YORK Process Systems
A JOHNSON CONTROLS COMPANY

REFRIGERATION CONTROL PANEL
OPERATING PROCEDURES

Frick

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2. CONTROL PANEL OVERVIEW

Introduction and Purpose

The compressor is controlled by an Allen-Bradley processor, hereafter referred to as the controller or PLC. The controller continuously monitors compressor and system conditions and operation. This manual explains how the controller is used to control the refrigeration system.
Operator interface is through a PanelView-Plus 1000 or 1250 Color, Touch Screen Operator Interface located on the front of the control panel. The interface is used for system monitoring, history, manual PID loop control, trending, and setpoint entry.

Equipment Settings Grid

Appendix A of this manual contains a list of supplied equipment settings including modbus protocols

Recommended Spare Parts List

Recommended Spare Parts lists are provided on request. Typical recommended spare parts would include:

- Circuit Breakers
- Fuses
- SPA2 Module
- Analog Input Module
- Analog Output Module
- RTD Input Module
- Discrete Input Module
- Discrete Output Module
- Power Supply
- Relay and Base

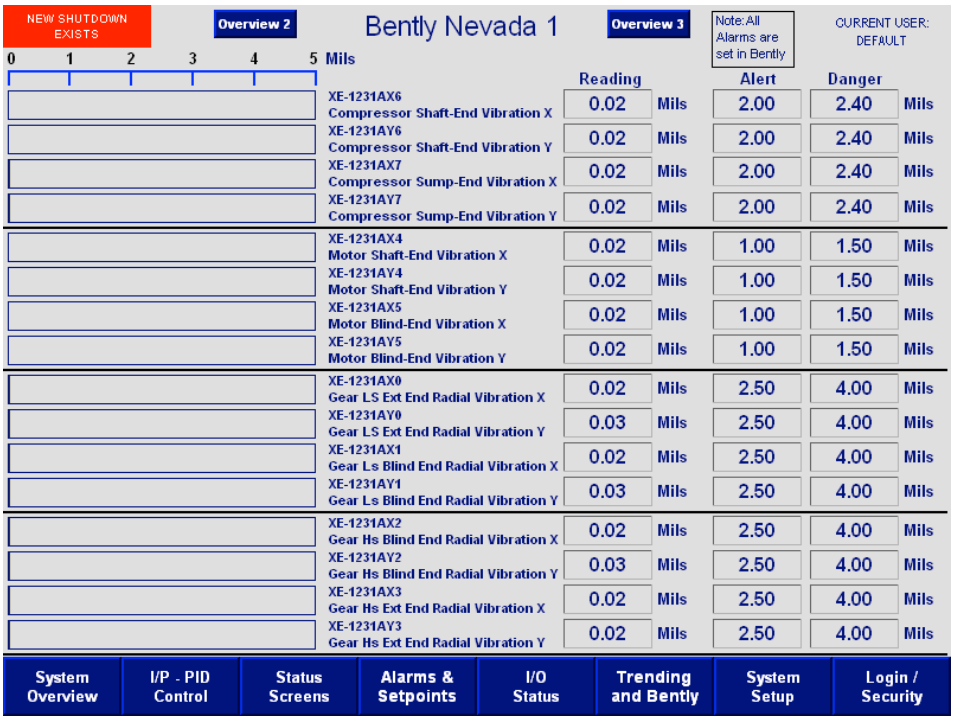
Please contact your Johnson Controls or York Process Systems Sales Representative to request a recommended spare parts list. Contact information can be found on the internet at www.jci.com or by calling Frick at (800)-ITSCOLD.

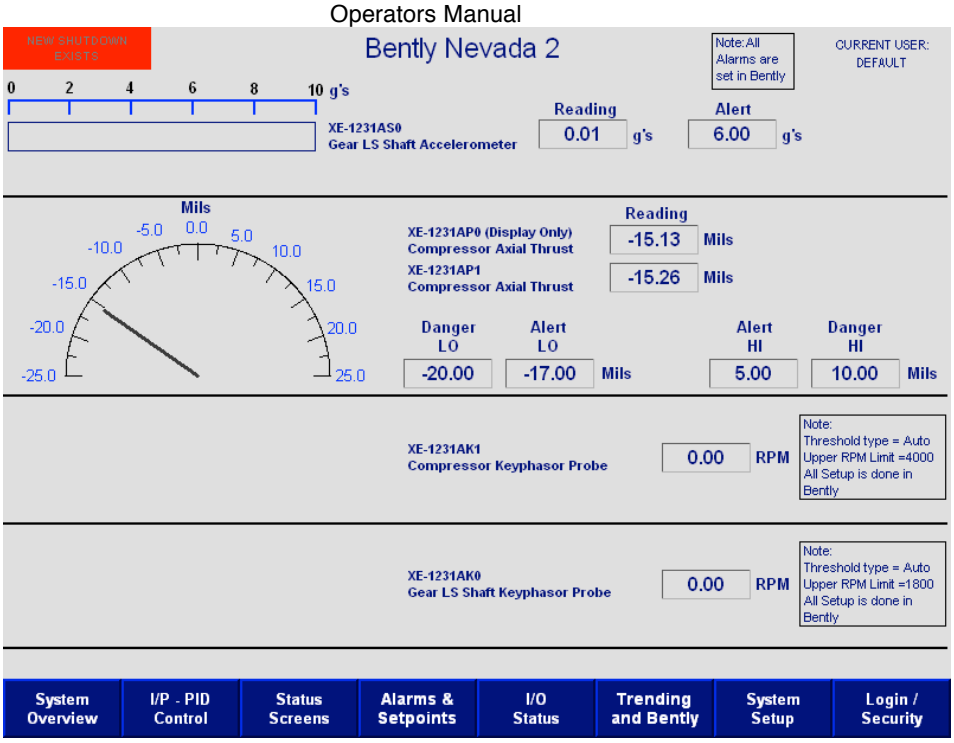
Common Control Panel Equipment

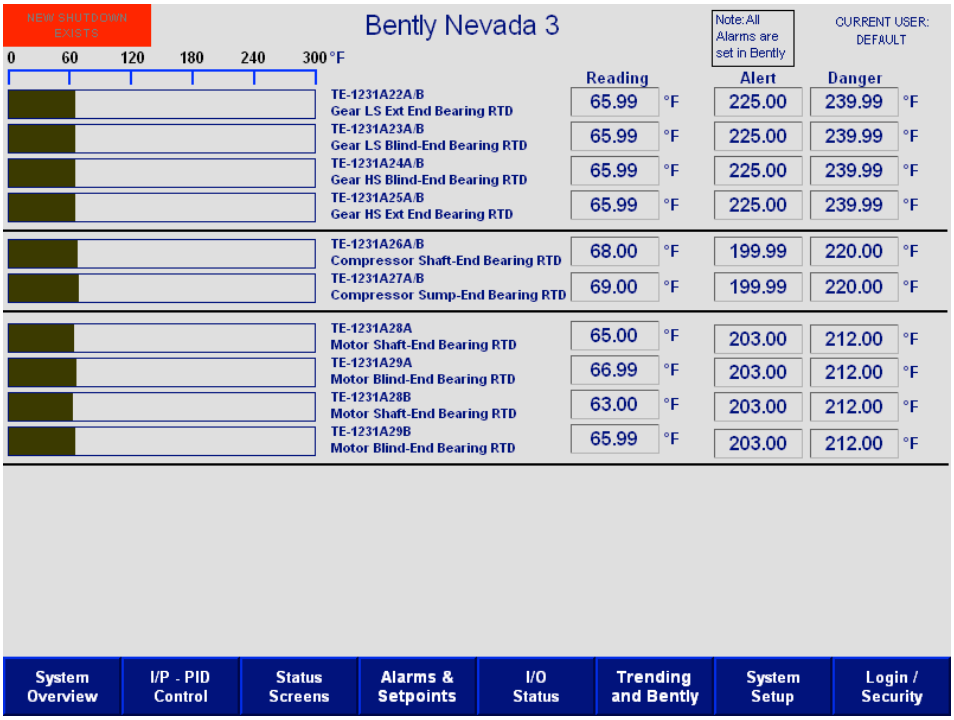
NOTE: The following equipment descriptions are for most refrigeration control panels. Projects with special requirements may or may not include the equipment listed.

Bently Nevada Vibration Monitoring System

- **Display** – The HMI has custom screens for monitoring the Bently. The Bently display content is automatically generated from the rack configuration and setpoints entered using the Bently Nevada Rack Configuration software. The display communicates to the Bently Nevada Rack with Modbus through the Prosoft card in slot 2 of the AB rack.







- **Rack Interface Module** – This module is used for uploading / downloading / monitoring of the Bently Nevada system using the Bently Nevada Configuration Software. A laptop running the Rack Configuration software can communicate to the Rack using a standard RS232 cable (Null Modem).
- **Relay Module** – This module is used to control the PLC interlocking signals.
- **Proximotor Module** – Monitors the vibration transducers mounted on the compressor or motor.

- **Keyphasor Module** – Monitors the keyphasors.
- RTD Module – Monitors compressor, gear, and motor mounted RTD's.
- **Communication Gateway Module** – Transfers Bently Nevada equipment status to the PLC using Modbus protocol.

SPA2 Module

The SPA or Site Programmable Alarm module is used for safety backup of transmitter data. The SPA2 module monitors a 4-20mA signal. When the signal falls above or below an alarm threshold, then a contact opens inside the SPA module which will cause the compressor to go into a shutdown condition.

SPA2 modules are commonly used to monitor Discharge High Pressure and Compressor Journal Bearing Inlet Low Differential Pressure. SPA modules can also be used to retransmit a 4-20mA signal. SPA2 series module setpoints can be monitored and changed through a RS232 interface on the front of the module with the Moore Industries (www.miinet.com) SPA2 Configuration Software.

HOA Switches

The following are a list of standard HOA switches located on the electrical control panel:

- **Compressor Aux Oil Pump (Auto / Manual)** – When in the Auto position, the PLC controls the oil pump. When in the Manual position, the pump will turn on immediately and run until the selector switch is returned to the auto position.
- **Gear Aux Oil Pump (Auto / Manual)** – When in the Auto position, the PLC controls the oil pump. When in the Manual position, the pump will turn on immediately and run until the selector switch is returned to the auto position.

Indicator Lights

The following are a list of standard indicator lights that are located on the electrical control panel:

- **Compressor AOP Running** – The compressor AOP running light is an indicator of the status of the auxiliary input for the motor. The indicator is illuminated when the auxiliary input to the controller is energized.
- **Gear AOP Running** – The compressor AOP running light is an indicator of the status of the auxiliary input for the motor. The indicator is illuminated when the auxiliary input to the controller is energized.
- **Compressor Running** – The compressor running light is an indicator of the status of the auxiliary input for the motor. The indicator is illuminated when the auxiliary input to the controller is energized.

Pushbuttons

The following pushbuttons are located on the control cabinet door.

- **Compressor Start** – Press to locally start the compressor. Please refer to the System Startup Procedures before pressing this button.
- **Compressor Stop** - Press to locally stop the compressor. Please refer to the System Shutdown Procedures before pressing this button.
- **Emergency Stop** – Pull to immediately shutdown the compressor. Push to unlatch and allow the operator to restart the compressor.

PLC Rack

The following are a list of modules that can be found mounted in the PLC rack.

- **Power Supply** – The power supply is used to supply power to the PLC backplane for use by the PLC cards.
- **Processor** – The PLC processor is the "decision making unit" and is generally referred to as the controller. This system utilizes the 1756-L61 CPU. The PLC program is loaded into the processor via RS232 or Ethernet interface. The processor scans the status of the I/O cards and sends command signals to the outputs.
- **Analog Input Card** – Analog input cards monitor the 4-20mA signals supplied from transmitter devices. The transmitter devices, typically Rosemount or similar, can be compressor mounted, package mounted, or from customer supplied equipment panels. Examples of typical 4-20mA analog inputs would be pressures, levels, motor current, and in some cases temperatures.
- **Analog Output Card** – Analog output cards supply a variable 4-20mA control signal to modulating valves (typically Fisher or Hanson style) and variable frequency drives. Example of typical 4-20mA analog outputs would be PRV position control, pressure control valves, level control valves, and temperature control valves.
- **Discrete Input** – Discrete input cards monitor the 120VAC or 24VDC signal supplied from a discrete switch or contact. Discrete devices are those that have an on or off state. Example of discrete input devices would be a level switches, pressure switches, thermostats, and auxiliary contacts.
- **Discrete Output** – Discrete output cards are used to control 24VDC or 120VAC devices. Examples of discrete output devices would be solenoids and relays.
- **RTD Module** – RTD input cards monitor the temperature of an RTD (resistive temperature device).
- **Ethernet Module** – The Ethernet card is used for downloading a PLC program into the PLC processor, monitoring the PLC status via laptop, monitoring the system status via PanelView plus, and for DCS communications. A category 5 (Cat-5) cable connects the Ethernet card to a switch for interface with all Ethernet compatible devices on the system.
- **ProSoft Modbus Module** – A ProSoft Modbus Card (1756-MNETR) is used to connect modbus capable devices to the PLC. The ProSoft configuration is handled by the PLC program & the Prosoft Configuration Builder Program (www.prosoft-technology.com). The ProSoft Modbus module is used to monitor Bently Nevada vibration information and can also be used for DCS communications.

3. GETTING STARTED

Navigating the Operator Interface

Figure 1 PanelView Plus 1250 Operator Interface (HMI)

All navigation is performed using the touch sensitive screen.

JCI Operator Interface Menu System

The JCI Operator Menu Interface is laid out so the operator can easily navigate from one screen to another without getting lost or having to navigate through a series of menus. The main menu is mapped across the bottom of the screen. Touching a menu button will bring up a list of screens within that submenu. To close a submenu popup screen simply click on the “Close Menu” button.

The Main Menu consists of the following submenu popup screens:

- System Overview
- I/P-PID Control
- Status Screens
- Alarms & Setpoints
- I/O Status
- System Trending & Bently
- System Setup
- Login / Language

The following section provides a detailed description of the submenu screens.

