



## 24P822 E-Flo®

## DC Control Module Kit

3A2527G  
EN

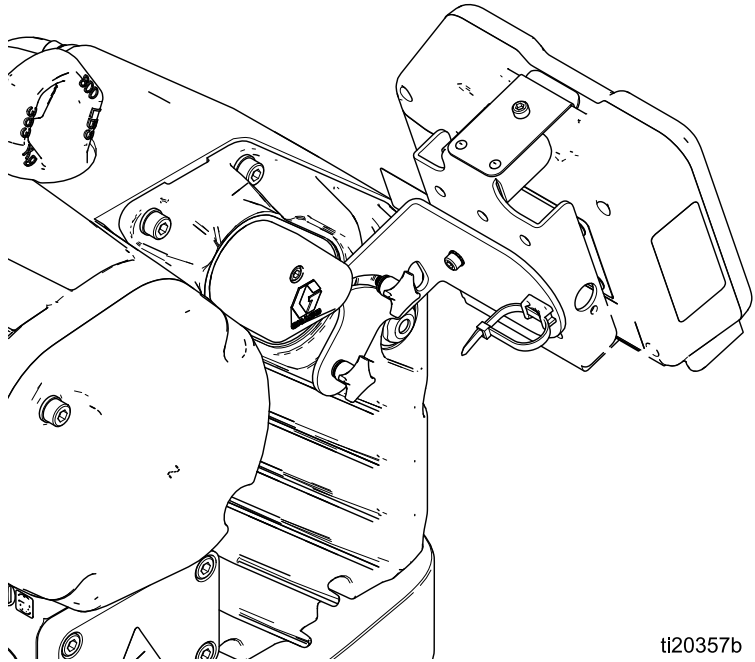
User Interface for E-Flo® DC Pumps with an Advanced Motor.  
For professional use only.



### Important Safety Instructions

Read all warnings and instructions in this manual, the supplied ADCM manual, and the E-Flo DC manuals. **Save these instructions.**

*See the separate manual (supplied) for complete warnings and approvals information about the 24L097 Advanced Display Control Module (ADCM).*



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## Related Manuals

Manual No.	Description
3A2526	Instructions-Parts Manual, E-Flo DC Motor
3A2096	Instructions-Parts Manual, E-Flo DC 4-Ball Piston Pumps
332013	Instructions-Parts Manual, for Advanced Display Control Module (ADCM)
3A0539	Instructions-Parts Manual, 4-Ball Lowers

# Control Module

The Control Module provides the interface for users to enter selections and view information related to setup and operation.

The screen backlight is factory set to remain on, even without screen activity. See **Setup Screen 4** to set the backlight timer to your preference. Press any key to restore.

Keys are used to input numerical data, enter setup screens, navigate within a screen, scroll through screens, and select setup values.

## Installation

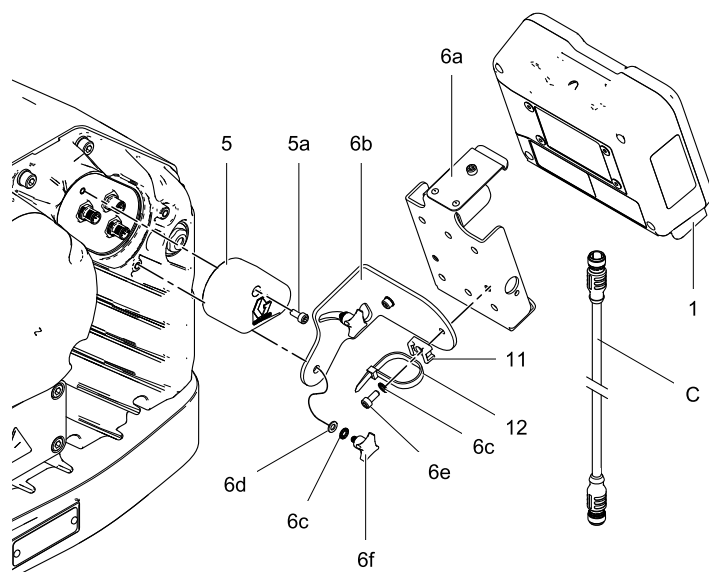
### Install the Control Module

1. Shut off and lock out power to the motor.
2. Install the jumper connector (5) over the top two terminals of the motor, using the screw (5a).

**NOTE:** To connect up to 8 motors together, see Appendix A in the E-Flo DC Motor Manual (3A2526), where the control module is the referenced intrinsically safe (IS) apparatus.

**NOTE:** See Appendix C for information about different multi-unit topologies.

3. Assemble the bracket kit (6a-6f) and the holder and tie (11, 12) as shown.
4. Install the module (1) in the bracket (6a), making sure the tabs at the bottom of the bracket engage the slots in the module, and the lip at the top of the bracket holds the module securely in place.
5. Connect the accessory cable (C), using the tie (12) as a strain relief as shown. See [Cable Connection, page 5](#).
6. Restore power to the motor.



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Figure 1 Install the Control Module

## Install Optional Accessory Kits

Optional accessory kits are available for purchase separately, including a pressure transducer kit (PN 24R050 for 4-ball pumps; PN 24Y245 for 2-ball pumps), a start/stop switch kit (PN 16U729), and a controller kit (24V001 ) for a back pressure regulator.

### Pressure Transducer Kit

1. To measure fluid pressure, install the pressure transducer in the fluid line with a tee fitting.

Option	Description
Closed Loop Control Enabled	If closed loop control is enabled on Setup Screen 8 (transducer 1) or Setup Screen 9 (transducer 2), install the transducer near the pump outlet, not near the end of the circulation line.
Closed Loop Control Not Enabled	Install the transducer where needed.

2. Connect the transducer cable to Port 7 (transducer 1) or Port 10 (transducer 2) on the control module.

### Start/Stop Switch Kit

1. Mount the switch near the control module, using the bracket provided.
2. Connect the switch cable to Port 4 on the control module.

### BPR Controller

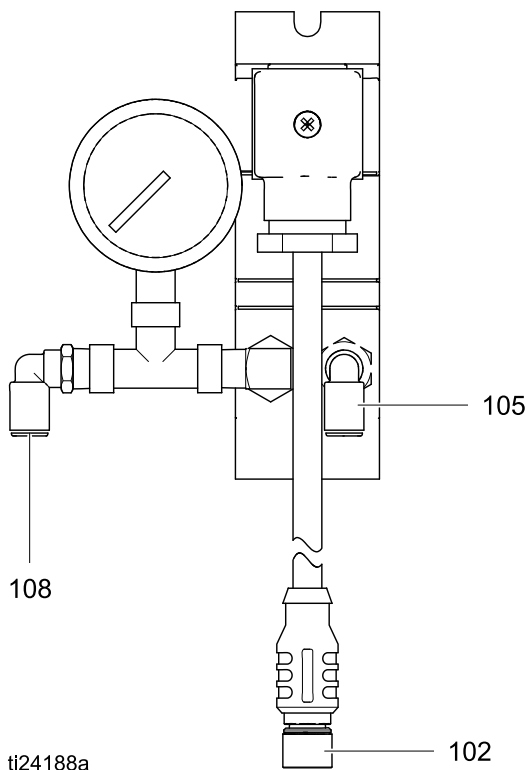
The BPR (back pressure regulator) controller enables the user to control the back fluid pressure from the control module.

1. Mount the BPR controller using the bracket provided.
2. Connect a supply air line to the BPR controller air inlet (105).

**NOTICE**

To prevent equipment damage, always apply air pressure to the BPR controller before applying power to the system.

3. Connect an air line from the BPR controller air output (108) to the BPR.
4. Connect the BPR controller input cable (102) to Port 8 on the control module.

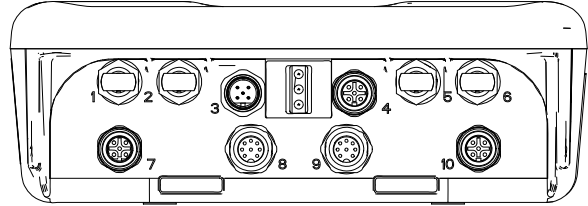


## Cable Connection

Order an accessory cable (C) from Table 1. Connect the cable to Port 3 on the bottom of the control module (see Fig. 2). Connect the other end to the power terminal (PT) on the motor (see Fig. 3). Connect other cables as described in Table 2.

Table 1 CAN Cables

Cable Part No.	Description
16P911	Intrinsically safe CAN cable, female x female, 3 ft (1 m)
16P912	Intrinsically safe CAN cable, female x female, 25 ft (8 m)

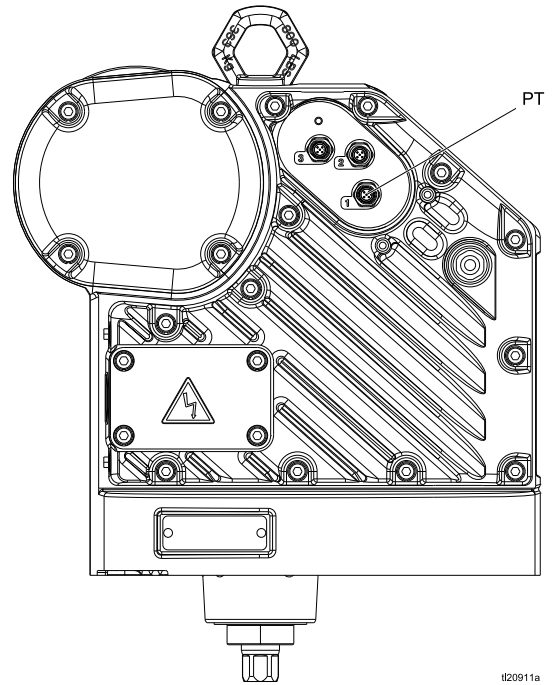


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Figure 2 ADCM Connectors

Table 2 ADCM Cable Connections

ADCM Port Number	Connector Purpose
1	Fiber Optic RX - to Fiber Optic Converter Module
2	Fiber Optic TX - to Fiber Optic Converter Module
3	Power and CAN communication
4	Start/Stop input
	Fill pump output
	Reed switch input/Drum cover switch input/Auxiliary output
5	Fiber Optic RX - to next ADCM
6	Fiber Optic TX - to next ADCM
7	Pressure transducer 1
8	BPR control 4-20mA output
9	Agitator control 4-20mA
10	Pressure transducer 2




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Figure 3 Motor Power Terminal

# Operation

## Module Screens

The Control Module has two sets of screens: Run and Setup. For detailed information see [Run Screens, page 13](#), and [Setup Screens, page 18](#).

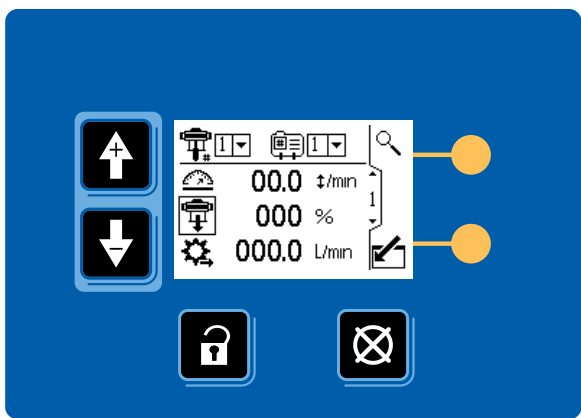
Press  to toggle between the Run screens and the Setup screens.

## Module Keys

Figure 4 is a view of the control module display and keys. Table 2 explains the function of the membrane keys on the control module. As you move through the screens, you will notice that most information is communicated using icons rather than words to simplify global communication. The detailed screen descriptions in [Run Screens, page 13](#), and [Setup Screens, page 18](#), explain what each icon represents. The two softkeys are membrane buttons whose function correlates with the screen content to the immediate left of the button.

**NOTICE**













To prevent damage to the softkey buttons, do not press the buttons with sharp objects such as pens, plastic cards, or fingernails.



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


Figure 4 Control Module Keypad and Display























Table 3 Module Keys

Membrane Keys	Softkeys
 <p>Press to toggle between Run screens and Setup screens.</p>	 <p><i>Enter Screen.</i> Highlight data that can be edited. Also changes the function of the Up/Down arrows so they move between data fields on the screen, rather than between screens.</p>
 <p><i>Error Reset:</i> Use to clear alarm after cause has been fixed. When there is no alarm to clear, this key will set the active pump's profile to Stop. Also used to cancel data entered and return to original data.</p> <p>NOTE: The pump stop function can be disabled in Setup Screen 16.</p>	 <p><i>Exit Screen.</i> Exit data editing.</p>
 <p><i>Up/Down Arrows:</i> Use to move between screens or fields on a screen, or to increment or decrement the digits in a settable field.</p>	 <p><i>Enter.</i> Press to activate a field for editing or to accept the highlighted selection on a dropdown menu.</p>
 <p><i>Softkeys:</i> Use varies by screen. See columns at right.</p>	 <p><i>Right.</i> Move to the right when editing number fields. Press again to accept the entry when all digits are correct.</p>
	 <p><i>Reset.</i> Reset totalizer to zero.</p>
	 <p><i>Activate Profile.</i> This softkey is disabled by default, and only appears on Setup Screens 1–4 if the "Profile Lock" box is checked on <a href="#">Setup Screen 17, page 30</a>. Press to activate the profile just edited.</p>
	 <p><i>Search.</i> Press in Run Screen 1 to make the active pump blink for identification.</p>
	 <p><i>Acknowledge.</i> Press to acknowledge that a software update has concluded.</p>






## Icons




As you move through the screens, you will notice that most information is communicated using icons rather than words to simplify global communication. The detailed screen descriptions in [Run Screens, page 13](#), and [Setup Screens, page 18](#), explain what each icon represents.

