

DULCOMETER® Slimflex 5 Cooling Tower and Boiler Controller

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



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

This document can be downloaded from the ProMinent.US website and is supplied on an accompanying USB stick. The part number for the USB stick is: **1079218**

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

Contents

1	Day-to-Day Browsing	4
1.1	The WiFi Connection.....	4
1.1.1	Using a PC or Tablet:	4
1.1.2	Using a Smartphone	5
1.1.3	Opening the Browser page using WiFi.....	6
1.2	The LAN Connection.....	7
1.3	The Home Screen.....	10
1.4	Home Page Services	11
1.4.1	Log-In.....	12
1.4.2	Home Page Detail	12
1.4.3	Home Page System Icons	13
1.4.4	Create a Report	14
1.5	View & Adjust Setpoints	15
1.6	Priming-Testing Pumps & Solenoids.....	17
2	Blowdown Controls: Towers, Boilers, Closed Loops	17
2.1	Conductivity Controlled Blowdown	18
2.2	Boiler Blowdown	20
2.3	Metered Blowdown.....	21
2.4	Percentage Time Blowdown	22
2.5	Variable Cycles.....	23
2.6	Blowdown Limit Alarms	24
2.7	Blowdown Interlocks-Flowswitches.....	25
2.8	Blocking-Delaying a Blowdown.....	26
2.9	Blowdown Diagnostics	27
3	Chemical Feed Controls: Inhibitor, Acid, Oxidant, Amine... ..	28
3.1	Water Meter Inhibitor Feed	28
3.2	Sensor Controlled Feeds	30
3.3	Proportional Feed.....	31
3.3.1	Bleed Based Feed	31
3.3.2	Time Modulation	32
3.3.3	Timed Cycling	33
3.4	Control During Events	34
3.5	Limiting Feed & Alarms.....	35
3.6	Interlocks	37
3.6.1	No feed on no flow	37
3.7	Blocking-Delaying a Feed	38
3.8	Feed Diagnostics.....	39
4	Biocide Events & Other Controls: Feeding by Time & Date	41
4.1	Setting & Viewing Events	41
4.2	Prebleed – Lockout	43
4.3	Alarm Relay.....	44
5	Sensors: Conductivity, Temperature, pH & ORP.....	45
5.1	Sensor Calibration:	45
5.1.1	Single Point – Grab Sample.....	45
5.1.2	Boiler Conductivity	46
5.1.3	pH Dual Buffer Calibration 1 of 2.....	47
5.1.4	Manual Inputs.....	49
5.1.5	CTFS Flowswitch Calibration	50
5.2	Sensor Alarms 1 of 2	51
5.3	Sensor Setup 1 of 2.....	52
5.4	Sensor Compensation	53

Slimflex 5 Browser

5.5	Sensor Diagnostics 1 of 2	54
5.6	Using Sensor Attributes for Phantoms	56
6	Measuring Volume: Water Meters	57
6.1	Configuring a New Meter	57
6.2	Copying Meters,.....	58
6.3	Flow Rate Conversion	59
6.4	Meter Diagnostics	60
6.5	Meter Alarms	61
7	Flowswitches, Interlocks & Contact Sets	62
7.1	Switching Meters & Contact Sets	62
7.2	Contact Set Alarms	63
7.3	Logically Inverting Contact Sets	64
7.4	Mirroring a Control ON/OFF.....	64
8	4-20mA Outputs	65
8.1	Configure: Manual-Auto Switch.....	65
8.2	Calibrate.....	66
8.3	Diagnostic & Mirroring	67
9	System Settings	68
9.1	Home & Diagnostic pages	68
9.1.1	S/N, Versions, Fuse & Fan state, Biofeed Week#.....	68
9.2	Activity Log:.....	69
9.2.1	User ID, time stamp.....	69
9.3	Communications:	70
9.3.1	LAN IP, Netmask, MAC, Gateway, Wifi IP	70
9.4	Time & Date:	71
9.4.1	Sync to Device.....	71
9.5	E-Mail Setup – Test.....	72
9.6	Enable I/O:.....	73
9.6.1	Enable IO, Assign to System#.....	73
9.7	System Setup:	74
9.7.1	Naming, Sunday=Day1 ,Metric Units, Restart Options	74
9.8	Passwords:	75
9.8.1	View-Set Access Level.....	75
10	Using the USB Port.....	76
10.1	Capturing Data 1 of 2.....	76
10.2	Save or Load the Program Configuration	77
10.2.1	Saving to the USB	78
10.2.2	Loading from the USB	78
10.2.3	Saving to/from flash using the controller keypad.....	78
10.3	Firmware Upgrade using USB.....	78
10.4	Remote HMI (Browser) Firmware Update	80
10.5	E-mail Reports and Alarms.....	81
10.5.1	E-mail Types:	81
10.5.1.1	ALARM: Sent once when an alarm first occurs.....	81
10.5.1.2	STATUS: Sent @ noon, midnight or both every day (12:00/24:00). Verifies that the controller is running & on the LAN.....	81
10.5.1.3	DATA LOG: Sent @ midnight (23:59) or hourly. Verifies that the controller is running & on the LAN.	81
10.5.1.4	H2Tronics eService Report: Third party software is needed for this option.	81
11	Appendices:.....	82

1 Day-to-Day Browsing

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

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

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

1.1 The WiFi Connection

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

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

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

1.1.1 Using a PC or Tablet:

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



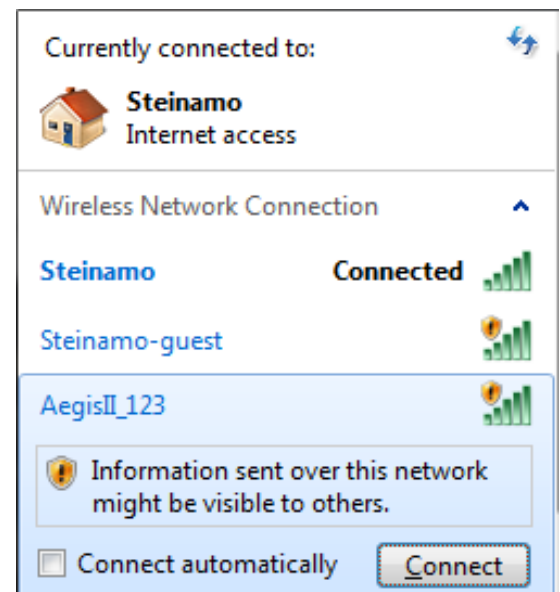
Click on the AegisII_123 choice and press the Connect button.

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

Further differentiate your controller WiFi name. Edit the name in the System pages. See [9.3.1 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](#)



Slimflex 5 Browser

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 _SF5_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:

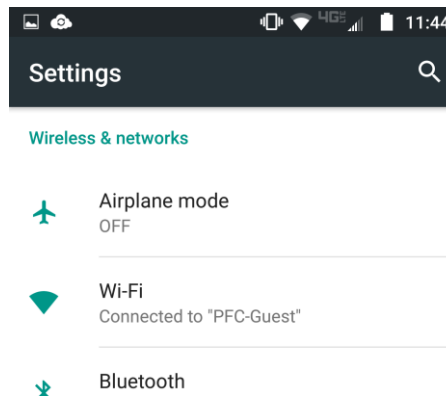
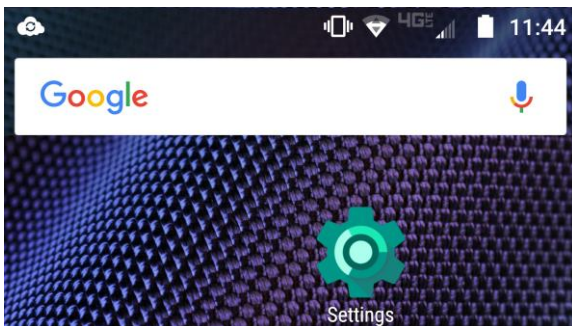
Once you are connected to a controller, you can edit the SSID (WiFi name) to make identification easier than trying to remember the three digits.

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

Here are examples using Android and iPhone;

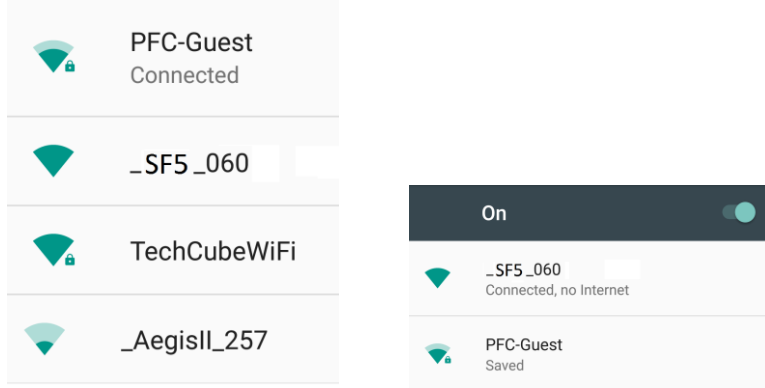
1.1.2.1 Setting up WiFi using an Android phone

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'.

Slimflex 5 Browser



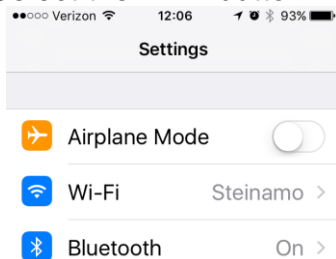
Continue with section [1.1.3 Opening the Browser page using WiFi](#)

1.1.2.2 Setting up WiFi using an iPhone

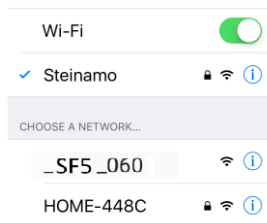
To connect your iPhone to an AegisII controller, make a **WiFi** connection; Select the Settings button from your desktop.



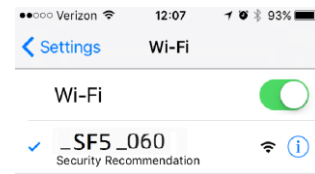
Select the **WiFi** button.



Choose your controller.



Note the connection status.



If you have more than one SF5 choice, the number on the screen represents the last 3 digits of the Slimflex controller serial number.

1.1.3 Opening the Browser page using WiFi

Once a WiFi connection is established, continue here with step 2.

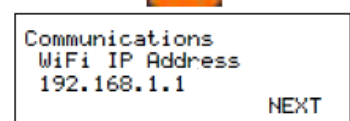
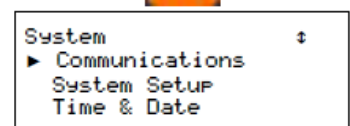
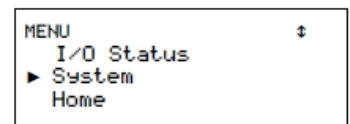
To connect to the controller and see the screen, open a browser and enter the controller's **WiFi** IP address. (Not the LAN IP).

Connection status

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



Slimflex 5 Browser

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. See section **1.3 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

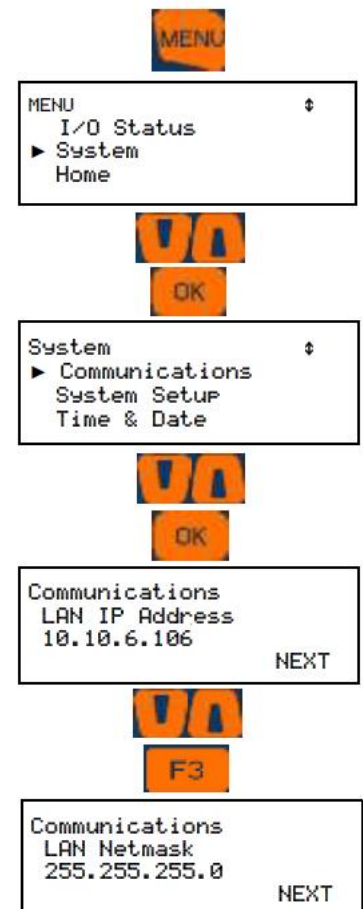
Once you have determined the IP address of the controller, you need to set a static IP address on your PC that is compatible with the controller address.

