% brightness).

See *SECTION 7 - LIQUID CRYSTAL DISPLAY*, *SECTION 8 - DISPLAY INTERFACE BOARD*, and *SECTION 9 - DISPLAY BACKLIGHT INVERTER BOARD* of this manual for details of the display interface.

Remote Setpoints

Remote Leaving Chilled Liquid Temperature and Current Limit setpoints can be input via the RS-232 E-Link Gateway interface at J2 or directly to the microboard at J22 (See *Figure 15 on page 47*). The inputs at J22 are configured with Program Jumpers JP23 and JP24 to accept these inputs in either 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA form. See *Program Jumpers* for configurations and *SECTION 22 - REMOTE SETPOINTS* of this manual for details of the Remote setpoints.

POWER SUPPLY

The microboard receives 3 supply voltages (Microboard J1) from the **Power Supply**; +12 VDC, -12 VDC, +5 VDC and ground. The -12 VDC and +12 VDC are used directly by various circuits. The +12 VDC and +5 VDC are input to **Voltage Regulators** to derive other regulated voltages. The +5 VDC (fused by 5 Amp fuse F1 on rev E (and later) boards) is input to a +3.3 VDC regulator. The output is a 3.3 VDC regulated voltage. The +12 VDC, fused by 5 Amp fuse F2 on rev E (and later) boards, is input to a 5 VDC regulator. The output of this regulator powers only the Analog circuits. This includes the MUX, A/D converter, CM-2 module, Mod A Solid State Starter Logic Board, Transducers and thermistors. As depicted on the microboard figure, these voltages can be monitored at Test Posts TP1 through TP6.

SERVICE REPLACEMENT

Replacement part number 331-02430-601 is supplied as service replacement for Microboard 031-01730-000. See *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* of this manual and *Renewal Parts – OptiView Control Center (Form 160.54-RP1)*. Replacement part 331-01730-601 (Microboard 031-01730-000) is no longer available.

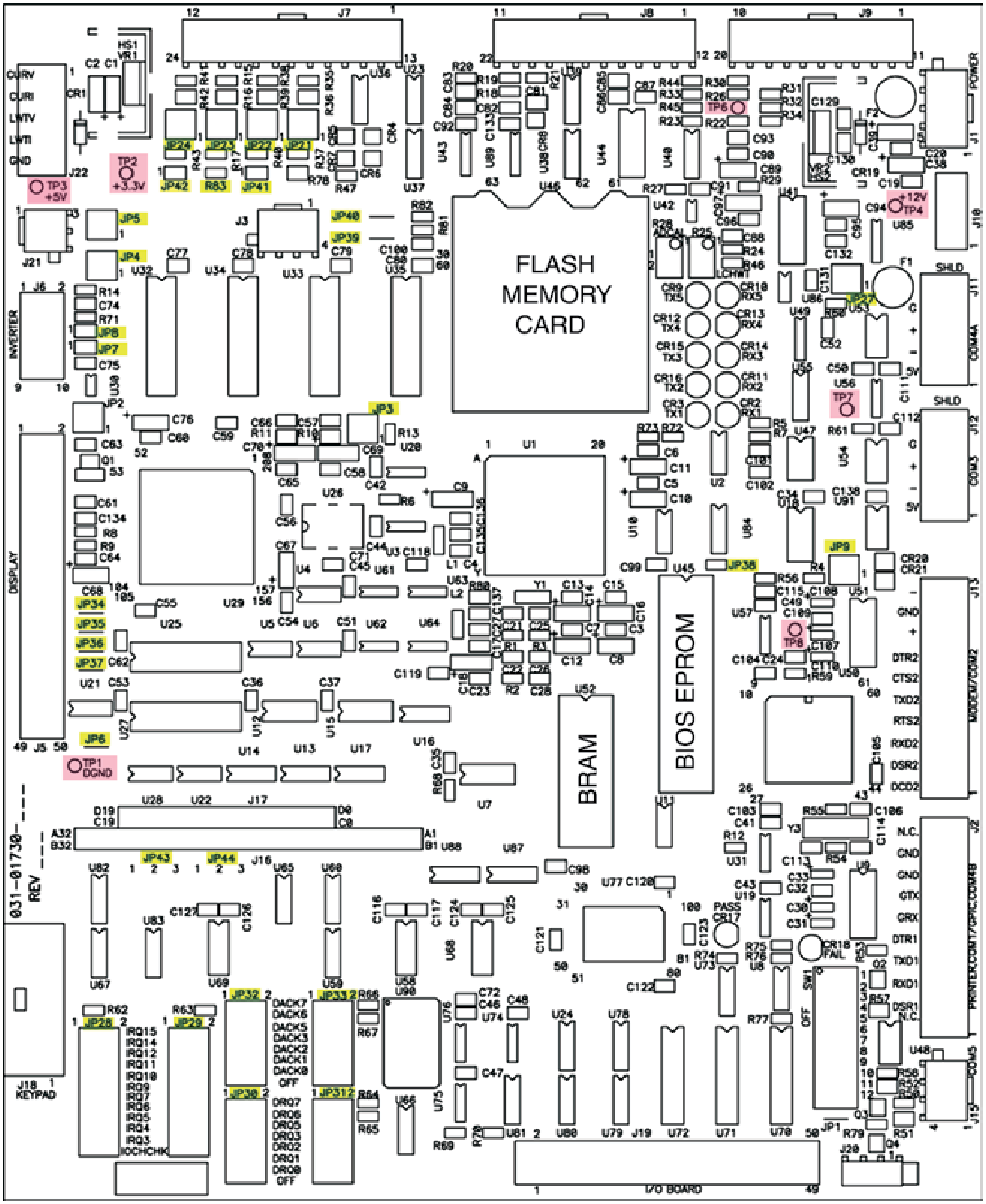


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FIGURE 10 - MICROBOARD 031-01730-000

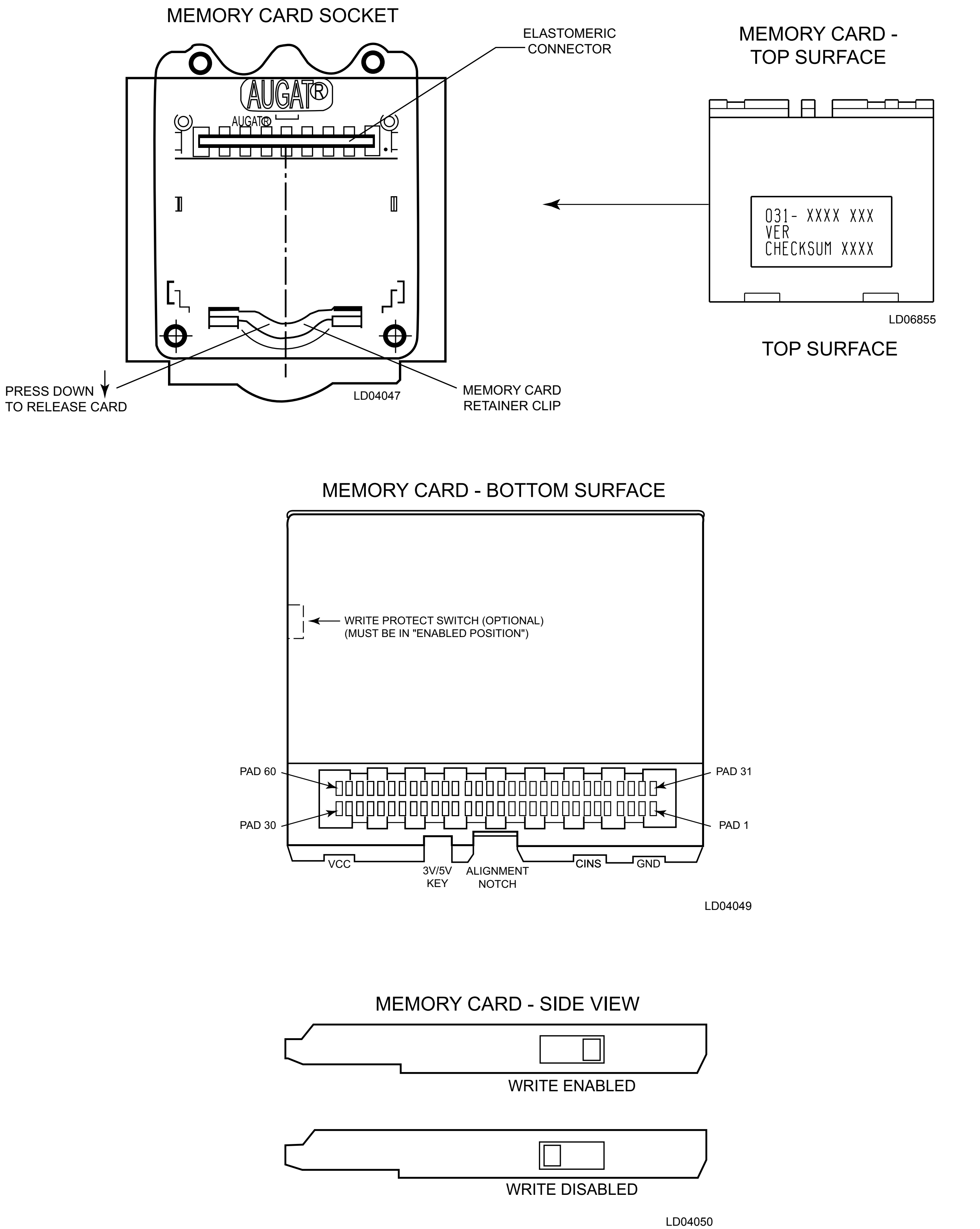


FIGURE 11 - FLASH MEMORY CARD

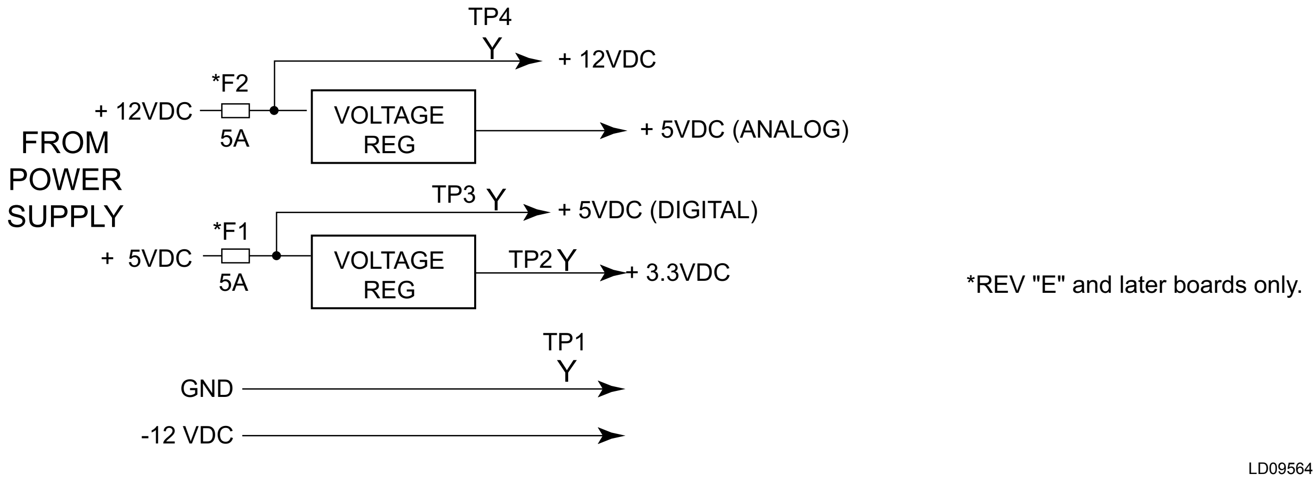


FIGURE 12 - MICROBOARD (031-01730-000) POWER SUPPLY TEST POINTS

PROGRAM JUMPERS

JP1 - Watchdog enable/disable. The position of this jumper, in conjunction with Program switch SW 1 position 12 enables or disables the program Watchdog protection.

CAUTION

Never disable the watchdog protection. Severe compressor or chiller damage could result. The ability to disable the watchdog protection is provided for factory testing only!!!

IN - Watchdog protection enabled.

OUT - Permits Program switch SW1 position 12 to enable or disable the program.

Watchdog protection as follows:

Position 12 **ON -** Watchdog protection enabled.

OFF - Watchdog protection disabled.

JP2 - Display power and logic levels. Determines the power supply voltage applied to the display.

Pins 1-2: +5 VDC SHARP LQ10D367/368 and LQ10D421 displays.

Pins 2-3: +3.3 VDC NEC NL6448ACCC33-24 and LG Semicon LP104V2-W displays.

JP3 - Display backlight enable signal level polarity. Jumper must be positioned according to the voltage level required to turn on the Display Backlight.

Pins 1-2: 0 VDC SHARP LQ10D421 Display.

Pins 2-3: +12 VDC or +5 VDC as determined by position of JP4. SHARP LQ10D367/368, NEC NL6448AC33-24 and LG Semicon LP104V2-W displays.

JP4 - Display backlight enable signal logic levels. Determines the logic levels of the Backlight enable signal.

Pins 1-2: +12 VDC/0 VDC SHARP LQ10D421 display.

Pins 2-3: +5 VDC/0 VDC SHARP LQ10D367/368 NEC NL6448AC33-24 and LG Semicon LP104V2-W displays.

JP5 - Display backlight power. Determines the power supply voltage applied to the Display Backlight Inverter Board.

Pins 1-2: +12 VDC. SHARP LQ10D367/368 and LQ10D421, NEC NL6448AC33-24 and LG Semicon LP104V2-W displays.

Pins 2-3: +5 VDC. Not Used.

JP6 - Display memory type. Jumper must be positioned according to type of RAM used for display memory devices (U25 and U27).

IN - EDO: (extended data out) type. Jumper should be IN.

OUT - FPM: (Fast Page Mode) type. Not Used.

JP7, JP8 - Display brightness control technique. Determines whether the display brightness is controlled by a variable voltage or variable resistance.

IN: Variable voltage (0-5.0 VDC). SHARP LQ10D367, LQ10D421 and LG Semicon LP104V2-W displays.

OUT: Variable resistance. NEC.

NL6448AC33-24 display.

JP9 - JP20 - Not Used.

JP21 - Factory mounted thermal-type flow sensor – evaporator. Style "F" (and later) chillers only (applies to Flash memory card version C.MLM.01.07.xxx (and later)).

OUT: Not Used.

Pins 1-2: Not Used.

Pins 2-3: Style "F" (and later) chillers with factory mounted evaporator thermal-type flow sensor.

JP22 - Factory mounted thermal-type flow sensor – condenser. Style "F" (and later) chillers only (Applies to Flash memory card version C.MLM.01.07.xxx (and later)).

OUT: Not Used.

Pins 1-2: Not Used.

Pins 2-3: Style "F" (and later) chillers with factory mounted condenser thermal-type flow sensor.

JP23 - Remote Current Li (J22) type. Configures Analog Input for 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA.

OUT: Allows a 0 to 10 VDC or 2 to 10 VDC input on J22-1.

Pins 1-2: Allows a 0 to 20mA or 4 to 20mA input on J22-2.

Pins 2-3: Not Used.

JP24 - Remote Leaving Chilled Liquid Temp setpoint (J22) type. Configures Analog Input for 0 to 10 VDC, 2 to 10 VDC, 0-20mA or 4 to 20mA.

OUT: Allows a 0 to 10 VDC or 2 to 10 VDC input on J22-3.

Pins 1-2: Allows a 0 to 20mA or input on J22-4.

Pins 2-3: Not Used.

JP25, JP26 - Not Used.

JP27 - COM 4 serial communications port. Configures COM 4 port to be either RS-485 for Multi-Unit Communications (COM 4A) or RS-232 for GPIC board (COM4B).

Pins 1-2: Enables port 4A. Allows an RS-485 connection to Microboard J11 for Multi-Unit Communications.

Pins 2-3: Enables port 4B. Allows an RS-232 connection to Microboard J2 for E-Link Gateway communications.

JP28 - PC-104 Port interrupt assignment. Assigns selected PC-104 interrupt request to PIRQ7 on the microprocessor. Interrupt request selections are silk screened on the microboard adjacent to the program jumper. Not used on YK chiller applications.

JP29 - PC-104 Port interrupt assignment. Assigns selected PC-104 interrupt request to PIRQ6 on the microprocessor. Interrupt request selections are silk screened on the microboard adjacent to the program jumper. Future modem application.

JP30 - PC-104 Port DMA assignment. Assigns selected PC-104 DMA request to PIRQ0 on the microprocessor. DMA request selections are silk screened on the microboard adjacent to the program jumper. Not used on YK Chiller applications.

JP31 - PC-104 Port DMA assignment. Assigns selected PC-104 DMA request to PIRQ1 on the microprocessor. DMA request selections are silk screened on the microboard adjacent to the program jumper. Not used on YK Chiller applications.

JP32 - PC-104 Port DMA acknowledge assignment. Assigns selected PC-104 DMA acknowledge to PDACK0 on the microprocessor. DMA acknowledge selections are silk screened on the microboard adjacent to the program jumper. Not used on YK Chiller applications.

JP33 - PC-104 Port DMA acknowledge assignment. Assigns selected PC-104 DMA acknowledge to PDACK1 on the microprocessor. DMA acknowledge selections are silk screened on the microboard adjacent to the program jumper. Not used on YK Chiller applications.

3

JP34 - Refrigerant type. Jumper must be positioned according to the refrigerant type installed in the chiller.

IN: R22

OUT: R-134a.

JP35 - Water/Brine application. Jumper must be positioned according to whether the chiller is cooling water or a brine solution.

IN: Water. Leaving Chilled Liquid Temperature setpoint range 38°F (36°F if Smart Freeze is enabled) to 70°F.

OUT: Brine. Leaving Chilled Liquid Temperature setpoint range 10°F to 70°F.

JP36 - Steam Turbine or Electric Motor drive - Determines the “Coastdown” duration (Oil Pump run duration after shutdown) and whether the “Motor Controller-Loss of Current” Program check is performed while the chiller is running.

IN: 150 seconds. Electric motor drive applications.

OUT: 15 minutes. Steam Turbine applications. MOTOR CONTROLLER-LOSS OF CURRENT check is not performed.

JP37 - Compressor Motor starter type.

IN: Electromechanical or Solid State Starter.

OUT: Variable Speed Drive Program Jumper JP39 must be IN for this application.

JP38 - BIOS EPROM U45 size. Jumper must be positioned according to size of U45. Jumper is a 10 Ohm resistor that is soldered to board. It is not a shunt jumper.

IN: 256K

OUT: 64K or 128K. Should be OUT for YK chiller applications.

JP39 - Solid State Starter style.

Note: On Variable speed Drive applications, this jumper must be IN.

IN: Mod A - Old style with Logic Board mounted in OptiView Control Center.

OUT: Mod B - New style with integrated Logic/Trigger Board mounted Starter cabinet.

JP40 - Not used.

JP43, JP44 – Display Controller (U29) type (rev E (and later) boards only)). Must be positioned according to the Display Controller type installed on Microboard. Configured at the time the board is manufactured and should not require field configuration.

Pins 1-2: Type 65548.

Pins 2-3: Type 65550 .

JP41, JP42 - High Speed Thrust Bearing Proximity probe type (Not applicable to P compressors and Style F (and later) chillers with G, Q and H5-8 compressors)). See *SECTION 15 - PROXIMITY PROBE* to determine which probe is present.

IN: Not Used.

OUT: +24 VDC Probe, part number 025-30961-000 or 025-35900-000.

JP43, JP44 - Display Controller (U29) type (rev E (and later) boards only)). Must be positioned according to the Display Controller type installed on Microboard. Configured at the time the board is manufactured and should not require field configuration.

Pins 1-2: Type 65548.

Pins 2-3: Type 65550.

PROGRAM SWITCHES

SW1

1 - Not Used.

2 - Oil Pump style - Configures Program operation for either Variable Speed Drive oil pump or fixed speed oil pump. Chillers equipped with the variable speed oil pump have a Program controlled Oil Heater and a different complement of solenoid valves than chillers equipped with a fixed speed oil pump.

ON: (Style D/E/F) Variable Speed Oil Pump - Configures the program to operate the oil pump VSD, the oil heater and the following Solenoid Valves: Oil Return and Liquid Line (J compressors only) connected in parallel to TB 1-6 1.

OFF: (Style C) Fixed Speed Oil Pump - Configures the program to operate the fixed speed oil pump and the following solenoid valves: TB1-34 Liquid Line, TB1-61 Oil Return and Vent Line connected in parallel, TB1-62 High Speed Thrust.

3 - Prerun - Determines the duration of the system pre-lube period.

ON: Extended prerun system pre-lube period is 180 seconds in duration. Oil pump runs for 167 seconds.

OFF: Standard prerun. system pre-lube period is 50 seconds in duration. Oil pump runs for 37 seconds.

4 - Diagnostics - Enables or disables software diagnostics.

ON: Enables software diagnostics. Disables normal chiller operation.

OFF: Disables software diagnostics. Enables normal chiller operation.

5 - Auto-restart - Determines the course of action required to restart the chiller, if a power failure occurs while the chiller is running.

ON: Chiller will automatically restart when power is restored.

OFF: Requires a manual reset after power is restored. The chiller will not start until the operator moves the START-RUN-STOP/RESET rocker switch to the STOP/RESET position. If in local mode, the chiller can be restarted by initiating a local start. If in remote mode, the chiller will restart upon receipt of a remote start signal .

6 - Anti-recycle - Enables or disables the anti-recycle timer.

CAUTION

The anti-recycle timer must never be disabled unless it is absolutely necessary to do so during troubleshooting.

ON: Enables anti-recycle timer. solid state starter and electro-mechanical starter applications - Chiller cannot be started at intervals shorter than once every 30 minutes. VSD applications (JP37 Out) – Chiller can be started at the completion of system coastdown at intervals shorter than once every 10 minutes up to five times. On the fifth shutdown, a 10-minute timer is started and restart is inhibited until the timer has elapsed.

OFF: Disables anti-recycle timer. Chiller can be started at the completion of System Coastdown, regardless of how long the chiller had been running.

7 - Compressor Motor Variable Speed Drive - Motor/Power Line frequency application.

ON: 50Hz.

OFF: 60Hz.

8 - Chilled Water Pump operation - Determines Chilled Water Pump control contacts (I/O Board TB2-44/45) operation when chiller shuts down on various **CYCLING** shutdowns.

ON: Enhanced operation. Contacts open at completion of System Coastdown after all shutdowns except when it shuts down on LEAVING CHILLED LIQUID - LOW TEMPERATURE, MULTIUNIT CYCLING - CONTACTS OPEN AND SYSTEM CYCLING - CONTACTS OPEN.

OFF: Standard operation. Contacts open at completion of System Coastdown after all shutdowns except when chiller shuts down on LEAVING CHILLED LIQUID - LOW TEMPERATURE. On Low Water temp shutdowns, they remain closed, causing the pump to continue to run while the chiller is shutdown.

9 - Not Used.

10 - Not Used.

11 - Not Used.

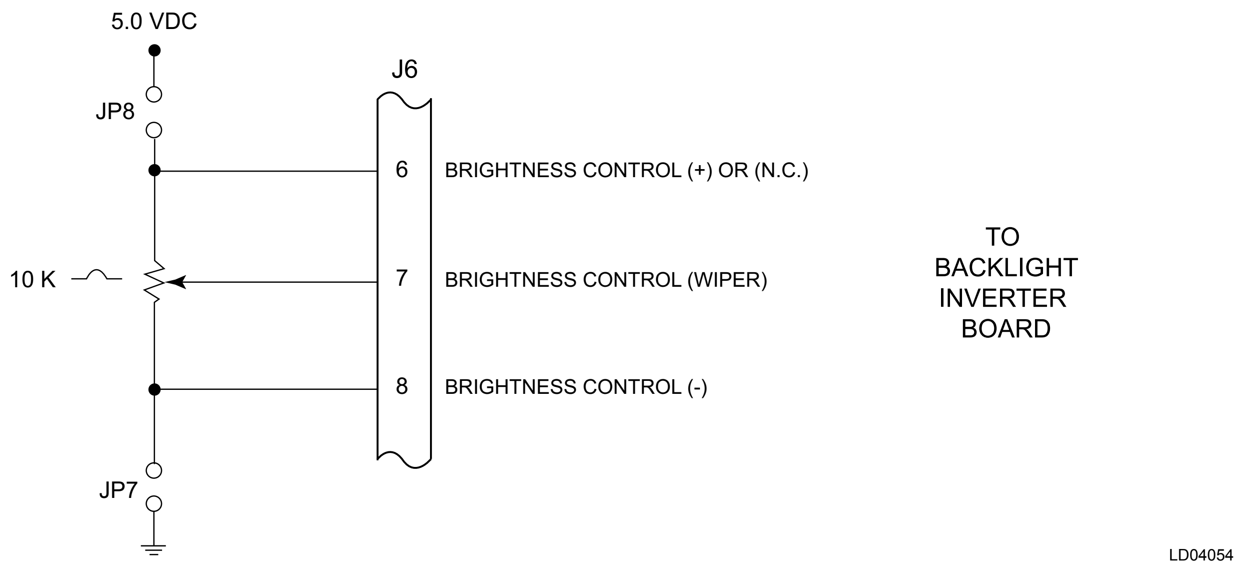
12 - Watchdog Protection -Used in conjunction with Program Jumper JP1 (see *Program Jumpers on page 42)* to enable/disable the program watchdog protection. With JP1 **IN,** this switch setting has no effect. With JP1 **OUT,** this switch setting determines whether the watchdog protection is enabled or disabled.

CAUTION

NEVER disable the watchdog protection! Severe compressor or chiller damage could result. The ability to disable the watchdog protection is provided for YORK factory testing only.

ON: Watchdog protection enabled.

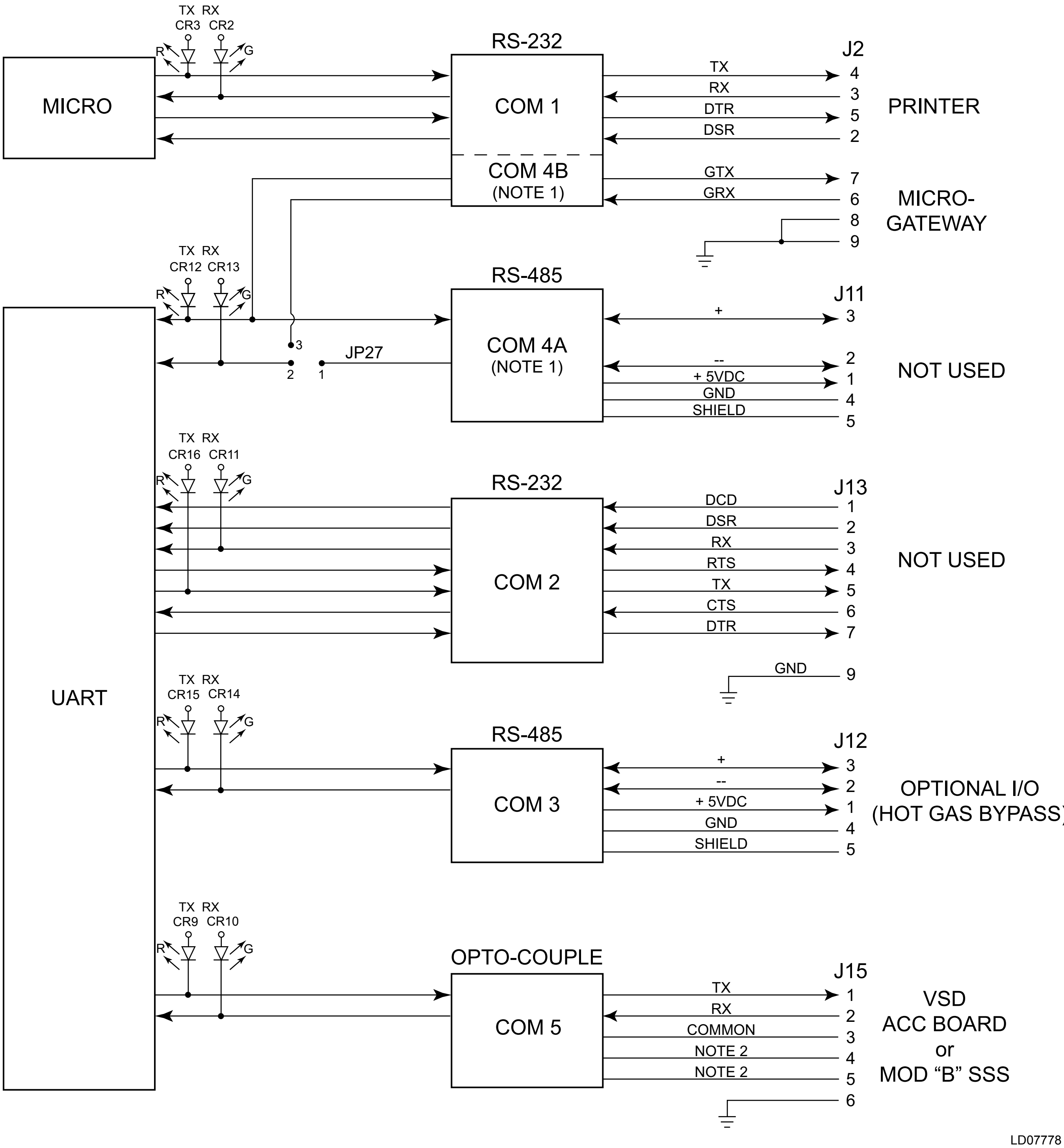
OFF: Watchdog protection disabled.



NOTES:

1. J6-6 not connected (N.C.) to Backlight Inverter Board when display is manufactured by Sharp or NEC.
2. The position of Program Jumpers JP7 and JP8 determine the output at J6-7; In = Variable Voltage; Out = Variable Resistance. Refer to Program Jumper Listing for applications.
3. Potentiometer is actually an integrated circuit that is the electrical equivalent of a 10KΩ potentiometer.

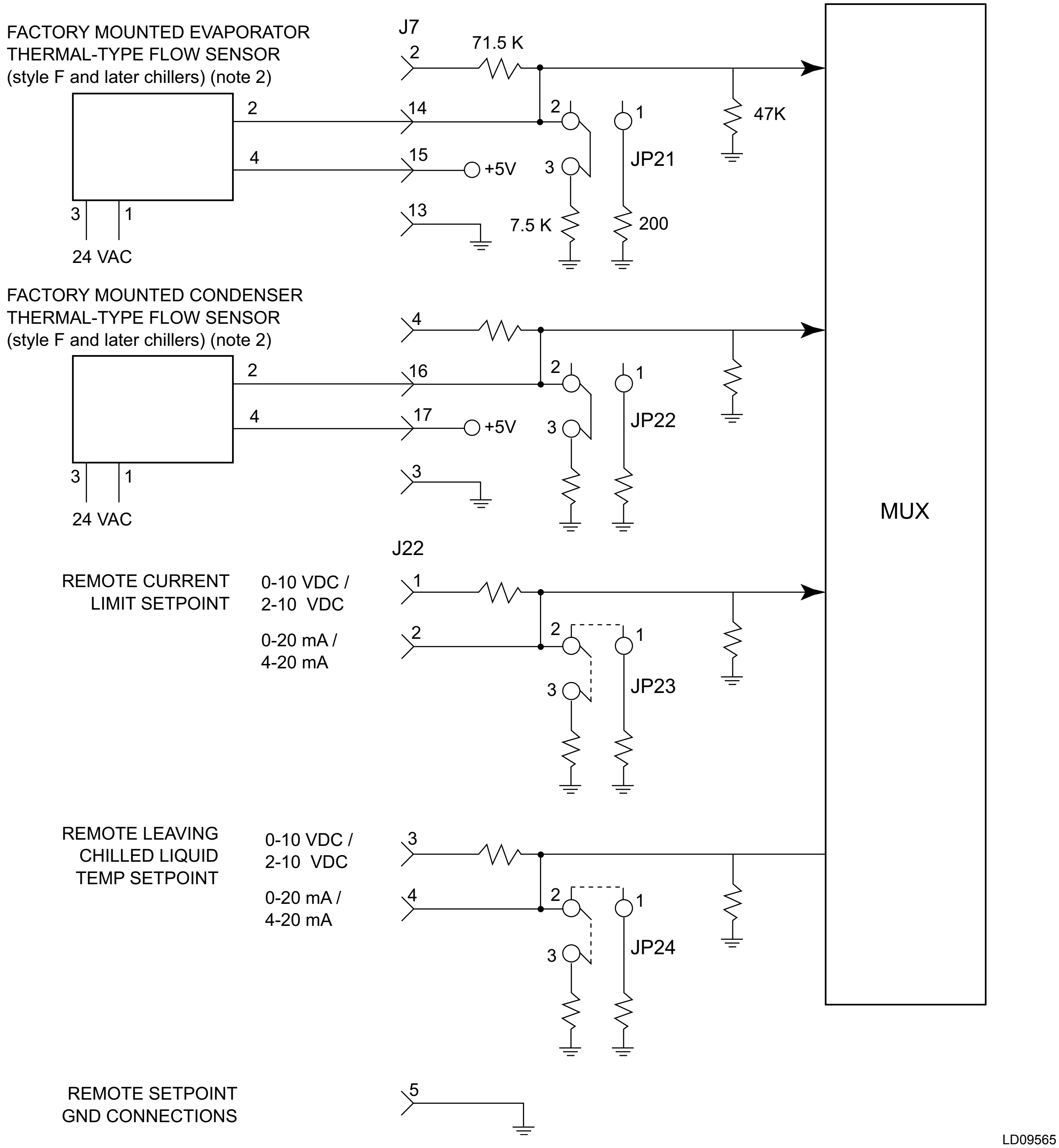
FIGURE 13 - MICROBOARD LAMP DIMMER CIRCUIT



NOTES:

1. Microboard Program Jumper JP27 determines whether COM 4A or 4B can be used. 1 and 2 - 4A, 2 and 3, 4B.
2. J15-4 Loop-Around Test IN. J15-5 Loop-Around Test OUT. See *Figure 115 on page 319* for details.

FIGURE 14 - MICROBOARD SERIAL DATA COMMUNICATIONS PORTS



NOTE:

1. Program Jumpers JP23 – JP24 must be positioned on pins 1-2 or 3-4 according to input signal type.
2. Applies to Flash memory card version C.MLM.01.07.xxx and later. Program Jumpers JP21 and JP22 must be on pins 2-3 on style F and later chillers equipped with factory-mounted thermal-type flow sensors.

FIGURE 15 - CONFIGURABLE ANALOG AND REMOTE SETPOINT INPUTS

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SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001

DESCRIPTION

Microboard 031-02430-000 is supplied in new production chillers from January 2004 to June 2006 (See *Figure 17 on page 66*). Although this board uses a different microprocessor and supporting components, chiller control and operator interface are the same as the previous 031-01730-000 Microboard. It uses the same mounting hole pattern and has the same interface connectors as the previous board, making it backward compatible to all previous YK OptiView Control Centers equipped with the 031-01730-000 Microboard.

After June 2006, new production YK chillers will be supplied with Microboard 03102430-001. This board is an upgraded version of the 031-02430-000 Microboard. Its physical dimensions, mounting and connections are the same as the 031-02430-000 Microboard. It is backward compatible to existing YK chillers using the 031-01730-000 or 031-02430-000 Microboards and is supplied as service replacement for these boards in kit 331-02430-601. The upgrade includes a larger BRAM (U38) and an additional RS-485 port on COM2 serial port (J13) for Modbus serial communications protocol to Variable Speed Drives. The details of the differences between the -000 board and -001 board are described in the respective areas of this section. These upgrades are necessary for the following applications that require RS-485 Modbus communications to the microboard:

- Medium Voltage Solid State Starter (MV SSS) and Medium Voltage Variable Speed Drive (MV VSD).
- New production Variable Speed Drives (VSD) after March 2007. With the VSD Modbus applications, the Adaptive Capacity Control (ACC) functionality is contained in the microboard and the ACC Board is not used.
- New production Style B LCSSS after mid 2008.

The board is supplied with +12 VDC (J1-3), -12 VDC (J1-4), +5 VDC (J1-1) and ground (J1-2) from the Power Supply (See *Figure 19 on page 67*). The -12 VDC is not used. The +5 VDC (fused by F1) can be monitored at TP3. It is applied to a +3.3 VDC regulator, +2.5 VDC regulator and used directly by the microboard circuits as the Vcc voltage. The outputs of these regulators are applied to Microboard circuits and can be monitored at TP2 and TP5 respectively. The +12 VDC (fused by F2) can be monitored at TP4. It is applied to a +5 VDC regulator and used directly by Microboard circuits. The output of the regulator is the +5 VDC (analog) supply that powers all analog circuits and is the source voltage for all transducers and thermistors. It can be monitored at TP10 as a 2.5 VDC value created by 1K Ohm resistors voltage divider circuit as shown.

Test Points

The power supply voltages can be measured at following test points: (See *Figure 19 on page 67*)

- TP1 GND
- TP2 +3.3 VDC
- TP3 +5 VDC
- TP4 +12 VDC
- TP5 +2.5 VDC
- TP10 +2.5 VDC

Boot-up Program

The BIOS (Basic Input Output System) EPROM (U37) contains the boot-up program. The YORK part number is 031-02429-001 and is used in both the 031-02430-000 and 031-02430-001 Microboards. It is available from the Baltimore Parts Distribution Center as a replacement part. The version is an alphanumeric code that identifies the application and the program revision level. The part number and version are printed on a label adhered to the surface of the EPROM. It is also displayed on the DIAGNOSTICS Screen in SERVICE access level.

The version is as follows:

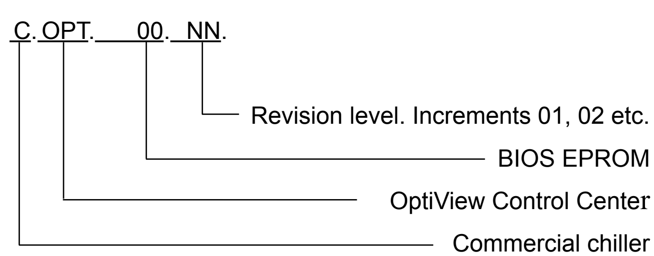


TABLE 4 - DIAGNOSTIC DISPLAY CODES

TEST	PASS CODE	FAIL ACTION	DISPLAY ON WHITE SCREEN
First init table complete	00	watchdog will cause reboot	No
SDRAM Regs. Configured	01	watchdog will cause reboot	No
Switch to Protected Mode	02	watchdog will cause reboot	No
Jump to 32-bit code	03	watchdog will cause reboot	No
Low memory test start	04	watchdog will cause reboot	No
Low memory test complete	P1	“F1” on display and halt	No
Full memory test complete	P2	“F2” on display and halt	No
FPGA configuration	05	“P2” will remain on LED display	No
Display Cont. Configured	06	“05” will remain on LED display	No
Flash Checksum Test	P3	“F3” will remain on LED display	Yes
BRAM test	P4	“F4” will remain on LED display	Yes
Flash Query Test	“passed”	“failed” and halt	Yes
Flash checksum	“passed”	“failed”, halt and display code = F3	Yes
BRAM Test	“passed”	“failed” and halt	Yes
MISCELLANEOUS CODES			
LED DISPLAY CODE		**DESCRIPTION**	
FF		FPGA Configuration Failed, trying again	
CH		Flash Checksum Test in progress	
AP		Application setup in progress	
CRITICAL CODES			
LED DISPLAY CODE		**DESCRIPTION**	
Ni		NMI handler invoked (should never occur)	
[ ]		GPF has occurred (should never occur)	

When power is first applied to the OptiView Control Center, a white screen is displayed while the boot-up is performed. During the boot-up, the program in the BIOS EPROM configures the microprocessor and related components and performs testing of certain components to ensure those components are operational.

The sequence of events in the boot-up process are listed in the *Table 4 on page 50*. The progress and pass/fail status of each step is displayed on the microboard 7-segment LED Display (U22). Due to the speed at which the boot-up proceeds, not all steps will be visible during the process. Not all pass/fail status is displayed on the white screen.

Chiller Operating Program

The Chiller Operating Program is a set of instructions to control the chiller. It contains the Safety and Cycling shutdown thresholds (non-changeable) and display screen messages and graphics.

The chiller operating program is stored in a non-removable Flash Memory Chip (U35) that is soldered to the microboard. New chillers are supplied programmed with the latest program available at the time of manufacture. The program version that is currently residing in the microboard Flash Memory Chip is displayed on the DIAGNOSTICS Screen in SERVICE access level.

The on-board program can be upgraded by downloading the latest version from a Program card using the procedure in the Service Replacement section of this manual.

Program Card

The on-board program can be upgraded by downloading the latest program version from a program card. This is a 2-1/8 x 3-3/8 x 1/8 in. plastic card weighing 1.1 oz (See *Figure 18 on page 67*). It is a portable memory storage device that is programmed with the chiller operating program. The program card part number for YK chillers is 031-02474-001 and is available from the Baltimore Parts Distribution Center (PDC). There is a Program card for each chiller type (YT, YK, YS, YR, YD, etc) and each has a unique part number. A label affixed to the Program card contains the part number and version. The version is an alpha-numeric code that identifies the chiller model applicability, language package, language package revision level and chiller operating program revision level.

The Program card is applicable to both NEMA and CE applications. The Program card for YK chillers has English, Simplified and Traditional Chinese, French, Portuguese, Spanish, Italian, German and Hungarian languages.

The program version that is currently residing in the microboard Flash Memory Chip is displayed as the "Controls" Software Version on the DIAGNOSTICS Screen in SERVICE access level.

The Program card obtained from the PDC is programmed with the latest version of the chiller operating program. Program cards can be reprogrammed.

A Program card for a particular chiller type can be used to re-program other chillers of the same type. For example, it is not necessary to have more than one YK Program card. A single YK card can be carried to different locations to re-program other YK OptiView Control Centers.

A Write Protect Switch on the edge of the Program card prevents inadvertent writing to the Card during program downloading.

Handling precautions for the Program card include:

- Do not allow dirt to enter connector
- Carry in protective sleeve
- Storage temperature range is -20 to 65°C (-4 to 149°F)

A label adhered to the Program card contains the version and YORK part number. The version is an alphanumeric code that identifies the chiller model applicability, language package, language revision level and chiller control revision level. The version is as follows:

C.OPT.nn.nn.nnn

- Language Package revision level (00,01,etc)
- Language Package (0=English only, 1=NEMA, 2=CE, 3=NEMA/CE)
- Controls Revision Level (00, 01, 02, etc)
- Chiller Model (01=OM, 02=YT, 03=YS, 05=YR, 11=YD)
- OptiView Control Center
- Commercial Chiller

The Program card is inserted into connector U33 to download a program. Refer to instructions under Service Replacement below.

Program Download Connector U33

A Program card is inserted into connector U33 to download a program. A protective cover prevents dirt from entering this connector.

! NOTE

IMPORTANT! ***The protective cover must be in place at all times when not performing a program download. If dirt accumulates inside this connector, re-programming will not be successful.***

Parallel Port Connector

Parallel port connector J4 is for future use. It is presently not supported.

BRAM (U38)

The BRAM (battery backed random access memory) memory device contains a battery that preserves the stored data during power failures. All of the programmed Setpoints, Sales Order Data, History Data, Time of Day and Calendar Data is stored here. The YORK Part number is printed on a label adhered to the surface of the BRAM. It is available from the Baltimore Parts Distribution Center as a replacement part.

The part number of the BRAM (U38) in the 031-02430–000 board is 031-02431-000 and its size is 32KB. It is installed in a 28-pin socket. Program Jumper JP14 is a non-removable (soldered) wire jumper that connects DC power to the appropriate pin on the BRAM for 32KB operation.

The part number of the BRAM (U52) in the 031-02430–001 board is 031-02565-000 and its size is 128KB. It is installed in a 32-pin socket. Program Jumper JP14 is a removable 2-pin shunt type jumper. The 128KB BRAM requires the shunt be NOT INSTALLED and the board is supplied in this configuration. If the shunt is installed on JP14, it would apply DC power to an incorrect pin on the 128KB BRAM and the board would not function. The 128KB BRAM is required for MV SSS, MV VSD, and those VSD that communicate with the microboard using Modbus serial communications protocol.

The 031-02430–001 board with 128KB BRAM requires software that has “BRAM size detect” capability. If it does not have this capability, the board will not function. YK chiller software version C.OPT.01.15.xxx (and later) has this capability and is required.

When replacing a 031-02430-000 Microboard with a 031-02430-001 Microboard in applications other than MV SSS, MV VSD and VSD Modbus, the smaller BRAM from the 031-02430-000 board can be transferred to the 031-02430-001 Microboard. See BRAM transfer exception in Microboard Service Replacement later in this section.

Watchdog Circuit

The Watchdog circuit performs two functions as follows:

- Power failure detection
- Program latch-up detection/prevention

The Watchdog Circuit monitors the +5 VDC from the power supply and the +3.3 VDC from the onboard regulator to determine when a power failure is occurring. If the +5 VDC decreases to the threshold of (+4.75 VDC to 4.5 VDC) or the +3.3 VDC decreases to the threshold of (3.04 VDC to 2.8 VDC), a reset is issued to the microprocessor and the chiller shuts down. When power is restored, the white screen is displayed and the boot-up is performed as described above. When the graphic screen is displayed, the message CONTROL PANEL – POWER FAILURE is displayed.

The Watchdog Circuit also ensures that the entire program is being executed and that the program has not latched-up, bypassing important safety checks. The Watchdog circuit is a timer that times-out if not given a reset pulse within its time-out period (1 to 2.25 seconds). To prevent a time-out, the microprocessor sends a reset pulse to the Watchdog circuit every time the complete program has been executed. Since it takes less than 1 second to perform the entire program, the Watchdog circuit doesn’t time-out under normal operation. However, if the entire program is not executed or something prevents the microprocessor from sending the reset pulse as described below, the Watchdog circuit times-out and sends a reset to the microprocessor, initiating a re-boot. If running, the chiller shuts down. The display momentarily blanks and white screen is displayed while the boot-up program executes as described above. When the graphic screen is displayed, either of two messages is displayed depending on the type of Watchdog shutdown as explained below.

There are two different watchdog initiated shutdowns; a HARDWARE watchdog initiated shutdown and a SOFTWARE watchdog initiated shutdown.

In the HARDWARE watchdog initiated shutdown, a program problem, on-board noise or hardware problem could prevent the watchdog time-out. If this occurs, a re-boot is initiated and when the graphic screen is displayed, CONTROL PANEL – POWER FAILURE is displayed.

In the SOFTWARE watchdog initiated shutdown, the program intentionally initiates the reboot because it has detected program interruption. After the re-boot, WATCHDOG – SOFTWARE REBOOT is displayed on the graphic screen.

Program Jumpers/Program Switches

The Program Jumpers and Program Switches are used to alter the program operation or configure the microboard hardware for specific operation. This allows the Program and Microboard to be universal for all standard applications. See *SECTION 3 - MICROBOARD 031-01730-000* and *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* for the function of each jumper and switch. The position of some jumpers can be determined by the Service technician to meet the desired operation. Others must be positioned according to the requirements of the size, type or style of components and thus are determined by the YORK factory. The jumpers are plastic sleeves with metal inserts that are inserted over 2-prong or 3-prong conductors. The Program Switches are miniature switches that are placed in either the ON or OFF position.

Keypad Interface

The keypad is read via J18. The keypad is a matrix of conductors arranged in rows and columns (See *Figure 50 on page 124 and Figure 51 on page 125*). There are 4 rows and 8 columns. When a key is pressed, the conductors are pressed together at that point, creating continuity between the row conductor and the column conductor. The keypad is read by applying a logic low to a row while leaving +5 VDC pull-up on all other rows. The microprocessor then reads the 8 columns. If any column has a logic low on it, the key corresponding to that coordinate (row, column) is being pressed. The microprocessor reads the entire keypad by repeating this routine beginning with row 1 and ending with row 4. The entire keypad is continually read while the Control Center is powered. See *SECTION 10 - KEYPAD* of this manual for details of the keypad.

CM-2 Board or Style A Solid State Starter Interface

The microboard retrieves certain operating parameters (via J10) from the compressor motor starter control board (CM-2 Current Board for Electromechanical Starter or Style A Solid State Starter Logic Board). See the appropriate section of this manual for detailed explanation of each board. Both boards contain an 8 channel multiplexer. The microprocessor sequentially and continually reads channels 0 through 7. It reads each channel by applying a 3-bit binary address to the multiplexer. A 0 to 5 VDC analog value is returned from each channel. The function of each is in the table below.

The microprocessor determines which board, and therefore which starter is present, by the value returned from channel 0. Since channels 0 through 6 are grounded, the CM-2 board returns a 0 VDC value. The Solid State Starter Logic Board returns a value greater than 0.41 VDC to +5 VDC. If the value is less than 0.4 VDC, it indicates the starter is an Electromechanical (EM) starter and the microprocessor then reads channel 7 to retrieve the peak motor current value. A value greater than 0.4 VDC indicates the starter is an A style Solid State Starter and the microprocessor reads channels 1 through 7.

In the Solid State Starter, channel 0 indicates the starter size (model) and voltmeter range (300 VAC or 600 VAC). Channel 1 is a hardware generated 100% FLA (prevents pre-rotation vanes from further opening) or 104% FLA (closes pre-rotation vanes until motor current is less than 102%) current limit override command that overrides normal Pro-rotation Vanes control. Channels 2 through 4 are analog voltages that represent phase A, B and C motor current. The highest phase is Channels 5 through 7 are analog voltages that represent phase A, B and C Line Voltage. The data for each channel is shown on the below.

TABLE 5 - MULTIPLEXER CHANNELS

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
CM-2	GND	GND	GND	GND	GND	GND	GND	Peak Motor Current (%FLA)
STYLE A SOLID STATE STARTER	Starter model/ voltmeter range	Current limit command	Phase C motor current	Phase B motor current	Phase A motor current	Phase A line voltage	Phase B line voltage	Phase C line voltage

Style B Solid State Starter Interface

Prior to June 2006, new production starters communicate with Microboard 031-02430-000 via the Opto-coupled COM5 serial data port (J15) using YORK proprietary protocol. The serial data is represented by +5 VDC and 0 VDC logic levels. TX data to the starter is at J15-1. RX data from the starter is at J15-2. Between June 2006 and mid 2008, new production chillers communicate with Microboard 031-02430-001 using the same protocol.

After mid 2008, new production Starters communicate with Microboard 031-02430-001 via COM 2 serial port (J13) using RS-485 Modbus protocol (requires software version C.OPT.01.18.307 or later). COM 2 serial port is selectable between RS-232 and RS-485 with Program Jumper JP17. It must be positioned on pins 1 and 2 to select RS-485 serial port operation. To allow Microboard 031-02430-001 to be used as service replacement for 031-01730-000 or 031-02430-000 boards non-modbus applications in the field, the COM 5 serial port is retained on the 031-02430-001 board.

With Microboard 031-02430-001 and software version C.OPT.01.18.307 (or later), when SSS-Mod B is selected as the motor drive type on the SETUP Screen, additional setpoints must be entered on this screen. The appropriate serial port (COM 2-Modbus or COM 5 YORK) must be enabled using the Motor Communications Protocol setpoint. The selections are Modbus or "YORK". When Modbus is selected, the Motor Node ID setpoint must be set to match the setting of the Starter Logic/Trigger Board Modbus Address Switch SW1. They must be both be set to "1".

See *Figure 21 on page 69* and *SECTION 13 - SOLID STATE STARTERS* for details of the solid state starter interface.

Variable Speed Drive Interface

Prior to June 2006, new production Variable Speed Drives communicate with Microboard 031-02430-000 via the Opto-coupled COM5 serial data port (J15) using a YORK proprietary protocol. The serial data is represented by +5 VDC and 0 VDC logic levels. TX data to the starter is at J15-1. RX data from the starter is at J15-2. Between June 2006 and March 2007, new production VSD communicate with Microboard 031-02430-001 using the same interface/protocol.

After March 2007, new production Variable Speed Drives communicate with Microboard 031-02430-001 via COM2 serial data port (J13) using RS-485 Modbus protocol. Software version C.OPT.01.16.xxx (or later) is required for COM2 Modbus operation. COM2 serial port is selectable between RS-232 and RS-485 with Program Jumper JP17. It must be positioned on pins 1 and 2 to select RS-485 serial port operation. With the VSD Modbus applications, the Adaptive Capacity Control (ACC) functionality is contained in the microboard and the ACC Board is not used.

To allow Microboard 031-02430-001 to be used as service replacement for 031-01730-000 or 031-02430-000 boards non-Modbus applications already in the field, the COM5 serial port is retained on the 031-02430-001 board.

With Microboard 031-02430-001 and software version C.OPT.01.16.xxx (or later), when "VSD-60Hz" or "VSD-50Hz" is selected on the SETUP Screen as the Motor Drive Type, additional setpoints must be entered on this Screen. The appropriate serial port (COM2-Modbus or COM5-YORK) must be enabled using the Motor Communications Protocol setpoint. The selections are Modbus or "York". When Modbus is selected, the Motor Node ID setpoint must be set to match the setting of the VSD Logic Board Modbus Address Switch SW3. They must be both set to "1".

There are two different types of Modbus protocol used, ASCII Mod D/Vyper and RTU Raptyr. With software version C.OPT.01.23.307 (and later), when VSD – 60Hz or 50Hz is selected for the Motor Drive Type setpoint on the SETPOINTS Screen, the microboard will poll on COM 2 alternating between the two protocols until one of them responds or until an initialization fault occurs. Once a valid response is received from either VSD type, the microboard will "remember" this, even after a power failure. This allows the correct screens to be displayed after a power failure, without repeating the poll interrogation. As long as the Motor Drive Type is not changed, once the microboard determines which VSD type is connected, it will not poll for the other. Only after a change of the Motor Drive Type setpoint, will the alternating between the two types be done again to determine the connected type.

See *Figure 21 on page 69* and *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* for details of the variable speed drive interface.

Medium Voltage Solid State Starter (MV SSS) and Medium Voltage Variable Speed Drive Interface (MV VSD)

These drives communicate with the microboard via the COM2 RS-485 Modbus serial port (J13). COM2 serial port is selectable between RS-232 and RS-485 with Program Jumper JP17. It must be positioned on pins 1 and 2 to select RS-485 serial port operation. See *Figure 21 on page 69* and *Medium Voltage Solid State Starter – Service (Form 160.00-M5) and Medium Voltage Variable Speed Drive – Service (Form 160.00-M6)* for details of this interface. Microboard (P/N 031-02430-001) is required for these applications. Software version C.OPT.01.15.xxx (or later) is required for MV SSS. Software version C.OPT.01.16.xxx (or later) is required for MV VSD. When the MV SSS or MV VSD is selected on the SETUP Screen, the COM2 serial port with Modbus protocol is automatically enabled. With the MV VSD, the Adaptive capacity Control functionality is contained on the microboard.

Printer Interface

An optional printer can be connected to COM1 RS-232 serial data port (J2). TX data to the printer is at J2-4. The DSR (Data Set Ready or busy) signal from the printer is at J2-2. Signal levels are standard RS-232. The microboard sends data to the printer at the selected baud rate until the printer buffer becomes full, whereupon the printer asserts its Busy signal. The microboard suspends data transmission until the printer can accept more data. Each printer must be setup/configured to operate properly with the microboard. The Baud, Data Bits, Parity and Stop Bits must be programmed on the COMMS Screen. Other printer setup is performed on the Printer Screen. Refer to *OptiView Control Panel – Operation (Form 160.54-O1)* for details of available printers and printer setup instructions.

E-Link Gateway Interface

An optional E-Link Gateway printed circuit board can be connected to the COM 4B RS-232 serial data port (J2). TX data to the E-Link Gateway is at J2-7. RX data from the E-Link Gateway is at J2-6. Signal levels are standard RS-232. The E-Link Gateway polls system pressures, temperatures and status from the microboard. It holds it for retrieval by third-party devices. See *SECTION 19 - COMMUNICATIONS* of this manual.

Digital inputs

The I/O Board converts the 115 VAC inputs to logic level inputs for the microboard at J19. A 115 VAC input to the I/O Board is converted to a logic low (less than 1 VDC). A 0 VAC input to the I/O Board is converted to a logic high (greater than 4 VDC). See *SECTION 6 - I/O BOARD* of this manual for details of the I/O Board.

Digital Outputs

The microboard controls 115 VAC relays and solenoids via the I/O Board (via J19). The I/O Board contains +12 VDC relays that isolate the microboard low voltage circuits from the 115 VAC device coils. Solid state switching devices are used to control the relays. The microboard energizes the +12 VDC relays by applying a ground to the coil input. They are de-energized by opening the ground path. The contacts of these relays switch 115 VAC to system relays and solenoids. The outputs that control the chilled liquid pump and compressor motor starter have anti-chatter (anti-recycle) timers associated with them. The output that controls relay K0 is not allowed to change at a rate greater than once every 10 seconds. The output that controls relay K13 is not allowed to change at a rate greater than once every 20 seconds.

The microboard controls actuator motors via Triacs on the I/O Board. Each actuator has an open winding and a close winding. Current flowing through a winding causes the actuator to rotate in the respective direction. Each winding is controlled by a Triac. The Triac is turned ON to allow current to flow through a winding. The microboard turns on the Triac by applying a logic low (less than 1 VDC) to the Triac driver on the I/O Board. It turns it OFF by applying a logic high (greater than 4 VDC). See *SECTION 6 - I/O BOARD* of this manual for details of the I/O Board.

Analog Inputs

System pressures, in the form of analog DC voltages, are input from Pressure Transducers. See *SECTION 20 - PRESSURE TRANSDUCERS* of this manual. Formulas and graphs are included to calculate the expected transducer output voltage for a given pressure input.

System temperatures, in the form of analog DC voltages, are input from thermistors. See *SECTION 21 - TEMPERATURE THERMISTORS* of this manual. Included are tables to convert the expected output voltage for any temperature applied to the thermistor.

Style "F" (and later) chillers are supplied with factory-mounted Flow Sensors on the evaporator and condenser. These are electronic thermal-type sensors. The operating principle of the sensor is thermal conductivity. It uses the cooling effect of a flowing liquid to sense flow. The temperature of the heated sensor tip is sensed by a thermistor located in the tip. A second thermistor, located higher in the tip in a non-heated area, is only affected by changes in liquid temperature. The temperatures sensed by the thermistors are compared. Flowing liquid carries heat away from the heated sensor tip, lowering its temperature. The higher the flow rate, the lower the tip temperature and therefore a lower differential between thermistors. Lower flow rates remove less heat from the tip allowing a higher tip temperature. The lower the flow, the greater the differential between thermistors. The sensor is vendor-calibrated to turn ON its output at a flow rate of 20cm (0.6 ft.)/second. This is the setpoint.

There are 11 LED's on the sensor that reflect the measured flow rate. The center located amber LED illuminates at the setpoint flow rate (and above). The 4 LED's to the left of the amber reflect flow rates below the setpoint. The 6 LED's to the right of the amber reflect flow rates above the setpoint. As the flow rate decreases from the setpoint, the LED display moves to the left. As the flow rate increases above the setpoint, the LED display moves to the right.

The sensor operates from a 24 VAC power source and has a solid state relay output. On each sensor, one side of the solid state relay (pin 4) is connected to +5 VDC on the microboard and the other side (pin 2) is connected to an Analog Input of the microboard (See *Figure 77 on page 175 and Figure 24 on page 72*). After power is applied, there is a thermal warm-up period of up to 20 seconds. During this time, the output could be unstable. When the setpoint (or greater) flow rate is sensed, the solid state relay output is turned ON causing it to conduct current through the 7.5K ohm Microboard load resistor to the +5 VDC. This applies greater than +4 VDC to the microboard input. When a flow rate less than the setpoint is sensed, the solid state relay output is turned OFF, resulting in no conduction through the load resistor. This applies less than 1 VDC to the microboard input. To determine the state of the solid state relay, first confirm that +5 VDC is present at pin 2 of the flow sensor. Then connect a voltmeter between the microboard TP1 (GND) and the respective flow sensor input to the microboard.

The software accommodates either the Paddle type sensors connected to the TB4 of the I/O Board or the Thermal type sensors connected to either J7 or J14 on the microboard. The actual connection point of the Thermal type sensors to the microboard is determined by the chiller vintage (See *Figure 77 on page 175 and Figure 24 on page 72*). On new production chillers before June 2009, they are provided connected to the microboard J7. On new production chillers after June 2009, they are provided connected to the microboard J14. To ensure that the program reads the correct input, the Flow Switch setpoint on the OPERATIONS Screen must be set appropriately as explained in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* .

Serial Data Ports

Microboard 031-02430-000 is equipped with 6 serial data ports. Microboard 031-02430-001 is equipped with 7 serial ports. See *Figure 21 on page 69*. Each port is dedicated for a specific function as follows:

A. COM1 (J2) – RS-232. Printer.

B. COM2 (J13) – RS-232 on Microboard 031-02430-000. RS-232 or RS-485, as selected with Program Jumper JP17 on Microboard 031-02430-001. The RS-485 port is used for Modbus communications to the Liquid Cooled Solid State Starter, Medium Voltage Solid State Starter, Medium Voltage Variable Speed Drive and Variable Speed Drives. The RS-232 port is not used.

C. COM3 (J12) – RS-485. Hot gas bypass, Heat Recovery, Head Pressure Control, Motor Monitoring.

D. COM4 (4A-J11), (4B-J2) – This port is actually two ports. However, they cannot be used simultaneously. The position of program jumper JP27 determines which port can be used. COM4A – RS485 not used. COM4B – RS-232 E-Link Gateway.

E. COM5 (J15) – Opto-coupled transmit/receive. VSD Adaptive Capacity Control Board or Style B Solid State Starter.

Each port is equipped with two LED's. A red TX LED illuminates as data is transmitted to or requested from another device. A green RX LED illuminates as data is received from another device. The RS-232 voltages are industry standard +5 to +25 VDC and -5 VDC to -25 VDC logic levels. The RS-485 voltages are industry standard 0 VDC and +1.5 to +5 VDC logic levels. COM5 logic levels are 0 VDC and +5 VDC. A diagnostic test can be performed on each serial port to confirm proper operation. See Diagnostics *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

The LED's and their functions are as follows:

- CR2 RX6 – Not used. Future COM6 serial port receive data.
- CR3 TX6 – Not used. Future COM6 serial port transmit data.
- CR4 RX1 – COM1 serial port receive data.
- CR5 TX1 – COM1 serial port transmit data.
- CR13 TX4 – COM4 serial port transmit data.
- CR14 RX4 – COM4 serial port receive data.
- CR15 TX3 – COM3 serial port transmit data.
- CR16 RX3 – COM3 serial port receive data.
- CR17 RX2 – COM2 serial port receive data.
- CR18 TX2 – COM2 serial port transmit data.
- CR19 RX5 – COM5 serial port receive data.
- CR20 TX5 – COM5 serial port transmit data.

Display Interface

The graphic screens displayed on the Liquid Crystal Display are created from the program downloaded from the Program card and stored in the Flash Memory Chip. The data to form these screens is output from J5. This data is in the form of red, green and blue drive signals applied to each of the 303,200 display pixels arranged in a matrix of 640 columns x 480 rows. Each pixel consists of 3 windows; red, green and blue, through which a variable amount of light from the Display Backlight, is permitted to pass to the front of the display. The drive signals determine the amount of light permitted to pass through each window. The overall pixel color is a result of the gradient of red, green and blue light allowed to pass. The drive signal for each pixel is an 18 bit binary word; 6 for each of the 3 colors. The greater the binary value, the more light is permitted to pass. The pixels are driven sequentially from left to right, beginning with the top row. To coordinate the drive signals and ensure that the pixels in each row are driven from left to right and the columns are driven from top to bottom, the drive signals are accompanied by a clock and horizontal and vertical sync signals.

During the boot-up, the program in the BIOS EPROM reads wire jumpers PID0 through PID3 on the Display Interface Board to determine the manufacturer of the display. Each display manufacturer requires a slightly different control. The program in the BIOS EPROM configures the microboard for correct operation for the actual display installed.

Different display manufacturers require different supply and control voltages for their displays and backlights. Program Jumpers JP2 through JP5 and JP7 and JP8 must be configured to provide the required supply and control voltages to the display and backlight control. *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* lists the required program jumper configuration for each display. Also, a label attached to the display mounting plate lists the required program jumper configuration for that display. The position of program jumper JP2 determines whether the supply voltage is +5 VDC or +3.3 VDC.

The microboard controls the Display Backlight via J6. The Display Backlight is the light source for the display. The Backlight Inverter Board provides a high voltage AC power source for the lamp. It converts low voltage DC via J6-1 (+12 VDC or +5 VDC, depending on position of Program Jumper JP5) to high voltage AC (500 to 1500 VAC). This high voltage AC is applied to the lamp to cause it to illuminate. The Backlight is turned ON and OFF with the "Backlight Enable" signal (J6-5). The position of Program Jumper JP4 determines whether this is a +12 VDC or +5 VDC signal. In some displays, the backlight turns ON when this signal transitions from low to high; others turn OFF when it transitions from high to low. The position of Program Jumper JP3 determines the transition that will occur when the microboard outputs the Backlight Enable signal. JP3 must be positioned according to the display manufacturer's requirement.

Under Program control, the microboard controls the backlight brightness via the Lamp Dimmer circuit output at J6-7. In order to extend the life of the Backlight lamp, the brightness is driven to 50% after 10 minutes of Keypad inactivity. At this brightness level, the graphics are still visible. When Keypad activity is detected (a key is pressed), the lamp is driven back to full (100%) brightness. Some display manufacturers require a variable voltage to vary the brightness; others require a variable resistance. Program Jumpers JP7 and JP8 must be configured to enable the appropriate technique. The Lamp Dimmer is an integrated circuit that is the electrical equivalent of a 10K ohm potentiometer with 100 positions or steps (See *Figure 20 on page 68*). The Lamp Dimmer controls the position of the potentiometer. The Lamp Dimmer varies the brightness of the backlight by applying a variable voltage (0 to 5.0 VDC) or a variable resistance (0 to 10K ohms) to the Backlight Inverter Board. If Program Jumpers JP7 and JP8 are installed, the Lamp Dimmer output is a variable voltage; if both are removed, the output is a variable resistance. The Lamp Dimmer outputs “Brightness Control Wiper” (J6-7) to the Backlight Inverter Board. If configured for variable voltage output, the voltage between J6-7 and J6-8 can be varied from 0 VDC (100% brightness) to 5.0 VDC (0% brightness). If configured for variable resistance, the resistance between J6-6 and J6-7 varies from 0 ohms (0% brightness) to 10K ohms (100% brightness).

See *SECTION 7 - LIQUID CRYSTAL DISPLAY*, *SECTION 8 - DISPLAY INTERFACE BOARD*, and *SECTION 9 - DISPLAY BACKLIGHT INVERTER BOARD* of this manual for details of the display interface.

Remote Setpoints

Remote Leaving Chilled Liquid Temperature and Current Limit setpoints can be input via the RS-232 E-Link Gateway interface at J2 or directly to the microboard at J22 (See *Figure 22 on page 70*). The inputs at J22 are configured with Program Jumpers JP23 and JP24 to accept these inputs in either 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA form. See *Program Jumpers* for configurations and *SECTION 22 - REMOTE SETPOINTS* of this manual for details of the Remote setpoints.

CONFIGURATION AND SETUP

The following functions are entered as setpoints on the SETUP Screen. See entry instructions in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

Chilled Liquid Pump Operation – Determines Chilled Liquid Pump control contacts (I/O Board TB2-44/45) operation when chiller shuts down on cycling shutdowns. Selections are:

1. *Standard* – Contacts open at completion of System Coastdown after all shutdowns except LEAVING CHILLED LIQUID – LOW TEMPERATURE. On this shutdown, they remain closed, causing the pump to continue to run while the chiller is shutdown.
2. *Enhanced* – Contacts open at completion of System Coastdown after all shutdowns except LEAVING CHILLED LIQUID – LOW TEMPERATURE, MULTI-UNIT CYCLING- CONTACTS OPEN and SYSTEM CYCLING – CONTACTS OPEN. On these shutdowns, they remain closed, causing the pumps to continue to run while the chiller is shutdown.

Motor Drive Type – Configures the program for the applicable compressor motor drive type. Selections are:

1. *EM* – Electromechanical Starter
2. *SSS-Mod A* – Style A Solid State Starter
3. *SSS-Mod B* – Style B Solid State Starter
4. *VSD-60Hz* – Variable Speed Drive, 60Hz
5. *VSD-50Hz* – Variable Speed Drive, 50Hz
6. *MV VSD* – 60Hz (Microboard 031-02430-001 with software version C.OPT.01.16.xxx (or later)
7. *MV VSD* – 50Hz (Microboard 031-02430-001 with software version C.OPT.01.16.xxx (or later)
8. *MV SSS* – (Microboard 031-02430-001 with software version C.OPT.01.15.xxx (or later)

Anti-recycle – Enables or Disables the Anti-recycle timer. Selections are:

1. *Enabled* – Enables the anti-recycle timer. Solid State Starters and electromechanical starter applications cannot be started at intervals shorter than once every 30 minutes. VSD applications can be started at the completion of System Coastdown up to 5 times. On the 5th shutdown, a 10-minute timer is started and restart is inhibited until the timer has elapsed.
2. *Disabled* – Disables the anti-recycle timer. Chiller can be started at the completion of System Coastdown, regardless of how long the chiller had been running.

CAUTION

The Anti-recycle timer must never be disabled unless advised by YORK factory.

Power Failure Restart – Determines the course of action required to restart the chiller, if a power failure occurs while the chiller is running. Selections are:

1. *Manual* – Requires a manual reset after power is restored. The chiller cannot be started until the operator moves the keypad Start-Run-Stop/Reset rocker switch to the stop/reset position.
2. *Auto* – Chiller will automatically restart when power is restored.

Coastdown – Determines the "Coastdown" duration (oil pump run duration after shutdown) and whether the "Motor Controller – Loss of Current" check and anti-recycle function is performed while the chiller is running. Selections are:

1. *Standard* – Electric motor applications. With software version C.OPT.01.14.306 (and earlier), when STANDARD is selected, the coastdown duration is 150 seconds. With software version C.OPT.01.16.307 (and later), when STANDARD is selected, the Coastdown Time setpoint appears. (See *Coastdown Time on page 60*). This setpoint is used to set the duration over the range of 240 (default) to 900 seconds or 150 (default) to 900 seconds as determined by the selection made for the Chiller Style/Compressor setpoint (on the OPERATIONS Screen).
2. *Enhanced* – "Coastdown" is 15 minutes in duration. Steam Turbine applications. "Motor Controller - Loss of Current" check and anti-recycle function is not performed since there is no motor current.

Pre-run – Determines the duration of the "System Prelube" period. Selections are:

1. *Standard* – "System Pre-lube" is 50 seconds in duration.
2. *Extended* – "System Pre-lube" is 180 seconds in duration.

Oil Pump Package – Configures the program for either Variable Speed Drive Oil Pump or Fixed Speed Oil Pump. Chillers equipped with the Variable Speed Drive Oil Pump have a Program controlled Oil Heater and a different complement of solenoid valves than chillers equipped with a Fixed Speed Oil Pump. A description of the two Oil Pumps is as follows:

1. *Variable Speed* (style D and later) – configures the program to operate the Variable Speed Drive Oil Pump, the Oil Heater (maintains oil temperature 50°F above condenser saturation temperature) and the Oil Return and Liquid Line (J compressors only) solenoid valves are connected in parallel to TB1-61.
2. *Fixed Speed* (style C) – Configures the program to operate the fixed speed Oil Pump and the following solenoid valves:
   - TB1-34 Liquid Line
   - TB1-61 Oil Return and Vent Line connected in parallel
   - TB1-62 High Speed Thrust

Motor Communications Protocol (VSD applications – Software version C.OPT.01.16.307 or later). (Style B Liquid Cooled Solid State Starter applications – Software version C.OPT.01.18.307 or later).

Only displayed when Motor Drive Type setpoint above is selected as "VSD-60Hz", "VSD-50Hz" or "SSS-Mod B". Allows the Service technician to enable the appropriate serial communications port for communications with the Style B Liquid Cooled Solid State Starter (LCSSS) or Variable Speed Drive (VSD). Early vintage Style B LCSSS and VSD communicate with the microboard using YORK protocol (COM 5 (J15)). Later vintage units use Modbus protocol (COM 2 (J13)).

The protocol selection enables the appropriate communications port:

- YORK enables COM 5 (J15)
- Modbus enables COM 2 (J13)

Selection required is based on the hardware and interface that is present. See *SECTION 13 - SOLID STATE STARTERS* and *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* to determine which hardware/interface is present. The chiller must be stopped with the START-RUN-STOP/RESET switch in the STOP/RESET position to change this setpoint. A description of the two protocols is as follows:

1. *YORK* – Enables COM 5 (J15) serial port. On Variable Speed Drive applications, used when the microboard is interfaced to the VSD via the ACC Board. On Style B Liquid Cooled Solid State

Starter applications, used when the microboard is interfaced to the LCSSS Logic/Trigger Board TB2.

2. *Modbus* – Enables COM 2 (J13) serial port. Microboard (P/N 031-02430-001) is required. Program Jumpers JP14 (BRAM size) and JP17 (COM 2 Serial Mode) must be configured per *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001*.

    - VSD Applications – Used when the ACC Board is not present and the microboard is interfaced directly to VSD Logic Board 031-02506 (J16). Microboard must be equipped with 128K BRAM (031-02565-000).
    - Style B Solid State Starter Applications – Used when the microboard is interfaced to the LCSSS Logic/Trigger Board 031-02505 (J14). Microboard can be equipped with either 32K BRAM (031-02431-000) or 128K BRAM (031-02565-000).

Motor Node ID (VSD applications – software version C.OPT.01.16.307 or later). (Style B Liquid Cooled Solid State Starter applications – software version C.OPT.01.18.307 or later).

Only displayed when Modbus is selected for the Motor Communications Protocol setpoint above. Allows the Service technician to enter the Modbus Address of the VSD logic board or Style B LCSSS Logic/Trigger Board. The Motor Node ID setpoint must match the Modbus Address assigned to these boards. Whenever the microboard is reading or writing to these devices, it transmits the address entered as the Motor Node ID setpoint. The device will only respond if the transmitted address matches the address assigned to the device. The chiller must be stopped with the START-RUN-STOP/RESET switch in the STOP/RESET position to change this setpoint.

- VSD Applications – Enter 1 for the Motor Node ID setpoint. Then set the Modbus Address of VSD Logic Board 031-02506 to "1" by setting Switch SW3 position 1 to ON with all other positions OFF.
- Style B Solid State Starter Applications – Enter 1 for the Motor Node ID setpoint. Then set the Modbus Address of the Logic/Trigger Board 031-02505 to 1 by setting Switch SW1 Position 1 to ON with all other positions OFF.

Coastdown Time (software version C.OPT.01.16.307 and later) – Only appears when STANDARD is selected for the Coastdown setpoint. Sets the duration of the coastdown period. The time is programmable over the range of 240 (default) to 900 seconds or 150 (default) to 900 seconds as determined by the selection made for the Chiller Style/Compressor setpoint on the OPERATIONS Screen. Refer to the Chiller Style/Compressor setpoint.

Condenser Temperature Range (software version C.OPT.01.19.307 and later) – Special order chillers that operate at higher than standard condenser temperatures require higher condenser high pressure warning and safety thresholds. This setpoint allows the software to be used in either standard or high temperature applications. This setpoint is set at the factory at time of manufacture and requires an ADMIN password to change it. It is only visible when set to Extended. The selections are:

1. *Standard* – Uses standard high pressure warning and safety shutdown thresholds as follows:
    - "Warning – High Pressure Limit" – Maximum allowable value is 162.5 psig
    - "Condenser – High Pressure" – Trip/reset threshold is 180/120 psig
    - "Condenser – High Pressure – Stopped" – Trip/reset threshold 160 psig.
2. *Extended* – Uses higher high pressure warning and safety shutdown thresholds as follows:
    - Warning – High Pressure Limit" – Maximum allowable value is 193.0 psig
    - "Condenser – High Pressure" – Trip/reset threshold is 200/140 psig
    - "Condenser – High Pressure – Stopped" – Trip/reset threshold is 170 psig

PRV Position (software version C.OPT.01.21.307 and later) – New production chillers after June 2009 can be equipped with an optional Pre-rotation Vanes potentiometer, regardless of other options. This setpoint allows the software to be used in all YK chillers, whether equipped with the potentiometer or not. The PRV position will be shown on respective screens when Enabled; not shown when Disabled.

1. *Enabled* – Automatically set to this setting if Hot gas bypass or Variable Geometry Diffuser (VGD) is enabled on the OPERATIONS Screen or Motor Drive Type setpoint is set to VSD or MVVSD. The actual connection point of the potentiometer is determined by the equipment configuration:
   - If equipped with a VSD in YORK Protocol configuration, it is connected to the ACC Board.
   - In Modbus Protocol configuration, it is connected to the microboard J7.

   If not equipped with VSD, but equipped with Hot gas bypass, the connection point is determined by which I/O Board is present. With I/O Board 371-02514-000, it is connected to this board; otherwise, it is connected to the microboard J7. If not equipped with Hot gas bypass but equipped with a VGD, it is connected to the microboard J7.

2. *Disabled* – Set to this position when not equipped with a PRV potentiometer. If equipped with a VSD, MVVSD or the Hot gas bypass or Variable Geometry Diffuser is enabled, this setpoint is automatically enabled and cannot be set to disabled.
   - Motor Monitoring (software version C.OPT.01.22.307 and later) – Allows the Motor Monitoring feature to be enabled or disabled.
   - Heat Recovery (software version C.OPT.01.21.307 (and later) – Allows the Heat Recovery feature to be enabled or disabled.
   - Head Pressure Control (software version C.OPT.01.21.307 (and later) – Allows the Head Pressure feature to be enabled or disabled.
   - Heat Pump Duty (Software Version C.OPT.01.23.307 and later) – Allows the Heat Pump Duty to be enabled or disabled.

Microboard Service Replacement

If the microboard is replaced within the warranty period, the defective board must be returned to YORK per the warranty return procedure. Use the return instructions and return address label provided with the replacement board.

To order a replacement Microboard for a YK Chiller, order part number 331-02430-601. This part number provides an 031-02430-001 Microboard that has been programmed with the latest version of the YK “Controls” software. It comes equipped with a BRAM (U38) and BIOS EPROM (U37). (Replacement Microboards cannot be ordered by the basic board part number of 031-02430-001). Refer to *Renewal Parts – OptiView Control Center (Form 160.54-RP1)*.

The microboard is shipped with a label on the outside of the shipping box that lists the part number of the pre-programmed Microboard (331-02430-601), the basic Microboard part number (031-02430-001) and the version of the pre-programmed “Controls” software (for example, C.OPT.01.14.306 or later).

Microboard 031-02430-000 is supplied as replacement part from January 2004 until June 2006. After this date, Microboard 031-02430-001 is supplied. This board is an upgraded version of the 031-02430-000 Microboard and is backward compatible to YK chillers presently using the 031-01730-000 or 031-02430-000 Microboards. The upgrade includes a larger BRAM and an additional RS-485 port on COM2 for Modbus serial communications. This upgrade is necessary to operate with those motor drives that communicate with the microboard using Modbus communications, which are:

- Medium Voltage Solid State Starter (MV SSS).
- Medium Voltage Variable Speed Drive (MV VSD).
- Variable Speed Drive (VSD) Modbus applications.
- Style B Liquid Cooled Solid State Starter (LC-SSS) Modbus applications.

A summary of the differences between 031-02430-000 and 031-02430-001 Microboards are shown in the following table:

TABLE 6 - SUMMARY OF DIFFERENCES

	031-02430-000	031-02430-001
BRAM	031-02431-000 (32KB)	031-02565-000 (128KB)
BRAM Socket	28 pin	32 pin
Program Jumper JP14	Non-removable wire	2-pin shunt type w/shunt removed
COM2 Serial Port	RS-232	RS-232 or RS485 as selected w/JP17. RS-485 is required for MVSSS, MVVSD, VSD and Style B LCSSS Modbus communications
Required Controls Software Version	Any version	C.OPT.01.15.xxx (or later) (see BRAM transfer exception below). MV VSD and VSD Modbus require C.OPT.01.16.xxx or later, Style B LCSSS Modbus requires C.OPT.01.18.307 (or later)
Application	Except MVSSS, MVVSD, VSD Modbus and Style B LCSSS Modbus	All including MVSSS, MVVSD, VSD Modbus and Style B LCSSS Modbus

When replacing a Microboard, it is sometimes desirable to transfer the BRAM from the defective board to the replacement board to save stored setpoint, History or Sales Order data. Not all BRAM devices are compatible with all Microboards. Also, not all BIOS EPROMs are compatible with all Microboards. The board will not function with incorrect memory components. Therefore, before attempting to transfer memory components between boards, refer to the following compatibility chart before proceeding:

TABLE 7 - MICROBOARD

Microboard	BRAM	BIOS EPROM
031-02430-001	031-02565-000*	031-02429-001
031-02430-000	031-02431-000	031-02429-001
031-01730-000	031-02028-000	031-01796-002

NOTE: *Refer to the following BRAM transfer exception.

When transferring a 32KB BRAM from 031-02430–000 Board to 031-02430–001 board - applications other than MV SSS, MV VSD and VSD Modbus applications, the 32KB BRAM (031-02431-000) from a 031-02430-000 board can be transferred to a 031-02430-001 board. This can be useful when it is desired to transfer a BRAM from one board to another to save stored setpoint, History or Sales Order data. In order to do this, the following must be performed:

1. Install a shunt over Program Jumper JP14. Use an unused black plastic shunt from JP9-12 (DO NOT USE JP1).
2. Install 32KB BRAM toward bottom of the BRAM socket (U38) so that there are 4 empty sockets at the top of the BRAM socket as shown in the following figure.

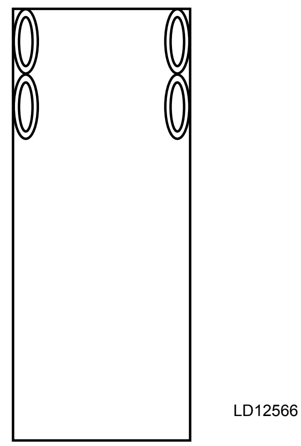


FIGURE 16 - BRAM SOCKET

3. With this configuration, the board can be operated with software versions before or later than version C.OPT.01.15.301.

Program card Service Replacement

Since one YK Program card can be used to re-program other YK chillers, it is not necessary for an individual Service technician to have more than one YK Program card. Program cards can be shared among Service technicians where appropriate.

However, since chiller operating programs are occasionally revised, the Service technician could have a Program card that does not contain the latest program. Program cards (031-02474-001) for YK chillers are available from the Baltimore Parts Distribution Center (PDC). The card received from the PDC is programmed with the latest version of the chiller operating program.

Program cards can be re-programmed with the latest program version.

DOWNLOADING A PROGRAM FROM A PROGRAM CARD

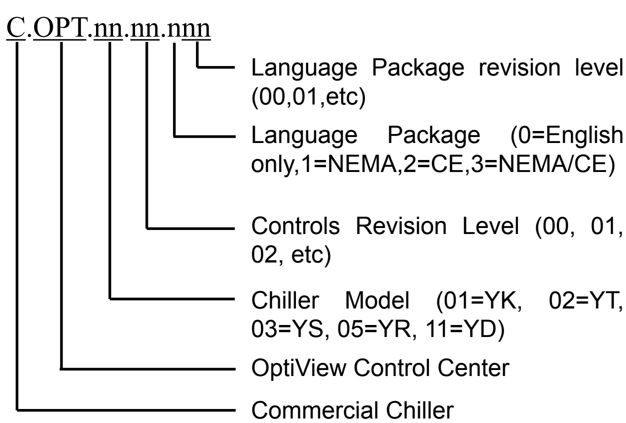
NOTE

The Program card Write Protect Switch must be in the "Write Protect" position!

CAUTION

There are 3 steps to the re-programming process: Erase, Program and Verification. Once the re-programming process is initiated, it automatically proceeds through these steps to completion. It cannot be manually terminated before completion. Therefore, once the process is initiated, the existing on-board program will be erased and replaced by the program in the Program card. Before proceeding, be absolutely certain the Program card is applicable to your chiller model. For example, if your chiller is a YK chiller, the Program card used MUST be for a YK chiller. If a YS chiller program is downloaded into a YK chiller, for example, the chiller will be rendered inoperable until this procedure is repeated using the correct Program card!

A label affixed to the Program card contains the card version. The version is an alpha-numeric code that identifies the chiller model applicability, language package and program revision level. The version is as follows:



Download the program as follows:

1. Remove power to OptiView Control Center.
2. Remove protective cover from Microboard connector U33.
3. Reposition Microboard Program Jumper JP6 to pins 2 and 3 (left-hand pins).
4. Insert Program card into Microboard connector U33.
5. Restore power to OptiView Control Center. A white screen appears displaying "Flash Checksum Test" and the microboard 7-segment LED (U22) displays "Ch". While this is displayed, the microboard is performing a checksum test on the Program card. This ensures the integrity of the card before the download procedure can begin. If the checksum test fails, the card is defective or corrupted and the download procedure cannot be performed. If the checksum test passes, the OptiView Flash PROGRAMMER Screen is displayed.
6. Press START key to start the downloading process. A dialog box appears asking if you want to "Erase Onboard Flash and Re-Program from Pc Card?". **Do not proceed until you understand the above caution!**
7. Use the ► key to scroll to YES.
8. Press ✓ key. The following steps will be performed:
   a. Erasing - During this procedure, the program in the microboard Flash Memory will be erased. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.
   b. Programming - During this procedure, the program in the Program card is downloaded into the microboard Flash memory. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.
   c. Verifying - During this procedure, a checksum test is performed on the new program in the microboard Flash Memory. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.

The microboard 7-segment LED Display (U22) displays the steps of the programming process while they are in effect. During the Erasing procedure, "Er" displayed. During the Programming procedure, "Pr" is displayed. During the Verifying procedure, "Ch" is displayed.

At the completion of the re-programming process, if it is successful, “Flash Has Been Successfully Programmed” is displayed and “Operation Successful” is displayed in the Status Code box. Otherwise, a message in the status box indicates the step that failed.

9. Remove power from OptiView Control Center.
10. Remove Program card from Microboard connector U33.
11. Install protective cover on Microboard connector U33.
12. Reposition Microboard Program Jumper JP6 to pins 1 and 2 (right-hand pins) pins.
13. Apply power to OptiView Control Center. The re-programming procedure is now complete.

PROGRAM JUMPERS

JP1– Parallel Port Enable/Disable. Used to enable and disable the parallel port in the microprocessor. Since the board is presently not populated with a parallel port connector, this jumper must be in the Disable position.

Pins 1-2: Enables Parallel Port.

Pins 2-3: Disables Parallel Port. Must be in this position for correct Microboard operation.

JP2 – Display power and logic levels Determines the power supply voltage applied to the display.

Pins 1-2: +5 VDC SHARP LQ10D367/368 (031-01774-000) displays.

Pins 2-3: +3.3 VDC SHARP LQ104V1DG61 (031-02886-000) and LG Semicon LP104V2-W (031-02046-000) displays.

JP3 – Display backlight enable signal level polarity. Jumper must be positioned according to the voltage level required to turn on the Display Backlight.

Pins 1-2: 0 VDC – not used.

Pins 2-3: +12 VDC or +5 VDC as determined by position of JP4. SHARP LQ10D367/368 (031-01774-000), SHARP LQ104V1DG61 (031-02886-000) and LG Semicon LP104V2-W (031-02046-000) displays.

JP4 – Display Backlight enable signal logic levels. Determines the logic levels of the Backlight Enable signal.

Pins 1-2: +12 VDC/0 VDC – not used.

Pins 2-3: +5 VDC/0 VDC SHARP LQ10D367/368 (031-01774-000), SHARP LQ104V1DG61 (031-02886-000) and LG Semicon LP104V2-W (031-02046-000) displays.

JP5 – Display Backlight power. Determines the power supply voltage applied to the Display Backlight Inverter Board.

Pins 1-2: +12 VDC. SHARP LQ10D367/368 (031-01774-000) and SHARP LQ104V1DG61 (031-02886-000) and LG Semicon LP104V2-W (031-02046-000) displays.

Pins 2-3: +5 VDC. Not used.

JP6 – Boot-up source. Determines whether the boot-up is performed from the Program card or EPROM U37.

Pins 1-2: Boots-up from EPROM U37. Must be in this position unless re-programming from the Program card.

Pins 2-3: Boots-up from the Program card. Must be in this position when re-programming from the Program card.

JP7, JP8 – Display brightness control technique. Determines whether the display brightness is controlled by a variable resistance or a variable voltage.

IN: Variable voltage (0 to 5.0 VDC). SHARP LQ10D367/368 (031-01774-000) and SHARP LQ104V1DG61 (031-02886-000), and LG Semicon LP104V2-W (031-02046-000) displays.

OUT: Variable resistance – not used.

JP9 – Not Used.

JP10 – Factory mounted thermal flow senor – evaporator. Heat recovery chillers and new production chillers after June 2009.

Pins 1-2: not used.

Pins 2-3: Heat Recovery chillers and new production chillers after June 2009.

JP11 – Factory mounted thermal flow sensor – condenser. Heat recovery chillers and new production chillers after June 2009.

Pins 1-2: not used.

Pins 2-3: Heat Recovery chillers and new production chillers after June 2009.

JP12 – Factory mounted thermal flow sensor – heating condenser water. Heat Recovery chillers.

Pins 1-2: not used.

Pins 2-3: Heat Recovery chillers.

JP13 – Watchdog Enable/Disable. Soldered wire jumper.

CAUTION

Never disable the watchdog protection. Severe compressor or chiller damage could result. The ability to disable the watchdog protection is provided for factory testing only.

IN: – Watchdog enabled.

OUT: – Watchdog disabled.

JP14 – BRAM size (Microboard 031-02430-001 only) – Must be positioned according to the size of the BRAM installed on the board.

IN: 32K (BRAM 031-02431-000).

OUT: 128K (BRAM 031-02565-000).

(For 031-02430-000 Microboards, this is a non-removable wire jumper soldered in place at time the board is manufactured. It must NOT be removed by field service personnel.

JP16 – Not Used.

JP17 – COM 2 Serial Port Mode (Microboard 031-02430-001 only). This port can operate in either RS-232 or RS-485 Mode, depending on the position of this jumper.

PINS 1-2: RS-485 (required for MV SSS, MV VSD and those Variable Speed Drives and Style B Liquid Cooled Solid State Starters that communicate with the microboard using Modbus protocol.

PINS 2-3: RS-232 (not used).

JP21 – Factory mounted thermal-type flow sensor – evaporator.

Pins 1-2: Not Used.

Pins 2-3: Factory mounted evaporator Thermal type flow sensor (new production chillers before June 2009) or Leaving Chilled Liquid Temperature Thermistor (chillers equipped with the optional Heat Pump Duty feature).

JP22 – Factory mounted thermal-type flow sensor – condenser.

Pins 1-2: Not Used.

Pins 2-3: Factory mounted condenser Thermal type flow sensor (new production chillers before June 2009).

JP23 – Remote Current Limit setpoint (J22) type. Configures Analog Input for 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA.

OUT: Allows 0 to 10 VDC or 2 to 10 VDC input on J22-1.

Pins 1-2: Allows a 0 to 20mA or 4 to 20mA input on J22-2.

Pins 2-3: Not used.

JP24 – Remote Leaving Chilled Liquid Temperature setpoint (J22) type. Configures Analog Input for 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA.

OUT: Allows 0 to 10 VDC or 2 to 10 VDC input on J22-3.

Pins 1-2: Allows a 0 to 20mA or 4 to 20mA input on J22-4.

Pins 2-3: Not used.

JP25 – DC Undervoltage signal for Proximity Probe.

Pins 1-2: Correct position for YK

Pins 2-3: Not Used

JP27 – COM 4 serial communications port. Configures COM 4 port for either RS-485 (COM 4A) or RS-232 for E-Link Gateway board (COM4B).

Pins 1-2: Enables port 4A. Allows an RS-485 connection to Microboard J11. Not used.

Pins 2-3: Enables port 4B. Allows an RS-232 connection to Microboard J2 for E-Link Gateway communications.

PROGRAM SWITCHES

SW1-1 – Refrigerant Selection. Must be set according to the refrigerant type installed in chiller.

ON – R-134a

OFF – R22

SW1-2 – Liquid Type. Must be set according to whether the chiller is cooling water or brine solution.

ON – Brine. Leaving Chilled setpoint range is 10°F to 70°F.

OFF – Water. Leaving Chilled setpoint range 38°F (36°F if Smart Freeze enabled) to 70°F.

SW1-3 – Diagnostics. Enables or Disables the software diagnostics. See *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

ON – Enables diagnostics. Disables normal chiller operation.

OFF – Disables diagnostics. Enables normal chiller operation.

SW1-4 – Not used.

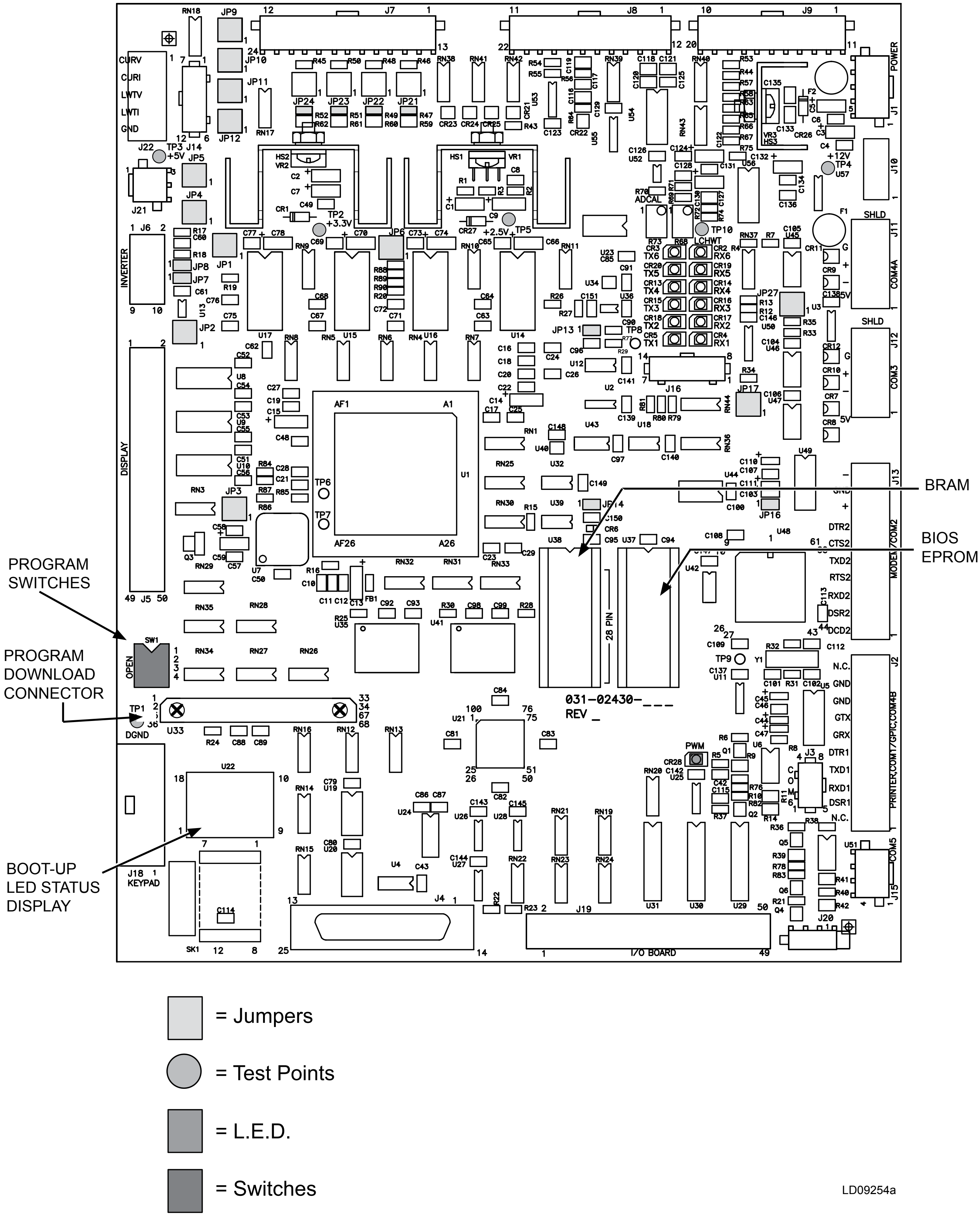


FIGURE 17 - MICROBOARD 031-02430-000 AND 031-02430-001

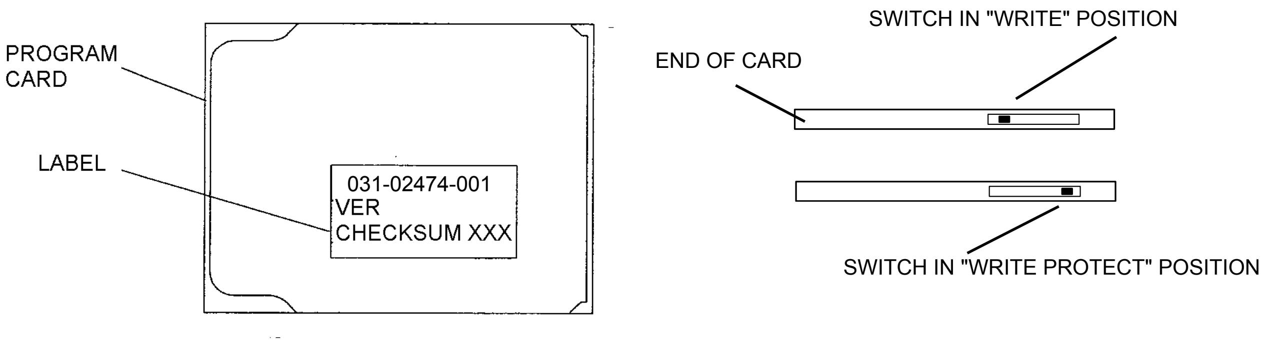


FIGURE 18 - PROGRAM CARD 031-02474-001

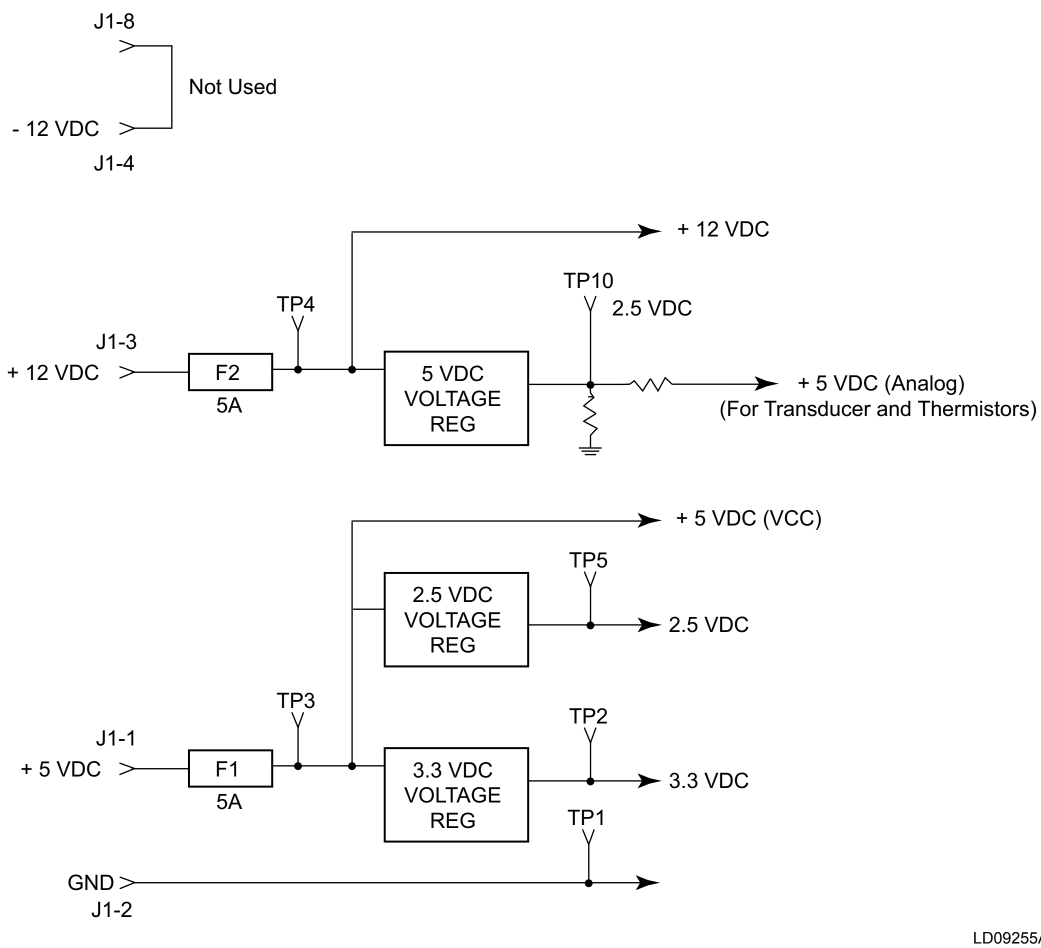
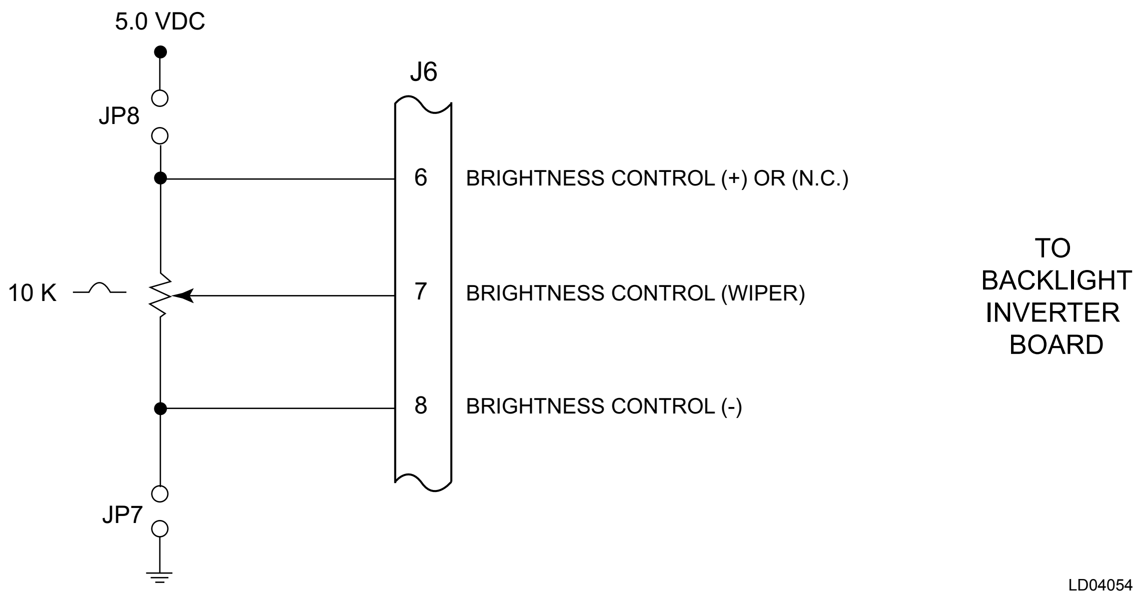


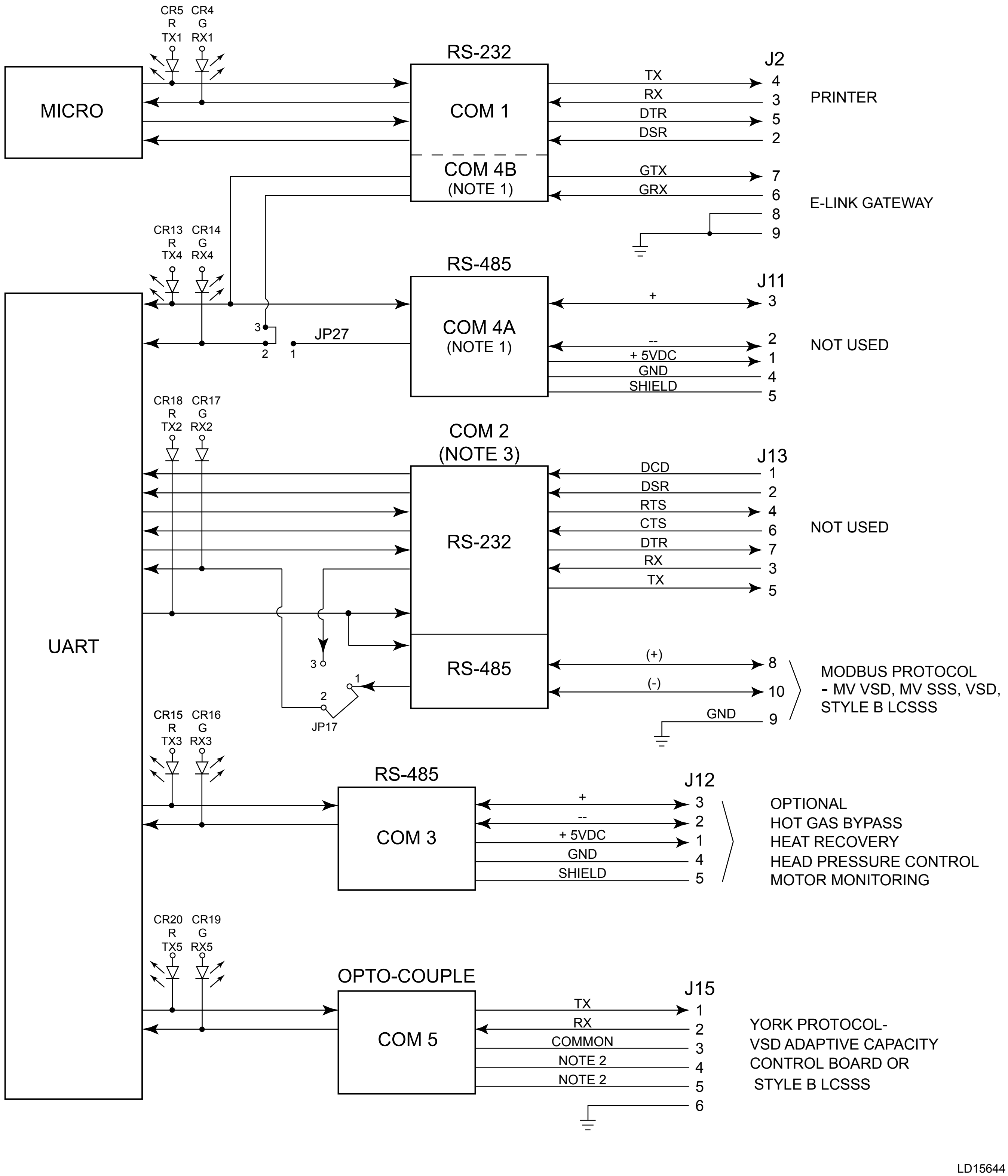
FIGURE 19 - MICROBOARD (031-02430-000 AND 031-02430-001) DC POWER SUPPLY TEST POINTS



NOTES:

1. J6-6 not connected (N.C.) to Backlight Inverter Board when display is manufactured by Sharp or NEC.
2. The position of Program Jumpers JP7 and JP8 determine the output at J6-7; In = Variable Voltage; Out = Variable Resistance. Refer to Program Jumper Listing for applications.
3. Potentiometer is actually an integrated circuit that is the electrical equivalent of a 10KΩ potentiometer.

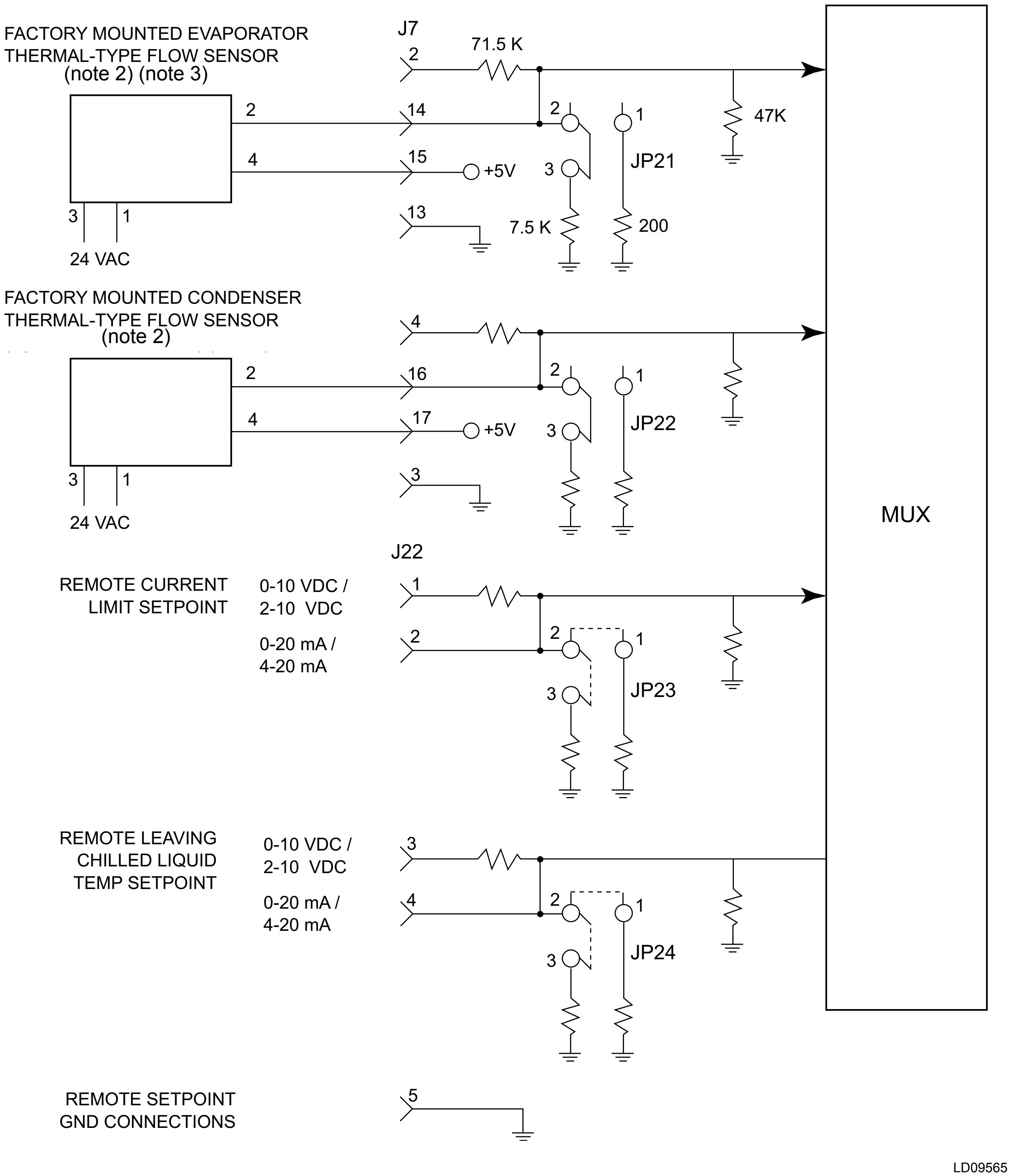
FIGURE 20 - MICROBOARD LAMP DIMMER CIRCUIT



NOTES:

1. Microboard Program Jumper JP27 determines whether COM 4A or 4B can be used. 1 and 2 - 4A, 2 and 3, 4B.
2. J15-4 Loop-Around Test IN. J15-5 Loop-Around Test OUT. See *Figure 115 on page 319* for details.
3. The COM 2 port has two selectable serial modes. It can operate in either RS-232 or RS-485 Mode, depending upon the position of program jumper JP17 as follows: On pins 1 and 2 for RS-485 operation. On Pins 2 and 3 for RS-232 operation. The COM 2 RS-485 port is not present on 031-02430-000 Microboard.

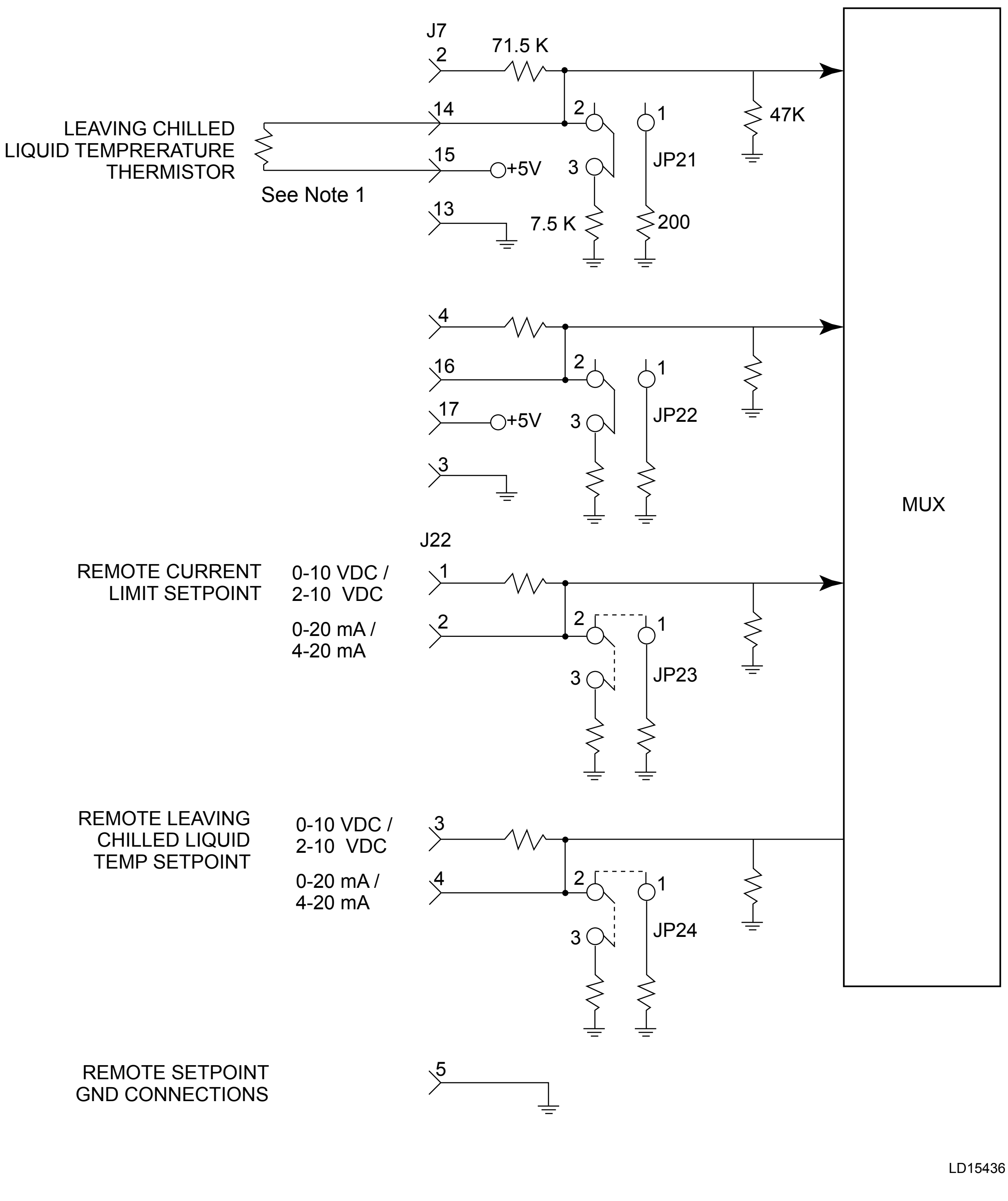
FIGURE 21 - MICROBOARD SERIAL DATA COMMUNICATIONS PORTS



NOTE:

1. Program Jumpers JP23 – JP24 must be positioned on pins 1-2 or 2-3 according to input signal type.
2. On new production chillers before June 2009, the Thermal type flow sensors are connected to Microboard J7 as shown above. Program Jumpers JP21 and JP22 must be on pins 2-3. On new production chillers after June 2009, the Thermal type flow sensors are connected to Microboard J14 (See *Figure 24 on page 72*).
3. Factory mounted evaporator Thermal type flow sensor (new production chillers before June 2009) or Leaving Chilled Liquid Temperature Thermistor (chillers equipped with the optional Heat Pump Duty feature)

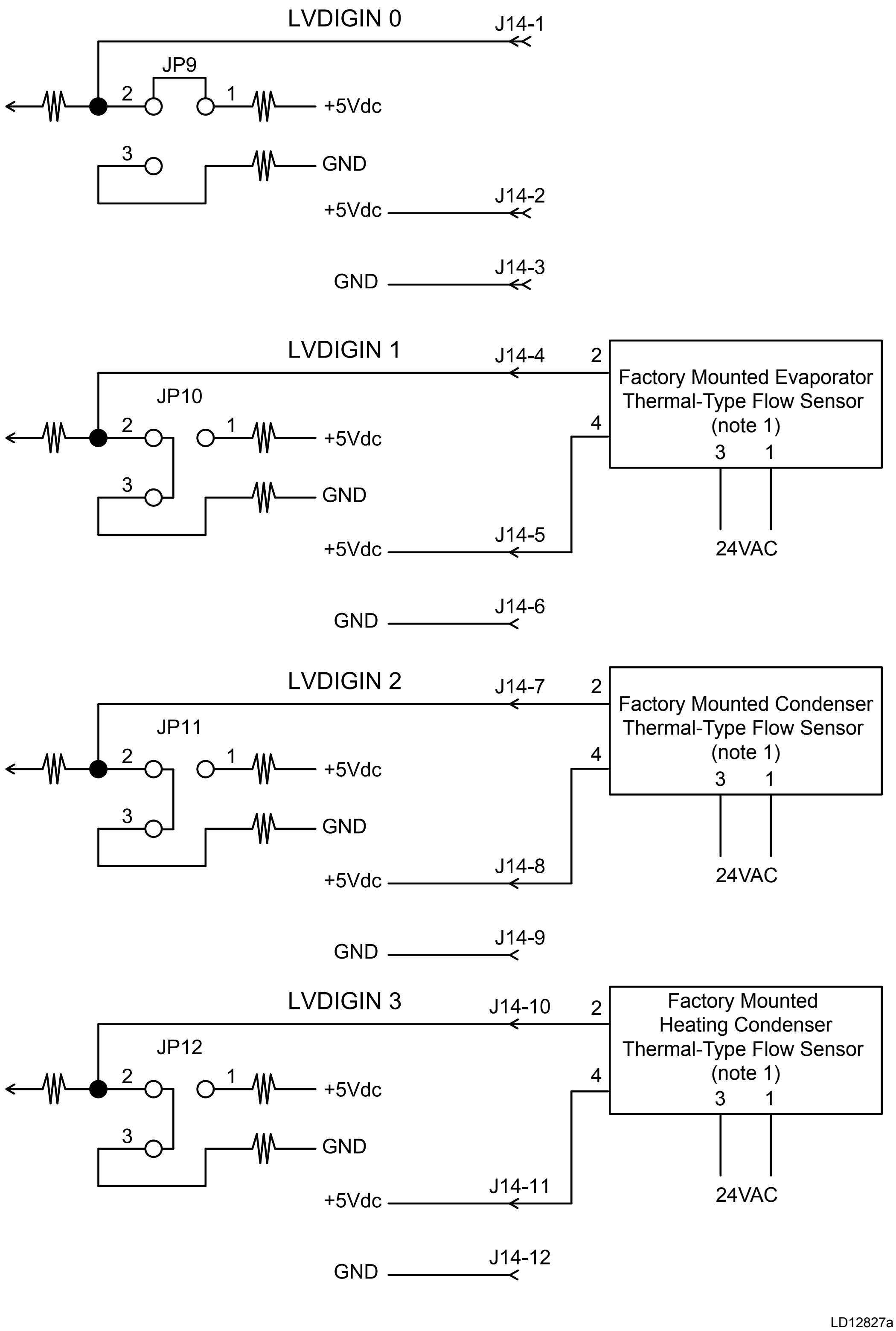
FIGURE 22 - CONFIGURABLE ANALOG AND REMOTE SETPOINT INPUTS



NOTE:

1. Program Jumper JP21 must be positioned on pins 2-3.

FIGURE 23 - CONFIGURABLE ANALOG AND REMOTE SETPOINT INPUTS (HEAT PUMP DUTY)



NOTE:

1. On new production chillers after June 2009, the Thermal type flow sensors are connected to Microboard J14 as shown above. Program Jumpers JP10 through JP12 must be positioned on pins 2-3 and software version C.OPT.01.21.307 (and later) is required. On new production chillers before June 2009, the Thermal type flow sensors are connected to Microboard J7 (See *Figure 22 on page 70*).

FIGURE 24 - LOW VOLTAGE DIGITAL INPUTS

SECTION 5 - MICROBOARD 031-03630-001

Microboard 031-03630-001 is supplied in new production YK chillers starting in June of 2015. Although this board uses a different microprocessor and supporting components, the chiller control and operator interface are the same as the previous 031-01730-000, 031-02430-000 and 031-02430-001 Microboards. It uses the same mounting hole pattern and has the same interface connectors as the previous boards except for the improved power supply connections and the VSOP and ACC board cables use removable screw terminal plugs.

It is backward compatible to existing YK chillers OptiView control panels and is supplied as service replacement for these boards in kit 331-03630-601 which contains the microboard and an SD card with the program.

The new 031-03630-001 microboard consists of a base board with a small daughter board mounted on the base board. This daughter board is the SMARC processor board. **The two boards are mated in the factory and cannot be replaced separately.**

All of the connectors for the sensors, communication ports display and keypad have the same connector designations. The jumpers related to the display and thermal flow switches remain the same and should be set to the same positions as the existing 02430 microboard. The SW1 DIP switch settings should be set the same as the SW1 switch positions on the 02430. Position SW1-4 on the 03630 is now used in place of JP6 on the 02430 to initiate a program update.

On the 02430 a BRAM chip stored the configurable setpoints, sales data and Real Time Clock. The BRAM chip has been replaced with FeRAM and a separate battery backed up Real Time Clock to maintain the time during power outages. The RTC Battery is a CR2032 button cell Lithium battery which can last over 10 years and is readily available at local stores.

The board is supplied with +12 VDC (J1-5), -12 VDC (J1-6), +5 VDC (J1-1 and J1-2), +24 VDC (J1-7) and ground (J1-3 and J1-4) from the Power Supply (See *Figure 27 on page 91*). The +5 VDC (fused by F1) can be monitored at TP12 and TP3. It is used by the microboard circuits and applied to a +3.3 VDC regulator. The outputs of this regulator is applied to Microboard circuits.

The +12 VDC (fused by F2) can be monitored at TP5 and TP4 in reference to TP1 GND. It is applied to a +5 VDC regulator and the output of the regulator is the +5 VDC (Analog) supply that powers all analog circuits and is the source voltage for all of the transducers and thermistors. The +5VA can be monitored at TP10 referenced to TP1 GND.

Test Points and LED Indicators

The primary power supplies have LEDs to indicate the presence of power. The voltages can be measured at the following test points in reference to TP1 or TP11 GND.

VOLTAGE	TEST POINT	VOLTAGE RANGE	FUSE	LED
+5 VDC	TP3	+4.92 to +5.28 VDC	F1 (5A)	CR56
+12 VDC	TP4	+11.58 to +12.5 VDC	F2 (5A)	CR57
-12 VDC	TP33	-11.5 to -12.5 VDC	F3 (5A)	CR58
+24 VDC	TP35	+22.4 to +26.7 VDC	F4 (4A)	CR59
+3.3 VDC	TP2	+3.25 to +3.43 VDC	n/a	CR62
VCC	TP15	+4.92 to +5.28 VDC	n/a	n/a
+5VA	TP10	+4.95 to +5.05	n/a	CR61
Battery	n/a	+2.95 to +3.45	n/a	n/a

Boot-up Program

The Boot-up Program is stored in Flash memory. It may be updated along with a new version of the operating program by inserting an SD card containing the new program into the SD card slot on the 03630 board, setting DIP Switch SW1 position 4 to ON and then applying power to the chiller. The Boot-up Program version is displayed on the DIAGNOSTICS Screen in SERVICE access level.

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TABLE 8 - DIAGNOSTIC DISPLAY CODES

LED DISPLAY CODE (NORMAL BOOT UP)	DESCRIPTION
00	DIP 4 OFF - Booting from internal Flash program
CH	Flash Checksum Test in progress
AP	Application program setup in progress
∞	Application program is running
LED DISPLAY CODE (OTHER)	
01	DIP 4 ON - Booting from SD card [Normal when loading a program]
02	DIP 4 ON - Booting from USB port
05	DIP 4 ON - PIC application is being configured
F0	DIP 4 OFF - Boot from internal Flash Failed [Try to reload the program]
F1	DIP 4 ON - Boot from SD card Failed [Bad SD card or Bad microboard]
F3	DIP 4 ON - Microboard Internal error [Bad Microboard]
F4	DIP 4 ON - Checksum Failed [Try to reload program, Bad microboard]
FF	DIP 4 ON - Boot from SD card Failed

NOTE: If the display stops at a 01 display, this may be an indication that the SD card reader is defective. If the display stops at the YORK logo with a white screen, this indicates that the board has no program to boot from.

When power is first applied to the OptiView Control Center, a white screen is displayed while the boot-up is performed. During the boot-up, the Boot-up program in the Flash Memory configures the microprocessor and related components and performs testing of certain components to ensure that those components are operational.

The sequence of events in the boot-up process are listed in the *Table 8 on page 74*. The progress and pass/fail status of each step is displayed on the microboard 7-segment LED Display (U25 and U26). Due to the speed at which the boot-up proceeds, not all steps will be visible during the process. Not all pass/fail status is displayed on the white screen.

CHILLER OPERATING PROGRAM

The Chiller Operating Program is a set of instructions to control the chiller. It contains the Safety and Cycling shutdown thresholds (non-changeable) and display screen messages and graphics.

The chiller operating program is stored in non-removable Flash Memory that is soldered to the microboard. New chillers are supplied programmed with the latest program available at the time of manufacture. The program version that is currently residing in the microboard Flash Memory Chip is displayed on the DIAGNOSTICS Screen in SERVICE access level. The on-board program can be upgraded by downloading the latest version from a Program card using the procedure in the Service Replacement section of this manual.

Program Card

The on-board program can be upgraded by downloading the latest program version from a program card. This is a SD format card which is 1-5/16" X 1". It is a portable Flash memory storage device that is programmed with the chiller operating program. The program card part number for YK chillers is 031-03601-001 and is available from the Baltimore

Parts Distribution Center (PDC). There is a Program card for each chiller type (YT, YK, YS, YR, YD, etc) and each has a unique part number. A label affixed to the Program card contains the part number and version. The version is an alpha-numeric code that identifies the chiller model applicability, language package, language package revision level and chiller operating program revision level.

The Program card is applicable to both NEMA and CE applications. The Program card for YK chillers has English, Simplified and Traditional Chinese, French, Portuguese, Spanish, Italian, German, Japanese, Korean and Hungarian languages.

The program version that is currently residing in the microboard Flash Memory Chip is displayed as the “Controls” Software Version on the DIAGNOSTICS Screen in SERVICE access level.

The Program card obtained from the PDC is programmed with the latest version of the chiller operating program. Program cards can be reprogrammed.

A Program card for a particular chiller type can be used to re-program other chillers of the same type. For ex-ample, it is not necessary to have more than one YK Program card. A single YK card can be carried to dif-ferent locations to re-program other YK OptiView Control Centers.

A Write Protect Switch on the edge of the Program card prevents inadvertent writing to the Card during program downloading.

Handling precautions for the Program card include:

- Do not allow dirt or water to enter the connector
- Operating temperature range for Commercial grade SD cards is -25°C to 85°C (-13°F to 185°F)

A label on the Program card contains the version and JCI part number. The version is an alphanumeric code that identifies the chiller model applicability, lan-guage package, language revision level and chiller control re-vision level. The version is as follows:

C.OPT.nn.nn.nnn

- nn (last two digits) – Language Package revision level (00,01,etc)
- n (third from last) – Language Package (0=English only, 1=NEMA, 2=CE, 3=NEMA/CE)
- nn (second group) – Controls Revision Level (00, 01, 02, etc)
- nn (first group) – Chiller Model (01=YK, 02=YT, 11=YD, 16=YMCC Mod A)
- OPT – OptiView Control Center
- C – Commercial Chiller

Program Download Connector J26

The SD Program card is inserted into connector J26 to download a program. Refer to instructions under Service Replacement.

FeRAM

The FeRAM (Ferroelectric Ramdom Access Memory) preserves the stored data during power failures. All of the programmed Setpoints, Sales Order Data and History Data is stored here. This memory does not require a battery.

Real Time Clock

The RTC (Real Time Clock) uses a common CR2032 button-cell lithium battery to maintain the time and date during power outtages. The battery life is over 10 years. This type of battery is used in watches and is readily available at drug stores and appliance stores.

SMARC Module

The SMARC Module is the processor card for the 031-03630-001 microboard. The SMARC Module and the baseboard are assembled as a pair in the board manufacturing factory and can not be swapped in the field. SMARC (Smart Mobility ARChitecture) is a relatively new standard to enable multiple vendors to provide high performance embedded processor cards. This will allow using future processors if the current ones become obsolete without having to re-design the microboard.

Watchdog Circuit

The Watchdog circuit performs two functions as follows:

- Power failure detection
- Program latch-up detection/prevention

The Watchdog Circuit monitors the +5 VDC from the power supply and the +3.3 VDC from the onboard regulator to determine when a power failure is occurring. If the +5 VDC decreases to the threshold of (+4.44 VDC to +4.68 VDC) or the +3.3 VDC decreases to the threshold of (+2.84 VDC to +3.04 VDC), a reset is issued to the microprocessor and the chiller shuts down. When power is restored, the white screen is displayed and the boot-up is performed as described above. When the graphic screen is displayed, the message CONTROL PANEL POWER FAILURE is displayed.

The Watchdog Circuit also ensures that the entire program is being executed and that the program has not latched-up, bypassing important safety checks. The Watchdog circuit is a timer that times-out if not given a reset pulse within its time-out period (1 to 1.204 seconds).

To prevent a time-out, the microprocessor sends a reset pulse to the Watchdog circuit every time the complete program has been executed. Since it takes less than 1 second to perform the entire program, the Watchdog circuit doesn't time-out under normal operation. However, if the entire program is not executed or something prevents the microprocessor from sending the reset pulse as described below, the Watchdog circuit times-out and sends a reset to the microprocessor, initiating a re-boot. If running, the chiller shuts down. The display momentarily blanks and the white screen is displayed while the boot-up program executes as described above. When the graphic screen is displayed, either of two messages is displayed depending on the type of Watchdog shutdown as explained below.

There are two different watchdog initiated shutdowns; a HARDWARE watchdog initiated shutdown and a SOFTWARE watchdog initiated shutdown.

In the HARDWARE watchdog initiated shutdown, a program problem, on-board noise or hardware problem could prevent the watchdog time-out. If this occurs, a re-boot is initiated and when the graphic screen is displayed, CONTROL PANEL – POWER FAILURE is displayed.

In the SOFTWARE watchdog initiated shutdown, the program intentionally initiates the reboot because it has detected program interruption. After the reboot, WATCHDOG – SOFTWARE REBOOT is displayed on the graphic screen.

Program Jumpers/Program Switches

The Program Jumpers and Program Switches are used to alter the program operation or configure the microboard hardware for specific operation. This allows the Program and Microboard to be universal for all standard applications. The position of some jumpers can be determined by the Service technician to meet the desired operation. Others must be positioned according to the requirements of the size, type or style of components and thus are determined by the YORK factory. The jumpers are plastic sleeves with metal inserts that are inserted over 2-prong or 3-prong conductors. The Program Switches are miniature switches that are placed in either the ON or OFF position.

PROGRAM JUMPERS

NOTE

When replacing a 02430 microboard with a 03630, use the same jumper positions for the jumpers marked with an *.

JP2* – Display power and logic levels Determines the power supply voltage applied to the display.

Pins 1-2: +5 VDC SHARP LQ10D367, LQ10D368 displays.

Pins 2-3: +3.3 VDC SHARP LQ104V1DG61, LQ104V1DG81 and LG Semicon LP104V2W displays.

JP3* – Display backlight enable signal level polarity. Jumper must be positioned according to the voltage level required to turn on the Display Backlight.

Pins 1-2: 0 VDC – Not used.

Pins 2-3: +12 VDC or +5 VDC as determined by position of JP4. SHARP LQ10D367 LQ10D368, SHARP LQ104V1DG61, LQ104V1DG81 and LG Semicon LP104V2W displays.

JP4* – Display Backlight enable signal logic levels. Determines the logic levels of the Backlight Enable signal.

Pins 1-2: +12/0 VDC – SHARP LQ104V1DG81.

Pins 2-3: +5 VDC/0 VDC SHARP LQ10D367, LQ10D368, LQ104V1DG61 and LG Semicon LP104V2-W displays.

JP5* – Display Backlight power. Determines the power supply voltage applied to the Display Backlight Inverter Board.

Pins 1-2: +12 VDC. SHARP LQ10D367, LQ10D368, LQ104V1DG61, LQ104V1DG81 and LG Semicon LP104V2-W displays.

Pins 2-3: +5 VDC. Not used.

JP7*, JP8* – Display brightness control technique. Determines whether the display brightness is controlled by a variable resistance or a variable voltage.

IN: Variable voltage (0 to 5.0 VDC). SHARP LQ10D367, LQ10D368, LQ104V1DG61, LQ104V1DG81 and LG Semicon LP104V2W displays.

OUT: Variable resistance – Not used.

JP10* – Factory mounted thermal flow senor – evaporator. Heat recovery chillers and new production chillers after June 2009.

Pins 1-2: Not used.

Pins 2-3: Heat Recovery chillers and new production chillers after June 2009.

JP11* – Factory mounted thermal flow sensor condenser. Heat recovery chillers and new production chillers after June 2009.

Pins 1-2: Not used.

Pins 2-3: Heat Recovery chillers and new production chillers after June 2009.

JP12* – Factory mounted thermal flow sensor – heating condenser water. Heat Recovery chillers.

Pins 1-2: Not used.

Pins 2-3: Heat Recovery chillers.

JP14 – Applies a 120 Ohm terminating resistor across the COM3 RS-485 port.

IN: Not used.

OUT: Normal position - no bias applied.

JP15 – Applies a pull-up voltage to the COM3 + terminal.

IN: Not used..

OUT: Normal position.

JP16 – Applies a pull-down voltage to the COM2 - terminal.

IN: Not used.

OUT: Normal position.

JP18 – Applies a 120 Ohm terminating resistor across the COM2 RS-485 port.

IN: Not used.

OUT: Normal position - no bias applied.

JP19 – Applies a pull-up voltage to the COM2 + terminal.

IN: Not used.

OUT: Normal position.

JP20 – Applies a pull-down voltage to the COM3 - terminal.

IN: Not used.

OUT: Normal position.

JP21* – Factory mounted evaporator thermal-type flow sensor.

Pins 1-2: Not used.

Pins 2-3: Factory mounted evaporator Thermal type flow sensor (new production chillers before June 2009) or Leaving Chilled Liquid Temperature Thermistor (chillers equipped with the optional Heat Pump Duty feature).

JP22* – Factory mounted condenser thermal-type flow sensor.

Pins 1-2: Not used.

Pins 2-3: Factory mounted condenser Thermal type flow sensor (new production chillers before June 2009).

JP23* – Remote Current Limit setpoint (J22) type. Configures Analog Input for 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA.

OUT: Allows 0 to 10 VDC or 2 to 10 VDC input on J22-1.

Pins 1-2: Allows a 0 to 20mA or 4 to 20mA input on J22-2.

Pins 2-3: 2-3: Not used.

JP24* – Remote Leaving Chilled Liquid Temperature setpoint (J22) type. Configures Analog Input for 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA.

OUT: Allows 0 to 10 VDC or 2 to 10 VDC input on J22-3.

Pins 1-2: Allows a 0 to 20mA or 4 to 20mA input on J22-4.

Pins 2-3: Not used.

JP25* – DC Undervoltage signal for Proximity Probe.

Pins 1-2: Correct position for YK

Pins 2-3: Not used

JP27 – Applies a pull-up voltage to the COM5B + terminal.

IN: Not used.

OUT: Normal position.

JP28 – Applies a 120 Ohm terminating resistor across the COM5B RS-485 port.

IN: Not used.

OUT: Normal position - no bias applied.

JP29 – Applies a pull-down voltage to the COM5B - terminal.

IN: Not used.

OUT: Normal position.

PROGRAM SWITCHES

SW1-1* – Refrigerant Selection. Must be set according to the refrigerant type installed in the chiller.

ON – R-134a

OFF – R22

Note that with Version 03 software and later, the refrigerant selection is performed on the SETUP screen because a third choice of R-513A has been added. When this is the case, position 1 of SW-1 has no effect.

SW1-2* – Liquid Type. Must be set according to whether the chiller is cooling water or brine solution.

ON – Brine. Leaving Chilled setpoint range is 10°F to 70°F.

OFF – Water. Leaving Chilled setpoint range 38°F (36°F if Smart Freeze enabled) to 70°F.

SW1-3* – Diagnostics. Enables or Disables the software diagnostics.

ON – Enables diagnostics. Disables normal chiller operation.

OFF – Disables diagnostics. Enables normal chiller operation.

SW1-4 – Boot from SD Card/Flash (This performs the same function as the JP6 jumper on the 02430 board.

ON – Enables boot from SD card to load a new program.

OFF – Boot the program stored in memory.

NOTE

The software for the 03630 uses the data entered on the Sales Order screen to determine proper control settings. After the Sales Order screen is fully entered, navigate: HOME>SETPOINTS>SETUP> DIAGNOSTIC and then press the Default Unit Setpoints button on the Diagnostic Screen to set the correct control parameters. Failure to do this will result in improper control.

Keypad Interface

The keypad is read via J18. The keypad is a matrix of conductors arranged in rows and columns (See *Figure 50 on page 124* and *Figure 51 on page 125*). There are 4 rows and 8 columns. When a key is pressed, the conductors are pressed together at that point, creating continuity between the row conductor and the column conductor. The keypad is read by applying a logic low to a row while leaving +5 VDC pull-up on all other rows. The microprocessor then reads the 8 columns. If any column has a logic low on it, the key corresponding to that coordinate (row, column) is being pressed. The microprocessor reads the entire keypad by repeating this routine beginning with row 1 and ending with row 4. The entire keypad is continually read while the Control Center is powered. See *SECTION 10 - KEYPAD* of this manual for details of the keypad.

CM-2 Board or Style A Solid State Starter Interface

The microboard retrieves certain operating parameters (via J10) from the compressor motor starter control board (CM-2 Current Board for Electromechanical Starter or Style A Solid State Starter Logic Board). See the appropriate section of this manual for de-tailed explanation of each board. Both boards contain an 8 channel multiplexer. The microprocessor sequen-tially and continually reads channels 0 through 7. It reads each channel by applying a 3-bit binary address to the multiplexer.

A 0 to 5 VDC analog value is returned from each channel. The function of each is in *Table 9 on page 79*.

The microprocessor determines which board, and therefore which starter is present, by the value returned from channel 0. Since channels 0 through 6 are grounded, the CM-2 board returns a 0 VDC value. The Solid State Starter Logic Board returns a value greater than 0.41 VDC to +5 VDC. If the value is less than 0.4 VDC, it indicates the starter is an Electromechanical (EM) starter and the microprocessor then reads channel 7 to retrieve the peak motor current value. A value greater than 0.4 VDC indicates the starter is an A style Solid State Starter and the microprocessor reads channels 1 through 7.

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In the Solid State Starter, channel 0 indicates the starter size (model) and voltmeter range (300 VAC or 600 VAC). Channel 1 is a hardware generated 100% FLA (prevents pre-rotation vanes from further opening) or 104% FLA (closes pre-rotation vanes until mo-tor current is less than 102%) current limit override command that overrides normal Pro-rotation Vanes control. Channels 2 through 4 are analog voltages that represent phase A, B and C motor current. The highest phase is Channels 5 through 7 are analog voltages that represent phase A, B and C Line Voltage. The data for each channel is shown on the below.

