AQUATRAC™
INSTRUMENTS, INC.
SYSTEM DESIGN & ENGINEERING

SlimFlex

Water Treatment Controller
For Cooling Towers

Measures Conductivity, ORP, Temperature,
Make-up Water Meter and Flowswitch

Controls the Bleed Solenoid,
Inhibitor, Oxidant and Biocide Pumps

Includes **Conductivity-Temperature-Flowswitch**
and **ORP** Sensors

Part No. CO-IN-CX-TB

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Safety

Electrical Shock Hazard

Removing the lower enclosure cover with the controller plugged in, exposes the user to AC line voltages.

There are no user serviceable parts behind the upper enclosure cover; do not remove.

All connections to building electrical systems must be installed by qualified personnel in accordance with local requirements.

USER WARNING : CAUTION

Cooling Tower Water Treatment Controllers operate 120VAC bleed solenoids & pumps 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, feed limits 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

Controllers are supplied with default bleed and feed and oxidant pump setpoints that will not be applicable to your cooling tower.

Select control modes, adjust setpoints and set biocide pump timing for your site and its water treatment program.

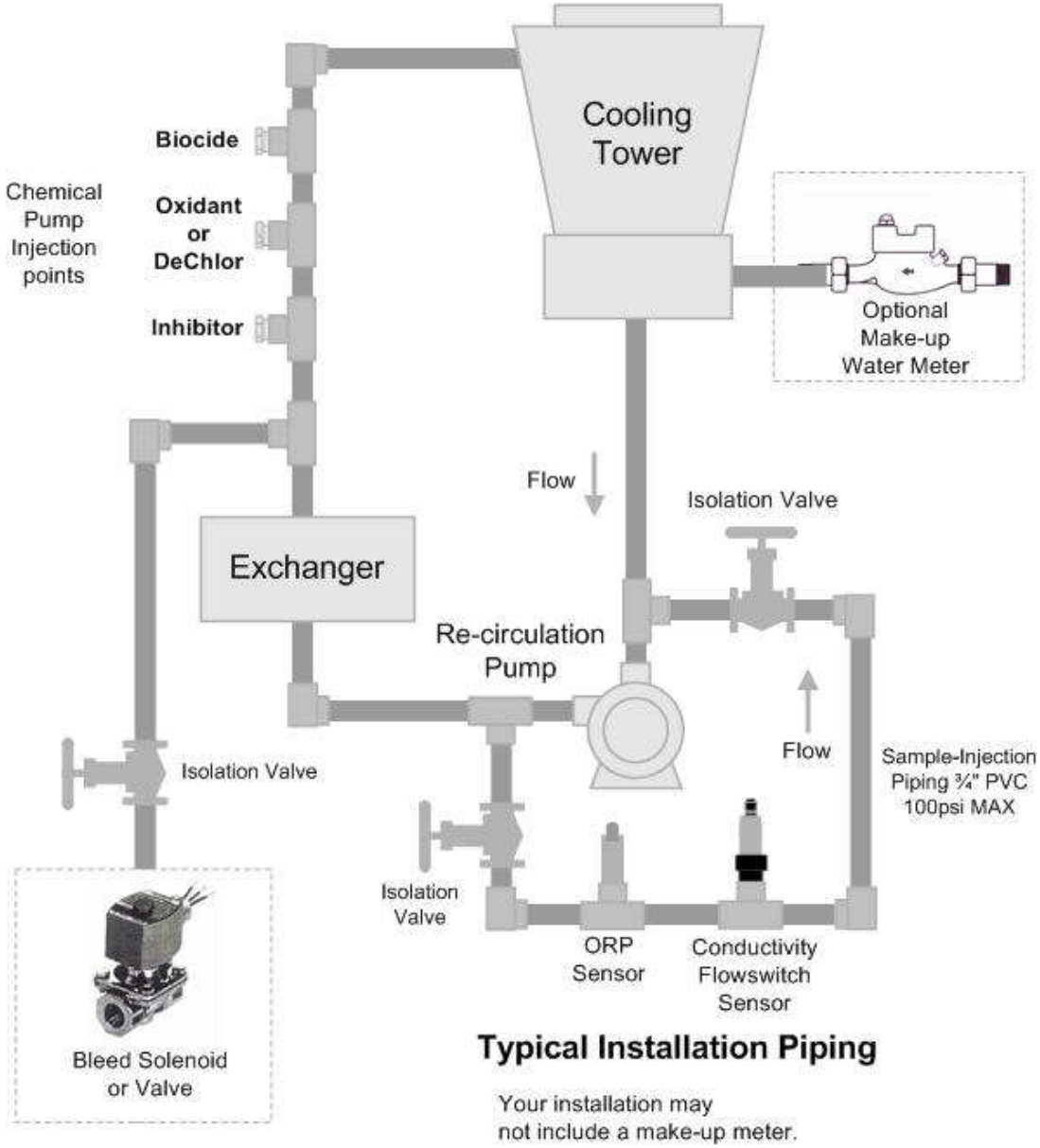
1. INSTALLATION

1.1 Sample Piping

Controller includes sensors and ¾’ PVC sensor entry fittings.

if you have not previously installed this type controller,
read **Appendix A: INSTALL** for plumbing and wiring guidelines

CAUTION: Do not exceed 100psi on ORP sensor or flowswitch.
Always close upstream isolation valves first.



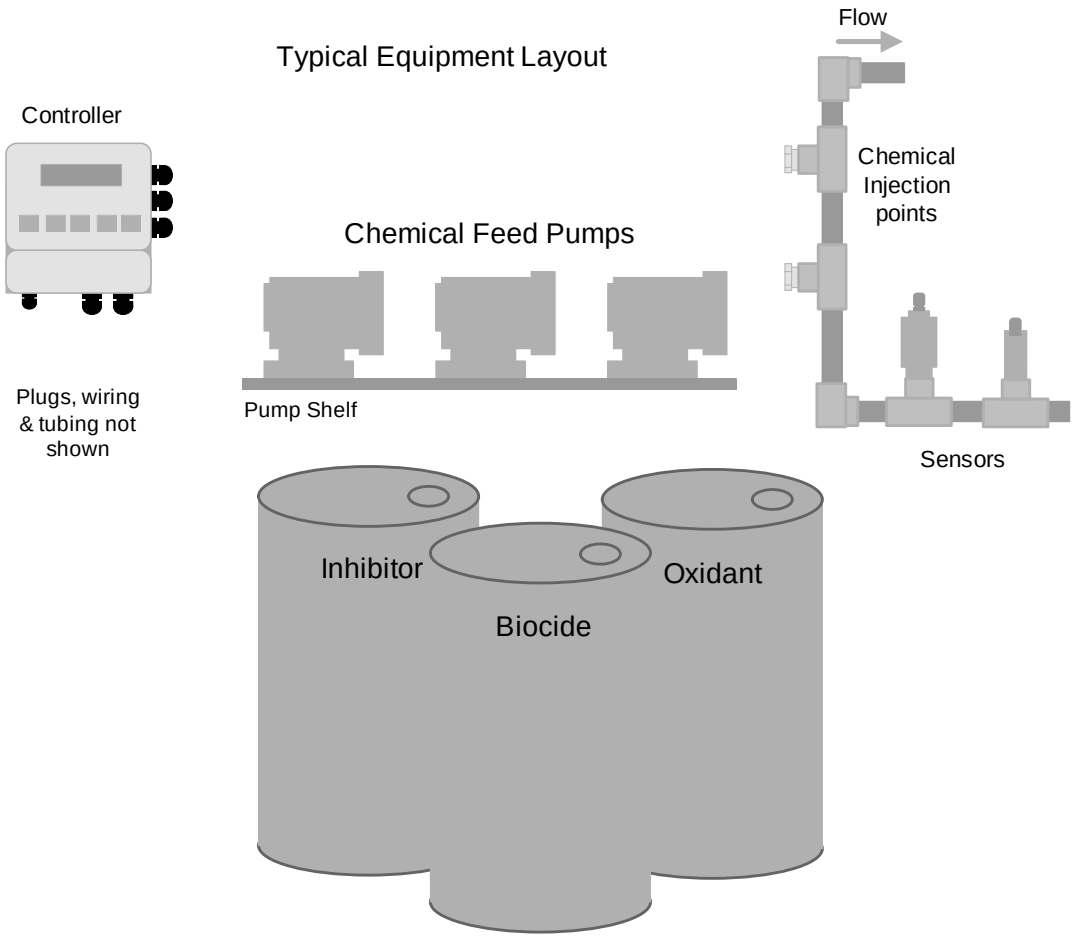
Typical Installation Piping

Your installation may
not include a make-up meter.

Smaller towers place the sensors
in the tower re-circulation line.

1.2 Controller Enclosure

Remove the lower, controller enclosure cover.
Hang the controller on a single #8-#10 screw located 60”, 150cm. above the floor
Install the bottom left & right mounting screws through the existing enclosure holes located behind the lower cover.



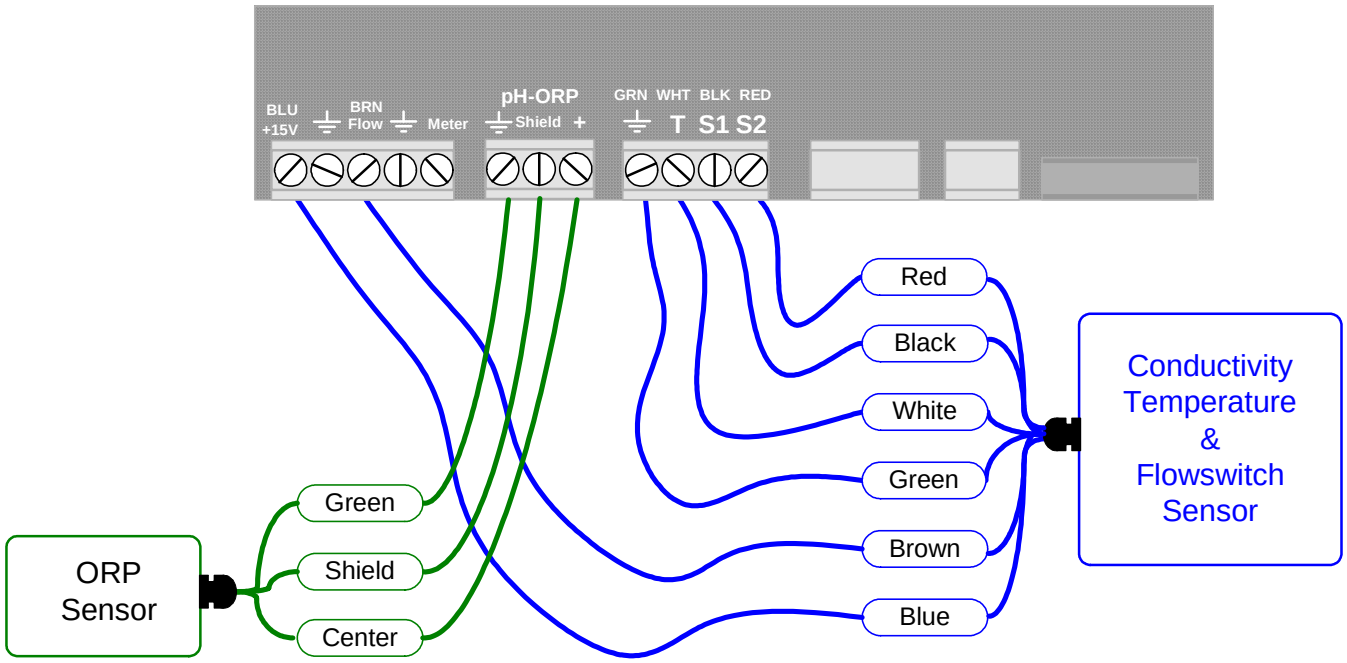
Although sensor cables and pump tubing may be extended, ease of servicing occurs when water treatment components are located in the same area.

Ensure that the lower enclosure cover is installed when not terminating sensor and water meter wiring.

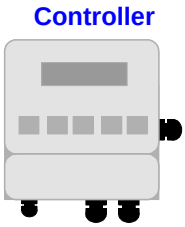
1.3 Sensors – Conductivity & ORP

After installing the conductivity and ORP sensors, open the sample piping downstream valve, then the upstream valve.
Verify that both sensor entries seal, leak and drip free

Controllers are supplied with sensors and optional flowswitch pre-wired.
The following graphic details connection points for sensors.



ORP sensors include a coaxial cable with tinned ends & a sensor entry 'T' with GREEN solution ground



Controllers are supplied with the Sensors prewired

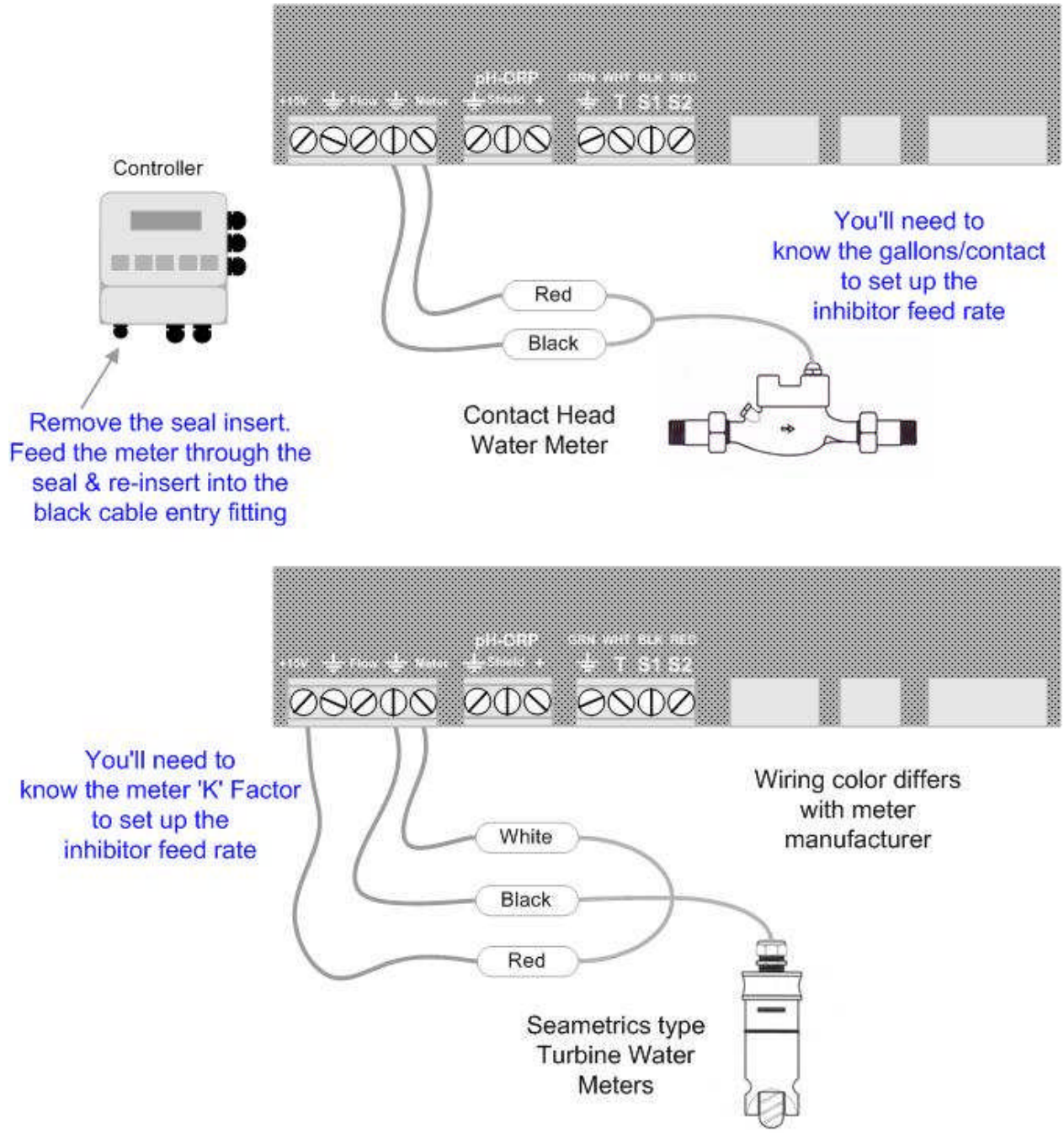
Feed the sensor cable through the entry seal & tighten the seal

Flowswitch Alternative: A dry contact set, closed when there is flow past the sensors may be used as an operating interlock in place of the flowswitch built into the conductivity sensor.

