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**

Slimflex 5 Browser

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

Contents

1 Day-to-Day Browsing

The purpose of this manual is the 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.

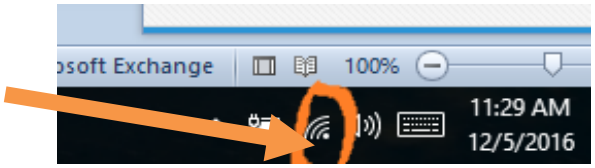
1.1 The WiFi Connection

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.

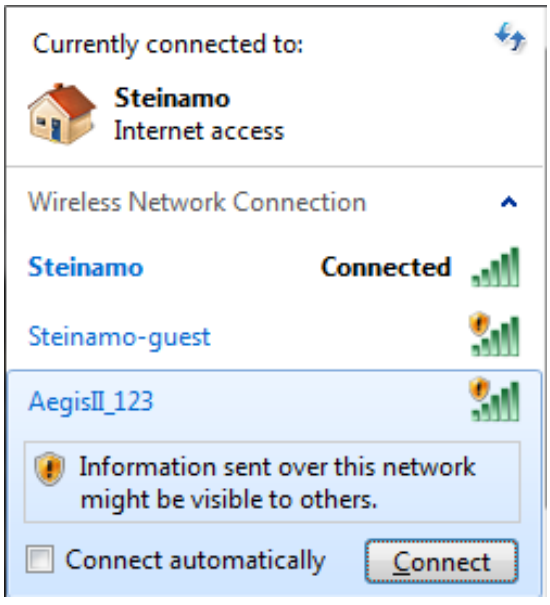
Step 1 is provided in two parts, **1.1.1 Using a PC or Tablet** and **1.1.2 Using a Smartphone**

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**

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.

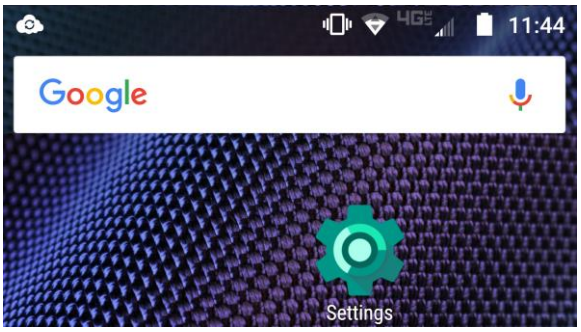
NOTE: The number 123 will be different on each controller. These 3 digits will be the same as the last 3 digits of the controller serial number. This allows you to differentiate between controllers if more than one is within WiFi range.

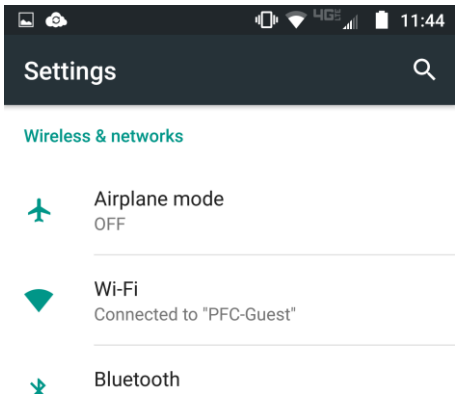
Sidebar:
Once you are connected to a controller, you can edit the SSID (WiFi name) to make identification easier than trying to remember the three digits.
See section **10.3 Communications** to make this change.

Here are examples using Android and IPhone;

1.1.2.1 Setting up WiFi using an Android phone

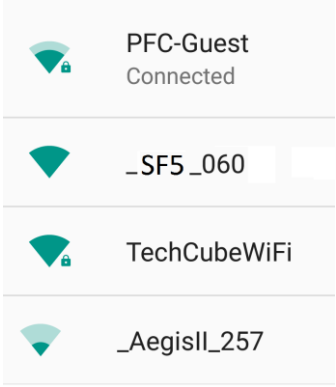
From your home page, press the settings button then choose Wi-Fi.

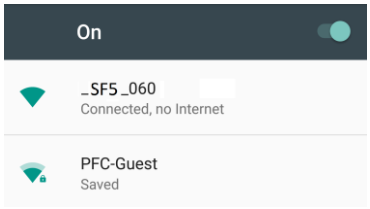




There may be more than one controller nearby. Choose your controller by comparing the serial numbers last 3 digits with the options on the phone. Select your controller. The status should change for that choice. See example picture below; AegisII_060 is ‘Connected, no Internet’.

Slimflex 5 Browser



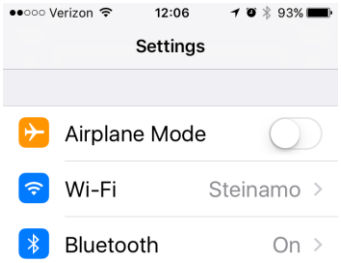


Continue with section **1.1.3 Opening the Browser page using WiFi**

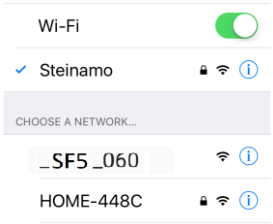
1.1.2.2 Setting up WiFi using an IPhone

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

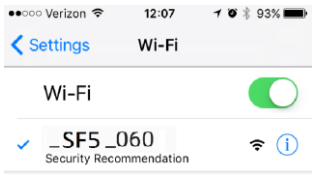
Select the **WiFi** button.



Choose your controller.



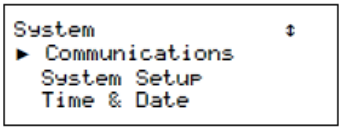
Note the connection status.

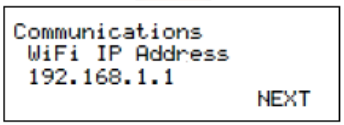


If you have more than one SF5 choice, the number on the screen represents the last 3 digits of the Slimflex controller serial number.

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.

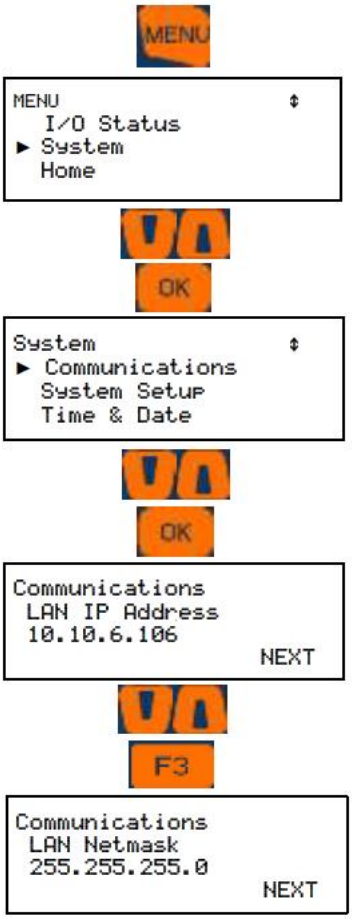
4) You will see the LAN IP address. Press the down

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

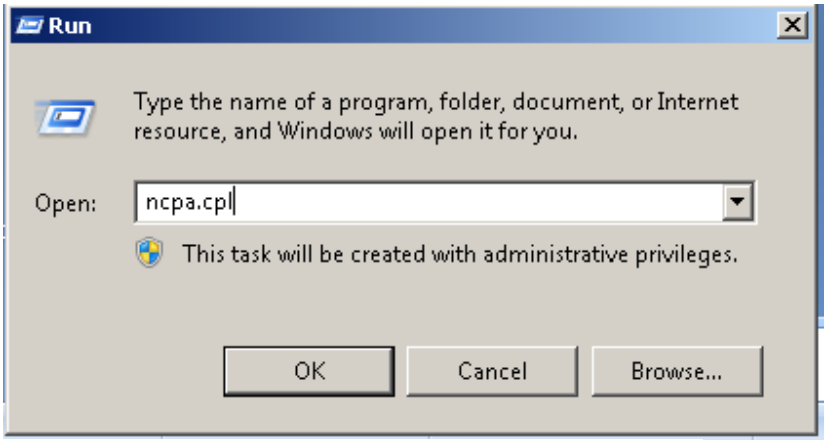
Once you have determined the IP address of the controller, you need to set a static IP address on your PC that is compatible with the controller address.

1.2.1.2 Setup the Local Area Connection on your PC

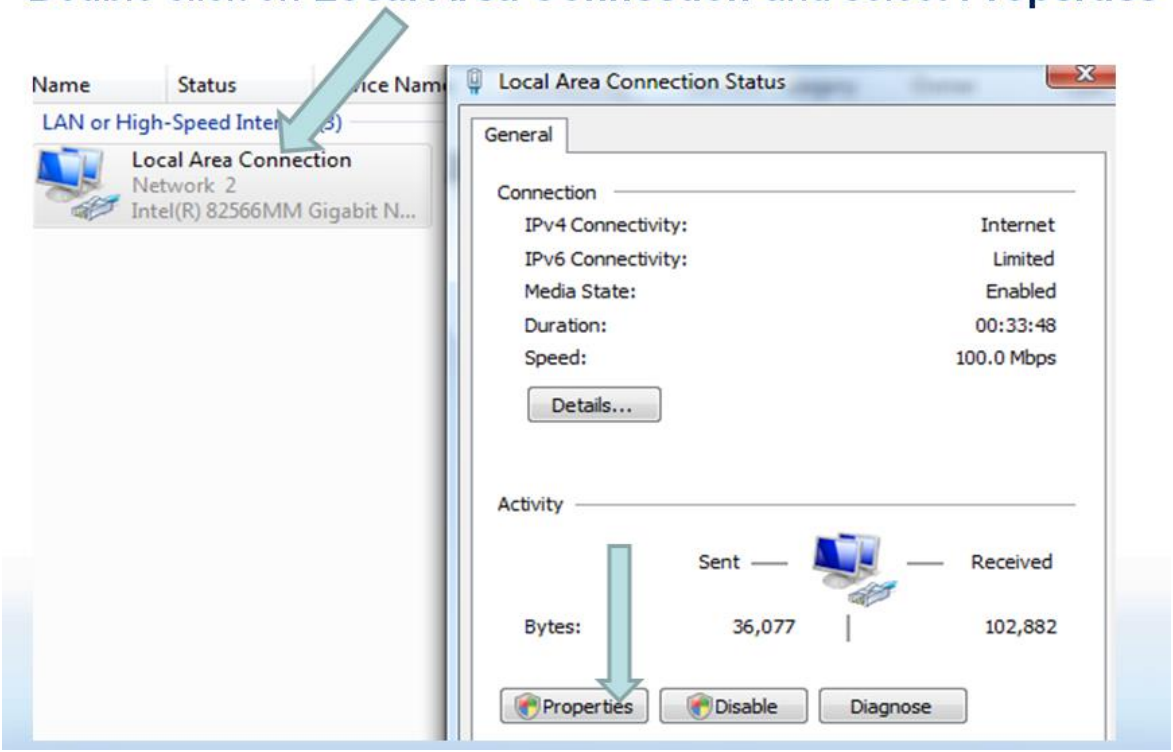
Depending on which version of Windows you are using, these instructions will vary. The idea is to set a compatible static IP address on your PC for the Ethernet port you will use to physically connect to the controller.
Use the following instructions for VISTA, WIN7, WIN8 and WIN10.

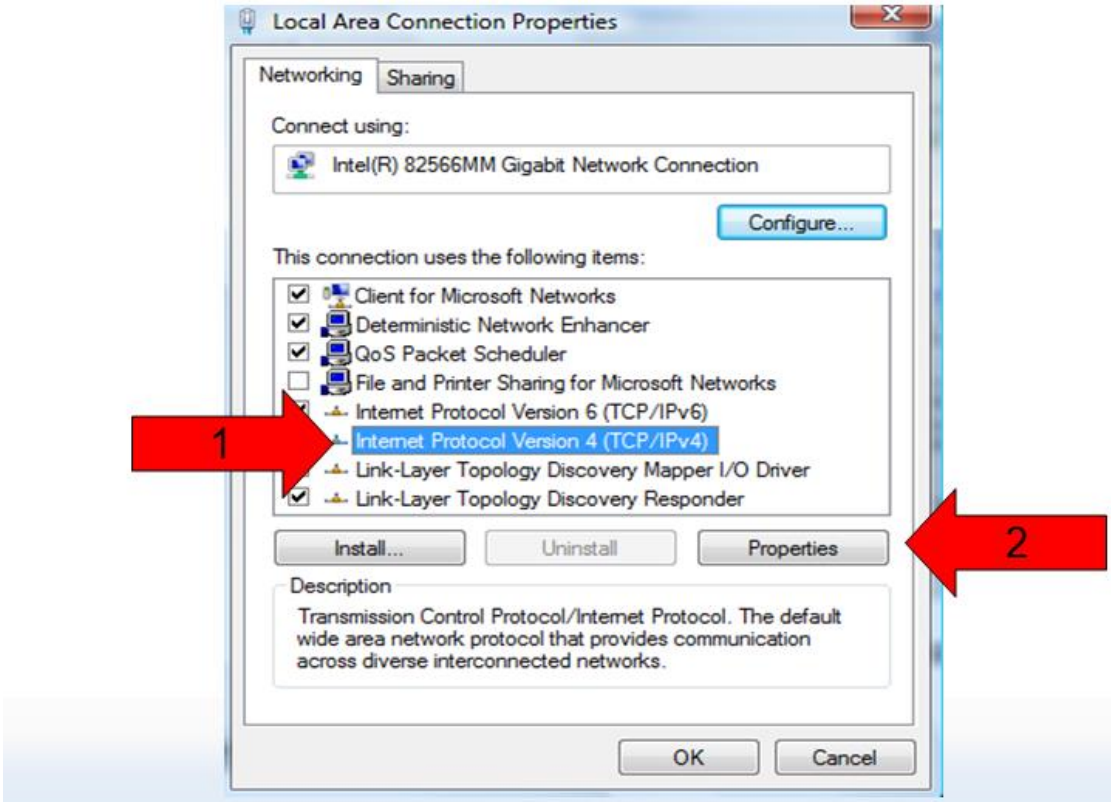
Hold down the Windows key  while you press the letter 'r '.

Enter ‘ncpa.cpl’ in the **Open** box.
Press **OK**.



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





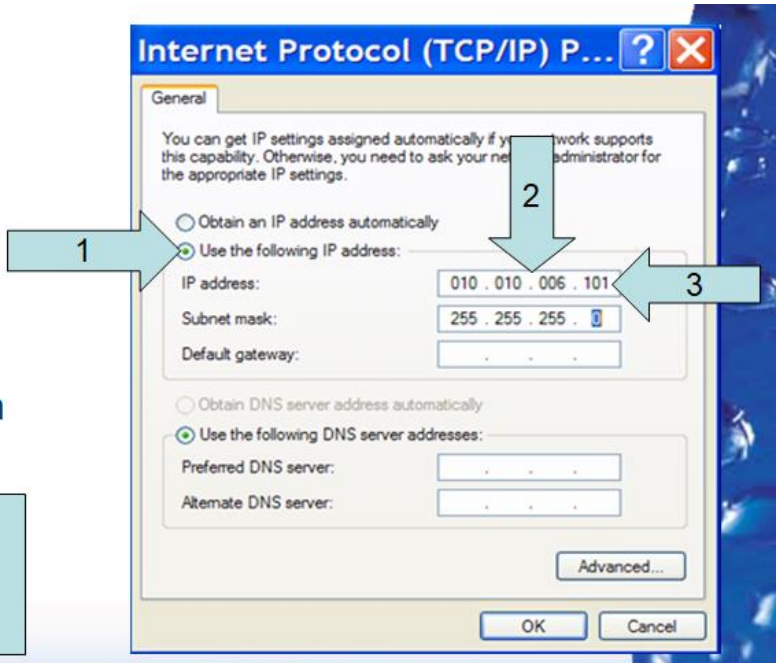
Select the 'Use the following IP address': circle (1)

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

1.3 The Home Screen

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

1.4 Home Page Services

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

1.4.1 Log-In

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

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

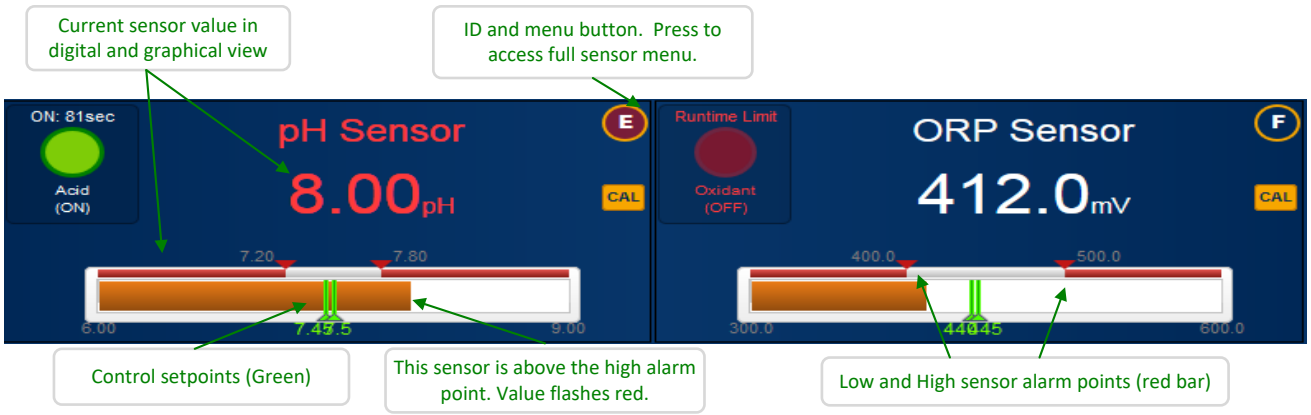
Two users cannot share the same password because only the password is used to identify keypad users. The controller displays **Password Fail** on a duplicate password.

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

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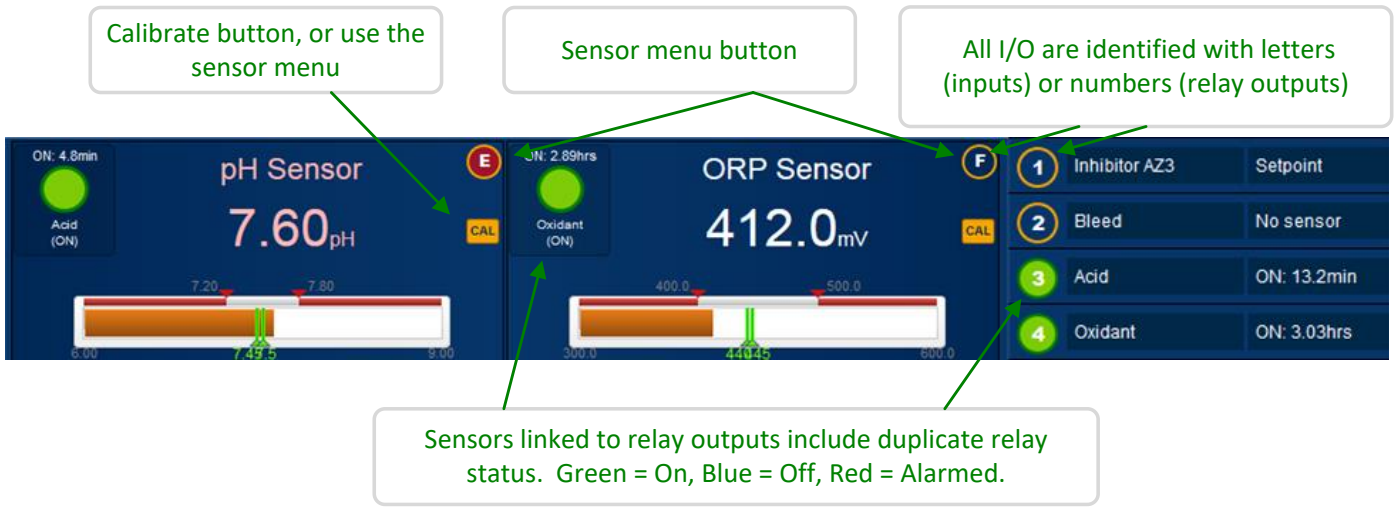
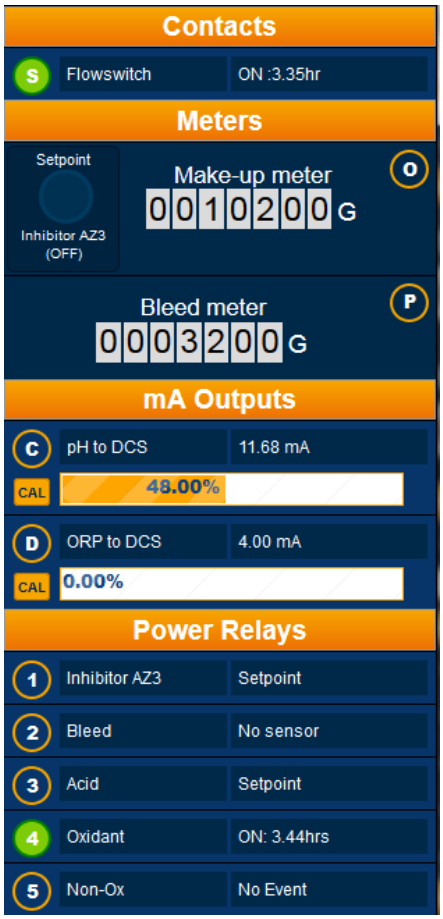


1.4.2.2 Digital I/O Display



Maximum of 6 digital inputs: Can be any combination of dry contact switches or digital watermeter signals from contact head or paddlewheel models.

See section 9 for 4-20mA output configuration

5 Digital output relays to power pumps, solenoids and MOV valves. See sections 2, 3 and 4

1.4.3 Home Page System Icons

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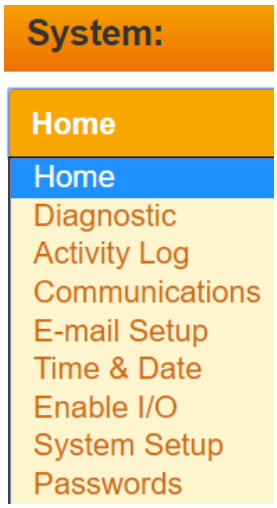
The home page has a variety of services unrelated to the program. These services are accessed via the icons in the upper left corner of the page.

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.**

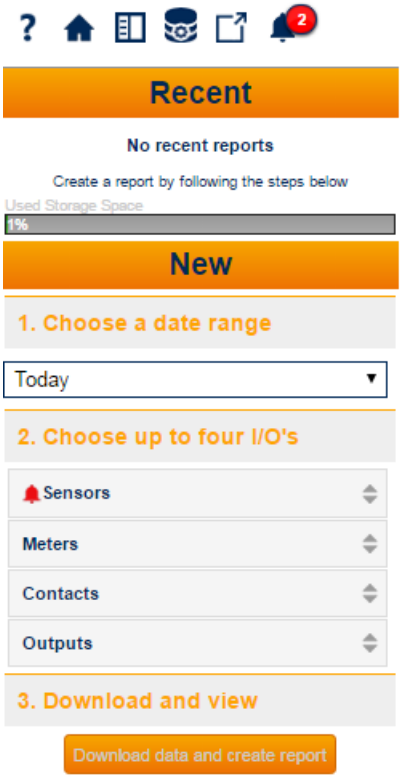


The change display icon allows users with dual systems to select how I/O points are displayed. See section **9.7 System Setup**

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.

1.4.4 Create a 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

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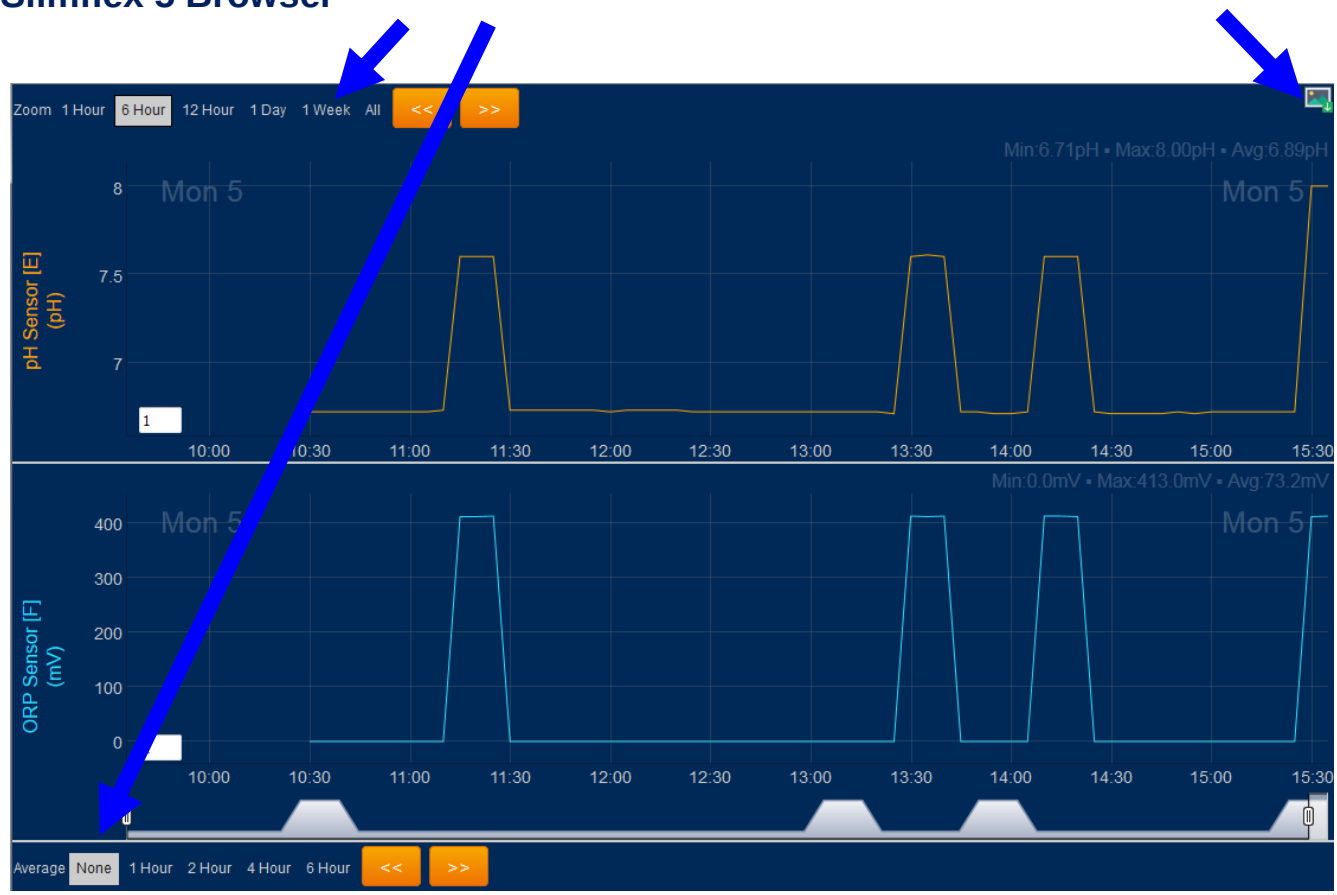
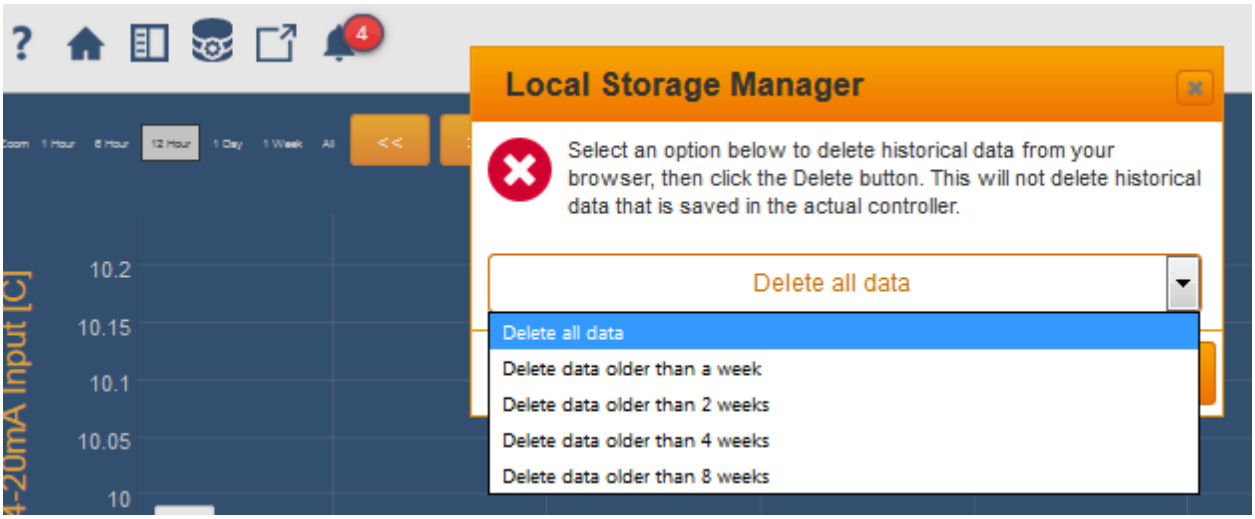
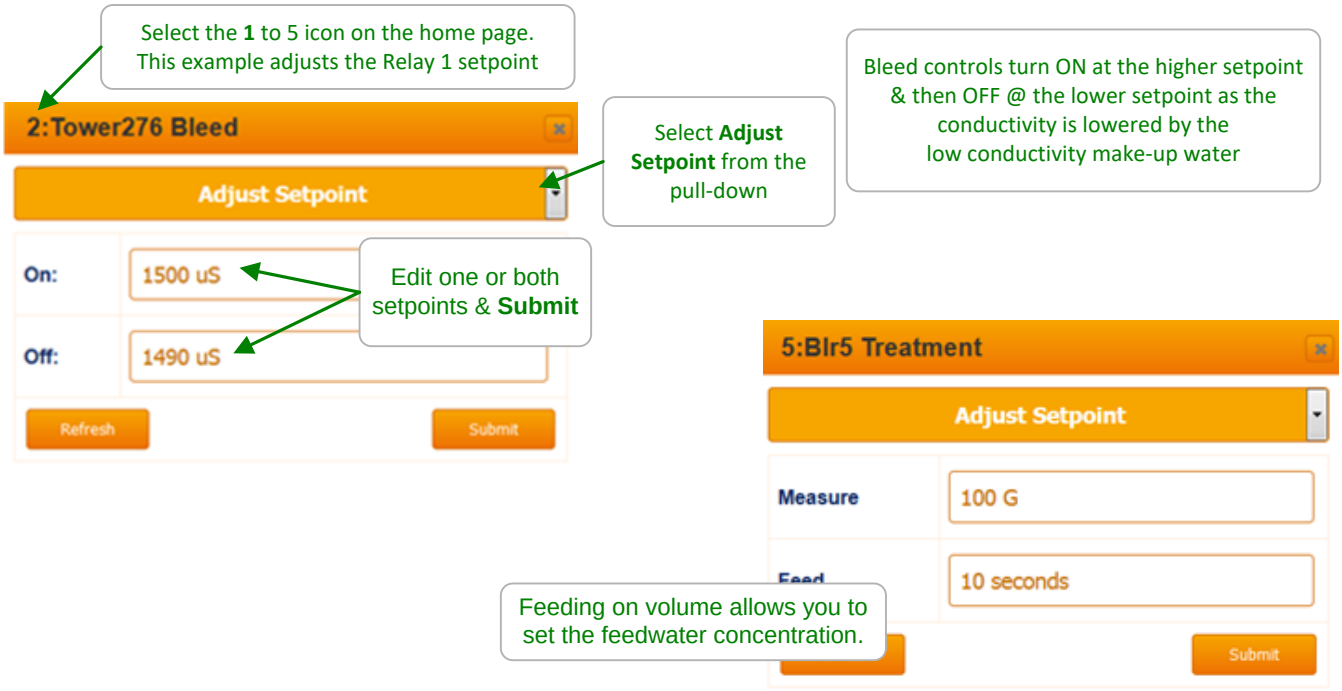


Manage the report database.



1.5 View & Adjust Setpoints



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.

