Servo Pump Controller User Guide

Version 3.1
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for use with:

Control Software version 1.14.04
on
Servo Pump Controller - Full Control model, PN 22991005

prepared by GPD Global® Documentation Department

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Contents

Release notes

What's new in version 3.1

Improvements

The descriptions listed in Table 2 (pg 40) for pins 10 and 11have been updated to clarify their function.

Safety notices

⚠ *WARNING:* Appropriate use

This equipment must be used in the manner indicated in these instructions. Use for any other purpose may cause damage to the equipment, injury, or death.

⚠ *WARNING:* ELECTRIC SHOCK

Equipment is electrical in nature and shock may occur if used improperly or opened while powered. Shock, injury, and death may occur. Unplug system before any maintenance or plugging or unplugging components.

Remove the electrical power cable from the AC outlet before the controller cover is opened. Only qualified personnel should remove the cover; there are no user-serviceable parts inside.

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⚠ *CAUTION:* Warranty

Any of the following that are done without the explicit and written approval of the manufacturer:

- conversions or additions,

- the use of non-original spare parts,

- repairs carried out by companies or persons that have not been authorized by the manufacturer

can lead to the warranty being rendered null and void. The manufacturer shall have no liability whatsoever for damage resulting from failure to follow the operation and maintenance instructions.

⚠ *CAUTION:* Qualifications of operating and maintenance personnel

The owner bears the responsibility for ensuring that operating and maintenance personnel have the required qualifications. The operation and maintenance instructions must be read and understood. Comply with the relevant applicable technical and safety regulations.

⚠ *CAUTION:* Organizational measures

The owner is to provide any personal protective equipment that is required. All the safety devices are to be checked regularly. Wear protective glasses and a protective suit for operation and cleaning to protect against any chemicals that may be sprayed out.

⚠ *CAUTION:* System provides outputs for heaters

Heaters must be protected from causing over heat. Integration in the final system must include a thermal snap switch or other fail safe over heat device. Heated devices must be guarded and labeled, Fire, burns, scalds, and other thermal injuries are possible. Unplug the system before servicing, and allow at least 30 minutes to cool down to room temperature before touching any heaters or similar device.

CAUTION: Exhaust considerations

No releases are generated during normal operations. End users should determine whether or not exhaust is required. Failure to provide exhaust may result in exposure to chemicals, resulting in illness injury and potentially death. When using hazardous materials, always provide enclosure with exhaust embedded and certified for use.

CAUTION: Flammable and volatile compounds

End users may select adhesives and compounds which are flammable and contain volatile organic compounds. End users must provide appropriate exhaust prevention of fire and other hazards in the final integration. Failure to provide such protection may result in fire resulting in damage to equipment the building in nearby environment, burns injuries and possibly death. End users must provide protection for fire risk generated by the chemicals of the use.

Warranty

General Warranty. Subject to the remedy limitation and procedures set forth in the Section "Warranty Procedures and Remedy Limitations," GPD Global warrants that the system will conform to the written description and specifications furnished to Buyer in GPD Global's proposal and specified in the Buyer's purchase order, and that it will be free from defects in materials and workmanship for a period of one (1) year. GPD Global will repair, or, at its option, replace any part which proves defective in the sole judgment of GPD Global within one (1) year of date of shipment/invoice. Separate manufacturers' warranties may apply to components or subassemblies purchased from others and incorporated into the system. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES,EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Limitations. GPD Global reserves the right to refuse warranty replacement, where, in the sole opinion of GPD Global the defect is due to the use of incompatible materials or other damages from the result of improper use or neglect.

This warranty does not apply if the GPD Global product has been damaged by accident, abuse, or has been modified without the written permission of GPD Global.

Items considered replaceable or rendered unusable under normal wear and tear are not covered under the terms of this warranty. Such items include fuses, lights, filters, belts, etc.

Warranty Procedures and Remedy Limitations. The sole and exclusive remedy of the buyer in the event that the system or any components of the system do not conform to the express warranties stated in the Section "Warranties" shall be the replacement of the component or part. If on-site labor of GPD Global personnel is required to replace the non-warranted defective component, GPD Global reserves the right to invoice the Buyer for component cost, personnel compensation, travel expenses and all subsistence costs. GPD Global's liability for a software error will be limited to the cost of correcting the software error and the replacement of any system components damaged as a result of the software error. In no event and under no circumstances shall GPD Global be liable for any incidental or consequential damages; its liability is limited to the cost of the defective part or parts, regardless of the legal theory of any such claim. As to any part claimed to be defective within one (1) year of date of shipment/invoice, Buyer will order a replacement part which will be invoiced in ordinary fashion. If the replaced part is returned to GPD Global by Buyer and found by GPD Global in its sole judgment to be defective, GPD Global will issue to Buyer a credit in the amount of the price of the replacement part. GPD Global's acceptance of any parts so shipped to it shall not be deemed an admission that such parts are defective.

Specifications, descriptions, and all information contained in this manual are subject to change and/or correction without notice.

Although reasonable care has been exercised in the preparation of this manual to make it complete and accurate, this manual does not purport to cover all conceivable problems or applications pertaining to this machine.

About this manual

This document provides an overview of the Servo Pump Controller plus setup and operating instructions, and details about communicating with the controller and programming it.

System overview

The Servo Pump Controller controls reservoir fluid pressure for automatically produced, consistent dispense results for any GPD Global fluid dispensing pump equipped with a servo motor.

This advanced table top controller automatically manages a timed fluid pressure cycle for a wide range of material viscosities by applying a specified amount of air pressure to a reservoir for a specified period of time. It also provides operating control over auxiliary functions such as reservoir heat.

Function

The Servo Pump Controller controls all motor aspects of a GPD Global pump for dot dispense and continuous dispense. Control is exerted through either the front panel, a foot pedal, or an external controller. The controller maintains a single recipe while under power. Some remote programming and control functions are available. Temperature control of a heated pump body and a heated reservoir are also available.

Applications

With the Servo Pump Controller controlling a GPD Global fluid dispense pump, the pump can process any application for which that pump is compatible.

Features

The Servo Pump Controller provides:

• control for operating GPD Global servo-controlled fluid-dispensing pumps.
• on/off control of a regulated input pressure to the fluid reservoir.
• internal air pressure **control** to pressure the supply **reservoir**. The minimum/maximum settings do not control air pressure, but they do create a flag on the main if air pressure is above/below setting values. Values are available for capture.
• dot dispensing and continuous dispensing mode options for GPD Global servo controlled pumps - for example: Precision Auger Pump, Volumetric (PCD Series) Pumps.
• control activated via the front panel, a foot pedal, or an external/remote controller.
• storage for 30 recipes which persist through a power cycle. Some remote programming and control functions are available.
• optional temperature control of a heated pump body and a heated reservoir.

Theory of operation

General theory of operation

The Servo Pump Controller may be connected to a robot or other control signal to start/stop the connected pump. Alternatively, use the start/stop button on the Servo Pump Controller.

The Servo Pump Controller is simple to set up and use:

1. Position the Servo Pump Controller on a level surface.

2. Mount your reservoir in the provided mount.

3. Power on the Servo Pump Controller and set it to online state.

4. Adjust controller recipe parameters as needed.

5. Start/Stop the pump with preferred activation method.

Online vs offline theory

The Online/Offline button on the front of the controller toggles the controller between online and offline states.

Numerous process settings can be edited regardless of Online/Offline status.

Offline

Offline status is the non-operational/power up condition. The pump motor is not energized and output pressure is disabled.

This is the safe/preferred state for any equipment change while the controller remains powered on.

Online

When the controller is online, the pump is ready to be run by any of the activation methods.

Specifications

Dimensions (W x D x H) . . . . . 247.65 mm x 279.4 mm x 101.6 mm (9.75" x 11" x 4")
Weight . . . . 4.27 kg (9.42 lb)

Power supply voltage . . . . input: 120/240 V, 50/60 Hz, Single Phase
Consumption rating . . . . 150 VA / 2.0 A

User interface . . . . Touch Screen with Servo Pump Controller software
Communication cables . . . . . . controller to pump (standard): 2 meter, high flex. Other lengths available.
External trigger signal . . . . +5 to 24 V-Dry Contact

Air pressure:
     Input . . . . 0-6.9 bar (0-100 psi)
     Output . . . . 0-4.1 bar (0-60 psi)
Air tube diameter:
     Input port . . . . 6 mm
     Output port . . . . 6 mm

Heater . . . . drives two 24VDC 23W heaters
External input . . . . PLC, robotic controller, foot switch
Operating temperatures . . . . . +10° C to +40° C (50° F to 104° F)
Pump compatibility . . . . Precision Auger Pump, PCD H Series Pumps

System requirements

Hardware and software needed to control/run the Servo Pump Controller:

Standard (included with controller):

Control Software (PN 2050-0077) - factory installed software; controls the controller.

Optional or provided by customer:
– Computer or controller - for external data acquisition/streaming.
– Robot with 24V output - for control by an external robot via digital signals.
– PLC or controller - for control by external inputs/outputs.
– Heater(s) - for heated reservoir and heated pump body.

Installation

Inspect equipment

Inspect the equipment and note any damage or defects.

⚠️ *CAUTION*: The system should not be used if damaged or defective.

Package contents

Your order includes these items:

Item	Part Number	Notes
Servo Pump Controller	22991005	
Power Cable	10/1400	
Hose	10/4622	Air In & Air Out
Reservoir Air Caps	10/3083 10/1514 10/1515 10/1542	3 cc 5 cc 10 cc 30 cc
Reservoir Air Cap Inserts	2675-0180	
User Guide	22940001	

Accessories

Your order may include these optional items:

• Foot Pedal
• Power Extension Cord*
• Reservoir Heater

* Various lengths are available

For part numbers, quotes, and further details, contact GPD Global.

Installation procedures

Physical installation

The Servo Pump Controller is designed for bench top use. It can be stacked vertically with other control boxes from GPD Global.

Controller touchscreen

To change the viewing angle of the controller touch screen, adjust the bail that flips up/down (on bottom of the controller).

Controller foot pedal

A foot pedal can be used in place of the controller Run button.

To install a foot pedal to work with the controller:

1. Locate the Foot Pedal connection on the controller rear panel (refer to Connection locations (pg 6)).

2. Plug the foot pedal into the Foot Pedal connection.

Reservoir mount and interface

To assemble your reservoir (syringe) with a GPD Global pump:

1. Identify a compatible pump [refer to referring to Specifications (pg 2)] for the controller and your process.

2. Screw a reservoir (syringe) and an appropriate needle/nozzle onto the compatible pump.

3. If the pump is to be mounted rather than hand held, mount it per *How to Use Taper-Lock Mount instructions* (PN 22200611).
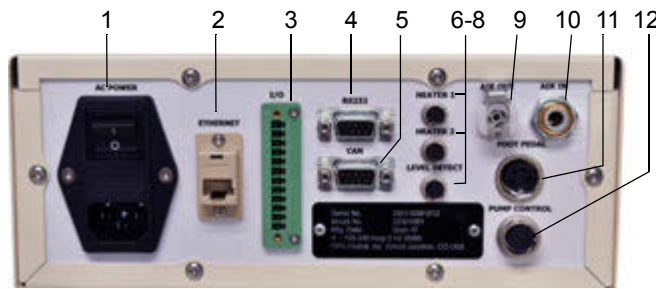
Interconnections

NOTE: Use Connection locations (pg 6) to identify the ports on the rear panel of the controller.

