1. INTRODUCTION

1.1 General

This document outlines the REM *Vue*®– *500S* compressor control panel operating philosophy for **Progress Energy**. A REM *Vue*®– *500S* control system will be programmed to safely start, stop, and automatically sequence a ***2-stage*** reciprocating compressor with a gas engine driver. The automatic sequence has been designed for control of a **Waukesha 5790GL** engine, and an **Ariel JGC/2** reciprocating compressor.

A Pro-face **5.7**" AGP Color touch-screen display mounted in the control panel door serves as the HMI (Human Machine Interface). The interface displays first-in shutdowns, an alarm history, sequencing messages, trending and all process real-time data. A separate pushbutton mounted on the door is provided for USD (Unit Shutdown).

This document covers both the standard base system, and several options summarized in the next sections.

1.2 Standard Base System

The base system control logic functionality is listed below. These are covered in greater detail in later sections.

- Lube oil pump control (prelube and postlube).
- Automatic engine crank.
- Engine fuel and ignition control.
- Automatic speed / bypass control with high discharge pressure override and low suction pressure override.
- Suction valve control.
- Cooldown stop sequencing.
- Blowdown valve control.
- Compressor stage differential pressure alarm & shutdown logic.
- Low class C discharge Logic.
- Shutdown Bypass Logic.
- Data logging and trending.
- Appendix A contains the standard I/O listing to implement the base system. This list also includes the I/O required for the optional add-ons.

1.3 Optional Functionality

The following functionality can be added to the base system at the Customer's request.

- Rod load calculations.
- Louver control.
- Remote Asset Management.
- Automatic compressor purge with Suction Valve.

2. START-UP / SHUTDOWN SEQUENCING

The operator must ensure that all shutdowns have been cleared before a start can be attempted. This may be confirmed by viewing the HMI 'Main' screen. Once all shutdowns have been cleared, a "READY FOR LOCAL START" message is displayed. A "READY FOR REMOTE START" will be displayed if the *Local / Remote* selector is in the remote position.

Table 2-1 describes the start-up sequencing in detail.

Table 2-1: Start-Up Sequencing

Item	Step	Description
1	Press *Start* on the HMI.	Initiates a start attempt. When the *Start* button is pressed the *Suction Override PID, Discharge Override PID,* and *Governor PID* outputs are reset to 0% (*Bypass Valve* fully open and *Governor* at minimum output signal). Each step through the start sequence will be displayed on the HMI 'Main' screen in the "UNIT STATUS" box. When a shutdown occurs the status will flash "SHUTDOWN". The *Alarms* button can be pushed to go directly to the 'Alarm Summary' screen for details. The setpoint, and timer parameters discussed in this section can be accessed from the HMI 'Sequence Parameter Setpoints' screen.
2	Prelube	• The *Auxiliary Lube* solenoid is energized. • The *Oil Permissive Pressure Fault Timer* is started, and displayed. • Both the engine and compressor lube oil pumps start. These pumps must generate minimum engine / compressor oil pressures before the *Oil Permissive Pressure Fault Timer* expires, or the start sequence will abort on an "ENGINE / COMPRESSOR PRELUBE PERMISSIVE FAULT SHUTDOWN". The pressures can be viewed from the 'Main' screen. • On obtaining both oil pressure permissives, the *Prelube Timer* will start.
3	Engine Crank	Following the completion of the *Prelube Timer*, the *Engine Crank* solenoid is energized. • The *Crank Timer* and *Engine Failed To Start Timer* are started. If RPM is not detected within 10 seconds the start sequence will abort on an "ENGINE FAILED TO CRANK SHUTDOWN".
4	Ignition/Fuel	• When the engine speed is greater than 50 RPM the *Engine Purge Timer* is started. • When the *Engine Purge Timer* expires the *Engine Ignition* module relay is energized to turn on the ignition and the *Fuel Delay Timer* is started. • The engine *Fuel* solenoid is energized when the *Fuel Delay Timer* expires. • After the fuel and ignition are on the engine speed is compared to the *Engine Crank Termination Speed* setpoint. When the speed exceeds

		this setting the *Engine Crank* solenoid is de-energized. • If the speed does not exceed the *Engine Running Speed Permit* setting before the *Engine Failed To Start Timer* expires the start sequence will abort on an "ENGINE FAILED TO START SHUTDOWN'. • If the start attempt is successful, the engine will accelerate to its *Engine Idle Speed Setpoint*. • If the RPM reading drops to 0 RPM after the engine has started the start / run sequence will abort on a "MAG PICKUP FAULT SHUTDOWN". • The lube oil pumps will continue to run for 20 seconds after the engine has started, and then shut off. • The Class C channels are enabled. • The 120 second *B Timer* starts. • The 20 second *b Timer* starts. • The *Remote Run Status* relay is energized. • Refer to Appendix B for Class A/B/b/C definitions.
5	Engine / Compressor Warm-up	Automatic loading of the unit is not permitted until the engine and compressor have warmed up. • When the *B Timer* expires, the *Engine Oil Temperature* and *Compressor Oil Temperature* are monitored. If the *Engine Oil Temperature* is below the *Engine Oil Temperature Load Permissive Setpoint* "ENGINE WARM-UP' will be displayed on the HMI 'Main' screen. . If the *Compressor Oil Temperature* is below the *Compressor Oil Temperature Load Permissive Setpoint* "COMPRESSOR WARM-UP' will be displayed on the HMI 'Main' screen. • When the oil temperatures reach the permissive setpoints the unit is ready to be loaded. A 'READY TO LOAD' message will be displayed on the HMI 'Main' screen. Automatic loading can be initiated by pressing the *Load* button.

2.1 Compressor Cooldown and Stop

Pressing the *Stop* button will initiate a cooldown stop sequence (Local or Remote mode). A Remote Stop command issued via remote Modbus communications will only be recognized if the unit is in Remote mode. The *Cooldown Timer* will commence. The *Cooldown Timer* is adjustable from the HMI 'Sequence Parameter Setpoints' screen. During the cooldown cycle, the *Cooldown Timer* will be displayed on the HMI 'Main' screen.

On a normal stop the *Suction Override PID* (not to be confused with the optional Suction Valve Control) and *Discharge Override PID* remain in Auto mode but are ramped slowly down to 0%. The *Unload / Cooldown Step Ramp Rate* can be adjusted from the 'Sequence Parameter Setpoints' screen. This will unload the unit based on the split range settings. The engine speed will ramp down to the *Minimum Load Speed* and the bypass valve will ramp open. The engine will then slow down to the *Engine Idle Speed.*

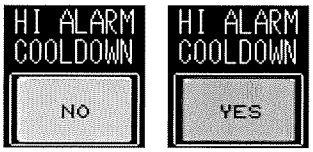
When the *Cooldown Timer* expires the *Engine Fuel* valve solenoid will de-energize, and three seconds later the *Engine Ignition* module relay will de-energize, thus stopping the engine. The *Governor* output is reset to 0%. The *Blowdown* valve a will stay closed.

The *Postlube Timer* is started. The *Auxiliary Lube* solenoid is energized, and the lube oil pumps will start and run for the preset *Postlube* time. The *Postlube Timer* is adjustable from the HMI 'Sequence Parameter Setpoints' screen.

The *Stop* button can be pushed at any time during the cooldown cycle to stop the unit immediately. The Load button can be pushed to cancel the cooldown cycle, and load the unit (Remote Stop input must be closed).

2.2 High Alarm Initiated Cooldown Stop

Each analog transmitter, TC, or RTD (if applicable) can be configured from the HMI to automatically initiate a cooldown stop if the high alarm is tripped. The setpoint screens include a button for each point to enable (YES) or disable (NO) this option.



A high shutdown will shut the unit down immediately, regardless of the option selection (YES or NO).

2.3 Engine / Compressor Shutdown

A shutdown is initiated if a discrete shutdown switch trips, an analog shutdown setpoint is exceeded, or an analog input sensor fails. On a shutdown the *Engine Fuel* valve solenoid will de-energize, and three seconds later the *Engine Ignition* module relay will de-energize, thus stopping the engine. The *Bypass* and *Governor* outputs are reset to 0%. The *Blowdown* valve will stay closed.

On the 'Main' screen the "UNIT STATUS" will display "SHUTDOWN". The *Alarms* button can be pressed to go directly to the 'Alarm Summary' screen to view the details of the shutdown.

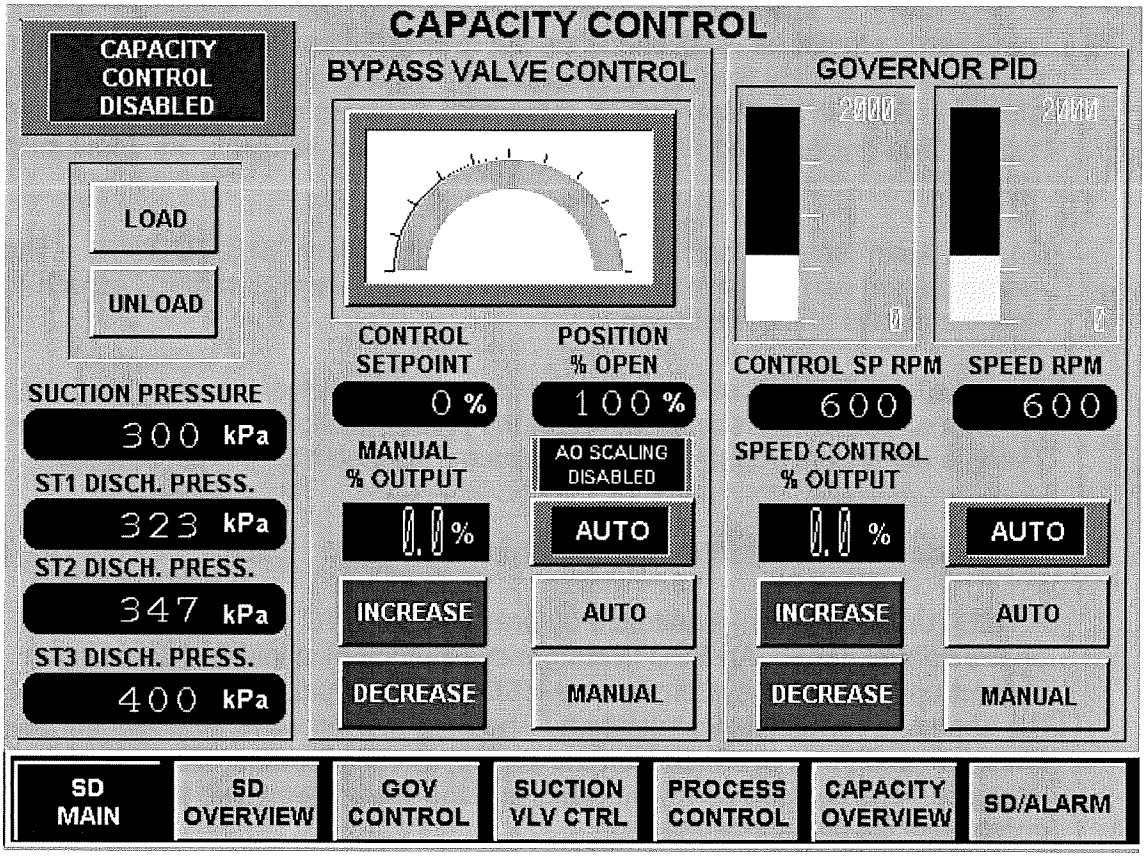
The *Postlube Timer* is started. The *Auxiliary Lube* solenoid is energized, and the lube oil pumps will start and run for the preset postlube time. The *Postlube Timer* is adjustable from the HMI 'Sequence Parameter Setpoints' screen.