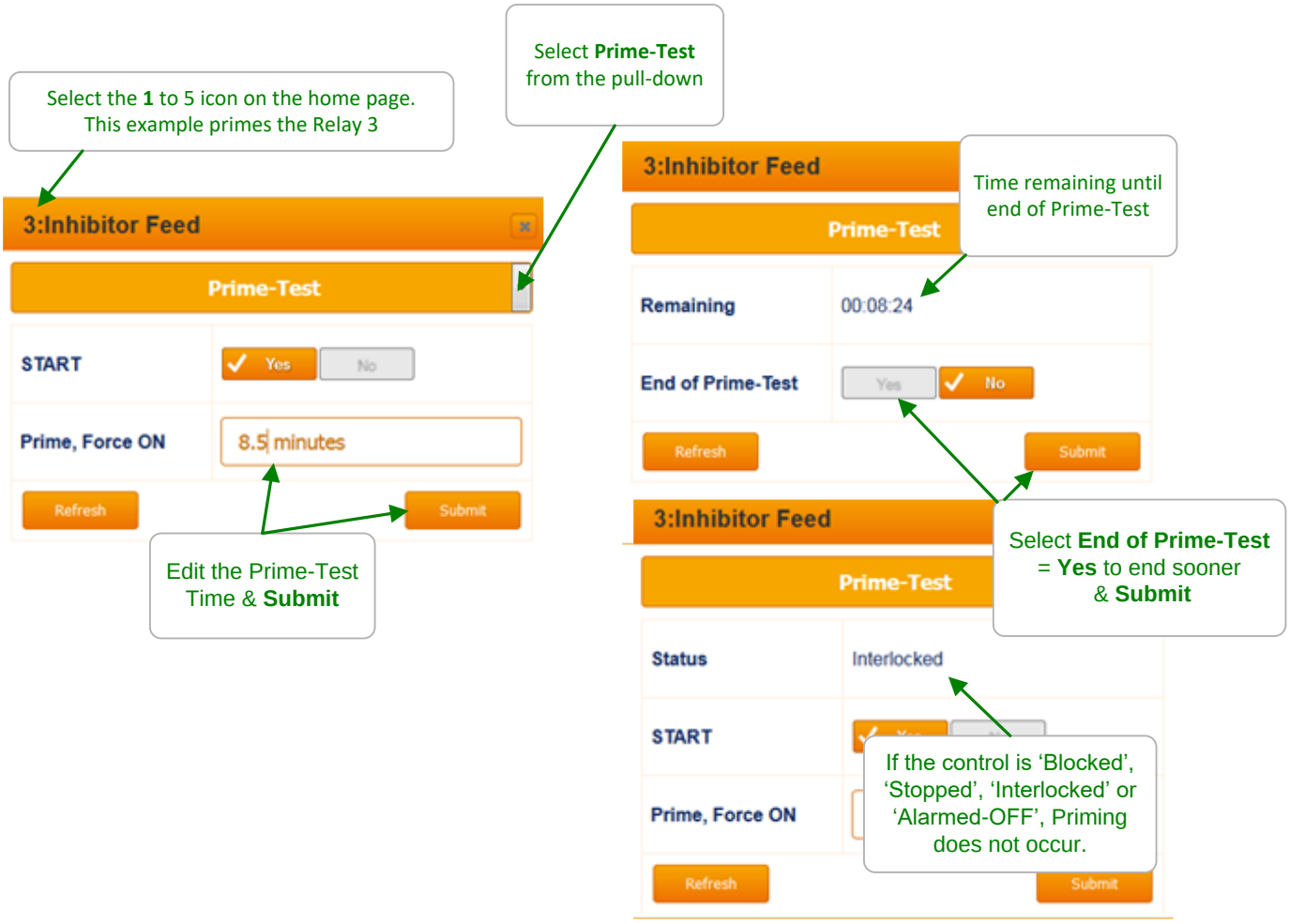
Inhibitor feeds may be delayed while the bleed solenoid in ON to prevent pumping inhibitor down the drain (See **Section 3.3.1 Bleed Based Feed**.)

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.

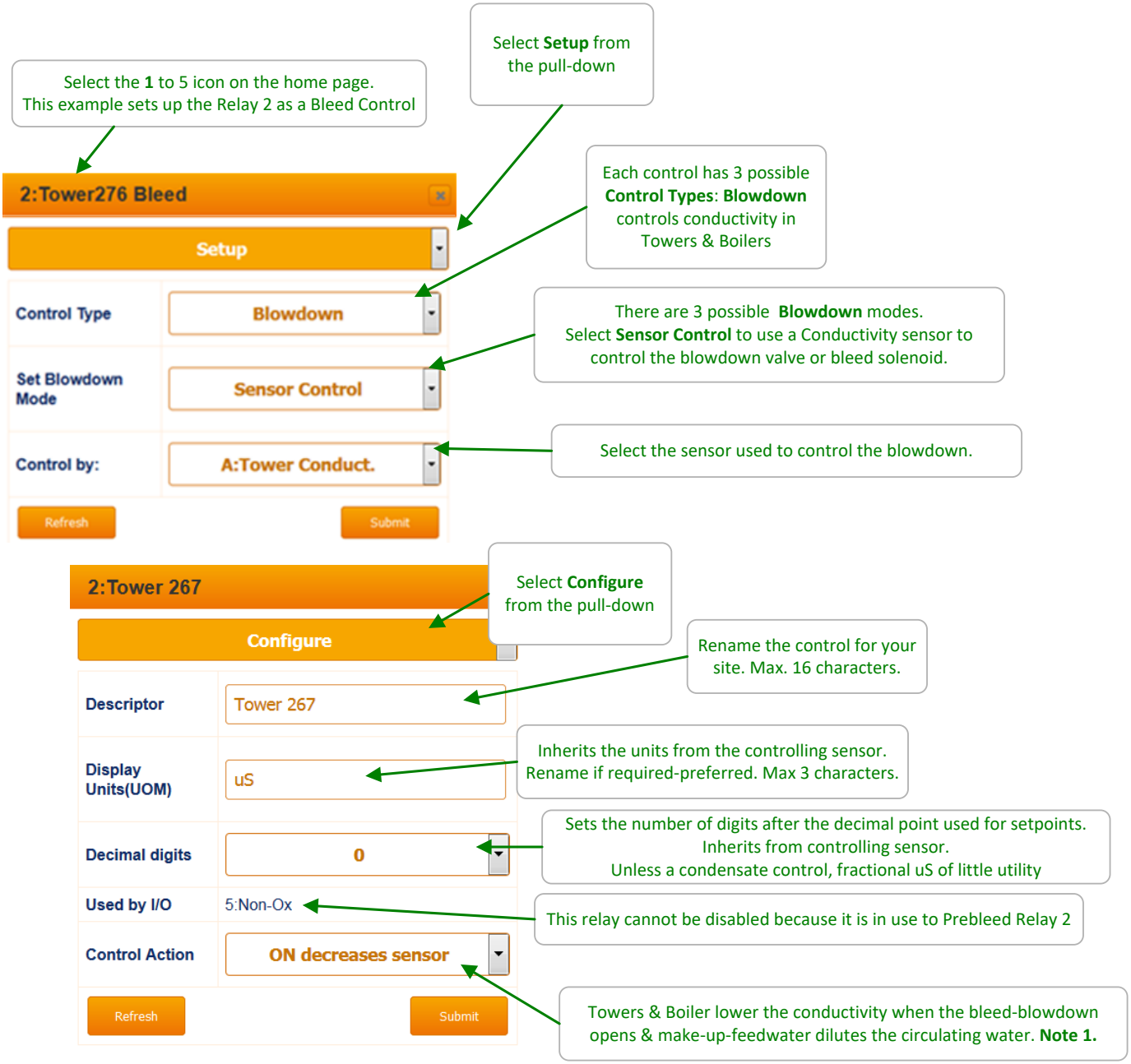
1.6 Priming-Testing Pumps & Solenoids



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

2 Blowdown Controls: Towers, Boilers, Closed Loops

2.1 Conductivity Controlled Blowdown

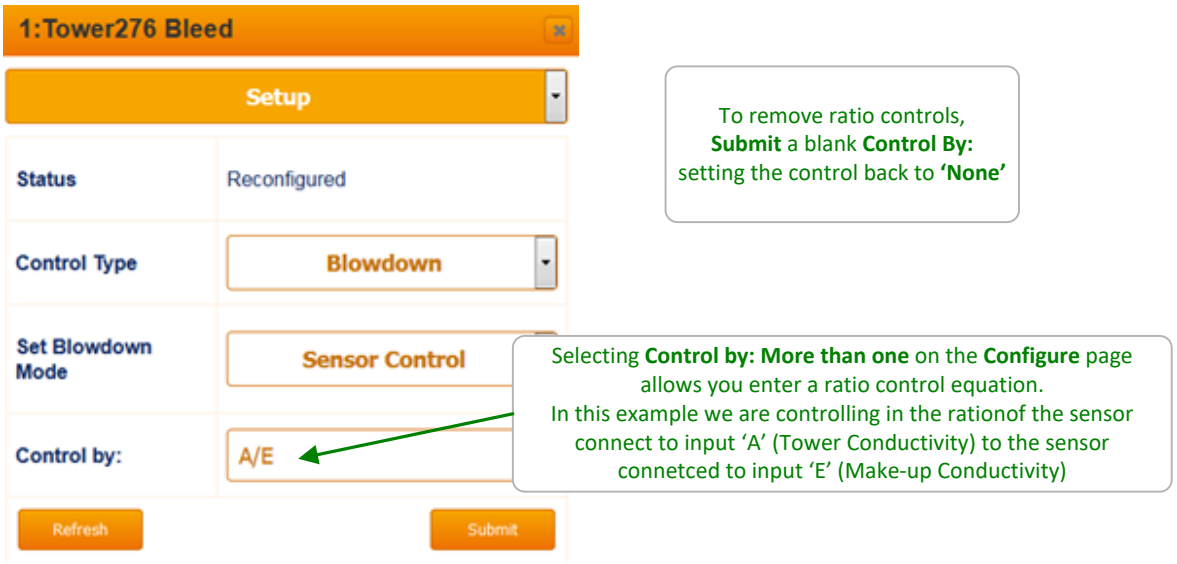


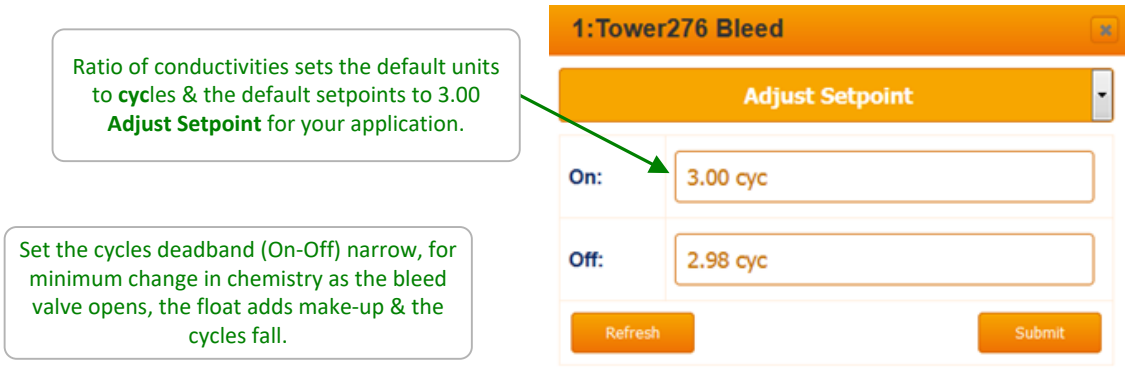
Sidebar:
Note 1: Closed loop conductivity controls usually use **Control Action ON increases sensor**
Select **Control by: More than one** to bleed on the ratio of tower to make-up conductivities.
See next page.

Conductivity Controlled Blowdown continued

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

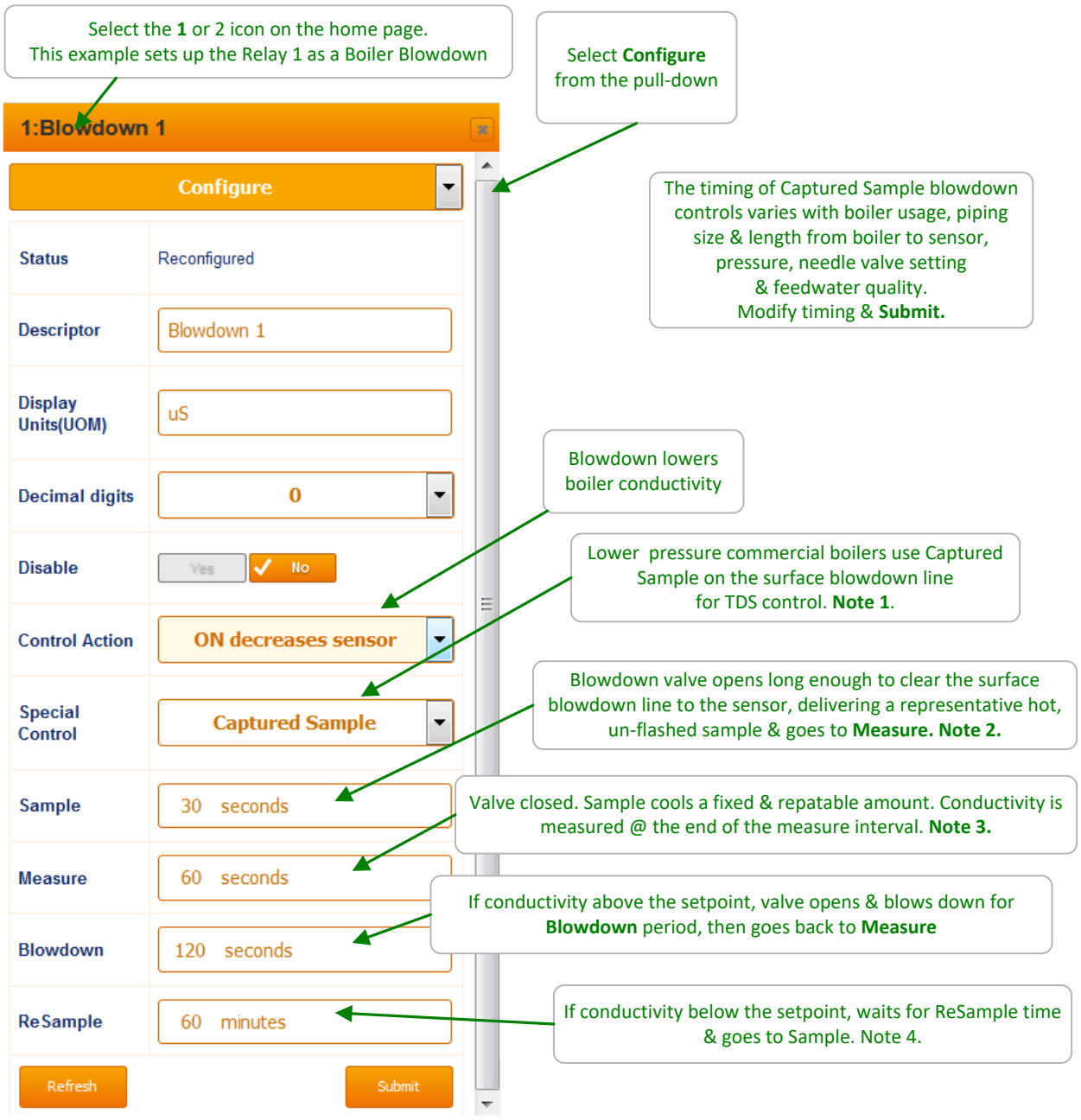
CAUTION: If your tower has a long holding time or large circulating volume or you are running the chemistry close to the scaling limit, look closely at control effects. Auto-Increasing cycles of concentration (make-up conductivity falls) when the bulk of the tower water has not changed, may scale heat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





Sidebar:
If this is a new tower to you, take the time to watch a bleed cycle.
The bleed opens but the conductivity continues to increase until the float opens.
(If you have a meter on the make-up you'll see it increment volume @ a higher rate)
The conductivity then starts to fall & may continue to fall after the bleed has turned OFF, depending on the float dead band.
You can't control inside of the float dead band but you can see the parts of the blowdown control: sensor, solenoid, meter, float … all working.

2.2 Boiler Blowdown



Sidebar:

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

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

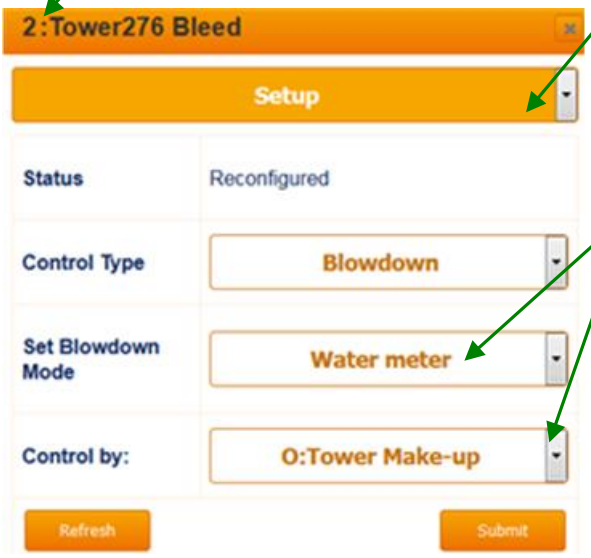
Note 3: If you modify **Measure** time or needle valve setting. Recalibrate because you've changed the temperature at the measure point.

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

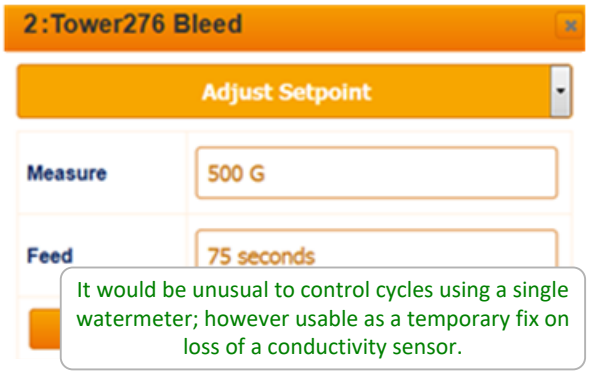
2.3 Metered Blowdown

Select the 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

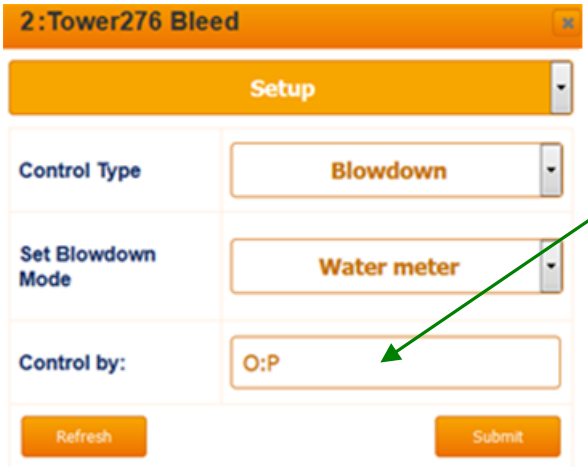


Select **Set Blowdown Mode** = **Water meter** & select the controlling meter & **Submit**.



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

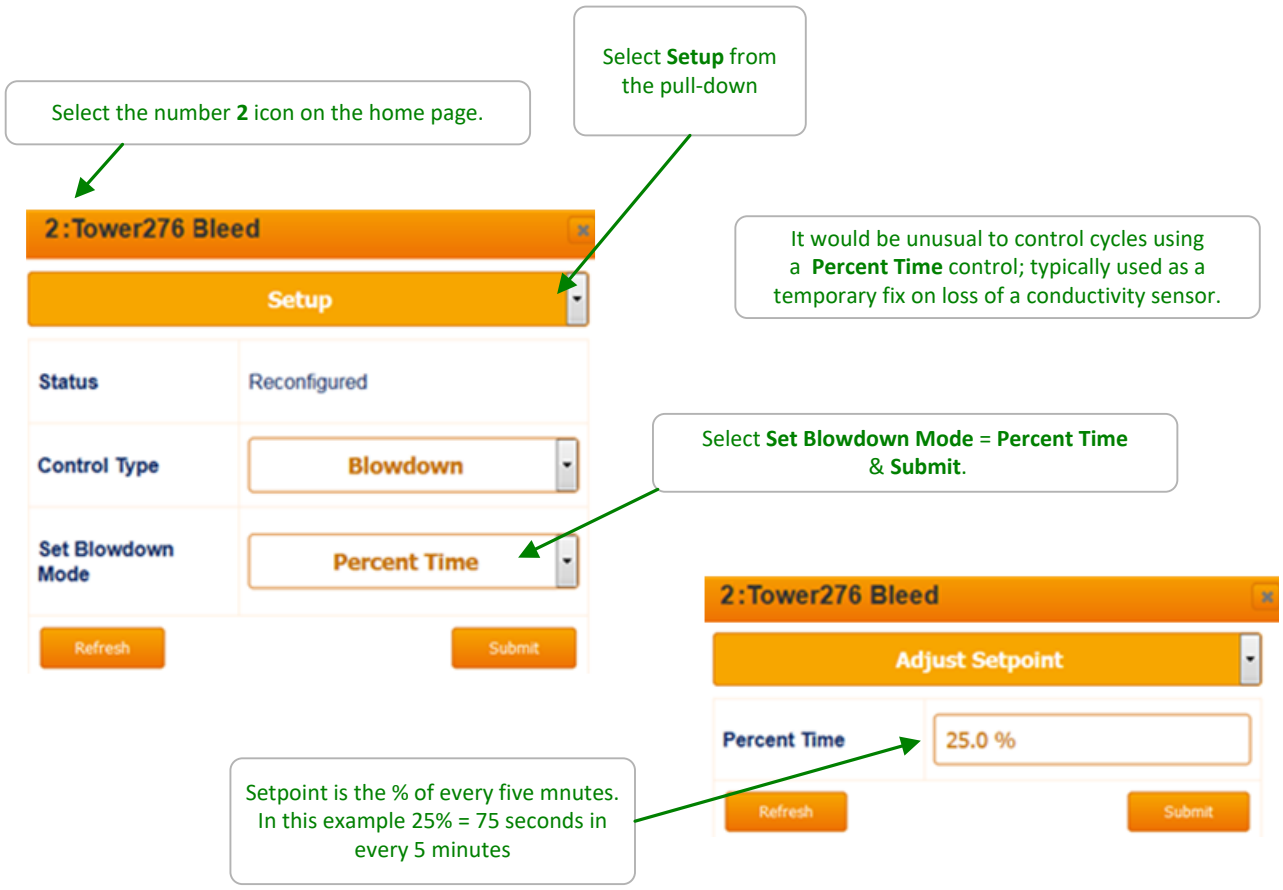
At sites where fouling or high silica prevents using contact conductivity sensors, two meter controls are **useable if make-up water chemistry constant**



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.

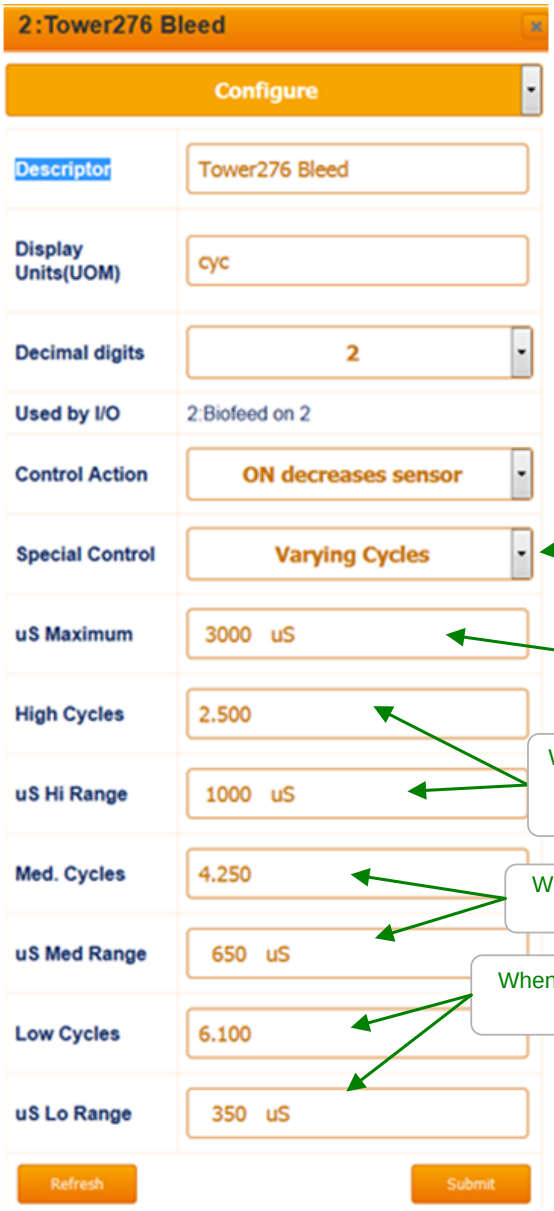
Slimflex 5 Browser
2.4 Percentage Time Blowdown



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

For example, if you use a **Percent Time** control to blowdown while you replace a sensor or meter, the bleed will turn OFF while the inhibitor feeds if you have configure the bleed to be 'Blocked by' the inhibitor pump.
However the bleed time owed in the current 5 minute cycle will be delivered when the inhibitor feed ends.

2.5 Variable Cycles



If your make-up changes seasonally or periodically and you have a 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.

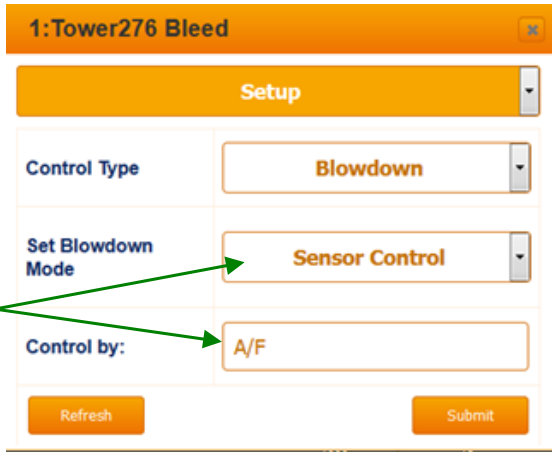
Varying Cycles is not a **Special Control** option until **Control By:** is set to the ratio of the Tower-to-Makeup conductivities, **A/F** in this example

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

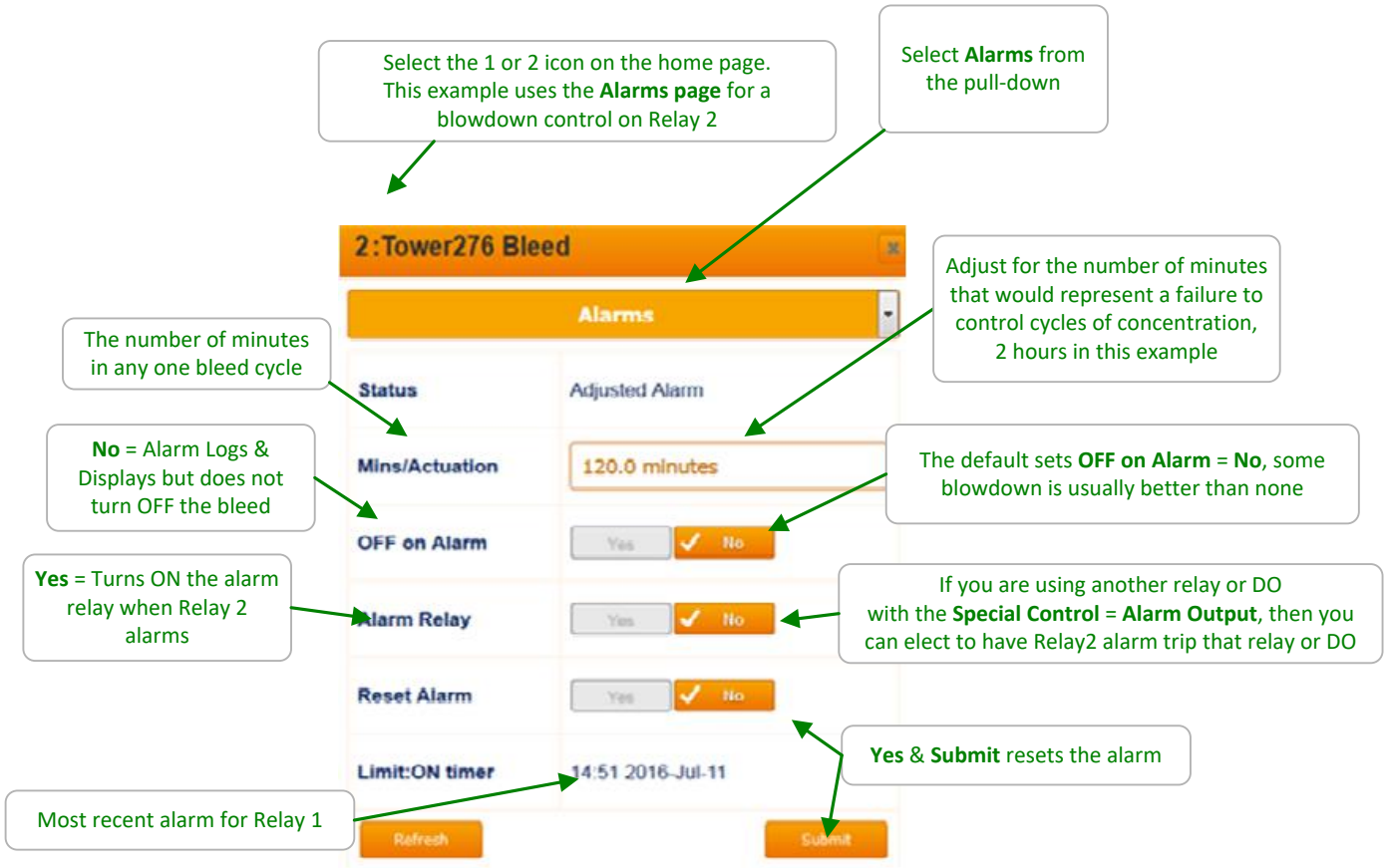
When the Make-up conductivity is less than 650 uS, the tower bleed is controlled to 4.25 cycles of concentration

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)

2.6 Blowdown Limit Alarms



Sidebar:

Obvious Alarm Causes:

Failed or blocked blowdown valve or solenoid, blowdown line inadvertently valved OFF after tower maintenance. If solenoid intermittent, check the static head required to operate.

Faulted or debris blocked blowdown meter for towers using sequential meter control.

Less Obvious Causes:

Undersized bleed as load increases &/or make-up chemistry changes.

Adding more gray water make-up @ higher than expected conductivity.

Failure to adjust bleed setpoints as seasonal changes in make-up chemistry occur.

Self Inflicted Causes:

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

Note:

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

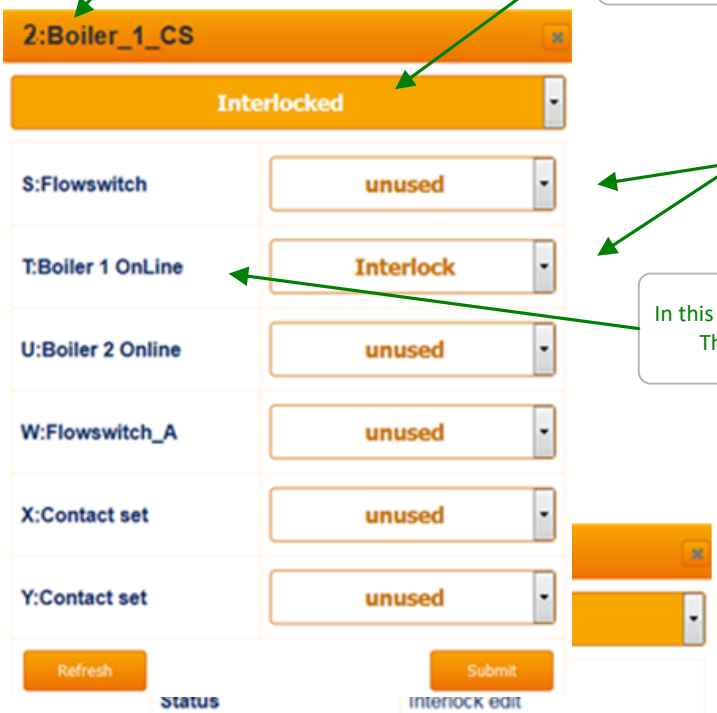
2.7 Blowdown Interlocks-Flowswitches

Select the 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**.

