SlimFlex microFlex: HELP

HELP Links

The first line of the controller LCD display may display a help number **?123** where **123** is a HELP number from **010** to **255**.

Example: LCD Displays `Off@  995  ?121`
`ON 1299uS`

`?121` The Bleed Solenoid is now ON
& the tower conductivity is now 1299uS.
The Bleed Solenoid will turn OFF when the
Tower conductivity is 995uS.

Alarms

The controller displays the highest priority alarm on its LCD display.
Other, lower priority alarms may display as you correct the initial, higher priority alarm.

Alarm Priority List

Alarm Message Priority 1..9	?Help Number	Notes
1. pH Sensor or ORP Sensor		Fails calibration, above high alarm or below low alarm. Requires pH or ORP sensor installed.
2. Conductivity		Fails calibration, above high alarm or below low alarm.
3. Acid Pump or Oxidant Pump		Feed limit timer exceeded, pump OFF
4. Inhibitor Pump		Day Feed limit timer exceeded, pump OFF
5. Temperature		Temperature out of range or wiring fault
6. Ext.Power		15V DC external supply thermally fused
7. Relay Power		12V DC internal Relay power fails, pumps & solenoid OFF
8. Measure Fault		Cannot measure sensor values, A/D converter fault
9. Clock Fault		Internal clock fails or microcontroller clock fault

?010 to ?012 Internet-Browser Option

010 IP Internet Protocol

View at **>UP>** or **>DOWN>** to: **LAN IP**
The displayed IP is the current controller LAN address.
If you are browsing the controller on a site LAN, you can key the controller IP into your browser address.
For example: if the controller IP is 192.168.2.101.
Key **http://192.168.2.101** into Internet Explorer **address** field & **Enter.**

If you are using a crossover cable & notebook PC to browse the controller, the first three numbers of the controller IP must match the temporary configuration on your notebook.
For example:
If the controller IP is **192.168.2.101**, set your notebook to **192.168.2.29** to browse the controller.
Or
If your notebook is IP is **10.10.6.45**, set the controller to **10.10.6.101** to browse the controller.

011 DHCP Dynamic Host Configuration Protocol

DHCP automatically acquires an IP from the local LAN DHCP server on controller power-up.
Most Ethernet LANs including residential DSL and cable based LANs, use DHCP as a default unless you have turned DHCP OFF in your server.

If a DHCP server exists on your LAN, the user set or default IP is overwritten every time the controller powers up and requests an IP from the DHCP or name server.
Since controllers verify their current IP every second, the correct, current IP is always displayed on the controller LCD.

If you connecting to the controller using a cross-over cable and the controller is never connected to a site LAN, then the IP you set using the controller keypad will not change.

012 MAC Media Access Control

View at **>UP>** or **>DOWN>** to: **LAN IP >ENTER> View MAC >ENTER>**

The MAC is the unique hardware ID of the controller's web server.
Its 12 numbers and letters, for example, **0003 750F 6EBB,** where the letters are limited to A to F.
Site IT staff may require the controller MAC so that they can allow the controller on the site LAN.
Although the controller formats the MAC to fit on a 16 character display, the MAC is usually written as six, two digit hex numbers. For example **0003 750F 6EBB** would be written as **00:03:75:0F:6E:BB**

101 Water Temperature & Sensor Type

Alarms display '**Temperature**' alarm on less than 0C,32F or greater 60C,140F

View at: **>UP>** or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>**

The displayed temperature is measured at the tip of the conductivity sensor and is used to temperature compensate the measured conductivity.
If the temperature measures between 0C,32F to 60C,140F, the conductivity is compensated at nominally 1.746%/C from 20C. This rate of compensation is typical for cooling tower applications.

The temperature displays '**fault**' if the measured temperature is outside of the 0-60C, 32-140F range. A faulted temperature is not used for conductivity thermal compensation.

A faulted temperature may be caused by switching the **GREEN** and **WHITE** wires at the controller sensor terminal block. If you have extended the sensor wires, you may have an open splice or you may have switched the wires colors during splicing.

Type=CT Sensors use an external flowswitch, are dark gray in color and use a full union piping entry fitting. If you are not using a flowswitch you will either have a jumper installed between the controller **Flow** and ⏚ terminals OR be wired to a set of dry contacts supplied by a building automation system

Type=CTF Sensors include a flowswitch built into the conductivity sensor & thread into a black entry fitting.

Wiring color coding is identical for both **Type=CTF** & **Type=CT** sensors.

102 14-20VDC External Power

Alarms display '**Ext Power**' alarm on less than 14VDC.

View at: **>UP>** or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>>DOWN> Ext. Power**

The controller supplies a thermally fused, 14 to 20VDC supply to power three turbine-paddlewheel water meters, thermal flowswitches and 4-20mA current loops.
You'll see several volts of variation in the displayed value as the controller reads the 120Hz. ripple on the unregulated supply.

LOW Ext. Power

If you read below 12VDC you have a load over 50mA OR a short circuit on the current loop or water meter. Disconnect the wire connected to the controller **+15V** terminal and the displayed voltage should be between 14 & 20 VDC.
The **+15V** terminal is thermally fused at 50mA so no controller damage occurs when the supply is short circuited, however the water meter or current loop won't be working.
If you read 7-12VDC with wires to the +15V terminal wiring disconnected, the line selection switch may be set to 230VAC and you are plugged into a 115VAC plug. This unlikely fault requires that the enclosure Keypad-Display cover has been removed and that the line selection switch has been incorrectly set 230.

HIGH Ext. Power

If you view an Ext. Power voltage above 20VDC, you may be powering the controller with 230VAC with the line selection switch set to 115VAC. Unplug the controller and correct this wiring fault or floating neutral, to avoid damaging the 115VAC pumps and solenoid powered by the controller.
Do not operate pumps and solenoids rated for 115VAC use at 230VAC.

Reduced operation with 'Ext Power' alarm

You can operate the controller with an Ext Power alarm. Three wire water meters powered by the controller will not measure. Current loops powered by the controller will not measure current. If the controller is powering a thermal Flowswitch, you will need to disconnect the wire connected to the controller **Flow** terminal and install a jumper between the **Flow** terminal and the adjacent Ground terminal. **WARNING:** Bypassing the Flowswitch allows the controller to pump chemicals and bleed while the cooling tower recirculation pump is OFF. Do not bypass the Flow unless the tower operates continuously.

103 Internal 12VDC Relay Power

Alarms display '**Relay Power**' alarm on less than 11.5VDC.

View at: **>UP>** or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>>DOWN> Relay Power**

The controller supplies a 12VDC to power the relays which switch AC power to the bleed solenoid and chemical pumps. This voltage will always read between 11.6 and 12.4 VDC.
Below 10VDC the power relays will not operate, pumps and the solenoid will not operate although the green LEDs which indicate Relay ON will still display.

LOW Relay Power

If you read below 10VDC , the line selection switch may be set to 230VAC and you are plugged into a 115VAC plug. This unlikely fault requires that the enclosure Keypad-Display cover has been removed and that the line selection switch has been incorrectly set to 230.
If you cannot correct this fault, pumps and the bleed solenoid will not operate. Unplug pumps and bleed solenoid and make alternative arrangement for control of the cooling tower water treatment program.

104 Clock Monitor

Alarms display '**Clock Fault**' alarm on a minute that exceeds 65 seconds.

The controller includes a battery backed real time clock which keeps track of time, date and day of the week. Clock information is used to feed timed biocides, update the daily pump and solenoid ON times and to maintain water meter days on-line and daily usage.

The controller microprocessor also has a high speed clock used to sequence keypad, communications and control functions. Both real time clock and microprocessor clocks must be operating for the controller to function.

If either clock fails, the clock monitor will set the '**Clock Fault**' alarm indicating mechanical, electrical or water damage to the controller circuit board. If the fault does not clear after disconnecting the water meter, flowswitch and sensor(s), unplug pumps and bleed solenoid and make alternative arrangement for control of the cooling tower water treatment program.

If the fault clears as the meter, flowswitch or sensor(s) is disconnected you may be cabled in a common conduit with 120VAC power. If you are using external dry contacts from the site building automation in place of a flowswitch, the contacts may be powered or cabled in common conduit with AC power.

105 Measure Monitor

Alarms display '**Measure Fault'** alarm on **Measure** less 2475 or greater than 2525.

View at: **>UP>** or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>>DOWN> Measure**

On every power ON, the controller checks the electronics which measure the conductivity, ORP, pH and temperature sensors and displays the results of the test on the LCD display.

Controllers with Measure Fault may also display Conductivity, Temperature, pH Sensor and ORP sensor alarms. Check the **Measure** level to verify that the controller can measure sensors.

'**Measure Fault'** may indicating mechanical, electrical or water damage to the controller circuit board. Unplug the controller and disconnect the water meter, flowswitch and sensor(s) then plug the controller in. Note that the '**Measure Fault'** is only checked on power ON.

Reduced operation with 'Measure Fault' alarm

You can operate the controller without using the Conductivity, pH or ORP sensors by:

1. Change the Bleed Mode to Percentage Time or Meter Control.
2. Change the Inhibitor Pump Feed Mode to Feed on Volume or Percentage Time.
3. Change the Oxidant Pump Feed Mode to Percentage Time
4. Change the Acid Pump Feed Mode to Feed on Volume

106 System Firmware Version & State

Firmware Version

80805 indicates that the controller is running the August 8th, 2005 release software
The first character indicates the month using **1..C** for January to December.

