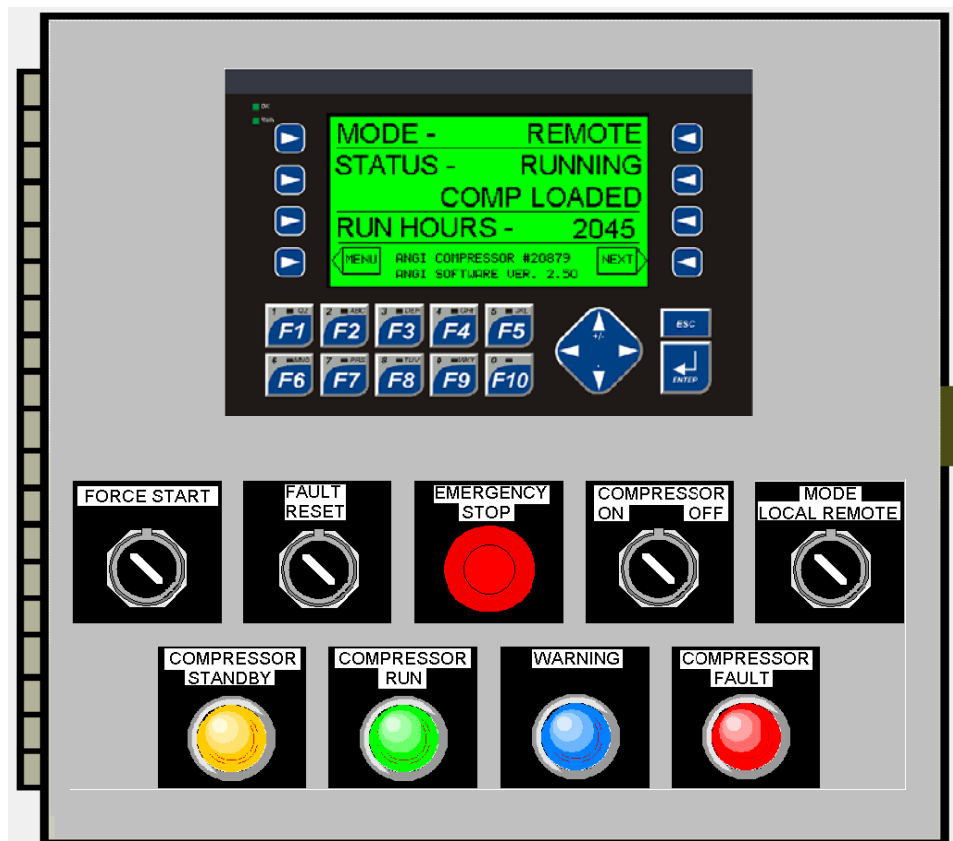


MAINTENANCE MANUAL

ANGI SERVICE

COMPRESSOR CONTROL PANEL (CCP)

with NX-OCS Control Software Version 2.50



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SPECIFICATIONS**Compressor Control Panel**

Control System.....	ANGI CCP NX Control System
OCS Power Supply Output.....	24 VDC @ 5.0 Amps
OCS Power Supply Input.....	100-240 VAC, 50/60 Hz
Maximum Temperature.....	50° C

NX251 Parameters

Software Package.....	CScene™ Version 8.52B, Ethernet
Software Version.....	ANGI CCP NX251 Version 2.50
Networks.....	CsCAN™, Ethernet TCP/IP
Network ID.....	Programmable in Setup Screen
Network Baud.....	125K (CsCAN™)
Firmware Revision.....	Firmware Rev. 12.06 FPGA Rev. 4.5
BIOS Revision.....	CPLD Rev. 0.2

Drawing Reference

Compressor Control Panel, Electrical Schematic.....	A80-30-XXXXX
Compressor Control Panel, Termination Panel.....	E03-80-XXXX

OCS UNIT Program Outline

Configure Parameters.....	configure machine parameters
Networks.....	write node data to master
Screens.....	screen display logic
Text Tables.....	text table to I/O pointers
Analog Input Monitor.....	read analog inputs
Digital Input Monitor.....	read digital inputs
Comp Sequence.....	compressor step sequence control
Outputs.....	digital outputs & display lamps
AI Monitor sbr.....	scale analog input & fault subroutine
DI Monitor sbr.....	digital input fault subroutine
Alarm Control.....	alarm screen subroutine
Alarm Load Log sbr.....	time & date stamp fault subroutine
Alarm Log Display.....	fault log history subroutine
Alarm Log Display.....	fault log history subroutine
Compact Flash.....	save/restore program and setpoints



IMPORTANT INFORMATION

USER MODIFICATION

ANGI must authorize all modification to this equipment. Any unauthorized modification to this equipment and or software will void the warranty. Modification may damage the equipment and cause bodily injury.

DISCLAIMER

ANGI disclaims any responsibilities whatsoever to the customer or to any person for injury or damage to, or loss of, property or value resulting from the use of its products which have been subjected to misuse, accidents, misapplied, repaired by unauthorized person, or improperly installed.

NOTICE: This manual is as current as possible at the time of printing and is subject to change without notice. For information not covered in this manual or further clarification, contact ANGI Customer Service.

CONTRACTOR OR INSTALLER: Leave this manual with the Unit station after installation is complete.

CUSTOMER: Retain this manual for future reference.

1. INTRODUCTION

This manual contains information on the operation and maintenance of ANGI OCS Compressor Control Panel, CCP, used in vehicle re-fueling applications. ANGI CNG Compressor Stations are designed for continuous duty, unattended operation. This compressor station compresses natural gas to a discharge pressure of 4500 psig at the specified inlet pressure.

The Compressor Control Panel is controlled by an ANGI NX-OCS control system. It provides automated compressor operation, sequence valve operation, shut down limit monitoring, fault annunciation, and remote paging annunciation.

The ANGI NX-OCS includes a graphical screen display and Smart Stack I/O modules. The OCS provides controller, networking, I/O and operator interface capabilities in one unit using a visual graphic display screen. The OCS has Serial and CAN (Controller Area Network) communication ports. The controller includes embedded features such as Ethernet, CompactFLASH® and Web Server. The units contain an RS-232 port for programming, debugging, monitoring and network administration from an IBM-compatible PC.

Cscape Software is used with the Graphical OCS. The Windows - based software package aids in the integration of a CAN-based Distributed Control System. The program is used for configuring controllers. Cscape is also used for OCS ladder logic, user displays, network configuration for global digital and analog data, setting system-wide security and monitoring other controllers in the system. The operator can upload, download, monitor and debug to any node on the network.

RUN and OK LEDs are physically located on the front panel of the NX OCS. CAN OK, and FIBER OK LEDs can be viewed on the back of the NX OCS next to the fiber connector. Virtual RUN and OK LEDs can be accessed by pressing the SYSTEM key. OCS LED indication:

- RUN – OFF indicates OCS is in IDLE/STOP mode. FLASHING indicates DO/IO mode or RUN with no ladder program. ON indicates ladder code in RUN.
- OK - OFF indicates self-tests failed, typically IO Configuration Error. ON indicates all self-tests passed.

- CAN - OK when randomly flashes during CAN communications.
- FIBER OK - ON indicates OCS's fiber input cable is receiving a carrier signal.

2. SYSTEM MENU

The System Menu is used to access and edit information using the OCS front panel. To enter the System Menu, press both ↑ and ↓ keys (Up and Down arrows) on the front panel of the NX. Press the ↑ and ↓ keys to scroll up or down through the menu options. The following list contains parameters that can be set or monitored while using the System Menu:

- Set Network ID
- Set Network Baud
- Set Contrast
- View OCS Status
- View OCS Diags
- View I/O Slots
- View Protocols
- Set Fkeys Mode
- Set RS232 Mode
- Set Time/Date
- Set Beeper
- Set Screen
- Compact Flash

Navigating through the System Menu by pressing the ↑ and ↓ keys scroll up or down through the menu options. Pressing the Enter key selects the system screen that the indicator arrow is pointing to. Once in a system screen, press ESC (if not currently modifying a field) to return to the main System Menu.

- Set Network ID - The first field contains the current network status. The second field contains the current Network ID of the model. Each unit on the network needs a unique ID number. Enter the correct ID number before physically attaching the unit to the network.
- Set Network Baud - This screen allows the user to select the current baud rate of the network. Note all devices on the network must be at the same baud rate. Cscan model: [125K, 250K, 500K, 1M]. Default set to 125K Baud.
- Set Contrast - This menu contains an editable bar graph entry allowing the user to set the contrast of the LCD display. Adjust the contrast to best site conditions.
- View OCS Status - This screen contains an editable field that sets the OCS scan mode and status fields that display information about the internal state of the OCS.

Model: Displays the controller model i.e NX251.

OCS Mode: Displays the current scanning mode (Idle, Run, DoIO). In Idle mode, the I/O is not scanned and the OCS ladder program does not execute. The green "RUN" LED is OFF. In Run mode, the ladder program executes and the green "RUN" LED illuminates. DoIO mode is similar to Run mode, except the ladder logic is not solved. In this mode the green "RUN" LED flashes.

Scan-Rate (ms.): Shows the number of milliseconds for an average program scan cycle.

OCS Net Use (%): Shows the percentage of the network used by the NX.

All Net Use (%): Shows the percentage of the network used by all devices on the network.

Ladder Size: Shows the number of bytes used by the ladder program.

Config Size: Shows the number of bytes used by the I/O configuration

Graphics Size: Shows the total size of the file containing graphics.

String Size: Shows the total size of the text stored in the String Table.

Bitmap Size: Shows the total size of the file containing bitmaps.

Text Tbl Size: Shows the number of bytes used by the text tables.

Font Tbl Size Shows the number of bytes used by the downloadable font table.

Protocol Size Shows the number of bytes used by the protocol table.

Firmware Rev: Shows the execution engine firmware version.

CPLD Rev: Shows the CPLD revision.

FPGA Rev: Shows the FPGA Image version.

Self-Test: Shows if the power-up self-test passed or failed by displaying Ok or Fault.

- **View OCS Diags** - This screen displays a list of self-test diagnostics results (no editable parameters). Each item describes a test and shows a result of Ok if the test passed or Fault/Warn if an error was found while running the test. Fault indications will prevent the loaded application from running. Warning indications allow the application to run but inform the user that a condition exists that needs correction.

System RAM - This test checks the functionality of the controller RAM at power up.

System BIOS - This test checks for a valid BIOS portion of the controller firmware.

Firmware - This test validates the controller firmware.