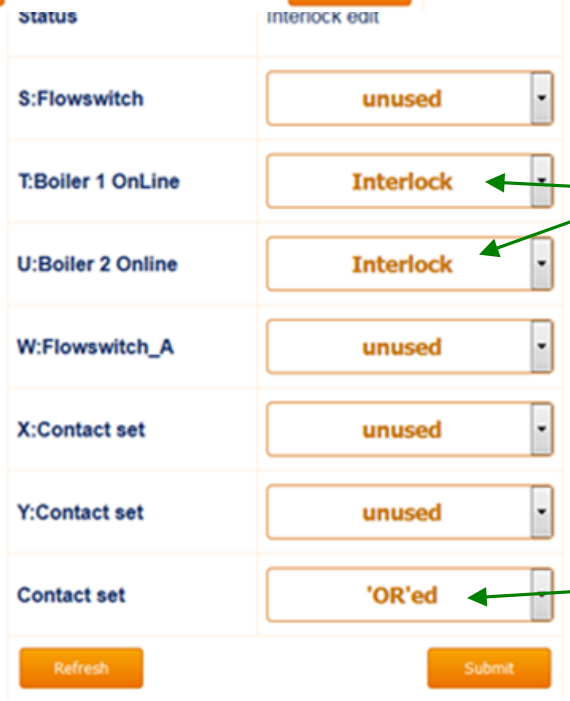


All enabled contact set type inputs are shown on the **Interlocked** page. Select or deselect one or more **Interlock** & **Submit**

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.

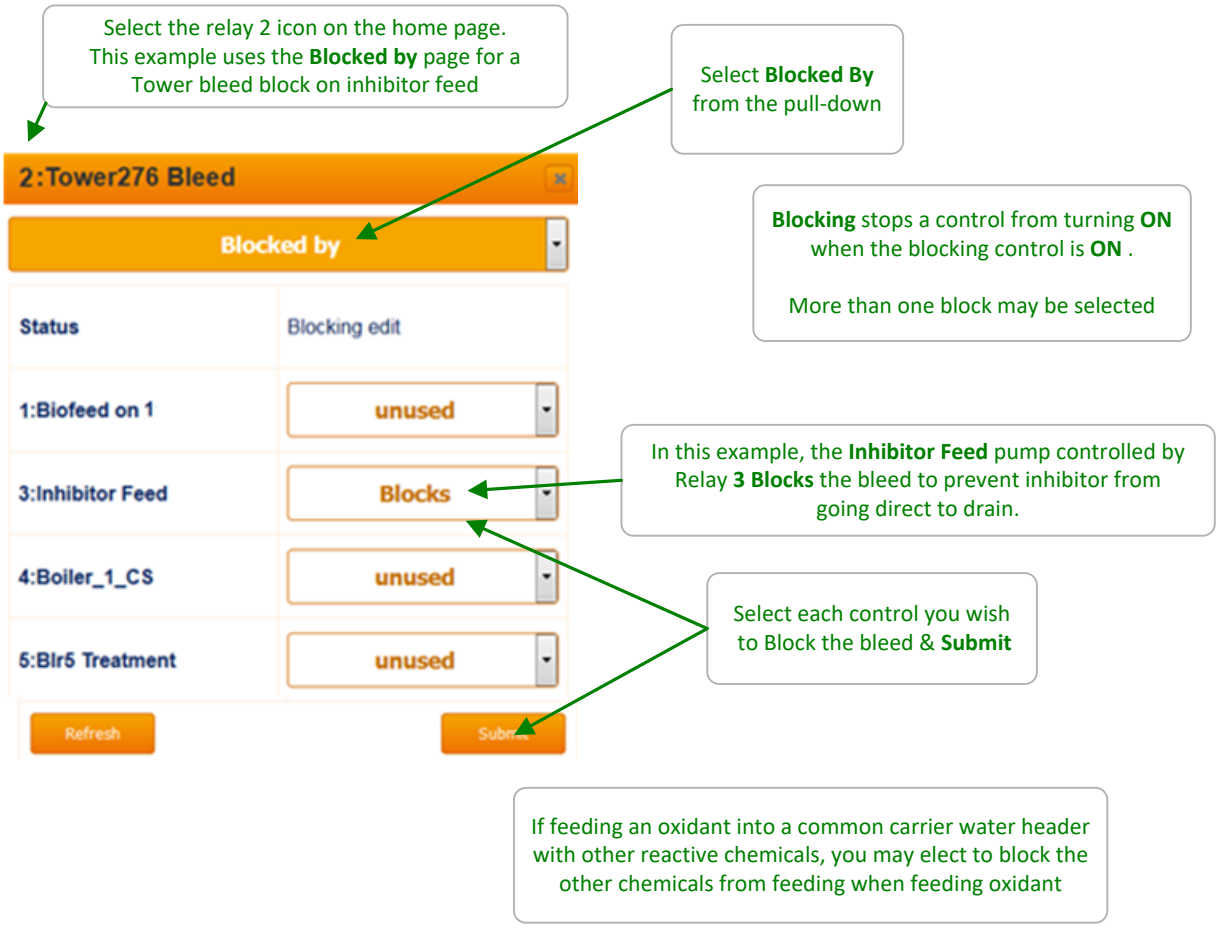
If either Boiler 1 (**T**) or Boiler 2 (**U**) is online, we want the sulfite pump to be feeding so we select both to **Interlock** & '**OR**' them.

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

2.8 Blocking-Delaying a Blowdown



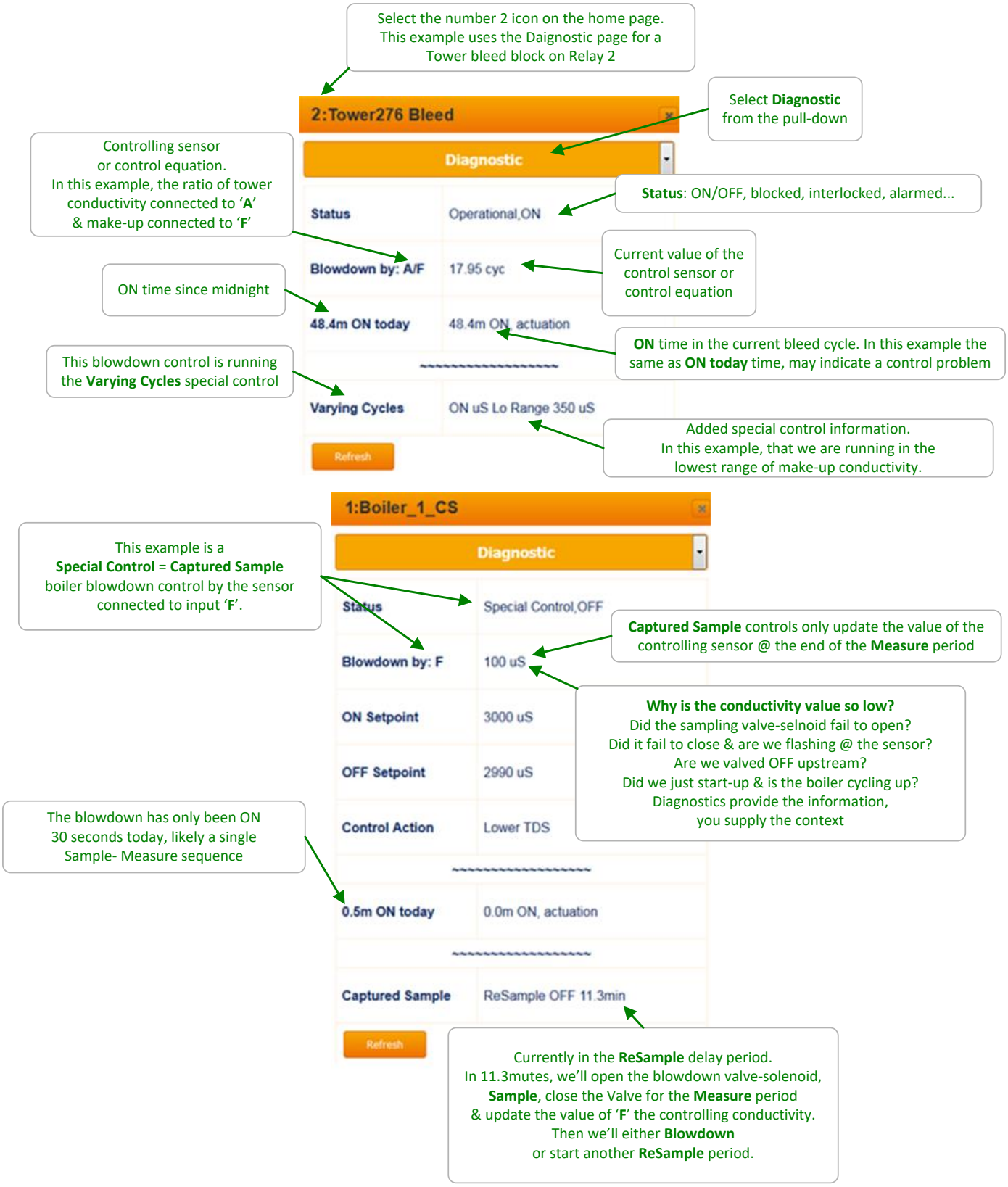
Sidebar:
Warning: A poorly conceived block may prevent a control from running or working correctly.
In this example, if the tower is bleed limited or the inhibitor pump undersized & therefore ON for an extended period, bleed control may fault.

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.

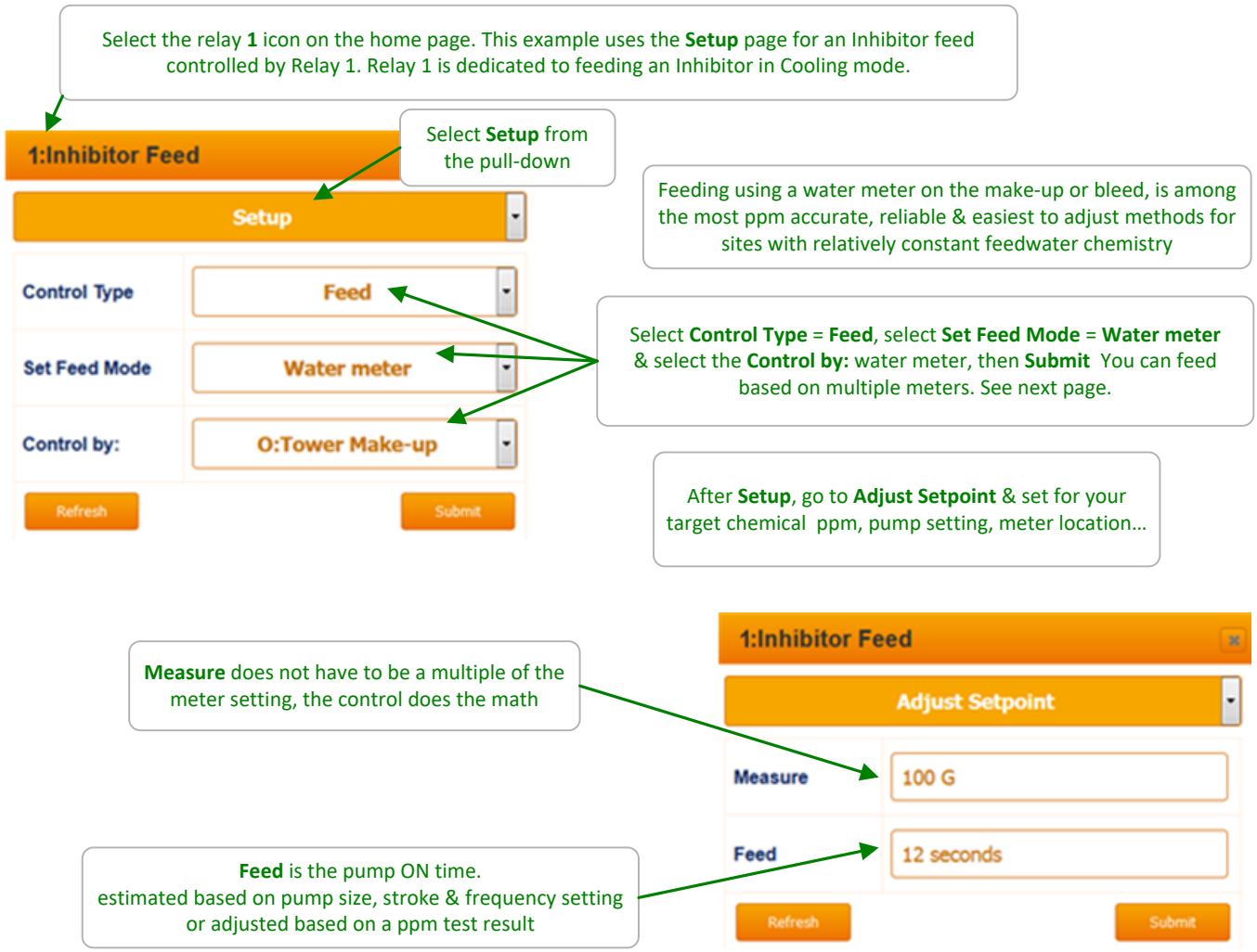
Blocking inhibitor feed is seldom used on larger circulating volume towers where the feed point is usually remote in time & volume from the bleed point.

2.9 Blowdown Diagnostics



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

3.1 Water Meter Inhibitor Feed



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

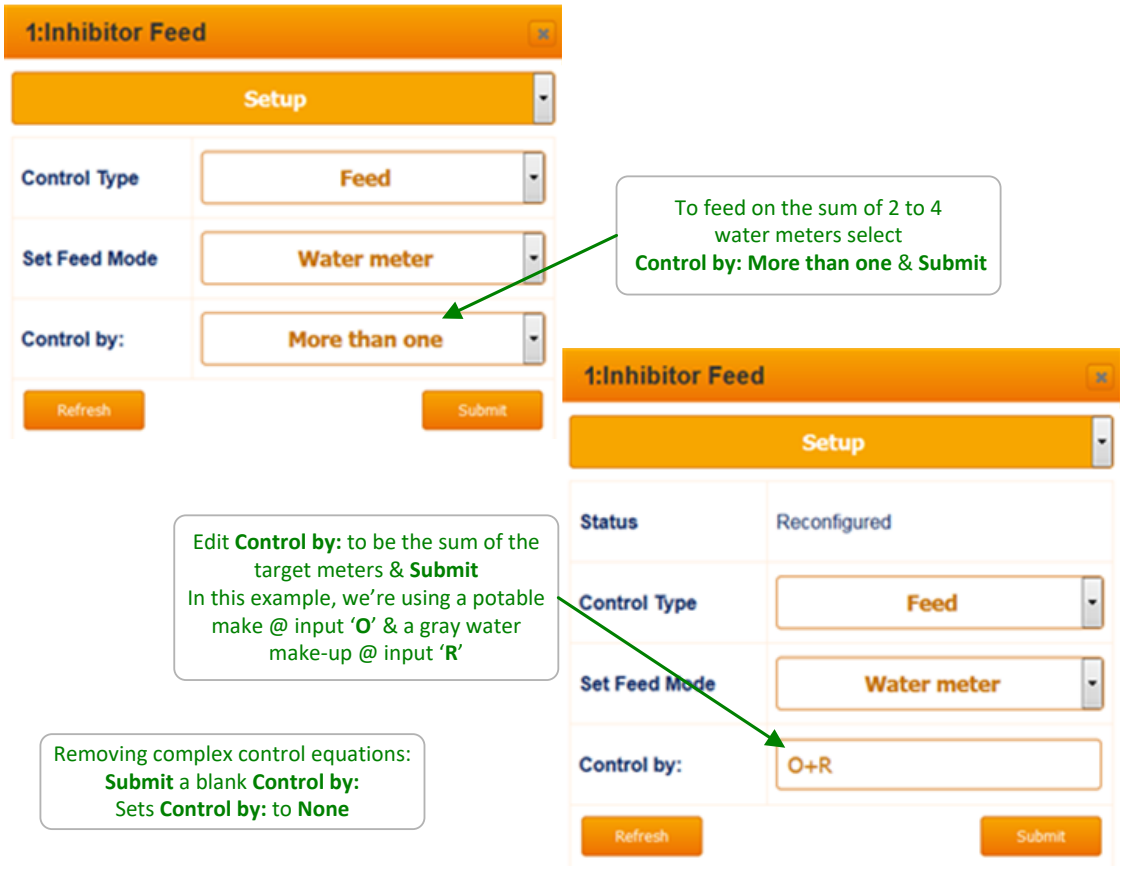
100 gallons of make-up needs a 10 ppm = (20ppm x 100%/50% / 4 cycles) feed.
An 8 GPD pump feeds @ (8 G / (24hr. x 3600 sec/hr))= $92.6E^{-6}$ G/sec.
Every 100 Gallons of make-up we'll need to feed (100G x 10 ppm)= $1E^{-3}$ gallons
which @ $92.6E^{-6}$ G/sec feed rate will take ($1E^{-3}$ / $92.6E^{-6}$)= 10.8 seconds

There are error sources: How accurate is the % active?
Is 8GPD @ site temperature range & static head? How accurate is the cycle control…..
This is a first guess; test ppm & adjust.
If this is a start-up, use pump Prime to get to an initial ppm.

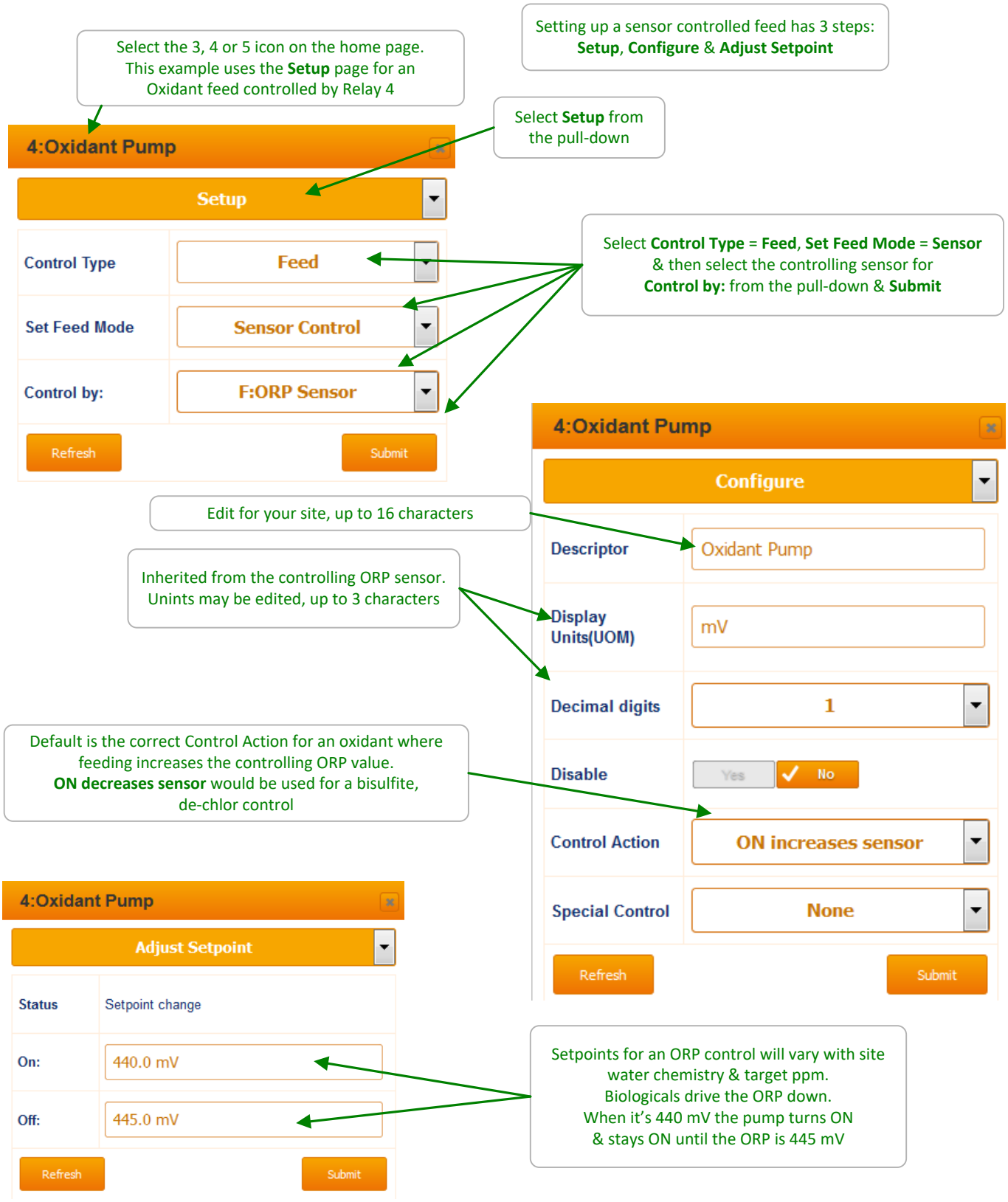
Water Meter Inhibitor Feed cont.

It's common to feed inhibitor on the sum of potable-city & gray water make-ups.
If inhibiting for corrosion control, then you may wish to feed more on gray water make-up; increase the grey water meter scaling accordingly.
(A 100G/contact gray meter set to 200G/contact will double the feed).
If inhibiting for scale, then you may wish to feed less inhibitor on gray make-up; decrease the gray water meter scaling proportionately.
(A 100G/contact gray meter set to 50G/contact will halve the feed).

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



3.2 Sensor Controlled Feeds

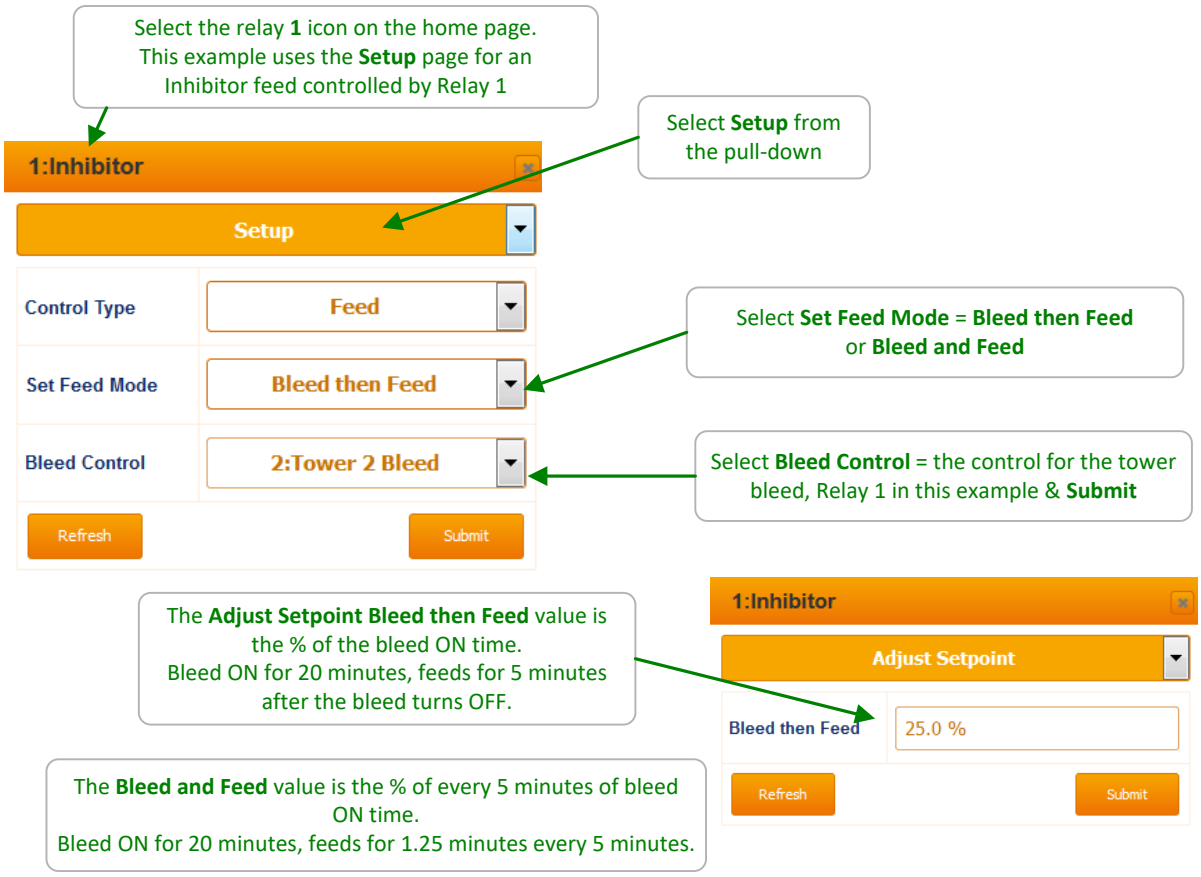


3.3 Proportional Feed

3.3.1 Bleed Based Feed

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

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



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

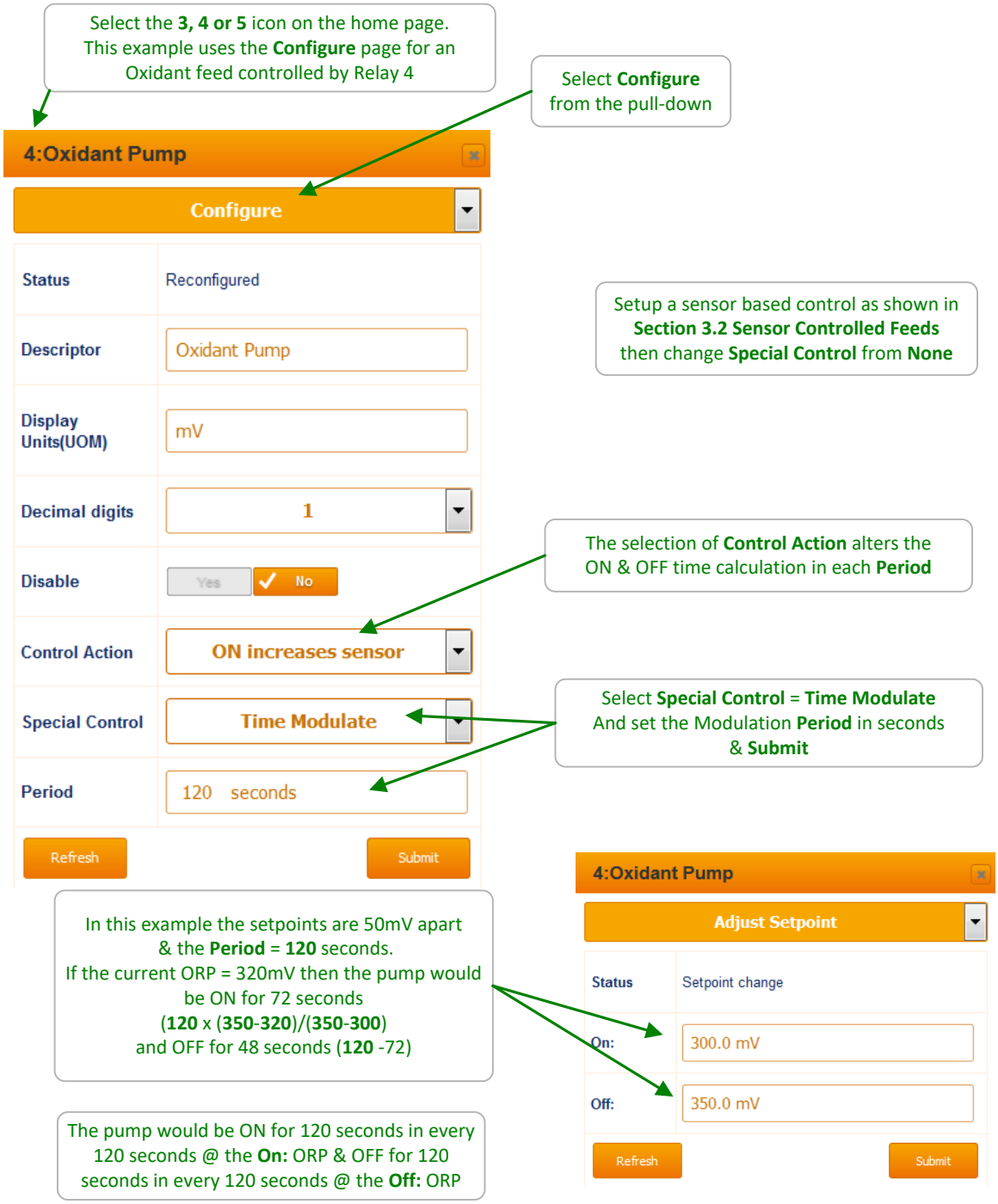
If the tower Bleeds for **X** Minutes, the Inhibitor is fed for a user set % of **X** minutes AFTER the bleed ends. It's a better way to feed inhibitor for small cooling towers than Bleed & Feed since less inhibitor is lost down the drain.

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

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

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.