TABLE 9 - MULTIPLEXER CHANNELS

	0	1	2	3	4	5	6	7
CM-2	GND	GND	GND	GND	GND	GND	GND	Peak Motor Current (%FLA)
STYLE A SOLID STATE STARTER	Starter model/ voltmeter range	Current limit command	Phase C motor current	Phase B motor current	Phase A motor current	Phase A line voltage	Phase B line voltage	Phase C line voltage

Style B Solid State Starter Interface

Style B Solid State Starters produced before June 2008 can communicate with the 031-03630-001 Microboard via the Opto-coupled COM5 serial data port (J15) using YORK proprietary protocol. The serial data is represented by +5 VDC and 0 VDC logic levels. TX data to the starter is at J15-1. RX data from the starter is at J15-2.

Style B Solid State Starters produced after mid 2008, communicate with the 031-03630-001 Microboard via the COM 2 serial port (J13) using RS-485 Modbus protocol. To allow Microboard 031-03630-001 to be used as a service replacement for 031-01730-000 or 031-02430-000 boards non-modbus applications in the field, the COM 5 serial port (J15) is retained on the 031-03630-001 board.

When SSS-Mod B is selected as the motor drive type on the SETUP Screen, additional setpoints must be entered on the screen. The appropriate serial port (COM 2-Modbus or COM 5 YORK) must be enabled using the Motor Communications Protocol setpoint. The selections are Modbus or “YORK”. When Modbus is selected, the Motor Node ID setpoint must be set to match the setting of the Starter Logic/Trigger Board Modbus Address Switch SW1. They must be both be set to “1”.

See *Figure 59 on page 138* and *SECTION 13 - SOLID STATE STARTERS* for details of the solid state starter interface.

Variable Speed Drive Interface

Variable Speed Drives produced before March 2007 communicate with Microboard 031-03630-001 via the Opto-coupled COM5 serial data port (J15) using the YORK proprietary protocol. The serial data is represented by +5 VDC and 0 VDC logic levels. TX data to the starter is at J15-1. RX data from the starter is at J15-2.

To allow Microboard 031-03630-001 to be used as the service replacement for 031-01730-000 or 031-02430-000 and 031-02430-001 boards non-Modbus applications already in the field, the COM5 serial port is retained on the 031-03630-001 board.

Variable Speed Drives built after March 2007 communicate with Microboard 031-03630-001 via the COM2 serial data port (J13) using RS-485 Modbus protocol.

With Microboard 031-03630-001 when “VSD-60Hz” or “VSD-50Hz” is selected on the SETUP Screen as the Motor Drive Type, additional setpoints must be entered on this Screen. The appropriate serial port (COM2-Modbus or COM5-YORK) must be enabled using the Motor Communications Protocol setpoint. The selections are Modbus or “York”. When Modbus is selected, the Motor Node ID setpoint must be set to match the setting of the VSD Logic Board Modbus Address Switch SW3. They must be both set to “1”.

There are two different types of Modbus protocol used. Modbus ASCII for Mod D/Vyper and Modbus RTU for Raptyr. When VSD – 60Hz or 50Hz is selected for the Motor Drive Type setpoint on the SETPOINTS Screen, the microboard will poll on COM 2 alternating between the two protocols until one of them responds or until an initialization fault occurs. Once a valid response is received from either VSD type, the microboard will “remember” this, even after a power failure. This allows the correct screens to be displayed after a power failure, without repeating the poll interrogation as long as the Motor Drive Type is not changed. Once the microboard determines which VSD type is connected, it will not poll for the other.

See *Figure 63 on page 153* and *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* Board for details of the variable speed drive interface.

Medium Voltage Solid State Starter (MV SSS) and Medium Voltage Variable Speed Drive Interface (MV VSD)

These drives communicate with the microboard via the COM2 RS-485 Modbus serial port (J13). See *Figure 29 on page 93* and Medium Voltage Solid State Starter – Service (Form 160.00-M5) and Medium Voltage Variable Speed Drive – Service (Form 160.00-M6) for details of this interface. When the MV SSS or MV VSD is selected on the SETUP Screen, the COM2 serial port with Modbus protocol is automatically enabled. With the MV VSD, the Adaptive capacity Control functionality is contained on the microboard.

Printer Interface

An optional printer can be connected to COM1 RS-232 serial data port (J2). TX data to the printer is at J2-4. The DSR (Data Set Ready or busy) signal from the printer is at J2-2. Signal levels are standard RS-232. The microboard sends data to the printer at the selected baud rate until the printer buffer becomes full, whereupon the printer asserts its Busy signal. The microboard suspends data transmission until the printer can accept more data. Each printer must be setup/configured to operate properly with the microboard. The Baud, Data

Bits, Parity and Stop Bits must be programmed on the COMMS Screen. Other printer setup is performed on the Printer Screen. Refer to *OptiView Control Panel - Operation (Form 160.54-O1)* for details of available printers and printer setup instructions.

SC-EQ Communication Interface

An optional SC-Equiptment printed circuit board can be connected to the COM 4B RS-232 serial data port (J2). TX data to the SC-EQ is at J2-7. RX data from the E-Link Gateway is at J2-6. Signal levels are standard RS-232. The SC-EQ Communication Interface polls sys-tem pressures, temperatures and status from the mi-croboard. It holds it for retrieval by third-party devices. See *SECTION 19 - COMMUNICATIONS* of this manual.

Digital Inputs

The I/O Board converts the 115 VAC inputs to logic level inputs for the microboard at J19. A 115 VAC input to the I/O Board is converted to a logic low (less than 1 VDC). A 0 VAC input to the I/O Board is converted to a logic high (greater than 4 VDC). See *SECTION 6 - I/O BOARD* of this manual for details of the I/O Board.

Digital Outputs

The microboard controls 115 VAC relays and solenoids via the I/O Board (via J19). The I/O Board contains +12 VDC relays that isolate the microboard low voltage circuits from the 115 VAC device coils. Solid state switching devices are used to control the relays. The microboard energizes the +12 VDC relays by applying a ground to the coil input. They are de-energized by opening the ground path. The contacts of these relays switch 115 VAC to system relays and solenoids. The outputs that control the chilled liquid pump and compressor motor starter have anti-chatter (anti-recycle) timers associated with them. The output that controls relay K0 is not allowed to change at a rate greater than once every 10 seconds. The output that controls relay K13 is not allowed to change at a rate greater than once every 20 seconds. The microboard controls actuator motors via Triacs on the I/O Board. Each actuator has an open winding and a close winding. Current flowing through a winding causes the actuator to rotate in the respective direction. Each winding is controlled by a Triac. The Triac is turned ON to allow current to flow through a winding. The microboard turns on the Triac by applying a logic low (less than 1 VDC) to the Triac driver on the I/O Board. It turns it OFF by applying a logic high (greater than 4 VDC). See *SECTION 6 - I/O BOARD* of this manual for details of the I/O Board.

Analog Inputs

System pressures, in the form of analog DC voltages, are input from Pressure Transducers. See *SECTION 20 - PRESSURE TRANSDUCERS* of this manual. Formulas and graphs are included to calculate the expected transducer output voltage for a given pressure input.

System temperatures, in the form of analog DC voltages, are input from thermistors. See *SECTION 21 - TEMPERATURE THERMISTORS* of this manual. Included are tables to convert the expected output voltage for any temperature applied to the thermistor.

Flow Switch

Style "F" (and later) chillers are supplied with factory-mounted Flow Sensors on the evaporator and condenser. These are electronic thermal-type sensors. The operating principle of the sensor is thermal conductivity. It uses the cooling effect of a flowing liquid to sense flow. The temperature of the heated sensor tip is sensed by a thermistor located in the tip. A second thermistor, located higher in the tip in a non-heated area, is only affected by changes in liquid temperature. The temperatures sensed by the thermistors are compared. Flowing liquid carries heat away from the heated sensor tip, lowering its temperature. The higher the flow rate, the lower the tip temperature and therefore a lower differential between thermistors. Lower flow rates remove less heat from the tip allowing a higher tip temperature. The lower the flow, the greater the differential between thermistors. The sensor is vendor-calibrated to turn ON its output at a flow rate of 20cm (0.6 ft.)/second. This is the setpoint.

The sensor operates from a 24 VAC power source and has a solid state relay output. On each sensor, one side of the solid state relay (pin 4) is connected to +5 VDC on the microboard and the other side (pin 2) is connected to an Analog Input of the microboard (See *Figure 24 on page 72 and Figure 30 on page 94*). After power is applied, there is a thermal warm-up period of up to 20 seconds. During this time, the output could be unstable. When the setpoint (or greater) flow rate is sensed, the solid state relay output is turned ON causing it to conduct current through the 7.5K ohm Microboard load resistor to the +5 VDC. This applies greater than +4 VDC to the microboard input. When a flow rate less than the setpoint is sensed, the solid state relay output is turned OFF, resulting in no conduction through the load resistor. This applies less than 1 VDC to the microboard input. To determine the state of the solid state relay, first confirm that +5 VDC is present at pin 2 of the flow sensor. Then connect a voltmeter between the microboard TP1 (GND) and the respective flow sensor input to the microboard.

The software accommodates either the Paddle type sen-sors connected to TB4 of the I/O Board or the Thermal type sensors connected to either J7 or J14 on the microboard. The actual connection point of the Thermal type sensors to the microboard is determined by the chiller vintage (See *Figure 30 on page 94* and *Figure 34 on page 102*). On new production chillers before June 2009, they are provided connected to the microboard J7. On new production chillers after June 2009, they are provided connected to the microboard J14. To ensure that the program reads the correct input, the Flow Switch setpoint on the OPERATIONS Screen must be set appropriately as explained in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES*.

Serial Data Ports

Microboard 031-03630-001 is equipped with 6 serial ports. See *Figure 21 on page 69*. Each port is dedicated for a specific function as follows:

A. COM1 (J2) – RS-232. Printer.
B. COM2 (J13) – RS-485. Modbus communications to the Liquid Cooled Solid State Starter, Medium Voltage Solid State Starter, Medium Voltage Variable Speed Drive and Variable Speed Drives.
C. COM3 (J12) – RS-485. Hot gas bypass, Heat Recovery, Head Pressure Control, Motor Monitoring.
D. COM4 (J2) – RS-232. E-Link Gateway.
E. COM5A (J15) – Opto-coupled transmit/receive. VSD Adaptive Capacity Control Board or Style B Solid State Starter.
F. COM5B (TB4) – RS-485. Future VGD actuator.

Each port is equipped with two LEDs. A red TX LED illuminates as data is transmitted to or requested from another device. A green RX LED illuminates as data is received from another device. The RS-232 voltages are industry standard +5 to +25 VDC and -5 VDC to -25 VDC logic levels. The RS-485 voltages are industry standard o VDC and +1.5 VDC to +5 VDC logic levels. COM5A logic levels are 0 VDC and +5 VDC. A diagnostic test can be performed on each serial port to confirm proper operation. See *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

The LEDs and their functions are as follows:

- CR41 RX1 – COM1 serial port receive data.
- CR42 TX1 – COM1 serial port transmit data.
- CR40 RX2 – COM2 serial port receive data.
- CR37 TX2 – COM2 serial port transmit data.
- CR38 RX3 – COM3 serial port receive data.
- CR35 TX3 – COM3 serial port transmit data.
- CR39 RX4 – COM4 serial port receive data.
- CR36 TX4 – COM4 serial port transmit data.
- CR44 RX3 – COM5A serial port receive data.
- CR43 TX3 – COM5A serial port transmit data.
- CR47 RX5B – COM5B serial port receive data.
- CR45 TX5B – COM5B serial port transmit data.

Display Interface

The graphic screens displayed on the Liquid Crystal Display are created from the program downloaded from the Program card and stored in the Flash Memory Chip. The data to form these screens is output from J5. This data is in the form of red, green and blue drive signals applied to each of the 303,200 display pixels arranged in a matrix of 640 columns x 480 rows. Each pixel consists of 3 windows; red, green and blue, through which a variable amount of light from the Display Backlight, is permitted to pass to the front of the display. The drive signals determine the amount of light permitted to pass through each window. The overall pixel color is a result of the gradient of red, green and blue light allowed to pass. The drive signal for each pixel is an 18 bit binary word; 6 for each of the 3 colors. The greater the binary value, the more light is permitted to pass. The pixels are driven sequentially from left to right, beginning with the top row. To coordinate the drive signals and ensure that the pixels in each row are driven from left to right and the columns are driven from top to bottom, the drive signals are accompanied by a clock and horizontal and vertical sync signals.

During the boot-up, the program in the FeRAM reads wire jumpers PID0 through PID3 on the Display Interface Board to determine the manufacturer of the display. Each display manufacturer requires a slightly different control. The program in the FeRAM configures the microboard for correct operation for the actual display installed.

Different display manufacturers require different supply and control voltages for their displays and backlights. Program Jumpers JP2 through JP5 and JP7 and JP8 must be configured to provide the required supply and control voltages to the display and backlight control. *SECTION 5 - MICROBOARD 031-03630-001* lists the required program jumper configuration for each display. Also, a label attached to the display mounting plate lists the required program jumper configuration for that display. The position of program jumper JP2 determines whether the supply voltage is +5 VDC or +3.3 VDC. The microboard controls the Display Backlight via J6. The Display Backlight is the light source for the display. The Backlight Inverter Board (FL Backlight Displays) provides a high voltage AC power source for the lamp. It converts low voltage DC via J6-1 (+12 VDC or +5 VDC, depending on position of Program Jumper JP5) to high voltage AC (500 to 1500 VAC). This high voltage AC is applied to the lamp to cause it to illuminate. The Backlight is turned ON and OFF with the “Backlight Enable” signal (J6-5). The position of Program Jumper JP4 determines whether this is a +12 VDC or +5 VDC signal. In some displays, the backlight turns ON when this signal transitions from low to high; others turn OFF when it transitions from high to low. The position of Program Jumper JP3 determines the transition that will occur when the microboard outputs the Backlight Enable signal. JP3 must be positioned according to the display manufacturer’s requirement. The microboard controls the backlight brightness via the Lamp Dimmer circuit output at J6-7. In order to extend the life of flourescent Backlight lamps, the brightness is driven to 50% after 10 minutes of Keypad inactivity. At this brightness level, the graphics are still visible. When Keypad activity is detected (a key is pressed), the lamp is driven back to full (100%) brightness. Some display manufacturers require a variable voltage to vary the brightness; others require a variable resistance. Program Jumpers JP7 and JP8 must be configured to enable the appropriate technique. The Lamp Dimmer is an integrated circuit that is the electrical equivalent of a 10K ohm potentiometer

with 100 positions or steps (See *Figure 28 on page 92*). The Lamp Dimmer controls the position of the potentiometer. The Lamp Dimmer varies the brightness of the backlight by applying a variable voltage (0 to 5.0 VDC) or a variable resistance (0 to 10K ohms) to the Backlight Inverter Board (If applicable). If Program Jumpers JP7 and JP8 are installed, the Lamp Dimmer output is a variable voltage; if both are removed, the output is a variable resistance. The Lamp Dimmer outputs “Brightness Control Wiper” (J6-7) to the Backlight Inverter Board. If configured for variable voltage output, the voltage between J6-7 and J6-8 can be varied from 0 VDC (100% brightness) to 5.0 VDC (0% brightness). If configured for variable resistance, the resistance between J6-6 and J6-7 varies from 0 ohms (0% brightness) to 10K ohms (100% brightness). See *SECTION 7 - LIQUID CRYSTAL DISPLAY*, *SECTION 8 - DISPLAY INTERFACE BOARD*, and *SECTION 9 - DISPLAY BACKLIGHT INVERTER BOARD* of this manual for details of the display interface.

Remote Setpoints

Remote Leaving Chilled Liquid Temperature and Current Limit setpoints can be input via the RS-232 E-Link Gateway interface at J2 or directly to the microboard at J22 (See *Figure 30 on page 94*). The inputs at J22 are configured with Program Jumpers JP23 and JP24 to accept these inputs in either 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or 4 to 20mA form. See Program Jumper configurations and *SECTION 22 - REMOTE SETPOINTS* of this manual for details of the Remote setpoints.

CONFIGURATION AND SETUP

The following functions are entered as setpoints on the SETUP Screen. See entry instructions in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

Chilled Liquid Pump Operation – Determines Chilled Liquid Pump control contacts (I/O Board TB2-44/45) operation when chiller shuts down on cycling shutdowns. Selections are:

1. *Standard* – Contacts open at completion of System Coastdown after all shutdowns except LEAVING CHILLED LIQUID – LOW TEMPERATURE. On this shutdown, they remain closed, causing the pump to continue to run while the chiller is shutdown.
2. *Enhanced* – Contacts open at completion of System Coastdown after all shutdowns except LEAVING CHILLED LIQUID – LOW TEMPERATURE, MULTI-UNIT CYCLING- CONTACTS OPEN and SYSTEM CYCLING – CONTACTS OPEN. On these shutdowns, they remain closed, causing the pumps to continue to run while the chiller is shutdown.

Motor Drive Type – Configures the program for the applicable compressor motor drive type. Selections are:

1. *EM* – Electromechanical Starter
2. *SSS-Mod A* – Style A Solid State Starter
3. *SSS-Mod B* – Style B Solid State Starter
4. *VSD-60Hz* – Variable Speed Drive, 60Hz
5. *VSD-50Hz* – Variable Speed Drive, 50Hz
6. *MVVSD-60Hz* – Medium Voltage VSD, 60 Hz
7. *MVVSD-50Hz* – Medium Voltage VSD, 50 Hz
8. MVSSS – Medium Voltage Solid State Starter

Anti-recycle – Enables or Disables the Anti-recycle timer. Selections are:

1. *Enabled* – Enables the anti-recycle timer. Solid State Starters and electromechanical starter applications cannot be started at intervals shorter than once every 30 minutes. VSD applications can be started at the completion of System Coastdown up to 5 times. On the 5th shutdown, a 10-minute timer is started and restart is inhibited until the timer has elapsed.
2. *Disabled* – Disables the anti-recycle timer. Chiller can be started at the completion of System Coastdown, regardless of how long the chiller had been running.

CAUTION

The Anti-recycle timer must never be disabled unless advised by YORK factory.

Power Failure Restart – Determines the course of action required to restart the chiller, if a power failure occurs while the chiller is running. Selections are:

1. *Manual* – Requires a manual reset after power is restored. The chiller cannot be started until the operator moves the keypad Start-Run-Stop/Reset rocker switch to the stop/reset position.
2. *Auto* – Chiller will automatically restart when power is restored.

Coastdown – Determines the “Coastdown” duration (oil pump run duration after shutdown) and whether the “Motor Controller – Loss of Current” check and anti-recycle function is performed while the chiller is running. Selections are:

1. *Standard* – Electric motor applications. When STANDARD is selected, the Coastdown Time setpoint appears. (See *Coastdown Time on page 85*). This setpoint is used to set the duration over the range of 240 (default) to 900 seconds or 150 (default) to 900 seconds as determined by the selection made for the Chiller Style/Compressor setpoint (on the OPERATIONS Screen).
2. *Enhanced* – “Coastdown” is 15 minutes in duration. Steam Turbine applications. “Motor Controller - Loss of Current” check and anti-recycle function is not performed since there is no motor current.

Pre-run – Determines the duration of the “System Prelube” period. Selections are:

1. *Standard* – “System Pre-lube” is 50 seconds in duration.
2. *Extended* – “System Pre-lube” is 180 seconds in duration.

Oil Pump Package – Configures the program for either Variable Speed Drive Oil Pump or Fixed Speed

Oil Pump. Chillers equipped with the Variable Speed Drive Oil Pump have a Program controlled Oil Heater and a different complement of solenoid valves than chillers equipped with a Fixed Speed Oil Pump. A description of the two Oil Pumps is as follows:

1. *Variable Speed* (style D and later) – configures the program to operate the Variable Speed Drive Oil Pump, the Oil Heater (maintains oil temperature 50°F above condenser saturation temperature) and the Oil Return and Liquid Line (J compressors only) solenoid valves are connected in parallel to TB1-61.
2. *Fixed Speed* (style C) – Configures the program to operate the fixed speed Oil Pump and the following solenoid valves:
    - TB1-34 Liquid Line
    - TB1-61 Oil Return and Vent Line connected in parallel
    - TB1-62 High Speed Thrust

Motor Communications Protocol (VSD applications (VSD and Style B LCSSS applications)

Only displayed when Motor Drive Type setpoint above is selected as "VSD-60Hz", "VSD-50Hz" or "SSS-Mod B". Allows the Service technician to enable the appropriate serial communications port for communications with the Style B Liquid Cooled Solid State Starter (LCSSS) or Variable Speed Drive (VSD). Early vintage Style B LCSSS and VSD communicate with the microboard using YORK protocol (COM 5 (J15)). Later vintage units use Modbus protocol (COM 2 (J13)).

The protocol selection enables the appropriate communications port:

- YORK enables COM 5 (J1A 5)
- Modbus enables COM 2 (J13)

Selection required is based on the hardware and interface that is present. See *SECTION 13 - SOLID STATE STARTERS* and *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* Board to determine which hardware/interface is present. The chiller must be stopped with the START-RUN-STOP/RESET switch in the STOP/RESET position to change this setpoint. A description of the two protocols is as follows:

1. *YORK* – Enables COM 5 (J15) serial port. On Variable Speed Drive applications, used when the microboard is interfaced to the VSD via the ACC Board. On Style B Liquid Cooled Solid State Starter applications, used when the microboard is interfaced to the LCSSS Logic/Trigger Board TB2.
2. *Modbus* – Enables COM 2 (J13) serial port.
    - VSD Applications – Used when the ACC Board is not present and the microboard is interfaced directly to VSD Logic Board 031-02506 (J16).
    - Style B Solid State Starter Applications – Used when the microboard is interfaced to the LCSSS Logic/Trigger Board 031-02505 (J14).

Motor Node ID (VSD and Style B Liquid Cooled Solid State Starter applications).

Only displayed when Modbus is selected for the Motor Communications Protocol setpoint. Allows the Service technician to enter the Modbus Address of the VSD logic board or Style B LCSSS Logic/Trigger Board. The Motor Node ID setpoint must match the Modbus Address assigned to these boards. Whenever the microboard is reading or writing to these devices, it transmits the address entered as the Motor Node ID setpoint. The device will only respond if the transmitted address matches the address assigned to the device. The chiller must be stopped with the START-RUN-STOP/RESET switch in the STOP/RESET position to change this setpoint.

- VSD Applications – Enter 1 for the Motor Node ID setpoint. Then set the Modbus Address of VSD Logic Board 031-02506 to "1" by setting Switch SW3 position 1 to ON with all other positions OFF.
- Style B Solid State Starter Applications – Enter 1 for the Motor Node ID setpoint. Then set the Mod-bus Address of the Logic/Trigger Board 031-02505 to 1 by setting Switch SW1 Position 1 to ON with all other positions OFF.

Coastdown Time – Only appears when STANDARD is selected for the Coastdown setpoint. Sets the duration of the coastdown period. The time is programmable over the range of 240 (default) to 900 seconds or 150 (default) to 900 seconds as determined by the selection made for the Chiller Style/Compressor setpoint on the OPERATIONS Screen. Refer to the Chiller Style/Compressor setpoint.

Condenser Temperature Range – Special order chillers that operate at higher than standard condenser temperatures require higher condenser high pressure warning and safety thresholds. This setpoint allows the software to be used in either standard or high temperature applications. This setpoint is set at the factory at time of manufacture and requires an ADMIN password to change it. It is only visible when set to Extended. The selections are:

1. *Standard* – Uses standard high pressure warning and safety shutdown thresholds as follows:
   - "Warning – High Pressure Limit" – Maximum allowable value is 162.5 psig
   - "Condenser – High Pressure" – Trip/reset threshold is 180/120 psig
   - "Condenser – High Pressure – Stopped" – Trip/reset threshold 160 psig.
2. *Extended* – Uses higher high pressure warning and safety shutdown thresholds as follows:
   - Warning – High Pressure Limit" – Maximum allowable value is 193.0 psig
   - "Condenser – High Pressure" – Trip/reset threshold is 200/140 psig
   - "Condenser – High Pressure – Stopped" – Trip/reset threshold is 170 psig

PRV Position New production chillers after June 2009 can be equipped with an optional Pre-rotation Vanes potentiometer, regardless of other options. This setpoint allows the software to be used in all YK chillers, whether equipped with the potentiometer or not. The PRV position will be shown on respective screens when Enabled; not shown when Disabled.

1. *Enabled* – Automatically set to this setting if Hot gas bypass or Variable Geometry Diffuser (VGD) is enabled on the OPERATIONS Screen or Motor Drive Type setpoint is set to VSD or MVVSD. The actual connection point of the potentiometer is determined by the equipment configuration:
   - If equipped with a VSD in YORK Protocol configuration, it is connected to the ACC Board.
   - In Modbus Protocol configuration, it is connected to the microboard J7.

   If not equipped with a VSD, but equipped with Hot gas bypass, the connection point is determined by which I/O Board is present. With I/O Board 371-02514-000 or 031-02895-000, it is connected to this board; otherwise, it is connected to the microboard J7. If not equipped with Hot gas bypass but equipped with a VGD, it is connected to the microboard J7.
2. *Disabled* – Set to this position when not equipped with a PRV potentiometer. If equipped with a VSD, MVVSD or the Hot gas bypass or Variable Geometry Diffuser is enabled, this setpoint is automatically enabled and cannot be set to disabled.
   - Motor Monitoring
     The Motor Monitoring feature to be enabled or disabled. Motor Monitoring can not be used with the 371-02514-000 since the Motor Monitoring and the Frick Analog board use differnt protocols.
   - Heat Recovery
     Allows the Heat Recovery feature to be enabled or disabled.
   - Head Pressure Control
     Allows the Head Pressure feature to be enabled or disabled.
   - Heat Pump Duty
     Allows the Heat Pump Duty to be enabled or disabled.

Microboard Service Replacement

If the microboard is replaced within the warranty period, the defective board must be returned to YORK per the warranty return procedure. Use the return instructions and return address label provided with the replacement board.

To order a replacement Microboard for a YK Chiller, order part number 331-03630-601. This part number provides an 031-03630-001 Microboard and SD card that have been programmed with the latest version of the YK "Controls" software. The Program must be loaded in the field by the service technician. Refer to *Renewal Parts – OptiView Control Center (Form 160.54-RP1)*.

The microboard is shipped with a label on the outside of the shipping box that lists the part number of the preprogrammed Microboard (331-03630-601), the basic Microboard part number (031-03630-001) and the version of the pre-programmed "Controls" software (for example, Y.OPT.01.01.308).

Microboard 031-03630-001 is supplied as replacement part after June 2015. This board is backwards compatible to YK chillers presently using the 031-01730-000, 031-02430-000 or 031-02430-001 Microboards. A new power supply harness p/n 571-06765-271 is required to connect the power supply to the improved power connection on the new microboard.

When replacing a 031-01730-000, 031-02430-000 or 031-02430-001 microboard with a 031-03630-001 microboard, all setpoints configurations and sales order data will need to be entered manually.

1. Record the setpoints and configuration settings and print the Setpoints and Sales Order reports.
2. Retrieve the sales order data using the YMSO utility program.
3. Shut down the chiller and then power off the unit following all JCI Safety Requirements.
4. Remove all of the wiring harness plugs from the old microboard and label any loose communication wires that are currently connected to J2, J13 or J12.
5. Loosen the ground screw that holds the power supply harness green ground wire and remove the power supply harness.
6. Remove the 10 microboard mounting screws and remove the old microboard.
7. Set the Jumpers JP2 through JP12 and JP21 through JP25 and SW1 switch on the 03630 to the same positions as those on the 02430 board. A description of these jumpers are found later in this document.
8. Install the new 03630 microboard using the screws previously removed.
9. Connect the power supply harness P2 to J2 on the power supply with the green and yellow ground wire oriented closest to the front of the panel. Attach the ground lug under the ground screw.
10. Connect power supply harness P30 to J30 on the panel wiring harness, J32 to P32 on the panel wiring harness, P1 to J1 on the 03630 and P3 to J3 on the 03630.
11. The VSOP J20 3 pin plug has been replaced by a removable screw terminal plug. The wires will need to be cut from the 02430 P20 plug. Strip the 3 wires 1/8” and insert them in the new 03630 J20 plug. Note that pin 1 on the 03630 board is opposite of where it was on the 02430 board. It is now on the left side of J20. Connect the White wire to terminal 1 of J20, the Red to terminal 2 and the Black to terminal 3.
12. If an ACC board is installed, the wires on the 02430 P15 plug will also need to be cut and stripped and inserted into the 03630 J15 COM5A removable screw terminal plug. Connect the Red wire to terminal 1, the White wire to terminal 2 and the Black wire to terminal 3.
13. If an ACC is not installed then if the starter is a VSD, MVVSD or MVSSS with Modbus communication, connect the Green wire to J13-2 (-), the White wire to J13-3 (+) and the Black wire to J13-4 (Gnd).
14. If an SC-EQ or E-Link is installed, connect the wires to 03630 J2. Connect the Red to terminal 6 GRX, Black to terminal 6 GTX.
15. If Expansion LTC I/O or a Motor Monitoring board is installed, connect the communication COM3 to the 03630 COM3 J12 Red wire to terminal 5 + and the Black wire to terminal 4 -.
16. Connect all of the remaining plugs to their appropriate connections on the microboard. All plugs are marked the same designation on the 03630 as they are on the 01730 and 02430.
17. Power up the panel with the rocker switch in the OFF position.
18. Enter the Sales Order data either manually or using the YMSO utility program then enter the setpoint and configuration data.

Program Card Service Replacement

Since one YK SD Program card can be used to reprogram other YK chillers, it is not necessary for an individual Service technician to have more than one YK Program card. Program cards can be shared among Service technicians where appropriate.

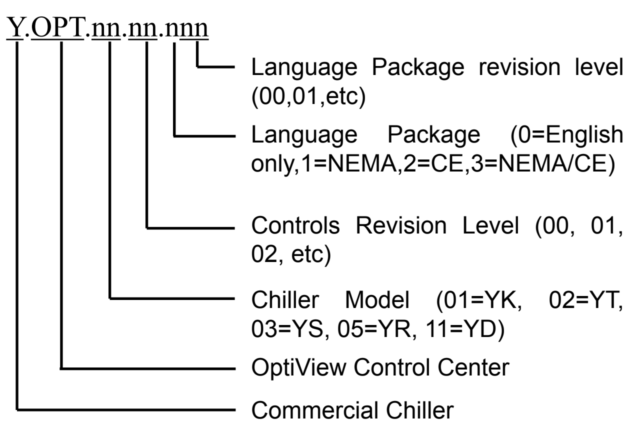
However, since chiller operating programs are occasionally revised, the Service technician could have a Program card that does not contain the latest program. Program cards (031-03601-001) for YK chillers are available from the Baltimore Parts Distribution Center (PDC). The card received from the PDC is programmed with the latest version of the chiller operating program. Program cards can be re-programmed with the latest program version.

DOWNLOADING A PROGRAM FROM A PROGRAM CARD

CAUTION

There are 3 steps to the re-programming process: Erase, Program and Verification. Once the re-programming process is initiated, it automatically proceeds through these steps to completion. It cannot be manually terminated before completion. Therefore, once the process is initiated, the existing on-board program will be erased and replaced by the program in the Program card. Before proceeding, be absolutely certain the Program card is applicable to your chiller model. For example, if your chiller is a YK chiller, the Program card used MUST be for a YK chiller. If a YS chiller program is downloaded into a YK chiller, for example, the chiller will be rendered inoperable until this procedure is repeated using the correct Program card!

A label affixed to the Program card contains the card version. The version is an alpha-numeric code that identifies the chiller model applicability, language package and program revision level. The version is as follows:



Download the program as follows:

1. Remove power to OptiView Control Center.
2. Reposition Microboard DIP switch SW1 position 4 to ON.
3. Insert Program card into Microboard connector J26.
4. Restore power to OptiView Control Center. A white screen appears displaying “Flash Checksum Test” and the microboard 7-segment LEDs (U25 and U26) displays “Ch”. While this is displayed, the microboard is performing a checksum test on the Program card. This ensures the integrity of the card before the download procedure can begin. If the checksum test fails, the card is defective or corrupted and the download procedure cannot be performed. If the checksum test passes, the OptiView Flash PROGRAMMER Screen is displayed.
5. Press START key to start the downloading process. A dialog box appears asking if you want to “Erase Onboard Flash and Re-Program from Pc Card?”. **Do not proceed until you understand the above caution!**
6. Use the ► key to scroll to YES.
7. Press ✓ key. The following steps will be performed:
    a. Erasing - During this procedure, the program in the microboard Flash Memory will be erased. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.
    b. Programming - During this procedure, the program in the Program card is downloaded into the microboard Flash memory. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.
    c. Verifying - During this procedure, a checksum test is performed on the new program in the microboard Flash Memory. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.

The microboard 7-segment LED Displays (U25 and U26) display the steps of the programming process while they are in effect. During the Erasing procedure, “Er” displayed. During the Programming procedure, “Pr” is displayed. During the Verifying procedure, “Ch” is displayed.

At the completion of the re-programming process, if it is successful, “Flash Has Been Successfully Programmed” is displayed and “Operation Successful” is displayed in the Status Code box. Otherwise, a message in the status box indicates the step that failed.

8. Remove power from OptiView Control Center.
9. Remove Program card from Microboard connector J26 by lightly pushing the SD card in and then releasing pressure. The SD card should pop out slightly allowing for removal.
10. Reposition Microboard DIP Switch SW1 position 4 to OFF.
11. Apply power to the OptiView Control Center. The re-programming procedure is now complete.

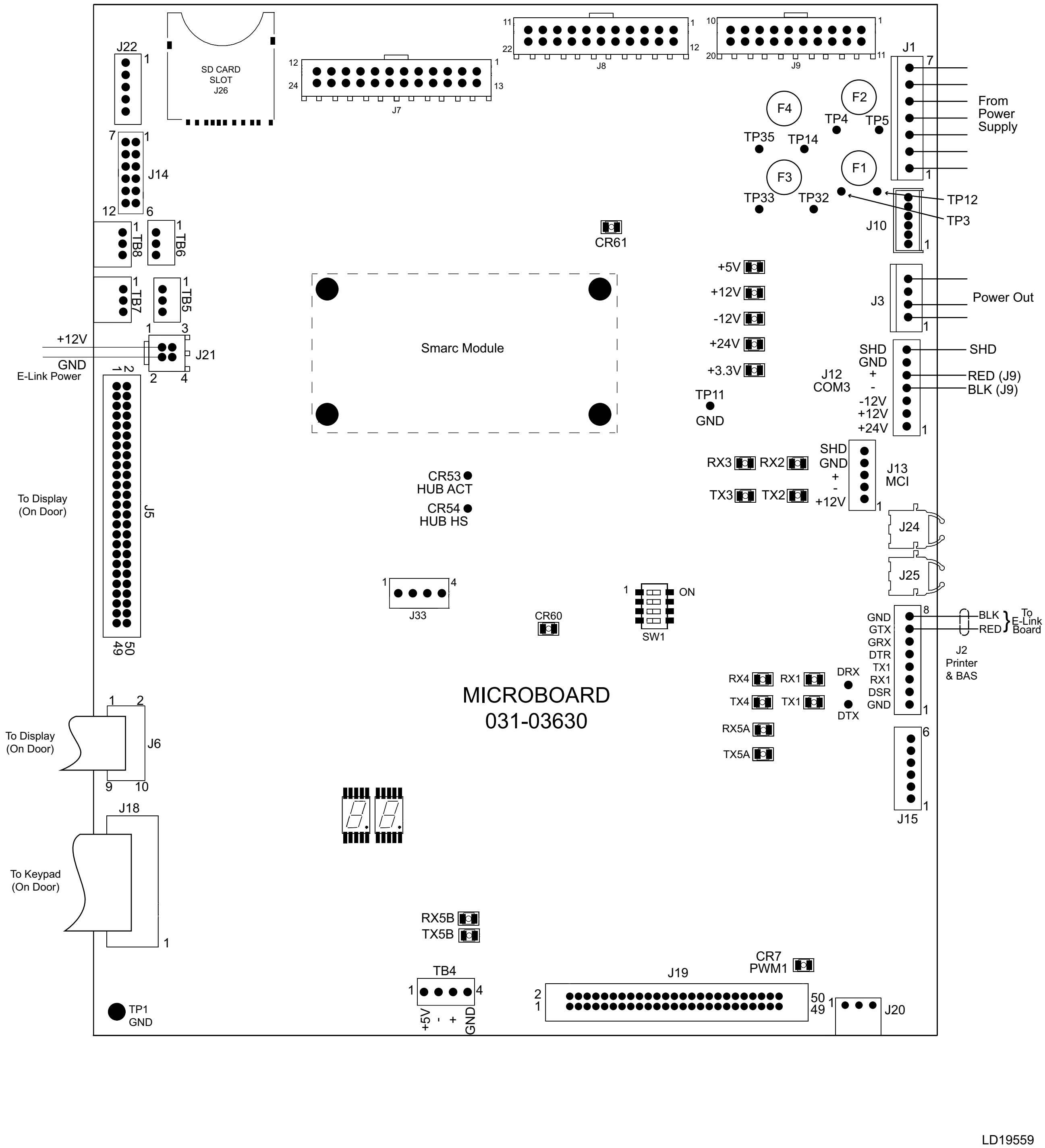


FIGURE 25 - MICROBOARD 031-03630-001

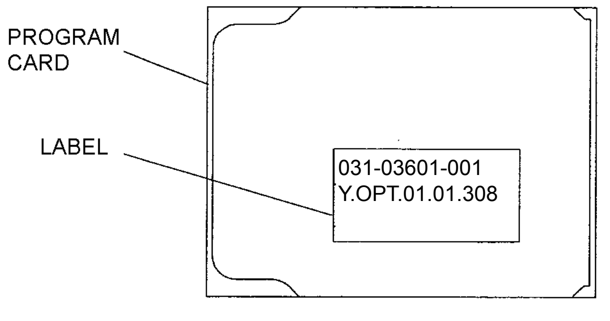
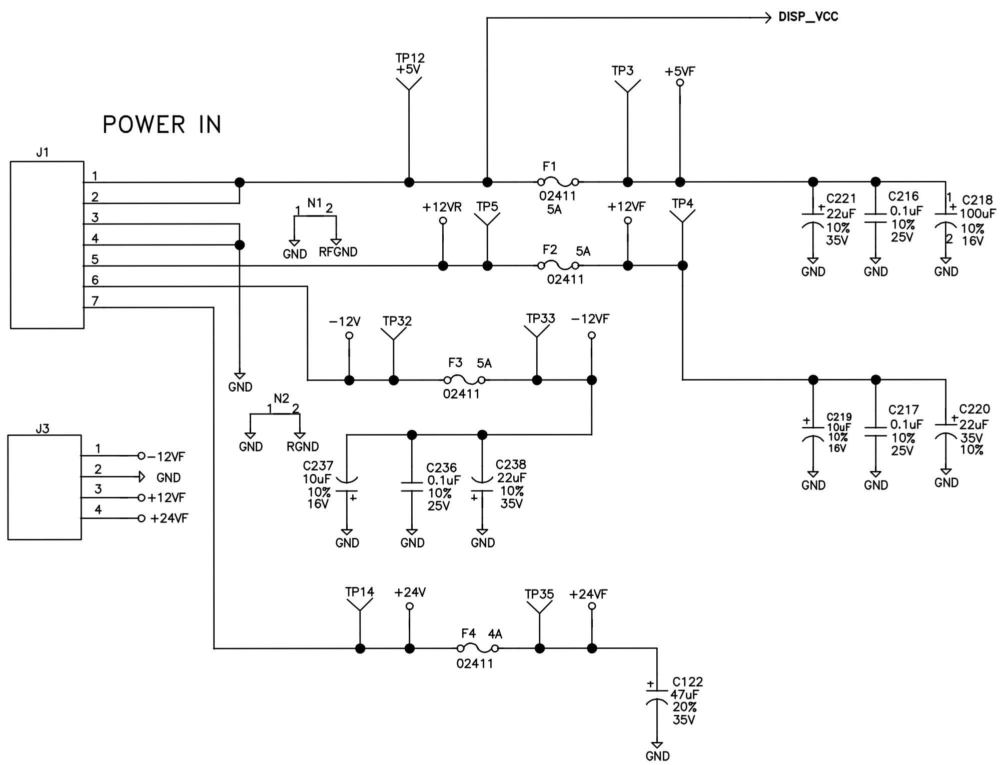
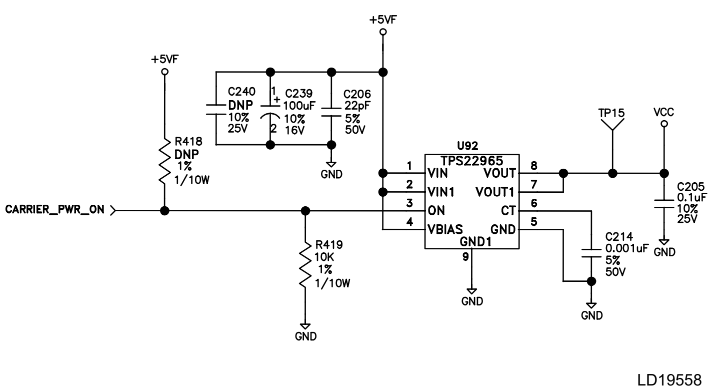


FIGURE 26 - PROGRAM CARD 031-03601-001



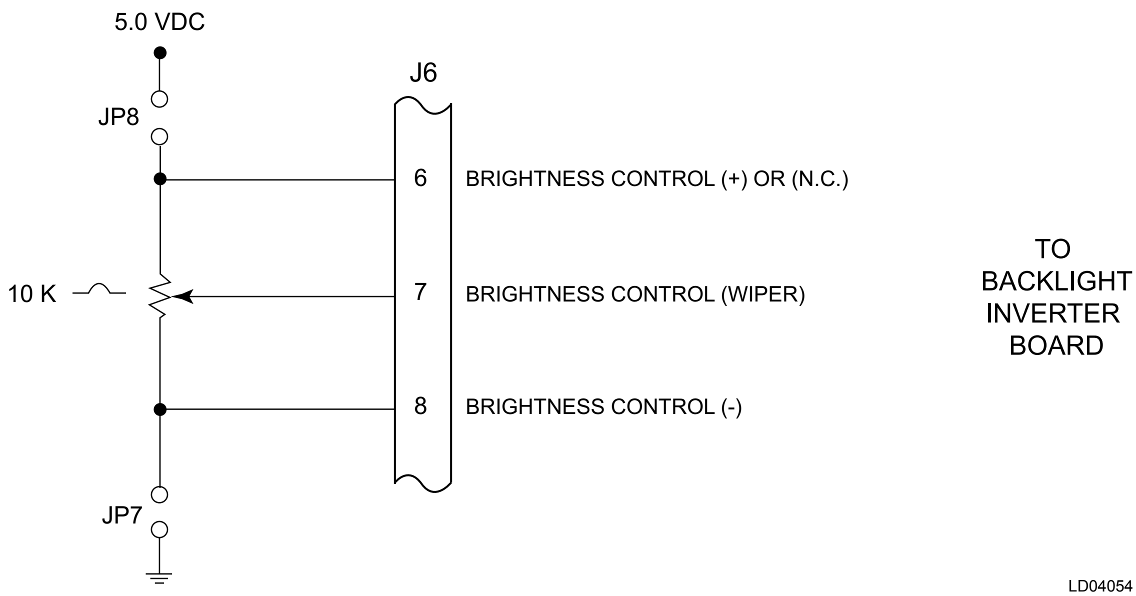
+5.0V Load to Switch Baseboard



Measure the power supply voltages with a Digital Volt Meter in reference to Ground at TP1 or TP11.

VOLTAGE	TEST POINT	VOLTAGE RANGE	FUSE	LED
+5 VDC	TP3	+4.92 to +5.28 VDC	F1 (5A)	CR56
+12 VDC	TP4	+11.58 to +12.5 VDC	F2 (5A)	CR57
-12 VDC	TP33	-11.5 to -12.5 VDC	F3 (5A)	CR58
+24 VDC	TP35	+22.4 to +26.7 VDC	F4 (4A)	CR59
+3.3 VDC	TP2	+3.25 to +3.43 VDC	n/a	CR62
VCC	TP15	+4.92 to +5.28 VDC	n/a	n/a
+5VA	TP10	+4.95 to +5.05	n/a	CR61
Battery	n/a	+2.95 to +3.45	n/a	n/a

FIGURE 27 - MICROBOARD (031-03630-001) DC POWER SUPPLY TEST POINTS



NOTES:

1. J6-6 not connected (N.C.) to Backlight Inverter Board when display is manufactured by Sharp or NEC.
2. The position of Program Jumpers JP7 and JP8 determine the output at J6-7; In = Variable Voltage; Out = Variable Resistance. Refer to Program Jumper Listing for applications.
3. Potentiometer is actually an integrated circuit that is the electrical equivalent of a 10KΩ potentiometer.

FIGURE 28 - MICROBOARD LAMP DIMMER CIRCUIT

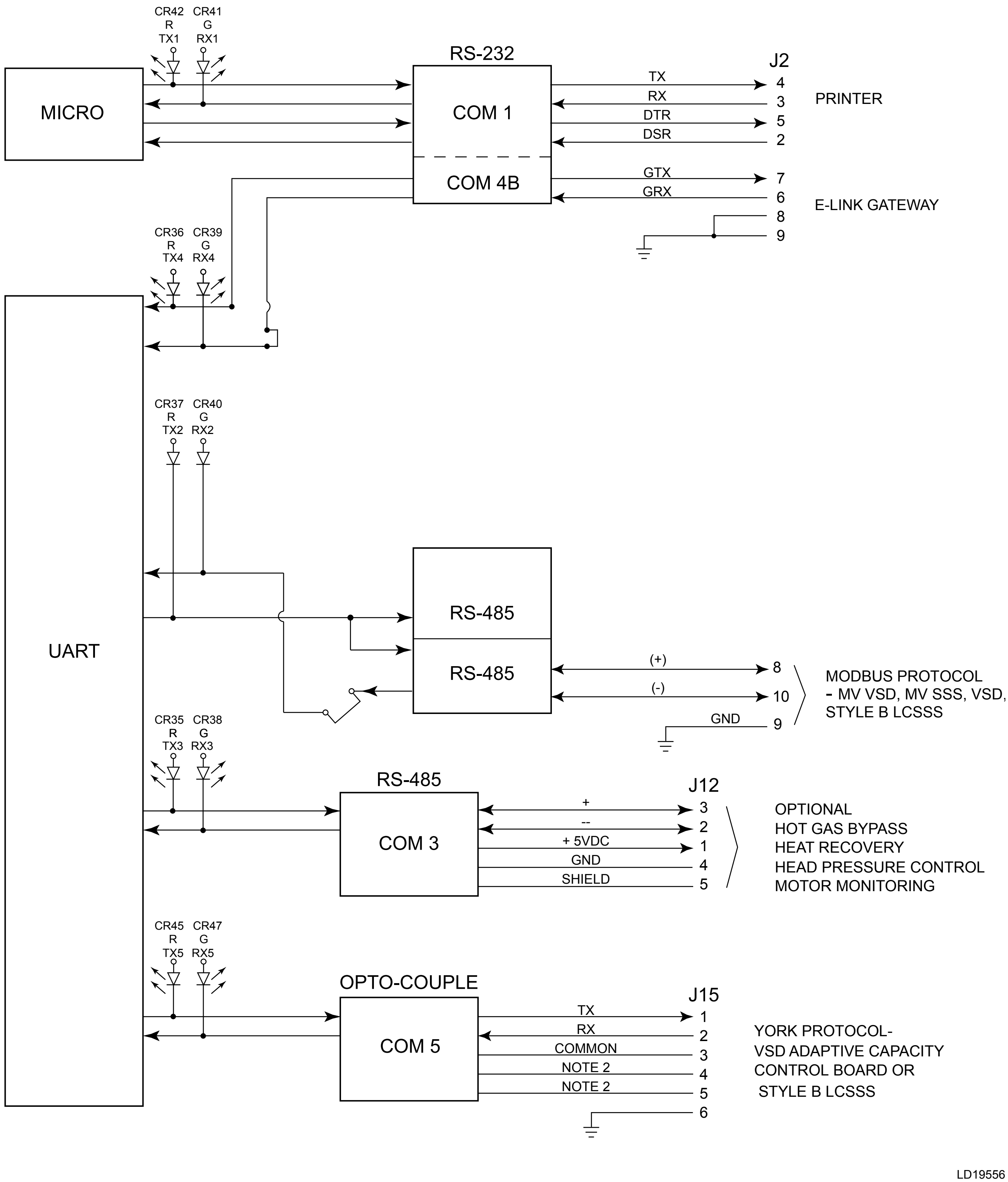
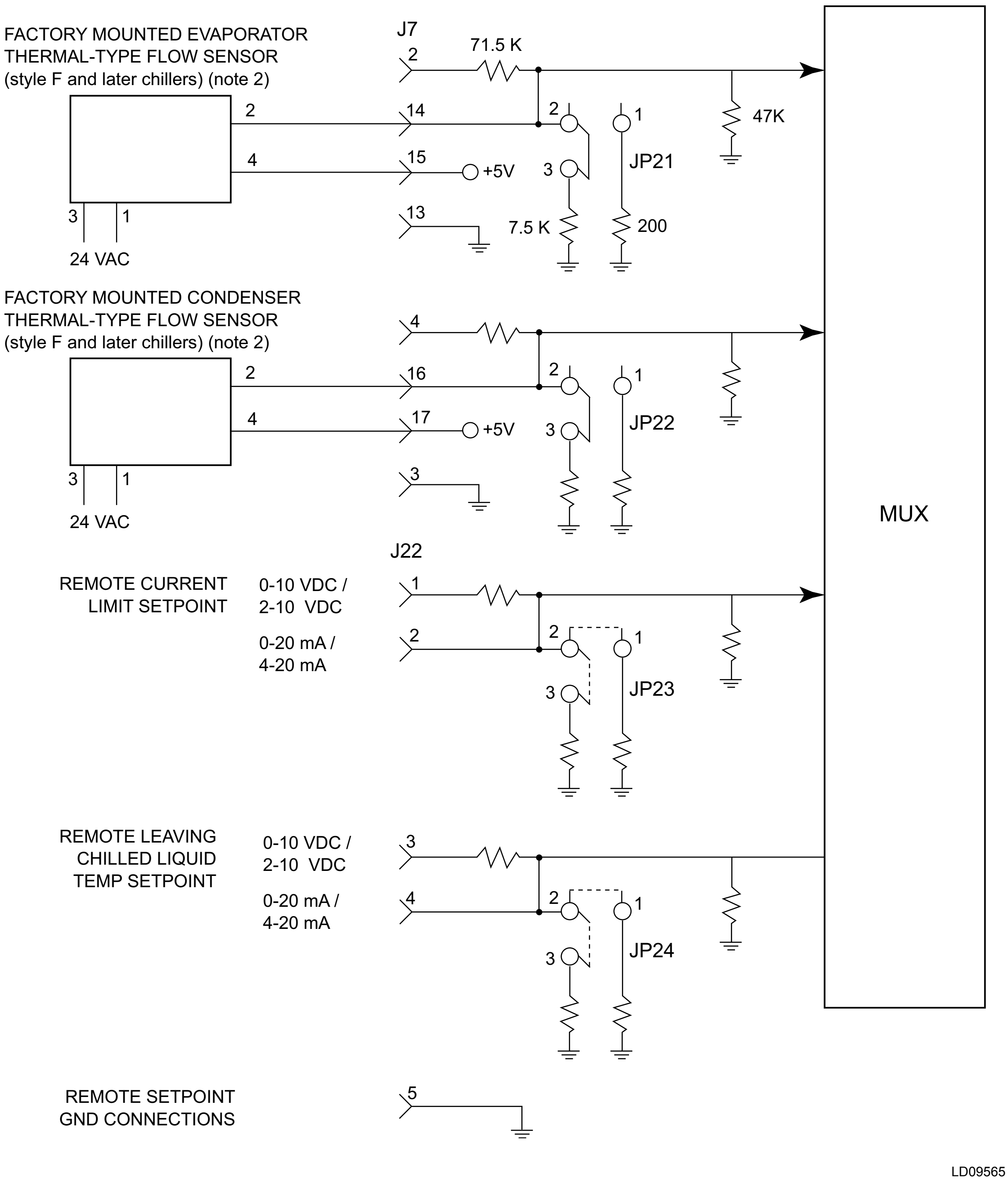


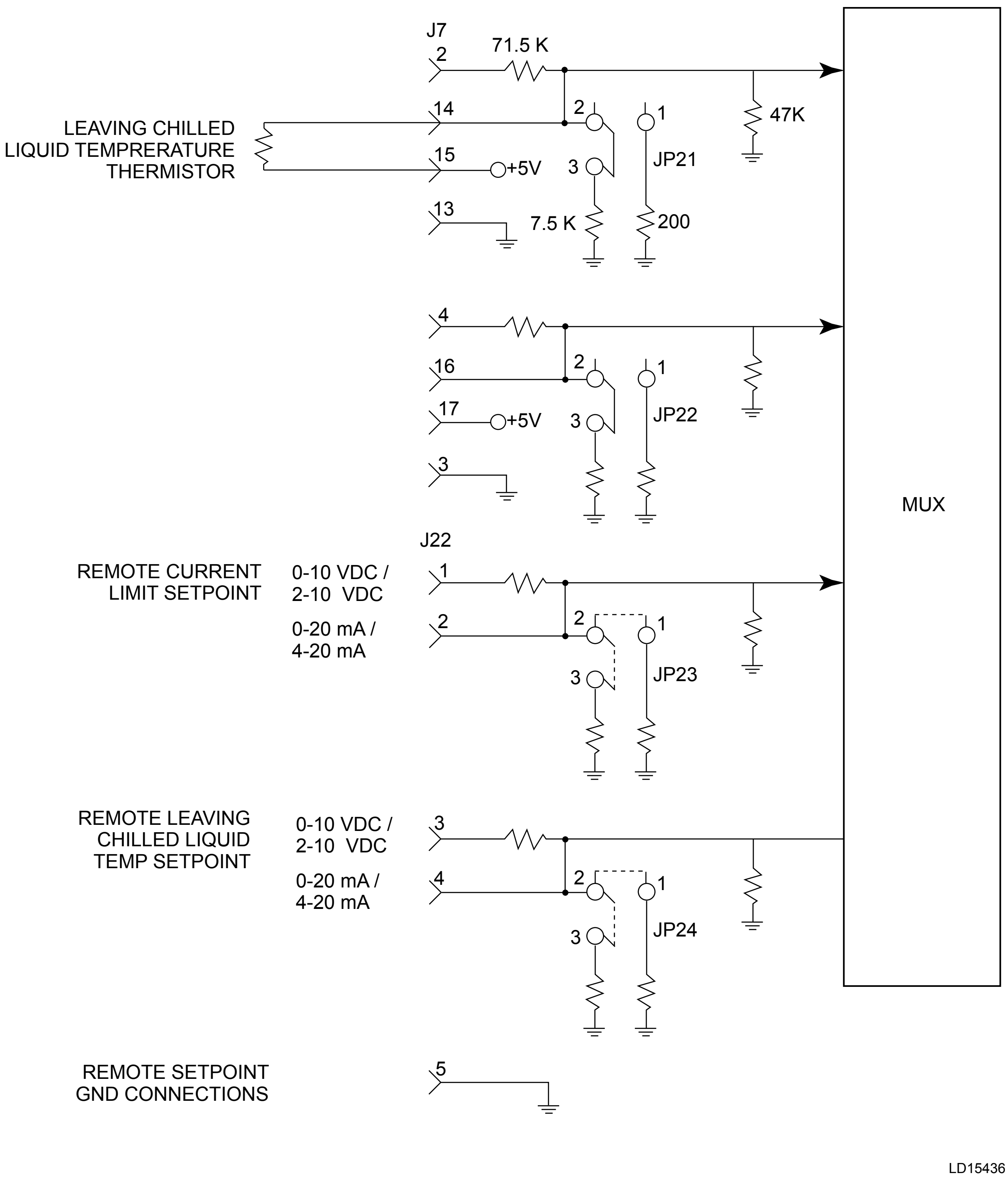
FIGURE 29 - MICROBOARD SERIAL DATA COMMUNICATION PORTS



NOTE:

1. Program Jumpers JP23 – JP24 must be positioned on pins 1-2 or 2-3 according to input signal type. (Voltage OUT, Current 1-2, 2-3 Not Used)
2. On new production chillers before June 2009, the Thermal type flow sensors are connected to Microboard J7 as shown above. Program Jumpers JP21 and JP22 must be on pins 2-3. On new production chillers after June 2009, the Thermal type flow sensors are connected to Microboard J14 (See *Figure 32 on page 96*).
3. Factory mounted evaporator Thermal type flow sensor (new production chillers before June 2009) or Leaving Chilled Liquid Temperature Thermistor (chillers equipped with the optional Heat Pump Duty.feature)

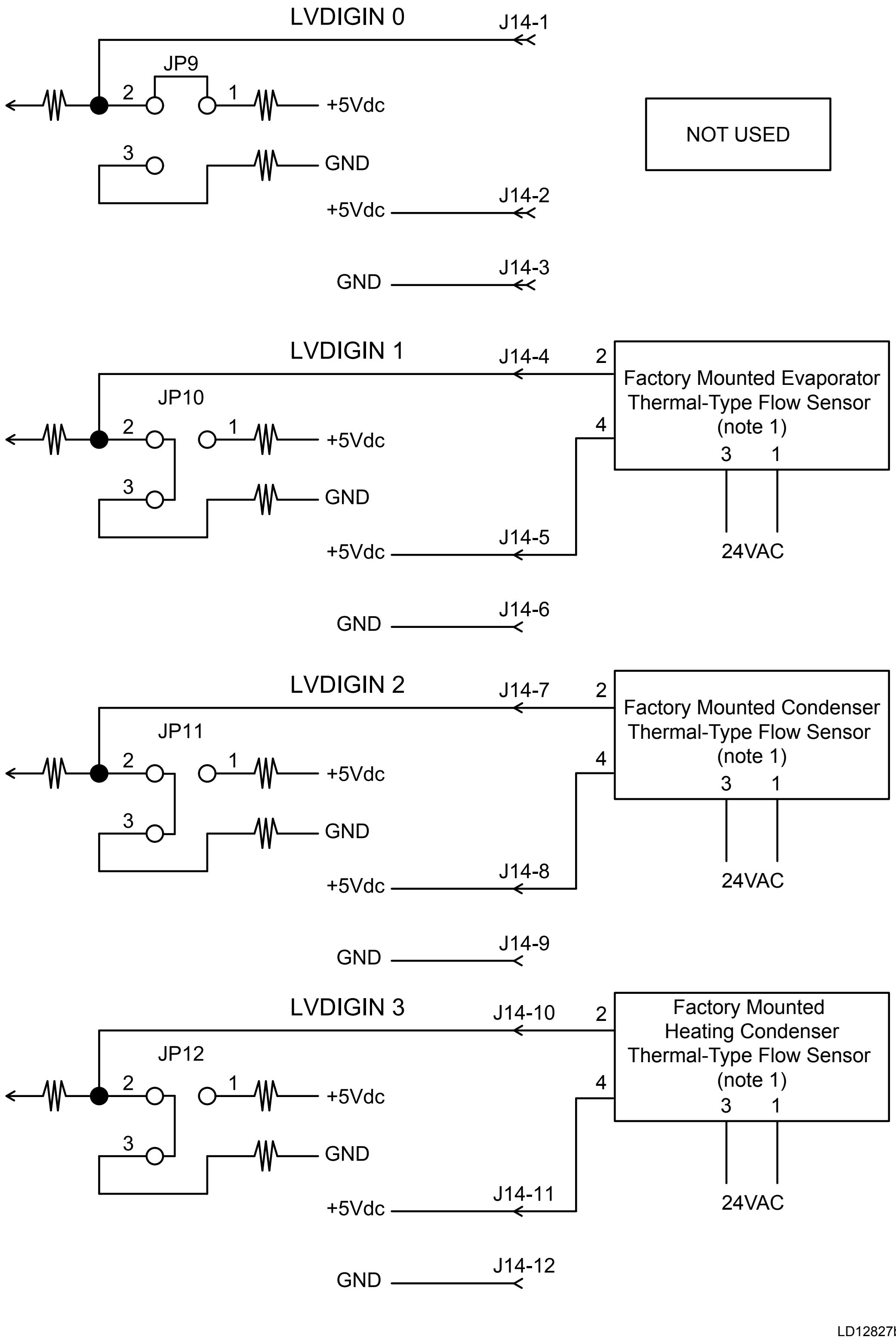
FIGURE 30 - CONFIGURABLE ANALOG AND REMOTE SETPOINT INPUTS



NOTE:

1. Program Jumper JP21 must be positioned on pins 2-3. (Thermal type Evaporator flow sensor for chillers produced before June 2009 and Leaving Chilled Liquid Temperature sensor for Heat Pump Duty chillers.)

FIGURE 31 - CONFIGURABLE ANALOG AND REMOTE SETPOINT INPUTS (HEAT PUMP DUTY)



NOTE:

1. On new production chillers after June 2009, the Thermal type flow sensors are connected to Microboard J14 as shown above. Program Jumpers JP10 through JP12 must be positioned on pins 2-3 and software version C.OPT.01.21.307 (and later) is required. On new production chillers before June 2009, the Thermal type flow sensors are connected to Microboard J7 (See *Figure 30 on page 94*).

FIGURE 32 - LOW VOLTAGE DIGITAL INPUTS

SECTION 6 - I/O BOARD

I/O BOARD

The I/O (input/output) Board conditions the Digital inputs for the microboard and conditions the microboard's Digital Outputs for application to other components and devices. The left side of the I/O Board performs the Digital inputs function; the right side performs the Digital Outputs function. See *Figure 33 on page 101.*

DIGITAL INPUTS

Digital inputs are ON/OFF inputs to the microboard from relay and switch contacts, such as flow switches, start/stop switch, and remote cycling/safety devices (See *Figure 34 on page 102*). The microprocessor reads the state of these contacts and reacts per the Program instructions. The contact voltage is 115 VAC when closed and 0 VAC when open. These voltages are not suitable for direct input to the microboard. Therefore, the I/O Board converts the 115 VAC / 0 VAC contact voltages to 0 VDC/+5 VDC logic level inputs for the microboard. Individual Optocoupler circuits (See *Figure 35 on page 103*) perform the conversion for each Digital Input. When the input is 115 VAC, the output will be 0 VDC; when the input is 0 VAC, the output will be +5 VDC.

Field connected Digital inputs, such as those from external devices that cycle the chiller, are connected to terminal strip TB4 (See *Figure 34 on page 102*). These inputs are in the form of dry contacts connected as shown in *Figure 36 on page 103*. The 115 VAC power source that is switched by the remote contacts is supplied by the I/O Board TB4-1. There are multiple TB4-1 terminals located adjacent to the field input connections, as shown in *Figure 33 on page 101 and Figure 34 on page 102*.

DIGITAL OUTPUTS

Digital Outputs are ON/OFF outputs from the microboard that control solenoid valves, motor contactors, actuators, system relays and provide operating status to external devices (See *Figure 37 on page 104*). Per Program instructions. The microboard energizes and de-energizes these devices.

The coils of these devices operate on 115 VAC and therefore cannot be directly connected to the microboard. The Digital Outputs section of the I/O Board contains +12 VDC coil relays that are driven by the microboard's logic level outputs. The contacts of these +12 VDC relays operate the external 115 VAC coil devices. On the I/O Board, one side of the each of the relay coils is permanently connected to +12 VDC at J19-26/27. The other side of each relay coil is connected to the microboard via I/O Board connector J19. The microboard energizes each relay by driving the appropriate input at J19 to logic low voltage level (ground potential). The DC voltage at the appropriate input pin at J19 will be a logic high (greater than +10 VDC) when the microboard is commanding a relay to de-energize; logic low (less than +1 VDC) when commanding a relay to energize.

Relay K18 is different from all other relays on the I/O Board; it has a 115 VAC coil. It provides the start/stop signal to the Compressor Motor Starter and provides **Compressor Run** status to remote devices (See *Figure 37 on page 104*). Relay K18 is controlled by DC relays K13 (start) and K14 (stop). To start the compressor motor, the microboard energizes K13 and K14 simultaneously. The 115 VAC at TB1-6 is applied to the coil of K18 via K13 contacts, energizing K18. Approximately 0.2 seconds later, K13 is de-energized. K18 remains energized through K14 contacts and holding contacts of K18. To stop the compressor motor, the microboard de-energizes K14. To prevent sags in Utility Power from chattering K18, the holding contact of K18, along with the contact of K13, creates an anti-chatter circuit for relay K18. Once energized, K18 cannot be re-energized until K13 is again energized; this will not occur until after a controlled shutdown has occurred and another start sequence has been initiated.

There are conditions external to the I/O Board required to energize relay K18. The 115 VAC will be present at TB1-16 only if the motor controller contacts CM are closed and the circuit between external Terminal Strip TB6-1 and TB6-53 is closed. The CM are located on the CM-2 Board (relay K1), Electromechanical Starter applications, the Solid State Starter Logic Board (relay K1), Solid State Starter applications or a relay mounted on the Variable Speed Drive Logic Board on Variable Speed Drive applications. The High Pressure safety switch "HP", must be closed and the **RUN** Switch "1SS" must be in the **Run** position.

6

TRIACS

Triacs are used to control the Pre-rotation Vanes actuator, Refrigerant Level Variable Orifice actuator and Variable Geometry Diffuser actuator (certain compressors only) (Refer *Figure 37 on page 104*, *Figure 73 on page 169* and *Figure 80 on page 216*).

An actuator has an open winding and a close winding. Current flowing through a winding will cause the actuator shaft to rotate in the respective direction. Each winding is controlled by a Triac.

When a Triac is turned ON, it permits current to flow through the actuator winding, causing the actuator shaft to rotate. Under Program control, the microboard turns the Triacs ON and OFF by applying control signals to the respective Triac Driver. The Triac Driver is an optocoupler device that isolates the microboard low voltage circuits from the higher actuator voltages. To turn on the Triac, the microboard drives the Triac Driver input to logic low (less than +1 VDC) level. The Triac driver responds by shorting the Triac GATE to Triac terminal 2. To turn the Triac OFF, the microboard opens its input to the Triac Driver and allows the input to pull up to +12 VDC. The Triac Driver responds by opening the short from triac Gate to Triac terminal 2.

A voltmeter can be used to determine if a Triac is turned ON or OFF. Measure across the Triac; from Triac terminal 1 to Triac terminal 2. When the Triac is turned OFF, the voltage will be approximately 20 to 30 VAC; when turned ON, it will be less than 10 VAC.

The Pre-rotation Vanes Actuator and Variable Geometry Diffuser actuator are manufactured by Barber-Coleman. This actuator has three windings; a Field winding and two direction windings. One direction winding produces clockwise rotation, the other produces counterclockwise rotation. The 115 VAC applied to the Field Winding induces a 20 to 30 VAC voltage into each of the direction windings. The desired rotation is produced by shorting the Actuator common terminal to the appropriate direction terminal, causing current to flow in the direction winding. As described previously in this section, Triacs control the current through the open and close windings.

The Refrigerant Level Variable Orifice Actuator on new production chillers is manufactured by Belimo. This actuator has two windings; open and close. One winding produces clockwise rotation and one produces counterclockwise rotation. This actuator operates from 24 VAC. As described previously in this section, Triacs are turned ON to allow current to flow through the appropriate winding to produce the desired rotation. If the OptiView Control Center is retrofit to an existing chiller, it could be equipped with a Barber-Coleman Level Actuator that operates as described above.

Chillers equipped with the Variable Geometry Diffuser are supplied with and require I/O Board 031-01743-002. This board is populated with the required Triacs Q3 and Q4 that apply the open and close signals to the Variable Geometry Diffuser ring actuator. See *SECTION 26 - VARIABLE GEOMETRY DIFFUSER.*

RELAY TIMING

Under Program control, the relays are energized and de-energized producing contact operation as follows. Unless otherwise noted, contact rating is 5 amps resistive or 2 Amps inductive at 250 VAC.

K0 - Chilled Water Pump Starter (TB2-44/45)

Dry closure contacts are used. When the chiller is started, the Contacts close 13 seconds after the start of System Pre-lube. Normally, they open coincident with the completion of System Coastdown with the following exceptions:

A. If a LEAVING CHILLED LIQUID - LOW TEMPERATURE cycling shutdown occurs, they do not open at the completion of System Coastdown. They remain closed for the duration of the shutdown or until the keypad COMPRESSOR switch is placed in the Stop-Reset (O) position, whereupon they open.

B. If Microboard Program Switch SW1-8 is in the ON position, they do not open at the completion of System Coastdown when the chiller shuts down on a MULTIUNIT CYCLING - CONTACTS OPEN or SYSTEM CYCLING - CONTACTS OPEN cycling shutdown. They remain closed for the duration of the shutdown or until the keypad COMPRESSOR switch is placed in the Stop-Reset (O) position, whereupon they open.

C. With software version C.OPT.01.23.307 (and later), while “Leaving Chilled Liquid – Flow Switch Open” cycling shutdown is active, the contacts remain closed until the chiller is given a stop command or has another fault.

With software version C.OPT.01.23.307 (and later), on those chiller shutdowns as per above where the contacts remain closed during shutdown, when a chiller restart occurs the contacts remain closed into and throughout the Pre-lube period and the Transducer Auto Zeroing is not performed. With previous software versions, the contacts open during the first 13 seconds of the Pre-lube on the restart and the Auto Zeroing is performed.

K1 - Anticipatory Alarm (TB2-55/56)

Dry closure contacts which close when one of the warning messages listed below are displayed. On most warnings, the contacts automatically open when the warning condition is no longer present. On those warnings marked with an asterisk, the contacts will open only after the warning condition is no longer present and the WARNING RESET key is pressed when logged in at OPERATOR access level or higher.

- Real Time Clock Failure
- Condenser or Evaporator Transducer Error*
- Refrigerant Level Out of Range
- Standby Lube-Low Oil Pressure*
- Setpoint Override*
- Condenser-High Pressure limit
- Evaporator-Low Pressure Limit
- Vanes Uncalibrated-Fixed Speed
- Harmonic Filter-Operation Inhibited
- Harmonic Filter-Data Loss
- Harmonic Filter-Input Frequency Out Of Range.

The following only applies to Flash memory card version C.MLM.01.05.xxx (and later)

- Excess Surge Detected*
- Surge Detected – Excess Surge Limit

K2 - Remote Mode Ready to Start (only operational in Digital, Analog or)(TB2-26/27)

Dry closure status contacts that are closed to indicate to a remote device that the chiller will start upon receipt of a remote start signal. The contacts open coincident with any Cycling or Safety shutdown or anytime the keypad COMPRESSOR switch is placed in the Stop-Reset (O) position. On cycling shutdowns, the contacts will close when the cycling condition clears. On safety shutdowns, the contacts will close only after the Safety condition clears. A manual reset is performed by placing the COMPRESSOR switch in the Stop-Reset (O) position and then back to the RUN (I) position.

K3 - Safety Shutdown Status (TB2-42/43)

Dry closure status contacts which close coincident with a safety shutdown. They remain closed until the safety condition clears and a manual reset is performed by placing the COMPRESSOR switch in the Stop-Reset(O) position, whereupon they open.

K4 - Cycling Shutdown Status (TB2-40/41)

Dry closure status contacts which close coincident with a cycling shutdown. They remain closed until the cycling condition clears, whereupon they open.

6

K5 - Condenser Motor Pump Starter (TB2-150/151) (applies to Flash memory card version C.MLM.01.04.xxx (and later))

Dry closure contacts which close coincident with beginning of System run. They open coincident with the beginning of System Coastdown with the following exceptions:

- If equipped with a Mod B solid state starter, the contacts remain closed at shutdown until all SCR Heat sink temperatures are less than or equal to 105°F or a maximum of 45 minutes.
- With software version C.OPT.01.23.307 (and later), while “Condenser – Flow Switch Open” cycling shutdown is active, the contacts remain closed until the chiller is given a stop command or has another fault.

If it is desired to supply the dry contacts with 115 VAC power from the OptiView Control Panel to control the Condenser Pump Motor Starter; a field installed wire must be connected from TB5-22 to I/O Board TB2-150. Then connect I/O Board TB2-151 to the Condenser Pump Motor Starter.

K6-K 9 - Not Used

K10 - Oil Heater (P compressors and all style "F" (and later) chillers equipped with Flash memory card version C.MLM.01.07.xxx or later version)) (TB1-64/17)

Contacts operate the same as K15.

K11 - Oil Pump Starter (TB 1-29/1) (Style "C" and earlier chillers)

In automatic operation, contacts close 13 seconds after System Pre-lube is initiated. Contacts open at completion of System Coastdown. In manual Oil Pump operation, the contacts close for the duration of manual pump operation. Anytime the chiller is not in System run or System Coastdown and a motor current value of greater than 15% FLA is detected, the contacts close until motor current is no longer detected, whereupon a complete System Coastdown is performed. If Standby Lubrication is enabled, contacts close for 2 minutes every 24 hours since the oil Pump was last automatically or manually run.

K12 - Oil Return Solenoid (all styles, fixed or variable speed oil pump). Liquid Line Solenoid (style D (and later) chillers - J compressor only, variable speed oil pump)). Vent line Solenoid (style "C" and earlier chillers, fixed speed oil pump). (TB1-61)

Contacts close 1 minute after System run is initiated. They open on chiller shutdown coincident with the beginning of System Coastdown.

With software version C.OPT.01.21.307 (and later), to avoid an OIL – LOW TEMPERATURE DIFFERENTIAL condition from preventing a chiller start after running at low load conditions for extended periods, the solenoid is cycled as follows while the chiller is running for P, Q and H9 compressors only:

- When the Oil Sump Temperature is less than the Oil Return Min setpoint, close (de-energize) the Oil Return Solenoid by de-energizing K12 relay.
- When the Oil Sump Temperature is greater than the Oil Return Min setpoint + 7°F, open (energize) the Oil Return Solenoid by energizing K12 relay.
- During coastdown and when not running, the solenoid operation is not changed from standard logic, it remains closed.
- During startup the operation is not changed from standard logic, it remains closed for 1 minute after System run.

K13 - Compressor Motor Starter (start) (TB1-6/16)

Contacts close coincident with the beginning of System run. They remain closed for 0.2 seconds and then open.

K14 - Compressor Motor Stop (stop) (TB 1-6/16)

Contacts close coincident with the beginning of System run. They remain closed for the duration of System run. They open coincident with the beginning of System Coastdown.

K15 - (TB1 -34/1)Oil Heater (Style D/E all compressor codes except P; Variable Speed Oil Pump)

Contacts are open whenever the Oil Pump is operating. When the Oil Pump is not operating, the contacts are operated to maintain the Oil Temperature at a target value of 50°F above the Condenser Saturated Temperature from a minimum of 110°F to a maximum of 160°F. The contacts close when the Oil Temperature decreases to 4°F below target value; open at 3°F above the target value.

On Liquid Line Solenoid (Style "C" (and earlier) chillers, fixed speed oil pump) the contacts function as follows:

- On Electromechanical and Solid State Starter applications the Contacts close 1 minute after System run is initiated.
- On Compressor Motor Variable Speed Drive applications, after the chiller has been running for greater than or equal to 1 minute the contacts close if the oil temperature reaches a value greater than 140°F. They remain closed until the oil temperature decreases to less than 135°F, whereupon they de-energize.

K16 - High Speed Thrust Solenoid (Style "C" and earlier chillers; Fixed Speed Oil Pump) (TB1-62/1)

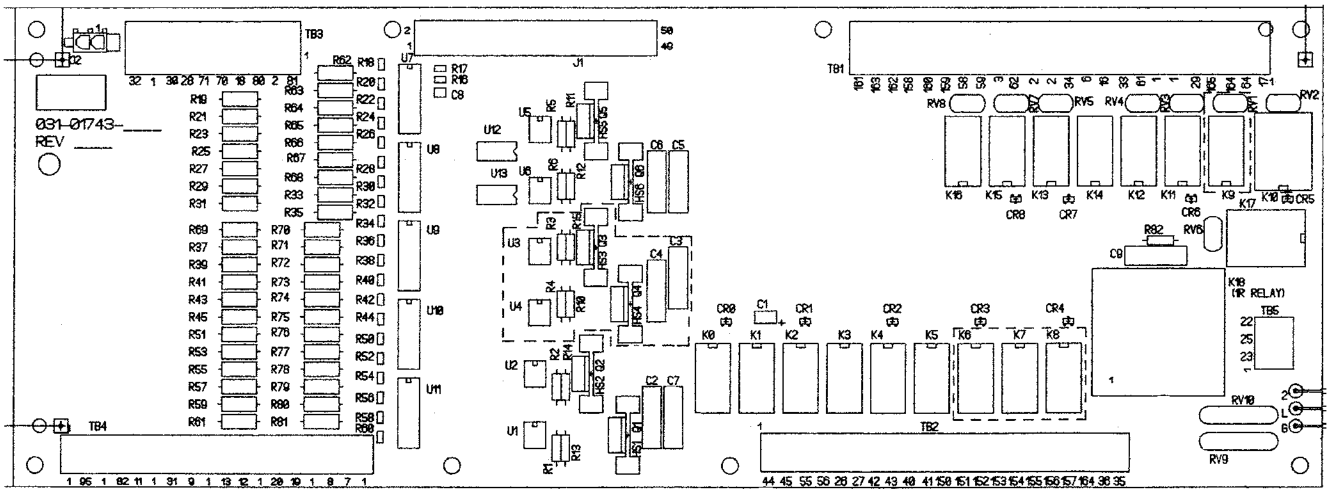
Contacts close 15 seconds after System run is initiated. They open on chiller shutdown coincident with the beginning of System Coastdown.

K17 - Condenser Motor Pump Starter (TB1-164)(If chiller is equipped with Mod B Solid State Starter, use K5 above)

Contacts operate the same as K14.

K18 - Compressor Motor Starter (TB5-22/25) Run Status (TB2-35/36)

Contacts operate the same as K14.



LD04055

FIGURE 33 - I/O BOARD

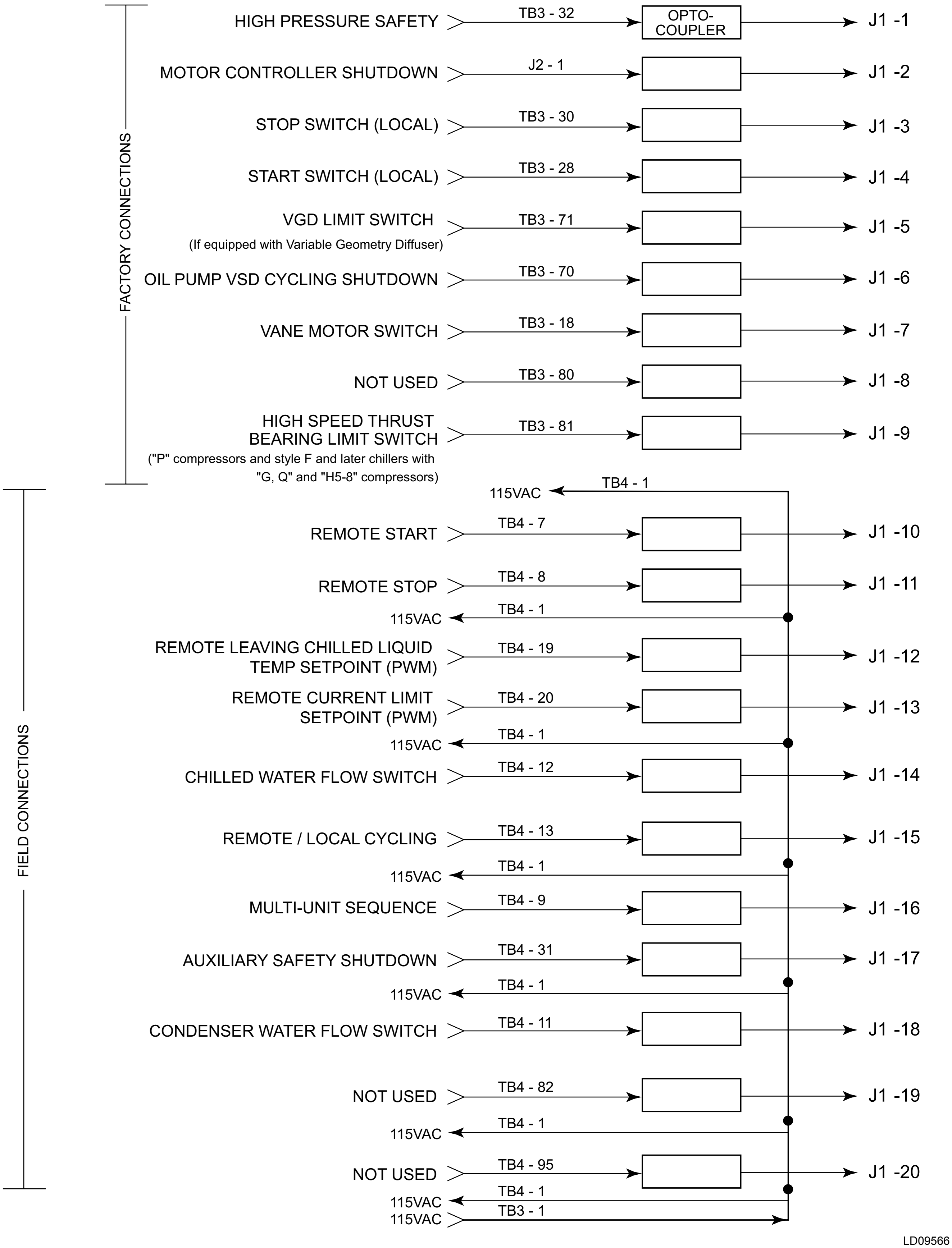


FIGURE 34 - I/O BOARD DIGITAL INPUTS

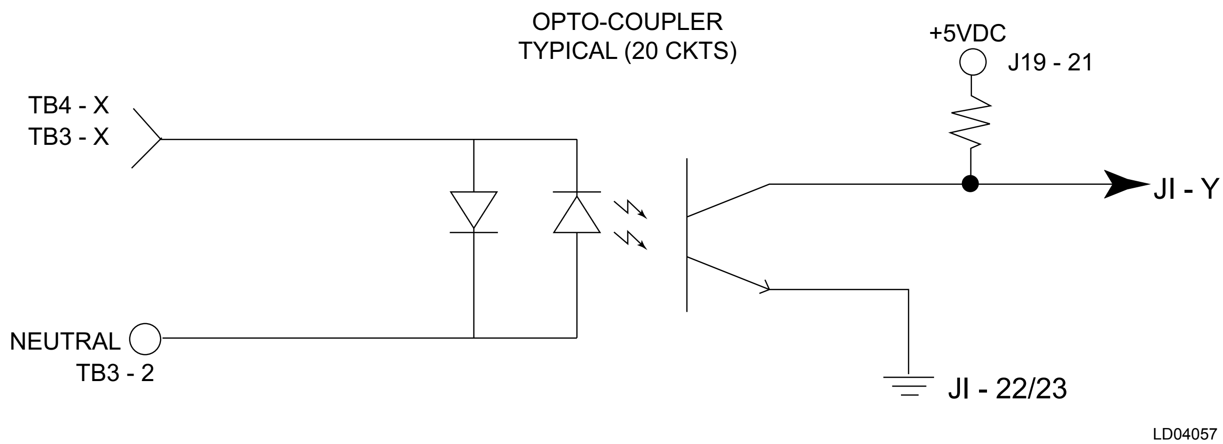


FIGURE 35 - I/O BOARD TYPICAL OPTOCOUPLER CIRCUIT

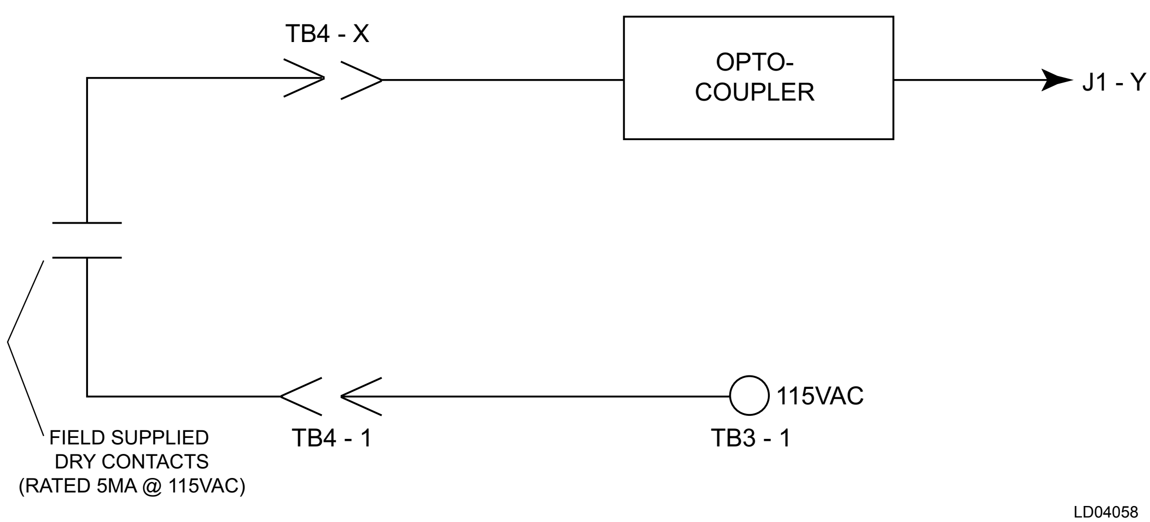


FIGURE 36 - I/O BOARD TYPICAL FIELD CONNECTIONS

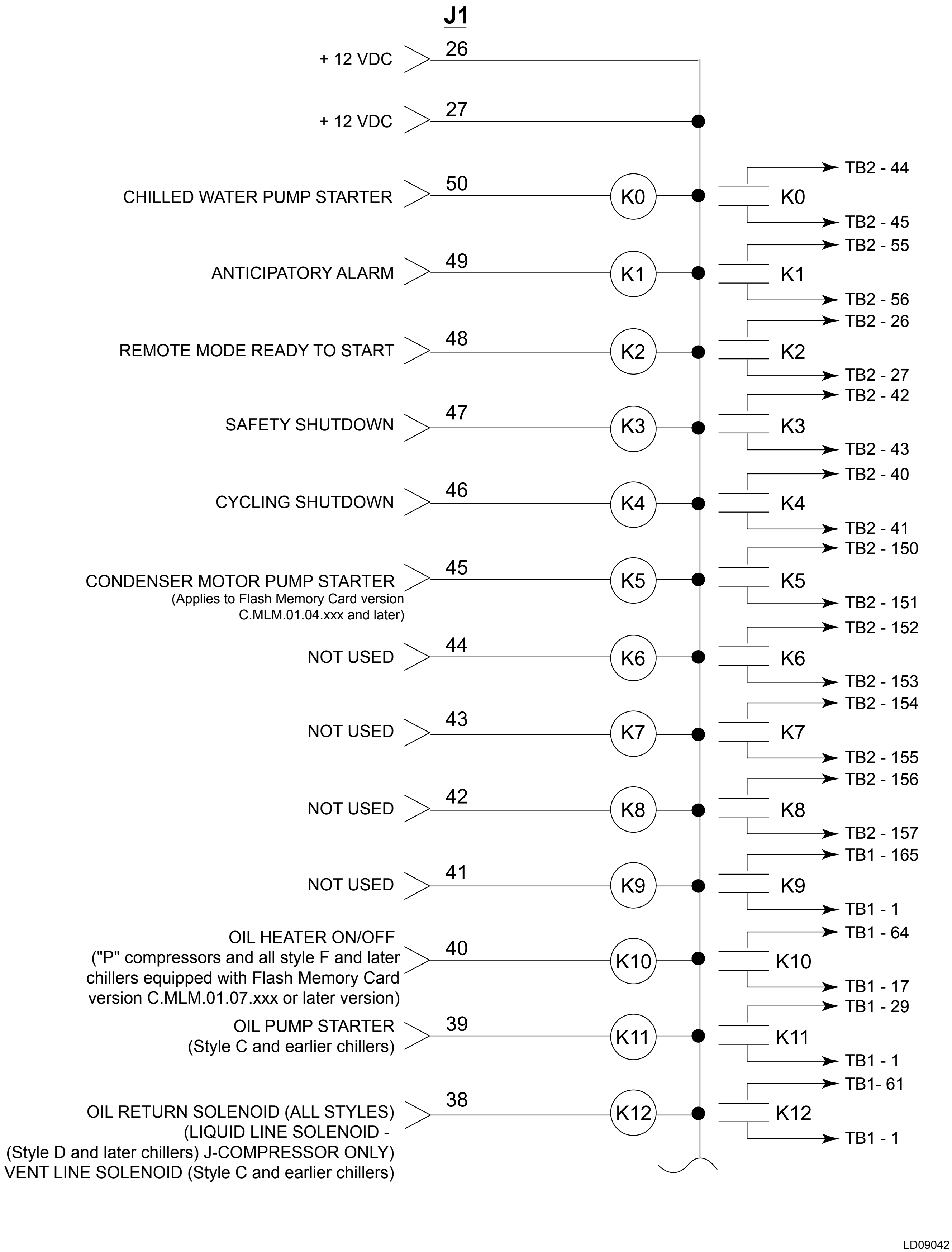
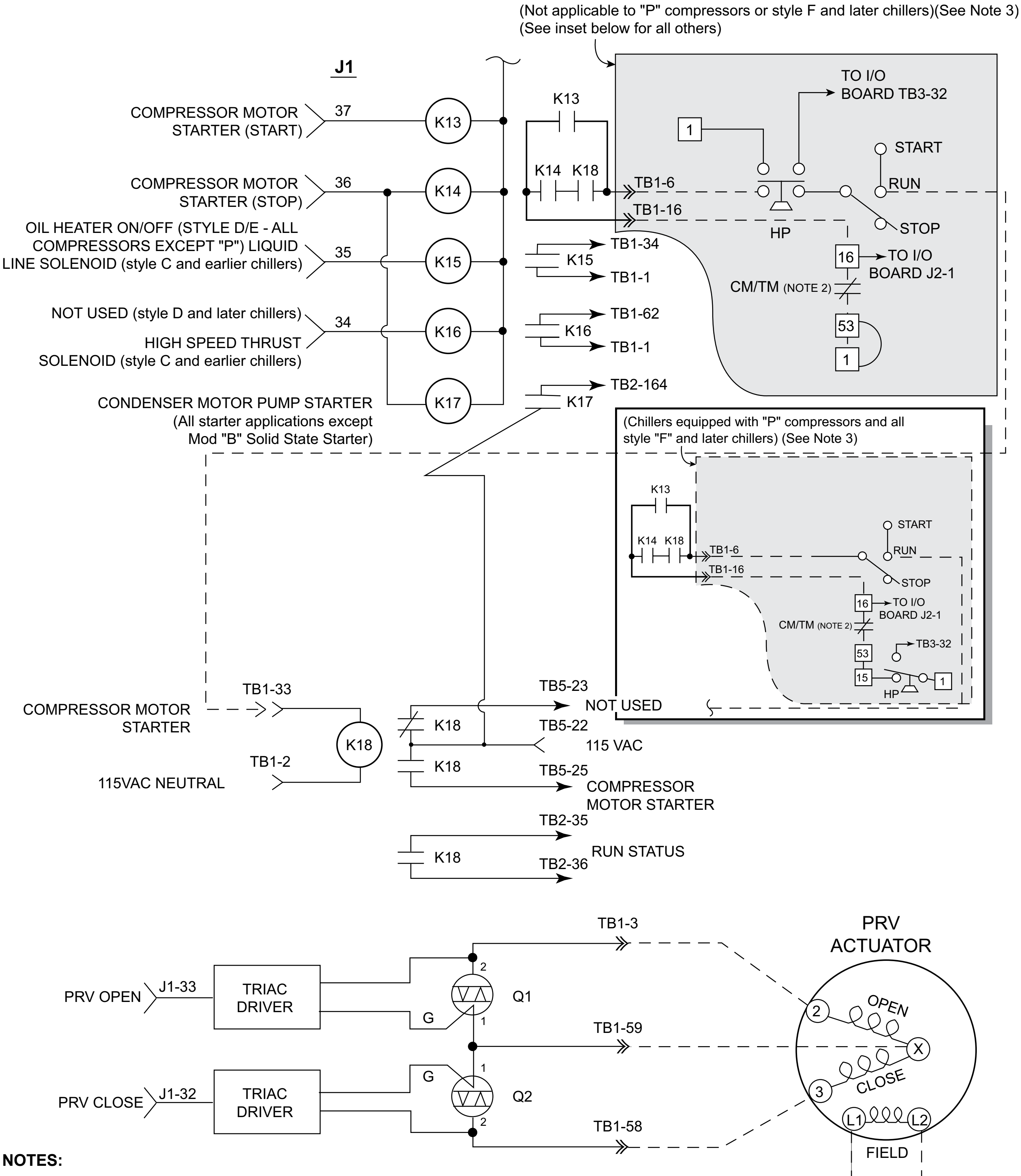


FIGURE 37 - J1 I/O BOARD DIGITAL OUTPUTS



NOTES:

1. – – – – – – – indicates wiring external to I/O Board.
2. CM – Contacts of relay K1 on Current Module (EM Starter Applications) or Solid State Starter Logic Board (Solid State Starter Applications) or VSD Logic Board (Compressor Motor Variable Speed Drive Applications).
3. Chillers equipped with P compressors and all style "F" and later chillers use a different High Pressure (HP) Switch and associated interface than other compressor applications.

FIGURE 37 - J1 I/O BOARD DIGITAL OUTPUTS (CONT'D)

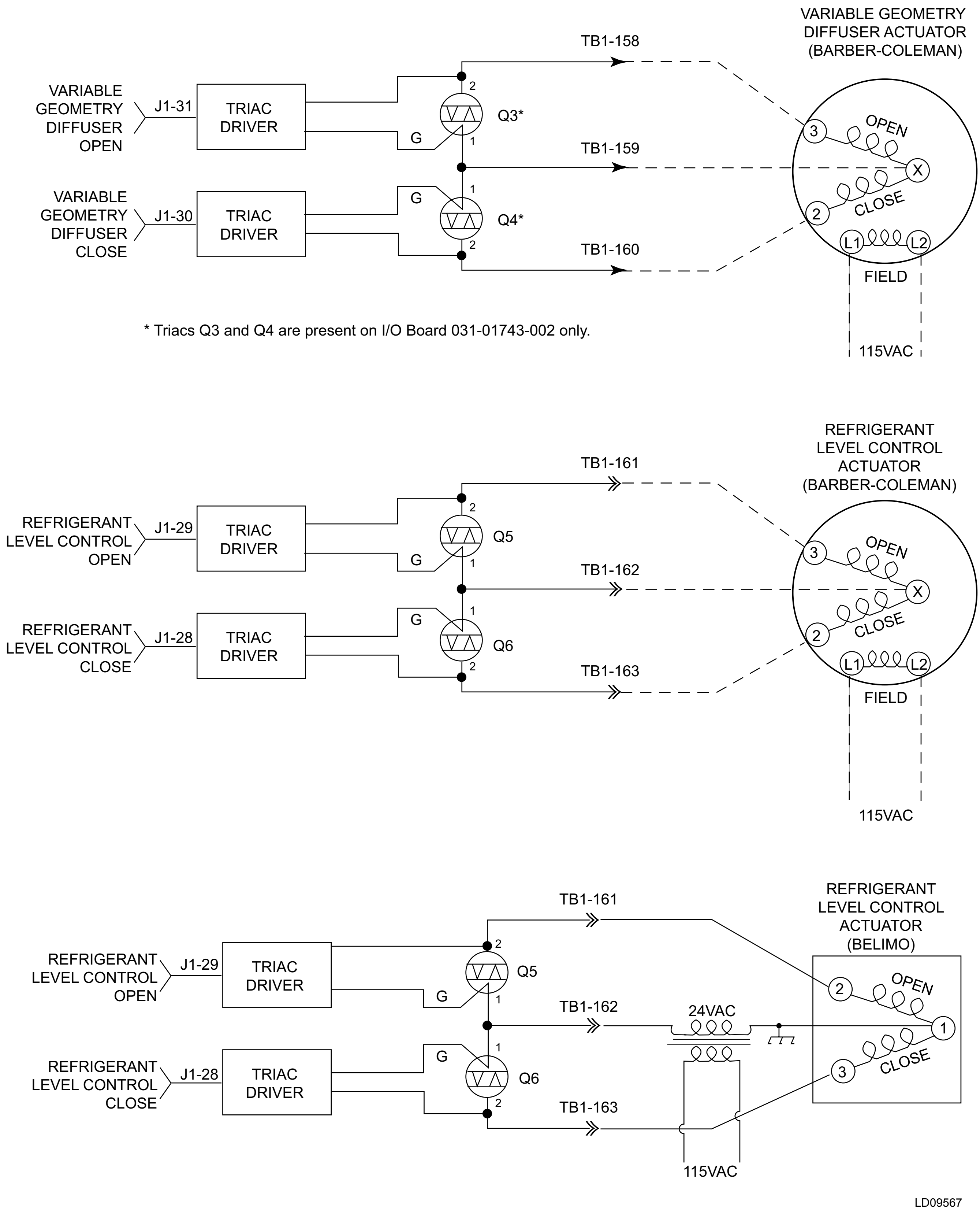


FIGURE 37 - J1 I/O BOARD DIGITAL OUTPUTS (CONT'D)

SECTION 7 - LIQUID CRYSTAL DISPLAY

A 10.4 in. color Liquid Crystal Display, along with supporting components Display Interface Board and Backlight Inverter Board are mounted on a plate that is attached to the OptiView Control Center door. A clear plexiglass faceplate prevents display surface damage. System operating parameters are displayed on various color graphic screens. The various display screens are selected for display using the keypad keys.

The Display provided in the new chiller or from YORK as a service replacement part, could be manufactured by any of several approved manufacturers. Each Display requires a specific Display Interface Board, Backlight Inverter Board, Inverter Board Interface Cable and Program Command Set. **Therefore, Service replacement Displays or supporting components cannot be arbitrarily selected!!!** As explained below, replacement Displays are provided from YORK as kits to ensure compatibility of all components. Non-compatibility of components will result in incorrect operation!!! See *SECTION 8 - DISPLAY INTERFACE BOARD* and *SECTION 9 - DISPLAY BACKLIGHT INVERTER BOARD* that follow this section. Displays that could be provided from YORK in new chillers or as replacement parts are:

- SHARP LQ104V1DG81 (031-03441-000)
- SHARP LQ104V1DG61 (031-02886-000)
- SHARP LQ10D367/368 (031-01774-000)
- LG SEMICON LP104V2-W (031-02046-000)

The YORK part numbers of the Display Interface Board, Backlight Inverter Board and Inverter Ribbon Cable provided, are listed on a label attached to the display mounting plate. These are the part numbers of the supporting components that are compatible with the installed display. These supporting components can be individually replaced. However, if the Liquid Crystal Display fails, Display Replacement Kit 331-01771-000 must be ordered as detailed on *page 109*. This kit contains a replacement Display and all compatible supporting components.

The Display has 307,200 pixels arranged in a 640 columns X 480 rows matrix configuration. Each pixel consists of 3 windows; red, green and blue, through which a variable amount of light from the Display Backlight is permitted to pass through the front of the display. Imbedded in each window of the pixel is a transistor, the conduction of which determines the amount of light that will pass through the window. The conduction of each transistor is controlled by a signal from the Display Controller on the microboard. The overall pixel color is a result of the gradient of red, green and blue light allowed to pass.

Under Program control, the Display Controller on the microboard sends a drive signal for each pixel to create the image on the display. Each pixel's drive signal is an 18 bit binary word; 6 bits for each of the 3 colors, red green and blue. The greater the binary value, the greater the amount of light permitted to pass. The columns of pixels are driven from left to right and the rows are driven top to bottom. To coordinate the drive signals and ensure that the columns are driven from left to right and the rows are driven from top to bottom, each drive signal contains a horizontal and vertical sync signal. The **Display Interface Board** receives these display drive signals from the microboard J5 and applies them to the Display at connector J1. See *Figure 46 on page 117*.

Although there are variations in control signal timing between different display manufacturers, *Figure 38 on page 110* depicts typical control signals. Since these control signals occur at rates greater than can be read with a Voltmeter, the following description is for information only.

There are 480 horizontal rows of pixels. Each row contains 640 3-window pixels. Beginning with the top row, the drive signals are applied within each row, sequentially left to right, beginning with the left most pixel and ending with the right most pixel. The rows are driven from top to bottom. The Vertical Sync (VSYNC) pulse starts the scan in the upper left corner. The first Horizontal Sync (HSYNC) pulse initiates the sequential application of RGB drive signals to the 640 pixels in row 1. Upon receipt of the ENABLE signal, an RGB drive signal is applied to the first pixel. As long as the ENABLE signal is present, RGB drive signals are then applied to the remaining 639 pixels at the CLK rate of 25.18MHz, or one every 39.72 nanoseconds. Typically it takes 31 microseconds to address all 640 pixels.

Similarly, the next HSYNC pulse applies drive signals to row 2. This continues until all 480 rows have been addressed. Total elapsed time to address all 480 rows is approximately 16 milliseconds. The next VSYNC pulse causes the above cycle to repeat.

Displays can be operated in Fixed Mode or Display Enable Mode. In Fixed Mode, the first pixel drive signal is applied a fixed number (48) of clock (CLK) cycles from the end of the HSYNC pulse and the drive signals are terminated a fixed number (16) of CLK cycles before the next HSYNC pulse. In Display Enable Mode, the pixel drive signals are applied to the pixels only while ENABLE signal is present. This signal is typically present 4 to 48 CLKS after the end of the HSYNC pulse and 2 to 16 CLKS before the next HSYNC pulse. All YORK applications operate in the Display Enable Mode. The state of the ENABLE (Display Interface Board J1-27) signal from the microboard places the Display in the desired mode as follows:

- SHARP LQ10D367/368 (031-01774-000) and LQ104V1DG61 (031-02886-000) Displays - When ENABLE maintained “low”, display operates in Fixed Mode.
- LG SEMICON Display (031-02046-000) does not have the Fixed Mode feature.

As described above, in OptiView Control Center applications, the Display scan is left to right, beginning with the top row and continuing sequentially through the rows to the last row. However, in Display applications other than OptiView Control Centers, image reversal is sometimes required. In image reversal applications, the scan is reversed; the scan is right to left, beginning with the last row and proceeding to the top row. The Scan Mode is determined by the configuration of wire jumpers on the Display Interface Board (See *SECTION 8 - DISPLAY INTERFACE BOARD*).

Displays by different manufacturers can require different timing and control signals. The microboard must know which Display is present in order provide the correct signals. Therefore, when AC control power is first applied to the OptiView Control Center, as part of the power-up sequence, the microboard reads the Panel ID wire jumpers P1D0 - P1D3 on the Display Interface Board and determines which Display is present. It can then provide the correct timing and control signals to produce the graphic image, as required by the Display manufacturer. Since the Display Interface Board identifies the Display for the microboard, there is a different Display Interface Board required for each Display application and each has a unique jumper configuration that identifies the Display. A complete explanation of this process is included in the preceding Microboard section and the Display Interface Board section that follows.

The DC power source to operate the Display is provided by the microboard J5. Some Display manufacturers require +5 VDC; others require +3.3 VDC. The position of Microboard Program Jumper JP2 determines which of these power sources is supplied to the Display. JP2 must be positioned according to the Display manufacturers requirements. Refer to Program Jumpers.

The Backlight Lamp provides the illumination for the display. Average lamp life is 25,000 hours (2.9 years). Some displays use one lamp. Others use two lamps. Lamps are replaceable, but not interchangeable between different displays. Each Display manufacturer specifies the required lamp for their display. Refer to replacement parts list for appropriate replacement lamp. Service replacement lamps are stocked in the Baltimore Parts Center.

The lamp is illuminated by applying a high voltage AC (500 to 1500 VAC) to it. This illumination voltage is created from a low level DC voltage (+12 VDC or +5 VDC as required by the Display manufacturer) by the Backlight Inverter Board. Lamp brightness is controlled by varying the high voltage AC. The greater the voltage the brighter the illumination. The lamp is controlled by ON/OFF commands and brightness control signals applied to the Backlight Inverter Board from the microboard. The microboard Program determines when the lamp is turned ON and OFF and the lamp brightness. Each Display manufacturer specifies the Backlight Inverter Board to be used. Therefore, it will vary according to the Display manufacturer.

The LQ104V1DG81 has and LED backlight and does not use a Backlight Inverter Board.

The ribbon cable that connects the microboard to the Backlight Inverter Board also varies according to the Display manufacturer’s requirements. See *Figure 47 on page 118* to *Figure 49 on page 121*. Microboard Program Jumpers JP3, 4, 5, 7 and 8 determine the voltage levels of the control signals sent to the Backlight Inverter Board and must be configured per the Display manufacturer’s requirements as listed. A detailed description of the operation of this board is in the Backlight Inverter Board section that follows. Also see the preceding Microboard section for a detailed description of the Lamp Dimmer circuit.

The actual Display that is installed in the OptiView Control Center of the new chiller is determined by the Display manufacturer contractual agreement in place during the time of OptiView Control Center production. Displays stocked for Service replacement are a result of that same agreement. Therefore, the Display received for service replacement may be by a different manufacturer than the one in the OptiView Control Center. Since each Display manufacturer requires a specific Display Interface Board, Backlight and Backlight Ribbon Cable, replacement Displays are ordered and supplied as a Display Replacement Kit (YORK Part Number 331-01771-000) to ensure component compatibility. The items supplied in the kit are compatible with the supplied Display. Display Replacement Kit 331-01771-000 consists of the following items mounted on a display mounting plate:

1. Liquid Crystal Display with Lamp
2. Appropriate Display Interface Board for item 1
3. Appropriate Backlight Inverter Board for item 1
4. Appropriate ribbon cable (Backlight Inverter Board to Microboard) for item 1
5. Ribbon cable (Display Interface Board to Microboard)
6. All mounting hardware
7. Installation instructions. A label attached to the display mounting plate lists the YORK part numbers of the Display supporting components mounted on the display mounting plate and the required Microboard Program Jumper (JP2 through 8) configurations. Microboard Program Jumpers JP2 through JP8 will have to be configured appropriately for the replacement display.

Display Handling

1. The display is made of glass. It could break if dropped.
2. The display front surface is easily scratched. If soiled, wipe with a dry cotton cloth. Use no water or chemicals.
3. The display is static sensitive. Electrostatic discharges may damage the display.
4. A laminated film is adhered to the display front glass surface to prevent it from being scratched. Peel off very slowly to prevent static damage.

WARNING

Always remove control power from the OptiView Control Center before connecting or disconnecting wires to the display. Connecting or disconnecting wires to the display with power applied will damage the display.

BACKLIGHT LAMP REPLACEMENT

SHARP LQ10D367/368 (031-01774-000) Display

Removal

The Lamp slides into the Display from left to right and is secured with a locking tab. See *Figure 39 on page 111*.

1. Remove control power from the OptiView Control Center.
2. Remove protective cover from rear of Display.
3. Disconnect lamp AC power connector from Backlight Inverter Board.
4. Using fingernail or thin flat blade screwdriver, bend the locking tab outward slightly to clear the lamp housing protrusion.
5. Grasp lamp AC power connector and gently pull until lamp housing clears locking tab.
6. Grasp lamp housing and pull until lamp housing is completely removed from the Display.

Installation

1. Slide new lamp into Display from left to right until lamp housing protrusion locks into Display locking tab.
2. Connect lamp AC power connector to Backlight Inverter Board.
3. Apply control power to OptiView Control Center.

LG Semicon LP104V2-W (031-02046-000) and SHARP LQ104V1DG61 (031-02886-000) Display

Removal

The lamp slides into the Display from left to right and is secured with a screw. See *Figure 40 on page 111*.

1. Remove control power from the OptiView Control Center.
2. Remove protective cover from rear of Display.
3. Disconnect lamp AC power connector from Backlight Inverter Board.
4. Using small Phillips screwdriver, remove lamp retaining screw.
5. Grasp lamp AC power connector and gently pull until lamp housing is completely removed from the Display.

Installation

New lamps may be installed as follows:

1. Slide new lamp into Display from left to right until lamp housing is fully inserted.
2. Secure lamp with lamp retaining screw.
3. Connect lamp AC power connector to Backlight Inverter Board.
4. Apply AC power to OptiView Control Center.

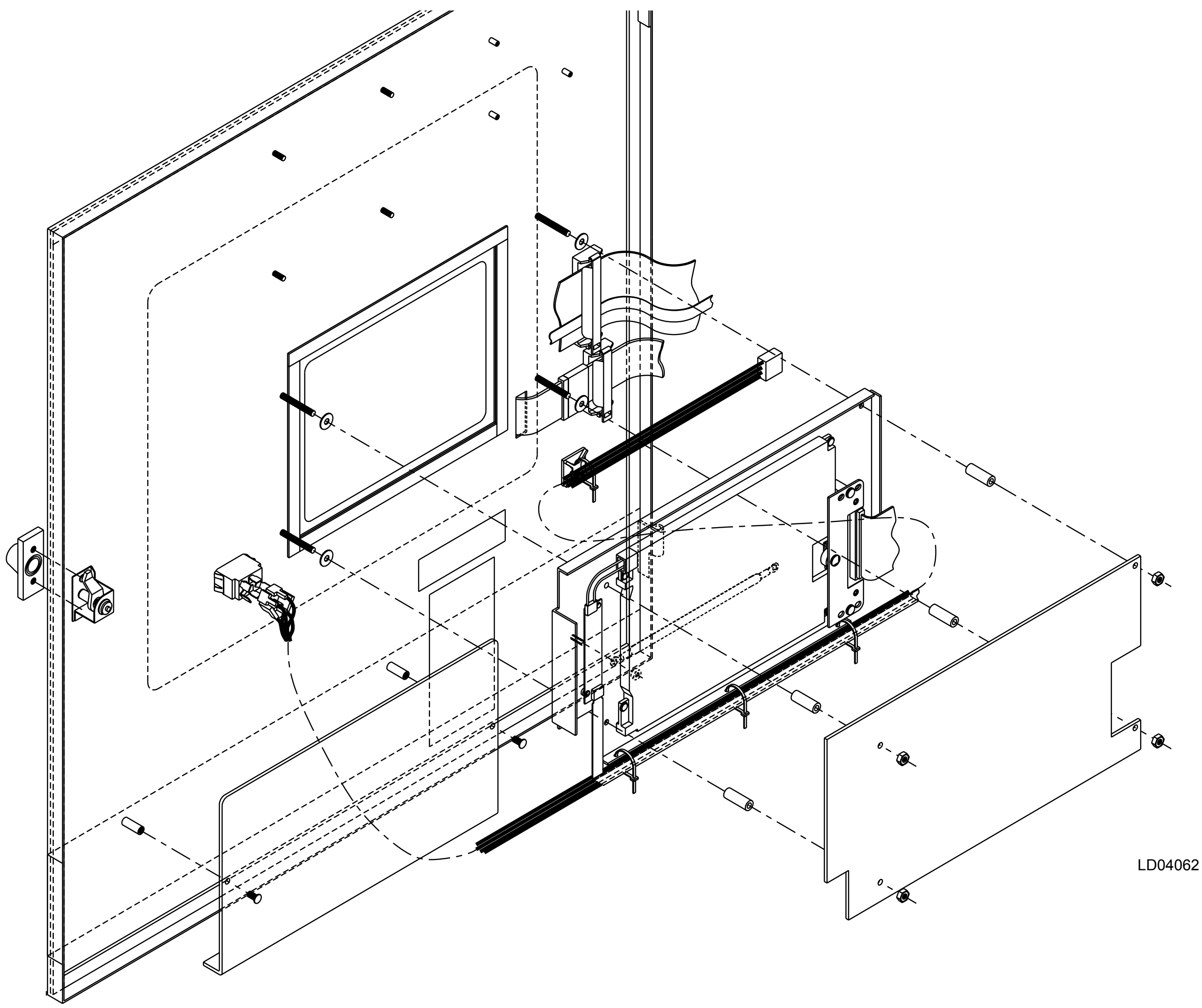
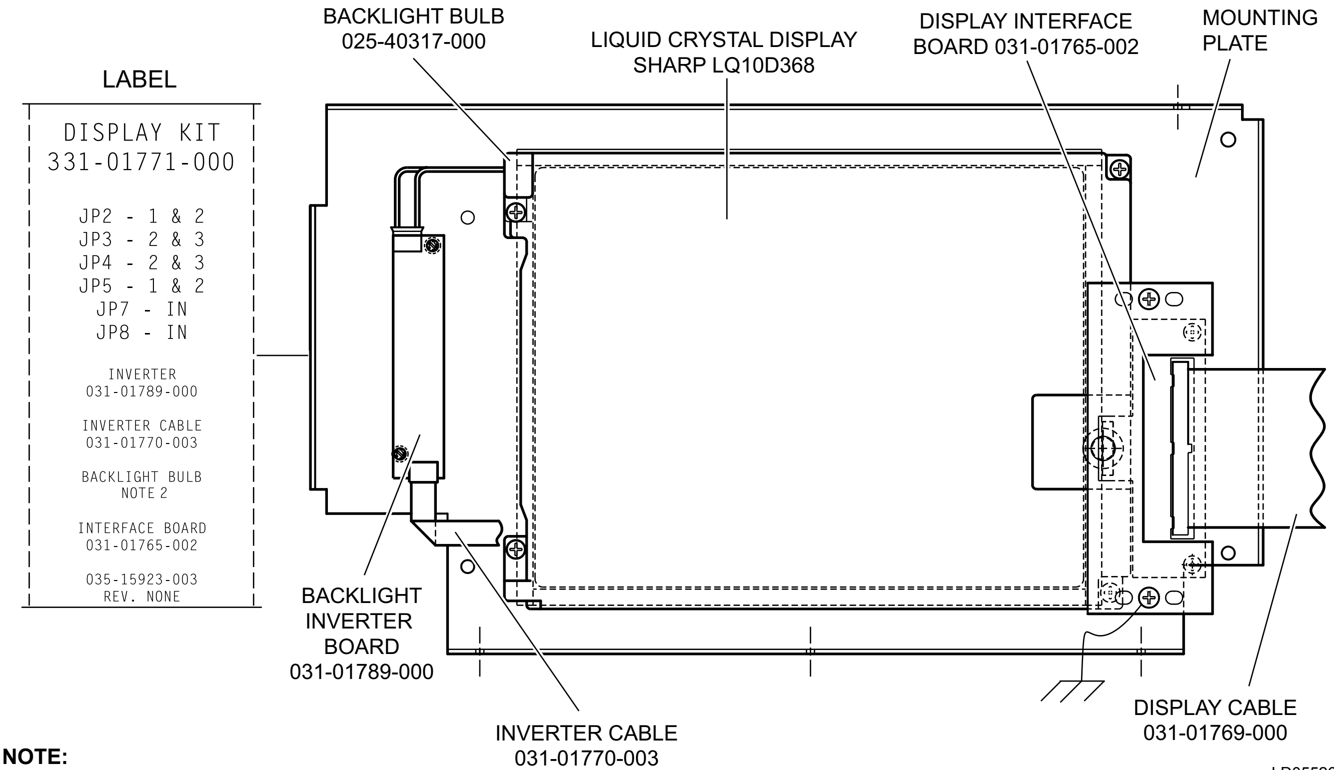


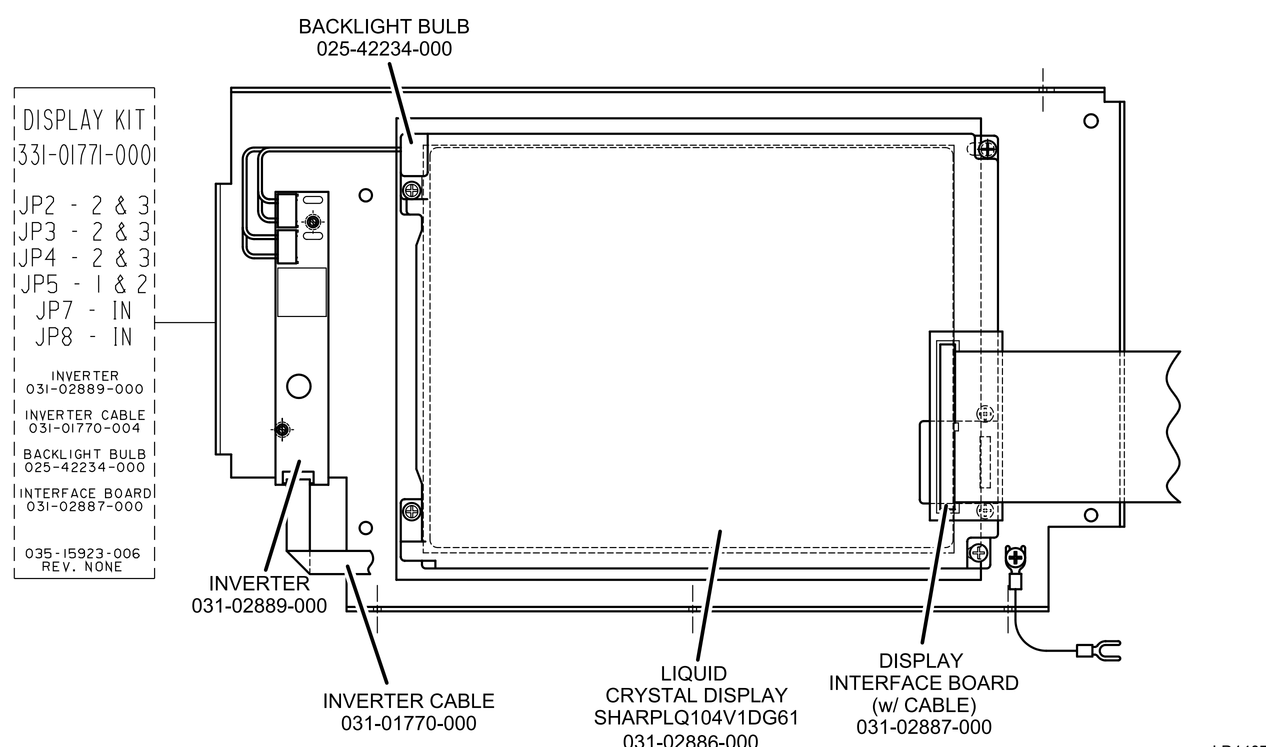
FIGURE 38 - DISPLAY MOUNTING



NOTE:

1. Configure Microboard Program Jumpers per label.
2. 025-33752-000 (before October 2002)
   025-40317-000 (after October 2002)

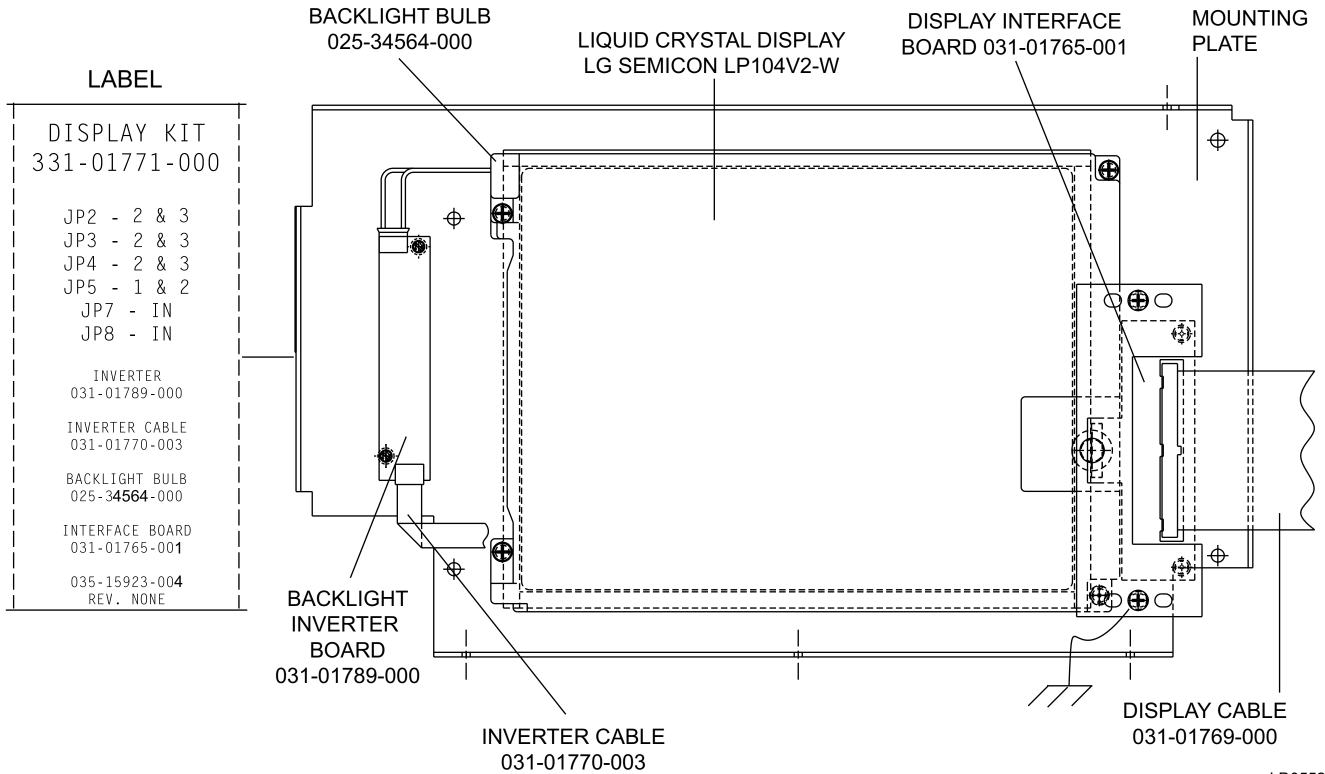
FIGURE 39 - LIQUID CRYSTAL DISPLAY ASSEMBLY – SHARP LQ10D367/368 (031-01774-000) DISPLAY



NOTE:

1. Configure Microboard Program Jumpers per label.

FIGURE 40 - LIQUID CRYSTAL DISPLAY ASSEMBLY – SHARP LQ104V1DG61 (031-02886-000) DISPLAY



NOTE:

1. Configure Microboard Program Jumpers per label.

FIGURE 41 - LIQUID CRYSTAL DISPLAY ASSEMBLY – LG SEMICON LP104V2-W (031-02046-000)

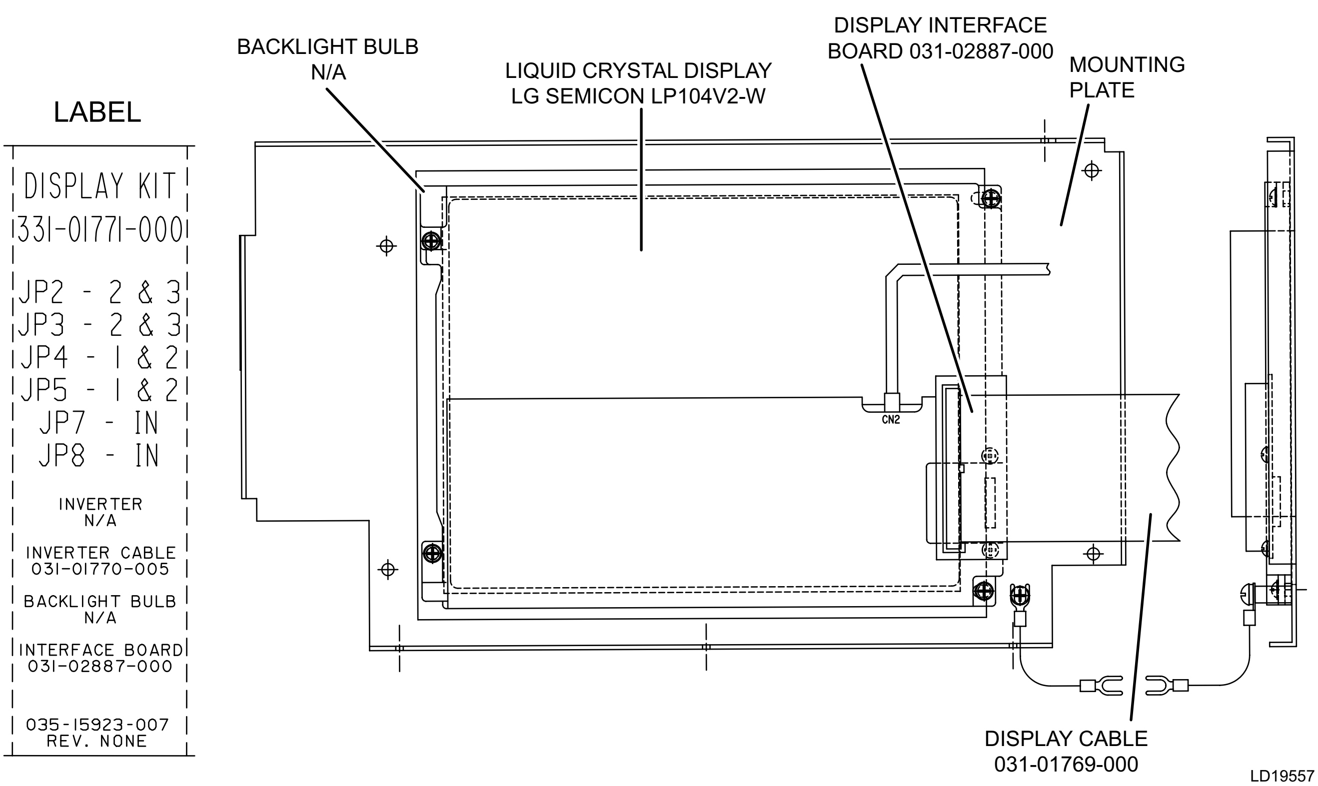


FIGURE 42 - LIQUID CRYSTAL DISPLAY ASSEMBLY – SHARP LQ104V1DG81 (031-01771-000)

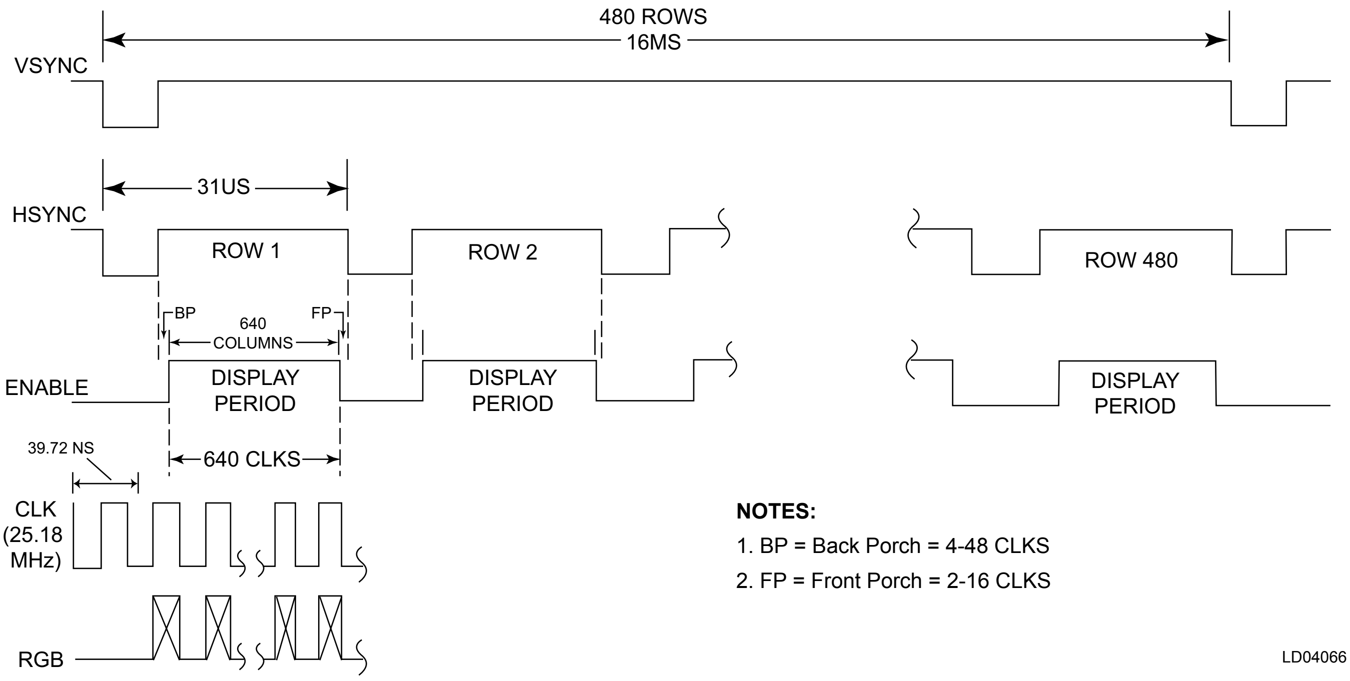


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FIGURE 43 - LIQUID CRYSTAL DISPLAY TYPICAL CONTROL SIGNAL TIMING

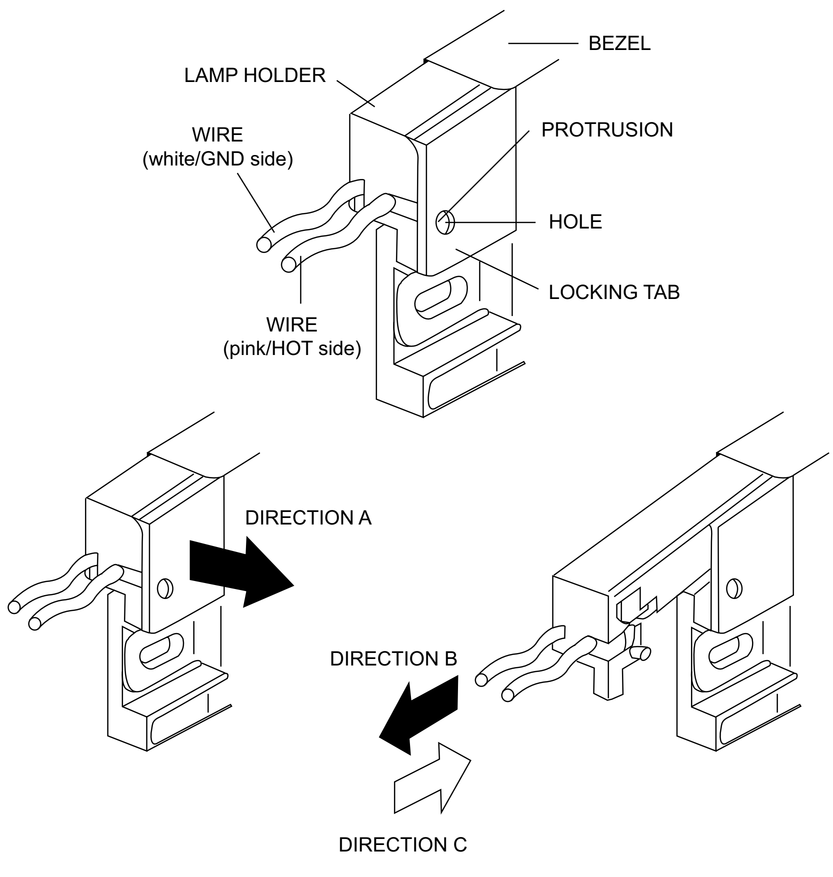


FIGURE 44 - DISPLAY (SHARP LQ10D367/368) LAMP REPLACEMENT

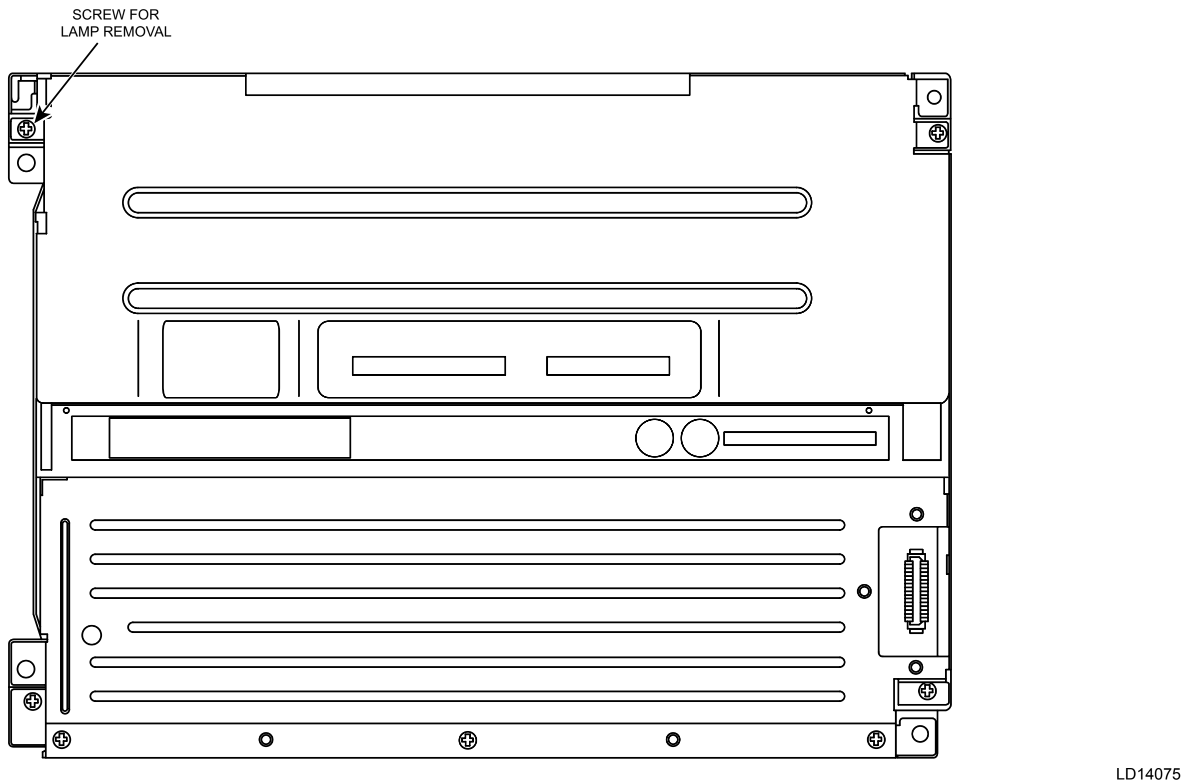


FIGURE 45 - DISPLAY (SHARP LQ104V1DG61 (031-02886-000) AND LG LP104V2-W (031-02046-000))

SECTION 8 - DISPLAY INTERFACE BOARD

The Display Interface Board is located on the Liquid Crystal Display and is part of the microboard interface to the Display. It permits the use of displays by different manufacturers, by providing the microboard with a means of automatically determining which Display is present.

Since different display manufacturers require different timing and control signals, the microboard Display Controller must be configured to meet the requirements of the actual display installed. When AC power is applied to the OptiView Control Center, the microboard reads the panel identification (PID0 thru PID3) voltage levels on the display interface board during the power-up sequence to determine which display is present. These voltage levels indicate the actual display installed and the Display Controller is automatically configured appropriately. To provide the appropriate Panel ID voltage levels for the different displays, there are different Display Interface Boards. These boards have permanent wire jumpers that provide the voltage levels to the microboard for Panel ID signals (PID0 thru PID3). These jumpers connect these signals to either ground or open-circuit. When connected to ground, the voltage level for that signal is 0 VDC. When open, the voltage level is the VCC logic level, which is either 3.3 VDC or 5.0 VDC, depending on the display (refer to Microboard Program Jumper JP2).

The following are the different Display Interface Boards and the Panel ID signals they provide to the microboard.

- Display Interface Board 031-01765-001

  Display Applicability:

  LG Semicon LP104V2-W (031-02046-000)

  PID0 – IN (GND)

  PID1 – OUT (VCC)

  PID2 – OUT (VCC)

  PID3 – OUT (VCC)

- Display Interface Board 031-01765-002

  Display Applicability:

  SHARP LQ10D367/368 (031-01774-000)

  PID0 – OUT (VCC)

  PID1 – IN (GND)

  PID2 – OUT (VCC)

  PID3 – OUT (VCC)

- Display Interface Board 031-02887-000

  Display Applicability:

  SHARP LQ104V1DG61 (031-02886-000)

  SHARP LQ104V1DG81 (031-03441-000)

  PID0 – OUT (VCC)

  PID1 – IN (pin 45 is tied to 44) (GND)

  PID2 – No Connection Open (VCC)

  PID3 – No Connection Open (VCC)

The Displays can operate in either Normal or Reverse Mode for the Right/Left (R/L) and Up/Down (U/D) scan. Normal for the R/L scan is left to right. Normal for the U/D scan is top to bottom. As used in the OptiView Control Center, it is configured to operate in Normal Mode for both of these scans. The Reverse Mode for R/L is right to left. Reverse Mode for U/D is bottom to top. The Display Interface Board provides the appropriate signals to the display to put it in Normal Scan Mode. By hard wired jumper or wiring configuration, the signal is either tied to ground, VCC (+3.3 VDC or +5 VDC, as determined by Microboard Program Jumper JP2) or left open as follows:

- Display Interface Board 031-01765-001

  Display Applicability:

  LG Semicon LP104V2-W (031-02046-000)

  P30 – OUT (Open)

  P31 – OUT (Open)

- Display Interface Board 031-01765-002

  Display Applicability:

  SHARP LQ10D367/368 (031-01774-000)

  P30 – IN (VCC)

  P31 - IN (GND)

- Display Interface Board 031-02887-000

  Display Applicability:

  SHARP LQ104V1DG61 (031-02886-000)

  SHARP LQ104V1DG81 (031-03441-000)

  J1-30 – (VCC)

  J1-31 – (GND)

Display Interface Boards are available individually for service replacement. The part number of the Display Interface Board for the installed display is listed on a label attached to the display mounting plate. The appropriate board is also supplied with display kit 331-01771-000.

The red, green and blue display drive and control signals are simply passed through the Display Interface Board. The value of VCC is either +5 VDC or +3.3 VDC, as determined by the position of Program Jumper JP2 on the microboard.

