Belliss & Morcom

ESP Series 7800

1100E Version 6.500

WH40/50 Model

Reciprocating Compressor Controller

INSTALLATION INSTRUCTION & MAINTENANCE MANUAL

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Table of Contents

ESP® *SERIES 7800PET AIR COMPRESSOR CONTROL SYSTEM*

Introduction:

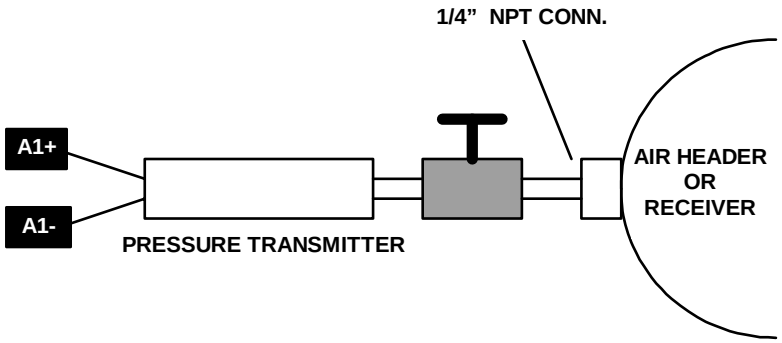
The Gardner Denver ESP® Series 7800 Electro-Pneumatic Control System is specifically designed for new installations and field retro-fit of existing industrial air compressors with two step, three step or five step unloading systems. The controller is designed to offer local control using a high quality pressure transmitter and solenoid valve(s) to provide for inlet valve regulation or clearance pocket operation for capacity control of reciprocating air compressors. In addition, the controller is capable of MASTER control automation from the Gardner Denver ESP 20/20 Series 1000 Multiple Air Compressor Management System through an Ethernet communication network. The controller is fully pre-packaged in a flange mounted version for door mounting in an existing control cabinet or in its own NEMA 4/12 enclosure (16" X 16" X 8"). The graphical display provides for local indication of the compressor's load and run status, and includes selectors for either CONTINUOUS / UNLOAD / AUTOMATIC control, SILENCE and RESET. The controller defaults to local control in the event of a failure of the master control signal. Optionally, a separate bracket is provided with the solenoid valve(s) mounted with pre-piped supply connection and conduit connection. On retrofit applications, this bracket is designed to be compressor mounted in the location of the removed pneumatic regulator that previously provided load control.

The Series 7800 Controller can accept up to 8 two-state input switches for malfunction detection on the compressor (switches by others). These switches are operator named and can be described as desired. Any input switch can be activated through the graphical operator interface screen and designated as an alarm only or an alarm and shutdown device.

Installation:

The Series 7800 controller must be located as close as possible to the compressor. Mounting the enclosure on the actual compressor is not recommended due to vibration and its effect on the controller. Either wall mounted or floor bracketed close to the compressor, the controller is now ready to be connected.

> A pressure transmitter is provided with the ESP 7800 and should be installed on the air receiver or main header and wired back to the controller. The connection points for the pressure transmitter are A1+ and A1-.



Connect Pressure Transmitter to Discharge Air Piping or Receiver

The ESP Series 7800 Controller

Electrical:

Power Source:

A 115 VAC power source is required to be installed and connected to the Series 7800 controller. The source should be protected for 15 amps. The internal circuits of the Series 7800 controller are protected by a replaceable fuse. Connections should be made as follows:

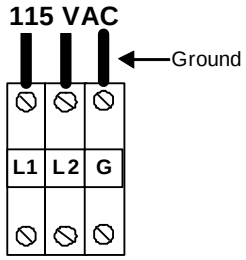


Figure 1 - Connect 115 VAC Power to Terminals L1, L2, GND

Solenoid Valves:

Each of the solenoid valves must be connected between the solenoid valve and the Series 7800 Controller. Wiring should be installed in conduit in accordance with all local codes. Wire insulation should be suitable for 115 volts AC. The recommended wire size is 16 gauge. Connections are as follows:

Two Step Connections

100% Solenoid Valve	Rly 3 Terminals 11 & 14

Three Step Connections

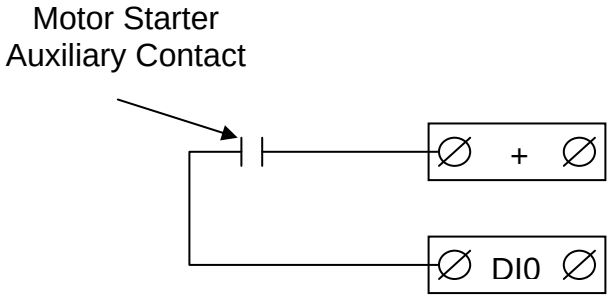
50% Solenoid Valve	Rly 3B Terminals 11 & 14
100% Solenoid Valve	Rly 3A Terminals 11 & 14

Five Step Connections

25% Solenoid Valve	Rly 3D Terminals 11 & 14
50% Solenoid Valve	Rly 3C Terminals 11 & 14
75% Solenoid Valve	Rly 3B Terminals 11 & 14
100% Solenoid Valve	Rly 3A Terminals 11 & 14

Motor Starter Feedback:

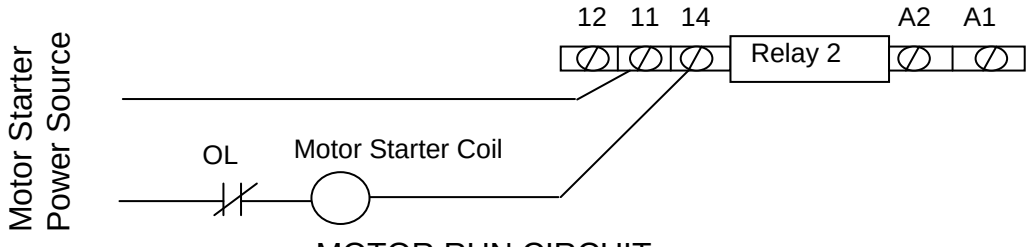
The ESP Series 7800 must receive a feedback signal from the motor starter to confirm compressor operation prior to allowing the compressor to load. Terminals are provided in the enclosure and must be wired to an isolated auxiliary contact in the motor starter, to terminals + and DI0 as follows.



