

DULCOMETER Aegis-II® Cooling Tower and Boiler Controller

Use your Tablet or Smartphone. I'm WiFi ready!



Please carefully read these operating instructions before use! - Do not discard this manual! The operator shall be responsible for any damage caused by installation or operating errors! Technical changes reserved.

Sidebars: Are used to explain typical uses for feed and control functions.

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1 Day-to-Day Browsing

The purpose of this manual is to show the user how to connect to the Aegis II controller using an Ethernet connection, or wirelessly via WiFi from a PC, tablet or smart phone. Secondly, to give examples of how to program the outputs, calibrate sensors and/or view the process.

The Installation and Operation manual has detailed sensor information, keypad instruction and controller details and specification.

The following sections detail connecting your smart device or PC to the controller. WiFi has the advantage of not requiring a physical cable. LAN setup follows this chapter, then the Home screen is explained as it is common to either connection method.

1.1 The WiFi Connection

A **WiFi** connection eliminates cables and the need to change your IP address.

There are two steps needed to fully connect to the controller. **Step 1:** Connect your device to the wireless network that includes your controller. **Step 2,** Enter the IP address of the controller in a browser app. There could be multiple devices on this network.

Step 1 is provided in two parts, [1.1.1 Using a PC or Tablet](#) and [1.1.2 Using a Smartphone](#)

1.1.1 Using a PC or Tablet:

Click on the **WiFi** icon on your desktop.



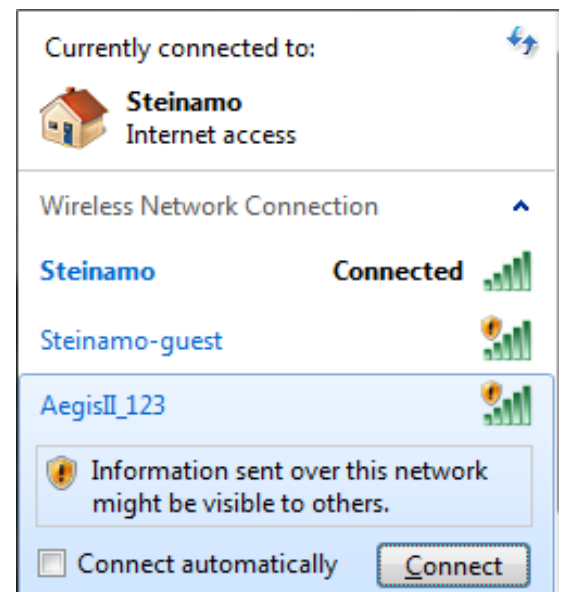
Click on the AegisII_123 choice and press the Connect button.

The number **123** in this example will be different on each controller. These 3 digits are taken from the last 3 digits of the controller serial number. This allows you to differentiate between controllers if more than one is within **WiFi** range.

Further differentiate your controller WiFi name. Edit the name in the System pages. See [10.3.1 LAN IP, Netmask, MAC, Gateway, Wifi IP](#)

You are now on the Aegis II **WiFi** network.

Continue with section [1.1.3 Opening the Browser page](#)



Sidebar:

Once you are connected to a controller, you can edit the SSID (WiFi name) to make identification easier than trying to remember the three digits.

See section [10.3 Communications](#) to make this change.

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1.1.2 Using a Smartphone

Navigate to your Smartphone setting page. Select the WiFi page. Select the AegisII_123 choice.

NOTE: The number **123** will be different on each controller. These 3 digits will be the same as the last 3 digits of the controller serial number. This allows you to differentiate between controllers if more than one is within WiFi range.

Sidebar:

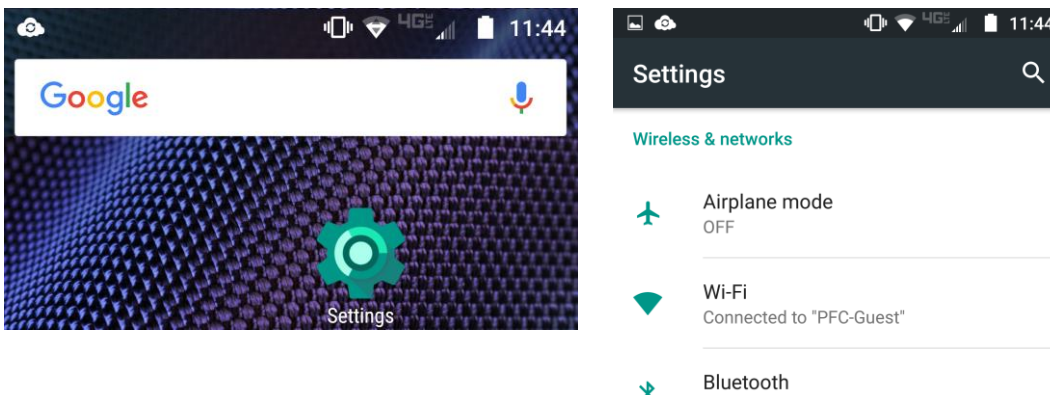
Once you are connected to a controller, you can edit the SSID (WiFi name) to make identification easier than trying to remember the three digits.

See section **10.3 Communications** to make this change.

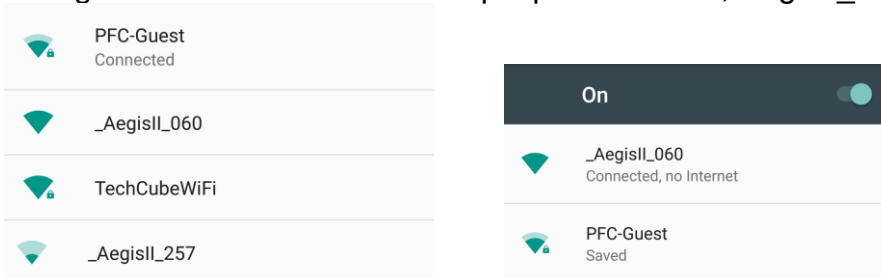
Here are examples using Android and iPhone;

1.1.2.1 Setting up WiFi using an Android phone

From your home page, press the settings button then choose Wi-Fi.



There may be more than one controller nearby. Choose your controller by comparing the serial numbers last 3 digits with the options on the phone. Select your controller. The status should change for that choice. See example picture below; AegisII_060 is 'Connected, no Internet'.

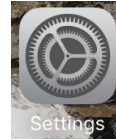


Continue with section **1.1.3 Opening the Browser page using WiFi**

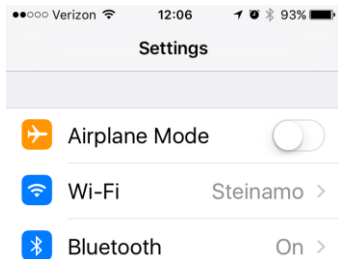
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1.1.2.2 Setting up WiFi using an iPhone

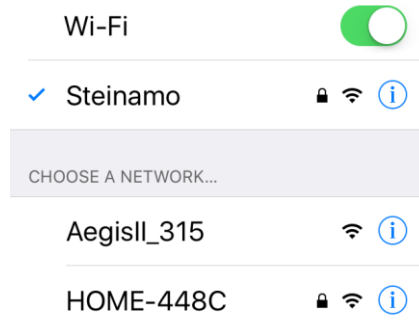
To connect your iPhone to an AegisII controller, make a **WiFi** connection; Select the Settings button from your desktop.



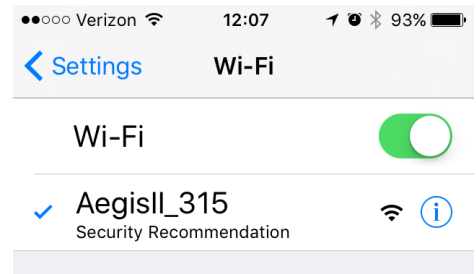
Select the **WiFi** button.



Choose your controller.



Note the connection status.

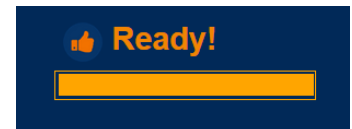


If you have more than one Aegis choice, the number on the screen represents the last 3 digits of the AegisII controller serial number.

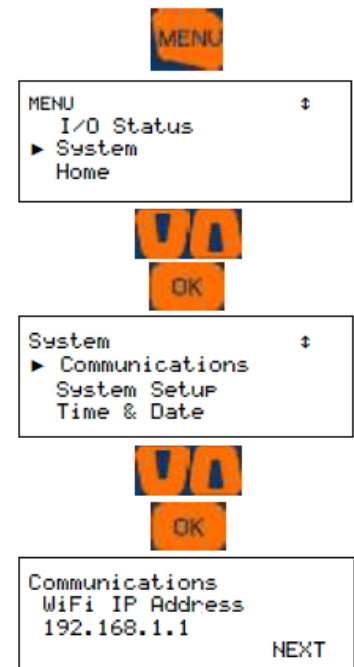
1.1.3 Opening the Browser page using WiFi

Once a WiFi connection is established, continue here with step 2. To connect to the controller and see the screen, open a browser and enter the controller's **WiFi** IP address. (Not the LAN IP). The default address is 192.168.1.1. If you do not see the connection status followed by the main page, it could be due to the WiFi address having been changed on the controller. Find the controller **WiFi** IP address using the controller keypad.

- 1) Press the Menu key
- 2) Press the up arrow (scroll up) until you see System. Press OK
- 3) You should be at the Communications menu. Press OK.
- 4) You will see the LAN IP address. Press the down arrow twice to see the WiFi IP Address. This is the address you need to use in the browser URL box. No need to add the WWW or Http. Just enter as shown here. 192.168.1.1 and press your return key.



Connection status



Once connected, you can see values and status of many I/O point but you will not be able to edit or make programming changes without logging in. This is the **HOME** screen.

See section **1.3 The Home Screen**

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1.2 The LAN Connection

The most common connection is via a Local Area Network (LAN) connection. This requires an Ethernet cable and you will need to set up your Ethernet port to match the address of the controller.

The Ethernet cable no longer needs to be a 'crossover' type unless you are running a Windows version earlier than VISTA. WIN7 onward will determine which wires need to be transmit and receive and adjust to match the signals on the cable.

Attach the cable to the LAN port on your PC and to the LAN port inside the controller. (Lower left-hand corner). A green light should be seen on both ports. The amber light will blink with each packet that passes by in either direction.

1.2.1.1 Determine the LAN IP address of the controller

The default LAN IP address is 10.10.6.106. If you have not changed it and if the controller has not been placed on the customers network, try this address. If it does not work, find the LAN address;

Press the menu key on the controller
Use the up arrow to System and press Enter
Press Enter for Communication
The LAN IP address is shown

Once you have determined the IP address of the controller, you need to set a static IP address on your PC that is compatible with the controller address.

1.2.1.2 Setup the Local Area Connection on your PC

Depending on which version of Windows you are using, these instructions will vary. The idea is to set a compatible static IP address on your PC for the Ethernet port you will use to physically connect to the controller.

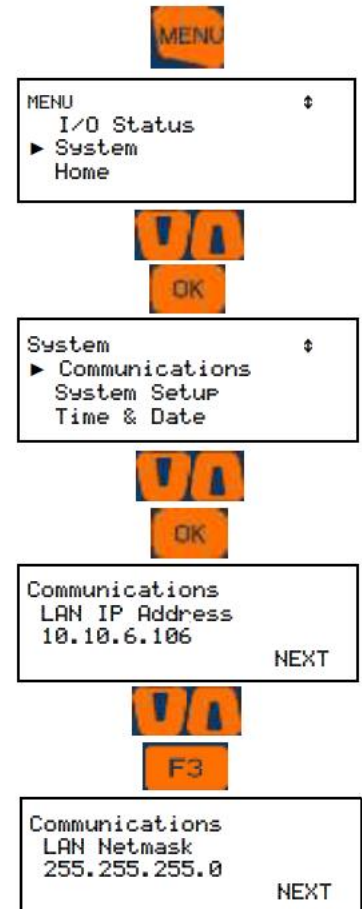
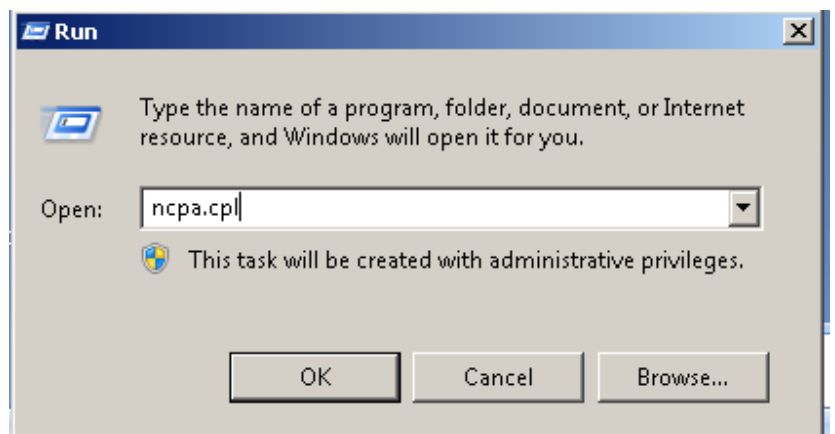
Use the following instructions for VISTA, WIN7, WIN8 and WIN10.

Hold down the Windows key



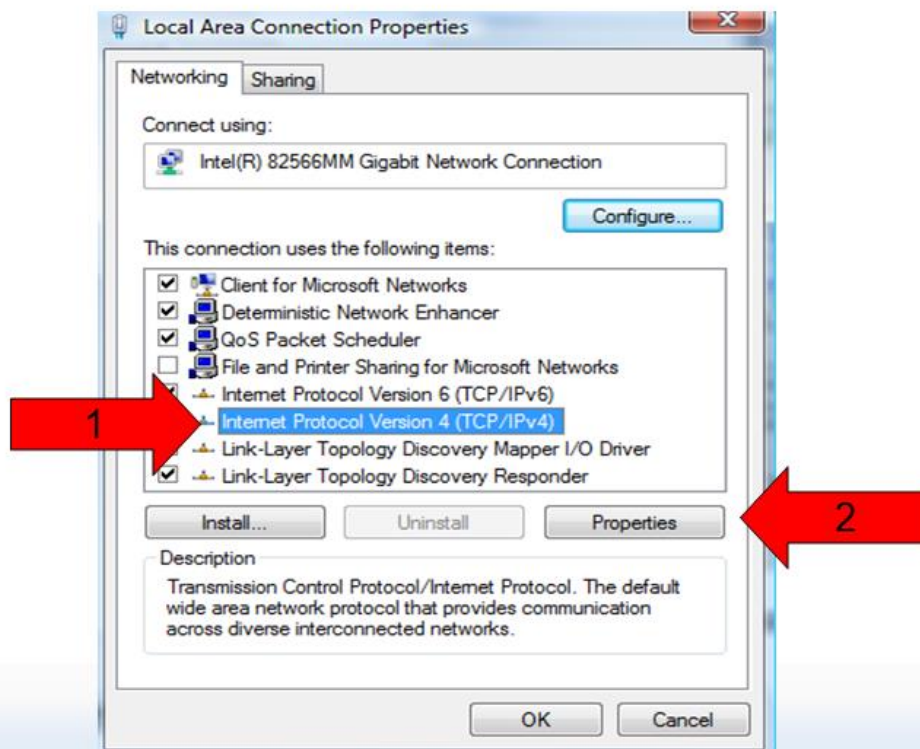
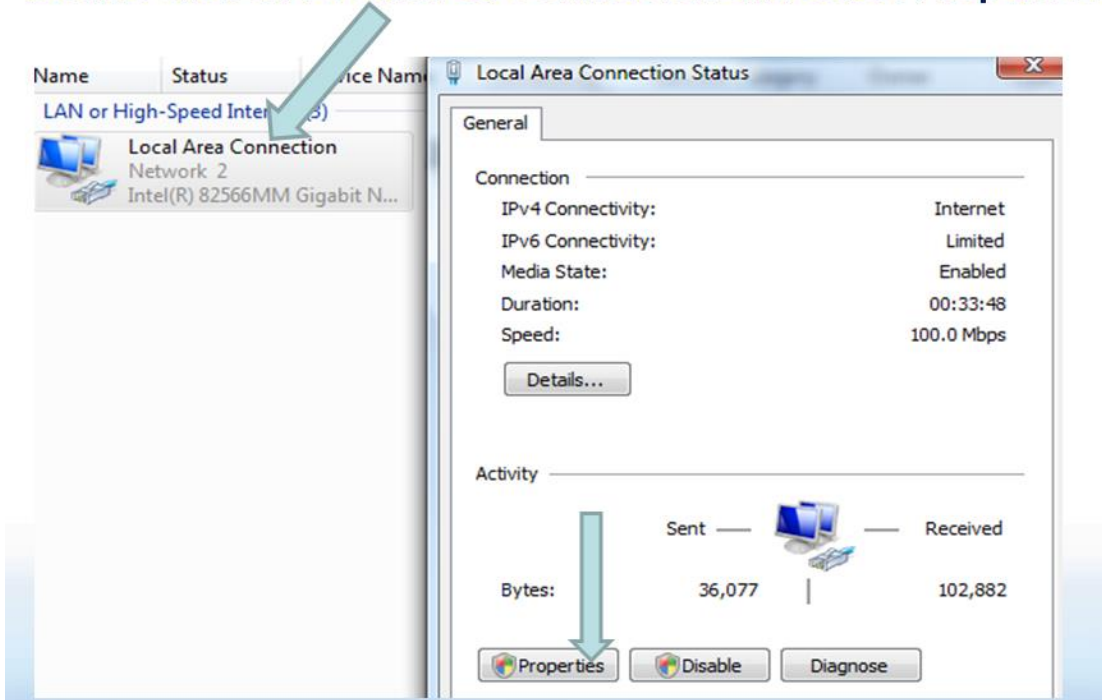
while you press the letter 'r'.

Enter 'ncpa.cpl' in the **Open** box.
Press **OK**.



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Double click on **Local Area Connection** and select **Properties**



- (1) Highlight Internet Protocol **Version 4** (TCP/IPv4)
- (2) Select Properties

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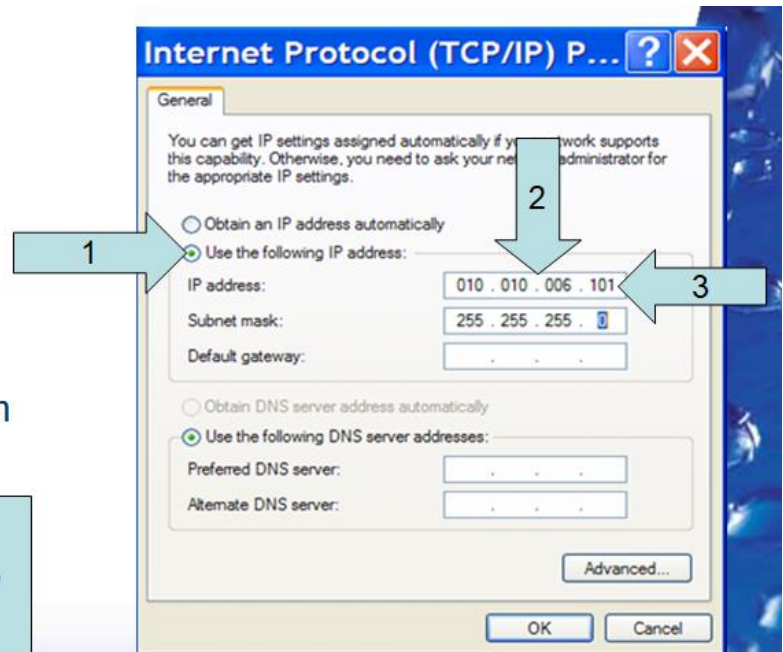
Select the 'Use the following IP address': circle (1)

Enter the first three numbers of the controller's IP address (2)

Example: 010.010.006.____

Then enter a number between 000 and 255 that is different from the controller address

In this example, since the controller IP is 010.010.006.106, we used 010.010.006.101 (3)



Press the Tab key and enter the Subnet mask of 255.255.255.0

Select OK here and on the Local Area Connection window

Sidebar:

If you change the port number from the default address of 80, the WiFi port address will be changed automatically as well.

