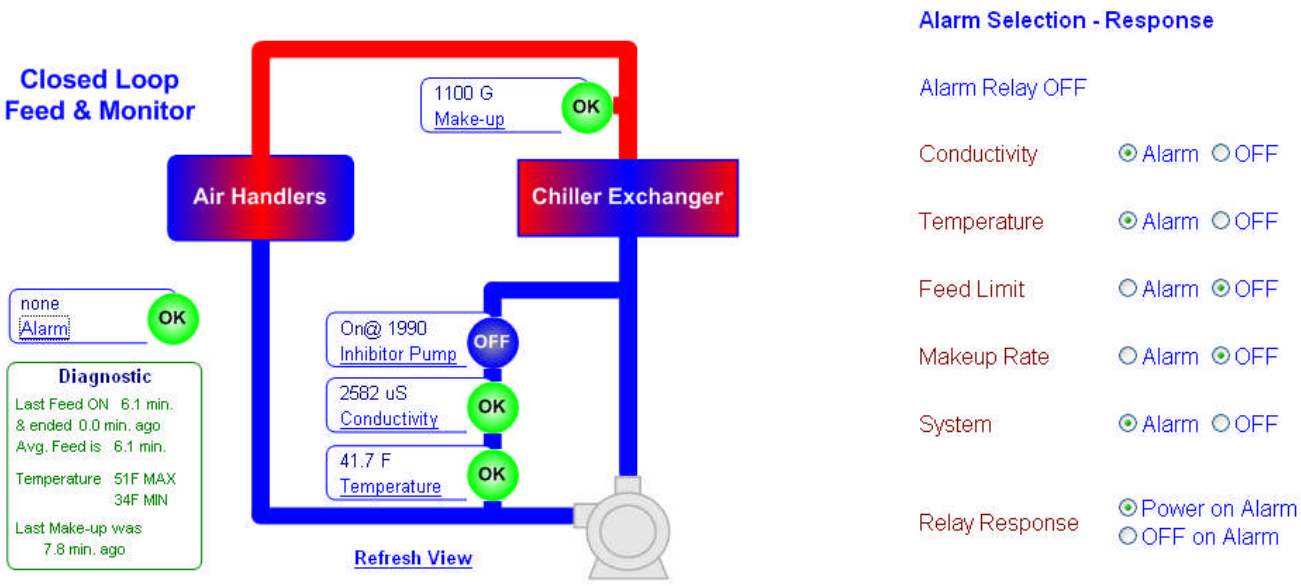
AQUATRAC™
INSTRUMENTS, INC.
SYSTEM DESIGN & ENGINEERING

microFlex

Water Treatment Controller
for Hot & Chilled Closed Loops



Measures Conductivity, Temperature,
Make-up Water Meter and Operating Interlock

Controls the Inhibitor Pump
And Alarm Relay

Part No. CL-AH

CONTENTS

Safety

Electrical Shock Hazard

Opening the enclosure door with the controller plugged in, exposes the user to AC line voltage.

Unplug the controller before opening the enclosure door.

USER WARNING : CAUTION

This Closed Loop Water Treatment Controller operates a chemical feed pump and a 120VAC alarm relay. It 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 limit 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 inhibitor feed setpoints and feed on conductivity mode that may not be applicable to your closed loop.

Select a feed mode, adjust setpoints and set alarms for your closed loop and its water treatment program.

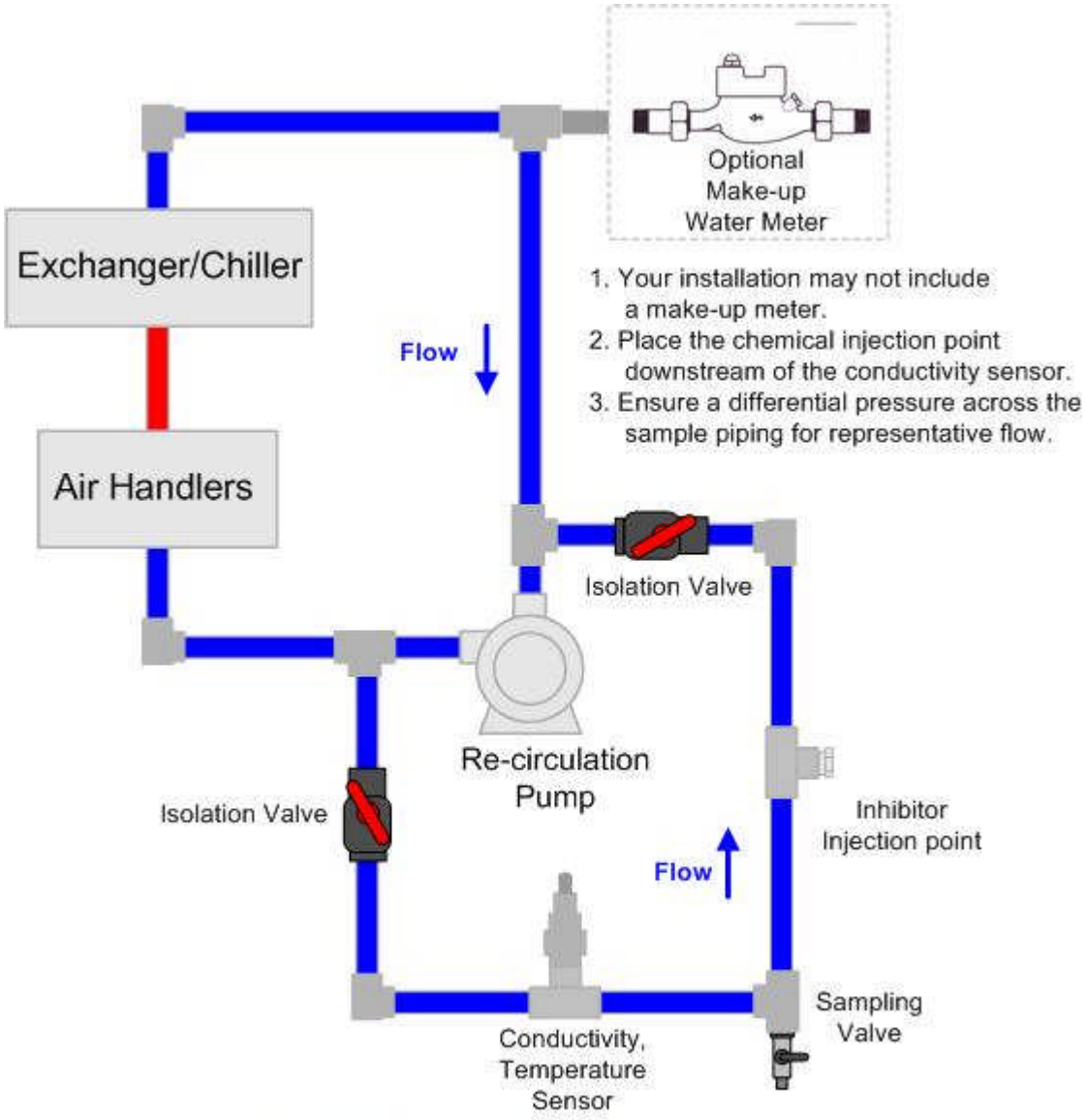
1. INSTALLATION

1.1 Sample Piping

The **CL-AH** Controller includes a conductivity- temperature sensor.

Chilled Loops: Sensor pre-wired to the controller with ¾' slip PVC entry fitting for sample piping typically plumbed in ¾" SCH80 PVC..
Hot loops: ¾" NPT steel sensor for sample piping typically plumbed in ¾" steel.

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

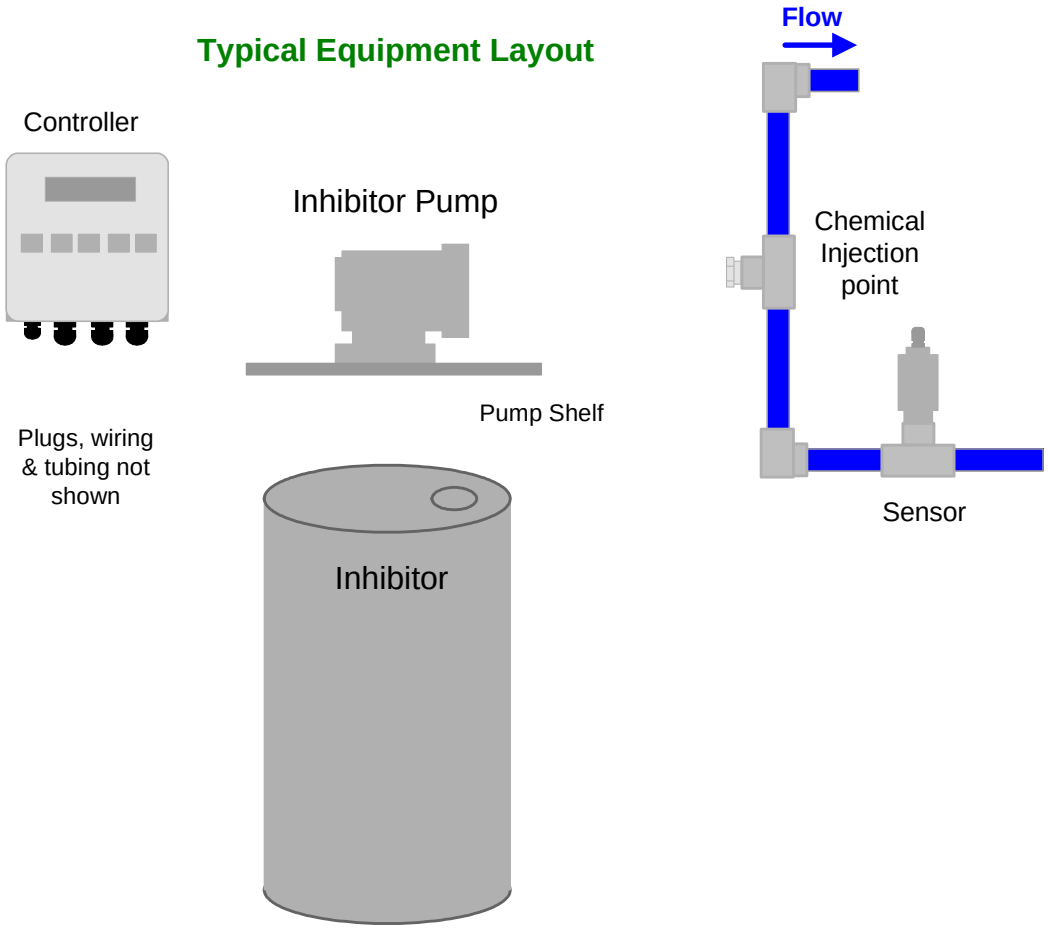


Typical Installation Piping

1.2 Controller Enclosure

Install the controller enclosure corner mounting hardware, available in the parts bag taped to back of enclosure.