Screen Icons	
 Pressure Control	 Profile Number
 Speed	 Volume
 Pump Pressure	 Flow Rate
 Pressure	 Target
 In Setup Mode	 Mode Select
 Pressure Mode	 Flow Mode
 System Mode/Type	 System Reset
 Lower Size	 Back Pressure Regulator
 Maximum Limit	 Minimum Limit
 Maximum and Minimum Limits	 Deviation Enable

Screen Icons	
 Alarm Enable	 Calibration
 Jog Mode	 Jog Up/Down
 Cycles	 Cycles Total
 Maintenance	 Units
 Transducer	 Pressure Transducer Off
 Calibration Scale	 Zero Offset
 Serial Number	 Control Location
 Local Control	 PLC/Remote Control
 Modbus Device	 Modbus Address
 Serial Port	 Serial Baudrate
 Calendar	 Clock









Screen Icons	
 <p>Password</p>	 <p>Lock Profile</p>
 <p>Configurable In/Out</p>	 <p>Agitator Speed Setting</p>
<p><b>Hz</b> Actual VFD Frequency</p>	 <p>Disable PLC/Network Control</p>

Screen Icons	
 <p>Tank Level</p>	 <p>Solenoid Output</p>
 <p>Cancel Key</p>	





## Screen Navigation and Editing

Refer to this section if you have questions about screen navigation or about how to enter information and make selections.






### All Screens

1. Use   to move between screens.
2. Press  to enter a screen. The first data field on the screen will highlight.
3. Use   to highlight the data you wish to change.
4. Press  to edit.

### Drop Down Field




1. Use   to highlight the correct choice from the dropdown menu.
2. Press  to select.
3. Press  to cancel.

### Number Field


1. The first digit will be highlighted. Use   to change the number.
2. Press  to move to the next digit.
3. When all digits are correct, press  again to accept.
4. Press  to cancel.


### Check Box Field




A check box field is used to enable or disable features in the software.

1. Press  to toggle between  and an empty box.
2. The feature is enabled if a  is in the box.

### Reset Field


The reset field is used for totalizers. Press  to reset the field to zero.

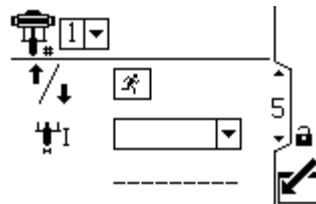
When all data is correct, press  to exit the screen.

Then use   to move to a new screen, or  to move between Setup screens and Run screens.

## Initial Setup

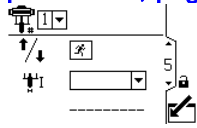
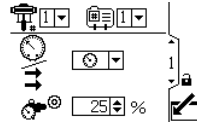
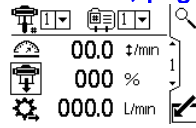
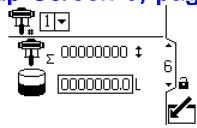
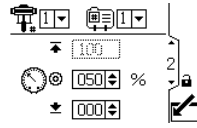
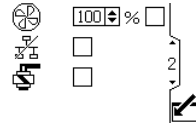
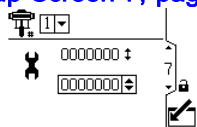
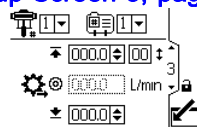
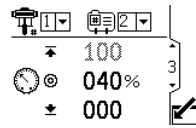
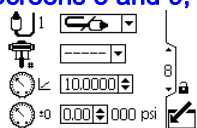
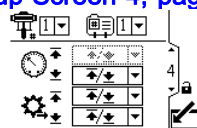
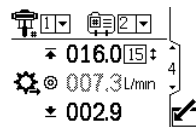
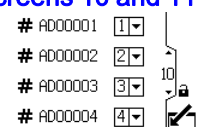
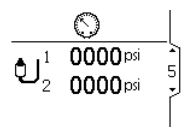
**NOTE:** Before creating the pump profiles in Setup Screens 1 through 4, you must set up the system parameters in Setup Screens 5 through 17, as follows.

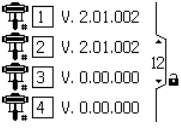
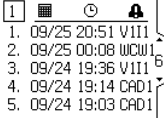

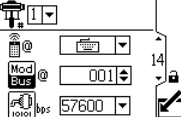

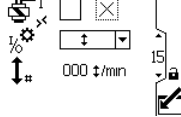

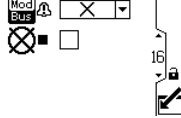

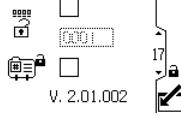

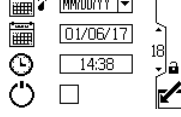

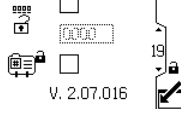
1. Press  to enter the Setup screens. Setup Screen 1 will appear.
2. Scroll to Setup Screen 5.



3. See [Setup Screen 5, page 24](#), and select the lower used in your system.
4. Continue setting the system parameters on [Setup Screen 6, page 25](#) through [Setup Screen 17, page 30](#).
5. Scroll to Setup Screen 1. Establish the profiles for each pump. See [Setup Screen 1, page 18](#) through [Setup Screen 4, page 22](#).

# Screen Map

INITIAL SETUP (Setup Screens 5–17)	SETUP AND EDIT PROFILES (Setup Screens 1–4)	RUN (Run Screens 1–9)
<p>Setup Screen 5, page 24</p> 	<p>Setup Screen 1, page 18</p> 	<p>Run Screen 1, page 13</p> 
▼	▼	▼
<p>Setup Screen 6, page 25</p> 	<p>Setup Screen 2, page 20</p> 	<p>Run Screen 2, page 14</p> 
▼	▼	▼
<p>Setup Screen 7, page 25</p> 	<p>Setup Screen 3, page 21</p> 	<p>Run Screen 3, page 15</p> 
▼	▼	▼
<p>Setup Screens 8 and 9, page 26</p> 	<p>Setup Screen 4, page 22</p> 	<p>Run Screen 4, page 15</p> 
▼		▼
<p>Setup Screens 10 and 11, page 27</p> 		<p>Run Screen 5, page 16</p> 
▼		▼
<p>CONTINUED ON THE NEXT PAGE.</p>		

<b>INITIAL SETUP</b> (Setup Screens 5–17)	<b>SETUP AND EDIT PROFILES</b> (Setup Screens 1–4)	<b>RUN</b> (Run Screens 1–9)
<p><b>Setup Screens 12 and 13, page 27</b></p> 		<p><b>Run Screens 6–9, page 16</b></p> 
		
<p><b>Setup Screen 14, page 28</b></p> 		
		
<p><b>Setup Screen 15, page 29</b></p> 		
		
<p><b>Setup Screen 16, page 29</b></p> 		
		
<p><b>Setup Screen 17, page 30</b></p> 		
		
<p><b>Setup Screen 18, page 31</b></p> 		
		
<p><b>Setup Screen 19, page 32</b></p> 		

# Run Screens

The Run screens display current target values and performance for a selected pump and profile. Any alarms will display in the sidebar at the right of the screen. Screens 6–9 display a log of the last 20 alarms for the active pump.

Information displayed on the Run screens corresponds to the Modbus Registers. See [Appendix A - Modbus Variable Map, page 38](#).

The active pump and profile may be changed in Run Screens 1, 2, and 3.

## Run Screen 1

This screen displays information for a selected pump and profile. A box around an icon indicates which mode the active pump and profile is running (pressure or flow).

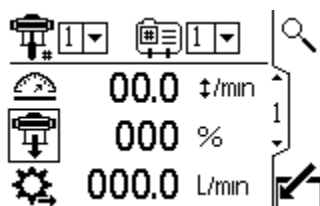


Figure 5 Run Screen 1

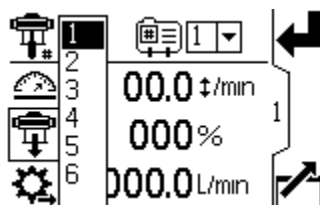


Figure 6 Select a Pump

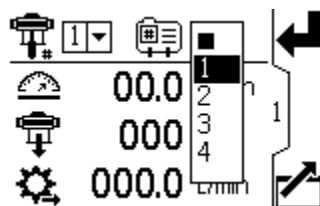


Figure 7 Select a Profile

Run Screen 1 Key	
	Enter the screen.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
	Select the desired profile (1 to 4), using the pull-down menu.
	Select from the profile drop-down menu to stop the pump.
	Displays current pump speed in cycles per minute.
	Displays current pump pressure as a percentage. If a transducer is used, this icon is replaced by the pressure icon.
	Displays current flow rate, in units as selected in <a href="#">Setup Screen 15, page 29</a> .
	Exit the screen.
	Signals the active pump to blink code 9 for identification.

## Run Screen 2

This screen displays information for controlling an electric agitator via a 4–20 mA signal to a Variable Frequency Drive (VFD).

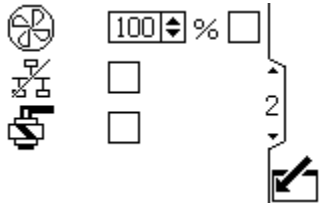


Figure 8 Run Screen 2



Figure 9 Set Agitator Speed Setpoint



Figure 10 Enable Control Output

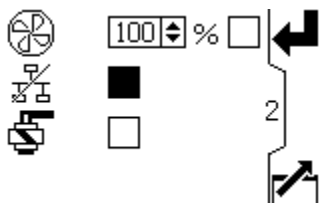


Figure 11 Disable Network Control



Figure 12 Manual Fill Pump Solenoid Control

Run Screen 2 Key	
	Enter the screen.
	Set the desired speed setpoint for the agitator, from 0 — 100 % (4–20 mA, Port 9). For example, a setting of 100% would correspond to 20 mA. A setting of 50 % would correspond to 12 mA.
	Select this box to disable network control of the agitator.
	Select this box and hold the softkey button to manually control the fill pump solenoid output.
	Exit the screen.

### Run Screen 3

This screen displays pressure settings for the active pump and profile.

**NOTE:** Some fields are grayed out, depending on setup selections.

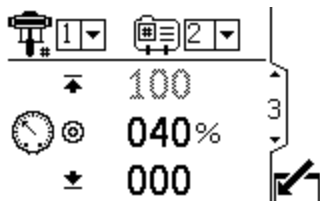


Figure 13 Run Screen 3, in Pressure Mode

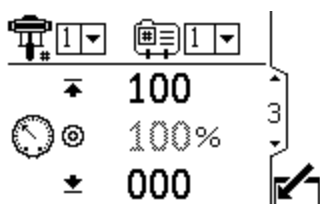


Figure 14 Run Screen 3, in Flow Mode

### Run Screen 4

This screen displays fluid flow settings for the active pump and profile.

**NOTE:** Some fields are grayed out, depending on setup selections.

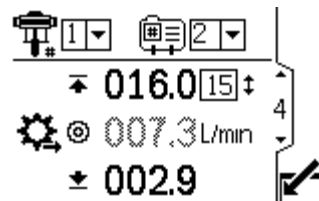


Figure 15 Run Screen 4, in Pressure Mode

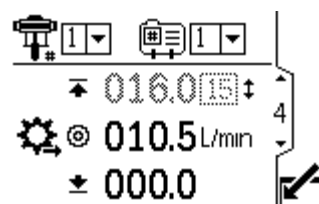


Figure 16 Run Screen 4, in Flow Mode

Run Screen 3 Key	
	Enter the screen.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
	Select the desired profile (1 to 4), using the pull-down menu.
	Select from the profile drop-down menu to stop the pump.
	Displays pressure maximum (first data field), target (second data field), and minimum (third data field), as selected in <a href="#">Setup Screen 2, page 20</a> . See <a href="#">Setup Screen 4, page 22</a> to set or disable the pressure alarms.
	Exit the screen.

Run Screen 4 Key	
	Enter the screen.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
	Select the desired profile (1 to 4), using the pull-down menu.
	Select from the profile drop-down menu to stop the pump.
	The first line displays the maximum flow rate and maximum cycle rate (displayed as a cpm conversion of the maximum flow setting). The second line displays the target flow rate. The third line displays the minimum flow rate. See <a href="#">Setup Screen 3, page 21</a> to establish these settings. See <a href="#">Setup Screen 4, page 22</a> to set or disable the flow alarms.
	Exit the screen.

## Run Screen 5

This screen displays the current pressure readings of transducers 1 and 2. Pressure can be displayed as psi, bar, or MPa. See [Setup Screen 15, page 29](#).