2.4 Unit Shutdown / Remote Emergency Shutdown (USD / ESD)

A USD (Unit Shutdown) is initiated by pressing the *USD* pushbutton mounted on the control panel. An ESD (Emergency Shutdown) is initiated by an open contact on the control system remote ESD discrete input. On a USD or ESD, the engine is immediately shut down. The *Engine Fuel* valve solenoid will de-energize, and three seconds later the *Engine Ignition* module relay will de-energize. The *Bypass* valve will open, and the *Blowdown* valve will open to completely de-pressurize the unit.

No engine/compressor postlube cycle is performed.

3. MANUAL LOADING CONTROL



3.1 Manual Bypass Valve Control

The *Bypass Valve* analog output can be placed in manual mode from the HMI 'Capacity Control' screen. The *Bypass Valve* will remain at its present position until ramped open or closed via the *Increase / Decrease* buttons on the screen. The desired position can also be directly entered. The manual position adjustment (0-100% output), control setpoint (0-100% output), and current position (0-100% open) are displayed.

The *Suction Override PID, and Discharge Override PID* controllers continue to operate when the *Bypass Valve* is in manual mode. When the output is returned to automatic mode the *Bypass Valve* will ramp back to the position specified by the automatic control logic.

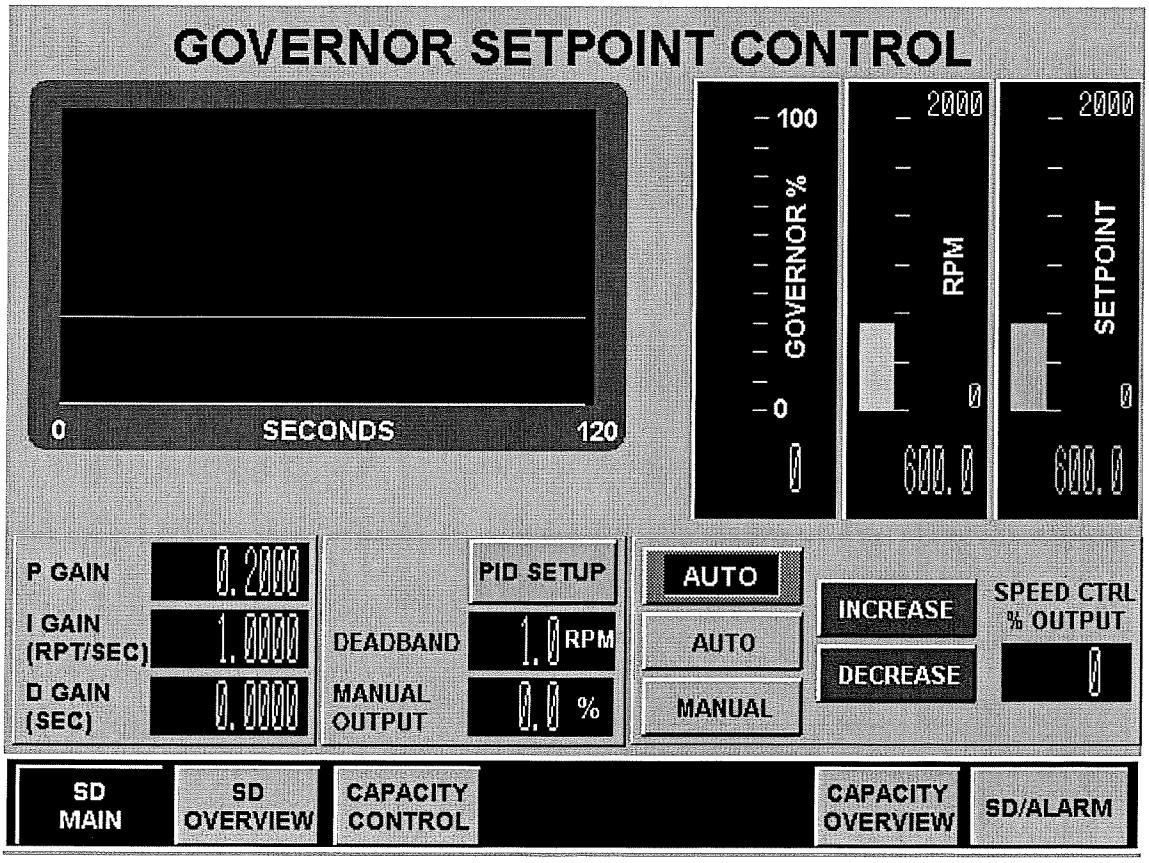
Manual *Bypass Valve* control is only permitted when the unit is not running, or when the unit has started, automatic loading has been initiated, and the engine speed has exceeded the *Engine Minimum Load Speed.*

The *Bypass Valve* AO Scaling option can be used to specify a specific output percentage of the analog output relating to the valve closed position. This setting can be adjusted from the 'Sequence Parameter Setpoints' screen.

For example, if the *Bypass Valve* is closed when the analog output reaches 80% the *Bypass Valve Scaling* setpoint can be changed to 80%. The logic will automatically rescale to operate at a range of 0-80%. The HMI indicators will continue to display the full 0-100% range. When the valve signal reaches 80% it will automatically be forced to 100% to ensure the valve is fully closed.

3.2 Manual Engine Speed Control

The *Governor* analog output can be placed in manual mode from the HMI 'Capacity Control' or 'Governor Setpoint Control' screens. The output will remain at its present position until the *Increase / Decrease* buttons are activated. The desired position can also be directly entered. The appropriate speed control output (0-100% output), engine speed (RPM), and control setpoint (RPM) are displayed.

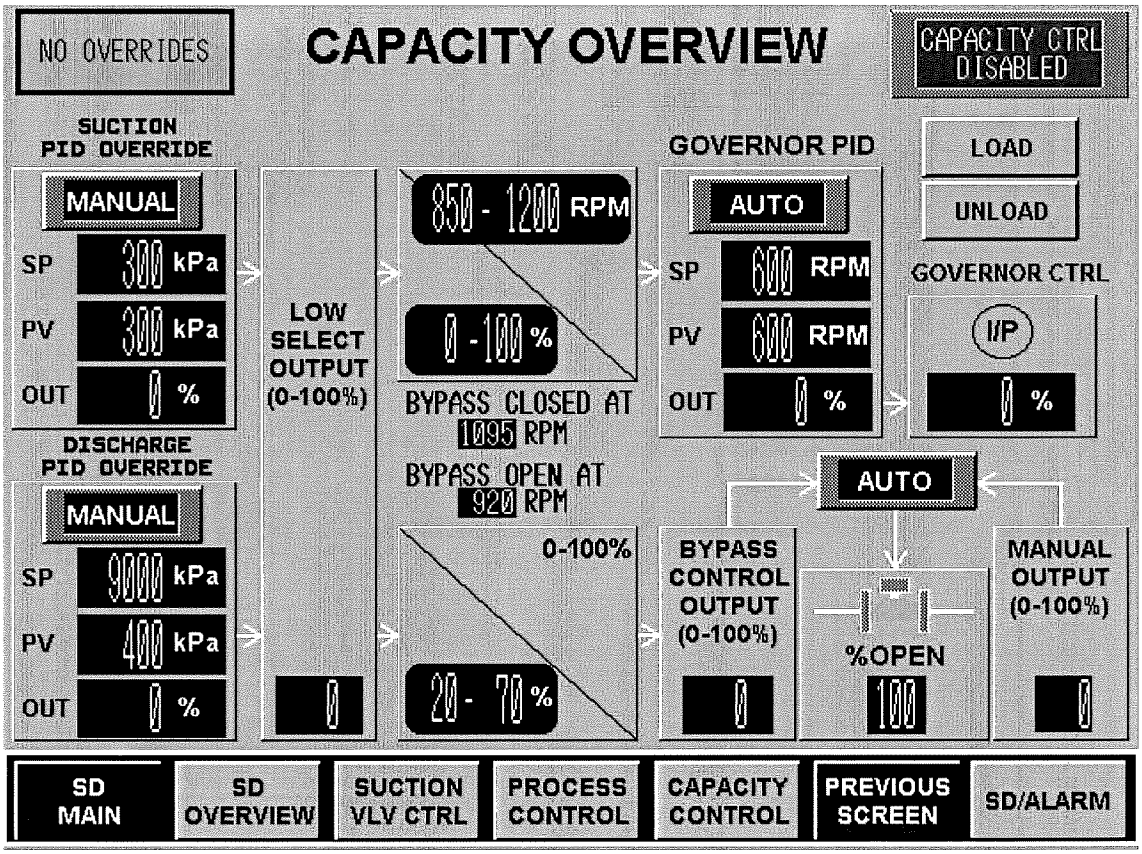


4. AUTOMATIC LOADING CONTROL

When a "READY TO LOAD" status is displayed on the HMI 'Main' screen, and the *Load* button is pressed the engine speed will ramp up to the *Engine Minimum Load Speed*. Once the engine speed reaches the *Minimum Load Speed,* the *Suction Override PID* and *Discharge Override PID* will remain in manual mode and start to slowly ramp from 0% to 100%. This *Initial Load Step Ramp Rate* can be accessed from the HMI 'Sequence Parameter Setpoints' screen. The unit will load by increasing the speed and closing the Bypass Valve based on the split range settings. If no override conditions exist, the Bypass Valve and Governor control signals will ramp up to 100%.

The *Suction Override PID* and *Discharge Override PID* will switch to automatic mode when they have ramped completely to 100%, or if a pressure override occurs during the load ramping. The *Initial Load – Delay Switch To Auto On Override* timer can be adjusted to avoid switching to automatic mode due to a brief pressure fluctuation.

Loading can be monitored from the 'Capacity Overview' screen.

