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SHIPCO® PUMPS
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AQUEOUS™

Automated Water Controls

Program Manual

2.X
1/2025

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FORM USER GUIDE AQUEOUS-MANUAL • ***Revised*** *11/23*

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Revision History

March 2022
Initial *Aqueous AWC*™ version 2.0 manual release.

June 2023
Revised to include information and updates made in *Aqueous AWC*™ version 2.1 and 2.2. Notable changes drastically affected the 4-inch HMI and new pictures were added for menus. Revised feature set and applicable wording throughout. Extended BACnet™ communication points list to include pump total and run cycle counters as Analog Inputs (v2.2).

November 2023
Added some clarification and troubleshooting on *PLC Ethernet* and *PLC Serial* pages for BACnet™ sections. Modified wording under *Relay Outputs* section to clarify controller's reserved relays and configurable relays.

January 2025
Added a note to clarify reading points and data types at the end of the Communication Points section.

Features

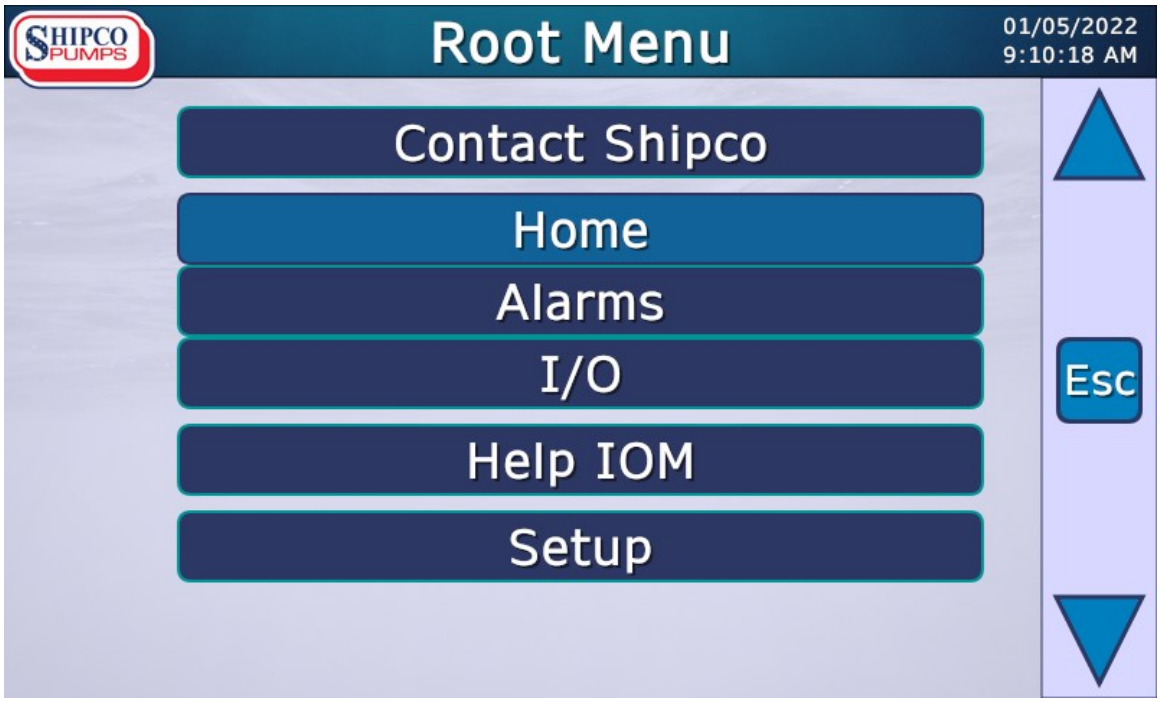
Aqueous Automated Water Controls™ or *Aqueous AWC*™ are typically used for (but not limited to) Condensate, Boiler Feed, Vacuum Producers, Vacuum Condensate, Vacuum Boiler Feed and Deaerators.

- Control circuit disconnect
- Audible alarm bell
- Auto / Off / Continuous or Auto / Off / Hand switch per pump
- **4-inch, 7-inch or 15-inch** Color Touchscreen HMI, NEMA 4
- **Pump control for up to 8 pumps** with status indication for idle/run/fault as well as totalized and cycle based run timers
- Pumps can be configured with **3 unique staging sequences** (e.g., vacuum, boiler feed, condensate, recirculation, etc.)
- **Up to 7 Relay outputs** configured per application. Typically used for ON/OFF operations based on sensor inputs (e.g., makeup, drain, steam injection, electric heaters, recirculation solenoids, blowdown timers, etc.)
- Analog input for Tank Level, Tank Temperature, Tank Pressure, Pump Discharge Pressure(s), System Pressure(s) used for pump staging, **2 flowmeters with temperature, 3 configurable spare sensors**. *Sensors priced separately unless otherwise noted.*
- **Up to 8 Analog outputs** configured per application. (e.g., modulated makeup, modulated steam regulators, VFD speed, etc.)
- Modulated vent sequence for Deaerators
- Communication with building automation and management systems via BACnet™ IP, BACnet™ MS/TP, Modbus® TCP or Modbus® RTU protocols
- Optional HMI cover for NEMA 4X and outdoor UV protection

4-INCH TOUCHSCREEN HMI NOTE	*Aqueous AWC*™ version 2.0 with a 4-inch Touchscreen HMI had a limited feature set. This HMI version only supports up to 4 pumps, 2 pump staging sequences, 3 relay outputs, 4 analog outputs and 1 configurable sensor. **2.0 (4 in)** is used to refer to this version, where applicable in this manual. *Aqueous AWC*™ version 2.1 (released May 2022) revised the 4-inch Touchscreen HMI to match the same feature set as both 7-inch and 15-inch Touchscreen HMI.

System Architecture

Root Menu



Contact Shipco

Displays Shipco® contact information. This is also the initial start-up screen with the software version number.

Home (or Tank Data / Pump Data) (p. 9)

Unit and/or pump status screen for a condensate, boiler feed, deaerator or vacuum unit.

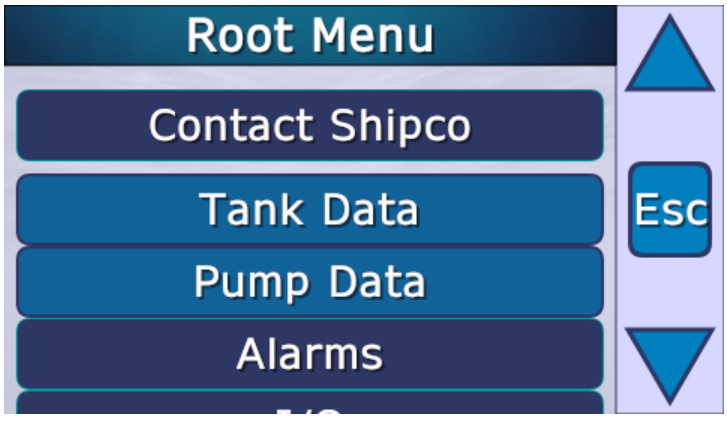
Note: Due to space limitations on 4-inch HMI, *Home* is replaced by *Tank Data* and *Pump Data* buttons which display separate tank status and pump status screens.

Alarms (p. 13)

View active alarms and alarm history log.

I/O (p. 15)

Displays sensor information for digital/analog inputs and outputs for the controller and any expansion I/O.



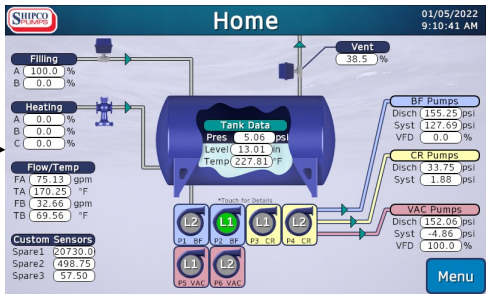
Root menu screen 4-inch Aqueous AWC™ Version 2.1+

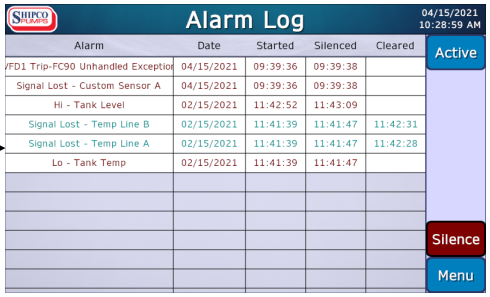
Help IOM

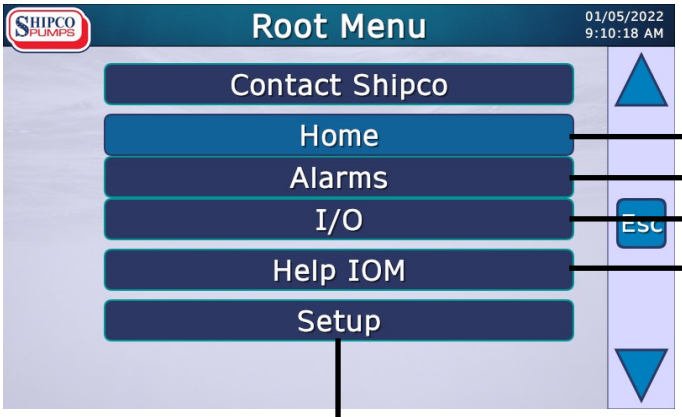
Displays a QR code which can be scanned by a phone or tablet device to download this manual.

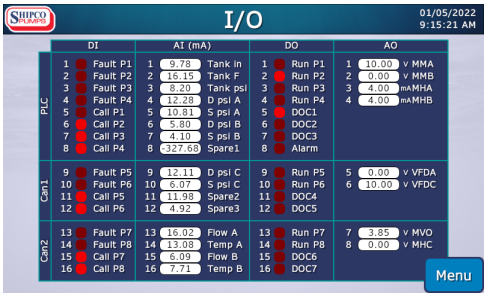
Setup (p. 17)

Change settings for sensors and adjust unit configuration.


Home
01/05/2022
9:10:41 AM
Filling
A 100.0 %
B 0.0 %
Heating
A 0.0 %
B 0.0 %
C 0.0 %
Flow/Temp
FA 75.13 gpm
TA 170.25 °F
FB 32.66 gpm
TB 69.56 °F
Custom Sensors
Spare1 20730.0
Spare2 498.75
Spare3 57.50
Vent
38.5 %
Tank Data
Pres 5.06 psi
Level 13.01 in
Temp 227.81 °F
BF Pumps
Disch 155.25 psi
Syst 127.69 psi
VFD 0.0 %
CR Pumps
Disch 33.75 psi
Syst 1.88 psi
VAC Pumps
Disch 152.06 psi
Syst -4.86 psi
VFD 100.0 %
Menu


Alarm Log
04/15/2021
10:28:59 AM
Alarm
Date
Started
Silenced
Cleared
VFD1 Trip-FC90 Unhandled Exceptio 04/15/2021 09:39:36 09:39:38
Signal Lost - Custom Sensor A 04/15/2021 09:39:36 09:39:38
Hi - Tank Level 02/15/2021 11:42:52 11:43:09
Signal Lost - Temp Line B 02/15/2021 11:41:39 11:41:47 11:42:31
Signal Lost - Temp Line A 02/15/2021 11:41:39 11:41:47 11:42:28
Lo - Tank Temp 02/15/2021 11:41:39 11:41:47
Active
Silence
Menu


Root Menu
01/05/2022
9:10:18 AM
Contact Shipco
Home
Alarms
I/O
Help IOM
Setup
Esc


I/O
01/05/2022
9:15:21 AM
DI
AI (mA)
DO
AO
PLC
Can1
Can2
Fault P1
Fault P2
Fault P3
Fault P4
Call P1
Call P2
Call P3
Call P4
Tank In
Tank F
Tank psi
D psi A
S psi A
D psi B
S psi B
Spare1
Run P1
Run P2
Run P3
Run P4
DOC1
DOC2
DOC3
Alarm
v MMA
v MMB
mAMHA
mAMHB
Fault P5
Fault P6
Call P5
Call P6
D psi C
S psi C
Spare2
Spare3
Run P5
Run P6
DOC4
DOC5
v VFDA
v VFDC
Fault P7
Fault P8
Call P7
Call P8
Flow A
Temp A
Flow B
Temp B
Run P7
Run P8
DOC6
DOC7
v MVO
v MHC
Menu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Manual
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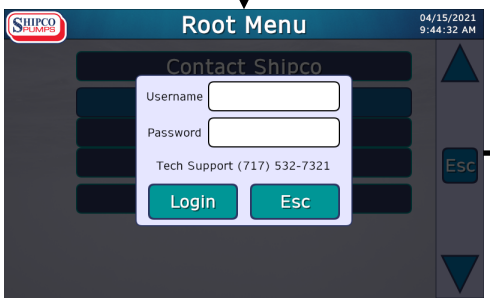
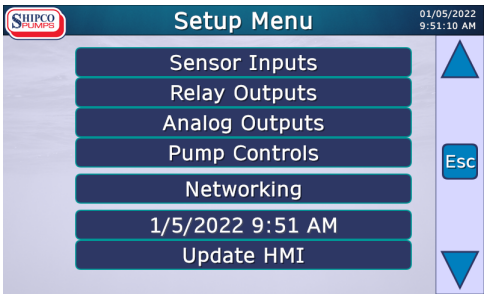
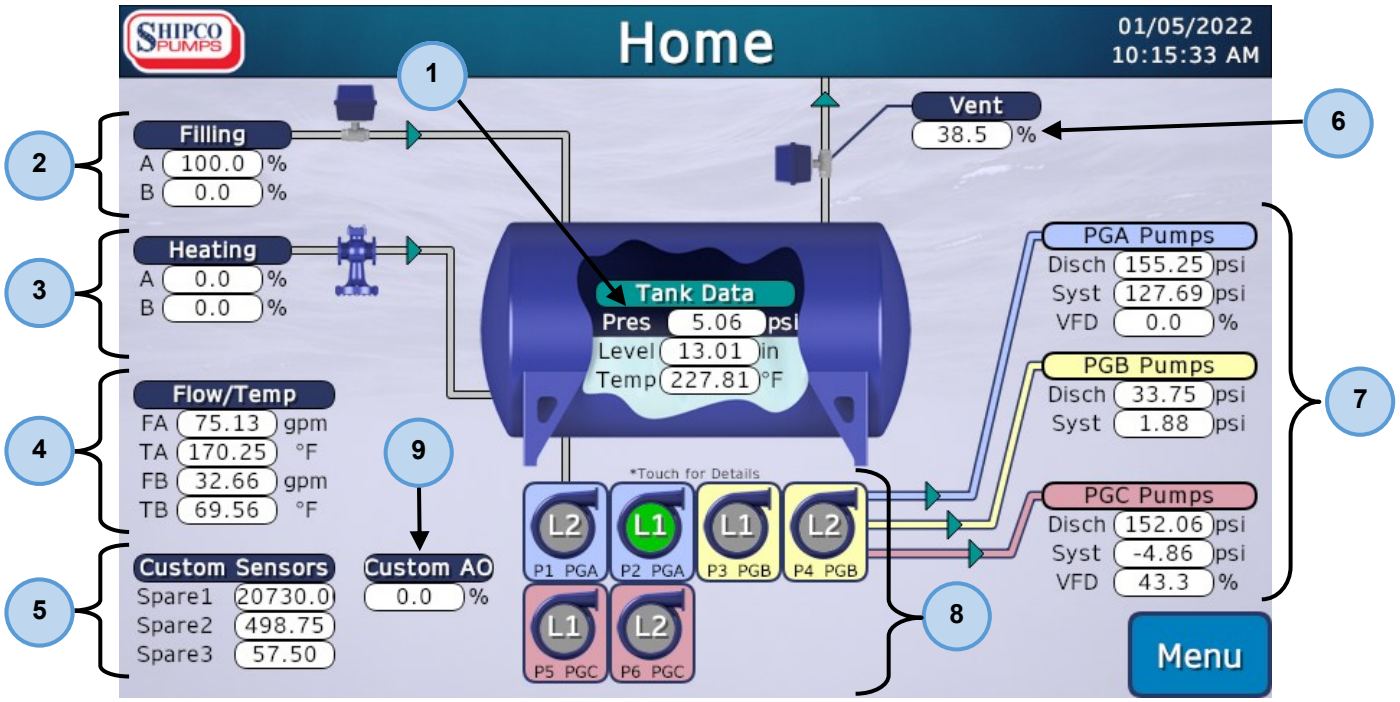
Menu


Root Menu
04/15/2021
9:44:32 AM
Contact Shipco
Username
Password
Tech Support (717) 532-7321
Login
Esc
Esc


Setup Menu
01/05/2022
9:51:10 AM
Sensor Inputs
Relay Outputs
Analog Outputs
Pump Controls
Networking
1/5/2022 9:51 AM
Update HMI
Esc

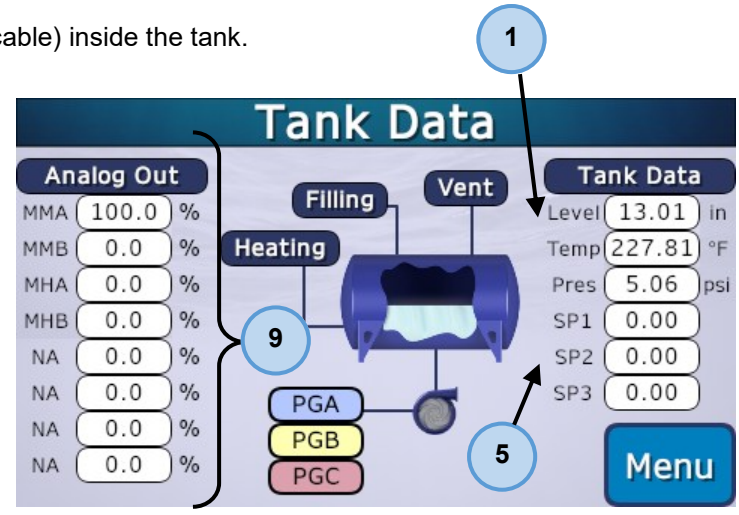
Home
(or Tank Data / Pump Data)



Example Home screen 7- and 15-inch

The Home screen displays useful information, current status of a unit and the status of any pumps, as well as other features that are included on the unit. Depending on the type of unit, only certain items on this screen may be visible.

1. Tank Data
The current water level, temperature and pressure (if applicable) inside the tank.



Tank Data screen 4-inch Aqueous AWC™ 2.1+

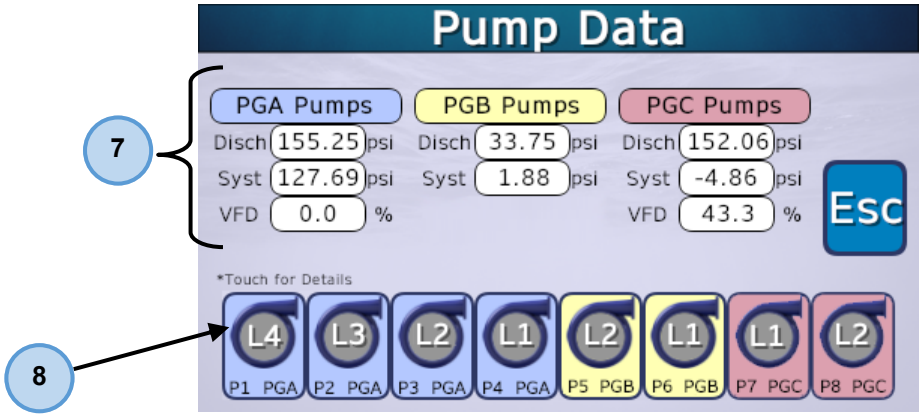
2. Filling
Percentage amount which a modulating make-up valve is open (up to 2 valves).

3. Heating
Percentage amount which a steam regulator is open (up to 3 regulators).

4. Flow/Temperature
Status indication for an additional 2 flow rate sensors (FA & FB expressed in gallons per minute) and/or 2 temperature sensors (TA & TB expressed in °F) placed on the unit.

5. Other Sensors
Additional user-defined sensors (added separately) which can be custom labeled and configured under *Custom Sensors* setup menu (page 25).

6. Vent
Percentage amount which an external varying vent valve is open. 100% indicates the vent is fully open.



Pump Data screen 4-inch Aqueous AWC™ 2.1+

7. Pump Groups

Pumps can be divided up into 3 pump groups. Each pump group is assigned a tag (or label) and color starting with blue, yellow and then red. Under *Pump Control* settings (page 38), a pump group can be assigned a specific alternation control type, pump staging sequence, timings, run permissions, etc. that differs from another pump group.

2.0 (4 in) Only 2 pump groups supported.

If applicable sensors or variable frequency drives (VFD) are used, pump discharge pressure, system pressure and percentage of VFD speed are presented under each pump group.

8. Pumps

Each pump is represented as an individual "card" icon on the home screen. Pumps are sequentially numbered by pump number (P#) beginning with P1, P2, etc. Tap on a pump's card for additional details such as run cycle timers and push-to-test functionality.

Count Maximum 8 pumps **2.0 (4 in)** Maximum 4 pumps

Group Within the card, a pump is also shown with its corresponding group tag and matching color as the card background.

Status The pump icon changes according to the current pump status.

Green = Active / Running

Red * = Fault / Problem

Grey = Inactive / Off

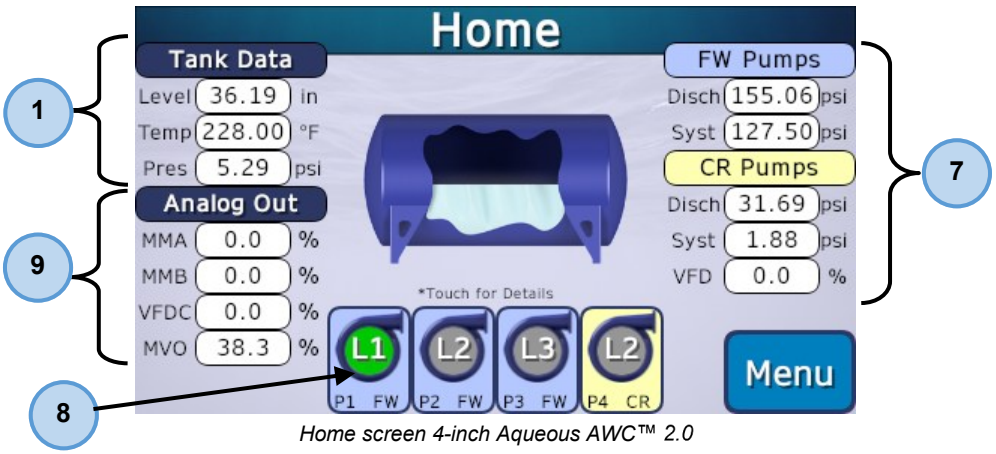
*** Any condition interrupting control will register as a fault (e.g., over-amperage or taking a pump out of "Auto" via the Auto/Off/Continuous selector switch on the unit control panel).**

Position Inside the pump icon, a pump is labeled with its sequencing lead-lag position (L#) within its designated pump group.