System State is of limited use to end users.

It's used to confirm two critical controller states and is viewed on the LCD display at:
Power Up Screen >ENTER> Current State >ENTER> >DOWN> to **State**

The first displayed number is either **240** or **244** and the second number is either **93** or **163**.

240 indicates that one or more midnights have occurred since the controller has last powered ON.
240 also indicates that a user adjustment of the clock changed the date.
244 indicates that the day has not changed.
The **240-244** information is used for the water meter days on-line and to correct biocide event timing.

93 indicates that the controller cannot communicate with the LAN web server option card.
93 would be displayed if the LAN option was not installed.
163 verifies that the controller is talking to, and updating the LAN web server option card.
163 is required for a user to monitor and control the controller using a browser.

107 Sensor Drive Level

View at: **>UP>** or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>>DOWN> Drive**

Drive verifies conductivity sensor auto-ranging and displays the sensor drive level in each range.
Drive is viewed on the LCD display at
Power Up Screen >ENTER> Current State >ENTER> >DOWN> to **Drive**

Cooling Tower Controllers:

Conductivities greater than nominally 1000uS will display **Drive** @ 70 to 75 mV.
Conductivities less than nominally 800uS will display **Drive** @ 995 to 1010 mV
The displayed **Drive** level will change as the measured conductivity moves between ranges.

108 Temperature Fails Calibrate

Alarms display '**Temperature**'.

If, after calibrating, the adjustment required to make the measured temperature match the user set **Calibrate** value is abnormal, the controller displays: `Advice ?108 Fails Calibrate`

>ENTER> ignores the `Advice` and sets the Temperature to the user set value.

>EXIT> resets the sensor to the factory settings.
Key **>EXIT** when you are trying to find out why the `Fails Calibrate` message is occurring.

`Fails Calibrate` can be caused by one or more of the following causes.
Once you have identified and corrected the cause, re-calibrate the temperature.

1. **Mis-wired sensor:** Verify the **GREEN** wire is firmly connected to the controller **GRN** ⏚ terminal and that the **WHITE** wire is firmly connected to the **WHT 'T'** terminal. If the sensor wires have been extended, go to the slice location and verify that extending has not switched wire colors and that both **WHITE** & **GREEN** wires are electrically connected.
2. **Incorrect Sensor Type**: All conductivity sensors include temperature measurement. **CTF** Sensors which include a flowswitch use a different type of thermal sensor from the **CT** conductivity sensors which do not include a flowswitch. The controller has been configured for either the **CT** or **CTF** sensor.
   View sensor type at:
   >UP> or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>**
   Identify sensor type:
   Type=CT are 4 wire sensors, dark gray in color and use a full union piping entry fitting.
   Type=CTF are 6 wire sensors and thread into a black entry fitting.
   An incorrect sensor type will cause **Fails Calibrate** faults.

?120 to ?129 Bleed Solenoid

121 ON or OFF on Conductivity Control

Viewed at **Bleed Solenoid >ENTER> >UP> Current State >ENTER>**
Displays when **Bleed Mode** is set to **Conduct.Control**

Bleed solenoid ON displays `Off@  995  ?121` **Solenoid turns OFF at 995uS**
`ON 1299uS` **Now ON, 1299uS current conductivity**

Bleed solenoid OFF displays `On@ 1000  ?121` **Solenoid turns ON at 1000uS**
`OFF  992uS` **Now OFF, 992uS current conductivity**

Current State shows why the bleed solenoid is ON or OFF and what's required to change its state.

If the solenoid is off, evaporation increases the tower water conductivity above the TurnON setpoint, turning ON the bleed solenoid.
If the solenoid is on, make-up water dilutes the cooling water, lowering the conductivity below the TurnOFF setpoint, turning OFF the bleed solenoid.

Current conductivity updates every second.

Application Note:
Conductivity Control is both the controller factory default bleed mode and the most common method of controlling cycles of concentration.
Sites which experience frequent changes in make-up hardness or silica may require intentionally lowering the setpoints to reflect the worst case, highest hardness or silica make-up. In this case, higher make-up use is the price of preventing scaling. Seasonal changes in make-up water chemistry require setpoint adjustment to either minimize water usage or to avoid scaling heat exchange surfaces.

122 ON or OFF on Meter Control

Viewed at **Bleed Solenoid >ENTER> >UP> Current State >ENTER>**
Displays when **Bleed Mode** is set to **Meter Control**

Bleed solenoid ON displays `Owes 72sec ?122` **Solenoid turns OFF in 72 seconds**
`ON ENTER=Stop` **Press ENTER to zero owed time & turn OFF Bleed Solenoid.**

Bleed solenoid OFF displays `On@ 68500 G ?122` **Solenoid turns ON when meter measures 68500**
`OFF 68400 G` **Now OFF, water meter measures 68400 Gallons**

Current State shows why the bleed solenoid is ON or OFF and what's required to change its state.

While the solenoid is off, evaporation lowers the level in the tower sump, the sump float drops & turns ON the make-up water and the make-up water meter measures volume.
Once the meter volume exceeds the Measure setpoint the Bleed Solenoid turns ON for the Bleed seconds. In this example the Bleed turns ON for 75 seconds after measuring 100 Gallons of Make-up.

If the solenoid is on, the owed time counts down to zero and then the Bleed Solenoid turns OFF.
If additional make-up volume is measured during the solenoid ON time, it's added to the time owed.

Meter volume and owed time updates every second.

Application Note:
Meter Control requires constant make-up chemistry and an unobstructed bleed solenoid which operates at a fixed, constant head. It's a control mode that's seldom used for other than as a short term maintenance bridge since variables like varying windage will change cycles of concentration.

123 ON or OFF on Percentage Time

Viewed at **Bleed Solenoid >ENTER> >UP> Current State >ENTER>**
Displays when **Bleed Mode** is set to **Percentage Time**

Bleed solenoid ON displays
```
Owes 186sec  ?123
ON   ENTER=Stop
```
Solenoid turns OFF in 186 seconds
Press ENTER to zero owed time & turn OFF Bleed Solenoid

Bleed solenoid OFF displays
```
On in 54sec ?123
OFF
```
Solenoid turns ON in 54 seconds
Now OFF

Current State shows why the bleed solenoid is ON or OFF and what's required to change its state.

Every 5 minutes, 300 seconds, the controller turns ON the bleed for the user set %Time. 100% turns ON the bleed continuously. 1% turns ON the bleed solenoid for 3 seconds every 300 seconds.

If the solenoid is on, the owed time counts down to zero and then the Bleed Solenoid turns OFF.
If the solenoid is off, the time counts down to zero and then the Bleed Solenoid turns ON.

Time updates every second.

Application Note:
Percentage Time is useful to test sizing on make-up and bleed piping.
If the make-up line is undersized and the bleed is bypassed or jammed open will the tower basin run dry?
Will the sump drain line handle continuous bleed without overflowing onto the roof?
Percentage Time requires constant make-up chemistry and an unobstructed bleed solenoid which operates at a fixed, constant head. It's a control mode that's seldom used for other than for testing or for a very short term maintenance bridge while repairs are implemented.

124 Biocide A or B Prebleeding Time

Viewed at **Bleed Solenoid >ENTER> >UP> Current State >ENTER>**
Displays before each biocide timed event when a **Biocide** sets **Prebleed** time greater than zero minutes.

Bleed solenoid displays `Bioprebleed ?124` **Biocide event set to Prebleed**
`ON for 36.4 min` **Bleed turns OFF in 36.4 minutes**

Current State shows why the bleed solenoid is ON or OFF and what's required to change its state.

Bioprebleed forces the bleed solenoid ON to lower the tower conductivity prior to feeding a biocide.
A lightly loaded tower with a low conductivity will not cycle up to the bleed TurnON setpoint during the biocide feed period or during the required reaction or 'kill time'.
Bioprebleed avoids sewering the biocide when the bleed solenoid turns ON.

Bioprebleed ends when the user set Prebleed time expires OR when the conductivity falls below the user set Prebleed conductivity OR when the user keys:
Bleed Solenoid >ENTER> >DOWN> End Prebleed >ENTER>

Inhibitor Feed during Prebleed:
If you are feeding inhibitor based on Bleed & Feed, Bleed then Feed or Make-up Meter modes, you will feed additional inhibitor using the Prebleed period to treat the added make-up.

Overlapping Prebleeds:
The following configuration is unlikely since dual organic biocides are usually alternated.
If the controller includes two timed biocides with overlapping timed events;
The most recent timed event sets both the prebleed time and conductivity

Example: BiocideA timed event prebleeds for 15 minutes or to 650uS at 7:00AM
BiocideB timed event prebleeds for 10 minutes or to 500uS at 7:10AM
If the tower conductivity did not fall below 650uS by 7:10AM,
the Prebleed time would be reset to 10 minutes
Prebleed would end if the conductivity falls below 500uS.
Worst case, both biocides pumps would turn ON at 7:20AM

Application Note:
Select biocide feed times for the lowest tower thermal load time allowing for the sum of the Prebleed and Lockout times.
If the tower is offline when the biocide feed event is scheduled, the controller will feed when the flowswitch turns ON.