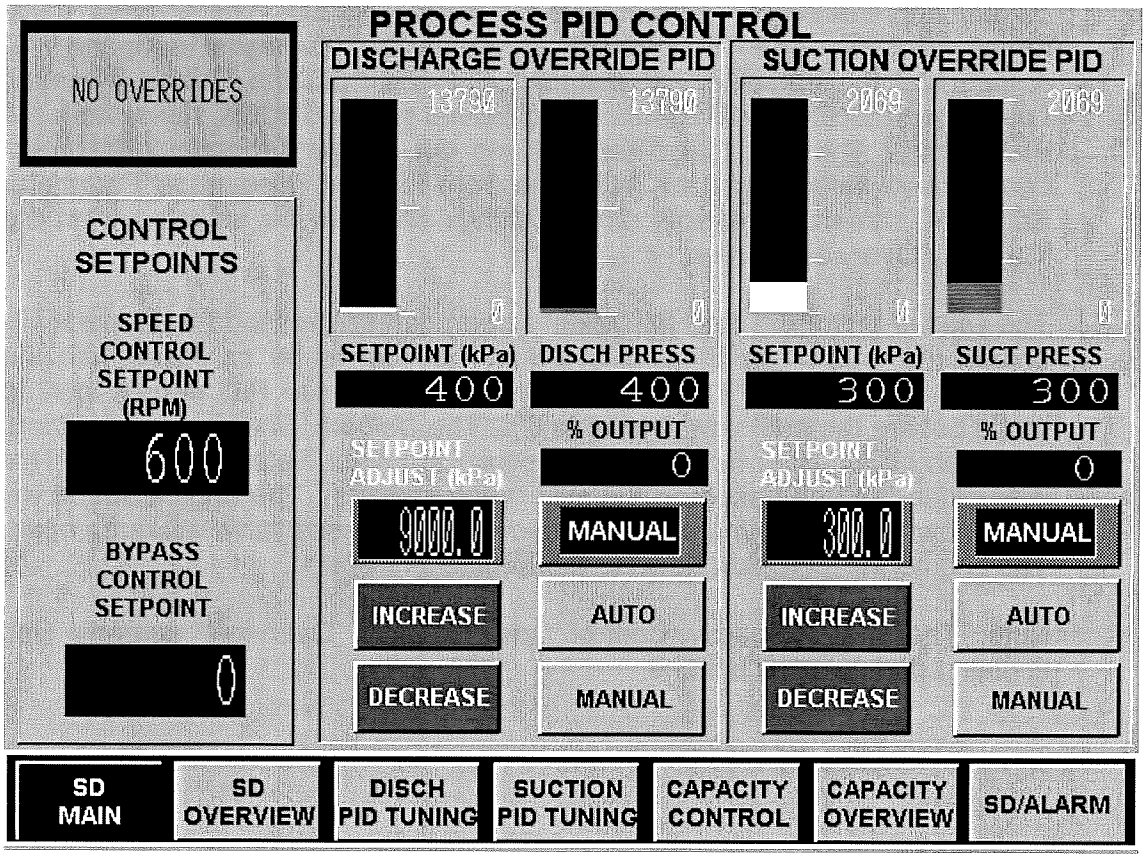


The lowest output signal from either the *Suction Override PID* or *Discharge Override PID* is split-ranged and sent to the Bypass Valve (20-70% PID output) and the engine governor (0-100% PID output). The Bypass Valve ramps from fully open to fully closed with a 20-70% signal from the PID output, and the engine speed setpoint changes from the *Engine Minimum Load Speed* to *Engine Maximum Load* Speed with a 0-100% signal from the PID output. The split range settings and the *Engine Minimum / Maximum Load Speed* settings can be accessed from the HMI 'Sequence Parameter Setpoints' screen. The split range settings can also be adjusted from the 'Capacity Overview' screen.

The *Unload* button on the HMI 'Main' screen can be pressed to automatically unload the unit. The *Suction Override PID* (not to be confused with the optional Suction Valve Control) and Discharge Override PID remain in Auto mode but are ramped slowly down to 0%. The *Unload / Cooldown Step Ramp Rate* can be adjusted from the 'Sequence Parameter Setpoints' screen. This will unload the unit based on the split range settings. The engine speed will ramp down to the *Minimum Load Speed* and the bypass valve will ramp open. The engine will then slow down to the *Engine Idle Speed*.

Note: The HMI 'Capacity Control' and 'Capacity Overview' screens also contain *Load / Unload* buttons.

4.1 Low Suction Pressure Override Control



The *Suction Override PID* can be accessed from the HMI 'Process PID Control' screen. If at anytime the *Stage 1 Suction Pressure* drops below the *Suction Override PID Setpoint* the output will begin to ramp down and the unit will unload by reducing the engine speed and then opening the Bypass Valve. From 100% to 0% the engine speed setpoint will be reduced from *Engine Maximum Load Speed* to *Engine Minimum Load Speed.* From 70% to 20% the Bypass Valve will stroke from fully closed to fully open. The split range settings determine how the unit will unload. These settings can be accessed from the HMI 'Sequence Parameter Setpoints' or 'Capacity Overview' screens.

The *Suction Override PID* can be placed in manual mode to manually load / unload the unit via the *Increase / Decrease* buttons. Manual control is only permitted when the unit is running, automatic loading has been initiated, and the engine speed has reached the *Engine Minimum Load Speed.*

4.2 High Discharge Pressure Override Control

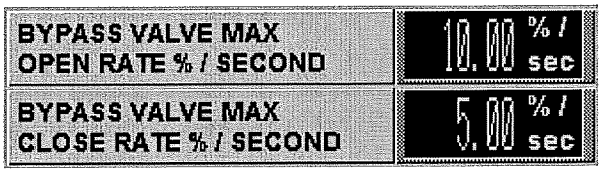
The *Discharge Override PID* can be accessed from the HMI 'Process PID Control' screen. If at anytime the Final *Discharge Pressure* rises above the *Discharge Override PID Setpoint* the output will begin to ramp down and the unit will unload by reducing the engine speed and then opening the Bypass Valve. From 100% to 0% the engine speed setpoint will be reduced from *Engine Maximum Load Speed* to *Engine Minimum Load Speed*. From 70% to 20% the *Bypass Valve* will stroke from fully closed to fully open. The split range settings determine how the unit will unload. These settings can be accessed from the HMI 'Sequence Parameter Setpoints' or 'Capacity Overview' screens.

The *Discharge Override PID* can be placed in manual mode to manually load / unload the unit via the *Increase / Decrease* buttons. Manual control is only permitted when the unit is running, automatic loading has been initiated, and the engine speed has reached the *Engine Minimum Load Speed.*

The PID controllers have the feature to limit the output, and to prevent the integral term from becoming excessive when the output reaches the limit (a reset windup situation). Both override PID controllers should be tuned to quickly respond to the pressure changes.

4.3 Bypass Valve Maximum Open/Close Rate Limits

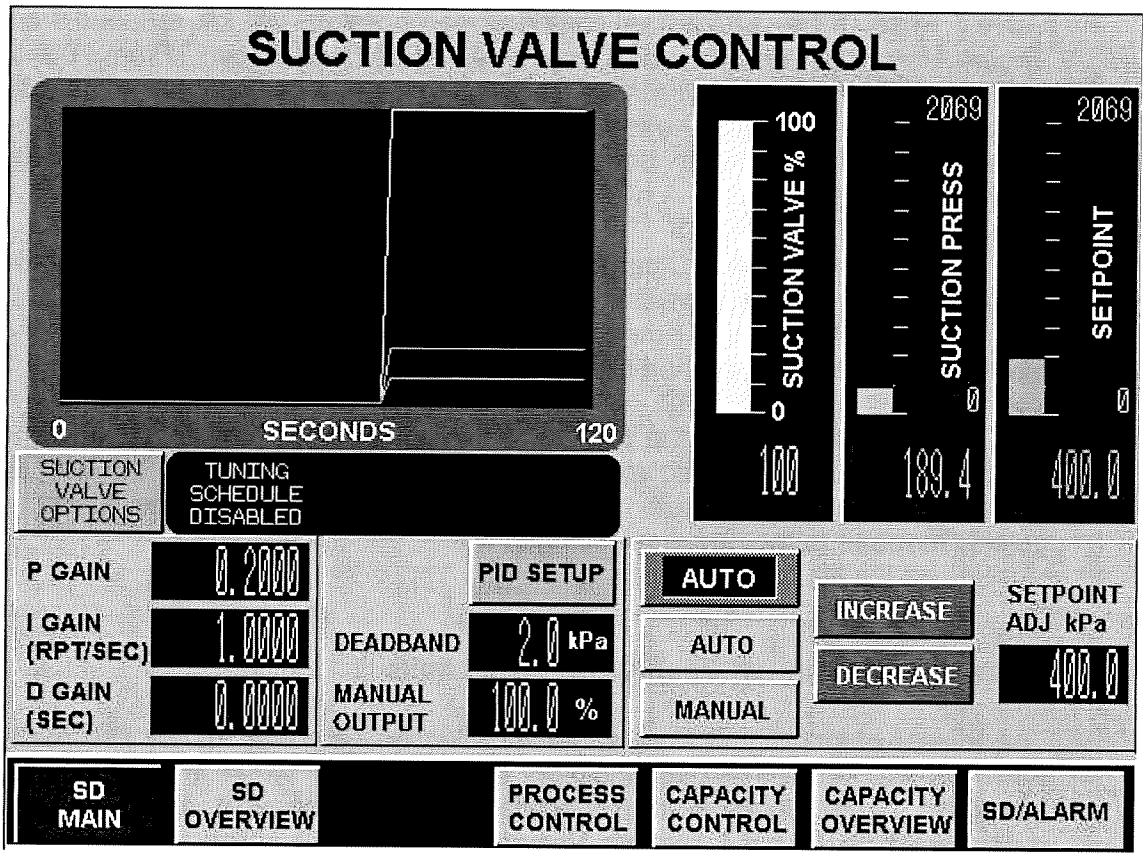
The lowest output signal from either the *Suction Override PID* or *Discharge Override PID* is split-ranged and sent to the Bypass Valve and the engine governor. The tuning of the override PIDs and the split range settings determine how fast the Bypass Valve will open/close. The Bypass Valve open/close rates can also be limited. The *Bypass Valve Max Open Rate %/Second and Bypass Valve Max Close Rate %/Second* can be adjusted from the HMI 'Sequence Parameter Setpoints' screen.



4.4 Suction Valve Control

Additional I/O Required:

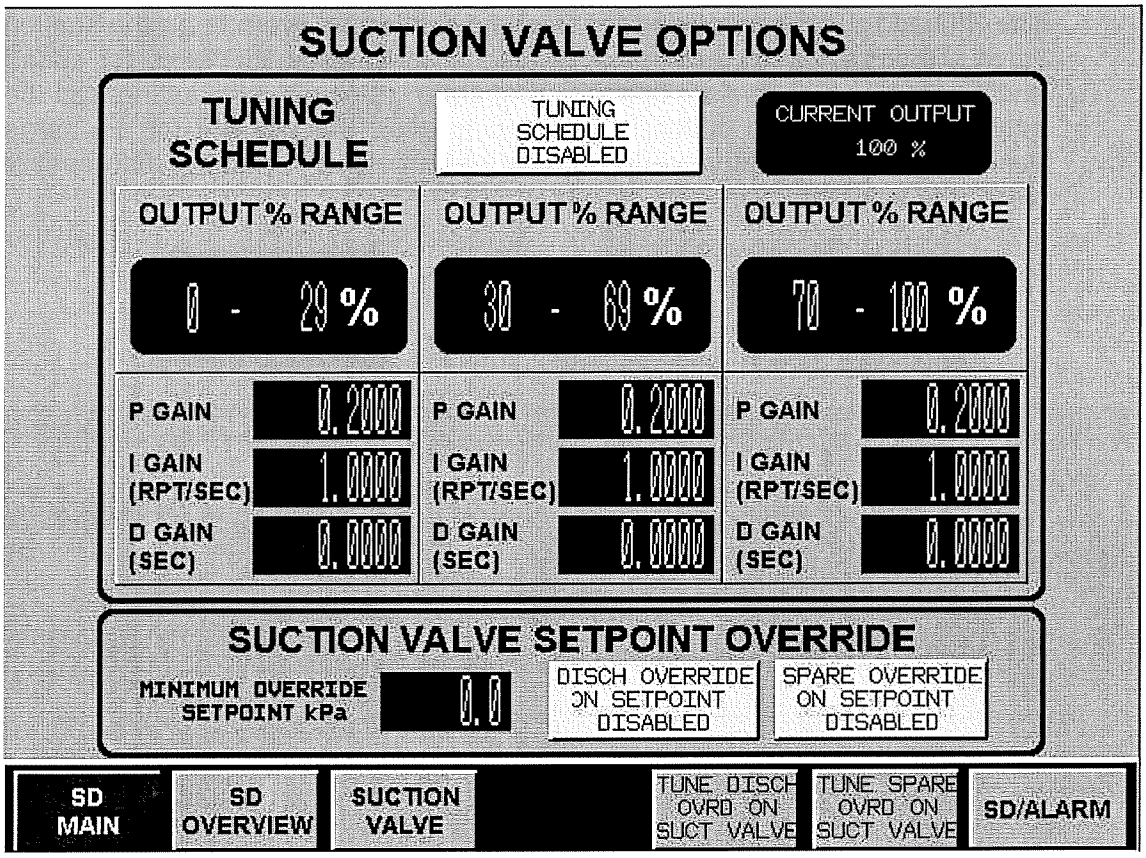
Analog Output: Suction Control Valve



The *Suction Valve PID* controller controls the operation of the *Suction Control Valve*, and is used to maintain a certain suction pressure into the compressor package. The output signal from the PID is sent to the *Suction Control Valve* analog output. If at anytime the suction pressure rises above the *Suction Valve PID Setpoint* the output will begin to ramp the valve closed.

