AQUATRAC™
INSTRUMENTS, INC.
SYSTEM DESIGN & ENGINEERING

AEGIS

Water Treatment Controller

Installation & Operating Manual

CONTENTS

Safety

 **Electrical Shock Hazard**

Opening the controller enclosure with the controller plugged in, exposes the user to AC line voltages on the lower of the two controller circuit boards.

Ground the controller AC power to the ground screw labeled  and located on the bottom, right of the aluminum backplate.

External, 120VAC socket or optional plug boxes are provided with controllers installed in North America. Both are grounded to the ground screw labeled  located on the bottom, center of the aluminum backplate.

USER WARNING : CAUTION

Water Treatment Controllers operate steam and water valves and may pump hazardous, corrosive and toxic chemicals. Opening the controller enclosure exposes user to the risk of electrical shock at power line voltages.

Understand fully the implications of the control setpoints, interlocks and alarms that you select. Harm to personnel and damage to equipment may result from mis-application.

Unplug or turn OFF the AC power to the controller if you have any concerns regarding safety or incorrect controller operation and notify supervisory staff.

YOUR CONTROLLER

AEGIS Controllers are supplied in many different configurations, part numbers and sensor sets. Applications extend beyond water treatment.

The **HELP** section depicts the installation plumbing header showing the sensor set supplied with your controller. It also includes the information for terminating the sensors supplied with your specific controller part number.

The **START-UP** section is specific to your application and details modifying the default controller settings for your site.

Navigation 1of3

KEYPAD

If you get lost in a sub-menu, press **EXIT** & you'll stop what you're doing & move back to the main menu

An **ENTER** symbol on the display signals that there are sub-menus available,

UP & **DOWN** to view options or to EDIT numbers

Move **RIGHT** to select next field when EDITing

ENTER to select an option & to execute EDITing

EXIT to escape option, info display or EDITing

MAIN MENU

The sensors and controls in the main menu vary with your controller part number and sensors and pumps that you enable or disable.

The main menu groups sensors with the pumps or solenoids that they control so you may find the menu order changing when you change an inhibitor pump for ***Bleed then Feed*** control to ***Water Meter ppm*** control.

Where are Sensors, Solenoids, Valves & Pumps Connected

You may modify the names of sensors, pumps and solenoids but the controller tags each input with a letter **A** to **Z** and each output with a number **1** to **9** representing where each is wired.

Inputs **A**, **B** and **G** and **O** to **V** have fixed wiring terminals on the upper controller board.
A is always a conductivity sensor, **B** a temperature sensor and **G** a 4-20mA input
Inputs **O** to **V** may be individually selected to be either a water meter, volume input or a contact set, flowswitch input.

Terminals for outputs **1** to **5** are located on the lower board.
They are ON/OFF power relays that switch 120 or 230VAC to pumps, valves and solenoids.

Terminals for outputs **6** to **9** are also located on the lower circuit board.
They are electronic switches used to frequency control pumps.

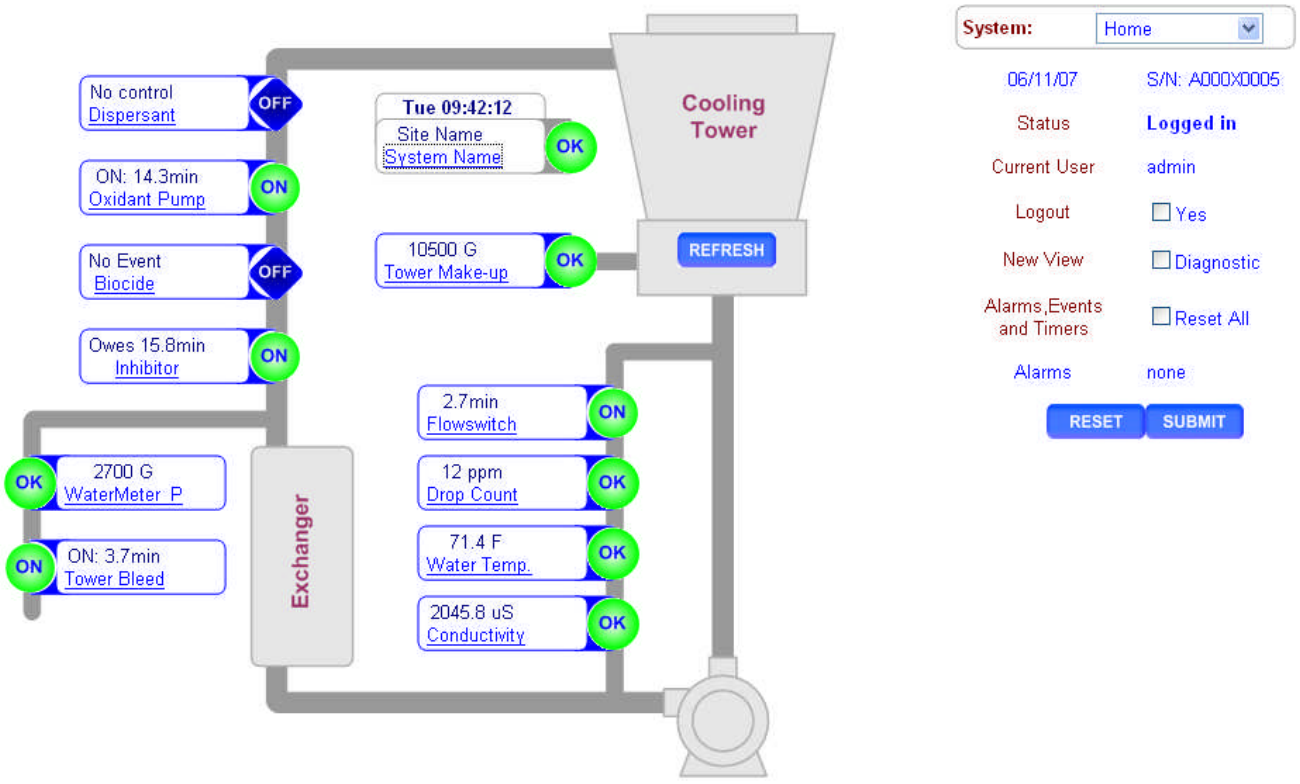
Inputs **C-D** and **E-F** are used for plug-in sensor cards which add optional conductivity, pH, ORP, corrosion rate, 4-20mA inputs & outputs to the controller.

Sensor inputs **H to N** and meter/contact set inputs **W to Z** don't physically exist in the controller and are used to calculate ppm & inventory, log manual entries, sum water meters & many other advanced controller functions.

BROWSER

Controllers with the '**LB**' LAN-Browser option include a built-in command & control web server with real time views of your controller operation.
You can browse with Mozilla's Firefox or Internet Explorer 7 over a 10BaseT Ethernet connection or the internal modem, if installed.

If the '**LB**' option is included in your controller, the Browser appendix '**C**' has been added to this manual



Sidebars: Are used to explain typical uses for feed and control functions.
Sidebars are at the bottom of the page detailing the function.
New users & users new to water treatment will find these explanations helpful.

FREQUENCY CONTROLLED PUMPS

Aegis controllers combine the 5 ON/OFF controls with 4 frequency controls.

Depending on your feed application, frequency controlled pumps may deliver more accurate feed, easier to understand setpoints and fed volume tracking, without increasing pump cost.

Frequency controlled pumps & the innovative way the Aegis uses them may new to you.
The Aegis lets you mix & match ON/OFF & frequency controls to fit your site:

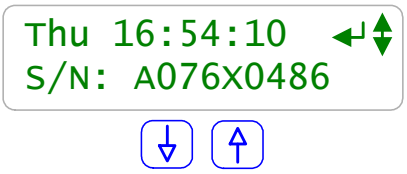
Typical Applications	**ON/OFF** Controller switches AC power ON/OFF to pump or solenoid.	**Frequency** Controller-to-pump cable varies stroke rate.
Typical Inhibitor Feed	Water meter control turns ON the pump for 10 seconds every 100 gallons of make-up	User sets target inhibitor ppm & control meters inhibitor based on make-up volume.
Blowdown or Bleed	Controller turns ON/OFF solenoid or motorized valve.	Not used
Typical Biocide Feed	Turn-on pump for 45 minutes @ 7:00 every Tuesday	Turn-on pump for 0.535 Gallons @ 7:00 every Tuesday
Acid Feed	Turn ON pump when pH greater than 7.65 & OFF when pH less than 7.55	Increase the acid feed rate as the pH increases.
Proportional Feed	Requires a 4-20mA controlled pump	Any sensor can control the feed rate from a 1000:1 turn down to maximum feed rate.
Tank Level Alarms Ppm Calculations	Requires feed meter on pump outlet or inlet.	Calculate tank level from fed volume. More than one pump may share a tank.
Typical Base Feed	Turn pump ON for 45 seconds every 5 minutes	Feed @ 4.5mL/minute
User Support	Relies on user to correctly set pump stroke & frequency	Won't let you set feed rate greater than the pump can deliver. Auto-switches from proportional to MAX rate depending on feed mode.

You can select one of 6 of the most popular ProMinent pumps for each frequency control which automatically sets the maximum stroke rate and volume per stroke OR you can define a mL/stroke and maximum frequency for any manufacturer's frequency controlled pump.

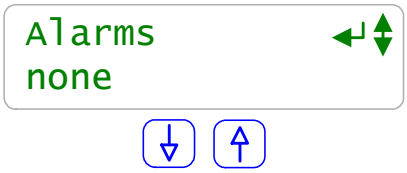
1.0 Day-to-Day Operation

1.1 Main Menu

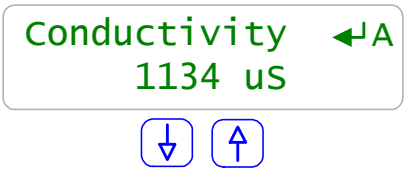
This is the power-on day of week & time display.
The Serial Number tracks special features &
the sensor set installed in your controller.
Press **ENTER** to view-set system settings



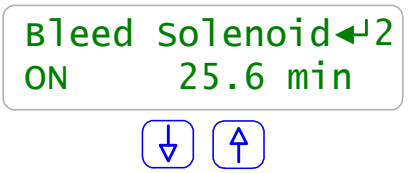
Active alarms are displayed by the letter, **A..Z**, of the input
or the number **1..9**, of the output
Press **ENTER** to reset alarms, to view alarm detail,
or to scroll the key-press log,



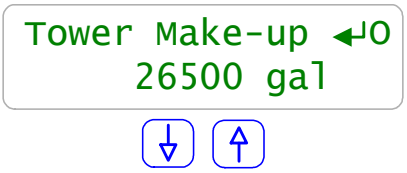
Present value of the conductivity connected to
sensor input '**A**'. Updates every second.
Press **ENTER** to Calibrate, view-set Alarms, Compensation



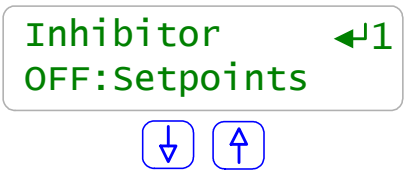
Conductivity '**A**' controls the Bleed Solenoid connected to
output '**2**' so they display together.
The Bleed has been ON for 25.6 minutes this cycle.
Press **ENTER** to view-set Setpoints, Configuration…



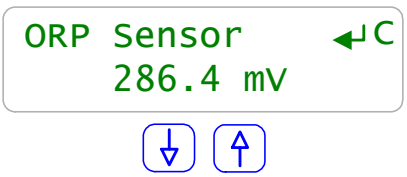
Volume from midnight on the water meter
connected to input '**O**'
Press **ENTER** to view-set Type, Annual Volume…



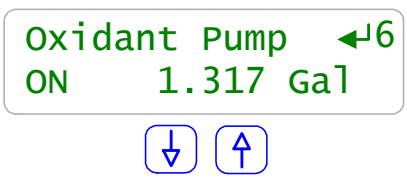
Water meter '**O**' controls the pump connected to output '**1**'
which is OFF, waiting for the meter to measure make-up.
Press **ENTER** to view-set Feed Rate, Feed Limits…



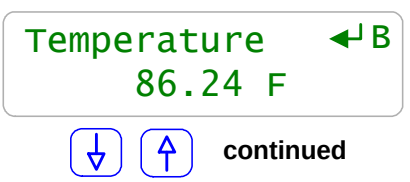
An ORP sensor is connected to controller input '**C**'.
Aegis controllers may include 1..4 ORP or pH sensors.
Press **ENTER** to Calibrate, view Diagnostics, Configure…



The ORP sensor frequency controls a pump connected to
output '**6**' which has pumped 1.317 Gallons this feed cycle
.Press **ENTER** to Adjust Setpoints, change Pump Type…



A temperature sensor is connected to controller input '**B**'
It's not used for control so it displays after the controls
Press **ENTER** to Calibrate, view Diagnostics, Configure…

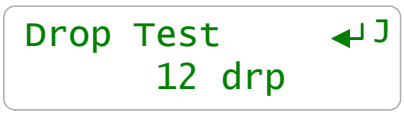


continued

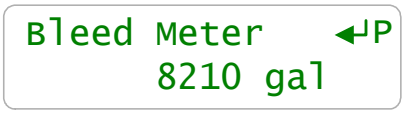
1.1 Main Menu cont.

Some controllers may include corrosion rate monitoring. A copper corrosion sensor is connected to controller input '**E**' & measuring a rate of 0.26 mils per year. Press **ENTER** to change metals, view diagnostics…

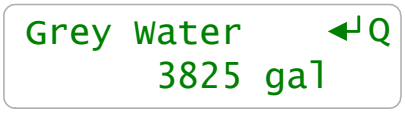
Users may use the controller to key in results of chemical tests. These results may be used to alarm, adjust feed rates… The result of a drop test is entered, logged and displayed on control input '**J**'



This controller measures the Tower Bleed volume on meter input '**P**'. The volume from midnight may be being used for cycle control and/or evaporation credits

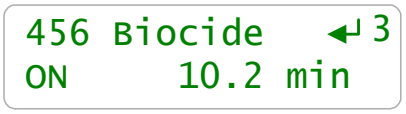


A second make-up source may be measured by turning on an unused input; '**Q**' in this example. It may then be summed with the potable make-up to feed inhibitor



Input '**S**' is the default flowswitch input. It's been ON today for 10.89 hours & since it now 16:54, this tower's re-circulation pumps turned ON @ 6:00AM

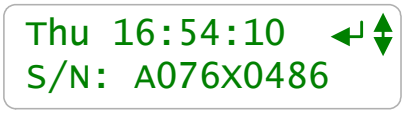
You can edit the name of any input or output. This biocide can be fed on a 1,7 or 28 days cycle.



You can set chemicals to feed before or after other chemicals to prevent feed line reactions or to sequence product delivery

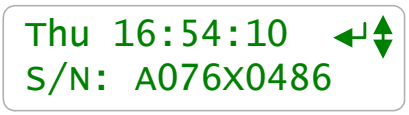
You can disable unused sensors, pumps or relays to un-clutter the display and turn them back ON as site needs change. Plug-in a new sensor card and the controller auto reconfigures

Key **EXIT** anytime on the **Main Menu** & you'll get back to this power ON display



1.2 Checking & Clearing Alarms

Key **DOWN** from the power ON display to view alarms.



In this example, the sensor connected to input '**B**' and the pump or solenoid to controlled by Relay '**2**' have alarmed

Press **ENTER** to view or clear **Alarms**

Press **ENTER** to clear **Alarms**, resets all alarmed feeds and controls, zeroing owed time & volume., and resets the delay on alarm for all sensors

Exit the acknowledge display by pressing **ENTER** or any key

Returns to the main menu **Alarms** display. See **Sidebar** @ bottom of page.

View Alarms

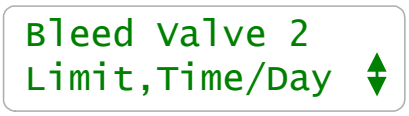
Press **ENTER** then **DOWN** to view active alarms. Alarms display until cleared so you'll know there was a problem although it may have occurred when you were not @ the controller.

and

Press **ENTER** at **Alarms** and **UP** or **DOWN** to view active alarms.

'**B**' is a Temperature sensor which has exceeded or is exceeding it's high alarm.

'**2**' is a bleed which has exceed it's minutes ON today alarm. Bleed solenoids are usually set to stay ON after alarming. Pumps are usually set to turn OFF on alarm



Sidebar: Feed limit and water meter alarms will immediately re-trip unless you adjust the alarm limits. Sensor alarms will re-trip after the user set 'Delay' unless the fault is corrected.

1.3 View & Adjust Setpoints

Key **UP** or **DOWN** to the target Pump, Valve or Solenoid then press **ENTER**.

Press **ENTER** @ Setpoints.
Setpoint types differ with control type and ON/OFF or frequency.
Refer to the following page for typical chemical feed setpoints.

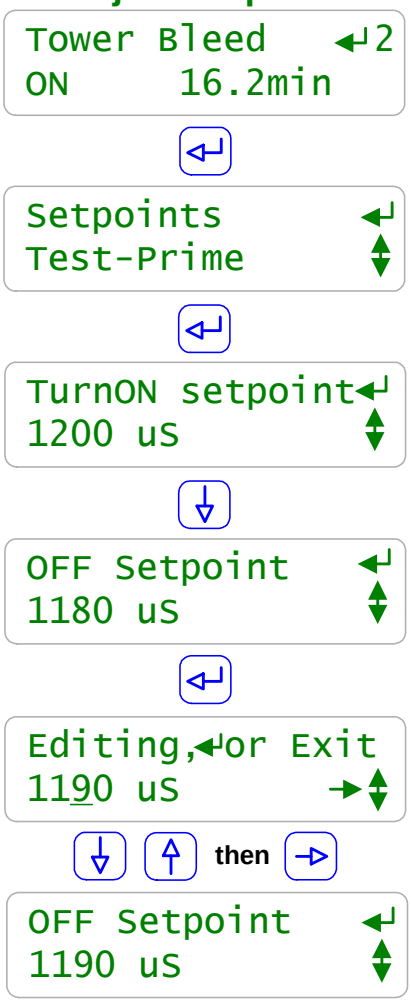
When the controlling conductivity exceeds **1200 uS** the **Tower Bleed** will **TurnON**.
Key **ENTER** to adjust.

When the controlling conductivity falls below **1180 uS** the **Tower Bleed** will **TurnOFF**.
Key **ENTER** to adjust.

Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **EXIT** to leave unchanged

Adjust Setpoints



Sidebar:
Relays controlled by sensors power Pumps and Solenoids ON and OFF.
(Relays are outputs **1** to **5**)
Frequency controlled Pumps feed chemicals at varying rates.
(Frequency controlled pumps are outputs **6** to **9**)

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 delay between feeding acid and measuring it's pH does not cause wide pH swings.

1.3 View & Adjust Setpoints

Meter Feed

The **Inhibitor** pump powered ON/OFF by relay **1** is **ON** and **Owes 2.6** minutes of feed time..

This inhibitor is fed based on the volume measured by the tower make-up meter

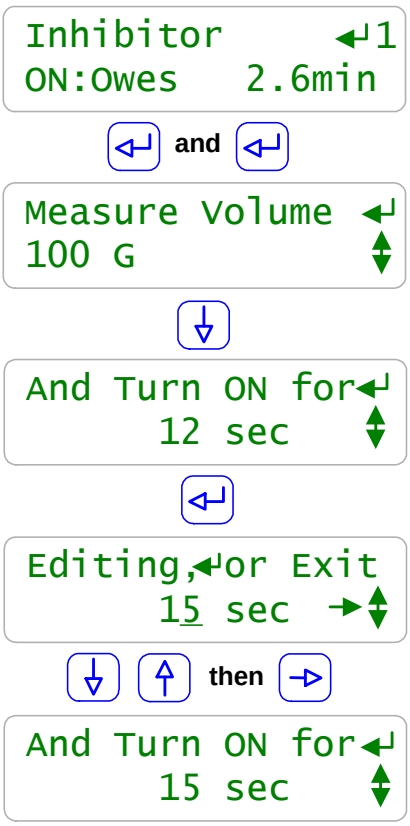
Key **ENTER** once to **Setpoints** and again to view the volume setpoint. Press **ENTER** to adjust.

Press **DOWN** to view the ON time setpoint. Every **100** Gallons of make-up the pump runs for **12** seconds.

Press **ENTER** to adjust.
Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **EXIT** to leave unchanged

In this example, we've increased the feed rate by 25% by extending the ON time from **12** to **15** seconds.



Bleed then Feed:

Cooling towers without make-up meters, use **Bleed then Feed** control for Inhibitor feed.

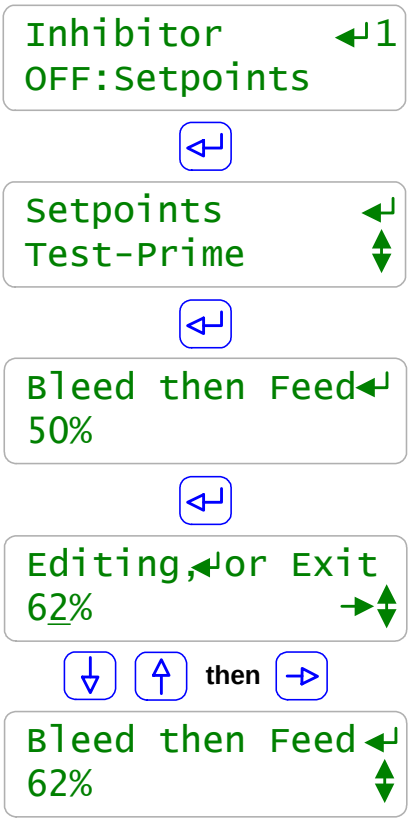
Example: After the tower has bled for 8.4 minutes, the Inhibitor pump turns ON for 8.4 minutes.

Key **ENTER** twice to view the present **Bleed then Feed** setpoint. In this example it's **50%.** If the bleed in ON for 8.4 minutes, inhibitor feeds for 4.2 minutes.

Press **ENTER** to adjust.
Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **EXIT** to leave unchanged.

In this example, we've increased the feed rate by 24% by extending the ON time from **50%** to **62%** seconds.



1.3 View & Adjust Setpoints

Key **UP** or **DOWN** to the target Pump, Valve or Solenoid then press **ENTER**.

The **Product Pump** frequency controlled by output **7** is **ON** and **Owes 0.051** Gallons of feed.

This chemical is fed based on the volume measured by the tower make-up meter

Key **ENTER** once to **Setpoints** and again to view the volume setpoint. Press **ENTER** to adjust.

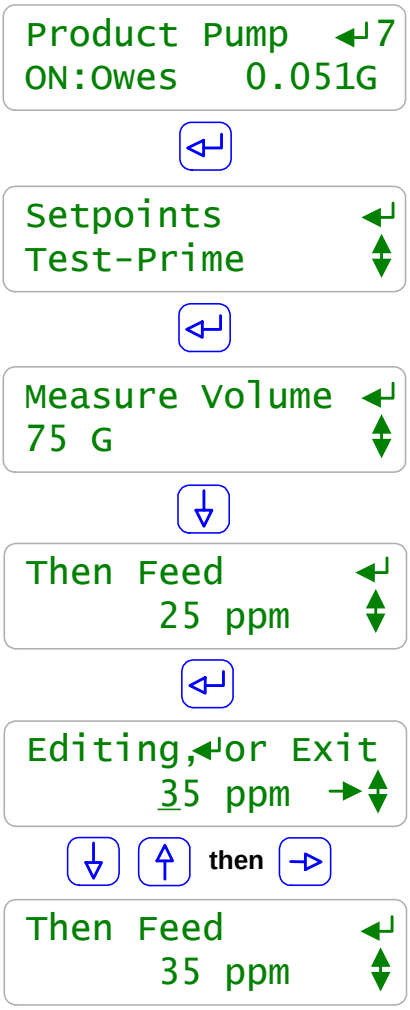
Press **DOWN** to view the **ppm** setpoint. Every **75** Gallons of make-up **25** ppm of product is fed.

Press **ENTER** to adjust. Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **EXIT** to leave unchanged

In this example, we've increased the feed rate by 40% by extending the feed rate from **25** to **35 ppm**

Adjust Setpoints
ppm Feed



Sidebar:
Controllers with the '**metric**' system option set, display volumes in **L**iters, not **G**allons

Inhibitors typically have a recommended **ppm** concentration for a target hardness or corrosion rate. In this page's example, we're feeding at 25ppm which is 0.0019 Gallons or 7mL for every 75 Gallons of make-up.

The **Measure Volume** does not have to be the Gallons/Contact of the make-up meter. The controller does the math.

The controller knows the mL/stroke rating for the No.**7** pump & it knows how many times the pump has stroked, so the controller knows the volume fed.

1.3 View & Adjust Setpoints

Key **UP** or **DOWN** to the target Pump, Valve or Solenoid then press **ENTER**.

The **Acid Pump**, frequency controlled by output **6** is **ON** and feeding at **65.84%** of maximum SPM (strokes/minute).

This chemical is fed based on the value of a pH sensor.

Key **ENTER** once to **Setpoints** and again to view the **100%ON Setpoint**. At pH's greater than 7.50 the '**6**' **Acid Pump** is @ maximum, rated SPM.

Press **ENTER** to adjust.

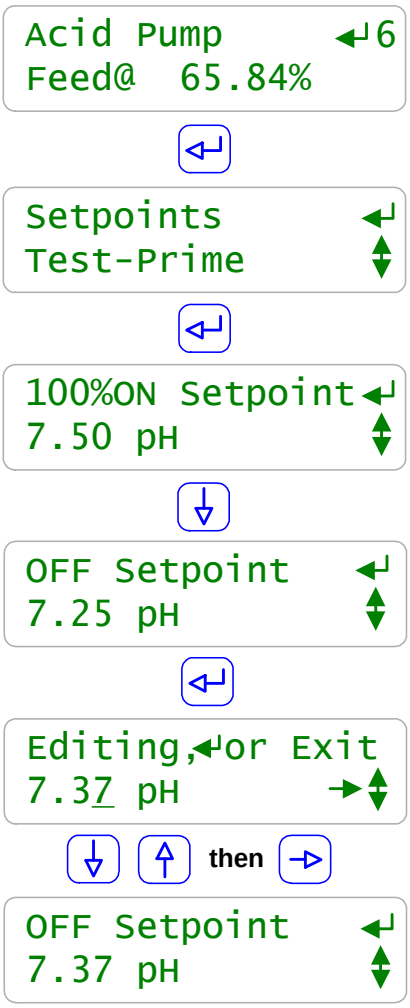
Press **DOWN** to view the **OFF Setpoint** setpoint. At pH's less than 7.25 the '**6**' **Acid Pump** is OFF.

Press **ENTER** to adjust.
Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the setpoint or **EXIT** to leave unchanged

In this example, we've narrowed the control range from 0.25pH (7.5-7.25) to 0.13pH (7.5-7.37).

Adjust Setpoints
Sensor Feed



Sidebar:
The controller knows the pump type connected to output '**6**' and its rated maximum SPM. Pumps of varying SPM and ml/stroke rating may be controlled at the same time.

The **Measure Volume** does not have to be the Gallons/Contact of the make-up meter. The controller does the math so use setpoints that make sense to you.

In this example, the green '**P6**' indicating LED on the lower controller board flashes at the pump stroke rate. As the feed rate approaches zero, the time between flashes increases.

Any sensor: temperature, stream demand, corrosion rate, ORP… may be used to frequency control any pump connected to outputs '**6**' to '**9**' delivering proportional control without using 4-20mA controlled pumps.

1.4 Priming-Testing Pumps & Solenoids

Key **UP** or **DOWN** to the target Pump, Valve or Solenoid then press **ENTER**.

The **Oxidant** pump controlled by relay **5** is **OFF**.

Key **ENTER** and **DOWN** to **Test-Prime**.

.

Key **ENTER** again to view or adjust the **Prime** ON time
Relays **1** to **5** default to **5** minutes.
Frequency controlled pumps **6** to **9** default to 100mL.

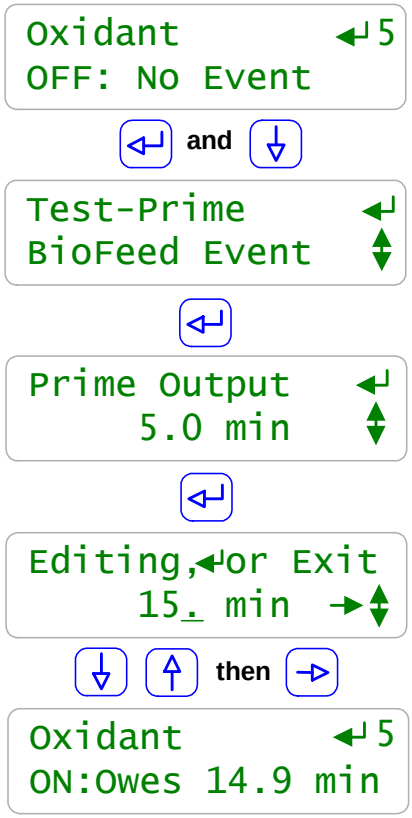
Press **ENTER** to adjust ON time or feed volume.
If you key **ENTER** twice you'll turn ON for the default time or volume

Press **ENTER** to adjust.
Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the prime time or **EXIT** to leave unchanged.

In this example, we're priming the **Oxidant** pump for 15 minutes. **Oxidant** now displays **ON** and counts down the owed time or volume.

Test-Prime



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

Ending Prime-Test:
Clear Alarms, Section 1.2 ends all owed time & volume for all pumps and solenoids.
Individual pumps may be reset by clearing the alarm. Refer to **2.7 Limiting Feed & Alarms**
Fail to Prime:
A pump or solenoid that is Interlocked, Blocked or OFF on alarm will not Prime.
The time or volume owed will be fed when the reason for no feed is removed.
The main menu display for the target pump or solenoid will display the reason for fail to prime
And the **Diagnostic** sub-menu will provide detail.

If the green LED on the lower controller circuit board is ON, the pump or valve connected to that output **1** to **9** should also be ON

2. Chemical Feed Controls: Inhibitor, Acid, Bleach, Amine…

2.1 Chemical Feed 101

Feed Methods: Water treatment uses 5 methods to feed chemicals. Make-up, Bleed and Sensor methods responds to increasing load by increasing the volume fed to maintain a target ppm.

Each method has its fit for cost, reliability, feed accuracy and water treatment system size & type.

Feed Method	How does it work	Chemical Fed	Typical Applications
Make-up	**Cooling Towers:** Feed when the cooling tower make-up water meter measures volume. **Boilers:** Feed when the boiler feed water meter measures volume.	Inhibitor Boiler Treatment	Towers may use more than one make-up source or may control based on bleed volume. Boilers may use a feedwater or softened make-up water meter. A contact set, ON when the feedwater pump is ON is often used as a make-up meter.
Bleed	**Bleed & Feed** Feed when the bleed solenoid is ON **Bleed then Feed** Feed after the bleed turns OFF proportional to the time the bleed was ON.	Inhibitor Inhibitor	Cooling towers where the bleed solenoid is ON more than 50% of the time. Towers with correctly sized bleeds, ON less than 50% at maximum load.
Sensor	**ON/OFF** Above the **ON** setpoint the pump turns **ON** and below the **OFF** setpoint the pump is **OFF** **Proportional** Feed rate varies linearly from OFF at the Turn OFF setpoint to maximum feed rate at the 100% ON setpoint	Acid, Oxidant, Amine, Sulfite, Dispersant….	pH, ORP, conductivity, temperature, steaming rate, corrosion rate, drop count, GPM make-up & many other sensors control these pumps. Proportional feeds use variable frequency, time modulation and 4-20mA to control feed.
Base	While the tower's running or the boiler is on-line; feed chemical	Sulfite, Amine, Boiler Treatment	Small boilers provide a contact set, closed when the boiler is on-line. Works best when the boiler load is constant.
Timed	Feed occurs at a user set time & day.	Biocides Oxidants Dispersants	Refer to Section 3. of this manual

2.1 Chemical Feed 101

If the concentration of chemical in your heating or cooling system is at the target ppm then all you have to do is add chemical to treat the make-up. Typically you'll estimate a feed rate, adjusting in subsequent weeks as indicated by ppm level testing.

