DULCOMETER
Aegis-II® Cooling Tower and Boiler Controller

Use your Tablet or Smartphone. I’m WiFi ready!
AEGIS II Browser

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 smartphone. 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.
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
1.1.2.2 Setting up WiFi using an IPhone

To connect your IPhone to an Aegis II 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 Aegis II 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.

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.
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.
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
1.3 The Home Screen

The home screen is divided into several sections or groups. Select icons for information or other menus. The I/O sections with dark blue background each have an assigned letter or number in a circle. Select the circle for menu choices for that point. These menus are explored in detail throughout this manual.

View from a Smartphone.

Scroll in any direction to access all I/O as shown in the above 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.

**Usernames with Default Passwords:**
Operator1 = 1  Operator2 = 2  Operator3 = 3  Operator4 = 4.
Configure5 = 5 Configure6 = 6 Configure7 = 7  Administrator = AAAAA

**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
Analog Input Display continued

Calibrate button. Or use sensor menu

Sensors linked to relay outputs include duplicate relay status. Green = On, Blue = Off, Red = Alarm

Sensors linked with pulse outputs include a duplicate output icon. Shows output in %

1.4.2.2 Digital I/O Display

Max of 8 Digital inputs: Can be any combination of dry contact switches or digital water meter 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
# 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.

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XYZ Inhibitor</td>
<td>Setpoint</td>
</tr>
<tr>
<td>2</td>
<td>Blowdown</td>
<td>ON: 5.5min</td>
</tr>
<tr>
<td>3</td>
<td>Acid</td>
<td>Timed Cycling</td>
</tr>
<tr>
<td>4</td>
<td>ABC Biocide</td>
<td>No Event</td>
</tr>
<tr>
<td>5</td>
<td>Alarm Output</td>
<td>Alarmed</td>
</tr>
<tr>
<td>6</td>
<td>Bleach Pump</td>
<td>Setpoint</td>
</tr>
<tr>
<td>7</td>
<td>EFG Biocide</td>
<td>No Event</td>
</tr>
<tr>
<td>8</td>
<td>P9 unused</td>
<td>No Event</td>
</tr>
</tbody>
</table>

## Meters

- **Turbine meter**: 0000000  G
- **Bleed meter**: 0000000  G

## mA Outputs

- **pH to DCS**: 12.59 mA
- **4-20mA Output**: 4.00 mA

## Power Relays

- **XYZ Inhibitor**: Setpoint
- **Blowdown**: ON: 5.5min
- **Acid**: Timed Cycling
- **ABC Biocide**: No Event
- **Alarm Output**: Alarmed

## Digital Outputs

- **Bleach Pump**: Setpoint
- **EFG Biocide**: No Event
- **P9 unused**: No Event
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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.

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 1.4.4 Create a Report

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

1.4.4 Create a Report

To create a report, select the report icon from the main screen.

Follow the three steps as shown.

1. Choose a date range.

The ‘Custom’ selection lets you create a graph of any range that exist in the database. There is a 31-day limit.
2. Select the I/O you wish to graph. Four points maximum. Checked boxes turn orange. After four boxes are checked, the remaining choices grey out and cannot be selected without un-checking one of the four.

3. Press the Download button.
Once the graph is open, the icons have the following properties.

- 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

Note the trend zoom tools. Click on this icon to export as a picture.
AEGIS II Browser

1.4.5 Manage the report database

When you create a graph by selecting I/O points, the browser downloads the data for the chosen points. This data is stored on your device (PC, smart phone, etc). Different browsers allow different amounts of memory to this file. The graph page keeps track of previous selections and expresses the total size of all downloaded data in a bar graph.

This picture depicts three previous graph configurations that have data in the graphing database. Click on one to create a graph, or remove them by selecting the X.

If you wish to keep the configuration but want to reduce the data, open the Manage Report Database window and make your selection. Press Delete.
1.5 **View & Adjust Setpoints**

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

**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.
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).

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 in 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)
1.6 Priming-Testing Pumps & Solenoids

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

Select the Prime-Test from the pull-down.