MOTOR FEED BACK CIRCUIT

Motor Run Circuit:

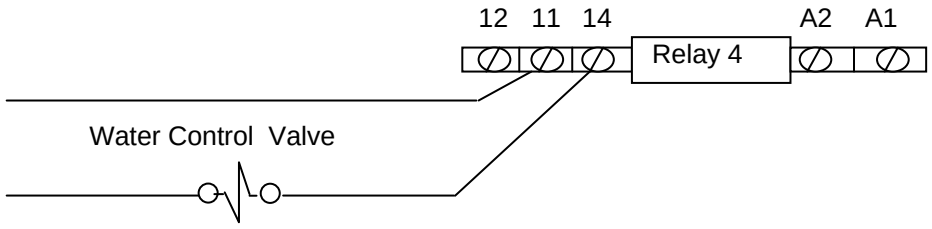
The controller will provide for motor control from several sources. In LOCAL control, the compressor can be manually started by the operator by pressing the START push button (F4) from the main screen. When CONSTANT operation is selected, the compressor motor will run until the operator presses F4 now labeled STOP, or should a malfunction occur. If the AUTOMATIC DUAL CONTROL function (AUTO) is selected when operating in the LOCAL mode, the ESP Series 7800 controller will measure periods of 0% load. When the compressor motor has run for the minimum period (set by the operator) and has been running unloaded for a pre-determined period (set by the operator), the compressor motor will shut down. When loading is again required, the ESP Series 7800 controller will initiate the motor starter run output. Connect the motor starter coil or starting circuit to the ESP 7800 as follows:



MOTOR RUN CIRCUIT

Cooling Water Solenoid Valve:

A cooling water solenoid valve is typically controlled by the motor starter, energized when the motor is running and de-energized when the motor is off. By moving the wiring to the ESP Series 7800 Controller, the valve is controlled in a more effective way, providing an off-delay when the motor is stopped, dissipating the residual heat from the compressor. If desired, the water solenoid valve may be connected to relay R4 terminals 11 and 14 as shown below:



WATER SOLENOID VALVE

Malfunction Switch Inputs:

The Series 7800 Controller can accept up to three (3) standard and optionally an additional seven (7) two-state switches for malfunction detection. Each input is selectable from list of pre-labeled descriptors covering the full range of commonly used detection devices. If a switch does not match one of the ten pre-designated labels, contact Gardner Denver for custom software to re-name the input in the PanelView Software. The connections for each switch are shown in the chart below. Any unused input should be left un-wired. The used inputs will be activated in a later section of this manual. All switches must be normally closed when the sensed measurement is satisfied. For instance, a low oil pressure switch is considered normally open, however closes when oil pressure is satisfied.

Malfunction Switch	Series 7800 Terminal #s
Malfunction Selection #1	DI 2 & (+)
Malfunction Selection #2	DI 3 & (+)
Malfunction Selection #3	DI 4 & (+)
Malfunction Selection #4	DI 5 & (+)
Malfunction Selection #5	DI 6 & (+)
Malfunction Selection #6	DI 7 & (+)
Malfunction Selection #7	DI 8 & (+)
Malfunction Selection #8	DI 9 & (+)

A digital switch description can be operator entered alphanumerically through the operator screen for each malfunction using the Digital Set Up Screens shown in the instructions below. An additional malfunction is detected through the motor starter feedback that indicates “Motor Failure” when the compressor is requested for operation and the motor starter does not respond.

Optional Analog Inputs (4-20 mA or RTD):

In addition to discharge pressure (standard on all Series 7800 controllers) up to twelve additional analog input devices can be included and set with a warning and a shutdown value. Each of the added analog input devices can be individually named alphanumerically by the operator using the Analog Set Up Screens described in the screen navigation section below.

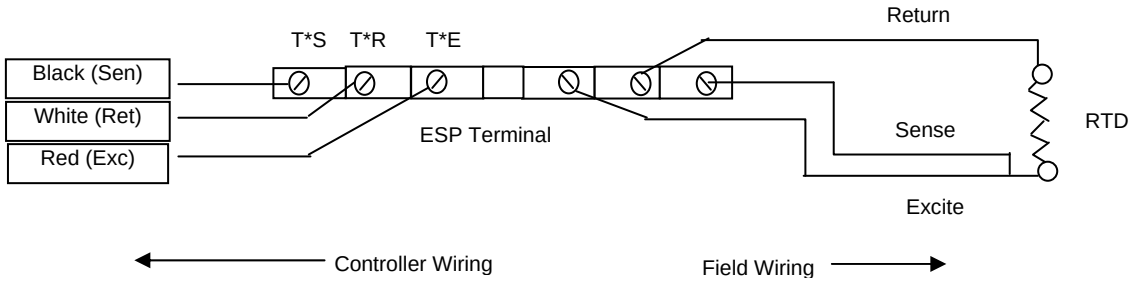
Connection points for 4-20mA analog inputs are as follows.

Analog Input (4-20 mA)	Series 7800 Terminal #s
Analog Input #1	A2+ & A2-
Analog Input #2	A3+ & A3-
Analog Input #3	A4+ & A4-
Analog Input #4	A5+ & A5-
Analog Input #5	A6+ & A6-

Temperature Inputs (RTDs):

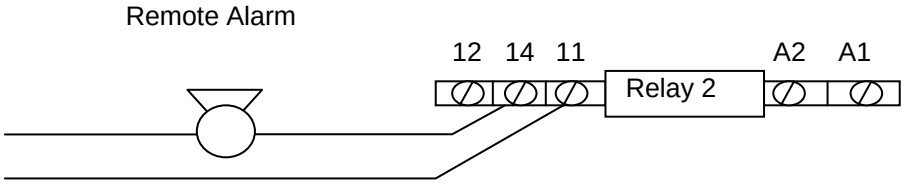
The ESP 7800 is provided standard with up to four RTD inputs, each 100 OHM platinum .00385 ohm/ohm/Cº three wire. The RTDs are each terminalized on three deck terminals and are designated as follows:

RTD	Excite (Red)	Return (White)	Sense (Black)
1	T1E	T1R	T1S
2	T2E	T2R	T2S
3	T3E	T3R	T3S
4	T4E	T4R	T4S



In addition, up to six motor RTD input signals can be specified and included in the controller. When specified, the RTD signals (3 wires each) are connected to terminals labeled T4 through T9. Connections are as shown above.

ALARM WIRING:
Wire the alarm to relay 1 as follows.



Alarm Horn Wired Normally Open (11 & 14)
(Normally Closed = 11 & 12)

Connections to ESP 20/20 Controller:

The connections to the ESP 20/20 Compressor Automation Controller is Ethernet and should be installed in conduit in accordance with all local codes. Wire type should be Category 5e. It is important to recognize that if five step control is selected, when operating in the “Master” mode, the compressor will function in a three step mode.

Set Up Configuration:

All system set-up is accomplished through the door mounted PanelView screens as described below.