When the port number is 80, it is implied, therefore, you do not include it in the addressing.

However, if it is other than 80, you need to include it when you try to connect to the controller.

For example: if you change the address to 100, the default LAN IP address will now be entered as such:

10.10.6.106:100

The WiFi default address is now:

192.168.1.1:100

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1.3 The Home Screen



View from Smartphone.
Scroll in any direction to
access all I/O as shown in
the PC/Tablet screen.



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1.4 Home Page Services

From the home page, you can see all the enabled inputs and outputs (I/O). Log-in to gain access to three levels of programming privileges. Operator has the least benefit, while Admin has full access.

1.4.1 Log-In

Once you are connected, log in by selecting a username and enter a password.

Username with Default Passwords:

Operator1 = 1 Operator2 = 2 Operator3 = 3 Operator4 = 4.

Configure5 = 5 Configure6 = 6 Configure7 = 7 Administrator = AAAA

Login Page: Operators can view all controller pages. No access to most System pages.
Configure users can edit the program. No access to most System pages.

Modify Passwords:

If the controller is accessible on the site LAN, you should modify all 8 passwords.

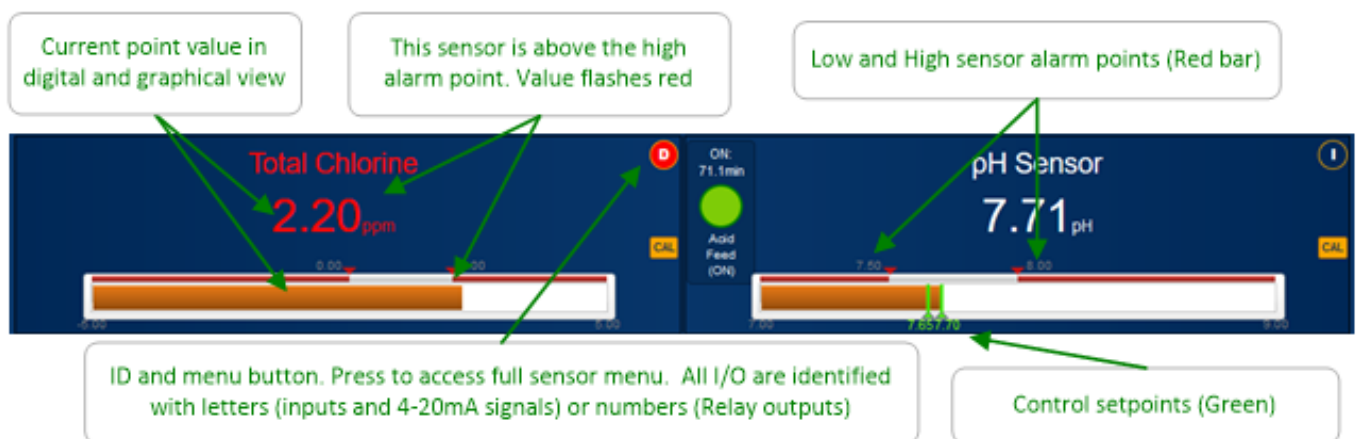
Two users cannot share the same password because only the password is used to identify keypad users. The controller displays **Password Fail** on a duplicate password.

See section **10.8 Passwords** to learn how to change passwords.

1.4.2 Home Page Detail

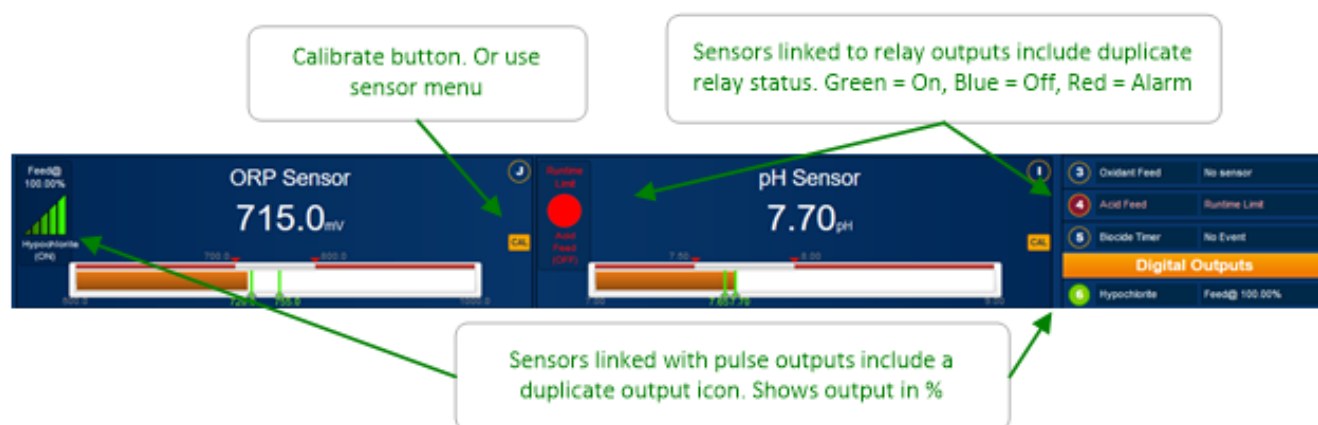
Now that you are logged in, you can edit the controller as well as monitor the action. The following pages break the Home page into sections to enhance identification.

1.4.2.1 Analog Input Display



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Analog Input Display continued



1.4.2.2 Digital I/O Display



Max of 8 Digital inputs: Can be any combination of dry contact switches or digital watermeter signals from contact head or paddle wheel models.

See section 9 for 4-20mA Output configuration

Max of 5 Digital Output Relays to power pumps, solenoids and MOV valves

Digital output configuration covered in sections 2, 3 and 4.


Max of 4 Pulse frequency or On/Off relays

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1.4.3 Home Page System Icons


The home page has a variety of services unrelated to the program. These services are accessed via the icons in the upper left corner of the page.





The User Manuals icon  gives you access to the two Aegis manuals; Operating and Browser (this manual). The Operating manual explains the keypad usage, wiring and specifications. The Browser manual shows you how to connect to and program an Aegis II controller.

The System Settings icon  has the following menus:  These menus are explained in sections **10 System Settings**.

System:
Home
Home
Diagnostic
Activity Log
Communications
E-mail Setup
Time & Date
Enable I/O
System Setup
Passwords

The change display icon  allows users with dual systems to select how I/O points are displayed. See section **10.7 System Setup**

The report icon  opens the report page. See section **1.2.4 Create a Report**

Finally, the alarm icon  displays current alarms. Clear them from this menu page.

1.4.4 Create a Report



Recent

No recent reports

Create a report by following the steps below

Used Storage Space

1%

New

1. Choose a date range

Today

2. Choose up to four I/O's

Sensors


Meters

Contacts







Outputs

3. Download and view

Download data and create report

To create a report, select the report icon  from the main screen. Follow the three steps as shown.

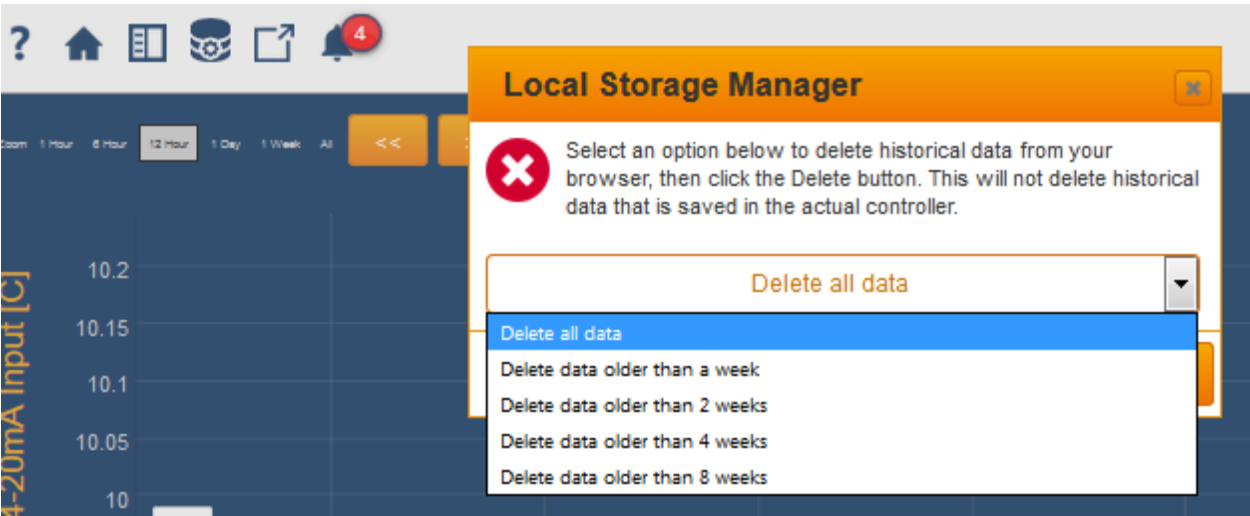
The Icons: 

-  Access the controller manuals
-  Exit from the report menu back to the Live view
-  Show/hide the report menu
-  Manage the report database
-  Show/hide the controller header
-  Show/acknowledge current alarms

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Manage the report database.



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1.5 View & Adjust Setpoints

Select the 1 to 9 icon on the home page. This example adjusts the Relay 1 setpoint

Select **Adjust Setpoint** from the pull-down

Bleed controls turn ON at the higher setpoint & then OFF @ the lower setpoint as the conductivity is lowered by the low conductivity make-up water

Edit one or both setpoints & **Submit**

Frequency or 'Pulse' controls feed chemical proportionally between setpoints. In this example the pump would feed @ 50% of rated when the pH = 7.45

100% pulses the pump @ its maximum frequency

In this example, we **Submit** a new setpoint, logging the activity

1: Tower276 Bleed

Adjust Setpoint

On: 1500 uS

Off: 1490 uS

Refresh Submit

7: Acid Pump

Adjust Setpoint

Status	Setpoint change
100%:	7.50 pH
0%:	7.40 pH

Refresh Submit

Sidebar:

Relays controlled by sensors power Pumps and Solenoids ON and OFF.

(Relays are outputs 1 to 5 & outputs 6 to 9 set to 'ON/OFF')

Frequency controlled Pumps feed chemicals at varying rates.

(Frequency controlled pumps are outputs 6 to 9 set to 'Pulse')

Tower Bleed solenoids use Setpoints 5uS to 20uS apart so that short bleeds are followed by short feeds. The resulting control has minimum variation in Inhibitor ppm and operates as close as possible to the target cycles of concentration.

ON-OFF Acid pumps use setpoints 0.05 pH apart so that the re-circulation delay between feeding acid and measuring its pH does not cause wide pH swings.

WARNING: Reversing setpoint order is blocked for ON/OFF controls but allowed for proportional Pulse controls. Reversing setpoints in this example would convert an Acid feed to a Caustic feed.

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View & Adjust Setpoints continued

Setpoint values vary with the configuration of each control and the type of control output; ON/OFF or variable frequency (pulse).

The image displays four screenshots of the AEGIS II Browser interface, each showing a different control panel. Callouts provide additional context for the setpoint values shown.

- 5:Blr5 Treatment**: The 'Adjust Setpoint' panel shows 'Measure' at 100 G and 'Feed' at 10 seconds. A callout states: "Feeding on volume allows you to set the feedwater concentration. This example uses an ON/OFF pump".
- 8:Sulfite Feed**: The 'Adjust Setpoint' panel shows 'Measure' at 100 G and 'Feed' at 10 ppm. A callout states: "Using a frequency controlled pump simplifies setting a feed concentration". Another callout points to the 'Feed' field: "Refer to 3.1 for feed setup".
- 8:Sulfite Feed**: The 'Adjust Setpoint' panel shows 'Percent Time' at 18.5 %. A callout states: "In this example, a Pulse control has been configured to ON/OFF, ON 18.5% of every 5 minutes".
- 9:Dispersant**: The 'Adjust Setpoint' panel shows 'Base Feed' at 12.5 mL/minute. A callout states: "In this example, a Pulse control feeds continuously. Typically the feed would interlocked with a flowswitch or boiler run contact set from the site DCS."

Sidebar:

Controls may be configured to prevent one chemical feeding while another feeds (See 'Blocking') into a common injection header.

Inhibitor feeds may be delayed while the bleed solenoid is ON to prevent pumping inhibitor down the drain (See Section 3.)

Pumps or blowdown valve controls may be turned OFF when the tower or boiler is offline (See Interlocks)

Pay attention to the number **1** to **9** that precedes the pump, valve or solenoid name. It's the physical location on the controller circuit board of the wiring that connects to the pump, valve or solenoid.

You may modify the name of the pump, valve or solenoid but you'll need to know which output is controlling so you can check that enclosure cover indicating light is ON when the pump, valve or solenoid is ON. (Relays 1-5 on the LHS & Pulse 6-9 on the RHS)

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1.6 Priming-Testing Pumps & Solenoids

Select the 1 to 9 icon on the home page. This example primes the Relay 3

Select **Prime-Test** from the pull-down

Time remaining until end of Prime-Test

3:Inhibitor Feed

Prime-Test

START ☒ Yes ☐ No

Prime, Force ON 8.5 minutes

Refresh Submit

Edit the Prime-Test Time & Submit

3:Inhibitor Feed

Prime-Test

Remaining 00:08:24

End of Prime-Test ☐ Yes ☒ No

Refresh Submit

Select **End of Prime-Test = Yes** to end sooner & Submit

3:Inhibitor Feed

Prime-Test

Status Interlocked

START ☒ Yes ☐ No

Prime, Force ON

Refresh Submit

If the control is 'Blocked', 'Stopped', 'Interlocked' or 'Alarmed-OFF', Priming does not occur.

7:Acid Pump

Prime-Test

START ☒ Yes ☐ No

Prime, Force ON 200.0 mL

Refresh Submit

Pulse controls prime on volume, not time

Refresh to update time or volume remaining

7:Acid Pump

Prime-Test

Remaining 195 mL

End of Prime-Test ☐ Yes ☒ No

Refresh Submit

Sidebar:

Priming may also be used to slug feed on system start-up in addition to testing pumps, valves or solenoids. Feed limit alarms may stop priming.

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2 Blowdown Controls: Towers, Boilers, Closed Loops

2.1 Conductivity Controlled Blowdown

Select the 1 to 9 icon on the home page. This example sets up the Relay 1 as a Bleed Control

Select **Setup** from the pull-down

Each control has 3 possible **Control Types**: **Blowdown** controls conductivity in Towers & Boilers

There are 3 possible **Blowdown** modes. Select **Sensor Control** to use a Conductivity sensor to control the blowdown valve or bleed solenoid.

Select the sensor used to control the blowdown. This pulldown selects from installed conductivity & toroidal sensors, 4-20mA inputs & 'Phantoms' of 'Unassigned' type

Select **Configure** from the pull-down

Rename the control for your site. Max. 16 characters.

Inherits the units from the controlling sensor. Rename if required-preferred. Max 3 characters.

Sets the number of digits after the decimal point used for setpoints. Inherits from controlling sensor. Unless a condensate control, fractional uS of little utility

Towers & Boiler lower the conductivity when the bleed-blowdown opens & make-up-feedwater dilutes the circulating water. **Note 1.**

'None' for typical tower controls. See 2.2 for Boiler blowdown & 2.5 for Varying Cycles.

This relay cannot be disabled because it is in use to Prebleed Relay 2

1: Tower276 Bleed	
Setup	
Control Type	Blowdown
Set Blowdown Mode	Sensor Control
Control by:	A: Tower Conduct.
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

1: Tower276 Bleed	
Configure	
Descriptor	Tower276 Bleed
Display Units(UOM)	uS
Decimal digits	0
Used by I/O	2: Biofeed on 2
Control Action	ON decreases sensor
Special Control	None
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Sidebar:

Note 1: Closed loop conductivity controls usually use **Control Action ON increases sensor**. Select **Control by: More than one** to bleed on the ratio of tower to make-up conductivities. See next page.

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Conductivity Controlled Blowdown continued

If you have a conductivity sensor installed in the tower make-up line, you can control on the ration of the tower conductivity to the make-up conductivity.

CAUTION: If your tower has a long holding time or large circulating volume or you are running the chemistry close to the scaling limit, look closely at control effects. Auto-Increasing cycles of concentration (make-up conductivity falls) when the bulk of the tower water has not changed, may scale heat exchangers.

1: Tower276 Bleed

Setup

Status	Reconfigured
Control Type	Blowdown
Set Blowdown Mode	Sensor Control
Control by:	A/E

Refresh

Submit

To remove ratio controls,
Submit a blank Control By:
setting the control back to 'None'

Selecting Control by: More than one on the Configure page
allows you enter a ratio control equation.
In this example we are controlling in the rationof the sensor
connect to input 'A' (Tower Conductivity) to the sensor
conncted to input 'E' (Make-up Conductivity)

Ratio of conductivities sets the default units
to cycles & the default setpoints to 3.00
Adjust Setpoint for your application.

Set the cycles deadband (On-Off) narrow, for
minimum change in chemistry as the bleed
valve opens, the float adds make-up & the
cycles fall.

1: Tower276 Bleed

Adjust Setpoint

On:	3.00 cyc
Off:	2.98 cyc

Refresh

Submit

Sidebar:

If this is a new tower to you, take the time to watch a bleed cycle.

The bleed opens but the conductivity continues to increase until the float opens.

(If you have a meter on the make-up you'll see it increment volume @ a higher rate)

The conductivity then starts to fall & may continue to fall after the bleed has turned OFF, depending on the float dead band.

You can't control inside of the float dead band but you can see the parts of the blowdown control: sensor, solenoid, meter, float ... all working.

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2.2 Boiler Blowdown

Select the 1 to 9 icon on the home page.
This example sets up the Relay 4 as a Boiler Blowdown

Select **Configure** from the pull-down

The timing of Captured Sample blowdown controls varies with boiler usage, piping size & length from boiler to sensor, pressure, needle valve setting & feedwater quality. Modify timing & **Submit**.

Blowdown lowers boiler conductivity

Lower pressure commercial boilers use Captured Sample on the surface blowdown line for TDS control. **Note 1**.

Blowdown valve opens long enough to clear the surface blowdown line to the sensor, delivering a representative hot, un-flashed sample & goes to **Measure**. **Note 2**.

Valve closed. Sample cools a fixed & repeatable amount. Conductivity is measured @ the end of the measure interval. **Note 3**.

If conductivity above the setpoint, valve opens & blows down for **Blowdown** period, then goes to **Measure**

If conductivity below the setpoint, waits for ReSample time & goes to Sample. **Note 4**.

Optional thermal switch @ sensor alarms if blowdown valve fails to open, piping valved OFF...

4:Boiler_4_CS	
Configure	
Descriptor	Boiler_4_CS
Display Units(UOM)	uS
Decimal digits	0
Disable	<input type="radio"/> Yes <input checked="" type="radio"/> No
Control Action	ON decreases sensor
Special Control	Captured Sample
Sample	30 seconds
Measure	60 seconds
Blowdown	120 seconds
ReSample	60 minutes
Fail-to-Sample	U:Thermal Switch
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Sidebar:

Note 1. Higher pressure, utility-power generation boilers use a continuous blowdown & a sample cooler to measure conductivity.

Note 2: Sensor installed upstream of the blowdown valve-solenoid & throttling needle valve. Needle valve downstream of blowdown valve. Lower reliability, steam rated solenoids limited to very low pressure boilers.

Note 3: If you modify **Measure** time or needle valve setting. Recalibrate because you've changed the temperature at the measure point.

Note 4: Boilers which cycle up slowly can extend Resample time to minimize **Sample** energy, water & chemical losses. Process boilers may need to **Sample** more frequently.

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2.3 Metered Blowdown

Select the 1 to 9 icon on the home page. This example sets up the Relay 1 as Meter controlled Bleed.

Select **Setup** from the pull-down

Select **Set Blowdown Mode = Water meter** & select the controlling meter & **Submit**.