Logic Error - This test checks for problems with the user program while running.

User Program - This tests for a valid user program and configuration data.

User Graphics - This test validates the user graphics.

W-Dog Trips - This test checks for resets caused by hardware faults, power brownouts or large amounts of electrical interference.

Net Errors - This test checks for abnormal network operations while running.

Network State - This test checks that the network sub-system is powered and operating correctly.

Network ID - This test checks that the network ID is valid.

- **View I/O Slots** - The View I/O Slots screen displays information about SmartStack modules that are currently connected to the NX.
- **View Protocols** - This screen displays protocol drivers loaded by the applications and their current revisions.
- **Set Time/Date** - This screen contains two editable enumerated fields for displaying and modifying the NX's time and date.

- **Set Screen** - This screen allows a screen saver to be enabled or disabled and the timeout for the screen saver to be set. To enable the screen saver, change Saver Enable to Yes. Edit the Timeout (min) to determine the number of minutes before the screen saver becomes active.
- **Compact Flash** – This screen allows the user to 1) Save Program to CF, 2) Load Application from CF, 3) Delete File, 4) Format CF.

OCS Reference	Maximum Range	Modbus Reference	Modbus Command(s)
%Q	2048	00001	Read Coil Status
%QG	256	09001	
%I	2048	10001	Read Input Status
%IG	256	13001	
%AI	512	512	Read Input Register
%AIG	32	33001	
%AQ	512	40001	Read Holding Register
%AQG	32	46001	

3. NETWORKS

The NX Controller has several network options to allow remote communications.

CsCAN is a peer-to-peer network developed by Horner Electric. CsCAN is similar to RS485 with multi-drop Nodes on the network. Networks exceeding the maximum total cable length must make use of repeaters. For example, a 125KBaud network running on Belden 3084A Cable can be extended from 500 meters. The two nodes at the physical end-points need to have 121 ohm, 1%, ¼ Watt terminating resistors connected across the CN_L and CN_H terminals.

Ethernet is built into Horner OCS controllers to provide advanced Ethernet communication capabilities. The Ethernet port Module uses a standard TCP/IP protocol. The RJ45 connector with a CAT5 or CAT6 cable can connect to a network hub/switch. It can communicate beyond the local network and onto the Internet. To do so, the Ethernet must be configured with the IP Address of a Network Gateway server, which allows communication outside the local network.

Modbus TCP is a Master/Slave protocol, which allows a remote Modbus TCP Master (client) to request services from a Modbus TCP Slave (server). All Modbus requests that contain the Ethernet Module's IP Address are serviced. Each Ethernet Module must have its own unique IP Address. The method uses Modbus Reference Table Shown here;

4. CONTROLS & INSTRUMENTATION

4.1. Control System Overview

The Compressor Control Panel, CCP, was developed by ANGI to provide complete compressor control functions required to allow fully automatic, unattended operation. The OCS controller provides fault code annunciation and log for quick fault recovery.

The Compressor System contains the reciprocating compressor, safety relief valves, inter-stage cooling, and coalescing filters. The gas is compressed to the specified discharge pressure in multiple stages of compression. An on-skid automatic inlet valve allows gas flow to the compressor. The inlet valve is open when the compressor is warming-up, running loaded, and cooling down. This valve remains closed when the compressor is off or in stand-by modes. After the final stage filtration, the discharge pressure is monitored by the OCS control system to determine if the compressor should start, continue running, or stop compressing gas. The Re-circulation System includes tubing lines and valves are installed between the 3rd and 4th stage filters and the receiver tank. During warm-up and cool-down and at pre-determined intervals during loaded operation, gas is allowed to flow through these lines. During these times, the compressor is operating unloaded which allows smooth starts and stops.

The Emergency Shutdown, ESD, is monitored by the ESD control relay located in the Compressor Control Panel. ESD is active when the ESD relay is de-energized. The ESD pushbutton, located on the panel, may activate an ESD. Also Gas Detectors that sense a High Gas Alarm will activate an ESD. Once ESD is active, the Emergency Shutdown stops all compressor operations. The OCS activates an ESD fault screen and may illuminate an ESD lamp. Activate the Reset pushbutton to return the controller to normal operation.

4.2. Master Control Operation (Optional)

One CCP may be selected as the Master. The OCS with Master Control provides a coordinated lead-lag start/stop control for multiple compressors. Monitoring all Unit Controllers (CCP) on each compressor station provides remote compressor sequence control and fault monitoring and annunciation. The Master Controller monitors the storage pressure as well

as the RUN HOURS of each compressor via a network connection. The Master calls the required number of compressors to satisfy the filling demands. The Lead-Lag control determines which compressors will run to complete

the filling sequence. Each compressor is assigned Lead, Lag#1, or Lag#2 based on total run hours. For any/all compressors to be available the following conditions must occur.

- CsCAN Network is OK.
- Use Compressor selected in Master setup.
- ON Keyswitch is selected
- Remote Keyswitch is selected.
- CCP not Faulted

4.3. Remote Compressor Operation

The compressors operate in REMOTE mode. The RUN signals from the Master, and will automatically start and stop based on the final discharge or storage filling demand pressures measured by the Master.

4.4. Control System Sequence Operation

With power supplied to the station and the ON/OFF key switch placed in the ON position, the OCS control system will sequence through each of the following operating modes. These modes of operation are:

MODE	ELECTRIC DRIVE	ENGINE DRIVE
OFF	Keyswitch OFF	Keyswitch OFF
STANDBY	Keyswitch ON	Keyswitch ON
WARMUP	Start Prelube Start Fan Motor Lube Pressure OK	Run Starter Engine Temp OK
RUNNING	Start Comp Motor Close Load Valve	Full Throttle Close Load Valve
COOL-DOWN	Open Load Valve Stop Comp Motor Stop Fan Motor	Open Load Valve Stop Comp Motor

5. Local Compressor Operation

As a stand alone or back-up mode of operation, the compressor can operate in LOCAL mode. Local mode ignores any remote RUN signals from the Master, and will automatically start and stop based on the final discharge pressure measured by the CCP. In LOCAL mode the compressor will start and run when all of the following conditions are met:

- a) The COMPRESSOR ON/OFF key switch located on the front panel of the CCP is turned ON.
- b) The REMOTE/LOCAL key switch on the front panel of the CCP is set to LOCAL MODE.
- c) The CCP is not faulted.
- d) The final discharge pressure is less than the START PRESSURE setpoint in the CCP.

The compressor continues to run until the final discharge pressure becomes greater than the STOP PRESSURE setpoint in the CCP, or the compressor is turned OFF or is FAULTED.

In LOCAL mode, each CCP will start and stop independent of the run hours and each machine will operate independent of the status of the MCP or other CCPs.

Stand-By Mode

In Stand-by mode the storage is full and the compressor is stopped. The control system monitors the discharge pressure against a START pressure limit. The compressor will remain in this mode until the storage is falls below the START pressure limit.

Warm-Up Mode

In Warm-Up mode the compressors have staged lubrication and warm-up times. The different applications have specific warm-up modes.

Once the control system detects that the gas storage has fallen below the START pressure limit, the inlet valve opens and the compressor drive motor is started.

Motor driven compressors require a Pre-Lubrication Time. The Pre-Lube may restart if lubrication pressure is not achieved within the timer setup. Up to three restarts may occur before a Pre-Lube Time Out alarm is annunciated.

Engine driven compressors require an Engine Warm-Up Time. The Engine Starter is cranked to start the engine. The engine may restart up to 5 tries after failed starts and a Max Starts Exceeded alarm is annunciated. Once started, the engine accelerates to warm speed. The engine remains at warm-up speed until the coolant temperature rises above the minimum temperature setpoint. Engine Warm-Up parameters are set at the factory.

During this warm-up period the load valve is open so that gas re-circulates through the captive receiver tank.

Load Mode

After a preset warm-up time period, the control system switches to loaded operation. To transition from the warm-up mode, while the compressor motor continues to run, the load valve is closed forcing the gas to flow into to the discharge piping rather than re-circulate. In blow down mode, the load valve opens briefly at one hour timed intervals to drain the filter bowls of accumulated fluids. The control system will continue to run in this mode until the discharge pressure reaches the STOP pressure setpoint defined in the OCS controller.

Run Hours accumulate a totalized count during loaded operation. The hour count may be used for maintenance schedules and Master Lead-Lag control.

Cool-Down Mode

Once the controller determines storage pressure is above the STOP pressure setpoint, the load valve opens and the compressor motor continues to run for a period of time (Cool Down #1 Timer). The compressor cools with the fan running for a period of time (Cool Down #2 Timer). After the Cool-Down timers expire, the control system returns to STAND-BY mode.

Faulted

During any of the modes of operations, the control system may detect a shutdown condition and the machine will be placed in FAULTED mode. In this mode the inlet suction valve is closed and compressor motor is stopped. The fault code and type of alarm are displayed on the OCS Alarm Screen.

6. OPERATOR SCREENS

The controllers contain operator screens that allow the User and Alarm screen numbers to be read. The following is a definition of the two types of screens:

Alarm Screen - These screens are forced to display faults generated in ladder logic. Follow the screen instructions to acknowledge and clear alarms.

User Screen – These screens display the CNG process. The operator can switch between screens by using the global keys or by using the NEXT (UP) and PREVIOUS (DOWN) touch keys on the controller.

MAIN – SCREEN #1

The MAIN Screen displays the current operation for the compressor. The F7 key is a short cut and directs the “MAIN” screen to display.

MODE -	REMOTE
STATUS -	RUNNING
START COMP MOTOR	
RUN HOURS -	2045
← MENU ANGI COMPRESSOR #20879 NEXT → ANGI SOFTWARE VER. 2.50	

MODE - The front panel key switches establish the active operating mode. The modes of operation are:

MODE	KEYSWITCH
OFF	Set to OFF
LOCAL	Set to Local
REMOTE	Set to Remote

STATUS - The control system displays the current status and sequence. The status modes are:

STATUS	PROCESS SEQUENCE
OFF	OFF
ON	STANDBY
WARMUP	START PRELUBE (Note*1) START FAN MOTOR PRELUBE < MIN. PRESSURE LUBE PRESSURE OK
RUNNING	START COMP MOTOR COMP LOADED
COOLDOWN	COMP UNLOADED STOP COMP MOTOR STOP FAN MOTOR
FAULTED	OFF

(Note*1) The Prelube pump shall restart if minimum pressure is not achieved. Up to 3 restarts may occur.