Standard Screen Layout and Contents

Figure 2 Topbar for the Alarms History Screen

Figure 3 Menu Buttons Typical for all screens

I/P-PID Control Menu Button

This menu provides access to all PID setpoints used for setting up the current to pneumatic (I/P) valves. The operator can manually control the selected valve by placing the valve in Manual Mode or allow the controller to automatically adjust the valve when selected for Auto Mode.

Status Screens Menu Button

This menu provides access to the Electric Motor Start / Inhibits and Runtimes screen. On applicable projects, customized status screens are also placed under this menu. From these screens, the operator can perform the following actions:

- View compressor AOP, Gear AOP, and compressor Motor run times.
- View Motor Start Inhibit status.
- View all start times within the last 24 hours
- Set Motor Full Load Amps.
- Set PRV Stop Load and Force Unload setpoints.
- View time and date of last compressor start.

Alarms / Setpoints Menu Button

This menu provides access to all of the Alarm Setpoint Entry screens and Alarm Status / Alarm History Screens. From these screens, the operator can perform the following actions:

- Edit analog input and RTD input alarm and shutdown setpoints and delays.
- View Active Alarms.
- View Alarm History.
- Reset Alarms.
- Silence Alarms.
- Clear Alarm History.
- View System Shutdown First Out Indicator.
- View System Shutdown Freeze Screens.

I/O Status Menu Button

This menu provides access to the current operating condition of all of the PLC analog and digital I/O cards. The screens are organized by card location. From these screens, the operator can perform the following actions:

- View status of all analog inputs including levels, pressures, and temperatures.
- View status of all discrete inputs including pushbuttons, level switches, motor auxiliaries, and estop buttons .

System Trending Menu Button

This menu provides access to the historical trending feature of the HMI. From these screens, the operator can perform the following actions:

- View historical data for all analog input and RTD input cards.
- View historical data for compressor Capacity Control equipment including suction, discharge, and PRV status.

System Setup Menu Button

This menu provides access to the system commissioning screens and equipment control setpoints. From these screens, the operator can perform the following actions:

- Access PanelView Plus panel configuration
- Set PLC date and Time
- Set compressor AOP and Gear AOP setpoints.
- Set PRV constants and view Pressure Ratio.
- Set Surge Control and Hot Gas Valve setpoints.
- Set Rate of Change Filter setpoints.
- Set Suction Pressure Pulldown setpoints.
- Set Sump Vent Valve timer setpoints (when controlled).
- Set Condenser Control setpoints (when controlled)

Login / Security Menu Button

This menu provides access to the user login / logout feature and, if specified, language switching capability. From these screens, the operator can perform the following actions:

- Login
- Logout
- Change text display language
- Change password

Current User Indicator

Figure 4 Current User Indicator

The Current User indicator is displayed in the upper left hand side of all screens. The indicator uses the format of “CURRENT USER:” with the username of the current user below. “Default” is displayed when no user is logged in.

Refer to the section “User Level Security” for more information on the Current User indicator.

Alarm Status Indicator

Figure 5 Alarm Status Indicator

The Alarm Status indicator is located in the upper right hand corner of all screens. The background color of the indicator is red for shutdowns and Yellow for alarms. The following are the status conditions that can be displayed:

- **No Alarms or Shutdowns** – No active alarms or shutdowns exist in the controller.

- **New Alarm Exists (Blinking Yellow)** – Displayed when an unacknowledged alarm exists in the controller.
- **New Shutdown Exists (Blinking Red)** – Displayed when an unacknowledged shutdown exists in the controller.
- **Alarm Exists** – Displayed when an acknowledged alarm exists in the controller.
- **Shutdown Exists** – Displayed when an acknowledged shutdown exists in the controller.

Screen Name Display

The Screen Name is displayed in the top center of all screens. This display is useful for keeping track of what screen the operator is currently viewing.

Common Colors

The following are common colors that are used throughout the HMI:

- **Yellow** – Alarm condition, or warning indication.
- **Red** – Shutdown condition or high alert indication.
- **Green** – On or Active. On setpoint entry boxes, green indicates that the user has the necessary security level to change the setpoint.
- **Grey** – Off
- **Blue** – Touch sensitive box
- **Orange** – Used on setpoint entry boxes to indicate that the user does not have the necessary security level to change the setpoint.

Common Terms

- **ALARM** - An alarm setpoint has been reached or exceeded and the compressor will continue to run.
- **AOP** - Auxiliary oil pump (also referred to as Lube Oil Pump).
- **AUTO (Automatic)** - The device is being controlled from the Allen-Bradley Processor.
- **I/P** – Current (milliamps DC) / Pneumatic (PSIA)
- **MAN (Manual)** - The device is being controlled from the PanelView 1000 .
- **PID** – (Proportional, Integral, Derivative) – This references the loops used to control the current to pneumatic (I/P) valves.
- **PLC** – Refers to the Allen Bradley SLC or ControlLogix processor that is installed in the control panel.
- **Recycle Delay** - this message indicates that the compressor has started and has shut down within the delay time that has been set to prevent the compressor from starting again. Recycle delay is intended to prevent damage to the compressor motor from successive restarts.
- **SHUTDOWN** - A critical safety limit has been reached or exceeded and the compressor has been shutdown.

Setpoint Entry Boxes

Figure 6 Setpoint Entry Box. The highlighted color reflects the user's security level. Green = access allowed, Orange = access denied.

Setpoint entry boxes are used by the operator to enter setpoints that are used by the controller to define parameters such as alarm delays, shutdown delays, PID gains and setpoints, control setpoints, etc. Setpoint Entry boxes have a "raised" border style, and are characterized by either a bright orange (access denied), or bright green (access

allowed) outline. A user must be logged in with the correct security level to change setpoints.

Value Display Boxes

Figure 7 Value Display Box

Value Display boxes show controller values such as temperatures, pressures, valve positions, and I/O status. Value Display boxes have an "inset" border style.

User Action Buttons

Figure 8 User Action Button (No highlight indicates that all user levels can access this button)

User Action Buttons are used by the operator to reset alarms, go to screens, and change system modes. User Action boxes are blue and, when applicable, have either a bright orange (access denied), or bright green (access allowed) outline. A user must be logged in with the correct security level to change setpoints.

Setpoint Security System

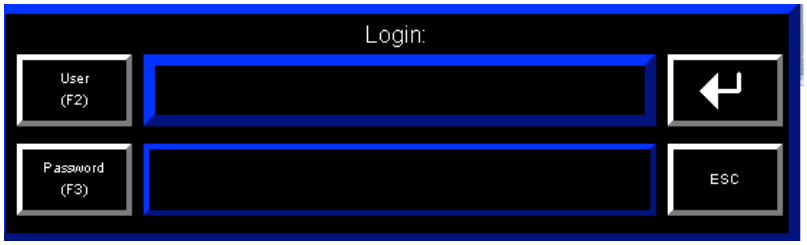


Figure 9 User Login Screen

User security is used to prevent unauthorized users from changing setpoints or controller modes. The user security system is similar in setup to the Frick Quantum LX controller.

Logging In and Logging Out

The Login / Logout function is performed through the Login / Language button on the bottom right hand corner of all screens. Use the following procedure to login to the HMI:

- Press the "Login / Language" button
- Press the green "Login" button.
- Press the "User (F2) button.
- Enter the required user level (OPER, ENG, or ADMIN)
- Press the Enter key at the bottom right had corner when finished.
- Press the "Password (F3)" button.
- Enter the password for the required user level.
- Press the Enter key at the bottom right hand corner when finished.
- Press the Enter button again (above the ESC button on the touch screen).

Users are automatically logged out after 30 minutes of no activity. Users can logout by pressing the red “Logout” button from the “Login / Language” submenu.

Changing User Passwords

Password can be changed from the blue “Password” button. The level 3 and York passwords can not be changed through the operator interface.

Use the following procedure to login to the HMI:

- Press the “Login / Language” button
- Press the blue “Password” button.
- Press the “Old Password (F2) button.
- Enter the Old Password.
- Press the Enter key at the bottom right had corner when finished.
- Press the “New Password (F3)” button.
- Enter the new password for the required user level.
- Press the Enter key at the bottom right hand corner when finished.
- Press the “Confirm Password (F4)” button.
- Re-enter the new password for the required user level.
- Press the Enter key at the bottom right hand corner when finished.
- Press the Enter button again (above the ESC button on the touch screen).

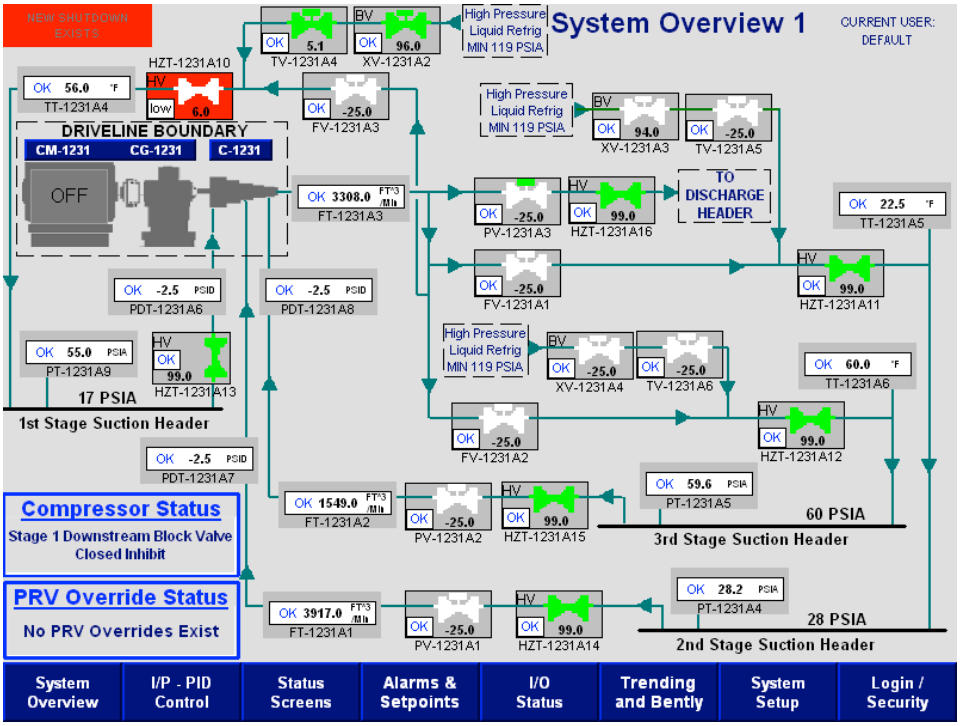
User Level Security

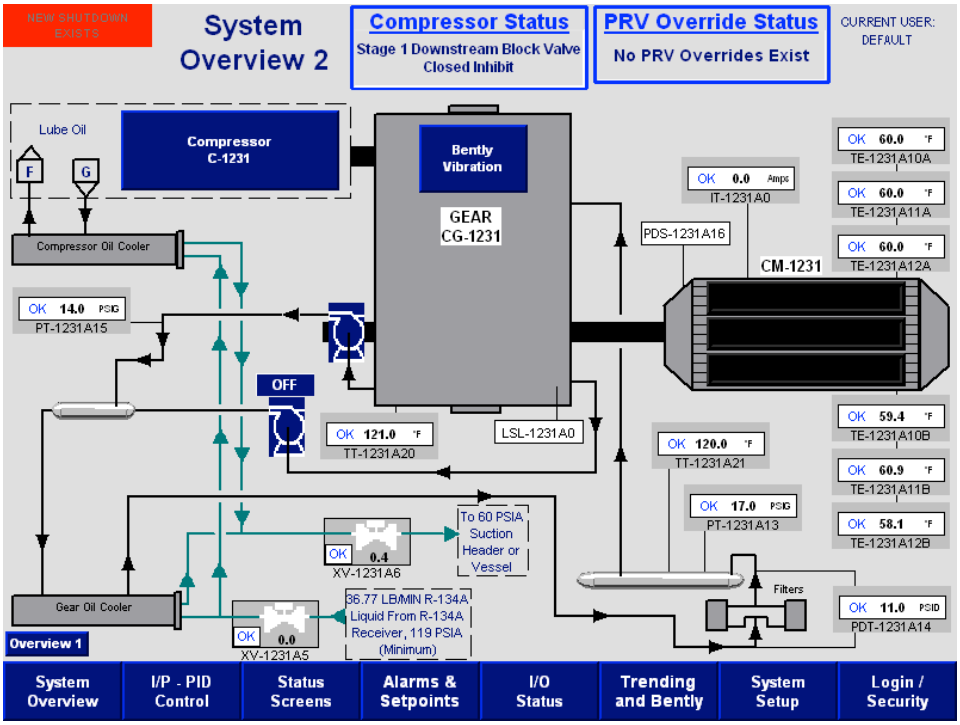
User security is setup at the factory with the operators of 1, 2, 3, and York.