The *Suction Valve* control will vary if the Automatic Compressor Purge is enabled or disabled (refer to Optional Functionality).

Additional options for the *Suction Valve* can be accessed from the HMI 'Suction Valve Options' screen.



4.4.1 Tuning Schedule For Suction Valve Control

The *Suction Valve PID* tuning schedule option can be used to specify different tuning parameters depending on the valve position (or upstream suction pressure if transmitter is provided).

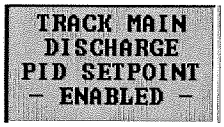
4.4.2 Discharge Override on Suction Valve Control

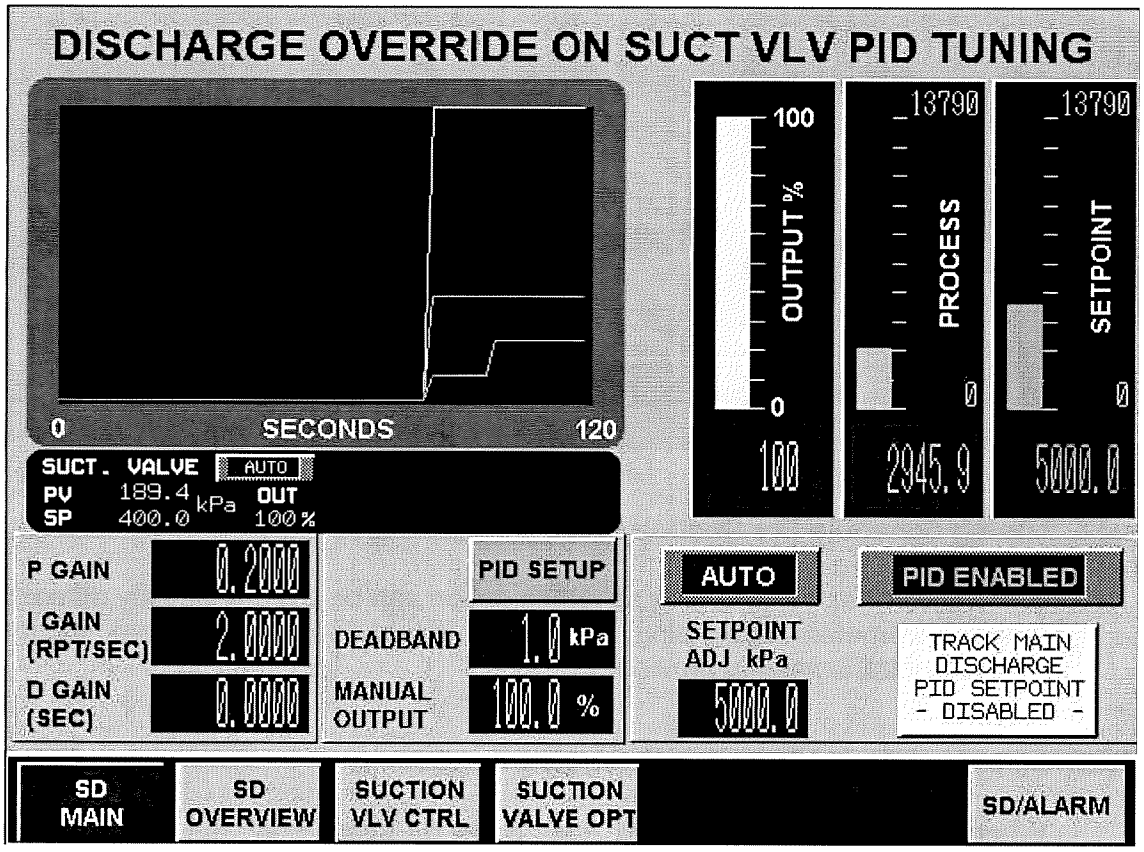
When this option is enabled the *Suction Valve PID* setpoint will be automatically reduced if a high discharge override occurs (DISCH OVRD OUTPUT < 100%).

Biased Setpoint = [(User Setpoint – Min. Ovrd Setpoint)*(Disch Ovrd%/100%]
+ Min. Ovrd Setpoint

The *Minimum Override Setpoint* can be adjusted to determine the minimum Suction Valve setpoint allowed due to an override condition (override PID at 0%).

The PID and setpoint provided for discharge pressure override on the suction valve are separate from the primary discharge override PID used for speed and bypass valve loading control. Separate setpoints and tuning can be entered for each. An option is provided to allow the setpoint for discharge override on the suction valve to automatically match the primary load control discharge setpoint.





A spare override is provided, and can be programmed (not HMI selectable) to provide an additional override based on other process conditions.

5. LOW CLASS C DISCHARGE LOGIC

Low class C discharge logic is provided for each compressor discharge stage. The setpoints are monitored when loading is initiated. The discharge pressures can be unstable during loading. Timers are used to temporarily bypass the logic. The timers are started individually when the pressures initially rise above the setpoints. Once the timers have expired, a shutdown will occur if the pressures drop back below the setpoints.

If the Shutdown Class for the low discharge logic is set to OTHER the logic is enabled when auto loading is initiated and disabled when unload or cooldown is initiated.

If the Shutdown Class for the low discharge logic is set to C the logic is enabled as soon as the unit is running, and remains enabled until the unit is stopped.

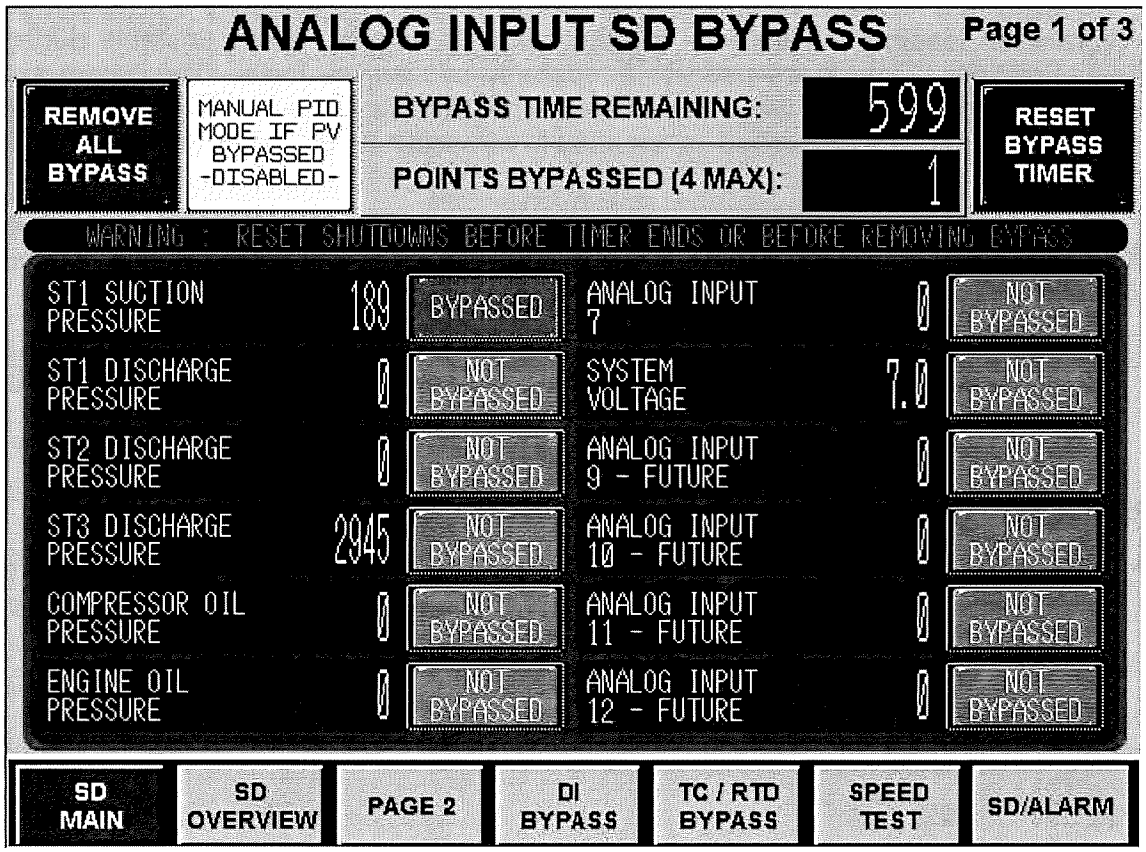
6. COMPRESSOR STAGE DIFFERENTIALS

The unit will be shut down if a high pressure differential is detected on any of the compression stages. The differential values are internally calculated by the REM *Vue*® – *500S*.

Stage 1 Differential = Stage 1 Discharge - Stage 1 Suction

Stage 2 Differential = Stage 2 Discharge - Stage 1 Discharge

7. SHUTDOWN BYPASS LOGIC



Occasionally, it is necessary to work on an end device while the unit is running. A channel *Shutdown Bypass* mode is provided for this purpose. Each channel can be individually bypassed from the HMI 'Shutdown Bypass' screens. Only four channels can be bypassed at any time.

Only the shutdown logic is bypassed. All other program functions related to the input remain active while the channel is bypassed. A complete review of the control implications should be considered before bypassing any input.

Any shutdown or alarm indicators relating to the channel will also remain active, but the unit will not shut down if the channel is driven to an unhealthy state.

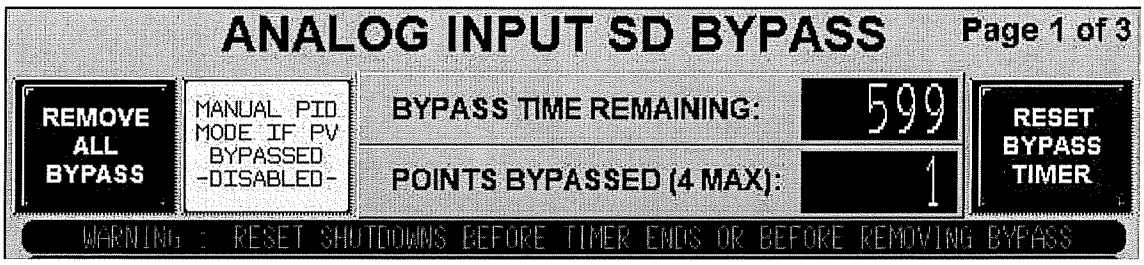
All shutdowns must be reset and cleared before the bypass is removed or the bypass timer expires to avoid an actual shutdown.

