microFlex

Water Treatment Controller
For Cooling Towers

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

Controls the Bleed Solenoid
and Inhibitor Pump

Part No. M02ACOIN

CONTENTS

Safety

Electrical Shock Hazard

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

Unplug the controller before opening the enclosure door.

USER WARNING : CAUTION

This Cooling Tower Water Treatment Controller operates a 120VAC bleed solenoid & chemical feed pump 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 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 bleed solenoid and inhibitor feed setpoints that will not be applicable to your cooling tower.

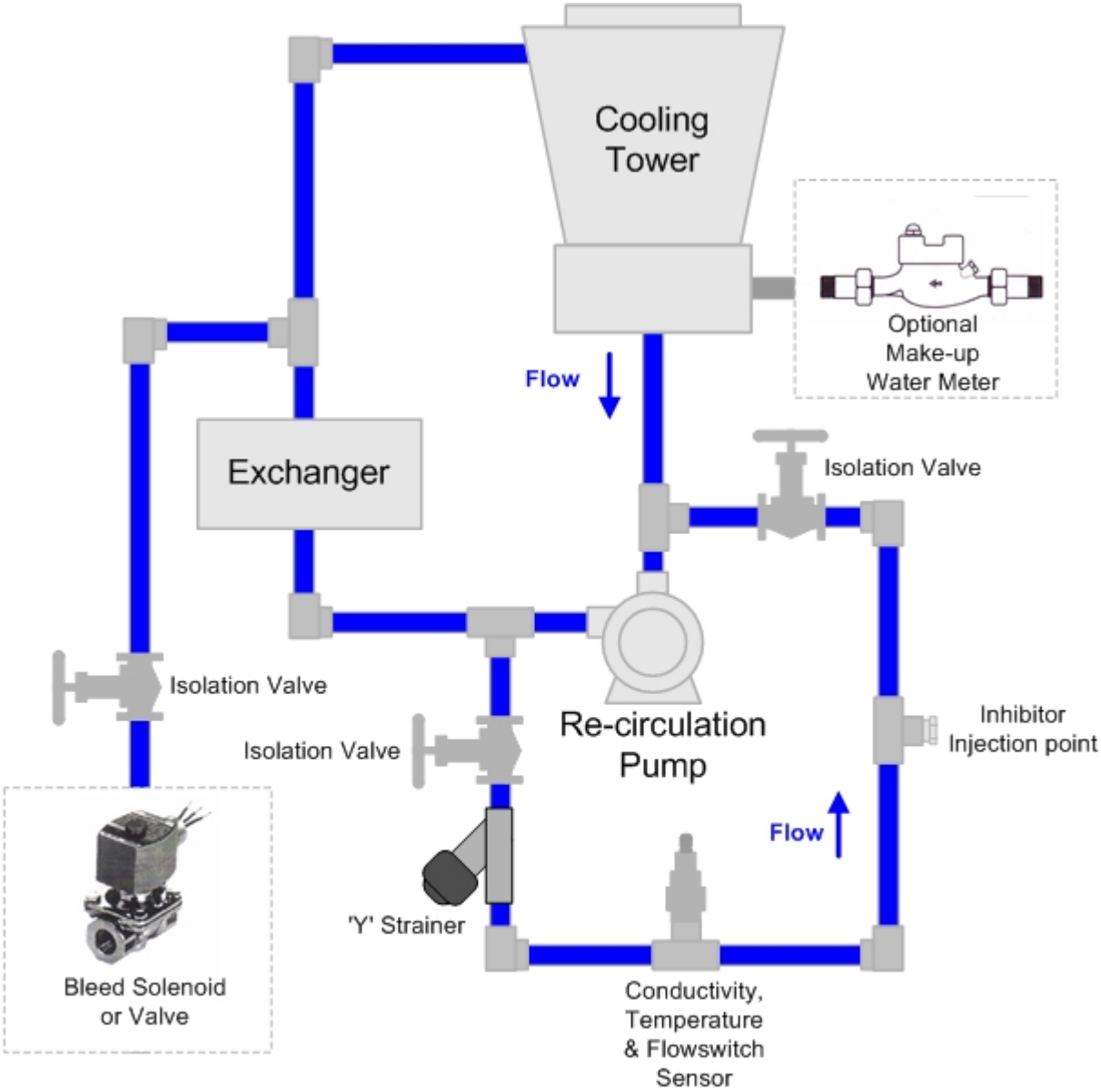
Select control modes, adjust setpoints and set pump timing for your site and its water treatment program.

1. INSTALLATION

1.1 Sample Piping

The **CO-IN** Controller includes a conductivity- temperature-flowswitch sensor pre-wired to the controller and a ¾' NPT PVC entry fitting.

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



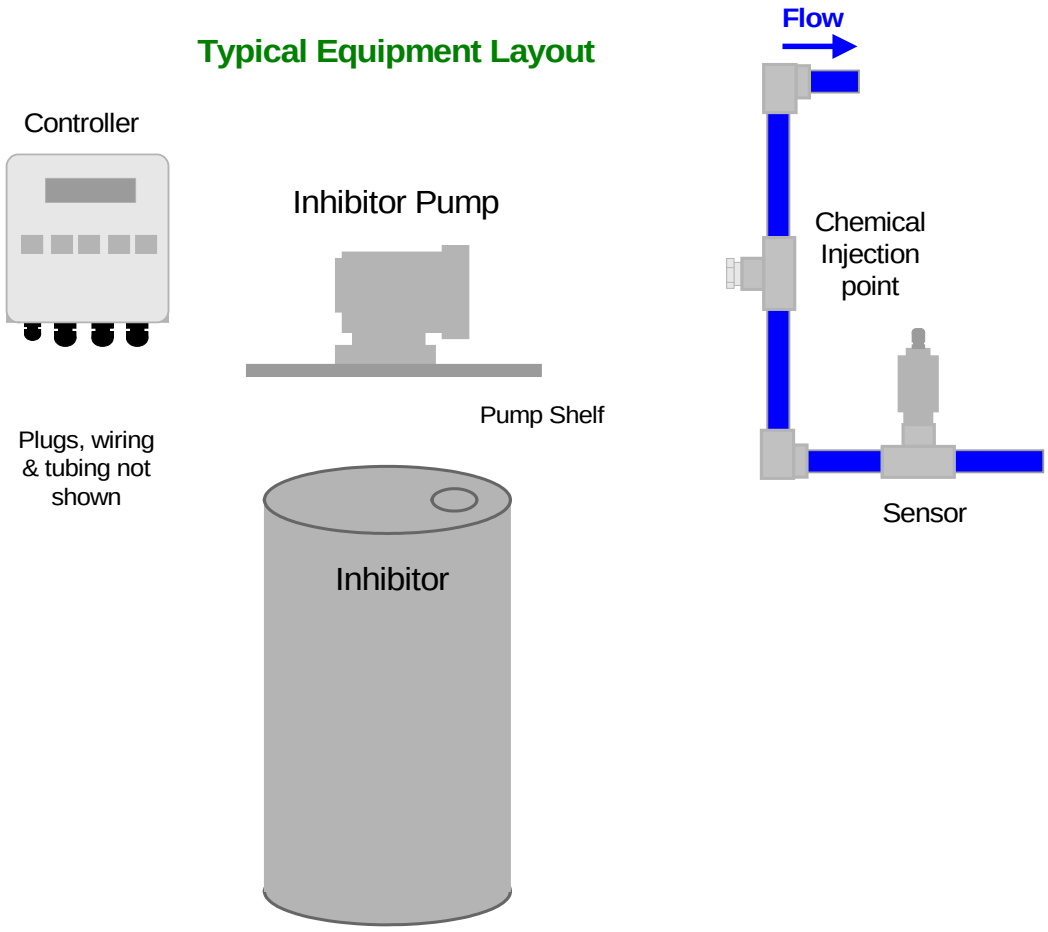
Typical Installation Piping

Your installation may not include a make-up meter. Smaller towers may install the conductivity sensor in the tower re-circulation line.