Check Pump Rating

Pumps are rated for Gallons/hour, Liters/hour pumping into a nominal feed line head or back pressure. The lower the back pressure, the higher the pumping rate. The following table is for ProMinent pumps feeding into a 40 PSI feed line, typical for cooling towers.

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

Your pump type may differ. These pumps are typical for small to medium cooling towers or boilers

Example: If you expected a cooling tower to make-up 50,000 Gallons over 12 hours & you needed to feed a 50 ppm product, you'd feed 2.5 Gallons or 9.46 L. Since actual water use is not linear over 12 hours & peaks around 2-3 PM, you'd probably select an 0704 pump over a 1601.

Feed Setpoints: Frequency Controlled Pumps

Water Meter Feed:
Adjust the **Measure Volume** setpoint to 100G or L and the **then Feed** setpoint to 50ppm
Bleed then Feed:
If you expected the bleed to be ON 25% of the time, it would be on for 3 hours in our 12 hour example. In those 3 hours we need to feed 9.46L or 52.5mL/min
(9460mL/180 minutes). Adjust the **mL/min** setpoint to 53. At 180SPM type 0704 pump can feed @ a max. of 75.6 mL/min so the controller will allow the setpoint.

Feed Setpoints: ON/OFF Pumps

Water Meter Feed:
At 50ppm we'll need to feed 19mL for every 100 Gallons of make-up.
If the 0704 pump is set to 100% stroke & frequency, it will need to be ON for 15 seconds.
(A 0704 pump feeds @ 75.6mL/min. 19mL/75.6mL x 60 secs = 15 sec.)
Adjust the **Measure Volume** setpoint to 100 and the **Turn ON for** setpoint to 15 sec.
Bleed then Feed:
If you expected the bleed to be ON 25% of the time, it would be on for 3 hours in our 12 hour example. In those 3 hours we need to feed 9.46L or 52.5mL/min
(9460mL/180 minutes). Adjust the **mL/min** setpoint to 53. At 180SPM type 0704 pump can feed @ a max. of 75.6 mL/min so 52.5mL/min = 69%.. Adjust the **%** setpoint to 69.

2.2 Water Meter Feed

To view or modify the meter controlling the feed, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Inhibitor** pump is powered by relay **1** and has no controlling sensor or water meter.

Key **ENTER** & **DOWN** to **Configure**.

Key **ENTER**, **ENTER** to modify the controlling sensor-meter.

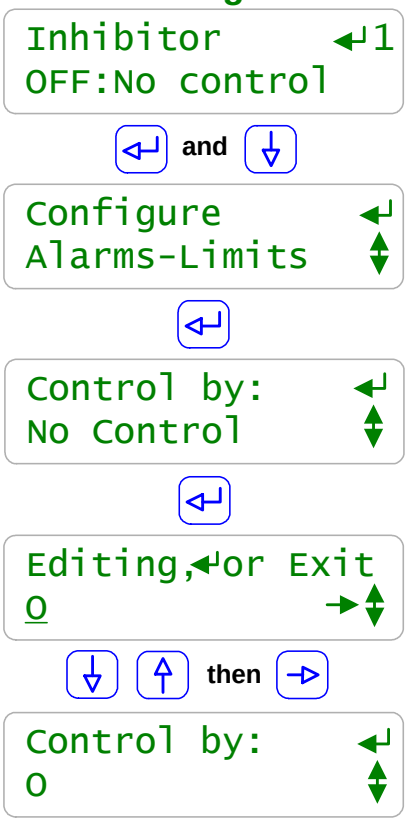
Key **UP** or **DOWN** to change the sensor-meter. Only enabled meters, contact sets and sensors will display as you scroll. Water & Meters are typically inputs '**O**' through '**R**'

Press **ENTER** to change the control or **EXIT** to leave unchanged

Key **RIGHT** to add (**+**), subtract (**-**) or sequence (**:**) other water meters.

In this example we have set the **Inhibitor** pump control to the water connected to controller input '**O**'

Controlling Meter



Sidebar:
Water meter and Feedwater Meter based controls feed proportional to load to maintain a target ppm of the fed chemical. Inhibitors, Boiler Treatment and Amines are usually fed to achieve a target ppm and therefore frequently meter controlled.

Meter based feeds are among the most reliable, accurate and simplest ways to feed.
The cost of installing a water meter is offset by the resulting feed reliability.

Summing Meters:
Up to 4 meters may be summed to control a pump. Use when towers have more than 1 make-up.
Sequencing Meters:
Refer to **5.3 Feed Verification** & **5.4 Cycle Controls**.

Oxidizing chemicals like bleach are almost never feed using a water meter since the demand is not proportional to the make-up volume.
pH correction, feeding acid based on make-up volume, only works if make-up water chemistry is constant. Even then a monitoring pH sensor is required.

2.3 Bleed Based Feed

To view or modify the pump feed method, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Inhibitor** pump is powered by relay **1** and has no feed method set.

Key **ENTER** & **DOWN** to **Configure**.

Key **ENTER**, **UP** to **Special Control** & then key **ENTER**.

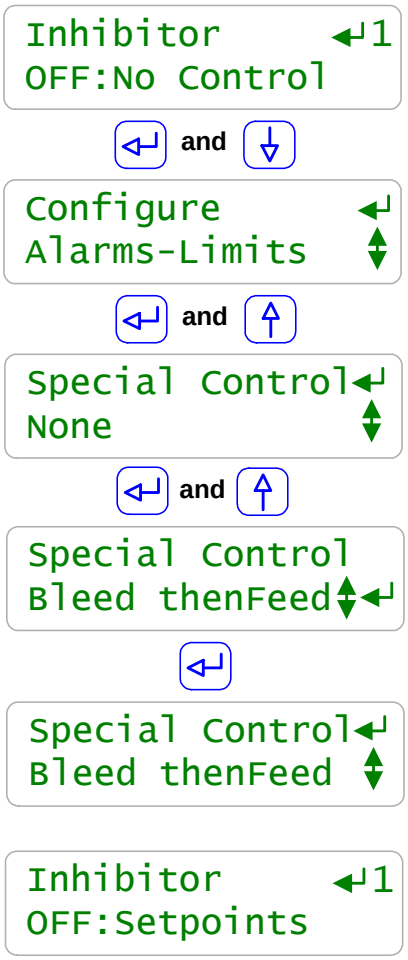
Key **UP** or **DOWN** to view **Special Controls** that can be used without a controller sensor or water meter.

Press **ENTER** to select **Bleed thenFeed** or **EXIT** to leave @ **None**

Special Controls that now display **Bleed thenFeed**. It's set at 50%. Refer to **1.3 View & Adjust Setpoints**

Now when we view the **Inhibitor** pump, it displays **OFF:Setpoints**, indicating that a control is active.

Bleed then Feed



Sidebar:
Bleed then Feed is used to feed cooling tower inhibitor when a make-up meter is not available and the bleed is ON 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 are only as reliable as the tower bleed solenoid and conductivity sensor. Refer to **2.5 Limiting Feed & Alarms** for guidelines on preventing overfeed and recovering from bleed fault.

2.4 Sensor Controlled ON/OFF Feeds

To view or modify the sensor controlling a pump key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Oxidant** pump is powered by relay **3** and has no control sensor set.

Key **ENTER** & **DOWN** to **Configure**.

Key **ENTER** to **Control by:** & then key **ENTER**.

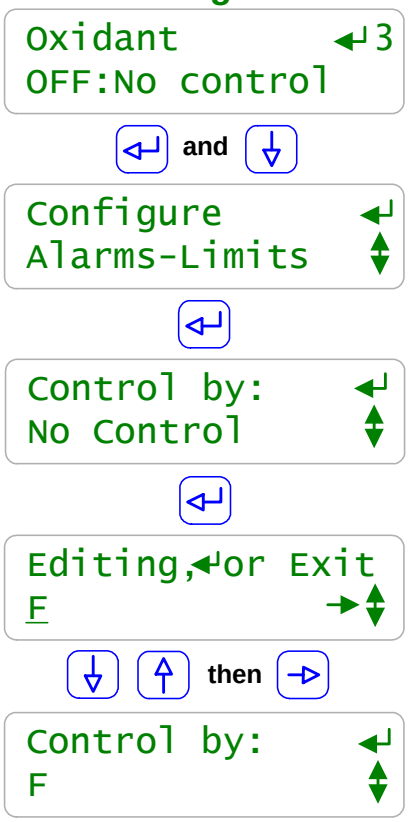
Key **UP** or **DOWN** to scroll through the sensors connected to the controller.

Key **RIGHT** to add(**+**), subtract(**-**), divide(**/**) or multiply(*****) more sensors to the control of Relay **3**.

In this example press **ENTER** to select sensor '**F**' or **EXIT** to leave @ **No Control.**

Control by: now displays **'F'** an ORP sensor. Refer to **1.3 View & Adjust Setpoints** to set the Oxidant feed ORP setpoints

Controlling Sensor



Sidebar:
Pumps powered by the controller Relays 1 to 5 are switched ON and OFF based on the value of the controlling sensor or sensors.

Control Type: See next page
Each sensor uses a control type based on the water treatment system's effect on the sensor. For example, a cooling tower conductivity and pH **rise** as the tower operates & both these sensor use a **Rising Setpoint**. The ORP of a tower **falls** as the tower operates & ORP uses a **Falling Setpoint**.

Sensor Math
Most feeds are controlled by a single sensor. If the control combines more than one sensor with different units the control setpoints must reflect the result. Example: If the sum of temperature and make-up rate in GPM control a pump, the ON/OFF setpoints are in degrees + rate.

Interlocking & Blocking:
Interlocking prevents a chemical from feeding when the tower or boiler is off line.
Refer to Section 2.8.
Blocking prevents one chemical from feeding while another is feeding. Refer to Section 2.9.

Reliability
Setpoints may be set incorrectly. Sensors eventually fail. Solenoids & Pumps fault.
Refer to Section 2.7 Limiting Feed & Alarms to control a fault response.

2.4 Sensor Controlled ON/OFF Feeds

To view or modify the Control Type key **UP** or **DOWN** to the target Pump or solenoid, & press **ENTER**.

In this example, the **Oxidant** pump is powered by relay **3** and has no controlling sensor set.

Key **ENTER** & **DOWN** to **Configure**.

Key **ENTER**, **UP** to **Control Type**.
Relay **3** is now controlled by a **Falling** setpoint; correct for an ORP controlled **Oxidant** feed.

Press **ENTER** to modify the displayed **Control Type**
Then **UP** or **DOWN** for options or **EXIT** to leave unchanged.

Falling: ON when below **Turn ON** setpoint & OFF when above **TurnOFF** setpoint (Oxidant & Caustic feeds).

Rising: ON when above **Turn ON** setpoint and OFF when below **TurnOFF** (Acid, AntiChlor Feed & Blowdown-Bleed controls).

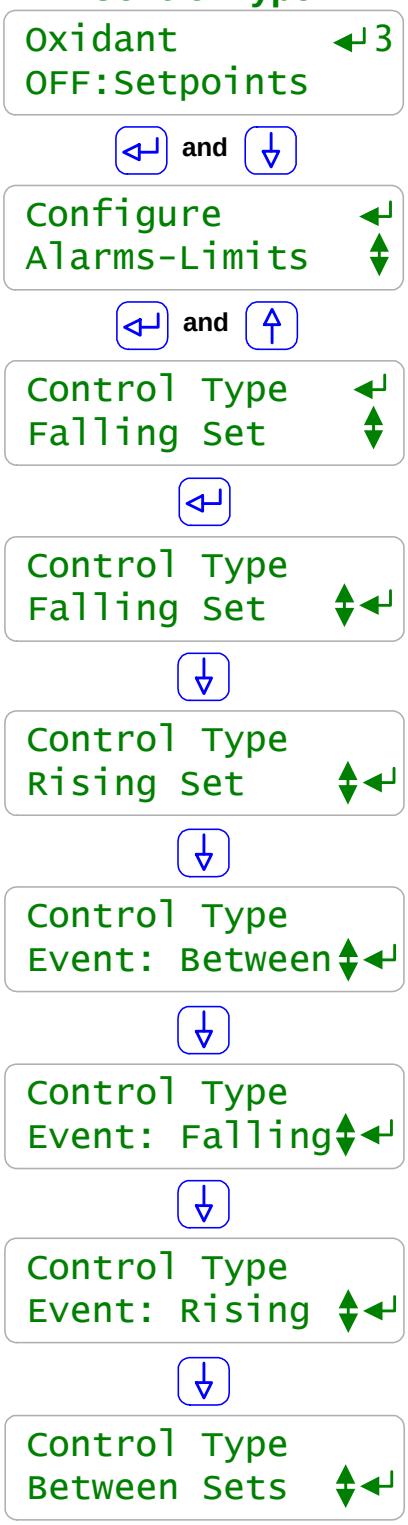
Event Between: ON during a timed Event & between **TurnON** & **TurnOFF** setpoints, otherwise OFF (Scheduled sequenced & level controls).

Event Falling: Active only during a timed Event (Scheduled Oxidant, high ppm chlorine feeds, *'Slug 'til it ORPs'* applications).

Event Rising: Active only during a timed Event (Scheduled bleed controls, lower the conductivity once a day in the air washer sump).

Between: ON between **Turn ON** & **TurnOFF** setpoints, otherwise OFF (Tank Level, chemical test drop count and Temperature controls).

Control Type



Sidebar:
Control type not applicable or displayed for water meter based feeds.
Control Type for frequency controlled pumps **6** to **9** are **Always** & **During Events**

2.4 Sensor Controlled ON/OFF Feeds

To view or modify the **Special Control** used on a pump or solenoid key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Chemical 123** pump is powered by relay **4** and has been **ON** this feed cycle for **104** seconds.

Key **ENTER** & **DOWN** to **Configure**.

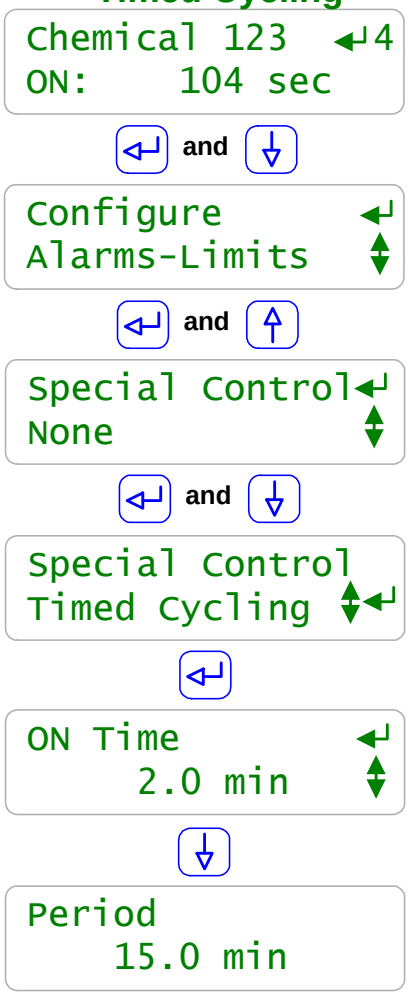
Then **UP** & **ENTER** at **Special Control**.

Key **DOWN** & **ENTER** to select **Timed Cycling** & **ENTER** once selected to view & adjust the cycling control timing.

Key **ENTER** to modify the default **2** minute **ON Time** Setpoint control turns ON & OFF Relay **4** during the **ON Time**.

Key **ENTER** to modify the default **15** minute **Period** Relay **4** is always OFF during 13 minutes in each **15** minute **Period.**

Special Control: Timed Cycling



Sidebar:
Often there is a long time delay between adding a chemical and measuring it's effect at a sensor which causes setpoint overshoot and poor control.
Examples: Pumping citric acid into a large swimming pool or adding bleach to a cooling system with a large sump volume.

The **Timed Cycling Special Control** feeds for a user defined **ON Time** then waits for a user defined time before feeding again, allowing the system to respond to the fed chemical. During the **ON Time** ON-OFF pumps and frequency controlled pumps feed on setpoint control.

The '**Chemical 123' Diagnostic** display counts down the time in the **ON Time** and OFF **Period.**

Selecting a **Special Control** automatically sets typical default times or sensor values.
Adjust the default values for your site's application.

2.4 Sensor Controlled ON/OFF Feeds

To view or modify the **Special Control** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Chemical 123** pump is powered by relay **4** and has been **ON** this feed cycle for **104** seconds.

Key **ENTER** & **DOWN** to **Configure**.

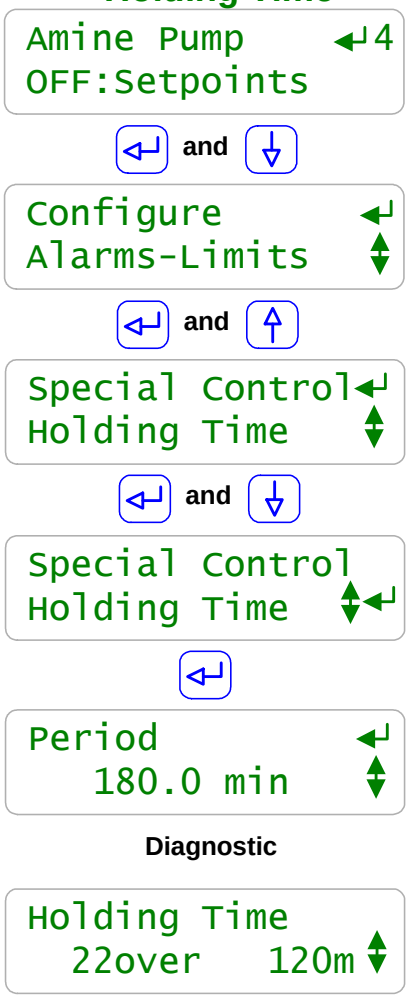
Then **UP** & **ENTER** at **Special Control**.

Key **DOWN** & **ENTER** to select **Holding Time** & **ENTER** once selected to view & adjust the **Holding Time** period .

Key **ENTER** to modify the default **180** minute **Holding Time**. Setpoint control uses the value of the controlling sensor averaged over the most recent 180 mnutes.

The **Diagnostic** display shows **22** logged sensor values averaged over the **120** minute **Holding Time** are controlling relay **4**.

Special Control: Holding Time



Sidebar:
If there is a very long time delay between adding a chemical and measuring it's effect at a sensor and/or the controlling sensor average is correct but controlling on discrete sensor values is inaccurate, the value of the controlling sensor can be averaged over a user defined **Holding Time**

Example: Feeding amine based on the condensate pH.

The **Holding Time Special Control** uses the logged values of the sensor averaged over the Holding Time to control an ON/OFF pump or solenoid or a frequency controlled pump.

Example: If the sensor logging period is 5 minutes and the **Holding Time** is 120 minutes, then the most recent 24 values of the sensor are used for control.

Holding Time applies only to the first sensor in a control averaged over 1440 minutes max.

2.5 Proportional Feed

Special Control: Time Modulate

To view or modify the **Special Control** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

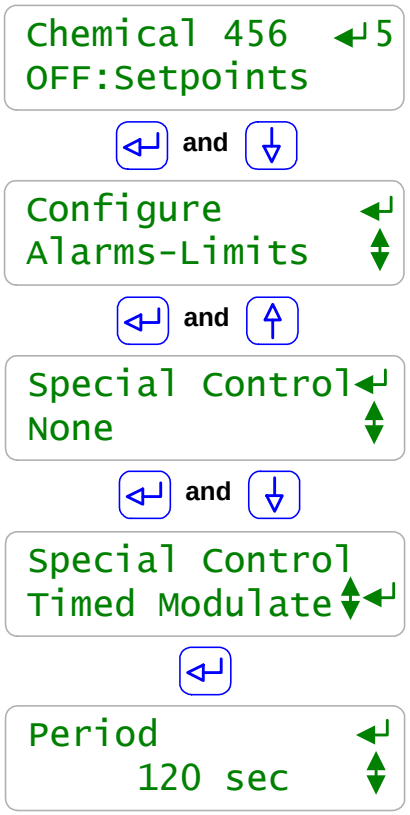
In this example, the **Chemical 456** pump is powered by relay **5** and is currently **OFF**.

Key **ENTER** & **DOWN** to **Configure**.

Then **UP** & **ENTER** at **Special Control**.

Key **DOWN** & **ENTER** to select **Time Modulate** & **ENTER** once selected to view & adjust the modulation timing.

Key **ENTER** to modify the default **120** second **Period**. Pump ON time will vary between 0 and 120 seconds in every 120 second period as the controlling varies between setpoints.



Sidebar:
Frequency controlled pumps connected to controller outputs '**6**' to '**9**' are proportionally controlled as the controlling sensor varies the pump frequency.

Often there is a need to proportionally control an ON/OFF pump connected to one of the controller power relays '**1**' to '**5**'.
Examples: The pump may be oversized for the application or turning down the pump stroke or frequency may cause loss of prime or feed line blocking.

The **Time Modulate Special Control:**
Turns OFF below the **TurnOFF** setpoint and is always ON above the **Turn ON** setpoint.
Between setpoints, linearly increases the ON time from zero @ the **TurnOFF** setpoint to always ON at the **Turn ON** setpoint.

Example: Period=**120** seconds, pH **Turn ON** = 7, pH **TurnOFF** = 8, current pH = 7.4.
ON time = 48 seconds in every 120 seconds, OFF time = 72 seconds in every 120 seconds.

Time Modulate Special Control works for both rising & falling setpoints.

2.6 Base Feed

Percent Time

To view or modify the **Special Control** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Inhibitor** pump is powered by relay **1** and is currently **OFF**.

Key **ENTER** & **DOWN** to **Configure**.

Then **ENTER** & **UP** to **Special Control**.

Key **ENTER** & **DOWN** to change **Special Control** from **None** to **Percent Time**. Frequency controlled pumps will display a **Base Feed** option.

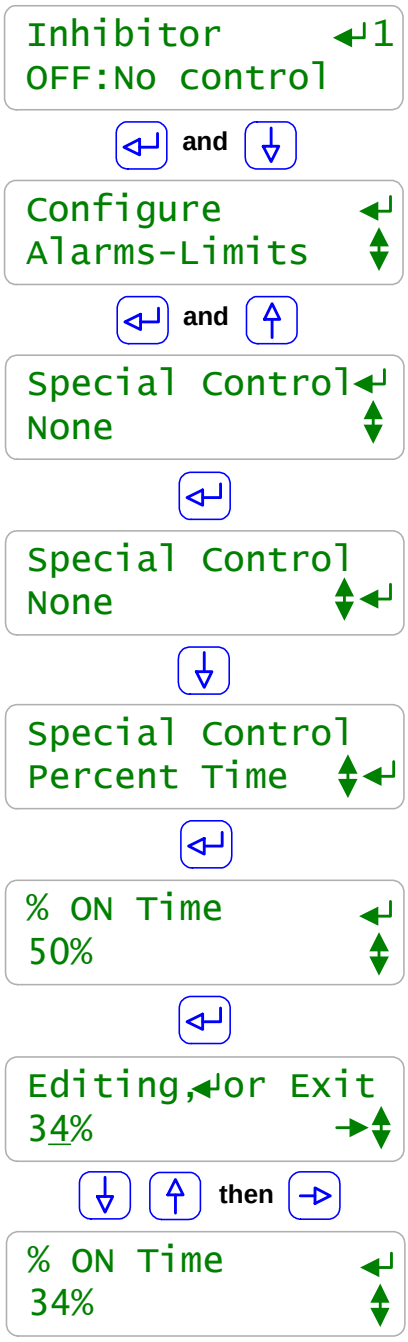
Key **ENTER** once selected to view & adjust the **% ON Time** from the default **50%.**

50% turns ON the pump for 150 seconds in every 300 seconds, 5 minutes

Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the prime time or **EXIT** to leave unchanged.

In this example we've decreased the base feed rate from 50% to 34%. The pump will be ON for 102 seconds in every 300 seconds.



Sidebar:
Base Feeds are used to continuously feed a chemical.
In some cases, as a temporary measure while a sensor is replaced or a water meter repaired or to pre-treat a system on start-up
Boiler chemicals are frequently base fed as long as the boiler's on-line contact set is closed.
Concentration is modified by changing the frequency controlled pump (**6** to **9**) feed rate or relay (**1** to **5**)**% ON Time**.

2.7 Limiting Feed & Alarms

To view or modify the **Alarms-Limits** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Inhibitor** pump is powered by relay **1** and is currently **ON** & owes 46 seconds of feed.

Key **ENTER** & **DOWN** to **Alarms-Limits** & key **ENTER**.

The **Minutes per Actuation** limit is the elapsed ON time for each ON-OFF cycle. Key **ENTER** to adjust. This alarm does not reset at midnight. After this pump has been ON for 25 hours, it will alarm.

The **Minutes per Day** limit is the total ON time In any one day. Key **ENTER** to adjust. The total time resets at midnight.

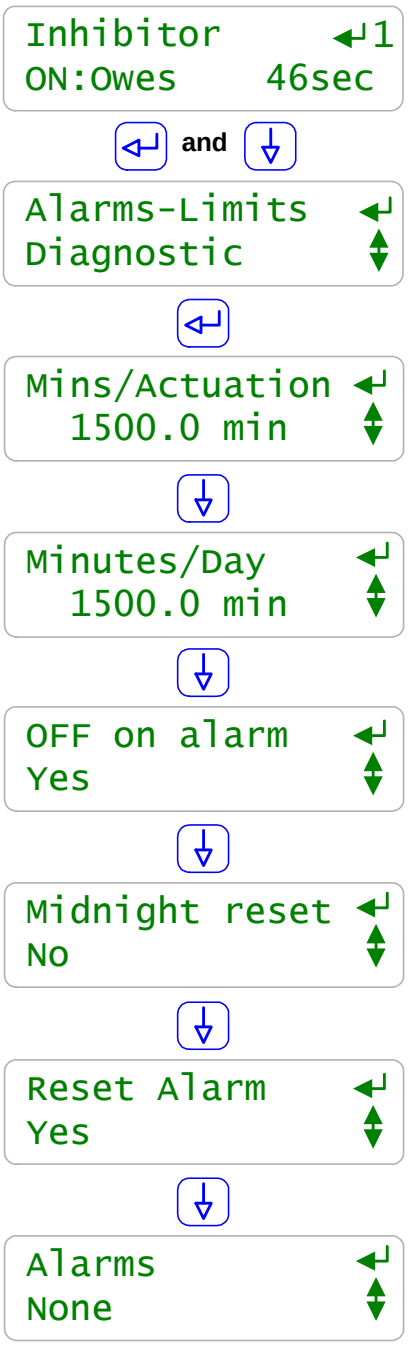
If this pump alarms, it will turn OFF. Bleed Solenoids are usually set NOT to turn **OFF on alarm**. Acid Pumps ALWAYS are set to **OFF on alarm**.

Set to **Yes** to automatically reset the alarm at midnight. Useful to limit the maximum amount of inhibitor fed/day. Always **No** for Acid Pumps; locate & correct the alarm cause.

Ends all owed time or volume. Ends biocide feed events. Will not restart after a **Minutes/Day** alarm unless limit extended

If this pump or solenoid has ever previously alarmed, displays type of alarm and time & date it occurred. Used to flag alarms that have been **Reset**

Alarms-Limits



Sidebar:
Alarms and Feed Limits prevent over feeds and/or alert users to operating faults.
Examples:
A bleed cycle that exceeds 60 minutes indicates a mechanical-electrical problem, set **Mins/Actuation** for the bleed @ 60 minutes.
An acid feed that exceeds 15 minutes indicates that we're out of acid, the pump's unplugged or incorrectly adjusted, the pH sensor isn't responding…

2.7 Limiting Feed & Alarms

To view or modify the **Alarms-Limits** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

In this example, the **Inhibitor 231** pump is frequency controlled by output **8** and is currently **ON** & **Owes 56.4 mL** of feed.

Key **ENTER** & **DOWN** to **Alarms-Limits** & key **ENTER**.

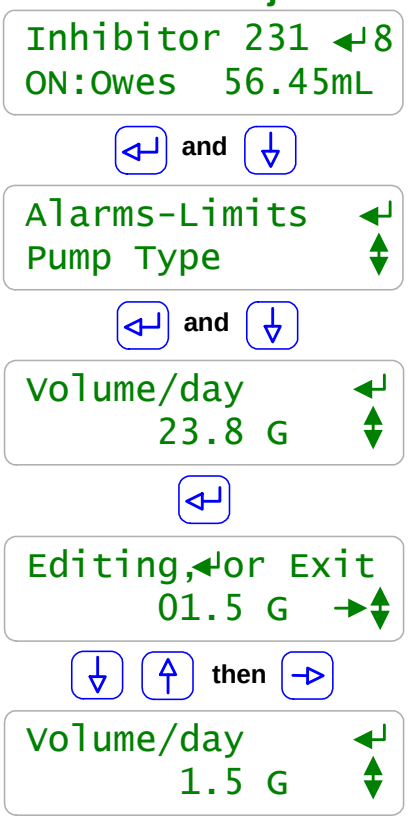
The **Volume/ day** limit is currently set @ 23.8 Gallons. Controllers set to metric units, will display in Liters. Key **ENTER** to adjust.

Key **RIGHT** to move the underline and then **UP** or **DOWN** to change the number.

Press **ENTER** to change the **Volume/day** limit or **EXIT** to leave unchanged.

In this example we've decreased the **Volume/day** limit from **23.8** to **1.5** Gallons
Sanity Check: An 18mL/minute pump, would have to be ON for more 3.5 hours to trip the alarm.

Alarms-Adjust



Sidebar:
Feed Limits are times for pumps & solenoids controlled by relays **1** to **5** and volumes for frequency controlled outputs **6** to **9**.

Set the limits so that worst case operation on the hottest day or highest boiler load will not trip the limit, avoiding nuisance alarms. In more critical applications, run the limit close to actual operating volume or time & use the limit alarms to flag atypical system operation.

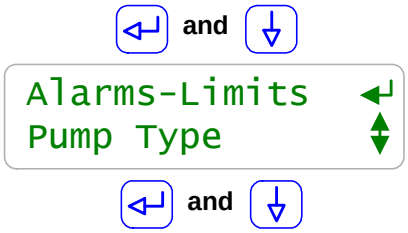
Typically you are only concerned with either the **Actuation** or **Day** limit.
Examples:
Inhibitors usually use the **Day** limit for both cost & ppm objectives, setting the **Actuation** limit so it never trips.
Oxidant feeds usually use the **Actuation** limit to prevent overfeeds & to detect loss of feed, setting the **Day** limit so it never trips.
Acid feeds would use both **Actuation** and **Day** limits since different fault types trip each limit alarm.

2.7 Limiting Feed & Alarms

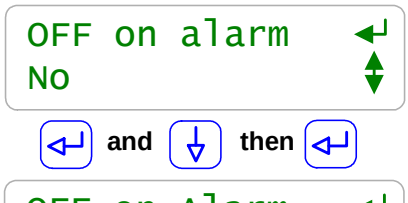
Alarms-OFF On Alarm

To view or modify the **Alarms-OFF on Alarm** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

Key **ENTER** & **DOWN** to **Alarms-Limits** & key **ENTER**.



Key **ENTER** & **DOWN** or **UP** to **OFF on Alarm**

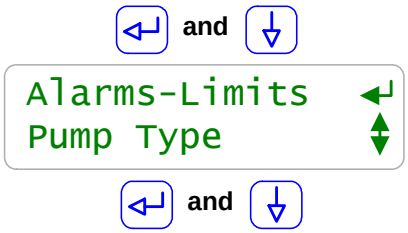


Key **ENTER, DOWN, ENTER**.
to change the **OFF on Alarm** from **No** to **Yes**
or **EXIT** to leave unchanged.