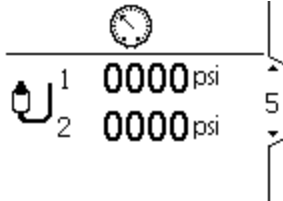


Figure 17 Run Screen 5

## Run Screens 6–9

Run Screens 6–9 display a log of the last 20 alarms, with date and time. The currently active pump is displayed in a box at the top left of the screen.

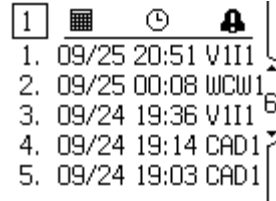


Figure 18 Run Screens 6–9 (Screen 6 shown)



# Notes

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# Setup Screens

Use the Setup screens to set control parameters for the motor. See [Screen Navigation and Editing, page 10](#), for information on how to make selections and enter data.

Inactive fields are grayed-out on a screen.

Information displayed on the Setup screens corresponds to the Modbus Registers. See [page 38](#)

**NOTE:** Before setting up profiles on Setup Screens 1–4, do the initial setup on Setup Screens 5–17. Screens 5–17 establish the configuration for your system and affect the displayed data.

## Setup Screen 1

Use this screen to set the operating mode for a selected pump and profile.

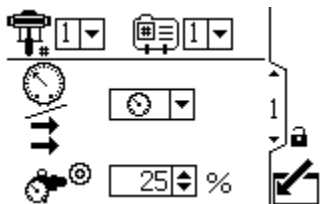


Figure 19 Setup Screen 1

Setup Screen 1 Key	
	Enter the screen.
	Pump selection — See Step 1.
	Profile selection — See Step 2.
	Pressure mode or Flow mode — See Step 3
	Setting for Back Pressure Regulator — See Step 4.
	Press to accept the selections.
	This softkey is disabled by default, and only appears if the “Profile Lock” box is checked on <a href="#">Setup Screen 17, page 30</a> . Press to activate the profile just edited.
	Exit the screen.

1. For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.

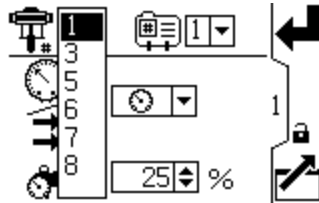


Figure 20 Select Pump Number

2. Select the desired profile (1 to 4), using the pull-down menu.

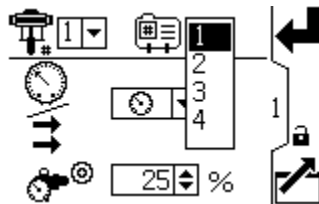


Figure 21 Select Profile Number

3. Select the desired operating mode (pressure or flow), using the pull-down menu.

- **In pressure mode**, the motor will adjust the pump speed to maintain the fluid pressure percentage set on Setup Screen 2. If the flow limit is reached before the target pressure, the unit will stop driving to the pressure (if set as an alarm).

- **In flow mode**, the motor will maintain a constant speed to maintain the target flow rate set on Setup Screen 3, regardless of the fluid pressure, up to the pump's maximum working pressure.

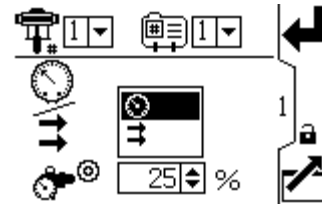


Figure 22 Select Mode (Pressure Mode Shown)

4. If the system is equipped with a back pressure regulator (BPR), set the target air pressure to the BPR from 0 to 100 percent (approximately 1 to 100 psi). Leave the field set to 000 for a system with no BPR.

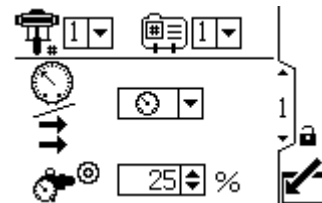


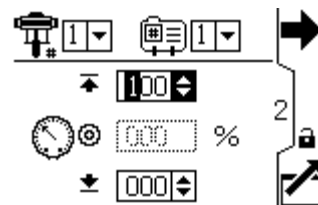
Figure 23 Set Back Pressure Regulator

## Setup Screen 2

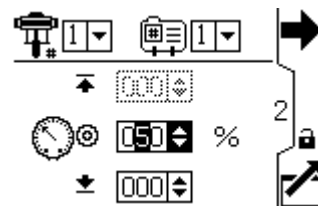
Use this screen to set the maximum, target, and minimum fluid pressure for a selected pump and profile. In pressure mode, you will set a target fluid pressure. In flow mode, you will set a maximum fluid pressure. In either pressure or flow mode, a minimum pressure may be set if desired. See [Setup Screen 4, page 22](#), to specify how the system will respond if the pump begins to operate outside of the set boundaries.

Setup Screen 2 Key	
	Enter the screen.
	Pump selection — See Step 1.
	Profile selection — See Step 2.
	Fluid pressure maximum— See Step 3.
	Fluid pressure target — See Step 4.
	Fluid pressure minimum — See Step 5.
	Press to accept the selections.
	This softkey is disabled by default, and only appears if the “Profile Lock” box is checked on <a href="#">Setup Screen 17, page 30</a> . Press to activate the profile just edited.
	Exit the screen.

- For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
- Select the desired profile (1 to 4), using the pull-down menu.
- In **flow mode**, set the desired maximum pump fluid pressure, as a percentage of the maximum pressure of your pump. **NOTE:** The motor will not run if the profile does not have a maximum pressure setting. This field is not used in pressure mode.



- In **pressure mode**, set the desired fluid pressure target as a percentage of the maximum pressure of your pump. This field is not used in flow mode.



**NOTE:** If closed loop pressure is enabled, the target pressure will be displayed as a pressure value rather than a percentage of maximum pressure. See [Setup Screens 8 and 9, page 26](#) to enable closed loop pressure control.

- If desired, set a minimum pump fluid pressure, as a percentage of the maximum fluid pressure of your pump.

### Setup Screen 3

Use this screen to set your flow rate settings for a selected pump and profile. In pressure mode, you will set a maximum flow rate. In flow mode, you will set a target flow rate. In either pressure or flow mode, a minimum flow rate may be set if desired. See Setup Screen 4 to specify how the system will respond if the pump begins to operate outside of the set boundaries.

1. For systems with multiple pumps and one display, select the desired pump (1 to 8) using the pull-down menu.
2. Select the desired profile (1 to 4) using the pull-down menu.
3. **In flow mode**, set a target flow rate. This field is not used in pressure mode.

Setup Screen 3 Key	
	Enter the screen to set or change preferences.
	Pump selection — See Step 1.
	Profile selection — See Step 2.
	Flow rate maximum— See Step 3.
	Flow rate target— See Step 4.
	Flow rate minimum — See Step 5.
	Press to accept the selections.
	This softkey is disabled by default, and only appears if the “Profile Lock” box is checked on <a href="#">Setup Screen 17, page 30</a> . Press to activate the profile just edited.
	Exit data editing.

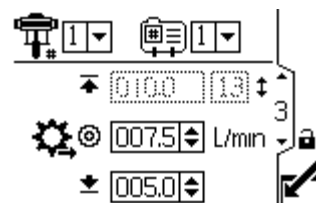


Figure 24 Flow Mode: Flow Rate Settings

4. **In pressure mode**, set the maximum flow rate. The software will calculate the number of pump cycles needed to achieve that flow rate. This field is not used in flow mode.

**NOTE:** The motor will not run if the profile does not have a maximum flow rate setting.

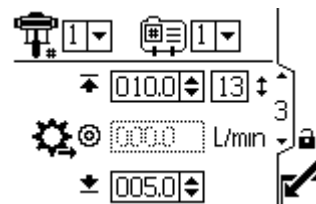


Figure 25 Pressure Mode: Flow Rate Settings

**NOTE:** With flow rate units of cc/min, the maximum value that can be displayed is 9999. If the field displays #####, the saved value is out of range. Go to [Setup Screen 15, page 29](#) and change the flow rate to a larger unit. Return to this screen and reduce the setting to a lower value that will be within the display’s range, then reset the flow rate units to cc/min.

5. If desired, set a minimum flow rate.

## Setup Screen 4

Use this screen to specify how the system will respond if the pump begins to operate outside of the pressure and flow settings established on Setup Screen 2 and Setup Screen 3. The operating mode (pressure or flow, set on Setup Screen 1) determines which fields are active.

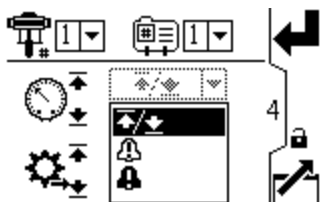











Figure 26 Alarm Preference Menu

-  **Limit:** The pump continues to run and issues no alert.
  - Maximum pressure set to Limit: The system reduces the flow if necessary to prevent the pressure from exceeding the limit.
  - Maximum flow set to Limit: The system reduces the pressure if necessary to prevent the flow from exceeding the limit.
  - Minimum pressure or flow set to Limit: The system takes no action. Use this setting if no minimum pressure or flow setting is desired.
-  **Deviation:** The system alerts you to the problem, but the pump may continue to run past the maximum or minimum settings until the system’s absolute pressure or flow boundaries are reached.
-  **Alarm:** The system alerts you to the alarm cause and shuts down the pump.

**NOTE:** Alert trigger time varies based on how far active measurements are from their set limits.

Setup Screen 4 Key	
	Enter the screen to set or change preferences.
	Pressure Alarm Enable Line 1 (Pressure Maximum): use dropdown menu to set as Limit, Deviation, or Alarm. Line 2 (Pressure Minimum): use dropdown menu to set as Limit, Deviation, or Alarm.
	Flow Rate Alarm Enable Line 3 (Flow Maximum): use dropdown menu to set as Limit, Deviation, or Alarm. Line 4 (Flow Minimum): use dropdown menu to set as Limit, Deviation, or Alarm.
	Press to accept the selections.
	This softkey is disabled by default, and only appears if the “Profile Lock” box is checked on <a href="#">Setup Screen 17, page 30</a> . Press to activate the profile just edited.
	Exit data editing.

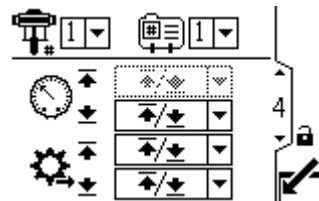


Figure 27 Setup Screen 4 (In Pressure Mode)

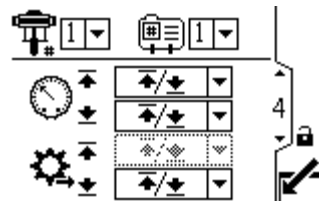






Figure 28 Setup Screen 4 (In Flow Mode)

### Pressure Mode Examples

- **Runaway Control:** The user may choose to set the maximum flow to Alarm. If the flow rate exceeds the maximum entered on Setup Screen 3, an Alarm symbol  will show on screen and the pump will shut down.
- **Detect a Plugged Filter or Pipe:** The user may choose to set the minimum flow to Deviation. If the flow rate drops below the minimum entered on Setup Screen 3, a Deviation symbol  will show on screen to warn the user that action should be taken. The pump continues to run.

### Flow Mode Examples

- **Runaway Control:** The user may choose to set the minimum pressure to Alarm. If a hose bursts, the pump will not change speed, but the back pressure will fall. When the pressure falls below the minimum entered on Setup Screen 2, an Alarm symbol  will show on screen and the pump will shut down.
- **Protect Connected Equipment:** The user may choose to set the maximum pressure to Limit to prevent the connected equipment from excessive pressure.
- **Detect a Plugged Filter or Pipe:** The user may choose to set the maximum pressure to Deviation. When the pressure exceeds the maximum entered on Setup Screen 2, a Deviation symbol  will show on screen to warn the user that action should be taken. The pump continues to run.

## Setup Screen 5

Use this screen to set the lower pump size (cc) of each pump. The default is blank; select the correct lower size, or custom. If custom is selected, enter the size of the lower in cc. This screen also activates jog mode, allowing you to position the motor/pump shaft for connection or disconnection.

**NOTE:** The motor will limit its pressure output when the selected lower is 750cc, to prevent exceeding the pressure rating of the lower.

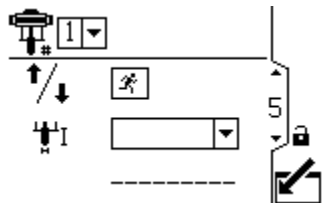


Figure 29 Setup Screen 5

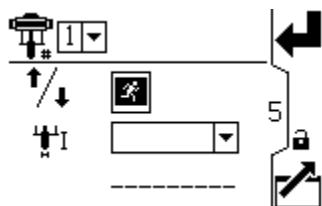


Figure 30 Select Jog Mode

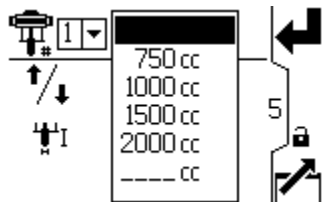


Figure 31 Select Pump Lower

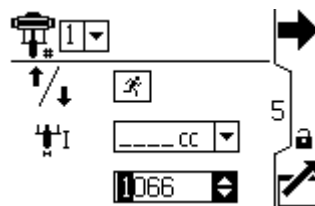


Figure 32 Select a Custom Lower

Setup Screen 5 Key	
	Enter the screen.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
	Select to enable jog mode. Use the arrow keys to move the motor/pump shaft up or down.
	Select the correct pump lower size from the drop-down menu. The default is blank. If custom is selected, a field will open to input the size of the lower in cc.
	Press to accept the selections.
	Exit the screen.