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

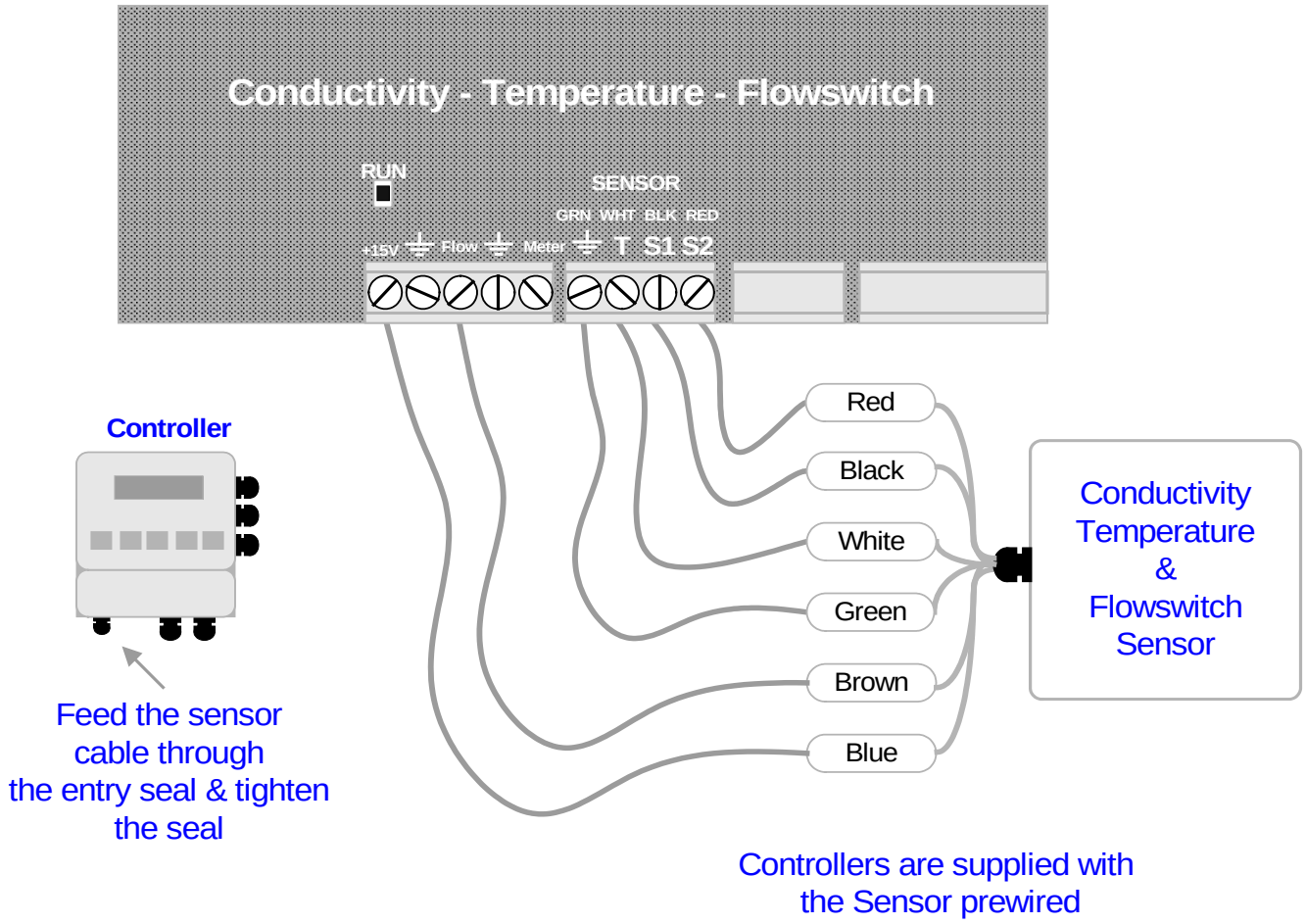


Although sensor cables and pump tubing may be extended, ease of servicing occurs when water treatment components are located in the same area.

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

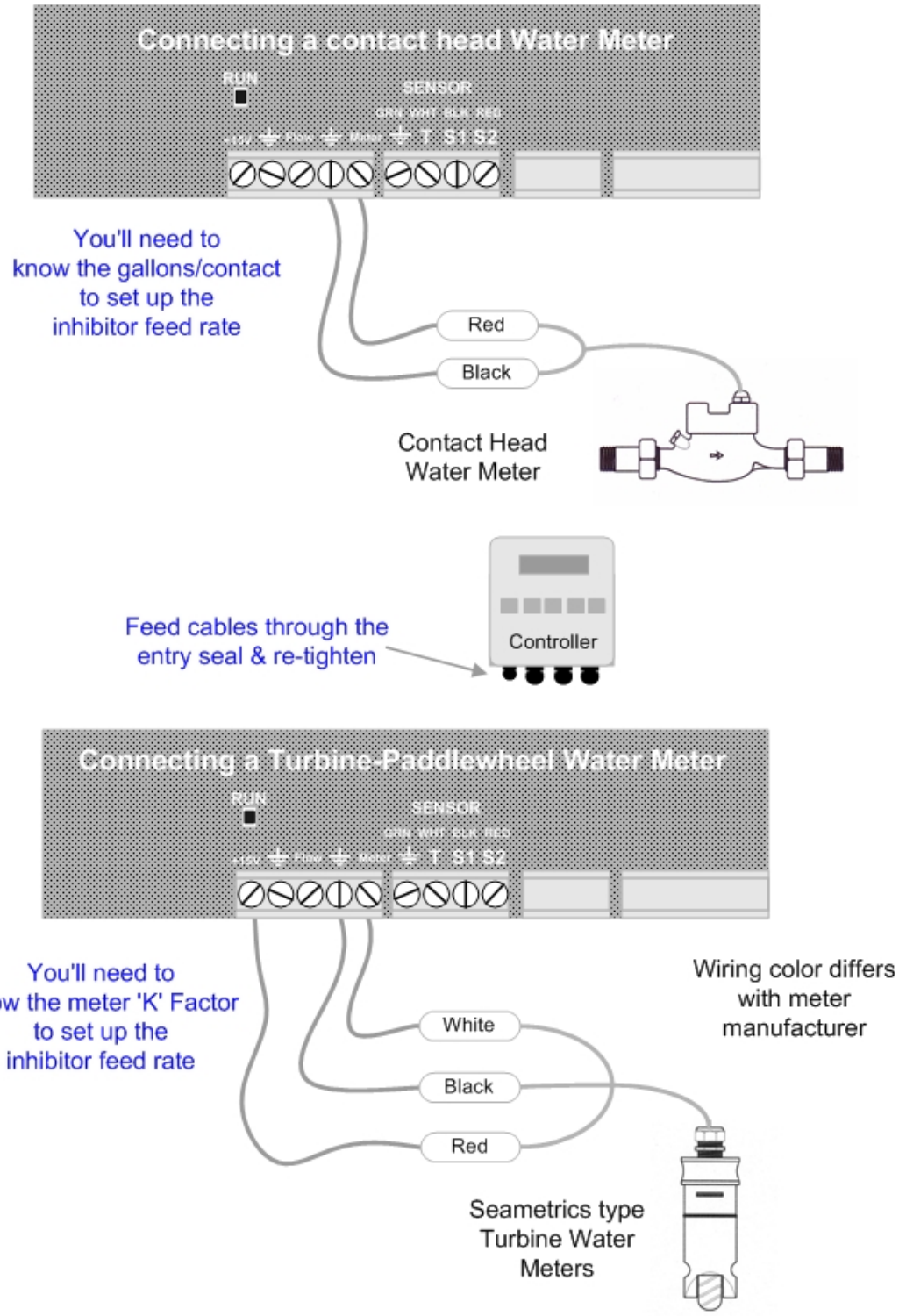
1.3 Sensors: Conductivity-Flowswitch

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.