ANALOG INPUTS, SCREENS #2 – 4

The Analog Input AIxx is associated with a SmartStack I/O module. The Analog Inputs are monitored in engineering units. The inputs are configured 4 to 20 mA signal = 6400 to 32000 count.

AI001 to AI008

C	AI01-INLET PRES (psi)	145.00
D	AI02-FINAL PRES (psi)	916.00
#	AI03-RESERVED	0.00
1	AI04-COMP OIL PRES (psi)	59.00
C	AI05-RECEIVER PRES (psi)	169.00
D	AI06-COMP TORQUE (%)	59.00
#	AI07-BOOSTER TORQUE (%)	37.00
2	AI08-SITE (amps)	1385.00
← DN ANALOG INPUT MONITOR CARD#1&#2: AI01 thru AI08 UP →		

AI009 to AI016

C	AI09-STAGE #1 TEMP (degF)	208.00
D	AI10-STAGE #1 PRES (psi)	217.00
#	AI11-SPARE	0.00
C	AI12-STAGE #2 TEMP (degF)	294.00
D	AI13-STAGE #2 PRES (psi)	431.00
#	AI14-SPARE	0.00
3	AI15-STAGE 3 TEMP (degF)	273.00
	AI16-GAS DETECTOR (%LEL)	2.00
← DN ANALOG INPUT MONITOR CARD #3: AI09 thru AI16 UP →		

AI017 to AI024

C	AI17-STAGE 3 PRES (psi)	2035.00
D	AI18-STAGE 4 TEMP (degF)	130.00
#	AI19-STAGE 4 PRES (psi)	3630.00
3	AI20-RESERVED	0.00
C	AI21-NOT USED	0.00
D	AI22-NOT USED	0.00
#	AI23-NOT USED	0.00
4	AI24-NOT USED	0.00
← DN ANALOG INPUT MONITOR CARD#3&#4: AI17 thru AI24 UP →		

The count is scaled and displayed to their respective engineering units. Refer to ANGI P&ID drawings for proper transducer scaling. Display options for pressure include psig, bar, or MPa. Display options for temperatures include °F or °C.

DIGITAL INPUTS, SCREENS #9 – 8

The Digital Input I0xx is associated with a Smart-Stack I/O module. 1-bit memory stores the state of one of the digital inputs.

I001 to I008

C	I001-ON KEYSWITCH	■
A	I002-RESET KEYSWITCH	■
R	I003-REMOTE KEYSWITCH	■
D	I004-DEMAND START KEYSW	□
	I005-FORCE START KEYSW	□
#	I006-ESD SHUTDOWN	■
1	I007-SPARE	□
	I008-UPS POWER	■
DIGITAL INPUT MONITOR		
CARD #1: I001 thru I008		

I009 to I016

C	I009-RECEIVER LEVEL SW	■
A	I010-OIL LEVEL SWITCH	■
R	I011-NO OIL FLOW - DNFT	■
D	I012-OIL TEMP SWITCH	■
	I013-VIBRATION SWITCH	■
#	I014-SOFT START STATUS	■
2	I015-MASTER KEYSWITCH	■
	I016-RESERVED	□
DIGITAL INPUT MONITOR		
CARD #2: I009 thru I016		

I017 to I024

C	I017-NOT USED	□
A	I018-NOT USED	□
R	I019-NOT USED	□
D	I020-NOT USED	□
	I021-NOT USED	□
#	I022-NOT USED	□
4	I023-NOT USED	□
	I024-NOT USED	□
DIGITAL INPUT MONITOR		
CARD #4: I017 thru I024		

DIGITAL OUPUTS – SCREEN #10

The Digital Output Q0xx is associated with a Smart-Stack I/O module. 1-bit memory stores the state of one of the digital outputs.

Q001 to Q008

C	Q001-INLET VALVE/HEATER	■
A	Q002-LOAD VALVE	■
R	Q003-FAN MOTOR	■
D	Q004-COMP MOTOR	■
	Q005-STANDBY LAMP	□
#	Q006-RUN LAMP	■
1	Q007-FAULT LAMP	□
	Q008-WARNING LAMP	□
DIGITAL OUTPUT MONITOR		
CARD #1: Q001 thru Q008		

Q009 to Q016

C	Q009-PRELUBE MOTOR	□
A	Q010-SPARE	■
R	Q011-RESERVED	□
D	Q012-RESERVED	□
	Q013-NX251 COOLING FAN	□
#	Q014-RUN BOOSTER	■
2	Q015-RUN COMP "B"	□
	Q016-RUN COMP "C"	□
DIGITAL OUTPUT MONITOR		
CARD #2: Q009 thru Q016		

Q017 to Q024

C	Q017-NOT USED	□
A	Q018-NOT USED	□
R	Q019-NOT USED	□
D	Q020-NOT USED	□
	Q021-NOT USED	□
#	Q022-AUTODIALER #1	□
4	Q023-AUTODIALER #2	□
	Q024-NOT USED	□
DIGITAL OUTPUT MONITOR		
CARD #4: Q017 thru Q024		

The Digital Inputs are displayed with Lamps. Input Lamps are GREEN when Off (inactive), and BLACK when ON (active). Refer to section "Digital Input Setup" for configuration settings.

This screen monitors the Digital Outputs. Output Lamps are GREEN when Off (inactive), and BLACK when ON (active).

ANALOG OUTPUTS – SCREEN #12

The Analog Output AQxx is associated with a SmartStack I/O module. The Analog Outputs are monitored in engineering units. The outputs are configured 4 to 20 mA signal = 6400 to 32000 count.

AQ001 to AQ006

#	AQ001-RESERVED	0
1	AQ002-RESERVED	0
#	AQ003-SPARE	0
2	AQ004-SPARE	0
#	AQ005-NOT USED	0
4	AQ006-NOT USED	0



ANALOG OUTPUT MONITOR
CARD#1/2/4: AQ01 thru AI06

The count is scaled and displayed to their respective engineering units. Refer to ANGI P&ID drawings for proper scaling. Display options for outputs include percent, or 4-20mA.

ELECTRONIC PRIORITY PANEL

The Master Compressor Station can remotely monitor the Electronic Priority Panel. Storage pressures are displayed and may be selected to Start/Stop the compressor. The EPP is controlled by an ANGI XLE control system and sends pressure values over the CAN network.

ELECTRONIC PRIORITY PANEL			
EPP	AI01 LOW BANK PRES (psi)	3518	
	AI02 MID BANK PRES (psi)	3918	
	AI03 HIGH BANK PRES (psi)	4102	
	AI04 INSTURMENT AIR (psi)	0	



REMOTE ANALOG MONITOR
EPP: AI01 thru AI04

The pressures are displayed to their respective engineering units. Refer to ANGI P&ID drawings for proper transducer scaling. Display options for pressure include psig, bar, or MPa.

MASTER CONTROL – SCREEN #14

The Master Compressor Station can remotely monitor the Slave Compressor B and Slave Booster. Compressor A is selected as the Master. Status is displayed for each compressor and booster.

Compressor #A, #B, and Booster

DEMAND 2	COMP #A	COMP #B	BOOSTER
RUN →			
ON →			
REMOTE →			
FAULT →			
HOURS →	2046	1374	7
LEADLAG →	LAG #1	LEAD	OFF



MASTER CONTROL
in COMP #A

The Master controller monitors all Compressor Controller Panels (CCP) and Booster Control Panel (BCP) via a CsCAN network connection. The Master provides remote Start/Stop control and fault monitoring and annunciation. The Master calls the required number of compressors to satisfy the filling demands. The Lead-Lag control determines which compressors will run by monitoring the RUN HOURS. Total hours determine which compressor is LEAD or LAG. The Master Control Panel determines which compressors are available. The compressor with the least amount of run hours is selected LEAD. The remaining compressors are selected as LAG#1, LAG#2, and LAG #3 respective to least to most run hours. LEAD-LAG selection is active when compressors are running.

The CsCAN Network monitors the status for the Compressors, Booster, and other units on the network. The Master sends a heartbeat signal to each node and determines if the node is active. Each unit has a specific Node Address and is assigned below.

NODE	UNIT
1	Compressor Control Panel "A"
2	Compressor Control Panel "B"
3	Booster Control Panel
5	Dryer Control Panel
10	Electronic Priority Panel
12	Time Fill Panel "A"
13	Time Fill Panel "B"

The unit is READY providing the following conditions are met.

- Network Heartbeat is OK.

- Keyswitch is ON.
- Keyswitch is REMOTE.
- No active FAULTS.

The Master monitors Compressors #A, #B and Booster. The control system displays the current Master status. The Master status modes are:

STATUS	PROCESS SEQUENCE
DEMAND	Number of compressors to run.
RUN	Unit is Running and Loaded.
ON	Unit Keyswitch is ON
REMOTE	Unit Keyswitch is REMOTE
FAULT	Unit is Faulted
HOURS	Unit Total Run Hours
LEAD/LAG	Unit Lead-Lag Status

Lamps are GREEN when Off (inactive), and BLACK when ON (active).

The Master adds the number of compressor available and READY. Generator power may also limit the number of compressors available to run. The DEMAND request may equal but not exceed the number of compressors that are READY. The following conditions are required for the Compressor to run.

Compressor Initial Requirements

- CsCAN Network is OK.
- Compressor selected in Master setup.
- Keyswitch set to ON.
- Keyswitch set to REMOTE.
- Compressor is not FAULTED.

The START and STOP pressures monitored by the Master, and default mode selects the final discharge pressure. Options to select Low bank pressure or High bank pressure are available. The Start Modes are selected from the Master Setup.

Mode	Start/Stop Setpoint	
1	Final Discharge (default)	Pressure
2	Low Bank Pressure	
3	High Bank Pressure	

The Master also determines when the Booster shall run. The Booster shall run while any Compressor is running. The following conditions are required for the Booster to run.

Booster Initial Requirements

- CsCAN Network is OK.
- Booster selected in Master setup.
- Keyswitch set to ON.

- Keyswitch set to REMOTE.
- Booster is not FAULTED.

Booster Run Requirements

- Compressor is running and loaded.
- Compressor Receiver Pressure has rundown.
- Inlet Pressure is low.

The DEMAND value determines the number of compressors needed for the CNG filling process. The LEAD compressor shall start immediately. The LAG#1 compressor has a time delay before starting the second compressor. This approach provides energy savings during peak electrical rate charges.

The Master monitors Compressors #A, #B and #C when all CCP's are setup and available the following conditions must occur.