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.

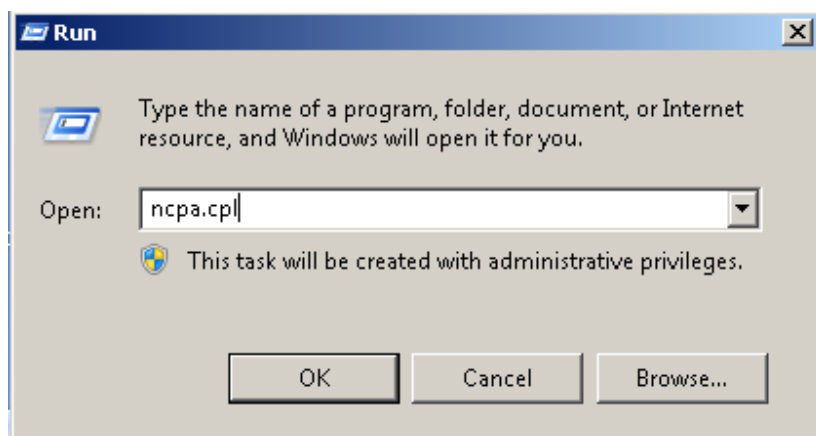
Use the following instructions for VISTA, WIN7, WIN8 and WIN10.

Hold down the Windows key  while you press the letter 'r'.

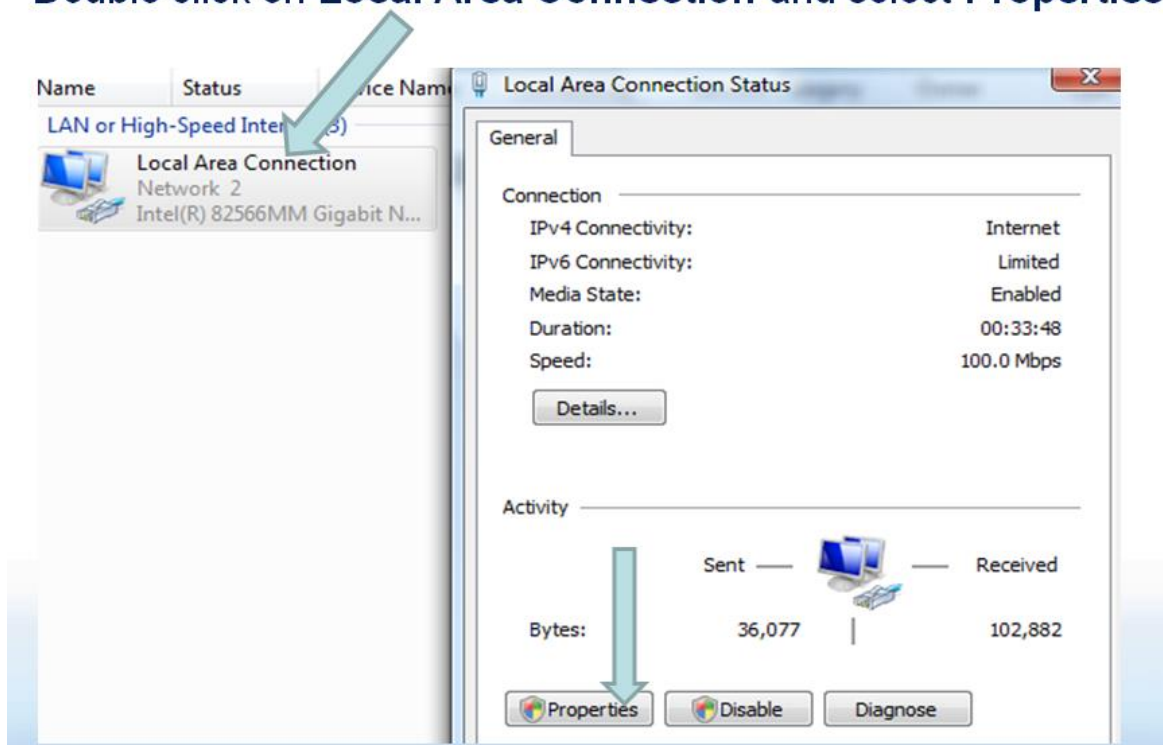


Slimflex 5 Browser

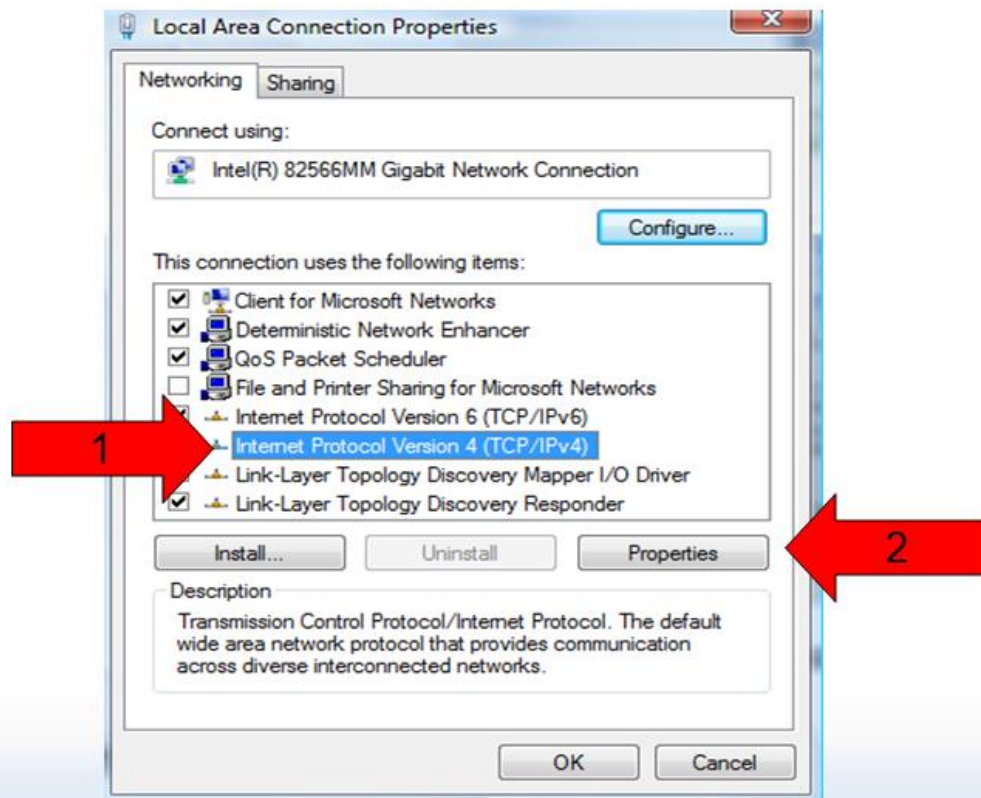
Enter 'ncpa.cpl' in the **Open** box.
Press **OK**.



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



Slimflex 5 Browser



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

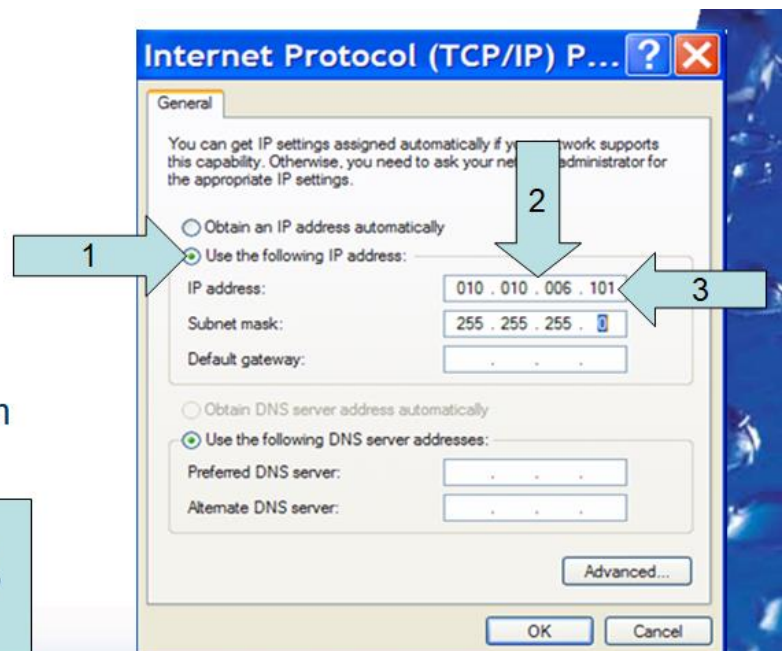
Select the 'Use the following IP address': circle (1)

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

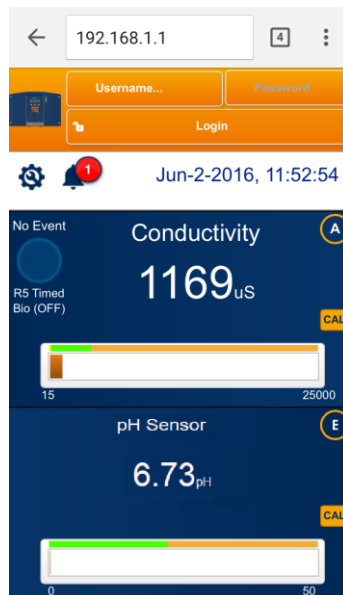
Slimflex 5 Browser

1.3 The Home Screen

Slimflex 5 Browser



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



1.4 Home Page Services

Slimflex 5 Browser

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

1.4.1 Log-In

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

Username with Default Passwords:

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

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

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

Modify Passwords:

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

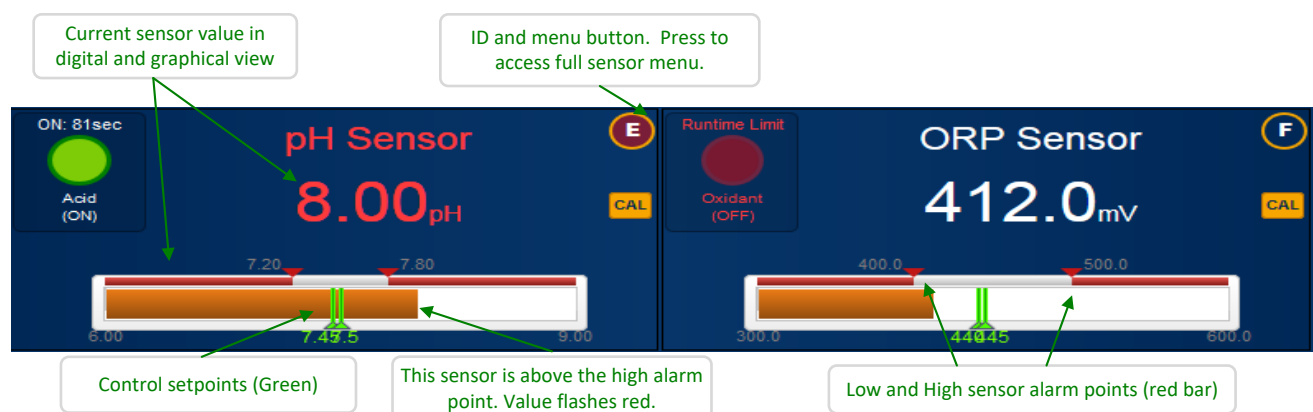
Two users cannot share the same password because only the password is used to identify keypad users. The controller displays **Password Fail** on a duplicate password.