It may be preferable to turn the recirculation pumps on early on biocide feed days to avoid feeding biocide when the tower is heavily loaded, and no amount or Prebleed can prevent cycling up the tower and sewering the biocide before it has time to work. It may be possible to avoid setting a Prebleed and incurring added make-up water and inhibitor usage.

Parallel concerns exist using Lockout to prevent bleed during the biocide reaction time. Now we're not concerned about sewering the biocide, we're trying to avoid scaling heat exchange surfaces.

125 Biocide A or B Lockout timer

Viewed at **Bleed Solenoid >ENTER> >UP> Current State >ENTER>**
Displays as each biocide timed event starts when a **Biocide** sets **Lockout** time greater than zero minutes.

Bleed solenoid displays

```
Biolockout ?125
OFFfor 112.2 min
```

Biocide event set to Lockout
Normal bleed control resumes in 112.2 minutes

Current State shows why the bleed solenoid is ON or OFF and what's required to change its state.

Biolockout prevents the bleed solenoid from turning during and after a Biocide feed event.
A lightly loaded tower with a low conductivity will not cycle up to the bleed TurnON setpoint during the Lockout period, providing the required Biocide reaction or 'kill time'.
Biolockout avoids sewering the biocide when the bleed solenoid turns ON.

Biolockout starts when the Biocide pump turns ON, after **Prebleed** ends

Biolockout ends when the user set Lockout time expires OR when the user keys:
Bleed Solenoid >ENTER> >DOWN> End Lockout >ENTER>

Overlapping Lockouts:
The following configuration is unlikely since dual organic biocides are usually alternated.
Avoid overlapping lockouts since lockout periods may be several hours in length.
If the controller includes two timed biocides with overlapping timed events; the most recent event sets the Lockout time.

Example: BiocideA Lockout is set to 180 minutes at 7:00AM every Monday
BiocideB Lockout is set to 120 minutes at 9:00AM every Monday
The bleed solenoid would be turned OFF from 7:00AM to 11:00AM every Monday.
It's unlikely that the user intended to operate the tower without bleed for such an extended period.
If you need to feed two chemicals at the same time, set the Lockout only on the first chemical fed.

Application Note:
Select biocide feed times for the lowest tower thermal load time allowing for the sum of the Prebleed and Lockout times.

If the tower is offline when the biocide feed event is scheduled, the controller will feed when the flowswitch turns ON and the Lockout time will start with the later feed time.
A later Lockout may cause overcycling and possible scaling as the Lockout extends into the high thermal load time of day.

It may be preferable to turn the recirculation pumps on early on biocide feed days to avoid feeding biocide when the tower is heavily loaded, limiting the Lockout time to the low thermal load period.
It may be possible to avoid setting a Lockout time if you can ensure a no load period after each biocide feed event.

127 Testing Bleed Solenoid

Viewed at **Bleed Solenoid >ENTER> >UP> Current State >ENTER>**
Displays after user keys **Bleed Solenoid >ENTER> >Down> Test >ENTER>**

Bleed solenoid ON displays

```
Owes 291sec ?127
ON  ENTER=Stop
```

Solenoid turns OFF in 291 seconds
Press ENTER to zero owed time & turn OFF Bleed Solenoid

Current State shows why the bleed solenoid is ON or OFF and what's required to change its state.

Test turns ON the Bleed Solenoid for 5 minutes or 300 seconds.
Use **Test** to verify that the solenoid turns ON and that there is unrestricted flow in the tower drain line.

Bleed & Feed and Bleed then Feed inhibitor feed modes cause the Inhibitor Pump to turn ON when the Bleed Solenoid is being tested.

?141 Conductivity

141 Conductivity Sensor Fails Calibrate / **Cooling Tower Sensors**
Alarms display '**Conductivity**'.

If, after calibrating, the adjustment required to make the measured conductivity match the user set **Calibrate** value is abnormal, the controller displays: `Advice ?141 Fails Calibrate`

>ENTER> ignores the `Advice` and sets the Conductivity to the user set value.

>EXIT> resets the sensor to the factory settings.
Key **>EXIT** when you are trying to find out why the `Fails Calibrate` message is occurring.

`Fails Calibrate` can be caused by one or more of the following causes.
Once you have identified and corrected the cause, re-calibrate the conductivity sensor.

1. Ensure that the sample line has flow and that the sensor is fully immersed. Make sure that the conductivity sample is removed from the sample line, so it's seeing the same water as the sensor. Sensors installed in metallic 'T's and or metallic piping, will not calibrate.

2. Remove the sensor and inspect for visible debris and fouling. If the site is subject to oil, grease or biological fouling, clean the sensor with alcohol and a soft brush. If the site is subject to silica fouling and has recently experienced a failure to control cycles or a change in make-up silica, clean the sensor with a stiff brush (silica or biofouling fouling is seldom visible). Re-install and re-calibrate.

3. Check that the sensor is thermally compensated by viewing the temperature at:
   >UP> or **>DOWN>** to: **Day & Time >ENTER> Current State >ENTER>**
   If the Temperature is within +/- 5 degrees of the expected tower temperature, the sensor is thermally compensated. If the temperature displays **'Fault'** and the conductivity tester is temperature compensated, `Fails Calibrate` may occur.
   If a sensor has been recently installed, check that the WHITE wire connects to WHT 'T' controller terminal and that the GREEN wire connects to the GRN Ground terminal

4. Verify the conductivity tester with a calibration solution.

5. If the conductivity sensor is remote from the controller, make sure that 120VAC cabling does not share the sensor cable conduit.

6. Verify that the chemical injection locations have not changed. Controllers without Control Verification, must inject chemicals downstream of the conductivity sensor. Pot feeders must be downstream of the conductivity sensor.

141 Conductivity Sensor Fails Calibrate / **Boiler Sensors**

Alarms display '**Conductivity**'.

If, after calibrating, the adjustment required to make the measured conductivity match the user set **Calibrate** value is abnormal, the controller displays:

```
Advice      ?141
Fails Calibrate
```

>ENTER> ignores the `Advice` and sets the Conductivity to the user set value.

>EXIT> resets the sensor to the factory settings.
Key **>EXIT** when you are trying to find out why the `Fails Calibrate` message is occurring.

NOTE:
The 'Conductivity' display will not change until the next Sample-Measure sequence completes. If you wish the see the immediate effect of calibration, press ENTER, UP & ENTER @ 'Sensor Watch'
If you wish to force a Sample-Measure sequence, press DOWN to 'Blowdown Valve' ENTER, UP, UP & ENTER @ 'Current State'. Press ENTER & a new Sample will start.

`Fails Calibrate` can be caused by one or more of the following causes.
Once you have identified and corrected the cause, re-calibrate the conductivity sensor.

Boiler calibration problems are usually due to one of three causes:

Plumbing Problems: Most plumbing problems occur on start-up.
If you've been controlling conductivity and accurate blowdown control fails, check the sensor. Refer to Help# 254 @ for information on using the 'Sensor Watch' value to identify plumbing problems.

Sensor Fault:
The continuous thermal cycling of captured sampling control stresses boiler conductivity sensors. Higher pressure boiler sensors typically have shorter service lives. The typical fault mode is seeping at the back of the sensor. Seeping sensors typically still track conductivity & control blowdown, but replacement is recommended.

Boiler sensors shipped between August 15/06 and March 31/07 are displaying a higher than expected failure rate. If you cannot maintain conductivity calibration and have a sensor shipped within the previous period, please contact cmena@Aquatrac.com for information on the fault and corrective action.

Wiring Problems: Most wiring problems occur on start-up.
If the conductivity sensor is remote from the controller, make sure that 120VAC cabling does not share the sensor cable conduit.
If the sensor cable is extended, check the splices.
Verify that both conductivity sensor wires are firmly connected to the controllers S1 & S2 terminals.

? 150 to ?160 Inhibitor

150 Inhibitor Pump OFF, Bleed & Feed Mode

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Bleed & Feed** and **Bleed Solenoid** is ON or OFF

Bleed solenoid ON displays `On in 26sec?150` **Pump turns ON in 26 seconds**
`OFF` **Now OFF**

Bleed solenoid OFF displays `Bleed off ?150` **Pump OFF because bleed is OFF.**
`OFF`

Current State shows why the inhibitor pump is ON or OFF and what's required to change its state.

When the bleed solenoid is ON, the controller sets the Inhibitor time owed every 5 minutes that the bleed is ON using the % Setpoint. For example, a 36% Setpoint, would set the time owed to 108 seconds every 300 seconds that the Bleed Solenoid is ON and turn the pump OFF for 192 seconds in every 300. When the Bleed Solenoid turns OFF, the Inhibitor pump is OFF.

150 Inhibitor Pump OFF, Bleed then Feed Mode

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Bleed Feed** and **Bleed Solenoid** is ON or OFF

Bleed solenoid OFF displays `Bleed off ?150` **Pump OFF because bleed is OFF**
`OFF` **and owed time is zero**

Bleed solenoid ON displays `Bleed on ?150` **Pump OFF because mode is Bleed then Feed**
`OFF` **setting time owed based on Bleed time**

Current State shows why the inhibitor pump is ON or OFF and what's required to change its state.

