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OPERATION

FRICK QUANTUM CONTROL PANEL

(VERSION 3.4x)

Contents

OPERATION 4
Quick Overview of Graphic Displays 4
OVERVIEW OF OPERATOR INTERFACE 5
OPERATOR ACCESS 5
KEYS AND KEY FUNCTIONS 6
KEYPAD KEYS 6
SCREEN KEYS 7
TO CHANGE SETPOINTS 7
COMMON TERMINOLOGY 8
GRAPHIC DISPLAYS 8
“OPERATING STATUS” DISPLAY 8
“OPERATING STATUS” DISPLAY - SCREEN KEY SET 11
“OPERATING STATUS - 2” DISPLAY 12
“MAIN MENU” DISPLAY 13
“MAIN MENU” DISPLAY - SCREEN KEY SET 13
MAIN MENU SELECTION - “ALARMS/SHUTDOWNS” DISPLAY 14
MAIN MENU SELECTION - ”ALARMS/SHUTDOWNS HISTORY” DISPLAY 15
MAIN MENU SELECTION - ”CONTROL SETUP” DISPLAY 15
CONTROL SETUP - CAPACITY CONTROL SETPOINTS DISPLAYS 16
“PROCESS TEMPERATURE CONTROL” DISPLAY 19
CONTROL SETUP - COMPRESSOR SAFETIES SETPOINTS 19
CONTROL SETUP - COMPRESSOR SAFETIES - ”DISCHARGE SAFETIES” DISPLAY 20
CONTROL SETUP - COMPRESSOR SAFETIES - ”SUCTION SAFETIES” DISPLAY 21
CONTROL SETUP - COMPRESSOR SAFETIES - ”ENTERING PROCESS SAFETIES” DISPLAY 22
CONTROL SETUP - ”MOTOR CONTROL SETPOINTS” DISPLAY 23
CONTROL SETUP - MOTOR CONTROL SETPOINTS - “RAM DBS MOTOR STARTER” DISPLAY 24
CONTROL SETUP - ”OIL SETPOINTS” DISPLAY 25
CONTROL SETUP - ”SLIDE VALVE SETPOINTS” DISPLAY 28
CONTROL SETUP - ”SETBACK SCHEDULE” DISPLAY 29
CONTROL SETUP - ”OPTIONS SETUP” DISPLAY 30
CONTROL SETUP - OPTIONS SETUP - ”CONDENSER CONTROL” DISPLAY 30
CONTROL SETUP - OPTIONS SETUP - “COMPRESSOR SEQUENCE CONTROL” (MODE 1) DISPLAY 32
CONTROL SETUP - OPTIONS SETUP -”COMPRESSOR SEQUENCE CONTROL” (MODE 2) DISPLAY 36
CONTROL SETUP - OPTIONS SETUP “COMPRESSOR INTERLOCK” DISPLAY 41
CONTROL SETUP - OPTIONS SETUP - ”INPUT MODULE SELECTION” DISPLAY 42
CONTROL SETUP - OPTIONS SETUP - ”AUXILIARY SETUP” DISPLAY 43
CONTROL SETUP - “SUCTION PRESSURE PULL DOWN” DISPLAY 44
CONTROL SETUP - “AUXILIARIES 3 - 8 SETUP” DISPLAY 45
CONTROL SETUP - “AUXILIARY ANALOG TEMPERATURES & PRESSURES” DISPLAY 46
CONTROL SETUP - “PUMPDOWN/DX CIRCUIT” DISPLAY 47
MAIN MENU SELECTION - ”SECURITY SETUP” DISPLAY 48
MAIN MENU SELECTION - ”ANALOG CALIBRATION” DISPLAY 49
ANALOG CALIBRATION - ”PRESSURE CALIBRATION” DISPLAY 50
ANALOG CALIBRATION - ”TEMPERATURE CALIBRATION” DISPLAY 51
ANALOG CALIBRATION - ”CALIBRATE MOTOR CURRENT” DISPLAY 52
ANALOG CALIBRATION - ”CALIBRATE SLIDE STOP” DISPLAY 52
ANALOG CALIBRATION - ”CALIBRATE SLIDE VALVE” DISPLAY 53
ANALOG CALIBRATION - ”CALIBRATE REMOTE CONTROL SETPOINT” DISPLAY 54
ANALOG CALIBRATION - ”CALIBRATE SLIDE VALVE POSITION” DISPLAY 55
ANALOG CALIBRATION - ”CALIBRATE AUXILIARY ANALOG” DISPLAY 55
ANALOG CALIBRATION - ”KILOWATT MONITOR CALIBRATION” DISPLAY 57
MAIN MENU SELECTION - ”PANEL SETUP” DISPLAY 57
PANEL SETUP - ”Change Current Time and Date” DISPLAY 58
PANEL SETUP - ”Pressure Units — PSIA, PSIG, or SI” DISPLAY 58
PANEL SETUP - ”Temperature Units — degrees Fahrenheit or Celsius” DISPLAY 58
PANEL SETUP - ”Language – English, Danish, German” DISPLAY 58
PANEL SETUP - ”Change Communications” DISPLAY 58
PANEL SETUP - ”CAPACITY CONTROL OPTIONS” DISPLAY 58
PANEL SETUP - ”SELECTABLE OPTIONS” DISPLAY 59
PANEL SETUP - SELECTABLE OPTIONS - “SCREEN SETTINGS” DISPLAY 62

"MAIN MENU" SELECTION - "REAL TIME TRENDING" DISPLAY 63
REAL TIME TRENDING - DATA LOG VIEW 64
REAL TIME TRENDING - TRENDING VIEW 64
REAL TIME TRENDING - OPERATING STATUS VIEW 65
MAIN MENU SELECTION - "HISTORY TRENDING" DISPLAY 65
"MAIN MENU" DISPLAY- "SERVICE SCREEN" DISPLAY 66
OPERATION OVERVIEW 67
Initial Setup Procedure 67
Compressor Start-Up Procedure 67
Compressor Stopping Procedure 67
Setup for Automatic Control 67
Remote Control of the Compressor 67
ALARMS/SHUTDOWNS MESSAGES 68

QUANTUM PUBLICATIONS

S90-010 O	Frick Quantum Control Panel OPERATION
S90-010 M	Frick Quantum Control Panel MAINTENANCE
E90-010 SPC	Frick Quantum Control Panel SPECIFICATIONS (& jumper and dip switch settings)
S90-010 CS	Frick Quantum Control Panel COMMUNICATIONS SETUP (setup and wiring for data communication using available protocols)

Quick Overview of Graphic Displays

"OPERATING STATUS" DISPLAY
- **"Compressor Mode"** SELECTION - [Remote], [Auto], [Manual Start], [Manual Stop]
- **"Slide Valve Mode"** SELECTION****** - [Remote], [Auto], [Manual Load], [Manual Unload], [Remote Slide Valve]*****
- **"Capacity Mode"** SELECTION****** - [Remote], [Auto], [Manual Load], [Manual Unload]
- **"Slide Stop Mode"** SELECTION****** - [Auto], [Manual Increase], [Manual Decrease]
- **"Oil Pump Mode"** SELECTION****** - [Auto], [Manual On], [Manual Off], [Oil Lead Pump 1 / 2]******
- **"COMPRESSOR SCREEN"** DISPLAY
- "**OPERATING STATUS PAGE 2"** DISPLAY - [Condenser Setpoints]*****, [Compressor Sequence Setpoints]*****, [Compressor Interlock Setpoints]*

"MAIN MENU" DISPLAY
- **"ALARMS/SHUTDOWNS"** DISPLAY - [Clear Alarms]
  - **"ALARMS/SHUTDOWNS HISTORY"** DISPLAY - [Freeze Display]
  - **"POWER DOWN"** DISPLAY
- **"CONTROL SETUP"** DISPLAY
  - **"CAPACITY CONTROL SETPOINTS"** DISPLAYS - [Make Active]
  - **"COMPRESSOR SAFETIES SETPOINTS"** DISPLAY
    - "DISCHARGE SAFETIES" DISPLAY
    - "SUCTION SAFETIES" DISPLAY
    - "ENTERING PROCESS SAFETIES" DISPLAY*****
  - **"MOTOR CONTROL SETPOINTS"** DISPLAY - [Clear Remaining Delay]
    - "POWER FAILURE RESTART" DISPLAY*****
    - "RAM DBS MOTOR STARTER" DISPLAY******
  - **"OIL SETPOINTS"** DISPLAY - [Liquid Injection Setpoints]******, [Filter Setpoints]******
  - **"SLIDE VALVE SETPOINTS"** DISPLAY******
  - **"SETBACK SCHEDULE"** DISPLAY - [Change Setpoints], [Activate]
  - **"OPTIONS SETUP"** DISPLAY
    - "CONDENSER CONTROL" DISPLAY*****
    - "COMPRESSOR SEQUENCE CONTROL" DISPLAY*****
    - "INPUT MODULE SELECTION" DISPLAY*****
    - "AUXILIARY SETUP" DISPLAY*****
    - "SUCTION PRESSURE PULL DOWN" DISPLAY*
  - **"AUXILIARIES 3 - 8 SETUP"** DISPLAY*****
  - **"AUXILIARY ANALOG TEMPERATURES & PRESSURES"** DISPLAY*****
  - **"PUMPDOWN/DX CIRCUIT SETUP"** DISPLAY*****
- **"SECURITY SETUP"** DISPLAY
- **"CALIBRATION"** DISPLAY
  - **"PRESSURE CALIBRATION"** DISPLAY
  - **"TEMPERATURE CALIBRATION"** DISPLAY
  - **"CALIBRATE MOTOR CURRENT"** DISPLAY
  - **"CALIBRATE SLIDE VALVE & SLIDE STOP"** DISPLAY******
  - **"CALIBRATE REMOTE CONTROL SETPOINT"** DISPLAY*****
  - **"CALIBRATE SLIDE VALVE POSITION"** DISPLAY******
  - **"CALIBRATE AUXILIARY ANALOG"** DISPLAY*****
  - **"KILOWATT MONITOR CALIBRATION"** DISPLAY*****
- **"PANEL SETUP"** DISPLAY
  - **"Change Current Time and Date"** DISPLAY
  - **"Pressure Units — PSIA, PSIG, or SI [BarA], [Bar], [KPAA]"** DISPLAY
  - **"Temperature Units — degrees Fahrenheit or Celsius"** DISPLAY
  - **"Language — English, Danish, German, other"** DISPLAY
  - **"Change Communications"** DISPLAY - ID #, Comm2 Setup, Detect I/O boards.
  - **"CAPACITY CONTROL OPTIONS"** DISPLAY - Enable up to 2 Types of Control Modes
  - **"SELECTABLE OPTIONS"** DISPLAY
- **"REAL TIME TRENDING"** DISPLAY
- **"HISTORY TRENDING"** DISPLAY
- **"SERVICE SCREEN"** DISPLAY
- **"ABOUT FRICK"** DISPLAY

*** If enabled**
**** If applicable from Factory Setup**

OVERVIEW OF OPERATOR INTERFACE

The compressor unit is controlled by a computer based machine control system. The controller continuously monitors the conditions and operation of the compressor unit and the various subsystems, it also directs the operation of components.

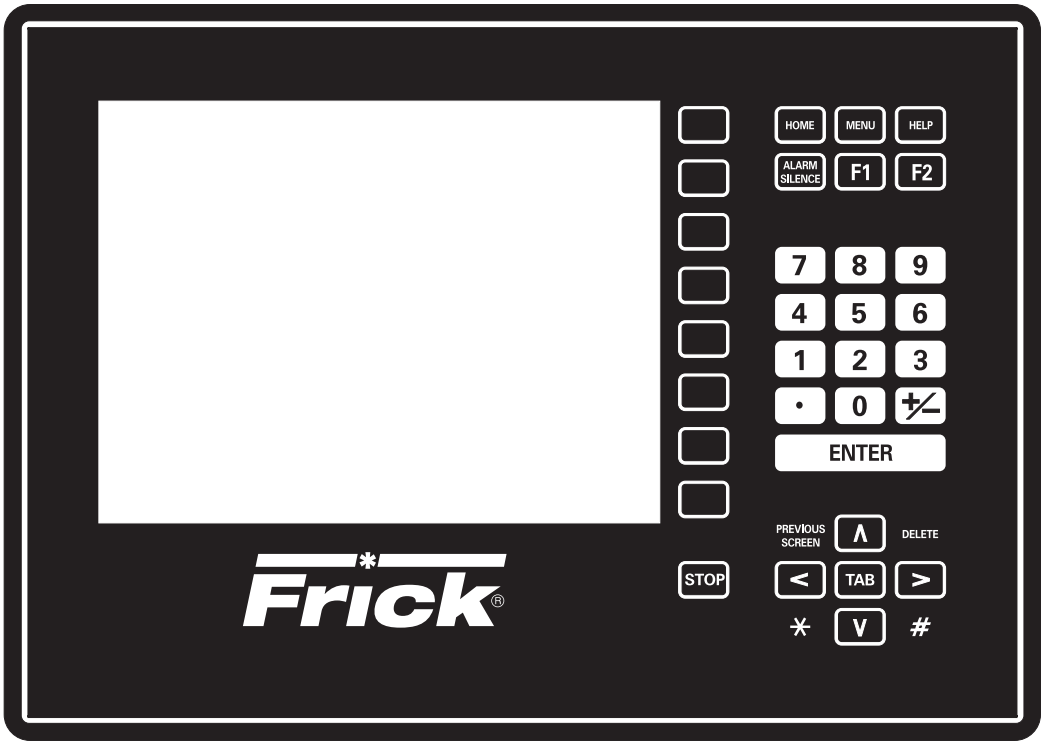
The panel user interface has been designed to allow an operator to efficiently access and control the operation of the compressor unit and subsystems. The control panel screen is used to display graphic displays. By pressing a key on the keypad, the labeled or described function is recognized by the control processor.

The following information in this manual is presented to help the operator to interact with the graphic displays and the Quantum compressor control panel. This manual is intended to describe all presently available features for the compressors listed in “Compressor Model Differences”. Reference this section for the differences of the compressor models that will apply to the displayed data and the setup and setpoint entry. (If applicable) is used throughout this manual to indicate when something might apply; either, because of the compressor model (see “Compressor Model Differences”) or because this feature or option was selected from a setup.

OPERATOR ACCESS

Operator access to this system is through various displays. A display is the physical representation of data on the screen. Icons have been used to help an operator quickly identify functions. An icon is a small graphic symbol representation. Each display has a title area. The title is descriptive of the display. The current day, date and time is shown in this title area. The day of the week, Sunday through Saturday (Sun. - Sat.) is displayed. The month of the year from January to December (Jan. - Dec.) is displayed. The day of the month from 1 to 31 and the year from 0001 to 9999 are displayed. The time displayed is the current time in 24 hours (military) format. The hours, minutes and seconds are displayed. The labeled keys on the panel keypad provide quick access to the operator’s needs. By pressing a labeled key on the keypad, the corresponding function is recognized. Most of the displays have screen keys that describe or show a function that is recognized when the coinciding keypad key to the right of the display screen is pressed. The screen keys provide access to other displays or commands. For easier viewing, related information is separated into boxes. The setup and setpoint entry is separated into logical control components. Setup selection of features and options has been provided to prevent the operator from unnecessary viewing and entering of unused control settings. The required control settings are clearly presented. To further assist the operator, an on-line help is provided. Some selections appear faded to indicate that this feature is unavailable. A feature can be unavailable because of setup selections such as the compressor model. Some selections appear faded to indicate that this feature might be available in a future software release.

KEYS AND KEY FUNCTIONS



KEYPAD KEYS

Following is a list of the labeled keypad keys and the actions that occur when they are pressed:

[STOP] - Immediately stops the compressor. The compressor is stopped regardless of any other conditions.

[HOME] - Shows the “Operating Status” display. This display is an overview of the present readings, operating modes and operating status.

[MENU] - Shows the “Main Menu” display. This display has the main selections for accessing information, setup of options, and setpoint entry.

[HELP] - Displays the on-line “HELP”. Information is shown for the operation of the compressor control panel.

[ALARM SILENCE] - Immediately silences a sounding alarm and turns off the alarm annunciation device that is connected to this panel.

[F1] - A function key that is only active when a display indicates it as a selection key. Its function is dependent on what the display indicates will occur.

[F2] - A function key that is only active when a display indicates it as a selection key. Its function is dependent on what the display indicates will occur.

NUMERALS **[0]** - **[9]** - The numerical keys are used to enter a value in a data field.

DECIMAL **[.]** - The decimal point is used when entering a decimal value in a data field.

[+/-] - When changing a value in a data field, this key will toggle the value between negative and positive.

[ENTER] - When changing data in a data entry field, this key will input the change.

[PREVIOUS SCREEN] - Shows the display that was viewed previously to the current display. Also is used to return to the previous set of screen keys when accessing different sets of screen key selections on the same display.

[DELETE] - When changing a value in a data field, this key will delete the selected character.

Up Arrow **[Λ]** - When in the mode of changing setpoints, this arrow is used to go to the previous data entry field.

Down Arrow **[V]** - When in the mode of changing setpoints, this arrow is used to go to the next data entry field.

Right Arrow **[>]** - When in the mode of changing setpoints, this arrow is used to go to the next data entry field. When in the mode of changing a data entry field, this arrow is used to go to the next character.

Left Arrow **[<]** - When in the mode of changing setpoints, this arrow is used to go to the previous data entry field. When in the mode of changing a data entry field, this arrow is used to go to the previous character.

SCREEN KEYS

Most of the displays have screen keys that are graphically depicted keys that describe or show a function that is recognized when the coinciding keypad key to the right of the panel display is pressed. A set of screen command keys (i.e. Compressor Mode) have a title area to describe the command control. Following are descriptions of the commonly used screen keys:

[Change Setpoints] - When at a display that has adjustable setpoint values, this positions the cursor at the first data entry field. (See "To Change Setpoints" for more information.)

[OK] - Available when in the changing setpoints mode, this accepts all data changes. Available as a response to a message, this approves continuing.

[CANCEL] - Available when in the changing setpoints mode, this rejects all data changes. Available as a response to a message, this disapproves continuing.

Arrows - Available when in the changing setpoints mode, they function the same as the panel keypad arrows.

[Increase Value] - Available when in the changing setpoints mode, this increases the selected setpoint by one unit each time it is pressed.

[Decrease Value] - Available when in the changing setpoints mode, this decreases the selected setpoint by one unit each time it is pressed.

[Up One] - Scrolls the data on the display to show one more previous line of data.

[Down One] - Scrolls the data on the display to show one more line of data.

[Page Up] - Scrolls the data on the display to show the previous page of data.

[Page Down] - Scrolls the data on the display to show the next page of data.

[Goto Start] - Scrolls the data on the display to show the the most recent data.

[Goto End] - Scrolls the data on the display to show the oldest data.

[More…] - Available when the selections are on more than one display. Is used to go to the next selections.

[…Back] - Available when the selections are on more than one display. Is used to go back to the previous selections.

[Make Active] - Available when viewing a set of capacity control setpoints. This command will make the capacity control setpoints being viewed the active control setpoints. Only one set of capacity control setpoints can be active. Activating a set will deactivate any other.

[Enable] - Available to place the indicated control setpoints or option into usage.

[Disable] - Available to remove the usage of the indicated control setpoints or option.

TO CHANGE SETPOINTS

WARNING **The Quantum has the capability of being modified by the user/owner in order to obtain different performance characteristics. Any modification to the standard default settings may have a severe negative impact on the operation and performance of the equipment. Any modification to these control settings is the sole responsibility of the user/owner and Frick disclaims any liability for the consequences of these modifications. It is possible that the modification of these settings may cause improper operation and performance that results in property damage, personal injury or death. It is the responsibility of the user/owner to evaluate and assess the consequences of their actions prior to modifying the controls for this unit.**

The setpoints define the operation and limits of the compressor unit and subsystems operation. Adjustable setpoints can easily be changed in the field. These setpoints are stored in EEPROM (nonvolatile memory).

NOTE: Adjustable Setpoints are not lost after power is interrupted. However, we suggest that a list of Adjustable Setpoints be recorded and stored safely to facilitate reentry, in case there is a need to return to the original settings.

1. From an adjustable setpoint display select the **[Change Setpoints]** key. This positions the cursor at the first data entry field. The selected data entry field can be identified by the black background and white text.

2. Use the arrow keys to move the cursor to the data entry field to be modified.

3. Having selected the setpoint to be changed, the numerical keys and the decimal key may be used to enter the new setpoint. Typing a new value will completely erase the old value.

4. To remove a typing mistake, the left and right arrow key can be used to position the cursor on the mistake and then use the **[DELETE]** key to erase it.

5. Press the **[ENTER]** key to input the new data in the data entry field.

6. If the value is out of bounds, an error message box displays the proper value range. Press the **[OK]** key to acknowledge the error message. Reenter the correct value.

7. Pressing the **[Enter]** key inputs the new setpoint and selects the next data entry field.

8. When finished making any changes to the data on an adjustable setpoint display press the **[OK]** key to accept all changes or press the **[CANCEL]** key to cancel all of the data changes.

Note: When the display units are selected to display in PSIG, an entry of a pressure value above 29.7 is as-

sumed to be PSIG, an entry less than or equal to 29.7 will cause a message box to appear after pressing the [ENTER] key. This message prompts the operator to select the unit of measure. The operator must select either the [HG] or the [PSIG] key.

COMMON TERMINOLOGY

Shutdown - A critical safety limit has been reached or exceeded and the compressor has been shutdown.

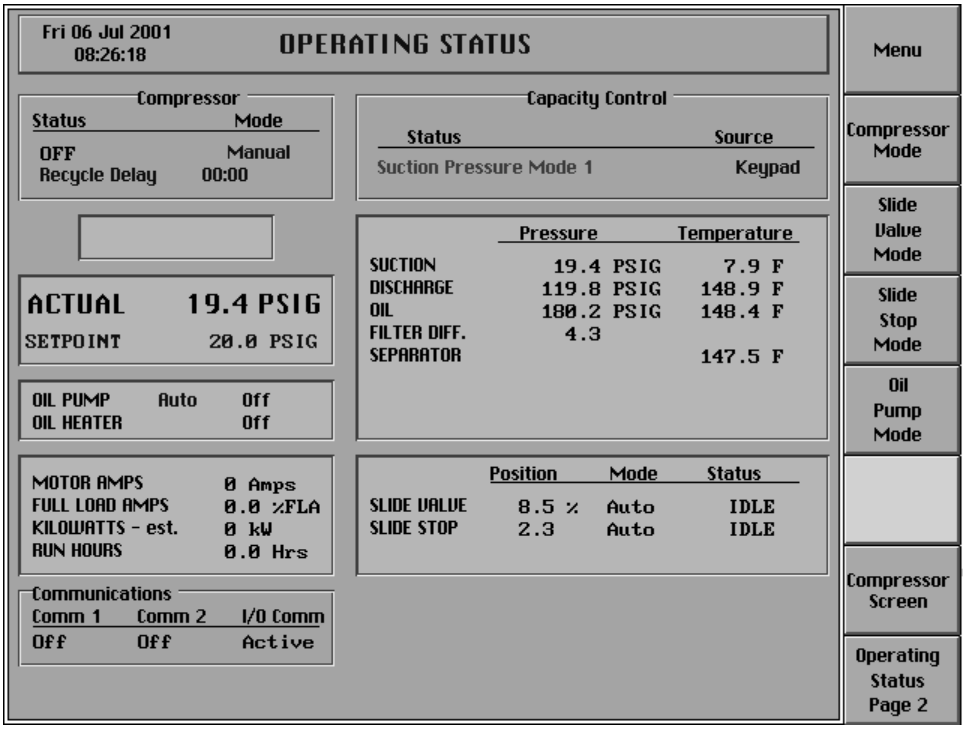
Alarm - An alarm setpoint has been reached or exceeded. The compressor will continue to run if running.

Manual - The device is being controlled from direct commands or keys at the local controller.

Auto (Automatic) - The device is being controlled from setpoints at the local controller.

Remote - The device is being controlled by a remote controller.

GRAPHIC DISPLAYS
"OPERATING STATUS" DISPLAY



Also called the "Home" display. The most important information about the compressor unit and the subsystems operation is displayed here. This display is shown when power is first turned on and when a key is pressed after the screen saver has turned off the backlight. The "Operating Status" display is continuously updated and provides a variety of information in regard to the current condition and performance of the compressor unit and subsystem.

The following information is shown on the left side of this display:

COMPRESSOR DATA BOX:

Shows the present operating status of the compressor and from what source it has been initiated:

- Status - One of the following messages is shown:
  - Off
  - Starting
  - Running
- Mode - One of the following messages is shown:
  - Manual - A compressor manual start or stop command was sent.
  - Automatic - The compressor auto command was sent. The compressor starting and stopping is being controlled from automatic cycling control setpoints at the panel. The automatic cycling control setpoints of the active capacity control are used.
  - Remote - The compressor remote command was sent. The compressor starting and stopping is through the serial com2 channel.

  Note: If there is a shutdown in response to a safety setting, a compressor in "Remote" or "Automatic" mode is placed into "Manual" mode requiring operator intervention.
- Recycle Delay - This message shows the remaining time in minutes for recycle delay. If the compressor has started and shut down within the recycle time delay

setpoint period, the Recycle Delay will prevent the compressor from starting until the delay time expires. This time delay is intended to prevent damage to the compressor motor from successive restarts.

Note: The remaining recycle delay time can be cleared from the "Motor Control" display.

- Pumpdown Delay - This message shows the remaining time in minutes for pumpdown delay. If the compressor is in Pumpdown, the Pumpdown Delay will prevent the compressor from stopping until the delay time expires or the suction pressure falls below the "On when above" pumpdown setpoint. This time delay is intended to provide enough time to remove the refrigerant gas.
  Note: While in pumpdown, the delay time and the "On when above" setpoint can be overridden to force the compressor to stop by pressing the [Compressor Stop] screen command key again.

COMPRESSOR ALARM STATUS BOX:

The alarm status is displayed in the indented box below the Compressor status box. The status box is blank with no message if there are no alarms or shutdowns present.

One of the following messages could be shown:

- ALARM - This message flashes when an alarm is present. An alarm is a condition that requires an operator to acknowledge it and allows the compressor to continue to run if it is running.
- SHUTDOWN - This message flashes when a shutdown is present. A shutdown is a condition that requires an operator to acknowledge it and causes the compressor to shut down. If the compressor cannot be stopped, it is minimally run in a protected state.

An Alarm or Shutdown message indicates an Alarm or Shutdown point has been reached, or exceeded. Select the **[Alarms/Shutdown]** key from the "Main Menu" display for details. For additional shutdown information, select the **[Alarms/Shutdown]** key from the "Main Menu" display and then the "Freeze" display.

When a Shutdown occurs, the display backlight will flash on and off to alert an operator of the shutdown. This visual alarm will help get the attention of the operator in a noisy engine room environment where audible alarms may not be heard. Pressing any key on the keypad will clear the flashing backlight.

SETPOINT BOX:

The following items are shown:

- Setpoint - This is the current control setpoint maintained by the internal capacity control.
- Actual - The current reading of the pressure or temperature that was chosen as the compressor control setpoint.

STATUS BOX OF OIL LUBRICATION DEVICES:

The operating status is shown for the following devices:

- Oil Pump (If a selected feature from Factory Setup) - The On or Off message is shown for the status of the oil pump. The Manual or Auto message is shown to indicate the position of the HAND-OFF-AUTO switch. If dual pump control was enabled in Factory Setup, the lead pump (either Oil Pump 1 or Oil Pump 2) is shown.
- Oil Heater - The On or Off message is shown for the status of the oil separator heater(s).

MOTOR INDICATION BOX:

The following items are shown:

- Motor Amps - The actual amps.
- Full Load Amps - The percentage of the drive motor full load amperage rating that the motor is currently using. %(FLA x SF)
- Kilowatts - est. or Kilowatts
  - Kilowatts - est. - The estimated motor voltage times motor amps.
  - Kilowatts - If Kilowatt monitoring was enabled in Panel Setup, the current value of the "kW Monitoring" analog input is displayed instead of an estimated value.
- Run Time Hours - The accumulated number of hours the motor has run.

COMMUNICATIONS BOX:

The Communication Ports Status is shown for Comm1, Comm2, and I/O Comm. One of the following messages is shown:

- Failed
- Off
- Active

The following information is shown on the right side of the "Operating Status" display:

CAPACITY CONTROL BOX:

Shows what is presently controlling the slide valve and from what source it was initiated.

- Status - One of the following control modes is shown:
  - Suction Pressure Mode 1
  - Suction Pressure Mode 2
  - Process Temperature Mode 1
  - Process Temperature Mode 2
  - Discharge Pressure Mode 1
  - Discharge Pressure Mode 2
  - Discharge Temperature Mode 1
  - Discharge Temperature Mode 2

Note: For safety reasons, even when in manual control, the control settings and safeties of the last control mode are active.

- Source - One of the following messages is shown:
  - Keypad - A slide valve command was sent from the panel keypad.
  - Remote-I/O - The status of the Process Mode Select input module (Input Module 19) forced Capacity Control to a different Mode. For this to occur, "Input Module Capacity Control Selection" must

be enabled in Panel Setup.
- Remote Comm. - A command was sent through the serial com2 channel that forced Capacity Control to a different control.
- Schedule - The capacity is being controlled from the setback schedule and the active capacity control mode. The mode 2 setpoints become active at the start time. At the stop time the mode 1 setpoints become active.

SENSOR INDICATION BOX:

The following sensors are displayed:
- Suction - Suction Pressure and Temperature are measured at the compressor inlet and the values are displayed along with the unit of measure.
- Discharge - Discharge Pressure and Temperature are measured at the compressor outlet and the values are displayed along with the unit of measure.
- Oil - Oil Pressure and Temperature are measured prior to entering the compressor and the values are displayed along with the unit of measure.
- Filter Diff. - (If applicable). Pressure drop across the oil filter. The main oil injection oil filter pressure drop value (differential) is displayed along with the unit of measure.
- Separator - Oil separator temperature value is displayed along with the unit of measure.
- Leaving Process - If “Process Temperature Control Modes” were enabled in Panel Setup, the Leaving Process temperature value is displayed along with the unit of measure.
- Balance Piston - If applicable, the balance piston pressure reading is displayed along with the unit of measure. This reading is a measurement of the oil pressure at the balance piston.

SLIDE VALVE and SLIDE STOP STATUS BOX:

- Position - The following values are shown:
  - Slide Valve or Capacity is shown depending on the compressor model (Reference “Compressor Model Differences”)
    - Slide valve - The position is displayed as a percentage. This value indicates the mechanical position of the slide valve and does not indicate the percentage of compressor capacity.
    - Capacity - The position is displayed as a percentage. This value indicates the mechanical position of the capacity control pistons and does not reflect the percentage of full load operation.
  - Slide Stop (If applicable, reference “Compressor Model Differences”) - The position is displayed as a ratio (volume index (VI)).

- Mode - The following are shown:
  - Slide Valve or Capacity (Reference “Compressor Model Differences”) - One of the following is shown:
    - Auto (Automatic) - Capacity is being controlled from active capacity control setpoints at the panel.
    - Manual - A manual load or unload command was sent.
    - Remote - The slide valve or capacity is being controlled from a remote device.
  - Slide Stop (If applicable, reference “Compressor Model Differences”) - One of the following is shown:
    - Auto (Automatic) - The movement of the slide stop is being controlled from internal logic at the panel.
    - Manual - A slide stop manual increase or decrease command was sent.

- Status - The following are shown:
  - Slide Valve or Capacity (Reference “Compressor Model Differences”) - One of the following could be shown:
    - Load - Indicates the compressor is loading and the slide valve or capacity value is increasing.
    - Unload - Indicates the compressor is unloading and the slide valve or capacity value is decreasing.
    - Idle - Indicates the slide valve or capacity is holding at the present position
  - Slide Stop (If applicable) - One of the following is shown:
    - Increase - Moving to a higher VI.
    - Decrease - Moving to a lower VI.
    - Idle - Not moving.

The following messages could be shown:

- Stop Load - If this message is shown, it indicates that the compressor is being prevented from further loading. The Stop Load setpoint that has been reached is shown next to the stop load message, i.e. Stop Load - High Motor Amps, this message indicates that the high motor amps stop load setpoint was reached and the compressor is being prevented from further loading. One of the following messages could be shown if the corresponding stop load setpoint is reached:
  - High Motor Amps
    The motor amps is greater than or equal to the “High Motor Amps Stop Load” setpoint, the compressor is prevented from further loading until the motor amps is less than this setpoint.
  - High Discharge Pressure
    The discharge pressure is greater than or equal to the “High Discharge Pressure Stop Load” setpoint, the compressor is prevented from further loading until the discharge pressure is less than this setpoint.
  - High Discharge Temperature
    The discharge temperature is greater than or equal to the “High Discharge Temperature Stop Load” setpoint, the compressor is prevented from further loading until the discharge temperature is less than this setpoint.
  - Low Suction Pressure
    The suction pressure is less than or equal to the “Low Suction Pressure Stop Load” setpoint, the compressor is prevented from further loading until the suction pressure is greater than this setpoint.

- High Suction Pressure
  The suction pressure is greater than or equal to the “High Suction Pressure Stop Load” setpoint, the compressor is prevented from further loading until the suction pressure is less than this setpoint.
- Low Process Temperature
  The process temperature is less than or equal to the “Low Process Temperature Stop Load” setpoint, the compressor is prevented from further loading until the process temperature is greater than this setpoint.
- Low Oil Flow
  This compressor configuration has a safety check that determined the suction pressure is greater than or equal to ((1.5 x oil pressure) + 15 lb. and (slide valve >= 48 %)), the compressor is prevented from further loading.

- Forced Unload - This message indicates that the compressor has been forced to unload. The force unload setpoint that has been reached is shown next to the message, i.e. Forced Unload - High Motor Amps, this message indicates that the high motor amps force unload setpoint was reached and the compressor has been forced to unload. One of the following messages could be shown if the corresponding force unload setpoint is reached:
  - High Motor Amps
    The motor amps is greater than or equal to the “High Motor Amps Force Unload” setpoint, the compressor is forced to unload until the motor amps is less than 1% of this setpoint.
  - High Discharge Pressure
    The discharge pressure is greater than or equal to the “High Discharge Pressure Force Unload” setpoint, the compressor is forced to unload until the discharge pressure is less than this setpoint.
  - High Discharge Temperature
    The discharge temperature is greater than or equal to the “High Discharge Temperature Stop Load” setpoint, the compressor is forced to unload until the discharge temperature is less than this setpoint.
  - Low Suction Pressure
    The suction pressure is less than or equal to the “Low Suction Pressure Force Unload” setpoint, the compressor is forced to unload until the suction pressure is greater than this setpoint.
  - High Suction Pressure
    The suction pressure is greater than or equal to the “High Suction Pressure Force Unload” setpoint, the compressor is forced to unload until the suction pressure is less than this setpoint.
  - Low Process Temperature
    The process temperature is less than or equal to the “Low Process Temperature Force Unload” setpoint, the compressor is forced to unload until the process temperature is greater than this setpoint.
  - Low Oil Flow
    This compressor configuration has a safety check that determined the suction pressure is greater than or equal to (1.5 x oil pressure) + 10 lb., the compressor is forced to unload to 50% slide valve.
  - VI OverRide
    In order for the slide stop to increase the slide valve is being forced to unload.

“OPERATING STATUS” DISPLAY - SCREEN KEY SET

Following are the screen key selections for the “Operating Status” display:

[Menu] - Shows the “Main Menu” display.

[Compressor Mode]
The following are the compressor mode screen command keys:

[Remote] - Selects the compressor to be controlled by a remote device.

[Auto] - Selects the compressor to be controlled from the automatic cycling setpoints.

[Manual Start] - Places the compressor unit in the start mode for running.

[Manual Stop] - Stops the compressor unit.

Depending on the compressor model either **[Slide Valve Mode]** or **[Capacity Mode]** is present. (Reference “Compressor Model Differences”)

[Slide Valve Mode] (If applicable, reference “Compressor Model Differences”) The following are the slide valve mode screen command keys:

[Remote] - The slide valve loading and unloading is controlled by a remote device.

[Auto] - The slide valve loading and unloading is under automatic capacity control settings.

[Manual Load] - Sends a load signal for the duration the key is pressed.