- CsCAN Network is OK.
- Compressor selected in Master setup.
- ON Keyswitch is selected
- Remote Keyswitch is selected.
- CCP not Faulted

MAIN MENU – SCREEN #19

Access this screen from the “MAIN” screen by selecting “MENU” Function Key.



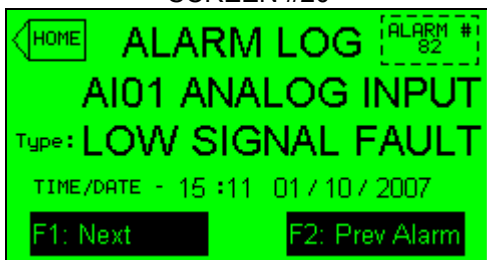
The Menu Screen provides quick access to the all operator screens. The table below includes NAME and SCREEN Number;

HOME → #1	ALARM LOG → #20
ANALOG MON → #2	WARN LOG → #21
DIGITAL MON → #9	MASTER → #14
PAGE HELP → #23	SET-UP → #39

7. ALARM LOG SCREEN

Access the Alarm Log Screen by pressing F8 Function key. The Alarm Log places a time and date stamp to each log entry.

SCREEN #20



The last 100 alarms are logged and stored. The information on the Alarm Log screen is as follows:

- **ALARM:** This displays the current alarm log code. The following table lists the Alarms;

ALARM	
CODE	DESCRIPTION
1- 24	Analog Inputs AI01 – AI24
46 – 64	Digital Inputs I06 – I24

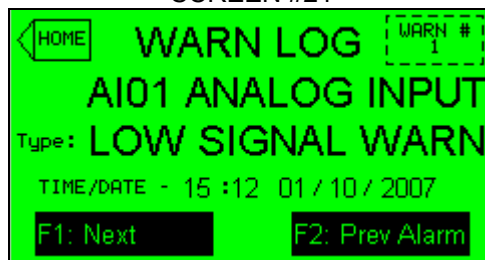
- **ALARM #:** The alarm log number identifies which of the last 100 alarms is being viewed.
- **UP:** Increase the Alarm Log Number by pressing the F1 key. When the Alarm Log Number reaches 100, it will advance the Alarm Log Number to 1.
- **DOWN:** Decrease the Alarm Log Number by pressing the F2 key. When the Alarm Log Number reaches 1, it will revert back to Alarm Log Number 99.
- **TYPE:** The alarm type identifies which condition the alarm was activated. The following table lists the Types of Alarms;

TYPES of ALARMS	
CODE	DESCRIPTION
0	No Fault
1	Broken Wire (Analog)
2	Low Signal Alarm (Analog) Low Signal Alarm (Digital)
5	High Signal Alarm (Analog)
6	Input Tripped (Internal)
12	Max Starts Exceeded
13	Timed Out

8. WARNING LOG SCREEN

Access the Warning Log Screen by pressing F9 Function key. The Warning Log places a time and date stamp to each log entry.

SCREEN #21



The last 100 Warnings are logged and stored. The information on the Warning Log screen is as follows:

- **WARNING:** This displays the current Warning log code. The following table lists the Warnings;

WARNING	
CODE	DESCRIPTION
1- 24	Analog Inputs AI01 – AI24
46 – 64	Digital Inputs I06 – I24

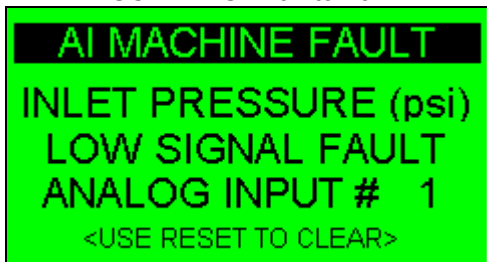
- **WARNING #:** The Warning log number identifies which of the last 100 Warnings is being viewed.
- **UP:** Increase the Warning Log Number by pressing the F1 key. When the Warning Log Number reaches 100, it will advance the Warning Log Number to 1.
- **DOWN:** Decrease the Warning Log Number by pressing the F2 key. When the Warning Log Number reaches 1, it will revert back to Warning Log Number 99.
- **TYPE:** The Warning type identifies which condition the warning was activated by. The following table lists the Types of Warnings;

TYPES of WARNINGS	
CODE	DESCRIPTION
0	No Fault
3	Low Signal Warning
4	High Signal Warning

9. MACHINE FAULT SCREENS

The alarm screen is annunciated when a machine fault occurs. A shutdown condition places the machine in FAULT mode.

SCREENS #101 to 104



The fault is displayed as long as the fault condition exists. The description for the fault and type of fault is displayed. The information on the Machine Fault screen is as follows:

- **FAULT:** This displays the active machine fault. The following table lists the Faults;

MACHINE FAULT	
CODE	DESCRIPTION
1- 24	Analog Inputs AI01 – AI24
46 – 64	Digital Inputs I006 – I024
97	Filter Dirty
98	Max Starts Exceeded
99	Timed Out (Pre-Lube Failure)

- **TYPE:** A number of digital inputs and analog transducers are monitored by the control system. The control system determines the type of fault associated with the analog or digital input. The following table lists the types of faults.

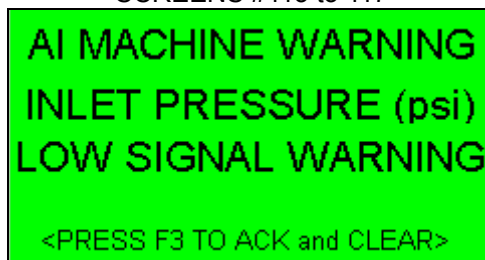
FAULT TYPES	
CODE	DESCRIPTION
0	No Fault
1	Broken Wire (Analog)
2	Low Signal Alarm (Analog/Dig)
5	High Signal Alarm (Analog)
6	Input Tripped (Internal)

- **RESET:** Activate the RESET Key Switch to clear the fault.

10. MACHINE WARNING SCREENS

The warning screen is annunciated when a machine warning level occurs. A warning condition allows the machine to continue running.

SCREENS #113 to 117



The warning is displayed as long as the warning condition exists. The description for the warning and type of warning displayed. The information on the Machine Fault screen is as follows:

- **WARNING:** This displays the active machine warning. The following table lists the Warnings;

MACHINE FAULT	
CODE	DESCRIPTION
1- 24	Analog Inputs AI01 – AI24
46 – 64	Digital Inputs I006 – I024
97	Filter Dirty
98	Max Starts Exceeded
99	Timed Out (Pre-Lube Failure)

- **TYPE:** A number of digital inputs and analog transducers are monitored by the control system. The control system determines the type of fault associated with the analog or digital input. The following table lists the types of faults.

FAULT TYPES	
CODE	DESCRIPTION
0	No Fault
2	Low Signal Warning (Analog)
5	High Signal Warning (Analog)
6	Input Tripped (Internal)

- **RESET:** Activate the F3 Function Key to Acknowledge and Reset the warning.

11. TROUBLESHOOTING

Faulted Conditions (General Note)

The fault condition must be verified with an on unit gauge or separate test device prior to carrying out any mechanical repairs. This is to insure that the fault indicated is due to the mechanical equipment not the monitoring system.

- A. If the fault can be verified without the unit running, do so. Correct the fault if needed.
- B. Clear the fault code using the FAULT RESET key switch.
- C. If the fault can only be verified with the unit running, follow the steps below.
- D. Clear the fault code using the FAULT RESET key switch.
- E. Turn the ON/OFF key switch to the ON position.
- F. Verify the fault, correct if needed.
- G. Clear the fault code using the FAULT RESET key switch.

Compressor Will Not Start

- A. Verify the compressor is not faulted. Clear any existing fault.
- B. Verify the key switch is in the ON position.
- C. Verify the thermal overload on the motor starter located in the control panel is not tripped.

Unit Shuts Down After Start Sequence

- A. Read fault lamps.
- B. Check motor starter, in the control panel, for over-load.

12. PASSWORD ACCESS/CHANGE

All Machine Parameters are password protected. Access is denied to individuals without a current password.

SCREEN #39



Enter a 4 digit password to access all Setup and Configuration Screens.

SCREEN #40



There is an option to change to Password code while in Setup Mode, First enter the "New Password". Enter the same code into "Confirm". Press F6 Function Key to enter new password into the controller.

Observe the Status Display which contains the following messages;

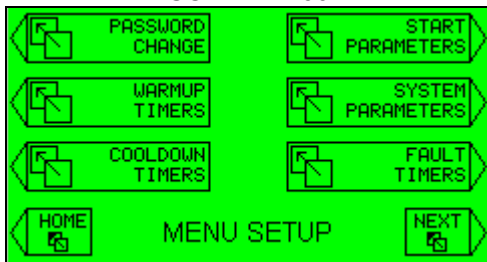
Press F6 to Enter (Password)
Password Accepted
Re-Enter Password

13. MACHINE PARAMETERS MENU

The main menu screens provide access to all machine parameters.

Press the function key for specific parameter setup or more setups. The menu includes NAME & SCREEN Number;

SCREEN #60



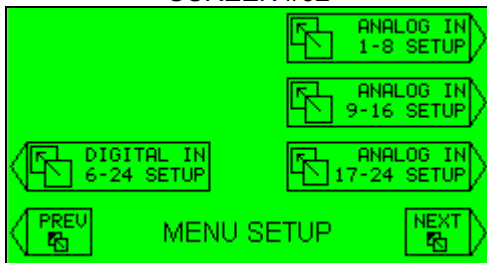
HOME → #1
PASSWORD CHANGE → #40
WARM-UP TIMERS → #65
COOL DOWN TIMERS → #66
START PARAMETERS → #67
SYSTEM PARAMETERS → #73
FAULT TIMERS → #69
next → #61

SCREEN #61



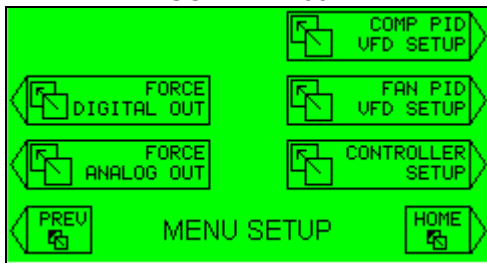
PREVIOUS → #60
MASTER SETUP → #78
PRELUBE SETUP → #70
DAUGHTER SETUP → #77
ENGINE SETUP → #71
PRIORITY SETUP → #88
TIME FILL SETUP → #87
NEXT → #62

SCREEN #62



PREVIOUS → #61
DIGITAL IN SETUP 6-24 → #170
ANALOG IN SETUP 1-8 → #200
ANALOG IN SETUP 9-16 → #216
ANALOG IN SETUP 17-24 → #232
NEXT → #63

SCREEN #63



PREVIOUS → #62
FORCE DIGITAL OUT → #79
FORCE ANALOG OUT → #80
COMP PID VFD SETUP → #90
FAN PID VFD SETUP → #92
CONTROLLER SETUP → #76
HOME → #1

14. WARM-UP TIMERS

WARM-UP TIMERS provide various time delays in the Startup Sequence. All timers are displayed in seconds.