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

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

Pulse controls prime on volume, not time.

Refresh to update time or volume remaining.

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.
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.

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.

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.

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

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.

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.
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.

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 ration of the sensor connected to input ‘A’ (Tower Conductivity) to the sensor connected to input ‘E’ (Make-up Conductivity).

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.
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...

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.
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.

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

At sites where fouling or high silica prevents using contact conductivity sensors, two meter controls are usable 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.

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

Select Set Blowdown Mode = Percent Time & Submit.

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

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

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 configure 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

If your make-up changes seasonally or periodically and you have a 2\textsuperscript{nd} 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.

<table>
<thead>
<tr>
<th>Control Action</th>
<th>SET ON decreases sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special Control</td>
<td>Varying Cycles</td>
</tr>
<tr>
<td>( uS ) Maximum</td>
<td>3000 ( uS )</td>
</tr>
<tr>
<td>High Cycles</td>
<td>2.500</td>
</tr>
<tr>
<td>( uS ) Hi Range</td>
<td>1000 ( uS )</td>
</tr>
<tr>
<td>Med. Cycles</td>
<td>4.250</td>
</tr>
<tr>
<td>( uS ) Med Range</td>
<td>650 ( uS )</td>
</tr>
<tr>
<td>Low Cycles</td>
<td>6.100</td>
</tr>
<tr>
<td>( uS ) Lo Range</td>
<td>350 ( uS )</td>
</tr>
</tbody>
</table>

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 capital letters! (A/F)
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.

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

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.

Yes & Submit resets the alarm.

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.
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.

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.

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.

**Blocked By**

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.

**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.

- **Status**: ON/OFF, blocked, interlocked, alarmed...
- **Blowdown by**: A/F
- **ON time since midnight**: 17.95 cys
- **48.4m ON today**: 48.4m ON, actuation
- **ON time in the current bleed cycle**: In this example the same as **ON today** time, may indicate a control problem.
- **Varying Cycles**: ON uS Le Range 350 uS
- **Captured Sample controls only update the value of the controlling sensor @ the end of the Measure period**

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

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

**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 11.3 minutes, 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.
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.

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

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.

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.

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.
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!

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 (20ppm x 100%/50% / 4 cycles) feed.
- An 8 GPD pump feeds (8 G / (24hr. x 3600 sec/hr.) 92.6E⁻⁶ G/sec.
- Every 100 Gallons of make-up we’ll need to feed (100G x 10 ppm) 1E⁻³ gallons which @ 92.6E⁻⁶ G/sec feed rate will take (1E⁻³ / 92.6E⁻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.

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.

Inherited from the controlling ORP sensor. Units 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.

Edit for your site, up to 16 characters.

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.

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Edit for your site, up to 16 characters.

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.
Sensor Controlled Feeds continued

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.

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.

NOTE: Relays 6 through 9 set in pulse output mode can be used to drive 4-20mA outputs. This allows the 4-20mA output to use Special Control programs: PID, Time Modulation and Timed Cycling.
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.
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.

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

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

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 
\[120 \times \frac{(350-320)}{(350-300)}\] 
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.
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.

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.
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.

**7: Chlor Pump pulse**

- **Status:** Reconfigured
- **Descriptor:** Chlor Pump pulse
- **Display Units (UOM):** mV
- **Decimal digits:** 0
- **Disable:** Yes
- **Control Action:** ON increases sensor
- **Special Control:** PID Control
- **mL/stroke:** 0.100
- **Rated SPM:** 240
- **Xp Proportnt:** 20,000 mV
- **Integral Rate:** 30 seconds
- **Difference Rate:** 15 seconds

**Configure**

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.

**PID Control**

- **PID Control:** 740 mV

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. 20mV (in this example) from the setpoint, the output will be at 100% on 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.
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.
3.5 Control During Events

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.

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.