For example, in the image on the next page, pump P2 is the lead pump (L1) within the PGA pump group; followed by pumps P3 (L2 or lag 2), P4 (L3 or lag 3), and P1 (L4 or lag 4). Pump P5 is the lead pump (L1) within the PGB pump group, etc.

9. Analog Out

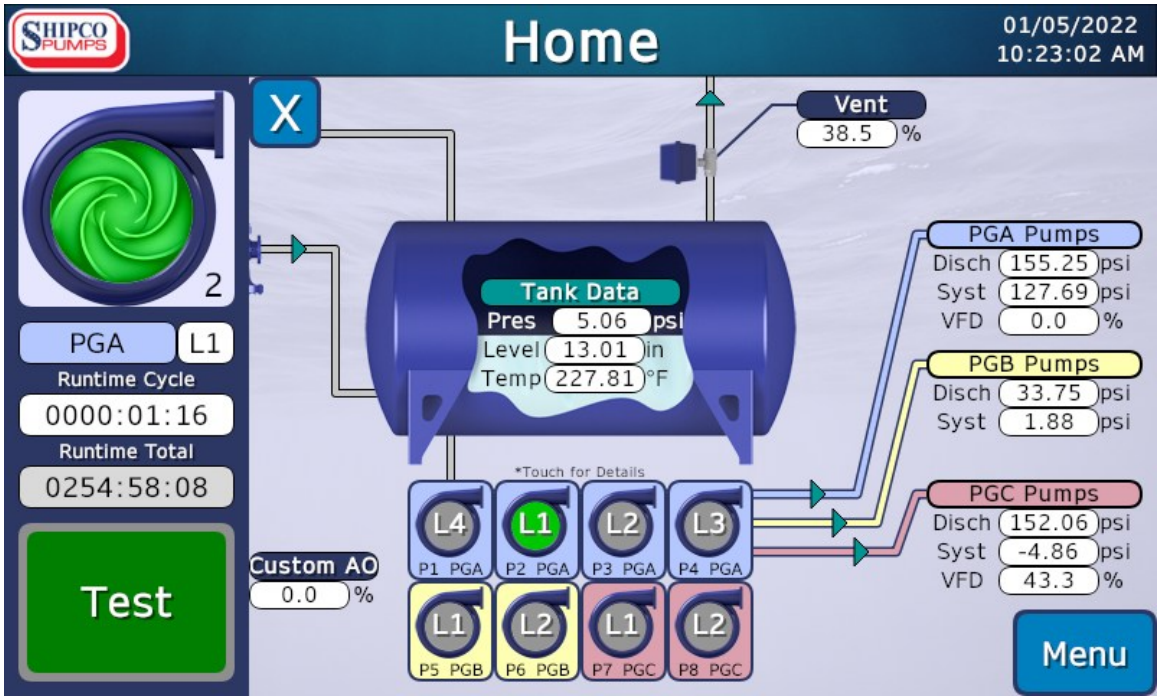
Percentage amount for various custom analog outputs indicating, for example, how much a valve is open or closed or the speed at which a VFD is running, etc.



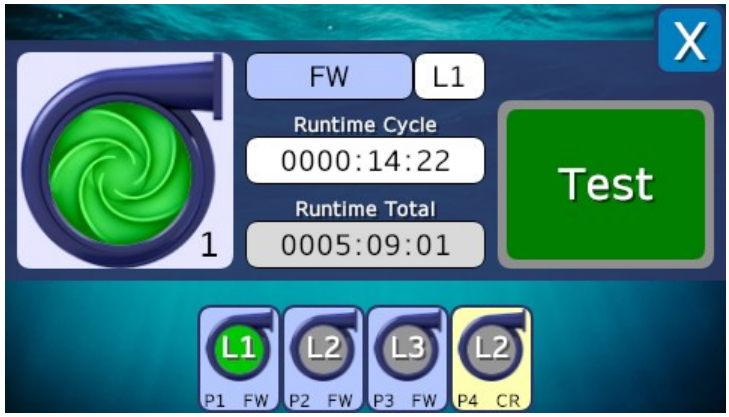
Home screen 4-inch Aqueous AWC™ 2.0

Pump Details Panel

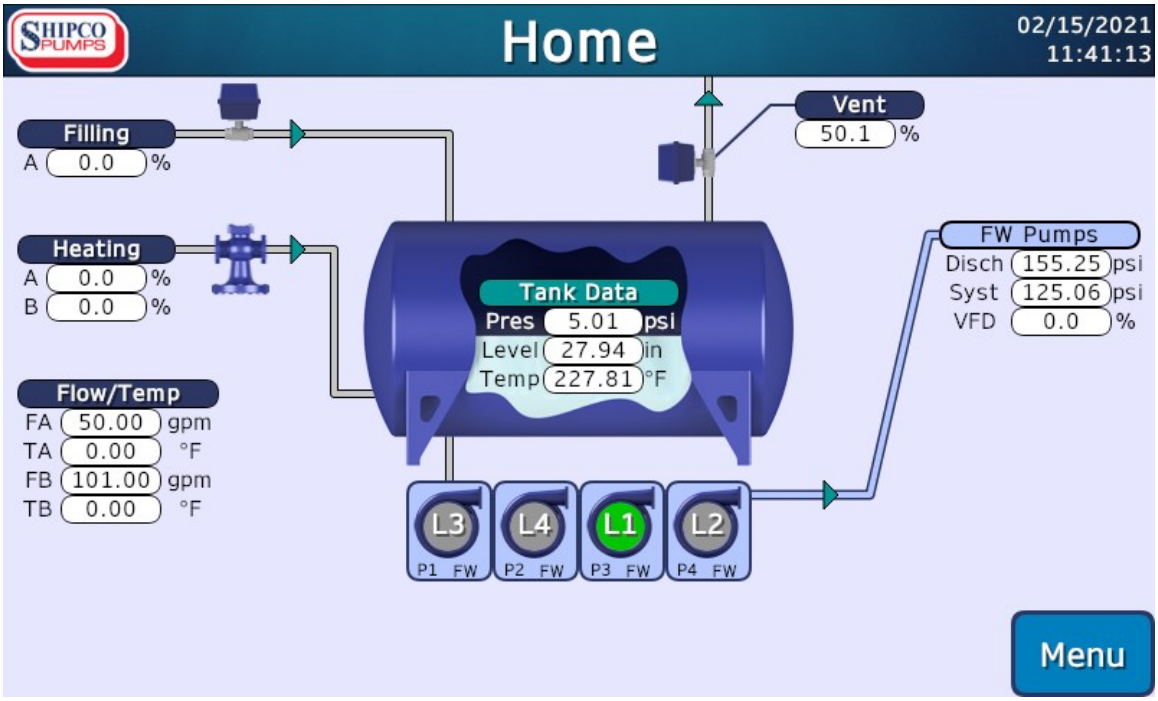
Tap any pump card to display pump runtime cycle, pump runtime total and a push-to-test button. Press and hold the "Test" button to energize the pump. Do not push-to-test if the pump is already running (green and animated). Tap any pump card to switch to a specific pump while this panel is open. Press the "X" button to dismiss the panel.



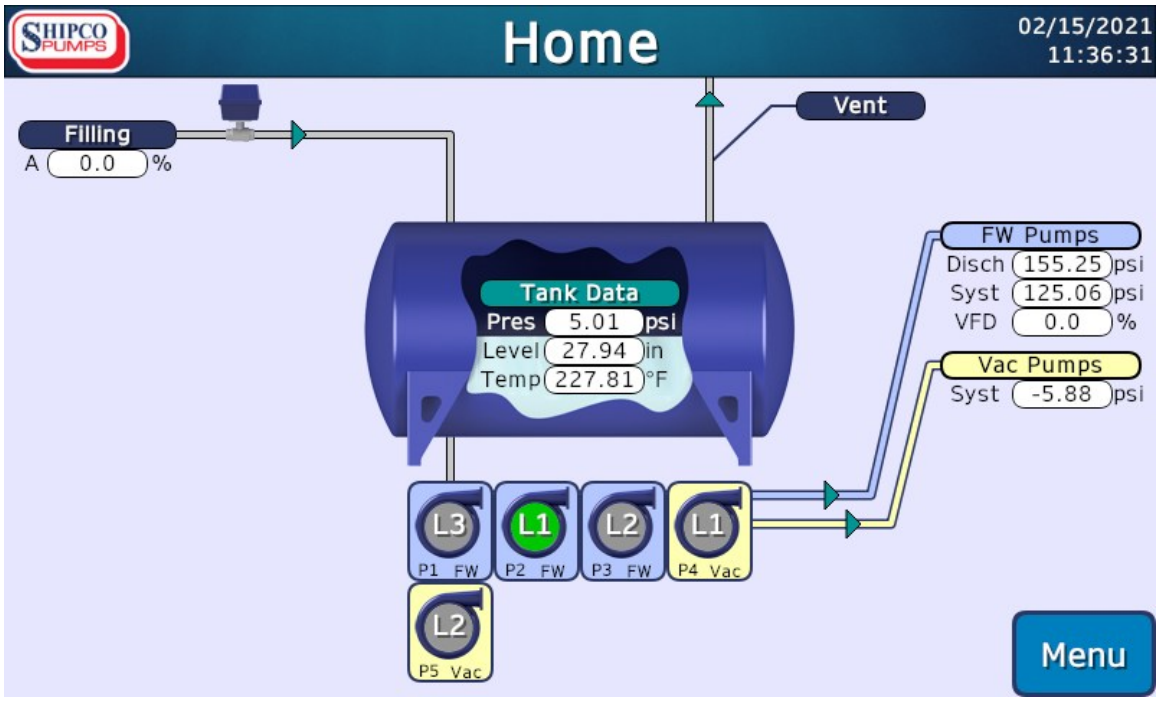
Pump details panel on 7- and 15-inch



Pump details panel on 4-inch



Example home screen of a deaerator unit.



Example home screen of a vacuum boiler feed unit.

Active Alarms

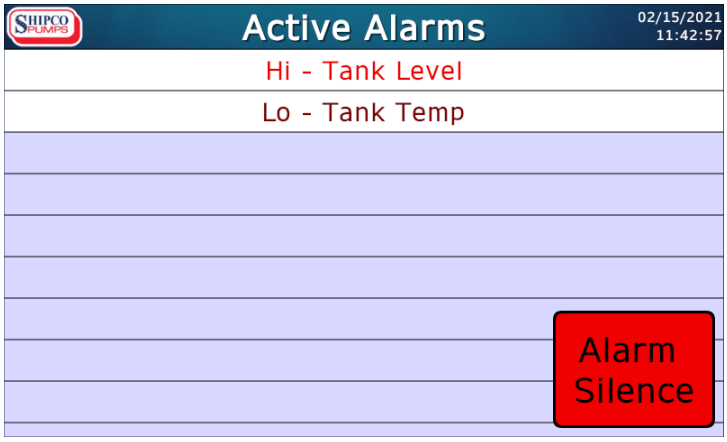
Alarms

Active Alarms on 7- and 15-inch

The *Active Alarms* screen shows a list of active alarms that are occurring in real-time. Alarm items in **bright red** are actively occurring and items in **dark red** have been silenced yet still active. Press **[Log]** to view the *Alarm Log*, a record of recent previous alarms (see page 14).

Active Alarm Pop-up

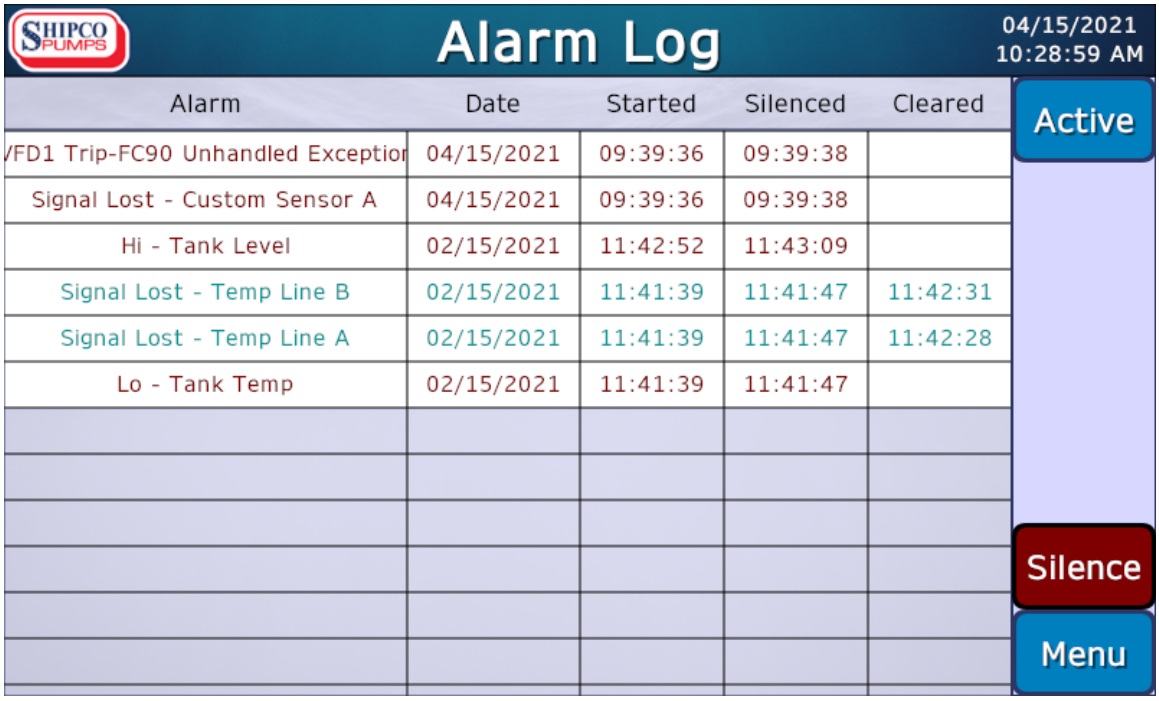
When an alarm is triggered the following alarm list pop-up screen appears. Pressing **[Alarm Silence]** dismisses the pop-up and returns to the previous screen and silences the audible alarm.



Active Alarms Popup with Alarm Silence button on 7- and 15-inch.

Alarm Log

Alarms

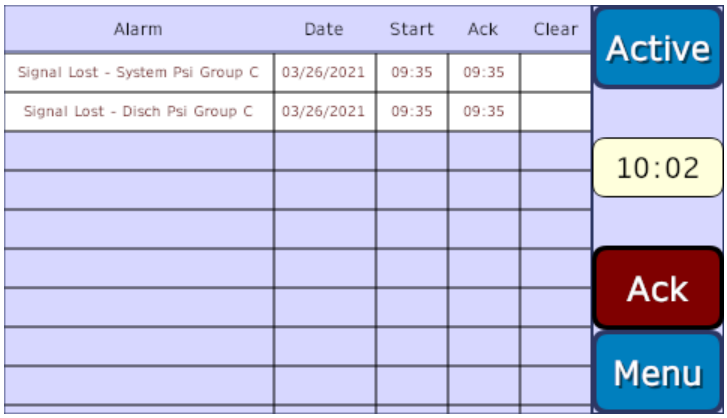


Alarms Log on 7- and 15-inch.

The Alarm Log screen shows a table of alarms that have previously occurred. Alarm items are shown with alarm description, date and time when the alarm first triggered, as well as the time it was silenced and/or cleared. Alarm items in **bright red** indicate the alarm is still actively occurring, items in **dark red** have been acknowledged and items in **light blue** have cleared.

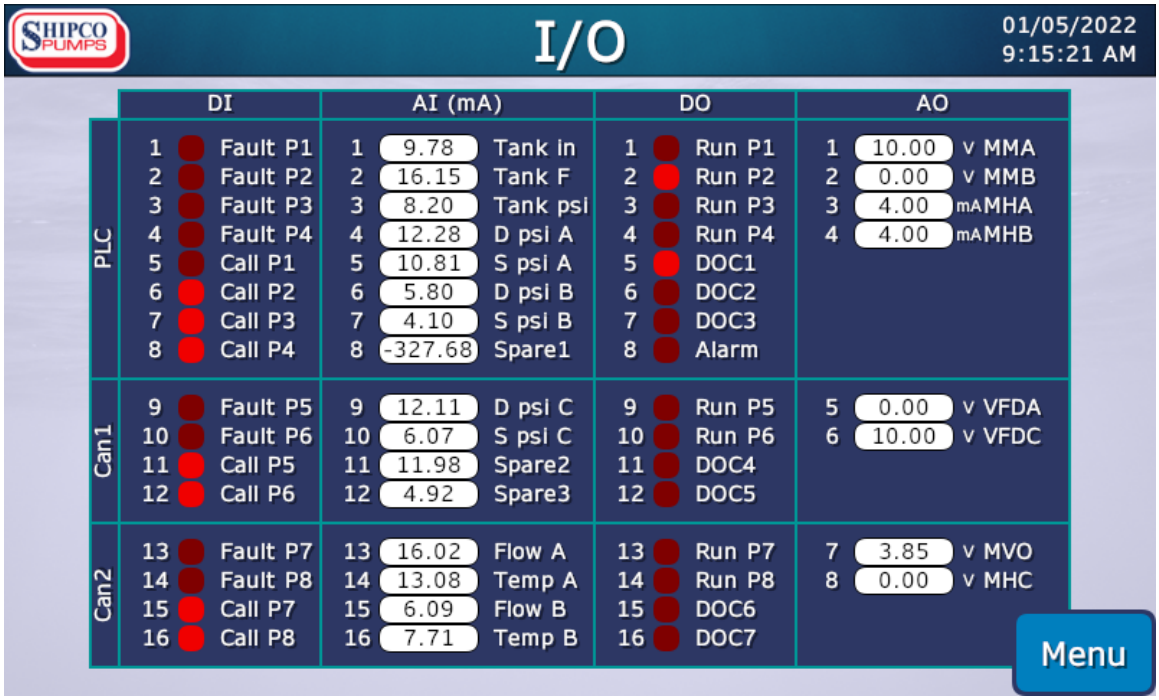
Press **[Active]** to return to the Active Alarms list.

Note: Maximum record of alarms is 255 after which the oldest alarms will be dropped from the local storage.



Alarms Log on 4-inch.

I/O (Input / Output)



I/O on 7- and 15-inch.

The I/O (input/output) screen displays all possible digital inputs (DI), analog inputs (AI), digital outputs (DO) and analog outputs (AO) across the local controller and, if present, any expansion I/O. Digital inputs and outputs are simply ON/OFF while analog inputs and outputs display the analogous sensor reading value.

Local (PLC)

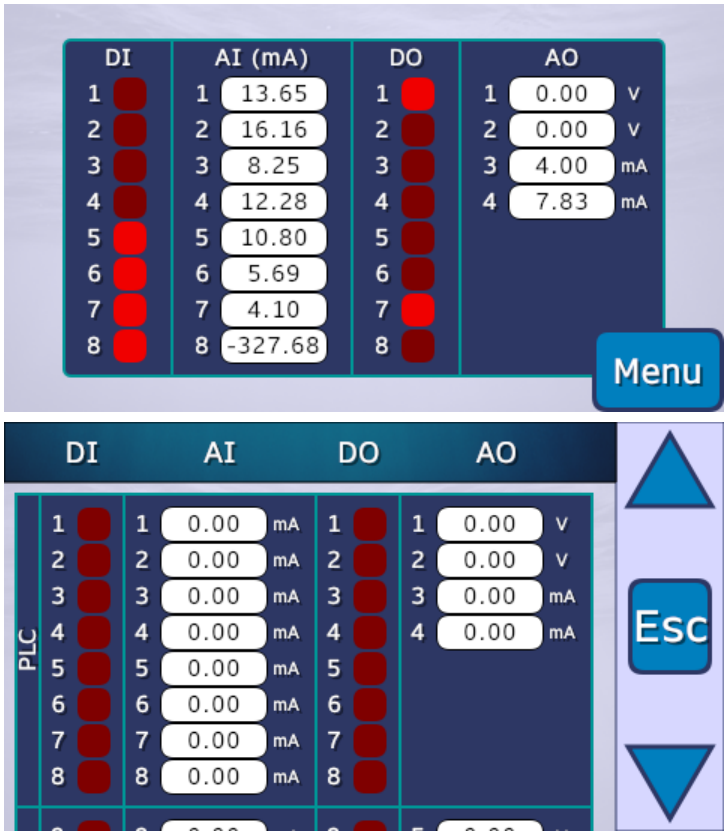
The local *Aqueous*™ controller features the following built-in I/O.

- 8 digital inputs
- 8 analog inputs
- 8 digital outputs
- 4 analog outputs

Expansion (CAN1 / CAN2)

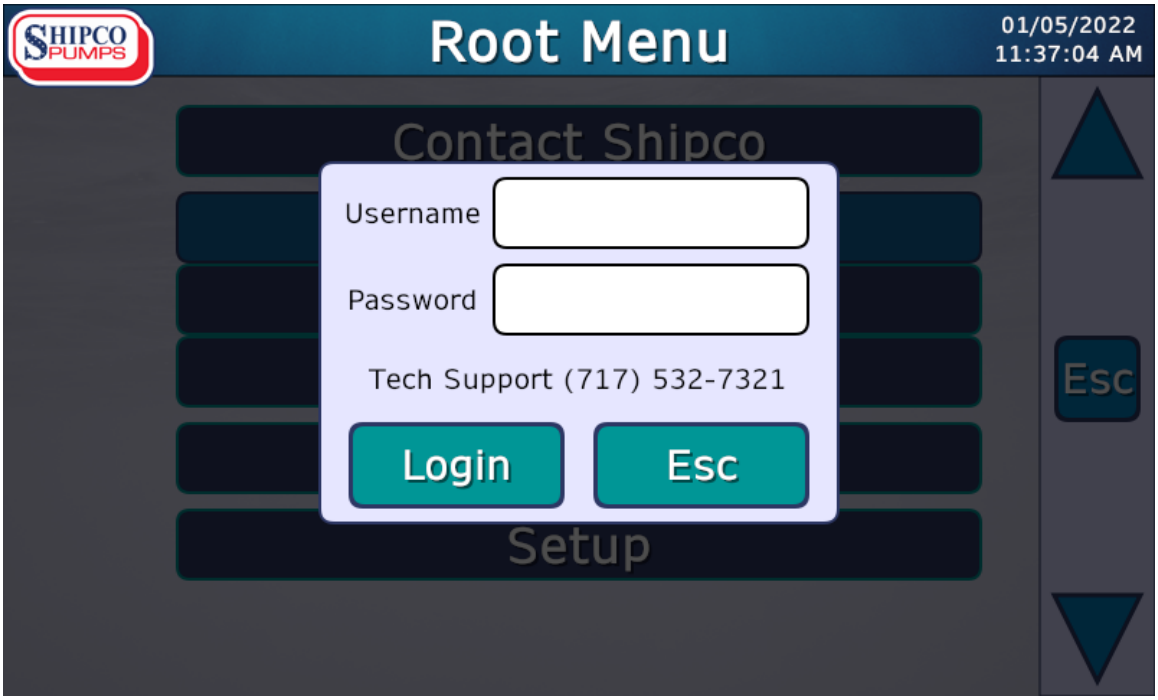
An expansion module can be added via CAN bus with the following additional I/O. Up to 2 expansion modules can be added.

