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OPERATION – BASIC

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OPERATION – BASIC
(SESSION LEVEL 0)

FRICK[®] QUANTUM[™]LX
COMPRESSOR
CONTROL PANEL
VERSION 6.5x

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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 is 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 screens. By pressing a key on the keypad, the labeled or described function is recognized by the control processor.

The following information is presented to help the operator interact with the graphic screens 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. This is because of the compressor model (see *Compressor Model Differences*) or because this feature or option was selected from a setup.

COMMON TERMINOLOGY

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

Warning - A Warning 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.

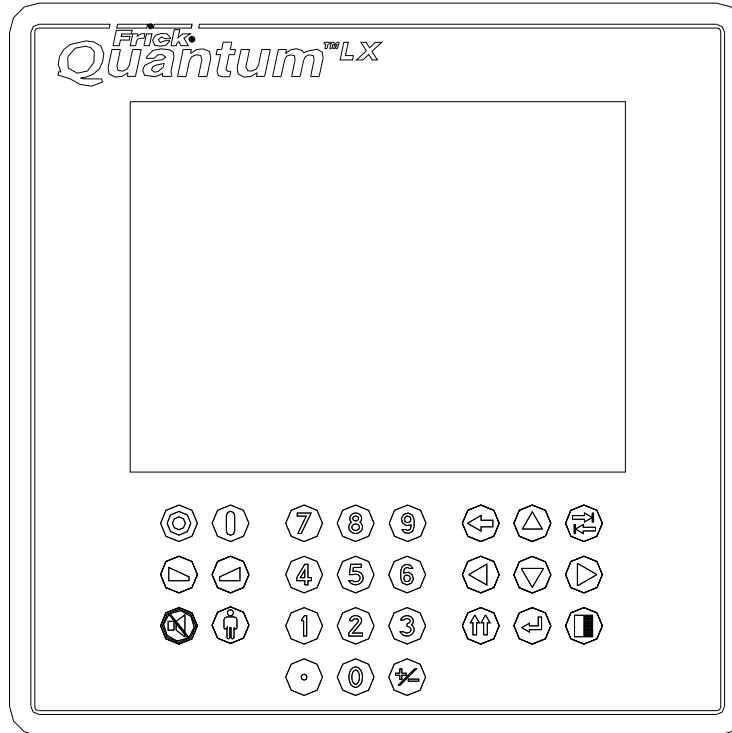
Auto (Automatic) - The device is being controlled from setpoints at the local controller.

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

OPERATOR ACCESS

Operator access to this system is through various screens. A screen is the physical representation of data on the display. Icons have been used to help an operator quickly identify functions. An icon is a small, graphic symbol representation. Each screen has a title area. The title is descriptive of the screen. 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 actual 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 screens have screen keys that describe or show a function that is recognized when the coinciding keypad key to the right of the screen is pressed. The screen keys provide access to other screens 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 have 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, 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

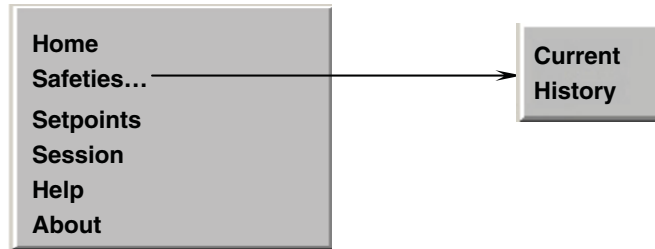


The following is a list of the labeled keypad keys and the actions that occur when they are pressed:

Key	Function
	[STOP] - Pressing this key immediately stops the compressor by placing it into Stop Mode. The compressor is stopped regardless of any other conditions.
	[START] - Pressing this key places the compressor unit into the Start Mode for running.
	[UNLOAD VALUE] - Unloads Capacity.
	[LOAD VALUE] - Loads Capacity.
	[ALARM SILENCE] - Immediately silences a sounding alarm and turns off the alarm annunciation device that is connected to this panel.
	[MANUAL] - Changes the compressor mode from its current mode to its previous mode.
	NUMERALS [0] - [9] - The numerical keys are used to enter a value in a data field.
	DECIMAL [.] - This key is used when entering a decimal value in a data field.
	[+/-] - When changing a value in a data field, this key toggles the value between negative and positive.

Key	Function
	[BACKSPACE] - Pressing this key will cause the current location of the cursor to backup one position per key depression. When changing a value in a data field, this key will delete the selected character.
	[UP ARROW] - Provides upward navigation within the <i>MAIN MENU</i> window.
	[TAB] - When in the mode of changing setpoints, pressing this key will cause the cursor to jump to the next data entry field.
	[LEFT ARROW] - When in the mode of changing setpoints, this key is used to go to the previous data entry field. When the <i>MAIN MENU</i> is shown, pressing this key will cancel the window.
	[DOWN ARROW] - Provides downward navigation within the <i>MAIN MENU</i> window.
	[RIGHT ARROW] - When in the mode of changing a data entry field, this key is used to go to the next character.
	[ENTER] - When changing data in a data entry field, this key will accept the change. This key is also used to select items on Menu Windows.
	[SUBMIT] - After changing a setpoint value, use this key to enter (submit) the finished page.
	[MENU] - Shows the <i>MAIN MENU</i> window. This window shows the main selections for accessing information, setup of options, and setpoint entry.

MENU STRUCTURE



The above graphic represents the menu structure, or tree, of the Quantum™-LX Basic screens. Use this tree when accessing the various screens. When this document is

viewed electronically, passing the mouse pointer over each of the above names, and then clicking on it, will take you directly to the page with that screen.

OPERATION OVERVIEW

Compressor Start-Up Procedure:

- The **Operating Status** screens provide quick access to the most important information and controls of the compressor unit and the subsystems.
- Starting status is shown for the Compressor on the **Operating Status** screen.
- Press the **0** button on the keypad (Start).
- All of the safeties are checked by the operating software. If any shutdown condition is present, the corresponding message will be shown, and the compressor is prevented from starting.
- The oil lubrication is automatically checked. If a problem has been detected, an appropriate message is issued and the compressor is prevented from starting. The problem will need to be resolved before continuing.
- The Slide Valve position is checked automatically. If the Slide Valve position is not correct, the compressor is prevented from starting. The problem will need to be resolved before continuing.
- If none of the above conditions has prevented the compressor from starting, a time delay is started that requires the starting conditions to remain satisfied for a period of five seconds for all compressor model types except **[Other Compressor Manuf.]**. The *Other*

compressor model type uses a 20 seconds delay. After the time delay 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 a message is issued and the compressor is shut down. The problem will need to be resolved before continuing.
- When the compressor begins running, the Oil Pressure values can be in a state of change. For a period of 10 seconds after the compressor status switches to *Running*, the low Oil Pressure warning and shutdown safeties are ignored.
- If all operating parameters are within acceptable limits, the compressor will go into RUN mode. No further operator intervention is normally needed.

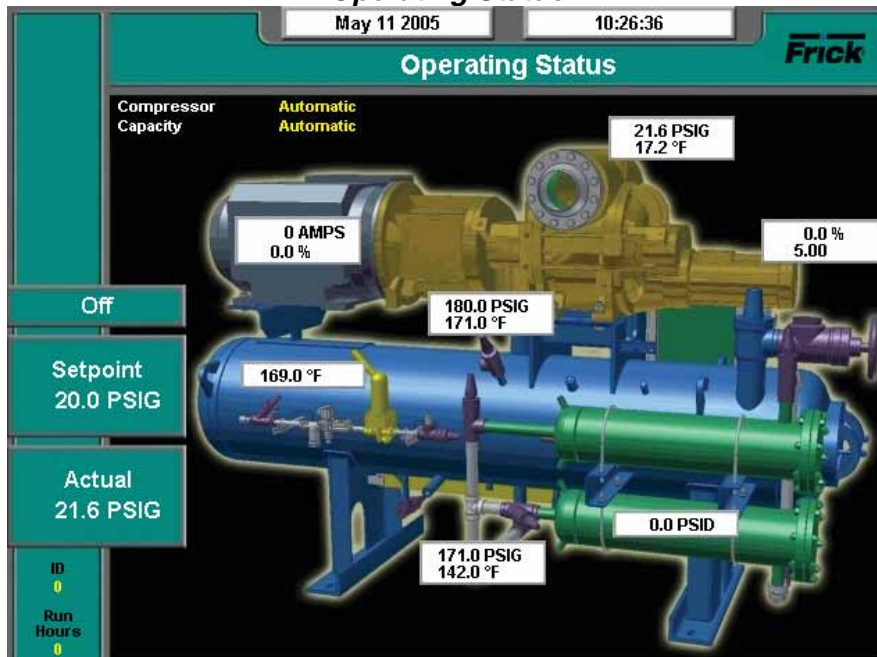
Compressor Stopping Procedure:

Press the **0** button on the keypad (Stop).