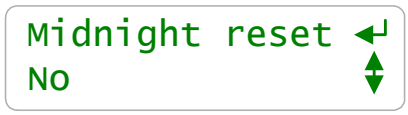
Alarms-Midnight

To view or modify the **Alarms-Midnight reset** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

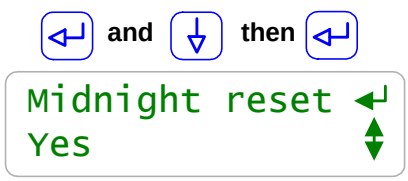
Key **ENTER** & **DOWN** to **Alarms-Limits** & key **ENTER**.



Key **ENTER** & **DOWN** or **UP** to **Midnight reset**



Key **ENTER, DOWN, ENTER**.
to change the **Midnight reset** from **No** to **Yes**
or **EXIT** to leave unchanged.



Sidebar:
Chemical feeds are usually all set to **OFF on alarm** since an overfeed indicates an operating problem which requires correction and continuing to feed may case damage or incur product cost. Bleeds & Blowdowns are not set to **OFF on Alarm**.

Inhibitor feeds are frequently set to **Midnight reset** to maintain daily cost-usage targets. Acid & Oxidant feeds are never set to **Midnight reset**.

2.8 No Feed on No Flow

To view or modify the **Interlocks** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

Key **ENTER** & **DOWN** to **Configure** & key **ENTER**.

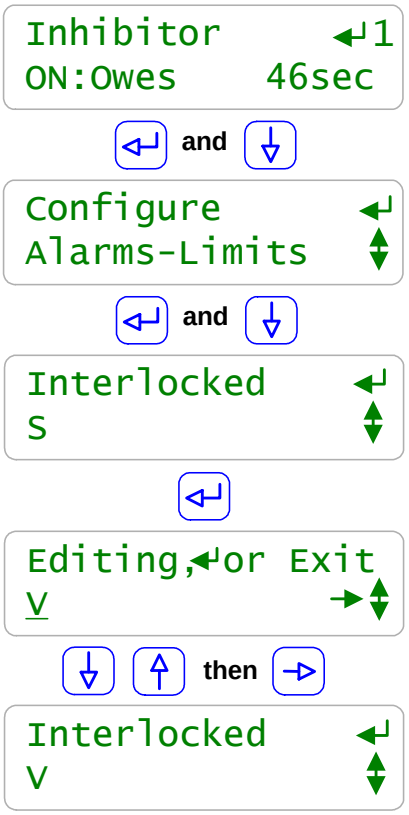
The **Inhibitor** pump is Interlocked by the flowswitch connected to controller input '**S**'.
When flowswitch '**S**' is **ON** the **Inhibitor** can pump.
Key **ENTER** to adjust.

UP or **DOWN** to change the **Interlock**.
Key **RIGHT** to use more than one flowswitch.

Press **ENTER** to change the **Interlock** or **EXIT** to leave unchanged.

In this example we've changed the flowswitch from controller contact set input '**S**' to '**V**'

Configure:Interlocks



Sidebar:
Interlocks are contact sets that must be closed for a Pump to feed, a Solenoid to open or a boiler Blowdown Valve to operate.

Cooling towers use a flowswitch in the sensor piping to detect that the cooling tower is operating & it's OK to feed chemicals & bleed the tower.
Boilers use dry contact sets from the boiler firing control or site automation to tell the controller that the boiler or boilers are on-line & it's OK to blowdown.

One or more closed contact sets may be required to **Interlock** a pump.
Examples:
If any of three boilers is on-line, feed sulfite. Each boiler has it's own on-line contact set connected to controller inputs '**T**', '**U**' & '**V**'. The sulfite pump **Interlocked** = **T/U/V**

If there is flow in the feed line(Input '**S**') and the tank level switch (Input '**T**') shows chemical available, feed chemical. The chemical pump **Interlocked** = **S+T**

Notice that Interlocks may be **OR**ed using the '**/**' symbol or **AND**ed using the'**+**' symbol.
The controller prevents a mix of **OR**s and **AND**s in any one **Interlock**.

2.9 Blocking a Feed

To view or modify the **Blocking** used on a pump or solenoid, key **UP** or **DOWN** to the target Pump, & press **ENTER**.

Key **ENTER** & **DOWN** to **Configure** & key **ENTER**.

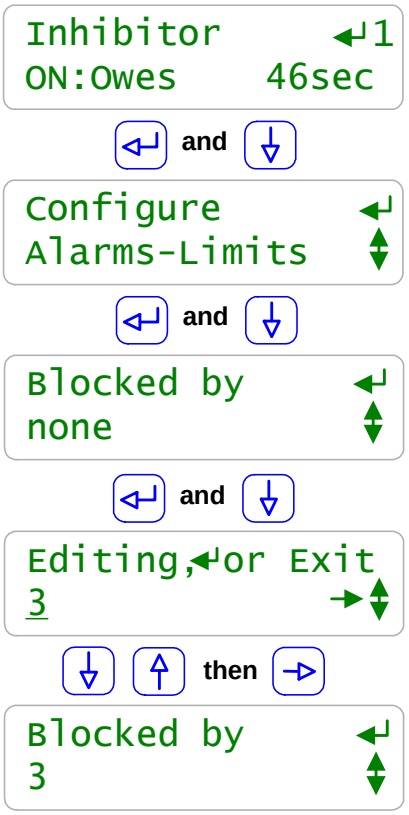
The **Inhibitor** pump is not blocked by any of the other pumps, valves or solenoids. Key **ENTER** to adjust.

UP or **DOWN** to change the **Blocked by**. Key **RIGHT** to add more than one **Block**.

Press **ENTER** to change **Blocked by** or **EXIT** to leave unchanged.

In this example we've prevented the Inhibitor from feeding if the pump connected to Relay '**3**' is ON.

Configure:Blocking



Sidebar:
Blocking prevents one or more chemicals from feeding at the same time. If you are owed time or volume on the blocked pump, the controller remembers and feeds when the block clears.

A pump may be **Blocked** by one or more other pumps, solenoids or valves.

Examples:
1. Some products jell or react in the feed line when fed at the same time.
   Block ChemicalA pump connected to Relay '**4**' with the ChemicalB connected to Frequency '**7**'.
   ChemicalA **Blocked by = '7'.**

2. Some inhibitors are degraded by high levels of oxidant. The Inhibitor pump is connected to Relay '**1**' & the Oxidant pump connected to relay '**3**'. Inhibitor **Blocked by = '3'**

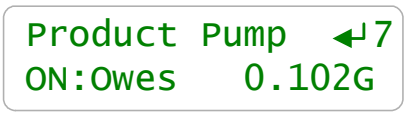
3. Three chemical pumps connected to Frequencies '**6**','**7**' & '**8**' share a common feed line.
   Only one can be fed at a time. Frequency**6 Blocked by = 'none'**,
   Frequency**7 Blocked by = '6+8'** and Frequency**8 Blocked by = '6+7'**.
   '**6**' can always feed, '**7**' feeds if '**6**' & '**8**' are OFF, '**8**' feeds if '**6**' & '**7**' are OFF

Caution: Be careful **Blocking** with frequency outputs '**6**' to '**9**' that are controlled by a sensor to ensure that they occasionally turn OFF to allow the blocked pump to feed.

2.10 Feed Diagnostics

Diagnostic

To view or modify the **Diagnostic** for a pump or solenoid, key **UP** or **DOWN** to the target Pump
The main menu display provides the current state.
Press **ENTER**.

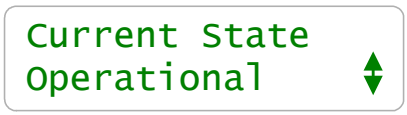


↵ and ↑

Key **ENTER** & **UP** to **Diagnostic** & key **ENTER**.
& **UP** or **DOWN** .

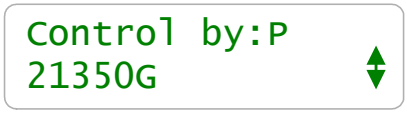
↵

Displays **Alarmed** if feed stopped on **Actuation** or **Day** limits.



↓

Displays the controlling sensor, meter or contact set.
This example shows a pump controlled by meter '**P**' and today's volume measured by '**P**'.



↓

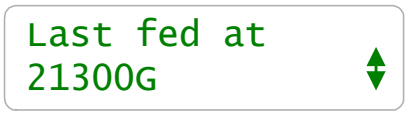
Displays the first setpoint type & value.
This example is meter controlled so the first setpoint is the volume measured by water meter '**P**'.

↓

Displays the 2nd setpoint type & value.
This example is a meter paced frequency controlled pump so the 2nd setpoint is the feed ppm for **75** Gallons.

↓

Meter paced feeds display the volume at the last feed.
This example shows feed @ **21300** Gallons. Since '**P**' now measures **21350** Gallons, the next feed will occur @ 21375 Gallons.



↓

Feed events can occur in parallel with other controls.
In this example there are no feed events set & it's **Day 12**, Thursday of week 2 of the **28** day, 4 week, feed cycle.

continued

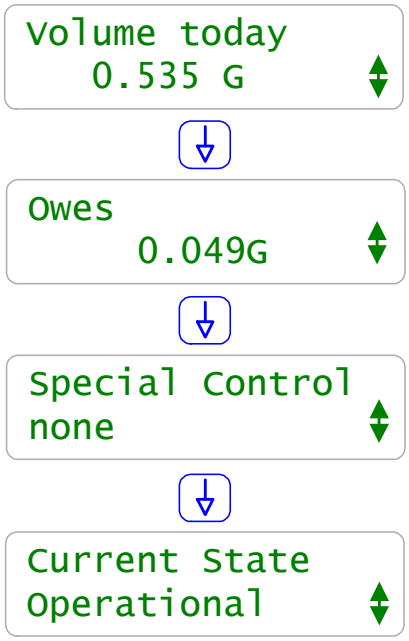
Sidebar:
Diagnostics vary with the output type and control. Relays '**1**' to '**5**' use ON time instead of the volumes of Frequency controls '**6**' to '**9**'.

The main menu displays **Blocked** & the blocking output OR **Lockout** & the **Interlock** input OR **Alarmed** if a pump cannot feed.

2.10 Feed Diagnostics

Diagnostic continued

Frequency controls '**6**' to '**9**' display **Volume** fed today from midnight.
Relay controls '**1**' to '**5**' display the ON time from midnight.



Frequency controls '**6**' to '**9**' display **Owed** volume.
Relay controls '**1**' to '**5**' display owed time.

Displays active **Special Control**;
Bleed & Feed, Bleed thenFeed, Percentage Time-Base Feed, Time Modulate, Timed Cycling, Holding Time..
Meter paced feeds don't use **Special Controls**.

& we're back at the top of the **Diagnostic** scroll.

Sidebar:
AEGIS controllers are **Diagnostic** intensive.
Each sensor, water meter , contact set, relay-frequency output and the controller itself has a **Diagnostic** display sequence.

Diagnostic tells you a lot about the operation of the treatment system and is invaluable if you have a configuration problem or feed fault.

Even if you have **Passwords** turned ON, any user can still view the **Diagnostics**.
An uniformed user reading you the **Diagnostic** screen sequence may save you a site trip.

Browser access available locally or remotely via a VPN or modem connection displays all controller Diagnostics.

3.0 Biocides: Feeding by Time & Date

3.1 Setting & Viewing Events

To add a **BioFeed Event** for a pump or solenoid, key **UP** or **DOWN** to the target Pump.

Key **ENTER** & **DOWN** to **BioFeed Event** & key **ENTER**.

Key **ENTER** to **Add an Event**.
Displays the current number of events, zero

Key **UP** or **DOWN** to change the **Day**.
Key **RIGHT** to adjust the **Start** time
& **RIGHT** to adjust the ON time in minutes.

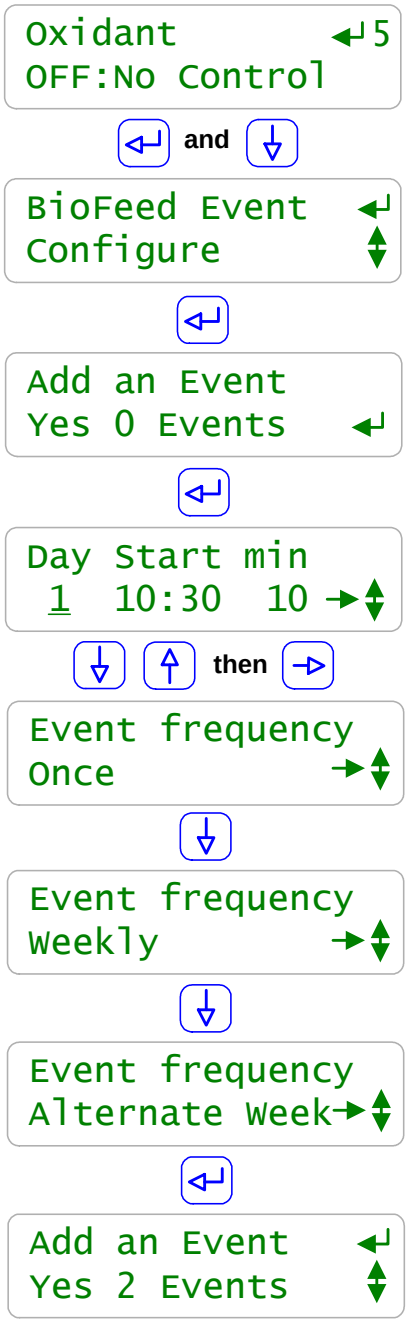
Press **ENTER** to set the **BioFeed Event**
or **EXIT** to leave unchanged.

After you set an event, you select a frequency based on the pump's **Event Cycle**.
This example uses the default 28 day **Event cycle.**

Key **UP** or **DOWN** to select **Once**, **Weekly** (4 events in 28 days) or **Alternate Week** (2 events in 28 days).

In this example we keyed **ENTER** @ **Alternate Week** and now **Add an Event** displays **2 Events**.

Biocide Feed Events



Sidebar:
Event Day can be set from **1** to **28** for Pumps set on a 28 day **Event Cycle** and from **1** to **7** for controllers set on a 7 day **Event Cycle** or always 1 on a 1 day **Event Cycle.**
Events repeat every **1**,**7** or **28** days.

Relays '**1**' to '**5**' feed time in minutes. Frequency controlled outputs '**6**' to '**9**' feed volume in mL.

3.1 Setting & Viewing Events

To edit an existing **BioFeed Event** (Relays '**1**' to '**5**') or a **BioVolume Feed** (Frequency controls '**6**' to '**9**') for a pump or solenoid, key **UP** or **DOWN** to the target Pump.

Key **ENTER** & **DOWN** to **BioVolume Feed** & key **ENTER**.

Key **DOWN** to **Edit an Event** & key **ENTER**.

Key **UP** or **DOWN** to view active events & then **ENTER** @ the event you wish to edit.

Key **UP** or **DOWN** to change the **Day**.
Key **RIGHT** to adjust the **Start** time
& **RIGHT** to adjust the feed volume in **mL**.

Press **ENTER** to set the edited **Event** or **EXIT** to leave unchanged.

In this example we're increasing the volume fed on **Day 24** (Wednesday of week 4) @ **6:30** AM from 200 to **250**mL

Edit BioVolume

Sidebar:
Events with zero minutes ON time or zero volume are deleted.

Each Relay '**1**' to '**5**' and Frequency control '**6**' to '**9**' may have up to 28 Events.
Each Relay and Frequency control may have its own **Event Cycle** of 1,7 or 28 days.

Selecting **BioVolume Feed** & **Delete Events**, removes ALL events.
Selecting **BioFeed Event** & **Delete Events**, removes ALL events.

BioVolume: If you key **DOWN** on feed **mL**, the volume fed goes to **500mL** after zero as an easy way to get to a larger volume than the default **120mL.**
Maximum volume per event is 25000mL, 25L

BioFeed: If you key **DOWN** on **ON min**, the volume fed goes to **120** minutes after zero as an easy way to get to a longer feed time than the default **15** minutes.
Maximum feed per event is 1440 minutes, 24 hours.

PotFeeders : Oxidizing biocides for smaller towers frequently use bleach tablets or pucks in pot feeders. A solenoid connected to Relay '**1**' to '**5**' is turned ON directing flow through the feeder. Verify that both isolation valves are open after filling the feeder.

3.2 Prebleed-Lockout

To view or set **Prebleed-Lockout** for a biocide feed pump or solenoid, key **UP** or **DOWN** to the target Pump.

Key **ENTER** & **DOWN** to **Configure** & key **ENTER**.

Key **UP** to **Special Control** & key **ENTER**.

Key **DOWN** & then **ENTER** to select **Prebleed-Lock**.
Key **ENTER** & **DOWN** @ **Prebleed-Lock** to view the current settings.

Bleed Output is the name of the **Tower Bleed** solenoid. Press **ENTER** to modify for controllers with more than one bleed control.

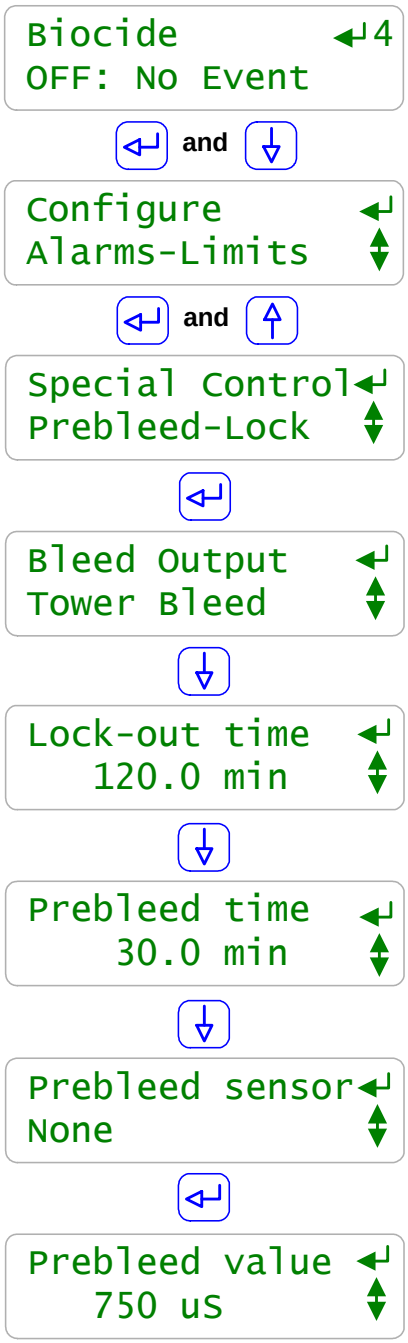
Lock-out time is the time that the **Bleed Output** is OFF during and after each biofeed. Press **ENTER** to modify. Set to zero for no **Lock-out.**

Prebleed time is the time that the **Bleed Output** is ON before each biofeed starts. Press **ENTER** to modify. Set to zero for no **Prebleed.**

Prebleed Sensor controls the **Bleed Output.** Press **ENTER** to modify. Set to **None** for no **Sensor.**

If you select a **Prebleed Sensor**, **Prebleed Value** is used to shorten the **Prebleed time**, preventing over bleeding; loss of water & treatment chemicals. Press **ENTER** to modify.

Prebleed-Lock



Sidebar:
Prebleed lowers tower conductivity before feeding biocide so make-up does not dilute the biocide. Biocides are preferably fed when tower thermal load is low & make-up is therefore limited.

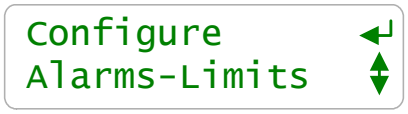
Lock-out prevents tower bleed during the time required for a biocide to act. It may not be necessary to **Lock-Out** lightly loaded towers. Do not **Lock-out** heavily thermally loaded towers for extended periods.

3.2 Prebleed-Lockout

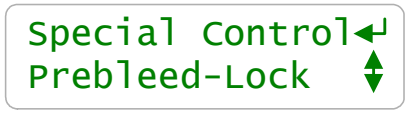
Lockout Time

To view or modify the **Lock-out time** for a biocide feed pump, key **UP** or **DOWN** to the target Pump.

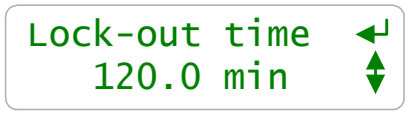
Key **ENTER** & **DOWN** to **Configure** & key **ENTER**.



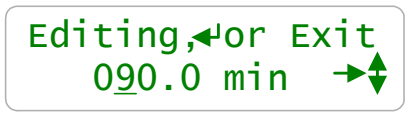
Key **UP** to **Special Control** & key **ENTER**.
Key **ENTER** @ **Prebleed-Lock**.



Lock-out time is currently 120 minute.
Press **ENTER** to modify.

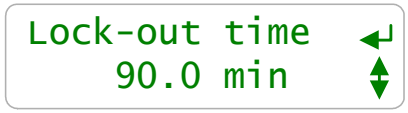


Key **UP** or **DOWN** to change the **Lock-out time**.
Key **RIGHT** to move the digit underline.



Press **ENTER** to set the **Lock-out time**.
or **EXIT** to leave unchanged.

In this example we've reduced the **Lock-out time** from 120 minutes to 90 minutes.
Set **Lock-out time** to zero for no **Lock-out.**



Sidebar:

Lock-out prevents tower bleed during the time required for a biocide to act. It may not be necessary to **Lock-Out** lightly loaded towers. Do not **Lock-out** heavily thermally loaded towers for extended periods.

Lock-out time starts when **Prebleed time** ends and the feed event starts. If you require 90 minutes of residence time for a biocide to be effective then **Lock-out time** = Feed time + 90 minutes.

Biocide Pumps powered by Relay '**1**' to '**5**' should be set to MAX stroke & frequency to slug feed.
Bioicide Feed on frequency controls '**6**' to '**9**' will feed at MAX frequency.
In either case, the feed objective is to get to the target kill concentration quickly.

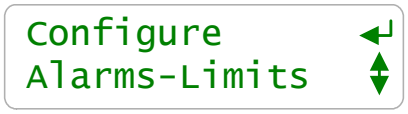
Prebleed time & **Prebleed value** are viewed and adjusted in the same way as **Lock-out time**.

3.2 Prebleed-Lockout

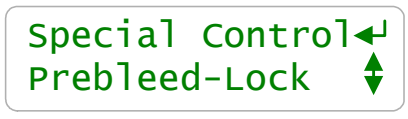
Prebleed-Output

To view or modify the **Prebleed Output** for a biocide feed pump, key **UP** or **DOWN** to the target Pump.

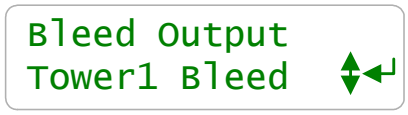
Key **ENTER** & **DOWN** to **Configure** & key **ENTER**.



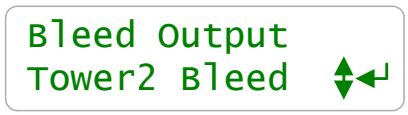
Key **UP** to **Special Control** & key **ENTER**.
Key **ENTER** @ **Prebleed-Lock** & **UP** or **DOWN** to **Bleed Output**.



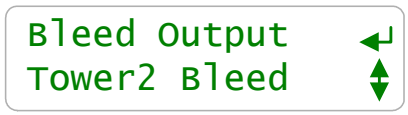
Bleed Output is currently set to **Tower1 Bleed**.
Press **ENTER** to modify.



Key **UP** or **DOWN** to change the **Bleed Output**.



Press **ENTER** to set the **Bleed Output**.
or **EXIT** to leave unchanged



In this example we've switched the **Bleed Output** from **Tower1 Bleed** to **Tower2 Bleed**.

Sidebar:
Most controllers are single tower & there only have one bleed solenoid or valve.
Bleed Output allows sites with more than one bleed control connect a bleed with its biocide feeds.

Alternate Feed Method:
You can also use **Prebleed** to feed another chemical prior to each BioFeed by powering the pump on the **Bleed Output**. It's a simple way to sequence feeds.

Remember you don't need to use both **Prebleed** and **Lock-out**.
The use of these controls will vary with the chemical fed and the type of water treatment system & the time of day when feed occurs.

Prebleed Sensor is viewed and adjusted in the same way as **Bleed Output**.

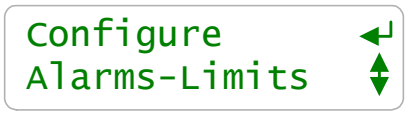
3.3 Event Cycle

To view or modify the **Event Cycle** for a biocide feed pump, key **UP** or **DOWN** to the target Pump.

Configure:
Event Cycle

↵ and ↓

Key **ENTER** & **DOWN** to **Configure** & key **ENTER**.



↵ and ↓

Key **DOWN** to **Event Cycle.**
This pump repeats its biocide events every **28 Days.**

Press **ENTER** to modify.

↵

Key **UP** or **DOWN** to change the **Event Cycle**.

↑

Press **ENTER** to select a new **Event Cycle**.
or **EXIT** to leave unchanged

↑

↵

In this example we've changed the **Event Cycle** from **28 Days** to **7 Days**.

Sidebar:
If you are feeding two organic biocides, alternating every week, you should use the default **28 Day Event Cycle**.

If you are feeding bleach or another oxidant, you are likely dosing 2 to 3 times week & never on Saturday or Sunday. You should use the **7 Day Event Cycle**

If you are using the Biofeed timer for a process type task like automating sensor cleaning or backwashing a filter, the **24 Hour Event Cycle** may fit your application.

Each Pump or Solenoid may have its own **Event Cycle**.

3.3 Event Diagnostics

To view the **Diagnostics** for a biocide feed pump, key **UP** or **DOWN** to the target Pump.

Key **ENTER** & **UP** to **Diagnostic** & key **ENTER**.

Key **UP** or **DOWN** to view.

Current State displays alarmed if feed limited.

Biocide feeds are often controlled by **Events** and not by sensors or water meters.

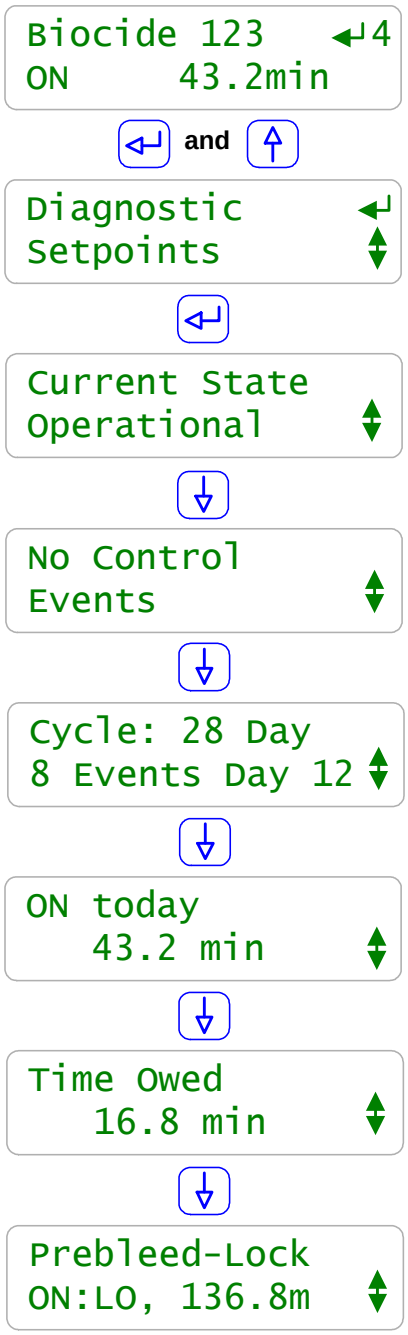
In this example **8 Events** occur in a 4 week cycle. Typical for a biocide fed twice a week. Its now **Day 12**, Thursday of Week 2.

In this example we've been **ON today** for the same time shown on the main menu display, **43.2** minutes. These times wouldn't match for products fed more than once a day

In this example we're owed **16.8** minutes of pump ON time indicating that this feed event will be 60 minutes total.

This biocide pump uses the **Prebleed-Lockout Special Control**. We're currently **ON** and the Lockout, **LO** expires in **136.8** minutes so the Lockout extends 90 minutes after feed ends.

Diagnostic



Sidebar:
When feeding biocides based on time (Relay '**1**' to '**5**') or volume (Frequency Controls '**6**' to '**9**'), you often want to know if you have fed, when feed ends or why you aren't feeding; **Diagnostic** provides this state information.
Prebleed counts down in **Diagnostic** & the feed starts. **Lockout** may extend beyond the end of the feed period, stopping the tower from bleeding.
Here's why the bleed is ON but the conductivity is less than the bleed setpoint.

4.0 Sensors: Conductivity, pH, ORP, Corrosion, 4-20mA…

4.1 Sensors 101

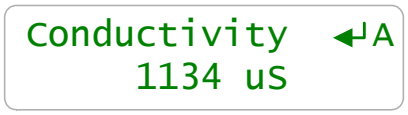
4-20mA Inputs: Specialized sensors for ClO_2, Chlorine and other process and water treatment parameters are connected to the controller 4-20mA inputs where they are used for control, monitoring and data logging.

Sensor Measures	Controls	Operating Issues / Notes
Conductivity	**Cooling, Tower Boiler:** TDS, cycles of concentration controls. **Condensate:** Monitoring and bypass valve control. **Closed Loops:** Automated inhibitor feed	The ratio of Tower to Make-up water conductivity may also be used for cycle control. Cycles of concentration are also controlled on the ratio of make-up to bleed volume using water meters with conductivity as monitoring only.
ORP	**Oxidants, Bleach:** Biocide control. **Anti-Chlor:** Bisulfite & other free chlorine supression fed upstream of ROs or prior to wastewater release**.**	Sensitive to fouling by high levels of iron and oils & greases. Install vertically, tip down. Conversion from ORP mV to ppm varies from site-to-site. No response @ very high oxidant levels.
pH	**Acid:** Increases tower cycles of concentration. Process applications. **Caustic:** Increases pH in both Tower and Boiler applications	Install vertically, tip down. Requires a solution ground. Reliability increases if calibrated in-line.
Corrosion Rate	Typically monitoring only for metals which suffer general corrosion: Steel, copper, Cupro-nickel, Admiralty and Zinc(Galvanizing).	Alarms on increase in corrosion rate & measures in MPY (mils per year) Not useable for metals which pit like Aluminum and Stainless steels.
Temperature	**Sulfite**: Temperature of Deaerator or boiler feedwater Temperature compensates conductivity and pH and is used to alarm on loss of cooling or freezing.	Sensors connect directly to the controller and sensor driver cards. Some sensor types are converted to 4-20mA inputs prior to measuring.
4-20mA Inputs	4-20mA represents GPM, Steam Demand, Level, remote pH & temperature… **Amine**: Steam Demand **Inhibitor-Treatment:** GPM. **Tank-Sump Level**: Alarms	Most operational problems occur during commissioning; ensuring the loop is powered and converting the measured current to the sensor units.

4.2 Sensor Calibration

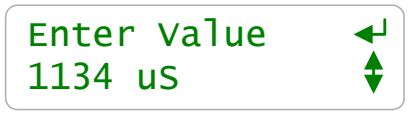
Sensor Calibrate

To calibrate a sensor, key **UP** or **DOWN** to the target sensor and press **ENTER**.



Key **ENTER** @ **Calibrate**.

Displays current value. Key **ENTER** to modify.



Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the digit underline.

Press **ENTER** to calibrate.
or **EXIT** to leave unchanged.

In this example we increased the value measured by a conductivity sensor from **1134 uS** to **1264 uS**.