- 4 digital inputs
- 4 analog inputs
- 4 digital outputs
- 2 analog outputs



I/O on 4-inch Aqueous AWC™ 2.0 (above), 2.1+ (below)

Setup Menu (Login)



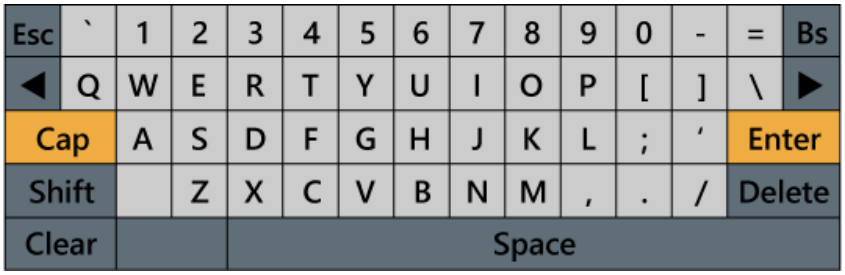
Setup is protected by a basic user name and password to prevent unintentional tampering with sensors and unit configuration. Default login credentials are:

Username: **SETUP** (*all caps*)

Password: **1234**

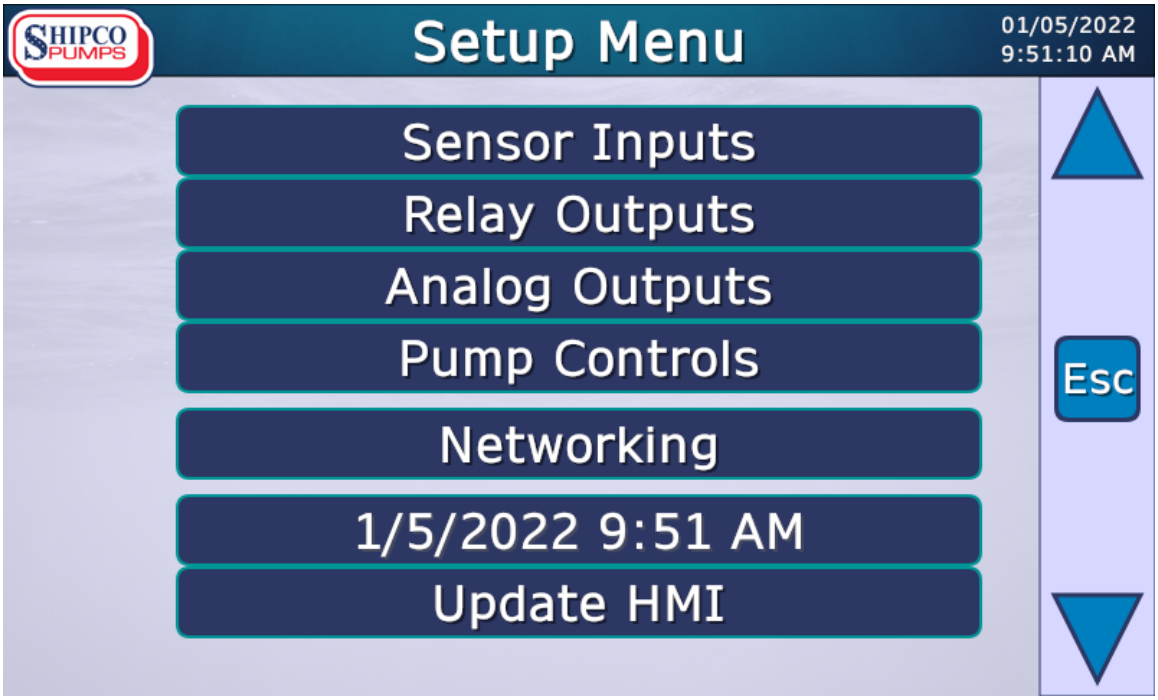
Otherwise login credentials are obtained by consulting the factory or your local service representative.

Tap inside the **[Username]** or **[Password]** fields to display the virtual keyboard. Pressing Caps Lock (***Cap***) toggles between uppercase and lowercase letters. Input the value for each field and press **[Login]** when finished or **[Esc]** to cancel. If the Username and Password are valid then the controller redirects to the Setup Menu.



Setup Menu

WARNING: Be cautious adjusting parameters in Setup! Certain parameters are factory set to design specifications and incorrectly adjusting these parameters could result in unit malfunction and/or serious equipment damage. Consult the factory before making adjustments which could affect unit operation.



Sensor Inputs (p. 19)
Configure various sensors and alarm set points.

Relay Outputs (p. 26)
Configure relay outputs (DO or digital output) contacts.

Analog Outputs (p. 28)
Configure analog outputs (AO) such as makeup, heaters, vent, etc.

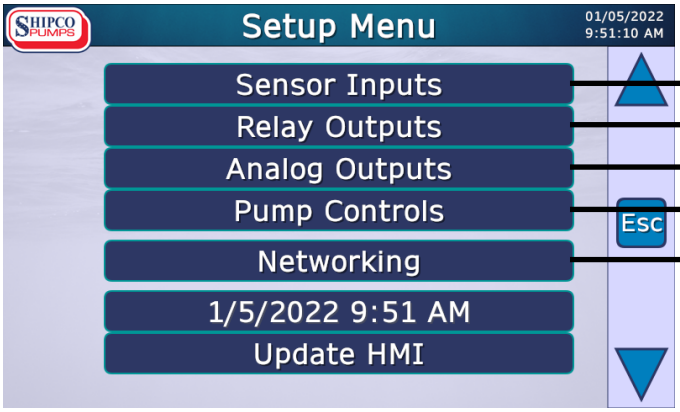
Pump Controls (p. 37)
Adjust pump controls, sequencing for pumps.

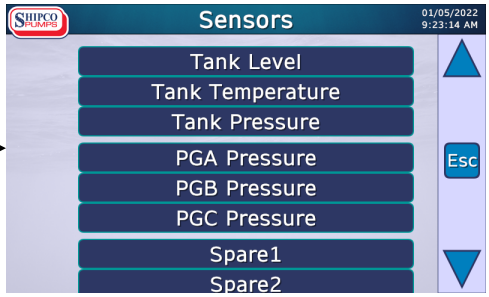
2.0 (4 in) *Separate "Pump Group A" and "Pump Group B" buttons are shown instead of "Pump Controls".*

Networking (p. 40)
Network communications for PLC Ethernet (BACnet IP and Modbus TCP), PLC Serial (BACnet MS/TP or Modbus RTU), Remote Overrides and Web Viewer.

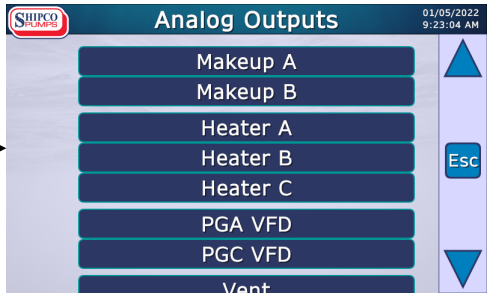
Date & Time
Adjust the controller's date and time.

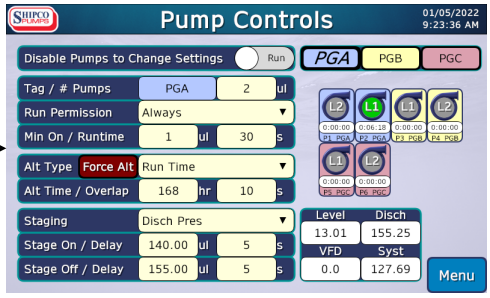
Update HMI
An option to trigger an HMI update when a USB drive containing update media is inserted into the HMI.

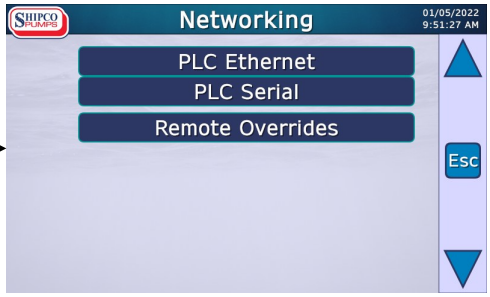

Setup Menu
01/05/2022
9:51:10 AM
Sensor Inputs
Relay Outputs
Analog Outputs
Pump Controls
Networking
1/5/2022 9:51 AM
Update HMI
Esc


Sensors
01/05/2022
9:23:14 AM
Tank Level
Tank Temperature
Tank Pressure
PGA Pressure
PGB Pressure
PGC Pressure
Spare1
Spare2
Esc

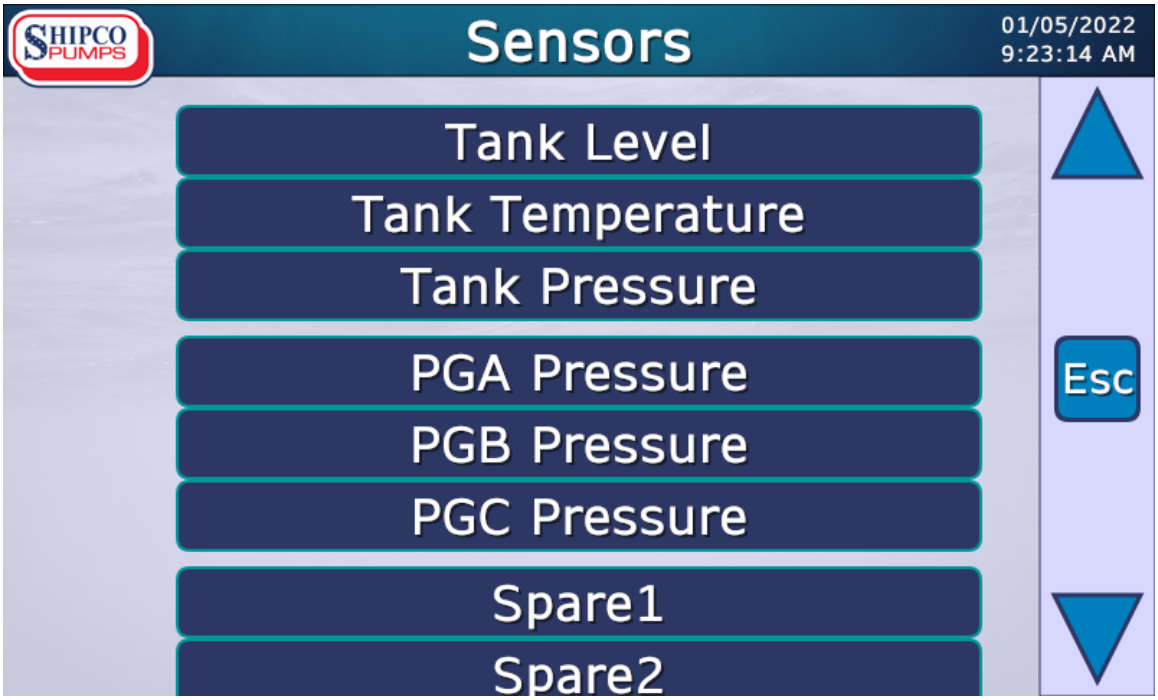

Relay Outputs
03/19/2021
10:17:44 AM
Timer:
On seconds
Off Hours
Bypass and
Chem Pump:
On/Off not
used.
Otherwise:
On/Off same
units as Type
If On > Off
Make on Rise
If Off > On
Make on Fall
1 Tag Makeup On 30.00
Type Tank Level Off 36.00
2 Tag Drain On 55.00
Type Tank Level Off 50.00
3 Tag DOC3 On 0.00
Type PGA Chem Pump Off 0.00
4 Tag DOC4 On 0.00
Type Disabled Off 0.00
Esc


Analog Outputs
01/05/2022
9:23:04 AM
Makeup A
Makeup B
Heater A
Heater B
Heater C
PGA VFD
PGC VFD
Esc


Pump Controls
01/05/2022
9:23:36 AM
Disable Pumps to Change Settings
Run
PGA
PGB
PGC
Tag / # Pumps PGA 2
Run Permission Always
Min On / Runtime 1 30
Alt Type Force Alt Run Time
Alt Time / Overlap 168 10
Staging Disch Pres
Stage On / Delay 140.00 5
Stage Off / Delay 155.00 5
Level Disch
13.01 155.25
VFD Syst
0.0 127.69
Menu


Networking
01/05/2022
9:51:27 AM
PLC Ethernet
PLC Serial
Remote Overrides
Esc

Sensors



Tank Level (p. 20)
Configuration for tank level sensor and alarm setpoints.

Tank Temperature (p. 21)
Configuration for tank temperature sensor and alarm setpoints.

Tank Pressure (p. 22)
Configuration for tank pressure sensor and alarm setpoints.

“Pump Group” Pressure (p. 23)
Configuration for pressure sensors applicable to each pump group. Menu items are labeled with corresponding pump group tag.

2.0 (4 in) Only 1 or 2 pump groups shown.

Flow/Temp (p. 24)
Configuration for additional flow and/or temperature sensors on the unit.

Custom Sensors (p. 25)
Configuration for extra or custom user-defined sensors. By default labels are “Spare1”, “Spare2”, etc.

Tank Level

Sensors

Sensor

Level (in) Current water level in the tank expressed in inches (read-only).

Signal (mA) Current 4-20 mA signal for water level sensor (read-only).

Min / Max (in) Minimum and maximum water level sensor range amount. Minimum is typically 0 inch and maximum is typically the diameter or height of the tank expressed in inches. This sensor and all alarms can be toggled **[ON]** / **[OFF]**.

Alarms

Alarm setpoints can be individually toggled **[ON]** / **[OFF]**.

Db (in) Tank water level deadband. The amount of level change that must occur before the controller releases an alarm status. Typically 1 inch.

HiHi (in) Tank water level must rise to this value before an extra-high water level (second) alarm status is triggered.

Hi (in) Tank water level must rise to this value before a high water level (first) alarm status is triggered.

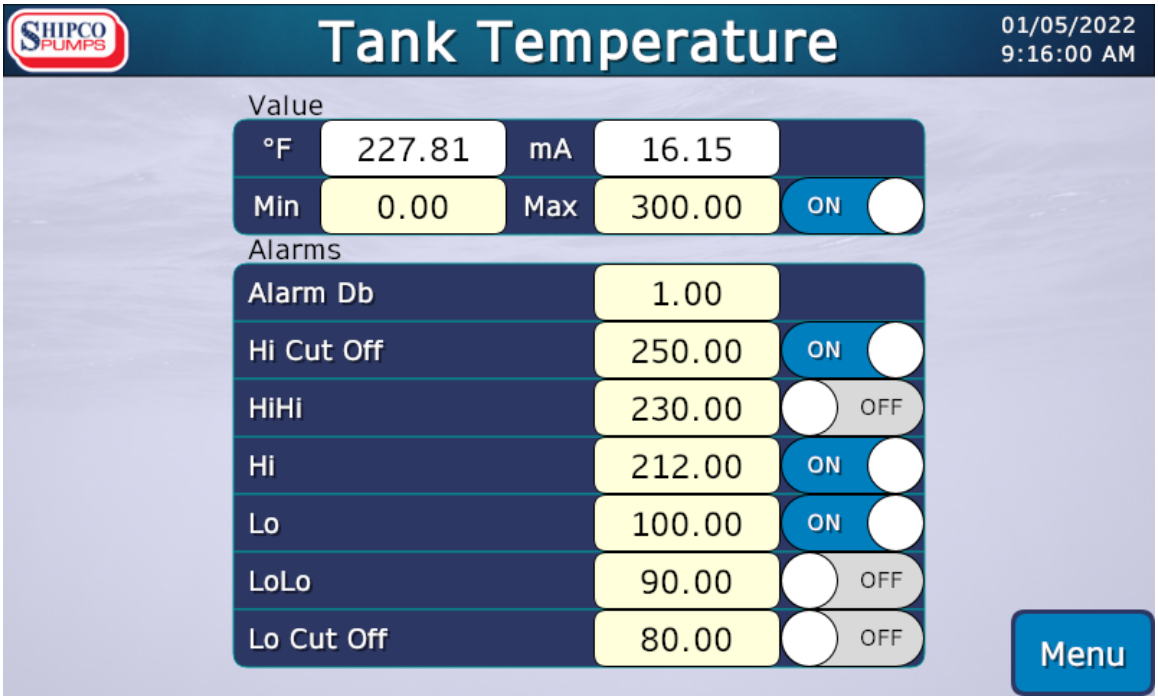
Lo (in) Tank water level must fall to this value before a low water level alarm (first) status is triggered.

LoLo (in) Tank water level must fall to this value before an extra-low water level (second) alarm status is triggered.

LCO (in) Tank water level must fall to this value before a low water level cut-off operation occurs where all pumps are shut off and alarm status is triggered.

Tank Temperature

Sensors



Sensor

Temperature (°F) Current water temperature in the tank expressed in °F (read-only).

Signal (mA) Current 4-20 mA signal for water temperature sensor (read-only).

Min / Max (°F) Minimum and maximum water temperature sensor range amount. Minimum is typically 0°F and maximum is typically 300°F. This sensor and all alarms can be toggled **[ON]** / **[OFF]**.

Alarms

Alarm setpoints can be individually toggled **[ON]** / **[OFF]**.

Db (°F) Tank water temperature deadband. The amount of temperature change that must occur before the controller releases an alarm status.

HCO (°F) Tank water temperature must rise to this value before a high water temperature cut-off operation occurs where all pumps are shut off to prevent seal damage and alarm status is triggered.

HiHi (°F) Tank water temperature must rise to this value before an extra-high water temperature (second) alarm status is triggered.

Hi (°F) Tank water temperature must rise to this value before a high water temperature (first) alarm status is triggered.

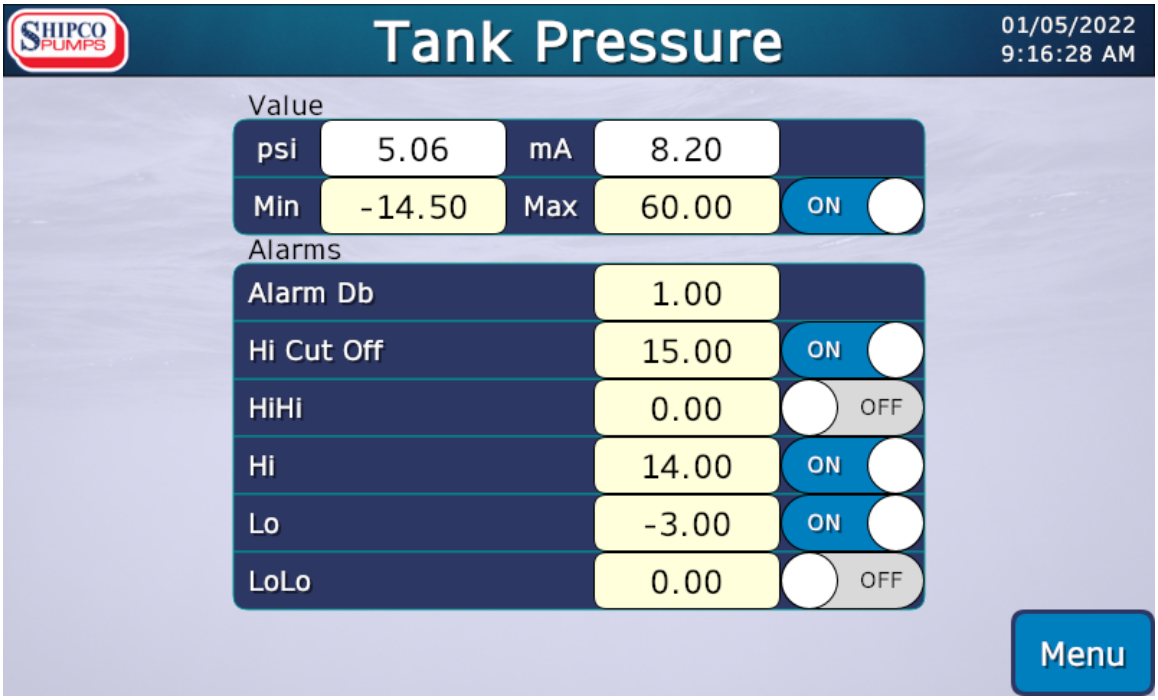
Lo (°F) Tank water temperature must fall to this value before a low water temperature alarm (first) status is triggered.

LoLo (°F) Tank water temperature must fall to this value before an extra-low water temperature (second) alarm status is triggered.

LCO (°F) Tank water temperature must fall to this value before a low water temperature cut-off operation occurs where all pumps are shut off and alarm status is triggered.

Tank Pressure

Sensors



Sensor

Pressure (psi) Current pressure in the tank expressed in psi (read-only).

Signal (mA) Current 4-20 mA signal for pressure sensor (read-only).

Min / Max (psi) Minimum and maximum tank pressure sensor range amount in the tank. Minimum is typically -14.5 psi and maximum is typically 60 psi. This sensor and all alarms can be toggled **[ON]** / **[OFF]**.

Alarms

Alarm setpoints can be individually toggled **[ON]** / **[OFF]**.

Db (psi) Tank pressure deadband. The amount of pressure change that must occur before the controller releases an alarm status. This is typically 1 psi.

HCO (psi) Tank pressure must rise to this value before a relief valve pressure alarm status is triggered.

HiHi (psi) Tank pressure must rise to this value before an extra-high tank pressure (second) alarm status is triggered.