SCREEN #65

START DELAY 1 (sec)	3.0
INLET VALVE OPEN --> FAN START	
START DELAY 2 (sec)	3.0
FAN START --> PRELUBE START	
START DELAY 3 (sec)	3.0
LUBE OK --> COMP START	
WARMUP DELAY (sec)	15.0
COMP MTR START --> LOAD MODE	
MENU WARM-UP TIMERS NEXT	

The Warm-Up Timers are used when starting the compressor and goes through the startup sequence. The timers control warmup sequence to loaded operation.

START DELAY 1: The time between the inlet valve opening and the cooling fan starting.

START DELAY 2: The time between the cooling fan starting and the pre-lube pump starting (if used).

START DELAY 3: The time between the Lube PSI (if pre-lube is used) reaching minimum start pressure and the compressor motor starting.

WARMUP DELAY: The time between the main motor (compressor) starting and the loaded condition.

Also refer to Startup Sequence Chart.

15. COOL-DOWN TIMERS

COOL-DOWN TIMERS provide various time delays in the Shutdown Sequence. Blow-Down timers cycle the load valve. All timers are displayed in seconds.

SCREEN #66

COOLDOWN DELAY 1 (sec)	5.0
UNLOAD --> COMP MTR STOP	
COOLDOWN DELAY 2 (sec)	5.0
COMP MTR STOP --> FAN STOP	
BLOW DOWN INTERVAL (sec)	3200.0
PURGE RECIRCULATION SYSTEM	
BLOW DOWN ON-TIME (sec)	5.0
MENU COOLDOWN TIMERS NEXT	

The Cool-Down Timers are used in the unloading and shutdown sequence of the machine. The load valve opens and the compressor motor continues to run for a period of time allowing the compressor to unload and cool down.

COOLDOWN DELAY 1: Delay 1 is the time between the load valve open and stopping the compressor motor. The compressor runs Unloaded in Recirculation Mode during Delay 1.

COOLDOWN DELAY 2: Delay 2 is the time to continue running the Cooling Fan. The controller goes into Standby Mode after Delay 2 times out.

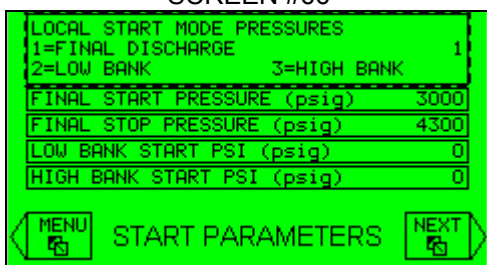
BLOW-DOWN INTERVAL: (If Used) allows gas to flow and purge the recirculation system. The Blow-Down Interval Timer is the time frame between each Blow-Down cycle. When the compressor is running and loaded the Timer starts timing. When the timer reaches the setpoint, the load valve turns off for a period of time (set in BLOW-DOWN TIME). When the BLOW-DOWN ON TIME expires, the Blow-Down interval timer resets and starts over. The cycle continues until the machine is unloaded.

BLOW-DOWN ON TIME: The valve unloads for a short period of time. (time is described in BLOW-DOWN INTERVAL).

16. START PARAMETERS

This screen allows the pressures to be adjusted to start/stop the compressor in Local Mode. Pressures are displayed in psig.

SCREEN #66



LOCAL START MODE PRESSURES: Select the pressure transmitter and configuration to start the compressor in LOCAL Mode. Enter the number for selected Start Mode;

1	Final Discharge Pressure < Start Pressure
2	Low Bank Pressure < Start Pressure
3	High Bank Pressure < Start Pressure

FINAL START PRESSURE (LOCAL): The pressure setpoint which starts or restarts the compressor. If the discharge pressure is lower than the setpoint, the start sequence is activated.

FINAL STOP PRESSURE (LOCAL): The setpoint pressure which stops the compressor and places the controller into STANDBY mode.

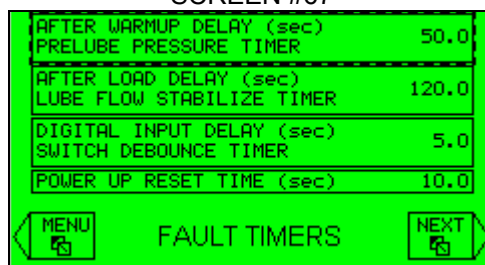
LOW BANK START PRESSURE (LOCAL): The low bank pressure setpoint which starts or restarts the compressor.

HIGH BANK START PRESSURE (LOCAL): The high bank pressure setpoint which starts or restarts the compressor.

17. FAULT TIMERS

Access this setup screen to adjust machine fault timers to certain machine/site conditions. Timers are displayed in seconds.

SCREEN #67



AFTER WARMUP DELAY: The timer starts when warmup begins and sets the time when the lubrication pressure is monitored. This timer allows time for the lubrication to reach pressure and stabilize. Cold ambient conditions may require longer times for lube oil to reach pressure.

AFTER LOAD DELAY: The timer starts when warmup begins and sets the time when lubrication flow (Ariel DNFT's) is monitored. The standard DNFT is factory set for (3) three minutes from no-flow to alarm/shutdown signal and is not adjustable.

DIGITAL INPUT DELAY: The debounce timer provides a time delay for digital input signals before annunciating an alarm. The timer applies to all digital inputs such as level switches, flow switches, temperature switches, motor T-Stats. Vibration and ESD inputs are not debounced.

POWER UP RESET TIME: The timer allows a delay during initial power-up to activate an AUTOMATIC RESET. When using a Generator adjust the timer to allow time for the Generator to start and distribute stable AC power.

Also refer to Digital and Analog input set-up for more information on fault monitoring.

18. PRELUBE SETUP

Determine if the Electric Drive is equipped with a Pre-Lube Motor/Pump. Note, Engine Drive use the same signal output for a Starter Motor. Pressures are displayed in psig. Timers are displayed in seconds.

SCREEN #70

USE PRELUBE LOGIC	
0=NO	1
1=YES	
MINIMUM PRELUBE PSI (psig)	35
PRELUBE ALARM TIMER (sec)	45.0

⏮ MENU
PRELUBE SETUP
NEXT ⏭

When Start Delay 2 timer expires, start the Pre-Lube Pump, and the Pre-Lube Timer. When the Compressor Oil PSI is greater than the Minimum Pre-Lube PSI, start the compressor motor. For an Engine unit, open the Fuel Inlet valve.

USE PRE-LUBE LOGIC: Enter "1" to enable Pre-Lube pump/motor. Enter "0" to disable this function (Engine Starter, CNG75).

MINIMUM PRE-LUBE PSI: The minimum pressure allowed before starting the compressor motor.

PRE-LUBE TIMER: If the Compressor Oil PSI does not rise above the minimum level before the Pre-Lube Timer expires, the logic sets a TIMED OUT (Internal) Alarm.

19. SYSTEM PARAMETERS

This screen sets up the machine identification and drive configuration. Global warning and alarm conditions are configured in this screen. Values are displayed in counts.

SCREEN #73

I/O AND DRIVE CONFIGURATION	
1=ELECTRIC DRIVE	1
2=BOOSTER/SCREW	
3=ENGINE DRIVE	
FAN ON above GAS %LEL	20
MAXIMUM STARTS PER HOUR (count)	8
MACHINE ID NUMBER (#)	20919
ALLOW WARNING SCREENS	1

⏮ MENU
SYSTEM PARAMETERS
NEXT ⏭

I/O & DRIVE CONFIGURATION: Enter the value for machine configuration setup;

- 1 = Electric Motor Drive
- 2 = Booster/Screw (Non Vilter Screw)
- 3 = Engine Drive

FAN ON GAS %LEL: Enter the value for GAS percent LEL which starts the fan motor. If the gas LEL is greater than the setpoint, the fan motor runs and discharges any gases present within the compressor skid area.

MAXIMUM STARTS PER HOUR: Enter the value for maximum start limit per hour. Determine maximum starts from the motor and drive manufacturer. Consider de-rating the value for unloaded conditions. Typically set to 8.

MACHINE ID NUMBER: Enter the ANGI job number, 5 digits, assigned to the CNG machine.

ALLOW WARNING SCREENS: Enter "1" to allow any Warning Screens selected in the Analog Input Setup. Enter "0" to disable all Warning functions.

20. CONTROLLER SETUP

This screen sets and monitors the controller. Refer to this screen when replacing a controller and using the same Node, IP address, and Run Hours. Temperatures are displayed in °F. Times are displayed in seconds.

SCREEN #76

COMPRESSOR RUN HOURS	8
ETHERNET IP ADDRESS	0.0.0.0
CSCAN NETWORK ID	1
INTERNAL TEMPERATURE (degF)	116.9
MIN. (degF)	70.8
MAX. (degF)	122.3
SCAN RATE AVERAGE (sec)	0.0343

MENU CONTROLLER SETUP HOME

COMPRESSOR RUN HOURS: Enter the value that represents the total run hours for this compressor.

ETHERNET IP ADDRESS: The NX Controller has a built in Ethernet Port. Each controller has a unique IP Address and configured to site specifications. The Ethernet RJ45 Port is 10/100BaseT. The Ethernet protocol is RTU Modbus.

Enter the IP Address ###.###.###.###

CSCAN NETWORK ID: The Node ID allows interaction between two or more controllers running the CsCAN protocol. Specific Node ID defined by the network must not be assigned to any other controller.

Enter the CsCAN Network ID #.

INTERNAL TEMPERATURES: The internal controller temperature is monitored for current temperature, and lifetime minimum/maximum temperature ranges.

SCAN RATE: This register displays the average scan rate of the controller in seconds.

21. MASTER SETUP

Use this screen to setup the Master using Lead-Lag control. Select the compressors that are available to run. Pressures are displayed in psig. Timers are displayed in seconds.