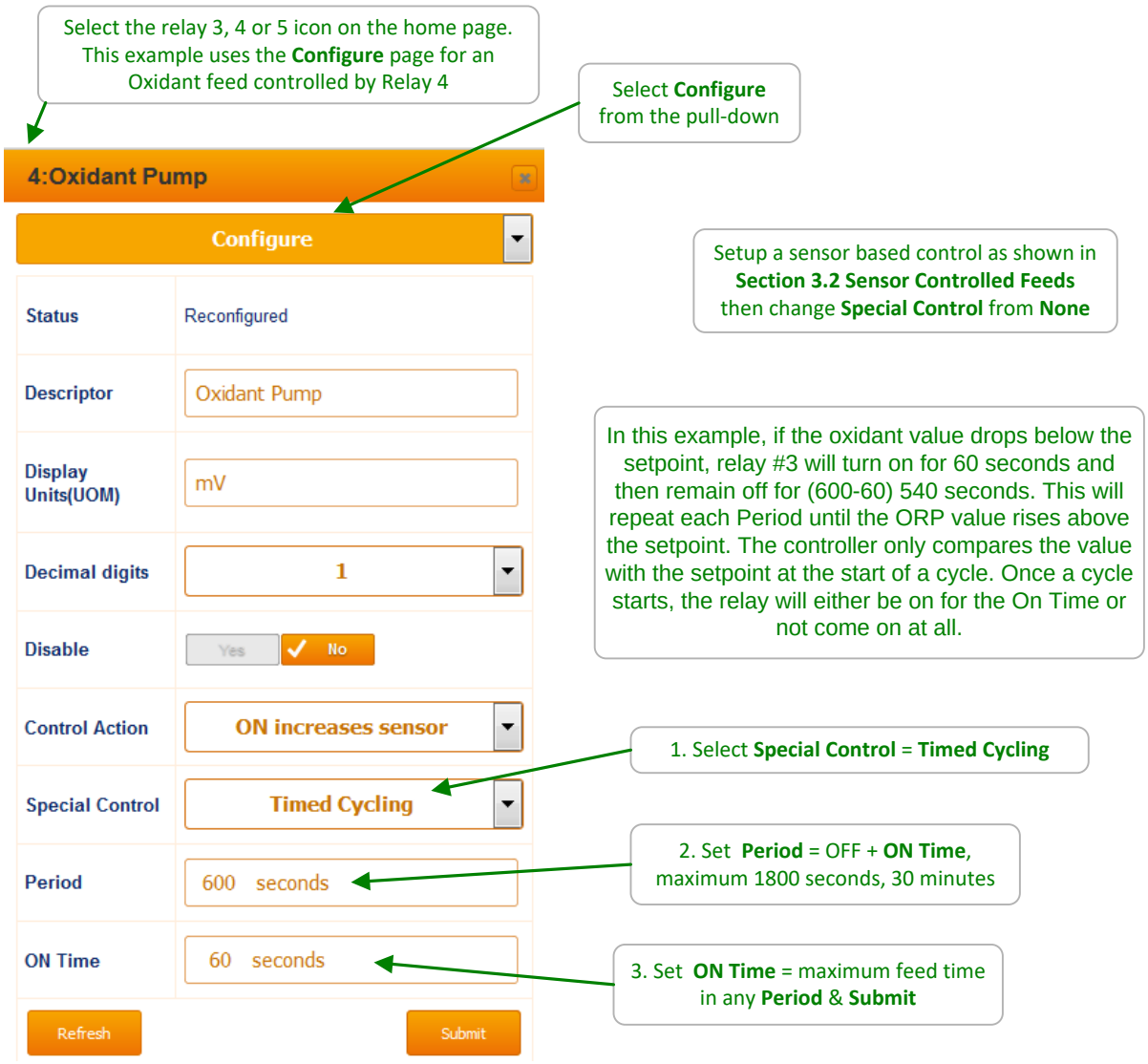


Sidebar:
Time Modulate Special Control is only selectable on Relays 3, 4 & 5

Slimflex 5 Browser
3.3 Proportional Feed
3.3.3 Timed Cycling

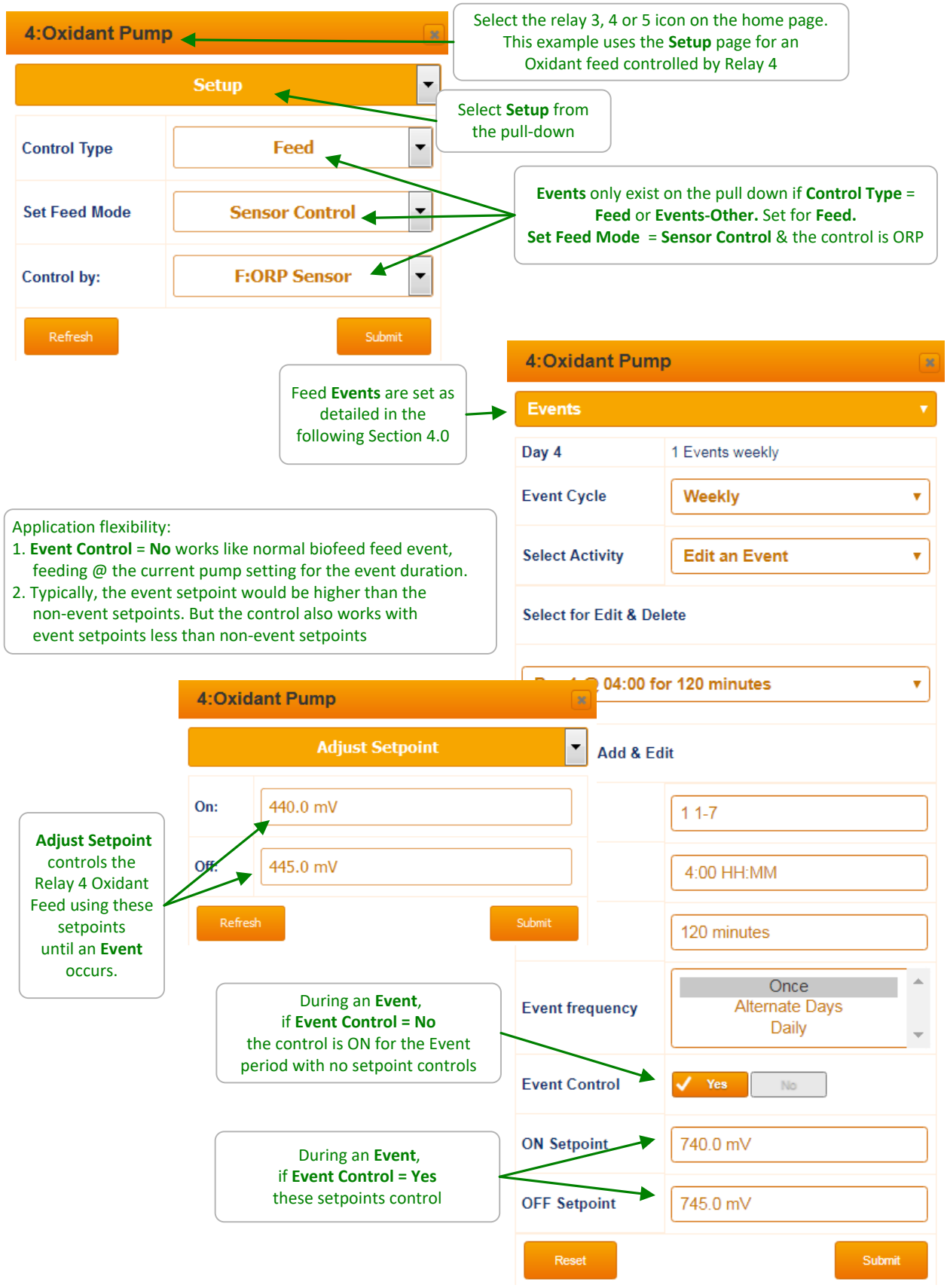
Timed Cycling allows time for the controlling sensor to measure the effect of chemical before feeding more chemical. **Timed Cycling** is used where a chemical is fed occasionally into a system with a large volume.
It may be several minutes before the chemical travels from the injection point through 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.



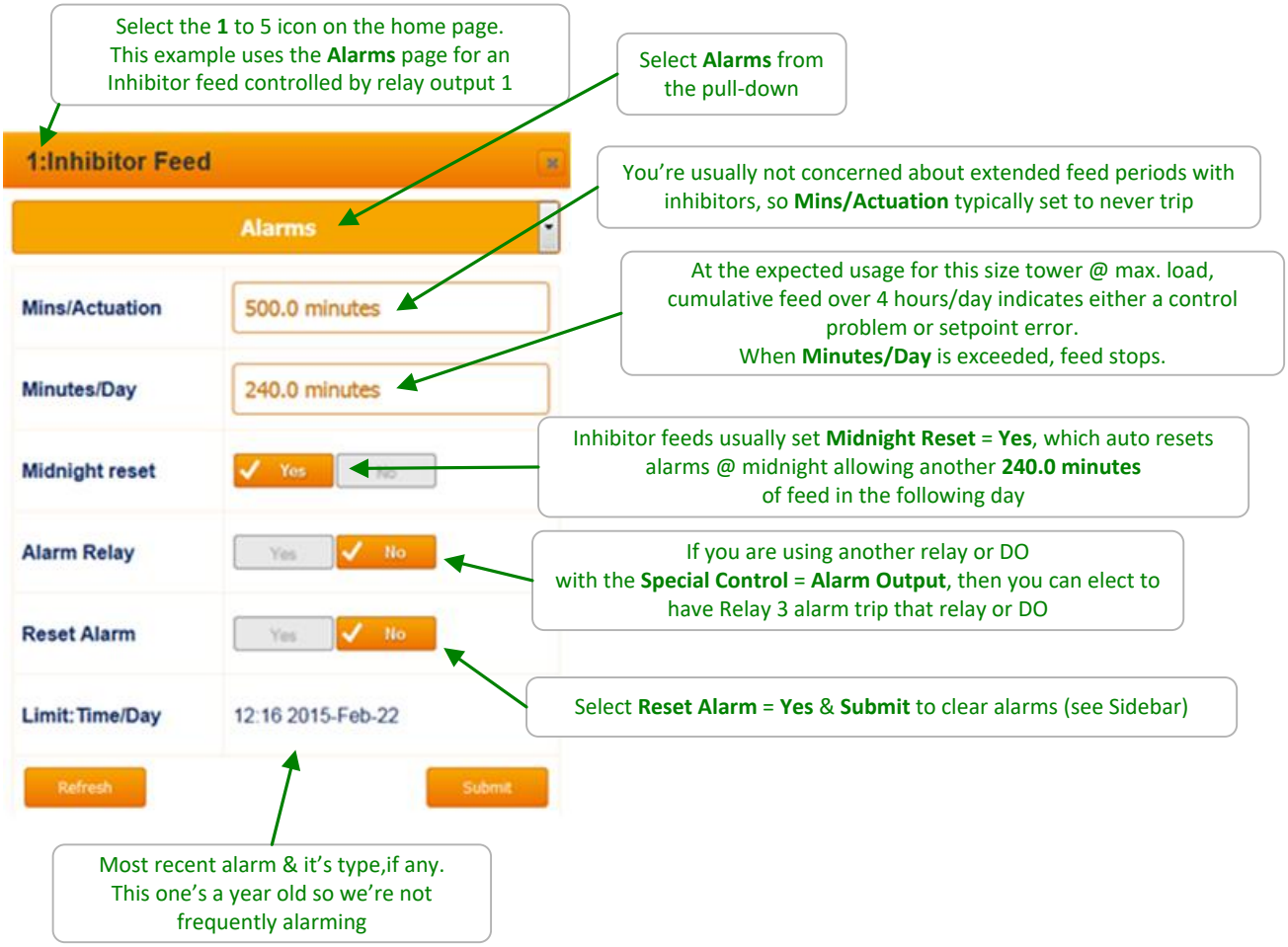
Sidebar:
Often there is a long time delay between adding a chemical and measuring its effect at a sensor which causes setpoint overshoot and poor control.

3.4 Control During Events



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.



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

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

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

Limiting Feed & Alarms cont.

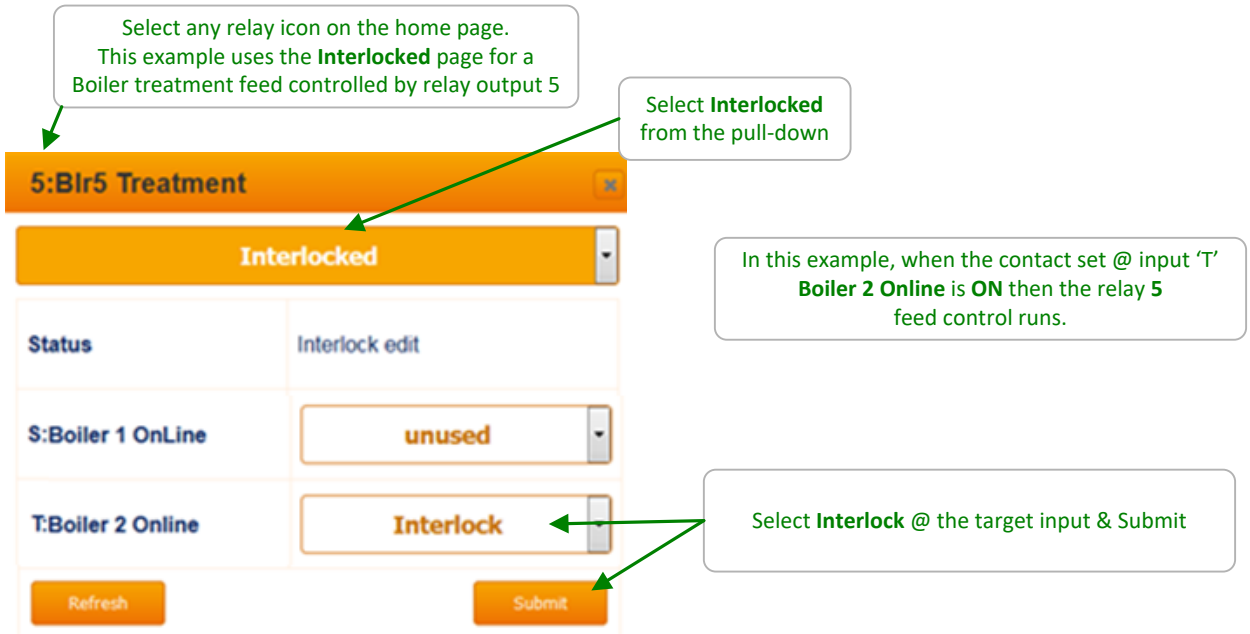
Alarms on feeds for acid, caustic or oxidants that are not tripping because they are set too tight to the normal operating or seasonal variation, usually indicate a maintenance response is required.

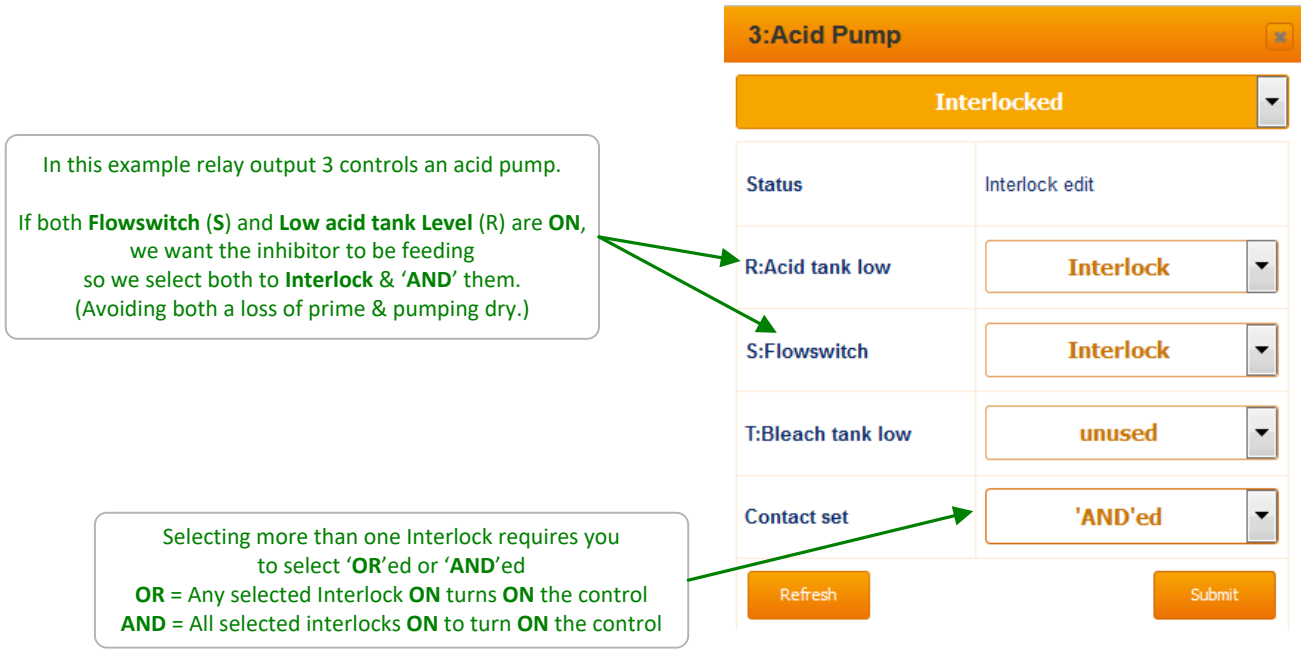
Make-up water chemistry may have changed. Towers may have added a gray water make-up or boilers may have deaerator problems or contaminated condensate return.
Sensors age, foul & drift. Meter wiring may be sharing conduit with power wiring…

Slimflex 5 Browser

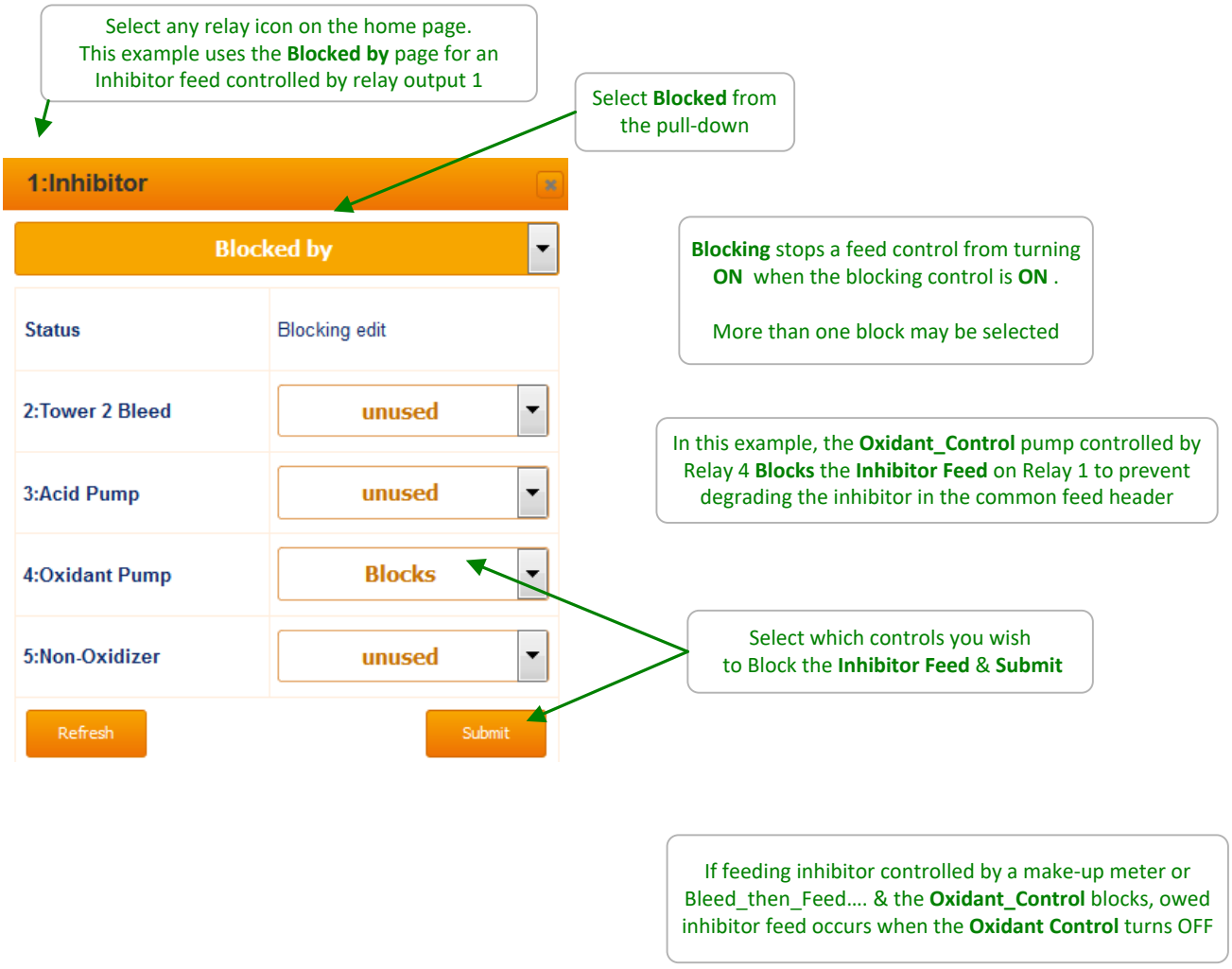
3.6 Interlocks

3.6.1 No feed on no flow





3.7 Blocking-Delaying a Feed



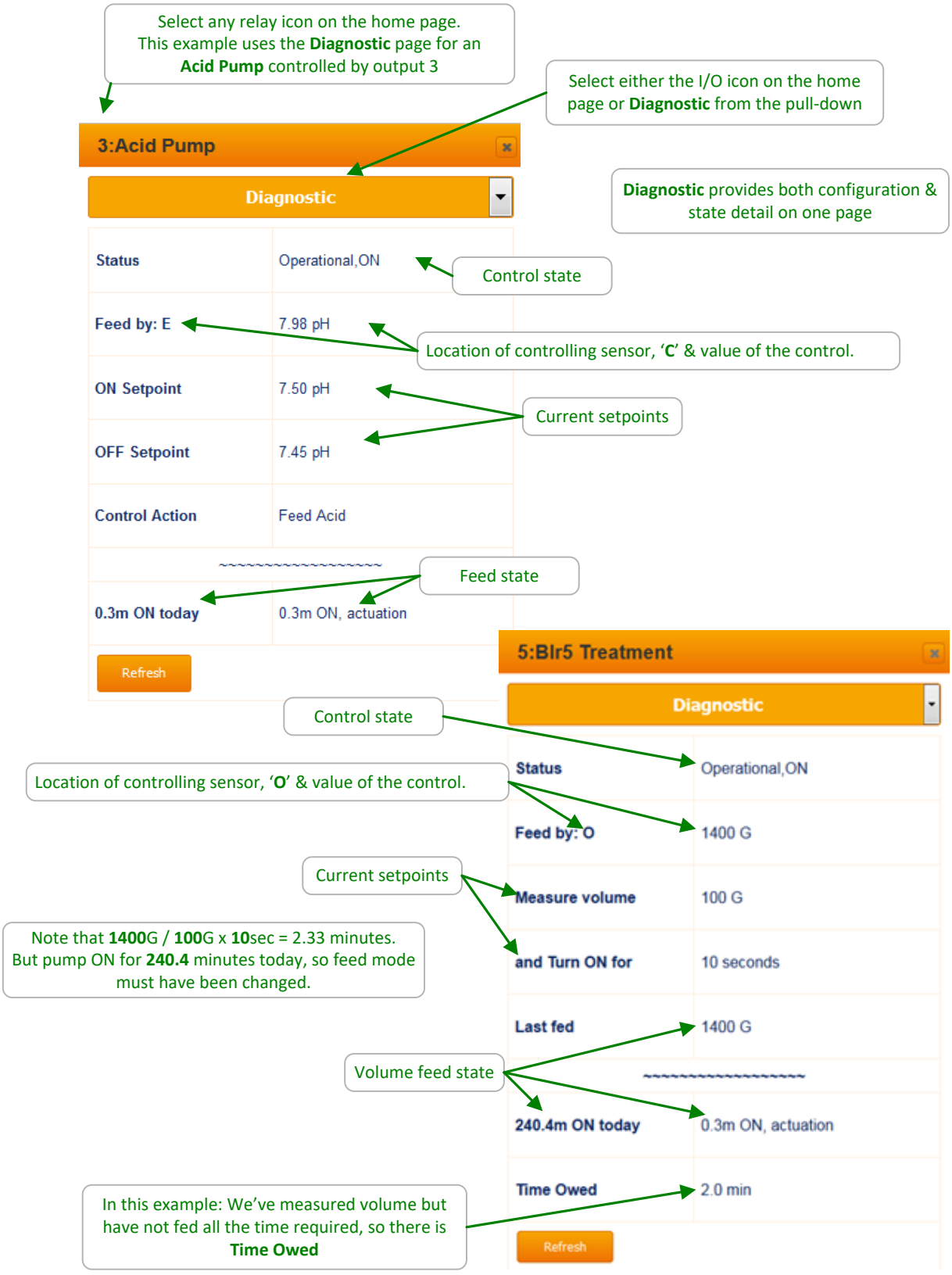
Sidebar:
Warning: A poorly conceived block may prevent a control from running or working correctly.

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

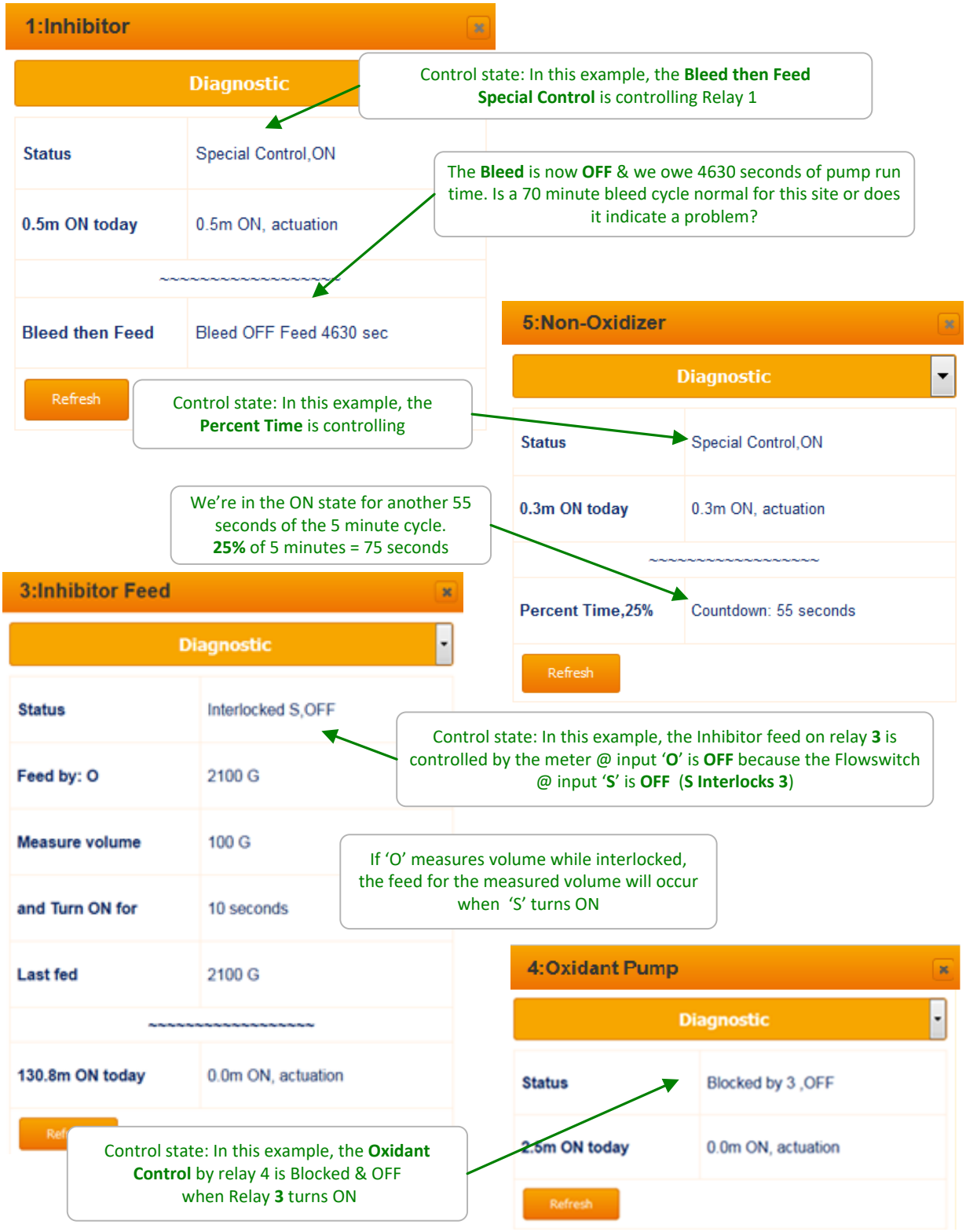
Generally (dependent on tower size, injection point & siting), once you've met the initial chlorine demand, setting ORP setpoints 5-10mV apart should result in short oxidant feed periods.

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

3.8 Feed Diagnostics

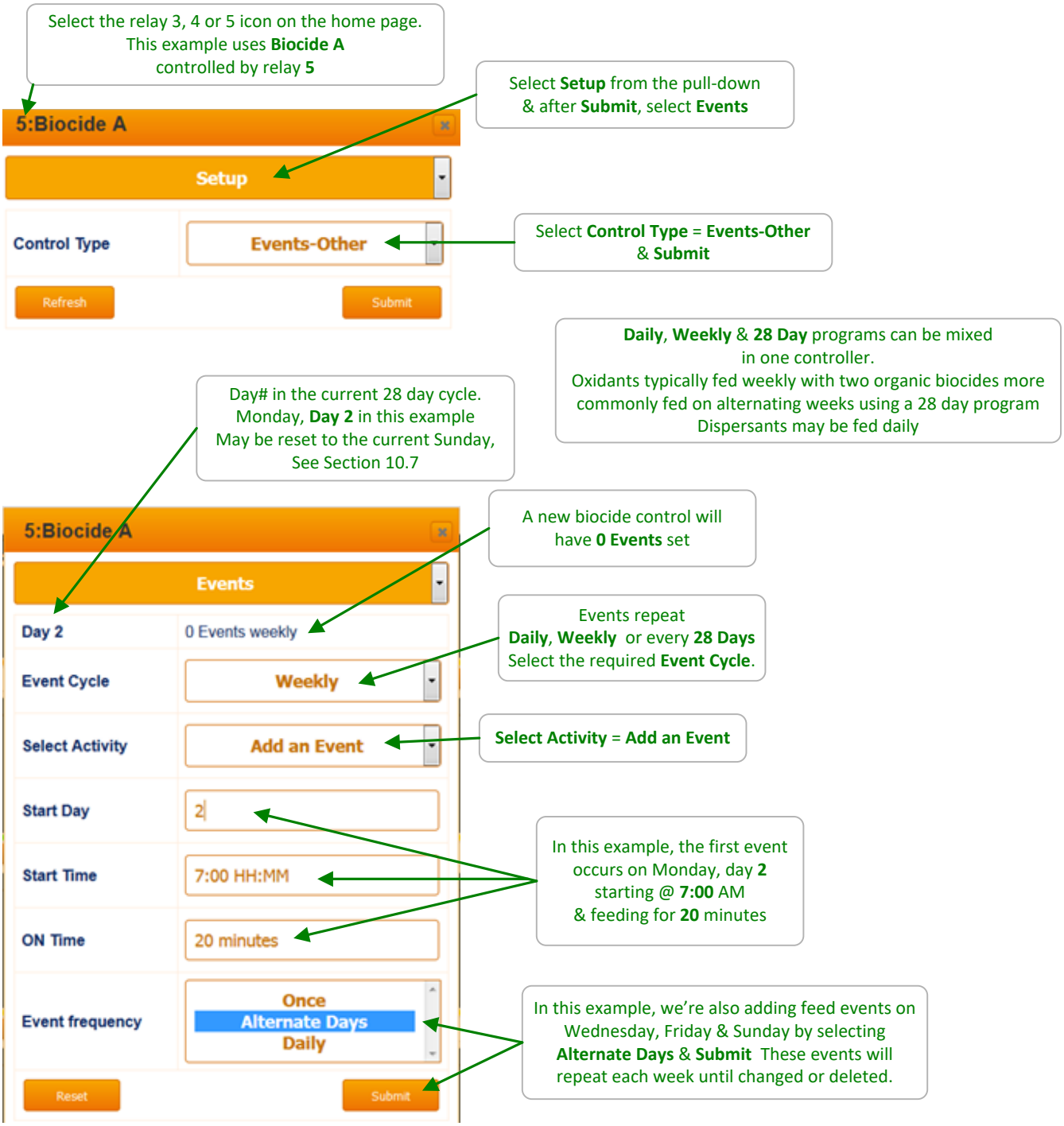


Feed Diagnostics cont.

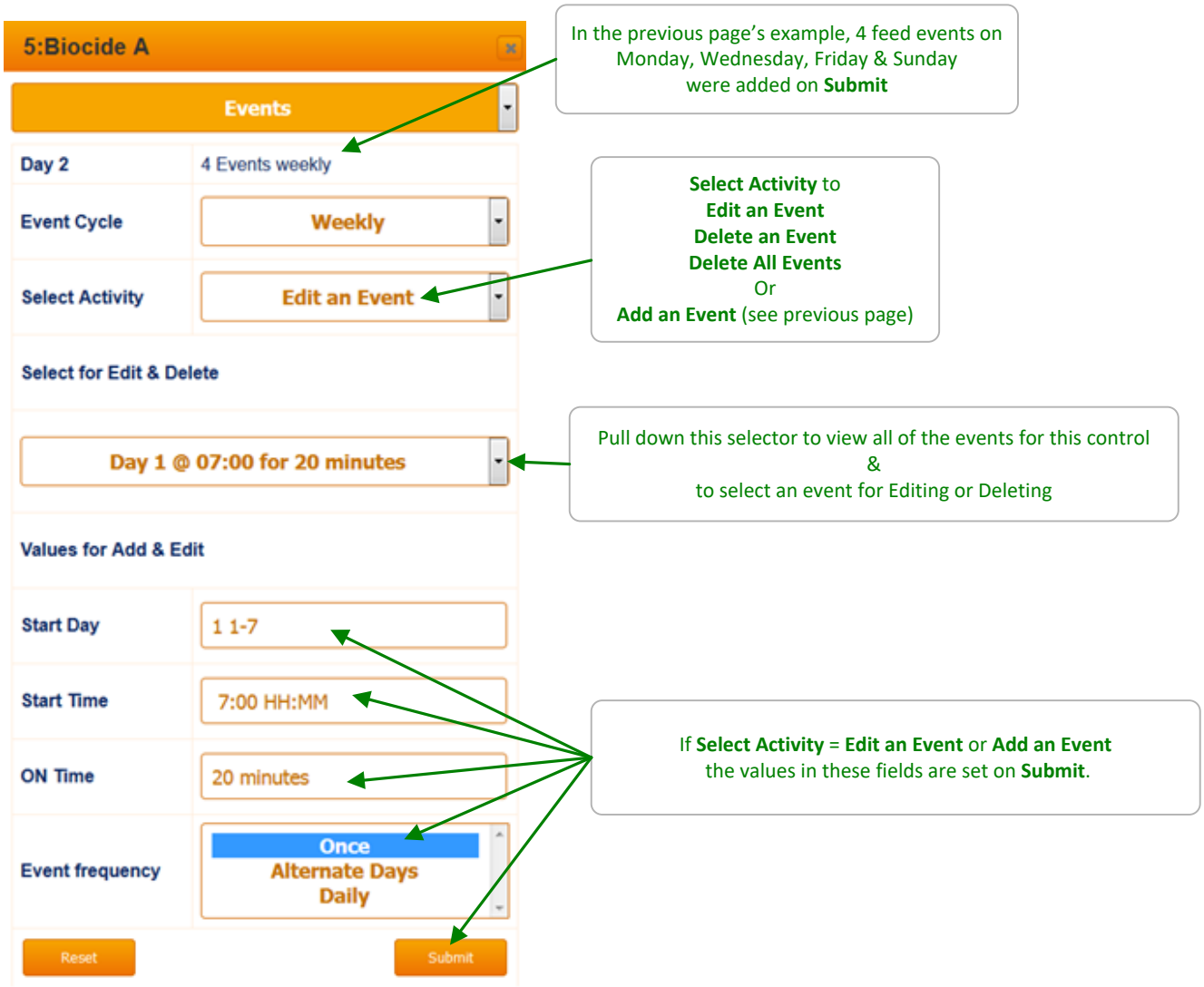


4 Biocide Events & Other Controls: Feeding by Time & Date

4.1 Setting & Viewing Events



Setting & Viewing Events cont.