Locate the controller at eye level, nominally 60”, 150cm. above the floor

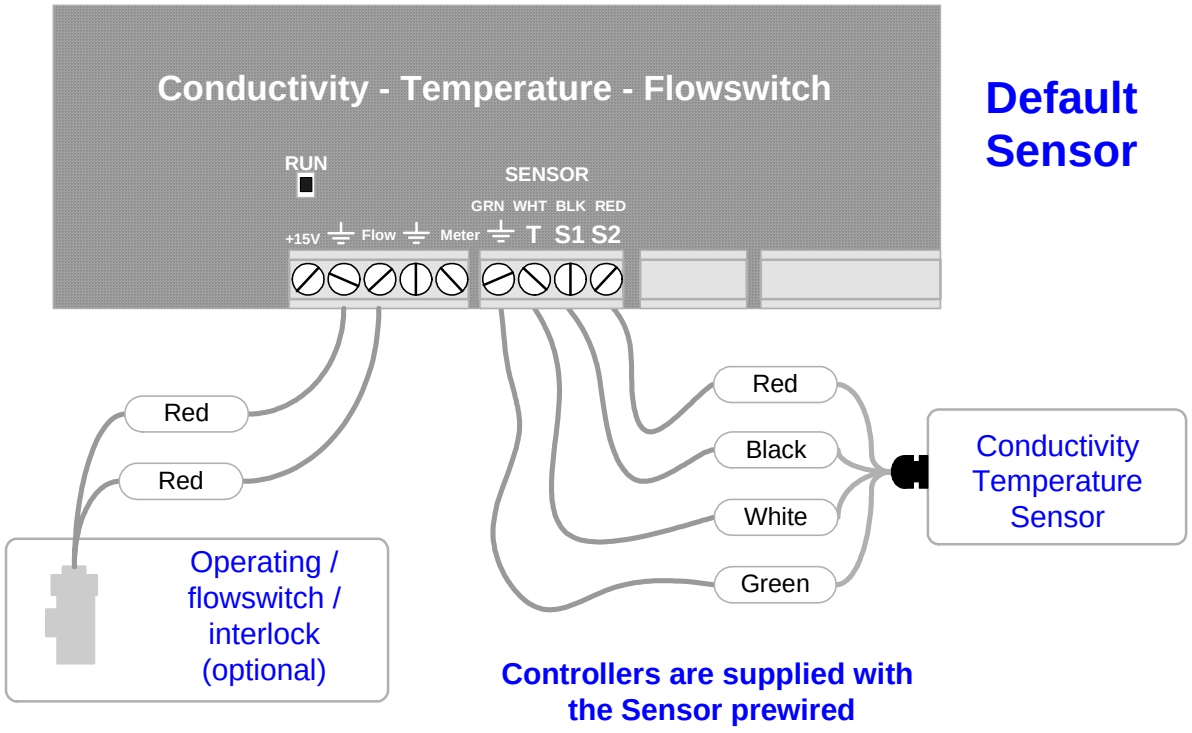


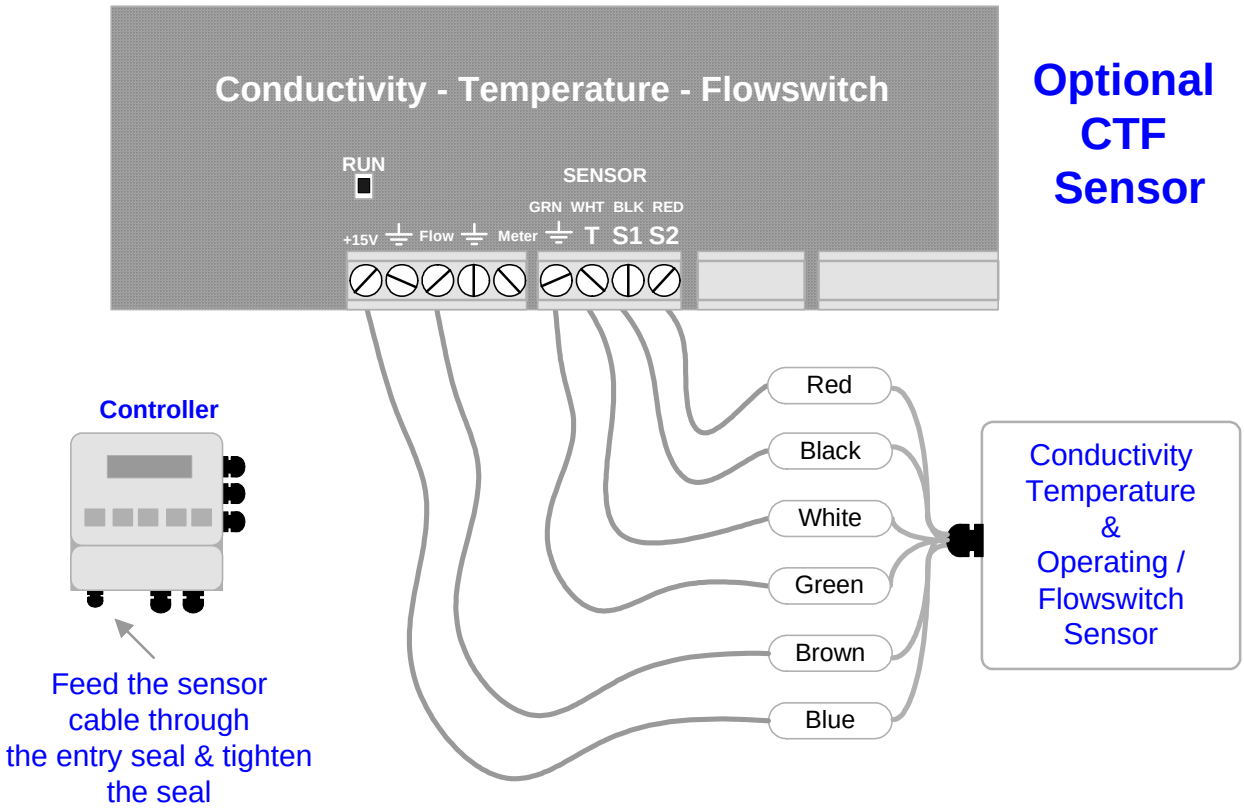
Although sensor cables and pump tubing may be extended, ease of servicing occurs when water treatment components are located in the same area.

Ensure that the controller enclosure door is closed & latched when not terminating sensor and water meter wiring.

1.3 Sensors: Conductivity-Operating Interlock

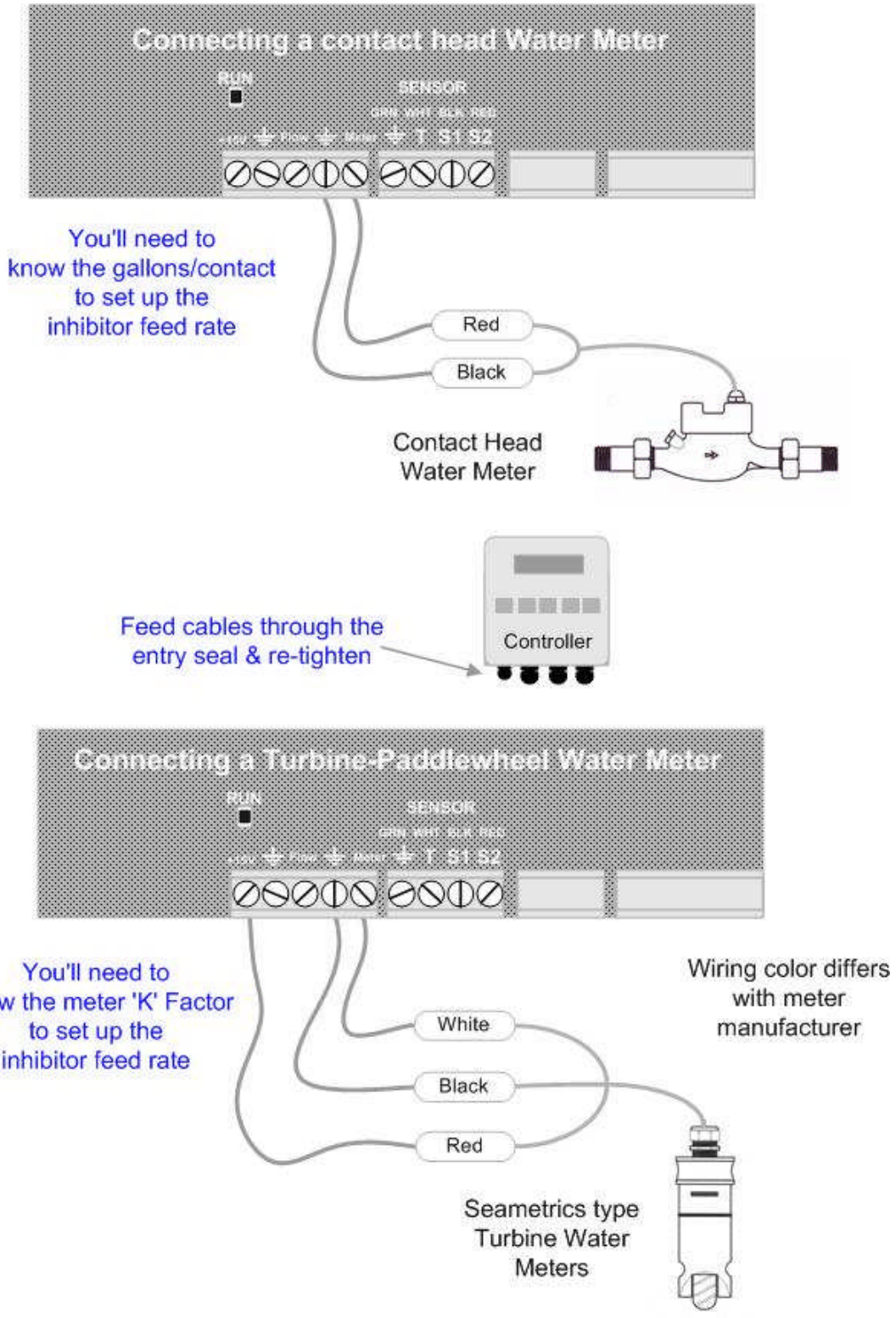
After installing the conductivity sensor, open the sample piping downstream valve, then the upstream valve. Verify that the sensor entry seals, leak and drip free





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.