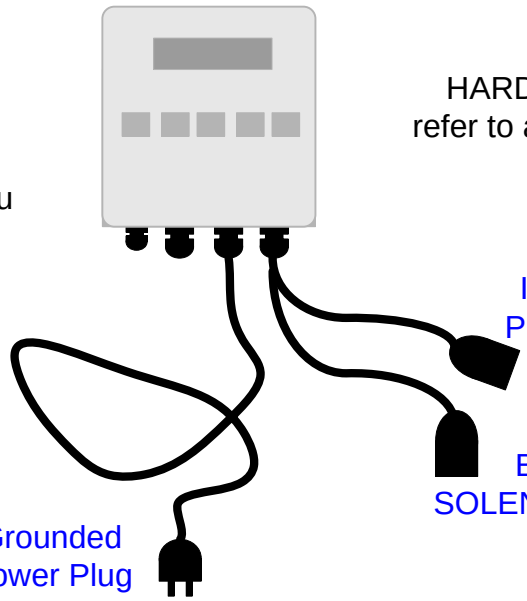


Do not install meter cabling in the same conduit at AC power wiring.

1.5 Inhibitor Pump & Bleed Solenoid

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

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



START-UP
BEFORE you plug-in pump and bleed solenoid.

Plug-in the controller.

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

Verify that the sensors are 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 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 & to Turn ON Password.

```
Tower Control  ↵
S/N: D905CF042
```

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 in the current 24 hours.

Press **ENTER** for Bleed Setpoints, Mode, Test and Current State.

```
Bleed Solenoid ↵
ON  10.1 hrs/day
```

Water meter measured volume in the current24 hour period.

Press **ENTER** to Install, Select type, View on-line total & days on-line.

```
12.4hr Make-up ↵
    10450  G
```

Inhibitor Pump ON or OFF and ON time in the current 24 hours.

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

```
Inhibitor Pump ↵
ON 108.2 min/day
```

2.1 Power-up Display & Keypad
continued

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

```
Flowswitch
ON  22.6 hrs/day
```

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

```
Diagnostics on
last 22.6 hrs
```

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

```
Tower Control  ↵
S/N: D041T0486
```

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

Alarm Relay, '**AR**' 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**.

```
Bleed Solenoid ↵
ON  8.7 hrs/day
```

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

```
Setpoints      ↵
Bleed Mode     ↓
```

Displays current bleed setpoints,
Varies with Bleed Mode

```
Turn ON  1150  ↵
TurnOFF  1140  ↓
```

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

```
Edit & Enter
Turn ON  1180 →↕
```

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

then

Press **ENTER**, displays current setpoints.

```
Turn ON  1180  ↵
TurnOFF  1140  ↓
```

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

Setpoints for Bleed on **Meter Control** bleed mode

```
Measure  100 G ↵
Bleed   20 sec ↓
```

Water Meter Control

Setpoints for **Percentage Time** bleed mode

```
Percentage Time
 15% each 5min ↵
```

% Time Control

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 operating deadband exceeds 10uS. The sump float mechanical deadband is added to the controller deadband.

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**.

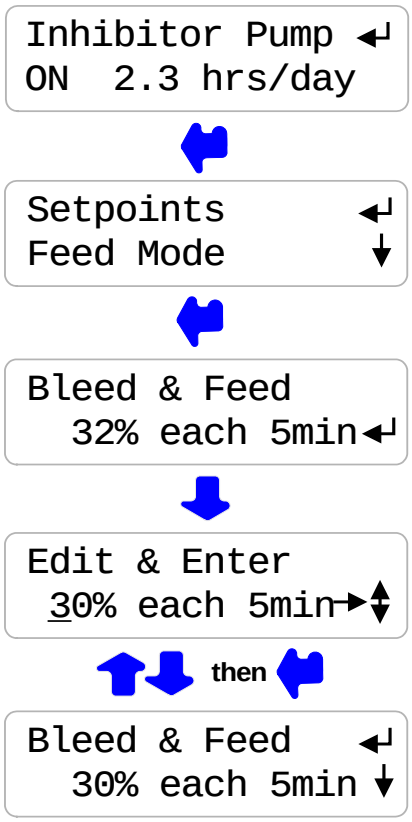
Press **ENTER** to view or adjust **Setpoints.**

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 **ENTER** to execute or
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 limit is 120 Minutes in a 24 hour period.

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

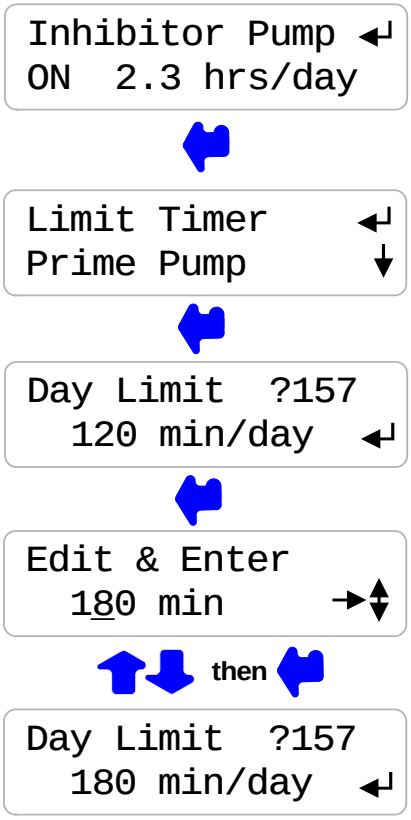
Press **DOWN** until **Limit Timer**.
Press **ENTER** to view or adjust **Limit Timer.**

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

Press **ENTER** adjust **Feed Limit**,

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

Press **ENTER**, displays the current limit, 180 minutes in 24 hours.



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

2.4 Verify Conductivity Sensor

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

Verify Temperature

Press **UP** or **DOWN** until you see **Tower Control** . Press ENTER.

```
Tower Control  ↵
S/N: D905CF042
```

Press **ENTER** & then press **ENTER** @ **Current State** to view temperature at the conductivity sensor.

```
Current State  ↵
Select Units   ↓
```

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

```
Temperature ?101
 87F Type=CTF   ↓
```

'**Fault**' automatically removes conductivity temperature compensation. **Type=CTF** indicates a **C**onductivity-**T**emperature-**F**lowswitch sensor
Key **EXIT** twice to return to Serial Number

Calibrate Conductivity

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

```
Conductivity   ↵
    1425 uS
```

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

```
Calibrate      ↵
Alarms         ↓
```

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

```
Edit & ENTER
    1883 uS   →↕
```

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.

```
Advice      ?141
Fails Calibrate↵
```

?141 indexes more explanation @ www.prominentcontroller.com

Displays the current, calibrated conductivity.

```
Conductivity   ↵
    1883 uS
```

2.5 Check Flowswitch & Install Water Meter

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

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

NOTE: An **OFF** flowswitch stops the **Inhibitor Pump** and the **Bleed Solenoid**. The flowswitch can be bypassed by jumpering the Flow terminal to ground.

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.

Flowswitch

```
Flowswitch
ON  22.6 hrs/day
```

Contact Head Watermeter

```
23.2 hr Make-up↵
    10450  G
```

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

```
Contact Head    ↵
Paddlewheel     ↓
```

```
G/Contact
 100            ↵
```

```
Edit & ENTER
  50            →↕
```

then

```
Contact Head    ↵
Paddlewheel     ↓
```

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

2.5 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 –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: 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.

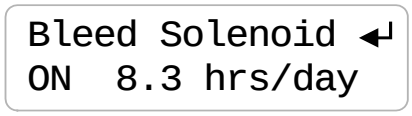
WARNING: Verify paddlewheel meters immediately and disconnect if not verified. Mis-wired paddlewheel meters will fail the meter Hall Effect sensor.