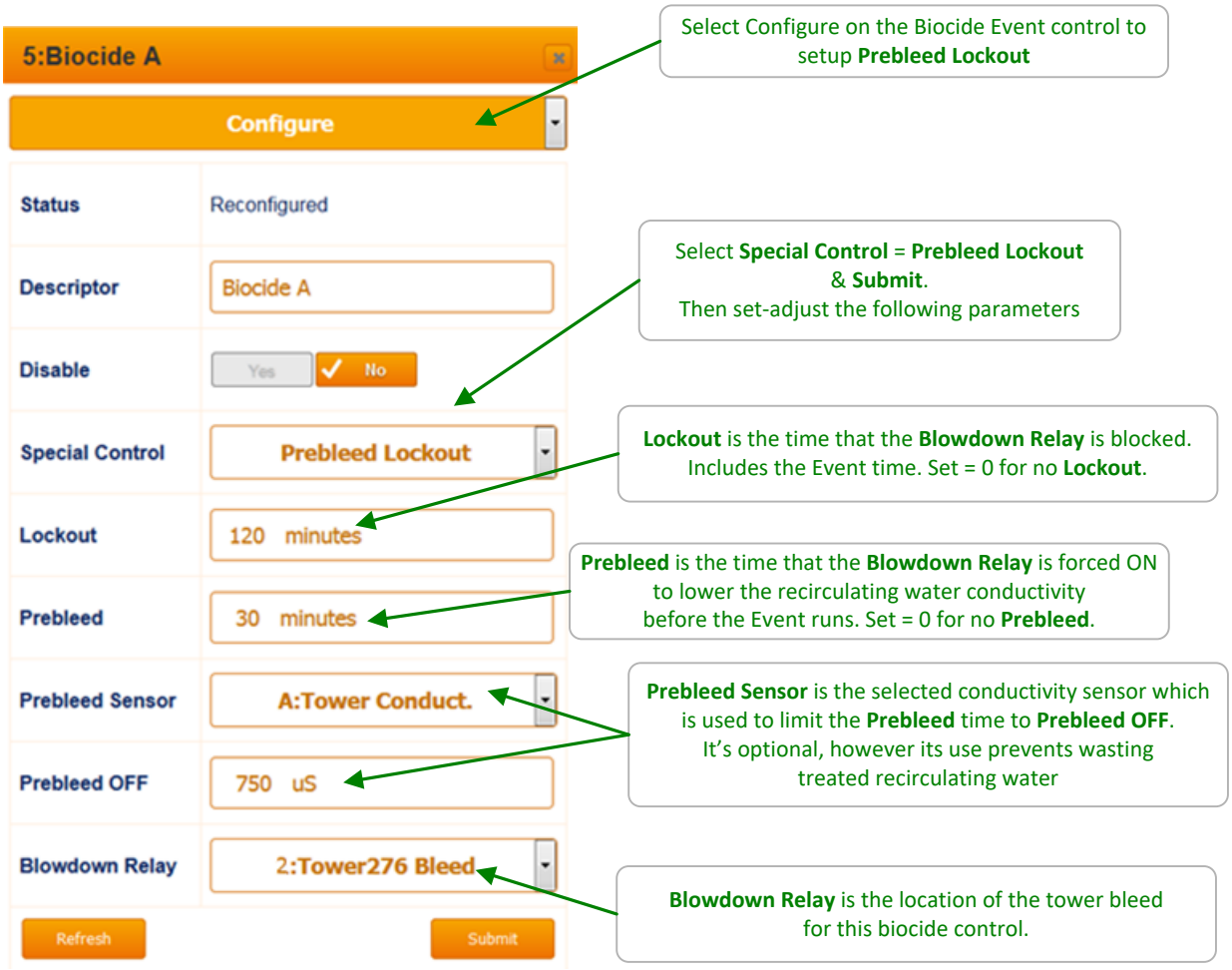


Sidebar:
Limit Alarms, Interlocking & Blocking also are used with Biocide Events.
They are set identical to those for **Chemical Feed Controls**.
Refer to Sections **3.6 and 3.7** for setup & state pages.

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….

4.2 Prebleed – Lockout

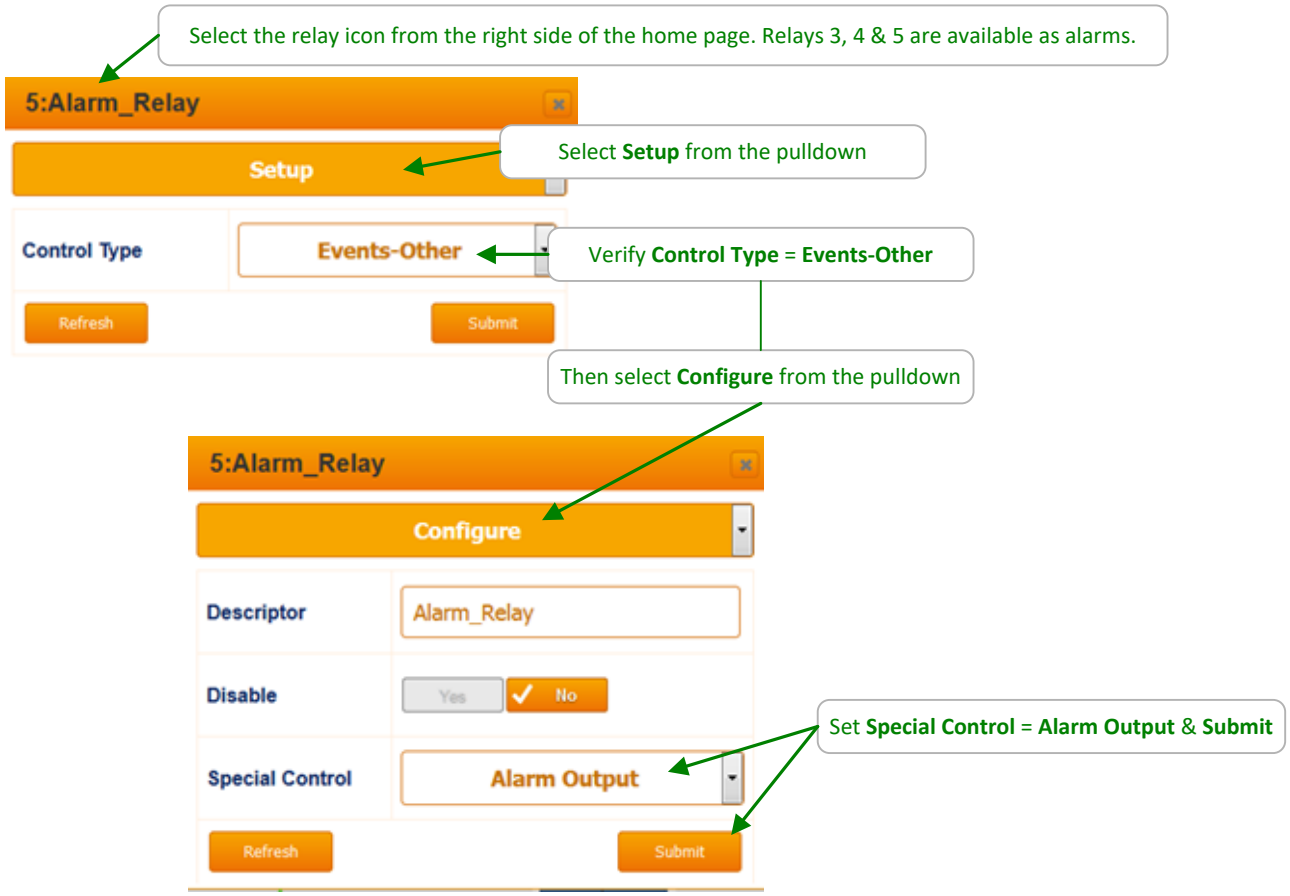


Sidebar:
Prebleed-Lockout is used to prevent to tower from making up during & diluting the biocide concentration. Use is determined by biocide type & required concentration-residence time

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.

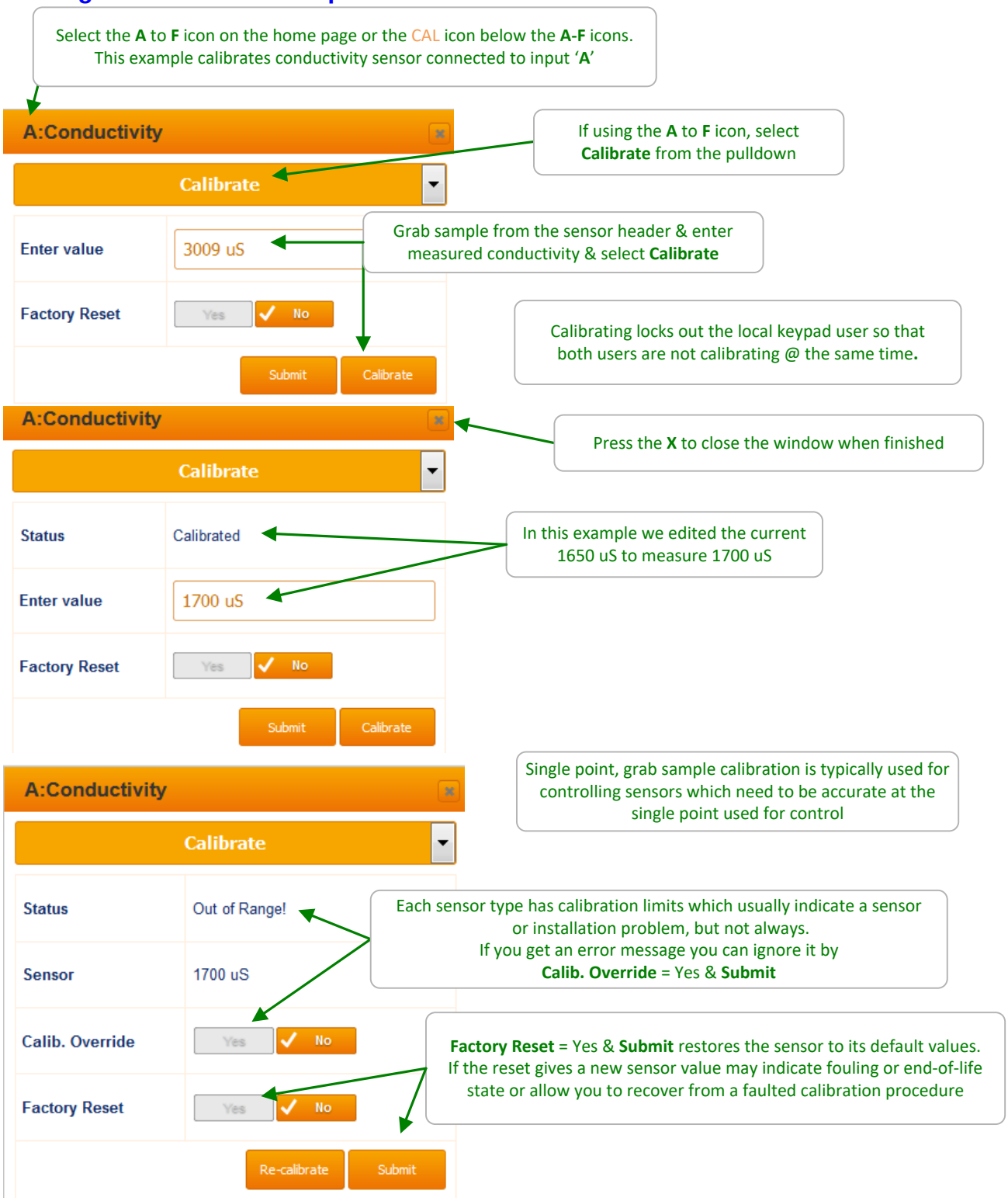
4.3 Alarm Relay



5 Sensors: Conductivity, Temperature, pH & ORP

5.1 Sensor Calibration:

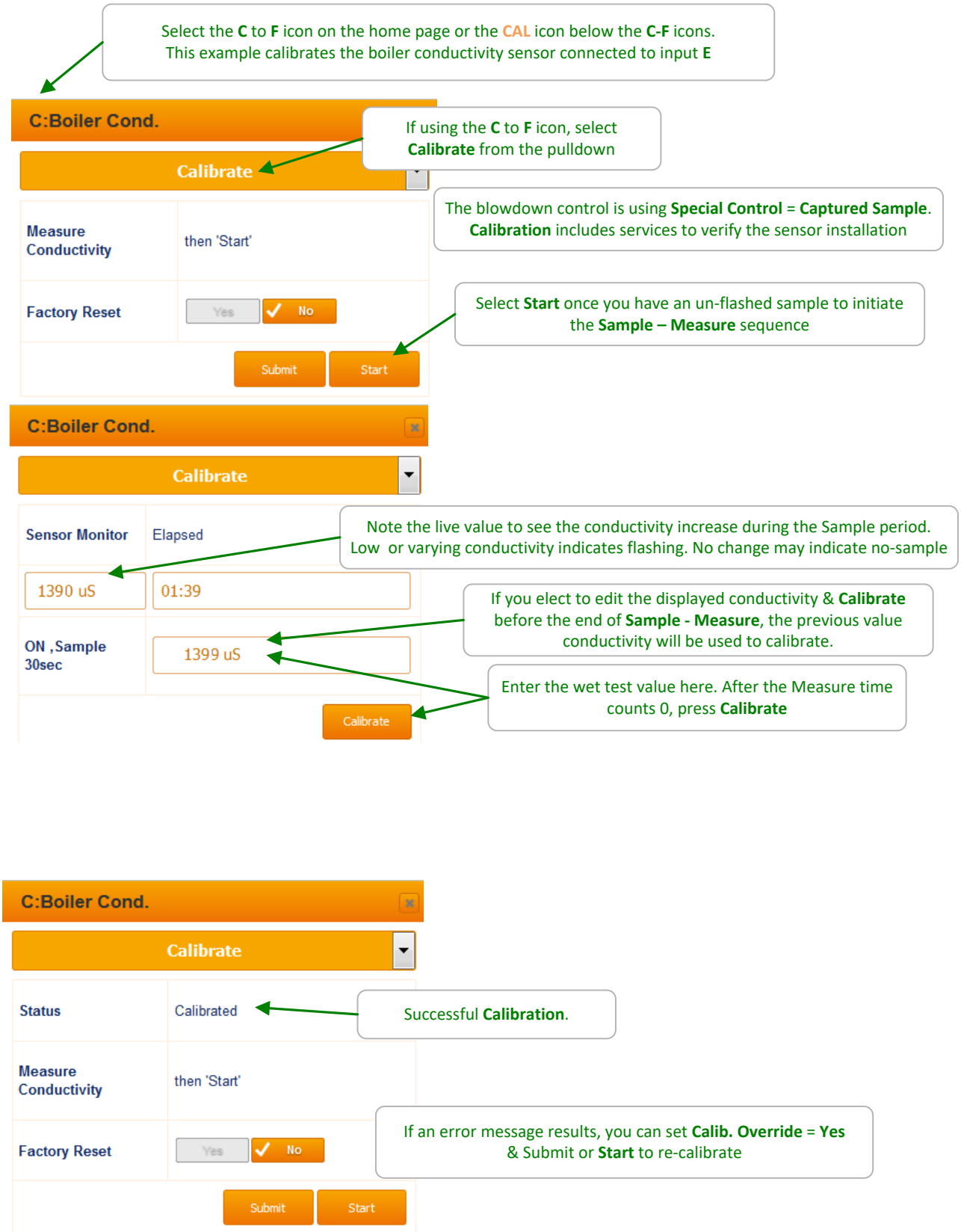
5.1.1 Single Point – Grab Sample



Slimflex 5 Browser

5.1 Sensor Calibration:

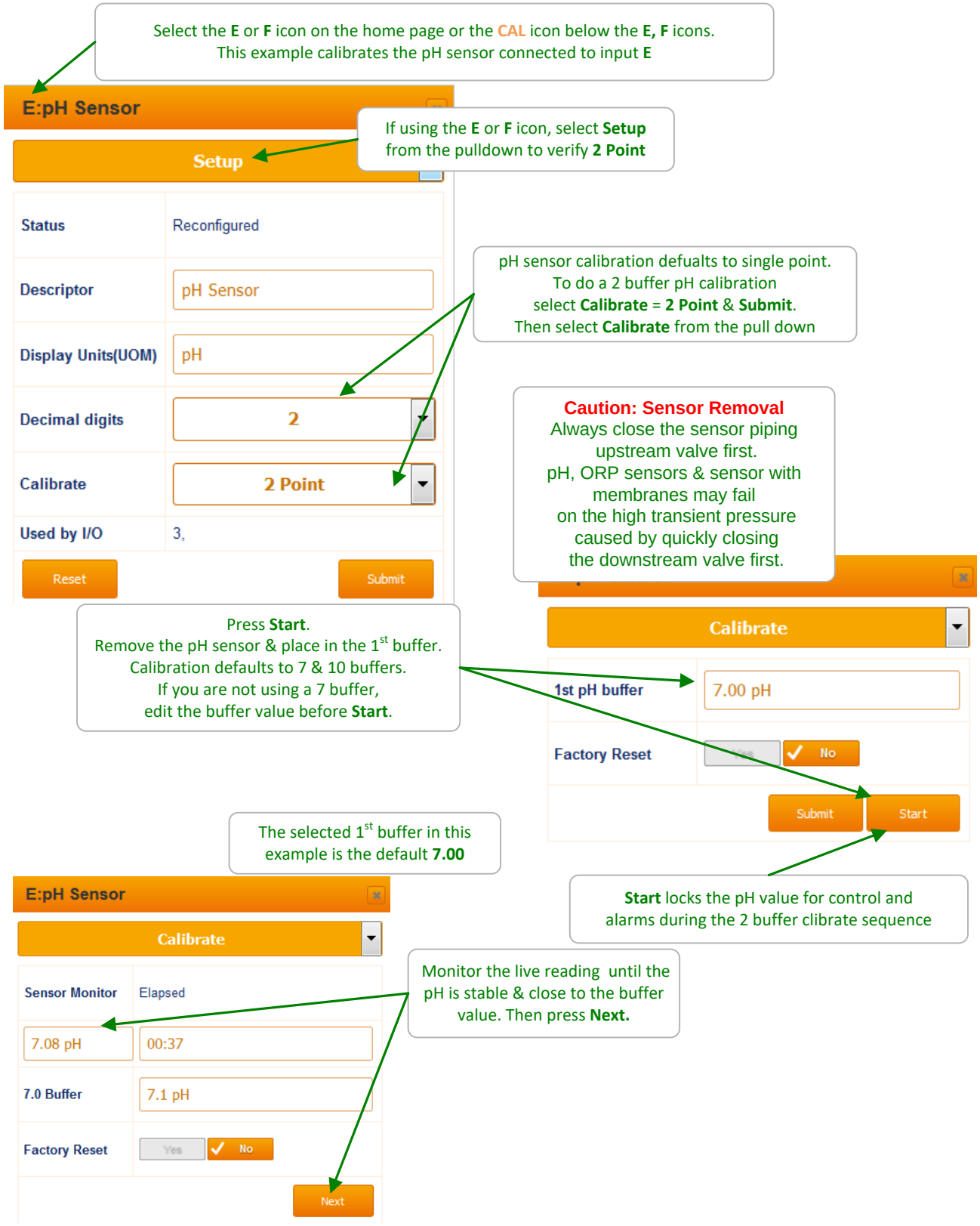
5.1.2 Boiler Conductivity



Slimflex 5 Browser

5.1. Sensor Calibration:

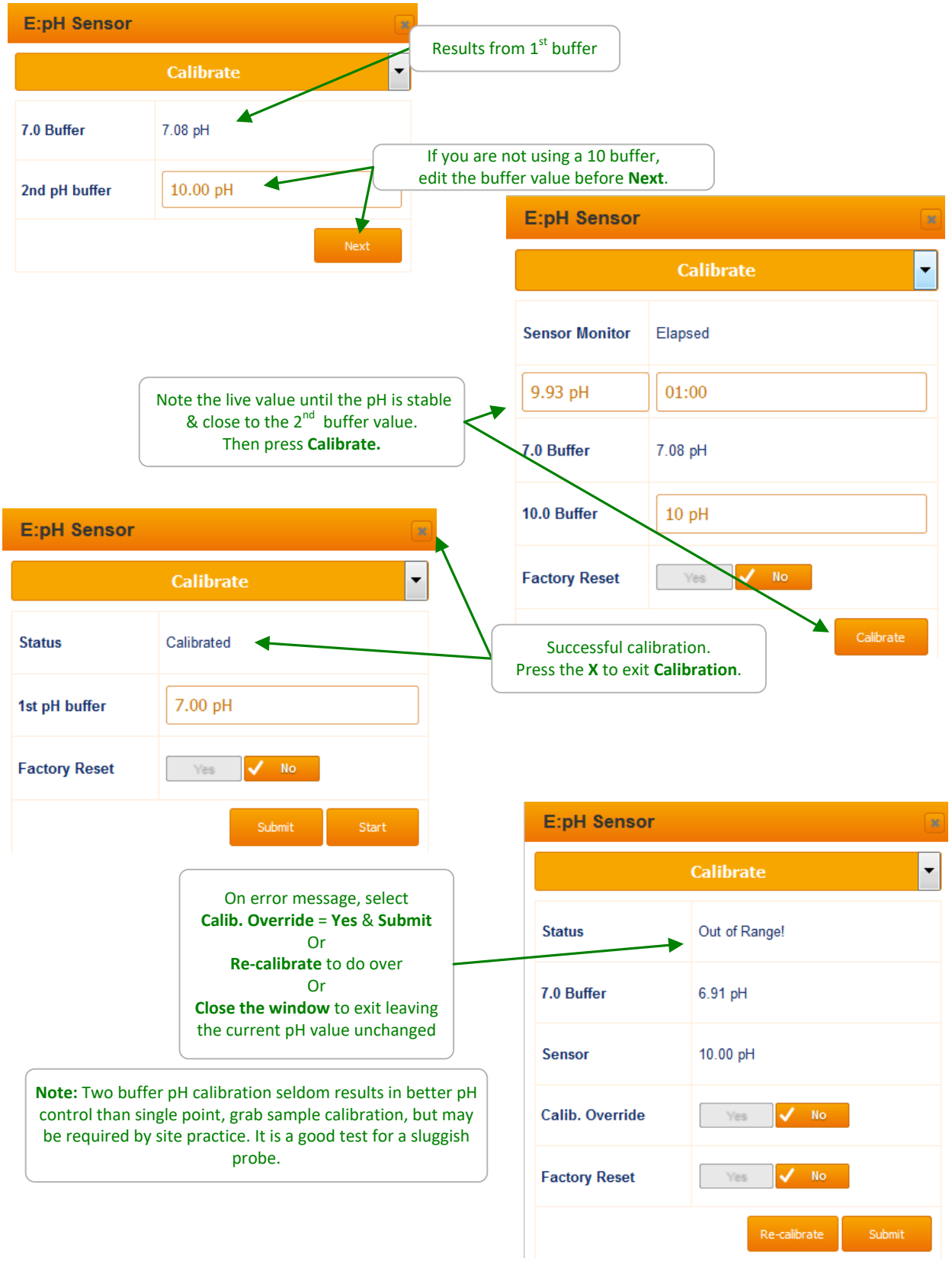
5.1.3 pH Dual Buffer Calibration 1 of 2



Slimflex 5 Browser

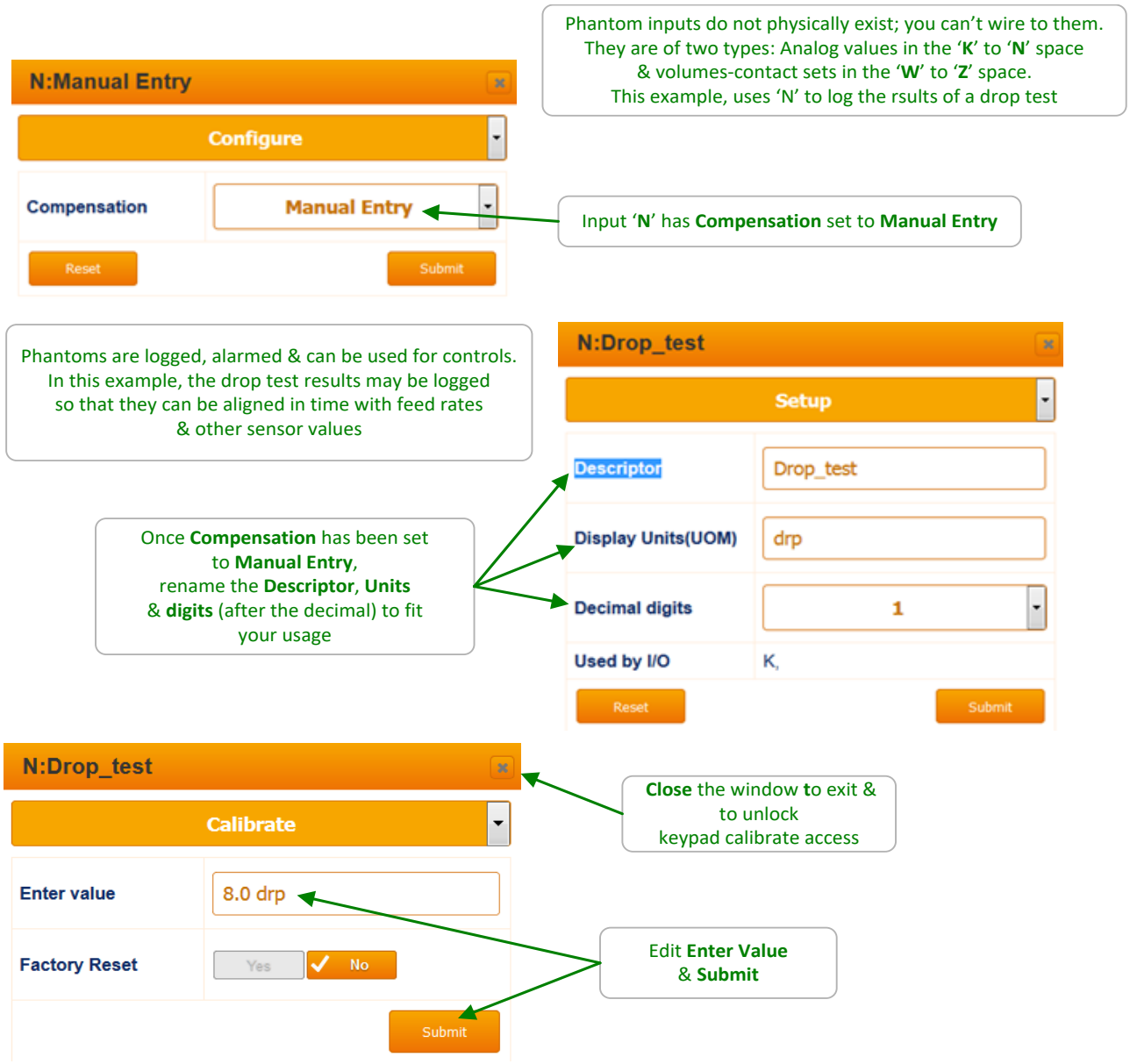
5.1 Sensor Calibration:

pH Dual Buffer Calibration 2 of 2



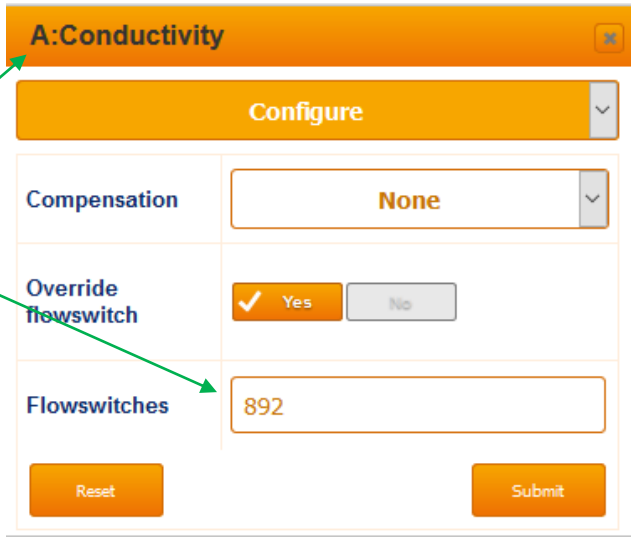
5.1 Sensor Calibration:

5.1.4 Manual Inputs

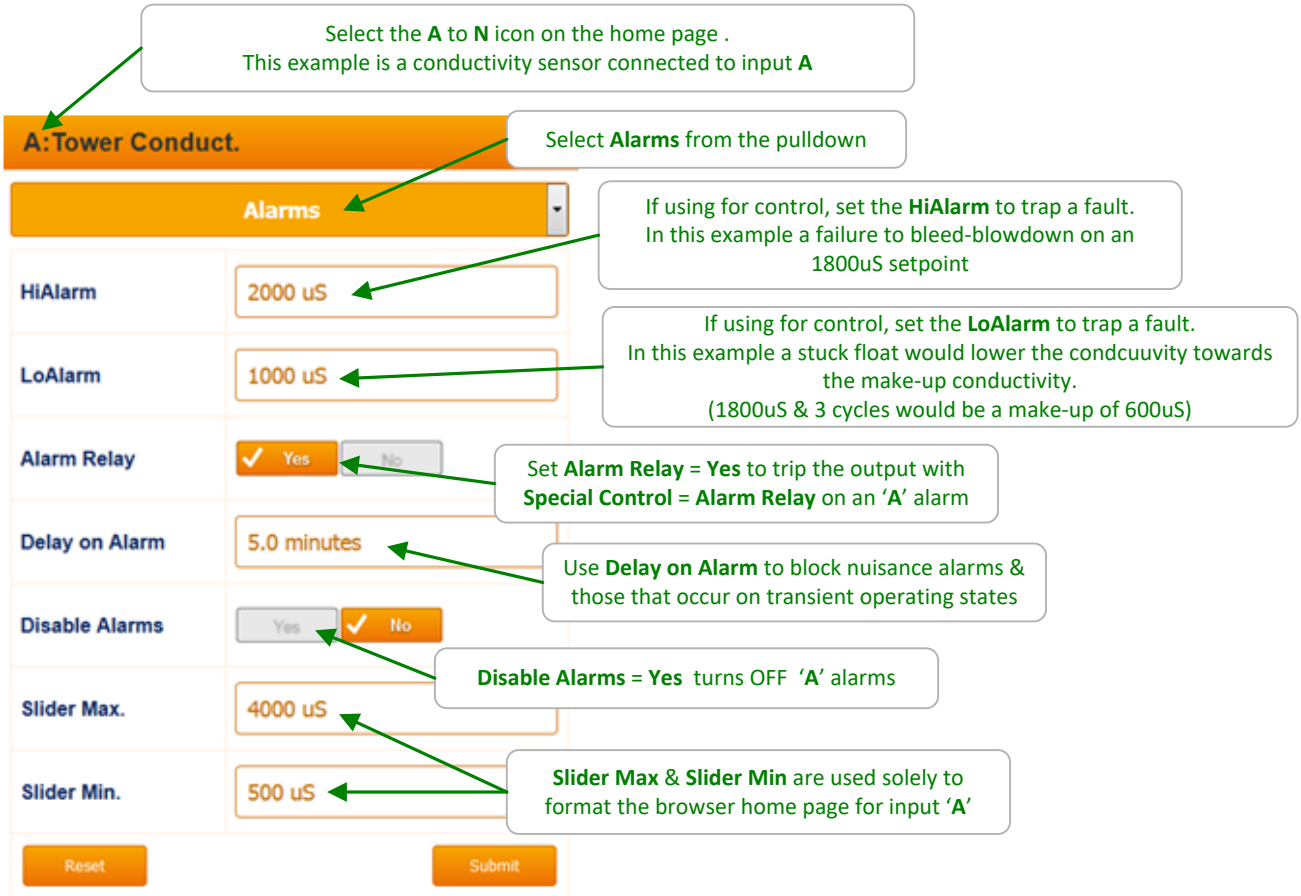


5.1.5 CTFS Flowswitch Calibration

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.