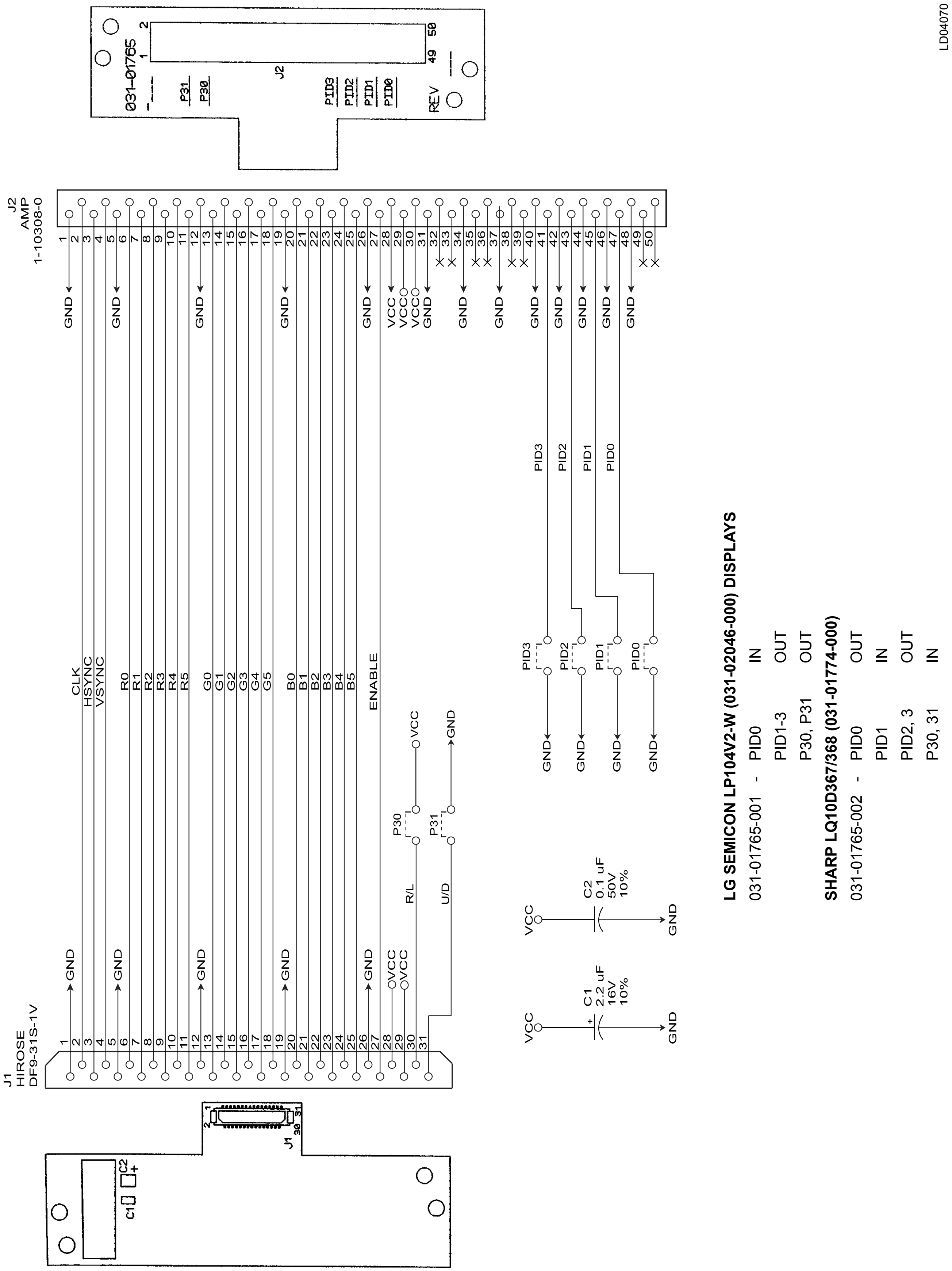


FIGURE 46 - DISPLAY INTERFACE BOARD 031-01765-001 AND 031-01765-002

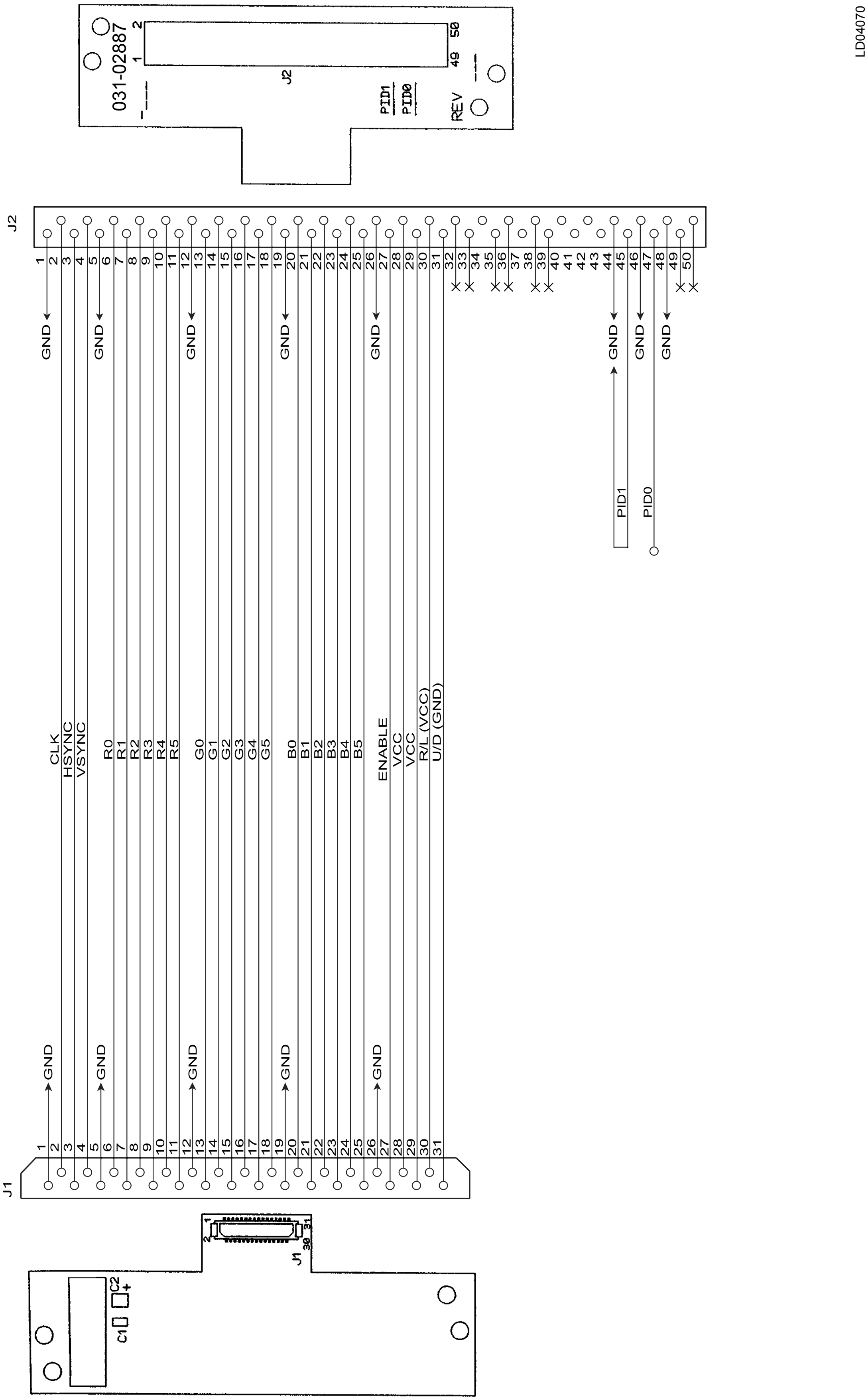


FIGURE 47 - DISPLAY INTERFACE BOARD 031-02887-000

SECTION 9 - DISPLAY BACKLIGHT INVERTER BOARD

The Display Backlight Inverter Board generates a high voltage AC signal that is applied to the backlight lamp, causing it to illuminate. The magnitude of the signal determines the lamp brightness. Displays by some manufacturers have two lamps; one at the top and one at the bottom of the display. Other Display manufacturers have only a lamp at the top of the display.

An Inverter converts low level DC voltage (+12 VDC or +5 VDC, as required by the manufacturer) from the microboard to a 500 to 1500 VAC 60KHz signal that is applied to the lamp. The higher the AC voltage, the greater the brightness of the lamp. When this voltage is not present, the lamp is turned OFF.

WARNING

High voltage, up to 1500 VAC, is present at the output of the backlight inverter board. See Figure 48 on page 120 and Figure 49 on page 121 and locate the output connectors. Use extreme caution when working in this area!

Different Display manufacturers require different Backlight Inverter Boards. The different board designs require different control voltage inputs. To accommodate these variations, Microboard Program Jumpers JP3 through JP5, JP7 and JP8 must be configured to provide the required voltage levels. A label attached to the display mounting plate lists the required Program Jumper configuration for that particular display. Refer to required Program Jumper configurations for the various Display applications.

Under Program control, the microboard generates the control signals that are applied to the Backlight Inverter Board. The Program determines when the lamp is turned ON and OFF. It also adjusts the lamp brightness. To increase the average lamp life of 25,000 hours, the lamp brightness is normally adjusted to 50%. This brightness level will still allow the display to be visible. When the Program senses a Keypad key has been pressed, it adjusts the brightness to 100% (maximum).

The lamp illumination high voltage AC is generated from either +12 VDC or +5 VDC as required by the manufacturer. Microboard Program Jumper JP5 must be positioned to provide the required voltage. The microboard provides the Backlight Enable signal. This signal turns the lamp ON and OFF. Some manufacturers require this signal to be +12 VDC, others require +5 VDC. Program Jumper JP4 must be positioned to provide the required voltage. Further, some applications require this signal to be a + VDC (+12 VDC or +5 VDC) to turn on the lamp. Others require this signal to be 0 VDC to turn on the lamp. Program Jumper JP3 must be positioned to provide the required polarity.

Depending upon the Display manufacturer, the brightness control input from the microboard must be either a variable voltage or a variable resistance. Microboard Program Jumpers JP7 and JP8 are used to provide the appropriate technique (See *Figure 13 on page 45*). The Lamp Dimmer circuit on the microboard is an Integrated Circuit (IC) that is the electrical equivalent of a 10K ohm potentiometer with 100 positions or steps. The Program adjusts the position of the potentiometer. When configured for variable voltage (JP7 and JP8 installed), the output between Microboard J6-7 and J6-8 is a 0 to +5.0 VDC signal. Not all applications require the full 5.0 VDC range. If configured for variable resistance (JP7 and JP8 removed), the output between Microboard J6-7 and J6-8 is a 0 to 10K ohm variable resistance.

The OptiView Control Center could be supplied with any of several approved Displays. Each Display requires a specific Backlight Inverter Board as specified below and in *Figure 48 on page 120 to Figure 49 on page 121*. These boards are individually available as service replacement parts (the required Backlight Inverter Board part number is listed on the label attached to the display mounting plate). However, service replacement Displays are provided in a kit (YORK P/N 331-01771-000) that includes the appropriate Backlight Inverter Board (See *SECTION 7 - LIQUID CRYSTAL DISPLAY*).

SHARP model LQ10D367/368 (031-01774-000) and LG Semicon LP104V2-W (031-02046-000) displays require a Backlight Inverter Board 031-01789-000 (See *Figure 48 on page 120*).

SHARP model LQ104V1DG61 display (031-02886-000) requires Backlight Inverter Board 031-02889-000 (See *Figure 48 on page 120*). These boards generate a lamp illumination high voltage AC from +12 VDC. When the Backlight Enable signal is +5 VDC, the high voltage signal is applied to the lamp. When the Enable is 0 VDC, the high voltage is removed from the lamp.

SHARP model LQ104V1DG81 (031-03441-000) has an LED backlight and therefore does not use a Backlight Inverter Board.

The lamp brightness is controlled by a variable voltage signal, developed by the Lamp Dimmer circuit (See *Figure 20 on page 68*) on the microboard and applied to the Inverter Board. The Lamp Dimmer circuit varies the voltage over the range of 0 to +3.0 VDC. 0 VDC produces maximum brightness (100%). +3.0 VDC produces minimum brightness (0%). Voltages between these values produce a linear brightness between 100% and 0%.

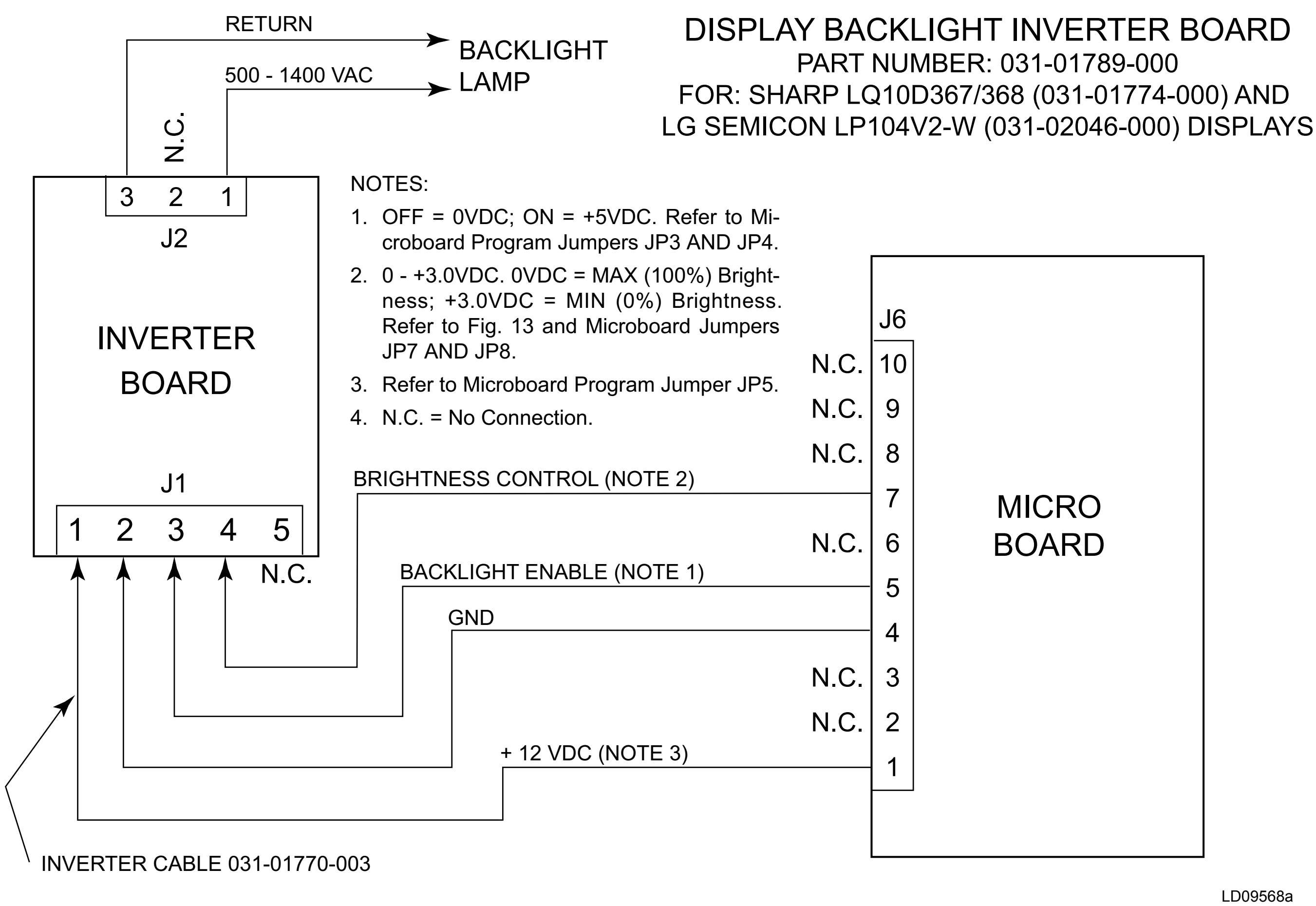
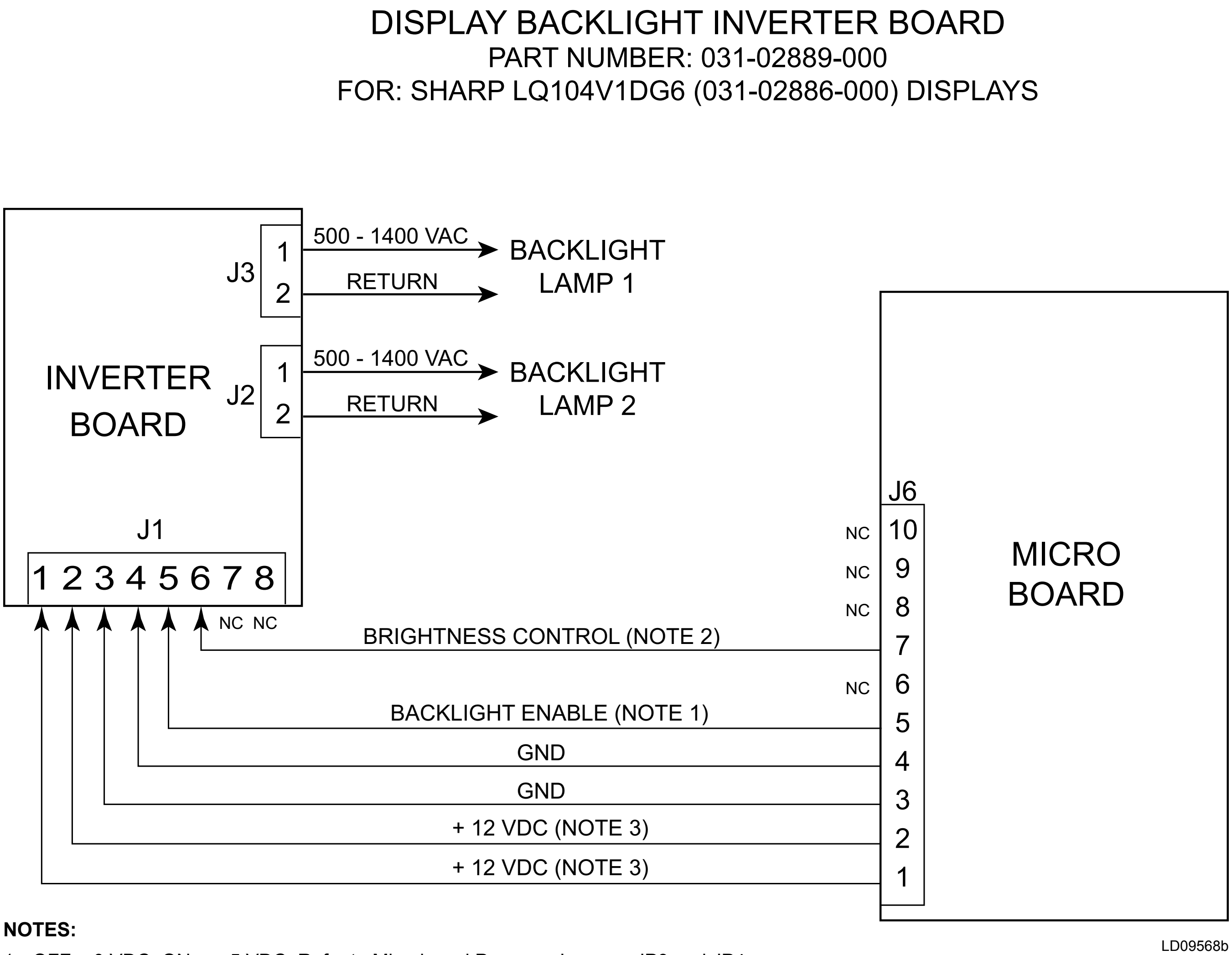


FIGURE 48 - DISPLAY BACKLIGHT INVERTER BOARD (SHARP LQ10D367/368 (031-01774-000) AND LG SEMICON LP104V2-W (031-02046-000))



NOTES:

1. OFF = 0 VDC; ON = + 5 VDC. Refer to Microboard Program Jumpers JP3 and JP4.
2. 0- + 3.0 VDC. 0 VDC = MAX (100%) brightness. +3 VDC = MIN (0%) brightness. Refer to Microboard Program Jumpers JP7 and JP8.
3. Refer to Microboard Program Jumper JP5.
4. N.C. = No Connection.

FIGURE 49 - DISPLAY BACKLIGHT INVERTER BOARD – SHARP LQ104V1DG61 DISPLAY 031-02886-000

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SECTION 10 - KEYPAD

The keypad contains touch-sensitive keys that allow the operator to interface with the OptiView Control Center. The operator presses the keys to request the desired screens of information and enter System Setpoints.

The top layer of the keypad contains embossed areas identifying the keys. Under each embossed key area are two conductors, one on top of the other, separated by an air space. The conductors are arranged in a matrix of rows and columns and connected to the keypad connector as shown in *Figure 50 on page 124*. The embossed area of each key is located directly over the intersection point of the conductors. Pressing the embossed key area causes contact and electrical continuity between the two conductors. For example, pressing the "1" key creates continuity between the keypad connector pin 5 (column 3) and pin 13 (row 4). Since this connector is interfaced to the microboard (J18), the microboard senses this continuity as described below and concludes the "1" key is pressed.

The microboard Program continuously scans the keypad to determine if a key is pressed. Beginning with row 1 and proceeding through all rows, the Program places a "logic low" (less than 1 VDC) on a row, a "logic high" (more than 4 VDC) on the remaining rows and reads the columns. A logic low in any column indicates a key in that column and row is pressed. For example, if at the time row 4 is being driven low, if column 3 is low, then the microprocessor concludes the key at coordinate of row 4 and column 3 is pressed. Since the coordinates of all keys are stored in the microboard's Program, it can identify which key is at this coordinate and responds accordingly. In this example the "1" key is pressed.

In order for the microboard to reliably detect closed and open keys, each key must meet a closed circuit and open circuit resistance requirement. When a key is pressed, the contact resistance must be less than 100 Ohms. When a key is not pressed, the contact resistance must be more than 1Meg Ohm. If the microboard is not responding to a pressed key, or if it's detecting a closed key when none are pressed, it could be because the contact resistance requirements are not being met. The operation of each key can be checked with an Ohmmeter. To check the open and closed contact resistance of any key, see *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

The keypad is attached to the front of the OptiView Control Center door with an adhesive backing. If service replacement is required, start at one corner and slowly peel the keypad from the door. The rear side of the replacement Keypad is coated with an adhesive covered with a paper backing. Remove the paper backing, align the Display and rocker switch openings and apply the keypad to the door.

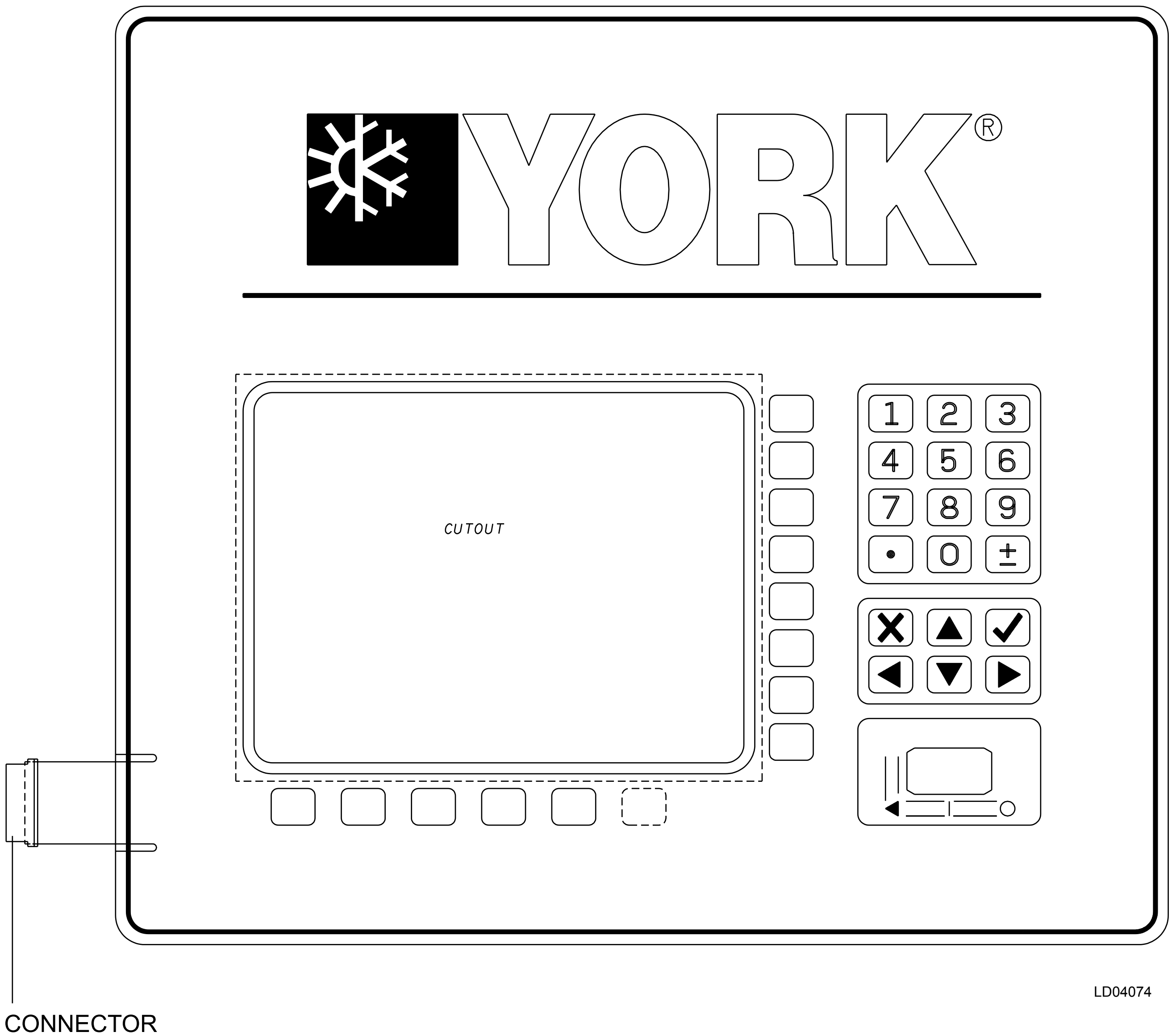
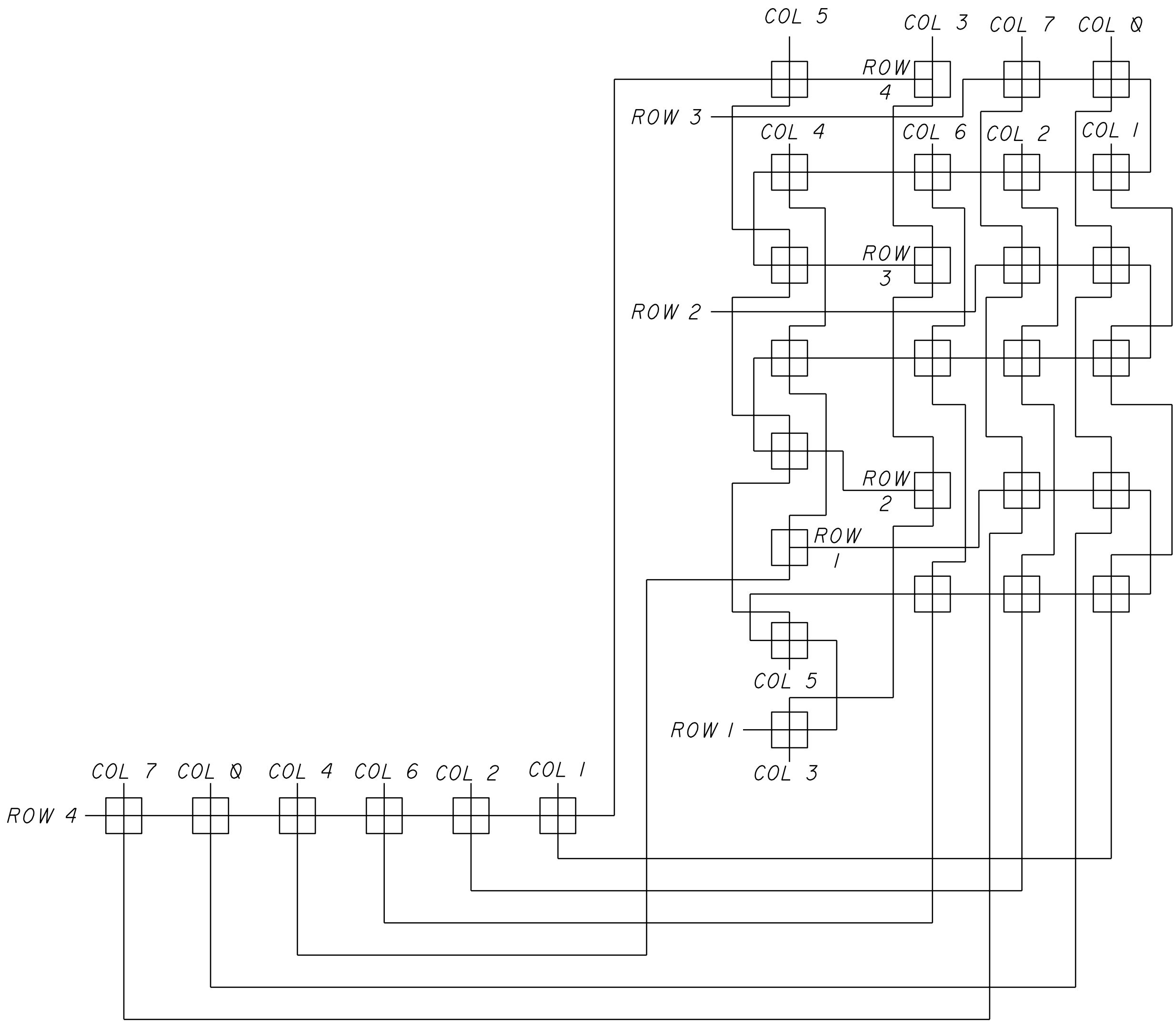
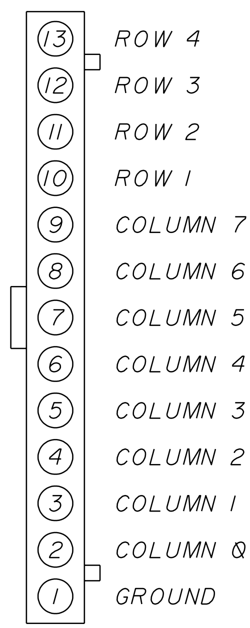


FIGURE 50 - KEYPAD INTERFACE



LD04075



CONNECTOR PIN OUT

LD04076

FIGURE 51 - KEYPAD

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SECTION 11 - POWER SUPPLY

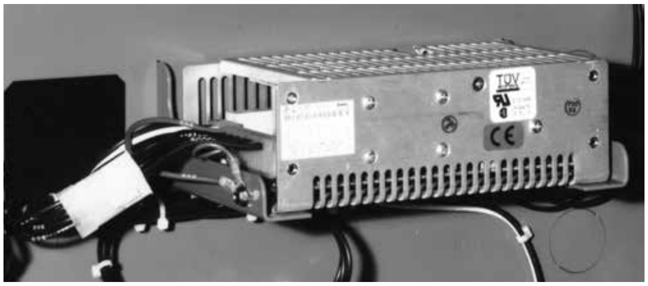
The Power Supply provides the DC power for the LCD Display and all the printed circuit boards in the OptiView Control Center. It receives a 102 VAC to 132 VAC input from an external power source and provides the following DC outputs:

- -12 VDC
- +12 VDC
- +5 VDC
- +24 VDC
- Ground

The +24 VDC output provides power to the CM-2 Board (Electromechanical Starter applications), Solid State Starter Logic Board (Mod A Solid State Starter), Solid State Starter Logic/Trigger Board (Mod B Solid State Starter) or Adaptive Capacity Control (ACC) (Variable Speed Drive applications). If the Chiller is equipped with Proximity probe Part number 025-30961-000 or 025-35900-000, the Probe is also powered by this +24 VDC.

The -12 VDC, +12 VDC, GND and +5 VDC outputs are applied to the microboard. There, these voltages are applied to the circuits requiring the respective voltage. From the microboard, the +12 VDC and +5 VDC are distributed to other system components requiring these voltages. These include the E-Link Gateway, Proximity probe (025-xxxxx-000 only), I/O Board, VSD Oil Pump, LCD Display and Display Backlight Inverter Board. The Condor Power Supply allows adjustment of the +5 VDC output. To account for losses in wiring and connections and ensure sufficient voltage level at the microboard input, the "V AdJ" (R51) potentiometer is adjusted to achieve +5.1 VDC at the input to the microboard J1-1.

As shown in *Figure 12 on page 41* (031-01730-000 Microboard) and *Figure 19 on page 67* (031-01730-000 Microboard), the microboard contains two voltage regulators that create separate +5 VDC and +3.3 VDC supplies. The +5 VDC supply is dedicated to all the microboard Analog circuits and is labeled as the +5 VDC (Analog) supply. It is also routed to all Pressure Transducers, Temperature Thermistors, Proximity probe and Motor Controller Board (CM-2, Mod A Solid State Starter Logic Board or VSD ACC Board).



29136A

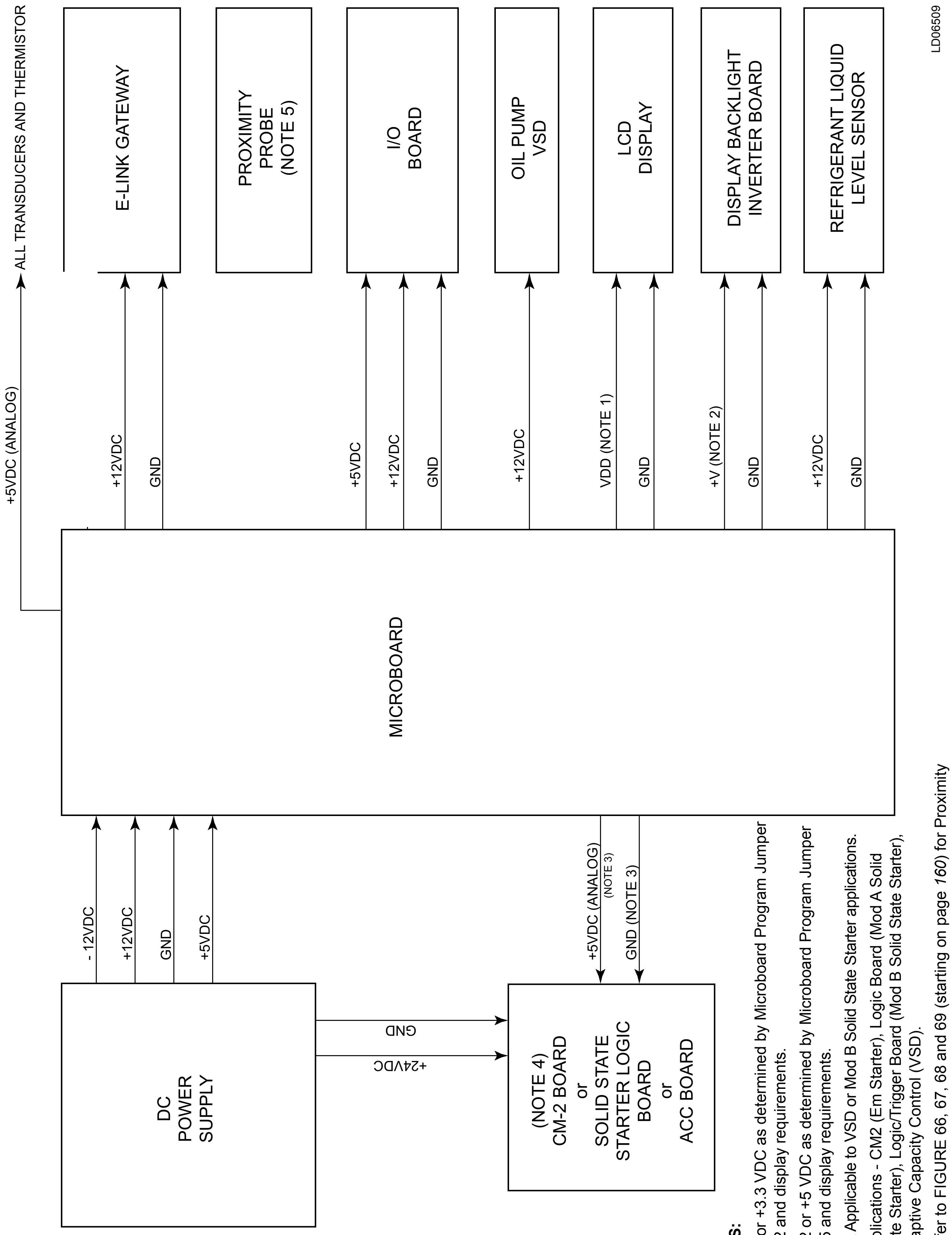
FIGURE 52 - POWER SUPPLY

This permits all Analog circuits to be powered by the same supply, eliminating any offsets caused by voltage regulator drift. Microboard 031-02430-000 has an additional voltage regulator that provides a 2.5 VDC power source. The +3.3 VDC supply is utilized by the Microprocessor, Flash memory card and other digital circuits. It could also be applied to the Backlight Inverter Board, depending on the Display manufacturer's requirements as explained below.

Different Display manufacturers can require different supply voltages for their display and supporting circuits. To accommodate the different Display manufacturer's voltage requirements, Microboard Program Jumpers JP2 and JP5 must be positioned to provide the required supply voltages to the Display and the Display Backlight Inverter Board. Either +5 VDC or +3.3 VDC, as determined by JP2, is applied to the Display. Either +12 VDC or +5 VDC, as determined by JP5, is applied to the Display Backlight Inverter Board. Refer to Microboard Program Jumpers.

The chiller could be equipped with either of two Proximity probes. The power supply requirements are different for these Probes. All probes operate from a +5 VDC power source. Probe 025-30961-000 and Probe 025-35900-000 require a +24 VDC source that is tapped off of the supply to the CM-2 Current Module (Electromechanical Starter applications), Solid State Starter Logic Board (Solid State Starter applications) or ACC Board (VSD applications) as shown in *SECTION 15 - PROXIMITY PROBE* of this manual.

The 031-03630-001 Microboard has a different J1 power connector and therefore requires a different power supply wiring harness. The new wiring harness part number is 571-06765-272.



NOTES:

1. +5 or +3.3 VDC as determined by Microboard Program Jumper JP2 and display requirements.
2. +12 or +5 VDC as determined by Microboard Program Jumper JP5 and display requirements.
3. Not Applicable to VSD or Mod B Solid State Starter applications.
4. Applications - CM2 (Em Starter), Logic Board (Mod A Solid State Starter), Logic/Trigger Board (Mod B Solid State Starter), Adaptive Capacity Control (VSD).
5. Refer to FIGURE 66, 67, 68 and 69 (starting on page *160*) for Proximity probe Power Connections. (Not applicable to P compressors and style F and later chillers with "G, Q" and "H5-8" compressors)

FIGURE 53 - POWER SUPPLY – DC POWER DISTRIBUTION (REFER TO OPTIVIEW CONTROL CENTER WIRING DIAGRAM FOR WIRE CONNECTIONS)

SECTION 12 - CURRENT MODULE (CM-2)

On applications where the Compressor Motor is controlled by an Electromechanical Starter, the OptiView Control Center is equipped with a current module. The Current Module provides compressor motor Overload and Power Fault protection. The Current Module also provides an analog voltage representing the compressor motor current to the microboard for display and current limit control. While the chiller is running, the microboard controls the Pre-rotation Vane (PRV) position to limit the motor current to the system 100% Full Load Amp (FLA) value.

The contacts of Current Module K1 relay (identified as CM contacts on the OptiView Control Center wiring diagram) are interfaced into the Motor Controller initiated shutdown circuit that is located between OptiView Control Center TB6-53 and I/O Board TB1-16 (See *Figure 37 on page 104 and Figure 55 on page 131*). They are also connected as a Digital Input to I/O Board J2-1. Relay K1 is normally energized, maintaining its contacts in a closed position. Whenever the Current Module initiates a chiller shutdown, it de-energizes K1, opening its contacts. This interrupts the circuit to I/O Expansion Board RUN relay coil 1R (K18), de-energizing it and causing the Starter to shutdown. Simultaneously, the microboard reads the opening of these contacts via I/O Board J2-1, initiates a System Coastdown and displays the appropriate message as described below.

Three current transformers in the compressor motor terminal box (See *Figure 56 on page 132*) provide 3 phase motor current signals to the Diode Bridge (DB). The required turns ratio of the Current Transformers is determined by the system 100% FLA. The Diode Bridge rectifies and combines the three signals into one DC signal that is applied to the parallel Variable Resistors (RES). These are factory adjusted (field adjusted on service replacements) to provide a nominal 1.0 VDC (0.15 to 1.10 VDC) signal to the Current Module at J1-1 and J1-2 when the compressor motor current is at 100% FLA. *Figure 56 on page 132* contains a formula to calculate the resistance of RES required to achieve 1.0 VDC at 100%FLA. The 100% FLA value is located on a label adhered to the inside of the OptiView Control Center door.

The motor current signal input at J1-1 and J1-2 is applied to potentiometer R8. This is factory adjusted (field adjusted on service replacements) to illuminate the 105% CURR indicator (CR6) when the compressor motor current reaches 105% FLA. This calibrated voltage is applied to the Power Fault detector, Overload detectors and Multiplexer (MUX).

The power fault circuit protects the compressor motor and driveline from transient torque damage. It anticipates the transient torque condition by detecting a momentary interruption in motor current and de-energizing the starter before damage can occur. If the chiller has been running for greater than 75 seconds and the motor current decreases to less than or equal to 10% FLA, a Power Fault shutdown is initiated. The Power Fault indicator (CR5) is illuminated and remains illuminated until manually reset with RESET switch S2. Relay K1 is de-energized for 1 second and then returned to the energized state. Relay K1 contacts (CM) open for 1 second and then return to the closed state. A System Coastdown is initiated and POWER FAULT is displayed on the Display. The chiller will automatically restart upon completion of System Coastdown**.**

If the motor current remains continuously at greater than or equal to 105% FLA for 50 seconds (Nominal), an OVERLOAD shutdown is initiated. The Overload indicator (CR4) is illuminated and remains illuminated until manually reset with RESET switch S2. Relay K1 is de-energized, opening K1 contacts (CM). Relay K1 remains de-energized until manually reset with RESET switch S2. A System Coastdown is initiated and MOTOR CONTROLLER - CONTACTS OPEN is displayed. The chiller cannot be started until RESET switch S2 is manually pressed.

If the motor current remains continuously at 245% FLA for 40 seconds, 290% FLA for 20 seconds or 360% FLA for 10 seconds, an OVERLOAD shutdown is initiated. Relay K1 and Overload indicator CR4 operate as described immediately above. A System Coastdown is initiated and MOTOR CONTROLLER - CONTACTS OPEN is displayed. The chiller cannot be restarted until RESET switch is manually pressed. LRA/FLA potentiometer R16 is factory adjusted (field adjusted on service replacements) to the ratio of Locked Rotor Amps to Full Load Amps. The correct setting is determined by dividing the LRA by the FLA. If Switch S1 is in the "Y-Delta/57%" position, there is no 245% FLA threshold. Switch S1 must be positioned according to the type of Electromechanical Starter present; UP for Y-delta or 57% Autotransformer starters, DOWN for all other starters.

The Multiplexer (MUX) is an electronic switch with 8 inputs and 1 output. The address applied to it determines the position of the switch (i.e., which input is routed to the output). The inputs to channel 0 through 6 are grounded (0 VDC) . The input to channel 7 is a 0 to 4.0 VDC analog signal, representing motor current over the range of 0 to 100% FLA. It is factory calibrated by potentiometer R34 to be 4.0 VDC when the compressor motor current is at 100% FLA. Under Program control, the microboard commands the MUX to route the inputs to the MUX output by applying 3-bit Binary addresses to the MUX address inputs at J5-1,2,3. The voltage level for a logic 1 is +12 VDC and logic 0 is 0 VDC. The microboard reads the MUX outputs at J5-6. It first addresses channel 0 to determine the type of starter applied. The 0 VDC at channel 0 indicates to the microboard that this is an Electromechanical Starter application. In all starter applications, the microprocessor reads channel 0 to determine the type starter applied:

- 0 VDC = EM starter
- More than 0 VDC=Solid State Starter

It then addresses channel 7 (ignoring channels 1 through 6) to read the analog motor current voltage. The microboard interprets this analog value in terms of % FLA and displays it upon operator keypad request. It also uses this value to invoke compressor motor Current Limit at 100% FLA and 104% FLA. When motor current rises to 100% FLA, the microboard prevents any further current rise by inhibiting further Pre-rotation Vanes (PRV) opening until it decreases to 98% FLA. If the motor current continues to rise to 104% FLA, the microboard applies a close signal to the PRV until the motor current decreases to 102% FLA. While Current Limit is in effect, MOTOR - HIGH CURRENT LIMIT is displayed.

As detailed in the *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual, to field calibrate potentiometer R8, the PRV must be manually operated to achieve 105% FLA compressor motor current. Therefore, during this procedure, Current Limit is not invoked until 107% FLA and 110% FLA. The first time the PRV OPEN key is pressed on the COMPRESSOR Screen after logging in at SERVICE access level, a 10 minute window is opened, allowing the current to rise to 107% FLA before further PRV opening is inhibited. This inhibit is released when the current decreases to 106% FLA. If the current continues to rise to 110%, manual control is overridden and a close signal is applied to the PRV until the current decreases to 109% FLA. After 10 minutes, the normal current limit thresholds of 100% FLA and 104% FLA are applied.

The MUX address inputs along with respective outputs are as shown in the following table:

TABLE 10 - MUX ADDRESS

BINARY			DECIMAL	OUTPUT
J5-1	J5-2	J5-3		
0	0	0	0	Ground
0	0	1	1	Ground
0	1	0	2	Ground
0	1	1	3	Ground
1	0	0	4	Ground
1	0	1	5	Ground
1	1	0	6	Ground
1	1	1	7	0 to 5.0 VDC motor current analog signal calibrated on CM-2 board to be +4.0 VDC at 100% FLA.

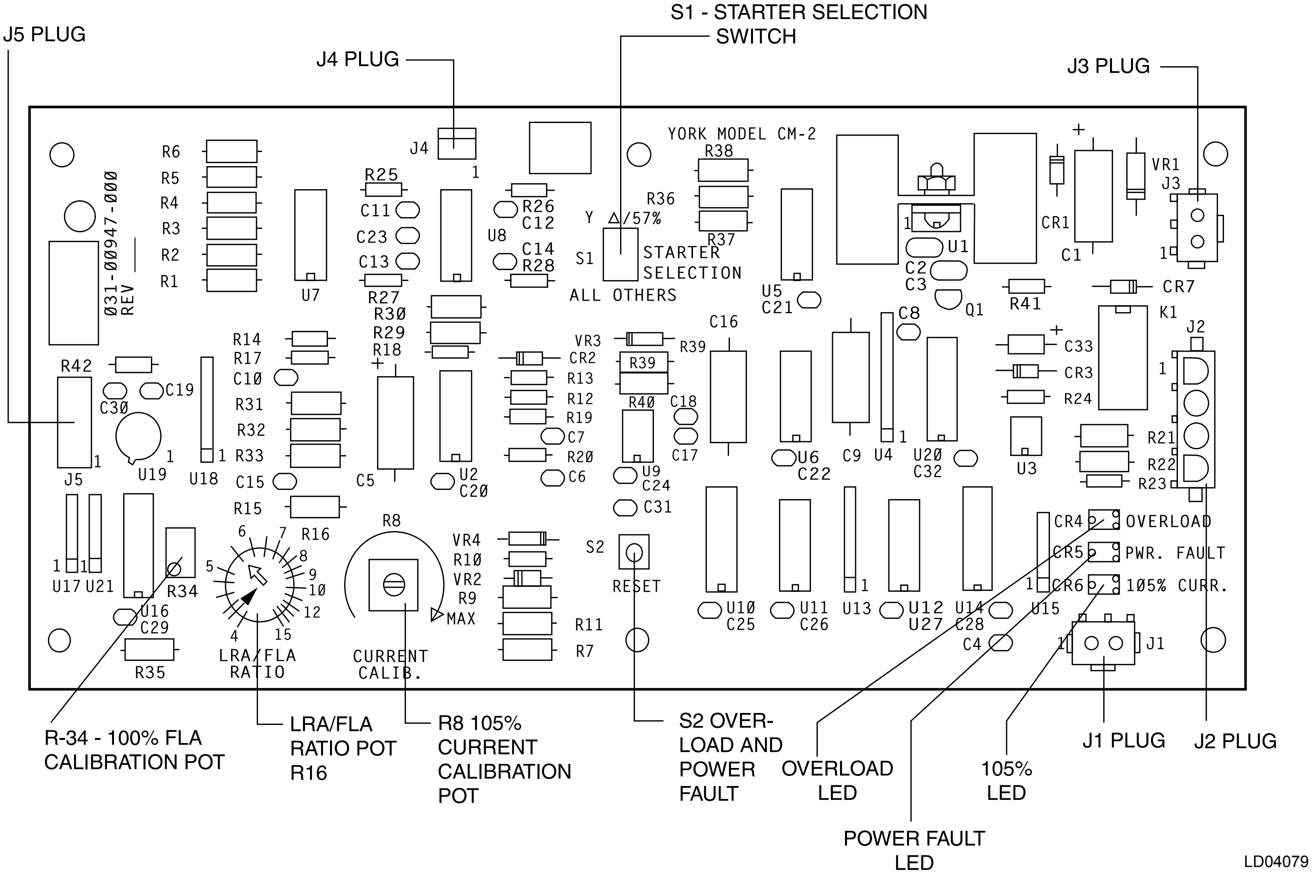


FIGURE 54 - CM-2 CURRENT MODULE (ELECTROMECHANICAL STARTER APPLICATION)

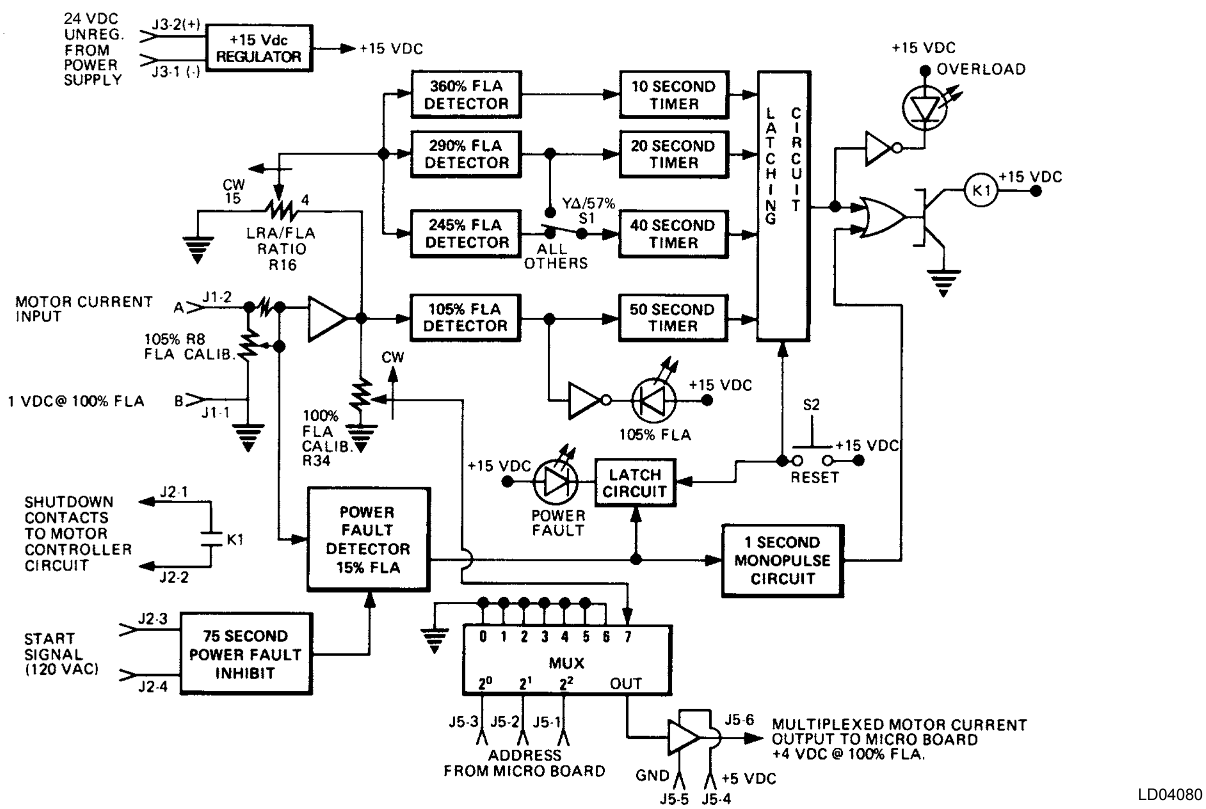
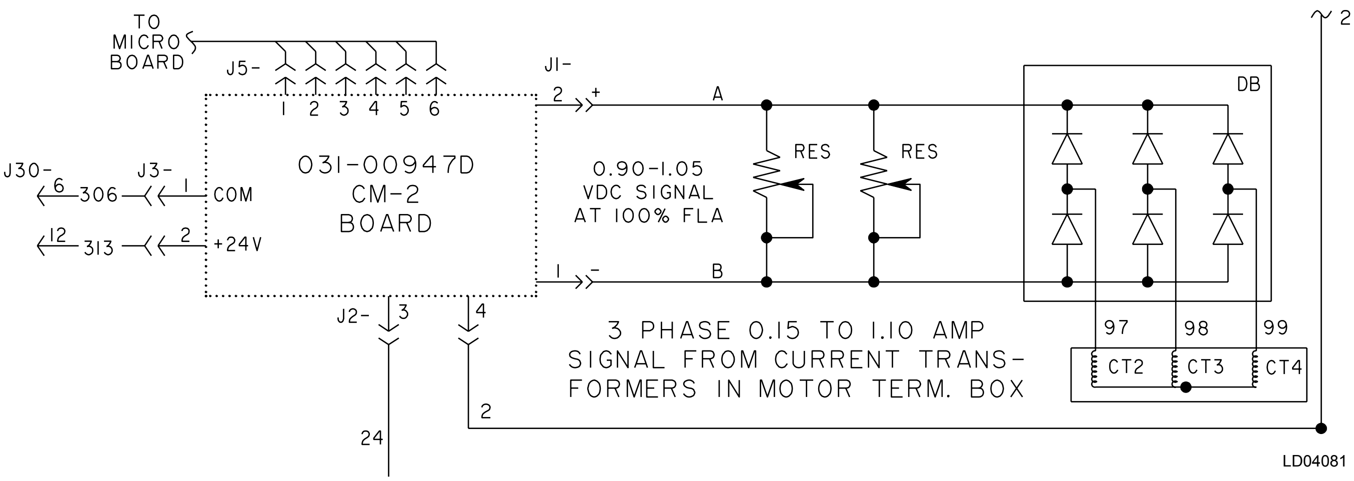


FIGURE 55 - CM-2 CURRENT MODULE (ELECTROMECHANICAL STARTER APPLICATIONS)



MOTOR VOLTAGE	FLA	CT RATIO	RES[D] (OHMS)
208-600	65-111[A] 112-224[A] 225-829[A] 830-1790[A]	200:1 350:1 700:1 1400:1	$R = \frac{1.282\ (\text{CT RATIO})}{\text{FLA}}$
2300-4160	11-18[C]	200:1	$R = \frac{0.247\ (\text{CT RATIO})}{\text{FLA}}$
	19-37[B]	200:1	$R = \frac{0.370\ (\text{CT RATIO})}{\text{FLA}}$
	38-123[A]	200:1	$R = \frac{0.740\ (\text{CT RATIO})}{\text{FLA}}$
	124-264[A]	350:1	
	265-518[A]	700:1	

NOTES:

A. Requires passing motor lead through current transformer (CT) once before connecting to power supply.

B. Requires passing motor lead through CT twice before connecting to power supply.

C. Requires passing motor lead through CT three times before connecting to power supply.

D. Calculates resistance of "RES" to achieve 1.0 VDC at FLA.

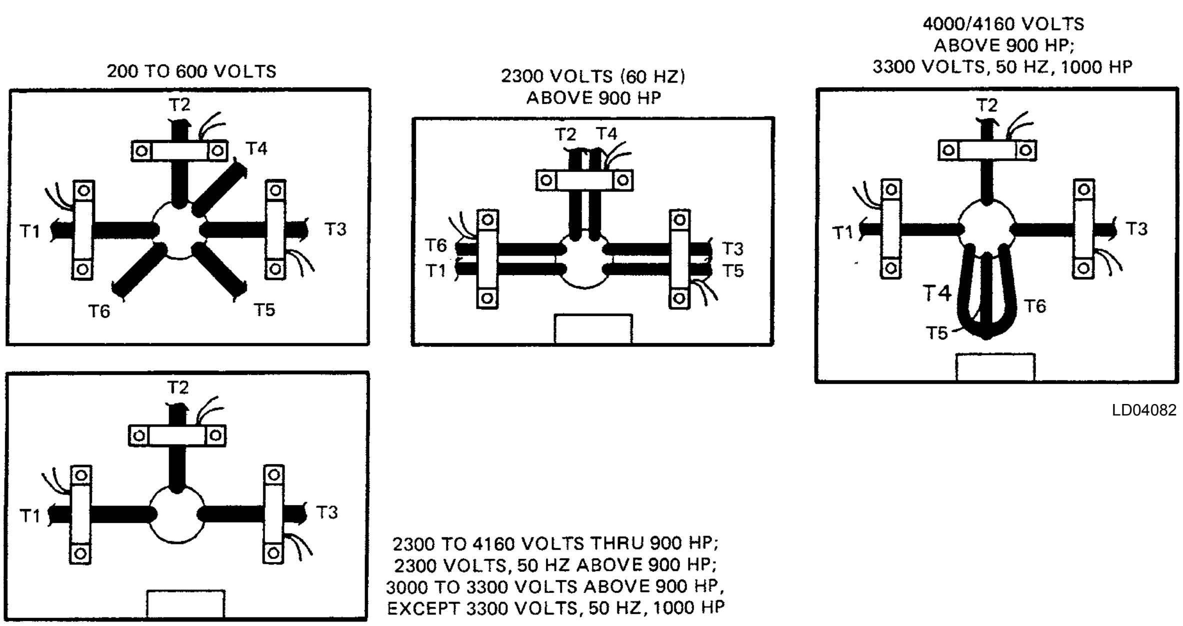


FIGURE 56 - CM-2 CURRENT MODULE – INTERFACE, CURRENT TRANSFORMERS, AND VARIABLE RESISTORS

SECTION 13 - SOLID STATE STARTERS

SOLID STATE STARTERS

The OptiView Control Center will accommodate several different Solid State Starters. Later vintage chillers are equipped with either the Medium Voltage Solid State Starter (MV SSS) or the Style B Liquid Cooled Solid State Starter (LCSSS). The MV SSS communicates with the microboard using RS-485 serial data with Modbus protocol. The Style B LCSSS contains an integrated Logic/Trigger Board located in the starter cabinet. This board communicates with the microboard using the following serial communications:

- Early vintage boards use an opto-coupled interface with YORK protocol.
- Later vintage boards (after mid 2008) use an RS-485 interface with Modbus protocol.

The Style A LCSSS was in production before the Style B LCSSS. With the Style A LCSSS, a Trigger Board resides inside the starter cabinet and a separate Logic Board is located inside the OptiView cabinet. This version communicates with the microboard via a multiplexed data interface.

If equipped with Microboard 031-01730-000, Program Jumper JP39 must be positioned to invoke appropriate Microboard operation for the starter applied. If equipped with Microboard 031-02430-000/001 or 031-03630-001, the starter selection is performed on the SETUP Screen (See *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES*.

MEDIUM VOLTAGE SOLID STATE STARTER

The Medium Voltage Solid State Starter (MV SSS) communicates with the microboard J13 COM 2 port with RS-485 serial data using Modbus protocol. This communication link transfers start/stop commands to the starter and receives status and operation data from the starter. A hardwired 115 VAC start signal is also applied to the starter via relay 1R (K18) contact closure. A Starter Initiated STOP relay, located in the starter, opens its contacts whenever the starter initiates a shutdown. The communications link and relay contact interface operate in the same way as described below for the Style B LCSSS.

Microboard 031-02430-001, equipped with the 128K BRAM and software C.OPT.01.15.xxx (or later) is required for this application. Microboard Program Jumpers JP14 and JP17 must be positioned appropriately. See *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* of this manual. On the SETUP Screen "MVSSS" must be selected for the Motor Drive Type setpoint.

The 031-03630-001 microboard COM 2 is designed as a RS-485 port so no jumper settings are needed.

The MV SSS MOTOR Screen contains information pertinent to the starter. A complete description, theory and operation of this starter are contained in *Medium Voltage Solid State Starter – Service (Form 160.00-M5).*

Style B Serial Interface LCSSS

A complete description, theory of operation and troubleshooting instructions of this LCSSS are contained in *Solid State Starter (Mod B) – Operation and Maintenance (Form 160.00-O2)*. The following describes the interface and interaction of the LCSSS with the OptiView Control Center.

As shown in *Figure 57 on page 137*, the LCSSS contains a single Logic/Trigger printed circuit board. This board performs the following functions:

- Generates the SCR trigger pulses.
- Receives start/stop commands from the microboard.
- Transmits status and fault data to the microboard.
- Generates all LCSSS initiated Safety and Cycling shutdowns.

The Logic/Trigger Board is powered by +24 VDC from the OptiView Control Center Power Supply. The OptiView Control Center Microboard (J15) communicates with this board via a 1200 baud 0 to +5 VDC serial data communications link. If this communications link does not operate properly, correct Microboard J15 serial port operation can be verified using the Serial Inputs and Outputs diagnostic procedure in *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual. The STOP relay contacts on the Logic/Trigger Board ensure that a positive shutdown occurs on all LCSSS initiated shutdowns.

After power has been applied to the system, the microboard will attempt to establish communications with the Logic/Trigger Board. If unsuccessful within 10 attempts, the microboard initiates a cycling shutdown and displays LCSSS INITIALIZATION FAILED on the System Details line of the OptiView Control Center display. The microboard will continue to establish communications until successful. Also, at power-up, the Logic/Trigger Board reads wire jumpers in its connector J1 to determine the LCSSS model applied (Refer to *Solid State Starter (Mod B) – Operation and Maintenance (Form 160.00-O2)*. If an invalid jumper configuration is read, the Logic/trigger Board initiates a cycling shutdown and LCSSS - INVALID CURRENT SCALE SELECTION is displayed on the System Details line of the OptiView Control Center Display. The model designation is transmitted to the microboard for display on the MOTOR Screen. This designation determines the allowable range for the Full Load Amps (FLA) setpoint and Start Current setpoint. There are 4 LCSSS models: 7L, 14L, 26L and 33L. Each model has an allowable Full Load Amps (FLA) range and Start Current range as listed later in this section.

Communications between the microboard and the Logic/Trigger Board are in the form of master and subordinate. The microboard is the master and the Logic/Trigger Board is the subordinate. The Logic/Trigger Board sends two types of data to the microboard: Status data and Fault data.

After successful initialization, the microboard sends a data request every 2 seconds. Normally, the Logic/Trigger Board responds to each request. However, if the microboard does not receive a response to 10 consecutive requests, the microboard initiates a cycling shutdown and displays LCSSS - SERIAL COMMUNICATIONS on the System Details line of the OptiView Control Center display. In addition, the Logic/Trigger Board will initiate the same cycling shutdown if it does not receive a data request from the microboard after 10 successive attempts to send data.

Prior to June 2006, new production chillers are equipped with Microboard 031-01730- 000 (early vintage) or 031-02430-000 (later vintage). The COM5 (J15) serial port on these boards communicates with the Starter Logic/Trigger Board 031-02001 (TB2) using YORK protocol. See *Figure 57 on page 137.*

After June 2006, Microboard 031-02430-001 is supplied in new production chillers. Until March 2007, the COM 5 (J15) serial port of this board communicates with Logic/Trigger Board 031-02001 (TB2) using YORK protocol. See *Figure 57 on page 137*. After March 2007, this Logic/Trigger Board is replaced with 031-02505 in new production chillers. YORK protocol is used until mid 2008 (See *Figure 58 on page 137*).

On new production chillers after mid 2008, Microboard 031-02430-001 COM 2 (J13) serial port communicates with Logic/Trigger Board 031-02505 (J14) using RS-485 Modbus protocol (See *Figure 59 on page 138*). This configuration requires Software version C.OPT.01.18.307 (or later). When using COM 2 serial port for starter communications, Microboard Program Jumper JP17 must be placed on pins 1 and 2. On the SETUP Screen, the COM 2 serial port is enabled by setting the Motor Communications Protocol setpoint to Modbus. The Motor Node ID setpoint must be set to "1" to match the Modbus Address assigned to the starter. The Modbus Address is set to "1" in the starter by placing Logic/Trigger Board switch SW1 position 1 to ON; all other positions to OFF. If the Motor Node ID does not match the Modbus Address assigned to the Logic/Trigger Board, the Logic/Trigger Board will not communicate with the microboard.

After June 2006, and up to June 2015 Microboard 031-02430-001 was supplied as the service replacement for all previous Microboards. After June 2015 the 031-03630-001 Microboard is supplied as the service replacement for all earlier vesions. To allow it to be backward compatible to all existing chillers, this board contains both the COM 5 opto-coupled YORK protocol serial port (J15) and the COM 2 RS-485 Modbus serial port (J13). See *Figure 57 on page 137*, *Figure 58 on page 137*, and *Figure 59 on page 138.*

After March 2007, Logic/Trigger Board 031-02505 is supplied as service replacement for all previous Logic/Trigger Boards. To allow it to be backward compatible to all existing chillers, this board contains both an opto-coupled YORK protocol serial port (TB2) and a RS-485 Modbus serial port (J14). See *Figure 57 on page 137, Figure 58 on page 137, and Figure 59 on page 138.*

Anytime the Logic/Trigger Board initiates a Cycling or Safety shutdown, it opens its STOP contacts that are connected in series with the OptiView Control Center's 1R (K18) RUN relay coil. The contacts remain open as long as the condition exists. The open STOP contacts interrupt the circuit to 1R causing it to de-energize, removing the run signal to the LCSSS. Simultaneously, the microboard reads the opening of the LCSSS STOP contacts via the I/O Board J2- 1. This signals the microboard that the LCSSS has initiated a shutdown. The Logic/Trigger Board sends the cause of the shutdown in response to the next data request. This is logged on the HISTORY Screen as the LAST FAULT WHILE RUNNING. A snapshot of the LCSSS operating parameters valid at the instant of the fault are also sent. Any additional faults that occur within the 2 second transmission time are also sent and logged on the HISTORY Screen under LAST TEN FAULTS. Refer to *Operation Manual (Form 160.54-O1)* for description of all Cycling and Safety shutdown messages.

While this data is being sent, LCSSS - SHUTDOWN - REQUESTING FAULT DATA is displayed on the System Details line of the OptiView Control Center display. If fault data is not returned within 2 seconds, the microboard will continue to send a request at 2 second intervals until the fault data is returned. If none is returned within 10 consecutive requests, it assumes it is not forthcoming and it displays LCSSS - STOP CONTACTS OPEN on the System Details line of the display.

The chiller can be started if there are no Safety and Cycling conditions. If the temperature of any of the SCR modules are greater than 110°F, the LCSSS cooling pump will run and the chiller will be inhibited from starting until the temperature has decreased below 109°F. While this Start Inhibit is in effect, LCSSS - HIGH TEMPERATURE PHASE X - STOPPED (where X is phase A, B, or C) is displayed on the System Details line of the display. When the chiller is started, the OptiView Control Center sends two start signals simultaneously to the Logic/Trigger Board. One is transmitted via the serial communications link. The other is the closure of 1R (K18) Start relay, applying 115 VAC to Logic/Trigger Board TB1-24. If these two signals are not received within 5 seconds of one another, the Logic/Trigger Board initiates a cycling shutdown and LCSSS - RUN SIGNAL is displayed on the System Details line of the display.

The Logic/Trigger Board transmits the following parameters over the serial communications link for display on the MOTOR Screen:

- Three phase motor current
- Three phase line-to-line motor supply voltage
- Input Power (KW)
- Three phase SCR module temperature
- Starter model designation

The following are the programmable setpoints associated with the LCSSS. They are programmed on the MOTOR Screen. See programming instructions in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

- **Full Load Amps -** This is the maximum allowed motor current at which this chiller is permitted to operate to achieve maximum design capacity. It is the Full Load Amps (FLA) of the chiller, as listed on the SALES ORDER Screen. Each starter model has a permissible range over which this setpoint can be programmed as follows:

LCSSS MODEL	PERMISSIBLE FLA
7L-46, 58 and 50	35 to 260 Amps
14L-17, 28, 46, 58 and 50	65 to 510 Amps
26L-17, 28, 46, 58 and 50	125 to 850 Amps
33L-17, 28, 46 and 50	215 to 1050 Amps

- **Start Current -** The Logic/Trigger Board will limit inrush motor current to this value during starting. The programmed value is sent to the Logic/Trigger Board over the serial communications link. This setpoint should be programmed to (0.45 x motor Delta Locked Rotor Amps) as listed on the SALES ORDER Screen. Each model starter has a permissible range over which this setpoint can be programmed as follows:

LCSSS MODEL	PERMISSIBLE START CURRENT RANGE
7L-46, 58 and 50	310 to 700 Amps
14L- 17, 28, 46, 58 and 50	620 to 1400 Amps
26L- 17, 28, 46, 58 and 50	1150 to 2600 Amps
33L-17, 28, 46 and 50	1460 to 3300 Amps

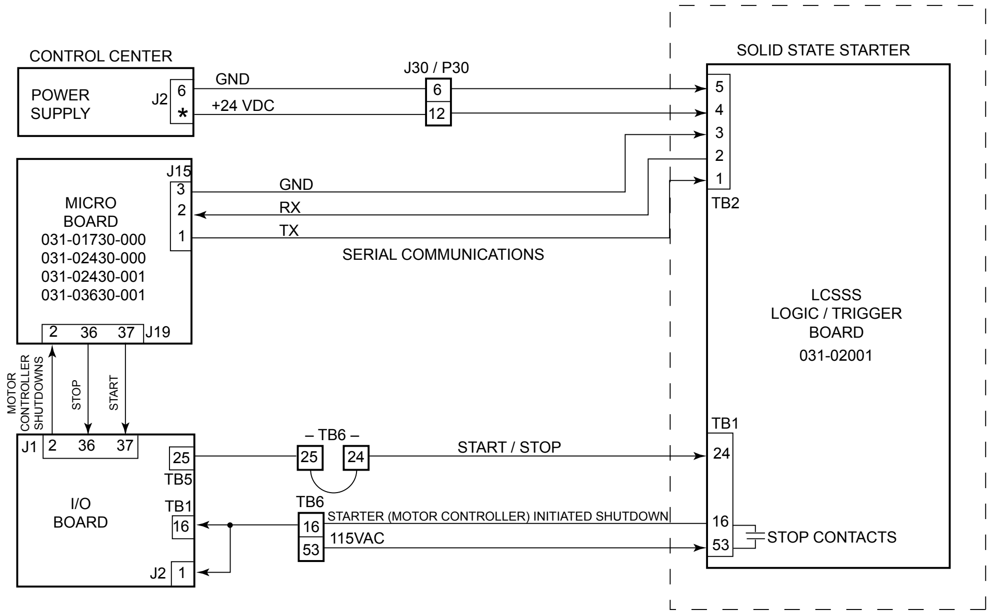
- **Supply Line Voltage Range -** This setpoint is the line voltage application and establishes the high and low line voltage shutdown thresholds. Shutdown and restart thresholds are contained in *Op*eration Manual (Form 160.54-O1) under the messages LCSSS - LOW SUPPLY LINE VOLTAGE and LCSSS - HIGH SUPPLY LINE VOLTAGE.

- **Open SCR Enable/Disable -** This enables or disables the Open SCR detection Safety protection performed by the Logic/Trigger Board. This protection must **never** be disabled unless advised by the YORK factory.

- **Kilowatt Hours (KWH) Reset -** This allows the accumulated KWH to be set to a desired starting value in the event the BRAM has to be field replaced. This must **never** be arbitrarily performed.

To ensure that the chiller is not permitted to run for extended periods with the supply line voltage outside of acceptable limits, the Logic/Trigger Board compares the actual 3-phase line voltage to the thresholds established with the Supply Line Voltage Range setpoint. Each supply voltage application has an allowable upper and lower limit. If the supply voltage goes above or below these limits continuously for 20 seconds, the Logic/Trigger Board initiates a cycling shutdown and displays LCSSS - HIGH SUPPLY LINE VOLTAGE or LCSSS - LOW SUPPLY LINE VOLTAGE as appropriate. The chiller will automatically restart when the line voltage is within the acceptable range.

While the chiller is running, the microboard will close or inhibit opening of the Pre-rotation Vanes (PRV), as required, to limit the compressor motor current to the Current Limit or Pulldown Demand Limit setpoint (30% to 100% FLA) that is in effect. The microboard calculates the "% Full Load Amps" (FLA) by dividing the highest phase of the 3-phase motor current, received from the Logic/Trigger Board, by the value programmed for the Full Load Amps setpoint. The message % FULL LOAD AMPS is displayed on the MOTOR Screen. If the motor current increases to the extent that the % FULL LOAD AMPS reaches 100% of the Current Limit setpoint, the Pre-rotation Vanes (PRV) are inhibited from further opening until the motor current decreases to less than or equal to 98% of the Current Limit setpoint. If the motor current increases to the extent that the % FULL LOAD AMPS is 104% of the Current Limit setpoint, the PRV will be driven closed until the % FULL LOAD AMPS decreases to 102% of the Current Limit setpoint. The PRV opening will then be inhibited until the % FULL LOAD AMPS decreases to less than or equal to 98% of the Current Limit setpoint.



NOTES:

* – “CONDOR” Power Supply; 13 – “POWER ONE” Power Supply

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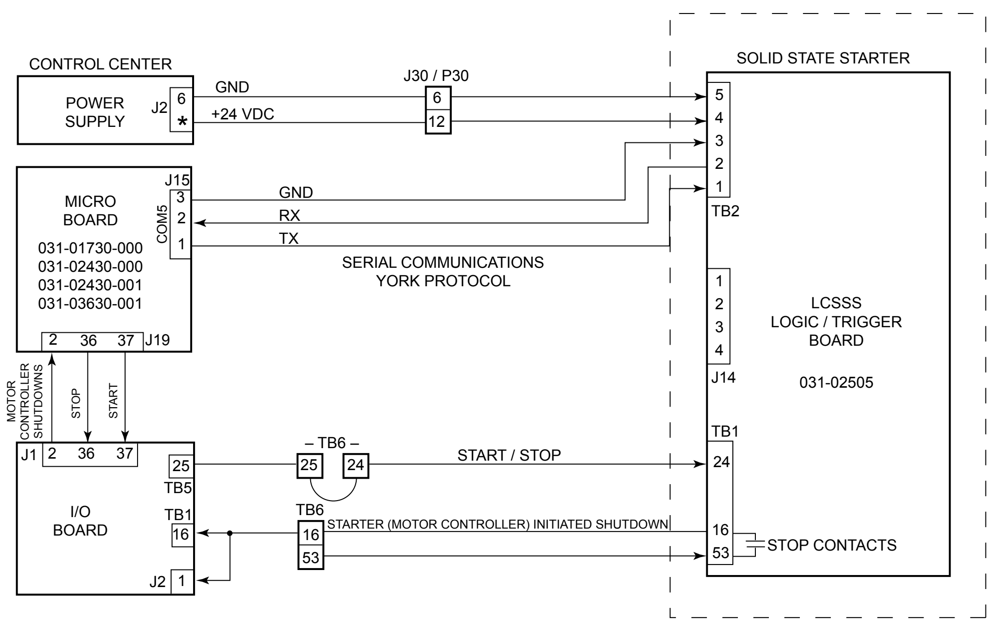
FIGURE 57 - STYLE B LIQUID COOLED SOLID STATE STARTER (LCSSS) – INTERFACE (YORK PROTOCOL)



NOTES:

* – “CONDOR” Power Supply; 13 – “POWER ONE” Power Supply

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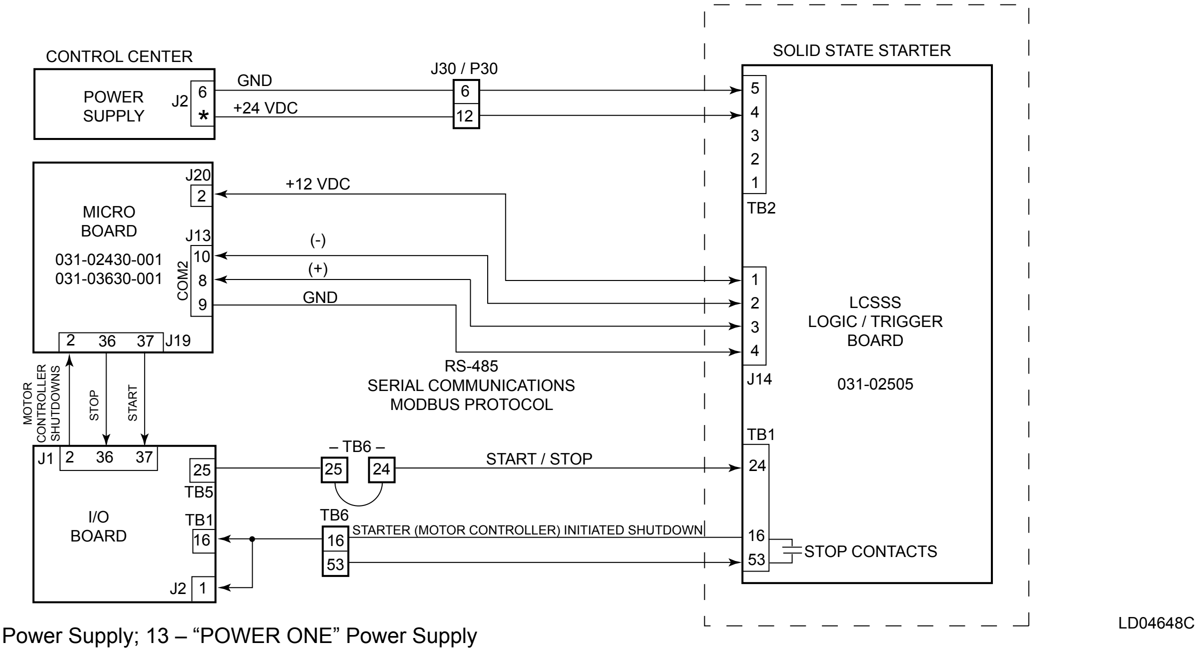
FIGURE 58 - STYLE B LIQUID COOLED SOLID STATE STARTER (LCSSS) – INTERFACE (YORK PROTOCOL)

13



NOTES:

* – “CONDOR” Power Supply; 13 – “POWER ONE” Power Supply

FIGURE 59 - STYLE B LIQUID COOLED SOLID STATE STARTER (LCSSS) – INTERFACE (MODBUS PROTOCOL)

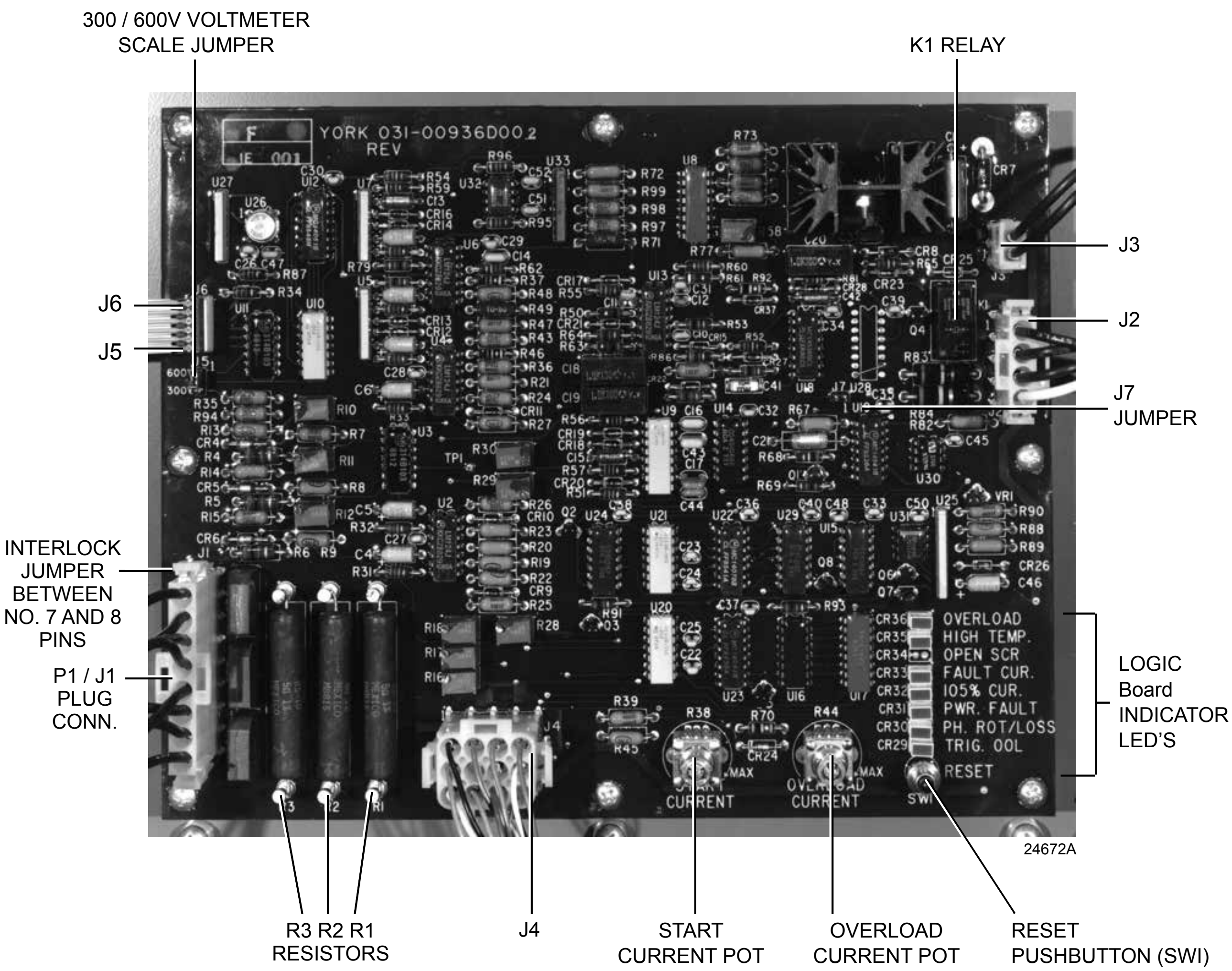


FIGURE 60 - SOLID STATE STARTER LOGIC BOARD

This board provides Overload, Power Fault, Fault Current, Phase Rotation/Loss, and Half Phase Protection for the Compressor Motor. It also receives SCR High Temp and Trigger Out Of Lock (OOL) shutdown signals from the Starter Trigger Board. Finally, it provides analog voltages representing Compressor Motor Current, Power Line Voltage, Current Limit commands and a Starter Model code to the microboard.

The contacts of Logic Board relay K1 (identified as CM contacts on the OptiView Control Center wiring diagram) are interfaced into the Motor Controller initiated shutdown circuit that is located between OptiView Control Center TB6-53 and I/O Board TB1-16 (See *Figure 36 on page 103 and Figure 55 on page 131*). They are also connected as a Digital Input to I/O Board J2-1. Relay K1 is normally energized, maintaining its contacts in a closed position. Whenever the Logic Board initiates a chiller shutdown, it de-energizes K1, opening its contacts. This interrupts the circuit to I/O Board RUN relay coil 1R (K18), de-energizing it and causing the Starter to de-energize. Simultaneously, the microboard reads the opening of these contacts via I/O Board J2-1, initiates a System Coastdown and displays the appropriate message as described below.

When the Logic Board detects an Overload condition, relay K1 contacts open and the Overload LED illuminates. MOTOR CONTROLLER – CONTACTS OPEN is displayed. The contacts remain open and the LED remains illuminated until manually reset with the Logic Board's S1 RESET switch. After S1 is pressed, the chiller can be restarted.

When a Power Fault, Fault Current or Half Phase condition is detected, relay K1 contacts open for 1 second and then close. The Power Fault LED illuminates and will remain illuminated until manually reset with the S1 RESET switch. POWER FAULT is displayed. At the completion of System Coastdown, the chiller will automatically restart.

When a Power Line Phase Rotation/Loss or Trigger Board Out of Lock (OOL) condition is detected, relay K1 contacts open and remain open for as long as the condition exists. If the contacts remain open for more than 3 seconds, MOTOR CONTROLLER – CONTACTS OPEN is displayed; if less than 3 seconds, POWER FAULT is displayed. The respective Phase Rotation/Loss or Trigger Board Out of Lock (OOL) LED illuminates and remains illuminated until manually reset with the S1 RESET switch. The chiller will automatically restart when the contacts close.

The Starter Trigger Board monitors the Starter's Silicon Controlled Rectifier (SCR) Heat sink temperature. Whenever the heat sink temperature increases to 212°F, the Trigger Board signals the Logic Board. MOTOR CONTROLLER – CONTACTS OPEN is displayed. The Logic Board illuminates the High Temp LED and opens relay K1 contacts. The LED remains illuminated and the contacts remain open until the temperature decreases to less than 110°F and manually reset with the Logic Board's S1 RESET switch. After S1 is pressed, the chiller can be restarted. In routine operation, each time the chiller is shutdown for any reason, it is prevented from restarting until the heat sink temperature decreases to less then 110°F. While it is waiting for the temperature to decrease to this threshold, the HIGH TEMP LED is illuminated, relay K1 contacts are open, and MOTOR CONTROLLER – CONTACTS OPEN is displayed. When the temperature is below 110°F, K1 contacts will open, the LED is extinguished, MOTOR CONTROLLER – CONTACTS OPEN message is cleared and the chiller will automatically restart.

The Multiplexer (MUX) is an electronic switch with 8 inputs and 1 output. The address applied to it determines the position of the switch and therefore the output. Under Program control, the microboard sequentially addresses MUX channels 0 through 7. The voltage output of each channel is listed in the *Table 11 on page 140*. Channel 0 is an analog voltage that represents the Starter Model and Power Line Voltage Voltmeter Scale. The Program uses this value to limit the Full Load Amps setpoint range to the maximum allowed value for the Starter size. This value also determines the Line Voltage Display Range and Motor Current Display Range. Channel 1 is a current limit command that forces the microprocessor to perform Pre-rotation Vanes inhibit and closure at the 100% and 104% FLA. This command is in addition to the microprocessor's Software Current Limit feature that's based on a calculation comparing the highest current phase to the programmed Full Load Amp setpoint to arrive at an FLA percentage. Channels 2 though 4 are analog voltages representing Phase C, B and A Power Line Voltages. Channels 5 through 7 are analog voltages representing Phase A, B and C Compressor Motor Current. The addresses are +12 VDC for logic high (1); less than 1 VDC for logic low (0).

The Logic Board MUX address inputs, along with the respective outputs are shown in *Table 11 on page 140*.

Mod A Multiplexed Data Interface LCSSS

A complete description, theory of operation and troubleshooting instructions of this LCSSS are contained in *Solid State Starter (Mod A) – Operation and Maintenance (Form 160.46-OM3.1)*.

As shown in *Figure 60 on page 138*, the Logic Board of this model starter is mounted inside the OptiView Control Center.

TABLE 11 - MICROBOARD MULTIPLEX CHANNELS

BINARY			DECIMALS	OUTPUT
J5-1	J5-2	J5-3		
0	0	0	0	Starter Model/Voltmeter/Ammeter full scale, max FLA: 0.41 to 0.77 VDC - 7L, 600 VAC, maximum FLA 281, full scale 787A 0.78 to 1.22 VDC – 14L, 300 VAC, maximum FLA 551, full scale 1574A 1.23 to 1.76 VDC – 14L, 600 VAC, maximum FLA 551, full scale 1574A 1.77 to 2.39 VDC – 26L, 300 VAC, maximum FLA 916, full scale 2938A 2.40 to 3.08 VDC – 26L, 600 VAC, maximum FLA 916, full scale 2938A 3.09 to 3.87 VDC – 33L, 300 VAC, maximum FLA 1134, full scale 3672A 3.88 to 5.00 VDC – 33L, 600 VAC, maximum FLA 1134, full scale 3672A
0	0	1	1	Current Limit commands 3.46 to 5.00 VDC - less than 98% FLA 1.21 to 3.45 VDC - more than or equal to100% FLA 0.0 to 1.20 VDC - more than or equal to104% FLA
0	1	0	2	Phase “C” AC Power Line voltage as follows: 300 VAC scale = VDC(out) = $\frac{VAC}{67.9}$ 600 VAC scale = VDC(out) = $\frac{VAC}{135.8}$
0	1	1	3	Phase B AC Power Line voltage. Same as Phase “C” above.
1	0	0	4	Phase A AC Power Line voltage Same as Phase “C” above.
1	0	1	5	Phase A Compressor Motor Current. 0 to +5 VDC spanning range in address 0 above.
1	1	0	6	Phase B Compressor Motor Current. 0 to +5 VDC spanning range in address 0 above.
1	1	1	7	Phase “C” Compressor Motor Current. 0 to +5 VDC spanning range in address 0 above.

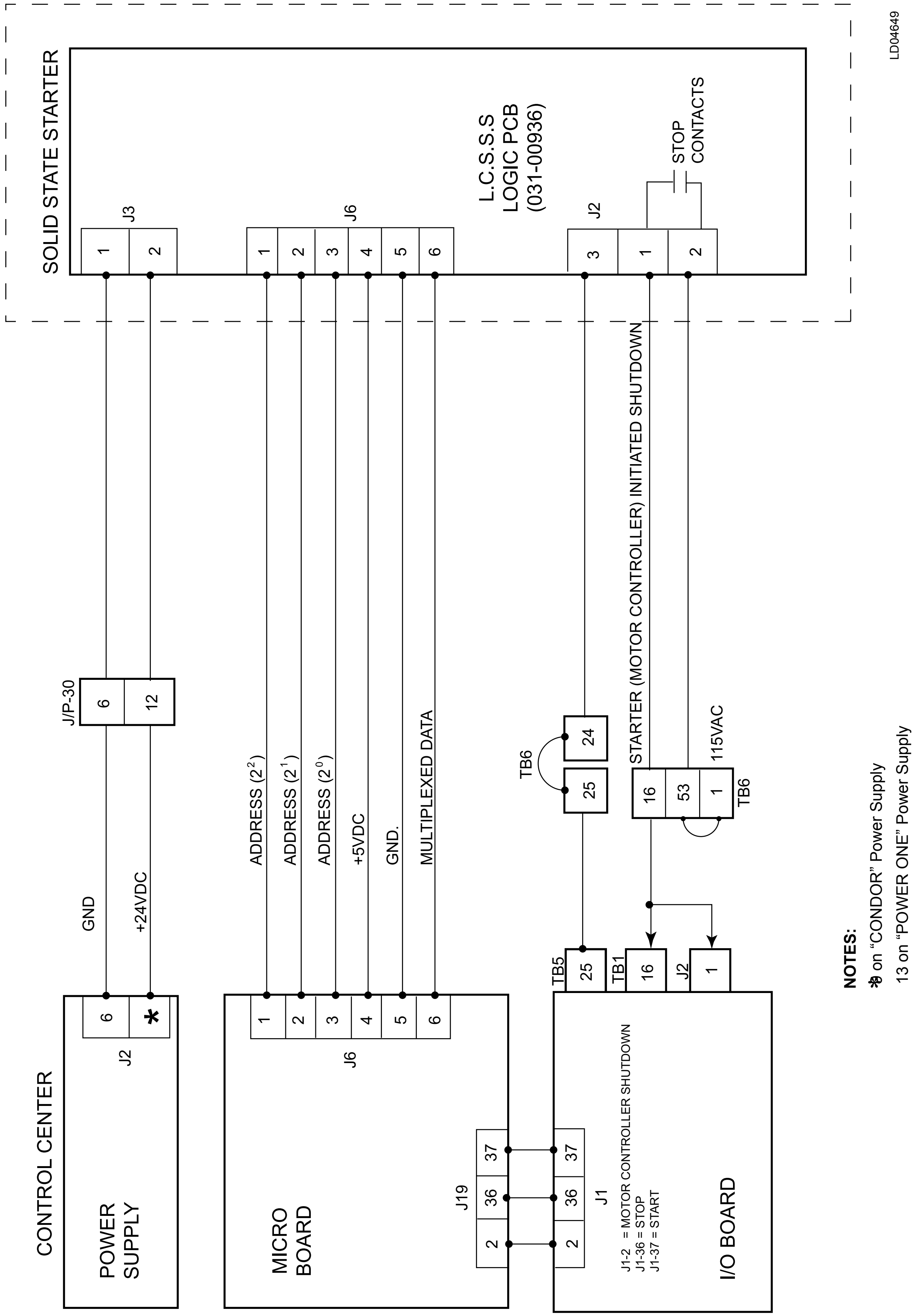


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FIGURE 61 - MOD A LIQUID COOLED SOLID STATE STARTER (LCSSS) – INTERFACE

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SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD

The optional YORK Variable Speed Drive (refer to *Variable Speed Drive – Service Instructions [Form 160.00-M1])*, uses an Adaptive Capacity Control (ACC) function to control the speed of the compressor motor. In new production chillers shipped before March 2007, this function is performed by the Adaptive Capacity Control Board (031-01782-xxx), which resides inside the OptiView Control Center. See *Figure 62 on page 152*. Prior to June 2006, the COM5 (J15) serial port of Microboard 031-01730-000 (early vintage) or 031-02430-000 and 031-03630-001 (later vintage) communicates with this ACC Board using YORK protocol. See *Figure 62 on page 152*. Between June 2006 and March 2007, the ACC board in new production chillers communicates with Microboard 031-02430-001 using the same interface/protocol.

On new production chillers after March 2007, the 031-02430-001 or 031-03630-001 Microboard COM2 (J13) serial port communicates with the VSD Logic Board 031-02506-xxx using RS-485 Modbus protocol. See *Figure 64 on page 154*. Software version C.OPT.01.16. xxx (or later) is required for COM2 Modbus operation. COM2 serial port is selectable between RS-232 and RS-485 operation with program Jumper JP17 on the 02430. It must be positioned on pins 1 and 2 to select RS-485 serial port operation. COM 2 is fixed at RS-485 on the 03630 and requires no jumper settings. When using Modbus protocol, the ACC functionality is contained in the 031-02430-001 Microboard and the ACC Board is not used.

To allow Microboard 031-03630-001 to be used as the service replacement for 031-01730-000 or 031-02430-000 board's non-Modbus applications already in the field, the COM5 serial port is retained on the 031-03630-001 board. See *Figure 62 on page 152* and *Figure 63 on page 153*.

With Microboard 031-02430-001 or 031-03630-001 and software version C.OPT.01.16.xxx (or later), when "VSD-60Hz" or "VSD-50Hz" is selected on the SETUP Screen, additional setpoints must be entered on this Screen. The appropriate serial port (COM2-Modbus or COM5-YORK) must be enabled using the Motor Communications Protocol setpoint. The selections are "Modbus or "York". Microboard 031-02430-001 must be equipped with 128KB BRAM (031-02565-000) to select Modbus. If Modbus is selected, the Motor Node ID setpoint must be set to match the setting of the VSD Logic Board Modbus Address Switch SW3. They must be both set to "1".

The 031-002506 VSD Logic Board contains both the Optocoupled YORK protocol serial Port (J11) and an RS-485 Modbus serial port (J16) to allow it to be used as a service replacement part for VSD Logic Board 031-01433-xxx and 031-02077-xxx. See *Figure 62 on page 152 and Figure 63 on page 153*.

With the Medium Voltage VSD (MV VSD), the ACC functionality resides in the 031-02430-001 or 031-03630-001 Microboard. The COM2 serial port of this board communicates with the MV VSD using Modbus protocol. Refer to *Medium Voltage Variable Speed Drive – Service (Form 160.00-M6)* for details of the MV VSD.

When the ACC Board is present, this is referred to as the YORK Protocol Configuration. See *Figure 62 on page 152 and Figure 63 on page 153*. When the microboard communicates directly with the VSD logic Board (ACC Board not present), this is the "Modbus Protocol configuration" (See *Figure 63 on page 153*). Software version C.OPT.01.15.307 (and earlier) can only operate in the YORK Protocol configuration. Software version C.OPT.01.16.307 (and later) can be used with either configuration.

YORK PROTOCOL CONFIGURATION

The ACC DETAILS Screen displays the pertinent ACC parameters as shown in *OptiView Control Panel – Operation (Form 160.54-O1)*, *Figure 35.*

The ACC Board performs the following functions:

- Acts as a bidirectional serial communications gateway between the microboard and the VSD Logic Board and VSD Harmonic Filter Logic Board.
- Tells the VSD Logic Board at what speed (frequency) to operate the compressor motor. The speed will be the lowest speed between 30 to 60 (50)Hz it can operate without compressor surging.
- Detects compressor surge conditions.
- Creates a **Surge Map** in battery backed memory by storing the Pre-rotation Vanes (PRV) position, motor speed (frequency) and Evaporator/Condenser Pressure Differential (head) that exists when each surge occurs.

The VSD consists of a Power Electronics Section, Logic Board and an optional Harmonic Filter with Harmonic Filter Logic Board, all mounted in a cabinet that is either mounted to the compressor motor or floor standing (retrofit applications). The ACC Board is mounted inside the OptiView Control Center. In operation, the VSD Logic Board:

A. Controls the VSD power electronics to drive the compressor motor at the speed designated by the ACC Board.

B. Monitors power electronics parameters and initiates chiller shutdowns when safety thresholds are exceeded.

C. Transmits the parameters to the ACC Board for transfer to the microboard for display.

The optional Harmonic Filter reduces the power line harmonics produced by the VSD. The Harmonic Filter Logic Board:

A. Controls the filter.

B. Monitors filter parameters and initiates chiller shutdowns when safety thresholds are exceeded.

C. Transmits these parameters to the ACC Board for transfer to the microboard for display.

Complete operation and service details of the VSD and ACC Board is contained in *Variable Speed Drive – Service Instructions (Form 160.00-M1)* and *Medium Voltage Variable Speed Drive – Service (Form 160.00-M6).*

The microboard communicates with the ACC Board, VSD Logic Board and the optional Harmonic Filter Logic Board via a 0 to +5 VDC 1200 baud serial communications (*Figure 62 on page 152*). The ACC Board is the center point of communications between the microboard and the VSD components. The communications is in master/subordinate form. The VSD Logic Board and Harmonic Filter Logic Boards act as subordinates to the ACC. The ACC acts as a subordinate to the microboard. The microboard initiates all communications by sending a command to the ACC Board. The ACC Board passes the command to the VSD Logic Board. The VSD Logic Board responds to the command by returning the requested data to the ACC Board and passes the command to the Harmonic Filter Logic Board. The Harmonic Filter Logic Board returns the requested data to the ACC Board. The ACC Board returns both the VSD Logic Board's response and the Harmonic Filter's response to the microboard.

There are three different commands issued from the microboard:

- Test and Initialize
- Fault Data Request
- Status Data Request

When power is first applied to the OptiView Control Center, the microboard establishes serial communications with the ACC, VSD Logic and Harmonic Filter Logic Boards. To establish communications, it sends a Test and Initialize command to the ACC Board, which sends the command on to the VSD Logic Board The VSD Logic Board relays the command to the Harmonic Filter Logic Board. If the VSD Logic and Harmonic Filter Boards respond appropriately to the ACC Board, the ACC Board responds to the microboard and communications are established. If any of these boards fail to respond to the first command, the microboard sends the command again 4 seconds later. It will continue to send this command at 4 second intervals until a response is received. If, after 10 attempts, no response is received, a cycling shutdown is performed and VSD –INITIALIZATION FAULT is displayed. The microboard will continue to establish communications until successful. Anytime communications have been established and then lost, the microboard will repeat this process to re-establish communications.

After communications have been established, the microboard sends a Fault Data Request command. If there have been any faults detected by the VSD Logic or Harmonic Filter Boards since communications were lost, they are returned to the microboard at this time. If there is no response within 2 seconds, this command is sent at 2 second intervals until a response is received. If no response is received in 10 attempts, a cycling shutdown is performed and VSD – SERIAL COMMUNICATIONS is displayed.

The microboard then begins normal communications with the ACC, VSD Logic and Harmonic Filter Boards. During normal communications, commands and data are exchanged every 2 seconds on the serial communications link. The microboard sends a Status Data Request command every 2 seconds to the ACC Board which is passed along to the VSD Logic Board and Harmonic Filter Logic Boards as described above. It expects to receive the data listed below in response to each of these commands. If a response is not received to 10 consecutive commands, a cycling shutdown is performed and VSD – SERIAL COMMUNICATIONS is displayed. The VSD Logic and Harmonic Filter Boards send the data listed below to the ACC Board and the ACC Board adds its data to it and returns all the data to the microboard in one response. This continues until the VSD Logic or Harmonic Filter Boards detect a fault condition.

As stated above, if communications are lost with the VSD Logic Board, a cycling shutdown is performed and VSD – SERIAL COMMUNICATIONS is displayed. However, if communications are lost with the Harmonic Filter Logic Board, no shutdown is performed, only WARNING – HARMONIC FILTER – DATA LOSS is displayed.

When a VSD fault condition is detected, the VSD Logic Board opens its VSD Stop Contacts that are connected in series with the OptiView Control Center's 1R (K18) RUN RELAY coil. This interrupts the circuit to 1R causing it to de-energize, removing the run signal to the VSD. Simultaneously, the microboard reads the opening of the VSD Stop Contacts via its interface to the OptiView Control Center's I/O Board input J2-1. This notifies the microboard that a VSD shutdown has occurred. The microboard requests the cause of the shutdown by sending a Fault Data Request command. While this request is being processed, the microboard displays VSD SHUTDOWN – REQUESTING FAULT DATA. When the cause of the shutdown is received, the microboard displays a message describing the shutdown (Refer to *OptiView Control Panel – Operation (Form 160.54-O1)* for complete listing of messages) and begins sending normal Status Data Request commands. If the fault data is not returned to the microboard within 2 seconds, it sends the command every 2 seconds until fault data is returned. If none is returned within 10 requests, it assumes it is not forthcoming and displays VSD – STOP CONTACTS OPEN.

The following VSD status data is transmitted from the VSD Logic Board to the ACC Board for transfer to the microboard for display:

- Output Frequency
- Output Voltage
- Output Current - three phase
- Input Power KW
- KWH
- 100% Job FLA
- DC Link Voltage
- DC Link Current
- Internal Ambient Temperature
- Inverter Heat sink Temperature – phase A, B, and C
- Converter Heat sink Temperature
- Pre-charge Relay energized/de-energized
- SCR Gate Drivers enabled/disabled
- Water (cooling) Pump ON/OFF
- VSD running/stopped
- VSD Software Version
- Motor HP

The following Harmonic Filter status data is transmitted from the Harmonic Filter Logic Board to the ACC Board for transfer to the microboard for display:

- Input KVA
- Total Power Factor
- Filter DC Link Voltage
- Input Voltage- phase A, B and C
- Input Voltage THD – phase A, B and C
- Input Peak Voltage – phase A, B and C
- Input Current – phase A, B and C
- Input Current TDD – phase A, B and C
- Filter Current – phase A, B and C
- Filter Heat sink Temperature
- Filter Operation- running/stopped
- Filter Pre-charge Relay – energized/de-energized
- Filter Supply Relay - energized/de-energized
- Input Phase Rotation – ABC/CBA
- Harmonic Filter – present/not present

The following ACC status data is transmitted from the ACC Board to the microboard for display.

- Delta P/P (head pressure)
- Pre-rotation Vanes position
- Surge count

The compressor motor speed can be controlled either manually in Manual Mode or automatically in Auto Mode.

In Manual Speed Control Mode, the speed can be controlled from the VSD TUNING Screen using Keypad keys. The speed can be set to a pre-selected frequency over the range of 10 to 60 (50)Hz, using the SET key. Or, it can be increased or decreased over the range of 0.0 to 60 (50)Hz in increments of 0.1 to 10Hz using the RAISE/LOWER keys. Or, it can be set to full speed using the FIXED key. Beginning with software version C.OPT.01.23.307 (and later), the E-Link Gateway serial communications can no longer change the setting from AUTO to FIXED.

Instructions for manual control are included in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. With software version C.OPT.01.19.307 (and later), this is displayed as SPEED COMMAND on the VSD TUNING Screen and ACC DETAILS Screen. Via Serial communications, the speed command is sent from the microboard to the ACC Board, where it is passed on to the VSD Logic Board. The VSD Logic Board controls the VSD to operate the motor at this frequency. While Manual control is selected, VALID POINT LED CR8 is illuminated, indicating that surges will not be mapped in the Surge Map. Anytime this LED is illuminated, surges are not mapped, as explained below. In making the transition from Manual to Auto Mode, if the speed was manually set to less than 30Hz, it will automatically be set to 30Hz and automatically adjusted from this value. If not in Current Limit and the actual speed is less than 60 (50)Hz, and 60 (50)Hz is selected, the speed will be increased as follows. If the Leaving Chilled Liquid Temperature is within 0.2°F, the PRV will simultaneously be driven closed according to the following:

Speed Increase

- 0.2 Hz every second if Leaving Chilled Liquid Temperature greater than 0.2°F below the setpoint and motor current is less than 80%FLA.
- 0.2 Hz every 1 + (% FLA-80) second if Leaving Chilled Liquid Temperature is greater than 0.2°F below the setpoint and the motor current is greater than 80% but less than 98%FLA.
- 0.2 Hz every 19 seconds if none of the above conditions are present.

PRV Close

A close signal of the following durations is applied every 4.5 seconds:

- 3.9 seconds if PRV position greater than 50%.
- 3.0 seconds if PRV position greater than 25% but less than 50%.
- 1.5 seconds if PRV position less than 25%.

In Auto Speed Control Mode, the ACC Board controls the speed. It determines the optimum compressor motor speed (frequency) over the range of 30 to 60 (50)Hz and sends this value to the VSD Logic Board via the serial communications link. The VSD logic Board controls the VSD to operate the motor at this frequency. The optimum speed is the slowest speed possible that will avoid compressor surge conditions but still allow the chiller to meet capacity requirements. This speed is found in an adaptive sense as explained below.

In determining the optimum motor speed, the ACC Board employs the following:

- **Delta P/P –** This is the chiller Head pressure. It is calculated as (Condenser Pressure minus Evaporator Pressure) divided by Evaporator Pressure. It ranges from 0.00 to 3.60. The ACC Board calculates this value from Evaporator and Condenser Pressure Values received from the microboard via serial communications link. The ACC Board returns the calculated Delta P/P value to the microboard for display over the same link.
- **Pre-rotation Vanes (PRV) position –** The Pre-rotation Vanes position, as used by the VSD control, is provided by a potentiometer mounted to the PRV control arm. The potentiometer interface varies according to whether or not the ACC Board is used. In YORK Protocol configuration, it is connected to the ACC Board (*Figure 62 on page 152 and Figure 63 on page 153*).

  In Modbus Protocol configuration, it is connected to the microboard (*Figure 63 on page 153*).

  The PRV position (0 to 100%) is displayed on the OptiView display as 0% when fully closed, 100 % when fully open and whole percentage points in between.

The potentiometer must be calibrated by a qualified Service technician using a procedure in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. No speed reduction is permitted if this calibration has not been performed.

- **Motor Speed –** This is the actual drive frequency of 30 to 60 (50)Hz.
- **Surge Map –** This contains the Delta P/P, PRV position and motor speed that existed at the instant of each previously encountered surge condition. These parameters are stored as a 3-dimensional array for each surge. The surge map is stored in the ACC Board's BRAM battery backed memory. The following procedures are detailed in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. The entire Surge Map can be printed by pressing the Surge Map Print keypad key. Surge Map Points can be automatically printed to an external printer as they are plotted. The Surge Map can be cleared.

CAUTION

The Surge Map must never be cleared unless advised by the YORK factory.

The following conditions must be met before speed reduction is permitted:

- The PRV calibration procedure must have been performed.
- Auto Speed Control Mode must be selected at the keypad.
- Current Limit must not be in effect. When current limit is in effect, Valid Point LED CR8 is illuminated.
- The Chiller must have been running for greater than 2 minutes.
- The Leaving Chilled Liquid Temperature must be within +0.3°F and –0.6°F of the Leaving Chilled Liquid setpoint. The Leaving Chilled Liquid Temperature must be stable. Lowering the speed while this temperature is unstable, would tend to increase the instability. The microboard calculates the stability by comparing the Leaving Chilled Liquid Temperature to the Leaving Chilled Liquid Temperature setpoint to arrive at a rate of change value.
- Certain applications, such as short chilled liquid loops, multi-pass evaporators, parallel chillers and light load conditions can cause excessive Pre-rotation Vane (PRV) movement resulting in leaving chilled liquid temperature control instability. This instability can be reduced by adjusting the Sensitivity setpoint on the OptiView EVAPORATOR Screen. The 50% selection reduces the magnitude of PRV movement over the NORMAL selection and the 30% selection reduces it even more. With Flash memory card version C.MLM.01.06.xxx (and later) or P compressors with C.MLM.04.02.xxx (and later), and the 50% or 30% sensitivity is selected, PRV movement is further reduced during low load conditions with variable speed drive as follows. When the PRV position is less than 25% and the Leaving Chilled Liquid Temperature is within plus or minus 2.5 °F of setpoint, the maximum allowed vane pulse is limited to 3.5 seconds at the 25% PRV position and 0.9 seconds at 0% position. PRV positions in between have linearly scaled maximums.

When the chiller is started, the speed is brought to 60Hz. After it has been running for greater than 2 minutes and the Leaving Chilled Liquid Temperature is within +0.3 and –0.6°F of the Leaving Chilled Liquid Temperature setpoint, the ACC Board evaluates if the speed can be reduced. If there are no conditions above that would inhibit speed reduction, the ACC Board compares the real-time Delta P/P, PRV Position and Motor Speed to the 3-dimensional arrays stored in the Surge Map. If the real-time array does not match any previous surge condition, the speed will be decreased 0.1Hz every 6 seconds until it is within 1Hz of previously plotted surge condition array in the Surge Map. It will then be decreased 0.1Hz every 9 seconds until it's to the lowest value allowed by the Surge Map. If no plotted points are encountered, the speed is lowered until a surge is encountered or a minimum of 30Hz is reached.

The ACC Board uses two different methods of **Surge Detection**; Delta P method and DC Link method. Surge detection is only enabled while the chiller is running. In detecting a surge using the Delta P method, the outputs of the Evaporator and Condenser Pressure transducers are monitored to detect when the difference between these pressures (Delta P) drops transiently toward Zero. This would be indicative of a surge. A Surge Detected by the Delta P method must have all of the following conditions occur within 5 seconds to be considered a valid surge:

- Delta P must make a negative transition and exceed 3.4 psig for 100 milliseconds.
- Delta P must also exceed 3.5 psig for at least 340 milliseconds.
- Delta P must make at least 2 positive transitions.

When this criteria is met, Surge LED CR9 illuminates for 2 seconds, indicating a valid surge has been detected. In detecting a surge using the DC Link method, the VSD's DC Link Current is monitored to detect when the current drops transiently toward zero. This, as the case with Delta P method, is indicative of a surge. A Surge Detected by this method must also meet the following requirements to be considered a valid surge:

- At least 6 DC Link surges must occur within 2 minutes, and
- At least 3 Delta P surges have occurred within the 2 minute interval.

When both these criteria have been met, Surge LED CR9 illuminates for 2 seconds, indicating a valid surge has been detected. The value displayed as ACC SURGE COUNT on the ACC DETAILS Screen is provided by the ACC Board. Each time the ACC Board detects a surge, the ACC Board increments the count, whether running at maximum or less than maximum frequency.

Each time a Valid Surge is detected, the ACC Board increases the motor speed (up to a maximum of 60 (50) HZ) to take the compressor out of surge. It also evaluates other chiller conditions to determine if the surge should be plotted on the Surge Map. Surges that occur during certain operating conditions are not plotted, as explained below. Whenever Valid Point LED CR8 is illuminated, surges are not plotted.

After each surge, the speed is increased either 1.0Hz or 0.8Hz, depending on operating conditions, in the following increments:

- 0.1 Hz every 2 seconds if motor current less than 80%FLA.
- 0.1 Hz every 2 seconds + (%FLA-80) if motor current greater than 80% FLA but less than 98%FLA.
- 0.1 Hz every 20 seconds if motor current greater than 98% FLA.

If Current Limit is in effect, or the Stability Timer is running when a surge occurs, the speed is increased 1.0Hz but the surge is not plotted on the Surge Map since these conditions would produce an erroneous value. Valid Point LED CR8 is illuminated as a visual indication that one or both of these conditions are in effect.

Otherwise, the speed is increased 0.8Hz and the surge event is plotted on the Surge Map. The Surge Margin Adjust setpoint can be used to add an extra margin of surge prevention. It is programmed over the range of 0.0 to 25.0Hz following instructions in *SECTION 31 - SYSTEM CALIBRATION, SERVICE SETPOINTS AND RESET PROCEDURES* of this manual. The Default value of 0 should provide proper operation in most applications.

When the speed has been increased either 1.0Hz or 0.8Hz, as described above, this speed is maintained for the next 15 seconds. During this period, new surges are ignored. When the 15 seconds have elapsed, a 5 minute time period is entered where the speed is inhibited from decreasing, but increases are allowed. If a surge is detected within this 5 minute period, it is not plotted on the Surge Map, but the speed is increased by the amount as described above. This is repeated as long as the compressor continues to surge. The compressor must be surge free for 5 minutes before a speed decrease is permitted or another surge can be plotted on the Surge Map.

The ACC Board counts the surges as they occur and sends a total count to the microboard for display on the ACC DETAILS Screen (note that the Total Surge Count displayed on the SURGE PROTECTION Screen and the Hot gas bypass Screen is that which is accumulated by the Surge Protection feature). The total surge count is not incremented if a different surge type occurs within 10 seconds of the previous surge. A surge that occurs within 10 seconds of the previous surge is only counted if it is of the same surge type. For example, if a Delta P surge is detected and a DC Link surge is detected within 10 seconds, the DC Link surge is not counted. If the DC Link surge occurred greater than 10 seconds after the Delta P surge, it would be counted.

A surge point can be manually inserted into the Surge Map using the Manual Surge Point keypad key on the ACC DETAILS Screen and switch SW1 on the ACC Board as described in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. This is only to be used for situations in which the automatic surge detection described above does not respond to surge events. This is usually not required and is to be used only by qualified Service technicians as a method of plotting a surge event that the ACC Board does not find on its own. At the instant the condition is identified as a surge event, Surge LED CR9 illuminates for 2 seconds. The motor speed, Delta P/P and PRV Position at the instant the point is established, is unconditionally plotted as a 3-dimensional array in the Surge Map as a surge condition, regardless of whether or not Valid Point LED CR8 is illuminated. The motor speed will be automatically increased as described above. Once plotted, the ACC Board will respond to this point in exactly the same way it responds to automatically plotted surge points, as described above.

Surge points can be printed from the ACC DETAILS Screen. The entire stored Surge Map can be printed using the Surge Map Print keypad key. Also, the surge points can be printed in real-time as they occur, using the Auto Print keypad key. Since the maximum rate at which new surges can be plotted is every five minutes, the rate at which new points are printed is also every five minutes.

When the PRV's approach their 100% open position, there is very little PRV movement remaining to compensate for an increasing load condition. Therefore, in Auto Speed Control Mode, if there is no Current Limit in effect, and the PRV position reaches greater than 98%, the speed is automatically increased at a rate based on the Delta T between the Leaving Chilled Liquid Temperature and the Leaving Chilled Liquid Temperature setpoint as follows:

- 0.1 Hz every 10 seconds if Delta T is greater than 0.2 and less than 0.5°F.
- 0.1 Hz every 8 seconds if Delta T is greater than 0.5 and less than 0.9°F.
- 0.1 Hz every 6 seconds if Delta T is greater than 0.9°F.

If Delta P/P ever increases to greater than 3.60, the speed will be slowly increased to 60Hz. If this were to occur, Delta P/P would have to decrease to less than 3.55 before a speed decrease would be allowed.

The microprocessor is the center point of the hardware architecture (*Figure 62 on page 152*). It coordinates the serial data communications between the OptiView Control Center Microboard and the VSD Logic Board and Harmonic Filter Logic Board. This serial data is in 0 to 5 VDC form. LED's YM XMT (CR7) and YM RCV (CR6) LED's illuminate during serial communications with the OptiView Control Center Microboard. Similarly, VS XMT (CR5) and VS RCV (CR4) LED's illuminate during serial communications with the VSD Logic Board. Serial communications with the Harmonic Filter Logic Board take place through the microprocessor via the Digital Signal Processor. This data is accompanied by a Framing pulse and a CLK signal. Although Evaporator and Condenser Pressures are transmitted to the ACC Board via the serial communications link for Delta P/P calculation, these pressures are also applied directly from the microboard to the MUX (multiplexer) for Delta P surge detection.

Also applied to the MUX, is the output of the PRV position potentiometer. Under Program control, these values are input to the microprocessor. The EPROM contains the operating program for the ACC Board. The RAM serves as the scratch pad memory. The BRAM is a battery backed memory device where the Surge Map is stored. The Watchdog circuit maintains the microprocessor in a reset state during low voltage conditions. This prevents the microprocessor from reading/writing or processing data until it and supporting circuits have sufficient supply voltage. The Watchdog also ensures that the entire Program is executed and that no Program latch-ups occur. Surge LED CR9 illuminates for 2 seconds when a valid surge condition has been detected as explained above. Valid Point LED CR8 illuminates whenever there is a condition in effect that prevents a Surge from being plotted on the Surge Map. These conditions are:

- Current Limit is in effect.
- Leaving Chilled Liquid Temperature Stability Timer is running, indicating an unstable control condition.
- Speed control is in Manual Mode.

Switch SW1 is used to manually insert (plot) a surge point in the Surge Map.

Test points are provided as follows:

- TPA: +5 VDC supply voltage.
- TPB: supply voltage ground.
- TPC: Watchdog power failure detected. Normally greater than +4.5 VDC. Transitions to logic low (less than 3.5 VDC) during low voltage conditions.

MODBUS PROTOCOL CONFIGURATION

In Modbus Protocol configuration (Microboard 031-02430-001 with software version C.OPT.01.16.307 and later), the ACC function is in the microboard and the ACC Board is not present. The microboard communicates directly with the VSD Logic Board through the Modbus serial communications (See *Figure 64 on page 154*). All the commands to the VSD and data from the VSD are via this communications link. Generally, the serial communications and data transfer and shutdown status is as described in *YORK Protocol Configuration on page 143*.

The ACC DETAILS Screen displays the pertinent ACC parameters as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 35.* (Software version C.OPT.01.19.307 (and later) provides the parameters in this description). The ACC function in the microboard performs the ACC surge detection. ACC surges are detected only when the drive is running at less than maximum frequency. With software version C.OPT.01.19.307 (and later), the surge detection and reaction routine is disabled until 5 seconds after the start frequency (25Hz for 50Hz applications/30Hz for 60Hz applications) is achieved. This prevents false surge conditions from being logged or reacted to.

The VSD Start Frequency setpoint (software version C.OPT.01.21.307 and later) allows the Service technician to enter the starting frequency from which the speed ramp-up will begin. This setpoint is programmable over the following range:

A. 60 Hz units – 30 Hz to 60 Hz (default 45 Hz)
B. 60 Hz units with Quick Restart- 30 Hz to 45 Hz (default 45 Hz)
C. 50 Hz units – 25 Hz to 5 0Hz (default 37.5 Hz)
D. 50 Hz units with Quick Restart – 25 Hz to 37.5 Hz (default 37.5 Hz)

The Surge Sensitivity setpoint is used to adjust the sensitivity of the ACC surge detection. It is programmable over the range of 1.5 to 2.5 (default 2.0); smaller values increase the sensitivity. Whenever an ACC surge is detected, the “ACC Surge Detected” LED momentarily illuminates and the “ACC Surge Count” increments (The “Surge Avoidance Surge Detected” LED is shown for reference only. It momentarily illuminates when the Surge Protection feature (See *SECTION 25 - SURGE PROTECTION*) detects a surge. These are only those surges that occur while the drive is running at maximum frequency. This LED should not be confused with ACC detected surge events).

The ACC Mapping Enable setpoint 0.5°F to 20.0°F (default 1.0°F). 0.5°F to 4.0°F (software version C.OPT.01.22.307 and earlier) allows the Service technician to set the Delta T (Leaving Chilled Liquid Temperature minus setpoint) needed to be met to enable surge mapping and speed reduction initially on startup.

Software version C.OPT.01.19.307 (and later) has increased noise filtering on the surge detection. Valid ACC surge points are stored in the Surge Map in the microboard BRAM, as displayed on the SURGE MAP Screen (see below). “Surge Map Point Count” displays the total number of data points contained in the surge map. Based on this surge detection, the speed command is sent to the VSD Logic Board and displayed on the ACC DETAILS Screen as “Command Frequency”. The “Speed Decrease Inhibit – Surge Map Point” LED illuminates when the speed cannot be reduced due to a mapped point. The “Mapping Inhibited” LED illuminates while a point is not allowed to be mapped (not allowed to slow down as well) due to unstable leaving chilled liquid temperature, manual speed control or current limit in effect.

With software version C.OPT.01.21.307 (and later), Surge Mapping is inhibited while a Soft Shutdown is in effect. In software versions C.OPT.01.20.307 (and earlier), if 2 surges are detected during the initial ramp (ramp towards maximum frequency after reaching start frequency), the command frequency is set to the maximum frequency regardless of motor current. This can result in motor current rising sharply and forcing vanes to have to close hard and even possibly a trip on high current or overload. In software version C.OPT.01.21.307 (and later), for every 2 surges that are detected during the initial ramp, increase the command frequency (no higher than the maximum frequency) by the amount listed in the following table. After increasing the command frequency, the initial ramp surge count is reset so it can react to another 2 surges and the initial ramp shall be continued. This logic shall be in effect during the entire initial ramp and take action as many times as necessary.

FREQUENCY COMMAND INCREASE	MOTOR CURRENT
1.0 Hz	> 90% FLA
1.5 Hz	>75% FLA
2.0 Hz	>60% FLA
4.0 Hz	> or = 60% FLA

The Pre-rotation Vanes Position potentiometer is connected to the microboard (See *Figure 64 on page 154*). It must be calibrated by a Service technician using the procedure in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

With software version C.OPT.01.19.307 (and later), to ensure that frequency increases do not cause excessive motor current resulting in overload shutdowns, frequency increase limitations are imposed based upon how close the actual motor current is to the chiller full load amps. In Automatic Frequency Control Mode, anytime the microboard ACC function increases the VSD or MV VSD output frequency, the frequency increase is limited by the motor current as follows. Although the incremental frequency increases can be less than allowed, they will never be greater than allowed. These limitations also apply to the frequency ramp that occurs at chiller start while ramping from start frequency 30Hz (60Hz applications) or 25Hz (50Hz applications) to maximum frequency. These limitations are not imposed in Manual Frequency Control:

- When motor current is less than or equal to 80% FLA - No Limiting
- When motor current is more than 80% FLA and less than or equal to 98% FLA - Increase 0.1Hz every {2 + (%FLA-80)} seconds
- When Motor Current more than 98% FLA - Increase 0.1Hz every 20 seconds

If heat pump duty is enabled and operating in Heating Mode, the VSD is commanded to run at maximum speed at all times. When Heat Pump Duty is set to Cooling Mode, the VSD operates.

With software version C.OPT.01.21.307 (and later) if motor current is greater than or equal to 101% FLA, the VSD speed command is decreased 0.1Hz every 3.0 seconds until the motor current is less than 101% FLA. The Surge Map takes priority over current limiting. Thus if there is a mapped surge point in the present sector, ACC current limiting shall not be allowed to decrease the frequency below the mapped point.

In previous software versions, the initial ramp is complete when either of the following conditions occur:

- Delta T is less than ACC Mapping Enable
- VSD Speed Command equals Maximum

In this version, the initial ramp will be complete when any of the following occur:

- Delta T less than ACC Mapping Enable
- VSD Speed Command equals Maximum
- Motor Current is more than or equal to 100 %FLA

When the VSD initiates a fault shutdown, it opens the VSD stop contacts on the VSD logic board, notifying the microboard as described in *YORK Protocol Configuration on page 143*.

The SURGE MAP screen displays the surge map in TABLE or LIST form, as shown in *OptiView Control Panel – Operation (Form 160.54-O1), FIGURE 37 and 38*. When set to TABLE, the map is shown graphically. The X-Axis is Delta P/P and the Y-Axis is PRV position. Each VSD frequency point is represented by an X in the table. The present operating conditions are indicated with an * and are detailed at the bottom of the screen under PRESENT.

If the present condition is the same as a mapped point, the * will be replaced by an O. To view the details of any mapped point, position the green box (□) over the desired X using the arrow keys (▲▼◄ ►). The VSD Output Frequency, Pre-rotation Vanes Position and Delta P/P of the selected point is displayed at the bottom of the screen under SELECTED. Surge points can be inserted manually using the MANUAL SURGE POINT key, while the chiller is running. They can be deleted manually using the REMOVE SURGE POINT key by positioning the □ over the desired X. When set to LIST, the Delta P/P, PRV Position and VSD Output Frequency of each mapped point are listed in rows. This is the same report that is generated when the surge map is sent to a printer. The PAGE UP and PAGE DOWN keys are used to scroll to the previous or next listing.

The stability limit programming button was removed from the ACC DETAILS screen in a previous software version. The stability limit default and maximum values are presently set to 7000. If a new version of software were installed in a chiller with stability limit set below 7000, the old value would be retained. The only way to clear it is to clear the BRAM. To prevent this from happening, this value is no longer programmable. It is now always set to 7000.

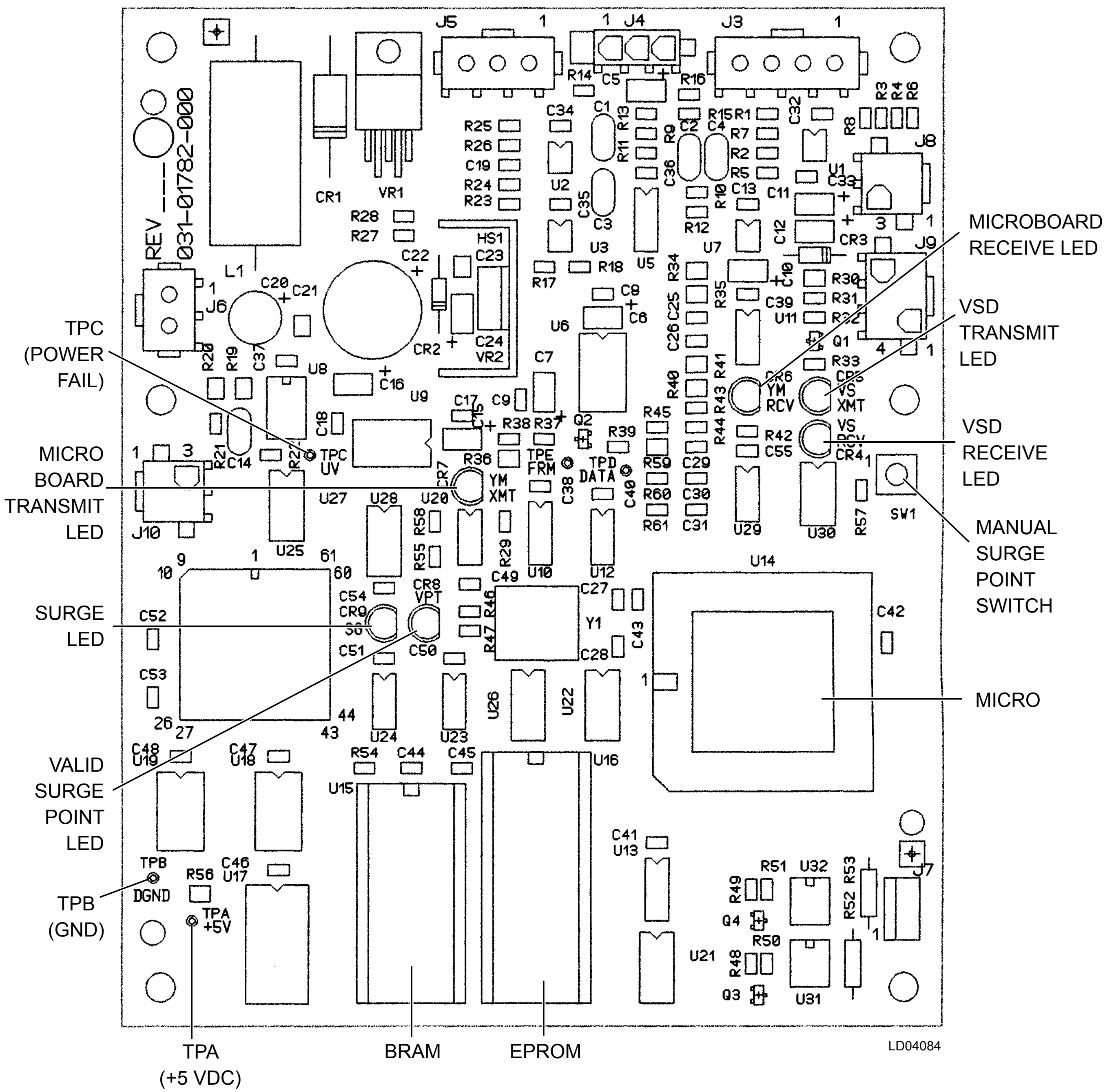

FIGURE 62 - COMPRESSOR MOTOR VARIABLE SPEED DRIVE (VSD) ADAPTIVE CAPACITY CONTROL (ACC) BOARD

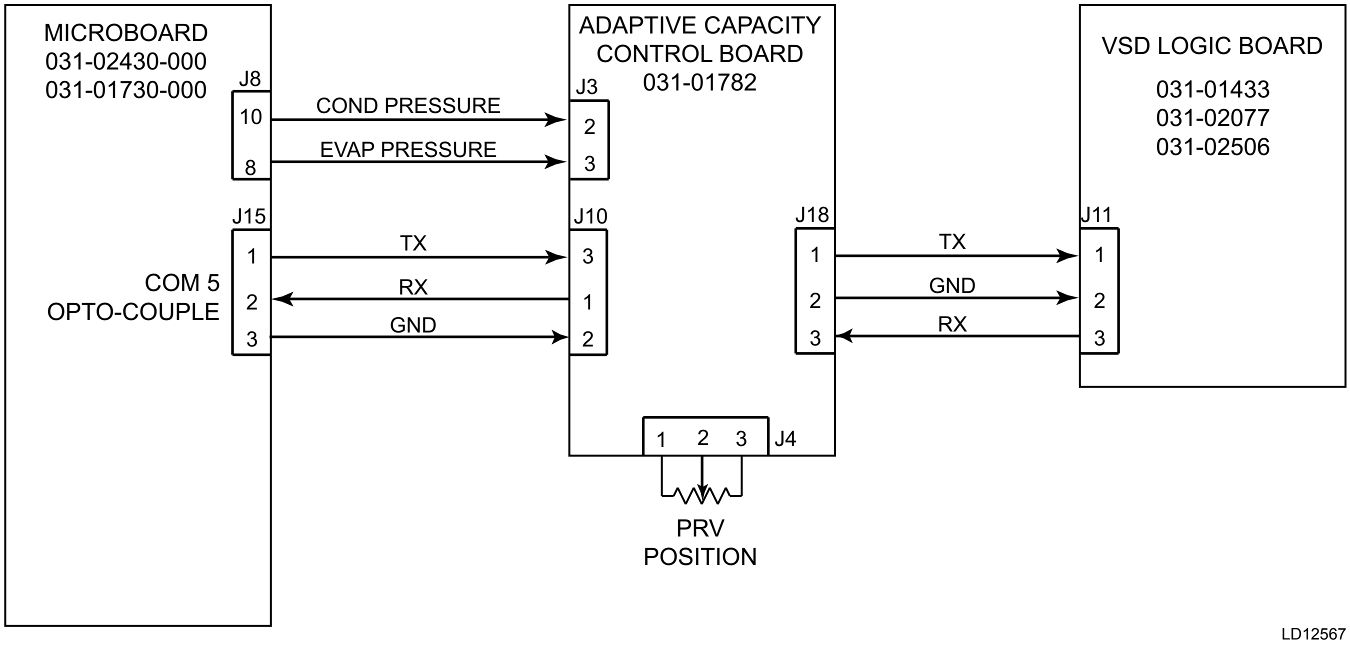

FIGURE 63 - SERIAL COMMUNICATIONS INTERFACE – YORK PROTOCOL

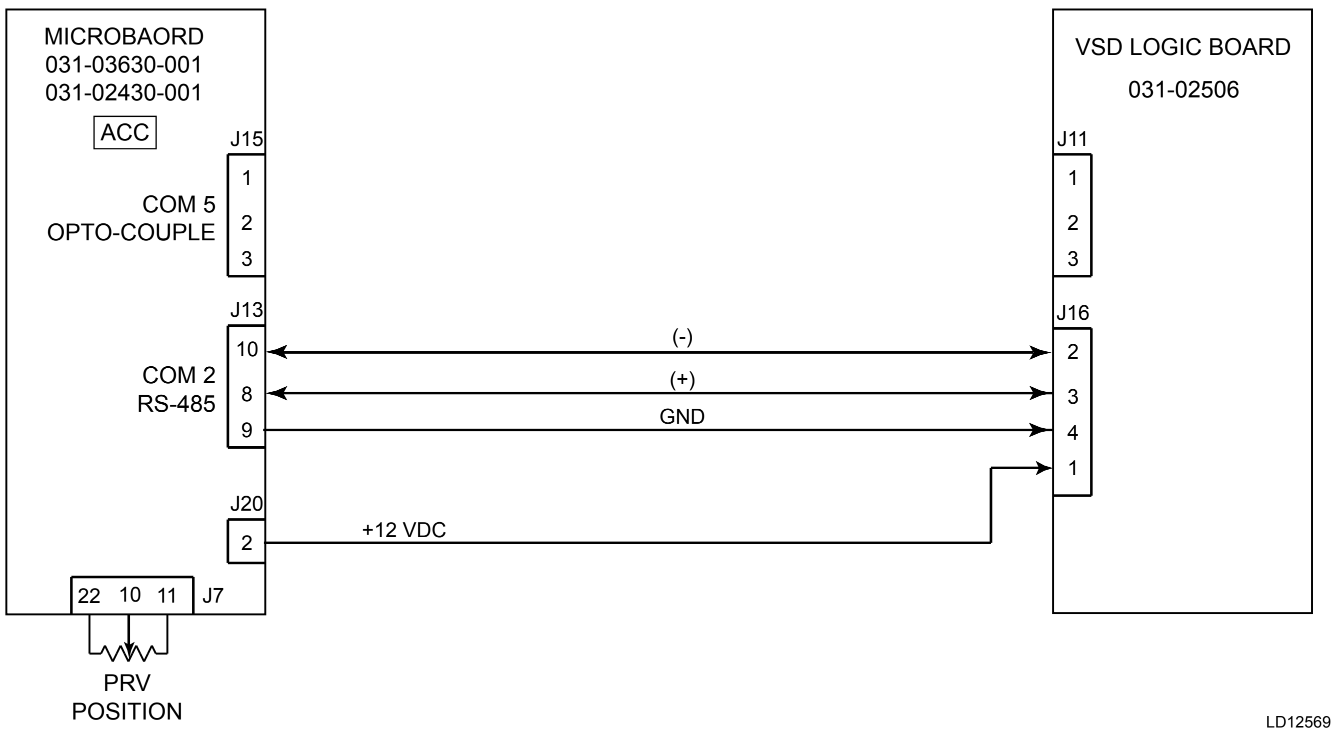

FIGURE 64 - SERIAL COMMUNICATIONS INTERFACE – MODBUS PROTOCOL

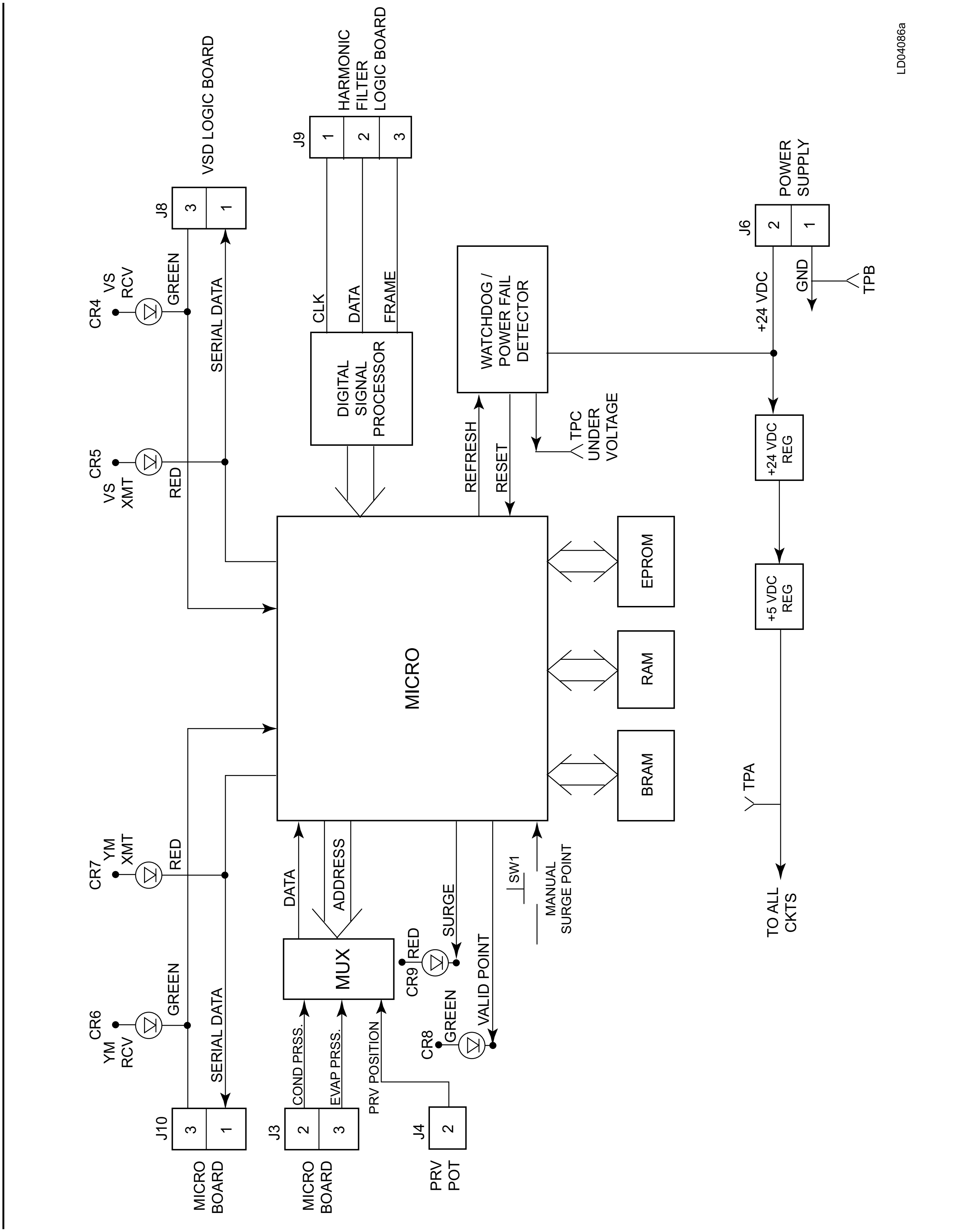

FIGURE 65 - ADAPTIVE CAPACITY CONTROL (ACC) BOARD

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SECTION 15 - PROXIMITY PROBE

The following applies to all applications except P compressors and style F (and later) **c**hillers with "G, Q" or "H5-8" compressors. For chillers equipped with P compressors, see *SECTION 16 - HIGH SPEED THRUST BEARING LIMIT SWITCH.* The Proximity probe senses the distance between the tip of the Proximity probe and the surface of the High Speed Thrust Collar. An earlier vintage Probe (025-30961-000) also sensed the High Speed Drain Line Oil Temperature. However, regardless of which Probe is installed, chillers equipped with Flash memory card version C.MLM.01.03 or later do not sense the High Speed Drain Line Oil Temperature. The different vintages of Proximity probes are shown at the end of this section.

The output of the Proximity circuit is connected to the microboard at J8-15 and is a 0 (0.089 VDC) to +4.4 VDC analog voltage corresponding to a measured distance of 10 to 99 mils. This is the PROXIMITY POSITION and is displayed as HIGH SPEED THRUST BEARING PROXIMITY POSITION = XX MILS on the Proximity probe CALIBRATION Screen. The output of the 025-30961-000 Probe Temperature Circuit is connected to the microboard at J8-1 and is a 0 to +4.5 VDC analog voltage corresponding to a measured temperature of 0°F (-177°C) to 300°F (148.9°C). This is the OIL DRAIN LINE TEMPERATURE and is displayed as HIGH SPEED THRUST BEARING OIL DRAIN TEMPERATURE = XXX°F on the COMPRESSOR Screen (not applicable to Flash memory card version C.MLM.01.03 or later).