- **OPER** - Lowest level of access. Can change capacity control setpoints and acknowledge alarms.
- **ENG** – Can change most setpoints except those located under the System Setup menu.
- **ADMIN** – Can change all setpoints including setup
- **York** – Same access as “3”. Included for technicians familiar with legacy PanelView setpoints

4. STATUS SCREENS

System Overview Screens





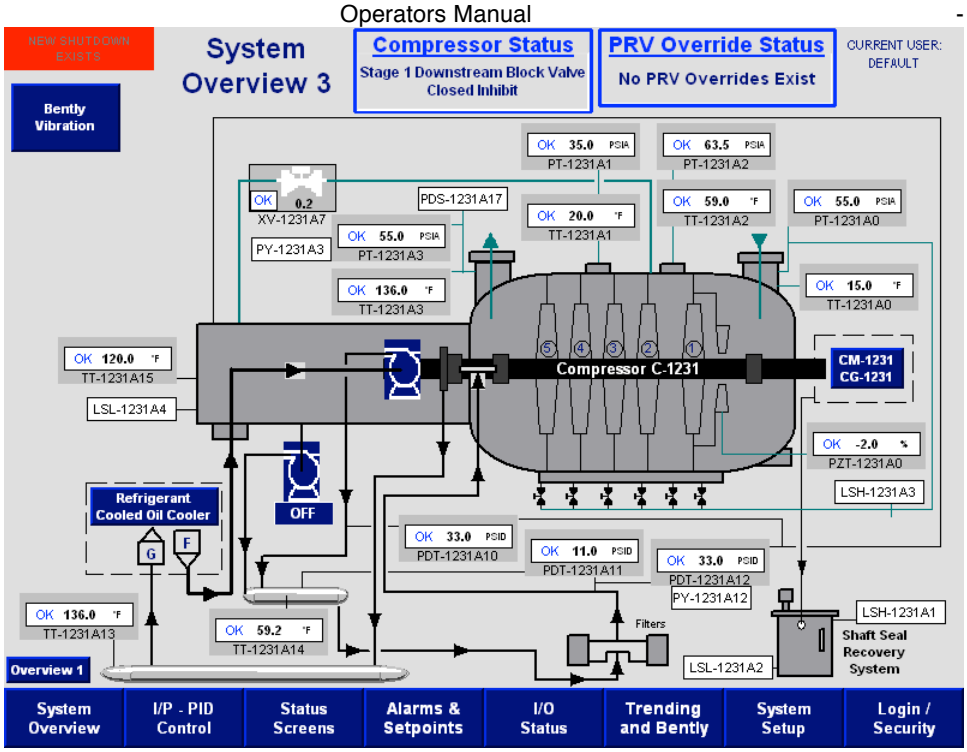


Figure 10 System Overview Screens

The System Overview screen 1 is the default HMI startup display. This screen is an overview of the entire system based on the P&I Diagram (659D2149). It consists of a general diagram of the critical components of the refrigeration system as well as motor status, analog inputs, RTD inputs, modulating valve positions, and information displays. System Overview 2 (659D2147) supplies a more detailed view of the gearbox & motor. Finally Stem Overview 3 (659D2146) supplies a more detailed look of the Compressor.

I/O Status Display

System critical temperatures, pressures, levels, and modulating valve positions are shown in their respective locations per the P&I Diagram.

Compressor Status

The compressor status is shown with respect to the running status of the compressor:

- ON = Green
- OFF = Grey

Comp / Gear Aux Oil Pump Status

The AOP status is shown with respect to the running status of the compressor and gear AOP:

- ON = 

- OFF = 

Modulating Valves

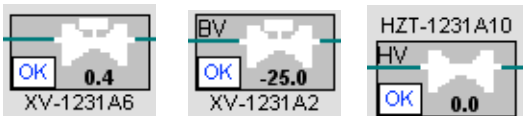
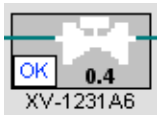
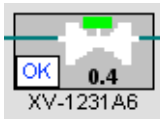
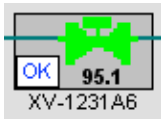


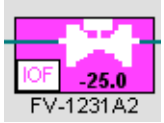
Figure 11 Represents the 3 styles of Valves

The modulating valve position is shown to the lower center of the valve box. Some limited function valve indicators will have a BV (Block Valve) or HV (Hand Valve) in the top left of the valve box. Block valve body and handle will turn green when the solenoid is energized. Hand valves have no solenoid so the image has no handle but the body turns green when the valve position is above 95%. Listed below are the different states of the valve indicator:

- 

This example is of a normal off / closed state
- 

The green handle indicates the solenoid for the valve is energized
- 

The green valve body indicates the valve is more than 95% open (adjustable 95 to 100%)
- 

The pink box & IOF indicate an out of range condition

Transmitter Indicator

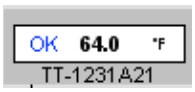


Figure 12 Multipurpose Transmitter Indicator

The Transmitter indicator can be used for Temperature, Flow, Current, Pressure, & Differential Pressure.

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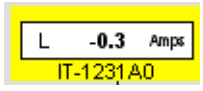
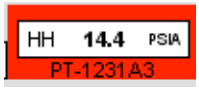
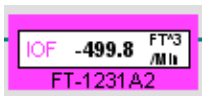
This example is of a normal reading transmitter
- 

This example is of transmitter in Alarm (H or L)

- 

This example is of transmitter in shutdown (HH or LL)
- 

The pink box & IOF indicate an out of range condition

SyncFault (Suction Pressure)

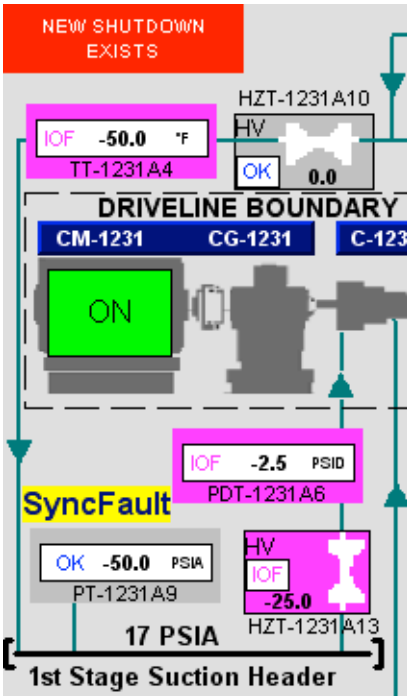


Figure 13 Above PT-1231A9 the SyncFault is active otherwise this space is empty

Comparator Compares Local (PT-1231A0) & Common Header Suction Pressure (PT-1231A9). The Comparator uses the Common Header Suction pressure unless the Delta PSI differs by more than the Setpoint default of 2 (0-10 adjustable) then it uses the Local Pressure.

Digital Indicators

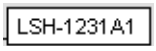
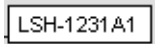
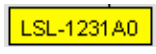


Figure 14 Above is an examples of digital alarm indicators

The digital alarm indicator are used for level swithces and SPA2 module alarm conditions.

- 

Normal State
- 

Level switch in alarm
- 

SPA2 signal in shutdown (Same for Level Switch)

Quick Link Buttons

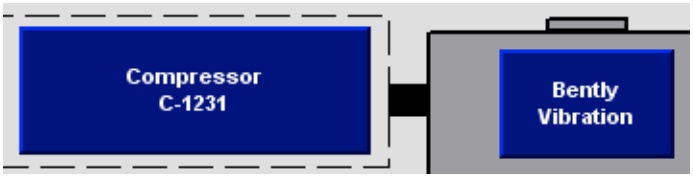


Figure 15 Above is an examples of two Quick Link Buttons

The blue Quick Link Buttons are on each of the Overview Screens to aid in moving between frequently used screens.

Motor Indicators & Alarms

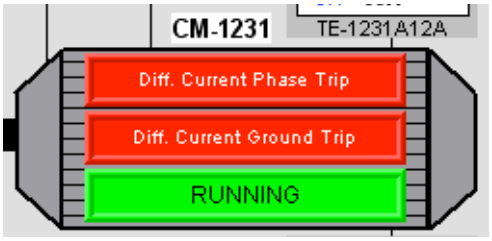


Figure 16 Motor indiactors

The motor will indicate running when the motor aux contact is made. The alarm states are tripped from the GE Multilin MIF II Digital Feeder Relay. The following are the trip states:

- Differential Current Phase Trip
- Differential Current Ground Trip

System Status Indicator

The System Status Indicator is an information display used to alert the operator of the current functioning status of the compressor system. The following states can be displayed:

- Compressor Ready To Start
- Electric Motor Anti Recycle Inhibit On (Recycle Delay)
- Compressor Running
- Compressor Running In Alarm
- System Shutdown
- System Starting - Starting Oil Pumps
- Starting Compressor
- Emergency Stop is Pressed
- Local Stop Button Pressed
- Remote Stop Pressed / Enabled
- Low Compressor Oil Sump Level Start Inhibit
- Low Gear Oil Sump Level Start Inhibit
- Low Comp Oil Sump Temp Start Inhibit
- DCS Permissive Start Inhibit
- MCC Permissive Start Inhibit
- Compressor Stage Drain High Level Inhibit
- Stage 1 Block Valve Closed Inhibit
- Stage 2 Upstream Block Valve Closed Inhibit

- Stage 2 Downstream Block Valve Closed Inhibit
- Stage 3 Upstream Block Valve Closed Inhibit
- Stage 3 Downstream Block Valve Closed Inhibit
- Stage 1 Downstream Block Valve Closed Inhibit
- Compressor Discharge Block Valve Closed Inhibit

PRV Overrides Indicator

The PRV Overrides Indicator is an information display used to alert the operator of any active conditions that will stop load or force unload the motor. The following states can be displayed:

- No PRV overrides exist
- Discharge Pressure Override
- Motor Current Stop Load
- Motor Current Force Unload
- PRV in slow Pulldown startup

Start Permissives (Compressor Summary Screen)

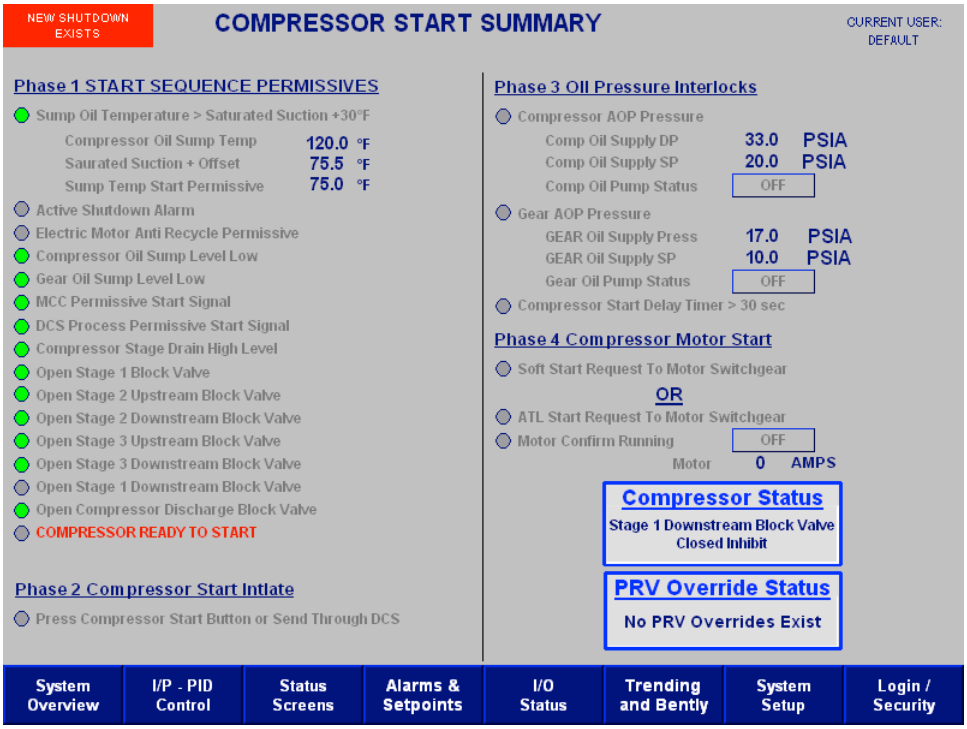


Figure 17 Compressor Start Summary Screen

The Compressor Start Summary Screen displays information regarding the Startup sequence and anything inhibiting the compressor from starting.

Phase 1 Start Sequence Permissives

The Phase 1 Start Sequence displays all of the permissives that must be met to receive the Compressor Ready To Start signal. The Compressor Ready To Start indicator will be

Red until all permissives are met and then turn Green. The round indicators in front of each permissive will be grey until met and then turn green to show it is OK.

Phase 2 Compressor Start Initiate

The Phase 2 Compressor Start Initiate is only waiting for the start button or DCS start signal to be sent.

Phase 3 Oil Pressure Interlocks

The Phase 3 Oil Pressure Interlocks showing that Compressor & Gearbox oil pressure is ok along with a 30 sec delay must be met for the automatic sequence to continue.

Phase 4 Compressor Motor Start

The Phase 4 Compressor Motor Start waits for either a soft start or ATL (Across The Line) signal. Then once the Compressor motor AUX contacts close the Compressor Status will display Compressor Running Status.

Note: For further detail see the Logic Diagram 669D0127 sheet 2 of 11.

Electric Motor Inhibits and Runtimes

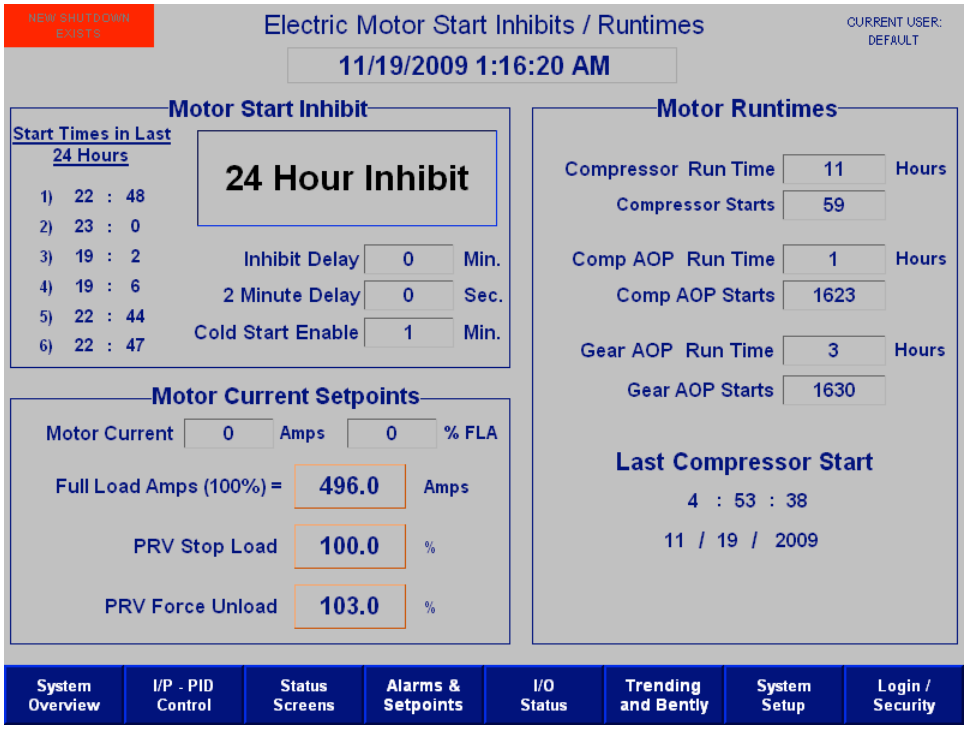


Figure 18 Typical Electric Motor Inhibits and Runtimes Screen

The Electric Motor Inhibits and Runtimes screen displays information regarding motor protection and motor runtimes. When anti-Recycle is active the compressor is prevented from starting. Anti-recycle is used to prevent excessive starting of the compressor to avoid damage to the motor.