Slimflex 5 Browser
5.2 Sensor Alarms 1 of 2

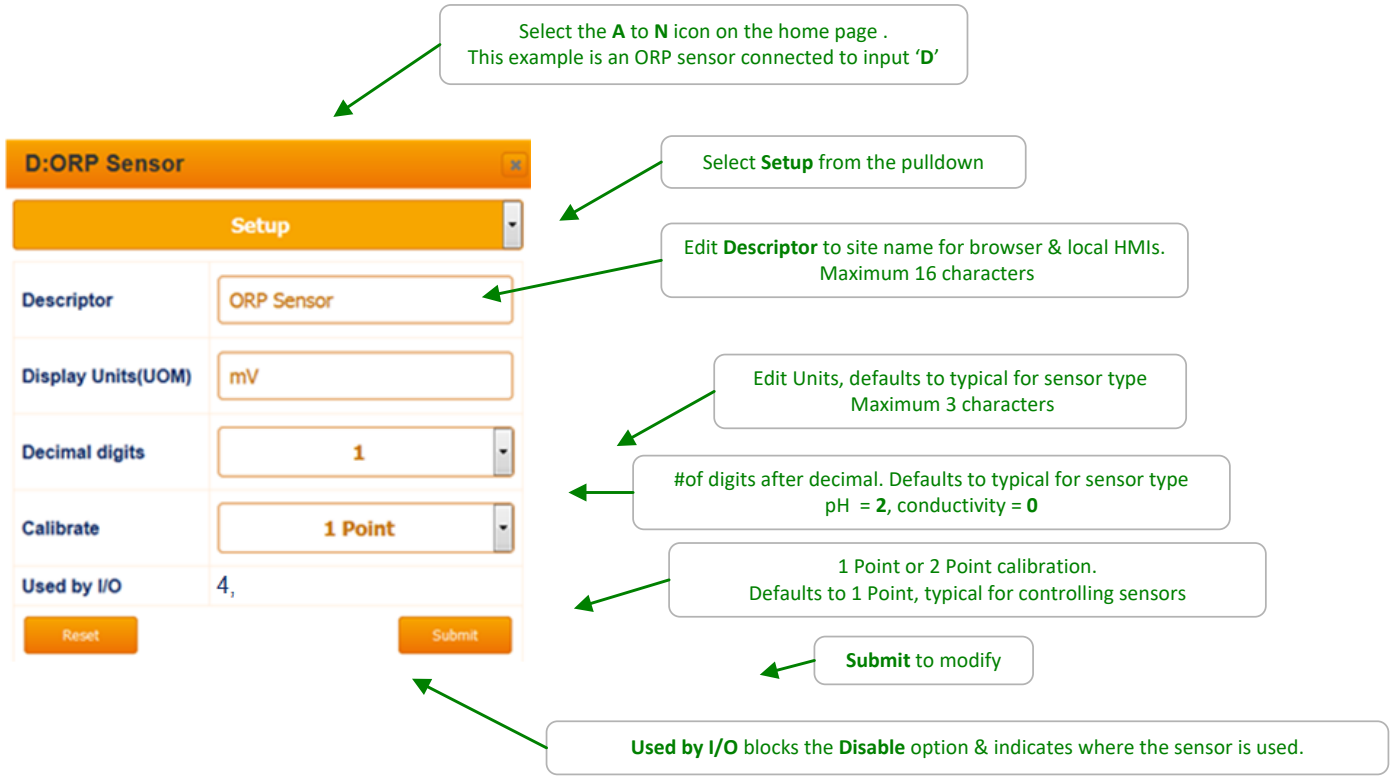


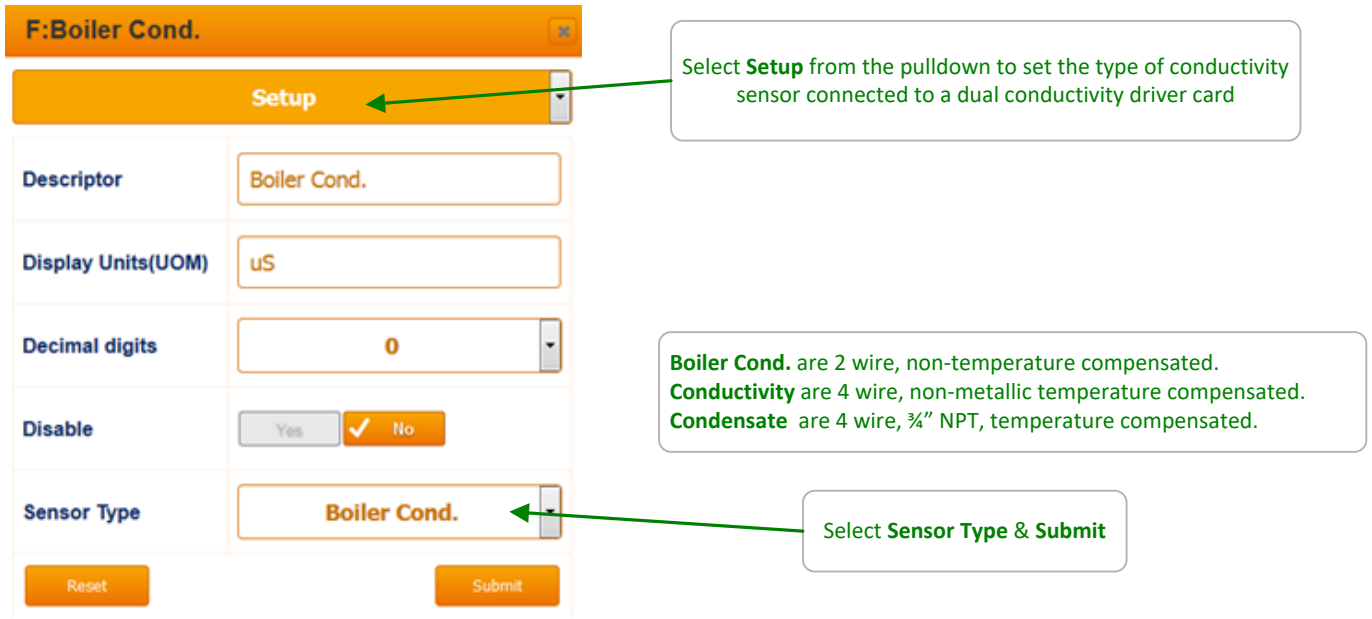
Sidebar:
Every sensor, water meter, flowswitch & each control has alarms.
Typically alarms are used to trap changes in operating conditions (make-up water, temperature..) mechanical faults (stuck floats, valved off or faulted blowdown-valves), feed issues (loss of prime, low tank level, tubing faults)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

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

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

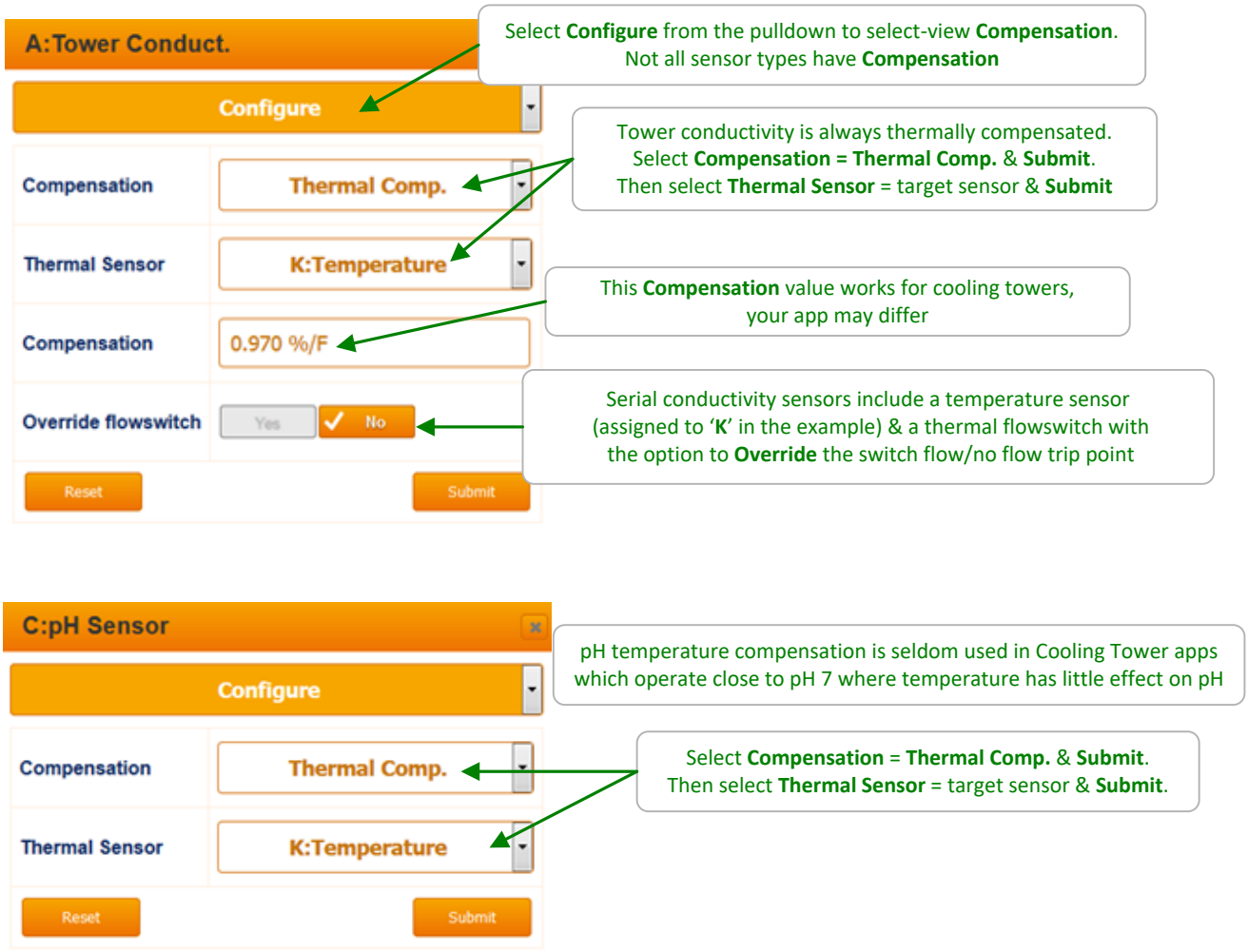
5.3 Sensor Setup 1 of 2





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

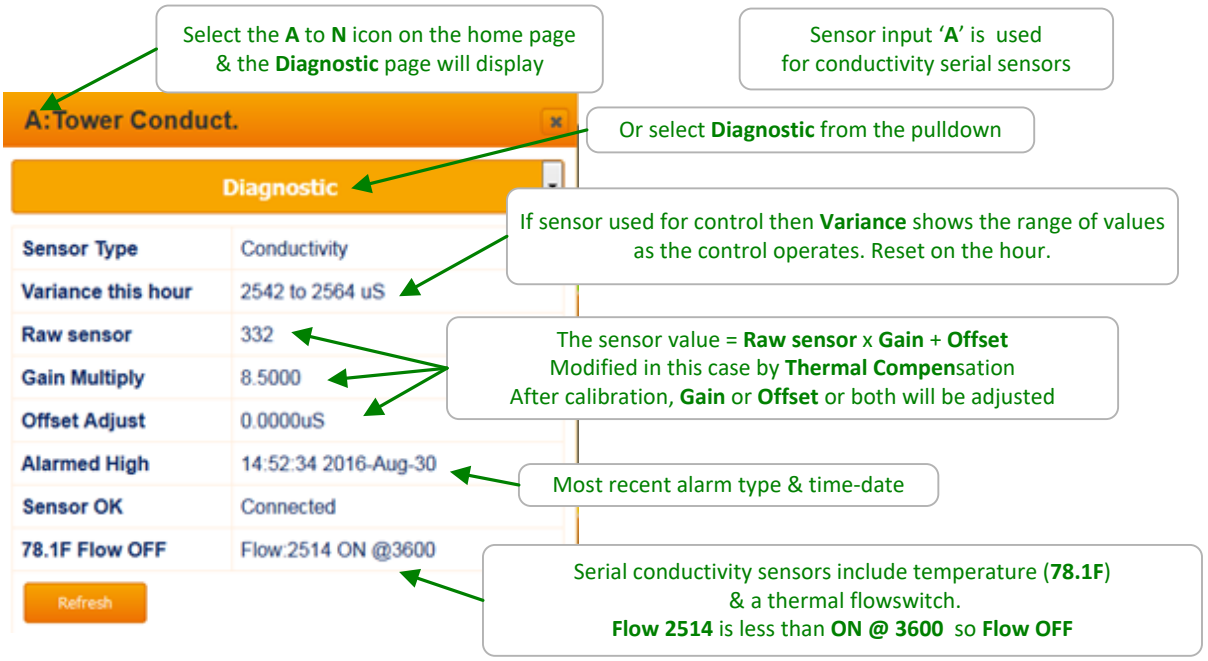
5.4 Sensor Compensation

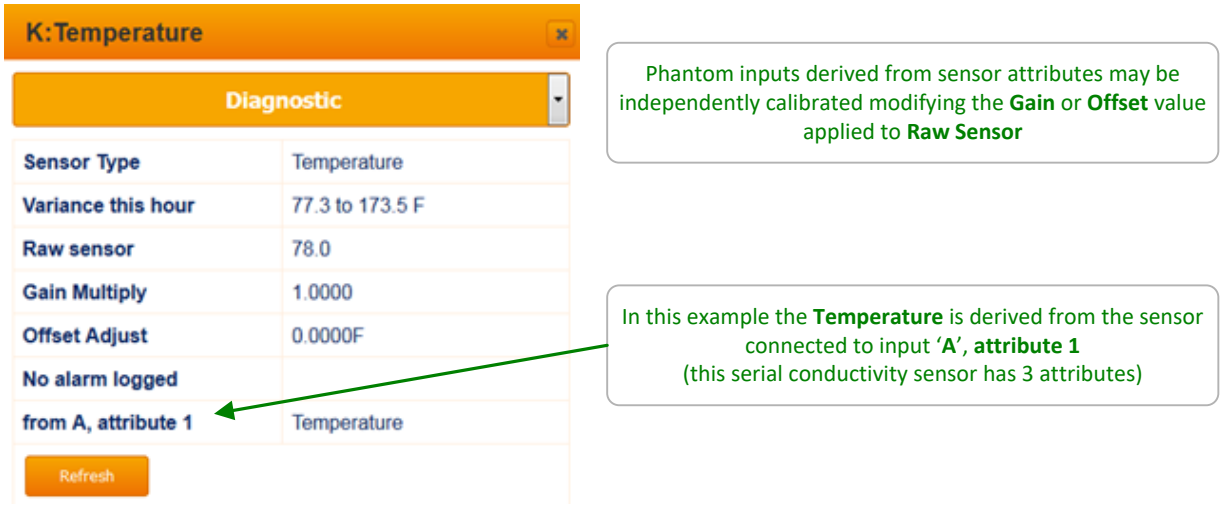


Sidebar:
Controllers are typically pre-configured for the target app.
So cooling tower controllers will include temperature compensated conductivity.

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

5.5 Sensor Diagnostics 1 of 2



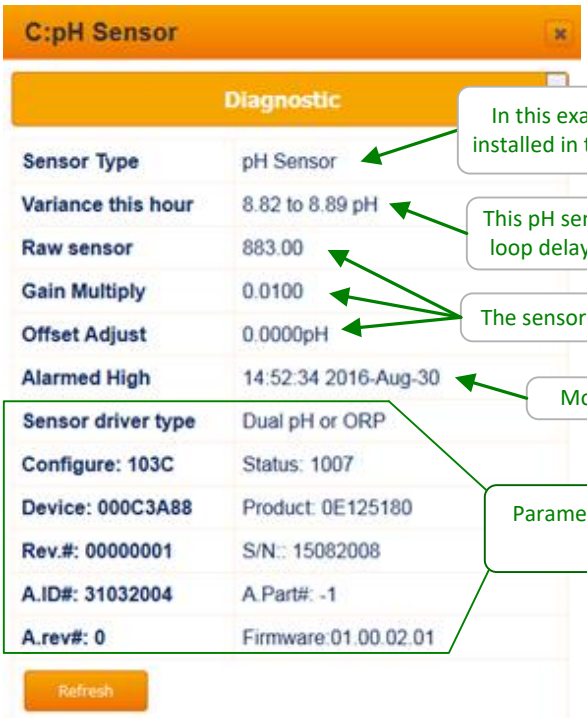


Sidebar:
Diagnostic is a summary of the sensor state.
Contents vary widely with sensor type.

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



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

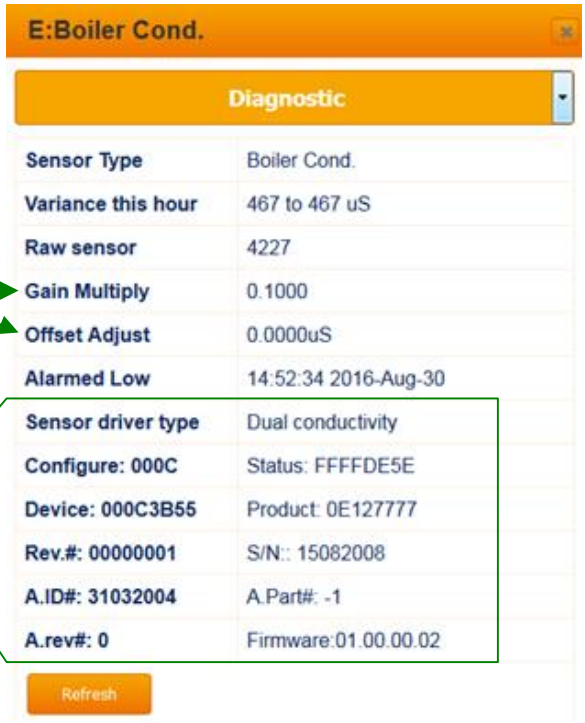
This pH sensor not used for control or the **Variance** would reflect the control loop delay dependant of feed point, sensor location & re-circ water volume

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

Most recent alarm type & time-date

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

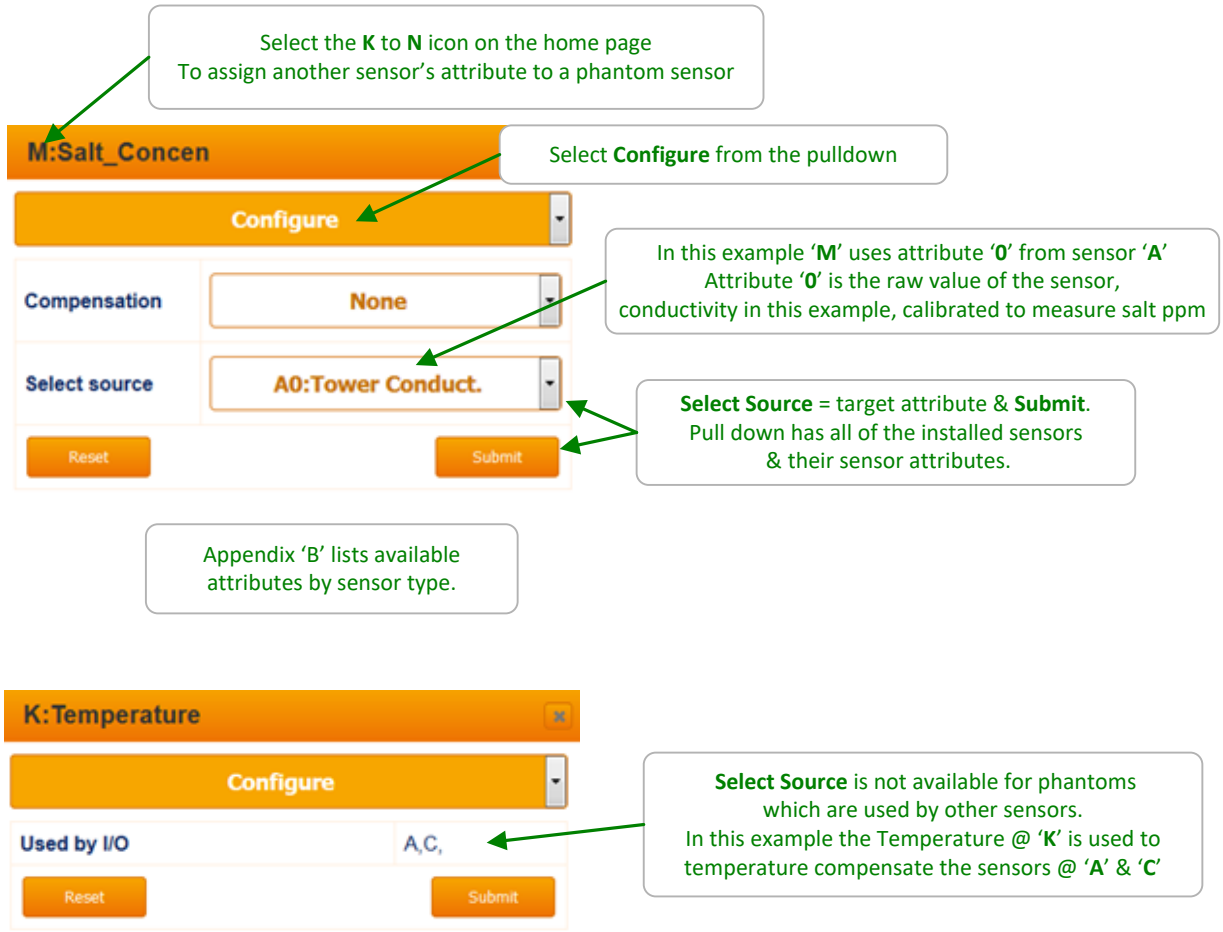
The sensor value = **Raw sensor** x **Gain** + **Offset**
Single point calibration modifies the **Gain** or **Offset** (varies with sensor type)
Two point calibration modifies both the **Gain** & **Offset**



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

5.6 Using Sensor Attributes for Phantoms

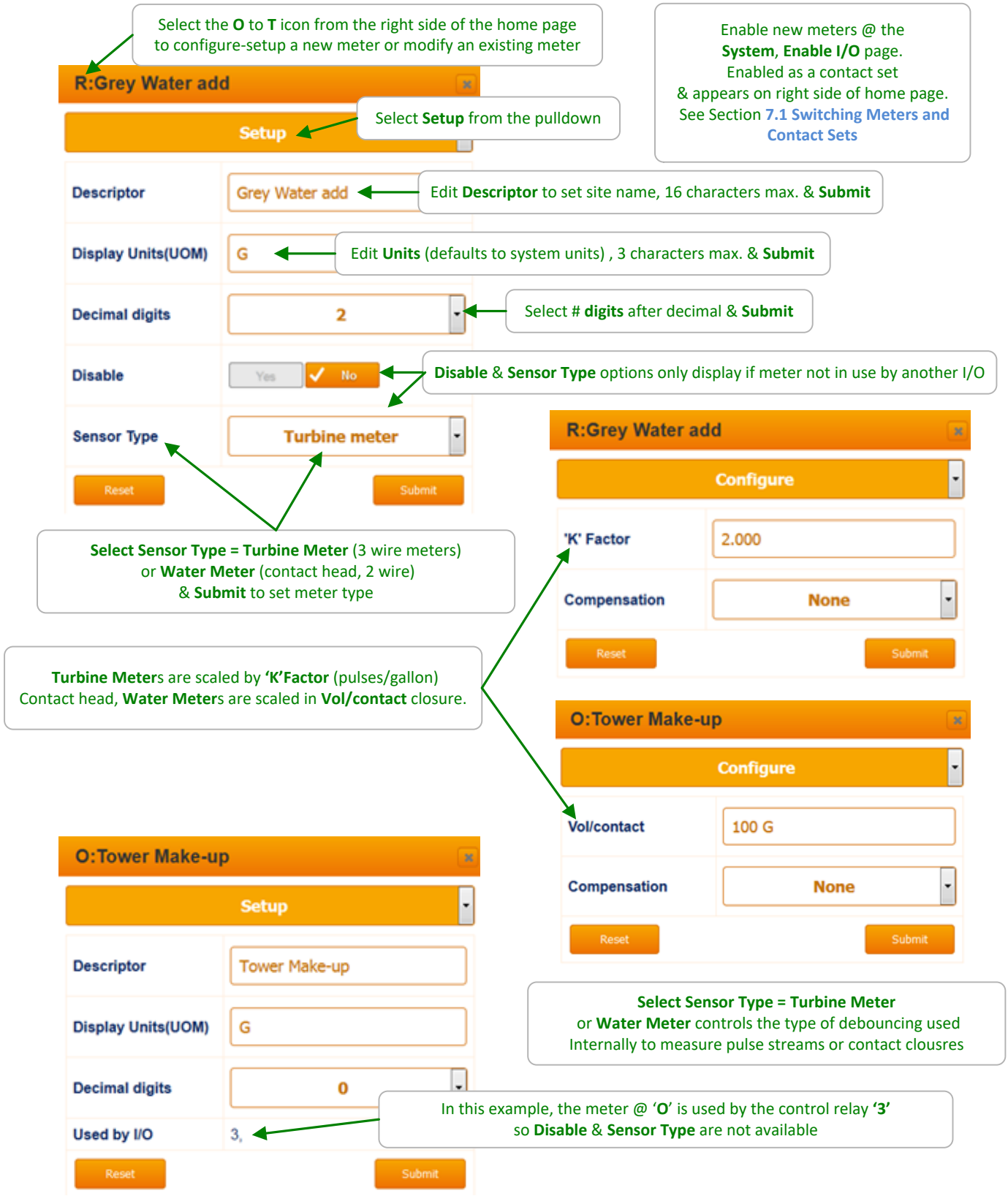
Analog Phantom sensors are input '**K**' through '**N**' and can be enabled from the **System Enable I/O** page.
Once enabled they will automatically appear on the home page for the controller and can be assigned attributes from sensors or used for manual entries.



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.