Disconnect the **BROWN Flow** wire and connect the alternative flowswitch to the **Flow** and adjacent **Ground** terminals.

1.4 Sensors – Water Meter

Refer to manufacturer's recommendations on meter orientation and upstream and downstream piping. Extend meter cables with AWG22, 2 or 3 conductor.

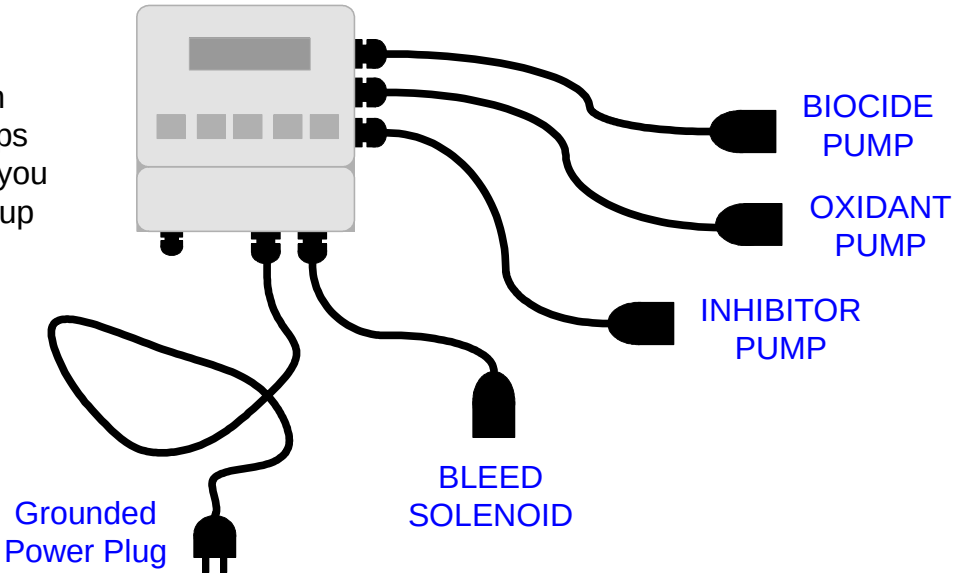


Do not install meter cabling in the same conduit at AC power wiring.

1.5 Pumps & Bleed Solenoid

The controller supplies the AC power for the pumps and solenoid.
Controller relays switch power to pumps and the solenoid, fused at a maximum of 5 Amps.

WARNING:
Do not plug-in controller, pumps or solenoid until you are ready to setup & operate



HARDWIRING:
refer to appendix 'C'

You may be using a pot feeder controlled by a solenoid to feed oxidant.
Verify that it's plugged into the middle of the three enclosure sidewall sockets.

START-UP *BEFORE you plug-in pumps and bleed solenoid.*

A: Plug-in the controller.

B: Set control modes and setpoints.

C: Set the feed limits on the inhibitor and oxidant pumps.

D: Verify that the sensors are reading correctly and set the alarms.

E: If you are using a water meter; force make-up and verify that meter is measuring the expected volume.

F: Verify that the flowswitch is working.

An overview of system operation is available in the **Yearly** section of 4.1 Maintenance.

2. START-UP
2.1 Power-up Display & Keypad

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

Enclosure keypad Response

UP or DOWN to the display you wish to view or EDIT & press ENTER

Power ON display: Day of Week & current time

Press ENTER for Controller Diagnostic, Clock, System configure, US-Metric set

```
Thu 16:54:10      ↵
S/N: T041T0486
```

Press ENTER to clear Alarms

```
Alarms            ↵
none
```

Current Conductivity sensor value

Press ENTER for Conductivity Calibrate & Alarms

```
Conductivity      ↵
    1425 uS
```

Solenoid ON or OFF and ON time today

Press ENTER for Bleed Setpoints, Mode, Test, End Prebleed or Lockout and Current State

```
Bleed Solenoid    ↵
ON      25.6min
```

Current ORP sensor value

Press ENTER for ORP Calibrate & Alarms

```
ORP               ↵
     237 mV
```

Oxidant ON or OFF and ON time today

Press ENTER for Oxidant Setpoints, Feed Mode, Limit Timer, Prime Pump and Current State

```
Oxidant Pump      ↵
ON      14.6min
```

2.1 Power-up Display & Keypad
continued

Water meter measured volume from midnight

Press ENTER to Install, Select type, View year-to-date & days on-line

```
Make-up Today  ↵
    10450  G
```

Inhibitor Pump ON or OFF and ON time today

Press ENTER for Inhibitor Setpoints, Feed Mode, Limit Timer, Prime Pump and Current State

```
Inhibitor Pump ↵
ON        9.2min
```

Flowswitch ON or OFF and ON time today

```
Flowswitch
ON      780.6min
```

Biocide Pump ON or OFF and ON time today & Cycle Day

Press ENTER for Add, Edit & Delete Events, Prebleed, Lockout, Prime Pump, Cycle Days and Current State

```
Biocide   Day 5↵
OFF      30.0min
```

If there are no options installed you'll view the power-up display

```
Thu 16:54:10   ↵
S/N: T041X0486
```

LAN –Browser Option
Displays current IP – see Appendix F, 'LAN' for User Manual

```
LAN IP         ↵
10.10.6.106
```

OR

4-20mA Output Option
Displays loop current – see Appendix D, '4-20mA OUTPUT' for User Manual

```
4-20mA Output  ↵
15.4mA
```

OR

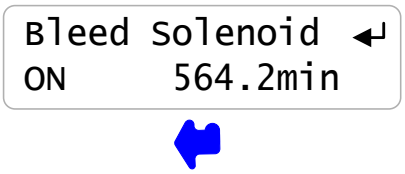
Alarm Relay Option
Displays relay state – see Appendix E, 'ALARM RELAY' for User Manual

```
Alarm Relay    ↵
Closed
```

2.2 Bleed Mode: Conductivity Setpoints

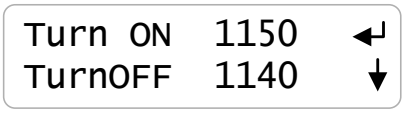
The factory default is 'Bleed on Conductivity'
Refer to *3.2 Bleed Controls*
to select one of three Bleed Modes

Press UP or DOWN until you see
'Bleed Solenoid' & press ENTER



Press ENTER to view or adjust Setpoints

Displays current bleed setpoints,
Varies with Bleed Mode



Press ENTER adjust Turn ON,
or DOWN & ENTER for TurnOFF

Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave the Setpoints unchanged

then

Press ENTER, displays current setpoints.

If you make Turn ON less than TurnOFF,
the setpoints will be switched.

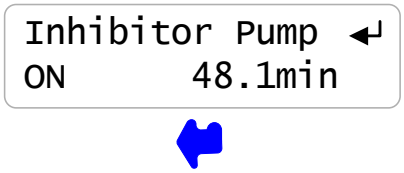
Sidebar: The difference between Turn ON & TurnOFF, the 'deadband', is usually set to 10uS. If you are watching the tower conductivity as the sump float turns the make-up water ON & OFF, you'll observe the operational deadband exceeds 10uS.

Delays in starting and stopping the make-up due to sump float trip points, increases the operational deadband beyond the controller ON–OFF setpoints.

2.3 Inhibitor Feed Mode: Setpoints, Feed Limits

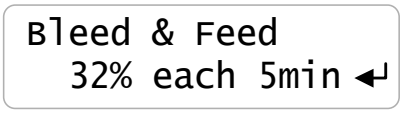
The factory default is 'Bleed & Feed'
Refer to *3.6 Inhibitor Controls*
to select one of four Feed Modes

Press UP or DOWN until you see
'Inhibitor Pump' & press ENTER



Press ENTER to view or adjust Setpoints

Displays current feed setpoints,
Inhibitor will be on for 32% of the time that the Bleed
Solenoid is ON; 96 seconds in every 5 minutes



Press ENTER adjust % of Bleed Time,

Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave the Setpoint unchanged

Press ENTER, displays current setpoint,
90 seconds in every 5 minutes

Sidebar: Bleed & Feed is the most common, but usually not the best way to feed inhibitor.

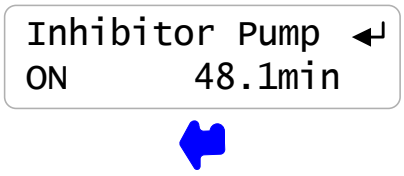
If you are not bleed limited, use Bleed then Feed mode to reduce inhibitor use.

If you are using a make-up water meter to control inhibitor feed, the controller will delay feeding when the bleed valve is ON to avoid pumping inhibitor down the drain.

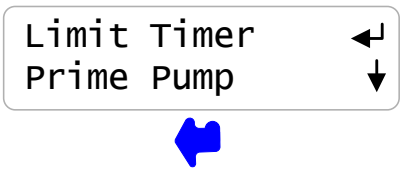
2.3 Inhibitor Feed Mode: Setpoints, Feed Limits
continued

The Inhibitor feed limit timer turns OFF the inhibitor pump to prevent overfeeding.
The factory default feed limit 180 Minutes/Day.

Press UP or DOWN until you see 'Inhibitor Pump' & press ENTER.



Press DOWN until Limit Timer.
Press ENTER to view or adjust Limit Timer.

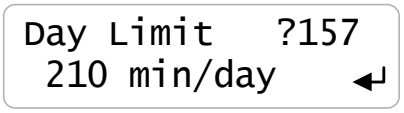


Displays feed limit in minutes,
?157 indexes more explanation @ www.Aquatrac.com

Press ENTER adjust Feed Limit,

Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave the Feed Limit unchanged

Press ENTER, displays current setpoint,
210 minutes/day



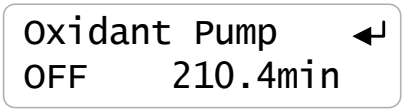
HELP: ?157 and other help numbers display wherever more explanation is available at www.Aquatrac.com.

If you are using water treatment controls for the first time, the language and application of some of the controller options and settings requires more detail than a 2 line display can deliver.

2.4 Oxidant: Setpoints, Feed Limit

The factory default is 'ORP Control
Refer to *3.4 Oxidant Controls*
to select one of two Control Modes

Press UP or DOWN until you see 'Oxidant Pump'.
The pump is OFF & has been ON for 210.4 minutes from midnight



Press ENTER.
Press ENTER to view or adjust Setpoints.

Displays current oxidant feed setpoints.
Pump turns ON when the ORP falls below 290mV and OFF when the ORP exceeds 300mV

Press ENTER adjust Turn ON,
or DOWN & ENTER for TurnOFF

Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave the Setpoints unchanged

Press ENTER, displays current setpoints.

If you make Turn ON greater than TurnOFF,
the setpoints will be switched

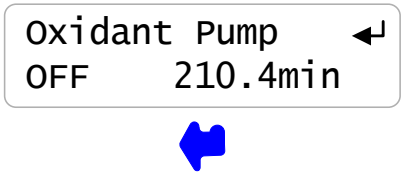
Sidebar: Oxidant control setpoints are usually set by measuring the available oxidant in the tower and observing the controller ORP millivolt level.

For example, if the ORP reads 315mV when the tower has 0.5ppm oxidant, setpoints of 315mV & 320mV will maintain the tower @ 0.5ppm.

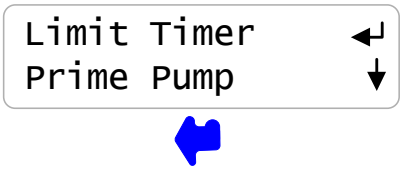
2.4 Oxidant: Setpoints, Feed Limit
continued

The feed limit timer turns OFF the oxidant pump to prevent overfeeding.
The factory default fed limit is 100 Minutes.

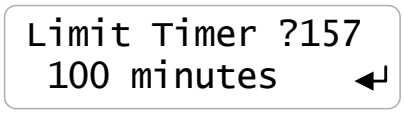
Press UP or DOWN until you see 'Oxidant Pump' & press ENTER.



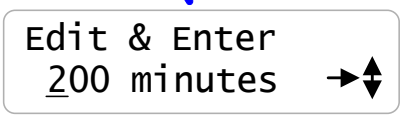
Press DOWN until Limit Timer.
Press ENTER to view or adjust Limit Timer.



Displays feed limit in minutes,
?157 indexes more explanation @ www.Aquatrac.com

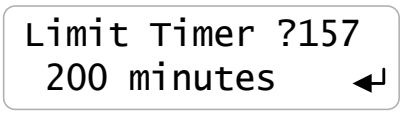


Press ENTER adjust Feed Limit,



Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave the Feed Limit unchanged

Press ENTER, displays current feed limit, 200 minutes



Sidebar: The ORP must exceed the TurnOFF setpoint within the feed limit time in minutes. The limit timer prevents oxidant overfeeding if the ORP sensor fouls or fails and would typically be set at 125% to 150% of the longest expected oxidant feed time.

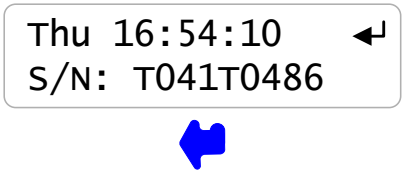
Note:
The Oxidant feed limit restarts every time the pump turns ON & does not reset at midnight.