SCREEN #78

Use Comp #1	1	Lead Start (psig)	3000
Use Comp #2	1	Lead Stop (psig)	3600
Use Comp #3	1	Lag#1 Start (psig)	2800
Max Comp #	3	Lag#1 Stop (psig)	3400
		Lag#2 Start (psig)	2600
		Lag#2 Stop (psig)	3200
		Start Lag Time(sec)	5.0
		Stop Lag Time (sec)	5.0

MENU MASTER SETUP HOME

USE COMP #1/2/3: Select which compressors the Master is allowed to control and available to run.

MAX COMP'S RUN: Select the maximum number of compressors allowed to run at one time. Determine this value based on available input power KVA.

START LAG TIME: The time delay before starting the next (Lag) compressor. Note that compressors are not allowed to start simultaneously, Lead → Lag#1 → Lag#2.

STOP LAG TIME: The wait time in Standby mode after stopping the compressor and allowing the compressor to restart.

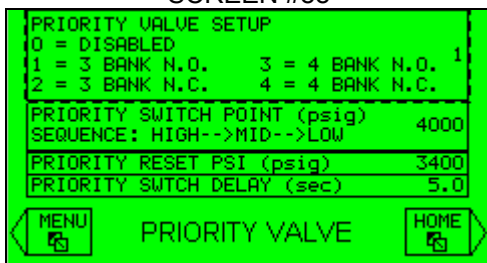
LEAD/LAG#1/LAG#2 START: The start pressure setpoint which starts the compressor. When the discharge or storage pressure is lower than the setpoint, the start (warm up) sequence is activated.

LEAD/LAG#1/LAG#2 STOP: The stop pressure setpoint which stops the compressor. When the discharge or storage pressure is greater than the setpoint, the cool down sequence is activated and the compressor later stops.

22. PRIORITY VALVES

The Priority system provides a filling sequencing to a three or four bank storage system. Pressures are displayed in psig. Timers are displayed in seconds.

SCREEN #88



```

PRIORITY VALVE SETUP
0 = DISABLED
1 = 3 BANK N.O.      3 = 4 BANK N.O. 1
2 = 3 BANK N.C.      4 = 4 BANK N.C.
PRIORITY SWITCH POINT (psig) 4000
SEQUENCE: HIGH-->MID-->LOW
PRIORITY RESET PSI (psig) 3400
PRIORITY SWITCH DELAY (sec) 5.0
  
```

The Priority Panel separates the gas into three banks for storage. When the compressor starts, the high bank fills first. When the pressure reaches the Priority Switch Point, the mid bank valve opens and starts filling mid bank. When the pressure reaches Priority Switch Point, the low bank valve opens and fills low bank. Fill is complete after all three banks have reached final pressure.

Typical Valve Pressure Settings

Bank	Storage 3600 psi	Storage 4500 psi
High	--	--
Mid	3200 psi	3800 psi
Low	3400 psi	4000 psi

PRIORITY VALVE MODE: Enter the number based on Priority Valves used.

1	3 Bank Normally Open Valves
2	3 Bank Normally Close Valves
3	4 Bank Normally Open Valves
4	4 Bank Normally Close Valves

PRIORITY SWITCH POINT: Enter the setpoint pressure to switch the bank valve and fill mid bank storage. Setpoint typically set to 4000 psig.

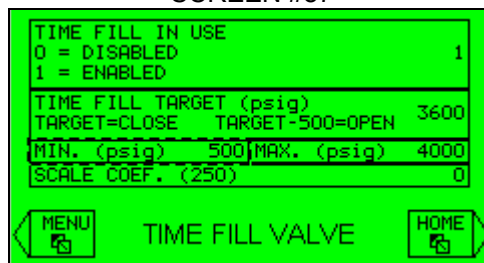
PRIORITY RESET PRESSURE: Enter the setpoint pressure to complete the storage fill and RESET the priority sequence. Setpoint typically set to 3400 psig.

PRIORITY SWITCH DELAY: The time delay for priority valves to switch close/open position. Setpoint typically 5.0 seconds.

23. TIME FILL VALVE

The Time Fill logic controller operates the Time Fill Valve to fill CNG vehicles. Pressures are displayed in psig.

SCREEN #87



```

TIME FILL IN USE
0 = DISABLED      1
1 = ENABLED
TIME FILL TARGET (psig)
TARGET=CLOSE  TARGET-500=OPEN 3600
MIN. (psig) 500 MAX. (psig) 4000
SCALE COEF. (250) 0
  
```

The Time Fill Valve is used to directly fill CNG vehicles to a pressure target. The controller calculates a setpoint target based 70°F and Scale Coefficient. Valve operates on a 500 psi Dead band.

TIME FILL IN USE: Enter a "1" to ENABLE or "0" to DISABLE Time Fill operations.

TIME FILL MINIMUM PRESSURE: The minimum pressure setpoint which establishes the lower range limit. Default setpoint to 500 psig.

TIME FILL MAXIMUM PRESSURE: The maximum pressure setpoint which establishes the upper range limit. Default setpoint to 4000 psig.

TIME FILL NOMINAL TARGET: The pressure setpoint target to fill the CNG vehicle. The fill valve closes when fill is complete. Default setpoint to 3600 psig.

TIME FILL SCALE COEFFICIENT: The coefficient value applied to calculate the target.

Typical Valve Pressure Settings

Bank	Storage 3600 psig	Storage 4500 psig
Target	3600 psig	4200 psig

24. ENGINE SETUP

Use this screen to setup the engine drive. Temperatures are displayed in °F. Timers are displayed in seconds.

SCREEN #71

START RETRY DELAY (sec)	30.0
MAX START CRANK TIME (sec)	8.0
START/DISENGAGE SPEED (rpm)	350
MAX RETRIES BEFORE FAULT (count)	4
MIN ENGINE COOLANT TEMP (deg F)	75
MIN ENG. WARMUP TIME (sec)	3.0
ENGINE COOLDOWN TIME (sec)	30.0

MENU ENGINE SETUP HOME

Engine Startup Sequence includes;

- 1) Engine gas supply valve opens.
- 2) Engine starter engages.
- 3) Engine RPM ramps to low idle and the starter disengages.
- 4) After a warm-up delay, the engine is ramped up to high idle speed.

A description of each of the timers is listed below.

START RETRY DELAY: The time delay before restarting the engine.

MAXIMUM START CRANK TIME: The maximum time allowed to start (crank) the engine.

START/DISENGAGE SPEED: When engine rpm is greater than setpoint, the engine is at running speed.

MAXIMUM RETRIES BEFORE FAULT: The maximum starts allowed before setting an alarm.

MINIMUM ENGINE COOLANT TEMP: When Engine Coolant Temperature is above this setpoint, the compressor goes into loaded operation.

MINIMUM ENGINE WARMUP TIME: The setpoint value here moves to START DELAY #3 Timer.

ENGINE COOLANT TIME: The setpoint value here moves to COOL-DOWN DELAY #1 Timer.

25. DAUGHTER STATION SETUP

Use this screen to setup a Daughter CNG Station. Pressures are displayed in psig.

SCREEN #77

USE DAUGHTER LOGIC	0
0=NO	
1=YES	
RECEIVER RUN DOWN START (psig)	200
RECEIVER RUN DOWN STOP (psig)	100
LOW INLET VALVE OPEN (psig)	0
LOW INLET VALVE CLOSE (psig)	0

MENU DAUGHTER SETUP HOME

USE DAUGHTER: Enter the value "1" to enable the controller to operate as a Daughter Station. The value "0" disables the Daughter Station logic.

RECEIVER RUN DOWN START: Enter the setpoint pressure to run down the Receiver Tank. If the tank pressure is greater than the setpoint, the inlet suction valves will CLOSE, and the compressor will run down the pressure in the receiver vessel.

RECEIVER RUN DOWN STOP: Enter the setpoint pressure that completes receiver run down and OPENS the inlet suction valve.

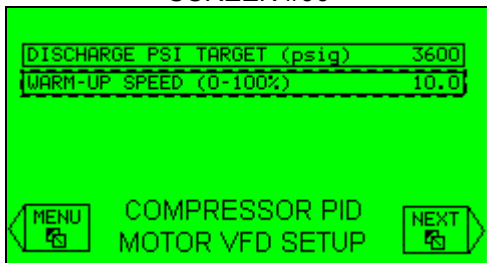
LOW INLET VALVE OPEN: Enter the setpoint pressure to OPEN the Low Inlet Valve. During RUN Mode, if the High Inlet Valve is Closed and tank is not in Run Down Mode, the Low Inlet Valve will OPEN.

LOW INLET VALVE CLOSE: Enter the setpoint pressure to CLOSE the Low Inlet Valve.

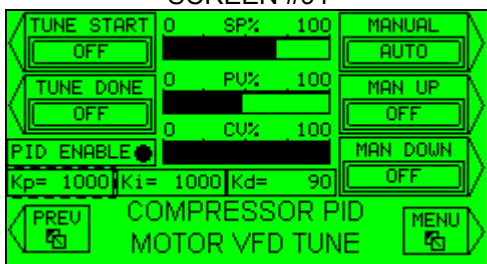
26. COMPRESSOR MOTOR PID SETUP

The compressor main motor has an option to use a Variable Frequency Drives, VFD. The PID controls are setup with two screens. Pressures are displayed in psig.

SCREEN #90



SCREEN #91



Variable Frequency Drives use PID controls for the Compressor speed control, and are only active prior to and during the loaded operation of the compressor. Speed is limited to the "warm-up" or "cool down" speed as the minimum manual setpoint.

DISCHARGE PSI TARGET: The PID setpoint that controls compressor main motor speed to discharge pressure target (psig).

WARM-UP SPEED: Enter the manual speed setpoint to control compressor speed during warm-up (0-100% = 0- 1800 rpm).

PID ENABLE: The PID is enabled while the compressor is running and loaded. Output Lamp is GREEN when Off (inactive), and BLACK when ON (active).

PROPORTIONAL GAIN (Kp): Sets the Proportional Gain (Kp) factor in terms of percent. 100 sets unity gain (gain of 1).

INTEGRAL RATE (Ki): Entered as a number of repeats per second (integration rate). In the PID equation this has the effect: $K_i * \text{Error} * dt$

DERIVATIVE GAIN (Kd): Entered as a time with a resolution of 10 mS. In the PID equation this has the effect: $K_d * \Delta \text{Error} / dt$.

MANUAL: In the AUTO mode, the PID tracks the CV value for bumpless transfer to MANUAL mode. In the MANUAL mode, the PID contains the value that is output to the CV within the clamp and slew limits.