1: Tower276 Bleed

Setup

Status Reconfigured

Control Type Blowdown

Set Blowdown Mode Water meter

Control by: O: Tower Make-up

Refresh Submit

1: Tower276 Bleed

Adjust Setpoint

Measure 500 G

Feed 75 seconds

It would be unusual to control cycles using a single watermeter; however usable as a temporary fix on loss of a conductivity sensor.

1: Tower276 Bleed

Setup

Control Type Blowdown

Set Blowdown Mode Water meter

Control by: O:P

Refresh Submit

At sites where fouling or high silica prevents using contact conductivity sensors, two meter controls are useable if make-up water chemistry constant

Select **Control By = More than one** & edit to get a Makeup:Bleed sequential control. In the example 'O' is the make-up meter & 'P' the bleed.

Measure 300 Gallons or Make-up & then Bleeds 100 Gallons. Cycles of concentration = 3.

1: Tower276 Bleed

Adjust Setpoint

Measure 300 G

Bleed 100 G

Refresh Submit

Sidebar:

Toroidal (non-contact) conductivity sensors are also used in towers where fouling blocks contact type, conventional sensors.

2.4 Percentage Time Blowdown

Select the 1 to 9 icon on the home page. This example sets up the Relay 1 as a time controlled Bleed.

Select **Setup** from the pull-down

It would be unusual to control cycles using a **Percent Time** control; typically used as a temporary fix on loss of a conductivity sensor.

Select **Set Blowdown Mode = Percent Time & Submit.**

Setpoint is the % of every five minutes. In this example 25% = 75 seconds in every 5 minutes

1: Tower276 Bleed

Setup

Status Reconfigured

Control Type Blowdown

Set Blowdown Mode Percent Time

Refresh Submit

1: Tower276 Bleed

Adjust Setpoint

Percent Time 25.0 %

Refresh Submit

Sidebar:

Blowdown controls like other controls can be interlocked with flowswitch(es) or run contact sets & are subject to run time limits - alarms & blocking by other controls.

For example, if you use a **Percent Time** control to blowdown while you replace a sensor or meter, the bleed will turn OFF while the inhibitor feeds if you have configured the bleed to be 'Blocked by' the inhibitor pump.

However the bleed time owed in the current 5 minute cycle will be delivered when the inhibitor feed ends.

2.5 Variable Cycles

1: Tower276 Bleed

Configure

Descriptor	Tower276 Bleed
Display Units(UOM)	cyc
Decimal digits	2
Used by I/O	2: Biofeed on 2
Control Action	ON decreases sensor
Special Control	Varying Cycles
uS Maximum	3000 uS
High Cycles	2.500
uS Hi Range	1000 uS
Med. Cycles	4.250
uS Med Range	650 uS
Low Cycles	6.100
uS Lo Range	350 uS

Refresh Submit

If your make-up changes seasonally or periodically and you have a 2nd conductivity sensor installed in the tower make-up line you can control using **Varying Cycles**.

No not use **Varying Cycles** if:

1. The holding time or turnover time of the tower is 'long' then the bulk of the tower water has not changed when the make-up conductivity changes & you may scale if hardness limited. 'Long' is site specific and a function of temperature, water chemistry and treatment program.
2. The make-up conductivity does not track the component that limits the maximum cycles. For example, hardness may increase with conductivity but silica may not & you may be silica limited.

Varying Cycles is not a **Special Control** option until **Control By:** is set to the ratio of the Tower-to-Makeup conductivities, **A/F** in this example

Set the maximum allowed tower water conductivity

When the Make-up conductivity ('F' in this example) is less than 1000uS, the tower bleed is controlled to 2.5 cycles of concentration

When the Make-up conductivity is less than 650 uS, the tower bleed is controlled to 4.25 cycles of concentration

When the Make-up conductivity is less than 350 uS, the tower bleed is controlled to 6.1 cycles of concentration

Set **Blowdown Mode** = **Sensor Control** and **Control by:** to **More than one**. Then edit to the ratio of the [Tower]/[Make-up]. In this example the tower conductivity is measured @ input 'A' & the make @ input 'F'
Mathematical expressions require capitol letters! (A/F)

1: Tower276 Bleed

Setup

Control Type	Blowdown
Set Blowdown Mode	Sensor Control
Control by:	A/F

Refresh Submit

2.6 Blowdown Limit Alarms

Select the 1 to 9 icon on the home page. This example uses the **Alarms** page for a blowdown control on Relay 1

Select **Alarms** from the pull-down

Adjust for the number of minutes that would represent a failure to control cycles of concentration, 2 hours in this example

The number of minutes in any one bleed cycle

No = Alarm Logs & Displays but does not turn OFF the bleed

Yes = Turns ON the alarm relay when Relay 1 alarms

The default sets **OFF on Alarm** = **No**, some blowdown is usually better than none

If you are using another relay or DO with the **Special Control** = **Alarm Output**, then you can elect to have Relay1 alarm trip that relay or DO

Most recent alarm for Relay 1

Yes & Submit resets the alarm

Status	Adjusted Alarm
Mins/Actuation	120.0 minutes
OFF on Alarm	Yes <input type="radio"/> No <input checked="" type="radio"/>
Alarm Relay	Yes <input type="radio"/> No <input checked="" type="radio"/>
Reset Alarm	Yes <input type="radio"/> No <input checked="" type="radio"/>
Limit:ON timer	14:51 2016-Jul-11

Refresh Submit

Sidebar:

Obvious Alarm Causes:

Failed or blocked blowdown valve or solenoid, blowdown line inadvertently valved OFF after tower maintenance. If solenoid intermittent, check the static head required to operate.
 Faulted or debris blocked blowdown meter for towers using sequential meter control.

Less Obvious Causes:

Undersized bleed as load increases &/or make-up chemistry changes.
 Adding more gray water make-up @ higher than expected conductivity.
 Failure to adjust bleed setpoints as seasonal changes in make-up chemistry occur.

Self-Inflicted Causes:

Recalibrating a low reading conductivity sensor rather than cleaning it or identifying the cause of the low reading. Sensor subsequently fails to track tower conductivity. This alarm may indicate higher levels of water & inhibitor usage.

Note:

No blowdown ON time may indicate a float stuck ON or partially ON

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2.7 Blowdown Interlocks-Flowswitches

Select the 1 to 9 icon on the home page. This example uses the **Interlocked** page for a boiler blowdown interlock on Relay 4

Select **Interlocked** from the pull-down

An **Interlock** stops a control from turning **ON** when the interlock is **OFF**.
If the control is **ON** when the Interlock turns **OFF**, the control turns **OFF**.

All enabled contact set type inputs are shown on the **Interlocked** page. Select or deselect one or more **Interlock & Submit**

In this example, the contact set input @ T must be **ON** for The Boiler 1 blowdown control on Relay 4 to run

Cooling tower feed systems use a common flowswitch to interlock the bleed & all the chemical feeds. Boiler blowdowns typically use a separate interlock for each boiler.

A cooling tower flowswitch typically comes from a CTFS sensor but can be from any digital input device that represents flow

In this example pulse output 8 controls a sulfite pump typically feeding into the Deaerator sump.
If either Boiler 1 (T) or Boiler 2 (U) is online, we want the sulfite pump to be feeding so we select both to **Interlock & 'OR'** them.

A flowswitch is part of a CTFS serial conductivity sensor. The temperature and flowswitch signals from this sensor must be assigned to phantom inputs. See section 5.6 Sensor Attributes for Phantoms

Selecting more than one Interlock requires you to select **'OR'ed** or **'AND'ed**
OR = Any selected Interlock **ON** turns **ON** the control
AND = All selected interlocks **ON** to turn **ON** the control

Status	Interlock edit
S:Flowswitch	unused
T:Boiler 1 OnLine	Interlock
U:Boiler 2 Online	Interlock
W:Flowswitch_A	unused
X:Contact set	unused
Y:Contact set	unused
Contact set	'OR'ed

Sidebar:

Contact sets that are ON are usually CLOSED, but you may invert the ON state to be ON when the contact set is OPEN; Section 7.3

2.8 Blocking-Delaying a Blowdown

Select the 1 to 9 icon on the home page. This example uses the **Blocked by** page for a Tower bleed block on inhibitor feed

Select **Blocked By** from the pull-down

Blocking stops a control from turning **ON** when the blocking control is **ON** .
More than one block may be selected

In this example, the **Inhibitor Feed** pump controlled by Relay **3 Blocks** the bleed to prevent inhibitor from going direct to drain.

Select which controls you wish to Block the bleed & **Submit**

If feeding an oxidant into a common header with other reactive chemicals, you may elect to block the other chemicals from feeding when feeding oxidant

Status	Blocking edit
1: Tower276 Bleed	Blocked by
2: Biofeed on 2	unused
3: Inhibitor Feed	Blocks
4: Boiler_1_CS	unused
5: Blr5 Treatment	unused
6: P6 unused	unused
7: Acid Pump	unused
8: Sulfite Feed	unused
9: Dispersant	unused

Refresh Submit

Sidebar:

Warning: A poorly conceived block may prevent a control from running or working correctly. In this example, if the tower is bleed limited or the inhibitor pump undersized & therefore ON for an extended period, bleed control may fault.

You could elect to have the Bleed Control block the Inhibitor Pump & if you set the Bleed Setpoint inside of the float conductivity change, you'll have little effect on Inhibitor Levels.

Bleed then Feed Inhibitor feed controls block the Inhibitor Pump by feeding after the bleed ends.

Blocking inhibitor feed is seldom used on larger circulating volume towers where the feed point is usually remote in time & volume from the bleed point.

2.9 Blowdown Diagnostics

Select the 1 to 9 icon on the home page. This example uses the Diagnostic page for a Tower bleed block on Relay 1

Select **Diagnostic** from the pull-down

Controlling sensor or control equation. In this example, the ratio of tower conductivity connected to 'A' & make-up connected to 'F'

ON time since midnight

This blowdown control is running the **Varying Cycles** special control

Status: ON/OFF, blocked, interlocked, alarmed...

Current value of the control sensor or control equation

ON time in the current bleed cycle. In this example the same as **ON today** time, may indicate a control problem

Added special control information. In this example, that we are running in the lowest range of make-up conductivity.

Refresh

4:Boiler_1_CS

This example is a **Special Control = Captured Sample** boiler blowdown control by the sensor connected to input 'F'.

Captured Sample controls only update the value of the controlling sensor @ the end of the **Measure** period

Why is the conductivity value so low?
Did the sampling valve-solenoid fail to open?
Did it fail to close & are we flashing @ the sensor?
Are we valved OFF upstream?
Did we just start-up & is the boiler cycling up?
Diagnostics provide the information, you supply the context

The blowdown has only been ON 30 seconds today, likely a single Sample- Measure sequence

Currently in the **ReSample** delay period. In 11.3mutes, we'll open the blowdown valve-solenoid, **Sample**, close the Valve for the **Measure** period & update the value of 'F' the controlling conductivity. Then we'll either **Blowdown** or start another **ReSample** period.

1: Tower276 Bleed	
Diagnostic	
Status	Operational, ON
Blowdown by: A/F	17.95 cyc
48.4m ON today	48.4m ON, actuation
Varying Cycles	
ON uS Lo Range 350 uS	
Refresh	

4: Boiler_1_CS	
Diagnostic	
Status	Special Control, OFF
Blowdown by: F	100 uS
ON Setpoint	3000 uS
OFF Setpoint	2990 uS
Control Action	Lower TDS
0.5m ON today	0.0m ON, actuation
Captured Sample	
ReSample OFF 11.3min	
Refresh	

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3 Chemical Feed Controls: Inhibitor, Acid, Oxidant, Amine...

3.1 Water Meter Inhibitor Feed

Select the **1 to 9** icon on the home page. This example uses the **Setup** page for an Inhibitor feed controlled by Relay **3**

Select **Setup** from the pull-down

Feeding using a water meter on the make-up or bleed, is among the most ppm accurate, reliable & easiest to adjust methods for sites with relatively constant feedwater chemistry

Select **Control Type = Feed**, select **Set Feed Mode = Water meter** & select the **Control by:** water meter, then **Submit**

After **Setup**, go to **Adjust Setpoint** & set for your target chemical ppm, pump setting, meter location...

Measure does not have to be a multiple of the meter setting, the control does the math

Feed is the pump ON time. estimated based on pump size, stroke & frequency setting or adjusted based on a ppm test result

If using a pulse or frequency controlled pump, each stroke delivers a fixed amount (of Dispersant in this example) so the **Feed** setpoint is in ppm

See Section 8.0 for ml/stroke defaults & adjustments.

3:Inhibitor Feed

Setup

Control Type: **Feed**

Set Feed Mode: **Water meter**

Control by: **O:Tower Make-up**

Refresh Submit

Adjust Setpoint

Measure: **100 G**

Feed: **12 seconds**

Refresh Submit

9:Dispersant

Adjust Setpoint

Measure: **100 G**

Feed: **10 ppm**

Refresh Submit

Sidebar:

If using a water meter on the bleed & a pulse-controlled pump, the nominal inhibitor ppm in the tower is the Feed setpoint x% active/100; 100% if feeding neat.

See following page for make-up meter example.

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Water Meter Inhibitor Feed cont.

It's common to feed inhibitor on the sum of potable-city & gray water make-ups.

If inhibiting for corrosion control, then you may wish to feed more on gray water make-up; increase the grey water meter scaling accordingly.

(A 100G/contact gray meter set to 200G/contact will double the feed).

If inhibiting for scale, then you may wish to feed less inhibitor on gray make-up; decrease the gray water meter scaling proportionately.

(A 100G/contact gray meter set to 50G/contact will halve the feed).

Changing the meter setup will also affect the totalized watermeter reading!

3:Inhibitor Feed

Setup

Control Type: **Feed**

Set Feed Mode: **Water meter**

Control by: **More than one**

Refresh Submit

To feed on the sum of 2 to 4 water meters select
Control by: More than one & Submit

3:Inhibitor Feed

Setup

Status: Reconfigured

Control Type: **Feed**

Set Feed Mode: **Water meter**

Control by: **O+R**

Refresh Submit

Edit **Control by**: to be the sum of the target meters & **Submit**
In this example, we're using a potable make @ input 'O' & a gray water make-up @ input 'R'

Removing complex control equations:
Submit a blank **Control by**:
Sets **Control by**: to **None**

Sidebar:

Simplified example: Yes, this begs for an app & likely you have access to one; if not:
An 8 GPD pump with the meter on the make-up & running 4 cycles of concentration feeding a 50% active product & requiring 20 ppm of inhibitor in the recirculating tower water:

100 gallons of make-up needs a 10 ppm ($20\text{ppm} \times 100\% / 50\% / 4 \text{ cycles}$) feed.

An 8 GPD pump feeds $(8 \text{ G} / (24\text{hr.} \times 3600 \text{ sec/hr.}) 92.6\text{E}^{-6} \text{ G/sec.}$

Every 100 Gallons of make-up we'll need to feed ($100\text{G} \times 10 \text{ ppm}$) 1E^{-3} gallons which @ $92.6\text{E}^{-6} \text{ G/sec}$ feed rate will take ($1\text{E}^{-3} / 92.6\text{E}^{-6}$) 10.8 seconds

There are error sources: How accurate is the % active?

Is 8GPD @ site temperature range & static head? How accurate is the cycle control?.....

This is a first guess; test ppm & adjust.

If this is a start-up, use pump Prime to get to an initial ppm.

3.2 Sensor Controlled Feeds

Select the 1 to 9 icon on the home page. This example uses the **Setup** page for an Oxidant feed controlled by Relay 2

Setting up a sensor controlled feed has 3 steps: **Setup, Configure & Adjust Setpoint**

Select **Setup** from the pull-down

Select **Control Type = Feed**, **Set Feed Mode = Sensor** & then select the controlling sensor for **Control by:** from the pull-down & **Submit**

Edit for your site, up to 16 characters

Inherited from the controlling ORP sensor. Unints may be edited, up to 3 characters

Default is the correct Control Action for an oxidant where feeding increases the controlling ORP value. **ON decreases sensor** would be used for a bisulfite, de-chlor control

Setpoints for an ORP control will vary with site water chemistry & target ppm. Biologicals drive the ORP down. When it's **300 mV** the pump turns ON & stays ON until the ORP is **325 mV**

2:Oxidant_Control

Setup

Control Type	Feed
Set Feed Mode	Sensor Control
Control by:	D:ORP Sensor

Refresh

Submit

2:Oxidant_Control

Configure

Descriptor	Oxidant_Control
Display Units(UOM)	mV
Decimal digits	1
Disable	<div>Yes</div> <div>✓ No</div>
Control Action	ON increases sensor
Special Control	None

Refresh

Submit

2:Oxidant_Control

Adjust Setpoint

Status	Setpoint change
On:	300.0 mV
Off:	325.0 mV

Refresh

Submit

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Sensor Controlled Feeds cont.

7:Acid Pump

Setup

Control Type	Feed
Mode	Pulse Output
Set Feed Mode	Sensor Control
Control by:	C:pH Sensor

Refresh

Submit

Outputs 6 to 9 may be **Mode** configured as either **Pulse Output** or **ON/OFF Output**. Use Pulse for frequency controlled pumps & ON/OFF for Run/Stop controlled pumps.

In this example, we've configured output 7 for a frequency controlled pump

7:Acid Pump

Configure

Descriptor	Acid Pump
Display Units(UOM)	pH
Decimal digits	2
Disable	<div>Yes</div> <div>✓ No</div>
Special Control	None
Pump Type	ProMinent 0704
mL/stroke	0.240

Refresh

Submit

If **Mode = Pulse Output**, the **Configure** page will show the installed **Pump Type** its nominal **mL/stroke** setting. Default **mL/stroke** assumes 100% stroke Refer to Section 8. for detail on pump selector & settings

7:Acid Pump

Adjust Setpoint

Status	Setpoint change
100%:	7.50 pH
0%:	7.45 pH

Refresh

Submit

Pump speed varies linearly between setpoints with maximum strokes/minute set by **Pump Type**

If **Mode = ON/OFF Output**, the **Adjust Setpoint** fields will be **On:** & **Off:**

Sidebar:

WARNING: Reversing setpoint order is blocked for ON/OFF controls but allowed for proportional Pulse controls. Reversing setpoints in this example would convert an Acid feed to a Caustic feed.

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3.3 Proportional Feed

3.3.1 Bleed Based Feed

Bleed & Feed and **Bleed then Feed** are used to feed inhibitor proportional to the tower bleed ON time. Commonly used on smaller towers without a make-up or bleed meter installed.

Bleed & Feed is usually only used when the tower is 'bleed limited', with the bleed undersized and ON for more than 50% of the time.

Sidebar:

Bleed then Feed is used to feed cooling tower inhibitor when a make-up meter is not available and the bleed is ON typically for less than 50% of the time that the tower is on-line.

If the tower Bleeds for **X** Minutes, the Inhibitor is fed for a user set % of **X** minutes AFTER the bleed ends. It's a better way to feed inhibitor for small cooling towers than **Bleed & Feed** since less inhibitor is lost down the drain.

Inhibitor savings averaging more than 20% were measured on a mix of small towers in California simply by switching from **Bleed & Feed** to **Bleed then Feed**.

Reliability:

Bleed then Feed & Bleed & Feed controls are only as reliable as the tower bleed solenoid and conductivity sensor. So set bleed limit alarms to trap control faults.

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3.3 Proportional Feed

3.3.2 Time Modulation

Time Modulation allows an ON/OFF pump to operate like a frequency or 4-20mA controlled pump. ON-OFF pumps are typically set to maximum stroke and rate when **Time Modulation** is selected.