When the bleed solenoid is ON, the controller sets the Inhibitor time owed every 5 minutes that the bleed is ON using the % Setpoint. For example, a 36% Setpoint, would set the time owed to 108 seconds every 300 seconds that the Bleed Solenoid is ON and turn the pump OFF for 192 seconds in every 300. When the Bleed Solenoid turns OFF, the Inhibitor pump turns ON if the owed time is greater than zero seconds.

151 Inhibitor Pump OFF, Feed on Volume Mode, Bleed Solenoid ON

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Bleed Feed** and **Bleed Solenoid** is ON

Bleed solenoid ON displays `Blocked! ?151` `Bleed on` **Pump OFF because mode is Feed on Volume & Bleed Solenoid is ON**

Current State shows why the inhibitor pump is ON or OFF and what's required to change its state.

The controller remembers that the make-up meter has measured volume and that Inhibitor Pump ON time is owed. When the Bleed Solenoid turns OFF, the Inhibitor Pump will turn ON for a time proportional to the measured make-up volume.

Delaying inhibitor feed while the bleed is ON prevents pumping chemical down the drain. This method that works well if the Bleed Solenoid TurnON & TurnOFF setpoints are no more than 10uS apart so that bleed intervals are short.

Feed on Volume is not recommended for towers that are bleed limited. A restricted or undersized bleed line forces the Bleed Solenoid to be ON for more than 50% to 75% of the time, leaving no time to feed inhibitor.

The `Blocked!` message only displays after the water meter has measured enough volume to require Inhibitor Pump ON time.

152 Inhibitor Pump OFF, Biocide Pump ON

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**

```
Biolockout ?152      Pump OFF because the Biocide Pump is ON
Biocide ON           and Stop Inhibitor has been set to Biofeed Blocks
```

Current State shows why the inhibitor pump is OFF.

Viewing & Adjusting Bioblock
>UP> or **>DOWN>** to:
Day & Date >ENTER>>DOWN> Stop Inhibitor >ENTER> No Bioblock (factory default)
Key **>DOWN>>ENTER>** to change between **Biofeed Blocks** & **No Bioblock.**

Application Note:

Bioblock would typically be used if an oxidizing biocide is fed into the same injection line as the inhibitor and the oxidant either jells or reacts with the inhibitor.
Bioblock turns OFF the Inhibitor Pump whenever a Biocide Pump is ON.
Biocide Prebleed and/or Lock-out settings may also prevent Inhibitor Feed by preventing bleed solenoid operation during the Biocide feed events.
Owed time on the Inhibitor Pump will run after the Biocide feed event ends.

153 Inhibitor Pump OFF on Feed Limit Timeout

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**

```
Timed out!  ?153     Pump OFF because ON time today greater than Limit Timer
OFF ENTER=Reset      Press ENTER to restart the pump after increasing the Limit Timer
```

Current State shows why the inhibitor pump is OFF and what's required to change its state.

Limit Timer is the maximum number of minutes/day that the Inhibitor Pump is ON.
The **Limit Timer** prevents inhibitor overfeeding.

View and Adjust the **Limit Timer** by: **>UP>** or **>DOWN>** to:
Inhibitor Pump >ENTER>>DOWN> Limit Timer >ENTER> 120 min/day (current setting)
Key **>ENTER>** again to adjust.

Why are you exceeding the Limit Timer?
Was the timer originally set too short?
If you are feeding based on Bleed Solenoid ON time, what increased the bleed time?
Is it hotter? Is the bleed partially blocked?
Were the setpoints on the Bleed Solenoid or Inhibitor pump changed in a way that increased the Inhibitor pump ON time?
If you are feeding based on make-up volume:
Was the **Measure** setpoint reduced or the **Feed** time increased?
Why is the tower using more make-up? Is it hotter?
Has the number of cycles been reduced? Are you losing water?

154 Inhibitor Pump ON, All Feed Modes

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Bleed & Feed** and **Bleed Solenoid** is ON

Bleed solenoid ON displays `Owes 131sec ?154` **Pump turns OFF in 131 seconds**
`ON ENTER=Stop` **Press ENTER to zero owed time & turn OFF Inhibitor Pump**

Current State shows why the inhibitor pump is ON and what's required to change its state.

Bleed & Feed

When the bleed solenoid is ON, the controller sets the Inhibitor time owed every 5 minutes that the bleed is ON using the % Setpoint. For example, a 72% Setpoint, would set the time owed to 216 seconds every 300 seconds that the Bleed Solenoid is ON.
A setpoint of 100% would turn ON the Inhibitor Pump whenever the Bleed Solenoid is ON.

Bleed then Feed

When the bleed solenoid is ON, the controller sets the Inhibitor time owed as a percentage of the bleed ON time using the % Setpoint. For example, if the Bleed is ON for 426 seconds a 31% Inhibitor Setpoint, would set the time owed to 132 seconds. When the bleed turns OFF after 426 seconds, the Inhibitor pump would turn ON for 132 seconds.

Feed on Volume

When the increase in water meter volume is greater then the **Measure** setpoint, the Inhibitor Pump turns ON for the **Feed** setpoint in seconds. If more volume is measured before the Owed time is zero, the extra time is added to Owed. If the Bleed Solenoid turns ON, the Inhibitor Pump turns OFF but the owed time continues to increase with increasing make-up volume.
Example: If **Measure** = 100 gallons and **Feed** = 12 seconds, every 100 Gallons on make-up volume would turn ON the Inhibitor pump for 12 seconds.

Percentage Time

Every 5 minutes that the Flowswitch is ON the Inhibitor pump turns ON for the % Setpoint.
For example, an 18% Inhibitor Setpoint, would set the time owed to 54 seconds.
The Inhibitor Pump would turn On for 54 seconds in every 300 seconds.

155 Inhibitor Pump OFF, Feed on Volume

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Feed on Volume**

```
On@ 54300 G ?155     Pump when the make-up meter measures 54,300 Gallons
OFF  54200 G         Pump is now OFF & water meter measures 54,200 Gallons
```

Current State shows why the inhibitor pump is OFF and what's required to change its state.

When the increase in water meter volume is greater then the **Measure** setpoint, the Inhibitor Pump turns ON for the **Feed** setpoint in seconds. If more volume is measured before the Owed time is zero, the extra time is added to Owed. If the Bleed Solenoid turns ON, the Inhibitor Pump turns OFF but the owed time continues to increase with increasing make-up volume.
In this example example: **Measure** = 100 gallons and **Feed** = 12 seconds,
every 100 Gallons on make-up volume would turn ON the Inhibitor pump for 12 seconds.
Today the cooling tower has made-up 54,200 Gallons and when it has made-up 54,300 Gallons, the Inhibitor Pump will turn ON

Application Note:
Measure setpoints do not have to be the same as the water meter Gallons-per-contact. The controller will do the math. For example if you have a 50 Gallon/Contact make-up meter you could set the **Measure** setpoint to 425 gallons and the **Feed** setpoint to 36 seconds. The controller will remember the 25 extra gallons not used for the 36 second feed.

Select the Inhibitor setpoints that fit for the pump settings and target inhibitor concentration, the controller will do the math to ensure an accurate feed on volume.

156 Inhibitor Pump OFF, Percentage Time Mode

Viewed at **Inhibitor Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Percentage Time** and **Bleed Solenoid** is ON or OFF

```
On in 53sec?156     Pump turns ON in 53 seconds
OFF                 Now OFF
```

Every 5 minutes that the Flowswitch is ON the Inhibitor pump turns ON for the % Setpoint.
For example, an 18% Inhibitor Setpoint, would set the time owed to 54 seconds.
The Inhibitor Pump would turn ON for 54 seconds in every 300 seconds and turn OFF for 246 seconds.
During the OFF time counts down from 246 to zero and then turns ON the Inhibitor Pump for 54 seconds.

157 Inhibitor Pump Feed Limit Timer

Alarms display **Inhibitor Pump**.

Viewed at **Inhibitor Pump >ENTER> >DOWN> Limit Timer >ENTER>**

```
Day Limit   ?157   Maximum Pump ON time in any day from midnight
 120 min/day       Current set to 120 minutes/day
```

Limit Timer prevents inhibitor overfeeding during any one day.

Application Note

If you are feeding based on the Bleed Solenoid ON time using **Bleed & Feed** or **Bleed then Feed** mode, anything which extends the bleed ON time, increases the inhibitor pump ON time.

If you are alarming and the **Limit Timer** is set correctly, the cause tells you system state:

1. If the make-up conductivity increases, bleed time increases. If hardness or silica increases with conductivity, you may not be feeding enough inhibitor, or you may wish to change the **Bleed Solenoid Setpoints**.
2. If the **Bleed Solenoid** setpoints have been reduced and the make-up conductivity has not changed, the bleed solenoid will be ON for a longer time.
3. If it's hotter than normal, the bleed will be ON longer than expected & you may need to increase the **Limit Timer**.
4. If the bleed is not keeping up with the thermal load because it's undersized or partially blocked, you'll see the **Conductivity** increasing above the setpoint. The longer bleed ON time may be causing the **Inhibitor Pump** alarm.