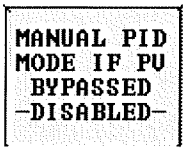
If the *Engine Speed* input (Overspeed Test) is activated the *Engine Overspeed Setpoint* will be reduced by 10% for the duration of the bypass.

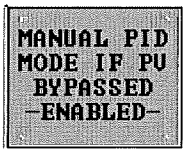
This allows the operator to test the overspeed function without taking the unit into a true overspeed condition.

The bypass function will bypass the channel for 10 minutes. The time remaining in the bypass will be indicated on the HMI 'Shutdown Bypass' screen. The *Shutdown Bypass Timer* can be restarted at any time during the bypass by pressing the *Reset Bypass Timer* button. An individual bypass can be manually cancelled at any time by pressing the bypass button, or all bypasses can be removed by pressing the *Remove All Bypass* button. If a channel is in an unhealthy state when the bypass ends (either manually cancelled, or timer expired) the unit will be shut down.

7.1 PID Mode During Shutdown Bypass







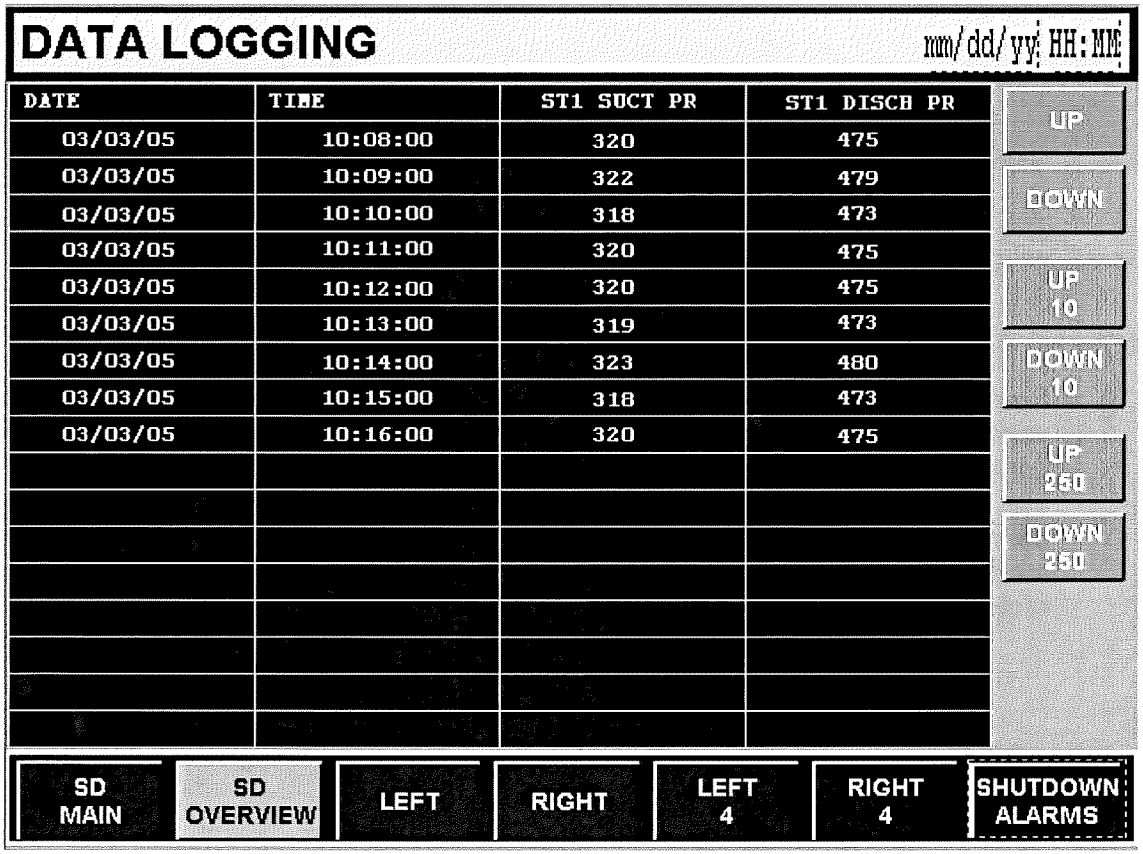
Some analog inputs and thermocouple inputs are used as the process variables for PID control. It may be undesirable to allow the PID to continue controlling to this input if it has been bypassed for calibration purposes. When the *Manual PID Mode If PV Bypassed* option is enabled any PID functions utilizing the input that has been bypassed will be temporarily forced to manual mode. The PID will return to the previous mode when the shutdown bypass is removed.

8. DATA LOGGING AND TRENDING

8.1 HMI Data Logging

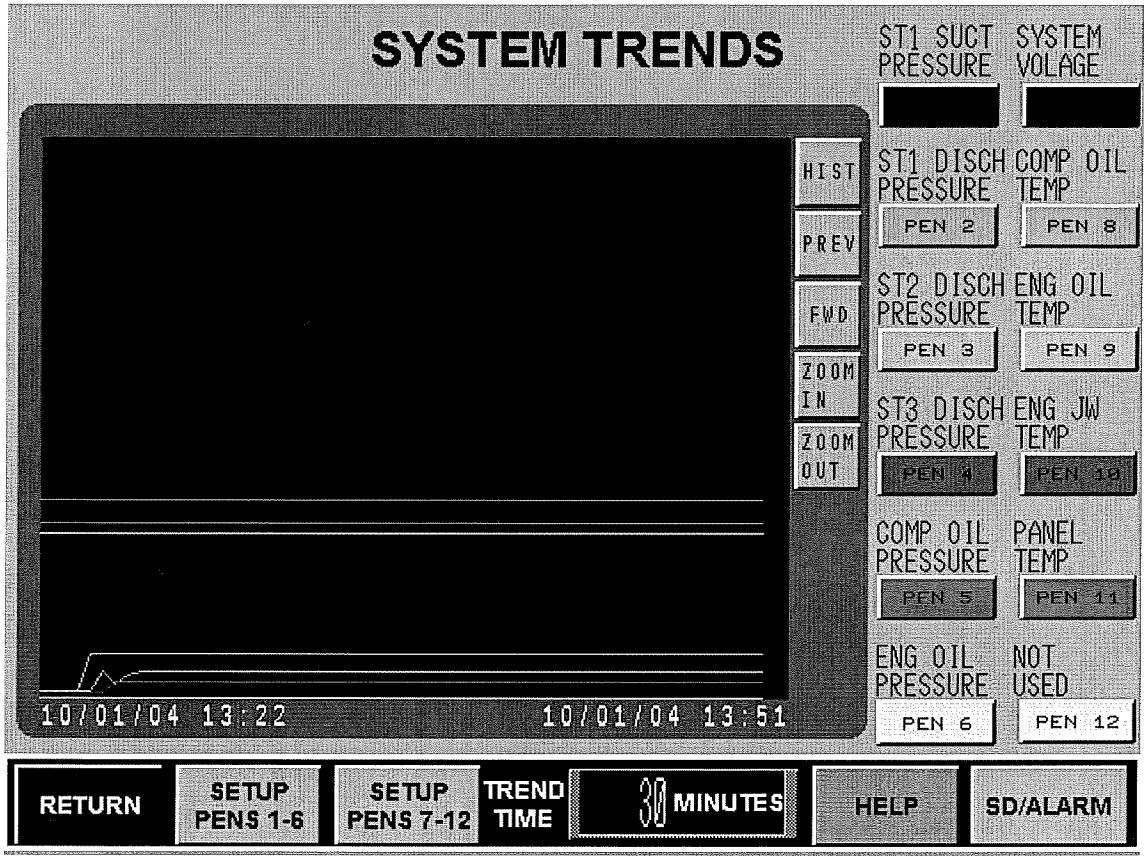
The HMI Data Log displays logged data in a table format. Each capture includes a date/time stamp, and all of the captured readings. The logging rate can be adjusted from the HMI 'Sequence Parameters' screens.

The Data Log display automatically captures a log when an alarm or shutdown occurs. The log stops updating 60 seconds after the unit is shutdown or stopped. The logged data can be transferred to a compactflash or USB card (refer to section "CF /USB Card Functions").



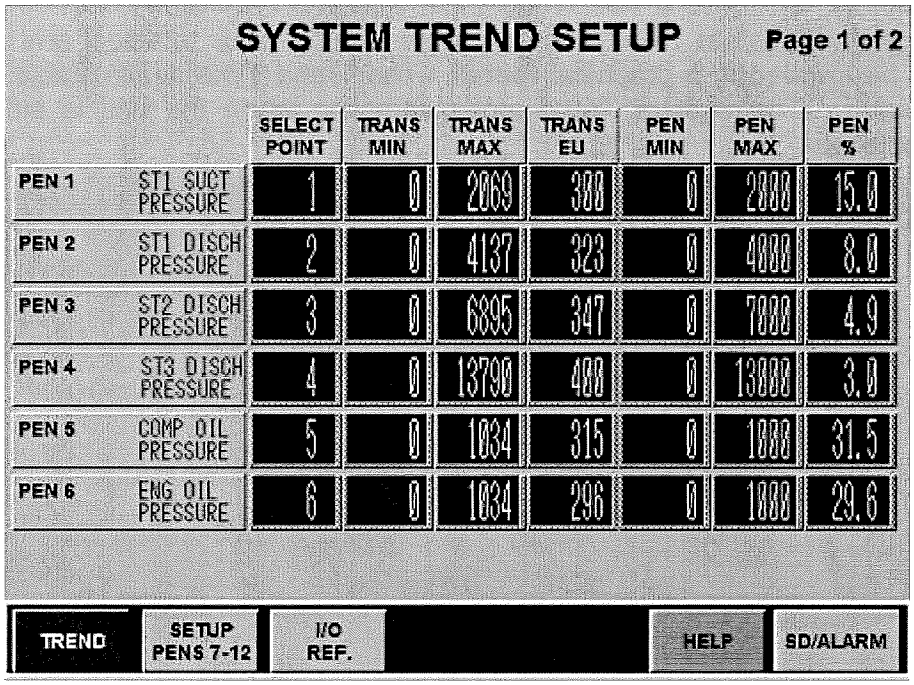
8.2 HMI Trending

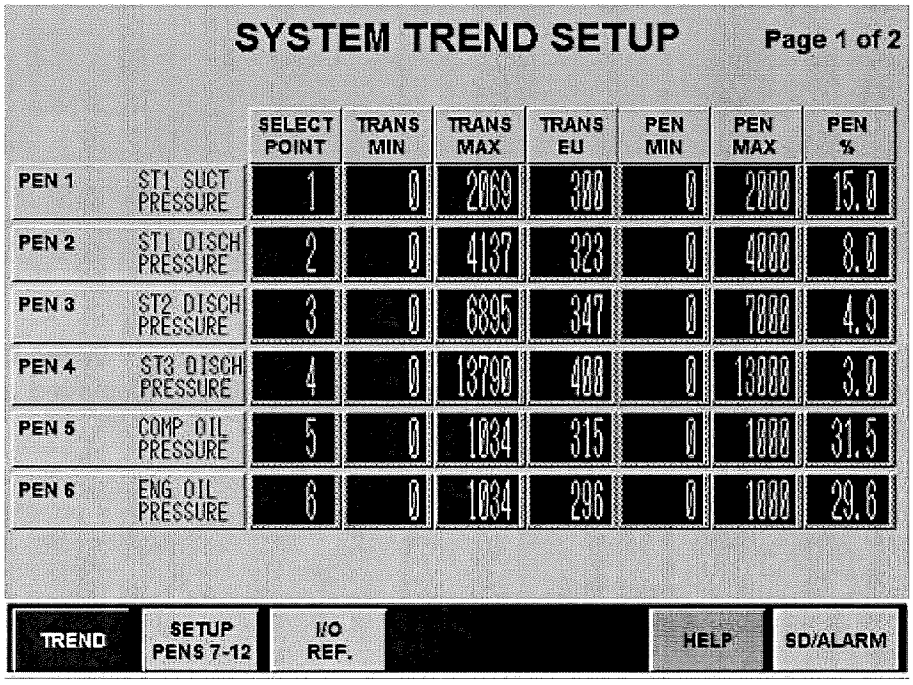
The HMI 'System Trends' screen allows the operator to select any 12 points to be trended in a graphical format. The Trend Time is adjustable from the screen. The System Trend stops sampling when the unit is stopped, or shutdown.