Select the 1 to 9 icon on the home page. This example uses the **Configure** page for an Oxidant feed controlled by Relay 2

Select **Configure** from the pull-down

Select **Configure** from the pull-down

Setup a sensor based control as shown in **Section 3.2 Sensor Controlled Feeds** then change **Special Control** from **None**

The selection of **Control Action** alters the ON & OFF time calculation in each **Period**

Select **Special Control = Time Modulate** And set the Modulation **Period** in seconds & **Submit**

In this example the setpoints are 50mV apart & the **Period** = 120 seconds.
If the current ORP = 320mV then the pump would be ON for 72 seconds
 $(120 \times (350-320)/(350-300))$
and OFF for 48 seconds $(120 - 72)$

The pump would be ON for 120 seconds in every 120 seconds @ the **On:** ORP & OFF for 120 seconds in every 120 seconds @ the **Off:** ORP

2:Oxidant_Control

Configure

Status	Reconfigured
Descriptor	Oxidant_Control
Display Units(UOM)	mV
Decimal digits	1
Disable	<input type="radio"/> Yes <input checked="" type="radio"/> No
Control Action	ON increases sensor
Special Control	Time Modulate
Period	120 seconds

Refresh Submit

2:Oxidant_Control

Adjust Setpoint

Status	Setpoint change
On:	300.0 mV
Off:	350.0 mV

Refresh Submit

Sidebar:

Time Modulate Special Control is only selectable on Relays 1-5 and 6-9 only when they are set to **Mode = ON/OFF Output**.

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3.3 Proportional Feed

3.3.3 Timed Cycling

Timed Cycling allows time for the controlling sensor to measure the effect of chemical before feeding more chemical. **Timed Cycling** is used where a chemical is fed occasionally into a system with a large volume.

It may be several minutes before the chemical travels from the injection point through the piping and sump and then back to the controlling sensor location at the recirculating pump.

Based on the setpoint, the relay will be on for the ON time in each period and off for the remainder of the period. Once the setpoint is reached, the relay will not turn on again until the setpoint calls for chemical. It is either on for the ON Time each period, or off for the complete period.

Select the 1 to 9 icon on the home page.
This example uses the **Configure** page for an Oxidant feed controlled by Relay 2

Select **Configure** from the pull-down

Setup a sensor based control as shown in **Section 3.2 Sensor Controlled Feeds** then change **Special Control** from **None**

In this example, if the oxidant value drops below the setpoint, relay #3 will turn on for 60 seconds and then remain off for (600-60) 540 seconds. This will repeat each Period until the ORP value rises above the setpoint. The controller only compares the value with the setpoint at the start of a cycle. Once a cycle starts, the relay will either be on for the On Time or not come on at all.

1. Select **Special Control** = **Timed Cycling**

2. Set **Period** = OFF + ON Time, maximum 1800 seconds, 30 minutes

3. Set **ON Time** = maximum feed time in any **Period** & **Submit**

2:Oxidant_Control	
Configure	
Status	Reconfigured
Descriptor	Oxidant_Control
Display Units(UOM)	mV
Decimal digits	1
Disable	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Control Action	ON increases sensor
Special Control	Timed Cycling
Period	600 seconds
ON Time	60 seconds
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Sidebar:

Often there is a long time delay between adding a chemical and measuring its effect at a sensor which causes setpoint overshoot and poor control.

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3.3 Proportional Feed

3.3.4 PID Controls (Relays 6 through 9 only)

Warning: An incorrectly configured PID control can be unstable or unresponsive when loaded or not. Wide swings in the sensor value can be the result of a poor configuration. If long delays (>5 minutes) exist in your control loop, or you are not experienced in PID control with long delays, we advise that you use a different proportional **Special Control**. (See section 3.3.2 and 3.3.3)

Select the 6 to 9 icon on the home page. This example uses the **Configure** page for an Oxidant feed controlled by Relay 7 in pulse mode

Select **Configure** from the pull-down

Setup a sensor based control as shown in **Section 3.2 Sensor Controlled Feeds** then change **Special Control** from **None** to **PID**

7:Chlor Pump pulse

Configure

Status	Reconfigured
Descriptor	Chlor Pump pulse
Display Units(UOM)	mV
Decimal digits	0
Disable	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Control Action	ON increases sensor
Special Control	PID Control
mL/stroke	0.100
Rated SPM	240
Xp Proportnl	20.000 mV
Integral Rate	30 seconds
Diffrence Rate	15 seconds

7:Chlor Pump pulse

Adjust Setpoint

PID Control 740 mV

PID Control only requires a single **Setpoint**

This example uses a pulse, variable frequency control. Selecting **PID Control** on a relay control adds a **Relay Period** field. The relay ON time is modulated by the PID control

Select **Special Control** = **PID Control**

Never change two or more parameters at the same time. This includes the pump output.

Proportional (band) is the range of control. 2.0pH (in this example) from the setpoint, the output will be at 100% and proportionally diminish until at the setpoint, the output will be off.

The Integral rate effects how strongly the output responds to the error based on the amount of time the process and setpoint are different. A larger value will have less effect. Zero is off. Rule of thumb; set equal to 1.5x or 2x lag time.

Lag Time: Difference from the moment the chemical is added until the probe sees a change.

The difference rate is based on the rate of change in the process. Set for 0 (zero is off) and if the output has an oscillation that cannot be stopped using P and I, start to increase D slowly. 99% of customers will not need this parameter. Do not exceed 0.2x lag time.

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3.4 Base Feed

Base Feed is usually interlocked with a tower flowswitch or the boiler run contact set & feeds chemical continuously while the flowswitch is ON or boiler on-line.

Select the **1 to 9** icon on the home page.
This example uses the **Setup** page for a Dispersant feed controlled by pulse output 9

Select **Setup** from the pull-down

1. Select **Control Type = Feed**
2. Select **Mode = Pulse Output**
3. Select **Set Feed Mode = Base Feed** & **Submit**

Then **Adjust Setpoint & Submit**
The pump type & ml/stroke are viewed - selected on the **Configure** page.

Relay 1-5 controlled base feeds are the same as Pulse 6-9 outputs configured **Mode = ON/OFF output** with **Set Feed Mode = Percent Time** & **Submit**

Then **Adjust Setpoint & Submit**
For ON/OFF **Percent Time** controls, the Setpoint = ON time in every 5 minutes.
In this example 25% = 75 seconds ON in every 300 seconds

The screenshots show the following configuration steps:

- Step 1:** Select the **1 to 9** icon on the home page. This example uses the **Setup** page for a Dispersant feed controlled by pulse output 9.
- Step 2:** Select **Setup** from the pull-down.
- Step 3:** Select **Control Type = Feed**, **Mode = Pulse Output**, and **Set Feed Mode = Base Feed**, then click **Submit**.
- Step 4:** Then **Adjust Setpoint & Submit**. The pump type & ml/stroke are viewed - selected on the **Configure** page.
- Step 5:** Relay 1-5 controlled base feeds are the same as Pulse 6-9 outputs configured **Mode = ON/OFF output** with **Set Feed Mode = Percent Time** & **Submit**.
- Step 6:** Then **Adjust Setpoint & Submit**. For ON/OFF **Percent Time** controls, the Setpoint = ON time in every 5 minutes. In this example 25% = 75 seconds ON in every 300 seconds.

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3.5 Control During Events

3:Oxidant_Feed

Setup

Control Type: **Feed**

Set Feed Mode: **Sensor Control**

Control by: **G:CBR Bromine**

Refresh Submit

Select the 1 to 9 icon on the home page. This example uses the **Setup** page for an Oxidant feed controlled by Relay 3

Select **Setup** from the pull-down

Events only exist on the pull down if Control Type = Feed
Set Feed Mode = Sensor Control
& the control is an oxidant, Bromine in this example

Feed **Events** are set as detailed in the following Section 4.0

3:Oxidant_Feed

Events

Day 2: 2 Events weekly

Event Cycle: **Weekly**

Select Activity: **Edit an Event**

Select for Edit & Delete

Application flexibility:

1. **Event Control = No** works like normal biofeed feed event, feeding @ the current pump setting for the event duration.
2. Typically, the event setpoint would be higher than the non-event setpoints. But the control also works with event setpoints less than non-event setpoints

3:Oxidant_Feed

Adjust Setpoint

On: 2.0 ppm

Off: 2.1 ppm

Refresh Submit

Adjust Setpoint controls the Relay 3 Oxidant Feed using these setpoints until an **Event** occurs.

During an **Event**, if **Event Control = No** the control is ON for the Event period with no setpoint controls

During an **Event**, if **Event Control = Yes** these setpoints control

3:Oxidant_Feed

Event frequency: **Once Alternate Days Daily**

Event Control: ☒ Yes ☐ No

ON Setpoint: 5.0 ppm

OFF Setpoint: 5.5 ppm

3.6 Limiting Feed & Alarms

Feed Limits are used both to prevent sensor controlled overfeeds & to block the effect of errors in adjusting feed rates or setpoints.

Configure both the alarm & response to the type of chemical & how you are controlling the feed.

Select the 1 to 9 icon on the home page. This example uses the **Alarms** page for an Inhibitor feed controlled by relay output 3

Select **Alarms** from the pull-down

You're usually not concerned about extended feed periods with inhibitors, so **Mins/Actuation** typically set to never trip

At the expected usage for this size tower @ max. load, cumulative feed over 4 hours/day indicates either a control problem or setpoint error. When **Minutes/Day** is exceeded, feed stops.

Inhibitor feeds usually set **Midnight Reset = Yes**, which auto resets alarms @ midnight allowing another **240.0 minutes** of feed in the following day

If you are using another relay or DO with the **Special Control = Alarm Output**, then you can elect to have Relay 3 alarm trip that relay or DO

Select **Reset Alarm = Yes & Submit** to clear alarms (see Sidebar)

Most recent alarm & it's type, if any. This one's a year old so we're not frequently alarming

3:Inhibitor Feed	
Alarms	
Mins/Actuation	500.0 minutes
Minutes/Day	240.0 minutes
Midnight reset	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Alarm Relay	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Reset Alarm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Limit: Time/Day	12:16 2015-Feb-22
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Sidebar:

Unlike Blowdown controls, Feed controls stop feeding when alarmed. If alarmed on **Mins/Actuation**, the alarm ends the **Actuation** period, so **Reset Alarm = Yes & Submit** re-starts the feed.

If alarmed on **Minutes/Day**, **Reset Alarm** does not restart the feed because we've still exceeded the **Minutes/Day** limit. If you need to continue to feed, increase the **Minutes/Day** limit.

In either case. The alarms are either set too tight, operating conditions may have changed or there is a control-pump-feed-sensor problem.

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Limiting Feed & Alarms cont.

Alarms on feeds for acid, caustic or oxidants that are not tripping because they are set too tight to the normal operating or seasonal variation, usually indicate a maintenance response is required.

Make-up water chemistry may have changed. Towers may have added a gray water make-up or boilers may have deaerator problems or contaminated condensate return.
Sensors age, foul & drift. Meter wiring may be sharing conduit with power wiring...

Frequency controlled pumps 6-9 have alarms set by pumped volume

7:Acid Pump

Alarms

vol.@ MAX spm	0.5 G
Volume/Day	12.7 G
Midnight reset	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Alarm Relay	<input checked="" type="button" value="Yes"/> <input type="button" value="No"/>
Reset Alarm	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>

Refresh Submit

Depending on the controlling sensor & the type of control, a sensor fault may cause the pump to ramp to maximum. This is the type of fault trapped by the **vol.@MAX spm** alarm

Volume/Day alarms stop feed on the volume pumped from midnight.
It would be prudent to use both alarms on an acid feed control

Base Feed, PID & proportional feed controls may never completely turn OFF so Actuation volume alarms are less effective with frequency controlled pumps.

Acid feeds usually set **Midnight Reset = No**.
If you are alarming, find the cause & correct

Sidebar:

Feed controls stop feeding when alarmed.

If alarmed on **vol.@MAXspm**, the alarm ends feed cycle, so **Reset Alarm = Yes & Submit** re-starts the feed.

If alarmed on **Volume/Day**, **Reset Alarm** does not restart the feed because we've still exceeded the **Volume/Day** limit. If you need to continue to feed, increase the **Volume/Day** limit.

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3.7 No Feed on No Flow

Select the 1 to 9 icon on the home page.
This example uses the **Interlocked** page for a Boiler treatment feed controlled by relay output 5

Select **Interlocked** from the pull-down

In this example, when the contact set @ input '**U**' **Boiler 2 Online** is **ON** then the relay 5 feed control runs.

Select **Interlock** @ the target input & Submit

Status	Interlock edit
S:Flowswitch	unused
T:Boiler 1 OnLine	unused
U:Boiler 2 Online	Interlock
W:Flowswitch_A	unused
X:Therm_Flowswitch	unused
Y:Contact set	unused

Refresh

Submit

In this example relay output 3 controls an inhibitor pump.

If both **Flowswitch (S)** and **Low_Level (U)** are **ON**, we want the inhibitor to be feeding so we select both to **Interlock** & '**AND**' them. (Avoiding both a loss of prime & pumping dry.)

Selecting more than one Interlock requires you to select '**OR**'ed or '**AND**'ed
OR = Any selected Interlock **ON** turns **ON** the control
AND = All selected interlocks **ON** to turn **ON** the control

Status	Interlock edit
S:Flowswitch	Interlock
T:Boiler 1 OnLine	unused
U:Low_Level	Interlock
W:Flowswitch_A	unused
X:Therm_Flowswitch	unused
Y:Contact set	unused
Contact set	'AND'ed

Refresh

Submit

3.8 Blocking-Delaying a Feed

Select the 1 to 9 icon on the home page.
This example uses the **Blocked by** page for an Inhibitor feed controlled by relay output 3

Select **Blocked** from the pull-down

Blocking stops a feed control from turning **ON** when the blocking control is **ON** .
More than one block may be selected

In this example, the **Oxidant_Control** pump controlled by Relay 2 **Blocks** the **Inhibitor Feed** on Relay 3 to prevent degrading the inhibitor in the common feed header

Select which controls you wish to Block the **Inhibitor Feed & Submit**

If feeding inhibitor controlled by a make-up meter or Bleed_then_Feed.... & the **Oxidant_Control** blocks, owed inhibitor feed occurs when the **Oxidant Control** turns OFF

Status	Blocking edit
1:Tower276 Bleed	unused
2:Oxidant_Control	Blocks
4:Boiler_1_CS	unused
5:Blr5 Treatment	unused
6:P6 unused	unused
7:Acid Pump	unused
8:Sulfite Feed	unused
9:Dispersant	unused

Refresh Submit

Sidebar:

Warning: A poorly conceived block may prevent a control from running or working correctly.

In this example, if the **Oxidant_Control** runs long because the chlorine demand is not met or the control setpoints are set too far apart, inhibitor levels in the recirculating water may fault.

Generally (dependent on tower size, injection point & siting), once you've met the initial chlorine demand, setting ORP setpoints 5-10mV apart should result in short oxidant feed periods.

If you have a large inhibitor pump &/or short inhibitor feeds, you could get the same result by blocking the **Oxidant_Control** with the inhibitor pump.

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3.9 Feed Diagnostics

Select the 1 to 9 icon on the home page. This example uses the **Diagnostic** page for an **Acid Pump** controlled by pulse output 7

Select either the I/O icon on the home page or **Diagnostic** from the pull-down

Diagnostic provides both configuration & state detail on one page

7:Acid Pump	
Diagnostic	
Status	Operational,ON
Feed by: C	7.32 pH
100%ON Setpoint	7.50 pH
OFF Setpoint	7.25 pH
Control Action	Between Sets

Volume today	0.288G
Refresh	

Control state

Location of controlling sensor, 'C' & value of the control.

Current setpoints

Feed state

Note that $1400\text{G} / 100\text{G} \times 10\text{sec} = 2.33$ minutes. But pump ON for **240.4** minutes today, so feed mode must have been changed.

5:Blr5 Treatment	
Diagnostic	
Status	Operational,ON
Feed by: O	1400 G
Measure volume	100 G
and Turn ON for	10 seconds
Last fed	1400 G

240.4m ON today	0.3m ON, actuation
Time Owed	2.0 min
Refresh	

Control state

Location of controlling sensor, 'O' & value of the control.

Current setpoints

Volume feed state

In this example: We've measured volume but have not fed all the time required, so there is **Time Owed**

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Feed Diagnostics cont.

3:Inhibitor Feed

Diagnostic

Status	Special Control,ON
5.7m ON today	5.7m ON, actuation
<hr/>	
Bleed then Feed	Bleed OFF Feed 7475 sec
<div>Refresh</div>	

Control state: In this example, the **Bleed then Feed Special Control** is controlling Relay 3

The **Bleed** is now **OFF** & we owe **7475** seconds of pump run time. Is a 2 hour bleed cycle normal for this site or does it indicate a problem?

9:Dispersant

Diagnostic

Status	Special Control,ON
130.7m ON today	0.7m ON, actuation
<hr/>	
Percent Time,25%	Countdown: 33 seconds
<div>Refresh</div>	

Control state: In this example, the **Percent Time Special Control** is controlling 9 configured as an ON/OFF output

We're in the ON state for another 33 seconds of the 5 minute cycle. 25% of 5 minutes = 75 seconds

3:Inhibitor Feed

Diagnostic

Status	Interlocked S,OFF
Feed by: O	2100 G
Measure volume	100 G
and Turn ON for	10 seconds
Last fed	2100 G
<hr/>	
130.8m ON today	0.0m ON, actuation
<div>Refresh</div>	

Control state: In this example, the Inhibitor feed on relay 3 is controlled by the meter @ input 'O' is OFF because the Flowswitch @ input 'S' is OFF (S Interlocks 3)

If 'O' measures volume while interlocked, the feed for the measured volume will occur when 'S' turns ON

2:Oxidant_Control

Diagnostic

Status	Blocked by 3 ,OFF
2.5m ON today	0.0m ON, actuation
<div>Refresh</div>	

Control state: In this example, the **Oxidant Control** by relay 2 is Blocked & OFF when Relay 3 turns ON

4 Biocide Events & Other Controls: Feeding by Time & Date

4.1 Setting & Viewing Events

Select the 1 to 9 icon on the home page.
This example uses **Biocide A**
controlled by relay 5

Select **Setup** from the pull-down
& after **Submit**, select **Events**

Control Type: **Events-Other**
Refresh Submit

Select **Control Type = Events-Other**
& **Submit**

Day# in the current 28 day cycle.
Monday, **Day 2** in this example
May be reset to the current Sunday,
See Section 10.7

Daily, Weekly & 28 Day programs can be mixed
in one controller.
Oxidants typically fed weekly with two organic biocides more
commonly fed on alternating weeks using a 28 day program
Dispersants may be fed daily

5:Biocide A

Events

Day 2 0 Events weekly

Event Cycle: **Weekly**

Select Activity: **Add an Event**

Select Activity = **Add an Event**

Start Day: **2**

Start Time: **7:00 HH:MM**

ON Time: **20 minutes**

Event frequency: **Once**
Alternate Days
Daily

Reset Submit

A new biocide control will
have **0 Events** set

Events repeat
Daily, Weekly or every **28 Days**
Select the required **Event Cycle**.

In this example, the first event
occurs on Monday, day **2**
starting @ **7:00 AM**
& feeding for **20 minutes**

In this example, we're also adding feed events on
Wednesday, Friday & Sunday by selecting
Alternate Days & **Submit**

Sidebar:

Relay 1-5 and ON-OFF 6-9 controls have timed events = **ON Time**.
Pulse-frequency controls 6-9 have volume feed events = **Volume**.

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Setting & Viewing Events cont.

5:Biocide A

Events

Day 2 4 Events weekly

Event Cycle Weekly

Select Activity Edit an Event

Select for Edit & Delete

Day 1 @ 07:00 for 20 minutes

Values for Add & Edit

Start Day 1 1-7

Start Time 7:00 HH:MM

ON Time 20 minutes

Event frequency Once
Alternate Days
Daily

Reset Submit

In the previous page's example, 4 feed events on Monday, Wednesday, Friday & Sunday were added on **Submit**

Select Activity to
Edit an Event
Delete an Event
Delete All Events
Or
Add an Event (see previous page)

Pull down this selector to view all of the events for this control & to select an event for Editing or Deleting

If Select Activity = Edit an Event or Add an Event the values in these fields are set on **Submit**.

Sidebar:

Limit Alarms, Interlocking & Blocking also are used with Biocide Events. They are set identically to those for **Chemical Feed Controls**. Refer to Sections 3.5 to 3.7 for setup & state pages.

Biocide feeds are always interlocked with the tower flowswitch.

Timed & Volume events can also be used to wash sensors, flush sumps, block other controls for event times....