[Manual Unload] - Sends an unload signal for the duration the key is pressed.

[Remote Slide Valve] - This shows if “Slide Valve Position Control” is enabled as a selectable option in Panel Setup. This key selects to control the slide valve based on the (4-20 ma) analog signal of the Remote Slide Valve Position input. The slide valve position control will display as a slide valve %.

[Capacity Mode] (If applicable, reference “Compressor Model Differences”) The following are the capacity mode screen command keys:

[Remote] - The capacity loading and unloading is controlled by a remote device.

[Auto] - The loading and unloading is under automatic capacity control settings.

[Manual Load] - Sends a load signal for the duration the key is pressed.

[Manual Unload] - Sends an unload signal for the duration the key is pressed.

[Slide Stop Mode] (If applicable, reference “Compressor Model Differences”) The following are the slide stop mode screen command keys:

[Auto] - The slide stop increase and decrease is under internal control that is based on the differential of the machines suction pressure and discharge pressure.

[Manual Increase] - Sends an increase signal for the duration the key is depressed.
[Manual Decrease] - Sends a decrease signal for the duration the key is depressed.

[Oil Pump Mode] (If applicable) The following are the oil pump mode screen command keys:

[Auto] - The oil pump is started and stopped under internal automatic control.
[Manual On] - Places the oil pump in the run mode.
[Manual Off] - Places the oil pump in the stop mode.

If dual pumps were enabled in Factory Setup, then a toggle key is provided that changes which pump is the lead, or first pump to be turned on.

[Oil Lead Pump 1] - Selects pump 1 to be the lead oil pump.
[Oil Lead Pump 2] - Selects pump 2 to be the lead oil pump

[Compressor Screen] - Shows the "Compressor Screen" display. This display shows a pictorial of a compressor and shows the compressor configuration, operating status and readings.

[Operating Status Page 2] - Shows the second Operating Status display.

"OPERATING STATUS - 2" DISPLAY

The following information is shown on this display:

Entering Process Temperature - If this temperature was enabled for monitoring in Panel Setup, it will be displayed along with the unit of measure. This reading is used to monitor the temperature of what is being processed.

Internal Panel Temperature - The main processor board is equipped with a temperature sensor. The panel has an operational temperature range that should be maintained. The operational temperature range is documented in the specifications document.

Panel Heater - The On or Off message is shown for the status of the panel heater. If the temperature sensor on the main processor board detects the temperature is less than or equal to 12 degrees C, the panel heater output is turned on. If the temperature is detected to be greater than 13 degrees C, the panel heater output is turned off. A temperature of 55 degrees F is attempted to be maintained.

Battery Status - The status of the battery on the main processor board is shown. If the battery looses too much charge, the panel date and time can be lost. The current voltage reading is shown along with one of the following messages:

OK - The voltage charge of the battery is fine.
Replace - The voltage charge of the battery is low and the battery should be replaced.

Power Up Time - The clock time when the Quantum program was started.

Last Power Down - The clock time when the Quantum program was last stopped.

Following are the screen key selections for the "Operating Status - 2" display:

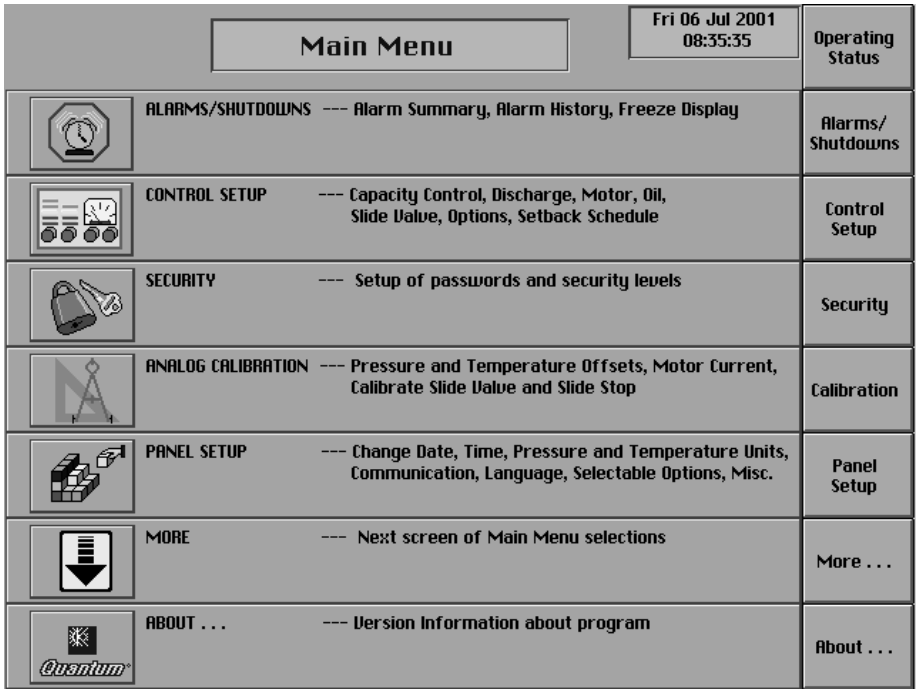
[Operating Status] - Shows the "Operating Status" display.

[Condenser Setpoints] - Shows the "Condenser Control" display. This key is shown if a type of Condenser Control was selected in Panel Setup.

[Compressor Sequence Setpoints] - Shows the "Compressor Sequence Control" display. This key is shown if Compressor Sequencing is enabled in Panel Setup.

[Compressor Interlock Setpoints] - Shows the "Compressor Interlock" display. This key is shown if Compressor Interlock is enabled from the Compressor Sequencing option in Panel Setup.

"MAIN MENU" DISPLAY



"MAIN MENU" DISPLAY - SCREEN KEY SET

The "Main Menu" display provides a selection of screen keys to guide the operator through all the displays. The following are descriptions of each screen selection and a listing of further selections:

[Operating Status] - Shows the "Operating Status" display.

[Alarms/Shutdowns] - Shows the "Alarms/Shutdowns" display which shows in red text the current Failures, and the Date, and Time of the Failure. The following selections are available:

- **[Clear Alarms]**
- Alarms/Shutdowns History Display
  - Freeze Display
- Power Down Display

[Control Setup] - Shows the "Control Setup" menu display. The following items are selections:

- Capacity Control Setpoints
- Compressor Safeties Setpoints
- Motor Control
- Oil Setpoints
- Slide Valve Setpoints (If applicable, reference "Compressor Model Differences")
- Setback Schedule
- Options Setup
- Auxiliaries 3-8 (If applicable, see Panel Setup)
- Auxiliary Analog Temperatures and Pressures (If applicable, see Panel Setup)
- Pumpdown/DX Circuit Setup (If applicable, see Panel Setup)

[Security] - Shows the current security privilege level and if setpoints are allowed to be changed from the keypad. Security can be changed on this display.

[Calibration] - Shows the "Analog calibration" display. From this display the following calibrations can be selected:

- Change Pressure Transducer Ranges and Offsets
- Change Temperature Probe Types, Ranges and Offsets
- Calibrate Motor Current
- Calibrate Slide Valve and Slide Stop (If applicable, reference "Compressor Model Differences")
- Calibrate Remote Control Setpoint (If applicable, see Panel Setup)
- Calibrate Slide Valve Position (If applicable)
- Calibrate Auxiliary Analog (If applicable, see Panel Setup)
- Kilowatt Monitor Calibration and Setup (If applicable, see Panel Setup)

[Panel Setup] - Shows the "Panel Setup" display. This display has the following menu items for setup:

- Change Current Time and Date
- Pressure Units
- Temperature Units
- Language
- Change Communications
- Capacity Control Options
- Selectable Options

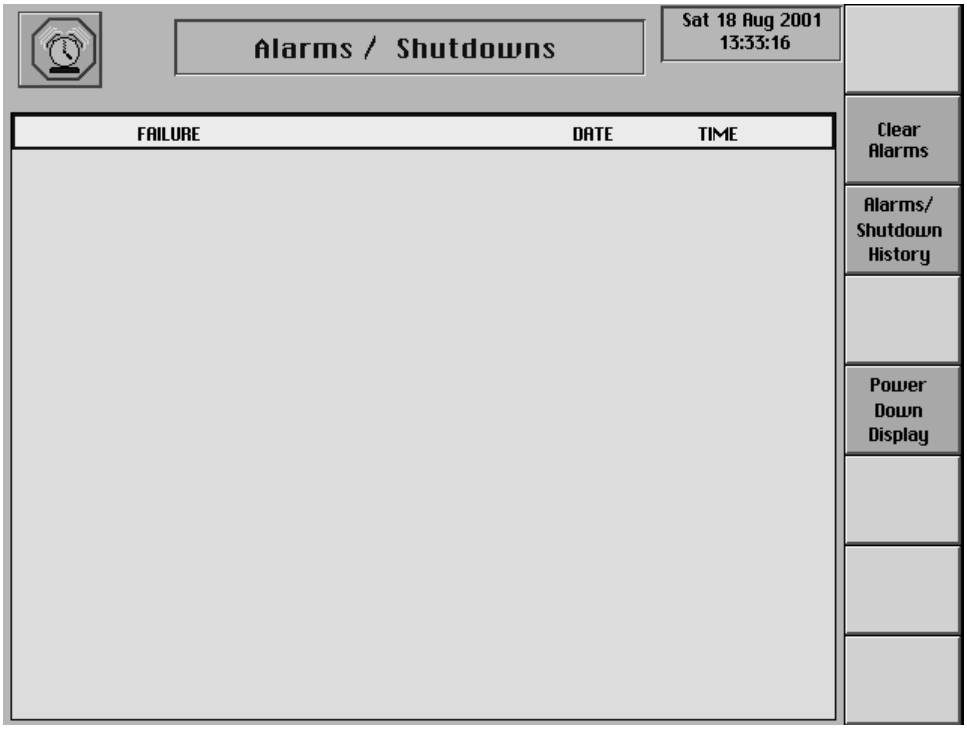
[About...] - Shows the "About" display. This display shows the software version, the sales order number, copyright notification, main board information, analog boards information and digital boards information.

[Real Time] - Real Time Trending feature.

[History] - Historical Trending and data logging.

[Service Screen] - This selection shows the "Service Screen" display that provides tools for troubleshooting and setting up the Quantum.

MAIN MENU SELECTION - “ALARMS/SHUTDOWNS” DISPLAY



This display is accessible from the “Main Menu” display. When an alarm or shutdown is triggered, a red descriptive message shows on this display. The date and time of the alarm or shutdown occurrence is shown to the right of it’s description. The most recent message will appear on the top line of the display with the oldest appearing at the bottom.

The following are the “Alarms/Shutdowns” display screen selection keys:

[Clear Alarms] - Selecting this key will clear all alarms and/or shutdowns from this display. It also de-energizes the Alarm and Shutdown output modules to silence any alarm annunciation device.

[Alarms/Shutdown History] - A full display of failures is stored, along with the Last Fail Date/Time, and the Last Clear Date/Time of the failure. The stored data shows on the “Alarms/Shutdowns History” display. The data is saved, even if there is a power outage. The last ten “Freeze” displays can be accessed from this display.

[Power Down Display] - This display shows the “Operating Status” display with the important values that were last saved to fast battery backup memory prior to a loss of power to the panel. This display can be distinguished from the “Operating Status” display by “— POWER” in the display title and there are no screen keys. This display can help the operator to identify the conditions and the date and time prior to a power loss.

NOTE: The “Power Down” display will appear with invalid data when power is initially furnished to the unit.

To resume normal operation it will be necessary to go through the following steps:

1. Correct the conditions causing the alarm.

2. Press the **[ALARM SILENCE]** key. (This action may precede correcting the conditions causing the alarm). Or, go to step 3.

3. To clear or reset the “Alarms/Shutdowns” display and turn off any alarm annunciation device, from the display press the **[Clear Alarms]** key. This will also clear the “ALARM” or “SHUTDOWN” message from the “Operating Status” display.

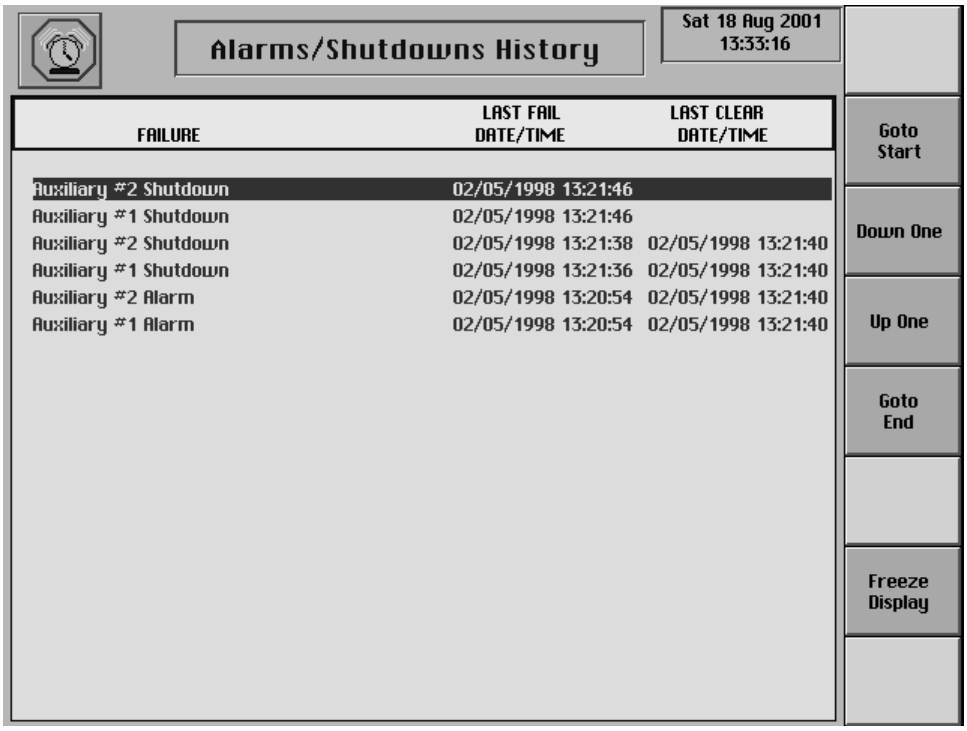
4. If the conditions causing the alarm have not been corrected or a new fault has occurred, a new “ALARM” or “SHUTDOWN” message will appear. The Alarms/Shutdowns history display keeps a record of the alarms and shutdowns. This information will help troubleshoot persistent operational problems.

5. The information on the “Freeze” display can help the operator to identify the cause of a fault which occurred when no one was present. The “Freeze” display freezes the information of the “Operating Status” display AT THE MOMENT OF A COMPRESSOR ALARM OR SHUTDOWN. The Freeze display has the same appearance and contains the same information as the “Operating Status” display. (For a description of the information presented by the “Freeze” display, refer to the “Operating Status” display.) The “Freeze” display will retain the information generated by an alarm or shutdown. The last ten alarms/shutdowns “Freeze” display screens are saved. This data is saved during a power outage.

Refer to the “Alarms/Shutdowns Message” section for a list of all the possible alarms.

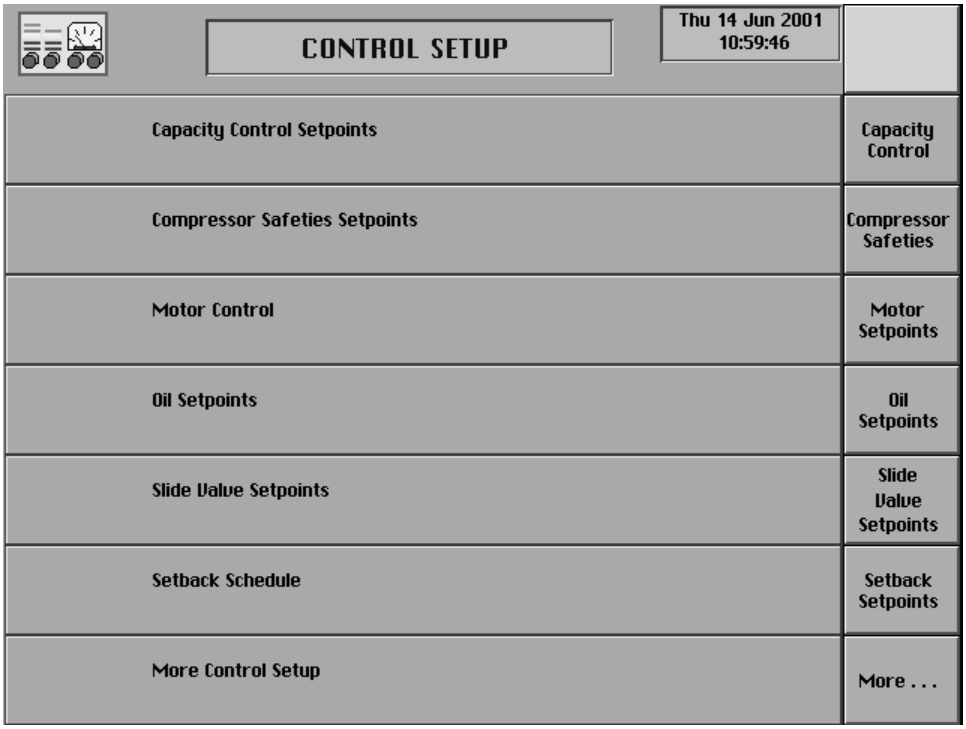
When a Shutdown occurs, the display backlight will flash on and off to alert an operator of the shutdown. This visual alarm will help get the attention of the operator in a noisy engine room environment where audible alarms may not be heard. Pressing any key on the keypad will clear the flashing backlight.

MAIN MENU SELECTION - ”ALARMS/SHUTDOWNS HISTORY” DISPLAY



[Freeze Display] - Accesses the “Freeze” display. Use the arrow keys or the screen command keys on the ‘Alarms/Shutdowns History” display to select an alarm or shutdown and then press this screen selection key to view it’s “Freeze” display

MAIN MENU SELECTION - ”CONTROL SETUP” DISPLAY



The “Control Setup” display is accessible from the main menu display. The following are the “Control Setup” display screen selections:

[Capacity Control] - Shows a display with selections for the capacity control setpoints that were enabled in Panel Setup. Only two types of capacity control setpoints can be enabled in Panel Setup. Only one capacity control mode can be active. The message “Active - Current Capacity Control” displays at the selected capacity control mode. The following setpoint displays are possible:

- Suction Pressure Mode 1
- Suction Pressure Mode 2
- Process Temperature Mode 1
- Process Temperature Mode 2
- Discharge Pressure Mode 1
- Discharge Pressure Mode 2
- Discharge Temperature Mode 1
- Discharge Temperature Mode 2

[Compressor Safeties] - Shows a display with selections to the compressor safeties displays. Following are the compressor safeties displays:

- Discharge Safeties
- Suction Safeties
- Entering Process Safeties (If applicable)

The following safety setpoint can be changed:

Hi Level Shutdown Delay - The time in seconds to delay after the High Liquid Level input is energized before the compressor will shut down.

[Motor Setpoints]

[Oil Setpoints]

[Slide Valve Setpoints] (If applicable)

[Setback Setpoints]

[Options Setup] - Shows a display with selections to other displays of enabled options. The following displays are possible:

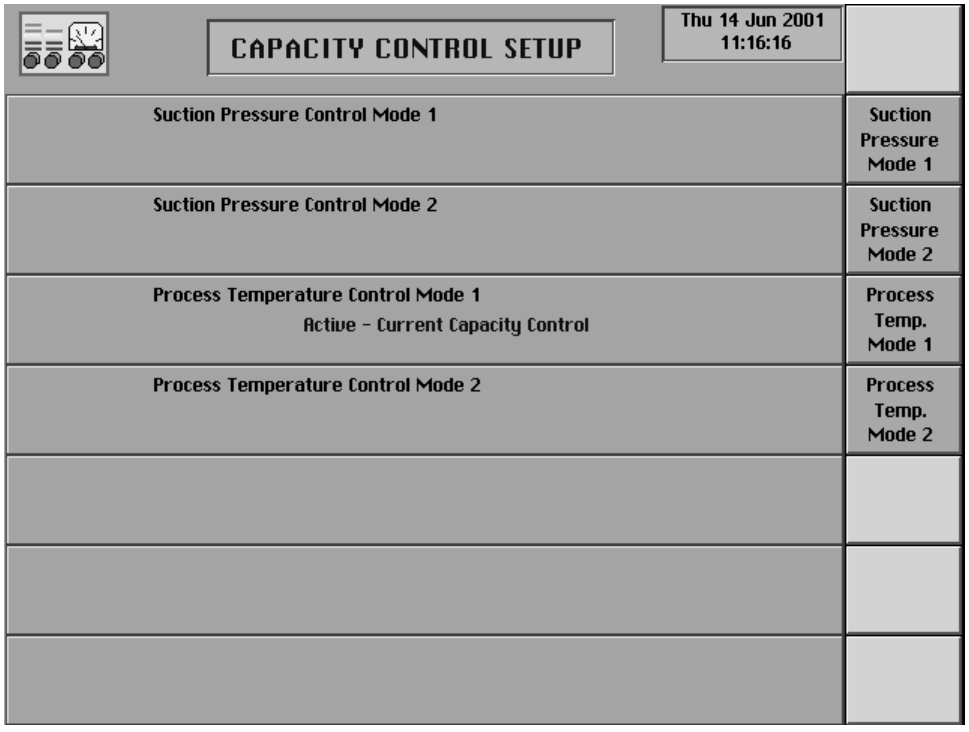
- Condenser Control (If applicable, see Panel Setup)
- Compressor Sequence Control or Compressor Interlock (If applicable, see Panel Setup)
- Input Module Capacity Control Selection (If applicable, see Panel Setup)
- Auxiliary Setup - Shows the “Auxiliary Setup” display for the analog auxiliaries 1-2 setpoints. (If applicable, see Panel Setup)
- Suction Pull Down (If applicable, see Panel Setup)

[Additional Auxiliaries] - Shows the “Auxiliaries Setup” display for the digital input auxiliaries 3-8 setpoints. (If applicable, see Panel Setup)

[Auxiliary Analog] - Shows the “Auxiliary Analog” display for setup of the Auxiliary Analog Temperatures and Pressures. (If applicable, see Panel Setup)

[Pumpdown/DX Circuit] (If applicable, see Panel Setup)

CONTROL SETUP -
CAPACITY CONTROL SETPOINTS DISPLAYS

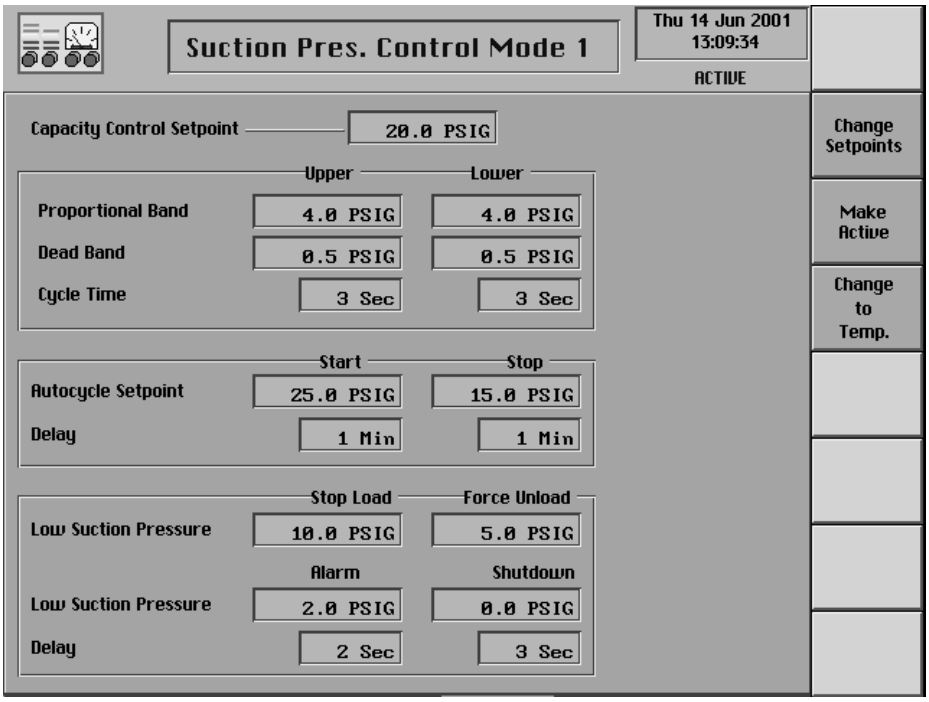


The capacity control selections that were enabled in Panel Setup, are shown. Only two types of capacity controls can be enabled in Panel Setup. Each type of capacity control has a Mode 1 and a Mode 2 setpoint display.

The following is a list of all the different capacity control setpoint displays:

- Suction Pressure Mode 1
- Suction Pressure Mode 2
- Process Temperature Mode 1
- Process Temperature Mode 2
- Discharge Pressure Mode 1
- Discharge Pressure Mode 2
- Discharge Temperature Mode 1
- Discharge Temperature Mode 2

Following is an example of a capacity control setpoint display:



The following setpoints are required for each of the capacity control setpoint displays:

Capacity Control - This setpoint is used to control the loading and unloading of the compressor when the Slide Valve Position is in the automatic (AUTO) mode.

NOTE: The process temperature reading is used for capacity control when discharge temperature capacity control is used.

The Proportional Band setpoint determines a range of capacity control values where pulsed output is used. Beyond the proportional band the output is continuously energized. The length of time the output will be pulsed on is proportional to the distance the actual reading is from the capacity control setpoint. The further the distance from setpoint, the longer the output is pulsed on and the shorter the output is off. The closer the distance to setpoint, the shorter the output is pulsed on and the longer the output is off. If the actual reading is midpoint from setpoint, the output is on and off an equal amount of time.

Upper Proportional Band - A band, measured in the units of the capacity control setpoint, above the upper dead band, where proportional load control is used. If the actual reading rises into this proportional band, the load output will be pulsed as explained above in the description about proportional band.

Lower Proportional Band - A band, measured in the units of the capacity control setpoint, below the lower dead band, where proportional unload control is used. If the actual reading falls into this proportional band, the unload output will be pulsed as explained above in the description about proportional band.

Upper Dead Band - A band, measured in the units of the capacity control setpoint, above the setpoint at which the compressor will neither load nor unload.

Lower Dead Band - A band, measured in the units of the capacity control setpoint, below the setpoint at which the compressor will neither load nor unload.

The cycle time setpoint determines the amount of time the output is on and off, when in the proportional band. At the completion of the cycle time the actual reading and necessary response is reevaluated. If a four second period is selected, then the following will result:

Proportional Distance Actual Reading is From Setpoint	Output Pulsed On (Seconds)	Output Off (Seconds)
0	0	4
1/4	1	3
1/2	2	2
3/4	3	1
1	4	0

Upper Cycle Time - This setpoint determines the amount of time in seconds that the load output is on and off, when in the upper proportional band. Refer to the above description about cycle time.

Lower Cycle Time - This setpoint determines the amount of time in seconds that the unload output is on and off, when in the lower proportional band. Refer to the above description about cycle time.

Start Autocycle - The compressor is started at this setpoint when it is under automatic control.

Stop Autocycle - The compressor is stopped at this setpoint when it is under automatic control.

Start Time Delay - The minimum time in minutes that the actual capacity control value must equal or exceed the start autocycle (automatic cycling) setpoint before the compressor will start. This timer helps prevent cycling a compressor on and off due to short or sudden changes in load within the refrigeration system.

Stop Time Delay - The minimum time in minutes that the actual capacity control value must equal or exceed the stop autocycle (automatic cycling) setpoint before the compressor will stop. This timer helps prevent cycling a compressor on and off due to short or sudden changes in load within the refrigeration system.

The following special key is on these displays:

[Make Active] - Selecting this key, switches the active control mode to the capacity control setpoints being viewed. Only one capacity control mode can be active.

The following special toggle key is on a “Suction Pressure Control Mode” display:

[Change To Temp.] - Changes the capacity control setpoint and actual reading along with the autocycle setpoints to display as temperature values.

[Change To Pressure] - Changes the capacity control setpoint and actual reading along with the autocycle setpoints to display as pressure values.

“SUCTION PRESSURE CONTROL MODE 1”
OR
“SUCTION PRESSURE CONTROL MODE 2”
OR
“PROCESS TEMPERATURE MODE #1”
OR
“PROCESS TEMPERATURE MODE #2”
OR
“DISCHARGE TEMPERATURE CONTROL MODE 1”
OR
“DISCHARGE TEMPERATURE CONTROL MODE 2”
OR
“DISCHARGE PRESSURE CONTROL MODE 1”
OR
“DISCHARGE PRESSURE CONTROL MODE 2”
DISPLAY

The following setpoints are required for separate entry into each of the control setpoint displays listed above:

Low Suction Pressure Stop Load - If the suction pressure is less than or equal to this setpoint, the compressor will be prevented from further loading until the suction pressure is greater than this setpoint. This setpoint helps avoid forced unloading.

Low Suction Pressure Force Unload - If the suction pressure is less than or equal to this setpoint, the compressor will be forced to unload until the suction pressure is greater than this setpoint. This setpoint helps avoid the low suction pressure alarm and shutdown.

Low Suction Pressure Alarm - If the suction pressure is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Suction Pressure Shutdown - If the suction pressure is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Low Suction Pressure Alarm Time Delay - The minimum time in seconds that the suction pressure is less than or equal to the low suction pressure alarm setpoint before notification of the alarm.

Low Suction Pressure Shutdown Time Delay - The minimum time in seconds that the suction pressure is less than or equal to the low suction pressure shutdown setpoint before the compressor will shut down.

The following setpoints are required for separate entry into the “Process Temperature Control” display (see opposite page):

Low Process Temperature Stop Load - If the process temperature is less than or equal to this setpoint, the compressor will be prevented from further loading until the process temperature is greater than this setpoint. This setpoint helps avoid forced unloading.

Low Process Temperature Force Unload - If the process temperature is less than or equal to this setpoint, the compressor will be forced to unload until the process temperature is greater than this setpoint. This setpoint helps avoid the low process temperature alarm or shutdown.

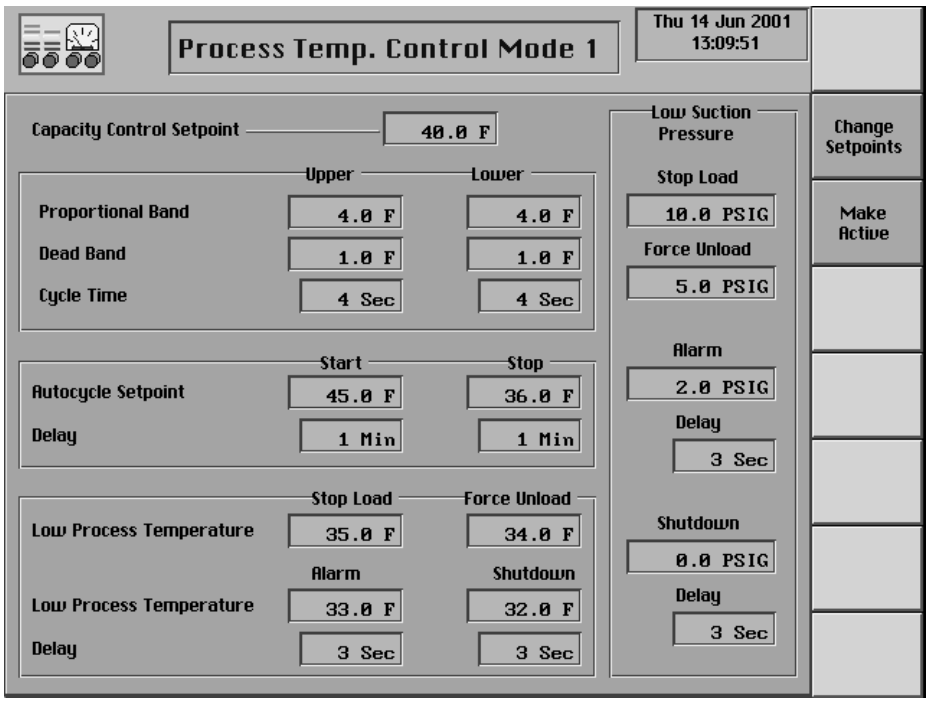
Low Process Temperature Alarm - If the process temperature is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Process Temperature Shutdown - If the process temperature is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Alarm Delay - The minimum time in seconds that the process temperature is less than or equal to the low process temperature alarm setpoint before notification of the alarm.

Shutdown Delay - The minimum time in seconds that the process temperature is less than or equal to the low process temperature shutdown setpoint before the compressor will shut down.

"PROCESS TEMPERATURE CONTROL" DISPLAY



CONTROL SETUP - COMPRESSOR SAFETIES SETPOINTS

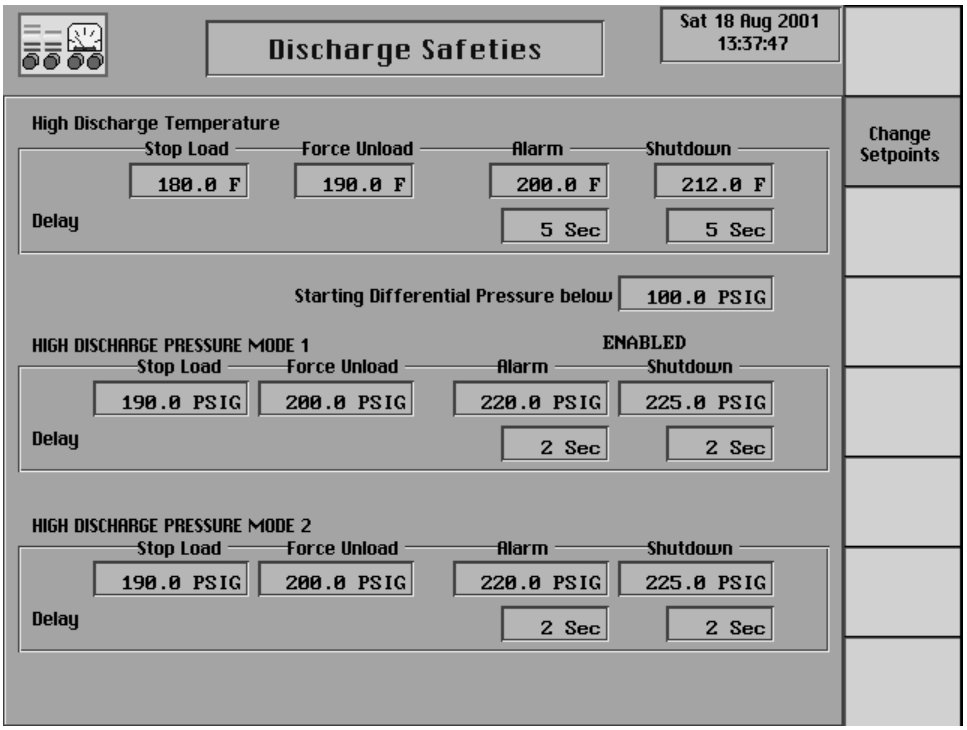
Compressor safeties are important for the safe operation of the compressor. The following setpoint displays can be accessed from this display:

- Discharge Safeties
- Suction Safeties
- Entering Process Safeties (If applicable)

The following safety setpoint is on the Compressor Safeties display:

High Level Shutdown Delay - The time in seconds to delay after the High Liquid Level input is energized before the compressor will shut down.

CONTROL SETUP -
COMPRESSOR SAFETIES - ”DISCHARGE SAFETIES” DISPLAY



The following discharge temperature setpoints are on this control setpoint display:

High Discharge Temperature Stop Load - If the discharge temperature is greater than or equal to this setpoint, the compressor will be prevented from further loading until the discharge temperature is less than this setpoint. This setpoint helps avoid forced unloading.

High Discharge Temperature Force Unload - If the discharge temperature is greater than or equal to this setpoint, the compressor will be forced to unload until the discharge temperature is less than this setpoint. This setpoint helps avoid the high discharge temperature alarm or shutdown.

High Discharge Temperature Alarm - If the discharge temperature is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Discharge Temperature Shutdown - If the discharge temperature is greater than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Alarm Delay - The minimum time in seconds that the discharge temperature is greater than or equal to the high discharge temperature alarm setpoint before notification of the alarm.