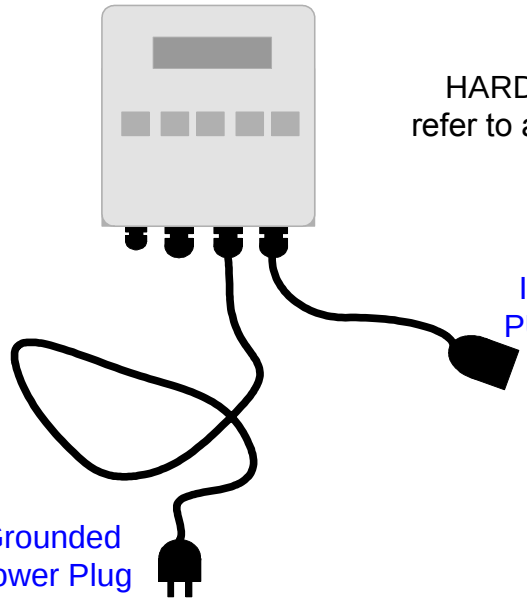


Do not install meter cabling in the same conduit at AC power wiring.

1.5 Inhibitor Pump & Alarm Relay

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

WARNING:
Do not plug-in inhibitor pump until you are ready to setup & operate



START-UP
BEFORE you plug-in the inhibitor pump.

Plug-in the controller.

Set control mode and setpoints.
Set the feed limit on the inhibitor pump.

Verify that the sensor is reading correctly and set the alarms.

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

Verify that the operating interlock - 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

Unique Controller Serial Number

Press **ENTER** for Controller Diagnostic, US-Metric select, Sensor type & to Turn ON Password.

```
Closed Loop      ↵
S/N: DA08CL184
```

Press **ENTER** to clear Alarms, to Configure the Alarm Relay and to select the faults that control the Alarm Relay.

```
Alarms           ↵
none
```

Current Conductivity sensor value. Press **ENTER** for Conductivity Calibrate & Alarms.

```
Conductivity     ↵
   3020 uS
```

Pump ON or OFF and ON time in the current 24 hours. Press **ENTER** for Feed Setpoints, Feed Mode, Feed Limit Timer, Prime and Current State.

```
Inhibitor Pump   ↵
ON  18.4 min/day
```

Water meter measured volume in the current 24 hour period. Press **ENTER** to Install, Select type, view on-line total, view-adjust Rate Alarm & days on-line.

```
12.4hr Make-up   ↵
   1525 G
```

Loop water temperature. Press **ENTER** to Calibrate & View-Adjust alarms.

```
Temperature      ↵
   48.2 F
```

2.1 Power-up Display & Keypad
continued

Interlock ON or OFF and ON time in most recent 24 hours.
Reset to zero on POWER OFF/ON.

```
Operating
ON   9.4 hrs/day
```

Diagnostics over the most recent 24 hours.
Reset to zero on POWER OFF/ON
Last feed, average feed, max-min temperature….

```
Diagnostics on
 12.4 hrs
```

If there is no option card installed,
you'll view the serial number power-up display.

```
Closed Loop      ↵
S/N: DA08CL184
```

Option Displays

LAN –Browser, '**LB**' Option
Displays current IP – see Appendix F, for User Manual link.

```
LAN: Static      ↵
192.168.002.101
```

OR

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

```
4-20mA Output    ↵
15.4mA
```

OR

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

```
Alarm Relay      ↵
Closed
```

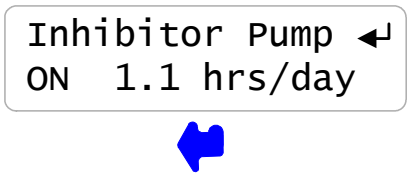
Note: The included alarm relay is hot, not dry.
The hot alarm relay either turns ON or turns OFF
120VAC on alarm

Sidebar: Cycling the controller power OFF/ON resets all of the hrs/day displays to zero. Run times and volumes are set to zero every 24 hours and are intended to give you a summary of the most recent 24 hours of control and feed.

2.2 Feed Mode: Conductivity Setpoints

The factory default control mode is '**Feed on Conductivity**'
Refer to **3.2 Feed Controls**
to select one of Feed Modes

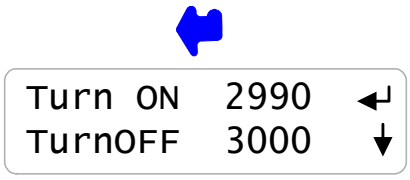
Press **UP** or **DOWN** until you see '**Inhibitor Pump**' & press **ENTER**.



Press **ENTER** to view or adjust **Setpoints**.

Displays current Feed setpoints,
Varies with Feed Mode

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

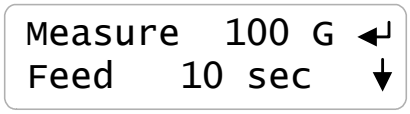


Press **UP-DOWN** to adjust and **RIGHT** to move the cursor.
Press **ENTER** to execute or
EXIT to leave the Setpoints unchanged

Press **ENTER**, displays current setpoints.

If you make **Turn OFF** less than **TurnON**,
the setpoints will be switched.

Setpoints for feed on **Meter Control** mode



Water Meter Control

Sidebar:
The difference between Turn ON & TurnOFF, the 'deadband', is usually set to 10uS.

If you are watching the loop conductivity increase as Inhibitor pump feeds you may see an overshoot depending on where you are injecting inhibitor, closed loop volume & loop recirculation rate.

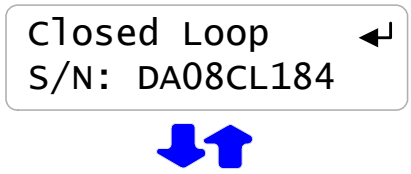
Keeping the deadband @ 10uS, limits conductivity under & overshoot and therefore inhibitor over-under feed.

2.3 Verify Conductivity Sensor

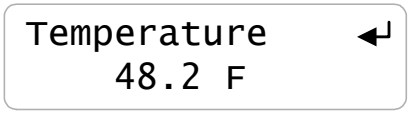
Open the downstream, then the upstream sample line isolation valves, immersing the conductivity sensor

Verify Temperature

Press **EXIT** until you see **Closed Loop** .
Press **UP** or **DOWN** to **Temperature**.



If the GREEN & WHITE wires are connected to the controller terminals, you'll view the current temperature.



Temperature is used to compensate the **Conductivity** measurement and may be used to alarm.

Calibrate Conductivity

Press **UP** until you see **Conductivity**.
Sample the loop 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 **ENTER** to execute or
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.

2.4 Check Operating Interlock & Install Water Meter

The **Operating** interlock is shipped jumpered, always ON.

Press **UP - DOWN** until you see **Operating**.
Displays **ON** or **OFF** and the total minutes ON in the current 24 period.

NOTE: An **OFF** Operating interlock stops the **Inhibitor Pump** from operating.

A make-up meter is not required for closed loop feed control. The factory default water meter is a 100 Gallons/contact contact head meter.

Press **UP - DOWN** until you see 0 to 24hr Make-up.
Displays make-up volume during the current 24 hour period.

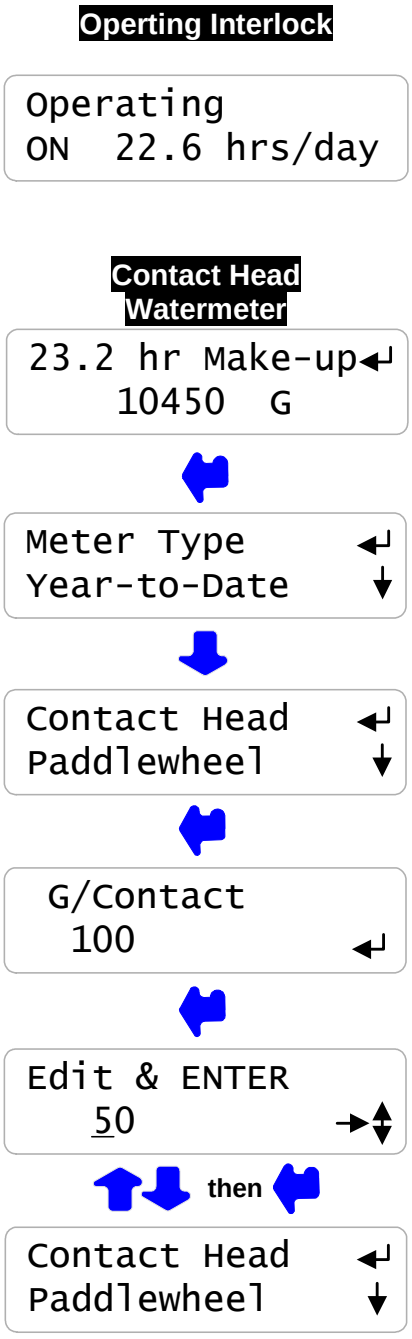
Make-up volume resets every 24 hours and every power OFF/ON to 0.0 hours

Press **ENTER** twice to view or change meter type.

Press **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 **ENTER** to execute or **EXIT** to leave Gallons/contact unchanged.

ENTER or **EXIT** displays the current meter type.



Sidebar: 2 wire meters are usually **Contact Head** type & 3 wire meters are typically Turbine or **Paddlewheel** water meters.

Few closed loops will use the **Operating** interlock & that's why its jumpered. Typically only those loops with frequent water loss or sites requiring a make-up rate alarm include a closed loop make-up meter.

2.4 Check Operating Interlock & 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 –Paddlewheel Watermeter

Press **UP - DOWN** until you see 0-24hr Make-up.
Displays make-up volume during the current 24 hour period.

```
6.4hr Make-up  ↵
   31450  G
```

Press **ENTER** twice to view or change meter type.

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

Press **DOWN** to select **Paddlewheel** type meter

```
Paddlewheel    ↵
Contact Head   ↓
```

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

```
'K'Factor
   100.0       ↵
```

Press **UP-DOWN** to adjust and **RIGHT** to move the cursor.
Press **ENTER** to execute or
EXIT to leave **'K' Factor** unchanged.

```
Edit & ENTER
   104.5       →↕
```

then

ENTER or EXIT displays the current meter type.

```
Paddlewheel    ↵
Contact Head   ↓
```

Sidebar:
Verify the meter. Force make-up by opening the loop to drain.
Verify that the make-up meter displays an increasing volume.

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

2.5 Plug-in Inhibitor Pump

Sections 2.2 to 2.4 adjust setpoints and verify sensors.
We're now ready for the inhibitor pump.

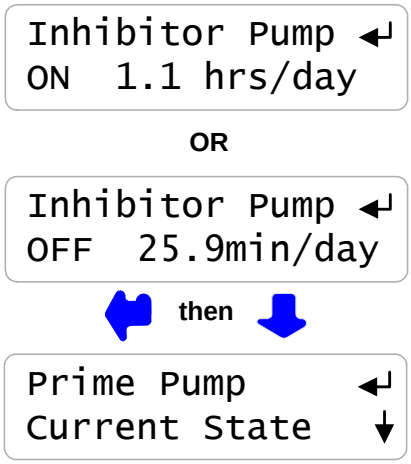
Plug the inhibitor pump into the bottom, right plug.
Press **UP** or **DOWN** to view **Inhibitor Pump**.