?170 to ?175 Biocide

170 Biocide Pump OFF

Viewed at **Biocide** or **Biocide A** or **Biocide B >ENTER> >UP> Current State >ENTER>**

```
Biocide      ?170      Biocide fed on timed events
OFF OK                 Pump OFF, no event scheduled for current time & day#
```

Controllers which include pH-ACID controls or ORP-Oxidant controls have a single **Biocide** pump.
Controllers without pH or ORP sensors have two biocides, **Biocide A** & **Biocide B.**

171 Prebleed before feeding Biocide

Viewed at **Biocide** or **Biocide A** or **Biocide B >ENTER> >UP> Current State >ENTER>**

```
BioPrebleed      ?171      Bleed Solenoid turns ON to lower conductivity
  21.3min                  Biocide feed event starts in 21.3 minutes
```

Controllers which include pH-ACID controls or ORP-Oxidant controls have a single **Biocide** pump.
Controllers without pH or ORP sensors have two biocides, **Biocide A** & **Biocide B.**

Prebleeding starts when the Biocide feed event is scheduled.
For example: If the **Prebleed** is 25 minutes and the biocide feed event is scheduled for 7:00AM.
If the **Flowswitch** is ON, the bleed will turn ON at 7:00 AM and the biocide pump will turn ON at 7:25AM.
If the tower **Conductivity** falls below the **Prebleed** conductivity, the biocide feed event may start at any time between 7:00AM and 7:25AM

At the end of **Prebleed**, the controller displays:

```
ON for 26.4min      Biocide feed event ends in 26.4 minutes
ON  ENTER=Stop      >ENTER> turns the Biocide Pump OFF, ending the event
```

If there is a **Lockout** time set, it will continue to prevent the **Bleed Solenoid** from turning ON.
End Bleed **Lockout** by:
Bleed Solenoid >ENTER>>DOWN> End Lockout >ENTER>

174 Biocide Events Full

Viewed at **Biocide** or **Biocide A** or **Biocide B >ENTER> >UP> Current State >ENTER>**

```
Advice      ?174     Displays after Add Events
Events Full!         Press >ENTER> to exit.
```

Controllers which include pH-ACID controls or ORP-Oxidant controls have a single **Biocide** pump.
Controllers without pH or ORP sensors have two biocides, **Biocide A** & **Biocide B.**

Up to 28 events in each **Cycle Days** may be set for each biocide pump.
If **Cycle Days** = 28, you could set one event per day or all 28 events on one day.
Typically organic biocides use a 28 day cycle, feeding once or twice a week.
Oxidizing biocides typically use the 7 day cycles feeding 2-3 times a day, excluding weekends when a comfort cooling tower will be offline.

Process oxidizing biocide applications or using the biocide events for sensor cleaning may use the 1 day cycle an event every 1 to 3 hours.
In each of these applications, 28 events meet the required feed frequency.

Any event may be edited to change the start or ON time:
View at **Biocide** or **Biocide A** or **Biocide B >ENTER> >DOWN> Edit 12 Events >ENTER>**

All events may be removed:
View at **Biocide** or **Biocide A** or **Biocide B >ENTER> >DOWN> Delete Events >ENTER>**

175 Biocide Feed Events Added

Viewed at **Biocide** or **Biocide A** or **Biocide B >ENTER> >UP> Current State >ENTER>**

```
Advice      ?175     Displays after Add Events
Now  8 events        Press >ENTER> to exit.
```

Controllers which include pH-ACID controls or ORP-Oxidant controls have a single **Biocide** pump.
Controllers without pH or ORP sensors have two biocides, **Biocide A** & **Biocide B.**

After one or more events are added, the controller acknowledges by displaying the current event total from 1 to a maximum of 28 events. The current number of events can be viewed or any event can be edited to change the start or ON time:
View at **Biocide** or **Biocide A** or **Biocide B >ENTER> >DOWN> Edit 8 Events >ENTER>**

?180 Flowswitch

180 No Flow, Flowswitch OFF

Viewed at **Bleed Solenoid** or **Inhibitor Pump** or **Acid Pump** or **Oxidant Pump** or **Biocide**
>ENTER> >UP> Current State >ENTER>

`No Flow!`	`?180`	**No water flowing in the injection line, tower recirculating pump OFF**
`OFF`		**All chemical pumps and bleed solenoid OFF**

The operation of the chemical pumps and the bleed solenoid requires that the cooling tower recirculating pump be ON to blend the injected chemical into the tower water and to provide a fresh sample of the cooling water to the controlling conductivity, pH and/or ORP sensors.

Flowswitches are typically installed to the sample-injection piping upstream of the chemical injection points. Flow closes the switch contact set and the controller displays **Flowswitch** ON.

Some sites may use a contact closure from the building automation system which closes when the recirculating pump is ON. This method is usually more reliable than a mechanical Flowswitch, however it does not detect accidental valve OFF of the sample-injection piping. If you are using this method, tag the sample-injection piping isolation valves '**DO NOT CLOSE**'

The **Flowswitch** connects to the controller terminals **Flow** and either of the adjacent **Ground** terminals. You can temporarily bypass the **Flowswitch** to identify a faulted **Flowswitch** by jumpering the **Flow** and **Ground** terminals.

Warning:
Do not operate the controller without a reliable Flowswitch or building automation contact set.
Damage to plant equipment, chemical overfeed and/or excessive water use may occur.

?190 to ?193 Watermeter

192 Water Meter Year-to-Date Volume

Viewed at **Make-up Today>ENTER> >Down> Year-to-Date >ENTER>**

```
Year-to-Date?192
   728000  G
```

Total measured make-up volume this year
Set to zero at each new year

Year-to-Date volume divided by **Days OnLine** is a measure of average daily water usage.
Zero Meter? may be used or may have been used to zero **Year-to-Date.**

Year-to-Date volume is independent of water meter type. If you switch **Meter Type** from **Contact Head** to **Paddlewheel**, **Year-to-Date** remains accurate if both the Volume/Contact and 'K' Factors were correct.

Factory default units are '**G**'allons and '**F**'ahrenhiet.
Switch to metric by: **>UP>** or **>DOWN>** to:
Day & Time >ENTER> >DOWN> Select Units >ENTER>>DOWN> Deg C Liters >ENTER

193 Water Meter and Controller Days Online

Viewed at **Make-up Today>ENTER> >Down> Days OnLine >ENTER>**

```
Days OnLine ?193
  247
```

Total days controller powered ON this year
Set to zero at each new year

Year-to-Date volume divided by **Days OnLine** is a measure of average daily water usage.
Zero Meter? may be used or may have been used to zero **Year-to-Date.**

If the controller has been unplugged, powered OFF for an extended period, power OFF days are not counted.
If the controller is powered by the tower recirculating pump power and the pump is OFF every night, each fractional or partial day is counted as 1 day OnLine. A day online for a SlimFlex controller at any period greater than 1 hour.

Days OnLine verifies that the controller is operating continuously between service intervals. You would expect that a monthly service check would show the **Days OnLine** increasing by 30 or 31 days.

?201 to ?202 4-20mA Output Option

201 Trim 4-20mA Zero

Viewed at **4-20mA Output >ENTER> >DOWN> Trim Zero >ENTER>**

```
Trim Zero   ?201
Now 4mA     6
```

Power and connect the 4-20mA current loop wiring.
Sets the current loop output to 4mA

Trim Zero corrects the 4mA electronic offset at both the controller 4-20mA transmitter and the receiving automation system or conductivity monitoring input. The **Trim Zero** adjustment has a limited range so that wiring and configuration errors cannot be obscured, or masked by the current loop zero calibration.

Trim Zero will not work if the current loop loop is open-circuited or not powered.

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

The current loop may be powered by the controller 15V supply or by the load. This loop is not powered!

Step 1:
Trim Zero requires a correctly operating current loop.

```
4-20mA Output
  8.65 mA
```

Open the current loop and insert a DC milli-ammeter.
Verify that you measure a loop current of 8.6mA

Step 2:
Key **>ENTER> >DOWN> Trim Zero >ENTER**
Your milli-ammeter should now display nominally 4mA +/- 0.5mA.
Step 3.
Key **>UP>** or **>DOWN>** to adjust the milli-ammeter reading until it reads 4mA
If the displayed number does not change when you key **>UP>** or **>DOWN>**, you have reached the end of the `Trim Zero` adjustment range.
Step 4.
Key **>EXIT>** To end adjust. Disconnect the milli-ammeter.

202 Trim 4-20mA Span

Viewed at **4-20mA Output >ENTER> >DOWN> Trim Span >ENTER>**

```
Trim Span   ?202      Power and connect the 4-20mA current loop wiring.
Now 20mA   91         Sets the current loop output to 20mA
```

Trim Span corrects the span electronic offset at both the controller 4-20mA transmitter and the receiving automation system or conductivity monitoring input. The **Trim Span** adjustment has a limited range so that wiring and configuration errors cannot be obscured, or masked by the current loop span calibration.