Shutdown Delay - The minimum time in seconds that the discharge temperature is greater than or equal to the high discharge temperature shutdown before the compressor will shut down.

Starting Differential Pressure below - If the differential pressure (the result from subtracting suction pressure from discharge pressure) is greater than or equal to this setpoint, when the compressor is starting, the compressor will shut down. This can prevent excessive torque on the motor at start-up.

If “dual discharge control” has been enabled in Factory Setup, the following discharge pressure setpoints will be necessary for “High Discharge Pressure Mode 2” in addition to “High Discharge Pressure Mode 1”:

High Discharge Pressure Stop Load - If the discharge pressure is greater than or equal to this setpoint, the compressor will be prevented from further loading until the discharge pressure is less than this setpoint. This setpoint helps avoid forced unloading.

High Discharge Pressure Force Unload - if the discharge pressure is greater than or equal to this setpoint, the compressor will be forced to unload until the discharge pressure is less than this setpoint. This setpoint helps avoid the high discharge pressure alarm or shutdown.

High Discharge Pressure Alarm - If the discharge pressure is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Discharge Pressure Shutdown - If the discharge pressure is greater than or equal to this setpoint, for the shutdown time delay, the compressor will be shut down.

Alarm Delay - The minimum time in seconds that the discharge pressure is greater than or equal to the high

discharge pressure alarm setpoint before notification of the alarm.

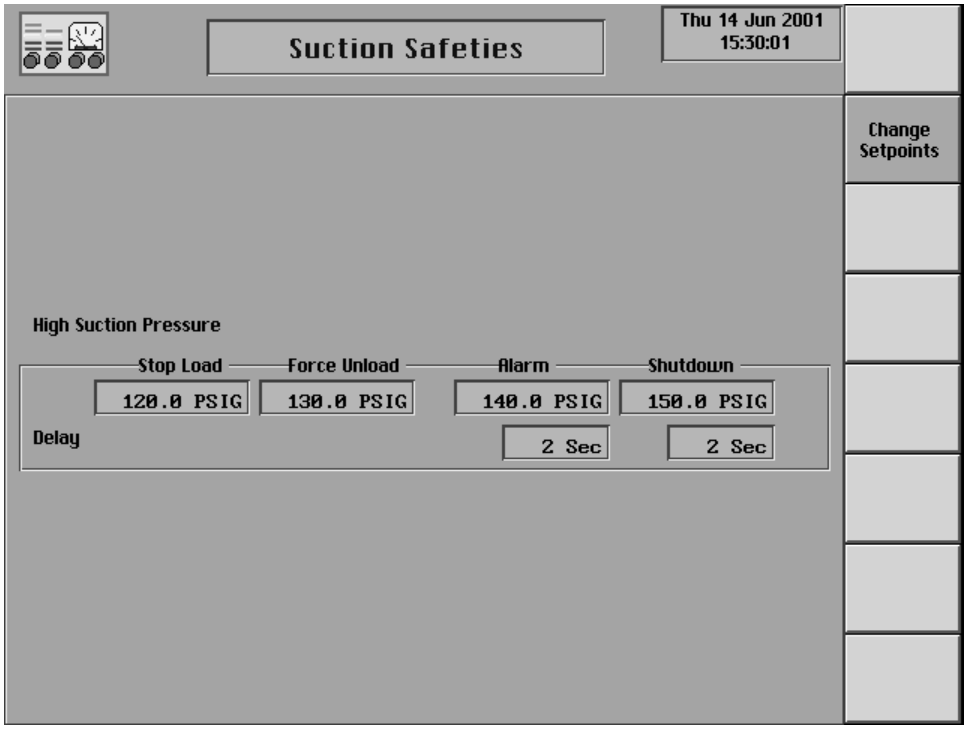
Shutdown Delay - The minimum time in seconds that the discharge pressure is greater than or equal to the high discharge pressure shutdown setpoint before the compressor will shut down.

If “dual discharge control” has been enabled in Factory Setup, either mode 1 or mode 2 setpoints must be chosen. “Activated” will be shown at the control setpoints that have been selected. The following special selection keys are on this display:

[High Discharge Mode 1] - Is shown if mode 2 is activated so that the operator can change to mode 1 setpoints.

[High Discharge Mode 2] - Is shown if mode 1 is activated so that the operator can change to mode 2 setpoints.

CONTROL SETUP - COMPRESSOR SAFETIES - ”SUCTION SAFETIES” DISPLAY



The following suction pressure setpoints are on this control setpoint display:

High Suction Pressure Stop Load - If the suction pressure is greater than or equal to this setpoint, the compressor will be prevented from further loading until the suction pressure is less than this setpoint. This setpoint helps avoid forced unloading.

High Suction Pressure Force Unload - If the suction pressure is greater than or equal to this setpoint, the compressor will be forced to unload until the suction pressure is less than this setpoint. This setpoint helps avoid a high suction pressure alarm or shutdown.

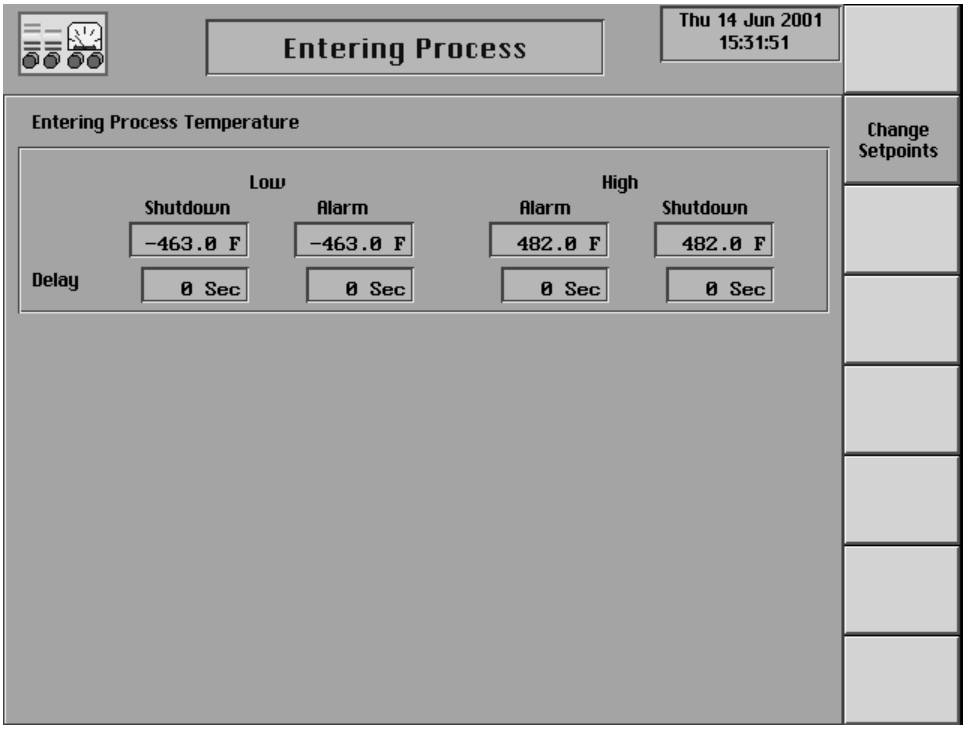
High Suction Pressure Alarm - If the suction pressure is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Suction Pressure Shutdown - If the suction pressure is greater than or equal to this setpoint, for the shutdown time delay, the compressor will be shut down.

Alarm Delay - the minimum time in seconds that the suction pressure is greater than or equal to the high suction pressure alarm setpoint before notification of the alarm.

Shutdown Delay - The minimum time in seconds that the suction pressure is greater than or equal to the high suction pressure shutdown setpoint before the compressor will shut down.

CONTROL SETUP -
COMPRESSOR SAFETIES -
”ENTERING PROCESS SAFETIES” DISPLAY



This display is shown if the “Entering Process Temperature” option was enabled in Panel Setup. This reading is useful for monitoring the temperature of what is being processed.

The following “Entering Process” temperature setpoints are on this control setpoint display:

Low Entering Process Temperature Alarm - If the “Entering Process” temperature is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Entering Process Temperature Shutdown - If the “Entering Process” temperature is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Low Entering Process Temperature Alarm Delay - The minimum time in seconds that the “Entering Process” temperature is less than or equal to the low “Entering Process” temperature alarm setpoint before notification of the alarm.

Low Entering Process Temperature Shutdown Delay - The minimum time in seconds that the “Entering Process” temperature is less than or equal to the low “Entering Process” shutdown setpoint before the compressor will shut down.

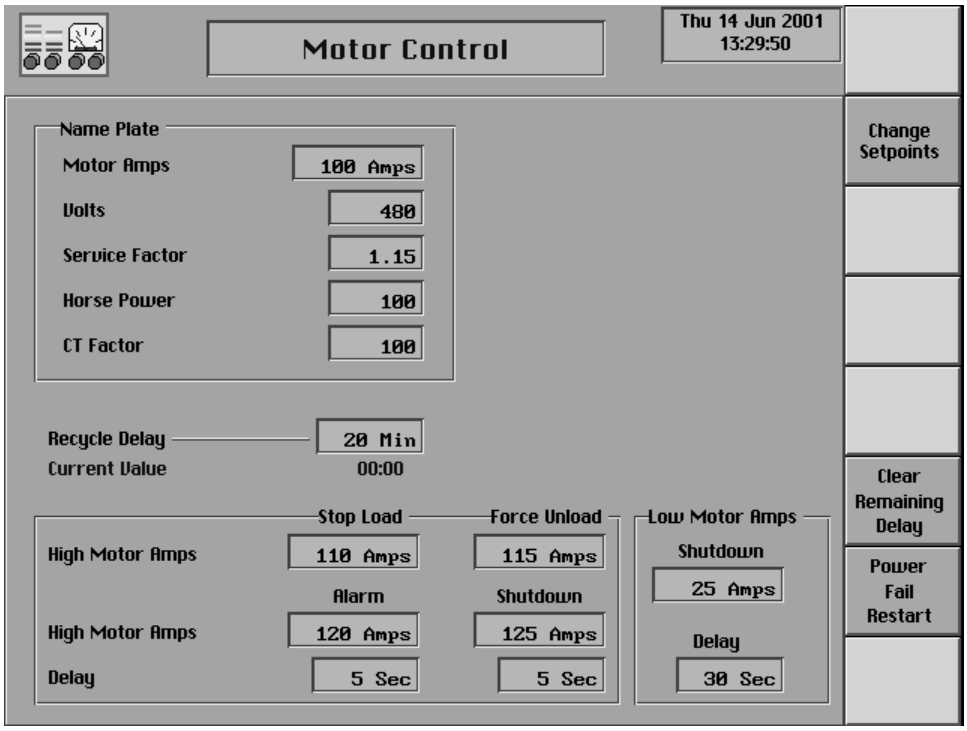
High Entering Process Temperature Alarm - If the “Entering Process” temperature is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Entering Process Temperature Shutdown - If the “Entering Process” temperature is greater than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

High Entering Process Temperature Alarm Delay - The minimum time in seconds that the “Entering Process” temperature is greater than or equal to the high “Entering Process” temperature alarm setpoint before notification of the alarm.

High Entering Process Temperature Shutdown Delay - The minimum time in seconds that the “Entering Process” temperature is greater than or equal to the high “Entering Process” temperature shutdown before the compressor will shut down.

CONTROL SETUP -
”MOTOR CONTROL SETPOINTS” DISPLAY



The following information should be recorded from the motor nameplate:

- Motor Amps
- Volts
- Service Factor - **Note: Not required if using DBS Delta.**
- Horse Power
- CT Factor - The Current Transformer Factor is printed on the current transformer in the compressor motor starter. **Note: Not required if using DBS Delta.**

  To verify that the CT has been sized properly, use the following equation:

  CTF = FLA (Full Load Amps) x Service Factor x 1.1 = Recommended CT (Round up to next highest 100 Amps)

  EXAMPLE: FLA = 182 Amps
  SF = 1.0
  CTF = (182 x 1.0 x 1.1) = 200.2 > Round up to 300 [use 300:5 CT]

The following setpoint is required for safe motor operation:

Recycle delay - Each time the compressor is started, this value will be loaded into the recycle delay timer. This time must elapse prior to allowing the compressor to restart. The timer will time out while the compressor is running or stopped since the recycle delay is a start-to-start protection. The recycle delay time is intended to prevent damage to the motor from successive restarts.

NOTE: Consult Motor Manufacturer for the recommended duration of the Recycle Delay.

The following setpoints are required for motor amps load control:

High Motor Amps Stop Load - The compressor slide valve will be prevented from loading until the motor amps is less than this setpoint.

Typical: Motor Amps Stop Load = FLA x 100%

High Motor Amps Force Unload - When the motor amps is greater than or equal to this setpoint, the compressor slide valve will be forced to unload until the motor amps is less than 1% of this setpoint.

Typical: Motor Amps Force Unload = FLA x 105%

High Motor Amps Alarm - If the motor amps is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Motor Amps Shutdown - If the motor amps is greater than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

High Motor Amps Alarm Delay - The minimum time in seconds that the motor amps is greater than or equal to the high motor amps alarm setpoint before notification of the alarm.

High Motor Amps Shutdown Delay - The minimum time in seconds that the motor amps is greater than or equal to the high motor amps shutdown setpoint before the compressor will shut down.

Low Motor Amps Shutdown - This setpoint is used to determine if the coupling has broken. If the motor amps is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Low Motor Amps Shutdown Delay - The minimum time in seconds that the motor amps is less than or equal to the low motor amps shutdown setpoint before the compressor will shut down.

Forced Unload Load Inhibit Delay - (If applicable, reference Appendix C). Once a force unload condition is cleared, this is the amount of time in seconds that the compressor is inhibited from loading.

The following special selections are on this display:

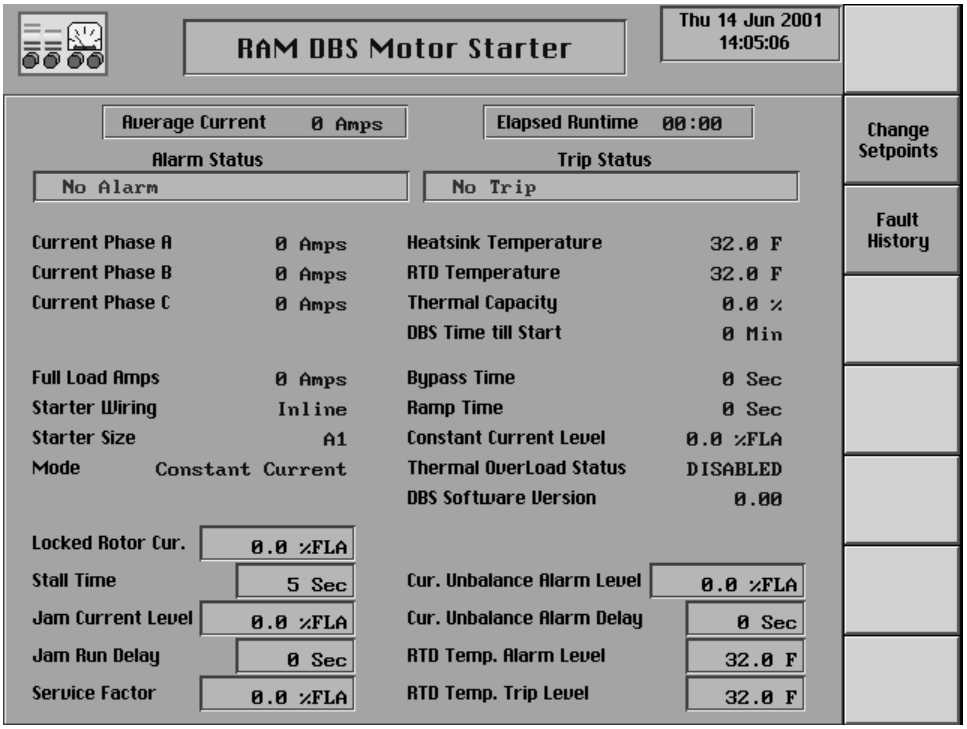
Clear Remaining Delay - This selection will cause a message box to appear saying "WARNING!!! This may cause damage to the motor. Continue?". Select the **[OK]** key to clear the Recycle Delay time or select the **[Cancel]** key to void clearing this timer.

Power Fail Restart - This selection is available if this option was enabled in Panel Setup. This selection displays the "Power Failure Restart" display. This display has the following setpoints:

Time after power fail allowing restart - The number of hours and minutes that the compressor is allowed to restart in its previous mode after a power loss can be changed.

DBS Motor Starter - This selection is available if this feature was selected in Factory Setup. This selection displays the "RAM DBS Motor Starter" display.

CONTROL SETUP - MOTOR CONTROL SETPOINTS - "RAM DBS MOTOR STARTER" DISPLAY



This display is available if a RAM DBS motor starter has been set up for use with the Quantum. The DBS accelerates the motor in a smooth stepless motion, therefore it reduces supply voltage dip during motor start and mechanical shock on the compressor. Reference the DBS Operator's Guide and Instruction Manual or Contact RAM Industries Inc. in Leesport, Pennsylvania at 800-220-8697 with any further questions concerning the setup and operation of the RAM DBS.

The current system conditions of the RAM DBS are displayed for monitoring. The "Time Till Start" value will also be displayed on both the "Motor Control" display and this display. This value and the current recycle delay timer must be zero prior to allowing the compressor to restart. These timers are intended to prevent damage to the motor from successive restarts. Both timers can be cleared by pressing the **[Clear Remaining Delay]** key on the "Motor Control" display. The "Time Till Start" is read from the RAM DBS.

The following RAM DBS setpoints are modifiable from this display:

Locked Rotor Current
Stall Time
Jam Current Level
Jam Run Delay

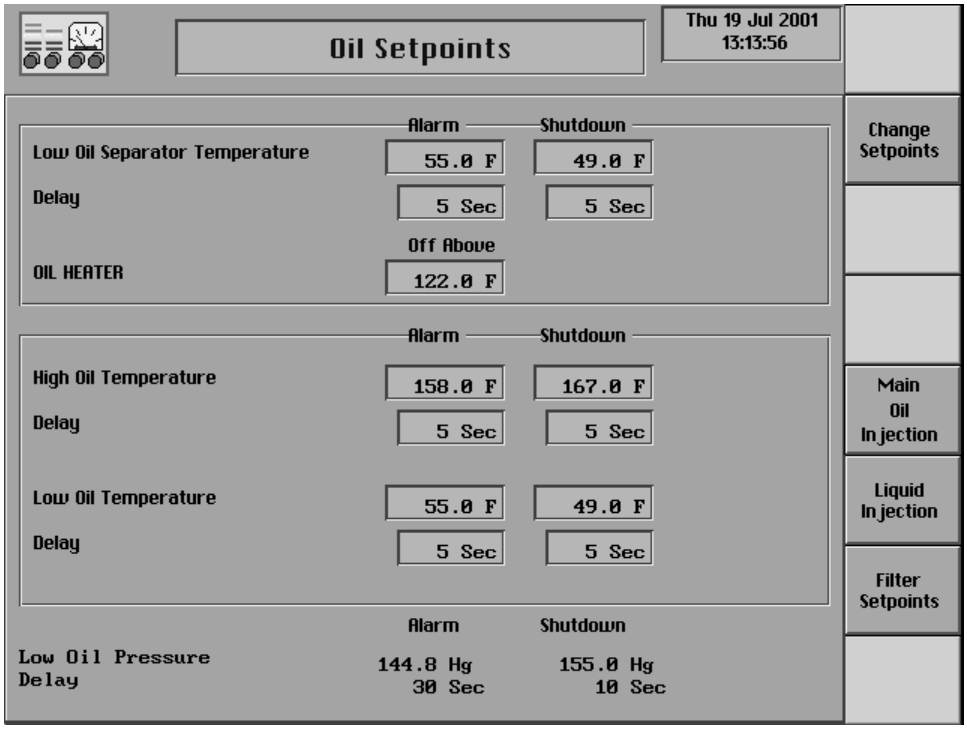
Service Factor
Current Unbalance Alarm Level
Current Unbalance Alarm Delay
RTD Temperature Alarm Level
RTD Temperature Alarm Delay

Alarms and trips (shutdowns) that are recorded by the DBS are shown on the “RAM DBS Motor Starter” display but must be cleared from the “Alarms / Shutdowns” display.

The following special selection is on this display:

- Fault History - This selection displays the “RAM DBS Motor Starter” display with the fault history of the RAM DBS system

CONTROL SETUP - ”OIL SETPOINTS” DISPLAY



The following oil separator setpoints are on this display:

Low Oil Separator Temperature Alarm - If the oil separator temperature is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Oil Separator Temperature Shutdown - If the oil separator temperature is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Low Oil Separator Temperature Alarm Delay - The minimum time in seconds that the oil separator temperature is less than or equal to the low oil separator temperature alarm setpoint before notification of the alarm.

Low Oil Separator Temperature Shutdown Delay - The minimum time in seconds that the oil separator temperature is less than or equal to the low oil separator shutdown setpoint before the compressor will shut down.

Oil Heater Off Above - While the compressor is not running, the oil separator heater(s) will be turned off if the temperature is greater than or equal to this setpoint; however, if the temperature is 1 °C below this setpoint the oil separator heater(s) will be turned on. If the compressor is running, the oil heater(s) are turned off.

The following oil setpoints are on this display:

High Oil Temperature Alarm - If the oil temperature is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Oil Temperature Shutdown - If the oil temperature is greater than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

High Oil Temperature Alarm Delay - The minimum time in seconds that the oil temperature is greater than or equal to the high oil temperature alarm setpoint before notification of the alarm.

High Oil Temperature Shutdown Delay - The minimum time in seconds that the oil temperature is greater than or equal to the high oil temperature alarm setpoint before the compressor will shut down.

Low Oil Temperature Alarm - If the oil temperature is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Oil Temperature Shutdown - If the oil temperature is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Low Oil Temperature Alarm Delay - The minimum time in seconds that the oil separator temperature is less than or equal to the low oil separator alarm setpoint before notification of the alarm.

Low Oil Temperature Shutdown Delay - The minimum time in seconds that the oil separator temperature is less than or equal to the low oil separator shutdown setpoint before the compressor will shut down.

The following displayed oil setpoints can not be modified:

Low Oil Pressure Alarm - If the oil pressure is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Oil Pressure Shutdown - If the oil pressure is less than or equal to this setpoint, for the shutdown time delay, the compressor will shutdown.

Low Oil Pressure Alarm Delay - The minimum time in seconds that the oil pressure is less than or equal to the low oil pressure alarm setpoint before notification of the alarm.

Low Oil Pressure Shutdown Delay - The minimum time in seconds that the oil pressure is less than or equal to the low oil pressure shutdown setpoint before the compressor will shut down.

The Low Oil Pressure Alarm and Shutdown is determined by the type of pump and its running mode, and from the pressure differential of the oil pressure reading above or below the discharge pressure reading. The following tables show the setup of the oil setpoints that are only modified in Factory Setup for rare and special situations:

Running Full Lube Pump and Running Cycling Pump
oil pressure - discharge pressure = oil pressure differential

	Alarm	Shutdown
Oil Pressure Differential	10 PSID	5 PSID
Time Delay	30 sec.	10 sec.

Other Manufacture's Compressor Pump (Full Lube)
oil pressure - discharge pressure = oil pressure differential

	Alarm	Shutdown
Oil Pressure Differential	25 PSID	20 PSID
Time Delay	5 sec.	5 sec.

Not Running Prelube Pump and Not Running Cycling Pump
discharge pressure - oil pressure = oil pressure differential

RWB II	Alarm	Shutdown
Oil Pressure Differential	25 PSID	30 PSID
Time Delay	30 sec.	10 sec.

RXF and RXB	Alarm	Shutdown
Oil Pressure Differential	35 PSID	40 PSID
Time Delay	30 sec.	10 sec.

Additional low oil pressure alarm and shutdown if:

Not Running Prelube Pump
oil pressure - suction pressure = oil pressure differential

	Alarm	Shutdown
Oil Pressure Differential	10 PSID	7 PSID
Time Delay	30 sec.	10 sec.

Additionally a safety check is made for low oil flow that will stop the compressor from loading or force the compressor to unload. This check is made only for a RWB with prelube or a RXB with no pump:

- If [oil pressure <= (1.5 x suction pressure) + 10 lb.] then the compressor will be forced to unload to 50% slide valve. If this condition is reached the message "Forced Unload - Low Oil Flow" is shown on the "Operating Status" display.

- If [oil pressure <= ((1.5 x suction pressure) + 15 lb.) and (slide valve >= 48 %)] then the compressor will be prevented from further loading. If this condition is reached the message "Stop Load - Low Oil Flow" is shown on the "Operating Status" display.

The following special selections are on this display:

[Main Oil Injection] - This selection is only available if it was enabled in Factory Setup. The following oil setpoints are on this display:

On at Discharge Temperature - If the high stage compressor is running and the discharge temperature is greater than or equal to this setpoint, for the time delay, the Main Oil Injection Discharge Temperature output on digital board #2 is energized.

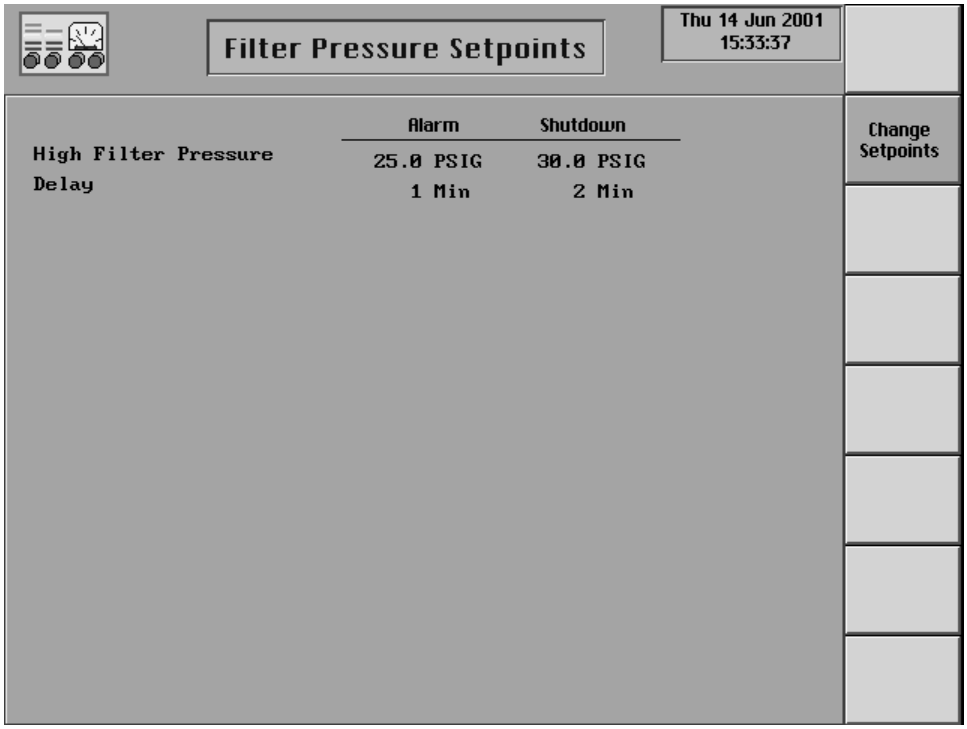
Delay - The minimum time in seconds that the discharge temperature is less than or equal to the "On at Discharge Temperature" setpoint before the Main Oil Injection Discharge Temperature output on digital board #2 is energized.

[Liquid Injection] - This selection is only available if the compressor has liquid injection oil cooling and it was enabled through Factory Setup. This selection displays the "Liquid Injection Cooling" display. Liquid injection controls the supply of liquid refrigerant to the compressor. Liquid injection is off (the solenoid is closed) if the compressor is off. This display has the following setpoints:

Oil Temperature On at - While the compressor is running, if the oil temperature equals or exceeds this setpoint, for the delay time, the liquid injection output will be energized or turned on to open a liquid valve. If the output is energized it will be de-energized or turned off, if the oil temperature is 1 °C below this setpoint.

Oil Temperature Delay - The minimum time in seconds that the oil temperature is greater than or equal to the oil temperature "On at" setpoint when the compressor is running, before the liquid injection output is turned on.

[Filter Setpoints] - This selection is only available if the compressor has an oil filter and it was enabled through Factory Setup. This selection displays the "Filter Pressure Setpoints" display. The filter pressure value equals the filter pressure reading minus the oil pressure reading, with only one exception that is if the pump is a prelube and liquid injection is enabled; then, the filter pressure value equals the discharge pressure reading minus the oil pressure reading.



This display has the following setpoints:

High Filter Pressure Alarm - If the filter pressure is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Filter Pressure Shutdown - If the filter pressure is greater than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

High Filter Pressure Alarm Delay - The minimum time in seconds that the filter pressure is greater than or equal to the high filter pressure alarm setpoint before notification of the alarm.

High Filter Pressure Shutdown Delay - The minimum time in seconds that the filter pressure is greater than or equal to the high filter pressure shutdown setpoint before the compressor will shut down.

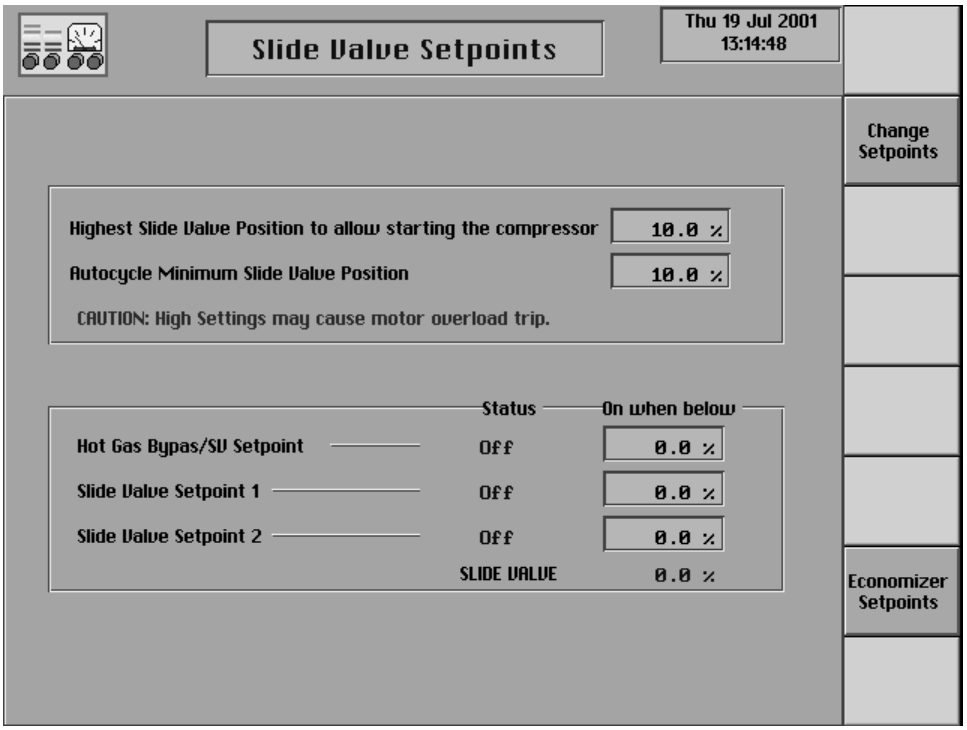
Overview of the Oil Pump Operation

A prelube pump is always turned on during compressor start. While the compressor is running the prelube pump is turned off. A full time pump is always turned on while the compressor is starting and running. A cycling pump is always turned on during compressor start. The cycling pump is cycled on and off while the compressor is running in response to the pressure differential calculation. The differential equals the discharge pressure reading minus the suction pressure reading. If the differential is less than or equal to 45 lb, the pump is turned on. If the differential is greater than 50 lb, the pump is turned off.

During the compressor stop cycle, the oil pump is used for a postlube operation that is performed to help unload the slide valve. During the postlube, the oil pump will be turned on for five minutes or until the slide valve is unloaded to or below the "Highest slide valve position to allow starting the compressor" setpoint. The compressor can not be restarted unless the slide valve is less than the "Highest slide valve position to allow starting the compressor" setpoint. If the slide valve does not unload below this setpoint within five minutes, the alarm message "Compressor Unload Failure - Alarm" is issued.

Dual pumps are enabled in Factory Setup. The lead pump is the pump selected to be the first pump to run. If the lead pump

CONTROL SETUP - ”SLIDE VALVE SETPOINTS” DISPLAY



has a pump auxiliary failure, an alarm message is issued and the other pump will be turned on. If the compressor has a “Low Oil Pressure Alarm” failure, the second pump will be turned on; then after a 30 seconds delay, the lead pump will be turned off. If while the compressor is running the second pump has an auxiliary failure or low oil pressure is encountered, a shutdown message and action is issued.

The “Slide Valve Setpoints” display is shown if it applies to this compressor model (Reference “Compressor Model Differences”). The following slide valve setpoints are on this control setpoint display:

Highest Slide Valve Position to allow Compressor Start - If the slide valve is above this slide valve position the compressor will not be allowed to start.

Minimum Slide Valve Position when in Autocycle - If automatic cycling (autocycle) is active, this is the slide valve position a running compressor will not unload below. This setpoint is useful for pumping down the refrigerant in a system.

Note the warning that says: “CAUTION: High settings may cause motor overload trip.”

Note: During the compressor stopping, the slide valve unload solenoid remains energized until the slide valve is unloaded to or below the “Highest slide valve position to allow starting the compressor” setpoint. If the slide valve does not unload below this setpoint within 5 minutes, the alarm message “Compressor Unable to Unload - Alarm” is issued.

The Hot Gas Bypass and Slide Valve Setpoints digital outputs are displayed on the slide valve setpoints display if it applies to this compressor model (Reference “Compressor Model Differences”) and if “Hot Gas Bypas/SV Setpoint” was enabled in Panel Setup. The on or off status of the outputs and the setpoint will be shown. The following outputs are used as an indicator of a slide valve position:

Hot Gas Bypass/Slide Valve Setpoint - This output is intended to be used for either Hot Gas Bypass control or as an indication of a slide valve position.
Slide Valve Setpoint 1
Slide Valve Setpoint 2

The following setpoint for the digital output is provided:

On when below - The digital output is turned on when the slide valve position is below this setpoint and turned off when the slide valve position equals or exceeds this setpoint.

The following special selection is on this display:

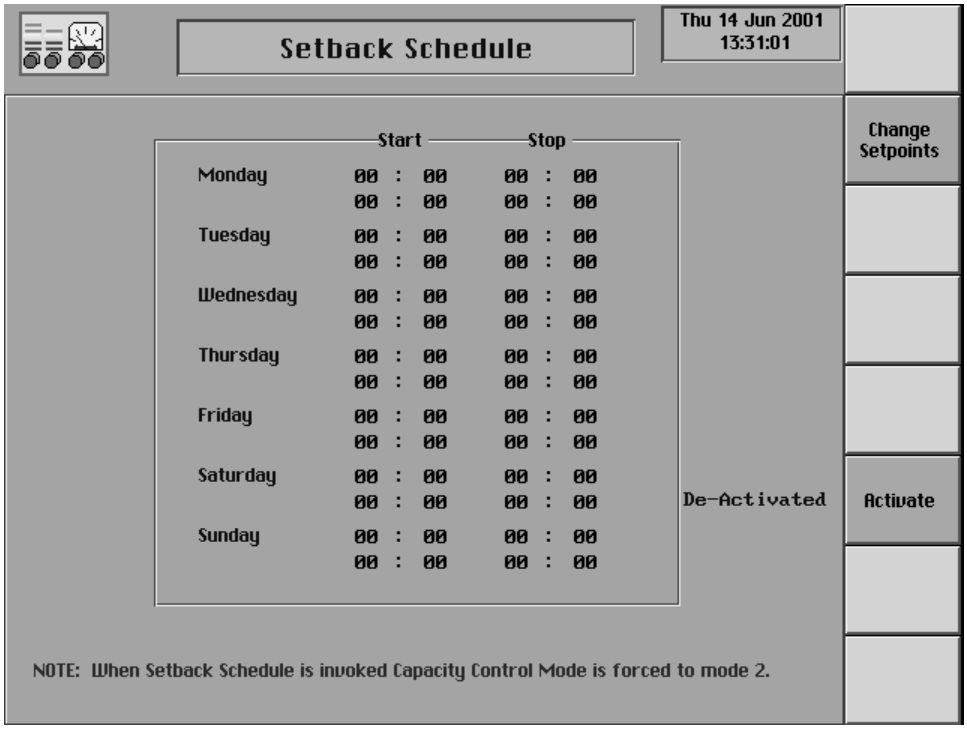
[Economizer Setpoints] - The following slide valve position setpoints are on this display:

On when above - The Economizer digital output (module 11on digital board #1) is turned on when the slide valve position is greater than this setpoint.