Once the compressor has been stopped, it cannot be restarted again for 20 minutes, this is known as Recycle Delay. Recycle delay time is the time that must elapse prior to allowing the compressor to restart. It is intended to prevent damage to the motor from successive restarts.

OPERATING DISPLAY SCREENS

Operating Status



SCREEN NAME: *Operating Status* or Home.

ACCESSING:  → Home

DESCRIPTION: This is the default screen. When power is applied, this screen will appear. Also called the **Home** screen. The most important information about the compressor and the applicable subsystems operation is displayed here. This screen 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** screen is continuously updated and provides a variety of information with regard to the current condition and performance of the compressor unit and subsystem.

The following information is shown on this screen:

DATE - The actual date will be displayed in this box. The date must first be set correctly on the **Configuration** screen. Once set, the date will be automatically adjusted for at the end of each month, much like the calendar feature of most modern watches. The primary use of the date feature is to provide a date stamp for Warnings and Shutdowns. (See also [TIME](#))

TIME - The actual time will be displayed in this box. The time must first be set correctly on the **Configuration** screen. The time will also need to be adjusted for those locations which observe Daylight Savings Time. The primary use of the time feature is to provide a time stamp for Warnings and Shutdowns. (See also [Date](#))

SCREEN TITLE - This is the title for the screen that is showing. Each screen will have a title. The Quantum™ LX manuals will extensively refer to screens by these names. When referred to in these manuals, screen names will be shown in bold italic print, such as ***Operating Status***.

COMPRESSOR MODEL - This is actually a rotating marquee. It will alternately display the model name of the compressor (such as RWF) and will then rotate to show Frick®. **NOTE:** The picture of the compressor shown above is for a RWF II. Any other compressor model may not appear the same, however, the values discussed here do not change, regardless of the compressor type.

COMPRESSOR RUN STATUS – This shows the actual status of the compressor.

- Off
- Running
- Starting
- Stopping
- Stopping - High Capacity
- Stopping - Pumpdown

PROCESS SETPOINT VALUE - This is the control setpoint maintained by the internal capacity control.

PROCESS ACTUAL VALUE - The actual reading of the pressure or temperature that was chosen as the compressor control setpoint.

ID - The value shown here is the number that has been assigned to this particular unit on the **Communications Setup** screen.

RUN HOURS – The value shown here is the total number of hours that the compressor has been actually running, since the last start.

WARNING/SHUTDOWNS STATUS AREA - The Warning/Shutdowns Status is displayed near the bottom left side of the screen. This area is blank with no message if there are no warnings or shutdowns present.

When a Warning or Shutdown occurs, a specific message will be shown. The message will be followed by either the word Warning or Shutdown. The description of Warning and Shutdown are:

WARNING - This message flashes when a warning is present. A warning is a condition that requires operator acknowledgement 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.

A Warning or Shutdown message indicates a Warning or Shutdown point has been reached, or exceeded.

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.

SENSOR READINGS - The following items are shown:

Motor Amps - The actual amps.

Suction Pressure - Is measured at the compressor inlet and the value is displayed along with the unit of measure.

Suction Temperature - Is measured at the compressor inlet and the value is displayed along with the unit of measure.

Discharge Pressure - Is measured at the compressor outlet and the value is displayed along with the unit of measure.

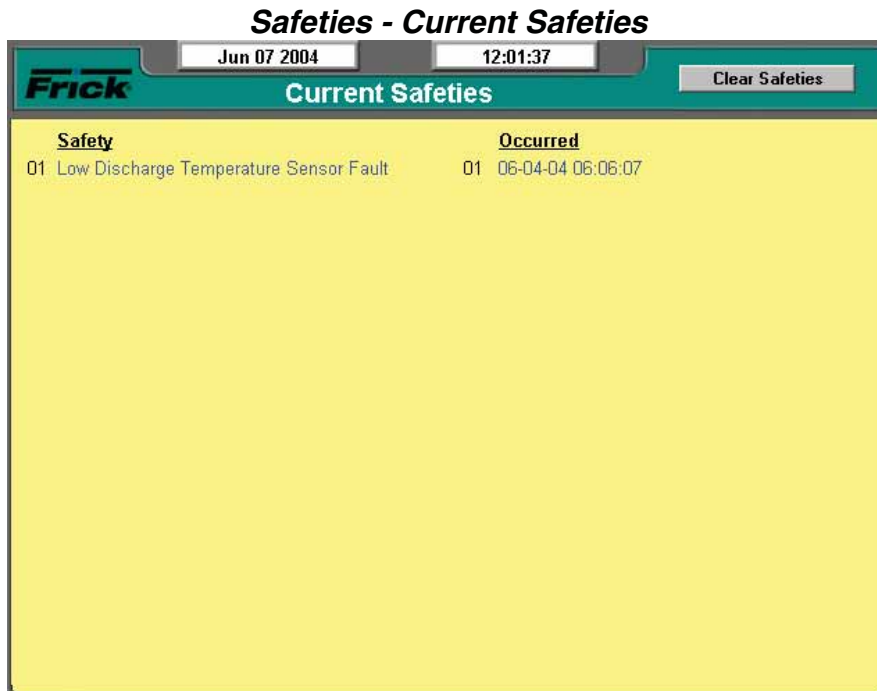
Discharge Temperature - Is measured at the compressor outlet and the value is displayed along with the unit of measure.

Oil Pressure - Is measured prior to entering the compressor and the value is displayed along with the unit of measure.

Oil Temperature - Is measured prior to entering the compressor and the value is displayed along with the unit of measure.

Filter Differential - 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 Temperature - The Oil Separator Temperature value is displayed along with the unit of measure.



SCREEN NAME: *Current Safeties.*

ACCESSING: → **Safeties...** → **Current**

DESCRIPTION: The **Current Safeties** screen shows the Warnings and Shutdowns that have recently occurred (up to 50). When a warning or shutdown is triggered, a blue descriptive message shows on this screen. The date and time of the warning or shutdown occurrence is shown to the right of its description. The most recent message will appear on the top line of the screen with the oldest appearing at the bottom. When a Warning or Shutdown is logged to this screen, it will also be logged to the **Safety History** screen.

The following **Current Safeties** screen key is provided:

[Clear Safeties] - Selecting this key will clear all warnings and/or shutdowns from this screen. It also de-energizes the Warning output module and energizes the Shutdown output module (digital outputs 23 and 24) to silence any warning annunciation device. This will also place a date/time stamp for the corresponding entry on the **Safety History** screen showing that the particular Warning or Shutdown was cleared. Clearing the entry on the **Current Safeties** screen, will not clear it from the **Safety History** screen.

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

1. Correct the condition(s) causing the warning.
2. Press the **[ALARM SILENCE]** key. (This action may precede correcting the condition(s) causing the warning). Or, go to step 3.
3. To clear or reset the **Warnings/Shutdowns** screen and turn off any warning annunciation

device, from the screen, press the **[Clear Safeties]** key. This will also clear any warning or shutdown messages from the **Operating Status** screen.

4. If the conditions causing the warning have not been corrected or a new fault has occurred, a new warning or shutdown message will appear. The **Safety History** screen keeps a record of the warnings and shutdowns. This information will help troubleshoot persistent operational problems.

Refer to the **Warnings/Shutdowns Message** section for a list of all the possible conditions.

When a Shutdown occurs, the screen backlight will flash on and off to alert an operator of the shutdown. This visual indication 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.