See section [9.8 Passwords](#) to learn how to change passwords.

1.4.2 Home Page Detail

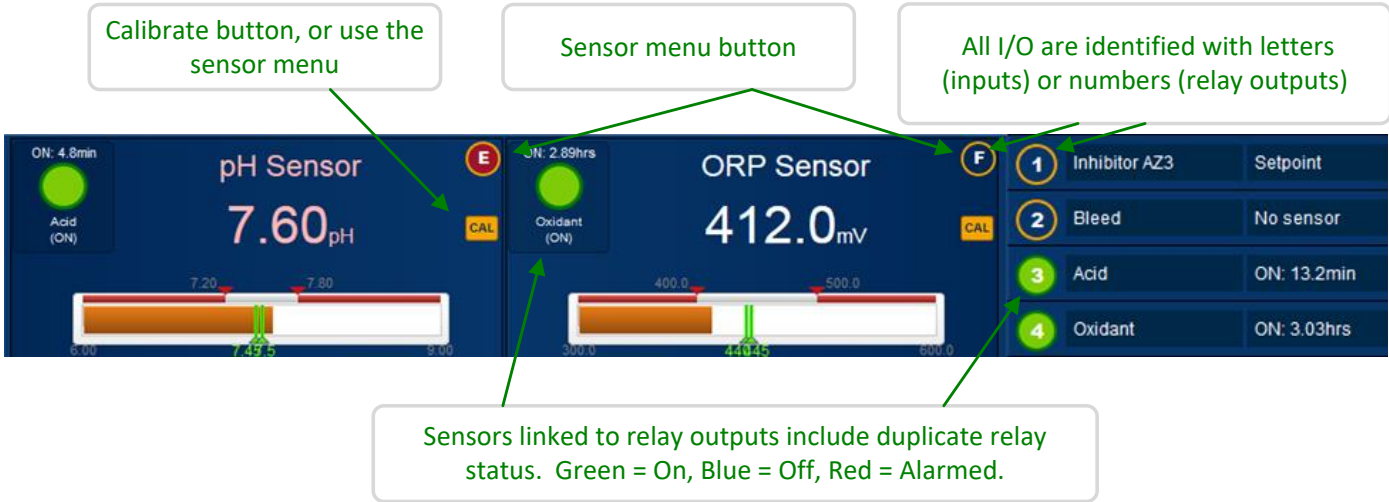
Now that you are logged in, you can edit the controller as well as monitor the action. The following pages break the Home page into sections to enhance identification.

1.4.2.1 Analog Input Display

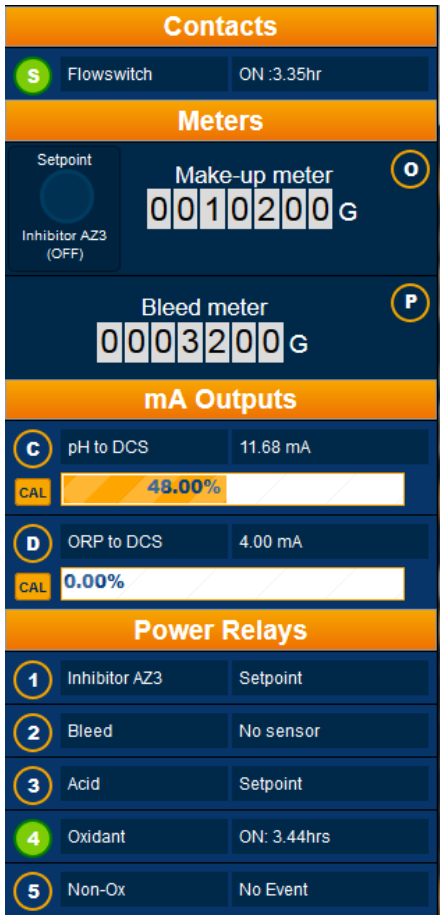


Analog Input Display continued

Slimflex 5 Browser



1.4.2.2 Digital I/O Display






1.4.3 Home Page System Icons


Slimflex 5 Browser


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




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

The System Settings icon  has the following menus:  These menus are explained in section [9 System Settings](#).

The change display icon  allows users with dual systems to select how I/O points are displayed. See section [9.7 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.







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

1.4.4 Create a Report

A screenshot of the 'Recent' report page. At the top is a navigation bar with icons for help, home, report menu, report database, report header, and alarm. Below the bar is an orange header with the word 'Recent'. The main content area shows 'No recent reports' and a message to 'Create a report by following the steps below'. A progress bar for 'Used Storage Space' is at 1%. Below this is an orange header with the word 'New'. The steps are: 1. Choose a date range (with a dropdown menu set to 'Today'), 2. Choose up to four I/O's (with four dropdown menus: Sensors, Meters, Contacts, and Outputs), and 3. Download and view (with an orange button labeled 'Download data and create report').

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

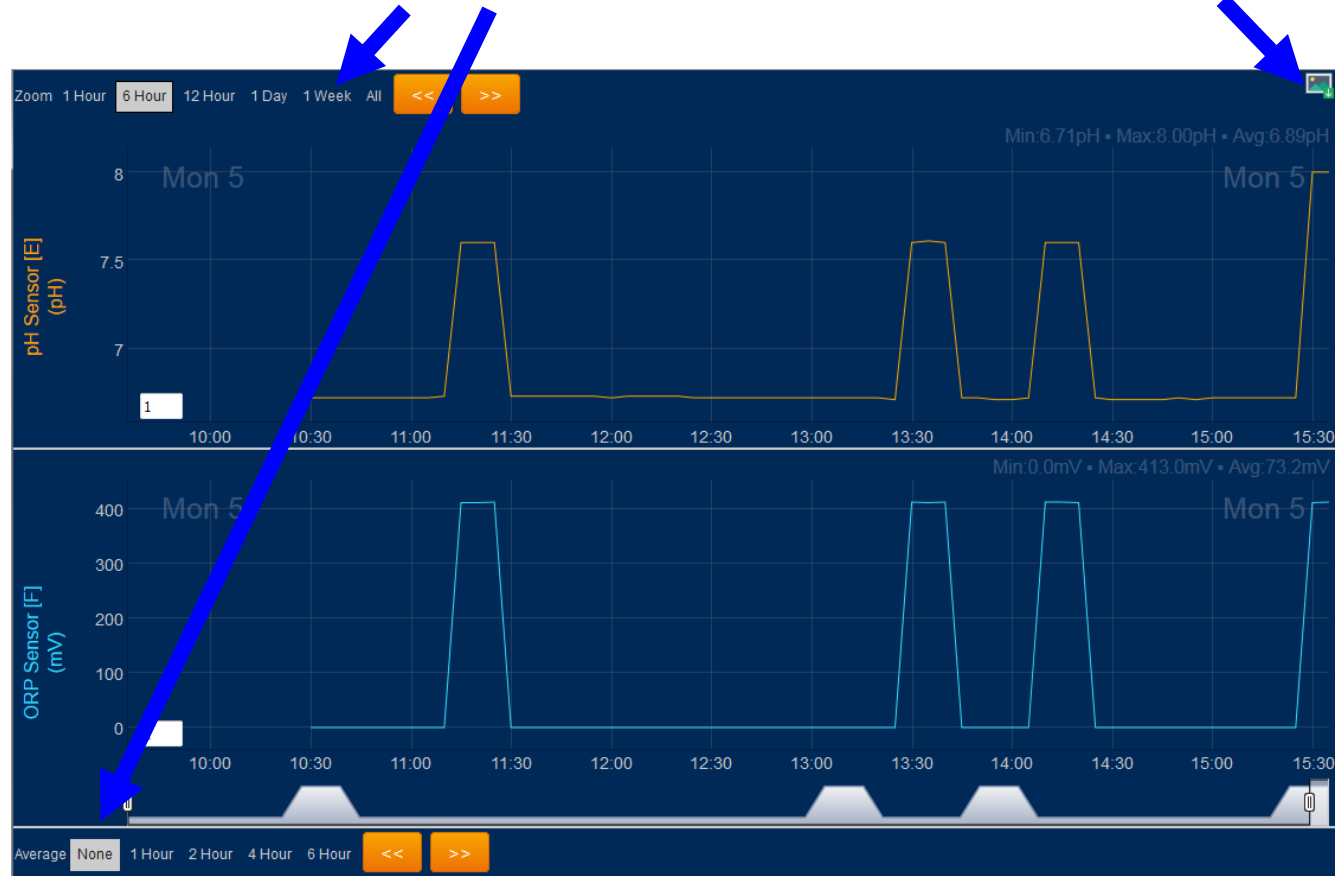
The Icons:      

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

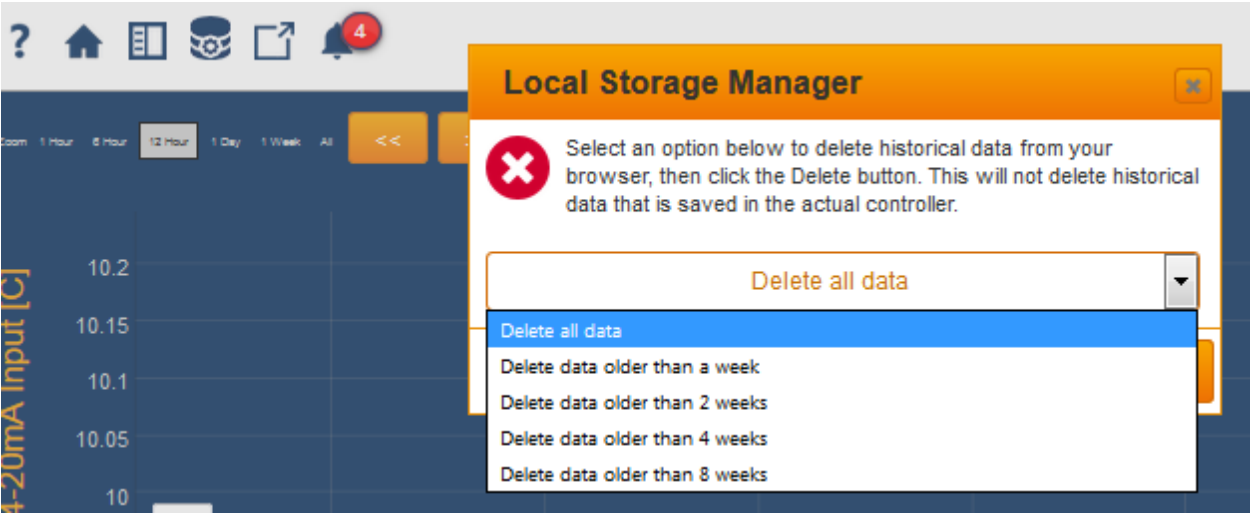
Note the trend zoom tools.

Export as a picture

Slimflex 5 Browser



Manage the report database.



1.5 View & Adjust Setpoints

Slimflex 5 Browser

Select the 1 to 5 icon on the home page. This example adjusts the Relay 1 setpoint

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

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

2:Tower276 Bleed

Adjust Setpoint

On: 1500 uS

Off: 1490 uS

Edit one or both setpoints & Submit

Refresh Submit

5:Blr5 Treatment

Adjust Setpoint

Measure 100 G

Feed 10 seconds

Submit

Feeding on volume allows you to set the feedwater concentration.

Sidebar:

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

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.

Controls may be configured to prevent one chemical feeding while another feeds (See [3.7 Blocking, Delaying a Feed](#)) into a common injection header.