## Setup Screen 6

Use this screen to view the grand totalizer value and set or reset the batch totalizer.

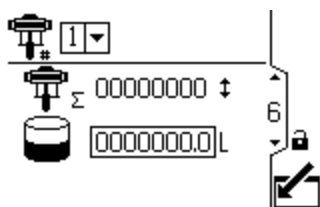


Figure 33 Setup Screen 6

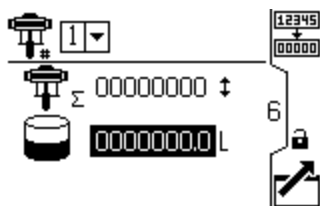


Figure 34 Reset the Totalizer

Setup Screen 6 Key	
	Enter the screen to set or change preferences.
	Grand Totalizer - displays the current grand total of pump cycles. Not resettable.
	Batch Totalizer - displays the batch total in selected volume units.
	Reset Batch Totalizer - resets the batch totalizer to zero.
	Press to accept the selections.
	Exit data editing.

## Setup Screen 7

Use this screen to set the desired maintenance interval (in cycles) for each pump. The screen also displays the current cycle count. An Advisory is issued when the counter reaches 0 (zero).

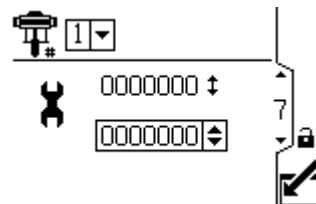


Figure 35 Setup Screen 7

Setup Screen 7 Key	
	Enter the screen.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
	Set the desired maintenance interval (in cycles) for each pump.
	Press to accept the selections.
	Exit the screen.

## Setup Screens 8 and 9

Use these screens to set up the pressure transducers. The screens are identical, except Screen 8 is for transducer 1 and Screen 9 is for transducer 2. Selecting a transducer and a pump activates closed loop pressure control.

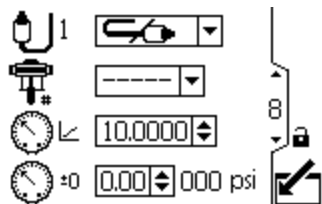


Figure 36 Setup Screens 8 and 9 (Screen 8 shown)

Setup Screens 8 and 9 Key	
	Select from the dropdown options to enable the transducer.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu. Enables closed loop pressure control and assigns the transducer to a pump.
	When the 5 psi transducer is selected, this becomes a check box. When selected, the tank level is reset to 100%.
	Enter the calibration scale factor from the transducer label.
	Enter the calibration offset value from the transducer label.
000 psi	Displays the current transducer reading.
	Exit data editing.
	Move between Setup Screens, fields on a screen, or to increment/decrement the digits when editing number fields.

**NOTE:** Closed loop pressure control requires the transducer to be installed near the pump outlet.

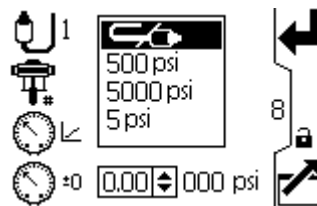


Figure 37 Select Pressure Transducer

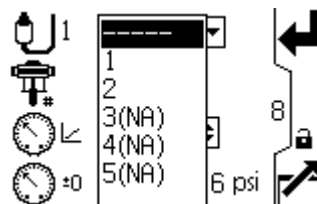


Figure 38 Select Pump to Enable Closed Loop Pressure Control

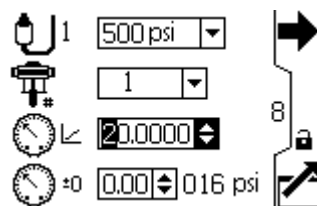


Figure 39 Enter Calibration Scale Factor

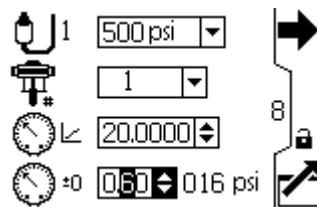


Figure 40 Enter Calibration Offset Value

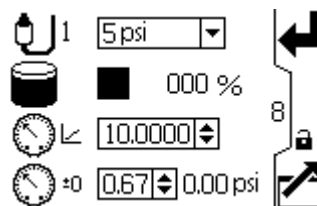


Figure 41 5 psi Level Sensor Selected Reset Full Tank Level

## Setup Screens 10 and 11

These screens are auto-populated by the software. Screen 10 displays the serial numbers of motors 1–4, and Screen 11 displays the serial numbers of motors 5–8.

**NOTE:** Changing the pump order will shift every other pump up one position. For example, if AD00001 is changed to be pump 4, AD00002 will become pump 1, AD00003 will become pump 2, and so on.

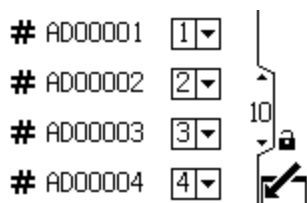


Figure 42 Setup Screens 10 and 11 (Screen 10 shown)

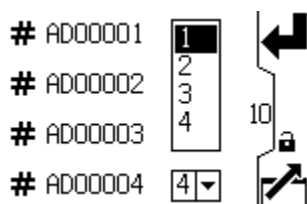


Figure 43 Select a Pump Number for Each Serial Number

## Setup Screens 12 and 13

These screens are auto-populated by the software. Screen 10 displays the software version numbers of motors 1–4, and Screen 11 displays the software version numbers of motors 5–8.

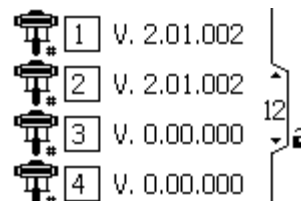


Figure 44 Setup Screens 12 and 13 (Screen 12 shown)

## Setup Screen 14

Use this screen to set your modbus preferences.

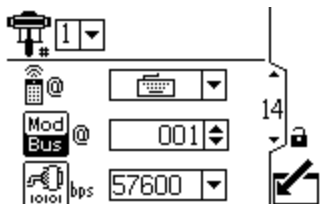


Figure 45 Setup Screen 14

Setup Screen 14 Key	
	Enter the screen.
	For systems with multiple pumps and one display, select the desired pump (1 to 8), using the pull-down menu.
	Control location. Select local  or remote  control from the dropdown options. Setting applies to the selected pump only.
	Enter or change the Modbus node ID. Value is between 1 and 247. Each pump requires a unique node ID, which identifies that pump if more than one pump is connected to the display.
	Select serial port baud rate from the dropdown options: 57600 or 115200. This is a system-wide setting.
	Press to accept the selections.
	Exit data editing.

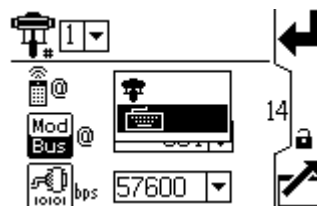


Figure 46 Select Local or Remote Control

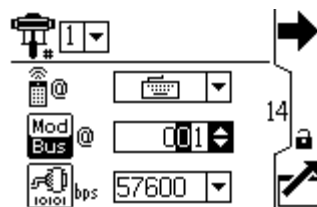


Figure 47 Set Modbus Node ID



Figure 48 Set Baud Rate (Bits Per Second)

**NOTE:** The following are fixed modbus settings, which cannot be set or changed by the user:

- 8 data bits,
- 2 stop bits,
- no parity.

## Setup Screen 15

This screen is for monitoring, setup, and control for some of the Integrated Paint Kitchen peripherals.

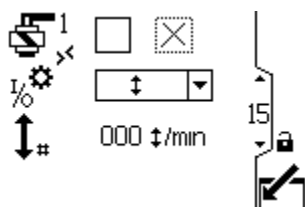






Figure 49 Setup Screen 15

Setup Screen 15 Key	
	Select this box and hold to manually control the fill pump solenoid.
	Select the connected peripheral — Reed Switch, Agitator Halt Drum Cover Switch, Auxiliary Solenoid.
 or 	Displays current reed switch cycle rate. Select this box and hold to manually control the Auxiliary Solenoid.

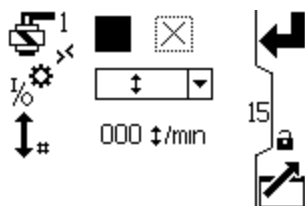


Figure 50 Manual Fill Pump Solenoid Control

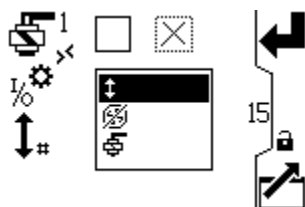


Figure 51 Configurable Input/Output Select

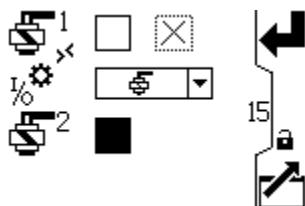


Figure 52 Manual Auxiliary Solenoid control

## Setup Screen 16

This screen is for enabling a modbus communications alarm and disabling the Stop Pump function of the Cancel key.

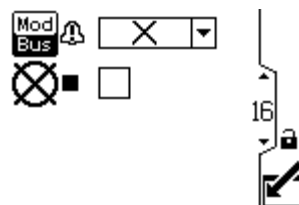




Figure 53 Setup Screen 16

Setup Screen 16 Key	
	Select the desired modbus alarm type (None, Deviation, Alarm).
	Select this box to disable the Stop Pump function of the Reset/Cancel key.

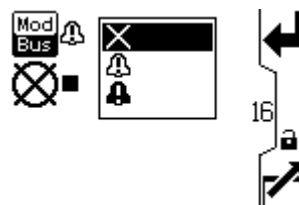


Figure 54 Select Modbus Alarm Type

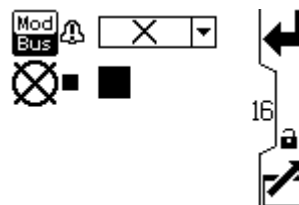


Figure 55 Select to Disable Cancel Button Pump Stop Function

## Setup Screen 17

Use this screen to set the desired units for pressure, totals, and flow.

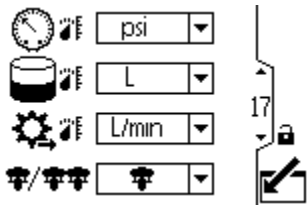


Figure 56 Setup Screen 17

Setup Screen 17 Key	
	Select desired pressure units (psi, bar, or MPa).
	Select desired volume units (liters, gallons, or cc).
	Select desired flow rate units (L/min, gpm, cc/min, oz/min, or cycles/min).
	Select desired system mode selection icon (single or dual). <b>NOTE:</b> "Dual" denotes E-Flo DC 2000, 3000, and 4000 circulation pump systems.
	Exit data editing.
	Move between Setup Screens, fields on a screen, or to increment/decrement the digits when editing number fields.



Figure 57 Select Desired Pressure Units

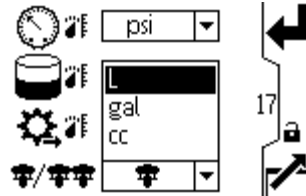


Figure 58 Select Desired Volume Units

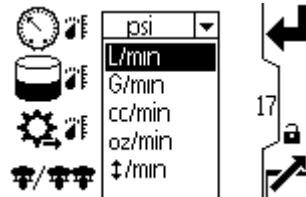


Figure 59 Select Desired Flow Rate Units

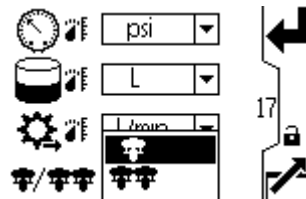


Figure 60 Select Desired System Mode

## Setup Screen 18

Use this screen to set your date format, date, time, or force a restart of the system when updating the software (update token inserted into the display). After the software update is completed successfully, the token must be removed prior to selecting the Acknowledge key or power cycling the display. If an update was concluded and the token is not removed, pressing the Acknowledge key will restart the update process.

**NOTE:** Refer to [Appendix D - Control Module Programming, page 53](#) for instructions on software updating. Software update is disruptive to all pumps connected to the display. All pumps attached to the display must not be pumping material when the software update is initiated.

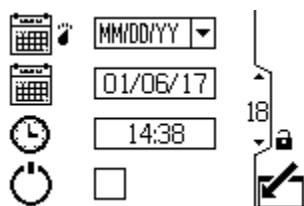


Figure 61 Setup Screen 18

Setup Screen 18 Key	
	Enter the screen to set or change preferences.
	Select your preferred date format from the dropdown menu. MM/DD/YY DD/MM/YY YY/MM/DD
	Set the correct date.
	Set the correct time.
	Restart the system.
	Press to accept the selections.
	Acknowledge software update concluded.
	Exit data editing.