Motor Current Setpoints

The “Motor Current Setpoints” section of the screen is used to set the parameters defining the FLA%, PRV stop load, and PRV force unload.

Motor Runtimes

The “Motor Runtimes” section displays run time information and number of start counts for the compressor motor and auxiliary oil pump motors. The last compressor start is logged on this display with the date and time being displayed

2 Minute Delay

Indicates two minute start inhibit delay time. Compressor startup will be permitted when this value is zero

Hot Start Delay

The Hot Start Delay is the amount of time between the stop and restart of the compressor. A hot start will be permitted when this value is zero.

Cold Start Delay (24 Hour Inhibit)

Indicates the maximum number of starts for the past 24 hours has been reached. The times of the last six starts are recorded under TIME OF LAST 6 STARTS. Compressor startup will be inhibited until 24 hours have elapsed since the first start. This will allow two consecutive starts with only a two minute inhibit between them.

Start Times in Last 24 Hours

The time of the six most recent compressor starts within a 24 hour period.

Actual Motor Amps

Displays the current Motor Amps transmitted from the C/T sensor.

FLA Setpoint

Enter the motor AMP Setpoint to be used as the 100% load value.

Actual FLA %

The current Motor Amps usage as a percentage of Full Load Amp draws.

Stop Load

When the motor FLA reaches or exceeds this setpoint, the pre-rotation vanes are prohibited from opening any further.
Range (0 – 110%)

Force Unload

When the motor FLA reaches or exceeds this setpoint, the pre-rotation vanes are ramped closed at a rate of 10% per second. The ramp time is adjustable and can be changed via the “Motor Current Force Unload” setpoint in the System Setup page accessed via the System Setup Menu.
Range (0 – 103%)

Number of Starts

The total number of starts for each motor.

Runtimes

The total running hours for each motor.

Date and Time of Compressor Start

The date and time of the last compressor start.

5. PID SCREENS

PID Setpoints

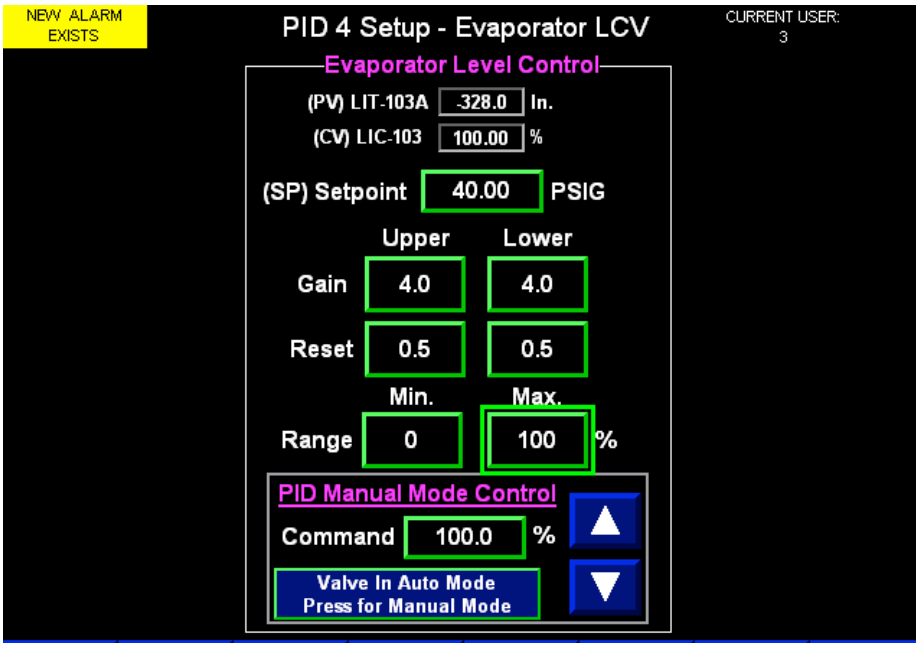


Figure 19 Represents a Typical PID Loop Screen

List of PID Loops

A detailed list of PID loop control can be found in both the Logic Diagrams (669D0127) and Pneumatic Electric Diagrams (669D0124) provided with the project

PID Loop Setpoints

Actual PV

The analog input (or process variable) is displayed along with its unit of measure. The PID loop will equalize this variable around the loop setpoint based on the gain and reset values.
NOTE: Rate (not adjustable on the display).

Setpoint SP

Enter the setpoint of the desired temperature, pressure, level, or flow to be maintained. The PID loop will equalize the process variable around this setpoint based on the gain, reset, and rate (not adjustable on the display). (See explanations of each below)

Gain

This is the Proportional Gain, ranging from .001 to 20. Gain acts directly on the change in error since the last scan (error is the setpoint (SP) minus the control variable (CV) value). Therefore, in the case of steady-state error, gain alone has no effect on the output. For this reason, gain cannot be used alone.

Gain is also used as a multiplier on the integral and derivative. A rule of thumb is to set this gain to one half the value needed to cause the output to oscillate when the reset is set to zero. Too much gain results in output oscillation (overshooting). Too little gain results in very slow performance

- **UPPER Gain -** This setpoint will be used when the process variable is above the loop setpoint.
- **LOWER Gain -** This setpoint will be used when the process variable is below the loop setpoint.
- **Adjusting Gain Values –** Increasing gain causes a FASTER response (valve ramps in larger increments). Decreasing gain causes a SLOWER response (valve ramps in smaller increments)

Reset TI

Reset is the Integral gain, adjustable from 0.001 to 20. This term acts only on the current error. It is used to reduce the current error to zero. Note that during steady-state conditions, integral multiplied by current error multiplied by gain is the only thing affecting the output. A rule of thumb is to set the reset as low as needed to prevent over-shooting.

- **UPPER Reset -** This setpoint will be used when the process variable is above the loop setpoint
- **LOWER Reset -** This setpoint will be used when the process variable is below the loop setpoint
- **Adjusting Reset Values -** Increasing reset causes a SLOWER response. Decreasing reset causes a FASTER response.

Range

The range is used to set minimum and maximum control values for the modulating valve. An example would be a minimum value of 20% for a pressure control valve that should never close to less than 20%.

Output CV

This displays the current control output in % open. *NOTE: When the valve is in manual mode, this value will represent the PID Loop control position if the valve were still in auto mode, and not the physical position of the valve.*

Manual / Auto Valve Control

Mode Change Bumpless Transition Operation

The control system utilizes a “bumpless” transition when switching from manual to auto control. Bumpless refers to the ramping of the valve in a smooth transition, as opposed to non-bumpless which would “slam” the valve from the manual position to the auto position.

Valve Modes Of Operation

The operator must be logged in with a minimum of level 2 to use the manual control feature. The following are the 2 states of the valve:

- Auto Mode – When the valve is in auto mode the control button will say “Valve in Auto Mode Press for Manual Mode”. Pressing the button will change the valve to manual mode.
- Manual Mode – When the valve is in Manual Mode, the control button will show “Valve in Manual Mode Press for Auto Mode”. Pressing the button will change the

valve to auto mode. The indicator will blink red when the modulating valve is placed in manual mode control.

Command Position

The Command Position represents the percentage location of the valve. 0% represents fully closed, 100% represents fully open. When the valve is in manual mode in can be ramped open and close using 2 different methods, by touching on the "Command" box and entering a command value, or by touching the blue ramp up or ramp down arrows.

NOTE: If a valve is left in manual mode, and the current user logs out, the valve mode status will show "Valve in Manual Mode Login to Change".

PRV Capacity Control

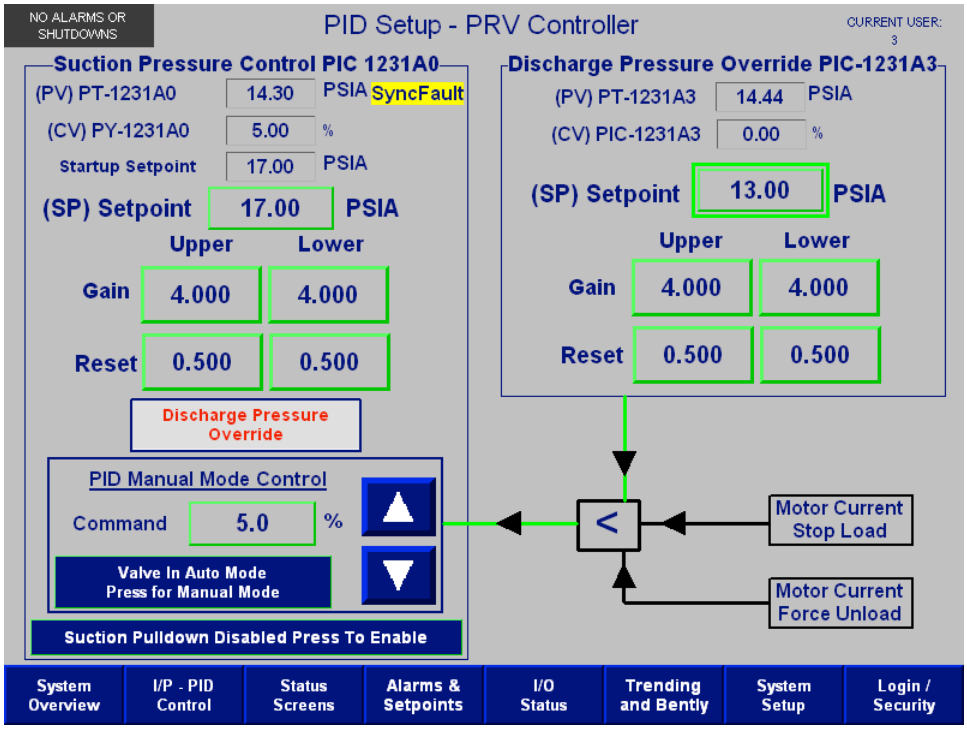


Figure 20 Typical PRV Capacity Control Screen with Discharge Pressure Override

PRV Overrides Indicator

The PRV Overrides Indicator is an information display used to alert the operator of any active conditions that will stop load or force unload the motor. The following states can be displayed:

- No PRV overrides exist
- Discharge Pressure Override
- Motor Current Stop Load
- Motor Current Force Unload
- PRV in slow Pulldown startup

Startup Setpoint

Default conditions will allow for the compressor to do a slow loading of the Pre Rotation Vanes according to setup parameters entered in the setup display section. This slow loading can be bypassed at any time of the startup procedure by pushing the Suction Slow Pulldown Enabled Press to Disable button. If the Slow Pulldown is disabled the pushbutton will display Suction Pulldown Disabled Press to Enable, this will disable all Slow Pulldown setpoints on startup.

Discharge Pressure Override

This override is designed to ramp the PRV's closed during high discharge pressure conditions. If the process variable (discharge pressure) exceeds the loop setpoint, the PID Loop will begin ramping down. When the output of the discharge loop is less than the output of the suction loop, the suction loop will begin ramping down at the same rate as the discharge loop in order to close the PRV's due to high discharge pressure

- **Upper Gain & Reset Setpoints -** The gain and reset setpoints are set for a faster response during high discharge pressure conditions. This allows the PRV's to close sooner in order to reduce the discharge pressure.
- **Lower Gain & Reset Setpoints -** The gain and reset setpoints are set for a slower response after the discharge pressure falls below the setpoint. This allows the PRV's to open slowly in order to prevent the discharge pressure from rising to quickly.

Override Comparator

The Override Comparator is located in the lower right portion of the screen (box with " < " symbol). The lines to & from the comparator to the PRV PID will normally be black. When Discharge Override, Motor Current Stop / Force Unload are active the lines will turn green as in figure 20.

Sync Fault

Figure 20 shows PT-1231A0 with SyncFault active otherwise this space is empty

A comparator compares Local (PT-1231A0) & Common Header Suction Pressure (PT-1231A9). The comparator uses the Common Header Suction pressure unless the Delta PSI differs by more than the Setpoint default of 2 (0-10 adjustable) then it uses the Local Pressure.

6. I/O Status Screens

Digital Inputs and Digital Outputs

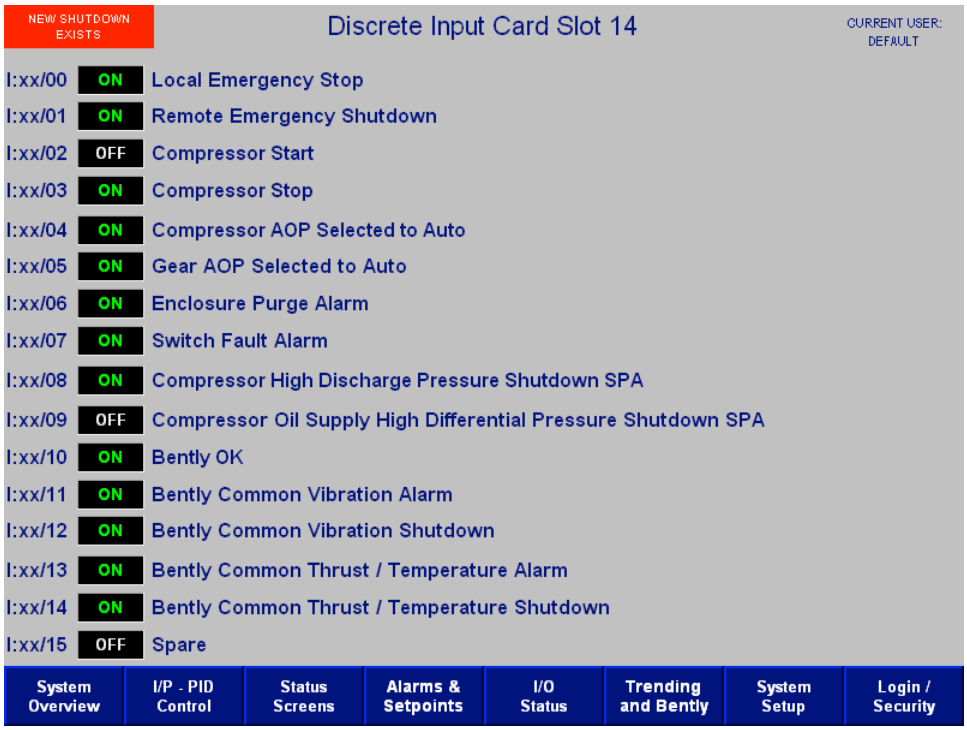


Figure 21 Typical Digital Input Status Screen

The Digital Inputs and Digital Outputs screen displays the actual states of all digital inputs wired to the controller. The inputs and outputs are listed in order as wired to the digital input card.