Inhibitor feeds may be delayed while the bleed solenoid is ON to prevent pumping inhibitor down the drain (See [Section 3.3.1 Bleed Based Feed](#).)

Pumps or blowdown valve controls may be turned OFF when the tower or boiler is offline (See section [3.6 Interlocks](#))

Pay attention to the number **1** to **5** 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.

Slimflex 5 Browser

1.6 Priming-Testing Pumps & Solenoids

The diagram illustrates the steps to perform a Prime-Test on a pump or solenoid in the Slimflex 5 Browser. It consists of two screenshots of the interface with callouts explaining the process.

Left Screenshot (Initial Setup):

- 3:Inhibitor Feed** (Header)
- Prime-Test** (Section Header)
- START** (Row): ☒ Yes, ☐ No
- Prime, Force ON** (Row):
- Buttons:** Refresh, Submit

Callouts for Left Screenshot:

- Select the 1 to 5 icon on the home page. This example primes the Relay 3
- Select **Prime-Test** from the pull-down
- Edit the Prime-Test Time & **Submit**

Right Screenshot (During Test):

- 3:Inhibitor Feed** (Header)
- Prime-Test** (Section Header)
- Remaining** (Row): 00:08:24
- End of Prime-Test** (Row): ☐ Yes, ☒ No
- Buttons:** Refresh, Submit

Callouts for Right Screenshot:

- Time remaining until end of Prime-Test
- Select **End of Prime-Test = Yes** to end sooner & **Submit**
- If the control is 'Blocked', 'Stopped', 'Interlocked' or 'Alarmed-OFF', Priming does not occur.

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

Slimflex 5 Browser

2.1 Conductivity Controlled Blowdown

Select the 1 to 5 icon on the home page.
This example sets up the Relay 2 as a Bleed Control

Select **Setup** from the pull-down

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

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

Select the sensor used to control the blowdown.

Select **Configure** from the pull-down

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

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

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

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.**

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

2: Tower 267	
Configure	
Descriptor	Tower 267
Display Units(UOM)	uS
Decimal digits	0
Used by I/O	5: Non-Ox
Control Action	ON decreases sensor
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Sidebar:

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

Slimflex 5 Browser

Conductivity Controlled Blowdown continued

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

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

1:Tower276 Bleed

Setup

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

Refresh

Submit

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

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

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

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

1:Tower276 Bleed

Adjust Setpoint

On:	3.00 cyc
Off:	2.98 cyc

Refresh

Submit

Sidebar:

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

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

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

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

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

Slimflex 5 Browser

2.2 Boiler Blowdown

Select the 1 or 2 icon on the home page.
This example sets up the Relay 1 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 back to **Measure**

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

1:Blowdown 1	
Configure	
Status	Reconfigured
Descriptor	Blowdown 1
Display Units(UOM)	uS
Decimal digits	0
Disable	<input type="radio"/> Yes <input checked="" type="radio"/> No
Control Action	ON decreases sensor
Special Control	Captured Sample
Sample	30 seconds
Measure	60 seconds
Blowdown	120 seconds
ReSample	60 minutes
<input type="button" value="Refresh"/> <input type="button" value="Submit"/>	

Sidebar:

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

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

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

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

Slimflex 5 Browser

2.3 Metered Blowdown

Select the number 2 icon on the home page.
This is the only relay that can control blowdown based on a Meter.

Select **Setup** from
the pull-down

2: Tower276 Bleed

Setup

Status	Reconfigured
Control Type	Blowdown
Set Blowdown Mode	Water meter
Control by:	O: Tower Make-up

Refresh Submit

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

2: Tower276 Bleed

Adjust Setpoint

Measure	500 G
Feed	75 seconds

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

2: Tower276 Bleed

Setup

Control Type	Blowdown
Set Blowdown Mode	Water meter
Control by:	O:P

Refresh Submit

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

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

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

2: Tower276 Bleed

Adjust Setpoint

Measure	300 G
Bleed	100 G

Refresh Submit

Slimflex 5 Browser

2.4 Percentage Time Blowdown

Select the number **2** icon on the home page.

Select **Setup** from the pull-down

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

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

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

2: Tower276 Bleed

Adjust Setpoint

Percent Time 25.0 %

Refresh Submit

Sidebar:

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

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

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

Slimflex 5 Browser

2.5 Variable Cycles

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

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

No not use **Varying Cycles** if:

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

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

Set the maximum allowed tower water conductivity

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

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

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

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

1: Tower276 Bleed	
Setup	
Control Type	Blowdown
Set Blowdown Mode	Sensor Control
Control by:	A/F
<div>Refresh Submit</div>	

2.6 Blowdown Limit Alarms

The screenshot shows the '2: Tower276 Bleed' page in the Slimflex 5 Browser. The 'Alarms' section is highlighted with a yellow background. The following table represents the data visible in the interface:

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

Annotations and their corresponding interface elements:

- Select the 1 or 2 icon on the home page. This example uses the **Alarms** page for a blowdown control on Relay 2** (points to the page title).
- Select **Alarms** from the pull-down** (points to the 'Alarms' dropdown menu).
- The number of minutes in any one bleed cycle** (points to the 'Mins/Actuation' field).
- Adjust for the number of minutes that would represent a failure to control cycles of concentration, 2 hours in this example** (points to the 'Adjusted Alarm' field).
- No = Alarm Logs & Displays but does not turn OFF the bleed** (points to the 'OFF on Alarm' radio button).
- The default sets **OFF on Alarm** = No, some blowdown is usually better than none** (points to the 'OFF on Alarm' radio button).
- Yes = Turns ON the alarm relay when Relay 2 alarms** (points to the 'Alarm Relay' radio button).
- If you are using another relay or DO with the **Special Control** = Alarm Output, then you can elect to have Relay2 alarm trip that relay or DO** (points to the 'Alarm Relay' radio button).
- Yes & Submit resets the alarm** (points to the 'Reset Alarm' radio button).
- Most recent alarm for Relay 1** (points to the 'Limit: ON timer' field).

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

Slimflex 5 Browser

2.7 Blowdown Interlocks-Flowswitches

Select the number 2 icon on the home page. This example uses the **Interlocked** page for a boiler blowdown interlock on Relay 2

Select **Interlocked** from the pull-down

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

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

In this example, the contact set input @ T must be **ON** for The Boiler 1 blowdown control on Relay 2 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 5 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

Slimflex 5 Browser

2.8 Blocking-Delaying a Blowdown

Select the relay 2 icon on the home page. This example uses the **Blocked by** page for a Tower bleed block on inhibitor feed

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

Blocking stops a control from turning **ON** when the blocking control is **ON** .

More than one block may be selected

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

Select each control you wish to Block the bleed & **Submit**

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

Status	Blocking edit
1:Biofeed on 1	unused
3:Inhibitor Feed	Blocks
4:Boiler_1_CS	unused
5:Blr5 Treatment	unused

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 number 2 icon on the home page. This example uses the Diagnostic page for a Tower bleed block on Relay 2

Select **Diagnostic** from the pull-down

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

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

Current value of the control sensor or control equation

ON time since midnight

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

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

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

Refresh

1:Boiler_1_CS

Diagnostic

Status: Special Control, OFF

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

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

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

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

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

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

## Slimflex 5 Browser

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

#### 3.1 Water Meter Inhibitor Feed

Select the relay 1 icon on the home page. This example uses the **Setup** page for an Inhibitor feed controlled by Relay 1. Relay 1 is dedicated to feeding an Inhibitor in Cooling mode.

Select **Setup** from the pull-down

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

Select **Control Type = Feed**, select **Set Feed Mode = Water meter** & select the **Control by:** water meter, then **Submit**. You can feed based on multiple meters. See next page.

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

1:Inhibitor Feed	
Setup	
Control Type	Feed
Set Feed Mode	Water meter
Control by:	O:Tower Make-up
<div>Refresh Submit</div>	

1:Inhibitor Feed	
Adjust Setpoint	
Measure	100 G
Feed	12 seconds
<div>Refresh Submit</div>	

#### Sidebar:

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

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

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

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

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

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

This is a first guess; test ppm & adjust.

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

## Slimflex 5 Browser

### Water Meter Inhibitor Feed cont.

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

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

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

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

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

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

**1:Inhibitor Feed**

**Setup**

Control Type	Feed
Set Feed Mode	Water meter
Control by:	More than one

Refresh Submit

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

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

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

**1:Inhibitor Feed**

**Status** Reconfigured

**Setup**

Control Type	Feed
Set Feed Mode	Water meter
Control by:	O+R

Refresh Submit

## 3.2 Sensor Controlled Feeds

Select the 3, 4 or 5 icon on the home page. This example uses the **Setup** page for an Oxidant feed controlled by Relay 4

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

Select **Setup** from the pull-down

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

Edit for your site, up to 16 characters

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

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

Setpoints for an ORP control will vary with site water chemistry & target ppm. Biologicals drive the ORP down. When it's 440 mV the pump turns ON & stays ON until the ORP is 445 mV

### 4:Oxidant Pump

**Setup**

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

Refresh Submit

### 4:Oxidant Pump

**Configure**

Descriptor	Oxidant Pump
Display Units(UOM)	mV
Decimal digits	1
Disable	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Control Action	ON increases sensor
Special Control	None

Refresh Submit

### 4:Oxidant Pump

**Adjust Setpoint**

Status	Setpoint change
On:	440.0 mV
Off:	445.0 mV

Refresh Submit

## Slimflex 5 Browser

### 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.

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

Select **Setup** from the pull-down

Select **Set Feed Mode = Bleed then Feed** or **Bleed and Feed**

Select **Bleed Control = the control for the tower bleed, Relay 1 in this example & Submit**

The **Adjust Setpoint Bleed then Feed** value is the % of the bleed ON time. Bleed ON for 20 minutes, feeds for 5 minutes after the bleed turns OFF.

The **Bleed and Feed** value is the % of every 5 minutes of bleed ON time. Bleed ON for 20 minutes, feeds for 1.25 minutes every 5 minutes.

#### 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.

## Slimflex 5 Browser

### 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 **3, 4 or 5** icon on the home page. This example uses the **Configure** page for an Oxidant feed controlled by Relay 4

Select **Configure** from the pull-down

Select **Configure** from the pull-down

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

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

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

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

Refresh Submit

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

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

4:Oxidant Pump

Adjust Setpoint

Status	Setpoint change
On:	300.0 mV
Off:	350.0 mV

Refresh Submit

#### Sidebar:

**Time Modulate Special Control** is only selectable on Relays 3, 4 & 5

## Slimflex 5 Browser

### 3.3 Proportional Feed

#### 3.3.3 Timed Cycling

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

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

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

Select the relay 3, 4 or 5 icon on the home page.  
This example uses the **Configure** page for an Oxidant feed controlled by Relay 4

Select **Configure** from the pull-down

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

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

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

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

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

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

#### Sidebar:

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

## 3.4 Control During Events

**4:Oxidant Pump**

**Setup**

Control Type	<b>Feed</b>
Set Feed Mode	<b>Sensor Control</b>
Control by:	<b>F:ORP Sensor</b>

Refresh Submit

Select the relay 3, 4 or 5 icon on the home page. This example uses the **Setup** page for an Oxidant feed controlled by Relay 4

Select **Setup** from the pull-down

Events only exist on the pull down if **Control Type = Feed** or **Events-Other**. Set for **Feed**.  
Set Feed Mode = **Sensor Control** & the control is ORP

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

Application flexibility:

- Event Control = No** works like normal biofeed feed event, feeding @ the current pump setting for the event duration.
- 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

**4:Oxidant Pump**

**Adjust Setpoint**

On:	440.0 mV
Off:	445.0 mV

Refresh Submit

**Events**

Day 4 1 Events weekly

Event Cycle **Weekly**

Select Activity **Edit an Event**

Select for Edit & Delete

**04:00 for 120 minutes**

**Adjust Setpoint** Add & Edit

Event frequency	Once Alternate Days Daily
Event Control	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
ON Setpoint	740.0 mV
OFF Setpoint	745.0 mV

Reset Submit

**Adjust Setpoint** controls the Relay 4 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

## Slimflex 5 Browser

### 3.5 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 5 icon on the home page. This example uses the **Alarms** page for an Inhibitor feed controlled by relay output 1

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

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

#### Sidebar:

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

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

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

## **Slimflex 5 Browser**

### **Limiting Feed & Alarms cont.**

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

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

## Slimflex 5 Browser

### 3.6 Interlocks

#### 3.6.1 No feed on no flow

Select any relay 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 '**T**' **Boiler 2 Online** is **ON** then the relay 5 feed control runs.