To connect the controller to air, power, and pump:

1. Connect air source to the Air In port. Refer to Specifications (pg 2).

2. Connect air hose to the Air Out port and to the reservoir cap.

3. Plug the power cable into the AC power outlet and an appropriate power receptacle. Refer to Specifications (pg 2).

4. Connect the pump to the controller by plugging the pump control cable into the Pump Control port.

Connection locations

Figure 1: Controller rear panel

1	AC Power	Turns on/off device power. Also acts as fuse holder and power cord connector.
2	Ethernet	Network connector for external data acquisition/streaming. Connect to external computer or controller. (RJ45)
3	I/O	Connector for external inputs/outputs. Connect to external PLC or controller.
4	RS232	Serial communication connector. Connect to external computer or controller. (D-sub 9)
5	CAN	Monitors pump motor. Connect to a computer. Sub (D-sub 9)
6	Heater 1	Controls external heater 1. (5 Pin)
7	Heater 2	Controls external heater 2. (5 Pin)
8	Level Detect	Not currently available.
9	Air Out	Controls air pressure during dispense. Air to reservoir toggles on/off.
10	Air In	Connector for external air source that is regulated to meet air input [Specifications](pg 2) (pg 2).
11	Foot Pedal	Foot pedal / pump on. (4 pin)
12	Pump Control	Pump connection. (20 pin)

Also refer to rear panel details in [Connector pin outs](pg 40) (pg 40).

Setup

Configuration

To configure the controller:

1. As needed, connect an external PLC, controller, or robot to the I/O port.

    An external robot can control the Servo Pump Controller via digital I/O, RS232, and/or TCP Modbus. This enables the robot to have control over the controller and determine which recipe is selected. For details, refer to <u>External robot control</u> (pg 37).

2. As needed, connect optional devices. Refer to <u>Customization</u> (pg 7).

    ⚠ *CAUTION:* Do not connect all optional items available into the controller at the same time or damage will occur and void the warranty.

3. Set initial air pressure setting per <u>Optimization</u> (pg 7).

4. Set values for Standby state and Hold state per <u>Reservoir parameters</u> (pg 18).

    For help identifying state icons, refer to <u>Panes - dispense parameter areas</u> (pg 10) and <u>Windows and fields</u> (pg 30).

Customization

As needed, any and/or all of the following optional devices may be connected to the controller; however, do not connect all available options to the controller at the same time.

⚠ *CAUTION:* Do not connect all optional items available into the controller at the same time or damage will occur and void the warranty. Contact GPD Global for approved combinations.

Item	Description
Ethernet	Connect an external computer or controller Ethernet cable to the Ethernet port.
Heater(s)	Connect an external heater(s) to the Heater 1 and/or Heater 2 port(s).

Optimization

RECOMMENDATION: Start with an initial air pressure setting of 5.51 bar (80 psi) and, as needed, adjust for optimal operations for your process.

Startup

1. With the power switch turned off, verify that a pump is plugged into the controller.

2. Turn on the power switch located on the rear panel.

3. Verify input air pressure supply meets <u>Specifications</u> (pg 2) and is connected to controller.

4. Verify output air pressure is connected to fluid reservoir.

Initial testing

To prepare the controller for operations:

1. Select a recipe per [Select recipe](#) (pg 17).

2. Select a dispense mode per [Select dispense mode](#) (pg 17).

3. Set the controller to online. Refer to [Set online/offline state](#) (pg 16) and [Common indicators](#) (pg 11).

4. **Function testing** - perform these tests to verify proper function:
   a. Set a positive Run set point pressure per [Set parameters and settings](#) (pg 18) and then run the controller by pressing and holding the Run button on the front panel.

      Air should be flowing out from the output air pressure line, causing material to be fed into the pump and, ultimately, dispensed (via pump motor).

   b. Release the Run button.

      Material should cease dispensing, air output should stop, and the pump should cease running.

Application testing

Perform application testing to determine specific fluid feed pressure ideal for the material to be dispensed. Application testing is similar to initial testing except you'll use a reservoir of material and adjust parameters, as needed, to suit the material.

NOTE: Use a material-filled reservoir for this procedure.

1. Install a material-filled reservoir.

2. Perform the [Initial testing](#) (pg 8) procedure, noting how material responds and then adjusting parameters accordingly.

Table 1: *Guidelines for application testing*

Fixed Element	Process	Reference
Time	To obtain a dispense in *n* seconds, adjust pressure until desired dispense results occur in the desired amount of time.	[Set parameters and settings](#) (pg 18)
Pressure	To obtain a dispense at *n* pressure, adjust time until desired dispense results occur at the desired pressure.	

Power down procedure

To turn off the controller, turn off the power switch located on the rear panel.

User Interface

Description of controls

*Figure 2: Controller front panel and sample touch screen window*

Item	Name	Description
1	Touch Screen	User interface.
2	Run button	Operator pushes button (or foot pedal) to run the controller, and releases button (or foot pedal) to stop the controller. OR Run function is activated and deactivated by external/remote controller.
3	Online/Offline button	• Toggles the controller between online and offline states. • The controller must be in the Online state before any activation method (Run button, foot pedal, external/remote controller) will function.
4		On/Off (Enable/Disable) toggle switch used in some touch screen windows. To use these enable/disable controls, press and release the icon to change its state. On Off

Description of windows

Windows

Refer to Windows and fields (pg 30) for an example of each window and its field descriptions.

A unique icon in the center top of each window identifies the window displayed. An identifying icon is located on all windows *except* the Main window.
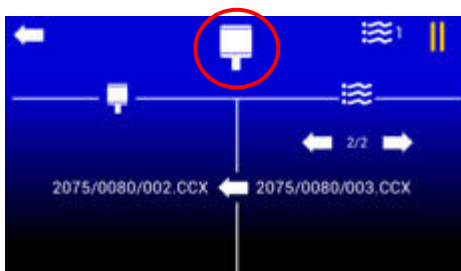
Panes - dispense parameter areas

The general process flow of a dispense is reflected in the layout of all dispense type windows.

Figure 3: The Dot Dispense Parameters window is an example of a dispense type window.

Item	Name	Description
1	Run	Parameters for the **forward rotation** portion of a dot dispense recipe.
2	Delay	Parameters for the **time** *between forward and reverse portions* of a dot dispense recipe.
3	Reverse	Parameters for the **reverse rotation** portion of a dot dispense recipe.
4	Disable Air Delay	**Disable Air Delay** - length of time the air remains on after the pump turns off. This delay occurs after the reverse dispense operation. Only if all reverse rotation values are set to 0, then the Disable Air Delay begins after the forward operation. Default = 0. *Recommendation for robot-controlled setups*: To avoid unnecessary cycling of air and hardware (and if your process allows it), match the amount of time to process from one dispense to the next with the value for "delay between forward and reverse" (Item 2).

System-wide command

The back arrow returns the display to the previous window. A back arrow is located on all windows *except* the Home window.
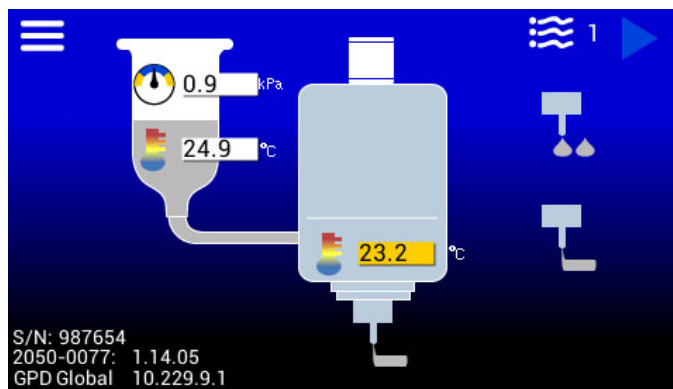
Common indicators

These status indicators are common to all windows:

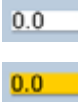| Item	Name	Description
	Online state status	Connection status of reservoir: • online (arrow)
	Offline state status	• offline (double vertical lines)
	Current recipe	Displayed value represents the current recipe number.

## Main window

Indicators in Main window

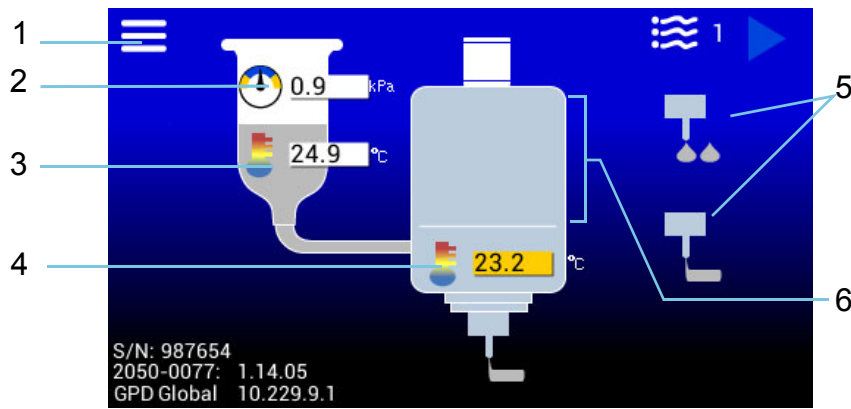These status indicators are used on the Main window:

Item	Name	Description
	Dispense mode	A nozzle image matching the currently selected dispense mode displays at the base of the pump body: • Dot dispense mode = nozzle dispensing dots
		• Continuous dispense mode = nozzle dispensing a line

Item	Name	Description
	Pump status	• Pump is running, busy, work-in-progress (left image).
		• Pump is disconnected (center image).
		• Pump is experiencing an error condition (right image). Refer to Troubleshooting (pg 26).
0.0 0.0	Value state	The field background color indicates value state. • White = within set range • Amber = outside set range
	Warning indicator	Applies to Level Detect. This indicator displays only when level detection is enabled and fluid level is low.
Error 512 Tracking	Error message	If an error occurs, an error message and code displays in bottom right corner. Refer to Error messages (pg 27).

Navigating with Main window

Item		Name	Description
1		Menu	Opens Menu (pg 31) window.
2 & 3		Reservoir settings	Press either of these icons/values to open Reservoir settings (pg 34).
			NOTE: Temperature value only displays when reservoir temperature is enabled.
			NOTE: Run activation only functions when temperature is within set range. Refer to Indicators in Main window (pg 11).
4		Pump settings	Press the indicated area, icon, or value to open Pump body settings (pg 35)
			NOTE: Icon/Value only displays when heater is enabled.
			NOTE: Run activation only functions when temperature is within set range. Refer to Indicators in Main window (pg 11).
5		Dispense modes	Press either of these icons to toggle between the dispense modes. An image matching the currently selected dispense mode displays at the base of the reservoir. • Dot dispense mode • Continuous/Line dispense mode
6		Dispense parameters	Press the indicated area to open a parameters window based on the selected dispense mode: • If Dot dispense mode is currently selected, press any of these areas to open Dot dispense window (pg 32). • If Continuous/Line mode is currently selected, press any of these areas to open Continuous dispense window (pg 33).

Menu structure

The menu icon , located on the Main window, opens the [Menu](pg 31) (pg 31) window.
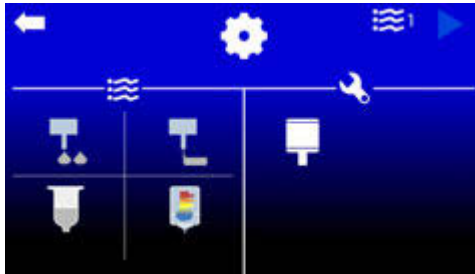
Use the Menu window to navigate to these destinations:

Icon	Description
	[Dot dispense window](#) (pg 32)
	[Continuous dispense window](#) (pg 33)
	[Reservoir settings](#) (pg 34)
	[Pump body settings](#) (pg 35)
	[Pump / Motor configuration](#) (pg 36)

Keypad for numeric input

Use the numeric keypad to change parameter values, setting values, and select a different recipe.