When the Probe is installed at the time of chiller manufacture, a reference position is established. It is the distance between the tip of the Probe and the surface of the High Speed Thrust Collar with a minimum of 25 psid oil pressure. Any distance between 37 and 79 mils is acceptable. It is established using a calibration procedure in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. This value is entered at the keypad as the Reference Position setpoint using the Proximity probe CALIBRAITION Screen. Distances outside the range of 37 to 79 mils will be rejected. The value is logged on a label adhered to the inside of the OptiView Control Center door. This value remains the Reference Position until the compressor is rebuilt, whereupon the calibration procedure must be repeated to establish a new Reference Position. Since this Reference Position value is stored in the BRAM (U52) memory device on the microboard, field replacement of either of these items requires the Reference Position setpoint to be programmed again.

The difference between the Reference Position and the actual Position is the PROXIMITY DIFFERENTIAL and is displayed as HIGH SPEED THRUST BEARING PROXIMITY DIFFERENTIAL = XX MILS on the COMPRESSOR Screen. For example, if the Reference Position is 50 mils and the actual Position is 45 mils, then the Differential is -5 mils; with the same Reference, if the actual Position is 55 mils, the Differential is +5 mils.

If the Differential increases to greater than or equal to 10 mils (+10, +11, etc.) or decreases to greater than or equal to 25 mils (-25, -26, etc.), a safety shutdown is performed and THRUST BEARING - Proximity probe CLEARANCE is displayed. With software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later), the clearance is only checked during the last 20 seconds of "System Pre-lube", during "System run" and during "Coastdown". Therefore, the fault is only detected during those periods. With all previous software versions, the clearance is continually checked. The –25 threshold must be exceeded for 2 continuous seconds to initiate a shutdown. The amount of time the +10 threshold has to be exceeded is dependent upon the software version. With software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later), the +10 threshold must be exceeded for 2 continuous seconds to initiate a shutdown. With all previous software, the +10 threshold only has to be exceeded for an instant to initiate a shutdown.

If the Reference Position is between 37 and 46 mils, the full -25 mil differential is not allowed; the maximum allowed distance between the tip of the Probe and the surface of the Thrust Collar is 23 mils. Therefore, when the distance decreases to less than or equal to 22 mils, the safety shutdown is performed, regardless of the Differential to the Reference Position.

If the distance decreases to less than or equal to -17 mils, a safety shutdown is performed and "THRUST BEARING - Proximity probe OUT OF RANGE" is displayed.

On chillers equipped with Probe 025-30961-000 and Flash memory card version C.MLM.01.02 (and earlier), if the Drain Line Temperature increases to greater than or equal to 250.0°F (121.1°C), a safety shutdown is performed and THRUST BEARING - HIGH OIL TEMPERATURE is displayed. If the Temperature signal output of the Probe decreases to 0 VDC, it is indicative of an open circuit or a broken wire to the Probe and a safety shutdown is initiated and "THRUST BEARING - OIL TEMPERATURE SENSOR" is displayed.

When any of the above Thrust Bearing related safety shutdowns occur, the chiller cannot be restarted until a special reset procedure is performed by a Service technician. Some of these shutdowns also require a thrust bearing inspection. The reset procedure and bearing inspection criteria is listed in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

The Proximity Position output of the Probe is measured at the microboard at J8-15 and is calculated as follows:

$$V = \frac{D - 8.14}{20.86}$$

$$D = 20.86 \times V + 8.14$$

Where: V = VDC
D = Distance in Mils

The High Speed Drain Temperature output of Probe 025-30961-000 is measured at the microboard at J8-1 and is calculated as follows:

$$V = \frac{T - 18.75}{62.5}$$

$$T = 62.5 \times V + 18.75$$

Where: V = VDC
T = Temperature in degrees F

The chiller could be equipped with one of several different Probes. The Probe differences vary with the vintage. The differences are listed in *Table 12 on page 159*. For service replacement, refer to part number listed in *Renewal Parts – OptiView Control Center (Form 160.54-RP1)* or the unit renewal parts manual.

For Microboard 031-01730-000, Microboard program jumpers JP41 and JP42 must be positioned appropriately to provide proper operation of actual probe installed. Refer to Microboard Program Jumpers.

The Probe cannot accurately measure the gap distance if its supply voltage, +24 VDC, decreases to less than 19.0 VDC. To prevent an invalid Proximity gap safety shutdown due to a Utility Power sag, the microboard monitors the Probe's 24 VDC power source at J9-12 on the microboard. If it decreases to less than 19.0 VDC, a cycling shutdown is performed and Proximity probe - LOW SUPPLY VOLTAGE is displayed. The chiller will automatically restart when the voltage increases above +19.7 VDC.

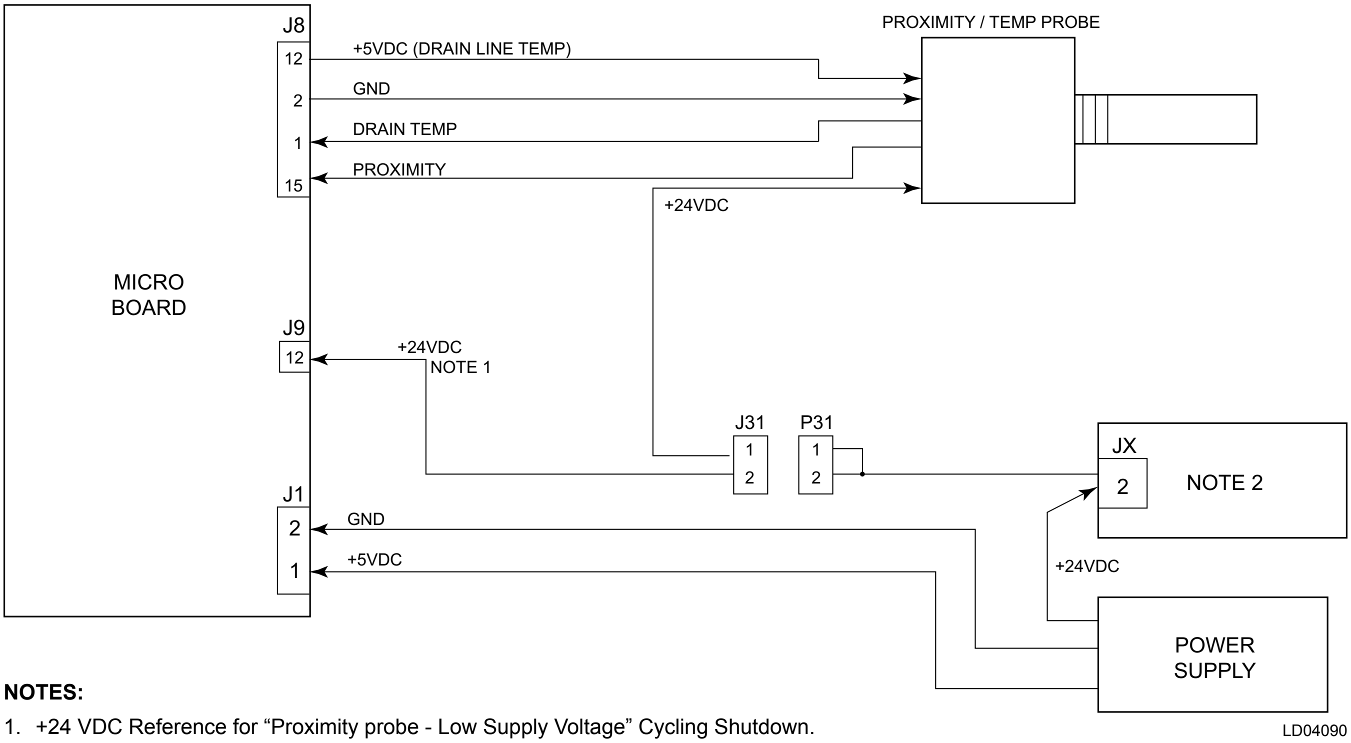
NOTE

IMPORTANT! Probes 025-35900-000, 025-35900-001 and 025-40496-000 do not sense the High Speed Drain Temperature. The value returned from the Probe for this temperature will be 0 VDC. If the software reads this value, the 0 VDC value will cause the chiller to be locked out on the safety "THRUST BEARING – OIL TEMPERATURE SENSOR" (complete explanation of this message is in OptiView Control Panel – Operation (Form 160.54-O1). Therefore, the software used must be of a later vintage that does not read this parameter. For Microboards 031-01730-000, Software versions C.MLM.01.03 (and later) do not read this parameter and are required for these probes. If the software does not meet this requirement, a new Flash Card (031-01797) must be ordered at the same time as the probe. For Microboards 031-02430-000/001, all versions of software do not read this input and therefore meet this requirement.

TABLE 12 - PROXIMITY PROBES

PART NUMBER	SUPPLY VOLTAGE	DESCRIPTION
025-30961-000	+24 VDC, +5 VDC	Production until April 2000. Senses Proximity. Also senses High Speed Drain Line Oil Temperature unless equipped with Flash memory card version C.MLM.01.03 or later. 1-piece integrated design that includes the electronics in the barrel of the probe. See *Figure 66 on page 160.*
025-35900-000	+24 VDC, +5 VDC	Production from April 2000 until March 2003. Senses Proximity only. Does not sense High Speed Drain Temperature. Supersedes probe 025-30961-000. 1-piece integrated design that includes the electronics in the barrel of the probe. See *Figure 67 on page 160.*
025-35900-001	+24 VDC, +5 VDC	Production from March 2003 until March 2006. Senses proximity only. Does not sense High Speed Drain Temperature. Supersedes probe 025-35900-000. 1-piece integrated design that includes the electronics in the barrel of the probe. See *Figure 67 on page 160.*
025-40496-000	+24V	Production after March 2006. Supersedes all previous probes. Senses proximity only. Does not sense High Speed Drain Temperature. This probe assembly is a 2-piece design that has the electronics in a module that is separate from the probe. This design allows the electronics portion of the probe to be replaced separately, thus eliminating the need to evacuate the chiller refrigerant charge when replacing only the electronics portion of the probe. The probe is connected to the electronics module with a coaxial cable. See *Figure 68 on page 161* for parts breakout of probe assembly 025-40496-000.

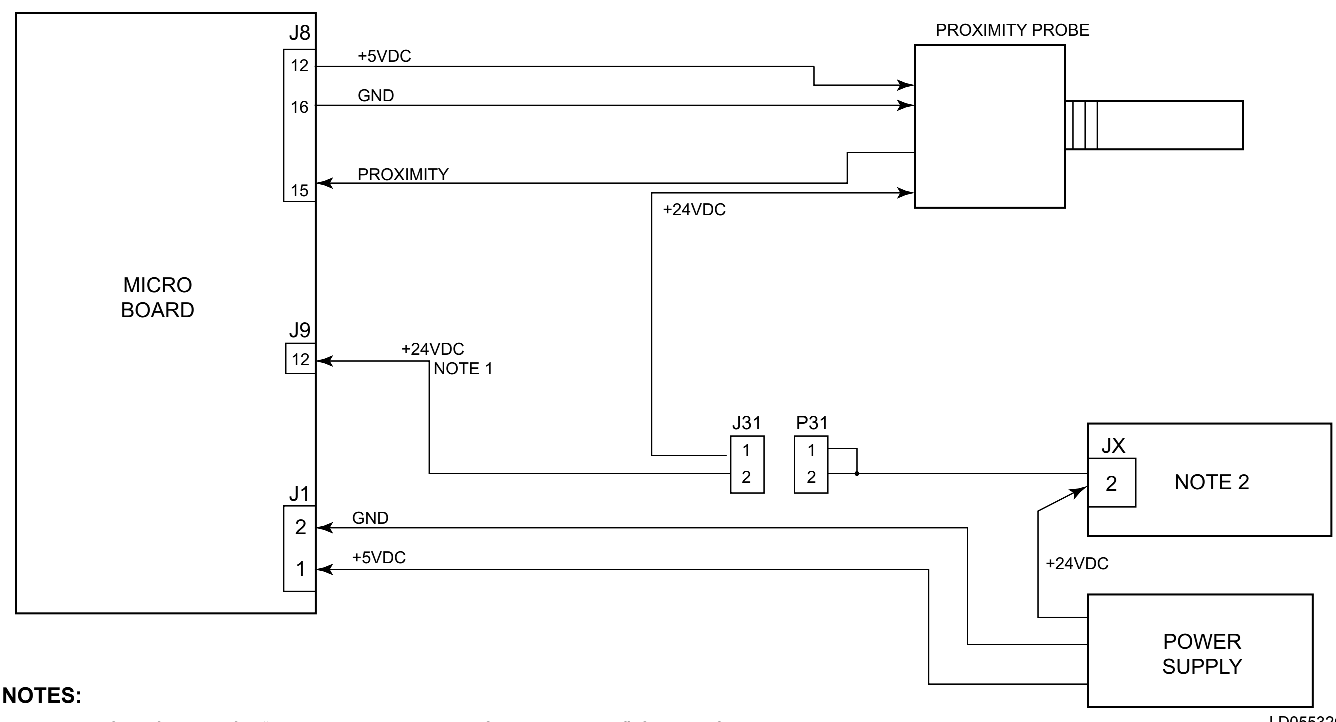
15



NOTES:

1. +24 VDC Reference for "Proximity probe - Low Supply Voltage" Cycling Shutdown.
2. CM-2 Board, Solid State Starter Logic Board or Adaptive Capacity Control Board as determined by the Starter Application.

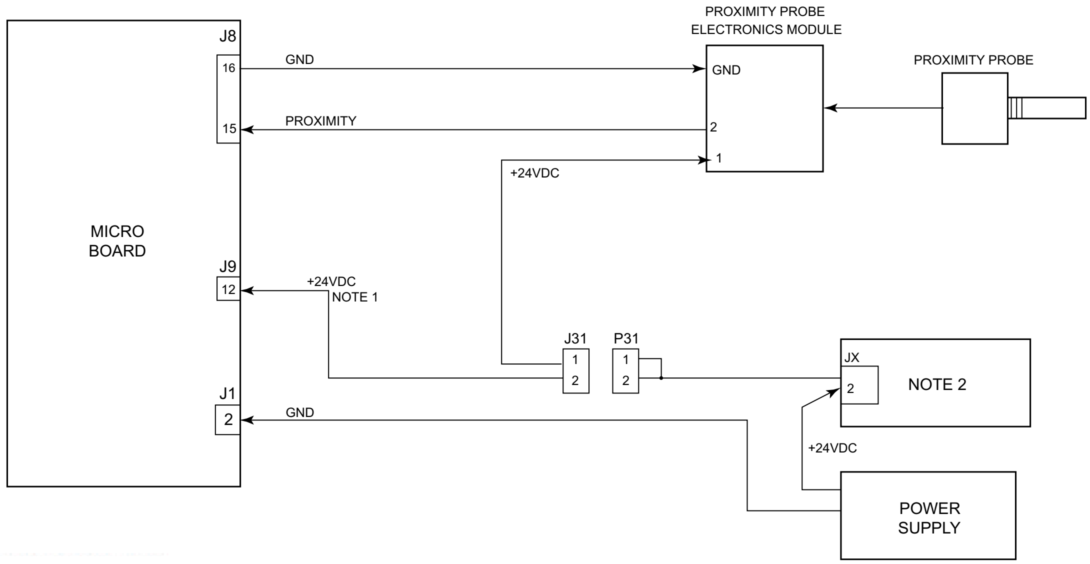
FIGURE 66 - PROXIMITY PROBE INTERFACE – PROBE PART NUMBER 025-30961-000



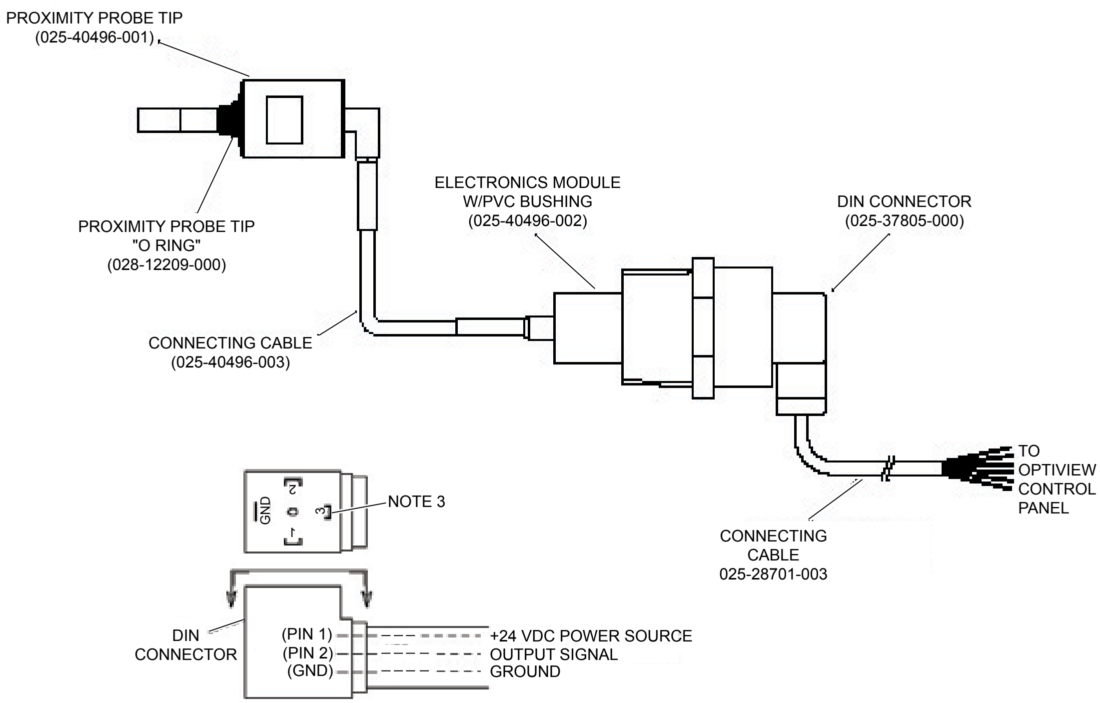
NOTES:

1. +24 VDC Reference for "Proximity probe - Low Supply Voltage" Cycling Shutdown.
2. CM-2 Board, Solid State Starter Logic Board or Adaptive Capacity Control Board as determined by the Starter Application.

FIGURE 67 - PROXIMITY PROBE INTERFACE – PROBE PART NUMBER 025-35900-000 AND 025-35900-001



LD05532A



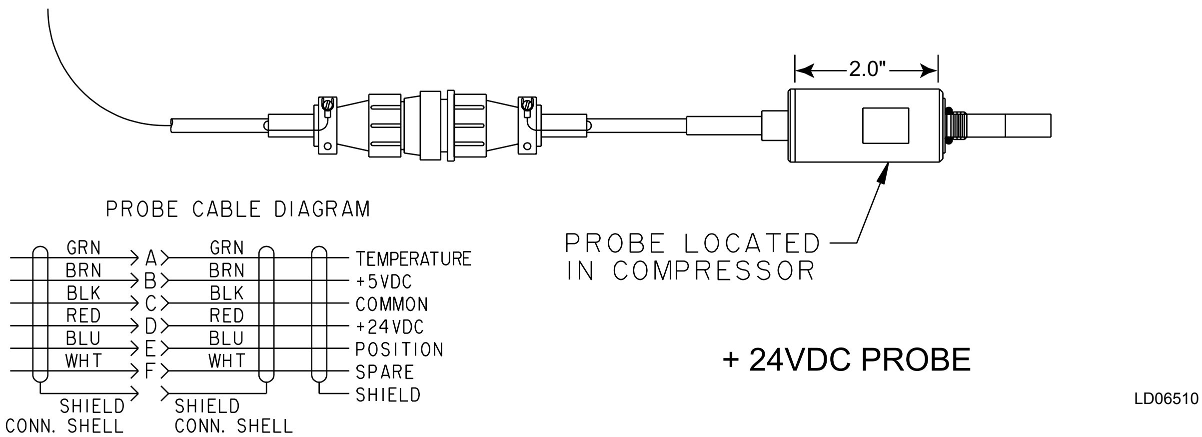
LD12570B

NOTES:

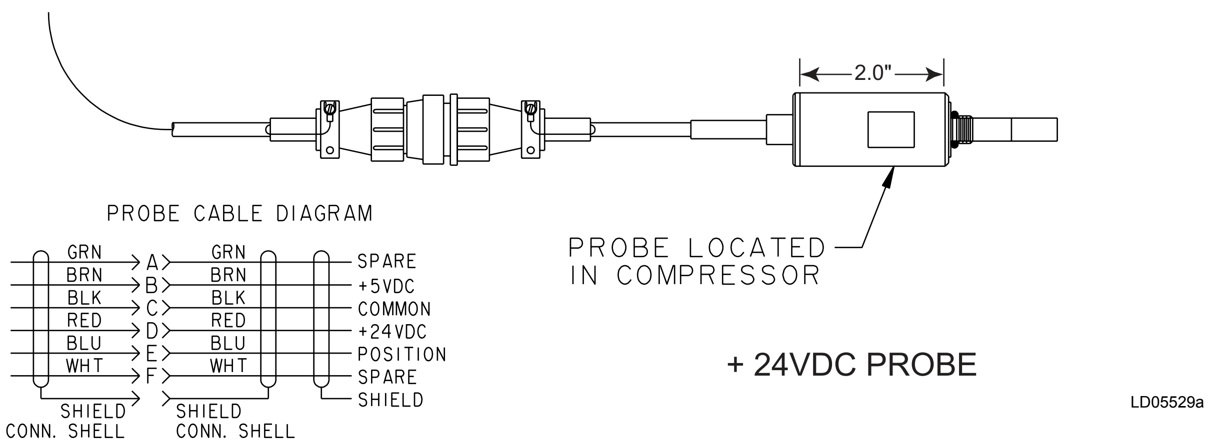
1. +24 VDC Reference for “Proximity probe – Low Supply Voltage” Cycling Shutdown.
2. CM-2 Board, Solid State Starter Logic Board or Adaptive Capacity Control Board, as determined by starter application.
3. No wire is permitted to be connected to DIN connector Pin3. This pin is for Probe manufacturer’s use only.
   Connecting a wire to this pin will cause Probe malfunction.
4. Probe assembly 025-40496-000 consists of: Proximity probe 025-40496-001, Electronics Module with PVC bushing 025-40496-002 and Probe to Electronics Module interconnecting cable 025-40496-003.
5. When replacing previous probe versions with this probe, use the existing cable and retrofit kit 364-51806-000, consisting of:
   025-40496-000 probe assembly (Refer to note 4)
   025-37805-000 DIN connector
   028-12209-000 O-ring
   035-21458-000 instruction drawing

FIGURE 68 - PROXIMITY PROBE INTERFACE – PROBE PART NUMBER 025-40496-000

15



YORK PART NUMBER
025-30961-000



YORK PART NUMBER
025-35900-000 and 025-35900-001

FIGURE 69 - PROXIMITY PROBE

SECTION 16 - HIGH SPEED THRUST BEARING LIMIT SWITCH

Chillers that are equipped with P compressors and style "F" and later chillers with G or "H5-8" compressors have a High Speed Thrust Bearing Limit Switch (025-34535-000) instead of the Proximity probe described in *SECTION 15 - PROXIMITY PROBE*. This device detects abnormal bearing position through probe contact instead of distance measurement as performed with the Proximity probe.

The High Speed Thrust Bearing Limit Switch is an assembly consisting of a pressure switch attached to a probe that protrudes into the compressor housing. When the bearing position decreases to greater than the allowed position, it comes into contact with the probe, causing the break-away probe to detach, exposing the pressure switch to the pressure inside the compressor. A set of normally closed contacts inside the switch open when the switch is exposed to a pressure of greater than 15 to 25 psig. One side of these contacts is connected to 115 VAC. The other side connects to I/O Board TB3-81. The microboard reads the state of these contacts through the I/O Board and when they open, a safety shutdown is performed and THRUST BEARING – LIMIT SWITCH OPEN is displayed on the System Details line of the Display. On the COMPRESSOR Screen, a red LED illuminates when the switch is closed; extinguishes when it is open.

CAUTION

After the HIGH SPEED THRUST BEARING safety shutdown has occurred, the chiller cannot be restarted until a Thrust Bearing inspection, followed by a special reset procedure which has been performed by a qualified Service technician. The reset procedure and Bearing inspection criteria are listed on page 271 of this manual.

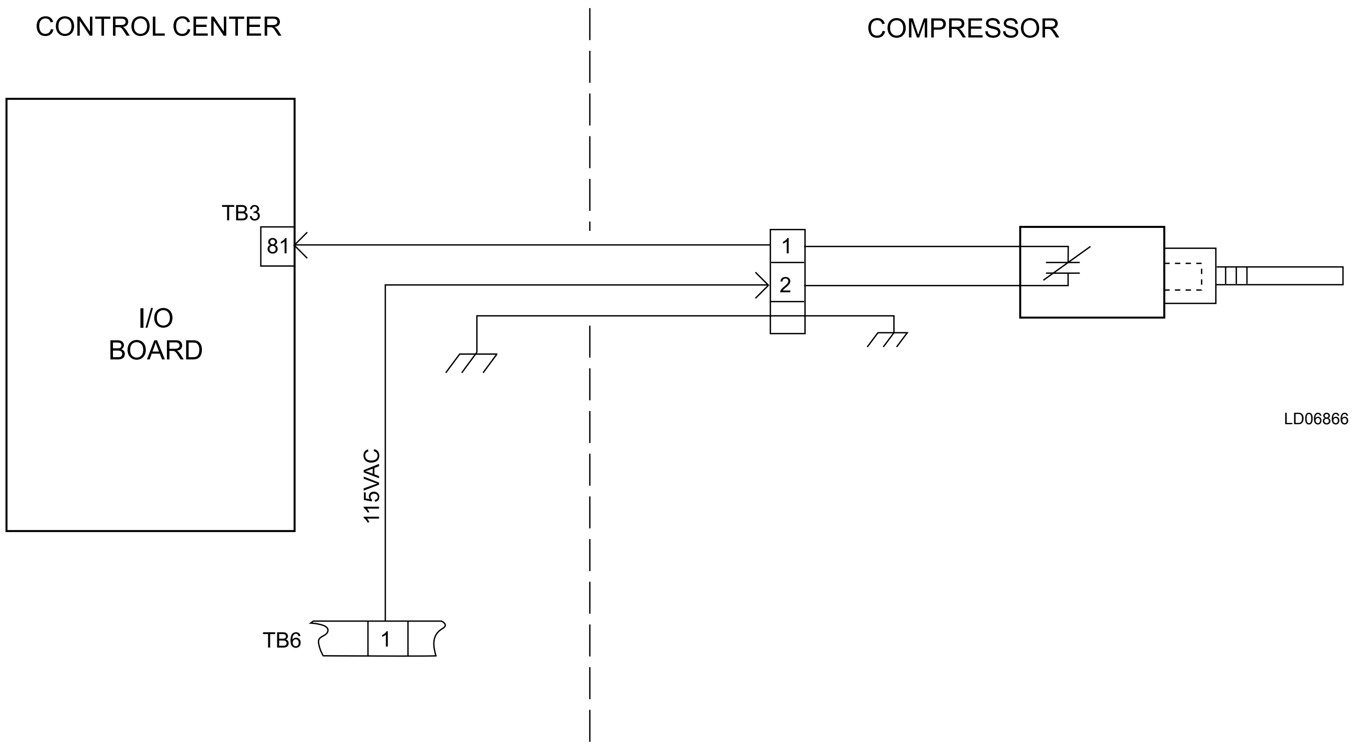


FIGURE 70 - HIGH SPEED THRUST BEARING LIMIT SWITCH – INTERFACE

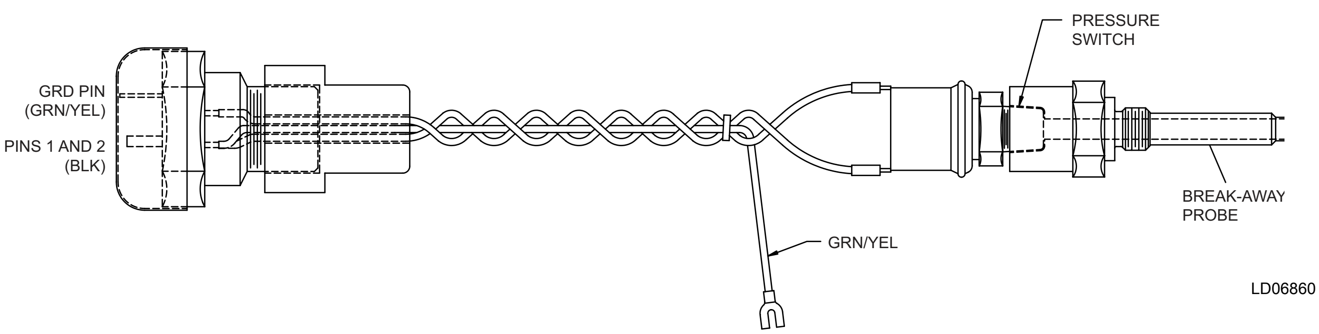


FIGURE 71 - HIGH SPEED THRUST BEARING LIMIT SWITCH

SECTION 17 - REFRIGERANT LEVEL CONTROL

The chiller can be provided with an optional Condenser Refrigerant Level Control. A Variable Orifice, located in the refrigerant liquid line between the Evaporator and Condenser, is used to control the refrigerant level in the Condenser. It is modulated by an Actuator that is driven by open and close output signals from Triacs on the I/O Board. These control signals originate at the microboard. Automatic or Manual level control is allowed. If Automatic control is selected, the Program modulates the Variable Orifice to maintain the Condenser refrigerant to a programmable setpoint level. If Manual control is selected, the Variable Orifice can be manually controlled with the keypad keys. This Manual control can also be used to place the Orifice in a fixed position.

Since the Level Control feature is optional, the Program operation described here must be “enabled” on those chillers so equipped and “disabled” on all other chillers. This procedure, along with the programming of setpoints described below, is performed on the REFRIGERANT LEVEL CONTROL/TUNING Screen using instructions in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

A Liquid Level Sensor (LLS) detects the Refrigerant Level in the condenser and outputs an analog voltage to the microboard that represents this level. The level is expressed as a percentage and is displayed on the CONDENSER Screen and the REFRIGERANT LEVEL CONTROL Screen as the REFRIGERANT LEVEL POSITION = XXX%. The Level Sensor is calibrated so that the refrigerant level is displayed as 0% when the level is at minimum; 100% when the level is at maximum. Levels between these extremes are linearly scaled. The level is at minimum when the chiller is shutdown with the orifice in the fully open position. The level is at maximum when the level is above the site glass, with the sensor fully covered.

The Level Sensor calibration procedure is in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. There are different versions of the Level Sensors as shown in *Figure 71 on page 164*. The operation of the sensors is the same. However, the differences affect the way the sensors are calibrated. Some sensors are equipped with adjustable potentiometers, while others are equipped with pushbuttons that are used to calibrate the sensor.

The desired refrigerant level to be maintained in the condenser is the Refrigerant Level setpoint and is displayed as REFRIGERANT LEVEL SETPOINT = XXX% on the CONDENSER Screen and the REFRIGERANT LEVEL CONTROL Screen.

This setpoint is programmed by a Service technician at chiller commissioning using the REFRIGERANT LEVEL CONTROL Screen. It is programmable over the range of 20% to 80%.

AUTOMATIC OPERATION

While the chiller is shut down, an Open signal is applied to the Actuator, driving the Orifice to the fully open position. This causes the Condenser Refrigerant Level to be approximately 0%. Elevated Evaporator Pressure with respect to Condenser Pressure could cause the level to be higher.

When a chiller start is initiated, there are two different courses of action taken, depending on the Flash memory card version as follows:

1. If equipped with Flash memory card version C.MLM.01.06.xxx (and earlier) or P compressors with C.MLM.04.02.xxx (and earlier).

   After the chiller is started, when the Vane Motor Switch (VMS) opens after entering System run, if the actual level is greater than the Level setpoint, the microboard begins controlling the level to the Level setpoint. However, if the actual level is less than the Level setpoint, a linearly increasing ramp is applied to the Level setpoint. This ramp causes the setpoint to increase from the initial refrigerant level to the programmed Level setpoint over a period of 15 minutes. While this ramp is in effect, the ramp value is displayed as REFRIGERANT LEVEL TARGET = XX% and replaces the Level setpoint message on the CONDENSER Screen. While the ramp is in effect, RAMP UP TIME REMAINING = XX MIN is displayed. After the 15 minute ramp period has elapsed, the refrigerant level is controlled to the programmed Level setpoint.

2. If equipped with Flash memory card version C.MLM.01.07.xxx (and later).

   Upon entering chiller Pre-lube, the Refrigerant Level close output is energized for the length of the programmable Valve Preset Time setpoint (0 to 100 seconds; default 50). After pre-positioning, the valve is held in this position until the first 3 minutes of Chiller Run Time has elapsed (Setting the Valve Preset Time to 0 seconds disables this pre-positioning feature). During this 3 minute period, the Refrigerant Level Override displays VALVE PRESET and the Override Time Remaining displays the time remaining in the 3-minute countdown timer. After the chiller has been running 3 minutes, if the level is greater than or equal to the Refrigerant Level setpoint, it begins controlling to the setpoint (with software version C.OPT.01.21.307 (and later), after entering System run, if the refrigerant level is greater than the programmed Level setpoint for 2 seconds, the preset/hold timer is canceled and normal level control is started immediately, regardless of whether or not the Preset position has been reached or the 3 minute timer has elapsed).

However, if it is less than the Refrigerant Level setpoint, a linearly increasing ramp limit, called the Refrigerant Level Target, is applied to the Refrigerant Level setpoint. This ramp limit allows the level to go from the present level to the Refrigerant Level setpoint over a period of time programmed as the Ramp-Up Time setpoint (3 to 15 minutes; default 8). During this ramp-up period, the Refrigerant Level Target is used to control the refrigerant level in the condenser and the Refrigerant Level setpoint message on the CONDENSER Screen is replaced by REFRIGERANT LEVEL TARGET = XX%. While the ramp is in effect, RAMP UP TIME REMAINING = XX MIN is displayed. After the ramp period has elapsed, the refrigerant level is controlled by the Refrigerant Level setpoint for the remainder of chiller run. If the Valve Preset Time is set to 0 seconds and the Ramp-Up Time setpoint is set to 15 minutes, the control will operate the same as previous Software versions, as described above.

The Program applies an open or close signal, as required, from the microboard to the actuator to maintain the level to the Level setpoint. The duration of the signal determines the magnitude of change to the Orifice position. The duration of the signal and whether it is an open or close signal depends upon the Proportion Error and the Rate of Change of the actual level compared to the Level setpoint in a recurring period of time called a Level Control Period. At the end of each Level Control Period, the Proportion error and Rate of Change are compared to control thresholds Proportion Limit Close, Proportion Limit Open and Rate Limit Close and Rate Limit Open. The result of this comparison determines the signal that will be applied to the actuator at the end of the Level Control Period as explained below. The setpoint values used by the program is determined by the Software vintage. In earlier versions, the values are programmable setpoints as shown below. In later versions, they are fixed and programmable values applied in two different Zones, as determined by the error relationship of the actual refrigerant level and the Level setpoint as shown below.

Software version C.MLM.01.11.xxx (and earlier) or C.OPT.01.11.xxx (and earlier)

- Level Control Period - 3.5 to 30.0 seconds (default 3.5)
- Proportion Limit Open - 10% to 50% (default 15)
- Proportion Limit Close -10% to 50% (default 45)
- Rate Limit Open - 5% to 50% (default 10)
- Rate Limit Close - 5% to 50% (default 10)
- Proportion Error Deadband - +3%
- Rate Error Deadband - +1%

Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306(and later)

In this version, some control thresholds are fixed while others are programmable. This provides more stable control in certain operating conditions. The control thresholds are applied in two different zones, as determined by the error relationship between the actual refrigerant level and the Level setpoint as shown below. Zone 1 parameters are used when the error is less than 9%. Zone 2 parameters are used when the error is greater than 9%. When transitioning from Zone 2 to Zone 1, the error must be less than 9% for 60 seconds before the Zone 1 parameters are used. If the error is greater than 9%, the Zone 2 parameters are immediately implemented.

On the REFRIGERANT LEVEL CONTROL Screen, the Zone Control State status box displays which zone of control is being used:

- ZONE 1
- ZONE 2
- ZONE CONTROL OFF (if chiller shutdown)

When transitioning from Zone 2 to Zone 1, ZONE 2 TO ZONE 1 is displayed and the ZONE CONTROL TIME REMAINING status box displays the amount of time remaining in the 60-second countdown timer.

The following are the control thresholds:

	Zone 1	Zone 2
Proportion Limit Open (fixed)	50%	52%
Proportion Limit Close (fixed)	45%	45%
Rate Limit* (setpoint)	3%-15%	3%-15%
Default	7%	5%
Period (setpoint) (seconds)	8-22	2.5-10
Default	15	2.5
	Zone 1 and Zone 2	
Level Setpoint	20% to 80%; default 30%	
Valve Preset Time (setpoint) (seconds)	0 to 100; default 50	
Ramp Up Time (setpoint) (minutes)	3 to 15; default 8	
Proportion Error Deadband -	+0%	
Rate Error Deadband –	+0%	

* This Rate Limit setpoint sets the Rate Limit threshold for refrigerant levels both above (open) and below (close) the Refrigerant Level setpoint.

The entire chiller run time is divided into Level Control Periods. They occur consecutively and continuously. The first one begins upon entering System run and when it ends the next one begins, etc. This repeats until the chiller is shutdown. The duration of these periods are programmed as the Level Control Period setpoint. At the completion of each Level Control Period, the actual level is compared to the Level setpoint. The result is the Proportion Error.

The Proportion Error is compared to setpoints Proportion Limit Open (if level is above setpoint) and Proportion Limit Close (if level is below setpoint). If the Proportion Error exceeds the Limit, the Proportion Error influence in the response will be large. If the Proportion Error is less than the Limit, the Proportion error influence in the response is determined by how close the Proportion Error is to the Limit; close yields larger influence, further yields smaller influence. To establish the response to the rate of change, the amount of change in the Level within the Level Control Period is compared to the Rate Limit Close (if level less than setpoint) and Rate Limit Open (if level greater than setpoint). If the result exceeds the setpoint, the rate influence in the response will be large; if less than the setpoint, the rate influence is determined by how close the result is to the setpoint; close yields larger influence, further yields smaller influence.

Therefore, per the above, the values programmed for Proportion Limit Open/Close and Rate Limit Open/Close determine the sensitivity of the level control. Smaller values generally yield greater response for the same level change in the Level Control Period. Also, the smaller the value programmed for the Level Control Period, the more often an output signal is applied to the Variable Orifice Actuator. The orifice valve movement is animated on the REFRIGERANT LEVEL CONTROL Screen as follows:

- When 0 to 20% open, shown fully closed
- When 20 to 40% open, shown as 20% open
- When 40 to 60% open, shown as 40% open
- When 60 to 80% open, shown as 80% open
- When 80 to 100% open, shown as 100% open

MANUAL OPERATION

The Orifice Actuator can be manually controlled from the keypad using the REFRIGERANT LEVEL CONTROL Screen after logging in at SERVICE access level. Open, Close, Hold and AUTO keys are used to control the Variable Orifice. Using the Open, Close and Hold keys, the Variable Orifice can be placed in a fixed position. Pressing the AUTO key returns Level Control to Automatic operation.

ACTUATORS

New production units use a Belimo actuator that operates from 24 VAC. If the OptiView Control Center is retrofit to an existing chiller, the chiller could be equipped with a Barber-Coleman actuator that operates from 115 VAC. The interface for both actuators is shown in *Figure 73 on page 169.* The description of the operation of both actuators is in the *SECTION 6 - I/O BOARD* of this manual.

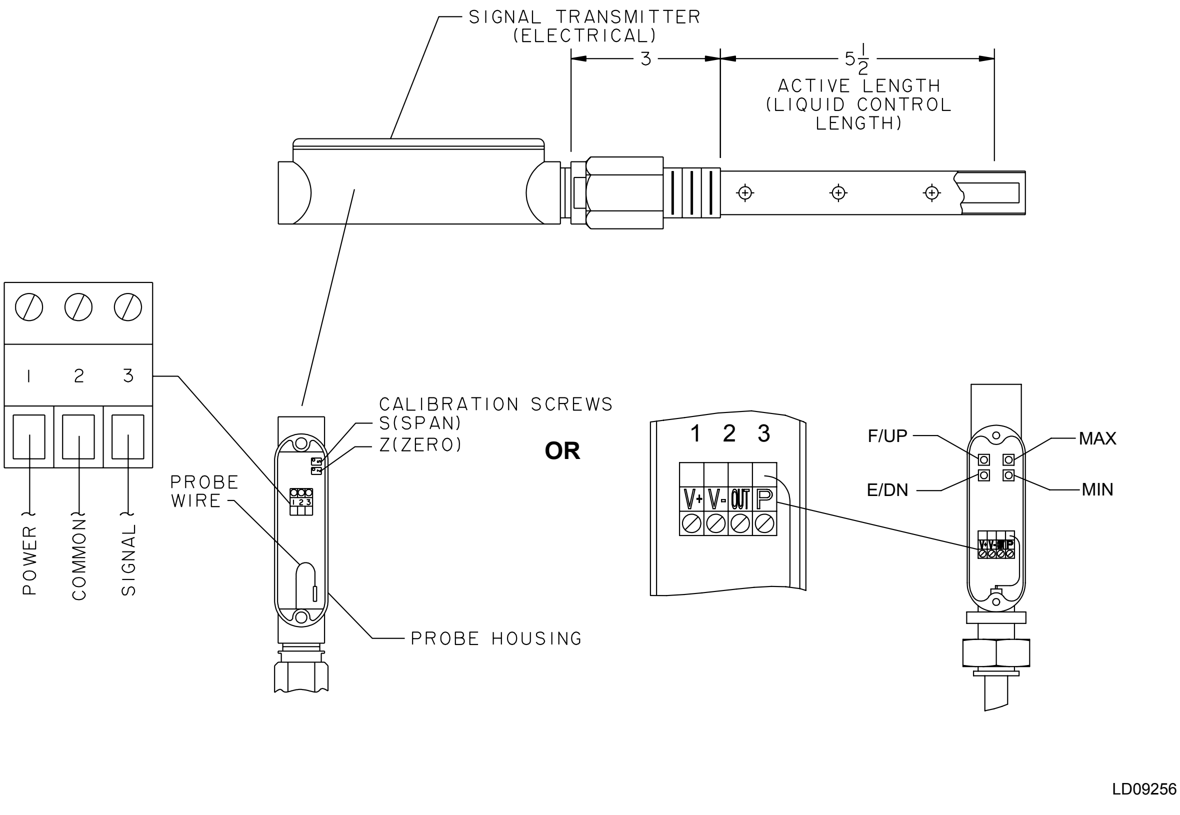


FIGURE 72 - REFRIGERANT LIQUID LEVEL SENSOR

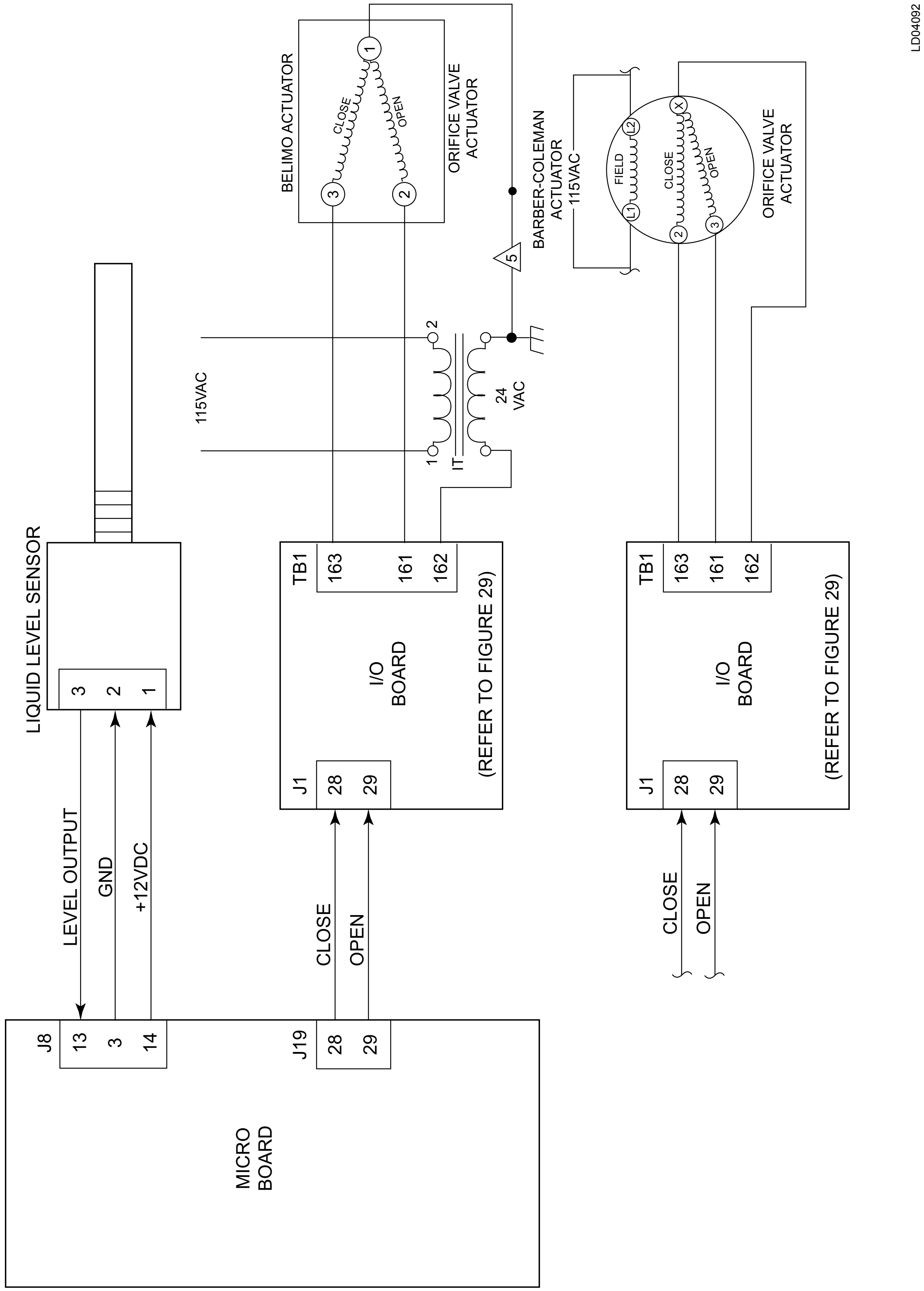


FIGURE 73 - REFRIGERANT LIQUID LEVEL CONTROL – INTERFACE

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SECTION 18 - OIL PUMP VARIABLE SPEED DRIVE

On Style D (and later) chillers, the oil pump is driven by a Variable Speed Drive (VSD) (Refer to *Variable Speed Oil Pump Drive (Form 160.52-M2)* for details of this device). In normal operation, the oil pump speed is automatically controlled to maintain a desired oil pressure. The speed can be manually controlled with the keypad keys using the OIL SUMP screen with SERVICE access level.

On those chillers equipped with the oil pump VSD, the VSD operation must be ENABLED by placing microboard program switch SW1-2 in the ON position. Chillers not equipped with the oil pump VSD must have this operation DISABLED by placing SW1-2 in the OFF position. Refer to microboard program switches.

The programming of the setpoints referred to below is performed on the OIL SUMP Screen using instructions in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. These setpoints should not be programmed by anyone other than a qualified Service technician. Variable speed oil pump chillers are not equipped with the Liquid Line Solenoid Valve (2SOL), or High Speed Thrust Solenoid Valve (4SOL). Therefore, when Oil Pump VSD operation is ENABLED with Program Switch SW1-2, the Program is configured to operate the chiller without these solenoid valves. Operation Sequence Timing Diagrams in *Figure 8 on page 29 and Figure 9 on page 30* depict chiller operation with the Oil Pump VSD enabled or disabled. Also, when equipped with the Oil Pump VSD, the microboard, under Program control, controls the Oil Heater to maintain a specific oil temperature as described in the "Oil Heater" section below.

AUTOMATIC OPERATION

Under program control, a speed command signal from the microboard controls the oil pump speed by varying the VSD output frequency. The speed command is in the form of a Pulse Width Modulation (PWM) Signal as explained below. During the System Pre-lube period and the first 15 seconds of System run, the Program operates the Oil Pump VSD over the range of 25Hz to 60Hz to maintain the oil pressure to the target value of 45 psid. For the remainder of System run and the Coastdown period, it operates it over the same frequency range to maintain the pressure to the programmed oil pressure setpoint.

When the chiller is started, 13 seconds after the System Pre-lube is initiated, the microboard (J20-3) starts the oil pump by driving the EN (enable) input of the oil pump VSD to a Logic Low level (less than 1 VDC). The microboard (J20-1) then applies a speed command signal to the PWM input of the VSD that ramps the VSD output frequency from 25 Hz (45 Hz on all P compressors; 45Hz on other compressor applications equipped with Flash memory card version C.MLM.01.05.xxx (and later)) to whatever frequency is required (up to a maximum of 60 Hz) to achieve the Target Oil Pressure.

(If equipped with flash memory card version C.MLM.01.08.xxx (and later), it is held at 45Hz for eight seconds before releasing to normal control).The target oil pressure is fixed at 45 psid. The speed command is displayed on the OIL SUMP screen as OIL PUMP DRIVE COMMAND FREQUENCY = XXHz. The speed command to the VSD is modulated as required to maintain the 45 psid target oil pressure for the remainder of system pre-lube and the first 15 seconds of system run. While this target is in effect, the OIL SUMP screen displays as TARGET OIL PRESSURE = 45 psid. The time remaining that the target oil pressure is in effect is displayed as a countdown timer in the message PULLDOWN TIME REMAINING = XX SEC. After the compressor has been running for 15 seconds, VSD speed is controlled to maintain the programmed oil pressure setpoint (20 to 45 psid), which is displayed on the OIL SUMP screen as SETPOINT OIL PRESSURE = XX psid.

During oil pump operation, the following minimum and maximum oil pressures are allowed:

1. During automatic operation, if the following conditions occur, a safety shutdown is performed and OIL - VARIABLE SPEED PUMP - PRESSURE SETPOINT NOT ACHIEVED is displayed. These conditions are not checked in MANUAL operation. With software version C.OPT.01.18.307 (or later), when the refrigerant selection (Microboard 031-02430-000/001 SW1-1) is set to R-22, these conditions are not checked.
    a. If the oil pressure is less than 35 psid (<25.0 psid for P compressors equipped with software version C.MLM.01.10A.or C.OPT.01.10A) for five continuous seconds during the last 10 seconds of system pre-lube or during the first 15 seconds of system run.

b. If the oil pressure is less than the programmed oil pressure setpoint and the speed command is at 60Hz for 5 continuous seconds, any time after the first 30 seconds of System run.

2. During automatic operation, if the oil pressure decreases to greater than or equal to 15 psid, a safety shutdown is performed and OIL - LOW DIFFERENTIAL PRESSURE is displayed. If it increases to greater than or equal to 90 psid (120.0 psid with software versions C.MLM.01.08.xxx (and later) or C.OPT.01.08A.xxx (and later)), a safety shutdown is performed and OIL - HIGH DIFFERENTIAL PRESSURE is displayed.

The microboard controls the VSD output frequency by applying a Pulse Width Modulation (PWM) speed command signal to the VSD. The signal is applied every 0.7 seconds. Within the 0.7 second period, the duration of time the signal is at logic low (less than 1 VDC) and logic high (+12 VDC) level determines the VSD output frequency between 25 and 60 Hz. If it remains at a logic high for the entire 0.7 second period, it is commanding the VSD output frequency to be 25 Hz. If it is low for the entire 0.7 second period, it is commanding the VSD output frequency to be 60 Hz.

Frequencies between these extremes are achieved by driving the signal low for a proportionate amount of time within the 0.7 second period. For example, if the signal is low for 50% (0.35 seconds) of the 0.7 second period, it would be commanding the VSD to operate at a frequency that is halfway between 25 and 60 Hz, or 42.5 Hz. The resolution, or smallest increment of change is 0.01 seconds. This allows the output frequency to be changed in 0.5 Hz steps. The VSD output frequency for any PWM input can be calculated as follows:

Frequency in Hz = (On-Time in seconds / 0.02) + 25

The entire oil pump run time is divided into Oil Pressure Control Periods. They run consecutively and continuously; when the first one ends, the next one begins, etc. This repeats until the oil pump is shutdown. The duration of the periods is determined by the Control Period setpoint. This setpoint is programmed in multiples of 0.3 seconds over the range of 0.3 to 2.7 seconds.

At the end of each period, the actual oil pressure is compared to the Oil Pressure setpoint and the speed command is changed as required to invoke VSD frequency changes to increase or decrease the oil pressure. If the error between the Oil Pressure setpoint and the actual oil pressure is less than plus or minus 6 psid, the frequency is increased or decreased 0.5 Hz to increase or decrease the oil pressure. However, if the error is greater than plus or minus 6 psid, the value programmed for Control Period setpoint determines the relative magnitude of correction applied to the VSD output frequency. The larger the programmed value, the greater the amount of correction above 0.5 Hz is applied.

To provide an operational status to the microboard (via I/O Board TB3-70), the VSD contains a set of normally open (N.O.) relay contacts that are driven closed as long as all the internal protection circuits are satisfied. They open anytime these circuits will not permit the VSD to operate. The opening of these contacts initiate a chiller cycling shutdown, displaying OIL - VARIABLE SPEED PUMP - DRIVE CONTACTS OPEN. After the problem has cleared, the contacts automatically close, except if the VSD experiences a short circuit on the output; this requires the VSD to be manually reset by the removal and restoration of the VSD AC Power.

MANUAL OPERATION

The oil pump can be manually operated using the OIL SUMP Screen when logged in with SERVICE ACCESS level. While the chiller is running, the speed can be manually adjusted over the range of 25 to 60Hz. When the chiller is not running, manual ON/OFF control, as well as manual speed control is permitted. After the pump is manually turned ON, it will automatically turn OFF after 10 minutes of operation, if not manually terminated earlier.

The RAISE and LOWER keys are used to increase and decrease the VSD output frequency in 0.5Hz increments. Each time the RAISE key is pressed, the frequency is increased 0.5Hz. Each time the LOWER key is pressed, the frequency is decreased 0.5Hz. Repeated presses of these keys are required to increase or decrease the frequency by greater amounts.

If the AUTO key is pressed, Automatic operation, as described above, is resumed.

If the SET key is pressed, the VSD is driven to a specific predetermined frequency. This permits service analysis of the oil pressure at various oil pump speeds. This frequency is programmed using instructions in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

During Manual operation, the OIL SUMP Screen can be used to monitor the actual oil pressure and the speed command.

OIL HEATER OPERATION

On chillers equipped with the Oil Pump VSD, the Oil Heater is controlled by the microboard via I/O Board The connection to the I/O Board is determined by the chiller style and compressor type as follows:

- TB1-34 - Style D and E chillers with G, H or J compressors
- TB1-64 - Style E chillers with P compressors and all Style "F" (and later) chillers

When the oil pump is not operating, the heater is turned ON and OFF to maintain a target value of 50°F above the Condenser Saturation Temperature. If the calculated target value is greater than 160°F, the target value defaults to 160°F. If the calculated target value is less than 110°F, it defaults to 110°F. When the temperature decreases to 4°F below the target value, the heater is turned ON; it is turned OFF at 3°F above the target.

To prevent overheating the oil in the event of an OptiView Control Center failure, thermostat 1HTR opens at 180°F.

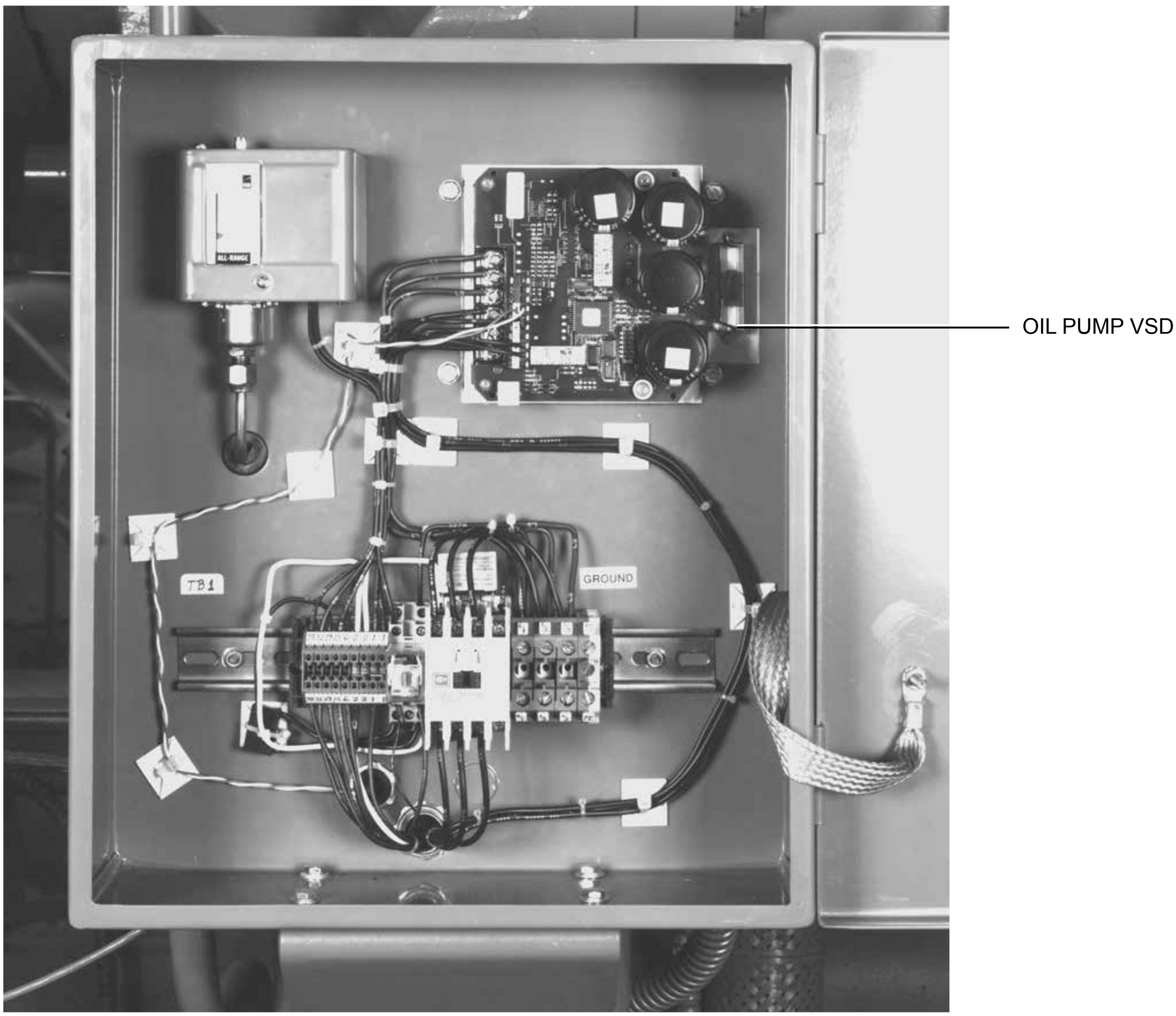

FIGURE 74 - OIL PUMP VARIABLE SPEED DRIVE (VSD)

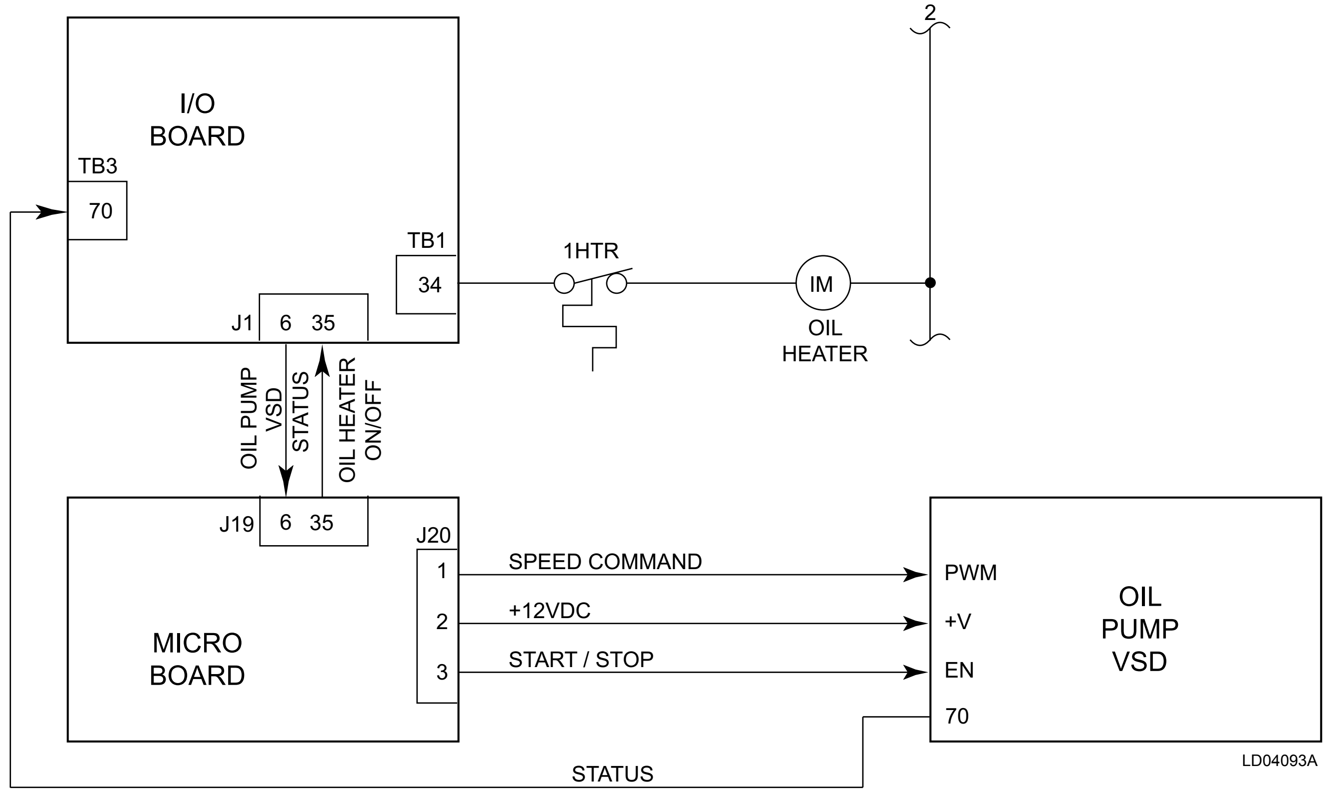

FIGURE 75 - OIL PUMP VSD / OIL HEATER CONTROL – INTERFACE

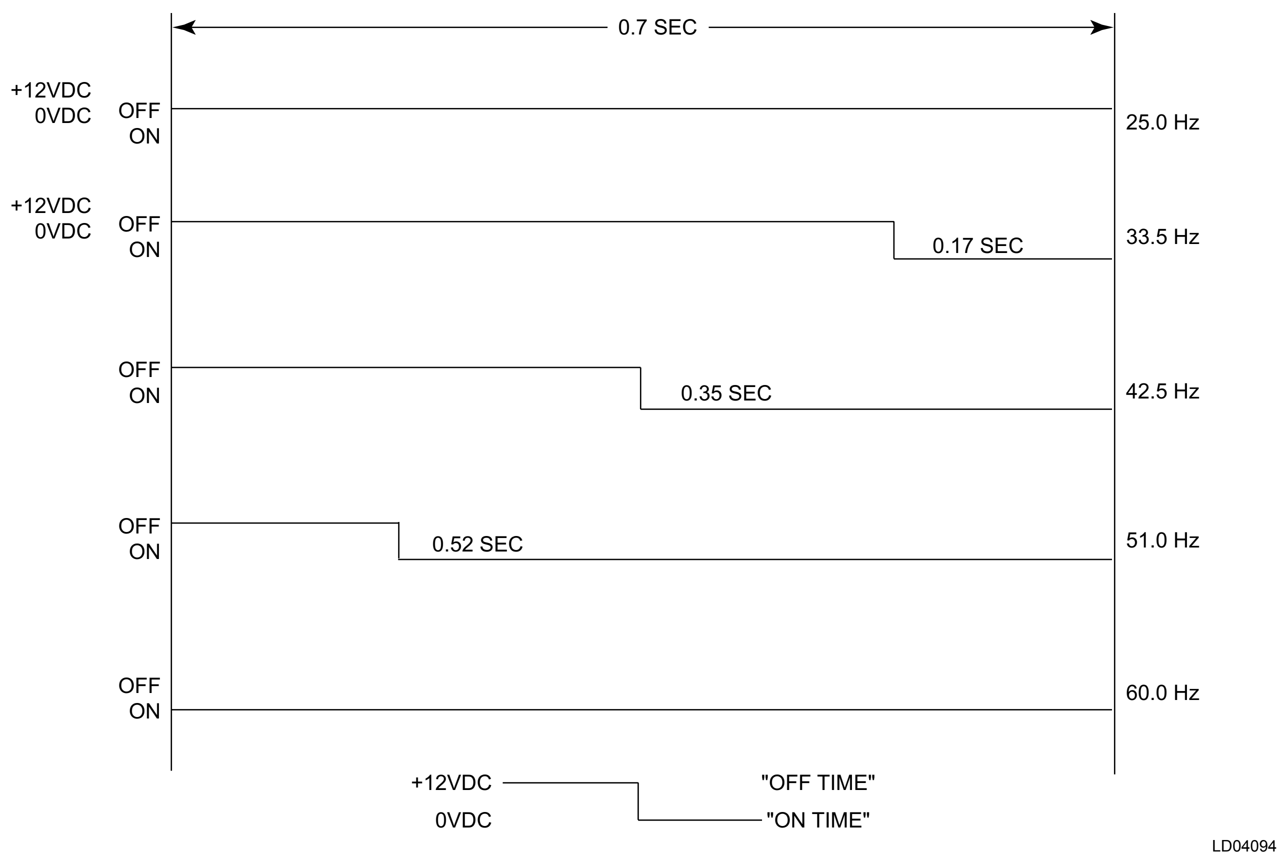

FIGURE 76 - OIL PUMP VSD SPEED CONTROL SIGNAL

SECTION 19 - COMMUNICATIONS

The complete description of the E-Link Gateway Installation Instructions are available in form P/N 24-10404-9 II. This form can be obtained from the Johnson Controls Portal under Equipment Communications and Integration in the Documents Library or ordered from Baltimore Parts Center.

The E-Link Gateway is an optional printed circuit board that provides an interface between the OptiView Control Center and the BAS or other selected networks. It can be mounted on the upper corner of the left wall of the OptiView Control Center or in its own enclosure in a remote location.

If installed in the OptiView Control Center, the E-Link Gateway is powered by +12 VDC from the microboard.

The E-Link Gateway communicates with the microboard COM 4B communications port via an RS-232 interface. As shown in *Figure 14 on page 46*, Microboard Program Jumper JP 27 must be placed on pins 2 and 3 to allow data to be received from the E-Link Gateway.

If the remote device that is connected to the E-Link Gateway is going to provide remote Start/Stop signals, Remote Leaving Chilled Liquid Temperature and/or Remote Current Limit Setpoint Resets, the Control Source must be set to ISN on the OPERATIONS Screen. Otherwise, communications will take place in any Control Source Mode.

In operation, the microboard provides chiller pressures, temperatures and status to the E-Link Gateway in response to requests from the E-Link Gateway. Microboard status LED's illuminate when the microboard transmits and receives data on COM 4B. Green LED CR13 (RX4) illuminates when data is being received from the E-Link Gateway. Red LED CR12 (TX4) illuminates when data is being transmitted to the E-Link Gateway. Similar LED's on the E-Link Gateway annunciate data transfer to/from the microboard.

If there is a communications problem between the microboard and E-Link Gateway, use the LED's described above to analyze the problem. The COM 4B Loop-back test can be used to verify operation of the microboard COM 4B communications port. See *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

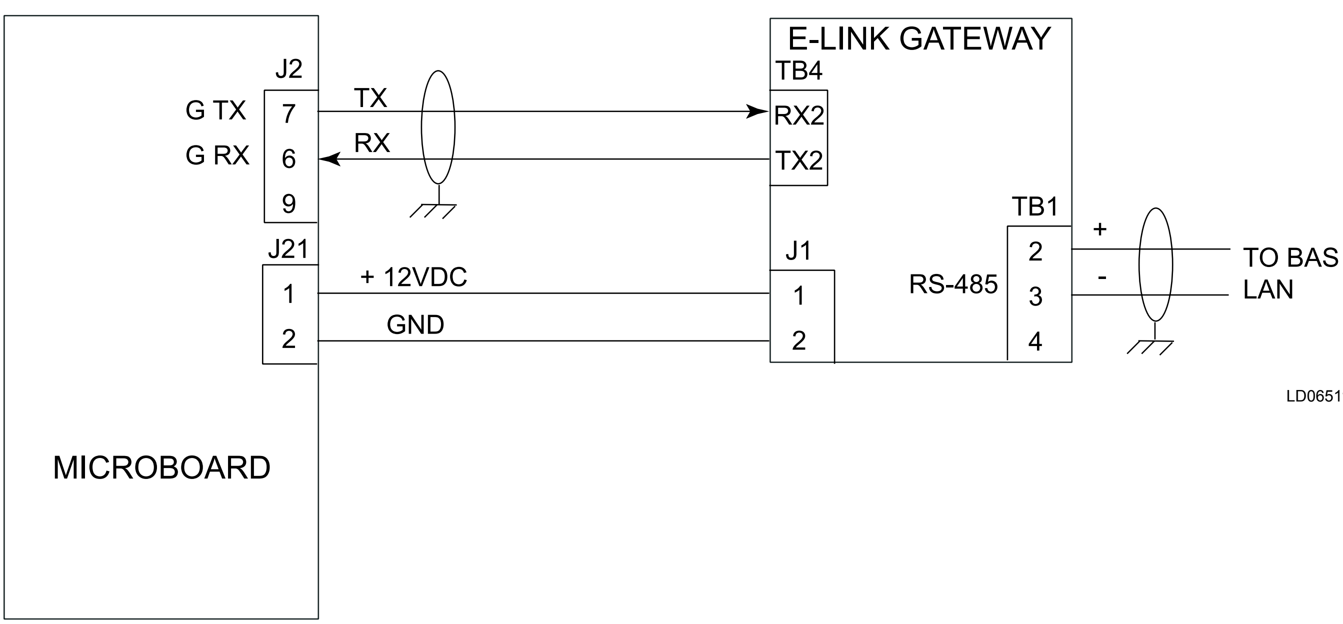

FIGURE 77 - E-LINK GATEWAY INTERFACE BLOCK DIAGRAM

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SECTION 20 - PRESSURE TRANSDUCERS

System pressures are sensed by pressure transducers. The evaporator, condenser, pump oil (high side) and sump oil (low side) pressures are sensed. If the chiller is equipped with the Variable Geometry Diffuser (VGD), a stall detection transducer is located in the discharge scroll of the compressor (See *SECTION 26 - VARIABLE GEOMETRY DIFFUSER* for details). There are different transducers used to sense these various pressures. The actual transducer used is determined by the required pressure range and refrigerant application. The operation of the various transducers is identical. The difference between them is the pressure range over which they operate. Each transducer has a different YORK part number. *Figure 78 on page 178* lists the transducers and the application of each one.

The transducers output a 0.5 to 4.5 VDC voltage that is analogous to the pressure applied to the device. These outputs are applied to the microboard, where this voltage is interpreted as a pressure value in terms of psig (pounds per square inch gauge) in English Mode or KpaG (Kilo Pascals) in Metric Mode. The Program converts the transducer output voltage to a pressure value with the appropriate formula in *Figure 78 on page 178*. The pressures are displayed and used for chiller control and safety shutdowns.

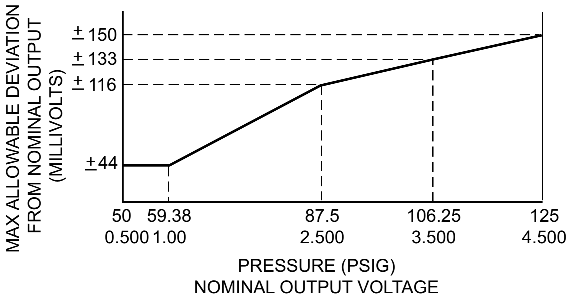
The evaporator and condenser pressures are converted to saturation temperatures per the appropriate refrigerant pressure/temperature conversion table contained in the Program. These Saturation Temperatures are displayed and used for chiller control.

The outputs of the Sump and Pump Oil Pressure transducers are displayed individually as psig values. However, the System Oil Pressure is displayed as a differential value in terms of psid (pounds per square inch differential in gauge). This psid value is arrived at by subtracting the Sump Oil Pressure transducer value from the Pump Oil Pressure transducer value. During the System Pre-lube period, the outputs of the Oil Pressure transducers are compared in a process called auto-zeroing. The differential between the sump and pump oil pressure transducer outputs during a 3 second period beginning 10 seconds after the start of the System Pre-lube period are compared to determine the offset between them. During this period, since both of the transducers are sensing the same pressure, their outputs should indicate the same pressure. However, due to accuracy tolerances in transducer design, differences can exist. Therefore, to compensate for differences between transducers and ensure differential pressure accuracy, this offset is factored with the actual differential pressure to produce the displayed psid value.

When the oil Pump is turned ON following the Auto-zeroing period, the displayed differential value then becomes the actual differential plus or minus the offset that existed during the Auto-zeroing period. For example, if the Pump transducer indicates 1.0 psig greater than the Sump transducer during the Auto-zeroing period, then 1.0 psig will subtracted from the displayed psid value while the pump is running. Similarly, if the Pump transducer indicates 1.0 psig less than the sump transducer during this period, then 1.0 psig would be subtracted from the displayed psid value while the pump is running. The Auto-zeroing will not be performed if either transducer is out of range.

The transducers operate from a +5 VDC power source. This supply voltage is provided from the Power supply via the microboard. Each transducer is connected to the microboard with three wires. Two wires provide the +5 VDC supply voltage and ground (GND) and the remaining wire connects the transducer output to the microboard. The voltage output of each transducer can be measured with a Voltmeter at the microboard. Measurement should be made from the transducer output to ground (GND). For example, the output of the Condenser transducer would be read from Microboard J8-21 (signal) to J8-22 (GND). To convert this output to a pressure, see the appropriate formula in *Figure 78 on page 178*. If the pressure is known, the transducer output can be predicted with the appropriate formula in *Figure 78 on page 178*.

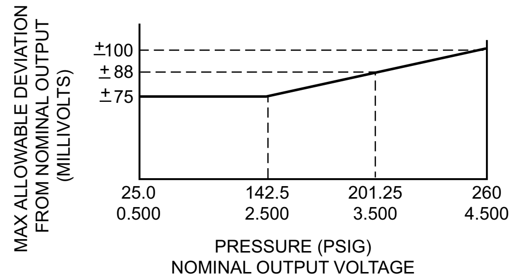
If any of the displayed pressures do not appear to be correct, see *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.



EVAPORATOR TRANSDUCER
(R22 WATER APPLICATIONS)
YORK PART NO. 025-28678-102
025-28678-113

$$V = \frac{(P \times 4) - 162.5}{75} \qquad P = \frac{(75 \times V) + 162.5}{4}$$

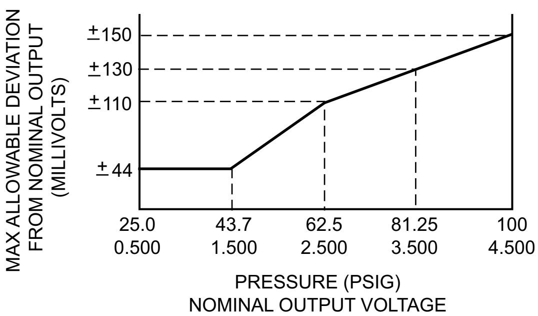
V = VOLTS DC P = PRESSURE (PSIG) LD05534A



OIL PRESSURE (LOW SIDE)
(R22 WATER AND BRINE APPLICATIONS)
YORK PART NO. 025-28678-004

$$V = \frac{P + 4.375}{58.75} \qquad P = (58.75 \times V) - 4.375$$

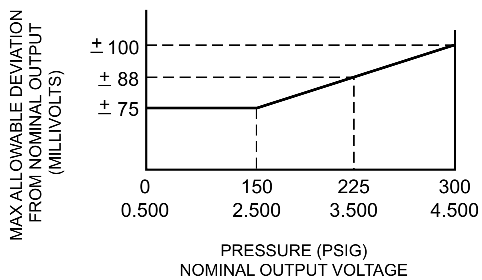
V = VOLTS DC P = PRESSURE (PSIG) LD04099A



EVAPORATOR TRANSDUCER
(R22 BRINE APPLICATIONS)
YORK PART NO. 025-28678-103
025-28678-114

$$V = \frac{P - 15.6}{18.75} \qquad P = 18.75 \times V + 15.6$$

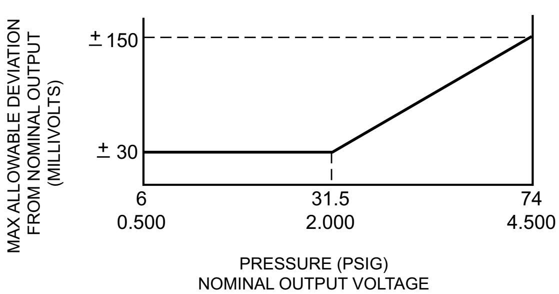
V = VOLTS DC P = PRESSURE (PSIG) LD05535A



PRESSURE TRANSDUCER
YORK PART NO. 025-28678-001
025-28678-006

$$V = \frac{P + 37.5}{75} \qquad P = (75 \times V) - 37.5$$

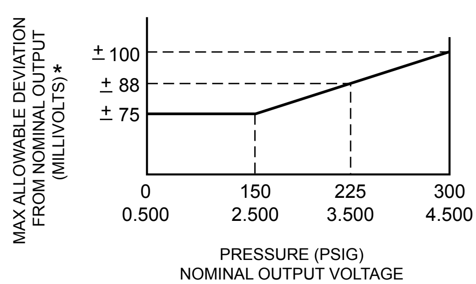
V = VOLTS DC P = PRESSURE (PSIG) LD05537A



EVAPORATOR TRANSDUCER
R134a WATER AND BRINE APPLICATIONS
YORK PART NO. 025-28678-112
025-28678-104

$$V = \frac{P + 2.5}{17} \qquad P = (17 \times V) - 2.5$$

V = VOLTS DC P = PRESSURE (PSIG) LD09969A

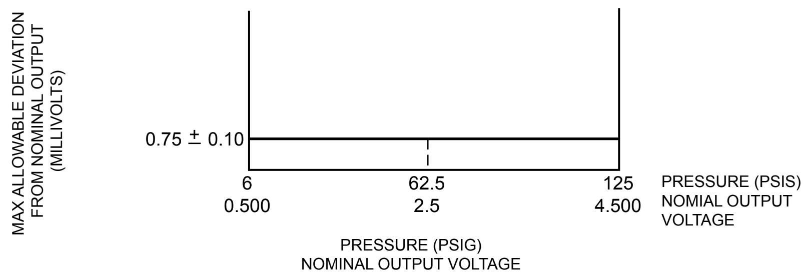


STALL PRESSURE TRANSDUCER
YORK PART NO. 025-39464-000
025-40088-000

$$V = \frac{P + 37.5}{75} \qquad P = (75 \times V) - 37.5$$

V = VOLTS DC P = PRESSURE (PSIG) LD09569a

FIGURE 78 - PRESSURE TRANSDUCERS



EVAPORATOR TRANSDUCER
YORK PART NO. 025-28678-115

$$V = \frac{P + 15.63}{31.25} \qquad P = (31.25 \times V) - 15.63$$

V = VOLTS DC P = PRESSURE (PSIG)

LD15644

FIGURE 78 - PRESSURE TRANSDUCERS (CONT'D)

TABLE 13 - PRESSURE TRANSDUCER APPLICATIONS

TRANSDUCER PART NUMBER*	FUNCTION	R22 APPLICATION	
		WATER	**BRINE**
025-28678-001	Condenser, High Oil	X	X
025-28678-102 025-28678-113	Evaporator	X	
025-28678-103 025-28678-114	Evaporator		X
025-28678-004	Low Oil	X	X
		R-134a	
025-28678-006	Condenser, Hi and Lo Oil	X	X
025-28678-112	Evaporator	X	X
025-28678-104	Evaporator	X	X
025-28678-115	Evaporator (Heat Pump Duty)	X	X
025-39464-000 025-40088-000	Stall Detection	X	X

NOTE: * Transducers 025-28678-001, -004, -102 and -103, 104 have NPTF threads.
Transducers 025-28678-006, -112, -113, -114 and 025-39464-000 and 025-40088-000 have straight threads with O-rings.

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SECTION 21 - TEMPERATURE THERMISTORS

System temperatures are sensed by thermistors. There are two different thermistor types used to sense the various system temperatures. Each type has its own YORK part number. Part numbers are listed in *YORK Renewal Parts List (Form 160.54-RP2)* or the unit renewal parts manual. The Return and Leaving Chilled Liquid, Return and Leaving Condenser Liquid, Drop Leg Refrigerant and Evaporator Temperatures are sensed by 3K Ohm thermistors. The Oil and Compressor Discharge temperatures are sensed by 50K Ohm thermistors.

The 3K Ohm thermistors are defined by the characteristic of being 3000 Ohms at 77°F (25°C). Similarly, the 50K Ohm thermistors are 50,000 Ohms at the same temperature. Both thermistor types vary their resistance as the sensed temperature varies. Both are negative temperature coefficient devices. That is, as the temperature increases, the resistance decreases. As the temperature decreases, the resistance increases.

The thermistors are connected to the microboard. A +5 VDC supply voltage is applied to one side of the thermistor. The other side of the thermistor is connected to ground through a series resistor on the microboard, thus forming a voltage divider network. The temperature applied to the thermistor determines the resistance value. The resistance value determines the amount of current that will flow through the thermistor and thus the voltage drop across it. The Program reads this voltage at the input to the microboard and converts it to a temperature value.

Each thermistor is connected to the microboard with two wires. One wire supplies the +5 VDC voltage and the other is the output of the thermistor. This output voltage can be measured with a Voltmeter. Measurement should be made from the thermistor output to ground (GND). For example, the Leaving Chilled Liquid Temperature would be read from Microboard J9-20 (output) to Microboard TP1 (GND). To convert this voltage to a pressure, see the appropriate volts/temperature tables as follows:

- Leaving Chilled Liquid Temperature – *Table 12*
- Leaving Chilled Liquid Temperature (Heat Pump applications) – *Table 13*
- Return Chilled Liquid Temperature – *Table 14*
- Return Chilled Liquid Temperature (Heat Pump Applications) – *Table 15*
- Return and Leaving Condensing Water – *Table 16*
- Oil and Discharge Temperature – *Table 17*
- Drop Leg Refrigerant Sensor – *Table 18*
- Evaporator Refrigerant Sensor – *Table 19*
- Leaving and Return Heating Condenser Water Temperature Sensor – *Table 20*

If any of the displayed pressures do not appear to be correct, see *SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING* of this manual.

TABLE 14 - LEAVING CHILLED LIQUID TEMPERATURE

TEMP (°F)	TEMP (°C)	VIN
9.90	-12.28	1.4280
10.00	-12.22	1.4310
10.09	-12.17	1.4341
10.19	-12.12	1.4371
10.29	-12.06	1.4402
10.39	-12.01	1.4432
10.48	-11.96	1.4463
10.58	-11.90	1.4493
10.68	-11.85	1.4423
10.77	-11.80	1.4554
10.87	-11.74	1.4584
10.97	-11.68	1.4615
11.06	-11.63	1.4645
11.16	-11.58	1.4676
11.25	-11.53	1.4706
11.35	-11.47	1.4737
11.45	-11.42	1.4767
11.54	-11.37	1.4798
11.64	-11.31	1.4828
11.73	-11.26	1.4859
11.83	-11.21	1.4889
11.93	-11.15	1.4920
12.02	-11.10	1.4950
12.12	-11.05	1.4981
12.21	-11.00	1.5011
12.31	-10.94	1.5042
12.40	-10.89	1.5072
12.50	-10.83	1.5103
12.59	-10.78	1.5133
12.69	-10.73	1.5164
12.78	-10.68	1.5194
12.88	-10.62	1.5225
12.97	-10.57	1.5255
13.07	-10.52	1.5286
13.16	-10.47	1.5316
13.26	-10.41	1.5347
13.35	-10.36	1.5377
13.45	-10.31	1.5408
13.54	-10.26	1.5438
13.64	-10.20	1.5469
13.73	-10.15	1.5499
13.83	-10.10	1.5530
13.92	-10.05	1.5560
14.01	-10.00	1.5591
14.11	-9.94	1.5621
14.20	-9.89	1.5652
14.29	-9.84	1.5682
14.39	-9.78	1.5713
14.48	-9.73	1.5743
14.57	-9.68	1.5774
14.67	-9.63	1.5804
14.76	-9.58	1.5835
14.85	-9.53	1.5865
14.95	-9.47	1.5896
15.04	-9.42	1.5926
15.13	-9.37	1.5957
15.22	-9.32	1.5987
15.32	-9.27	1.6018
15.41	-9.22	1.6048
15.50	-9.17	1.6079
15.60	-9.11	1.6109
15.69	-9.06	1.6140
15.78	-9.01	1.6170
15.87	-8.96	1.6201
15.97	-8.91	1.6231
16.06	-8.86	1.6262
16.15	-8.81	1.6292
16.24	-8.76	1.6322
16.34	-8.70	1.6353
16.43	-8.65	1.6383
16.52	-8.60	1.6414
16.61	-8.55	1.6444
16.70	-8.50	1.6475
16.80	-8.45	1.6505
16.89	-8.40	1.6536
16.98	-8.35	1.6566
17.07	-8.30	1.6597
17.16	-8.25	1.6627
17.26	-8.19	1.6658
17.35	-8.14	1.6688
17.44	-8.09	1.6719
17.53	-8.04	1.6749
17.63	-7.98	1.6780
17.72	-7.93	1.6810
17.81	-7.88	1.6841
17.90	-7.83	1.6871
17.99	-7.78	1.6902
18.08	-7.73	1.6932
18.17	-7.68	1.6963
18.26	-7.63	1.6993
18.35	-7.58	1.7024
18.44	-7.53	1.7054
18.54	-7.48	1.7085
18.63	-7.43	1.7115
18.72	-7.38	1.7146
18.81	-7.33	1.7176
18.90	-7.28	1.7207
18.99	-7.23	1.7237
19.08	-7.18	1.7268
19.17	-7.13	1.7298
19.26	-7.08	1.7329
19.36	-7.02	1.7359
19.45	-6.97	1.7390
19.54	-6.92	1.7420
19.63	-6.87	1.7451
19.72	-6.82	1.7481
19.81	-6.77	1.7512
19.90	-6.72	1.7542
19.99	-6.67	1.7573
20.08	-6.62	1.7603
20.17	-6.57	1.7634
20.26	-6.52	1.7664
20.35	-6.47	1.7695
20.44	-6.42	1.7725
20.53	-6.37	1.7756
20.62	-6.32	1.7786
20.71	-6.27	1.7817
20.80	-6.22	1.7847
20.89	-6.17	1.7878
20.98	-6.12	1.7908
21.07	-6.07	1.7939
21.16	-6.02	1.7969
21.25	-5.97	1.8000
21.34	-5.92	1.8030
21.43	-5.87	1.8060
21.52	-5.82	1.8091
21.61	-5.77	1.8121
21.70	-5.72	1.8152
21.79	-5.67	1.8182
21.88	-5.62	1.8213
21.97	-5.57	1.8243
22.06	-5.52	1.8274
22.15	-5.47	1.8304
22.24	-5.42	1.8335
22.33	-5.37	1.8365
22.42	-5.32	1.8396
22.51	-5.27	1.8426
22.60	-5.22	1.8457
22.69	-5.17	1.8487
22.78	-5.12	1.8518
22.87	-5.07	1.8548
22.96	-5.02	1.8579
23.04	-4.98	1.8609
23.13	-4.93	1.8640
23.22	-4.88	1.8670
23.31	-4.83	1.8701
23.40	-4.78	1.8731
23.49	-4.73	1.8762
23.58	-4.68	1.8792
23.67	-4.63	1.8823
23.75	-4.58	1.8853
23.84	-4.53	1.8884
23.93	-4.48	1.8914
24.02	-4.43	1.8945
24.11	-4.38	1.8975
24.20	-4.33	1.9006
24.29	-4.28	1.9036
24.37	-4.24	1.9067
24.46	-4.19	1.9097
24.55	-4.14	1.9128
24.64	-4.09	1.9158
24.73	-4.04	1.9189
24.82	-3.99	1.9219
24.91	-3.94	1.9250
24.99	-3.89	1.9280

TABLE 14 - LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
25.08	-3.84	1.9311
25.17	-3.79	1.9341
25.26	-3.74	1.9372
25.35	-3.69	1.9402
25.43	-3.65	1.9433
25.52	-3.60	1.9463
25.61	-3.55	1.9494
25.70	-3.50	1.9524
25.79	-3.45	1.9555
25.87	-3.41	1.9585
25.96	-3.36	1.9616
26.05	-3.31	1.9646
26.14	-3.26	1.9677
26.23	-3.21	1.9707
26.31	-3.16	1.9738
26.40	-3.11	1.9768
26.49	-3.06	1.9798
26.58	-3.01	1.9829
26.67	-2.96	1.9859
26.76	-2.91	1.9890
26.84	-2.87	1.9920
26.93	-2.82	1.9951
27.02	-2.77	1.9981
27.11	-2.72	2.0012
27.20	-2.67	2.0042
27.28	-2.62	2.0073
27.37	-2.57	2.0103
27.46	-2.52	2.0134
27.55	-2.47	2.0164
27.64	-2.42	2.0195
27.73	-2.37	2.0225
27.81	-2.33	2.0256
27.90	-2.28	2.0286
27.99	-2.23	2.0317
28.08	-2.18	2.0347
28.17	-2.13	2.0378
28.25	-2.08	2.0408
28.34	-2.03	2.0439
28.43	-1.98	2.0469
28.52	-1.93	2.0500
28.61	-1.88	2.0530
28.69	-1.84	2.0561
28.78	-1.79	2.0591
28.87	-1.74	2.0622
28.96	-1.69	2.0652
29.04	-1.64	2.0683
29.13	-1.59	2.0713
29.22	-1.54	2.0744
29.31	-1.49	2.0774
29.39	-1.45	2.0805
29.48	-1.40	2.0835
29.57	1.35	2.0866
29.66	-1.30	2.0896
29.75	-1.25	2.0927
29.83	-1.21	2.0957

TEMP (°F)	TEMP (°C)	VIN
29.92	-1.16	2.0988
30.01	-1.11	2.1018
30.10	-1.06	2.1049
30.18	-1.01	2.1079
30.27	-0.96	2.1110
30.36	-0.91	2.1140
30.45	-0.86	2.1171
30.53	-0.82	2.1201
30.62	-0.77	2.1232
30.71	-0.72	2.1262
30.79	-0.67	2.1293
30.88	-0.62	2.1323
30.97	-0.57	2.1354
31.06	-0.52	2.1384
31.14	-0.48	2.1415
31.23	-0.43	2.1445
31.32	-0.38	2.1476
31.41	-0.33	2.1506
31.49	-0.28	2.1536
31.58	-0.23	2.1567
31.67	-0.18	2.1597
31.76	-0.13	2.1628
31.84	-0.09	2.1658
31.93	-0.04	2.1689
32.02	0.01	2.1719
32.10	0.06	2.1750
32.19	0.11	2.1780
32.28	0.16	2.1811
32.37	0.21	2.1841
32.45	0.25	2.1872
32.54	0.30	2.1902
32.63	0.35	2.1933
32.72	0.40	2.1963
32.81	0.45	2.1994
32.89	0.49	2.2024
32.98	0.54	2.2055
33.07	0.59	2.2085
33.16	0.64	2.2116
33.24	0.69	2.2146
33.33	0.74	2.2177
33.42	0.79	2.2207
33.51	0.84	2.2238
33.59	0.88	2.2268
33.68	0.93	2.2299
33.77	0.98	2.2329
33.86	1.03	2.2360
33.94	1.08	2.2390
34.03	1.13	2.2421
34.12	1.18	2.2451
34.21	1.23	2.2482
34.29	1.27	2.2512
34.38	1.32	2.2543
34.47	1.37	2.2573
34.56	1.42	2.2604
34.64	1.47	2.2634

TEMP (°F)	TEMP (°C)	VIN
34.73	1.52	2.2665
34.82	1.57	2.2695
34.91	1.62	2.2726
34.99	1.66	2.2756
35.08	1.71	2.2787
35.17	1.76	2.2817
35.26	1.81	2.2848
35.34	1.86	2.2878
35.43	1.91	2.2909
35.52	1.96	2.2939
35.51	1.95	2.2970
35.70	2.06	2.3000
35.78	2.10	2.3031
35.87	2.15	2.3061
35.96	2.20	2.3092
36.05	2.25	2.3122
36.13	2.29	2.3153
36.22	2.34	2.3183
36.31	2.39	2.3214
36.40	2.44	2.3244
36.48	2.49	2.3274
36.57	2.54	2.3305
36.66	2.59	2.3335
36.75	2.64	2.3366
36.83	2.68	2.3396
36.92	2.73	2.3427
37.01	2.78	2.3457
37.10	2.83	2.3488
37.18	2.88	2.3518
37.27	2.93	2.3549
37.36	2.98	2.3579
37.45	3.03	2.3610
37.54	3.08	2.3640
37.62	3.12	2.3671
37.71	3.17	2.3701
37.80	3.22	2.3732
37.89	3.27	2.3762
37.98	3.32	2.3793
38.07	3.37	2.3823
38.15	3.42	2.3854
38.24	3.47	2.3884
38.33	3.52	2.3915
38.42	3.57	2.3945
38.51	3.62	2.3976
38.60	3.67	2.4006
38.69	3.72	2.4037
38.77	3.76	2.4067
38.86	3.81	2.4098
38.95	3.86	2.4128
39.04	3.91	2.4159
39.13	3.96	2.4189
39.22	4.01	2.4220
39.30	4.06	2.4250
39.39	4.11	2.4281
39.48	4.16	2.4311

TABLE 14 - LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
39.57	4.21	2.4342
39.66	4.26	2.4372
39.74	4.30	2.4403
39.83	4.35	2.4433
39.92	4.40	2.4464
40.01	4.45	2.4494
40.10	4.50	2.4525
40.19	4.55	2.4555
40.27	4.59	2.4586
40.36	4.64	2.4616
40.45	4.69	2.4647
40.54	4.74	2.4677
40.63	4.79	2.4708
40.71	4.84	2.4738
40.80	4.89	2.4769
40.89	4.94	2.4799
40.98	4.99	2.4830
41.07	5.04	2.4860
41.16	5.09	2.4891
41.24	5.13	2.4921
41.33	5.18	2.4952
41.42	5.23	2.4982
41.51	5.28	2.5012
41.60	5.33	2.5043
41.69	5.38	2.5073
41.78	5.43	2.5104
41.87	5.48	2.5134
41.96	5.53	2.5165
42.05	5.58	2.5195
42.14	5.63	2.5226
42.23	5.68	2.5256
42.31	5.73	2.5287
42.40	5.78	2.5317
42.49	5.83	2.5348
42.58	5.88	2.5378
42.67	5.93	2.5409
42.76	5.98	2.5439
42.85	6.03	2.5470
42.94	6.08	2.5500
43.03	6.13	2.5531
43.12	6.18	2.5561
43.21	6.23	2.5592
43.30	6.28	2.5622
43.39	6.33	2.5653
43.48	6.38	2.5683
43.57	6.43	2.5714
43.65	6.47	2.5744
43.74	6.52	2.5775
43.83	6.57	2.5805
43.92	6.62	2.5836
44.01	6.67	2.5866
44.10	6.72	2.5897
44.19	6.77	2.5927
44.28	6.82	2.5958
44.37	6.87	2.5988
44.46	6.92	2.6019
44.55	6.97	2.6049
44.64	7.02	2.6080
44.73	7.07	2.6110
44.82	7.12	2.6141
44.91	7.17	2.6171
45.00	7.22	2.6202
45.09	7.27	2.6232
45.18	7.32	2.6263
45.27	7.37	2.6293
45.36	7.42	2.6324
45.46	7.48	2.6354
45.55	7.53	2.6385
45.64	7.58	2.6415
45.73	7.63	2.6446
45.82	7.68	2.6476
45.91	7.73	2.6507
46.00	7.78	2.6537
46.09	7.83	2.6568
46.18	7.88	2.6598
46.27	7.93	2.6629
46.36	7.98	2.6659
46.45	8.03	2.6690
46.55	8.08	2.6720
46.64	8.13	2.6751
46.73	8.18	2.6781
46.82	8.23	2.6811
46.91	8.28	2.6842
47.00	8.33	2.6872
47.09	8.38	2.6903
47.18	8.43	2.6933
47.27	8.48	2.6964
47.36	8.53	2.6994
47.45	8.58	2.7025
47.55	8.64	2.7055
47.64	8.69	2.7086
47.73	8.74	2.7116
47.82	8.79	2.7147
47.91	8.84	2.7177
48.00	8.89	2.7208
48.09	8.94	2.7238
48.18	8.99	2.7269
48.27	9.04	2.7299
48.37	9.10	2.7330
48.46	9.15	2.7360
48.55	9.20	2.7391
48.64	9.25	2.7421
48.74	9.30	2.7452
48.83	9.35	2.7482
48.92	9.40	2.7513
49.01	9.45	2.7543
49.11	9.51	2.7574
49.20	9.56	2.7604
49.29	9.61	2.7635
49.38	9.66	2.7665
49.48	9.71	2.7696
49.57	9.76	2.7726
49.66	9.81	2.7757
49.75	9.86	2.7787
49.84	9.91	2.7818
49.94	9.97	2.7848
50.03	10.02	2.7879
50.12	10.07	2.7909
50.22	10.12	2.7940
50.31	10.17	2.7970
50.40	10.22	2.8001
50.50	10.28	2.8031
50.59	10.33	2.8062
50.68	10.38	2.8092
50.78	10.43	2.8123
50.87	10.48	2.8153
50.96	10.53	2.8184
51.06	10.59	2.8214
51.15	10.64	2.8245
51.24	10.69	2.8275
51.34	10.75	2.8306
51.43	10.80	2.8336
51.52	10.85	2.8367
51.62	10.90	2.8397
51.71	10.95	2.8428
51.80	11.00	2.8458
51.90	11.06	2.8458
51.99	11.11	2.8519
52.09	11.16	2.8549
52.18	11.21	2.8580
52.28	11.27	2.8610
52.37	11.32	2.8641
52.46	11.37	2.8671
52.56	11.42	2.8702
52.65	11.47	2.8732
52.75	11.53	2.8763
52.84	11.58	2.8793
52.94	11.63	2.8824
53.03	11.68	2.8854
53.13	11.74	2.8885
53.22	11.79	2.8915
53.32	11.85	2.8946
53.41	11.90	2.8976
53.51	11.95	2.9007
53.60	12.00	2.9037
53.70	12.06	2.9068
53.79	12.11	2.9098
53.89	12.16	2.9129
53.98	12.21	2.9159
54.08	12.27	2.9190
54.17	12.32	2.9220
54.27	12.37	2.9251
54.36	12.42	2.9281
54.46	12.48	2.9312
54.55	12.53	2.9342

TABLE 14 - LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
54.65	12.58	2.9373
54.74	12.63	2.9403
54.84	12.69	2.9403
54.93	12.74	2.9464
55.03	12.80	2.9495
55.12	12.85	2.9525
55.22	12.90	2.9556
55.32	12.96	2.9586
55.41	13.01	2.9617
55.51	13.06	2.9647
55.61	13.12	2.9678
55.70	13.17	2.9708
55.80	13.22	2.9739
55.90	13.28	2.9769
56.00	13.33	2.9800
56.09	13.38	2.9830
56.19	13.44	2.9861
56.29	13.50	2.9891
56.39	13.55	2.9922
56.48	13.60	2.9952
56.58	13.66	2.9983
56.68	13.71	3.0013
56.78	13.77	3.0044
56.87	13.82	3.0074
56.97	13.87	3.0105
57.07	13.93	3.0135
57.17	13.98	3.0166
57.26	14.03	3.0196
57.36	14.09	3.0227
57.46	14.15	3.0257
57.56	14.20	3.0287
57.66	14.26	3.0318
57.76	14.31	3.0348
57.86	14.37	3.0379
57.96	14.42	3.0409
58.06	14.48	3.0440
58.15	14.53	3.0470
58.25	14.58	3.0501
58.35	14.64	3.0531
58.45	14.70	3.0562
58.55	14.75	3.0592
58.65	14.81	3.0623
58.75	14.86	3.0653
58.85	14.92	3.0684
58.95	14.97	3.0714
59.05	15.03	3.0745
59.15	15.08	3.0775
59.25	15.14	3.0806
59.35	15.20	3.0836
59.45	15.25	3.0867
59.55	15.31	3.0897
59.65	15.36	3.0928
59.75	15.42	3.0958
59.85	15.47	3.0989
59.95	15.53	3.1019
60.05	15.58	3.1050
60.15	15.64	3.1080
60.25	15.70	3.1111
60.36	15.76	3.1141
60.46	15.81	3.1172
60.56	15.87	3.1202
60.66	15.92	3.1233
60.76	15.98	3.1263
60.86	16.03	3.1294
60.96	16.09	3.1324
61.06	16.15	3.1355
61.17	16.21	3.1385
61.27	16.26	3.1416
61.37	16.32	3.1446
61.47	16.37	3.1477
61.57	16.43	3.1507
61.67	16.48	3.1538
61.78	16.55	3.1568
61.88	16.60	3.1599
61.98	16.66	3.1629
62.08	16.71	3.1660
62.18	16.77	3.1690
62.28	16.82	3.1721
62.39	16.88	3.1751
62.49	16.94	3.1782
62.59	17.00	3.1812
62.69	17.05	3.1843
62.80	17.11	3.1873
62.90	17.17	3.1904
63.01	17.23	3.1934
63.11	17.28	3.1965
63.22	17.35	3.1995
63.32	17.40	3.2025
63.43	17.46	3.2056
63.53	17.52	3.2086
63.63	17.57	3.2117
63.74	17.63	3.2147
63.84	17.69	3.2178
63.95	17.75	3.2208
64.05	17.81	3.2239
64.16	17.87	3.2269
64.26	17.92	3.2300
64.37	17.98	3.2330
64.47	18.04	3.2361
64.58	18.10	3.2391
64.68	18.16	3.2422
64.79	18.22	3.2452
64.90	18.28	3.2483
65.00	18.33	3.2513
65.11	18.40	3.2544
65.21	18.45	3.2574
65.32	18.51	3.2605
65.43	18.57	3.2635
65.53	18.63	3.2666
65.64	18.69	3.2696
65.75	18.75	3.2727
65.85	18.81	3.2757
65.96	18.87	3.2788
66.06	18.92	3.2818
66.17	18.98	3.2849
66.28	19.05	3.2879
66.39	19.11	3.2910
66.49	19.16	3.2940
66.60	19.22	3.2971
66.71	19.28	3.3001
66.82	19.35	3.3032
66.93	19.41	3.3062
67.03	19.46	3.3093
67.14	19.52	3.3123
67.25	19.58	3.3154
67.36	19.65	3.3184
67.47	19.71	3.3215
67.58	19.77	3.3245
67.68	19.82	3.3276
67.79	19.88	3.3306
67.90	19.95	3.3337
68.01	20.01	3.3367
68.12	20.07	3.3398
68.23	20.13	3.3428
68.34	20.19	3.3459
68.45	20.25	3.3489
68.56	20.31	3.3520
68.67	20.37	3.3550
68.78	20.43	3.3581
68.90	20.50	3.3611
69.01	20.56	3.3642
69.12	20.62	3.3672
69.23	20.68	3.3703
69.34	20.75	3.3733
69.45	20.81	3.3763
69.56	20.87	3.3794
69.67	20.93	3.3824
69.78	20.99	3.3855
69.89	21.05	3.3885
70.01	21.12	3.3916
70.12	21.18	3.3946
70.24	21.25	3.3977
70.35	21.31	3.4007
70.46	21.37	3.4038
70.58	21.44	3.4068
70.69	21.50	3.4099
70.80	21.56	3.4129
70.92	21.62	3.4160
71.03	21.69	3.4190
71.15	21.75	3.4221
71.26	21.81	3.4251
71.37	21.87	3.4282
71.49	21.94	3.4312
71.60	22.00	3.4343
71.72	22.07	3.4373

TABLE 14 - LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
71.83	22.13	3.4404
71.95	22.20	3.4434
72.06	22.26	3.4465
72.18	22.32	3.4495
72.29	22.39	3.4526
72.41	22.45	3.4556
72.52	22.51	3.4587
72.64	22.58	3.4617
72.75	22.64	3.4648
72.87	22.71	3.4678
72.98	22.77	3.4709
73.10	22.84	3.4739
73.21	22.90	3.4770
73.33	22.96	3.4800
73.44	23.02	3.4831
73.56	23.09	3.4861
73.68	23.16	3.4892
73.80	23.22	3.4922
73.92	23.29	3.4953
74.04	23.36	3.4983
74.16	23.42	3.5014
74.28	23.49	3.5044
74.40	23.56	3.0575
74.52	23.62	3.5105
74.64	23.69	3.5136
74.75	23.75	3.5166
74.87	23.82	3.5197
74.99	23.89	3.5227
75.11	23.95	3.5258
75.23	24.02	3.5288
75.35	24.09	3.5319
75.47	24.15	3.5349
75.60	24.22	3.5380
75.72	24.29	3.5410
75.84	24.36	3.5441
75.96	24.42	3.5471
76.08	24.49	3.5501
76.20	24.56	3.5532
76.32	24.62	3.5562
76.44	24.69	3.5593
76.57	24.76	3.5623
76.69	24.83	3.5654
76.81	24.90	3.5684
76.93	24.96	3.5715
77.05	25.03	3.5745
77.18	25.10	3.5776
77.30	25.17	3.5806
77.43	25.24	3.5837
77.55	25.31	3.5867
77.68	25.38	3.5898
77.80	25.45	3.5928
77.93	25.52	3.5959
78.05	25.59	3.5989
78.17	25.65	3.6020
78.30	25.72	3.6050
78.42	25.79	3.6081
78.55	25.86	3.6111
78.67	25.93	3.6142
78.80	26.00	3.6172
78.93	26.07	3.6203
79.05	26.14	3.6233
79.18	26.21	3.6264
79.31	26.29	3.6294
79.44	26.36	3.6325
79.57	26.43	3.6355
79.69	26.50	3.6386
79.82	26.57	3.6416
79.95	26.64	3.6447
80.08	26.71	3.6477
80.20	26.78	3.6508
80.33	26.85	3.6538
80.46	26.92	3.6569
80.59	27.00	3.6599
80.72	27.07	3.6630
80.85	27.14	3.6660
80.98	27.21	3.6691
81.11	27.29	3.6721
81.24	27.36	3.6752
81.37	27.43	3.6782
81.50	27.50	3.6813
81.63	27.57	3.6843
81.76	27.65	3.6874
81.89	27.72	3.6904
82.02	27.79	3.6935
82.15	27.86	3.6965
82.28	27.94	3.6996
82.41	28.01	3.7026

TABLE 15 - LEAVING CHILLED LIQUID TEMPERATURE (HEAT PUMP APPLICATIONS)

TEMP (°F)	TEMP (°C)	VIN
0.04	-17.76	1.0107
3.02	-16.10	1.0889
5.87	-14.52	1.1670
8.63	-12.98	1.2451
11.30	-11.50	1.3232
13.89	-10.60	1.4014
16.42	-8.66	1.4795
18.89	-7.29	1.5576
21.32	-5.93	1.6357
23.71	-4.61	1.7139
26.07	-3.29	1.7920
28.40	-2.00	1.8701
30.71	-0.72	1.9482
33.01	0.56	2.0264
35.30	1.83	2.1045

TEMP (°F)	TEMP (°C)	VIN
37.58	3.10	2.1826
39.87	4.37	2.2607
42.15	5.64	2.3389
44.45	6.92	2.4170
46.76	8.20	2.4951
49.09	9.49	2.5732
51.44	10.80	2.6514
53.82	12.12	2.7295
56.23	13.46	2.8076
58.69	14.83	2.8857
61.19	16.61	2.9639
63.74	17.64	3.0420
66.35	19.08	3.1201
69.02	20.57	3.1982
71.78	22.10	3.2764

TEMP (°F)	TEMP (°C)	VIN
74.62	23.68	3.3545
77.56	25.31	3.4326
80.61	27.00	3.5107
83.77	28.76	3.5889
87.10	30.61	3.6670
90.57	32.54	3.7451
94.23	34.57	3.8232
98.13	36.74	3.9014
102.28	39.04	3.9795
106.72	41.51	4.0576
111.53	44.18	4.1357
116.76	47.09	4.2139
122.56	50.31	4.2920
129.02	53.90	4.3701
136.37	57.98	4.4482

TABLE 16 - RETURN CHILLED LIQUID TEMPERATURE

TEMP (°F)	TEMP (°C)	VIN
15.01	-9.44	1.5918
15.16	-9.36	1.5967
15.31	-9.27	1.6016
15.46	-9.19	1.6064
15.61	-9.11	1.6113
15.76	-9.02	1.6162
15.91	-8.94	1.6211
16.05	-8.86	1.6260
16.20	-8.78	1.6309
16.35	-8.70	1.6357
16.50	-8.61	1.6406
16.64	-8.53	1.6455
16.79	-8.45	1.6504
16.94	-8.37	1.6553
17.09	-8.28	1.6602
17.23	-8.21	1.6650
17.38	-8.12	1.6699
17.53	-8.04	1.6748
17.68	-7.96	1.6797
17.82	-7.88	1.6846
17.97	-7.80	1.6895
18.11	-7.72	1.6943
18.26	-7.63	1.6992
18.41	-7.55	1.7041
18.55	-7.47	1.7090
18.70	-7.39	1.7139
18.84	-7.31	1.7188
18.99	-7.23	1.7236
19.13	-7.15	1.7285
19.28	-7.07	1.7334
19.43	-6.98	1.7383
19.57	-6.91	1.7432
19.71	-6.83	1.7480
19.86	-6.74	1.7529
20.00	-6.67	1.7578
20.15	-6.58	1.7627
20.29	-6.51	1.7676
20.44	-6.42	1.7725
20.58	-6.34	1.7773
20.73	-6.26	1.7822
20.87	-6.18	1.7871
21.01	-6.11	1.7920
21.16	-6.02	1.7969
21.30	-5.94	1.8018
21.45	-5.86	1.8066
21.59	-5.78	1.8115
21.73	-5.71	1.8164
21.88	-5.62	1.8213
22.02	-5.54	1.8262
22.17	-5.46	1.8311
22.31	-5.38	1.8359
22.45	-5.31	1.8408
22.60	-5.22	1.8457
22.74	-5.14	1.8506
22.88	-5.07	1.8555
23.03	-4.98	1.8604
23.17	-4.91	1.8652
23.31	-4.83	1.8701
23.45	-4.75	1.8750
23.60	-4.67	1.8799
23.74	-4.59	1.8848
23.88	-4.51	1.8896
24.02	-4.43	1.8945
24.16	-4.36	1.8994
24.31	-4.27	1.9043
24.45	-4.19	1.9092
24.59	-4.12	1.9141
24.73	-4.04	1.9189
24.87	-3.96	1.9238
25.01	-3.88	1.9287
25.16	-3.80	1.9336
25.30	-3.72	1.9385
25.44	-3.64	1.9434
25.58	-3.57	1.9482
25.72	-3.49	1.9531
25.86	-3.41	1.9580
26.00	-3.33	1.9629
26.14	-3.26	1.9678
26.28	-3.18	1.9727
26.42	-3.10	1.9775
26.56	-3.02	1.9824
26.71	-2.94	1.9873
26.85	-2.86	1.9922
26.99	-2.78	1.9971
27.13	-2.71	2.0020
27.27	-2.63	2.0068
27.41	-2.55	2.0117
27.55	-2.47	2.0166
27.70	-2.39	2.0215
27.84	-2.31	2.0264
27.98	-2.23	2.0313
28.12	-2.16	2.0361
28.26	-2.08	2.0410
28.40	-2.00	2.0459
28.54	-1.92	2.5058
28.68	-1.84	2.0557
28.82	-1.77	2.0605
28.96	-1.69	2.0654
29.10	-1.61	2.0703
29.24	-1.53	2.0752
29.38	-1.46	2.0801
29.52	-1.38	2.0850
29.66	-1.30	2.0898
29.80	-1.22	2.0947
29.94	-1.14	2.0996
30.08	-1.07	2.1045
30.22	-0.99	2.1094
30.36	-0.91	2.1143
30.50	-0.83	2.1191
30.64	-0.76	2.1240
30.78	-0.68	2.1289
30.92	-0.60	2.1338
31.06	-0.52	2.1387
31.20	-0.44	2.1436
31.34	-0.37	2.1484
31.48	-0.29	2.1533
31.62	-0.21	2.1582
31.76	-0.13	2.1631
31.90	-0.06	2.1680
32.04	0.02	2.1729
32.18	0.10	2.1777
32.32	0.18	2.1826
32.46	0.26	2.1875
32.60	0.33	2.1924
32.74	0.41	2.1973
32.88	0.49	2.2021
33.02	0.57	2.2070
33.16	0.64	2.2119
33.30	0.72	2.2168
33.44	0.80	2.2217
33.59	0.88	2.2266
33.73	0.96	2.2314
33.87	1.04	2.2363
34.01	1.12	2.2412
34.15	1.19	2.2461
34.29	1.27	2.2510
34.43	1.35	2.2559
34.57	1.43	2.2607
34.71	1.51	2.2656
34.85	1.58	2.2705
34.99	1.66	2.2754
35.13	1.74	2.2803
35.27	1.82	2.2852
35.41	1.89	2.2900
35.55	1.97	2.2949
35.69	2.05	2.2998
35.83	2.13	2.3047
35.97	2.21	2.3096
36.11	2.28	2.3145
36.25	2.36	2.3193
36.39	2.44	2.3242
36.53	2.52	2.3291
36.67	2.59	2.3340
36.81	2.67	2.3389
36.95	2.75	2.3438
37.09	2.83	2.3486
37.23	2.91	2.3535
37.37	2.98	2.3584
37.51	3.06	2.3633
37.66	3.14	2.3682
37.80	3.22	2.3730
37.94	3.30	2.3779
38.08	3.38	2.3828
38.22	3.46	2.3877
38.36	3.53	2.3926

TABLE 16 – RETURN CHILLED LIQUID TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
38.51	3.62	2.3975
38.65	3.69	2.4023
38.79	3.77	2.4072
38.93	3.85	2.4121
39.07	3.93	2.4170
39.21	4.01	2.4219
39.35	4.08	2.4268
39.50	4.17	2.4316
39.64	4.24	2.4365
39.78	4.32	2.4414
39.92	4.40	2.4463
40.06	4.48	2.4512
40.20	4.56	2.4561
40.34	4.63	2.4609
40.48	4.71	2.4658
40.62	4.79	2.4707
40.76	4.87	2.4756
40.91	4.95	2.4805
41.05	5.03	2.4854
41.19	5.11	2.4902
41.33	5.18	2.4951
41.48	5.27	2.5000
41.62	5.34	2.5049
41.76	5.42	2.5098
41.90	5.50	2.5146
42.05	5.58	2.5195
42.19	5.66	2.5244
42.33	5.74	2.5293
42.48	5.82	2.5342
42.62	5.90	2.5391
42.76	5.98	2.5439
42.90	6.06	2.5488
43.05	6.14	2.5537
43.19	6.22	2.5586
43.33	6.29	2.5635
43.48	6.38	2.5684
43.62	6.46	2.5732
43.76	6.53	2.5781
43.91	6.62	2.5830
44.05	6.69	2.5879
44.19	6.77	2.5928
44.34	6.86	2.5977
44.48	6.93	2.6025
44.62	7.01	2.6074
44.77	7.10	2.6123
44.91	7.17	2.6172
45.06	7.26	2.6221
45.20	7.33	2.6270
45.35	7.42	2.6318
45.49	7.50	2.6367
45.64	7.58	2.6416
45.79	7.66	2.6465
45.93	7.74	2.6514
46.08	7.82	2.6563
46.22	7.90	2.6611
46.37	7.98	2.6660
46.51	8.06	2.6709
46.66	8.15	2.6758
46.80	8.22	2.6807
46.95	8.31	2.6855
47.09	8.38	2.6904
47.24	8.47	2.6953
47.39	8.55	2.7002
47.53	8.63	2.7051
47.68	8.71	2.7100
47.82	8.79	2.7148
47.97	8.87	2.7197
48.11	8.95	2.7246
48.26	9.03	2.7295
48.41	9.12	2.7344
48.56	9.20	2.7393
48.70	9.28	2.7441
48.85	9.36	2.7490
49.00	9.45	2.7539
49.15	9.53	2.7588
49.30	9.61	2.7637
49.44	9.69	2.7686
49.59	9.77	2.7734
49.74	9.86	2.7783
49.89	9.94	2.7832
50.04	10.02	2.7881
50.19	10.11	2.7930
50.34	10.19	2.7979
50.48	10.27	2.8027
50.63	10.35	2.8076
50.78	10.43	2.8125
50.93	10.52	2.8174
51.08	10.60	2.8223
51.23	10.68	2.8271
51.38	10.77	2.8320
51.53	10.85	2.8369
51.68	10.93	2.8418
51.83	11.02	2.8467
51.98	11.10	2.8516
52.13	11.18	2.8564
52.28	11.27	2.8613
52.44	11.36	2.8662
52.59	11.44	2.8711
52.74	11.52	2.8760
52.89	11.61	2.8809
53.04	11.69	2.8857
53.19	11.77	2.8906
53.34	11.86	2.8955
53.50	11.95	2.9004
53.65	12.03	2.9053
53.80	12.11	2.9102
53.95	12.20	2.0150
54.11	12.28	2.9199
54.26	12.37	2.9248
54.41	12.45	2.9297
54.56	12.53	2.9346
54.72	12.62	2.9395
54.87	12.71	2.9443
55.02	12.79	2.9492
55.17	12.87	2.9541
55.33	12.96	2.9590
55.48	13.05	2.9639
55.64	13.13	2.9688
55.79	13.22	2.9736
55.95	13.31	2.9785
56.11	13.40	2.9834
56.26	13.48	2.9983
56.42	13.57	2.9932
56.57	13.65	2.9980
56.73	13.74	3.0029
56.89	13.83	3.0078
57.04	13.91	3.0127
57.20	14.00	3.0176
57.36	14.09	3.0225
57.51	14.17	3.0273
57.67	14.26	3.0322
57.83	14.35	3.0371
57.99	14.44	3.0420
58.15	14.53	3.0469
58.31	14.62	3.0518
58.47	14.71	3.0566
58.62	14.79	3.0615
58.78	14.88	3.0664
58.94	14.97	3.0713
59.10	15.06	3.0762
59.26	15.15	3.0811
59.42	15.23	3.0859
59.59	15.33	3.0908
59.75	15.42	3.0957
59.91	15.51	3.1006
60.07	15.60	3.1055
60.23	15.68	3.1104
60.39	15.77	3.1152
60.55	15.86	3.1201
60.72	15.96	3.1250
60.88	16.05	3.1299
61.04	16.13	3.1348
61.20	16.22	3.1396
61.37	16.32	3.1445
61.53	16.41	3.1494
61.69	16.50	3.1543
61.85	16.58	3.1592
62.02	16.68	3.1641
62.18	16.77	3.1689
62.34	16.86	3.1738
62.51	16.95	3.1787
62.67	17.04	3.1836
62.84	17.13	3.1885
63.01	17.23	3.1934
63.17	17.32	3.1882

TABLE 16 – RETURN CHILLED LIQUID TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN	TEMP (°F)	TEMP (°C)	VIN	TEMP (°F)	TEMP (°C)	VIN
63.34	17.41	3.2031	69.36	20.76	3.3740	75.87	24.37	3.5449
63.51	17.51	3.2080	69.54	20.86	3.3789	76.07	24.49	3.5498
63.68	17.60	3.2129	69.72	20.96	3.3838	76.26	24.59	3.5547
63.84	17.69	3.2178	69.90	21.06	3.3887	76.46	24.70	3.5596
64.01	17.78	3.2227	70.08	21.16	3.3936	76.65	24.81	3.5645
64.18	17.88	3.2275	70.26	21.26	3.3984	76.84	24.91	3.5693
64.34	17.97	3.2324	70.45	21.36	3.4033	77.04	25.02	3.5742
64.51	18.06	3.2373	70.63	21.46	3.4082	77.24	25.14	3.5791
64.68	18.16	3.2422	70.81	21.56	3.4131	77.44	25.25	3.5840
64.85	18.25	3.2471	70.99	21.66	3.4180	77.64	25.36	3.5889
65.02	18.35	3.2520	71.17	21.76	3.4229	77.84	25.47	3.5938
65.19	18.44	3.2568	71.36	21.87	3.4277	78.04	25.58	3.5986
65.36	18.53	3.2617	71.54	21.97	3.4326	78.24	25.69	3.6035
65.53	18.63	3.2666	71.72	22.07	3.4375	78.44	25.80	3.6084
65.70	18.72	3.2715	71.91	22.17	3.4424	78.64	25.91	3.6133
65.87	18.82	3.2764	72.09	22.27	3.4473	78.84	26.02	3.6182
66.04	18.91	3.2813	72.28	22.38	3.4521	79.04	26.14	3.6230
66.21	19.01	3.2861	72.46	22.48	3.4570	79.25	26.25	3.6279
66.39	19.11	3.2910	72.64	22.58	3.4619	79.45	26.36	3.6328
66.56	19.20	3.2959	72.83	22.69	3.4668	79.66	26.48	3.6377
66.73	19.30	3.3008	73.01	22.79	3.4717	79.86	26.59	3.6426
66.91	19.40	3.3057	73.20	22.89	3.4766	80.07	26.71	3.6475
67.08	19.49	3.3105	73.38	22.99	3.4814	80.27	26.82	3.6523
67.25	19.58	3.3154	73.57	23.10	3.4863	80.48	26.94	3.6572
67.43	19.68	3.3203	73.76	23.20	3.4912	80.68	27.05	3.6621
67.60	19.78	3.3252	73.95	23.31	3.4961	80.89	27.16	3.6670
67.77	19.87	3.3301	74.14	23.41	3.5010	81.10	27.28	3.6719
67.95	19.97	3.3350	74.33	23.52	3.5059	81.31	27.40	3.6768
68.12	20.07	3.3398	74.53	23.63	3.5107	81.52	27.51	3.6816
68.30	20.17	3.3447	74.72	23.74	3.5156	81.72	27.62	3.6865
68.48	20.27	3.3496	74.91	23.84	3.5205	81.93	27.74	3.6914
68.66	20.37	3.3545	75.10	23.95	3.5254	82.14	27.86	3.6963
68.83	20.46	3.3594	75.29	24.05	3.5303	82.35	27.97	3.7012
69.01	20.56	3.3643	75.48	24.16	3.5352	82.56	28.09	3.7061
69.19	20.66	3.3691	75.68	24.27	3.5400			

TABLE 17 - RETURN CHILLED LIQUID TEMPERATURE (HEAT PUMP APPLICATIONS)

TEMP (°F)	TEMP (°C)	VIN
0.04	-17.76	1.1353
2.79	-16.23	1.2134
5.44	-14.76	1.2915
8.02	-13.32	1.3696
10.53	-11.93	1.4478
12.98	-10.57	1.5259
15.39	-9.23	1.604
17.75	-7.92	1.6821
20.08	-6.62	1.7603
22.38	-5.34	1.8384
24.66	-4.08	1.9165
26.92	-2.82	1.9946
29.17	-1.57	2.0728
31.41	-0.33	2.1509
33.66	0.92	2.229

TEMP (°F)	TEMP (°C)	VIN
35.9	2.17	2.3071
38.15	3.42	2.3853
40.41	4.67	2.4634
42.69	5.94	2.5415
44.99	7.22	2.6196
47.31	8.51	2.6978
49.67	9.82	2.7759
52.06	11.14	2.854
54.49	12.49	2.9321
56.96	13.87	3.0103
59.5	15.28	3.0884
62.1	16.72	3.1665
64.77	18.21	3.2446
67.51	19.73	3.3228
70.35	21.31	3.4009

TEMP (°F)	TEMP (°C)	VIN
73.29	22.94	3.479
76.36	24.64	3.5571
79.55	26.42	3.6353
82.89	28.28	3.7134
86.41	30.23	3.7915
90.12	32.29	3.8696
94.07	34.49	3.9478
98.31	36.84	4.0259
102.87	39.37	4.104
107.81	42.12	4.1821
113.26	45.14	4.2603
119.3	48.50	4.3384
126.1	52.28	4.4165
133.93	56.63	4.4946

TABLE 18 - RETURN AND LEAVING CONDENSING WATER

TEMP (°F)	TEMP (°C)	VIN
40.12	4.51	1.8408
40.27	4.59	1.8457
40.42	4.68	1.8506
40.58	4.77	1.8555
40.73	4.85	1.8604
40.88	4.93	1.8652
41.03	5.02	1.8701
41.18	5.10	1.8750
41.33	5.18	1.8799
41.48	5.27	1.8848
41.64	5.36	1.8896
41.79	5.44	1.8945
41.94	5.52	1.8994
42.09	5.61	1.9043
42.24	5.69	1.9092
42.39	5.77	1.9141
42.54	5.86	1.9189
42.70	5.94	1.9238
42.85	6.03	1.9287
43.00	6.11	1.9336
43.15	6.19	1.9385
43.30	6.28	1.9434
43.45	6.36	1.9482
43.60	6.44	1.9531
43.75	6.53	1.9580
43.90	6.61	1.9629
44.05	6.69	1.9678
44.20	6.78	1.9727
44.35	6.86	1.9775
44.50	6.95	1.9824
44.65	7.03	1.9873
44.80	7.11	1.9922
44.95	7.20	1.9971
45.10	7.28	2.0020
45.25	7.36	2.0068
45.40	7.45	2.0117
45.55	7.53	2.0166
45.70	7.61	2.0215
45.85	7.70	2.0264
46.00	7.78	2.0313
46.15	7.86	2.0361
46.30	7.95	2.0410
46.45	8.03	2.0459
46.60	8.11	2.0508
46.75	8.20	2.0557
46.90	8.28	2.0605
47.05	8.36	2.0654
47.20	8.45	2.0703
47.35	8.53	2.0752
47.50	8.61	2.0801
47.65	8.70	2.0850
47.79	8.77	2.0898
47.94	8.86	2.0947
48.09	8.94	2.0996
48.24	9.02	2.1045
48.39	9.11	2.1094
48.54	9.19	2.1143
48.69	9.27	2.1191
48.84	9.36	2.1240
48.99	9.44	2.1289
49.14	9.52	2.1338
49.29	9.61	2.1387
49.44	9.69	2.1436
49.59	9.77	2.1484
49.74	9.86	2.1533
49.89	9.94	2.1582
50.03	10.02	2.1631
50.18	10.10	2.1680
50.33	10.18	2.1729
50.48	10.27	2.1777
50.63	10.35	2.1826
50.78	10.43	2.1875
50.93	10.52	2.1924
51.08	10.60	2.1973
51.23	10.68	2.2021
51.38	10.77	2.2070
51.53	10.85	2.2119
51.68	10.93	2.1268
51.83	11.02	2.2217
51.97	11.10	2.2266
52.12	11.18	2.2314
52.27	11.26	2.2363
52.42	11.35	2.2412
52.57	11.43	2.2461
52.72	11.51	2.2510
52.87	11.60	2.2559
53.02	11.68	2.2607
53.17	11.76	2.2656
53.32	11.85	2.2705
53.47	11.93	2.2754
53.62	12.01	2.2803
53.77	12.10	2.2852
53.92	12.18	2.2900
54.07	12.26	2.2949
54.21	12.34	2.2998
54.36	12.42	2.3047
54.51	12.51	2.3096
54.66	12.59	2.3145
54.81	12.67	2.3193
54.96	12.76	2.3242
55.11	12.84	2.3291
55.26	12.92	2.3340
55.41	13.01	2.3389
55.56	13.09	2.3438
55.71	13.17	2.3486
55.86	13.26	2.3535
56.01	13.34	2.3584
56.16	13.42	2.3633
56.31	13.51	2.3682
56.46	13.59	2.3730
56.61	13.67	2.3779
56.76	13.76	2.3828
56.91	13.84	2.3877
57.06	13.92	2.3926
57.21	14.01	2.3975
57.36	14.09	2.4023
57.51	14.17	2.4072
57.66	14.26	2.4121
57.81	14.34	2.4170
57.97	14.43	2.4219
58.12	14.51	2.4268
58.27	14.60	2.4316
58.42	14.68	2.4365
58.57	14.76	2.4414
58.72	14.85	2.4463
58.87	14.93	2.4512
59.02	15.01	2.4561
59.17	15.10	2.4609
59.33	15.18	2.4658
59.48	15.27	2.4707
59.63	15.35	2.4756
59.78	15.43	2.4805
59.93	15.52	2.4854
60.09	15.61	2.4902
60.24	15.69	2.4951
60.39	15.77	2.5000
60.54	15.86	2.5049
60.69	15.94	2.5098
60.85	16.03	2.5146
61.00	16.11	2.5195
61.15	16.20	2.5244
61.30	16.28	2.5293
61.45	16.36	2.5342
61.61	16.45	2.5391
61.76	16.53	2.5439
61.91	16.62	2.5488
62.06	16.70	2.5537
62.21	16.78	2.5586
62.36	16.87	2.5635
62.52	16.96	2.5684
62.67	17.04	2.5732
62.82	17.12	2.5781
62.98	17.21	2.5830
63.13	17.30	2.5879
63.29	17.38	2.5928
63.44	17.47	2.5977
63.59	17.55	2.6025
63.75	17.64	2.6074
63.90	17.72	2.6123
64.06	17.81	2.6172
64.21	17.90	2.6221
64.36	17.98	2.6270
64.52	18.07	2.6318
64.52	18.07	2.6367
64.83	18.24	2.6416

TABLE 18 - RETURN AND LEAVING CONDENSING WATER (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
64.98	18.32	2.6465
65.14	18.41	2.6514
65.29	18.50	2.6563
65.45	18.58	2.6611
65.60	18.67	2.6660
65.76	18.76	2.6709
65.91	18.84	2.6758
66.07	18.93	2.6807
66.22	19.01	2.6855
66.38	19.10	2.6904
66.54	19.19	2.6953
66.69	19.27	2.7002
66.85	19.36	2.7051
66.00	18.89	2.7100
67.16	19.53	2.7148
67.32	19.62	2.7197
67.47	19.71	2.7246
67.63	19.80	2.7295
67.78	19.88	2.7344
67.94	19.97	2.7393
68.10	20.06	2.7441
68.26	20.15	2.7490
68.41	20.23	2.7539
68.57	20.32	2.7588
68.73	20.41	2.7637
68.89	20.50	2.7686
69.05	20.58	2.7734
69.21	20.67	2.7783
69.36	20.76	2.7832
69.52	20.85	2.7881
69.68	20.94	2.7930
69.84	21.02	2.7979
70.00	21.11	2.8027
70.16	21.20	2.8076
70.32	21.29	2.8125
70.48	21.38	2.8174
70.64	21.47	2.8223
70.80	21.56	2.8271
70.96	21.65	2.8320
71.12	21.74	2.8369
71.28	21.82	2.8418
71.44	21.91	2.8467
71.61	22.01	2.8516
71.77	22.10	2.8564
71.93	22.19	2.8613
72.09	22.27	2.8662
72.25	22.36	2.8711
72.41	22.45	2.8760
72.57	22.54	2.8809
72.73	22.63	2.8857
72.89	22.72	2.8906
73.05	22.81	2.8955
73.22	22.90	2.9004
73.38	22.99	2.9053
73.54	23.08	2.9102

TEMP (°F)	TEMP (°C)	VIN
73.71	23.17	2.9150
73.87	23.26	2.9199
74.04	23.36	2.9248
74.20	23.45	2.9297
74.37	23.54	2.9346
74.53	23.63	2.9395
74.70	23.72	2.9443
74.86	23.81	2.9492
75.03	23.91	2.9541
75.19	24.00	2.9590
75.36	24.09	2.9639
75.52	24.18	2.9688
75.69	24.27	2.9736
75.85	24.36	2.9785
76.02	24.46	2.9834
76.19	24.55	2.9883
76.35	24.64	2.9932
76.52	24.74	2.9980
76.69	24.83	3.0029
76.85	24.92	3.0078
77.02	25.01	3.0127
77.19	25.11	3.0176
77.36	25.20	3.0225
77.53	25.30	3.0273
77.70	25.39	3.0322
77.86	25.48	3.0371
78.03	25.57	3.0420
78.20	25.67	3.0469
78.37	25.76	3.0518
78.54	25.86	3.0566
78.71	25.95	3.0615
78.88	26.05	3.0664
79.05	26.14	3.0713
79.22	26.24	3.0762
79.40	26.34	3.0811
79.57	26.43	3.0859
79.74	26.52	3.0908
79.91	26.62	3.0957
80.08	26.71	3.1006
80.26	26.81	3.1055
80.43	26.91	3.1104
80.60	27.00	3.1152
80.77	27.10	3.1201
80.95	27.20	3.1250
81.12	27.29	3.1299
81.29	27.39	3.1348
81.47	27.49	3.1396
81.64	27.58	3.1445
81.81	27.67	3.1494
81.99	27.77	3.1543
82.16	27.87	3.1592
82.33	27.96	3.1641
82.51	28.06	3.1689
82.69	28.16	3.1738
82.86	28.26	3.1787

TEMP (°F)	TEMP (°C)	VIN
83.04	28.36	3.1836
83.22	28.46	3.1885
83.39	28.55	3.1934
83.57	28.65	3.1982
83.75	28.75	3.2031
83.93	28.85	3.2080
84.10	28.95	3.2129
84.28	29.05	3.2178
84.46	29.15	3.2227
84.65	29.25	3.2275
84.83	29.35	3.2324
85.01	29.45	3.2373
85.19	29.55	3.2422
85.37	29.65	3.2471
85.55	29.75	3.2520
85.73	29.85	3.2568
85.92	29.96	3.2617
86.10	30.06	3.2666
86.28	30.16	3.2715
86.47	30.26	3.2764
86.65	30.36	3.2813
86.84	30.47	3.2861
87.02	30.57	3.2910
87.21	30.67	3.2959
87.39	30.77	3.3008
87.58	30.88	3.3057
87.76	30.98	3.3105
87.95	31.09	3.3154
88.13	31.19	3.3203
88.32	31.29	3.3252
88.51	31.40	3.3301
88.70	31.50	3.3350
88.88	31.60	3.3398
89.07	31.71	3.3447
89.26	31.81	3.3496
89.44	31.91	3.3545
89.63	32.02	3.3594
89.82	32.12	3.3643
90.01	32.23	3.3691
90.20	32.34	3.3740
90.39	32.44	3.3789
90.59	32.55	3.3838
90.78	32.66	3.3887
90.97	32.76	3.3936
91.16	32.87	3.3984
91.35	32.97	3.4033
91.54	33.08	3.4082
91.74	33.19	3.4131
91.93	33.30	3.4180
92.13	33.41	3.4229
92.32	33.51	3.4277
92.52	33.62	3.4326
92.72	33.74	3.4375
92.91	33.84	3.4424
93.11	33.95	3.4473

TABLE 18 - RETURN AND LEAVING CONDENSING WATER (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
93.31	34.06	3.4521
93.51	34.17	3.4570
93.70	34.28	3.4619
93.90	34.39	3.4668
94.10	34.50	3.4717
94.30	34.61	3.4766
94.50	34.73	3.4814
94.70	34.84	3.4863
94.90	34.95	3.4912
95.11	35.06	3.4961
95.31	35.18	3.5010
95.52	35.29	3.5059
95.72	35.40	3.5107
95.93	35.52	3.5156
96.13	35.63	3.5205
96.34	35.75	3.5254
96.54	35.86	3.5303
96.75	35.98	3.5352
96.96	36.09	3.5400
97.17	36.21	3.5449
97.38	36.33	3.5498
97.59	36.44	3.5547
97.80	36.56	3.5596
98.01	36.68	3.5645
98.22	36.79	3.5693
98.43	36.91	3.5742
98.64	37.03	3.5791
98.86	37.15	3.5840
99.07	37.26	3.5889
99.29	37.39	3.5938
99.50	37.50	3.5986

TEMP (°F)	TEMP (°C)	VIN
99.71	37.62	3.6035
99.93	37.74	3.6084
100.14	37.86	3.6133
100.36	37.98	3.6182
100.58	38.10	3.6230
100.79	38.22	3.6279
101.01	38.34	3.6328
101.23	38.46	3.6377
101.45	38.59	3.6426
101.67	38.71	3.6475
101.89	38.83	3.6523
102.11	38.95	3.6572
102.33	39.08	3.6621
102.55	39.20	3.6670
102.78	39.33	3.6719
103.00	39.45	3.6768
103.22	39.57	3.6816
103.45	39.70	3.6865
103.67	39.82	3.6914
103.89	39.94	3.6963
104.12	40.07	3.7012
104.35	40.20	3.7061
104.58	40.33	3.7109
104.81	40.45	3.7158
105.04	40.58	3.7207
105.27	40.71	3.7256
105.50	40.84	3.7305
105.73	40.96	3.7354
105.96	41.09	3.7402
106.20	41.23	3.7451
106.44	41.36	3.7500

TEMP (°F)	TEMP (°C)	VIN
106.67	41.49	3.7549
106.91	41.62	3.7598
107.14	41.75	3.7646
107.38	41.88	3.7695
107.62	42.01	3.7744
107.86	42.15	3.7793
108.11	42.29	3.7842
108.35	42.42	3.7891
108.59	42.55	3.7939
108.84	42.69	3.7988
109.08	42.83	3.8037
109.32	42.96	3.8086
109.57	43.10	3.8135
109.82	43.24	3.8184
110.06	43.37	3.8232
110.31	43.51	3.8281
110.56	43.65	3.8330
110.81	43.79	3.8379
111.05	43.92	3.8328
111.31	44.06	3.8477
111.36	44.09	3.8525
111.82	44.35	3.8574
112.08	44.49	3.8623
112.34	44.64	3.8672
112.59	44.78	3.8721
112.85	44.92	3.8770
113.11	45.06	3.8818
113.37	45.21	3.8867
113.63	45.35	3.8916
113.88	45.49	3.8965
114.14	45.64	3.9014