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

Status	Interlock edit
S:Boiler 1 OnLine	unused
T:Boiler 2 Online	Interlock

In this example relay output 3 controls an acid pump.  
If both **Flowswitch (S)** and **Low acid tank Level (R)** are **ON**, we want the inhibitor to be feeding so we select both to **Interlock** & '**AND**' them. (Avoiding both a loss of prime & pumping dry.)

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

Status	Interlock edit
R:Acid tank low	Interlock
S:Flowswitch	Interlock
T:Bleach tank low	unused
Contact set	'AND'ed

## Slimflex 5 Browser

### 3.7 Blocking-Delaying a Feed

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

Select **Blocked** from the pull-down

**Blocked by**

Status	Blocking edit
2:Tower 2 Bleed	<b>unused</b>
3:Acid Pump	<b>unused</b>
4:Oxidant Pump	<b>Blocks</b>
5:Non-Oxidizer	<b>unused</b>

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 4 **Blocks** the **Inhibitor Feed** on Relay 1 to prevent degrading the inhibitor in the common feed header

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

Refresh 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.

## Slimflex 5 Browser

### 3.8 Feed Diagnostics

Select any relay icon on the home page. This example uses the **Diagnostic** page for an **Acid Pump** controlled by output 3

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

**Diagnostic** provides both configuration & state detail on one page

<b>3:Acid Pump</b>	
<b>Diagnostic</b>	
Status	Operational, ON
Feed by: E	7.98 pH
ON Setpoint	7.50 pH
OFF Setpoint	7.45 pH
Control Action	Feed Acid
~~~~~	
0.3m ON today	0.3m ON, actuation
Refresh	

Control state

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

Current setpoints

Feed state

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

5:Blr5 Treatment	
Diagnostic	
Status	Operational, ON
Feed by: O	1400 G
Measure volume	100 G
and Turn ON for	10 seconds
Last fed	1400 G
~~~~~	
240.4m ON today	0.3m ON, actuation
Time Owed	2.0 min
<b>Refresh</b>	

Control state

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

Current setpoints

Volume feed state

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

## Slimflex 5 Browser

### Feed Diagnostics cont.

The image displays four diagnostic panels from the Slimflex 5 Browser, each with a title bar and a 'Diagnostic' dropdown menu. The panels are interconnected by green arrows pointing to specific data points, with callout boxes providing context.

**1:Inhibitor**

Status	Special Control,ON
0.5m ON today	0.5m ON, actuation
~~~~~	
Bleed then Feed	Bleed OFF Feed 4630 sec
<input type="button" value="Refresh"/>	

Control state: In this example, the **Bleed then Feed Special Control** is controlling Relay 1

The **Bleed** is now **OFF** & we owe 4630 seconds of pump run time. Is a 70 minute bleed cycle normal for this site or does it indicate a problem?

Control state: In this example, the **Percent Time** is controlling

We're in the ON state for another 55 seconds of the 5 minute cycle. 25% of 5 minutes = 75 seconds

5:Non-Oxidizer

Status	Special Control,ON
0.3m ON today	0.3m ON, actuation
~~~~~	
Percent Time,25%	Countdown: 55 seconds
<input type="button" value="Refresh"/>	