Display keypad

To display the keypad, press any icon associated with a value or any value associated wtih an icon.

Save edit

To save entered value and close the keypad, press "ENTER" in the bottom right-hand corner of the keypad.

Cancel edit

To cancel entered value and close the keypad, press "X" in the upper right-hand corner of the keypad.

Decimal places

Parameter and setting values display decimal places when appropriate. If you try to enter decimal places where they are not used/displayed, the decimal portion of your entry will be ignored.

Operating instructions

> *NOTE:* If you use a glove or stylus to enter values on the touch screen, a capacitive type glove/stylus is required.

Power on/off

Servo Pump Controller power

Power on

Turn on the power switch located on the rear panel.

Power off

To turn off the controller, turn off the power switch located on the rear panel.

Set online/offline state

Toggle the controller to an online or offline state using the Online/Offline button on the front panel of the controller.

The icon reflecting the connection state - ▶ online or ‖ offline - displays in the upper right corner of the screen.

The controller starts up in the offline state. It must be set online in order to run the connected pump.

Run pump

Run the pump, i.e., control pump reservoir pressure, via any of these methods:

- Run button - on controller front panel
- Foot pedal - connected to controller
- Digital I/O - via an external controller connected to controller
- RS232 - use force run command (**frun**). Refer to ASCII command set (pg 46).
- TCP Modbus - set force run register (**ForceRun**). Refer to Process image (pg 56).

To run controller:

1. Perform Startup (pg 7).

2. Perform Initial testing (pg 8).

3. To run the pump:
   - Press and hold the Run button, or
   - Depress and hold the foot pedal, or
   - External controller sends a signal.

   Run set point fluid pressure is achieved.

4. To stop the pump:
   - Release the Run button, or
   - Release the foot pedal, or
   - External controller sends a signal.

   Holding set point fluid pressure is achieved.

Stop controller

Setting the controller to the Offline state using the Online/Offline button immediately halts pump operation.

The ‖ indicator displays when the controller is set to Offline.

Change equipment

Prior to making any equipment changes (replacing reservoir, etc.), power off the controller or set it to Offline state.

⚠️ *CAUTION*: All hardware setup must be complete prior to setting the controller Online.

Select recipe

Recipes can be assigned using a value from 1-30. Current recipe details are retained through a power cycle.

To change to a different recipe:

1.   Press the ≋ icon. A keypad displays.

2.   Enter a different recipe number.

Select dispense mode

The currently selected dispense mode is indicated by an image at the base of the reservoir on the Main window. For details, refer to "Dispense modes" in Navigating with Main window (pg 13).

Toggle to a different dispense mode:

Press the desired dispense mode icon (Item A).

The image at the base of the reservoir (Item B) changes to indicate the newly selected dispense mode.
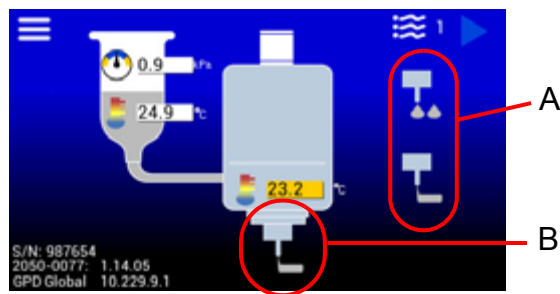
Select units of measure

If you prefer to use a a unit of measure other than the default, press the pressure or temperature symbol to select a different unit of measure option. For details, refer to Units of measure defaults (pg 29).

Set parameters and settings

How to:	Reference
Edit parameters	Dot dispense parameters (pg 18)
	Continuous/line dispense parameters (pg 19)
Turn heater on/off	Reservoir temperature settings (pg 19)
Edit temperature set point	Pump body temperature settings (pg 20)
Edit temperature limits	

Reservoir parameters

Dot dispense parameters

1. In the Main window, press the ▤ icon. Refer to Menu (pg 31).

2. Press the ▆ icon.

    The Dot dispense window (pg 32) displays.

3. As needed, set new values:
    a. In the appropriate pane, press desired icon. A keypad displays.
    b. Enter a new value.
    c. Press ENTER to save change or X to cancel change.

4. As needed, repeat prior step to change additional parameters.

Continuous/line dispense parameters

1. In the Main window, press the [icon] icon. Refer to [Menu](pg 31) (pg 31).

2. Press the [icon] icon.

    The [Continuous dispense window](pg 33) (pg 33) displays.

3. As needed, set new values:
    a. In the appropriate pane, press desired icon. A keypad displays.
    b. Enter a new value.
    c. Press ENTER to save change or X to cancel change.

4. As needed, repeat prior step to change additional parameters.

Temperature settings

> *NOTE*: Settings can be changed regardless of controller Online/Offline status.

Reservoir temperature settings

To edit the reservoir temperature settings:

1. In the Main window, press the [icon] icon. Refer to [Menu](pg 31) (pg 31).

2. Press the [icon] icon. The [Reservoir settings](pg 34) (pg 34) window displays.

3. **Heater power** - To change the on/off state of the heater, press and release the heater On/Off control to toggle between on and off.

4. **Temperature set point** - To change the value:

    a. Press the *left arrow* in the [icon] icon. A keypad displays.
    b. Enter new value.
    c. Press ENTER to save change or X to cancel change.

5. **Temperature upper limit** - To change the value:

    a. Press the *top right arrow* in the [icon] icon. A keypad displays.
    b. Enter new value.
    c. Press ENTER to save change or X to cancel change.

6. **Temperature lower limit** - To change the value:

    a. Press the *bottom right arrow* in the [icon] icon. A keypad displays.
    b. Enter new value.
    c. Press ENTER to save change or X to cancel change.

Pump body temperature settings

To edit the temperature settings:

1. In the Main window, press the ▤ icon. Refer to [Menu](#) (pg 31).

2. Press the 📋 icon. The [Pump body settings](#) (pg 35) window displays.

3. **Heater power** - To change the on/off state of the heater, press and release the heater On/Off control to toggle between on and off.

4. **Temperature set point** - To change the value:

    a. Press the *left arrow* in the ❄ icon. A keypad displays.
    b. Enter new value.
    c. Press ENTER to save change or X to cancel change.

5. **Temperature upper limit** - To change the value:

    a. Press the *top right arrow* in the ❄ icon. A keypad displays.
    b. Enter new value.
    c. Press ENTER to save change or X to cancel change.

6. **Temperature lower limit** - To change the value:

    a. Press the *bottom right arrow* in the ❄ icon. A keypad displays.
    b. Enter new value.
    c. Press ENTER to save change or X to cancel change.

Programming instructions

> *NOTE:* "Pump" is used herein as a generic term to represent *a head that moves fluid*; e.g., reservoir, valve.

Interfacing with controller

Program via RS232 interface

To use the RS232 interface to program the controller:

1. Power off the controller.

2. Plug an RS232 connector into the controller.

3. For programming, use the ASCII Commands and ASCII Command Set reference material provided in the [RS232 programming](#) (pg 44)

Program via Ethernet

To use the Ethernet interface to program the controller:

1. Power off the controller.

2. Plug an Ethernet connector into the controller.

3. For programming, use the Process Image Data and Process Image Type reference material provided in the [Modbus TCP/IP programming](#) (pg 50)*.*

Basic interface operations

Examples of usage for the programmer/integrator interfacing with the controller.

Set offline - disable controller operations

Setting the controller Offline will disable the controller such that no valves are in operation. This can be done in the following:

Process Image

```
OnlineState=0
```

ASCII Command

```
onst=0
```

Set online - enable controller operations

Setting the controller Online enables the controller and immediately begins controlling pressure at the holding pressure set point; therefore, the holding pressure set point should be set before setting the controller Online.

Recommended steps (initialization)

- Set dispense mode

There are two dispense modes: continuous and dot. Each mode has a holding pressure set point; therefore, it is recommended you set this prior to use.

- Set holding pressure set point

    This depends on the dispense mode selected.

- Set online

Set continuous dispense mode

Process Image

```
DispenseMode=1
```

ASCII Command

```
dmod=1
```

Set online

If set online, the holding pressure set point will be achieved.

Process Image

```
OnlineState=1
```

ASCII Command

```
onst=1
```

Run (Dispense)

When a run command is asserted (i.e., digital input signal) the controller will run the pump. This requires the controller to be Online (see .

Differences between Dot mode and Continuous mode

- Continuous - runs the pump until the run command is no longer asserted.

- Dot - runs the pump for a predetermined period of time.

   NOTE: The run activation signal must be deactivated before another run cycle can occur.

Determine when Dot completed

Monitor the pump busy signal or register to determine when a Dot activation has completed.

```
0 = not busy (completed)
1 = busy
```

Process Image

```
PumpBusy
```

ASCII Command

```
pbsy
```

Error Handling

There are multiple ways to detect and determine if an error has unexpectedly occurred while the controller is in operation.

Detect faults

- Check for fault condition
    - monitor PumpFault digital output
    - read PumpFault register

Process Image Read

```
PumpFault
```

ASCII Command

```
pflt
v 1
```

Determine error source

When a fault condition occurs, the following can be done to determine what the error is:

- Check the error code
    - Read Error register
- Check the error message
    - Read ErrorMsg register(s)

Error code

Process Image Read

```
Error
```

ASCII Command

```
errn
```

Error Message

Process Image Read

```
ErrorMsg
```

ASCII Command

```
errm
```

Routine maintenance

Cleaning

Periodically wipe the external surfaces of the controller with a clean, dry, soft cloth.

Troubleshooting

Symptoms and solutions

Symptom

This pump status indicator displays on the Main window.

Problem: The pump is disconnected.

Action: Plug the pump control cable into the controller Pump Control port. Clear the error condition that will occur.

Symptom

This pump status indicator displays on the Main window.

Problem: An error condition has occurred for the pump. To determine source of error, refer to Error messages (pg 27).

Action: To clear an error condition, set the controller to Online using the Online/Offline button.

Symptom

This low level warning indicator displays on the Main window.

Problem: A low fluid level condition has occurred in the reservoir.

Action: Either refill the reservoir or replace it with a full reservoir.

Symptom

The controller will not enter Run mode.

Problem: The temperature may be outside specified temperature range.

Action: Inspect the Main window for temperature warning indicators. Refer to Common indicators (pg 11).

Symptom
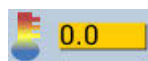
This temperature warning indicator (amber background) displays on the Main window. Value may vary.

Problem: Temperature is outside specified temperature range or heater is malfunctioning.

Action:

- If temperature is below set point, wait until set point has been achieved. The controller will not function when temperature is outside set point range. If two heaters are in use, the temperature for both heaters must be within set point range before controller will function.

- If temperature significantly exceeds set point, turn off the controller and call support.

- Inspect heaters and replace as needed.