MAN UP: While in Manual mode, activate the momentary MANUAL UP, Function Key Switch, to increase the CV Output value.

MAN DOWN: While in Manual mode, activate the momentary MANUAL DOWN, Function Key Switch, to decrease the CV Output value.

AUTOTUNE: While the PID is in Auto mode, activate the TUNE START to automatically tune the process. The Function Key input starts the AUTOTUNE cycle and needs to be held during the full tuning cycle. If AUTOTUNE is negated, the controller stops auto-tuning and reverts to the previous settings. At the conclusion of the AUTOTUNE cycle, the controller coefficients are updated and the TUNE DONE output is active (BLACK when ON).

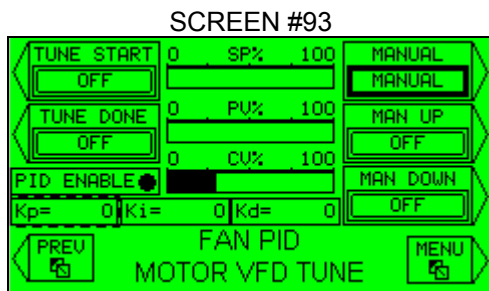
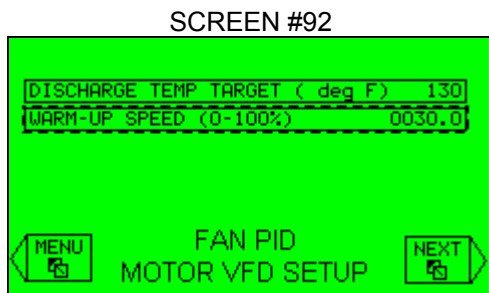
SP%: The Setpoint display that represents Discharge Pressure Target scaled to 0-100%.

PV%: The Process Variable display that represents Final Discharge Pressure scaled to 0-100%.

CV%: The Control Variable display that represents Speed Output to VFD scaled to 0-100%.

27. FAN MOTOR PID SETUP

The fan motor has an option to use a Variable Frequency Drives, VFD. The PID controls are setup with two screens. Temperatures are displayed in °F.



Variable Frequency Drives use PID controls for the Fan Motor speed control, and are only active prior to and during the loaded operation of the compressor. Speed is limited to the "warm-up" or "cool down" speed as the minimum manual setpoint.

DISCHARGE TEMP TARGET: The PID setpoint that controls Fan Motor speed to final discharge temperature target (°F).

WARM-UP SPEED: Enter the manual speed setpoint to control fan speed during warm-up (0-100% = 0- 1800 rpm).

PID ENABLE: The PID is enabled while the compressor is running and loaded. Output Lamp is GREEN when Off (inactive), and BLACK when ON (active).

PROPORTIONAL GAIN (Kp): Sets the Proportional Gain (Kp) factor in terms of percent. 100 sets unity gain (gain of 1).

INTEGRAL RATE (Ki): Entered as a number of repeats per second (integration rate). In the PID equation this has the effect: $K_i * \text{Error} * dt$

DERIVATIVE GAIN (Kd): Entered as a time with a resolution of 10 mS. In the PID equation this has the effect: $K_d * \Delta \text{Error} / dt$.

MANUAL: In the AUTO mode, the PID tracks the CV value for bumpless transfer to MANUAL mode. In the MANUAL mode, the PID contains the value that is output to the CV within the clamp and slew limits.

MAN UP: While in Manual mode, activate the momentary MANUAL UP, Function Key Switch, to increase the CV Output value.

MAN DOWN: While in Manual mode, activate the momentary MANUAL DOWN, Function Key Switch, to decrease the CV Output value.

AUTOTUNE: While the PID is in Auto mode, activate the TUNE START to automatically tune the process. The Function Key input starts the AUTOTUNE cycle and needs to be held during the full tuning cycle. If AUTOTUNE is negated, the controller stops auto-tuning and reverts to the previous settings. At the conclusion of the AUTOTUNE cycle, the controller coefficients are updated and the TUNE DONE output is active (BLACK when ON).

SP%: The Setpoint display that represents Discharge Temperature Target scaled to 0-100%.

PV%: The Process Variable display that represents Final Discharge Temperature scaled to 0-100%.

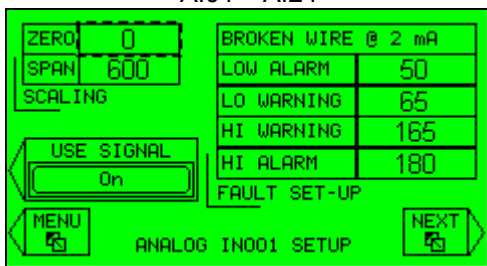
CV%: The Control Variable display that represents Speed Output to VFD scaled to 0-100%.

28. ANALOG INPUT SETUP

Each analog input used requires a setup. The analog inputs, AI01 to AI24, have a unique Identification Number (ID). The setup information configures the controller when to monitor the input for fault conditions.

SCREEN #200 (200 – 246)

AI01 – AI24



THIS SETUP HAS BEEN PERFORMED AT THE FACTORY AND MAY BE DIFFERENT FOR EACH ANALOG INPUT – DO NOT ALTER SETUP

USE SIGNAL: Toggle Keypad “OFF” or “ON”

FAULT SET-UP: Analog Transducers are monitored by the control system. The control system determines the type of fault associated with the analog input. Enter the scaled value (-32000 to 32000) that triggers an Alarm.

Example; Pressure Transducer PT5 has a pressure range 0 - 6000 psi.

ANALOG FAULT TYPE SETTINGS	
VALUE	DESCRIPTION
2 mA	Broken Wire
0	Low Signal Alarm
50	Low Signal Warning
3800	High Signal Warning
4000	High Signal Alarm

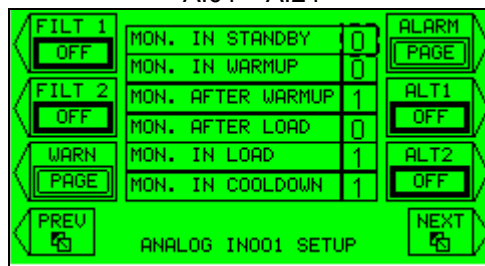
SCALE: Refer to the specification for each Analog Transducers to enter the ZERO and SCALE values. Also refer to ANGI's P&ID drawing.

ANALOG SCALING	
VALUE	DESCRIPTION
0	Zero
6000	Span

The second screen monitors the analog inputs, AI01 to AI24, for certain fault conditions. Digital Filtering Warning Page, and Alarm Page (dial out) functions can also be applied.

SCREEN #201 (201 – 247)

AI01 – AI24



The control system may detect a shutdown condition and the machine will be placed in FAULTED mode. Select when to monitor the analog input during the step sequence.

MONITOR MODE: Enter “1” = Yes or “0” = No

- MONITOR IN STANDBY:
- MONITOR IN WARM-UP:
- MONITOR AFTER WARM-UP
- MONITOR AFTER LOAD (FULL DELAY)
- MONITOR IN LOAD (RUNNING)
- MONITOR IN COOLDOWN (COOLDOWN #1)

Toggle Keypad “OFF” or “ON” for the following functions;

FILTER 1: Filter refers to averaging, AVG, the previous and current values (transducers under 300 psig).

FILTER 2: Filtering refers to a 10% change on the previous and last values (transducers above 300 psig).

ALARM PAGE: Allows the controller to send the current Alarm and page over the network.

WARN PAGE: Allows the controller to send the current Warning and page over the network.

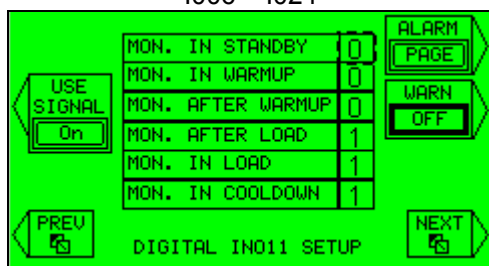
PRES: Change engineering units for Alternate Pressure. Toggle Keypad “OFF” to display “psig”. Toggle Keypad “ON” to display “MPa”.

TEMP: Change engineering units for Alternate Temperature. Toggle Keypad “OFF” to display degrees Fahrenheit °F. Toggle Keypad “ON” to display degrees Centigrade °C.

29. DIGITAL INPUT SETUP

Each digital input used requires setup. The digital input range for I06 to I24 and each has a unique Identification Number, (ID). The setup information configures the controller when to monitor the input for fault conditions.

SCREENS #170 (170 – 186)
I006 – I024



MON. IN STANDBY	0
MON. IN WARMUP	0
MON. AFTER WARMUP	0
MON. AFTER LOAD	1
MON. IN LOAD	1
MON. IN COOLDOWN	1

USE SIGNAL: On

ALARM: PAGE, WARN OFF

PREV, NEXT

DIGITAL IN011 SETUP

THIS SETUP HAS BEEN PERFORMED AT THE FACTORY AND MAY BE DIFFERENT FOR EACH DIGITAL INPUT – DO NOT ALTER SETUP

USE SIGNAL: Toggle Keypad “OFF” or “ON”

The control system may detect a shutdown condition and the machine will be placed in FAULTED mode. Select when to monitor the analog input during the step sequence.