**3:Inhibitor Feed**

Status	Interlocked S,OFF
Feed by: O	2100 G
Measure volume	100 G
and Turn ON for	10 seconds
Last fed	2100 G
~~~~~	
130.8m ON today	0.0m ON, actuation
<input type="button" value="Refresh"/>	

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 4 is Blocked & OFF when Relay 3 turns ON

4:Oxidant Pump

Status	Blocked by 3 ,OFF
2.6m ON today	0.0m ON, actuation
<input type="button" value="Refresh"/>	

Slimflex 5 Browser

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

4.1 Setting & Viewing Events

Select the relay 3, 4 or 5 icon on the home page.
This example uses **Biocide A**
controlled by relay 5

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

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

Refresh Submit

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

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

5:Biocide A

Events

Day 2 0 Events weekly

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

Select Activity: **Add an Event**
Select Activity = **Add an Event**

Start Day: **2**

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

ON Time: **20 minutes**

Event frequency: **Once**
Alternate Days
Daily

Reset Submit

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

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

In this example, we're also adding feed events on
Wednesday, Friday & Sunday by selecting
Alternate Days & **Submit**. These events will
repeat each week until changed or deleted.

Slimflex 5 Browser

Setting & Viewing Events cont.

5:Biocide A

Events

Day 2 4 Events weekly

Event Cycle Weekly

Select Activity Edit an Event

Select for Edit & Delete

Day 1 @ 07:00 for 20 minutes

Values for Add & Edit

Start Day 1 1-7

Start Time 7:00 HH:MM

ON Time 20 minutes

Event frequency Once
Alternate Days
Daily

Reset Submit

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

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

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

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

Sidebar:

Limit Alarms, Interlocking & Blocking also are used with Biocide Events. They are set identical to those for **Chemical Feed Controls**. Refer to Sections 3.6 and 3.7 for setup & state pages.

Biocide feeds are always interlocked with the tower flowswitch.

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

Slimflex 5 Browser

4.2 Prebleed – Lockout

5:Biocide A

Configure

Status	Reconfigured
Descriptor	Biocide A
Disable	<input type="radio"/> Yes <input checked="" type="radio"/> No
Special Control	Prebleed Lockout
Lockout	120 minutes
Prebleed	30 minutes
Prebleed Sensor	A:Tower Conduct.
Prebleed OFF	750 uS
Blowdown Relay	2:Tower276 Bleed

Refresh **Submit**

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

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

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

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

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

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

Sidebar:

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

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

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

Slimflex 5 Browser

4.3 Alarm Relay

Select the relay icon from the right side of the home page. Relays 3, 4 & 5 are available as alarms.

Select **Setup** from the pulldown

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

Then select **Configure** from the pulldown

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

5:Alarm_Relay	
Setup	
Control Type	Events-Other
<div>Refresh Submit</div>	

5:Alarm_Relay	
Configure	
Descriptor	Alarm_Relay
Disable	<div>Yes No</div>
Special Control	Alarm Output
<div>Refresh Submit</div>	

5 Sensors: Conductivity, Temperature, pH & ORP

5.1 Sensor Calibration:

5.1.1 Single Point – Grab Sample

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

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

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

Calibrating locks out the local keypad user so that both users are not calibrating @ the same time.

Press the **X** to close the window when finished

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

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

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

Factory Reset = Yes & Submit restores the sensor to its default values. If the reset gives a new sensor value may indicate fouling or end-of-life state or allow you to recover from a faulted calibration procedure

The interface consists of three main sections, each representing a sensor calibration window for 'A: Conductivity'.

- Section 1 (Top):** Shows the initial state. The 'Enter value' field contains '3009 uS'. The 'Factory Reset' section has 'Yes' and 'No' buttons, with 'No' selected. The 'Submit' and 'Calibrate' buttons are at the bottom.
- Section 2 (Middle):** Shows the value changed to '1700 uS'. The 'Factory Reset' section has 'Yes' and 'No' buttons, with 'No' selected. The 'Submit' and 'Calibrate' buttons are at the bottom.
- Section 3 (Bottom):** Shows an 'Out of Range!' error message. The 'Sensor' field shows '1700 uS'. The 'Calib. Override' section has 'Yes' and 'No' buttons, with 'No' selected. The 'Factory Reset' section has 'Yes' and 'No' buttons, with 'No' selected. The 'Re-calibrate' and 'Submit' buttons are at the bottom.

Slimflex 5 Browser

5.1 Sensor Calibration:

5.1.2 Boiler Conductivity

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

If using the **C to F** 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

Note the live value 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.

Enter the wet test value here. After the Measure time counts 0, press **Calibrate**

Successful **Calibration**.

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

C:Boiler Cond.

Calibrate

Measure Conductivity then 'Start'

Factory Reset Yes No

Submit Start

C:Boiler Cond.

Calibrate

Sensor Monitor Elapsed

1390 uS 01:39

ON ,Sample 30sec 1399 uS

Calibrate

C:Boiler Cond.

Calibrate

Status Calibrated

Measure Conductivity then 'Start'

Factory Reset Yes No

Submit Start

Slimflex 5 Browser

5.1. Sensor Calibration:

5.1.3 pH Dual Buffer Calibration 1 of 2

Select the **E** or **F** icon on the home page or the **CAL** icon below the **E**, **F** icons.
This example calibrates the pH sensor connected to input **E**

If using the **E** or **F** icon, select **Setup** from the pull down to verify **2 Point**

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

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

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

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

Monitor the live reading until the
pH is stable & close to the buffer
value. Then press **Next**.

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

E:pH Sensor	
Status	Reconfigured
Descriptor	pH Sensor
Display Units(UOM)	pH
Decimal digits	2
Calibrate	2 Point
Used by I/O	3,
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

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

E:pH Sensor	
Calibrate	
Sensor Monitor	Elapsed
7.08 pH	00:37
7.0 Buffer	7.1 pH
Factory Reset	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
<input type="button" value="Next"/>	

Slimflex 5 Browser

5.1 Sensor Calibration: pH Dual Buffer Calibration 2 of 2

E:pH Sensor [X]

Calibrate

7.0 Buffer 7.08 pH

2nd pH buffer 10.00 pH

Next

Results from 1st buffer

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

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

E:pH Sensor [X]

Calibrate

Sensor Monitor Elapsed

9.93 pH 01:00

7.0 Buffer 7.08 pH

10.0 Buffer 10 pH

Factory Reset Yes No

Calibrate

Successful calibration. Press the X to exit **Calibration**.

E:pH Sensor [X]

Calibrate

Status Calibrated

1st pH buffer 7.00 pH

Factory Reset Yes No

Submit Start

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

Note: Two buffer pH calibration seldom results in better pH control than single point, grab sample calibration, but may be required by site practice. It is a good test for a sluggish probe.

E:pH Sensor [X]

Calibrate

Status Out of Range!

7.0 Buffer 6.91 pH

Sensor 10.00 pH

Calib. Override Yes No

Factory Reset Yes No

Re-calibrate Submit

Slimflex 5 Browser

5.1 Sensor Calibration:

5.1.4 Manual Inputs

N:Manual Entry

Configure

Compensation

Manual Entry

Reset

Submit

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

Input 'N' has Compensation set to Manual Entry

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

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

N:Drop_test

Setup

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

Reset

Submit

N:Drop_test

Calibrate

Enter value

8.0 drp

Factory Reset

Yes

✓

No

Submit

Close the window to exit & to unlock keypad calibrate access

Edit Enter Value & Submit

Slimflex 5 Browser

5.1.5 CTFS Flowswitch Calibration

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

A:Conductivity

Configure

Compensation	None
Override flowswitch	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flowswitches	892

Reset

Submit

Slimflex 5 Browser

5.2 Sensor Alarms 1 of 2

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

Select **Alarms** from the pulldown

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

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

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

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

Disable Alarms = **Yes** turns OFF '**A**' alarms

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

A: Tower Conduct.	
Alarms	
HiAlarm	2000 uS
LoAlarm	1000 uS
Alarm Relay	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Delay on Alarm	5.0 minutes
Disable Alarms	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Slider Max.	4000 uS
Slider Min.	500 uS
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

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.

Slimflex 5 Browser

5.3 Sensor Setup 1 of 2

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

Select **Setup** from the pulldown

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

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

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

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

Submit to modify

Used by I/O blocks the **Disable** option & indicates where the sensor is used.

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.

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

D:ORP Sensor	
Setup	
Descriptor	ORP Sensor
Display Units(UOM)	mV
Decimal digits	1
Calibrate	1 Point
Used by I/O	4,
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

F:Boiler Cond.	
Setup	
Descriptor	Boiler Cond.
Display Units(UOM)	uS
Decimal digits	0
Disable	<input type="button" value="Yes"/> <input checked="" type="button" value="No"/>
Sensor Type	Boiler Cond.
<input type="button" value="Reset"/> <input type="button" value="Submit"/>	

Sidebar:

Disabled sensors do not appear on either the local or browser HMIs or any option pull down.
Sensors cannot be disabled while in use for control, compensation.....
Disabled sensors are re-enabled on the **System / Enable I/O** page. See section 9.6

Slimflex 5 Browser

5.4 Sensor Compensation

A: Tower Conduct.

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

Configure

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

Reset Submit

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

C: pH Sensor

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

Configure

Compensation	Thermal Comp.
Thermal Sensor	K:Temperature

Reset Submit

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

Sidebar:

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

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

Slimflex 5 Browser

5.5 Sensor Diagnostics 1 of 2

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

Sensor input '**A**' is used for conductivity serial sensors

Or select **Diagnostic** from the pulldown

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

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

Most recent alarm type & time-date

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

A: Tower Conduct.

Diagnostic

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

Refresh

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)

K: Temperature

Diagnostic

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

Refresh

Sidebar:

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

Slimflex 5 Browser

5.5 Sensor Diagnostics 2 of 2

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

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

C:pH Sensor

Diagnostic

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

Refresh

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

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

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

Most recent alarm type & time-date

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

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

E:Boiler Cond.

Diagnostic

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

Refresh

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

Slimflex 5 Browser

5.6 Using Sensor Attributes for Phantoms

Analog 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.

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

Select **Configure** from the pulldown

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

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

Appendix 'B' lists available
attributes by sensor type.

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

M:Salt_Concen

Configure

Compensation **None**

Select source **A0:Tower Conduct.**

Reset **Submit**

K:Temperature

Configure

Used by I/O **A,C**

Reset **Submit**

Sidebar:

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

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

Slimflex 5 Browser

6 Measuring Volume: Water Meters

6.1 Configuring a New Meter

Select the **O** to **T** 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

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 Switching Meters and Contact Sets

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.

R:Grey Water add

Configure

'K' Factor 2.000

Compensation None

O: Tower Make-up

Configure

Vol/contact 100 G

Compensation None

O: Tower Make-up

Setup

Descriptor Tower Make-up

Display Units(UOM) G

Decimal digits 0

Used by I/O 3,

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

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

Slimflex 5 Browser
6.2 Copying Meters,

Use Copy Meter to sum make-up or blowdown volumes from multiple meters.

Z:Water meter

Configure

CompensationNone

Sensor TypeWater meter

Select sourcenone

Reset

Submit

Enable an digital phantom **O** through **Z**

Use the **Configure** menu and select type **Water meter**

R:Water meter

Configure

Vol/contact100 G

CompensationCopy meter

Target MeterZ:Water meter

Reset

Submit

Select **Compensation** = **Copy Meter**

Q: Tower blowdown

Configure

R Factor10.000

CompensationCopy meter

Target MeterZ:Water meter

Reset

Submit

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

Meters

Feedwater 1

0001900 G

Boller 1 | Boller 2

Backup Feed

0000007 G

Boller 1 | Boller 2

Sum of O and P

0001907 G

Boller 1 | Boller 2

The Sum of **O** and **P** are displayed on meter **Z**

Slimflex 5 Browser

6.3 Flow Rate Conversion

Water meters display the number of gallons measured. Use an analog phantom I through N to display the flow rate of a Turbine style meter.

Convert a paddlewheel meter to a flow rate in GPM. Cannot convert contact head meters.

Enable an analog phantom I through N

N:Flow rate

Configure

Compensation	Not applicable
Select source	P1:Rate

Reset

Submit

The Flow Rate is displayed on the Home screen. Units are set based on the system choice of Metric or not.

Flow rate

Boller 1 | Boller 2

125.1 gpm

1.0

25.0

100.0

Use the Configure menu to choose the Rate attribute from the meter. Press Submit.

Slimflex 5 Browser

6.4 Meter Diagnostics