Error messages

The following chart defines the error message(s) that may display in the bottom right corner of the Main window along with how to resolve each error.
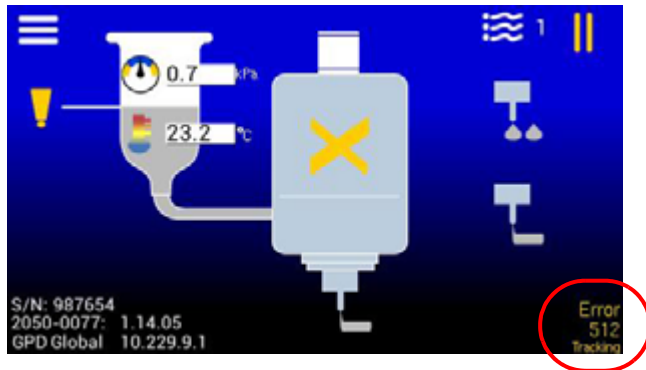
TIP: Motor control type errors may be displayed in multiples. For example: `Tracking, Phasing`

Error Code	Error message	Problem	Solution
-101	Pump Disconnected	The pump is disconnected from the controller.	Plug the pump control cable into the controller.
Motor Control Errors:			
1	CRC	Data flash CRC failure. Fatal error; cannot be cleared.	Inspect the integrity of the pump, the motor, and the pump control cable (that connects to the controller).
2	Internal	Amplifier internal error. Fatal error; cannot be cleared.	
4	Sh.Circuit	Short circuit.	
8	Amp+Temp	Amplifier over temperature.	
16	Motor+Temp	Motor over temperature.	
32	+Volt	Over voltage.	
64	-Volt	Inadequate voltage.	
128	Feedback	Feedback fault.	
258	Phasing	Phasing error.	
512	Tracking	Tracking error.	
1024	+Current	Over current.	
2048	FPGA1	FPGA error type 1.	
4096	CmdLost	Command input lost.	
8192	FPGA2	FPGA error type 2.	
16384	Safety	Safety circuit fault.	
32768	CurCtrl	Unable to control current.	

Testing procedure

Confirm controller operations by performing the <u>Initial testing</u> (pg 8) procedure using a pump reservoir filled either with water or an appropriate test material.

Removal & replacement of components

Fuses

To replace a fuse:

1. Using the tip of a small screwdriver, pry the fuse holder from the center of the AC power connector located on the rear panel.

2. Remove and replace one or both fuses.

3. Slide fuse holder into AC power connector.

Suggested spare parts

Description	Part No.	Qty
Coupling Insert for Reservoir Air Cap	2675-0180	4
Reservoir Air Cap, 3 cc	10/3083	2
Reservoir Air Cap, 5 cc	10/1514	2
Reservoir Air Cap, 10 cc	10/1515	2
Reservoir Air Cap, 30 cc	10/1542	2
Temperature Fuse, 2A	4300-0118	2

Appendices

Units of measure defaults

The currently selected units of measure display on the screen next to its corresponding value.

Values with multiple units (e.g., kPa, PSI) can be selected by the user.

Figure 4: Available units of measure

Rotation	Degrees (angle)
Speed	Degrees (angle) n/s
Acceleration/Deceleration	Degrees (angle) n/s²
Time	Milliseconds
Pressure	kPa (default)	PSI
Temperature	Celsius (default)	Fahrenheit

To change units of measure:

1. Locate a value with units of measure that you want to change.

    For example, let's assume you want to change from kPa to PSI.

2. Press the displayed units of measure (kPa) to cycle through the available measurement
    units until the desired unit (PSI) appears.

Windows and fields
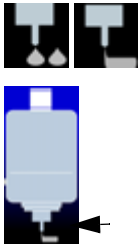
Main

Use the Main window to:

- access the menu window
- select a dispense mode or a recipe
- access dispense mode settings for the currently selected dispense mode
- monitor reservoir pressure
- monitor temperature (if heaters enabled) of reservoir and pump body
- determine pump connection status

For additional details about the Main window, refer to Indicators in Main window (pg 11) and Navigating with Main window (pg 13).

Item	Name	Description
	Reservoir pressure	• Current reservoir air pressure • Press this value to navigate to Dot dispense window (pg 32) or Continuous dispense window (pg 33).
	Reservoir temperature	• Current temperature of reservoir (if heaters enabled) • Press this value to navigate to Reservoir settings (pg 34).
	Pump body temperature	• Current temperature of pump body (if heaters enabled) • Press this value to navigate to Pump body settings (pg 35).
	Dispense modes	Selects either dot dispense mode or continuous/line dispense mode. • Press a dispense mode icon to select that mode. • The mode icon will display at the base of the reservoir, and when a recipe is selected, it will dispense in the selected dispense mode. The currently selected dispense mode is indicated at the base of the reservoir. For example, the reservoir shown at left indicates continuous/line dispense mode.

Menu

Use the Menu window to navigate to parameters and settings windows.
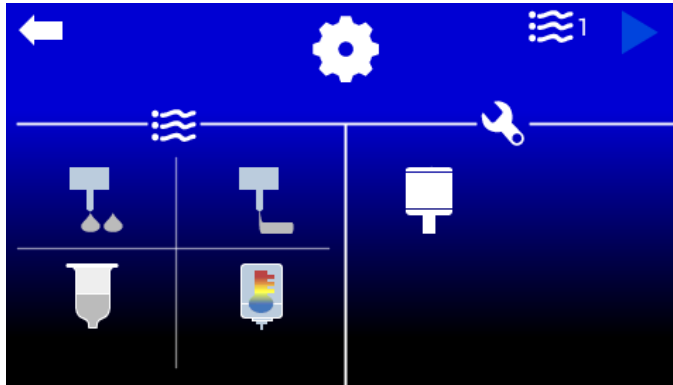
⚙	Settings window.	
≋	Menu choices	
	Opens Dot dispense window (pg 32) window.	
	Opens Continuous dispense window (pg 33) window.	
	Opens Reservoir settings (pg 34) window.	
	Opens Pump body settings (pg 35) window.	
🔧	Hardware parameters categories.	
	Opens Pump / Motor configuration (pg 36) window.	

Parameters

Dot dispense window

Use this window to edit dot dispense parameter values.

	Dot dispense parameters window.	
	Forward rotation*	
	Acceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Speed	Used to drive the pump motor. Degrees (angle) n/s
	Deceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Time / Delay	Milliseconds
	Reverse rotation*	
	Acceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Speed	Used to drive the pump motor. Degrees (angle) n/s
	Angle	Degrees (angle)
	Deceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Delay for pressure off	
	Time / Delay	Milliseconds
* Rotation - the amount of rotation of the auger driven by the motor (+ forward, - reverse).		

Continuous dispense window

Use this window to edit line dispense (i.e., continuous dispense) parameter values.

	Continuous dispense parameters window	
	Forward rotation*	
	Acceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Speed	Used to drive the pump motor. Degrees (angle) n/s
	Deceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Time / Delay	Milliseconds
	Reverse rotation*	
	Acceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Speed	Used to drive the pump motor. Degrees (angle) n/s
	Angle	Degrees (angle)
	Deceleration	Used to drive the pump motor. Degrees (angle) n/s^2
	Delay for pressure off	
	Time / Delay	Milliseconds
* Rotation - the amount of rotation of the auger driven by the motor (+ forward, - reverse).		

Settings

Reservoir settings

Use this window to edit reservoir settings.

	Reservoir settings window.	
	Temperature	Current temperature settings for temperature control.
	Heater control	Toggles heater on/off. Heater is turned on. Heater is turned off.
	Reservoir temperature settings	Enter values for reservoir temperature (Celsius) settings here: • Set point value = arrow on left • Upper limit value = arrow at top right • Lower limit value = arrow at bottom right Temperature values and icon appear gray when this option is turned off.
	Hardware settings.	Controls for optional hardware.
	Air pressure	Enter values for min/max air pressure and air pressure set point: • Air pressure set point (kPa) = arrow at top • Minimum / low air pressure as measured by pressure sensor (kPa) = arrow at left • Maximum / high air pressure as measured by pressure sensor (kPa) = arrow at right
	Level detect	Not currently functional. Toggles the reservoir level detect on/off.
	Reservoir mixer	Not currently functional. Toggles the reservoir mixer on/off.

Pump body settings

Use this window to edit pump body settings.
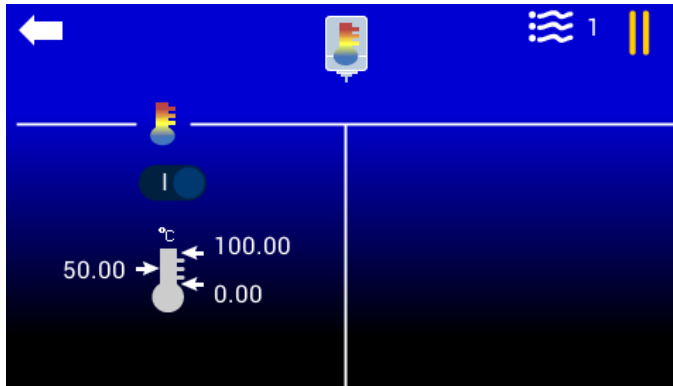
	Pump body settings window.	
	Temperature	Current temperature settings for temperature control.
	Heater control	Toggles heater on/off.
		Heater is turned on.
		Heater is turned off.
	Pump body temperature settings	Enter values for pump body temperature (Celsius) settings here: • Set point value at left arrow. • Upper limit value at top right arrow. • Lower limit value at bottom right arrow. Temperature values and icon appear gray when this option is turned off.

Pump / Motor configuration

Use this window to edit pump selection and motor configuration.

	Pump / Motor settings window.	
	Pump / Motor	Displays the currently active configuration. For example: 2075/0080/002.CCX
	Menu	Allows: • navigating through a list of possible configurations • setting the active configuration
	Configuration selector	Press the **arrow located on the center divider line** to set the configuration displayed in the right pane as the currently active configuration in the left pane. For example, 2075/0080/003.CCX is shown in the right pane. Pressing the center divider line causes the left pane to also display 2075/0080/003.CCX and set this configuration as the currently active configuration.
	Configuration menu	Press the left/right arrows to cycle through the list of possible configuration. The numerals between the arrows (2/2) indicate which configuration is selected from the total configuration count.

Available Configurations:

      2075/0080/002.CCX - for use with Precision Auger Pump

      2075/0080/003.CCX - for use with PCD3 Pump

External robot control

An external robot can control the Servo Pump Controller via digital signals. Doing so makes the following functions available:

- Run - puts the controller into the Run state to start dispensing.
- Profile Select (1-3) - the combined state of these 3 signals determines which recipe is selected via a user-supplied cable and foot pedal, a 24V signal, and a solid state relay (or dry contact).

The following state of the controller can be monitored via digital output signals:

- Ready - the controller is capable of being put into the Run state.
- Busy - the controller is currently dispensing.
- Fault - the controller is in an error condition.

I/O polarity choices

To use an external robot, select from the following instructions that applies to the type of I/O polarity used by your robot.

REQUIRED: External robot must have 24V output

TIP:

PNP = sourcing; high side switching.

NPN = sinking; low side switching.

PNP start/stop only

To use an external robot to start/stop the controller:

1. Route ground from controller I/O 11 to robot ground.
2. Route 24V trigger signal from controller I/O 2 to robot signal.

PNP start/stop with optional outputs

To use an external robot to start/stop the controller and to monitor available output signals:
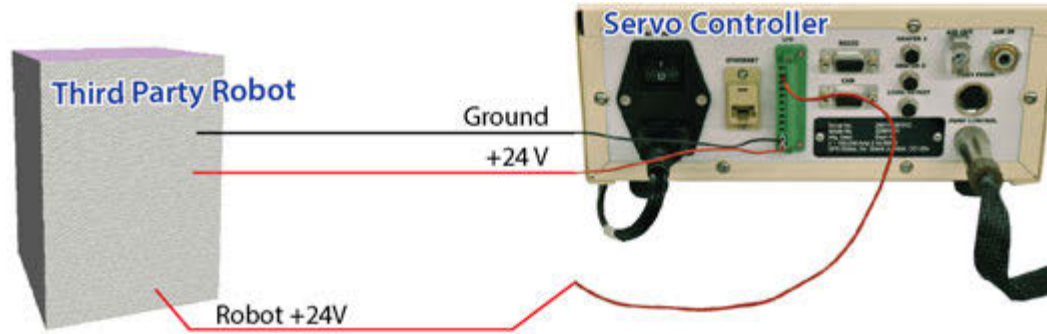
1. Route ground from controller I/O 11 to robot ground.