MONITOR MODE: Enter “1” = Yes or “0” = No

- MONITOR IN OFF: ESD and Vibration only
- MONITOR IN STANDBY:
- MONITOR IN WARM-UP:
- MONITOR AFTER WARMUP
- MONITOR AFTER LOAD (FULL DELAY)
- MONITOR IN LOAD (RUNNING)
- MONITOR IN COOLDOWN (COOLDOWN #1)

30. STARTUP SEQUENCE

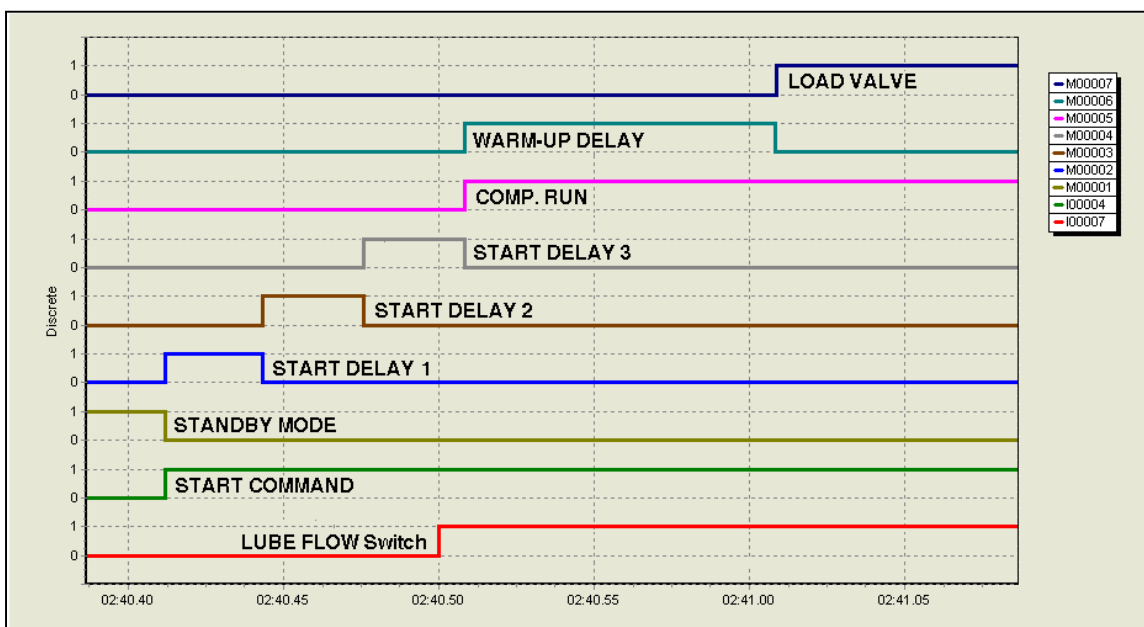
The Startup Sequence outlines the Timers and Sequence of operation. All Timers are site specific and do not reflect the settings in this chart. Refer to Warm-Up Timers function and description.

START DELAY 1: Delay 1 is the time between the inlet valve opening and the cooling fan starting.

START DELAY 2: Delay 2 is the time between the cooling fan starting and the pre-lube pump starting.

START DELAY 3: Delay 3 is the time between the Lube PSI reaching minimum start PSI and the compressor motor starting.

WARM-UP DELAY: Warm-up Delay is the time between the compressor motor starting and the load valve turning on.

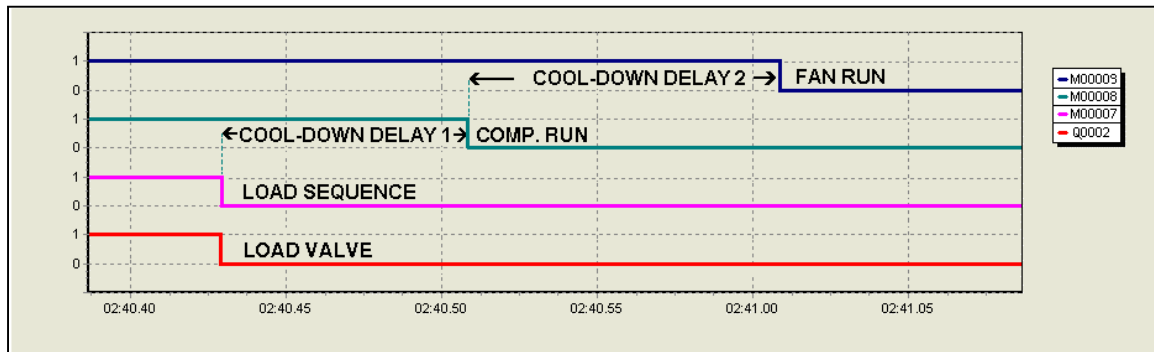


31. COOL-DOWN SEQUENCE

The Cool-Down, Shutdown, Sequence, outlines the Timers and Sequence of operation. All Timers are site specific and do not reflect the settings in this chart. Refer to Cool-Down Timers function and description.

COOL-DOWN DELAY #1: The time between the load valve opens and stopping the compressor motor. The compressor runs in Recirculation Mode during Delay 1.

COOL-DOWN DELAY #2: The time allowed running the Cooling Fan after the Main Motor stops. The controller goes into Standby Mode after Delay 2 times out.



32. CsCAN NETWORK SETUP

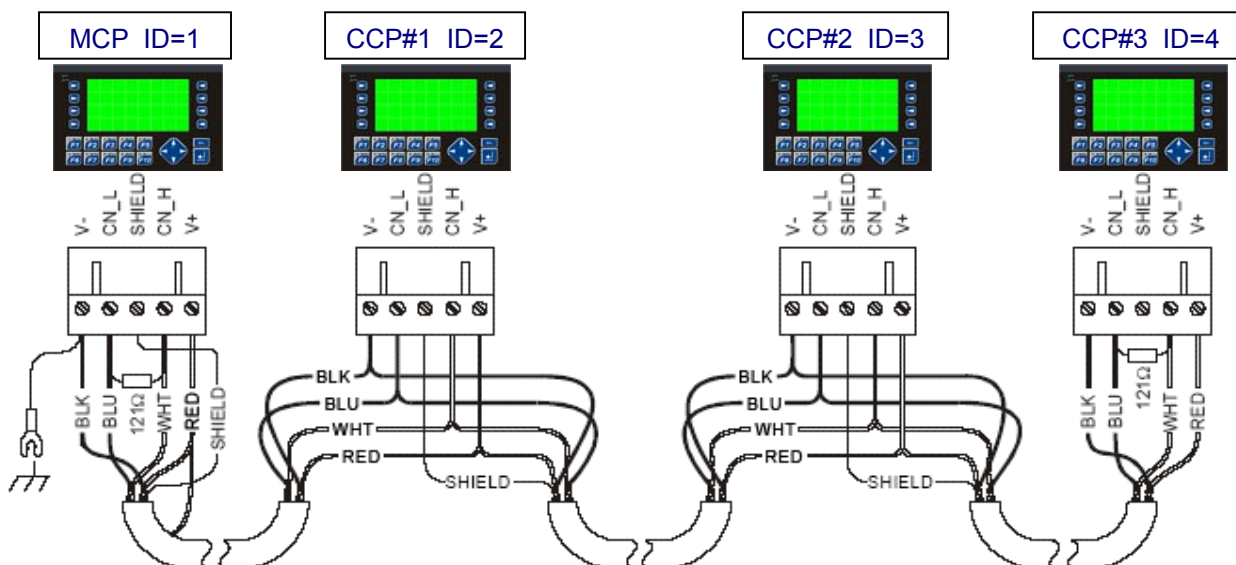
32.1. CABLE SETUP - CsCAN

- Wire the CAN network in a daisy-chained fashion such that there are exactly two physical endpoints on the network.
- The two nodes at the physical end-points need to have 121 ohm 1% terminating resistors connected across the CN_L and CN_H terminals.
- Use data conductors (CN_L and CN_H) that are 24 AWG shielded twisted pair for "thin cable" and 22 AWG shielded twisted pair for "thick cable." They must also have 121-ohm characteristic impedance. In typical industrial environments, use Belden wire #3084A ("thin"). In environments where noise is a concern, and/or network cable lengths are greater than 100 meters, use Belden cable #3082A ("thick").
- Place data conductors (CN_L and CN_H) into a twisted pair together. If local codes require the local CAN power supply to be earth grounded, connect the V- power conductor to a good earth ground at one place only on the network, preferably at a physical endpoint. If multiple power supplies are used, only one power supply must have V- connected to earth ground. The remaining power supplies need to be isolated.
- For a section of cable between two nodes, the cable shield is connected to the cable shield input at one end of the cable only.

32.2. CsCAN TEST

- The CsCAN communications can be tested with a DC voltmeter. Measure the dc voltage at the OCS controller between terminals V- and CN-L to be 2.5 volts dc. Measure the dc voltage between terminals V- and CN-H to be 2.5 volts dc. If voltage deviates +/- 0.2 vdc from 2.5 vdc, then disconnect one node at a time and determine which node is affecting the network. Example: a bad node may cause the RS-422/485 drivers to pull the signal to 3.0 vdc. The solution would be replacing the OCS controllers which affect the network bus. A better communication test is using an oscilloscope to monitor the data pulses. Refer to RS-422/485 applicable codes to determine if CsCAN communications installation is compliant.
- The CAN OK LED can be viewed on the back of the NX OCS next to the fiber optic connectors. The LED randomly flashes during CAN communications.
- All devices on the network must be at the same baud rate. A device configured for the wrong baud rate can shut down the network entirely.
- Network Baud Rate vs. Cable Length

1Mbit / sec.	40m (131 feet)
500Kbit / sec.	100m (328 feet)
250Kbit / sec.	200m (656 feet)
125Kbit / sec.	500m (1,640 feet)



33. ETHERNET NETWORKS

33.1. ETHERNET SETUP

The Ethernet is built into Horner OCS controllers to provide advanced Ethernet communication capabilities. The Ethernet port Module uses a standard TCP/IP protocol. The RJ45 connector with a CAT5 or CAT6 cable can connect to a network hub/switch. It can communicate beyond the local network and onto the Internet. To do so, the Ethernet must be configured with the IP Address of a Network Gateway server, which allows communication outside the local network.

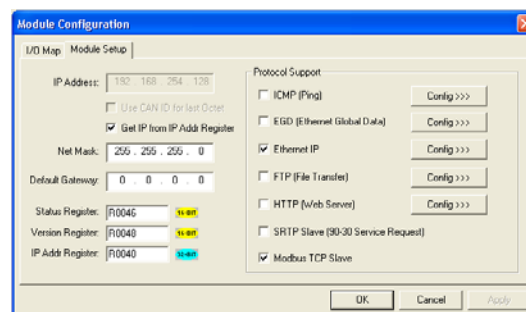
When connecting an Ethernet Module to a local network, always consult with a Network Administrator. The Network Administrator can aid in configuring Ethernet Hubs, Routers, Switches, Gateways and Servers. The Ethernet Module's IP Address will be read or edited from register in ANGI Setup Screen.

Modbus TCP is a Master / Slave protocol, which allows a remote Modbus TCP Master (client) to request services from a Modbus TCP Slave (server). The Ethernet Module acts as a Modbus TCP Slave, which responds to requests from one or more Modbus TCP Masters.

33.2. ETHERNET MODULE CONFIG.

To configure the Ethernet Module, use Cscape Programming Software to perform the following six steps:

- On the main Cscape screen, select the Controller menu and its I/O Configure sub-menu to open the I/O Configuration dialog.
- Verify the OCS Model with the one shown in the I/O Configuration dialog.



- Local Networks may require different "Net Mask" and "Default Gateway" as shown in Module Configuration.