2.6 Plug-in Pump and Bleed Solenoid

Sections 2.1 to 2.5 adjust setpoints and verify sensors. We're now ready for the bleed solenoid and the inhibitor pump, verifying each one as it's plugged in.

Bleed Solenoid

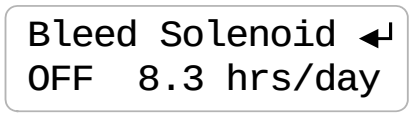
Plug the bleed solenoid into the top, right plug. Press **UP** or **DOWN** to view **Bleed Solenoid**.



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

OR

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

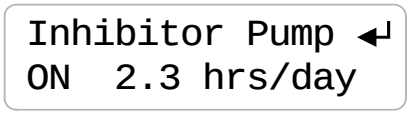


If **OFF**, press **ENTER** & **DOWN** to **Test Bleed**. Press **ENTER** and the **Bleed Solenoid** & **Bleed** light will turn ON for 5 minutes

then

Inhibitor Pump

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



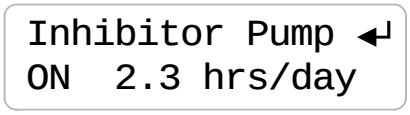
If **ON**, verify that the green **Inhibit** light on the inside of the enclosure is ON.

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

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

then

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



Sidebar: The **Bleed Solenoid** and Pump will not turn ON unless the **Flowswitch** is ON. The internal **Bleed** & **Inhibit** lights will not turn ON unless the **Flowswitch** is ON. An **Inhibitor Pump** 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 Check Controls

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

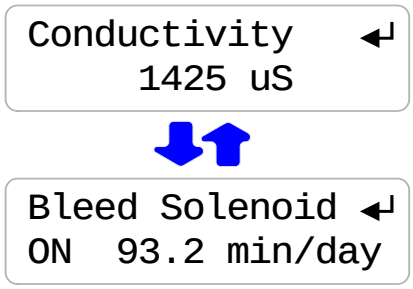
Conductivity & Bleed

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 Bleed controlled by a Make-up Meter or Percentage time differs.



Water Meter or Bleed & Inhibitor Pump

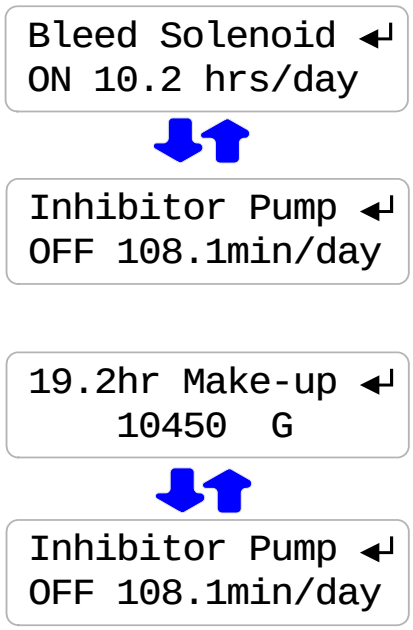
If the Inhibitor feed mode is set to '**Bleed & Feed**', the **Inhibitor Pump** will turn ON when the Bleed turns ON.

If the % of each 5 minutes is set to less than 100%, the **Inhibitor Pump** will turn ON & OFF while the Bleed is 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 **Inhibitor Pump** will not turn ON unless the **Flowswitch** is ON.
The **Inhibitor Pump** turns OFF if the Feed Limit 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 **2.4 Verify Conductivity Sensor**

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

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

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

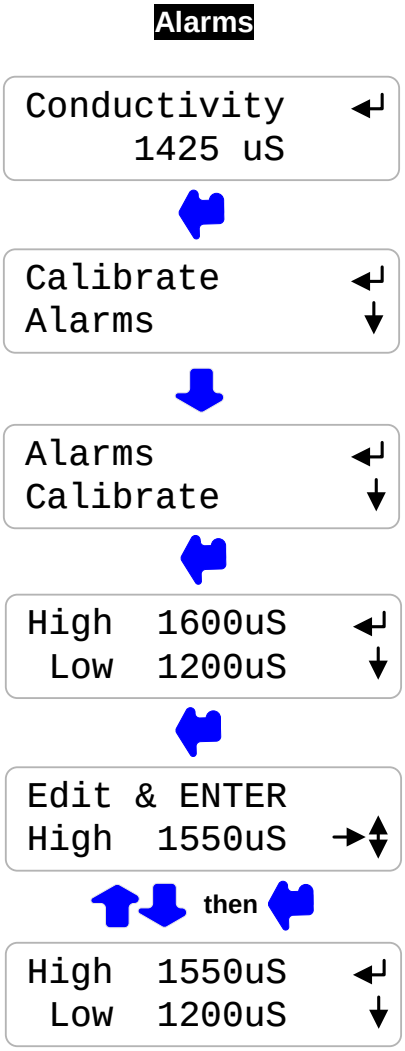
Press **ENTER** to adjust the **High** Alarm or **DOWN** & **ENTER** to adjust the **Low** Alarm

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.

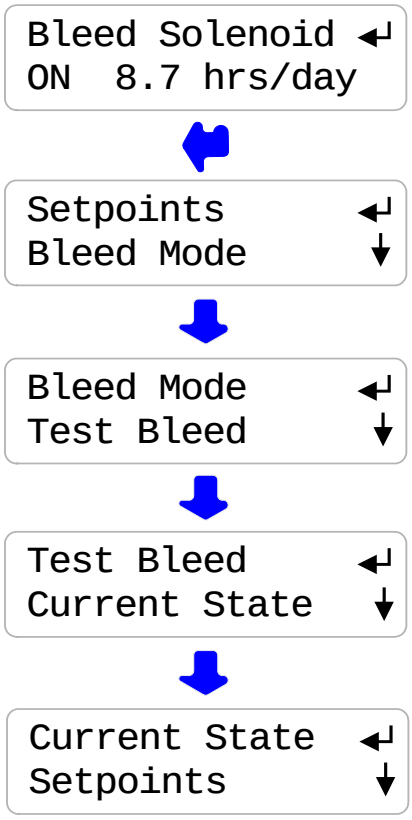


Sidebar: A Conductivity alarm may occur when the tower shuts down and drains the sample line.

3.2 Bleed Controls

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

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



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
the **Bleed Solenoid** for 5 minutes.
'**Alarms**', **ENTER** and '**Clear Alarms**' ,
ENTER ends the Test.

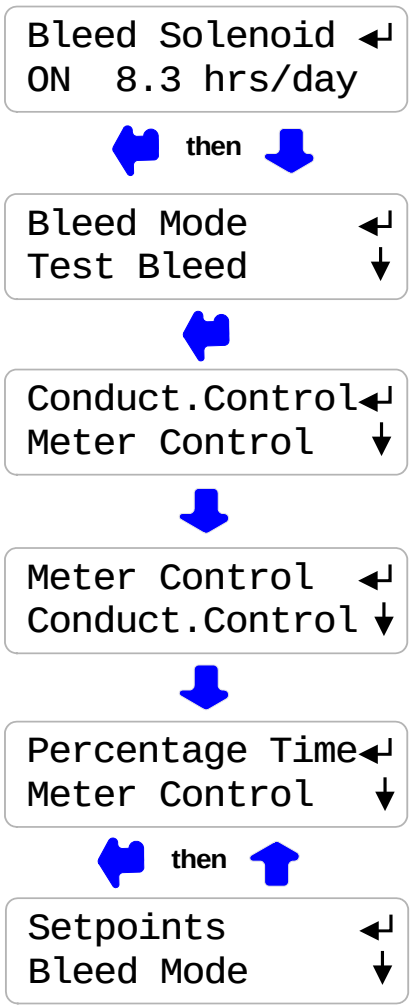
Press **ENTER** @ **Current State** to view control status.
Display varies with **Bleed Mode.**

Sidebar: Test Bleed will not turn ON the **Bleed Solenoid** if the **Flowswitch** is OFF.