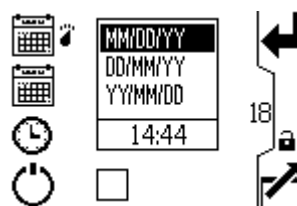


Figure 62 Select the Date Format

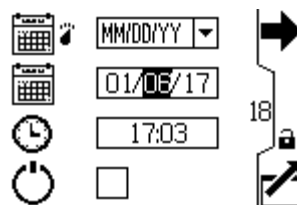


Figure 63 Set the Date



Figure 64 Set the Time



Figure 65 Initiate Software Update (Reset)

## Setup Screen 19

Use this screen to enter a password that will be required to access the Setup screens. This screen also displays the software version.

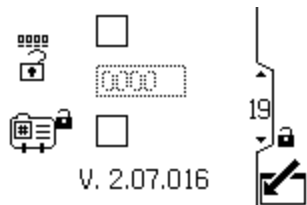


Figure 66 Setup Screen 19

Setup Screen 19 Key	
	Enter the screen to set the password.
<input checked="" type="checkbox"/>	When the top box of the screen is checked, the password is active. To temporarily disable the password, uncheck the box. The password field will be grayed-out.
	Enter the desired 4-digit password.
	Check the box to lock out the profile field in the Run screens.
	Exit data editing.

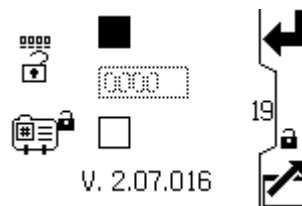


Figure 67 Set the Password

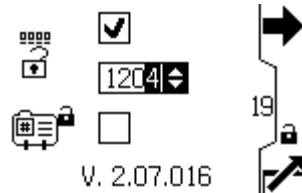


Figure 68 Disable the Password

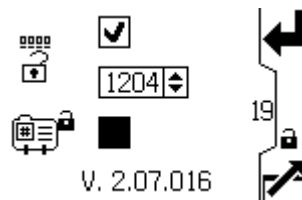





Figure 69 Lock the Profile



# Error Code Troubleshooting

Error codes can take three forms:


- Alarm : alerts you to the alarm cause and shuts down the pump.
- Deviation : alerts you to the problem, but pump may continue to run past the set limits until the system's absolute limits are reached.
- Advisory : information only. Pump will continue to operate.



**NOTE:** On Advanced motors, flow (K codes) and pressure (P codes) can be designated as alarms or deviations. See [Setup Screen 4, page 22](#).

**NOTE:** In the error codes listed below, an “X” means the code is associated with the display only.

**NOTE:** In the error codes listed below, a “\_” in the code is a placeholder for the number of the pump where the event occurred.

**NOTE:** The blink code is displayed using the power indicator on the motor. The blink code given below indicates the sequence. For example, blink code 1–2 indicates 1 blink, then 2 blinks; the sequence then repeats.

**NOTE:** A blink code of 9 is not an error code, but an indicator of which pump is active (  softkey has been pushed, see [Run Screen 1, page 13](#)).

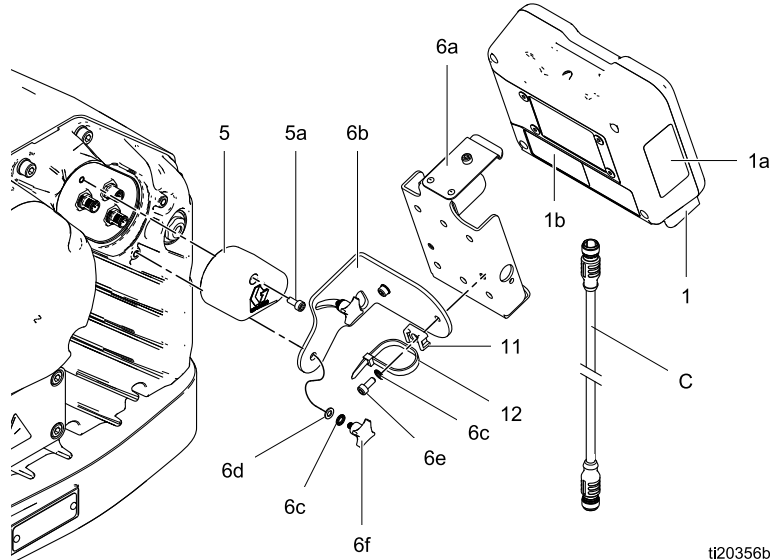
Display Code	Applicable Motor	Blink Code	Alarm or Deviation	Description
None	Basic	6	Alarm	The Mode Select knob is set between Pressure  and Flow  . Set knob to the desired mode.
None	Basic and Advanced	9	None	A blink code of 9 is not an error code, but an indicator of which pump is active.
CAC_	Advanced	None	Alarm	Display detects a loss of CAN communication. Flashing alarm appears on the display, and the blink code occurs.
CAD_	Advanced	2–3	Alarm	Unit detects a loss of CAN communication. This alarm is only logged. No flashing alarm appears on the display, but the blink code does occur.
C3G_	Advanced	None	Deviation	Display detects a loss of modbus communication when modbus deviation is enabled on Setup Screen 16.
C4G_	Advanced	None	Alarm	Display detects a loss of modbus communication when modbus alarm is enabled on Setup Screen 16.
CBN_	Basic and Advanced	2–4	Deviation	Temporary circuit board communication failure.
CCN_	Basic and Advanced	3–6	Alarm	Circuit board communication failure.
END_	Basic and Advanced	5–6	Advisory	A calibration of the encoder and stroke range is in progress.
ENN_	Advanced	None	Advisory	Dual lower system calibration completed successfully.
E5F_	Advanced	None	Advisory	Dual lower system calibration error. System running too rapidly to perform calibration.
E5S_	Advanced	None	Advisory	Dual lower system calibration stopped or interrupted.
E5U_	Advanced	None	Advisory	Dual lower system calibration unsteady. System could not determine optimum setting.
EBCX	Advanced	None	Advisory	Run/Stop switch in Stop position (closed).

Display Code	Applicable Motor	Blink Code	Alarm or Deviation	Description
K1D_	Advanced	1–2	Alarm	Flow is below minimum limit.
K2D_	Advanced	None	Deviation	Flow is below minimum limit.
K3D_	Advanced	None	Deviation	Flow exceeds maximum target; also indicates pump runaway condition exists.
K4D_	Basic and Advanced	1	Alarm	Flow exceeds maximum target; also indicates pump runaway condition exists.
MND_	Advanced	None	Advisory	Maintenance counter is enabled and countdown reached zero (0).
P1D_	Advanced	None	Deviation	Unbalanced load. Dual Lower system — P1D1 = Motor 1 is requiring less force to hold speed; pump lower may need service. P1D2 = Motor 2 is requiring less force than motor 1 to hold speed.
P9D_	Advanced	None	Deviation	Major unbalanced load — see P1D_ (P9D_ is higher magnitude)
P1I_	Advanced	1–3	Alarm	Pressure is below minimum limit.
P2I_	Advanced	None	Deviation	Pressure is below minimum limit.
P3I_	Advanced	None	Deviation	Pressure exceeds maximum target.
P4I_	Advanced	1–4	Alarm	Pressure exceeds maximum target.
P5DX	Advanced	None	Deviation	More than one pump is assigned to a transducer. The assignment for that transducer is automatically cleared under this condition. User must reassign.
P6CA or P6CB	Advanced	None	Deviation	For units without closed loop pressure control: Transducer (A or B) is enabled but not detected.
P6D_	Advanced	1–6	Alarm	For units with closed loop pressure control: Transducer is enabled but not detected.
T2D_	Basic and Advanced	3–5	Alarm	Internal thermistor disconnected or motor temperature is below 0° C (32° F).
T3D_	Basic and Advanced	5	Deviation	Motor over temperature — Motor will throttle itself to stay below 85° C (185° F) internally.
V1I_	Basic and Advanced	2	Alarm	Brown out; voltage supplied to motor is too low.
V1M_	Basic and Advanced	2–6	Alarm	AC power is lost.
V4I_	Basic and Advanced	3	Alarm	Voltage supplied to motor is too high.
V9M_	Basic and Advanced	7	Alarm	Low supply voltage detected at start up.
WCW_	Advanced	None	Alarm	System type mismatch; motor is an E-Flo DC dual lower system and the display configuration does not match. Change the display's system type on the Setup Units screen (screen 15).
WMC_	Basic and Advanced	4–5	Alarm	Internal software error.

Display Code	Applicable Motor	Blink Code	Alarm or Deviation	Description
<b>WNC_</b>	Basic and Advanced	3–4	Alarm	Software versions do not match.
<b>WNN_</b>	Advanced	None	Alarm	System type mismatch; motor is an E-Flo DC single lower system and the display configuration does not match. Change the display's system type on the Setup Units screen (screen 12 in dual lower mode).
<b>WSC_</b>	Advanced	None	Deviation	Profile is set to 0 pressure or 0 flow.
<b>WSD_</b>	Advanced	1–5	Alarm	Invalid lower size; occurs if the unit is operated before setting up the lower size.
<b>WXD_</b>	Basic and Advanced	4	Alarm	An internal circuit board hardware failure is detected.

# Parts

## 24P822 Control Module Kit



ti20356b

Ref	Part	Description	Qty	Ref	Part	Description	Qty
1	24P821	DISPLAY KIT, control module; includes item 1a; see manual 332013 for approvals information about the bare ADCM module	1	6a	---	BRACKET, control module	1
1a▲	16P265	LABEL, warning, English	1	6b	---	BRACKET, mounting	1
1b▲	16P265	LABEL, warning, French	1	6c	---	LOCKWASHER, external tooth; M5	4
1c▲	16P265	LABEL, warning, Spanish (shipped loose)	1	6d	---	WASHER; M5	2
5	24N910	CONNECTOR, jumper; includes item 5a	1	6e	---	SCREW, cap, socket head; M5 x 12 mm	2
5a	---	SCREW, cap, socket head; M5 x 40 mm	1	6f	---	KNOB; M5 x 0.8	2
6	24P823	BRACKET KIT, control module; includes items 6a-6f	1	11	---	HOLDER, tie	1
				12	---	STRAP, tie	1

▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

Items marked --- are not available separately.

Cable (C) is shown for reference but is not included in the kit. Order desired length separately. See [Cable Connection, page 5](#).

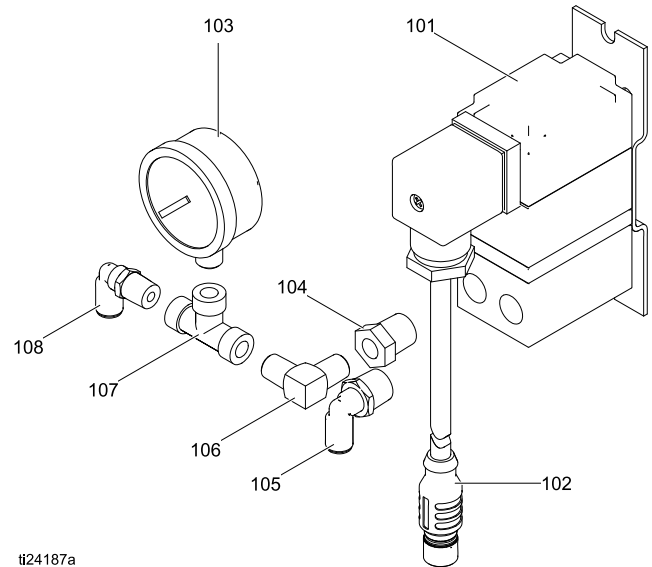
# Accessory Kits

## Run/Stop Switch Kit 16U729

The kit includes the switch and enclosure, a mounting bracket, and cables. Parts are not sold separately.

## Pressure Transducer Kit 24R050 (for 4-Ball pumps) and Kit 24Y245 (for 2-Ball pumps)

Each kit includes the fluid pressure sensor with cable, an adaptor, and an o-ring. Parts are not sold separately.



ti24187a

## BPR Controller Kit 24V001

Ref	Part	Description	Qty
101	---	TRANSDUCER, miniature	1
102	---	CABLE, F/C, I.S., 8 M	1
103	110436	GAUGE, pressure, air	1
104	100030	BUSHING	1
105	198178	ELBOW	1
106	110207	ELBOW	1
107	C19466	TEE	1
108	198171	ELBOW	1

--- Parts not sold separately.

## Appendix A - Modbus Variable Map

To communicate through fiber optics with the E-Flo DC Control Module, reference the appropriate hardware as shown in manual 332356. That manual indicates various options for connecting fiber optic cables from the control module to the non-hazardous area. The following table lists Modbus registers available to a PC or PLC located in the non-hazardous area.

Table 4 shows the registers needed for basic operation, monitoring, and alarm control features. Tables 5 and 6 provide bit definitions as needed for certain registers. Table 7 shows the units and how to convert the register value to a unit value.

Reference the Modbus communication settings selected in [Setup Screen 14, page 28](#).