2. Route 24V trigger signal from controller I/O 2 to robot signal.

3. Route 24V from controller I/O 12 to robot source.

4. To monitor controller reservoir signals, connect robot to controller output pins 6 (Ready), 7 (Busy), and 8 (Fault). Output voltage for pins 6, 7, 8 is equal to voltage on pin 12.

NPN start/stop only

To use an external robot to start/stop the controller:

REQUIRED: Customer-supplied Relay (solid state preferred) and Wiring
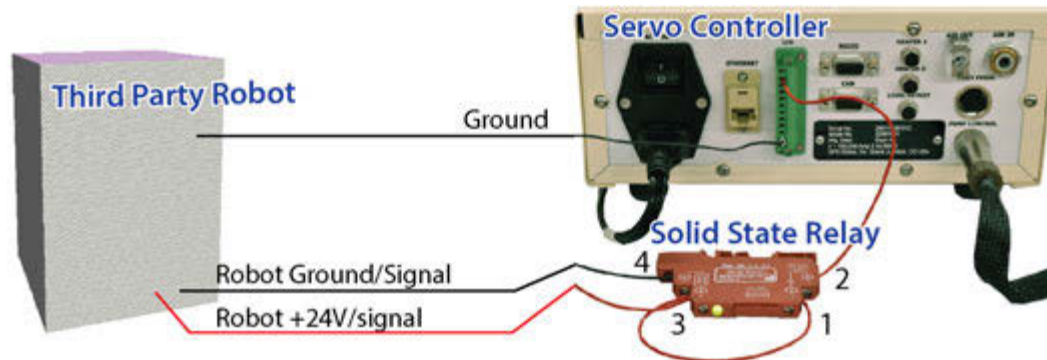
1. Route ground from controller I/O 11 to robot ground.

2. Jumper relay 3 to 1.

3. Route relay 2 to controller I/O 2.

4. Route robot ground/signal to relay 4.

5. Route robot 24V trigger signal to relay 3.

NPN start/stop with optional outputs

To use an external robot to start/stop the controller and to monitor available output signals:

REQUIRED: Customer-supplied Relay (solid state preferred) and Wiring

NOTE: Additional relays may be necessary to convert for NPN input.
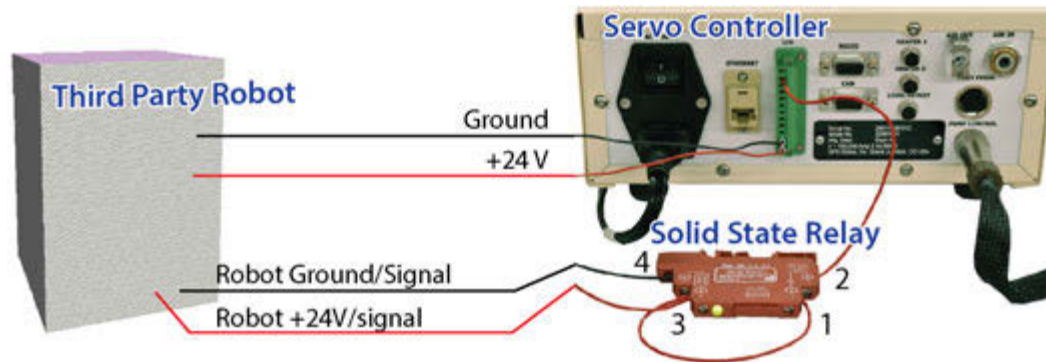
1. Route ground from controller I/O 11 to robot ground.

2. Jumper relay 3 to 1.

3. Route relay 2 to controller I/O 2.

4. Route robot ground/signal to relay 4.

5. Route robot 24V trigger signal to relay 3.

6. Route 24V from controller I/O 12 to robot source.

7. To monitor controller reservoir signals, connect robot to controller output pins 6 (Ready), 7 (Busy), and 8 (Fault). Output voltage for pins 6, 7, 8 is equal to voltage on pin 12.

Communications

Input/Output signals

Figure 5: *IO is Opto-couple isolated.*
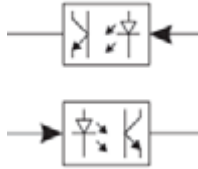
Table 2: *External Input/Output Connector Pin Descriptions*

Pin	I/O Description	I/O Function	I/O State
1	Digital Input	Pump Direction	
2	Digital Input	Pump On	
3	Digital Input	Profile Select 1	
4	Digital Input	Profile Select 2	Active: High (+24V)
5	Digital Input	Profile Select 3	Inactive: Open circuit
6	Digital Output	Pump Ready	
7	Digital Output	Pump Busy	
8	Digital Output	Pump Fault	
9	Reserved	Reserved	0 - 10 VDC
10	Reserved	Reserved	0 - 10 VDC Analog Return
11	Ground	Ground/24V Com	Ground/+5-28VDC common
12	--	Customer input	+5-28VDC

Connector pin outs

Figure 6: *Jumpers*
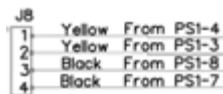
NOTE: Jumpers are required on all header pins.

Figure 7: *AMS (voltage feedback)*
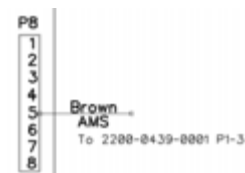
Figure 8: *Ethernet*

Figure 9: *External I/O*
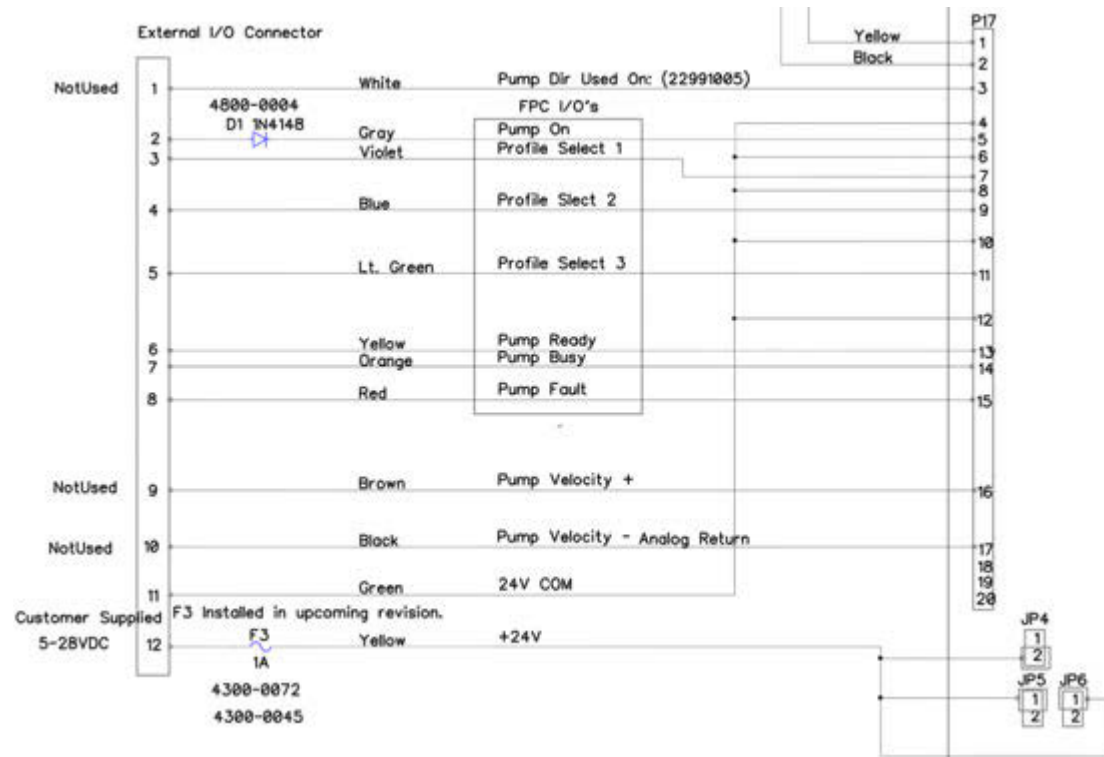
Figure 10: *RS232*

Figure 11: *Pumps*
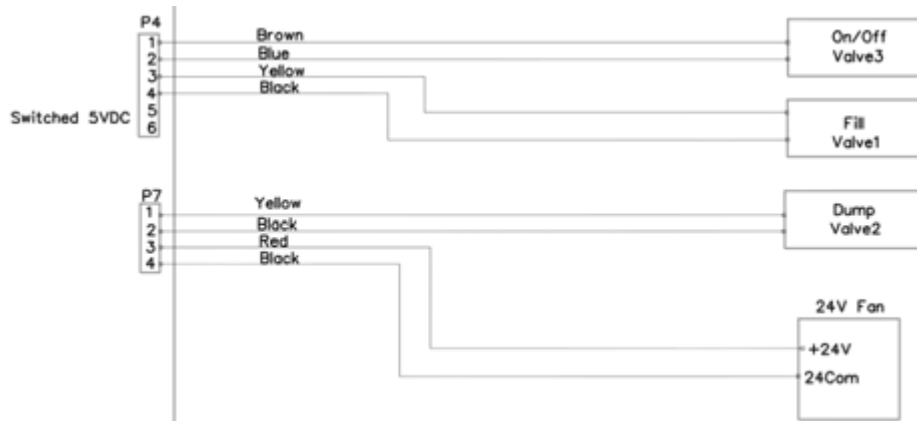
Figure 12: *CAN*

Figure 13: Foot Pedal

Figure 14: Heater(s)

Ethernet TCP/IP

The Ethernet TCP/IP communication port provides an additional means beyond the touch screen for reading and writing controller parameters.

This method uses:

- Default IPv4 Address: 10.229.0.1
- Subnet Mask: 255.0.0.0
- Gateway: 10.0.0.1
- Log Destination IPv4 Address: 10.254.254.254

Network configurations

The user's PC can allow communication with the Servo Pump Controller with either a switch (recommended) or by direct connection (alternative).

Sample TPC/IP configuration:

- IPv4 Address: 10.229.0.10
- Subnet Mask: 255.0.0.0
- Gateway: 10.0.0.1

Figure 15: Recommended: network configuration using a switch to communicate with controller
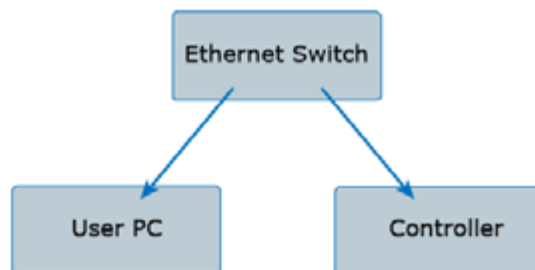
Figure 16: Alternative: network configuration using direct connection to communicate with controller

Log message output

The controller emits log messages in Syslog protocol format to the log destination address specified, i.e., Log Destination IPv4 Address noted here: [Ethernet TCP/IP](#) (pg 42).

Logging can be enabled by:
- Setting the LogEnable register in the process image
- Setting ASCII command: `loge=1`

Logging level can be set by:
- Setting the LogLevel register in the process image
- Setting ASCII command: `logl={level}`
  - Example of setting log level to Informational: `logl=6`

RS232 programming

The RS232 communication port provides an additional means beyond the touch screen for reading and writing controller parameters. This method of communication uses a text based (ASCII character set) command and response protocol.