Sidebar:
Single Point Calibration: All sensors but some 4-20mA inputs can be single point calibrated. Aquatrac recommends that you measure a sample from the sensor installation line and calibrate the sensor based on the grab sample. It's the simplest, most repeatable method.

Corrosion rate sensors are not calibrated.

Water treatment systems, setpoint control so that the conductivity, pH or ORP is controlled within a narrow range, allowing simple single point calibration.

Process control and monitoring only sites which may operate over a wide sensor range benefit from 2 point calibration. For these users, the controller supports direct set of sensor OFFSET & GAIN.

Calibration Faults: Refer to the next page for options on fault.

Inventory and Manual Input sensors
Use **Calibrate** when you fill a tank to correct the **Inventory** level.
Use **Calibrate** after you measure a drop count to update a **Manual Input**.

4.2 Sensor Calibration

If the controller cannot calibrate you'll view this warning after you modify the sensor value & key **ENTER**.

Key **ENTER** to ignore the warning or **EXIT** to return the sensor to its pre-calibration value.

To reset the sensor to its factory default setting key **ENTER** and **DOWN** to **Factory Reset**.

Press **ENTER**.
Factory Reset doesn't correct the problem which caused the warning

In this example, we started at **1134 uS**, got a warning when we calibrated at **1264 uS** and returned to **846 uS** after **Factory Reset**. Looks like this sensor is fouled.

Calibrate Faults

Sidebar:
Sensor Fault: The controller verifies that sensor OFFSET or GAIN required to make the sensor read its new value are within the range of typical sensor operation.
If out of range, **Sensor Fault** displays.

Fault Cause varies with sensor type**.**
Conductivity: Fouling lowers the measured value. Remove and inspect. Whitish deposits indicate overcycling & may require HCl cleaning to remove. If no visible fouling, clean with alcohol or solvent then **Factory Reset**. Refer to Section 7. for boiler sensors.

ORP: Verify sensor cable not shortened & firmly connected. Verify not visibly fouled. If stream contains organics, clean with alcohol or solvent. If stream high in iron or copper restore the sensor's platinum surface with Aqua Regia or equal.

pH: Verify solution ground connected & excess sensor cable coiled at sensor, not in enclosure. Verify sensor cable not shortened & firmly connected. Then replace if no recovery after **Factory Reset**. pH sensor life decreases with handling and temperature extremes.

Temperature: Verify color coding correct and sensor wires firmly connected. Inspect sensor for damage or leaking.

4.3 Sensor Alarms

To view or adjust sensor alarm, key **UP** or **DOWN** to the target sensor and press **ENTER**.

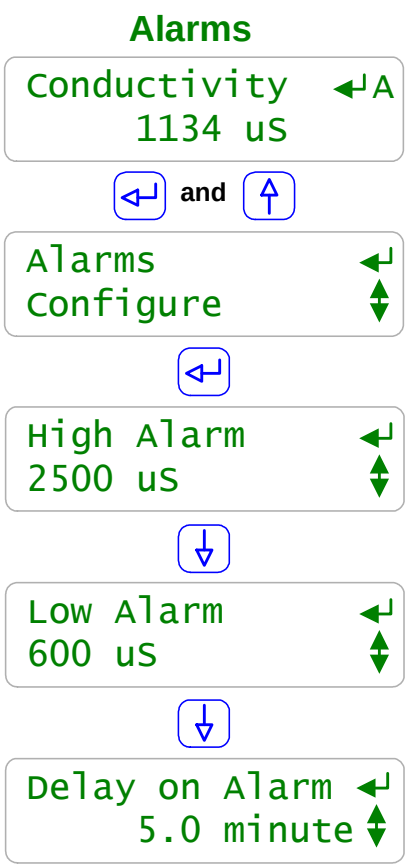
Key **UP** and **ENTER** @ **Alarms**.

In this example, the controller will alarm if the conductivity exceeds **2500 uS** Key **ENTER** to modify.

In this example, the controller will alarm if the conductivity falls below **600 uS** Key **ENTER** to modify.

Delay on Alarm prevents nuisance alarms by requiring, in this example, **5** minutes of fault occur before alarming.

Set the Delay to zero minutes if you require an immediate alarm. Key **ENTER** to modify.



Sidebar:
Sensor Alarms: Nuisance alarms tend to be ignored.
Select alarm limits that represent control fault or sensor failure.

Example:
If the tower make-up is 450uS and you are controlling at 2.5 cycles or 1125uS…

Set the **Low Alarm** at 900uS because if you ever get to 900uS you have a leak or water loss causing undercycling. If your biocide feed **Prebleed** lowers the conductivity below 900uS, then set the **Low Alarm** lower.

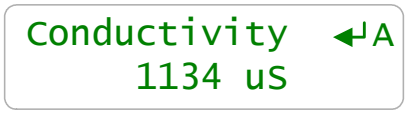
Set the **High Alarm** at 1300uS because if you ever get to 1300uS, bleed control has failed. The bleed solenoid has faulted: The bleed line is blocked or valved off: The controller relay fuse has opened: You're being punished for a misspent youth. If your biocide feed **Lockout** period results in a higher conductivity, increase the **High Alarm**. If your treatment program scales at a conductivity higher than 1250uS without scaling, reduce the **High Alarm**.

If the feed program has a tight temperature limit set the Temperature alarm to alert you.

4.3 Sensor Alarms

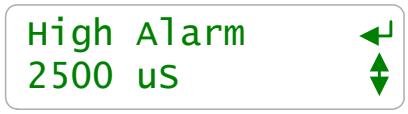
Adjust Alarms

To adjust a sensor alarm, key **UP** or **DOWN** to the target sensor and press **ENTER**.



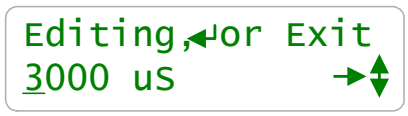
Key **UP** and **ENTER** @ **Alarms**.

Key **UP** or **DOWN** to select **High Alarm**, **Low Alarm** or **Delay on Alarm** & press **ENTER**.



Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the digit underline.

Press **ENTER** to modify.
or **EXIT** to leave unchanged.



In this example we've increased the **High Alarm** from **2500 uS** to **3000 uS**.

Sidebar:
Reset Alarms: Section 1.2 **Clear Alarms** resets the **Delay on Alarm** time
If the **Delay on Alarm** is set to zero minutes and the sensor is above the **High Alarm** or below the **Low Alarm**, the sensor alarm will immediately re-trip.

Alarms when Tower OFF Line:
If the sensor installation piping drains or siphons when the tower turns OFF and a sensor alarm results, install a check valve on the sensor line.
A check valve will prevent alarms but more importantly will prevent wet-dry cycles from depositing on sensing surfaces, causing calibration problems and shortening sensor life.

4.4 Sensor Configure

To view or modify sensor configuration, key **UP** or **DOWN** to the target sensor and press **ENTER**.

Key **DOWN** and **ENTER** @ **Configure**.
Key **UP** or **DOWN** to view current configuration.

Sensor **Description** may be up to 14 characters & numbers
Press **ENTER** to modify.

Sensor **units** may be up to 3 characters & numbers.
In most cases, you'll use default units.
4-20mA Inputs may use '**%**','**ppm**','**GPM**', **LBH**… as **units**
Press **ENTER** to modify.

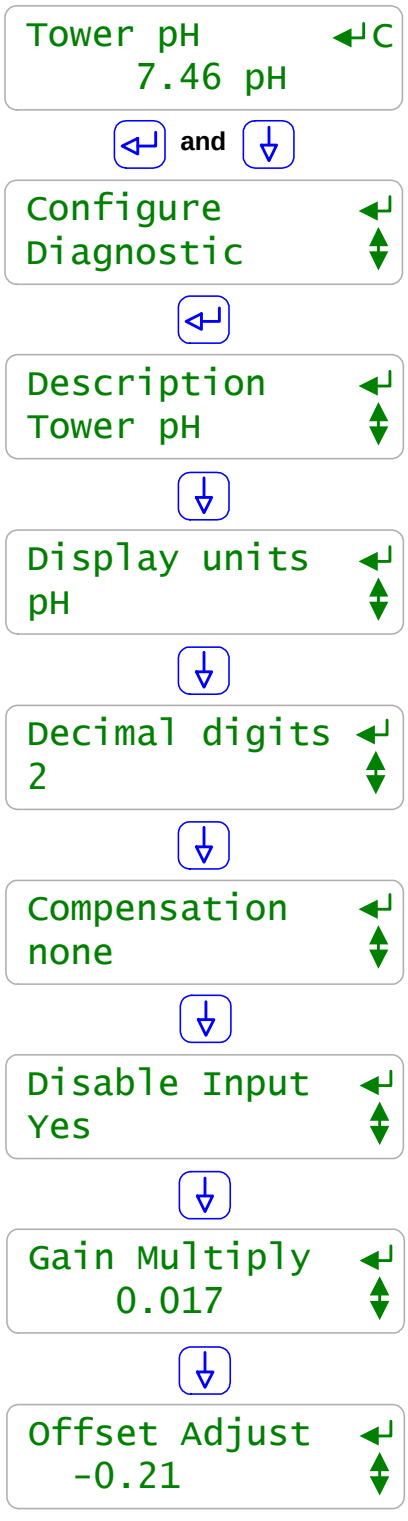
Sensor values may be displayed with from zero to three digits of resolution after the decimal.
Conductivity is usually 0, ORP 1,
pH & corrosion rate typically 2 and ppm 3 digits
Press **ENTER** to modify.

Available **Compensation** varies with sensor type.
pH may have **Temperature** compensation.
Press **ENTER** to select & modify.

A sensor used for control or to compensate another sensor, cannot be disabled.
Disable unused sensors to unclutter and speed display scrolling.

Although you can override single point calibration by directly modifying the sensor **Gain** & **Offset**, this is seldom done.

These values are more useful in flagging failing and fouling sensors

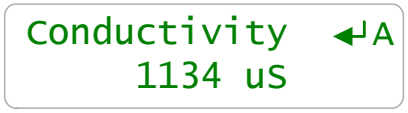


Sidebar:
The following pages detail modifying sensor configuration.

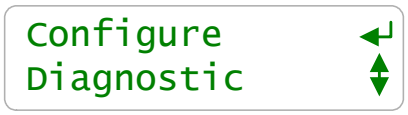
4.4 Sensor Configure

Edit Description

To modify sensor **Description**, key **UP** or **DOWN** to the target sensor and press **ENTER**.

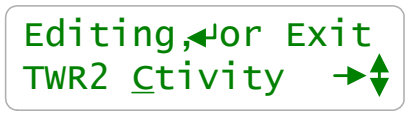


Key **DOWN** and **ENTER** @ **Configure**.



Key **ENTER** to view **Description**.
Sensor **Description** may be up to 14 characters & numbers
Press **ENTER** to modify.

Key **UP** or **DOWN** to change the underlined letter or digit.
Key **RIGHT** to move the underline.



Press **ENTER** to save the new **Description**.
or **EXIT** to leave unchanged.

In this example we've changed the name of the **Conductivity** sensor connect to control input '**A**'; from **Conductivity** to **TWR2 COND.**

Sidebar:
Description editing using the keypad is limited to capital letters and numbers to keep scrolling time reasonable.
Browser users are not limited but all user text editing is rejected if it contains HTML delimiters like < >.

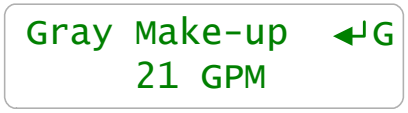
Avoid assigning duplicate or similar names for sensors, requiring the user to identify using only the identifying letter '**A**' to '**N**'.

Each sensor has only one name. It's the same for both Keypad-LCD and Browser users and is included in the controller data logs.

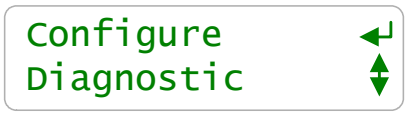
4.4 Sensor Configure

Adjust Resolution

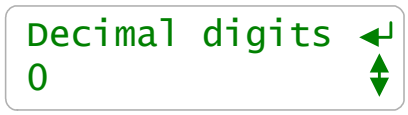
To modify sensor **Resolution**, the number of digital after the decimal, key **UP** or **DOWN** to the target sensor and press **ENTER**.



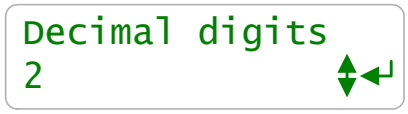
Key **DOWN** and **ENTER** @ **Configure**.



Key **DOWN** to view **Decimal digits**. Press **ENTER** to modify.

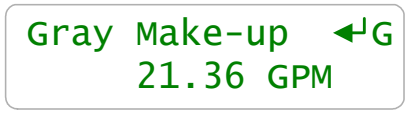


Key **UP** or **DOWN** to change the resolution.



Press **ENTER** to set a new **Decimal digits**. or **EXIT** to leave unchanged.

In this example we've changed the number of digits after the decimal point from **0** to **2**, changing the display of **Gray Make-up** from **21 GPM** to **21.36 GPM**.



Sidebar:
When you select the number of digits displayed after the decimal:

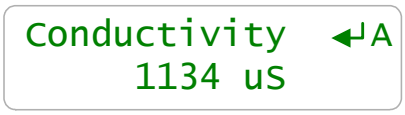
1. Keep the number to a minimum to unclutter the display, making sensor values easier to read & remember.
2. Conductivity is usually not measured with more than 1uS resolution & is never controlled within 1uS so it's not necessary to display fractional uS.
3. Small changes in calculated ppm may indicate a large change in chemical usage so three digits after the decimal is useful.

The displayed resolution of a sensor does not alter the data log resolution or the resolution used for control or the accuracy of sensor calculations.

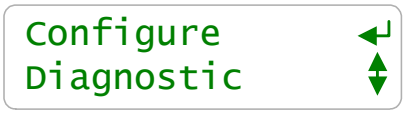
4.4 Sensor Configure

Disabling Sensors

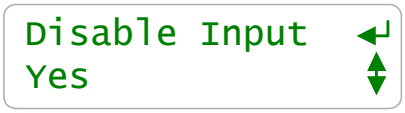
To **Disable** a sensor, key **UP** or **DOWN** to the target sensor and press **ENTER**.



Key **DOWN** and **ENTER** @ **Configure**.



Key **DOWN** to view **Disable Input**.
Press **ENTER** to **Disable**.

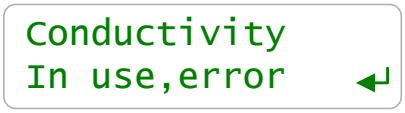


The controller removes the sensor from the display **UP** - **DOWN** sequence and reorders the display.

OR

or

If the sensor is in use for control, used to compensate another sensor or used for inventory or manual entry, it will NOT be disabled & you'll see this display.
Key **EXIT**.



Sidebar:
Disabling a sensor removes it from the display and all selection menus used for control and compensation. Data logging stops for disabled sensors.
Refer to **11.4 Enabling Inputs & Outputs** if you need to re-enable a disabled sensor.

Use Disable Input to unclutter the display, reducing scrolling key presses.

Display Sequence:
The controlling sensor is immediately followed by the controlled pump or solenoid so you can **UP** – **DOWN** between the two.
Sensors unused for control are next, followed by Pumps or Solenoids with BioFeed events, then unused outputs without control or events.

Pumps and valves controlled by more than one sensor, use only the first sensor for sequencing the display.

If a sensor controls more than one output, then more than one output will follow the sensor in the display sequence.

4.5 Sensor Compensation

Some sensor compensation, like thermal compensation is user selectable.
Other types of compensation are set by the sensor driver card, like corrosion rate.
Each sensor type has its own set of compensations.

Sensor Type	Compensation	User Sets or Selects
Conductivity	**Temperature** or **None**	Temperature sensor '**B**' to '**G**' Compensation rate in %/degree
4-20mA Input	**Temperature** or **Rate-to-Volume** or **None**	Temperature sensor '**B**' to '**G**' Compensation rate in %/degree Target meter '**O**' to '**V**' for resulting volume. Rate measured in volume/minute or volume/hour. (Water flow rate is usually GPM or LPM, Steam production is usually LBs/hour)
Corrosion Rate	Set if driver card installed	Alloy Number. (1=Steel, 2=Copper …) Conductivity Sensor '**A**' & '**C**' to '**G**' (Used to correct MPY for error due to water resistance between coupon tips)
pH	**Temperature** or **None**	Temperature sensor '**B**' to '**G**' Controller supplies compensation rate per degree.
ppm	**Calculate ppm** or **None**	Inhibitor Pump '**6**' to '**9**' or feed meter '**O**' to '**V**' Make-up volume meter '**O**' to '**V**' Cycle Method: Fixed or Meter. If Meter, select bleed meter '**O**' to '**V**'
Manual	**Manual Input** or **None**	Enable an input '**H**' to '**N**' for use as manual test or drop count tracker.
Inventory	Set by the volume meter or pump which uses the input.	Enable an input '**H**' to '**N**' for use as Inventory
ORP	**None**	ORP is not temperature compensated
Temperature	**None**	It's tempting to temperature compensate temperature in the way that salty snacks and junk food are tempting. We need to be strong & resist.

4.5 Sensor Compensation

Thermal Compensation

To view of modify sensor **Compensation**, key **UP** or **DOWN** to the target sensor and press **ENTER**.

Key **DOWN** and **ENTER** @ **Configure**.

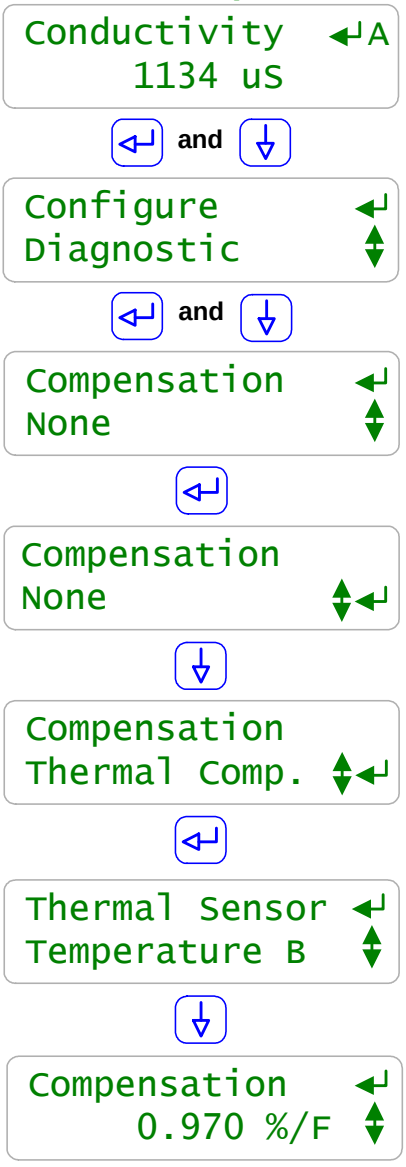
Key **DOWN** to view **Compensation**. Displays current **Compensation** type; **None** in this example. Press **ENTER** to modify.

Press **UP** or **DOWN** & **ENTER** to select. Key **EXIT** to not modify.

In this example we selected **Thermal Compensation**. The controller then displayed **None** as the temperature sensor & we scrolled to and keyed **ENTER** @ **Temperature B**.

Key **DOWN** to view or modify the %/degree value.

This value is typical for cooling water & is not modified unless you are immersed in brine or another non-cooling water stream.



Sidebar:

Conductivity Temperature Compensation:

Cooling tower applications use conductivity as a measure of total dissolved solids (TDS).
If we didn't temperature compensate then we'd have an error of roughly 1%/F in the TDS.
A typical cooling tower 15 degree F temperature rise would cause about a 15% error in TDS because water is more conductive as temperature increases even though the TDS hasn't significantly changed.
We temperature compensate conductivity so it tracks TDS, the variable we want to control.

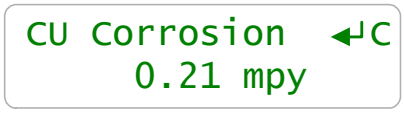
pH Temperature Compensation:

If your site switches to free cooling and water temperature spans 40-60F in a day then temperature compensating pH is worth the slight decrease in overall reliability.
Otherwise you won't see any measurable benefit in temperature compensating pH.

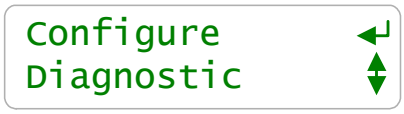
4.5 Sensor Compensation

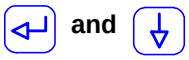
Corrosion Rate

To view of modify **Corrosion** rate sensors, key **UP** or **DOWN** to the target sensor and press **ENTER**.



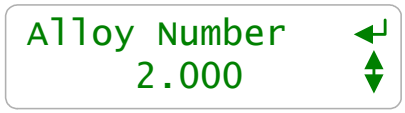
Key **DOWN** and **ENTER** @ **Configure**.



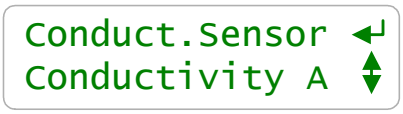


Key **DOWN** to view **Compensation**. Displays the **Corrosion Compensation** type. Press **ENTER** to view settings or modify.

The **Alloy Number** for copper is **2.0**. The default **Alloy Number** is carbon steel @ **1.0** Press **ENTER** to modify.



The compensating **Conductivity Sensor** is **Conductivity A**. Reproducible results in conductivity controlled towers do not require a conductivity sensor. Select a sensor if your process conductivity varies. Press **ENTER** to modify.



Sidebar:

Corrosion Rate Measurements:

Weight loss coupons are commonly used to measure average corrosion rate over the coupon immersion period. The AEGIS' corrosion rate measurement uses **LPR** (Linear Polarization Resistance) for a corrosion rate that's updated every 2 minutes.

Although it's not as accurate as weight loss, it responds immediately to changes in corrosivity & is sensitive enough to detect when you are feeding oxidant, which marginally increases corrosion rate. Sensor life in treated cooling waters is many years.

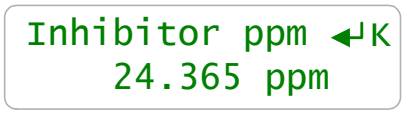
Corrosion rates are measured in mils/year, MPY where 1mil = 0.001".

LPR is a proven technique for real time measurement of general corrosion rates for all of the metals and alloys in typical cooling water systems. It is not useable for aluminum or stainless steels, which pit rather than corrode uniformly.

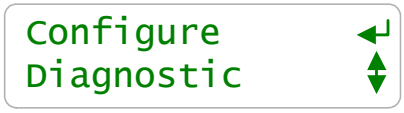
4.5 Sensor Compensation

Calculate ppm

To view or modify **Calculate ppm** sensors, key **UP** or **DOWN** to the target sensor and press **ENTER**.

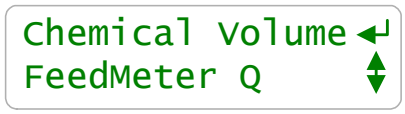


Key **DOWN** and **ENTER** @ **Configure**.



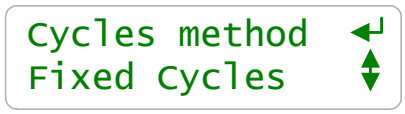
Key **DOWN** to **Compensation.**
Displays **Calculate ppm Compensation** type.
Press **ENTER** twice to view settings or modify.

The **Chemical Volume** meter measures fed volume and is installed on a pump OR is one of the Frequency controlled pumps '**6**' to '**9**'
Press **ENTER** to modify.

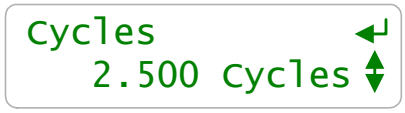


The **Make-up Volume** meter measures the tower OR boiler make-up volume.
Press **ENTER** to modify.

Cycles method may be **Fixed** as in this example OR calculated based on the ratio of Make-up to Bleed water meters.
Press **ENTER** to modify.



Since this example is **Fixed Cycles**, we need to tell the controller the cycles of concentration; **2.5 Cycles** in this example. Press **ENTER** to modify.



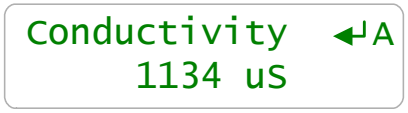
Sidebar:
Calculate ppm:
If the controller knows the volume of chemical fed, the make-up volume and cycles of concentration then the ppm of the fed chemical can be calculated.
The 1mL/pulse Tacmina positive displacement feed meters installed on the pump outlet or the inlet of fractional HP boiler feed pumps are an accurate way to measure volume fed.
In this example, the feed meter is connected to controller input '**Q**'.

Phantom Inputs 'H' to 'N'
In this example we've enabled phantom input '**K**' for use as a ppm sensor.
'**H**' to '**N**' may also be used as **Inventory** or **Manual Input** sensors.

4.6 Sensor Diagnostics

Diagnostic

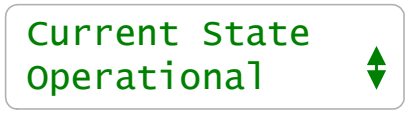
To view sensor **Diagnostics**, key **UP** or **DOWN** to the target sensor and press **ENTER**.



Key **UP** and **ENTER** @ **Diagnostic**.

Sensor Type; **Conductivity** in this example. Also displays pH, ORP, Temperature, Boiler Cond., Condensate, unused, 4-20mA Input or Corrosion.

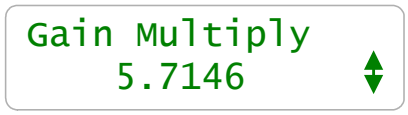
Current State may also display **Alarmed**, **Fail Calibrate**, **4-20mA Open** (4-20mA Inputs only), or **Overrange** (Hardware fault)



Current value of the sensor. With user set digits after the decimal and user set units.

Thermal Compensation is used with cooling tower and condensate conductivity sensors & usually not with boiler conductivity sensors.

Gain Multiply is the value required to make the displayed conductivity match your last calibration.



Default Gain is the **Gain** after a **Factory Reset**. An increasing **Gain Multiply** usually Indicates a fouling sensor.

continued

Sidebar:
Diagnostic displays how the sensor is configured, compensated and calibrated.
This is where you go if you have a non-obvious sensor problem.

4.6 Sensor Diagnostics

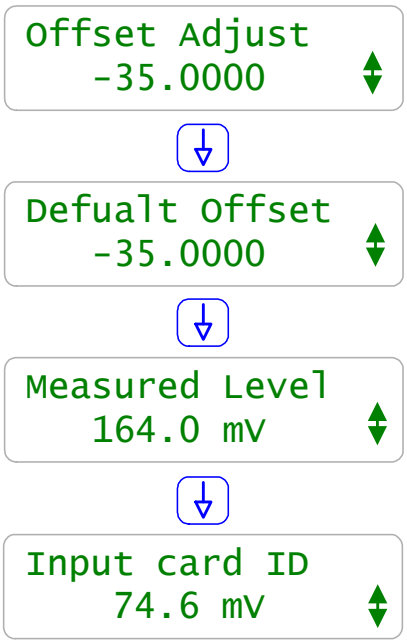
Diagnostic cont.

Offset Adjust is the value required to make the displayed pH, ORP, temperature or corrosion rate match your last calibration.

Default Offset is the **Offset** after a **Factory Reset**. pH & ORP sensors with offsets twice the default offset will not usually track & have failed, contaminated or fouled. Refer to Section **4.2 Calibrate Faults.**

Measured Level is the sensor voltage measured by the controller. Useful when converting 4-20mA currents to GPM… & diagnosing non-tracking sensors.

The controller uses the **card ID** to auto-configure on new driver cards. Some cards also use this level to determine range.



Sidebar:

Gain & Default Gain

When you calibrate a conductivity sensor, the controller adjusts the GAIN to make your measured value match the displayed value.

Offset & Default Offset

When you calibrate a pH, ORP, temperature or corrosion rate sensor, the controller adjusts the OFFSET to make your measured value match the displayed value.

When you two point calibrate a 4-20mA input, the controller adjusts both OFFSET and GAIN.

Inventory, ppm and Manual Sensors:

These sensor types use only the OFFSET to set the displayed value.
The controller ignores GAIN for these sensor types.
For example when you fill a tank and **Calibrate** an Inventory sensor to display 48.5 Gallons, **Offset Adjust** will display 48.5.

Measured Level:

pH sensors have a well defined mV to pH relationship.
Example pH7 = 0mV, pH10=176 mV and pH4 = -176 mV.
Displayed sensor value = (**GAIN** x **Measured Level**) + **OFFSET**.
Using this simple equation, you can directly modify the OFFSET & GAIN to get a desired display.
This is seldom done, but it's convenient for some unusual sensor types.

4.6 Sensor Diagnostics

Corrosion Rate

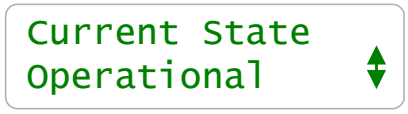
To view **Corrosion Rate** sensor **Diagnostics**, key **UP** or **DOWN** to the target sensor and press **ENTER**.

and

Key **UP** and **ENTER** @ **Diagnostic**.

Sensor Type displays **Corrosion**.

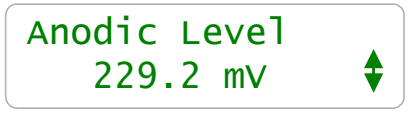
Current State may also display **Alarmed** if above the **High Alarm** or below the **Low Alarm** for longer than the **Delay on Alarm** period.



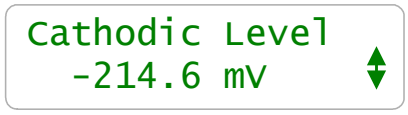
Current value of the **Corrosion Rate** in mils/year where 1mil = 0.001".

Compensation displays **Corrosion**.

Anodic Level is the first of the multiple step measurement sequence that repeats every 2 minutes. **Anodic Level** is usually '+' and increases with increasing corrosion rate.



Cathodic Level is the 2nd step. **Cathodic Level** is usually '-' and increases with increasing corrosion rate.



continued

Sidebar:
Corrosion Rate has a unique set of diagnostics.
Anodic and **Cathodic** levels should be opposite is sign and nominally the same magnitude
If not, the sensor tips may be fouled, debris blocked or pitting.

4.6 Sensor Diagnostics

Corrosion Rate

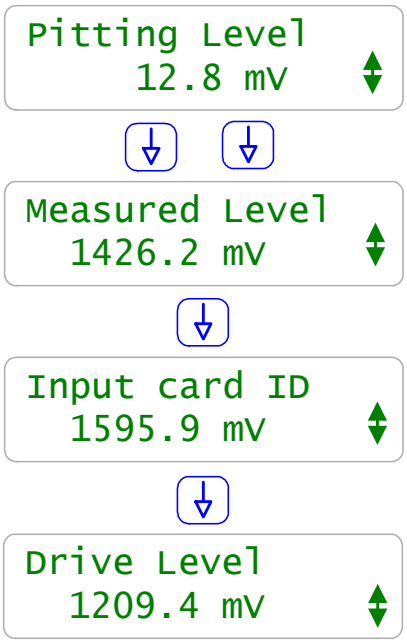
Pitting Level is typically much less than the **Anodic** or **Cathodic** level.

Skips **Gains** & **Offsets.**

Measured Level will change 4 times as the corrosion rate driver sequences through a measurement; about every 30 seconds.

Input card ID is nominally 1600mV for dual corrosion rate and 1510mV for a single corrosion rate driver card.

Drive Level is used to offset **Measured Level**.
Measured Level = **Drive Level** +
(**Anodic** or **Cathodic** or **Pitting**) level.



Sidebar:
Pitting Level
Linear Polarization corrosion rate sensors work correctly unless pitted.
Pitting usually only occurs under deposits in cooling water systems since water treatment prevents pitting on exposed surfaces.

Alarms:
If the magnitude of **Pitting Level** exceeds the **Anodic** or **Cathodic** level, the controller sets the '*Sensor Pitted*' alarm at corrosion rates > 2 mpy.