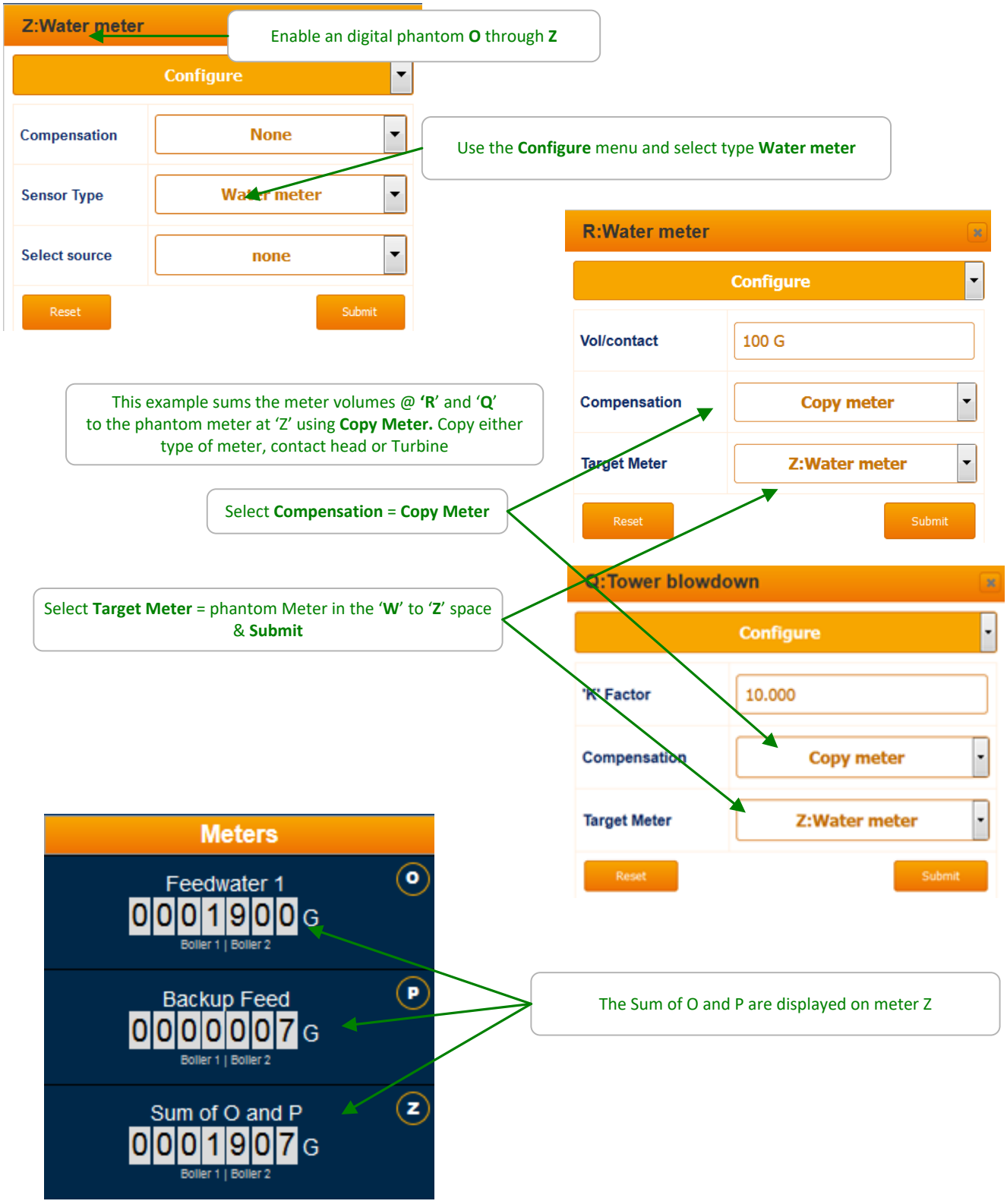
6 Measuring Volume: Water Meters

6.1 Configuring a New Meter



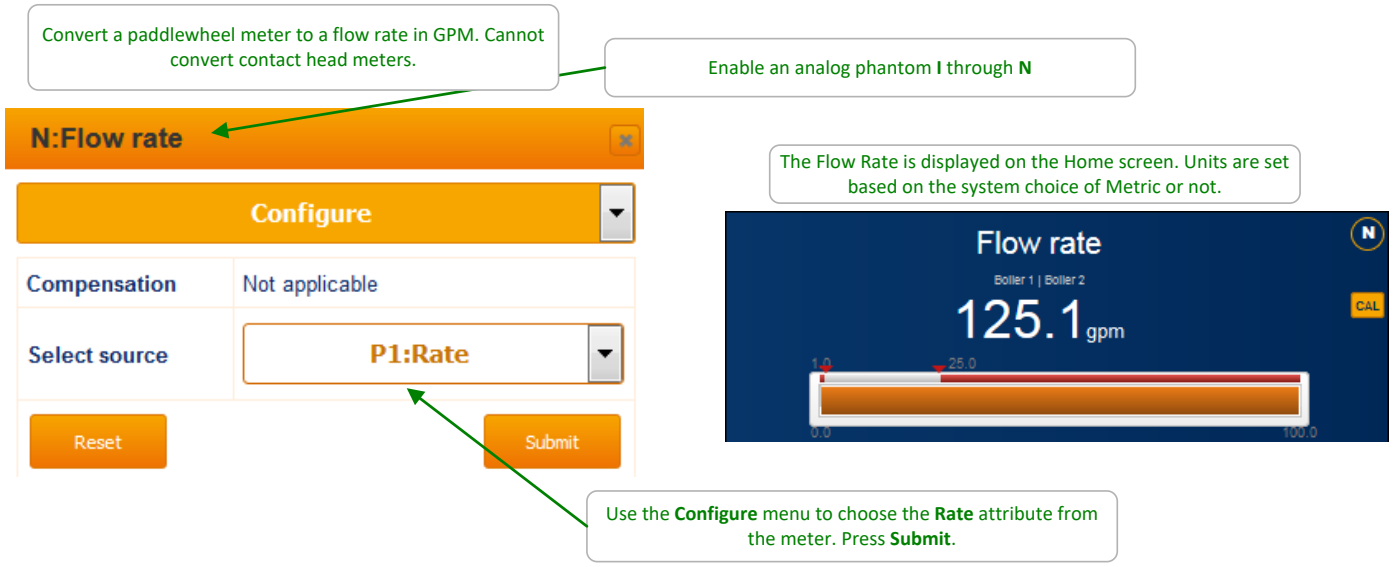
6.2 Copying Meters,

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



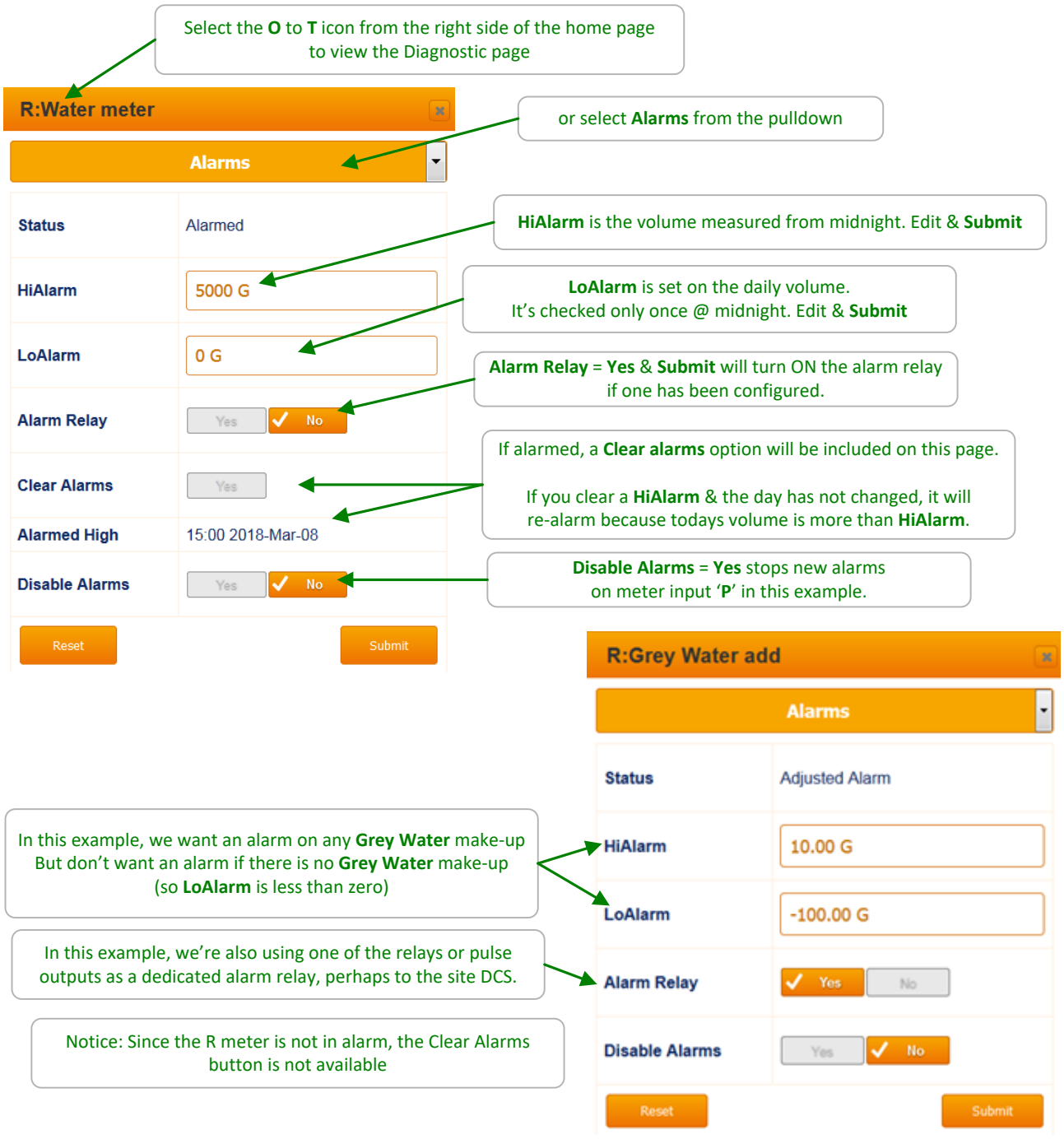
6.3 Flow Rate Conversion

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.



6.4 Meter Diagnostics

6.5 Meter Alarms



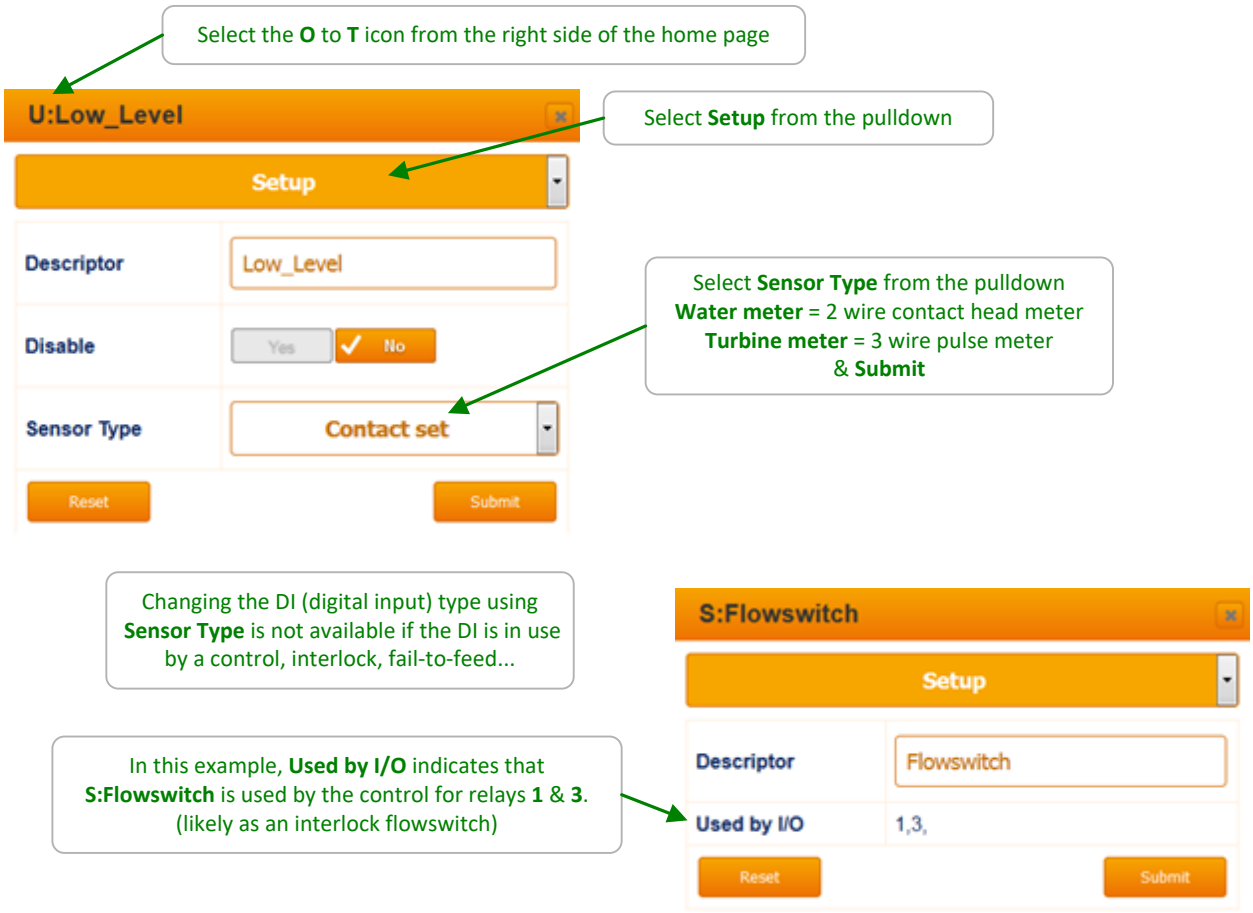
7 Flowswitches, Interlocks & Contact Sets

7.1 Switching Meters & Contact Sets

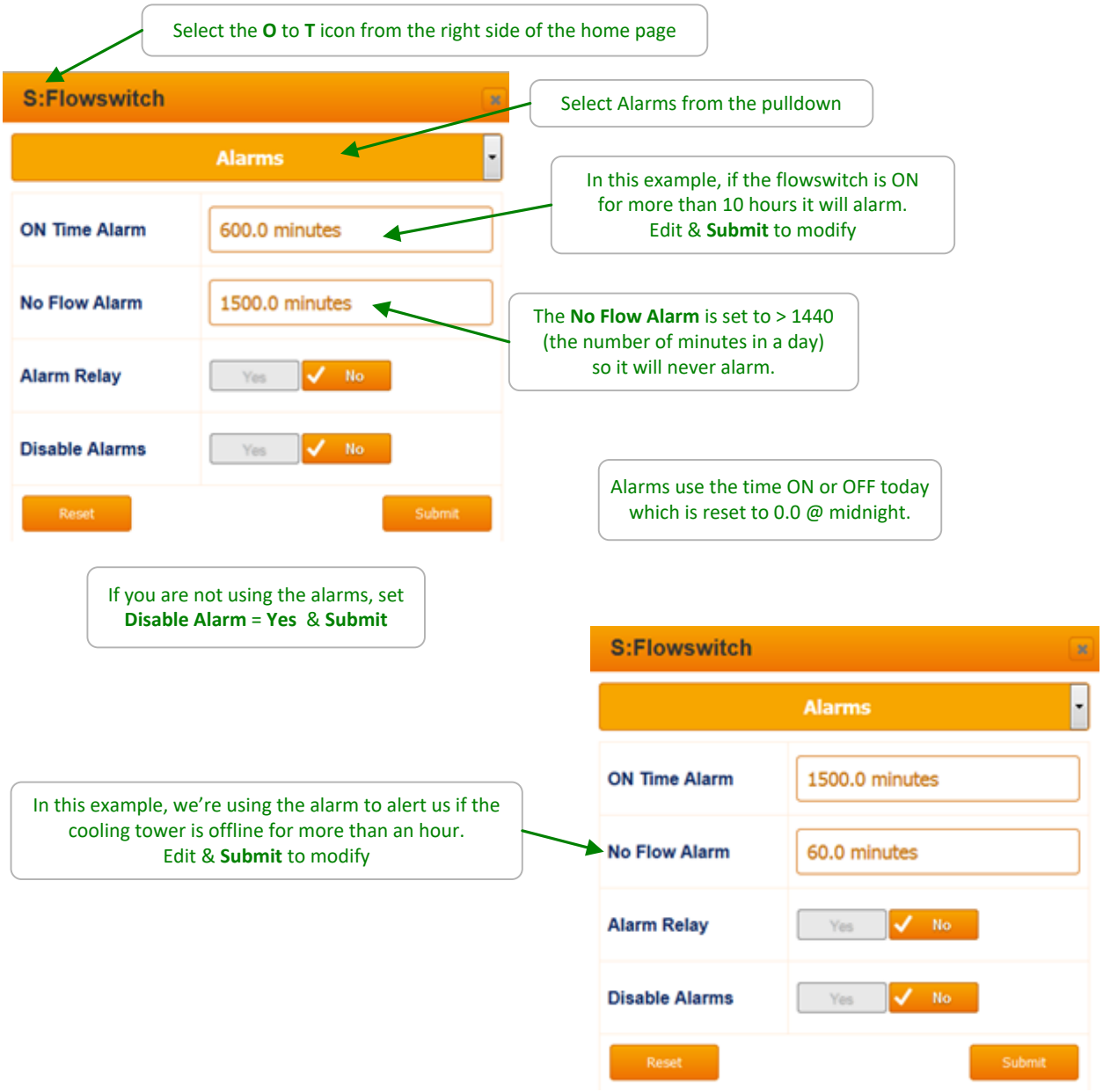
Volume meters and contact set inputs are connected in the '**O**' to '**T**' namespace.
They are also in the '**W**' to '**Z**' phantom space.
If the meter or contact set input is not being used for control, it can be re-purposed, making a contact set a meter or the reverse.

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).



7.2 Contact Set Alarms

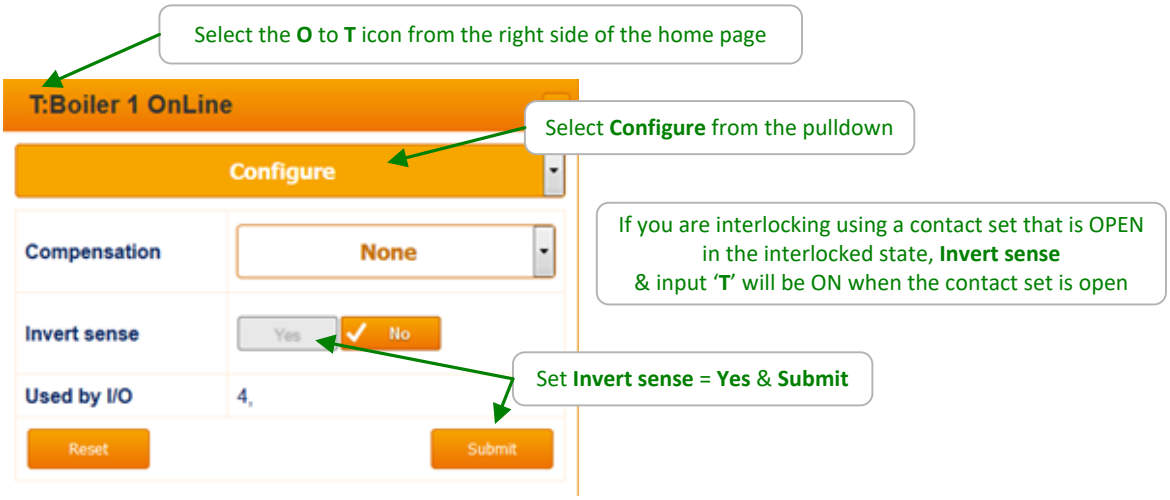


Sidebar:

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

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

7.3 Logically Inverting Contact Sets



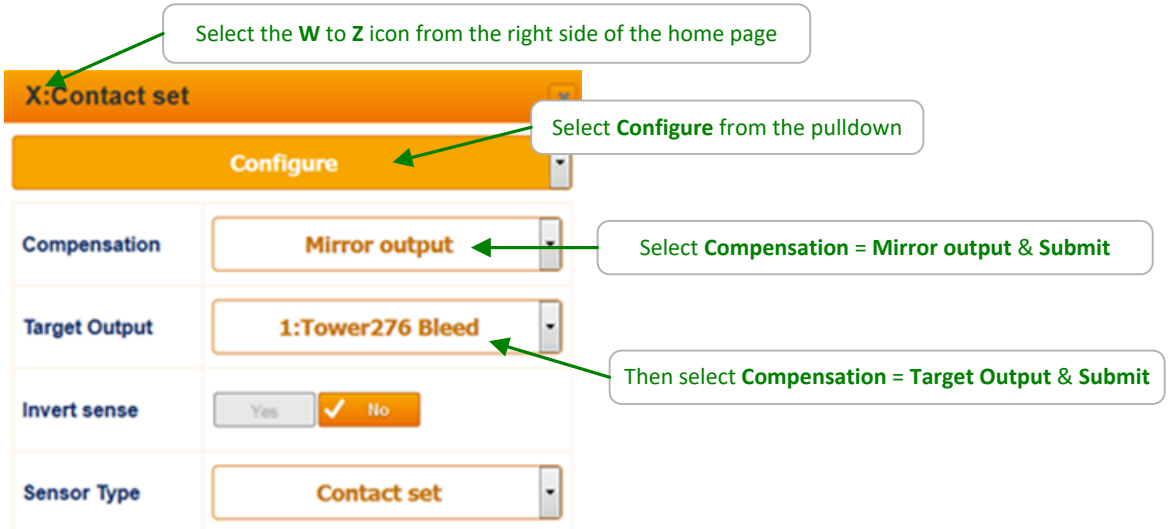
7.4 Mirroring a Control ON/OFF

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.

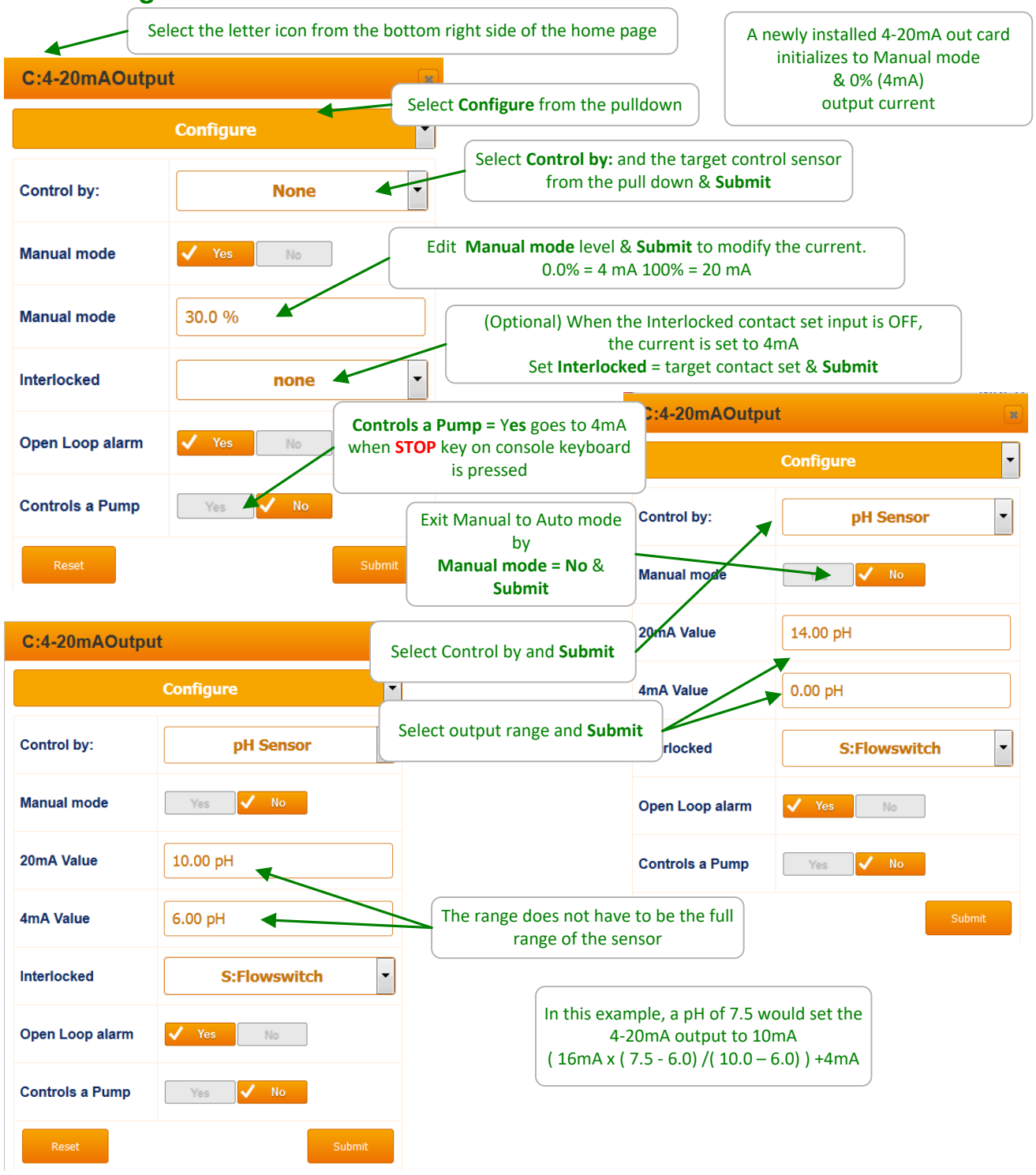
For example:
Site doesn't have a bleed meter installed but needs to feed into the bleed line whenever the bleed is ON (perhaps a de-chlor or a sequestrant for a component that's concentrated when the tower cycles up).
Relay 1 controls the bleed on conductivity
Relay 4 feeds the bleed line chemical, configured 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.



8 4-20mA Outputs

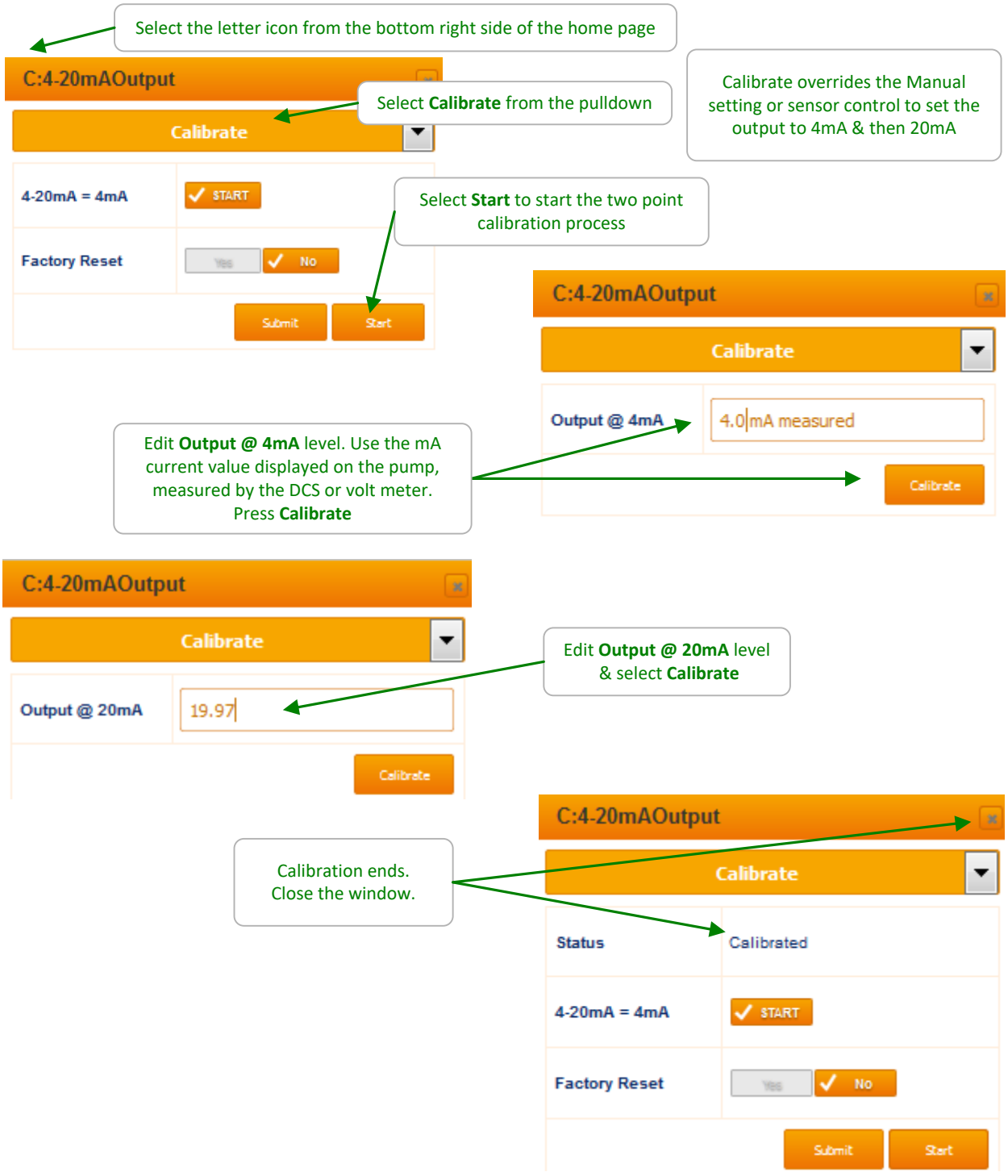
8.1 Configure: Manual-Auto Switch



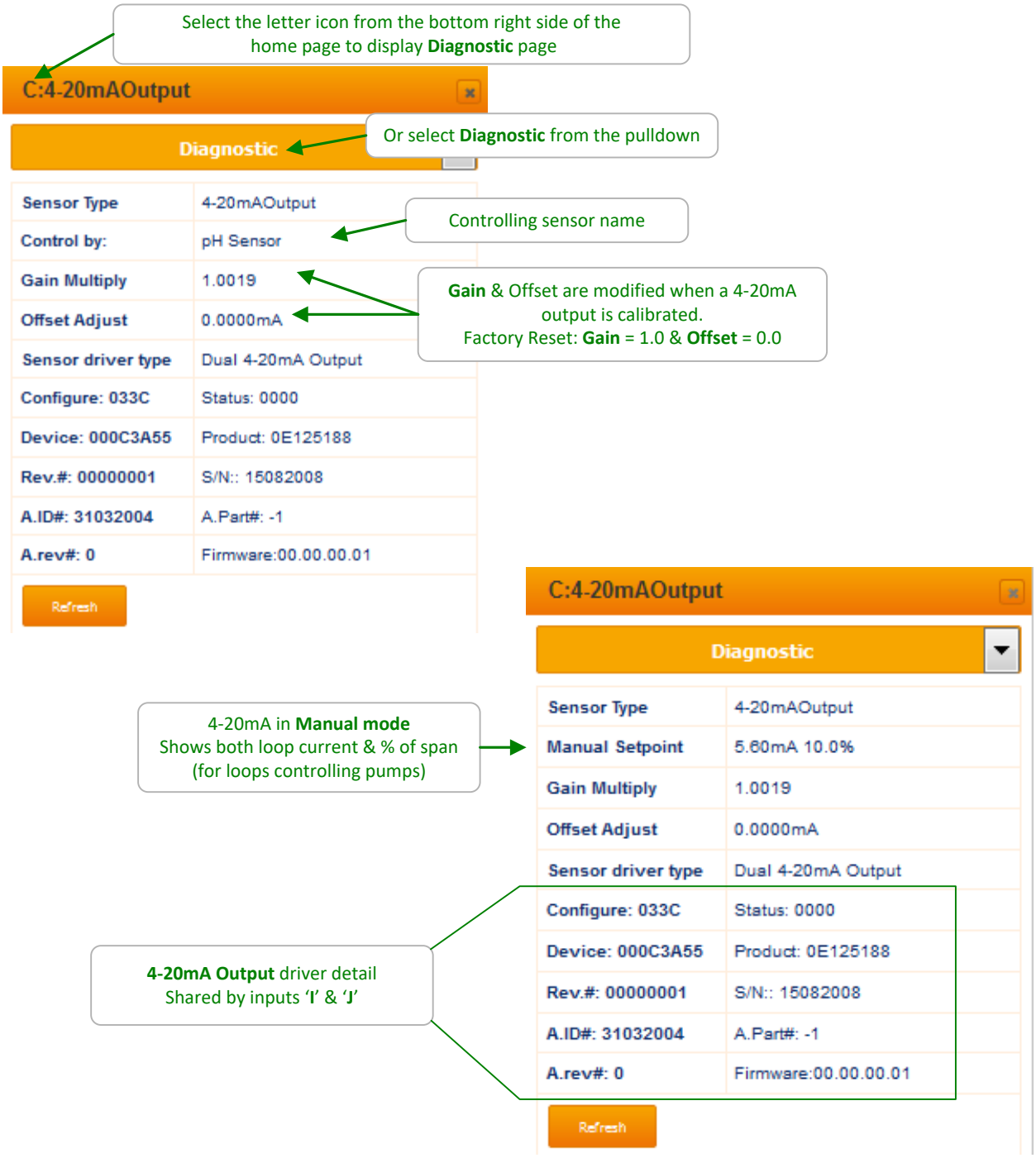
Sidebar: Manual Mode

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.