2.5 Verify Conductivity & ORP Sensors

Open the downstream, then the upstream sample line isolation valves, immersing the conductivity & ORP sensors

Verify Temperature

Press UP or DOWN until you see Day & Time.
Press ENTER.



Press ENTER & then press ENTER to view temperature at the conductivity sensor.

If the GREEN & WHITE wires are connected to the controller terminals, you'll view the current temperature.
'Fault' indicates a wiring or sensor problem.

'Fault' automatically removes conductivity temperature compensation.
Key EXIT twice to return to Day & Time

Calibrate Conductivity

Press DOWN until you see Conductivity.
Sample the tower water & verify that the displayed conductivity matches the measured conductivity.

Adjust the displayed conductivity by pressing ENTER twice.

Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave Conductivity unchanged.

then

You'll see this screen if the sensor is fouled, miswired, not immersed or you keyed incorrectly.
Press ENTER to ignore or EXIT to return to Factory Default.

?141 indexes more explanation @ www.Aquatrac.com

Displays the current, calibrated conductivity.

2.5 Verify Conductivity & ORP Sensors
continued

Open the downstream, then the upstream sample line isolation valves, immersing the conductivity & ORP sensors

Press UP - DOWN until you see ORP.
Sample the tower water & verify that the displayed ORP matches the measured ORP.

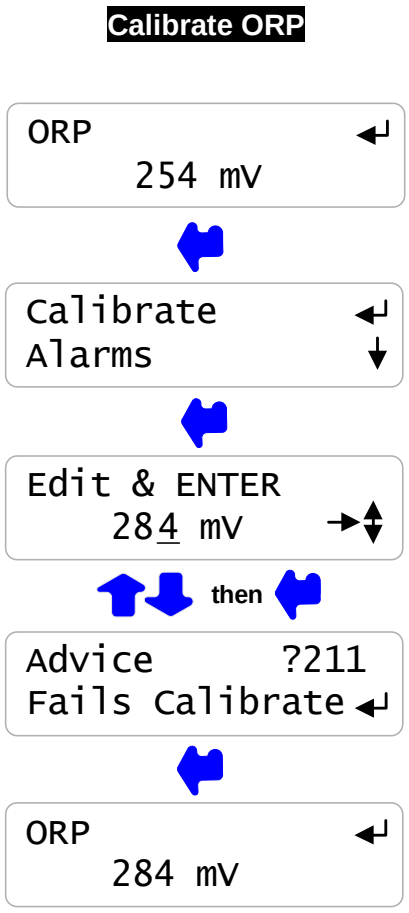
Adjust the displayed ORP by pressing ENTER twice.

Press UP-DOWN to adjust and RIGHT to move the cursor.
Press EXIT to leave ORP unchanged.

You'll see this screen if the sensor is fouled, miswired, not immersed or you keyed incorrectly.
Press ENTER to ignore or EXIT to return to Factory Default.

?211 indexes more explanation @ www.Aquatrac.com

Displays the current, calibrated ORP



Sidebar: ORP's typically are 50 to 150mV in towers with no residual oxidant.

Negative ORPs are almost never measured in cooling towers and usually indicate a fouled or miswired sensor.

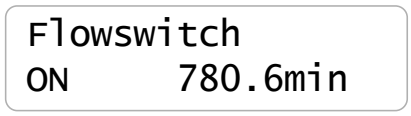
The correlation between ORP & available oxidant varies with treatment program, cycles of concentration and make-up water chemistry.

2.6 Check Flowswitch & Install Water Meter

Open the downstream, then the upstream sample line isolation valves, immersing the conductivity & ORP sensors.
Note: The thermal flowswitch requires a maximum of 30 seconds to respond to the change from NO-Flow to Flow

Flowswitch

Press UP - DOWN until you see Flowswitch. Displays ON or OFF and the total minutes ON from midnight.
NOTE: An OFF flowswitch stops all pumps and the bleed solenoid.



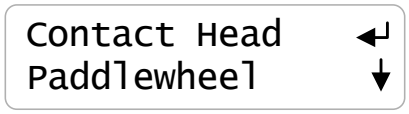
The flowswitch can be bypassed by jumpering the Flow terminal to ground.

Contact Head Watermeter

The factory default water meter is a 100 Gallons/contact contact head meter

Press UP - DOWN until you see Make-up Today. Displays make-up volume from midnight.

Press ENTER twice to view or change meter type.

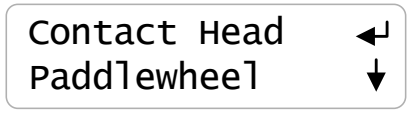


Key ENTER to view or change the gallons/contact. Metric users will view volumes in 'L'iters & L/Contact

Press UP-DOWN to adjust and RIGHT to move the cursor. Press EXIT to leave Gallons/contact unchanged.

then

ENTER or EXIT displays the current meter type.



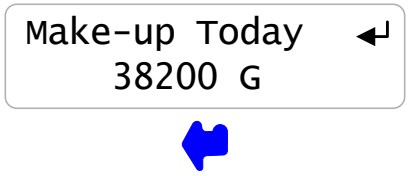
Sidebar: 2 wire meters are usually Contact Head & 3 wire meters are Turbine or Paddlewheel.

2.6 Check Flowswitch & Install Water Meter
continued

Turbine-Paddlewheel type water meters provide pulses per Gallon or Liter.
The number of Pulses/Unit Volume is the 'K' factor.

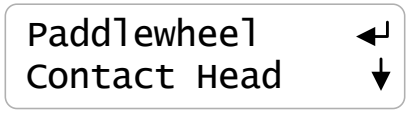
Turbine –Paddlewhell Watermeter

Press UP - DOWN until you see Make-up Today. Displays make-up volume from midnight.

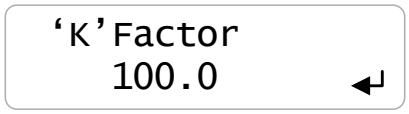


Press ENTER twice to view or change meter type.

Key DOWN to select Paddlewheel type meter

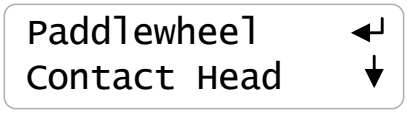


Key ENTER to view or change the pulses per Gallon.
Metric users view pulses per Liter.



Press UP-DOWN to adjust and 'K' Factor unchanged.

ENTER or EXIT displays the current meter type.



Sidebar: Force make-up by either opening the bleed solenoid bypass or lowering the Bleed Setpoints.

Verify that the make-up meter displays an increasing volume as the float opens the make-up line. Close bypass or reset Bleed Setpoints after verifying the meter.

WARNING: Verify paddlewheel meters immediately and disconnect if not verified. Mis-wired paddlewheel meters will fail the meter Hall Effect sensor.

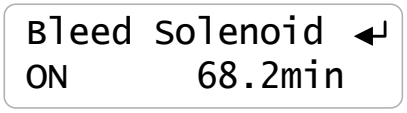
2.7 Plug-in Pumps and Bleed Solenoid

Sections 2.1 to 2.6 adjust setpoints and verify sensors. We're now ready for the bleed solenoid and each chemical pump, verifying each one as it's plugged in.

Remove the lower access panel on the controller enclosure.

Bleed Solenoid

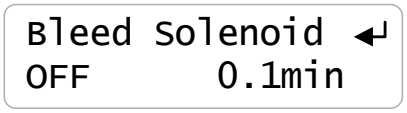
Plug the bleed solenoid into the right bottom plugs. Press UP or DOWN to view Bleed Solenoid.



If ON, verify that the green R1 light on the right side of the enclosure is ON.

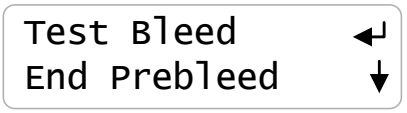
OR

Verify that the bleed solenoid is open and that tower water is going to drain.



then

If OFF, press ENTER & DOWN to Test Bleed. Press ENTER and the Bleed & R1 light will turn ON for 5 minutes



Inhibitor Pump

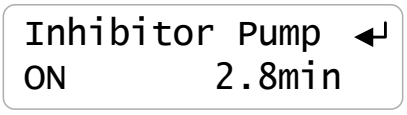
Plug the inhibitor pump into the top of the 3 sidewall plugs. Press UP or DOWN to view Inhibitor Pump.

If ON, verify that the green R2 light on the right side of the enclosure is ON.

then

Verify that the pump is stroking, primed and feeding inhibitor.

If OFF, press ENTER & DOWN to Prime Pump.



Press ENTER and the Inhibitor Pump & R2 light will turn ON for 5 minutes

Sidebar: The Bleed Solenoid and Pumps will not turn ON unless the Flowswitch is ON. The R1,R2,R3 & R4 lights will not turn ON unless the Flowswitch is ON.

Inhibitor pumps set to 'Bleed then Feed' or 'Feed on Volume' modes will not feed if the Bleed Solenoid is ON. Feed starts as soon as Bleed ends.

2.7 Plug-in Pumps and Bleed Solenoid

continued

Oxidant Pump

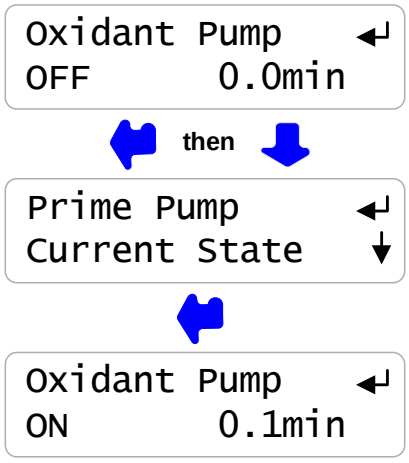
Plug the oxidant pump into the middle of the 3 sidewall plugs. Press UP or DOWN to view Oxidant Pump.

If ON, verify that the green R3 light on the right side of the enclosure is ON.

Verify that the pump is stroking, primed and feeding oxidant.

If OFF, press ENTER & DOWN to Prime Pump.

Press ENTER and the Oxidant Pump & R3 light will turn ON for 5 minutes



See Section *3.7 Biocide Events*, to set biotiming

Biocide Pump

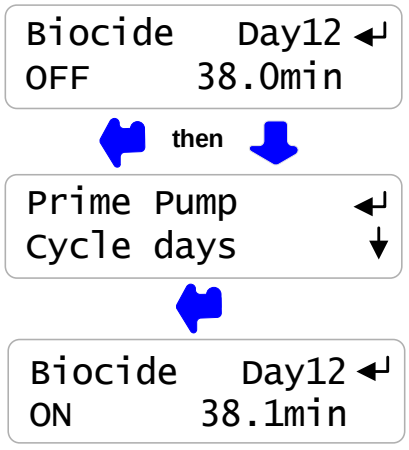
Plug the Biocide pump into the lowest of the 3 sidewall plugs. Press UP or DOWN to view Biocide.

If ON, verify that the green R4 light on the right side on the enclosure is ON.

Verify that the pump is stroking, primed and feeding oxidant.

If OFF, press ENTER & DOWN to Prime Pump.

Press ENTER and the Biocide pump & R4 light will turn ON for 5 minutes



Reinstall the lower access panel on the controller enclosure.

Sidebar: The Bleed Solenoid and Pumps will not turn ON unless the Flowswitch is ON.

Priming the Biocide pump does not cause a bleed solenoid Prebleed or Lockout.

Press ENTER at 'Alarms' and ENTER at 'Clear Alarms' to end Test Bleed or Prime Pumps.

2.8 Check Controls

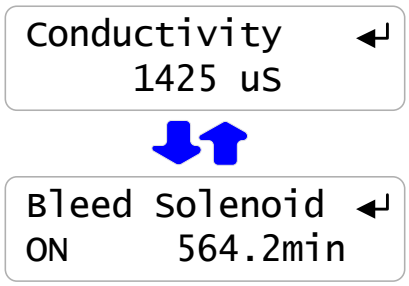
Verify that the controls work in the way that you expect for this site.

Conductivity & Bleed

Watch the Conductivity increase as the tower operates.

The Bleed Solenoid will turn ON as the conductivity exceeds the Turn ON setpoint.

As the tower makes up, the Conductivity will fall below the TurnOFF setpoint and the Bleed Solenoid will turn OFF.



Verifying a 'Meter Control' or 'Percentage Time' Bleed Mode differs.

Water Meter or Bleed & Inhibitor Pump

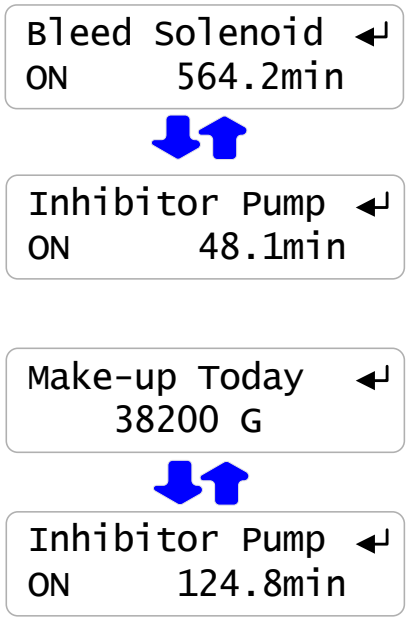
If the Inhibitor feed mode is set to 'Bleed & Feed', the Inhibitor Pump will turn ON when the Bleed turns ON.

If the % of each 5 minutes is set to less than 100%, the Inhibitor Pump will turn ON & OFF while the Bleed in ON.

If the Inhibitor feed mode is set 'Bleed then Feed', the Inhibitor Pump will always be OFF when the Bleed is ON & will turn ON as soon as the bleed turns OFF.

If the inhibitor pump is set to 'Feed on Volume' , the inhibitor pump will turn ON after measuring Make-up.

If the Bleed is ON, the Inhibitor Pump will wait until the Bleed turns OFF before turning ON.



Sidebar: The Bleed Solenoid and Pumps will not turn ON unless the Flowswitch is ON.
The Inhibitor Pump turns OFF if the daily Feed Limit is exceeded.
Increase the Limit Timer to allow the pump to turn ON.

Bleed Solenoids may turn OFF if Biocide is set to Prebleed and a timed event is scheduled.
Bleed Solenoids may not turn ON if Biocide is set to Lockout and a timed event has started.

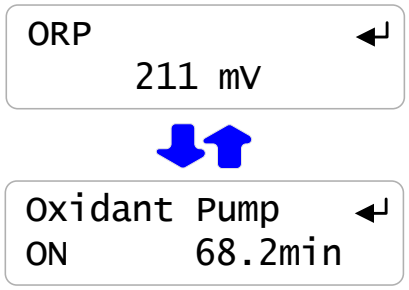
2.8 Check Controls
continued

ORP & Oxidant

Watch the ORP decrease as the tower operates and consumes oxidant.

The Oxidant Pump will turn ON as the ORP falls below the Turn ON setpoint.

As the oxidant demand is met, the ORP will exceed the TurnOFF setpoint and the Oxidant Pump will turn OFF.