Analog Inputs

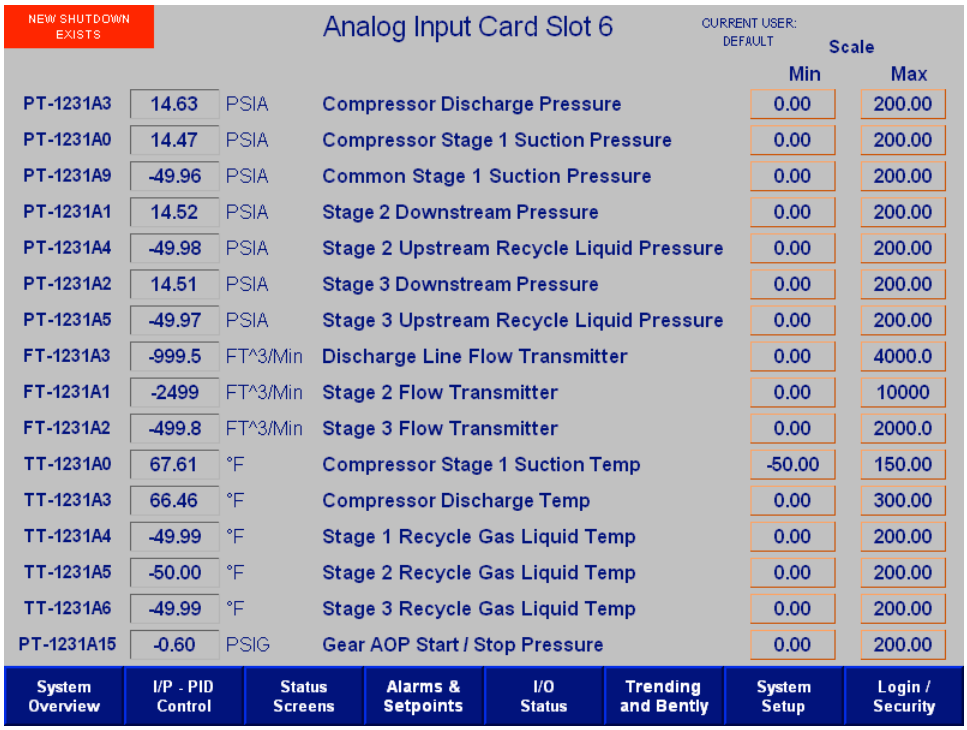


Figure 22 Typical Analog Input Status Screen

The Analog Inputs screen displays the scaled values of all analog transmitters wired to the controller. The inputs are listed in order as wired to the analog input card.

Scale Min and Scale Max

The scaled value is calculated using the min and max range values for each transmitter. For a 4-20mA transmitter, the scaled value at 4mA will equal the value shown in the “Scale Min” box. The scaled value at 20mA will equal the value shown in the “Scale Max” box.

RTD Inputs

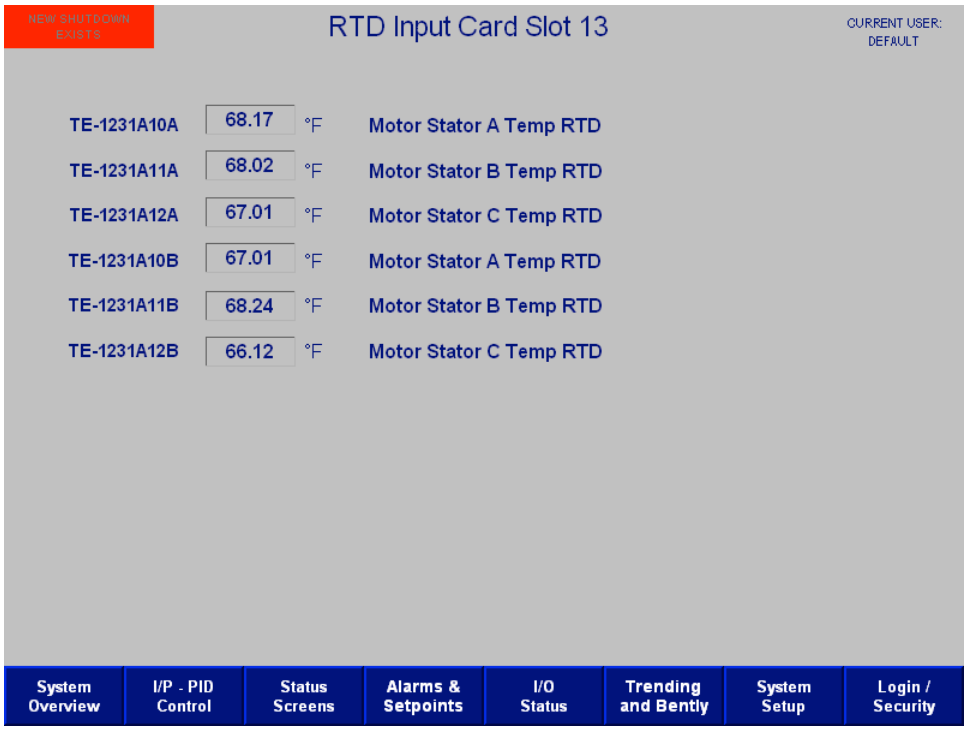


Figure 23 Typical RTD Input Status Screen

The RTD Inputs screen displays the actual temperature of all RTD's wired to the controller. The RTD's are listed in order as wired to the RTD input card. Since the processor derives the temperature directly from the resistance sensed at the RTD, no scaling is required.

Analog Outputs

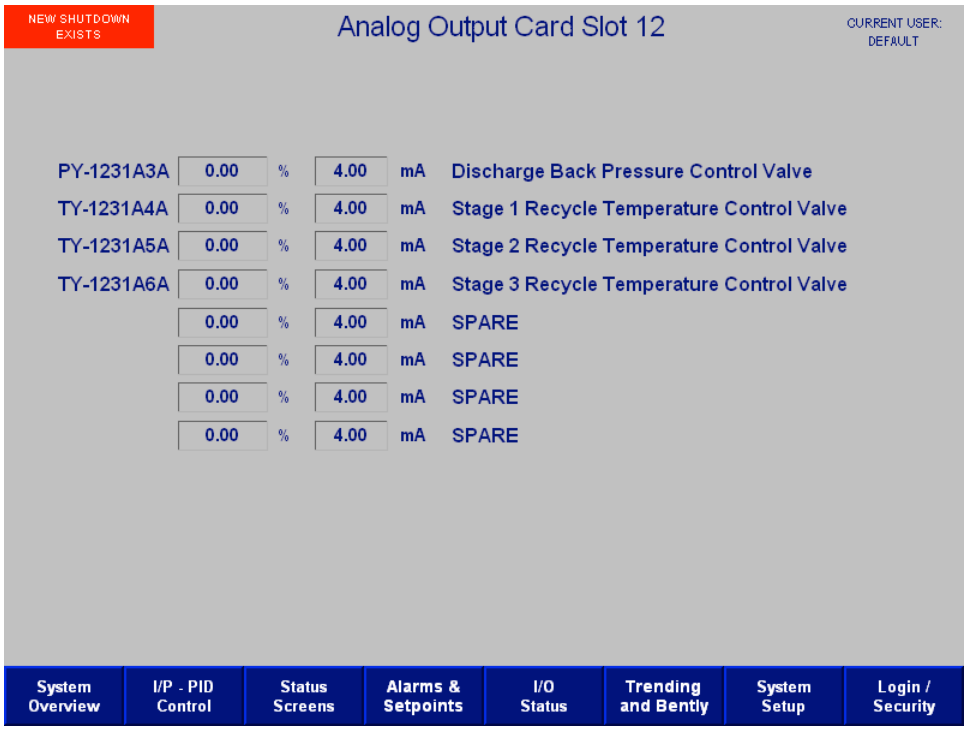


Figure 24 Typical Analog Output Status Screen

The Analog Outputs screen displays the scaled (0 to 100%) values of all analog transmitters in the controller. The outputs are listed in order as wired to the analog input card.

7. ALARM SCREENS

Alarm Setpoint Entry Screens

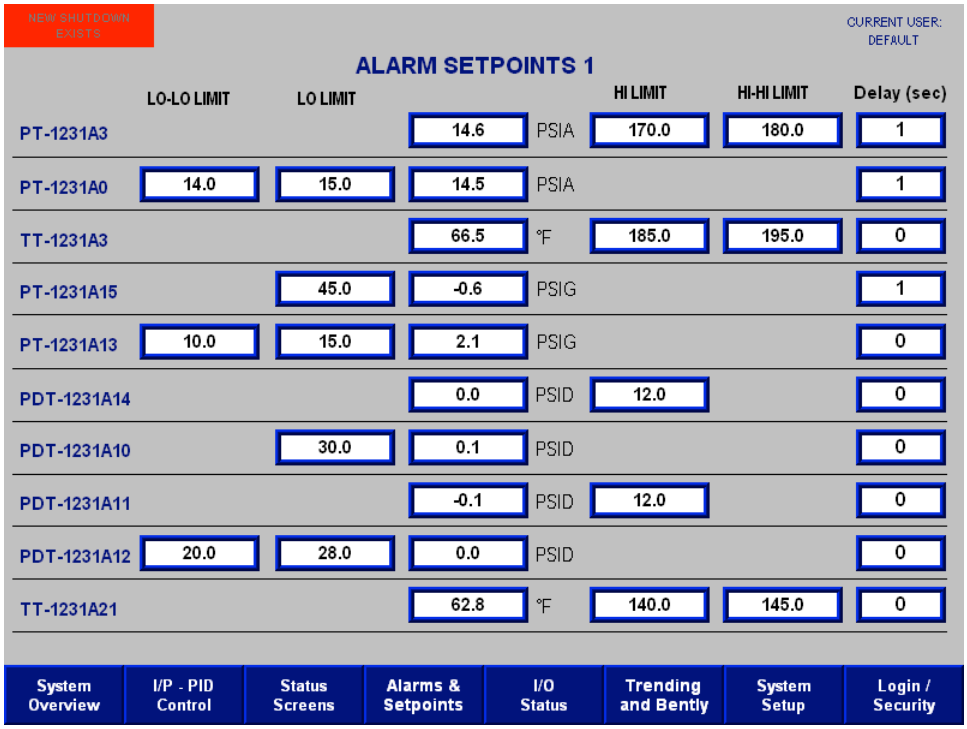


Figure 25 Analog Alarm Setpoint Entry Screen

The analog Alarm Setpoint Entry Screens are used for entering in low alarm / shutdown, and high alarm / shutdown, setpoints and delays. The center value is the current reading of the analog input.

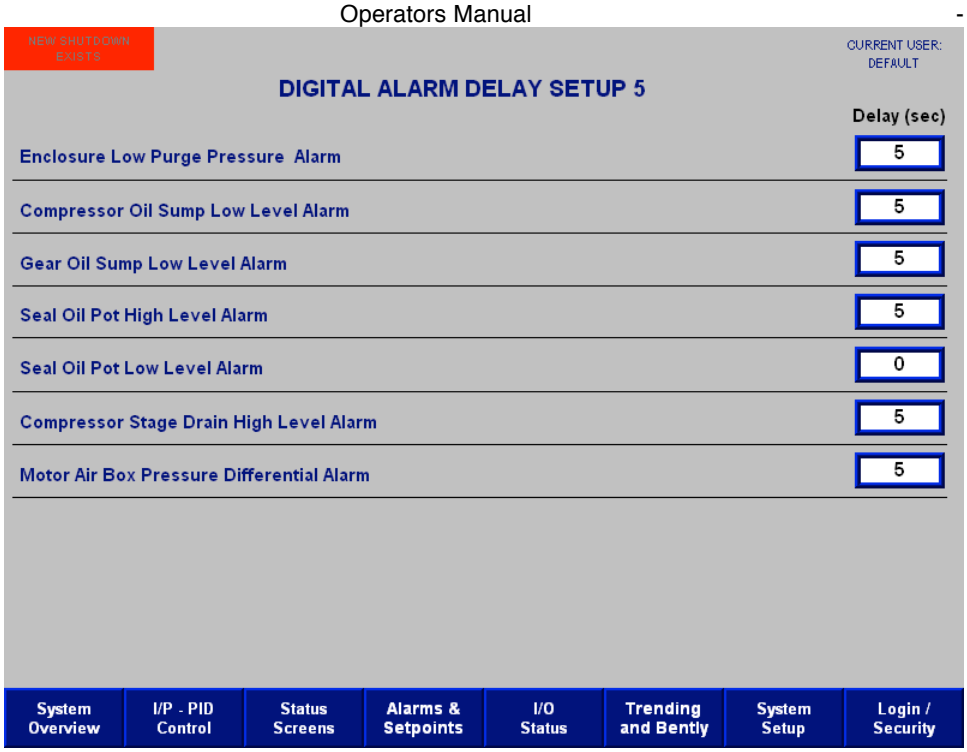


Figure 26 Digital Alarm Setpoint Entry Screen

The Digital Alarm setup page allows for limited adjustment of the alarm delay time.