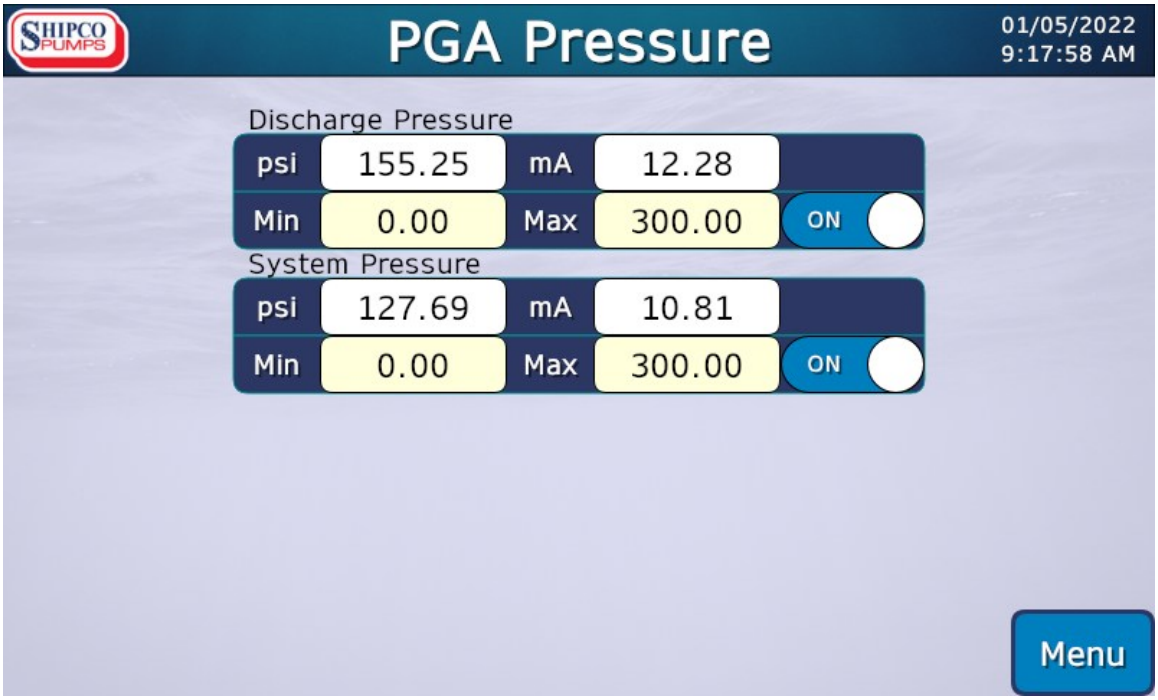
Hi (psi) Tank pressure must rise to this value before a high tank pressure (first) alarm status is triggered.

Lo (psi) Tank pressure must fall to this value before a low tank pressure alarm (first) status is triggered.

LoLo (psi) Tank pressure must fall to this value before an extra-low pressure (second) alarm status is triggered.

“Pump Group” Pressure

Sensors



Defines scaling for discharge pressure and/or system pressure sensors for a specific pump group. The defined tag label for each pump group is displayed. Refer to *Pump Controls* (p. 37) to set or rename the pump group.

Discharge Pressure

Pressure (psi) Current discharge pressure for pump group expressed in psi (read-only).

Signal (mA) Current 4-20 mA signal for discharge pressure sensor (read-only).

Min / Max (psi) Minimum and maximum discharge pressure range amount for pump group. This sensor can be toggled **[ON]** / **[OFF]**.

System Pressure

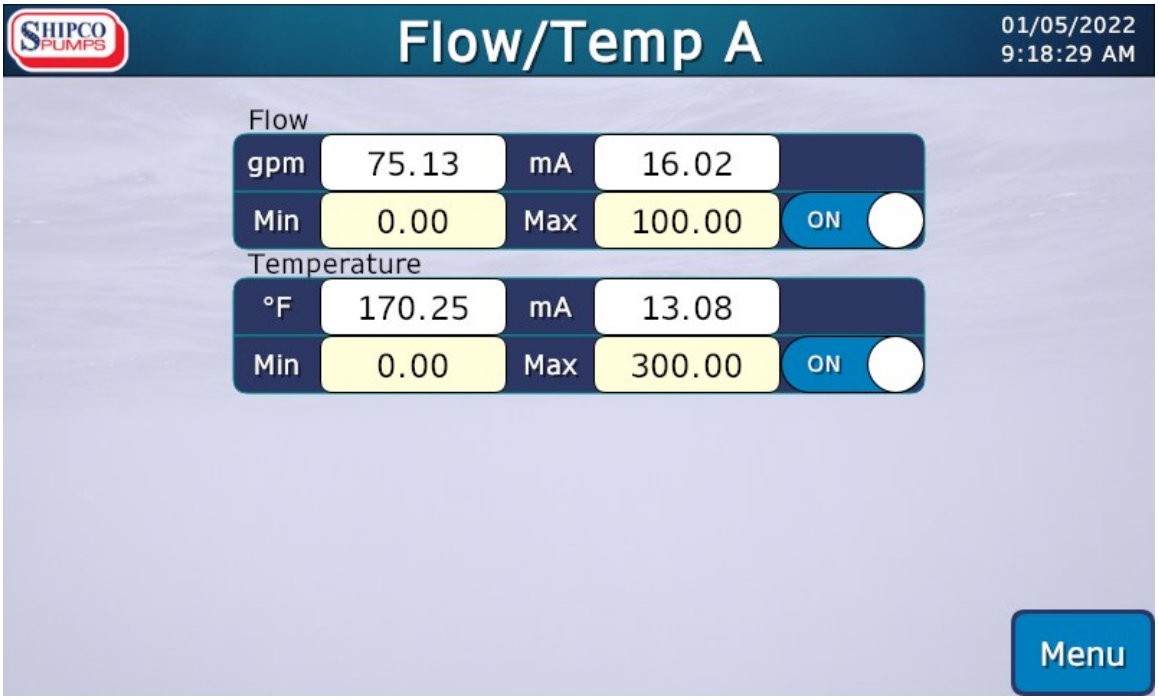
Pressure (psi) Current system pressure for pump group expressed in psi (read-only).

Signal (mA) Current 4-20 mA signal for system pressure sensor (read-only).

Min / Max (psi) Minimum and maximum system pressure range amount for pump group. This sensor be toggled **[ON]** / **[OFF]**.

Flow & Temperature

Sensors



Defines scaling for additional flow rate and temperature sensors (Flow/Temp A and Flow/Temp B, respectively known as "Line A" and "Line B", are defined on separate screens). Both Lines A and B are required when using a modulating orifice vent valve on a deaerator (see *Vent,* p. 34).

Flow Sensor

Flow (gpm) Current flow rate expressed in gallons per minute (gpm) (read-only).

Signal (mA) Current 4-20 mA signal for flow rate sensor (read-only).

Min / Max (gpm) Minimum and maximum flow rate sensor range amount. This sensor can be toggled **[ON]** / **[OFF]**.

Temperature Sensor

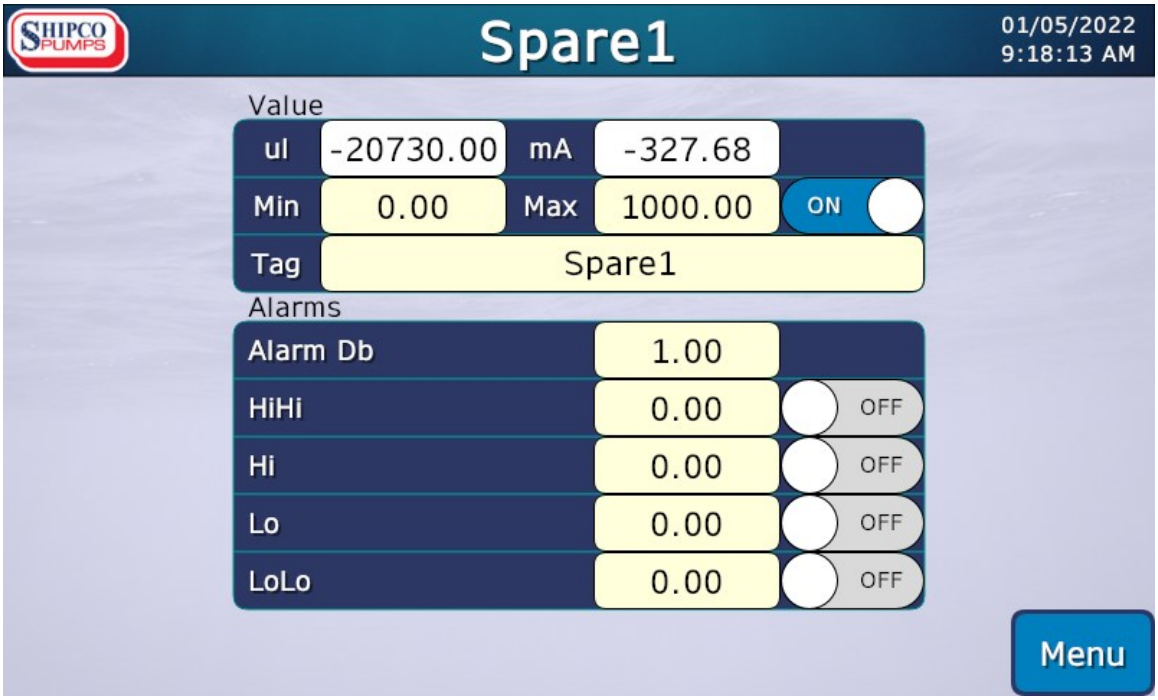
Temperature (°F) Current temperature expressed in °F (read-only).

Signal (mA) Current 4-20 mA signal for temperature sensor (read-only).

Min / Max (°F) Minimum and maximum temperature sensor range amount. This sensor can be toggled **[ON]** / **[OFF]**.

Custom

Sensors



Defines scaling and alarm set points for a custom sensor (if available). Up to 3 configurable sensors.

2.0 (4 in) Only 1 configurable sensor.

Sensor

Tag A label given to identify the custom sensor. The tag name is displayed in dropdown lists.

Value (ul) Current custom sensor value (read-only). The amount is unitless.

Signal (mA) Current 4-20 mA signal for sensor (read-only).

Min / Max (ul) Minimum and maximum custom sensor range amount. This sensor and all alarms can be toggled **[ON]** / **[OFF]**.

Alarms

Alarm setpoints can be individually toggled **[ON]** / **[OFF]**.

Db (ul) Custom sensor deadband. The amount of change that must occur before the controller releases an alarm status.

HiHi (ul) Custom sensor reading must rise to this value before an extra-high (second) alarm status is triggered.

Hi (ul) Custom sensor reading must rise to this value before a high (first) alarm status is triggered.

Lo (ul) Custom sensor reading must fall to this value before a low (first) status is triggered.

LoLo (ul) Custom sensor reading must fall to this value before an extra-low (second) alarm status is triggered.

Relay Outputs

IMPORTANT: Relays are 300V 3A rated and acceptable for use in 120VAC or 24VDC/VAC control circuits.
Certain relays such as pumps and general alarm are **already reserved** by the controller and are not configurable from this menu. Refer to *I/O* section, page 15 or *Wiring Diagram*, pages 52-53.

Relay Outputs on 7- and 15-inch

Up to 7 configurable relay outputs (also known as digital outputs or contacts) can be set for specific use in the controller. This screen is used to bind these additional relays to open/close by sensor input, timer or other circumstances.

2.0 (4 in) Only up to 3 additional relay outputs.

Tag

A label to easily identify the purpose of the relay. By default labels are “DOC1”, “DOC2”, etc.

Type

Choose a sensor, timer or special case from the **[Type]** dropdown list to bind a relay to. More information on the different contact categories is explained on the following page.

Disabled	Relay is disabled or not applicable.
Tank Level	*(Sensor).* Relay contact engaged on tank level. **[On]** and **[Off]** expressed in inches.
Tank Temp	*(Sensor).* Relay contact engaged on tank temperature. **[On]** and **[Off]** expressed in °F.
Tank Pres	*(Sensor).* Relay contact engaged on tank pressure. **[On]** and **[Off]** expressed in psi.
“Spare” (Custom)	*(Sensor).* Custom sensor label is shown here. Relay contact engaged on custom sensor where **[On]** and **[Off]** expressed as the unit of measure for the sensor. Refer to *Custom Sensors* setup, page 25.
Timer	*(Timer).* Relay contact closes for **[On]** seconds every **[Off]** hours. Typically used for blowdown solenoids.
PG(A|B|C) Bypass	*(Bypass).* Relay contacts used for bypass recirculation pumps per pump group.
PG(A|B|C) Chem	*(Chemical Feed Pump).* Relay contacts used when chemical feed pumps are present per pump group.

Sensor

The *Sensor* types engage relay contacts within a specified range based on the input from the chosen sensor. For *Sensor* types, the units of **[On]** and **[Off]** inherit the units of measure for the chosen sensor. Configuration is as follows:

If the [On] value > [Off] value, then *make on rise*.

If the [Off] value > [On] value, then *make on fall*.

For a "*make on rise*" example, a relay contact controlling an overflow drain solenoid valve is closed when the level of water rises to the **[On]** value of 55 inches, opening the drain valve and discharging water from the tank. When the level falls to the **[Off]** value of 50 inches, the relay contact is opened and the drain valve closes.

For a "*make on fall*" example, a relay contact controlling a makeup solenoid valve is closed when the level of water falls to the **[On]** value of 30 inches, opening the solenoid and allowing water into the tank. When the level rises to the **[Off]** value of 36 inches, the relay contact is open and the solenoid closes.

Timer

[On] is expressed in *seconds*.

[Off] is expressed in *hours*.

The *Timer* type is used to close relay contacts on a recurring interval. **[On]** is the amount of time in seconds that the relay contact remains closed. **[Off]** is the amount of time in hours that the relay contact spends open (waiting) before it is closed again.

For example, a relay contact controlling a valve for blowdown operation is opened every 6 hours and remains open for exactly 30 seconds then closes again and the cycle repeats. The **[Off]** value is 6; the number of hours to wait. The **[On]** value is 30; the number of seconds the relay contact stays closed with the valve open.

Bypass

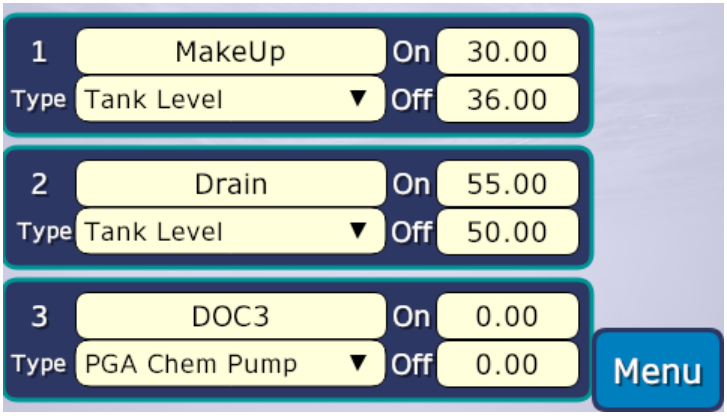
The corresponding [On] and [Off] values are not used.

A *Bypass* type relay closes when the number of pumps on equals the minimum number of pumps within the pump group (see the **[Min On]** setting within the applicable pump group under *Pump Controls*, page 38). This is typically a minimum flow recirculation solenoid, piped off the discharge header and back to the receiver. If the number of pumps on is greater than **[Min On]**, then the system demand is greater than the minimum flow rate for continuous run pumps and the relay opens; closing the recirculation solenoid.

Chemical Feed Pump

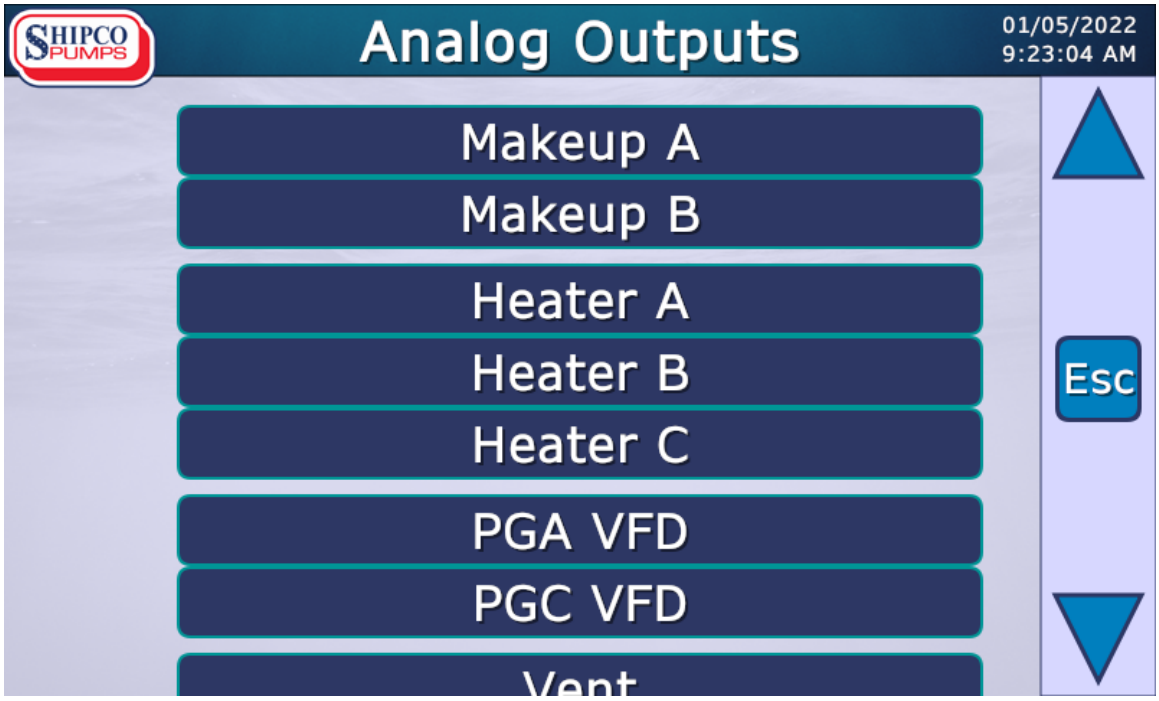
The corresponding [On] and [Off] values are not used.

A *Chemical Feed Pump* type is powered when any number of pumps are running within the pump group. This is an end switch to notify the chemical system that water is actively moving through the pumping system.



Relay Outputs on 4-inch

Analog Outputs



Analog outputs are used to adjust actuating valves, equipment and/or drives and how they react to sensor input changes. Examples include modulating makeup valves, regulators that release steam (heaters), variable frequency drives (VFDs) controlling pump motors, etc.

The options displayed on this screen vary depending on the installed equipment on the unit.

Note: Some 2-10V actuators will register 20% output (2V) as 0 and 0% output as a loss of signal.

Makeup (p. 30)

Configuration for 1 or 2 modulating makeup valves. A makeup feed valve will modulate to increase or decrease the flow of makeup water into the tank.

Heater (p. 31)

Configuration for up to 3 steam regulator valves. A steam regulator will modulate to increase or decrease the flow of steam into the tank.

“Pump Group” VFD (p. 32)

Configuration for variable frequency drives (VFDs) applicable to a pump group. Menu items are prefixed with corresponding pump group tag followed by “VFD”. VFDs variably speed up or slow down the motor .

Vent (p. 34)

Configuration of a variable vent valve which throttles deaerator vent capacity to the live deaerator load.

Custom Analog Outputs (p. 35)

For any additional equipment not explicitly defined or commonly used on a unit and which utilizes an analog output on the controller. Up to 2 custom analog outputs can be assigned a control type. May be initially shown as “AOC1” or “AOC2”.

Linear Control Information

Linear control maintains a ratio within a provided minimum and maximum range.

$$CV = \frac{PV - Min}{Max - Min}$$

CV = Control Variable (or "Output", what changes)

PV = Process Variable (or "Actual", what is monitored)

Min = Minimum user defined value

Max = Maximum user defined value

$$\text{if } PV > Max, CV = 100\%$$
$$\text{if } PV < Min, CV = 0\%$$

PID Control Information

PID control maintains a set point. PID stands for Proportional–Integral–Derivative and is a control loop feedback mechanism for applications requiring continuous modulating control.

CV = Control Variable (or "Output", what changes)

PV = Process Variable (or "Actual", what is monitored)

SP = Set Point (or target value, what the PV should be)

e = "error" (how far off the PV is from the target)

P, I and **D** = coefficients for the proportional, integral, and derivative

$$CV = P\left(e + \int_0^I e dI + \frac{e de}{dD}\right)$$

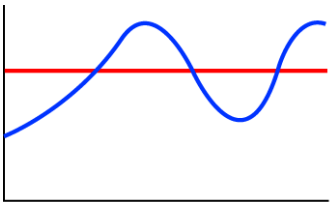
$$e = (SP - PV)$$

PID Tuning Example

1. Set **P**, **I** and **D** coefficients = 0. **D** typically remains 0.

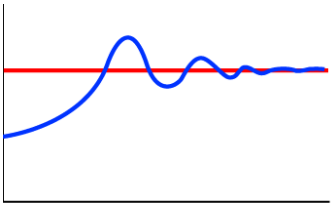
CV will not change

2. Increase **P** value for a small overshoot.



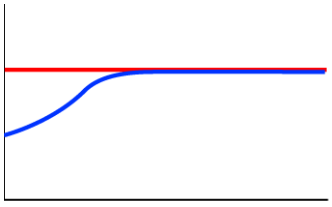
P↑ I = 0

3. Increase **I** value to reduce bounce or hunting.



P↑ I↓

Fast response

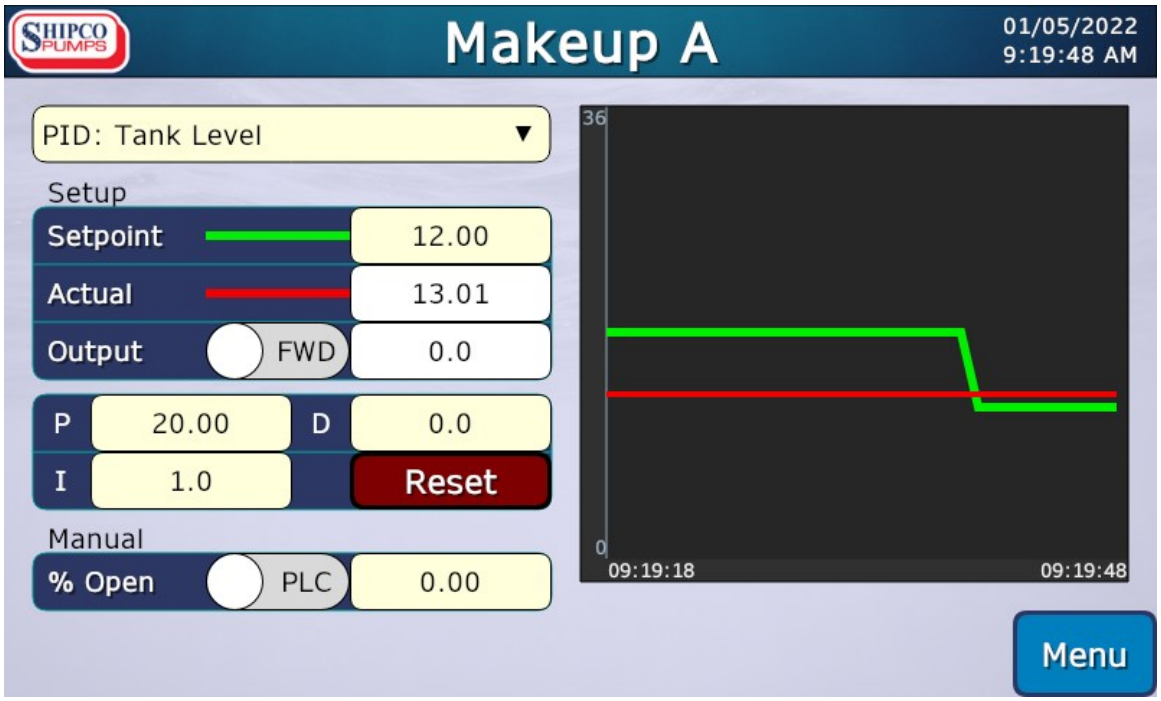


P↓ I↑

No overshoot

Makeup

Analog Outputs



Control Type

For modulating makeup valves A & B, if present, choose a control method from the **[Control Type]** dropdown list.