Each pen can be turned on/off with the buttons on the right. When the pen is configured, the selected point description is automatically displayed above the button.

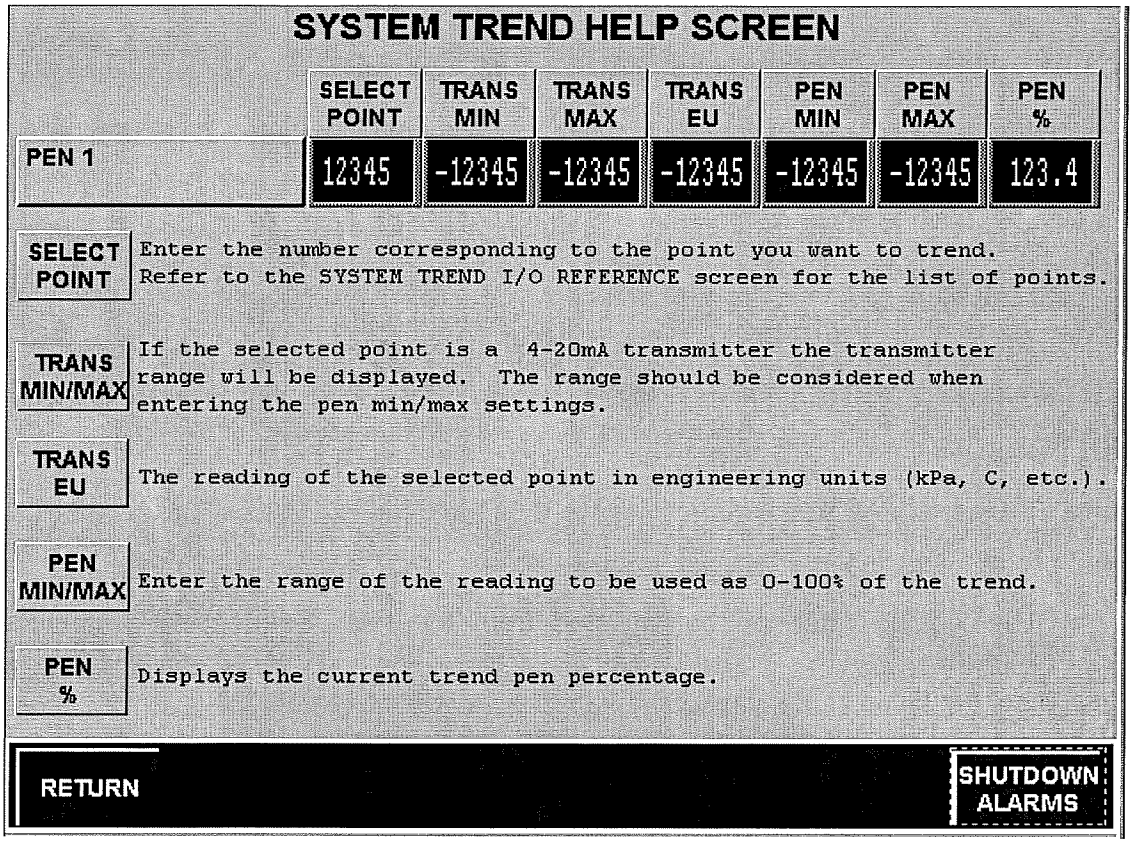
Each pen is individually configured on the SYSTEM TREND SETUP screens.





An I/O reference screen is provided. This screen lists the numbers to be entered when selecting the point to trend.

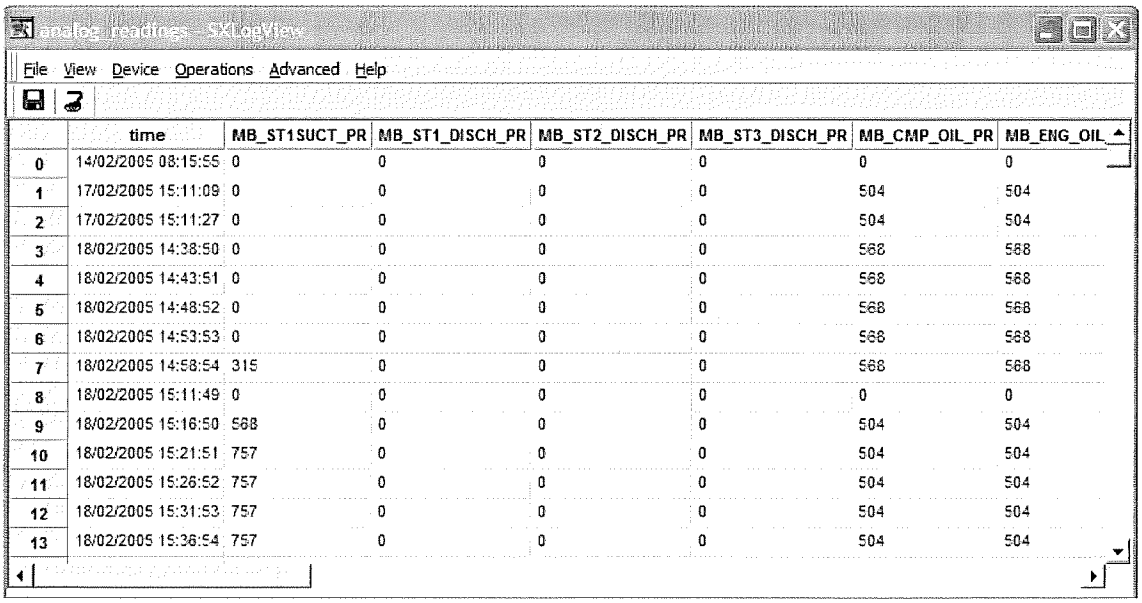
The SYSTEM TREND HELP SCREEN explains the purpose of each field.



Note: An 'Exhaust Temperature Trend' is also provided for units that include temperature monitoring on engine cylinder temperatures.

8.3 Controller Data Logging

The Controller Data Log stores logged data in the memory of the controller. The REM *Vue*®– *500* IO Tool Kit software package is required to configure the log, and to retrieve the logged data from the controller. Each capture includes a date/time stamp, and all of the captured readings.



	time	MB_ST1SUCT_PR	MB_ST1_DISCH_PR	MB_ST2_DISCH_PR	MB_ST3_DISCH_PR	MB_CMP_OIL_PR	MB_ENG_OIL
0	14/02/2005 08:15:55	0	0	0	0	0	0
1	17/02/2005 15:11:09	0	0	0	0	504	504
2	17/02/2005 15:11:27	0	0	0	0	504	504
3	18/02/2005 14:38:50	0	0	0	0	568	568
4	18/02/2005 14:43:51	0	0	0	0	568	568
5	18/02/2005 14:48:52	0	0	0	0	568	568
6	18/02/2005 14:53:53	0	0	0	0	568	568
7	18/02/2005 14:58:54	315	0	0	0	568	568
8	18/02/2005 15:11:49	0	0	0	0	0	0
9	18/02/2005 15:16:50	568	0	0	0	504	504
10	18/02/2005 15:21:51	757	0	0	0	504	504
11	18/02/2005 15:26:52	757	0	0	0	504	504
12	18/02/2005 15:31:53	757	0	0	0	504	504
13	18/02/2005 15:36:54	757	0	0	0	504	504

The logging rate can be adjusted from the HMI 'Sequence Parameters' screens.

The Controller Data Log automatically captures a log when an alarm or shutdown occurs. The log stops updating 60 seconds after the unit is shutdown or stopped.

9. OPTIONAL FUNCTIONALITY

The functionality in this section may be added to the standard package for the posted costs available from the Applications Engineer. These costs include any extra I/O and configuration time to implement the option. The additional I/O points required for these options are listed in Appendix A.

9.1 Rod Load Calculations

Compressor stage differential pressure alarm/shutdown calculations are based on the specific cylinder characteristic curves. The standard base option is a straight discharge-suction calculation.

The rod-loading calculations are based on the compressor suction and discharge pressures, in conjunction with a Rod-Loading formula.

When doing calculations for stage 2, and stage 3 the previous stages discharge value will be used as the setpoint value for PS.

9.2 Louver Control

Additional I/O Required:

Thermocouple:	Intercooler Temperature Aftercooler Temperature
Analog Output:	Louver 1 Louver 2

Two *Cooler PID* controllers within the REM *Vue*® – *500S* accomplish louver control. *Louver 1* control is based on the process *Intercooler Temperature*. *Louver 2* control is based on *Aftercooler Temperature*. Standard PID screens with auto/manual options will be provided on the HMI.

9.3 Remote Asset Management

Compressor Remote Asset Management to include internet initialization and commissioning, daily acquisition and report of 15 data points, bi-directional control, demand poll capability and alarm notification capability.

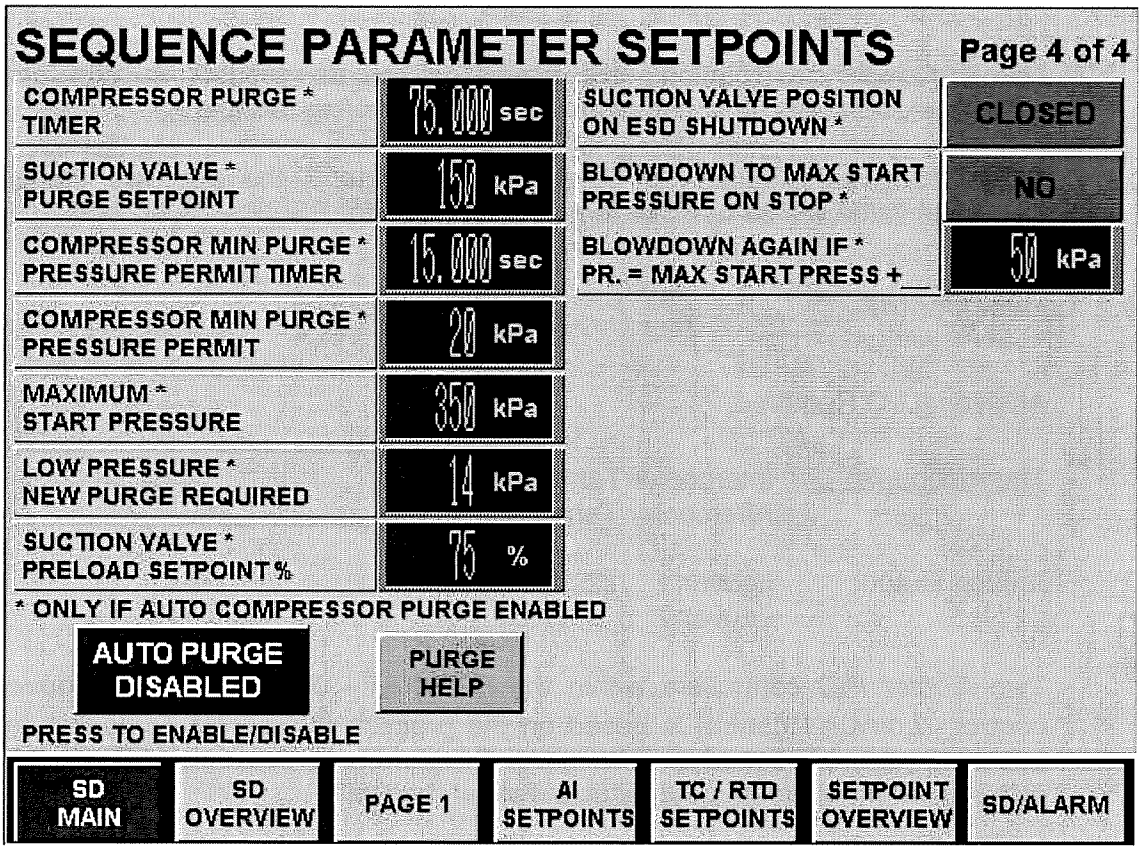
9.4 Automatic Compressor Purge With Suction Control Valve

Additional I/O Required:

Analog Outputs: Suction Control Valve
Bypass Control Valve

Digital Outputs: Blowdown Valve

This logic can be enabled, and configured from the HMI 'Sequence Parameter Setpoints' screens.