Off when below - The Economizer digital output (module 11on digital board #1) is turned off when the slide valve position goes below this setpoint.

Note: These setpoints are active only when the compressor is running.

CONTROL SETUP - ”SETBACK SCHEDULE” DISPLAY



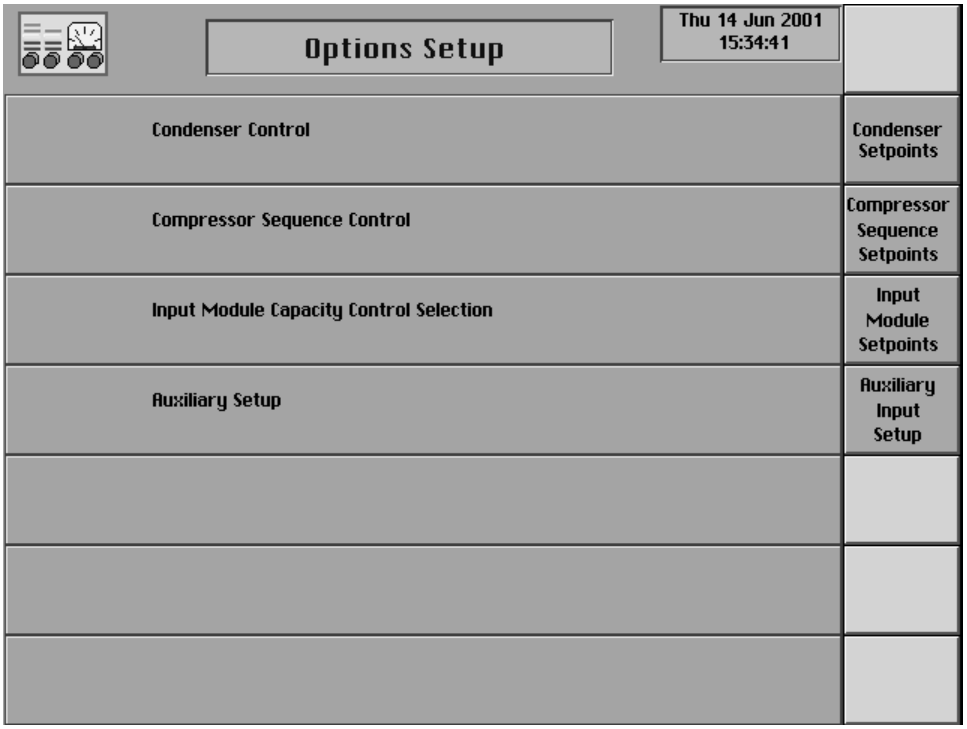
Setback is another set of capacity control setpoints (mode 2) that is initiated and removed by time of day. Setback can be used to save energy. At night or on weekends, when room doors are kept closed, a higher temperature can be set to reduce energy consumption.

This display shows a time schedule. Two different start and stop times can be entered for each day of the week. The setback schedule is only effective if the compressor is in automatic. The setback schedule must be activated to switch the presently active capacity control mode to the mode 2 (setback) setpoints at the start time. At the stop time the control mode is returned to the mode 1 (normal) setpoints. An entry of 00:00 will void the time entry field. If setback is required at midnight (00:00) use 00:01. The following are descriptions of the setpoints:

Start - time of day to switch to the mode 2 (setback) setpoints of the active capacity control.

Stop - time of day to return to the mode 1 (normal) setpoints of the active capacity control.

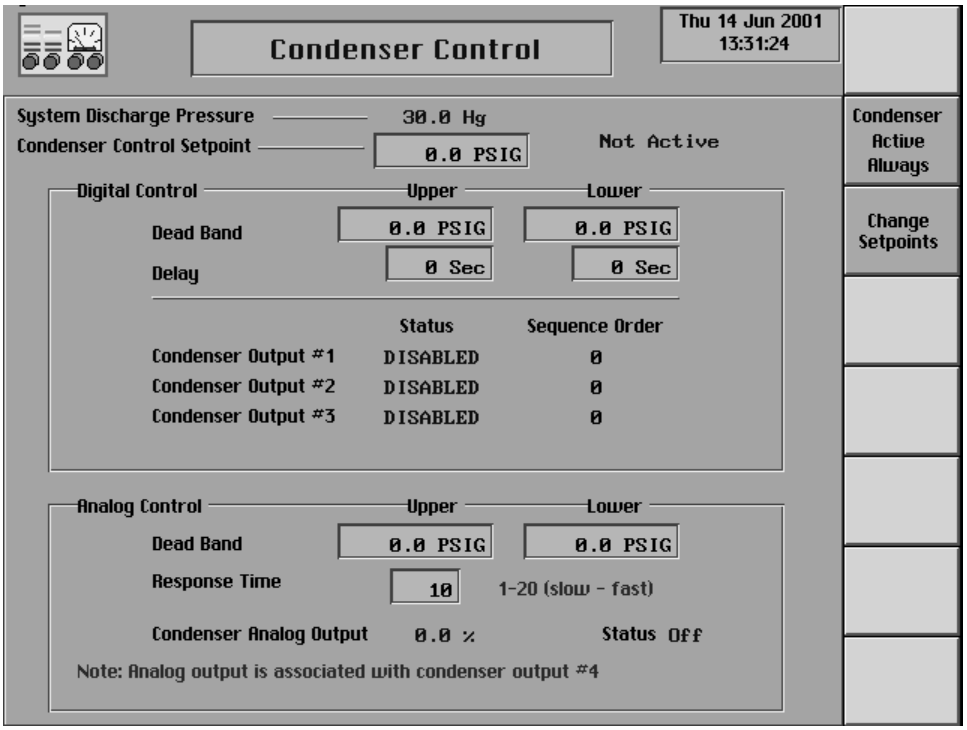
CONTROL SETUP - ”OPTIONS SETUP” DISPLAY



Options that were enabled in Panel Setup, are shown. The following displays are possible:

- Condenser Control
- Compressor Sequence Control or Compressor Interlock
- Input Module Capacity Control Selection
- Auxiliary Setup
- Suction Pull Down

CONTROL SETUP - OPTIONS SETUP - ”CONDENSER CONTROL” DISPLAY



The “Condenser Control” display is shown if a type of “Condenser Control” was selected in Panel Setup. Only the setpoints of the selected condenser control will show. Sequence setpoints are based on the system discharge pressure, analog channel 11. An additional pressure sensor for system discharge is required. The discharge level the condensers are operating on has its own pressure to maintain. The control system maintains discharge pressure by sequencing the condenser devices. Digital control is used to turn on and off the condenser digital outputs. Analog control is used to vary the analog signal of the condenser analog output.

This setpoint is required for both Digital and Analog Control:

Condenser Control Setpoint - This is used to control the sequencing on and off of the condenser digital outputs and/or the signal strength of the condenser analog output.

A Digital Control data box is shown if digital control is selected. The status of the condenser outputs is shown:

- On - This output is energized.
- Off - This output is de-energized.
- Disabled - A zero (0) has been entered for the sequence order which disables this output from being turned on.

The digital control settings on this display are useful for sequencing condenser fans and pumps. The following set points are required:

Upper Dead Band - A discharge pressure band above the condenser control setpoint at which the condenser digital outputs will neither be turned on or turned off.

Lower Dead Band - A discharge pressure band below the condenser control setpoint at which the condenser digital outputs will neither be turned on or turned off.

Upper Delay - The minimum time in seconds that the system discharge pressure must be at or above the condenser control setpoint plus the upper dead band before an output is turned on. This timer is used to allow the system to respond to the change in the amount of condensing. If the pressure falls below this pressure for any reason at any time, the start time delay will be reset to start counting again if needed.

Lower Delay - The minimum time in seconds that the system discharge pressure must be at or below the condenser control setpoint minus the lower dead band before an output is turned off. This timer is used to allow the system to respond to the change in the amount of condensing. If the pressure rises above this pressure for any reason at any time, the start time delay will be reset to start counting again if needed.

Sequence Order - A numerical number will indicate the order in which the condenser output is turned on. Sequencing starts from 1 and goes up in numerical order. Stopping of condenser devices is in reverse order of the starting. The number zero (0) should be entered to disable that device from being sequenced on. A condenser output that is given a zero (0) will be immediately turned off. The following condenser outputs require a setpoint for a sequence position:

- Condenser Output #1
- Condenser Output #2
- Condenser Output #3
- Condenser Output #4 - If digital control is selected and analog control is not selected, this output can be sequenced using the digital control setpoints. When analog control is selected, this output is associated with it.

An Analog Control data box is shown if analog control is selected. The status of condenser output #4 is shown in the analog data box along with the relative percent value of the analog output signal.

The following analog control settings are required:

Upper Dead Band - A discharge pressure band above the condenser control setpoint at which the condenser analog output signal will neither be increased or decreased.

Lower Dead Band - A discharge pressure band below the condenser control setpoint at which the condenser analog output signal will neither be increased or decreased.

Response Time - A response time of 1 to 20 refers to the relative time in seconds it takes to raise the analog signal to its maximum output if the system discharge pressure is greater than or equal to the condenser control setpoint plus the analog control upper dead band. The response time is also used as the relative time in seconds it takes to lower the analog signal to its minimum output if the system discharge pressure is less than or equal to the condenser control setpoint minus the analog control lower dead band. A response time of 1 is the slowest and 20 is the fastest.

A toggle key is provided that changes when the condenser control is active:

[Condenser Active Always] - Selects the condenser control to be active always even when the compressor is not running.

[Condenser Active Running] - Selects the condenser control to be active only when the compressor is running.

[Not Active] - Selects the condenser control to be currently not active.

Digital Condenser Control

The following is a description of the condenser control logic when only digital condenser control is enabled.

If the system discharge pressure is above the condenser control setpoint the following is repeated until all condenser outputs are turned on:

1. If the system discharge pressure continues to rise and is greater than or equal to the condenser control setpoint plus the digital control upper dead band, then the next condenser output is turned on. When a condenser output is turned on, the upper delay time is used to set a timer that must time out before the next condenser output will be turned on.

If the system discharge pressure is below the condenser control setpoint the following is repeated until all condenser outputs are turned off:

1. If the system discharge pressure continues to fall and is less than or equal to the condenser control setpoint minus the digital control lower dead band, then the last condenser output that is on, is turned off. When a condenser output is turned off, the lower delay time is used to set a timer that must time out before the next condenser output will be turned off.

Analog Condenser Control
The following is a description of the condenser control logic when only analog condenser control is enabled.

If the system discharge pressure is above the condenser control setpoint:

1. If the system discharge pressure is greater than or equal to the condenser control setpoint plus the analog control upper dead band, then condenser output #4 is turned on (if it is not already on) and the analog output signal is increased using the response time.

If the system discharge pressure is below the condenser control setpoint:

1. If the system discharge pressure continues to fall and is less than or equal to the condenser control setpoint minus the analog control lower dead band, then the analog output signal is decreased using the response time. When the signal reaches its minimum output, condenser output #4 is turned off.

Digital and Analog Condenser Control
The following is a description of the condenser control logic when digital and analog condenser control is enabled.

If the system discharge pressure is above the condenser control setpoint the following is repeated until all condenser outputs are turned on:

1. If the system discharge pressure is greater than or equal to the condenser control setpoint plus the analog control upper dead band, then condenser output #4 is turned on (if it is not already on) and the analog output signal is increased using the response time.

   Note: Condenser output #4 must first be turned on before the other condenser digital outputs are allowed to be turned on.

2. If the system discharge pressure continues to rise and is greater than or equal to the condenser control setpoint plus the digital control upper dead band, then the analog output signal is quickly decreased to the minimum signal and the next condenser output is turned on. When a condenser output is turned on, the upper delay time is used to set a timer that must time out before the next condenser output will be turned on.

If the system discharge pressure is below the condenser control setpoint the following is repeated until all condenser outputs are turned off:

1. If the system discharge pressure continues to fall and is less than or equal to the condenser control setpoint minus the analog control lower dead band, then the analog output is decreased using the response time. When all the condenser outputs are off then condenser output #4 is turned off.

2. If the system discharge pressure continues to fall and is less than or equal to the condenser control setpoint minus the digital control lower dead band, then the analog output signal is quickly increased to the maximum signal and the last condenser output that is on, is turned off. When a condenser output is turned off, the lower delay time is used to set a timer that must time out before the next condenser output will be turned off.

CONTROL SETUP - OPTIONS SETUP - "COMPRESSOR SEQUENCE CONTROL" (MODE 1) DISPLAY

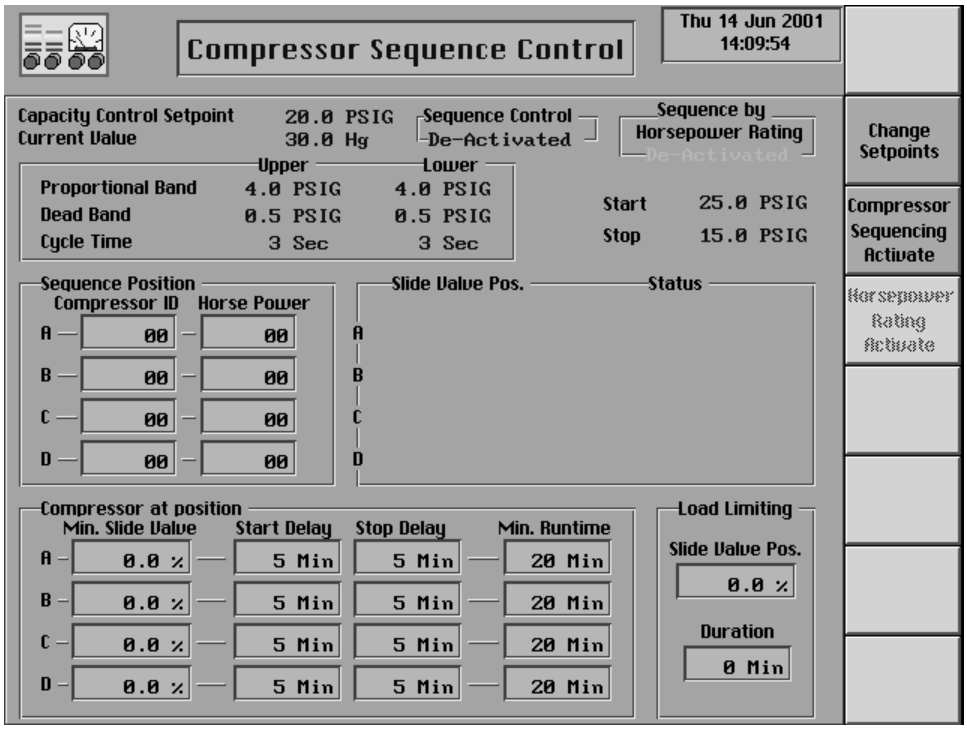
The "Compressor Sequence Control" display is shown if it was selected as an option in Panel Setup. For quick access to this display there is a **[Compressor Sequence Setpoints]** screen key on the "Operating Status -2" display. This sequencing is intended for compressors that are operating to maintain the same capacity control setpoint. The settings on this display are used to sequence the compressors when a compressor is in the remote start mode of operation and in remote slide valve mode and available to run (not in shutdown/cutout or recycle delay). This sequence control is only used for compressors with a variable slide valve and will work with existing Frick RWB, RXB, and RXF panels. Serial communication using the Com-1 port is used for this sequencing. See wiring diagrams for Quantum multicompressor sequencing (drawing nos. 640A0042 and 640A0050)

The setpoints that are currently being used for capacity control are only shown here for referencing. These setpoints are taken from the active capacity control settings at the panel where compressor sequencing is activated. "Current Value" is the current or actual reading of the pressure or temperature process variable that was chosen as the capacity control method. Compressor Sequencing can be enabled from panel setup and entered on more than one panel. However, for proper control, only the Compressor Sequencing settings at one panel should be made active. The following describes how compressor sequencing uses the capacity control setpoints:

Capacity Control - This is the reading which the control sequence will attempt to maintain for the indicated process. This setpoint is used to control the loading and unloading of the compressors.

The Proportional Band setpoint determines a range of capacity control values where proportionally timed pulsed output is used. Beyond the proportional band the output is continuously energized. The length of time the output will be pulsed-on is proportional to the distance from the "Current Value" to the capacity control setpoint. The further the distance from setpoint, the longer the output is pulsed on and the shorter the output is off. The closer the distance to

"COMPRESSOR SEQUENCE CONTROL" (MODE 1) DISPLAY



setpoint, the shorter the output is pulsed on and the longer the output is off. If the actual reading is midway from setpoint, the output is on and off an equal amount of time. (See "Cycle Time").

Upper Proportional Band - A band, measured in the units of the capacity control setpoint, above the upper dead band, where proportional load control is used. If the actual reading rises into this proportional band, the load output will be pulsed as explained above in the description about proportional band. When in this band the control system will begin the process of starting compressors. Previously started compressors must be loaded greater than 90% slide valve before starting a new compressor.

Lower Proportional Band - A band, measured in the units of the capacity control setpoint, below the lower dead band, where proportional unload control is used. If the actual reading falls into this proportional band, the unload output will be pulsed as explained above in the description about proportional band.

Upper Dead Band - A band, measured in the units of the capacity control setpoint, above the setpoint at which the compressor will neither load nor unload.

Lower Dead Band - A band, measured in the units of the capacity control setpoint, below the setpoint at which the compressor will neither load nor unload.

The Cycle Time setpoint determines the amount of time the output is on and off, when in the proportional band. At the completion of the cycle time, the actual reading and necessary response is reevaluated. If a 4 second period is selected, then the following will result:

Proportional Distance Actual Reading is From Setpoint	Output Pulsed On (Seconds)	Output Off (Seconds)
0	0	4
1/4	1	3
1/2	2	2
3/4	3	1
1	4	0

Upper Cycle Time - This setpoint determines the amount of time in seconds that the load output is on and off, when in the upper proportional band. Refer to the above description about cycle time.

Lower Cycle Time - This setpoint determines the amount of time in seconds that the unload output is on and off, when in the lower proportional band. Refer to the above description about cycle time.

Start - A compressor is started at this setpoint. This is the "Start Autocycle" setpoint of the active capacity control. A compressor is started at this setpoint during compressor sequencing.

Stop - A compressor is stopped at this setpoint. This is the "Stop Autocycle" setpoint of the active capacity control. A compressor is stopped at this setpoint during compressor sequencing.

The load limiting setpoints are used if no compressors are running and the equalized system is to be slowly pulled down to normal. These setpoints limit the compressor loading when first starting a compressor:

Slide Valve Position - the slide valve position setpoint that the control system will hold the slide valve until the duration timer has timed out.

Duration Time - the amount of time in minutes to hold the compressor at the "Load Limiting Slide Valve Position" setpoint. If load limiting is not desired, set this time to zero (0).

When the first compressor is started, the sequence will allow that compressor to load up to the "Slide Valve Position" setpoint and hold the compressor at this setpoint until the "Duration Time" has timed out or the current reading of the process variable falls below the "Start" setpoint.

The following set points are required for each compressor on the suction level:

(A - D) Compressor ID - A through D represent the sequence position. Any machine can be set for any sequence position. The letter determines the starting order of the compressors, position A is the first position. If the "Start" setpoint is maintained, the lead or first machine started, will always load up first and then the next sequence position on up as they are needed. The stopping of compressors is done in the reverse order of the starting. The compressor ID# should be entered in the proper sequence position for the suction level it is located on. Each compressor must have a unique ID# entered at their control panel. A zero (0) disables or removes a compressor ID from being sequenced.

Unload Minimum Slide Valve Position - This is the slide valve position a compressor will be allowed to unload to. The compressors will unload to the minimum slide valve position for that machine, when the reading is below the capacity control lower deadband. This set point is only used if more than one compressor is running. When only one compressor is running it is allowed to fully unload. This set point can prevent short cycling of compressors in the unload sequence. Short cycling occurs when a compressor is stopped and the current reading quickly rises and an already running compressor is unable to compensate because it is running at full load, so a compressor is cycled back on very shortly after a compressor was stopped. A screw compressor has some minimum built-in capacity that cannot be shed, generally in the range of 10-15% of full load capacity, when the compressor is stopped the control system needs to compensate for this loss. If a compressor that is running at full load is allowed to unload to a minimum slide valve position, this compressor will then be able to compensate for the extra load that occurs when another compressor is stopped.

The computer will not unload a compressor below this set point during normal system operation. For example, if compressor "A" is running at 100 % capacity and compressor "B" is running and has been unloaded to the minimum slide valve position, "B" is still contributing somewhat to the capacity. To take "B" off line would be to lose approximately 10% of the total capacity. If "A" was already loaded to 100% capacity, it would not be able to load to compensate for losing the 10% "B" dropped off. The current reading would rise and "B" would be cycled on again. If the current reading remains low (below the lower deadband) for the predetermined time (stop time delay), "B" will then stop. "A" will have sufficient reserve capacity to maintain the loss of "B". The control of this set point is in percentage of slide valve, not compressor capacity. With some experimentation, it is possible to find the right value for the minimum slide valve position set points that neither undercompensate for the built-in capacity, resulting in short cycling of the compressors, nor overcompensates for the built-in capacity, resulting in inefficient operation (where the sum of the capacity of the compressors that are running is significantly less than the full load capacity of the next compressor in the unload sequence).

Start Time Delay - The minimum time in minutes that the current reading must be at or above the "Start" setpoint before a compressor will start. This timer helps prevent cycling compressors on and off due to short sudden changes in load within the system. If the current reading falls below the "Start" setpoint for any reason at any time, the start time delay will be reset to start counting again if needed. When a compressor is starting, the start time delays will be reset to start counting again if needed for a next compressor.

Stop Time Delay - The minimum time in minutes that the current reading must be at or below the "Stop setpoint before a compressor will stop. This timer helps prevent cycling compressors on and off due to short sudden changes in load within the system. If the current reading rises above the "Stop" setpoint for any reason at any time, the stop time delay counter will be reset to start counting again if needed. When a compressor is stopping, the stop time delays will be reset to start counting again if needed for a next compressor.

Minimum Run Time - the minimum time in minutes that the compressor must run before it is allowed to stop. This time should be as long as the recycle delay time. If the compressor has run out its recycle delay time and is turned off it will still be available to run as soon as required.

A toggle key is provided for compressor sequencing:

[Activate] - Selects the compressor control to be currently active.

[De-Activate] - Selects the compressor control to be currently not active.

Note: Only one panel should have compressor sequencing active.

Compressor Sequence Status
The active capacity control setpoints and capacity control reading are only shown here for referencing.

The following data is displayed for each compressor to be sequenced:

- Slide Valve %
- Slide Valve Status - One of the following could be shown:
  - Load - Indicates the compressor is being told to load.
  - Unload - Indicates the compressor is being told to unload.
  - Idle - Indicates the compressor is neither being told to load or unload.

  NOTE: The displayed status does not necessarily reflect the current solenoid status.
- Sequence Status - One of the following text strings could be shown:
  - Off in Remote Start
  - Off in Manual Start
  - Off in Autocycle Start
  - Off in Recycle Delay
  - Shutdown
  - Running in Remote Start
  - Running in Manual Start
  - Running in Autocycle Start
  - Not Communicating
  - Not in Remote Start
  - Slide Valve not in Remote
  - Unable to Start
  - Starting

COMPRESSOR SEQUENCE OVERVIEW

The above settings are used to sequence the selected compressors. Only a compressor that is in both remote compressor mode and remote slide valve mode will be started, stopped, loaded or unloaded using this sequence control. If one of these compressors is failed, shutdown (cutout), in recycle delay, or unable to communicate, that compressor will be skipped and the next compressor in the sequence (if there is one) will be controlled.

Compressor sequencing allows for staging the compressors in an energy efficient method and provides a smooth transition from one compressor to another, while also giving operator flexibility.

The deadband determines how quickly the system will respond to a change in the process. For an example, a booster compressor might have a deadband of 0.5 PSIG for a quicker response than the high stage compressor with a deadband of 1.0 PSIG.

The proportional band and the cycle time determine how smoothly the compressor loads or unloads and can be used to prevent overshooting the process setpoint.

Lowering the “Unload Minimum Slide Valve Position” setpoint, or lengthening the “Stop Time Delay”, or lengthening the “Minimum Run Time” can be used to prevent a compressor from cycling off and on too quickly.

The refrigeration load refers to the demand for loading of compressors to reduce the rise in capacity that has resulted from an increased need for refrigeration in the plant. When the load rises, this means the capacity has risen. When the load falls, this means the capacity has fallen. Compressors need to load if the “Current Value” is greater than or equal to the “Capacity Control” setpoint plus the “Upper Dead Band” setpoint and they need to be unloaded if the “Current Value” is less than or equal to the “Capacity Control” setpoint minus the “Lower Dead Band” setpoint.

When starting a compressor, a start command is sent from the panel that has compressor sequencing activated to the selected compressor every 30 seconds for 3 minutes. Should the compressor not start in that time period, the sequence status message “Unable to Start” is shown. If this occurs, the next compressor in the sequence (if there is one) will be sent the start command when it’s “Start Delay” times out. The “Unable to Start” message will clear after a time delay. The time delay is based on the worst case situation which requires 3 minutes for each available compressor. If there are 4 compressors, the delay will be 12 minutes. When this message is cleared, the compressor is again available for sequencing.

The following is an example of sequencing compressors:

On System Start-up - The first available compressor in the order of “A”, “B”, “C”, and “D” will start if the capacity is greater than or equal to the “Start” setpoint for it’s “Start Delay” time period. If “A” is not available then “B” will start when it’s “Start Delay” has timed out. If “B” is not available then “C” will start when it’s “Start Delay” has timed out. If “C” is not available then “D” will start when it’s “Start Delay” has timed out.

On an initial or cold start-up (no compressors are running) and “Load Limiting” has been enabled, then the first compressor started will load to the “Load Limiting Slide Valve Position” setpoint and remain there until the “Load Limiting Duration Time” has timed out or until the current reading of the process variable falls below the “Start” setpoint.

Load Rises - If the current reading continues to be greater than or equal to the “Capacity Control” setpoint plus the “Upper Dead Band” setpoint, then the first compressor in the order of “A”, “B”, “C”, and “D” that is running will be loaded to 100%, followed by the next running compressor in the sequencing. When at 100%, the load signal will be sent to that compressor every minute to ensure the compressor remains fully loaded.

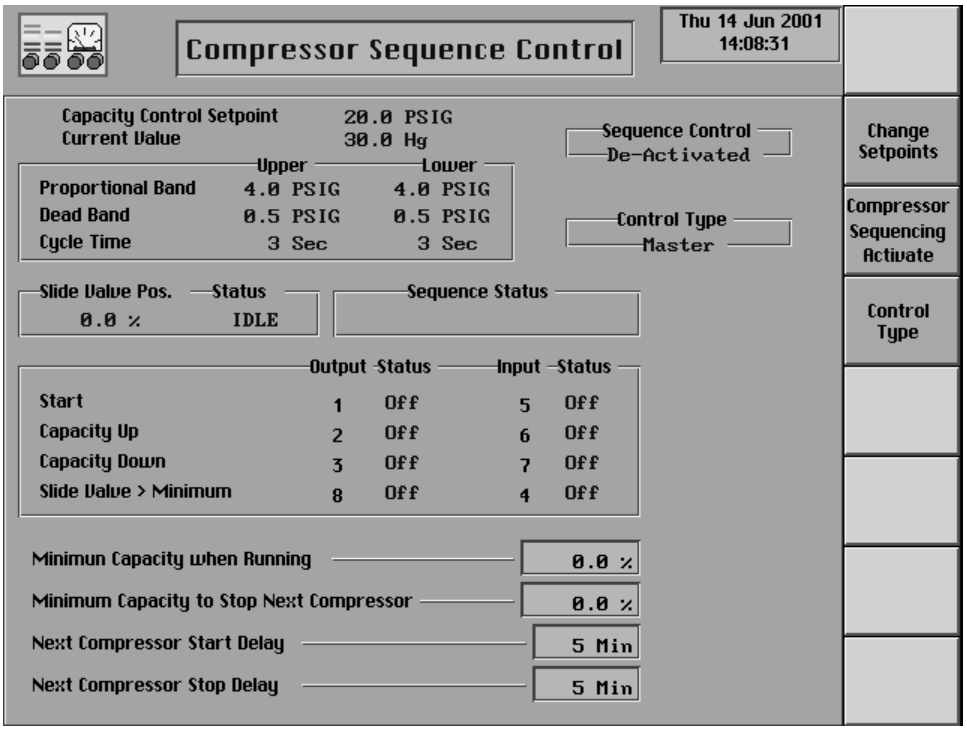
If all running compressors are loaded greater than 90% slide valve position, then the next available compressor in the order of “A”, “B”, “C”, and “D” will be started if the current reading of the process variable is greater than the “Start” setpoint for it’s “Start Delay” time.

Load Falls - If the current reading of the process variable falls to or below the “Stop” setpoint, then the last compressor in the order of “A”, “B”, “C”, and “D” that is running will be unloaded to its “Min. Slide Valve Position” setpoint, followed by the next running compressor in reverse sequencing. For example, if “A” and “B” are running, “B” is unloaded to it’s “Min. Slide Valve Position” setpoint and then “A” is unloaded to it’s “Min. Slide Valve Position” setpoint.

Only the last two running compressors may unload to their “Min. Slide Valve Position” setpoint while any other running compressor will remain loaded. If a running compressor drops below its “Min. Slide Valve Position” setpoint, it will be given a load pulse every 15 seconds to bring it back to the “Min. Slide Valve Position”. If more than one compressor is running and the compressors have unloaded to their “Min. Slide Valve Position” setpoint, then the last compressor in the sequence will be stopped if the “Current Value” is less than the “Stop” setpoint for the “Stop Delay” time and the compressor has run for longer than it’s “Min. Run Time” setpoint.

If only one compressor is running, then this compressor may unload completely and stop when the current reading of the process variable is less than the “Stop” setpoint.

CONTROL SETUP - OPTIONS SETUP - ”COMPRESSOR SEQUENCE CONTROL” (MODE 2) DISPLAY



This display is shown if the Compressor Sequencing Mode 2 option was selected in Panel Setup. This option is not applicable for standard Frick products. It is only available for Gram compressors. Compressor Sequencing setpoints are based on the suction level that the compressors to be sequenced are operating on. The compressors must be on the same suction level because each suction level has its own settings to maintain. The settings on this display are used to sequence the compressors when a compressor is in the remote mode of operation and in remote slide valve mode and not in shutdown. This sequence control is only used for compressors with a variable slide valve. The panels selected for compressor sequence control mode 2 must be connected via the proper hardware connection.

Compressor Sequence Status
The active capacity control setpoints and capacity control reading are shown here for referencing.

The following data is displayed for this compressor:

- Sequence Control:
  - **Activated** - This compressor is being controlled from the “Compressor Sequencing Mode 2” control logic.
  - **De-Activated** - This compressor is not being controlled from the “Compressor Sequencing Mode 2” control logic.

- Control Type:
  - Leader - The panel is selected as the Leader for compressor sequencing control. The Leader is able to control one or more subsequent Followers.
  - Follower - This panel is selected as a Follower for com-pressor sequencing control. The Followers will be controlled by the setpoint of the Leader.
- Slide Valve Pos. - The actual % reading of the slide valve position.
- Slide Valve Status - One of the following could be shown:
  - Load - Indicates the compressor is being told to load.
  - Unload - Indicates the compressor is being told to unload.
  - Idle - Indicates the compressor is neither being told to load or unload.
- Sequence Status - One of the following text strings could be shown:
  - Off in Remote Start
  - Off in Manual Start
  - Off in Autocycle Start
  - Off in Recycle Delay
  - Shutdown
  - Running in Remote Start
  - Running in Manual Start
  - Running in Autocycle Start
  - Not in Remote Start
  - Slide Valve not in Remote
- Output Status (Digital Board 2):
  - Start (Output 1) - This output is energized to signal the next panel to start the compressor. This output is de-energized to signal the next panel to stop the compressor.
  - Capacity Up (Output 2) - This output is energized to signal the next panel to load the compressor.
  - Capacity Down (Output 3) - This output is energized to signal the next panel to unload the compressor.
  - Slide Valve > Minimum (Output 8) - This output is energized to signal the previous panel that the Follower's slide valve reading is above the "Minimum Capacity when Running" setpoint.
- Input Status (Digital Board 2):
  - Start (Input 5) - This input is energized to signal this panel to start the compressor. This input is de-energized to signal this panel to stop the compressor.
  - Capacity Up (Input 6) - This input is energized to signal this panel to load the compressor.
  - Capacity Down (Input 7) - This input is energized to signal this panel to unload the compressor.
  - Slide Valve > Minimum (Input 4) - This input is energized to signal this panel that the slide valve reading of the next compressor is above that panel's "Minimum Capacity when Running" setpoint.

The active capacity control setpoints are shown here for referencing. The active capacity control setpoints are taken from the capacity control settings at this panel. "Actual" is the current reading of the pressure or temperature that was chosen as the capacity control setpoint. For proper control, only one panel should be selected as the Leader for compressor sequencing. The Leader compressor sequence controller attempts to maintain the capacity control setpoint by loading and unloading in response to the following capacity control setpoints. The Follower compressor sequence con-troller is signaled from a previous panel to load or unload and then uses the following capacity control setpoints to determine when to pulse the panel's local slide valve load and slide valve unload outputs. The signal for loading or unloading from the previous panel overrides the Follower's capacity control settings that might be determining the op-posite local capacity control. For example, the Follower's local settings could indicate it should be loading, but a signal from a previous panel could be telling it to unload. In this situation the Follower will unload, but it will pulse according to its local settings. The Follower's local settings are used to de-termine pulse loading or unloading and if these settings don't coincide with the Leader's settings, then improper pulsing can result. For good capacity control, it is important that each panel is properly set up. The following describes the compressor sequencing capacity control setpoints:

- Capacity Control - This is the reading which the Leader compressor sequence controller will attempt to maintain. This setpoint at each panel is used to control the loading and unloading of the compressor.

The Proportional Band setpoint determines a range of capacity control values where pulsed output is used. Beyond the proportional band the output is continuously energized. The length of time the output will be pulsed on is proportional to the distance the actual reading is from the capacity control setpoint. The further the distance from setpoint, the longer the output is pulsed on and the shorter the output is off. The closer the distance to setpoint, the shorter the output is pulsed on and the longer the output is off. If the actual reading is midpoint from setpoint, the output is on and off an equal amount of time.

- Upper Proportional Band - A band, measured in the units of the capacity control setpoint, above the upper dead band, where proportional load control is used. If the actual reading rises into this proportional band, the load output will be pulsed as explained above in the description about proportional band. When in this band, the Leader compressor sequence controller will begin the process of starting the compressor.

- Lower Proportional Band - A band, measured in the units of the capacity control setpoint, below the lower dead band, where proportional unload control is used. If the actual reading falls into this proportional band, the unload output will be pulsed as explained above in the description about proportional band.

- Upper Dead Band - A band, measured in the units of the capacity control setpoint, above the setpoint at which the compressor will neither load nor unload.

- Lower Dead Band - A band, measured in the units of the capacity control setpoint, below the setpoint at which the compressor will neither load nor unload.

The Cycle Time setpoint determines the amount of time the output is on and off, when in the proportional band. At the completion of the cycle time the actual reading and necessary response is reevaluated. If a 4 second period is selected, then the following will result:

Proportional Distance Actual Reading is From Setpoint	Output Pulsed On (seconds)	Output Off (seconds)
0	0	4
1/4	1	3
1/2	2	2
3/4	3	1
1	4	0

Upper Cycle Time - This setpoint determines the amount of time in seconds that the load output is on and off, when in the upper proportional band. Refer to the above description about cycle time.

Lower Cycle Time - This setpoint determines the amount of time in seconds that the unload output is on and off, when in the lower proportional band. Refer to the above description about cycle time.