If a conductivity sensor is selected and more than 50% of the measurement voltage is used to overcome the water resistance, the controller sets the 'Low Conductivity' alarm.

These alarms alert you to error in the displayed corrosion rate.

5.0 Measuring Volume: WaterMeters, Inventory, Verify Feed

5.1 Meters 101

Controller Meter Inputs: Four controller inputs '**O**' to '**R**' are defaulted to meter inputs.
Four controller inputs '**S**' to '**V**' may be user configured as meter inputs to a maximum of 8.
Any Contact Head, Turbine or Feed Verify type meter connects to any controller meter input.

Meter Type	Operation/ Installation / Cabling	Operating Issues / Notes
Contact Head	Meter contact set closes every 100 or 25 or 10 Gallons. Meters are fixed Volume/Contact or configured with moveable magnets. Usually must be horizontal. Most are cabled 2 wire. Electronic switch versions are 3 wire.	The meter of choice for ¾" and 1" make-up lines. Typically not cost effective on larger piping although common on piping up to 6" diameter. 2 wire meters are not polarity sensitive.
Turbine, Paddlewheel	Insertion type meter provides pulses per gallon which decrease with increasing piping size. '**K**' Factor = Pulses/Gallon. Not sensitive to installation orientation. Cabled 3 wire. High temperature versions used for boiler feedwater.	**Warning:** Miswiring may fail the Hall effect sensor within several hours. Do not connect meter prior to commissioning. Upstream and downstream minimum straight piping and full line required. Insertion meters which output a sine wave require a signal conditioner at the meter.
Rate 4-20mA	Connect to fixed controller input '**G**' or to optional 4-20mA input cards. Cabled 2 wire. Controller may convert rate to volume for control or feed on rate.	Typically these are turbine-paddlewheel meters with a pulse-to-rate signal conditioner built into or located at the meter insertion site. May have a local power supply or are powered by controller 15VDC supply.
Feed Verify	Feed meters installed on pump outlet or inlet. Cabled 3 wire.	Both precision 1mL/Pulse and lower cost stroke counters are used. Measure fed volume for ppm and Inventory calculations.
Copied	Meters and Pumped volumes may be copied to other meters for summing control & data logging.	Copying requires only controller configuration.
Boiler Feedwater Pump ON	Contact set closes when boiler feedwater pump ON. Low cost feedwater meter works like a contact head meter.	Applicable for boilers that do not re-circulate. Requires only a relay rated for pump VAC or a contact set signal from boiler DCS.

5.2 Configuring a New Meter

To configure a meter, key **UP** or **DOWN** to the target meter and press **ENTER**.

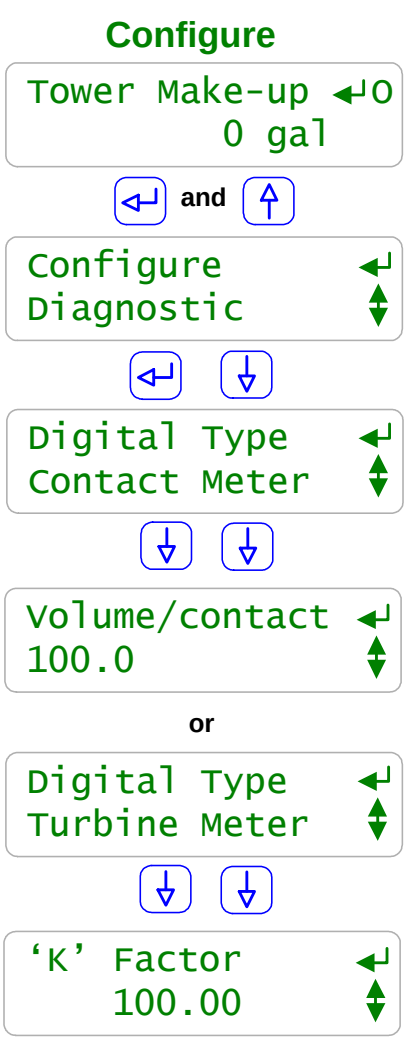
Key **UP** and **ENTER** @ **Configure**.

Key **DOWN** to **Digital Type**
If you are not installing a Contact Head meter, Key **ENTER** and change the **Type**.

Key **DOWN** to **Volume/Contact** and key **ENTER** and adjust if not **100** Gallons/contact closure.

If you've selected **Turbine Meter**.

Key **DOWN** to **'K' Factor.**
Key **ENTER** and adjust the **'K' Factor** or Pulses-per-Gallon for your meter type and pipe size..



Sidebar:

Contact Head Meters

Meters may often be user configured for many Gallon/Contact or Liter/Contact settings. Make sure you get the volume/contact correct or feed concentration errors will occur.

Turbine-Paddlewheel Meters

Nominal **'K' Factors** or Pulses-per-Gallon are listed for each pipe size on the manufacturer's web site or on the installation manual supplied with the meter.
When meter are supplied with entry fittings, the actual 'K' factor is frequently labeled on the body of the meter.

Common Meter Wiring Errors:

1. Switching wire colors when extending 3 wire meter cables.
2. Routing meter wiring in the same conduit as AC power.
   Meter cables are low voltage. If site practice allows, tie wrap meter cabling to the outside of conduit rather than share a conduit with AC power.

5.2 Configuring a New Meter

Select Digital Type

To change a meter type, key **UP** or **DOWN** to the target meter and press **ENTER**.

Key **UP** and **ENTER** @ **Configure**.

Key **DOWN** to **Digital Type**
Displays current type, in this example a contact head meter.

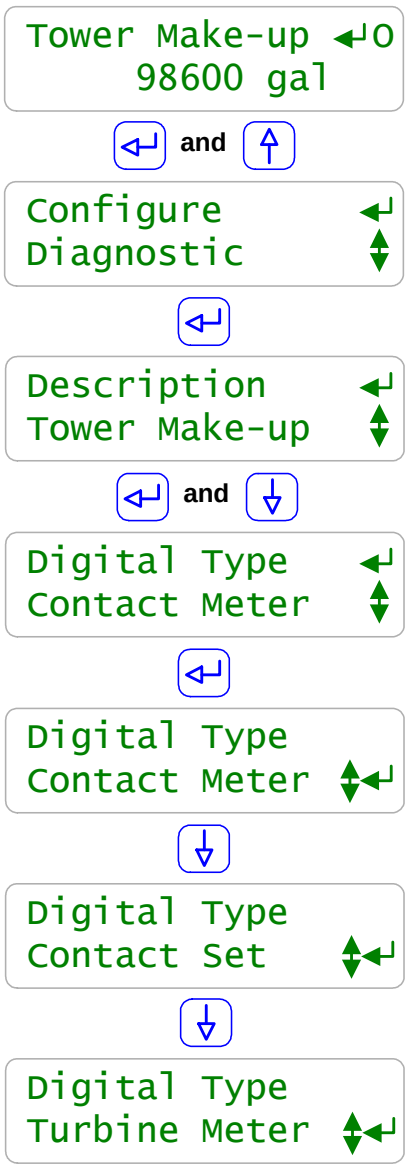
Key **ENTER** and change the **Type**.

Key **UP** or **DOWN** to scroll types and key **ENTER** to select.

Key **EXIT** to remain as a **Contact Meter.**

Select **Contact Set** to use input '**O**' for a flowswitch, boiler ON-line switch or tank level switch.

If you change meter types, verify that **Volume/contact** or '**K' Factor** matches the installed meter



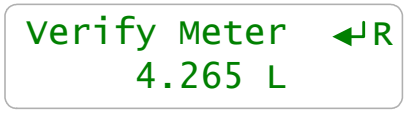
Sidebar:
Digital Type
The eight controller inputs '**O**' to '**V**' may be configured to any combination of meter and contact set inputs. Meter inputs measure volume and contact sets measure state, ON or OFF.

Contact Set Debouncing:
Mechanical water meter contact sets bounce when closing or opening. The controller software debounces so that you don't measure extra counts when you select **Contact Meter**.
Maximum Turbine Pulse Rate:
Turbine pulse streams are not debounced and will measure up to 400 pulses/sec. or Hertz. 400 Hz. is faster than the pulse stream from the Seametrics type meter at maximum **'K' Factor**.

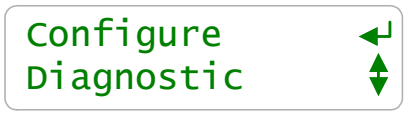
5.3 Feed Verification & Inventory

Feed Verify Select

To configure or view a verify meter, key **UP** or **DOWN** to the target meter and press **ENTER**.



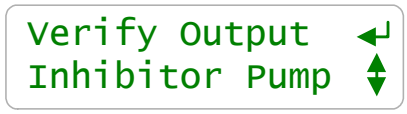
Key **UP** and **ENTER** @ **Configure**.



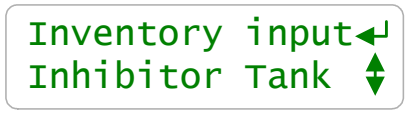
Key **UP** and **ENTER** @ **Feed Verify**.

Key **DOWN** and **ENTER** to initially select **Feed Verify** OR **ENTER** twice to view settings.

The **Verify Output** is the feeding pump or solenoid. In this example we've selected the **Inhibitor Pump**. Key **ENTER** to modify.



The optional **Inventory input** logs pumped volume. In this example we've selected the **Inhibitor Tank**. We'd previously renamed input 'L' as **Inhibitor Tank**. Key **ENTER** to modify.



Wait-to-verify is the time the controller waits for **Verify Meter** to measure volume before alarming. **30 seconds** works for all but the slowest feed rates. Key **ENTER** to modify.

Sidebar:

Feed Verify uses a feed meter on the pump to ensure chemical is pumped when the pump is turns **ON**. Any water meter input '**O**' to '**Z**' can be used for a **Verify Meter**.

Once you've set up the **Verify Meter**, you'll need to tell it which Pump to verify and if you wish keep track of the chemical pumped, which input to use for **Inventory**.

More than one **Verify Meter** can use the same **Inventory input** since more than one pump may use the same tank or tote.

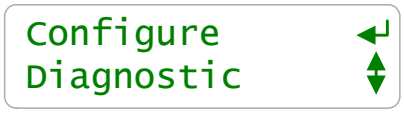
Feed meters may be built into the pump, installed on the pump feed tubing or on the pump suction tubing for fractional HP boiler feed pumps.

5.3 Feed Verification & Inventory

Feed Verify Output

To configure or view a verify meter, key **UP** or **DOWN** to the target meter and press **ENTER**.

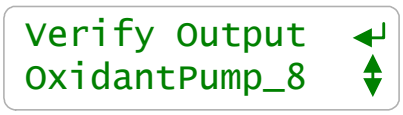
Key **UP** and **ENTER** @ **Configure**.



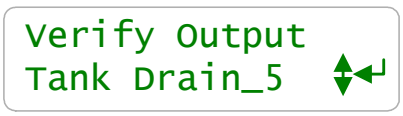
Key **UP** and **ENTER** @ **Feed Verify**.

Key **ENTER**, **ENTER** to display the current **Verify Output**.

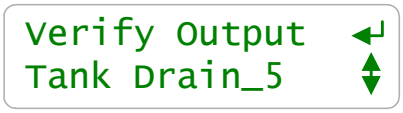
Key **ENTER** and **DOWN** to select a new **Verify Output**.
OR **EXIT** for no change.



In this example the **Verify Output** is a drain solenoid.
Key **ENTER** to select.



Every time **Tank Drain_5** operates, **Drain Meter Q** must measure flow within 30 seconds or the controller will alarm. Adjust the **Wait-to-Verify** time if 30 seconds is not a long enough to wait for '**Q**' volume



Sidebar:
Feed Verify can be used to check any control or feed with a downstream water meter.

In this example we have a product mix tank or a neutralization sump with a drain solenoid, **Tank Drain_5** controlled by Relay 5. **Drain Meter Q** is used to verify that the drain solenoid operated, the drain isn't blocked, the drain line isn't obstructed downstream of the meter…

Relays '**1**' to '**5**' and frequency controlled Pumps '**6**' to '**9**' can be alarmed on fail to feed with the **Feed Verify Compensation**.

Many pumps can be purchased with a low cost option that provides a contact closure whenever the pump feeds, typically every stroke.

These contact sets can **Feed Verify** that the pump has not lost prime, become unplugged or run out of chemical in applications where the accuracy of a higher cost 1mL/pulse meter is not required.

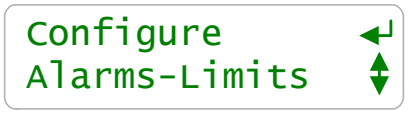
5.4 Cycle Controls

Sequencing Meters

To configure a bleed for meter control key **UP** or **DOWN** to the target bleed and press **ENTER**.

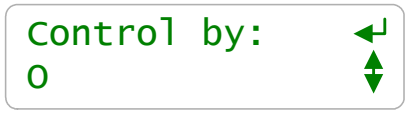
↵ and ↓

Key **DOWN** and **ENTER** @ **Configure**.



↵ and ↓

Key **ENTER** and **DOWN** to **Control by:** and key **ENTER**

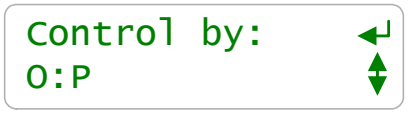


↵

Once you select a water meter for control, The controller limits the operator to '**+**','**-**' and '**:**' when you key **RIGHT**.

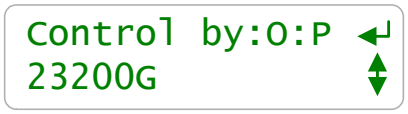
Key **UP** or **DOWN** to select meters for control. In this example we're controlling on tower make-up '**O**' and bleed meter '**P**'.

↓ ↑ then →



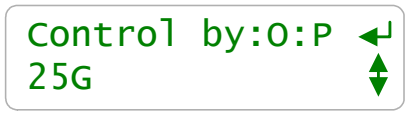
When '**O**' measures its setpoint volume, it turns ON the bleed until '**P**' measures it's setpoint volume.

Diagnostic: Wait for 'O'



The **Bleed Valve Diagnostic** for an '**O**' setpoint = 100 and a '**P**' setpoint = 25; waits for '**O**' to equal **23200** Gallons Then counts down '**P**' from **25** gallons.

Diagnostic: Wait for 'P'



Sidebar:
Cycles of concentration are usually set by the conductivity control that operates the bleed solenoid. If the make-up conductivity & chemistry is constant, two water meters can be used for cycles of concentration control.

For every 100 Gallons of Make-up, the controller opens the bleed solenoid until it measures 25 Gallons. The result is 4 cycles of concentration.
Is this example, the conductivity sensor is used only to monitor the tower and not to operate the bleed solenoid. Volume setpoints can be adjusted for any Cycles target.

Don't worry about the math and each meter's volume/contact rating or 'K' factor. The controller takes care of these details.

5.5 Copying Meters

To copy a meter volume to another meter, key **UP** or **DOWN** to the meter and press **ENTER**.

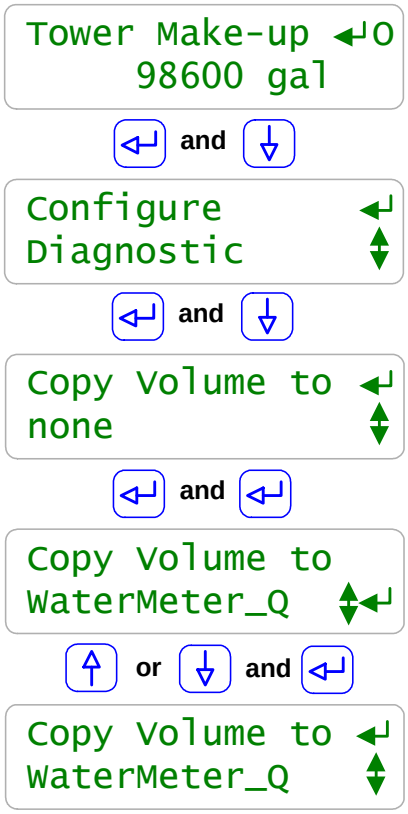
Key **DOWN** and **ENTER** @ **Configure**.

Key **ENTER** and **DOWN** to **Copy Volume to:** and key **ENTER ENTER**

Key **UP** or **DOWN** to select a target meter.

In this example we're copying **Tower Make-up** '**O**' to **WaterMeter_Q**.

Copy Volume to



Sidebar:
The volume measured by one water meter can be copied to another water.
There are several uses for copying meters:
1. More than one meter can be summed for each meter in an O:P type Cycle Control.
2. Several tower's make-ups or boiler's feedwater volumes may be summed to a single meter for logging or alarming purposes. If you enabled a phantom input, '**W**' to '**Z**' you don't need to give up a physical controller meter input to sum volumes.

Meter Control Equations:
Up to 4 Meters can be summed or differenced to control a pump without using **Copy Volume to.**
Copy Volume to adds flexibility to configuring volume feed controls

Operation:
Only the incremental volume measured is copied, not the meter daily total.
Copying starts when you set **Copy Volume to.**
Constraint:
The target meter of a **Copy Volume to** cannot be copied to prevent a run-away circular copy. In this example, if you copied meter '**O**' to Meter '**Q**' and then copied '**Q**' to '**O**', you'd quickly get an infinite volume. The controller blocks this type of circular reference.

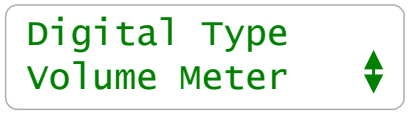
5.6 Meter Diagnostics

Diagnostic

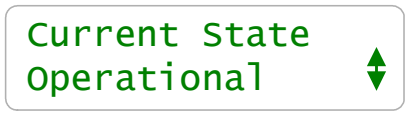
To view Diagnostic for a meter key **UP** or **DOWN** to the target meter and press **ENTER**.

Key **UP** and **ENTER** @ **Diagnostic**.

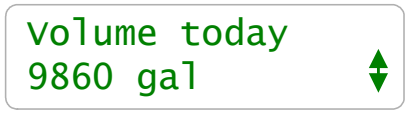
Both Turbine & Contact Head meter display as **Digital Type Volume Meter**.



Displays **Alarmed** if **Volume Today** greater than **High Alarm** or less than **Low Alarm**.

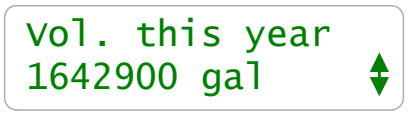


Volume Today is the measured volume from midnight of the current day.



Compensation displays **Feed Verify** if its set on the displayed meter.

Vol. this year is the measured volume in the current calendar year.



continued

Sidebar:
If we are viewing the **Volume Today** at noon and this tower runs 24 hours a day, is this the expected volume for the target cycles of concentration and thermal load?

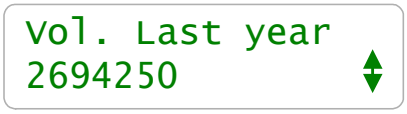
If it's high, are we losing water? If it's low is the meter volume/contact correct? & if it is, is the conductivity control accurate & bleed functioning? or are the cycles of concentration assumptions used for treatment concentration incorrect?

Diagnostics are only useful if you draw operating conclusions from the data.

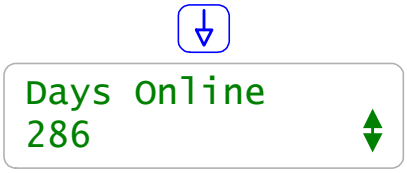
5.6 Meter Diagnostics

Diagnostic cont.

Vol. Last year is the measured volume in the previous calendar year.



Days Online is the number of days that this meter has been enabled and operating in this controller.



Volume/Contact or **'K' Factor** is the current scaling factor for the installed meter

Sidebar:
If **Days Online** = 286 and **Vol. this year** = 1642900 & the tower or boiler operates 24/7 then we're averaging 5750 Gallons/day.
Is this the expected volume for the target cycles of concentration and thermal load?
If we've been averaging 5750 and today at noon we've measured
Volume today = 9860 Gallons, why the increase?

Meter Alarms: Low Alarm
The **Low Alarm** for water meters only trips at midnight if the meter has not exceeded the **Low Alarm** volume. Set **Low Alarms** = 0 to prevent alarms @ midnight.

Use **Low Alarm** to flag towers or boilers that have not made-up,
towers that have had no blowdown or chemicals that have not fed.

Meter Alarms: High Alarm
The **High Alarm** for water meters trips when the meter exceeds the **High Alarm** volume.

Set **High Alarms** higher than the volume expected @ highest thermal load
to prevent nuisance alarms OR close to actual usage to flag you on increased load..

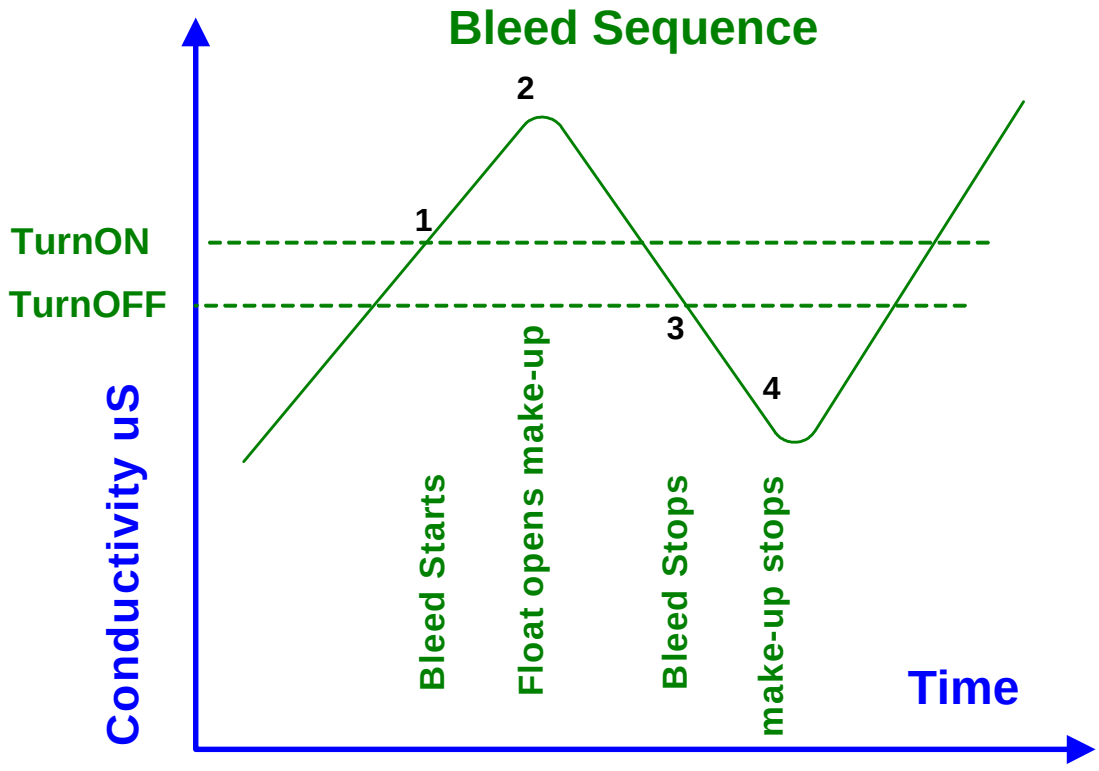
Set **High Alarms** on feed verify meters to flag you on increased usage.

Note; clearing a water meter **High Alarm** without adjusting the **High Alarm** level
will immediately trip another alarm on the meter.

6.0 Cooling Tower Bleed

6.1 Make it Bleed 101

Bleed Control Objective: Bleed setpoints for small and medium size cooling towers should be no more than 10uS apart so that short bleeds are followed by short feeds.
A 10uS control window usually results in the minimum variation in cycles of concentration and inhibitor ppm. Since you calculate expected inhibitor and water usage based on cycles of concentration, minimum variation in cycles increases calculation accuracy.



Notice that the actual minimum and maximum conductivity, **2** & **4**, are set by the make-up float and not by the controller ON & OFF setpoints, **1** & **3**.

Observe a bleed cycle. The amount of conductivity overshoot and undershoot on setpoints shows you the effect of the float and possibly where the make-up enters the sump.

The effect of the bleed cycles on larger cooling towers is more variable. Make-up may be continuous and not ON/OFF. The large water volume is slow to cycle up and slow to change conductivity when the bleed valve opens. Power generation towers frequently use modulating valves for blowdown so that both make-up and bleed may be continuous.

New Construction: It's not uncommon to undersize the bleed line so that the conductivity continues to increase even though the bleed is always ON. Watch for this deficiency during the first hot period & set your bleed and conductivity alarms tight to flag on possible fault.

6.2 Bleed Alarms

To view or adjust the bleed **Alarms,** key **UP** or **DOWN** to the target valve or solenoid and press **ENTER**.

Key **DOWN** and **ENTER** @ **Alarms**.

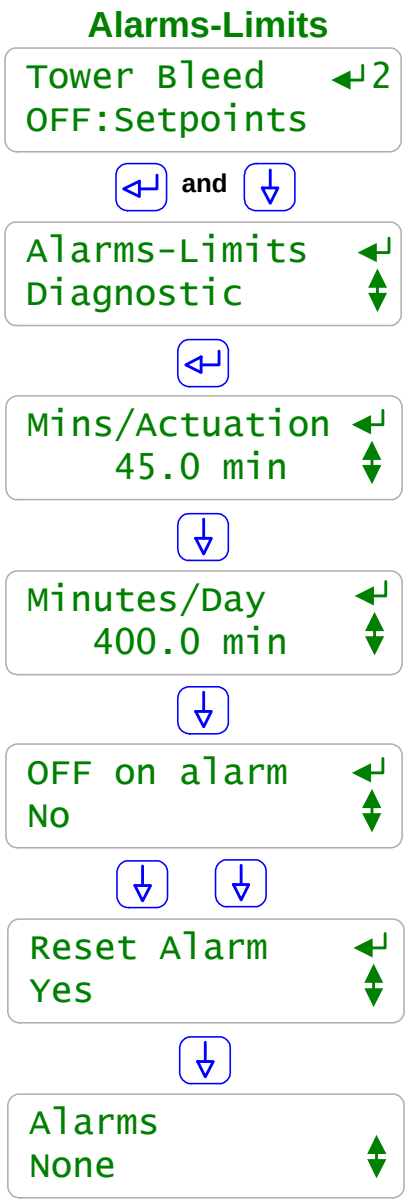
Actuation minutes is the time between **Turn ON** & **TurnOFF** setpoints. Increases with the difference in uS between setpoints. Typically set 20% to 50% greater than longest bleed cycle time. Key **ENTER** to modify.

The Minutes per day alarm is useful for picking up increasing in thermal load. In this example, the tower runs 16 hours/day & when loaded, bleed 30% of the time. Key **ENTER** to modify.

'NO' on **OFF on Alarm** logs the alarm but keeps the bleed ON. Typically never set to **YES** for bleed valves, Key **ENTER** to modify.

We skip **Midnight Reset**, seldom used on Bleed alarms. Key **ENTER** to reset a bleed alarm. Will re-trip if either alarm time remains exceeded.

Displays the last bleed alarm cause and its date stamp.



Sidebar:
Alarms: Because bleed On time alarms are usually not set to turn OFF the bleed, they are typically set tighter to actual operating times for a tower under maximum thermal load.

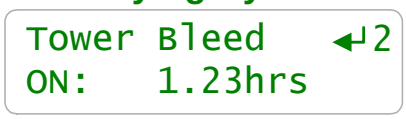
These alarms can be used to flag you on maintenance problems with the bleed or changes in the thermal loading of the tower. An increase in make-up conductivity or an error in adjusting bleed setpoints could also increase bleed time & trip the alarm.

The **Minutes/Actuation** alarm starts timing when the bleed turns ON and returns to zero when the bleed turns OFF. This alarm does not reset it timing at midnight since an actuation period or bleed cycle may bridge two days.

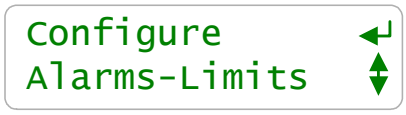
6.3 Variable Cycles

Configure:
Varying Cycles

To select **Varying Cycles** key **UP** or **DOWN** to the target valve or solenoid and press **ENTER**.



Key **DOWN** and **ENTER** @ **Configure**.



Key **UP** and **ENTER** @ **Varying Cycles**.

Key **DOWN** & **ENTER** to select.

Varying Cycles requires seven setpoints, 3 make-up ranges and 3 corresponding cycles of concentration and the maximum tower sump conductivity. See the following page.

.

Sidebar:
Varying Cycles: Controls tower bleed on the ratio of the Tower to Make-up conductivity. The user selects the cycles of concentration for three ranges of make-up conductivity and a maximum tower sump conductivity.
The controller measures the make-up conductivity and controls bleed @ one of the three cycles of concentration. If the tower sump exceeds the maximum conductivity, the tower conductivity is used to control the bleed & to reduce the sump conductivity.

Where Used:
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.

Where Not Used:
1. If 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. If 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.

6.3 Variable Cycles

Setpoints: Varying Cycles

To view or adjust the **Varying Cycles** setpoints key **UP** or **DOWN** to the target valve or solenoid and press **ENTER**.

Key **ENTER** @ **Setpoints**.

When the make-up conductivity less than **Low Range**, in this example **350 uS**, the bleed controls @ **Low Cycles** Key **ENTER** to modify.

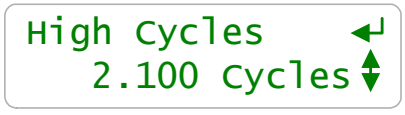
in this example **Low Cycles** = **6.1** so the tower sump would be nominally 2135 uS (350 x 6.1). Key **ENTER** to modify.

When the make-up conductivity less than **Medium Range**, in this example **650 uS**, the bleed controls @ **Med. Cycles** Key **ENTER** to modify.

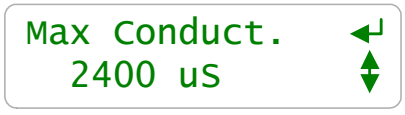
in this example **Med. Cycles** = **3.3** so the tower sump would be nominally 2145 uS (650 x 3.3). Key **ENTER** to modify.

When the make-up conductivity less than **High Range**, in this example **1000 uS**, the bleed controls @ **High Cycles** Key **ENTER** to modify.

in this example **High Cycles** = **2.1** so the tower sump would be nominally 2100 uS (1000 x 2.1). Key **ENTER** to modify.



If the tower sump exceeds **Max Conduct**, **2400 uS** in this example, the bleed opens to limit the conductivity. Key **ENTER** to modify.



6.4 Diagnostics

Diagnostic

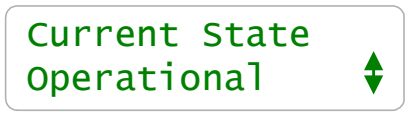
To view the bleed **Diagnostic** key **UP** or **DOWN** to the target valve or solenoid and press **ENTER**.

↵ and ↑

Key **UP** and **ENTER** @ **Diagnostic**.

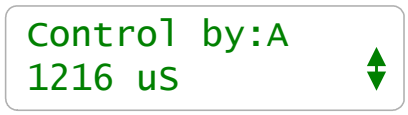
↵

Current State will display **Interlocked** if flowswitch @ conductivity sensor OFF or **Special Control** if **Varying Cycles** selected



↓

Control by: displays the sensor or sensors Controlling **Tower Bleed**.
In this example it's the conductivity sensor @ input 'A' which has a current value of **1216 uS**
Control by = **A/C** would indicate that **Tower Bleed** is controlled by the ratio of sensors '**A**' and '**C**'.