**Table 4 Modbus Registers**

Modbus Register	Variable	Register Access	Size	Notes/Units
403225	Fill Pump Solenoid Out	Read/Write	16 Bit	0 = Off, 1 = On
403226	Solenoid Out Keep Alive	Read/Write	16 Bit	Write any value to activate.
403227	Reed Switch Count	Read/Write	16 Bit	Cycle count
403228	Tank Level 1 Full Pressure	Read/Write	16 Bit	Pressure units, see Table 7.
403229	Tank Level 2 Full Pressure	Read/Write	16 Bit	Pressure units, see Table 7.
403230	Actual Tank Level 1%	Read/Write	16 Bit	Pressure units, see Table 7.
403231	Actual Tank Level 2%	Read/Write	16 Bit	Pressure units, see Table 7.
403232	Configurable IO Type	Read/Write	16 Bit	0 = Reed switch input, 1 = Drum cover switch input
403233	Agitator Half Status	Read/Write	16 Bit	0 = Drum cover down, 1 = Drum cover up, 2 = Accessory solenoid out
403234	Accessory Solenoid Out	Read/Write	16 Bit	0 = Off, 1 = On
<hr/>				
404100	Pump Status Bits	Read Only	16 Bit	See Table 6 for bit definitions.
404101	Actual Pump Speed	Read Only	16 Bit	Speed units, see Table 7.
404102	Actual Pump Flow Rate	Read Only	16 Bit	Flow units, see Table 7.
404103	Actual Pump Pressure	Read Only	16 Bit	Percent pressure, see Table 7.
404104	Transducer 1 Pressure	Read Only	16 Bit	Pressure units, see Table 7.
404105	Transducer 2 Pressure	Read Only	16 Bit	Pressure units, see Table 7.
404106	Batch Total High Word	Read Only	16 Bit	Volume units, see Table 7.
404107	Batch Total Low Word	Read Only	16 Bit	Volume units, see Table 7.
404108	Grand Total High Word	Read Only	16 Bit	Pump cycles, see Table 7.
404109	Grand Total Low Word	Read Only	16 Bit	Pump cycles, see Table 7.
404110	Maintenance Total High Word	Read Only	16 Bit	Pump cycles, see Table 7.
404111	Maintenance Total Low Word	Read Only	16 Bit	Pump cycles, see Table 7.
404112	Pump Alarms 1 High Word	Read Only	16 Bit	See Table 5 for bit definitions.
404113	Pump Alarms 1 Low Word	Read Only	16 Bit	See Table 5 for bit definitions.
404114	Display Alarms High Word	Read Only	16 Bit	See Table 5 for bit definitions.

Modbus Register	Variable	Register Access	Size	Notes/Units
404115	Display Alarms Low Word	Read Only	16 Bit	See Table 5 for bit definitions.
404116	Pump Alarms 2 High Word	Read Only	16 Bit	See Table 5 for bit definitions.
404117	Pump Alarms 2 Low Word	Read Only	16 Bit	See Table 5 for bit definitions.
404118	System Type	Read Only	16 Bit	0 = Single lower, 1 = Dual lower
404119	Run/Stop Switch State	Read Only	16 Bit	0 = Switch closed (Stop state), 1 = Switch open (Run state)

**Extended Modbus Variables**

The registers shown in this section are intended for advanced integration solutions, where the user desires full control of the system by the PLC. For optimal communication latency, it is recommended that only the registers which will be monitored and changed on a regular basis be mapped and the remaining parameters be configured with the display.

404150	Pressure Minimum	Read Only	16 Bit	Pressure units, see Table 7.
404151	Pressure Target	Read Only	16 Bit	Pressure units, see Table 7.
404152	Pressure Maximum	Read Only	16 Bit	Pressure units, see Table 7.
404153	Flow Minimum	Read Only	16 Bit	Flow units, see Table 7.
404154	Flow Target	Read Only	16 Bit	Flow units, see Table 7.
404155	Flow Maximum	Read Only	16 Bit	Flow units, see Table 7.
404156	Mode	Read Only	16 Bit	0 = pressure, 1 = flow
404157	BPR % Open	Read Only	16 Bit	Value will be 0-100 (Approximately 1-100 psi, see manual 332142 for information on BPR control kit)
404158	Pressure/Force Min Alarm Type	Read Only	16 Bit	0 = limit, 1 = deviation, 2 = alarm
404159	Pressure/Force Max Alarm Type	Read Only	16 Bit	0 = limit, 1 = deviation, 2 = alarm
404160	Flow Min Alarm Type	Read Only	16 Bit	0 = limit, 1 = deviation, 2 = alarm
404161	Flow Max Alarm Type	Read Only	16 Bit	0 = limit, 1 = deviation, 2 = alarm

**Integration Setup Block**

This section contains system-level control variables that may need to be monitored or controlled on occasion (infrequently).

404200	Local/Remote Control	Read / Write	16 Bit	0 = local, 1 = remote/PLC
404201	Active Profile Number	Read / Write	16 Bit	0 = stopped, 1, 2, 3, 4
404202	Pump Control Bitfield	Read / Write	16 Bit	See Table 6 for bit definitions.
404203	Maintenance Interval High Word	Read / Write	16 Bit	Pump cycles, see Table 7.
404204	Maintenance Interval Low Word	Read / Write	16 Bit	Pump cycles, see Table 7.

Appendix A - Modbus Variable Map

Modbus Register	Variable	Register Access	Size	Notes/Units
404205	Transducer 1 type	Read / Write	16 Bit	0 = None, 1 = 500 psi (3.47 mPa, 34.74 bar), 2 = 5000 psi (34.47 mPa, 344.74 bar), 3 = 5 psi (34.5 kPa 0.345 bar) Tank level sensor.
404206	Transducer 2 type	Read / Write	16 Bit	
404207	Closed Loop Enable Transducer 1	Read / Write	16 Bit	0 = Not Enabled, 1 = Enabled (Note: only 1 transducer can be enabled for closed loop control)
404208	Closed Loop Enable Transducer 2	Read / Write	16 Bit	
404209	Reserved	Read / Write	16 Bit	N/A
404210	Pump Lower Type	Read / Write	16 Bit	0 = Invalid/Not configured, 1 = 145cc, 2 = 180cc, 3 = 220cc, 4 = 290cc, 5 = 750cc, 6 = 1000cc, 7 = 1500cc, 8 = 2000cc, 9 = custom size
404211	Pump Lower Size	Read / Write	16 Bit	Actual lower size in cc
404212	Agitator 4-20mA Output	Read / Write	16 Bit	0-100 = 4-20mA
404213	Agitator 4-20mA Output Enable	Read / Write	16 Bit	0 = Disable, 1 = Enable
404214	BPR % Open Stop Profile	Read / Write	16 Bit	Setting for when the stop profile is active to hold fluid line pressure when the pump is stopped. (See 405107 below)
404215	Reserved for E-Flo DCX2			
404216	Reserved for E-Flo DCX2			
<b>Profile Setup</b>				
404250	Password Enable	Read / Write	16 Bit	0 = Disable, 1 = Enable
404251	Profile Lock	Read / Write	16 Bit	0 = Unlocked, 1 = Locked
<b>Profile Setup</b>				
403102	Display seconds	Read Only	16 Bit	Use as heartbeat.
<b>Profile Setup Blocks</b>				
Each profile block is a group of 12 registers. The profile (1-4) is the 4th digit (x) in the register number and corresponds with the actual user profile being defined. For example, register 405x00 will represent 405100, 405200, 405300, and 405400.				
405x00	Pressure/Force Minimum	Read / Write	16 Bit	Pressure units, see table 7.
405x01	Pressure/Force Target	Read / Write	16 Bit	Pressure units, see table 7.
405x02	Pressure/Force Maximum	Read / Write	16 Bit	Pressure units, see table 7.
405x03	Flow Minimum	Read / Write	16 Bit	Flow units, see table 7.



Modbus Register	Variable	Register Access	Size	Notes/Units
405x04	Flow Target	Read / Write	16 Bit	Flow units, see table 7.
405x05	Flow Maximum	Read / Write	16 Bit	Flow units, see table 7.
405x06	Mode Select	Read / Write	16 Bit	0 = pressure, 1 = flow
405x07	BPR % Open	Read / Write	16 Bit	Value will be 0-100 (Approximately 1-100 psi, see manual 332142 for information on BPR control kit)
405x08	Pressure/Force Min Alarm Type	Read / Write	16 Bit	0 = limit, 1 = deviation, 2 = alarm
405x09	Pressure/Force Max Alarm Type	Read / Write	16 Bit	0 = limit, 1 = deviation, 2 = alarm
405x10	Flow Min Alarm Type	Read / Write	16 Bit	0 = limit, 1 = deviation, 2 = alarm
405x11	Flow Max Alarm Type	Read / Write	16 Bit	0 = limit, 1 = deviation, 2 = alarm

NOTE: See [Error Code Troubleshooting, page 33](#), for a description of each alarm.

Table 5 Alarm Bits

404112 - Pump Alarms Word 1			
Bit	Event Type	Event Code	Event Name
0	Deviation	T3D_	Over Temperature
2	Alarm	P6D_	Pressure Transducer Missing
3	Deviation	ERR_	Internal Software Error
4	Advisory	MND_	Maintenance Count
5	Alarm	V1M_	AC Power Loss
6	Alarm	T2D_	Low Temperature
7	Alarm	WNC_	Version Mismatch
8	Alarm	CCN_	IPC Communication
9	Alarm	WMC_	Internal software error
10	Deviation	P5D_	Multiple Pumps Assigned to Transducer
11	Deviation	WSC_	Zero setting on active profile
12	Advisory	END_	Encoder/stroke range calibration in progress
13	Alarm	A4N_	Over Current
14	Alarm	T4D_	Over Temperature
15	Alarm	WCW_	Dual lower system with display in single lower mode
404113 - Pump Alarms Word 2			
Bit	Event Type	Event Code	Event Name
0	Alarm	K1D_	Minimum Speed
1	Deviation	K2D_	Minimum Speed
2	Alarm	K4D_	Maximum Speed
3	Deviation	K3D_	Maximum Speed
4	Alarm	P1I_	Minimum Pressure
5	Deviation	P2I_	Minimum Pressure
6	Alarm	P4I_	Maximum Pressure
7	Deviation	P3I_	Maximum Pressure
8	Alarm	V1I_	Under Voltage
9	Alarm	V4I_	Over Voltage
10	Alarm	V1I_	High Pressure 120V
11	Alarm	CAD_	CAN Communication Pump
13	Alarm	WXD_	Board Hardware
14	Alarm	WSD_	Invalid Lower Size
15	Alarm	CAC_	CAN communications display

404114 - Display Alarms Word 1			
Bit	Event Type	Event Code	Event Name
1	Deviation	P6C_	Pressure Transducer Missing
others	—	—	Reserved
404115 - Display Alarms Word 2			
Bit	Event Type	Event Code	Event Name
0	Deviation	P5D_	Transducer Assignment Conflict
1	Deviation	P1D_	Unbalanced Load
2	Deviation	CAG_	Solenoid Keep Alive Signal Not Detected
3	Deviation	C3GX	Modbus Communications Lost
4	Alarm	C4GX	Modbus Communications Lost
5	Deviation	P9D_	Major Unbalanced load (x2 System)
6	Advisory	EBCX	Run/Stop Switch Closed
7	Advisory	ENN_	X2 Calibration Completed
8	Advisory	E5F_	X2 Calibration Error, too fast
9	Advisory	E5S_	X2 Calibration error, aborted
10	Advisory	E5U_	X2 Calibratoin Error, unsteady
15	Alarm	CAC_	CAN Communication Display
others	—	—	Reserved
404116 - Pump Alarm2 Word 1			
Reserved			
404117 - Pump Alarm2 Word 2			
Bit	Event Type	Event Code	Event Name
0	Advisory	E5F_	Dual lower system calibration error
1	Advisory	ENN_	Dual lower system calibration complete
2	Alarm	WNN_	Single lower system with display in dual lower mode
3	Deviation	P1D_	Unbalanced load
4	Advisory	E5S_	Dual lower system calibration stopped or interrupted
5	Advisory	E5U_	Dual lower system calibration unsteady
6	Alarm	V9M_	Low supply voltage detected at startup
7	Deviation	CAG_	Communication with register 403226 halted
8	Deviation	C3G_	Modbus communication lost
9	Alarm	C4G_	Modbus communication lost
10	Alarm	P9D_	Unbalanced load
others	—	—	Reserved

**Table 6 Pump Status and Control Bits**

<b>404100 - Pump Status Bits</b>	
Bit	Meaning
0	Reads 1 if the pump is trying to move
1	Reads 1 if the pump is actually moving
2	Reads 1 if there are any active alarms
3	Reads 1 if there are any active deviations
4	Reads 1 if there are any active advisories
5	Setup changed
6	Reserved
7	Run/Stop switch closed
8	Profile 1 changed
9	Profile 2 changed
10	Profile 3 changed
11	Profile 4 changed
others	Reserved for future use
<b>404202 - Pump Control Bits</b>	
Bit	Meaning
0	Reads 0 for an active alarm or deviation. Reset to 1 to clear.
1	Set to 1 to reset the batch total
2	Set to 1 to reset the maintenance counter
others	Reserved for future use - only write 0