Trim Span will not work if the current loop is open-circuited or not powered.

```
4-20mA Output      The current loop may be powered by the controller 15V supply
Disconnected!      or by the load. This loop is not powered!
```

Step 1:
Trim Span requires a correctly operating current loop.

```
4-20mA Output      Open the current loop and insert a DC milli-ammeter.
  14.12 mA             Verify that you measure a loop current of 14.1mA
```

Step 2:
Key **>ENTER> >DOWN> Trim Span >ENTER**
Your milli-ammeter should now display nominally 20mA +/- 0.5mA.
Step 3.
Key **>UP>** or **>DOWN>** to adjust the milli-ammeter reading until it reads 20mA
If the displayed number does not change when you key **>UP>** or **>DOWN>**, you have reached the end of the `Trim Span` adjustment range.
Step 4.
Key **>EXIT>** To end adjust. Disconnect the milli-ammeter.

?211 ORP Sensor

211 ORP Sensor Fails Calibrate page 1 of 2

Alarms display '**ORP Sensor**'.

If, after calibrating, the adjustment required to make the measured ORP mV match the user set **Calibrate** value is abnormal, the controller displays: `Advice ?211 Fails Calibrate`

>ENTER> ignores the `Advice` and sets the ORP mV to the user set value.

>EXIT> resets the sensor to the factory settings.
Key **>EXIT>** when you are trying to find out why the `Fails Calibrate` message is occurring.

`Fails Calibrate` can be caused by one or more of the following causes.
Once you have identified and corrected the cause, re-calibrate the ORP sensor.

1. Ensure that the sample line has flow and that the sensor is installed vertically, tip down and fully immersed. Make sure that the free oxidant sample is removed from the sample line, so it's seeing the same water as the sensor.

2. Remove the sensor and inspect for visible debris and fouling. If the site is subject to oil, grease or biological fouling, clean the sensor with alcohol and a soft brush. If the site is subject to silica fouling and has recently experienced a failure to control cycles or a change in make-up silica, clean the sensor with a stiff brush (silica or biofouling fouling is seldom visible). Re-install and re-calibrate.

3. Ensure that the ORP smaller center conductor is connected to the **pH-ORP** terminal block '**+**' terminal and the braided shield is connected to the **Shld** terminal.

4. Verify the ORP tester with a calibration solution.

5. If the ORP sensor is remote from the controller, make sure that 120VAC cabling does not share the sensor cable conduit.

5. Verify that the chemical injection locations have not changed. Controllers without Control Verification, must inject oxidant downstream of the ORP sensor. Pot feeders must be downstream of the ORP sensor.

6. If the ORP sensor is over a year old, replace it. If the downstream sample line isolation valve is closed BEFORE the upstream valve when isolating the piping. ORP sensors may fail on overpressure. Similar failures occur if the upstream sample line isolation valve is opened BEFORE the downstream valve when placing the piping in service.

7. Verify that the GREEN solution ground is attached to the bottom of the ORP sensor entry 'T' and connected to the GROUND terminal on the controller pH-ORP terminal block. ORP sensors may drift without a sensor solution ground cable.

8. Excess ORP sensor cable should be coiled <u>outside</u> of the controller enclosure, away from 120VAC cabling. Shortening the ORP sensor cable is not advised. The black insulation between the braid and internal clear insulation is conductive and will short circuit the sensor unless you are very careful stripping the layer to expose at least ¼" of clear inner insulation.

Application Note: ORP Sensors

When ORP sensors fail they tend to read a low value and fail to change when the free oxidant in the cooling tower changes. Since the failed ORP sensors often read less than the **Oxidant Pump** setpoint, the controller displays the **Oxidant Pump** alarm when the pump ON time exceeds the **Limit Timer.**

If you do not have a wiring or installation fault, the most likely causes of ORP sensor failure are:

1. Fouled Sensor: ORP sensors foul easily in high solids or biologically loaded towers. Remove the sensor, wipe off the silver surface with a paper towel or soft brush and re-install. If it reads correctly, up the flow rate in the sample line to keep it cleaner.
2. Contaminated Sensor: High iron or copper levels plate onto the sensors platinum surface. Usually this is a problem at sites that are switching from manually feed oxidant to ORP control. Previously high oxidant levels may have caused high iron or copper levels in the cooling water. A contaminated sensor can be restored with strong acid cleaning. Sulfuric acid is not strong enough to strip the contaminated platinum surfaces. Contaminated sensors usually read a low ORP and do not response when the oxidant level increases.
3. Overpressured Sensor: ORP sensors are filled with potassium hydroxide with the tip of the sensor sealed with an ‘O’ ring. ORP sensors are typically rated at 100psi. If you close the downstream sample line isolation valve before the upstream, you can fail the ‘O’ ring and contaminate the internal potassium hydroxide with tower water. A similar fault can occur if you open the upstream valve before the downstream valve. This preventable failure requires sensor replacement and has same symptoms as the first two fault causes.

ORP sensors are more rugged than pH sensors. They are not sensitive to electrical noise like pH sensors and unlike pH sensors they do not change their electrical characteristics at low temperatures. If you avoid the causes 2 & 3 of ORP sensor failure, ORP sensors are low maintenance and have long operating lives.

?212 pH Sensor

212 pH Sensor Fails Calibrate page 1 of 2

Alarms display '**pH Sensor**'.

If, after calibrating, the adjustment required to make the measured pH match the user set **Calibrate** value is abnormal, the controller displays: `Advice ?212 Fails Calibrate`

>ENTER> ignores the `Advice` and sets the pH to the user set value.

>EXIT> resets the sensor to the factory settings.
Key **>EXIT>** when you are trying to find out why the `Fails Calibrate` message is occurring.

`Fails Calibrate` can be caused by one or more of the following causes.
Once you have identified and corrected the cause, re-calibrate the pH sensor.

1. Ensure that the sample line has flow and that the sensor is installed vertically, tip down and fully immersed. Make sure that the pH sample is removed from the sample line, so it's seeing the same water as the pH sensor.

2. Remove the sensor and inspect for visible debris and fouling. If the site is subject to oil, grease or biological fouling, clean the sensor with alcohol and a soft brush. If the site is subject to silica fouling and has recently experienced a failure to control cycles or a change in make-up silica, clean the sensor with a stiff brush (silica or biofouling fouling is seldom visible). Re-install and re-calibrate.

3. Ensure that the pH smaller center conductor is connected to the **pH-ORP** terminal block '**+**' terminal and the braided shield is connected to the **Shld** terminal.

4. Verify the pH tester with a calibration solution. Typically pH10 or pH9 buffers are used for cooling towers.

5. Verify that the chemical injection locations have not changed. Controllers without Control Verification, must inject acid downstream of the pH sensor.

6. If the pH sensor is over a year old, replace it. If the downstream sample line isolation valve is closed BEFORE the upstream valve when isolating the piping. pH sensors may fail on overpressure. Similar failures occur if the upstream sample line isolation valve is opened BEFORE the downstream valve when placing the piping in service.

7. Verify that the GREEN solution ground is attached to the bottom of the pH sensor entry 'T' and connected to the GROUND terminal on the controller pH-ORP terminal block. pH sensors will drift without a sensor solution ground cable. Ensure that the controller is plugged into a grounded electrical outlet

8. Excess pH sensor cable should be coiled <u>outside</u> of the controller enclosure, away from 120VAC cabling. Shortening the pH sensor cable is not advised. The black insulation between the braid and internal clear insulation is conductive and will short circuit the sensor unless you are very careful stripping the layer to expose at least ¼" of clear inner insulation.

212 pH Sensor Fails Calibrate page 2 of 2

Application Note: pH Sensors

When pH sensors fail they do not track changes in the cooling water pH. Failed pH sensors may read a high or low pH so acid may never be fed or the **Acid Pump** ON time may exceed the **Limit Timer** and the controller will display the **Acid Pump** alarm.

If you do not have a wiring or installation fault, the most likely causes of pH sensor failure are:

1. Sensor Aging: Wide and frequent thermal changes may micro crack the pH sensitive glass over time. Once the thin sensor bulb glass cracks, the sensor will not track tower pH. For the same reason, it's preferable to calibrate the sensor in the sample piping by testing a sample of the tower water. Less sensor handling usually provides a longer pH sensor service life.
2. Fouled Sensor: pH sensors can foul in high solids, high silica or biologically loaded towers and in greasy-oily waste water streams. Remove the sensor, clean with alcohol and a soft brush. If the sensor is fouled with whitish carbonate, remove scale with HCL until fizzing stops. Re-install & re-calibrate. If the pH sensor is subject to frequent fouling, consider automating the cleaning using a biocide timer. If the pH sensor is frequently scaling, the bleed solenoid setpoints may be too high for the make-up chemistry or the water treatment program. Verify that the conductivity sensor is reading correctly.
3. Overpressured Sensor: pH sensors are filled with potassium hydroxide with the tip of the sensor sealed with an 'O' ring. pH sensors are typically rated at 100psi. If you close the downstream sample line isolation valve before the upstream, you can fail the 'O' ring and contaminate the internal potassium hydroxide with tower water. A similar fault can occur if you open the upstream valve before the downstream valve. This preventable failure requires pH sensor replacement.

pH sensors are less prone to fouling than ORP sensors, likely since the pH sensitive glass does not react with cooling water iron or copper levels like an ORP sensor's platinum surface. Sensor internal resistance increases as water temperature falls, increasing sensitivity to electrical noise. As the water temperature falls below 50F or 10C, a pH that drifts or appears unstable usually indicates that the sensor cable is not coiled and routed away from 120VAC wiring.
Do not extend pH sensor cables.