Alarm Navigation Box

Figure 27 Alarm Navigation Box found on Alarm History and Active Alarms Screen

The Alarm Navigation Box is used on the Alarms History and Active Alarms screen. Each screen is capable of storing up to 100 alarms, but only 15 can be displayed at a time. The buttons on the Navigation box are used to control a highlighter, which shows focus on an alarm. The Navigation box is broken down into 3 columns. The columns are used as follows:

- Column 1 – These 2 buttons are used to move the highlighter to the top or the bottom of the alarm list.
- Column 2 – These 2 buttons are used to move the highlighter up or down 1 page of alarms, or approximately 15 alarm messages.
- Column 3 – These 2 buttons are used to move the highlighter up or down 1 alarm message.

Alarm Silence and Alarm Reset Buttons

The Alarm Banner, Active Alarms, and Alarms History screen all include the ability to silence and reset alarms. Silencing, or acknowledging, an alarm / shutdown will cause the following to happen:

- Change the alarm indicator from New Shutdown/New Alarm Exists to Shutdown/Alarm Exists.
- Remove the alarm occurrence from the Active Alarms Screen.
- Silence alarm horn (on equipped machines).

Resetting an alarm / shutdown will cause the following to happen:

- Change the alarm indicator on the top right of all screens to No Alarms or Shutdown
- Clear the Active Alarms Screen.
- Silence alarm horn (on equipped machines).
- Energize the Common Alarm Relay (Used for alarm indicator lights and dry-contact interlocking).
- Energize the Common Shutdown Relay (Used for alarm indicator lights and dry-contact interlocking).

Note: Once an alarm or shutdown has been tripped, the actual value must return to within the respective alarm and shutdown range before it can be reset on the active alarm or alarm history display. See the Alarms and Shutdowns section of this manual for a detailed description of the alarm logic

New Alarm Banner

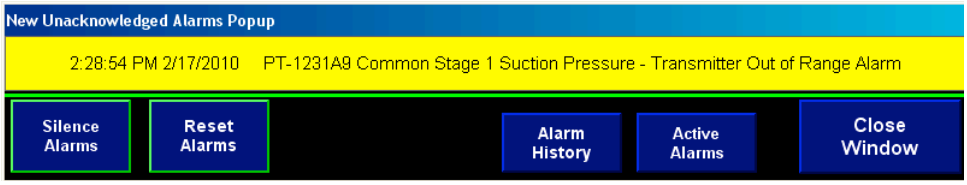


Figure 28 New Alarm Banner showing an analog shutdown

The New Alarm Banner is displayed at the top of the HMI display any time a new alarm or shutdown occurs. The New Alarm Banner is a “Pop-Up” style window and includes the ability to Silence or Reset Alarms. Analog Alarms and Shutdowns are displayed in the format: Tag, Description, Low / High Reading Alarm / Shutdown. Discrete Alarms and Shutdowns are displayed using a description of the alarm / shutdown and the tag if applicable.

Note: Active Alarms cannot be reset until the error or conditions that caused the alarm to occur have been corrected.

Active Alarms

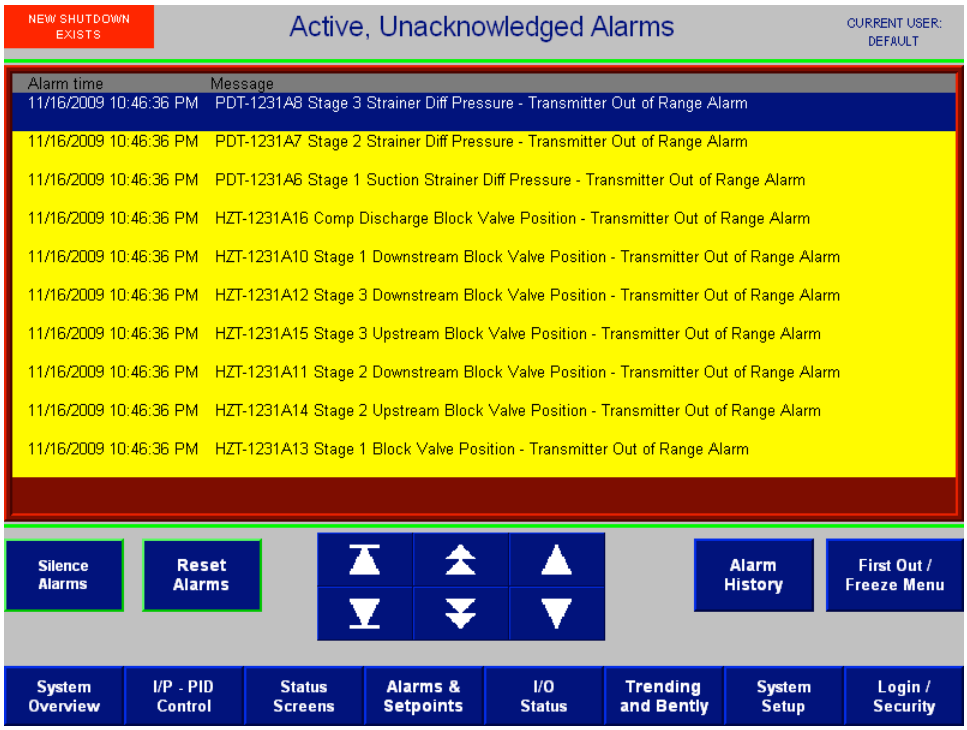


Figure 29 Active Alarms Screen showing alarms in yellow and shutdowns in red

The Active Alarms screen display all active, unacknowledged alarms and includes the ability to silence and reset alarms. Up to 100 unacknowledged alarms can be viewed using the alarm navigation box.

Alarms and Shutdowns are displayed in the format: Alarm Date, Alarm Time, Tag ID, Description, Low/High Reading Alarm/Shutdown. Discrete Alarms and Shutdowns only display a tag ID when applicable.

Alarms History

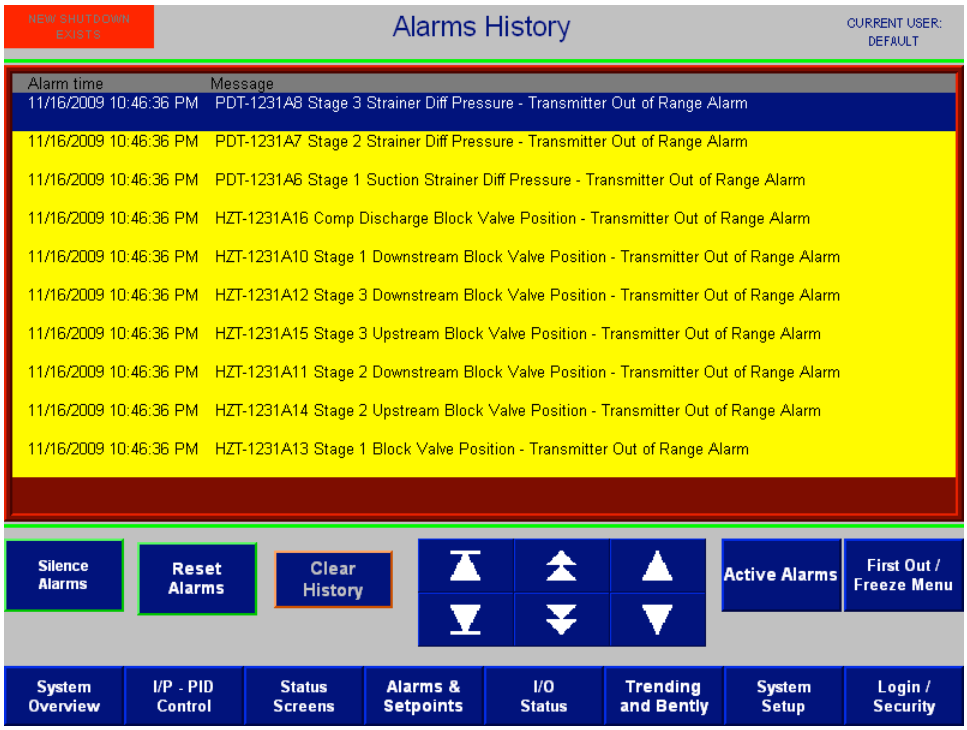


Figure 30 Alarms History Screen showing alarms in yellow and shutdowns in red

The Alarms History screen display all acknowledged alarms and includes the ability to silence and reset active alarms. Up to 100 acknowledged alarms can be viewed using the alarm navigation box. Alarms and Shutdowns are displayed in the format: Alarm Date, Alarm Time, Tag ID, Description, Low/High Reading Alarm/Shutdown. Discrete Alarms and Shutdowns only display a tag ID when applicable.

The Clear History Button is used to clear all alarms from the Alarms History Display box.

First Out / Freeze

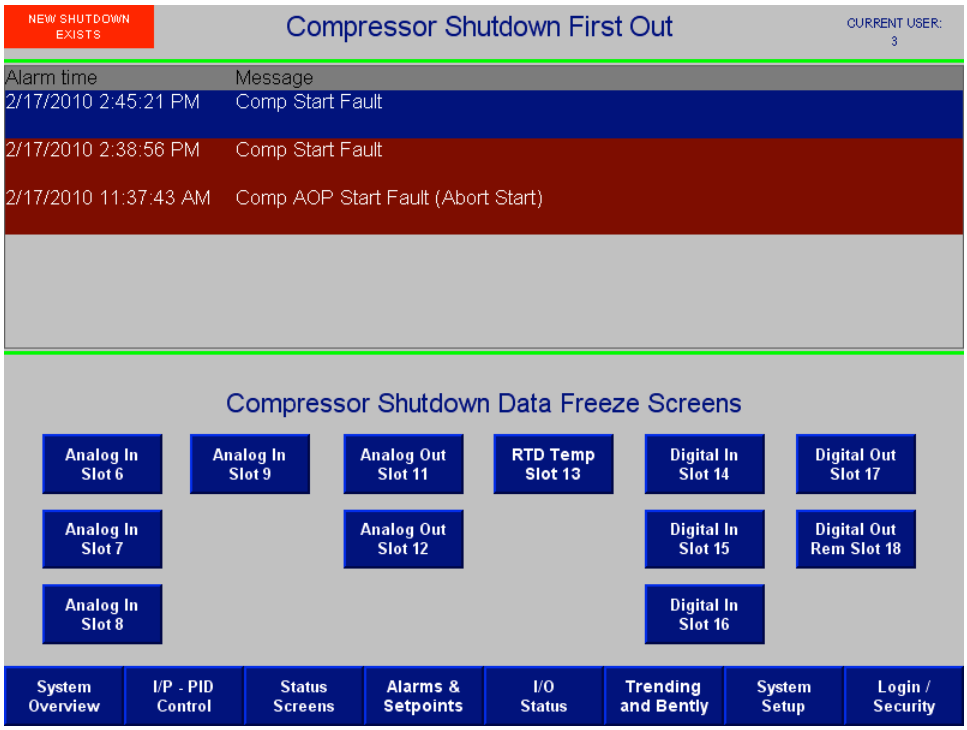


Figure 31 Compressor Shutdown First Out Screen with links to freeze screens at bottom

The first out screen identifies the specific fault that has shutdown the compressor. The fault description, tag number, and date / time stamp are displayed. The first out fault will not be reset until the shutdown has been reset from the active alarm screen.

Freeze Screens

On the lower half of the First-Out Screen are buttons to view instantaneous data captured at the moment of a system shutdown. This data is updated after every system shutdown. The values displayed on the Freeze Screens are in a format identical to the I/O data screens used for real time data.

8. TRENDING SCREENS

Purpose of Trending

Trending screens are used to view historical data in a graphical format. The primary purpose(s) of viewing the trended information is troubleshooting machine events (alarms, shutdowns, etc), tuning PID Loops, and record keeping. All Analog Input, Analog Output, and RTD temperatures can be viewed. Trending snapshots are shown in a 10 minute format.

Screen Features include the ability to go back in time several hours to view historical data, view up to 8 pens at a time, pause, and scale adjustment.

Trending Screen

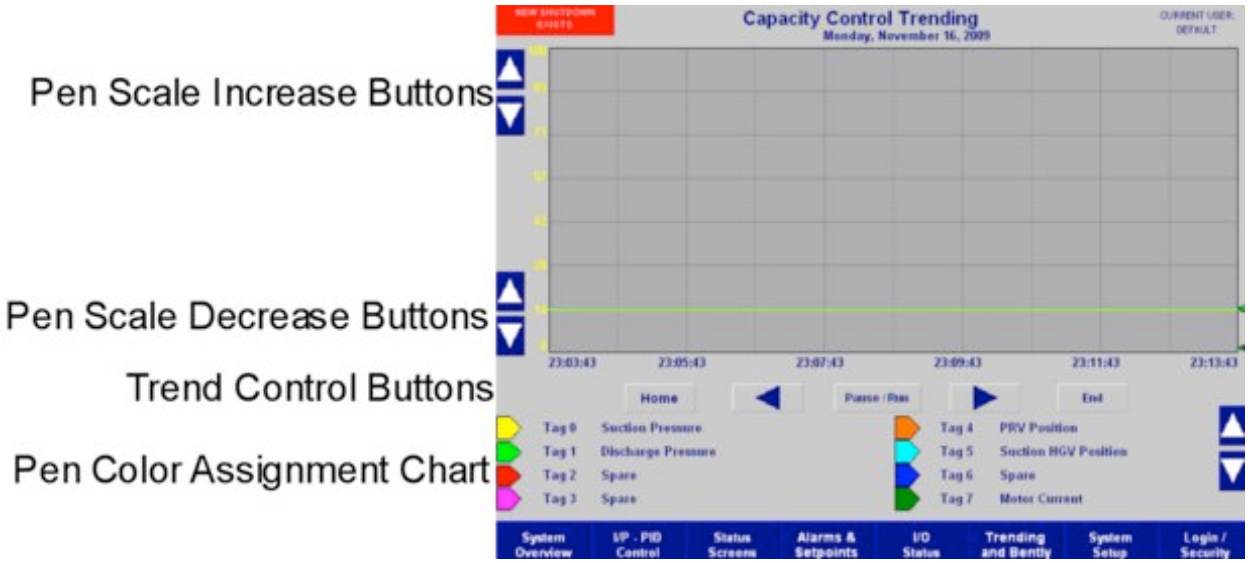


Figure 32 Typical Trending Screen for 4-20mA transmitters, comments show location of buttons on screen

Pen Color Assignment Chart

Used to show which pen value is assigned to which pen.