3.2 Bleed Controls
Continued

Bleed Solenoid Bleed Modes

Press **ENTER** then **DOWN** @ **Bleed Solenoid**



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

Most cooling towers operate with **Conductivity Control**. **Bleed Solenoid** opens at **TurnON** conductivity setpoint and closes at the **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

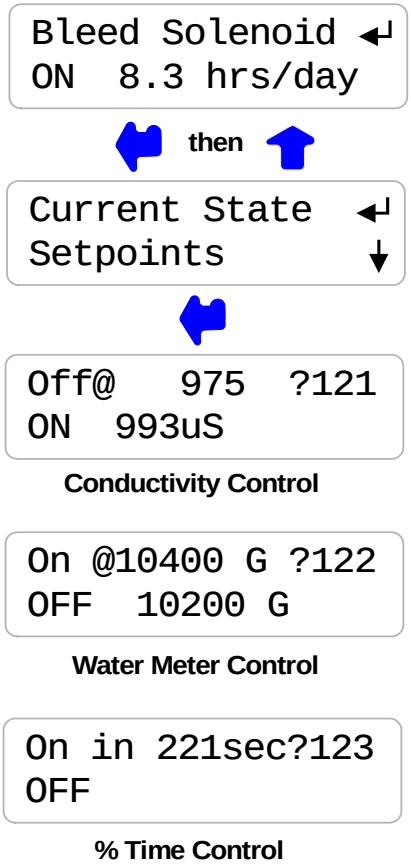
Press **ENTER** then **UP** @ **Bleed Solenoid**.

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

Conductivity Control
If **ON**, displays TurnOFF setpoint, **975.**
& current conductivity,**993.**
If **OFF**, displays TurnOFF setpoint,**1000.**
& current conductivity,**993.**

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

Percentage Time Control
If **ON**, displays **Owes 41 sec ?123**
& **ON ENTER=Stop**
If **OFF**, displays seconds to turn ON,



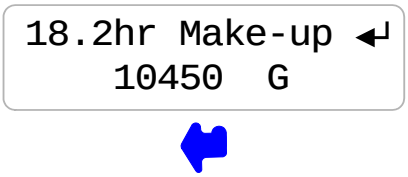
HELP: ?121,122 & **?123** and other help numbers display wherever more explanation is available at www.prominentcontroller.com.

The **ON ENTER=Stop** option ends the current bleed cycle or %Time ON period. Control resumes when Make-up volume is measured if Water Meter Control or within 5 minutes if Percentage Time Control.

3.3 Make-up Meter

Meter type selection & installation detailed in Section **2.5 Check Flowswitch & Install Water Meter**

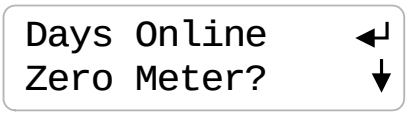
Press **UP - DOWN** until you see **'Make-up'** & press **ENTE**R .



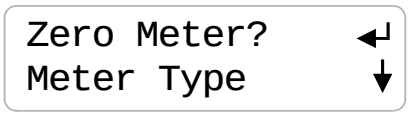
Press **ENTER** to view current type or to select **Contact Head** or **Paddlewheel** water meter.

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

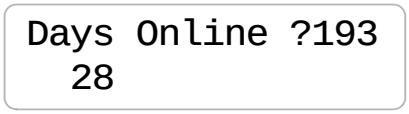


Press **ENTER** to reset **Year-to-date**, **Days OnLine** and 24 hr Make-up to zero.
Warning: Cannot Undo



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

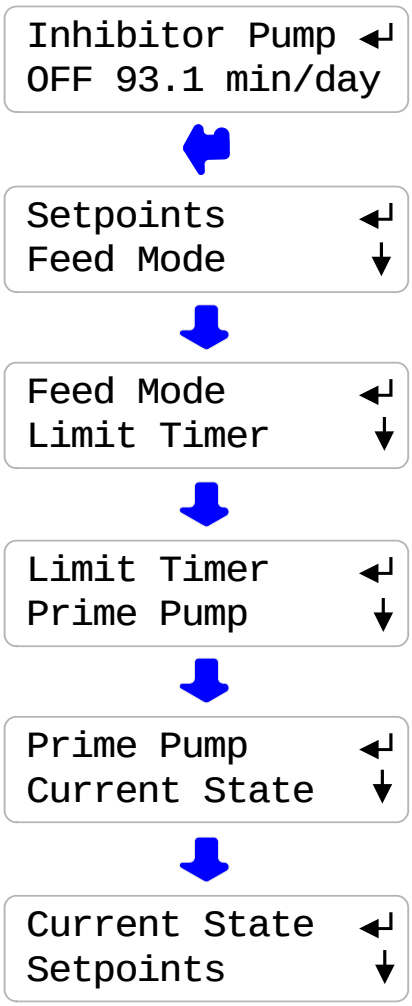
Sidebar: Year-to-date divided by Days OnLine is average usage, a figure of merit for a tower tonnage.

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

3.4 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** with time ON 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 **Bleed & Feed**, **Bleed then Feed**, **Percentage Time** OR **Feed on Volume**.

Press **ENTER** to set maximum feed minutes in a 24 hour period.

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**.

Sidebar: Prime Pump will not turn ON the **Inhibitor 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.

3.4 Inhibitor Controls
Continued

Inhibitor Pump Feed Modes

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

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

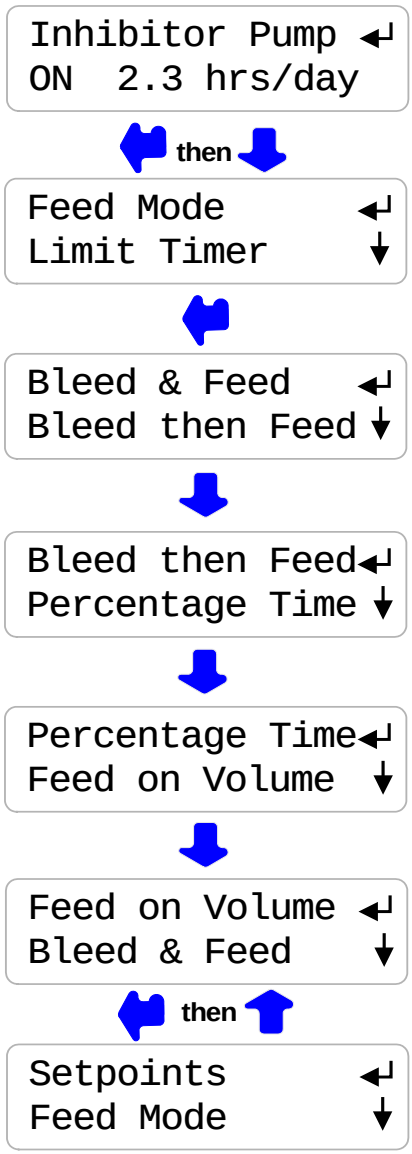
Bleed & Feed Mode
Inhibitor Pump turns ON when **Bleed Solenoid** ON. Pump switches ON & OFF during bleed at user set % of 5 minutes

Bleed then Feed Mode
Inhibitor Pump turns ON after **Bleed Solenoid** turns OFF. Pump ON for user set % of Bleed time

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

Water Meter Mode
Feed on Volume 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 8 seconds.