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.
3.6 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

**Inhibitor Feed**

<table>
<thead>
<tr>
<th>Mins/Actuation</th>
<th>500.0 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes/Day</td>
<td>240.0 minutes</td>
</tr>
<tr>
<td>Midnight reset</td>
<td>Yes</td>
</tr>
<tr>
<td>Alarm Relay</td>
<td>Yes</td>
</tr>
<tr>
<td>Reset Alarm</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**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

**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.
Limiting Feed & Alarms continued

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...

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.
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.

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
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.

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.
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

Diagnosis provides both configuration & state detail on one page.

Control state

Location of controlling sensor, ‘C’ & value of the control.

Current setpoints

Feed state

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

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

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

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

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

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

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.

**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**.
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…. 

4.2 Prebleed – Lockout

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 the 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.
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

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.
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.

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

5.1 Sensor Calibration:

5.1.1 Single Point – Grab Sample

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

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’.

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

In this example we edited the current 1650 μS to measure 1700 μS.

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

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.
5.1 Sensor Calibration:

5.1.2 DPD: Oxidant Sensors

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.
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.
5.1. Sensor Calibration:
5.1.4 pH Dual Buffer Calibration

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. If using the A to N icon, select Setup from the pulldown to verify 2 Point.

Select the pH Sensor.
Display Units (UOM) is pH.
The decimal digits are 2.
Calibrate is set to 2 Point.
Used by I/O is L.

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 calibrate sequence.

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

Press Start to calibrate the pH sensor. The 1st pH buffer is 7.00 pH. Refresh until the pH is stable & close to the buffer value. Then press Next.

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

**pH Dual Buffer Calibration 2 of 2**

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

**Note:** Two buffer pH calibration seldom results in better pH control than single point, grab sample calibration, but may be required by site practice.
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. If using the A to N icon, select Setup from the pulldown & check Calibrate = 1 Point. 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.

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.
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.

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)

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

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
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

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.

Select Calibrate to complete

Status = Calibrated on success or error message

Cancel to exit & to unlock keypad calibrate access
5.1 Sensor Calibration:
5.1.6 Inventory

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.

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.

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

Cancel to exit & to unlock keypad calibrate access.
5.1 Sensor Calibration:
5.1.7 LSI & Manual Inputs

LSI (Langelier Saturation Index) Compensation was selected for phantom sensor input ‘L’
Calibrate 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

LSI recalculated.
Cancel to exit & to unlock keypad calibrate access

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.
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.

Input ‘N’ has Compensation set to Manual Entry.

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.

Edit Enter Value & Calibrate

Cancel to exit & to unlock keypad calibrate access.
5.1.8 CTFS Flowswitch Calibration

The “Flow” value shown on the conductivity Diagnostic page shows the current value of the flowswitch. Turn the water on and off to see the high and low values for flow. Edit the Configure/Flowswitches box above to be in the center of these two values. Press the Refresh button to see the current Flow value.

Example: If the flow on value is 1047 with the water running, and 847 when the water is off, the halfway point is 947. Edit the Flowswitches value based on this calculation.

5.1.9 Corrosion Rate Calibration

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

Select the A to N icon on the home page. This example is a conductivity sensor connected to 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.
5.2 Sensor Alarms

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.
### 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

**ORP Sensor**

<table>
<thead>
<tr>
<th><strong>Descriptor</strong></th>
<th>ORP Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display Units/UOM</strong></td>
<td>mV</td>
</tr>
<tr>
<td><strong>Decimal digits</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Calibrate</strong></td>
<td>1 Point</td>
</tr>
<tr>
<td><strong>Used by I/O</strong></td>
<td>7, 8,</td>
</tr>
</tbody>
</table>

**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

**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)

**B:Steel Corrosion**

**Sensor Alloy**

<table>
<thead>
<tr>
<th><strong>Other</strong></th>
</tr>
</thead>
</table>

**Alloy#**

| 1.000              |

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

**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.
5.3 Sensor Setup

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, ¾" NPT, temperature compensated.

G: CLE3 Chlorine

Select Sensor Type & Submit

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

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**.