The following setpoints are required for each compressor to be sequenced:

Minimum Capacity when Running - This is the slide valve position a compressor will continuously load to, when started. The compressor will not unload below this setpoint during normal system operation. The last compressor that was signaled to start will be the first compressor to unload to it's "Minimum Capacity when Running" setpoint. Once the compressor has unloaded to this capacity position, a previous compressor is then allowed to unload. When the slide valve is above this setpoint +1, the Follower sequence controller energizes the Slide Valve > Minimum Capacity output.

Minimum Capacity to Stop Next Compressor - If this compressor unloads to or below this setpoint and the next compressor stop delay has timed out, then the Follower Start output signal is de-energized to tell the next com-pressor to stop. This compressor unloads to this capac-ity position after the next compressor is running at or below it's "Minimum Capacity when Running" setpoint.

Next Compressor Start Delay - The minimum time in minutes that the actual capacity must be at or above the starting capacity control setting before the Leader sequence controller will start it's compressor. Also, the minimum time in minutes that a compressor must be at or above 98% slide valve position before the Follower Start output signal is energized to start the next com-pressor and the Capacity Up output signal is ener-gized to tell the next compressor to load.. This timer helps prevent cycling compressors on and off due to short sudden changes in load within the system. If the Leader's current reading falls below its "Capacity Control" setpoint plus the "Upper Dead Band" setpoint, the Leader's start time delay will be reset to start counting again. If a running compressor's slide valve position falls below 98%, the start time delay for starting the next compressor will be reset to start counting again.

Next Compressor Stop Delay - The minimum time in minutes that a running compressor must be at or below the "Minimum Capacity to Stop Next Compressor" slide valve position before the Follower Start output is de-ener-gized to signal the next compressor to stop. This is also the minimum time in minutes that the actual capacity must be at or below the "Capacity Control" setpoint minus the "Lower Dead Band" setpoint before the Leader that has already unloaded the compressor to at or below its "Minimum Capacity when Running" setpoint+ 1, will further unload the compressor to below its "Minimum Slide Valve Position to Start" setpoint, then stop. This timer helps prevent compressors from cy-cling on and off due to short sudden changes in load within the system. If a running compressor's slide valve position rises above the "Minimum Capacity to Stop Next Compressor" setpoint, the stop timer for stopping the next compressor will be reset to start counting again. And if the actual capacity rises above the Leader's stop-ping capacity control setting, the Leader's stop time delay counter will be reset to start counting again.

A toggle key is provided for compressor sequencing:

[Compressor Sequencing Activate] - Selects to use compressor sequencing to control this compressor. The delay timers that are present when sequence control is activated won't change by simply changing the setpoint. Sequence control must be de-activated and then activated again.

[Compressor Sequencing De-Activate] - Selects to not use compressor sequencing to control this compressor. The Digital Board 2 outputs, 1 through 3 and 8, are turned off.

A toggle key is provided for control type:

[Control Type Leader] - Only one panel should be selected as the Leader. The Leader compressor sequence controller attempts to maintain it's capacity control setpoint by being the first compressor to start and then loads and unloads in response to it's capacity control setpoints and furthermore will signal the next panel(a Follower) to do likewise.

[Control Type Follower] - The Follower compressor sequence controller is signaled from a previous panel to load or unload and then uses it's capacity control setpoints to determine when to pulse the panel's local slide valve load and slide valve unload outputs.

COMPRESSOR SEQUENCE OVERVIEW

The above settings are used to sequence the compressors that have been setup for compressor sequence control mode 2. The panels selected for compressor sequence control mode 2 must be connected via the proper hardware connection. Only a compressor that is in both remote compressor mode and remote slide valve mode (and not in shutdown), will be started, stopped, loaded or unloaded using this sequence control.

The refrigeration load refers to the demand for loading of compressors to reduce the rise in capacity that has resulted from an increased need for refrigeration in the plant. When the load rises this means the capacity has risen. When the load falls this means the capacity has fallen. Compressors need to load if the Leader sequence controller's capacity reading is above it's "Upper Dead Band" setpoint plus the "Capacity Control" setpoint and compressors need to unload if the Leader sequence controller's capacity reading is below it's "Capacity Control" setpoint minus the "Lower Dead Band" setpoint. During compressor sequencing and in the description of it, if the Capacity Up output (request to load the next compressor) is energized, then the Capacity Down output (request to unload the next compressor) is not energized; and likewise, if the Capacity Down output is energized, then the Capacity Up output is not energized.

If one of these compressors has been told to run, but remains off due to remaining recycle delay time or other conditions preventing the compressor from running, then no sequencing will happen until the compressor is running or shutdown.

If one of these compressors is not in remote compressor mode or is not in remote slide valve mode or is in shutdown, that compressor is not available to be sequenced. However, it will signal its capacity control requirements to the next compressor.

Because the next compressor is forced to load to the "Minimum Capacity when Running" setpoint, excess capacity could occur causing the previous compressor to adjust by unloading a little. If the load continues to rise, then the previous compressor that unloaded to below 98% will load again to at or above 98% prior to signaling the next compressor to load.

The following is an example of sequencing compressors:

On System Start-up - The Leader compressor will start if the capacity is greater than or equal to the "Upper Dead Band" plus the "Capacity Control" setpoint for the "Next Compressor Start Delay" time period. If the Leader is not available to be sequenced, then the Leader's Start Follower output and Capacity Up output are energized. If the Follower with the Start Follower input and the Capacity Up input energized is not available to be sequenced, then the Follower's Start Follower output and Capacity Up output are energized.

On an initial start-up of a compressor, the compressor started will load to the "Minimum Capacity when Running" setpoint and remain at or above this setpoint until stopping. A Follower sequence controller energizes the Slide Valve > Minimum Capacity output when the slide valve is above the "Minimum Capacity when Running" setpoint + 1.

Load Rises - If the "Actual" reading continues to be greater than or equal to the "Upper Dead Band" plus the "Capacity Control" setpoint at the Leader sequence controller, then the first available compressor in the order the panels are wired, starting with the Leader sequence control panel, is selected to load to 100%, followed by the next.

If the running compressor loads to at or above 98% slide valve position for the "Next Compressor Start Delay" time period, then the Start Follower output and Ca-pacity Up output are energized.

Load Falls - If the "Actual" reading falls to or below the "Capacity Control" setpoint minus the "Lower Dead Band" setpoint at the Leader sequence controller, then the last compressor that is running will be selected for unloading. If the Start Follower output is energized (indi-cating another compressor has been told to run), the Capacity Down output is energized. If the Start Follower output is not energized and the Capacity Down input is energized, then this compressor is unloaded to it's "Mini-mum Capacity when Running" setpoint. If the Start Follower output is energized and the Slide Valve > Mini-mum Capacity input is not energized (indicating the next compressor has been unloaded to at or below the "Minimum Capacity when Running" setpoint), then this compressor is unloaded to or below its "Minimum Ca-pacity to Stop Next Compressor" setpoint. When the "Next Compressor Stop Delay" is timed out then the Start Follower and Capacity Down outputs are de-energied.

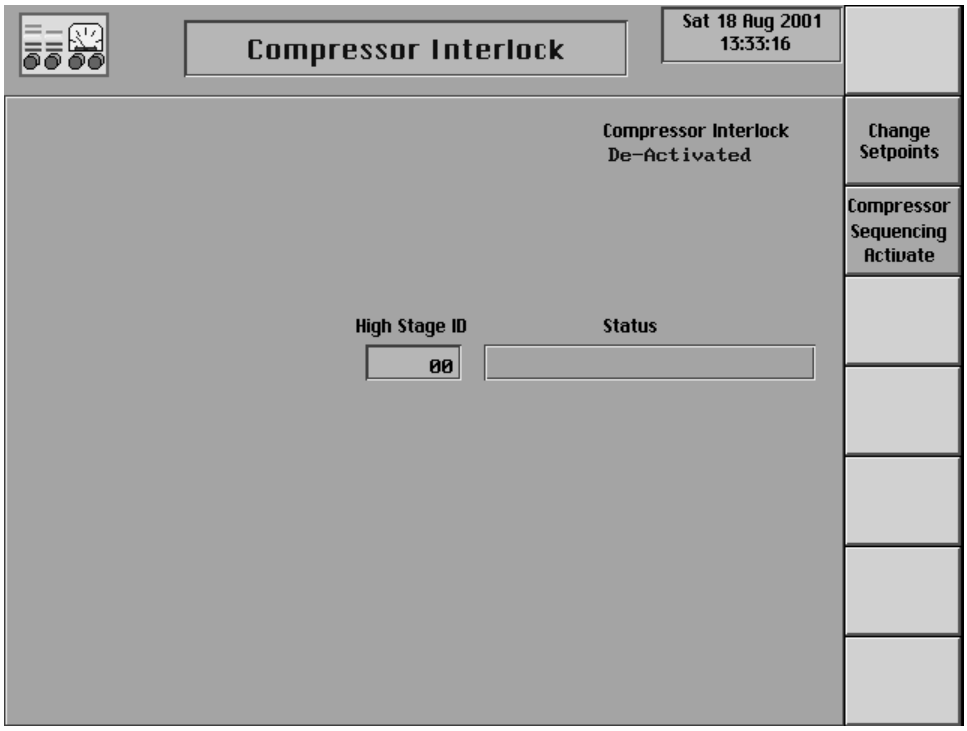
A running compressor that is signaled to stop will unload to or below it's "Highest Slide Valve Position to allow starting the compressor" setpoint and then will stop. The Leader sequence controller is the last compressor to unload. The Leader will unload the compressor to the "Minimum Capacity when Running" setpoint and if the Leader's stop delay has timed out, the Leader will unload the compressor to it's "Highest Slide Valve Position to allow starting the compressor" setpoint before stopping this compressor.

COMPRESSOR SEQUENCE CONTROL (MODE 2) WIRING

Grammatic 2502 or Quantum ***Digital Board 2***		**Grammatic 1502**
P1-1 Output 1	Start / Follower Start	DI-4 Input 4
P1-2 Output 2	Capacity Up / Follower Capacity Up	DI-5 Input 5
P1-3	from	Gram +24 VDC Digital Supply
P1-5 Output 3	Capacity Down /Follower Capacity Down	DI-6 Input 6
P1-6 Input 4	Slide Valve > Minimum / Capacity > Minimum	DI-2 Input 2
P2-1 Input 5	Start / Follower Start	DO-7 Output 19
P2-2 Input 6	Capacity Up / Follower Capacity Up	DO-8 Output 20
+24 VDC (Quantum Supply)	to	Digital Output Relay Common
P2-4 to +24 VDC Return (Quantum Supply)		No Connection
P2-5 Input 7	Capacity Down /Follower Capacity Down	DO-9 Output 21
P2-6 Output 8	Slide Valve > Minimum / Capacity > Minimum	DO-10 Output 22

Note: Use ODCM-5, 5 V digital output modules and IDCM-5, 5 V digital input modules.

CONTROL SETUP - OPTIONS SETUP
"COMPRESSOR INTERLOCK" DISPLAY



This display is shown if the "Compressor Interlock" option of "Compressor Sequencing" was selected in Panel Setup. For quick access to this display there is a **[Compressor Interlock Setpoints]** screen key on the "Operating Status - 2" display. Compressor interlocking is used to interlock the running of one high stage compressor with one booster compressor. This option should be selected and set up on the booster compressor and requires serial communication between the two compressors using the Com-1 port. Reference drawings 640A0042 and 640A0050. These compressors are sequenced only if the compressor is in the remote start mode of operation and in remote slide valve mode and available to run, i.e. not in shutdown (cutout) or recycle delay.

When Compressor Interlock is activated, the program checks the running status of the two compressors. When the booster is started, the program checks if the high stage machine is running. If it is not running, it is told to start. After the high stage is confirmed to be running, the booster will start. If the booster is running and the high stage compressor has a shutdown, the booster shuts down with a "Compressor Interlock Failure". If the booster is stopped, both machines will stop.

This display has the following setpoint:

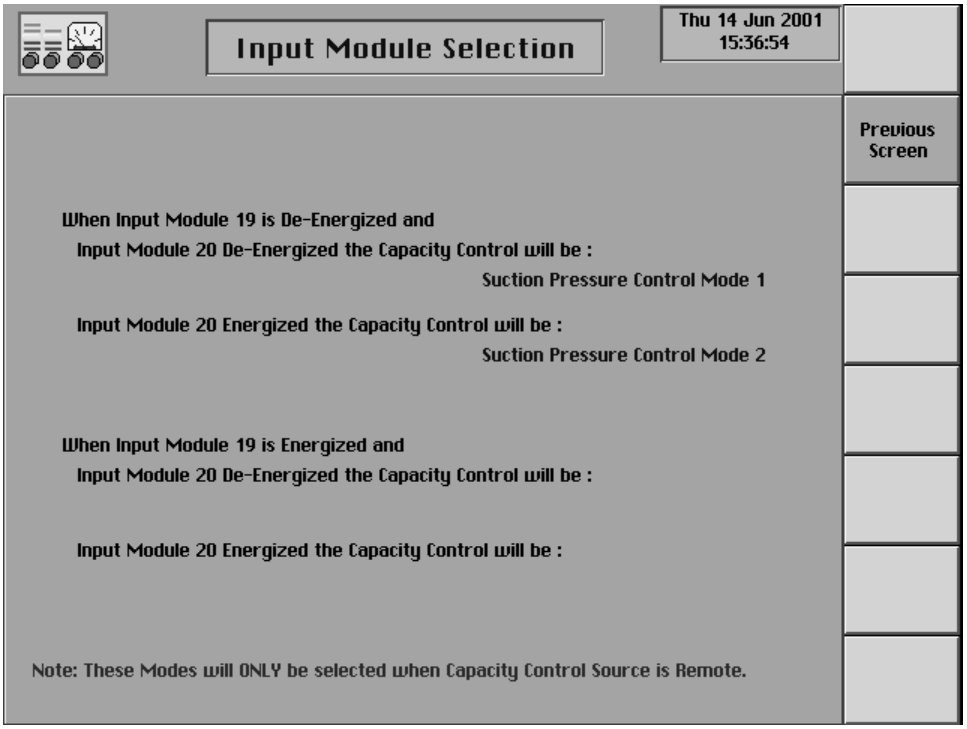
High Stage ID - The Identification number of the high stage compressor.

A toggle key is provided for compressor sequencing:

[Activate] - Selects the compressor control to be currently active.

[De-Activate] - Selects the compressor control to be currently not active.

CONTROL SETUP -
OPTIONS SETUP -
”INPUT MODULE SELECTION” DISPLAY



This display is shown if the ”Input Module Capacity Control Selection” was enabled in Panel Setup. The following control logic is concluded about input module 19 and 20:

When input module 19 is de-energized, the enabled capacity control that is listed first on the “Capacity Control” display will be the capacity control that will be made active using the following control logic:

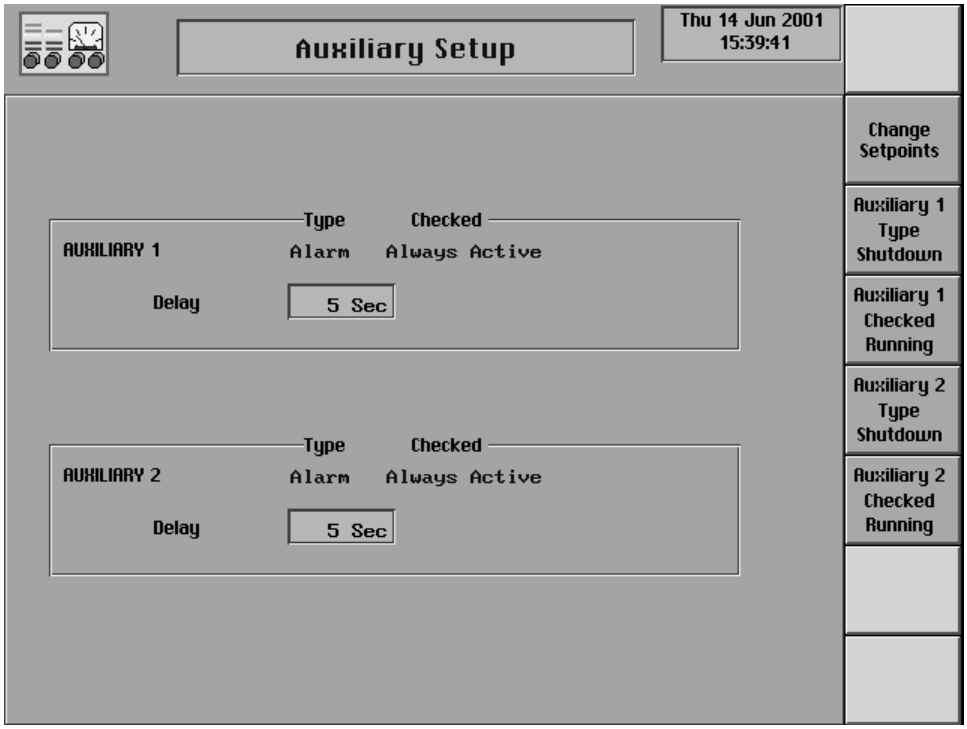
- When input module 20 is not energized: Mode 1 is the active capacity control
- When input module 20 is energized: Mode 2 is the active capacity control.

When input module 19 is energized, if a second capacity control has been enabled, the enabled capacity control listed secondly on the “Capacity Control” display will be the capacity control that will be made active using the following control logic:

- When input module 20 is not energized: Mode 1 is the active capacity control.
- When input module 20 is energized: Mode 2 is the active capacity control.

When this feature is enabled, these inputs force which capacity control is active, even if a different capacity control mode is selected somewhere else. Only if the capacity control mode was forced by these inputs will Remote-I/O be displayed for the capacity control source on the “Operating Status” display. The **[Make Active]** key will not be available on a capacity control setpoint display when this feature has been enabled.

CONTROL SETUP -
OPTIONS SETUP -
”AUXILIARY SETUP” DISPLAY



This display is shown if a type of “Auxiliary 1 and 2” control was selected in Panel Setup. The auxiliary digital input modules can be selected as an alarm or a shutdown when the auxiliary input is de-energized. The auxiliary can be checked either “Always Active” or “When running”. “Always Active” means that at anytime the input module is de-energized, the selected type of auxiliary will occur if the module remains de-energized for the length of the delay period. “When running” means that only when the compressor is running and the input module is de-energized, the selected type of auxiliary will occur if the module remains de-energized for the length of the delay period.

The following screen keys are used to setup how the auxiliary will function:

[Change Setpoints] - Changes the number of seconds to delay prior to producing either an alarm or a shutdown.

A toggle key is provided that changes between the following types of auxiliary:

[Auxiliary 1 Type Alarm] - If the Auxiliary 1 is presently a shutdown type of auxiliary this screen key is shown so that the operator can change the auxiliary to an alarm type.

[**Auxiliary 1 Type Shutdown]** - If the Auxiliary 1 is presently an alarm type of auxiliary, this screen key is shown so that the operator can change the auxiliary to a shutdown type.

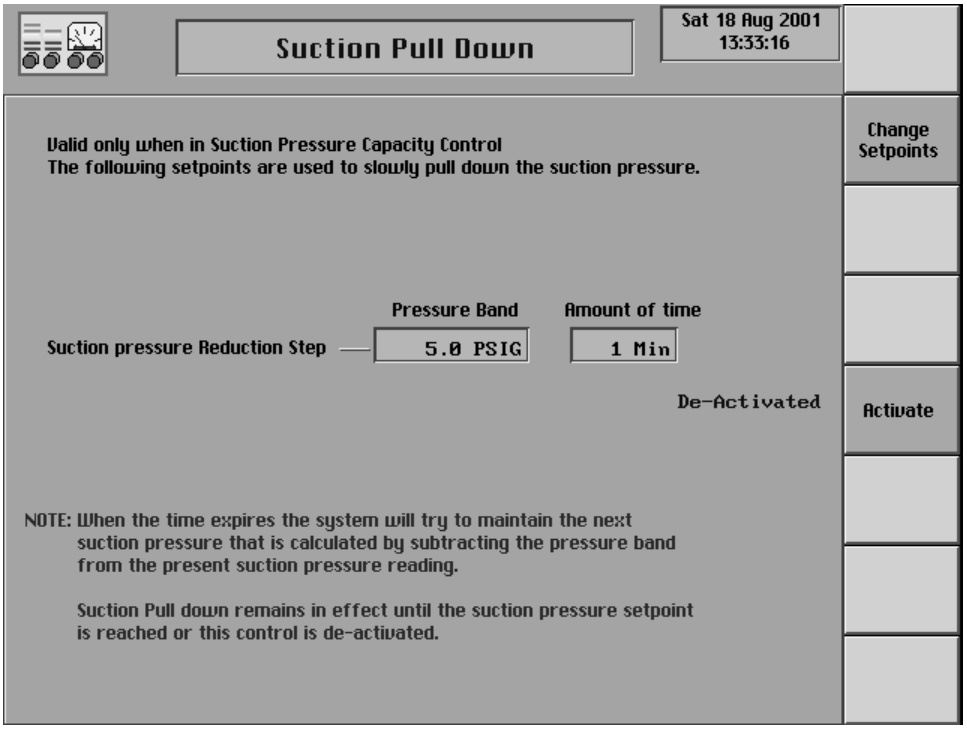
A toggle key is provided that changes when the auxiliary is checked:

[Auxiliary 1 Checked Always] - If the Auxiliary 1 input module is presently checked “When running”, this screen key is shown so that the operator can change when it is checked to “Always Active”.

[Auxiliary 1 Checked Running] - If the Auxiliary 1 input module is presently checked “Always Active”, this screen key is shown so that the operator can change when it is checked to “When running”.

Note: If an Auxiliary 2 option was also selected, then the screen keys described above but labeled “Auxiliary 2” are relevant to setting up the Auxiliary 2 input module.

CONTROL SETUP -
"SUCTION PRESSURE PULL DOWN" DISPLAY



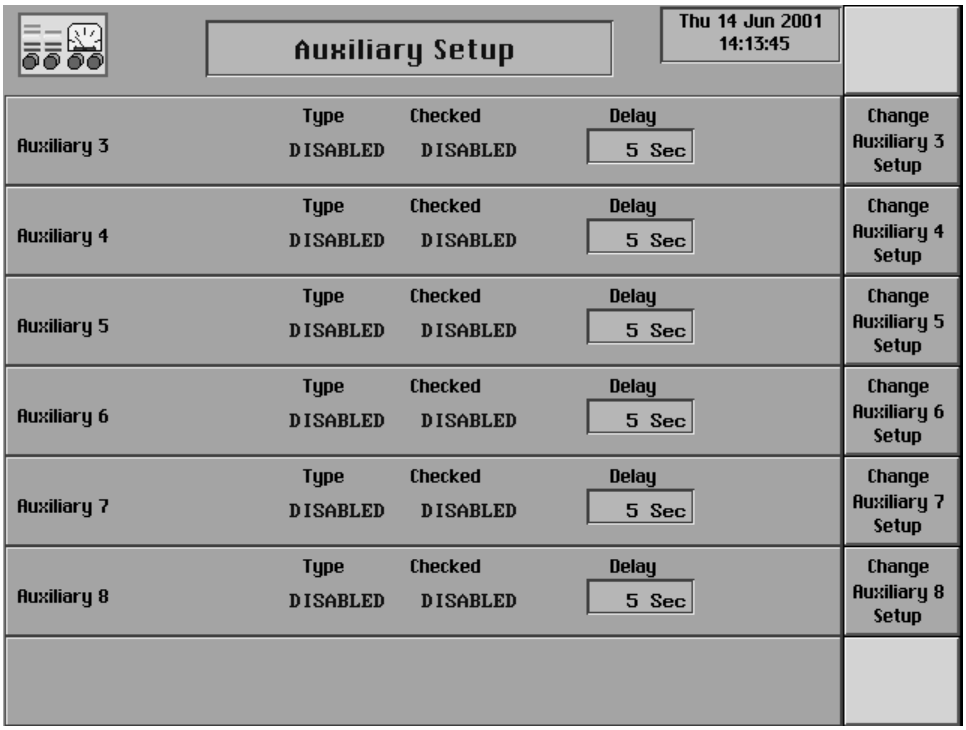
This display is shown if the "Suction Pull Down" option was selected in Panel Setup. This option is only valid when in Suction Pressure Capacity Control. With this option enabled, the suction pressure can be slowly lowered in steps from the "Starting Suction Pressure" setpoint to the "Suction Pressure Capacity Control" setpoint. Slowly "walking" the pressure down prevents rapid drops in system pressure that cause violent boiling of refrigerant in the system. When the "Suction Pull Down" feature is activated and the compressor is started, the capacity control setpoint is changed to the current suction pressure. After the "Amount of Time" setpoint has timed out, the capacity control setpoint is changed again. The capacity control setpoint is reduced by the amount of the "pressure band". The system steps down to this setpoint and stays there until the time-out period has again elapsed. Then the capacity control setpoint is reduced again. The capacity control setpoint changes regardless of whether the system is following it or not. The "Suction Pressure Pull Down" feature is reactivated every time the machine is started unless it is deactivated.

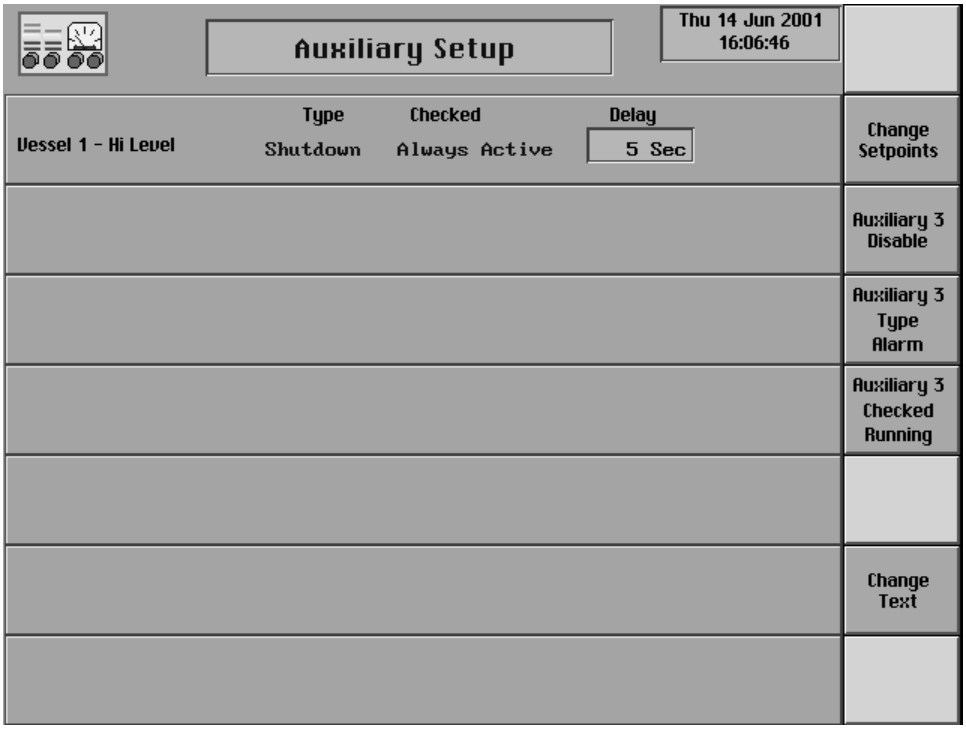
This display has the following setpoints:

Suction Pressure Reduction Step Pressure Band - This is the amount of suction pressure that will be used to step down the system. This value is subtracted from the starting suction pressure to provide a capacity control setpoint. The capacity control setpoint continues to be calculated by subtracting the pressure band from the previously calculated capacity control setpoint until the suction pressure reading reaches the operator entered capacity control setpoint.

Suction Pressure Reduction Step Amount of Time - This is the time in minutes the suction pressure is maintained at each step during suction pressure pull down.

CONTROL SETUP -
"AUXILIARIES 3 - 8 SETUP" DISPLAY



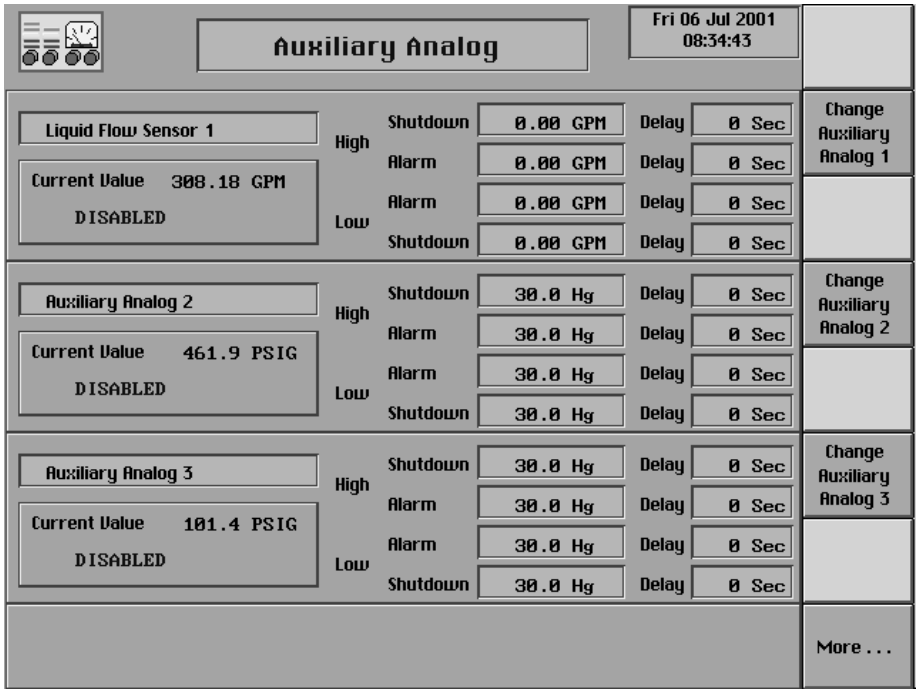


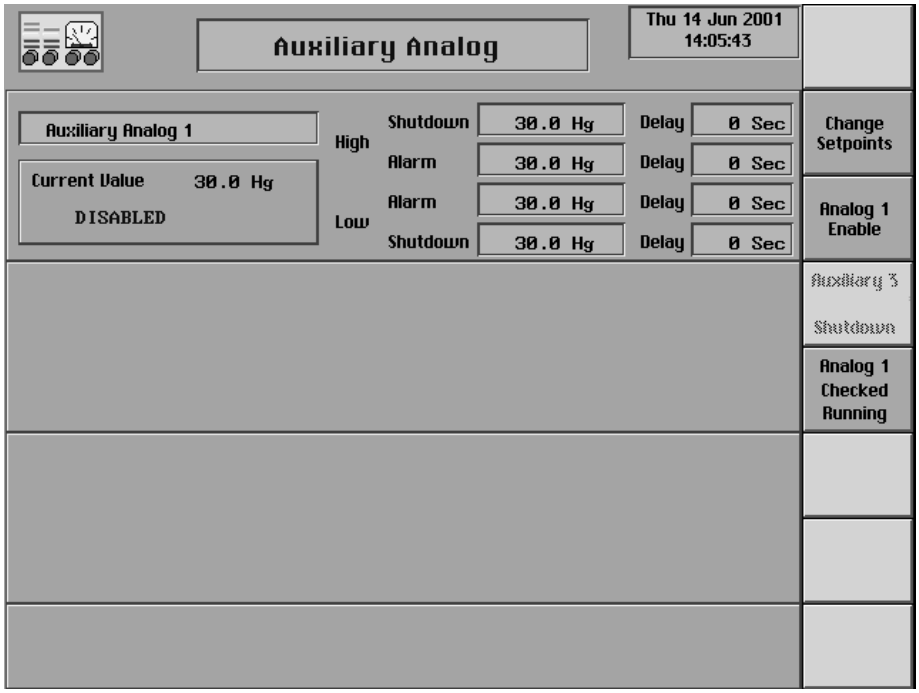
The Auxiliaries #3 - #8 are programmable digital inputs on Digital I/O Board #2. These additional auxiliaries have the same settings as Auxiliary #1 and #2 (See "Auxiliary Setup" Display). In addition to these settings there is a toggle key that changes between the following selections:

[Auxiliary "x" Enable] - This key is provided if this feature is disabled for this auxiliary. "x" is used here to refer to the auxiliary (3-8) that has been selected for setup.

[Auxiliary "x" Disable] - This key is provided if this feature is enabled. "x" is used here to refer to the auxiliary (3-8) that has been selected for setup.

CONTROL SETUP - "AUXILIARY ANALOG TEMPERATURES & PRESSURES" DISPLAY





The Temperature/Pressure Monitoring Auxiliary Analogs #1-#9 and the Side Load/Economizer analog inputs of Analog Board #2 are set up here. These analog auxiliaries can be used for either temperature or pressure monitoring. Switching them to temperature or pressure analog readings is done in Factory Setup. This display shows the current reading of the analog value.

This display has the following setpoints:

High Shutdown - If the analog reading is greater than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

High Shutdown Delay - The minimum time in seconds that the analog reading is greater than or equal to the analog shutdown before the compressor will shut down.

High Alarm - If the analog reading is greater than or equal to this setpoint, for the alarm time delay, an alarm occurs.

High Alarm Delay - The minimum time in seconds that the analog reading is greater than or equal to the high analog alarm setpoint before notification of the alarm.

Low Alarm - If the analog reading is less than or equal to this setpoint, for the alarm time delay, an alarm occurs.

Low Alarm Delay - The minimum time in seconds that the analog reading is less than or equal to the analog alarm setpoint before notification of the alarm.

Low Shutdown - If the analog reading is less than or equal to this setpoint, for the shutdown time delay, the compressor will shut down.

Low Shutdown Delay - The minimum time in seconds that the analog reading is less than or equal to the analog shutdown setpoint before the compressor will shut down.

The following screen keys are used for each auxiliary analog to setup how the analog reading will be used:

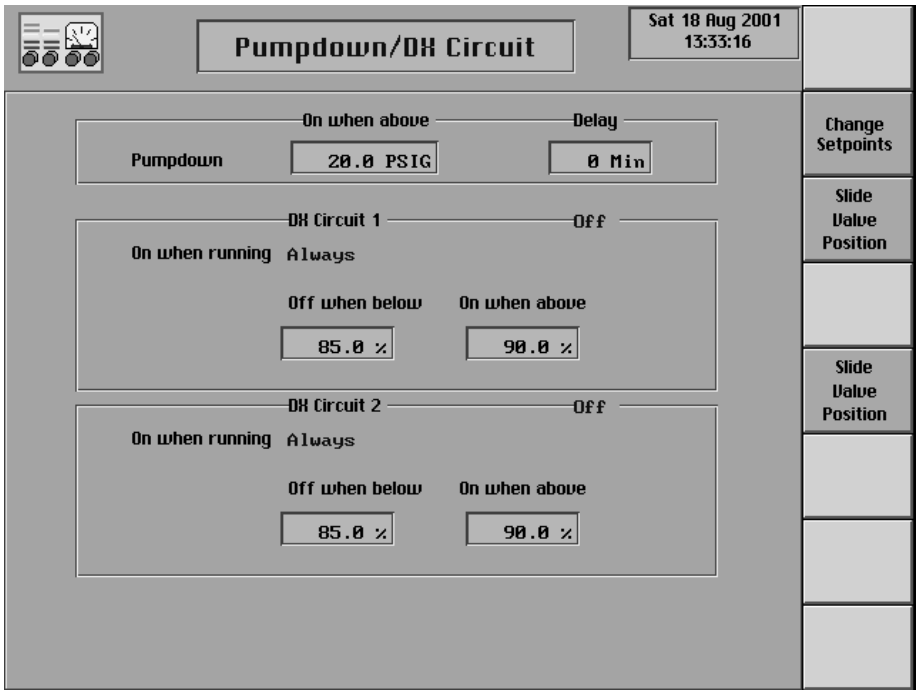
[Change Setpoints] - Changes the alarm settings and delay seconds that produce either an alarm or a shutdown.

A toggle key is provided that changes when the failure is checked:

[Analog 1 Checked Always] - If the Analog 1 input module is presently checked “When running”, this screen key is shown so that the operator can change when it is checked to “Always Active”.

[Analog 1 Checked Running] - If the Analog 1 input module is presently checked “Always Active”, this screen key is shown so that the operator can change when it is checked to “When running”.