Graphical Screen Navigation

Power Up:

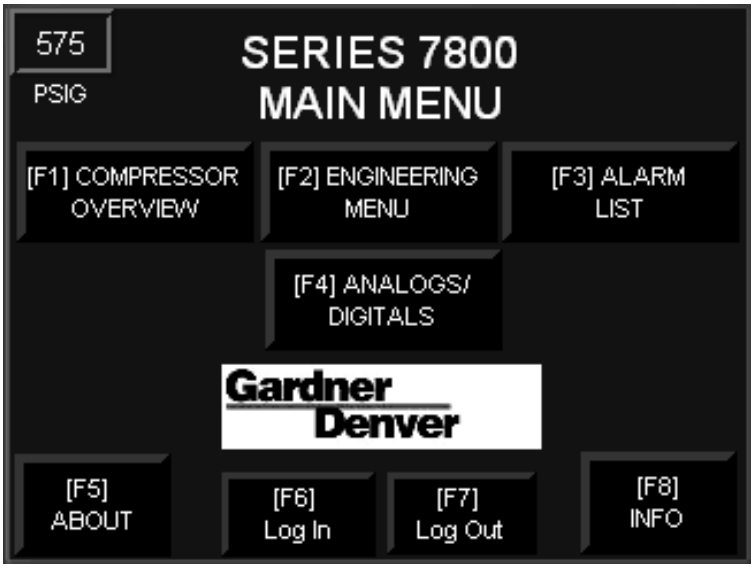
When the system is first powered or when the operator selects the “INFO” button from the Main Menu, the following screen is displayed. Information about the system, the serial number and where to call for assistance is found on this screen as shown below.

On power-up the following BOOT screen will appear. From this screen, the operator can view the controller's serial number and pertinent contact information about where to receive assistance with the control system. The time and date are also displayed. By pressing the [F8] key, the operator enters the Main Menu screen.

POWER-UP SCREEN

Main Menu Screen:

The MAIN MENU SCREEN provides the operator with the selections for navigation throughout the system and allows for password log in and out for restricted screens.



MAIN MENU SCREEN

The operator may select from the following menu, any of the following areas of the controller.

[F1] Overview Screen: This accesses the main viewing screen for the operation of the compressor. The compressor can be manually started and stopped and the operating mode set from this screen.

[F2] Engineering Menu: A user name and password is required to enter this screen. All system configuration is performed behind this menu selection.

[F3] Alarm List: The controller keeps a log of all alarm events with date and time of the event recorded. This selection accesses the listing.

[F4] Analogs/Digitals: The operator can access the screens displaying all analog data and digital statuses from this selection.

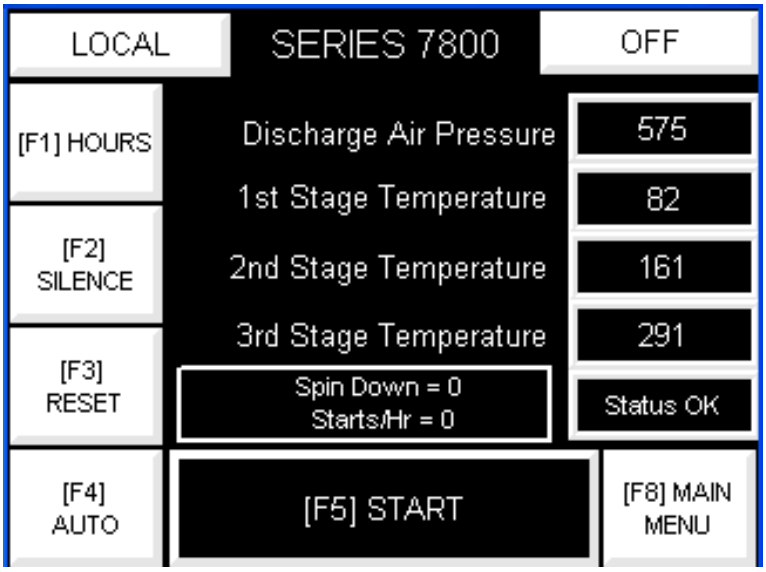
[F5] Log In: Press [F5] to enter the log in area. The operator will be prompted to enter a user name and password to allow access to restricted screens.

[F6] Log Out: After the operator has completed the requirement for access to restricted screens, the Log Out key [F6] will remove the access rights. This will automatically occur should the screen remain inactive for 30 seconds, returning the display to the overview screen.

[F8] Info: Pressing [F8] returns the operator to the main Boot screen for system information.

Compressor Overview Screen:

When selected from the Main Menu by pressing [F1], the following screen will appear.



Compressor Overview Screen

This is the main operator's screen and where the display should be kept during normal operation. Starting from the upper left corner and working counter-clockwise around the screen, the following information and operator interfaces are described below.

Master/Local Indicator:

When the Series 7800 controller is connected to the Gardner Denver Series 1000 Master Controller, this indicator informs the operator whether the controller is under Master or Local control. When no central controller is connected, this indicator always displays LOCAL.

[F1] Hours:

Press [F1] to view the hours accumulated for run and load periods as well as the count down seconds for the compressor to stop after running unloaded for a predetermined period while in the AUTO mode.

There are two timers included in the display labeled “OFF TIME”. The greater of the two values are digitally displayed. The first is the minimum run time counting down to zero. This timer starts counting down as soon as the compressor starts in LOCAL control. The second timer digitally displays the cool-down or unloaded operation period. This timer begins counting down when the compressor unloads to 0% and resets whenever the compressor re-loads. If in LOCAL control and in AUTO, the compressor motor will automatically shut down if both timers equal zero. The display indicates in seconds, the greater value of the two timers. Press [F8] to return to the Compressor Overview Screen.

[F2] Silence:

By pressing [F2] the isolated alarm output relay is turned off. This does not clear the alarm condition, however extinguishes the audiable alarm if connected (by others).

[F3] Reset:

Alarm conditions are reset by pressing [F3]. The alarm condition will be cleared and the alarm relay will be turned off (if not previously silenced above) and the compressor is available for re-starting by the operator. The alarm message remains in the Alarm List however until cleared by an

authorized operator. All alarms will reset, however if a shutdown condition still exists when the compressor is re-started, it will again shut down and alarm after 10 seconds.

[F4] Auto/Unload/Const:

The [F4] function key serves as a multi-state push button, changing the operation on each push of the key. The three states are as follows:

- **AUTO-** indicates automatic dual control operation. When under LOCAL control and AUTO is selected, the compressor motor will automatically shut down if both the minimum run timer and the cool-down timer have both been satisfied. The greater value of these two timers is displayed in on the MAIN screen in the cell labeled, "OFF TIMER". The value displayed is either that of the minimum run timer counting down to zero or the cool down timer counting down to zero. The minimum run timer starts counting down as soon as the compressor starts The cool down timer begins counting down when the compressor unloads to 0% and resets whenever the compressor re-loads. If in AUTO, the compressor motor will automatically shut down if both timers equal zero.
- **UNLOAD-** commands the compressor to operate unloaded indefinately when selected. This is primarily used when testing the compressor or while "running in" new moving parts such as new rings. The compressor will not shut down while running unloaded while in this mode of operation and the cool-down timer is not activated.
- **CONST-** This mode allows the compressor while in LOCAL control, to operate constantly regardless of its load status. The minimum run and cool-down timers are disabled while in the CONST mode.