Disabled Makeup valve control is disabled or not applicable.

PID: Tank Level Makeup valve modulates to maintain a tank level set point **[Setpoint]** (inch).

Additionally shown are the read-only variables ***Actual (PV)*** process (actual, what is monitored) and ***Output (CV)*** control (what changes). Toggle the **[FWD]** / **[REV]** switch if the control type is reverse-acting (e.g., normally open instead of normally closed).

The values for PID control — proportional (%), integral (repetitions per second), derivative (seconds) — can be adjusted via respective **[P]**, **[I]** and **[D]** fields (advanced users only). Press **[Reset]** to reset these values to factory defaults.

Graph

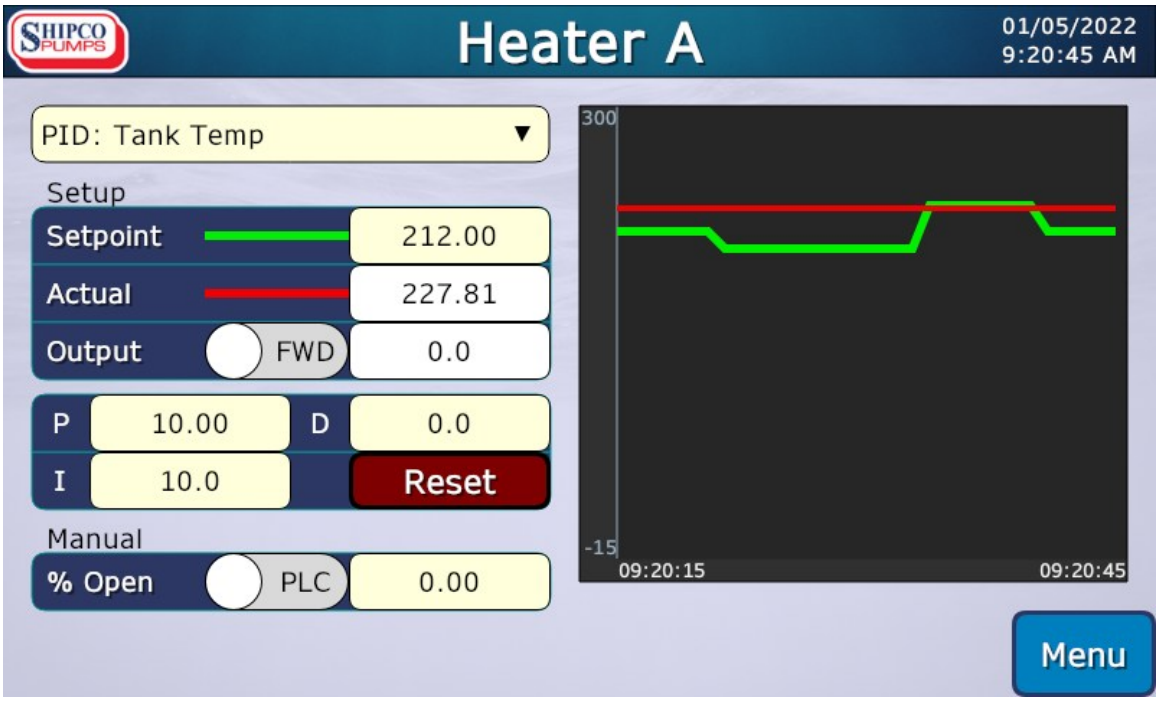
The graph displays the target **[Setpoint]** versus ***Actual (PV)*** changes over a brief period of time. Ideally the actual would closely match the target.

Manual

Manual is shown when a control type (except Disabled) is chosen. Manual % allows the user to take manual control of the modulating makeup valve. Enter a percentage **[%]** which the valve is to open between 0 (full closed) and 100 (full open), then toggle the **[PLC]** / **[MAN]** switch to disable or enable manual control.

Heaters

Analog Outputs



Control Type

For steam regulator valves A, B & C, if present, choose a control method from the **[Control Type]** dropdown list.

Disabled	Steam regulator control is disabled or not applicable.
PID: Tank Temp	Steam regulator modulates to maintain a tank temperature set point **[Setpoint]** (°F). Typically used on atmospheric applications.
PID: Tank Pres	Steam regulator modulates to maintain a tank pressure set point **[Setpoint]** (psi). Typically used on pressurized applications.
PID: Spare# Temp Limit	Steam regulator modulates to maintain pressure set point **[Setpoint]** (psi) within a sparge tube and uses ON/OFF temperature limits. Typically used on atmospheric applications with sparge tube pressure wired into a “Spare#” input.

Additionally shown are the read-only variables ***Actual (PV)*** process (actual, what is monitored) and ***Output (CV)*** control (what changes). Toggle the **[FWD]** / **[REV]** switch if the valve is reverse-acting (e.g., normally open instead of normally closed).

The values for PID control — proportional (%), integral (repetitions per second), derivative (seconds) — can be adjusted via respective **[P]**, **[I]** and **[D]** fields (advanced users only). Press **[Reset]** to reset these values to factory defaults.

Graph

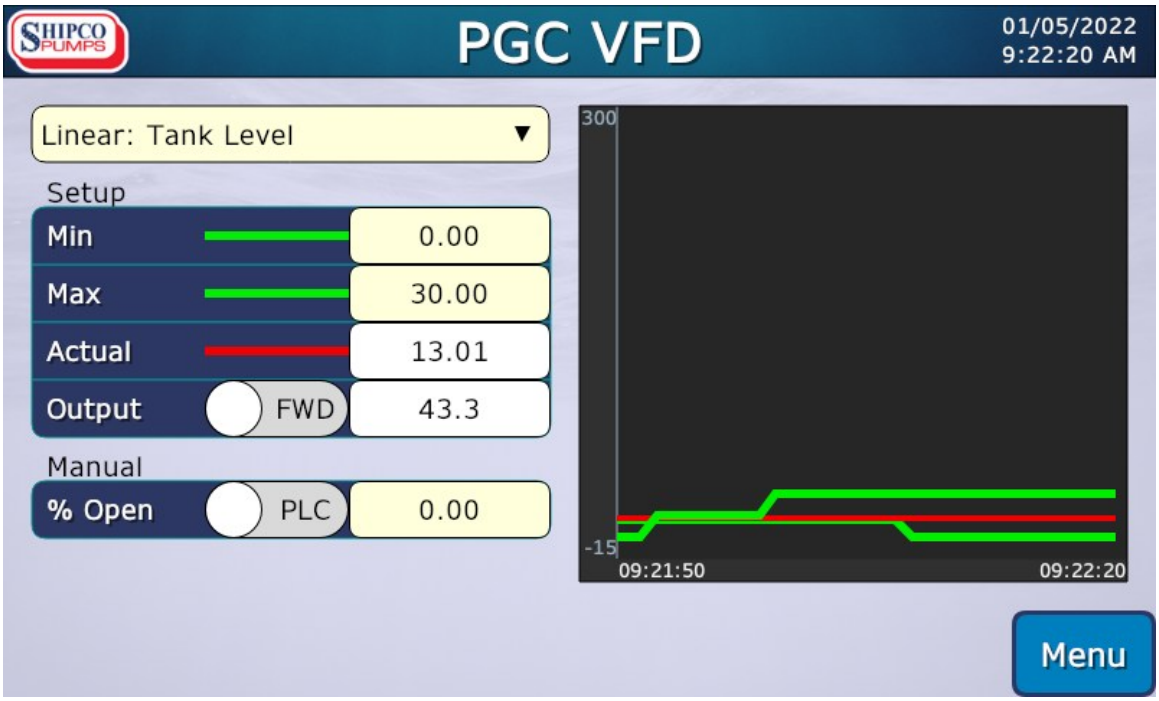
The graph displays the target **[Setpoint]** versus ***Actual (PV)*** changes over a brief period of time. Ideally the actual would closely match the target.

Manual

Manual is shown when a control type (except Disabled) is chosen. Manual % allows the user to take manual control of the steam regulator valve. Enter a percentage **[%]** which the valve is to open between 0 (full closed) and 100 (full open), then toggle the **[PLC]** / **[MAN]** switch to disable or enable manual control.

"Pump Group" VFDs

Analog Outputs



Example of a linear control type.

Control Type

For variable frequency drives (VFDs) on a specific pump group, if present, choose a control method from the **[Control Type]** dropdown list.

Disabled VFDs are disabled or not applicable.

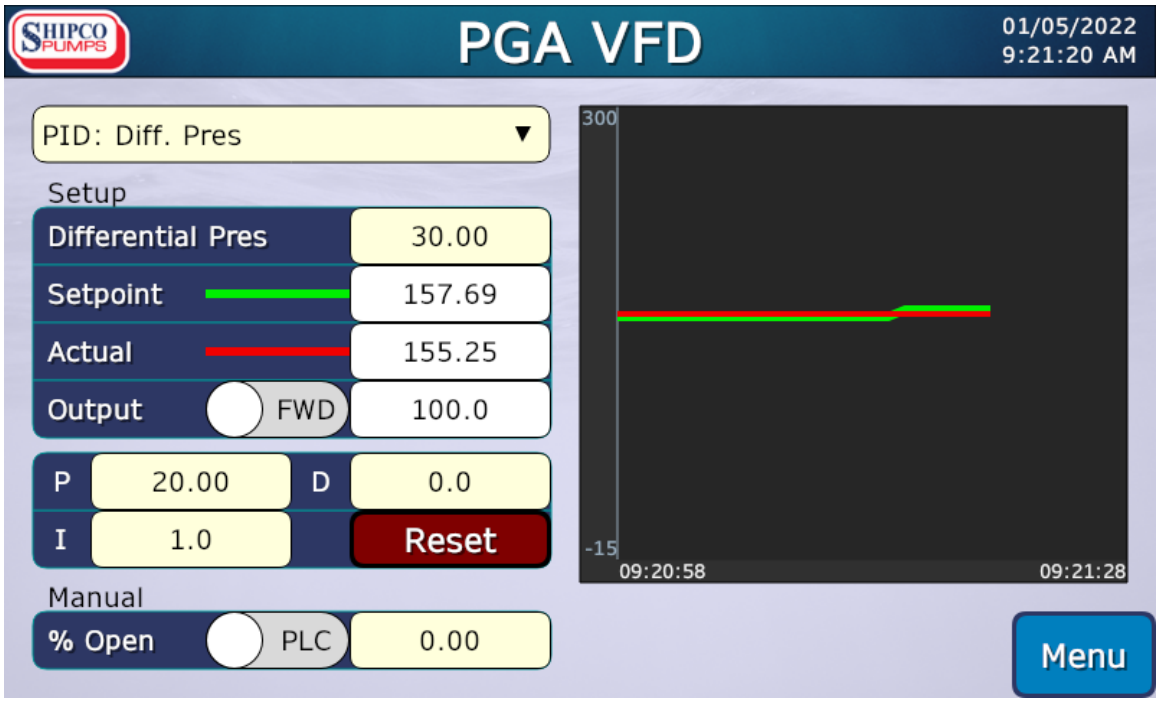
Linear: Tank Level VFDs modulate to maintain a ratio between minimum **[Min]** (inch) and maximum **[Max]** (inch) level range. This control type is typically used on condensate units to dampen water hammer.

Linear: Syst Pres VFDs modulate to maintain a ratio between minimum **[Min]** (psi) and maximum **[Max]** (psi) pressure range. This control type is typically used on boiler feed units without a modulated feed valve where system pressure is measured in the steam header to limit discharge pressure based on downstream boiler pressure.

PID: Tank Level VFDs modulate to maintain a tank level set point **[Setpoint]** (inch). This control type is typically used on high-temperature, pressurized condensate units to maintain a water seal and limit flashing.

PID: Disch Pres VFDs modulate to maintain a discharge pressure set point **[Setpoint]** (psi). This control type is typically used on transfer pumps to limit pump flow rate (gallons per minute) based on a variable demand (modulated valve).

PID: Syst Pres VFDs modulate to maintain a system pressure set point **[Setpoint]** (psi). This control type is typically used on vacuum units where the system pressure is measured in the condensate return line to maintain a consistent vacuum by changing the volumetric flow (cubic feet per minute or CFM) of the vacuum pumps.



Example of a PID control type.

PID: Diff. Pres VFDs modulate to maintain a differential pressure set point (psi). This control type is typically used on boiler feed units with a modulated feed valve where system pressure is measured in the steam header. This control type has the highest possible turndown based on the boiler water consumption and operating pressure to overcome.

[Differential Pres] was introduced in place of **[Setpoint]** since the differential influences the Setpoint.

Additionally shown are the read-only variables ***Actual (PV)*** process (actual, what is monitored) and ***Output (CV)*** control (what changes). Toggle the **[FWD] / [REV]** switch if the VFD is reverse-acting.

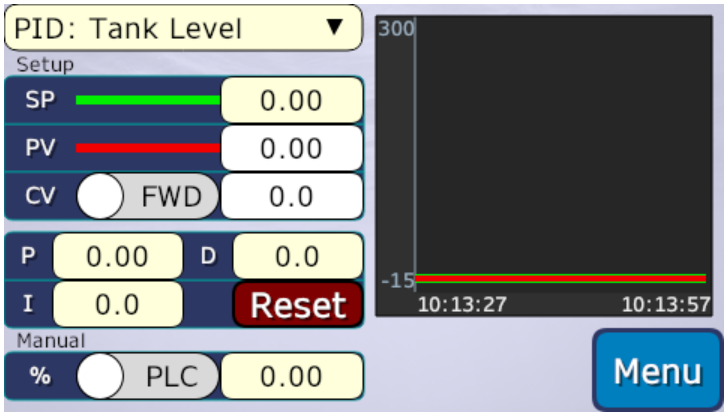
The values for PID control — proportional (%), integral (repetitions per second), derivative (seconds) — can be adjusted via respective **[P]**, **[I]** and **[D]** fields (advanced users only). Press **[Reset]** to reset these values to factory defaults.

Graph

When the control type is a Linear selection, the graph shows the ***Actual (PV)*** with the minimum **[Min]** and maximum **[Max]**. The actual will fluctuate between the minimum and maximum. When the control type is a PID selection, the graph displays the target **[Setpoint]** versus ***Actual (PV)*** changes over a brief period of time. Ideally the actual would closely match the target.

Manual

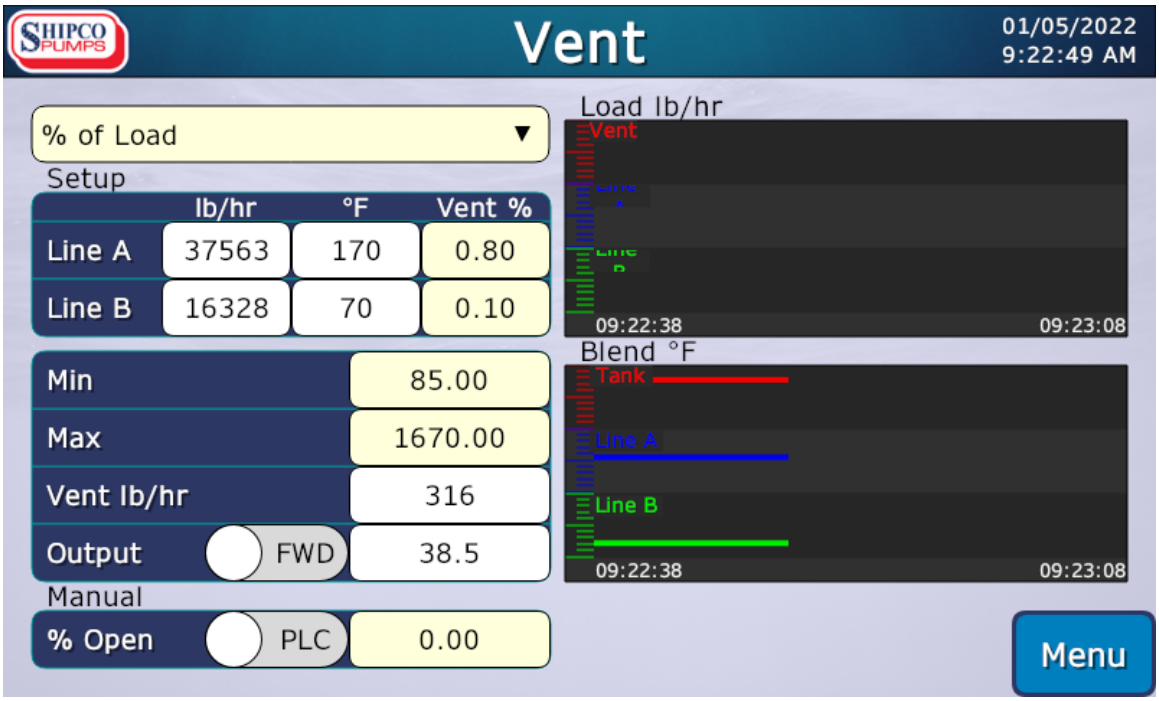
Manual is shown when a control type (except Disabled) is chosen. Manual % allows the user to take manual control of the VFD speed. Enter a percentage **[%]** which the VFD is to run between 0 (no speed) and 100 (full speed), then toggle the **[PLC]** / **[MAN]** switch to disable or enable manual control.



Analog Outputs on 4-inch

Vent

Analog Outputs



Used to configure a calibrated modulating vent valve for use with deaerator applications to limit steam loss based on live load. Requires additional flow rate and temperature sensors to be installed (see *Flow & Temperature*, p. 24).

Control Type

For vent, if present, choose a control method from the **[Control Type]** dropdown list.

Disabled Vent control is disabled or not applicable.

% of Load Sets the vent to react to changes in load.

Both Line A (LA) and Line B (LB) have their corresponding flow load expressed in pounds-per-hour (***lb/hr***) and temperature (***°F***) displayed for each line. Industry standard fixed vent orifices are sized between 0.1–0.5% of nominal deaerator capacity. This sequence modulates a linear control valve to throttle venting for live loads. **[Vent %]** can be adjusted for 2 independent flow measurements in order to account for higher oxygen contents in cold makeup versus hot condensate returns.

Vent Scale **[Min]** and **[Max]** are dependent on vent valve capacity and preset by the factory. These values **should not** be changed without first consulting the factory! The load amount being vented is shown as ***Vent lb/hr***.

Additionally shown are the read-only ***Output (CV)*** control variable (what changes). Toggle the **[FWD]** / **[REV]** switch if the vent is reverse-acting (e.g., normally open instead of normally closed).

Manual

Manual is shown when a control type (except Disabled) is chosen. Manual % allows the user to take manual control of the vent. Enter a percentage **[%]** which the vent is to open between 0 (full closed) and 100 (full open), then toggle the **[PLC]** / **[MAN]** switch to disable or enable manual control. **IMPORTANT:** In case of emergency pressure vessels can be quickly vented by toggling manual and setting to 100%.

Custom

Analog Outputs

The *Aqueous* controller supports assigning custom analog outputs to react to changes based on a chosen sensor input and also how the analog should react to that sensor input. This allows for possibilities of specialized equipment or adding custom equipment later without re-programming the controller.

Tag

A label to easily identify the purpose of the custom analog output. By default labels are “AOC1”, “AOC2”, etc.

Type

Choose a control method for the custom analog output from the **[Type]** dropdown list.

Disabled	Custom analog output is disabled or not applicable.
Linear	Custom analog output reacts to changes based on an inclusive minimum **[Min]** and maximum **[Max]** range.
PID	Custom analog output modulates to maintain a set point **[Setpoint]** .

Reference (PV)

Select the process value sensor to complete the feedback loop.

Tank Level	Reacts to changes in tank level.
Tank Temp	Reacts to changes in tank temperature.
Tank Pres	Reacts to changes in tank pressure.
“Spare” (Custom)	Custom sensor label is shown here. Reacts to changes in custom defined sensor input. Refer to *Custom Sensors* setup, page 25.

Discharge (A|B|C)	Custom analog output reacts to changes in pump group discharge pressure.
System (A|B|C)	Custom analog output reacts to changes in pump group system pressure.
Differential (A|B|C)	Custom analog output reacts to changes in pump group differential pressure.

Additionally shown are the read-only variables ***Actual (PV)*** process (what is monitored) and ***Output (CV)*** control (what changes). Toggle the **[FWD]** / **[REV]** switch if the equipment is reverse-acting.

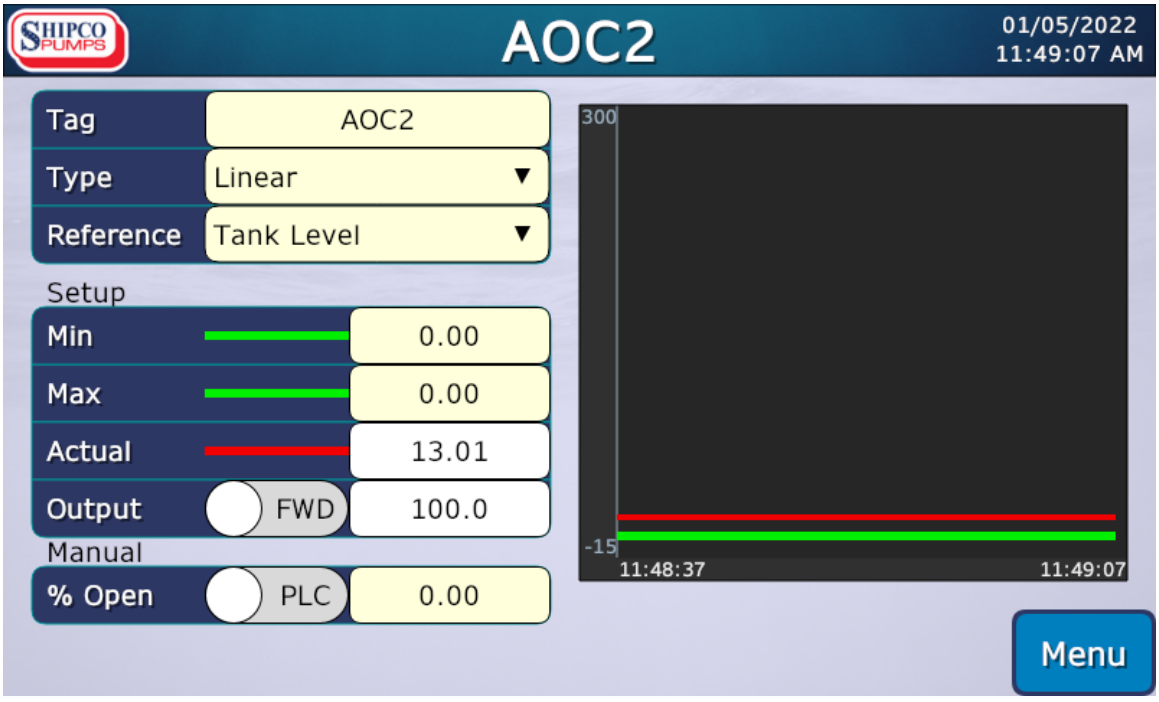
The values for PID control — proportional (%), integral (repetitions per second), derivative (seconds) — can be adjusted via respective **[P]**, **[I]** and **[D]** fields (advanced users only). Press **[Reset]** to reset these values to factory defaults.