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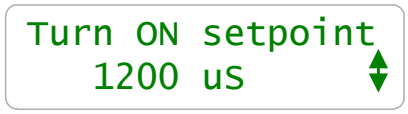
When sensor '**A**' exceeds **Turn ON setpoint**, **1200 uS** in this example, **Tower Bleed** turns ON.

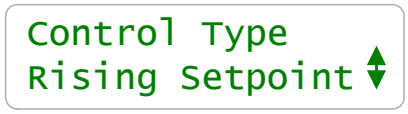


↓

When sensor '**A**' exceeds **OFF setpoint**, **1190 uS** in this example, **Tower Bleed** turns OFF.

↓

Bleed controls are usually **Rising Setpoint** since the conductivity rises as the tower operates.

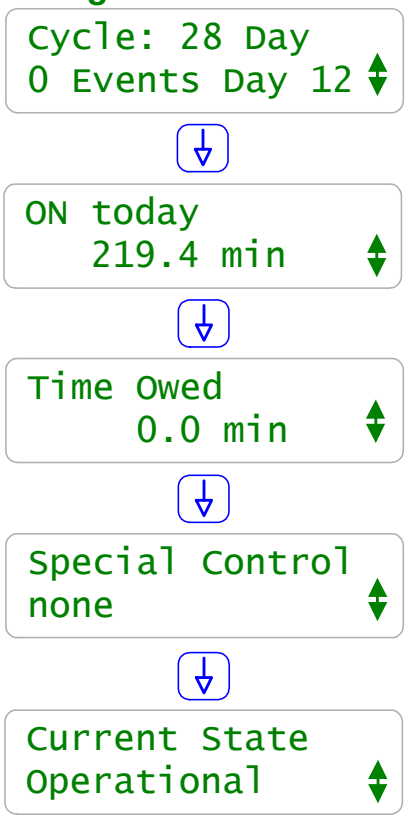


continued

Sidebar:
Current State: Displays '**Feed Limited'** on alarm and '**Blocked'** if the bleed relay has one or more blocking relays set. Typically you would not '**Block'** the bleed.
Control Type: Rising Setpoint
1. The tower evaporates water, increasing the sump conductivity until it exceeds the **Turn ON setpoint**.
2. The bleed solenoid opens and lowers the sump level.
3. The tower float then opens the make-up, adding low conductivity water to the sump.
4. The sump conductivity falls below the **OFF Setpoint** and the bleed solenoid closes.

Diagnostic continued

Bleed controls usually don't use the biofeed, event timers. In this example there are zero bleed events set for **Day 12**, Thursday of week 2 of a 4 week cycle.



Since midnight, **Tower Bleed** has been ON, bleeding, for 219.4 minutes.

Time Owed for **Tower Bleed** will count down to zero if you had set a **Prime-Test** period in minutes.

If a **Special Control** is set, displays the current state of the control.

We're back at the start of the **Diagnostic** scroll.

Sidebar:

ON Today: If the tower has been operating for 10 hours today, then its bleeding for about 36% of the time; typical for a tower under load.

If the tower has been operating for 4 hours today, then its bleeding for about 90% of the time indicating that the bleed may be undersized or partially blocked or bleed setpoints may be set incorrectly,
or that make-up conductivity has changed..
An increase in tower thermal load could cause the conductivity to rise beyond the **Turn ON** setpoint because the bleed can't keep up.

Special Control: Varying Cycles

Displays '**Offline**' if not controlled by a ratio of conductivities. Correct **Control by:**

Displays '**Low Range**', '**Med. Range**' or '**High Range**' depending on the make-up conductivity and controls the bleed to maintain the cycles of concentration setpoint for the displayed range.

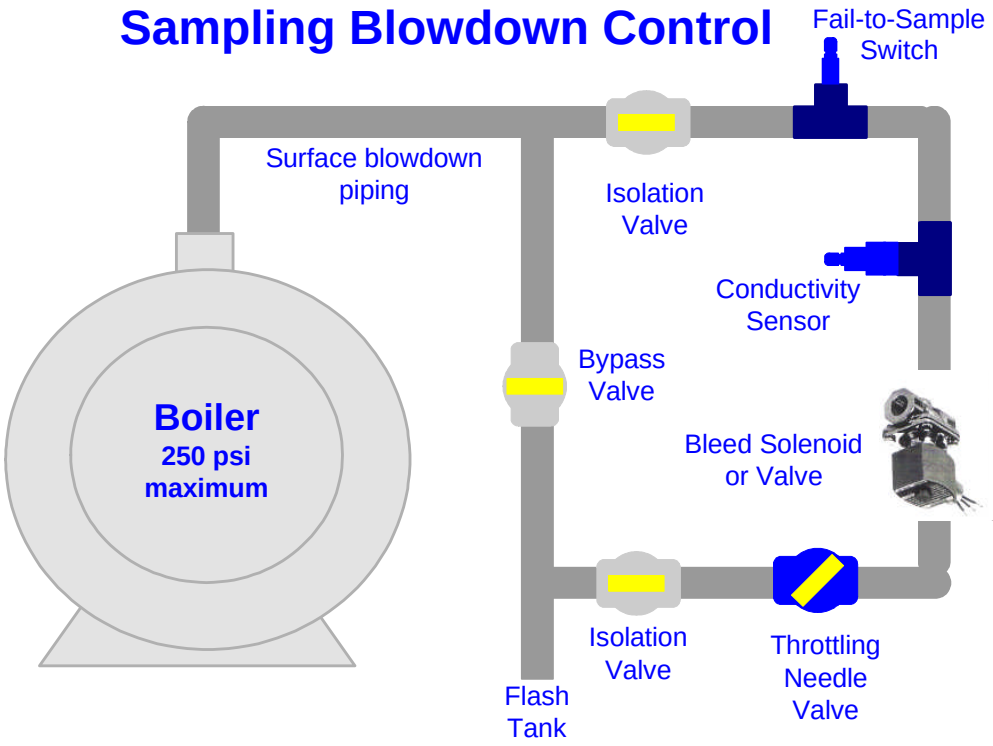
Displays '**Max Conduct**.' if sump conductivity exceeds maximum setpoint.
The controller sets the **TurnOFF** setpoint 1% below the '**Max. Conduct**' setpoint.
For example, if **Max. Conduct** = 3000 uS, **TurnOFF** would be 2970 uS.

7.0 Boiler Blowdown

7.1 Boiler Blowdown 101

Continuous Boiler Blowdown: Is common on larger, high pressure boilers and routes a continuous low flow stream through a sample cooler upstream of the thermally compensated conductivity sensor. The blowdown valve is installed on a parallel line to the flash tank. Blowdown control is configured like a cooling tower bleed and is therefore not detailed in this section of the manual.

Sampling Blowdown Control: Is preferred for smaller and medium sized boilers because it does not require a continuous sample stream or a sample cooler. The 2 wire conductivity sensor is thermally compensated by the Sample-Measure sequence with blowdown flow trimmed by the throttling valve downstream of the conductivity sensor.

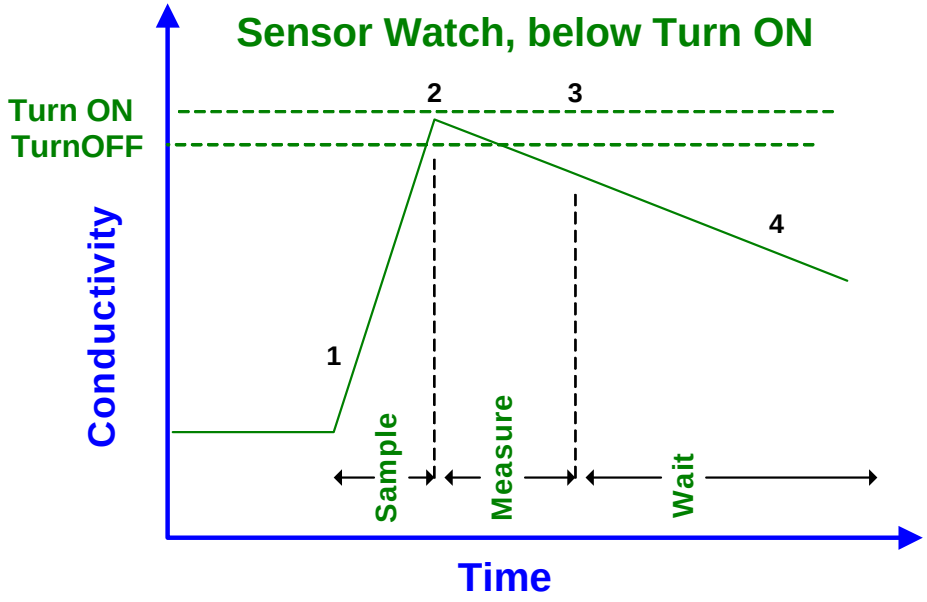


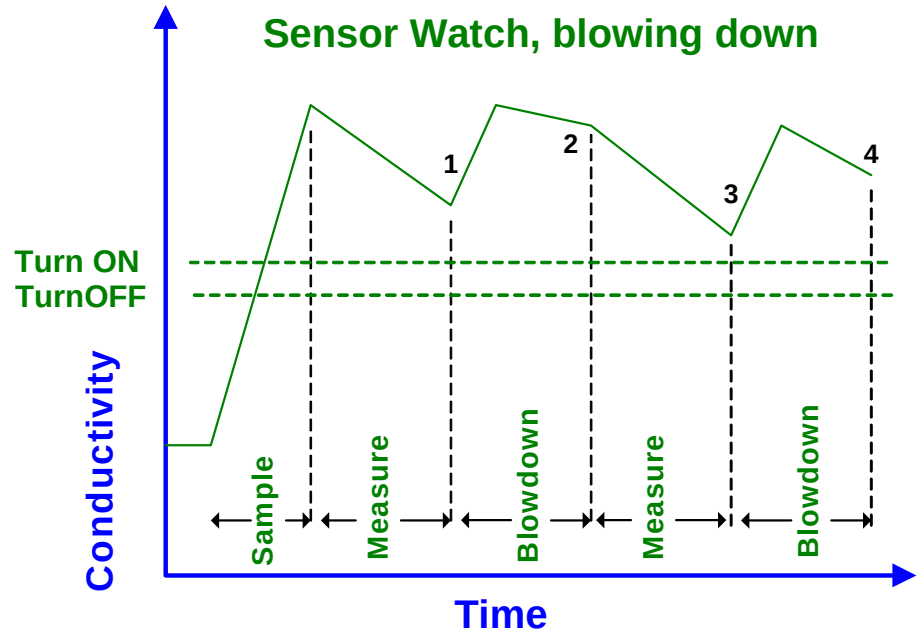
Sampling blowdown control requires that there are no piping restrictions upstream of the conductivity sensor, no partially closed valves & no orifice unions. Flashing upstream of the sensor causes low & varying conductivity measurements and results in poor or no blowdown control.

If you don't get a boiler water sample because a valve has been closed upstream or downstream of the sensor OR the blowdown valve fails, the sensor will display a low conductivity & you may be unaware that the boiler conductivity is increasing. The optional Fail-to-Sample thermal switch trips a controller alarm when the controller can't sample the boiler water conductivity.

7.1 Boiler Blowdown 101

Sampling, 1 to 2: Opens the blowdown valve long enough to get a fresh **Sample** of boiler water to the conductivity sensor. During the **Sample** time the sensor is heating rapidly so it appear the conductivity is increasing.
Measure, 2 to 3: The blowdown valve closes and during the **Measure** time a fixed and repeatable amount of cooling occurs, so it appear the that conductivity is falling.
Blowdown OR **Wait, 3**: At the end of Measure, if the conductivity is less than the **Turn ON** setpoint, the controller **Waits** a user set time, period **3 to 4**, until the next **Sample**.

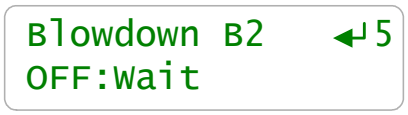




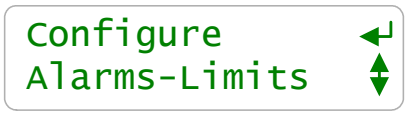
Blowdown, 1 to 2 & **3 to 4**: If the conductivity is above the **Turn On** setpoint the controller does **Blowdown** & **Measure**, period **2 to 3**, until the conductivity at the end of **Measure** is below the **TurnOFF** setpoint. Then another **Wait** period starts.

7.2 Adjusting Boiler Blowdown Timing

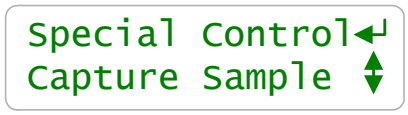
To view or adjust the **Captured Sample** blowdown control timing key **UP** or **DOWN** to the target blowdown valve and press **ENTER**.



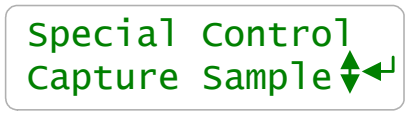
Key **DOWN** and **ENTER** @ **Configure**.



Key **UP** to **Special Control**& verify that it displays **Capture Sample**.

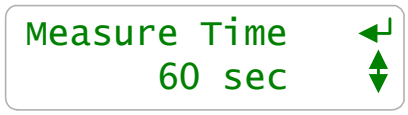


Key **ENTER** to view or adjust timing.

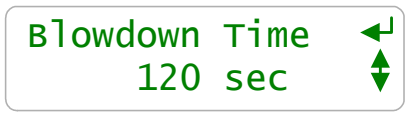


Sampling Time is the time to clear the surface blowdown line between the boiler and the sensor. **Sampling time** increase with both longer piping runs and reduced throttling valve flow. Key **ENTER** to adjust.

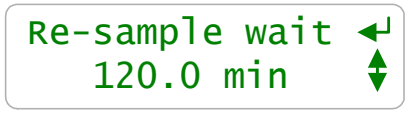
Measure Time is the sensor cooling time & include the time required for the valve to close. 60 to 120 seconds works for most blowdowns. Key **ENTER** to adjust.



Blowdown Time is the time the valve is open if the conductivity is higher than the **Turn ON** setpoint @ the end of **Measure Time**. 120 to 600 seconds works for most blowdowns. Key **ENTER** to adjust.



Re-Sample Time is the time the valve is closed if the conductivity is lower than the **Turn OFF** setpoint @ the end of **Measure Time**. Varies widelt from 15 minutes to 16 hours, 960 minutes. Key **ENTER** to adjust.



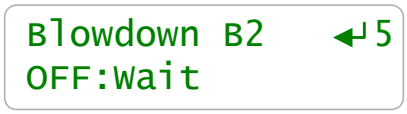
Key **ENTER** to select a **Fail-to-Sample** input.

Sidebar:
Re-sample Time: Varies with boiler load type. Process boilers check conductivity frequently. Lightly loaded or constant load boilers check every few hours.

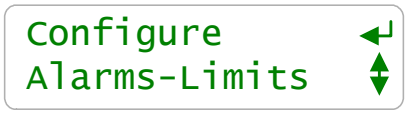
7.2 Adjusting Boiler Blowdown Timing

Captured Sample: Adjust Timing

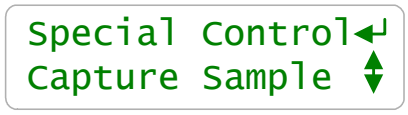
To view or adjust the **Captured Sample** blowdown **Sampling Time** key **UP** or **DOWN** to the target blowdown valve and press **ENTER**.



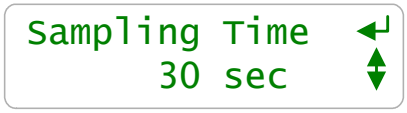
Key **DOWN** and **ENTER** @ **Configure**.



Key **UP** to **Special Control** and key **ENTER** twice.

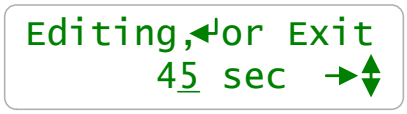


Key **ENTER** to adjust **Sampling Time** or key down to view, adjust other blowdown timing.

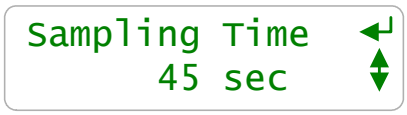


Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **Sampling Time**.
or **EXIT** to leave unchanged.



In this example we've increased the **Sampling Time** from 30 to 45 seconds.



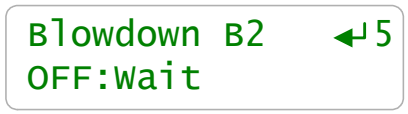
Sidebar:
Measure Time, **Blowdown Time** and **Re-sample wait** are viewed and modified in the same way as **Sample Time**.
Whenever you modify **Captured Sample** timing a new **Sample** time starts immediately.

Setting a Re-sample Wait Time:
Energy, softened make-up and treatment chemicals are lost during each **Sample** so its appealing to set a long **Re-sample Wait** time.
Set the **Re-sample Wait** time to reflect the time it takes the boiler to increase conductivity under the worst case, heaviest load and lowest percentage of condensate return.
A high percentage of condensate return usually means that it takes longer to increase boiler water conductivity.

7.3 Fail-to-Sample

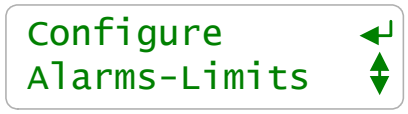
Fail-to-Sample switch

To view or install a **Captured Sample** blowdown **Fail-to-Sample** switch key **UP** or **DOWN** to the target blowdown valve and press **ENTER**.



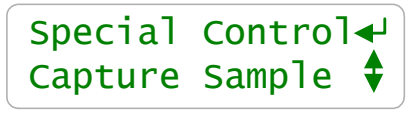
↵ and ↓

Key **DOWN** and **ENTER** @ **Configure**.



↵ and ↑

Key **UP** to **Special Control** and key **ENTER** twice then **UP**.

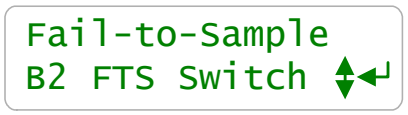


↵ ↵ and ↑

Key **ENTER** to select a **Fail-to-Sample** thermal switch.

Key **UP** or **DOWN** to view the enabled contact set inputs.
In this example we've enabled an input and named it **B2 FTS Switch**

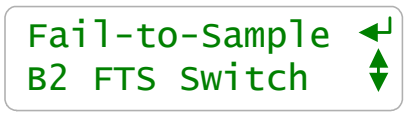
↵ and ↓ ↑



Press **ENTER** to select a **Fail-to-Sample** switch or **EXIT** to leave as **None**.

↵

In this example we've set the **Blowdown B2 Fail-to-Sample** switch as **B2 FTS Switch**.



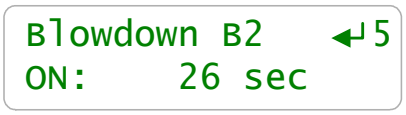
Sidebar:
Fail-to-Sample: At the end of a **Sample** period when the piping at and upstream of the conductivity sensor is hottest, the controller checks the **Fail-to-Sample** switch.
If the switch is hotter than 190F to 200F (88C to 93C) its contact set is closed.
An open contact set indicates a **Fail-to-Sample** and the controller sets an alarm.

If the surface blowdown line is accidentally valved OFF upstream or downstream of the **Fail-to-Sample** switch or the blowdown valve does not open, the piping never heats, the switch contacts never close & the controller alarms.

Surface blowdown piping cools to ambient during the **Re-sample Wait** time and the **Fail-to-Sample** contact set opens.

7.4 Sensor Watch & Blowdown Diagnostics

To view a **Captured Sample** blowdown **Diagnostic** key **UP** or **DOWN** to the target blowdown valve and press **ENTER**.



Key **UP** and **ENTER** @ **Diagnostic**.

Sensor Watch is the real time value of the conductivity sensor. It shows the effects of heating cooling and flashing. Use **Sensor Watch** to observe the effect of the blowdown valve opening and closing on measured conductivity.

Displays the state of the **Fail-to-Sample** thermal switch. Alarms if **OFF** at the end of **Sample**.

Displays the state of the blowdown valve, **OFF** and counts down the time remaining in the **Wait** period between **Samples**. In this example we have **38.4** minutes until the next **Sample**.

THEN

Displays the state of the blowdown valve, **ON** and counts down the seconds remaining in the **Sample** period.

THEN

Displays the state of the blowdown valve, **OFF** and counts down the seconds remaining in the **Measure** period.

ABOVE SETPOINT

Displays the state of the blowdown valve, **ON** and counts down the seconds remaining in the **Blowdown** period.

OR

Displays the state of the blowdown valve, **OFF** and counts down the minutes remaining in the **Wair** period.

BELOW SETPOINT

Sidebar:
Conductivity Value Display: The value of the blowdown controlling sensor shown on the main menu scroll is the value at the end of **Measure**. It only changes at the end of each Measure period.

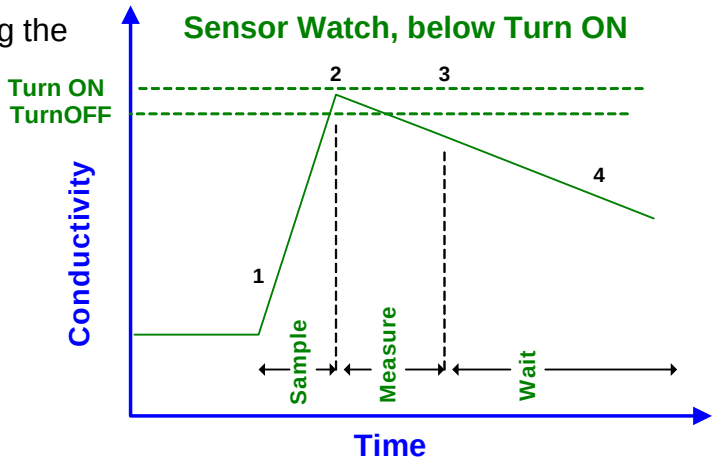
7.4 Sensor Watch & Blowdown Diagnostics

Lets re-visit the graphics shown in **7.1 Boiler blowdown 101** using the **Sensor Watch** conductivity display as a diagnostic.

If conductivity does not rise during the **1-2** period, then we didn't open the valve & didn't **Sample**.

If it's erratic during the **1-2** period an frequently falls to low values then we're flashing at the sensor.

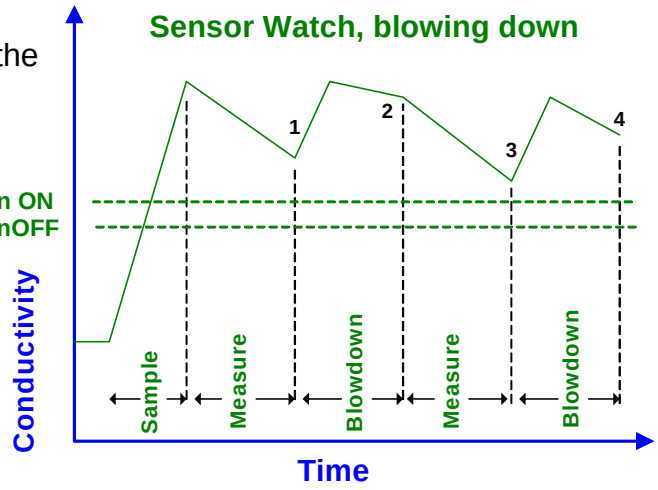
If Conductivity doesn't fall during the **2-3** period, then we're not closing the valve or solenoid.



At the end of **Measure**,**1** the **Blowdown** valve opens and initially the conductivity increases as the sensor heats.

On smaller boilers you may then see the conductivity fall as lower conductivity feedwater enters the boiler.

At the end of each **Blowdown** period, the conductivity should be lower as the conductivity trends to the **Turn OFF** setpoint.



Sidebar:
Flashing: Flashing at the conductivity sensor causes poor control because the sensor is measuring a varying mix of water and steam. Frequently flashing deposits solids on the sensor, fouling it an causing a low conductivity measurement.
In some cases you can limit flashing by reducing the flow at the throttling or needle valve.

Effective Blowdown Control:
Accurate, non-drifting blowdown control requires a non-flashed sample at the conductivity sensor, fixed **Measure** time and throttling valve setting.
Any change in timing or plumbing which effects the temperature at the start or end of the **Measure** time requires a conductivity sensor calibration.

8.0 Flowswitches & Contact Sets

8.1 Contact Sets 101

Flowswitch: Provides a set of contacts that close when there is flow past or through the sensor. Flowswitch contact sets are used to permit the operation of pumps and solenoids.

Interlock: The contact set or flowswitch must be closed to allow operation. If the contact set is open, the pump or valve displays **Interlocked**.

Contact Set	Controls	Operating Issues / Notes
Flowswitch	**Flow:** OK to turn ON pump, solenoid or valve. **No Flow:** Immediately turns OFF an **Interlocked** pump, solenoid or valve.	Contact set closes when flow measured. Default: Connect to controller input '**S**' A manual RUN/STOP switch may be used in place of or in series with a Flowswitch.
Boiler Online Contacts	**Online:** OK to blowdown the boiler and feed treatment chemicals. **Offline:** Immediately stop blowdown and chemical feed.	Contact set from boiler firing control or site automation system. Usually closed when boiler on line. Defaults: Boiler 1 online connects to '**S**' Boiler 2 online connects to '**T**'
Level Switches	**High Level:** Stop fill or start mix & neutralize. **Low Level:** Stop chemical feed and/or alarm.	Level switches which use floats can usually flip the float to change OPEN contacts to CLOSED.
Pressure Switch	Sequences solenoids and pumps. May alarm on both closed/High Pressure and open/No pressure contact sets.	May be used to start a feed, flush or backwash sequence. May be used to verify that the previous sequence occurs if initiated by other controllers. Monitor de-aerator pressure.
Thermal Switch	Fail-to-Sample switch verifies blowdown sample at measuring conductivity sensor. Verifies that boiler bottom blowdown has been manually opened and closed.	Low cost thermal switches may be purchased with a wide range of trip temperatures.

Dry Contact Sets:
Contact sets connected to the controller must be 'dry', without AC or DC voltage on either of the contact set wires. Contact sets cannot be shared between the controller and any other controller type or automation system.

8.2 Switching Meters & Contact Sets

To switch a meter-volume input to a contact set input key **UP** or **DOWN** to the target contact set and press **ENTER**.

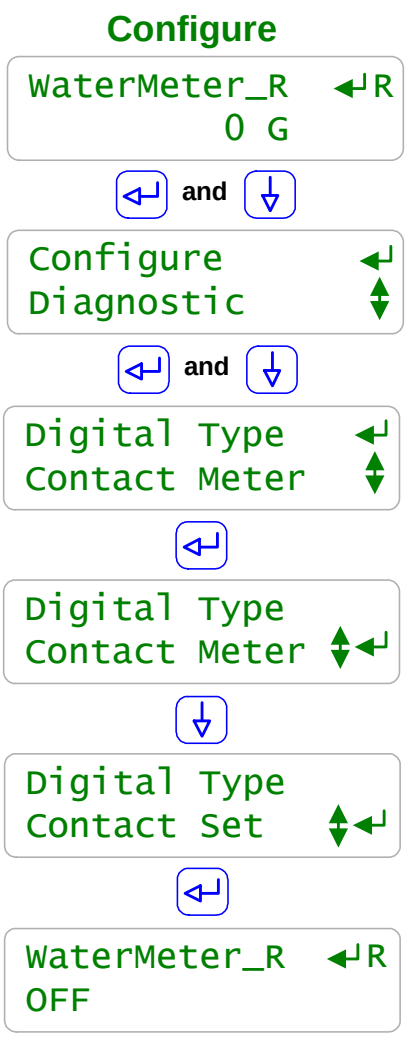
Key **DOWN** and **ENTER** @ **Configure**.

Key **DOWN** to **Digital type** and **ENTER** to modify.

Key **DOWN** to **Contact Set** and **ENTER** to select.

When you key **ENTER** the controller returns you to the main menu. In this example **WaterMeter_R** is now a contact set and **OFF**.

Key **ENTER** and **UP** to **Configure** to modify the '**R**' input name to reflect its use as contact set.



Sidebar:

Volume & Contact Set Inputs:

Controller inputs '**O**' through '**V**' may be set individually to be a water meter or a contact set. The controller is defaulted to meters at inputs '**O**' to '**R**' and contact sets at inputs '**S**' to '**V**'.

Phantom Inputs:

Controller inputs '**W**' through '**Z**' do not have physical terminals but may be enabled individually as either water-volume meters or contact sets. Phantom meters are used as '**Rate-to-volume'** or '**Copy Volume to'** targets. Phantom contact sets are used to '**Mirror'** controller outputs and then to sequence or block other controller outputs

8.3 Contact Set Alarms

To view or modify contact set **Alarms** key **UP** or **DOWN** to the target contact set input and press **ENTER**.

Key **UP** and **ENTER** @ **Alarms**.

Alarms if the contact set is **ON** today for longer than the **ON Time Alarm**. Timing resets every time contact set turns **OFF** and at midnight.

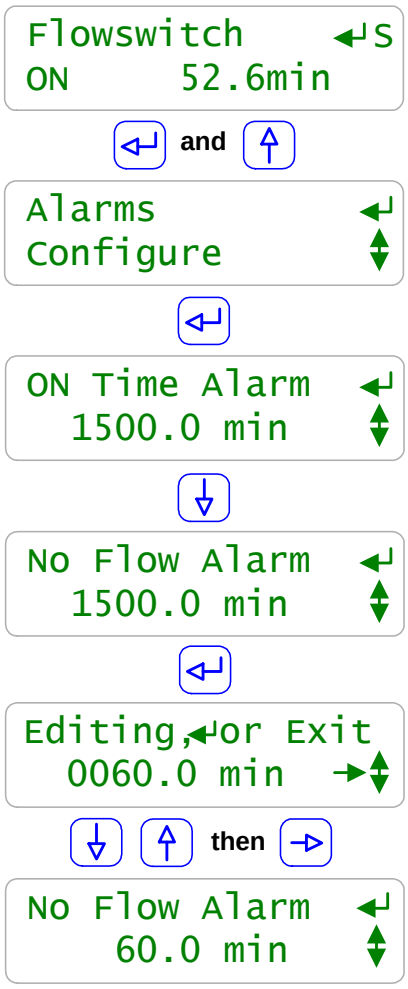
Alarms if the contact set is **OFF** today for longer than the **No Flow Alarm**. Timing resets every time contact set turns **ON** and at midnight.

Keying **ENTER** to modify.
Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **No Flow Alarm**.
or **EXIT** to leave unchanged.

In this example we've reduced the **No Flow Alarm** from its factory default of **1500** minutes to **60** minutes.

Alarms



Sidebar:
Default alarm times are set so that contact sets won't alarm unless user configured.
It's unlikely that you would set both alarms on any one contact set but the ability to alarm both ON & OFF states gives you a lot of application flexibility.

ON Time Alarm:
If the pressure switch on your RO or sidestream filter shows high pressure for more than 30 minutes, you'd like to log an alarm.
If the flowswitch on a comfort cooling tower which typically in ON between 6:00AM & 6:00PM Is ON for more than 13 hours either the flowswitch has faulted OR tower operation has changed.

No Flow Alarm:
If you had a treatment system that runs 24/7 you'd want to alarm on a flowswitch That has no flow since it indicates that the sensor or injection line is blocked or inadvertently valved OFF.
If you expected a bottom blow thermal switch to trip daily when the bottom blow valve is manually opened, you want an alarm if this bottom blowdown did not occur.

8.4 Mirroring Outputs

Mirror: A contact set can be **ON** or **OFF** if a Pump, Valve or Solenoid is **ON** or **OFF**

To view or modify a **Mirror** contact set key **UP** or **DOWN** to the target contact set and press **ENTER**.

Key **DOWN** and **ENTER** @ **Configure**.

Key **UP** and **ENTER** @ **Mirror output** then **UP** or **DOWN** to the Pump, Valve or Solenoid that in this example you wish **Permit Feed X** to **Mirror**.