RS232 settings

Baud	115200
Data Bits	8
Stop Bits	1
Parity	None

ASCII commands

Command Structure

The actual ASCII string for the commands / responses are shown in the tables below.
NOTE: - `\n` refers to a single newline character (ASCII character 10).

Writing a variable value

`var=val\n`

ex. writing a variable value

Command	Response
dfsp=100.0\n	`v\n`

Reading a variable value

`var\n`

ex. reading a variable value

Command	Response
dfsp\n	`v 100.0\n`

Bad command / response

ex. bad command

Command	Response
badcmd\n	`e 1\n`

Responses

Success Responses

Always begins with a **v** character.

`v\n`	the command succeeded
`v xxx\n`	the command succeeded and returned a value - value format is defined by the command

Error Response

`e x\n`	the command failed with error code x

Error Codes

Error Code	Description	Example
1	Unknown command	`badcmd\n`
2	Malformed command	`dfsp=\n`
3	Value out of range	`dfsp=-2.0\n`
4	Write-only, value of variable cannot be read	`abcd\n`
5	Read-only, value of variable cannot be changed	`pbsy=1\n`

ASCII command set

KEY for Table 3

Column	Code	Description
R/W	R	Read
	W	Write
Controller	F	Advanced FPC Controller
	S	Servo Pump Controller
	(blank)	Reserved

Table 3: ASCII Command Set

Command	Description	R/W	Notes	Controller
General				
prdy	Pump ready	R	0=pump is not ready, 1=pump ready	F,S
pbsy	Pump busy	R	0=pump is not busy, 1=pump is busy	F,S
pflt	Pump fault	R	0=pump not in a fault state, 1=pump is in a fault state	F,S
pprs	Pump present	R	0=pump is not present/connected,1=pump is present/connected	S
pion	Pump on	R	0=pump signal not active, 1=pump signal activated	F,S
prf1	Profile Select 1 signal	R	0=inactive,1=active	F,S
prf2	Profile Select 2 signal	R	0=inactive,1=active	F,S
prf3	Profile Select 3 signal	R	0=inactive,1=active	F,S
unit	Unit Select signal	R	0=inactive,1=active	
pdir	Pump Direction signal	R	0=inactive,1=active	S
pval	Pump valid and compatible with controller	R	0=pump invalid,1=pump valid	
pcnf	The currently active pump configuration	R/W		F,S
dmod	The dispense mode	R/W	0=dot,1=continuous,65535=auto/wire mode	F,S
onst	Online state of the controller (online or offline)	R/W	1=Online, 0=Offline, transitions to Online clear faults	F,S
frun	Forces the pump to run with the current parameters	R/W	1=Run, 0=Idle	F,S
recp	The currently selected recipe	R/W	Zero based index, recp=0 is the first recipe	F,S
loge	Log enable	R/W	0=disable,1=enabled	F,S
logl	The logging level	R/W		F,S
wnvr	Writes current configuration parameters to non volatile ram	R/W	0=no action, non-zero=performs write	F,S
Servo Controller Parameters				

Table 3: ASCII Command Set   (cont'd)

Command	Description	R/W	Notes	Controller
dfsp	Dot Forward Speed (°/s)	R/W	Positive non-zero number	S
dfac	Dot Forward Acceleration (°/s²)	R/W	Positive non-zero number	S
dfdc	Dot Forward Deceleration (°/s²)	R/W	Positive non-zero number	S
dfrt	Dot Forward Rotation (°)	R/W	Positive non-zero number	S
drsp	Dot Reverse Speed (°/s)	R/W	Positive non-zero number	S
drac	Dot Reverse Acceleration (°/s²)	R/W	Positive non-zero number	S
drdc	Dot Reverse Deceleration (°/s²)	R/W	Positive non-zero number	S
drrt	Dot Reverse Rotation (°)	R/W	Positive number	S
drdl	Dot Reverse Delay (ms)	R/W	Non-negative number	S
cfsp	Continuous Forward Speed (°/s)	R/W	Positive non-zero number	S
cfac	Continuous Forward Acceleration (°/s²)	R/W	Positive non-zero number	S
cfdc	Continuous Forward Deceleration (°/s²)	R/W	Positive non-zero number	S
crsp	Continuous Reverse Speed (°/s)	R/W	Positive non-zero number	S
crac	Continuous Reverse Acceleration (°/s²)	R/W	Positive non-zero number	S
crdc	Continuous Reverse Deceleration (°/s²)	R/W	Positive non-zero number	S
crrt	Continuous Reverse Rotation (°)	R/W	Positive number	S
crdl	Continuous Reverse Delay (ms)	R/W	Non-negative number	S
prvs	Servo pump total revolutions	R	Valid only with EEPROM pumps	
FPC / Time Pressure Controller Parameters				
cths	The hold mode set point while in continuous mode	R/W		F
ctrs	The run mode set point for a continuous dispense	R/W		F
ctss	The standby mode set point while in continuous mode	R/W		F
ctst	The standby mode timeout period (ms) while in continuous mode	R/W	Non-negative number	F
dths	The hold mode set point (kPa) while in dot mode	R/W		F
dtrs	The run mode set point (kPa) for a dot dispense	R/W		F
dtrt	The amount of time (ms) that the dispense will run for in dot mode	R/W	Non-negative number	F
dtss	The standby mode set point (kPa) while in dot mode	R/W		F
dtst	The standby mode timeout period (ms) while in dot mode	R/W	Non-negative number	F
faps	The current fluid pressure (kPa)	R		F
zfp	Zeroes the fluid pressure sensor to the current pressure	R/W	Write Non-zero	F

Table 3: ASCII Command Set   (cont'd)

Command	Description	R/W	Notes	Controller
zrp	Zeroes the reservoir pressure sensor to the current pressure	R/W	Write Non-zero	F
Body/Needle Temperature				
btrd	Body/Needle Temperature Ready	R	0=not ready, 1=ready	F,S
bten	Body/Needle Temperature Enable	R/W	0=disable,non-zero=enabled	F,S
btrx	Body/Needle RTD Present	R	0=no rtd, 1=rtd detected	F,S
btmp	Body/Needle Temperature (°C)	R	Positive Number	F,S
btsp	Body/Needle Temperature Setpoint (°C)	R/W	Positive Number	F,S
btlo	Body/Needle Temperature Minimum (°C)	R/W	Positive Number	F,S
bthi	Body/Needle Temperature Maximum (°C)	R/W	Positive Number	F,S
btpp	Body/Needle Temperature, PID Proportional Gain	R/W		F,S
btpi	Body/Needle Temperature, PID Integral Gain	R/W		F,S
btpd	Body/Needle Temperature, PID Derivative Gain	R/W		F,S
btpe	Body/Needle Temperature, PID Integral Error Rate	R/W		F,S
btpm	Body/Needle Temperature, PID Integral Maximum	R/W		F,S
btpt	Body/Needle Temperature, PID Time base (ms)	R/W	non-zero	FS,
btpw	Body/Needle Temperature, PWM Period (ms)	R/W	non-zero	F,S
btpr	Body/Needle Temperature, sample rate (ms)	R/W	non-zero	F,S
btfb	Body/Needle Temperature, filter band	R/W		F,S
btfl	Body/Needle Temperature, filter length	R/W		F,S
Reservoir				
rlvd	Reservoir Level Detect Enable	R/W	0=disable,non-zero=enabled	F,S
rlvs	Reservoir Level Detect Status	R	0=not active,1=active	F,S
rmix	Reservoir Mixer Enable	R/W	0=disable,non-zero=enabled	F,S
Reservoir Temperature				
rtrd	Reservoir Temperature Ready	R	0=not ready, 1=ready	F,S
rten	Reservoir Temperature Enable	R/W	0=disable,non-zero=enabled	F,S
rtrx	Reservoir RTD Present	R	0=no rtd, 1=rtd detected	F,S
rtmp	Reservoir Temperature (°C)	R	Positive Number	F,S
rtsp	Reservoir Temperature Setpoint (°C)	R/W	Positive Number	F,S
rtlo	Reservoir Temperature Minimum (°C)	R/W	Positive Number	F,S
rthi	Reservoir Temperature Maximum (°C)	R/W	Positive Number	F,S
rtpp	Reservoir Temperature, PID Proportional Gain	R/W		F,S
rtpi	Reservoir Temperature, PID Integral Gain	R/W		F,S
rtpd	Reservoir Temperature, PID Derivative Gain	R/W		F,S
rtpe	Reservoir Temperature, PID Integral Error Rate	R/W		F,S

Table 3: ASCII Command Set   (cont'd)

Command	Description	R/W	Notes	Controller
rtpm	Reservoir Temperature, PID Integral Maximum	R/W		F,S
rtpt	Reservoir Temperature, PID Period (ms)	R/W	non-zero	F,S
rtpw	Reservoir Temperature, PWM Period (ms)	R/W	non-zero	F,S
rtpr	Reservoir Temperature, sample rate (ms)	R/W	non-zero	F,S
rtfb	Reservoir Temperature, filter band	R/W		F,S
rtfl	Reservoir Temperature, filter length	R/W		F,S
Reservoir Pressure				
rard	Reservoir Air Ready	R	0=not ready, 1=ready	S
raps	Reservoir Air Pressure (kPa)	R	Positive Number	F,S
rast	Reservoir Air Set Point (kPa)	R/W	Positive Number	S
rhip	Reservoir Max Air Pressure (kPa)	R/W	Positive Number	S
rlop	Reservoir Min Air Pressure (kPa)	R/W	Positive Number	S
dadl	Disable Air Delay (ms)	R/W	Non-negative number	S

Modbus TCP/IP programming

This device implements the Modbus® TCP/IP protocol which provides an additional communication interface to the Servo Pump Controller through the Ethernet connection.

The process image can be accessed via Modbus® TCP/IP using the following address scheme:

- 00000 to 09999 : Coil addressing
- 10000 to 19999 : Discrete input addressing
- 30000 to 39999 : Input register addressing
- 40000 to 49999 : Holding register addressing

Process image data

Use this process image data when communicating with the Servo Pump Controller via its Ethernet connection. Refer to .

Process image types

Content in the file provides reference information for data in the file. Also refer to .