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

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

R:Water meter

Diagnostic

Sensor Type	Water meter
Vol. this year	6711 G
1 Days Online	Vol/Day,6711 G
Volume Total	6711 G
Vol. last year	0 G
Input Firmware Driver	built-in
Configure: 0000	Status: 0000
Device: 000C4E31	Product: 0E12519A
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:01.01.02.00

Refresh

or select **Diagnostic** from the pulldown

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

Total since meter installed

Q:Tower Blowdown

Diagnostic

Sensor Type	Water meter
Vol. this year	377 G
1 Days Online	Vol/Day,377 G
Volume Total	377 G
Vol. last year	0 G
Input Firmware Driver	built-in
Configure: 0000	Status: 0000
Device: 000C4E31	Product: 0E12519A
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:01.01.02.00

Refresh

DI (Digital Input) driver detail Shared by all inputs 'O' thru 'T'

SF5_Browser.doc

60

Slimflex 5 Browser

6.5 Meter Alarms

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

or select **Alarms** from the pulldown

R:Water meter

Alarms

Status	Alarmed
HiAlarm	5000 G
LoAlarm	0 G
Alarm Relay	<input type="radio"/> Yes <input checked="" type="radio"/> No
Clear Alarms	<input type="radio"/> Yes
Alarmed High	15:00 2018-Mar-08
Disable Alarms	<input type="radio"/> Yes <input checked="" type="radio"/> No

Reset Submit

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.

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**.

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

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.

Notice: Since the R meter is not in alarm, the Clear Alarms button is not available

R:Grey Water add

Alarms

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

Reset Submit

7 Flowswitches, Interlocks & Contact Sets

7.1 Switching Meters & Contact Sets

Volume meters and contact set inputs are connected in the 'O' to 'T' namespace.

They are also in the 'W' to 'Z' phantom space.

If the meter or contact set input is not being used for control, it can be re-purposed, making a contact set a meter or the reverse.

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

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

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

Select **Setup** from the pulldown

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

U:Low_Level

Setup

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

Reset Submit

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

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

S:Flowswitch

Setup

Descriptor	Flowswitch
Used by I/O	1,3,

Reset Submit

Slimflex 5 Browser

7.2 Contact Set Alarms

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

Select Alarms from the pulldown

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

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

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

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

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

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

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

Sidebar:

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

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

Slimflex 5 Browser

7.3 Logically Inverting Contact Sets

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

Select **Configure** from the pulldown

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

Set Invert sense = Yes & Submit

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

7.4 Mirroring a Control ON/OFF

A phantom contact set may be configured to mirror any relay. 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

Relay 4 feeds the bleed line chemical, configured to base feed @ 5mL/minute

Phantom Contact Set 'X' mirrors Relay 1 & Interlocks Relay 4

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.

Select the **W** to **Z** icon from the right side of the home page

Select **Configure** from the pulldown

Select **Compensation = Mirror output** & Submit

Then select **Compensation = Target Output** & Submit

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

Slimflex 5 Browser

8 4-20mA Outputs

8.1 Configure: Manual-Auto Switch

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

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

Select **Configure** from the pulldown

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

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

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

Controls a Pump = Yes goes to 4mA when **STOP** key on console keyboard is pressed

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

Select **Control by** and **Submit**

Select output range and **Submit**

The range does not have to be the full range of the sensor

In this example, a pH of 7.5 would set the 4-20mA output to 10mA
$$(16\text{mA} \times (7.5 - 6.0) / (10.0 - 6.0)) + 4\text{mA}$$

C:4-20mAOutput

Configure

Control by: **None**

Manual mode ☒ Yes ☐ No

Manual mode **30.0 %**

Interlocked **none**

Open Loop alarm ☒ Yes ☐ No

Controls a Pump ☐ Yes ☒ No

Reset **Submit**

C:4-20mAOutput

Configure

Control by: **pH Sensor**

Manual mode ☐ Yes ☒ No

20mA Value **14.00 pH**

4mA Value **0.00 pH**

Interlocked **S:Flowswitch**

Open Loop alarm ☒ Yes ☐ No

Controls a Pump ☐ Yes ☒ No

Reset **Submit**

Sidebar: Manual Mode

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

Slimflex 5 Browser

8.2 Calibrate

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

Select **Calibrate** from the pulldown

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

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

Edit **Output @ 4mA** level. Use the mA current value displayed on the pump, measured by the DCS or volt meter. Press **Calibrate**

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

Calibration ends. Close the window.

The screenshots show the following steps:

- Initial State:** The 'C:4-20mAOutput' window has a pulldown menu set to 'Calibrate'. Below it, there are fields for '4-20mA = 4mA' (with a 'START' button) and 'Factory Reset' (with 'Yes' and 'No' buttons). At the bottom are 'Submit' and 'Start' buttons.
- Starting Calibration:** The 'Start' button is clicked. The '4-20mA = 4mA' field now shows '4.0|mA measured'.
- Calibrating 4mA:** The '4.0|mA measured' value is entered into the 'Output @ 4mA' field. The 'Calibrate' button is clicked.
- Calibrating 20mA:** The 'Output @ 20mA' field is shown with the value '19.97' entered. The 'Calibrate' button is clicked.
- Calibration Complete:** The 'Status' field shows 'Calibrated'. The '4-20mA = 4mA' field shows 'START' and the 'Factory Reset' field shows 'No'.

Slimflex 5 Browser

8.3 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

Sensor Type	4-20mAOutput
Control by:	pH Sensor
Gain Multiply	1.0019
Offset Adjust	0.0000mA
Sensor driver type	Dual 4-20mA Output
Configure: 033C	Status: 0000
Device: 000C3A55	Product: 0E125188
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:00.00.00.01

Refresh

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

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

Sensor Type	4-20mAOutput
Manual Setpoint	5.60mA 10.0%
Gain Multiply	1.0019
Offset Adjust	0.0000mA
Sensor driver type	Dual 4-20mA Output
Configure: 033C	Status: 0000
Device: 000C3A55	Product: 0E125188
Rev.#: 00000001	S/N:: 15082008
A.ID#: 31032004	A.Part#: -1
A.rev#: 0	Firmware:00.00.00.01

Refresh

Slimflex 5 Browser

9 System Settings

9.1 Home & Diagnostic pages

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

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

System: Home

Language: English

2017-Apr-10 S/N: 123

Status: Logged in

Current User: Operator1

Logout: Yes

Keep session active: Yes ☒ No

Reset Submit

Duplicates login state from top, right of home page

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

Disables the 30 minute timer

System: Diagnostic

Diagnostic

Serial number	123
Firmware	17.12.07.00
HMI Firmware	17.03.23.00
Web Browser HMI Version	05.00.00.00
Relay Fuse	OK
Watchdog Resets	0
Admin Password	Default
O-T wiring	OK
Fan speed	3720 RPM
Biotiming, Events	Thu, WEEK 1

Refresh

Select Diagnostic from the pulldown

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

Controller services & controls

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

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

Default = AAAA, otherwise known only to the Admin

Status of the power for 3 wire turbine meters connected to inputs 'O' thru 'T'.

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

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

Slimflex 5 Browser

9.2 Activity Log:

9.2.1 User ID, time stamp

System: Activity Log

Activity Log

67 Events, 1-10

Mar

8

IO	Activity	User ID	Time
K:	Activity ,Enabled	admin	10:09:43
L:	Activity ,Enabled	admin	10:09:48
K:	Configure ,Type changed	admin	10:09:59
L:	Activity ,Changed	admin	10:10:10
Q:	Activity ,Changed	admin	10:10:52
Q:	Activity ,Changed	admin	10:10:52
Q:	Activity ,Changed	admin	10:10:52
Q:	Activity ,Changed	admin	10:11:06
Q:	Activity ,Changed	admin	10:11:14
R:	Activity ,Changed	admin	10:11:37

Next Submit

System: Activity Log

Activity Log

0 Events, 1-0

May

1

No activity file

Submit

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

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

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

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

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

Next selection not shown @ end of day's activities
In this example, we are viewing events **1-10** of **67** total activities

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

Slimflex 5 Browser

9.3 Communications:

9.3.1 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 does not include a **DHCP client** which means when you connect to the site LAN you'll need to assign a static IP valid for the LAN.

The screenshot shows the 'System: Communications' configuration page. It features a table with fields for LAN and WiFi settings. Callouts provide additional context for several fields:

- Communications**: Select **Communications** from the **System** pulldown
- LAN IP Address**: Static IP **LAN** address of the controller. If you edit & **Submit** to modify, you'll lose the current browser connection on the current IP
- LAN Netmask**: Set **LAN Netmask** to desired netmask & **Submit**
- LAN Gateway** and **LAN Primary DNS**: If you are using the E-mail functionality (alarms & auto-reporting), then the **LAN Gateway** should match other devices on this LAN
- LAN Secondary DNS**: Controller WiFi is limited to HTTP, browser services for mobile devices & notebook WiFi & therefore uses a fixed IP address. With the SSID set on the System Setup page
- WiFi SSID**: The WiFi SSID defaults to **_SF5_xxx** where **xxx** = last 3 numbers of the controller serial number. Edit to modify & **Submit**

System: Communications	
Communications	
LAN IP Address	10.10.6.118
LAN Netmask	255.255.255.0
LAN MAC Address	54:10:ec:58:ee:7c
LAN Gateway	10.10.6.19
LAN Primary DNS	10.10.6.1
LAN Secondary DNS	0.0.0.0
WiFi IP Address	192.168.1.1
WiFi Netmask	255.255.255.0
WiFi SSID	_SF5_123
<div>Reset Submit</div>	

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 Day to Day Browsing** for connection information.

Slimflex 5 Browser

9.4 Time & Date:

9.4.1 Sync to Device

System: Time & Date

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

Time & Date

Date DD/MM/YY

08/03/18

Time HH:MM:SS

16:46:55

Weekday

Thu

[Set fields to match my computer](#)

Reset

Submit

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

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

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

SF5_Browser.doc

71

Slimflex 5 Browser

9.5 E-Mail Setup – Test

System: E-mail Setup

E-mail Setup

E-mail Enabled ☒ Yes ☐ No

E Service Reports ☐ Yes ☒ No

E-mail day's summary **None** **E-mail day's summary**

E-mail on Alarm ☐ Yes ☒ No

Mail To: datastream@prominent.us

cc E-mail to stein.peter@prominent.com

cc E-mail to Unassigned

cc E-mail to Unassigned

cc E-mail to Unassigned

SMTP IP Address 43.228.184.6

SMTP Port 2525

SMTP Username sf5@prominent.us

SMTP Password

SMTP reset ☐ Yes ☒ No

Test E-mail ☐ Yes ☒ No

Next mail 58.0min

Reset **Submit**

Select **E-mail Setup** from the **System** pulldown

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

E Service Reports requires a paid subscription to H2Tronics.

E-mail day's summary **None** Choose to receive a file or email

E-mail day's summary = 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

Edit **Mail To** = your email & **Submit**

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

Set the SMTP back to the factory default parameters

Set **Test E-Mail To = Yes & Submit** whenever you modify E-mail parameters.

Select **Refresh** every few seconds.
Status line on this page will show if you are getting stuck getting to the SMTP server

System: E-mail Setup

E-mail Setup

Status **Mail sent**

E-mail Enabled ☒ Yes ☐ No

Slimflex 5 Browser

9.6 Enable I/O:

9.6.1 Enable IO, Assign to System#

Sidebar:

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

If you select two systems (Section 9.7 System Setup), you will see the menu on the left. A single system user will see the menu in the lower right corner of this page.

This is the display you will see if you have chosen 2 systems on the System setup page. You can place any I/O point into either system or both. This will affect how the information is displayed in any reports

To enable an I/O, use the box at the bottom of the page.

Enable I/O

Enable I/O

Configure	Sensor
C:Boiler 1 Cond.	Boiler 1
D:Boiler 2 Cond.	Boiler 2
E:B1 Cond Output	Boiler 1
F:B2 Cond Output	Boiler 2
Enable I/O	none

ResetSubmit

Select Enable I/O from the System pulldown

All I/O are divided into 3 pages. This is the Sensor page. Choose a system for each point and Submit. Use the pulldown to see Control and Meter/Contact set choices

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

Enable I/O

Enable I/O

One System	No View-Config
Enable I/O	Y:Contact set

ResetSubmit

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

Slimflex 5 Browser

9.7 System Setup:

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

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

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

The screenshot shows the 'System Setup' page in the Slimflex 5 Browser. The page has an orange header with 'System Setup' and a dropdown menu. Below the header is a table with various settings. Green arrows point from text boxes to specific fields or buttons, providing instructions on how to configure them.

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

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

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

Select **Keypad Password = Yes & Submit**
Shares passwords & access level with the controller keypad users, see Section 9.7 Passwords for more information.

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

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

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

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

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

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

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

Slimflex 5 Browser

9.8 Passwords:

9.8.1 View-Set Access Level

System: Passwords

Select **Passwords** from the **System** pulldown

Passwords

Status	Login @ Admin	Only the Admin user can change the Access Level for other users
New Password	AAAA	Edit passwords & Submit In this example, the Admin password is @ default
Confirm Password	AAAA	
Select User	O:Operator1	O = Operate level access & C = Configure level access Set Select User = one of seven users & select Access Level = Operate or Configure & Submit to modify Access Level
Access Level	Operate	
Reset Submit		

Access Level is used to prevent casual users from inadvertently modifying controls

System: Passwords

Passwords