**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.
5.5 Sensor Diagnostics

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

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

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

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
5.5 Sensor Diagnostics  3 of 3

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

Sensor inputs ‘G’ (4-20mA input) & ‘H’ (10mV/C thermal sensor input) are fixed in controller hardware unlike the sensor driver slots @ C-D, E-F & I-J

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 10.99mA x 0.833 -3.333 = 5.82ppm (ppm = mA x Gain + Offset)

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

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)
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

In this example ‘M’ uses attribute ‘0’ from sensor ‘A’
Attribute ‘0’ 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’

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.
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

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.

- Select Setup from the pulldown menu.

- 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.

- 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.

In this example, the meter @ 'O' is used by the control relay '3' so Disable & Sensor Type are not available.
6.2 Copying, Flow Rate Alarms & Rate-to-Volume

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

FlowRate Alarm is used to alarm on high or low flow rate. Disabled when offline on 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.

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.
## 6.3 Meter Diagnostics

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.

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Water meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol. this year</td>
<td>12600 G</td>
</tr>
<tr>
<td>20 Days Online</td>
<td>Vol./Day: 630 G</td>
</tr>
<tr>
<td>Volume Total</td>
<td>107500 G</td>
</tr>
<tr>
<td>Vol. last year</td>
<td>0 G</td>
</tr>
<tr>
<td>Rate</td>
<td>52.8 gpm</td>
</tr>
<tr>
<td>No alarm logged</td>
<td></td>
</tr>
<tr>
<td>Input Firmware Driver</td>
<td>built-in</td>
</tr>
<tr>
<td>Configure:</td>
<td>0000</td>
</tr>
<tr>
<td>Device:</td>
<td>000C4E31</td>
</tr>
<tr>
<td>Product:</td>
<td>PE12519A</td>
</tr>
<tr>
<td>Rev#:</td>
<td>00000001</td>
</tr>
<tr>
<td>S/N:</td>
<td>15082008</td>
</tr>
<tr>
<td>A.ID#:</td>
<td>31032004</td>
</tr>
<tr>
<td>A.rev#:</td>
<td>0</td>
</tr>
</tbody>
</table>

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

**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.**

**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’

---

**Q: Tower blowdown**

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Turbine motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol. this year</td>
<td>76927.01 G</td>
</tr>
<tr>
<td>20 Days Online</td>
<td>Vol./Day: 3848.35 G</td>
</tr>
<tr>
<td>Volume Total</td>
<td>708929.60 G</td>
</tr>
<tr>
<td>Vol. last year</td>
<td>0.00 G</td>
</tr>
<tr>
<td>Rate</td>
<td>19.7 gpm</td>
</tr>
<tr>
<td>No alarm logged</td>
<td></td>
</tr>
<tr>
<td>Input Firmware Driver</td>
<td>built-in</td>
</tr>
<tr>
<td>Configure:</td>
<td>0001</td>
</tr>
<tr>
<td>Device:</td>
<td>000C4E31</td>
</tr>
<tr>
<td>Product:</td>
<td>PE12519A</td>
</tr>
<tr>
<td>Rev#:</td>
<td>00000001</td>
</tr>
<tr>
<td>S/N:</td>
<td>15082008</td>
</tr>
<tr>
<td>A.ID#:</td>
<td>31032004</td>
</tr>
<tr>
<td>A.rev#:</td>
<td>0</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>HiAlarm</th>
<th>50000 G</th>
</tr>
</thead>
<tbody>
<tr>
<td>LoAlarm</td>
<td>100 G</td>
</tr>
</tbody>
</table>

**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.

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 today's 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.
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).
7.2 Contact Set Alarms

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

ON Time Alarm 600.0 minutes
No Flow Alarm 1500.0 minutes
Alarm Relay Yes ☑ No
Disable Alarms Yes ☑ No

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.

Edit & Submit to modify
If you are not using the alarms, set Disable Alarm = Yes & Submit

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

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

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

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.
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.
8 Frequency Controlled Pumps

8.1 Selecting a Pump, Adjust mL/stoke & SPM

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

Select Configure from the pulldown

Select Pump Type = one of the 6 built-in pumps & Submit

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.