If **ON**, verify that the green **Bleed** light on the inside of the enclosure is ON.

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

If **OFF**, press **ENTER** & **DOWN** to **Prime Pump**.

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



Sidebar:
The **Inhibitor Pump** will not turn ON unless the **Operating** interlock is ON.
The internal **Bleed** light will not turn ON unless the **Operating** interlock is ON.

If the **Operating** jumper in not installed, then the controller requires a dry contact set from either a flowswitch or a DCS or Energy Management System to operate the **Inhibitor Pump**.

If **Operating** interlock is OFF, **Inhibitor Pump** will display **No Flow!**

2.6 Check Controls

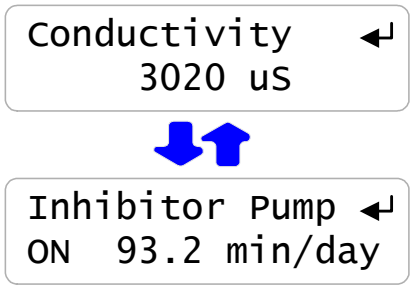
Verify that the inhibitor feed control works in the way that you expect for this site.

Conductivity & Feed

Watch the **Conductivity** increase as the **Inhibitor** Pump runs.

The **Inhibitor Pump** will turn ON as the **Conductivity** falls below the **Turn ON** setpoint.

As the loop makes up, the **Conductivity** will fall below the **TurnON** setpoint and the **Inhibitor Pump** will turn ON, raising the **Conductivity** until it exceeds the **TurnOFF** setpoint..



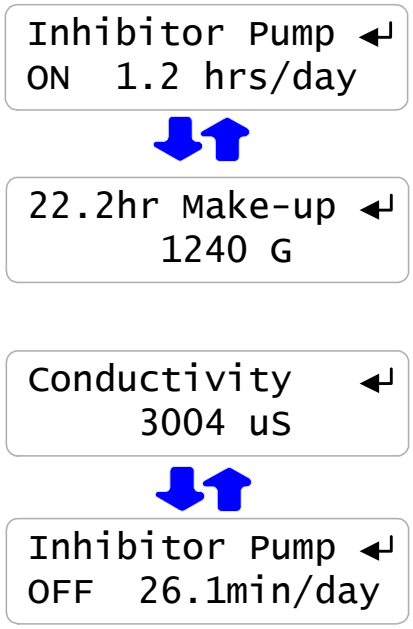
Water Meter & Feed

If the **Inhibitor Pump** feed mode is set to '**Meter Control'**, the **Inhibitor Pump** will turn ON when the **Make-up** meters a **Measure** setpoint volume.

The **Inhibitor Pump** will run for the **Feed** setpoint seconds.

You should see the **Conductivity** increase as inhibitor is added to the closed loop make-up water.

There may be a delay depending on the location the inhibitor is injected and the time required for its effect to be measured at the **Conductivity** sensor.



Sidebar: The **Inhibitor Pump** will not turn ON unless the **Operate** interlock is ON.

The **Inhibitor Pump** turns OFF if the feed **Limit Timer** is exceeded.
Increase the **Limit Timer** & **Clear Alarms** to allow the pump to turn ON.

Feed limited inhibitor pumps reset every 24 hours of controller run time OR on power OFF/ON.

3. OPERATION
3.1 Conductivity Sensor

Sensor calibration and temperature verify is detailed in Section **2.3 Verify Conductivity Sensor**

Press **UP - DOWN** until you see **Conductivity**.

Press **ENTER** & then **DOWN** to **Alarms**.

Press **ENTER** to view or adjust **Alarms**.

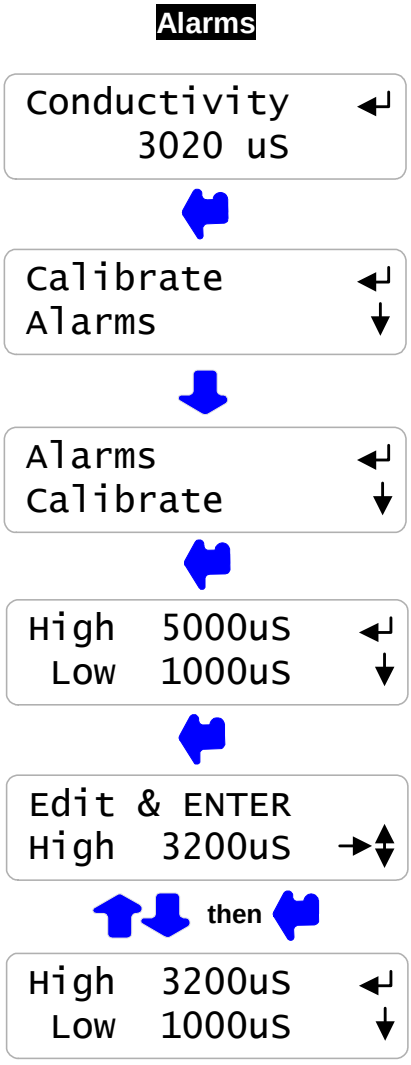
Press **ENTER** to adjust the **High** Alarm or **DOWN** & **ENTER** to adjust the **Low** Alarm

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

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

'**Alarms**' displays **Conductivity** on fault and resets automatically if the measured conductivity is between the **High** & **Low** alarm levels.

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



Sidebar:
A Conductivity alarm will display if a failure to calibrate is ignored and it will remain until the sensor is returned to factory default or calibrated correctly.

If the sensor line is not immersed when the closed loop re-circulating pump turns OFF, you may get a conductivity alarm depending on where you have set the **Low** alarm.

3.2 Feed Controls

For conductivity control setpoints see
Section **2.2 Feed Mode: Conductivity Setpoints**

Press **UP - DOWN** until you see **Inhibitor Pump**.
Displays **ON** or **OFF** and ON time
in the current 24 hour period.

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

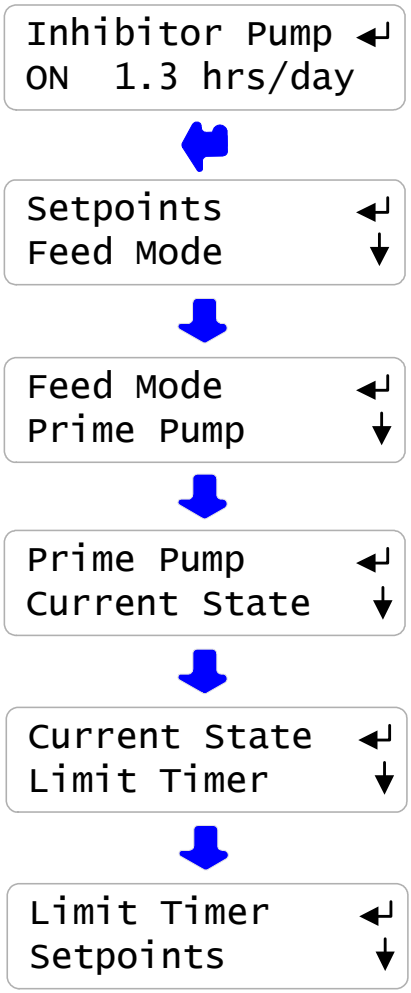
Press **ENTER** view current mode or to select from
Conductivity Control OR **Meter Control**.

Press **ENTER** @ **Prime Pump** to turn ON
the **Inhibitor Pump** for 5 minutes.

'**Alarms**', **ENTER** and '**Clear Alarms**' ,
ENTER ends priming.

Press **ENTER** @ **Current State** to view control status.
Display varies with **Feed Mode.**
Prime Pump can be ended by keying
ENTER @ **Current State**.

Press **ENTER** @ **Limit Timer** to view or adjust the maximum
pump ON time in any 24 hours.



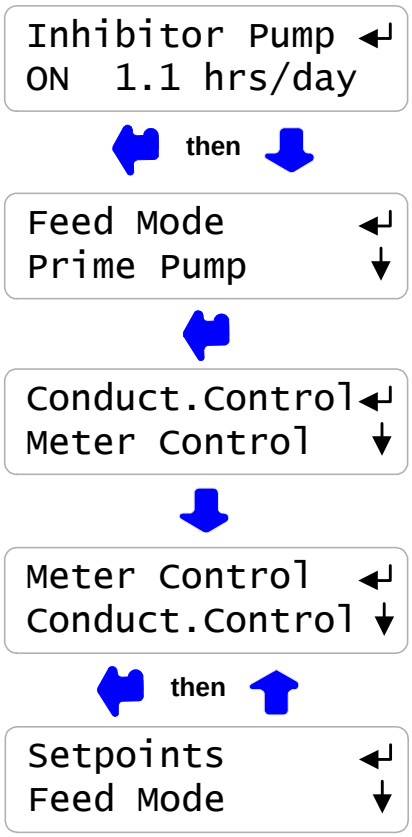
Sidebar:
Prime Pump will not turn ON the **Inhibitor Pump** if the **Operate** interlock is OFF
or if the **Limit Timer** alarm is active.

Limit Timer alarms reset automatically every 24 hours or when controller
power is turned OFF/ON .

3.2 Feed Controls
Continued

Inhibitor Pump Feed Modes

Press **ENTER** then **DOWN** @ **Inhibitor Pump**



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

Most closed loops operate with **Conductivity Control**. **Inhibitor Pump** feeds @ **TurnON** conductivity setpoint and stops at the **TurnOFF** setpoint

Meter Control measures a user set volume on the **Make-up** water meter then turns ON the **Inhibitor Pump** for a user set time.
For example:
Measure 100 Gallons of make-up & feed for 10 seconds.

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

Sidebar:
The controller is defaulted to conductivity control, typical for most closed loop controllers which feed an inhibitor which raises the closed loop water conductivity.

If you are feeding a chemical which does not alter the loop conductivity, you may elect to feed volumetrically, using a make-up water meter to get a target ppm of chemical into the closed loop.

3.2 Feed Controls
Continued

Current State of the Inhibitor Pump Control

Press **ENTER** then **UP** @ **Inhibitor Pump**.

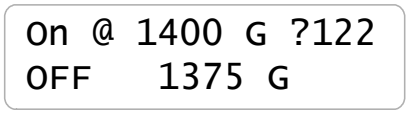
then

Press **ENTER** @ **Current State**.

Conductivity Control
If **ON**, displays TurnOFF setpoint, **3000.**
& current conductivity, **2946.**
If **OFF**, displays TurnON setpoint, **2990.**
& current conductivity, **3005.**

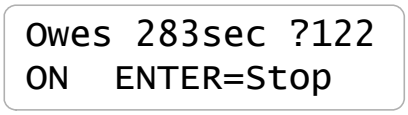
Conductivity Control

Water Meter Control
If **ON**, displays **Owes 26 sec ?122**
& **ON ENTER=Stop**
If **OFF**, displays turn-on volume, **1400**
& current volume **1375**



Water Meter Control

Priming
If **ON**, displays **Owes 283 sec ?122**
& **ON ENTER=Stop**



Priming Pump

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

The **ON ENTER=Stop** option ends the current owed time ON period.
Control resumes when Make-up volume is measured if Water Meter Control is selected.