Status	Login @ configure	Each user can see their current Access Level
User ID	Configure5	Only the user can modify the User ID that appears in the Activity Log & the Login selector. Edit & Submit
New Password	5	Edit passwords & Submit In this example, the Configure5 password is @ default
Confirm Password	5	
Reset Submit		

Default Passwords:

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

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

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

Modify Passwords:

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

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

Slimflex 5 Browser

10 Using the USB Port

10.1 Capturing Data 1 of 2

The SlimFlex5 controller logs all enabled sensors, flow switches, meter values, relay ON times, fed volumes and status. This data is easily captured from the USB port located behind the communication light cover. The USB flash drive must be FAT32, a 4GB storage limit.

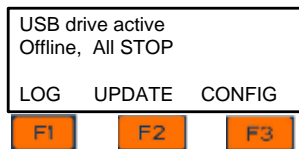


Phillips head screw
Hinges (2)



Figure 67 USB Access Door Closed [Top] and Open [Bottom]

- 1- Insert a USB flash drive into the USB port shown. The OLED screen will acknowledge the drive.



- 2- Choose F1, LOG to set up the download.
- 3- Choose the amount of history, DAY [F1], WEEK [F2], or MONTH [F3]. When you choose the period, the download starts.
- 4- *During the download, the keypad and browser connection are locked. The controller outputs are turned off!*
- 5- The controller display will show the progress of the download
- 6- Once complete, the display will show the file name uploaded to the USB flash drive (ending in "csv"), the size of the file in number of records or time stamps, and instructs you to remove the drive to return the controller to normal operation.
- 7- The filename includes the last three digits of the controller serial number, the year and day of the year. In this example, 123, 17 and 101 respectively in this example.
- 8- Don't forget to close and re-secure the access door to assure the interior of the controller is not subjected to moisture or corrosive fumes from the environment.

Select upload size
ESC to previous
DAY WEEK MONTH

Select upload size
ESC to previous
Log#38 of 2880

AL123_17_101.csv
2880 Log records
Remove USB drive



CSV File Name Format

The name of a CSV Log saved on your USB drive is created based on the following format:
AL123_17_101.csv: AL = CSV Log file, 17 is the year 2017, 101 is the day of the year.

Slimflex 5 Browser

No special conversion program or Excel add-in is needed to import the CSV formatted data into Microsoft Excel® or similar spreadsheet programs. Refer to your spreadsheet or graphing software product to learn how to import CSV data. (CSV = Comma Separated Value). See example on next page.

Datalog example opened in Excel:

	A	B	C	D	E	F	G	H	I	J
1	SF5									
2	Serial number	Site name	Controller name							
3	20173425123	Office demo	Stein							
4	Log records									
5	I/O	Location	A	C	D	O	S	1	2	3
6	I/O	Units	uS	pH	mV	Gal	sec	sec	sec	sec
7	Date	Time	Conductivity	pH Sensor	ORP Sensor	Recirc Flow	Delta Alar	Inhibitor	Bleed	Acid
8	10/9/2018	16:31:30	1440	7	330	0	30	0	0	30
9	10/9/2018	16:31:00	1440	7.01	333	0	30	0	0	30
10	10/9/2018	16:30:30	1441	7	333	0	30	0	0	30
11	10/9/2018	16:30:00	1439	7.01	338	0	30	0	30	30
12	10/9/2018	16:29:30	1440	7	337	0	30	0	30	30
13	10/9/2018	16:29:00	1439	7.01	337	0	30	0	30	30
14	10/9/2018	16:28:30	1440	7.01	335	0	30	0	30	0
15	10/9/2018	16:28:00	1440	7	338	0	30	0	30	0

Table 20 Partial example of captured data

Box A1 = Controller Type

Inputs are denoted by letters and relays by numbers. (Line 5)

Values shown are as taken, not averaged over the period.

Relays show ON-time in seconds when in on/off mode.

Only I/O that are currently enabled are included in report.

Above report was taken from a controller set for gathering data every 30 seconds. (note 'Time' in column B). Early versions of the SF5 firmware were locked at 5 minutes per sample. The latest version allows for 30 second, 1, 2, 5, 30 or 60 minute sample rate selection. See the System Setup menu.

10.2 Save or Load the Program Configuration

Perform this step prior to a Firmware Upgrade. See section 13.3 Firmware Upgrade using USB.

A program configuration is a list of instructions that the user can edit. Set-points, calibrations, names of I/O are all saved in the program configuration. You can save the configuration via a USB drive for backup purposes or to clone another controller. (Save from one controller and Load the configuration onto another.)

To see how to access the USB port, see section 13.1 Capturing Data.



Configuration File Name Format

The name of a configuration saved on your USB drive is created based on the following format:

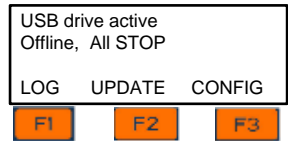
AC123_18_292.cfg: AC = Configuration file, 18 is the year 2018, 292 is the day of the year.

Slimflex 5 Browser

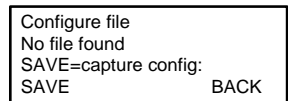
10.2.1 Saving to the USB

- 1- To save a copy of your current program onto a USB drive, insert a USB into the USB port located behind the Communication panel.

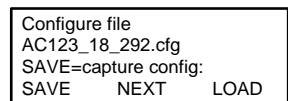
- 2- Press F3 Config



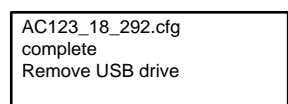
- 3- If you have not previously saved a program on this USB you can only F1 SAVE a copy to the USB.



- 4- If you have a previously saved program, you have the choice of saving F1 or loading F3.



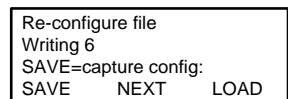
In either case, press **F1 SAVE** to copy the current configuration to the USB drive. When the save is complete, the display will notify you to remove the USB drive.



10.2.2 Loading from the USB

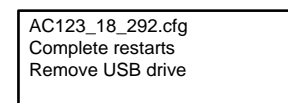
- 1- To load a previously saved program from the USB to your controller, insert the USB drive with the saved configuration into the USB port as explained in step 1 above.

- 2- Press F3 Config



- 3- Press F3 Load.

- 4- The controller loads the program from your USB and notifies you to remove it.



Sometimes referred to as “Cloning”, a saved program file can be loaded onto a different SlimFlex5 controller. They will then have the same configuration.

10.2.3 Saving to/from flash using the controller keypad

A copy of the configuration can be saved to the controller flash memory for immediate recall at a later time. Press Menu, scroll up to System and press OK. Scroll up to Configuration and press OK. Save or load a configuration.

10.3 Firmware Upgrade using USB

If necessary, your controller can have the firmware upgraded. Firmware is a set of instructions which tell the controller CPU how to operate. Firmware is not your ‘program configuration’ which determines which relay operates when and how. The program configuration can be saved and if needed, re-loaded, or copied to another controller. See section, [13.2 Save or Load the Program Configuration](#)

Slimflex 5 Browser



1 File Please

To avoid accidents and confusion with this important process, please remove all files from the USB drive prior to adding the .hex file. The controller will only allow you to view one file. Be sure you copy the correct file to the USB. If you have more than one, you may load the wrong file.



Firmware File Name Format

The name of a Firmware hex type file has the following format:

APS17091200.hex: APS = SlimFlex5 Firmware, 170912 is the date: YYMMDD, 00 is for USB.

Obtain the hex file from the ProMinent.com web site (see instructions in section [13.4 Remote HMI \(Browser\) Firmware Update](#))

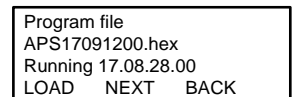
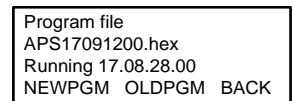
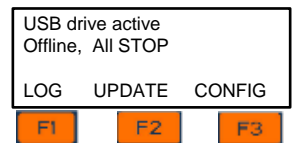
Insert the thumb drive with the new file into the USB port located behind the Communication panel. See section [13.1 Capturing Data](#) above to find the USB port.

Press F2, UPDATE

The display now shows the one file from the USB drive; APS17091200.hex and the current hex file in use; Running : 17.08.28.00. Note: These numbers are date codes, year, month and day. '00' Indicates that this is a USB type file.

Your dates will differ from this example!

If the file on line 2 is the new firmware file, press F1 NEWPGM to select the new hex file. Press F1 Load to install the new hex file.

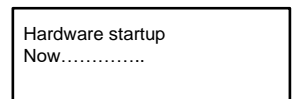
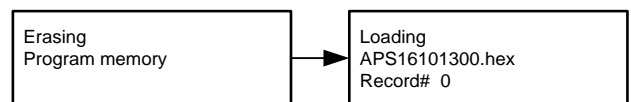
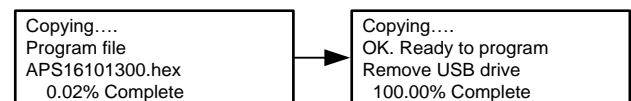


The firmware is copied to the controller. When complete SlimFlex5 will notify you to remove the USB drive.

After you remove the drive, the controller will erase the existing firmware and install the new one.

Once the new firmware is installed, the controller will restart.

Verify the new firmware is loaded: On the keypad, press Menu, up arrow to System, press OK, up arrow to Diagnostic, press OK, then up arrow to see the version.



Slimflex 5 Browser


10.4 Remote HMI (Browser) Firmware Update

This firmware should be updated if a browser connection does not display correctly or if recommended by a ProMinent factory technician. This program is related to how your PC, tablet or Smartphone displays the controller information on your screen.


This firmware is used across multiple controller platforms. It is located in one place on our website....

1. Download and the latest version of the Remote HMI file from our web site. Click on the link:

http://prominent.us/products/Controllers_Monitors/Cooling_Tower_Boiler_Controllers/AEGIS_II

2. Select the Info/downloads tab  and **choose the latest Site firmware** (Remote HMI Updates). Press the Download button as shown below.

Remote HMI Updates (Web Browser HTML Updates)






Version	Update Summary	Release Date	
06.00.00.00	• Fix: Graph View showing the wrong date on x-axis in German language	March 09, 2018	
05.00.00.00	• Fix: Disappearing Submit button on calibration pages	February 23, 2018	
Help Files	Aegis Browser Manual and Aegis Installation and OperatingManual PDF files	February 23, 2018	

Figure 68 Remote HMI Updates

3. Find the Zip file in your Downloads directory. Unzip the files from this folder and save them in the folder of your choice.
4. Copy the "site" folder from step 3
5. Insert a USB thumb-drive into your computer
6. Paste the "site" folder to the root of the USB thumb-drive
7. **Eject your USB drive before you remove it from your computer**, then insert it into the controller's USB port. (See [figure 66](#) in section [13.1 Capturing Data](#))
8. The controller OLED display should show the message: "**USB DRIVE ACTIVE**". If the controller does not display this message, then remove the USB drive and try again. The USB drive should be configured as FAT32.
9. Press F2 (UPDATE)
9. Press F2 (SITE)
10. Wait until the controller tells you to remove the USB drive
11. Open a web browser then go to <http://10.10.6.106> (or whatever the IP Address of your controller is)

For more information on using a browser, consult the SlimFlex5 Browser manual.

Slimflex 5 Browser

10.5 E-mail Reports and Alarms

The E-mail function is explained in the SlimFlex5 Browser manual. You cannot access this feature through the keypad. The following explanation is for informational purposes only.

The E-mail tool can send four types of information; Alarms, Status, Data log data and eService reports. Setup is via a PC or smart phone browser.

During controller power up or reset, E-mail initializes as disabled.

10.5.1 E-mail Types:

10.5.1.1 ALARM: Sent once when an alarm first occurs.

- Lists all active alarms.

- Includes enabled sensor, meter & contact values for alarm context

- User Enabled/Disabled.

10.5.1.2 STATUS: Sent @ noon, midnight or both every day (12:00/24:00). Verifies that the controller is running & on the LAN.

- Includes enabled sensor, meter & contact values.

- Allows for commercial systems to experience some run time and some of the day is left to respond to operating issues.

10.5.1.3 DATA LOG: Sent @ midnight (23:59) or hourly. Verifies that the controller is running & on the LAN.

- Includes enabled output run times or volumes and sensor, meter & contact values. User Enabled/Disabled.

Each of the above E-mail types send Comma Separated Values (CSV); one line per I/O or Alarm so that both the subject & body can be easily parsed into a logging app, a typical use for the DAILY type.

Will make text-to-speech entertaining (bit encoded value-states are therefore intentionally excluded).

10.5.1.4 H2Tronics eService Report: Third party software is needed for this option.

- Contact Technical Support or H2Tronics for more information.

Slimflex 5 Browser

11 Appendices:

a. IO Namespace: Letters & Numbers

The controller uses the letters 'A' to 'Z' to refer to sensors, meters, contact sets, phantoms & 4-20mA outputs and the numbers '1' to 5' to refer to controls.

Users can assign site specific names to all of the I/O. 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 'phantoms', meaning they don't have physical wiring location within the enclosure. 'Phantoms' are used to represent calculated & derived values that are logged, alarmed & may be used for control.

I/O	Type	Notes
A	Serial sensors	3 wire Conductivity-Flowswitch-Temperature
C-D E-F	Dual sensor driver cards 3 types in any combination	pH-ORP: configurable as dual pH or dual ORP or pH-ORP 4-20mA output Conductivity (boiler and cooling)
G	No used	
H	Not used	
K-N	Phantom sensors	Calculated, (Manual) or derived from other sensors & meters
O-T	Volume meter & contact set inputs	Each of 6 inputs configurable as Turbine, Contact Head meter or Contact Set
W-Z	Phantom volume meter & contact set inputs	Calculated (Fail-to-Feed, Fail-to-Sample) or derived from other sensors & meters
1-2	Line powered control relays	Form C, powers pumps, solenoids & motorized valves
3-5	Dry or line powered control relays	Form C, may be used dry or powered.
6-9	Not used	

Slimflex 5 Browser

b. Input Attributes & Phantoms

Many of the sensors connected to the controller have attributes other than the default value.

For example, the serial conductivity sensor measures conductivity, temperature & includes a flowswitch. The conductivity is the default value of the sensor connect to input 'A' (attribute A0) & the Temperature (attribute A1) & the flowswitch (attribute A2).

Notice that the A1 attribute is of the same type as the A0 attribute, both are sensor values but the A2 attribute is a contact set attribute (ON/OFF).

Attributes can be assigned to phantom inputs where they are logged, alarmed & used for control. A phantom input cannot be assigned to another phantom. (prevents circular references).

Phantoms in the **K-N** space are sensors. Those in the **W-Z** space are volumes & contact sets.

I/O	Type	Attribute x = I/O	Phantom
A	Serial Conductivity	x0 Conductivity x1 Temperature x2 Flowswitch	K-N K-N W-Z
	Serial Corrosion Rate	Not used	K-N K-N
	Serial Differential Pressure	Not used	K-N K-N K-N
C-D E-F I-J	pH-ORP driver card	x0 ORP or pH x1 Temperature if pH	K-N K-N
	Conductivity card	x0 Conductivity x1 Temperature if 'Conductivity' or 'Condensate'	K-N K-N K-N
	pH- 4-20mA input card	Not used	K-N K-N
	Serial Sensor card	Not used	
H	Temperature	Not used	K-N K-N
O-T	Volume meters	x0 Volume Today x1 Rate x2 Volume this Year x3 Volume total	W-Z K-N W-Z W-Z

Use the x0 attribute if you wish to have one sensor display two values.

For example, using a conductivity sensor to measure conductivity & salt concentration

c. 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**, or **E-F** driver card is removed, all of the dependencies are removed on the next power ON. Outputs that use the removed driver sensor(s) for control have the control equation removed. Other sensors which use the removed driver sensors are modified.

When you install a new driver, the sensor inputs default. For example adding a pH-ORP driver, configures for one pH & one ORP sensor on power ON.

Auto-Removing Phantoms:

Phantoms are auto-removed if they are derived from inputs \geq 'C'

If the Phantom is in use as an interlock a latching alarm is set.

Phantoms derived from input 'A' is not auto-removed unless the sensor type is changed.

This is done to prevent wholesale auto-reconfiguration & safety related interlock removals on 'A' CTFs conductivity sensors.