CONTROL SETUP - “PUMPDOWN/DX CIRCUIT” DISPLAY



This display is shown if ”Pumpdown/DX Circuit” control was enabled in Panel Setup. Pumpdown provides for pumping down the refrigerant (removal of the refrigerant gas). For example, this can be used for removing the refrigerant from a shell and tube heat exchanger to prevent its standing water from freezing. When pumpdown is enabled and the compressor is stopped, the DX circuit’s digital outputs are de-energized; but the compressor remains running for the delay period. The time remaining for pumpdown is displayed on the “Operating Status” display in the compressor status box. When the delay period times out or the suction pressure falls below the “On When Above” setpoint, the compressor is turned off. To force a compressor that is in pumpdown to stop, press the compressor stop screen command key again.

This display has the following setpoints for Pumpdown:

On when above - After sending the compressor stop command, if the suction pressure reading is above this setpoint, pumpdown will be invoked. In pumpdown, the compressor will stay on to continue vaporizing the refrigerant.

Delay - The amount of time in minutes the compressor will pumpdown before it is stopped.

This display provides for the setup of the DX (direct expansion) circuits (DX Circuit #1 and DX Circuit #2). The settings will determine when to turn on and off these digital outputs. This display shows the current status of the digital outputs.

This display has the following slide valve setpoints for both DX Circuits:

Off when below - If the compressor is running and control was selected as “and at proper slide valve position”, then the DX Circuit output is off if the slide valve is below this setpoint.

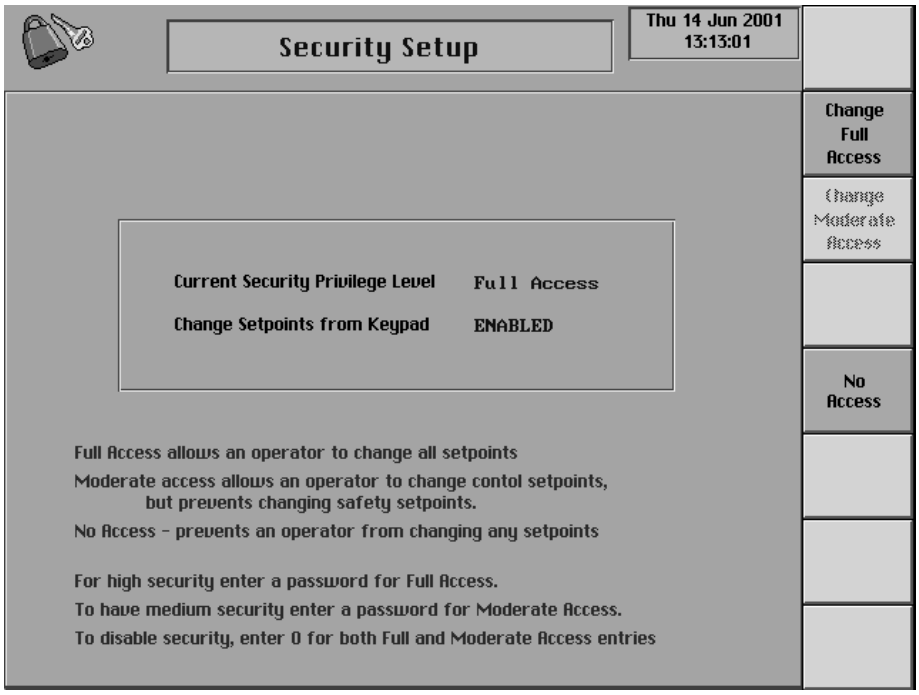
On when above - If the compressor is running and control was selected as “and at proper slide valve position”, then the DX Circuit output is on if the slide valve is above this setpoint.

A toggle key is provided for each of the outputs to determine when the output is energized:

[Slide Valve Position] - The slide valve setpoints will be used to turn on and off this digital output, when the compressor is running.

[Always] - This output will always be turned on when the compressor is running.

MAIN MENU SELECTION - ”SECURITY SETUP” DISPLAY



Security can be setup to allow different operators different access rights to setpoints. If access is presently denied when an operator selects to **[Change Setpoints]** then a message box will appear prompting the operator to enter a password. If an operator has not changed any setpoint within the last 15 minutes, the access level will change to no access.

Three levels of access rights to changing setpoints are provided:

1. Full access - allows an operator to change all setpoints.
2. Moderate access - allows an operator to change setpoints, but prevents changing safety setpoints.
3. No access - prevents an operator from changing any setpoint.

To have full access requiring a password, enter a password other than zero for the full access entry. To have moderate access, enter a different password for the moderate access entry than the full access entry. If an operator does not know an entered password then they are prevented from changing any setpoints. To disable security, enter zero for both full and moderate access entries. Disabling security allows any operator to change all setpoints without entering a password.

The following information about the current security access is shown:

Current Security Privilege Level:
1. No Access
2. Moderate Access
3. Full Access

Change Setpoints from Keypad:
1. Enabled
2. Disabled

If a password exists, then selecting a screen key will cause a password entry box to appear. To change a password the operator must enter their password and accept it (OK) which will cause another password entry box to appear. It prompts the operator to enter the password for this access level. Accepting it will cause another password entry box to appear. It prompts the operator to reenter the password to verify it. Properly reentering the password will cause a message box to appear that says “Pass Number Changed”. Improperly reentering the password will cause a message box to appear that says “Bad Verify Pass Number Not Changed”.

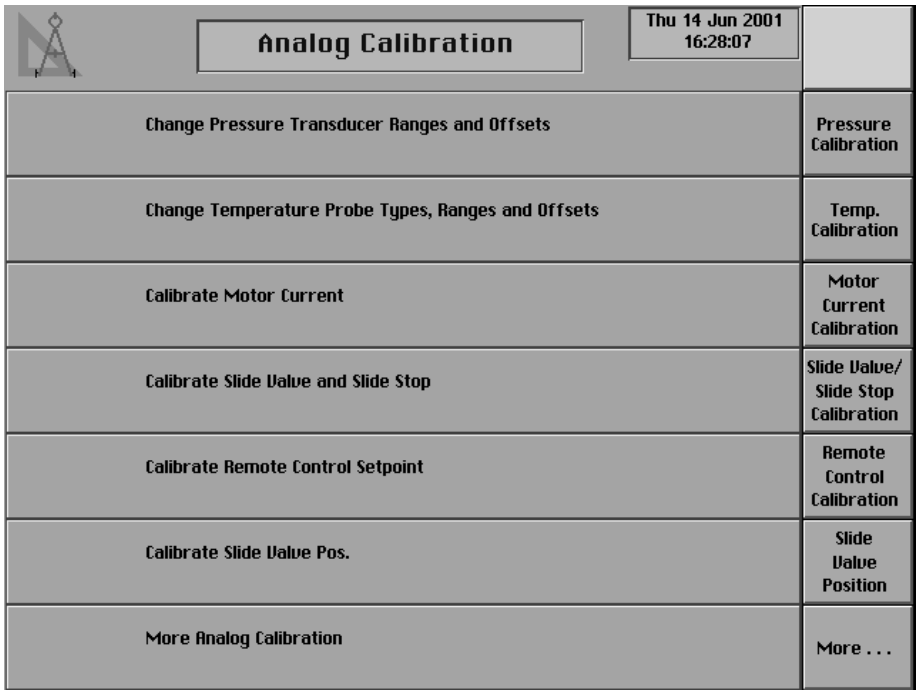
The following screen keys are used to setup security.

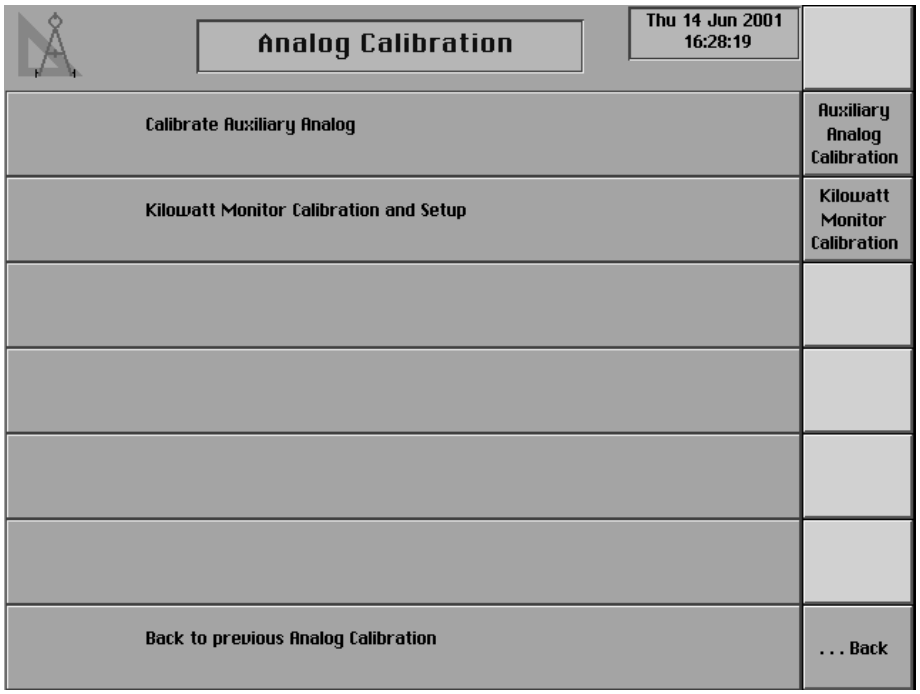
[Change Full Access] - Select this key to change the full access password. The operator can also enter the current password to acquire full access privilege without changing the password.

[Change Moderate Access] - Select this key to change the moderate access password. The operator can also enter the current password to acquire moderate access privilege without changing the password.

[No Access] - Select this key to change the current access privilege to no access. This cancels security access to the system. A password must be reentered to gain security access after pressing this key.

MAIN MENU SELECTION - ”ANALOG CALIBRATION” DISPLAY





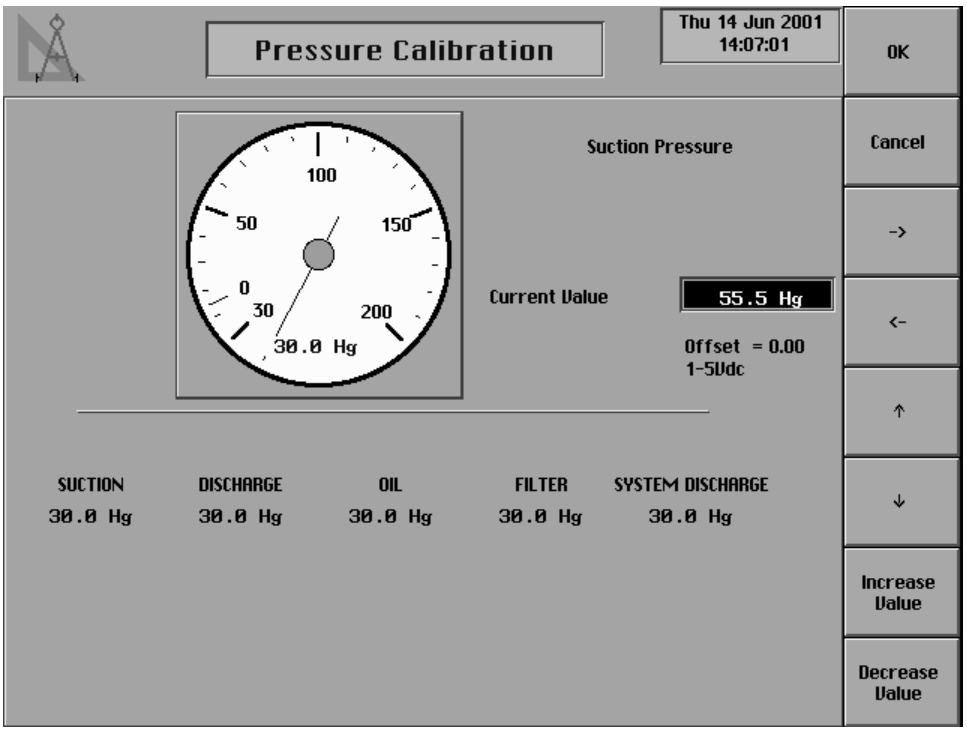
!!! Warning Entering Calibration Screens !!!

You are attempting to modify critical system control settings. Any modifications of these settings may have a significant impact on the operation and performance of the pertinent equipment. By undertaking to modify these settings, you are assuming all responsibility for those actions. At the very minimum, prior to any such action, you should have thoroughly read and understood all manuals and literature accompanying the unit. **IMPROPER CONTROL SETTINGS MAY CREATE AN OPERATING CONDITION WHERE THERE IS THE POTENTIAL OF PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**

The following analog calibration selections are shown:

- Change Pressure Transducer Ranges and Offsets
- Change Temperature Probe Types, Ranges and Offsets
- Calibrate Motor Current (Not applicable if using a RAM DBS Motor Starter)
- Calibrate Slide Valve and Slide Stop (If applicable, reference “Compressor Model Differences”)
- Calibrate Remote Control Setpoint (If applicable, see Panel Setup)
- Calibrate Slide Valve Position (If applicable, see Panel Setup)
- Calibrate Auxiliary Analog (If applicable, see Panel Setup)
- Kilowatt Monitor Calibration and Setup (If applicable, see Panel Setup)

ANALOG CALIBRATION - ”PRESSURE CALIBRATION” DISPLAY

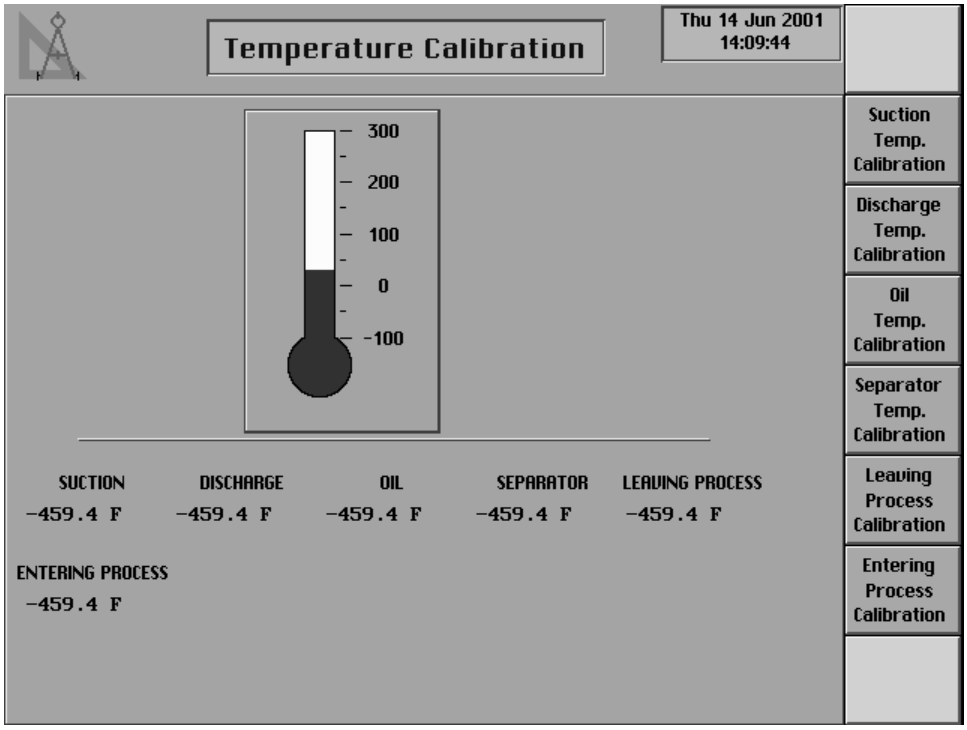


This display shows a picture of a pressure gauge. Below the gauge is shown the current pressure readings for:

- Suction
- Discharge
- Oil
- Filter (If applicable)
- System Discharge (Required for Condenser Control)
- Balance Piston (If applicable)

The Setting for the “Current Value” is blank until a pressure for calibration is selected from the screen keys. A screen key exists for each of the displayed pressure readings. When a pressure calibration is selected the identification of the pressure transducer and its settings are shown. It is at this time that the gauge will also show the current reading. Select the **[Calibration Setpoints]** key to modify the present calibration. **Note: The measurement range of transducers is usually given in PSIA. If another pressure unit has been selected in Panel Setup, the operator can temporarily change the pressure units in Panel Setup to use PSIA, then enter the PSIA ranges for all the transducers and finish by returning the pressure units in Panel Setup to the prior selection.**

ANALOG CALIBRATION - ”TEMPERATURE CALIBRATION” DISPLAY

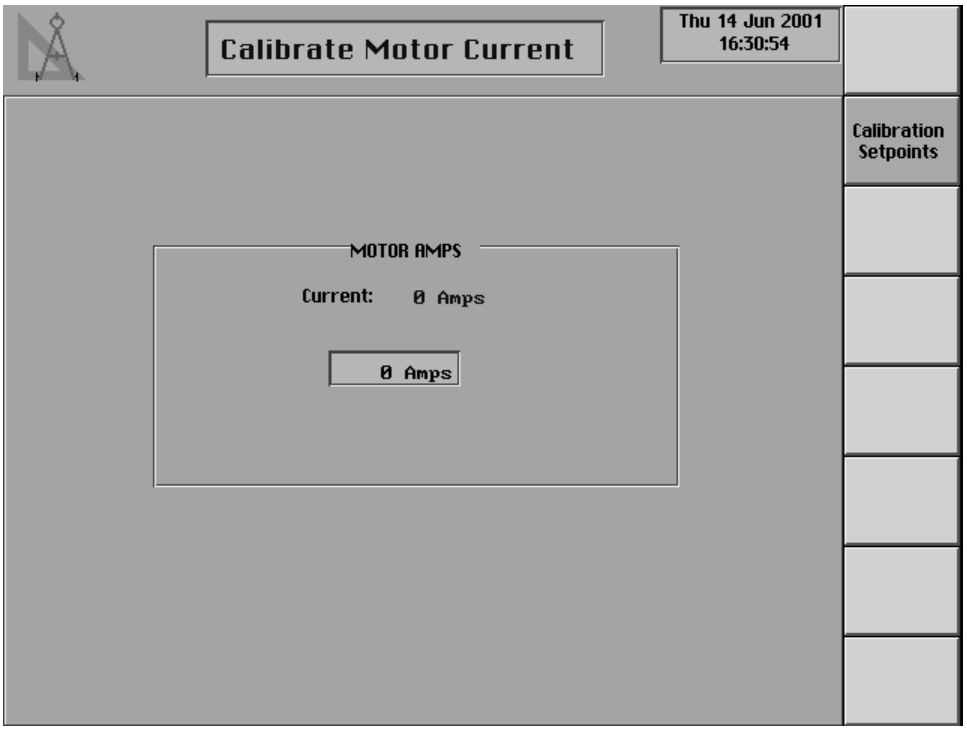


This display shows a thermometer and the current temperature readings for:

- Suction
- Discharge
- Oil
- Separator
- Leaving Process (If Process Temperature Capacity Control was enabled)
- Entering Process (If applicable, see Panel Setup)

The Setting for the “Current Value” is blank until a temperature for calibration is selected from the screen keys. A screen key exists for each of the displayed temperature readings. When a temperature calibration is selected, the identification of the temperature measurement sensor and its settings are shown. It is at this time that the thermometer will also show the current reading. Select the **[Calibration Setpoints]** screen key to modify the present calibration.

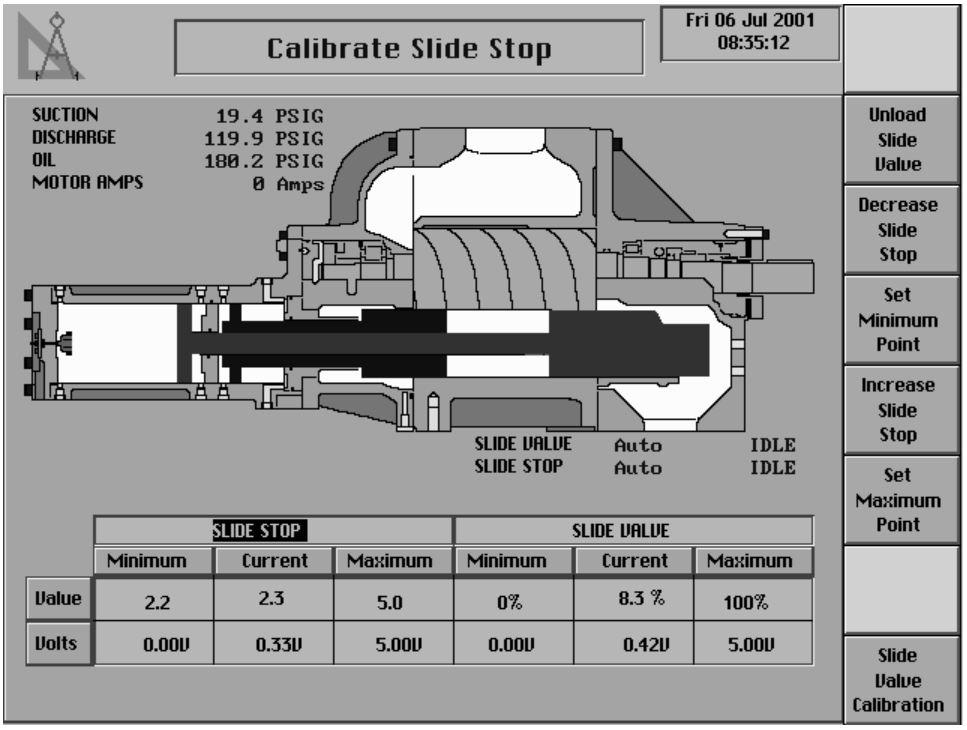
ANALOG CALIBRATION - ”CALIBRATE MOTOR CURRENT” DISPLAY



This display shows the current reading of the motor amps. Select the **[Calibration Setpoints]** screen key to modify what should be shown as the current reading.

Note: The motor current must be calibrated while the compressor is running and preferably with the compressor loaded.

ANALOG CALIBRATION - ”CALIBRATE SLIDE STOP” DISPLAY



	SLIDE STOP			SLIDE VALVE		
	Minimum	Current	Maximum	Minimum	Current	Maximum
Value	2.2	2.3	5.0	0%	8.3 %	100%
Volts	0.00V	0.33V	5.00V	0.00V	0.42V	5.00V

The “Calibrate Slide Stop” display is shown if it applies to the compressor model (Reference “Compressor Model Differences”). It shows a pictorial representation of a slide valve and slide stop. The slide valve and slide stop status information, the motor amps reading, and the suction, discharge, and oil pressure readings are shown here for quick reference. The same information of the slide valve and slide stop status box, shown on the Operating Status display, is also shown here for quick reference. The screen heading and the highlighted heading in the table, both depict what is presently selected to be calibrated. The slide stop should be calibrated prior to calibrating the slide valve. Calibrating the slide stop requires setting the minimum and maximum slide stop. The minimum slide stop value represents the furthermost position the slide stop can be decreased to. The maximum slide stop value represents the furthermost position the slide stop can be increased to. The current reading is the reading that changes when increasing or decreasing the slide stop. An invalid reading is indicative of the need to calibrate. The volts reading corresponds to the metered voltage that is measured when the slide stop is at the displayed position. The screen keys are positioned in the order they should be used. (The RWB model 355 and 283 are exceptions to this sequence order. With these the **[Decrease Slide Stop]** should precede the **[Unload Slide Valve]**). The following keys are provided:

[Unload Slide Valve] - The initial selection of this key will cause the slide valve position to continuously unload. Selecting this key again will stop the slide valve at the current position. The slide valve position should be unloaded until it does not interfere with decreasing the slide stop.

[Decrease Slide Stop] - The initial selection of this key will cause the slide stop to continuously decrease. Selecting this key again will stop the slide stop at the current position. To decrease the slide stop to the minimum point, it is necessary that the slide valve position be increased until the slide stop will no longer decrease.

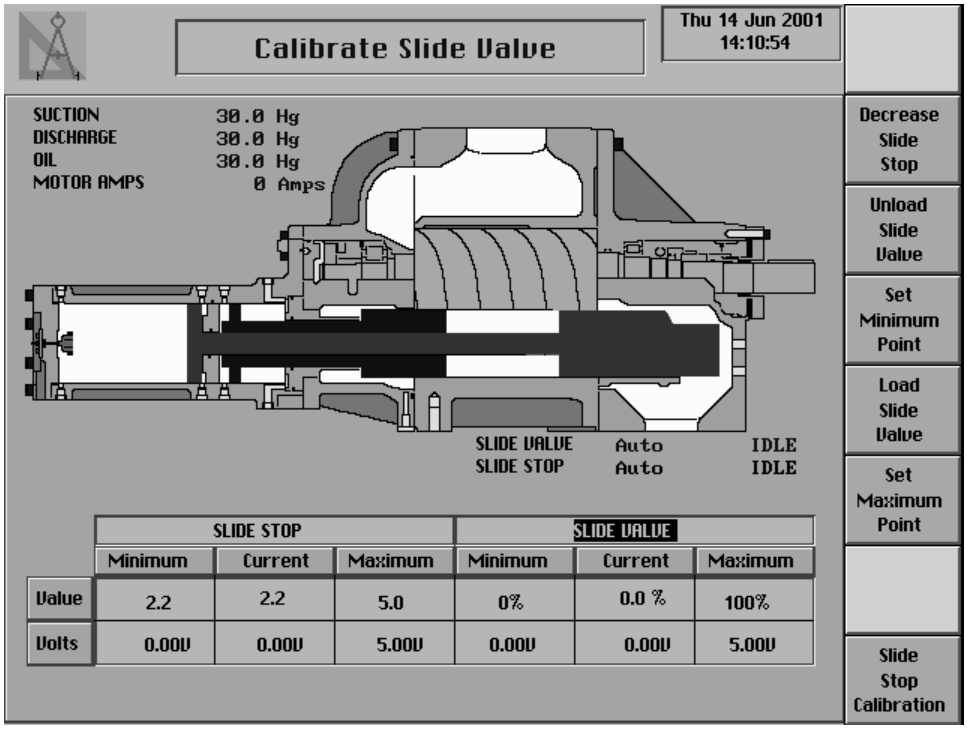
[Set Minimum Point] - This key should be selected when the slide stop is at the minimum position or lowest voltage reading. The minimum slide stop value of 2.2 will then be set as the current slide stop value.

[Increase Slide Stop] - The initial selection of this key will cause the slide stop to continuously increase. Selecting this key again will stop the slide stop at the current position.

[Set Maximum Point] - This key should be selected when the slide stop is at the maximum position or highest voltage reading. The maximum slide stop value of 5.0 will then be set as the current slide stop value.

[Slide Valve Calibration] - Shows the slide valve calibration display.

ANALOG CALIBRATION - ”CALIBRATE SLIDE VALVE” DISPLAY



This display is shown if it applies to the compressor model (Reference “Compressor Model Differences”). This display shows a pictorial representation of a slide valve and slide stop. Reference the picture of the “Calibrate Slide Stop” display. The slide valve and slide stop status information, the motor amps reading, and the suction, discharge, and oil

pressure readings are shown here for quick reference. The screen heading and the highlighted heading in the table, both depict what is presently selected to be calibrated. The minimum slide valve value represents the furthermost position the slide valve can be unloaded to and is always set at 0%. The maximum slide valve value represents the furthermost position the slide valve can be loaded to and is always set at 100%. The current reading is the reading that changes when increasing or decreasing the slide valve. An invalid current reading is indicative of the need to calibrate. The volts reading corresponds to the metered voltage that is measured when the slide valve is at the displayed position. The screen keys are positioned in the order they should be used. The following keys are provided:

[Decrease Slide Stop] - The initial selection of this key will cause the slide stop to continuously decrease. Selecting this key again will stop the slide stop at the current position. For proper calibration of the slide valve, the slide stop should be decreased to the minimum point.

[Unload Slide Valve] - The initial selection of this key will cause the slide valve to continuously unload. Selecting this key again will stop the slide valve at the current position.

[Set Minimum Point] - This key should be selected when the slide valve is at the furthermost unload position. The minimum slide valve value of 0% will then be set as the current slide valve value.

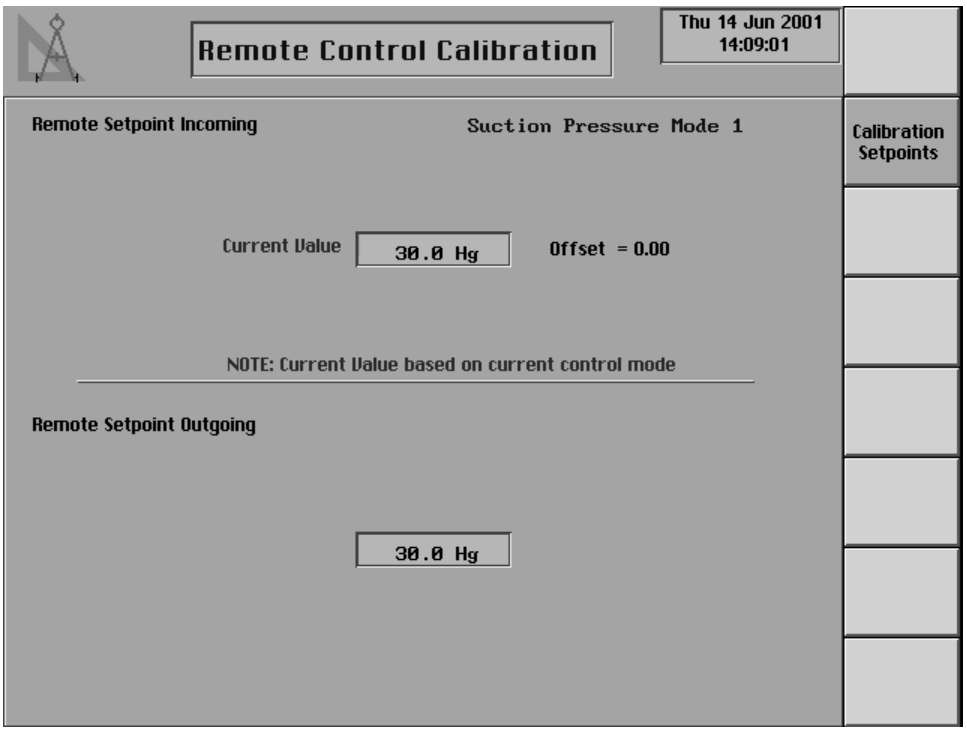
[Load Slide Valve] - The initial selection of this key will cause the slide valve to continuously load. Selecting this key again will stop the slide valve at the current position.

[Set Maximum Point] - This key should be selected when the slide valve is at the furthermost load position. The maximum slide valve value of 100% will then be set as the current slide valve value.

[Slide Stop Calibration] - Shows the slide stop calibration display.

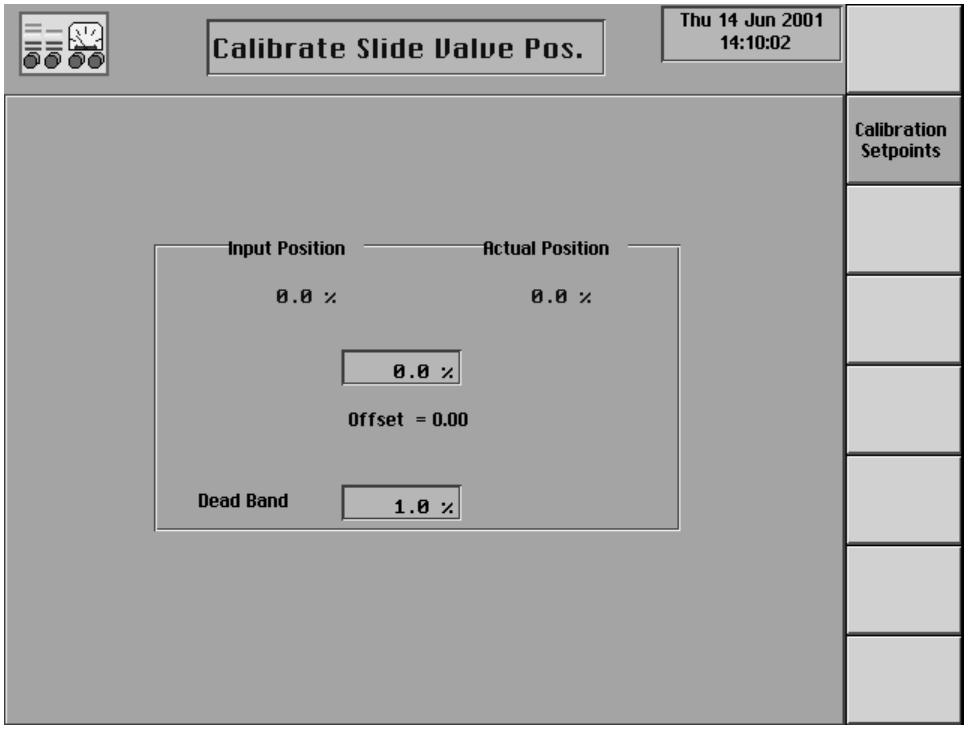
Note: If a force unload or a stop load condition is present as shown on the "Operating Status" display, this will interfere with the proper calibration.

ANALOG CALIBRATION - "CALIBRATE REMOTE CONTROL SETPOINT" DISPLAY



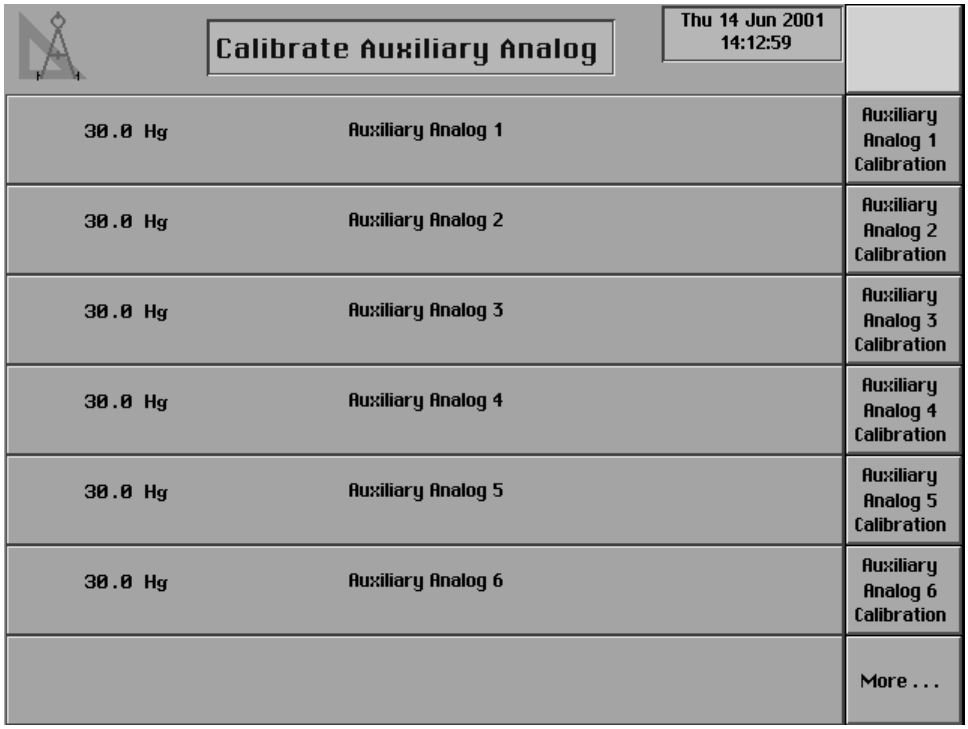
This shows if the "Remote Control Setpoint" was enabled in Panel Setup. This display is used to calibrate the analog signal of the Remote Control Setpoint input and the Remote Control Setpoint output. The "Remote Setpoint Incoming" is used to calibrate the analog signal of the Remote Control Setpoint input. Selecting **[Remote Setpoint]** from the slide valve mode screen command keys on the "Operating Status" display, selects the "Remote Setpoint Incoming" as the capacity control setpoint. The active capacity control mode is shown because the current value is based on this control value. The "Remote Setpoint Outgoing" is used to calibrate the analog signal of the Remote Control Setpoint output. The "Remote Setpoint Outgoing" is the corresponding calibrated output signal of the current active capacity control setpoint.