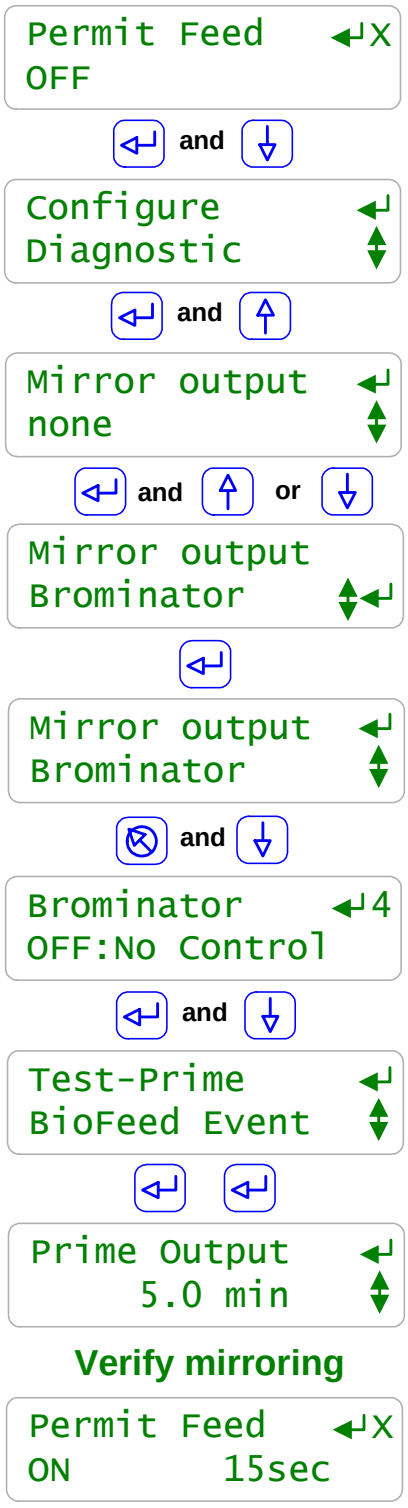
In this example we key **ENTER** selecting the **Brominator** output.

Now, let's demonstrate a **Mirror** by keying **EXIT** and **UP** or **DOWN** to **Brominator**.

In this example Relay **4** is powering the **Brominator**.

Key **ENTER** and **DOWN** @ **Brominator** to **Test-Prime**.

Key **ENTER** twice to **Test-Prime** for **5.0** minutes.



Verify mirroring

Key **EXIT** and **UP** or **DOWN** to **Permit Feed** @ **X**. '**X**' is mirroring & **ON** when Brominator is **ON**.

Sidebar:
Mirroring, **Inverting** & **Contact Set Controls** support varied and complex applications. Many sites won't use these extra contact set functions, however for those sites which need these controls, they are built into each controller.

8.5 Inverting Contact Sets

A contact set **ON** can be switched to **OFF** using **Invert Sense.**

To view or modify a contact set **Invert Sense** key **UP** or **DOWN** to the target contact set and press **ENTER** then **DOWN**.

Note that in this example **RUN/STOP U** is currently **OFF**.

Key **ENTER** @ **Configure**. and then **UP** to **Invert Sense**

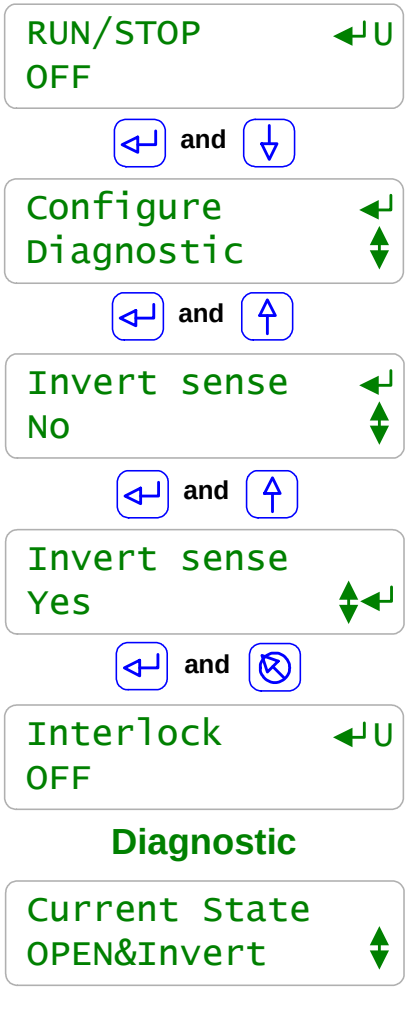
Key **ENTER** and **UP** to display **Yes**.

Key **ENTER** to select **YES** and **EXIT** to display that in this example **RUN/STOP U** now displays **ON**.

Key **ENTER** and **UP** to **RUN/STOP U Diagnostic**.

Current State displays that the '**U**' contact set is **OPEN** and that '**U**' is inverted, **&Invert**.

Invert sense



Diagnostic

Sidebar:
Inverting Sense:
Contact sets interlock and control when they are **ON**.
For non-inverted contact sets, **ON** is when the contact set is closed.

If you wish to Interlock or control when the contact set is open, set Invert sense to YES.
If your contact sets are open when they are measuring the state you wish to alarm, control using or log, set Invert sense to YES.

RUN/STOP an 'Invert sense' Example:
Contact set '**U**' is used for a RUN/STOP switch.
The switch contacts are OPEN when the switch is set to RUN.
Invert sense is set for '**U**' so that RUN displays on the controller as **ON** and so that '**U**' can be used as a flowswitch for pumps and solenoids.

8.6 Contact Set Controls

In this example the **Backwash** solenoid is powered by relay **4**.
Relay **4** is controlled by filter **Pressure** switch '**V**'

To view or modify the **Backwash** setpoints key **UP** or **DOWN** to **Backwash** and press **ENTER**.

Key **ENTER** @ **Setpoints** and then **UP** or **DOWN** to the **Setpoint** you wish to modify.

In this example we've already modified **TurnON** to 30 seconds

Key **ENTER** @ **OFF Setpoint** to modify
Frequency controlled pumps will display **then Feed** and a setpoint in **mL**.

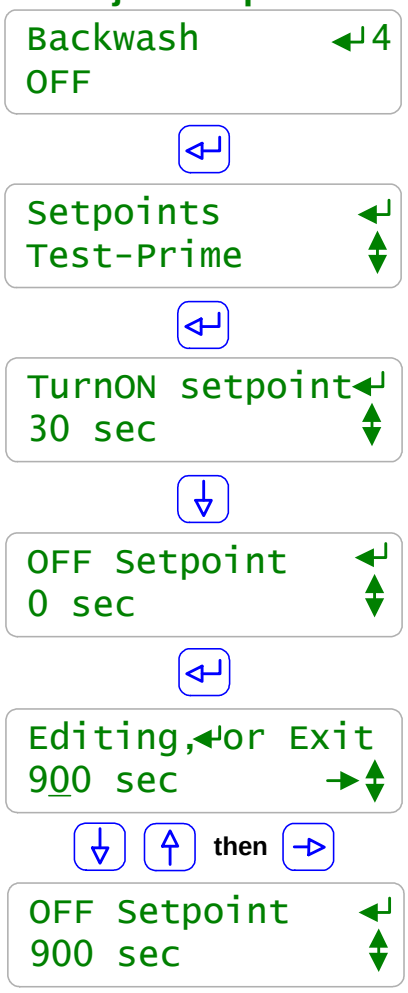
Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **OFF Setpoint**.
or **EXIT** to leave unchanged.

Each time you modify you'll get an extra digit.
So in this example you'll have to edit twice to get to 3 digits from the default 1 digit

See the following **Contact Set Control Example**.

Adjust Setpoints



Sidebar:
Contact Set Control Example:
A pressure switch connected to controller input '**V**' turns **ON** when the pressure drop across a sidestream filter indicates a need for a backwash sequence.
The **TurnON Setpoint** is set to 30 seconds to prevent transient states from triggering a backwash.
The **OFF Setpoint** is set to 900 seconds, 15 minutes, the time required to backwash the filter.

Set the **ON Time alarm** on **Pressure** '**V**' to 20 minutes, because if '**V**' hasn't turned **OFF** in 20 minutes, then backwashing failed and filter pressure is still high.

Owed Time or Volume:
Contact set controls work by adding time or volume to the controlled output.
Reset alarms zeroes time (Relays **1** to **6**) or volume (Pumps **6** to **9**) owed.
Time or volume owed adds to any existing owed so every time a controlling contact set turns **OFF** and then **ON** for more than **TurnON Setpoint**, the owed time or volume increases.
Contact set controls work in parallel with **Prime-Test** am **Biofeed** event time or volume owed.

9.0 Frequency Controlled Pumps

9.1 Selecting a Pump

Controller outputs '**6**' to '**9**' are used for frequency controlled pumps.

To view or modify a **Pump Type** key **UP** or **DOWN** to the target pump and press **ENTER** then **UP**.

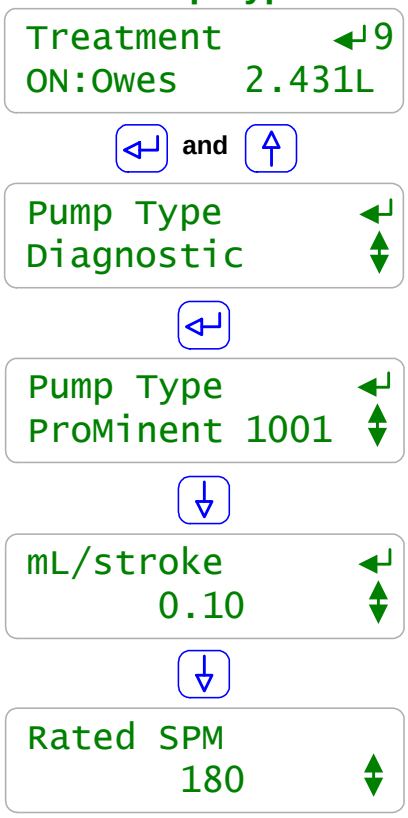
Key **ENTER** @ **Pump Type**.

Displays one of six default pump types or **Other**. In this example **Treatment** '**9**' controls a **ProMinent 1001** type pump. Key **ENTER** to modify.

Displays the current **mL/stroke** volume in mL. In this example, it's the default for a **ProMinent 1001** type pump. Key **ENTER** to modify.

Displays the current **Rated SPM** in strokes per minute. In this example, it's fixed by selecting a **ProMinent 1001** type pump.

Pump Type



Sidebar:

Pump Type:

If you select one of the 6 built-in ProMinent pumps, the feed volume mL/stroke and maximum frequency are correctly and automatically assuming a nominal 40pis feed line pressure.

If you select '**Other**' as a pump type, you'll need to provide both the nominal mL/stroke and maximum stroke rate. Pumps with maximum stroke rates from 50 SPM to 400 SPM are supported by the controller.

Relay Controls:

Frequency controlled pumps may be switched ON/OFF by one of the controller's relays '**1**' to '**5**'. Disconnect and remove the frequency control cable and plug the pump power cord into the controller.
This is not the best use for a frequency controlled pump but if you need more than the controller's four frequency controls, its an option.

9.1 Selecting a Pump

To install a new a **Pump Type** key **UP** or **DOWN** to the target pump and press **ENTER** then **UP**.

Key **ENTER** @ **Pump Type**.

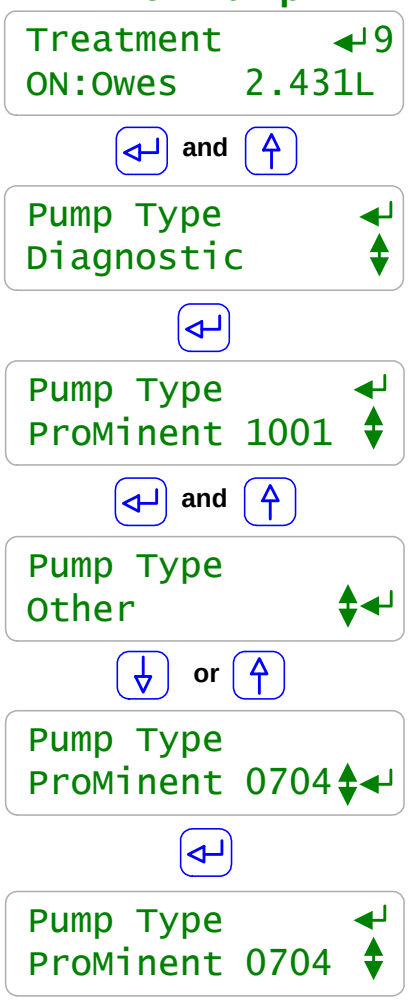
Displays one of six default pump types or **Other**. In this example **Treatment** '**9**' controls a **ProMinent 1001** type pump. Key **ENTER** to modify or install.

Key **ENTER** @ **Pump Type Other** If you are not installing one of the 6 built-in ProMinent pumps shown in the following table.

Key **UP** or **DOWN** to the installed **Pump Type** and key **ENTER** or **EXIT** to leave the **Pump Type** unchanged.

In this example we've changed the pump controlled by **Treatment** '**9**' from a **ProMinent 1001** to a **ProMinent 0704**.

New Pump



Built-in Pump types

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

Your pump type may differ. These pumps are typical for small to medium cooling towers or boilers

9.2 Copying a Pump Volume

To copy a frequency controlled pump volume to a volume meter or inventory sensor input key **UP** or **DOWN** to the target pump and press **ENTER**.

Key **DOWN** and **ENTER** @ **Configure**.

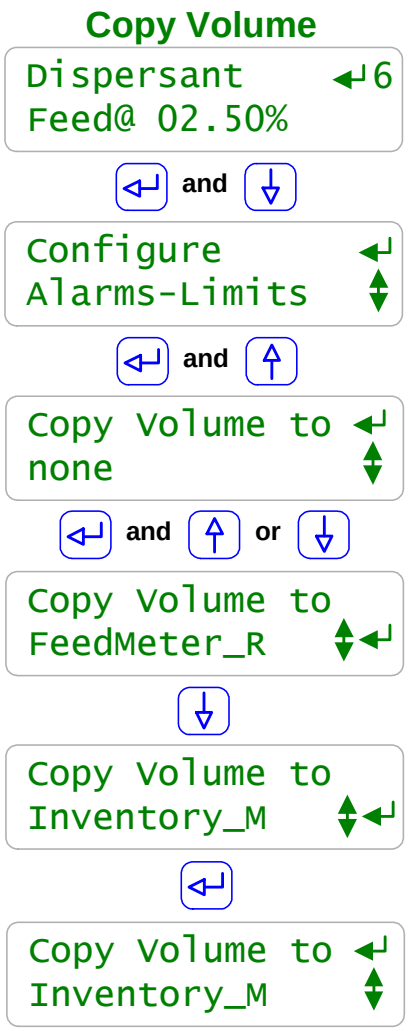
Key **UP** to **Volume to** and key **ENTER** to modify.

Key **UP** or **DOWN** to the copy target input and then **ENTER** to select.

Water meter inputs '**O**' to '**Z**' sum the pump volume with volume measured by the meter.

Sensor inputs '**H**' to '**N**' subtract the pump volume from the sensor inventory or tank volume.

In this example we've selected sensor input **Inventory_M**. More than one pump may be copied to **Inventory_M** and volumes measured by meters '**O**' to '**Z**' may also be copied to **Inventory_M**.



Sidebar:
Copying Volumes:
Pumped volumes are summed to volume meter inputs '**O**' to '**Z**' and subtracted from sensor inventory inputs '**H**' to '**N**'.

Inventory Applications: Summing to Sensor
If more than one frequency controlled pump is feeding from the same tank, both pumps can be set to Copy Volume to the same tank to display and alarm on a calculated tank volume. A Feed Verify meter can also share the same calculated volume.

Proportional Feed Application: Summing to Meter
If you wish to feed 100mL of dispersant after every 1000mL of inhibitor, copy the inhibitor pump volume to a water meter.
Then use the water meter to feed 100ml of dispersant every time it measures 1000mL.
The meter doesn't need to physically exist, so you could enable and use one of the phantom inputs '**W**' to '**Z**' to avoid using one of the existing meter-contact set inputs '**O**' to '**V**'.

9.3 Adjusting mL/stroke

To modify a frequency controlled pump's mL/stroke key **UP** or **DOWN** to the target pump and press **ENTER**.

Key **UP** to **Pump Type** and **ENTER**.

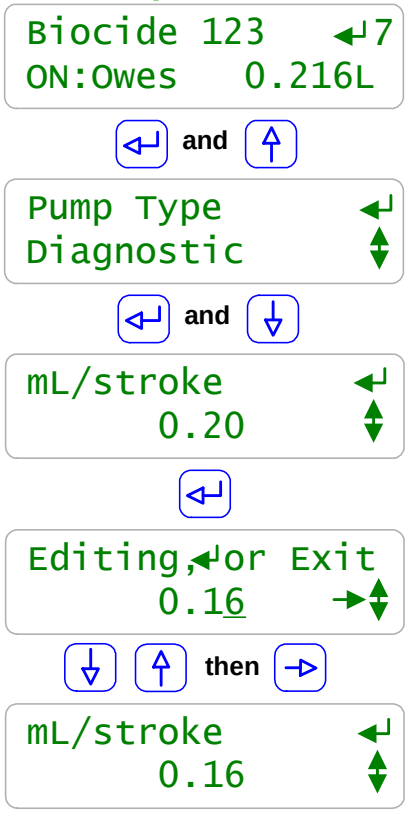
Key **DOWN** & **ENTER** at **mL/stroke** to modify.

Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **mL/stroke**.
or **EXIT** to leave unchanged.

In the example we've decreased the **mL/stroke** from **0.02** mL to **0.16** mL

Pump ml/stroke



Sidebar:

Product Concentration Error Sources

ppm level errors can be caused by: Product formulation inaccuracy, loss of active product due to extended storage, settling-separation or temperature, reaction of the product with other fed chemicals, errors in the ppm test method or its reagent, inaccuracy or incorrect scaling of the make-up or feedwater meter **and** errors in the mL/stroke setting of the feed pump.

Calibrating Stroke Volume:

When your chemical ppm tests don't match the feed ppm setpoints or the calculated inventory doesn't match the actual tank volume, then consider calibrating the pump ml/stroke.
If you find you're correcting the mL/stroke value frequently, then its very likely that the error source is not the mL/stroke setting since the feed head hasn't changed.

Calculated Adjust:

If you test 5% higher than the ppm feed setpoint, then adjust the mL/stroke x 1.05.
This method is minimum effort but it may mask other contributors to concentration error.

Pump from a Graduated Cylinder:

Pump 100 to 250mL from a graduated cylinder and note the change in inventory or fed volume. Correct the mL/stroke accordingly.

Calibration Limits:

The controller limits the range of **mL/stroke** calibration for the built-in ProMinent pumps.

9.4 Setting the SPM Rating

To modify a frequency controlled pump's Strokes-per-Minute maximum key **UP** or **DOWN** to the target pump and press **ENTER**.

Key **UP** to **Pump Type** and **ENTER**.

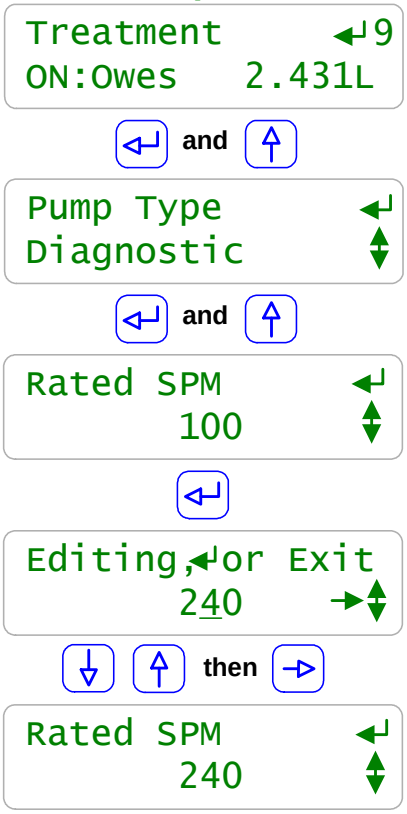
Key **UP** & **ENTER** at **Rated SPM** to modify.

Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **Rated SPM**.
or **EXIT** to leave unchanged.

In the example we've increased the **Rated SPM** from **100** to **240** strokes per minute.

Pump SPM



Sidebar:
Strokes per Minute:
Only **Other** type pumps can adjust the Rated SPM from 50 to 400 strokes per minute.
The built-in ProMinent pumps have preset SPM ratings.

The controller uses the **Rated SPM** and **mL/stroke** to verify that feed **mL/minute** setpoints can be delivered.

Don't set the **Rated SPM** for the pump higher than its nameplate rating since the action of the pump on overspeed may not be defined and in the worst case the pump may stall. Not an issue for the built-in ProMinent pumps.

10.0 4-20mA Outputs

10.1 4-20mA Output Setpoints

4-20mA Outputs display both the loop current and its corresponding the 0-100%. This example display occurs on installing a new 4-20mA output card.

To view or modify a current output **Manual** setpoint key **UP** or **DOWN** to the target output and press **ENTER**.

Key **ENTER** @ **Setpoints**.

Manual = User sets current. **Auto** = Sensor controls current. Displays the present **0%** to **100%** output setpoint. Key **ENTER** to modify.

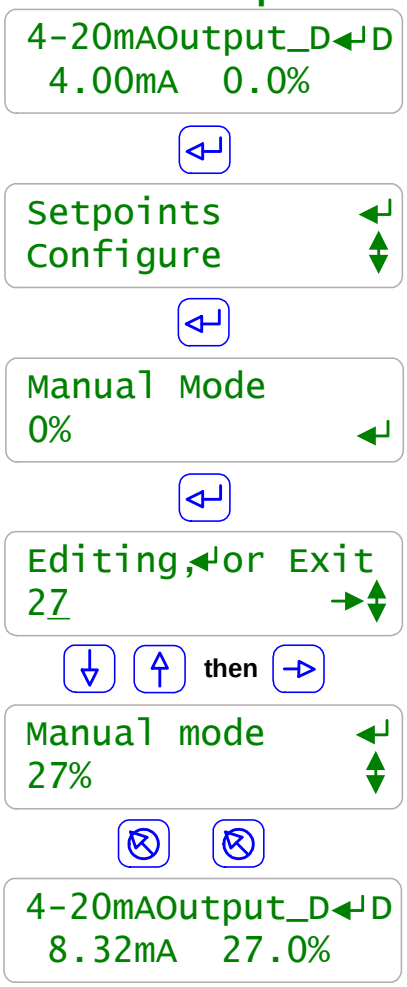
Key **UP** or **DOWN** to change the underlined digit. Key **RIGHT** to move the underline.

Press **ENTER** to save the new **Manual Mode** setpoint or **EXIT** to leave unchanged.

Key **EXIT** twice to view the effect of the new setpoint.

In the example we've increased the loop current from **4.00mA** to **8.32mA**.

Manual Setpoint



Sidebar:

Manual Mode:

Use **Manual mode** to verify the 100% ON=20mA, OFF=4mA or modulate operation of the proportional pump or valve that the 4-20mA output is controlling.
Use **Manual mode** to verify the monitoring input that is using the current loop value to represent a controller conductivity, pH, ORP or corrosion rate sensor or ppm calculation.

Load Powered 4-20mA Loop:

4-20mA current outputs are powered by the loop load or by the controller 15VDC power supply. Building automation system typically supply 24VDC to power current loops. Current loop controlled pumps and valves usually use the controller 15VDC supply to power the loop.

Open Loop Alarm:

The DC isolated 4-20mA output alarms on an open loop or a loss of loop power.

10.1 4-20mA Output Setpoints

In this example a conductivity sensor is controlling the 4-20mA out current. The **100.0%** indicates that the conductivity is greater than the 20mA setpoint

To view or modify the **20mA Setpoint** press **ENTER**.

Key **ENTER** @ **Setpoints**.

Key **DOWN** to **20mA Setpoint**.
When the conductivity sensor measures than **1000uS** the loop current is **20mA**
Key **ENTER** to modify.

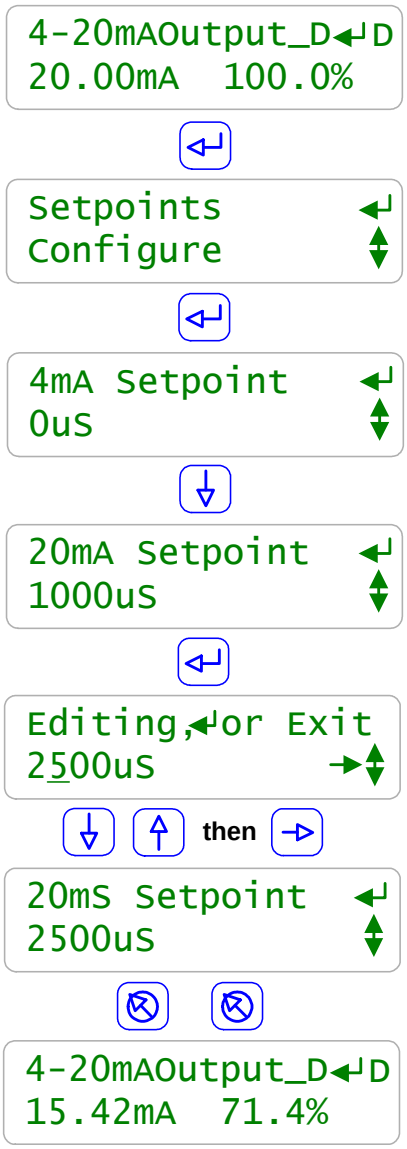
Key **UP** or **DOWN** to change the underlined digit.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **20mA Setpoint** .
or **EXIT** to leave unchanged.

Key **EXIT** twice to view the effect of the new setpoint.

In the example the loop current is now **15.46mA**.
71.4% of the **0uS** to **2500uS** span is 1785uS

Sensor Setpoint



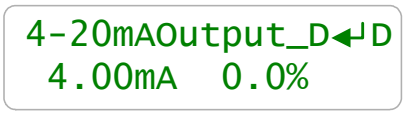
Sidebar:
Setpoints: Setpoints may be positive or negative numbers.
The 4mA Setpoint may be greater or less than the 20mA setpoint so that the loop current may either increase or decrease as the controlling sensor increases.
A pH sensor can control an acid pump on one 4-20mA output and a caustic pump on another 4-20mA output.

Calculating Loop Current:
4-20mA Output current (mA) = 4 + 16 x (Sensor Value / (**20mA Setpoint – 4mA Setpoint**))
Use the absolute value of the setpoint difference for **20mA Setpoint** < **4mA Setpoint**.
For this page's example **15.42mA** = 4 + 16 (1785 / (**2500** - **0**)

10.2 4-20mA Configuration

Select Sensor

To view or modify the sensor controlling the 4-20mA output current, key **UP** or **DOWN** to the target 4-20mA output and press **ENTER**.



↵ and ↑

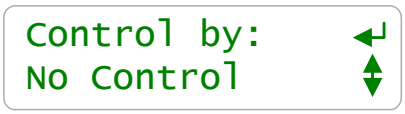
Key **UP** and **ENTER** @ **Configure**.

↵

We're presently in **Manual** mode. Key **ENTER** to **Return to Auto** and then **UP** to **Control by:**

↵ and ↑

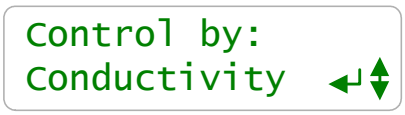
Key **ENTER** to modify **Control by:**



Key **UP** or **DOWN** to scroll through all enabled sensors.
Key **ENTER** to select or **EXIT** to leave unchanged.

↵ and ↑ or ↓

In this example we selected **Conductivity** to control the 4-20mA loop current.



Sidebar:
Control by: Any enabled sensor of any type 'A' to 'N' may be used to control the 4-20mA loop current.
Once you've selected a controlling sensor, adjust the **4mA Setpoint** and **20mA Setpoint** to reflect the range for either control of a pump or valve or for a remote DCS monitoring input.

Example: You are controlling the 4-20mA output current using a pH sensor.

If the 4-20mA current is controlling a pump feeding acid you could set 4mA= 7.0pH and 20mA = 8.0pH.
The pump would be OFF at 7.0pH and at 100% at 8.0pH.

If the 4-20mA current is monitored by a building automation system or distributed control system, you could set 4mA= 6.0pH and 20mA = 10.0pH. since this span represents the likely range of measured pH.

10.2 4-20mA Configuration

To calibrate, view or modify
a 4-20mA output
key **UP** or **DOWN** to the target output
and press **ENTER** then **UP**.

Key **ENTER** @ **Configure**.

The 4-20mA current output is in **Manual** mode
The current mA level is fixed at the user set level.

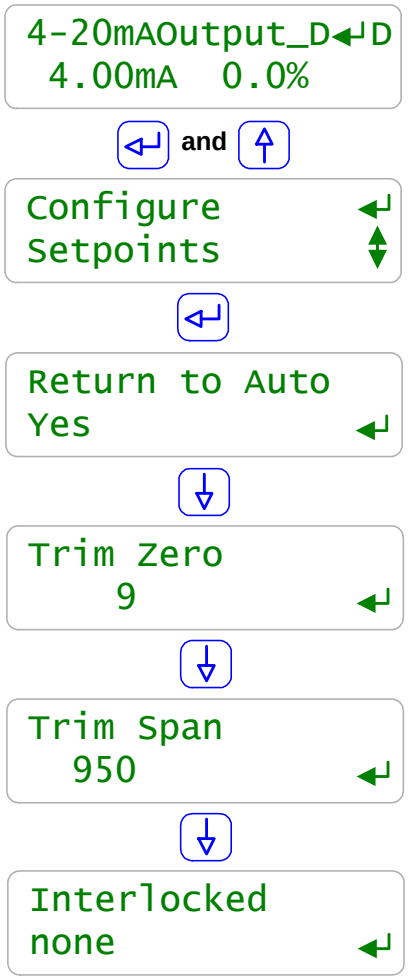
Selecting **Auto** controls the current based on the value
of a sensor and the 4mA and 20mA setpoints.

Trim Zero adjusts the 4mA level.
Put a mA meter is series with the loop current and
key **ENTER** and **UP** or **DOWN** to adjust.

Trim Span adjusts the 20mA level.
Put a mA meter is series with the loop current and
key **ENTER** and **UP** or **DOWN** to adjust.

4-20mA outputs may be **Interlocked** like pumps and valves.
When the interlock is **ON** the current is **4.00mA**, **0%**
key **ENTER** and **UP** or **DOWN** to select an interlock.

Calibrate - Interlock



Sidebar:
Calibrate:
Trim Zero and **Trim span** places the current loop into **Manual** mode and
then adjusts the zero, 4mA or span, 20mA level.
Set your digital voltmeter to measure mA and install it in *series* with the current loop wiring.
(*Series:* Disconnect one 4-20mA wire from the controller terminal.
Connect the wire to the DVM '-' or Common and connect the DVM '+' to the wiring terminal)

If **UP** or **DOWN** stops changing the measured current it's because
you've hit the limits of loop adjustment.

Resolution: The nominal resolution of the current loop is 0.1%.
Example: If 4mA = 0uS and 20mA = 1000uS the current loop has 1uS resolution.
If 4mA = 0uS and 20mA = 10000uS, the current loop has 10uS resolution.

11.0 System Settings

11.1 Passwords

Controllers are defaulted to **Keypad Password** OFF.

To turn ON the **Keypad Password** press **ENTER** and **DOWN** to **Configure** at the power up or day-time display.

Key **ENTER** @ **Configure**.

Key **DOWN** to **Keypad Password**.