3.2 Feed Controls: Feed Limits continued

The Inhibitor feed limit timer turns OFF the inhibitor pump to prevent overfeeding.
The factory default limit is 60 Minutes in a 24 hour period.

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

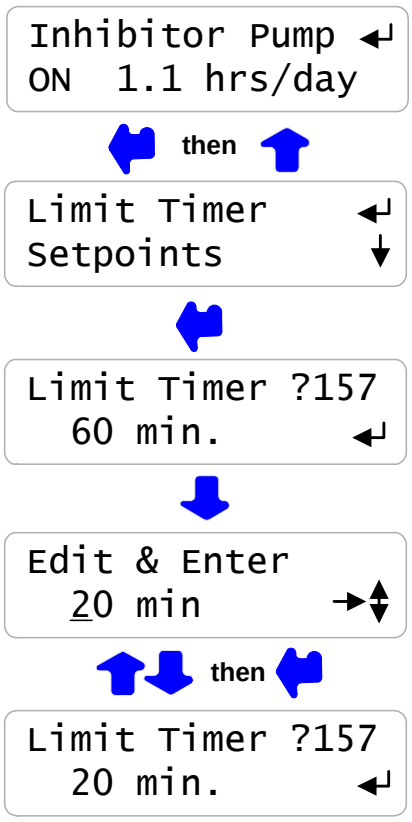
Press **UP** to **Limit Timer**.
Press **ENTER** to view or adjust **Limit Timer.**

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

Press **ENTER** adjust **Limit Timer**,

Press **UP-DOWN** to adjust and **RIGHT** to move the cursor.
Press **ENTER** to execute or
EXIT to leave the **Limit Timer** unchanged

Press **ENTER**, displays the current limit,
20 minutes in 24 hours.

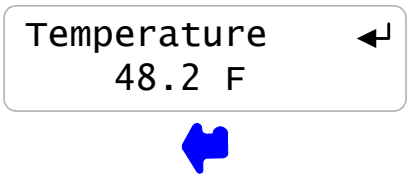


HELP: ?157 and other help numbers display wherever more explanation is available at www.aquatrac.com

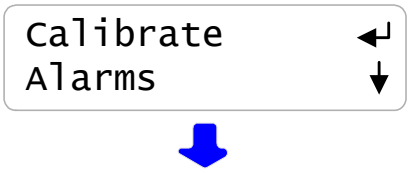
If you are using water treatment controls for the first time, the language and application of some of the controller options and settings requires more detail than the controller 2 line display can deliver.

3.3 Temperature

Press **EXIT** until you see **Closed Loop** .
Press **UP** or **DOWN** to **Temperature**.

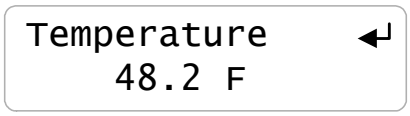


Press **ENTER** twice to **Calibrate Temperature**.



Press **ENTER**, **DOWN** & **ENTER** to view or adjust **Temperature Alarms**.

Temperature Calibrate
Press **UP** until you see **Temperature**.



Adjust the displayed **Temperature** by pressing **ENTER** twice.

Press **UP-DOWN** to adjust and **RIGHT** to move the cursor.
Press **ENTER** to execute or
EXIT to leave **Temperature** unchanged.

then

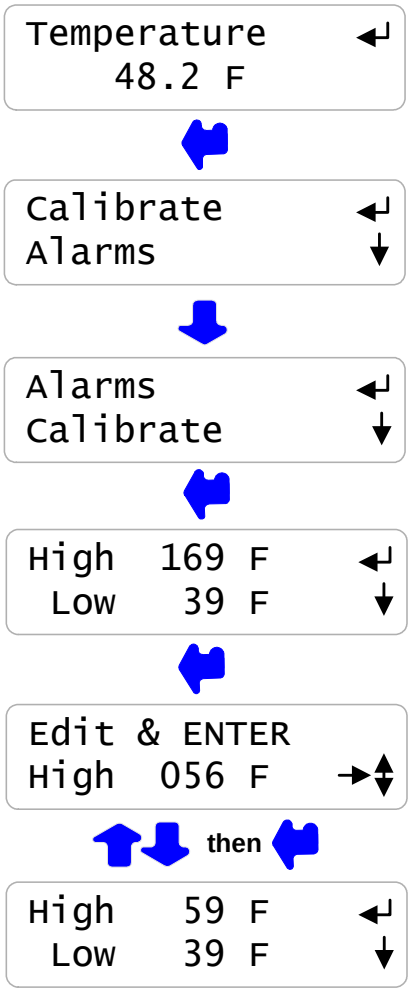
You'll see this screen if the sensor is miswired or you keyed incorrectly.
Press **ENTER** to ignore or **EXIT** to return to Factory Default.

In this example, we've adjusted the **Temperature** from **48.2 F** to **46.5 F**.

Sidebar:
If you elect to ignore the **Fails Calibrate** warning, the controller sets the Temperature Alarm to remind you of an uncorrected problem.

3.3 Temperature continued

Temperature Alarms
Press **EXIT** until you see **Closed Loop**.
Press **UP** or **DOWN** to **Temperature**.



Press **ENTER** & then **DOWN** to **Alarms**.

Press **ENTER** to view or adjust **Alarms**.

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 **ENTER** to execute or
EXIT to leave **Alarm** unchanged.

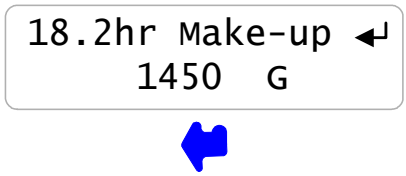
ENTER updates the alarms & displays the current **High** & **Low** Alarms.

'**Alarms**' displays **Temperature** on fault and resets automatically if the measured temperature is between the **High** & **Low** alarm levels.

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

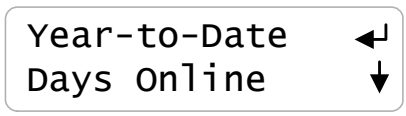
3.4 Make-up Meter

Press **UP - DOWN** until you see **'Make-up'** & press **ENTE**R .

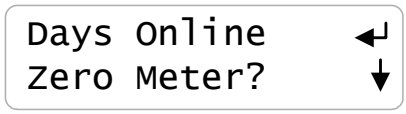


Press **ENTER** to view current type or to select **Contact Head** or **Paddlewheel** water meter.

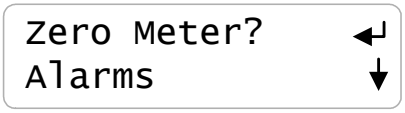
Press **DOWN** & **ENTER** for volume during the most recent 365 days. Resets to zero every 365 days.



Press **DOWN** & **ENTER** for the number of 24 hour periods of powered up time in the current year



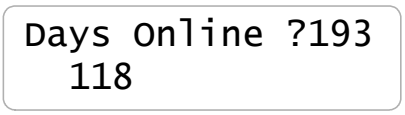
Press **ENTER** to reset **Year-to-date**, **Days OnLine** and 24 hr Make-up to zero.
Warning: Cannot Undo



Press **DOWN** & **ENTER** to view or adjust the make-up rate alarm settings.

Year-to-Date is updated every 24 hours of power ON. Displays in 'L'iters if metric selected.

Days water meter ON in current year. Resets to zero every 365 days.



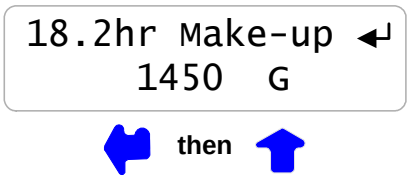
Press **EXIT** to return to previous display

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

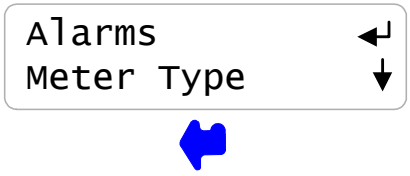
3.4 Make-up Meter continued

Make-up Rate Alarm

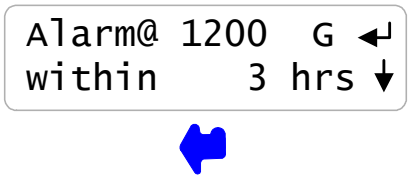
Press **UP - DOWN** until you see **'Make-up'** & press **ENTE**R .



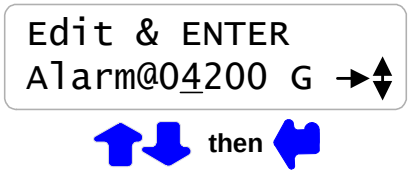
Press **ENTER** & then **UP** to **Alarms**.



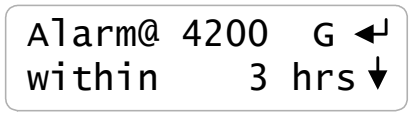
Press **ENTER** to view or adjust **Alarms**.
If the water meter measures more than **1200** Gallons of make-up in **3** hours, it will alarm.



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 **ENTER** to execute or **EXIT** to leave **Alarm** unchanged.



ENTER updates the alarms & displays the Current volume and time alarm setpoints.

Sidebar:
Hours may be set from 1 to 24.
Volume may be any value up to 99,999.

Clear Alarms zeroes each hour's volume record, resetting the rate alarm calculation and clearing the Make-up alarm.

Use this alarm to alert you to a leak or an open crossover valve.

3.5 Alarms

Press **UP - DOWN** until you see **'Alarms'** & press **ENTER** .

Press **ENTER** to **Clear Alarms**, reset the **Inhibitor Pump Limit Timer**, end pump priming and time owed and reset the **Make-up** meter rate alarm. Does not clear calibration faults.

Press **ENTER** to view or **Select Alarms**. which control the 120 VAC, hot alarm relay.

Press **ENTER** to view or modify hot alarm relay response on alarm.

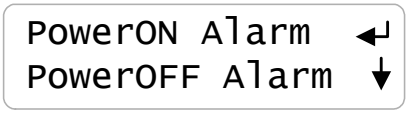
Alarm Response

Press **UP - DOWN** until you see **'Alarms'** & press **ENTER**.

and

Press **UP** to **Alarm Response** and **ENTER** to view current setting or to modify.

In this example, the Alarm relay will turn ON on alarm, supplying 120VAC.



Press **DOWN** & **ENTER** to select **PowerOFF on Alarm**. This setting would also alarm if the controller was unplugged or lost 120VAC power.

Key EXIT to return to **Alarm Response** or to leave the current setting unchanged.

3.5 Alarms continued

Select Alarms

Press **UP - DOWN** until you see **'Alarms'** & press **ENTER**.