TABLE 19 - OIL AND DISCHARGE TEMPERATURE

TEMP (°F)	TEMP (°C)	VIN
31.99	-0.01	0.2637
32.63	0.35	0.2686
33.27	0.71	0.2734
33.90	1.06	0.2783
34.51	1.39	0.2832
35.12	1.73	0.2881
35.73	2.07	0.2930
36.32	2.40	0.2979
36.91	2.73	0.3027
37.49	3.05	0.3076
38.05	3.36	0.3125
38.61	3.67	0.3174
39.18	3.99	0.3223
39.72	4.29	0.3271
40.26	4.59	0.3320
40.80	4.89	0.3369
41.33	5.18	0.3418
41.85	5.47	0.3467
42.37	5.76	0.3516
42.89	6.05	0.3564
43.39	6.33	0.3613
43.89	6.61	0.3662
44.39	6.88	0.3711
44.88	7.16	0.3760
45.36	7.42	0.3809
45.84	7.69	0.3857
46.32	7.96	0.3906
46.79	8.22	0.3955
47.25	8.47	0.4004
47.72	8.73	0.4053
48.18	8.99	0.4102
48.63	9.24	0.4150
49.07	9.48	0.4199
49.52	9.73	0.4248
49.97	9.98	0.4297
50.40	10.22	0.4346
50.83	10.46	0.4395
51.26	10.70	0.4443
51.69	10.94	0.4492
52.11	11.17	0.4541
52.53	11.41	0.4590
52.94	11.63	0.4639
53.36	11.87	0.4688
53.77	12.10	0.4736
54.17	12.32	0.4785
54.57	12.54	0.4834
54.97	12.76	0.4883
55.37	12.98	0.4932
55.76	13.20	0.4980
56.15	13.42	0.5029
56.54	13.63	0.5078
56.92	13.85	0.5127
57.31	14.06	0.5176
57.68	14.27	0.5225
58.06	14.48	0.5273
58.43	14.68	0.5322
58.81	14.90	0.5371
59.18	15.10	0.5420
59.54	15.30	0.5469
59.90	15.50	0.5518
60.26	15.70	0.5566
60.63	15.91	0.5615
60.98	16.10	0.5664
61.33	16.30	0.5713
61.69	16.50	0.5762
62.04	16.69	0.5811
62.39	16.88	0.5859
62.73	17.07	0.5908
63.07	17.26	0.5957
63.41	17.45	0.6006
63.75	17.64	0.6055
64.09	17.83	0.6104
64.43	18.02	0.6152
64.76	18.20	0.6201
65.09	18.38	0.6250
65.42	18.57	0.6299
65.75	18.75	0.6348
66.08	18.93	0.6396
66.40	19.11	0.6445
66.72	19.29	0.6494
67.04	19.47	0.6543
67.36	19.65	0.6592
67.68	19.82	0.6641
68.00	20.00	0.6689
68.31	20.17	0.6738
68.62	20.35	0.6787
68.93	20.52	0.6836
69.24	20.69	0.6885
69.55	20.86	0.6934
69.86	21.04	0.6982
70.17	21.21	0.7031
70.47	21.37	0.7080
70.77	21.54	0.7129
71.07	21.71	0.7178
71.37	21.87	0.7227
71.67	22.04	0.7275
71.96	22.20	0.7324
72.26	22.37	0.7373
72.55	22.53	0.7422
72.84	22.69	0.7471
73.14	22.86	0.7520
73.43	23.02	0.7568
73.72	23.18	0.7617
74.00	23.34	0.7666
74.29	23.50	0.7715
74.57	23.65	0.7764
74.86	23.81	0.7813
75.14	23.97	0.7861
75.42	24.12	0.7910
75.70	24.28	0.7959
75.98	24.44	0.8008
76.25	24.59	0.8057
76.53	24.74	0.8105
76.81	24.90	0.8154
77.09	25.05	0.8203
77.36	25.20	0.8252
77.63	25.35	0.8301
77.90	25.50	0.8350
78.17	25.65	0.8398
78.44	25.80	0.8447
78.71	25.95	0.8496
78.98	26.10	0.8545
79.24	26.25	0.8594
79.50	26.39	0.8643
79.77	26.54	0.8691
80.03	26.69	0.8740
80.30	26.84	0.8789
80.56	26.98	0.8838
80.82	27.12	0.8887
81.08	27.27	0.8936
81.33	27.41	0.8984
81.59	27.55	0.9033
81.85	27.70	0.9082
82.11	27.84	0.9131
82.37	27.99	0.9180
82.62	28.12	0.9229
82.87	28.26	0.9277
83.12	28.40	0.9326
83.37	28.54	0.9375
83.62	28.68	0.9424
83.88	28.82	0.9473
84.13	28.96	0.9521
84.38	29.10	0.9570
84.62	29.24	0.9619
84.87	29.37	0.9668
85.11	29.51	0.9717
85.36	29.65	0.9766
85.61	29.79	0.9814
85.85	29.92	0.9863
86.10	30.06	0.9912
86.34	30.19	0.9961
86.58	30.32	1.0010
86.82	30.46	1.0059
87.06	30.59	1.0107
87.30	30.72	1.0156
87.54	30.86	1.0205
87.78	30.99	1.0254
88.02	31.12	1.0303
88.25	31.25	1.0352
88.49	31.39	1.0400
88.72	31.51	1.0449
88.96	31.65	1.0498
89.20	31.78	1.0547
89.43	31.91	1.0596
89.67	32.04	1.0645

TABLE 19 - OIL AND DISCHARGE TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
89.90	32.17	1.0693
90.13	32.30	1.0742
90.36	32.42	1.0791
90.59	32.55	1.0840
90.82	32.68	1.0889
91.05	32.81	1.0938
91.28	32.94	1.0986
91.51	33.06	1.1035
91.74	33.19	1.1084
91.96	33.31	1.1133
92.19	33.44	1.1182
92.42	33.57	1.1230
92.64	33.69	1.1279
92.87	33.82	1.1328
93.10	33.95	1.1377
93.32	34.07	1.1426
93.54	34.19	1.1475
93.77	34.32	1.1523
93.99	34.44	1.1572
94.21	34.56	1.1621
94.43	34.69	1.1670
94.65	34.81	1.1719
94.88	34.94	1.1768
95.10	35.06	1.1816
95.32	35.18	1.1865
95.53	35.30	1.1914
95.75	35.42	1.1963
95.97	35.54	1.2012
96.19	35.66	1.2061
96.41	35.79	1.2109
96.63	35.91	1.2158
96.84	36.03	1.2207
97.06	36.15	1.2256
97.27	36.26	1.2305
97.49	36.39	1.2354
97.70	36.50	1.2402
97.92	36.63	1.2451
98.13	36.74	1.2500
98.35	36.86	1.2549
98.56	36.98	1.2598
98.77	37.10	1.2646
98.98	37.21	1.2695
99.20	37.34	1.2744
99.41	37.45	1.2793
99.62	37.57	1.2842
99.83	37.69	1.2891
100.04	37.80	1.2939
100.25	37.92	1.2988
100.46	38.04	1.3037
100.67	38.15	1.3086
100.88	38.27	1.3135
101.09	38.39	1.3184
101.29	38.50	1.3232
101.50	38.61	1.3281
101.71	38.73	1.3330
101.92	38.85	1.3379
102.13	38.96	1.3428
102.33	39.08	1.3477
102.54	39.19	1.3525
102.74	39.30	1.3574
102.95	39.42	1.3623
103.15	39.53	1.3672
103.36	39.65	1.3721
103.56	39.76	1.3770
103.77	39.88	1.3818
103.97	39.99	1.3867
104.18	40.10	1.3916
104.38	40.21	1.3965
104.58	40.33	1.4014
104.78	40.44	1.4063
104.99	40.55	1.4111
105.19	40.66	1.4160
105.39	40.78	1.4209
105.59	40.89	1.4258
105.80	41.00	1.4307
105.99	41.11	1.4355
106.19	41.22	1.4404
106.39	41.33	1.4453
106.59	41.44	1.4502
106.79	41.55	1.4551
106.99	41.66	1.4600
107.19	41.78	1.4648
107.39	41.89	1.4697
107.59	42.00	1.4746
107.79	42.11	1.4795
107.99	42.22	1.4844
108.18	42.33	1.4893
108.38	42.44	1.4941
108.58	42.55	1.4990
108.78	42.66	1.5039
108.97	42.76	1.5088
109.17	42.88	1.5137
109.37	42.99	1.5186
109.56	43.09	1.5234
109.76	43.20	1.5283
109.95	43.31	1.5332
110.15	43.42	1.5381
110.34	43.53	1.5430
110.54	43.64	1.5479
110.73	43.74	1.5527
110.93	43.85	1.5576
111.12	43.96	1.5625
111.32	44.07	1.5674
111.51	44.18	1.5723
111.70	44.28	1.5771
111.90	44.39	1.5820
112.09	44.50	1.5869
112.28	44.60	1.5918
112.48	44.71	1.5967
112.67	44.82	1.6016
112.86	44.93	1.6064
113.06	45.04	1.6113
113.25	45.14	1.6162
113.44	45.25	1.6211
113.63	45.35	1.6260
113.82	45.46	1.6309
114.01	45.56	1.6357
114.20	45.67	1.6406
114.40	45.78	1.6455
114.59	45.89	1.6504
114.78	45.99	1.6553
114.97	46.10	1.6602
115.16	46.20	1.6650
115.35	46.31	1.6699
115.54	46.41	1.6748
115.73	46.52	1.6797
115.92	46.63	1.6846
116.11	46.73	1.6895
116.30	46.84	1.6943
116.49	46.94	1.6992
116.67	47.04	1.7041
116.86	47.15	1.7090
117.05	47.25	1.7139
117.24	47.36	1.7188
117.43	47.46	1.7236
117.62	47.57	1.7285
117.80	47.67	1.7334
117.99	47.78	1.7383
118.18	47.88	1.7432
118.37	47.99	1.7480
118.56	48.09	1.7529
118.74	48.19	1.7578
118.93	48.30	1.7627
119.12	48.40	1.7676
119.31	48.51	1.7725
119.49	48.61	1.7773
119.68	48.72	1.7822
119.87	48.82	1.7871
120.05	48.92	1.7920
120.24	49.03	1.7969
120.43	49.13	1.8018
120.61	49.23	1.8066
120.80	49.34	1.8115
120.98	49.44	1.8164
121.17	49.54	1.8213
121.35	49.64	1.8262
121.54	49.75	1.8311
121.72	49.85	1.8359
121.91	49.95	1.8408
122.10	50.06	1.8457
122.28	50.16	1.8506
122.47	50.27	1.8555
122.65	50.37	1.8604
122.84	50.47	1.8652
123.02	50.57	1.8701

TABLE 19 - OIL AND DISCHARGE TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
123.21	50.68	1.8750
123.39	50.78	1.8799
123.58	50.88	1.8848
123.76	50.98	1.8896
123.94	51.08	1.8945
124.13	51.19	1.8994
124.31	51.29	1.9043
124.50	51.39	1.9092
124.68	51.49	1.9141
124.86	51.59	1.9189
125.05	51.70	1.9238
125.23	51.80	1.9287
125.42	51.90	1.9336
125.60	52.00	1.9385
125.78	52.10	1.9434
125.97	52.21	1.9482
126.15	52.31	1.9531
126.33	52.41	1.9580
126.52	52.52	1.9629
126.70	52.62	1.9678
126.88	52.72	1.9727
127.07	52.82	1.9775
127.25	52.92	1.9824
127.43	53.02	1.9873
127.62	53.13	1.9922
127.80	53.23	1.9971
127.98	53.33	2.0020
128.17	53.43	2.0068
128.35	53.53	2.0117
128.53	53.63	2.0166
128.71	53.73	2.0215
128.90	53.84	2.0264
129.08	53.94	2.0313
129.26	54.04	2.0361
129.44	54.14	2.0410
129.63	54.24	2.0459
129.81	54.34	2.0508
129.99	54.44	2.0557
130.17	54.54	2.0605
130.36	54.65	2.0654
130.54	54.75	2.0703
130.72	54.85	2.0752
130.90	54.95	2.0801
131.09	55.05	2.0850
131.27	55.15	2.0898
131.45	55.25	2.0947
131.63	55.35	2.0996
131.82	55.46	2.1045
132.00	55.56	2.1094
132.18	55.66	2.1143
132.36	55.76	2.1191
132.54	55.86	2.1240
132.73	55.97	2.1289
132.91	56.07	2.1338
133.09	56.17	2.1387
133.27	56.27	2.1436
133.46	56.37	2.1484
133.64	56.47	2.1533
133.82	56.57	2.1582
134.00	56.67	2.1631
134.18	56.77	2.1680
134.37	56.88	2.1729
134.55	56.98	2.1777
134.73	57.08	2.1826
134.91	57.18	2.1875
135.09	57.28	2.1924
135.28	57.38	2.1973
135.46	57.48	2.2021
135.64	57.58	2.2070
135.82	57.68	2.2119
136.01	57.79	2.2168
136.19	57.89	2.2217
136.37	57.99	2.2266
136.55	58.09	2.2314
136.73	58.19	2.2363
136.92	58.29	2.2412
137.10	58.39	2.2461
137.28	58.49	2.2510
137.46	58.59	2.2559
137.65	58.70	2.2607
137.83	58.80	2.2656
138.01	58.90	2.2705
138.19	59.00	2.2754
138.37	59.10	2.2803
138.56	59.20	2.2852
138.74	59.30	2.2900
138.92	59.40	2.2949
139.11	59.51	2.2998
139.29	59.61	2.3047
139.47	59.71	2.3096
139.65	59.81	2.3145
139.84	59.92	2.3193
140.02	60.02	2.3242
140.20	60.12	2.3291
140.39	60.22	2.3340
140.57	60.32	2.3389
140.75	60.42	2.3438
140.94	60.53	2.3486
141.12	60.63	2.3535
141.30	60.73	2.3584
141.49	60.83	2.3633
141.67	60.93	2.3682
141.85	61.03	2.3730
142.04	61.14	2.3779
142.22	61.24	2.3828
142.40	61.34	2.3877
142.59	61.44	2.3926
142.77	61.54	2.3975
142.95	61.64	2.4023
143.14	61.75	2.4072
143.32	61.85	2.4121
143.51	61.95	2.4170
143.69	62.05	2.4219
143.87	62.15	2.4268
144.06	62.26	2.4316
144.24	62.36	2.4365
144.43	62.47	2.4414
144.61	62.57	2.4463
144.80	62.67	2.4512
144.98	62.77	2.4561
145.17	62.88	2.4609
145.35	62.98	2.4658
145.54	63.08	2.4707
145.72	63.18	2.4756
145.91	63.29	2.4805
146.09	63.39	2.4854
146.28	63.49	2.4902
146.46	63.59	2.4951
146.65	63.70	2.5000
146.84	63.81	2.5049
147.02	63.91	2.5098
147.21	64.01	2.5146
147.39	64.11	2.5195
147.58	64.22	2.5244
147.77	64.32	2.5293
147.95	64.42	2.5342
148.14	64.53	2.5391
148.32	64.63	2.5439
148.51	64.73	2.5488
148.70	64.84	2.5537
148.88	64.94	2.5586
149.07	65.04	2.5635
149.26	65.15	2.5684
149.45	65.26	2.5732
149.63	65.36	2.5781
149.82	65.46	2.5830
150.01	65.57	2.5879
150.20	65.67	2.5928
150.38	65.77	2.5977
150.57	65.88	2.6025
150.76	65.98	2.6074
150.95	66.09	2.6123
151.14	66.19	2.6172
151.33	66.30	2.6221
151.51	66.40	2.6270
151.70	66.51	2.6318
151.89	66.61	2.6367
152.08	66.72	2.6416
152.27	66.82	2.6465
152.46	66.93	2.6514
152.65	67.03	2.6563
152.84	67.14	2.6611
153.03	67.24	2.6660
153.22	67.35	2.6709
153.41	67.46	2.6758

TABLE 19 - OIL AND DISCHARGE TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
153.60	67.56	2.6807
153.79	67.67	2.6855
153.98	67.77	2.6904
154.17	67.88	2.6953
154.36	67.98	2.7002
154.55	68.09	2.7051
154.74	68.19	2.7100
154.94	68.31	2.7148
155.13	68.41	2.7197
155.32	68.52	2.7246
155.51	68.62	2.7295
155.70	68.73	2.7344
155.90	68.84	2.7393
156.09	68.94	2.7441
156.28	69.05	2.7490
156.47	69.16	2.7539
156.67	69.27	2.7588
156.86	69.37	2.7637
157.05	69.48	2.7686
157.25	69.59	2.7734
157.44	69.69	2.7783
157.64	69.81	2.7832
157.83	69.91	2.7881
158.02	70.02	2.7930
158.22	70.13	2.7979
158.41	70.23	2.8027
158.61	70.34	2.8076
158.80	70.45	2.8125
159.00	70.56	2.8174
159.19	70.67	2.8223
159.39	70.78	2.8271
159.59	70.89	2.8320
159.78	70.99	2.8369
159.98	71.11	2.8418
160.18	71.22	2.8467
160.37	71.32	2.8516
160.57	71.43	2.8564
160.77	71.54	2.8613
160.97	71.66	2.8662
161.16	71.76	2.8711
161.36	71.87	2.8760
161.56	71.98	2.8809
161.76	72.09	2.8857
161.96	72.21	2.8906
162.15	72.31	2.8955
162.35	72.42	2.9004
162.55	72.53	2.9053
162.75	72.64	2.9102
162.95	72.76	2.9150
163.15	72.87	2.9199
163.35	72.98	2.9248
163.55	73.09	2.9297
163.75	73.20	2.9346
163.96	73.32	2.9395
164.16	73.43	2.9443

TEMP (°F)	TEMP (°C)	VIN
164.36	73.54	2.9492
164.56	73.65	2.9541
164.76	73.76	2.9590
164.96	73.87	2.9639
165.17	73.99	2.9688
165.37	74.10	2.9736
165.57	74.21	2.9785
165.78	74.33	2.9834
165.98	74.44	2.9883
166.19	74.56	2.9932
166.39	74.67	2.9980
166.60	74.78	3.0029
166.80	74.89	3.0078
167.00	75.01	3.0127
167.21	75.12	3.0176
167.42	75.24	3.0225
167.62	75.35	3.0273
167.83	75.47	3.0322
168.04	75.58	3.0371
168.24	75.69	3.0420
168.45	75.81	3.0469
168.66	75.93	3.0518
168.87	76.04	3.0566
169.07	76.16	3.0615
169.28	76.27	3.0664
169.49	76.39	3.0713
169.70	76.51	3.0762
169.91	76.62	3.0811
170.12	76.74	3.0859
170.33	76.86	3.0908
170.54	76.97	3.0957
170.75	77.09	3.1006
170.96	77.21	3.1055
171.18	77.33	3.1104
171.39	77.45	3.1152
171.60	77.56	3.1201
171.81	77.68	3.1250
172.02	77.80	3.1299
172.24	77.92	3.1348
172.45	78.03	3.1396
172.66	78.15	3.1445
172.88	78.27	3.1494
173.10	78.40	3.1543
173.31	78.51	3.1592
173.53	78.63	3.1641
173.74	78.75	3.1689
173.96	78.87	3.1738
174.17	78.99	3.1787
174.39	79.11	3.1836
174.61	79.23	3.1885
174.83	79.36	3.1934
175.04	79.47	3.1982
175.26	79.60	3.2031
175.48	79.72	3.2080
175.70	79.84	3.2129

TEMP (°F)	TEMP (°C)	VIN
175.92	79.96	3.2178
176.14	80.08	3.2227
176.36	80.21	3.2275
176.58	80.33	3.2324
176.80	80.45	3.2373
177.02	80.57	3.2422
177.25	80.70	3.2471
177.47	80.82	3.2520
177.69	80.95	3.2568
177.91	81.07	3.2617
178.14	81.20	3.2666
178.36	81.32	3.2715
178.59	81.45	3.2764
178.81	81.57	3.2813
179.04	81.70	3.2861
179.26	81.82	3.2910
179.49	81.95	3.2959
179.72	82.07	3.3008
179.94	82.20	3.3057
180.17	82.32	3.3105
180.40	82.45	3.3154
180.63	82.58	3.3203
180.86	82.71	3.3252
181.09	82.83	3.3301
181.32	82.96	3.3350
181.55	83.09	3.3398
181.78	83.22	3.3447
182.01	83.35	3.3496
182.24	83.47	3.3545
182.48	83.61	3.3594
182.71	83.73	3.3643
182.94	83.86	3.3691
183.17	83.99	3.3740
183.41	84.12	3.3789
183.65	84.26	3.3838
183.88	84.38	3.3887
184.12	84.52	3.3936
184.36	84.65	3.3984
184.59	84.78	3.4033
184.83	84.91	3.4082
185.07	85.05	3.4131
185.31	85.18	3.4180
185.55	85.31	3.4229
185.79	85.45	3.4277
186.03	85.58	3.4326
186.27	85.71	3.4375
186.51	85.85	3.4424
186.75	85.98	3.4473
186.99	86.11	3.4521
187.24	86.25	3.4570
187.48	86.38	3.4619
187.73	86.52	3.4668
187.97	86.66	3.4717
188.22	86.80	3.4766
188.46	86.93	3.4814

TABLE 19 - OIL AND DISCHARGE TEMPERATURE (CONT'D)

TEMP (°F)	TEMP (°C)	VIN
188.71	87.07	3.4863
188.96	87.21	3.4912
189.21	87.35	3.4961
189.46	87.48	3.5010
189.71	87.62	3.5059
189.96	87.76	3.5107
190.21	87.90	3.5156
190.46	88.04	3.5205
190.71	88.18	3.5254
190.96	88.32	3.5303
191.22	88.46	3.5352
191.47	88.60	3.5400
191.73	88.75	3.5449
191.98	88.88	3.5498
192.23	89.02	3.5547
192.49	89.17	3.5596
192.75	89.31	3.5645
193.01	89.46	3.5693
193.27	89.60	3.5742
193.53	89.75	3.5791
193.79	89.89	3.5840
194.05	90.03	3.5889
194.31	90.18	3.5938
194.57	90.32	3.5986
194.84	90.47	3.6035
195.10	90.62	3.6084
195.37	90.77	3.6133
195.63	90.91	3.6182
195.90	91.06	3.6230
196.16	91.21	3.6279
196.43	91.36	3.6328
196.70	91.51	3.6377
196.97	91.66	3.6426
197.24	91.81	3.6475
197.51	91.96	3.6523
197.78	92.11	3.6572
198.06	92.26	3.6621
198.33	92.41	3.6670
198.61	92.57	3.6719
198.88	92.72	3.6768
199.15	92.87	3.6816
199.43	93.02	3.6865
199.71	93.18	3.6914
199.99	93.34	3.6963
200.27	93.49	3.7012
200.55	93.65	3.7061
200.83	93.80	3.7109
201.11	93.96	3.7158
201.39	94.11	3.7207
201.68	94.27	3.7256
201.97	94.44	3.7305
202.25	94.59	3.7354
202.54	94.75	3.7402
202.82	94.91	3.7451
203.11	95.07	3.7500
203.40	95.23	3.7549
203.69	95.39	3.7598
203.99	95.56	3.7646
204.28	95.72	3.7695
204.57	95.88	3.7744
204.86	96.04	3.7793
205.16	96.21	3.7842
205.46	96.37	3.7891
205.76	96.54	3.7939
206.05	96.70	3.7988
206.35	96.87	3.8037
206.65	97.04	3.8086
206.96	97.21	3.8135
207.26	97.37	3.8184
207.57	97.55	3.8232
207.87	97.71	3.8281
208.17	97.88	3.8330
208.48	98.05	3.8379
208.79	98.22	3.8428
209.10	98.40	3.8477
209.42	98.57	3.8525
209.73	98.75	3.8574
210.04	98.92	3.8623
210.35	99.09	3.8672
210.67	99.27	3.8721
210.99	99.45	3.8770
211.31	99.62	3.8818
211.62	99.80	3.8867
211.94	99.97	3.8916
212.27	100.16	3.8965
212.59	100.34	3.9014
212.92	100.52	3.9063
213.24	100.70	3.9111
213.57	100.88	3.9160
213.90	101.06	3.9209
214.23	101.25	3.9258
214.56	101.43	3.9307
214.89	101.61	3.9355
215.23	101.80	3.9404
215.56	101.99	3.9453
215.90	102.17	3.9502
216.24	102.36	3.9551
216.58	102.55	3.9600
216.92	102.74	3.9648
217.26	102.93	3.9697
217.60	103.12	3.9746
217.95	103.31	3.9795
218.30	103.51	3.9844
218.65	103.70	3.9893
219.00	103.90	3.9941
219.35	104.09	3.9990
219.70	104.29	4.0039
220.06	104.49	4.0088

TABLE 20 - DROP LEG REFRIGERANT SENSOR

TEMP (°F)	TEMP (°C)	VIN
0.01	-17.77	0.753
3.72	-15.71	0.831
7.21	-13.77	0.909
10.51	-11.94	0.987
13.65	-10.20	1.066
16.65	-8.53	1.144
19.56	-6.91	1.222
22.36	-5.36	1.300
25.09	-3.84	1.378
27.74	-2.37	1.456
30.34	-0.92	1.534
32.89	0.49	1.613
35.40	1.89	1.691
37.87	3.26	1.769
40.31	4.62	1.847
42.73	5.96	1.925
45.14	7.30	2.003
47.53	8.63	2.081
49.92	9.96	2.160
52.31	11.28	2.238
54.70	12.61	2.316
57.10	13.95	2.394
59.52	15.29	2.472
61.95	16.64	2.550
64.40	18.00	2.628
66.89	19.38	2.707
69.40	20.78	2.785
71.97	22.21	2.863
74.57	23.65	2.941
77.23	25.13	3.019
79.96	26.65	3.097
82.73	28.19	3.175
85.60	29.78	3.254
88.56	31.42	3.332
91.59	33.11	3.410
94.75	34.86	3.488
98.06	36.70	3.566
101.50	38.61	3.644
105.10	40.61	3.722
108.90	42.73	3.801
112.92	44.96	3.879
117.17	47.32	3.957
121.76	49.87	4.035

TABLE 21 - EVAPORATOR REFRIGERANT SENSOR

TEMP (°F)	TEMP (°C)	VIN
0.04	-17.76	1.135
2.79	-16.23	1.214
5.44	-14.76	1.292
8.02	-13.32	1.370
10.53	-11.93	1.448
12.98	-10.57	1.526
15.39	-9.23	1.604
17.75	-7.92	1.683
20.08	-6.62	1.761
22.38	-5.34	1.839
24.66	-4.08	1.917
26.92	-2.82	1.995
29.17	-1.57	2.073
31.41	-0.33	2.151
33.66	0.92	2.230
35.90	2.17	2.308
38.15	3.42	2.386
40.41	4.67	2.464
42.69	5.94	2.542
44.99	7.72	2.620
47.31	8.51	2.698
49.67	9.82	2.777
52.06	11.15	2.855
54.49	12.50	2.933
56.96	13.87	3.011
59.50	15.28	3.089
62.10	16.72	3.167
64.77	18.21	3.245
67.51	19.73	3.324
70.35	21.31	3.402
73.29	22.94	3.480
76.36	24.65	3.558
79.55	26.42	3.636
82.89	28.27	3.714
86.41	30.23	3.792
90.12	32.29	3.871
94.07	34.49	3.949
98.31	36.84	4.027
102.87	39.38	4.105
107.81	42.12	4.183
113.26	45.15	4.261
119.30	48.50	4.339
126.10	52.28	4.418

TABLE 22 - LEAVING AND RETURN HEATING CONDENSER WATER TEMPERATURE SENSOR

TEMP (°F)	TEMP (°C)	VIN
32.63	0.35	1.713
37.47	3.03	1.870
42.23	5.68	2.026
46.96	9.97	2.182
51.68	10.93	2.338
56.44	13.57	2.495
61.28	16.26	2.651
66.23	19.01	2.807
71.36	21.86	2.963
76.70	24.61	3.120
82.32	27.955	3.276
88.31	31.28	3.432
94.74	34.85	3.588
101.8	38.77	3.745
109.6	43.11	3.901
118.5	48.05	4.057
128.9	53.83	4.213
141.7	60.94	4.370
158.2	70.11	4.526

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SECTION 22 - REMOTE SETPOINTS

REMOTE OPERATING MODES

There are three different Remote operating Modes that can be selected at the keypad: Analog Remote Mode, Digital Remote Mode or ISN(BAS) Remote Mode.

The OptiView Control Center can receive a Remote Current Limit and/or a Remote Leaving Chilled Liquid Temperature setpoint via the following:

Analog Remote Mode

Analog Remote Mode has the following Analog Inputs:

- 0 to 10 VDC Analog Input
- 2 to 10 VDC Analog Input
- 0 to 20mA Analog Input
- 4 to 20mA Analog Input

When equipped with software version C.OPT.01.18.307 (or later), software filtering is applied to these inputs. This stabilizes the remote setpoint values under electrical noise conditions and when the inputs are unstable.

The Analog Inputs are connected to the microboard J22 as shown in *Figure 15 on page 47* and described below. Microboard Program Jumpers JP23 and JP24 must be positioned appropriately to receive either a 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or a 4 to 20mA signal. Refer to Microboard Program Jumpers and explanation below for required configurations.

Digital Remote Mode

Digital Remote Mode has a Pulse Width Modulation (PWM) Input.

The PWM inputs are in the form of a 1 to 11 second re-lay contact closure that applies 115 VAC to the I/O Board TB4-19 (Leaving Chilled Liquid Temp) and TB4-20 (Remote Current Limit) for 1 to 11 seconds. See *Figure 34 on page 102*. The source of 115 VAC is I/O Board TB4-1. The PWM input must be received at a frequency of at least once every 30 minutes. If not received within this time interval, the Program assumes the remote de-vice is defective and defaults the Current Limit setpoint to 100% and the Leaving Chilled Liquid Temperature setpoint to the locally programmed Local BASE value.

ISN(BAS) Remote Mode

ISN Remote Mode uses RS-232 serial port via E-Link Gateway.

The Analog Inputs are connected to the microboard J22 as shown in *Figure 30 on page 94* and described below. Microboard Program Jumpers JP23 and JP24 must be positioned appropriately to receive either a 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA or a 4 to 20mA signal. Refer to Microboard Program Jumpers and explanation below for required configurations.

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The PWM inputs are in the form of a 1 to 11 second relay contact closure that applies 115 VAC to the I/O Board TB4-19 (Leaving Chilled Liquid Temp) and TB4-20 (Remote Current Limit) for 1 to 11 seconds. See *Figure 34 on page 102*. The source of 115 VAC is I/O Board TB4-1. The PWM input must be received at a frequency of at least once every 30 minutes. If not received within this time interval, the Program assumes the remote device is defective and defaults the Current Limit setpoint to 100% and the Leaving Chilled Liquid Temperature setpoint to the locally programmed Local **BASE** value.

The microboard COM 4B RS-232 (J2) receives the setpoints in serial data form from the E-Link Gateway located inside the OptiView Control Center enclosure. The E-Link Gateway receives setpoints from remote external devices and transfers them to the microboard.

CURRENT LIMIT

Remote Current Limit setpoint with 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA, 4 to 20mA or Pulse Width Modulation Signal – The Remote Current Limit setpoint can be reset over the range of 100% to 30% Full Load Amps (FLA) by supplying (by others) a 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA, 4 to 20mA or 1 to 11 second Pulse Width Modulated (PWM) signal to the OptiView Control Center. The OptiView Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate remote mode must be selected: analog remote mode must be selected when using a voltage or current signal input. Digital Remote Mode must be selected when using a PWM input.

- If Analog Remote Mode is selected, the Remote Analog Input Range setpoint must be set to 0 to 10 VDC or 2 to 10 VDC as detailed below, regardless of whether the signal is a voltage or current input signal type.
- Microboard Program Jumper JP23 must be positioned appropriately per the input signal type as detailed below. It is recommended that a qualified Service technician position this jumper.

NOTE

IMPORTANT! - The signal type used for Remote Current Limit setpoint reset and the signal type used for Remote Leaving Chilled Liquid Temperature setpoint reset must be the same. For example, if a 0 to 10 VDC signal is being used for Remote Leaving Chilled Liquid Temperature Reset, then a 0 to 10 VDC signal must be used for Remote Current Limit Reset.

0 to 10 VDC

As shown in *Figure 30 on page 94*, connect input to Microboard J22-1 (signal) and J22-5 (GND). The setpoint varies linearly from 100% to 30% FLA as the input varies from 0 to l0 VDC. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 0 to 10 VDC and Microboard Program Jumper JP23 has been removed. Calculate the setpoint for various inputs as follows:

Setpoint (%) = 100 – (VDC x 7)

For example, if the input is 5 VDC, the setpoint would be set to 65% as follows:

Setpoint (%) = 100 – (5 x 7)
= 100 – 35
= 65%

2 to 10 VDC

As shown in *Figure 30 on page 94*, connect input to Microboard J22-1 (signal) and J22-5 (GND). The setpoint varies linearly from 100% to 30% FLA as the input varies from 2 to 10 VDC. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 2 to 10 VDC and Microboard Program Jumper JP23 has been removed. Calculate the setpoint for various inputs as follows:

Setpoint (%) = 100 – [(VDC – 2) x 8.75]

For example, if the input is 5 VDC, the setpoint would be set to 74% as follows:

Setpoint (%) = 100 – [(5 - 2) x 8.75]
= 100 – [3 x 8.75]
= 100 – 26.25
= 74%

0 to 20mA

As shown in *Figure 30 on page 94*, connect input to Microboard J22-2 (signal) and J22-5 (GND). The setpoint varies linearly from 100% to 30% FLA as the input varies from 0mA to 20mA. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 0 to 10 VDC and Microboard Program Jumper JP23 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

Setpoint (%) = 100 – (mA x 3.5)

For example, if the input is 8mA, the setpoint would be set to 72% as follows:

Setpoint (%) = 100 – (8 x 3.5)
= 100 – 28
= 72%

4 to 20mA

As shown in *Figure 30 on page 94*, connect input to Microboard J22-2 (signal) and J22-5 (GND). The setpoint varies linearly from 100% to 30% FLA as the input varies from 4mA to 20mA. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 2 to 10 VDC and Microboard Program Jumper JP23 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

Setpoint (%) = 100 – [(mA – 4) x 4.3 75]

For example, if the input is 8mA, the setpoint would be set to 83% as follows:

Setpoint (%) = 100 – [(8–4) x 4.375]
= 100 – (4 x 4.375)
= 100 – 17.5
= 82.5
= 83%

PWM

The Pulse Width Modulation input is in the form of a 1 to 11 second relay contact closure that applies 115 VAC to the I/O Board TB4-20 for 1 to 11 seconds. As shown in *Figure 34 on page 102*, connect dry closure relay contacts between I/O Board TB4-20 (signal) and TB4-l (115 VAC). The setpoint varies linearly from 100% to 30% as the relay contact closure time changes from 1 to 11 seconds. The relay contacts should close for 1 to 11 seconds at least once every 30 minutes to maintain the setpoint to the desired value. If a 1 to 11 second closure is not received within 30 minutes of the last closure, the setpoint is defaulted to 100%. A closure is only accepted at rates not to exceed once every 70 seconds. This input will only be accepted in Digital Remote Mode. Calculate the setpoint for various pulse widths as follows:

Setpoint (%) = 100 – [(pulse width in seconds – 1) x 7]

For example, if the relay contacts close for 3 seconds, the setpoint would be set to 86% as follows:

Setpoint (%) = 100 – [(3 –1) x 7]
= 100 – (2 x 7)
= 100 – 14
= 86%

RS-232

As shown in *Figure 29 on page 93*, a setpoint can be received in serial data form at Microboard J2 from the E-Link.

LEAVING CHILLED LIQUID TEMPERATURE

Remote Leaving Chilled Liquid Temperature setpoint with 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA, 4 to 20mA or Pulse Width Modulation Signal – Remote Leaving Chilled Liquid Temperature setpoint reset can be accomplished by supplying (by others) a 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA, 4 to 20mA or 1 to 11 second Pulse Width Modulated (PWM) signal to the OptiView Control Center. The Leaving Chilled Liquid Temperature setpoint is programmable over any of the following ranges:

- 38°F to 70°F (water applications)
- 36°F to 70°F (water applications with Smart Freeze protection enabled)
- 10°F to 70°F (brine applications)

The Remote Input Signal changes the setpoint by creating an offset above the locally programmed Leaving Chilled Liquid Temperature Base setpoint value. The setpoint can be remotely changed over the range of the value programmed for the Remote Reset Temperature Range setpoint (10, 20, 30, or 40°F with Software version C.OPT.01.18.307 (or later); 10 or 20°F with earlier software versions).

For example, if the Local setpoint is 40°F and the Remote Reset Temperature Range setpoint is programmed for 10°F, the Leaving Chilled Liquid Temperature setpoint can be remotely reset over the range of 40°F to 50°F. The setpoint received through the COM 4B RS-232 serial port is not an offset that is applied to the locally programmed "base" value as described above. Rather, it is an actual setpoint value. The locally programmed value is not used as a "base" in this application.

The OptiView Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate Remote Mode must be selected:
  a. Analog Remote Mode must be selected when using a voltage or current signal input.
  b. Digital Remote Mode must be selected when using a PWM input.
- If Analog Remote Mode is selected, the Remote Analog Input Range setpoint must be set to 0 to 10 VDC or 2 to 10 VDC as detailed below, regardless of whether the signal is a voltage or current signal type.
- Microboard Program Jumper JP24 must be positioned appropriately per the input signal type as detailed below. It is recommended a qualified Service technician position this jumper.

NOTE

IMPORTANT! - The signal type used for Remote Leaving Chilled Liquid Temperature setpoint reset and the signal type used for Remote Current Limit setpoint reset must be the same. For example, if a 0 to 10 VDC signal is being used for Remote Current Limit setpoint reset, then a 0 to 10 VDC signal must be used for Leaving Chilled Liquid Temperature reset.

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0 to 10 VDC

As shown in *Figure 30 on page 94*, connect input to Microboard J22-3 (signal) and J22-5 (GND). A 0 VDC signal produces a 0°F offset. A 10 VDC signal produces the maximum offset above the Local setpoint value (as allowed by the Remote Reset Temperature Range setpoint). The setpoint is changed linearly between these extremes as the input varies linearly over the range of 0 VDC to 10 VDC. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 0 to 10 VDC and Microboard Program Jumper JP24 has been removed. Calculate the setpoint for various inputs as follows:

$$\text{Offset (°F)} = \frac{(\ \text{VDC})(\text{Remote Reset Temp Range})}{10}$$

Setpoint (°F) = Local Setpoint + Offset

For example, if the input is 5 VDC and the Remote Reset Temperature Range setpoint is programmed for 10°F and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F, the setpoint would be set to 45°F as follows:

$$\text{Offset (°F)} = \frac{5 \text{ x } 10}{10} = \frac{50}{10} = 5\text{°F}$$

$$\text{Setpoint} = 40 + 5 = 45\text{°F}$$

2 to 10 VDC

As shown in *Figure 30 on page 94*, connect input to Microboard J22-3 (signal) and J2-5 (GND). A 2 VDC signal produces a 0°F offset. A 10 VDC signal produces the maximum allowed offset above the Local Setpoint value (as allowed by the Remote Reset Temperature Range setpoint). The setpoint is changed linearly between these extremes as the input varies over the range of 2 VDC to 10 VDC. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 2 to 10 VDC and the microboard Program Jumper JP24 has been removed. Calculate the setpoint for various inputs as follows:

$$\text{Offset (°F)} = \frac{(\ \text{VDC} - 2)(\text{Remote Reset Temp Range})}{8}$$

Setpoint (°F) = Local Setpoint + Offset

For example, if the input is 5 VDC and the Remote Reset Temperature Range setpoint is programmed for 10°F and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F, the setpoint would be set to 43.8°F.

$$\text{Offset (°F)} = \frac{(5 - 2)(10)}{8} = \frac{(3)(10)}{8} = \frac{30}{8} = 3.8\text{°F}$$

$$\text{Setpoint (°F)} = 40 + 3.8 = 43.8\text{°F}$$

0 to 20mA

As shown in *Figure 30 on page 94*, connect input to Microboard J22-4 (signal) and J22-5 (GND). A 0mA signal produces a 0°F offset. A 20mA signal produces the maximum allowed offset above the Local setpoint value (as allowed by the Remote Reset Temperature Range setpoint). The setpoint is changed linearly between these extremes as the input varies over the range of 0 to 20mA. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 0 to 10 VDC and Microboard Program Jumper J24 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

$$\frac{\text{Offset (°F)} = (\text{mA})(\text{Remote Reset Temp Range})}{20}$$

Setpoint (°F) = Local Setpoint + Offset

For example, if the input is 8mA, the Remote Reset Temperature Range setpoint is programmed for 10°F and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F, the setpoint would be set to 44°F as follows:

$$\text{Offset (°F)} = \frac{(8)(10)}{20} = \frac{80}{20} = 4\text{°F}$$

$$\text{Setpoint (°F)} = 40 + 4 = 44\text{°F}$$

4 to 20mA

As shown in *Figure 30 on page 94*, connect input to Microboard J22-4 (signal) and J22-5 (GND). A 4mA signal produces a 0°F offset. A 20mA signal produces the maximum allowed offset above the Local Setpoint value (as allowed by the Remote Reset Temperature Range setpoint). The setpoint is changed linearly between these extremes as the input varies over the range of 4 to 20mA. This input will only be accepted when Analog Remote Mode is selected, the Remote Analog Input Range setpoint is set for 2 to 10 VDC and Microboard Program Jumper JP24 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

$$\text{Offset (°F)} = \frac{\text{(mA–4)(Remote Reset Temp Range)}}{16}$$

$$\text{Setpoint (°F)} = \text{Local Setpoint} + \text{Offset}$$

For example, if the input is 8mA, and the Remote Reset Temperature Range setpoint is programmed for 10°F and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F, the setpoint would be set to 42.5°F as follows:

$$\text{Offset (°F)} = \frac{(8-4)(10)}{16} = \frac{(4)(10)}{16} = \frac{40}{16} = 2.5\text{°F}$$

$$\text{Setpoint (°F)} = 40 + 2.5 = 42.5$$

PWM

The Pulse Width Modulation input is in the form of a 1 to 11 second relay contact closure that applies 115 VAC to the I/O Board TB4-19 for 1 to 11 seconds. As shown in *Figure 34 on page 102*, connect dry closure relay contacts between I/O Board TB4-19 (input) and TB4-1 (115 VAC). A contact closure time (pulse width) of 1 second produces a 0°F offset. An 11 second closure produces the maximum allowed offset above the Local Setpoint value (as allowed by the Remote Reset Temperature Range setpoint). The relay contacts should close for 1 to 11 seconds at least once every 30 minutes to maintain the setpoint to the desired value. If a 1 to 11 second closure is not received within 30 minutes of the last closure, the setpoint is defaulted to the Local setpoint value. A closure is only accepted at rates not to exceed once every 70 seconds. This input will only be accepted in Digital Remote Mode. Calculate the setpoint for various pulse widths as follows:

$$\text{Offset (°F)} = \frac{\text{(pulse width in seconds – 1)(Remote Reset Temp Range)}}{10}$$

$$\text{Setpoint (°F)} = \text{Local Setpoint} + \text{Offset}$$

For example, if the relay contacts close for 5 seconds and the Remote Reset Temperature Range setpoint is programmed to 10°F and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F, the setpoint would be set to 44°F as follows:

$$\text{Offset (°F)} = \frac{(5-1)(10)}{10} = \frac{(4)(10)}{10} = \frac{40}{10} = 4\text{°F}$$

$$\text{Setpoint (°F)} = 40 + 4 = 44\text{°F}$$

RS-232

As shown in *Figure 29 on page 93*, a setpoint can be received in serial data form at the microboard COM 4B serial port (J2) from the E-Link Gateway.

LEAVING CONDENSER LIQUID TEMPERATURE (HEAT PUMP MODE)

(Software version C.OPT.01.23.307 (and later))

Heat Pump is an available option for certain models of YK chillers. On a Heat Pump equipped chiller, with Heat Pump Duty enabled, the chiller control can be switched between Cooling and Heating Mode using the Heat Pump Operational setpoint. In Cooling Mode, the chiller controls the Leaving Chilled Liquid to the leaving Chilled Liquid Temperature setpoint. In Heating Mode, the chiller controls the Leaving Condenser Liquid Temperature to the Leaving Condenser Liquid Temperature setpoint. These two setpoints share a single remote input that resets the appropriate setpoint based on the Heat Pump Operational Mode. When in Cooling Mode, the signal on this input sets the Leaving Chilled Liquid Temperature setpoint. When in Heating Mode, this signal sets the Leaving Condenser Liquid Temperature setpoint.

The Cooling Mode remote reset of the Leaving Chilled Liquid Temperature setpoint is explained under "Leaving Chilled Liquid Temperature" above.

The Heating Mode remote reset of the Leaving Condenser Liquid Temperature setpoint can be accomplished by supplying (by others) a 0 to 10 VDC, 2 to 10 VDC, 0 to 20mA, 4 to 20mA or a Pulse Width modulated (PWM) signal to the same inputs as used for the Leaving Chilled Liquid Temperature setpoint inputs as explained above. The Leaving Condenser Liquid Temperature setpoint is programmable over the range of 65°F to 122°F. The remote input signal changes the setpoint by creating an offset "below" the locally programmed Leaving Condenser Liquid setpoint value. The setpoint can be remotely changed over the range of the value programmed for the Leaving Condenser Liquid Remote Reset Temperature Range (10, 20, 30, or 40°F). The remote setpoint received through the COM4B RS-232 serial port is not an offset that is applied to the Local Setpoint. Rather, it's an actual setpoint value.

The OptiView Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate Remote Mode must be selected:
    1. Analog Remote Mode must be selected when using a voltage or current signal input.
    2. Digital Remote Mode must be selected when using a PWM input. ISN must be selected when using a serial communications input.
- If Analog Remote Mode is selected, the Remote Analog Input Range setpoint must be set to 0 to 10 VDC or 2 to 10 VDC as detailed below, regardless of the whether the signal is a voltage or current signal type.
- The Remote Reset Temperature Range in the following descriptions is the Leaving Condenser Remote Reset Range.

0 to 10 VDC

As shown in *Figure 30 on page 94*, the input is connected to Microboard J22-3 (signal) and J22-5 (GND). A 0 VDC signal produces a 0 VDC offset. A 10 VDC signal produces the maximum offset below the Local Setpoint value (as allowed by the Remote Reset Temperature Range setpoint). Select Analog Remote Mode. The Remote Analog Input Range setpoint must be set to 0 to 10 VDC and Microboard JP24 must be removed. The setpoint is calculated as follows:

$$\text{Offset (°F)} = \frac{(\ \text{VDC})(\text{Remote Reset Temp Range})}{10}$$

Setpoint (°F) = Local Setpoint – Offset

2 to 10 VDC

As shown in *Figure 30 on page 94*, the input is connected to Microboard J22-3 (signal) and J2-5 (GND). A 2 VDC signal produces a 0°F offset. A 10 VDC signal produces the maximum allowed offset below the Local setpoint value (as allowed by the Remote Reset Temperature Range setpoint). Select Analog Remote Mode. The Remote Analog Input Range setpoint must be set to 2 to 10 VDC and Microboard JP24 must be removed. The setpoint is calculated as follows:

$$\text{Offset (°F)} = \frac{(\ \text{VDC-2})(\text{Remote Reset Temp Range}}{8}$$

Setpoint (°F) = Local Setpoint – Offset

0 to 20mA

As shown in *Figure 30 on page 94*, the input is connected to Microboard J22-4 (signal) and J22-5 (GND). A 0mA signal produces a 0°F offset. A 20mA signal produces the maximum allowed offset below the Local setpoint value (as allowed by the Remote Reset Temperature Range setpoint). Select Analog Remote Mode. The Remote Analog Input Range setpoint must be set to 0 to 10 VDC and Microboard JP24 must be placed on pins 1 and 2. The setpoint is calculated as follows:

$$\text{Offset (°F)} = \frac{(\text{mA})(\text{Remote Reset Temp Range})}{20}$$

Setpoint (°F) = Local Setpoint – Offset

4 to 20mA

As shown in *Figure 30 on page 94*, the input is connected to Microboard J22-4 (signal) and J22-5 (GND). A 4mA signal produces a 0°F offset. A 20mA signal produces the maximum allowed offset below the Local Setpoint value (as allowed by the Remote Reset Temperature Range setpoint). Select Analog Remote Mode. The Remote Analog Input Range setpoint must be set to 2 to 10 VDC and Microboard JP24 must be placed on pins 1 and 2. The setpoint is calculated as follows:

$$\text{Offset (°F)} = \frac{\text{(mA-4)(Remote Reset Temp Range)}}{16}$$

Setpoint(°F) = Local Setpoint – Offset

PWM

The Pulse Width Modulation input is in the form of a 1 to 11 second relay contact closure that applies 115 VAC to the I/O Board TB4-19 for 1 to 11 seconds. As shown in *Figure 34 on page 102*, connect dry closure contacts between I/O Board TB4-19 (signal) to TB4-1 (115 VAC). A 1 second closure produces a 0°F offset. An 11 second closure produces the maximum allowed offset above the Local Setpoint (as allowed by the Remote Reset Temperature Range setpoint). Select Digital Remote Mode. The relay contact closure should occur at least once every 30 minutes to maintain the setpoint to the desired value. If a contact closure is not received within 30 minutes of the last closure, the setpoint is defaulted to the Local setpoint value. A closure is only accepted at rates not to exceed once every 70 seconds. The setpoint is calculated as follows:

$$\text{Offset(°F)} = \frac{\text{(PW – 1)(Remote Reset Temp Range)}}{10}$$

Where PW = Pulse Width in seconds

Setpoint (°F) = Local Setpoint - Offset

RS-232

As shown in *Figure 29 on page 93*, a setpoint can be received in serial form at the microboard COM4B serial port (J2) from the E-Link Gateway. Select ISN Remote Mode.

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SECTION 23 - HOT GAS BYPASS

With the optional hot gas bypass feature, the control center modulates a valve located in the hot gas bypass connection between the condenser and the evaporator to control the flow of gas to the evaporator. The valve is modulated in response to load and surging conditions.

A hot gas bypass Screen, accessed from the COMPRESSOR Screen displays all the applicable parameters and allows a Service technician to program the applicable s and manually control the Hot gas valve. If the chiller is equipped with the optional Hot gas bypass Control, it must be enabled from the OPERATIONS Screen using a procedure in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. If disabled, the valve is driven to the fully closed position.

The microboard controls the hot gas valve by sending a positioning command over the COM3 RS-485 serial communications link to the optional I/O Board that is mounted inside the Control Center. This board converts the command into the appropriate signal to control the valve as explained later in this section. The valve position is displayed on the Hot gas bypass Screen as 0% (closed) to 100% (fully open).

A potentiometer mounted on the Pre-rotation Vanes provides PRV position for this feature, as explained later in this section). It is displayed on the hot gas bypass screen as 0% (closed) to 100% (fully open).

The evaporator and condenser pressure transducers provide these pressure values to the microboard. The microboard uses these values to calculate the Delta P/P parameter as follows:

$$\frac{\text{Condenser Pressure - Evaporator Pressure}}{\text{Evaporator Pressure}}$$

Although this parameter is not used in the Hot gas Control, it represents compressor "Head" and is displayed on the Hot gas bypass Screen for reference only. These pressures are also used to detect when a surge occurs.

The hot gas valve is modulated in response to certain load conditions and surge events as described below under Operations. The load conditions are represented by the value "Temperature Differential (Leaving Chilled Liquid Temperature minus setpoint)" on the hot gas screen. The surge events it reacts to are detected by the surge protection feature (See *SECTION 25 - SURGE PROTECTION*). For reference, surge detect indicators and the total surge count are displayed on the Hot gas Screen as follows.

Each time a surge is detected, the Surge Avoidance Surge Detected indicator illuminates momentarily (if equipped with a VSD or MV VSD, this feature only detects surges while the drive is running at maximum frequency) (If equipped with software version C.OPT.01.18.307 or earlier, the indicator is labeled Surge Detected and it illuminates whenever a surge is detected, regardless of VSD operating frequency.

If equipped with a VSD (in Modbus Protocol configuration) or a MV VSD, the ACC Surge Detected indicator illuminates momentarily when a surge is detected by the ACC function in the microboard, while the drive is running at less than maximum frequency. Software version C.OPT.01.18.307 or earlier does not have this indicator. The Surge Avoidance Surge Count (displayed as "Total Surge Count" in software version C.OPT.01.18.307 (and earlier)) is the total number of surges detected by the Surge Protection feature (if equipped with a VSD or MV VSD, this feature only detects surges while the drive is running at maximum frequency).

SETPOINTS

Hot gas bypass setpoints are as follows:

- **Surge Sensitivity** (0.3 to 1.3; default 0.3) – Determines the surge detection sensitivity. The smaller the number, the greater the sensitivity. Programmable in 0.1 increments. This setpoint is programmed on the SURGE PROTECTION Screen and is common to the Surge Protection feature.
- **Hold Period** (30 to 120 minutes; default 30) – This is the period of time after no more surges are detected that the Hot gas valve closing will begin. It will be driven toward the closed position in increments equal to the Close Percentage setpoint at 10 minute intervals until fully closed. Programmable in 1 minute increments.
- **Close Percentage** (5 to 15%; default 5%) – This is the incremental amount that the Hot gas valve will be closed at 10 minute intervals after the Hold Period has elapsed. See *Hold Period* above.

- **Minimum Load** (0°F to 4°F; default 0°F) – This sets the Minimum Load override threshold. It is the offset below the Leaving Chilled Liquid Temperature Setpoint at which the Hot gas bypass Valve will be opened to the position allowed per the Maximum Open setpoint (25% to 100%). With Heat Pump Duty enabled and operating in Heating Mode, it is the offset above the Leaving Condenser Liquid Temperature setpoint that the valve will be opened. If "0" is entered for this value, this feature is disabled.
- **Max**imum **Open** (25% to 100%; default 100%) – This is the maximum allowed position for the Hot gas valve during a Minimum Load override condition. Allows the user to adjust the quantity of Hot gas for the local requirements.

OPERATION

While the chiller is shutdown, the Hot gas valve is driven to the fully closed position. While the chiller is running, the valve is modulated in response to low load, high load or surge conditions. However, manual control can override this operation.

In standard operation or with Heat Pump Duty enabled and operating in Cooling Mode, if the Leaving Chilled Liquid Temperature decreases to less than the Minimum Load setpoint, the valve is opened to the maximum allowed by the Maximum Open setpoint and MINIMUM LOAD (OVERRIDE in software version C.OPT.01.18.307 (and earlier)) is displayed as the Hot gas bypass Control Mode on the Hot gas bypass Screen. For example, if the Minimum Load is set for 4°F and the Maximum Open is set for 80%, the valve will be positioned to 80% open when the Leaving Chilled Liquid Temperature decreases to more than 4°F below the Leaving Chilled Liquid Temperature setpoint. After this Minimum Load Override is initiated, as the Leaving Chilled Liquid Temperature rises to the Leaving Chilled Liquid Temperature setpoint, the valve is closed by an amount proportional to the difference between the temperature delta and the Minimum Load setpoint. In this example, when the Leaving Chilled Liquid Temperature increases to 2°F below the Leaving Chilled Liquid Temperature setpoint, the valve will be positioned to 40% open. The valve is closed accordingly until the temperature delta is 0°F.

If Heat Pump Duty is enabled, the Hot gas operates as it does in a standard YK chiller without Heat Pump ability. However, in Heating Mode, Hot gas operation is the same as Cooling Mode except for the operation during low load conditions, which is as follows.

When the Leaving Condenser Liquid Temperature exceeds the Minimum Load setpoint (1 to 4°F above the Leaving Condenser Liquid Temperature Setpoint) the Hot gas valve is opened to the position allowed per the Maximum Open setpoint (25 to 100%). For example, if the Minimum Load setpoint equals 4°F, Maximum Open setpoint equals 100%, Heating setpoint equals 105°F, and leaving Condenser Liquid Temperature is greater than 109°F, the Hot gas valve would be opened to the 100% position. When the leaving Condenser Liquid Temperature falls to 107°F, the valve closes to 50% and finally to 0% when this temperature falls back to 105°F. All other aspects of Hot gas control remain unchanged in Heating Mode.

If the Pre-rotation Vanes are more than 95% open and the Leaving Chilled Liquid Temperature is at least 5°F above the Leaving Chilled Liquid Temperature setpoint, the valve is set to one-half of its present position for 10 minutes. After the 10 minutes have elapsed, the valve is driven fully closed.

With software version C.OPT.01.18.307 (and earlier), if the chiller is equipped with a Variable Speed Drive (VSD), whenever the VSD is running at less than full speed (50/60Hz), the Hot gas bypass Valve is driven to the fully closed position and OVERRIDE is displayed as the Hot gas bypass Control Mode.

If none of the above conditions are in effect, the Hot gas bypass Valve is driven to the fully closed position, until a surge condition is detected. When a surge is detected, the Hot gas valve is opened a certain percentage every few minutes until the surging stops or the valve is fully opened as follows:

- If Hot gas valve is fully closed, it is driven to the 50% position. There will be no valve response to surge events for the next 5 minutes.
- If Hot gas valve position is less than 35%, it is driven to the 50% position. There will be no valve response to surge events for the next 3.5 minutes.
- If Hot gas valve position is greater than 35% but less than 50%, it is driven to the 50% position. There will be no valve response to surge events in the next 2 minutes.
- If Hot gas valve position is greater than 50%, it is driven open another 10%. There will be no valve response to surge events in the next 2 minutes.

After the chiller has not surged for the period of time programmed as the Hold Period setpoint, the valve is driven toward the closed position at 10 minute intervals by incremental amounts determined by the Close Percentage setpoint. After it is fully closed, it remains there until another surge is detected.

Whenever the Hot gas valve is partially or fully open, the existing safety check that subtracts the evaporator saturation temperature from the leaving chilled liquid temperature changes the range from standard range of (-2.5°F to +25°F) to (-5.0°F to +25°F). Whenever the Hot gas bypass Valve is closed or not used, this safety check uses the standard values.

If RS-485 serial communications between the microboard and the Analog I/O Board are lost continuously for 20 seconds, WARNING – EXTERNAL I/O – SERIAL COMMUNICATIONS is displayed on the System Details line of the Display and the Hot gas valve will remain at the position when communications were lost.

HOT GAS OPERATION WITH VARIABLE GEOMETRY DIFFUSER (VGD)

Since the VGD operates by pulsing the diffuser ring open until stall is detected, there are some conditions where this probing can actually cause a surge. Therefore, to eliminate unnecessary Hot gas valve movement, the Hot gas valve is not opened on the first surge or when the VGD is closing. When a surge is detected, the Hot gas valve will not be opened until a second surge is detected. This gives the VGD a chance to close and stabilize the chiller without opening the Hot gas valve. While the VGD operation is inhibiting Hot gas operation, VGD OVERRIDE (OVERRIDE in software version C.OPT.01.18.307 (and earlier)) is displayed as the Hot gas Control Mode.

Whenever the Hot gas valve is not closed, the VGD is maintained at the last position. This keeps the VGD at a position of similar surge stability when the system head is later lowered and the Hot gas valve closes.

MANUAL CONTROL

The Hot gas bypass Valve can be manually controlled from the Hot gas bypass Screen in SERVICE access level. Manual control has priority over Minimum Load Override, Variable Speed Drive Override and Automatic Control.

When the OPEN or CLOSE key is pressed, the valve position will be increased or decreased by 5% to a maximum of 100% or minimum of 0%. Each time either key is pressed, the LED in the respective key will illuminate for 2 seconds. The Hot gas bypass Control Mode will display MANUAL.

I/O BOARD

The I/O Board supplied for Hot gas bypass applications is mounted on the right hand wall inside the Control Center. This board receives a Hot gas bypass Valve position command via RS-485 serial communications from the microboard COM3 port. It converts this command into a 0 to 10 VDC signal that is applied to the valve. This signal positions the valve over the range of 0% (fully closed) to 100% (fully open). Positions between these extremes are linearly scaled (a 50% position would be achieved with a 5 VDC signal).

There are two different I/O Boards that could be present for Hot gas bypass Control. Early vintage chillers use Analog I/O Board 371-02514-000. After June 2009, I/O Board 031-02895-000 is used (See *SECTION 24 - SMART FREEZE PROTECTION*; Microboard 031-02430-001 equipped with software version C.OPT.01.21.307 or later is required). Since these boards use different protocols, the microboard must know which board is present in order to be able to communicate with it. The microboard determines which board is present by the features that are enabled:

- If Heat Recovery and/or or Head Pressure control is enabled, it knows the 031-02895-000 board is present and only the 031-02895-000 board is polled.
- If only Hot gas bypass is enabled, the microboard automatically determines which board is present. At boot-up, the microboard alternates between polling the 031-02895-000 board and the 371-02514-000 Board. Once a valid response is received from one of these two boards, the communications will continue to only poll that board type.

Below is a description of the interface for each board.

Analog I/O Board 371-02514-000

This board communicates with the microboard COM3 serial port using Opto-22 protocol. It is compatible with Microboard 031-01730-000 and 031-02430-000/-001, equipped with any software version. See *Figure 79 on page 215.*

This board must be configured properly for the Hot gas control. The on-board Program Jumpers must be configured as follows:

JUMPER	POSITION
J1 and J2	pins 2 and 3
J25 and J26	pins 2 and 3
J13, J39 and J40	pins 1 and 2

A 499 ohm, 1%, ½w resistor is connected between P10-2 and P10-5 to convert the 0 to 20mA output to a 0 to 10 VDC output required for the Hot gas valve Actuator.

I/O Board 031-02895-000

This board communicates with the microboard COM3 serial port using Modbus protocol. It is only compatible with Microboard 031-02430-000/-001 equipped with software version C.OPT.01.21.307 (or later). It is not compatible with Microboard 031-01730-000 or any previous software versions. See *Figure 80 on page 216.*

If the chiller is equipped with Heat Recovery or Head Pressure Control, theses features are also interfaced to this board. All Chillers supplied with the Heat Recovery feature are also supplied with the Hot gas bypass feature.

Service Replacement

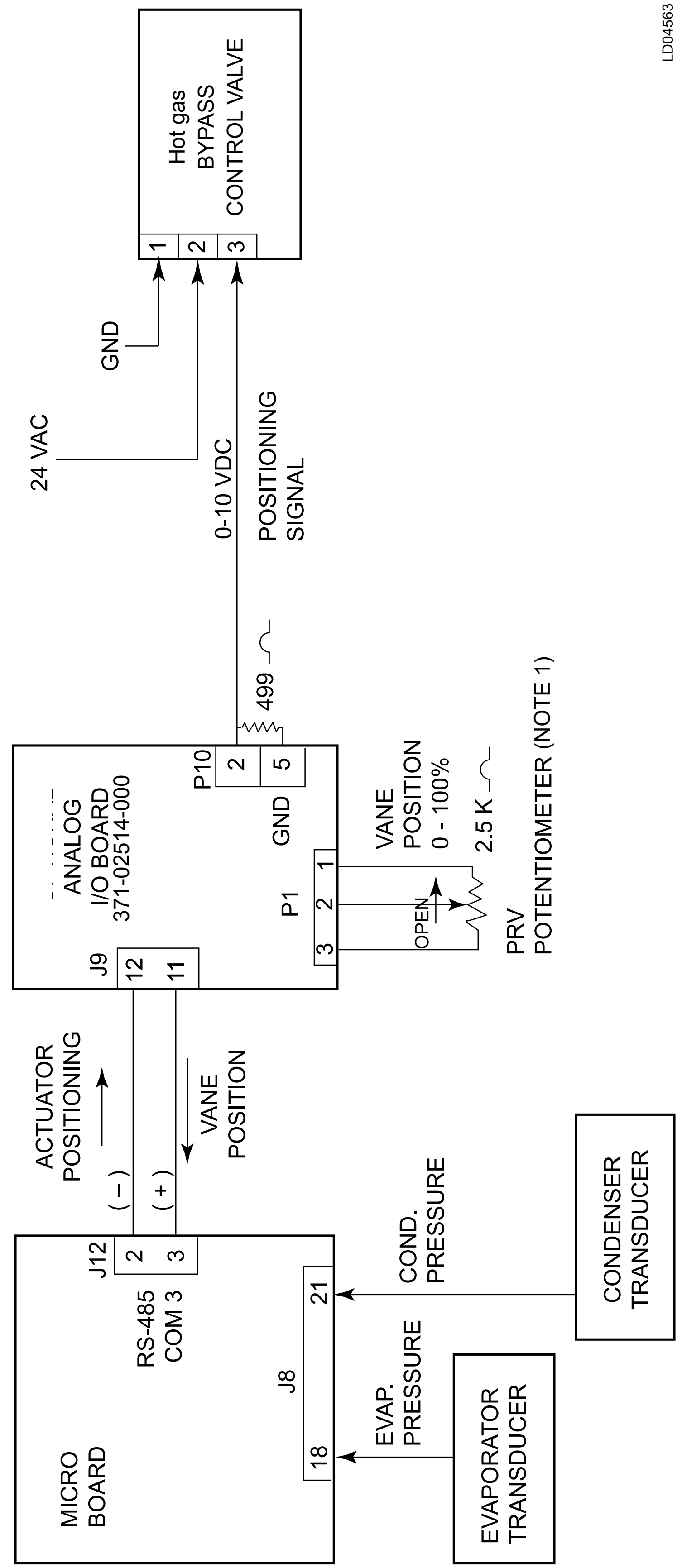
Replace the defective board with the same part number board. This prevents any compatibility issues.

PRE-ROTATION VANES POTENTIOMETER

A 2.5K ohm potentiometer, mounted on the Pre-rotation Vanes control arm, provides a 0 to 5 VDC voltage that represents a PRV position of 0% (fully closed) to 100% (fully open) as displayed on the Hot gas bypass Screen. To ensure accuracy, a PRV calibration procedure must be performed as detailed in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

The potentiometer could be connected to the Variable Speed Drive (VSD) Adaptive Capacity Control (ACC) Board, Analog I/O Board 371-02514-000 or Microboard 031-02430-001. The actual connection point is determined by the motor drive type and hardware configuration as follows:

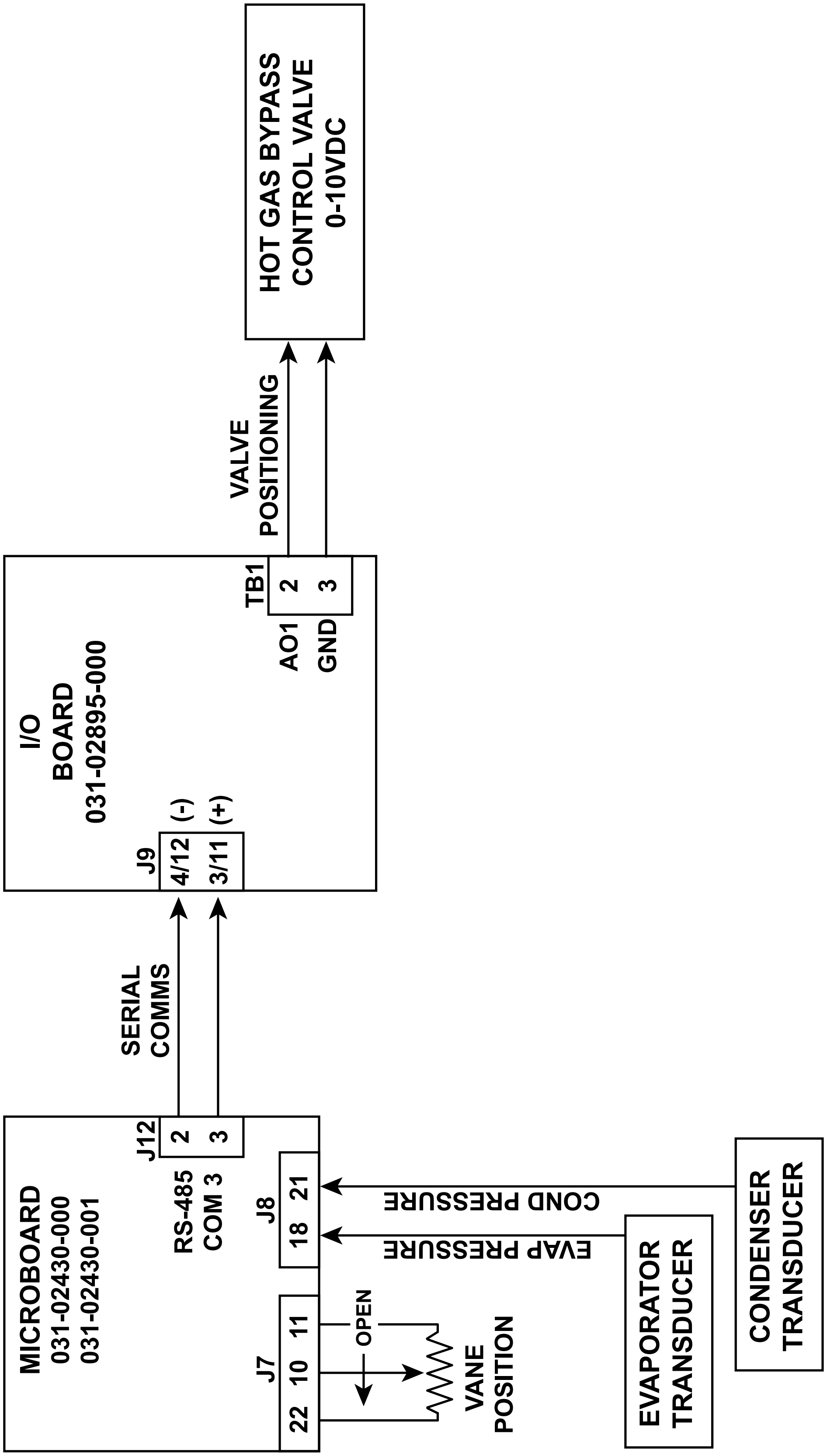
- If starter type is VSD, the potentiometer is connected to either the ACC Board or the microboard, depending upon where the ACC function is performed. If the ACC board is present it is connected to the ACC Board J4. If the ACC Board is not present (ACC function performed in the microboard) it is connected to the microboard J7.
- If the starter type in not VSD, the potentiometer is connected to either the Analog I/O Board or Microboard depending on which I/O Board is present. If Analog I/O Board 371-02514-000 is present, it is connected to this board at P1. If I/O Board 031-02895-000 is present, it is connected to the microboard J7.



NOTES:

1. If chiller is equipped with a Compressor Motor Variable Speed Drive, the PRV potentiometer is connected to either the Adaptive Capacity Control Board (J4) or the microboard J7, depending on where the ACC function is performed. Refer to explanation in this section.

FIGURE 79 - INTERFACE, HOT GAS BYPASS (ANALOG I/O BOARD 371-02514-000)



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NOTES:

1. If chiller is equipped with a Compressor Motor Variable Speed Drive, the PRV potentiometer is connected to either the Adaptive Capacity Control Board (J4) or the microboard J7, depending on where the ACC function is performed. Refer to explanation in this section.

FIGURE 80 - INTERFACE, HOT GAS BYPASS (I/O BOARD 031-02895-000)

SECTION 24 - SMART FREEZE PROTECTION

The smart freeze feature prevents nuisance chiller shutdowns due to brief periods of chilled liquid flow fluctuations or other brief operating conditions that would normally cause LOW EVAPORATOR PRESSURE safety shutdowns. With this feature enabled and activated, the chiller is permitted to ride through these temporary conditions. Also, this feature allows the Leaving Chilled Liquid Temperature setpoint to be set as low as 36.0°F. Smart Freeze protection can be enabled or disabled at the keypad, by a Service technician, using a procedure detailed in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual. It cannot be used in brine cooling mode.

The basis of this feature is that the chilled liquid contains an amount of heat, which cannot be eliminated immediately. Therefore, it requires a certain amount of time for the liquid to change to a solid. During this period of time, those parameters that determine when solidification will occur, are evaluated and the appropriate Low Evaporator Temperature shutdown threshold is applied. This threshold could be lower, but not higher than the normal safety threshold.

Smart Freeze protection uses the Evaporator Refrigerant Temperature as one of the variables to determine when freezing is imminent. If the chiller is equipped with the Evaporator Refrigerant Temperature Sensor (RT7), and the sensor is enabled using *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual, this value is used as the refrigerant temperature. Otherwise, the Evaporator Saturation Temperature (as derived from the output of the Evaporator Pressure Transducer. The pressure is converted to a temperature via the appropriate refrigerant "pressure/temperature lookup table") is used as the refrigerant temperature.

When Smart Freeze protection is enabled, the Leaving Chilled Liquid Temperature setpoint can be set as low as 36.0°F. If set to less than 38.0°F, the Leaving Chilled Liquid – Low Temperature cycling shutdown threshold becomes a minimum of 34.0°F.

Unless Smart Freeze protection is activated, the fixed Low Evaporator Pressure Safety thresholds (R22 – 54.3 psig, 29.6°F) (R-134a – 25.0 psig, 28.7°F) are used.

Smart Freeze protection is activated only when the feature is enabled AND the Leaving Chilled Liquid Temperature setpoint is less than 38°F. Once activated, the total number of seconds that the Evaporator Refrigerant Temperature is below the freeze threshold is counted. The freeze threshold is 32.8°F (refrigerant temperature sensor RT7) or 34.0° (evaporator saturation temperature See Note 1 below.). The count is incremented once for every second the Evaporator Refrigerant Temperature is below the freeze threshold and decremented once for every second it is above the freeze threshold (but is never decremented below zero). Thus if the Evaporator Refrigerant Temperature goes below the freeze threshold for 30 seconds, then goes above it for 10 seconds, then goes below the threshold for 5 seconds, the total number of seconds the Evaporator Refrigerant Temperature was below the freeze threshold was 25 seconds. If Smart Freeze is no longer activated due to the Leaving Chilled Liquid Temperature setpoint being raised to greater than or equal to 38.0°F, the total number of seconds being tracked is set to zero.

The number of seconds it will take the chilled liquid to freeze is based on how far the Evaporator Refrigerant Temperature is below the freeze threshold as follows:

$$A = \frac{4053.7}{B}$$

Where: A = Number of seconds to freezing
B = (freeze threshold – evaporator refrigerant temperature)

Thus, if the Evaporator Saturation Temperature is being used as the Evaporator Refrigerant Temperature and that temperature is 26.0°F, it would take 8 minutes and 26 seconds for the chilled liquid to freeze.

When the total number of seconds the Evaporator Refrigerant Temperature is below the freeze threshold exceeds the "Number of seconds to freezing", a safety shutdown is performed and EVAPORATOR – LOW PRESSURE – SMART FREEZE is displayed on the System Details line of the display.

Even though Smart Freeze protection is enabled and activated, the Pre-Rotation Vanes Load Inhibit still occurs at the same thresholds as with normal operation; inhibit at 56.2 psig (R22) and 27.0 psig (R-134a). As in normal operation, loading will be allowed when the pressure increases to 57.5 psig (R22) and 28.0 psig (R-134a).

The following is a summary of the operation with Smart Freeze disabled and enabled.

SMART FREEZE DISABLED

- Minimum Leaving Chilled Liquid setpoint - 38.0°F
- Low Chilled Liquid Temp cycling shutdown threshold - 1° to 34.0°F below the Leaving Chilled Liquid Temperature setpoint, as programmed, or a minimum of 36.0°F.
- Low Evaporator Pressure safety shutdown threshold

  R22 - 54.3 psig (29.6°F)

  R-134a – 25.0 psig (28.7°F)
- PRV Load Inhibit

  R22 – 56.2 psig

  R-134a – 27.0 psig
- Load Inhibit disable

  R22 – 57.5 psig

  R-134a – 28.0 psig

SMART FREEZE ENABLED

- Minimum Leaving Chilled Liquid setpoint - 36.0°F
- If the Leaving Chilled Liquid Temperature setpoint is greater than or equal to 38.0°F:
  1. The Low Leaving Chilled Liquid Temperature cycling shutdown threshold is 1 to 34.0°F below the Leaving Chilled Liquid Temperature setpoint, as programmed, or a minimum of 36.0°F.
  2. The Low Evaporator Pressure safety shutdown threshold is the same as Smart Freeze disabled above.
- If the Leaving Chilled Liquid Temperature setpoint is less than 38.0°F:
  1. The Low Leaving Chilled Liquid Temperature cycling shutdown threshold is 1 to 3.0°F below the Leaving Chilled Liquid Temperature setpoint, as programmed, or a minimum of 34.0°F.
  2. Low Evaporator Pressure shutdown threshold is determined by how far the Evaporator Refrigerant Temperature is below the freeze threshold of 32.8°F (refrigerant temperature sensor RT7) or 34.0°F (Evaporator Saturation Temperature. See Note 1 below.) and the total number of seconds it remains there. See explanation above.
- PRV Load Inhibit is the same as Smart Freeze Disabled above.
- Load Inhibit Disable is the same as Smart Freeze Disable above.

Note 1: The freeze threshold evaporation saturation temperature is 32.0°F on Flash memory card version C.MLM.01.01 (and earlier).

SECTION 25 - SURGE PROTECTION

The Surge Protection feature detects surge events for Surge Avoidance and the Hot gas bypass feature. It provides a running count of the surges detected over the lifetime of the chiller. It allows the user to define how many surges are excessive and how the control will react to an excess surge condition. When excessive surging is detected, it can be configured to shutdown the chiller or initiate a Surge Correction/Avoidance Mode or simply display a warning message.

The detection and counting of surges in this feature is independent of the surge detection/counting performed by the Compressor Motor Variable Speed Drive (VSD) Adaptive Capacity Control (ACC) surge detection. The ACC surge detection creates a surge map used to control the speed of the drive. In new production chillers before March 2007, the ACC function and ACC surge detection are performed by the ACC Board (this is called the YORK Protocol configuration). In new production chillers after March 2007, the ACC surge detection is performed by the ACC function in the microboard and the ACC Board is not present (this is called the Modbus Protocol configuration). All Medium Voltage Variable Speed Drives (MV VSD) use this later configuration. The surge events detected and accumulated by the ACC function are displayed on the ACC Screen.

With software version C.OPT.01.19.307 and later (in Modbus Protocol configuration), there's an "ACC Surge Detected" LED on the SURGE PROTECTION Screen that annunciates the ACC detected surges. This is provided on this screen for reference only. To eliminate counting and reacting to surges caused by the ACC function, the Surge Protection feature only detects and reacts to those surges that occur while the VSD is running at maximum frequency (speed). See *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* and *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* of this manual for details of these configurations. Due to service parts replacement, early production chillers could be in the Modbus Protocol configuration.

The SURGE PROTECTION Screen, accessible from the COMPRESSOR Screen, displays all parameters relevant to this feature. All setpoints for this feature are maintained on this screen. The parameters displayed on this screen vary according to the software version and compressor motor type as noted below.

SURGE DETECTION

Surge events are detected by monitoring the relationship between the Condenser Pressure and Evaporator Pressure while the chiller is running. When the difference between these pressures decreases transiently and remains so for a period of time described below, and then makes a positive transition within 7 seconds (90 seconds with software version C.MLM.01.10B.xxx and later) or C.OPT.01.10B.xxx and later), a surge event has been detected.

The surge detection sensitivity for the Surge Protection feature is set with the Surge Sensitivity setpoint on the SURGE PROTECTION Screen. It is adjustable over the range of 0.3 (default) to 1.3. Smaller values increase the sensitivity. This sensitivity setting is not to be confused with the Surge Sensitivity setpoint on the ACC DETAILS Screen. The Surge Sensitivity setpoint on that screen adjusts the sensitivity of the ACC Surge Detection feature in the microboard when configured in Modbus Protocol configuration (software version C.OPT.01.16.307 and later).

The Evaporator Pressure Transducer output is subtracted from the Condenser Pressure output to determine the differential. If either of the following negative transitions occur in the differential followed by a 0.061 VDC positive differential transition within 7 seconds (90 seconds for P and Q compressors with software version C.MLM.01.10B.xxx and later) or C.OPT.01.10B.xxx and later), a surge event is detected:

- If the differential decreases more than 0.6 VDC for more than 0.260 seconds.
- If the differential decreases more than x.x VDC for more than 0.390 seconds.

NOTE

x.x VDC calculated as [(Surge Sensitivity setpoint x 300) x 1.22] ÷ 1000

Each time a surge is detected by the Surge Protection feature, the Surge Avoidance Surge Detected indicator illuminates momentarily (if equipped with a VSD or MV VSD, this feature only detects surges while the drive is running at maximum frequency). If equipped with software version C.OPT.01.18.307 or earlier, the

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indicator is labeled Surge Detected and it illuminates whenever a Surge Detected, regardless of VSD operating frequency.

If equipped with a VSD (in Modbus Protocol configuration) or a MV VSD, the ACC Surge Detected indicator illuminates momentarily when a surge is detected by the ACC function in the microboard, while the drive is running at less than maximum frequency. Software version C.OPT.01.18.307 or earlier does not have this indicator.

The Surge Avoidance Surge Count (displayed as "Total Surge Count" in software version C.OPT.01.18.307 and earlier) is the total number of surges detected by the Surge Protection feature (if equipped with a VSD or MV VSD, this feature only detects surges while the drive is running at maximum frequency). The Surge Avoidance Surge Count can be cleared using an ADMIN password following procedure in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

The Surge Window Count accumulates the number of surges that occur within the Surge Window Time. This time is programmable over the range of 1 to 5 minutes using the Count Window setpoint. The number of surges that occur within the Surge Window Time are compared to the Count Limit setpoint (4 to 20) to determine if an excess surge condition exists, as explained below.

EXCESS SURGE DETECTION

An excess surge condition is detected by comparing the number of surge events that occur in a selectable time period to a selectable threshold.

If the number of surge events (Surge Window Count) detected in the time period programmed as the Count Window setpoint (1 to 5 minutes; default 5) (default 3 with Software version C.MLM.01.09.xxx (and later) or C.OPT.01.09.301 (and later)) exceed the threshold programmed as the Count Limit setpoint (4 to 20; default 4) (default 15 with Software version C.MLM.01.09.xxx (and later) or C.OPT.01.09.301 (and later)) an excess surge condition has been detected.

Unless the Shutdown or Extended Run features have been enabled, as explained below, the chiller will continue to run under the same conditions displaying WARNING – EXCESS SURGE DETECTED. This message will be displayed until manually reset with the WARNING RESET key in OPERATOR access level.

SURGE PROTECTION

The Control Center can be configured to take the following courses of action when an excess surge condition has been detected. The Shutdown setpoint is used to invoke a safety shutdown. The Extended Run setpoint is used to invoke a special 10 minute Surge Correction/Avoidance Mode that temporarily eliminates the conditions causing the surging, while allowing the chiller to continue to run. If the chiller is equipped with the Hot gas bypass feature and/or a Compressor Motor Variable Speed Drive (VSD), certain Hot gas valve position and VSD speed criteria must be met before the Shutdown or Extended Run functions are performed as explained below.

When a surge is detected, the following courses of action are taken:

- If the Shutdown setpoint is enabled, and the Extended Run setpoint is disabled, a safety shutdown will be performed and SURGE PROTECTION - EXCESS SURGE is displayed.
- If the Shutdown setpoint is disabled and the Extended Run setpoint is enabled, the Pre-rotation Vanes are driven closed for 10 minutes and WARNING – SURGE PROTECTION – EXCESS SURGE LIMIT is displayed. When the 10 minutes have elapsed, if the Surge Window Count is less than or equal to the Count Limit, this message and load inhibit are automatically cleared, otherwise another 10 minute period is initiated. Alternating with this message is WARNING – EXCESS SURGE DETECTED that is displayed until manually reset with the WARNING RESET key in OPERATOR access level. During the 10-minute period, a countdown timer on the SURGE PROTECTION Screen displays the time remaining in the period. See Hot gas bypass and Compressor Motor Variable Speed Drive exception above.
- If both the Shutdown and Extended Run setpoints are enabled, the 10 minute Extended Run period is invoked as above. However, if the Surge Window Count exceeds the Count Limit at the end of the 10 minute Extended Run period, a safety shutdown is performed and SURGE PROTECTION – EXCESS SURGE is displayed.

HOT GAS BYPASS/COMPRESSOR MOTOR VARIABLE SPEED DRIVE (VSD) APPLICATIONS

Equipped With Hot gas

The Hot gas valve position must be 100% before the Extended Run Mode is implemented.

Equipped With VSD

Software version CMLM.01.08.xxx (and earlier) or C.OPT.08A.300 - The Extended Run Mode will not be implemented unless the VSD output frequency is at maximum.

Software version C.MLM.01.09.xxx (and later) or C.OPT.09.301 (and later) – The Extended Run Mode, Shutdown Mode and EXCESS SURGE WARNING message will not be implemented unless the VSD output frequency is at maximum.

Equipped With Both Hot gas and VSD

Software version C.MLM.01.08.xxx (and earlier) or C.OPT.08A.300 – The Extended Run Mode will not be implemented unless the Hot gas valve position is 100% and the VSD output frequency is at maximum.

Software version C.MLM.01.09.xxx (and later) or C.OPT.01.09.301 (and later) – The Extended Run Mode, Shutdown Mode and EXCESS SURGE WARNING message will not implemented unless the Hot gas valve position is 100% and the VSD output frequency is at maximum.

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SECTION 26 - VARIABLE GEOMETRY DIFFUSER

Certain YORK compressors are equipped with a Variable Geometry Diffuser (VGD). It is used to reduce rotating stall conditions and associated stall noise. Stall may occur at low load conditions with high head. A mechanical ring, located in the diffuser passage after the impeller discharge, is mechanically operated through linkages via an electric actuator like that used to operate the pre-rotation vanes. It is closed (extended) to narrow the diffuser gap. It is opened (retracted) to open the diffuser gap. An internal actuator end switch prevents travel beyond the fully open or closed positions. The VGD limit switch indicates when the VGD is fully closed. The switch closes when the VGD is in the fully closed position. The switch status is displayed on the VGD screen and VGD SETPOINTS Screen (Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later)). It's displayed as Closed when the VGD is in the full closed position Otherwise, it is displayed as Open. In response to a stall condition, the ring is closed as much as necessary to eliminate the stall. Since stall is caused by reduced gas flow through the compressor, narrowing the diffuser gap reduces the cross sectional area through which the gas flows, thereby increasing the gas velocity through the compressor. The diffuser ring is also closed in response to surge conditions as described below.

Software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later) is required for this feature.

The VARIABLE GEOMETRY DIFFUSER screen displays all parameters relevant to this feature. All setpoints are maintained on the VARIABLE GEOMETRY DIFFUSER SETPOINTS screen.

STALL DETECTION

Stall noise in the compressor discharge is detected as gas pressure pulsations. (See *Figure 91 on page 236.* A Stall Pressure Transducer (025-39464-000 or 025-40088-000), mounted in the discharge scroll of the compressor, detects the pressure pulsations and outputs DC voltage pulsations to the Stall Detector Board (031-02418-000 or 031-2418-001). This board converts the voltage pulsations into an analog voltage that represents the magnitude of the stall noise. This analog voltage is displayed on the VARIABLE GEOMETRY DIFFUSER Screen as STALL DETECTOR VOLTAGE and is input to the microboard where it is compared to the Low Limit and High Limit setpoint thresholds to determine if the stall noise is acceptable or unacceptable. In a typical YK chiller, a signal below 0.5 VDC indicates little or no stall. A signal above 0.8 VDC indicates stall noise is present.

SURGE DETECTION

Surge events are sensed as described in *SECTION 23 - HOT GAS BYPASS* and *SECTION 25 - SURGE PROTECTION* of this manual.

AUTOMATIC OPERATION

The VGD operation is illustrated in the State Diagram illustrated in *Figure 82 on page 229* The "States" are shown in circles. They are Stall Waiting, Stall Reacting, Probing, Surge Reacting, Surge Waiting and Hot gas Override. Arrows on the diagram indicate actions that move the control from one "State" to another. For clarity, different arrow line styles are used for Stall (—), Surge (— . —) and Hot gas (– – –) response actions. During chiller operation, the current state is displayed as the CONTROL STATUS on the VARIABLE GEOMETRY DIFFUSER Screen.

In general, the VGD is maintained in the most open position possible that does not allow stall. It is fully open when the chiller is started. If stall occurs, it is driven toward the close position until the stall is eliminated. After a wait period, it is again pulsed open until either a stall occurs or the fully open position is reached, whereupon the cycle repeats. In response to a surge, it is driven toward the close position for a selectable period of time. After a wait period, it is again pulsed open unless another surge occurs, whereupon Hot gas operation overrides VGD operation and the VGD is held in place.

The Diffuser Gap Open and Diffuser Gap Close LED's on the VARIABLE GEOMETRY DIFFUSER Screen illuminate when the program is initiating the respective output. The following sections describes the operating states:

Chiller Off, Pre-lube or Coastdown

The VGD diffuser gap is driven fully open.

Stall Waiting

This state is entered on startup, after a Stall Reaction, or Hot gas valve closure. The VGD is held in last position until one of the following occurs:

- The PROBE WAIT time period (0.5 to 15 minutes; default 10; as programmed with the Probe Wait Time setpoint) expires. When the timer expires, the Probing state is entered. The time remaining in the PROBE WAIT time period is displayed on the VARIABLE GEOMETRY DIFFUSER Screen as TIME REMAINING.
- A stall is detected (Stall Detector Board output goes above the High Limit setpoint). Enters Stall Reacting State.
- A surge is detected and enters Surge Reacting State.
- The compressor Pre-rotation Vanes (PRV) position increases more than the PRV Offset (1 to 5%; default 3; as programmed with the PRV Offset setpoint). Enters Probing state. The PRV position is displayed on the VARIABLE GEOMETRY DIFFUSER Screen as 0% (fully closed) to 100% (fully open).

NOTE

Setting the PRV Offset setpoint to 0% disables this function. Probing will be initiated based on PROBE WAIT time only.

Probing

In this state, the VGD mechanism is opened in pulses to open the diffuser gap. The pulses are initiated every 10 seconds. The duration of the pulses are defined by the Open Pulse setpoint (1 to 9 seconds; default 2). This probing continues until the Stall Detector Board output exceeds the High Limit setpoint (0.5 to 1.2 VDC; default 0.8) to indicate stall is present or a surge is detected. Typically, at lower loads below 70%, stall will be sensed and controlled before a surge occurs. At higher loads and very high heads or lift, a surge can occur while probing which may be momentary in nature and not evidenced as stall noise.

The number of times the Stall Detector Board output goes above the High Limit setpoint threshold is displayed on the VGD SETPOINTS Screen as the VGD Count. This count can be reset using an ADMIN access level. The accumulated time the Stall Detector Board output voltage is greater than the HIGH LIMIT threshold is displayed on the VGD Screen as VGD TIME.

Stall Reacting

If a stall is detected from the Probing, Stall Waiting or Surge Waiting (software version C.OPT.01.23.307 and later) states, the state is changed to Stall Reacting.

In this state, the diffuser gap is closed until the Stall Detector Board output drops below the Low Limit setpoint (0.4 to 0.8 VDC; default 0.6). After Stall Reacting, the state returns to Stall Waiting, or Surge Waiting (software version C.OPT.01.23.307 and later) depending on the state it was previously in. If it entered Stall Reacting from Stall Waiting, it returns to Stall Waiting. If equipped with software version C.OPT.01.23.307 (and later), it could have entered from Surge Waiting. If this is the case, it will return to Surge Waiting only if there is still time remaining on the Surge Waiting Timer. If no time remaining, it transitions out of Stall Reacting as it normally does.

If equipped with the optional Hot gas bypass feature and the Hot gas valve position is greater than 0% when the stall is detected, the VGD is held in its last position. It is not driven closed.

Surge Reacting

The VGD is closed for a specific time period, defined by the Surge React Time setpoint (1 to 30 seconds; default 5). A surge is detected as detailed in *SECTION 23 - HOT GAS BYPASS* and *SECTION 25 - SURGE PROTECTION* of this manual. The Surge Detected LED on the VARIABLE GEOMETRY DIFFUSER Screen illuminates for 5 seconds each time a surge is detected. The program looks at a change in the condenser minus evaporator pressures over a short time period to detect a back flow or surge condition of the compressor. A surge is generally of more concern and potentially damaging to the compressor than stall. So, if a surge is detected, this overrides any of the Stall action states. Opening the diffuser gap may lower the lift capability of the machine. Therefore, there are some conditions where the Probing can actually cause a surge. In this case it is likely that simply closing the diffuser gap some amount will stabilize the compressor. Therefore, for units with VGD and Hot gas options, the Hot gas bypass Valve will not be opened on the first surge or during the time the VGD is closing.

Surge Waiting

The VGD is held in last position for a wait time, defined by the Probe Wait Time setpoint (0.5 to 15 minutes; default 10). During this period, the controls will look for a second surge. If a second surge occurs, normal Hot gas bypass Control takes over and Hot gas bypass Override state is entered. If there are no other surges detected during this period, the VGD returns to Probing.

The time remaining in the PROBE WAIT time period is displayed on the VARIABLE GEOMETRY DIFFUSER Screen as TIME REMAINING.

With software version C.OPT.01.22.307 (or earlier), any stall conditions are ignored in this state. With software version C.OPT.01.23.307 (and later), if a stall is detected while in Surge Waiting, the control transitions to Stall Reacting, where the VGD is driven closed until stall is no longer detected. Then if the Surge Waiting Timer is still active, it transitions back to Surge Waiting, otherwise it transitions out of Stall Reacting as it normally does.

Hot gas bypass Override

Applies for units with optional Hot gas bypass. Whenever the Hot gas bypass Valve position is greater than 0%, the VGD mechanism will be kept at its last position. This keeps the VGD at a position of similar surge stability when the system head is later lowered and the hot gas valve closes. This state remains in effect until the Hot gas valve position returns to 0% (or if equipped with software version C.OPT.01.21.307 and later, a stall is detected) whereupon it returns to the Stall Reacting State.

Hot gas bypass operates as described in *SECTION 23 - HOT GAS BYPASS* of this manual. Except that on surge response, the Hot gas valve will not be opened until a second surge is detected. The Hot gas Minimum Load Override function is not affected by VGD operation.

PRV-VGD Inhibit

If the Pre-rotation Vanes position exceeds the PRV-VGD Inhibit setpoint (40% to 100%), the VGD is pulsed open per the Open Pulse setpoint. While this is in effect, Control Status displays PRV POSITION OVERRIDE.

STALL SENSOR VALIDATION

(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later)).

This feature verifies the operation of the Stall Pressure Transducer by comparing its voltage output to the voltage output of the Condenser Pressure Transducer. Since both transducers are measuring essentially the same pressure, both outputs should be within an acceptable range of each other. If the Stall Transducer is not reading accurately, a warning message is displayed and the Variable Geometry Diffuser operation is disabled.

While the chiller is running, the outputs of the Stall Transducer and Condenser Transducer are compared. If the difference between them exceeds 0.28 VDC for 3 continuous minutes, the VGD is driven to the full open position and WARNING – CONDENSER OR VGD SENSOR FAILURE is displayed. The VGD is held in the open position until the warning is manually cleared. It can be cleared when the voltages are within the acceptable range of each other and the WARNING RESET key is pressed in SERVICE access level. When the warning is cleared, the VGD returns to normal operation.

The Stall Pressure Transducer unprocessed DC voltage output passes through the Stall Detector Board J2-2 and is connected to the microboard at J8-1. This value is then used for comparison to the condenser transducer.

EXTREME STALL MONITOR

(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

The Variable Geometry Diffuser ring can be damaged by operating in extreme stall for long periods of time. To prevent damage, the VGD is disabled during extreme stall conditions and a warning message is displayed.

While the chiller is running, if the Stall Detector Voltage (output of the Stall Detector Board) exceeds twice the High Limit setpoint, for the duration programmed as the Extreme Stall Duration setpoint (10 to 20 minutes; default 10), the VGD is driven to the full open position and WARNING – CONDITIONS OVERRIDE VGD is displayed. The VGD is held in the open position until the warning is manually cleared. It can be cleared after the Stall Detector Voltage returns to less than two times the

HIGH LIMIT Setpoint. Press the WARNING RESET key in SERVICE access level to clear. After it is cleared, the VGD returns to normal operation.

The extreme stall condition is not checked under the following conditions:

- While the VGD is in Manual Control Mode.
- While the VGD is fully closed (VGD Limit Switch closed).
- While the Pre-rotation Vanes position is greater than the PRV VGD Inhibit setpoint.

MANUAL OPERATION

The VGD can be manually controlled from the VARIABLE GEOMETRY DIFFUSER Screen in SERVICE access level, whether the chiller is running or not. Pressing the OPEN, CLOSE or HOLD key invokes manual operation and the VGD Control Mode displays MANUAL. Each time the OPEN or CLOSE keys are pressed, the respective output is energized and the associated LED illuminates. Pressing the HOLD key causes the Hold LED to illuminate and the VGD to be held in its present position. Pressing the AUTO key invokes automatic operation and AUTO is displayed as the Control Mode.

SETPOINTS

The following setpoints are entered on the VARIABLE GEOMETRY DIFFUSER SETPOINTS Screen. They require SERVICE access level.

- Enable/Disable - Enables or Disables the VGD feature. Default is Disabled. Chiller must be stopped to change this setpoint.
- Surge React (1-30 seconds; default 5) - Specifies the duration of the close pulse applied to the VGD in response to a surge.
- PRV Offset (0-5%; default 3) – If the VGD control is in the Stall Waiting state and the Pre-rotation Vanes position increases by more than this value, the Probing state will be entered. If the PRV Offset is set to 0%, the Stall Waiting state is performed based only on the Probe Wait setpoint interval.
- Probe Wait (0.5-15 minutes; default 10) – Specifies how long the VGD control remains in the Stall Waiting or Surge Waiting states before entering the Probing state.
- Open Pulse (1-9 seconds; default 2) – Specifies the length of the open pulse applied to the VGD during 10 second periods while in the Probing state.
- High Limit (0.5 to 1.2 VDC; default 0.6V (0.8V with software version C.OPT.01.22.307 and earlier)) – Specifies the Stall Detector Board output voltage that represents an acceptable amount of stall noise. Above this value is unacceptable.

The minimum difference between the High Limit setpoint and the Low Limit setpoint is 0.1 VDC. If a Low Limit setpoint is entered which is less than 0.1 VDC below the High Limit setpoint, the High Limit setpoint is adjusted so that it is 0.1 VDC above the newly entered Low Limit value.

- Low Limit (0.4-0.8 VDC; default 0.5V (0.6V with software version C.OPT.01.22.307 and earlier)) – in the Stall Reacting State, the VGD is driven closed until the Stall Detector Board output voltage decreases to this level.

The minimum difference between the High Limit setpoint and the Low Limit setpoint is 0.1 VDC. If a Low Limit setpoint is entered which is less than 0.1 VDC below the High Limit setpoint, the High Limit setpoint is adjusted so that it is 0.1 VDC above the newly entered Low Limit value.

- Extreme Stall Duration (10 to 20 minutes; default 10 minutes)(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))– Specifies the maximum allowed time an extreme stall condition can exist before the Variable Geometry Diffuser operation is disabled (and driven full open) to protect it from damage.
- PRV VGD Inhibit (40% -100%; default 100%; 95% with software version C.OPT.01.22 and earlier) (Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later)) - While the re-rotation vanes position is greater than this setpoint, extreme stall conditions are not checked, the VGD control is inhibited and the VGD will be pulsed open according to the Open Pulse setpoint. While this is in effect, PRV POSITION OVERRIDE is displayed as Control Status.

PRE-ROTATION VANES POSITION

The Pre-rotation Vanes position, as used by the VGD control, is provided by a potentiometer mounted to the PRV control arm. The potentiometer interface varies according to how the chiller is equipped as follows:

- If the chiller is equipped with a Compressor Motor Variable Speed Drive, the potentiometer is connected to either the Adaptive Capacity Control (ACC) Board or the microboard, depending on where the ACC function is performed. If the ACC Board is present, the potentiometer is connected to the ACC Board J4. In applications where the ACC functionality is contained in Microboard 031-02430-001 (ACC Board not used), the potentiometer is connected to the microboard J7.
- If the chiller is not equipped with a Variable Speed Drive, but is equipped with the Hot gas bypass option, the PRV potentiometer is connected to either the Analog I/O Board or Microboard depending on which I/O Board is present. If Analog I/O Board 371-02514-000 is present, it is connected to this board at P1. If I/O Board 031-02895-000 is present, it is connected to the microboard J7.
- If the chiller has neither a Variable Speed Drive nor the Hot gas option, the potentiometer is connected directly to the microboard at J7.

I/O BOARD

Chillers equipped with this feature are supplied with and require I/O Board 031-01743-002. This board is populated with the required triacs Q3 and Q4 that apply the open and close signals to the VGD actuator. I/O Board 031-01743-001 does not contain required triacs Q3 and Q4.

STALL TRANSDUCER

Detects stall noise as high frequency pressure fluctuations in the discharge scroll of the compressor. It converts the pressure pulsations to DC voltage pulsations and applies them to the Stall Detector Board. Early vintage chillers were shipped with Stall Transducer 025-39464-000. Later chillers are shipped with Stall Transducer 025-40088-000. These transducers require different wiring connections at the transducer. Check the part number of the replacement transducer and make connections at the transducer connector as follows:

Transducer 025-39464-000
pin 1 - signal out - WHT
pin 2 - ground - BLK
pin 3 - +5 VDC supply voltage - RED

Transducer 025-40088-000
pin 1 - +5 VDC supply voltage - RED
pin 2 - ground - BLK
pin 3 - signal out - WHT

STALL DETECTOR BOARD

The Stall Detector Board (031-02418-000) converts the Stall Transducer DC voltage pulsations to an analog DC voltage output (J2-4) that represents the magnitude of stall noise and applies it to the microboard (J7-23). This board also provides a path for the Stall Transducer unprocessed DC voltage pulsations output to be connected from J2-2 to the microboard (J8-1). This output is used for the Stall Sensor Validation feature.

There are two versions of the Stall Detector Board as follows:

031-02418-000

Supplied in new production chillers and as replacement part until June 2007.

031-02418-001

Supplied in new production chillers and as replacement part after June 2007. This board contains a filter that removes the noise associated with high gas flow/low head conditions and thus prevents VGD closing in response to conditions that are not true stall conditions. Shunt jumper JP1 allows operation with or without the filter. With JP1 in the ENHANCED position (on pins 1 and 2), the filter is engaged. With it in the STANDARD position (on pins 2 and 3), the filter is not engaged and would operate the same as the -000 board above. Use the following guidelines:

- ENHANCED Mode – The board is shipped configured in this mode. In this mode, it filters the noise associated with high gas flow/low head conditions and thus prevents VGD closing in response to conditions that are not true stall conditions. The presence of this filter could require adjustment of the setpoints as follows: The Stall Detector Board outputs an analog voltage (displayed as STALL DETECTOR VOLTAGE on the VGD Screen) that represents the magnitude of stall noise present. When it reaches the value programmed as the High Limit setpoint (typically set to 0.8 VDC), the VGD closes until the voltage decreases to the Low Limit setpoint (typically set to 0.6 VDC). Since the filter causes the STALL DETECTOR VOLTAGE to typically run 0.2 to 0.3 VDC lower than Standard Mode for the same condition, it may be necessary to lower the High Limit and Low Limit setpoints if valid stall conditions are not being detected or surge occurs before stall is detected. Ideally, stall should be detected before surge occurs, allowing the VGD to react before surge. Also, since the PRV Position – VGD Inhibit Setpoint was the original vehicle to avoid VGD reaction to high gas flow/low head conditions, this setpoint should be set to 95% or 100% to avoid interference when Enhanced Mode is selected.

- STANDARD Mode – This mode should not be used unless under the advisement of Johnson Controls technical support. Provides the same operation as the 031-02418-000 board. Does not filter high gas flow/low head noise conditions as described in enhanced mode above.

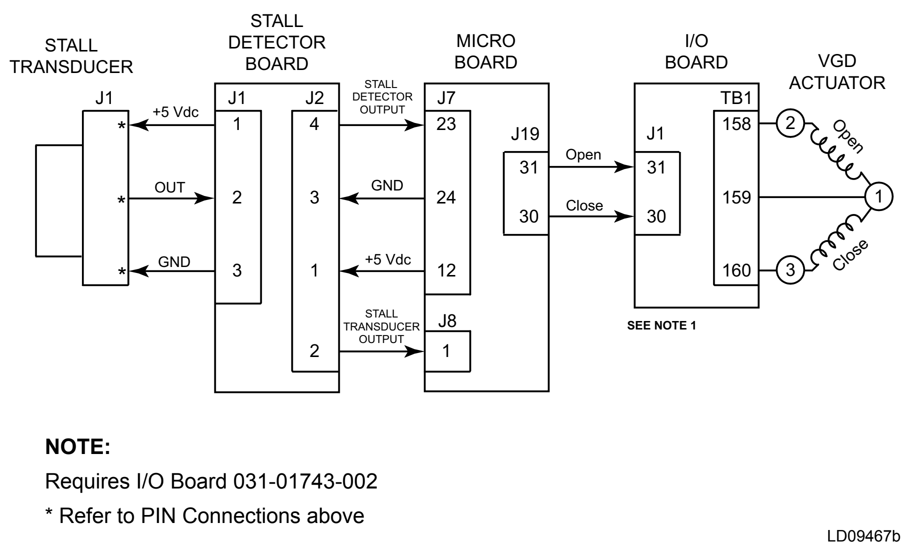
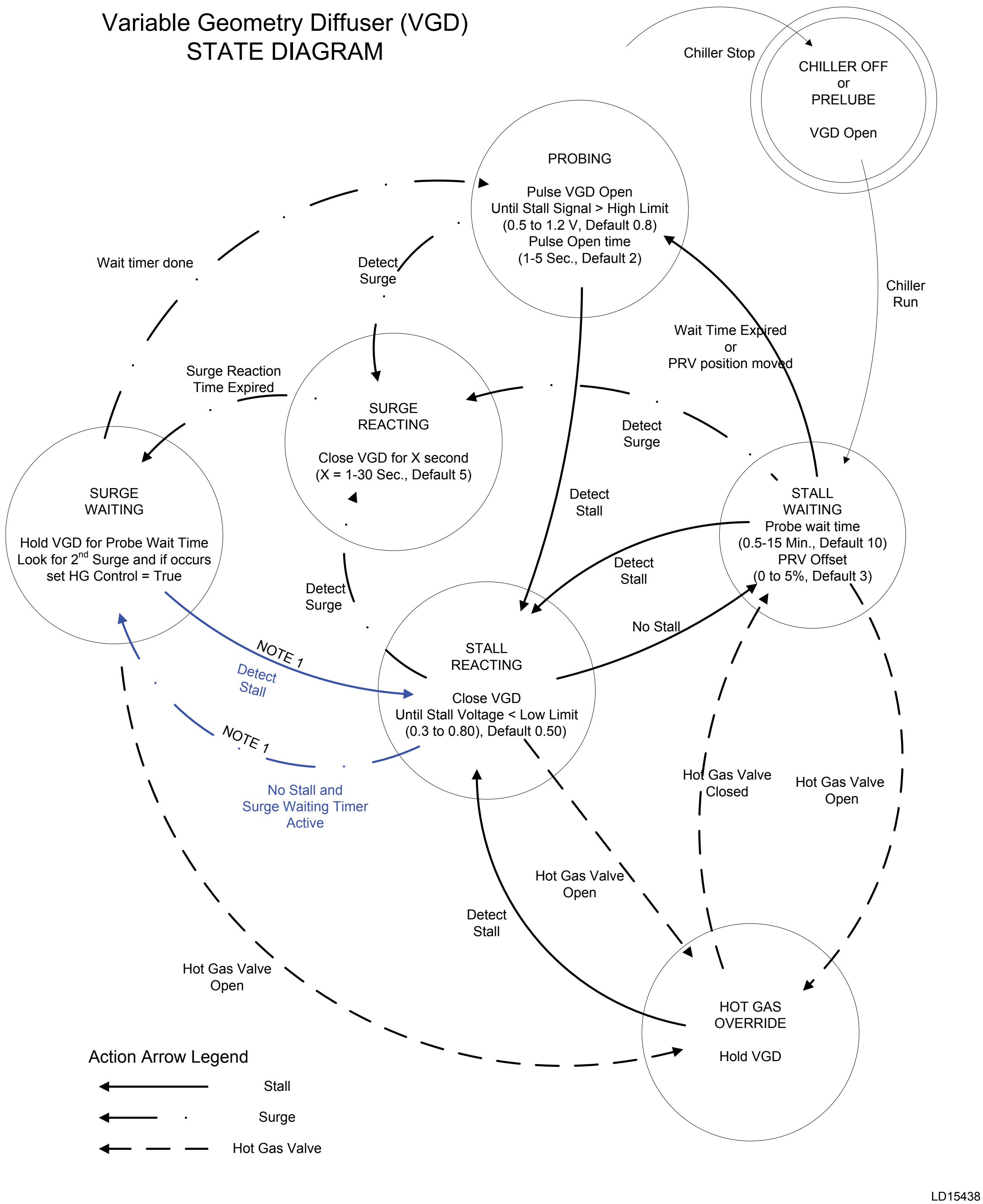


FIGURE 81 - VARIABLE GEOMETRY DIFFUSER BLOCK DIAGRAM



NOTES:

1. Software version C.OPT.01.23.307 (and later),

FIGURE 82 - VARIABLE GEOMETRY DIFFUSER STATE DIAGRAM

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SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001

Beginning August 2009, new chillers equipped for Hot gas bypass, Heat Recovery and/or Head Pressure Control options will be equipped with Input/Output Board 031-02895-000. It provides both Analog and Digital Input/Output capability to the microboard from external devices. *Figure 83 on page 232* is a top level block diagram of this board. *Figure 84 on page 232 through Figure 90 on page 235* show details of the I/O circuits and should be referred to while reading the following description of the board operation. *Figure 91 on page 236* is a board layout showing component identification.

The board is manufactured with either a -000 or -001 part number suffix. The -000 board is only populated with the components required for options requiring small additional I/O counts. The -001 board is for future use.

This board operates from +12 VDC (TP3) and +24 VDC (TP4) power supply voltages. The +12 VDC applied to the +5 VDC regulator produces a +5 VDC regulated output (TP2), which causes the POWER LED (CR3) to illuminate. These voltages are referenced to GND (TP1).

Power fail circuits detect low DC voltage and put the processor into a reset state as long as the voltage is below a threshold. This prevents the processor from processing data while the DC Voltage is below the minimum required for stable circuit operation. The low voltage reset thresholds are:

- +5 VDC supply @ 4.41 VDC-4.87 VDC
- +12 VDC supply @ 9.6 VDC-11.2 VDC

When the I/O Board is operating, the STATUS LED (CR8) flashes at a regular interval (1/sec) indicating that the board is functional.

This board communicates with the microboard COM 3 serial port (J12) using Modbus Protocol RS-485 serial communications. When a read/write request is sent from the microboard, the microboard's TX3 (CR15) LED illuminates. When that request is received at the I/O Board, the I/O Board's RX (CR4) LED illuminates. When the I/O Board responds, the I/O Board's TX (CR5) LED illuminates. When the response is received at the microboard, the microboard's RX3 (CR16) illuminates.

Each read/write request from the microboard contains a Modbus Net address. In order for the I/O Board to respond to the microboard's requests, the Modbus Net address of the I/O Board must match the one sent from the microboard. The Modbus Net address of the I/O Board is set with 4 position DIP switch SW1, labeled NET ADDRESS. This should be set to "1" by setting SW1-1 to ON and the other segments to OFF.

The operating program is stored in the processor. The program is downloaded into the processor through the J1 programming port at the time of board manufacture. Service replacement boards are provided preloaded with the proper software. It is not necessary to field load software into the board.

This board is only compatible with Microboard 031-02430-000/-001 equipped with software version C.OPT.01.21.307 (or later). It cannot be used with Microboard 031-01730-000 or any previous software versions.

See the following sections of this manual for a description of how this board is interfaced for these applications:

- **Hot gas bypass** - *SECTION 23 - HOT GAS BYPASS*
- **Heat Recovery** - *SECTION 28 - HEAT RECOVERY*
- **Head Pressure Control** - *SECTION 29 - HEAD PRESSURE CONTROL*

NOTE

Important! ***These are not general purpose I/O points available for field use. Unless specifically listed in above referenced sections of this manual, the I/O point cannot be used.***

DIGITAL INPUTS

120 VAC Digital inputs

These inputs accept a 120 VAC input. *Figure 84 on page 232* is a detail of this input and is representative of all of these inputs. Each input is applied to the respective (+) and (-) input. Each input is applied to an optocoupler circuit that converts the AC voltage to a DC voltage. Each input has an LED associated with it. The respective LED illuminates when the 120 VAC input is present. Otherwise, it is extinguished. The -000 board is component populated for 2 inputs. The -001 board is populated for 6 inputs.

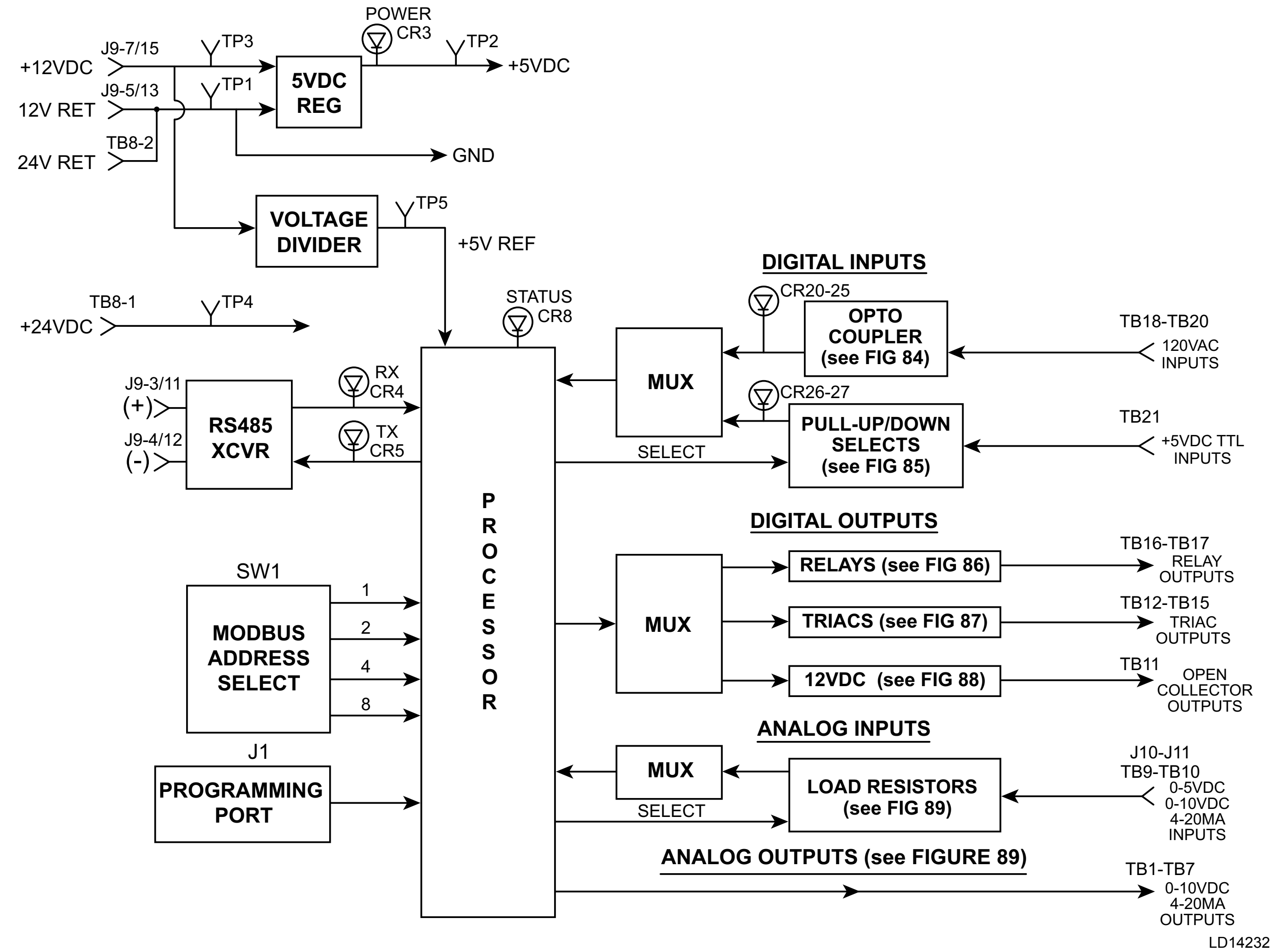


FIGURE 83 - LTC I/O BOARD BASIC BLOCK DIAGRAM

INPUT	CONNECTION	LED
DI1	TB20-1(+)	CR20
	-2(-)	
DI2	TB20-3(+)	CR21
	-4(-)	
DI3	TB19-1(+)	CR22
	-2(-) (-001 board only)	
DI4	TB19-3(+)	CR23
	-4(-) (-001 board only)	
DI5	TB18-1(+)	CR24
	-2(-) (-001 board only)	
DI6	TB18-3(+)	CR25
	-4(-) (-001 board only)	

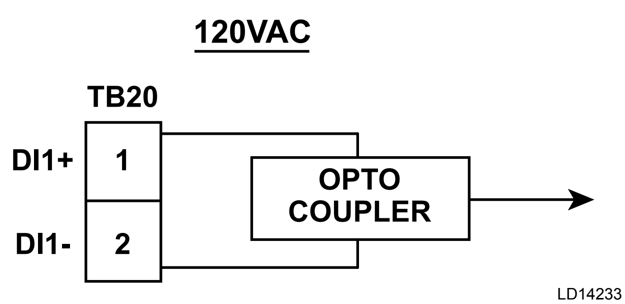


FIGURE 84 - 120 VAC DIGITAL INPUT

+5 VDC Digital inputs (-001 Board only)

There are 2 each +5 VDC TTL inputs. *Figure 85 on page 233* is a detail of an input and is representative of all of these inputs. Each input accepts an open/close input that can be configured in either pull-up configuration (+5 VDC when open/0 VDC when closed) or pull-down configuration (0 VDC when open/+5 VDC when closed). It is connected between the +5 VDC and the DI input for a pull-up configuration; between the GND and DI input for a pull-down configuration. Under Program control, the pull-up/pull-down selector switch connects the input load resistor to either +5 VDC (pull-up) or ground (pull-down) per the requirements of the input.

INPUT	CONNECTION	LED
DI7	TB21-1 +5 VDC	CR26
	-2 DI7	
	-3 GND	
DI8	TB21-4 +5 VDC	CR27
	-5 DI8	
	-6 GND	

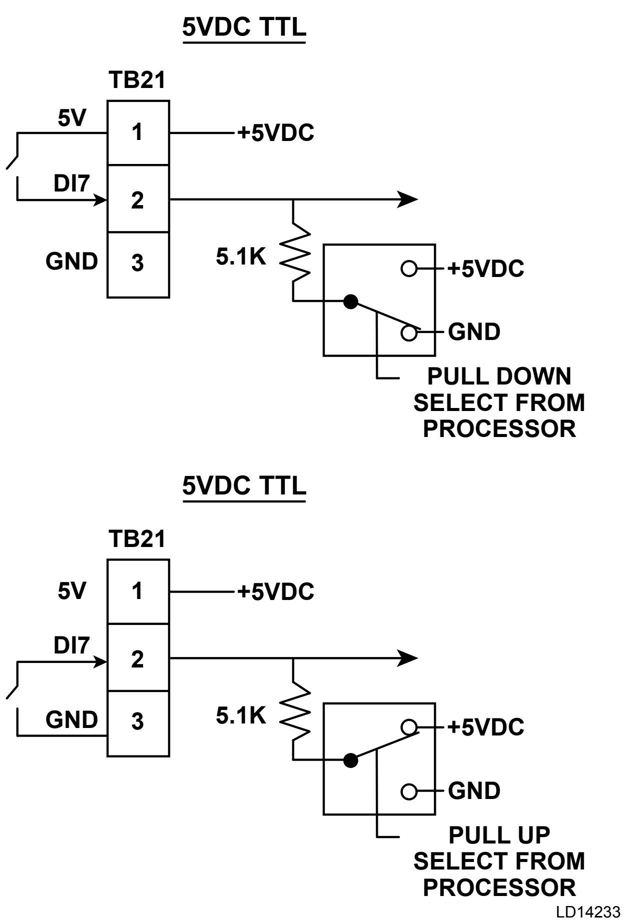


FIGURE 85 - +5 VDC DIGITAL INPUT

DIGITAL OUTPUTS

Relay Outputs (-001 Board only)

There are 2 each 120/240 VAC relay contact outputs. *Figure 86 on page 233* is a detail of an output and is representative of all these outputs. Each relay has one set of normally open contacts that are closed and opened under Program control. The relay contact rating is 250 VAC, 5 amps resistive, 2 amps inductive. Each output is connected between the respective COM(X) and NO(X) terminals.

OUTPUT	CONNECTION
DO1	TB17-1 COM1
	-2 NO1
DO2	TB16-1 COM2
	-2 NO2

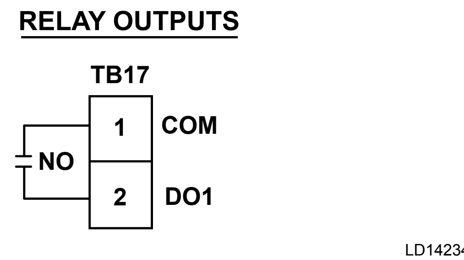


FIGURE 86 - RELAY OUTPUTS

Triac Outputs (-001 Board only)

There are 4 each 24/120 VAC triac outputs. *Figure 87 on page 233* is a detail of an output and is representative of all these outputs. Each output can switch 2 amps at 17-132 VAC. Each output is connected between the respective RET and DO(X) connection.

OUTPUT	CONNECTION
DO5	TB15-1 Ret
	-2 DO5
DO6	TB14-1 Ret
	-2 DO6
DO7	TB13-1 Ret
	-2 DO7
DO8	TB12-1 Ret
	-2 DO8

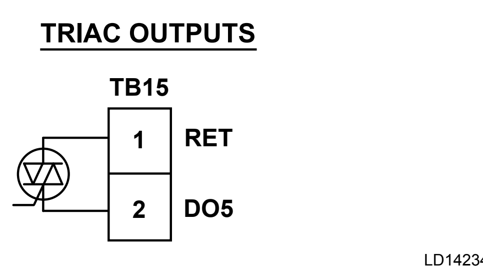


FIGURE 87 - TRIAC OUTPUTS

Open Collector Outputs (-001 Board only)

There are 2 each open collector outputs. *Figure 88 on page 234* is a detail of an output and is representative of all these outputs. Each output switches a ground connection through an onboard solid state device to an external load connected to the board supplied +12 VDC power source. Each output is connected between the respective +12 VDC and DO(X) terminals.

OUTPUT	CONNECTION
DO3	TB11-1 +12 VDC
	-2 DO3
DO4	-3 +12 VDC
	-4 DO4

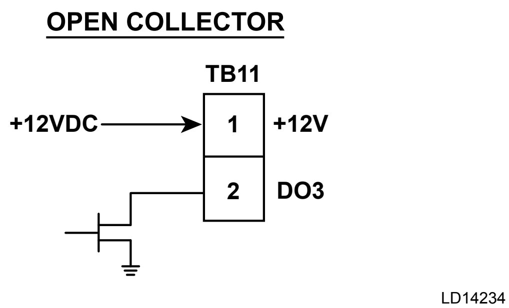


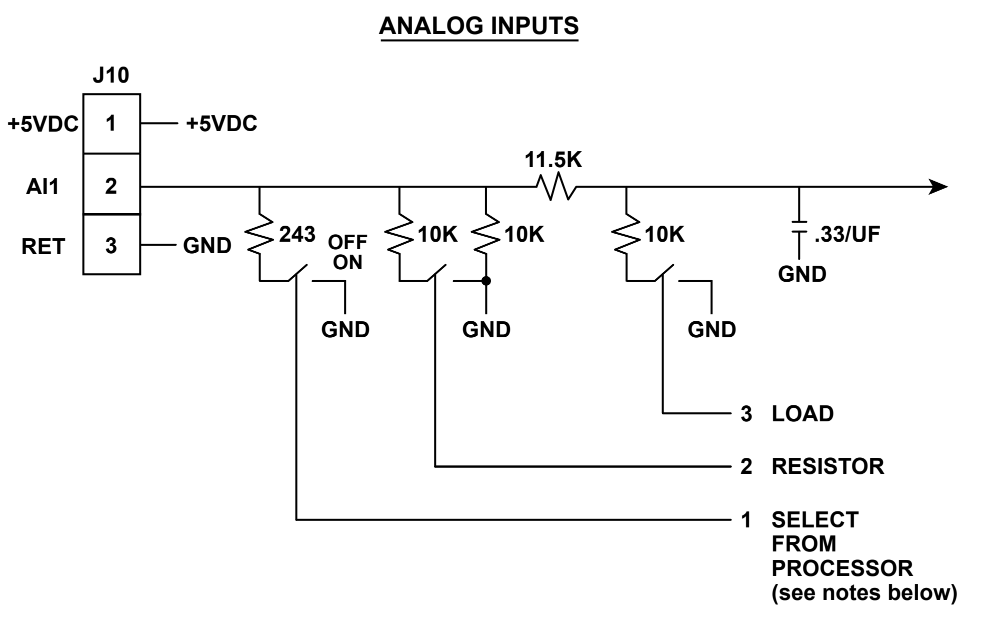
FIGURE 88 - OPEN COLLECTOR

ANALOG INPUTS

There are 8 each Analog Inputs on the -000 board and 16 each on the -001 board. *Figure 89 on page 234* is a detail of this input and is representative of all these inputs. Each input accepts either a 0 to 5 VDC, 0 to 10 VDC, 4 to 20mA, Transducer or Thermistor input. The on-board software configures each input per the requirements of the input type. The configuration consists of selecting the appropriate input series resistor to ground. The software closes the appropriate switch(s) (1, 2, 3), selecting the appropriate input resistor. *Figure 89 on page 234* shows the switch settings and resistance values for each input type.

Inputs AI7 and AI8 have dual input connectors that allow either a pin/socket connection or screw terminal connection as shown below.

Thermistors and transducers operate from the board supplied +5 VDC supply voltage. To compensate for a varying +5 VDC supply voltage, this voltage is compared to a precise +5 VDC reference. The output of the device is adjusted according to any difference.



	1	2	3	Resistor (Ohms)
0-5VDC, TRANSDUCER, THERMISTOR	OFF	OFF	OFF	10K
0-10VDC	OFF	OFF	ON	10K-11.5K
THERMISTOR	OFF	ON	OFF	5K
4-20mA	ON	OFF	OFF	243

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FIGURE 89 - ANALOG INPUTS

INPUT	CONNECTION
AI1	J10-1 +5 VDC
	-2 AI1
	-3 Ret
AI2	J10-4 +5 VDC
	-5 AI2
	-6 Ret
AI3	J10-7 +5 VDC
	-8 AI3
	-9 Ret
AI4	J10-10 +5 VDC
	-11 AI4
	-12 Ret
AI5	J10-13 +5 VDC
	-14 AI5
	-15 Ret
AI6	J10-16 +5 VDC
	-17 AI6
	-18 Ret
AI7	J10-19 +5 VDC
	-20 AI7 or TB9-1
	-21 Ret TB9-2
AI8	J10-22 +5 VDC
	-23 AI8 or TB9-3
	-24 Ret TB9-4
AI9	J11-1 +5 VDC (-001 board only)
	-2 AI9
	-3 Ret
AI10	J11-4 +5 VDC (-001 board only)
	-5 AI10
	-6 Ret
AI11	J11-7 +5 VDC (-001 board only)
	-8 AI11
	-9 Ret
AI12	J11-10 +5 VDC (-001 board only)
	-11 AI12
	-12 Ret
AI13	J11-13 +5 VDC (-001 board only)
	-14 AI13
	-15 Ret
AI14	J11-16 +5 VDC (-001 board only)
	-17 AI14
	-18 Ret
AI15	J11-19 +5 VDC (-001 board only)
	-20 AI15
	-21 Ret
AI16	J11-22 +5 VDC (001 board only)
	-23 AI16
	-24 Ret

ANALOG OUTPUTS

There are five analog outputs on the -000 board and seven on the -001 board. *Figure 90 on page 235* is a detail of this input and is representative of all these inputs. Each output can provide a 0 to 10 VDC output (between terminals 2 and 3) or 4 to 20mA output (between terminals 1 and 3).

OUTPUT	CONNECTION
AO1	TB1-1 4 to 20mA
	-2 0-10V
	-3 Ret
AO2	TB2-1 4 to 20mA
	-2 0-10V
	-3 Ret
AO3	TB3-1 4 to 20mA
	-2 0-10V
	-3 Ret
AO4	TB4-1 4 to 20mA
	-2 0-10V
	-3 Ret
AO5	TB5-1 4 to 20mA
	-2 0-10V
	-3 Ret
AO6	TB6-1 4 to 20mA (-001 board only)
	-2 0-10V
	-3 Ret
AO7	TB7-1 4 to 20mA (-001 board only)
	-2 0-10V
	-3 Ret

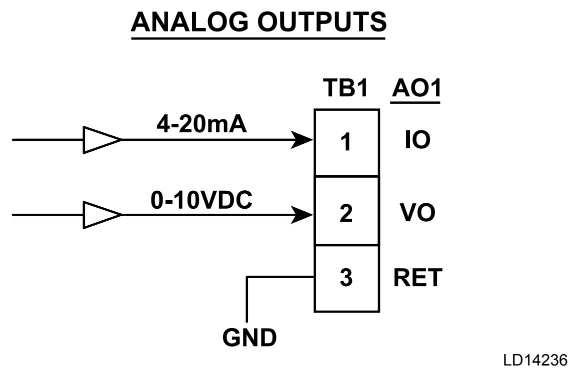

FIGURE 90 - ANALOG OUTPUTS

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AUTO DETECTION

Earlier vintage chillers use Analog I/O Board 371-02514-000 for the ht gas bypass feature. This board also connects to the COM3 serial port (J12). Since this board uses different protocol than the 031-02895-xxx board, the microboard must know which board is present in order to be able to communicate with it.

The microboard determines which board is present by the features that are enabled:

- If heat recovery and/or or head pressure control is enabled, it knows the 031-02895-xxx board is present and only the 031-02895-xxx board is polled.
- If only hot gas bypass is enabled, the microboard automatically determines which board is present. At boot-up, the microboard alternates between polling the 031-02895-xxx board and the 371-02514-000 Board. Once a valid response is received from one of these two boards, the communications will continue to only poll that board type.

DIAGNOSTIC SCREEN

The DIAGNOSTIC Screen (See *Figure 106 on page 306*), accessible from the MAIN DIAGNOSTICS Screen, is used to analyze the analog and Digital inputs and outputs. It is also used to manually control the digital outputs and set analog output voltages.

There are two versions of this screen available as follows:

Service Access level

The voltage value of each analog input at the board input terminals/pins, as interpreted by the I/O Board and transmitted to the microboard, is displayed as ANALOG INPUTS.

The voltage value sent from the microboard to the I/O board for analog output displays as ANALOG OUTPUTS.

The ON/OFF status of the Digital inputs and Digital Outputs are indicated with an LED. It is illuminated when the input or output is on; extinguished when it is off.

Modbus communication error counters are displayed as follows, along with the ability to reset the counters:

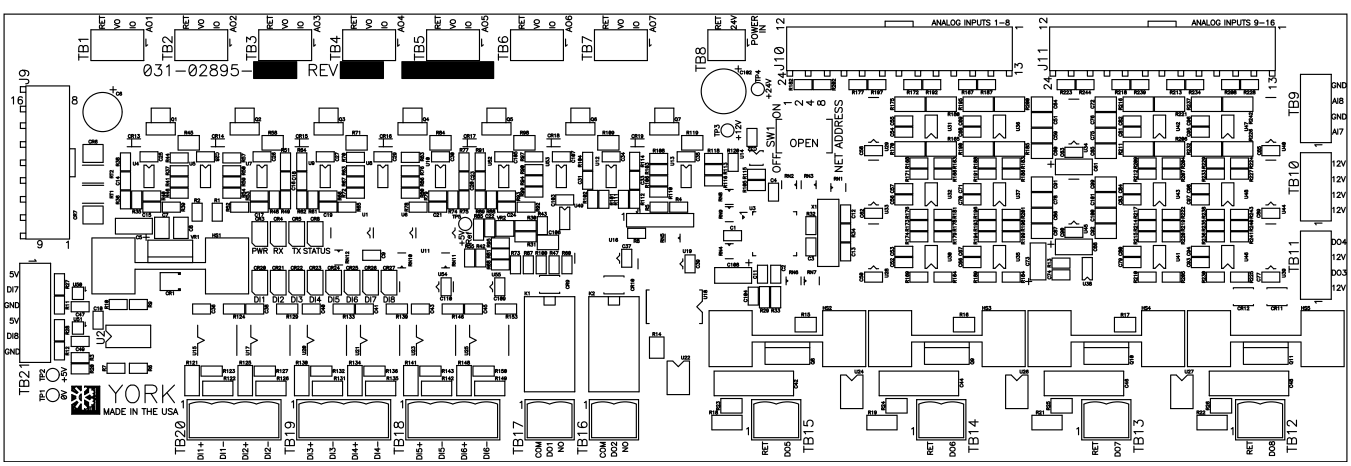
- ID faults – This is the number of packets received with an incorrect subordinate ID.
- Checksum errors – This is the number of checksum errors encountered in communication.
- Error packets – This is the number of error packets received.
- Timeout Faults – Number of timeout faults encountered. A timeout is registered when no valid response is received for a poll within two seconds.

SERVICE access level plus Microboard DIP Switch 1-3 to ON (See *Figure 17 on page 66*)

In addition to the displays above, the following can be performed.

The digital outputs can be individually turned on or off. Use the SELECT DIGITAL OUTPUTS key to select the desired output, then use the ENABLE and DISABLE keys to turn it on or off.

The analog outputs can be individually set to a desired voltage value. Use the SELECT ANALOG OUTPUT key to select the desired output, then use the numeric keys to set it to the desired value.



LD14349

FIGURE 91 - I/O BOARD (031-02895-XXX)

SECTION 28 - HEAT RECOVERY (SOFTWARE VERSION C.OPT.01.21.307 AND LATER)

This option uses two tube bundles in the condenser. The lower bundle is the standard condenser bundle and is piped to the cooling tower water source. The upper tube bundle is used to recover waste heat rejection for use in a closed loop heating circuit. Chillers equipped with this feature are also equipped with the Hot gas bypass feature.

On a heat recovery chiller, the chiller primary control remains the cooling load. So, the compressor capacity is still functioning according to the Leaving Chilled Water Temperature setpoint.

The desired hot water temperature leaving the heating bundles is obtained by regulating the heat rejection through the standard lower tube bundle (sourced by cooling tower or other water circuit). This is done by controlling the temperature of the Return Condenser Water Temperature (by tower bypass circuit to elevate the temperature of the return condenser water) or varying the condenser water flow. This control can be performed by the OptiView Control Center or an external controller. If the OptiView Control Center is used to perform this control, The Heat Recovery Control Valve is modulated to control the Leaving Heating Condenser Water Temperature to the Hot Water setpoint. The control output to the valve is Direct Acting (when the Leaving Heating Condenser Water Temperature rises above the Hot Water setpoint, the valve is driven more open to provide greater cooling to the standard lower tube bundle).

The heat recovery bundle is provided with a Leaving Heating Condenser Water Thermistor, Return Heating Condenser Water Thermistor and a Heating Condenser Water Flow Switch. The heat recovery circuit control is only active when the flow sensor indicates flow.

If the chiller is equipped for Heat Recovery, the feature must be ENABLED on the SETUP Screen. Otherwise, it must be DISABLED. Once enabled, the HEAT RECOVERY Screen is available from the CONDENSER Screen. All of the Heat Recovery parameters are displayed on this screen. If Head Pressure Control is also enabled, the Head Pressure parameters appear on the HEAT RECOVERY Screen (there is no separate HEAD PRESSURE CONTROL screen in this configuration).

NOTE

The heat recovery feature cannot be used with the Heat Pump feature. If HEAT PUMP Duty is enabled, heat recovery will be disabled and locked.

INPUTS/OUTPUTS

The I/O used for the heat recovery feature is:

- Leaving Heating Condenser Water Temperature Thermistor input
- Return Heating Condenser Water Temperature Thermistor input
- Heating Condenser Water Flow Switch input (paddle or thermal type)
- Heat Recovery Control Valve output (0 to 10 VDC or 4 to 20mA)

The above are interfaced to the LTC I/O Board 031-02895-000 as shown in *Figure 92 on page 238* (the thermal flow switch connects directly to the microboard). The operation of this I/O Board is explained in *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001*. The microboard communicates with this board using RS-485 Modbus serial communications. The microboard reads the Heating Condenser Water Temperature Thermistors and the Flow Switch status via this interface. It also drives the Heat Recovery Control Valve via a 0 to 10 VDC or 4 to 20mA output as described below.

Use *Figure 17 on page 66* to convert the heating condenser thermistors voltage output to a (°F) temperature value.

CONTROL

If the OptiView Control Center is used to control the heat recovery valve, then the hot water control setpoint on the HEAT RECOVERY screen must be enabled. If disabled, only the heat recovery inputs are displayed. When enabled, all of the control parameters are displayed on this screen as described below.

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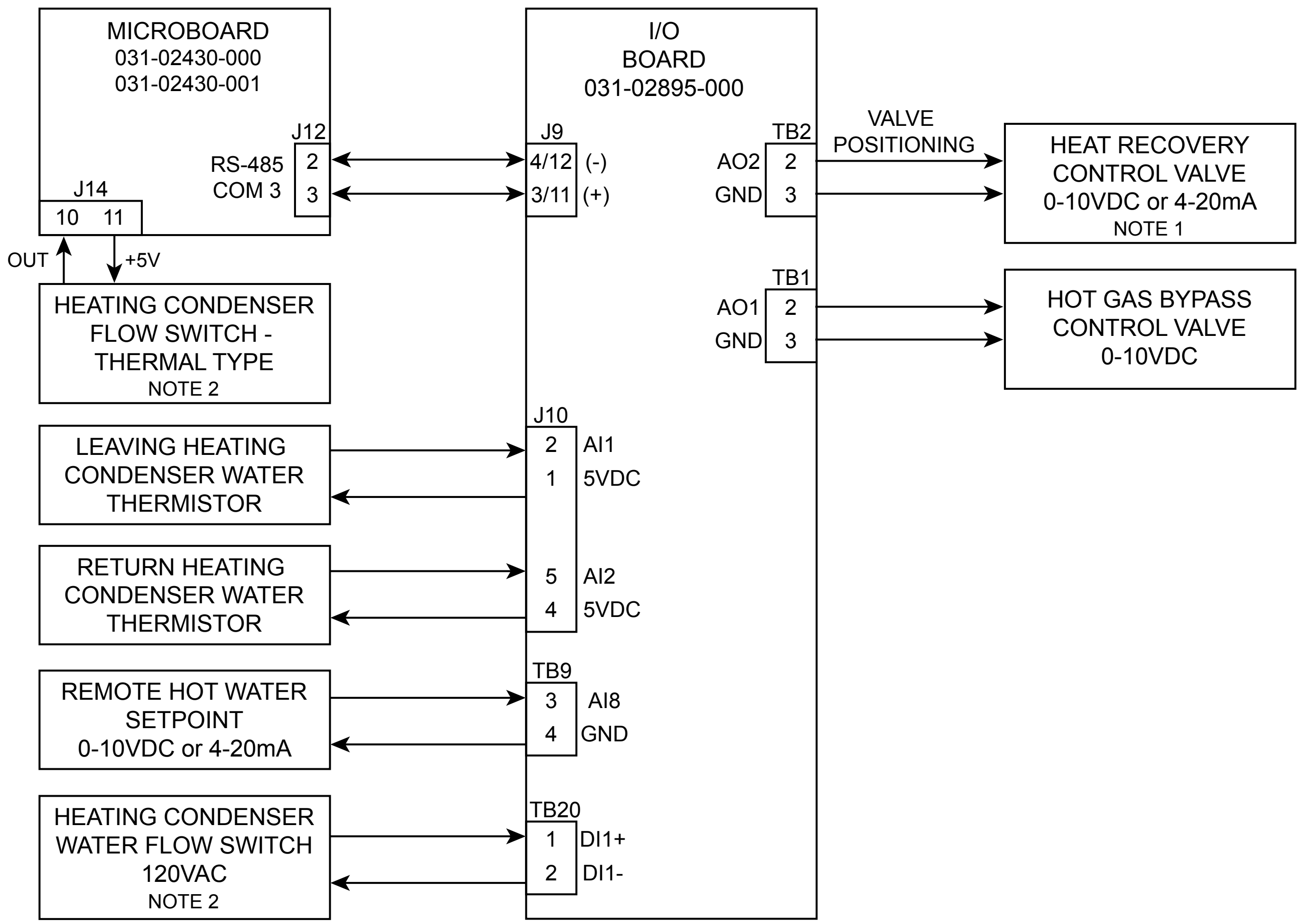
Setpoints

- Hot Water Control setpoint – (Extended temp range equals 65.0°F to 125.0°F; default 95.0) (Standard temp range equals 65.0°F to 112°F; default 95.0) Sets the temperature that the Leaving Heating Condenser Water Temperature will be controlled to Displayed as Active Hot Water setpoint.