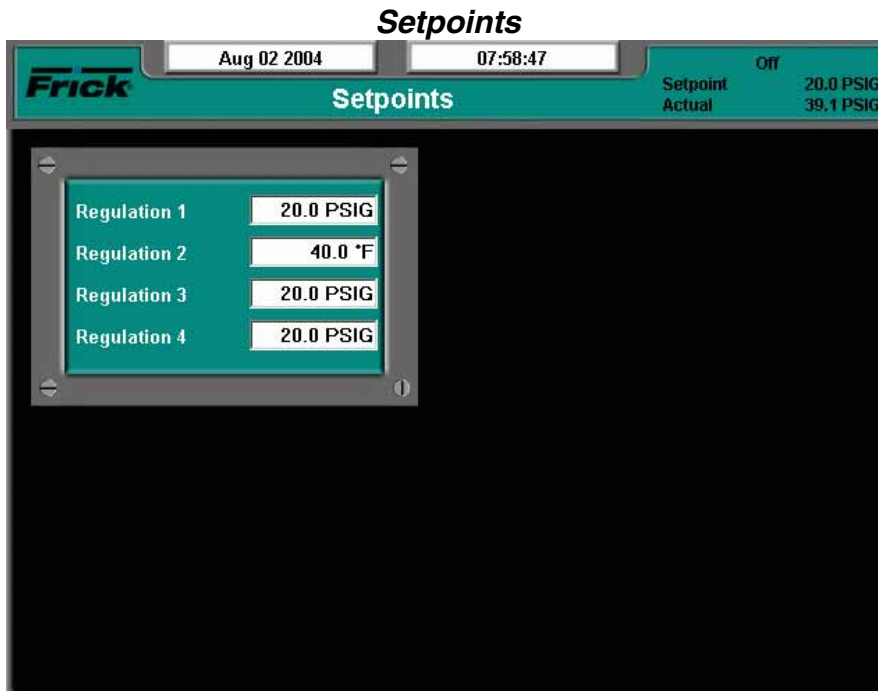
Safeties - History - Safety History

Jan 12 2005		09:02:16	
Frick Safety History			
Safety	Occurred	Cleared	
01 Compressor Capacity Unload Warning	01 01-11-05 12:17:34		
02 Stopping Failure - Motor Amps	02 06-03-04 14:55:38	06-03-04 15:07:16	
03 Oil Pump 1 Auxiliary Warning	03 06-03-04 13:35:59	06-03-04 14:31:37	
04 Low Oil Pressure Shutdown	04 06-03-04 13:23:28	06-03-04 14:31:37	
05 Low Oil Pressure Warning	05 06-03-04 13:18:28	06-03-04 14:31:37	
06 Oil Level Shutdown	06 06-03-04 13:13:28	06-03-04 14:31:37	
07 Stopping Failure - Motor Amps	07 06-03-04 13:08:34	06-03-04 14:31:37	
08 False Running Failure -- Motor Amps	08 06-03-04 13:08:27	06-03-04 14:31:37	
09 False Running Failure -- Motor Amps	09 06-03-04 13:06:04	06-03-04 14:31:37	
10 Stopping Failure - Motor Amps	10 06-03-04 13:00:38	06-03-04 14:31:37	
11 False Running Failure -- Motor Amps	11 06-03-04 13:00:32	06-03-04 14:31:37	
12 Low Oil Pressure Shutdown	12 06-03-04 12:23:41	06-03-04 14:31:37	
13 Low Oil Pressure Warning	13 06-03-04 12:18:41	06-03-04 14:31:37	
14 Oil Level Shutdown	14 06-03-04 12:13:41	06-03-04 14:31:37	
15 Stopping Failure - Motor Amps	15 06-03-04 12:08:46	06-03-04 14:31:37	
16 False Running Failure -- Motor Amps	16 06-03-04 12:08:40	06-03-04 14:31:37	
17 Low Oil Pressure Shutdown	17 06-03-04 11:48:48	06-03-04 14:31:37	
18 Low Oil Pressure Warning	18 06-03-04 11:43:48	06-03-04 14:31:37	
19 Stopping Failure - Motor Amps	19 06-03-04 11:38:55	06-03-04 14:31:37	
20 Oil Level Shutdown	20 06-03-04 11:38:48	06-03-04 14:31:37	
21 Stopping Failure - Motor Amps	21 06-03-04 11:32:49	06-03-04 11:33:35	
22 Stopping Failure - Motor Amps	22 06-03-04 11:32:08	06-03-04 11:32:43	
23 Low Oil Pressure Shutdown	23 06-03-04 10:58:29	06-03-04 11:32:02	
24 Low Oil Pressure Warning	24 06-03-04 10:53:29	06-03-04 11:32:02	


SCREEN NAME: **Safety History.**



DESCRIPTION: The **Safety History** screen shows the warnings and shutdowns that have recently occurred (up to 50 maximum). When a warning or shutdown is triggered, a blue descriptive message shows on this screen. The date and time of the warning or shutdown occurrence is shown to the right of its description, followed by the date and time that the safety was cleared (if applicable, from the **Current Safeties** screen). The most recent message will appear on the top line of the screen with the oldest appearing at the bottom.



SCREEN NAME: *Capacity Control.*

ACCESSING:  → **Setpoints**

DESCRIPTION: All setpoints having to do with Compressor Control are found here.

This screen will list all Regulation modes which have been setup by the supervisor. A setpoint box is provided next to each available Regulation mode, along with the proper units (pressure, temperature, etc.). The user may need to set each box to the setpoint value that they wish to have the compressor maintain for that particular mode.

Although the mode itself cannot be changed manually at the Basic level, it can be changed automatically if the unit has been set by the supervisor to run in Scheduling mode. This feature is automatic in nature, and requires no intervention by the operator. Scheduling will cause the

compressor to run in any four of the possible Regulation modes, based upon a pre-programmed time schedule.

The following Regulation Modes could be shown (depending on the setup):

- Regulation 1
- Regulation 2
- Regulation 3
- Regulation 4



SCREEN NAME: *Session.*

ACCESSING: 

DESCRIPTION: This screen allows the user/supervisor to access the various available user levels. This is also where the user can select the language, pressure units, temperature units and date format.

The following Setpoints may be changed:

User Level - Level 0 is referred to as the BASIC level, and is used to access the very basics of compressor operation. Level 0 requires no password.

Password - To access any level above level 0, a password must be entered that matches the password that has previously been assigned to each user level by the supervisor.

The following pull-down menus have been provided:

Language - You may choose from the following list:

- English
- French
- Chinese
- Portuguese

Pressure Units - You may choose from the following list:

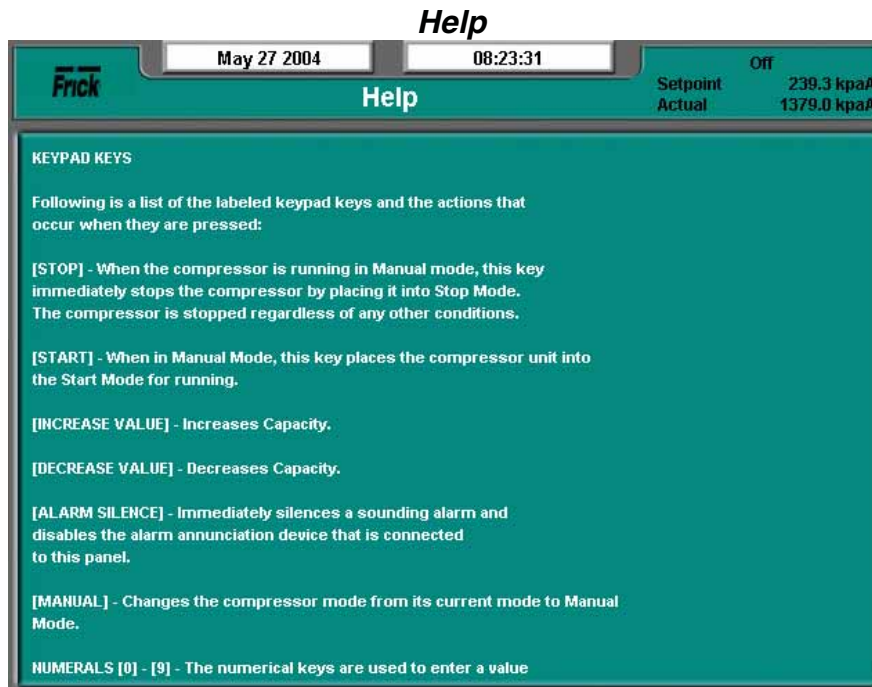
- Kpa
- Bar
- BarA
- PSIA
- PSIG/hg

Temperature Units - You may choose from the following list:


- Celcius
- Fahrenheit

Date Format - You may choose from the following list:

- US
- Europe



SCREEN NAME: *Help.*

ACCESSING: 

DESCRIPTION: This screen provides the user with specific information as to the function of all keypad keys, as well as all screen keys, and changing Setpoints.

KEYPAD KEYS

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

[STOP] - When the compressor is running in Manual mode, this key immediately stops the compressor by placing it into Stop Mode. The compressor is stopped regardless of any other conditions.

[START] - When in Manual Mode, this key places the compressor unit into the Start Mode for running.

[INCREASE VALUE] - Increases Capacity.

[DECREASE VALUE] - Decreases Capacity.

[ALARM SILENCE] - Immediately silences a sounding alarm and disables the alarm annunciation device that may be connected to this panel.

[MANUAL] - Changes the compressor mode from its current mode to its previous mode.

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.

[BACKSPACE] - Pressing this key will cause the current location of the cursor to backup one position per key depression. When changing a value in a data field, this key will delete the selected character.

[UP ARROW] - Provides upward navigation within the Main MENU window.

[TAB] - When in the mode of changing setpoints, pressing this key will cause the cursor to jump to the next data entry field.

[LEFT ARROW] - When in the mode of changing setpoints, this arrow is used to go to the previous character within a data entry field. When the *MAIN MENU* is shown, pressing this key will cancel the window.

[DOWN ARROW] - Provides downward navigation within the *MAIN MENU* window.

[RIGHT ARROW] - When in the mode of changing a data entry field, this arrow is used to go to the next character.

[ENTER] - When changing data in a data entry field, this key will accept the change. This key is also used to select items on Menu Windows.

[SUBMIT] - After changing a setpoint value, Use this key to enter (submit) the change.