[F5] STOP/START:

The STOP and the START function are controlled by function key [F5]. When the compressor is stopped, the screen graphic above [F5] indicates START and is green. When the compressor is running, the screen graphic above [F5] indicates STOP and is red. The STOP function is a programmed stop operation that provides time to unload all steps of compressor control prior to stopping the motor. See the section below that describes the PROGRAMMED STOP feature. If an emergency occurs and an immediate stop is required, press the EMERGENCY STOP push button. The STOP and START feature on [F5] does not function while the controller is in MASTER control. If the compressor needs to be stopped while in MASTER under an emergency condition, immediately press the EMERGENCY STOP push button.

[F8] Main Menu:

Press the [F8] function key to return to the Main Menu.

Alert Indicator:

When there are no alarming issues with the compressor, this tile is blank. Whenever an alarming event has taken place and prior to it being cleared by the operator, this area of the screen will turn red with the indication of ALERT and will blink. When the condition is cleared, the tile will return to blank.

Analog Indicators (3):

The first three optional analog indicators with their custom entered descriptors will display on the compressor overview screen. It is important that if there are more than three optional analog inputs to the controller, that the first three designated analog inputs are the most important and the ones desired to be displayed on the overview screen.

System Pressure:

System pressure is indicated digitally and is labeled as Discharge Air Pressure. The standard transmitter is ranged at 0 – 750 PSIG and the display is scaled for the same.

Operational Status:

The operational status indicates if the motor is OFF, if in STANDBY, if the compressor RUNNING, or if the compressor is in FAULT.

- OFF indicates that the system is in LOCAL control and the START push button must be pressed to start the compressor.
- STANDBY indicates that the compressor is shutdown on its internal timers in LOCAL or by the MASTER controller and may start automatically without notice.
- UNLOADED indicates that the motor is running in either LOCAL or MASTER control and that the compressor is idling and not producing any compressed air.
- LOADED (25%, 50%, 75%, 100%) depending on the type of compressor and the load steps selected, the display will indicate the percent loaded in both LOCAL and MASTER control. If a two step control is selected, the two states are UNLOADED and LOADED 100%.
- FAULT is indicated whenever the controller in LOCAL control requests that the motor should be operating and there is no feedback confirmation from the motor starter, or that any of the digital or analog devices have shut the compressor motor off.

Starts Per Hour: Indicator allows the operator to see how many times the compressor has started in the last hour. If the value exceeds the preset maximum, the compressor will not be allowed to start until sufficient time has elapsed and the timer is reset. A manual override can be accessed behind the password protected area of the system screens.

Spin Down Time: Whenever the motor is stopped, the spin down timer must equal zero before the operator can restart the compressor. Until this value equals zero, the start push button is inoperable.

Return to Main Menu

Once returned to the Main Menu screen, the operator may select [F3] to view the Alarm List screen as indicated below.

Alarm List Screen

[F3] Alarm List:

From this screen the operator can acknowledge any or all alarm, placing the acknowledgement data and time to the right of each alarm listing.
[F1] Acknowledge - to acknowledge an individual alarm
[F2] Acknowledge All - to acknowledge all alarms.

[F4] Analogs/Digitals:

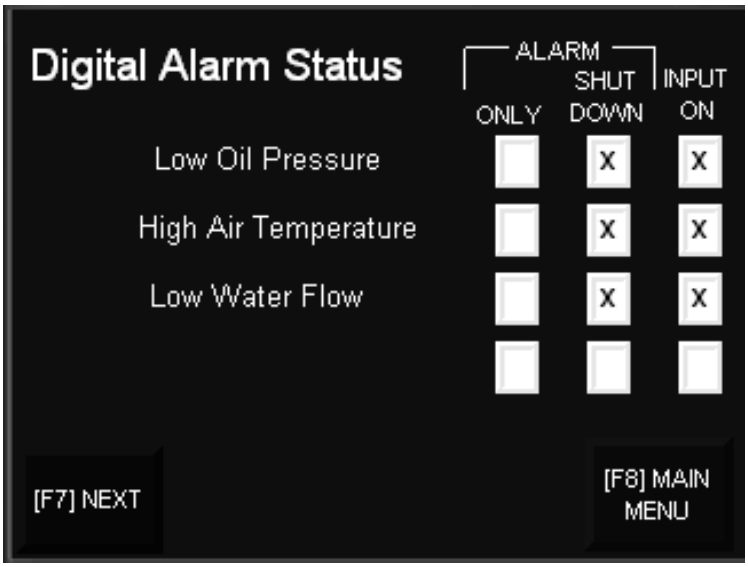
In order to access the status of each analog and digital device connected to the system, the operator can press [F4]. The following screen will appear

displaying only the analog devices designated in the factory set up. Analogs that are in their normal state will display in white lettering and those in alarm will be displayed in red.

From this screen, the digital input statuses and descriptors can be accessed as well as gauges that provide the analog values in a gauge format. To access these areas, function keys [F1] and [F2] are assigned respectively.

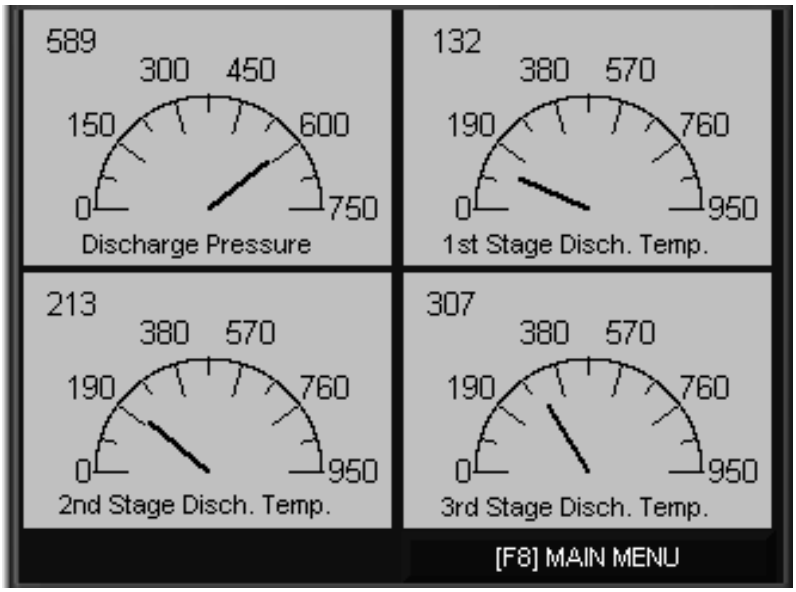
[F1] Digital Status:

Press [F1] to access the following screen. If more than four digital devices are installed, press [F7] to advance to the next screen. Press [F8] to return to the Main Menu.



[F2] Gauges:

Press [F2] to access the following screen. If more than three analog are installed, an advance button with the function key [F7] will be present and the



screen can be advanced to additional gauges. Press [F8] to return to the Main Menu.