Graph

When the control type is a Linear selection, the graph shows the current ***Actual (PV)*** with the minimum **[Min]** and maximum **[Max]**. The current will fluctuate between the minimum and maximum. When the control type is a PID selection, the graph displays the target **[Setpoint]** versus current ***Actual (PV)*** changes over a brief period of time. Ideally the current would closely match the target.

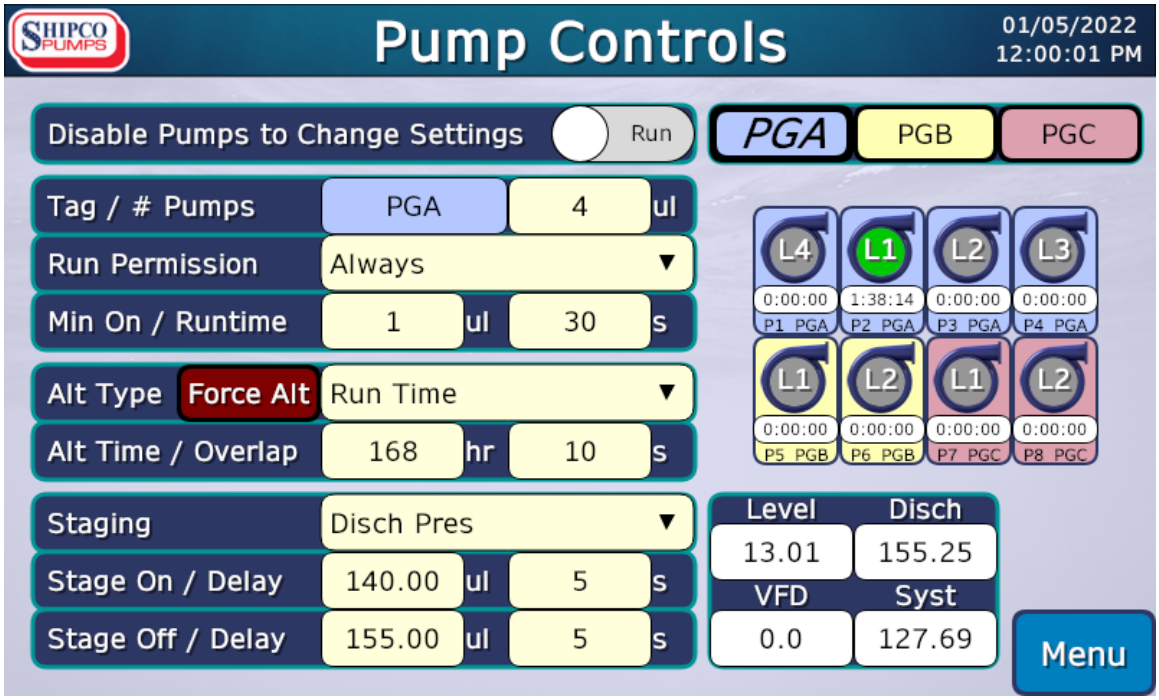
Manual

Manual is shown when a control type (except Disabled) is chosen. Manual % allows the user to take manual control of the equipment. Enter a percentage **[%]** which the equipment is to module to between 0 and 100, then toggle the **[PLC]** / **[MAN]** switch to disable or enable manual control.



Pump Controls

(or Pump Group A / B)



Pump Controls screen on 7- and 15-inch

Groups

Pumps that are grouped will alternate and stage together as a set. There are three available groups of pump settings so that multiple pumps can operate under different control paradigms. The total number of pumps **[No. Pumps]** between all groups cannot exceed 8 pumps. Discharge pressure (**Disch**), System pressure (**Syst**) and variable frequency drive speed % (**VFD**) are specific to each group.

Note: *You will need to choose a Group first to display and interact with the following group options.*

Disable Pumps to Change Settings

Pump settings cannot be changed while pump group is in **[Run]** mode. Switch setting to **[Config]** to disable all pumps within a pump group to make adjustments. Return setting to **[Run]** mode when finished.

Tag

Assigns a label to the pump group (maximum 4 characters).

2.0 (4 in) *Tag is labeled as Pump Group A and Pump Group B respectively.*

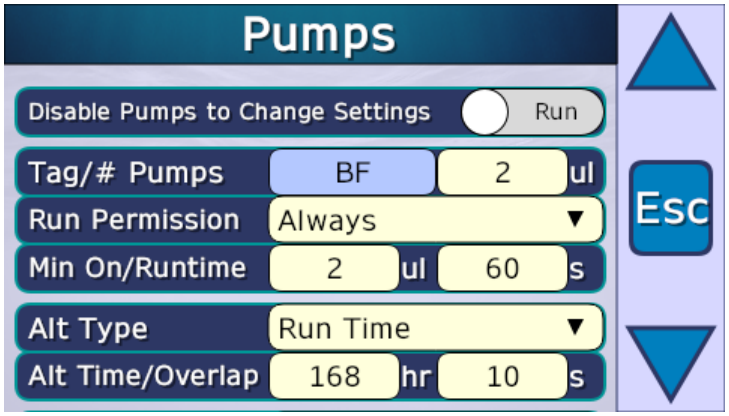
Force Alt *(Force Alternate)*

Press **[Force Alt]** to manually alternate the pumps in the specific group. The current lead pump in the group will be held on for **[Overlap]** seconds after an alternation.

Alt Type *(Alternation Type)*

If or when pumps should alternate.

Disabled Pumps will not alternate. Lead/lag positions will default to 1-n counted left to right within the group. **[Alt Time]** and **[Overlap]** are not used for this sequence.



Pump Controls screen on 4-inch

Run Time Typical for continuous run applications. Pumps will alternate after the lead pump has accumulated **[Alt Time]** run hours. The current lead pump will be kept on for **[Overlap]** seconds after an alternation.

Cycle Typical for ON/OFF applications. Pumps will alternate once all energized pumps are turned off. **[Alt Time]** and **[Overlap]** are not used for this sequence.

Staging

The determining factor for how pumps energize on and off. This is determined by the type of unit and may be limited to features available on the unit. **Note:** With the exception of Relay Logic, Make on Rise / Make on Fall can be changed by **[Stage On]** and **[Stage Off]**.

Note: There are two separate **[Delay]** fields (referred to here as **[Delay On]** and **[Delay Off]**) which correspond with **[Stage On]** and **[Stage Off]** respectively.

Relay Logic This control sequence allows for innumerable configurations where pumps are controlled by relays and timers outside the Shipco® *Aqueous* controller.

Pumps energize when the controller sees a closed relay (or digital input). Pumps de-energize when the controller sees an open relay and the specified **[Min RunTime]** has been satisfied.

[Delay], **[Stage On]**, **[Stage Off]**, **[Run Permission]**, and **[Min On]** are not used for this sequence.

Tank Level Staging based on tank level. This control sequence is typical for condensate return applications.

If the tank ***level*** is above **[Stage On]**, the next pump will energize every **[Delay On]** seconds until all pumps in the group are energized. If the tank ***level*** drops below **[Stage Off]**, the last pump will de-energize every **[Delay Off]** seconds until **[Min On]** number of pumps is achieved.

[Min On], **[Delay Off]** and **[Min RunTime]** are typically set to 0 for instant shut-off in condensate return units.

Disch Pres Staging based on discharge pressure (***Disch***) which is typical for transfer and boiler feed pumps on a common header.

If discharge pressure (***Disch***) is below **[Stage On]**, the next pump will energize every **[Delay On]** seconds until all pumps in the group are energized. If discharge pressure (***Disch***) is above **[Stage Off]**, the last pump will de-energize every **[Delay Off]** seconds until the **[Min On]** number of pumps is achieved. **[Min RunTime]** must also be satisfied before pumps will de-energize.

Syst Pres Staging based on system pressure, which is typical for vacuum pumps. System pressure (***Syst***) is the vacuum sensor located on the condensate return line.

If system pressure (***Syst***) is above **[Stage On]**, the next pump will energize every **[Delay On]** seconds until all pumps in the group are energized. If system pressure (***Syst***) is below **[Stage Off]**, the last pump will de-energize every **[Delay Off]** seconds until the **[Min On]** number of pumps is achieved. **[Min RunTime]** must also be satisfied before pumps will de-energize.

Diff. Pres Staging based on differential pressure which is typical for boiler feed pumps with variable frequency drives (VFDs); this sequence operates few pumps at high speed.

System pressure (***Syst***) is the steam pressure sensor located on the steam main near the boilers.

If discharge pressure (***Disch***) is below system pressure (***Syst***) + **[Stage On]**, the next pump will energize every **[Delay On]** seconds until all pumps in the group are energized. If discharge pressure (***Disch***) is above system pressure (***Syst***) + **[Stage Off]**, the last pump will de-energize every **[Delay Off]** seconds until the **[Min On]** number of pumps is achieved. **[Min RunTime]** must also be satisfied before pumps will de-energize.

*Note: In reference to pump affinity laws and the notion that "many hands make light work," Shipco® prefers the **"% Speed"** sequence over **"Diff. Pres"** to reduce amperage draw and extend pump life.*

% Speed Staging based on the speed percentage of drives. Typical for boiler feed pumps with variable frequency drives (VFDs); this sequence operates many pumps at low speed.

System pressure (***Syst***) is the steam pressure sensor located on the steam main near the boiler(s).

If **VFD** speed % is above **[Stage On]**, the next pump will energize every **[Delay On]** seconds until all pumps in the group are energized. If **VFD** speed % is below **[Stage Off]**, the last pump will de-energize every **[Delay Off]** seconds until the **[Min On]** number of pumps is achieved. **[Min RunTime]** must also be satisfied before pumps will de-energize.

"Spare" (Custom) Custom sensor label is shown here. Refer to *Custom Sensors* setup, page 25. Staging based on the selected custom defined sensor input. Make on Rise / Make on Fall determined by **[Stage On]** > **[Stage Off]** or **[Stage On]** < **[Stage Off]**.

Run Permission

If pumps should run on a contact close or always.

Always Staging will proceed normally.

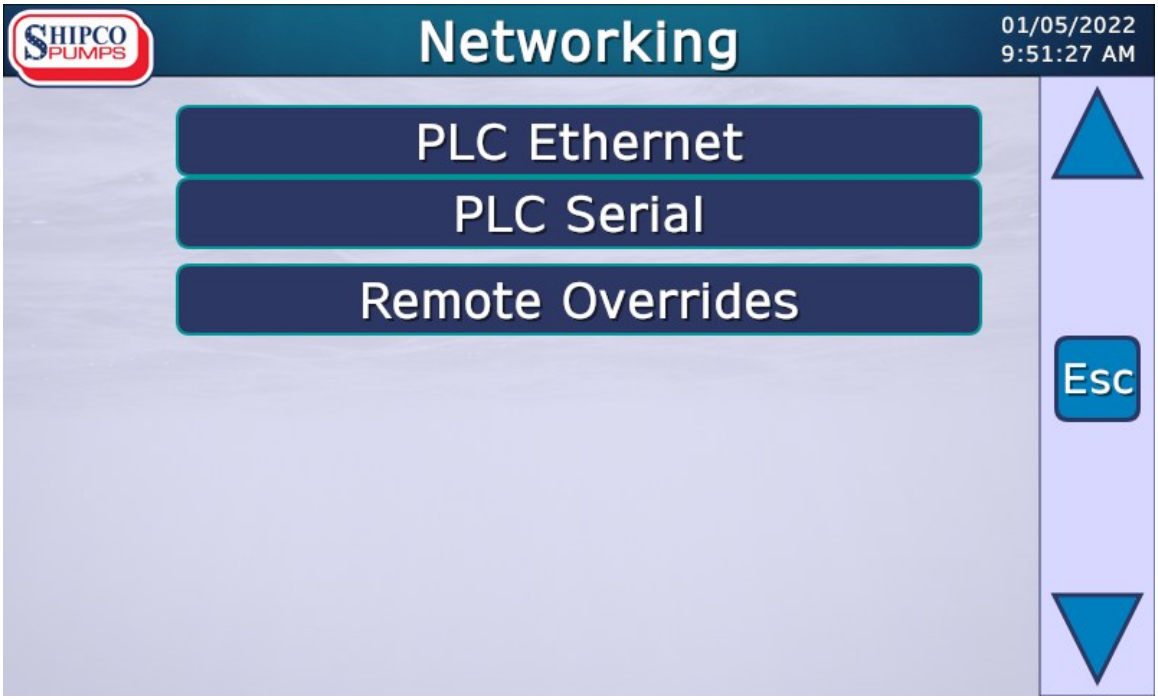
Interlock This is an end switch to disable all pumps within a group. If the controller's digital input is closed, staging will proceed normally. Once open, all pumps will de-energize immediately and the staging sequence will reset the required number of pumps. The interlock contact is the same as the run command input for the lead pump in the group.

Typically used with a boiler level call to energize the primary pump and discharge pressure staging in order to energize standby pump on pressure sag with time delay.

Force Run command inputs operate in parallel to pump sequence. If pump run command is closed, pump will energize regardless of staging. If pump run command is open, PLC will remain in control.

Typically used on vacuum units with accumulator float switches to keep vacuum pumps on until all condensate has been lifted from below grade.

Networking



PLC Ethernet (p. 41)
Configuration for connecting the controller via Ethernet to use BACnet™ IP or Modbus® TCP.

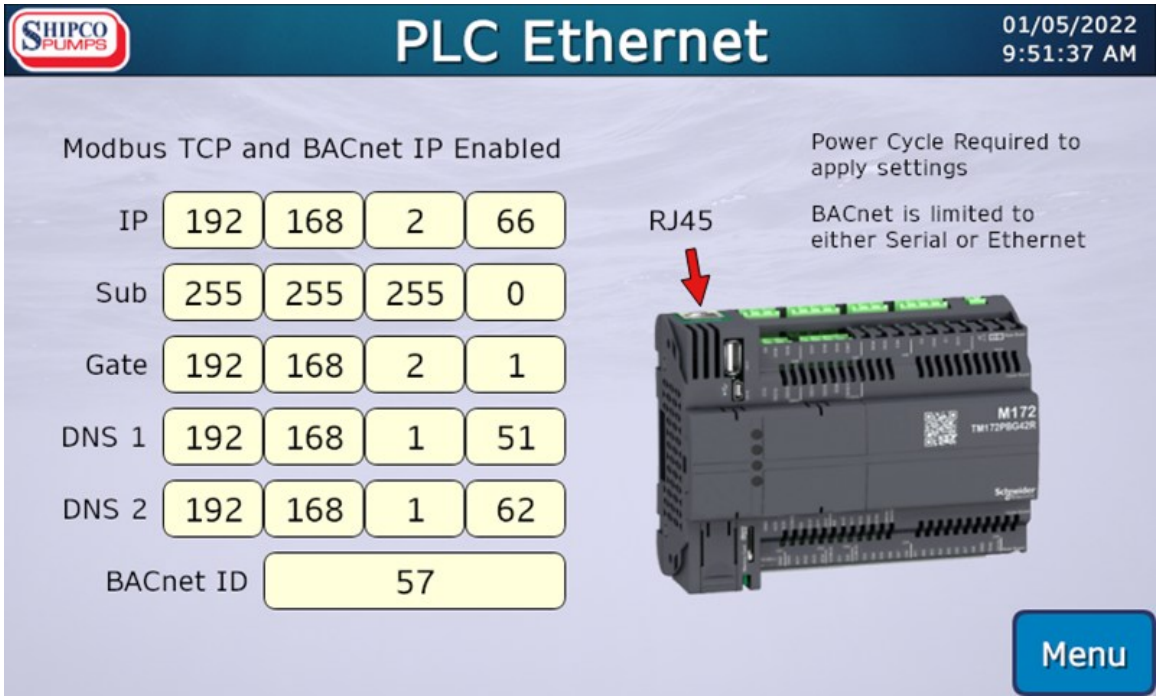
PLC Serial (p. 42)
Configuration for connecting the controller via RS-485 Serial to use BACnet™ MS/TP or Modbus® RTU.

Remote Overrides (p. 43)
Operator access to building management system (BMS) remote overrides.

Web Viewer (p. 44)
Configuration for connecting the HMI via Ethernet to monitor and control the HMI via a web browser.

PLC Ethernet

Networking



Ethernet Configuration

Modbus® TCP and/or BACnet™ IP requires physical connection to the 10/100 Mbps Ethernet (**LAN**) port on the top of the controller. Both Modbus® TCP and BACnet™ IP are usable simultaneously via Ethernet.

DO NOT connect to the HMI touchscreen display unless using *Web Viewer* (refer to *Web Viewer*, page 44).

Consulting with local information technology (IT) or computer network personnel may be necessary to obtain the following information.

IP	IP address expressed in IPv4 dot-decimal notation.
Sub (Subnet)	Subnet Mask address expressed in IPv4 dot-decimal notation.
Gate (Gateway)	Gateway address expressed in IPv4 dot-decimal notation.
DNS 1 & 2	Primary and/or secondary DNS server addresses expressed in IPv4 dot-decimal notation.
BACnet ID	Device ID is a network-wide unique number from 0 to 4194302. ***Note:*** Changing **[BACnet ID]** requires a controller restart to take effect.

BACnet™ IP

BACnet™ communication is limited to either Serial or Ethernet; it cannot be used on both physical interfaces simultaneously. If unable to communicate using BACnet™ IP, try setting **[Protocol]** to *Modbus RTU* from *PLC Serial* menu (page 42) and power cycle; this disables BACnet™ MS/TP.

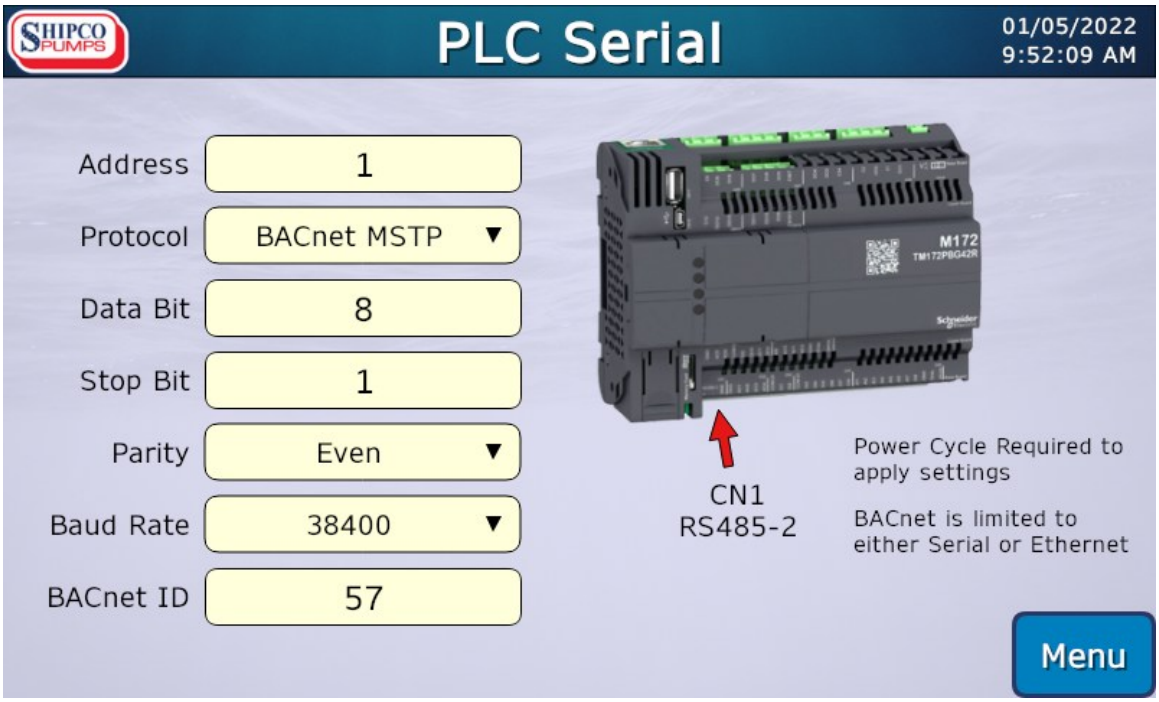
The port used for BACnet™ IP is port 47808 (0xBAC0). The port cannot be adjusted at this time.

Modbus® TCP

The port used for Modbus® TCP is port 502. The port cannot be adjusted at this time.

PLC Serial

Networking



Serial Configuration

Modbus® RTU and/or BACnet™ MS/TP requires physical connection to the **CN1** RS485-2 terminal block on the controller. Attach positive [+], negative [-] and ground/shield wires [G] to the **CN1** terminal block (see Wiring Diagram, page 52). Wiring should be shielded appropriately to minimize interference or signal disruption.

Address	Serial MAC address for the controller; a number between 0 and 255.
Protocol	Select *Modbus RTU* (default) or *BACnet MSTP*. ***Note:*** Changing **[Protocol]** requires a controller restart.
Data Bit	Number of data bits; typically either 7 or 8 (default).
Stop Bit	Number of stop bits; typically either 1 (default) or 2.
Parity	Select parity setting: *Even* (default), *Odd* or *None*.
Baud Rate	Available baud rates are 9600, 19200, 38400, 57600, 76800 and 115200.
BACnet ID	Device ID is a network-wide unique number from 0 to 4194302. ***Note:*** Changing **[BACnet ID]** requires a controller restart.