Verifying an Oxidant controlled by 'Percentage Time' mode differs since pump ON and OFF times do not respond to ORP level..

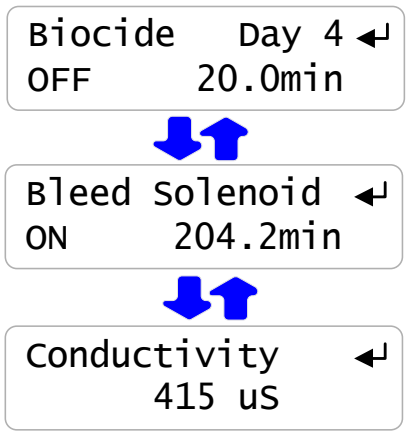
Biocide Pump & Bleed Valve - Conductivity

If you have not set a Biocide Prebleed or Lockout, the Biocide pump will turn ON for the preset time on the selected Day#

Prebleed time starts at the time set for the event & ends after the Prebleed time OR when the conductivity target is met.

Lockout time starts after the timed event ends, turning OFF the Bleed

During Prebleed watch the Bleed Solenoid & Conductivity. During Lockout, watch the Bleed Solenoid 'Status'



Press ENTER & DOWN @ Bleed Solenoid for Prebleed and/or Lockout end options.

Sidebar: ORP is a indirect measure of available oxidant & may change slowly at high oxidant levels. ORP typically will not change if there is no residual oxidant in the tower.
The Oxidant Pump turns OFF if the Feed Limit is exceeded.
Press ENTER @ 'Alarms' & 'Clear Alarms' to reset.

If you set the Prebleed conductivity below the make-up conductivity, then you will always prebleed for the prebleed time. If you require a long Lockout, feed during low or no tower load to prevent over-cycling the tower.

3. OPERATION
3.1 Conductivity Sensor

Sensor calibration and temperature verify is detailed in Section *2.5 Verify Conductivity & ORP Sensors*

Press UP - DOWN until you see Conductivity.

Press ENTER & then DOWN to Alarms.

Press ENTER to view current alarms or adjust

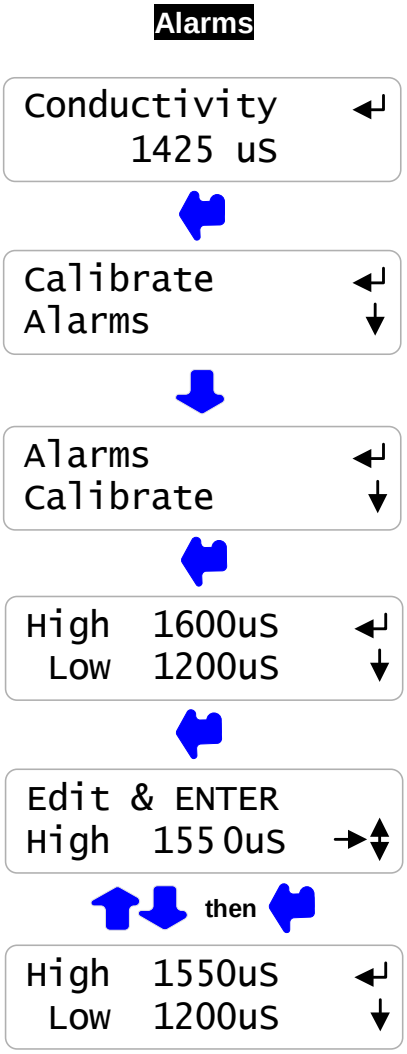
Press ENTER to adjust the High Alarm or DOWN & ENTER to adjust the Low Alarm

Press UP-DOWN to adjust and RIGHT to move the cursor. Press EXIT to leave Alarm unchanged.

ENTER updates the alarms & displays the current High & Low Alarms.

Conductivity Alarms display on the 'Alarms' display and resets automatically.

'Clear Alarms' does not reset a conductivity alarm above the High or less than the Low Alarm level.



Sidebar: Conductivity alarms may occur when the tower shuts down and drains the sample line or when a Biocide event Prebleed, lowers the conductivity.

3.2 Bleed Controls

For conductivity control setpoints Section *2.2 Bleed Mode: Conductivity Setpoints*

Press UP - DOWN until you see Bleed Solenoid. Displays ON or OFF and ON time from midnight.

Press ENTER to view or adjust Setpoints. Setpoints vary with selected Bleed Mode.

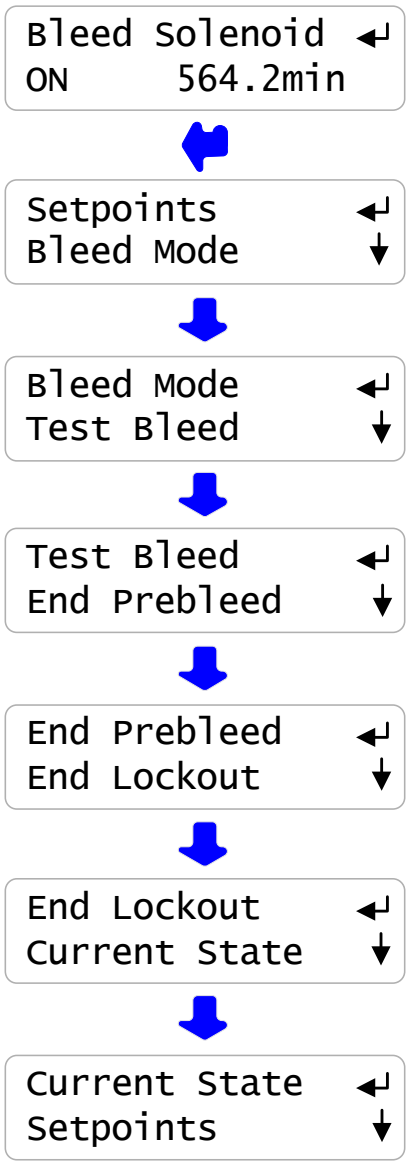
Press ENTER view current mode or to select from Conductivity Control, Percentage Time OR Meter Control.

Press ENTER @ Test Bleed to turn ON bleed solenoid for 5 minutes. 'Alarms'-'Clear Alarms' ends the Test.

Press ENTER @ End Prebleed to a start Biocide Event on a prebleeding Bleed Solenoid.

Press ENTER @ End Lockout to a return to normal Bleed Solenoid control.

Press ENTER @ Current State to view control status. Display varies with Bleed Mode



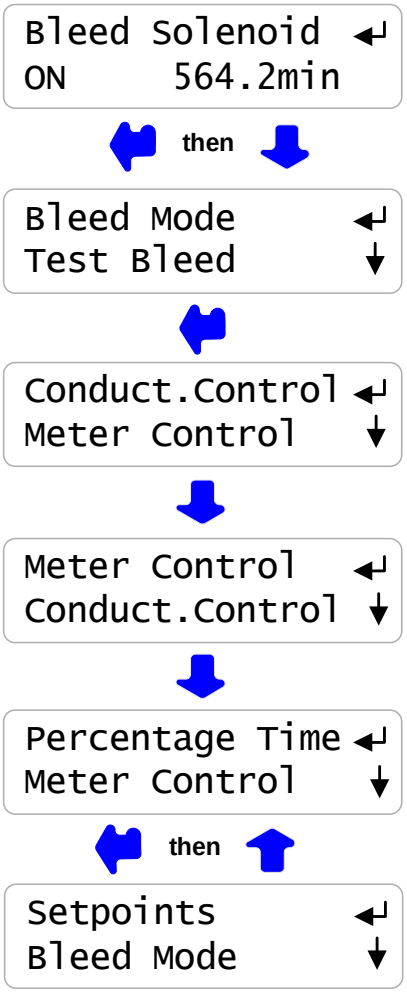
Sidebar: Test Bleed will not turn ON the solenoid if the flowswitch is OFF.

End Prebleed & End Lockout have no effect if the Bleed Solenoid is not Prebleeding or Locked Out.

3.2 Bleed Controls
Continued

Bleed Solenoid Bleed Modes

Press ENTER then DOWN @ Bleed Solenoid



Press ENTER @ Bleed Mode to view current mode and to select a new mode

Most cooling towers operate with Conductivity Control. Bleed solenoid opens at TurnON conductivity setpoint and closes at TurnOFF setpoint

Meter Control Measures a user set volume on the Make-up water meter then turns ON the bleed solenoid for a user set time.
For example:
Measure 100 Gallons of make-up & bleed for 10 seconds.

Percentage Time turns ON the bleed solenoid for a user set % of 5 minutes.

NOTE: If you change the Bleed Mode, press UP to Setpoints & ENTER to adjust for the new Bleed Mode.

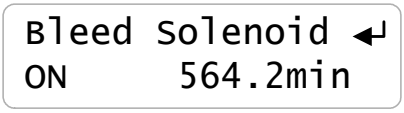
Sidebar: 'Meter Control' is used where sensor fouling from silica or organics continuously fouls the conductivity sensor.

'Percentage Time' is used short term to bleed while replacing a sensor or installing a water meter.

3.2 Bleed Controls
Continued

Current State of the Bleed Solenoid Control

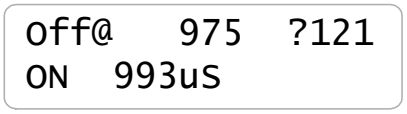
Press ENTER then UP @ Bleed Solenoid



then

Press ENTER @ Current State

If bleed ON, displays TurnOFF setpoint,975 & current conductivity,993
If bleed OFF, displays TurnOFF setpoint,1000 & current conductivity,993



Mode = Conductivity Control

If bleed ON, displays Owes 101 sec ?122 & ON ENTER=Stop
If bleed OFF, displays turn-on volume, 10400 & current volume 10,200

Mode = Water Meter Control

If bleed ON, displays Owes 41 sec ?123 & ON ENTER=Stop
If bleed OFF, displays seconds to turn ON,

Mode = % Time Control

HELP: ?121,122 & **?123** and other help numbers display wherever more explanation is available at www.Aquatrac.com.

ON ENTER=Stop ends the current feed cycle or %Time ON period.

3.3 ORP Sensor

Sensor calibration is detailed in Section *2.5 Verify Conductivity & ORP Sensors*

Press UP - DOWN until you see ORP.

Press ENTER & then DOWN to Alarms.

Press ENTER to view current alarms or adjust

Press ENTER to adjust the High Alarm or DOWN & ENTER to adjust the Low Alarm

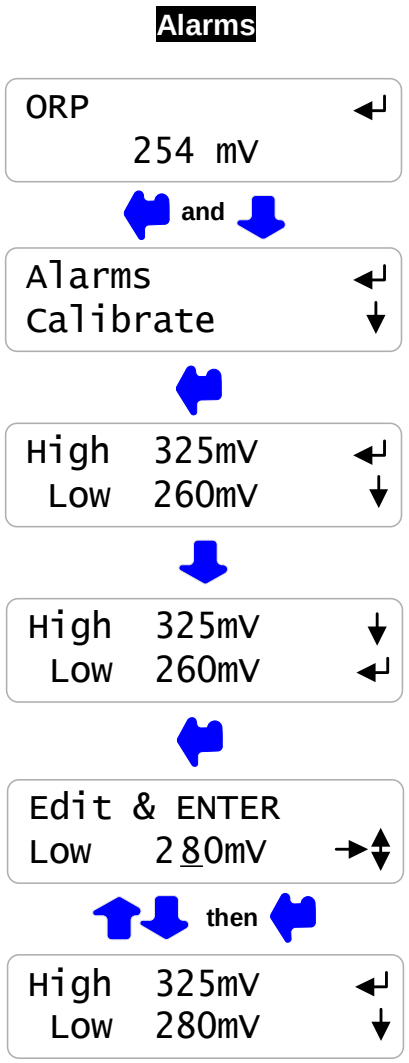
Press UP-DOWN to adjust and RIGHT to move the cursor. Press EXIT to leave Alarm unchanged.

ENTER updates the alarms & displays the current High & Low Alarms.

ORP Alarms display on the 'Alarms' display and resets automatically.

'Clear Alarms' does not reset an ORP alarm above the High or less than the Low Alarm level.

High alarms occur on an oxidant overfeed
Low alarms occur on a failure to feed oxidant



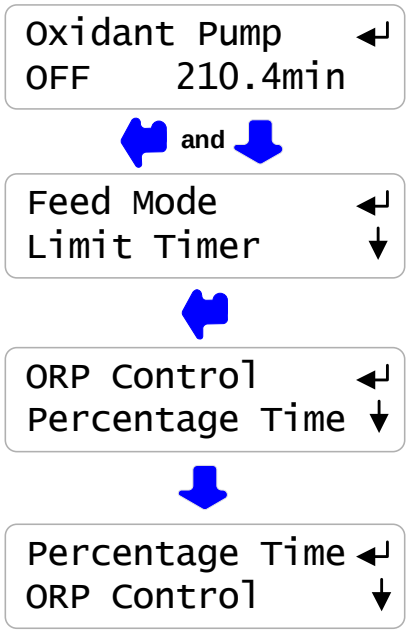
Sidebar: ORP alarms may occur when the tower shuts down and drains the sample line or when an ORP sensor fouls.

Surface fouling of ORP sensors in low flow rate sample lines is the primary cause of ORP sensor faults. Sensors can be cleaned with a paper towel or soft bristle brush.

3.4 Oxidant Controls

For ORP Control setpoints & Pump limit timer see Section *2.4 Oxidant: Setpoints, Feed Limit*

Oxidant Pump Control Modes
Press ENTER then DOWN @ Oxidant Pump



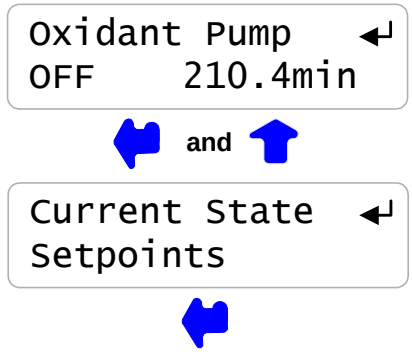
Press ENTER @ Feed Mode to view current mode and to select a new mode

Most cooling towers operate with ORP Control. Oxidant Pump ON at TurnON mV setpoint and OFF at TurnOFF setpoint

Percentage Time turns ON Oxidant Pump for a user set % of 5 minutes.
It's used to base feed or to bypass an ORP sensor

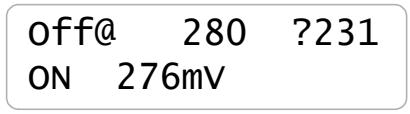
NOTE: If you change the Feed Mode, press UP to Setpoints & ENTER to adjust for the new Feed Mode.