Return to Main Menu

[F6] Log In:

In order to access restricted screens, there are two levels of log in. The operator may have access to Level 1, however Level 2 is reserved for factory set up. In order to access the system set up, including the Engineering Menu, the user name and password are entered by pressing [F6]. Once the log in pop up screen appears, press [F2] to enter the user name and Enter ◄┘ to accept. Press [F3] to enter the password and Enter ◄┘ to accept. After both user name and password are entered, press the Enter ◄┘ key. Access is now permitted for the authorized screens.

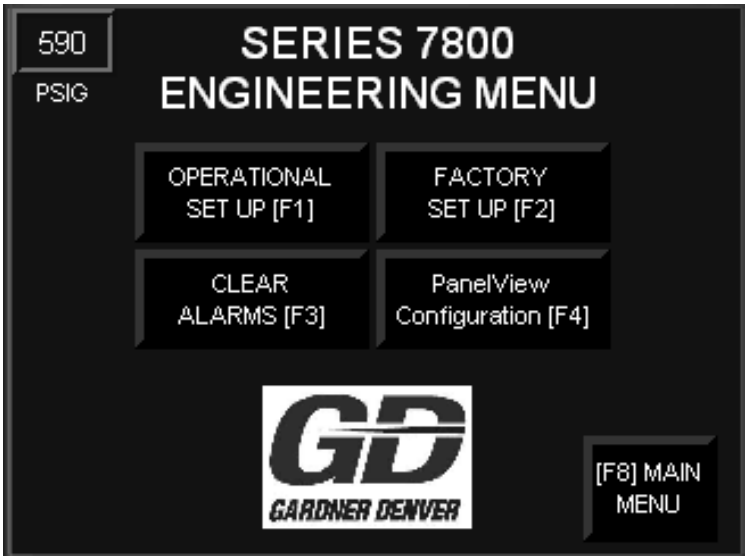
[F7] Log Out:

By pressing [F7] the system is returned to unrestricted access only. The user name and password will need to be re-entered in order to access the restricted areas. If the restricted access is available and no screen activity occurs for 30 minutes, the log out will be automatically initiated and the compressor overview screen will be automatically displayed.

[F2] Engineering Menu:

The Engineering Menu is accessible only if the Level 1 or Level 2 user name and password have been entered. Once the password has been successfully entered and the [F2] key is pressed, the following screen will appear.

Engineering Menu

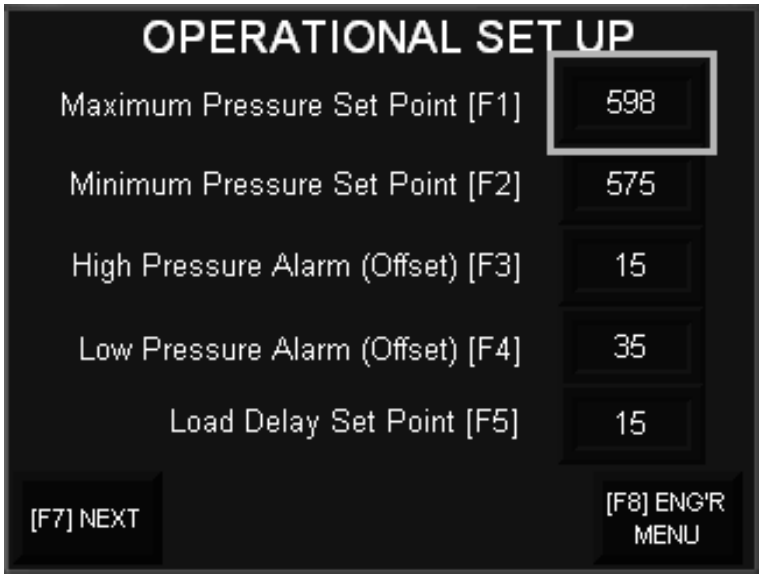


Engineering Menu

From the Engineering Menu, the following access is permitted with the Level 1 user name and password.

[F1] Operational Set Up

Access to the compressor's operational set points is obtained by pressing [F1]. The following screen is displayed.



Operational Set Up Screen 1

[F1] Maximum Pressure Set Point:

By pressing [F1], a pop up screen allows the operator to enter the unload pressure set point for the compressor. The compressor will be 100% unloaded when this pressure level is reached when operating in Local control. This set point is ignored when operating under Master control.

[F2] Minimum Pressure Set Point:

By pressing [F2], a pop up screen allows the operator to enter the load pressure set point for the compressor. The compressor will be 100% loaded when this pressure level is reached when operating in Local control. This set point is ignored when operating under Master control.

Note: when 3 step or 5 step control is selected, the intermediate step set points are calculated between the maximum and the minimum set point entries.

Pressure Adjustment:

The pressure set points for all loading and unloading are calculated by the processor for LOCAL operation. Only the maximum pressure and the minimum pressure setpoints are entered by the operator and all intermediate step setpoints are calculated. For example, if the maximum pressure is entered at 590 PSIG and the minimum pressure is entered at 577 PSIG, the following set points would be automatically calculated for each of the step options:

Two Step Control – Dead Band = 15 PSI

	Load	**Unload**
Load 100%	577 PSIG	590 PSIG

Three Step Control – Dead Band = 8 PSI

	Load	**Unload**
Load 50%	582 PSIG	590 PSIG
Load 100%	577 PSIG	585 PSIG

Five Step Control – Dead Band = 4 PSI

	Load	**Unload**
Load 25%	586 PSIG	590 PSIG
Load 50%	583 PSIG	587 PSIG
Load 75%	580 PSIG	584 PSIG
Load 100%	577 PSIG	581 PSIG

Note, when two-step is selected, a minimum difference between the maximum and minimum pressure setpoints is limited to 4 PSIG. When three-step is selected, a minimum difference between the maximum and minimum pressure setpoints is limited to 8 PSIG. When five-step is selected, a minimum difference between the maximum and minimum pressure setpoints is limited to 15 PSIG. If less than the minimum value is entered, the value will automatically default to the minimum value indicated above.

[F3] High Pressure Alarm (Offset):

Enter the offset value in PSI that the alarm will sound when high pressure is reached. The value represents the absolute pressure rise above the maximum pressure set point entered at [F1] where the alarm will be initiated. For instance, if the maximum pressure set point is 595 PSIG, and the offset is 10 PSI, then the alarm will be initiated at 605 PSIG.

[F4] Low Pressure Alarm (Offset):

Enter the offset value in PSI that the alarm will sound when low pressure is reached. The value represents the absolute pressure below the minimum pressure set point entered at [F2] where the alarm will be initiated. For instance, if the minimum pressure set point is 575 PSIG, and the offset is 20 PSI, then the alarm will be initiated at 555 PSIG.

[F5] Load Delay Set Point:

The LOAD DELAY is entered using the key [F1] and is entered in seconds. Use the pop up screen and the numeric key pad to enter this value. This field has a minimum entry of 5 seconds and a maximum of 50 seconds. The usual requirement is 10-20 seconds, necessary to get the motor up to full speed prior to allowing loading.

[F7] Next:

Press [F7] to advance to the next Operational Set Up Screen.