Press **ENTER** & then **DOWN** to **Select Alarms**. Press **ENTER** to view or modify selection.

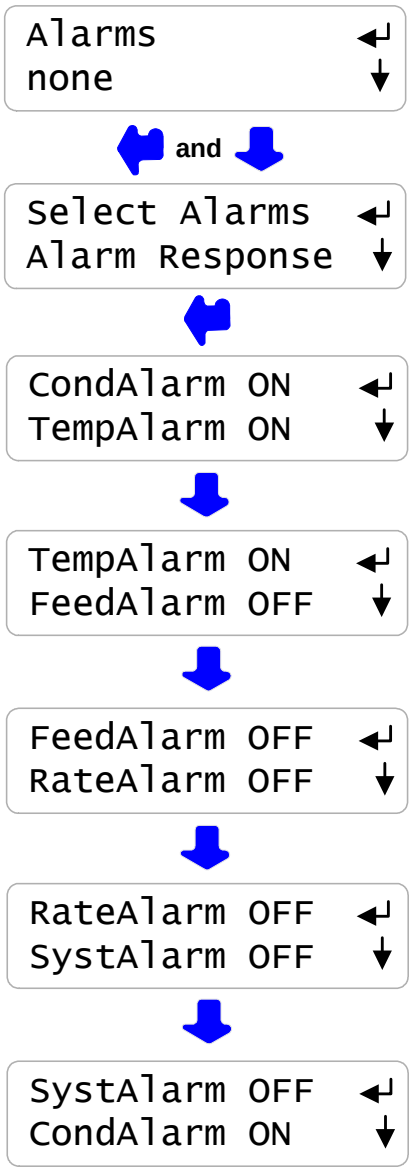
A high or low conductivity alarm will operate the alarm relay. Key **ENTER** to switch **OFF** or **DOWN** for next selection.

A high or low temperature alarm will operate the alarm relay. Key **ENTER** to switch **OFF** or **DOWN** for next selection.

A time limited inhibitor pump will NOT operate the alarm relay. Key **ENTER** to switch **ON** or **DOWN** for next selection.

A make-up water meter rate alarm will NOT operate the alarm relay. Key **ENTER** to switch **ON** or **DOWN** for next selection.

A System alarm will NOT operate the alarm relay. Key **ENTER** to switch **ON** or **DOWN** for next selection. System Alarms: refer to Section Alarms 3.7.



Sidebar:
Note: These alarm settings only control the built-in hot alarm relay that switches 120VAC. They have not effect on the dry contact 'AR' Alarm Relay option.

The controller is defaulted to both Conductivity and Temperature alarms since these faults are typically highest priority for closed loop sites.

3.6 Diagnostics

Diagnostics displays operating information from the last controller power OFF/ON. This controller has been operating for **17.4** hours from the last power OFF/ON

The time that the **Inhibitor Pump** is ON depends on conductivity setpoints, pump rate setting, loop recirculation rate and volume and make-up volume.

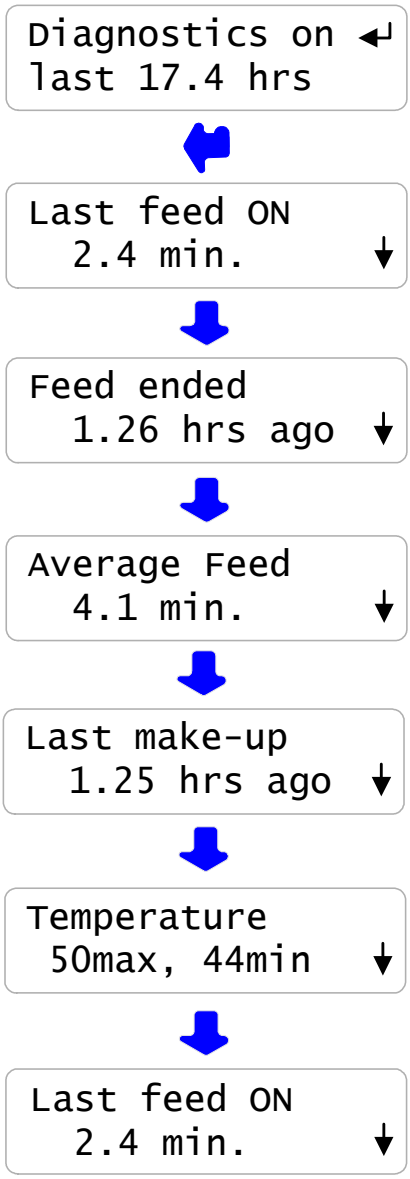
Closed loops are seldom completely closed. If you are feeding frequently or continuously then you either know why or you have an operating problem.

Average Feed is calculated over a maximum of the most recent 24 hours. Increasing **Average Feed** time may indicate increasing closed loop water loss.

If the **Inhibitor Pump** is controlled by the **Make-up**, you would see that the last **Feed Ended** when the **Last make-up** occurred.

Temperature max and **Temperature min** may vary on loop that does not re-circulate continuously.

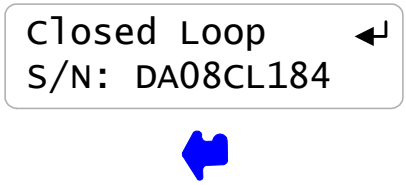
The usefulness of **Diagnostic** information varies with each site's closed loop piping, water chemistry and treatment program.



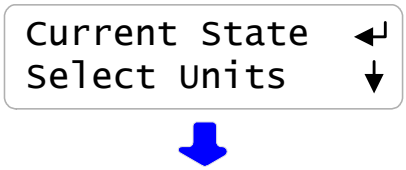
3.7 System

System Menu Options

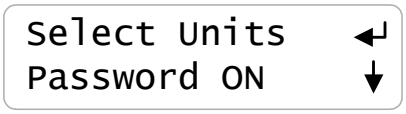
Press **EXIT** until you see the **Closed Loop**.
Press **ENTER** view System options.



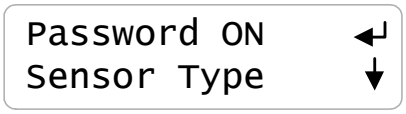
Press **ENTER** to view **Current State**
Controller diagnostics



Press **ENTER** to view or change
US or Metric units.



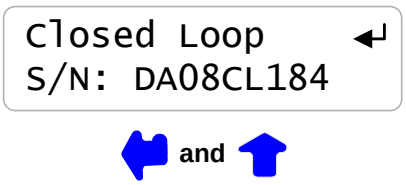
Press **ENTER** to turn ON the controller **Password**.
For **Edit Password**, turning OFF the **Password** and entering a **Password** refer to Section **3.8 Password**



Press **ENTER** to view or change the sensor type.
Controllers are shipped with correct sensor selected.

Sensor Type

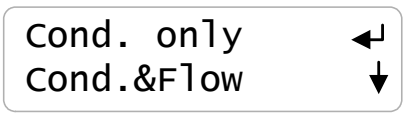
Press **EXIT** until you see the **Closed Loop**.
Press **ENTER** and **UP** to **Sensor Type**.



Press **ENTER** to view or modify the current **Sensor Type**.

The current sensor is Conductivity and Temperature only , the default sensor for hot & chilled loops.

Press **DOWN** and **ENTER** if you have installed a sensor with a built-in flowswitch. If you ordered the controller with the **CTF** option, **Cond.&Flow** is already selected.

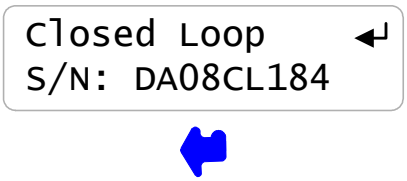


Press **EXIT** to leave selected **Sensor Type** unchanged.

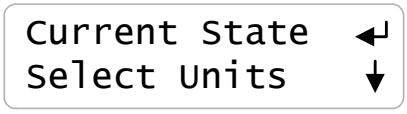
3.7 System- continued

System : Current State

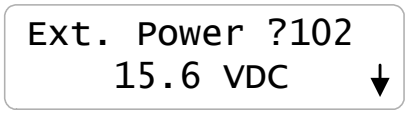
Press **EXIT** until you see '**Closed Loop**.
Press **ENTER, ENTER** view **Current State**.



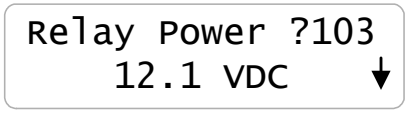
Current State displays Controller internal diagnostics



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

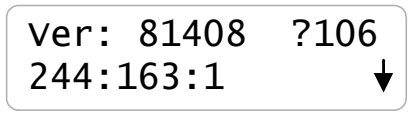


Internal power used for **Inhibitor Pump** and **Alarm** relays.
Always displays 11.8 to 12.2. Alarms on fault.

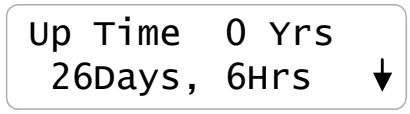


Conductivity sensor **Drive** displays, 72-76mV or 990 – 1020mV as the sensor drive auto-ranges.
Alarms and cannot measure conductivity if out of range.

Firmware Version.
Checks that user setpoints & options being saved & that the internal Clocks are operating,
The last digit tracks the 24 hour resets of the '**LB**' web server.



Time from most recent power OFF-ON
If **Up Time** is always less than 24 hours then controller AC power is being turned OFF daily.



Controller operating time from installation updated every hour.
If **Powered** time increases by 7 days every week, then the controller is continuously operating.

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.

3.7 System
continued

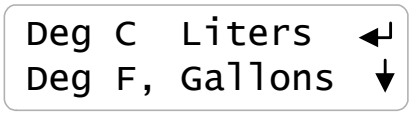
System : Select Units

Press **EXIT** until you see the '**Closed Loop'**.
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



Sidebar:
Select Units changes make-up meter units, total volume units and volume per contact units.

Temperature compensation of conductivity, switches automatically between C & F
as does the System:**Current State** display of temperature.

3.8 Password

Password is turned OFF in new controllers

Press **EXIT** until you see **Closed Loop**.

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

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

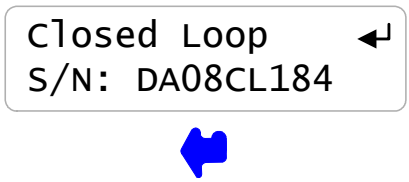
Press **UP** or **DOWN** to view the current state of the controller. Any **ENTER** key will prompt for the password, displaying the default password **123**.