AUTO PURGE DISABLED

Suction Valve control is "free-running", and is independent of run state. The valve is not forced closed when the unit is shutdown or stopped. Options shown with * are not active.

AUTO PURGE ENABLED

The *Suction Valve* is closed on all stops or shutdowns. The *Suction Valve Position on ESD SHUTDOWN* can be set to open or closed (depending on upstream block valves).

The compressor is automatically purged on the next start if an ESD class fault has occurred (Blowdown Valve will be open prior to starting), or if the system pressure drops below the *Low Pressure New Purge Required* setpoint while the unit is stopped (Blowdown Valve will remain closed until start is initiated – then open for purge cycle).

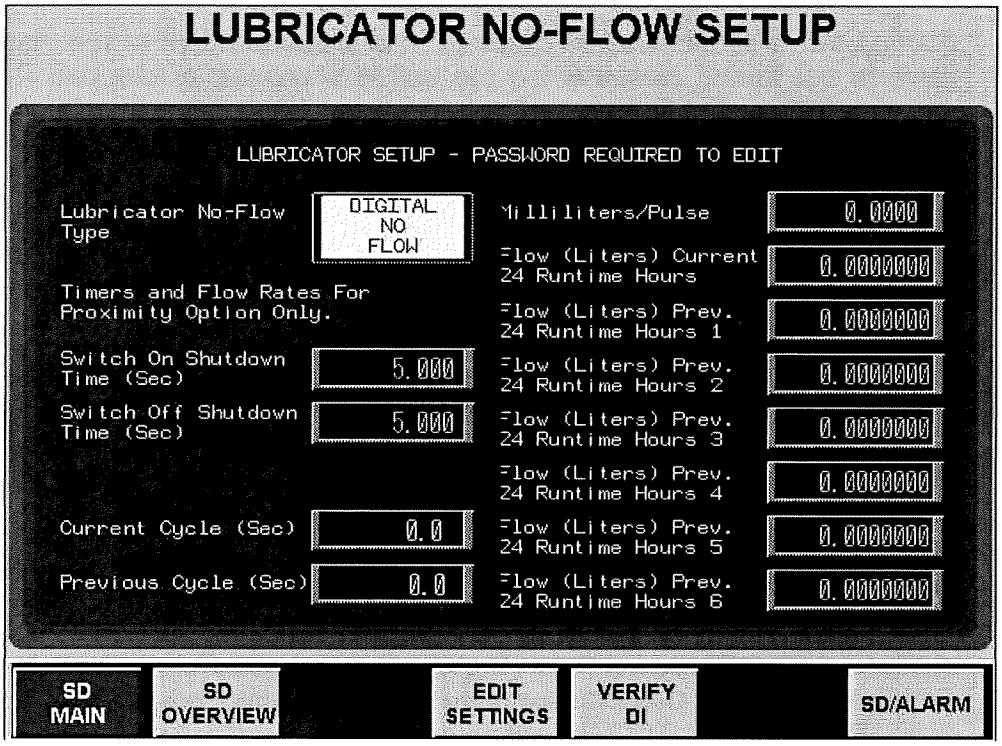
During the purge sequence the *Suction Valve* controls to the *Suction Valve Purge Setpoint* for the duration of the *Compressor Purge Timer*. The *Bypass Valve* automatically steps to the closed position after 30 seconds. If the suction pressure does not reach the *Compressor Min Purge Pressure Permit* setpoint before the *Compressor Min Purge Pressure Permit Timer* expires a PURGE FAULT SHUTDOWN will be generated.

When the purge is complete or if a "warm start" is initiated (no purge required) the Blowdown Valve opens until the suction pressure drops below the *Maximum Start Pressure* setpoint.

The *Suction Valve* flips to auto mode when the unit reaches running status. The valve controls to a reduced setpoint until loading has been initiated. The *Suction Valve Preload Setpoint %* setpoint is adjusted to determine what percentage of full setpoint the unit will run at until loading is initiated. The reduced setpoint is also used if the operator initiates an unload, or cooldown.

9.5 Lubricator No Flow Detection

Digital No Flow or Pulsing Proximity Switch options are provided for lubricator no flow detection. The 'Lubricator No Flow Setup' screen with the lubricator options can be accessed from the 'Verify Discrete Input' screen.



9.5.1 Digital No Flow

Standard option. Digital No Flow device provides a constant switch state (typically closed) as long as sufficient flow is detected. Discrete input is handled as a standard Class B input.

9.5.2 Pulsing Proximity Switch

Proximity switch continuously changes state as long as sufficient flow is detected. Unit will shutdown if switch remains in the open or closed positions for longer than the specified shutdown time period (HMI adjustable). The "Current Cycle" and "Previous Cycle" times are displayed. A pulse flow rate can be entered. This rate will be used to calculate the total flow for the current 24 runtime hour period. The previous six 24 runtime hour periods are also displayed.

10. MISCELLANEOUS

10.1 Password Protection

The following HMI screens are password protected.

- 'Analog Input Setpoints'
- 'TC / RTD Setpoints'
- 'Sequence Parameter Setpoints'
- 'Differential and RPM Setpoints'
- 'AI Transmitter Ranges'
- 'DI/AI/TC/RTD Class Configuration'
- 'DI/AI/TC/RTD Shutdown Bypass
- 'PID Setup'

The password will be set to a value of 1 when the panel ships. The password can be changed to a site specific number from the HMI 'Sequence Parameter Setpoints' screen.

Screens that do not require password entry are provided for viewing the engine/compressor/sequence parameters. Alarm setpoints, and certain sequence parameters can be adjusted from these screens.

10.2 Verify Discrete Input

The open /closed status of each discrete input can be viewed from the HMI 'Verify Discrete Input' screen.

10.3 Force Discrete Output

When the unit is not running, selected digital outputs can be manually forced on/off from the HMI 'Force Discrete Output' screen. Typically, only one output can be forced on at any time. This manual logic is automatically disabled when a start is initiated.

10.4 Run Time Hours / Number Of Start Attempts

The engine *Run Time Hours* and *Number Of Start Attempts* can be viewed from the HMI 'Panel Control' screen.

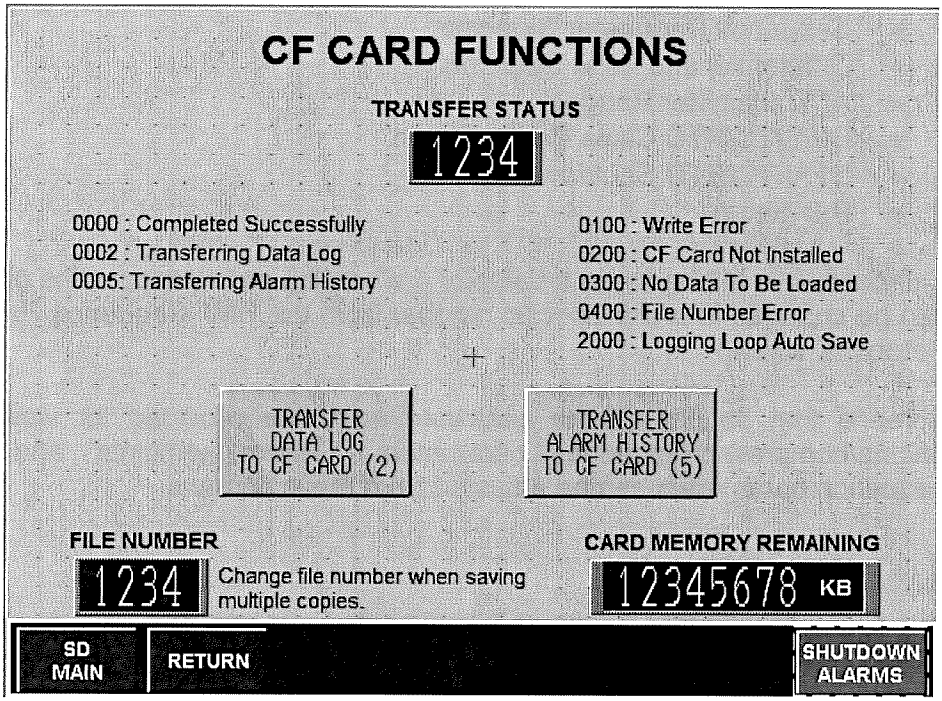
10.5 Oil Change

The control system will calculate, based on runtime hours and operator setpoint, the next required oil change.

10.6 CF Card Functions

A COMPACTFLASH card can be used to capture the HMI alarm history, and datalog archives. The data is stored on the CF card in csv format. The card data can be retrieved using a CF card reader, or using the GP PRO configuration software.

The CF card functions can be accessed via the CF CARD FUNCTION goto button on the 'Panel Control' screen.