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4.2 Prebleed – Lockout

5:Biocide A	
Configure	
Status	Reconfigured
Descriptor	Biocide A
Disable	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Special Control	Prebleed Lockout
Lockout	120 minutes
Prebleed	30 minutes
Prebleed Sensor	A: Tower Conduct.
Prebleed OFF	750 uS
Blowdown Relay	1: Tower276 Bleed
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Select **Configure** on the Biocide Event control to setup **Prebleed Lockout**

Select **Special Control** = **Prebleed Lockout** & **Submit**.
Then set-adjust the following parameters

Lockout is the time that the **Blowdown Relay** is blocked. Includes the Event time. Set = 0 for no **Lockout**.

Prebleed is the time that the **Blowdown Relay** is forced ON to lower the recirculating water conductivity before the Event runs. Set = 0 for no **Prebleed**.

Prebleed Sensor is the selected conductivity sensor which is used to limit the **Prebleed** time to **Prebleed OFF**. It's optional, however its use prevents wasting treated recirculating water

Blowdown Relay is the location of the tower bleed for this biocide control.

Sidebar:

Prebleed-Lockout is used to prevent to tower from making up during & diluting the biocide concentration. Use is determined by biocide type & required concentration-residence time

Prebleed is typically used for cycles limited towers with **Lockout** more common on towers inhibited for corrosion control. Few sites need to use both.

Prebleed costs both water & its inhibitor, but there may be no choice if hardness cycles limited. **Lockout** has a lower cost but not applicable for many sites.

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4.3 Alarm Relay

Select the control# icon from the right side of the home page

Select **Setup** from the pulldown

Verify **Control Type** = **Events-Other**

Then select **Configure** from the pulldown

Set **Special Control** = **Alarm Output** & **Submit**

5:Alarm_Relay	
Setup	
Control Type	Events-Other
Refresh	Submit

5:Alarm_Relay	
Configure	
Descriptor	Alarm_Relay
Disable	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Special Control	Alarm Output
Refresh	Submit

Sidebar:

If **Special Control** = **Alarm Output** is set for a pulse-frequency control (6 to 9), the control is converted to an ON/OFF control on **Submit**.

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4.4 Sensor Wash

Sensor Wash is useable for systems-sites where all of the sensors are installed in a common header.

Sensor Wash locks all of the sensor values prior to starting the wash event, blocking alarms & unexpected sensor values on the HMIs.
If concerned about other controls running during a wash, block (Section 3.7) the controls.

Select the control# icon from the right side of the home page

5:Sensor_Wash

Configure

Status

Reconfigured

Descriptor

Sensor_Wash

Disable

Yes

☒

No

Special Control

Sensor Wash

Wash END delay

300 seconds

Refresh

Submit

Sensor_wash is only available on controls
Control Type = Events-Other

Select **Special Control = Sensor Wash** & Submit

Then edit **Wash END delay** & Submit

Wash END delay is the time after the washing event has ended that sensor vlaues remain locked to allow recovery from washing

Sensor Wash events are set like all other feed events on either time (Relay controls 1 to 5 & ON/OFF Pulse controls) or pumped volume (Pulse controls 6 -9).

5:Sensor_Wash

Events

Status

No Events set

Day 1

0 Events daily

Event Cycle

Daily

Select Activity

Add an Event

Start Time

7:00 HH:MM

ON Time

20 minutes

Event frequency

Once

Alternate Hours

Hourly

Reset

Submit

5 Sensors: Conductivity, pH, ORP, Corrosion, 4-20mA...

5.1 Sensor Calibration:

5.1.1 Single Point – Grab Sample

Select the A to N icon on the home page or the **CAL** icon below the A-N icons.
This example calibrates conductivity sensor connected to input 'A'

A: Tower Conduct.

Calibrate

If using the A to N icon, select Calibrate from the pulldown

Enter value

1650 uS

Factory Reset

Yes No

Calibrate Cancel

Grab sample from the sensor header & enter measured conductivity & select Calibrate

Calibrating locks out the local keypad user so that both users are not calibrating @ the same time.
Cancel to remove the lock & exit calibration

A: Tower Conduct.

Calibrate

Status

Calibrated

Enter value

1700 uS

Factory Reset

Yes No

Calibrate Cancel

In this example we edited the current 1650 uS to measure 1700 uS

Exit by selecting Cancel @ the end of Calibration or you'll lock out keypad calibration for this sensor for 15 minutes.

A: Tower Conduct.

Calibrate

Status

Out of Range

Sensor

3000 uS

Calib. Override

Yes No

Factory Reset

Yes No

Cancel Re-Calibrate Submit

Single point, grab sample calibration is typically used for controlling sensors which need to be accurate at the single point used for control

Each sensor type has calibration limits which usually indicate a sensor or installation problem, but not always.
If you get an error message you can ignore it by Calib. Override = Yes & Submit

Factory Reset = Yes & Submit restores the sensor to its default values.
Useful for pH, ORP & Conductivity sensors.
New sensor value may indicate fouling or end-of-life state or allow you to recover from a faulted calibration procedure

Cancel leaves the sensor value unchanged, Removes the lock out on keypad calibration & exits.

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5.1 Sensor Calibration:

5.1.2 DPD: Oxidant Sensors

C:CLE3 Chlorine

Calibrate

DPD Sample

& START

Factory Reset

Yes

No

Start

Cancel

Select the **A to N** icon on the home page or the **CAL** icon below the A-N icons. This example calibrates chlorine sensor connected to 4-20mA input C

If using the **A to N** icon, select **Calibrate** from the pulldown

Grab sample from the sensor installation header & press **Start**

Start saves the current value of the sensor for use when you complete the DPD test.

This page locks out the keypad due from calibration the sensor @ '**C**'. **Cancel** to exit the page & unlock.

C:CLE3 Chlorine

Calibrate

CLE3 Chlorine

2.35 ppm 14sec

Calibrate

Refresh

Cancel

When you have the result of the DPD test, edit the displayed value & **Calibrate**

Use **Cancel** to exit the DPD calibration

Refresh shows the time since the value @ **Start** was captured

C:CLE3 Chlorine

Calibrate

Status

Calibrated

DPD Sample

& START

Factory Reset

Yes

No

Start

Cancel

Calibrate shows 'Calibrated' on success. **Cancel** to exit

Factory Reset = Yes & Submit restores the 4-20mA-to-ppm conversion to its factory default

if you get a calibration error message you can ignore it by **Calib. Override = Yes & Submit** or re-calibrate by selecting **Start**

Sidebar:

The DPD calibration applies to CLB, CTE & CLE3 Chlorine, CGE, CBR Bromine & PAA Peracetic sensors. All of these sensors connect to 4-20mA input driver cards. The G input does not have the necessary voltage to power a loop for the ProMinent amperometric sensors.

ProMinent does not recommend ORP sensor calibration. If the sensor is not tracking, clean with a mild acid. The Offset may be adjusted +/- 40mV if necessary. Rather, consider changing the setpoint. There are many non-oxidants that affect ORP sensors falsely.

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5.1 Sensor Calibration:

5.1.3 Boiler Conductivity

Select the **A to N** icon on the home page or the **CAL** icon below the A-N icons.
This example calibrates the boiler conductivity sensor connected to input **E**

If using the **A to N** icon, select **Calibrate** from the pulldown

The blowdown control is using **Special Control = Captured Sample**.
Calibration includes services to verify the sensor installation

Select **Start** once you have an un-flashed sample to initiate the **Sample – Measure** sequence

Select **Cancel** to exit **Calibration**. Removes the calibration lockout for the keypad user & the calibration state from the blowdown valve control

Use **Refresh** to see the conductivity increase during the Sample period.
Low or varying conductivity indicates flashing. No change may indicate no-sample

If you elect to edit the displayed conductivity & **Calibrate** before the end of **Sample - Measure**, the previous value conductivity will be used to calibrate.

If you edit the displayed conductivity & **Calibrate** after the end of **Measure**, the current, updated value conductivity will be used to calibrate.

Refresh during the **Measure** interval should show a stable & falling conductivity, verifying that the valve-solenoid has closed & that the sample is cooling a fixed & repeatable amount

Successful **Calibration**. Select **Cancel** to exit & remove keypad calibration lock-out

If an error message results, you can set **Calib. Override = Yes** & Submit or **Start** to re-calibrate

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5.1. Sensor Calibration:

5.1.4 pH Dual Buffer Calibration 1 of 2

Select the **A to N** icon on the home page or the **CAL** icon below the A-N icons.
This example calibrates the pH sensor connected to input C

C:pH Sensor

Setup

Descriptor	pH Sensor
Display Units(UOM)	pH
Decimal digits	2
Calibrate	2 Point
Used by I/O	L ₁

If using the **A to N** icon, select **Setup** from the pull down to verify **2 Point**

pH sensor calibration defaults to single point.
To do a 2 buffer pH calibration
select **Calibrate = 2 Point** & **Submit**.
Then select **Calibrate** from the pull down

Caution: Sensor Removal

Always close the sensor piping
upstream valve first.
pH, ORP sensors & sensor with
membranes may fail
on the high transient pressure
caused by quickly closing
the downstream valve first.

Press **Start**.
Remove the pH sensor & place in the 1st buffer.
Calibration defaults to 7 & 10 buffers.
If you are not using a 7 buffer,
edit the buffer value before **Start**.

Start locks the pH value for control and
alarms during the 2 buffer clibrate sequence

C:pH Sensor

Calibrate

1st pH buffer	7.00 pH
Factory Reset	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>

Select **Cancel** to exit **Calibration**.
Removes the calibration lockout for the keypad user
& unlocks the frozen value of pH

C:pH Sensor

Calibrate

7.0 Buffer	7.04 pH 31sec
Factory Reset	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>

The selected 1st buffer in this
example is the default **7.00**

Refresh until the pH is stable
& close to the buffer value.
Then press **Next**.

Select **Cancel** to exit **Calibration**.

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5.1 Sensor Calibration: pH Dual Buffer Calibration 2 of 2

C:pH Sensor

Calibrate

7.0 Buffer 7.05 pH

2nd pH buffer 10.00 pH

Next Cancel

Results from 1st buffer

If you are not using a 10 buffer, edit the buffer value before **Next**.

Select **Cancel** to exit **Calibration**.

Refresh until the pH is stable & close to the 2nd buffer value. Then press **Calibrate**.

C:pH Sensor

Calibrate

7.0 Buffer 7.05 pH

10.0 Buffer 9.61 pH 25sec

Factory Reset Yes ☒ No

Calibrate Refresh Cancel

C:pH Sensor

Calibrate

Status Calibrated

1st pH buffer 7.00 pH

Factory Reset Yes ☒ No

Start Cancel Submit

Successful calibration. Press **Cancel** to exit **Calibration**.

On error message, select **Calib. Override = Yes & Submit**
Or
Re-calibrate to do over
Or
Cancel to exit leaving the current pH value unchanged

Note: Two buffer pH calibration seldom results in better pH control than single point, grab sample calibration, but may be required by site practice

C:pH Sensor

Calibrate

Status Out of Range

7.0 Buffer 7.05 pH

Sensor 10.00 pH

Calib. Override Yes ☒ No

Factory Reset ☒ Yes No

Cancel Re-Calibrate Submit

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5.1 Sensor Calibration:

5.1.5 4-20mA Input Loop Calibration 1 of 3

4-20mA inputs may be single or two point calibrated if they do not require a DPD test.

Both options calibrate the sensor represented by the 4-20mA input & not the underlying 4-20mA current loop.

For example: If calibrating a 4-20mA Temperature sensor, you are correcting the sensor to read the current measured Temperature test.

Select the **A to N** icon on the home page or the **CAL** icon below the A-N icons. This example calibrates the 4-20mA sensor connected to input G

Once a sensor has been selected for control by a relay, the Setup menu changes. 'Sensor Type' will not be seen. In its place is a Used by note depicting the relay being controlled.

See section 3.2 Sensor Controlled Feeds. Choose a different sensor to release this sensor setup page. **Remember to return the sensor selection when done.**

If using the **A to N** icon, select **Setup** from the pulldown & check **Calibrate = 1 Point**

Used by I/O 2,

In this example we're going to single point Calibrate a Sensor Type = Other

Edit the sensor value & **Calibrate** Status = **Calibrated** & displays new value

Cancel To exit & to unlock keypad calibrate access

G:4-20mA Input

Setup

Descriptor: 4-20mA Input

Display Units(UOM): C

Decimal digits: 2

Calibrate: 1 Point

Disable: Yes ☐ No ☒

Sensor Type: Other

20mA Value: 100.00 C

4mA Value: 0.00 C

Reset Submit

1: Acid Pump

Setup

Control Type: Feed

Set Feed Mode: Sensor Control

Control by: E:pH Sensor

Minimum ON time

G:4-20mA Input

Calibrate

Enter value: 50.01 C

Factory Reset: Yes ☐ No ☒

Calibrate Cancel

G:4-20mA Input

Calibrate

Status: Calibrated

Enter value: 48.50 C

Factory Reset: Yes ☐ No ☒

Calibrate Cancel

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5.1 Sensor Calibration: 4-20mA Input Loop Calibration 2 of 3

On this page we are 2 point calibrating a 4-20mA Temperature sensor.
Verify the **Setup** page **Calibrate = 2 Point** & select **Calibrate** from the pull down.

G:4-20mA Input

Calibrate

Enter 1st value	25 C
Calibrate 4-20mA	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Factory Reset	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Start Cancel Submit

In this example we're going to 2 point Calibrate a Sensor Type = Other which requires (in this example) that you either put the temperature sensor into 2 solutions of differing temperatures OR use a 4-20mA current loop emulator

Enter the first temperature & **Start**
(In this example, spanned 0-100C, 8mA = 25C)

G:4-20mA Input

Calibrate

First value	30.11 C
Enter 2nd value	50.00
Calibrate 4-20mA	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Factory Reset	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Calibrate Refresh Cancel

Move the sensor or modify the loop current, entre the 2nd temperature & **Calibrate**
(In this example, spanned 0-100C, 12mA = 50C)

G:4-20mA Input

Calibrate

Status	Calibrated
Enter 1st value	50.00 C
Calibrate 4-20mA	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Factory Reset	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Start Cancel Submit

Status = **Calibrated** & displays most recent value

Sensor type = Other
Always calibrates.
Understandably, there are no calibration limits for 'Other' sensors

Cancel to exit & to unlock keypad calibrate access

AEGIS II Browser

5.1 Sensor Calibration: 4-20mA Input Loop Calibration 3 of 3

You'll rarely need to calibrate the underlying 4-20mA current loop.

However, if **Setup** page **Sensor type** = **Other** and **Calibrate** = **2 Point** you can calibrate the underlying 4mA & 20mA levels as follows:

You'll need either a current loop emulator Connected to input 'G' (in this example) or the means to switch the current loop to 4mA & then to 20mA

Set **Calibrate 4-20mA** = **Yes** & **Submit**

Set the current loop @ 'G' to 4mA & **Start**

Set the current loop @ 'G' to 20mA & **Next**

Select **Calibrate** to complete

Status = **Calibrated** on success or error message

The measured 4 & 20 levels are the actual currents at input 'G'.
If they are not nominally 4 & 20mA, then that may indicate why you are calibrating input 'G' or you may have an emulator problem

Cancel to exit & to unlock keypad calibrate access

G:4-20mA Input

Calibrate

Enter 1st value: 50.04 C

Calibrate 4-20mA: ☒ Yes ☐ No

Factory Reset: ☐ Yes ☒ No

Start Cancel Submit

G:4-20mA Input

Calibrate

Connect 4mA test & Start

Factory Reset: ☐ Yes ☒ No

Start Cancel Submit

G:4-20mA Input

Calibrate

Connect 4mA test: 4.00 mA measured

Connect 20mA test & Next

Factory Reset: ☐ Yes ☒ No

Next Refresh Cancel

G:4-20mA Input

Calibrate

Connect 4mA test: 4.00 mA measured

Connect 20mA test: 20.00 mA measured

Factory Reset: ☐ Yes ☒ No

Calibrate Refresh Cancel

G:4-20mA Input

Calibrate

Status: Calibrated

Enter 1st value: 100.40 C

Calibrate 4-20mA: ☐ Yes ☒ No

Factory Reset: ☐ Yes ☒ No

Start Cancel Submit

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5.1 Sensor Calibration:
5.1.6 Inventory

K:Inhibitor_Tank

Setup

Status	Reconfigured
Descriptor	Inhibitor_Tank
Display Units(UOM)	G
Decimal digits	2
Disable	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>

Phantom inputs do not physically exist; you can't wire to them. They are of two types: Analog values in the 'K' to 'N' space & volumes-contact sets in the 'W' to 'Z' space. This example, uses 'K' as a tank level

Input 'K' has Compensation set to Inventory

K:Inventory

Configure

Compensation	Inventory
O: Tower Make-up	unused
P: Feedwater	unused
Q: Tower blowdown	unused
R: Grey Water add	unused
V: Water meter	unused
Z: Water meter	unused
6: Inhibitor Pump	Target Output
8: ORP pid	unused

Inventory subtracts the volume pumped by pulse controls and/or the volume measured by displacement metering on the pump head from the user set volume

In this example, the volume pumped by pulse control '6' lowers the tank level

Phantoms are logged, alarmed & can be used for controls. In this example, likely only a low tank level alarm is used

K:Inventory

Calibrate

Enter value

99.99 G

When the tank is refilled, edit Enter Value & Calibrate to set the current tank level

Cancel to exit & to unlock keypad calibrate access

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5.1 Sensor Calibration:

5.1.7 LSI & Manual Inputs 1 of 2

L:LSI

Calibrate

Alkalinity 95 ppm

Factory Reset Yes No

Calibrate Cancel

LSI (Langelier Saturation Index) **Compensation** was selected for phantom sensor input 'L'
Calbrate prompts for those values not measured by the controller

In this example both the pH & conductivity are measured by controller sensors, so only 2 parameters are required to calculate the LSI. (Temperature always measured by the controller)

Measure **Alkalinity**, edit & **Calibrate**

L:LSI

Calibrate

CaCO3 Hardness 75 ppm

Factory Reset Yes No

Calibrate Refresh Cancel

Measure **Hardness**, edit & **Calibrate**

Calibration completes.
LSI recalculated.

Cancel to exit & to unlock keypad calibrate access

L:LSI

Calibrate

Status Calibrated

Alkalinity 95 ppm

Factory Reset Yes No

Calibrate Cancel

Sidebar:

Ryznar Stability Index or 'Ryznar' is a generalized measure of scaling-corrosivity & calculated concurrently from the same parameters & sensors as LSI. The Ryznar value is displayed on the LSI **Diagnostics** page & Ryznar alarms are set on the LSI **Alarms** page

Manual LSI values are clamped to block measure-entry errors;

Alkalinity: 30 to 140 ppm

Hardness: 50 to 400 ppm

Conductivity: 100 to 10,000 uS

pH: 6 -10

If you enter a value outside of the range, the value is set to the closest range limit.

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LSI & Manual Inputs 2 of 2

N:Manual Entry

Configure

Compensation **Manual Entry**

Reset Submit

Phantom inputs do not physically exist; you can't wire to them. They are of two types: Analog values in the 'K' to 'N' space & volumes-contact sets in the 'W' to 'Z' space. This example, uses 'N' to log the results of a drop test

Input 'N' has **Compensation** set to **Manual Entry**

Phantoms are logged, alarmed & can be used for controls. In this example, the drop test results may be logged so that they can be aligned in time with feed rates & other sensor values

Once **Compensation** has been set to **Manual Entry**, rename the **Descriptor**, **Units** & **digits** (after the decimal) to fit your usage

N:Drop_test

Setup

Descriptor	Drop_test
Display Units(UOM)	drp
Decimal digits	1
Used by I/O	K,

Reset Submit

N:Drop_test

Calibrate

Enter value 8|drp

Factory Reset Yes No

Calibrate Cancel

Edit Enter Value & Calibrate

Cancel to exit & to unlock keypad calibrate access

5.1.8 CTFS Flowswitch Calibration

A CTFS flowswitch can be adjusted by editing the "Flowswitches" value box in the conductivity -Configure menu. Lowering the value will cause the switch to turn on for a smaller amount of flow but may have difficulty turning off at no flow.