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

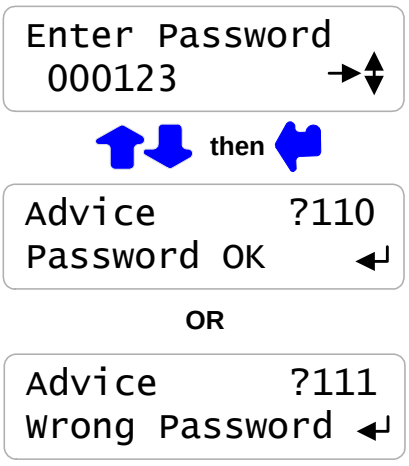
A correct password displays, **Password OK**. Press any key to start operating the controller.

Press **ENTER** to re-key an incorrect password

Turning ON Password



Password ON



OR

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.

3.6 Password
continued

Modifying the Password

Press **EXIT** until you see **Closed Loop**.
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:

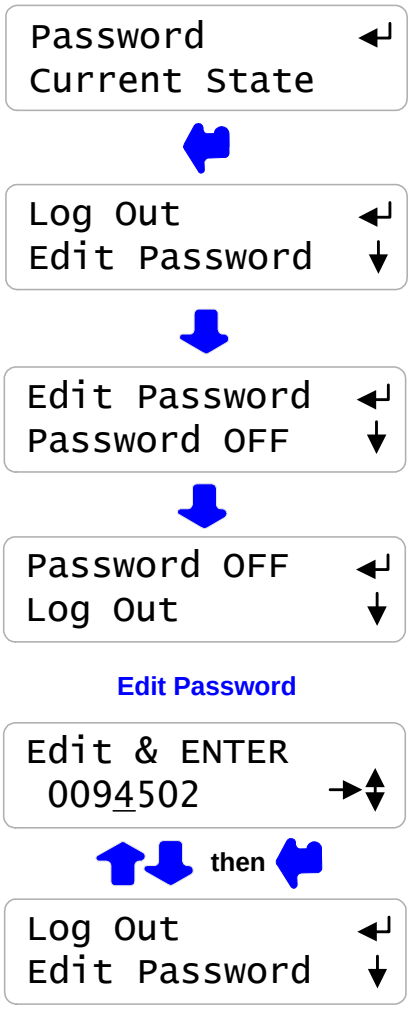
Press **ENTER** to **Log Out**.
If you forget to **Log Out**, the controller logs you out 30 minutes after the last key press and on controller power OFF/ON.

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

Press **DOWN** to **Password OFF**.
Pressing **ENTER** turns OFF **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** from Aquatrac.

The controller password is '**123**' after you key in the **Reset Password** in response to the password prompt.

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 Inhibitor Pump. Make-up water or Pump rate & stroke may have changed. Higher temperatures or loop water loss may be extending inhibitor ON times. A low conductivity may indicate an inhibitor pump fault, loss of prime, unplugged, out of chemical…. A low conductivity may also indicate a high rate of water loss. A high conductivity may indicate a siphoning feed.
	Scan Sensors, Pump ON time and Make-up Meter	If there's a make-up meter, you'd expect daily volume to reflect how closed your closed loop is. High make-up may indicate a leak, open drain valve or open cross-over valve. No make-up may be typical for your loop so any measured make-up indicates a fault. **Alarm Relay Monitored?** If you have connected the controller powered alarm relay into your site DCS (Distributed Control System) or EMS (Energy Management System), and configured the alarm setpoints for likely or common loop faults, there's little need for a daily check. Ensure you've configured the alarm relay to alarm on a loss of controller power.

Frequency	Activity	Method
Monthly or Quarterly	Verify Conductivity	Sample the loop water conductivity. Verify controller matches the sample +/-25uS Conductivity sensors should not drift or require cleaning. Closed loops conductivity sensors are not usually subject to fouling. Adjust your maintenance interval to target those loops that have demonstrated operational problems.
	Note Make-up Volume	Make-up volumes will vary widely depending on how closed your loop is & understandably, if you have a meter installed.
	Verify Feed	Visually inspect sample-injection piping for leaking fittings, feed injection point and sensor entries. Tightly closed loops benefit from a check to ensure the inhibitor pump is primed and operational.
	Verify Interlock	If you are using an interlock or flowswitch, valve off the sample line OR have the DCS switch open the interlocking contact set & verify that the controller **Operating** display shows OFF.

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

4.2 Spare Parts

4.2.1 Line Fuse

Protects	Rating / Type	Manufacturer – Vendor
Controller, Pump and Hot , 120VAC Alarm	5 Amps @ 115VAC 5mm x 20mm, Fast Acting	Littlelfuse, Type 217, 250VAC Digikey Part# F953-ND www.digikey.com 1-800-344-4539

4.2.2 Controller Parts

Part#	Description
Fuses-T	120VAC Fuse Kit, 10 x 5A Controller Fuses,
A261205	Conductivity-Temperature sensor

On-Line Help

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

Users Manual

Download **microCL_User** from www.aquatac.com

Appendix A: INSTALL

A.1 PLUMBING

Typical sample-chemical injection piping operates at 40-60psi and is plumbed in solvent welded SCH80 PVC (chilled loops) or carbon steel (hot loops).
Sample piping is usually fed from the discharge side of the re-circulation pump, returning to either the suction side of the pump.
Ensure that the sample piping flow exceeds 1 GPM and that the sample stream represents the closed water.
'Y' strainers in the sample loop are not recommended unless the debris will mechanically damage the conductivity sensor. Strainer filters are usually the first location to plug, turning OFF pumps and the bleed solenoid on no flow.
NEW CONSTRUCTION: After pressure testing, valve OFF the sample piping during post-construction re-circulation piping cleaning and passivation.

A.2 SENSOR

Conductivity sensors may be installed in any orientation, which allows them to be serviced.
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 several hundred feet using multiple pair AWG22 cable.
Always splice sensor wires in an electrical fitting to allow both inspection and sensor replacement.
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 inhibitor downstream of the conductivity sensor as recommended by the chemical supplier.

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 sensor, controller, chemical pump and drum is as close together as access allows. You'll be able to see where all the wires, plugs and tubing goes, watch the pump turn ON as you prime, grab a sample to calibrate conductivity…
If you have the space; locate sample piping on the left, pump & chemical drum 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 LCD 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 an '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 -Browser, 4-20mA Output OR Alarm Relay option card.

Analog – Digital I/O	Rating - Detail	Notes
Conductivity	1 Temperature Compensated conductivity sensor. Displays 1uS resolution. Rated 125psi, 35-120F,	Autoranging from 100uS to 10000uS.
Water Meter Operating / Interlock	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	1 SPDT, Inhibitor Pump or Motorized Valve 1 SPST, Hot Alarm Relay	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.	Alarms on open 4-20mA 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 Internet Explorer & Mozilla Firefox browsers. XML real time controller data	User set Static IP, defaulted to 10.10.6.101. DHCP available on request. Fixed, viewable MAC.

Closed Loop: Water Treatment Controller

Controls	Rating – Detail	Notes
Inhibitor Pump	Controls: Conductivity & Water Meter. Feed limit timer, auto-reset every 24 hours.	Reverse conductivity default
Hot Alarm Relay	Alarms on: Conductivity, Temperature, High Make-up Rate, Feed Limit, System fault. User Selects which faults trip relay.	Default: alarm on conductivity & temperature User selects action of hot alarm relay on Alarm. OFF on Alarm OR 120VAC on Alarm
Operating / Interlock	Inhibitor Pump OFF when operating contact set opens.	Default: Jumpered ON

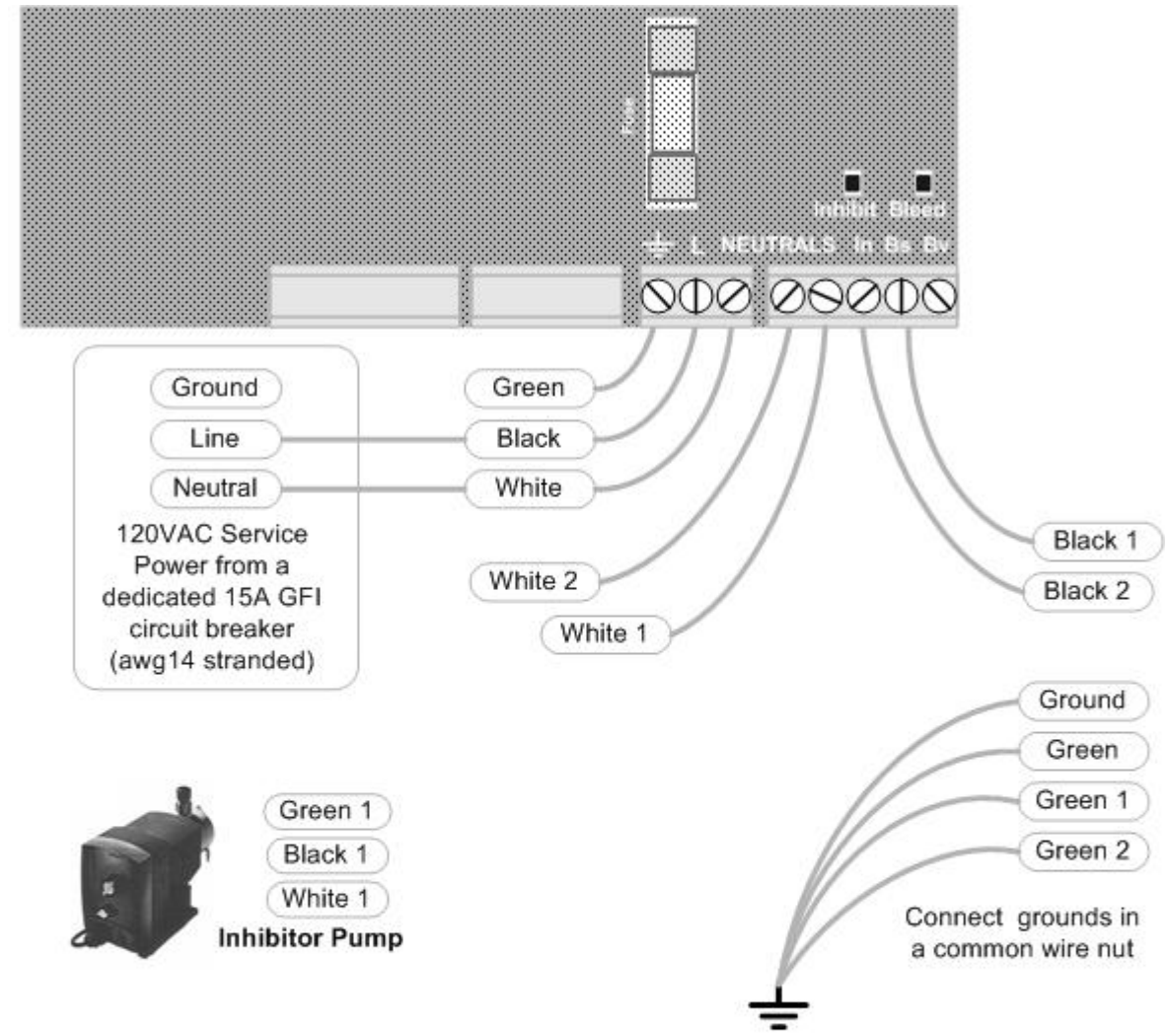
System	Rating - Detail	Notes
Controller Configuration	User settings and configuration written on silicon.	Makes user configuration the factory default.