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

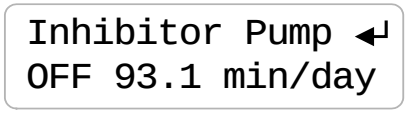


Sidebar: Bleed & Feed is used on bleed limited towers where the bleed solenoid is ON for more than 50% of the time.
Bleed then Feed is used on towers which don't have a make-up water meter; typically reducing inhibitor usage over **Bleed & Feed** since you are not pumping inhibitor with the Bleed ON.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

3.4 Inhibitor Controls
Continued

Current State of the Inhibitor Pump Control

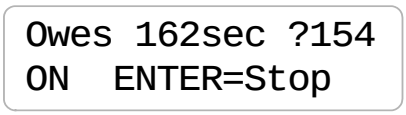
Press **ENTER** then **UP** @ **Inhibitor Pump**.



then

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

Bleed & Feed Mode
If **Bleed Solenoid** is ON: displays **Owes 233sec ?154**
OR **On in 86sec ?150**
If the **Bleed Solenoid** is OFF: displays **Bleed Off ?150**



Bleed & Feed

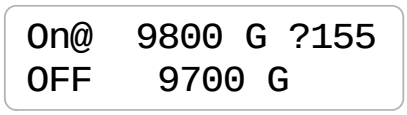
Bleed then Feed Mode
If **ON**, displays **Owes 101 sec ?150**
If **OFF**, displays '**Bleed Off**'

Bleed then Feed

Percentage Time Mode
If **ON**, displays **Owes 41 sec ?156**
If **OFF**, displays seconds to turn ON,

Percentage Time

Water Meter Mode
If **ON**, displays **Owes 38 sec ?154**
If **OFF**, displays turn-on meter volume, **9800**
& current meter volume **9700**



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 Solenoid** turns OFF.
ON ENTER=Stop ends the current **Feed on Volume** cycle or %Time ON period.

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

3.5 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 Bleed Solenoid is open depends on sump volume, load and conductivity setpoints.

An operating cooling tower would typically bleed every 30 minutes to every two hours, depending on setpoints, load and make-up float operation.

Average Bleed is calculated over a maximum of the most recent 24 hours. Increasing **Average Bleed** time may indicate a change in make-up chemistry or a restricted bleed or a higher thermal load.

Pump ON time verifies setpoints and feed mode selection. For example: If you are feeding '**Bleed then Feed**' at 25% of bleed time & the **Last bleed ON** = **21.5** min then **Last Feed ON** = **32** sec.

If the **Inhibitor Pump** is controlled by the **Bleed Solenoid**, you would see that the last **Feed Ended** when the **Bleed Ended**.

If the **Inhibitor Pump** is controlled by the **Make-up**, you would see that the last **Feed Ended** when the **Last make-up**. occurred
If the **Last make-up** occurred several days ago, there's understandably a metering problem

Temperature max may influence biocide type & frequency. **Temperature min** may indicate a switch to free cooling and an increased sensitivity to flat plate exchanger fouling.

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

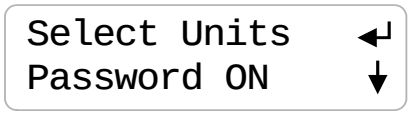
3.6 System- Alarms

System Menu Options

Press **UP - DOWN** until you see the **Tower Control**.
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 **3.7 Password**

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 pump & solenoid owed times to zero and resets the **Inhibitor Pump** feed limit alarm.

Conductivity sensor 'Out-of-Calibration' and High-Low Alarms and System Alarms auto-clear when the problem is corrected.

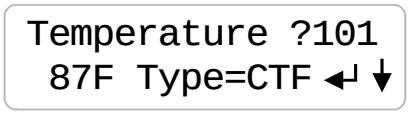
3.6 System- Alarms
continued

System : Current State

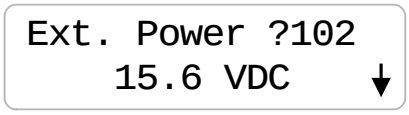
Press **UP - DOWN** until you see the **Tower Control**.
Press **ENTER** view System options.

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

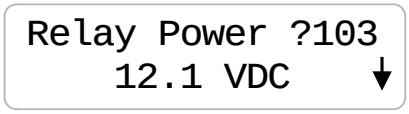
Temperature at the conductivity sensor.
Displays '**Fault**' if not used to compensate conductivity, indicating a wiring or sensor problem.
Press **ENTER** to adjust **Temperature**.



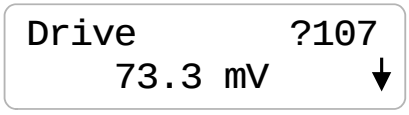
External **Power** used for paddlewheel water meters and to power 4-20mA current loops
Alarms on short circuits, recovers automatically when wiring corrected.



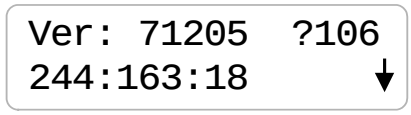
Internal power used for **Bleed Solenoid** and **Inhibitor Pump** relays.
Always displays 11.8 to 12.2. Alarms on fault.



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



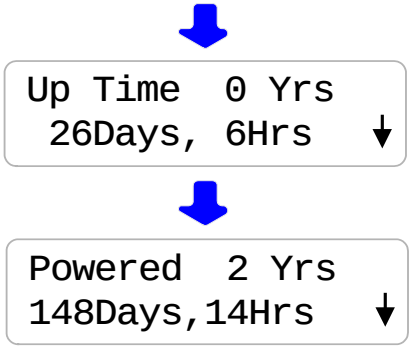
Continued on next page

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.

3.6 System- Alarms
continued

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.



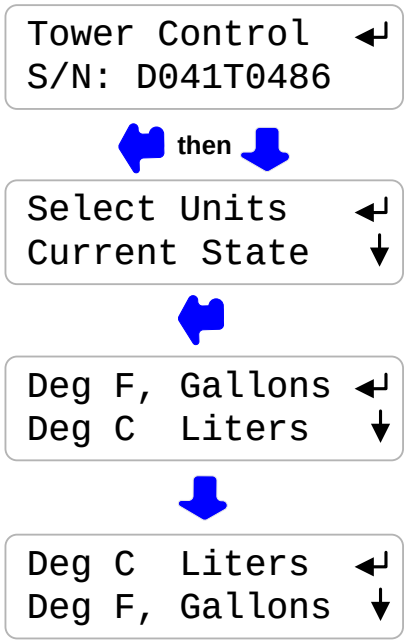
System : Select Units

Press **UP - DOWN** until you see the **Tower Control**.
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.

3.7 Password

Password is turned OFF in new controllers

Press **UP - DOWN** until you see **Tower Control**.

Press **ENTER** & **DOWN** 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.

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

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.

3.7 Password
continued

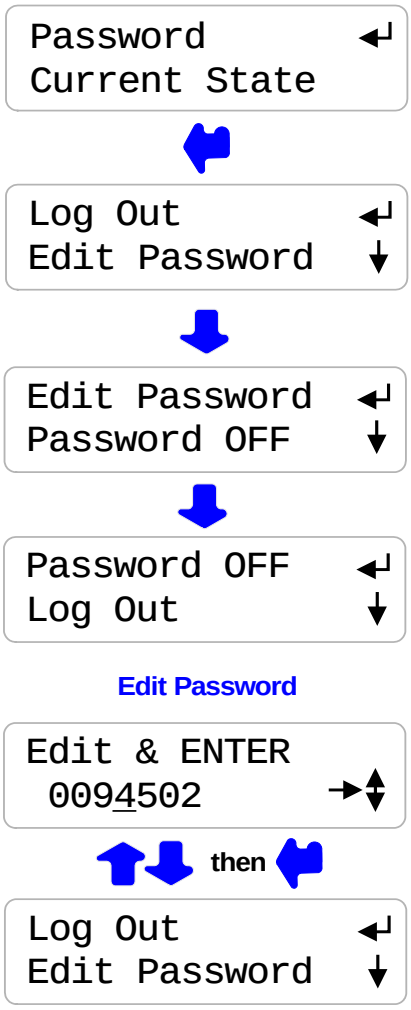
Press **UP - DOWN** until you see **Tower Control**.
Then press ENTER & UP to view **Password** tools.