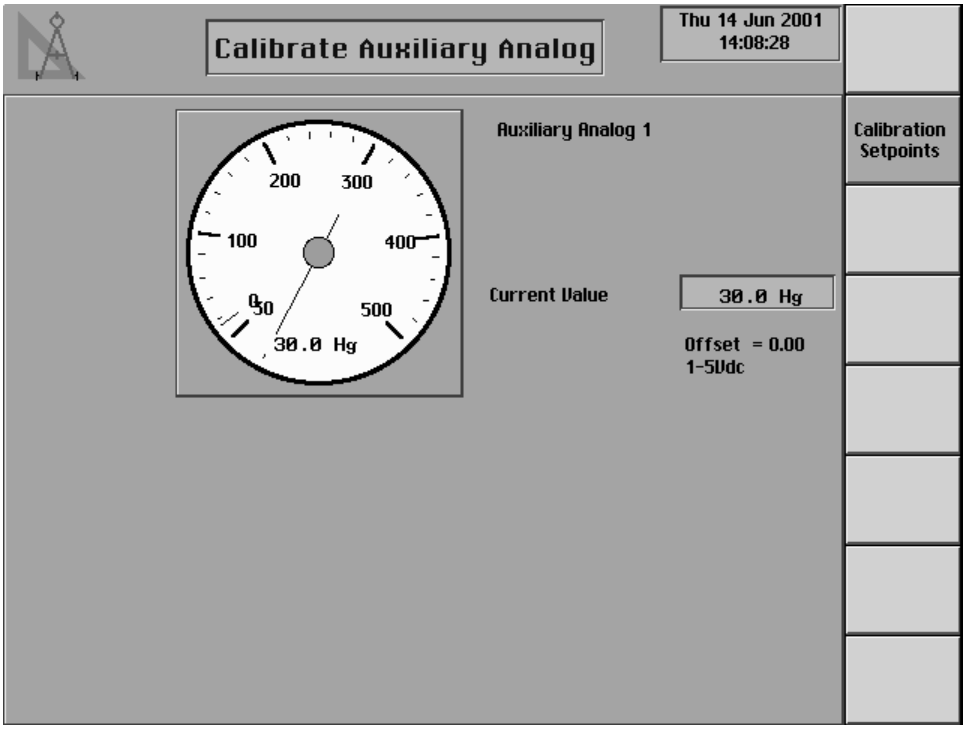
ANALOG CALIBRATION - ”CALIBRATE SLIDE VALVE POSITION” DISPLAY



This shows if “Slide Valve Position Control” was enabled in Panel Setup. This display is used to calibrate the analog signal of the Remote Slide Valve Position input. Selecting **[Remote Slide Valve]** from the slide valve mode screen command keys on the “Operating Status” display, selects a remote (4-20 ma) signal to control the slide valve.

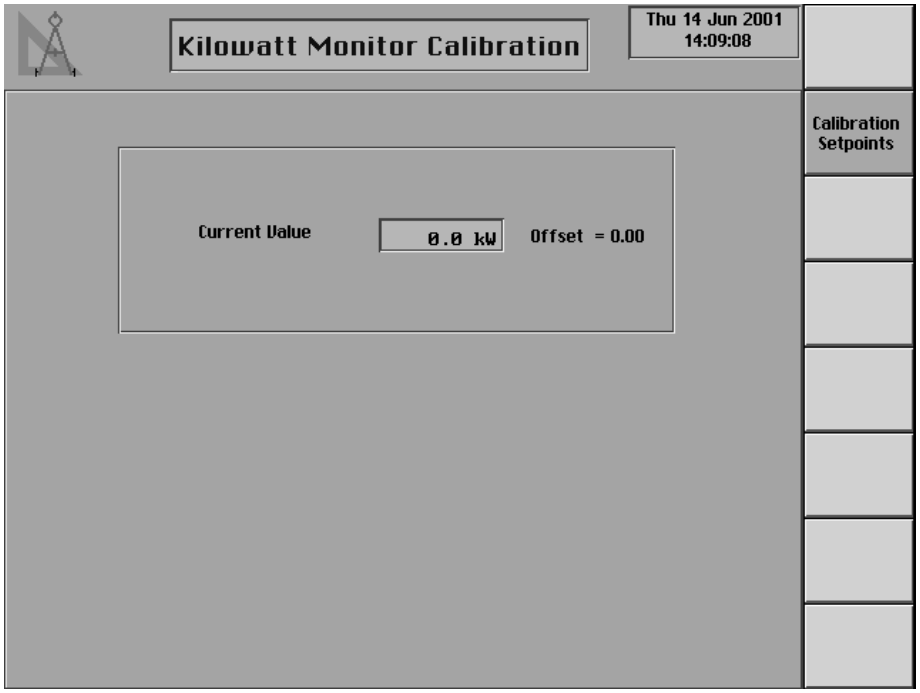
ANALOG CALIBRATION - ”CALIBRATE AUXILIARY ANALOG” DISPLAY





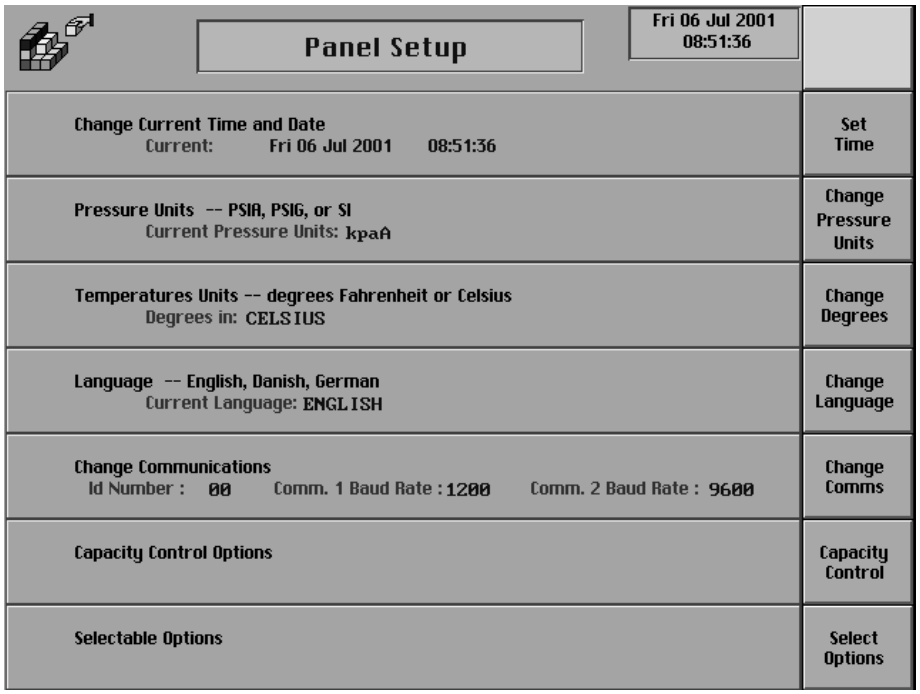
This shows if “Auxiliary Analog Temperatures and Pressures” was enabled in Panel Setup. This display is shown for the Auxiliary Analog Inputs. These inputs are switched to either temperature or pressure in Factory Setup. The current values of the auxiliary analogs are displayed on the “Auxiliary Analog Temperatures and Pressures” displays that are accessed from Control Setup.

ANALOG CALIBRATION - ”KILOWATT MONITOR CALIBRATION” DISPLAY



This shows if “Kilowatt Monitor Calibration and Setup” was enabled in Panel Setup. This display is shown for calibrating the Kilowatt input. The current value of the kW Monitoring analog input is displayed on the “Operating Status” display.

MAIN MENU SELECTION - ”PANEL SETUP” DISPLAY



The current setup is shown at the Panel Setup selection. The following Panel Setup displays can be selected:

- Change Current Time and Date
- Pressure Units — PSIA, PSIG, or SI
- Temperature Units — degrees Fahrenheit or Celsius
- Language — English, Danish, German
- Change Communications
- Capacity Control Options
- Selectable Options

PANEL SETUP - "Change Current Time and Date" DISPLAY

The following screen keys are provided:

[Increase Minutes]
[Increase Hours]
[Increase Day]
[Increase Month]
[Increase Year]
[Decrease Year]

PANEL SETUP - "Pressure Units — PSIA, PSIG, or SI" DISPLAY

The following screen keys are provided:

[Change to PSIA]
[Change to PSIG]
[SI Units]
[Change to BarA] (Bar Absolute)
[Change to Bar] (Bar Gauge)
[Change to KPAA] (KPA Absolute)

PANEL SETUP - "Temperature Units — degrees Fahrenheit or Celsius" DISPLAY

The following screen keys are provided:

[Change to Fahrenheit]
[Change to Celsius]

PANEL SETUP - "Language – English, Danish, German" DISPLAY

The other Panel Setup selections are removed from the display and the following screen selections are provided:

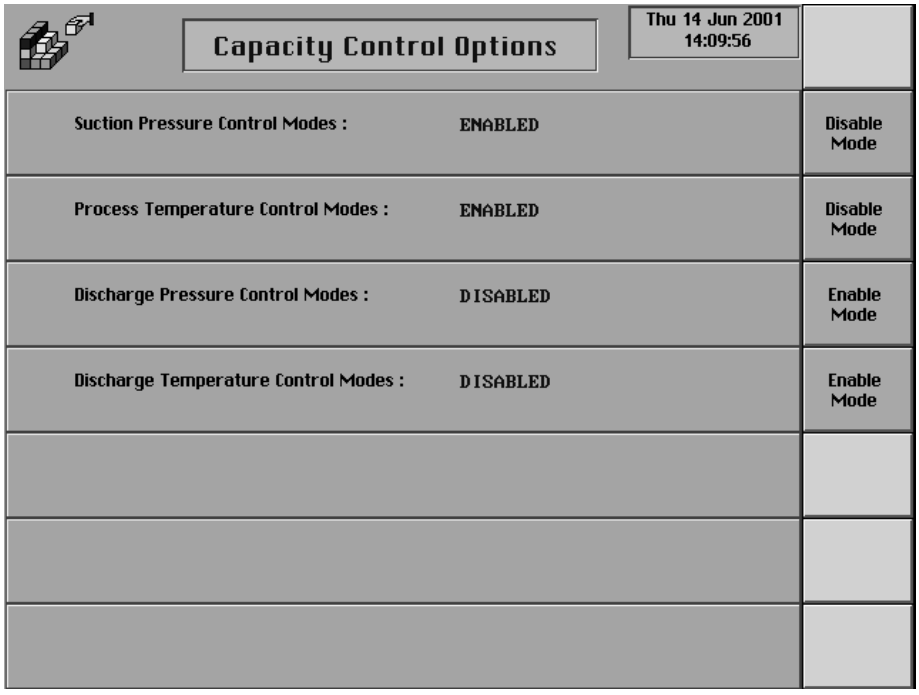
[Change to English]
[Change to Danish]
[Change to German]
[Change to Spanish]
[Change to Other lang.]

PANEL SETUP - "Change Communications" DISPLAY

The following screen selections are provided:

[Change Setpoints] - Select this key to change the panel ID number.
[Change to 19200 Baud] - A toggle key that changes between the baud rates of 1200, 2400, 4800, 9600, 19200, 38400, 76800, and 115200 is provided for the Comm2 setup.
[A-B Comm.] - A toggle key that provides a method of selecting one protocol to communicate to the panel. This key changes between enabling A-B(Allen-Bradley), ModBus, York ISN, or Frick communication protocol. For further setup reference publication S90-010 CS.
[Detect I/O Boards] - Select this key to detect all connected Analog and Digital boards. If a board has been removed a communication error shutdown will be issued until this key is selected. Reference the "About" display to view what was detected.

PANEL SETUP - "CAPACITY CONTROL OPTIONS" DISPLAY



The capacity control options that were enabled in Panel Setup are shown. Only two control modes can be enabled. A control mode that is currently the active capacity control mode can not be disabled unless another capacity control

mode has been enabled. The other enabled capacity control is made active, when disabling the current one, so active capacity control setpoints can always be viewed and modified. The following capacity control modes are provided as selections:

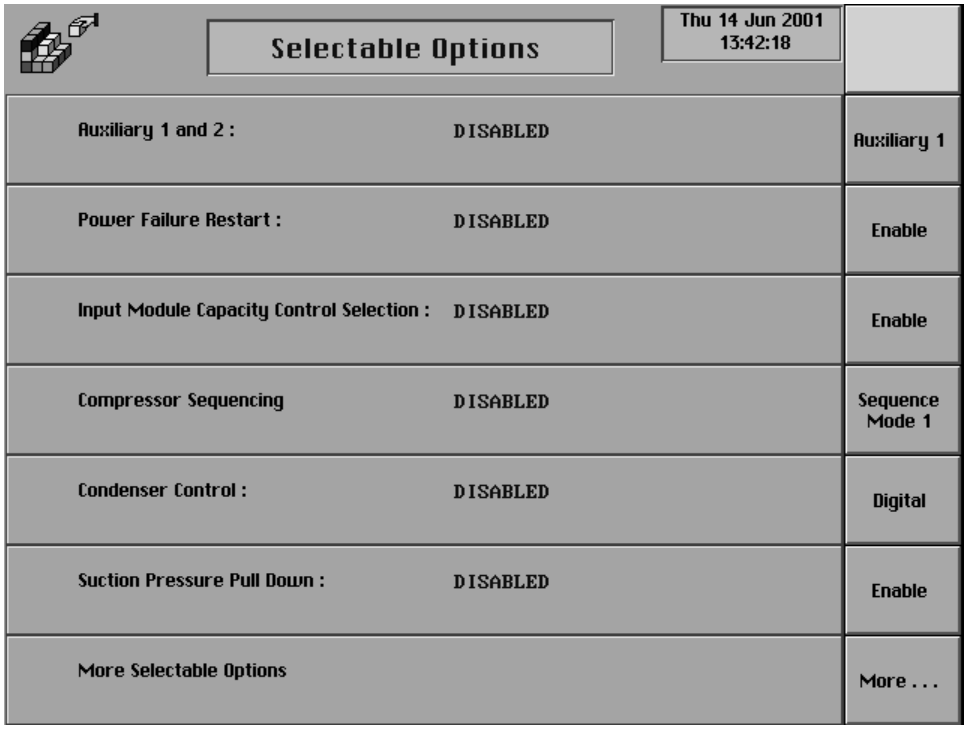
- Suction Pressure Control Modes
- Process Temperature Control Modes
- Discharge Pressure Control Modes
- Discharge Temperature Control Modes

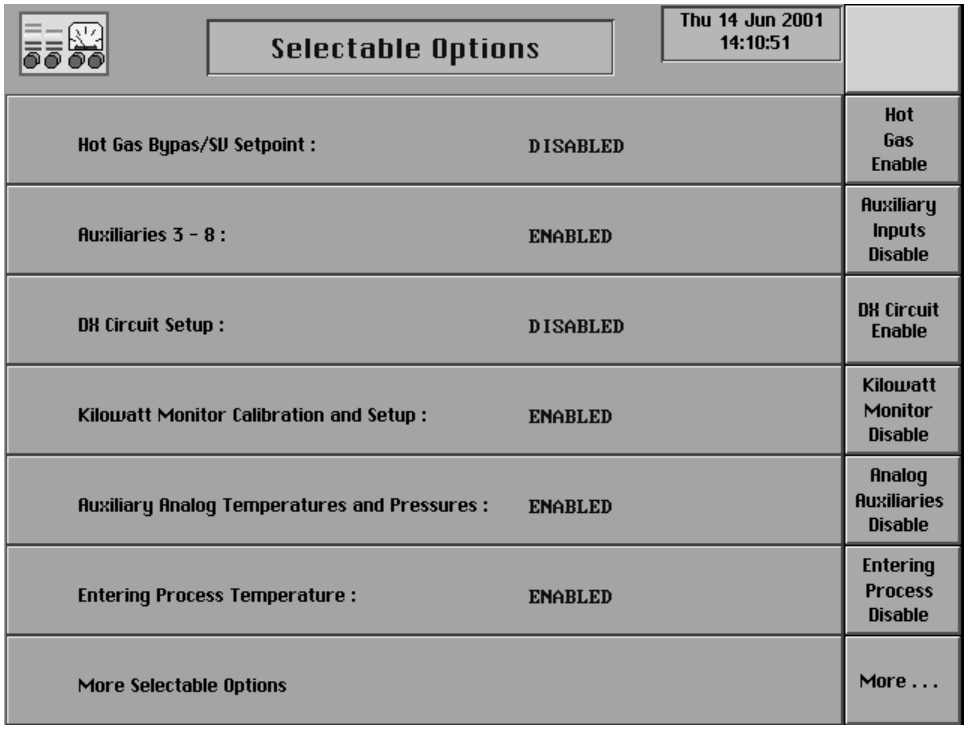
The following selection key is provided:

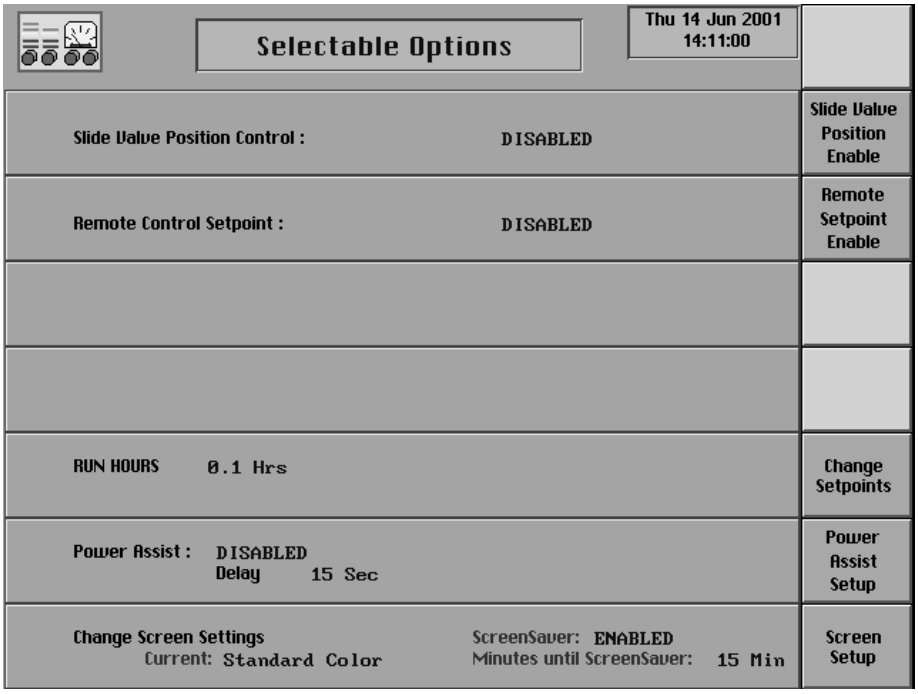
[Enable Mode] - This key is provided if the control is disabled.

[Disable Mode] - This key is provided if the control is enabled.

PANEL SETUP - ”SELECTABLE OPTIONS” DISPLAY







The operator will only see the setpoints that are relevant to their plant by enabling or disabling options and selecting options from this display. Reference the Quantum drawings for proper setup of options. Screen setup features are also selected from this display. The present setup is shown. Following are the options that can be selected:

Auxiliary 1 and 2 - This provides for selecting these auxiliary digital input modules to be used as an alarm or a shutdown when the auxiliary input is de-energized. For further setup see the "Auxiliary Setup" display. A toggle key is provided that changes between the following selections:

[Disable]
[Auxiliary 1]
[Auxiliary 2]
[Auxiliary 1 and 2]

Power Failure Restart - This selection is provided to prevent a compressor from restarting after not having power for a selectable length of time. This option can prevent problems that occur with restarting a refrigeration system after long periods of power loss. For further setup, see the Power Fail Restart selection on the "Motor Control Setpoints" display. A toggle key is provided that changes between the following selections:

[Enable] - This key is provided if control is disabled.
[Disable] - This key is provided if control is enabled.

Input Module Capacity Control Selection - This provides for selecting the capacity control via the two digital input modules rather than via the keypad or communication port. For further setup, see the "Input Module Control Selection" display. A toggle key is provided that changes between the following selections:

[Enable] - This key is provided if control is disabled.
[Disable] - This key is provided if control is enabled.

Compressor Sequencing - A toggle key is provided that changes between the following selections:

[Sequence Mode 1] - This key is provided to select a method of sequencing compressors using serial communication. This is an adaptation of the Lead-Lag option used in other Frick panels. For further setup, see the "Compressor Sequence Control (Mode 1)" display.
[Sequence Mode 2] - This key is provided to select a method of sequencing compressors using digital inputs and outputs. This selection is only available for a Gram compressor. For further setup, see the "Compressor Sequence Control (Mode 2)" display.
[Compressor Interlock] – This key is provided to select a method of sequencing a High Stage compressor with a Booster compressor using serial communication. For further setup, see the "Compressor Interlock" display.
[Disable] - This key is provided if feature is enabled.

Condenser Control - This provides a method for stepping on and off condenser digital outputs and varying the Condenser Analog output signal. For further setup, see the "Condenser Control" display. A toggle key is provided that changes between the following selections:

[Digital] - This key selects control of the condenser digital outputs.
[Analog] - This key selects control of the condenser analog output.
[Digital Analog] - This key selects control of the condenser digital outputs and the condenser analog output.

[Disable] - This key is provided to disable condenser control.

Suction Pressure Pull Down - This option provides for a slow lowering of the suction pressure when in Suction Pressure Capacity Control. Slowly "walking" the pressure down prevents rapid drops in system pressure that causes violent boiling of refrigerant in the system.

[**Enable]** - This key is provided if the control is disabled.
[Disable] - This key is provided if the control is enabled.

Hot Gas Bypass/SV Setpoint - This option is available if it applies to the compressor model (Reference "Compressor Model Differences"). This feature is provided to turn on up to three digital outputs based on an entered slide valve position setpoint. For further setup see the "Slide Valve Setpoints" display. A toggle key is provided that changes between the following selections:

[Hot Gas Enable] - This key is provided if the control is disabled.
[Hot Gas Disable] - This key is provided if the control is enabled.

Auxiliaries 3-8 - This provides for selecting additional (more than 2) auxiliary digital input modules to be used as an alarm or a shutdown when the auxiliary input is de-energized. For further setup see the "Auxiliaries 3-8 Setup" display. A toggle key is provided that changes between the following selections:

[Auxiliary Inputs Enable] - This key is provided if feature is disabled.
[Auxiliary Inputs Disable] - This key is provided if feature is enabled.

Pumpdown/DX Circuit - This option is available if it applies to the compressor model (Reference "Compressor Model Differences"). This provides for setup of the DX (direct expansion) circuits (DX Circuit #1 and DX Circuit #2). Settings will determine when these digital outputs are turned on and off. For further setup see the "Pumpdown/DX Circuit" display. A toggle key is provided that changes between the following selections:

[Enable] - This key is provided if feature is disabled.
[Disable] - This key is provided if feature is enabled.

Kilowatt Monitor Calibration and Setup - This provides for using the kW Monitoring analog channel 16. If Kilowatt monitoring is enabled, the current value of the kW Monitoring analog input is displayed on the "Operating Status" display. For further setup see the "Kilowatt Monitor Calibration" display. A toggle key is provided that changes between the following selections:

[Kilowatt Monitor Enable] - This key is provided if feature is disabled.
[Kilowatt Monitor Disable] - This key is provided if feature is enabled.

Auxiliary Analog Temperature and Pressures - This provides for using one or up to ten analog input auxiliaries to monitor either temperature or pressure readings. For further setup see the "Auxiliary Analog Temperatures & Pressures" display and the "Calibrate Auxiliary Analog" display. A toggle key is provided that changes between the following selections:

[Analog Auxiliaries Enable] - This key is provided if feature is disabled.
[Analog Auxiliaries Disable] - This key is provided if feature is enabled.

Entering Process Temperature - This provides for using the Entering Process Temperature analog channel 4. If this is enabled, the current value of the Entering Process Temperature analog input is displayed on the "Operating Status" display. For further setup see the "Temperature Calibration" display and the "Entering Process Safeties" display. A toggle key is provided that changes between the following selections:

[Entering Process Enable] - This key is provided if feature is disabled.
[Entering Process Disable] - This key is provided if feature is enabled.

Slide Valve Position Control - This option is available if it applies to the compressor model (Reference "Compressor Model Differences"). This provides for using the Remote Slide Valve Position analog channel 13. The remote (4-20 ma) input signal to this channel can be used to control the slide valve. For further setup see the "Calibrate Slide Valve Position" display and the **[Remote Slide Valve]** command key from the slide valve mode screen command keys on the "Operating Status" display. A toggle key is provided that changes between the following selections:

[Slide Valve Position Enable] - This key is provided if feature is disabled.
[Slide Valve Position Disable] - This key is provided if feature is enabled.

Remote Control Setpoint - This provides for using the Remote Control Setpoint analog input (channel 12) and the Remote Control Setpoint analog output (channel 4) for capacity control of compressors. For further setup see the "Calibrate Remote Control Setpoint" display and the **[Remote Setpoint]** command key from the slide valve mode screen command keys on the "Operating Status" display. A toggle key is provided that changes between the following selections:

[Remote Setpoint Enable] - This key is provided if this feature is disabled.
[Remote Setpoint Disable] - This key is provided if this feature is enabled.

Permissive Start - The input used for this feature is Module 17 on the Digital I/O Board 2.

[Always] - This input must be energized to start the compressor. And if the compressor is running and this input is de-energized, the compressor is stopped.

[Starting] - This input needs to be energized only to start the compressor.
[Disable] - This key is provided to disable this feature.

Run Hours - The [Change Setpoints] key is provided to change the number of hours the compressor ran.

Power Assist - This provides for using the Power Assist digital output to get hot gas to the check valve when the compressor is stopped. A key is provided for Power Assist Setup that further provides a toggle key that changes between the following selections:

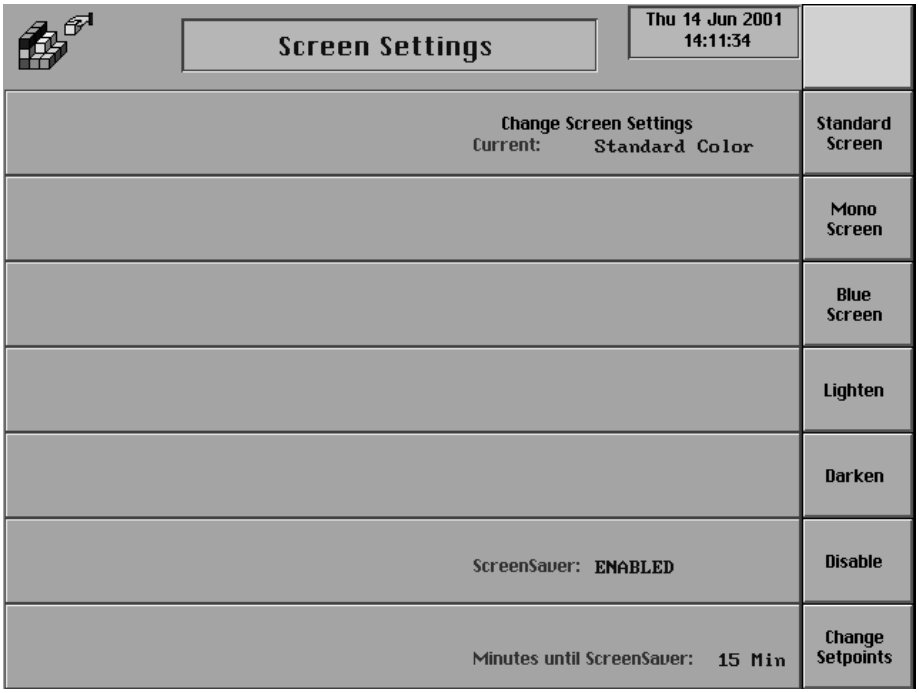
[Enable] - This key is provided if feature is disabled.
[Disable] - This key is provided if feature is enabled.

A **[Change Setpoints]** key is provided to change the number of seconds that the power assist output is energized after the compressor is stopped.

Change Screen Settings
The following key is provided:

[Screen Setup] - Shows a display for changing the screen settings.

PANEL SETUP - SELECTABLE OPTIONS - "SCREEN SETTINGS" DISPLAY



The other options that can be selected are removed from the display and the following selections are provided:

[Standard Screen] - Frick "Blue" screen color is used.

[Mono Screen] - A gray screen color is used.

[Blue Screen]

[Lighten] - The screen color is lightened.

[Darken] - The screen color is darkened.

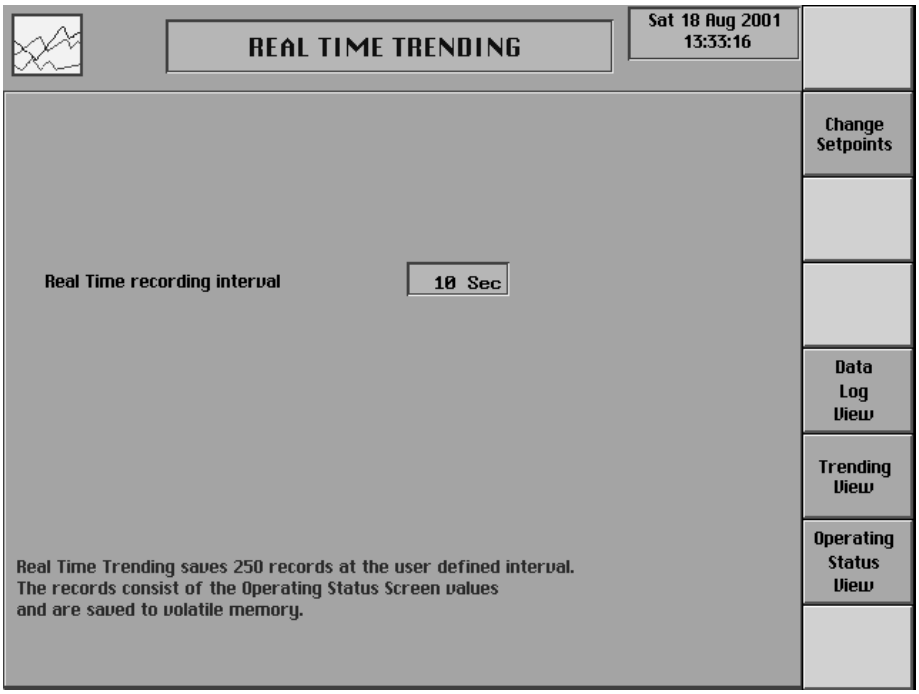
ScreenSaver - A toggle key is provided:

[Disable] - Disables the screen saver.

[Enable] - Enables the screen saver. When there is no keypad activity at the panel this screen saver will turn off the backlight until a key is pressed. The screen saver increases the life of the backlight.

[Change Setpoints] - Select to change the "Minutes until screen saver:" setpoint.

"MAIN MENU" SELECTION - "REAL TIME TRENDING" DISPLAY



Real time trending saves 250 recordings of the data items from the "Operating Status" display. The data is stored in RAM memory. RAM memory is volatile memory and all information is lost if the power to the panel is lost. The data can be selected to be saved as frequently as once a second.

The following setpoint is provided:

Real time recording interval – The time interval in seconds that defines how often the trending data values are recorded.

The following screen command keys are provided:

[Data Log View] - Accesses the "Real Time Trending" Display for viewing the data in a tabular format.

[Trending View] - Accesses the "Real Time Trending" Display for viewing the data in a graphical format.

[Operating Status View] - Accesses the "Real Time Trending" Display for viewing the data as it was on the "Operating Status" display format.

The data items to be viewed are selected from either "Data Log View" or "Trending View" display. The recorded data of a pressure or a temperature reading can be added or removed from what is currently displayed. Up to nine separate channels can be viewed at a time in any order. The screen command keys are used to select what data and time period to view. The "Data Log View" shows (hg) values in parenthesis.

The following screen command key is provided for both the Data Log View above and the Trending View that follows:

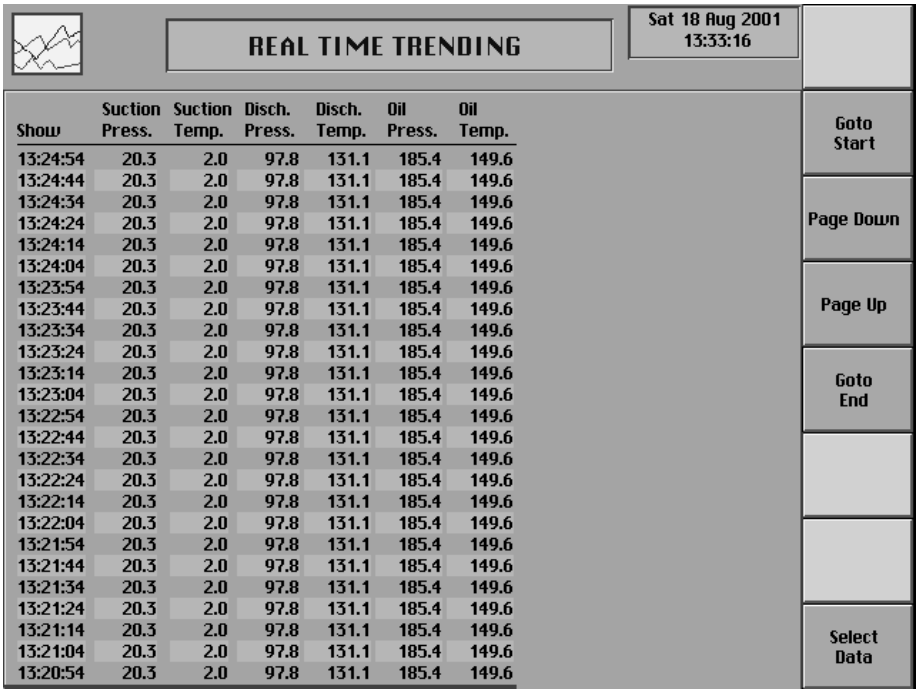
[Select Data] -Changes the screen command keys to the following selections of data to show:

- Suction Pressure
- Suction Temperature
- Discharge Pressure
- Discharge Temperature
- Oil Pressure
- Oil Temperature
- Filter Pressure
- Separator Temperature
- Balance Piston
- Process Temperature
- Motor Current
- Slide Valve
- Slide Stop
- Status

A toggle key is provided for each of the data selections:

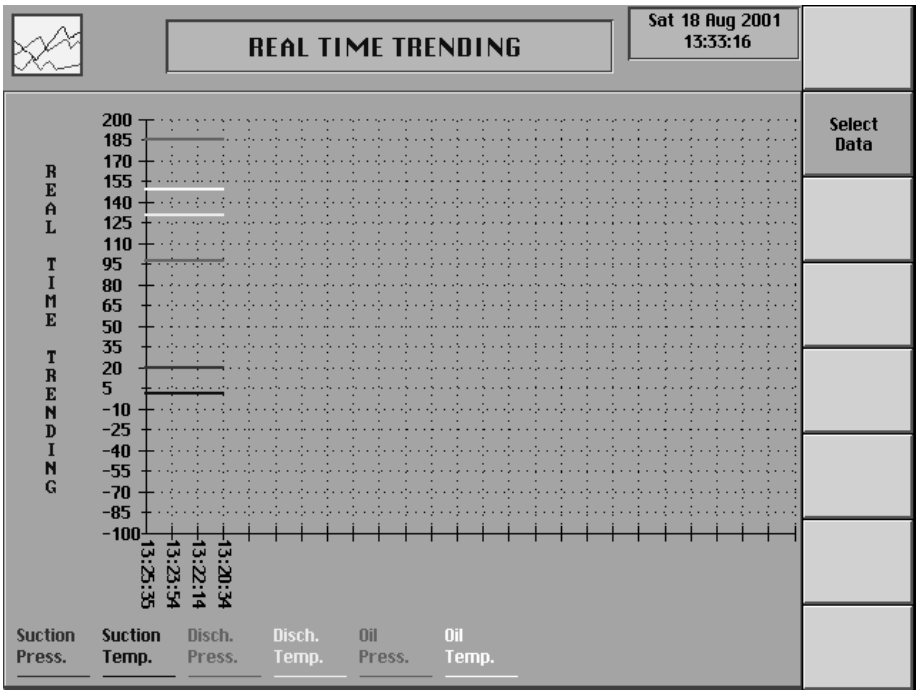
[Show] - Selects the data to be shown.
[Remove] - Removes this data from being shown.