NOTES:
1. If Head Pressure Control is ENABLED and Hot Water Control is DISABLED or if Hot Water Control is ENABLED but there is NO water flow in the heating condenser, valve control will automatically switch over to the Head Pressure Control.

2. The chiller could be equipped with either paddle/differential pressure (120VAC) type or Thermal Type (+5VDC) flow switches. Each Type must be connected as shown.

LD14238

FIGURE 92 - HEAT RECOVERY BLOCK DIAGRAM

- Control Valve Output Settings:
  a. TYPE – Makes the control signal to the Heat Recovery Control Valve either 0 to 10 VDC or 4-10mA (default 0 to 10 VDC).
  b. PID OUTPUT – Makes the control signal to the Heat Recovery Control Valve either Direct or Reverse acting (default Direct). Set to Direct for this application.
  c. SET – Is used to manually set the Heat Recovery Control Valve to any position between 0.0% and 100%.
  d. AUTO – Returns the Heat Recovery Control Valve to Automatic Control Mode (default Auto).
- Hot Water Control – Sets the proportional gain of the control:

  P – Sets the proportional gain of the control over the range of 0.00 to 5.00(default 2.00)

  I – Sets the integral gain of the control over the range of 0.0 to 5.00 (default 2.00)

  D – Sets the derivative gain of the control over the range of 0.0 to 5.00 (default 0.00)
- Remote Input Type – Configures the LTC I/O Board input (TB9-3/4) to accept either a 0-10 VDC or 4 to 20mA input signal type for the Remote Hot Water setpoint input.

When Hot Water Control is active, the Control Valve Output is modulated by a direct acting PID control. The inputs to the PID control are the Leaving Heating Condenser Water Temperature and the Hot Water setpoint (the Active Hot Water setpoint displays the setpoint in use). The PID control error is defined as (Hot Water setpoint – Leaving Heating Condenser Water Temperature). The PID control's proportional, integral and derivative gains are programmable using the CHANGE SETPOINTS key. The Control Valve position is displayed as 0.0% to 100% in the box labeled CONTROL VALVE OUTPUT. The control output to the valve is Direct Acting (when the Leaving Heating Condenser Water Temperature rises above the Hot Water Setpoint, the valve is driven more open to provide greater cooling to the standard lower tube bundle). The following diagram shows the PID controller.

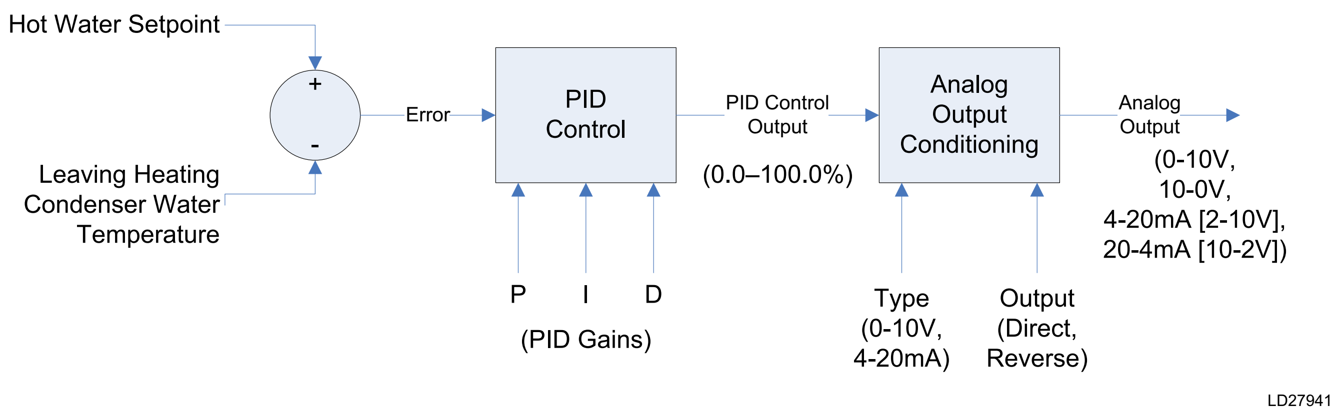


FIGURE 93 - PID CONTROLLER DIAGRAM

The Control Valve Output Settings keys are used to configure the output signal to the Heat recovery Control Valve. The Type setpoint is used to make the control signal either 0 to 10 VDC or 4 to 20mA. The Auto setpoint is used to place the control in Automatic Mode. The Set setpoint places the valve control in manual. It is used to manually position the control valve at any position between 0.0% and 100%. The Control Valve Control Mode shall be reset to Auto upon logging out of Service Level Access. The Control Valve Control Mode data box displays the Operating Mode as MANUAL or AUTO as appropriate.

The PID Output setpoint is used to configure the signal to the Control Valve to be DIRECT or REVERSE acting (default DIRECT). In this application, it should be set to DIRECT. The output for each setting is per the following table:

CONTROL VALVE OUTPUT TYPE	PID OUTPUT	PID CONTROL 0% OUTPUT	PID CONTROL 100% OUTPUT
0-10V	Direct	0V	10V
0-10V	Reverse	10V	0V
4 to 20mA	Direct	4mA (2V)	20mA (10V)
4 to 20mA	Reverse	20mA (10V)	4mA (2V)

If the chiller is equipped with both Heat Recovery and Head Pressure Control (See *SECTION 29 - HEAD PRESSURE CONTROL*) and both are enabled, there is not a Control Valve for each feature. Rather, there is one common valve that is either performing Hot Water Control for Heat Recovery or it is performing Head Pressure Control. It will not be performing control for both features at the same time. Normally, it will be performing Hot Water Control until certain operating conditions cause it to switch over to Head Pressure Control. The PID Control Mode displays which feature is controlling the valve at any given time. When performing Hot Water Control, HOT WATER is displayed. When performing Head Pressure Control, HEAD PRESSURE is displayed. There are also conditions under which it not controlling either feature, in which case INACTIVE is displayed and the valve is set to 0% position. Which feature is controlling the valve at any instant and when it is inactive is determined by operating conditions as shown in the following flow chart.

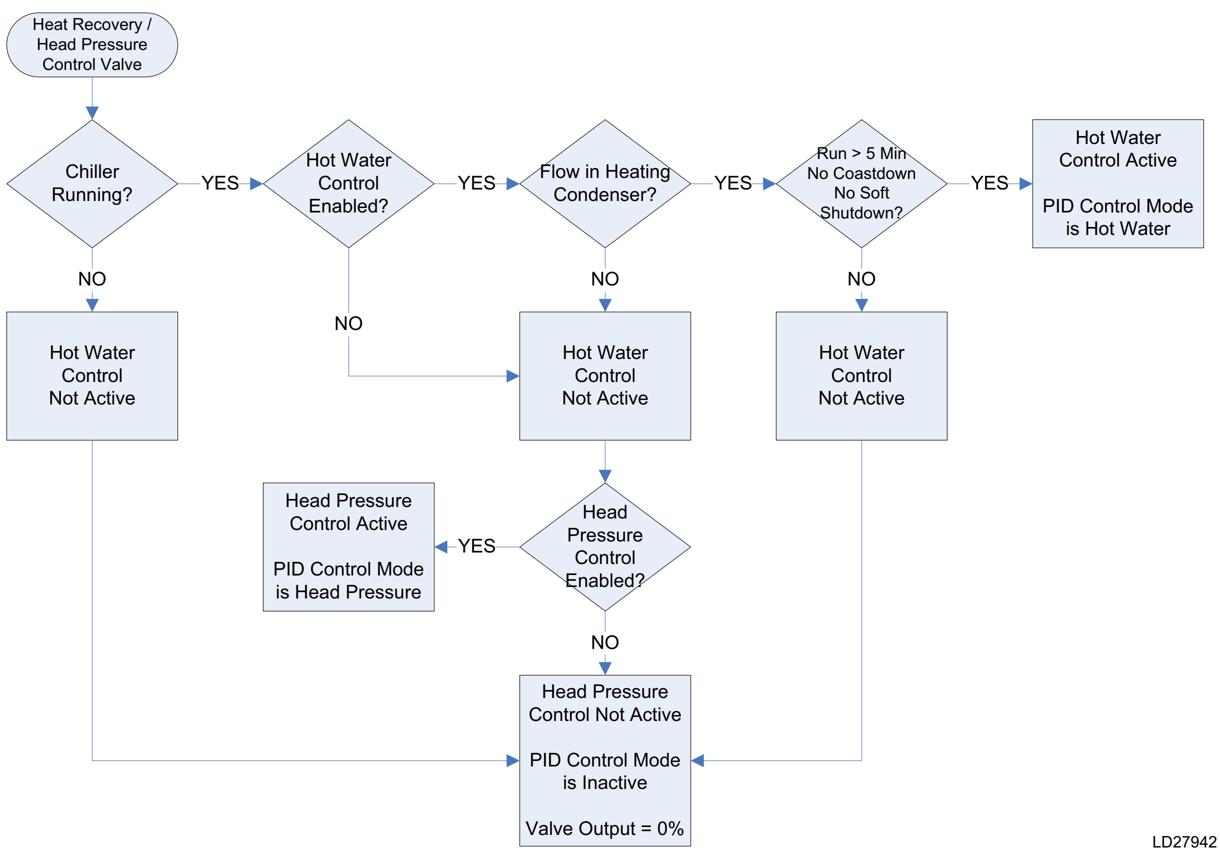


FIGURE 94 - HEAT RECOVERY FLOW DIAGRAM

REMOTE HOT WATER SETPOINT

The Hot Water setpoint can be remotely changed based on the chiller's Control Source setting. The Active Hot Water setpoint will contain the actual setpoint being used for Hot Water Control. The following table shows what setpoint is used based on the Control Source.

The allowable range for the Active Hot Water setpoint is the same as the Local Hot Water setpoint. If a remote value is received that is greater than the maximum, the active setpoint shall be set to the maximum. If a remote value is received that is less than the minimum, the active setpoint shall be set to the minimum. The Remote Hot Water setpoint Input Type selects the type of input signal to be used (0-10V or 4 to 20mA) when the Control Source is set to Analog.

The Remote Input Type setpoint is used to configure the LTC I/O Board input TB9-3/4 to accept either a 0 to 10 VDC or 4 to 20mA input for the Remote setpoint input. This setpoint must be set to the same value for the actual input applied. Otherwise, the remote setpoint will not be interpreted correctly. The Active Hot Water setpoint data box displays the remote setpoint that is in effect.

CONDENSER FLOW SWITCH OPEN FAULT

The CONDENSER-FLOW SWITCH OPEN Cycling Shutdown is changed when Heat Recovery is enabled. It shall shut the unit down only if both the Condenser Flow Switch and the Heating Condenser Flow Switch are open using the same timing as in the current logic. If either flow switch is closed, the chiller will not shut down.

TABLE 23 - CONTROL SOURCE SETPOINTS

ACTIVE HOT WATER SETPOINT	CONTROL SOURCE	INPUT	DESCRIPTION
Hot Water Setpoint	Local and Digital	Heat Recovery Screen	Locally programmed value
Remote Hot Water Setpoint	BAS	YORK Talk III Comms	Remote value via communications (GPIC List)
Remote Hot Water Setpoint Offset	Analog	Analog Input	Offset added to local Hot Water Setpoint 0V = -0°F offset, 10V = -20°F offset 4mA = -0°F offset, 20mA = -20°F offset

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SECTION 29 - HEAD PRESSURE CONTROL (SOFTWARE VERSION C.OPT.01.21.307 AND LATER)

YK chillers are capable of operation within a wide range of condenser water temperatures. However, a minimum condenser water temperature, as specified in the Engineering Guide, is required to maintain sufficient pressure differential (head) between the condenser and evaporator for proper oil and refrigerant management in the chiller.

Should colder condenser water temperatures be anticipated at the cooling source, a field mounted facility control means may be provided to ensure adequate head pressure exists. The preferred means would be a cooling tower bypass circuit that maintains a constant flow rate through the condenser, since this would maintain adequate tube velocity in the condenser, while regulating the return cooling water to the condenser. However, a two-way condenser water throttling valve, a variable speed cooling tower pump, or tower fan control circuit might also be employed.

The head pressure control function provides an analog output control signal from the OptiView Control Center that responds to the programmed Head Pressure (Condenser Pressure minus Evaporator Pressure) setpoint. The output is direct acting (as the Head Pressure increases above the setpoint, the valve is driven more open to provide less tower bypass or more flow through the condenser).

If the chiller is equipped for Head Pressure Control, the feature must be ENABLED on the SETUP Screen using the Head Pressure Control setpoint. Otherwise it must be DISABLED. Once enabled, the HEAD PRESSURE CONTROL Screen is available from the CONDENSER Screen. All of the Head Pressure Control parameters are displayed on this screen. If Heat Recovery is also enabled, the Head Pressure parameters appear on the HEAT RECOVERY Screen (there is no separate HEAD PRESSURE CONTROL Screen in this configuration).

NOTE

The Head Pressure feature cannot be used with the Heat Pump feature. If HEAT PUMP Duty is enabled, Head Pressure will be disabled and locked.

INPUTS/OUTPUTS

The I/O used for Head Pressure Control feature is:

- Evaporator Transducer
- Condenser Transducer
- Head Pressure Control Valve output (0 to 10 VDC or 4 to 20mA)

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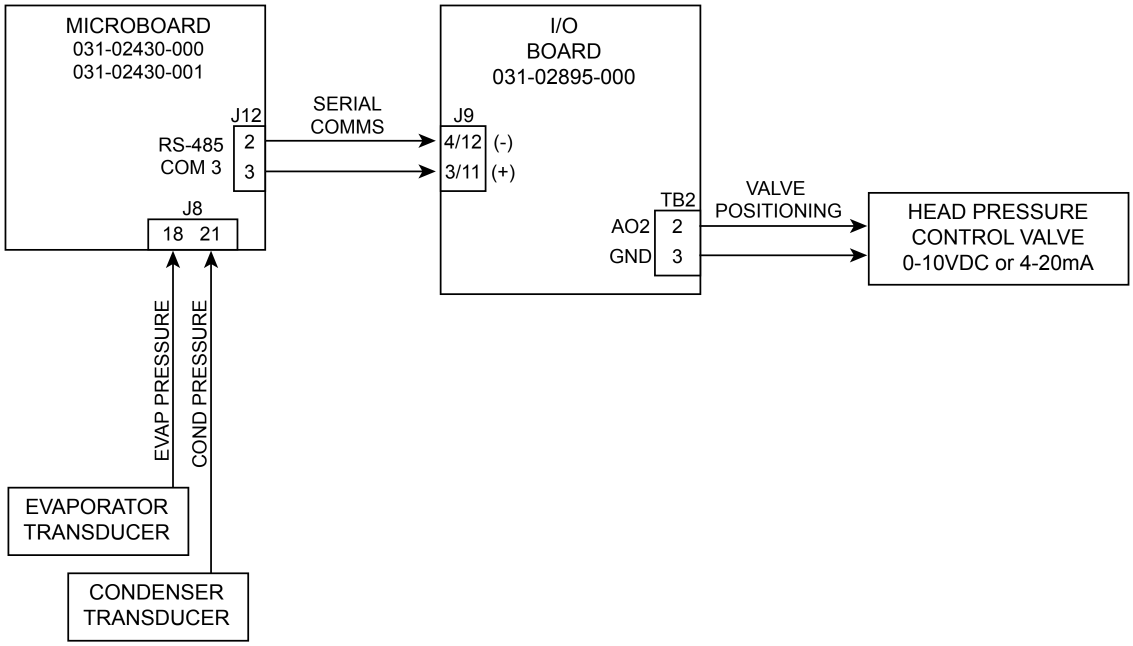

FIGURE 95 - HEAD PRESSURE CONTROL BLOCK DIAGRAM

The evaporator and condenser transducers are connected to the microboard as shown in *Figure 95 on page 243*. This provides the head pressure (condenser minus evaporator) to the microboard. The Head Pressure Control Valve is driven from the LTC I/O Board 031-02895-000. The operation of this board is explained in *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001*. The microboard communicates with this board using RS-485 Modbus serial communications. It sends the valve positioning command, via this serial link, to the I/O Board where it is converted to a 0 to 10 VDC or 4 to 20mA positioning signal that is applied to the valve as described below.

CONTROL

When Head Pressure Control is enabled, all the following programmable settings and applicable parameters are available on the HEAD PRESSURE CONTROL Screen (or HEAT RECOVERY Screen, if Heat Recovery is enabled).

Setpoints

- Head Pressure setpoint (15.0 psid to 60.0 psid; default 23 psid) - Sets the Head Pressure that the control will control to. Value entered is displayed as Head Pressure setpoint.
- Control Valve Output Settings:

  TYPE – Makes the control signal to the Head Pressure Control Valve either 0 to 10 VDC or 4-10mA (default 0 to 10 VDC).

  PID OUTPUT – Makes the control signal to the Head Pressure Control Valve either Direct or Reverse acting (default Direct). Set to Direct for this application.

  SET – Is used to manually set the Head Pressure Control Valve to any position between 0.0% and 100%.

  AUTO – Returns the Head Pressure Control Valve to Automatic Control Mode (default Auto).

- Head Pressure Control – Sets the proportional gain of the control:

  P- Sets the proportional gain of the control over the range of 0.00 to 5.00(default 2.00).

  I – Sets the integral gain of the control over the range of 0.0 to 5.00 (default 2.00).

  D – Sets the derivative gain of the control over the range of 0.0 to 5.00 (default 0.00).

When Head Pressure Control is enabled, the Control Valve Output is modulated by a direct acting PID control. The inputs to the PID control are the chiller Head Pressure (Condenser Pressure – Evaporator Pressure) and the Head Pressure setpoint. The PID control error is defined as Head Pressure setpoint – Head Pressure. The PID control's proportional, integral and derivative gains are programmable using the CHANGE SETPOINTS key. The Control Valve position is displayed as 0.0% to 100% in the box labeled CONTROL VALVE OUTPUT. The control output to the valve is direct acting (as the Head Pressure increases above the setpoint, the valve is driven more open to provide less tower bypass or more flow through the condenser). The following diagram shows the PID controller.

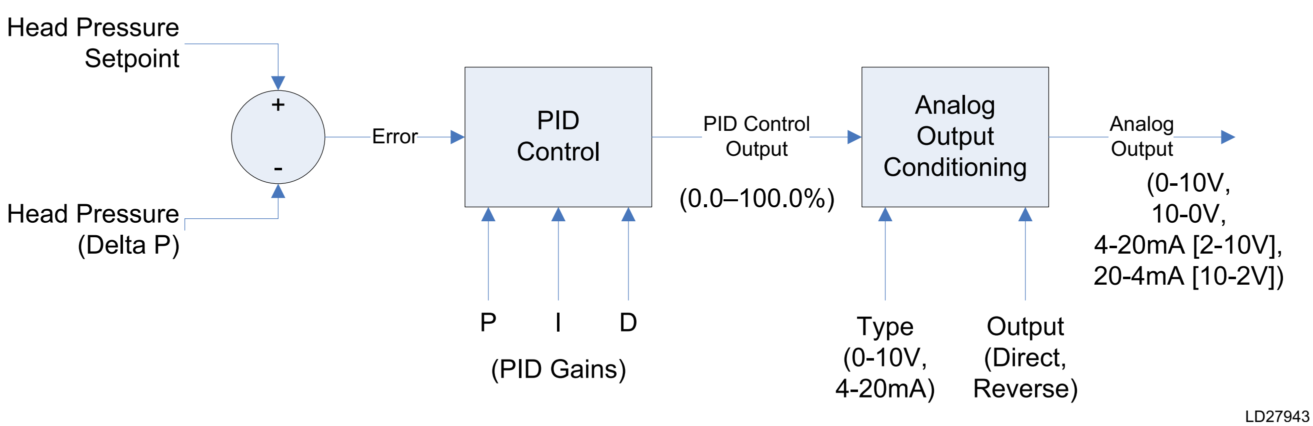

FIGURE 96 - HEAD PRESSURE CONTROL FLOW DIAGRAM

The Control Valve Output Settings keys are used to configure the output signal to the Heat Recovery Control Valve. The Type setpoint is used to make the control signal either 0 to 10 VDC or 4 to 20mA.

The Auto setpoint is used to place the control in Automatic Mode. The Set setpoint places the valve control in manual. It is used to manually position the control valve at any position between 0.0% and 100%. The Control Valve Control Mode shall be reset to Auto upon logging out of Service Level Access. The Control Valve Control Mode data box displays the operating Mode as MANUAL or AUTO as appropriate.

The PID Output setpoint is used to configure the signal to the Control Valve to be DIRECT or REVERSE acting (default DIRECT). In this application, it should be set to DIRECT. The output for each setting is per the following table.

CONTROL VALVE OUTPUT TYPE	PID OUTPUT	PID CONTROL 0% OUTPUT	PID CONTROL 100% OUTPUT
0-10V	Direct	0V	10V
0-10V	Reverse	10V	0V
4 to 20mA	Direct	4mA (2V)	20mA (10V)
4 to 20mA	Reverse	20mA (10V)	4mA (2V)

OPERATION WHEN EQUIPPED WITH BOTH HEAT RECOVERY AND HEAD PRESSURE CONTROL

If the chiller is equipped with both Heat Recovery and Head Pressure Control and both are enabled, there is no separate HEAD PRESSURE CONTROL Screen. All Head Pressure Control Parameters and setpoints are shown on the HEAT RECOVERY Screen. Also, there is not a Control Valve for each feature. Rather, there is one common valve that is either performing Hot Water Control for Heat Recovery or Head Pressure Control. It will not be performing control for both features at the same time. Normally, it would be performing Hot water Control until certain operating conditions cause it to switch over to Head Pressure Control. The PID Control Mode displays which feature is controlling the valve at any given time. When performing Hot Water Control, “Hot Water“ is displayed. When performing Head Pressure Control, “Head Pressure“ is displayed. There are also conditions under which it is not controlling either feature, in which case “Inactive“ is displayed and the valve is set to 0% position. Which feature is controlling the vale at any given instant and when it is inactive is determined by operating conditions as shown in flow chart in *SECTION 28 - HEAT RECOVERY* .

Remote Head Pressure Setpoint

This setpoint cannot be set from a remote input.

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SECTION 30 - QUICK START (SOFTWARE VERSION C.OPT.01.21.307 AND LATER)

The Quick Start feature is useful in data center and process control applications where it is desirable to re-establish cooling as fast as possible after a shutdown or power failure. This feature, when enabled, allows quicker starts and restarts than normal control. It does this by reducing the time cycle for chiller restart and once running, loading the chiller as fast as possible. After the chiller is running and has met a specified setpoint or a specified period of time has elapsed, control returns to normal.

In order to use this feature, the chiller must be equipped with a Variable Speed Drive (VSD) (in Modbus Protocol configuration) or a medium Voltage VSD. The low inrush current of a VSD allows more starts per hour and allows the chiller to start with a more open vane position.

Although not required, the hot gas bypass option is recommended, as it will allow the chiller to startup more smoothly with less chance of surging.

QUICK START MODES

The quick start feature has two different start modes:

- **Quick Restart –** When a chiller shuts down, if certain conditions are met at the completion of coastdown (within 30 seconds thereafter), the VSD is started immediately with no pre-lube. The vanes are given a constant open pulse and after the VSD achieves its start frequency, the speed ramp rate is faster than with normal control.
- **Quick Normal Start –** If the conditions for a quick restart are not met, the next time the chiller is started, it has a pre-lube period just like a normal start, however the vanes will begin to open at the beginning of pre-lube, instead of waiting until system run. At the completion of pre-lube, the VSD is started and after the VSD achieves its Start Frequency, the speed ramp rate is faster than with normal control.

Although an Uninterruptible Power Supply (UPS) is not required for the quick start feature, powering the OptiView Control Center and VSD (except for the trigger board) with 115 VAC from a UPS will reduce the time to restart after a power failure due to elimination of the OptiView reboot time. This provides the fastest possible ability to start or restart after generator or utility power is restored.

The quick start feature must be enabled per the procedure below to make it operational. There are certain requirements and limitations applied that determine if quick start can be enabled.

Once enabled, all setpoints and parameters related to this feature are displayed on the QUICK START screen, accessible from the SETPOINTS screen when logged in at SERVICE access level.

NOTE

If it is desired to use the quick start feature while heat pump duty is enabled, quick start is only available when heat pump duty operational mode setpoint is set to cooling mode. When the heat pump duty operational setpoint is set to heating mode, quick start is automatically disabled.

SETPOINTS

The following setpoints are listed on the QUICK START Screen. Use the CHANGE SETPOINTS key and UP/DN Arrow keys to place a green box around the desired setpoint to be changed. Then press the ✓ key. A box will appear with the allowable values. Enter/Select the desired value and press the ✓ key.

Quick Start Mode

(Enabled, Disabled; default Disabled)

This setpoint is used to enable and disable the quick start feature. It can only be enabled when the motor drive type setpoint is set to VSD and the Motor Communications Protocol is set to Modbus. Or, the Motor Drive Type setpoint is set to MVVSD. If heat pump duty is enabled, the Quick Start feature can only be enabled when the Heat Pump Operational Mode setpoint is set to COOLING. The default is Disabled.

Quick Start can only be enabled using an ADMIN password. When logged in at ADMIN access level, a QUICK START key will appear on the SETPOINTS Screen. Pressing this key will navigate to the QUICK START Screen where this setpoint is used to enable/disable the feature.

Quick start can be disabled when logged in at SERVICE access level. However, once disabled, it requires an ADMIN password to enable it again, as explained above.

Quick Start Mode will be automatically disabled when any of the following occur:

- The Motor Drive Type is changed to something other than VSD or MVVSD.
- The Motor Communications Protocol is changed to YORK.
- The Heat Pump Duty (if enabled) Operational setpoint is set to Heating Mode.

Quick Pulldown Setpoint Offset

(0°F to 10°F; default 5°F)

This setpoint sets the Leaving Chilled Liquid Temperature at which the control transitions from Quick Start Mode to normal operation. It is entered in the form of an offset above the active Leaving Chilled Liquid Temperature (LCHLT) setpoint. Once the leaving chilled liquid temperature falls below the Active LCHLT setpoint + Quick Pulldown Setpoint Offset, PRV (Quick Restart) and speed control (Quick Restart and Quick Normal Start) revert to normal automatic control. Lower values of this offset result in faster pulldown times but can result in overshoot of the LCHLT setpoint. Setting the value to its minimum of 0 results in the fastest pulldown time but nearly always results in setpoint overshoot. Depending upon how close the Low Chilled Liquid Temperature shutdown threshold is to the LCHLT setpoint, this could result in a Low Chilled Liquid Temperature cycling shutdown.

The leaving chilled liquid temperature and setpoint is shown on the QUICK START Screen for reference. This setpoint sets one of the two setpoints that determine when the control transitions from Quick Start Mode to normal operation. The other is the Pulldown Override Time below.

Pulldown Override Time

0 min to 15 min; default 10 min)

This setpoint is the length of time the PRV is held open (Quick restart) and the ACC speed (Quick Restart and Quick Normal Start) is increased on startup if the Quick Pulldown Setpoint Offset is not reached. This could be due to hitting current limit during the pulldown. If the Quick Pulldown Setpoint Offset is not reached in the Pulldown Override Time, PRV and ACC speed control will revert back to normal automatic control.

- **VSD Start Frequency** (60Hz units with quick start enabled equals 30Hz to 45Hz; default 45Hz) (50Hz equals 25Hz to 37.5Hz; default 37.5Hz) - This setpoint is the same as shown on the ACC DETAILS Screen. It can be programmed on either the ACC Screen or the QUICK START Screen. It sets the VSD start frequency from which the speed will ramp from.
- **ACC Mapping Enable** (0.5°F to 4.0°F; default 1.0°F) - This is the same setpoint as shown on the ACC DETAILS Screen. It can be programmed on either the ACC Screen or the QUICK START Screen. It sets the Delta T needed to be met to enable surge mapping and speed reduction initially on startup.
- **Quick Ramp Current Threshold** (20% to 80% FLA; default 50%) - This setpoint sets the motor current threshold where the VSD speed command ramp rate changes. At or below this threshold the speed command ramp is 4X of standard control. Over this threshold, the ramp rate is 2X of standard control until it hits the standard current limiting over 80% FLA. Higher current thresholds can result in faster pulldown times. However, setting this value too high can result in slower pulldown times due to hitting the current limit sooner on pulldown.
- **Coastdown Time –** When Quick Start is enabled, the minimum programmable coastdown time for this setpoint is lowered as follows:
    - Q Compressors from 150 seconds to 60 seconds
    - J7 and K7 Compressors from 240 to 150 seconds
    - All other Compressors from 150 to 90 seconds
- The shorter the programmed Coastdown Time, the less time it takes from a shutdown or power failure until the compressor can be restarted. This value is programmable from the SETUP Screen. The actual mechanical Coastdown Time should be observed while performing several hard stops (with control panel rocker switch) on the chiller at various load/head conditions and visually checking when rotation stops. The time period programmed for the Coastdown Time needs to be longer than the longest physical time it takes the compressor rotation to stop.

OPERATION

When Quick Start Mode is enabled, there are several operational enhancements common to both Quick Restart and Quick Normal Start to decrease time between starts as follows:

- The Coastdown time can be shortened using the Coastdown Time setpoint. The shortest possible time for the Coastdown Time setpoint should be determined using the procedure above under Coastdown Time setpoint.
- The OIL - LOW TEMPERATURE DIFFERENTIAL threshold is decreased to 10°F (from 30 or 40, depending on conditions) for 15 minutes after the last shutdown (the timer begins when the run signal is removed).
- The Oil Heater is controlled to maintain a minimum oil temperature, ensuring it is warm enough to allow a restart as follows: While the oil pump is running, if oil temperature is less than 100°F, the Oil Heater is turned ON until it reaches greater than 105°F whereupon it is turned OFF. In order for this function to operate, a wiring change is required to the Oil Heater wiring as described below.
- The Hot gas bypass Valve is positioned to the Maximum Open setpoint value during Soft Shutdown, Coastdown and while not running. It returns to normal control (closed) when the Run signal is ENABLED.
- The PRV open/close status switch does not have to be closed in order to start.

Quick Restart

Whenever the chiller shuts down, for whatever reason, the following will occur in preparation for a Quick Restart: During the Coastdown period and for 30 seconds after the end of Coastdown, the PRV and Variable Orifice positions are held in place, a precharge command is sent to the VSD, the chilled Liquid Pump contacts TB2-44/45 are maintained closed and the Oil Pump continues to run (target oil pressure 45 psid).

When Coastdown has completed (and for 30 seconds thereafter), if the following conditions are met, a run command is sent to the VSD and the Quick Pulldown begins. No Pre-lube occurs.

- Oil Pressure more than 25 psid
- VSD has completed Precharge
- Chiller start signal (local or remote) is present
- No faults/inhibits present
- Chilled liquid flow switch is closed

Since there is no Pre-lube, the Auto-zeroing that normally occurs between the Oil Pressure Transducers during Pre-lube, does not occur. The offset calculation from the last Quick Normal Start is used. The level control preset (for the duration set by the Valve Preset Time setpoint) does not take place.

When the run command is sent to the VSD, the chiller enters System run and the Quick Pulldown begins. The QUICK PULLDOWN IN EFFECT LED on the QUICK START Screen illuminates while the Quick Pulldown is in effect. The Level Control begins ramping immediately, rather than waiting for 3 minutes after entering System run, as it does in normal operation. The Oil Pump continues to use the Target Oil Pressure of 45 psid for the first 15 seconds into run, then reverts to the programmed setpoint value. The speed command programmed as the VSD Start Frequency setpoint is sent to the VSD. The speed will ramp up to maximum frequency from this point at 4X the standard control until it reaches the current set as the Quick Ramp Current Threshold setpoint (20-80% FLA), whereupon it ramps at 2X standard control until it reaches the standard current limiting over 80% FLA, whereupon it ramps at standard rate. A continuous open signal is applied to the PRV.

The continuous open signal to the PRV and the quick VSD speed ramping will continue until either the Leaving Chilled Liquid Temperature decreases to the temperature set by the Quick Pulldown Setpoint Offset (0 to10°F) setpoint or the Pulldown Override Time (0 to 15 min) setpoint has elapsed, whereupon all VSD speed control and PRV control returns to standard.

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In order for a Quick Restart to be performed after a power failure, the power failure duration must be no longer than about 60 seconds. Data centers can generally guarantee stable generator power to be available 15 seconds or less following a power failure. Longer power failures will result in a Quick Start (see below) rather than a Quick Restart.

If the criteria for a Quick Restart above is not met within 30 seconds after coastdown has completed, the following control returns to standard control:

- Chilled Liquid Pump control returns to standard
- PRV control returns to standard

- Variable Orifice control returns to standard and is opened
- Oil Pump control is returned to standard and turns off

If a Quick Restart did not occur within 30 seconds of the end of Coastdown as described above, the next start that occurs will be a QUICK NORMAL START as described below.

Quick Normal Start

If a Quick restart does not occur within 30 seconds after the end of Coastdown as described above, the next start that occurs will be a Quick Normal Start. This is a start that uses a Pre-lube but loading is faster than normal.

During the Pre-lube, a continuous open signal is given to the PRV as soon as the oil pump run signal is enabled. This open signal will be sent until the Pre-lube is complete, whereupon PRV control returns to normal automatic control. The level Control and Oil Pump are controlled during Pre-lube and System run as in normal operation. At the completion of Pre-lube, a run command is sent to the VSD, the chiller enters System run and the Quick Pulldown begins. The "Quick Pulldown In Effect" LED on the QUICK START Screen illuminates while the Quick Pulldown is in effect. The speed command programmed as the VSD Start Frequency setpoint is sent to the VSD. The speed will ramp up to maximum frequency from this point at 4X the standard control until it reaches the current set as the Quick Ramp Current Threshold setpoint (20-80% FLA), whereupon it ramps at 2X standard control until it reaches the standard current limiting over 80% FLA, whereupon it ramps at standard rate to full speed. If at any time during this ramping to full speed, if the Leaving Chilled Liquid Temperature decreases to the temperature set by the Quick Pulldown Setpoint Offset (0 to 10°F) setpoint, the Pulldown Override Time (0 to 15 min) setpoint has elapsed (whichever occurs first) or the motor current is greater than 100% FLA, the Quick Pulldown terminates and all VSD speed control returns to normal control.

Summary

The following table compares a Normal Start, Quick Normal Start and a Quick Restart. The Normal Start is that which has been the standard starting sequence and that which occurs when the Quick Start feature is disabled. This is a high level comparison and does not include all details of Quick Start Mode.

TABLE 24 - COMPARE A NORMAL START, QUICK NORMAL START, AND A QUICK RESTART.

NORMAL START (STANDARD LOGIC)	QUICK NORMAL START	QUICK RESTART
Minimum Coastdown Time 150 sec (Q Compressors) 240 sec(J7,K7 Compressors) 150 sec(all other Compressors)	Minimum Coastdown Time 60 sec (Q Compressors) 150 sec (J7, K7 Compressors) 90 sec (All other Compressors)	Minimum Coastdown Time 60 sec (Q Compressors) 150 sec (J7, K7 Compressors) 90 sec (All other Compressors)
Chiller Off PRV Closed Variable Orifice Opened Hot gas Closed	Chiller Off PRV Closed Variable Orifice Opened Hot gas Opened	Coastdown PRV Held (Open) Variable Orifice Held (Open) Hot gas Opened
Pre-lube PRV Closed Variable Orifice Preset/Held Hot gas Closed	Pre-lube PRV Opened Variable Orifice Preset/Held Hot gas Opened	No Pre-lube
VSD Run Signal Enabled	VSD Run Signal Enabled	VSD Run Signal Enabled
PRV Controlled by Capacity Control Variable Orifice Preset/Held/Ramp VSD to Start Frequency Hot gas Standard Control	PRV Controlled by Capacity Control Variable Orifice Preset/Held/Ramp VSD to Start Frequency Hot gas Closed (Std Control)	PRV Given Constant Open Signal Variable Orifice Ramp VSD to Start Frequency Hot gas Closed (Std Control)
Slow Ramp-up of Speed	Quick Ramp-up of Speed Speed Control Returns to Standard when LCHLT less than Active LCHLT Setpoint + Quick Pulldown Setpoint Offset OR when Run Time more than Pulldown Override Time	Quick Ramp-up of Speed PRV and Speed Control Return to Standard when LCHLT less than Active LCHLT Setpoint + Quick Pulldown Setpoint Offset OR when Run Time > Pulldown Override Time

The following topics detail how the individual functions are changed for Quick Restarts and Quick Normal Starts:

PRV Control

When Quick Start is enabled the PRV switch shall be ignored and does not have to be closed in order to start.

When Quick Start is ENABLED the PRV position will be held during coastdown and for 30 seconds after coastdown. If a quick restart is not initiated, the PRV control will return to standard during the not running state.

When Quick Start is ENABLED during normal start-ups, a continuous open signal will be sent to the PRV as soon as the oil pump run signal is enabled during pre-lube. This open signal will be sent to the PRV until pre-lube is complete and then PRV control will return to standard automatic.

When Quick Start is ENABLED during quick restarts, when the VSD is given a run signal, a continuous open signal will be sent to the PRV. The open signal will be sent to the vanes until LCHLT falls below the Quick Pulldown Setpoint Offset. Once this occurs, vane control shall revert to standard automatic control. Any kind of limiting (current, etc.) that would close the vanes will cause the vane control to revert back to standard automatic control and operate as it currently does. The PRV control will also be returned to normal if the Pulldown Override Time timer expires. This timer shall begin counting when the run signal is enabled.

VSD Control

When Quick Start is ENABLED, the VSD shall be sent a precharge command during coastdown and for 30 seconds after the end of coastdown.

Chilled Liquid Flow

Normal operation checks for chilled liquid flow beginning 5 seconds before the end of pre-lube. When Quick Start is ENABLED this check is done before restarting. If chilled liquid flow is not present by 30 seconds after the end of coastdown, the chiller will revert to standard quick normal start logic.

Chilled Liquid Pump Control

Normal operation turns the chilled liquid pump off at the end of coastdown. When Quick Start is ENABLED the chilled liquid pump is kept on for 30 seconds after coastdown is completed. If a quick restart is not initiated within 30 seconds of the end of coastdown, the pump is returned to normal control.

Condenser Level Control

When Quick Start is ENABLED the variable orifice position will be held in its current position during coastdown and for 30 seconds after the completion of coastdown. If a quick restart does not occur within 30 seconds of the end of coastdown the variable orifice control will revert to standard logic and open.

When Quick Start is ENABLED, if a quick restart does not occur within 30 seconds of the end of coastdown, set a QUICK PRESET TIMER to the programmed level control preset time. Count this timer down to 0. When the next normal quick start occurs, subtract the quick preset timer's current value from the preset time so the VO does not close too far and would essentially return to the last position it had held.

For normal operation a condenser level setpoint ramping algorithm is employed if the preset timer is set to zero or the chiller is running or if the preset timer is not zero and the chiller has been running for longer than 180 seconds. When Quick Start is ENABLED, for quick restarts only, the preset timer is ignored (no preset takes place) and the ramping algorithm is engaged immediately upon achieving a run state. For quick normal starts, level control works as it does currently.

Oil Sump Control

When Quick Start is ENABLED the pressure offset calibration (and the associated fault) is disabled for quick restarts only. The offset calculation from the last normal start shall be used. For a normal quick start the calibration and fault shall be active during pre-lube per the standard logic.

Normal operation checks for low oil pressure (greater than 25psid) beginning 5 seconds before the end of pre-lube. When Quick Start is ENABLED this check shall begin before restarting If the chiller does not restart, this check will still be done on the next normal quick start using standard logic. If oil pressure is not present by 30 seconds after the end of coastdown, the chiller will revert to standard quick normal start logic but will not fault on low oil pressure. This fault is currently only active during pre-lube and run. It shall not cause a shutdown during coastdown or while not running.

Normal operation turns the oil pump off at the end of coastdown. When Quick Start is ENABLED the oil pump shall be kept running through coastdown until 30 seconds after the end of coastdown and into the restart. If a quick restart does not occur within 30 seconds of the end of coastdown, the oil pump shall return to standard control and turn off.

When Quick Start is ENABLED oil pressure pulldown is in effect (45 psid target) throughout coastdown, 30 seconds after coastdown is complete and 15 seconds into run if a quick restart is initiated.

The OIL - LOW TEMPERATURE DIFFERENTIAL cycling shutdown threshold is 30 or 40°F depending on conditions. When Quick Start is ENABLED this threshold is reduced to 10°F for 15 minutes after the last shutdown. This 15 minute time shall begin when the run signal is DISABLED.

With the Quick Start feature, the Oil Heater is controlled to maintain a minimum oil temperature, ensuring it is warm enough to allow a restart as described below.

While the oil pump is running, if oil temperature is less than 100°F, turn the Oil Heater on and if oil temperature is greater than 105°F, turn the Oil Heater off. Otherwise, do not change existing logic. The Oil Heater wiring must be changed in order to make this function work properly. In standard configuration, the Oil heater does not have AC power available to it (from TB5-23) when the chiller run signal is enabled. Since the Oil Heater logic with Quick Start, as described above, requires the heater to be turned on while the Oil Pump is running (which is while the chiller run signal is enabled), the Oil Heater wiring must be changed to a terminal (TB5-22) that has AC power, while the run signal is enabled by relocating wire #23 on I/O Board TB5-23 to TB5-22.

Hot gas Control

When Quick Start is enabled the hot gas output shall be set to the programmed Maximum Open value during all of the following conditions:

- During soft shutdown
- During coastdown
- While not running

Hot gas shall return to normal control (closed) when the run signal is enabled.

ACC Control

When the VSD has reached the VSD Start Frequency, the ACC speed command shall be ramped towards the maximum VSD frequency at a rate defined by the following table.

INITIAL RAMP FREQUENCY INCREASE RATE	CONDITIONS REQUIRED
0.1Hz / 2 sec	Quick Start Disabled
0.1Hz / 1 sec	Quick Start Enabled and Motor Current more than Quick Ramp Disable
0.1Hz / 0.5 sec	Quick Start Enabled and Motor Current less than or equal to Quick Ramp Disable

These rates will be reduced by the present ACC logic that limits the rate of speed increases when motor current is greater than 80% FLA. This initial ramp will continue until one of the following Quick Ramp Disable conditions are present:

- Motor Current more than 100% FLA
- LCHLT less than Active LCHLT setpoint + Quick Pulldown Setpoint Offset
- Command Frequency equals Maximum VSD Frequency
- Run Time more than Pulldown Override Time

Once one of these conditions is met, ACC control shall return to standard.

SECTION 31 - HEAT PUMP DUTY (SOFTWARE VERSION C.OPT.01.23.307 AND LATER)

Heat Pump is an available option for certain models of YK chillers. On a Heat Pump equipped chiller, with Heat Pump Duty enabled, the chiller control can be switched between Cooling and Heating Mode. In Cooling Mode, the chiller controls the Leaving Chilled Liquid to the Leaving Chilled Liquid Temperature setpoint. In Heating Mode, the chiller controls the Leaving Condenser Liquid Temperature to the Leaving Condenser Liquid Temperature setpoint. When Heat Pump is enabled, certain conditions are automatically set as described below.

All setpoints pertinent to this feature are maintained on the HEAT PUMP Screen.

INPUTS/OUTPUTS

Due to the higher temperatures and pressures required in Heating Mode, the following sensors are changed from normal operation:

- Leaving Chilled Liquid Temperature Thermistor – This Thermistor is moved to Microboard jumper configurable input connector J7-14. Program Jumper JP21 must be positioned on pins 2-3. The new temperature range is 0-136.4°F.
- Entering Chilled Liquid Temperature Thermistor – This thermistor remains at its normal location, but the temperature range of this thermistor is increased to 0-133.9°F.
- Evaporator Transducer – Higher range Transducer 025-28678-115 is required. This transducer has a higher pressure range (0-125 psig).

SETPOINTS

Heat Pump Duty Enable/Disable

If equipped for Heat Pump duty, the feature must be set to ENABLED on the SETUP Screen using an ADMIN password, to make the feature operational. The access level must be ADMIN and the Refrigerant Type must be set to R-134a (SW1-1) for the setpoint to appear on this screen. If refrigerant type is changed after Heat Pump Duty has been enabled, Heat Pump Duty becomes disabled and disappears from the SETUP Screen. When enabled, the HEAT PUMP Screen is accessible from the CONDENSER Screen.

Operational Mode

Sets the Heat Pump operation to either COOLING (default) or HEATING operation. In order to change this setpoint, the access level must be OPERATOR (or higher) and the COMPRESSOR switch must be in the Stop-reset Position.

Heating Sensitivity

Adjusts the sensitivity of the PRV response to changes in the Leaving Condenser Liquid Temperature in Heating Mode. Can be set to NORMAL (default), 50%, 30%, 10%. Normal is the standard setting and provides the longest PRV pulse for a given change. The 50%, 30% and 10% selections provide decreasing pulse durations for the same change in the Leaving Condenser Liquid Temperature. Select smaller settings, as necessary, to prevent overshoot of the Leaving Condenser Liquid Temperature setpoint.

Local Leaving Condenser Liquid Temperature Setpoint

Sets the Local setpoint (entered at the keypad) to which the Leaving Condenser Liquid Temperature will be controlled in Heating Mode. Programmable over the range of 65.0°F to 122.0°F (default 95.0°F). Requires OPERATOR or higher access level.

Remote Leaving Condenser Liquid Temperature Setpoint

This setpoint can be set from a remote device as follows: ISN Mode – setpoint sent via E-Link Gateway serial communications to COM4B serial port. Digital Mode – 1-11 second signal that adds offset (over the range of the Leaving Condenser Liquid Temperature Range setpoint) to the locally entered value (1S = 0%, 11S equals 100% offset). Analog Mode – 0 to 10 VDC/2 to 10 VDC or 0 to 20mA/4 to 20mA signal that adds offset (over the range of the Leaving Condenser Liquid Temperature Range setpoint) to the locally entered value (0V/2V/0mA/4mA equals 0%, 10V/20mA equals 100% offset).

Leaving Condenser Liquid Temperature Range

Sets the range over which an analog signal (0 to 20mA, 4 to 20mA, 0 to 10 VDC or 2 to 10 VDC) in Analog Remote Mode or a PWM signal (1-11 seconds) in Digital

Remote Mode, can reset the Leaving Condenser Liquid Temperature Setpoint below the operator programmed Local setpoint (see above) while the Heat Pump is in HEATING Mode. Programmable values are 10, 20, 30 or 40°F(default 10°F). This number is subtracted from the Local setpoint to create a range over which the remote device can reset the setpoint. For example, if this setpoint is set for 10°F and the Local setpoint is 90°F, the remote device can set the Leaving Condenser Liquid Temperature setpoint over the range of 90 to 80°F. Requires OPERATOR or higher access level.

Leaving Condenser Liquid Temperature Cycling Offset-Shutdown

Specifies the Leaving Condenser Liquid Temperature at which the Heat Pump will shutdown on "Leaving Condenser Liquid – High Temperature" cycling shutdown in Heating Mode. This is done by defining an offset above the Leaving Condenser Liquid Temperature setpoint. The offset is programmable over the range of 1 – 59°F (default 1°F) above the setpoint, to a maximum of 125°F. Anytime the Leaving Condenser Liquid Temperature setpoint is decreased, this shutdown threshold becomes 125°F for the next 10 minutes. After 10 minutes, the shutdown threshold becomes the programmed setpoint offset value. The actual offset being used is displayed as "Effective Offset" on this screen. Usually, the offset that is used is the same as the programmed value. However, the setpoint used can change automatically to prevent the leaving Condenser Liquid temperature from going above the maximum allowed temperature of 125°F. For example, if the offset is set to 6°F but the Leaving Condenser Liquid Temperature setpoint is set to 120°F, the Effective Offset used will be 5 because 6 would allow it to exceed the maximum of 125.

Leaving Condenser Liquid Temperature Cycling Offset-Restart

This specifies the Leaving Condenser Liquid temperature at which the Heat Pump will restart after a shutdown on a "Leaving Condenser Liquid Temperature – High Temperature" cycling shutdown in Heating Mode. This is done by defining an offset below the Leaving Condenser Liquid Temperature setpoint. It is programmable over a range of 0 to 67°F (default 0°F) below the Leaving Condenser Liquid Temperature setpoint, to a minimum of 55°F. The chiller will automatically restart when this temperature is reached. This setpoint can be used to reduce chiller cycling by delaying the Heat Pump restart until the heating load has increased. Requires OPERATOR or higher access level.

Heating LCHLT (Leaving Chilled Liquid Temperature) Shutdown

In Heating Mode, the existing "Leaving Chilled Liquid Temperature – Low Temperature" cycling shutdown logic will include an additional check to its existing logic that will cause a shutdown in Heating Mode. This setpoint allows the user to specify the Leaving Chilled Liquid Temperature at which the Heat Pump will shut down on "Leaving Chilled Liquid – Low Temperature" cycling shutdown when the Heat Pump is operating in Heating Mode. The low limit for this setpoint is the higher of (Leaving Condenser Liquid Temperature setpoint minus 71°F) or (Cooling Mode Leaving Chilled Liquid Temperature Shutdown Temperature). The high limit for this setpoint is the Leaving Condenser Liquid Temperature setpoint. The default is (Leaving Condenser Liquid Temperature setpoint minus 60°F). The Heat Pump will restart when the Leaving Chilled Liquid Temperature exceeds this shutdown temperature by 5°F. Requires OPERATOR or higher access level.

CONTROL

To make Heat Pump duty operational, it must be enabled on the SETUP Screen using an ADMIN password. Once enabled, a HEAT PUMP Screen is accessible from the CONDENSER Screen. All applicable parameters and setpoints are displayed and maintained on the HEAT PUMP Screen. The Heat Pump control can be switched between Heating Mode and Cooling Mode using the Operational Mode setpoint.

In Heating Mode, the Heat Pump controls the Leaving Condenser Liquid Temperature to the Active Leaving Condenser Liquid Temperature setpoint. In Local Mode, this is the local keypad entered setpoint. In ISN, Analog or Digital Remote modes, it is the remote setpoint input (see above). While running, "System run – Heating Mode" is displayed on the System Status Line and "Heat Pump – Leaving Condenser Liquid Control" is displayed on the System Details line. If the Leaving Condenser Liquid Temperature increases to the Leaving Condenser Liquid Temperature setpoints – Shutdown threshold, a cycling shutdown is performed and "Leaving Condenser Liquid Temperature – High Temperature" is displayed. The Heat Pump will restart when the Leaving Condenser Liquid Temperature decreases to the threshold programmed with the Leaving Condenser Liquid Temperature Cycling Offset – Restart threshold. To avoid overcooling the Leaving Chilled Liquid Temperature in Heating Mode, if the Leaving Chilled Liquid Temperature decreases to the

Heating LCHLT (Leaving Chilled Liquid Temperature) Shutdown threshold, a cycling shutdown is performed and “Leaving Chilled Liquid – Low Temperature” is displayed. The Heat Pump will restart when the Leaving Chilled Liquid Temperature exceeds this shutdown temperature by 5°F. In most applications, the 50% (default) setting of the Heating Sensitivity setpoint will properly control the Leaving Condenser Liquid Temperature to the Leaving Condenser Liquid Temperature setpoint. If greater Pre-rotation Vanes response is needed, use the NORMAL setting. If less PRV response is needed, due to setpoint overshoot, the Heating Sensitivity setpoint can be incrementally reduced (50%, 30%, 10%) until the overshoot is reduced or eliminated.

In Cooling Mode, the chiller controls the leaving Chilled Liquid Temperature to the Leaving Chilled Liquid Temperature setpoints as displayed on the EVAPORATOR Screen. While running, “System run – Cooling Mode” on the System Status Line and “Heat Pump – Leaving Chilled Liquid Control” is displayed on the System Details line while running. In this mode, all functions of the chiller are the same as in a standard YK chiller without Heat Pump ability.

HOT GAS BYPASS CONTROL

In Cooling Mode, the hot gas operates as it does in a standard YK chiller without Heat Pump ability.

In heating mode, hot gas operation is the same as Cooling mode except for the operation during low load conditions, which is as follows: When the Leaving Condenser Liquid Temperature exceeds the Minimum Load setpoint (1 to 4°F above the Leaving Condenser Liquid Temperature Setpoint) the Hot gas valve is opened to the position allowed per the Maximum Open setpoint (25 to 100%). For example, if the Minimum Load setpoint equals 4°F, Maximum Open setpoint equals 100%, Heating setpoint equals 105°F, and leaving Condenser Liquid Temperature greater than 109°F, the Hot gas valve would be opened to the 100% position. When the leaving Condenser Liquid Temperature falls to 107°F, the valve closes to 50% and finally to 0% when this temperature falls back to 105°F. All other aspects of Hot gas control remain unchanged in Heating Mode. See *SECTION 23 - HOT GAS BYPASS* in this manual for details of the hot gas bypass operation.

HEAT RECOVERY AND HEAD PRESSURE CONTROL

When Heat Pump Duty is enabled, Heat Recovery and Head Pressure Control are automatically disabled and locked.

QUICK START

The Quick Start feature is only available when Heat Pump operation is set to Cooling Mode and is automatically disabled when Heating Mode is selected.

VARIABLE SPEED DRIVE

If the chiller is equipped with a VSD, it will operate at full speed (50Hz or 60Hz) at all times when Heat Pump operation is set Heating Mode. In Cooling Mode, it operates normally.

CONDENSER TEMPERATURE RANGE

The Condenser Temperature Range setpoint is automatically set to Extended.

CONDENSER HIGH PRESSURE WARNING

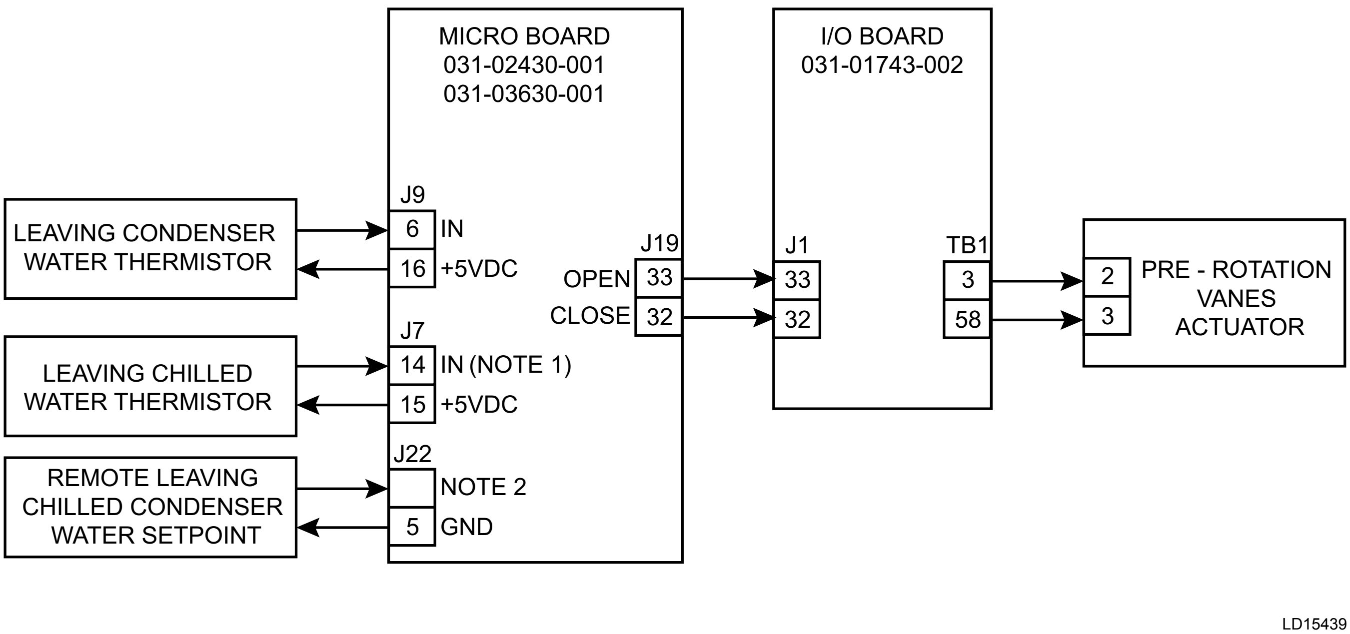
The Condenser High Pressure Warning Setpoint threshold is automatically set to 193 psig.

GPIC OBJECTS

Read objects:

- Active Leaving Condenser Liquid Temperature setpoint: Object Type AV, Object Slot 34
- Local Leaving Condenser Liquid Temperature setpoint: Object Type AV, Object Slot 35

The only write object is Remote Leaving Condenser Liquid Temperature setpoint with an Object type of AV, Object Slot 3.



NOTES:

1. Requires program jumper JP21 positioned on pins 2 and 3 with leaving chilled thermistor connected to J7 as shown.
2. 0 to 10 VDC or 2 to 10 VDC input = J22-3
   0 to 20mA or 4 to 20 MA input = J22-4
3. Input resets Leaving Chilled Setpoint when heat pump operational mode setpoint is set to "Cooling"
   Input resets Leaving Condenser Setpoint when heat pump operational mode setpoint are set to "Heating".

FIGURE 97 - HEAT PUMP DUTY BLOCK DIAGRAM

SECTION 32 - MOTOR MONITORING
(SOFTWARE VERSION C.OPT.01.22.307 AND LATER)

The optional Motor Monitoring feature allows monitoring of the compressor motor windings temperatures, bearing temperatures, bearing vibration and motor cooling coil leak detection. Any combination of winding, bearing and leak monitoring can be selected based on the requirements of the job. Therefore, not all sensors may be present in all applications. Setpoints on the MOTOR DETAILS Screen allow any combination of these items to be enabled or disabled based on the actual equipment applied.

The motor could be equipped with different types of sensors for this monitoring. Either RTD's or thermistors could be applied for winding and bearing temperature monitoring. Motor cooling coil leak detection could be performed with either an optical sensor or float sensor. Setpoints on the MOTOR DETAILS Screen allow for the selection of the actual sensor type applied.

The hardware involved in this feature consists of motor temperature sensors, vibration sensors, a cooling coil leak detection sensor and a Motor Monitoring Board (See *Figure 98 on page 257*).

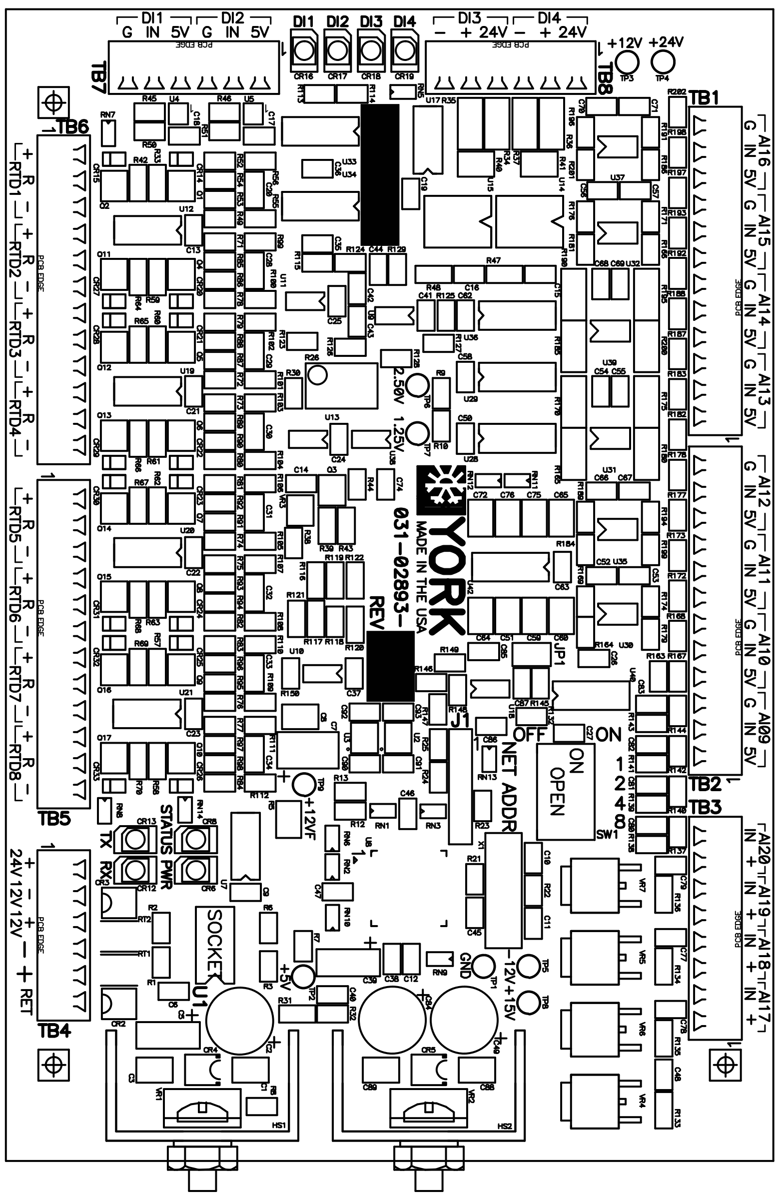


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FIGURE 98 - MOTOR MONITORING BOARD (031-02893-000/001)

MOTOR MONITORING BOARD BASIC BLOCK DIAGRAM

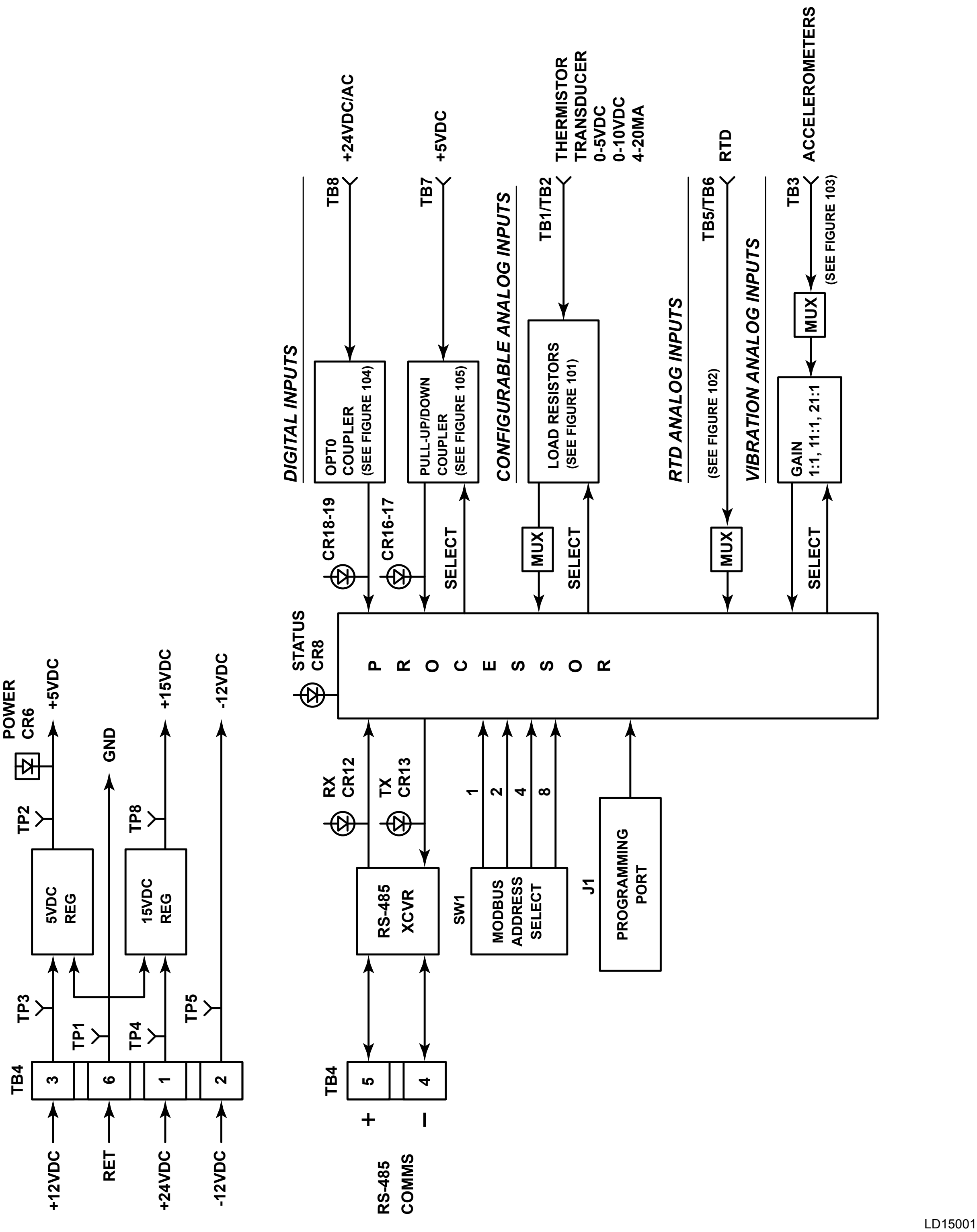


FIGURE 99 - MOTOR MONITORING BOARD BASIC BLOCK DIAGRAM

This board resides in an enclosure that is mounted separately from the OptiView Control Center. The Motor Monitoring Board receives the outputs of the sensors and transmits the sensor values to the microboard COM3 port via RS-485 Modbus serial communications. The microboard sends the temperatures, vibration values and leak status to the display. It also compares these parameters to warning and safety shutdown thresholds. When the parameter exceeds the warning threshold, a warning message is displayed. When it exceeds the safety threshold, a safety shutdown is performed.

The motor monitoring feature must be enabled on the SETUP Screen. When enabled, the MOTOR DETAILS screen and MOTOR SETPOINTS screen are available, where all information pertinent to this feature is displayed as follows: The MOTOR DETAILS screen displays the temperature and vibration values, along with the leak status. It also allows a service technician to individually enable/disable the winding temperature, bearing temperature, vibration and cooling coil leak monitoring or enable the sensor type, based on the actual equipment applied. The MOTOR SETPOINTS screen allows a service technician to enter the WINDING and BEARING HIGH TEMPERATURE warning/safety shutdown thresholds, the high vibration warning/safety shutdown thresholds, set the vibration input gain and enable/disable individual winding temperatures. Procedures to enter these setpoints are in *SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES* of this manual.

MOTOR MONITORING BOARD

There are two versions of this board. The difference between the boards is the component population. The board part number is 031-02893-XXX (with XXX being -000 or -001). The different boards are identified by the 3-digit suffix (-000 or -001). The -001 board is fully populated and can be used in any application. On the -000 board, the RTD analog input and vibration analog input components are not populated. Therefore, it cannot be used in applications requiring those sensor types. The board is shown in *Figure 98 on page 257*.

The board accepts both analog and Digital inputs from motor sensing devices (See *Figure 99 on page 258*). It transmits the data to the microboard using Modbus RS-485 serial communications. In some applications, certain sensors are connected to the VSD, instead of the Motor Monitoring Board, and the data is sent to the microboard via the VSD to Microboard RS-485 Modbus Serial Communications.

The board receives +24 VDC, +12 VDC and -12 VDC power at TB4. The +12 VDC is applied to a +5 VDC regulator to create the +5 VDC supply voltage. The POWER LED (CR6) illuminates when this +5 VDC is present. The +24 VDC is applied to a +15 VDC regulator to create the +15 VDC supply voltage. These voltages can be read at the following Test Points:

TP1	GND
TP2	+5 VDC
TP3	+12 VDC
TP4	+24 VDC
TP5	-12 VDC
TP6	+2.5 VDC reference
TP7	+1.25 VDC reference
TP8	+15 VDC
TP9	+12 VDC filtered

When the onboard program is running and operating normally, STATUS LED (CR8) blinks 2 times a second.

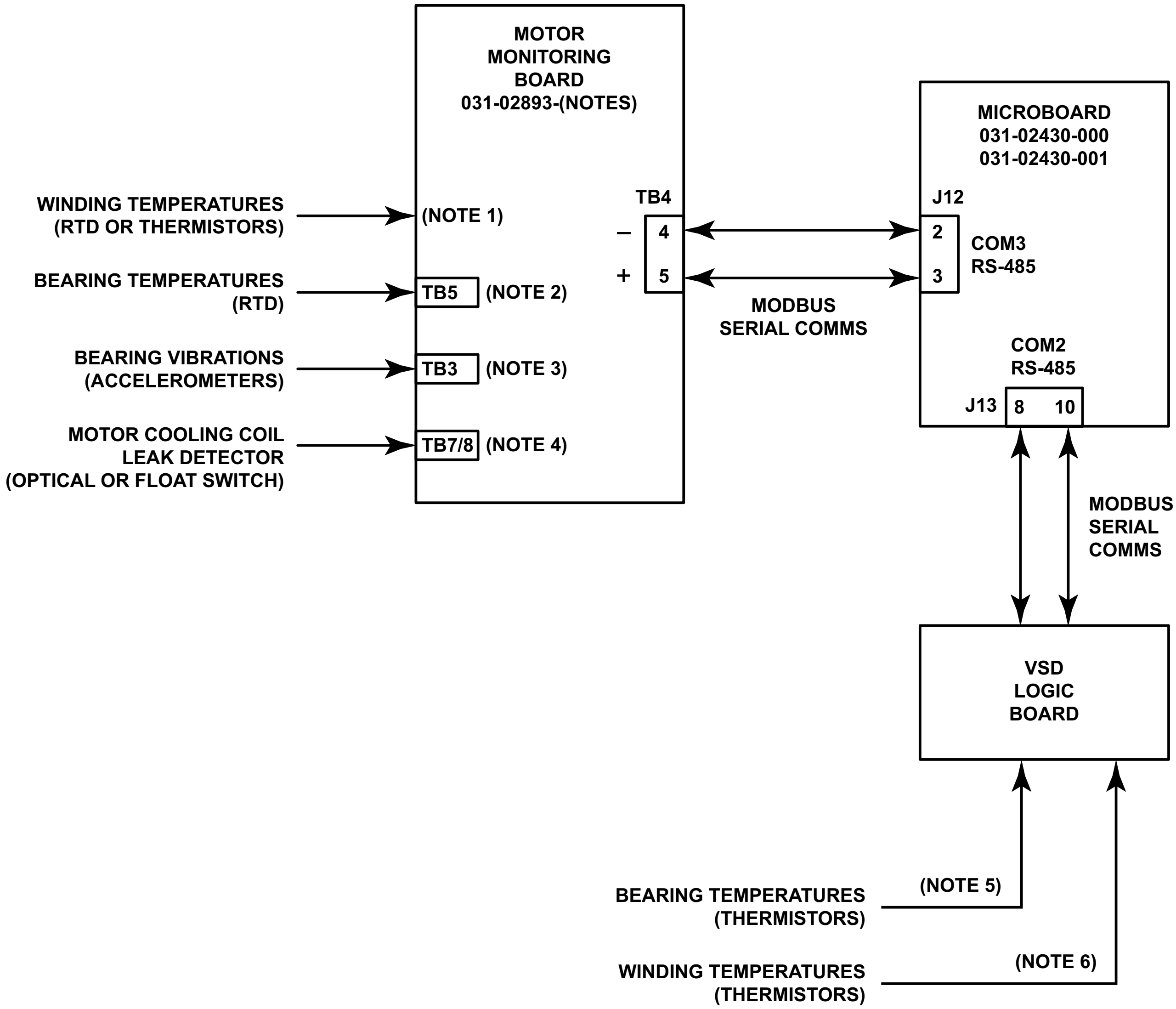
The Motor Monitoring Board communicates with the microboard using RS-485 Modbus serial communications. Every 2 seconds, the microboard reads data from and sends commands to the Motor Monitoring Board. The RX LED (CR12) illuminates as the data bits pass by the LED arriving on the Motor monitoring Board. The TX LED (CR13) illuminates as the data bits pass by the LED, leaving the board. The Network Address of this board is 2. This is set with the NETWORK ADDRESS switch SW1 as follows:

(Off = Switch open, On = Switch closed)

1=Off
2=On
4=Off
8=Off

The board does not contain a separate program storage device. The boards are programmed at the time of manufacture, and the program cannot be changed in the field.

MOTOR MONITORING BLOCK DIAGRAM



NOTES

There are two Motor Monitoring Boards that can be used: 031-02893-(with suffix -000 or -001). The board required depends on the sensing devices used, as indicated above and notes below.

1. When Winding RTD's are used, they are connected to TB5/6 and the -001 board is required. When Winding Thermistors are used, they can be connected to TB1 (using the -000 or -001 board) or the VSD (see Note 6) and the temperature values transmitted via existing VSD to Microboard Serial Communications
2. When Bearing RTD's are used, they are connected to the Motor Monitoring Board TB5 and the -001 board is required. When Thermistors are used, they are connected to the VSD (see Note 5) and the temperatures are sent via existing VSD to Microboard Serial Communications.
3. The -001 board is required.
4. Either the -000 or -001 board can be used.
5. Bearing temperatures can either be provided via direct RTD connection to the Motor Monitoring Board (see Note 2) or Thermistors connected to the VSD and provided via existing VSD to Microboard Serial Communications.
6. When thermistors are used for Winding Temperatures, they can be connected to the Motor Monitoring Board TB1 (see Note 1) or the VSD and the temperature values transmitted via existing VSD to Microboard Serial Communications.

LD15000

FIGURE 100 - MOTOR MONITORING BLOCK DIAGRAM

The Motor Monitoring Board (See *Figure 100 on page 260*) has up to 4 different sections of inputs (depending on the board part number) as follows:

- Configurable Analog Inputs

  There are 8 configurable Analog Inputs: AI9 - AI12 (TB2) and AI13 AI16 (TB1). Each input can be configured to accept one of the following types of inputs: 3K Thermistor, 10K Ohm Thermistor, 50K Ohm Thermistor, Pressure Transducer, 0 to 5 VDC, 0 to 10 VDC or 4 to 20mA. Each input is configured by a command sent from the microboard via the serial communications. Each input is configured by putting either 243 Ohm, 5K Ohm or 10K Ohm load resistor to ground on the input. See below for the configurations.

- Digital inputs

  There are 2 low voltage DC inputs: DI1 and DI2 (TB7). Each input can be configured in either a pull-up or pull-down configuration. In the pull-up configuration, the input is high when the input switch is open; low when closed. In the Pull-down configuration, the input is low when the input switch is open; high when closed. Both of these inputs have an LED (DI1 and DI2) that illuminates when the input is high. Each input is configured by a command from the microboard via serial communications. There are 2 Optocoupler AC/DC inputs: DI3 and DI4 (TB8). These inputs can accept either 24 VAC or 24 VDC inputs. When the input signal is present, the input is considered active. Both of these inputs have an LED (DI3 and DI4) that illuminates when the input is active. There is no configuration on these inputs.

- RTD Analog Inputs

  The -001 board can accept up to 8 RTD inputs: RTD1-RTD4 (TB6) and RTD5-RTD8 (TB5). There is no configuration on these inputs.

- Vibration Analog Inputs

  The -001 board can accept up to 4 Vibration Analog Inputs - AI17 through AI20 (TB3). A command from the microboard, via the serial communications, sets the gain of each input to 1:1, 11:1 or 21:1(default). The gain value transmitted is programmed by a Service technician using the VIBRATION GAIN SETPOINT key on the MOTOR SETPOINTS Screen. Program Jumper JP1 must always be removed. It is only installed for manufacturing testing.

WINDING TEMPERATURES

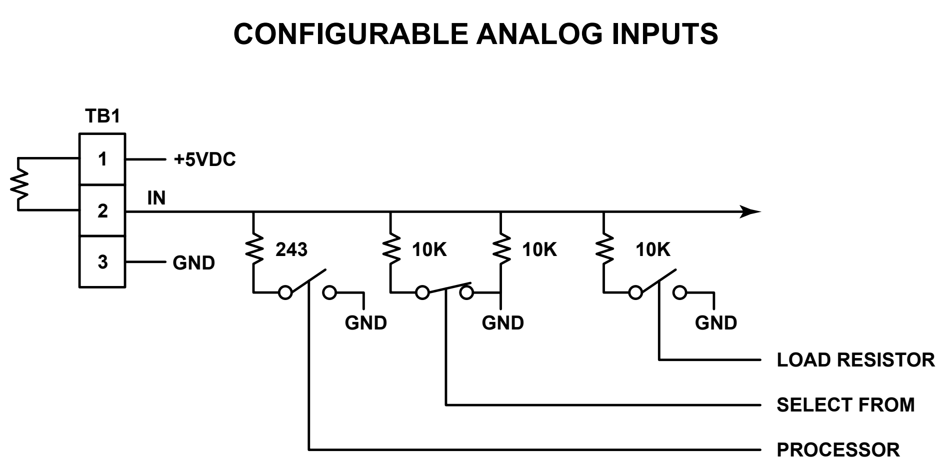
The motor windings temperatures can be monitored with either RTD's or thermistors. When RTD's are used, there are 6 (2 per phase) RTD's and the -001 Motor Monitoring Board is required. When thermistors are used, there are 3 thermistors (1 per phase). The thermistors could be connected to the Motor Monitoring Board or the Variable Speed Drive. If connected to the Motor Monitoring Board, either the -000 or -001 board can be used. See *Figure 101 on page 262*.

The Winding Temperature Protection setpoint must be set to the sensor type that is used. Once set, the microboard via serial communications, commands the Motor Monitoring Board to read the appropriate sensor inputs and it also sends configuration commands as stated below. If set to any setting other than DISABLED, the respective temperatures are displayed on the MOTOR DETAILS Screen. The settings are:

- DISABLED Disables the Winding Temperature feature. No Winding sensor inputs are read, no winding temperatures are displayed and the heading, text and data boxes do not appear. The High Winding Temperature Fault and Warning will not occur. This setting is used when the motor is not equipped with winding temperature sensors or if is desired to disable the feature for service reasons. This is the default setting. The Motor Monitoring Board is commanded to not read any of its winding temperature sensor inputs. The winding displays can be individually disabled using the Temperature Disable setpoint (ADMIN access level) on the MOTOR SETPOINTS Screen.
- RTD Enables and displays the 6 (2 per phase) motor winding temperatures, as reported by the winding RTD's, via the Motor Monitoring Board serial communications. The microboard commands the Motor Monitoring Board to read the sensor inputs at the following points:

TB6-1,2,3	|Motor Winding Phase A1 Temperature
TB6-4,5,6	Phase A2 Temperature
TB6-7,8,9	Phase B1 Temperature
TB6-10,11,12	Phase B2 Temperature
TB5-1,2,3	Phase C1 Temperature
TB5-4,5,6	Phase C2 Temperature

- THERMISTOR Enables and displays the 3 motor winding temperatures, as reported by the thermistors via the Motor Monitoring Board serial communications. The microboard sends a command to have the Motor Monitoring Board read the sensor inputs at the following points and another command to configure these inputs to accept a 50K Ohm Thermistor.



NOTES
Phase A thermistor connection shown. Typical of all thermistor inputs.

LD15004

FIGURE 101 - WINDING TEMPERATURE – THERMISTORS

Motor Winding Phase

TB1-1,2	A Temperature
TB1-4,5	B Temperature
TB1-7,8	C Temperature

- VSD THERMISTOR Enables and displays the 3 motor winding temperatures, as reported by the thermistors via the VSD to Microboard serial communications. The Motor Monitoring Board is commanded to not read any of its winding sensor inputs.

The enabled winding temperatures for phase A, B and C, along with the Average Winding Temperature, are displayed on the MOTOR DETAILS Screen. They are displayed over the range of: RTD = 32.0 399.5°F; Thermistors = 31.2 412.5°F. If the Winding Temperature Protection setpoint (On the MOTOR DETAILS Screen) is set to DISABLED, no temperatures are displayed and the heading, text and data boxes do not appear. Individual winding temperatures can be disabled using the Temperature Disable setpoint (on the MOTOR SETPOINTS Screen). When an individual temperature is disabled, the temperature data boxes do not appear. Any RTD that registers as an open is considered invalid and displays as XXX.X.

The Average Winding Temperature is the average of all enabled and valid motor winding temperatures. Any winding temperature that registers as open, out of range or disabled is not used in the calculation. When RTD's are used for winding temperature measurement, there are a maximum of 6 temperatures used to calculate the average. When thermistors are used, there are a maximum of 3 temperatures used to calculate the average. The text description and data box do not appear when the Winding Temperature Protection setpoint is set to disabled.

On the microboard, the winding temperatures are compared to warning and safety shutdown thresholds. These thresholds are entered using the Winding Setup setpoint (on the MOTOR SETPOINTS Screen). The HIGH WINDING TEMPERATURE SHUTDOWN safety threshold is programmable over the range of 266 320°F (default 311). The WINDING HOTSPOT ALLOWANCE safety shutdown threshold is programmable over the range of 0 18°F (default 0). The values programmed for these safety thresholds are displayed in the respective data boxes on the MOTOR SETPOINTS Screen.

When any of the enabled winding temperatures exceeds [High Winding Temperature Shutdown threshold minus 18°F] for at least 3 continuous seconds, Warning Motor High Winding Temperature is displayed. This warning automatically clears when all winding temperatures decrease below the warning threshold. This warning not occur when the Winding Temperature Protection setpoint is set to disabled on the MOTOR DETAILS Screen. Also, it will not act on any RTD input registering as an open RTD or any individual winding temperature sensor that has been disabled with the Temperature Disable setpoint on the MOTOR SETPOINTS Screen.

When either of the following conditions occur, a safety shutdown is performed and Motor-High Winding Temperature is displayed:

- Any of the enabled motor winding temperatures exceeded the programmed High Winding Temperature Shutdown Threshold plus the programmed Winding Hotspot Allowance threshold for 3 continuous seconds.

  -OR-

- The Average Winding Temperature has exceeded the programmed High Winding Temperature Shutdown threshold for 3 continuous seconds.

The chiller can be restarted after all winding temperatures decrease to at least 18° F (10° C) below the shutdown threshold and the COMPRESSOR Switch is placed in the Stop-Reset position). This safety shutdown will not occur when the Winding Temperature Protection setpoint is set to disabled on the MOTOR DETAILS Screen. Also, it will not act on any RTD input registering as an open RTD or any individual winding temperature sensor that has been disabled with the Temperature Disable setpoint on the MOTOR SETPOINTS Screen.

See *Table 25 on page 269* for RTD resistance/voltage table. See *Table 26 on page 269* for Thermistor resistance/voltage table.

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BEARING TEMPERATURES

The motor bearing temperatures can be monitored with either RTD's or thermistors. Both the shaft end bearings and opposite shaft end bearings are monitored. Therefore, 2 RTD's or thermistors are used. When RTD's are used, they are connected to the Motor Monitoring Board and the -001 board is required. When thermistors are used, they are connected to the Variable Speed Drive.

The Bearing Temperature Protection setpoint must be set to the sensor type that is used. Once set, the microboard, via serial communications, commands the Motor Monitoring Board to read the appropriate sensor inputs. If set to any setting other than DISABLED, the respective temperatures are displayed on the MOTOR DETAILS Screen. The settings are:

- DISABLED Disables the Bearing Temperature feature. No bearing temperatures are displayed and the heading, text and data boxes do not appear. The High Bearing Temperature Fault and Warning will not occur. This setting is when if the motor is not equipped with bearing temperature sensors or if is desired to disable the feature for service reasons. This is the default setting. The Motor Monitoring Board is commanded to not read any of its bearing temperature sensor inputs.
- RTD Enables and displays the 2 motor bearing temperatures, as reported by the bearing RTD's, via the Motor Monitoring Board serial communications. The microboard commands the Motor Monitoring Board to read the sensor inputs at the following points:

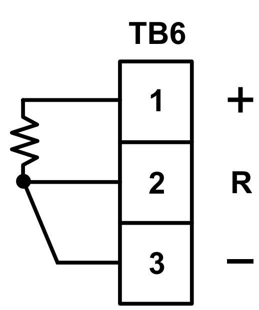
TB5-7,8,9	Motor Bearing Opposite Shaft End Temperature
TB5-10,11,12	Motor Bearing Shaft End Temperature

- VSD THERMISTOR Enables and displays the 2 motor bearing temperatures, as reported by the bearing thermistors via the VSD Logic Board serial communications. The Motor Monitoring Board is commanded to not read any of its bearing temperature inputs.

The enabled bearing temperatures for the shaft end and opposite shaft end bearings are displayed on the MOTOR DETAILS Screen. They are displayed over the range of 32.0 399.5°F. If the Bearing Temperature Protection setpoint (on the MOTOR DETAILS Screen) is set to DISABLED, no temperatures are displayed, and the heading, text and data boxes do not appear. Any RTD that registers as an open is considered invalid and displays as XXX.X.

On the microboard, the bearing temperatures are compared to warning and safety shutdown thresholds. These thresholds are entered using the Bearing Setup setpoint (on the MOTOR SETPOINTS Screen). The HIGH BEARING TEMPERATURE SHUTDOWN safety threshold is programmable over the range of 149 212°F (default 203). The HIGH BEARING TEMPERATURE WARNING threshold is programmable over the range of 140 194°F (default 194). The values programmed for these thresholds are displayed in the respective data boxes on the MOTOR SETPOINTS Screen.

RTD ANALOG INPUTS



NOTES
Phase A RTD connection shown. Typical of all RTD inputs.

LD15005

FIGURE 102 - WINDING AND BEARING TEMPERATURE – RTD

When either of the enabled motor bearing temperatures exceeds the programmed High Bearing Temperature Warning for 3 continuous seconds, Warning Motor High Bearing Temperature is displayed. This warning will automatically clear when both bearing temperatures decrease below the warning threshold. This warning will not occur when the Bearing Temperature Protection setpoint is set to disabled on the MOTOR DETAILS Screen. Also, it will not act on any RTD input registering as an open RTD.

When either of the enabled bearing temperatures exceed the programmed High Bearing Temperature Shutdown threshold for 3 continuous seconds, a safety shutdown is performed and Motor High Bearing Temperature is displayed. The chiller can be restarted after both bearing temperatures decrease to at least 9°F below the shutdown threshold and the COMPRESSOR Switch is placed in the Stop-Reset position. This safety shutdown will not occur when the Bearing Temperature Protection setpoint is set to disabled on the MOTOR DETAILS Screen. Also, it will not act on any RTD input registering as an open RTD.

See *Table 25 on page 269* for RTD resistance/voltage table. See *Table 26 on page 269* for Thermistor resistance/voltage table.

VIBRATION

The motor bearing vibration is monitored with accelerometers. Both the shaft end and opposite shaft end bearings are monitored. The -001 board is required.

The Bearing Vibration Protection setpoint must be set to the sensor type that is used. Once set, the microboard via serial communications, commands the Motor Monitoring Board to read the appropriate sensor inputs and it also sends configuration commands as below. If set to any setting other than DISABLED, the respective vibration values are displayed on the MOTOR DETAILS Screen. The settings are:

- DISABLED - Disables the Bearing Vibration Protection feature. No bearing vibration values are displayed and the heading, text and data boxes do not appear. The High Bearing Vibration Fault, Warning and Baseline Not Set Warning will not occur. This setting is used when the motor is not equipped with bearing vibration sensors or if is desired to disable the feature for service reasons. This is the default setting. The Motor Monitoring Board is commanded to not read any of its vibration sensor inputs.
- ROLLING ELEMENT - Enables and displays the Bearing Vibration Protection feature. Displays the shaft end and opposite shaft end vibration values as reported by the vibration sensors via the Motor Monitoring Board serial communications. The Vibration Baseline values, created by either manual entry or by running the auto baseline routine are shown, along with the Auto Baseline and Auto Baseline setpoint keys. The microboard sends a command to have the Motor Monitoring Board read the sensor inputs at the following points and another command to set the gain of these inputs. The Gain value [1;1, 11:1, 21:1(default)] sent is the value set with the Vibration Gain setpoint (on the MOTOR SETPOINTS Screen).

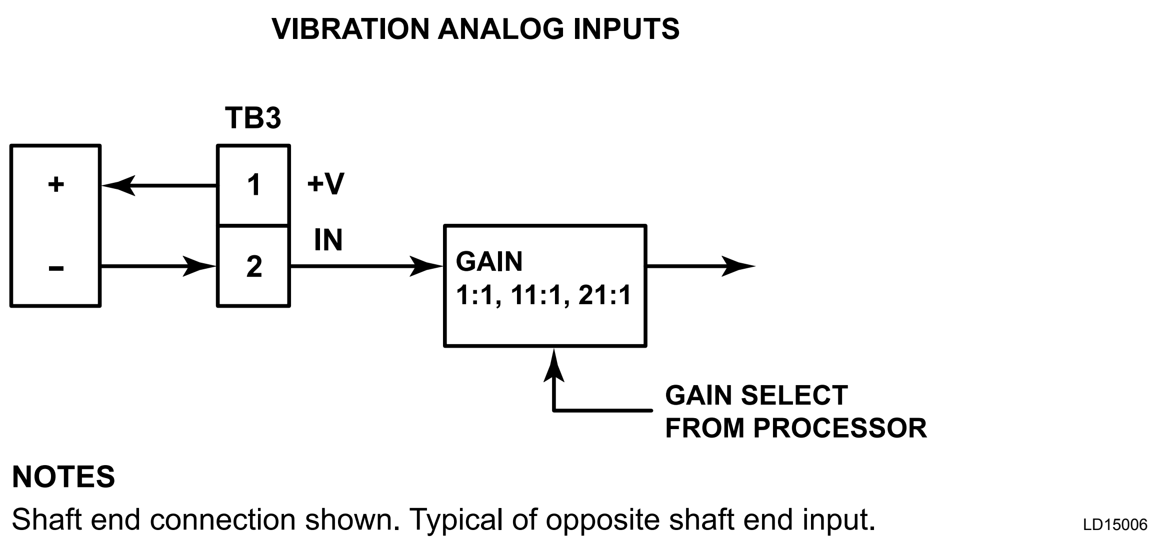


FIGURE 103 - BEARING VIBRATION SENSOR

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TB3-1,2	Motor Bearing Shaft End Vibration
TB3-3,4	Motor Bearing Opposite Shaft End Vibration

The Vibration Gain setpoint is used to enter the appropriate gain [1;1, 11:1, 21:1(default)] for the vibration sensor input circuits of the Motor Monitoring Board. An ADMIN password is required. The Gain value entered is transmitted from the microboard to the Motor Monitoring Board via serial communications.

The enabled vibration values for the shaft end and opposite shaft end bearings are displayed on the MOTOR DETAILS Screen. The vibration values are not in any particular units of measure. They are relative values expressed over the range of 0.0 to 30.0. The larger the number, the greater the magnitude of vibration represented. If the Motor Vibration Protection setpoint is set to DISABLED, no vibration values are displayed and the heading, text and data boxes do not appear.

Vibration Baseline values must be established for the Shaft End and Opposite Shaft End bearings. They are established and displayed on the MOTOR DETAILS Screen. They are programmable over the range of 0.1 to 5.0 (default 2) and are expressed in the same units as the vibration values above. The Baseline values are established by either manual entry using the Manual Baseline setpoint or automatically by running the Auto Baseline Routine. Special password 0 3 6 8 is required. The Auto Baseline routine is initiated with the Auto Baseline setpoint. It can be run after the chiller has been running for greater than 2 minutes. The vibration level of each bearing is independently averaged for 1 hour at 1 minute intervals while the chiller is running. The time remaining in the routine is displayed as Auto Baseline Time Left on the MOTOR DETAILS Screen. At the completion of the routine, the derived values are displayed. WARNING MOTOR BEARING VIBRATION BASELINE NOT SET is displayed until both the Shaft end and Opposite Shaft End motor bearing vibration baseline values are entered. While this message is displayed, the vibration baseline values are set to X.X.

On the microboard, the Bearing Shaft End and Opposite Shaft End vibration values are compared to warning and safety shutdown thresholds. The actual thresholds used will be either the values derived from the Vibration Baseline setpoints (as explained below) or the values manually entered with the VIBRATION SETUP SETPOINT key. Normally, the Baseline derived values are used but they can be overridden by manual entry. The actual thresholds that the software is using are displayed in the Motor Bearings High Vibration Warning and High Vibration Warning data boxes on the MOTOR SETPOINTS Screen. The HIGH VIBRATION WARNING threshold is programmable over the range of range is 1.0 to 15 (default Baseline X2). The High Vibration Shutdown threshold is programmable over the range of 2.0 to 30 (default Baseline X3). These thresholds are in the same units of measure as the vibration values as explained above. The vibration must exceed each threshold continuously for the number of seconds programmed with the Delay setpoints, before the Warning or Safety shutdown occurs. The warning Delay is programmable over the range of 0-120 seconds (default 30). The safety shutdown delay is programmable over the range of 0-30 seconds (default 15). The Delays are programmed with the Vibration Setup setpoint.

The Vibration Baseline values are used to create the vibration Warning and Thresholds as follows:

NOTE

If the calculated value exceeds the minimum and maximum limits of the Shutdown (2.0 to 30.0) or Warning (1.0 to 15.0) threshold, the threshold is set to the respective upper or lower limit.

- Shaft End High Vibration Warning - Shaft End Vibration Baseline X2
- Shaft End High Vibration Warning Default - Shaft End Vibration Baseline X2
- Opposite Shaft End High Vibration Warning - Opposite End Vibration Baseline X2
- Opposite Shaft End High Vibration Warning Default - Opposite End Vibration Baseline X2
- Shaft End High Vibration Shutdown - Shaft End Vibration Baseline X3
- Shaft End High Vibration Shutdown Default - Shaft End Vibration Baseline X3
- Opposite Shaft End High Vibration Shutdown - Opposite Shaft End Vibration Baseline X3
- Opposite Shaft End High Vibration Shutdown Default - Opposite Shaft End Vibration Baseline X3

The values used by the software depend upon the sequence in which the setpoints are entered. If Vibration Baseline values are established after thresholds have been entered with the Vibration Setup setpoint, the baseline derived Shutdown and Warning thresholds override the thresholds entered with the Vibration Setup setpoint. Thresholds entered with the Vibration Setup setpoint after baseline derived Shutdown and Warning thresholds are entered, override Baseline derived values.

When either the Shaft End or Opposite Shaft End motor bearing vibration has exceeded the value programmed for the High Vibration Warning setpoint for the programmed number of DELAY seconds, Warning Motor High bearing Vibration is displayed. This warning will automatically clear when both vibration values decrease below the warning threshold. This warning does not occur when the Motor Vibration Protection setpoint is set to disabled on the MOTOR DETAILS Screen or while the Warning Motor Bearing Vibration Baseline Not Set warning is displayed.

When either the Shaft End or Opposite Shaft End motor bearing vibration has exceeded the value programmed for the High Vibration Shutdown setpoint for the programmed number of DELAY seconds, a safety shutdown is performed and Motor High Bearing Vibration is displayed. The chiller can be restarted after both the vibration values decrease below the shutdown threshold and the Compressor Switch is placed in the Stop-Reset (O) position. This safety shutdown does not occur when the Motor Vibration Protection setpoint is set to disabled on the MOTOR DETAILS Screen or while the Warning Motor Bearing Vibration Baseline Not Set warning is displayed.

COOLING COIL LEAK DETECTION

The Motor Cooling Coil leak detection is performed with either a Float Switch or an Optical sensor. Either the -000 or -001 board can be used.

The Motor Cooling Coil Leak Protection Setpoint must be set to the sensor type that is used. Once set, the microboard, via serial communications, commands the Motor Monitoring Board to read the appropriate sensor input and it also sends a configuration command as described below. When set to any setting other than disabled, the LED status indicator is displayed and the MOTOR COOLING COIL safety fault will occur when the sensor indicates a leak. The settings are:

- DISABLED - Disables the Motor Cooling Coil Leak Protection feature. The status LED and text do not appear. The Motor Cooling Coil Leak fault will not occur. This setting is used when the motor is not equipped with a leak detector or if it is desired to disable this feature for service reasons. This is the default setting. The Motor Monitoring Board is commanded to not read any of its leak sensor inputs.

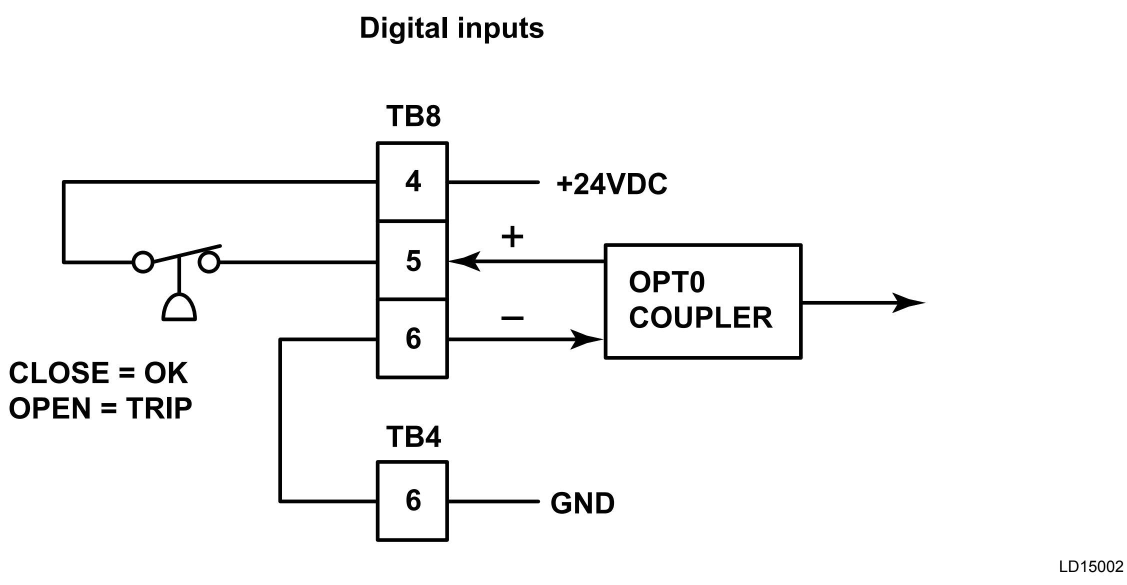

FIGURE 104 - MOTOR COOLING COIL LEAK DETECTOR – FLOAT SENSOR

Digital inputs (CONTINUED)

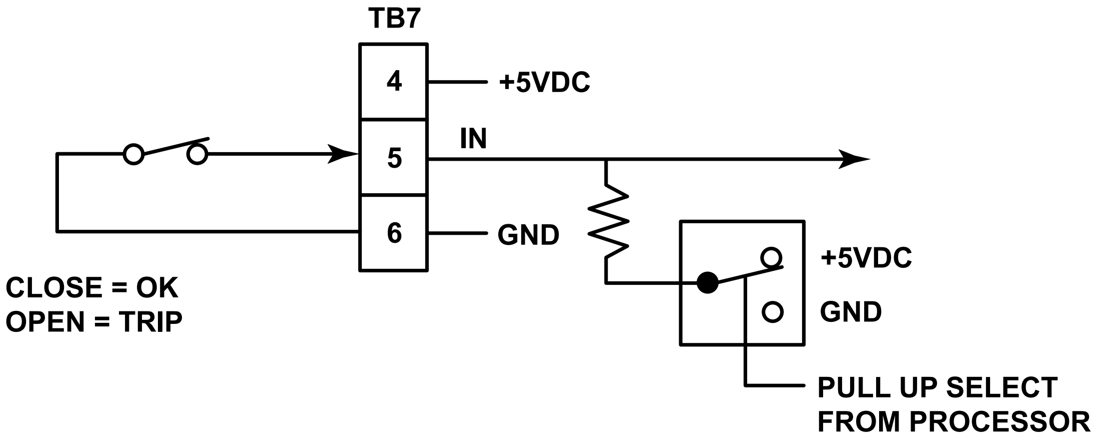

FIGURE 105 - MOTOR COOLING COIL LEAK DETECTOR – OPTICAL SENSOR

- OPITICAL - Enables the optical sensor Digital Input and displays the leak status, as reported by the optical leak sensor, via the Motor Monitoring Board serial communications. The microboard commands the Motor Monitoring Board to read the sensor input at TB7-4,5,6. Another command is sent that configures the Digital Input for pull-up configuration. In the pull-up configuration, an open switch (leak detected) input produces a +5 VDC input at TB7-5 (see below).
- FLOAT - Enables the float sensor Digital Input and displays the leak status, as reported by the float leak sensor, via the Motor Monitoring Board serial communications. The microboard commands the Motor Monitoring Board to read the sensor input at TB8-4,5,6.

The optical sensor contains a switch that is connected between TB7-5 (input) and TB7-6 (GND). With no leak being detected, the switch closes producing a less than 1 VDC input at TB7-5, as measured to TB7-6. When a leak is detected, the switch opens producing a +5 VDC input at J7-5, as measured to TB7-6.

The Float Sensor contains a switch that is connected between TB8-5 (input) and TB8-4 (+24 VDC). With no leak being detected, the switch closes producing +24 VDC input at TB8-5, as measured to TB8-6. When a leak is detected, the switch opens producing a less than 1 VDC input at TB8-5, as measured to TB8-6.

An LED status indicator, labeled Motor Cooling Coil Leak Detected appears on the MOTOR DETAILS Screen. It illuminates when a leak is detected.

If the Motor Cooling Coil Leak Detector has registered a fault condition for at least 3 continuous seconds, a safety shutdown is performed and Motor Cooling Coil Leak is displayed. The chiller can be started after the leak sensor no longer indicates a leak and the COMPRESSOR switch is placed in the Stop-Reset position.

TABLE 25 - RTD RESISTANCE/TEMPERATURE CHART

RESISTANCE (OHMS)	°C	°F
100.0	0.00	32.00
105.9	15.13	59.23
111.9	30.59	87.06
117.8	45.86	114.54
123.8	61.45	142.62
129.8	77.13	170.83
135.7	92.61	198.70

RESISTANCE (OHMS)	°C	°F
141.7	108.43	227.18
147.6	124.07	255.32
153.6	140.04	284.08
159.5	155.83	312.49
165.5	171.96	341.53
171.5	188.18	370.72
177.4	204.20	399.56

TABLE 26 - THERMISTOR RESISTANCE/TEMPERATURE CHART

THERMISTOR RESISTANCE (OHMS)	°C	°F
165667	-0.442	31.20
106304	8.390	47.10
77581	14.970	58.95
60641	20.309	68.56
49468	24.856	76.74
41545	28.854	83.94
35635	32.449	90.41
31056	35.737	96.33
27405	38.782	101.81
24425	41.633	106.94
21947	44.324	111.78
19854	46.884	116.39
18063	49.333	120.80
16513	51.690	125.04
15157	53.967	129.14
13963	56.178	133.12
12902	58.332	137.00
11954	60.438	140.79
11101	62.503	144.51
10329	64.534	148.16
9629	66.538	151.77
8989	68.518	155.33
8403	70.482	158.87
7864	72.433	162.38
7367	74.375	165.87
6907	76.313	169.36
6480	78.251	172.85
6082	80.192	176.35
5711	82.142	179.86
5364	84.103	183.39

THERMISTOR RESISTANCE (OHMS)	°C	°F
5039	86.080	186.94
4734	88.076	190.54
4446	90.097	194.17
4176	92.146	197.86
3920	94.228	201.61
3678	96.349	205.43
3449	98.514	209.33
3232	100.729	213.31
3025	103.001	217.40
2829	105.336	221.60
2642	107.744	225.94
2464	110.233	230.42
2293	112.814	235.07
2131	115.500	239.90
1975	118.305	244.95
1827	121.245	250.24
1684	124.340	255.81
1547	127.614	261.71
1416	131.096	267.97
1290	134.821	274.68
1169	138.835	281.90
1052	143.193	289.75
940	147.971	298.35
831	153.267	307.88
727	159.219	318.59
626	166.021	330.84
529	173.966	345.14
435	183.518	362.33
344	195.478	383.86
257	211.400	412.52

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SECTION 33 - SYSTEM CALIBRATION, SERVICE SETPOINTS, AND RESET PROCEDURES

The chiller is supplied from the YORK factory with all factory mounted components fully calibrated. The following procedures are used to verify these calibrations or calibrate a component after it has been field replaced.

Most of the following procedures require the Service technician to be logged in at SERVICE access level (Access Code 1 3 8 0). However, others require the ADMIN (Administration) access level. The ADMIN Password changes daily and is valid for 1 calendar day only. This password is obtained by contacting the local Johnson Controls Service Office. When requesting this password, supply the "Controls" version of software (available on the DIAGNOSTIC Screen) and the calendar day on which you intend to use it.

Programmable Service setpoints are used by the Program to control critical chiller operation. Also, some of these setpoints can be used to enable or disable certain features. Although they have been entered at the YORK factory, they can be changed by a field Service technician. If the BRAM battery backed memory device is field replaced, all of the programmed setpoints will be lost. They will have to be re-entered into the new BRAM. Each of these setpoints is described below. Programming procedures and OptiView Control Center Keypad operation required in the procedures below are detailed in *OptiView Control Panel – Operation (Form 160.54-O1)*. In general, the following procedure is used to enter setpoints in this section:

1. Log in with the appropriate access level.
2. Select the appropriate Display Screen.
3. Press the desired setpoint key.

   A dialog box appears, giving the minimum and maximum allowed values, Default value and present value. The dialog box can be canceled at any time by pressing the CANCEL (X) key.
4. If the dialog box begins with the word "Enter", use the numeric keys to enter the desired value. Leading zeroes are not necessary. Press the • key to place a decimal point at the appropriate place. Pressing the ✓ key displays the Default value. Pressing the ✓ key clears the entry. The ◀ key is a backspace key and causes the entry point to move back one space. If the dialog box begins with SELECT or ENABLE, use the ◀ and ▶ keys to select the desired value. The ◀ key decreases the value, and the ▶ key increases the value.
5. Press the ENTER (✓) key. If the value is within range, it is accepted and the dialog box disappears. The chiller will begin to operate based on the new value. If out of range, the value is not accepted and a message describing why it is not acceptable is displayed momentarily.

Some safety shutdowns will not permit the chiller to start until a special reset procedure is performed. These reset procedures require SERVICE access level and should not be performed by anyone other than a Service technician. Each of these procedures is described below.

ELECTROMECHANICAL STARTER APPLICATIONS

If the Compressor Motor is driven by an Electromechanical Starter, the OptiView Control Center is equipped with a CM-2 Current Module along with supporting components Diode Bridge (DB) and Calibration Resistors (RES), as described in a previous chapter of this manual. The following procedures can be used to verify the calibration and perform the calibration, if necessary. In addition to the calibration, Switch S1 and potentiometer R16 have to be set appropriately on the CM-2 Module. If the CM-2 and/or RES are field replaced, field calibration is necessary.

CM-2 Settings

1. Place Switch S1 in the appropriate position per the Starter type:

   UP: Y-Delta or 57% Auto-transformer Starter

   DOWN: All others
2. Calculate LRA/FLA ratio by dividing the Motor Lock Rotor Amps by the chiller Full Load Amps (LRA/FLA = ratio) and then adjust potentiometer R16 to the ratio value.

Calibration Verification

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select MOTOR Screen and set Current Limit and Pulldown Demand Limit setpoints to 100% FLA.
3. Run chiller. Read compressor motor current in Phase A, B, and C using a clamp-on Ammeter. Apply ammeter to highest Phase.
4. Select COMPRESSOR Screen.
5. Manually operate the Pre-rotation Vanes by pressing the OPEN and CLOSE Keys as required to achieve a motor current equivalent to 100% FLA as indicated by the clamp-on Ammeter. The motor current value on the Display should indicate 100% FLA.
6. Manually operate the Pre-rotation Vanes by pressing the OPEN and CLOSE keys as required to achieve a motor current equivalent to 105% FLA as indicated by the clamp-on Ammeter. The 105% LED on the CM-2 Module should illuminate.

If the calibration verification does not perform as above, the following Calibration procedure will have to be performed.

Calibration

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select MOTOR Screen and set Current Limit and Pulldown Demand Limit setpoints to 100% FLA.
3. Select COMPRESSOR Screen.
4. Run chiller and read compressor motor current in Phase A, B and C using a clamp-on Ammeter. Apply Ammeter to highest Phase.
5. Manually operate the Pre-rotation Vanes by pressing the OPEN and CLOSE Keypad keys as required to achieve a motor current equivalent to 100% FLA as indicated by the clamp-on Ammeter. The voltage across Variable Resistors (RES) should be 0.90 to 1.05 VDC. Measure this voltage by connecting a Voltmeter at CM-2 Board J1-2 (+) to J1-1(-). If necessary, adjust RES to achieve this value. *Figure 56 on page 132* contains formulas to calculate the resistance of RES required to achieve this voltage. Adjust both resistors equally such that the combined resistance equals the calculated value.
6. Manually operate the Pre-rotation Vanes by pressing the OPEN, CLOSE and HOLD Keypad keys, as required, to achieve a motor current equivalent to 105% FLA as indicated by the clamp-on Ammeter. Loosen locking nut on potentiometer R8 on CM-2 and adjust until the CM-2 Module 105% LED illuminates. Counterclockwise increases signal level; Clockwise decreases signal level. Tighten locking nut.
7. Manually operate the Pre-rotation Vanes by pressing the OPEN and CLOSE Keypad keys, as required, to achieve a motor current equivalent to 100% FLA as indicated by the clamp-on Ammeter. Loose locking nut on potentiometer R34 on CM-2 and adjust until the motor current value on the Display indicates 100% FLA. Clockwise increases the signal level; Counterclockwise decreases the signal level. Tighten locking nut.

SOLID STATE STARTER APPLICATIONS

When the compressor motor is driven by a YORK Solid State Starter, one of three different Starters could be applied. Later production chillers are equipped with either the Style B Liquid Cooled Solid State Starter (LCSSS) or the Medium Voltage Solid State Starter (MVSSS). Earlier production vintage chillers are equipped with the Style A Solid State Starter. See *SECTION 13 - SOLID STATE STARTERS* for details of each of these starters. Use the following procedure to select the appropriate motor drive type, then select the appropriate procedure below for the starter type selected.

Motor Drive Type Selection:

- Microboard 031-1730-000: Position Program Jumpers JP37 and JP39 appropriately per *SECTION 3 - MICROBOARD 031-01730-000*.
- Microboard 031-02430-000/001:
  1. Chiller must be stopped and RUN switch must be in Stop-Reset position.
  2. Select SETUP Screen.
  3. Press CHANGE SETTINGS key.
  4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place the box around Motor Drive Type setpoint.
  5. Press ✓ key. A dialog box will appear with the range of settings. Use ◄ ► keys to select “SSS-Mod A”, “SSS-Mod B” or “MV SSS”, as appropriate.
  6. Press ENTER (✓) key.

Mod B Liquid Cooled Solid State Starter

1. At the keypad, log in at SERVICE access level using Password 1 3 8 0.
2. Select MOTOR Screen.
3. Enter the following setpoints using the procedures below:

Full Load Amps

This is the Full Load Amps (FLA) of the chiller as listed on the SALES ORDER Screen. The microboard uses the programmed value to perform Current Limit functions and display compressor motor current in terms of %FLA.

1. Press FULL LOAD AMPS key.
2. Use numeric keypad keys to enter correct value.
3. Press ENTER (✓) key.

Start Current

The Logic/Trigger Board will limit compressor motor current to this value during starting. The correct value is (0.45 x Delta Locked Rotor amps), as listed on the SALES ORDER Screen.

1. Press STARTING CURRENT key.
2. Use numeric keypad keys to enter correct value.
3. Press ENTER (✓) key.

Voltage Range

This is the compressor motor AC power line application. Selections are 200-208, 220-240, 380, 400, 415, 440-480, 550-600 and disabled. The microboard uses the programmed value to determine the overvoltage and undervoltage shutdown thresholds for LCSSS – HIGH SUPPLY LINE VOLTAGE and LCSSS – LOW SUPPLY LINE VOLTAGE cycling shutdowns as described in *OptiView Control Panel – Operation (Form 160.54-O1)*. If DISABLED is selected, the shutdown thresholds will be ignored. This check should not be arbitrarily disabled.

1. Press VOLTAGE RANGE key.
2. Use ◄ and ► keys to scroll to desired value.
3. Press ENTER (✓) key.

Open SCR Enable/Disable

This allows the Open SCR safety check, performed by the Logic/Trigger Board, to be disabled. This must NEVER be disabled unless advised by the YORK factory.

1. Press OPEN SCR key.
2. Use ◄ and ► keys to select Enable or Disable.
3. Press ENTER (✓) key.

Kilowatt Hours (KWH) Reset

This allows the KWH to be set to a desired starting value in the event the BRAM has to be field replaced. This must never be arbitrarily performed.

1. Press KWH RESET key.
2. Use numeric keypad keys to enter desired value.
3. Press ENTER (✓) key.

Motor Communications Protocol

(Software version C.OPT.01.18.307 (and later))

Allows the Service technician to enable the appropriate serial communications port for communications with the Style B Liquid Cooled Solid State Starter (LCSSS). Early vintage Style B LCSSS communicate with the microboard using YORK protocol (COM 5 (J15)). Later vintage units (after mid 2008 use Modbus protocol (COM 2 (J13)).

The protocol selection enables the appropriate communications port: YORK enables COM 5 (J15); Modbus enables COM 2 (J13). Selection required is based on the hardware and interface that is present. See *SECTION 13 - SOLID STATE STARTERS* to determine which hardware/interface is present.

- YORK - Enables COM 5 (J15) serial port. Used when the microboard is interfaced to the LCSSS Logic/Trigger Board TB2.
- Modbus - Enables COM 2 (J13) serial port. Microboard 031-02430-001 or 031-03630-001 is required. Program Jumpers JP14 on the 02430 (BRAM size) and JP17 (COM 2 Serial Mode) must be set to Pins 1-2 for RS-485. Used when the microboard is interfaced to LCSSS Logic/Trigger Board 031-02505 (J14). The 031-02430-001 microboard can be equipped with either 32K BRAM (031-02431-000) or 128K BRAM (031-02565-000).

1. Chiller must be stopped and RUN switch must be in Stop-Reset position.
2. Select SETUP Screen.
3. Press CHANGE SETTINGS key.
4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place box around the Motor Communications Protocol setpoint.
5. Press ✓ key. A dialog box will appear with the range of settings. Use ◄► keys to select "YORK" or Modbus, as appropriate.
6. Press ENTER (✓) key.

Motor Node ID

(Software version C.OPT.01.18.307 (and later))

Only displayed when Modbus is selected for the Motor Communications Protocol setpoint above. The Motor Node ID must be set to match the setting of the LCSSS Logic/Trigger Board Modbus Address Switch SW1. The address assigned to the Logic/trigger Board is "1". This is done by setting Logic/Trigger Board 031-02505 Modbus Address Switch SW1 position 1 to ON; all other positions to OFF.

1. Chiller must be stopped and RUN switch must be in Stop-Reset position.
2. Select SETUP Screen.
3. Press CHANGE SETTINGS key.
4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place box around the Motor Node ID setpoint.
5. Press ✓ key. A dialog box will appear with the range of settings. Use numeric keys to set this value to "1".
6. Press ENTER (✓) key.

Mod A Liquid Cooled Solid State Starter

The following procedures can be used to verify the calibration and perform the calibration if necessary. If the Logic Board is field replaced, field calibration is necessary. Logic Board Program Jumper JP5 (300V/600V) must be placed in the appropriate position per the compressor motor AC power line.

Logic Board Program Jumper

Place Jumper J5 (300V/600V) in appropriate position per the Compressor Motor AC Power Line application as follows:

600V - Place over pins 1 and 2 for 380/400/415, 440/460/480 or 550/575/600 VAC applications.

300V - Place over pins 2 and 3 for 200/208 or 220/230/240 VAC applications.

Setpoints

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select MOTOR Screen.
3. Enter the following setpoints using procedures below:

Full Load Amps

This is the Full Load Amps (FLA) of the chiller as listed on the SALES ORDER Screen. The microboard uses the programmed value to perform Current Limit functions and display compressor motor current in terms of % FLA.

1. Press FULL LOAD AMPS key.
2. Use numeric keypad keys to enter correct value.
3. Press ENTER (✓) key.

Voltage Range

This is the AC Power line voltage applied to the Compressor Motor. Selections are - 380, 400, 415, 440-480, 550-600 and Supply Voltage Range Disabled. The microboard uses the programmed selection to determine the overvoltage and undervoltage thresholds for Starter High Supply Line Voltage and Starter Low Supply Line Voltage. Cycling shutdowns as described in *OptiView Control Panel – Operation (Form 160.54-O1)*. If Supply Voltage Range Disabled is selected, the thresholds will be ignored and these shutdowns will not occur. This check should not be arbitrarily disabled.

1. Press VOLTAGE RANGE key.
2. Use ◄ and ► keys to scroll to desired value.
3. Press ENTER (✓) key.

Current Unbalance Check Enable/Disable

While the chiller is running, if the compressor Motor current in phase A, B and C becomes unbalanced, a safety shutdown is performed. Refer to *OptiView Control Panel – Operation (Form 160.54-O1)* for complete description of this check. This setpoint allows the check to be enabled or disabled. If enabled, the check is performed; if disabled, the check is not performed.

1. Press CURRENT UNBALANCE key.
2. Use ◄ and ► keys to select Enable or Disable.
3. Press ENTER (✓) key.

Calibration Verification

At the keypad, login at SERVICE access level using access code 1 3 8 0.

1. Compressor Motor current display accuracy
   a. Run chiller.
   b. Select COMPRESSOR Screen.
   c. Use the Pre-rotation Vanes HOLD keypad key to stabilize the Compressor Motor current.
   d. Measure phase A, B and C Compressor Motor current with a clamp-on ammeter. Compare the Ammeter values with displayed motor current values. If displayed values are not within +5% of Ammeter values, refer to *Solid State Starter (Mod A) – Operation and Maintenance (Form 160.46-OM3.1)* to troubleshoot the starter.
2. Start Current - Proper starting current is (45% x Delta locked Rotor amps).
   a. Select COMPRESSOR Screen.
   b. Start chiller and monitor Compressor Motor starting current in phase A, B and C on the COMPRESSOR Screen.

      Highest phase should be equivalent to (45% x Delta Locked rotor amps).
3. Overload
   a. Select COMPRESSOR Screen.
   b. Run chiller and monitor Compressor Motor current on the COMPRESSOR Screen.
   c. Manually operate the Pre-rotation Vanes by pressing the OPEN, CLOSE and HOLD keys, as required, until the highest phase indicates a current equivalent to 105% FLA.

      The Display should indicate 105% and the 105% LED on the Solid State Starter Logic Board should illuminate when the 105% FLA value is reached.

Calibration

If the calibration verification does not perform as above, one or both of the following Calibration procedures will have to be performed.

At the keypad, log in at SERVICE access level using access code 1 3 8 0.

1. Start Current
   a. Select COMPRESSOR Screen.
   b. Loosen locking nut on Solid State Starter Logic Board potentiometer R38.
   c. Start chiller and monitor Compressor Motor starting current in Phase A, B and C on the COMPRESSOR Screen.
   d. While chiller is starting, adjust START CURRENT potentiometer (R38) on Solid State Starter Logic Board to achieve the proper starting current of (0.45 x Delta Locked rotor Amps) on the highest phase. Turning R38 Clockwise increases current; Counterclockwise decreases current. Multiple starts could be required to achieve the correct calibration. Tighten locking nut.
2. Overload
   a. Select COMPRESSOR Screen.
   b. Run Chiller and monitor Compressor Motor current on the COMPRESSOR Screen.
   c. Manually operate the Pre-rotation Vanes by pressing the OPEN, CLOSE and HOLD keypad keys, as required, until the highest phase indicates a current equivalent to 105% FLA. Adjust OVERLOAD potentiometer (R44) on Solid State Starter Logic Board until the 105% FLA LED illuminates. Clockwise increases signal level; Counterclockwise decreases signal level. Tighten locking nut.

Medium Voltage Solid State Starter

1. At the keypad, log in at SERVICE access level using password 1 3 8 0.
2. Select MOTOR Screen.
3. Enter the following setpoints using procedures below:

Full Load Amps

This is the Full Load Amps (FLA) of the chiller as listed on the SALES ORDER Screen. The microboard uses the programmed value to perform Current Limit functions and display compressor motor current in terms of %FLA.

1. Press FULL LOAD AMPS key.
2. Use numeric keypad keys to enter the correct value.
3. Press ENTER (✓) key.

Start Current

The starter will limit compressor motor current to this value during starting. The correct value is (0.45 x Delta Locked Rotor Amps), as listed on the SALES ORDER Screen.

1. Press STARTING CURRENT key.
2. Use numeric keypad keys to enter correct value.
3. Press ENTER (✓) key.

COMPRESSOR MOTOR VARIABLE SPEED DRIVE APPLICATIONS

When the compressor motor is driven by a YORK Variable Speed Drive, there could be a Variable Speed Drive (VSD) or a Medium Voltage Variable Speed Drive (MV VSD) applied. Early vintage VSD's contain an Adaptive Capacity Control (ACC) Board in the OptiView cabinet that interfaces the microboard using YORK Protocol serial communications. With the later vintage VSD, the ACC functionality resides in the microboard, the ACC Board is not present and the VSD Logic Board directly interfaces the microboard directly using RS-485 Modbus Protocol serial communications. The MV VSD is also interfaced to the microboard with RS-485 Modbus serial communications. See *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* for the different possible configurations before proceeding.

1. At the keypad, log in at SERVICE access level (unless otherwise noted) using password 1 3 8 0.
2. Enter the following setpoints using the procedures detailed below.

Motor Drive Type

The Variable Speed Drive type applied must be set as follows. Select the procedure based on the microboard that is present.

- Microboard 031-1730-000: Position Program Jumpers JP37 and JP39 appropriately per *SECTION 3 - MICROBOARD 031-01730-000*.
- Microboard 031-02430-000/001, 031-03630-001:
    1. Chiller must be stopped and RUN switch must be in Stop-Reset position.
    2. Select SETUP Screen.
    3. Press CHANGE SETTINGS key.
    4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place box around the MOTOR DRIVE TYPE setpoint.
    5. Press ✓ key. A dialog box will appear with the range of settings. Use ◄ ► keys to select "VSD-60Hz", "VSD-50Hz" or "MV VSD", as appropriate.
    6. Press ENTER (✓) key.

Motor Communications Protocol

(Software version C.OPT.01.16.xxx (and later))

Only displayed when Motor Drive Type setpoint above is selected as "VSD-60Hz" or "VSD-50Hz". The Service technician must enable the appropriate serial communications port for communications to the Variable Speed Drive (VSD). Entered as "YORK" to enable COM5 (J15) or Modbus to enable COM2 (J13). Selection required is based on the hardware and interface that is present. See *SECTION 14 - ADAPTIVE CAPACITY CONTROL BOARD* (VSD) to determine which hardware/interface is present before making selection.

- YORK – Enables COM5 (J15) serial port. Used when the microboard is interfaced to the Variable Speed Drive via the ACC Board.
- MODBUS – Enables COM2 (J13) serial port. Used when the ACC Board is not present and the microboard is interfaced directly to the Variable Speed Drive Logic Board. In order to select Modbus, Microboard 031-02430-001 or 031-03630-001 is required.

Microboard 031-02430-001 must be equipped with the 128K BRAM (031-02565-000). With this Microboard, Program Jumpers JP14 (BRAM size) for the 02430 and JP17 (COM 2 Serial Mode must be set to Pins 1-2 for RS-485.

1. Chiller must be stopped and RUN switch must be in Stop-Reset position.
2. Select SETUP Screen.
3. Press CHANGE SETTINGS key.
4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place box around the Motor Communications Protocol setpoint.
5. Press ✓ key. A dialog box will appear with the range of settings. Use ◄ ► keys to select “YORK” or Modbus, as appropriate.
6. Press ENTER (✓) key.

Motor Node ID

(Software version C.OPT.01.16.xxx (and later))

Only displayed when Modbus is selected for the Motor Communications Protocol setpoint above. The Motor Node ID must be set to match the setting of the VSD Logic Board Modbus Address Switch SW3. The address assigned to the VSD Logic Board is “1”. This is done by placing the VSD Logic Board Modbus Address Switch SW3 position 1 to "ON" with all other positions to OFF, and setting this setpoint to “1.

1. Chiller must be stopped and RUN switch must be in Stop-Reset position.
2. Select SETUP Screen.
3. Press CHANGE SETTINGS key.
4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place box around the Motor Node ID setpoint.
5. Press ✓ key. A dialog box will appear with the range of settings. Use numeric keys to set this value to “1”.
6. Press ENTER (✓) key.

Full Load Amps (VSD)

This is the Full Load Amps (FLA) of the chiller as listed on the SALES ORDER Screen. The microboard uses the programmed value to perform Current Limit functions and display compressor motor current in terms of %FLA.

1. Place Compressor Start/Stop Switch in the Stop-Reset (O) position.
2. Select VSD DETAILS Screen from the MOTOR Screen.
3. Inside the VSD, locate the small trim pot on the VSD Logic Board; (R34) on Logic Board 031-02506; (R28) on all other Logic Boards.
4. While monitoring the VSD Full Load Amps 000.0 A message on the VSD DETAILS Screen, adjust this trim pot until the correct Full Load Amps value is displayed. Clockwise will increase the value.

Full Load Amps (MV VSD)

This is the Full Load Amps (FLA) of the chiller as listed on the SALES ORDER Screen. The microboard uses the programmed value to perform Current Limit functions and display compressor motor current in terms of %FLA.

1. Select MOTOR Screen.
2. Press FULL LOAD AMPS key.
3. Use NUMERIC Keypad keys to enter the correct value.
4. Press ENTER (✓) key.

Pre-rotation Vanes Position Potentiometer

See the *Pre-rotation Vanes Calibration on page 294* in this section for the procedure.

Adaptive Capacity Control

1. Select ACC DETAILS Screen.
2. The following keys are available:
    a. Surge Map Clear – Clears all previously established surge points that are stored in memory. When this key is pressed, a dialog box appears requesting the special ACC Map Clear Password. Enter 0 3 6 8 and press the ENTER (✓) key. A message is displayed advising the clearing is in progress. If ACC Board is present, press switch SW1 (for at least 1 second) on the ACC Board within 15 seconds of pressing the ENTER key. Another message is displayed when the clearing has completed. IMPORTANT! – This should not be performed unless advised by YORK factory Service.

b. Surge Map Print – Prints the entire array of stored surge points to a printer connected to COM1 serial port.

c. Auto Map Print – Prints new surge points, as they are established, to a printer connected to COM1 serial port.

d. Manual Surge Point – (This key is also available on the SURGE MAP Screen with software version C.OPT.19.307 (and later)). Captures the instantaneous operating conditions and stores them as a surge point in the surge map. When this key is pressed, a dialog box appears requesting the special password. Enter 0 3 6 8 and press the ENTER key. The chiller must be running to enter this point. If ACC board is present, press switch SW1 (for at least 1 second) on the ACC board within 15 seconds of pressing this key.

e. Surge Margin Adjust – Refer to *Opti Speed VSD Service Manual (Form 160.00-M4)*.

f. Surge Sensitivity – (software version C.OPT.01.19.307 (and later); Modbus Protocol configuration only)) – Sets the sensitivity of the ACC surge detection in the microboard. Programmable over the range of 1.5 to 2.0 (default 2.0). Smaller values increase the sensitivity.

g. VSD Start Frequency (software version C.OPT.01.21.307 (and later); Modbus Protocol configuration only)) - Sets the starting frequency from which the ramp-up will begin. Programmable over the following range:60Hz units – 30Hz to 60Hz (default 45Hz), 60Hz units with Quick Restart-30Hz to 45Hz (default 45Hz), 50Hz units – 25Hz to 50Hz (default 37.5Hz), 50Hz units with Quick Restart – 25Hz to 37.5Hz (default 37.5Hz).

h. ACC Mapping Enable (software version C.OPT.01.21.307 (and later); Modbus Protocol configuration only)) – Sets the Delta T (Leaving Chilled Liquid Temperature - setpoint) needed to be met to enable surge mapping and speed reduction initially on startup. Programmable over the range of 0.5°F to 20.0°F (default 1.0°F), 0.5°F to 4.0°F (software version C.OPT.01.22.307 (and earlier)).

3. Select SURGE MAP Screen (software version C.OPT.01.19.307 (and later); Modbus Protocol configuration only)).
4. The following keys are available:
    a. Manual Surge Point – see above
    b. Remove Surge Point – Allows a mapped surge point to be manually removed. Position the green box (□) over the desired surge point marked as X on the SURGE MAP Screen using the keypad arrow keys (▲▼◄►). Then press the REMOVE SURGE POINT key. A dialog box will appear requesting a special password. Enter 0 3 6 8 and press the ENTER key. The selected point will be removed.

Kilowatt Hours

1. At the keypad, log in at ADMIN access level.
2. Select MOTOR Screen.
3. Press KWH RESET key.
4. Use numeric keypad keys to enter desired value.
5. Press ENTER (✓) key.

Frequency Control

The VSD Frequency can be manually controlled as follows:

1. Select VSD TUNING Screen from the COMPRESSOR Screen.
2. On the VSD TUNING Screen, press the appropriate key as follows:
    a. Set – Places Frequency Control in Manual Mode. Sets the VSD speed at a specific frequency between 1.0 and 60 (50)Hz.
    b. Auto – Places the VSD in automatic frequency control. The frequency is determined by the ACC Board to achieve slowest speed possible while avoiding surge.
    c. Fixed – Sets the VSD frequency at maximum: 60 (50)Hz.
    d. Raise – Places Frequency Control in Manual Mode. Increases the VSD frequency by 0.1 to 10.0Hz, as programmed with the INCR AMT (increment amount) key.

       Each press of this key increases the frequency by the programmed Amount (0.1 to 10.0Hz).

e. Lower – Places frequency Control in Manual Mode. Decreases the VSD frequency by 0.1 to 10.0Hz, as programmed with the INCR AMT (increment amount) key.

   Each press of this key decreases the frequency the programmed amount (0.1 to 10.0Hz).

f. Incr Amt - Programmable setpoint (0.1 to 10.0Hz) that determines the amount of increase or decrease in VSD frequency that occurs with each press of the INC or DEC key in Manual Frequency Control Mode.

PROXIMITY PROBE

The following applies to all applications except P compressors and Style F and later chillers equipped with "G, Q" or "H5-8" compressors. When the Probe is installed at the time of manufacture or after the compressor is rebuilt in the field, a Reference Position is established. This remains the Reference Position until the Compressor is rebuilt. It is the distance (in mils) between the tip of the Probe and the surface of the High Speed Thrust Collar with a minimum of 25 psid oil pressure. Any distance between 37 and 79 mils is acceptable. This Reference Position is written on a label that is adhered to the inside of the OptiView Control Center door. It is also stored in the BRAM memory device on the microboard; if the BRAM is replaced, the original Reference Position value must be programmed using the procedure below. A complete description of the Proximity probe and the Reference Position is contained in *SECTION 15 - PROXIMITY PROBE* of this manual.

In the procedures below, the Reference Position can be established through a calibration procedure or a previously established Reference Position can be entered, without performing the calibration procedure.

Anytime the chiller shuts down on a THRUST BEARING safety shutdown, there is the potential that Compressor damage has occurred. Therefore, the shutdown must be evaluated by a qualified Service technician before restarting the chiller. Depending upon the actual shutdown message, the evaluation could require a bearing inspection. To prevent the chiller from restarting without the proper evaluation, restart is inhibited until a special reset procedure is performed. This procedure is listed below and must not be performed by anyone other than a qualified Service technician.

Calibration

Perform this procedure at the time of manufacture or if the compressor is rebuilt in the field.

1. At the keypad, login at SERVICE access level using access code 1 3 8 0.
2. Place Compressor Start/Stop Switch in the Stop-Reset (O) position.
3. Select Proximity probe CALIBRATE Screen from COMPRESSOR Screen.
4. On Proximity probe CALIBRATE Screen, press START CALIB key to initiate the calibration. The CALIBRATION IN PROGRESS LED will illuminate and the oil pump will start automatically. The oil pressure is displayed on the screen. If the CANCEL CALIB key is pressed during the procedure, the oil pump is turned off and the calibration is terminated.
5. When the oil pressure has reached 25 psid, the Program reads the proximity gap and the START CALIB key label changes to ACCEPT CALIB.
6. Press the ACCEPT CALIB key. The measured gap is entered as the Reference Position. Log this value on the Label adhered to the inside of the OptiView Control Center door. This remains the Reference Position until the Compressor is rebuilt.

Reference Position Entry

Perform this procedure if the Reference Position had been previously established, but lost from memory due to replacement of the BRAM (U52) or other event.

1. At the keypad, login at SERVICE access level using access code 1 3 8 0.
2. Place the Compressor Start/Stop Switch in the Stop-Reset (O) position.
3. Select Proximity probe CALIBRATE Screen from COMPRESSOR Screen.
4. On Proximity probe CALIBRATE Screen, press the ENTER REFERENCE key.
5. Locate previously established Reference Position that has been logged on label adhered to inside of OptiView Control Center door. Using numeric keypad keys, enter this value. Only values between 37 and 79 mils will be accepted.
6. Press ENTER (✓) key.

Safety Shutdown Reset/Inspection Procedure

As explained above, to prevent possible compressor damage, the chiller should not be restarted after a THRUST BEARING safety shutdown until the shutdown has been evaluated. Therefore, to prevent the chiller from being restarted by anyone other than a qualified Service technician, the chiller cannot be restarted until the special reset procedure below is performed. The evaluation that has to be performed after each shutdown depends on the actual message displayed and the circumstances of the shutdown (refer to HISTORY Screen) as follows:

A. THRUST BEARING - Proximity probe CLEARANCE - If the shutdown was caused by the gap increasing to greater than or equal to +10 mils from the Reference Position, perform a Bearing inspection. If there is damage, repair compressor. Otherwise, perform reset procedure below and restart chiller. If shutdown was caused by gap decreasing to greater than or equal to -25 mils from the Reference Position, perform the reset procedure below and restart the chiller.

B. THRUST BEARING - Proximity probe OUT OF RANGE - Perform reset procedure below and restart chiller.

C. THRUST BEARING - HIGH OIL TEMPERATURE (Not applicable to chillers equipped with Program version C.MLM.01.03 or higher) - If there have been two consecutive shutdowns, perform a Bearing inspection. Otherwise, perform reset procedure below and restart chiller.

D. THRUST BEARING - OIL TEMPERATURE SENSOR (Not applicable to chillers equipped with Program version C.MLM.01.03 or higher) - Perform reset procedure below and restart chiller.

Reset Procedure

In order for the following procedure to be successful, the Proximity clearance must be between +10 and –25 mils of the Reference Position and the High Speed Drain Temperature must be greater than 50.0°F and less than or equal to 179°F.

1. Place the keypad Rocker Switch in the Stop-Reset (O) position.
2. At the keypad, login at SERVICE access level using access code 1 3 8 0.
3. After Coastdown is complete, select Proximity probe CALIBRATE Screen from COMPRESSOR Screen.
4. Press FAULT ACKNOWLEDGE key. ENTER PASSWORD TO CLEAR FAULT is displayed in a dialog box.
5. Enter 1 3 9 7 and press the ENTER (✓) key. This clears the fault and allows the chiller to be started.

HIGH SPEED THRUST BEARING LIMIT SWITCH

The following is only applicable to chillers equipped with P compressors and style F and later chillers with “G, Q” or “H5-8” compressors: Anytime the chiller shuts down on a HIGH SPEED THRUST BEARING safety shutdown, displaying the message THRUST BEARING - LIMIT SWITCH OPEN, there is the potential that compressor damage has occurred. Therefore, a bearing inspection must be performed by a qualified Service technician before restarting the chiller. To prevent the chiller from restarting without the proper bearing evaluation, restart is inhibited until a special reset procedure is performed, as detailed below.

1. Place the COMPRESSOR Switch in the Stop-Reset position.
2. At the keypad, login at SERVICE access level using access code 1 3 8 0.
3. Select COMPRESSOR Screen.
4. After Coastdown is complete, press FAULT ACKNOWLEDGE key. ENTER PASSWORD TO CLEAR FAULT is displayed in a dialog box.
5. Enter 1 3 9 7 and press the ENTER (✓) key. If the Limit Switch is closed, this clears the fault and allows the chiller to be started.

REFRIGERANT LEVEL CONTROL

A complete description of the Condenser refrigerant level control and the setpoints that affect this control are provided in *SECTION 17 - REFRIGERANT LEVEL CONTROL* of this manual. These setpoints are listed below. The Program uses these setpoints to control the refrigerant to the desired level. If the chiller is equipped with this feature, the Program control must be ENABLED and the setpoints programmed using the procedure below.

The refrigerant level can be manually controlled through manual control of the Variable Orifice using the procedure below.

The refrigerant Level Sensor, located in the Condenser, must be properly calibrated to accurately detect the refrigerant level in the Condenser. The procedure below is used to perform this calibration.

Enable/Disable

If the chiller is equipped with the Refrigerant Level Control, Level control operation must be ENABLED. Otherwise, it must be DISABLED. Use following procedure:

1. At the keypad, log in at SERVICE access level, using access code 1 3 8 0.
2. Select SETPOINTS Screen. From SETPOINTS Screen select SETUP Screen. From SETUP Screen select OPERATIONS Screen.
3. Use ◄ and ► keys to select Enable or Disable.
4. Press ENTER (✓) key.

Setpoints

The following are the setpoints and range of programmable values. The DEFAULT value is shown in parenthesis. The DEFAULT value is the recommended value and should provide proper operation in most applications. However, the setpoint can be programmed to other values to compensate for local operating conditions. There are two different setpoint sets used depending upon the software vintage. Select the appropriate procedure per the installed software as follows:

Software version C.MLM.01.11.xxx (and earlier) or C.OPT.01.11.xxx (and earlier).

a. Level setpoint - 20% to 80% (50%).

b. Level Control Period - 1.0 to 5.0 seconds. 3.5 to 30 seconds (Flash memory card version C.MLM.01.06.xxx and later and P compressors with C.MLM.04.02.xxx).

   The Default value varies depending upon the Flash memory card version and compressor application: versions C.MLM.01.06.xxx (and earlier) (3.5 seconds); version C.MLM.01.07.xxx and later (10.0 seconds P compressors; 3.5 seconds all other compressors).

c. Proportion Limit Open - 10% to 50% (15%).

d. Proportion Limit Close - 10% to 50% (45%).

e. Rate Limit Open - 10% to 50% (10%) 5% to 50% (10%) (Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx).

f. Rate Limit Close - 10% to 50% (10%). 5% to 50% (10%) (Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx).

g. Valve Preset Time - 0 to 100 seconds (50 seconds) (Flash memory card version C.MLM.01.07.xxx and later).

h. Ramp-up Time - 3 to 15 minutes (8 minutes) (Flash memory card version C.MLM.01.07.xxx and later).

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select REFRIGERANT LEVEL CONTROL Screen from the CONDENSER Screen.
3. On the REFRIGERANT LEVEL CONTROL Screen, select the setpoint to be programmed or press the SETPOINTS key for more setpoints.
4. Using the numeric keypad keys, enter desired value.
5. Press ENTER (✓) key.

Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306(and later)

	Zone 1	Zone 2
Rate Limit	3% to 15% Default 7	3% to 15% Default 5
Period (seconds)	8 to 22 default 15	2.5 to 10 Default 2.5

	Zone 1 and Zone 2
Level Setpoint	20% to 80% Default 50%.

(30% software version C.OPT.01.18.307 (and earlier))

Valve Preset Time (setpoint) (seconds)	0 to 100 Default 50
Ramp Up Time (setpoint) (minutes)	3 to 15 Default 8

Proportion Error Deadband - +0%
Rate Error Deadband – +0%

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1. At the keypad, login at SERVICE access level using access code 1 3 8 0.
2. Select the REFRIGERANT LEVEL CONTROL Screen from the CONDENSER Screen.
3. Press the appropriate key to select the setpoint to be programmed.

   (If selecting Period or Rate setpoint, press the SET ZONES key. A green box appears around the first changeable setpoint. Use the ▲,▼,◄,► keys to place the green box around the desired setpoint to be changed. Press ENTER (✓) key. A dialog box will appear with the range of settings).
4. Using the numeric keypad keys, enter the desired value.
5. Press ENTER (✓) key.

Manual Control

The Variable Orifice can be manually controlled as follows:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select REFRIGERANT LEVEL CONTROL Screen from the CONDENSER Screen.
3. On the REFRIGERANT LEVEL CONTROL Screen, press the OPEN, CLOSE or HOLD key as required to control the Variable Orifice to achieve the desired refrigerant level. Pressing the AUTO key invokes automatic operation.