[MENU] - Shows the *MAIN MENU* window. This window shows the main selections for accessing information, setup of options, and setpoint entry.

SCREEN KEYS

TO CHANGE THE ADJUSTABLE SETPOINTS

The adjustable setpoints define the operation and limits of the compressor unit and subsystems operation. Adjustable Setpoints are stored in EEPROM (non-volatile memory) and are easily changed in the field.

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.

The **[TAB]** key is used to maneuver around the screen.

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

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.

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 **[BACKSPACE]** key to erase it.

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

If the value is out of bounds, an error message box shows and displays the proper value range. Press the **[OK]** key to acknowledge that you saw the error message. Re-enter the correct value.

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

When finished making any changes to the data on an adjustable setpoint, press the **[SUBMIT]** key to accept all changes or select another screen 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 assumed 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.

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

Correct the conditions causing the alarm.


Press the **[ALARM SILENCE]** key. (This action may precede correcting the conditions causing the alarm).

To clear or reset the 'Warnings/Shutdowns' screen, from the 'Current Safeties' screen press the **[Clear Safeties]** key. This will also clear the 'WARNING' or 'SHUTDOWN' message from the **Operating Status** screen.

If the conditions causing the fault have not been corrected or a new fault has occurred, a new 'WARNING' or 'SHUTDOWN' message will appear. The Warning/Shutdowns history screen keeps a record of the warnings and shutdowns. This information will help troubleshoot persistent operational problems.



SCREEN NAME: *About*.

ACCESSING:  → **About**

DESCRIPTION: The **About** screen shows all microprocessor-based circuit boards that have been detected by the Quantum™ LX, as well other related software information.

The following information is shown here:

Linux Kernel - The Quantum™ LX controller runs on a Linux programming architecture (rather than Microsoft Windows). This is the software version number for the main Linux Kernel (or program).

York Quantum Software - This is the version of the software program that does the actual control of the compressor. It runs in the Linux environment.

Sales Order - A six digit numerical value that has been assigned to a specific compressor package by Frick Company. It is very important to have this number available when calling the factory for assistance or parts ordering.

Item - This is actually an extension of the Sales Order number. It would potentially be used for a multiple compressor site, where the same Sales Order number was assigned for all compressors. The Item Number would be different for each compressor.

Analog Boards - Shows all analog boards that were detected through communications at the last power up. If a board is detected, the software version of the program running on that board (with date of the software) will be shown.

Digital Boards - Shows all digital boards that were detected through communications at the last power up. If a board is detected, the software version of the program running on that board (with date of the software) will be shown.

IO Boards - Shows all other I/O boards that were detected through communications at the last power up. If a board is detected, the software version of the program running on that board (with date of the software) will be shown.

Drive Controller - Shows motor or engine drive controllers that were detected through communications at the last power up. If a board is detected, the software version of the program running on that board (with date of the software) will be shown.

Warnings/Shutdowns Messages

When a Shutdown occurs, the display backlight will flash on and off to alert an operator of the shutdown. This visual warning 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.

NOTE: refer to S100-200/210 IOM for further Vyper message details.

Following is the alphabetical listing of all the possible conditions:

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

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

Auxiliary Input 1-20 Shutdown - The Auxiliary #1-20 input module has been setup to indicate a shutdown when it is de-energized and it became de-energized.

Auxiliary Input 1-20 Warning - The Auxiliary #1-20 input module has been setup to indicate a warning when it is de-energized and it became de-energized.

Balance Piston 1 Shutdown - Balance piston control has been enabled. This shutdown will occur 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.

Balance Piston 2 Shutdown - Balance piston control has been enabled. This shutdown will occur if the difference 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.

Balance Piston 3 Shutdown - Balance piston control has been enabled. This shutdown will occur if the Balance Piston output module (digital output module 12) is energized, then Balance Piston pressure must be within 20lb. of Oil Pressure.

Compressor Auxiliary Shutdown - 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 Capacity Unload Warning - While stopping the compressor or if the compressor is off, this indicates that the Slide Valve position has not unloaded below the *Highest Slide Valve Position to allow starting the compressor* setpoint.

DBS Communication Failure Warning – It has been detected that the program is no longer able to communicate to a RAM DBS Motor Starter.

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

DBS - Current Unbalance – Either the current between two phases has exceeded the setpoint value longer than the time delay setpoint, or there is a voltage unbalance between phases, or the SCR operation is abnormal.

DBS - Heatsink Over-temperature – Either the temperature of the heat sink has exceeded the maximum safe operating temperature of 85 deg. C. or heat sink cable connection P2 is loose.

DBS – Jam – The current exceeded the Jam Trip level set point longer than the time delay set point while in the RUN state.

DBS - Phase Loss – This will occur if there is a loss of at least one phase of supply voltage or the loss of at least one phase of current feedback.

DBS - Phase Reversal – Either there is an incorrect phase order at the DBS chassis input terminals, or the control power was applied before the three phase power.

DBS - RTD Overtemperature –The RTD temperature sensor is out of range.

DBS - RTD Temperature – The RTD temperature sensor is out of range.

DBS - Short Circuit – The current exceeded 800% of FLA set point while the motor was starting.

DBS - Shorted SCR – This failure may occur if there is a defective SCR or a defective bypass contactor. It may also occur if the motor is disconnected. Also, inspect the main contacts of the bypass contactor.

DBS - Thermal Overload – Either the calculated thermal capacity of the motor exceeded 100% of limit, or the motor is "short-cycling".

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

Digital Board 1 Reset - If a reset of Digital Board 1 occurs, a shutdown will result to prevent the motor from restarting.

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

Digital Board 2 Reset - If a reset of Digital Board 2 occurs, a shutdown will result to prevent the motor from restarting.

Discharge Temperature Saturation Shutdown - This Shutdown applies if Superheat has been enabled. When

running, a shutdown will occur if TDsat plus setpoint temperature is greater than the Discharge Temperature for the setpoint time.

Discharge Temperature Saturation Warning - This warning applies if Superheat has been enabled. When running, a warning will occur if TDsat plus setpoint temperature is greater than the Discharge Temperature for the setpoint time.

False Running Failure -- Compressor Confirmed Running Input - 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 Running 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 1-20 Shutdown - The Auxiliary Analog #1-20 value was greater than or equal to the high Auxiliary Analog #1-20 shutdown setpoint for its time delay.

High Auxiliary Analog 1-20 Warning - The Auxiliary Analog #1-20 value was greater than or equal to the high Auxiliary Analog #1-20 warning setpoint for its time delay.

High Compressor Vibration Shutdown - Suction - If the Suction End Compressor Vibration sensor registers a reading that is higher than the value that has been set for the *Suction End High Shutdown*, for the period of time as set for the *Suction End High Shutdown Delay*, a Shutdown will be generated.

High Compressor Vibration Warning - Suction - If the Suction End Compressor Vibration sensor registers a reading that is higher than the value that has been set for the *Suction End High Warning*, for the period of time as set for the *Suction End High Warning Delay*, a Warning will be generated.

High Compressor Vibration Shutdown - Discharge - If the Discharge End Compressor Vibration sensor registers a reading that is higher than the value that has been set for the *Discharge End High Shutdown*, for the period of time as set for the *Discharge End High Shutdown Delay*, a Shutdown will be generated.

High Compressor Vibration Warning - Discharge - If the Discharge End Compressor Vibration sensor registers a reading that is higher than the value that has been set for the *Discharge End High Warning*, for the period of time as set for the *Discharge End High Warning Delay*, a warning will be generated.

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 Discharge Pressure Warning – The Discharge Pressure was greater than or equal to the active *High Discharge Pressure Warning* setpoint for its time delay.

High Discharge Pressure Shutdown -- Dual Discharge Mode 1 - The Discharge Pressure was greater than or equal to the active *High Discharge Pressure Shutdown* setpoint for its time delay.

High Discharge Pressure Warning -- Dual Discharge Mode 1 - The Discharge Pressure was greater than or equal to the active *High Discharge Pressure Warning* setpoint for its time delay.

High Discharge Pressure Shutdown -- Dual Discharge Mode 2 - The Discharge Pressure was greater than or equal to the active *High Discharge Pressure Shutdown* setpoint for its time delay.

High Discharge Pressure Warning -- Dual Discharge Mode 2 - The Discharge Pressure was greater than or equal to the active *High Discharge Pressure Warning* setpoint for its time delay.

High Discharge Pressure Sensor Fault - This shutdown message is issued if the Discharge Pressure reading was to the upper or maximum range (out of range) for its sensor.

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 Temperature Warning - The Discharge Temperature was greater than or equal to the *High Discharge Temperature Warning* 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 Economizer Warning - The Auxiliary Analog #10 value was greater than or equal to the high Auxiliary Analog #10 warning 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 Entering Process Temperature Warning - The Entering Process Temperature was greater than or equal to the *High Entering Process Temperature Warning* setpoint for its time delay.