Operational Set Up Screen 2

[F1] Starts Per Hour: Enter the maximum starts per hour as recommended by the motor manufacturer. The motor will not start if this value has been met.

[F2] Water Timer Off Delay:

Key [F2] accesses the WATER TIMER setpoint in seconds. Use the pop up screen and the numeric key pad to enter this value. This field has a minimum value of 0 second and a maximum value of 999 seconds. This selects the off delay period for the water solenoid valve to remain opened following a motor shut down. This feature allows the compressor to cool to a lower temperature after the motor stops.

[F3] Min Run Timer in Minutes:

Key [F3] accesses the MINIMUM TIMER setpoint in minutes. Use the pop up screen and the numeric key pad to enter this value. This field has a minimum value of 1 minute and a maximum value of 9999 minutes. This is the minimum time in minutes that the compressor must operate in order for it to be automatically shut down when operating in LOCAL and in the AUTO mode.

[F4] Cool-Down Timer in Minutes:

Key F4 accesses the field labeled Cool Down Timer in Minutes. Use the pop up screen and the numeric key pad to enter this value. This is the time in minutes that while operating in LOCAL and AUTOMATIC mode, that the compressor must run fully unloaded before the motor will shut down. This field has a minimum entry value of 1 minute and a maximum value of 9999 minutes.

[F5] Spin Down Timer Set:

The Spin Down Timer controls the time in seconds that the compressor must remain off once the motor output is turned off. This allows the motor to come to a rest before it is released for a restart by the controller.

[F6] Hours Reset:

When the [F6] key is pressed, a new screen appears that allows the hours accumulated for elapsed run time and load time to be reset to zero or any desired value. When this screen is accessed, press [F1] to re-enter the run hours and [F2] to re-enter the load hours.

[F8] Engineering Menu:

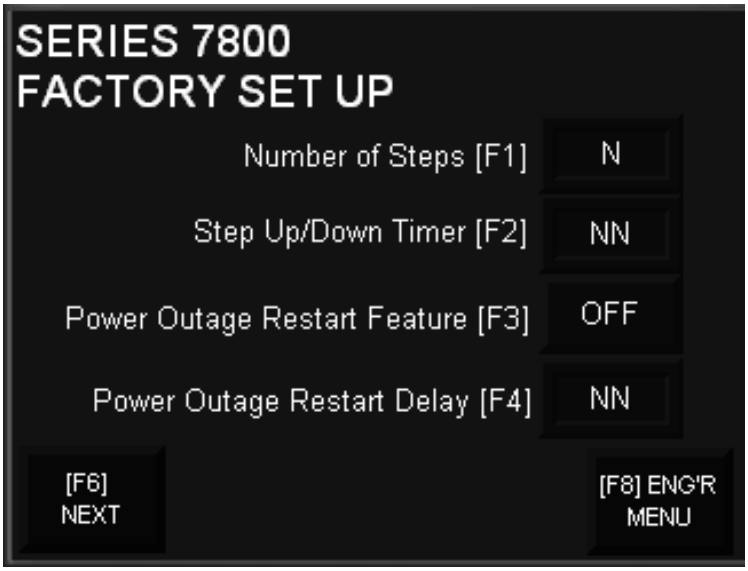
Press [F8] to return the screen to the Engineering Menu.

From the Engineering Menu the PanelView configuration area can be reached by pressing [F4]. A screen will be displayed to make certain that you really want to escape from the operating software and enter the PanelView configuration area. All operator control of the compressor will be lost, however the compressor will safely operate while in the configuration mode. This area is primarily used to reset the time of day clock and the date. No other areas of the set up should be modified unless by a qualified Allen Bradley trained technician. Further details on the PanelView set up will be discussed later in this manual.

[F2] Factory Set Up:

Only when the Level 2 user name and password are entered, will the Factory Set Up pages be accessible. This area is reserved for settings that should not be modified once the compressor is placed in operation. When the [F2] key is pressed after the proper user name and password has entered, the following screen will be displayed.

Factory Set Up



[F1] Number of Steps:

Key [F1] accesses this field allowing the operator to select the number of loading steps available on the compressor. Use the pop up screen and the numeric key pad to enter this value. This field has a minimum value of 2 and a maximum value of 5. Only 2, 3 and 5 are valid entries. If a 4 is selected, the processor will automatically return the field to 2. Note that two-step control requires one solenoid valve, three-step control requires two solenoid valves and five step control requires four solenoid valve. There is an option for a five step/three valve arrangement found on some compressors. Consult Gardner Denver with such an application.

[F2] Step Up/Down Timer:

Key [F2] accesses the Step Up/Down Timer setpoint in seconds. Use the pop up screen and the numeric key pad to enter this value. This timer sets the time between loading and unloading between steps on compressors with 3 or five step controls. This field has a minimum value of 1 second and a maximum value of 8 seconds. This is the minimum time in seconds between loading and unloading steps. This should be set at 2 seconds.

[F3] Power Outage Restart Feature:

When the Power Outage Restart Feature option is selected, the compressor will automatically re-start after a power outage. The [F3] toggles this feature

On and Off. Only compressors that were operating at the time of the outage will re-start automatically. A time delay is provided below to allow for staggered re-starting of multiple compressors, avoiding compressors starting at the same time.

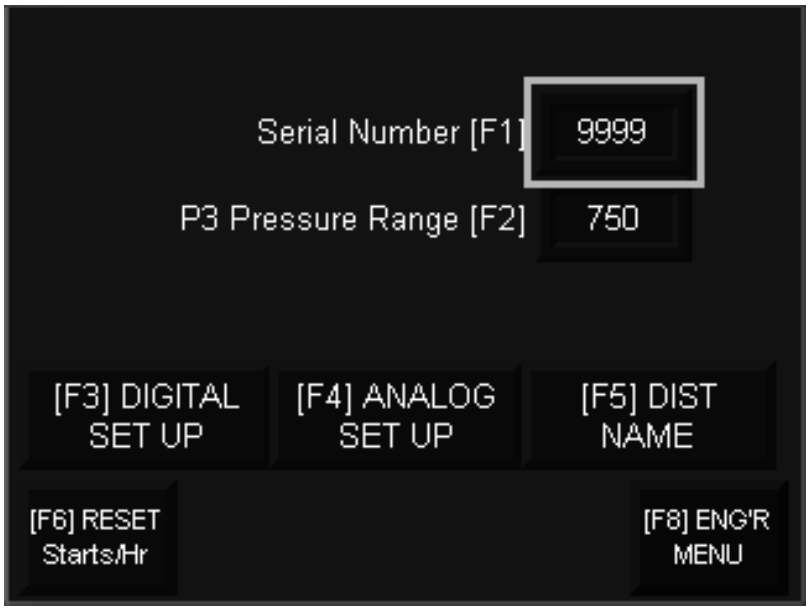
[F4] Power Outage Restart Delay:

Enter the time is seconds that power must be present before the compressor will automatically restart following a loss of power.