Pen Scale Increase / Decrease Buttons

The Pen Scale Increase / Decrease Buttons are used to zoom in and zoom out the Pen Scale Value. The top 2 buttons increase and decrease the max scale value. The bottom 2 buttons increase and decrease the min scale value. Scaling can be adjusted by 50 units at a time (50 PSI, 50%, 50Amps).

Trend Control Buttons

The trend control buttons are used to control the time axis of the chart. There are 5 trend control buttons which include:

- **Home** – Moves the current snapshot to the current time on the trend chart.
- **Go Left** – Move the time snapshot left (back in time), 10 minutes.
- **Pause / Run** – Pauses or un-pauses the real-time trend.
- **Go Right** – Moves the time snapshot right (forward in time), 10 minutes.

- **End** – Moves the current snapshot to the end of the real-time trend.

9. SETUP SCREENS - Commissioning

HMI Display Setup

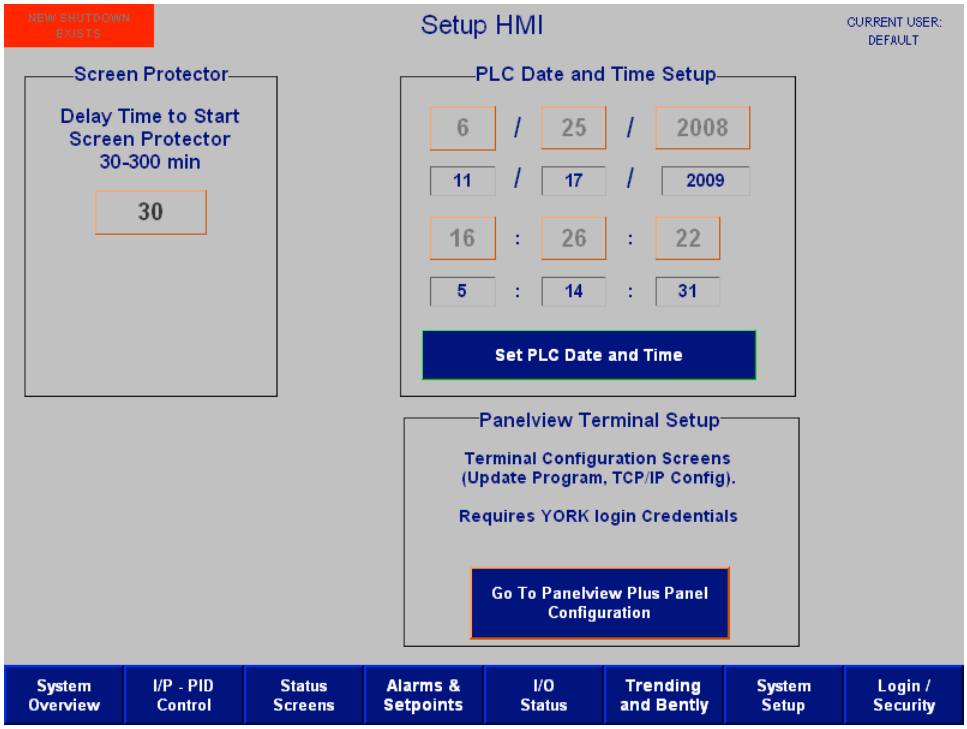


Figure 33 HMI Display Setup Screen

Screen Protector

The screen protector is used to prevent screen “burn”, primarily on the overview screen. If the overview screen is active for the delay setpoint (30 – 300 minutes), a temporary logo screen will appear for 60 seconds, and then the overview screen will reappear. The screen protector feature can be disabled if desired.

PLC Date and Time Setup

This function is used to configure the PLC Date and Time to match real-world date and time. PLC Date and Time is primarily critical for any time clock specific features or controls, and DCS communications.

PanelView Plus Panel Configuration

This function is used to shut down the HMI operator interface screen and enter the PanelView Plus panel configuration. The PanelView Plus panel configuration can be used to access the following functions:

- Load application from flash card
- Change panel regional settings
- Change TCP/IP address for networking and communications
- Change screen saver settings
- Enable / Disable screen cursor
- Adjust display intensity
- View event logs

- View terminal status

AOP Setpoints

Figure 34 Compressor and Gear AOP Setup Screen

Overview of AOP control

This screen is intended to give the startup technician flexibility in configuring the oil pump operation to the particular job. Time delays can be changed on this screen; however, pressure setpoints must be changed on the Pressure Alarms screen. The description of operation is inherent in the screen itself, therefore, no further operating descriptions are defined.

NOTE: The machine Logic Diagram contains more detailed information on the control sequence of the Gear and Compressor Auxiliary Oil Pump.

Compressor AOP Setpoints

The following is a list of setpoints displayed on compressor AOP setup section. Some of these setpoints can only be adjusted from the alarm setpoints screen:

- **Start Comp AOP if Diff. Pressure is** < - When the compressor is running and the Compressor AOP S/S Diff Pressure is below this value, the AOP will start. This setpoint can only be changed from the Alarms setpoint screen that has the Compressor AOP S/S Oil Diff. Pressure.
- **Run Comp AOP for** - In low oil pressure conditions, the compressor AOP will run for this length of time to increase the AOP pressure to maintain safe operating conditions and prevent an alarm or shutdown.
- **Post Lube for** – When the compressor is stopped or shutdown, the compressor AOP will run for this length of time to maintain adequate lube oil pressure.
- **Compressor Start Permissive** – The Compressor Journal Bearing Oil Inlet Diff Pressure must be above this value to energize the permissive that will allow the

compressor to start. This setpoint can only be changed from the Alarms setpoint screen that has the Compressor Journal Bearing Oil Inlet Diff. Pressure.

- **Run Comp AOP for xxx Min. Every xx Hours When Comp Not Running** – When the compressor is not running, these parameters define how frequent, and the length of time, that the compressor AOP will run to maintain adequate lube oil pressure to system components.

Gear AOP Setpoints

The following is a list of setpoints displayed on Gear AOP setup section. Some of these setpoints can only be adjusted from the alarm setpoints screen:

- **Start Gear AOP if Diff. Pressure is <** - When the compressor is running and the Gear AOP S/S Pressure is below this value, the Gear AOP will start. This setpoint can only be changed from the Alarms setpoint screen that has the Gear AOP S/S Oil Pressure.
- **Run Gear AOP for** - In low oil pressure conditions, the Gear AOP will run for this length of time to increase the AOP pressure to maintain safe operating conditions and prevent an alarm or shutdown.
- **Post Lube for** - When the compressor is stopped or shutdown, the Gear AOP will run for this length of time to maintain adequate lube oil pressure.
- **Compressor Start Permissive** - The Gear Journal Bearing Oil Inlet Pressure must be above this value to energize the permissive that will allow the compressor to start. This setpoint can only be changed from the Alarms setpoint screen that has the Gear Journal Bearing Oil Inlet Pressure.

Setup Page 1

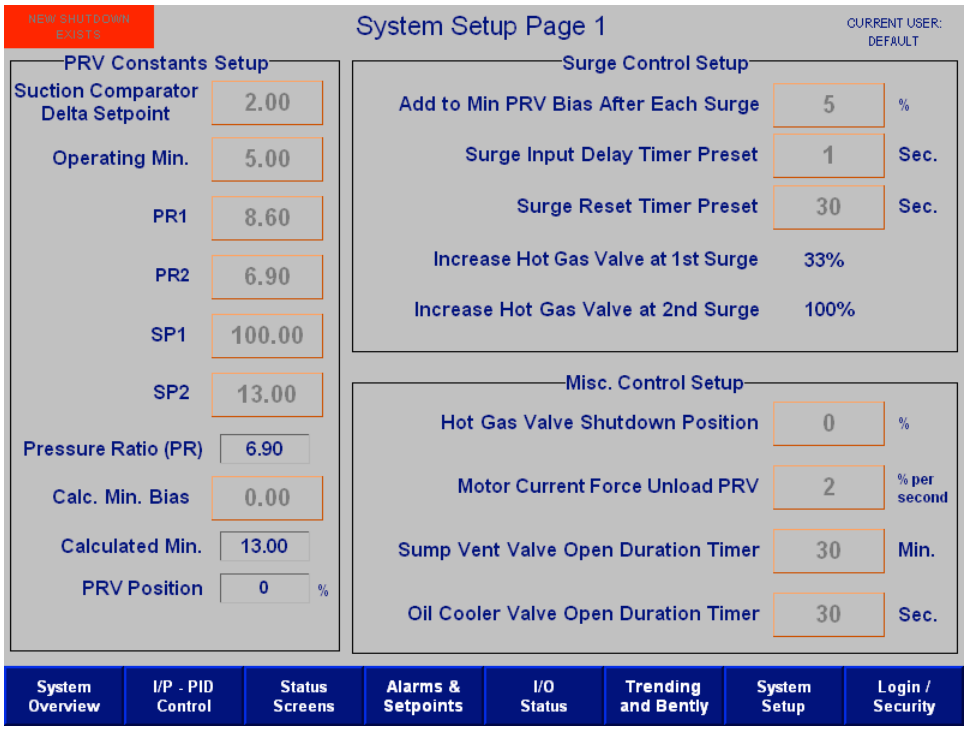


Figure 35 System Setup Page 1 Screen

PRV Constants Setup

The PRV constants Setup section is used to view and adjust the setpoints that control the operation of the PRV. Setpoints in this section include:

- **Suction Comparator Delta Setpoint** – value for the comparator that compares Local (PT-1231A0) & Common Header Suction Pressure (PT-1231A9) to determine which one will be used for capacity control.
- **Operating Min**. – This is the fixed operating minimum PRV position. The Control Minimum PRV will not fall below this setpoint with or without bias. (0% when not running, 5% when running)
- **PR1** - Maximum Pressure Ratio
- **PR2** - Minimum Pressure Ratio
- **SP1** - PRV position at maximum pressure ratio
- **SP2** - PRV position at minimum pressure ratio
- **Pressure Ration (PR)** - (Pressure Ratio) = Discharge Pressure / Suction Pressure
- **Calc. Min. Bias** - A setpoint entry will increase or decrease the Control Minimum PRV value (explained below) that is calculated in the processor. A negative entry will decrease the minimum PRV. A positive entry will increase the minimum PRV.
- **Calculated Min**. - Displays the Minimum Pre Rotation Vane Position 0 - 100 %. This value is calculated from the processor using the compressor suction pressure, discharge pressure and other constants of the compressor capacity. The PRV's will not fall below this setpoint during normal operation or during force unload conditions. The hot gas valve will begin to open when the PRV closes to this minimum value.

Surge Control Setup

NOTE: For a more detailed explanation of surge control refer to the YORK Process Systems – Application Engineering Standard 1500.12

- **Add to Min PRV Bias After Each** Surge - On the first event, the respective hot gas valve is opened to the preset value (default 25%) and the surge bias (see below) is added to the PRV Control Minimum.
- **Surge Input Delay Timer Preset** - This adjustable time setpoint defines the length of time in-between recorded surges. No matter how many times the surge input opens and closes during this time, only one surge event will be recorded. This prevents multiple surges from occurring due to chatter of the discrete surge input. (Default 10 seconds, adjustable 0-30 seconds)
- **Surge Reset Timer Preset** - This adjustable time setpoint defines the length of time to accumulate surge events. This timer is started with the first surge event. Subsequent surge events must occur before this preset time in order to count as a second or third surge. If this time expires, the surge counter will reset to zero. Any surge that takes place after this time expires will be counted as the first surge event.
- **Increase Hot Gas Valve at 1st Surge** - After the first surge event the recycle gas valve is adjust this amount.
- **Increase Hot Gas Valve at 2nd Surge** - After the second surge event the recycle gas valve is adjust this amount.

Misc. Control Setup

- **Hot Gas Valve Shutdown Position** – This is the position the Recycle Gas Valve will go to on a system shutdown.
- **Motor Current Force Unload PRV (% / Second**) – In High Motor Current Situations, the PRV is Unloaded to stabilize the motor current. This setpoint adjusts how far the PRV is unloaded every second during a force unload condition.
- **Sump Vent Valve Open Duration Timer** – This is the Length of time it would take, in minutes, to fully open the Sump Vent Valve from 0 to 100%. The default value for this timer is 30 minutes. The Sump Vent Valve begins to open 30 seconds after the Compressor Motor Auxiliary input is energized.
- **Oil Cooler Valve Open Duration Timer** – This is the Length of time it would take, in seconds, to fully open the Oil Cooler Valve from 0 to 100%. The default value for this timer is 30 seconds.

Setup Page 2

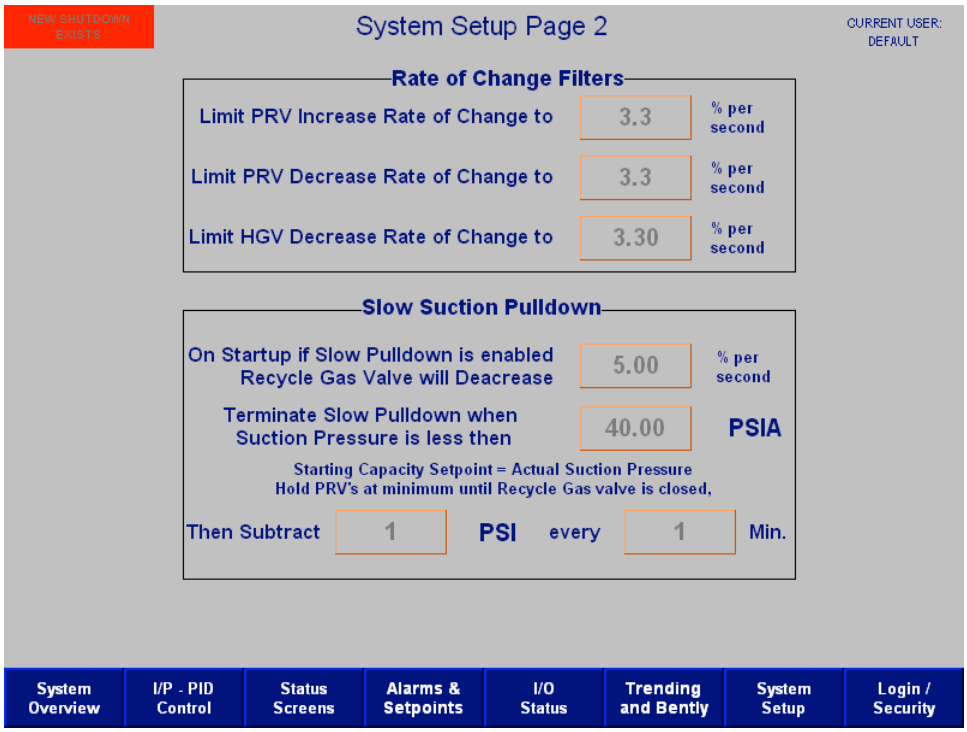


Figure 36 System Setup Page 2 Screen

Rate of Change Filters

Rate of Change filters are used to prevent the PRV and Hot Gas Valve from ramping open or close to fast. In the case of the Hot Gas Valve, only the decrease rate is adjusted to allow rapid opening in the case of surge conditions. To allow complete PID control over the valves, enter 100% / second.