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**.



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** from the controller manufacturer.
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 sensor and Inhibitor Pump. Make-up water or Pump rate & stroke may have changed. Higher temperatures may be extending inhibitor ON 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.
	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 & the cause of low run time on the inhibitor pump. If the cooling tower is on line, verify that the Flowswitch shows ON. 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. Zero 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. After 12 hours you'd expect to see 100 to 200 minutes of bleed & 20 to 50 minutes in inhibitor pump time.

Frequency	Activity	Method
Weekly	Verify Conductivity	Sample the tower water conductivity. Verify controller matches the sample +/-25uS Conductivity sensors should not drift or require cleaning. Scaling sensors may indicate a restricted bleed, varying make-up hardness, incorrect Bleed Solenoid 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.
	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 within 10 seconds of valve closing.
	'Y' Strainer Filter	If the sample line has a 'Y' strainer, clean the filter to prevent an unplanned 'no flow' outage. **Open the downstream, then the upstream valve** and verify that the Flowswitch displays ON within 10 seconds of valve opening
	System Check	Visually inspect sample-injection piping for leaking fittings, feed injection point and sensor entries.

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

Frequency	Activity	Method
Yearly	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.
	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 it's 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) is 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.

4.1 Spare Parts

4.1.1 Line Fuse

Protects	Rating / Type	Manufacturer – Vendor
Controller, Pumps and Bleed Solenoid	5 Amps @ 115VAC 5mm x 20mm, Fast Acting	Littlelfuse, Type 217, 250VAC Digikey Part# F953-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
S-E3/4	Conductivity entry fitting for 3/4NPT PVC 'T'
CO-IN-NS	Spare Controller without sensors & entry fittings
R171230	Enclosure Power cable entry fitting, PG11
R717231	Enclosure Sensor cable entry fitting, PG9

On-Line Help

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

Users Manual

Download **AQC2_User.pdf** from aquatrac.com

Manual Version	Detail
07/05	Issued with initial field trial controllers
02/06	CO-IN Production

Appendix A: INSTALL

A.1 PLUMBING

Typical sample-chemical injection piping operates at 40-60psi and is plumbed in solvent welded SCH40 or 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.
'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 SENSORS

Conductivity sensors may be installed in any orientation which allows removal for cleaning. Do not hang conductivity sensors in metallic tower sumps.
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 50 feet, 15m 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.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 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
CTF: Conductivity Temperature Flowswitch Sensor	1 Temperature Compensated conductivity sensor. Displays 1uS resolution. Rated 100psi Flowswitch trips @ 1GPM within 30 seconds from 32-125F, 0-50C.	Autoranging from 100uS to 10000uS. **CTF** integral flowswitches typically trip within 10 seconds of flow ON/OFF.
Water Meter & Flowswitch Inputs	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, Bleed Solenoid or Motorized Valve 1 SPST, Inhibitor Pump	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.

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 Feed limit timer, reset every 14 hours.	User sets % of Bleed ON time used for Inhibitor feed.
Flowswitch	Bleed Solenoid & Pumps OFF when Flowswitch contact set opens.	Flowswitch included in Conductivity sensor

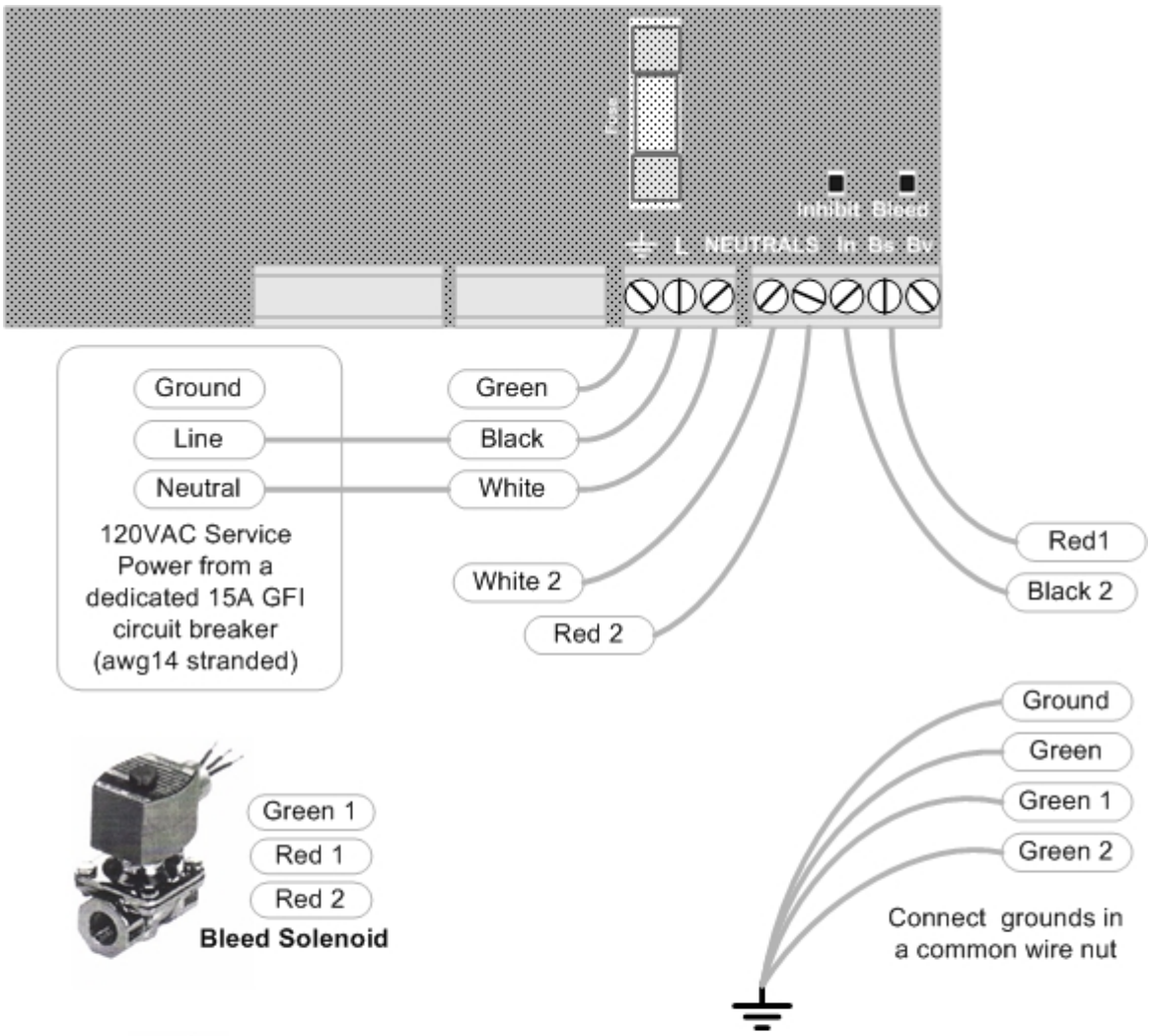
System	Rating - Detail	Notes
Controller Configuration	User settings and configuration written on silicon.	Makes user configuration the factory default.