?230 to ?234 Oxidant Pump

231 ON or OFF on ORP Control

Viewed at **Oxidant Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **ORP Control**

Oxidant Pump ON displays `Off@  325  ?231` **Pump turns OFF at 325 mV**
`ON  311 mV` **Now ON, 311 mV current ORP**

Oxidant Pump OFF displays `On@  300  ?231` **Pump turns ON at 300 mV**
`OFF  304 mV` **Now OFF, 304 mV current ORP**

Current State shows why the Oxidant Pump is ON or OFF and what's required to change its state.

If the **Oxidant Pump** is OFF, the residual oxidant in the tower water holds the measured ORP above the TurnON setpoint. As residual oxidant is consumed, the ORP falls below the TurnON setpoint.
turning ON the Oxidant Pump.
If the **Oxidant** is ON, oxidant is consumed until the biological demand is met and then the ORP starts to increase. Once the ORP exceeds the TurnOFF setpoint, the Oxidant Pump turns OFF.

ORP updates every second.

Application Note:
ORP Control is both the controller factory default feed mode and the most common method of controlling available oxidant using ORP.
Sites which experience frequent changes in oxidant demand due to changing temperature, make-up water or biological load, use ORP Control to maintain a target available oxidant residual.

If you are not legally required to maintain a specified free oxidant level, ORP setpoints trade biological control for corrosivity. Cooling water systems with copper exchanger tubing and/or galvanized towers usually minimize the free oxidant level to limit corrosion.

Unlike conductivity control, optimal ORP control is not easily defined since it incorporates water treatment program objectives and may involve interaction with an organic biocide.

If the water treatment program requires a constant residual oxidant level, adjust the ORP setpoints for 10mV between TurnON & TurnOFF. You'll see many short feed cycles while the tower is on-line.

If the water treatment program requires an interval of very high residual (slug feeding) level, adjust the ORP setpoints for 50-75mV between TurnON & TurnOFF. You may see a single daily feed cycle or perhaps a feed cycle every other day.

The relationship between ORP and available oxidant is non-linear & varies from site-to-site. However if a sample of cooling water has 0.5ppm of free Chlorine and the ORP measures 325mV, then setting the controller to turn ON oxidant at 325mV and OFF at 335mV will maintain 0.5ppm of free Chlorine.

If you change the tower bleed setpoints, therefore its pH, you'll need to adjust the Oxidant pump setpoints.

233 Oxidant Pump, Percentage Time & Priming

Viewed at **Oxidant Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Percentage Time** or after **Prime Pump**

`Owes 131sec ?233`	**Pump turns OFF in 131 seconds**
`ON ENTER=Stop`	**Press >ENTER> to zero owed time & turn OFF pump**
	Percentage Time mode only
`On in 209sec?156`	**Pump turns ON in 209 seconds**
`OFF`	**Now OFF**

Current State shows why the oxidant pump is ON and what's required to change its state.

Percentage Time
Every 5 minutes that the Flowswitch is ON the **Oxidant Pump** turns ON for the % Setpoint.
For example, an 18% Oxidant Setpoint, would set the time owed to 54 seconds.
The **Oxidant Pump** would turn ON for 54 seconds in every 300 seconds.

Prime Pump
Prime the **Oxidant Pump** by **>UP>** or **>DOWN>** to:
Oxidant Pump >ENTER> >DOWN> Prime Pump >ENTER the **Feed** setpoint in seconds.

Priming adds 5 minutes or 300 seconds to the pump owed time. If the **Flowswitch** is OFF, the **Oxidant Pump** will turn ON as soon as the **Flowswitch** is ON.

234 Oxidant Pump Feed Limit Timer

Alarms display **Oxidant Pump**.

Viewed at **Oxidant Pump >ENTER> >DOWN> Limit Timer >ENTER>**

```
Timed Out   ?234      Limit Timer exceeded
OFF ENTER=RESET       Oxidant Pump OFF, key >ENTER> to reset & restart pump
```

Limit Timer prevents oxidant overfeeding during each ON/OFF control cycle.

Application Note

The **Oxidant Pump Limit Timer** set shuts OFF the pump or pot feeder, preventing a corrosive, high residual on ORP sensor fault. The **Limit Timer** setting is typically set to 25-30% longer than the time required to correct the ORP under higher thermal load or dirty, upset operating conditions. The time to correct the ORP varies with the biological load, volume of water in the system, pump GPH size and stroke and frequency settings.

If you are alarming and the **Limit Timer** is set correctly, the cause tells you system state:

1. If ORP sensor is not responding to the change in tower water residual and oxidant pumps, the **Limit Timer** will turn OFF the Oxidant **Pump**. Verify the ORP sensor reads the correct, cooling water residual.
2. If the oxidant pump loses prime or runs out of oxidant, the controller will set the **Oxidant Pump** alarm since the tower water ORP will not increase when the oxidant pump is ON, exceeding the **Limit Timer**.
3. If the **Oxidant Pump** stroke or frequency have been reduced, the pump will be ON for a longer period, exceeding the **Limit Timer**.
4. If make-up water type has changed or if gray water is being blended with potable make-up water, the **Oxidant Pump** will run longer to compensate & may exceed the **Limit Timer**.

SlimFlex microFlex: HELP
?240 to ?246 Acid Pump

241 ON or OFF on pH Control

Viewed at **Acid Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **pH Control**

Acid Pump ON displays	`Off@ 7.95 ?241` `ON 8.11pH`	**Pump turns OFF at 7.95 pH** **Now ON, 8.11 current pH**
Acid Pump OFF displays	`On@ 8.00 ?241` `OFF 7.92pH`	**Pump turns ON at 8.00 pH** **Now OFF, 7.92 current pH**

Current State shows why the acid pump is ON or OFF and what's required to change its state.

While the **Acid Pump** is OFF, evaporation increases the tower water pH above the TurnON setpoint, turning ON the acid pump.
If the **Acid Pump** is ON, acid lowers the cooling water pH below the TurnOFF setpoint, turning OFF the acid pump.

pH updates every second.

Application Note:
pH Control is both the controller factory default acid feed mode and the most common method of increasing cycles of concentration and reducing make-up volume.
Sites feed sulfuric acid to reduce hardness, allowing higher cycles of concentration without scaling.
Higher cycles of concentration uses less make-up water and usually less inhibitor.

Cycles of Concentration: If the make-up water conductivity is 500uS and the Bleed Solenoid setpoint is 1000uS, you are operating your cooling tower at 2 cycles of concentration. Generally 1.5 cycles of concentration is poor and 6 cycles more than you usually require. Increasing the cycles of concentration above an optimum, does not significantly reduce the make-up volume.

Make-up Sets Cycles of Concentration
The maximum cycles of concentration are usually limited by the tower make-up chemistry. The worst case maximum cycles may also be limited by widely varying make-up water chemistry.
Conductivity is used as a measure of hardness, sulfates and/or silica in the tower water, since the levels of these components which cause scaling are not easily, directly measurable.
At most sites, the make-up conductivity tracks those components which cause scaling. Therefore, controlling the tower conductivity by setting the Bleed Solenoid setpoints, limits the maximum concentration of scaling components.

How many cycles of concentration? Your water treatment provider matches the water treatment and make-up water chemistry to the target cycles of concentration. Feeding sulfuric acid to reduce the concentration of scaling components is frequently an option.

Acid Pump Setpoints
The water treatment provider sets the **Acid Pump** setpoints to meet the target cycles on concentration. Typically setpoints range between 7.5pH and 9pH with a deadband (**TurnON** – **TurnOFF** setpoints) of 0.05pH.

243 Acid Pump, Feed on Volume

Viewed at **Acid Pump >ENTER> >UP> Current State >ENTER>**
Displays when **Feed Mode** is set to **Feed on Volume**

```
On@ 26100 G ?243     Pump when the make-up meter measures 26,100 Gallons
OFF  26000 G         Pump is now OFF & water meter measures 26,000 Gallons

Owes  58sec ?243     Pump ON for 58 seconds
ON  ENTER=Stop       Key >ENTER> to zero owed time and turn pump OFF.
```

Current State shows why the acid pump is OFF and what's required to change its state.

When the increase in water meter volume is greater then the **Measure** setpoint, the Acid Pump turns ON for the **Feed** setpoint in seconds. If more volume is measured before the Owed time is zero, the extra time is added to Owed.
In this example example: **Measure** = 100 gallons and **Feed** = 8 seconds,
every 100 Gallons on make-up volume would turn ON the acid pump for 8 seconds.
Today the cooling tower has made-up 26,000 Gallons and when it has made-up 26,100 Gallons, the Acid pump will turn ON for 8 seconds.

Application Note:
Warning: pH control based on a make-up water meter requires constant make-up water chemistry to maintain the cooling water pH within the target range

Measure setpoints do not have to be the same as the water meter Gallons-per-contact. The controller will do the math. For example if you have a 50 Gallon/Contact make-up meter you could set the **Measure** setpoint to 425 Gallons and the **Feed** setpoint to 36 seconds. The controller will remember the 25 extra gallons not used for the 36 second feed.