Electrical	Rating - Detail	Notes
AC Input	115 VAC, 50/60Hz,	
Fusing	5 Amps @ 115VAC	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, ”5.9W x ”5.9H x 3.5”D 150mmW x150mm H x 90mm D	Nominal dimensions, excluding entry fittings and flexible conduit. Enclosure door hinged left. Allow 8”, right for door opening Allow 18”, below for cable access.

Appendix C: HARDWIRING

Controller are shipped with pre-wired AC power cord & Inhibitor Pump socket



WARNING:

1. Use multiple strand, copper AC power wiring. Do not use solid conductors.

2. Pump and Solenoid Outputs are fused at 5 Ams total. AC wiring must be minimum AWG18, rated 300V

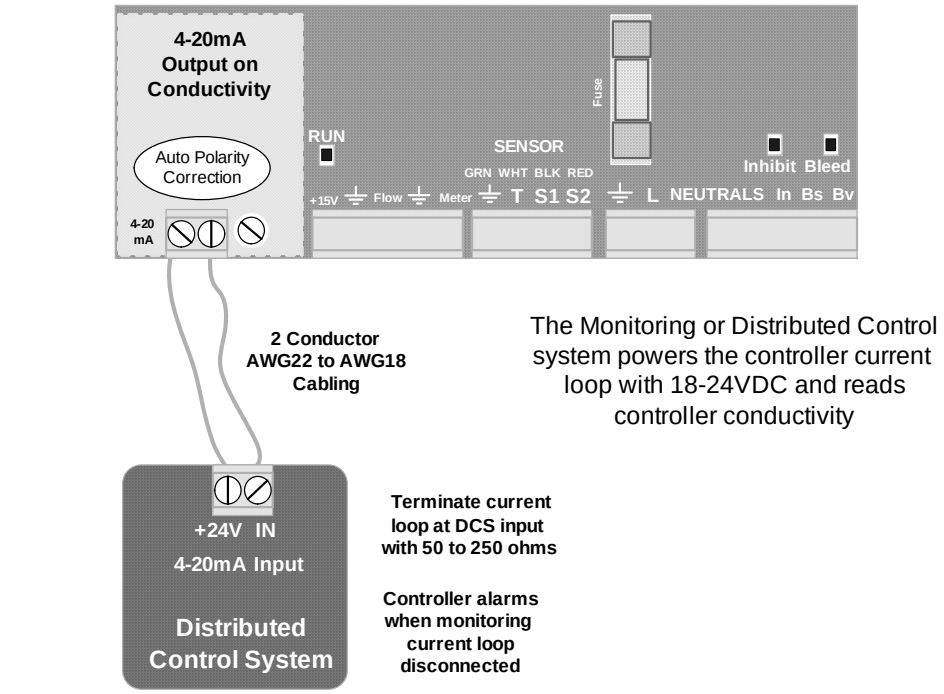
3. Do not exceed AWG14.

Appendix D: 4-20mA Output Option

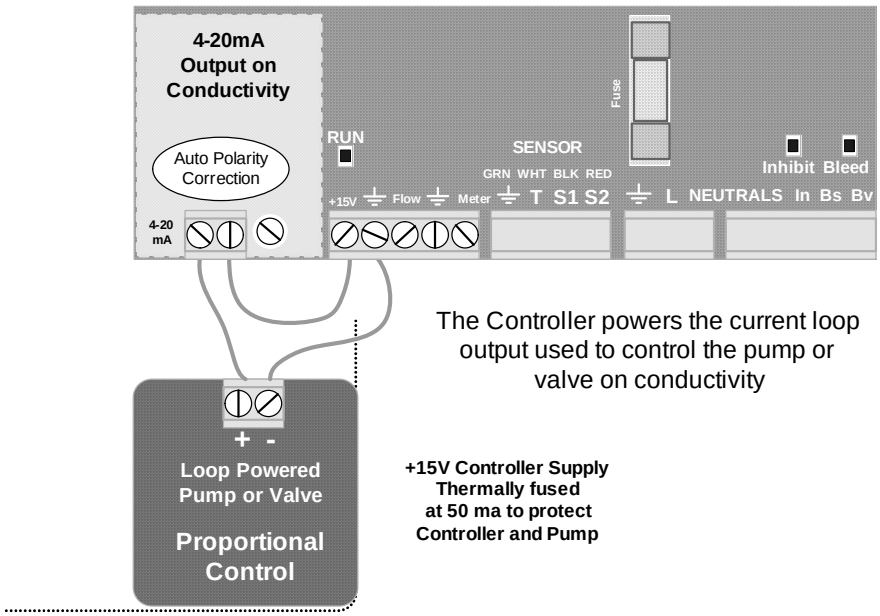
The optional 4-20mA output on conductivity is DC isolated from the controller & may be either powered by the load or by the controller DC supply. The 4-20mA output is auto-polarity correcting.

D1. WIRING

LOAD POWERED 4-20mA Output



CONTROLLER POWERED 4-20mA Output



Appendix D: 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

```
4-20mA Output   ↵
15.4mA
```

OR

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

```
4-20mA Output   ↵
Disconnected!
```

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

```
Select Span     ↵
Trim Zero       ↓
```

Press ENTER @ Trim Zero to calibrate the 4mA level

```
Trim Zero       ↵
Trim Span       ↓
```

Press ENTER @ Trim Span to calibrate the 20mA level

```
Trim Span       ↵
Select Span     ↓
```

View & Adjust Span

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

```
Select Span     ↵
Trim Zero       ↓
```

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

```
 4mA=   100uS   ↵
20mA=  5000uS   ↓
```

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

```
Edit & ENTER
 4mA=  2500uS   →↕
```

ENTER updates the Span.
EXIT leaves Span unchanged

then

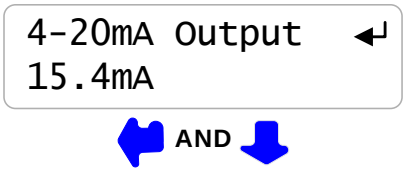
```
 4mA=  2500uS   ↵
20mA=  5000uS   ↓
```

Appendix D: 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.

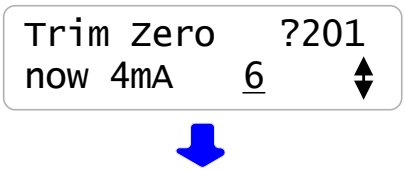
Press ENTER & then DOWN at 4-20mA Output



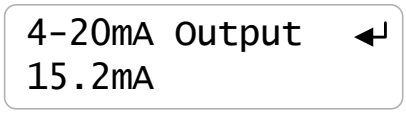
Press ENTER at Trim Zero to adjust the 4mA level.

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

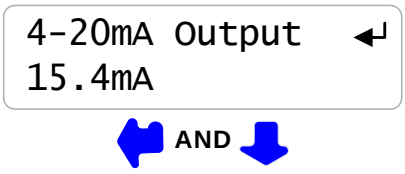
Press UP or DOWN until you read 4mA on the milli-ammeter.



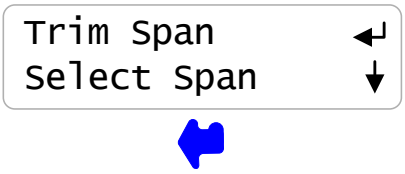
Press ENTER to view the output current and verify that the milli-ammeter reads the same current.



Press ENTER & then DOWN at 4-20mA Output

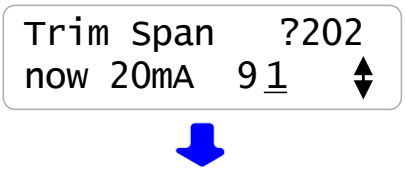


Press ENTER at Trim Span to adjust the 20mA level.

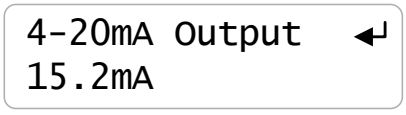


Connect a DC milli-ammeter in series with either of the current loop wires.

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



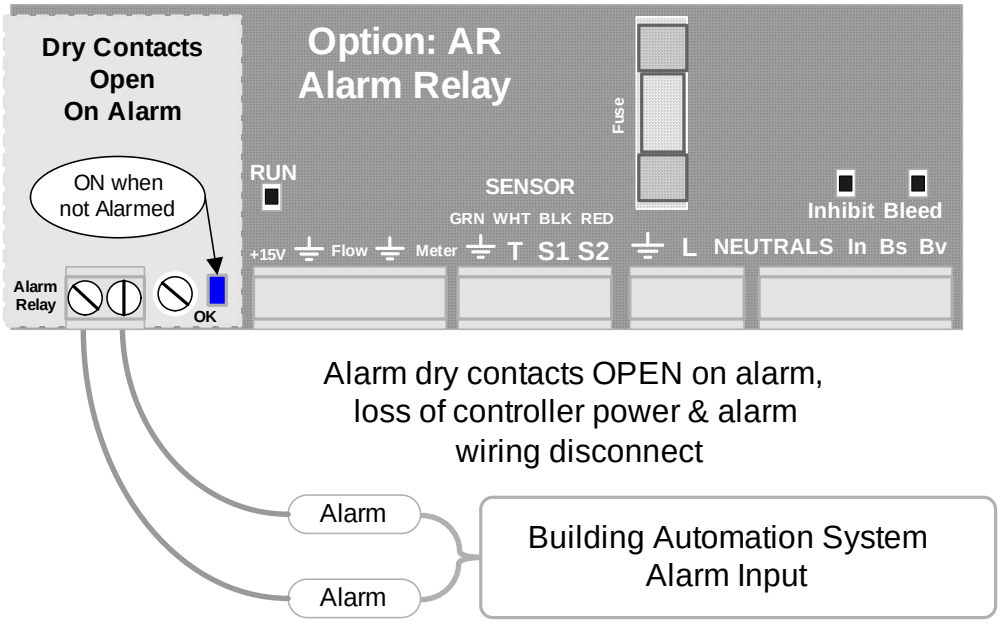
Press ENTER to view the output current and verify that the milli-ammeter reads the same current.



Appendix E: Alarm Relay Option

E.1 WIRING ALARM CONTACTS

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



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: LAN - Browser Option

Download TACO_LAN manual from www.aquatrac.com

Do not connect the controller to the site LAN without permission from the site IT staff.

The factory default IP is 10.10.6.101.
The controller micro-server uses a static IP. Set the controller IP to the IP assigned by the site IP staff before connecting the controller to the site LAN.

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 TACO_LAN manual.