Current State of Oxidant Pump Control
Press ENTER then UP @ Oxidant Pump



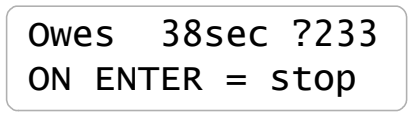
Press ENTER @ Current State

If pump OFF, displays Turn ON setpoint,260 & current ORP,266
If pump ON, displays TurnOFF setpoint,280 & current ORP,276



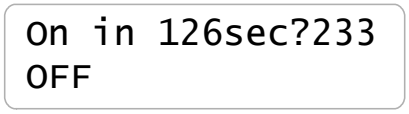
Mode = ORP Control

If pump ON, displays Owes 38 sec ?233 & ON ENTER=Stop
ENTER ends current feed period
Seconds count down to zero, then Pump switches OFF.



Mode = Percentage Time - ON

If pump OFF, displays 126 seconds to turn ON.
Seconds count down to zero, then Pump switches ON
?231& **?233** Help numbers display wherever more explanation is available at www.Aquatrac.com



Mode = Percentage Time - OFF

3.5 Make-up Meter

Meter type selection & installation detailed in Section *2.6 Check Flowswitch & Install Water Meter*

Press UP - DOWN until you see 'Make-up Today' & press ENTER .

```
Make-up Today  ↵
    38200 G
```

Press ENTER to view current type or to select Contact Head or Paddlewheel water meter.

```
Meter Type     ↵
Year-to-Date   ↓
```

Key DOWN & ENTER for volume this year.

```
Year-to-Date   ↵
Days Online    ↓
```

Key DOWN & ENTER for days on-line this year

```
Days Online    ↵
Zero Meter?    ↓
```

Key ENTER to reset Year-to-Date, Days OnLine and Make-up Today to zero.
Warning: Cannot Undo

```
Zero Meter?    ↵
Meter Type     ↓
```

Volume this year to date.
Displays in 'L'iters if metric selected.

```
Year-to-Date?192
    765200 G
```

Days controller installed and operating this year.
Does not count days controller powered OFF.

```
Days Online ?193
  215
```

Press EXIT to return to previous display

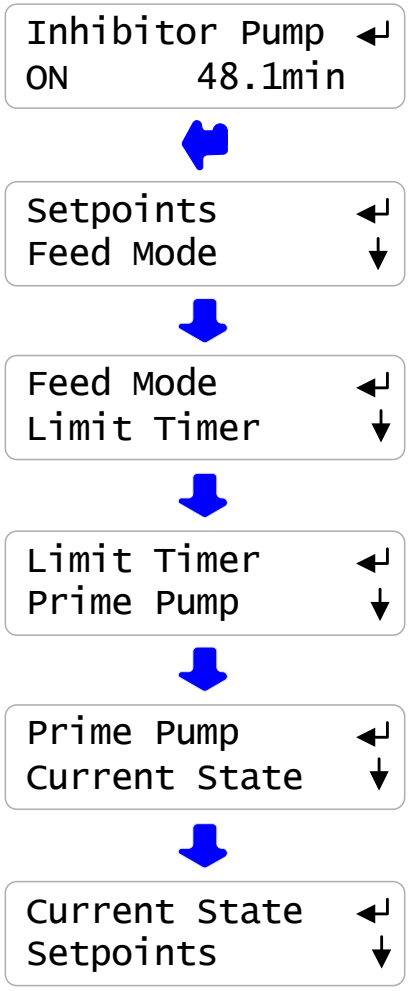
Sidebar: Year-to-Date volume divided by Days OnLine is average usage, a figure of merit for a tower tonnage.

HELP: ?192 & **?193** and other help numbers display wherever more explanation is available at www.Aquatrac.com.

3.6 Inhibitor Controls

For inhibitor control setpoints & feed limit, refer to Section *2.3 Inhibitor Feed Mode: Setpoints, Feed Limits*

Press UP - DOWN until you see Inhibitor Pump. Displays ON or OFF and ON time from midnight.



Press ENTER to view or adjust Setpoints. Setpoints vary with selected Feed Mode.

Press ENTER view current mode or to select from Bleed & Feed, Bleed then Feed, Percentage Time OR Feed on Volume.

Press ENTER to set maximum feed minutes /day

Press ENTER @ Prime Pump to turn ON Inhibitor Pump for 5 minutes. 'Alarms'-'Clear Alarms' ends Priming.

Press ENTER @ Current State to view control status. Display varies with Feed Mode

Sidebar: Prime Pump will not turn ON the Pump if the flowswitch is OFF.

Inhibitor pumps set to 'Bleed then Feed' or 'Feed on Volume' modes will not feed if the Bleed Solenoid is ON. Feed starts as soon as Bleed ends.

3.6 Inhibitor Controls
Continued

Inhibitor Pump Feed Modes

Press ENTER then DOWN @ Inhibitor Pump

Press ENTER & DOWN @ Feed Mode to view current mode and to select a new mode

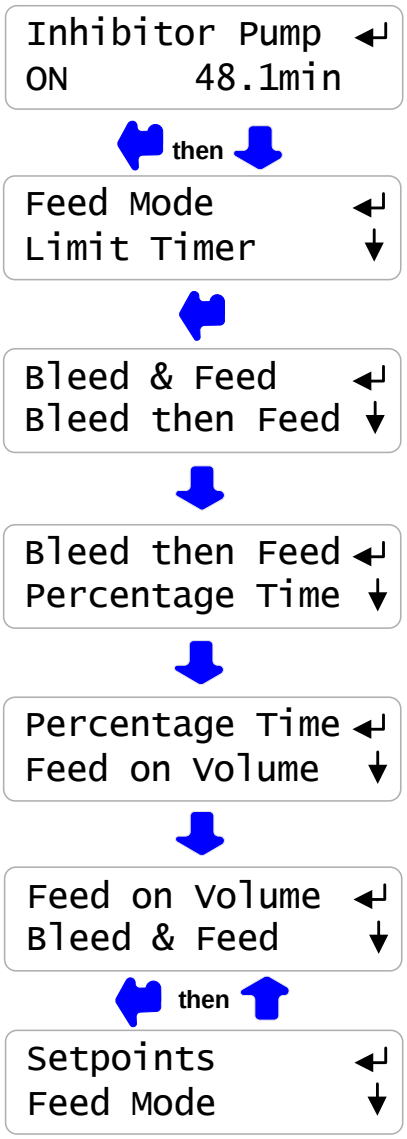
Inhibitor pump turns ON when Bleed solenoid ON. Pump switches ON & OFF during bleed at user set % of 5 minutes

Inhibitor pump turns ON after Bleed solenoid turns OFF. Pump then is ON for the user set % of Bleed time

Percentage Time turns ON the Inhibitor Pump for a user set % of 5 minutes.

Feed on Volume measures a user set volume on the Make-up water meter then turns ON the Pump for a user set time.
For example:
Measure 100 Gallons of make-up & feed for 8 seconds.

NOTE: If you change the Feed Mode, press UP to Setpoints & ENTER to adjust for the new Feed Mode.



Sidebar: Bleed & Feed is used on bleed limited towers where the bleed solenoid is ON for more than 50% of the time.
Bleed then Feed is used on towers which don't have a make-up water meter; typically reducing inhibitor usage over Bleed & Feed since you are not pumping inhibitor with the Bleed ON.
Percentage Time is used to base feed during start-up or when the tower is not loaded.
Feed on Volume is usually the most accurate & reliable way to feed for towers which have a make-up meter.

3.6 Inhibitor Controls
Continued

Current State of the Inhibitor Pump Control

Press ENTER then UP @ Inhibitor Pump

```
Inhibitor Pump ↵
ON      48.1min
```

then

Press ENTER @ Current State

```
Current State  ↵
Setpoints
```

If Bleed ON: displays Owes 233sec ?154
OR On in 86sec ?150
Seconds count down to zero and pump changes state.
If Bleed OFF: displays Bleed Off ?150

```
Owes 162sec ?154
ON  ENTER=Stop
```

Mode = Bleed & Feed

If Pump ON, displays Owes 101 sec ?150
If Pump OFF, displays 'Bleed Off'

```
Bleed Off   ?150
OFF
```

Mode = Bleed then Feed

If Pump ON, displays Owes 41 sec ?156
If Pump OFF, displays seconds to turn ON.
Seconds count down to zero & pump changes state.

```
On in 267sec?156
OFF
```

Mode = Percentage Time

If Pump ON, displays Owes 38 sec ?154
If Pump OFF, displays turn-on volume, 9800
& current volume 9700

```
On@  9800 G ?155
OFF   9700 G
```

Mode = Feed on Volume

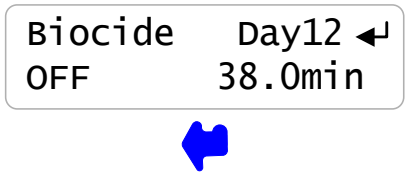
Sidebar: Bleed & Feed applies the %of Bleed to each 300 seconds on Bleed ON time
Bleed then Feed applies the %of Bleed to the total Bleed ON time.
Feed on Volume feeds after the Bleed turns OFF.
ON ENTER=Stop ends the current feed cycle or %Time ON period.

HELP: ?150,?154,?155 & **?156** and other help numbers display wherever more explanation is available at www.Aquatrac.com.

3.7 Biocide Events

Biocide Menu Options

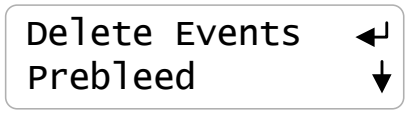
Press UP - DOWN until you see 'Biocide'
Displays ON or OFF and ON time from midnight.
Day# in selected Cycle 1..28 or 1..7 or 1



Press ENTER to Add a new biocide event.

Press ENTER view or edit current events.
Displays # of events 1..28
'Edit' not displayed if no events set.

Press ENTER to delete all events.
'Delete' not displayed if no events set.



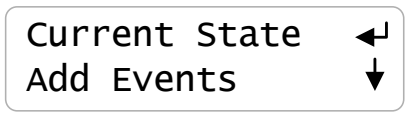
Press ENTER to view or edit Prebleed Time & Conductivity.
Prebleed runs before each event.
Factory default is 0 minutes Prebleed.

Press ENTER to view or edit Bleed Lockout Time.
Lockout starts when each event starts.
Factory default is 0 minutes Lockout.

Press ENTER to turn ON Biocide Pump for 5 minutes.
'Alarms', 'Clear Alarms' ends Prime Pump.
Prebleed & Lockout do not run when Prime Pump runs.

Press enter to view or edit Cycle Days.
Events repeat every 28 days, 7days or 1 day.
Factory default is 28 Days

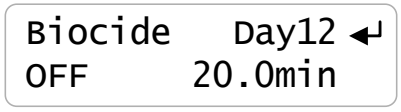
Press ENTER @ Current State to view Biocide status.



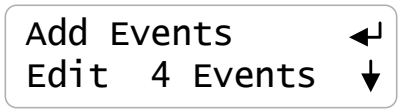
3.7 Biocide Events
continued

Biocide 'Add Events'

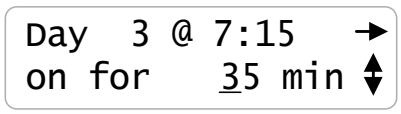
Press UP - DOWN until you see 'Biocide'
Press ENTER.



Press ENTER to Add an Event.



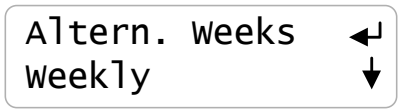
Press RIGHT to move the underline to the value you wish to change & then UP – DOWN to adjust.
Days 1,8,15 & 22 are Sundays on 28 Day Cycles.
Time is 24 hour format. 14:00 is 2:00PM.



then

Press ENTER after selecting your event.

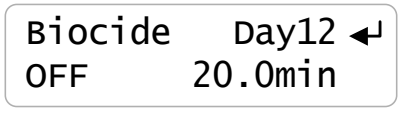
Key UP – DOWN to select how often you wish to run the event.



28 Day Cycle offers Once,Weekly or Alternate Weeks.
7 Day Cycle offers Once,Daily or Alternate Days.
1 Day Cycle offers Once,Hourly or Alternate Hours.

Press ENTER to select frequency.
Displays revised total events. We started with 4 events, added a Weekly event & now have 8 events.

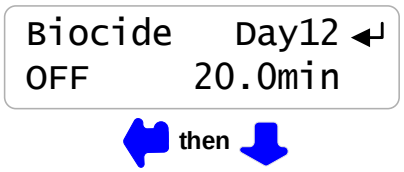
You can set up to 28 Biocide events.
This example turns ON the pump for 35 minutes every Tuesday at 7:15 AM.



3.7 Biocide Events
continued

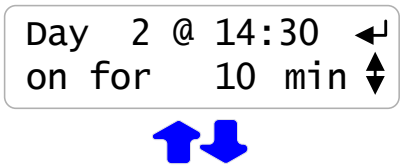
Biocide 'Edit Events'

Press UP - DOWN until you see 'Biocide'
Press ENTER & DOWN to Edit Events.



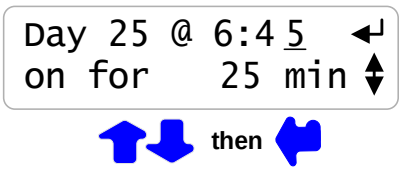
Press ENTER to view and edit current events.

Press UP – DOWN to select an event for editing.
In this example, select 1 of 8 events.



Press ENTER on the selected event.

Press RIGHT to place the underline where you wish to adjust.
Press UP – DOWN to adjust.
This example changes the event start time from 6:00AM to 6:45AM.



Press ENTER to end or EXIT to make no changes.
Setting a run time to 0, removes the event.

Sidebar: Events are re-sequenced by Day & Time whenever you Edit Events or Add Events.
Keying UP in Edit Events displays the event sequence from Day 1 to Day 28.

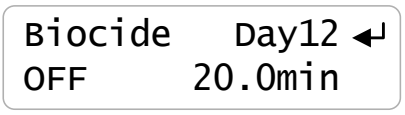
Day 1 is always Sunday for 28 and 7 Day Cycles.
The range of Day numbers changes as the Cycle Days changes from 1..28, 1..7 or 1.

If you change Cycle Days, all events are deleted.

3.7 Biocide Events
Continued

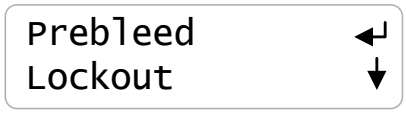
Biocide 'Prebleed'

Press UP - DOWN until you see 'Biocide'
Press ENTER & DOWN to Prebleed.

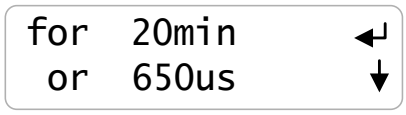


then

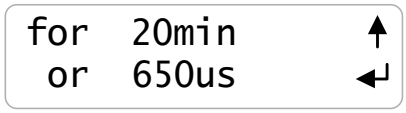
Press ENTER to view and edit Prebleed.



This example turns ON the bleed for 20 minutes before each biocide event.
Prebleed ends if the tower conductivity falls below 650uS.



Press ENTER to adjust time
or DOWN & ENTER to adjust conductivity.