High Limit Discharge Pressure Shutdown - The Discharge Pressure was greater than or equal to the active *High Discharge Pressure Shutdown* setpoint for its time delay.

High Limit Discharge Temperature Shutdown - The Discharge Temperature was greater than or equal to the active *High Discharge Temperature Shutdown* setpoint for its time delay.

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

High Manifold Pressure Shutdown - This shutdown applies if Engine Drive was enabled. When the Manifold Pressure exceeds this setpoint, an alarm will occur.

High Manifold Pressure Warning - This warning applies if Engine Drive was enabled. When the Manifold Pressure exceeds this setpoint, a warning will occur.

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

High Motor Current Warning - The Motor Amps was greater than or equal to the *High Motor Amps Warning* setpoint for its time delay.

High Motor Stator #1 Temperature Warning – If Motor Stator #1 temperature sensor registers a reading that is higher than the value that has been set for the *Motor Stator #1 Temp. Warning*, for the period of time as set for the *Motor Stator #1 Temp. Warning Delay*, a warning will be generated.

High Motor Stator #1 Temperature Shutdown – If Motor Stator #1 temperature sensor registers a reading that is higher than the value that has been set for the *Motor Stator #1 Temp. Shutdown*, for the period of time as set for the *Motor Stator #1 Temp. Shutdown Delay*, a Shutdown will be generated.

High Motor Stator #2 Temperature Warning – If Motor Stator #2 temperature sensor registers a reading that is higher than the value that has been set for the *Motor Stator #2 Temp. Warning*, for the period of time as set for the *Motor Stator #2 Temp. Warning Delay*, a warning will be generated.

High Motor Stator #2 Temperature Shutdown – If Motor Stator #2 temperature sensor registers a reading that is higher than the value that has been set for the *Motor Stator #2 Temp. Shutdown*, for the period of time as set for the *Motor Stator #2 Temp. Shutdown Delay*, a Shutdown will be generated.

High Motor Stator #3 Temperature Warning – If Motor Stator #3 temperature sensor registers a reading that is higher than the value that has been set for the *Motor Stator #3 Temp. Warning*, for the period of time as set for the *Motor Stator #3 Temp. Warning Delay*, a warning will be generated.

High Motor Stator #3 Temperature Shutdown – If Motor Stator #3 temperature sensor registers a reading that is higher than the value that has been set for the *Motor Stator #3 Temp. Shutdown*, for the period of time as set for the *Motor Stator #3 Temp. Shutdown Delay*, a Shutdown will be generated.

High Motor Temperature Warning - Shaft Side – The motor has temperature sensors that monitor the Shaft Side bearing. If the temperature of this bearing exceeds the *Shaft Side High Warning* setpoint, for a period of time exceeding the *Shaft Side High Warning Delay* setpoint,

this Warning will occur. The default values for these setpoints are 203° F and a delay of 5 seconds.

High Motor Temperature Warning - Opposite Shaft Side – The motor has temperature sensors that monitor the Opposite Shaft Side bearing. If the temperature of this bearing exceeds the *Opposite Shaft Side High Warning* setpoint, for a period of time exceeding the *Opposite Shaft Side High Warning Delay* setpoint, this Warning will occur. The default values for these setpoints are 203° F and a delay of 5 seconds.

High Motor Temperature Shutdown - Shaft Side – The motor has temperature sensors that monitor the Shaft Side bearing. If the temperature of this bearing exceeds the *Shaft Side High Shutdown* setpoint, for a period of time exceeding the *Shaft Side High Shutdown Delay* setpoint, this Shutdown will occur. The default values for these setpoints are 221° F and a delay of 5 seconds.

High Motor Temperature Shutdown - Opposite Shaft Side – The motor has temperature sensors that monitor the Opposite Shaft Side bearing. If the temperature of this bearing exceeds the *Opposite Shaft Side High Shutdown* setpoint, for a period of time exceeding the *Opposite Shaft Side High Shutdown Delay* setpoint, this Shutdown will occur. The default values for these setpoints are 221° F and a delay of 5 seconds.

High Motor Vibration Shutdown - Opposite Shaft Side - If the Opposite Shaft Side Drive Vibration sensor registers a reading that is higher than the value that has been set for the *Opposite Shaft High Shutdown*, for the period of time as set for the *Opposite Shaft High Shutdown Delay*, a Shutdown will be generated.

High Motor Vibration Warning - Opposite Shaft Side - If the Opposite Shaft Side Drive Vibration sensor registers a reading that is higher than the value that has been set for the *Opposite Shaft High Warning*, for the period of time as set for the *Opposite Shaft High Warning Delay*, a warning will be generated.

High Motor Vibration Shutdown - Shaft Side - If the Shaft Side Drive Vibration sensor registers a reading that is higher than the value that has been set for the *Shaft Side High Shutdown*, for the period of time as set for the *Shaft Side High Shutdown Delay*, a Shutdown will be generated.

High Motor Vibration Warning - Shaft Side - If the Shaft Side Drive Vibration sensor registers a reading that is higher than the value that has been set for the *Shaft Side High Warning*, for the period of time as set for the *Shaft Side High Warning Delay*, a warning will be generated.

High Oil Filter Pressure Warning - The Oil Filter Pressure was greater than or equal to the *High Filter Pressure Warning* 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 Pressure Sensor Fault - This shutdown message is issued if the Oil Pressure reading was to the upper or maximum range (out of range) for its sensor.

High Oil Pressure Shutdown – The Oil Pressure was greater than or equal to the *High Oil Pressure Shutdown* 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 Oil Temperature Warning - The Oil Temperature was greater than or equal to the *High Oil Temperature Warning* setpoint for its time delay.

High RPM Shutdown - This shutdown applies if Engine or Turbine Drive was enabled. If the RPM's of the motor exceeds this setpoint, a shutdown will occur.

High RPM Warning - This warning applies if Engine or Turbine Drive was enabled. If the RPM's of the motor exceeds this setpoint, a warning will occur.

High Suction Pressure Shutdown - The Suction Pressure was greater than or equal to the active *High Suction Pressure Shutdown* setpoint for its time delay.

High Suction Pressure Warning - The Suction Pressure was greater than or equal to the active *High Suction Pressure Warning* 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.

Kobe High Oil Pressure Shutdown – If the compressor type is set to Other Manufacturer (Kobe), the oil pump type is set to Demand and if Oil Pressure rises above 325 PSIA for more than 5 seconds this shutdown will occur. This shutdown is only active when the compressor is running and is also not checked for the first 90 seconds after the compressor starts.

Kobe Low Oil Differential 1 Shutdown – If the compressor type is set to Other Manufacturer (Kobe), the oil pump type is set to Demand and if the differential between Oil Pressure and Suction Pressure is less than 50 PSI for 5 seconds this shutdown will occur. This shutdown is only active when the compressor is running and is also not checked for the first 90 seconds after the compressor starts.

Kobe Low Oil Differential 2 Shutdown – If the compressor type is set to Other Manufacturer (Kobe), the oil pump type is set to Demand and the differential between Oil Pressure and Suction Pressure is less than Suction Pressure times 0.8 for 5 seconds this shutdown will occur. This shutdown is only active when the compressor is running and is also not checked for the first 90 seconds after the compressor starts.

Liquid Slugging Shutdown - This shutdown is triggered off of a sudden decrease in Discharge Temperature that is greater than the Liquid Slugging Shutdown setpoint for a

five (5) second period. That is, if the Discharge Temperature is 130 degrees F, and the Liquid Slug Shutdown setpoint is 20 degrees F, then a sudden drop in Discharge Temperature from 130 to 110 degrees F within a five second period will generate a shutdown condition.

Liquid Slugging Warning - This warning is triggered off of a sudden decrease in Discharge Temperature that is greater than the Liquid Slug Warning setpoint for a five (5) second period. That is, if the Discharge Temperature is 130 degrees F, and the Liquid Slugging Warning setpoint is 10 degrees F, then a sudden drop in Discharge Temperature from 130 to 120 degrees F within a five second period will generate a warning condition.

Low Auxiliary Analog 1-20 Shutdown - The Auxiliary Analog #1-20 value was less than or equal to the low Auxiliary Analog #1-20 shutdown setpoint for its time delay.

Low Auxiliary Analog 1-20 Warning - The Auxiliary Analog #1-20 value was less than or equal to the low Auxiliary Analog #1-20 warning setpoint for its time delay.

Low Discharge Pressure Sensor Fault - This shutdown message is issued if the Discharge Pressure reading was to the lower or minimum range (out of range) for its sensor.

Low Discharge Temperature Sensor Fault - This shutdown message is issued if the Discharge Temperature reading was to the lower or minimum range (out of range) out of range for its sensor.

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 Economizer Warning - The Auxiliary Analog #10 value was less than or equal to the low Auxiliary Analog #10 warning 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 Entering Process Temperature Warning - The Entering Process Temperature was less than or equal to the *Low Entering Process Temperature Warning* setpoint for its time delay.