A:Conductivity

Configure

Compensation None

Override flowswitch ☒ Yes ☐ No

Flowswitches 892

Reset Submit

AEGIS II Browser
5.1.9 Corrosion Rate Calibration

B:Corrosion

Configure

Sensor Alloy

Reset

Carbon Steel

Carbon Steel

Copper

Cupro-Nickel

Admiralty

Zinc

Other

A corrosion rate sensor should never be calibrated. Open the Configuration menu and select the Alloy you are using. Press Submit

AEGIS II Browser

5.2 Sensor Alarms 1 of 2

Select the **A to N** icon on the home page .
This example is a conductivity sensor connected to input **A**

Select **Alarms** from the pulldown

A: Tower Conduct.

HiAlarm	2000 uS
LoAlarm	1000 uS
Alarm Relay	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Delay on Alarm	5.0 minutes
Disable Alarms	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Slider Max.	4000 uS
Slider Min.	500 uS

Reset Submit

If using for control, set the **HiAlarm** to trap a fault.
In this example a failure to bleed-blowdown on an 1800uS setpoint

If using for control, set the **LoAlarm** to trap a fault.
In this example a stuck float would lower the conductivity towards the make-up conductivity.
(1800uS & 3 cycles would be a make-up of 600uS)

Set **Alarm Relay = Yes** to trip the output with
Special Control = Alarm Relay on an 'A' alarm

Use **Delay on Alarm** to block nuisance alarms &
those that occur on transient operating states

Disable Alarms = Yes turns OFF 'A' alarms

Slider Max & Slider Min are used solely to
format the browser home page for input 'A'

Sidebar:

Every sensor, water meter, flowswitch & each control has alarms.

Typically, alarms are used to trap changes in operating conditions (make-up water, temperature...) mechanical faults (stuck floats, valved off or faulted blowdown-valves), feed issues (loss of prime, low tank level, tubing faults) & sensor faults (failure to track, fouling...)

Setting alarms too tight so that they trip frequently under normal operating variances, may result in a critical alarm getting a slow or no response.

Understandably alarms are set to reflect site practice, chemistry & plumbing & time of year. Review each control loop, its sensor-meter, interlock, pump or actuator & setpoints. It's typical that sensor & feed limit alarms in concert can trip on the most likely faults.

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5.2 Sensor Alarms 2 of 2

LSI alarms differ from other sensor alarms which are limited to high & low alarms referenced to the current value of the sensor.

Sensor high & low alarms & LSI alarms latch. Meaning they persist until **Clear Alarms**.

All unacknowledged alarms flash the red led at the top, right of the controller enclosure cover & appear on the home page on the browser HMI.

Select the **A to N** icon on the home page .
This example is LSI on phantom input 'L'

Select **Alarms** from the pulldown

Practice varies, but typically any LSI > 0 indicates scaling

Again, opinions vary, but typically Ryznar > 8.0 indicates a corrosive stream

And typically a Ryznar < 6.0 indicates scaling

The LSI & Ryznar levels for alarms vary widely.
In the absence of guidelines for your water chemistry, metallurgy, exchanger tube type & treatment program, it's you & Wikipedia

Clear Alarms = Yes & Submit resets the alarm on 'L' only

If a sensor has previously alarmed, the most recent alarm type & when it occurred are here.
LSI displays either **Scale Alarm** or **Corrode Alarm**

LSI & Ryznar duplicate a response on scaling.
Not surprising since both indexes are derived from the same parameter set.

L:LSI	
Alarms	
Status	Alarmed
LSI Scaling	0.50
RYZ Corrode	8.50
RYZ Scaling	4.50
Alarm Relay	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Delay on Alarm	5.0 minutes
Clear Alarms	<input type="button" value="Yes"/>
Scale Alarm	10:28 2016-Aug-29
Disable Alarms	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Slider Max.	10.00
Slider Min.	-10.00
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

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5.3 Sensor Setup 1 of 2

Select the **A to N** icon on the home page .
This example is an ORP sensor connected to input 'D'

Select **Setup** from the pulldown

Edit **Descriptor** to site name for browser & local HMIs.
Maximum 16 characters

Edit Units, defaults to typical for sensor type
Maximum 3 characters

#of digits after decimal. Defaults to typical for sensor type
pH = 2, conductivity = 0

1 Point or 2 Point calibration.
Defaults to 1 Point, typical for controlling sensors

Submit to modify

Used by I/O blocks the **Disable** option & indicates where the sensor is used.
Controls 7 & 8 in this example

D:ORP Sensor	
Setup	
Descriptor	ORP Sensor
Display Units(UOM)	mV
Decimal digits	1
Calibrate	1 Point
Used by I/O	7,8,
Reset	Submit

Select **Configure** from the pulldown to set the **Sensor Alloy** for corrosion rate sensors. Defaults to **Carbon Steel**

If the **Sensor Alloy** pull down does not have the electrode metallurgy you're using, select **Other** & **Submit**
(Commonly used metals for cooling towers are in the pull down)

Alloy# is the ratio of **Other** electrodes to Carbon Steel (= 1.000)
weight loss for LPR type sensors.

B:Steel Corrosion	
Configure	
Sensor Alloy	Carbon Steel
Reset	Submit

B:Steel Corrosion	
Configure	
Sensor Alloy	Other
Alloy#	1.000
Reset	Submit

Sidebar:

Disabled sensors do not appear on either the local or browser HMIs or any option pull down.
Sensors cannot be disabled while in use for control or compensation.
Disabled sensors are re-enabled on the **System / Enable I/O** page.

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5.3 Sensor Setup 2 of 2

F:Boiler Cond. ✕

Setup ▼

Descriptor	Boiler Cond.
Display Units(UOM)	uS
Decimal digits	0
Disable	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sensor Type	Boiler Cond.

Select **Setup** from the pulldown to set the type of conductivity sensor connected to a dual conductivity driver card

Boiler Cond. are 2 wire, non-temperature compensated.
Conductivity are 4 wire, non-metallic temperature compensated.
Condensate are 4 wire, 3/4" NPT, temperature compensated.

Select **Sensor Type** & **Submit**

G:4-20mA Input ✕

Setup ▼

Descriptor	4-20mA Input
Display Units(UOM)	C
Decimal digits	2
Calibrate	2 Point
Disable	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sensor Type	Other
20mA Value	100.00 C
4mA Value	0.00 C

G:CLE3 Chlorine ✕

Setup ▼

Descriptor	CLE3 Chlorine
Display Units(UOM)	ppm
Decimal digits	2
Disable	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sensor Type	CLE3 Chlorine
Sensor Range	CLE3 0-10ppm

Defined **Sensor Types** may have more than one available **Sensor Range**.
Select **Sensor Type** & **Submit**
Then Select **Sensor Range** & **Submit**

4-20mA inputs @ 'G' and on dual 4-20mA input driver cards can select **Sensor Type** = **Other** to install sensor type not shown in the **Sensor Type** pull down

Sensor Type = **Other** may set a user defined loop span for the sensor & **Submit**

Sidebar:

Selecting a **Sensor Type** installs the correct 4-20 mA to sensor value conversion & sets calibration limits.

5.4 Sensor Compensation

A: Tower Conduct.

Configure

Compensation	Thermal Comp.
Thermal Sensor	K:Temperature
Compensation	0.970 %/F
Override flowswitch	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Reset Submit

Select **Configure** from the pulldown to select-view **Compensation**.
Not all sensor types have **Compensation**

Tower conductivity is always thermally compensated.
Select **Compensation = Thermal Comp.** & **Submit**.
Then select **Thermal Sensor = target sensor** & **Submit**

This **Compensation** value works for cooling towers,
your app may differ

Serial conductivity sensors include a temperature sensor
(assigned to 'K' in the example) & a thermal flowswitch with
the option to **Override** the switch flow/no flow trip point

Some amperometric oxidant sensors may be pH corrected.
Seldom useful for cooling towers where cycle control fixes
the pH. More useful for process apps where pH varies

Select **Compensation = pH Corrected** & **Submit**.
Then select **pH Sensor = target sensor** & **Submit**.

G:CLE3 Chlorine

Configure

Compensation	pH Corrected
pH Sensor	C:pH Sensor

Reset Submit

pH Sensor may be selected = **Manual**
& **Submit** to get a **Manual pH** entry value

pH temperature compensation is seldom used in Cooling Tower apps
which operate close to pH 7 where temperature has little effect on pH

C:pH Sensor

Configure

Compensation	Thermal Comp.
Thermal Sensor	K:Temperature

Reset Submit

Select **Compensation = Thermal Comp.** & **Submit**.
Then select **Thermal Sensor = target sensor** & **Submit**.

Sidebar:

Controllers are typically pre-configured for the target app.
So cooling tower controllers will include a temperature compensated conductivity.

If you are re-purposing a controller or adding additional sensors & controls then you may be changing-modifying the default compensation.

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5.5 Sensor Diagnostics 1 of 3

Select the **A to N** icon on the home page & the **Diagnostic** page will display

Sensor inputs '**A**' & '**B**' are used for serial sensors

Or select **Diagnostic** from the pulldown

If sensor used for control then **Variance** shows the range of values as the control operates. Reset on the hour.

The sensor value = **Raw sensor** x **Gain** + **Offset**
Modified in this case by **Thermal Compensation**
After calibration, **Gain** or **Offset** or both will be adjusted

Most recent alarm type & time-date

Serial conductivity sensors include temperature (**78.1F**) & a thermal flowswitch.
Flow 2514 is less than **ON @ 3600** so **Flow OFF**

A: Tower Conduct.

Diagnostic

Sensor Type	Conductivity
Variance this hour	2542 to 2564 uS
Raw sensor	332
Gain Multiply	8.5000
Offset Adjust	0.0000uS
Alarmed High	14:52:34 2016-Aug-30
Sensor OK	Connected
78.1F Flow OFF	Flow:2514 ON @3600

Refresh

Serial sensors auto-install on power ON.
If you switch types & the previous type was used for control, the control is disabled

Wiring-connection problems flagged here

Attributes which may be assigned to phantoms '**K**' to '**N**' (See Section 5.6) are displayed @ the source sensor I/O location.
The '**Pitting**' or imbalance value in this example

Some fields are specific to the sensor type.
In this case the corrosion rate sensor is using Carbon Steel electrodes

B: Steel Corrosion

Diagnostic

Sensor Type	Corrosion
Variance this hour	11.5 to 11.5 mpy
Raw sensor	11.5
Gain Multiply	1.0000
Offset Adjust	0.0000mpy
Alarmed High	12:08:23 2016-Jul-26
Sensor OK	Connected
Pitting 0.12mpy	Carbon Steel

Refresh

Sidebar:

Diagnostic is a summary of the sensor state.
Contents vary widely with sensor type.

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5.5 Sensor Diagnostics 2 of 3

Select the **A to N** icon on the home page & the **Diagnostic** page will display

Sensor inputs 'C-D', 'E-F' and 'I-J' are used for driver cards so the installed sensor will vary with the type of installed card: pH-ORP, conductivity, 4-20mA input, serial sensor or pH-Temperature

C:pH Sensor

Diagnostic

Sensor Type	pH Sensor
Variance this hour	8.82 to 8.89 pH
Raw sensor	883.00
Gain Multiply	0.0100
Offset Adjust	0.0000pH
Alarmed High	14:52:34 2016-Aug-30
Sensor driver type	Dual pH or ORP
Configure: 103C	Status: 1007
Device: 000C3A88	Product: 0E125180
Rev.#: 00000001	S/N: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:01.00.02.01

Refresh

In this example, there is a pH-ORP card installed in the **C-D** slot & 'C' is a pH sensor

This pH sensor not used for control or the **Variance** would reflect the control loop delay dependant of feed point, sensor location & re-circ water volume

The sensor value = **Raw sensor** x **Gain** + **Offset**

Most recent alarm type & time-date

Parameters for the **Dual pH or ORP** card installed in the C-D slot

The sensor value = **Raw sensor** x **Gain** + **Offset**
Single point calibration modifies the **Gain** or **Offset** (varies with sensor type)
Two point calibration modifies both the **Gain & Offset**

Parameters for the **Dual conductivity** card installed in the E-F slot

E:Boiler Cond.

Diagnostic

Sensor Type	Boiler Cond.
Variance this hour	467 to 467 uS
Raw sensor	4227
Gain Multiply	0.1000
Offset Adjust	0.0000uS
Alarmed Low	14:52:34 2016-Aug-30
Sensor driver type	Dual conductivity
Configure: 000C	Status: FFFFDE5E
Device: 000C3B55	Product: 0E127777
Rev.#: 00000001	S/N: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:01.00.00.02

Refresh

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5.5 Sensor Diagnostics 3 of 3

Select the **A to N** icon on the home page
& the **Diagnostic** page will display

G:CLE3 Chlorine

Diagnostic

Sensor Type	CLE3 Chlorine
Variance this hour	5.80 to 5.84 ppm
Sensor Range	0.00 to 10.00 ppm
Raw sensor	10.99mA 58.3%
Gain Multiply	0.8330
Offset Adjust	-3.3330ppm
Alarmed High	14:52:34 2016-Aug-30
Input Firmware Driver	built-in
Configure: 003C	Status: 0003
Device: 000C3B40	Product: 0E120712
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:00.00.00.14

Refresh

In this example, a 4-20mA CLE3 Chlorine sensor is connect to input 'G'

The user selected **0.00 to 10.00 ppm** CLE3 sensor type converts the 4-20mA signal (**10.99mA** or **58.3%** of span) from the sensor to a ppm value.

In this example $10.99\text{mA} \times 0.833 - 3.333 = 5.82\text{ppm}$
(ppm = mA x Gain + Offset)

L:LSI

Diagnostic

Sensor Type	Calculated
Scale Alarm	14:52:34 2016-Aug-30
Ryznar	6.4
Alkalinity	95ppm
CaCO3 Hardness	75ppm
Temperature	89.9F
pH Sensor	8.88
Conductivity	2564uS
No source selected	

Refresh

Phantom inputs configured to calculate LSI show Ryznar & the values of the LSI-Ryznar calculation parameters on the Diagnostic page.

K:Temperature

Diagnostic

Sensor Type	Temperature
Variance this hour	77.3 to 173.5 F
Raw sensor	78.0
Gain Multiply	1.0000
Offset Adjust	0.0000F
No alarm logged	
from A, attribute 1	Temperature

Refresh

Phantom inputs derived from sensor attributes may be independently calibrated modifying the **Gain** or **Offset** value applied to **Raw Sensor**

In this example the **Temperature** is derived from the sensor connected to input 'A', **attribute 1** (this serial conductivity sensor has 3 attributes)

AEGIS II Browser

5.6 Using Sensor Attributes for Phantoms

Phantom sensors are input 'K' through 'N' and can be enabled from the **System Enable I/O** page.

Once enabled they will automatically appear on the home page for the controller and can be assigned attributes from sensors or used for manual entries and inventory & LSI calculations.

Select the **K** to **N** icon on the home page
To assign another sensor's attribute to a phantom sensor

Select **Configure** from the pulldown

In this example '**M**' uses attribute '**O**' from sensor '**A**'
Attribute '**O**' is the raw value of the sensor, conductivity in this example, calibrated to measure salt ppm

Select **Source** = target attribute & **Submit**.
Pull down has all of the installed sensors & their sensor attributes.

Appendix 'B' lists available attributes by sensor type.

Volume measuring meters have a **Rate** attribute which can be assigned to a sensor.
In this example the turbine meter @ input '**Q**'s rate is assigned to the phantom @ '**N**'

Select **Source** is not available for phantoms which are used by other sensors.
In this example the Temperature @ '**K**' is used to temperature compensate the sensors @ '**A**' & '**C**'

M:Salt_Concen
Configure
Compensation: None
Select source: A0: Tower Conduct.
Reset Submit

N:Flow rate
Configure
Compensation: Not applicable
Select source: Q1: Rate
Reset Submit

K:Temperature
Configure
Used by I/O: A,C,
Reset Submit

Sidebar:

Phantom Sensors 'K' to 'N' and phantom meters-contact sets 'W' to 'Z' are logged, alarmed & can be used for compensation & controls.

They are phantom in the sense that they do not have wiring locations.

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5.7 Inventory: Using feed meters & pumped volumes

Select the **K** to **N** icon on the home page
To make a phantom input track tank volume

Select **Configure** from the pulldown

Select **Compensation = Inventory** & **Submit**

Inventory displays all of the volume measuring inputs & pulse controlled pumps.

If using a Tacmina or equivalent displacement meter on an ON/OFF pump, they are typically set to 1mL/pulse.
If U.S. units, meter scaling = 3785 pulses/G
If metric units scaling = 1000 pulses / L

Select all of the meters & pumps that use the target tank & **Submit**.
In this example only the Inhibitor Pump uses the target tank

Initial tank level & tank level on refill is set using **Calibrate**.
Measured & pumped volumes are subtracted from the **Calibrate** value.

K:Inventory	
Configure	
Compensation	Inventory
O: Tower Make-up	unused
P: Feedwater	unused
Q: Tower blowdown	unused
R: Grey Water add	unused
V: Water meter	unused
Z: Water meter	unused
6: Inhibitor Pump	Target Output
8: ORP pid	unused
<div>Reset Submit</div>	

K:Inventory

Calibrate

Enter value 99.99 G

Calibrate Cancel

Sidebar:

Metric or U.S. units are set on the **System / System Setup** page.

The controller converts the pumped mL/stroke setting to either Liters or Gallons depending on the **System Setup metric units = Yes - No** setting.

Volume meters are assumed to measure either Gallons (U.S. units) or Liters (Metric) when calculating **Inventory** - tank levels or ppm concentrations.

Scale all of the volume meters according to the System units setting.

6 Measuring Volume: Water Meters, Inventory, Verify Feed

6.1 Configuring a New Meter

Select the **O to V** icon from the right side of the home page to configure-setup a new meter or modify an existing meter

Enable new meters @ the **System, Enable I/O** page.
Enabled as a contact set & appears on right side of home page.
See Section 7.1 to switch to meter.

Select **Setup** from the pulldown

Edit **Descriptor** to set site name, 16 characters max. & **Submit**

Edit **Units** (defaults to system units) , 3 characters max. & **Submit**

Select # **digits** after decimal & **Submit**

Disable & **Sensor Type** options only display if meter not in use by another I/O

Select **Sensor Type** = **Turbine Meter** (3 wire meters) or **Water Meter** (contact head, 2 wire) & **Submit** to set meter type

Turbine Meters are scaled by '**K**' Factor (pulses/gallon)
Contact head, **Water Meters** are scaled in **Vol/contact** closure.

Select **Sensor Type** = **Turbine Meter** or **Water Meter** controls the type of debouncing used Internally to measure pulse streams or contact closures

In this example, the meter @ '**O**' is used by the control relay '**3**' so **Disable** & **Sensor Type** are not available

R:Grey Water add

Setup

Descriptor: Grey Water add

Display Units(UOM): G

Decimal digits: 2

Disable: Yes No

Sensor Type: Turbine meter

Reset Submit

R:Grey Water add

Configure

'K' Factor: 2.000

Compensation: None

Reset Submit

O: Tower Make-up

Configure

Vol/contact: 100 G

Compensation: None

Reset Submit

O: Tower Make-up

Setup

Descriptor: Tower Make-up

Display Units(UOM): G

Decimal digits: 0

Used by I/O: 3,

Reset Submit

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6.2 Copying, Flow Rate Alarms & Rate-to-Volume

V:Water meter

Configure

Vol/contact	100.0 G
Compensation	Copy meter
Target Meter	Z:Water meter

Reset Submit

Use **Copy Meter** to sum make-up or blowdown volumes from multiple towers or boilers

Select **Compensation = Copy Meter**

Select **Target Meter** = phantom Meter in the 'W' to 'Z' space & **Submit**

This example sums the meter volumes @ 'V' and 'Q' to the phantom meter at 'Z' using **Copy Meter**

Q:Tower blowdown

Configure

'K' Factor	10.000
Compensation	Copy meter
Target Meter	Z:Water meter

Reset Submit

FlowRate Alarm is used to alarm on high or low flow rate. Disabled when offline or if **Flowswitch** not 'None'

Select **Compensation= FlowRate Alarm** & **Submit**

Then set **High & Low** alarms & **Submit**.
Set **Low Alarm** < 0 if you don't want a low flow alarm or if flow is not continuous.