Table 7 Units

Unit Type	Selectable Units	Units Register	Converting registers to unit values	Register value for 1 unit
Pressure	Percent	n/a	Pressure = Register	1 = 1% Pressure
Pressure	psi	403208 = 0	Pressure = Register	1 = 1 psi
	Bar	403208 = 1	Pressure = Register/10	10 = 1.0 Bar
	MPa	403208 = 2	Pressure = Register/100	100 = 1.00 Mpa
Speed	Cycles/min	n/a	Speed = Register/10	10 = 1.0 cycle/min
Flow	Liters/min	403210 = 0	Flow = Register/10	10 = 1.0 L/min
	Gallons/min	403210 = 1	Flow = Register/10	10 = 1.0 Gal/min
	cc/min	403210 = 2	Flow = Register	1 = 1 cc/min
	oz/min	403210 = 3	Flow = Register	1 = 1 oz/min
	Cycles/min	403210 = 4	Flow = Register/10	10 = 1.0 cycle/min
Volumet	Liters	403209 = 0	Volume = 1000*High + Low/10	0 (High) / 10 (Low) = 1.0 L
	Gallons	403209 = 1	Volume = 1000*High + Low/10	0 (High) / 10 (Low) = 1.0 Gal
Cyclest†	Pump Cycles	n/a	Cycles = 10000*High + Low	0 (High) / 1 (Low) = 1 cycle

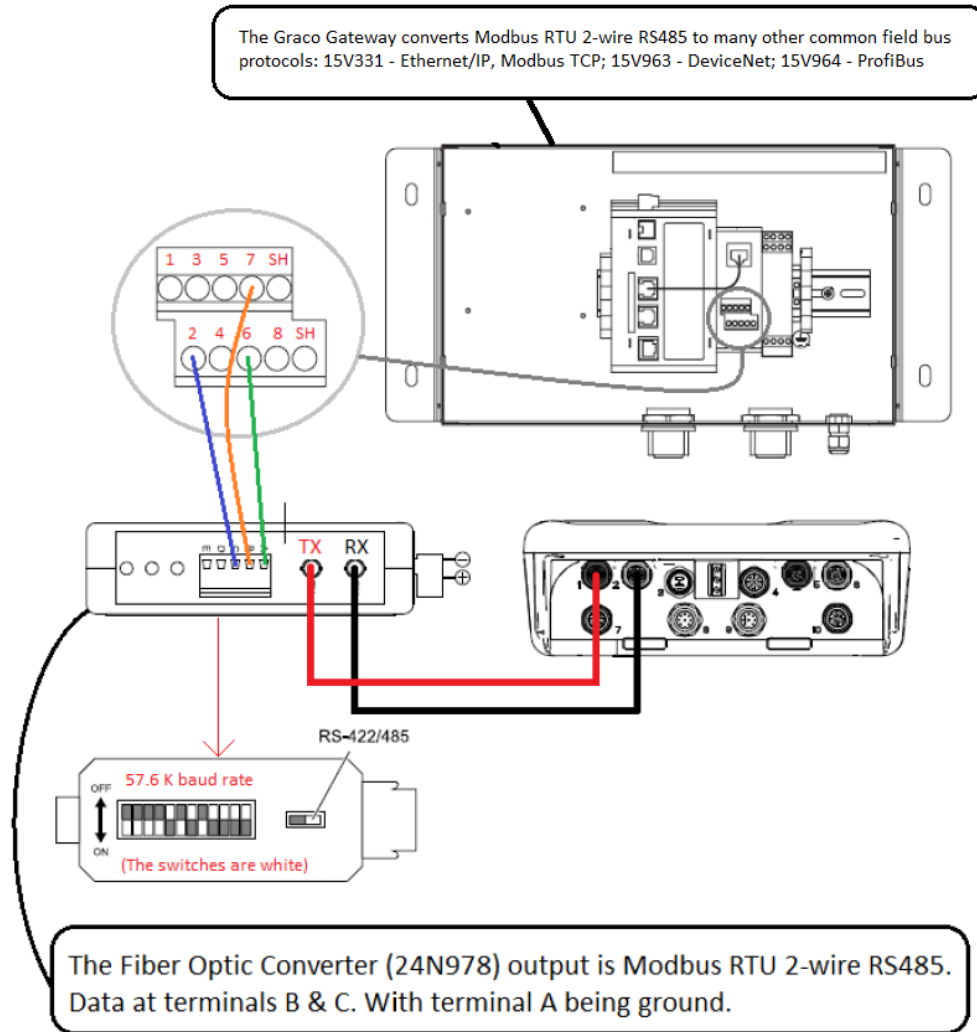
† Example of converting volume register reading to units: If the reading for register 404106 (volume high word) is 12, and the reading for register 404107 (volume low word) is 34, the volume is 12003.4 liters.  $12 * 1000 + 34/10 = 12003.4$ .

†† Example of converting cycles register reading to units: If the reading for register 404108 (cycles high word) is 75, and the reading for register 404109 (cycles low word) is 8000, the volume is 758,000 cycles.  $75 * 10000 + 8000 = 758000$ .

# Appendix B - Pump Control from a PLC

This guide shows how to use the information in Appendix A to control a pump remotely from a PLC. The steps progress from basic pump control to more advanced monitoring and alarm control features.

**E Flo DC to Graco Gateway Connection Diagram**



It is important that you first follow all directions in the Setup Screens to configure your system properly. Test that the pump operates correctly when controlled from the Display. Make sure the display, fiber optics, communication gateway, and PLC are connected properly. Refer to Communication Kit manual. Use Setup Screen 12 to enable remote control and set your modbus preferences.

1. **Enable PLC control:** Set register 404200 to 1.

2. **Run a pump:** Set register 404201. Enter 0 for stopped, 1 to 4 for the desired profile.

3. **View pump profile:** Read register 404201. This register updates automatically to reflect the actual pump status. If the profile is changed from the display, this register changes as well. If the pump stops due to an alarm, this register will read 0.

4. **View pump status:** Read register 404100 to see the status of the pump. See Appendix A, Table 6, for a description of each bit.
  - Example 1: Register 404100, bit 1, reads 1 if the pump is currently moving.
  - Example 2: Register 404100, bit 2 reads 1 if the pump has an active alarm.
5. **Monitor alarms and deviations:** Read register 404112 to 404115. Each bit in these registers corresponds to an alarm or deviation. See Appendix A, Table 5. I
  - Example 1: Pressure falls below the minimum setting entered on Setup Screen 2. It will show on bit 4 of register 404113 if minimum pressure is set to Alarm, and on bit 5 of register 404113 if minimum pressure is set to Deviation.
  - Example 2: The system is set up for a pressure transducer on Setup Screen 8, but no transducer is detected. It will show on bit 1 of register 404114.
6. **Monitor pump cycle rate, flow rate, and pressure:** Read registers 404101 to 404105. Note that pressure is available only if a pressure transducer is connected to the display. Register 404104 shows the pressure on transducer 1. Register 404105 shows the pressure on transducer 2. See Appendix A, Table 7 for units for these registers.
  - Example 1: If register 404101 reads 75, the pump speed is 7.5 cycles/minute.
  - Example 2: If register 404103 reads 67, the pump is operating at 67 percent pressure.
7. **Reset active alarms and deviations:** Clear the condition that caused the alarm. Set register 404202, bit 0, to 1 to clear the alarm. The pump will be in profile 0 due to the alarm. Set 404201 to the desired profile to run the pump again.

## Application Note 1 - Flow mode vs Pressure Mode

In the majority of applications it is desirable to always run in flow mode and allow the back pressure regulator to control the line pressure. This ensures that the material velocity is always at the target for particulate suspension.

- To determine whether or not the pump can be run exclusively in flow mode, test with the maximum flow demand, open up all robot drops and spray guns, etc. Then check the pump outlet pressure to see if the BPR can maintain it. If so, then pressure mode is not needed.
- If the BPR cannot hold the fluid pressure during peak material demand times, then it will be

necessary to run pressure mode during production. In this mode the pump will speed up to match demand and hold the target pressure. It will also slow down automatically to maintain pressure when the demand drops.

Use of this mode likely means switching back and forth between pressure mode and flow mode; pressure mode during production and flow mode in off production. See the following application note for considerations in this scenario.

## Application Note 2 - Pump Setpoint transitions

For applications where the flow rate and pressure settings are being changed periodically, such as during off production times, it is important to consider the following:

- When the pump is in pressure mode, it will come to a complete stop at any time if the back pressure in the line is equal to or above the pressure setpoint of the pump.
- Viscosity changes throughout time can increase the back pressure in the line, such that when it is time to switch from flow mode (off production) to pressure mode, the pump will not move, because a new, higher, pressure set point is needed to overcome the increased back pressure.
- We recommend reading the active pressure or force before switching to pressure mode and using that for the new pressure setpoint - Read from register 404103 if the motor is operating without a pressure sensor (ie. Force/% mode).
- Read from register 404104 if the motor is controlling from pressure sensor 1 or register 404105 for pressure sensor 2 - For applications with a pneumatic BPR, the profile BPR setpoint can be used to manage the system through the Graco BPR controller kit (24V001).

- In off production flow mode, register 405107 (405X07 for profile X) can be set to 0 (%) to fully open the BPR. This allows the target flow rate to flow with reduced pressure, and therefore lower energy consumption. For example:

Using profile 1, while in off production the pump is set in flow mode (register 405106 = 1) with a flow rate target setting of 8 gallons/minute (30 liters/minute) (register 405104 = 80) and the profile maximum pressure setting was left at the system default. Before switching to pressure mode, save the value of the current pressure from register 404104 (The motor is controlling to the feedback provided by pressure sensor 1) and use that value as the new setting for the pressure target in register 405101. Then set the mode register (405106) to 0 (pressure mode)

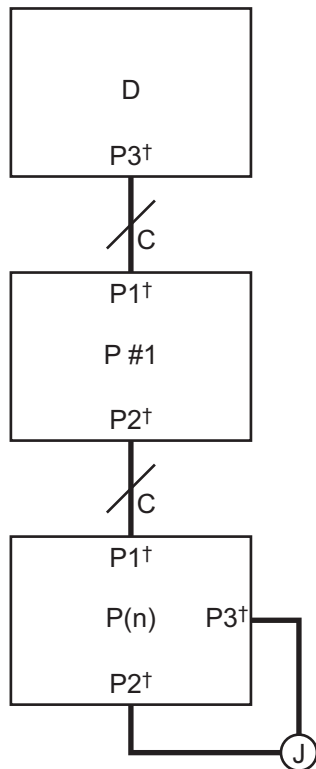
Note: Using only profile 1 (4 are available) allows you to control the pump with fewer registers mapped. However, if it is desired to configure multiple profiles then the above scenario can be applied where 405X01 is the pressure target for profile X, 405X04 is the flow rate target for profile X and so on for the other profile variables.



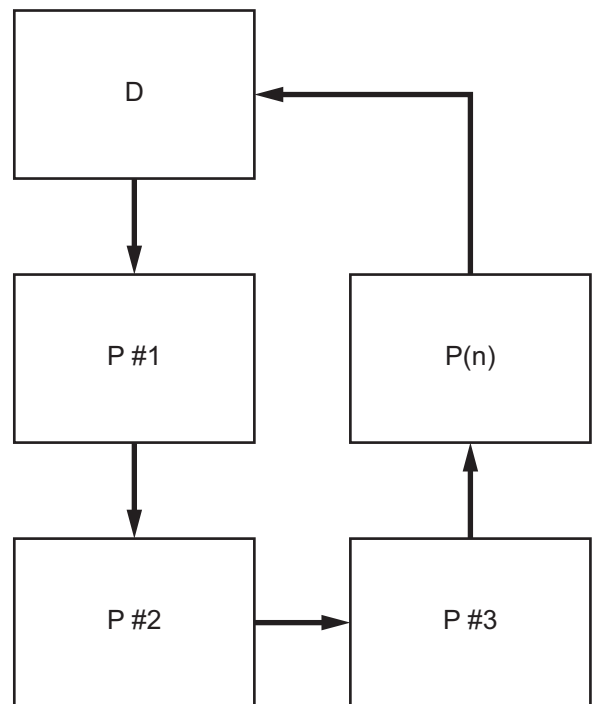
## Appendix C - System Configurations

These configuration diagrams show basic communication interconnections. For creating a system that will use pressure transducers, BPR controls, or shutoff switches, consult with your Graco distributor.