REAL TIME TRENDING - DATA LOG VIEW



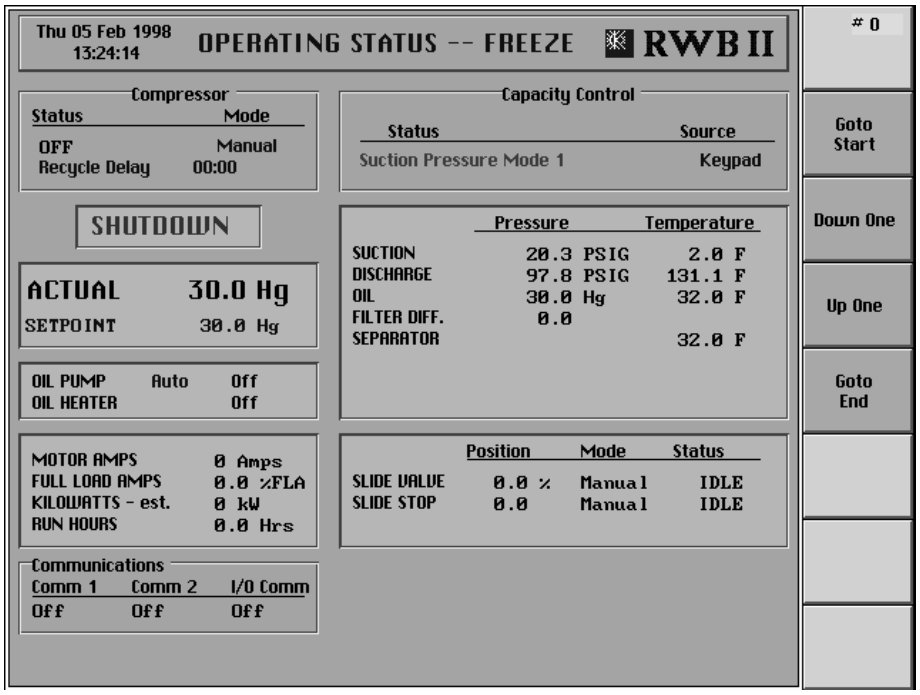
Show	Suction Press.	Suction Temp.	Disch. Press.	Disch. Temp.	Oil Press.	Oil Temp.
13:24:54	20.3	2.0	97.8	131.1	185.4	149.6
13:24:44	20.3	2.0	97.8	131.1	185.4	149.6
13:24:34	20.3	2.0	97.8	131.1	185.4	149.6
13:24:24	20.3	2.0	97.8	131.1	185.4	149.6
13:24:14	20.3	2.0	97.8	131.1	185.4	149.6
13:24:04	20.3	2.0	97.8	131.1	185.4	149.6
13:23:54	20.3	2.0	97.8	131.1	185.4	149.6
13:23:44	20.3	2.0	97.8	131.1	185.4	149.6
13:23:34	20.3	2.0	97.8	131.1	185.4	149.6
13:23:24	20.3	2.0	97.8	131.1	185.4	149.6
13:23:14	20.3	2.0	97.8	131.1	185.4	149.6
13:23:04	20.3	2.0	97.8	131.1	185.4	149.6
13:22:54	20.3	2.0	97.8	131.1	185.4	149.6
13:22:44	20.3	2.0	97.8	131.1	185.4	149.6
13:22:34	20.3	2.0	97.8	131.1	185.4	149.6
13:22:24	20.3	2.0	97.8	131.1	185.4	149.6
13:22:14	20.3	2.0	97.8	131.1	185.4	149.6
13:22:04	20.3	2.0	97.8	131.1	185.4	149.6
13:21:54	20.3	2.0	97.8	131.1	185.4	149.6
13:21:44	20.3	2.0	97.8	131.1	185.4	149.6
13:21:34	20.3	2.0	97.8	131.1	185.4	149.6
13:21:24	20.3	2.0	97.8	131.1	185.4	149.6
13:21:14	20.3	2.0	97.8	131.1	185.4	149.6
13:21:04	20.3	2.0	97.8	131.1	185.4	149.6
13:20:54	20.3	2.0	97.8	131.1	185.4	149.6

REAL TIME TRENDING - TRENDING VIEW

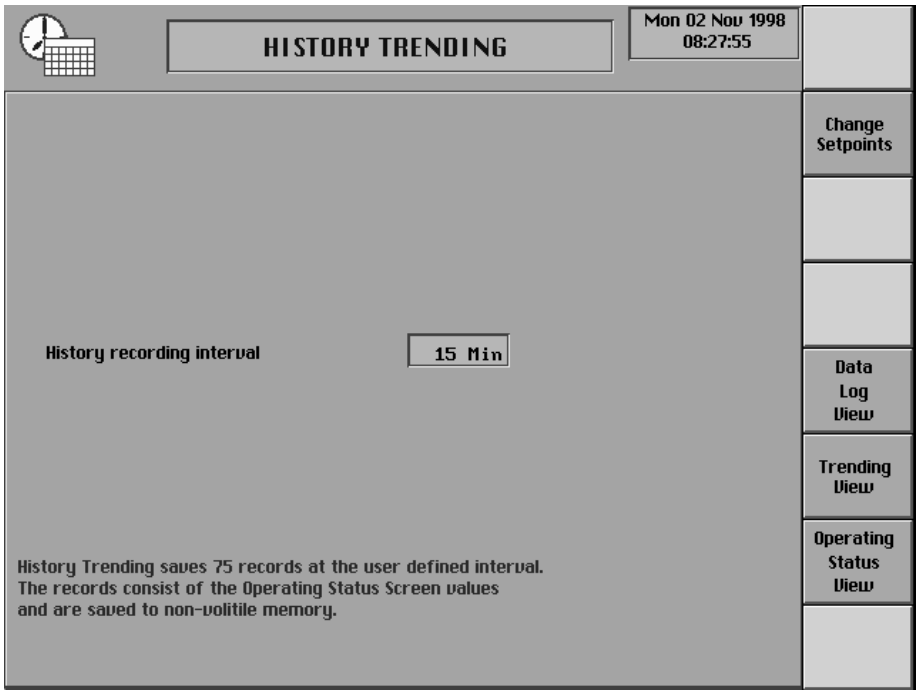


Because real time trending saves 250 recordings of the data items from the “Operating Status” display, there are 250 “Real Time Trending - Operating Status View” displays that can be accessed.

REAL TIME TRENDING - OPERATING STATUS VIEW



MAIN MENU SELECTION - “HISTORY TRENDING” DISPLAY



History trending saves 75 recordings of the data items from the “Operating Status” display. History data is stored in EPROM memory. EPROM memory is nonvolatile and all information is retained even if the power to the panel is lost. The frequency at which the data is saved can be selected.

The following setpoint is provided:

History recording interval – The time interval in minutes that defines how often the trending data values are recorded. The time interval ranges from 15 minutes up to 60 minutes.

The following screen command keys are provided:

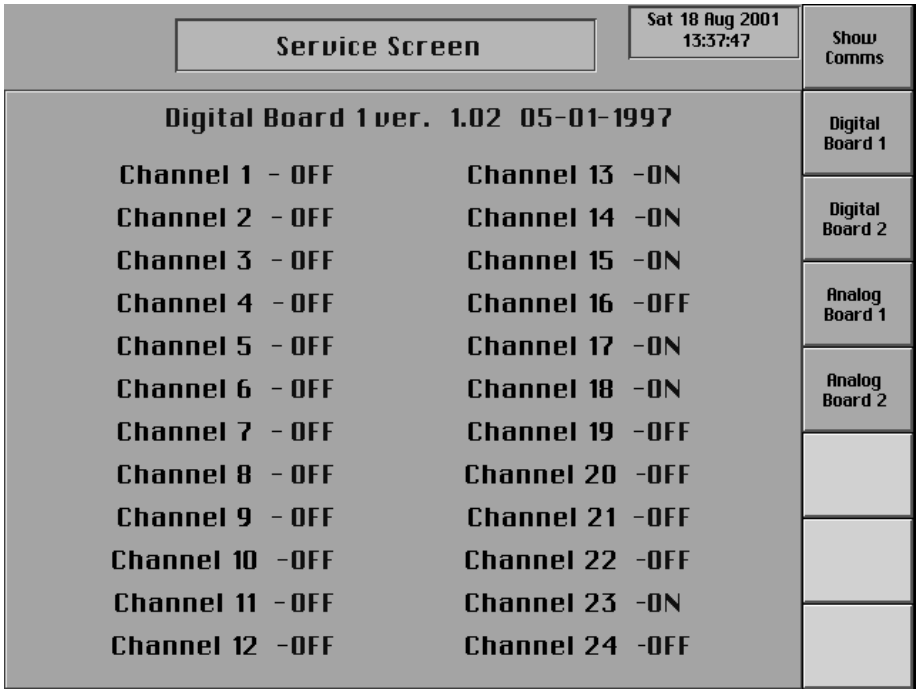
[Data Log View] – Accesses the “History Trending” Display for viewing the data in a tabular format.

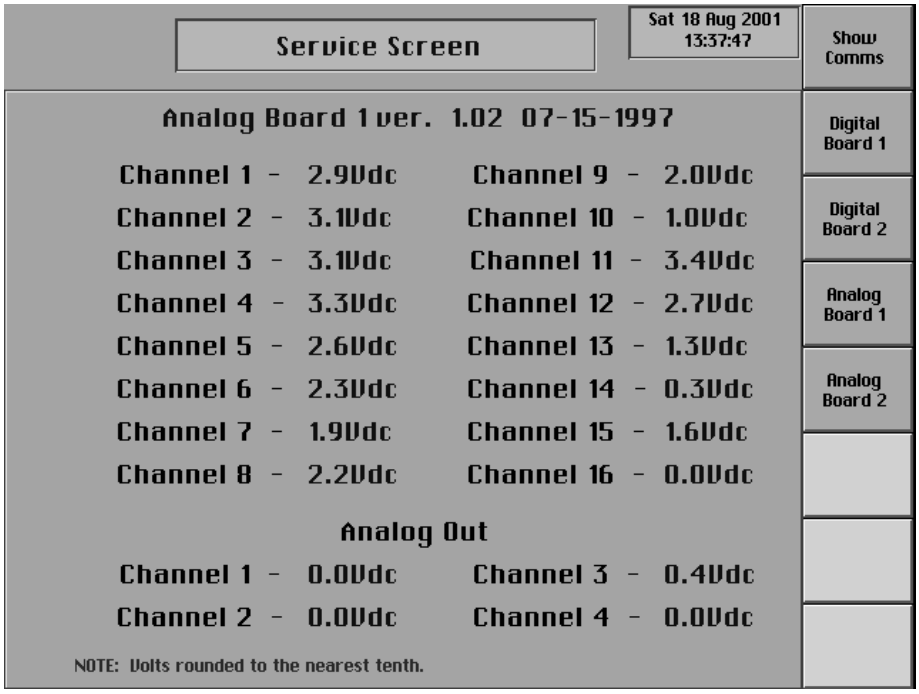
[Trending View] – Accesses the “History Trending” Display for viewing the data in a graphical format.

[Operating Status View] – Accesses the "History Trending" Display for viewing the data as it was on the "Operating Status" display format.

The History Trending data is viewed the same as the Real Time Trending data except that only 75 records are saved and at a minimum time interval of every 15 minutes. Reference the "Real Time Trending" displays for a description of the "Trending" displays.

"MAIN MENU" DISPLAY- "SERVICE SCREEN" DISPLAY





These displays have been provided to help the service technician. They can be accessed from the service screen display.From here the service technician can view communication data that is transferred in and out of the Comm2 port or the raw data from an analog or a digital board. Select the [Show Comms] screen key to view a display that is a snapshot of the data transfer from the Comm2 communication port. There are screen key selections to access the separate displays for each of the analog and digital boards that are present. Digital values are shown as ON or OFF. Analog values are converted from binary to show volts. The error factor is +/- .05 volts.

OPERATION OVERVIEW

Initial Setup Procedure:

1. Factory Setup should be performed by a Factory Representative or Distributor to setup the customer specific control features which should not need to be changed by operators.
2. Panel Setup is performed to setup panel features and options which can later be changed by an operator. Features such as the panel time, and screen color are changed here. Options such as condenser control are enabled here. The operator can avoid viewing and entering settings of unused controls by keeping unused options disabled.
3. Calibrate the control devices.
4. From Control Setup enter and setup the control settings.
5. From Security Setup establish the desired access rights of the operators.
6. The Operating Status displays now provide quick access to the most important information and controls of the compressor unit and the subsystems.

Compressor Start-Up Procedure:

- Starting is shown for the Compressor status on the “Operating Status” display.
- All the safeties are checked. If any shutdown condition is present the corresponding alarm message is shown and the compressor is prevented from starting.
- The oil lubrication is checked. A prelube pump needs a 5 lb oil pressure differential to allow the compressor to start. A full time pump needs a 20 lb oil pressure differential to allow the compressor to start. Other compressor manufacturer’s oil pumps need a 30 lb oil pressure differential to allow the compressor to start. If one of these conditions is not present an alarm message is issued and the compressor is prevented from starting.
- The slide valve position is checked to see if it is less than or equal to the “Highest Slide Valve Position to allow starting the compressor” setpoint. If the slide valve position is higher than this, the compressor is prevented from starting.
- If none of the above conditions has prevented the compressor from starting, the compressor and the recycle delay timer are started.
- If within 30 seconds the Compressor Start Auxiliary input has not been energized, or motor current is not detected, then an alarm message is issued and the compressor is shut down.
- When the compressor begins running, the oil pressure values are in a state of change. For a period of 10 seconds after the compressor status switches to “Running”, the low oil pressure alarm and shutdown safeties are ignored.

Compressor Stopping Procedure:

During the compressor stopping, the slide valve unload solenoid remains energized until the slide valve is unloaded to or below the “Highest slide valve position to allow starting the compressor” setpoint. If the slide valve does not unload below this setpoint within 5 minutes, the alarm message “Compressor Unable to Unload - Alarm” is issued.

Setup for Automatic Control:

In order to operate a compressor at peak efficiency, under full load and part load conditions complex control sequences must be used. In order to obtain the efficiencies, automatic control is almost mandatory. Automatic control of the slide stop and slide valve increases the compressor efficiency over a wide operating range. The following steps (which are relevant) should be taken to control in automatic:

- The compressor should be in automatic (automatic cycling) so the compressor will start and stop according to the autocycle setpoints.
- The oil pump should be in auto because it’s operation coincides with that of the compressor.
- The slide valve and the slide stop should be in automatic so they are controlled by setpoints and internal control logic.

Note: If there is a shutdown in response to a safety setting, a compressor in “Automatic” mode is placed into “Manual” mode requiring operator intervention.

Remote Control of the Compressor:

The following digital outputs and inputs have been provided that can be used to control the compressor from another controller such as a PLC:

- Ready to Run - This output is energized while the compressor is not shutdown and the recycle delay has timed out.
- Remote Enabled - This output is energized while the compressor is in remote start mode.
- Remote Start / Run / Stop - If the compressor is in remote start mode with no recycle delay time and this input is energized, the compressor is started. If this input is energized and the compressor is started, it will continue to run. If this input is de-energized, the compressor is stopped.
- Remote Load or Remote C.C step 1 for step units
    - Remote Load - If the slide valve is in remote mode and this input is energized, the slide valve load solenoid will be energized provided there are no safety overrides preventing loading.
    - Remote C.C step 1 for step units - If the capacity mode is in remote this input is used to step on and off capacity according to the Remote Capacity Control chart.

- Remote Unload or Remote C.C. step 2 for step units
  - Remote Unload - If the slide valve is in remote and this input is energized, the slide valve unload solenoid will be energized.
  - Remote C.C step 2 for step units - If the capacity mode is in remote this input is used to step on and off capacity according to the Remote Capacity Control chart.

Remote Capacity Control Chart

Input \ %Capacity	25	50	75	100
3-Step Input 4		OFF	OFF	ON
3-Step Input 5		OFF	ON	ON
4-Step Input 4	OFF	ON	OFF	ON
4-Step Input 5	OFF	OFF	ON	ON

- Recycle Delay - This output is energized while the remaining time in minutes for recycle delay is greater than zero. Recycle delay time is the time that must elapse prior to allowing the compressor to restart. This timer times out while the compressor is running or stopped since the recycle delay is a start-to-start protection. The recycle delay time is intended to prevent damage to the motor from successive restarts. For further setup see the “Motor Control Setpoints” display

- Sequence Input - When this input is energized, the compressor sequencing that was enabled in panel setup is activated. When this input is de-energized, compressor sequencing is deactivated if the sequence module activated it.

The “Hot Gas Bypas/SV Setpoint” option can be used. This option, which is enabled in Panel Setup, is not available for all compressor models (Reference “Compressor Model Differences”). Three digital outputs are provided that signal when the slide valve has reached preset positions. For further setup see the “Slide Valve Setpoints” display.

The Remote Control Setpoint option can be used. This option, which is enabled in Panel Setup, is not available for all compressor models (Reference “Compressor Model Differences”). This uses the Remote Control Setpoint analog input and the Remote Control Setpoint analog output for capacity control of compressors. For further setup see the “Calibrate Remote Control Setpoint” display.

The Remote Slide Valve Position option can be used. This option, which is enabled in Panel Setup, is not available for all compressor models (Reference “Compressor Model Differences”). This uses a (4-20 ma) input signal to the Remote Slide Valve Position analog channel 13 to control the slide valve. For further setup see the “Calibrate Slide Valve Position” display and the **[Remote Slide Valve]** command key from the slide valve mode screen command keys on the “Operating Status” display.

The Slide Valve Position \ Capacity analog output can be used to determine the present slide valve position % or capacity % dependent on the compressor model (Reference “Compressor Model Differences”). A (4-20 ma) output signal to the Slide Valve Position \ Capacity analog output (Channel #3 on Analog Board #1) corresponds to the present percent (%) value displayed on the “Operating Status” display.

ASCII commands (See “Microprocessor Telecommunications) using serial communication to the Com-2 port can be used. A compressor should be in both remote compressor mode and remote slide valve or capacity mode for remote control.

Note: If the compressor is in “Remote” mode and communication through the communication port has not occurred for five minutes, then the compressor is placed into “Automatic” mode and the slide valve is placed into “Auto” mode.

Note: If there is a shutdown in response to a safety setting, a compressor in “Remote” mode is placed into “Manual” mode requiring operator intervention.

ALARMS/SHUTDOWNS MESSAGES

When a Shutdown occurs, the display backlight will flash on and off to alert an operator of the shutdown. This visual alarm will help get the attention of the operator in a noisy engine room environment where audible alarms may not be heard. Pressing any key on the keypad will clear the flashing backlight.

Following is a list of all the possible alarms:

Analog Board 1 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Analog Board 1.

Analog Board 2 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Analog Board 2.

Analog Board 3 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Analog Board 3.

Analog Board 4 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Analog Board 4.

Auxiliary #1 Alarm - The Auxiliary #1 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #1 Shutdown - The Auxiliary #1 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #2 Alarm - The Auxiliary #2 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #2 Shutdown - The Auxiliary #2 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #3 Alarm - The Auxiliary #3 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #3 Shutdown - The Auxiliary #3 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #4 Alarm - The Auxiliary #4 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #4 Shutdown - The Auxiliary #4 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #5 Alarm - The Auxiliary #5 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #5 Shutdown - The Auxiliary #5 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #6 Alarm - The Auxiliary #6 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #6 Shutdown - The Auxiliary #6 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #7 Alarm - The Auxiliary #7 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #7 Shutdown - The Auxiliary #7 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary #8 Alarm - The Auxiliary #8 input module has been setup to indicate an alarm when it is de-energized and it became de-energized.

Auxiliary #8 Shutdown - The Auxiliary #8 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Balance Piston Failure Shutdown - Balance piston control was enabled in Factory Setup. There are 3 conditions that will cause a “Balance Piston Failure Shutdown”:

1. If the difference between discharge pressure and suction pressure is less than 60 lb and the Balance Piston output module (digital output module 12) is de-energized, then the balance piston pressure must be 1.1 times suction pressure plus or minus 15 lb.
2. If the difference between discharge pressure and suction pressure is greater than or equal to 60 lb. and the Balance Piston output module (digital output module 12) is de-energized, then the balance piston pressure must be 50 lb below discharge pressure plus or minus 15 lb.
3. If the Balance Piston output module (digital output module 12) is energized, then balance piston pressure must be within 20 lb of oil pressure.

Compressor Aux. Failure - This shutdown message is issued if while the compressor is running, the Compressor Auxiliary input module, which receives feedback from the motor starter, becomes de-energized.

Compressor Interlock Failure - This shutdown message is issued if while the compressor is running the Compressor Auxiliary input module becomes de-energized for five seconds.

Compressor Starting Failure - Aux. - This shutdown message is displayed if after 30 seconds from sending the compressor start command, the compressor auxiliary input module is still not energized.

Compressor Starting Failure - Low Motor Amps - This shutdown message is displayed if after 30 seconds from sending the compressor start signal, the motor amps reading is not greater than the “Low Motor Amps Shutdown” setpoint.

Compressor Stopping Failure - Aux. - This shutdown message is issued if while stopping the compressor, after 8 seconds from the compressor stop command the compressor auxiliary is energized. While this condition is present, the oil pump (if available) is on and liquid injection (if available) is allowed on and the slide valve is unloaded to 0% to safeguard the compressor.

Compressor Stopping Failure - Motor Amps - This shutdown message is issued if while stopping the compressor, after 12 seconds from the compressor stop command the motor current reading is above the “Low Motor Amps Shutdown” setpoint. While this condition is present, the oil pump (if available) is on and liquid injection (if available) is allowed on and the slide valve is unloaded to 0% to safeguard the compressor.

Compressor Unable to Unload - Alarm - While stopping the compressor or the compressor is off, the slide valve position has not unloaded below the “Highest Slide Valve Position to allow starting the compressor” setpoint.

DBS Alarm - The RAM DBS Motor Starter is responding that it has an alarm condition.

DBS Trip - The RAM DBS Motor Starter is responding that it has a shutdown condition.

Digital Board 1 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Digital Board 1.

Digital Board 2 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Digital Board 2.

Digital Board 3 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Digital Board 3.

Digital Board 4 Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to Digital Board 4.

Discharge Pressure Sensor Fault - This shutdown message is issued if the discharge pressure reading was out of range for its sensor.

Discharge Temperature Sensor Fault - This shutdown message is issued if the discharge temperature reading was out of range for its sensor.

False Start Failure - Aux. - This shutdown message is issued if while the compressor is off the compressor auxiliary is energized. While this condition is present, the oil pump (if available) is on and liquid injection (if available) is allowed on and the slide valve is unloaded to 0% to safeguard the compressor.

False Start Failure - Motor Amps - This shutdown message is issued if while the compressor is off, the motor current reading is above the "Low Motor Amps Shutdown" setpoint. While this condition is present, the oil pump (if available) is on and liquid injection (if available) is allowed on and the slide valve is unloaded to 0% to safeguard the compressor.

High Auxiliary Analog #1 Alarm - The Auxiliary Analog #1 value was greater than or equal to the high Auxiliary Analog #1 alarm setpoint for its time delay.

High Auxiliary Analog #1 Shutdown - The Auxiliary Analog #1 value was greater than or equal to the high Auxiliary Analog #1 shutdown setpoint for its time delay.

High Auxiliary Analog #2 Alarm - The Auxiliary Analog #2 value was greater than or equal to the high Auxiliary Analog #2 alarm setpoint for its time delay.

High Auxiliary Analog #2 Shutdown - The Auxiliary Analog #2 value was greater than or equal to the high Auxiliary Analog #2 shutdown setpoint for its time delay.

High Auxiliary Analog #3 Alarm - The Auxiliary Analog #3 value was greater than or equal to the high Auxiliary Analog #3 alarm setpoint for its time delay.

High Auxiliary Analog #3 Shutdown - The Auxiliary Analog #3 value was greater than or equal to the high Auxiliary Analog #3 shutdown setpoint for its time delay.

High Auxiliary Analog #4 Alarm - The Auxiliary Analog #4 value was greater than or equal to the high Auxiliary Analog #4 alarm setpoint for its time delay.

High Auxiliary Analog #4 Shutdown - The Auxiliary Analog #4 value was greater than or equal to the high Auxiliary Analog #4 shutdown setpoint for its time delay.

High Auxiliary Analog #5 Alarm - The Auxiliary Analog #5 value was greater than or equal to the high Auxiliary Analog #5 alarm setpoint for its time delay.

High Auxiliary Analog #5 Shutdown - The Auxiliary Analog #5 value was greater than or equal to the high Auxiliary Analog #5 shutdown setpoint for its time delay.

High Auxiliary Analog #6 Alarm - The Auxiliary Analog #6 value was greater than or equal to the high Auxiliary Analog #6 alarm setpoint for its time delay.

High Auxiliary Analog #6 Shutdown - The Auxiliary Analog #6 value was greater than or equal to the high Auxiliary Analog #6 shutdown setpoint for its time delay.

High Auxiliary Analog #7 Alarm - The Auxiliary Analog #7 value was greater than or equal to the high Auxiliary Analog #7 alarm setpoint for its time delay.

High Auxiliary Analog #7 Shutdown - The Auxiliary Analog #7 value was greater than or equal to the high Auxiliary Analog #7 shutdown setpoint for its time delay.

High Auxiliary Analog #8 Alarm - The Auxiliary Analog #8 value was greater than or equal to the high Auxiliary Analog #8 alarm setpoint for its time delay.

High Auxiliary Analog #8 Shutdown - The Auxiliary Analog #8 value was greater than or equal to the high Auxiliary Analog #8 shutdown setpoint for its time delay.

High Auxiliary Analog #9 Alarm - The Auxiliary Analog #9 value was greater than or equal to the high Auxiliary Analog #9 alarm setpoint for its time delay.

High Auxiliary Analog #9 Shutdown - The Auxiliary Analog #9 value was greater than or equal to the high Auxiliary Analog #9 shutdown setpoint for its time delay.

High Discharge Temperature Alarm - The discharge temperature was greater than or equal to the high discharge temperature alarm setpoint for its time delay.

High Discharge Temperature Shutdown - The discharge temperature was greater than or equal to the high discharge temperature shutdown setpoint for its time delay.

High Discharge Pressure Alarm - The discharge pressure was greater than or equal to the active high discharge pressure alarm setpoint for its time delay.

High Discharge Pressure Shutdown - The discharge pressure was greater than or equal to the active high discharge pressure shutdown setpoint for its time delay.

High Economizer Alarm - The Auxiliary Analog #10 value was greater than or equal to the high Auxiliary Analog #10 alarm setpoint for its time delay.

High Economizer Shutdown - The Auxiliary Analog #10 value was greater than or equal to the high Auxiliary Analog #10 shutdown setpoint for its time delay.

High Entering Process Temperature Alarm - The entering process temperature was greater than or equal to the "High Entering Process Temperature Alarm" setpoint for its time delay.

High Entering Process Temperature Shutdown - The entering process temperature was greater than or equal to the "High Entering Process Temperature Shutdown" setpoint for its time delay.

High Liquid Level Shutdown - The corresponding input module was de-energized.

High Motor Current Alarm - The motor amps was greater than or equal to the high motor amps alarm setpoint for its time delay.

High Motor Current Shutdown - The motor amps was greater than or equal to the high motor amps shutdown setpoint for its time delay.

High Oil Filter Pressure Alarm - The oil filter pressure was greater than or equal to the "High Filter Pressure Alarm" setpoint for its time delay.

High Oil Filter Pressure Shutdown - The oil filter pressure was greater than or equal to the "High Filter Pressure Shutdown" setpoint for its time delay.

High Oil Temperature Alarm - The oil temperature was greater than or equal to the "High Oil Temperature Alarm" setpoint for its time delay.

High Oil Temperature Shutdown - The oil temperature was greater than or equal to the "High Oil Temperature Shutdown" setpoint for its time delay.

High Starting Differential Pressure - Shutdown - The differential pressure (discharge pressure minus suction pressure) was greater than or equal to the "Starting Discharge Pressure below" setpoint when starting the compressor.

Hi Suction Pressure Alarm - The suction pressure was greater than or equal to the active high suction pressure alarm setpoint for its time delay.

Hi Suction Pressure Shutdown - The suction pressure was greater than or equal to the active high suction pressure shutdown setpoint for its time delay.

Insufficient Main Oil Pressure Shutdown - The slide valve is greater than 50% and the oil pressure (PSIA) is less than or equal to the suction pressure (PSIA) multiplied by 1.5 and then added to 15.0.

Low Auxiliary Analog #1 Alarm - The Auxiliary Analog #1 value was less than or equal to the low Auxiliary Analog #1 alarm setpoint for its time delay.

Low Auxiliary Analog #1 Shutdown - The Auxiliary Analog #1 value was less than or equal to the low Auxiliary Analog #1 shutdown setpoint for its time delay.

Low Auxiliary Analog #2 Alarm - The Auxiliary Analog #2 value was less than or equal to the low Auxiliary Analog #2 alarm setpoint for its time delay.

Low Auxiliary Analog #2 Shutdown - The Auxiliary Analog #2 value was less than or equal to the low Auxiliary Analog #2 shutdown setpoint for its time delay.

Low Auxiliary Analog #3 Alarm - The Auxiliary Analog #3 value was less than or equal to the low Auxiliary Analog #1 alarm setpoint for its time delay.

Low Auxiliary Analog #3 Shutdown - The Auxiliary Analog #3 value was less than or equal to the low Auxiliary Analog #3 shutdown setpoint for its time delay.

Low Auxiliary Analog #4 Alarm - The Auxiliary Analog #4 value was less than or equal to the low Auxiliary Analog #4 alarm setpoint for its time delay.

Low Auxiliary Analog #4 Shutdown - The Auxiliary Analog #4 value was less than or equal to the low Auxiliary Analog #4 shutdown setpoint for its time delay.

Low Auxiliary Analog #5 Alarm - The Auxiliary Analog #5 value was less than or equal to the low Auxiliary Analog #5 alarm setpoint for its time delay.

Low Auxiliary Analog #5 Shutdown - The Auxiliary Analog #5 value was less than or equal to the low Auxiliary Analog #5 shutdown setpoint for its time delay.

Low Auxiliary Analog #6 Alarm - The Auxiliary Analog #6 value was less than or equal to the low Auxiliary Analog #6 alarm setpoint for its time delay.

Low Auxiliary Analog #6 Shutdown - The Auxiliary Analog #6 value was less than or equal to the low Auxiliary Analog #6 shutdown setpoint for its time delay.

Low Auxiliary Analog #7 Alarm - The Auxiliary Analog #7 value was less than or equal to the low Auxiliary Analog #7 alarm setpoint for its time delay.

Low Auxiliary Analog #7 Shutdown - The Auxiliary Analog #7 value was less than or equal to the low Auxiliary Analog #7 shutdown setpoint for its time delay.

Low Auxiliary Analog #8 Alarm - The Auxiliary Analog #8 value was less than or equal to the low Auxiliary Analog #8 alarm setpoint for its time delay.

Low Auxiliary Analog #8 Shutdown - The Auxiliary Analog #8 value was less than or equal to the low Auxiliary Analog #8 shutdown setpoint for its time delay.

Low Auxiliary Analog #9 Alarm - The Auxiliary Analog #9 value was less than or equal to the low Auxiliary Analog #9 alarm setpoint for its time delay.

Low Auxiliary Analog #9 Shutdown - The Auxiliary Analog #9 value was less than or equal to the low Auxiliary Analog #9 shutdown setpoint for its time delay.

Low Economizer Alarm - The Auxiliary Analog #10 value was less than or equal to the low Auxiliary Analog #10 alarm setpoint for its time delay.

Low Economizer Shutdown - The Auxiliary Analog #10 value was less than or equal to the low Auxiliary Analog #10 shutdown setpoint for its time delay.

Low Entering Process Temperature Alarm - The entering process temperature was less than or equal to the "Low Entering Process Temperature Alarm" setpoint for its time delay.

Low Entering Process Temperature Shutdown - The entering process temperature was less than or equal to the "Low Entering Process Temperature Shutdown" setpoint for its time delay.

Low Motor Current Shutdown - This shutdown message is displayed if the motor amps reading was less than or equal to the "Low Motor Amps Shutdown" setpoint while the compressor was running,

Low Oil Pressure Alarm - The compressor was running. Either the oil pressure of a running pump was less than or equal to the "Low Oil Pressure Alarm" setpoint, or the oil pressure of a not running pump was less than or equal to the "Low Oil Pressure Alarm" setpoint for its time delay.

Low Oil Pressure Shutdown - The compressor was running. Either the oil pressure of a running pump was less than or equal to the "Low Oil Pressure Shutdown" setpoint, or the oil pressure of a not running pump was less than or equal to the "Low Oil Pressure Shutdown" setpoint for its time delay.

Low Oil Separator Temperature Alarm - The oil separator temperature was less than or equal to the "Low Oil Separator Temperature Alarm" setpoint for its time delay.

Low Oil Separator Temperature Shutdown - The oil separator temperature was less than or equal to the "Low Oil Separator Temperature Alarm" setpoint for its time delay.

Low Oil Temperature Alarm - The oil temperature was less than or equal to the "Low Oil Temperature Alarm" setpoint for its time delay.

Low Oil Temperature Shutdown - The oil temperature was less than or equal to the "Low Oil Temperature Shutdown" setpoint for its time delay.

Low Process Temperature Alarm - Process temperature was the active capacity control and the process temperature was less than or equal to the low process temperature alarm setpoint for its time delay. This process temperature is the leaving process temperature.

Low Process Temperature Shutdown - Process temperature was the active capacity control and the process temperature was less than or equal to the low process temperature shutdown setpoint for its time delay. This process temperature is the leaving process temperature.

Low Suction Pressure Alarm - The suction pressure was less than or equal to the active low suction pressure alarm setpoint for its time delay.

Low Suction Pressure Shutdown - The suction pressure was less than or equal to the active low suction pressure shutdown setpoint for its time delay.

Missing Oil Pressure Alarm - The oil pressure (PSIA) is less than the suction pressure (PSIA) multiplied by 1.1 and then added to 15.0.

Missing Oil Pressure Shutdown - The oil pressure (PSIA) is less than the suction pressure (PSIA) added to 15.0.

Motor Starter Comm. Fail - Shutdown - It has been detected that the program is no longer able to communicate to a RAM DBS Motor Starter.

Oil Level Shutdown - The corresponding input module for low oil level was de-energized for five minutes.

Oil Log Shutdown - Oil log was enabled in Factory Setup and the Compressor has not started and the oil pump has already run for the fail delay time.

Oil Pressure Sensor Fault - This shutdown message is issued if the oil pressure reading was out of range for its sensor.

Oil Pump Aux Failure - While starting the oil pump, the Oil Pump Auxiliary input module did not energize within 5 seconds. Or, while the oil pump was running the Oil Pump Auxiliary input module de-energized.

Oil Pump #1 Aux. Alarm - While starting Oil Pump #1, the Oil Pump #1 Auxiliary input module did not energize within five seconds. Or, while this oil pump was running the Oil Pump #1 Auxiliary input module de-energized. This indicates dual pump control and "Pump #1" is the lead pump.

Oil Pump #1 Aux. Failure Shutdown - While starting Oil Pump #1, the Oil Pump #1 Auxiliary input module did not energize within five seconds. Or, while this oil pump was running the Oil Pump #1 Auxiliary input module de-energized. This indicates dual pump control and "Pump #1" is the last pump to start.

Oil Pump #2 Aux. Alarm - While starting Oil Pump #2, the Oil Pump #2 Auxiliary input module did not energize within five seconds. Or, while this oil pump was running the Oil Pump #2 Auxiliary input module de-energized. This indicates dual pump control and "Pump #2" is the lead pump.

Oil Pump #2 Aux. Failure Shutdown - While starting Oil Pump #2, the oil pump auxiliary input module did not energize within five seconds. Or, while the oil pump was running the oil pump auxiliary input module de-energized. This indicates dual pump control and "Pump #2" is the last pump to start.

Oil Temperature Sensor Fault - This shutdown message is issued if the oil temperature reading was out of range for its sensor.

Separator Temperature Sensor Fault - This shutdown message is issued if the oil separator temperature reading was out of range for its sensor.

Suction Pressure Sensor Fault - This shutdown message is issued if the suction pressure reading was out of range for its sensor.

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