Q:Tower blowdown

Configure

'K' Factor	10.000
Compensation	FlowRate Alarm
High Alarm	100.0 gpm
Low Alarm	50.0 gpm
Flowswitch	W:Flowswitch_A

Reset Submit

Alarms do not occur when **Flowswitch = OFF**
Optional: Select a **Flowswitch** & **Submit**

V:Water meter

Configure

Vol/contact	100.0 G
Compensation	Rate to Vol.
Flowrate sensor	G:4-20mA Input

Reset Submit

Select **Compensation= Rate to Vol** & **Submit**
Then select a **Flowrate sensor** & **Submit**

Use **Rate to Vol** to convert a 4-20mA input on **Flowrate** to a volume on a meter input.

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6.3 Meter Diagnostics

Select the **O** to **V** icon from the right side of the home page to view the Diagnostic page

Meters display the volume measured from midnight on the home page.

O: Tower Make-up

Diagnostic

Sensor Type	Water meter
Vol. this year	12600 G
20 Days Online	Vol/Day,630 G
Volume Total	107500 G
Vol. last year	0 G
Rate	52.8gpm
No alarm logged	
Input Firmware Driver	built-in
Configure: 0000	Status: 0000
Device: 000C4E31	Product: 0E12519A
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:01.01.00.05

Refresh

or select **Diagnostic** from the pulldown

Useful if the towers run 7 days/week otherwise discount for typical ON/OFF day ratio

Total since meter installed

Contact head meters calculate **Rate** using the interval since the last volume increase event. Therefore not representative on first count of a new cooling day or first count on a new bleed cycle

Volume resolution (digits after the decimal) is set by **Decimal Digits** on the **Setup** page

Q: Tower blowdown

Diagnostic

Sensor Type	Turbine meter
Vol. this year	76927.01 G
20 Days Online	Vol/Day,3846.35 G
Volume Total	798929.50 G
Vol. last year	0.00 G
Rate	19.7gpm
No alarm logged	
Input Firmware Driver	built-in
Configure: 0001	Status: 0000
Device: 000C4E31	Product: 0E12519A
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:01.01.00.05

Refresh

Turbine type meters calculate **Rate** every second as meter pulse counts are measured. Therefore **Rate** is more representative than contact head meter rates because counting occurs more frequently.

DI (Digital Input) driver detail Shared by all inputs 'O' thru 'V'

6.4 Meter Alarms

Select the **O** to **V** icon from the right side of the home page to view the Diagnostic page

or select **Diagnostic** from the pulldown

HiAlarm is the volume measured from midnight. Edit & **Submit**

LoAlarm is set on the daily volume. It's checked only once @ midnight. Edit & **Submit**

Alarm Relay = Yes & **Submit** will turn ON the alarm relay if one has been configured.

Disable Alarms = Yes stops new alarms on meter input 'P' in this example.

P:Feedwater	
Alarms	
HiAlarm	50000 G
LoAlarm	100 G
Alarm Relay	<input type="radio"/> Yes <input checked="" type="radio"/> No
Disable Alarms	<input type="radio"/> Yes <input checked="" type="radio"/> No
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

If alarmed, a **Clear alarms** option will be included on this page.

If you clear a **HiAlarm** & the day has not changed, it will re-alarm because todays volume is more than **HiAlarm**.

In this example, we want an alarm on any **Grey Water** make-up
But don't want an alarm if there is no **Grey Water** make-up
(so **LoAlarm** is less than zero)

In this example, we're also using one of the relays or pulse outputs as a dedicated alarm relay, perhaps to the site DCS.

R:Grey Water add

Alarms

Status	Adjusted Alarm
HiAlarm	10.00 G
LoAlarm	-100.00 G
Alarm Relay	<input checked="" type="radio"/> Yes <input type="radio"/> No
Disable Alarms	<input type="radio"/> Yes <input checked="" type="radio"/> No
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

7 Flowswitches, Interlocks & Contact Sets

7.1 Switching Meters & Contact Sets

Volume meters and contact set inputs are connected in the ‘O’ to ‘V’ namespace. They are also in the ‘W’ to ‘Z’ phantom space. If the meter or contact set input is not being used for control, it can be re-purposed, making a contact set a meter or the reverse.

When an input in the ‘O’ to ‘Z’ namespace is enabled, it’s initially configured as a contact set.

Contact sets are ON when the contact set is closed. The logical sense of the input may be inverted so that ON = contact set open (Refer to Section 7.3).

Select the **O** to **V** icon from the right side of the home page

U:Low_Level

Setup

Descriptor	Low_Level
Disable	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Sensor Type	Contact set

ResetSubmit

Select **Setup** from the pulldown

Select **Sensor Type** from the pulldown
Water meter = 2 wire contact head meter
Turbine meter = 3 wire pulse meter
& Submit

Changing the DI (digital input) type using **Sensor Type** is not available if the DI is in use by a control, interlock, fail-to-feed...

In this example, **Used by I/O** indicates that **S:Flowswitch** is used by the control for relays 1 & 3. (likely as an interlock flowswitch)

S:Flowswitch

Setup

Descriptor	Flowswitch
Used by I/O	1,3,

ResetSubmit

AEGIS II Browser

7.2 Contact Set Alarms

Select the **O** to **V** icon from the right side of the home page

Select Alarms from the pulldown

In this example, if the flowswitch is ON for more than 10 hours it will alarm. Edit & **Submit** to modify

The **No Flow Alarm** is set to > 1440 (the number of minutes in a day) so it will never alarm.

Alarms use the time ON or OFF today which is reset to 0.0 @ midnight.

S:Flowswitch	
Alarms	
ON Time Alarm	600.0 minutes
No Flow Alarm	1500.0 minutes
Alarm Relay	<input type="radio"/> Yes <input checked="" type="radio"/> No
Disable Alarms	<input type="radio"/> Yes <input checked="" type="radio"/> No
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

If you are not using the alarms, set **Disable Alarm = Yes** & **Submit**

In this example, we're using the alarm to alert us if the cooling tower is offline for more than an hour. Edit & **Submit** to modify

S:Flowswitch	
Alarms	
ON Time Alarm	1500.0 minutes
No Flow Alarm	60.0 minutes
Alarm Relay	<input type="radio"/> Yes <input checked="" type="radio"/> No
Disable Alarms	<input type="radio"/> Yes <input checked="" type="radio"/> No
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

Sidebar:

Contact set alarms are frequently used to flag unusual operating conditions or outages.

If you are alarming on an event that bridges midnight, bear in mind that the ON or OFF time that trips the alarm is reset @ midnight.

7.3 Logically Inverting Contact Sets

Select the **O** to **V** icon from the right side of the home page

Select **Configure** from the pulldown

If you are interlocking using a contact set that is OPEN in the interlocked state, **Invert sense** & input 'T' will be ON when the contact set is open

Set **Invert sense** = Yes & **Submit**

T:Boiler 1 OnLine	
Configure	
Compensation	None
Invert sense	<input type="radio"/> Yes <input checked="" type="radio"/> No
Used by I/O	4,
<input type="button" value="Reset"/>	<input type="button" value="Submit"/>

7.4 Fail-to-Feed

Fail-to-Feed alarms on the contact set input that monitors the pump head feed meter if measured feed events do not occur every **Delay on Alarm** period while the pump is ON.

In this example **U:Monitor Feed** would display a '**Fail to Feed**' alarm if a feed contact closure did not occur every 30 seconds or less while Relay 3 is ON, unless 'U' alarms were disabled.

If you wire the feed verify meter in parallel to a volume meter input, you can measure the actual volume fed.

Select the **O** to **V** icon from the right side of the home page

Select **Configure** from the pulldown

Set **Compensation** = Fail to Feed & **Submit**

Then select **Target Output** = target control and **Delay on Alarm** = time between measured feed volume pulses & **Submit**

Fail-to-feed uses a meter on the output of the pump like those made by Tacmina, which measure volumes in the mL range. Depending on the pump size, there will be a delay between turning ON the pump & measuring the first & subsequent feed pulses.

U:Monitor_feed	
Configure	
Compensation	Fail to Feed
Target Output	3:Inhibitor Feed
Delay on Alarm	30 seconds
Invert sense	<input type="radio"/> Yes <input checked="" type="radio"/> No
<input type="button" value="Reset"/>	<input type="button" value="Submit"/>

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7.5 Mirroring a Control ON/OFF

A phantom contact set may be configured to mirror a relay (1-5) or a pulse output (6-9) configured as an ON/OFF control. When the control is ON, the phantom contact set is ON.

This compensation is available to link controls when simply wiring them in parallel wouldn't work.

For example:

Site doesn't have a bleed meter installed but needs to feed into the bleed line whenever the bleed is ON (perhaps a de-chlor or a sequestrant for a component that's concentrated when the tower cycles up).

Relay 1 controls the bleed on conductivity

Pulse 8 feeds the bleed line chemical, configured to base feed @ 5mL/minute

Phantom Contact Set 'X' mirrors Relay 1 & Interlocks Pulse 8

When done with **Mirror output** (instead of simply using conductivity to control Pulse 8) any blocking or Prebleed-Lockout that stops Relay 1, stops feeding into the bleed line.

The screenshot shows the configuration page for a Phantom Contact Set. The interface is titled "X:Contact set" and has a "Configure" button. Below this, there are four configuration fields: "Compensation" (set to "Mirror output"), "Target Output" (set to "1:Tower276 Bleed"), "Invert sense" (set to "No"), and "Sensor Type" (set to "Contact set"). At the bottom are "Reset" and "Submit" buttons. Green callout boxes provide instructions: "Select the W to Z icon from the right side of the home page" points to the "X:Contact set" header; "Select Configure from the pulldown" points to the "Configure" button; "Select Compensation = Mirror output & Submit" points to the "Compensation" dropdown; and "Then select Compensation = Target Output & Submit" points to the "Target Output" dropdown.

X:Contact set	
Configure	
Compensation	Mirror output
Target Output	1:Tower276 Bleed
Invert sense	<input type="radio"/> Yes <input checked="" type="radio"/> No
Sensor Type	Contact set
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

8 Frequency Controlled Pumps

8.1 Selecting a Pump, Adjust mL/stroke & SPM

Select the '6' to '9' icon from the right side of the home page

Select **Configure** from the pulldown

6:Inhibitor Pump

Configure

Status Reconfigured

Descriptor Inhibitor Pump

Disable Yes ☐ No ☒

Pump Type ProMinent 1602

mL/stroke 0.130

Refresh **Submit**

Pump Type sets limits on mL/minute setpoints

Set **Pump Type** = one of the 6 built-in pumps & **Submit**
Setting both the maximum SPM & typical 40 psi head feed rate

Use the default **mL/stroke** unless:
1. You require the accuracy the you would get from calibrating with a graduated cylinder.
2. The pump is not @ 100% stroke.

Be aware that the output of most pumps will vary when backpressure changes. Using a back pressure valve will hold that pressure steady.

Select **Pump Type** = **Other** for larger pulse-frequency controlled pumps & **Submit**

Edit **mL/stroke** & **Rated SPM** for the installed pump & **Submit**
'Other' type pumps are limited to 25 **mL/stroke**.
Listed pumps are limited to 2.0 **mL stroke**.
All have no minimum limit.

Exercise care not to exceed the Rated SPM for the pump, response to high pulse rates is indeterminate and maximum feed rates will be incorrect.

9:Dispersant

Configure

Descriptor Dispersant

Disable Yes ☐ No ☒

Special Control None

Pump Type Other

mL/stroke 5.000

Other Pump 400 Rated SPM

Refresh **Submit**

Built-in Pump types

Pump Type	mL/stroke	Liters/hr	Gallons/hr
1601	0.13	1.404	0.371
1602	0.24	2.592	0.685
1001	0.10	1.080	0.285
1002	0.24	2.592	0.685
0704	0.42	4.536	1.198
0705	0.50	5.400	1.427

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9 4-20mA Outputs

9.1 Configure: Manual-Auto Switch

Select the letter icon from the bottom right side of the home page

A newly installed 4-20mA out card initializes to Manual mode & 0% (4mA) output current

Select **Configure** from the pulldown

Select **Control by:** and the target control sensor from the pull down & **Submit**

Edit **Manual mode** level & **Submit** to modify the current.
0.0% = 4 mA 100% = 20 mA

(Optional) When the Interlocked contact set input is OFF, the current is set to 4mA
Set **Interlocked** = target contact set & **Submit**

I:4-20mAOutput

Configure

Control by: **None**

Manual mode ☒ Yes ☐ No

Manual mode 47.6 %

Interlocked **none**

Open Loop alarm ☒ Yes ☐ No

Controls a Pump ☐ Yes ☒ No

Reset **Submit**

J:4-20mAOutput

Configure

Control by: **pH Sensor**

Manual mode ☒ Yes ☐ No

Manual mode 25.0 %

Interlocked **S:Flowswitch**

Open Loop alarm ☒ Yes ☐ No

Reset **Submit**

Controls a Pump = Yes goes to 4mA when **STOP** key pressed

Exit Manual to Auto mode by **Manual mode = No & Submit**

In Auto mode, edit both **20mA Value & 4mA Value & Submit**

J:4-20mAOutput

Configure

Control by: **pH Sensor**

Manual mode ☐ Yes ☒ No

20mA Value 10.00 pH

4mA Value 6.00 pH

Interlocked **S:Flowswitch**

Open Loop alarm ☒ Yes ☐ No

Reset **Submit**

In this example, a pH of 7.5 would set the 4-20mA output to 10mA

$$(16\text{mA} \times (7.5 - 6.0) / (10.0 - 6.0)) + 4\text{mA}$$

Sidebar: Manual Mode

Use **Manual mode** to verify the pump is 100% ON=20mA, completely OFF=4mA. and to verify the loop span on the monitoring DCS that is using the current loop value to represent a controller conductivity, pH, ORP, corrosion rate sensor or ppm calculation.

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9.2 Calibrate

Select the letter icon from the bottom right side of the home page

Select **Calibrate** from the pulldown

Calibrate overrides the Manual setting or sensor control to set the output to 4mA & then 20mA

Select **Start** to start the two point calibration process

Edit **Output @ 4mA** level & select **Calibrate**

Use the mA current value displayed on the pump, measured by the DCS or meter

Edit **Output @ 20mA** level & select **Calibrate**

Factory Reset = Yes & Submit
Returns the 4-20mA outputs to default

Calibration ends.
Select **Cancel** to return the current loop to Manual or sensor control & exit calibration

J:4-20mAOutput

Calibrate

4-20mA = 4mA ☒ START

Factory Reset ☐ Yes ☒ No

Start Cancel Submit

J:4-20mAOutput

Calibrate

Output @ 4mA 3.95

Calibrate Refresh Cancel

J:4-20mAOutput

Calibrate

Output @ 20mA 19.86

Calibrate Refresh Cancel

J:4-20mAOutput

Calibrate

Status Calibrated

4-20mA = 4mA ☒ START

Factory Reset ☐ Yes ☒ No

Start Cancel Submit

9.3 Diagnostic & Mirroring

Select the letter icon from the bottom right side of the home page to display **Diagnostic** page

J:4-20mAOutput

Diagnostic

Or select **Diagnostic** from the pulldown

Sensor Type	4-20mAOutput
Control by:	pH Sensor
Gain Multiply	1.0057
Offset Adjust	0.0031mA
Sensor driver type	Dual 4-20mA Output
Configure: 003C	Status: 0000
Device: 000C3A55	Product: 0E125188
Rev.#: 00000001	S/N: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:00.00.00.01

Refresh

Controlling sensor name

Gain & Offset are modified when a 4-20mA output is calibrated.
Factory Reset: **Gain** = 1.0 & **Offset** = 0.0

Mirroring a Pulse Controlled Pump
If you select a pump to control the 4-20mA output from the **Control by:** pull down
The 4-20mA output is automatically spanned
4mA = 0 SPM to 20mA = 100% SPM.

Mirroring provides a way to implement more complex controls on a 4-20mA output or to monitor pump speed on a DCS

I:4-20mAOutput

Diagnostic

4-20mA in **Manual mode**
Shows both loop current & % of span
(for loops controlling pumps)

Sensor Type	4-20mAOutput
Manual Setpoint	12.96mA 56.0%
Gain Multiply	1.0000
Offset Adjust	0.0000mA
Sensor driver type	Dual 4-20mA Output
Configure: 033C	Status: 0000
Device: 000C3A55	Product: 0E125188
Rev.#: 00000001	S/N: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:00.00.00.01

Refresh

4-20mA Output driver detail
Shared by inputs 'I' & 'J'

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10 System Settings

10.1 Home & Diagnostic pages

S/N, Versions, Fuse & Fan state, Biofeed Week#

Select the controller icon at the top of the home page to get to the **System** pull down

System:

Home

Language: English

2017-Apr-10 S/N: 123

Status: Logged in

Current User: Operator1

Logout: Yes

Keep session active: Yes ☒ No

Reset Submit

Select **Diagnostic** from the pulldown

Does not affect manually entered text

Duplicates login state from top, right of home page

Logout here or on the home page. Logs out automatically if no activity for 30 minutes

Disables the 30 minute timer

Select Diagnostic from the pulldown

Diagnostic

Serial number: 123

Firmware: 17.03.17.00

HMI Firmware: 16.04.06.00

Web Browser HMI Version: 01.08.00.00

Relay Fuse: OK

Watchdog Resets: 4

Admin Password: Default

O-T wiring: OK

U-V wiring: OK

Fan speed: 3750 RPM

Events: Mon, WEEK 2

Refresh

The last three digits of the serial number. Used to ID E-mail, tags the log & activity files

Controller services & controls

Line power fuse for relays 1 & 2. May be used to power loads switched by relays 3-5.

Accumulates CPU crashes. Should read 0. Check incoming power.

Default = AAAAA, otherwise known only to the Admin

Power for 3 wire turbine meters connected to inputs 'O' thru 'T'.

Power for 3 wire turbine meters connected to inputs 'U' thru 'V'. U and V have a separate power supply from O – T.

Cooling fan fault shuts down all sensor driver cards & controls. Displays only fault message on local HMI display

Events are entered as daily, weekly or monthly (28 days). In daily, every day is day = 1. In weekly, every Sunday is Sunday = 1. This page shows the 28 day cycle. This is day 9 of 28.

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10.2 Activity Log:

10.2.1 User ID, time stamp

System: Activity Log

Activity Log

82 Events, 41-50

Sep

1

IO	Activity	User ID	Time
A:	Alarms Alarmed High	System	12:38:01
C:	Alarms Alarmed High	System	12:38:01
E:	Alarms Alarmed Low	System	12:38:01
F:	Alarms Alarmed Low	System	12:38:01
L:	Alarms Scale Alarm	System	12:38:01
M:	Alarms Alarmed High	System	12:38:01
S:	Activity Adjusted Alarm	admin	12:38:52
U:	Activity Changed	admin	13:40:30
U:	Activity Changed	admin	13:40:41
U:	Configure Compen. modify	admin	13:41:04

NextBackSubmit

System: Activity Log

Activity Log

0 Events, 1-0

May

1

No activity file

Submit

Select **Activity Log** from the **System** pulldown

Initially displays the current day's activities in blocks of 10

View another day: Select Month & Day & **Submit** (ast six months selectable)

List activities both by **User ID** & those that occur Automatically (**System**).

In these Activities, the System logs Alarmed activities & the admin user adjusts the Alarms on Input 'S'

Next selection not shown @ end of day's activities
In this example, we are viewing events **41-50** of **82** total activities

If you select a day when the controller was powered OFF or prior to it's installation, you'll get this response

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10.3 Communications: 1 of 2

10.3.1 LAN IP, Netmask, MAC, Gateway, Wifi IP

You'll need to be logged in as the admin user to modify **Communications**.

The top of the page will prompt you with the required login if you are not allowed to modify the current page.

The controller includes a **DHCP client** which means when you connect to the site LAN you can assign a static IP valid for the LAN or select DHCP and let the network assign a compatible IP address to the controller.