Common Process Image
As of 03/16/2020

Name	Description	Address	Type
PartNumber	The GPD part number of the device	400000	GPDPartNumber
SerialNumber	The unique serial number of the device	400010	GPDSerialNumber
DeviceName	A name describing the device	400020	ZString
Manufacturer	The manufacturer of the device	400030	ZString
ModelId	The model identifier of the device	400040	ZString
FirmwareVersion	Firmware version of the device	400050	ZString
DeviceFunction	The overall function (or purpose) of the device	400060	ZString
NetIPAddr	The IP address of the device	400070	IPv4Address
NetSubnet	The subnet mask of the device	400080	IPv4Address
NetGateway	The network gateway for the device	400090	IPv4Address
NetDNS	The network DNS for the device	400100	IPv4Address
LogDest	The network destination for log messages	400110	IPv4Address
BoardTemp	The board temperature, from temperature sensor on device circuit board	400120	Temperature
ScriptSize	The size of the PAWN script currently loaded on the device	400122	UInt16
ScriptVersion	The version of the script currently loaded, should be set in the application script	400123	ZString
ReadNVRAM	Reads configuration data from non-volatile random access memory into memory	400133	UInt16
ScriptId	The script identifier of the currently loaded script, this should be used to uniquely identify a compiled script	400143	ZString
ScriptPartNumber	The part number of the currently loaded application script.	400170	ZString
LibVersion	The library version of the firmware	400180	ZString
ErrorMsg	A description of the last error condition as indicated in Error	400200	ZString
TRISA	PORTA pin directions	400293	UInt16
TRISB	PORTB pin directions	400294	UInt16
TRISC	PORTC pin directions	400295	UInt16
TRISD	PORTD pin directions	400296	UInt16
TRISE	PORTE pin directions	400297	UInt16
TRISF	PORTF pin directions	400298	UInt16
TRISG	PORTG pin directions	400299	UInt16
RA0	The state of PORT RA0	400300	Boolean
RA1	The state of PORT RA1	400301	Boolean
RA2	The state of PORT RA2	400302	Boolean
RA3	The state of PORT RA3	400303	Boolean
RA4	The state of PORT RA4	400304	Boolean
RA5	The state of PORT RA5	400305	Boolean
RA6	The state of PORT RA6	400306	Boolean
RA7	The state of PORT RA7	400307	Boolean
RA8	The state of PORT RA8	400308	Boolean
RA9	The state of PORT RA9	400309	Boolean
RA10	The state of PORT RA10	400310	Boolean
RA11	The state of PORT RA11	400311	Boolean

Name	Description	Address	Type
RA12	The state of PORT RA12	400312	Boolean
RA13	The state of PORT RA13	400313	Boolean
RA14	The state of PORT RA14	400314	Boolean
RA15	The state of PORT RA15	400315	Boolean
RB0	The state of PORT RB0	400316	Boolean
RB1	The state of PORT RB1	400317	Boolean
RB2	The state of PORT RB2	400318	Boolean
RB3	The state of PORT RB3	400319	Boolean
RB4	The state of PORT RB4	400320	Boolean
RB5	The state of PORT RB5	400321	Boolean
RB6	The state of PORT RB6	400322	Boolean
RB7	The state of PORT RB7	400323	Boolean
RB8	The state of PORT RB8	400324	Boolean
RB9	The state of PORT RB9	400325	Boolean
RB10	The state of PORT RB10	400326	Boolean
RB11	The state of PORT RB11	400327	Boolean
RB12	The state of PORT RB12	400328	Boolean
RB13	The state of PORT RB13	400329	Boolean
RB14	The state of PORT RB14	400330	Boolean
RB15	The state of PORT RB15	400331	Boolean
RC0	The state of PORT RC0	400332	Boolean
RC1	The state of PORT RC1	400333	Boolean
RC2	The state of PORT RC2	400334	Boolean
RC3	The state of PORT RC3	400335	Boolean
RC4	The state of PORT RC4	400336	Boolean
RC5	The state of PORT RC5	400337	Boolean
RC6	The state of PORT RC6	400338	Boolean
RC7	The state of PORT RC7	400339	Boolean
RC8	The state of PORT RC8	400340	Boolean
RC9	The state of PORT RC9	400341	Boolean
RC10	The state of PORT RC10	400342	Boolean
RC11	The state of PORT RC11	400343	Boolean
RC12	The state of PORT RC12	400344	Boolean
RC13	The state of PORT RC13	400345	Boolean
RC14	The state of PORT RC14	400346	Boolean
RC15	The state of PORT RC15	400347	Boolean
RD0	The state of PORT RD0	400348	Boolean
RD1	The state of PORT RD1	400349	Boolean
RD2	The state of PORT RD2	400350	Boolean
RD3	The state of PORT RD3	400351	Boolean
RD4	The state of PORT RD4	400352	Boolean
RD5	The state of PORT RD5	400353	Boolean
RD6	The state of PORT RD6	400354	Boolean
RD7	The state of PORT RD7	400355	Boolean
RD8	The state of PORT RD8	400356	Boolean
RD9	The state of PORT RD9	400357	Boolean
RD10	The state of PORT RD10	400358	Boolean
RD11	The state of PORT RD11	400359	Boolean

Name	Description	Address	Type
RD12	The state of PORT RD12	400360	Boolean
RD13	The state of PORT RD13	400361	Boolean
RD14	The state of PORT RD14	400362	Boolean
RD15	The state of PORT RD15	400363	Boolean
RE0	The state of PORT RE0	400364	Boolean
RE1	The state of PORT RE1	400365	Boolean
RE2	The state of PORT RE2	400366	Boolean
RE3	The state of PORT RE3	400367	Boolean
RE4	The state of PORT RE4	400368	Boolean
RE5	The state of PORT RE5	400369	Boolean
RE6	The state of PORT RE6	400370	Boolean
RE7	The state of PORT RE7	400371	Boolean
RE8	The state of PORT RE8	400372	Boolean
RE9	The state of PORT RE9	400373	Boolean
RE10	The state of PORT RE10	400374	Boolean
RE11	The state of PORT RE11	400375	Boolean
RE12	The state of PORT RE12	400376	Boolean
RE13	The state of PORT RE13	400377	Boolean
RE14	The state of PORT RE14	400378	Boolean
RE15	The state of PORT RE15	400379	Boolean
RF0	The state of PORT RF0	400380	Boolean
RF1	The state of PORT RF1	400381	Boolean
RF2	The state of PORT RF2	400382	Boolean
RF3	The state of PORT RF3	400383	Boolean
RF4	The state of PORT RF4	400384	Boolean
RF5	The state of PORT RF5	400385	Boolean
RF6	The state of PORT RF6	400386	Boolean
RF7	The state of PORT RF7	400387	Boolean
RF8	The state of PORT RF8	400388	Boolean
RF9	The state of PORT RF9	400389	Boolean
RF10	The state of PORT RF10	400390	Boolean
RF11	The state of PORT RF11	400391	Boolean
RF12	The state of PORT RF12	400392	Boolean
RF13	The state of PORT RF13	400393	Boolean
RF14	The state of PORT RF14	400394	Boolean
RF15	The state of PORT RF15	400395	Boolean
RG0	The state of PORT RG0	400396	Boolean
RG1	The state of PORT RG1	400397	Boolean
RG2	The state of PORT RG2	400398	Boolean
RG3	The state of PORT RG3	400399	Boolean
RG4	The state of PORT RG4	400400	Boolean
RG5	The state of PORT RG5	400401	Boolean
RG6	The state of PORT RG6	400402	Boolean
RG7	The state of PORT RG7	400403	Boolean
RG8	The state of PORT RG8	400404	Boolean
RG9	The state of PORT RG9	400405	Boolean
RG10	The state of PORT RG10	400406	Boolean
RG11	The state of PORT RG11	400407	Boolean

Name	Description	Address	Type
RG12	The state of PORT RG12	400408	Boolean
RG13	The state of PORT RG13	400409	Boolean
RG14	The state of PORT RG14	400410	Boolean
RG15	The state of PORT RG15	400411	Boolean
AnalogInCh0	The normalized value of the analog input channel 0	400412	Float
AnalogInCh1	The normalized value of the analog input channel 1	400414	Float
AnalogInCh2	The normalized value of the analog input channel 2	400416	Float
AnalogInCh3	The normalized value of the analog input channel 3	400418	Float
AnalogInCh4	The normalized value of the analog input channel 4	400420	Float
AnalogInCh5	The normalized value of the analog input channel 5	400422	Float
AnalogInCh6	The normalized value of the analog input channel 6	400424	Float
AnalogInCh7	The normalized value of the analog input channel 7	400426	Float
AnalogOutCh0	The normalized value of the analog output channel 0	400428	Float
AnalogOutCh1	The normalized value of the analog output channel 1	400430	Float
AnalogOutCh2	The normalized value of the analog output channel 2	400432	Float
AnalogOutCh3	The normalized value of the analog output channel 3	400434	Float
AnalogOutCh4	The normalized value of the analog output channel 4	400436	Float
AnalogOutCh5	The normalized value of the analog output channel 5	400438	Float
AnalogOutCh6	The normalized value of the analog output channel 6	400440	Float
AnalogOutCh7	The normalized value of the analog output channel 7	400442	Float
AnalogInCh8	The normalized value of the analog input channel 8	400444	Float
AnalogInCh9	The normalized value of the analog input channel 9	400446	Float
AnalogInCh10	The normalized value of the analog input channel 10	400448	Float
AnalogInCh11	The normalized value of the analog input channel 11	400450	Float
AnalogInCh12	The normalized value of the analog input channel 12	400452	Float
AnalogInCh13	The normalized value of the analog input channel 13	400454	Float
AnalogInCh14	The normalized value of the analog input channel 14	400456	Float
AnalogInCh15	The normalized value of the analog input channel 15	400458	Float
LogEnable	Enables or disables log messages, 0 = disabled, non-zero = enabled	400500	Boolean
LogLevel	The log level threshold for log messages	400501	LogLevel
Reset	Resets/Restarts the device when value 0xA55A is written	400502	UInt16
BootloaderStart	Restarts the device in bootloader mode when value 0xA55A is written, enabling the device to have it's firmware updated	400503	UInt16
WriteNVRAM	Writes data to non-volatile memory where: 0xA55A=saves all, alternatively as a bitmask: 0x1=saves all, 0x2=saves configuration, 0x4=saves all recipes, 0x8=saves current recipe, 0x10=saves provisioning data	400504	UInt16
Safe	Forces the system/hardware to go to a safe state	400505	Boolean
Error	The error code of the system/device (0 = no error)	400506	Int16
AInSlopeCh0	The slope in the linear equation for analog input channel 0	400507	Float
AInOffsetCh0	The offset in the linear equation fo analog input channel 0	400509	Float
AInSlopeCh1	The slope in the linear equation for analog input channel 1	400511	Float
AInOffsetCh1	The offset in the linear equation fo analog input channel 1	400513	Float
AInSlopeCh2	The slope in the linear equation for analog input channel 2	400515	Float
AInOffsetCh2	The offset in the linear equation fo analog input channel 2	400517	Float
AInSlopeCh3	The slope in the linear equation for analog input channel 3	400519	Float
AInOffsetCh3	The offset in the linear equation fo analog input channel 3	400521	Float

Name	Description	Address	Type
AInSlopeCh4	The slope in the linear equation for analog input channel 4	400523	Float
AInOffsetCh4	The offset in the linear equation fo analog input channel 4	400525	Float
AInSlopeCh5	The slope in the linear equation for analog input channel 5	400527	Float
AInOffsetCh5	The offset in the linear equation fo analog input channel 5	400529	Float
AInSlopeCh6	The slope in the linear equation for analog input channel 6	400531	Float
AInOffsetCh6	The offset in the linear equation fo analog input channel 6	400533	Float
AInSlopeCh7	The slope in the linear equation for analog input channel 7	400535	Float
AInOffsetCh7	The offset in the linear equation fo analog input channel 7	400537	Float
AOutSlopeCh0	The slope in the linear equation for analog output channel 0	400539	Float
AOutOffsetCh0	The offset in the linear equation fo analog output channel 0	400541	Float
AOutSlopeCh1	The slope in the linear equation for analog output channel 1	400543	Float
AOutOffsetCh1	The offset in the linear equation fo analog output channel 1	400545	Float
AOutSlopeCh2	The slope in the linear equation for analog output channel 2	400547	Float
AOutOffsetCh2	The offset in the linear equation fo analog output channel 2	400549	Float
AOutSlopeCh3	The slope in the linear equation for analog output channel 3	400551	Float
AOutOffsetCh3	The offset in the linear equation fo analog output channel 3	400553	Float
AOutSlopeCh4	The slope in the linear equation for analog output channel 4	400555	Float
AOutOffsetCh4	The offset in the linear equation fo analog output channel 4	400557	Float
AOutSlopeCh5	The slope in the linear equation for analog output channel 5	400559	Float
AOutOffsetCh5	The offset in the linear equation fo analog output channel 5	400561	Float
AOutSlopeCh6	The slope in the linear equation for analog output channel 6	400563	Float
AOutOffsetCh6	The offset in the linear equation fo analog output channel 6	400565	Float
AOutSlopeCh7	The slope in the linear equation for analog output channel 7	400567	Float
AOutOffsetCh7	The offset in the linear equation fo analog output channel 7	400569	Float