Level Sensor Calibration

There are two different versions of the Refrigerant Level Sensors. The operation of both the sensors is the same. However, the difference is in the calibration adjustments. Some sensors are equipped with adjustable potentiometers labeled “S”(span) and “Z”(zero). Others are equipped with calibration pushbuttons labeled “F/UP”, “E/DN”, “MAX”, and “MIN”.

The calibration instructions for the Refrigerant Level Sensor is contained in Service Instruction SI0187.

OIL PUMP VARIABLE SPEED DRIVE

On certain model chillers, the oil pump is driven by a small Variable Speed Drive. A complete description of the Drive operation and the setpoints that affect this control are provided in *SECTION 18 - OIL PUMP VARIABLE SPEED DRIVE* of this manual. The setpoints are listed below. The Program Variable Speed Drive operation must be ENABLED and the setpoints programmed using the procedures below. Also, the Oil Pump Speed can be manually controlled using the procedure below.

Enable/Disable

The Oil Pump Variable Speed Drive Program operation must be enabled.

The procedure varies according to the microboard installed as follows:

Microboard 031-01730-000

Program Switch SW1-2 ON – Enabled
OFF – Disabled

Microboard 031-02430-000/001, 031-03630-001

Entered as setpoint on SETUP Screen. Follow procedure later in this section under “Microboard 031-02430-000/-001, 031-03630-001 Setup/Configuration”.

Setpoints

The following are the setpoints and range of programmable values. The DEFAULT values (shown in parenthesis) are the recommended values and should provide proper operation in most applications. However, the setpoints can be programmed to other values as required.

- Oil Pressure setpoint - 20 to 45 psid (35)
- Control Period – 0.3 to 2.7 seconds in 0.3 second increments. (0.3)

Enter setpoints using procedure below:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select OIL SUMP Screen.
3. On the OIL SUMP Screen, press the appropriate key to select the setpoint to be programmed.
4. If the Dialog box begins with the word “Enter”, use the numeric keypad keys to enter the desired value. If it begins with “Select”, use the ◄ and ► keys to select desired value.
5. Press ENTER (✓) key.

Manual Control

The Oil Pump speed can be manually controlled between 25 and 60(50)Hz as follows:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.

2. Select OIL SUMP Screen.
3. The speed can be increased and decreased in 0.5Hz increments using the RAISE and LOWER keys. Each time the key is pressed, the frequency is changed 0.5Hz.

OR

The speed can be set to a specific frequency, as programmed by the SET key as follows:

1. Press SET key.
2. Use the numeric keys to enter the desired value.
3. Press ENTER (✓) key.
4. If the AUTO key is pressed, automatic speed control is invoked.

OIL RETURN MIN

(Software version C.OPT.01.21.307 and later; P,Q,H9 compressors only)

To avoid an OIL – LOW TEMPERATURE DIFFERENTIAL cycling condition from preventing a chiller start after running at low load conditions for extended periods, the Oil Return Solenoid (1SOL) is cycled closed when the oil temperature gets too low on the P, Q and H9 compressor chillers, while the chiller is running. The OIL RETURN MIN SETPOINT key appears on the OIL SUMP Screen when the Chiller Style/Compressor Type setpoint (on the OPERATIONS Screen) is set to P, Q or H9 compressor in SERVICE access level. This setpoint is programmable over the range of 80.0°F to 110.0°F (default 95.0°F) and controls the oil return Solenoid as follows:

- When the compressor is running and the Oil Sump Temperature is less than Oil Return Min setpoint, close (de-energize) the Oil Return Solenoid by de-energizing K12 relay.
- When the compressor is running and Oil Sump Temperature is greater than Oil Return Min + 7°F, open (energize) the Oil Return Solenoid by energizing K12 relay.
- During coastdown, the solenoid operation is not changed from standard logic, it remains closed. During startup the operation is not changed from standard logic, it remains closed for 1 minute after System run.

In previous software versions, the Oil Return Solenoid (1SOL) is opened 1 minute into System run and remains open until System Coastdown.

STANDBY LUBRICATION

To maintain oil seal integrity while the chiller is shutdown, a feature can be enabled that turns on the Oil Pump for 2 minutes every 24 hours if the chiller has not been run in the past 24 hours. While the Oil Pump is running, STANDBY LUBE IN PROCESS, along with a countdown timer displaying the time remaining in the lube cycle is displayed. If the chiller is style D equipped with an Oil Pump Variable Speed Drive, the operating oil pressure will be the programmed Oil Pressure setpoint.

If at least 15 psid of oil pressure is not achieved within 30 seconds of turning on the Oil Pump, the cycle is terminated and WARNING - STANDBY LUBE - LOW OIL PRESSURE is displayed and no more standby lubrications will occur until a.) the FAULT ACKNOWLEDGE keypad key is pressed after login at SERVICE access level, at which point another lube cycle will be attempted or b.) the chiller is started.

Standby lubrication cycles will not be performed if either Oil Pressure transducer is reading a pressure out of its range (HOP less than or equal to 6.8 psig; LOP is less than or equal to 0 psig). This ensures that the oil pump will not be turned on with the shells at atmospheric pressure, as they would be during maintenance.

When logged in at SERVICE access level, the time remaining until the next Standby lubrication cycle is displayed as NEXT OIL SEAL LUBRICATION = xx Hrs on the OIL SUMP Screen.

To ENABLE or DISABLE the Standby lubrication cycles, proceed as follows:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select OIL SUMP Screen.
3. Use ◄ and ► keys to select Enable or Disable.
4. Press ENTER (✓) key.

HIGH CONDENSER PRESSURE WARNING THRESHOLD

The Condenser Pressure at which a High Pressure warning message is displayed and the Pre-rotation Vanes are inhibited from further opening, is programmable over the range of 44.9 to 162.5 psig (R-134a), or 84.0 to 246.3 psig (R22). The Default value for R-134a is 162.5 psig. The Default for R22 is 246.3 psig. The threshold is automatically set to 193 psig when the Heat Pump Duty is set to enabled. The warning message will clear and the PRV inhibit is removed when the pressure decreases to 5 psig below the programmed value. Proceed as follows to enter this value:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select CONDENSER Screen.
3. On the CONDENSER Screen, press HIGH PRESSURE WARNING THRESHOLD key.
4. Using numeric keypad keys, enter desired value.
5. Press ENTER (✓) key.

BRINE LOW EVAPORATOR PRESSURE CUTOUT

On Brine cooling applications, the LOW EVAPORATOR PRESSURE safety shutdown threshold is programmable over the range of 25.0 to 54.3 psig (Default 54.3 psig) for R22 Refrigerant and 6.0 to 25.0 psig (Default 25.0 psig) for R-134a Refrigerant. The actual percentage of Brine solution determines this threshold. It is calculated at the YORK factory and programmed at the time of manufacture. If the BRAM memory device on the microboard is replaced, the threshold will have to be programmed in the field. The threshold is logged on an adhesive label attached to the inside of the OptiView Control Center door. Proceed as follows to enter this value:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select EVAPORATOR Screen.
3. On the EVAPORATOR Screen, press the BRINE LOW EVAPORATOR CUTOUT key.
4. Using numeric keypad keys, enter desired value.
5. Press ENTER (✓) key.

LEAVING CHILLED LIQUID TEMPERATURE CONTROL SENSITIVITY

This setpoint adjusts the Leaving Chilled Liquid Temperature control sensitivity. It determines the magnitude of Pre-rotation Vanes (PRV) response to correct the error between the Leaving Chilled Liquid Temperature setpoint and the actual liquid temperature leaving the chiller. There are three selections as follows:

Normal - Provides standard control operation. PRV open and close pulses are standard durations for any given error. Longest allowed pulse is 18 seconds in duration. This selection will provide proper operation in most applications.

50% - Provides less sensitivity than the NORMAL selection. The longest allowed open or close pulse is limited to 50% of the maximum allowed with the NORMAL selection. This provides less overall PRV movement than the NORMAL selection. This selection will reduce PRV instability in short chilled liquid loops, multi-pass chillers, parallel chiller configurations and other applications that cause PRV instability.

30% - Provides less sensitivity than the 50% selection. The longest allowed open or close pulse is limited to 30% of the maximum allowed with the NORMAL selection. This provides less overall PRV movement than the 50% selection. It's beneficial in the same applications as the 50% selection, but that require greater stability. This selection available with Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx).

Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx have special variable speed low load operation as follows: If the chiller is equipped with the YORK Compressor Motor Variable Speed Drive and the 50% or 30% Sensitivity is selected, the Pre-rotation Vane (PRV) movement is reduced further than described above when the chiller is operating at low load. When the PRV position is less than 25% and the Leaving Chilled Liquid Temperature is within plus or minus 2.5 °F of setpoint, the maximum allowed vane pulse is limited to 3.5 seconds at the 25% PRV position and 0.9 seconds at 0% position. PRV positions in between have linearly scaled maximums.

Proceed as follows to select this value:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select EVAPORATOR Screen.
3. Press SENSITIVITY key.
4. Use ◄ and ► keys to select desired value.
5. Press ENTER (✓) key.

DROP LEG REFRIGERANT TEMPERATURE

The chiller can be equipped with a refrigerant temperature sensor in the drop leg between the condenser and evaporator. If ENABLED with the procedure below, this temperature is displayed on the CONDENSER Screen as the “Drop Leg Temperature”. It is subtracted from the Condenser Saturation Temperature to produce “Sub Cooling Temperature”, also displayed on the CONDENSER Screen. If the chiller is equipped with the Drop Leg Refrigerant Temperature sensor, the values are displayed on the CONDENSER Screen only if ENABLED with the following procedure:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select CONDENSER Screen.
3. Press DROP LEG key.
4. Use ◄ and ► keys to select Enable or Disable.
5. Press ENTER (✓) key.

SMART FREEZE PROTECTION

This feature is described in *SECTION 24 - SMART FREEZE PROTECTION* of this manual. When turned on, it allows the Leaving Chilled Liquid Temperature setpoint to be as low as 36°F for water cooling applications. Along with this feature is a correspondingly lower Low Water Temperature Cycling Shutdown threshold and LOW EVAPORATOR PRESSURE safety shutdown threshold. The Smart Freeze Protection feature can be turned ON or OFF using the following procedure:

1. Shutdown the chiller and wait for completion of COASTDOWN.
2. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
3. Select EVAPORATOR Screen.
4. Press SMART FREEZE key.
5. Use ◄ and ► keys to select ON or OFF.
6. Press ENTER (✓) key.

EVAPORATOR REFRIGERANT TEMPERATURE

If the chiller is equipped with an Evaporator Refrigerant Temperature sensor, the feature must be enabled with the procedure below. If not equipped with this sensor, it must be disabled. If enabled, this temperature is displayed on the EVAPORATOR Screen, and is also used in the SMART FREEZE PROTECTION LOW EVAPORATOR PRESSURE safety shutdown threshold calculation, as explained in *SECTION 24 - SMART FREEZE PROTECTION* of this manual.

Use the following procedure to Enable or Disable this feature:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select EVAPORATOR Screen.
3. Press REFRIGERANT key.
4. Use ◄ and ► keys to select Enabled or Disabled.
5. Press **ENTER** (✓) key.

HOT GAS BYPASS CONTROL

A complete description of the optional Hot gas bypass Control and the setpoints that affect this control are provided in *SECTION 23 - HOT GAS BYPASS* of this manual. The setpoints are listed below. If the chiller is equipped with this feature, it must be ENABLED and the setpoints programmed using the procedure below. Otherwise, it must be DISABLED. The Hot gas valve can be manually controlled using the procedure below. The total lifetime Surge Count can be cleared. However, this should NOT be arbitrarily performed! Since the Pre-Rotation Vanes (PRV) position is used in the Hot gas control, the PRV position feedback potentiometer must be calibrated with the procedure below.

Enable/Disable

If the chiller is equipped with the optional Hot gas bypass Control, operation must be ENABLED. Otherwise, it must be DISABLED. Use the following procedure:

1. Shutdown chiller and place COMPRESSOR Start/stop Switch in the Stop-Reset (O) position.
2. At the keypad, log in at SERVICE access level, using password 1 3 8 0.
3. Select SETPOINTS Screen. From SETPOINTS Screen, select SETUP Screen. From SETUP Screen, select OPERATIONS Screen.
4. Use ◄ and ► keys to select Enable or Disable.
5. Press ENTER (✓) key.

Setpoints

The following are the setpoints and range of programmable values. The DEFAULT value is shown in parentheses. The Default value is the recommended value and should provide proper operation in most applications. However, the setpoint can be programmed to other values to compensate for local operating conditions. There are two different setpoint sets used depending upon the software vintage. Select the appropriate procedure per the installed software as follows:

1. At the keypad, login at SERVICE access level using password 1 3 8 0.
2. Select Hot gas bypass Screen from the COMPRESSOR Screen.
3. On the Hot gas bypass Screen, press the appropriate key to select the setpoint to be programmed.
4. Using the numeric Keypad keys, enter the desired value.
5. Press ENTER (✓) key.

Manual Control

The Hot gas valve can be manually controlled as follows:

1. At the keypad, log in at SERVICE access level using password 1 3 8 0.
2. Select Hot gas bypass Screen from the COMPRESSOR Screen.
3. On the Hot gas bypass Screen, press the OPEN or CLOSE keys as desired. Each time the key is pressed, the valve position will be increased or decreased 5%. Pressing the AUTO key invokes automatic operation.

Pre-rotation Vanes Position Potentiometer Calibration

See *Pre-rotation Vanes Calibration on page 294* in this section for the procedure.

CHILLER STARTS AND OPERATING HOURS RESET

The Number of Starts and the Operating Hours can be reset to zero or preset to a desired number. However, this should never be arbitrarily performed. Use the following procedure:

1. At the keypad, login at ADMIN access level. This password changes daily. Contact your local Johnson Controls Service Office.
2. Select OPERATIONS screen.
3. Press NUMBER of STARTS or OPERATING HOURS key as appropriate.
4. Using numeric keypad keys, enter desired number.
5. Press ENTER (✓) key.

SERVICE PHONE NUMBERS

(Applies to Flash memory card version C.MLM.01.05.xxx and later)

Two service phone numbers (Regional and Local), with labels, can be displayed on the OPERATIONS Screen. The Default value for the Regional number is the “North American Toll Free Number” (1-800-861-1001). However, the label and number can be changed to any desired value. The Default value for the Local label and number is blank. The Service technician enters the Local phone number and label.

The entry format consists of 4 fields (rows), vertically from the top. Up to 40 characters/numbers can be entered for each field.

Field 1 – Regional phone number label. Default value is “Johnson Controls North American Parts Center Toll Free Number”.

Field 2 – Regional phone number. Default value is 1-800-861-1001.

Field 3 – Local service phone number label. Default value is blank.

Field 4 – Local service phone number. Default value is blank.

Use the following procedure to change any of the fields:

1. At the keypad, login at SERVICE access level using access code 1 3 8 0.
2. Select OPERATIONS Screen.
3. Press EDIT PHONE NUMBERS key.
4. Use ▲ and ▼ keys to move green selection box to the desired field to be changed.
5. Press the ENTER (✓) key.
6. In the Dialog box that appears, a red box appears over the first changeable value. Use the ◄ and ► keys to position the red box over the number character to be changed or entered. Use the ▲ and ▼ keys to scroll sequentially through numbers, alphabet characters and punctuation marks to select the desired value. When the desired value displayed, use the ◄ and ► keys to move the red

box to the next value to be changed. The numeric keypad keys can also be used to enter numbers. Continue this process until all desired values have been entered.

7. After all desired values have been entered in previous step, press ENTER (✓) key.

SURGE PROTECTION

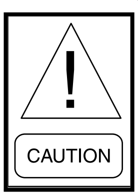
(Applies to Flash memory card version C.MLM.01.05.xxx and later)

A complete description of the Surge Protection feature and setpoints that affect this control are provided in *SECTION 25 - SURGE PROTECTION* of this manual. Although most setpoints are entered with OPERATOR access level, the Surge Sensitivity setpoint and Total Surge Count clearing require SERVICE access level or higher.

Surge Sensitivity

1. At the keypad, log in at SERVICE access level, using 1 3 8 0.
2. Select SURGE PROTECTION Screen from COMPRESSOR Screen.
3. Press SURGE SENSITIVITY key.
4. Using numeric and decimal point keypad keys, enter desired value. Programmable over range of 0.3 to 1.3. Default value is 0.3. Use leading zeroes where necessary and place decimal point between first and second digit (ie; 0.3, 1.2, etc.)
5. Press ENTER (✓) key.

Clear Surge Count



This should NOT be arbitrarily performed.

1. At the keypad, log in at ADMIN access level. Obtain ADMIN password from local service office. This password changes daily.
2. Select SURGE PROTECTION Screen from COMPRESSOR Screen.
3. Press CLEAR SURGE COUNT key.

SALES ORDER DATA

All of the Sales Order Data, except the “Chiller Commissioning Date” is entered at the YORK factory at the time of chiller manufacture. The Service technician must enter the Chiller Commissioning Date and modify the Job Name or Job Location if necessary at the completion of commissioning. Normally, the remainder of the Sales Order Data should never be modified. However, if there is a change to the chiller design, in the field, this data can be modified. If the BRAM battery-backed memory device fails and requires field replacement, all of the data will be lost and will have to be manually programmed.

When replacing a Microboard, it might be desirable to transfer the BRAM from the defective board to the replacement board to save stored Sales Order data. Since not all BRAM devices are compatible with all Microboards, first determine if the BRAM can be transferred before making the transfer. See the microboard Service Replacement in *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001* of this manual.

There are three different Passwords used, depending on the circumstances, to change the Sales Order Data as follows:

- **Chiller Commissioning -** Service technician must use password 1 3 8 0 to enter the Commissioning Date and modify Job Name and Job Location if necessary.
- **Modifying Sales Order Data -** Service technician must use the ADMIN password. This password changes daily. Contact your local Johnson Controls Service Office.
- **BRAM Replacement -** If the BRAM is field replaced, the Service technician must use password 0 2 2 8 to enter all Sales Order Data into a new blank BRAM. When logged in at this level, the ACCESS LEVEL shown will be TEST OP. This password only works with a blank BRAM and is only applicable to chillers equipped with Flash memory card Version C.MLM.01.01 and later.

CAUTION

When using this password to enter data into a new blank BRAM, the FINISH PANEL SETUP procedure (listed at the end of the entry procedure below) must be performed after all data has been entered. Failure to perform this procedure will result in unreliable OptiView Control Center operation! If this procedure is performed before entering all data, the ability to enter more data will be terminated.

Use the following procedure to enter data:

1. At the keypad, log in at the appropriate access level to change the desired values.
2. From the SETPOINTS Screen, select SETUP SCREEN. From the SETUP Screen, select SALES ORDER Screen.
3. If logged in at SERVICE access level, press SET ORDER INFO key to enter Commissioning date, Job Name or Location and proceed to step 4. If logged in at ADMIN or Test Op level, Press SELECT key to select the data category (ORDER, DESIGN, NAMEPLATE, SYSTEM) to be entered.
4. Press CHANGE key. The first changeable area in the selected category will be outlined in a green selection box. The procedure can be terminated anytime after this by pressing the CANCEL (x) key.
5. Use the ▲ and ▼ keys to move the green selection box to the desired value to be changed, within the category selected.
6. Press ENTER (✓) key.
7. Enter the appropriate data. Use the numeric keypad keys to enter numbers. Use the • key to enter a decimal point. Use the ▲ and ▼ keys to scroll sequentially up and down through the alphabet to enter letters or a comma (,), slash (/) or minus sign (-). Each time the ▲ key is pressed, the next higher sequential alphabet letter is displayed. Each time the ▼ key is pressed, the next lower alphabet letter is displayed. The comma, slash and minus sign can be selected after scrolling through the entire alphabet. During the entry process, the ◄ key can be used to backspace and the ► key can be used to forward space.
8. Press ENTER (✓) key.
9. Use ▲ and ▼ keys to select another value to be changed within the same category or press CANCEL (X) key to exit and allow selection of another category.
10. **Extremely Important!** If the procedure above was performed using password 0 2 2 8 to enter data into a new blank BRAM, the following procedure must be performed after all the desired data is entered. If the following procedure is performed before entering all of the data, the ability to enter more data will be terminated. Failure to perform this procedure after all data has been entered will result in unreliable OptiView Control Center Operation!
    a. On SALES ORDER screen, press FINISH PANEL SETUP key.
    b. Use ◄ and ► key to select YES.
    c. Press ENTER (✓) key.

CUSTOM USER ID AND PASSWORDS

When logging in, the user is requested to enter a User ID, followed by a Password. The universal and Default User ID is zero (0). The universal Password to log in at OPERATOR access level is 9 6 7 5. The universal Password to log in at SERVICE access level is 1 3 8 0. No log in is required for VIEW access level. However, if desired, the Service technician can establish up to four custom User ID's and Passwords that can be used by Operations personnel to log in at VIEW, OPERATOR, or SERVICE level.

Up to four Custom Users can be established with User ID's from 1 to 9999. Each user can be assigned a Password of 0 to 9999 and an access level of VIEW, OPERATOR or SERVICE.

Use the following procedure to establish Custom Users:

1. At the keypad, log in at SERVICE access level using 1 3 8 0.
2. From the SETPOINTS Screen, select SETUP Screen. From SETUP Screen, select USER Screen.
3. Press CHANGE USER ATTRIBUTES key. The first changeable area is outlined in a green selection box.
4. Use the ◄ , ► , ▲ or ▼ keys to move the green selection box to the desired value to be changed.

5. Press the ENTER (✓) key.
6. Using numeric Keypad keys, enter desired parameter as follows:

   User ID – 1 to 9999 (numbers cannot be duplicated for more than one user)
   Password – 0 to 9999
   Access Level – 0 = VIEW, 1 = OPERATOR, 2 = SERVICE

7. Press ENTER (✓) key.
8. After all values have been entered, press CANCEL key (X) to exit.

RECORD SETPOINT CHANGES

(Flash memory card version C.MLM.01.06.xxx and later or C.MLM.04.02.xxx)

This feature provides a record of the last 75 setpoint changes. The date and time the setpoint was changed, the new setpoint value and the Access Level and User ID used to make the change are stored. The SECURITY LOG Screen and the SECURITY LOG DETAILS Screen display levels of this information.

On the SECURITY LOG Screen, accessible from the HISTORY Screen, the setpoint, setpoint category and new setpoint value are listed and numbered in reverse order in which they were changed. The most recent is listed as number 1; the next most recent as number 2, etc. A PRINT key allows printing this entire list. Since 15 changes can be displayed at one time, multiple pages could be necessary to display all the changes. PAGE-UP and PAGE-DOWN keys are provided to view the entire list. If it is desired to view the details of a particular setpoint change, select the setpoint change number with the LOG ENTRY key and then press the VIEW DETAILS key. This moves to the SECURITY LOG DETAILS Screen.

The SECURITY LOG DETAILS Screen displays the following setpoint change details. The setpoint is selected from the list on the SECURITY LOG Screen as explained in the previous paragraph.

- Setpoint Category
- Setpoint
- Date and time of change
- Access Level and User ID used to make the change
- Old Value
- New Value

The following setpoint changes are not logged:

- Clock Mode
- Custom Screen Slot Numbers
- Advanced Diagnostics Communication Port Tests
- Advanced Diagnostics Secondary Multiplexer Freeze
- Soft Shutdown Initiated by Operator
- System Language
- Display Units
- Any Print Report
- Cancel any Print Report
- Schedule Clear
- Schedule Repeat Exception Days
- Schedule Start and Stop Times
- Log In/Log Out
- User Attributes for ID, Password and Level
- Trend Start/Stop
- Trend Slot Numbers, Minimums and Maximums
- Trend Trigger Data
- Trend Print Mode
- Trend View Mode

View the setpoint changes as follows:

1. At the keypad, login at SERVICE access level using access code 1 3 8 0.
2. From the HISTORY Screen, select SECURITY LOG Screen to view the complete list of setpoint changes.
3. To view the details of a particular setpoint change, select it with the LOG ENTRY key, then press VIEW DETAILS key. This causes a jump to the SECURITY LOG DETAILS Screen where the setpoint change details are displayed.

CHILLER STYLE/COMPRESSOR

(Flash memory card version C.MLM.01.07.xxx and later)

If equipped with Flash memory card version C.MLM.01.07.xxx and later, the Chiller Style/Compressor combination must be entered. The various YK chiller style/compressor combinations are equipped differently and have different control requirements. Variables include the following:

- High Speed Thrust Bearing proximity sensing – Proximity probe input at Microboard J8-15 or Limit Switch input at I/O Board TB3-81.
- Flow Sensor – Paddle type or Factory Mounted Thermal Type. The paddle type applies 115 VAC to the I/O Board Digital inputs TB4-12 (evaporator) and TB4-11 (condenser). The factory mounted thermal type (available with style F chillers), applies +5 VDC to the microboard Analog Inputs at J7-14 (evaporator) and J7-16 (condenser). Flash memory card version C.MLM.01.07.xxx and C.MLM.01.07A.xxx automatically selects the Flow Sensor input, either Analog or Digital per the Chiller Style/Compressor setpoint selection. Flash memory card version C.MLM.01.08.xxx (and later), allows the use of either the Thermal type (Analog) or Paddle-type (Digital) flow sensors in the style F chillers. With these versions, the actual Flow Sensor type present must be entered using the Flow Switch setpoint.
- Oil Heater Outputs – Either TB1-34 or TB1-64 on I/O Board.
- Refrigerant Level Control Default Period – Either 3.5 seconds or 10.0 seconds.
- "Oil – Variable Speed Pump-Pressure setpoint Not Achieved" safety shutdown threshold – Either 25 psid or 35 psid.

Flash memory card version C.MLM.01.07.xxx and later are applicable and backward compatible to all YK chiller style/compressor combinations. They contain all control variables for all combinations. For correct chiller control, the correct CHILLER STYLE/COMPRESSOR combination must be entered. Once the applicable Chiller/Compressor combination is entered, the program automatically bundles the functionality and chiller control per the tables below.

For example, if equipped with C.MLM.01.08.105A (or later):

Example 1

If the chiller is a style F and equipped with a J or H3 compressor, enter "Style F/J,H3 Compr". The program will read the Proximity probe input at Microboard J8-15, control the Oil Heater from TB1-64, make the Level Control Period Default 3.5 seconds, the Oil Pressure safety threshold below is 35 psid and will read the Flow Sensor inputs at either I/O Board TB4-11/12 or Microboard J7-14/16 as programmed with the Flow Switch setpoint.

Example 2

If the chiller is a style E and equipped with a P compressor, enter "Style E/P Compr". The program then reads the Proximity Limit Switch at I/O Board TB3-81, controls the Oil Heater from TB1-64, makes the Level Control Period Default 10.0 seconds, the Oil Pressure safety threshold below would be 25 psid and reads the Flow Sensor input at I/O Board TB4-11/12.

TABLE 27 - FLASH MEMORY CARD VERSION C.MLM.01.07.XXX AND C.MLM.01.07A.XXX

CHILLER STYLE/ COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*
"Style CDE/GHJ Compr"	Probe	TB1-34	3.5 sec	Digital (Paddle Type)	35 psid
"Style E/P Compr"	Limit Switch	TB1-64	10.0 sec	Digital (Paddle Type)	25 psid
"Style F/GH Compr"	Limit Switch	TB1-64	3.5 sec	Analog (Thermal Type)	35 psid
"Style F/J Compr"	Probe	TB1-64	3.5 sec	Analog (Thermal Type)	35 psid
"Style F/P, Compr"	Limit Switch	TB1-64	10.0 sec	Analog (Thermal Type)	25 psid

NOTE: * Not applicable to Style C (and earlier) chillers.

TABLE 28 - FLASH MEMORY CARD VERSION C.MLM.01.08.XXX

CHILLER STYLE/ COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*
“Style CDE/GHJ Compr”	Probe	TB1-34	3.5 sec	Digital (Paddle Type)	35 psid
“Style E/P Compr”	Limit Switch	TB1-64	10.0 sec	Digital (Paddle Type)	25 psid
“Style F/GH Compr”	Limit Switch	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
“Style F/J Compr”	Probe	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
“Style F/P, Compr”	Limit Switch	TB1-64	10.0 sec	Programmable (Analog or Digital)	25 psid

NOTE: * Not applicable to Style C (and earlier) chillers

TABLE 29 - FLASH MEMORY CARD VERSION C.MLM.01.08.105A AND C.MLM.01.08.206A (AND LATER)

CHILLER STYLE/ COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*
“Style CDE/GHJ Compr”	Probe	TB1-34	3.5 sec	Digital (Paddle Type)	35 psid
“Style E/P Compr”	Limit Switch	TB1-64	10.0 sec	Digital (Paddle Type)	25 psid
“Style F/G, H5-8 Compr”	Limit Switch	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
“Style F/J, H3 Compr”	Probe	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
“Style F/P, Compr”	Limit Switch	TB1-64	10.0 sec	Programmable (Analog or Digital)	25 psid

NOTE: * Not applicable to Style C (and earlier) chillers

TABLE 30 - SOFTWARE VERSION C.MLM.01.10B.XXX (AND LATER) OR C.OPT.01.10B.XXX (AND LATER)

CHILLER STYLE/ COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*
“Style CDE/GHJ Compr”	Probe	TB1-34	3.5 sec	Digital (Paddle Type)	35 psid
“Style E/P Compr”	Limit Switch	TB1-64	10.0 sec	Digital (Paddle Type)	25 psid
“Style F/G, H5-8 Compr”	Limit Switch	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
“Style F/J, H3 Compr”	Probe	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
“Style F/P, Q LH9 Compr”	Limit Switch	TB1-64	10.0 sec	Programmable (Analog or Digital)	35 psid

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TABLE 31 - SOFTWARE VERSION C.OPT.01.16.XXX (AND LATER)

CHILLER STYLE/ COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*	STANDARD COASTDOWN TIME
"Style CDE/GHJ Compr"	Probe	TB1-34	3.5 sec	Digital (Paddle Type)	35 psid	Programmable 150-900 sec
"Style E/P Compr"	Limit Switch	TB1-64	10.0 sec	Digital (Paddle Type)	25 psid	Programmable 150-900 sec
"Style F/G, H5-8 Compr"	Limit Switch	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid	Programmable 150-900 sec
"Style F/J1-J5H3 Compr" "Style G/ K1-K4 Compr"	Probe	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid	Programmable 150-900 sec
"Style F and G/ PQH9 Compr"	Limit Switch	TB1-64	10.0 sec	Programmable (Analog or Digital)	35 psid	Programmable 150-900 sec
"Style F/J7 Compr" "Style G/K6-K7 Compr"	Probe	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid	Programmable 240-900 sec

Enter the appropriate chiller/compressor combination as follows:

1. At the keypad, login at SERVICE access level using password 1 3 8 0.
2. Select SETPOINTS/SETUP/OPERATIONS Screen.
3. Press the CHILLER STYLE/COMPRESSOR key.
4. Use ◄ or ► keys to select the appropriate chiller style/compressor combination. Default is "Style F/G,H5-8 Compr".
5. Press ENTER (✓) key.

FLOW SWITCH

(Flash memory card version C.MLM.01.08.xxx and later)

Style E (and earlier) chillers are supplied with Paddle type flow sensors. Style F (and later) chillers are supplied with factory mounted Thermal type flow sensors. The Paddle type sensors are connected to the I/O Board 115 VAC Digital inputs TB4-12 (evaporator) and TB4-11 (condenser). The Thermal type sensors are connected to either J7 or J14 on the microboard, depending on the vintage of the chiller. On new production chillers before June 2009, they are provided connected to the microboard J7 (See *Figure 22 on page 70*). On new production chillers after June 2009, they are provided connected to the microboard J14 (See *Figure 23 on page 71*).

In order for the program to read the correct flow sensor input, the Flow Switch setpoint on the OPERATIONS Screen must be set appropriately in the procedure below. The correct setting is determined by the software version and the actual flow sensor connection point to the OptiView Control Center as follows:

With software version C.OPT.01.20.307 (and earlier), supplied before June 2009, the selections are ANALOG or DIGITAL. Select ANALOG when the Thermal type flow sensors are connected to the microboard J7 (See *Figure 22 on page 70*). Select DIGITAL when the Paddle type sensors are connected to the I/O Board TB4 (See *Figure 34 on page 102*).

With software version C.OPT.01.21.307 (and later), supplied after June 2009, the selections are J7, J14 or TB4. Select J7 when the Thermal type flow sensors are connected to the microboard J7 (See *Figure 24 on page 72*). Select J14 when the Thermal type sensors are connected to the microboard J14 (See *Figure 24 on page 72*). Select TB4 when the Paddle type sensors are connected to the I/O Board TB4 (See *Figure 34 on page 102*) and the Heating Condenser Water Paddle type flow sensor is connected to the LTC I/O Board J20 (if equipped with the Heat Recovery option; see *Figure 91 on page 236*).

After the selection is made, the program will read the flow sensor input at the selected connection point and ignore the other connection points.

Enter the applicable flow sensor type as follows:

1. Select SETPOINTS/SETUP/OPERATIONS Screen.
2. Press FLOW SWITCH key.
3. Use ◄ or ► keys to make selection. Each time the key is pressed, the selections are alternately displayed.
4. Press ENTER (✓) key.

MICROBOARD 031-02430-000-001 AND 031-03630-001 SETUP/CONFIGURATION

The following functions are programmed as setpoints on the Microboards. See the appropriate Microboard *SECTION 4 - MICROBOARD 031-02430- 000 AND 031-02430-001 or SECTION 5 - 031-03630-001* for an explanation of each setpoint.

- Chilled Liquid Pump Operation.
- Motor Drive Type.
- Anti-recycle.
- Power Failure Restart.
- Coastdown.
- Pre-Run.
- Oil Pump Package.
- Motor Communications Protocol (Only appears when VSD-50Hz, VSD-60Hz or SSS-Mod B is elected as Motor drive Type setpoint above. Applicable to Microboard 031-02430-001 with software version C.OPT.01.16.307 (or later) for VSD applications and C.OPT.01.18.307 (or later) for LCSSS applications).
- Motor Node ID (Only appears when Modbus selected as Motor Communications Protocol above).
- Coastdown Time (software version C.OPT.01.16.307 and later).
- Condenser Temperature Range (software version C.OPT.01.19.307 and later) Only appears when set to “Extended”, using an ADMIN password (automatically set to Extended when Heat Pump Duty is set to enabled).
- PRV Position-enable/disable (software version C.OPT.01.21.307 (and later).
- Motor Monitoring - enable/disable (software version C.OPT.01.22.307 and later).
- Heat recovery-enable/disable (software version C.OPT.01.21.307 and later).
- Head Pressure Control-enable/disable (software version C.OPT.01.21.307 and later).
- Heat Pump Duty – enable/disable (software version C.OPT.01.23.307 and later)(only appears when logged in at ADMIN access level.

Program the above setpoints as follows:

1. At the keypad, login at SERVICE access level using access code 1 3 8 0 or required password as listed above. (“Motor Drive Type” requires chiller to be stopped with COMPRESSOR switch in the Stop-Reset position).
2. Select SETUP Screen from SETPOINTS Screen.
3. Press CHANGE SETTINGS key.
4. A green box will appear around the first changeable setpoint. Use ▲▼ keys to place the box around the setpoint to be changed.
5. Press ✓ key. A dialog box will appear with the range of settings.
6. Use ◄► keys to scroll to desired setting.
7. Press ✓ key.

VARIABLE GEOMETRY DIFFUSER

(Applicable to chillers equipped with Variable Geometry diffuser only. Requires Software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later)).

A complete description of the Variable Geometry Diffuser (VGD) operation and setpoints that affect this control is detailed in *SECTION 26 - VARIABLE GEOMETRY DIFFUSER* of this manual. The setpoints are listed below. If the compressor is equipped with this feature, it must be enabled and the setpoints programmed using the procedure below. Otherwise, it must be disabled. The VGD can be manually controlled using the procedure below. If the chiller is equipped with the Compressor Motor Variable Speed Drive or the optional Hot gas bypass, the Pre-rotation Vanes (PRV) calibration is performed per procedures applicable to those features listed elsewhere in this section. Otherwise, the PRV must be calibrated per the procedure below.

Enable/Disable

If the compressor is equipped with the VGD, it must be enabled. Otherwise it must be disabled. Use the following procedure:

1. Shutdown chiller and place COMPRESSOR start/ Stop Switch in the Stop-Reset position.
2. At the keypad, log in at SERVICE access level, using password 1 3 8 0.
3. Select SETPOINTS/SETUP/OPERATIONS screen.
4. Use ◄ and ► keys to select Enable or Disable as required.
5. Press ENTER (✓) key.

VGD Count

The VGD Count is displayed on the VGD Screen. It is the number of times the Stall Detector Board output goes above the High Limit setpoint. This count can be cleared as follows:

1. At the keypad, log in at ADMIN access level.
2. Select COMPRESSOR/VGD/VGD SETPOINTS Screen.
3. Using numeric keypad keys, enter desired number.
4. Press ENTER (✓) key.

Setpoints

The following are the setpoints and range of programmable values. The DEFAULT value is shown in parentheses. The default value is the recommended value and should provide proper operation in most applications. However, the setpoint can be programmed to other values to compensate for local operating conditions.

A. Surge Reaction Time - 1 to 30 seconds (5)

B. PRV Offset – 0 to 5% (3)

C. Probe Wait Time – 0.5 to 15 minutes (10)

D. Open Pulse – 1 to 9 seconds (2)

E. High Limit – 0.5 to 1.2 VDC (0.6V; 0.8V with software version C.OPT.01.22.307 and earlier))

F. Low Limit – 0.4 to 0.8 VDC (0.5V; 0.6V with software version C.OPT.01.22.307 (and earlier))

G. Extreme Stall Duration – 10 to 20 minutes (10)

(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

H. PRV VGD Inhibit – 40% to 100% (100%; 95% with software version C.OPT.01.22 (and earlier))

(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

Use the following procedure:

1. At the keypad, log in at SERVICE access level using access code 1 3 8 0.
2. Select COMPRESSOR/VGD/VGD SETPOINTS Screen.
3. On the VGD SETPOINTS Screen, press the appropriate key to select the setpoint to be programmed.
4. Using the numeric keypad keys, enter the desired value.
5. Press ENTER (✓) key.

Manual Control

The VGD can be manually controlled as follows:

1. At the keypad, log in at SERVICE access level using access level code 1 3 8 0.
2. Select VARIABLE GEOMETRY DIFFUSER Screen from the COMPRESSOR Screen.
3. On the VARIABLE GEOMETRY DIFFUSER Screen, press the OPEN, CLOSE or HOLD key as desired. Each time the OPEN or CLOSED key is pressed, the respective output is energized for 2 seconds and the respective LED illuminates for 2 seconds. Pressing the HOLD key causes the HOLD LED to illuminate and the VGD to be held in its present position with. Pressing the AUTO key invokes automatic operation.

Pre-rotation Vanes Calibration

There is one procedure for all Pre-rotation Vanes (PRV) calibrations. The following procedure applies to the Compressor Motor Variable Speed Drive (VSD), Hot gas bypass, Variable Geometry Diffuser and any other PRV calibration.

1. Place the COMPRESSOR switch in the Stop-Reset position (O) and wait until the System Coastdown is complete.
2. At the keypad, login at SERVICE access level.
3. Select the PRE-ROTATION VANES CALIBRATE screen from the COMPRESSOR screen.
4. The pot should be initially set so that the feedback at the fully closed PRV position is 0.3 VDC to 0.7 VDC. Press the START CALIBRATION key to initiate the calibration. The CALIBRATION IN PROGRESS and PRV OPENING LED

will illuminate and an open signal is applied to the PRV. After a 60 second delay, the program begins evaluating the feedback voltage from the PRV potentiometer. When the feedback voltage stops increasing and remains stabilized (so that there is no more than + 0.025 VDC deviation) for 25 continuous seconds, the feedback voltage is logged as the 100% position. A close signal is then applied to the PRV and illuminates the PRV CLOSING LED. After a 10 second delay, the program begins evaluating the feedback voltage from the PRV potentiometer. When the feedback voltage stops decreasing and remains stabilized (so that there is no more than + 0.025 VDC deviation) for 25 continuous seconds, the feedback voltage is logged as the 0% position. These endpoint voltages are stored in the BRAM as the full open and full closed positions.

5. If the difference between the endpoint voltages is greater than 0.5 VDC, PRV CALIBRATION SUCCESSFUL is displayed. Otherwise, PRV CALIBRATION UNSUCCESSFUL is displayed. Also, if the endpoints are not established within 10 minutes, PRV CALIBRATION UNSUCCESSFUL is displayed.

NOTE

The calibration procedure can be terminated at any time during the procedure by pressing the CANCEL CALIB key. If the PRV were previously calibrated successfully, it will revert to using the previous calibration values. If they were not previously calibrated successfully, they will remain uncalibrated.

HIGH CONDENSER PRESSURE FAULT WHILE SHUTDOWN – RESET PROCEDURE

(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

High temperature condenser water flowing through the condenser while the chiller is shutdown can cause a condenser high pressure condition in the condenser resulting in loss of refrigerant. This anticipatory safety fault annunciates condenser high pressure conditions when the chiller is not running as follows:

While the chiller is stopped, if the Condenser Pressure exceeds 160.0 psig (R-134a), 240.0 psig (R22), a safety fault occurs and CONDENSER – HIGH PRESSURE - STOPPED is displayed. The chiller can be started after the Condenser Pressure decreases to less than 160.0 (R-134a), 240.0 psig (R22) and a special reset procedure is performed as follows:

1. Place the COMPRESSOR switch in the Stop-Reset position.
2. At the keypad, login at SERVICE access level using code 1 3 8 0.
3. Select Condenser screen.
4. Press the FAULT ACKNOWLEDGE key on the CONDENSER Screen. A dialog box appears displaying ENTER PASSWORD TO CLEAR FAULT.
5. Enter 1 3 9 7 and press the ENTER key (✓).

This anticipatory fault is only performed while the chiller is stopped. If a CONDENSER – HIGH PRESSURE fault is detected while the chiller is in Pre-lube, System run or Coastdown, the fault is handled in the normal way and does not require the special reset procedure.

MOTOR LUBRICATION NOTIFICATION

This feature applies to software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later) or Y.OPT.01.00.308 up to Y.OPT.01.00C.308.

This feature provides an indication when the compressor motor lubrication is required. The lubrication requirement and notification is based on the OPERATING HOURS SINCE LAST MOTOR LUBRICATION.

There are up to three levels of notification, each indicating an increasing level of urgency. WARNING – MOTOR BEARING LUBE SUGGESTED is displayed when the hours exceed 1000 hours. If there is no response, WARNING – MOTOR BEARING LUBE REQUIRED is displayed when the hours exceed 1200 hours. If there is still no response, a safety shutdown is performed when the hours exceed 1400 hours and MOTOR – LACK OF BEARING LUBRICATION is displayed.

To provide a record of when a motor lubrication is performed, the operator enters his/her initials, name or User ID using the MOTOR LUBE ACKNOWLEDGE key on the MOTOR LUBRICATION Screen. The date and time of this entry is automatically logged as the Date of Last Lubrication and Time of Last Lubrication. This also clears any motor lubrication warning or safety that is in effect and resets the Operating Hours Since Last Lubrication to zero.

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The MOTOR LUBRICATION Screen, accessible from the MOTOR Screen in any access level, displays information applicable to this feature.

When both motors have been lubricated, the operator must acknowledge the lubrication has been performed. This is done by entering his/her initials, name or User ID as a 3 to 8 character string. The entry is displayed as the operator initials at Last Lubrication. The date and time of this entry is automatically logged as the Date of Last Motor Lubrication and Time of Last Motor Lubrication. This entry also resets the Operating Hours Since Last Lubrication to zero.

This entry also resets the motor lubrication warning messages: WARNING – MOTOR BEARING LUBE SUGGESTED, WARNING – MOTOR BEARING LUBE REQUIRED and safety shutdown MOTOR – LACK OF BEARING LUBRICATION.

Enter your initials, name or User ID using the following procedure. The entry must be a minimum of 3 characters and a maximum of 8 characters.

1. At the keypad, log in at using Password 9 6 7 5. If resetting the safety shutdown “Motor – Lack of Lubrication”, place COMPRESSOR switch in Stop-reset (O) position.
2. Press the MOTOR LUBE ACKNOWLEDGE key. A dialog box appears. A red box highlights the first changeable location.
3. Use the ▲▼ keys to scroll sequentially through the alphabet to enter letters or numbers. Each time the ▲ is pressed, the next higher sequential alphabet letter or number is displayed. Each time the ▼ is pressed, the next lower alphabet letter or number is displayed. When the desired letter or number is displayed, use the ► key to forward space the red box for the next entry. Use the ◄ key to backspace, if necessary.
4. To write over an existing entry or to place a blank space, scroll to the beginning of the alphabet. The selection before the letter A is a blank space. Use the • key to enter a period/decimal point. During the entry process, if it is desired to exit the dialog box and retain the previous entry, press the CANCEL (X) key.
5. When all of the desired characters have been entered, press the ENTER (✓) key.

Motor Lube Date

Normally, the Date of Last Lubrication is automatically recorded when the operator enters his/her initials, name or User ID with the MOTOR LUBE ACKNOWLEDGE key in the above procedure. However, if it is necessary to modify the motor lubrication date after that procedure was performed, proceed as follows:

1. At the keypad, login at ADMIN access level.
2. Press the Motor Lube Date key.
3. Using the number keys, enter the desired date.
4. Press the ENTER (✓) key.

Software version C.OPT.01.16.xxx (and later) adds the Auto Lube and Shutdown setpoints to the MOTOR Screen.

The Auto Lube setpoint accommodates those chillers that are equipped with Automatic Motor Lubrication hardware that automatically lubricates the motor. Since chillers that are equipped with Automatic Motor Lubrication hardware don’t require manual lubrication, the motor lubrication warnings (reminders) and safety shutdown are unnecessary. Therefore, when the automatic lubrication hardware is present, the Auto Lube setpoint must be ENABLED. With this setting, no lubrication warnings or shutdown will occur.

If the Auto Lube setpoint is DISABLED, as it should be when not equipped with the Automatic Motor Lubrication hardware, the motor lubrication warnings and shutdown will occur at the associated elapsed run times. With this setting, the Shutdown setpoint can be used to enable or disable the safety shutdown that occurs at 1400 hours since last lubrication. The safety shutdown can be enabled or disabled per the customer’s preference. If enabled, the safety shutdown will occur at the normal 1400 hours. If disabled, a warning will be displayed but the safety shutdown will not occur.

Use the following procedure:

1. At the keypad, login at SERVICE access level using access level 1 3 8 0.
2. From the MOTOR Screen, select the MOTOR LUBE Screen.
3. Press the AUTO LUBE key.
4. Use the ◄ and ► keys to select Enable or Disable as desired per above.
5. Press ENTER key.

6. If Disable is selected in step 4, press the SHUTDOWN key.
7. Use the ◄ and ► keys to select Enable or Disable as desired per above.
8. Press ENTER (✓) key.

MOTOR LUBRICATION NOTIFICATION

This feature applies to OptiView Panel 03630 Software version Y.OPT.01.00D.308 (and later).

The MOTOR LUBRICATION Screen, accessible from the MOTOR Screen in any access level, displays information applicable to this feature.

This feature provides an indication when the compressor motor lubrication is required. The lubrication requirement and notification is based on the OPERATING HOURS SINCE LAST MOTOR LUBRICATION.

There are up to three levels of notification, each indicating an increasing level of urgency. WARNING – MOTOR BEARING LUBE SUGGESTED is displayed when the hours exceed the service level setting for lubrication (750 to 15000; Default 1200 hours) minus 200 hours. If there is no response, WARNING – MOTOR BEARING LUBE REQUIRED is displayed when the hours exceed the lubrication interval setting. If there is still no response, a safety shutdown is performed when the hours exceed lubrication interval setting plus 200 hours. MOTOR – LACK OF BEARING LUBRICATION is then displayed.

To provide a record of when a motor lubrication is performed, the operator enters his/her initials, name or User ID using the MOTOR LUBE ACKNOWLEDGE key on the MOTOR LUBRICATION Screen. The date and time of this entry is automatically logged as the Date of Last Lubrication and Time of Last Lubrication. This also clears any motor lubrication warning or safety that is in effect and resets the Operating Hours Since Last Lubrication to zero.

The MOTOR LUBRICATION Screen, accessible from the MOTOR Screen in any access level, displays information applicable to this feature.

When both motor bearings have been lubricated, the operator must acknowledge the lubrication has been performed. This is done by entering his/her initials, name or User ID as a 3 to 8 character string. The entry is displayed as the operator initials at Last Lubrication. The date and time of this entry is automatically logged as the Date of Last Motor Lubrication and Time of Last Motor Lubrication. This entry also resets the Operating Hours Since Last Lubrication to zero.

This entry also resets the motor lubrication warning messages: WARNING – MOTOR BEARING LUBE SUGGESTED, WARNING – MOTOR BEARING LUBE REQUIRED and safety shutdown MOTOR – LACK OF BEARING LUBRICATION.

Enter your initials, name or User ID using the following procedure. The entry must be a minimum of 3 characters and a maximum of 8 characters.

1. At the keypad, log on at using Password 9 6 7 5. If resetting the safety shutdown “Motor – Lack of Lubrication”, place COMPRESSOR switch in Stop position.
2. Press the MOTOR LUBE ACKNOWLEDGE key. A dialog box appears. A red box highlights the first changeable location.
3. Use the ▲▼ keys to scroll sequentially through the alphabet to enter letters or numbers. Each time the ▲ is pressed, the next higher sequential alphabet letter or number is displayed. Each time the ▼ is pressed, the next lower alphabet letter or number is displayed. When the desired letter or number is displayed, use the ► key to forward space the red box for the next entry. Use the ◄ key to backspace, if necessary.
4. To write over an existing entry or to place a blank space, scroll to the beginning of the alphabet. The selection before the letter A is a blank space. Use the • key to enter a period/decimal point. During the entry process, if it is desired to exit the dialog box and retain the previous entry, press the CANCEL (X) key.
5. When all of the desired characters have been entered, press the ENTER (✓) key.

Motor Lube Date

Normally, the Date of Last Lubrication is automatically recorded when the operator enters his/her initials, name or User ID with the MOTOR LUBE ACKNOWLEDGE key in the above procedure. However, if it is necessary to modify the motor lubrication date after that procedure was performed, proceed as follows:

1. At the keypad, login at ADMIN access level.
2. Press the Motor Lube Date key.
3. Using the number keys, enter the desired date.
4. Press the ENTER (✓) key.

Change Lube Type

When logged on at the service level, the technician can set the type of lubricant to use by pressing the Change Lube Type key. The tech can then choose from 4 common lubricants or "see Motor Nameplate" if none of the 4 listed are appropriate.

Motor Auto Lube

The Motor Lube setpoint accommodates those chillers that are equipped with Automatic Motor Lubrication hardware that automatically lubricates the motor. Since chillers equipped with Automatic Motor Lubrication hardware will not display lubrication warnings. When the Auto Lube Setpoint on the Setup screen is set to QLS401 the lubrication intervals are set internal to the lube system. When the P203 is installed, the OptiView controls the lubrication interval as set by the service technician. The OptiView will look for a time when the chiller is not running beginning at 200 hours less than the Lube Period setting. If the chiller is stopped during that period, the auto lube will be performed. If the chiller is not stopped and lubricated by the time the Operating Hours Since Last Motor Lubrication reach the Lube Period setting + 200 hours, the chiller will stop to lubricate the motor and then restart.

If the Auto Lube setpoint is NONE, as it should be when not equipped with the Automatic Motor Lubrication hardware, the motor lubrication warnings and shutdown will occur at the associated elapsed run times. With this setting, the safety shutdown can be enabled or disabled per the customer's preference. If enabled, the safety shutdown will occur at the normal interval. If disabled, a warning will be displayed but the safety shutdown will not occur.

Use the following procedure:

1. At the keypad, login at SERVICE access level using access level 1 3 8 0.
2. From the MOTOR Screen, select the MOTOR LUBE Screen.
3. Press the AUTO LUBE key.
4. Use the ◄ and ► keys to select Enable or Disable as desired per above.
5. Press ENTER key.
6. If Disable is selected in step 4, press the SHUTDOWN key.
7. Use the ◄ and ► keys to select Enable or Disable as desired per above.
8. Press ENTER (✓) key.

QUICK START

(Software version C.OPT.01.21.307 and later)

The Quick Start feature is useful in data center and process control applications where it is desirable to reestablish cooling as fast as possible after a shutdown or power failure. This feature, when enabled, allows quicker starts and restarts than normal by reducing the cycle time and once running, loading the chiller as fast as possible. By default, this feature is disabled. It must be enabled to use it. A complete explanation of this feature and the following setpoints is contained in *SECTION 30 - QUICK START* of this manual.

- Quick Start Enable
- Quick Pulldown Setpoint Offset
- Pulldown Override Time
- VSD Start Frequency
- Mapping Enable
- Quick ramp Current Threshold

This feature can only be enabled if the Motor Drive Type setpoint is set to MV VSD or VSD (and the Motor Communications Protocol setpoint is set to Modbus). It requires and ADMIN password to change. When logged in at ADMIN level, a QUICK START key appears on the SETPOINTS Screen. Pressing this key will navigate to the QUICK START Screen where the Quick Start Mode setpoint is used to enable/disable this feature as follows:

1. At the keypad, log in at ADMIN access level using an ADMIN password.
2. Select QUICK START screen from the SETPOINTS screen.
3. Press CHANGE SETPOINTS key.
4. A green box will appear around the Quick Start Mode setpoint.
5. Press the ✓ key. A dialog box will appear allowing enable/disable of the feature.
6. Use the ◄ and ► keys to select Enable.
7. Press the ✓ key.

Once enabled, the Quick Start setpoints can be changed using the following procedure.

1. At the keypad, login at SERVICE access level using access code 1380.

2. Select QUICK START from the SETPOINTS Screen.
3. Press CHANGE SETPOINTS key.
4. A green box will appear around the first changeable setpoint. Use the UP/DN arrow keys to place the box around the setpoint to be changed.
5. Press the ✓ key.
6. Use the ◄ and ► keys to select the desired setting.
7. Press the ✓ key.

HEAT PUMP DUTY

(Software Version C.OPT.01.23.307 and later)

The Heat Pump Duty feature is an available option on certain model YK chillers after January 2011. The feature is enabled and disabled on the SETUP Screen. Once enabled, Heat Pump Duty can be switched between Cooling Mode and Heating Mode on the HEAT PUMP Screen. In Cooling Mode, the chiller controls the Leaving Chilled Liquid Temperature to its setpoint. In Heating Mode, the chiller controls the Leaving Condenser Liquid Temperature to its setpoint. Details of the Heat Pump operation are in *SECTION 31 - HEAT PUMP DUTY* of this manual.

Enable/Disable

Use the following procedure:

1. At the keypad, log in at ADMIN access level using an ADMIN password.
2. Select SETUP Screen from the SETPOINTS Screen.
3. Press CHANGE SETPOINTS key.
4. A green box will appear around the first changeable setpoint. Use Up/Down arrows to place the box around the Heat Pump Duty setpoint (The Refrigerant Selection setpoint must be set to R- 134a in order for this setpoint to appear).
5. Press ✓ key. A dialog box appears with the range of settings.
6. Use left/right arrow keys to select the desired setting.
7. Press ✓ key.

Setpoints

Refer to the *HEAT PUMP Screen* section in *Operation Manual 160.54-O1* and enter the following setpoints:

- Heating Sensitivity
- Operational Mode
- Leaving Condenser Liquid Temperature – Setpoint
- Leaving Condenser Liquid Temperature – Range
- Leaving Condenser Liquid Temperature Cycling Offset – Shutdown
- Leaving Chilled Liquid Temperature Cycling Offset – Restart
- Heating LCHLT (Leaving Chilled Liquid Temperature) Shutdown

MOTOR MONITORING SOFTWARE (VERSION C.OPT.01.22.307 AND LATER)

The optional Motor Monitoring feature monitors the winding temperatures, bearing temperatures and vibration and provides motor cooling coil leak detection. To use this feature, it must be enabled on the SETUP Screen. By default, this feature is disabled. When enabled, there are two display screens for this feature:

- The Motor DETAILS Screen is available from the MOTOR Screen.
- The MOTOR SETPOINTS Screen is available from the Motor DETAILS Screen.

A complete explanation of this feature and the following setpoints is contained in *SECTION 32 - MOTOR MONITORING* of this manual.

MOTOR DETAILS SCREEN

This screen allows any combination of winding temperature, bearing temperature and bearing vibration sensing to be enabled or disabled based on the actual equipment applied. The motor could be equipped with different types of sensors for motor monitoring. Either RTD's or thermistors could be applied for winding and bearing temperature monitoring. Motor cooling coil leak detection could be done with either an optical or float sensor. Setpoints on this screen allow for the enabling of the actual sensor type applied. Also on this screen, vibration baseline data can be entered manually or by running an auto baseline routine that plots a baseline over a 1 hour period while the chiller is running. To access the MOTOR DETAILS screen:

1. At the keypad, login at SERVICE access level using password 1 3 8 0.
2. From the MOTOR Screen, select the MOTOR DETAILS Screen and enter the following setpoints using the procedures below.

Winding Temperature Protection

Enables the type of temperature sensing device used to sense motor winding temperatures. Set to RTD when the winding sensors are RTD's. Set to Thermistor when the winding sensors are thermistors. Set to Disabled when the motor is not equipped with winding temperature sensors or it is desired to disable the feature for service reasons. The default setting is Disabled. To set the appropriate type of temperature sensing device:

1. Press WINDING TEMPERATURE PROTECTION key.
2. A dialog box appears with the selections.
3. Use ◄ and ► keys to select Disabled, RTD or Thermistor, as appropriate.
4. Press ENTER (✓) key.

Bearing Temperature Protection

Enables the type of temperature sensing device used to sense motor bearing temperatures. Set to RTD when the bearing sensors are RTD's. Set to VSD Thermistor when the bearing sensors are thermistors. Set to Disabled when the motor is not equipped with bearing temperature sensors or it is desired to disable the feature for service reasons. The default setting is Disabled. Select the appropriate sensing device as follows:

1. Press BEARING TEMPERATURE PROTECTION key.
2. A dialog box appears with the selections.
3. Use ◄ and ► keys to select Disabled, RTD or VSD Thermistor, as appropriate.
4. Press ENTER (✓) key.

Motor Vibration Protection

Enables and Disables the Motor Bearing Vibration Protection feature. Set to Rolling Element when the motor is equipped with bearing vibration sensors. Set to Disabled when the motor is not equipped with bearing vibration sensors or when it is desired to disable the feature for service reasons. The default setting is Disabled. To Enable or Disable the Motor Bearing Vibration Protection feature:

1. Press MOTOR VIBRATION PROTECTION key.
2. A dialog box appears with the selections.
3. Use ◄ and ► keys to select Disabled or Rolling Element, as appropriate.
4. Press ENTER (✓) key.

Cooling Coil Leak Detection

Enables the type of leak detection device used to detect a leak of the motor cooling coil. Set to Optical when the sensor is the optical type. Set to Float when the sensor is the float type. Set to Disabled when the motor is not equipped with leak sensors or for service reasons. The default setting is Disabled. To enable the type of leak detection:

1. Press MOTOR COOLING COIL LEAK PROTECTION key.
2. A dialog box appears with the selections.
3. Use ◄ and ► keys to select Disabled, Optical or Float, as appropriate.
4. Press ENTER (✓) key.

Manual Baseline

This setpoint is used to manually enter vibration baseline values (0.1 to 5.0; Default 2) for the Shaft End and Opposite Shaft End bearings. These values are not in any particular units of measure. They are relative values. The larger the number, the greater the magnitude of vibration represented. A special password is required. To enter the desired vibration baseline values:

1. Press MANUAL BASELINE key. A dialog box appears requesting a special password.
2. Using numeric keypad keys, enter 0 3 6 8 and press the ENTER (✓) key. A green box appears around the Shaft End vibration baseline value.
3. Press ENTER (✓) key. A dialog box appears giving the range of values.
4. Using numeric keypad keys, enter the desired value.
5. Press ENTER (✓) key.
6. Using the ► key, move the green box around the Opposite Shaft End vibration baseline value.
7. Press ENTER (✓) key. A dialog box appears giving the range of values.

8. Using numeric keypad keys, enter desired value.
9. Press ENTER (✓) key.

Auto Baseline

This key is used to run the auto baseline routine to automatically establish a vibration baseline for the shaft end and opposite shaft end bearings. The vibration level of each bearing is independently averaged for 1 hour at 1 minute intervals, while the chiller is running (for at least 2 minutes. While the routine is running, the time remaining in the 1 hour routine is displayed on this screen as "Auto Baseline Time Left XX Min". At the completion of the routine, the derived values appear on the Screen as the VIBRATION BASELINE values (0.1 to 5.0) for the shaft end and opposite shaft end bearings. These values are not in any particular units of measure. They are relative values. The larger the number, the greater the magnitude of vibration. A special password is required. This key only appears while the chiller is running and after 2 minutes of compressor operation. To initiate the Auto Baseline routine:

1. The chiller must be running (for at least 2 minutes).
2. Press the AUTO BASELINE key. A dialog box appears requesting a special password.
3. Using numeric keypad keys, enter 0 3 6 8 and press the ENTER (✓) key.
4. The Auto Baseline routine begins running.
5. At the completion of 1 hour, the routine terminates and the derived values appear as the Vibration Baselines for the Shaft End and Opposite Shaft End bearings.
6. If you need to terminate the routine before the 1 hour completion, repeat steps 2 and 3.

MOTOR SETPOINTS SCREEN

This screen allows programming of the WINDING and BEARING HIGH TEMPERATURE warning/safety shutdown thresholds and the high vibration warning/safety shutdown thresholds, along with the vibration input gain. Also, individual winding temperature sensors can be disabled on this screen.

Temperature Disable

This setpoint allows the individual winding temperature sensors to be enabled or disabled. A sensor can be disabled if it is defective or for service reasons. Otherwise, it should be enabled. The respective temperature data box on this screen reflects enabled or disabled status. When a sensor is disabled, the respective temperature data box does not appear on the MOTOR DETAILS Screen. This key is only shown when logged at ADMIN access level and Winding Temperature Protection setpoint on the MOTOR DETAILS Screen is not set to disabled. Enable or Disable the individual winding temperature sensors as follows:

1. Login at ADMIN access level.
2. Press TEMPERATURE DISABLE key. A green box appears around the Motor Windings Phase A Temperature.
3. Use ◄ and ► keys to place the green box around the sensor to be enabled or disabled.
4. When the desired sensor is selected, press the ENTER (✓) key. A dialog box appears allowing selection of enable or disable.
5. Use left/right arrow keys, select enable or disable, as desired.
6. Press ENTER (✓) key.
7. Repeat steps 3 through 6 until all sensors have been enabled or disabled as desired.
8. Press CANCEL (X) key to exit.

Winding Setup

This setpoint is used to enter the High Winding Temperature (266 to 320°F; default 311) and High Hotspot Allowance (0 to 18°F; default 0) safety shutdown thresholds. This key is not shown when the Winding Temperature Protection setpoint on the MOTOR DETAILS Screen is set to disabled. To enter desired values:

1. Press WINDING SETUP key. A green box appears around the High Winding Temperature Shutdown setpoint.
2. Press ENTER (✓) key. A dialog box appears with the range of allowed values.
3. Using numeric keypad keys, enter the desired value.
4. Press ENTER (✓) key.
5. Use Up/Down arrow keys to place the green box around the Winding Hotspot Allowance setpoint.
6. Press ENTER (✓) key. A dialog box appears with the range of allowed values.

7. Using numeric keypad keys, enter the desired value.
8. Press ENTER (✓) key.
9. Press CANCEL (X) key to exit.

Vibration Setup

This setpoint is used to enter the Motor Bearings High Vibration Shutdown safety threshold (2.0 to 30; default baseline X3) and High Vibration Warning threshold (1.0 to 15; default baseline X2) for the shaft end and opposite shaft end bearings, along with the desired delays for each:

- Shutdown equals 0 to 30 seconds, default 15
- Warning equals 0 to 120 seconds; default 30

The vibration values are not in any particular units of measure. They are relative values. The larger the number, the greater the magnitude of vibration represented. This key is not shown when the Motor Vibration Protection setpoint on the MOTOR DETAILS Screen is set to disabled. To enter desired values:

1. Press VIBRATION SETUP key. A green box appears around the High Vibration Shutdown Shaft End setpoint.
2. Press ENTER (✓) key. A dialog box appears with the range of allowed values.
3. Using numeric keypad keys, enter desired value
4. Press ENTER (✓) key.
5. Use Up/Down and Left/Right arrow keys to place the green box around the next desired value to be changed.
6. Repeat steps 2 through 5 until all desired values have been entered.
7. Press CANCEL (X) key to exit.

The actual values used for the VIBRATION safety shutdown and warning thresholds will be either the values entered manually with this setpoint or the values derived from the Vibration Baseline setpoints (provided they don't exceed the minimum and maximum limits of the shutdown and warning thresholds. See below and Manual Baseline and Auto Baseline setpoints on MOTOR DETAILS screen). The values used depend on the sequence in which they are entered. Whichever values are entered last, are the ones that are used. The active threshold values are displayed in the Motor Bearings High Vibration shutdown and High Vibration Warning data boxes on this MOTOR SETPOINTS Screen. The Vibration Baseline values from which the Vibration Shutdown and Warning thresholds are derived, are displayed on the MOTOR DETAILS Screen. The thresholds are derived from these values as follows:

NOTE

If the calculated value exceeds the minimum and maximum limits of the Shutdown (2.0 to 30.0) or Warning (1.0 to 15.0) threshold, the calculated value is not used and the threshold is set to the respective upper or lower limit.

- Shaft End High Vibration Warning - Shaft End Vibration Baseline X2
- Shaft End High Vibration Warning Default - Shaft End Vibration Baseline X2
- Opposite Shaft End High Vibration Warning - Opposite End Vibration Baseline X2
- Opposite Shaft End High Vibration Warning Default - Opposite End Vibration Baseline X2
- Shaft End High Vibration Shutdown - Shaft End Vibration Baseline X3
- Shaft End High Vibration Shutdown Default - Shaft End Vibration Baseline X3
- Opposite Shaft End High Vibration Shutdown - Opposite Shaft End Vibration Baseline X3
- Opposite Shaft End High Vibration Shutdown Default - Opposite Shaft End Vibration Baseline X3

Vibration Gain

This setpoint is used to enter values for the vibration input gain [1:1, 11:1, 21:1 (default)]. This key is only shown when logged at ADMIN access level and Motor Vibration Protection setpoint on the MOTOR DETAILS Screen is not set to disabled. To enter desired values:

1. Login at ADMIN access level.
2. Press VIBRATION GAIN key. A green box appears around the Vibration Input Gain setpoint.
3. Press ENTER (✓) key. A dialog box appears with the range of allowed values.
4. Use ◄ and ► keys to select the desired value.
5. Press ENTER (✓) key.
6. Press CANCEL (X) key to exit.

Bearing Setup

This setpoint is used to enter the High Bearing Temperature Shutdown safety threshold (149 to 212°F; default 203) and High Bearing Temperature Warning threshold (140 to 194°F; default 194). This key is not shown when the bearing temperature protection setpoint on the MOTOR DETAILS Screen is set to disabled. To enter desired values:

1. Press BEARING SETUP key. A green box appears around the High Bearing Temperature Shutdown setpoint.
2. Press ENTER (✓) key. A dialog box appears with the range of allowed values.
3. Using numeric keypad keys, enter desired value.
4. Press ENTER (✓) key.
5. Use Up/Down arrow keys to place the green box around the High Bearing Temperature Warning setpoint.
6. Press ENTER (✓) key. A dialog box appears with the range of allowed values.
7. Using numeric keypad keys, enter the desired value.
8. Press ENTER (✓) key.
9. Press CANCEL (X) key to exit.

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SECTION 34 - DIAGNOSTICS AND TROUBLESHOOTING

The problems that could be encountered in the OptiView Control Center are in the following categories:

- Keypad
- Display
- Serial Input/Output (I/O)
- Digital Input/Output (I/O)
- Analog Inputs

There is a Diagnostic and associated Troubleshooting Procedure for each category. They are described on the following pages. Each diagnostic is accessed from the DIAGNOSTICS MAIN Screen, which is entered using the procedure below. If there is an OptiView Control Center problem, determine the category of the problem. Then perform the applicable diagnostic. If the diagnostic reveals a malfunction, perform the troubleshooting procedure to locate the defective component.

There are several documents that must be referred to while performing the Diagnostics and Troubleshooting procedures. Each procedure references the Section and figures of this manual that describe the operation of the component being tested. Also, the applicable OptiView Control Center wiring diagram must be used as listed in the Associated Literature table at the front of this manual.

There are two versions of the Diagnostics screens available as follows:

1. Shown in *Figure 98 on page 257 through Figure 108 on page 308*. These screens are used during the diagnostics and troubleshooting process. They allow output states to be changed. Access the DIAGNOSTICS MAIN Screen as follows:

   a. The chiller must be stopped.

   b. Place Compressor Start/Stop switch in the Stop-Reset position (O).

   c. Ensure the Compressor motor current is 0% FLA.

   d. Log in at SERVICE access level using access code 1 3 8 0.

   e. Move Microboard Program Switch SW1-4 (Microboard 031-01730-000); SW1-3 (Microboard 031-02430-000/001 or 031-03630-001) to the ON position. A watchdog reset will occur and the boot-up process will com-mence. At the completion of the boot-up pro-cess, the DIAGNOSTICS MAIN Screen will appear.

NOTE

If the Program Switch is moved to the ON position before step 4 above is performed, the LOG IN key will be displayed and logging in at SERVICE access level must be performed before the Main Screen is displayed.

2. Not shown. Available when logged in at SERVICE access level, whether the chiller is running or not. Accessed from the SETUP Screen via the SETPOINTS Screen. There are two screens available that allow the Analog Input voltage levels and Digital I/O states to be monitored. These screens are preceded by a general screen that provides the installed software versions.

DIAGNOSTICS SCREEN

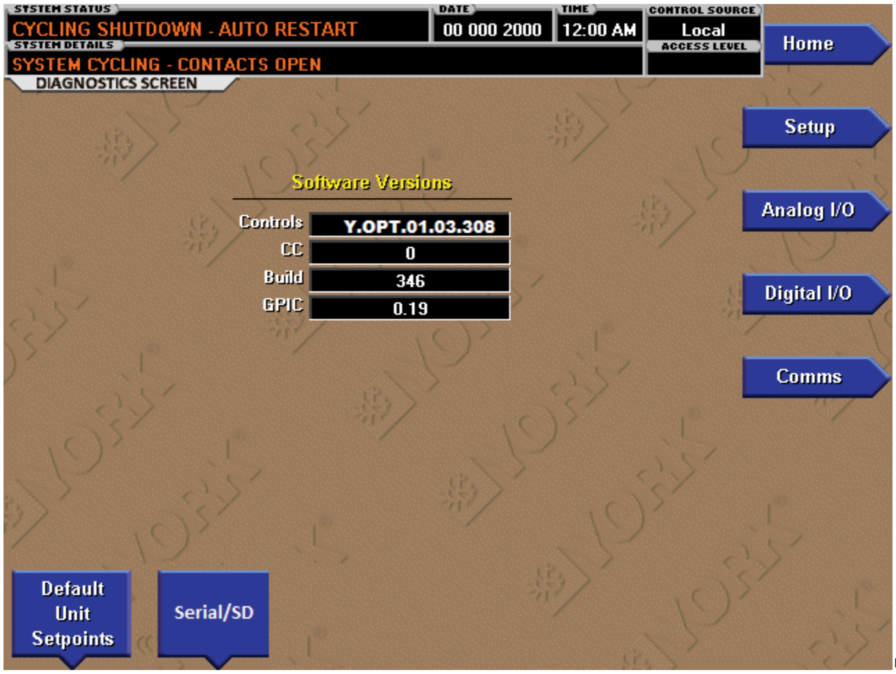


FIGURE 106 - DIAGNOSTICS SCREEN

This screen shows the software that is loaded onto the microboard and the motor starter connected to the microboard via serial communications.

Controls – Software that controls the chiller.

CC – Version of Control Routines.

BIOS – BIOS EPROM on Microboard.

Build – Iteration of the software development.

GPIC – Version of points list exposed to SC-EQ.

Ext I/O – Software in I/O Board 031-02895-000.

SSS, VSD, MVSSS or MVVSD – software that is in the respective device.

Modbus UI - Motor Monitoring – Software in Motor Monitoring Board.

BUTTONS

Default Unit Setpoints

Many of the control parameters are automatically configured by pressing this button after the Sales Order screen is entered. Failure to press this button can result in unstable control. Note that some versions of software also have a Default Setpoints button on the Capacity Control screen. That button does not need to be pressed because the Default Unit Setpoints button on the Diagnostic screen will set all of the parameters.

NAVIGATION

Serial/SD – Navigates to the Serial/SD screen where data logging and Save and Restore Parameters is accomplished.

Erase All NOVRAM (Displayed at Admin Level) – Pressing this button erases all of the sales order setpoints, configurations and history in the microboard.

Home – Returns to the Home screen

Setup – Navigates to the Setup screen

Analog I/O – Navigates to the Analog I/O screen

Digital I/O – Navigates to the Digital I/O screen

Comms – Navigates to Comms screen

SERIAL/SD SCREEN

LD22791

FIGURE 107 - SERIAL/SD SCREEN

This screen shows the SD card status and enables System Backup & Restore along with data logging.

BUTTONS

Data Logging – Four modes are available:

- **Disabled**
- **Serial –** data logs to the printer port
- **SD** – data logs to an SD card (Any size is supported)
- **Serial/SD –** data logs to both the printer port and the SD

Logging Interval – Adjustable from 0.1 to 60 seconds.

SD Logging Overwrite – Two modes are available:

- **Disabled –** Will stop logging to the SD card when it is full.
- **Enabled –** Will Overwrite the oldest day file with the present day log information. The SD Data log creates a file for each day. This file is in .csv format and can be read by Microsoft Excel where the chiller operating parameters can be analyzed and plotted.

See *Table 33 - Data Logging on page 378* for a list of the chiller parameters that are data logged.

Eject SD Card – Pressing this button before removing the SD card prevents it from being corrupted which could happen if the card is removed during a write event and this button was not pressed.

NOTE: System Backup and Restore buttons are only visible when Data logging is Disabled. System Backup allows all of the chiller parameters to be saved to an SD card and Restored to a replacement microboard. This is equivalent to swapping the BRAM chip in the 02430 microboard.

System Backup – When pressed, saves the current chiller parameters to the SD card. A portion of a blank SD card is reserved for this data and the rest of the card can be used for Data logging. When Data logging is turned on, the chiller parameters are automatically saved to the SD card at midnight each day.

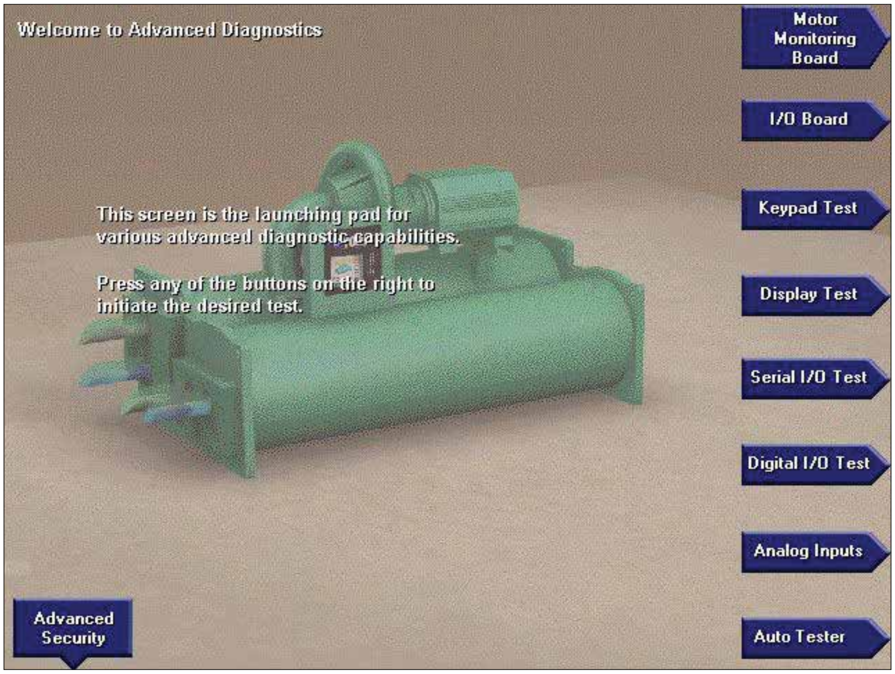
System Restore – When pressed, writes the parameters that were saved on the SD card back to the microboard NOVRAM memory.

NAVIGATION

Home – Returns to the Home screen

Diagnostics – Navigates to the Diagnostic screen

MAIN DIAGNOSTICS SCREEN



LD14328a

FIGURE 108 - MAIN DIAGNOSTICS

Each of the Diagnostics is accessed from this screen. Press the appropriate key to select the desired diagnostic. After each diagnostic is performed, return to this MAIN Screen, from which the next diagnostic can be selected.

Some of the diagnostics have sub-screens that are accessed from the selected diagnostic screen. The sub-screens are shown indented below:

MAIN SCREEN

- Monitor Monitoring Board (software version C.OPT.01.22.307 and later)
- I/O Board (software version C.OPT.01.21.307 and later)
- Keypad test
- Display test
    - Bit patterns test
    - All red
    - All green
    - All blue
    - All white
    - All black
- Serial I/0 test
- Digital I/0 test
- Analog Inputs

The ADVANCED SECURITY key is used during the manufacturing process and has no field service use.

MOTOR MONITORING BOARD DIAGNOSTIC SCREEN (SOFTWARE VERSION C.OPT.01.22.307 AND LATER)

LD14330

FIGURE 109 - MOTOR MONITORING BOARD DIAGNOSTIC SCREEN

This diagnostic screen is used to analyze the analog and Digital inputs of the Motor Monitoring Board. The inputs are identified by terminal strip and terminal number. Also, serial communications error statistics are displayed here. See the description of this board in *SECTION 32 - MOTOR MONITORING* of this manual.

ANALOG INPUTS

The voltage level of each Analog Input (as measured to ground) at the indicated input terminals is displayed as X.XX VDC.

- **TB1-2** Motor Winding Phase A Temperature (50K Ohm thermistor)
- **TB1-5** Motor Winding Phase B Temperature (50K Ohm thermistor)
- **TB1-8** Motor Winding Phase C Temperature (50K Ohm thermistor)
- **TB2-11** Not used
- **TB2-8** Not used
- **TB2-5** Not used
- **TB2-2** Not used
- **TB1-11** Not used

VIBRATION INPUTS

Gain - Displays the value programmed for the Vibration Input Gain setpoint for the accelerometer inputs. The gain can be changed from this screen using the CHANGE GAIN key. See below.

Vibration - The accelerometer vibration level input (as measured to ground) at the indicated terminals is displayed as XX.X. The vibration values are not in any particular units of measure. They are relative values. The larger the number, the greater the magnitude of vibration.

- **TB3-2** Motor Bearing Shaft End Vibration (accelerometer)
- **TB3-4** Motor Bearing Opposite Shaft End Vibration (accelerometer)
- **TB3-6** Not used
- **TB3-8** Not used

RTD INPUTS

The voltage level of each RTD at the indicated input terminals is displayed as X.XX VDC. An LED illuminates to indicate an open RTD. All inputs are 100 Ohm RTD's.

TB6-1,3	Motor Winding Phase A1 Temperature
TB6-4,6	Motor Winding Phase A2 Temperature
TB6-7,9	Motor Winding Phase B1 Temperature
TB6-10,12	Motor Winding Phase B2 Temperature
TB5-1,3	Motor Winding Phase C1 Temperature
TB5-4,6	Motor Winding Phase C2 Temperature
TB5-7,9	Motor Bearing Opposite Shaft End Temperature
TB5-10,12	Motor Bearing Shaft End Temperature

Digital inputs

The state of each Digital Input is depicted by an LED. TB7 accepts +5 VDC inputs. TB8 accepts 24 VAC or DC inputs. When the input is high (24 VAC/DC or +5 VDC), the LED is illuminated. Otherwise, it is extinguished.

TB7-5	Motor Cooling Coil Leak Detector (low voltage optical)
TB7-2	Not used
TB8-5,6	Motor Cooling Coil Leak Detector (float switch)
TB8-2,3	Not used

MODBUS COMMUNICATION COUNTERS

The following error counts are displayed. Pressing the RESET COUNTERS key resets them to zero.

- ID Faults
- Checksum Errors
- Error Packets
- Timeout Faults

PROGRAMMABLE

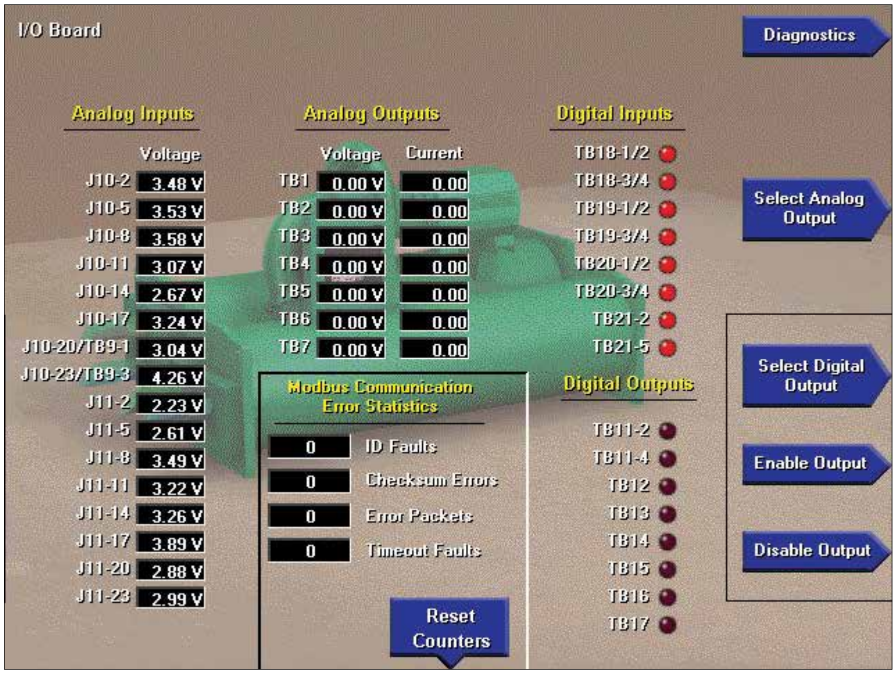
Change Gain

Access Level Required: ADMIN

This key can be used to change the input gain of the accelerometer vibration inputs. This key is only shown when Microboard switch SW1-3 is set to ON. Programmable as 1:1, 11:1 or 21:1. Gain of individual inputs cannot be changed. When any one is changed, they are all changed to the same value.

1. Begin with Microboard switch SW1-3 in the OFF position.
2. Login at VIEW access level.
3. Place Microboard switch SW1-3 in the ON position.
4. After reboot, on DIAGNOSTICS LOGIN Screen, login at ADMIN access level.
5. Press CHANGE VIBRATION key. A green box appears around the first Vibration Input Gain setpoint.
6. Press ENTER (✓) key. A dialog box appears with the range of allowed values.
7. Use ◄ and ► keys to select desired value.
8. Press ENTER (✓) key.
9. Press CANCEL (X) key to exit.

I/O BOARD (031-02895-000) DIAGNOSTIC SCREEN (SOFTWARE VERSION C.OPT.01.21.307 AND LATER)



LD14329

FIGURE 110 - I/O BOARD DIAGNOSTIC SCREEN

This diagnostic screen is used to analyze the analog and Digital inputs and outputs of I/O Board 031-02895-000. The outputs can be manually set to a desired level from here. Also, serial communications error statistics are displayed here. See the description of this board in *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001* of this manual.

ANALOG INPUTS

The voltage level of each Analog Input at the indicated input terminals is displayed as x.xx VDC.

ANALOG OUTPUTS

The analog outputs are in the form of 0 to 10 VDC or 0 to 20mA at each of the listed connectors. The values displayed are the values the I/O Board is intending to provide at the output connector. The voltage output is at terminal 2 of each output connector and is displayed as x.xx VDC. The current output is at terminal 1 of each output connector and is displayed a xx.xxmA

The voltage value and the current value are directly scaled over their respective ranges of 0 to 10 VDC and 0 to 20mA. For example, when the voltage output (terminal 2) is at 0 VDC, the current output (terminal 1) is at 0mA. A 10 VDC output produces a 20mA output. a 5 VDC output produces a 10mA output, etc.

To test an output, each output can be manually set to any desired value within its range limits. The desired value is set in terms of a voltage value. For example, if the voltage is set to 5 VDC, the current value will automatically be set to 10mA. When Diagnostic Mode is exited (DIP Switch 3 is set back to OFF position), outputs revert to Program control.

To manually set the output:

1. Press the SELECT ANALOG OUTPUT key, A green box will be placed around the first changeable output.
2. Use the keypad UP and DOWN arrow keys to place the green box around the desired output.
3. Press the ENTER (✓) key. A box will appear showing the range of allowed voltage values.
4. Using the keypad keys, enter the desired voltage value.

34

5. Press the ENTER (✓) key. The entered voltage value and corresponding current value will be shown in the selected output box. The voltage value is at terminal 2 of the selected output. The current value is at terminal 1 of the selected output.

Digital inputs

The state of each Digital Input is directly depicted by an LED. When the input is high (120 VAC or +5 VDC), the LED is illuminated). Otherwise, it is extinguished.

DIGITAL OUTPUTS

The state of each output is depicted by an LED. When the output is ON, it is illuminated. Otherwise, it is extinguished.

To test an output, each output can be manually set to ON or OFF. The motor controller circuit must be opened before manual control is allowed. Removing J2 from the I/O Board opens this circuit. When Diagnostic Mode is exited (DIP Switch 3 is set back to the OFF position), outputs revert to Program control.

To manually set the output:

1. Press SELECT DIGITAL OUTPUT key. A yellow arrowhead will appear to the right of the first digital output.
2. Use the UP and DOWN arrow keys to place the arrowhead at the desired output.
3. Press ENABLE OUTPUT key to turn the output on. Press the DISABLE OUTPUT key to turn the output off.

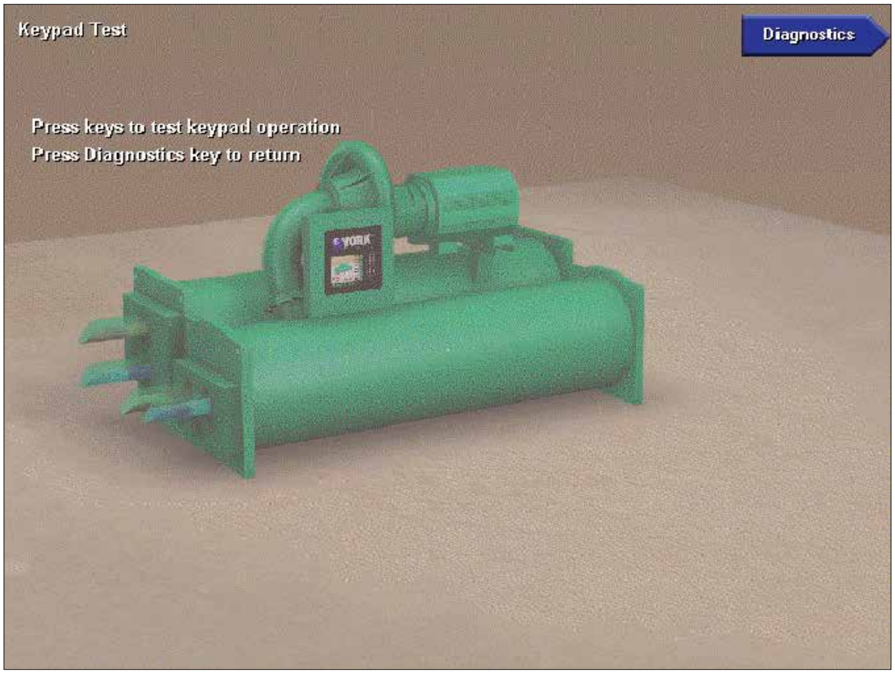
MODBUS COMMUNICATION ERROR COUNTERS

The following error counts are displayed:

- ID Faults
- Checksum Errors
- Error Packets
- Timeout Faults

Press the RESET ERROR COUNTERS key to reset these counters to zero.

KEYPAD TEST



00336VIP

FIGURE 111 - KEYPAD TEST SCREEN

This diagnostic is used to verify Keypad operation and the microboard's ability to respond to a pressed key. See the description of Keypad operation in *SECTION 10 - KEYPAD* of this manual.

PROCEDURE

1. Press each keypad key. As the key is pressed, an illuminated LED is displayed corresponding to the key location on the keypad.
2. Press the DIAGNOSTICS key to return to the MAIN DIAGNOSTICS Screen.

TROUBLESHOOTING

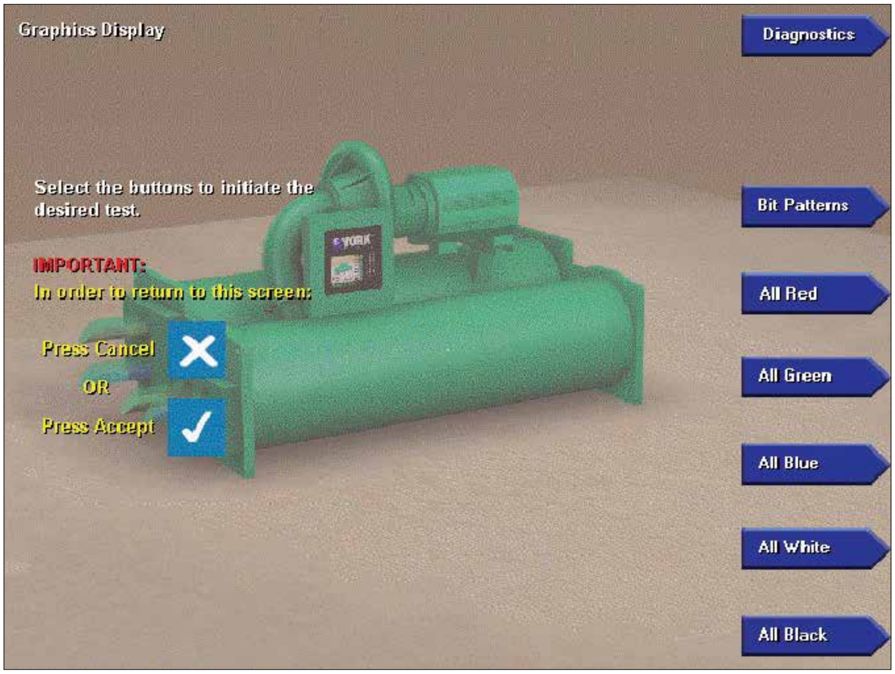
If an LED is not displayed when a key is pressed, the keypad, keypad ribbon cable or microboard could be defective. Use the following procedure to locate the defective component.

1. **Keypad**
   a. Disconnect the Ribbon Cable from the keypad.
   b. Identify row/column coordinate of the key to be tested. See *Figure 51 on page 125*.
   c. In the keypad connector, locate the pins of the row/column coordinate of the key of the key to be tested.
   d. Insert the leads of an Ohmmeter into the pins identified in step "c" above.
   e. Press the key to be tested. If the contact resistance is greater than 100 Ohms, the keypad is defective.
   f. Release the key. If the contact resistance is greater than 1 Meg Ohm, the keypad is defective.
2. **Ribbon Cable**

   Using an ohmmeter, perform a continuity test on all conductors in the ribbon cable. An open circuit would indicate the Ribbon Cable is defective.
3. **Microboard**

   There are no checks or measurements to be made on the microboard. If the keypad and ribbon cable check OK per the above procedures, the microboard is most likely the cause of the problem.

DISPLAY TEST MAIN SCREEN



00337VIP

FIGURE 112 - DISPLAY TEST MAIN SCREEN

Each display diagnostic is accessed from this screen. After each diagnostic is performed, return to this screen, from which the next diagnostic can be selected. See the description of Display operation in *SECTION 7 - LIQUID CRYSTAL DISPLAY, SECTION 8 - DISPLAY INTERFACE BOARD, and SECTION 9 - DISPLAY BACKLIGHT INVERTER BOARD* of this manual.

PROCEDURE

1. Press the appropriate keypad key to perform the desired test from the list below.
2. Press the CANCEL (X) or ENTER (✓) key to terminate test and return to DISPLAY TEST MAIN Screen, from which another test can be selected.
3. When all the desired tests have been performed, press the DIAGNOSTICS key to return to the MAIN DIAGNOSTICS Screen.

- **Bit Patterns -** This test is used to detect jitter and alignment defects. It verifies proper operation and compatibility of the microboard Display Controller with the display. Four vertical bars of green, dark blue, light blue and yellow, outlined by a red border are displayed. If the vertical bars are not stable or straight, or the red border is not completely visible, then either the microboard Program Jumpers are not configured correctly for the installed display or the microboard Display Controller is defective. See *Figure 91 on page 236.*
- **All Red -** This test verifies the operation of all of the red pixels. All of the red pixels are turned on to create a completely red screen. Any red pixels that do not turn on will appear as black dots on the display. If any black dots appear, first ascertain it is not caused by dirt that is lodged between the display surface and the protective plastic cover. It is normal for a small number of randomly spaced pixels to not illuminate. It is not necessary to replace the display if a small number of black dots appear. They will not be visible on the normal screens displayed outside of this diagnostic mode. However, large black areas would be indicative of a defective display.
- **All Green -** This test verifies the operation of all of the green pixels. All of the green pixels are turned on to create a completely green screen. See the description of the *All Red* test above.

- **All Blue -** This test verifies the operation of all of the blue pixels. All of the blue pixels are turned on to create a completely blue screen. See the description of the *All Red* test above.
- **All White -** This test verifies the display's ability to turn on all pixels to display a completely white screen. Any pixel that does not turn on will appear as a black dot. See the description of the *All Red* test above.
- **All Black -** This test verifies the display's ability to turn off all pixels to display a completely black screen. Any pixel that does not turn off will appear as a red, green, blue or white dot. See the description of the *All Red* test above.

BIT PATTERNS TEST SCREEN

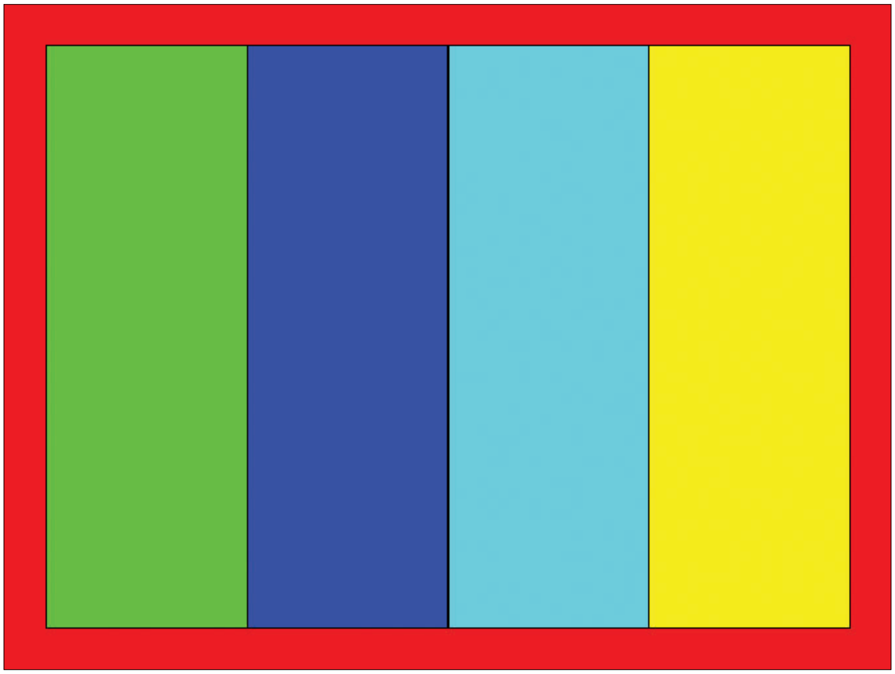


FIGURE 113 - BIT PATTERNS TEST SCREEN

TROUBLESHOOTING

If any of the tests from the previous screen do not perform correctly as described, perform the applicable procedure below:

Test Failed

Bit Patterns - If the vertical bars are not straight or if the red border is not completely visible, either the microboard Program Jumpers are not configured correctly or for the installed Display or the microboard is defective.

All Red, All Green, All Blue, All White or All Black

If these tests do not produce appropriate solid color screens, the Display Ribbon Cable, Display Interface Board, Microboard or Display could be defective. To locate the defective component perform tests in the following order:

1. **Display Ribbon Cable**

   Using an Ohmmeter, perform a continuity test on all conductors in the ribbon cable. An open circuit would indicate the ribbon cable is defective.

2. **Display Interface Board**

   Using an Ohmmeter, perform a continuity test on all conductors of the Interface Board. An open circuit would indicate the Interface Board is defective.

3. **Microboard**

   a. With the “All Red” test selected, the voltage at Microboard J5-6 through J5-11 (Red drivers bits 0 through 5), as measured to GND, should be greater than 3.0 VDC. If not, the microboard is defective.

   b. With the “All Green” test selected, the voltage at Microboard J5-13 through J5-18 (Green drivers bits 0 through 5), as measured to GND, should be greater than 3.0 VDC. If not, the microboard is defective.

   c. With the “All Blue” test selected, the voltage at Microboard J5-20 through J5-25 (Blue drivers bits 0-5), as measured to Grid, should be greater than 3.0 VDC. If not, the microboard is defective.

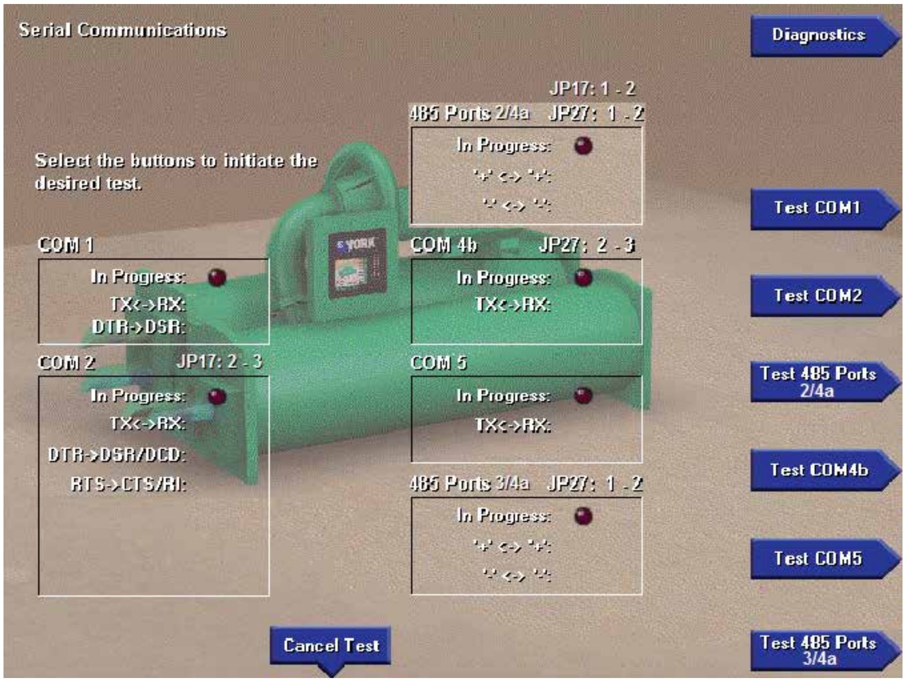
d. With the "All White" test selected, the voltage at Microboard J5-6 through J5-11, J5-13 through J5-18 and J5-20 through J5-25 should be greater than 3.0 VDC. If not, the microboard is defective.

e. With the "All Black" test selected, the voltage at Microboard J5-6 through J5-11, J5-13 through J5-18 and J5-20 through J5-25 should be greater than 1.0 VDC. If not, the microboard is defective.

4. **Display**

   If the Display Ribbon Cable, Display Interface Board and Microboard check OK per the above procedures, the Display is most likely the cause of the problem.

SERIAL INPUTS/OUTPUTS TEST SCREEN



LD15435

FIGURE 114 - SERIAL INPUTS/OUTPUTS TEST SCREEN

This diagnostic is used to verify correct operation of the Serial Data Ports. There is a test for each of the six serial data ports. Each RS-232 port (COM 1, 2 and 4b) is tested by transmitting serial test data from outputs to inputs of each port. Both the transmit and receive functions as well as the control lines are tested. The RS-485 ports (COM 3, 4a, and 2) are tested by transmitting serial test data from one RS-485 port to another. The TX/RX opto-coupled port (COM 5) is tested by transmitting serial test data from the TX output to the RX input. If the received data matches the transmitted data, PASS is displayed, indicating the serial port is OK. Otherwise, FAIL is displayed, indicating the serial port is defective. Prior to performing each test, the Service technician must install a wire loop-back connection as described below. See *SECTION 3 - MICROBOARD 031-01730-000* and *Figure 14 on page 46* of this manual for description of the Serial data Ports.

PROCEDURE

1. Using small gauge wire, fabricate loop-back connections and install as follows for each port to be tested. Failure to install the loop-back connection or configure the microboard Program Jumper as noted will result in a FAIL outcome for the test.

	From	**To**
COM 1	J2-4 (TX)	J2-3 (RX)
	J2-5 (DTR)	J2-2 (DSR)

	From	**To**
COM 2	J13-5 (TX)	J13-3 (RX)
	J13-7 (DTR)	J13-1(DCD) and J13-2(DSR)
	J13-4 (RTS)	J13-6 (CTS) and J13-8 (RI)

RS-485	**From**	**To**
(COM	J13-8 (+)	J11-3 (+)
2/4a)	J13-10 (-)	J11-2 (-)

This test applicable to software version C.OPT.01.23.307 (and later). Microboard Program Jumpers JP17 and JP27 must be installed in position 1 and 2.

RS-485	**From**	**To**
(COM	J12-3 (+)	J11-3 (+)
3 and 4a)	J12-2 (-)	J11-2 (-)

Microboard Program Jumper JP27 must be installed in position 1 and 2.

	From	**To**
COM 4b	J2-7 (GTX)	J2-6 (GRX)

Microboard Program Jumper JP27 must be installed in position 2 and 3.

	From	To
COM 5	J15-1 (TX)	J15-4
	J15-2 (RX)	J15-5
	J15-3 (Common)	J15-6

Make individual wire connections or use YORK loop-around diagnostic connector 025-33778-000 as depicted in *Figure 115 on page 319* This connector is available from the Baltimore Parts Center.

2. After connecting appropriate loop-back connections above, press the appropriate key to initiate the desired test. An LED will illuminate indicating the test is in progress. If it is desired to terminate the test, press the CANCEL TEST key. Test data is sent from an output to an input as described below. At the completion of each test, if the data received matches the data sent, the serial port operates properly and PASS is displayed. Otherwise, FAIL is displayed, indicating the serial port is defective. A FAIL result would be indicative of a defective Microboard. The following is a description of each test.

   COM 1 – Two tests are performed. Test data is sent from TX (J2-4) to RX (J2-3) at 9600 Baud and DTR (J2-5) is set to a Logic High level and read at DSR (J2-2). If any test fails, COM 1 tests are terminated.

   COM 2 – Three tests are performed. Test data is sent from TX (J13-5) to RX (J13-3) at 19200 Baud. DTR (J13-7) is set to a Logic High and read at DSR (J13-2) and DCD (J13-1). RTS (J13-4) is set to a Logic High and read at CTS (J13-6) and R1 (J13-8). If any test fails, COM 2 tests are terminated.

   RS-485 (COM 2 and 4a) – Software version C.OPT.01.23.307 (and later) only. Test data is sent from COM 2 RS-485 port to COM 4a RS-485 port at 19200 Baud. Test data is then sent from COM 4a to COM 2 at the same rate. If either test fails, the test is terminated.

   RS-485 (COM 3 and 4a) – Test data is sent from COM 3 RS-485 port to COM 4a RS-485 Port at 19200 Baud. Test data is then sent from COM 4a to COM 3 at the same rate. If either test fails, the test is terminated.

   COM 4b – Test data is sent from GTX (J2-7) to GRX (J2-6) at 19200 Baud.

   COM 5 – Test data is sent from TX (J15-1) to J15-4 at 1200 Baud. This output turns the microboard's loop-around test transistor on and off, applying 0 to +5 VDC pulses from J15-5 to RX (J15-2) input.

3. After all desired tests have been performed, press the DIAGNOSTICS key to return to the MAIN DIAGNOSTICS Screen.

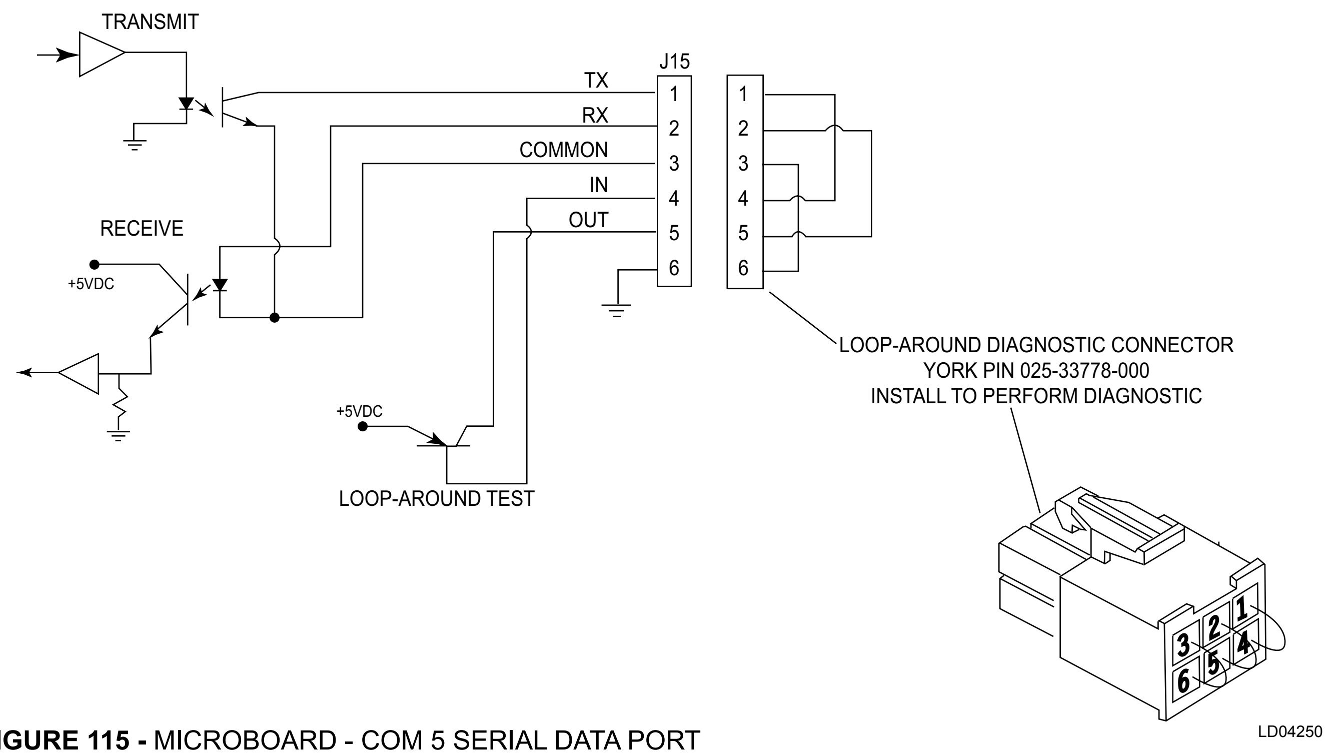


FIGURE 115 - MICROBOARD - COM 5 SERIAL DATA PORT

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DIGITAL INPUTS/OUTPUTS TEST SCREEN

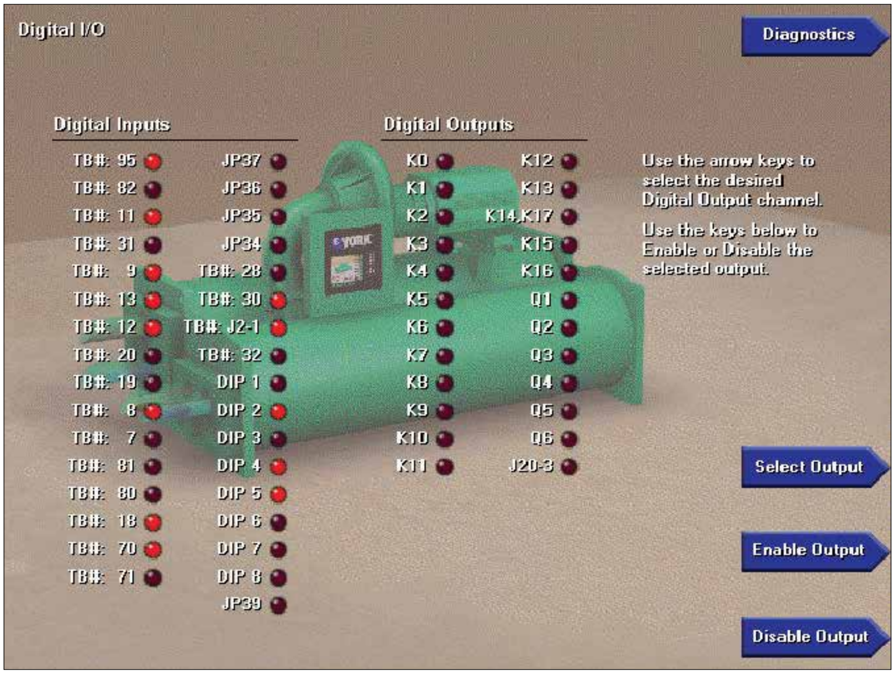

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FIGURE 116 - DIGITAL INPUTS/OUTPUTS TEST SCREEN

This diagnostic is used to analyze the Digital inputs and outputs of the microboard. See description of I/O Board in *SECTION 6 - I/O BOARD* of this manual.

The state of each Microboard Digital Input, Program Jumper and Program DIP Switch, as interpreted by the microboard, is depicted by an LED. If the microboard interprets its input as being at a Logic Low (less than 1.0 VDC) level, the LED is illuminated. If interpreted as being at a Logic High (greater than 4.0 VDC) level, the LED is extinguished.

The state of the microboard's intended drive signals to each of the relays on the I/O Board is depicted by an LED. If the intended output is a Logic Low level (less than 1.0 VDC), the LED is illuminated. If the intended output is a Logic High level (greater than 10.0 VDC), the LED is extinguished. Logic Low outputs energize the relays. Logic High outputs de-energize the relays. The state of any output can be manually set to either the Enabled (Logic Low) or Disabled (Logic High) state.

PROCEDURE

Digital inputs

1. The Digital inputs are listed on this screen according to:
    a. Terminal number on the I/O Board.
    b. Microboard Program Jumpers and Program DIP Switches.

    Figure 34 on page 102 shows the devices connected to these terminals. *SECTION 3 - MICROBOARD 031-01730-000* lists the functions of the Program Jumpers and Switches.
2. With 115 VAC applied to a particular I/O Board Digital Input, the applicable LED should be illuminated. If the LED is not illuminated, perform appropriate troubleshooting procedure below.
3. With 0 VAC applied to a particular I/O Board Digital Input, the applicable LED should be extinguished. If the LED is not extinguished, perform appropriate troubleshooting procedure below.
4. If a Program Jumper is present, the applicable LED should be extinguished. If the LED is not extinguished, the microboard is defective.
5. If a Program Jumper is not present, the applicable LED should be illuminated. If the LED is not illuminated, the microboard is defective.
6. If a Program Switch (DIP) is in the ON position, the applicable LED should be illuminated. If the LED is not illuminated, the microboard is defective.

7. If the Program Switch (DIP) is in the OFF position, the applicable LED should be extinguished. If the LED is not extinguished, the microboard is defective.

8. When all desired tests have been performed, press DIAGNOSTICS key to return to MAIN DIAGNOSTICS Screen.

Digital Outputs

1. **IMPORTANT! -** The following steps cannot be performed until the Motor Controller connection between TB6-1 and TB6-53 has been removed. This connection could be a jumper or it could be a connection from external devices in the starter. The Program will prevent manual control of Digital Output devices until this connection is removed.

2. The Digital Outputs are listed on this screen according to Relay and Triac number (KI, Q3, etc). *Figure 37 on page 104* shows the external devices that are connected to these Relays and Triacs and the functions of each one.

3. Press SELECT key. An arrow will appear adjacent to relay KO. With software version C.OPT.01.23.307 (and later), when Japanese, Korean or Chinese language is selected, the arrow is replaced with a green box.

4. Select a relay or triac for manual control by using the ◄ and ► keys to place the arrow adjacent to the desired device.

5. Press the ENABLE OUTPUT key to enable the selected output. The LED adjacent to the selected output should illuminate. If it does not, perform Keypad Diagnostic test. If a relay is selected, it should energize, closing its contacts. If a triac is selected, it will turn on, energizing the device it is connected to. If the relay does not energize or triac does not turn on, perform appropriate troubleshooting procedure below.

6. Press the DISABLE OUTPUT key to disable the selected output. The LED adjacent to the selected output should extinguish. If it does not, perform Keypad Diagnostic test. If a relay is selected, it should de-energize, opening its contacts. If a triac is selected, it will turn off, de-energizing the device it is connected to. If relay does not de-energize or triac does not turn off, perform appropriate troubleshooting procedure below.

7. When all desired tests have been performed, press DIAGNOSTICS key to return to the MAIN DIAGNOSTICS Screen.

8. Install Motor Controller connection from TB6-1 to TB6-53 removed in step 1.

Digital inputs Troubleshooting

If any of the Digital inputs tests fail to perform as described above, perform the following steps in sequence. See *Figure 34 on page 102* and applicable wiring diagram referenced at the beginning of *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001*. If a defective component is found during any of the following steps, replace the component as instructed and repeat the Digital inputs Procedure above to determine if the problem has been resolved.

1. Remove I/0 Board ribbon cable. Using an Ohmmeter, perform a continuity check on I/O Board ribbon cable J1-21 to J19-21, J1-22 to J19-22 and applicable output pin of function that failed in procedure above. If an open circuit is detected, replace ribbon cable. Otherwise, install ribbon cable and proceed to next step.

2. Measure the +5 VDC supply voltage to the I/0 Board on the I/0 Board between J1-21 and J1-22. If greater than 4.5 VDC, proceed to next step. If less than 4.5 VDC, disconnect the ribbon cable at I/O Board J1 and repeat the measurement at J1. If less than 4.5 VDC, replace the microboard and re-install the ribbon cable.

3. With 115 VAC (plus or minus 10%) applied to the I/O Board Digital Input that failed in procedure above, the applicable I/O Board output at J1 should be at a Logic Low level (less than 1.0 VDC). If it is greater than 1.0 VDC, replace the I/O Board. If the output is at a Logic Low level, the applicable LED should be illuminated. If the LED is not illuminated, replace the microboard.

4. With 0 VAC applied to the I/O Board Digital Input that failed in procedure above, the applicable I/O Board output at J1 should be at a Logic High level (greater than 4.0 VDC). If it is less than 4.0 VDC, replace the I/0 Board. If the output is at a Logic High level, the applicable LED should be extinguished. If it is not extinguished, replace the microboard.

Digital Outputs Troubleshooting

If any of the Digital Outputs tests fail to perform as described above, perform the following steps in sequence. See *Figure 37 on page 104* and applicable wiring diagram referenced at the beginning of *SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001*. If a defective component is found during any of the steps, replace the component as instructed and repeat the procedure above to determine if the problem has been resolved.

1. Remove I/O Board ribbon cable. Using an Ohmmeter, perform a continuity test on the cable J1-25 to J19-25, J1-26 to J19-26 and applicable output pin of function that failed in procedure above. If an open circuit is detected, replace ribbon cable. Otherwise, install ribbon cable and proceed to next step.
2. Measure the +12 VDC supply voltage to the I/O Board on I/O Board between J1-26 (+12 VDC) and J1-25 (GND). If greater than 11.0 VDC, proceed to next step. If less than 11.0 VDC, disconnect ribbon cable at I/O Board J1 and repeat measurement at JI. If less than 11.0 VDC, replace the microboard. Re-install the ribbon cable.
3. Using the Digital Outputs procedure above, select the output that failed the Digital Output test above.
4. Press ENABLE OUTPUT key. The LED adjacent to the selected output will illuminate. The appropriate Microboard output pin at J19 for the selected output should be at a Logic Low level (less than 1.0 VDC). If it is greater than 1.0 VDC, replace the microboard. With the output at a Logic Low, the following should occur:
    a. If a relay is selected as the output, the contacts of the relay should be closed. If they are not closed, replace the I/O Board.
    b. If a Triac is selected as the output, the Triac should be turned on. If the Triac has not turned on, replace the I/O Board. See note 1 below for Triac testing.
5. Press DISABLE OUTPUT key. The LED adjacent to the selected output will extinguish.
    a. If a relay is selected as the output, the appropriate Microboard output pin at J19 for the selected output should be at a Logic High (greater than 10.0 VDC) level. With the output at a Logic High level, the relay contacts should be open. If they are not open, replace the I/O Board. If it is less than 10.0 VDC, remove the ribbon cable from J1 of the I/O Board. On the I/O Board, measure the resistance from J1-26 to the appropriate pin of J1 on the I/O Board for the selected relay. If the resistance is greater than 100 Ohms, replace the I/O Board. If the resistance is less than 100 Ohms, replace the microboard.
    b. If a Triac is selected as the output, the appropriate Microboard output pin at J19 for the selected output should be at a Logic High (greater than 10.0 VDC) level. If it is less than 10.0 VDC, replace the microboard. With the output at a Logic High level, the Triac should be turned off. If the Triac has not turned off, replace the I/O Board. See note 1 below for Triac testing.

Notes

The load (actuator) must be connected across the Triac to determine the ON/OFF state of the Triac. The ON/OFF state of the Triac can be determined by measuring across the device (for example, TB1-3 to TB1-59 or TB1-58 to TB1-59) with an AC Voltmeter. If the Triac is turned on, the voltage will be less than 10 VAC. If the Triac is turned off, the voltage will be greater than 100 VAC (Slide Valve Actuator) or greater than 20 VAC (PRV, Hot gas or Refrigerant Level Control Actuator).

ANALOG INPUTS TEST SCREEN

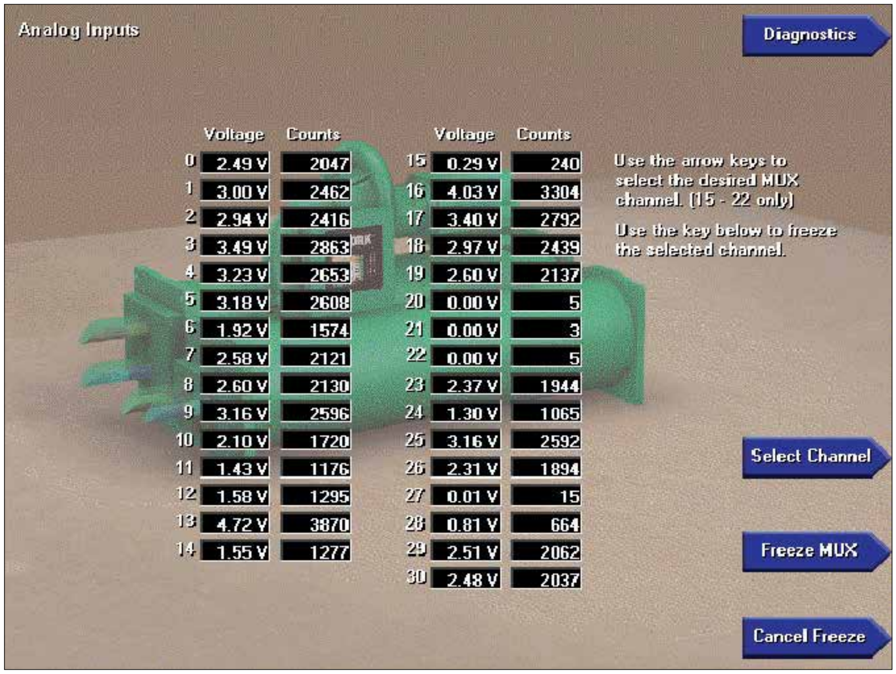

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FIGURE 117 - ANALOG INPUTS TEST SCREEN

This diagnostic is used to analyze the Analog Inputs to the microboard. The voltage level of each Analog Input, as interpreted by the microboard, is displayed. The counts listed for each parameter is the Analog-to-Digital (A/D) converter value and is for manufacturing and engineering use only.

If the chiller is shutting down on an Analog Safety or is prevented from starting because of an Analog Input, there is probably an Analog Input problem. This screen can be used in the investigation of this problem.

NOTE

Important! ***This test does not apply to the Leaving Chilled Liquid Temperature Analog Input, Proximity probe DC Voltage reference or a 0 to 10 VDC Remote Setpoint input at channels 27 and 28.***

The following is a list of the Analog Inputs displayed. See the appropriate Section of this manual for an explanation of each: *SECTION 12 - CURRENT MODULE (CM-2), SECTION 13 - SOLID STATE STARTERS, SECTION 15 - PROXIMITY PROBE, SECTION 17 - REFRIGERANT LEVEL CONTROL, SECTION 20 - PRESSURE TRANSDUCERS, AND SECTION 21 - TEMPERATURE THERMISTORS.*

Channel

0 - +2.5 VDC Analog supply voltage reference. Microboard TP6.

1 - Not Used

2 - Return Chilled Liquid Temperature

3 - Leaving Condenser Liquid Temperature

4 - Return Condenser Liquid Temperature

5 - Drop Leg Refrigerant Temperature

6 - Discharge Temperature

7 - Oil Temperature

8 - Evaporator Refrigerant Temperature

9 - Condenser Pressure

10 - Evaporator Pressure

11 - Sump Oil Pressure

12 - Pump Oil Pressure

13 - Proximity probe DC Voltage Reference (Not applicable to P compressors and style "F" and later chillers with “G, Q” and “H5-8” compressors)

14 - Proximity probe Position (Not applicable to P compressors and style "F" and later chillers with “G, Q” and “H5-8” compressors)

15 - Solid State Starter/CM-2 MUX output Channel 0

16 - Solid State Starter/CM-2 MUX output Channel 1

17 - Solid State Starter/CM-2 MUX output Channel 2

18 - Solid State Starter/CM-2 MUX output Channel 3

19 - Solid State Starter/CM-2 MUX output Channel 4

20 - Solid State Starter/CM-2 MUX output Channel 5

21 - Solid State Starter/CM-2 MUX output Channel 6

22 - Solid State Starter/CM-2 MUX output Channel 7

23 - Refrigerant Level Position

24 - Stall Transducer Output (Chillers equipped w/ Variable Geometry Diffuser)(Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

25 - Stall Detector Board Output (chillers equipped with Variable Geometry Diffuser only) (Software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later))

26 - Pre-rotation Vanes potentiometer Output (chillers equipped with Variable Geometry Diffuser but not equipped with Compressor Motor Variable Speed Drive or Hot gas bypass) (Software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and later))

27 - Remote Leaving Chilled Liquid Temperature Setpoint (0 to 20mA or 4 to 20mA)

28 - Remote Current Limit Setpoint (0 to 20mA or 4 to 20mA)

29 - Condenser Flow Sensor (Style F and later chillers until June 2009. After September 2010, Leaving Chilled Liquid Temperature Thermistor on Heat Pump applications)

30 - Evaporator Flow Sensor (Style F and later chillers until June 2009)

Procedure

1. From the list above, select the Analog Input Channel that is malfunctioning. All inputs except channel 0, 15 through 22, 27 and 28 are sensors that connect directly to the microboard via shielded cable. Channel 0 is a reference voltage for the Analog circuits on the microboard. Channels 15 through 22 are multiplexed outputs from the Solid State Starter (Solid Sate Starter applications) or CM-2 Current Module (Electromechanical Starter applications). Channels 27 and 28 are Remote setpoint inputs used in Analog Remote Mode.

2. Refer to the appropriate Wiring Diagrams listed in front of this manual to identify the device that performs this function and the jack and pin connection to the microboard.

   Channel 0

   Using a Voltmeter, measure the voltage between Microboard TP6 (+2.5 VDC) and TP1 (GND).

   Compare this measured value to the displayed value. If the value is not within plus or minus 10%, replace the microboard.

   All channels except 0, 1, 15-22

   Using a Voltmeter, measure the Analog Input to the microboard. Make the measurement between the device output and ground connection to the device. For example, measure the output of the Evaporator Transducer at Microboard J8-18 (signal) to J8-9 (GND).

   Channels 15-22

   Select the desired channel by pressing the SELECT CHANNEL key and using the ◄ and ► keys to place the arrow head next to the desired channel. Then, freeze the address of that channel to the Solid State Starter or CM-2 MUX. Then measure MUX output at Microboard J10-6 (signal) to J10-5 (GND). When completed, press CANCEL FREEZE key.

   Channels 27, 28

   NOTE

   IMPORTANT! ***This procedure only applies to 4 to 20mA inputs. It does not apply to 0-10 VDC inputs. Using a Voltmeter, measure the Remote Current Limit setpoint input at J22-2 (signal) or Remote Leaving Chilled Liquid Temperature setpoint input at J22-4 (signal) to J22-5 (GND).***

3. Compare the measured value in the previous step with the value displayed on the ANALOG INPUTS Screen for that value.

4. If the measured value is not within plus or minus 15% of the displayed value, replace the microboard. Otherwise, proceed to the troubleshooting procedure below to find the cause of the problem.
5. When all desired tests have been performed, press DIAGNOSTICS key to return the MAIN DIAGNOSTICS Screen.

Troubleshooting

All Channels except 0, 1, 15-22, 27, 28

1. Disconnect both ends of the cable of the Analog Input that is malfunctioning. Using an Ohmmeter, perform a continuity test on all conductors in the cable. An open circuit would indicate the cable is defective.
2. Using a Voltmeter, measure the +12 VDC supply voltage input at the microboard J1-3 (+12 VDC) to J1-2 (GND). If voltage is less than 11.5 VDC, check wiring to Power Supply. If wiring is OK, the Power Supply is most likely defective.
3. Using a Voltmeter, measure the supply voltage (+5 VDC, +1 2 VDC or +24 VDC) to the sensor. If voltage is not within plus or minus 10% of specified voltage, disconnect J7, J8 and J9 from the microboard. This disconnects all analog devices from the microboard. If the voltage increases to the correct level, a Thermistor or Transducer is shorted. Locate the shorted device and replace it. If, after disconnecting the connectors the supply voltage is still not within 10% of the specified value, the voltage supply source (Microboard or Power Supply) is most likely defective.
4. Verify sensor accuracy using appropriate test device. Replace the sensor if necessary.

Channels 15 - 22

1. Disconnect both ends of the ribbon cable connected to Microboard J10. Using an Ohmmeter, perform a continuity test on all conductors in the cable. An open circuit would indicate the cable is defective.
2. Using a Voltmeter, measure the +12 VDC supply voltage input at the microboard J1-3 (+12 VDC) to J1-2 (GND). If the voltage is less than 11.5 VDC, check the wiring to Power Supply. If wiring is OK, the Power Supply is most likely defective.
3. Using a Voltmeter, measure the +5 VDC supply voltage to the Solid State Starter Logic Board or CM-2 Board. Make measurement at Microboard J10-4 (+5 VDC) to J10-5 (GND). If voltage is less than 4.5 VDC, replace the microboard.
4. Using a Voltmeter, verify the correct address is being sent from the microboard to the Solid State Starter Logic Board or CM-2 Board. Freeze address as described above. If the address is correct, the Solid State Starter Logic Board or CM-2 Board or input devices to these boards are most likely the cause of the problem. If address is not correct, the microboard is most likely the cause of the problem.
5. Press **CANCEL FREEZE** key.

Channels 27, 28

1. See *SECTION 3 - MICROBOARD 031-01730-000* "Microboard Program Jumpers" and verify Program Jumpers JP23 and JP24 are configured correctly for the type of input (0 to 10 VDC or 4 to 20mA).
2. Disconnect both ends of the cable of the remote input that is malfunctioning. Using an Ohmmeter, perform a continuity check on all conductors in the cable. An open circuit would indicate the cable is defective.
3. If steps are OK, problem most likely is in the remote device that supplies the remote signal.

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SECTION 35 - SYSTEM COMMISSIONING CHECKLIST

Use the following checklist during commissioning to ensure all setpoints have been programmed to the desired value and all calibrations have been performed. The programming of some of the setpoints require a SERVICE access level. To ensure access to all setpoints, login at SERVICE access level before beginning. The setpoints are grouped under the display screen in which they appear. The indented screens are subscreens of the numbered screens and are accessed from the numbered screens. An explanation of each setpoint or calibration procedure below is contained in the reference document listed in parenthesis adjacent to each item. If any setpoint has to be changed, use the standard programming procedures in *OptiView Control Panel – Operation (Form 160.54-O1)*. Thresholds, values and calibrations of items marked with an asterisk (*) were determined and entered/set at the YORK factory at the time of manufacture.

1. **PROGRAM JUMPERS/SWITCHES** (160.54-M1)

    ____ Verify Microboard Program Jumpers and program switches are configured appropriately. If equipped with microboard (P/N 031-01730-000), see *SECTION 3 - MICROBOARD 031-01730-000)*. If equipped with microboard (P/N 031-02430-000/-001), see *SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001)*.

2. **EVAPORATOR Screen** (160.54-O1)
    Enter the following setpoints:

    ____ Leaving Chilled Liquid Temp (except ISN Remote Mode)

    ____ Remote Leaving Chilled Liquid Temp Setpoint Range (except ISN Remote Mode)

    ____ Low Chilled Liquid Temp Cycling Shutdown Temperature

    ____ Low Chilled Liquid Temp Cycling Shutdown Restart Temperature

    ____ Leaving Chilled Liquid Temp Control Sensitivity (160.54-M1)

    ____ Brine Low Evaporator Pressure Cutout Threshold* (160.54-M1)

    ____ Smart Freeze Protection ON/OFF (160.54-M1)

    ____ Refrigerant Temp Sensor Enable/Disable (160.54-M1)

3. **CONDENSER Screen** (160.54-M1)

    ____ Enter the High Pressure Limit/Warning Threshold Setpoint

    ____ Drop Leg Refrigerant Temp Sensor Enable/Disable

4. **HEAT RECOVERY Screen**
    (Software version C.OPT.01.21.307 and later)

    ____ Hot Water Control Enable/Disable

    ____ Hot Water Setpoint

    ____ Head Pressure Setpoint

    ____ Remote Input Type

    ____ Control Valve Output Settings - Type

    ____ Control Valve Output Settings – PID Output

    ____ Control Valve Output Settings – Set

    ____ Control Valve Output Settings – Auto

    ____ Hot Water Control – P

    ____ Hot Water Control - I

    ____ Hot Water Control - D

    ____ Head Pressure Control – P

    ____ Head Pressure Control – I

    ____ Head Pressure Control - D

5. **HEAD PRESSURE CONTROL Screen**
    (Software version C.OPT.01.21.307 and later)

    ____ Head Pressure Setpoint

    ____ Control Valve Output Settings – Type

    ____ Control Valve Output Settings – PID Output

    ____ Control Valve Output Settings – Set

    ____ Control Valve Output Settings – Auto

    ____ Head Pressure Control – P

    ____ Head Pressure Control – I

    ____ Head Pressure Control - D

6. **HEAT PUMP DUTY Screen**
(Software version C.OPT.01.23.307 and later)

____ Heating Sensitivity

____ Operational Mode

____ Leaving Condenser Liquid Temperature – Setpoint

____ Leaving Condenser Liquid Temperature – Range

____ Leaving Condenser Liquid Temperature Cycling Offset – Shutdown

____ Leaving Chilled Liquid Temperature Cycling Offset – Restart

____ Heating LCHLT (Leaving Chilled Liquid Temperature) Shutdown

7. **REFRIGERANT LEVEL CONTROL/ TUNING Screen** (160.54-M1)

Verify the following setpoints:

____ Level Setpoint*

____ Control Period*

____ Proportional Limit Open* (Software version C.MLM.01.11.xxx (and earlier) or C.OPT.01.11.xxx (and earlier))

____ Proportional Limit Close* (Software version C.MLM.01.11.xxx (and earlier) or C.OPT.01.11.xxx (and later))

____ Rate Limit Open* (Software version C.MLM.01.11.xxx (and earlier) or C.OPT.01.11.xxx (and earlier))

____ Rate Limit Close* (Software version C.MLM.01.11.xxx (and earlier) or C.OPT.01.11.xxx (and earlier))

____ Manual or Auto control (as desired)

____ Verify Refrigerant Level Sensor calibration

____ Valve Preset Time (Software version C.MLM.01.07.xxx (and later) or C.OPT.01.14.xxx (and later))

____ Ramp-up Time (Software version C.MLM.01.07.xxx (and later) or C.OPT.01.14.xxx (and later))

____ Rate Limit (Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

8. **COMPRESSOR Screen** (160.54-M1)

____ Select Pre-rotation Vanes Manual or Auto control

Proximity probe CALIBRATION Screen (except *P* compressors)

____ Verify that a proximity probe reference position* had been entered

PRE-ROTATION VANES CALIBRATE Screen

____ Perform pre-rotation vanes calibration (compressor motor VSD and hot gas bypass applications only)

VSD TUNING Screen

____ Select auto or manual compressor motor frequency control (compressor motor VSD applications only)

9. **Hot gas bypass Screen** (160.54-M1)

If chiller is equipped with optional hot gas bypass, enable operation on the OPERATIONS screen and enter the following setpoints:

____ Maximum Open (Flash memory card version C.MLM.01.05.xxx and later)

____ Surge Sensitivity (moved to SURGE PROTECTION screen in flash memory card version C.MLM.01.05.xxx and later)

____ Hold Period

____ Close Percentage

____ Minimum Load

____ Manual or Auto Control, as desired

10. **SURGE PROTECTION Screen** (160.54-M1)

(Flash memory card version C.MLM.01.05.xxx and later)

____ Enable/Disable Excess Surge Shutdown feature

____ Enable/Disable Extended Run feature

____ Count Window

____ Count Limit

____ Surge Sensitivity

11. **VARIABLE GEOMETRY DIFFUSER Screen** (160.54-M1)

    If compressor is equipped with the Variable Geometry Diffuser (VGD), enable operation on the OPERATIONS screen and enter the following setpoints:

    ____ Surge Reaction Time

    ____ PRV Offset

    ____ Probe Wait Time

    ____ Open Pulse

    ____ High Limit

    ____ Low Limit

    ____ Extreme Stall Duration (Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

    ____ PRV VGD inhibit (Software version C.MLM.01.14.xxx (and later) or C.OPT.01.14.306 (and later))

    ____ Manual or auto control, as desired

12. **OIL SUMP Screen** (160.54-M1)

    ____ Standby Lubrication Enable/Disable. If chiller is equipped with the oil pump Variable Speed Drive (VSD), verify the following setpoints have been entered:

    ____ Oil Pressure Setpoint*

    ____ Control Period*

    ____ Manual or auto control (as desired)

    ____ Oil Return Minimum (software version C.OPT.01.21.307 and later)

13. **MOTOR Screen**

    ____ Enter the desired current limit setpoint (160.54-O1)

    ____ Enter the desired pulldown demand limit and time setpoint (160.54-O1)

Solid State Starter Applications (160.54-M1)
Mod B Solid State Starter

Verify the following setpoints were programmed:

____ Full Load Amps*

____ Start Current*

____ Supply Voltage Range*

____ Enable Open SCR Detection

____ Enable Shorted SCR Detection (Flash memory card version C.MLM.01.04.xxx and later)

____ KWH Reset

Medium Voltage Solid State Starter

Verify the following setpoints have been programmed:

____ Full Load Amps*

____ Start Current*

Mod A Solid State Starter

Verify the following setpoints have been programmed:

____ Full Load Amps*

____ Supply Voltage Range*

____ Current Unbalance Check - Enable or Disable*

Logic Board

____ Verify location of 300V/600V jumper*

____ Verify Start Current calibration*

____ Verify 105% FLA calibration*

Electromechanical Starter Applications: (160.54-M1)

Current Module

____ Verify Switch S1 (Y delta/57% or all others) setting*

____ Verify Pot R16 (LRA/FLA ratio) setting*

____ Verify Slide Bar Resistor “RES” setting*

____ Verify 105% FLA calibration*

____ Verify 100% FLA display*

Variable Speed Drive Applications: (160.54-M1, 160.00-M4 (VSD), 160.00-M6 (MV VSD)

VSD DETAILS Screen (VSD)

____ Set chiller Full Load Amps (FLA) value by adjusting potentiometer on VSD logic board (R34 on logic board 031-02506; R28 on all others)

MOTOR Screen (MV VSD)

____ Full Load Amps

ADAPTIVE CAPACITY CONTROL (ACC) DETAILS Screen

____ Surge Map Clear

____ Surge Map Print

____ Auto Map Print

____ Surge Margin Adjust

____ Auto Map Print (Modbus Protocol configuration; software version C.OPT.01.18.307 and later)

____ Surge Sensitivity (software version C.OPT..01.21.307 and later)

____ Manual Surge Point

____ Mapping Enable (Modbus Protocol configuration; software version C.OPT.01.21.307 and later)

____ VSD Start Frequency (Modbus Protocol configuration; software version C.OPT.01.21.307 and later)

MOTOR LUBRICATION **Screen**

____ Enable/Disable Motor Auto Lubrication (software version C.OPT.01.16.xxx (or later))

____ Enable/Disable the Motor Lubrication Warning Safety Shutdown (if Motor Lube is disabled) (software version C.OPT.01.16.xxx (or later))

MOTOR DETAILS SCREEN (Software version C.OPT.01.22.307 and later)

____ Winding Temperature Protection

____ Bearing Temperature Protection

____ Motor Vibration Protection

____ Motor Cooling Coil Leak Protection

____ Manual Baseline or Auto Baseline

MOTOR SETPOINTS SCREEN (Software version C.OPT.01.22.307 and later)

____ Temperature Disable

____ Winding Setup

____ Vibration Setup

____ Vibration Gain

____ Bearing Setup

14. **SETPOINTS Screen** (160.54-O1)

    With the exception of the "Remote Analog Input Range", the setpoints listed on the SETPOINTS Screen have already been programmed above on previous screens. The values shown reflect the previously programmed values. However, the setpoints listed here can be changed on this screen if desired. This screen is used primarily as a central location from which most setpoints can be programmed. If it is not desired to change any of the listed setpoints, proceed to the SETUP Screen below.

    ____ Remote Analog Input Range

SETUP Screen

____ Enable clock

____ Enter clock time and date

____ Select 12- or 24-hour Display Mode

Microboard 031-01730-000:

____ The state of program jumpers/switches that affect chiller operation are displayed. These were configured in Step 1. Confirm they are correct. (*SECTION 3 - MICROBOARD 031-01730-000*)

Microboard 031-02430-000/-001, 031-03630-001:

____ The state of program switches SW1-1 (refrigerant selection) and SW1-2 (liquid type) is displayed. These were configured in Step 1. Confirm they are correct. (*SECTION 4 - MICROBOARD 031-02430-000 AND 031-02430-001 or SECTION 5- 031-03630-001*).