NOTE: The PID Loop Gain and Reset setpoints control the ramping of all valves. These filters are used to prevent ramping of the valve open or closed too fast.

Slow Suction Pulldown

- **On Startup if Slow Pulldown is enabled Recycle Gas Valve will decrease (% / second)** –The recycle gas valve will ramp closed at this interval.
- **Terminate Slow Pulldown when Suction Pressure is less then** – If the suction pressure falls below this value, then Slow Pulldown will be terminated and normal system operation will resume.
- **Hold PRV's at minimum until Recycle Gas Valve is closed, then subtract xx PSIG ever xx Sec**. - The PLC will then subtract a set amount (in PSIG) from the capacity setpoint at a rate specified by the technician. The result will be the new capacity control setpoint.
- **Slow Pulldown Enable / Disable** – Located on the PRV PID Screen this toggle button is used to enable or disable the slow suction pressure Pulldown feature of the compressor.

  Note: Upon slow Pulldown activation, the actual suction pressure will be written to the capacity control setpoint to prevent the PRV's from opening while the recycle gas valve is ramping closed.

Setup Page 3

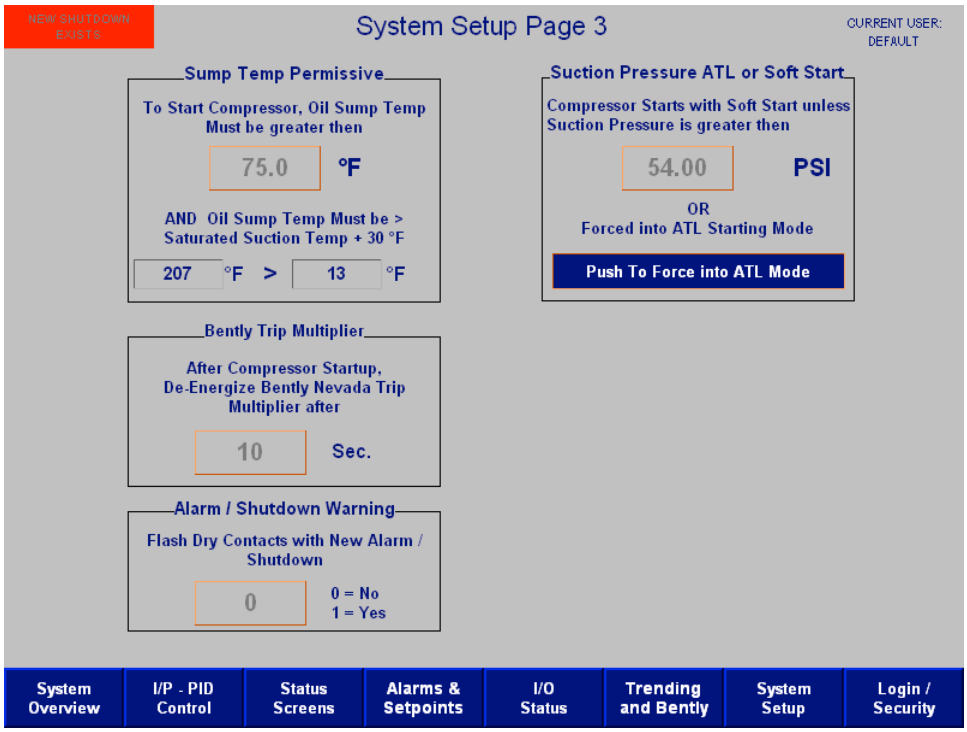


Figure 37 System Setup Page 3 Screen

Sump Temp Permissive

The compressor oil sump temperature must be greater than this setpoint to allow the compressor sump temp permissive signal to be true. Oil heaters are used to maintain adequate sump temperature during system shutdown in cold climates. Also, the oil sump temperature must be greater than the value of (Saturated Suction Temperature at suction pressure) + (30F)

Bently Trip Multiplier

Most of the motor temperatures and vibrations are monitored and alarmed using a Bently Nevada Vibration Monitoring System. During system startup vibration levels are much higher than normal, and often higher then system shutdown values. The Trip Multiplier is a dry-contact signal used to prevent nuisance alarms and shutdowns during system startup. When the trip multiplier signal is energized, the Bently Nevada system uses a multiplied value (default 1x) for shutdown setpoints. For example, when the Trip Multiplier signal is energized, a Vibration Shutdown setpoint of 2 mil with a trip multiplier setting of 2x, would be 4 mil during system startup. The compressor motor auxiliary contacts must be energized for 10 seconds until the trip multiplier signal will de-energize.

Alarm / Shutdown Warning

This system provides the customer with a dry set of contact to monitor the alarm and shutdown status of the control system. These contacts are normally energized and will open when an alarm or shutdown occurs. The options for these contacts are as follows:

Flash with new occurrence (NO) – When set to no the alarm and shutdown relays will remain de-energized anytime an alarm or shutdown is active.

Flash with new occurrence (YES) – This option will open and close the relay repeatedly every second when a new alarm or shutdown occurs. When the alarm or shutdown is acknowledged the relay will be de-energized. This option can be enabled in order to differentiate between an existing and new alarm.

Note: The compressor shutdown light and alarm light will respond according to dry contact setup.

Suction Pressure ATL or Soft Start

The Suction Pressure ATL or Soft Start selection setpoint will determine which start signal will be sent to the compressor motor switchgear based on the suction pressure at startup.

- **Compressor Starts with Soft Start unless Suction Pressure is greater then ##.## PSI** – If the suction pressure is above 54 (adjustable 0 to 200) PSIA the ATL (Across The Line) start signal will be sent. If the pressure is less than the set value it will issue the Soft Start signal.
- **Push To Force into ATL Mode** –This button is used to ignore the setpoint & force the ATL (Across The Line) signal to be sent.
  Note: Caution is to be used when forcing this mode especially if more than one compressor is forced at the same time.

Setup Page 4

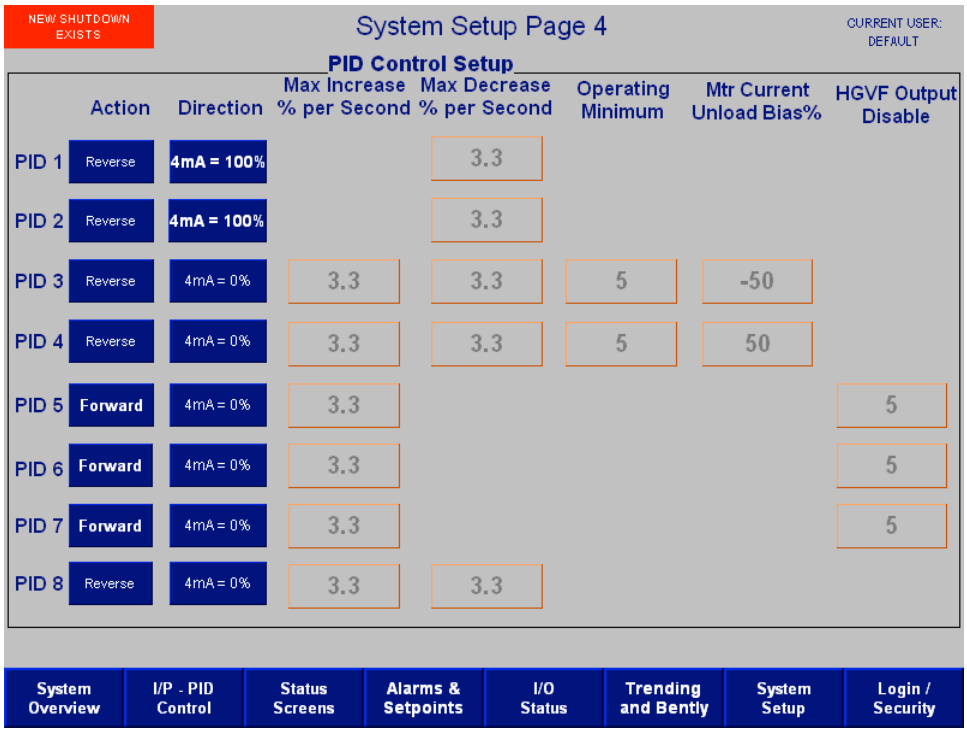


Figure 38 System Setup Page 4 Screen

Action

Determines the response of the PID loop. Forward action will be a direct action loop, if the pressure or temperature increases the output will increase. For Reverse acting as the pressure or temperature increases the value will decrease.

Direction

Determines the direction of the PID loop for the valve. If 4mA = 100% then the valve will be open at 4mA, if 20mA = 100% then the valve will be open at 20mA.

Rate of Change Filters

Rate of Change filters (Max Increase & Max Decrease) are used to prevent the PID Valves from ramping open or closed too fast. To allow complete PID control over the valves, enter 100% / second.
NOTE: The PID Loop Gain and Reset setpoints control the ramping of all valves. These filters are used to prevent ramping of the valves open or closed too fast.

Operating Minimum

The Minimum the valve can be closed. Default 5% (adjustable 0 to 100%) see 669D0127 sheet 8

Mtr Current Unload Bias

The Motor Current Unload Bias will change the rate of the valve unloading during a Current Force Unload condition. Default 0 (adjustable -50% to 50%)

HGVF Output Disable

The Hot Gas Valve Flow Output Disable will keep the PID (PID 5, 6, or 7) output at 0% if the corresponding Flow Controller (PID 1, 2, or HGVF) is closed more than this setpoint Default 5% (Adjustable). This protects against adding Hot Gas Liquid Injection when you have reduced flow preventing a surge condition. see 669D0127 sheet 7

NOTE: The Hot Gas Valves are Reverse Acting (4ma = Open) so the logic box "IS FLOW CONTROLLER FIC-1231A#A OUTPUT < 95%?" is understood to be the inverse value for this setpoint.

Setup Page 5

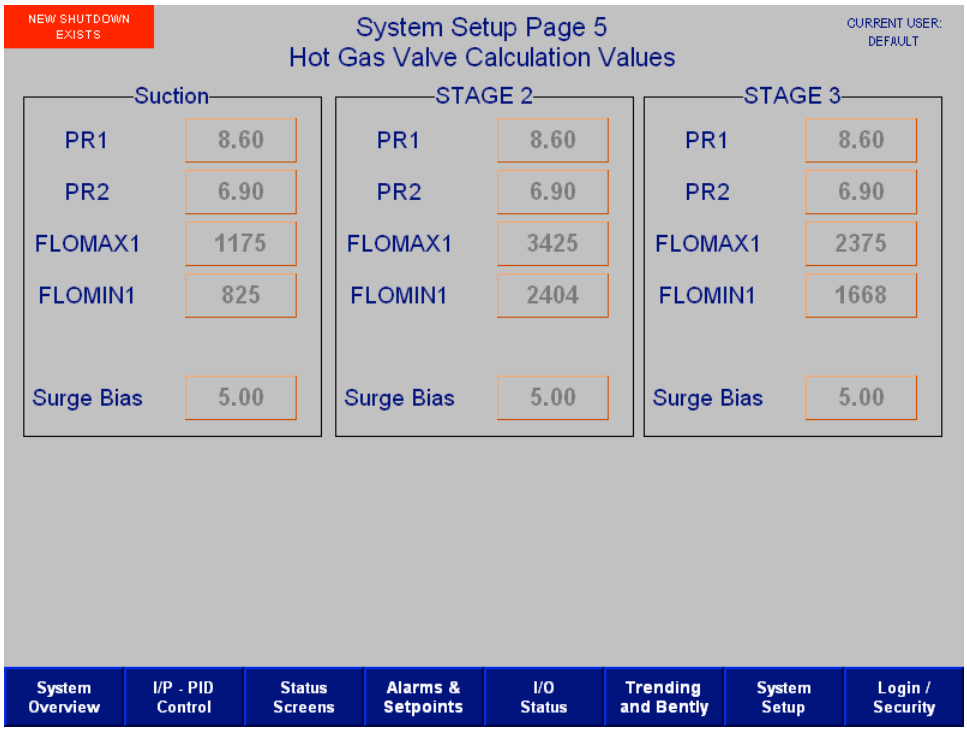


Figure 39 System Setup Page 5 Screen

Suction

The Suction Hot Gas Valve PR1, PR2 FLOMAX1, & FLOMIN1 are constants used in flow calculations. These values are located in a table on 669D0127 sheet 10.

Stage 2 & 3

The PR1, PR2 FLOMAX1, & FLOMIN1 are constants used in flow calculations. These values are located in a table on 669D0127 sheet 9.

Surge Bias

The Surge Bias is the percentage that is added to the Minimum Compressor Flow while in a surge condition. Default 5% (Adjustable 0 to 100%)

10. MODBUS DCS ADDRESSING

Modbus Port Settings and Connection

Connection to the Frick PLC is done through a ProSoft MVI56-MNETR module. A DB9 pin to RJ45 adaptor is included for ease of connection.

For a detailed listing of Modbus Addresses see:

Document Name: C1231X Modbus Mapping
Document Number: 13706-MUS-INS-PH-0013-C1231X