Low Main Oil Injection Pressure Shutdown - This shutdown can occur if Oil Injection was enabled. The Oil Injection Pressure (channel 15, Analog Board 2) must be greater than or equal to the Suction Pressure times 1.5, plus the setpoint to be in the safe condition, otherwise this shutdown will occur.

Low Motor Current Shutdown - This shutdown message is issued if, while the compressor was running, the Motor Amps reading was less than or equal to the *Low Motor Amps Shutdown* setpoint.

Low Oil Pressure Sensor Fault - This shutdown message is issued if the Oil Pressure reading was to the lower minimum range (out of range) for its sensor.

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

Low Oil Temperature Sensor Fault - This shutdown message is issued if the Oil Temperature reading was to the lower or minimum range (out of range) for its sensor.

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

Low Oil Temperature Warning - The Oil Temperature was less than or equal to the *Low Oil Temperature Warning* setpoint for its time delay.

Low RPM Shutdown - This shutdown applies if Engine or Turbine Drive was enabled. If the RPM's of the motor drops below this setpoint, a shutdown will occur.

Low RPM Warning - This warning applies if Engine or Turbine Drive was enabled. If the RPM's of the motor drops below this setpoint, a warning will occur.

Low Separator Temperature Sensor Fault - This shutdown message is issued if the Separator Temperature reading was to the lower or minimum range (out of range) for its sensor.

Low Separator Temperature Shutdown - The Oil Separator Temperature was less than or equal to the *Low Oil Separator Temperature Shutdown* setpoint for its time delay.

Low Separator Temperature Warning - The Oil Separator Temperature was less than or equal to the *Low Oil Separator Temperature Warning* setpoint for its time delay.

Low Suction Pressure Sensor Fault - This shutdown message is issued if the Suction Pressure reading was to the lower or minimum range (out of range) for its sensor.

Low Suction Shutdown -- Regulation Mode 1 - When running in Regulation Mode 1, if the Suction Pressure was less than or equal to the active Regulation Mode 1 *Low Suction Shutdown* setpoint for its time delay.

Low Suction Warning -- Regulation Mode 1 - When running in Regulation Mode 1, if the Suction Pressure was less than or equal to the active Regulation Mode 1 *Low Suction Warning* setpoint for its time delay.

Low Suction Shutdown -- Regulation Mode 2 - When running in Regulation Mode 2, if the Suction Pressure was less than or equal to the active Regulation Mode 2 *Low Suction Shutdown* setpoint for its time delay.

Low Suction Warning -- Regulation Mode 2 - When running in Regulation Mode 2, if the Suction Pressure was less than or equal to the active Regulation Mode 2 *Low Suction Warning* setpoint for its time delay.

Low Suction Shutdown -- Regulation Mode 3 - When running in Regulation Mode 3, if the Suction Pressure was less than or equal to the active Regulation Mode 3 *Low Suction Shutdown* setpoint for its time delay.

Low Suction Warning -- Regulation Mode 3 - When running in Regulation Mode 3, if the Suction Pressure was less than or equal to the active Regulation Mode 3 *Low Suction Warning* setpoint for its time delay.

Low Suction Shutdown -- Regulation Mode 4 - When running in Regulation Mode 4, if the Suction Pressure was less than or equal to the active Regulation Mode 4 *Low Suction Shutdown* setpoint for its time delay.

Low Suction Warning -- Regulation Mode 4 - When running in Regulation Mode 4, if the Suction Pressure was less than or equal to the active Regulation Mode 4 *Low Suction Warning* setpoint for its time delay.

Missing Oil Pressure Shutdown A - The Oil Pressure (PSIA) is less than the Suction Pressure (PSIA) multiplied by 1.1 and then added to 15.0, then delayed by 2 min.

Missing Oil Pressure Shutdown B - The Oil Pressure (PSIA) is less than the Suction Pressure (PSIA) added to 15.0, then delayed by 25 sec.

Missing Oil Pressure Warning - The Oil Pressure (PSIA) is less than the Suction Pressure (PSIA) multiplied by 1.1 and then added to 15.0, then delayed by 25 sec.

Oil Level Shutdown - The corresponding input module for low Oil Level was de-energized for five (5) minutes.

Oil Log Shutdown - Oil log was enabled and the Compressor has not started and the Oil Pump has already run for the fail delay time.

Oil Pump Auxiliary Failure - While starting the Oil Pump, the Oil Pump Auxiliary input module did not energize within five (5) seconds, or, while the Oil Pump was running, the Oil Pump Auxiliary input module de-energized.

Oil Pump 1 Auxiliary Warning - While starting Oil Pump #1, the Oil Pump #1 Auxiliary input module did not energize within five (5) 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 Auxiliary Shutdown - While starting Oil Pump #1, the Oil Pump #1 Auxiliary input module did not energize within five (5) 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 Auxiliary Warning - While starting Oil Pump #2, the Oil Pump #2 Auxiliary input module did not energize within five (5) 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 Auxiliary Shutdown - While starting Oil Pump #2, the Oil Pump auxiliary input module did not energize within five (5) 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.

Process Stopped - Check Event Log for Details – One of the control program subroutine processes has stopped functioning and a message has been entered into the event log. This is a Warning message.

Regulation Mode 1 Shutdown – When the selected regulation control process for Regulation Mode 1 has exceeded it's setpoint for the delay period, a Shutdown occurs.

Regulation Mode 1 Warning – When the selected regulation control process for Regulation Mode 1 has exceeded it's setpoint for the delay period, a Warning occurs.

Regulation Mode 2 Shutdown – When the selected regulation control process for Regulation Mode 2 has exceeded it's setpoint for the delay period, a Shutdown occurs.

Regulation Mode 2 Warning – When the selected regulation control process for Regulation Mode 2 has exceeded it's setpoint for the delay period, a Warning occurs.

Regulation Mode 3 Shutdown – When the selected regulation control process for Regulation Mode 3 has exceeded it's setpoint for the delay period, a Shutdown occurs.

Regulation Mode 3 Warning – When the selected regulation control process for Regulation Mode 3 has exceeded it's setpoint for the delay period, a Warning occurs.

Regulation Mode 4 Shutdown – When the selected regulation control process for Regulation Mode 4 has exceeded it's setpoint for the delay period, a Shutdown occurs.

Regulation Mode 4 Warning - When the selected regulation control process for Regulation Mode 4 has exceeded it's setpoint for the delay period, a Warning occurs.

Sequencing Slide Valve Failure Shutdown – When in sequencing mode, if the controlling compressor fails to properly load the Slide Valve, a shutdown occurs, and control moves to the next compressor.

Start Failure Shutdown For Engine And Turbine - This message may be issued if Engine or Turbine was enabled, and the start delay period to get to a running condition has expired.

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.

Starting Failure - No Compressor Auxiliary - This shutdown message is displayed if after 450 seconds from sending the compressor start command, the compressor auxiliary input module is still not energized.

Starting Low Oil Pressure Shutdown – This safety is active if the compressor type is set to Other Manufacturer, Other Manufacturer (Kobe) or Other Manufacturer (Mycom) and the oil pump type is set to Full Time. When the compressor is starting, if Oil Pressure does not rise above Discharge Pressure plus the Low Oil Pressure Shutdown setpoint plus 10 PSI within 30 seconds this shutdown will occur. The default value for the Low Oil Pressure Shutdown setpoint is 20 PSI.

Starting Superheat Shutdown - This message may be issued if Superheat was enabled. A shutdown will occur if TDsat plus temperature setpoint is greater than the Separator temperature.

Stopping Failure - Compressor Auxiliary - 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.

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.

Vyper - Interface Board Power Supply - This fault is set on every power-up. It is immediately cleared, and logged in the fault history to record the occurrence of the power loss.

Vyper Communications Failure Warning - If Vyper option is enabled and the Comms communication has failed, this warning is shown.

Vyper - Interface Board to Panel Communications Loss - This fault occurs when the Frick Interface Board loses communications from the Quantum™ LX Control Panel, meaning it has not received any data for a period of fifteen seconds. It is only applicable in automatic mode.

Vyper - Interface Board Motor Current > 15% - This fault occurs whenever the Vyper™ is running and a motor current of less than 10 % FLA is detected for at least twenty-five continuous seconds. This fault is only checked when the Run Acknowledge output is engaged. Therefore, it is NOT checked during STANDBY, which prevents this fault from occurring during STANDBY.

Vyper - Interface Board Run Signal - This fault occurs if the Run Signal from the Quantum Control Panel is high, but the speed command being sent over the RS-485

communications link is zero. It may also occur if the Run Signal is low, but the speed command is not zero. Both conditions must be present for five seconds before the fault is set, and are only applicable in automatic mode.

Vyper – Initialization - At power-up, all the boards go through a process called initialization. At this time, memory locations are cleared, jumper positions are checked, and serial communications links are established.