Enter the following setpoints: (160.54-M1)

____ Chilled Liquid Pump Operation

____ Motor Drive Type

____ Anti-Recycle

____ Power Failure Restart

____ Coastdown

____ Pre-run

____ Oil Pump Package

____ Motor Communications Protocol (software version C.OPT.01.16.xxx (or later) for VSD applications; software version C.OPT.01.18.307 (or later) for LCSSS applications) – When VSD-50Hz, VSD-60Hz or SSS-Mod B is selected as Motor Drive type setpoint

____ Motor Node ID (software version C.OPT01.16.xxx or later) for VSD applications; software version C.OPT.01.18.307 (or later) for LCSSS applications – When Modbus is selected as Motor Communications Protocol setpoint

____ Coastdown Time (software version C.OPT.01.16.307 and Later - only appears if Coastdown setpoint above is set to STANDARD)

____ Condenser Temperature Range (software version C.OPT .01.19.307 and later)

____ PRV Position Enable/Disable (software version C.OPT.01.21.307 and later)

____ Motor Monitoring (software version C.OPT.01.22.307 and later)

____ Heat Recovery Enable/Disable (software version C.OPT.01.21.307 and later)

____ Head Pressure Control Enable/Disable (software version C.OPT.01.21.307 and later)

____Heat Pump Duty Enable/Disable (Software version C.OPT.01.23.307 and later)

QUICK START Screen (Software version C.OPT.01.21.307 and later)

____ Quick Start Mode Enable/Disable

____ Quick Start Pulldown Setpoint Offset

____ Pulldown Override Time

____ VSD Start Frequency

____ Mapping Enable

____ Quick Ramp Current Threshold

SCHEDULE Screen

____ Enable or disable daily start/stop schedule as required.

____ Enter Chiller Start/Stop schedule if required

USER Screen

____ Select desired Display Language

____ Select desired Display Units; English or Metric

____ If desired, establish custom User IDs and Passwords (160.54-M1)

COMMS Screen

If modem and or printer is connected to the microboard serial data ports, enter the following parameters as required for each device connected:

____ Baud rate

____ Number of data bits

____ Number of stop bits

____ Parity

Enter appropriate number for Modem, Printer or ISN Remote application:

____ Chiller ID (identification)

Printer Screen

If printer is connected to microboard serial ports, enter the following:

____ Automatic print logging enable/disable

____ Automatic printer logging start time

____ Automatic print logging interval

____ Printer type

____ Report type; Status, Setpoints, Schedule or Sales Order

SALES ORDER Screen

____ Enter system commissioning date

OPERATIONS Screen (160.54-M1)

____ Select desired Control Source (Operating Mode); Local, ISN Remote, Digital Remote or Analog Remote

____ Refrigerant Level Control operation Enable/Disable

____ Hot gas bypass Control (optional) Enable/Disable

____ Variable Geometry Diffuser (Enable/Disable) (Chillers equipped with Variable Geometry Diffuser. Software version C.MLM.01.10.xxx (and later) or C.OPT.01.10.302 (and Later)

____ Edit regional phone number if necessary (Flash memory card version C.MLM.01.05.xxx and later)

____ Enter local phone number (Flash memory card version C.MLM.01.05.xxx and later)

____ Enter Chiller Style/Compressor (Flash memory card version C.MLM.01.07.xxx and later)

____ Enter Flow Sensor type (Flash memory card version C.MLM.01.08.xxx and later).

SECTION 36 - SOFTWARE ENHANCEMENTS

SI0006 - SOFTWARE ENHANCEMENTS EFFECTIVE MAY 2001

GENERAL

Beginning May 2001, an enhanced flash memory card will be supplied with new production NEMA 1-4 and CE chillers. New features are outlined below and are also included in *OptiView Control Panel – Operation (Form 160.54-O1)* and *Service Manual (Form 160.54-M1)*.

Flash memory card versions and part numbers are applied as follows:

- NEMA 1-4 Chillers
  C.MLM.01.05A.102 (031-01797-001)
- CE Chillers
  C.MLM.01.05A.203 (031-01797-002)

The enhanced flash cards are also available from the Baltimore Parts Distribution Center for retrofit to existing chillers.

SURGE PROTECTION

The surge protection feature detects surge events and provides a running count of the events that occur over the lifetime of the chiller. An excess surge threshold can be programmed to detect excessive surging. If excess surging is detected, it can be configured to shutdown the chiller or initiate a special surge correction/avoidance mode or simply display a warning message. A SURGE PROTECTION screen displays all parameters relevant to this feature.

TREND Screen – TRIGGERED CHART

A triggered chart can now be created, which is in addition to the one screen and continuous chart types that can be created in previous flash memory card versions. With the triggered chart type, data collection can be set to start or stop based upon the status of up to two operator selected conditions (triggers) and a selected trigger delay. If start is selected, data collection will not begin until all triggers have been satisfied and any selected trigger delay has elapsed. data collection will stop after the completion of one screen of data. If stop is selected, data collection will begin when manually initiated, and will stop when all triggers have been satisfied and any selected trigger delay has elapsed.

This feature is a valuable troubleshooting tool for Service technicians. It allows an event that occurs during unattended hours to be captured for viewing at a later time. The trigger event results in a screen of frozen trend data that will remain on the screen until manually cleared.

DISPLAY OF SERVICE PHONE NUMBERS

Two service phone numbers (regional and local), with labels, can be displayed on the OPERATIONS screen. The default value for the regional number is the North American toll free number. However, the label and number can be changed to any desired value. The local label and number can also be entered.

Hot gas bypass ENHANCEMENT

In previous flash memory card versions, when the Leaving Chilled Liquid Temperature decreased to the minimum load setpoint, the hot gas valve was opened to 100% . In this version, the valve will be opened to the position programmed as the maximum open setpoint (25% to 100%), which allows for better control of the minimum load conditions. After the minimum load operation is activated, the valve will be closed proportionately as the Leaving Chilled Liquid Temperature (LCLT) increases to the LCLT setpoint.

Evaporator Transducer or Temperature Sensor Safety Shutdown

In previous flash memory card versions, the conditions for this safety shutdown were checked after the first 10 minutes of chiller run. Under certain operating conditions, this would result in unnecessary shutdowns. In this version, in addition to the previous criteria, the shutdown conditions are not checked unless smart freeze is enabled and the evaporator refrigerant temperature RT7 (if enabled) or evaporator saturation temperature (derived from the evaporator pressure transducer) is less than 32° F.

SI0006 - SOFTWARE ENHANCEMENTS EFFECTIVE MAY 2001 (CONT'D)

COMPRESSOR MOTOR VARIABLE SPEED DRIVE

1. The compressor motor Variable Speed Drive (VSD) Phase A, B and C output current to the motor is now displayed on the VSD TUNING screen.
2. The new 351HP VSD is supported. In this model, the three inverter assemblies are mounted on a single baseplate instead of three individual heat sink assemblies like other models. Therefore, the VSD DETAILS screen and the HARMONIC FILTER DETAILS screen display a single baseplate temperature instead of the Phase A, B and C temperatures displayed on other models.

OIL PUMP VARIABLE SPEED DRIVE

In previous flash memory card versions, the oil pump VSD starts at 25Hz when turned on during System Prelube. In this version, the VSD starts at 45Hz, which provides greater reliability in achieving the required 45 psid target oil pressure at chiller start.

SI0019 - SOFTWARE ENHANCEMENTS EFFECTIVE MARCH 2002

GENERAL

Beginning March 2002, an enhanced flash memory card will be supplied in new production YK NEMA 1-4 and CE chillers. The new features are outlined below.

The flash memory card versions and part numbers are as follows:

- NEMA 1-4 chillers (except *P* compressors) C.MLM.01.06.100 (031-01797-001)
- CE chillers (except *P* compressors) C.MLM.01.06.200 (031-01797-002)
- NEMA 1-4 chillers (*P* compressors) C.MLM.04.02.100 (031-02073-001)
- CE chillers (*P* compressors) C.MLM.04.02.200 (031-02073-002)

These versions are also available from the Baltimore Parts Distribution Center for retrofit to existing chillers.

OPERATOR SOFT SHUTDOWN

This feature allows an operator (logged in at OPERATOR access level, or higher) to manually initiate a soft shutdown by closing the pre-rotation vanes before shutting down the chiller, which reduces compressor bearing wear by eliminating compressor backspin at shutdown.

While the chiller is running, a SOFT SHUTDOWN key is available on the HOME screen (when access level is OPERATOR or higher). Pressing this key causes the pre-rotation vanes to be driven fully closed. While they are closing, VANES CLOSING BEFORE SHUTDOWN is displayed on the system status line. LOCAL STOP is displayed on the system details line. When the Vane Motor Switch (VMS) closes, indicating the vanes have fully closed (or 3.5 minutes have elapsed, whichever occurs first), the start signal is removed from the starter and a normal coastdown is performed.

While the vanes are closing during the soft shutdown, if a standard local stop is initiated with the front panel rocker switch, or if any faults other than the following occur, the soft shutdown is terminated and it will immediately enter a normal coastdown period:

- Leaving Chilled Liquid – Low Temperature
- Remote Stop
- Multi-unit Cycling – Contacts Open
- System Cycling – Contacts Open
- Control Panel – Schedule

Following an operator initiated soft shutdown, the front panel rocker switch must be placed in the stop/reset position and then to the start position in order to start the chiller after a soft shutdown has been performed.

RECORD SETPOINT CHANGES

This feature provides a record of the last 75 setpoint changes. The date and time the setpoint was changed, the new setpoint value and the access level and User ID used to make the change are stored in the BRAM. The SECURITY LOG screen and the SECURITY LOG DETAILS screen display levels of this information. Both screens are available in SERVICE access level or higher.

On the SECURITY LOG screen, accessible from the HISTORY screen, the setpoint, setpoint category and new setpoint value are listed and numbered in reverse order in which they were changed. The most recent is listed as number 1; the next most recent as number 2, etc. A PRINT key allows printing this entire list. Since 15 changes can be displayed at one time, multiple pages could be necessary to display all the changes. PAGE-UP and PAGE-DOWN keys are provided to view the entire list. To view the details of a particular setpoint change, select the setpoint change number with the LOG ENTRY key, and then press the VIEW DETAILS key, which moves it to the SECURITY LOG DETAILS screen.

The SECURITY LOG DETAILS screen, accessible from the SECURITY LOG screen, displays the following setpoint change details. The setpoint is selected from the list on the SECURITY LOG screen as explained in the previous paragraph. A PRINT key is provided to print this information.

- Setpoint Category
- Setpoint
- Date and time of change
- Access Level and User ID used to make the change
- Old Value
- New Value

SI0019 - SOFTWARE ENHANCEMENTS EFFECTIVE MARCH 2002 (CONT'D)

The following setpoint changes are not logged:

- Clock Mode
- Custom Screen Slot Numbers
- Advanced Diagnostics Communication Port Tests
- Advanced Diagnostics Secondary Multiplexer Freeze
- Soft Shutdown Initiated By Operator
- System Language
- Display Units
- Any Print Report
- Cancel Any Print Report
- Schedule Clear
- Schedule Repeat Exception Days
- Schedule Start and Stop Times
- Log In/Log Out
- User Attributes For ID, Password and Level
- Trend Start/Stop
- Trend Slot Numbers, Minimums and Maximums
- Trend Trigger Data
- Trend Print Mode
- Trend View Mode

LEAVING CHILLED LIQUID TEMPERATURE CONTROL SENSITIVITY SETPOINT

In addition to the NORMAL and 50% selections provided in previous software versions, a 30% selection was added to this version. This provides less overall Pre-rotation Vane (PRV) movement than the 50% selection by limiting the longest allowed pulse to 3.5 seconds. This selection can used when the 50% selection does not reduce the PRV instability to the desired level.

REFRIGERANT LEVEL CONTROL

The following features provide improved level control stability.

- Level Control Period Setpoint – Now programmable over the range of 3.5 to 30.0 seconds. Previously, it was 1.0 to 5.0 seconds.
- The message WARNING – REFRIGERANT LEVEL OUT OF RANGE and the associated lower signal that opens the valve until the level is within range was eliminated.
- The ramp-up feature is now only executed immediately after chiller start. Subsequent ramp functions during chiller run have been eliminated.
- Rate Limit Open Setpoint – Now programmable over the range of 5% to 50%. Previously, it was 10% to 50%.
- Rate Limit Close Setpoint – Now programmable over the range of 5% to 50%. Previously, it was 10% to 50%.
- The duration of the open or close pulse applied to the valve actuator is now independent of the selected period setpoint. It is now a fixed percentage of 3.5 seconds. Previously, it was a percentage of the period setpoint. Therefore, longer periods would produce longer output pulses for the same error, resulting in unstable operation under certain conditions.

COMPRESSOR MOTOR VARIABLE SPEED DRIVE

- The conditions to produce the HARMONIC FILTER – LOGIC Board OR COMMUNICATIONS cycling shutdown must now be present for 10 communication cycles before a shutdown is performed.
- If either the 50% or 30% LCLT sensitivity setpoint is selected, pre-rotation vane movement is further reduced when the chiller is operating at low load. When the vane position is less than 25% and LCLT is within plus or minus 2.5°F of setpoint, the maximum vane pulse is limited to 3.5 seconds at 25% position and 0.9 seconds at 0% position. Vane positions in between have linearly scaled maximums.
- In previous flash memory card versions, the set frequency setpoint feature on the VSD TUNING screen did not correctly set the desired frequency in 50Hz applications, which was corrected in this version.
- Harmonic filter currents are now correctly displayed at maximum values.

HISTORY

CHILLER RUN TIME is now included on HISTORY DETAILS display and print.

Hot gas bypass

The hot gas valve position is now animated on the Hot gas bypass screen.

SI0034 - SOFTWARE ENHANCEMENTS EFFECTIVE AUGUST 2002

Flash Memory card

Beginning August 2002, an enhanced flash memory card will be supplied in new production YK chillers. These cards will accommodate the YK Style "F" chiller, scheduled for future release. The cards are also available from the Baltimore Parts Distribution Center as replacement parts. They supersede all previous versions of the same part number. The enhancements that affect the OptiView Control Center are listed below.

The new versions are:

- NEMA 1-4 chillers (all compressors) C.MLM.01.07.104 (031-01797-001)
- CE chillers (all compressors) C.MLM.01.07.205 (031-01797-002)

In addition to being used on all YK Style F chiller/compressor combinations, they are backward compatible to all previous style YK chiller/compressor combinations. The new card supersedes and will be supplied in place of (P/N 031-02073-001) and (P/N 031-02073-002) flash memory cards that were previously used for *P* compressor applications. Part number 031-01797-001 will be supplied in place of part numbers 031-02073-001 and 031-01797-002 will be supplied in place of 031-02073-002.

The various YK chiller modification level (style)/compressor combinations are equipped differently and have different control requirements. Variables include the following:

- High Speed Thrust Bearing proximity sensing – Proximity probe or Limit Switch
- Flow Sensor – Paddle type (115 VAC Digital Input) or factory mounted thermal type sensor (+5 VDC Analog Input)
- Oil Heater Outputs – Either TB1-34 or TB1-64 on I/O Board
- Refrigerant Level Control Default Period – Either 3.5 seconds or 10.0 seconds
- Oil – Variable Speed Pump-Pressure Setpoint not Achieved safety Shutdown Threshold – 25 psid or 35 psid

Flash memory card version C.MLM.01.07.xxx and later are applicable and backward compatible to all YK chiller/compressor combinations. They contain all control variables for all combinations. For correct control, the chiller mod level/compressor size combination must be entered (using SERVICE access level) using the CHILLER MOD SETPOINT key on the OPERATIONS screen. The selections are as follows: (Default is Mod F – GH Compr)

- Mod F – GH Compr
- Mod F – J Compr
- Mod F – P, Q Compr
- Mod CDE – GHJ Compr
- Mod E – P Compr

Once the appropriate chiller/compressor combination is entered, the program automatically bundles the functionality and control per the following table:

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SI0034 - SOFTWARE ENHANCEMENTS EFFECTIVE AUGUST 2002 (CONT'D)

CHILLER MOD – COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*
Mod C, D, E – G, H, J Compr	Probe	TB1-34	3.5 sec	Paddle Type	35 psid
Mod E – P Compr	Limit Switch	TB1-64	10.0 sec	Paddle Type	25 psid
Mod F – G, H Compr	Limit Switch	TB1-64	3.5 sec	Factory Mounted Thermal Type	35 psid
Mod F – J Compr	Probe	TB1-64	3.5 sec	Factory Mounted Thermal Type	35 psid
Mod F – P, Q Compr	Limit Switch	TB1-64	10.0 sec	Factory mounted Thermal Type	25 psid

* Not applicable to Mod C (and earlier) chillers.

FACTORY MOUNTED FLOW SENSORS

Style F (and later) chillers are supplied with factory-mounted flow sensors on the evaporator and condenser. These are electronic thermal-type sensors. The operating principle of the sensor is thermal conductivity. It uses the cooling effect of a flowing liquid to sense flow. The temperature of the heated sensor tip is sensed by a thermistor located in the tip.

A second thermistor, located higher in the tip in a non-heated area, is only affected by changes in liquid temperature. The temperatures sensed by the thermistors are compared. Flowing liquid carries heat away from the heated sensor tip, lowering its temperature. The lower temperature differential between the two thermistors indicates the liquid is flowing. A higher differential indicates no flow. Each device operates from a 24 VAC power source and has a solid state relay output. On each sensor, one side of the solid state relay output (pin 2) is connected to the microboard +5 VDC and the other side (pin 4) is connected to a Microboard Analog Input.

When flow is sensed, the solid state relay output is turned on causing it to conduct current through the 7.5K ohm microboard load resistor to the +5 VDC. This applies more than +4 VDC to the microboard input (evaporator J7-14; condenser J7-16). When no flow is sensed, the solid state relay output is turned off, resulting in no conduction through the load resistor. This applies less than 1 VDC to the microboard input. To determine the state of the solid state relay, first confirm that +5 VDC is present at pin 2 of the flow sensor. Then connect a voltmeter from Microboard J7-14 (evaporator) or J7-16 (condenser) to Microboard TP1 (ground).

The power source is connected to the sensor as follows:

From	**To**
Sensor pin 1	TB1-162 (24 VAC)
pin 3	TB6-5 (GND)

The sensor outputs are connected to the microboard as follows:

Evaporator:

From	**To**
Sensor pin 2	Microboard J7-1 (+5 VDC)
pin 4	J7-14 (input to Microboard)

Condenser:

From	**To**
Sensor pin 2	Microboard J7-15 (+5 VDC)
pin 4	J7-16 (input to Microboard)

SI0034 - SOFTWARE ENHANCEMENTS EFFECTIVE AUGUST 2002 (CONT'D)

Microboard Program Jumpers JP21 and JP22 must be placed in the positions 2 and 3.

Proximity probe/LIMIT SWITCH

Previously, YK chillers equipped with *P* compressors used the high speed thrust bearing limit switch and all other compressors used the proximity probe. With Style F chillers, only the *J* compressor will use the proximity probe. compressors G, H and P will use the limit switch.

In previous flash memory card versions, the Thrust Bearing Limit Switch indication shows a lit LED for a normal condition and unlit for a faulted condition. In this version, an unlit LED indicates a normal condition and a lit LED indicates a faulted condition.

REFRIGERANT LEVEL CONTROL

In previous flash memory card versions, this control operates as follows:

When the chiller enters system run, if the refrigerant level position is less than the control setpoint, a linearly increasing ramp limit, called the refrigerant level target, is applied to the control setpoint. This ramp limit allows the level to go from the present programmed level to the programmedcontrol setpoint over a period of 15 minutes. During these 15 minutes, the refrigerant level target is used to control the condenser refrigerant level. The control setpoint is used to control the refrigerant level for the remainder of chiller run.

In this version, the control will operate as follows:

- While the chiller is stopped, or if the level control is disabled, the refrigerant level lower output is energized.
- Upon entering chiller pre-lube, the refrigerant level raise output is energized for the length of the programmable valve preset time setpoint (0 to 100 seconds; default 50; SERVICE access level). After pre-positioning, the valve is held in this position until the first three minutes of chiller run time have elapsed. Setting the valve preset time to 0 seconds disables this pre-positioning feature. Setting the valve preset time to a value greater than 50 seconds has no effect on the pre-lube time.
- After three minutes of run time, if the refrigerant level is less than the control setpoint, a linearly increasing ramp limit, called the refrigerant level target, is applied to the programmed control setpoint. This ramp limit allows the level to go from the present level to the control setpoint over a period of time programmed as the ramp-up time setpoint (3 to 15 minutes; default 8; SERVICE access level). During this ramp-up period, the refrigerant level target is used to control the refrigerant level in the condenser. The control setpoint is used to control the level during the remainder of chiller run.
- If the valve preset time setpoint is set to 0 seconds and the ramp-up time setpoint is set to 15 minutes, Refrigerant level control will operate exactly the same as previous flash memory card versions.

Microboards

Since the new version flash memory card (as described above) is applicable to all YK chillers with any compressor, the microboard replacement kit (P/N 331-01730-604) previously supplied for YK chillers equipped with *P* compressors is no longer required. The standard microboard replacement kit (P/N 331-01730-601) will be supplied when part number 331-01730-604 is ordered.

SI0058 - SOFTWARE ENHANCEMENTS EFFECTIVE FEBRUARY 2003

GENERAL

Beginning February 2003, an enhanced Flash memory card will be supplied in all new production YK chillers. These cards are backward compatible to all previous YK chillers and are available from the Baltimore Parts Distribution Center as replacement parts. The enhancements are outlined below.

The versions and part numbers are applied as follows:

- NEMA 1-4 chillers
  C.MLM.01.08.105 (p/n 031-01797-001)
- CE chillers
  C.MLM.01.08.206 (p/n 031-01797-002)

FLOW SENSORS

Mod Style F chillers are provided with factory mounted thermal-type flow sensors for the evaporator and condenser. However, this Flash memory card version allows Style F chillers to use either the thermal-type or field installed paddle-type flow sensor. The thermal-type sensors interface to Microboard +5 VDC Analog Inputs at J7-14 (evaporator) and J7-16 (condenser). The paddle-type sensors interface to the I/O Board 115 VAC Digital inputs at TB4-12 (evaporator) and TB4-11 (condenser). For the program to read the appropriate inputs for the flow sensor status, the actual sensor type used must be entered at the keypad OPERATIONS Screen using the SERVICE access level.

If the chiller mod style level setpoint on the OPERATIONS screen is set to *F* (any compressor), the FLOW SWITCH key appears on the OPERATIONS screen allowing the flow sensor type to be entered. The selections are ANALOG (thermal-type) or DIGITAL (paddle-type). If Analog is selected, the program reads the thermal-type flow sensor inputs at Microboard Analog Inputs J7-14 (evaporator) and J7-16 (condenser) and ignores the digital inputs. If digital is selected, the program reads the paddle-type sensor inputs at the I/O board digital inputs TB4-12 (evaporator) and TB4-11 (condenser) and ignores the analog inputs.

Enter the applicable flow sensor type as follows:

1. Select SETPOINTS/SETUP/OPERATIONS screen.
2. Press FLOW SWITCH key.
3. Use ◄ or ► keys to select flow sensor type. Each time the key is pressed, analog or digital is alternately displayed.
4. Press ENTER (✓) key.

VARIABLE SPEED DRIVE OIL PUMP

When the oil pump is started during system pre-lube, the pump speed command is held at 45Hz for the first eight seconds before releasing to normal control.

Oil Pressure Threshold

The threshold for OIL – HIGH DIFFERENTIAL PRESSURE safety shutdown is changed from 90 psid to 120 psid .

COMPRESSOR MOTOR VARIABLE SPEED DRIVE (VSD)

This flash memory card version supports VSD part number 371-03789-XXX (503HP; 60Hz) (419HP; 50Hz). Display messages unique to this drive are displayed appropriately on the screens as follows: Phase A, B and C baseplate temperatures are displayed on the VSD DETAILS screen and filter baseplate temperature is displayed on the FILTER DETAILS Screen.

In addition to standard VSD cycling messages, the following cycling shutdown messages apply to this VSD:

VSD – LOW PHASE A INVERTER BASEPLATE TEMPERATURE

The chiller has shutdown because the baseplate temperature has decreased to less than 37°F.

VSD – LOW PHASE B INVERTER BASEPLATE TEMPERATURE

Same as Phase A above.

SI0058 - SOFTWARE ENHANCEMENTS EFFECTIVE FEBRUARY 2003 (CONT'D)

VSD – LOW PHASE C INVERTER BASEPLATE TEMPERATURE

Same as Phase A above.

In addition to standard VSD safety shutdown messages, the following safety shutdown messages apply to this VSD:

VSD – HIGH PHASE A INVERTER BASEPLATE TEMPERATURE

The chiller has shutdown because the baseplate temperature has increased to greater than 158°F.

VSD – HIGH PHASE B INVERTER BASEPLATE TEMPERATURE

Same as Phase A above.

VSD – HIGH PHASE C INVERTER BASEPLATE TEMPERATURE

Same as Phase A above.

HARMONIC FILTER – HIGH BASEPLATE TEMPERATURE

The chiller has shutdown because the baseplate temperature has increased to greater than 194°F.

E-LINK GATEWAY

In previous flash card versions, START INHIBIT and MODIFIED RUN codes were transmitted into CYCLING and SAFETY shutdown slots in the E-Link Gateway. This alarmed external devices that a cycling or safety shutdown has occurred, when in reality, a start inhibit such as anti-recycle or a modified run event such as current limit is in effect was an incorrect operation. In this version, the codes are transmitted into the proper slots in the E-Link Gateway.

SECURITY LOG Screen

In previous flash card versions, some setpoint changes were not logged in metric mode. All setpoint changes are now logged.

SI0062 - SOFTWARE ENHANCEMENTS EFFECTIVE MARCH 2003

GENERAL

Beginning March 2003, an enhanced flash memory card will be supplied in all new production YK chillers. These cards are backward compatible to all previous YK chillers and are available from the Baltimore Parts Distribution Center as replacement parts. The enhancements are outlined below.

The versions and part numbers are applied as follows:

- NEMA 1-4 chillers
  C.MLM.01.08.105A (p/n 031-01797-001)
- CE chillers
  C.MLM.01.08.206A (p/n 031-01797-002)

Chiller Style/Compressor Setpoint

In previous flash memory card version, this setpoint key (located on OPERATIONS Screen), was labeled CHILLER MOD. For clarity, this setpoint key is now labeled CHILLER STYLE/COMPRESSOR (English only). The functionality of this setpoint has changed slightly as follows:

The previous choice of Style F chiller/G, H comp is now Style F chiller/G, H5-8 compr. The previous choice of Style F chiller/J compr is now Style F chiller/J, H3 compr.

The chiller style/compressor selections are shown below.

CHILLER STYLE/ COMPRESSOR	PROXIMITY SENSE	OIL HEATER OUTPUT*	LEVEL CONTROL PERIOD DEFAULT	FLOW SWITCH	OIL-VARIABLE SPEED PUMP-PRESSURE SETPOINT NOT ACHIEVED THRESHOLD*
Style C, D and E/ G, H and J Compr	Probe	TB1-34	3.5 sec	Digital (Paddle Type)	35 psid
Style E/ P Compr	Limit Switch	TB1-64	10.0 sec	Digital (Paddle Type)	25 psid
Style F/ G and H5-8 Compr	Limit Switch	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
Style F/ J and H3 Compr	Probe	TB1-64	3.5 sec	Programmable (Analog or Digital)	35 psid
Style F/ P, Q Compr	Limit Switch	TB1-64	10.0 sec	Programmable (Analog or Digital)	25 psid

* Not applicable to Style "C" (and earlier) chillers

SI0080 - SOFTWARE ENHANCEMENTS EFFECTIVE JANUARY 2004

GENERAL

Beginning January 2004, enhanced software will be supplied in all new production YK chillers. It is backward compatible to all previous YK chillers. The enhancements are outlined below.

The versions and part numbers for 031-01730-000 Microboards are as follows:

- NEMA 1-4 chillers
  C.MLM.01.09.106 (p/n 031-01797-001)
- CE chillers
  C.MLM.01.09.207 (p/n 031-01797-002)

The version and part number for 031-02430-000 Microboards for both NEMA 1-4 and CE chillers is C.OPT.01.09.301 (p/n 031-02474-001).

OPTISAVE ENERGY ANALYZER FEATURE

This feature reveals the advantage of a compressor motor VSD. It calculates the amount of energy that has been saved by having a VSD instead of a constant speed drive. The savings are determined by calculating the energy consumption of a constant speed drive and subtracting the measured energy consumption of the variable speed drive. The resulting difference is the energy savings. This data is displayed, but does not affect chiller operation or performance.

Although this feature is present in this software, it is not operational until enabled using a special procedure.

Refer to *Service Information Letter SI0068* for a complete description of this feature. It provides all required installation, enable and setup information.

SURGE PROTECTION

If the chiller is equipped with a compressor motor VSD:

- The surge shutdown feature, extended run feature and surge Warning messages will not be performed unless the VSD output frequency is at maximum.

If the chiller is equipped with both a VSD and the hot gas bypass feature:

- The hot gas valve position must be at 100% AND the VSD output frequency must be at maximum before the above surge features are performed.

For all applications, the count Window setpoint default is now three minutes (was five minutes). The count limit setpoint default is 15 surges (was four surges).

PRE-ROTATION VANES CALIBRATION

There is now one procedure for all pre-rotation vanes (PRV) calibrations. This procedure applies to the Compressor Motor VSD, hot gas bypass, variable geometry diffuser, and any other PRV calibration.

1. Place the COMPRESSOR switch in the STOP-RESET position (O) and wait until the system coastdown is complete.
2. At the keypad, login at SERVICE access level.
3. Select the PRE-ROTATION VANES CALIBRATE screen from the COMPRESSOR screen.
4. Press the START CALIBRATION key to initiate the calibration. The CALIBRATION IN PROGRESS and PRV OPENING LED will illuminate and an open signal is applied to the PRV.

   After a 60 second delay, the program begins evaluating the feedback voltage from the PRV potentiometer. When the feedback voltage stops increasing and remains stabilized (so that there is no more than plus or minus 0.25 VDC deviation) for 25 continuous seconds, the feedback voltage is logged as the 100% position. A close signal is then applied to the PRV and illuminates the PRV CLOSING LED.

   After a 10 second delay, the program begins evaluating the feedback voltage from the PRV potentiometer. When the feedback voltage stops decreasing and remains stabilized (so that there is no more than plus or minus 0.25 VDC deviation) for 25 continuous seconds, the feedback voltage is logged as the 0% position. These endpoint voltages are stored in the BRAM as the full open and full closed positions.
5. If the difference between the endpoint voltages is greater than 0.5 VDC, PRV CALIBRATION SUCCESSFUL is displayed. If it is less than 0.5 VDC, PRV CALIBRATION UNSUCCESSFUL is displayed. Also, if the endpoints are not established within 10 minutes, PRV CALIBRATION UNSUCCESSFUL is displayed.

SI0080 - SOFTWARE ENHANCEMENTS EFFECTIVE JANUARY 2004 (CONT'D)

NOTE

The calibration procedure can be terminated at any time during the procedure by pressing the CANCEL CALIB key. If the PRVs were previously calibrated successfully, they will revert to using the previous calibration values. If they were not previously calibrated successfully, they will remain uncalibrated.

VSD ADAPTIVE CAPACITY CONTROL - STABILITY LIMIT SETPOINT

This compressor motor VSD setpoint default is now 7000 (was 4500).

E-LINK GATEWAY INDUCED REBOOTS

With previous flash memory card versions, E-Link Gateway communications could cause the microboard to randomly reboot was corrected in this version.

SI0089 - SOFTWARE ENHANCEMENTS EFFECTIVE MAY 2004

GENERAL

Beginning May 2004, enhanced software will be supplied in all new production YK chillers. It is backward compatible to all previous YK chillers. The enhancements are outlined below.

Microboard versions and part numbers are 031-01730-000:

- NEMA 1-4 chillers
  C.MLM.01.11.108 (p/n 031-01797-001)
- CE chillers
  C.MLM.01.11.209 (p/n 031-01797-002)

The version and part number for 031-02430-000 microboards for both NEMA 1-4 and CE Chillers is C.OPT.01.11.303 (p/n 031-02474-001).

HIGH CONDENSER PRESSURE FAULT WHILE SHUTDOWN

High temperature condenser water flowing through the condenser while the chiller is shutdown can cause a condenser high pressure condition resulting in loss of refrigerant. Therefore, an anticipatory safety fault was created to annunciate condenser high pressure conditions when the chiller is stopped. While the chiller is stopped, if the condenser pressure exceeds 160.0 psig (R-134a), 240.0 psig (R22), a safety fault occurs and CONDENSER – HIGH PRESSURE - STOPPED is displayed.

The chiller can be started after the condenser pressure decreases to less than 160.0 psig (R-134a), 240.0 psig (R22) and a special reset procedure is performed as follows:

1. Place the COMPRESSOR switch in the STOP-RESET position.
2. At the keypad, login at SERVICE access level using code 1 3 8 0.
3. Select COMPRESSOR screen.
4. Press the FAULT ACKNOWLEDGE key on the COMPRESSOR screen. A dialog box displays ENTER PASSWORD TO CLEAR FAULT.
5. Enter 1 3 9 7 and press the ✓ key ().

This anticipatory fault is only performed while the chiller is stopped. If a CONDENSER – HIGH PRESSURE fault is detected while the chiller is in pre-lube, system run or coastdown, the fault is handled in the normal way and does not require the special reset procedure.

STYLE B SOLID STATE STARTER FAULTS

The following changes apply to faults detected by the Style B Liquid Cooled Solid State Starter (LCSSS).

Open SCR (Silicon Controlled Rectifier) Fault

When the solid state starter initiates a shutdown, the fault data transferred to the OptiView Control Center is a function of the EPROM (U16) in the starter logic/trigger board.

Previously, in starters equipped with EPROM version C.SSS.01.00 through C.SSS.01.02, when an open SCR fault occurred, the fault data returned from the starter did not identify the phase in which the fault occurred. Therefore, the message displayed by the OptiView Control Center was LCSSS – OPEN SCR. New version C.SSS.01.03 EPROM now supplied in the starter logic/trigger board, returns fault data that identifies the phase in which the open SCR condition is detected.

This flash memory card version interprets this fault data and displays a message that identifies the defective phase. Therefore, when this flash memory card version is used with a starter logic/trigger board equipped with version C.SSS.01.03 (and later) EPROM, LCSSS – PHASE X OPEN SCR (X is replaced by A, B or C as appropriate) is displayed when the fault occurs.

Start Inhibit Faults

The following start inhibit faults are no longer logged on the HISTORY screen. They will continue to be displayed on the system details line of the display and transferred to the E-Link Gateway.

LCSSS – PHASE X HEATSINK TEMPERATURE – STOPPED (X is replaced by A, B or C as appropriate)

Diagnostics Screen

The communications error counters now count up to 65535 (was 255).

SI0089 - SOFTWARE ENHANCEMENTS EFFECTIVE MAY 2004 (CONT'D)

Variable Speed Oil Pump

In previous fash memory card versions, the manual frequency could be changed only when the pump was running. The manual frequency can now be changed whether the pump is running or not.

Invalid System Details Messages

In previous flash memory card versions, certain operating conditions that could cause messages on the system details line of the display to become stuck. The most prevalent one was MOTOR – HIGH CURRENT LIMIT was corrected in this version.

History Data Storage

The data capture has been modified to ensure that all data is that which is valid at the instant of the event.

SOFTWARE ENHANCEMENTS EFFECTIVE MARCH 2005

GENERAL

Beginning March 2005, enhanced software will be supplied in new production YK chillers. It is backward compatible to all previous YK chillers. The enhancements are outlined below.

The versions and part numbers are:

Microboard (P/N 031-01730-000)

- NEMA 1-4 chillers
  C.MLM.01.14.111 (031-01797-001)
- CE chillers
  C.MLM.01.14.212 (031-01797-002)

Microboard (P/N 031-02430-000)

- NEMA 1-4 and CE chillers
  C.OPT.01.14.306 (031-02474-001)

STALL SENSOR VALIDATION

This feature verifies the operation of the stall pressure transducer (used for the variable geometry diffuser (VGD) operation) by comparing its voltage output to the voltage output of the condenser pressure transducer while the chiller is running. If the stall transducer is not reading within an acceptable range of the condenser transducer, WARNING – CONDENSER OR VGD SENSOR FAILURE is displayed and the VGD is driven to the open position until the warning is manually cleared.

EXTREME STALL MONITOR

To prevent VGD damage, the VGD is disabled during extreme stall conditions and a warning message is displayed. While the chiller is running, if the stall detector voltage (output of the stall detector board) exceeds twice the high limit setpoint, for the duration programmed as the extreme stall duration setpoint (10 to 20 minutes), the VGD is driven to the full open position and WARNING – CONDITIONS OVERRIDE VGD is displayed until the stall detector voltage returns to less than two times the high limit setpoint and the warning is manually cleared.

VGD INHIBIT SETPOINT

A new setpoint, PRV VGD Inhibit, was added to the VGD operation. This setpoint is programmable over the range of 40% to 100%; default 95%. While the pre-rotation vanes position is greater than this setpoint, the VGD is pulsed open according to the open pulse setpoint and PRV POSITION OVERRIDE is displayed as control status.

VGD LIMIT SWITCH

The status of the VGD limit switch is now displayed on the VGD and the VGD SETPOINTS screens. The limit wwitch is closed and displayed as CLOSED when the VGD is in the full closed position. Otherwise, it is displayed as OPEN.

MOTOR LUBRICATION NOTIFICATION

This feature provides an indication when the compressor motor lubrication is required. The notification is based on the OPERATING HOURS SINCE LAST MOTOR LUBRICATION. Up to three levels of notification are provided, each indicating an increasing level of urgency. WARNING – MOTOR BEARING LUBE SUGGESTED is displayed when the hours exceed 1000 hours. If there is no response, WARNING – MOTOR BEARING LUBE REQUIRED is displayed when the hours exceed 1200 hours. If there is still no response, a safety shutdown is performed when the hours exceed 1400 hours and MOTOR – LACK OF BEARING LUBRICATION is displayed. The operator enters his/her initials, name or user ID to provide a record of when a motor lubrication was performed and clear any motor lubrication warning or safety that is in effect.

SOFTWARE ENHANCEMENTS EFFECTIVE MARCH 2005 (CONT'D)

CONDENSER REFRIGERANT LEVEL CONTROL

In previous software versions, all control thresholds were programmable. In this version, some control thresholds are fixed while others are programmable, which provides more control in certain operating conditions. The control thresholds are applied in two different zones, as determined by the error relationship between the actual refrigerant level and the level setpoint as shown below. Zone 1 parameters are used when the error is less than 9%. Zone 2 parameters are used when the error is greater than 9%. When transitioning from Zone 2 to Zone 1, the error must be less than 9% for 60 seconds before the Zone 1 parameters are used. If the error is greater than 9%, the Zone 2 parameters are immediately implemented. The following are the control thresholds used for this control:

	Zone 1	**Zone 2**
Proportion Limit Open (fixed)	50%	52%
Proportion Limit Close (fixed)	45%	45%
Rate Limit (setpoint)	3%-15% default 7	3%-15% default 5
Period (setpoint) (seconds)	8-22 default 15	2.5-10 default 2.5

	Zone 1 and Zone 2
Level Setpoint	20% to 80% default 30%
Valve Preset Time (setpoint) (seconds)	0 to 100 default 50
Ramp Up Time (setpoint) (minutes)	3 to 15 default 8

COMPRESSOR PROTECTON FAULTS

The following compressor protection faults have been added.

MOTOR – CURRENT >15% FLA

In this version, the start inhibit is instantaneously invoked as soon as a greater than 15% FLA motor current is detected while the chiller is shutdown. Previously, it was not put into effect until the invalid motor current was present for at least 10 seconds.

VSD – FREQUENCY > 0HZ

This new start inhibit is set whenever the chiller is shutdown and a compressor motor VSD output rrequency of greater than 0Hz is detected.

VSD – LOW FREQUENCY DETECTED

This new safety shutdown is set whenever the chiller is running and the Compressor Motor VSD output frequency decreases to less than half speed (25Hz for 50Hz units; 30Hz for 60Hz units) after having reached that speed while starting.

STANDBY LUBRICATION

In low ambient temperature conditions, oil foaming when the pump is first turned on results in a sawtooth pressure ramp until it establishes a steady pressure. Although the pressure builds to 15 psid within seconds at pump turn on, a subsequent negative transition below 15 psid within the first 30 seconds is detected as a standby lube failure. In this software version, the low oil pressure threshold is not applied until after the first 30 seconds of oil pump operation, which allows sufficient time to establish steady pressure above 15 psid.

OPTISAVE KW METERING FEATURE

This feature provides customers currently employing a solid state starter or electromechanical starter with the means to determine their potential savings that would be realized by switching to a VSD

VARIABLE SPEED OIL PUMP (MANUAL CONTROL)

In previous software versions: The LOWER key causes a decrease in the command frequency by the manual increment amount, down to the manual increment Amount. In this version the LOWER key causes a decrease in the command frequency, by the manual increment amount, down to 25/30Hz.

SI0148 - SOFTWARE ENHANCEMENTS EFFECTIVE JUNE 2006

GENERAL

Beginning June 2006, enhanced software will be supplied in new production YK chillers. It is backward compatible to all previous YK chillers equipped with Microboard 031-02430-000 or 031-02430-001. The enhancements are outlined below.

The version and part number for microboards (P/NS 031-02430-000 and 031-02430-001) for both NEMA 1-4 and CE chillers is C.OPT.01.15.011 (031-02474-001).

MEDIUM VOLTAGE SOLID STATE STARTER

This software version is necessary for medium voltage solid state starter applications.

575V/60HZ VARIABLE SPEED DRIVE

This software version is necessary for 575V/60Hz VSD applications.

The following cycling shutdowns apply to 575V/60HZ VSD:

- VSD-PRECHARGE-LOW DC BUS VOLTAGE

  If the DC Link voltage does not reach at least 60 VDC (within 4 seconds) or at least 600 VDC (within 20 seconds) after the precharge command has been received, this shutdown is performed.

- VSD-PRECHARGE-DC BUS VOLTAGE IMBALANCE

  If the half DC link voltage does not remain within plus or minus 106 VDC of the DC link voltage divided by 2 during the pre-charge interval, this shutdown is performed.

- VSD-LOW DC BUS VOLTAGE

  If the DC Link Voltage falls below 600 VDC while running, this shutdown is performed.

- VSD-DC BUS VOLTAGE IMBALANCE

  If the half DC link Voltage does not remain within plus or minus 106 VDC of the DC Link Voltage divided by two while running, this shutdown is performed.

- VSD-HARMONIC FILTER-PRECHARGE-LOW DC BUS VOLTAGE

  If the DC link voltage does not reach at least 60 VDC (within 100 milliseconds) or at least 630 VDC (within five seconds) after the filter precharge command has been received, this shutdown is performed.

- VSD-HARMONIC FILTER-DC BUS VOLTAGE IMBALANCE

  If the half DC link Voltage does not remain within plus or minus 63 VDC of the DC Link Voltage divided by 2, this shutdown is performed.

The following safety shutdowns apply to 575V/60Hz VSD:

- VSD-HARMONIC FILTER-HIGH BASEPLATE TEMPERATURE

  If the Baseplate temperature rises above the following limits, this shutdown is performed:

  424HP – 70.0° F, 174.2°C

  608HP – 88.0° F, 190.4°C

- Microboard Applicability

  This software will operate in microboard (P/N 31-02430-000 or 031-02430-001). However, this version (or later versions) is required for microboard (P/N 031-02430-001).

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SI0158 - SOFTWARE ENHANCEMENTS EFFECTIVE OCTOBER 2006

GENERAL

Beginning October 2006, enhanced software will be supplied in new production YK chillers. It is backward compatible to all previous YK chillers equipped with microboard (P/N 031-02430-000 or 031-02430-0001). The enhancements are outlined below.

The version and part number for both NEMA 1-4 and CE chillers is C.OPT.01.15A.307 (031-02474-001).

LANGUAGES

Version C.OPT.01.15.011 was released as English only. This version allows display in English, Chinese Traditional, Chinese Simplified, French, Spanish, Italian, German or Hungarian.

SI0164 - SOFTWARE ENHANCEMENTS EFFECTIVE APRIL 2007

GENERAL

Beginning April 2007, enhanced software will be supplied in new production YK chillers and replacement Microboard kit 331-02430-601. This software is backward compatible to all previous YK chillers equipped with microboard (P/N 031-02430-000 or 031-02430-001). The enhancements are listed below.

The version and part number for both NEMA 1-4 and CE chillers is C.OPT.01.16.xxx (031-02474-001).

SELECTABLE COASTDOWN TIME SETPOINT

To ensure bearing lubrication until the compressor motor stops rotating at chiller shutdown, the oil pump runs for the duration of the coastdown period. Larger motors require a longer coastdown time than the standard 150 seconds. Therefore, when STANDARD is selected for the coastdown setpoint on the SETUP screen, new setpoint coastdown time allows the service technician (in SERVICE access level) to enter a coastdown time appropriate for the motor applied. The time is programmable over a range based on the selection made for the chiller style/compressor setpoint on the OPERATIONS screen.

- For Style F/J7 and G/K6-K7, the range is 240 (Default) to 900 seconds.
- For all others, the range is 150 (default) to 900 seconds.

CHILLED AND CONDENSER WATER – FLOW SWITCH SHUTDOWNS

To prevent nuisance flow switch shutdowns due to momentary flow interruption or rapid water temperature changes that can affect Thermal Flow Sensors, the following extended flow switch delays are implemented for both Analog and Digital flow sensor selections.

Leaving Chilled Liquid – Flow Switch Open – The chilled water flow switch has remained open for five continuous seconds (two continuous seconds with software version C.OPT.01.15A.xxx (and earlier)) while the chiller is running or failed to close during the prelube period. The chiller will automatically restart when the flow switch closes.

Condenser – Flow Switch Open – The condenser flow switch has remained open for 30 continuous seconds (two continuous seconds with software version C.OPT.01.15A.xxx (and earlier)) while the chiller is running. This check is bypassed for the first 30 seconds of system run.

CURRENT IMBALANCE MESSAGES

The safety shutdown messages MOTOR OR STARTER – CURRENT IMBALANCE and LCSSS – OUTPUT CURRENT IMBALANCE have been combined into one message MOTOR OR STARTER – OUTPUT CURRENT IMBALANCE for both VSDs and Style B solid state starter chillers.

NEW TREND/CUSTOM VIEW SLOT NUMBERS

The following slot numbers were added:

2849 ACC Surge Count
2850 ACC Surge Type
2857 ACC Surge Point Count
2858 ACC Surge Delta P/P
2859 ACC Surge Output Frequency
2860 ACC Surge PRV Position

TREND SCALING ERROR CORRECTION

In previous software versions, the software automatically rescaled the Y-Axis range (on certain parameters) after the operator had selected the range, which could result in reducing the overall range. The Y-Axis is now scaled to accommodate the highest value selected.

VARIABLE SPEED DRIVE – INVALID CURRENT LIMIT MESSAGE

In previous software versions, when operating at less than full speed (60Hz/50Hz) and pressing the FIXED key on the VSD TUNING screen, the message MOTOR – HIGH CURRENT LIMIT was displayed until the drive reached full speed. While this message was displayed, the PRVs are inhibited from opening.

In this version, LOAD CONTROL MODE is displayed instead of MOTOR – HIGH CURRENT LIMIT under this condition.

SI0164 - SOFTWARE ENHANCEMENTS EFFECTIVE APRIL 2007 (CONT'D)

The compressor motor VSD has not yet reached full speed after having been commanded to do so in manual speed control. While this is displayed, the Pre-rotation Vanes are inhibited from further opening.

NEW CHILLER STYLE/COMPRESSOR SELECTIONS

The existing selections are changed as follows:

Existing	Change to
Style F/J, H3 compr	Style F/J1-J5H3 compr
Style F/PQH9 compr	Style F and G/PQH9 compr

The following new selections were added on the OPERATIONS screen:

- Style F/J7 compressor
- Style G/K1-K4 compressor
- Style G/K6-K7 compressor

Functionally, these new selections are the same as Style F/J1-J5H3 and are as follows:

- Proximity Sense = Probe
- Oil Heater Output = TB1-64
- Level Control Period = 3.5 seconds
- Flow Switch = Programmable (analog or digital)
- Variable Speed Drive Oil Pump “Pressure setpoint not achieved” = 35 psid

MOTOR LUBRICATION WARNINGS AND SHUTDOWN

This software version adds the auto lube and shutdown setpoints on the MOTOR screen. Chillers that are equipped with automatic motor lubrication hardware do not require manual lubrication and do not require the motor lubrication warnings (reminders) or the warning safety shutdown. Therefore, when the automatic lubrication hardware is present, the auto lube setpoint must be enabled. With this setting, no lubrication warnings or shutdown will occur.

If the auto lube setpoint is disabled, as it should be when not equipped with the automatic motor lubrication hardware, the motor lubrication warnings and shutdown will occur at the associated elapsed run times. With this setting, the shutdown setpoint is used to enable or disable the safety shutdown that occurs at the required lube period. The shutdown can be enabled or disabled per the customer's preference. If disabled, a warning will be displayed but the safety shutdown will not occur.

E-LINK GATEWAY - MOTOR LUBRICATION WARNING CODE CORRECTION

Previous software versions send an incorrect warning code to the E-Link Gateway for the warning MOTOR – BEARING LUBE SUGGESTED, which sends a Code 5: CONDENSER – HIGH PRESSURE LIMIT. This error was corrected in this software version. The new codes sent to the E-Link Gateway are:

- MOTOR-BEARING LUBE SUGGESTED

  Warning Code 36
- MOTOR-BEARING LUBE REQUIRED

  Warning Code 37
- MOTOR-LACK OF BEARING LUBRICATION

  Warning Code 38

MEDIUM VOLTAGE VARIABLE SPEED DRIVE

When used with microboard (P/N 031-02430-001), this software supports the Medium Voltage Variable Speed Drive (MV VSD). Refer to *Operator Manual (Form 160.00-O6)* and *Medium Voltage Variable Speed Drive – Service (Form 160.00-M6)* for this product.

Since the MV VSD does not save snapshot data when faulting, history reports do not include snapshot data of shutdowns. Report contains only motor run state, PRV position and MV VSD fault code.

SI0164 - SOFTWARE ENHANCEMENTS EFFECTIVE APRIL 2007 (CONT'D)

MOTOR COMMUNICATIONS PROTOCOL SETPOINT

On new production chillers before March 2007, the VSD Adaptive Capacity Control (ACC) board communicates with the microboard COM5 serial port using YORK protocol. After this date, on new production chillers, the ACC functionality is contained in the microboard and the ACC board is not present. On these chillers, the VSD logic board communicates directly with the microboard COM2 serial port using Modbus protocol. To allow this software to accommodate new production chillers and earlier chillers, this software allows selection of either YORK or Modbus protocol when VSD-50Hz/VSD-60Hz is selected for the motor drive type setpoint. When used with Modbus protocol, microboard (P/N 031-02430-001) is required (reference SI0155). The protocol selection enables the appropriate serial communication port:

- YORK enables COM5
- Modbus enables COM2.

The hardware present determines which protocol should be selected (reference SI0155): If the ACC board is used, select YORK. Otherwise, select Modbus.

With Modbus protocol, the device that the microboard serially communicates with is assigned an address. On VSD applications, this device is the VSD logic board. Whenever the microboard is reading or writing to this board, it transmits this address. If the transmitted address matches the address assigned, the logic board responds. Otherwise, it ignores the command/request. The address assigned to the VSD logic board is 1, which is done by the positioning the VSD logic board Modbus address switch SW3 Position 1 to ON and setting the Motor Node ID setpoint to 1. If these two values are not set to the same number, the VSD logic board will not communicate with the microboard.

NEW SETPOINTS

The following new setpoints are programmed on the SETUP Screen.

Motor Communications Protocol

Access Level Required: SERVICE

Only displayed when VSD-60Hz or VSD-50Hz is selected for motor drive type setpoint, which allows the service technician to enable the appropriate serial communications port for communications to the VSD. Entered as YORK to enable COM5 (J15) or Modbus to enable COM2 (J13). Selection is based on hardware and interface. If ACC board is used, select YORK. Otherwise, select Modbus. Microboard (P/N 031-02430-001) must be equipped with 128KB BRAM (P/N 031-02565-000) to select Modbus. Chiller must be stopped with the start-run-stop switch in the stopped position to change this setpoint.

Motor Node ID

Access Level Required: SERVICE

Only displayed when Modbus is selected for the motor communications protocol setpoint above, which Allows the service technician to enter the Modbus address of the VSD logicboard. Must be set to 1. The VSD Logic board Modbus address switch SW3 must also be set to 1. Chiller must be stopped with the start-run-stop switch in the stopped position to change this setpoint.

The following screens are affected by this new protocol selection:

- COMMS screen.

  When MODBUS COMMS are selected, the COM2 SETUP key on the COMMS screen is not displayed.

- MODBUS DIAGNOSTICS Screen.

  When Modbus Protocol is selected, the VSD COMMS screen is replaced by the DIAGNOSTICS VSD (Modbus) Screen. A RESET COUNTERS key is present allowing the error counters to be reset to zero. This screen displays the following Modbus communications error counters:

  Panel to VSD

  VSD to Panel

  FTR to VSD (if IEE 519 filter present and enabled)

FORM 160.54-M1
ISSUE DATE: 10/25/2019

SI0186 - SOFTWARE ENHANCEMENTS EFFECTIVE OCTOBER 2006

GENERAL

Beginning March 2008, enhanced software will be supplied in new production YK chillers and replacement microboard kit (P/N 331-02430-601). This software is backward compatible to all previous YK chillers equipped with microboard (P/N 031-02430-000 or 031-02430-001). The enhancements are listed below. The version and program card part number for both NEMA 1-4 and CE chillers is C.OPT.01.18.307 (P/N 031-02474-001).

LIQUID COOLED SOLID STATE STARTER – MOTOR COMMUNICATIONS PROTOCOL SETPOINT

This software supports both YORK and Modbus protocol versions of the serial communications between the microboard and the solid state starter logic/trigger board. Although this software version supports both protocols, the logic/trigger board will not be converted to Modbus capability until later in mid 2008.

In new production chillers before mid 2008, Microboard COM 5 port (J15) communicates with the LCSSS logic/trigger board (P/N 031-02001 or 031-02505) (TB2) using YORK protocol. In new production chillers beginning mid 2008, the microboard RS-485 COM 2 port (J13) will communicate with the Logic/Trigger Board (P/N 031-02505) (J14) using Modbus protocol.

The protocol and motor drive type selection is made on the SETUP screen, using SERVICE access level. When SSS-MOD B is selected as the motor drive type setpoint, the motor communications protocol setpoint is used to select either YORK or Modbus protocol, as appropriate. The appropriate selection depends on the actual hardware/interface that is present. As a guide, the starter logic/trigger board is not scheduled to be converted to Modbus capability in new production chillers until mid 2008. A service information letter will be issued at that time defining the hardware/interface/setup requirements for Modbus protocol.

OIL PRESSURE SAFETY – R22 APPLICATIONS

When the refrigerant selection (Microboard SW1-1) is set to R-22 and the oil pump package (SETUP Screen) is set to VARIABLE SPEED, the OIL-VARIABLE SPEED PUMP-SETPOINT NOT ACHIEVED safety shutdown is not performed.

MEDIUM VOLTAGE VSD

Supported applications include 11KV, 12.47KV and 13.8KV.

Oil-Low Temperature Differential Cycling Shutdown

When the chiller has been shutdown for less than 30 minutes, a restart should be allowed when the oil temperature minus the condenser saturation temperature is greater than 30°F. In the previous software version, this threshold was erroneously set to 40°F.

Leaving Chilled Liquid-Low Temperature Shutdown Offset

The low temperature shutdown threshold is programmed as an offset below the LCLT setpoint using the shutdown setpoint. In previous software versions, this value was displayed as OFFSET on the upper right area of the EVAPORATOR screen. It did not always accurately reflect the actual offset being used by the software.

In this version, OFFSET will be replaced with EFFECTIVE OFFSET, and will automatically change to reflect the actual offset being used. Usually, the offset used is the same as the value programmed for the shutdown setpoint. However, the offset being used will automatically change, based on the values programmed for the LCTC setpoint and the shutdown setpoint, to prevent the leaving chilled liquid temperature from going below the minimum allowed value:

- 36°F (water)
- 34°F (water with smart freeze enabled)
- 6°F (brine).

For example, if it is set to 45°F (water) and the shutdown setpoint is set to 4°F, the effective offset is displayed as 4°F. If the Leaving setpoint is lowered to 38°F, the effective offset will change to 2°F. If the leaving chilled setpoint is raised back to 45°F, the effective offset will revert back to the shutdown setpoint.

ANALOG REMOTE SETPOINTS FILTERING

This software version provides filtering on the Analog Leaving Chilled Liquid Temperature setpoint and the Current Limit setpoint inputs. This stabilizes these remote setpoint values under noisy conditions and when the inputs are unstable.

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REMOTE RESET TEMPERATURE RANGE SETPOINT

In previous software versions, this setpoint could be set to 10°F or 20°F. In this version it can be set to 10°F, 20°F, 30°F, or 40°F.

SI0201 - SOFTWARE ENHANCEMENTS (VER 19) EFFECTIVE OCTOBER 2008

GENERAL

Beginning October 2008, enhanced software will be supplied in new production YK chillers and replacement Microboard kit 331-02430-601. This software is backward compatible to all previous chillers equipped with Microboard 031-02430-000 or 031-02430-001. The enhancements are listed below.

The version and program card part number for NEMA 1-4 and CE chillers is C.OPT.01.19.307 (P/N 031-02474-001).

ACC AND SURGE DETECTION DISPLAY ENHANCEMENTS

With the integration of the Variable Speed Drive Adaptive Capacity Control (ACC) function into the microboard (in software version C.OPT.01.16.307), it is necessary to add screens and LED indicators and additional parameters to certain screens to compensate for the loss of ACC Board indicators.

The parameters displayed on the following screens now vary according to the selection made for the Motor Communications Protocol setpoint on the SETUP Screen. It is set to either YORK or Modbus, as determined by the existing hardware/interface. The correct selection must be made in order for the microboard to communicate with the drive, as explained below. Service technicians should refer to this manual to determine existing hardware/interface configuration.

In new production chillers before March 2007, the microboard communicates with the VSD Logic Board via the ACC board using YORK protocol serial communications. In this configuration, the ACC function is performed by the ACC Board. The Motor Communications Protocol setpoint must be set to YORK in this configuration. This configuration is referred to below as “YORK Protocol configuration”. After this date, the microboard communicates directly with the VSD Logic Board using Modbus protocol serial communications and the ACC Board is not present. In this configuration, the ACC function is performed by the microboard. The Motor Communications Protocol setpoint must be set to Modbus in this configuration. This configuration is referred to below as “Modbus Protocol configuration”. All MV VSD applications use Modbus protocol. Due to service parts replacement, early production chillers could be in the Modbus configuration.

With the integration of the ACC function into the microboard, there are now two Surge Detection features. Although they use the same detection logic, each has its own Sensitivity setpoint and each one performs detection based on the starter type as follows:.

1. The existing Surge Protection feature detects surges for Surge Avoidance and hot gas bypass and uses the Surge Sensitivity setpoint on the SURGE PROTECTION Screen. If equipped with a Solid State Starter or Electromechanical Starter, this feature detects all surges. If equipped with a VSD (in YORK or Modbus Protocol configuration) or MV VSD, it only detects those surges that occur while the drive is running at maximum frequency. The surge avoidance surge count increments each time a surge is detected by the Surge Protection feature.
2. The ACC function in the microboard (in Modbus Protocol configuration) uses the Sensitivity setpoint on the ACC DETAILS Screen and detects only those surges that occur while the VSD or MV VSD is running at less than maximum frequency. When these surges are detected, the ACC Surge Count is incremented. This surge detection is used to determine if the VSD can reduce speed.

VSD Tuning Screen

This screen is now as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 24*. The following data boxes are added:

- **% Full Load Amps –** Displays the motor current as a percentage of chiller full load amps as calculated by the microboard from current values returned from the drive Logic Board.
- **Command Frequency –** In Modbus Protocol configuration, this is the speed command being sent to the Drive Logic Board in either Auto or Manual Speed Control Mode. In YORK Protocol configuration, it is only displayed in Manual Speed Control Mode and it is the speed command being sent from the microboard to the ACC Board in Manual Speed Control Mode.

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The INCR AMOUNT key was renamed MANUAL INCREMENT. This key now only applies to MANUAL SPEED CONTROL MODE. It defines the amount by which the manual raise and lower commands will change the command frequency to the VSD in manual speed control mode.

Adaptive Capacity Control Details Screen (Modbus Configuration)

This screen is shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 36* shows this screen in Modbus protocol configuration. The following data boxes are added: ®

- **Temperature Differential (LCHLT – Setpoint)** – Displays the difference between the LCLT and the Leaving Chilled Liquid Temperature setpoint.
- **Command Frequency –** Displays the speed command being sent to the drive logic board in either auto or manual speed control mode.
- **Surge Map Point Count –** Displays the total number of data points contained in the surge map.
- **ACC Surge Count –** Increments when a surge is detected while the drive is running at less than maximum frequency.

The following LED indicators are added:

- **Speed Decrease Inhibit – Surge Map Point –** Illuminates when the ACC function in the microboard is unable to reduce speed due to a mapped surge point. Otherwise, it is extinguished.
- **Mapping Inhibited –** Illuminates while the ACC function in the microboard is not allowed to map (i.e., not allowed to slow down as well) points due to unstable leaving chilled liquid temperature, manual speed control or current limit (chiller FLA only). Otherwise, it is extinguished. The logic to control this is the same as used for the VPT LED (CR8) on the ACC board.
- **ACC Surge Detected –** Illuminates momentarily when a surge is detected by the ACC function in the microboard, while the drive is running at less than maximum frequency.
- **Surge Avoidance Surge Detected –** Illuminates momentarily when a surge is detected by the Surge Protection feature. This feature only detects surges that occur while the drive is running at maximum frequency.

Adaptive Capacity Control Details Screen (YORK Protocol)

The following Setpoint keys are removed from this screen:

- Local Motor Current Limit
- Pulldown Demand Limit
- Pulldown Demand Time

The SURGE MAP navigation key has been added. This key will move to the subscreen that displays the surge map. Only appears at SERVICE (or higher) access level.

The Manual Surge Point Key

When this key is pressed, a dialog box appears that asks for a password. Once password 0 3 6 8 has been entered and the ENTER key has been pressed, the present operating condition is logged into the surge map as a valid surge point. The chiller must be running to enter the point.

This screen is shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 35,* the ACC DETAILS Screen in YORK Protocol configuration. The following data boxes are added:

- **Temperature Differential (LCHLT – Setpoint)** – Displays the difference between the Leaving Chilled Liquid Temperature and the Leaving Chilled Liquid Temperature setpoint.
- **Command Frequency –** It is only displayed in Manual Speed Control Mode and it is the speed command being sent from the microboard to the ACC Board in Manual Speed Control Mode.
- **ACC Surge Count –** Count is provided by the ACC Board and it increments when any surge is detected by the ACC Board, whether running at maximum or less than maximum frequency.

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The following setpoint keys are removed from this screen:

- Local Motor Current Limit
- Pulldown Demand Limit
- Pulldown Demand Time

Surge Map Screen

When in Modbus protocol configuration, a SURGE MAP screen displays the surge map in a table or list form when the MAP VIEW key is selected on the SURGE MAP screen.

With the MAP VIEW set to TABLE, as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 37*, the map is shown graphically. The X-Axis is Delta P/P and the Y-Axis is PRV position. Each VSD frequency point is represented by an *X* in the table. The present operating conditions are indicated with an asterisk (*) and are detailed at the bottom of the screen under PRESENT, as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 37*. If the present condition is the same as a mapped point, the * will be replaced by an *O*. To view the details of any mapped point, position the green box (□) over the desired *X* using the keypad arrow (▲▼◄►) keys. The VSD output frequency, Pre-rotation vanes position and selected point's Delta P/P is displayed at the bottom of the screen under SELECTED. The default position for the □ is in the upper left corner of the view window. Once moved, it will remain at the last position. The speed decrease inhibit-surge map point LED, Mapping inhibited LED and ACC surge detected LED are also on this screen. They function the same as the duplicate LEDs on the ACC DETAILS screen.

With the MAP VIEW set to LIST, as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 38*, the Delta P/P, PRV Position and VSD output frequency of each mapped point are listed in rows. This is the same report that is generated when the surge map is sent to a printer. Therefore, this view cannot be selected while a print is in process. The PAGE UP and PAGE DOWN keys are used to scroll to the previous or next listing.

Hot gas bypass Screen

The hot gas bypass control mode data box on this screen now displays minimum load, VSD or VGD, based on the actual override in effect. Previously, OVERRIDE was displayed as a general message for any of these conditions. See *Override Hot gas bypass Override on page 225*.

In previous software versions, when the drive was running less than full speed, normal hot gas operation, including the minimum load operation was overridden and the Hot gas bypass Valve was driven to the fully closed position. In this version, the Minimum Load function is allowed to operate even when the VSD is at less than full speed. The Minimum Load function opens the hot gas bypass valve to the maximum allowed by the maximum open setpoint (25% to 100%) when the LCLT decreases to less than the minimum load setpoint, programmed as an offset below the LCLT setpoint.

The surge detected LED is replaced by a surge avoidance surge detected LED. It illuminates momentarily when a surge is detected by the surge protection feature. If equipped with a VSD (YORK or Modbus protocol configuration) or MV VSD, this feature only detects surges that occur while the drive is running at maximum frequency.

An ACC surge detected LED was added to this screen when in Modbus protocol configuration. It illuminates momentarily when a surge is detected by the ACC function in the microboard while the drive is running at less than maximum frequency.

The surge avoidance surge count is the total surges accumulated by the surge protection feature. If the unit is equipped with a liquid cooled solid state or electromechanical starter, it is the total surges detected. If equipped with a VSD (YORK or Modbus protocol configuration) or MV VSD, it is only the surges detected while the drive is running at maximum frequency.

OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 36 shows this screen in Modbus protocol configuration.

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Surge Protection Screen

The CLEAR SURGE COUNT key was removed in the previous software version, but it was re-instated in this version. This key clears the surge avoidance surge count of the surge protection feature using an ADMIN password. If equipped with a liquid cooled solid state or electromechanical starter, these are the total surges detected. If equipped with a VSD (YORK or Modbus Protocol configuration) or MV VSD, these are the total surges detected while the drive was running at maximum frequency.

The surge detected LED is replaced by a surge avoidance surge detected LED. It illuminates momentarily when a surge is detected by the surge protection feature. If equipped with a VSD (YORK or Modbus protocol configuration) or MV VSD, this feature only detects surges that occur while the drive is running at maximum frequency..

An ACC surge detected LED was added to this screen when in Modbus protocol configuration as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 36*. It illuminates momentarily when a surge is detected by the ACC function in the microboard while the drive is running at less than maximum frequency.

The surge avoidance surge count is the total surges accumulated by the surge protection feature. If the unit is equipped with a liquid cooled solid state or electromechanical starter, it is the total surges detected. If equipped with a VSD (YORK or Modbus protocol configuration) or MV VSD, it is only the surges detected while the drive is running at maximum frequency.

The SURGE SENSITIVITY key allows the service technician to adjust the sensitivity of the surge detection of the surge protection feature (Surge Avoidance Surge Detection). Programmable over the range of 0.3 (default) to 1.3. Smaller values increase the sensitivity. If equipped with a liquid cooled solid state or electromechanical starter, these are the total surges detected by this feature. If equipped with a VSD (YORK or Modbus protocol configuration) or MV VSD, these are the surges that are detected while the drive is running at maximum frequency.

Trending

In previous software versions, the evaporator and condenser small temperature difference were both labeled small temperature difference. In this version, they are labeled as evaporator small temperature difference and condenser small temperature difference.

There are a maximum of 20 divisions on the Y-Axis, regardless of access level. In previous software versions, there were a maximum of 23 in service mode, and sometimes 20 divisions in view mode.

Italian Language Corrections

The Italian translations of the following messages were corrected in this software version:

- Condenser-Pressure Transducer Out of Range
- VSD-Low Converter Heat sink Temperature
- Control Panel-Power Failure
- Refrigerant Level Control Screen-Set Zone
- Setup Screen-Change Settings
- History Screen Vane Motor Switch Open
- Slots Screen Small Temperature Difference
- History Screen-Leaving Chilled Liquid – Flow Switch Open

ACC Corrections/Enhancements

Frequency Command - In previous software versions, there were certain conditions (such as current limit) under which an incorrect frequency command was sent to the VSD, which was corrected in this version.

Frequency Command Increase - To ensure that VSD or MV VSD frequency increases do not cause excessive motor current resulting in overload shutdowns, frequency increase limitations were imposed based upon how close the actual motor current is to the chiller full load amps.

In automatic frequency control mode, anytime the microboard ACC function increases the VSD or MV VSD output frequency, the frequency increase is limited by the motor current as follows:

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- When motor current less than or equal to 80% FLA - No Limiting
- When motor current more than 80% FLA and less than or equal to 98% FLA - Increase 0.1Hz every {2 + (% FLA - 80)} seconds
- When motor current more than 98% FLA - Increase 0.1Hz every 20 seconds

Although the incremental frequency increases can be less than allowed, they will never be greater than allowed. These limitations also apply to the frequency ramp that occurs at chiller start while ramping from start frequency 30Hz (60Hz applications) or 25Hz (50Hz applications) to maximum frequency. These limitations are not imposed in manual frequency Control.

Surge Detection and Reaction During Chiller Start - The surge detection and reaction routine is now disabled until five seconds after the start frequency (25Hz for 50Hz applications/30Hz for 60Hz applications) is achieved, which prevents false or transient surge conditions from being logged or reacted to.

Extended Condenser Temperature Range

Certain applications must operate at higher condenser temperatures. The maximum allowable condenser temperature is increased from 116°F to 128°F. The resulting higher operating pressures require higher warning and safety shutdown thresholds than are in previous software versions.

To use this software in the standard and the higher temperature applications, a condenser temperature range setpoint was added to the SETUP screen as shown in *OptiView Control Panel – Operation (Form 160.54-O1) FIGURE 44* to allow selection of standard (default) or extended, which is set at the factory and requires an ADMIN password to change it. It is only visible when set to extended.

When set to standard, the following warning and safety shutdown thresholds are unchanged. When set to extended, they are as follows:

- **Warning – High Pressure Limit –** Maximum allowable value is 193.0 psig, with no change to the default value.
- **Condenser – High Pressure –** Trip/Reset threshold is 200/140 psig.
- **Condenser – High Pressure – Stopped –** Trip/Reset threshold is 170 psig.

To accommodate the higher temperatures, these chillers will be equipped with a different High Pressure Cutout Switch (HPCO) that can be set to trip at a higher pressure.

VGD Setpoint Defaulting Correction

In previous software versions, the PRV-VGD inhibit setpoint (40% to 100%) would reset to its default value (95%) upon power-up following a power failure. This software version correctly maintains the last programmed value.

Refrigerant Level Control

The level control setpoint default was changed from 30% to 50%.

Trend Setup Screen

This software version fixed a problem that prevents the Y-Axis maximum allowed display values in all six data points to be set in metric mode.

Program card Downloading

Although the procedure has not changed, the program downloading was modified to reduce the download time.

Medium Voltage Variable Speed Drive – Variable Maximum Values

The following MVVSD variables are now allowed to be a maximum value of 65,535:

- MVVSD Bus Voltage
- MVVSD Output Current (3 phases)
- MVVSD Input Voltage
- MVVSD Output Voltage

SI0210 - SOFTWARE ENHANCEMENTS (VER 20) EFFECTIVE JUNE 2009

GENERAL

Beginning June 2009, enhanced software will be supplied in new production YK chillers and replacement microboard kit (P/N 331-02430-601). This software is backward compatible to all previous chillers equipped with microboard 031-02430-000 or (P/N 031-02430-001). The enhancements are listed below.

The software version and Program card part number is C.OPT.01.20.307 (P/N 031-02474-001).

MEDIUM VOLTAGE VARIABLE SPEED DRIVE

The following new features were added.

New Data Values

The following new values are read from the MV VSD:

- Programmed Maximum Drive Output Frequency
- Programmed Motor Power Rating

Mobus Address	Name	Scale
40033	Rated Output Voltage	x10
40034	Rated Output KW	x10
40058	Rated Output Frequency (History Data)	x10
40059	Rated Output KW(History Data)	x10

MV VSD Model

The MV VSD model is displayed on the MV VSD DRIVE screen in the data box labeled MV VSD model as a number representing the horsepower rating followed by HP (i.e.; 1500HP). The model number is derived from the Motor Rated Voltage (Modbus Address 40012) and the programmed drive current (Modbus Address 40013) according to the following table. If this results in a model that is not defined in the lookup table, the model number is displayed as INVALID and the chiller will not be allowed to run while this is displayed.

MOTOR RATED VOLTAGE (V)				
		2300 V	**3300 V**	**4160 V**
MODEL IN HP	500	107 A	78 A	62 A
	600	129 A	93 A	74 A
	700	157 A	110 A	87 A
	800	172 A	124 A	99 A
	900	202 A	141 A	112 A
	1000	224 A	156 A	125 A
	1250	280 A	195 A	155 A
	1500	336 A	235 A	186 A
	1750	392 A	274 A	217 A
	2000	438 A	312 A	248 A
	2250	494 A	345 A	274 A
	2500	561 A	391 A	310 A
Max. Job/Rated 100% FLA (A) (Programmed Drive Current)				

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Full Load Amps Setpoint (Maximum Value)

The maximum allowed programmable value of the full load amps setpoint on the MV VSD screen is now set to the programmed drive current (Modbus Address 40013) value received from the MV VSD. In previous software versions, it was derived from a lookup table based on the motor rated voltage and MV VSD model.

Motor Voltage Rating

On the MV VSD screen, the Voltage Rating display has been changed to read Motor Voltage Rating. Displayed in volts, as received from the MV VSD. If any invalid Motor Voltage Rating is received from the MV VSD, INVALID is displayed and the chiller will not be allowed to run while this is displayed.

Output Frequency Rating

A new data box is added to the MV VSD screen labeled output frequency rating. The rated output frequency (Modbus Address 40033), as received from the MV VSD, is displayed here. This value is the maximum drive frequency (Hz) when it receives a 100% speed command from the OptiView Control Center. If the value received is not 50 Hz or 60 Hz, INVALID is displayed. If this is the case, then the motor voltage rating (above) determines the maximum frequency as follows:

Motor Voltage Rating	Output Frequency Rating
2300 V or 4160 V	60 Hz
3300 V	50 Hz

Toll Free Phone Number

The label for the toll free number was changed from YORK International North American Toll Free Number to Johnson Controls North America Parts Center.

Japanese Language

Japanese was added to the selection of languages.

Variable Speed Drive Low Frequency Fault

In previous software versions, the VSD – LOW FREQUENCY DETECTED safety fault occurs when the VSD frequency is below 1Hz less than the minimum allowed running frequency after having reached the minimum frequency.

In this software version, the requirement to reach the minimum frequency before the fault can be detected, has been eliminated. Also, 20 and 25 second timers were added to the requirement. After a 20 second bypass after entering system run, the frequency must be 1Hz less than the minimum frequency for 25 consecutive seconds before the fault will shutdown the chiller”.

SI0212 - SOFTWARE ENHANCEMENTS (VER 21) EFFECTIVE JUNE 2009

GENERAL

Beginning August 2009, enhanced software will be supplied in new production YK chillers and replacement microboard kit (P/N 331-02430-601). This software is backward compatible to all previous chillers equipped with microboard (P/N 031-02430-000) or (031-02430-001. The enhancements are listed below.

The version and program card part number is C.OPT.01.21-307 (031-02474-001).

LARGE TONNAGE CHILLER I/O Board

This software version supports the new LTC I/O Board (P/N 031-02895-000/001). This board communicates with the microboard COM3 serial port (J12-2/3) using RS-485 Modbus protocol communications. This board is used for HOT GAS bypass, HEAT RECOVERY and HEAD PRESSURE CONTROL screen options. It interfaces the microboard to the components used for these options. A new diagnostics screen was created from the diagnostics screen to support this board.

OPTISAVE 2 KW INPUT

The Optisave 2 KW input (4 to 20mA) will now be wired to the LTC I/O Board (TB9-1/2), if present.

PRE-ROTATION VANES POSITION POTENTIOMETER

Previously, only those chillers equipped with VSD, hot gas bypass or VGD were equipped with a PRV position potentiometer. All new chillers will be equipped with a PRV potentiometer, regardless of other options.

To allow this software to be backward compatible to all previous chillers not equipped with a PRV potentiometer or the options listed above, a new key labeled PRV POSITION was added to the SETUP screen, which allows the PRV potentiometer input to be enabled or disabled.

If equipped with any of the above options, this setpoint is automatically set to enabled, and cannot be changed. If not equipped with any of the above options nor with a PRV potentiometer, this should be set disabled. If not equipped with any of the above options but factory equipped with a PRV potentiometer, the software reads the potentiometer input at microboard input J7-10.

VSD ADAPTIVE CAPACITY CONTROL ENHANCEMENTS

The following enhancements were added.

ACC Details Screen - New Setpoints

New setpoint were added as follows:

- **VSD Start Frequency –** Allows the service technician to set the starting frequency from which the ramp-up will begin. Only shown Modbus protocol configuration. GPIC object AV36. Programmable over the following range:
    a. 60Hz units – 30Hz to 60Hz (default 45Hz)
    b. 60Hz units with Quick Restart – 30Hz to 45Hz (default 45Hz)
    c. 50Hz units – 25Hz to 50Hz (default 37.5Hz)
    d. 50Hz units with Quick Restart – 25Hz to 37.5Hz (default 37.5Hz)
- **ACC Mapping Enable –** Allows the service technician to set the Delta T (LCLT setpoint) needed to be met to enable surge mapping and speed reduction initially on startup. Only shown in Modbus protocol configuration. Programmable over the range of 0.5°F to 4.0°F (default 1.0°F). GPIC object AV37.
- **Surge Sensitivity –** This key is now only shown in Modbus protocol configuration.

ACC Surge Mapping

In Modbus Protocol configuration, ACC surge mapping is now inhibited during soft shutdowns.

ACC Current Limiting

In this software version, when in Modbus protocol configuration, if the motor current is greater than or equal to 101 % FLA, the VSD speed command is decreased 0.1Hz every 3.0 seconds until the motor current is less than 101 %FLA. The surge map takes priority over current limiting. Thus, if there is a mapped surge point in the present sector, ACC current limiting shall not be allowed to decrease the frequency below the mapped point.

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In previous software versions, the initial ramp is complete when either of the following conditions occur:

- Delta T less than ACC Mapping Enabled
- VSD Speed Command Equals Maximum

In this version, the initial ramp will be complete when any of the following occur:

- Delta T Less Than ACC Mapping Enable
- VSD Speed Command Equals Maximum
- Motor Current Greater than or Equal to 100 % FLA

Stability Limit

The STABILITY LIMIT PROGRAMMING button was removed from the ACC DETAILS screen in a previous software version. The stability limit default and maximum values are set to 7000. If a new version of software was installed in a chiller with stability limit set below 7000, the old value would be retained. The only way to clear it would be to clear the BRAM. To prevent this from happening, this value is no longer programmable. It is now always set to 7000.

Surge During Initial Ramp

In previous software versions, if two surges are detected during the initial ramp (ramp towards maximum frequency after reaching start frequency), the command frequency is set to the maximum frequency regardless of motor current, which can result in motor current rising sharply and forcing vanes to have to close hard and even possibly trip on high current or overload.

In this software version, for every two surges that are detected during the initial ramp, increase the command frequency (no higher than the maximum frequency) by the amount listed in the following table. After increasing the command frequency, the initial ramp surge count is reset so it can react to another two surges and the initial ramp shall be continued. This logic shall be in effect during the entire initial ramp and take action as many times as necessary.

FREQUENCY COMMAND INCREASE	MOTOR CURRENT
1.0 Hz	More than 90 %FLA
1.5 Hz	More than 75 %FLA
2.0 Hz	More than 60 %FLA
4.0 Hz	Less than or equal to 60 %FLA

VSD High Instantaneous Current Fault

In previous software versions, the VSD-HIGH PHASE X INSTANTANEOUS CURRENT fault (VSD) and VSD-HIGH INSTANEOUS CURRENT fault (MV-VSD) are a cycling shutdown. In this version, they become a safety shutdown if the same fault (on any phase) occurs three times in 90 minutes. The first two shutdowns with the 90-minute window will be cycling shutdowns, as it is presently. If a third one occurs within 90 minutes of the first, the third will be a safety shutdown that requires a manual restart.

The 90-minute window applies to a HIGH INSTANTANEOUS fault on any phase. Three faults on any phase in 90 minutes results in the third fault becoming a safety shutdown. Likewise, one fault on each of the three phases results in the third fault becoming a safety shutdown.

Refrigerant Level Control Enhancements

During the Valve Preset Time and subsequent 3 minute hold period after entering System run on startup, if the actual refrigerant level is greater than the programmed Level setpoint for 2 seconds, the preset/hold timer is canceled and normal level control is started immediately. This only applies to the programmed Level Control setpoint and not the Ramped Level setpoint and only occurs while the chiller is running.

Korean Language

Korean has been added to the available languages.

Oil Sump Enhancements

In previous software versions, the Oil Return Solenoid (1SOL) is opened one minute into System run and remains open until System Coastdown.

SI0212 - SOFTWARE ENHANCEMENTS (VER 21) EFFECTIVE JUNE 2009 (CONT'D)

In this version, to avoid an OIL – LOW TEMPERATURE DIFFERENTIAL condition from preventing a chiller start after running at low load conditions for extended periods, the Oil Return Solenoid (1SOL) is now cycled closed when the oil temperature gets too low on the P, Q and H9 compressor chillers, while the chiller is running.

An OIL RETURN MIN SETPOINT key now appears on the OIL SUMP screen when the chiller style/compressor type setpoint (on the OPERATIONS screen) is set to P, Q or H9 compressor in SERVICE access level. This setpoint is programmable over the range of 80.0°F to 110.0°F (default 95.0°F) and controls the oil return solenoid as follows:

- When the compressor is running and the oil sump temperature is less than the oil return minimum-setpoint, close (de-energize) the oil return solenoid by de-energizing K12 relay.
- When the compressor is running and oil sump temperature is greater than the oil return minimum plus 7°F, open (energize) the oil return solenoid by energizing K12 relay.
- During coastdown, the solenoid operation is not changed from standard logic, it remains closed. During startup, the operation is not changed from standard logic, it remains closed for one minute after system run.

An oil–saturated condenser temperature data box is added to the OIL SUMP screen, which displays the difference between the oil temperature and the saturated condenser temperature. This parameter is useful when analyzing oil heater operation since it is used in the control of the oil heater.

Variable Geometry Diffuser Operation With Hot gas bypass

If the VGD operation is in the hot gas override state and a stall is detected, it will transition to the stall reacting State. In previous software versions, it would not react to stall in the hot gas override state.

Trend Data Point Max (Y-Axis) Setup

This software version allows a greater range of the trend maximum display value for the Y-Axis.

Heat Recovery

This software supports the new heat recovery option. This option uses two tube bundles in the condenser. The lower bundle is the standard condenser bundle and is piped to the cooling tower water source. The upper tube bundle is used to recover heat waste heat rejection for use in a closed loop heating circuit.

On a heat recovery chiller, the chiller primary control remains the cooling load. So, the compressor capacity is still functioning according to the Leaving Chilled Water Temperature (LCWT) setpoint.

The desired hot water temperature leaving the heating bundles is obtained by regulating the heat rejection through the standard lower tube bundle (sourced by cooling tower or other water circuit). This is done by controlling the temperature of the Return Condenser Water Temperature (by tower bypass circuit to elevate the temperature of the return condenser water) or varying the condenser water flow. This control can be performed by the control center or an external controller. If the OptiView Control Center is used to perform this control, The heat recovery control valve is modulated to control the leaving heating condenser Water temperature to the hot water setpoint. The control output to the valve is direct acting (when the leaving heating condenser water temperature rises above the hot water setpoint, the valve is driven more open to provide greater cooling to the standard lower tube bundle).

The heat recovery bundle is provided with a Leaving Heating Condenser Water Thermistor, Return Heating Condenser Water Thermistor and a Heating Condenser Water Flow Switch. The heat recovery circuit control is only active when the flow sensor indicates flow.

If the chiller is equipped for heat recovery, enable the feature on the SETUP screen. Disable the feature, if chiller is not equipped. Once enabled, the HEAT RECOVERY screen is available from the CONDENSER screen. All heat recovery parameters are displayed on this screen. If the HEAD PRESSURE CONTROL screen is also enabled, the head pressure parameters appear on the HEAT RECOVERY screen (No separate HEAD PRESSURE CONTROL screen in this configuration).

A complete explanation of this feature is contained in *Service Manual (Form 160.54-M1)*, *SECTION 28 - HEAT RECOVERY.*

SI0212 - SOFTWARE ENHANCEMENTS (VER 21) EFFECTIVE JUNE 2009 (CONT'D)

Head Pressure Control

YK chillers are capable of operation within a wide range of condenser water temperatures. However, a minimum condenser water temperature, as specified in the engineering guide, is required to maintain sufficient pressure differential (head) between the condenser and evaporator for proper oil and refrigerant management in the chiller.

Should colder condenser water temperatures be anticipated at the cooling source, a field mounted facility control means may be provided to ensure adequate head pressure exists. The preferred means would be a cooling tower bypass circuit that maintains a constant flow rate through the condenser, since this would maintain adequate tube velocity in the condenser, while regulating the return cooling water to the condenser. However, a two-way condenser water throttling valve, a variable speed cooling tower pump, or tower fan control circuit might also be employed.

The head pressure control function provides an analog output control signal from the OptiView Control Center that responds to the programmed head pressure (condenser pressure minus evaporator pressure) setpoint. The output is direct acting (as the head pressure increases above the setpoint, the valve is driven more open to provide less tower bypass or more flow through the condenser).

If the chiller is equipped with HEAD PRESSURE CONTROL, the feature must be enabled on the SETUP screen using the head pressure control setpoint. Otherwise it must be disabled. Once enabled, the HEAD PRESSURE CONTROL screen is available from the CONDENSER screen. All of the head pressure control parameters are displayed on this screen. If heat recovery is also enabled, the head pressure parameters appear on the HEAT RECOVERY screen (No separate HEAD PRESSURE CONTROL screen is in this configuration).

A complete explanation of this feature is contained in *Service Manual (Form 160.54-M1)*.

Quick Start Mode

The quick start feature is useful in data center and process control applications where it is desirable to re-establish cooling as fast as possible after a shutdown or power failure. This feature, when enabled, allows quicker starts and restarts than normal control, which is done by reducing the time cycle for chiller restart and once running, loading the chiller as fast as possible. After the chiller is running, and has met a specified setpoint or a specified period of time has elapsed, control returns to normal.

To use this feature, the chiller must be equipped with a VSD (in Modbus Protocol configuration) or a MV VSD. The low inrush current of a VSD allows more starts per hour and allows the chiller to start with a more open vane position.

Although not required, the hot gas bypass option is recommended, as it will allow the chiller to startup more smoothly with less chance of surging.

Quick Start has two different start modes:

- **Quick Restart –** When a chiller shuts down, if certain conditions are met at the completion of coastdown (and within 30 seconds thereafter), the VSD is started immediately with no pre-lube. The vanes are given a constant open pulse and after the VSD achieves its start frequency, the speed ramp rate is faster than with normal control.
- **Quick Normal Start –** If the conditions for a quick restart are not met, the next time the chiller is started, it has a pre-lube period just like a normal start, however the vanes will begin to open at the beginning of pre-lube, instead of waiting until system run. At the completion of pre-lube, the VSD is started and after the VSD achieves its start frequency, the speed ramp rate is faster than with normal control.

To take full advantage of the quick start feature after a power failure, the OptiView Control Center and VSD control power (except for the trigger board) must be on a UPS, which prevents a reboot of both on a power failure and keeps communications between them active throughout the utility power failure. This provides the fastest possible ability to start or restart after generator or utility power is restored.

SI0212 - SOFTWARE ENHANCEMENTS (VER 21) EFFECTIVE JUNE 2009 (CONT'D)

This feature can only be enabled if the motor drive type setpoint is set to MV VSD or VSD (and the motor communications protocol setpoint is set to Modbus). It requires an ADMIN password to change. When logged in at ADMIN access level, a QUICK START key will appear on the SETPOINTS screen. Pressing this key will navigate to the QUICK START screen where the quick start mode setpoint is used to enable/disable this feature as explained in the setpoints section below.

Once enabled, all setpoints and parameters related to this feature are displayed on the QUICK START screen, accessible from the SETPOINTS screen when logged in at SERVICE access level.

A complete explanation of this feature is contained in *Service Manual (Form 160.54-M1)*, *SECTION 30 - QUICK START.*

SI0224 - SOFTWARE ENHANCEMENTS (VER 22) EFFECTIVE APRIL 2010

GENERAL

Beginning April 2010, enhanced software will be supplied in new production YK chillers and replacement microboard kit (P/N 331-02430-601). This software is backward compatible to all previous YK chillers equipped with microboard (P/N 031-02430-000) or (P/N 031-02430-001). The enhancements are listed below.

The version and program card part number is C.OPT.01.22.307 (P/N 031-02474-001).

MOTOR MONITORING

This software version supports the optional Motor Monitoring feature. This feature allows monitoring of the compressor motor windings temperatures, bearing temperatures, bearing vibration and motor cooling coil leak detection. Any combination of winding, bearing and leak monitoring can be selected based on the requirements of the job. Therefore, not all sensors may be present in all applications. Setpoints allow any combination of these items to be enabled or disabled based on the actual equipment applied.

The motor could be equipped with different types of sensors for this monitoring. Either RTDs or thermistors could be applied for winding and bearing temperature monitoring. Motor cooling coil leak detection could be performed with either an optical sensor or float sensor. Setpoints allow for the selection of the actual sensor type applied.

The hardware involved in this feature consists of motor temperature sensors, vibration sensors, a cooling coil leak detection sensor and a motor monitoring board. This board resides in an enclosure that is mounted separately from the OptiView Control Center. The motor monitoring board communicates with the microboard COM3 port via RS-485 Modbus serial communications. Whenever a monitored parameter exceeds a warning or safety threshold, a warning is displayed or a safety shutdown is performed as appropriate. The messages and actions are detailed in *OptiView Control Panel – Operation (Form 160.54-O1).*

The motor monitoring feature must be enabled. Once enabled, the MOTOR DETAILS and MOTOR SETPOINTS screens are available, where all information pertinent to the feature are displayed.

Refer to *OptiView Control Panel – Operation (Form 160.54-O1)* for display screens and messages. See *SECTION 32 - MOTOR MONITORING on page 257* for a complete explanation of this feature.

SI0252 - SOFTWARE ENHANCEMENTS (VER 23) EFFECTIVE MAY 2011

GENERAL

Beginning May 2011, enhanced software will be supplied in new production YK chillers and replacement microboard kit (P/N 331-02430-601). This software is backward compatible to all previous YK chillers equipped with microboard (P/N 031-02430-000) or (P/N 031-02430-001). The enhancements are listed below.

The version and program card part number is: C.OPT.01.23.307 (P/N 031-02474-001).

HEAT PUMP DUTY

Heat pump duty is now an available option for certain models of YK chillers. On a heat pump equipped chiller, with heat pump duty enabled, the chiller control can be switched between cooling and heating mode. In cooling mode, the chiller controls the leaving chilled liquid to the LCLT setpoint. In heating mode, the chiller controls the LCLT to the leaving condenser liquid temperature setpoint. All setpoints pertinent to this feature are maintained on the HEAT PUMP screen.

VARIABLE GEOMETRY DIFFUSER

VGD Screens

The following enhancements have been made:

- Discharge pressure and condenser pressure are now displayed.
- VGD limit switch is now labeled VGD closed limit switch and functions the same as before.
- The surge detected LED is replaced with a surge avoidance surge detected LED, which illuminates when full speed surges are detected.
- ACC surge detected LED is added when the motor drive type setpoint is set to VSD and the Motor Communications Protocol setpoint is set to MODBUS. It illuminates when running at less than full speed.

Setpoints

The following enhancements have been made:

- The VGD high limit setpoint default changed from 0.8V to 0.6V.
- The VGD low limit setpoint default changed from 0.6V to 0.5V.
- The PRV VGD inhibit setpoint default changed from 95% to 100%.

Operation

The VGD logic was modified. If a stall is detected in the SURGE WAITING state, transition to the STALL REACTING state until stall is no longer detected. Once stall is no longer detected and if the surge waiting timer is still active, transition back to the SURGE WAITING state. If the surge waiting timer is not active, then transition out of the STALL REACTING state is as presently done.

PRE-ROTATION VANES SCREEN

The PRV feedback voltage is now always shown on this screen when the PRV potentiometer is connected directly to the microboard.

OIL SYSTEM

In previous software versions, the condition for the oil – low temperature differential start inhibit is checked while the chiller is stopped and during the first 10 seconds of pre-lube. In this version, check only when the chiller is stopped and not during pre-lube.

In addition to the existing required conditions, the WARNING - STANDBY LUBE – LOW OIL PRESSURE warning is now set when either the pump or sump oil pressure is less than two psig.

VARIABLE SPEED DRIVE

Setpoints

The following enhancements were made:

- The Building Automation System (BAS), via E-Link Gateway interface, can no longer change the VSD FREQUENCY CONTROL MODE setpoint (AUTO/FIXED), which is presently GPIC command object BV10 and was deleted from the GPIC points list.
- The default value for the FREQUENCY CONTROL MODE setpoint is changed from manual to auto.
- The ACC MAPPING ENABLE setpoint programmable range increased from 0.5 to 4.0°F to 0.5 to 20.0°F.

SI0252 - SOFTWARE ENHANCEMENTS (VER 23) EFFECTIVE MAY 2011 (CONT'D)

FAULTS

If the VSD – HIGH PHASE (X) INSTANTANEOUS FAULT CYCLING fault occurs three times in 10 minutes, the third shutdown becomes a safety fault.

Warnings

The following warning was added:

Warning – Harmonic Filter – Not Running. This warning is set when all of the following are true for 20 continuous seconds:

- Chiller is running.
- Filter is enabled.
- Filter present status is true.
- Run time is greater than 20 seconds.
- Filter operating mode is stopped.

This warning is released when the chiller is stopped, but will be displayed until manually cleared using the WARNING RESET key when logged in at Operator (or higher) Access Level.

Serial Communications

When VSD – 60Hz or 50Hz is selected for the MOTOR DRIVE TYPE setpoint on the SETPOINTS screen, the microboard will poll on COM 2 alternating between Modbus ASCII Vyper/D Mod and Modbus RTU Raptyr protocols until one responds or until an initialization fault occurs. Once a valid response is received from either VSD type, the microboard will remember the response, even after a power failure, which allows the correct screens to be displayed after a power failure, without repeating the poll interrogation. As long as the motor drive type is not changed, once the microboard determines which VSD type is connected, it will not poll for the other. Only after a the motor drive type setpoint changes, will the two types alternate to determine the connected type.

Screens

Temperature Differential (LCHLT – Setpoint) is now displayed on the surge map screen.

HISTORY SCREEN

The following enhancements were made:

- The VGD pressure voltage is now displayed as discharge pressure.
- The ACC surge count is now displayed when MOTOR DRIVE TYPE setpoint is set to any VSD.
- The VGD limit switch is now displayed as VGD closed limit switch.

TRENDING

New Slots

The following enhancements were made:

- Surge Avoidance Surge Count is Slot No. 8238.
- ACC Surge Count is Slot No. 2849.

PUMP CONTROL

In previous software versions, the chilled water pump contacts and the condenser water pump contacts open on loss of water shutdowns. The pump control contacts will now remain closed on these shutdowns as follows:

- While the chiller is shutdown on leaving chilled liquid – flow switch open cycling shutdown, the chilled water pump contacts (TB2-44/45) remain closed until the chiller is given a stop command or has another fault.
- While the chiller is shutdown on condenser – flow switch open cycling shutdown, the condenser pump contacts (TB2-150/151) remain closed until the chiller is given a stop command or has another fault.

In previous software versions, on those shutdowns where the chilled water pump contacts (TB2-44/45) remained closed during shutdown, the contacts would open at the beginning of system pre-lube and reclose 13 seconds into pre-lube on a chiller restart, which allowed for the transducer auto-zeroing that occurred between 10-13 seconds of the pre-lube. In this software version, on those chiller shutdowns where the contacts remain closed during shutdown, when a chiller restart occurs, the contacts remain closed into and throughout the pre-lube period and the transducer auto-zeroing is not performed (the values from the last auto-zeroing are used).

SI0252 - SOFTWARE ENHANCEMENTS (VER 23) EFFECTIVE MAY 2011 (CONT'D)

DIAGNOSTICS

COM2 RS-485 Port

In previous software versions, there was no serial port loopback test for COM2 RS-485. This software version adds a loopback test that operates like the other loopback tests. It performs the test by transferring data between COM2 and COM4a and comparing transmitted data to received data. Pass/fail criteria is the same as the other tests. The loopback connections are as follows:

TABLE 32 - LOOP BACK CONNECTIONS

RS-485	FROM	TO
(COM 2/4a)	J13-8 (+)	J11-3 (+)
	J13-10 (-)	J11-2 (-)

Install Microboard Program Jumpers JP17 and JP27 in positions 1 and 2.

Digital I/O

When performing offline control of the outputs in Japanese, Korean or Chinese, the SELECTION arrow is replaced with a green box around the selected output.

DATE FORMAT

The calendar date can be displayed in three different formats. Change the format using the new DATE FORMAT setpoint on the USER screen, which can be done at the operator access level. The selectable formats are:

- DD MMM YYYY (default)
- DD.MM.YYYY, or
- YYYY-MM-DD

SECURITY LOG – MANUAL RESET WARNINGS

In previous software versions, a generic message WARNING RESET was added to the security log when any manual reset warning was acknowledged (by pressing WARNING RESET). In this version, the warning message that is being reset is entered as follows:

- Condenser or Evaporator Transducer Warning
- Standby Lube Low Oil Pressure Warning
- Excess Surge Detected Warning
- Condenser or VGD Sensor Failure Warning
- Conditions Override VGD Warning Reset
- Purge High Pressure Warning
- Purge Float Switch Error Warning
- Excess Purge Warning
- Purge Canister #X Full Warning
- Setpoint Override Warning
- Filter Not Running Warning

SI0265 - SOFTWARE ENHANCEMENTS (VER 24) EFFECTIVE MAY 2012

GENERAL

Beginning May 2012, enhanced software is being supplied in new production YK chillers and replacement microboard kit 331-02430-601. This software is backward compatible to all previous YK chillers equipped with microboard 031-02430-000 or 031-02430-001. The enhancements are listed below.

The Panel Software version is C.OPT.01.24.308 and the program card part number is: (P/N 031-02474-001).

To retrofit your chiller to this S/W version you must order the EPROM BIOS Software Version: C.OPT.00.04 (P/N 031-02429-002).

Reduced Panel Boot Time – Quick Start

The OptiView panel boot time has increased due to the addition of several new languages. The time to run the checksum on this much larger file cause the boot up time to be too long for desired non-UPS Quick Start time. The BIOS and controller program have been changed to allow the user to set a parameter which will either cause the whole file to be checked every time the panel boots or, the user can choose to have the panel check the complete file when initially loading a new version of software. After the initial software load checksum test, this portion of the test is skipped on subsequent boot ups thereby decreasing the boot up time. The following changes were made to support this new feature.

1. **BIOS Changes**

   The 031-02430 board BIOS software was changed to add the ability to turn the bootup flash checksum test on and off. Additionally, the bootup logo was changed to conform to the JCI standard "YORK by Johnson Controls". The new BIOS eprom is P/N 031-02429-002.

2. **Panel Logic Changes**

   A Checksum Test enable/disable setting has been added to the BRAM to maintain the user setting during panel power outages.

3. **Diagnostics Screen**

   A “Checksum Test” button has been added to the Diagnostics Screen to enable/disable the bootup flash checksum test. When set to enabled, the flash checksum test is run every time the controller boots up. When this parameter is set to disabled, the flash checksum test is run once after an initial loading of a new program from the flash card and then this check is skipped at all future controller boot ups. Once the program is copied from the flash card to the microboard flash, there is no risk of the program being corrupted. This button is only shown when the Access Level is Service or higher.

Subcooler Tube Freeze Prevention Logic

A potential exists to freeze subcooler tubes on brine chillers when a customer has multiple chillers and uses a valve to isolate a non-running chiller. If this valve leaks and below freezing brine circulates through the evaporator, the refrigerant temperature in the subcooler can drop below freezing. The following changes have been made to the control logic to protect the subcooler tubes and warn the customer of the issue.

1. **Condenser Pump Control**

   If the chiller is Stopped and the Condenser Pump is off, the pump is turned on whenever the Saturated Condenser Temp < 35.0 °F.

   If the pump is on only due to the Saturated Condenser Temp, it is turned off whenever the Saturated Condenser Temp > 40.0 °F unless other program logic is requesting it to continue to run.

2. **Warning – Condenser – Freeze Threat From Low Pressure**

   If the chiller is stopped and the Saturated Condenser Temperature falls below 35.0 °F, the panel will display the message: “Warning – Condenser – Freeze Threat From Low Pressure”.

   This warning will automatically reset whenever the chiller is running or the Saturated Condenser Temperature is > 40.0 °F

3. **Condenser – Freeze Threat – Flow Switch Open**

   If the Chiller is stopped, the Saturated Condenser Temperature < 35.0 °F and the Condenser Flow Switch has been open for > 60 seconds or longer, the panel will display the message: “Condenser – Freeze Threat – Flow Switch Open”

SI0265 - SOFTWARE ENHANCEMENTS (VER 24) EFFECTIVE MAY 2012 (CONT'D)

This warning will automatically reset whenever the chiller is running or the Saturated Condenser Temperature is > 40.0 °F or the Condenser Flow Switch closes.

Diagnostics - Analog Screen

Text has been added next to all the used input channels to make it easier to understand what inputs are associated to what voltage.

Diagnostics - Digital Screen

Low Voltage Digital Inputs J14-1, J14-4, J14-7 and J14-10 were added to the Digital Inputs Diagnostic screen. J14-1 = Chilled Liquid Thermal-Type flow switch. J14-7 = Condenser Liquid Thermal-Type flow switch, and J14-10 Heat Recovery Condenser Liquid Thermal-Type flow switch.

Sales Order Data Upload

The factory sales order upload port was moved from COM2 to COM4b.

Surge Avoidance Surge Sensitivity

The Surge Avoidance Surge Sensitivity previously updated changes only on power up. This has now been enhanced to immediately update any changes to Surge Avoidance Surge Sensitivity when they are entered.

Anti-Recycle Start Inhibit

The Anti-Recycle Start Inhibit did not work properly in V17 through V23 after any immediate shutdown Cycling Fault. This start inhibit feature has been corrected to function properly.

Heat Pump Duty

The Heat Pump Duty enable on the Setup Screen is selectable in Test Op Access Level and above when the refrigerant is R134a.

Graphics Library - Selection Box Wraparound

An enhancement has been added to allow the green selection box to wrap around when scrolling through a list of programmable items. For example, when scrolling through the programmable settings on the Setup Screen, when pressing the down arrow while on the bottom item, the green box will move to the top item.

Password Field Clear on Failure

Add a feature to automatically clear the password field on a re-prompt after a password entry failure.

Run Time Precision in Reports

A Seconds field has been added to the Run Time in the History and Status Reports to allow better fault event correlation

PC Printer Type

A new selection for Printer Type called PC has been added. When PC is selected, the time delays required for the printers have been removed allowing printing reports to a PC to be much faster than printing to a printer.

Language Enhancements

Russian – The Russian Language has been added as a standard language selection

Japanese

1. Evaporator Screen – Corrected the font sizing on this screen
2. Condenser Screen – Corrected the font sizing

SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013

GENERAL

Beginning May 2013, enhanced software will be supplied in new production YK chillers and replacement microboard kit 331-02430-601. This software is backward compatible to all previous YK chillers equipped with microboard 031-02430-000 or 031-02430-001. The enhancements are listed below.

The Panel Software version and program card part number is: C.OPT.01.25C.308 (P/N 031-02474-001)

The EPROM BIOS Software Version: C.OPT.00.04 (P/N 031-02429-002)

The following program issues and display errors have been corrected:

Low Oil Temperature Differential History Log - The Low Oil Temperature Differential Start Inhibit is excluded from the Fault History Log since it is not a shutdown fault.

Proximity Probe Calibration - The Proximity Probe Calibrationis is added to the events shown in the security log.

Condenser Pump Output at Bootup - Corrected the condition which previously closed the Condenser Pump run output momentarily upon bootup.

Heat Recovery Head Pressure Control PID Windup Issue - In previous software a windup occurred with the heat recovery and head pressure control PID control loop. This issue was fixed giving better control.

Display of ECLT on Heat Pump Screen - The Heat Pump screen now correctly displays the Return Condenser Liquid Temperature.

Incorrect Display of MVSSS KW - The largest size MVSSS starters now correctly displays the amount of displayed KW.

Incorrect MVSSS Starter Model - The Solid State Starter (SSS) Screen for the MVSSS now correctly displays:

<Max Starting Current>K<Max Motor Current>-<Voltage Code>

Leaving Chilled Liquid Shutdown Temperature

The past logic that set the Shutdown Temperature to its minimum for 10 minutes on a LCHLT Setpoint increase has been changed to a variable slope.

NAME	CALCULATION	LOWEST VALUE	HIGHEST VALUE
Shutdown Temperature	LCHLT Setpoint - Shutdown Temperature Offset, or Lowest Value, whichever is highest. (value ramped as described below)	*W: 36.0 °F *S: 34.0 °F *B: 6.0 °F	C: 69.0 °F H: 85.0 °F

W = Water Mode, Smart Freeze Disabled
S = Water Mode, Smart Free Enabled
B = Brine Mode enabled
C = Cooling Mode
H = Heat Pump

On startup, the Shutdown Temperature is set to the calculated value.

On a LCHLT Setpoint decrease or Shutdown Temperature Offset increase, the Shutdown Temperature is decreased immediately.

On a LCHLT Setpoint increase or Shutdown Temperature Offset decrease, the Shutdown Temperature is increased at a rate of 0.05 °F/sec.

Leaving Condenser Liquid Shutdown Temperature

The logic that set the Shutdown Temperature to its maximum for 10 minutes on a LCLT Setpoint decrease has been changed to a variable slope.

NAME	CALCULATION	LOWEST VALUE	HIGHEST VALUE
Shutdown Temperature	LCLT Setpoint + Shutdown Temperature Offset, or Highest Displayed Value, whichever is lowest (value ramped as described below)	66.0 °F	125.0 °F

SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013 (CONT'D)

On startup the Shutdown Temperature is set to the calculated value.

On a LCLT Setpoint increase or Shutdown Temperature Offset increase, the Shutdown Temperature is increased immediately.

On a LCLT Setpoint decrease or Shutdown Temperature Offset decrease, the Shutdown Temperature is decreased at 0.05 °F/sec.

Maximum Limit for LCHLT Setpoint

The maximum limit for the local and remote LCHLT setpoint was changed from 70.0°F to 72.0°F.

Warning – DC Bus Active

A non-annunciating warning has been added to alert the user that the MVVSD, VSD or Harmonic Filter DC bus voltage is above 50 VDC posing a potential safety issue if the cabinet is opened. This warning is active when the chiller is in the Stopped State and is automatically cleared in any other state. The warning message reads "Warning – VSD – DC Bus Active" in yellow text. The Warning Relay is not activated for this warning. This warning only applies when the Motor Drive Type is VSD 50Hz, VSD 60Hz, or MVVSD. VSD 50 and 60Hz includes Vyper and Raptyr designed drives.

Stall Voltage Precision

The precision of the Stall Voltage and programmable High Limit and Low Limit has been changed from tenths to hundredths. The programmable limits have been changed as follows:

PROGRAM SETTING	SCREEN	MODE	MIN.	MAX.	DEFAULT
High Limit	VGD Setpoints	Service Access	0.35 V	1.20 V	0.60 V
Low Limit	VGD Setpoints	Service Access	0.30 V	0.80 V	0.50 V

Auto VSD Speed Control at Wide Open Vanes

The, ACC control did not allow the VSD speed to be increased to control capacity until the PRV position was greater than or equal to 98% PRV position. Once above 98% PRV, VSD speed increases were allowed until the PRV position fell below 95%. This has been changed to allow speed increases when the PRV position is above 95% and released when the PRV position falls below 93%. This change was needed because of inconsistent PRV readings or the PRV's being out of calibration.

Subcooler Tube Failure

Liquid Level Setpoint Not Achieved Warning

An Automatic Reset Warning has been added that displays the message "Warning – Liquid Level Setpoint not Achieved". This warning is set when all of the following are true for 10 continuous minutes:

- Chiller is Running
- Run Time > 30 minutes
- Refrigerant Level > (Refrigerant Level setpoint +15%) OR Refrigerant Level < (Refrigerant Level setpoint -15%)

It is released when:

- Chiller is not Running
- (Refrigerant Level setpoint -15%) < Refrigerant Level < (Refrigerant Level setpoint +15%)

When this warning occurs, it shall be added to the security log.

Refrigerant Level Control Modifications

Refrigerant level control should not be set to Disable on variable orifice chillers. To correct the misuse of the feature, operation of the outputwas changed as follows:

If the Refrigerant level control is disabled:

- Refrigerant Level Lower (open) output is de-energized
- Refrigerant Level Raise (close) output is energized

Loss of Subcooler Liquid Seal Warning

If the chiller has been running for 30 minutes or more and the Drop Leg Temperature is less than the Return Condenser Liquid Temperature continuously for two minutes, the following warning message is displayed:

"Warning - Loss of Subcooler Liquid Seal"

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SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013 (CONT'D)

This warning requires a manual reset when the above conditions are no longer true. The message “Loss of Subcooler Liquid Seal Warning Reset” is added to the Security Log when the warning is reset.

Motor Controller Fault Monitoring

The software will continuously monitor the fault code registers for as long as a motor controller fault indication (115V fault signal or ‘fault present’ bit in the comms packet) exists. If the ‘first fault’ code changes, the panel displays the new code on the System Details line. If the ‘first fault’ type changes from Cycling to Safety, the internally posted, generic “Motor Controller” fault is updated to Safety as well. If the ‘first fault’ type changes from Safety to Cycling, the internally posted, generic “Motor Controller” fault remains as a Safety.

In the event of a VSD fault, the panel currently polls the drive for fault codes and a status snapshot, which are logged in the fault history. Subsequently, the panel repeatedly attempts “clear fault” commands to the drive until all VSD fault indications are absent, but it does not pay any further attention to the fault codes.

This change applies to all motor controller types.

Isolation Valves for Brine Applications

An option has been added to install motorized isolation valves with limit feedback on both the discharge and the liquid lines. The outputs to both valves will be placed in parallel. The valve feedback will be placed in series. When this option is disabled, the outputs will be placed into the open position and the inputs ignored.

Isolation Valve I/O

BOARD	REFERENCE	HEADER / TERMINAL	ITEM
I/O Board	K6	J19-44 / 152, 153	Isolation Valves Open Output
I/O Board	K7	J19-43 / 154, 155	Isolation Valves Close Output
I/O Board	U11C	J19-19 / 82, 1	Isolation Valves Opened Feed-back
I/O Board	U11D	J19-20 / 95, 1	Isolation Valves Closed Feed-back

Isolation Valve Configuration

PROGRAM SETTING	SCREEN / BUTTON	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Isolation Valves	Setup Screen	Service Access	Choices: Disabled Enabled		Disabled

System Screen Changes for Isolation Valves

The following have been added to the System Screen to the right of the Evaporator when the Isolation Valves are enabled.

- Text heading “Isolation Valves”
- LED with label “Closing”

  Will be illuminated when “Isolation Valves Close Output” is energized and “Isolation Valves Closed Feedback” is not energized.
- LED with label “Closed”

  Will be illuminated when “Isolation Valves Close Output” is energized and “Isolation Valves Closed Feedback” is energized.
- LED with label “Opening”

  Will be illuminated when “Isolation Valves Open Output” is energized and “Isolation Valves Opened Feedback” is not energized.
- LED with label “Opened”

  Will be illuminated when “Isolation Valves Open Output” is energized and “Isolation Valves Opened Feedback” is energized.

Isolation Valve Control

If the Isolation Valves option is enabled:

When the compressor enters prelube and while the compressor is running:

- Isolation Valves Open output is energized.
- Isolation Valves Close output is de-energized.

When the compressor is stopped, after coastdown:

- Isolation Valves Open output is de-energized.
- Isolation Valves Close output is energized.

SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013 (CONT'D)

If the Isolation Valves option is disabled:

- Isolation Valves Open output is energized.
- Isolation Valves Close output is de-energized.
- Status of the Isolation Valves Opened or Closed inputs is ignored.

Faults

"Isolation Valves - Not Closed"

This cycling fault is set when the following conditions exist for 3 continuous seconds:

- Isolation Valves Close Output is energized > 40 seconds, but Isolation Valves Closed Feedback is not energized

This cycling fault is released when Isolation Valves Closed input is energized.

"Isolation Valves - Not Opened"

This safety fault is set when the following conditions exist for 3 continuous seconds:

- Isolation Valves Open Output is energized > 40 seconds, but Isolation Valves Opened Feedback is not energized.

This safety fault is released when the Compressor is in stopped state and the Compressor switch is placed into the stop position.

History Report

When the Isolation Valve option is enabled, the state of the Isolation Valves (Closed, Opening, Opened, Closing) will appear on the Status Report under the Condenser heading.

Data Logging

LD17022

FIGURE 118 - DIAGNOSTIC SCREEN

Data Logging Control

When Data Logging is enabled, data values are serially transmitted to the RS-232 port at an interval defined by the Data Logging Interval. The data will be comma separated with a carriage return and line feed transmitted at the end of each transmission interval. All data transmitted at each interval will be from the same snapshot in time.

Respective data shall be converted to Metric units when the Data Display Mode is set to Metric.

While Data Logging is enabled, the automatic fault data print is disabled.

Data Logging Configuration

Two buttons have been added to the Diagnostic screen to allow someone at Service Level to enable and set the time interval for logging data to a PC connected to the control panel serial port.

PROGRAM SETTING	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Data Logging	Service Access	Choices: Disabled Enabled		Disabled
Data Logging Interval	Service Access	0.1 sec	60.0 sec	sec

The following is a list of all data values that are included in Data Logging and the heading text that shall be included as the first line of data logging when it is enabled:

Note that with a 03630 microboard and V00C or V03A software you can also data log to an SD card. *See page 307* for details.

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SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013 (CONT'D)

TABLE 33 - DATA LOGGING

NUMBER	DATA VALUE	HEADING TEXT
CHILLER DATA		
1	Date (DD/MM/YYYY format)	Date
2	Time (24 Hour format)	Time
3	Elapsed Time (seconds since data logging started)	Elapsed Time
4	Entering Chilled Liquid Temperature	ECHLT
5	Leaving Chilled Liquid Temperature	LCHLT
6	Active LCHLT Setpoint	LCHLT Setp
7	Remote LCHLT Setpoint	LCHLT Remote Setp
8	Entering Condenser Liquid Temperature	ECLT
9	Leaving Condenser Liquid Temperature	LCLT
10	Evaporator Press	Evap Press
11	Condenser Press	Cond Press
12	Delta Pressure	Delta P
13	Delta P / P	Delta P/P
14	Motor Current %FLA	Motor Curr
15	Active Motor Current Setpoint	Motor Curr Setp
16	PRV Position	PRV Pos
17	PRV Control Mode	PRV Mode
18	HGBP Command Position	HGBP Cmd
19	HGBP Control Mode	HGBP Mode
20	Condenser Refrigerant Liquid Level	Liquid Level
21	Active Refrigerant Level Setpoint	Act Level Setp
22	Level Control State	Level Control State
23	Evaporator Small Temperature Difference	Evap Small Temp Diff
24	Evaporator Saturation Temperature	Evap Sat Temp
25	Evaporator Refrigerant Temperature	Evap Refrig Temp
26	Evaporator Flow Switch	Evap Flow Switch
27	Condenser Small Temperature Difference	Cond Small Temp Diff
28	Condenser Saturation Temperature	Cond Sat Temp
29	Condenser Drop Leg Temperature	Cond Drop Leg Temp
30	Condenser Flow Switch	Cond Flow Switch
31	Subcooling	Subcooling
32	Discharge Temperature	Discharge Temp
33	Discharge Superheat	Discharge Sheat
34	Discharge Pressure	Discharge Press
35	Stall Detector Voltage	Stall Detector Voltage
36	Stall Detector High	Stall Detector High
37	VGD Control State	VGD State
38	VGD Control Mode	VGD Mode
39	Surge Detected	Surge Detected
40	Surge Count	Surge Count
41	Motor Run	Motor Run
42	Oil Pump Pressure	Oil Pump

SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013 (CONT'D)

TABLE 33 - DATA LOGGING (CONT'D)

NUMBER	DATA VALUE	HEADING TEXT
43	Oil Sump Pressure	Oil Sump
44	Oil Differential Pressure	Oil Diff Pressure
45	Oil Pump Command Frequency	Oil Pump Cmd Freq
46	Oil Pump Pressure Setpoint	Oil Pump Pres Setp
47	Proximity Differential	Prox Diff
48	Thrust Bearing Limit Switch	Thrust Limit Swtch
49	Stall Detector Board Output Voltage	Stall Det Volt
50	HGBP Valve Opening	HGBP Valve Open
51	HGBP Valve Closing	HGBP Valve Close
VSD DATA		
#	Data Value	Heading Text
52	ACC Delta P / P	ACC Delta P/P
53	ACC Surge Detection	ACC Surge
54	ACC Surge Frequency	ACC Surge Freq
55	ACC Surge Map Count	ACC Map Count
56	VSD Command Frequency	VSD Cmd Freq
57	VSD Output Frequency	VSD Output Freq
58	VSD Control Mode (Auto/Manual)	VSD Mode
59	VSD DC Bus Voltage (Highest of the 6 for MVVSD)	VSD DC Bus
60	VSD Output Voltage	VSD Output Volt
61	VSD Phase A Current	VSD Phase A Cur
62	VSD Phase B Current	VSD Phase B Cur
63	VSD Phase C Current	VSD Phase C Cur
64	VSD Trigger SCR On	VSD SCR On
65	VSD Converter Heatsink Temperature	VSD Conv Temp
66	VSD Phase A Heatsink Temperature	VSD Phase A Temp
67	VSD Phase B Heatsink Temperature	VSD Phase B Temp
68	VSD Phase C Heatsink Temperature	VSD Phase C Temp
69	VSD Inverter Baseplate Temperature	VSD Inv Temp
IEEE 519 DATA		
#	Data Value	Heading Text
70	Filter Running	Filter Run
71	Filter Precharge Contactor	Filter Precharge
72	Filter Supply Contactor	Filter Contactor
73	Filter DC Bus	Filter DC Bus
74	Filter Baseplate Temperature	Filter Base Temp
75	Filter L1 – L2 RMS Voltage	Filter L1-L2 Volt
76	Filter L2 – L3 RMS Voltage	Filter L2-L3 Volt
77	Filter L3 – L1 RMS Voltage	Filter L3-L1 Volt
78	Filter L1 – N Peak Voltage	Filter L1-N Volt
79	Filter L2 – N Peak Voltage	Filter L2-N Volt
80	Filter L3 – N Peak Voltage	Filter L3-N Volt
81	Filter L1 RMS Filter Current	Filter L1 Filter Cur
82	Filter L2 RMS Filter Current	Filter L2 Filter Cur

SI0271 - SOFTWARE ENHANCEMENTS (VER 25) EFFECTIVE AUGUST 2013 (CONT'D)

TABLE 33 - DATA LOGGING (CONT'D)

NUMBER	DATA VALUE	HEADING TEXT
83	Filter L3 RMS Filter Current	Filter L3 Filter Cur
84	Filter L1 RMS Supply Current	Filter L1 Supply Cur
85	Filter L2 RMS Supply Current	Filter L2 Supply Cur
86	Filter L3 RMS Supply Current	Filter L3 Supply Cur
87	Filter Maximum Total Demand Distortion	Filter Max Demand
SSS DATA		
#	Data Value	Heading Text
52	SSS Phase A Current	SSS Phase A Cur
53	SSS Phase B Current	SSS Phase B Cur
54	SSS Phase C Current	SSS Phase C Cur
55	SSS Phase A Voltage	SSS Phase A Volt
56	SSS Phase B Voltage	SSS Phase B Volt
57	SSS Phase C Voltage	SSS Phase C Volt
LCSSS DATA		
#	Data Value	Heading Text
52	LCSSS Phase A Current	LCSSS Phase A Cur
53	LCSSS Phase B Current	LCSSS Phase B Cur
54	LCSSS Phase C Current	LCSSS Phase C Cur
55	LCSSS Phase A Voltage	LCSSS Phase A Volt
56	LCSSS Phase B Voltage	LCSSS Phase B Volt
57	LCSSS Phase C Voltage	LCSSS Phase C Volt
58	LCSSS Phase A Temperature	LCSSS Phase A Temp
59	LCSSS Phase B Temperature	LCSSS Phase B Temp
60	LCSSS Phase C Temperature	LCSSS Phase C Temp

Seal Lubrication Timer and Warning

When Standby Lube is enabled, seal lubrication is performed by running the Oil Pump for two minutes. Seal lubrication is performed once every twenty-four hours since the Oil Pump was last run for at least two minutes. It was found that the twenty-four hour time period could drift by several hours. This was corrected. Also, the “Warning – Seal Lubrication In Progress” was changed to be a non-annunciating warning.

Remote Analog Hot Water Setpoint

The Hot Water Setpoint on the Heat Recovery screen did not control the remote analog signal when in Remote Source at View Access level. The setpoint worked properly in Service mode. This has been corrected to work properly in all access modes.

SI0283 - SOFTWARE ENHANCEMENTS (VER 26) EFFECTIVE APRIL 2014

GENERAL

Beginning in April 2014, enhanced software will be supplied in new production YK chillers and replacement microboard kit 331-02430-601. This software is backward compatible to all previous YK chillers equipped with microboard 031-02430-000 or 031-02430-001. The enhancements are listed below.

The Panel Software version and program card part number is: C.OPT.01.26.308 (P/N 031-02474-001)

The EPROM BIOS Software Version: C.OPT.00.04 (P/N 031-02429-002)

Head Pressure Control Output

Two setpoint buttons have been added to the Head Pressure/Heat Recovery screen, “Minimum Position” and “Shutdown Position”. Access to this screen is available at Service level and above. User changes to these setpoints are recorded in the setpoints Report and the History Log.

LD18177

FIGURE 119 - HEAD PRESSURE CONTROL SCREEN

The Minimum Position is active when the condenser pump run contacts are closed which happens at chiller start at the end of pre-lube. The minimum will act as a maximum to the PID control if the Direction setpoint is set to Reverse. The Shutdown Position is active when the condenser run contacts are open which in the LC-SSS is after coastdown and the SCR heatsink temperatures are below 105°F. All other starter types open the condenser pump run contacts at the start of coastdown.

Both settings have a minimum limit of 0% and a maximum limit of 100% with an initial default position of 0%.

	MINIMUM	MAXIMUM	DEFAULT
P	0	5	2
I	0	5	2
D	0	5	0

The PID reaction can be tuned using the Change Setpoints button and then selecting the P, I or the D parameter.

Increasing the P value or Decreasing the I value will speed up the rate of change of the valve signal.

MVVSD Power Fault Recovery / Catch A Spinning Load CASL

Power Fault Recovery is an option that is available on MVVSD drives. When the input power supply drops below 85% of nominal voltage overall, the MVVSD will deactivate the output to the compressor motor. The drive can maintain adequate bus voltage charge level for a power fault of up to 10 seconds long. During that 10 second period, the OptiView control panel will hold the condenser level control, PRV, VGD, and Hot Gas at the current commanded positions. If the input power is restored within 10 seconds, the condenser level control, PRV, VGD, and Hot Gas will be returned to automatic control. The VSD speed command will be set to the same or slightly less than the VSD speed command before the input power loss. After 10 seconds of input power loss, the MVVSD drive will generate an Input Power Supply fault.

If the input power is restored within 30 seconds, an enhanced quick start is initiated. In enhanced quick start, the condenser level control, PRV, VGD, and Hot Gas will be returned to automatic control and coastdown will be shortened and the chiller transitioned to run while the compressor is potentially rotating.

A Power Fault Recovery screen has been added that is accessible from the MVVSD screen and provides Power Fault Recovery Control indication and configuration.

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SI0283 - SOFTWARE ENHANCEMENTS (VER 26) EFFECTIVE APRIL 2014 (CONT'D)

The following settings are displayed on the Power Fault Recovery Screen:

PROGRAM SETTING	SCREEN	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
VSD Low Frequency Fault Time	Power Fault Recovery - Button 8	*	60 sec	120 sec	60 sec
CASL VSD Speed Percentage	Power Fault Recovery - Button 9	*	80%	100%	93%

NOTE: * Visible in view mode, but only editable in Admin access level and above.

These setpoints have also been added to the Setpoints report and the History log in the MVVSD section.

The VSD Low Frequency Fault Time will adjust the amount of time that the VSD speed can be below the minimum speed. When Power Fault Recovery Control is not enabled, this setting will have no affect and the Low Frequency Fault will be the standard time of 25 seconds.

LD18178

FIGURE 120 - POWER FAULT RECOVERY SCREEN

Other Changes

1. Head Pressure control can now operate when a Heat Pump is in the cooling mode.
2. Bootup of the panel after power restoration on chillers with Quick Start, but no UPS:
    a. If coastdown is not complete, quick start proceeds as normal with a quick restart occurring within 30 seconds of the end of coastdown.
    b. If coastdown is complete, and the Time Since Coastdown completed is < 2 minutes quick restart is initiated. If the Time Since Coastdown is > 2 minutes, a Quick Normal Start (prelube and quick loading) is initiated.

    A quick restart without prelube is initiated for 30 seconds. To do a quick restart within this 30 second time period, the following must be true:

    - Oil Pressure > 25 psid
    - VSD has completed precharge (Trigger SCR Output is enabled)
    - Chiller start signal is present (local or remote)
    - No faults/inhibits present
    - Chilled liquid flow is present

    For both of the above situations (a or b) if all of the above conditions are not met within 30 seconds, Quick Start will revert to a Quick Normal Start.

    If the Panel Switch is placed into the STOP/RESET position, Quick Start operation shall be cancelled and the next start will be a Quick Normal Start.
3. On the Sales Order Screen, the field descriptor has been changed for Tubes to Tubes Code.
4. The LCSSS communications has been changed for Modbus ASCII to Modbus RTU.

SI0283 - SOFTWARE ENHANCEMENTS (VER 26) EFFECTIVE APRIL 2014 (CONT'D)

5. On heat pump-equipped YK chillers with a LC-SSS, the condenser loop liquid is typically too hot to cool the SSS. In these applications the SSS is piped to the evaporator loop instead of the condenser loop. Therefore, instead of running the condenser liquid pump to cool the SSS, the evaporator liquid pump will be activated.

   The Evaporator Liquid Pump is turned on if any of the three phase heatsink temperatures is above 105 °F within 45 minutes of the last chiller stop. This provides quicker cooling of the heat sinks between chiller starts. Once the heatsink temperatures are all below 105 °F, the Evaporator Liquid Pump will not be turned on again until the next chiller start cycle.

6. The default value for Standby Lube has been changed from Disable to Enabled.
7. The setpoint changes logged into the security log when in Metric mode were not correct. This has been fixed.
8. Data Logging Enabled was not saved to BRAM and reverted to Disabled after a power failure. This has been changed to save the Data Logging setpoint during a power failure.
9. The Cursor Keys action has been changed to repeat every 150mS as long as the key is held in. This will make navigating Raptyr waveforms easier.
10. The COM2 port on the OptiView Control Panel used for Vyper has been changed to display No Parity.
11. The Unit Operating Code number 14 = “Unit Starting – MVVSD Startup – Drive Not Ready” has been added.
12. The Unit Safety Fault Code number 113 = “MV-VSD – Excessive Shutdowns” has been added.
13. The surge map selection box could not navigate to the bottom row or rightmost column of the Surge Map. This has been fixed in this release.
14. The bug has been fixed that prevented the proper display of the Input Power when an IEEE 519 filter was present with a Vyper drive.
15. Corrected a bug that prevented proper operation of the Hot Gas while in Heating Mode of a Heat Pump.
16. Corrected operation of Smart Freeze when Data Display Mode is in Metric Mode.
17. Corrected bug to now log values in Metric when Data Display Mode is set to Metric.
18. Corrected bug that transmitted a 0 for the ACC surge Frequency Data Logging entry.
19. Corrected bug that displayed a Baseplate Temperature header regardless if the IEEE 519 filter is a Mod D or a Vyper drive.
20. Corrected bug that capped the Input and Output voltages for a MVVSD to 4500V when display was set to Metric.

SI0300 - SOFTWARE ENHANCEMENTS (VER 27) EFFECTIVE JUNE 2015

GENERAL

Beginning June 2015, enhanced software will be supplied in new production YK chillers and the replacement microboard kit 331-02430-601. Software version 27 is applicable to the 031-02430-000/001 microboards. The same software when used in the new 031-03630-001 microboard is called Version 0. The software is equivalent for both microboards. This software is backward compatible to all previous YK chillers equipped with microboard 031-02430-000 or 031-02430-001. Version 0 Software is only compatible with microboard 031-03630-000. The enhancements are listed below.

The panel software version and program card part numbers are:

031-02430-001/001 = C.OPT.01.27.308 (P/N 031-02474-001)
031-03630-001 = Y.OPT.01.00.308 (P/N 031-03601-001)

LOSS OF SUBCOOLER LIQUID SEAL DETECTION IMPROVEMENTS

The logic initially released in v.25C software allowed nuisance warnings of Loss of Subcooler Liquid Seal when the entering Condenser Liquid Temperature was cold. The v.27 logic has been improved to eliminate these nuisance warnings. A Subcooler Effectiveness is now calculated and then compared to high and low acceptable values to determine if there is a Loss of Subcooler Liquid Seal.

Subcooler Effectiveness =

$$\frac{\text{(Cond Sat Temp-Drop Leg Ref Temp)}}{\text{(Cond Sat Temp-Entering Cond Liq Temp)}}$$

The calculated Subcooler Effectiveness value is compared to the Subcooler Effectiveness Low value 0.4 and the Subcooler Effectiveness High value 1.5 (both values are adjustable if needed using an Admin password. If the calculated Subcooler Effectiveness is less than the Subcooler Effectiveness Low value or greater than the Subcooler Effectiveness High value continuously for two minutes after running for at least 30 minutes, the warning: “WARNING – LOSS OF SUBCOOLER LIQUID SEAL” will be displayed. The warning can be manually reset when any of the warning conditions are no longer in effect.

The Subcooler Effectiveness and the Low and High thresholds are displayed on the Refrigerant Level Control screen when the user is logged in at Service or Admin level.

QUICK START – OIL HEATER CONTROL

To prevent overloading of the three phase transformer that powers the oil pump and oil heater, the Quick Start logic has been modified to **NOT** turn the Oil Heater on while the Oil pump is running. On startup the Shutdown Temperature is set to the calculated value.

SUBCOOLER TUBE FREEZE PROTECTION

Condenser Pump Control

If the Drop Leg Temperature is Disabled and the chiller is Stopped and the Condenser Pump is off, the pump will be turned on when the Saturated Condenser Temp is < 34.0°F. (formerly 35°F)

If the pump is on only due to the Saturated Condenser Temp, it will be turned off when the Saturated Condenser Temp is > 36.0 °F (formerly 40°F). If other logic calls for it to be on, it will remain on.

If the Drop Leg Temperature is Enabled and the chiller is stopped and the Condenser Pump is off, the pump will be turned on when the Drop Leg Temp is < 35.0 °F.

If the pump is on only due to the Drop Leg Temperature, it will be turned off when the Drop Leg Temperature is > 36.0 °F for 5 consecutive minutes. If other logic calls for it to be on, it will remain on.

Warning – Condenser – Freeze Threat from Low Pressure

If the Drop Leg Temperature Sensor is Enabled:

The warning is set when All of the following are true:

- Chiller State is Stopped
- Saturated Condenser Temperature is < 34.0 °F
- Drop Leg Temperature is < 35.0 °F

The warning is released when Any of the following are true:

- Chiller State is not Stopped
- Saturated Condenser Temperature is > 36.0 °F
- Drop Leg Temperature is > 38.0 °F

SI0300 - SOFTWARE ENHANCEMENTS (VER 27) EFFECTIVE JUNE 2015 (CONT'D)

If the Drop Leg Temperature Sensor is Not Enabled:

The warning is set when All of the following are true:

- Chiller State is Stopped
- Saturated Condenser Temperature is < 34.0 °F

The warning is released when Any of the following are true:

- Chiller State is not Stopped
- Saturated Condenser Temperature is > 36.0 °F

Warning - Condenser – Freeze Threat – Flow Switch Open

If the Drop Leg Temperature Sensor is Enabled:

The warning is set when All of the following are true:

- Chiller State is Stopped
- Saturated Condenser Temperature is < 34.0 °F
- Drop Leg Temperature is < 35.0 °F
- Condenser Flow Switch is Open Continuously for > 1 minute

The warning is released when Any of the following are true:

- Chiller State is not Stopped
- Saturated Condenser Temperature is > 36.0 °F
- Drop Leg Temperature is > 36.0 °F for 5 continuous minutes
- Condenser Flow Switch is closed

If the Drop Leg Temperature Sensor is Not Enabled:

The warning is set when All of the following are true:

- Chiller State is Stopped
- Saturated Condenser Temperature is < 34.0 °F
- Condenser Flow Switch is Open Continuously for > 1 minute

The warning is released when Any of the following are true:

- Chiller State is not Stopped
- Saturated Condenser Temperature is > 36.0 °F
- Condenser Flow Switch is closed

SETUP SCREEN

On all language selections except English, the VSD communication protocol selection box was not displayed until the 02430 microboard established communications with the VSD. This prevented the user from selecting the correct VSD communication protocol. This has been corrected.

PRV CALIBRATION SCREEN

When an ACC board is installed and the VSD communications must therefore be YORK Protocol, the PRV calibration voltage is monitored in the ACC board and not communicated to the microboard. The PRV Calibration Screen displayed a PRV Calibration Voltage box and title but no voltage update which was confusing to the user. The screen has been changed to not show this text and voltage box when the panel is set to the YORK Protocol.

MOTOR LUBRICATION

Initial Panel Last Lubrication Date

The last lubrication date was not always set properly in the factory. The program has been changed to automatically set the date of last lubrication when the factory presses the Finish Setup button.

Motor Auto Lubrication

The Setup Screen has been changed to allow the Service level user the capability to select the type of Auto Lubrication system installed.

PROGRAM SETTING	SCREEN / BUTTON	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Motor Auto Lube Type	Setup Screen	Service Access	Choices: • None • QLS401 • P203 • Sleeve		None

None is unchanged. The user must lubricate the motor manually and may use the Acknowledgement Button to log the completion of the lubrication

QLS401 Auto-Lubrication System is unchanged in operation. This system is pre-configured to inject grease into the motor bearings at a factory configured time interval set in the QLS401.

SI0300 - SOFTWARE ENHANCEMENTS (VER 27) EFFECTIVE JUNE 2015 (CONT'D)

P203 Auto-Lubrication System A new version of the auto-luber, the Lincoln P203 allows the OptiView panel to control the lubrication timing which allows the lubrication to only be applied while the motor is not operating. The P203 also has a low grease level switch that is monitored by the OptiView to provide a message to the user that the grease reservoir must be filled.

The P203 will perform a lubrication at 900 hours of operation since the last lubrication if the motor is stopped. If the chiller runs 1400 hours since the last lubrication without stopping, a cycling fault will occur, the chiller will shut down and the bearings will be automatically lubricated. The chiller will then restart at the completion of the lubrication. Chiller startup is inhibited during the auto-lube process.

Sleeve Bearings Motors with sleeve bearings use oil which does not require changing as often as motors with ball bearings that require grease. Additional messages have been added to support Sleeve Bearings Lubrication.

Appropriate messages for each of the lubrication choices are displayed and user actions logged.

Warning – Motor Oil Change Suggested is displayed at 4000 operating hours since the last motor lubrication. A completed lube acknowledgement will clear the message.

Warning – Motor Oil Change Required is displayed at 5000 operating hours since the last motor lubrication. A completed lube acknowledgement will clear the message.

Warning – Lack of Motor Oil Change is displayed at 6000 operating hours since the last motor lubrication. A completed lube acknowledgement will clear the message. If the Shutdowns setting is set to Enabled, this third message will be treated as a Safety Fault and will therefore shut down the chiller until the motor lubrication is performed and acknowledged.

ISOLATION VALVES

The control of Isolation Valves is changed to the following LTC I/O board locations.

BOARD	REFERENCE	HEADER / TERMINAL	ITEM
LTC I/O Board	K1	DO1/TB17-1,2	Isolation Valves Open
LTC I/O Board	K2	DO2/TB16-1,2	Isolation Valves Close
LTC I/O Board	N/A	DI4 / TB19-3,4	Isolation Valves Opened
LTC I/O Board	N/A	DI5 / TB18-1,2	Isolation Valves Closed

HEAD PRESSURE AND HEAT RECOVERY

The minimum access level for the Head Pressure Control and Heat Recovery Screens has been changed to Operator.

CHILLER STYLE

Program additions have been made to support the high temperature heat pump compressors Style G/U1-2 and Style G/U3-4,7.

ERASE BRAM

The “Erase All BRAM” button has been added to the Diagnostics Screen. The “Erase All BRAM” button is only visible when the following conditions are true:

- Access Level is Admin
- Chiller is Stopped
- Panel Switch is OFF

Selection of the “Erase All BRAM” button displays a confirmation box with the string “Erase All BRAM and reboot? If “Yes” is selected ALL data stored in the OptiView BRAM will be erased and then the panel rebooted. This includes the Sales Data so, this function must only be used when factory Product Technical Support advises to do so and issues the Admin password to allow the function.

SI0300 - SOFTWARE ENHANCEMENTS (VER 27) EFFECTIVE JUNE 2015 (CONT'D)

E-LINK CODE ADDITIONS

The following new code definitions have been added in this software release and is compatible with the E-Link data table for YK OptiView BAS (Rev K_04a).

E-LINK CODE ADDITIONS	
UNIT SAFETY FAULT CODES	
CODE	**DESCRIPTION**
15	Motor - Lack of Motor Oil Change
UNIT CYCLING FAULT CODES	
CODE	**DESCRIPTION**
69	Motor Auto Lubrication In Progress
UNIT WARNING CODES	
19	Warning – Auto Lube Req’d On Next Shutdown
20	Warning – Auto Lube Grease Level Low
21	Warning – Auto Lube Failed
22	Warning – Motor Oil Change Suggested
23	Warning – Motor Oil Change Required
24	Warning – Lack of Motor Oil Change

LANGUAGES

The panel now supports Turkish.

LCHWT REMOTE RESET

When a BAS system changes the LCHWT setpoint up more than the Low Water Temperature Offset the chiller controller with v.24 software and later, the chiller control should have ramped the new setpoint up from the old setpoint at the rate of 0.2°F per second to allow the chiller to unload and not cause a LWT shutdown. This did not work properly and was fixed in this v.27/v.0 release.

NOTES

The following factors can be used to convert from English to the most common SI Metric values.

TABLE 34 - SI METRIC CONVERSION

MEASUREMENT	MULTIPLY ENGLISH UNIT	BY FACTOR	TO OBTAIN METRIC UNIT
Capacity	Tons Refrigerant Effect (ton)	3.516	Kilowatts (kW)
Power	Horsepower	0.7457	Kilowatts (kW)
Flow Rate	Gallons / Minute (gpm)	0.0631	Liters / Second (l/s)
Length	Feet (ft)	0.3048	Meters (m)
	Inches (in)	25.4	Millimeters (mm)
Weight	Pounds (lbs)	0.4536	Kilograms (kg)
Velocity	Feet / Second (fps)	0.3048	Meters / Second (m/s)
Pressure Drop	Feet of Water (ft)	2.989	Kilopascals (kPa)
	Pounds / Square Inch (psi)	6.895	Kilopascals (kPa)

TEMPERATURE

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32° and multiply by 5/9 or 0.5556.

Example: (45.0°F - 32°) x 0.5556 = 7.22°C

To convert a temperature range (i.e., a range of 10°F) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

Example: 10.0°F range x 0.5556 = 5.6°C range

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