Press RIGHT to place the underline where you wish to adjust.
Press UP – DOWN to adjust
or EXIT to make no changes.

then

This example changes the prebleed conductivity from 650uS to 600uS.

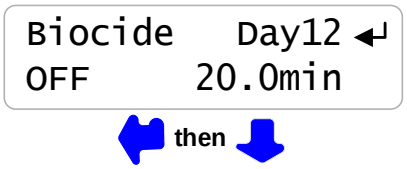
Sidebar: Prebleeding turns on the bleed solenoid before each biocide event to lower the tower conductivity. Prebleeding limits bleed and sewering of the biocide during the 'kill time'

Biocides are usually fed during tower low load or no-load so Prebleeding may not be required.

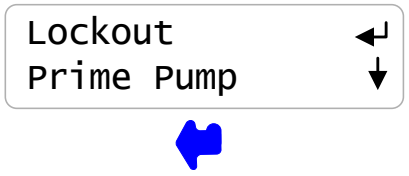
Prebleeding is also used to prevent overcycling during the Lockout period when the bleed is OFF.

3.7 Biocide Events
continued

Biocide 'Lockout'
Press UP - DOWN until you see 'Biocide'
Press ENTER & DOWN to Lockout.

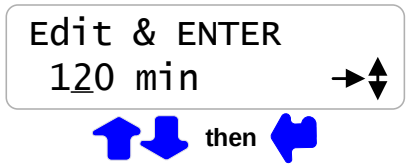


Press ENTER to view and edit Lockout time.
Press ENTER to edit or press EXIT.



Factory default Lockout is set to 0 minutes.
Press ENTER to adjust.

Press RIGHT to place the underline
where you wish to adjust.
Press UP – DOWN to adjust
or EXIT to make no changes.



Biocide 'Cycle Days'
Press UP - DOWN until you see 'Biocide'
Press ENTER & DOWN to Cycle Days.

Press ENTER to view and edit Cycle Days.
Press ENTER to edit or press EXIT.

Key UP – DOWN to select 28,7 or 1 day
& then press ENTER.
Changing Cycle Days deletes existing events.

Biocide events repeat every 28, 7 or 1 day.

Sidebar: Lockout prevents the bleed solenoid from turning ON during the biocide 'kill time' and sewering the biocide.
Lockout is usually used with Prebleed to prevent tower overcycling during the Lockout period.

Non-Oxidizing biocides typically use a 28 or 7 Day cycle.
Oxidizing biocides typically use a 7 or 1 day cycle.

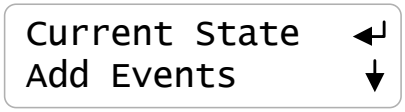
3.7 Biocide Events
continued

Biocide 'Current State'

Press UP - DOWN until you see 'Biocide'
Press ENTER & UP to Current State.

then

Press ENTER to view Current State.

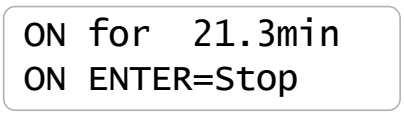


If there are no Biocide feed events running, displays OFF.

OR

If a Biocide feed event is running, counts down remaining time.

Press ENTER to end event
or EXIT to return to Current State



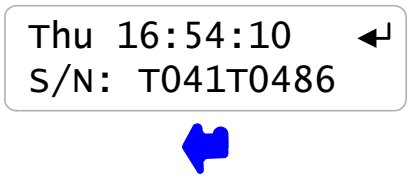
Sidebar: Bleed Solenoid Prebleeding starts when an event is scheduled.
Biocide pump turns ON after Prebleed time ends.
Bleed Solenoid Lockout starts when biocide pump turns ON.

HELP: ?170 and other help numbers display wherever more explanation is available at www.Aquatrac.com

3.8 System- Alarms

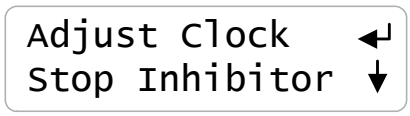
System Menu Options

Press UP - DOWN until you see Day & Time
Press ENTER view System options.

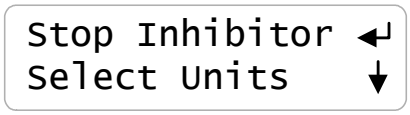


Press ENTER to view Current State
Controller diagnostics

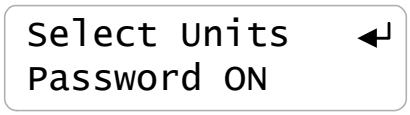
Press ENTER to view and adjust clock.



Press ENTER to stop inhibitor feed
during Oxidant and Biocide feeds



Press ENTER to view or change
US or Metric units.



Press ENTER to turn ON the user password.
If **PASSWORD** on, press ENTER for password tools

Alarms

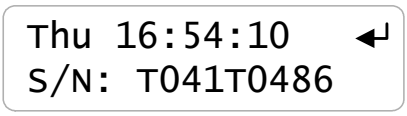
Press UP - DOWN until you see Alarms
The first alarm to trip will display or 'none' if no alarms

Press ENTER to Clear Alarms.
Clearing alarms sets all pump & solenoid owed times to zero.
Sensor Alarms,'Out-of-Calibration' and System Alarms auto-clear when the fault is corrected

3.8 System- Alarms
continued

System : Current State

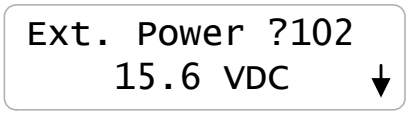
Press UP - DOWN until you see Day & Time
Press ENTER view System options.



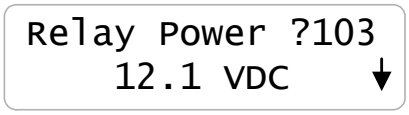
Press ENTER to view Current State
Controller diagnostics

Temperature at the conductivity sensor.
Press ENTER to adjust.
Displays 'Fault' if not used to compensate conductivity,
Indicates wiring or sensor problem.

Power used for paddlewheel water meters
and to power 4-20mA current loops
Alarms on short circuits, recovers when wiring corrected.

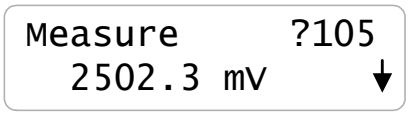


Internal power used or bleed solenoid and pump relays.
Always 11.8 to 12.2.
Alarms on fault.



Auto-ranging conductivity sensor drive,
70-80mV or 950-1050 mV.
Alarms and cannot measure conductivity if out of range.

pH-ORP sensor offset, 2475 to 2525mV
Alarms and cannot measure any sensors if out of range.



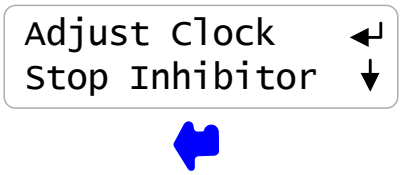
Firmware version & internal diagnostic.
Checks that user setpoints being saved & Clock valid,

Sidebar: System: Diagnostics verifies the controller operation & alerts you to wiring problems with conductivity temperature, paddlewheel water meters and controller powered 4-20mA current loops.

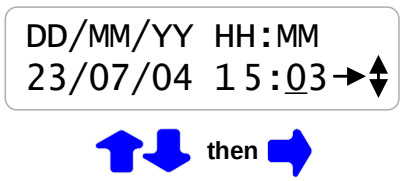
3.8 System- Alarms
continued

System : Adjust Clock

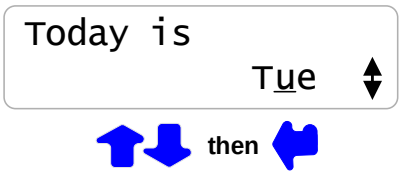
Press UP - DOWN until you see Day & Time
Press ENTER & DOWN to Adjust Clock.



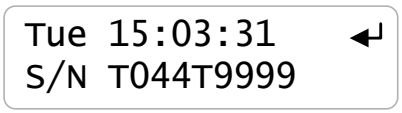
Press ENTER to view or adjust current Date & Time.
Press EXIT to leave changed
or RIGHT to move the underline.
Press UP – DOWN to EDIT.



After ENTER, press UP-DOWN to select day of the week.

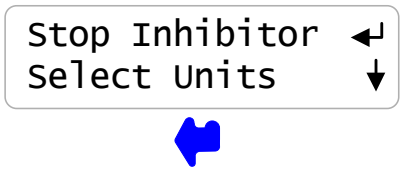


Day of the week is important for Biocide events
which use Sunday as Day 1.

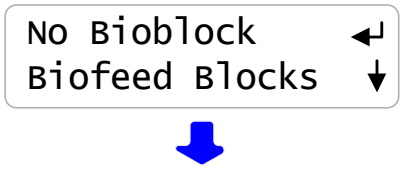


System : Stop Inhibitor

Press UP - DOWN until you see Day & Time
Press ENTER & DOWN to Stop Inhibitor.



Press ENTER to view or adjust current
Inhibitor feed sequence.



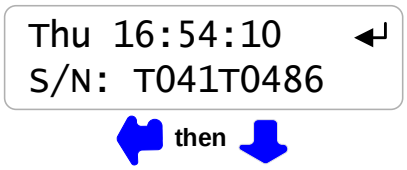
'No Bioblock' is the Factory Default.
'Biofeed Blocks' stops the Inhibitor Pump whenever the
Oxidant Pump or Biocide pump is ON.

Sidebar: Sites where Biocide & Oxidant are fed into the same sample-feed piping as the Inhibitor may cause jelling or inhibitor degradation.
Blocking the inhibitor pump prevents product mixing in the sample-feed piping.

3.8 System- Alarms
continued

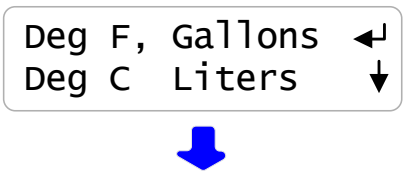
System : Select Units

Press UP - DOWN until you see Day & Time
Press ENTER & DOWN to Select Units



Press ENTER to view or adjust current Select Units.

Press EXIT to leave changed
Or DOWN to change.



Key ENTER to:
Set to U.S. units, degrees Fahrenheit & Gallons
Or
Set to Metric, degrees Centigrade & Liters

System : Adjust Temperature

Press UP - DOWN until you see Day & Time
Press ENTER twice to adjust Temperature

Press UP – DOWN to EDIT or RIGHT to move the underline
Press EXIT to leave changed or
ENTER to change the temperature

A Temperature displaying Fault cannot be adjusted.

Temperature cannot be adjusted more than
+/-18F or +-/10C from the factory default.
Press EXIT on this message to return to
Temperature factory default setting.

Sidebar: Select Units changes make-up meter units, year-to-date units and volume per contact units.
Temperature compensation of conductivity, switches automatically between C & F as does the System:Current State display of temperature.
NOTE: If you adjust the Temperature, you'll need to re-calibrate conductivity

3.9 Password

Password is turned OFF in new controllers

Press UP - DOWN until you see Day & Time

Press ENTER & UP to select **Password ON**

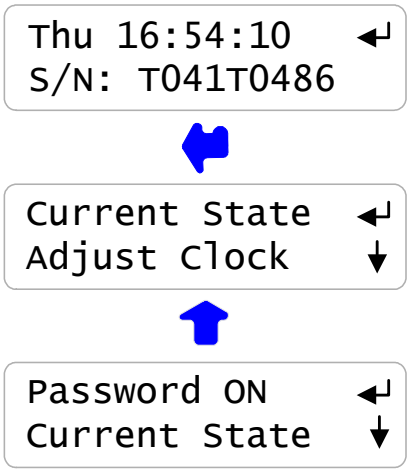
If you press ENTER you'll be prompted for a password then next time you press ENTER.

Press UP or DOWN to view the current state of the controller. Any ENTER key will prompt for the password, displaying the default password **123**.

Use the UP, DOWN & RIGHT keys to enter a password then key ENTER.

A correct password displays, **Password OK**. Press any key to start operating the controller.

Turning ON Password



Password ON

Sidebar: When you first select **Password ON**, the default password is **123**.

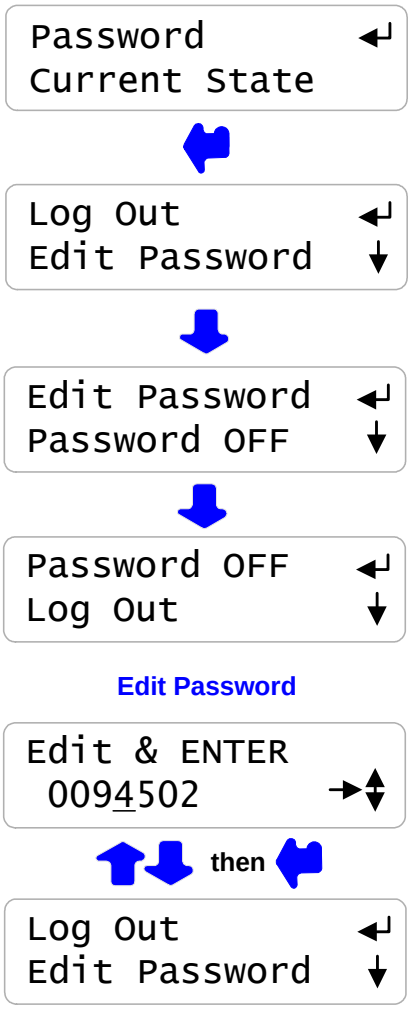
Whenever you **Enter Password** the controller displays the default password.
If you have not changed the default password, press ENTER to log in.

3.9 Password
continued

Press UP - DOWN until you see Day & Time.
Then press ENTER & UP to view **Password** tools.

Password tools are available when **Password** is **ON** and you are logged in. Press ENTER to view the tools:

Press ENTER to Log Out.



Press DOWN & then ENTER to view & change the current password

Press DOWN to **Password OFF**.
Pressing ENTER turns OFF PASSWORD.

Edit Password

Press RIGHT & UP – DOWN to change the current password.

ENTER changes the password.
Press EXIT to leave the password unchanged

Sidebar: If your controller is password protected. Select **Edit Password** and change the password from the '**123**' factory default.

Passwords may be from 1 to 6 numbers. Leading zeros are ignored.

If you forget your password, you'll require the controller serial number to get a **Reset Password**. The controller password is '**123**' after you key in the **Reset Password**.

4. MAINTENANCE

4.1 Guidelines

Modify the maintenance guidelines to reflect both the site priorities and the site water treatment program.

Guidelines are for controller function only. Water treatment program maintenance requirements are provided by the site water treatment provider.