8.2 Calibrate



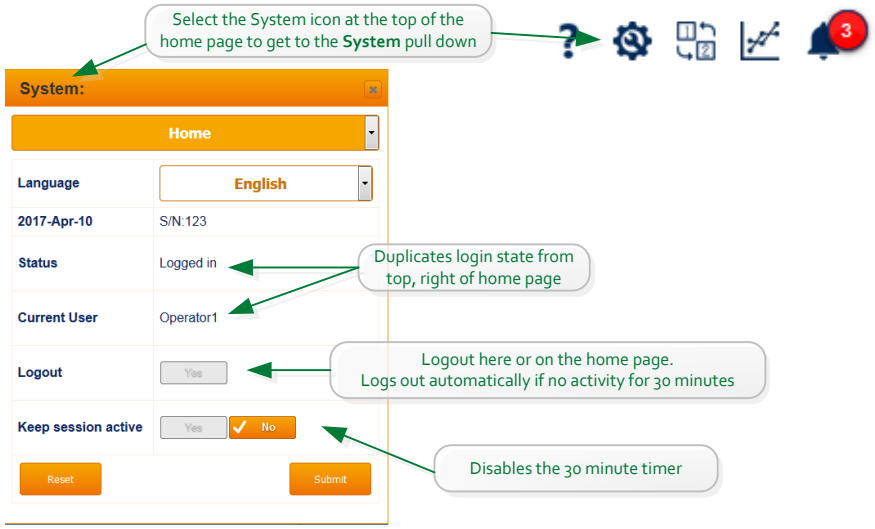
8.3 Diagnostic & Mirroring

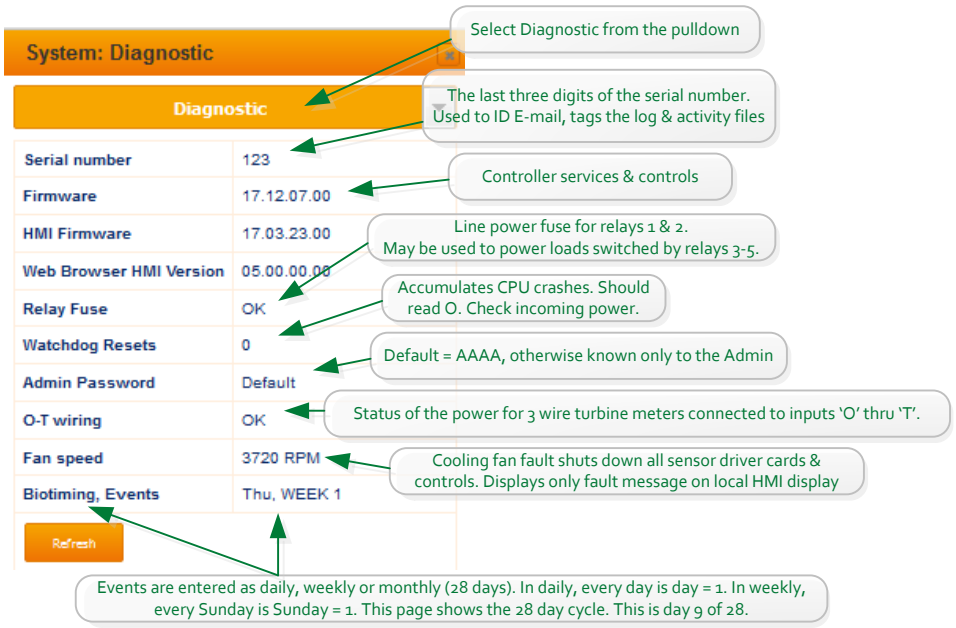


9 System Settings

9.1 Home & Diagnostic pages

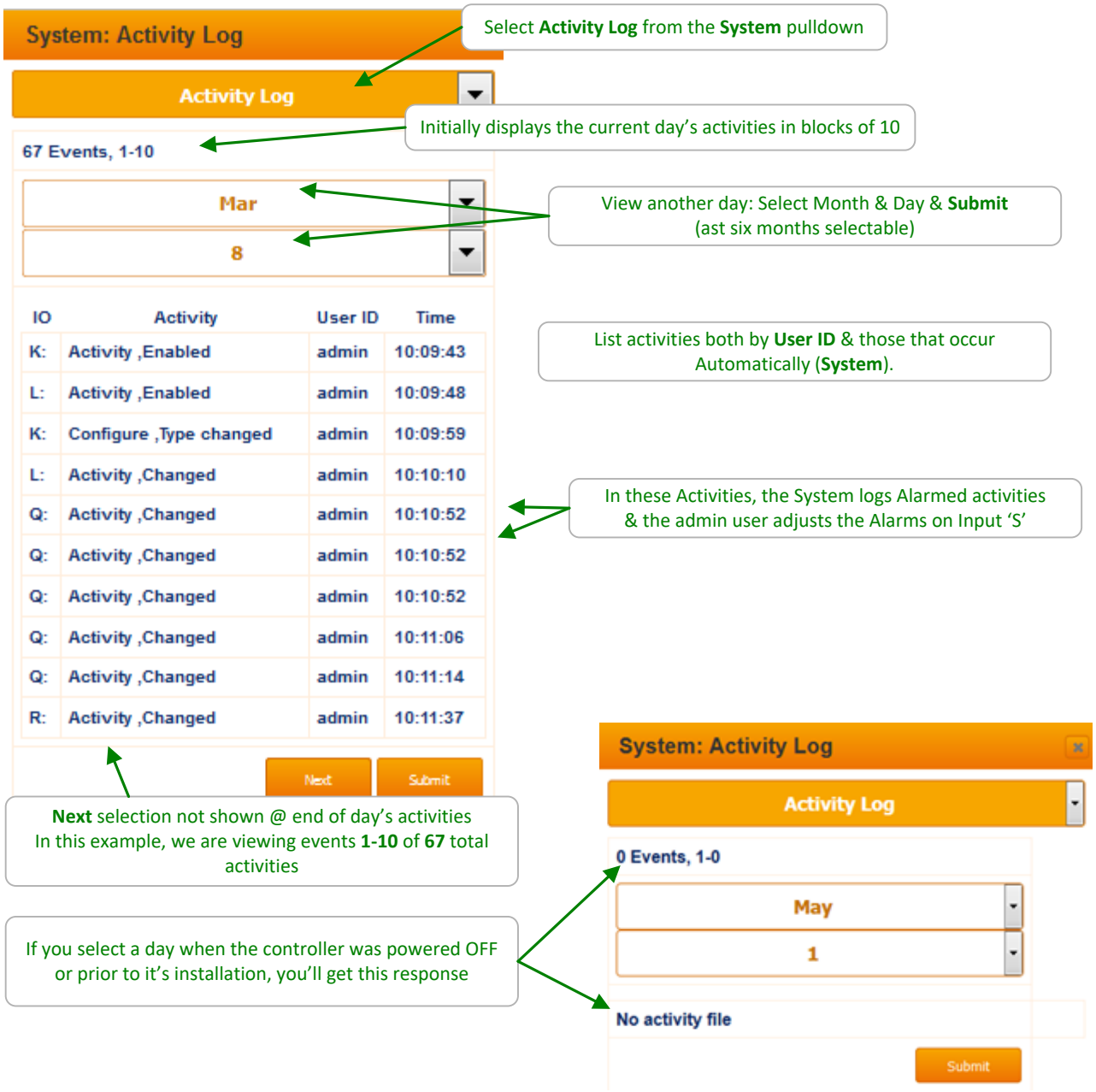
9.1.1 S/N, Versions, Fuse & Fan state, Biofeed Week#





9.2 Activity Log:

9.2.1 User ID, time stamp

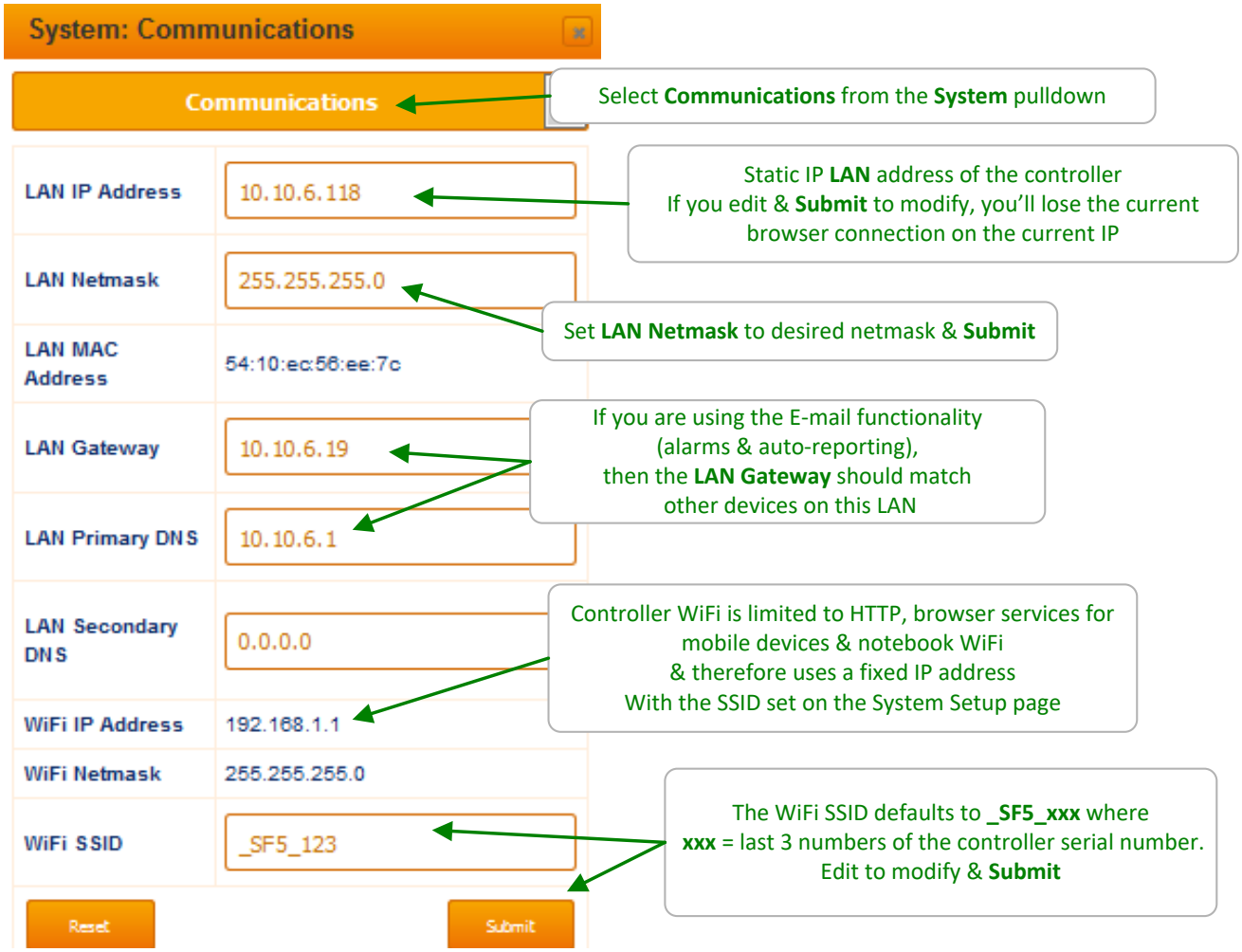


9.3 Communications:

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.



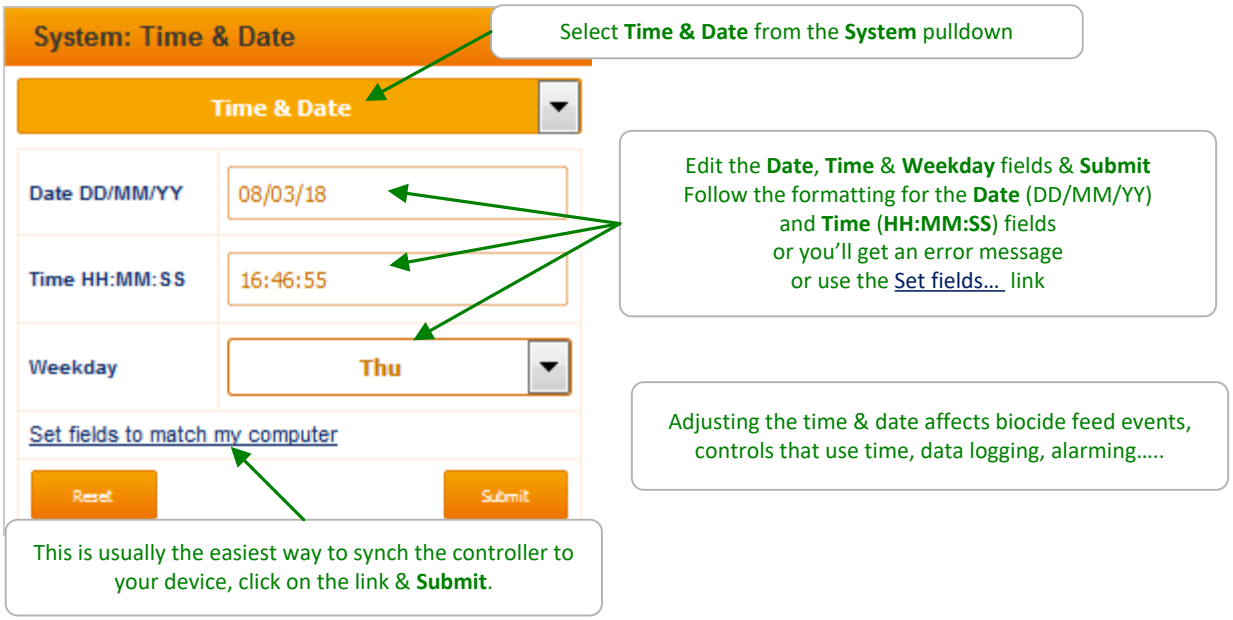
Sidebar:
If you modify the IP or Netmask & can no longer connect, the current IP & Netmask can be viewed on the local HMI (keypad & display)

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

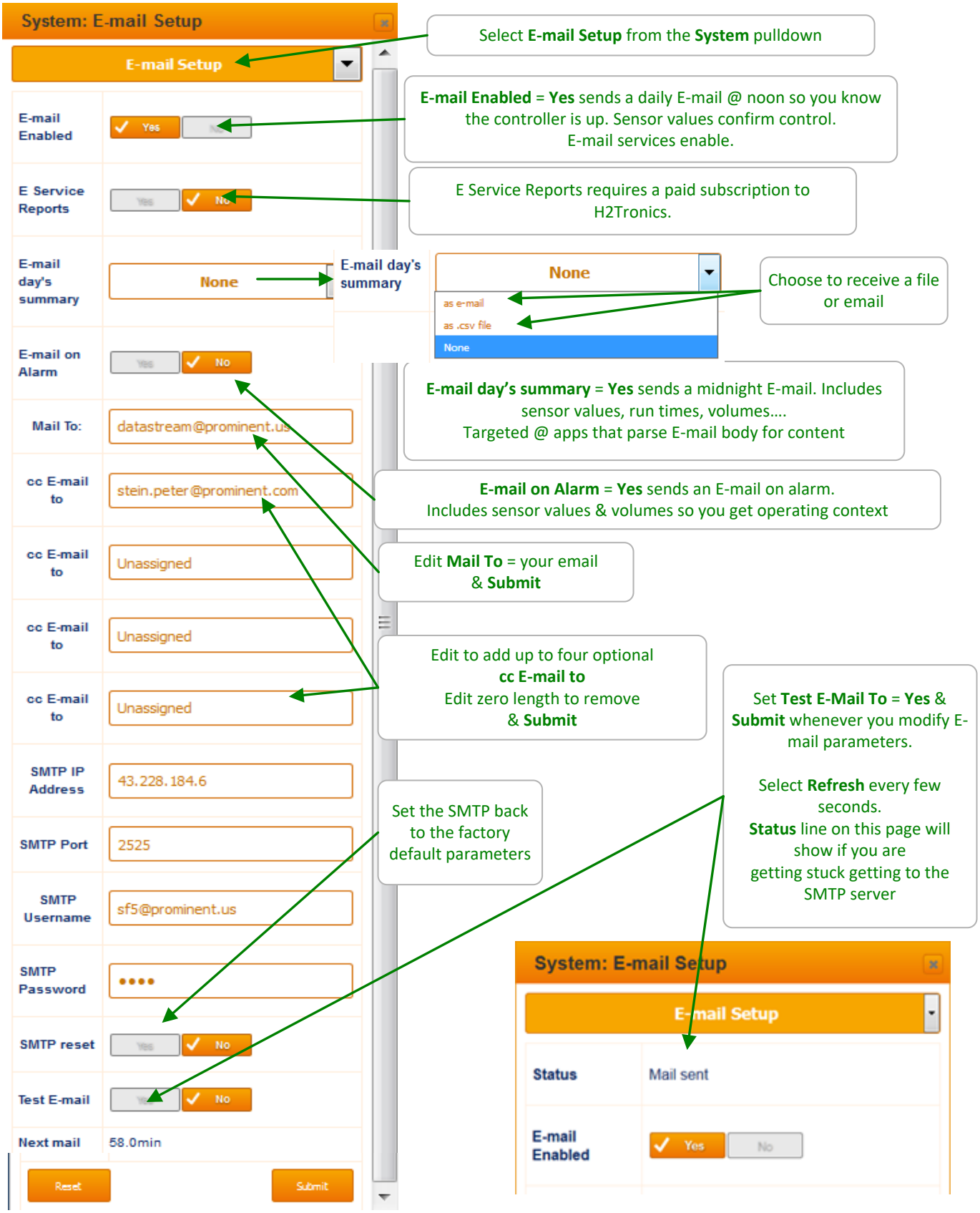
LAN (Local Area Network) refers to the Ethernet port connection. WiFi refers to the wireless connection. See section **1 Day to Day Browsing** for connection information.

9.4 Time & Date:

9.4.1 Sync to Device



Slimflex 5 Browser
9.5 E-Mail Setup – Test



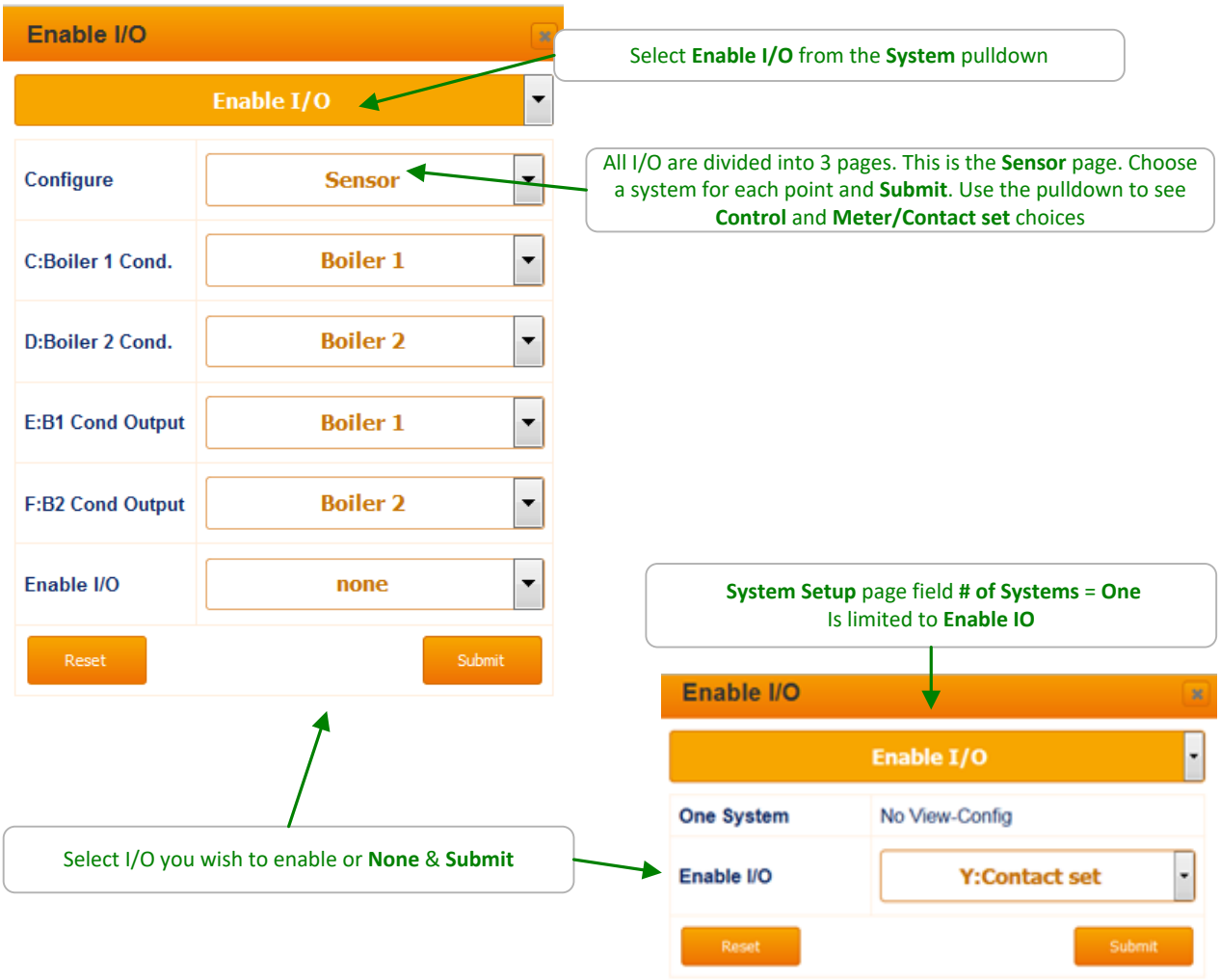
9.6 Enable I/O:

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

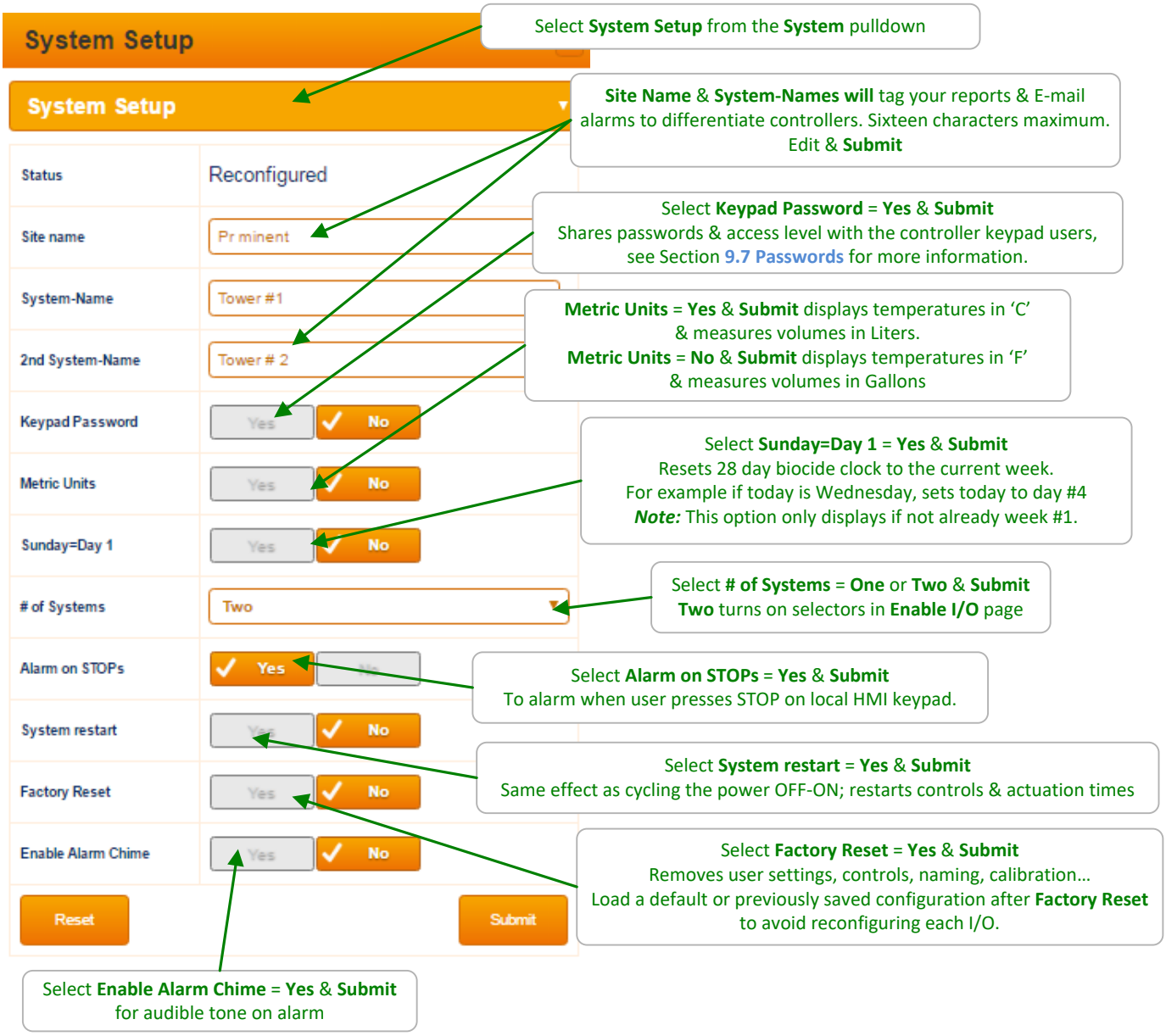
To enable an I/O, use the box at the bottom of the page.



9.7 System Setup:

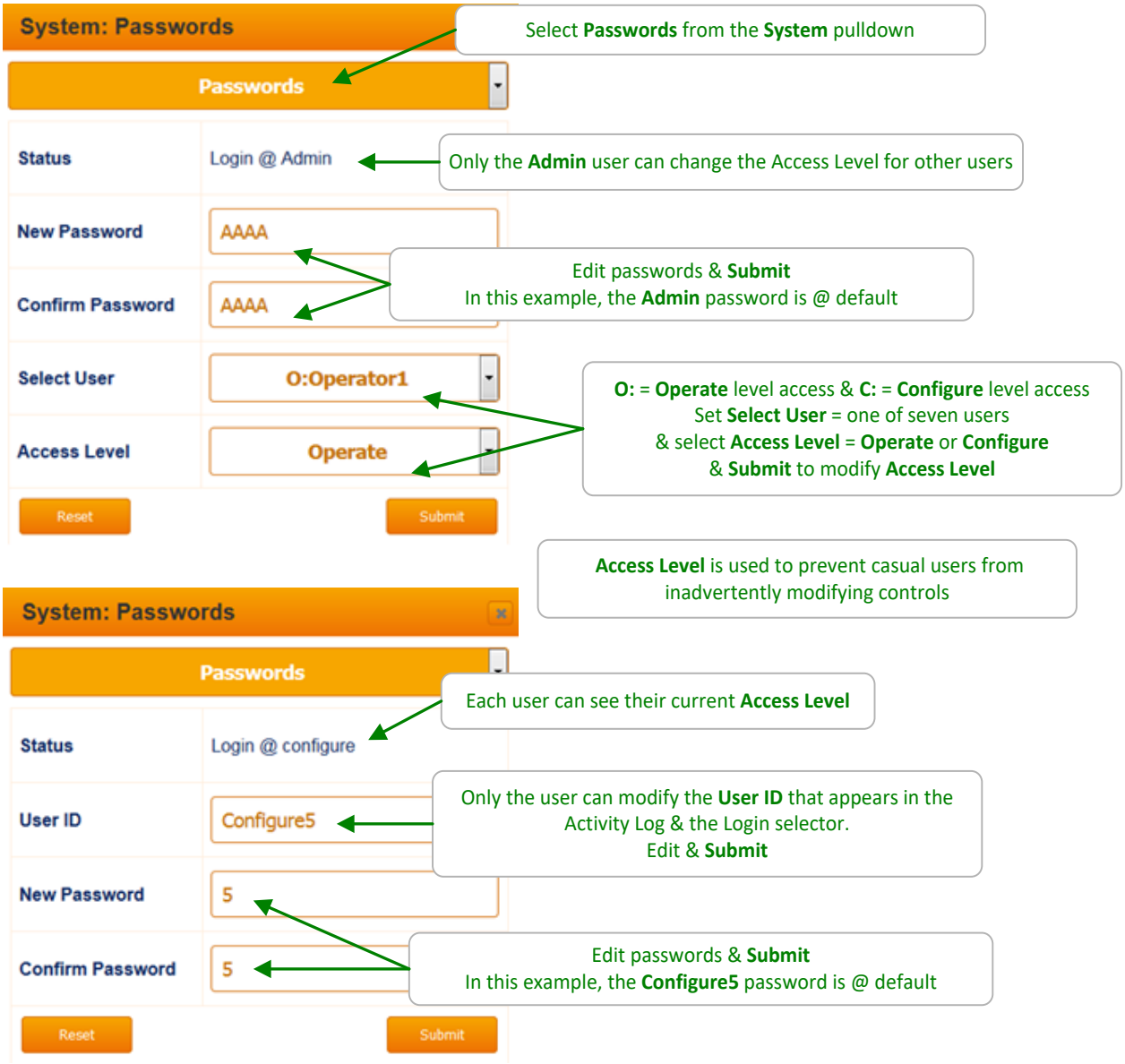
9.7.1 Naming, Sunday=Day1 ,Metric Units, Restart Options

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.



9.8 Passwords:

9.8.1 View-Set Access Level



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.

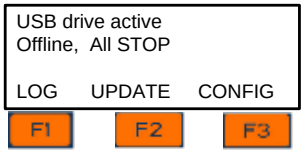
Slimflex 5 Browser
10 Using the USB Port

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.

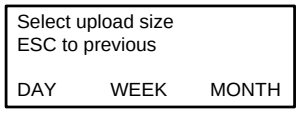
Figure 67 USB Access Door Closed [Top] and Open [Bottom]

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



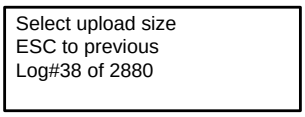
2- Choose F1, LOG to set up the download.

3- Choose the amount of history, DAY [F1], WEEK [F2], or MONTH [F3]. When you choose the period, the download starts.

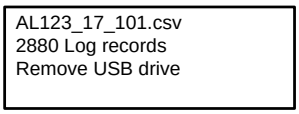


4- During the download, the keypad and browser connection are locked. The controller outputs are turned off!

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.

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: A**L** = CSV **L**og 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 Seperated 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 numbe	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	Conductiv	pH Sensor	ORP Sens	Recirc Flo	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.

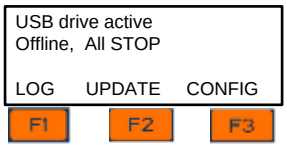
Configuration File Name Format

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.

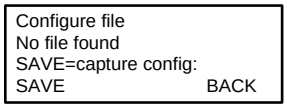
10.2.1 Saving to the USB

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.

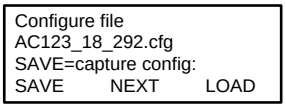
2- Press F3 Config



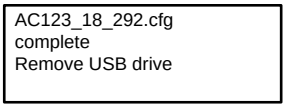
3- If you have not previously saved a program on this USB you can only F1 SAVE a copy to the USB.



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

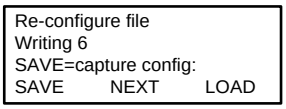


In either case, press **F1 SAVE** to copy the current configuration to the USB drive. When the save is complete, the display will notify you to remove the USB drive.



10.2.2 Loading from the USB

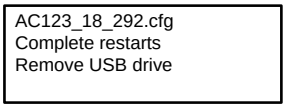
1- To load a previously saved program from the USB to your controller, insert the USB drive with the saved configuration into the USB port as explained in step 1 above.



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**

1 File Please

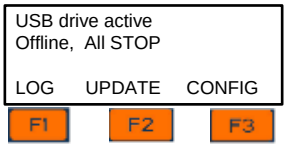
To avoid accidents and confusion with this important process, please remove all files from the USB drive prior to adding the .hex file. The controller will only allow you to view one file. Be sure you copy the correct file to the USB. If you have more than one, you may load the wrong file.

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.

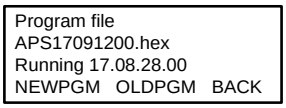
Obtain the hex file from the ProMinent.com web site (see instructions in section 13.4 Remote HMI (Browser) Firmware Update

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.



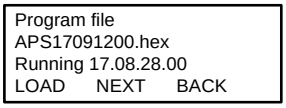
Press F2, UPDATE

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.

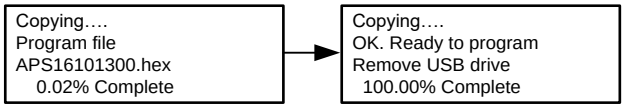


Your dates will differ from this example!

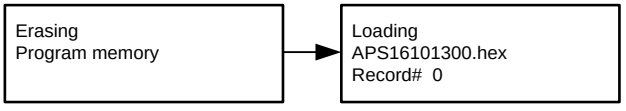
If the file on line 2 is the new firmware file, press F1 NEWPGM to select the new hex file. Press F1 Load to install the new hex file.



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.

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.

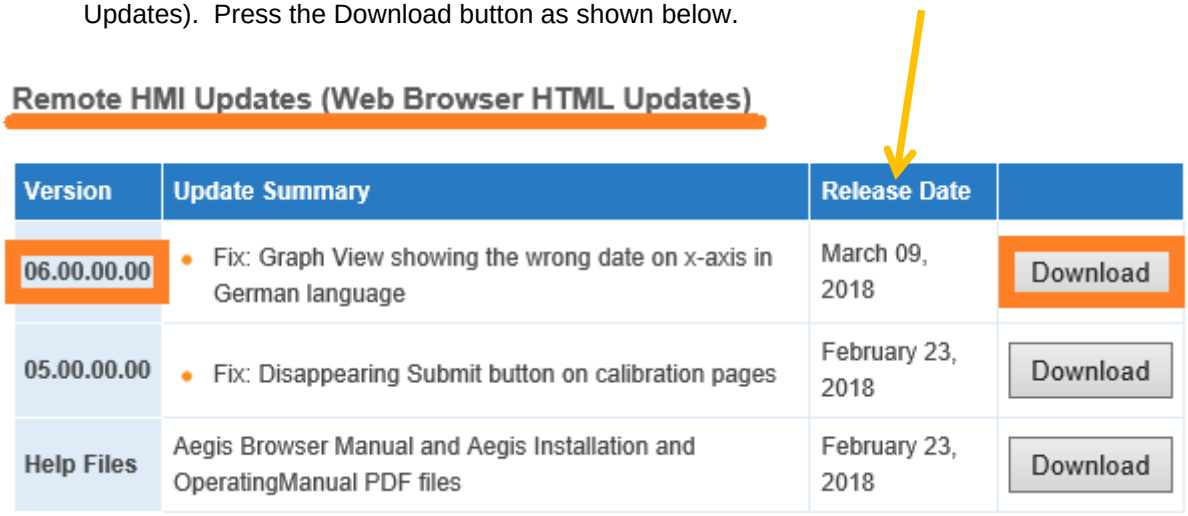


Figure 68 Remote HMI Updates

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.

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.

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	

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	**K-N**
		x1 Temperature	**K-N**
		x2 Flowswitch	**W-Z**
	Serial Corrosion Rate	Not used	**K-N**
			K-N
	Serial Differential Pressure	Not used	**K-N**
			K-N
			K-N
C-D	pH-ORP driver card	x0 ORP or pH	**K-N**
E-F		x1 Temperature if pH	**K-N**
I-J	Conductivity card	x0 Conductivity	**K-N**
		x1 Temperature if 'Conductivity'	**K-N**
		or 'Condensate'	**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	**W-Z**
		x1 Rate	**K-N**
		x2 Volume this Year	**W-Z**
		x3 Volume total	**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 >= '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.