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.

### Built-in Pump types

<table>
<thead>
<tr>
<th>Pump Type</th>
<th>ml/stroke</th>
<th>Liters/hr</th>
<th>Gallons/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1601</td>
<td>0.13</td>
<td>1.404</td>
<td>0.371</td>
</tr>
<tr>
<td>1602</td>
<td>0.24</td>
<td>2.592</td>
<td>0.685</td>
</tr>
<tr>
<td>1001</td>
<td>0.10</td>
<td>1.080</td>
<td>0.285</td>
</tr>
<tr>
<td>1002</td>
<td>0.24</td>
<td>2.592</td>
<td>0.685</td>
</tr>
<tr>
<td>0704</td>
<td>0.42</td>
<td>4.536</td>
<td>1.198</td>
</tr>
<tr>
<td>0705</td>
<td>0.50</td>
<td>5.400</td>
<td>1.427</td>
</tr>
</tbody>
</table>
9 4-20mA Outputs

9.1 Configure: Manual-Auto Switch

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.
9.2 Adding Special Control to 4-20mA Outputs

Select a frequency pump 6 through 9. If not available, enable one. Only Relays 6 through 9 will work.

Set the relay Control Type as Feed and based on the sensor of choice.

Must use the Pulse Output choice.

Set up the Configure, alarm and setpoint menus as needed. Close the relay menu window when done.

Open the 4-20mA output menu. Use the Setup menu to edit the output name/description.

Use the Configure menu to set the Control by. The pulse output relay will be identified by the relay name. My relay 6 is named Acid Control so I chose it here.

Switch to Manual mode to test the output.

The 4 and 20mA output values are driven by the relay and cannot be adjusted here. Set the Interlock here or in the relay.

The Open Loop alarm choice will alarm this output if the 4-20mA wires are not connected correctly. With Controls a Pump set to YES, the output will drop to 0% if the STOP button is pressed on the controller panel or if the Control By is set to a relay.

Switch to Manual mode to test the output.
9.3 Calibrate a 4-20mA Output

Select the letter icon from the bottom right side of the home page
Select Calibrate from the pulldown
Select Start to start the two point calibration process
Calibrate overrides the Manual setting or sensor control to set the output to 4mA & then 20mA

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
9.4 Diagnostic & Mirroring

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

Or select Diagnostic from the pulldown.

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.

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

4-20mA Output driver detail:
Shared by inputs ‘Y’ & ‘J’.
## AEGIS II Browser

### 10 System Settings

#### 10.1 Home & Diagnostic pages

Select the controller icon at the top of the home page to access the **System** menu.

**System:***

### Home

<table>
<thead>
<tr>
<th>Date</th>
<th>S/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-Jun-13</td>
<td>2017057141</td>
</tr>
</tbody>
</table>

**Status:** Logged in

**Current User:** admin

**Logout:** Yes

- **Date and controller serial number:**
  - Date: 2019-Jun-13
  - S/N: 2017057141

- **Current Log on state and user:**
  - Status: Logged in
  - Current User: admin

- **Logout here or on the home page. Logs out automatically if no activity for **Browser Logon** minutes. See System Setup for minutes selection.**

### System: Diagnostic

**Diagnostic**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial number</td>
<td>2017057141</td>
</tr>
<tr>
<td>Firmware</td>
<td>19.05.29.00</td>
</tr>
<tr>
<td>HMI Firmware</td>
<td>16.07.11.00</td>
</tr>
<tr>
<td>Web Browser HMI Version</td>
<td>11.00.00.00</td>
</tr>
<tr>
<td>Relay Fuse</td>
<td>OK</td>
</tr>
<tr>
<td>Watchdog Resets</td>
<td>4</td>
</tr>
<tr>
<td>Admin Password</td>
<td>Default</td>
</tr>
<tr>
<td>O-T wiring</td>
<td>OK</td>
</tr>
<tr>
<td>U-V wiring</td>
<td>OK</td>
</tr>
<tr>
<td>Fan speed</td>
<td>4020 RPM</td>
</tr>
<tr>
<td>Biotiming, Events</td>
<td>Thu, WEEK 1</td>
</tr>
</tbody>
</table>