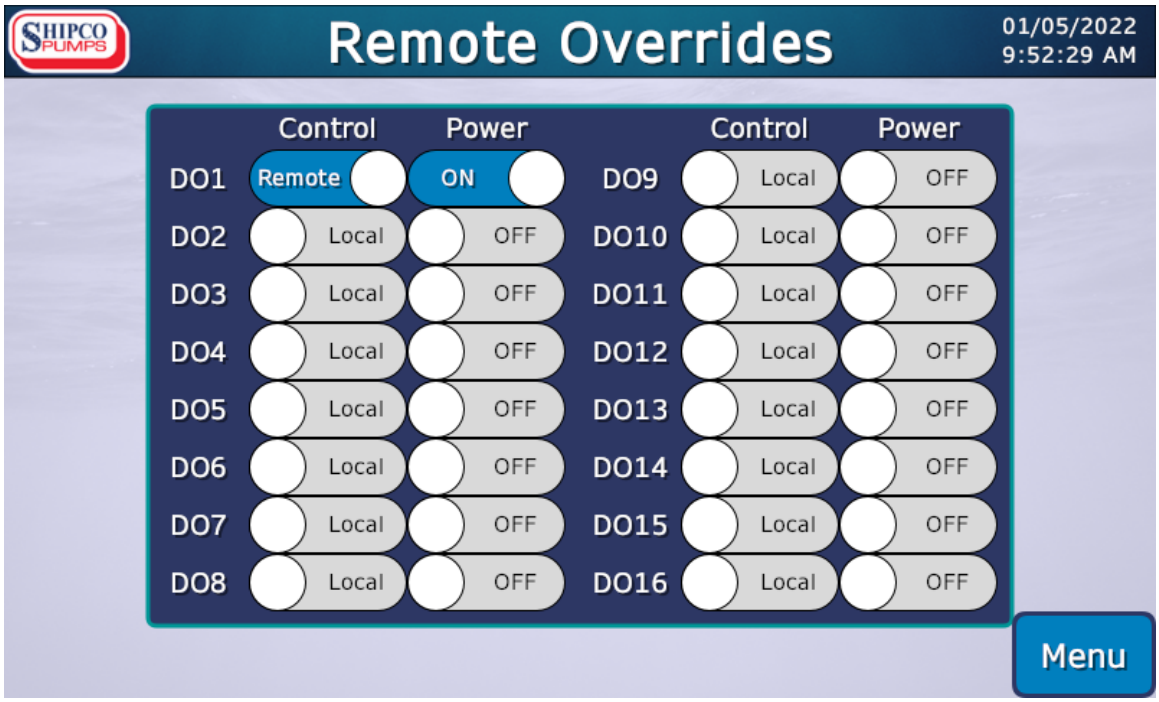
Note: An issue exists where **[Protocol]**, **[Parity]** and **[Baud Rate]** dropdowns appear empty when adjusted and PLC is restarted. The adjusted parameters are still retained by the PLC but are unable to be set in the HMI dropdowns.

BACnet™ MS/TP

BACnet™ communication is limited to either Serial or Ethernet; it cannot be used on both physical interfaces simultaneously. The default **[Protocol]** is *Modbus RTU*. Changing **[Protocol]** to *BACnet MSTP* will disable BACnet™ IP over Ethernet.

Remote Overrides

Networking



Remote Overrides

Allows the specified relay (or digital output) output feature to be overridden allowing a building management system (BMS) to remotely control the output. For a specific digital output, the corresponding Control location must be set to REMOTE, then toggling an output's Power switch to ON will override the controller and energize the specific output. Setting Control location to LOCAL allows the PLC to regain control and the Power switch setting is ignored.

Control

LOCAL (0) = Controller manages the output.

REMOTE (1) = Building management system (BMS) manages the output.

Power

OFF (0) = Output is not energized.

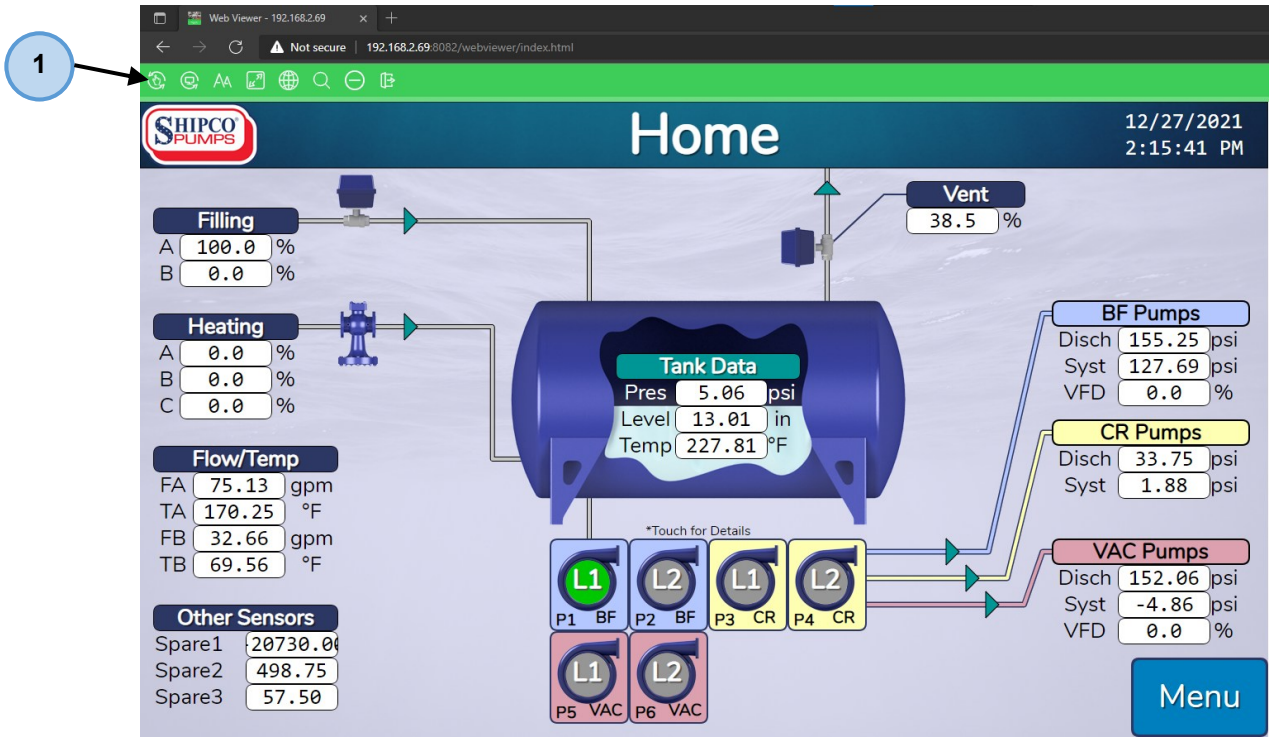
ON (1) = Output is energized.

If the controller is connected via BACnet™ or Modbus®, the commands listed on this screen allow the specified output to be ON or OFF for manual remote override by changing the appropriate communication register (refer to Appendix "Communication Points"). This screen allows maintenance personnel at the controller to remove BMS overrides.

For example, if a pump is connected to energize via DO1, a user must first toggle the DO1 Control switch to "REMOTE" thereby relinquishing control from the controller. To manually turn on said pump remotely, a user must toggle the DO1 Power switch to "ON" on this screen (or "1" via register) and the motor turns on.

Web Viewer

Networking



Web Viewer

Web Viewer enables remotely monitoring and operating the controller HMI from a modern web browser on a desktop computer or mobile device. **Web Viewer must be activated with a license on the HMI device in order to use.**

Connect Ethernet to HMI

Web Viewer requires an Ethernet connection to the HMI. **DO NOT connect Ethernet (LAN) to the PLC controller!** Access the HMI configuration by repeatedly tapping diagonally opposite corners of the HMI display independently, not simultaneously (one finger on the screen at a time).

Either Ethernet ETH1 or ETH2 port on the HMI can be used and must be assigned an individual IP, Subnet and Gateway address expressed in IPv4 dot-decimal. Primary and secondary DNS server fields are also provided if necessary. Consulting with local information technology (IT) or computer network personnel may be necessary to obtain this information.

Accessing Web Viewer

This manual assumes the HMI is connected to an internal network. Routing and securing connections over the Internet for remote accessibility via VPN, Citrix or other service is not covered in this manual. Use a modern web browser to access the HMI via its assigned IP address and port **8082**. Be sure to also include "/webviewer/" in the path.

`http://[your HMI IPv4 address]:8082/webviewer/`

On the presented login screen, enter the following case-sensitive credentials.

User ID: Webview Password: Aqu@web54321

Once logged in, the HMI should be accessible. Click the icon in the top left corner **(#1)** to adjust between *Monitoring* (can't modify or click) and *Operation* control. *Operation* control allows a user to click and adjust anything as if they were physically present at the control panel.

Appendix

Communications Points (p. 47)

Wiring Diagram (p. 52)

Technical Data (p. 54)

Communications Points

BACnet™ and Modbus® for Aqueous AWC™ 2.x

See *Reading Communication Points* (p. 51) for more information about reading points.

No.	Name	Ver	Description	Unit	BACnet Name	BACnet	Modbus
1	TL_Value	2.0	Tank Level	in	AI_TL_Value	AI 0	8960
2	TT_Value	2.0	Tank Temperature	°F	AI_TT_Value	AI 1	8962
3	TP_Value	2.0	Tank Pressure	psi	AI_TP_Value	AI 2	8964
4	DPA_Value	2.0	Discharge Pres Group A	psi	AI_DPA_Value	AI 3	8966
5	SPA_Value	2.0	System Pres Group A	psi	AI_SPA_Value	AI 4	8968
6	DPB_Value	2.0	Discharge Pres Group B	psi	AI_DPB_Value	AI 5	8970
7	SPB_Value	2.0	System Pres Group B	psi	AI_SPB_Value	AI 6	8972
8	DPC_Value	2.0	Discharge Pres Group C	psi	AI_DPC_Value	AI 7	8974
9	SPC_Value	2.0	System Pres Group C	psi	AI_SPC_Value	AI 8	8976
10	AIC1_Value	2.0	Custom Sensor 1	ul	AI_AIC1_Value	AI 9	8978
11	AIC2_Value	2.0	Custom Sensor 2	ul	AI_AIC2_Value	AI 10	8980
12	AIC3_Value	2.0	Custom Sensor 3	ul	AI_AIC3_Value	AI 11	8982
13	FLA_Value	2.0	Flow Line A	gpm	AI_FLA_Value	AI 12	8984
14	FLA_lbhr	2.0	Flow Line A lb/hr	lb/hr	*n/a*	*n/a*	8986
15	TLA_Value	2.0	Temperature Line A	°F	AI_TLA_Value	AI 13	8988
16	FLB_Value	2.0	Flow Line B	gpm	AI_FLB_Value	AI 14	8990
17	FLB_lbhr	2.0	Flow Line B lb/hr	lb/hr	*n/a*	*n/a*	8992
18	TLB_Value	2.0	Temperature Line B	°F	AI_TLB_Value	AI 15	8994
19	MVO_lbhr	2.0	Mod Vent Target Output lb/hr	lb/hr	*n/a*	*n/a*	8996
20	MMA_CV	2.0	Mod Makeup A 1000 = %100.0 Open	%	AI_MMA_CV	AI 16	8998
21	MMB_CV	2.0	Mod Makeup B 1000 = %100.0 Open	%	AI_MMB_CV	AI 17	8999
22	MHA_CV	2.0	Mod Heater A 1000 = %100.0 Open	%	AI_MHA_CV	AI 18	9000
23	MHB_CV	2.0	Mod Heater B 1000 = %100.0 Open	%	AI_MHB_CV	AI 19	9001
24	MHC_CV	2.0	Mod Heater C 1000 = %100.0 Open	%	AI_MHC_CV	AI 20	9002
25	VFDA_CV	2.0	VFD A 1000 = %100.0 Full Speed	%	AI_VFDA_CV	AI 21	9003
26	VFDB_CV	2.0	VFD B 1000 = %100.0 Full Speed	%	AI_VFDB_CV	AI 22	9004
27	VFDC_CV	2.0	VFD C 1000 = %100.0 Full Speed	%	AI_VFDC_CV	AI 23	9005
28	MVO_CV	2.0	Mod Vent 1000 = %100.0 Open	%	AI_MVO_CV	AI 24	9006
29	AOC1_CV	2.0	Custom 1 1000 = %100.0 Open	%	AI_AOC1_CV	AI 25	9007
30	AOC2_CV	2.0	Custom 2 1000 = %100.0 Open	%	AI_AOC2_CV	AI 26	9008
31	AOC3_CV	2.0	Custom 3 1000 = %100.0 Open	%	AI_AOC3_CV	AI 27	9009
32	P1_Status	2.0	Pump 1 Status 0=Off 1=On 2=Fault	ul	AI_P1_Status	AI 28	9014
33	P2_Status	2.0	Pump 2 Status 0=Off 1=On 2=Fault	ul	AI_P2_Status	AI 29	9015
34	P3_Status	2.0	Pump 3 Status 0=Off 1=On 2=Fault	ul	AI_P3_Status	AI 30	9016
35	P4_Status	2.0	Pump 4 Status 0=Off 1=On 2=Fault	ul	AI_P4_Status	AI 31	9017
36	P5_Status	2.0	Pump 5 Status 0=Off 1=On 2=Fault	ul	AI_P5_Status	AI 32	9018
37	P6_Status	2.0	Pump 6 Status 0=Off 1=On 2=Fault	ul	AI_P6_Status	AI 33	9019
38	P7_Status	2.0	Pump 7 Status 0=Off 1=On 2=Fault	ul	AI_P7_Status	AI 34	9020
39	P8_Status	2.0	Pump 8 Status 0=Off 1=On 2=Fault	ul	AI_P8_Status	AI 35	9021

No.	Name	Ver	Description	Unit	BACnet Name	BACnet	Modbus
40	RT_Tot_P1	2.2	RunTimer Totalized Pump 1 Sec	sec	AI_RT_Tot_P1	AI 36	9022
41	RT_Tot_P2	2.2	RunTimer Totalized Pump 2 Sec	sec	AI_RT_Tot_P2	AI 37	9024
42	RT_Tot_P3	2.2	RunTimer Totalized Pump 3 Sec	sec	AI_RT_Tot_P3	AI 38	9026
43	RT_Tot_P4	2.2	RunTimer Totalized Pump 4 Sec	sec	AI_RT_Tot_P4	AI 39	9028
44	RT_Tot_P5	2.2	RunTimer Totalized Pump 5 Sec	sec	AI_RT_Tot_P5	AI 40	9030
45	RT_Tot_P6	2.2	RunTimer Totalized Pump 6 Sec	sec	AI_RT_Tot_P6	AI 41	9032
46	RT_Tot_P7	2.2	RunTimer Totalized Pump 7 Sec	sec	AI_RT_Tot_P7	AI 42	9034
47	RT_Tot_P8	2.2	RunTimer Totalized Pump 8 Sec	sec	AI_RT_Tot_P8	AI 43	9036
48	RT_Cyc_P1	2.2	RunTimer Cycle Pump 1 Sec	sec	AI_RT_Cyc_P1	AI 44	9038
49	RT_Cyc_P2	2.2	RunTimer Cycle Pump 2 Sec	sec	AI_RT_Cyc_P2	AI 45	9040
50	RT_Cyc_P3	2.2	RunTimer Cycle Pump 3 Sec	sec	AI_RT_Cyc_P3	AI 46	9042
51	RT_Cyc_P4	2.2	RunTimer Cycle Pump 4 Sec	sec	AI_RT_Cyc_P4	AI 47	9044
52	RT_Cyc_P5	2.2	RunTimer Cycle Pump 5 Sec	sec	AI_RT_Cyc_P5	AI 48	9046
53	RT_Cyc_P6	2.2	RunTimer Cycle Pump 6 Sec	sec	AI_RT_Cyc_P6	AI 49	9048
54	RT_Cyc_P7	2.2	RunTimer Cycle Pump 7 Sec	sec	AI_RT_Cyc_P7	AI 50	9050
55	RT_Cyc_P8	2.2	RunTimer Cycle Pump 8 Sec	sec	AI_RT_Cyc_P8	AI 51	9052
56	HMI_Enrgz_P1	2.0	Output Energize Pump 1	1/0	BI_Enrgz_P1	BV 0	9094
57	HMI_Enrgz_P2	2.0	Output Energize Pump 2	1/0	BI_Enrgz_P2	BV 1	9095
58	HMI_Enrgz_P3	2.0	Output Energize Pump 3	1/0	BI_Enrgz_P3	BV 2	9096
59	HMI_Enrgz_P4	2.0	Output Energize Pump 4	1/0	BI_Enrgz_P4	BV 3	9097
60	HMI_Enrgz_P5	2.0	Output Energize Pump 5	1/0	BI_Enrgz_P5	BV 4	9098
61	HMI_Enrgz_P6	2.0	Output Energize Pump 6	1/0	BI_Enrgz_P6	BV 5	9099
62	HMI_Enrgz_P7	2.0	Output Energize Pump 7	1/0	BI_Enrgz_P7	BV 6	9100
63	HMI_Enrgz_P8	2.0	Output Energize Pump 8	1/0	BI_Enrgz_P8	BV 7	9101
64	HMI_Enrgz_Alm	2.0	Output Energize Alarm	1/0	BI_Enrgz_Alm	BV 8	9102
65	HMI_Enrgz_DOC1	2.0	Output Configurable Relay 1	1/0	BI_Enrgz_DOC1	BV 9	9103
66	HMI_Enrgz_DOC2	2.0	Output Configurable Relay 2	1/0	BI_Enrgz_DOC2	BV 10	9104
67	HMI_Enrgz_DOC3	2.0	Output Configurable Relay 3	1/0	BI_Enrgz_DOC3	BV 11	9105
68	HMI_Enrgz_DOC4	2.0	Output Configurable Relay 4	1/0	BI_Enrgz_DOC4	BV 12	9106
69	HMI_Enrgz_DOC5	2.0	Output Configurable Relay 5	1/0	BI_Enrgz_DOC5	BV 13	9107
70	HMI_Enrgz_DOC6	2.0	Output Configurable Relay 6	1/0	BI_Enrgz_DOC6	BV 14	9108
71	HMI_Enrgz_DOC7	2.0	Output Configurable Relay 7	1/0	BI_Enrgz_DOC7	BV 15	9109
72	Alm_TL_Sig	2.0	Alarm Tank Level Signal Lost	1/0	BI_Alm_TL_Sig	BV 60	9110
73	Alm_TL_HiHi	2.0	Alarm Tank Level HiHi	1/0	BI_Alm_TL_HiHi	BV 61	9111
74	Alm_TL_Hi	2.0	Alarm Tank Level Hi	1/0	BI_Alm_TL_Hi	BV 62	9112
75	Alm_TL_Lo	2.0	Alarm Tank Level Lo	1/0	BI_Alm_TL_Lo	BV 63	9113
76	Alm_TL_LoLo	2.0	Alarm Tank Level LoLo	1/0	BI_Alm_TL_LoLo	BV 64	9114
77	Alm_TL_LCO	2.0	Alarm Tank Level Lo Cutoff	1/0	BI_Alm_TL_LCO	BV 65	9115
78	Alm_TT_Sig	2.0	Alarm Tank Temp Signal Lost	1/0	BI_Alm_TT_Sig	BV 66	9116
79	Alm_TT_HiHi	2.0	Alarm Tank Temp HiHi	1/0	BI_Alm_TT_HiHi	BV 67	9117
80	Alm_TT_Hi	2.0	Alarm Tank Temp Hi	1/0	BI_Alm_TT_Hi	BV 68	9118
81	Alm_TT_Lo	2.0	Alarm Tank Temp Lo	1/0	BI_Alm_TT_Lo	BV 69	9119
82	Alm_TT_LoLo	2.0	Alarm Tank Temp LoLo	1/0	BI_Alm_TT_LoLo	BV 70	9120
83	Alm_TT_LCO	2.0	Alarm Tank Temp Lo Cutoff	1/0	BI_Alm_TT_LCO	BV 71	9121
84	Alm_TT_HCO	2.0	Alarm Tank Temp Hi Cutoff	1/0	BI_Alm_TT_HCO	BV 72	9122
85	Alm_TP_Sig	2.0	Alarm Tank Pres Signal Lost	1/0	BI_Alm_TP_Sig	BV 73	9123

No.	Name	Ver	Description	Unit	BACnet Name	BACnet	Modbus
86	Alm_TP_HiHi	2.0	Alarm Tank Pres HiHi	1/0	BI_Alm_TP_HiHi	BV 74	9124
87	Alm_TP_Hi	2.0	Alarm Tank Pres Hi	1/0	BI_Alm_TP_Hi	BV 75	9125
88	Alm_TP_Lo	2.0	Alarm Tank Pres Lo	1/0	BI_Alm_TP_Lo	BV 76	9126
89	Alm_TP_LoLo	2.0	Alarm Tank Pres LoLo	1/0	BI_Alm_TP_LoLo	BV 77	9127
90	Alm_TP_HCO	2.0	Alarm Tank Pres Hi Cutoff	1/0	BI_Alm_TP_HCO	BV 78	9128
91	Alm_DPA_Sig	2.0	Alarm Discharge Pres A Signal Lost	1/0	BI_Alm_DPA_Sig	BV 79	9129
92	Alm_SPA_Sig	2.0	Alarm System Pres A Signal Lost	1/0	BI_Alm_SPA_Sig	BV 80	9130
93	Alm_DPB_Sig	2.0	Alarm Discharge Pres B Signal Lost	1/0	BI_Alm_DPB_Sig	BV 81	9131
94	Alm_SPB_Sig	2.0	Alarm System Pres B Signal Lost	1/0	BI_Alm_SPB_Sig	BV 82	9132
95	Alm_DPC_Sig	2.0	Alarm Discharge Pres C Signal Lost	1/0	BI_Alm_DPC_Sig	BV 83	9133
96	Alm_SPC_Sig	2.0	Alarm System Pres C Signal Lost	1/0	BI_Alm_SPC_Sig	BV 84	9134
97	Alm_AIC1_Sig	2.0	Alarm Analog 1 Signal Lost	1/0	BI_Alm_AIC1_Sig	BV 85	9135
98	Alm_AIC1_HiHi	2.0	Alarm Analog 1 HiHi	1/0	BI_Alm_AIC1_HiHi	BV 86	9136
99	Alm_AIC1_Hi	2.0	Alarm Analog 1 Hi	1/0	BI_Alm_AIC1_Hi	BV 87	9137
100	Alm_AIC1_Lo	2.0	Alarm Analog 1 Lo	1/0	BI_Alm_AIC1_Lo	BV 88	9138
101	Alm_AIC1_LoLo	2.0	Alarm Analog 1 LoLo	1/0	BI_Alm_AIC1_LoLo	BV 89	9139
102	Alm_AIC2_Sig	2.0	Alarm Analog 2 Signal Lost	1/0	BI_Alm_AIC2_Sig	BV 90	9140
103	Alm_AIC2_HiHi	2.0	Alarm Analog 2 HiHi	1/0	BI_Alm_AIC2_HiHi	BV 91	9141
104	Alm_AIC2_Hi	2.0	Alarm Analog 2 Hi	1/0	BI_Alm_AIC2_Hi	BV 92	9142
105	Alm_AIC2_Lo	2.0	Alarm Analog 2 Lo	1/0	BI_Alm_AIC2_Lo	BV 93	9143
106	Alm_AIC2_LoLo	2.0	Alarm Analog 2 LoLo	1/0	BI_Alm_AIC2_LoLo	BV 94	9144
107	Alm_AIC3_Sig	2.0	Alarm Analog 3 Signal Lost	1/0	BI_Alm_AIC3_Sig	BV 95	9145
108	Alm_AIC3_HiHi	2.0	Alarm Analog 3 HiHi	1/0	BI_Alm_AIC3_HiHi	BV 96	9146
109	Alm_AIC3_Hi	2.0	Alarm Analog 3 Hi	1/0	BI_Alm_AIC3_Hi	BV 97	9147
110	Alm_AIC3_Lo	2.0	Alarm Analog 3 Lo	1/0	BI_Alm_AIC3_Lo	BV 98	9148
111	Alm_AIC3_LoLo	2.0	Alarm Analog 3 LoLo	1/0	BI_Alm_AIC3_LoLo	BV 99	9149
112	Alm_FLA_Sig	2.0	Alarm Flow Line A Signal Lost	1/0	BI_Alm_FLA_Sig	BV 100	9150
113	Alm_TLA_Sig	2.0	Alarm Temp Line A Signal Lost	1/0	BI_Alm_TLA_Sig	BV 101	9151
114	Alm_FLB_Sig	2.0	Alarm Flow Line B Signal Lost	1/0	BI_Alm_FLB_Sig	BV 102	9152
115	Alm_TLB_Sig	2.0	Alarm Temp Line B Signal Lost	1/0	BI_Alm_TLB_Sig	BV 103	9153
116	Alm_P1_Fault	2.0	Alarm Pump 1 Fault	1/0	BI_Alm_P1_Fault	BV 104	9154
117	Alm_P2_Fault	2.0	Alarm Pump 2 Fault	1/0	BI_Alm_P2_Fault	BV 105	9155
118	Alm_P3_Fault	2.0	Alarm Pump 3 Fault	1/0	BI_Alm_P3_Fault	BV 106	9156
119	Alm_P4_Fault	2.0	Alarm Pump 4 Fault	1/0	BI_Alm_P4_Fault	BV 107	9157
120	Alm_P5_Fault	2.0	Alarm Pump 5 Fault	1/0	BI_Alm_P5_Fault	BV 108	9158
121	Alm_P6_Fault	2.0	Alarm Pump 6 Fault	1/0	BI_Alm_P6_Fault	BV 109	9159
122	Alm_P7_Fault	2.0	Alarm Pump 7 Fault	1/0	BI_Alm_P7_Fault	BV 110	9160
123	Alm_P8_Fault	2.0	Alarm Pump 8 Fault	1/0	BI_Alm_P8_Fault	BV 111	9161
124	Alm_PowerCycle	2.0	Alarm PLC Power Cycle	1/0	BI_Alm_PowerCycle	BV 112	9162
125	Alm_Can1_Link	2.0	Alarm IO Expansion 1 Comm Lost	1/0	BI_Alm_Can1_Link	BV 113	9163
126	Alm_Can2_Link	2.0	Alarm IO Expansion 2 Comm Lost	1/0	BI_Alm_Can2_Link	BV 114	9164
127	REM_Ctrl_DO1	2.0	Remote Control Of Digital Out 1	1/0	BV_Ctrl_DO1	BV 16	9165
128	REM_Pwr_DO1	2.0	Remote On/Off Digital Out 1	1/0	BV_Pwr_DO1	BV 17	9166
129	REM_Ctrl_DO2	2.0	Remote Control Of Digital Out 2	1/0	BV_Ctrl_DO2	BV 18	9167
130	REM_Pwr_DO2	2.0	Remote On/Off Digital Out 2	1/0	BV_Pwr_DO2	BV 19	9168