Vyper - Stop Contacts - This fault occurs if the No Fault signal from the Vyper™ is low. It indicates a fault is present at the Vyper™ or the Harmonic Filter, but the communications data contains no Vyper™ fault data for twenty seconds. The Frick Interface Board will send Initialize data requests while this fault is active.

Vyper - Harmonic Filter Logic Board Or Communications – This fault occurs if the No Fault signal from the Vyper™ is low, indicating a fault is present at the Vyper™ or the Harmonic Filter, but the communications data contains no Harmonic Filter fault data for twenty seconds. The Frick Interface Board will send Initialize data requests while this fault is active.

Vyper - Harmonic Filter High Total Demand Distortion – This shutdown indicates that the filter is not operating correctly or the input current to the Vyper™ / filter system is not sinusoidal. This fault occurs when any of the three phases of Total Demand Distortion is greater than 25.0 %, for forty-five continuous seconds while the Vyper™ is running.

Vyper - Harmonic Filter Input Frequency Out of Range (Warning Only) - The Harmonic Filter monitors the line frequency on its inputs. If this frequency is out of range, it will cease filtering, and set a bit in the communications packet. This warning is indicated whenever this bit is set.

Vyper - High Phase A Inverter Baseplate Temp. – A thermistor sensor is located inside the IGBT Module on the Vyper™ power unit. If at anytime this thermistor detects a temperature of 175°F (79°C) or higher of the Phase A Inverter, a shutdown will occur. The cooling fans and coolant pump on the Vyper™ will continue to run after the shutdown, until the thermistor temperature has dropped to below 165°F (74°C). This shutdown requires a manual reset via the Reset push button on the Vyper™ logic board.

Vyper - High Phase B Inverter Baseplate Temp. – A thermistor sensor is located inside the IGBT Module on the Vyper™ power unit. If at anytime this thermistor detects a temperature of 175°F (79°C) or higher of the Phase B Inverter, a shutdown will occur. The cooling fans and coolant pump on the Vyper™ will continue to run after the shutdown, until the thermistor temperature has dropped to below 165°F (74°C). This shutdown requires a manual reset via the Reset push button on the Vyper™ logic board.

Vyper - High Phase C Inverter Baseplate Temp. – A thermistor sensor is located inside the IGBT Module on the Vyper™ power unit. If at anytime this thermistor detects a temperature of 175°F (79°C) or higher of the Phase C Inverter, a shutdown will occur. The cooling fans and coolant pump on the Vyper™ will continue to run after the shutdown, until the thermistor temperature has dropped to

below 165°F (74°C). This shutdown requires a manual reset via the Reset push button on the Vyper™ logic board.

Vyper - Low Phase A Inverter Baseplate Temp. – The phase A heatsink temperature and the inverter module base plate temperature are compared to a lower limit of 37°F. If the inverter module base plate temperature falls below this limit the unit will trip and the Quantum™ LX Panel will display this message. In addition, if both the inverter and converter temperatures fall below the 37°F limit, the unit will trip and the fan(s) and water pump will be energized.

Vyper - Low Phase B Inverter Baseplate Temp. – The phase B heatsink temperature and the inverter module base plate temperature are compared to a lower limit of 37°F. If the inverter module base plate temperature falls below this limit the unit will trip and the Quantum™ LX Panel will display this message. In addition, if both the inverter and converter temperatures fall below the 37°F limit, the unit will trip and the fan(s) and water pump will be energized.

Vyper - Low Phase C Inverter Baseplate Temp. – The phase C heatsink temperature and the inverter module base plate temperature are compared to a lower limit of 37°F. If the inverter module base plate temperature falls below this limit the unit will trip and the Quantum™ LX Panel will display this message. In addition, if both the inverter and converter temperatures fall below the 37°F limit, the unit will trip and the fan(s) and water pump will be energized.

Vyper - High Phase A Instantaneous Current – Phase A of the output line to the motor is monitored via a current transformer within the drive. The unit's Phase A of instantaneous output current is compared to a prescribed limit which is contained in the hardware. If the peak current limit is exceeded, the unit will trip and the Quantum™ LX Panel will display this message.

Vyper - High Phase B Instantaneous Current – Phase B of the output line to the motor is monitored via a current transformer within the drive. The unit's Phase B of instantaneous output current is compared to a prescribed limit which is contained in the hardware. If the peak current limit is exceeded, the unit will trip and the Quantum™ LX Panel will display this message.

Vyper - High Phase C Instantaneous Current – Phase C of the output line to the motor is monitored via a current transformer within the drive. The unit's Phase C of instantaneous output current is compared to a prescribed limit which is contained in the hardware. If the peak current limit is exceeded, the unit will trip and the Quantum™ LX Panel will display this message.

Vyper - Phase A Gate Driver – The unit's phase bank assembly shall contain one IGBT gate driver control board. This board monitors the saturation voltage drop across the Phase A Gate Driver while gated on. If the IGBT's Phase A Gate Driver saturation voltage exceeds the prescribed limit, the gate driver will make the determination that a short circuit is present. This in turn shall cause the unit to trip and the Quantum™ LX Panel shall display this message. If the driver board's power

supply voltage falls below the permissible limit, this same message shall be generated.

Vyper - Phase B Gate Driver – The unit's phase bank assembly shall contain one IGBT gate driver control board. This board monitors the saturation voltage drop across the Phase B Gate Driver while gated on. If the IGBT's Phase B Gate Driver saturation voltage exceeds the prescribed limit, the gate driver will make the determination that a short circuit is present. This in turn shall cause the unit to trip and the Quantum™ LX Panel shall display this message. If the driver board's power supply voltage falls below the permissible limit, this same message shall be generated.

Vyper - Phase C Gate Driver – The unit's phase bank assembly shall contain one IGBT gate driver control board. This board monitors the saturation voltage drop across the Phase C Gate Driver while gated on. If the IGBT's Phase C Gate Driver saturation voltage exceeds the prescribed limit, the gate driver will make the determination that a short circuit is present. This in turn shall cause the unit to trip and the Quantum™ LX Panel shall display this message. If the driver board's power supply voltage falls below the permissible limit, this same message shall be generated.

Vyper - Single Phase Input Power – The Vyper's SCR Trigger Control board contains circuitry that checks the three-phase mains for the presence of all three line voltages. If all line voltages are not present, the unit will trip and the Quantum™ LX Panel will display this message.

Vyper - 105% Motor Current Overload – The Vyper™ Logic Board generates this shutdown by reading the current from the 3 output current transformers. The shutdown is generated when the Vyper™ Logic board has detected that the highest of the three output phase currents has exceeded 105% of the programmed 100% full load amps (FLA) value for more than 40 seconds. If this is detected, the unit will trip and the Quantum™ LX panel will display the fault message.

Vyper - High DC Bus Voltage – The DC link overvoltage trip level is determined by hardware on the logic board and it is designed to trip the unit at 745 +/- 17 VDC for both 60 and 50 Hz VSD's. If the DC bus current exceeds this level, the unit will trip and the Quantum™ LX Panel will display this message.

Vyper - Logic Board Power Supply – The various DC power supplies which power the Logic Board are monitored via hardware located on the Logic Board. If any of these power supplies fall outside their allowable limits, the unit will trip and the Quantum™ LX Panel will display the fault message.

Vyper - Low DC Bus Voltage – The DC link under voltage trip level must be set at 500 VDC for 60 Hz and 414 VDC for 50 Hz VSD's. If the DC link drops below this level, the unit will trip, and the Vyper™ Logic Board will initiate a system shutdown.

Vyper - DC Bus Voltage Imbalance – The 1/2 DC link voltage magnitude must remain within ± 88 VDC of the

total DC link voltage divided by two for both 60 and 50 Hz VSD's. If the 1/2 DC link magnitude exceeds the ± 88 volt window, the unit will trip and the Quantum™ LX will display this message.

Vyper - High Internal Ambient Temperature – The logic board contains a temperature sensor which monitors the unit's internal ambient temperature. The magnitude of the unit's internal temperature is compared to a limit of 145°F. If this limit is exceeded the unit will trip and the Quantum™ LX panel will display this message. The fan(s) and water pump remain energized until the internal temperature drops below 137°F. The fan(s) and water pump will be de-energized when the internal temperature drops below 137°F.

Vyper - High Inverter Baseplate Temperature – A thermistor sensor is located inside the IGBT Module on the Vyper™ power unit. If at anytime this thermistor detects a temperature of 175°F (79°C) or higher, a shutdown will occur. The cooling fans and coolant pump on the Vyper™ will continue to run after the shutdown, until the thermistor temperature has dropped to below 165°F (74°C). This shutdown requires a manual reset via the Reset push button on the Vyper™ logic board.

Vyper - Logic Board Processor – This shutdown is generated if a communications problem occurs between the two microprocessors on the Vyper™ Logic Board. If this shutdown occurs, replace the Vyper™ Logic board.