Process Image

As of 03/16/2020

Name	Description	Address	Type
PumpConfig	The currently active pump configuration	400800	ZString
ScreenshotEnable	Creates a screenshot of the HMI saved to SD card	400970	UInt16
ScreenshotFile	The filename on SD card where the screenshot will be saved.	400980	ZString
BodyTempIntgMax	The maximum integral value for the PID controller for the pump body temperature controller	400992	Float
BodyTempIntgRate	The maximum amount of integral per update for the PID controller for the pump body temperature controller	400994	Float
RsrvrTempIntgMax	The maximum integral value for the PID controller for the reservoir temperature controller	400996	Float
RsrvrTempIntgRate	The maximum amount of integral per update for the PID controller for the reservoir temperature controller	400998	Float
EncoderResolution	Number of encoder counts per revolution of the motor	401000	Count
FinalDriveRatio	The motor to auger gear ratio, how many revolutions of the motor equals one auger revolution	401002	Float
RsrvrTempRTDPresent	Indicates if an RTD is currently connected to the controller for the reservoir	401004	Boolean
BodyTempRTDPresent	Indicates if an RTD is currently connected to the controller for the pump body	401005	Boolean
RsrvrTemp	The current temperature of the reservoir the RTD value	401006	Temperature
BodyTemp	The current temperature of the pump body	401008	Temperature
BodyTempReady	The body temperature is within specifications	401010	Boolean
ForceRun	Forces the pump to run with the current parameters	401011	Boolean
PumpOn	Signals the controller to begin running the pump	401012	Boolean
PumpDirection	Indicates the current direction to drive the pump	401013	Boolean
PumpProfileSelect1	Pump control profile select #1, the profile is selected by the three profile select inputs (8 possible profiles)	401014	Boolean
PumpProfileSelect2	Pump control profile select #2, the profile is selected by the three profile select inputs (8 possible profiles)	401015	Boolean
PumpProfileSelect3	Pump control profile select #3, the profile is selected by the three profile select inputs (8 possible profiles)	401016	Boolean
PumpPresent	Indicates if the controller detects that a pump is present	401017	Boolean
reserved1	Reserved register	401018	Boolean
LvlDtct	The status of the level detect sensor	401019	Boolean
RsrvrTempReady	The reservoir temperature is within specifications	401020	Boolean
OnlineState	Online state of the controller (online or offline)	401021	Boolean
reserved2	Reserved register	401022	Boolean
reserved3	Reserved register	401023	Boolean
reserved4	Reserved register	401024	Boolean
RsrvrAirPressure	The current air pressure of the reservoir	401025	Pressure
PumpReady	Indicates if the pump is ready to be driven	401027	Boolean
PumpBusy	Indicates if the pump is busy performing an operation	401028	Boolean
PumpFault	Indicates if the pump is in a fault state	401029	Boolean
RsrvrHeaterOn	Controls the reservoir heater	401030	Boolean
BodyHeaterOn	Controls the pump body heater	401031	Boolean
SystemAirOn	Controls the system air solenoid	401032	Boolean
RsrvrTempProp	Reservoir Temperature, Proportional Gain	401033	Float
RsrvrTempIntg	Reservoir Temperature, Integral Gain	401035	Float
RsrvrTempDeriv	Reservoir Temperature, Derivative Gain	401037	Float
RsrvrTempPIDPeriod	Reservoir Temperature, PID Period (ms)	401039	UInt16
RsrvrTempPWMPeriod	Reservoir Temperature, PWM Period (ms)	401040	UInt16
RsrvrTempSampleRate	Reservoir Temperature, sample rate (ms)	401041	UInt16
BodyTempProp	Body Temperature, Proportional Gain	401042	Float
BodyTempIntg	Body Temperature, Integral Gain	401044	Float
BodyTempDeriv	Body Temperature, Derivative Gain	401046	Float
BodyTempPIDPeriod	Body Temperature, PID Period (ms)	401048	UInt16
BodyTempPWMPeriod	Body Temperature, PWM Period (ms)	401049	UInt16
BodyTempSampleRate	Body Temperature, sample rate (ms)	401050	UInt16
RsrvrTempDutyCycle	Reservoir Temperature, current heater output duty cycle	401051	Float
BodyTempDutyCycle	Body Temperature, current heater output duty cycle	401053	Float
RsrvrTempPowerGain	Reservoir Temperature, gain for the PID control output	401055	Float
BodyTempPowerGain	Body Temperature, gain for the PID control output	401057	Float
RsrvrTempRTDAlpha	The reservoir RTD alpha value	401059	Float
BodyTempRTDAlpha	The pump body RTD alpha value	401061	Float
SelectedRecipe	The currently selected recipe	401069	UInt16
BodyAirReady	Indicates if the current body air pressure is within specifications	401070	Boolean
RsrvrAirReady	Indicates if the current reservoir air pressure is within specifications	401071	Boolean
BodyTempOffset	Offset applied to the pump body temperature value	401074	Float
RsrvrTempOffset	Offset applied to the reservoir temperature value	401078	Float
BodyTempFilterBand	The band width of the software filter for the pump body temperature	401080	Float
BodyTempFilterLength	The sample length of the software filter for the pump body temperature	401082	UInt16
RsrvrTempFilterBand	The band width of the software filter for the reservoir temperature	401083	Float
RsrvrTempFilterLength	The sample length of the software filter for the reservoir temperature	401085	UInt16
PrevDispenseType	The dispense mode used in the previous dispense cycle	401086	UInt16
RsrvrAirOffset	Offset applied to the reservoir air pressure value	401087	Float
DisableAirDelay	The amount of time (ms) that must pass after a dispense before the system air will disable	401100	UInt16
DotForwardAccel	The forward motion motor acceleration used when dispensing a dot	401101	RotationalAcceleration
DotForwardDecel	The forward motion motor deceleration used when dispensing a dot	401103	RotationalAcceleration
DotForwardSpeed	The forward motion motor speed used when dispensing a dot	401105	RotationalSpeed
DotForwardRotation	The amount of rotation the auger will rotate when the motor is driven in the forward direction while dispensing a dot	401107	Angle
DotReverseAccel	The reverse motion motor acceleration used when dispensing a dot	401109	RotationalAcceleration
DotReverseDecel	The reverse motion motor deceleration used when dispensing a dot	401111	RotationalAcceleration
DotReverseSpeed	The reverse motion motor speed used when dispensing a dot	401113	RotationalSpeed
DotReverseRotation	The amount of rotation the auger will rotate when the motor is driven in the reverse direction while dispensing a dot	401115	Angle
DotReverseDelay	The amount of time (ms) that must pass after the forward rotation of the auger before rotating in the reverse direction whil	401117	UInt16

Name	Description	Address	Type
ContForwardAccel	The forward motion motor acceleration used when dispensing continuously	401118	RotationalAcceleration
ContForwardDecel	The forward motion motor deceleration used when dispensing continuously	401120	RotationalAcceleration
ContForwardSpeed	The forward motion motor speed used when dispensing continuously	401122	RotationalSpeed
ContReverseAccel	The reverse motion motor acceleration used after a continuous dispense has stopped	401124	RotationalAcceleration
ContReverseDecel	The reverse motion motor deceleration used after a continuous dispense has stopped	401126	RotationalAcceleration
ContReverseSpeed	The reverse motion motor speed used after a continuous dispense has stopped	401128	RotationalSpeed
ContReverseRotation	The amount of rotation the auger will automatically rotate after the continuous dispense has stopped	401130	Angle
ContReverseDelay	The amount of time (ms) that must pass after the continuous dispense has stopped before rotating the auger in the reverse	401132	UInt16
ContUseAnalogSpeed	Indicates if the speed values for ContForwardSpeed and ContReverseSpeed come from the analog input	401133	Boolean
BodyTempEnable	Enables the pump body temperature control	401134	Boolean
BodyTempSetpoint	The current setpoint for the pump body temperature	401135	Temperature
RsrvrTempEnable	Enables the reservoir temperature control	401137	Boolean
RsrvrTempSetpoint	The current setpoint for the reservoir temperature	401138	Temperature
RsrvrAirMaxPressure	The maximum allowable air pressure for the reservoir	401140	Pressure
RsrvrAirMinPressure	The minimum allowable air pressure for the reservoir	401142	Pressure
RsrvrLvlDtctEnable	Enables the level detection for the reservoir	401144	Boolean
RsrvrMixerEnable	Enables the reservoir mixer	401145	Boolean
DispenseMode	Indicates the dispense mode type to use	401146	UInt16
RsrvrTempMin	The minimum temperature value of the reservoir to be considered within 'tolerance'	401147	Temperature
RsrvrTempMax	The maximum temperature value of the reservoir to be considered within 'tolerance'	401149	Temperature
BodyTempMin	The minimum temperature value of the pump body to be considered within 'tolerance'	401151	Temperature
BodyTempMax	The maximum temperature value of the pump body to be considered within 'tolerance'	401153	Temperature
RsrvrAirSetPoint	The set point for the reservoir air pressure	401155	Pressure

Process Image Types

Process Image Types   As of 04/06/2016

PI Type	OPC Type	Unit	Range	Description	Notes
UInt16	Word		0 ≤ N ≤ 65535	16 bit unsigned integer	
Int16	Short		-32768 ≤ N ≤ 32767	16 bit signed integer	
UInt32	DWord		0 ≤ N ≤ 4294967295	32 bit unsigned integer	
Int32	Long		-2147483648 ≤ N ≤ 2147483647	32 bit signed integer	
Float	DWord		2E-38≤ N ≤ 2E38	single precision floating point	
Count	DWord		0 ≤ N ≤ 4294967295	32 bit signed number	
Name(N)	String.N		[A-Za-z\b]	A string of characters of max length N, null terminated ASCII string	
Boolean	Short		true|false		
ZString(N)	String.N	byte	^ .{0,N}$		Note that the zero terminator may not be present at MODBUS/OPC protocol levels.
GPD Part Number	String.10		^[0-9]{4}-[0-9]{4}(-[0-9]+)?$		
GPD Serial Number	String.10		^[0-9]{7,9}$	NNN = product code, nnnn = sequential machine id e.g. 2220281 222=uMAX 0281=machine #281	
IPv4 Address	String.16		^(?:[0-9]{1,3}\.){3}[0-9]{1,3}$ ¹	standard octet dotted notation	e.g. 192.18.0.1
Distance	Float	mm	±10E38		
Duration	DWord	ms	0 ≤ N ≤ 4294967295]	a span of time (ms)	
Angle	Float	°	±360°		
Speed	float	mm/s	±10E38		
Acceleration	Float	mm/s²	±10E38		
RotationalSpeed	Float	° n/s	±10E38		
RotationalAcceleration	Float	° n/s²	±10E38		
Temperature	Float	°C	±10E38		
Pressure	Float	kPa	±10E38		
LogLevel	Word		0-8	Log message levels	0=emergency, 1=alert, 2=critical, 3=error, 4=warning, 5=notice, 6=info, 7=debug, 8=trace
CultureInfo	String.6	https://msdn.microsoft.com/en-us/library/ee825488(v=cs.20).aspx	^[a-z]{2}-[A-Z]{2}$	Cultural information for localization, the two character language code followed by the two character country code	example. 'en-US'

1 the given regex is a simplistic match - it does not enforce ranges on the octets. A more accurate version is this: ^(?:(?:25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)\.){3}(?:25[0-5]|2[0-4][0-9]|[01]?[0-9][0-9]?)$