Connections for Local Control  
Single display and 1 or more pumps in a chain



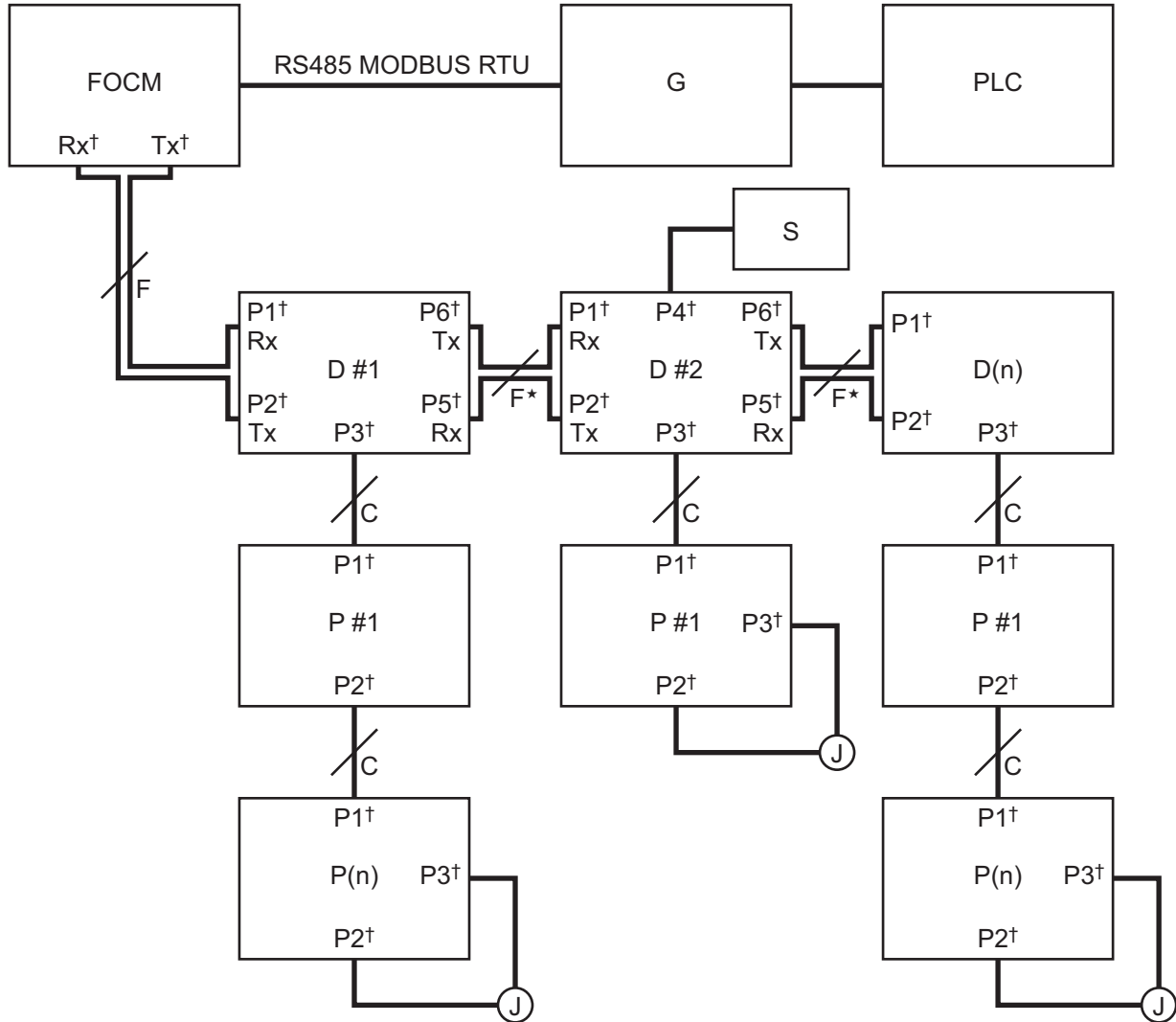
Communication Equivalent



D: Display  
 C: CAN cable  
 P #: Pump number  
 P(n): Last pump; maximum allowed in one chain = 8  
 J: Jumper  
 † Cable plug on device; see  
[Cable Connection, page 5](#)

**NOTE:** Physical connection loss between any 2 devices will shut down all devices in the entire chain. If the pump with the jumper installed is powered down, all pumps will stop working.

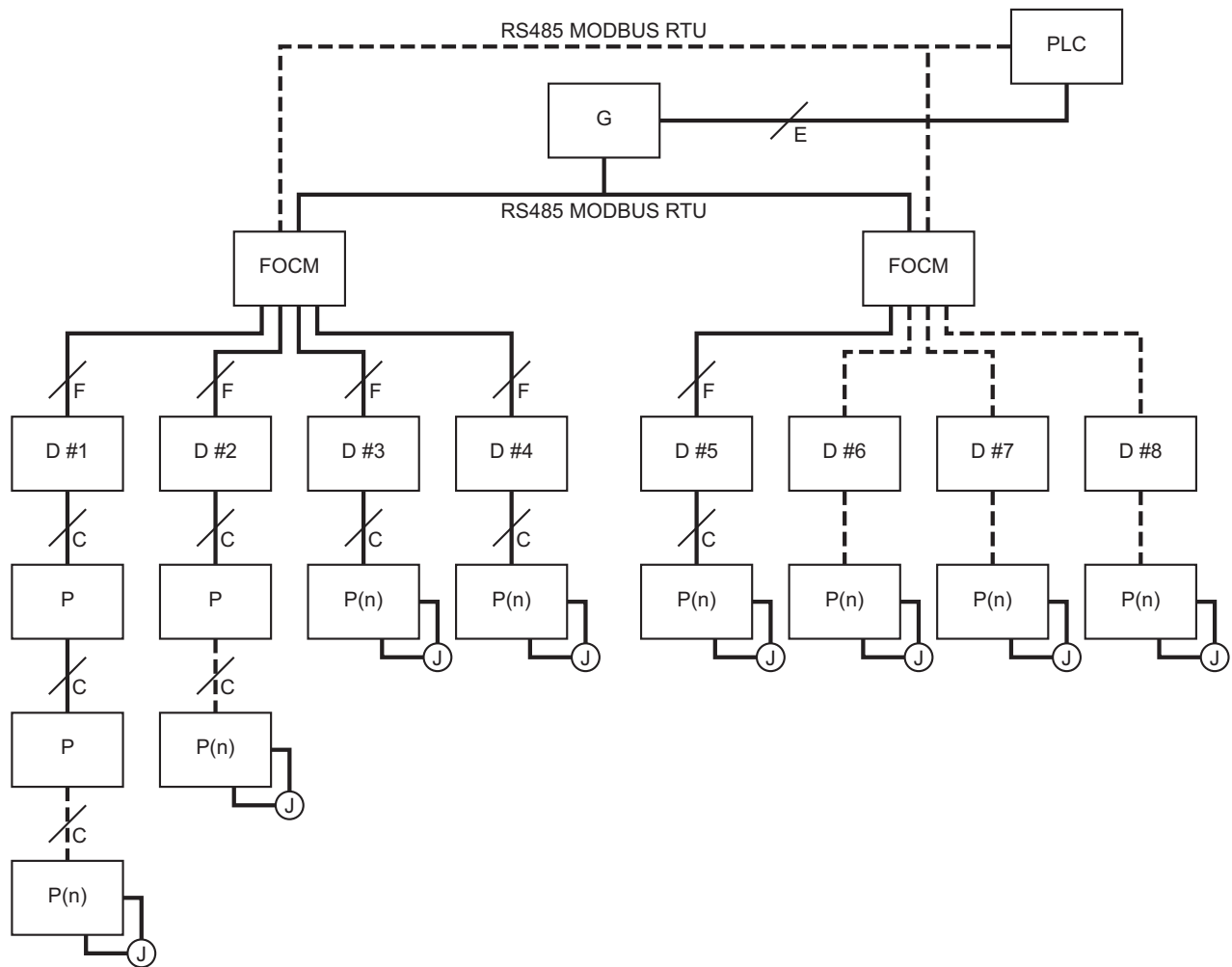
Connections for Remote Control



FOCM: Fiber Optic Converter Module (24R086)  
 G: Graco Gateway  
 D #: Display number  
 D(n): Last display  
 P #: Pump number  
 P(n): Last pump; maximum allowed in a chain = 8  
 J: Jumper  
 S: Run/Stop switch  
 F: Fiber optic cable  
 C: CAN cable  
 † Cable plug on device; see  
[Cable Connection, page 5](#)

\* Loss of remote communication between any 2 displays will cause all pumps attached to displays after the break to cease remote control. The pumps after the break can still be controlled locally by the display to which they are connected.  
**NOTE:** If a Run/Stop switch is used with a display, activating the switch will stop all pumps attached to that display.

Large Configuration



FOCM: Fiber Optic Converter Module (24R086)  
 G: Graco Gateway  
 D #: Display number  
 D(n): Last display  
 P #: Pump number  
 P(n): Last pump; maximum allowed in a chain = 8  
 J: Jumper  
 S: Run/Stop switch  
 F: Fiber optic cable  
 C: CAN cable  
 E: Ethernet or other field bus cable



**NOTE:** This configuration reduces the number of pumps that will be taken out of service if the communication lines for a single display are damaged.

## Configuration Parts

Configurations require purchase of separate interconnection items. Choose the appropriate cable lengths for your configuration.

Identifier	Part Number	Description
FOCM	24R086	Fiber Optic Converter Module; contains one fiber optic connection module; configuring the FOCM for additional displays will require purchase of up to 3 additional fiber optic connection modules (M) within one FOCM.
M	24N978	Module, Fiber Optic Connection
F		Cable, Fiber Optic pair; when used, 1 required for interconnection between each device
	16M172	50 ft (15 m)
	16M173	100 ft (30 m)
	17B160	330 ft (100 m)
G	15V331	Gateway
D	24P822	Control Module Kit with ADCM 24L097; includes 1 jumper

# Appendix D - Control Module Programming

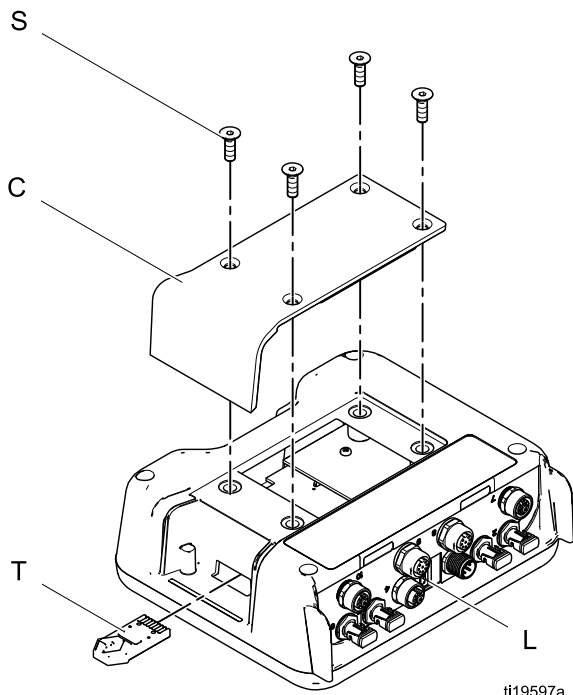
				
<p>To help prevent fire and explosion, do not connect, download, or remove the token unless the unit is removed from the hazardous (explosive atmosphere) location.</p>				

- All data in the module may be reset to factory default settings. Record all settings and user preferences before the upgrade, for ease of restoring them following the upgrade.
- The latest software version for each system can be found at [www.graco.com](http://www.graco.com).

## Software Upgrade Instructions

**NOTE:** If the software on the token is the same version that is already programmed on the module, nothing will happen (including flashing red light). No harm can be done by attempting to program the module multiple times.

1. Remove power from the Graco Control Module by turning off system power.  
**NOTE:** Alternately, software update can be done without removing power by using the system reset button on Setup Screen 16 (date and time) to initiate the update after token insertion.
2. Remove access cover (C).



ii19597a

3. Insert and press the token (T) firmly into the slot.  
**NOTE:** Token has no preferred orientation.
4. Supply electrical power to the Graco Control Module.
5. The red indicator light (L) will flash while the software is being loaded on the display. When the software is completely loaded, the red light will turn off.

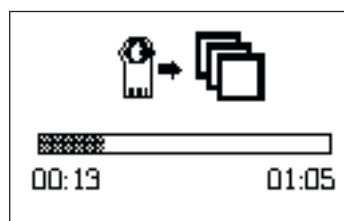
<b>NOTICE</b>
<p>To prevent corrupting the software, do not remove the token, turn off the system power, or disconnect any modules until the status screen indicates that updates are complete.</p>

6. The following screen will be shown when the display turns on.



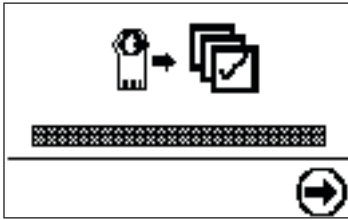
*Communications with motors established.*

7. Wait for update to complete.  
**NOTE:** The approximate time until completion is shown along bottom of progress bar.



Appendix D - Control Module Programming

8. Updates are complete. Icon indicates update success or failure. Unless the update was unsuccessful, remove the token (T) from the slot.



Icon	Description
	Update successful
	Update unsuccessful
	Update complete; no change necessary

9. Press to continue. If the token is still inserted, the remote loading procedure will begin anew. Return to step 5 for step progression if the update restarts.
10. Remove power from the Graco Control Module by turning off system power.
11. If the token is still inserted, remove from the slot.
12. Reinstall the access cover and secure with screws (S).



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