Frequency	Activity	Method
Daily	Check for Alarms.	Identify and correct the cause of alarms on sensors and pumps. Make-up water or Pump rate & stroke may have changed. Higher temperatures may be extending oxidant run times. Debris may have partially blocked the bleed line. A high conductivity may indicate a blocked or failed bleed solenoid. A low conductivity may indicate an overflowing tower basin or a scheduled prebleed before a biocide feed. A low ORP may indicate a gas blocked pump, a pot feeder out of pucks or a pump timed out on feed limit. A high ORP may indicate a siphoning pump or a fouled ORP sensor.
	Scan Sensors, Make-up Meter & Flowswitch	If there's a make-up meter, you'd expect daily volume to increase with temperature. High make-up may indicate a stuck make-up float. No make-up may indicate a valved-off or faulted meter & a cause of low run time on the inhibitor pump. If the tower in on line, very the Flowswitch shows ON.
	Note ON times for Solenoids & Pumps	If you check at the same time every day you would expect the bleed solenoid and inhibitor pumps ON times to vary only with temperature. No Bleed solenoid time may indicate a fouled conductivity sensor. Typical cooling towers bleed no more than 40% of the time and feed 5-10% of the time. At noon you'd expect to see 100 to 200 minutes of bleed & 20 to 50 minutes in inhibitor pump time. If this morning was a biocide feed day, verify that the Biocide ON time shows the event time.

Frequency	Activity	Method
Weekly	Verify Conductivity	Sample the tower water conductivity. Verify controller matches sample +/-25uS Conductivity sensors should not drift or require cleaning. Scaling sensors may indicate a restricted bleed, varying make-up hardness, incorrect setpoints or water treatment program. Fouled sensors may indicate organic, biofilms, oils or silica. Depending on the type of foulant, a change in program or a switch in the bleed control method may be required.
	Verify ORP	Verify controller ORP matches sample ORP +/-10mV. If you can wipe the ORP sensor and it reads correctly, increase the flow rate in the sample line. High levels of copper or iron contaminate the ORP sensor.
	Note Make-up Volume	Weekly water usage indicates both average tower load and maximum daily temperature. High water usage may result from a change in controller setpoints or a leak or overflow in the cooling water system.
	Verify Flowswitch	**Close the upstream sample line isolation valve then the downstream valve** & verify that the Flowswitch displays OFF.
	'Y' Strainer Filter	If the sample line has a 'Y' strainer, clean the filter to prevent a unplanned 'no flow' outage. **Open the downstream, then the upstream valve** and verify that the Flowswitch displays ON.
	System Check	Visually inspect sample-injection piping for leaking fittings, feed injection points and sensor entries.

Sidebar: Maintenance Guidelines for water treatment are set by the chemical treatment program vendor.

Frequency	Activity	Method
Yearly	ORP Sensor	The service life of an ORP sensor is reduced by extreme temperature swings and frequent removal for calibration-cleaning. Incorrect sample line isolation valve sequencing stresses the sensor seal & shortens sensor life. Replace the ORP sensor annually.
	Calibrate Conductivity Tester	Verify the conductivity tester annually with a calibration solution using a solution that's as close as possible to the controller conductivity setpoints. Replace outdated calibration solutions.
	Replace ORP test solutions. Verify ORP tester	If you are using ORP calibration solutions, replace outdated solutions. If you are using an ORP tester, re-calibrate it using a test solution.
	Observe a Bleed Control Cycle	Observe as the tower cycles up and the conductivity exceeds the Turn ON setpoint. Observe the unobstructed flow from the bleed line, if its visible. Note the conductivity when the float opens the make-up line. Verify that the bleed solenoid shuts off flow when the conductivity falls below the lower setpoint. Note the conductivity when the float closes the make-up line. Verify that the difference between Make-up ON & OFF conductivities is greater than the difference between Setpoint TurnON & TurnOFF conductivities. Optimal control occurs when the bleed setpoint deadband (TurnON – TurnOFF) in less than the make-up float ON-OFF conductivity difference.
	Verify Water Meter	If a make-up water meter is installed, verify that the controller measures an increase in make-up volume while the make-up float opens the make-up line. Is the expected volume measured for the size of the line and the float ON time? If not, the meter Volume/Contact or 'K' factor may have been set incorrectly or the water meter may have been cabled in a common conduit with AC power.

Frequency	Activity	Method
Yearly	Observe an Oxidant Feed Cycle. (This may take some time, but it's worth doing whenever you make changes to setpoints or oxidant type or when make-up chemistry changes)	Observe the slow fall of ORP as the residual oxidant reacts with the biological load or is lost over the top of the tower. Note the time when the Oxidant pump or feeder turns ON. Initially there may be little or no ORP response as oxidant is fed particularly if the biological load is high. The ORP will increase once oxidant is no longer required to react with the tower biological load. Note the elapsed time when the Oxidant pump turns OFF. If you are not legally required to maintain a specified free oxidant level, ORP setpoints trade biological control for corrosivity. Cooling water systems with yellow metal exchanger tubing and/or galvanized towers usually minimize the free oxidant level to limit corrosion. Unlike conductivity control, optimal ORP control is not easily defined since it incorporates water treatment program objectives and may involve interaction with an organic biocide. If the water treatment program requires a constant residual oxidant level, adjust the ORP setpoints for 10mV between TurnON & TurnOFF. You'll see many short feed cycles while the tower is on-line. If the water treatment program requires an interval of very high residual (slug feeding) level, adjust the ORP setpoints for 50-75mV between TurnON & TurnOFF. You may see a single daily feed cycle or perhaps a feed cycle every other day.
	Residual Oxidant and ORP	The relationship between ORP and available oxidant is indirect & varies from site-to-site. However if a sample of cooling water has 0.5ppm of free Chlorine and the ORP measures 325mV, then setting the controller to turn ON oxidant at 325mV and OFF at 335mV will maintain 0.5ppm of free Chlorine. If you change the towerbleed setpoints, therefore it's pH, you'll need to adjust the Oxidant pump setpoints.

4.1 Spare Parts

4.1.1 Line Fuse

Protects	Rating / Type	Manufacturer – Vendor
Controller, Pumps and Bleed Solenoid	5 Amps @ 115VAC 2 Amps @ 230VAC 5mm x 20mm, Fast Acting	Littlelfuse, Type 217, 250VAC Digikey Part# F953-ND Digikey Part# F950-ND www.digikey.com 1-800-344-4539

4.1.2 Controller Parts

Part#	Description
SFuse	120VAC Fuse Kit, 10 x 5A Controller Fuses,
CTF	Conductivity-Temperature-Flowswitch sensor
CTF-Entry	Conductivity entry fitting for PVC ¾" NPT 'T' fitting
A261105A	12mm ORP sensor
A261103	ORP sensor holder, ¾" NPT slip
CO-IN-CX-TB-NS	Spare Controller without sensors & entry fittings
R171232	Enclosure LAN cable entry weather seal
R171230	Enclosure Power cable entry fitting, PG11
R171231	Enclosure Sensor cable entry fitting, PG9

On-Line Help

Browse to **www.Aquatrac.com/help** with the 3 digit HELP#' from the controller LCD display.
LCD display HELP numbers are preceded by '?'

Users Manual

Download **AQCX_F_User** from www.Aquatrac.com

Manual Version	Detail
05/06	Initial release
5/07	Adds CSA required descriptors & installation advisory

Appendix A: INSTALL

A.1 PLUMBING

Typical sample-chemical injection piping operates at 40-60psi and is plumbed in SCH80 PVC.
Sample piping is usually fed from the discharge side of the re-circulation pump, returning to either the suction side of the pump or to the tower basin.
Ensure that the sample piping flow exceeds 1 GPM and that the sample stream represents the tower water.
Avoid sample piping which drains whenever the tower is off-line. Solids will accumulate on the sensors requiring re-calibration and cleaning.
A backcheck may be required at some sites to prevent reverse flow through the injection-sensor piping when the recirculation pump is OFF.
'Y' strainers in the sample loop are not recommended unless the debris will mechanically damage the ORP or conductivity sensors. Strainer filters are usually the first location to plug, turning OFF pumps and the bleed soloenoid on no flow.
NEW CONSTRUCTION: After pressure testing, valve OFF the sample piping during post-construction re-circulation piping cleaning and passivation.

A.2 SENSORS

Conductivity sensors may be installed in any orientation which allows them to be removed for cleaning. Do not hang conductivity sensors in metallic tower sumps.
ORP sensors must be installed vertically, tip down to prevent air blocking of the reference junction.
Water meter and sensor wiring cannot be installed in the same conduit as 120VAC power, pump or solenoid wiring. Even a short section of shared conduit may cause operational problems.
Sensor wires may be extended up to 200 feet using multiple pair AWG22 cable. Always splice sensor wires in an electrical fitting to allow both inspection and sensor replacement.
Both the center conductor and the shield or an ORP sensor must extended. The shield of an ORP sensor is a signal level and is not ground. Carefully note the color coding used for center conductor & shield to avoid wiring errors at the controller terminals.
Extend the conductivity sensor using the same colors as the sensor to avoid wiring errors at the controller terminals.
Contact head water meters and mechanical flowswitches are not polarized, simplifying cable extension.
CAUTION: Three wire turbine-paddlewheel meters are polarity sensitive and can be permanently damaged by miswiring. Wait until you are ready to start-up the controller before connecting this type of meter to the controller. Meter wiring errors are easily detected and corrected at start-up.

A.3 CHEMICAL INJECTION

Inject water treatment chemicals downstream of sensors as recommended by the chemical supplier.
Do not inject bleach or other oxidants upstream of a recirculating pump or condenser – heat exchanger.
Bleach is frequently injected into the tower sump or into the recirculation line using a quill.

A.4 BLEED LOCATION

The optimum bleed solenoid location is after the condenser – heat exchanger.
Never install the bleed on the sample line, upstream of the sensors and flowswitch.
If you are installing a bleed solenoid on the tower sump, ensure that the head or pressure at the bleed solenoid is sufficient to operate the solenoid.
Verify that the solenoid is sized for the maximum tower load at the target cycles, on the hottest day of summer. If the bleed is on for more than 50% of the time, inhibitor feed options will be limited.

A.5 MAKE-UP METER

Ensure that the meter manufacturer's recommendations for orientation and upstream and downstream piping are observed.
Orientation may be limited for contact head meters, while straight upstream and downstream piping is required to prevent errors in turbine-paddlewheel meters.
Contact head meters have a Gallon/Contact or Liter/Contact rating. In some meters this value can be altered by moving magnets or gears. Typical meters are rated 10, 50 & 100 Gallons/contact.
Turbine-Paddlewheel meters have a 'K' Factor which is the number of pulses / Gallon or pulses/Liter. Some manufacturers have both nominal values listed by meter size and calibration values on the meter body.
Take the time to get the meter volume/contact or 'K' factor correct, since most meters are used to control inhibitor feed and inhibitor ppm errors result when meters are incorrectly configured.

A.6 CONTROLLER ENCLOSURE

The optimum location for sensors, controller, chemical pumps and drums is as close together as access allows. You'll be able to see where all the wires, plugs and tubing goes, watch pumps turn ON as you prime, grab samples to calibrate sensors…
If you have the space; sample piping on the left, pumps & drums on the right with the controller in the middle.
Wall mount the controller enclosure at eye height for a 5' to 5'6" person so that an operator does not have to reach over drums or pumps to use the controller key pad.

In areas with daily ambient temperatures over 100F, 40C, locate the controller out of direct sunlight or beneath a sunshade. Internal temperatures over 115F, 45C will degrade the controller display.

Do not punch conduit access holes in the top of the enclosure to avoid condensation damage to the controller electronics.
Plug the controller into a dedicated, 'Always ON' utility outlet. Maximum controller current @ 120VAC is 5 Amps.

Appendix B: SPECIFICATIONS

Each controller includes an option card slot.
Auto re-configuration occurs on installation of one of LAN, 4-20mA Output OR Alarm Relay option card.

Analog – Digital I/O	Rating - Detail	Notes
Conductivity Flowswitch Sensor	1 Temperature Compensated conductivity sensor. Displays 1uS resolution. Rated 100psi, 35-120F, 2-50C Flowswitch switches @ 1GPM	Conductivity autoranging from 100uS to 10000uS. Flowswitch, Max. 30 second ON-OFF & OFF-ON response over rated temperature.
ORP	1 ORP sensor, 0-1000mV Displays 1 mV resolution. Measures 0.15mV resolution Rated 100psi, 35-120F	Includes solution ground.
Water Meter Flowswitch	Flowswitch, Dry Contacts, 250mS response. Water Meter, 400 Hz max 0.5mA @ 5VDC measurement current	Contact head meter software debounced. Turbine-Paddle wheel rating = Seametrics max pulse rate.
Relay Outputs	4 SPST,	Relays rated 10A, 120VAC Controller fused @ 5 Amps
4-20 ma Output on conductivity ('CL' optional card)	1, DC isolated, loop powered. Nominal 0.1% resolution. Auto polarity correction field wiring.	Alarm on open loop. Auto-configure on Driver installation and removal Software calibration of span & zero
Alarm Relay ('AR' optional card)	Dry contact set. Rated 500mA @ 24VDC	Closed in the non-alarmed state. Contact set opens on alarm or loss of controller power.