**Select Diagnostic from the pulldown**

- **Controller serial number:** S/N 2017057141
- **Firmware versions:**
  - 19.05.29.00
  - 16.07.11.00
- **Relay fuse status:** OK
- **Watchdog Resets:** 4
- **Admin Password:** Default
- **O-T wiring:** OK
- **U-V wiring:** OK
- **Fan speed:** 4020 RPM
- **Biotiming, Events:** Thu, WEEK 1

**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.**

- **Cooling fan fault shuts down all sensor driver cards & controls. Displays only fault message on local HMI display.**
- **Power status for 3 wire inputs 'O' thru 'T'.**
  - Default = AAAA, otherwise known only to the Admin
  - Power status for 3 wire inputs 'U' and 'V'. U and V have a separate power supply from O – T.

Accumulates CPU crashes. Should read 0. Check incoming power.
10.2 Activity Log:
10.2.1 User ID, time stamp

Select Activity Log from the System pulldown

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

View another day: Select Month & Day then press Submit
(Last six months selectable)

The list shows the I/O point effected, a description of the activity, the User that made the change and the time

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

In these examples, the System logs input M is Alarmed & the admin user adjusted the Alarms on Input ‘S’

Next button is removed when at end of list.
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

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 12:38:01
U: Activity Changed admin 13:40:30
U: Activity Changed admin 13:40:41
U: Configure Compens.modif admin 13:41:04

next back Submit

System: Activity Log

Activity Log

0 Events, 1-0

May

1

Submit

No activity file
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 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.
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.
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-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

Choose E-mail status: Disable, Midnight, Noon and Midnight & Noon
Includes sensor values & volumes so you get operating context.

Edit Mail To = your email & Submit

Edit to add 3 optional cc E-mail to & Submit

Continued on next page
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.

<table>
<thead>
<tr>
<th>SMTP IP Address</th>
<th>43.228.184.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMTP Port</td>
<td>2525</td>
</tr>
<tr>
<td>SMTP Username</td>
<td><a href="mailto:aegis@prominent.us">aegis@prominent.us</a></td>
</tr>
<tr>
<td>SMTP Password</td>
<td>****</td>
</tr>
<tr>
<td>SMTP reset</td>
<td>Yes</td>
</tr>
<tr>
<td>Test E-mail</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Reset the SMTP setting to those shown on this page
Send a status report to all email addresses listed above
Next report is expected to send...
AEGIS II Browser

10.5 Time & Date:
10.5.1 Sync to Device

Select Time & Date from the System pulldown

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 synch the controller to your device, click on the link & Submit.
AEGIS II Browser

10.6 Enable I/O:
10.6.1 Enable IO, Assign to System#

Sidebar:
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.

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.

Select Enable I/O from the System pulldown

The Configure box allows you to see all Sensors, Meter/Contacts or Control relays. This example shows all Control relays. Edit this choice to see Sensors or the Meter Contact lists.

If the System Setup page field # of Systems = Two, this page allows you to select to which system the I/O pertains.

System Setup page field # of Systems = One
Is limited to Enable IO as there are not systems to designate.

Select I/O you wish to enable or None & Submit
AEGIS II Browser

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.

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

Logging rate set the frequency of data points stored in the database

Browser logout will end the browser session after x minutes of inactivity

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
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.

**Default Passwords:**
Operator1 = 1  Operator2 = 2  Operator3 = 3  Operator4 = 4.
Configure5 = 5  Configure6 = 6  Configure7 = 7  Administrator = AAAAA

**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.
AEGIS II Browser

**Passwords: 2 of 2**

10.8.2 View-Set Access Level - Users 1 - 7

<table>
<thead>
<tr>
<th>Status</th>
<th>Login @ operate</th>
</tr>
</thead>
<tbody>
<tr>
<td>User ID</td>
<td>Operator1</td>
</tr>
<tr>
<td>New Password</td>
<td><strong>...</strong></td>
</tr>
<tr>
<td>Confirm Password</td>
<td><strong>...</strong></td>
</tr>
</tbody>
</table>

- 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**.
AEGIS II Browser

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.