Vyper - Run Signal – Upon receipt of either of the two run commands, a 5-second timer will start. If the missing run signal is not asserted within the 5-second window, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - High Converter Heatsink Temperature – A thermistor sensor is located behind the last SCR/Diode block on the copper chill plate of the Vyper™ Power Unit. If at anytime this thermistor detects a temperature of 170°F (76°C) or higher, a shutdown will occur. The cooling fans and coolant pump on the Vyper™ will continue to run after the shutdown, until the thermistor temperature has dropped to below 160°F (71°C). This shutdown requires a manual reset via the Reset push button on the Vyper™ Logic board.

Vyper - Invalid Current Scale Selection – The J1 connector on the Vyper™ Logic board contains jumpers along with wires from the output CTs. Since the part number of the Logic board is the same on all horsepower sizes, the jumpers tell the logic board the size of the Vyper™ being employed in order to properly scale the output current. If the jumper configuration is found by the Logic board to be invalid, the system will be shut down and the above message will be generated.

Vyper - Low Inverter Baseplate Temperature – The phase bank assembly heatsink temperature and the inverter module base plate temperature are compared to a lower limit of 37°F. If the inverter module base plate temperature falls below this limit the unit will trip and the Quantum™ LX Panel will display this message.

Vyper - Serial Communication – When requesting Status data, the response data from the Vyper™ includes a bit that indicates whether communications were lost from the Frick Interface Board to the Vyper™. If this bit is high for 22 consecutive seconds, this fault occurs. This fault also occurs whenever a receive, timeout, or checksum fault is detected on the Vyper™ communications, for twenty continuous seconds. While this fault is active, the Frick Interface Board will send Initialize data requests in order to reestablish the communications link. All serial input data is also cleared.

Vyper - Precharge Lockout – If the Vyper™ fails to meet the precharge criteria, then the precharge circuit will wait for a period of 10 seconds. During this time, the unit's cooling fans and coolant pump remain energized in order to cool the input SCR's. Following this 10-second cool-down period, precharge will again be initiated. The unit will attempt to meet the precharge criteria three consecutive times. If the Vyper™ fails to meet the precharge criteria on three consecutive tries, the Vyper™ will shut down, lock out, and display this message. In order to initiate precharge again, the Quantum™ LX panel's compressor switch must first be placed into the STOP/RESET position.

Vyper - Low Converter Heatsink Temperature – The phase bank assembly heatsink temperature and the inverter module base plate temperature are compared to a lower limit of 37°F. If the inverter base plate temperature or the converter heat sink temperature falls below 37°F, this message will be displayed. In addition, if both temperatures fall below the 37°F limit, the unit will trip and the fan(s) and water pump will be energized.

Vyper - Current Imbalance – When the average of the three output phase currents exceeds 80% of the 100% Job FLA, the % Output Current Imbalance is calculated using the following equation:
$$\frac{(|I_a - I_{ave}|) + (|I_b - I_{ave}|) + (|I_c - I_{ave}|)}{3 I_{ave}} [100]$$

$$I_{ave} = (I_a + I_b + I_c) / 3$$
 If the % Imbalance exceeds 30% continuously for 45 seconds the unit shall trip and the Quantum™ LX panel shall display this message. The imbalance fault is disabled when the average of the three output phase currents drops below 80% FLA.

Vyper - Precharge / DC Bus Voltage Imbalance – The 1/2 DC link voltage magnitude will remain within ± 88VDC of the total DC link voltage divided by two during the precharge interval for both the 60 and 50 Hz VSD's. If not, the Quantum™ LX panel will display this message. The definition for this fault is identical to "VSD - DC Bus Voltage Imbalance", except that the fault has occurred during the precharge period which begins during prelude.

Vyper - Precharge / High DC Bus Voltage – The DC link voltage will reach at least 500 VDC within 20 seconds after the precharge signal has been asserted on the 60 Hz VSD and at least 414 VDC within 20 seconds on the 50 Hz VSD. If not, the Quantum™ LX panel will display this message.

Vyper - Precharge / Low DC Bus Voltage – This fault has two different timing events. First, the DC Bus voltage must be equal to or greater than 50 VDC for 60 Hz (41 VDC for 50 HZ) 4 seconds after precharge has begun.

Second, the DC Bus voltage must be equal to or greater than 500 VDC for 60 Hz (414 VDC for 50 HZ) 20 seconds after precharge has begun. The unit is shut down and this message is generated if any of these conditions are not met.

Vyper - Harmonic Filter High DC Bus Voltage – The harmonic filter's DC link voltage is continuously monitored and if the level exceeds a range of 822 to 900 VDC, a Filter Bus Over-Voltage shutdown is initiated.

Vyper - Harmonic Filter High Phase C Current – The unit's three phases of instantaneous output current are compared to a prescribed limit, which is contained in the hardware. If the Phase C signal exceeds the prescribed limit, the filter will be inhibited from operating by inhibiting the Current Regulator Run signal for five to six input line voltage. If the Phase C signal exceeds the prescribed threshold three times in 60 line cycles, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter High Phase B Current – The unit's three phases of instantaneous output current are compared to a prescribed limit, which is contained in the hardware. If the Phase B signal exceeds the prescribed limit, the filter will be inhibited from operating by inhibiting the Current Regulator Run signal for five to six input line voltage. If the Phase B signal exceeds the prescribed threshold three times in 60 line cycles, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter High Phase A Current – The unit's three phases of instantaneous output current are compared to a prescribed limit, which is contained in the hardware. If the Phase A signal exceeds the prescribed limit, the filter will be inhibited from operating by inhibiting the Current Regulator Run signal for five to six input line voltage. If the Phase A signal exceeds the prescribed threshold three times in 60 line cycles, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter Phase Locked Loop – This shutdown indicates that a circuit called a "phase locked loop" on the Filter Logic board has lost synchronization with the incoming power line for a period of time.

Vyper - Harmonic Filter Logic Board Power Supply – This shutdown indicates that one of the low voltage power supplies on the Filter Logic board have dropped below their permissible operating voltage range.

Vyper - Harmonic Filter Precharge / High DC Bus Voltage – The DC link voltage will reach at least 525 VDC within 5 seconds after the precharge relay is pulled in on the 60 Hz 519 filter and at least 425 VDC within 5 seconds on the 50 Hz 519 filter. If not, the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter Precharge / Low DC Bus Voltage – The DC link voltage will reach at least 50 VDC within 100 msec after the precharge relay has been pulled in on the 60 Hz 519 filter and at least 41 VDC within 100 msec on the 50 Hz 519 filter. If not, the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter DC Current Transformer 1 – During initialization, the output voltage of DC Current Transformer 1 which sense the filter's input current will be monitored and compared against a level of ± 147 mv (± 6010 A to D counts). If the offset error falls outside this range, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter DC Current Transformer 2 – During initialization, the output voltage of DC Current Transformer 2 which sense the filter's input current will be monitored and compared against a level of ± 147 mv (± 6010 A to D counts). If the offset error falls outside this range, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter High Baseplate Temp. – The unit contains one heatsink assembly for the 305 Hp. The Filter's power module base plate temperature will feed the Harmonic Filter Logic board. This temperature is compared in software to a limit of 79°C and if this limit is exceeded, the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter Low DC Bus Voltage – The DC link voltage magnitude should remain within -80 VDC of the bus voltage setpoint determined from the peak input voltage. If the DC link voltage magnitude falls outside this range for 100 msec the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter DC Bus Voltage Imbalance – The 1/2 DC link voltage magnitude will remain within ± 50 VDC of the total DC link voltage divided by two during the precharge interval for both 60 and 50 Hz 519 filters. If not, the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter 110% Input Current Overload – The overload threshold and timer functions reside in software on the Harmonic Filter's Logic board. The unit's three

phases of RMS output current are compared to the overload threshold magnitude. If this threshold is exceeded for 40 seconds the unit will trip and the Quantum™ LX panel will display this message.

Vyper - Harmonic Filter Run Signal – When a digital run command is received at the filter logic board from the Vyper™ Logic board, a 1/10 second timer is begun. A redundant run command must also occur on the serial data link from the Vyper™ Logic board before the timer expires. If not, the Vyper™ will be shut down and this Fault message will be displayed.

Vyper - Interface Board NovRAM Failure – The integrity of the NovRAM is verified on every power-up. A known value is written to a specified location in NovRAM, read back from that location, and compared to the value originally written. If the two values do not match, the NovRAM Failure fault is displayed.

Vyper - Harmonic Filter Serial Communication – When requesting Status data, the response data from the Harmonic Filter includes a bit that indicates whether communications were lost from the Vyper™ to the Harmonic Filter. If this bit is high for twenty consecutive seconds, this warning is indicated. This warning is also indicated whenever a receive, timeout, or checksum fault is detected on the Harmonic Filter communications, for twenty continuous seconds.

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