The Power Outage Restart Feature is requested at the owner's risk and must be activated by the factory prior to shipment under security level three. Unless the motor starting equipment is provided with power monitoring controls and phase reversal controls, the Power Outage Restart Feature may attempt to start a compressor without proper power restoration. Damage to the compressor, compressor motor or the starting equipment may result. Gardner Denver does not advise the use of this feature unless proper power managing devices are provided on the motor starting equipment.

Compressors that were not operating when the power is removed, will require a manual re-start by the operator.

[F6] Next



Factory Set Up Page 2

[F1] Serial Number:

The serial number is entered at the factory before shipment. It should match the label found on the back panel of the assembly. Serial numbers are four digits and assigned by Gardner Denver Corporation.

[F2] P3 Pressure Range:

The pressure transmitter provided with the controller has been scaled in the controller. However, should a new or replacement pressure transmitter of a different range be installed, enter the new range at [F2] on this page. All pressure transmitters must be zero based.

[F3] Digital Set Up:

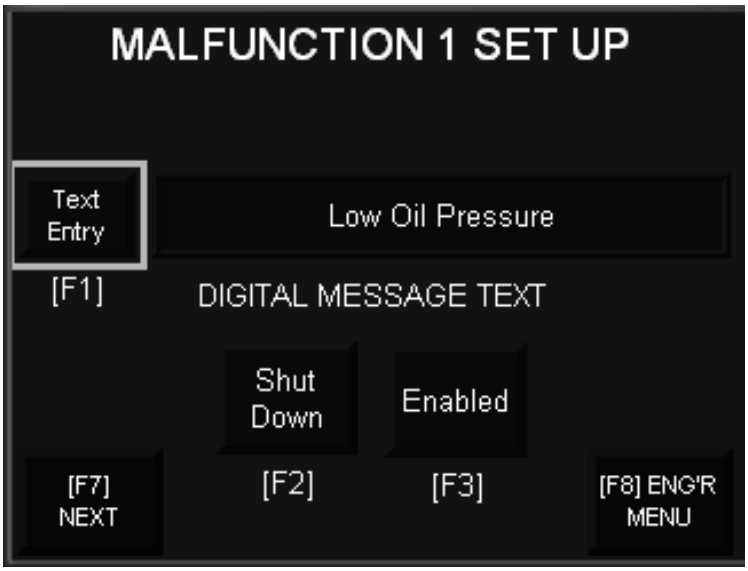
By pressing [F3], the factory technician enters set up pages for up to eight digital inputs. Pages for each of the eight digital switches are the same, therefore only the page for digital input 1 is shown below. The factory technician can advance or go back from page to page using the designated function keys found on each screen, or return to the Engineering Menu.

[F4] Analog Set Up:

By pressing [F4], the factory technician enters set up pages for up to twelve analog inputs. Pages for each of the twelve analog devices are the same, therefore only the page for digital input 1 is shown below. The factory technician can advance or go back from page to page using the designated function keys found on each screen, or return to the Engineering Menu.

[F6] Starts Per Hour Reset:

If the maximum starts per hour has been met, an authorized operator my enter this page and reset the value to zero by pressing [F6]. This should never be reset except in a dire emergency when it is imperative that the compressor is started even though the preset number of starts per hour have been met.



[F2] Digital Input Set Up Page

[F1] Text Entry:

When [F1] is pressed, an alpha numeric pop up display is opened that allows the factory technician to enter the description of the digital input up to 25 characters. Use the left ⇤ key and the right ⇥ curser keys to advance around the alpha numeric display. Press [F1] to accept the selected character into the field. Press the enter ↵ key to accept the final description.

[F2] Alarm Only / Shut Down:

The [F2] key toggles between Alarm Only and Shut Down. When Alarm Only is selected, and the alarm is enabled, only the message will appear and will be logged in the alarm list. The relay output will be activated and can be Silenced or Reset from the Compressor Overview screen. When Shut Down is selected, all of the above will occur however the motor will also shut down.

[F3] Enabled / Disabled:

The [F3] key toggles between Enabled and Disabled and activate or de-activates the digital input alarm.

[F7] Analog Set Up:

By pressing [F7], the factory technician enters set up pages for up to 10 optional analog devices. The devices need to be specified at the time of order so that the necessary analog input modules of the proper type, can be

installed on the product. The analog devices can provide either 4-20 mA signals or RTD signals.

The factory technician can set up each point with the following screens. Two screens are designated for each analog device. Only the screens for analog one are shown below. The technician can advance through and back from each screen or return to the Engineering Menu by following the key designations on each screen.

Analog Set Up Screen

[F1] Warning:

Press [F1] to enter the set point that an alarm will occur as a warning on rising or falling value of the analog device measured at designated point. Use the pop up screen and the numeric key pad to enter this value. This value should be at least 10% or more offset from the shut down set point. When this point is reached, an alarm message will appear and be recorded in the alarm list. The alarm output will be energized. The compressor will continue to run and load as required.

[F2] Shut Down:

Press [F2] to enter the set point that an alarm and compressor shut down will occur on rising or falling value of the analog device measured at designated point. Use the pop up screen and the numeric key pad to enter this value.

This value should be at least 10% or more offset from the warning set point above. When this point is reached, an alarm message will appear and be recorded in the alarm list. The alarm output will be energized. The compressor will shut down and a reset will be required to restart the compressor and restore it to service. If the alarm condition still exists, the compressor will again shut down.

[F3] Text Entry:

When [F3] is pressed, an alpha numeric pop up display is opened that allows the factory technician to enter the description of the digital input up to 25 characters. Use the left ⇤ key and the right ⇥ curser keys to advance around the alpha numeric display. Press [F1] to accept the selected character into the field. Press the enter ↵ key to accept the final description.

[F4] Alarm Action:

Any analog device can be set for either a high limit alarm or a low limit alarm. Air temperature for instance will be set as a high limit alarm whereas oil pressure will be set as a low limit alarm. Use the [F4] function key to toggle the action of each alarm as either a high or low limit alarm.

[F5] Calibrate:

When [F5] is pressed a new screen will be displayed as follows.

Calibration Screen

[F1] Input Type:

Press [F1] to toggle the input device between 4-20 mA and RTD. The input device must match the input module on the controller and will be set by the factory as such.

[F2] Low (4-20 MA Range):

Press [F2] to set the lower range value of a 4-20 MA device only if 4-20 MA is selected above. This is the value that the input will read at 4 MA.

[F3] High (4-20 MA Range):

Press [F2] to set the upper range value of a 4-20 MA device only if 4-20 MA is selected above. This is the value that the input will read at 20 MA.

Note that the input is activated on the screen if RTD is selected or if there is a high range indicted. Otherwise, the input will be out of service and disabled.

[F8] Return:

Return the screen to the previous screen.

Once all of the analog devices are configured, return to the Engineering Menu by pressing [F8].