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 LCD contrast
Browser ('LB' optional card)	10BaseT Ethernet RJ45 Jack Full command & control via browser. XML real time controller data	User set fixed IP. Fixed MAC

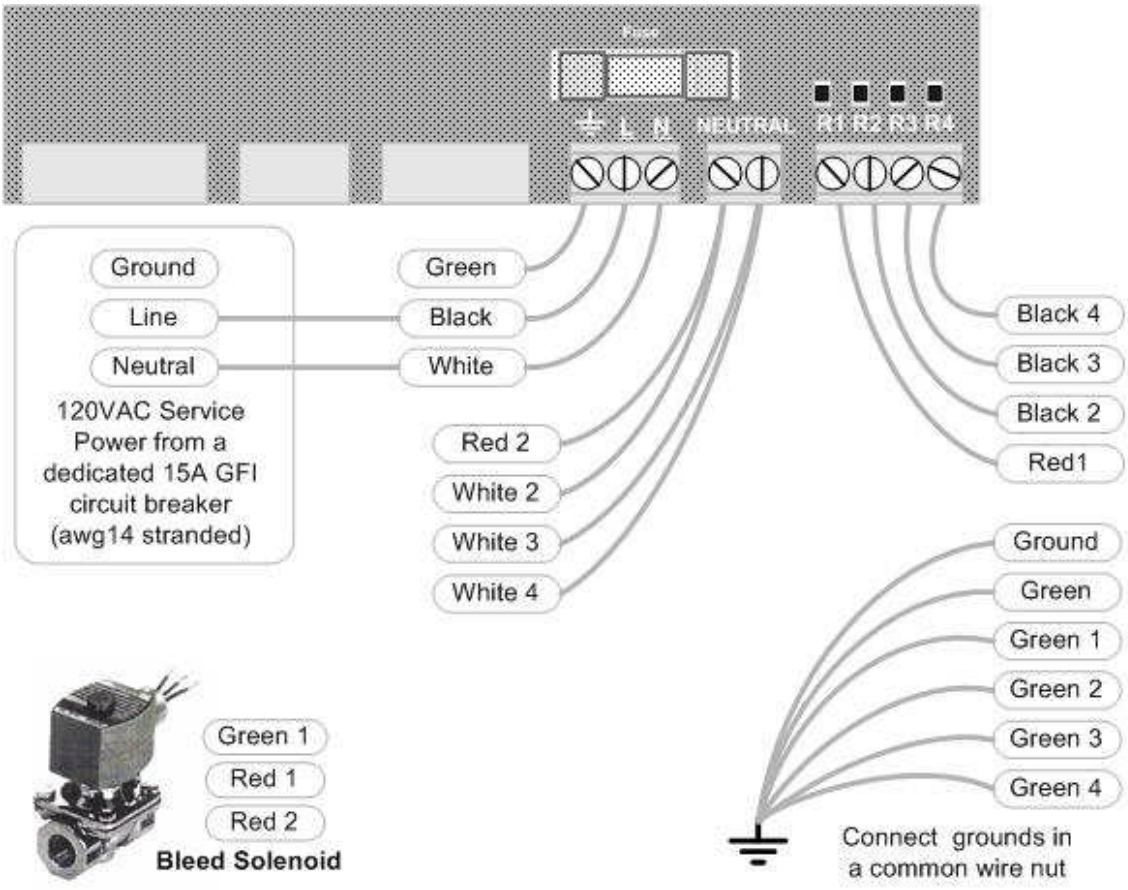
Controls	Rating - Detail	Notes
Bleed Solenoid	Controls: Conductivity, Water Meter & Percentage Time.	
Inhibitor Pump	Controls: Bleed & Feed, Bleed then Feed, Feed on Volume & Percentage Time Daily feed limit timer.	User sets % of Bleed ON time used for Inhibitor feed. User selected block on Oxidant & Biocide feed.
Oxidant Pump	Controls: ORP & Percentage Time. Feed limit timer on each ON-OFF sequence.	User selected reset of feed limit timeout at midnight.
Biocide (Timed Events)	28 Events in a cycle. 1 minute resolution Lockout, Prebleed on both time and conductivity.	User selected 1,7 or 28 day cycle.
Thermal Flowswitch	Bleed Solenoid & Pumps OFF when no flow.	CTF sensor combines Conductivity-Temperature-Flowswitch in one sensor. Flowswitch trips at 1GPM within 30 seconds.

System	Rating - Detail	Notes
Controller Configuration	User settings and biocide events written on silicon.	Makes current configuration factory default.
Clock	Battery backed, 5 years of normal usage.	CR2032 clock battery available at Radio Shack.

Electrical	Rating - Detail	Notes
AC Input	115 or 230 VAC, 50/60Hz,	Switch selectable
Fusing	5 Amps @ 120VAC 2 Amps @ 240VAC	5x20mm, 120VAC fusing:
Surge-Spike Suppression	Bleed solenoid relay contacts snubbed 0.1uF, 150R Varistor on AC power input	Controller electronics transformer isolated from AC line
AC Terminals	AC Input & Output : maximum. Stranded AWG 14, 150mm^2	
Sensor, Digital Input Terminals	AWG 22, 0.25 – 0.50mm^2	
Paddlewheel Meter Power 4-20mA output loop power	14 – 20 VDC, unregulated Thermally fused @ 50mA	4-20mA output option can be powered by load or by controller

Mechanical	Rating	Notes
Enclosure	Non-metallic, NEMA4X, IP65 7”W x 6”H x 4”D 180mm W x 150mm H x 100mm D Pollution degree 2 Installation category II Altitude 2000m Humidity up to 85% Temperature: 5C to 40C Rated for indoor use	Nominal dimensions, excluding entry fittings and flexible conduit. Enclosure door hinged left. Allow 12”, right for pump Allow 18”, below for cable-conduit access.

Appendix C: HARDWIRING



Green 1
Red 1
Red 2
Bleed Solenoid

Green 2
White 2
Black 2
Inhibitor Pump

Green 3
White 3
Black 3
Oxidant Pump

Green 4
White 4
Black 4
Biocide Pump

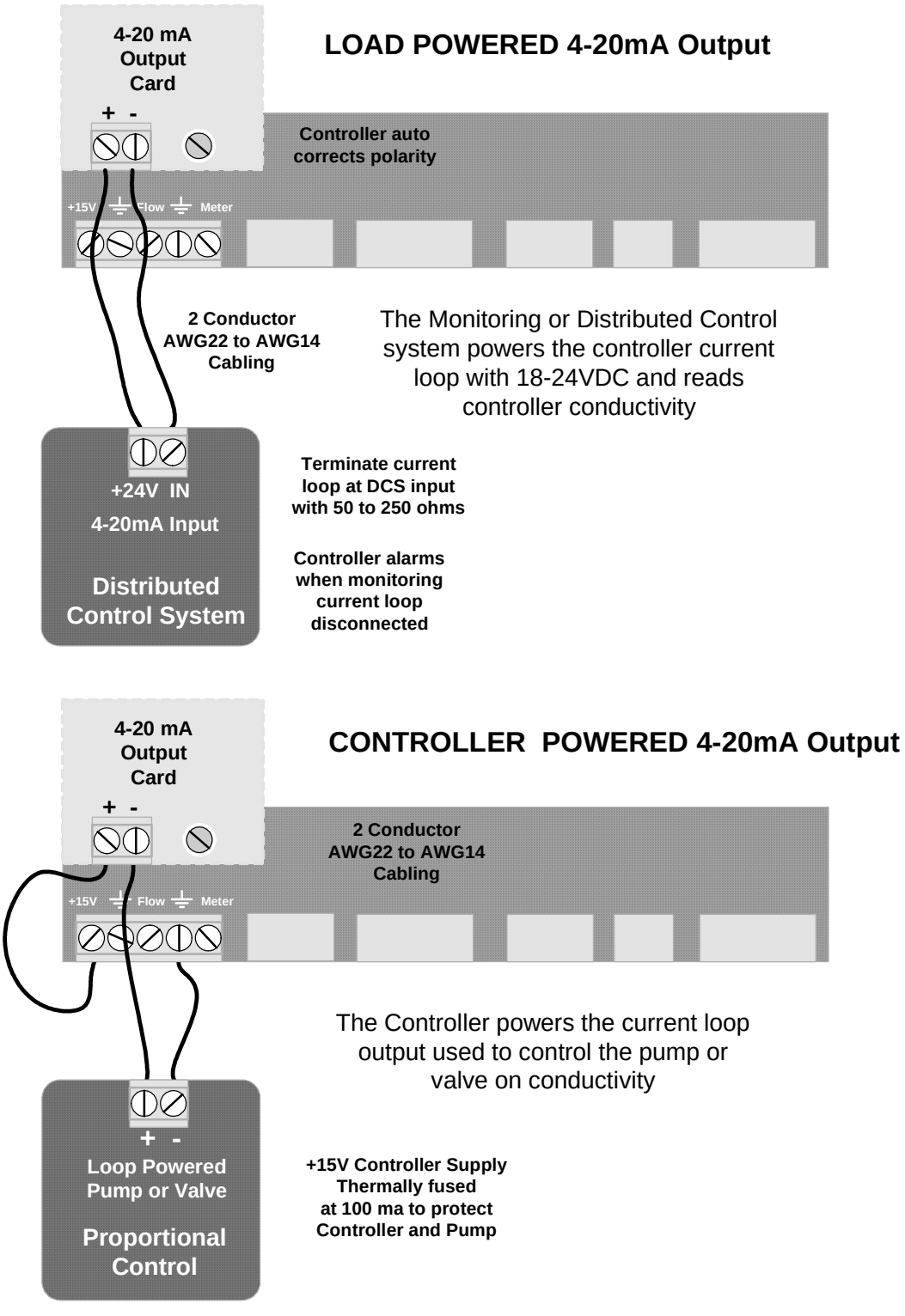
HARDWIRING REQUIREMENTS:

1. If you are hardwiring anything more than the AC power, an external terminal enclosure is required.
2. Do not exceed AWG14 for AC power wiring.
3. Pump and Bleed Solenoid outputs are fused at 5 amps/ 120VAC total.
   AC wiring must be minimum AWG18, rated 300V.
4. Use multiple strand, copper AC power wiring.
   Do not use solid conductors.

Appendix D: 'CL' 4-20mA Output Option

The optional 4-20mA output on conductivity is DC isolated from the controller & may be either powered by the load or by the controller DC supply. The 4-20mA output is auto-polarity correcting & detects an open or unpowered loop.

D1. WIRING



Appendix D: 'CL' 4-20mA Output Option
D.2 VIEW & ADJUST SPAN

The displayed value of the 4-20mAloop current depends on both the conductivity and the Span

OR

If the current loop output is disconnected you'll see this display in place of the mA level.

Press ENTER @ Select Span to view or adjust the Span
Span sets the conductivity at 4mA & at 20mA

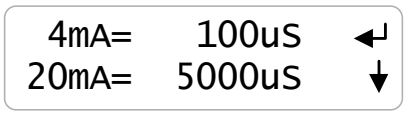
Press ENTER @ Trim Zero to calibrate the 4mA level

Press ENTER @ Trim Span to calibrate the 20mA level

View & Adjust Span

Press ENTER @ 4-20mA Output
& then DOWN to Select Span
Press ENTER.

Displays current Span.
Press ENTER to adjust 4mA level
or DOWN & ENTER to adjust 20mA level.



Press RIGHT to place the underline
under the digit you wish to adjust.
Press UP – DOWN to adjust.

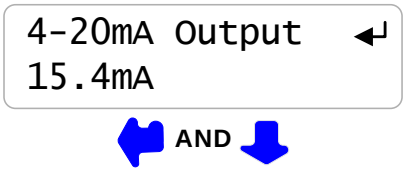
ENTER updates the Span.
EXIT leaves Span unchanged

Appendix D: 'CL' 4-20mA Output Option

D.3 CALIBRATE

Calibration is seldom necessary & is used to correct to offset errors.
The range of Zero & Span adjustment is limited.
If you are not able to calibrate:
A: Verify your milli-ammeter B: If Load Powered, verify you have at least 15VDC available.

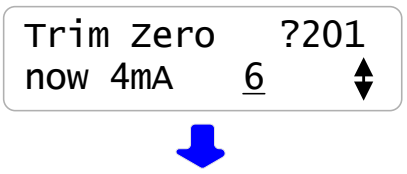
Press ENTER & then DOWN at 4-20mA Output



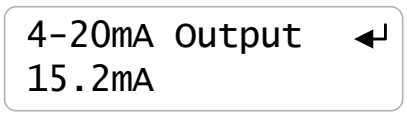
Press ENTER at Trim Zero to adjust the 4mA level.

Connect a DC milli-ammeter in series with either of the current loop wires.

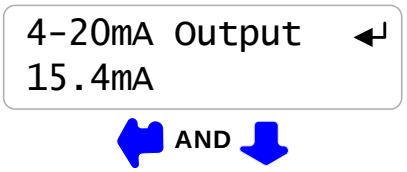
Press UP or DOWN until you read 4mA on the milli-ammeter.



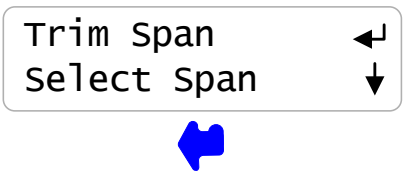
Press ENTER to view the output current and verify that the milli-ammeter reads the same current.



Press ENTER & then DOWN at 4-20mA Output

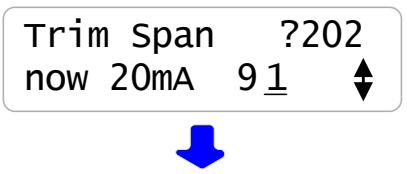


Press ENTER at Trim Span to adjust the 20mA level.

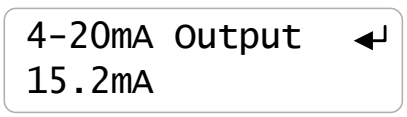


Connect a DC milli-ammeter in series with either of the current loop wires.

Press UP or DOWN until you read 20mA on the milli-ammeter.



Press ENTER to view the output current and verify that the milli-ammeter reads the same current.

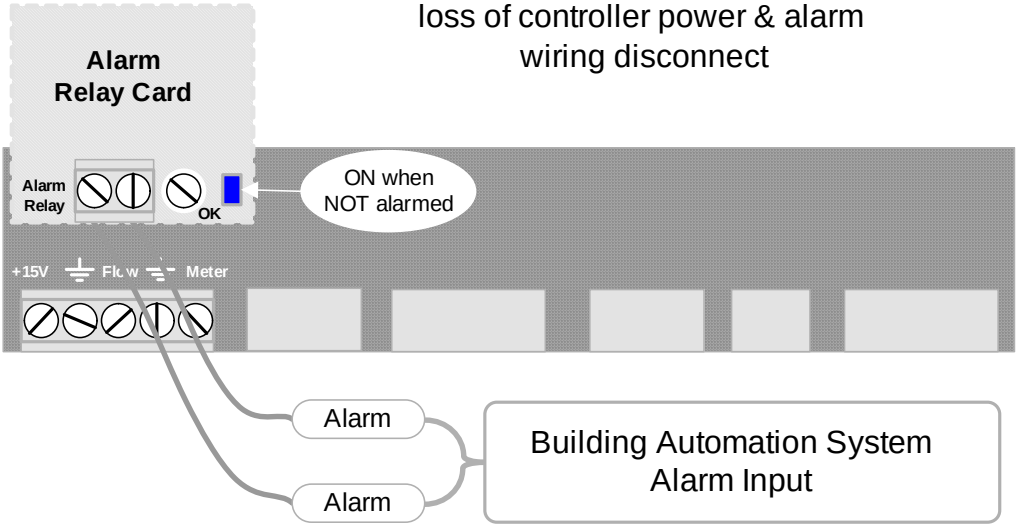


Appendix E: 'AR' Alarm Relay Option

E.1 WIRING ALARM CONTACTS

Alarm contacts rated 500mA at 24VDC.
Requires optional Alarm Relay Card

Alarm dry contacts OPEN on alarm, loss of controller power & alarm wiring disconnect



Wire alarm contacts AWG22 to AWG18, 2 conductor

E.2 ALARM DISPLAYS

Press UP - DOWN until you see Alarms

If the Alarm Relay Card is installed you'll see one of the following displays.

```
Alarms ↵
none
```

If Alarms & 'none' then the alarm contacts will be closed

```
Alarm Contacts
CLOSED,No Alarm
```

OR

Alarm contacts open on alarm.

```
Alarm Contacts
OPEN,Alarm
```

This display verifies the contact set state measured at the Building Automation System input terminals.

Appendix F: 'LB' LAN - Browser Option

Download SFlex_LB manual from www.Aquatrac.com

Do not connect the controller to the site LAN without permission and an IP address from the site IT staff.

You can use a crossover cable to connect to your notebook PC to view the controller state. Information on browsing controllers is available in the SFlex_LB manual.