<table>
<thead>
<tr>
<th>I/O</th>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-B</td>
<td>Serial sensors</td>
<td>3 wire Conductivity-Flowswitch-Temperature or Corrosion Rate or Differential pressure sensors</td>
</tr>
<tr>
<td>C-D</td>
<td>Dual sensor driver cards</td>
<td>pH-ORP: configurable as dual pH or dual ORP or pH-ORP</td>
</tr>
<tr>
<td>E-F</td>
<td>6 types in any combination</td>
<td>4-20mA input</td>
</tr>
<tr>
<td>I-J</td>
<td></td>
<td>Conductivity pH &amp; 4-20mA input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dual serial sensor</td>
</tr>
<tr>
<td>G</td>
<td>Built-in 4-20mA input</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Built-in 10mV/C temperature sensor input</td>
<td></td>
</tr>
<tr>
<td>K-N</td>
<td>Phantom sensors</td>
<td>Calculated (Inventory, Manual) or derived from other sensors &amp; meters</td>
</tr>
<tr>
<td>O-V</td>
<td>Volume meter &amp; contact set inputs</td>
<td>Each of 6 inputs configurable as Turbine, Contact Head meter or Contact Set</td>
</tr>
<tr>
<td>W-Z</td>
<td>Phantom volume meter &amp; contact set inputs</td>
<td>Calculated (Fail-to-Feed, Fail-to-Sample) or derived from other sensors &amp; meters</td>
</tr>
<tr>
<td>1-2</td>
<td>Line powered control relays</td>
<td>Form C, powers pumps, solenoids &amp; motorized valves</td>
</tr>
<tr>
<td>3-5</td>
<td>Dry or line powered control relays</td>
<td>Form C, may be used dry or powered.</td>
</tr>
<tr>
<td>6-9</td>
<td>Pulse or ON/OFF controls</td>
<td>Dry contact sets used to pulse or enable pumps, alarm… 24V 250mA max.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>I/O</th>
<th>Type</th>
<th>Attribute</th>
<th>x = I/O</th>
<th>Phantom</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-B</td>
<td>Serial Conductivity</td>
<td>x0 Conductivity, x1 Temperature, x2 Flowswitch</td>
<td>K-N, K-N, W-Z</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serial Corrosion Rate</td>
<td>x0 Corrosion Rate, x1 Pitting Rate (Imbalance)</td>
<td>K-N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serial Differential Pressure</td>
<td>x0 Differential Pressure, x1 Inlet Pressure, x2 Outlet Pressure</td>
<td>K-N, K-N, K-N</td>
<td></td>
</tr>
<tr>
<td>C-D</td>
<td>pH-ORP driver card</td>
<td>x0 ORP or pH, x1 Temperature if pH</td>
<td>K-N, K-N</td>
<td></td>
</tr>
<tr>
<td>E-F</td>
<td>Conductivity card</td>
<td>x0 Conductivity, x1 Temperature if ‘Conductivity’ or ‘Condensate’</td>
<td>K-N, K-N</td>
<td></td>
</tr>
<tr>
<td>I-J</td>
<td>pH- 4-20mA input card</td>
<td>x0 pH, x1 Temperature-pH side</td>
<td>K-N, K-N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serial Sensor card</td>
<td>Identical sensors &amp; attributes To A-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Temperature</td>
<td>x0 Temperature, x1 Rate</td>
<td>K-N, K-N</td>
<td></td>
</tr>
<tr>
<td>O-V</td>
<td>Volume meters</td>
<td>x0 Volume Today, x1 Rate, x2 Volume this Year, x3 Volume total</td>
<td>W-Z, K-N, W-Z</td>
<td></td>
</tr>
</tbody>
</table>

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.
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