Factory Set Points:

Security Level One-

Function	Setpoint
Maximum Pressure	XXX PSI
Minimum Pressure	XX PSI
Load Delay Timer	8 Sec.
Cool Down Timer	10 Min.
Number of Steps	2
Step Delay	2 Sec.
Water Timer	360 Sec.
Minimum Run Timer	30 Min.

Security Level Two-

Unless otherwise specified, all malfunctions are set as disabled and all shutdown bits are set as disabled. The actual malfunctions must be set-up in the field by the installer or may be pre-ordered when the Series 7800 is purchased. Any pre-set malfunction or shut down options by the factory will be indicated on the shipping documents.

Once the above configurations have been considered and properly set, the ESP Series

7800 Controller is ready to be placed in operation.

Operation:

The operation can take on two modes, LOCAL or MASTER. When the ESP Series 7800 Controller is connected via Ethernet to the ESP 20/20 Controller, the MASTER mode can only be selected from the ESP 20/20 controller. If the ESP 20/20 controller is not connected, or should it fail through power outage or processor fault, the Series 7800 controller will automatically resume LOCAL mode control.

Local Operation:

In LOCAL control, the operator can use the panel mounted operator interface display selections to affect the local operation as follows.

CONST/UNLOAD/AUTO Selector:

In the CONT (continuous) mode, the compressor will operate under the control of the LOCAL pressure setpoints, provided the MASTER signal is absent from the ESP 20/20 Controller, however the motor will operate continuously regardless of the load status of the compressor, until the operator manually turns off the motor. This feature is disabled in the MASTER mode.

In the UNLOAD position, the motor will operate however the compressor will be forced to unload and remain unloaded until the selector is moved out of the position. This can be used during maintenance testing or for wearing in of replacement compressor parts. This feature is functional in both the LOCAL and MASTER modes of operation.

In the AUTO mode the compressor will operate under the control of the LOCAL pressure setpoints, provided the MASTER signal is absent from the ESP 20/20 Controller, however the motor will operate continuously until the compressor is unloaded 100% for 10 consecutive minutes (adjustable by the operator). When

this period has expired, and the minimum run period has expired, the compressor motor will shut down. Immediately upon the drop in pressure to the first cut-in set point, the motor will re-start and the loading will commence following the load delay.

Emergency Stop

The Emergency Stop is a mushroom head type push button that will shut the motor starter circuit off as well as notify the processor of the stop condition. This function is active in both LOCAL and MASTER control. A fault message will appear on the operator interface display when the Emergency Stop is engaged.

Programmed Stop

When the Start/Stop button [F5] is pressed on the main screen while the compressor motor is running, the programmed stop function is initiated. If the compressor is fully unloaded at the time that the stop button is pressed, the controller will immediately shut down the compressor. However if the compressor is fully or partially loaded when the stop button is pressed, the controller will provide an orderly unloading of each step in sequence and then only after fully unloaded, will the controller stop the compressor. **IN THE CASE OF AN EMERGENCY, THE EMERGENCY STOP SHOULD BE USED TO IMMEDIATELY SHUT DOWN THE COMPRESSOR MOTOR WITHOUT REGARD TO ITS LOAD STATUS.**

Master Operation:

Under MASTER control, the local pressure setpoints are removed from control and the motor run and compressor load control originates from the ESP 20/20 Controller. See the ESP 20/20 Controller manual for details of this operation. The Emergency stop button functions when in MASTER control, as well as the UNLOAD position on the CONT/UNLOAD/AUTO mode selector. Please note that the LOCAL FAILURE TIMER can latch when a compressor fault occurs while in the MASTER mode and can only be reset by returning the control to LOCAL and manually starting the compressor with the local start push button. Once operational in LOCAL, the control can be returned to MASTER and the ESP 20/20 Controller will resume control. IT IS IMPORTANT TO RECOGNIZE THAT WHILE UNDER MASTER CONTROL, THE SERIES 7800 MODE SELECTOR MUST BE IN THE AUTO POSITION. Otherwise a fault will occur when the compressor is shut down automatically under MASTER control.

See the section under LOCAL OPERATION describing the LOCAL FAILURE TIMER.

Refer to the ESP 20/20 Manual for the description of operation in MASTER control.

Security:

Two levels of security exist in the PanelView and restrict access as follows. Without a user name and password, the following screens are accessible by the operator.

Boot Screen
Main Menu Screen
Compressor Overview Screen
Alarm List
Analog and Digital Status Screens

Level One:

Level One is protected by a user name and password that is requested when switching from the Main Menu screen to the Engineering Menu screen allowing access to the following screens in addition to the above.

Operational Set Up Screens
Hours Reset

Level Two:

Level Two is protected by a user name password that is required when the operator goes beyond the screens protected by the Level One user name and password above. This is usually for initial set-up only however may need to be modified from time to time as malfunction sensing switches are added or deleted from the control scheme, or when alarms are changed to shutdown functions or vice-versa, or the addition of analog measuring devices. In addition to all of the screens listed above, the operator has access to the following:

Digital Set Up Screens
Analog Set Up Screens
System Set Up Screens

Passwords:

User names and passwords will be provided on a separate document for security reasons.

Statement of Limited Warranty

Gardner Denver, Inc, as a designer and fabricator of compressed air management systems and controls, guarantees our equipment to be free of defects in design and workmanship for a period of one year from start up or eighteen months from the date of release for shipment. All equipment included on any system, manufactured by others, and included as an integral part of the system, will be subject to the terms and conditions of any warranty or agreement of the original equipment manufacturer (OEM). **Any liability for consequential and incidental damage is expressly disclaimed. There is no implied warranty of merchantability nor any other warranty which extends beyond the description on the face hereof.**

Defects in design or workmanship are subject to the following conditions:

Design

If Gardner Denver is given the full design responsibility, including equipment selection and component interaction circuits, and design, then Gardner Denver will fully guarantee the equipment to be sound and to perform in the specified and proposed manner. Gardner Denver does not warrant design details nor specific components requested by the customer and incorporated on the final design. Any OEM equipment, that does not perform to published specifications, will be the responsibility of the OEM.

Workmanship

Gardner Denver guarantees our workmanship to be equal to the standard of custom and usage for the application. Any failure as a result of substandard workmanship on the part of Gardner Denver, excluding OEM equipment; will be considered the responsibility of Gardner Denver International Inc.

The evaluation and disposition of all claims of warranty will be the sole responsibility of Gardner Denver, and our decision is final. Repair or replacement will be at the option of Gardner Denver. Gardner Denver will have no responsibility for any repair unless first given notice and a reasonable opportunity for Gardner Denver to make the repair. No returned parts will be accepted, nor will any warranty consideration commence unless a bona fide purchase order from a responsible party is obtained by Gardner Denver to cover any expenses not considered by Gardner Denver to be part of this warranty. Labor associated with the repair or replacement of parts considered under the above conditions to be covered under this warranty will be provided at no cost to the owner.

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