The screenshot shows the 'System: Communications' page. At the top, there is a dropdown menu labeled 'System: Communications' with a downward arrow. Below it is a section titled 'Communications' with a downward arrow. The main content area contains several fields for configuration:

- LAN IP Address:** 10.10.6.116
- DHCP:** Yes (disabled), No (selected with a checkmark)
- LAN Netmask:** 255.255.255.0
- LAN MAC Address:** 00:1e:c0:ef:6d:f4
- LAN Gateway:** 192.168.100.1
- LAN Primary DNS:** 10.10.6.1
- LAN Secondary DNS:** 0.0.0.0
- WiFi IP Address:** 192.168.1.1
- WiFi Netmask:** 255.255.255.0
- WiFi SSID:** AegisII_123
- HTTP Port:** 80

Annotations with arrows point to specific elements:

- Select **Communications** from the **System** pulldown
- Current IP **LAN** address of the controller
If you edit & **Submit** to modify, you'll lose the current browser connection. Re-connect using the new IP address
- Select DHCP if you wish the system to choose the IP address. This ensures the controller is visible from and compliant with the customers network
- Set **LAN Netmask** to desired netmask & **Submit**
- If you are using the E-mail functionality (alarms & auto-reporting), then the **LAN Gateway** should match other devices on this LAN
- Controller WiFi is limited to HTTP browser services for mobile devices & notebook WiFi & therefore uses a fixed IP address. With the SSID set on the System Setup page
- The WiFi SSID defaults to **_AegisII_xxx** where **xxx** = last 3 numbers of the controller serial number. Edit to modify & **Submit**
- The HTTP port is defaulted to 80, the standard browser port

Sidebar:

If you modify the IP or Netmask & can no longer connect, the current IP & Netmask can be viewed on the local HMI (keypad & display).

Key **Menu / Up / System / OK / Communication / OK & Up - Down** to scroll through the settings.

LAN (Local Area Network) refers to the Ethernet port connection. WiFi refers to the wireless connection. See section 1.1 for connection information.

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Communications: 2 of 2

10.3.2 Com card setup

The communication card adds the option of communicating with a wide range of standard equipment protocol. This card includes a serial slave port for connection with a plant serial MODBUS, or a variety of Gateways for access to MODBUS TCPIP, serial or IP BACnet or most any protocol with the proper Gateway.

The communication card includes two 4-20mA outputs while allowing a dual 4-20mA input card to be piggy-backed on the com card.

The Pyxis fluorometer is compatible with the MODBUS Master serial port while a serial Master can attach to the serial Slave port. The second slave port can be used to pass along the Master communication.

Consult the Addendum: Aegis II Communication Driver manual for complete instructions.

Note: The below picture is the lower part of the System: Communications menu from the previous page.

Pyxis connected	No	Pyxis Fluorometer status
Modbus Slave	RTU Serial Connection	Slave port status
RTU address	10	Serial MODBUS setup. Port number must be unique to the network The baud rate, parity and stop bit settings must match the Master port
RTU Baud rate	19200	
RTU parity	EVEN	
RTU stop bits	ONE	
<div>Reset</div> <div>Submit</div>		

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10.4 Time & Date:

10.4.1 Sync to Device

The screenshot shows the 'System: Time & Date' configuration interface. At the top, a dropdown menu is set to 'Time & Date'. Below this, there are three input fields: 'Date DD/MM/YY' with the value '02/09/16', 'Time HH:MM:SS' with the value '11:13:55', and 'Weekday' with a dropdown menu showing 'Fri'. A link labeled 'Set fields to match my computer' is positioned above the 'Reset' and 'Submit' buttons. Green arrows point from callout boxes to these specific elements: the dropdown menu, the Date field, the Time field, the Weekday dropdown, the 'Set fields to match my computer' link, and the 'Submit' button.

System: Time & Date

Select **Time & Date** from the **System** pulldown

Time & Date

Date DD/MM/YY 02/09/16

Time HH:MM:SS 11:13:55

Weekday Fri

[Set fields to match my computer](#)

Reset Submit

Edit the **Date**, **Time** & **Weekday** fields & **Submit**
Follow the formatting for the **Date** (DD/MM/YY)
and **Time** (HH:MM:SS) fields
or you'll get an error message
or use the [Set fields...](#) link

Adjusting the time & date affects biocide feed events,
controls that use time, data logging, alarming.....

This is usually the easiest way to sync the controller to
your device, click on the link & **Submit**.

10.5 E-Mail Setup – Test

System: E-mail Setup

E-mail Setup

Status

Mail sent

E-mail Enabled

✓ Yes

No

E Service Reports

✓ Yes

No

E-mail Daily Data Log

✓ Yes

No

E-mail on Alarm

✓ Yes

No

E-mail Status at 12PM

✓ Yes

No

E-mail Status at Midnight

✓ Yes

No

Mail To:

youraddress@yahoo.com|

cc E-mail to

Unassigned

cc E-mail to

Unassigned

cc E-mail to

Unassigned

cc E-mail to

Unassigned

Select E-mail Setup from the System pulldown

E-mail Enabled = Yes sends a daily E-mail @ noon so you know the controller is up. Sensor values confirm control. E-mail services enable.

E Service Reports requires a paid subscription to H2Tronics.

E-mail Daily Data Log= Yes sends a midnight E-mail. Includes sensor values, run times, volumes.... Targeted @ apps that parse E-mail body for content

E-mail on Alarm = Yes sends an E-mail on alarm. Includes sensor values & volumes so you get operating context

E-mail Status = Yes sends an E-mail on alarm. Includes sensor values & volumes so you get operating context. Choose noon, midnight, both or neither.

Edit Mail To = your email & Submit

Edit to add up to four optional cc E-mail to Edit zero length to remove & Submit

Continued on next page

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Continued from previous page

SMTP IP Address	<input type="text" value="43.228.184.6"/>	<p>Shown are the default SMTP settings that point to the Prominent SMTP server. This is a free service. If you cannot use the service, enter your service information and press Submit.</p>
SMTP Port	<input type="text" value="2525"/>	
SMTP Username	<input type="text" value="aegis@prominent.us"/>	
SMTP Password	<input type="password" value="...."/>	
SMTP reset	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>	<p>Reset the SMTP setting to those shown on this page</p>
Test E-mail	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>	<p>Send a status report to all email addresses listed above</p>
Next mail	<input type="text" value="2.15hrs"/>	<p>Next report is expected to send ...</p>
<div><input type="button" value="Reset"/> <input type="button" value="Submit"/></div>		

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10.6 Enable I/O:

10.6.1 Enable IO, Assign to System#

Sidebar:

All I/O points can be enabled and used in the program. Enabled points are displayed on the main screen. If a point is disabled, it is removed from the main screen and has no programmable function.

If you select two systems (System Setup menu), you will see the menu on the left. A single system user will see the menu in the lower right corner of this page.

Enable I/O

Select **Enable I/O** from the **System** pulldown

To select a System# for **Sensor** or **Control** or **Meter-Contact Set**, select **Configure** to I/O type & **Submit**

Configure	Control
1: Tower276 Bleed	Shared
2: Oxidant_Control	Shared
3: Inhibitor Feed	Shared
4: Boiler_1_CS	Shared
5: Sensor_Wash	Shared
6: Inhibitor Pump	Boiler_System
7: ORP_ONOFF	Tower_System
8: ORP pid	Shared
9: Dispersant	Shared
Enable I/O	Y: Contact set

Reset Submit

If the **System Setup** page field **# of Systems = Two** Enable I/O shows selectors for each I/O type.

System Setup page field **# of Systems = One** Is limited to **Enable IO**

Select I/O you wish to enable or **None** & **Submit**

Enable I/O

One System No View-Config

Enable I/O Y: Contact set

Reset Submit

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10.7 System Setup:

10.7.1 Naming, Sunday=Day1 ,Metric Units, Restart Options

You'll need to be logged in as the admin user to modify **System Setup**.

The top of the page will prompt you with the required login if you are not allowed to modify the current page.

The screenshot shows the 'System Setup' page in the AEGIS II browser. The page has an orange header bar with the title 'System Setup'. Below the header, there is a table with various configuration options. Each option has a label, a value field, and a 'Yes'/'No' button. Some buttons have a checkmark icon. Arrows point from text boxes to specific fields and buttons, providing instructions on how to configure the system.

System Setup	
Status	Reconfigured
Site name	Prminent
System-Name	Tower #1
2nd System-Name	Tower # 2
Keypad Password	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Metric Units	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Sunday=Day 1	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
# of Systems	Two
Alarm on STOPs	<input checked="" type="button" value="Yes"/> <input type="button" value="No"/>
System restart	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Factory Reset	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Enable Alarm Chime	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

Select **System Setup** from the **System** pulldown

Site Name & System-Names will tag your reports & E-mail alarms to differentiate controllers. Sixteen characters maximum.
Edit & **Submit**

Select **Keypad Password = Yes & Submit**
Shares passwords & access level with browser users, see Section 10.7

Metric Units = Yes & Submit displays temperatures in 'C' & measures volumes in Liters.
Metric Units = No & Submit displays temperatures in 'F' & measures volumes in Gallons

Select **Sunday=Day 1 = Yes & Submit**
Resets 28 day biocide clock to the current week.
For example if today is Wednesday, sets today to day #4
Note: This option only displays if not already week #1.

Select **# of Systems = One or Two & Submit**
Two turns on selectors in **Enable I/O** page

Select **Alarm on STOPs = Yes & Submit**
To alarm when user presses STOP on local HMI keypad.

Select **System restart = Yes & Submit**
Same effect as cycling the power OFF-ON; restarts controls & actuation times

Select **Factory Reset = Yes & Submit**
Removes user settings, controls, naming, calibration...
Load a default or previously saved configuration after **Factory Reset** to avoid reconfiguring each I/O.

Select **Enable Alarm Chime = Yes & Submit**
for audible tone on alarm

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10.8 Passwords: 1 of 2

10.8.1 View-Set Access Level - Admin

The System Passwords screen allows users to change their passwords.

The Passwords screen seen by the Admin user is different from the other users. This page describes the Admin version. The next page explains the Users version.

Changes made on these pages are logged in the Activity Log.

The screenshot shows the 'System: Passwords' interface. At the top is a title bar 'System: Passwords' with a close button. Below it is a dropdown menu labeled 'Passwords'. The main area contains several fields and buttons:

- Status:** A text field showing 'Login @ Admin'.
- New Password:** A text input field containing 'AAAA'.
- Confirm Password:** A text input field containing 'AAAA'.
- admin:** A text field showing 'View-Set Access'.
- Select User:** A dropdown menu showing 'O:Operator1'.
- Access Level:** A dropdown menu showing 'Operate'.
- Reset user password:** A section with three buttons: 'Yes', '✓' (selected), and 'No'.
- Buttons:** 'Reset' and 'Submit' buttons at the bottom.

Annotations with arrows point to various elements:

- An arrow points to the 'Passwords' dropdown menu with the text: 'Select **Passwords** from the **System** pulldown'.
- An arrow points to the 'Status' field with the text: 'Shows the user or lets you know you need to be logged in as Admin if a user attempts to perform a function that is not allowed at their access level'.
- Two arrows point to the 'New Password' and 'Confirm Password' fields with the text: 'In this section, any user can change their password. Edit the passwords in both boxes & press **Submit**. In this example, the default **Admin** password is shown.'
- Two arrows point to the 'Select User' and 'Access Level' dropdowns with the text: 'This section is only available to the Admin user: Select a user, choose an Access Level and press Submit.'
- An arrow points to the 'Reset user password' section with the text: 'The 'Operate' Access Level is used to prevent casual users from inadvertently modifying controls.'
- A large box at the bottom contains the text: 'This function can only be performed by the Admin user. Although, each user can always change his/her own password, the Admin user can also reset other user passwords to their default. Select a user, press **Reset user password** and then press **Submit**. This button does not affect the Admin password.'

Default Passwords:

Operator1 = 1 Operator2 = 2 Operator3 = 3 Operator4 = 4.

Configure5 = 5 Configure6 = 6 Configure7 = 7 Administrator = **AAAA**

Login Page: Operators can view all controller pages. No access to most System pages.
Configure users can edit the program. No access to most System pages.

Modify Passwords:

If the controller is accessible on the site LAN, you should modify all 8 passwords.

Two users cannot share the same password because only the password is used to identify keypad users. The controller displays **Password Fail** on a duplicate password.

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Passwords: 2 of 2

10.8.2 View-Set Access Level - Users 1 - 7

System: Passwords

Passwords

Status

Login @ operate

User ID

Operator1

New Password

..

Confirm Password

..

Reset

Submit

Select Passwords from the System pulldown

Shows Access Level

The 'Operate' Access Level is used to prevent casual users from inadvertently modifying controls.

Displays User name. Edit and press Submit.

Use these boxes to change your current password. Enter the same word into both boxes and press Submit.

11 Appendices:

a. IO Namespace: Letters & Numbers

The controller uses the letters 'A' to 'Z' to refer to sensors, meters, contact sets & 4-20mA outputs and the numbers '1' to '9' to refer to controls

Users can assign site specific names to all of the I/O, A-Z & 1-9. The I/O letters & numbers are a convenient, compact way to describe both the physical location of the I/O within the controller enclosure & the capabilities of each I/O.

Some letters are 'phantom', meaning they don't have physical wiring location within the enclosure. 'Phantoms' are used to represent calculated & derived values that are logged, alarmed & may be used for control.

I/O	Type	Notes
A-B	Serial sensors	3 wire Conductivity-Flowswitch-Temperature or Corrosion Rate or Differential pressure sensors

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C-D E-F I-J	Dual sensor driver cards 6 types in any combination	pH-ORP: configurable as dual pH or dual ORP or pH-ORP 4-20mA input 4-20mA output Conductivity pH & 4-20mA input Dual serial sensor
G	Built-in 4-20mA input	
H	Built-in 10mV/C temperature sensor input	
K-N	Phantom sensors	Calculated (Inventory, Manual) or derived from other sensors & meters
O-V	Volume meter & contact set inputs	Each of 6 inputs configurable as Turbine, Contact Head meter or Contact Set
W-Z	Phantom volume meter & contact set inputs	Calculated (Fail-to-Feed, Fail-to-Sample) or derived from other sensors & meters
1-2	Line powered control relays	Form C, powers pumps, solenoids & motorized valves
3-5	Dry or line powered control relays	Form C, may be used dry or powered.
6-9	Pulse or ON/OFF controls	Dry contact sets used to pulse or enable pumps, alarm... 24V 250mA max.

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b. Input Attributes & Phantoms

Many of the sensors connected to the controller have attributes other than the default value.

For example, the serial conductivity sensor measures conductivity, temperature & includes a flowswitch. The conductivity is the default value of the sensor connect to input 'A' (attribute A0) & the Temperature (attribute A1) & the flowswitch (attribute A2).

Notice that the A1 attribute is of the same type as the A0 attribute, both are sensor values but the A2 attribute is a contact set attribute (ON/OFF).

Attributes can be assigned to phantom inputs where they are logged, alarmed & used for control. A phantom input cannot be assigned to another phantom. (prevents circular references).

Phantoms in the **K-N** space are sensors. Those in the **W-Z** space are volumes & contact sets.

I/O	Type	Attribute x = I/O	Phantom
A-B	Serial Conductivity	x0 Conductivity x1 Temperature x2 Flowswitch	K-N K-N W-Z
	Serial Corrosion Rate	x0 Corrosion Rate x1 Pitting Rate (Imbalance)	K-N K-N
	Serial Differential Pressure	x0 Differential Pressure x1 Inlet Pressure x2 Outlet Pressure	K-N K-N K-N
C-D E-F I-J	pH-ORP driver card	x0 ORP or pH x1 Temperature if pH	K-N K-N
	Conductivity card	x0 Conductivity x1 Temperature if 'Conductivity' or 'Condensate'	K-N K-N K-N
	pH- 4-20mA input card	x0 pH x1 Temperature-pH side	K-N K-N
	Serial Sensor card	Identical sensors & attributes To A-B	
H	Temperature	x0 Temperature x1 Rate	K-N K-N
O-V	Volume meters	x0 Volume Today x1 Rate x2 Volume this Year x3 Volume total	W-Z K-N W-Z W-Z

Use the x0 attribute if you wish to have one sensor display two values.

For example, using a conductivity sensor to measure conductivity & salt concentration

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c. 4-20mA Input Selectable Types

Knowing the sensor type connected to a 4-20mA input allows the controller to:

- A. Scale the input correctly for the selected sensor type
- B. Provide calibration & calibration limits appropriate to selected type
- C. Clamp the measured sensor values so that an open loop doesn't measure a negative ppm or conductivity

Select **Sensor Type** = Other if A,B or C not applicable

Sensor Type	Span Options & units	mA Span	G=Gain, O=Offset Span not user modifiable
Other	Generic 0-100	4-20	User modifiable span G= 6.25, O=-25
CBR Bromine	CBR 0-2ppm	4-16	G=0.167, O=-0.667
	CBR 0-10ppm	4-16	G=0.833, O=-3.333
CGE Chlorine	CGE 0-2 ppm	4-16	G=0.167, O=-0.667
	CGE 0-10ppm	4-16	G=0.833, O=-3.333
CLE3 Chlorine	CGE 0-2ppm	4-16	G=0.167, O=-0.667
	CGE 0-10ppm	4-16	G=0.833, O=-3.333
	CGE 0-100ppm	4-16	G=8.33, O=-33.33
CLO Chlorine	CLO 0-2ppm	4-16	G=0.167, O=-0.667
	CLO 0-10ppm	4-16	G=0.833, O=-3.333
CTE Chlorine	CTE 0-2ppm	4-16	G=0.167, O=-0.667
	CTE 0-10ppm	4-16	G=0.833, O=-3.333
Diff.Pressure	DeltaP 0-100psi	4-20	G= 6.25, O=-25
Fluorescent	Fluor 0-200ppm	4-20	G= 12.5, O=-50
PAA 0-200ppm	PAA 0-200ppm	4-16	G=16.67, O=-66.67
	PAA 0-2000ppm	4-16	G=166.67, O=-666.67
pH-transducer	pH 0 to 14	4-20	4mA=-1.45pH 20mA=15.45pH pH outside of 0-14 blocked G=1.056, O=-5.674 5.373mA=0pH, 18.6mA=14pH
ORP-transducer	ORP 0-1000mV	4-20	G= 62.5, O=-250
Temperature	Temp. 0-100C	4-20	G= 6.25, O=-25
Toroidal	Tor. 0-10000uS	4-20	G= 625, O=-2500
	Tor. 0-100000uS	4-20	G= 6250, O=-25000

Notes:

1. Gain & Offset return to the table values @ Calibrate = Factory Reset
2. The preceding table applies to the ChemFeed version of the Aegis II

d. Enabling-Disabling I/O & Adding-Removing Driver Cards

Inputs A-Z cannot be disabled if in use.

The disable option in both the HTTP & local HMIs is replaced with a message telling you where the target sensor is used, so you can remove the dependency.

Note that the sensor can be used for control, compensation of other sensors & in the case of sensors with more than one attribute; as a source for phantom sensors.

When you disable a sensor, the compensation is removed so that if for example:

You disable a thermally compensated conductivity sensor and the thermal sensor is subsequently removed or disabled, there is no conflict when the conductivity sensor is re-enabled, but it's no longer thermally compensated.

When a **C-D**, **E-F** or **I-J** driver card is removed, all of the dependencies are removed on the next power ON. Outputs that use the removed driver sensor(s) for control have the control equation removed. Other sensors which use the removed driver sensors are modified.

When you install a new driver, the sensor inputs default. For example, adding a pH-ORP driver, configures for one pH & one ORP sensor on power ON.

Auto-Removing Phantoms:

Phantoms are auto-removed if they are derived from inputs \geq 'C'

If the Phantom is in use as an interlock a latching alarm is set.

Example: User removes a serial sensor card with a CTFS sensor OR connects a corrosion rate sensor to a CTFS sensor input on a serial sensor card.

Phantoms derived from inputs 'A' & 'B' are not auto-removed unless the sensor type is changed.

This is done to prevent wholesale auto-reconfiguration & safety related interlock removals on 'A' & 'B' CTFs conductivity sensors.