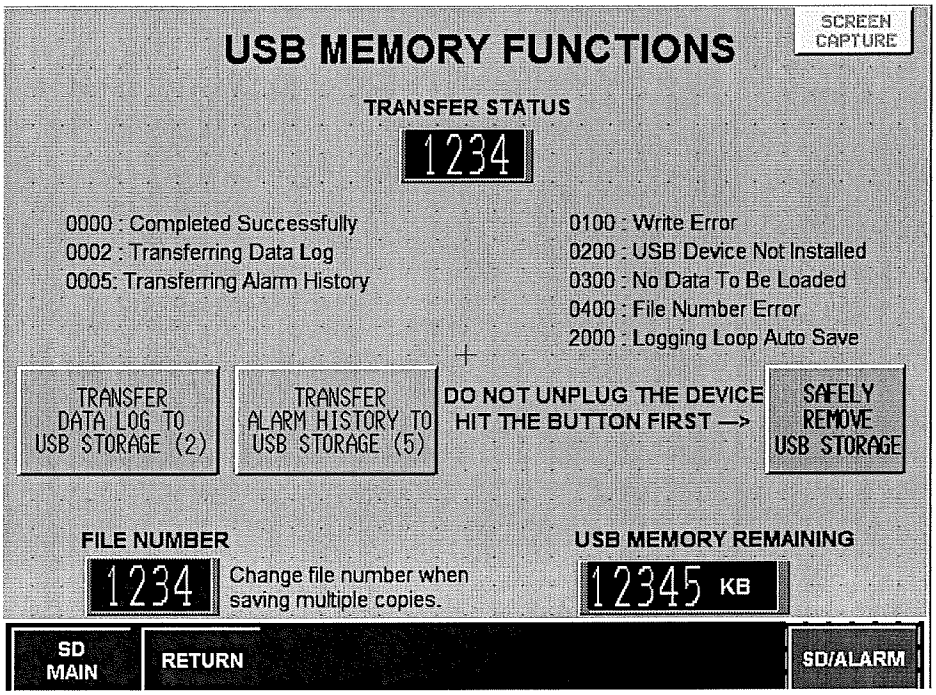
Once the CF card is inserted, the transfer buttons can be pressed to activate the data transfer. Separate buttons are provided for transferring the HMI Data Log, and Alarm History to the card. The FILE NUMBER can be incremented when saving multiple copies of the files. The TRANSFER STATUS indicates the current status of the transfer, and any error information. The CARD MEMORY REMAINING is also displayed.

10.7 USB Memory Functions (Available only on AGP 3000 series HMI)

In addition to the COMPACTFLASH memory option, the AGP 3000 series Pro-face HMI supports USB memory functions. USB memory can be optionally setup for data transfer functions instead of using the CF card.

A USB memory stick can be used to capture the HMI alarm history, and datalog archives. The data is stored on the USB memory in csv format.

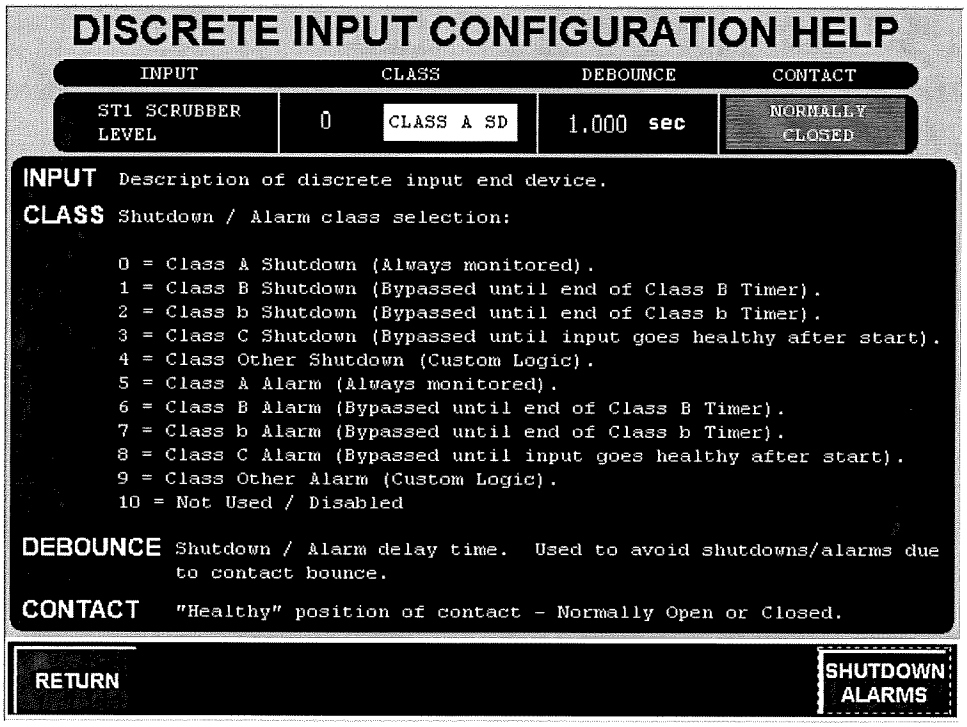
The USB memory functions can be accessed via the USB CARD FUNCTION goto button on the 'Panel Control' screen.



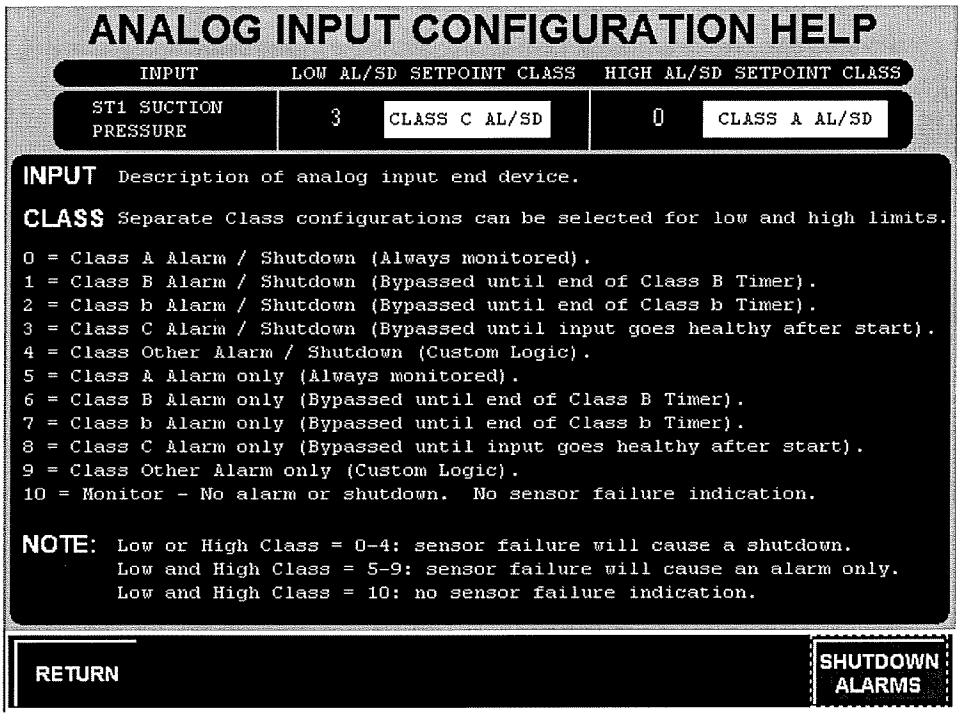
Once the USB stick is inserted, the transfer buttons can be pressed to activate the data transfer. Separate buttons are provided for transferring the HMI Data Log, and Alarm History. The FILE NUMBER can be incremented when saving multiple copies of the files. The TRANSFER STATUS indicates the current status of the transfer, and any error information. The CARD MEMORY REMAINING is also displayed.

10.8 Configurable Inputs

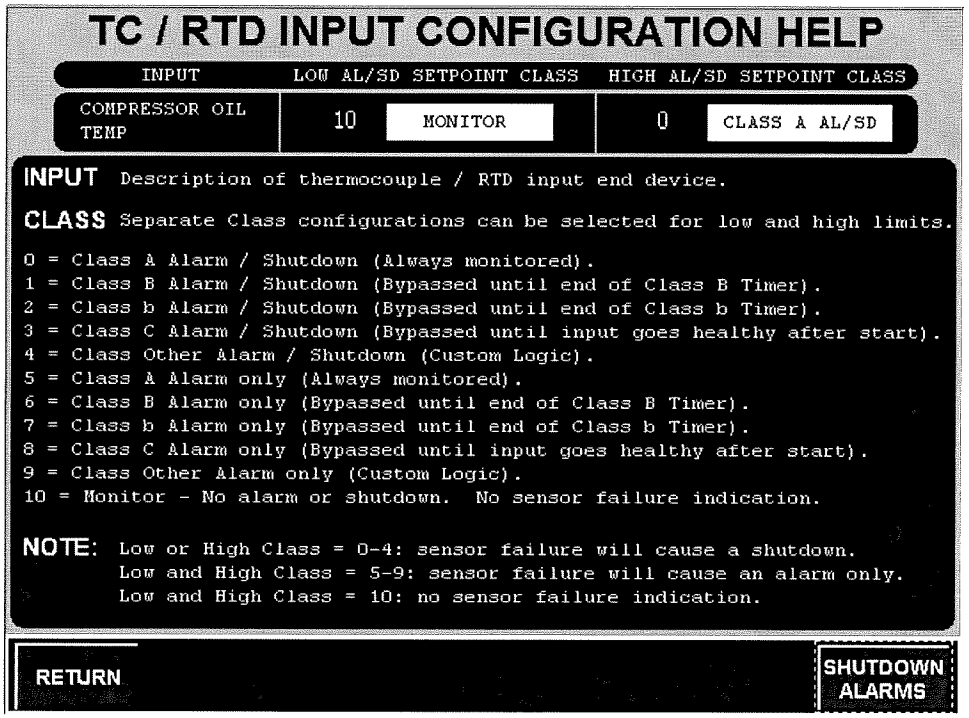
The discrete inputs can be configured from the HMI screen. Options are provided for CLASS type, DEBOUNCE time, and CONTACT type.



The analog inputs can be configured from the HMI screen. Options are provided for LOW AL/SD SETPOINT CLASS type, and HIGH AL/SD SETPOINT CLASS type. Alarm only class options are now provided.



The thermocouple / RTD inputs can be configured from the HMI screen. Options are provided for LOW AL/SD SETPOINT CLASS type, and HIGH AL/SD SETPOINT CLASS type. Alarm only class options are now provided.



11. MODBUS COMMUNICATIONS

This panel will be provided with MODBUS functionality. The following points will be available for read access:

- All Analog Input Readings
- All Analog Output Values (percent)
- All Thermocouple Input Readings
- All Discrete Input Open/Closed Statuses
- All Discrete Output On/Off Statuses
- Engine Run Time Hours
- First Out Indication
- Latched Alarm and Shutdown Indication

The following points will be available for read/write access:

- Remote Start
- Remote Stop
- Remote Reset
- Remote Engine Maximum Load Speed Setpoint
- Remote PID Control Setpoints
- Remote Load / Unload

A *Local/Remote* selector on the HMI is used to determine whether the local operator or the remote host has control.

11.1 Local Mode

Remote Start, Stop and Reset commands via communications are ignored. Remote setpoints are automatically reset to the local setpoint values. Remote Stop discrete input remains active.

11.2 Remote Mode

Local Stop and Remote Stop discrete input remain active. The local Start and Reset commands are ignored. Local setpoints are automatically reset to the remote setpoint values.

APPENDIX A

Input/Output List

See I/O list provided separately.

APPENDIX B

Definitions

Table B-1: Alarm/Shutdown Classification Definitions

Class	Description
Class A	Class A alarm/shutdown functions are always enabled. All Class A shutdowns must be cleared before the unit can be started. Examples: Engine Oil Level, Cylinder Discharge Temperature
Class B	Class B alarm/shutdown functions are disabled until the B Timer is started. Class B functions are bypassed until the B Timer expires. Examples: Lubricator No Flow, Engine Jacket Water Temperature
Class b	Class b alarm/shutdown functions are disabled until the b Timer is started. Class b functions are bypassed until the b Timer expires. Examples: Engine/Compressor Oil Pressures
Class C	Class C alarm/shutdown functions are disabled until the unit is running. Class C functions are then individually monitored. When a Class C function becomes healthy it is enabled, and will cause an alarm/shutdown if it then goes unhealthy.

PLEASE APPROVE AND RETURN.

Comments: _____

_____

_____

Approved by: _____ Approval date: _____

END DOCUMENT