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, Solenoid & Inhibitor



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

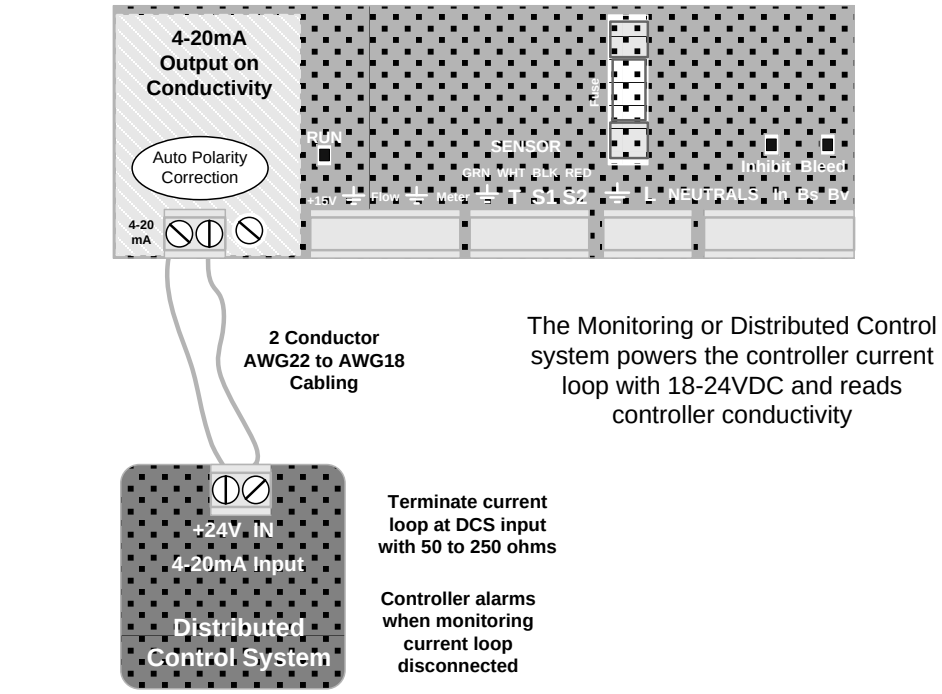
3. Do not exceed AWG14.

Appendix D: 4-20mA Output Option

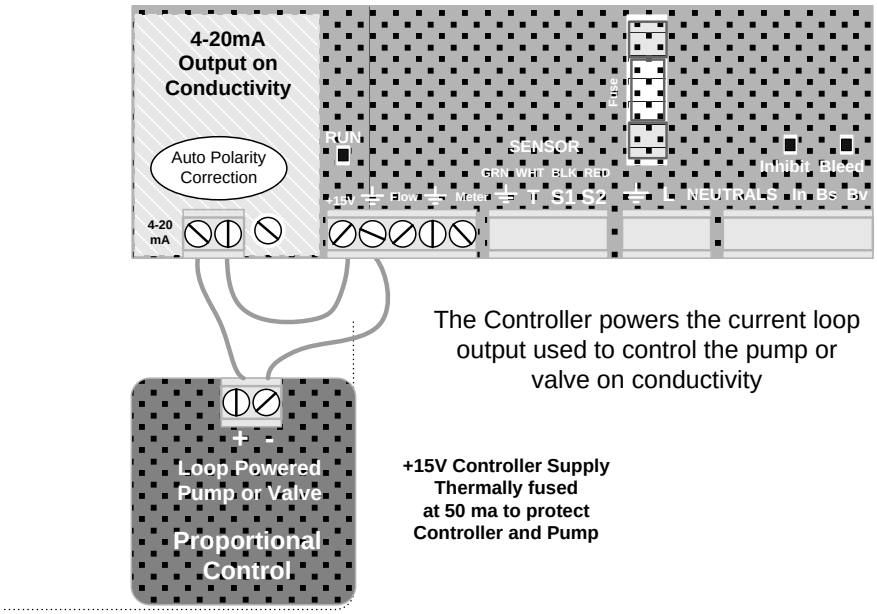
The optional 4-20mA output on conductivity is DC isolated from the controller & may be either powered by the load or by the controller DC supply. The 4-20mA output is auto-polarity correcting.

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  →↕
```

then

ENTER updates the Span.
EXIT leaves Span unchanged

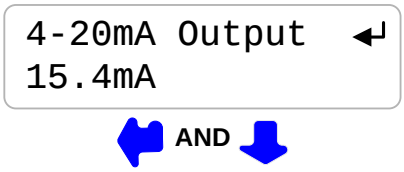
```
 4mA=  2500uS  ↵
20mA=  5000uS  ↓
```

Appendix D: 4-20mA Output Option

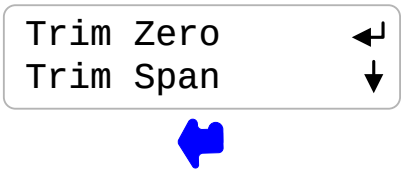
D.3 CALIBRATE

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

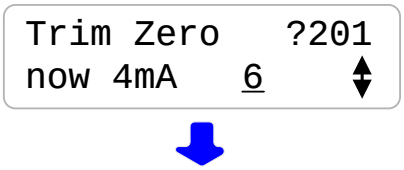


Press ENTER at Trim Zero to adjust the 4mA level.



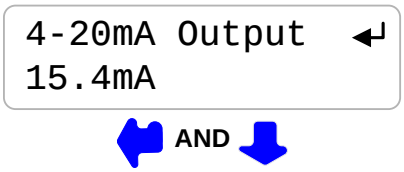
Connect a DC milli-ammeter in series with either of the current loop wires.

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

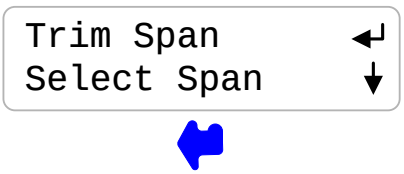


Press ENTER to view the output current and verify that the milli-ammeter reads the same current.

Press ENTER & then DOWN at 4-20mA Output

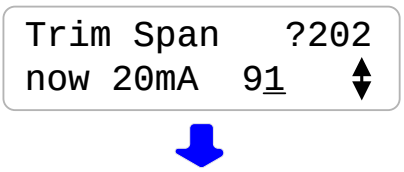


Press ENTER at Trim Span to adjust the 20mA level.



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.

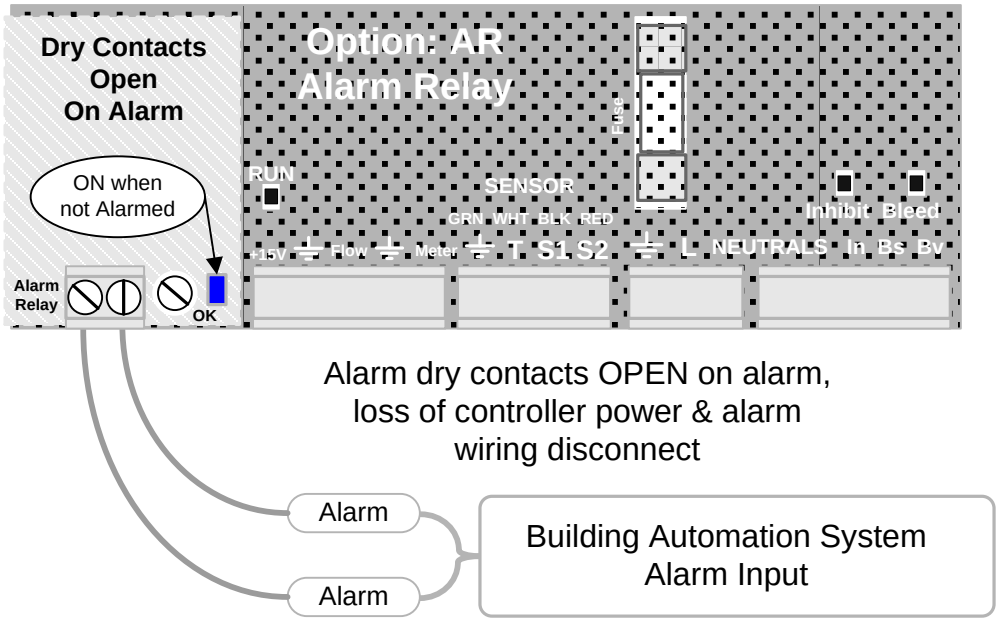


Press ENTER to view the output current and verify that the milli-ammeter reads the same current.

Appendix E: Alarm Relay Option

E.1 WIRING ALARM CONTACTS

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



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: LAN - Browser Option

Download Sflex_LB manual from www.prominentcontroller.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.