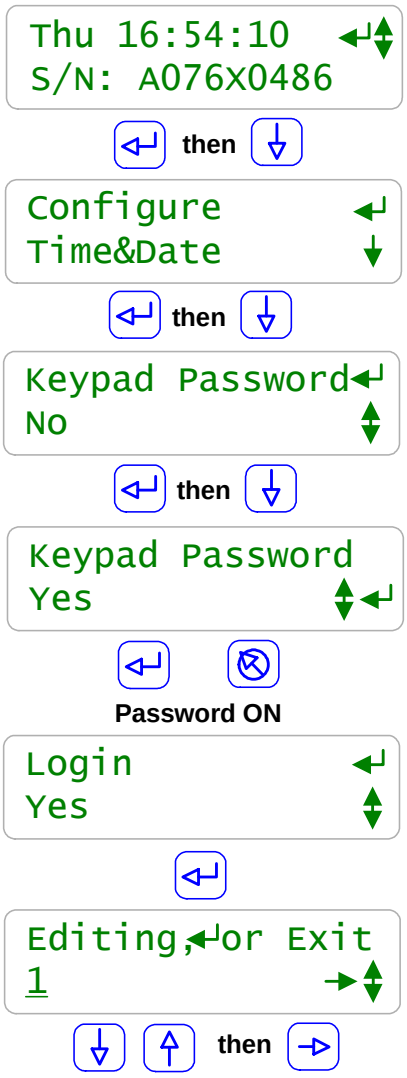
Key **ENTER DOWN ENTER** to turn ON **Keypad Password**.

You'll view the **Login** display when you select a password protected part of the controller. See **Login Displays**:.
Key **ENTER**

Key **UP** or **DOWN** to change the underlined letter or digit.
Key **RIGHT** to move the underline.

Press **ENTER** to **Login**.
If you have not keyed any of the current, valid passwords, you'll view an error message.

Turn ON Passwords



Sidebar:
Default Passwords:
The first time you turn ON **Keypad Password** the 8 default passwords are**:**
Operator1 = **1** Operator2 = **2** Operator3 = **3** Operator4 = **4**.
Configure5 = **5** Configure6 = **6** Configure7 = **7** Administrator = **AAAA**
There are 3 password levels, Operator, Configure and Administrator.
The 8 default User IDs are used in the controller's keypress log.

Modify Password: Once you Login you can modify you password.
Refer to the following page.

Login Displays: Prompts you for the required password level. **Login** @ **Admin**, **Config** or **Operate** depending on what key press activity required a password.

11.1 Passwords

After you've turned ON passwords and logged in as one of the eight users:

To modify your **Keypad Password** press **ENTER** and **UP** to **Passwords** at the power up or day-time display.

Key **ENTER** @ **Passwords**.

To **Logout** as the current user, key **ENTER** at **Logout**.
The controller automatically logs you out 30 minutes after your last key press.
Note that this display shows **Operator1,** your user ID.

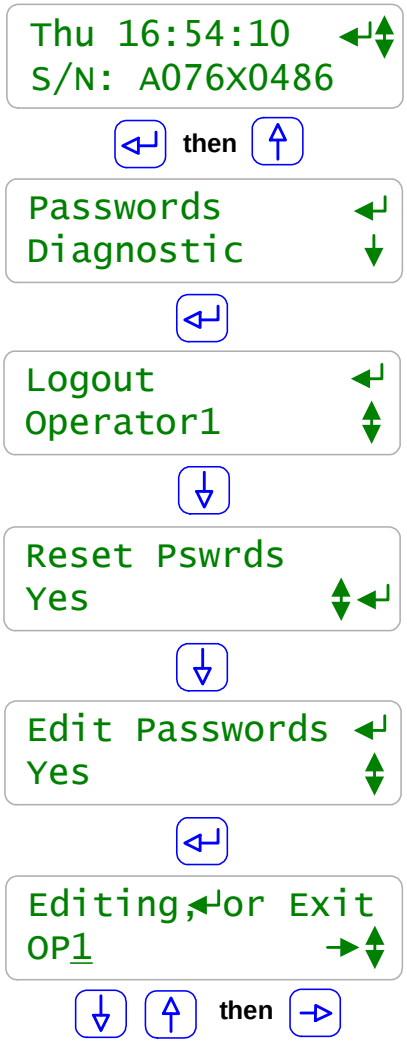
Key **ENTER** at **Reset Pswrds**.
to key in the reset code which returns all passwords to default.

Key **ENTER** at **Edit Passwords** to view or modify your password.

Key **UP** or **DOWN** to change the underlined letter or digit.
Key **RIGHT** to move the underline.

Press **ENTER** to change your password or EXIT to leave unchanged.
In this example we changed **Operator1**'s default password from '**1**' to **OP1**.

Modify Password



Sidebar:
Modify Passwords:
Because all 8 default passwords are listed on the previous page.
You'll should modify all 8 passwords when you initially turn ON passwords.
Passwords are limited to 8 capital letters and numbers.
Any space in a password ends the password on both editing and **Login** password entry

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

Reset Passwords: If you forget your password, a **Reset Password** is available from Aquatrac & specific to your controller's serial number that sets all passwords to default.

Passwords: This menu item only displays on controllers that have turned ON **Keypad Password**.

11.2 Time & Date

To view or adjust the **Time&Date**
press **ENTER** and **DOWN** to **Time&Date**
at the power up or day-time display.

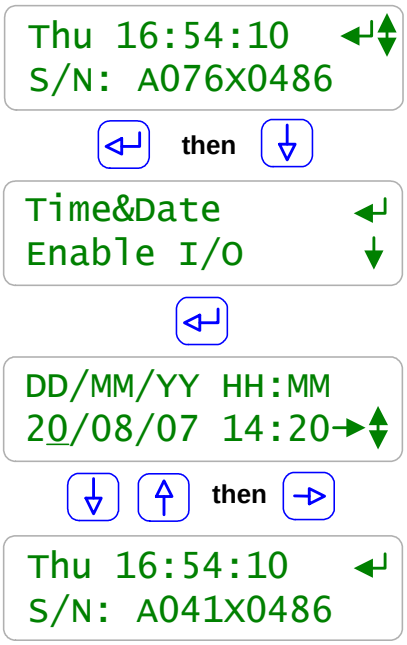
Key **ENTER** @ **Time&Date**.

See **Controller Response to a new Time&Date:**
on this page **Sidebar** prior to adjusting.

Display current date and time.
Key **UP** or **DOWN** to change the underlined digits.
Key **RIGHT** to move the underline.

Press **ENTER** to save the new **Time&Date**.
or **EXIT** to leave unchanged.

Time & Date



Sidebar:
Time & Date:
The controller uses a 24 hour clock where 14:30 is 2:30 PM.
When you set the Date, the controller automatically sets the correct day of the week.

Controller Response to a new Time&Date:
When you change the time & date, the controller:
1. Turns all outputs OFF, resets all control timing and restarts the logging period on each I/O
2. Ends prebleeds, lock-outs and zeroes time and volume owed which ends all BioFeed events.
3. Does a midnight reset which will may set volume-meter Low Alarms and
   will reset any output alarms set to reset @ midnight.
4. Sets the biocide Day 1 to the most recent Sunday.
   Example: If you are at Day 19, Thursday of week 3, on a 28 day biocide cycle.
   After a **Time&Date** change you are now at, Day 5,Thursday of week 1

11.3 Keypress-Alarm Log

View Activity Log

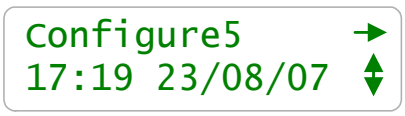
To view the **Activity Log** press **ENTER** and **DOWN** to **Activity Log** at the **Alarms** display.

Key **ENTER** @ **Activity Log**.

Each entry in the log initially displays it's activity as you key **DOWN** .

In this example the feed limit **Alarms** for **Bleed Valve 2** were **Adjusted**.

Key **RIGHT** to view the User ID and the Time & Date stamp for the Activity.



Key **RIGHT** again to get back to the **Activity** or key **DOWN** to scroll the User ID and Time-Date stamps.

Scroll UP or **DOWN** through the Activity Log.
Keying **RIGHT** to view the User Ids & Time-Date stamps

Sidebar:
Keypress-Alarm Log:
The log contains the last 25 activities that effect the operation of the controller.
Most recent activities first. Both keypad and browser user activities are logged.

User IDs:
Keypad Password ON: Logs the User IDs listed in **Section 11.1 Sidebar::Default Passwords**.
Keypad Password OFF: Logs all User IDs as **Keypad**.
Browser user IDs are always logged because login is required to browse.
Actions taken by the controller, like configuring a new driver card, use the **System** used ID.

11.4 Enabling Inputs & Outputs

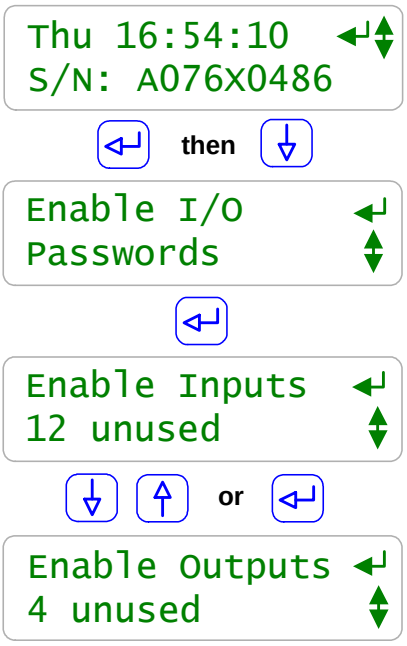
To **Enable I/O** press **ENTER** and **DOWN** to **Enable I/O** at the power up or day-time display..

Key **ENTER** @ **Enable I/O**.

Displays the number of sensor inputs and meter-contact input available for enabling. Key **ENTER** to select one.

Displays the number of relays and frequency controlled outputs available for enabling. Key **ENTER** to select one.

Enable I/O



Sidebar:

Disabling I/O:

Individual Inputs and Outputs are disabled by keying **ENTER** at the target I/O display and selecting a **Configure** sub-menu option.
I/O in use by the controller for control or sensor compensation cannot be disabled.
Disabled I/O does not display, is not logged and does not appear in the selections used to compensate and configure other enabled I/O

Enabling Inputs:

Sensor inputs **A**:Conductivity, **B**:Temperature and **G**:4-20mA Input are fixed.
A,**B** & **G** may be enabled or disabled but their function is fixed.
The function of Sensor inputs **C-D** and **E-F** is set by the installed sensor-driver card to be another conductivity or a pH, ORP, corrosion rate…
Phantom Sensor inputs '**H**' to '**N**' are enabled as needed to for tank inventory and ppm calculations and to log manually entered drop counts.

Meter-Volume and Contact Set Inputs '**O**' to '**V**' are enabled and configured for either water-volume meters OR flowswitches, boiler ON line contact sets, level-pressure switches …
Phantom Meter-Volume or Contact Set inputs '**W**' to '**Z**' are enabled as needed as **'Rate-to-Volume'** and **'Copy Volume to'** target or as **'Mirror Output'** targets.

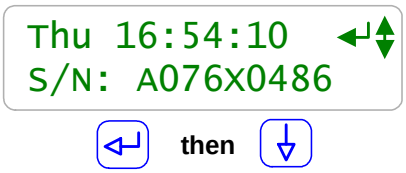
Enabling Outputs:

Outputs **1** to **5** are AC power switching relays that are enabled to power pumps, solenoids or motorized valves.
Outputs **6** to **9** are frequency controlled outputs that are enable to proportionally control pumps.

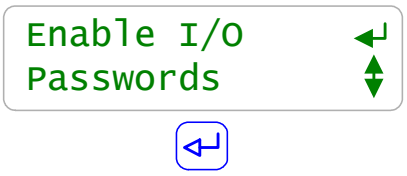
11.4 Enabling Inputs & Outputs

Enable an Input

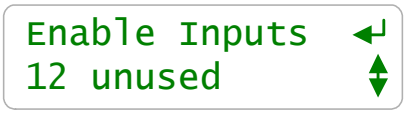
To enable a sensor, meter-volume or contact set input press **ENTER** and **DOWN** to **Enable I/O** at the power up or day-time display..



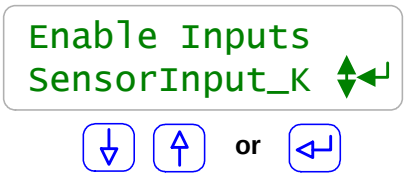
Key **ENTER** @ **Enable I/O**.



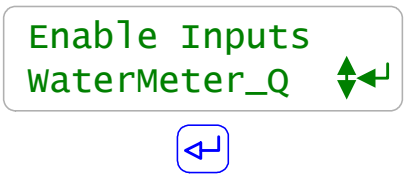
In this controller 12 of the 26 sensor, meter-volume and contact set inputs are unused..
Key **ENTER** to select one.



Key **UP** or **DOWN** to scroll through the unused, disabled inputs
Key **ENTER** select one
or **EXIT** to not select any inputs.



In this example we'll **Enable WaterMeter_Q**.
After enabling, scroll to **WaterMeter_Q** input, re-name it and configure it for use.



Sidebar:
Enabling Inputs:
In each controller there are 26 inputs; 14 Sensors '**A**' to '**N**'
and 12 Meter-Volume or Contact Sets '**O**' to '**Z**'.
Of the 14 sensors, 7, **A-G**, have terminal blocks where you can connect actual sensors and 7, **H-N**, are 'Phantom' and are used for manual and calculated values.
Of the 12 Meter-Volume or Contact Sets, 8, **O-V** have terminal blocks where you can connect actual meters or contact sets and 4, **W-Z** are 'Phantom' and are used for copy targets and mirroring.

Enabling Outputs:
Outputs are enabled in the same way as inputs. Each controller has 9 outputs.
Outputs **1-5** are relays which switch controller AC power to turn ON and OFF pumps, valves and solenoids.
Outputs **6-9** are frequency controls which are connected to frequency controlled pumps by a 2 wire control cable. The pumps are plugged into the AC power and the controller modifies the feed rate by changing the pump stroke frequency.

11.4 Metric & U.S. Units

To view or adjust the Metric - U.S. Units setting press **ENTER** and **DOWN** to **Configure** at the power up or day-time display.

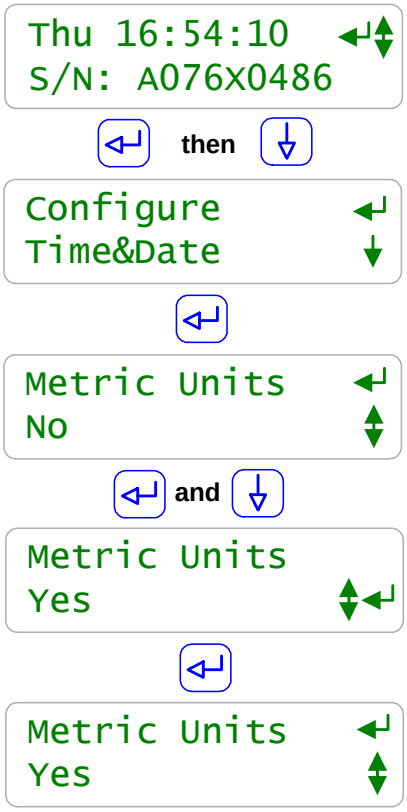
Key **ENTER** @ **Configure**

This controller in currently set to U.S. units. Temperatures are in F and volumes greater than 100mL are in Gallons.

Key **ENTER** to **DOWN** to switch to **Metric Units**.

Key **ENTER** to set **Metric Units** or **EXIT** to leave as U.S. Units.

Switch to Metric



Sidebar:
Commissioning:
Select U.S. or Metric Units when you commission or install the controller.
Data logging uses the Units setting for the units on logged volumes and temperatures.
Changing units does not change data already logged.

Metric Inputs:
Non 4-20mA temperature inputs are converted to Centigrade using the default offset and gain for each of the thermal input type.
If you switch back to U.S. units, temperatures are converted to Fahrenheit using the default offset & gain, removing the effect of any user calibration.
Inventory volumes are calculated in Liters but units are not changed.
ppm calculations now assume metered volumes in Liters and not gallons.
Metric Outputs:
Pumped volumes are reported in mL & Liters.
Biofeed event volumes are in Liters and not Gallons.
The controller uses the units of the controlling sensor for setpoints.
If a water meter was set to measure Gallons prior to switching the **Metric Units**, it will still display Gallons on the meter and wherever it's used for control.

11.6 Configurations

To view or adjust the configuration of the whole controller press **ENTER** and **DOWN** to **Configure** at the power up or day-time display.

Key **ENTER** @ **Configure**

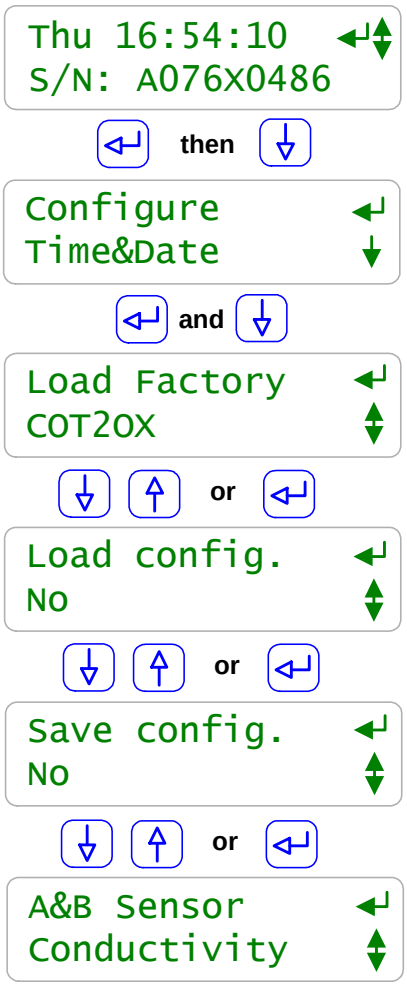
Requires 'LB' Option

Load Factory configures the controller to one of the 1 to 15 configurations shipped with the controller. This controller is currently running the COT2OX, Conductivity, dual biocide & ORP, configuration. . View and select an alternative controller configuration by keying **ENTER**.

Load Config. returns to the last saved configuration. Key **ENTER**,select **Yes** & **ENTER**.

After you've modified the controller for your site and its water treatment program, **Save config.** by keying **ENTER** & selecting **Yes** Once saved, you can always recover by using **Load config**.

The **A&B** controller inputs may be configured for several sensor types. Usually this is done once/site. Key **ENTER** to view or modify the current **A&B Sensor** type.



Sidebar:

Warning: Load Factory & **Load config** controller re-configuration may change sensors, Meters & contact sets, pump and solenoid controls, biofeed events. Reconfiguration and run occurs as soon as either option selected.

Load Factory: 'LB' Option

Up to 15 configurations may be included with the controller.
The configurations shipped with the controller may make it easy to add a 2nd boiler blowdown, a make-up conductivity or an ORP controlled bleach feed.
They may also include complete preset feed programs complete with setpoints, pump type selection and biofeed timing.

Recommended:

Turn on Keypad password (Manual Section 11.4).
Log on as the 'admin' and modify the password if this controller is Is likely to be accessed by uniformed users. Do this to prevent accidental or malicious controller reconfiguration.

11.7 Communications

This display sequence is only applicable to controllers with the '**LB**', LAN-Browser option.

To view or adjust the controller Ethernet setting press **ENTER** and **DOWN** to **Communicate** at the power up or day-time display.

Key **ENTER** @ **Communicate**

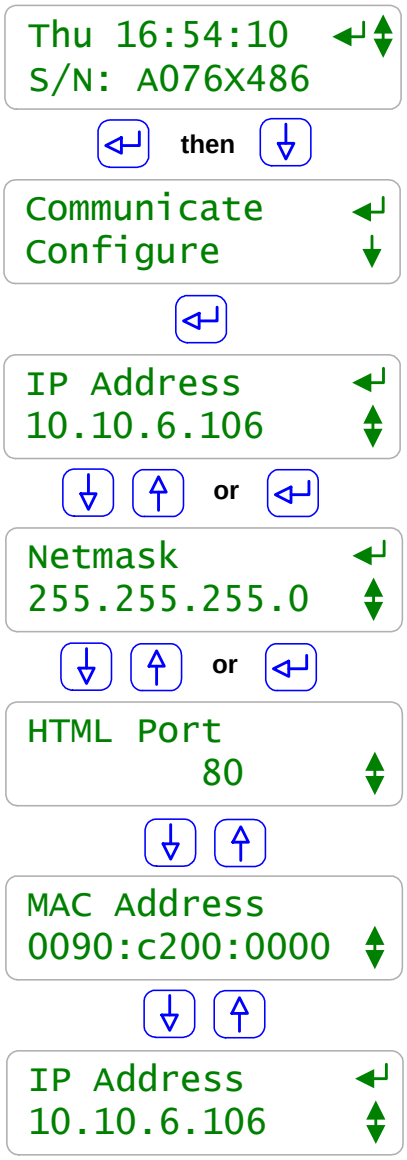
Displays the current LAN **IP address**.
In this example, it's the factory default.
If you are connecting into the site LAN, **IP address** is assigned by the site IT staff.
Key **ENTER** to modify.

Netmask is usually this value for most sites.
Key **ENTER** to modify.

This is the default **HTML Port** for browsing.
It can be modified only via the browser.

The site IT staff may require the controller **MAC Address** to register-allow the controller on the site network.
The **MAC address** is six 2 digit hexadecimal numbers, separated by colons into 3 groups of 4 to fit the LCD screen.
In this example, the **MAC address** is **00 90 C2 00 00 00**

Communicate



Sidebar:
Warning: Do not connect the controller Ethernet connection into a site LAN until the site IT staff have assigned a valid IP Address.

Not Connected to the Site LAN:
Leave the IP Address at 10.10.6.106. Connect a crossover cable from your notebook PC to the controller and browse 10.10.6.106.
Browser passwords are the same as the default keypad passwords listed in manual Section **11.1 Passwords**.
You'll need to configure your notebook to connect.
Refer to Appendix '**C**' **'LB' LAN Browser Option** at the back of this manual.

11.7 Communications

This display sequence is only applicable to controllers with the '**LB**', LAN-Browser option.

To view or adjust the Ethernet **IP Address** press **ENTER** and **DOWN** to **Communicate** at the power up or day-time display.

Key **ENTER** @ **Communicate**

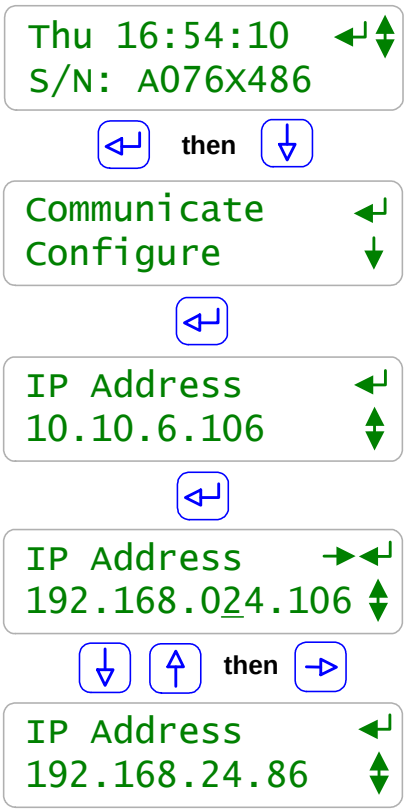
Key **ENTER** to modify.

Key **UP** or **DOWN** to change the underlined number
Key **RIGHT** to move to the next 3 digit number.

Key **ENTER** to change or **EXIT** to leave the **IP Address** unchanged.

In this example we've changed the **IP Address** from **10.10.6.106** to **192.168.24.86**.

Modify IP Address

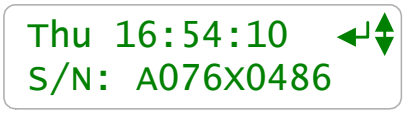


Sidebar:
Warning: Do not connect the controller Ethernet connection into a site LAN until the site IT staff have assigned a valid IP Address.

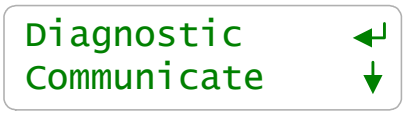
Using An Ethernet CrossOver Cable:
You'll need to set your notebook PC's IP Address to the same network to browse the controller using a crossover cable. In this pages example, the controller **IP Address** is **192.168.24.86**. To be on the same network, your notebook needs an **IP Address 192.168.24.**xxx where xxx is any number from 1 to 255, excluding **86**.

11.8 System Diagnostic

To view the controller's **Diagnostic** press **ENTER** at the power up or day-time display.

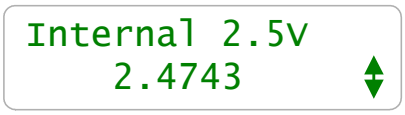


Key **ENTER** @ **Diagnostic**.

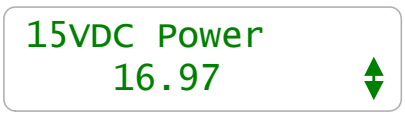


Displays the state of the Relay 1 to Relay 5 AC power fuse. Displays '**OPEN**' if AC fuse has failed.

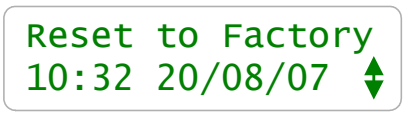
The **Internal 2.5V** level corrects analog voltages measured by the controller. Displays from 2.4500 to 2.5500.



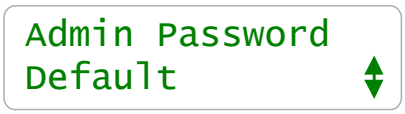
The **15VDC Power** level is the unregulated voltage @ the controllers **+DC Power Output** terminals. Displays from 15 to 23 Volts depending on AC line voltage and load on the **+DC Power Output** supply.



Displays the time and date of the last controller reset or the time and date of the most recent **Load Factory** was executed.



An **Admin Password** @ **Default** has not been modified from '**AAAA**'. If modified displays '**Changed**'.



An **Watchdog Resets** should always display **0**. An increasing number of **Resets** indicates corrupted firmware or controller electrical fault or interference.

The controller **Firmware Version** indicates the date of issue of the software operating the controller.

Sidebar:
Reset to Factory: Sets all volume-water meter totals for this year and the previous year to zero.

12.0 Product Support

12.1 Application & Technical Support

www.aquatrac.com
Aquatrac Instruments, Inc.
1957 Cedar Street
Ontario, CA
91761

7:00AM-4:00PM PACIFIC TIME **800.909.9283**

CENTRAL TIME ZONE **847.550.0948**

AEGIS controllers are supplied in a many configurations; some with specialized controls. The controller Serial Number and Part number available on the top, center of the controller circuit board, helps us to help you.

Replacement Sensors and Parts:
Controller User and Technical Manuals:
Click on the AEGIS controller icon @ **www.aquatrac.com**

Upgrade Kits:
Controls and sensors can be added to installed controllers. Upgrade kits include sensor, entry fitting, driver card and installation instructions
Click on the AEGIS controller icon @ **www.aquatrac.com**

AC Power Fuse:
This fuse provides AC power to the pumps, solenoids and valves connected to Relays '**1**' to '**5**'.

Protects	Rating / Type	Manufacturer – Vendor
Power Relays 1 to 5 AC Fuse	5 Amps @ 120VAC 2.5 Amps @ 250VAC 5mm x 20mm, Fast Acting	Littlelfuse, Type 217P, 250VAC Digikey Part# F2395-ND Digikey Part# F2400-ND www.digikey.com 1-800-344-4539 OR Aquatrac Part# **AG-FUSE**, 10 fuse kit

12.3 Specifications

Analog – Digital I/O	Rating - Detail	Notes
Analog Inputs **A...G** **H...N**	**7 Analog Sensors** of which 3 are fixed, **A**: Conductivity, **B**:Temperature & **G**:4-20mA Input. Socketed for two single or dual sensor drivers or 4-20mA output cards @ Inputs **C-D** and **E-F** **7 Phantom** analog inputs may be used for ppm, inventory, manual data logging…	Controller auto-configures on Driver card installation and removal. pH, ORP, Conductivity, pH-Temperature, Corrosion Rate, 4-20mA Input & Output cards available
4-20 mA Outputs **Uses C-D and/ or** **E-F sockets**	**0 to 4**, DC isolated, loop powered. Nominal 0.1% resolution. Auto polarity correction field wiring.	Single & Dual Drivers Alarms on open current loop.
Digital Inputs **O...V** **U...Z**	**8 Meter & Contact Set** Dry Contacts, 250mS response Water Meters, 400 Hz max 0.5mA @ 5VDC measurement current. **4 Phantom** inputs may be used for volume tracking, mirroring…	User configurable as water meters or contact sets. Contact head meters software debounced. Turbine-Paddle wheel rating = Seametrics max pulse rate.
Relay Outputs **1..5**	**5** 1 SPST, 4 SPDT Fused @ 6.3A 120VAC or 3.15A 230VAC.	Relays rated 10A, 120VAC Detection and Alarm on relay AC fusing.
Frequency Outputs **6..9**	**4** Isolated, Dry Contact SPST Outputs 400 SPM maximum.	500 ohms in series with non-polarized, bounce free, silicon contact sets.

Mechanical	Rating	Notes
Enclosure **Rating, Dimensions,** **Weight**	Non-metallic, NEMA4X, IP66 7.5”W x 11.3”H x 5.5”D 190mmW x 287mmH x 140mmD 15 lb. 7 Kg nominal Mounting hardware included.	Nominal dimensions, excluding entry fittings and external power and sensor cabling. Enclosure door hinged left.
120VAC 4 Plug Box **(optional)**	Rated for outdoor use. Includes 36” of flexible non-metallic conduit	Plug boxes not available for controllers shipped outside of North America
ON/OFF Switch **(optional)**	IP67 rated 10A @ 125/250VAC	Mounted bottom, left of enclosure door.

12.3 Specifications

Communications User Interface	Rating - Detail	Notes
Keypad - LCD	5 Key Tactile feedback: UP / DOWN / ENTER / EXIT / RIGHT 2 Line x 16 Character, Backlit	Scan rate 100mS nominal User adjustable contrast
USB	Data log download. View-configuration upload.	Includes display support for USB connection state
10 BaseT, TCP-IP Ethernet LAN (Optional)	HTML – AJAX micro Web Server for Mozillla's Firefox and IE7 Full command, control, reconfigure via browser. Network parameters and HTML port user set. Static IP	Password, UserID protected. Auto-configures views linking sensors and controls.
Modem (Optional)	56K, V.90 PPP access provides remote browsing via Mozillla's Firefox and IE7	Alarms accessed via Trackster3 polling.

Electrical	Rating - Detail	Notes
AC Input	120 or 230 VAC, 50/60Hz,	Switch selectable
5 Relay Fusing	6.3 Amps @ 120VAC 3.15 Amps @ 230VAC	5x20mm, AC fusing: Relays alarm & OFF on fusing.
120VAC Power Cord	0 to 1, AWG18, NEMA grounded plug, SJTW jacket, black, 60"	Quantity varies with controller part number.
120VAC Pump-Solenoid Plug Sockets	0 to 5, AWG18, 3 wire, 12" long NEMA receptacle sockets, black.	Quantity varies with controller part number.
Surge-Spike Suppression Control Fusing	Relays 2-5 NO contacts snubbed 0.1uF, 150R Varistor on control AC input	Controller, transformer isolated from AC line. Control fusing not user accessible.
AC Terminals	AWG 14, 150mm^2 UL rated 300V @ 10A Rising clamp type.	Electrical grounds at bottom of aluminum backplate. Conductor insulation rated 600VAC minimum.
Sensor, Digital Input Terminals	AWG 22, 0.25 – 0.50mm^2	MAX AWG14, 150 150mm^2
DC Loop – Turbine Meter Power	15 – 22 VDC, unregulated Thermally fused @ 100mA hold, trip @ 200mA	Available at 3 field wiring terminals: **+DC Power Output**