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Span Options &amp; units</th>
<th>mA Span</th>
<th>G=Gain, O=Offset</th>
<th>Span not user modifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>Generic 0-100</td>
<td>4-20</td>
<td>User modifiable span</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$G= 6.25, \ \ O=-25$</td>
<td></td>
</tr>
<tr>
<td>CBR Bromine</td>
<td>CBR 0-2ppm</td>
<td>4-16</td>
<td>$G=0.167, \ \ O=-0.667$</td>
<td></td>
</tr>
<tr>
<td>CBR 0-10ppm</td>
<td>4-16</td>
<td>$G=0.833, \ \ O=-3.333$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CGE Chlorine</td>
<td>CGE 0-2 ppm</td>
<td>4-16</td>
<td>$G=0.167, \ \ O=-0.667$</td>
<td></td>
</tr>
<tr>
<td>CGE 0-10ppm</td>
<td>4-16</td>
<td>$G=0.833, \ \ O=-3.333$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLE3 Chlorine</td>
<td>CGE 0-2ppm</td>
<td>4-16</td>
<td>$G=0.167, \ \ O=-0.667$</td>
<td></td>
</tr>
<tr>
<td>CLE3 Chlorine</td>
<td>CGE 0-10ppm</td>
<td>4-16</td>
<td>$G=0.833, \ \ O=-3.333$</td>
<td></td>
</tr>
<tr>
<td>CLE3 Chlorine</td>
<td>CGE 0-100ppm</td>
<td>4-16</td>
<td>$G=8.33, \ \ O=-33.33$</td>
<td></td>
</tr>
<tr>
<td>CLO Chlorine</td>
<td>CLO 0-2ppm</td>
<td>4-16</td>
<td>$G=0.167, \ \ O=-0.667$</td>
<td></td>
</tr>
<tr>
<td>CLO 0-10ppm</td>
<td>4-16</td>
<td>$G=0.833, \ \ O=-3.333$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTE Chlorine</td>
<td>CTE 0-2ppm</td>
<td>4-16</td>
<td>$G=0.167, \ \ O=-0.667$</td>
<td></td>
</tr>
<tr>
<td>CTE 0-10ppm</td>
<td>4-16</td>
<td>$G=0.833, \ \ O=-3.333$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diff. Pressure</td>
<td>DeltaP 0-100psi</td>
<td>4-20</td>
<td>$G=6.25, \ \ O=-25$</td>
<td></td>
</tr>
<tr>
<td>Fluorescent</td>
<td>Fluor 0-200ppm</td>
<td>4-20</td>
<td>$G=12.5, \ \ O=-50$</td>
<td></td>
</tr>
<tr>
<td>PAA 0-200ppm</td>
<td>PAA 0-200ppm</td>
<td>4-16</td>
<td>$G=16.67, \ \ O=-66.67$</td>
<td></td>
</tr>
<tr>
<td>PAA 0-2000ppm</td>
<td>4-16</td>
<td>$G=166.67, \ \ O=-666.67$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH-transducer</td>
<td>pH 0 to 14</td>
<td>4-20</td>
<td>4mA=$-1.45pH$ 20mA=$15.45pH$ pH outside of 0-14 blocked $G=1.056, \ \ O=-5.674$ 5.373mA=0pH, 18.6mA=14pH</td>
<td></td>
</tr>
<tr>
<td>ORP-transducer</td>
<td>ORP 0-1000mV</td>
<td>4-20</td>
<td>$G=62.5, \ \ O=-250$</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Temp. 0-100C</td>
<td>4-20</td>
<td>$G=62.5, \ \ O=-25$</td>
<td></td>
</tr>
<tr>
<td>Toroidal</td>
<td>Tor. 0-10000uS</td>
<td>4-20</td>
<td>$G=625, \ \ O=-2500$</td>
<td></td>
</tr>
<tr>
<td>Toroidal</td>
<td>Tor. 0-100000uS</td>
<td>4-20</td>
<td>$G=6250, \ \ O=-25000$</td>
<td></td>
</tr>
</tbody>
</table>

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 >= ‘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’ CTFSs conductivity sensors.