No.	Name	Ver	Description	Unit	BACnet Name	BACnet	Modbus
131	REM_Ctrl_DO3	2.0	Remote Control Of Digital Out 3	1/0	BV_Ctrl_DO3	BV 20	9169
132	REM_Pwr_DO3	2.0	Remote On/Off Digital Out 3	1/0	BV_Pwr_DO3	BV 21	9170
133	REM_Ctrl_DO4	2.0	Remote Control Of Digital Out 4	1/0	BV_Ctrl_DO4	BV 22	9171
134	REM_Pwr_DO4	2.0	Remote On/Off Digital Out 4	1/0	BV_Pwr_DO4	BV 23	9172
135	REM_Ctrl_DO5	2.0	Remote Control Of Digital Out 5	1/0	BV_Ctrl_DO5	BV 24	9173
136	REM_Pwr_DO5	2.0	Remote On/Off Digital Out 5	1/0	BV_Pwr_DO5	BV 25	9174
137	REM_Ctrl_DO6	2.0	Remote Control Of Digital Out 6	1/0	BV_Ctrl_DO6	BV 26	9175
138	REM_Pwr_DO6	2.0	Remote On/Off Digital Out 6	1/0	BV_Pwr_DO6	BV 27	9176
139	REM_Ctrl_DO7	2.0	Remote Control Of Digital Out 7	1/0	BV_Ctrl_DO7	BV 28	9177
140	REM_Pwr_DO7	2.0	Remote On/Off Digital Out 7	1/0	BV_Pwr_DO7	BV 29	9178
141	REM_Ctrl_DO8	2.0	Remote Control Of Digital Out 8	1/0	BV_Ctrl_DO8	BV 30	9179
142	REM_Pwr_DO8	2.0	Remote On/Off Digital Out 8	1/0	BV_Pwr_DO8	BV 31	9180
143	REM_Ctrl_DO9	2.0	Remote Control Of Digital Out 9	1/0	BV_Ctrl_DO9	BV 44	9181
144	REM_Pwr_DO9	2.0	Remote On/Off Digital Out 9	1/0	BV_Pwr_DO9	BV 45	9182
145	REM_Ctrl_DO10	2.0	Remote Control Of Digital Out 10	1/0	BV_Ctrl_DO10	BV 46	9183
146	REM_Pwr_DO10	2.0	Remote On/Off Digital Out 10	1/0	BV_Pwr_DO10	BV 47	9184
147	REM_Ctrl_DO11	2.0	Remote Control Of Digital Out 11	1/0	BV_Ctrl_DO11	BV 48	9185
148	REM_Pwr_DO11	2.0	Remote On/Off Digital Out 11	1/0	BV_Pwr_DO11	BV 49	9186
149	REM_Ctrl_DO12	2.0	Remote Control Of Digital Out 12	1/0	BV_Ctrl_DO12	BV 50	9187
150	REM_Pwr_DO12	2.0	Remote On/Off Digital Out 12	1/0	BV_Pwr_DO12	BV 51	9188
151	REM_Ctrl_DO13	2.0	Remote Control Of Digital Out 13	1/0	BV_Ctrl_DO13	BV 52	9189
152	REM_Pwr_DO13	2.0	Remote On/Off Digital Out 13	1/0	BV_Pwr_DO13	BV 53	9190
153	REM_Ctrl_DO14	2.0	Remote Control Of Digital Out 14	1/0	BV_Ctrl_DO14	BV 54	9191
154	REM_Pwr_DO14	2.0	Remote On/Off Digital Out 14	1/0	BV_Pwr_DO14	BV 55	9192
155	REM_Ctrl_DO15	2.0	Remote Control Of Digital Out 15	1/0	BV_Ctrl_DO15	BV 56	9193
156	REM_Pwr_DO15	2.0	Remote On/Off Digital Out 15	1/0	BV_Pwr_DO15	BV 57	9194
157	REM_Ctrl_DO16	2.0	Remote Control Of Digital Out 16	1/0	BV_Ctrl_DO16	BV 58	9195
158	REM_Pwr_DO16	2.0	Remote On/Off Digital Out 16	1/0	BV_Pwr_DO16	BV 59	9196
159	REM_MMA_Man	2.0	HMI Mod Makeup A Manual Control	1/0	BV_Ctrl_MMA	BV 32	9197
160	REM_MMA_Perc	2.0	HMI Mod Makeup A 1000=%100.0	%	AVr_MMA_Perc	AV 0	9198
161	REM_MMB_Man	2.0	HMI Mod Makeup B Manual Control	1/0	BV_Ctrl_MMB	BV 33	9200
162	REM_MMB_Perc	2.0	HMI Mod Makeup B 1000=%100.0	%	AVr_MMB_Perc	AV 1	9201
163	REM_MHA_Man	2.0	HMI Mod Heater A Manual Control	1/0	BV_Ctrl_MHA	BV 34	9203
164	REM_MHA_Perc	2.0	HMI Mod Heater A 1000=%100.0	%	AVr_MHA_Perc	AV 2	9204
165	REM_MHB_Man	2.0	HMI Mod Heater B Manual Control	1/0	BV_Ctrl_MHB	BV 35	9206
166	REM_MHB_Perc	2.0	HMI Mod Heater B 1000=%100.0	%	AVr_MHB_Perc	AV 3	9207
167	REM_MHC_Man	2.0	HMI Mod Heater C Manual Control	1/0	BV_Ctrl_MHC	BV 36	9209
168	REM_MHC_Perc	2.0	HMI Mod Heater C 1000=%100.0	%	AVr_MHC_Perc	AV 4	9210
169	REM_MVO_Man	2.0	HMI Vent Orifice Manual Control	1/0	BV_Ctrl_MVO	BV 40	9212
170	REM_MVO_Perc	2.0	HMI Vent Orifice 1000=%100.0	%	Avr_MVO_Perc	AV 8	9213
171	REM_VFDA_Man	2.0	HMI VFD A Manual Control	1/0	BV_Ctrl_VFDA	BV 37	9215
172	REM_VFDA_Perc	2.0	HMI VFD A 1000=%100.0	%	AVr_VFDA_Perc	AV 5	9216
173	REM_VFDB_Man	2.0	HMI VFD B Manual Control	1/0	BV_Ctrl_VFDB	BV 38	9218
174	REM_VFDB_Perc	2.0	HMI VFD B 1000=%100.0	%	AVr_VFDB_Perc	AV 6	9219
175	REM_VFDC_Man	2.0	HMI VFD C Manual Control	1/0	BV_Ctrl_VFDC	BV 39	9221
176	REM_VFDC_Perc	2.0	HMI VFD C 1000=%100.0	%	AVr_VFDC_Perc	AV 7	9222

No.	Name	Ver	Description	Unit	BACnet Name	BACnet	Modbus
177	REM_AOC1_Man	2.0	HMI Config Analog 1 Manual Control	1/0	BV_Ctrl_AOC1	BV 41	9224
178	REM_AOC1_Perc	2.0	HMI Config Analog 1 1000=%100.0	%	AVr_AOC1_Perc	AV 9	9225
179	REM_AOC2_Man	2.0	HMI Config Analog 2 Manual Control	1/0	BV_Ctrl_AOC2	BV 42	9227
180	REM_AOC2_Perc	2.0	HMI Config Analog 2 1000=%100.0	%	AVr_AOC2_Perc	AV 10	9228
181	REM_AOC3_Man	2.0	HMI Config Analog 3 Manual Control	1/0	BV_Ctrl_AOC3	BV 43	9230
182	REM_AOC3_Perc	2.0	HMI Config Analog 3 1000=%100.0	%	AVr_AOC3_Perc	AV 11	9231

Reading Communications Points

BACnet

BACnet objects provided with corresponding instance number.

- **AI** = Analog Input
- **AV** = Analog Value
- **BI** = Binary Input
- **BV** = Binary Value

Modbus

All Modbus addresses listed are 16-bit Holding Registers (4xxxx or 4xxxxx). They can be read and written using the following Modbus Function Codes (FC).

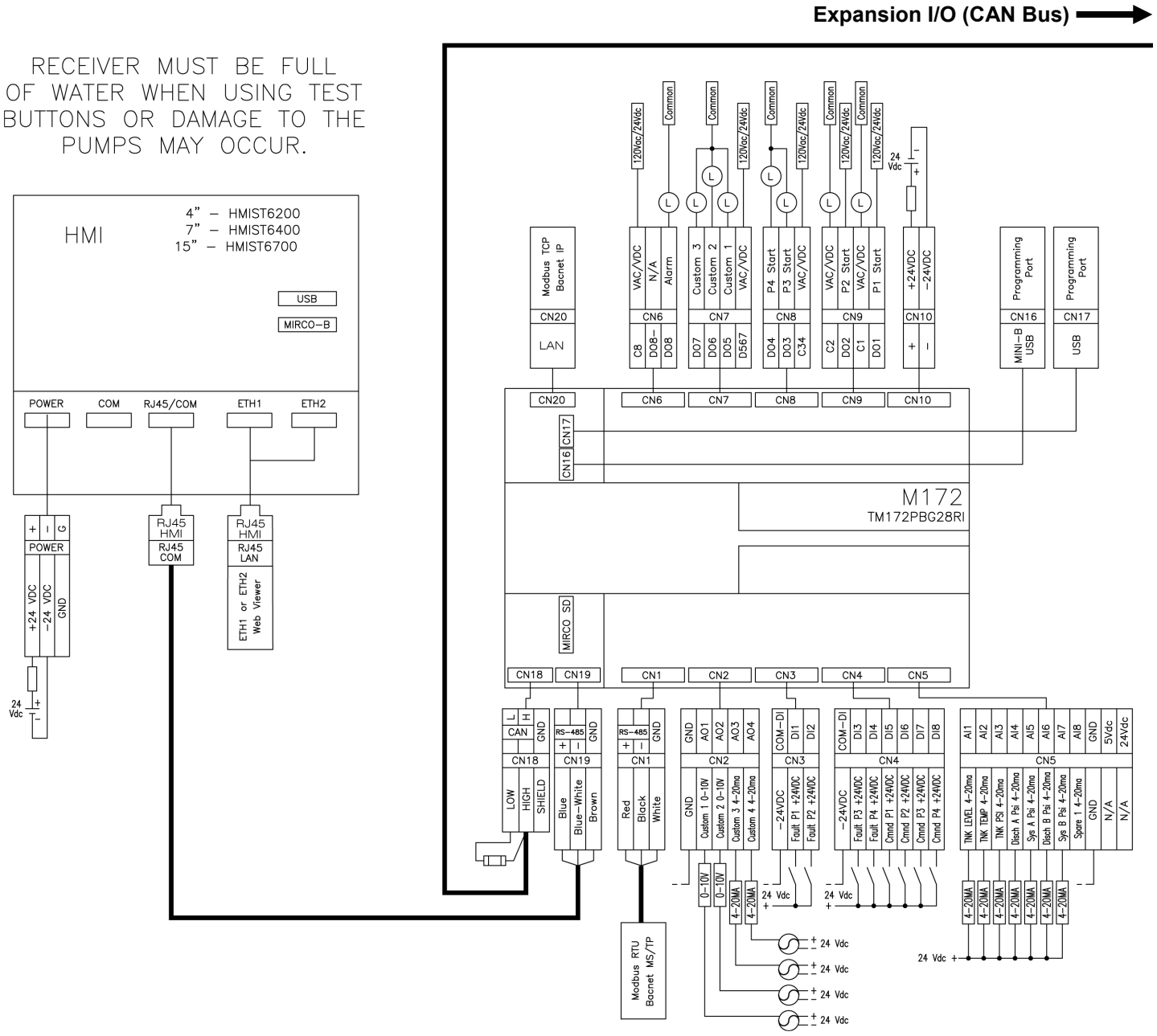
- FC=03 Read Multiple Holding Registers
- FC=06 Write Single Holding Register
- FC=16 Write Multiple Holding Registers

Data Types

For units of measure (*Unit* column) listed as either "**1/0**" (ON/OFF, binary) or "**%**" (percentage) the data type format is **Unsigned 16-bit Integer** values. Percentages may return 0-1000 where 0 = 0.0% and 1000 = 100.0% (e.g., 79 = 7.9%, 100 = 10.0%, 856 = 85.6%, etc.)

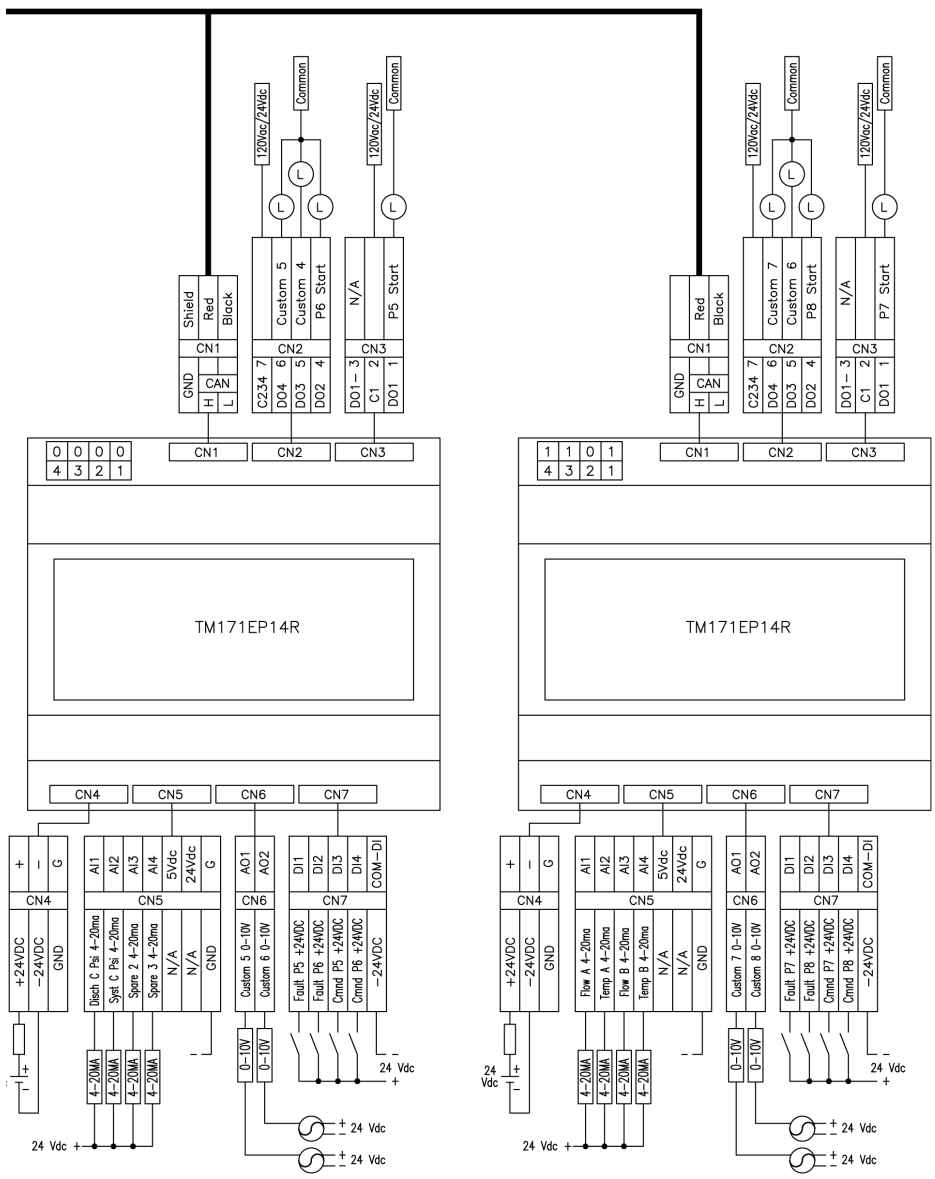
For all other units of measure the data type format is **32-bit floating point** values (consumes two 16-bit registers).

Wiring Diagram



Wiring Diagram
(continued)

Expansion I/O (CAN Bus)



Technical Data

This information is excerpted from ***Schneider Electric®*** literature with provided ***Schneider Electric®*** Product Data Sheet reference.

Controller — Product Data Sheet TM172PBG28RI

Product Name:	Modicon M171/M172
Total inputs/outputs:	28 (8 digital input, 8 analog input, 4 analog output, 8 digital output)
Discrete input voltage:	24 V AC/DC
Sensor power supply:	5 V DC 50 mA supplied by the controller
	24 V DC 150 mA supplied by the controller
[Us] rated supply voltage:	24 V +/- 10 % AC
	20...38 V DC
Power consumption in W:	12 W 24 V AC/DC
Realtime clock:	Built-in <= 30 s/month -4…149 °F (-20…65 °C)
Ambient air temperature for operation:	-4…149 °F (-20…65 °C) UL 60730-1
	-4…140 °F (-20…60 °C) horizontal UL 60730-1
Ambient air temperature for storage:	-22…158 °F (-30…70 °C)
Relative humidity:	5…95 % non-condensing
IP degree of protection:	IP20

Expansion I/O — Product Data Sheet TM171EP14R

Total inputs/outputs:	14 (4 digital input, 4 analog input, 2 analog output, 4 digital output)
Discrete input voltage:	24 V AC/DC
Sensor power supply:	12 V DC 85 mA
[Us] rated supply voltage:	24 V

4” HMI Touchscreen — Product Data Sheet HMIST6200

Product Name:	Harmony ST6
Display:	4-inch Color TFT LCD, 16 million colors, 480 x 272 pixels
[Us] rated supply voltage:	24 V DC +/- 20 %
Power consumption in W:	6.9 W
Inrush Current:	30 A
Realtime Clock	Built-in 0…50°C ; Built-in 10…90 % RH
Ambient air temperature for operation	32…122 °F (0…50 °C)
Ambient air temperature for storage	-4…140 °F (-20…60 °C)
Relative humidity	10…90 % non-condensing
Operating altitude	6561.68 ft (2000 m)
IP degree of protection	IP20 IEC 61131-2 (rear panel) ; IP65 IEC 61131-2 (front panel)
NEMA degree of protection	NEMA 4 front panel (indoor use) ; NEMA 13 front panel (in enclosure)

7” HMI Touchscreen — Product Data Sheet HMIST6400

Product Name:	Harmony ST6
Display:	7-inch Color TFT LCD, 16 million colors, 800 x 480 pixels
[Us] rated supply voltage:	24 V DC +/- 20 %
Power consumption in W:	9 W
Inrush Current:	30 A
Realtime Clock	Built-in 0…50°C ; Built-in 10…90 % RH
Ambient air temperature for operation	32…122 °F (0…50 °C)
Ambient air temperature for storage	-4…140 °F (-20…60 °C)
Relative humidity	10…90 % non-condensing
Operating altitude	6561.68 ft (2000 m)
IP degree of protection	IP20 IEC 61131-2 (rear panel) ; IP65 IEC 61131-2 (front panel)
NEMA degree of protection	NEMA 4 front panel (indoor use) ; NEMA 13 front panel (in enclosure)

15” HMI Touchscreen — Product Data Sheet HMIST6700

Product Name:	Harmony ST6
Display:	15-inch Color TFT LCD, 16 million colors, 1366 x 768 pixels
[Us] rated supply voltage:	24 V DC +/- 20 %
Power consumption in W:	18.5 W
Inrush Current:	30 A
Realtime Clock	Built-in 0…50°C ; Built-in 10…90 % RH
Ambient air temperature for operation	32…122 °F (0…50 °C)
Ambient air temperature for storage	-4…140 °F (-20…60 °C)
Relative humidity	10…90 % non-condensing
Operating altitude	6561.68 ft (2000 m)
IP degree of protection	IP20 IEC 61131-2 (rear panel) ; IP65 IEC 61131-2 (front panel)
NEMA degree of protection	NEMA 4 front panel (indoor use) ; NEMA 13 front panel (in enclosure)

AQUEOUS™

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