Select the Acid Pump setpoints that fit for the pump settings and target pH concentration, the controller will do the math to ensure an accurate feed on volume.

244 Feed Limit Timer

Alarms display **Acid Pump**.

Viewed **Acid Pump >ENTER> >DOWN> Limit Timer >ENTER>**

```
Timed Out   ?244      Limit Timer exceeded
OFF ENTER=RESET       Acid Pump OFF, key >ENTER> to reset & restart pump
```

Limit Timer prevents acid overfeeding during each ON/OFF control cycle.

Application Note
The **Acid Pump Limit Timer** shuts OFF the pump, preventing a corrosive, low pH on pH sensor fault. The **Limit Timer** setting is typically set to 25-30% longer than the time required to correct the pH under higher thermal load. The time to correct pH varies with the volume of water in the sump-piping and acid pump GPH size and stroke and frequency settings.
If you are alarming and the **Limit Timer** is set correctly, the cause tells you system state:

1. If pH sensor is not responding to the change in tower water pH and acid pumps, the **Limit Timer** will turn OFF the **Acid Pump**. Verify the pH sensor reads the correct, cooling water pH.
2. If the acid pump loses prime or runs out of acid, the controller will set the **Acid Pump** alarm since the tower water pH will not decrease when the acid pump is ON, exceeding the **Limit Timer**.
3. If the **Acid Pump** stroke or frequency have been reduced, the pump will be ON for a longer period, exceeding the **Limit Timer**.
4. If make-up water hardness has increased, the **Acid Pump** will run longer to compensate & may exceed the **Limit Timer**.

249 Priming the Acid Pump

Viewed at **Acid Pump >ENTER> >UP> Current State >ENTER>**

```
Owes 218sec ?243      Pump ON for 218 seconds
ON   ENTER=Stop       Key >ENTER> to zero owed time and turn pump OFF.
```

Current State shows why the acid pump is ON and what's required to change its state.

Prime the **Acid Pump** by **>UP>** or **>DOWN>** to:
Acid Pump >ENTER> >DOWN> Prime Pump >ENTER.

Priming adds 5 minutes or 300 seconds to the pump owed time.
If the **Flowswitch** is OFF, the **Acid Pump** will turn ON as soon as the **Flowswitch** is ON.

?250 to ?255 Captured Sample Boiler Blowdown

250 Sampling

Viewed at **Blowdown Valve >ENTER> >UP> >UP> Current State >ENTER>**

```
ON,Sampling ?250
  21 sec Stop= ↵
```

Blowdown Valve OPEN, sampling boiler water

Key >ENTER> to end Sampling & start the Measure period.

Current State shows why the blowdown valve is ON and what's required to change its state.

The displayed time in seconds counts down to zero and then the Blowdown Valve closes for the **Measure** period.

During Sampling, boiler pressure forces boiler water into the surface blowdown line, providing a fresh, representative sample to the conductivity sensor. The conductivity of the sample is measured and the controller display updated after the Blowdown Valve closes and the **Measure** period ends.

The factory default **Sample** time is 30 seconds. This period works well for sensors located 20-30 feet, 10m, from the point the surface blowdown line exits the boiler.
Sensors located within several feet or meters of the boiler can use a shorter 10 second **Sample** time.
Sensors located a 100 feet / 30m or more from the boiler may require **Sample** times over 60 seconds to purge the piping between the boiler and sensor.

Selecting a Sample Time
The factory default 30 second **Sample** will work for typical installations.

Setting the **Sample** time longer than needed to deliver a fresh sample to the sensor may waste both energy and water treatment chemicals. The actual time required to clear the piping to the sensor varies widely with boiler pressure, throttling valve setting and piping size, length and routing between boiler and flash tank.

The easiest way to check **Sample** time is to set the **Re-Sample** time to 5 minutes and the blowdown setpoints above the current boiler conductivity. Watch as the controller Samples, Measures and updates the conductivity every 5 minutes. If your boiler is typical, conductivity won't increase measureably in 5 minutes and you should see less than 25uS difference between the 2nd and 3rd Samples.

If displayed conductivity rises with each sample. Increase **Sample** time so that two sequential samples measure within 25uS.

Optimizing Sample Time
Use the previous **Selecting a Sample Time** procedure, reduce the **Sample** time until sequential samples differ by more than 25uS & then increase the **Sample** time by 2-3 seconds.

251 Measure

Viewed at **Blowdown Valve >ENTER> >UP> >UP> Current State >ENTER>**

```
OFF,Measure ?251
 104 sec Stop=↵
```

Blowdown Valve CLOSED, sensor temperature falling

Key >ENTER> to end Measure & start either Waiting or Blowdown.

Current State shows why the blowdown valve is OFF and what's required to change its state.

The displayed **Measure** time in seconds counts down to zero and then conductivity is measured. The controller display is then updated and the controller enters either **Re-Sample** or **Blowdown** depending on the measured conductivity and the controller **Blowdown Valve** setpoints.

During the **Measure** period, the boiler water at the sensor cools towards ambient temperature. At the end of the **Measure** period the boiler water conductivity is measured. If the conductivity is above the **Turn On** setpoint, the controller starts **Blowdown**. If the conductivity is less than the **TurnOFF** setpoint, the controller starts **Re-Sample - Waiting** ,

Since the boiler pressure is controlled, the boiler water temperature is constant. The temperature at the sensor is fixed and repeatable since the **Measure** time is constant. It does not matter what the actual sensor temperature is, only that the conductivity used for blowdown control is measured and displayed at the same temperature each time.

The 60 second factory default **Measure** time works for most installations. If you change **Measure** time, Re-calibrate the conductivity, since you have changed the amount of cooling that occurs during **Measure** and therefore changed the temperature when the conductivity is measured.

The longer the **Measure** time the more repeatable the conductivity measurement at the end of the **Measure** period. Increasing the Measure time beyond 120 seconds does not measurably improve conductivity control.

The **Blowdown Valve** is closed during the **Measure** time so the boiler water sample is not moving. Flashing that may have occurred during the **Sample** period may not cause conductivity measurement errors if the sensor location is fully immersed by the end of the **Measure** period.

More Blowdown Time

Note that if **Blowdown** time is set to 120 seconds and the **Measure** time is set to 60 seconds, the blowdown valve is open for 2/3 of the time when the boiler water conductivity is above the **Turn ON** setpoint.

If you are not getting enough blowdown, open the throttling valve instead of increasing the Blowdown time. Tighter control results since the conductivity is checked more frequently.

252 Blowdown

Viewed at **Blowdown Valve >ENTER> >UP> >UP> Current State >ENTER>**

```
ON,Blowdown ?252
  86 sec Stop=↵
```

Blowdown Valve OPEN, boiler water conductivity falling

Key >ENTER> to end Blowdown & start the Measure period.

Current State shows why the blowdown valve is ON and what's required to change its state.

The displayed **Blowdown** time in seconds counts down to zero and then the **Blowdown Valve** closes and **Measure** starts.

During the **Blowdown** period, boiler pressure forces boiler water through the surface blowdown line and Into the flash tank. Boiler make-up enters the boiler to maintain the water level and dilutes the water in the boiler, lowering the boiler water conductivity.

While the boiler is blowing down, it's providing a fresh sample of boiler water to the conductivity sensor so that when the **Blowdown** period ends, the sample at the sensor is the current conductivity of the boiler water.

The controller starts a **Measure** period at the end of every Blowdown period checking the conductivity at the end of the Blowdown period.

Selecting a Blowdown Time
The factory default **Blowdown** time is set to 60 seconds.
If the **Conductivity** is still above the **Turn OFF** setpoint, another **Blowdown** time starts. **Blowdown-Measure** cycle continues until the **Conductivity** is less than the **TurnOFF** setpoint.
Setting the **Blowdown** time over 300 seconds, may over blow the boiler, lowering the **Conductivity** far below the **TurnOFF** setpoint and wasting energy & water treatment chemicals.
Setting the **Blowdown** time less than 30 seconds does not usually result in tighter conductivity control.

Most sites operate with **Blowdown** times between 60 & 180 seconds.

Caution: Do not set the **Blowdown** time less than the **Sample** time.

More Blowdown Time
Note that if **Blowdown** time is set to 60 seconds and the **Measure** time is set to 60 seconds, the blowdown valve is open for 50% of the time when the boiler water conductivity is above the **Turn ON** setpoint.
If you are not getting enough blowdown, open the throttling valve instead of increasing the Blowdown time. Tighter control results since the conductivity is checked more frequently.

You are not getting enough blowdown if the conductivity continues to increase as the controller cycles through several **Blowdown:Valve Open – Measure:Valve Closed** cycles

253 Waiting – the ReSample Period

Viewed at **Blowdown Valve >ENTER> >UP> >UP> Current State >ENTER>**

```
OFF,Waiting ?253
24.6 min Stop=↵
```

Blowdown Valve CLOSED, boiler water conductivity rising

Key >ENTER> to end Waiting & start Sampling.

Current State shows why the blowdown valve is OFF and what's required to change its state.

The displayed **Waiting** time in minutes counts down to zero and then the **Blowdown Valve** opens and **Sample** starts.

Selecting a ReSample Time

The factory default **ReSample** time of 60 minutes works for a large number of sites.

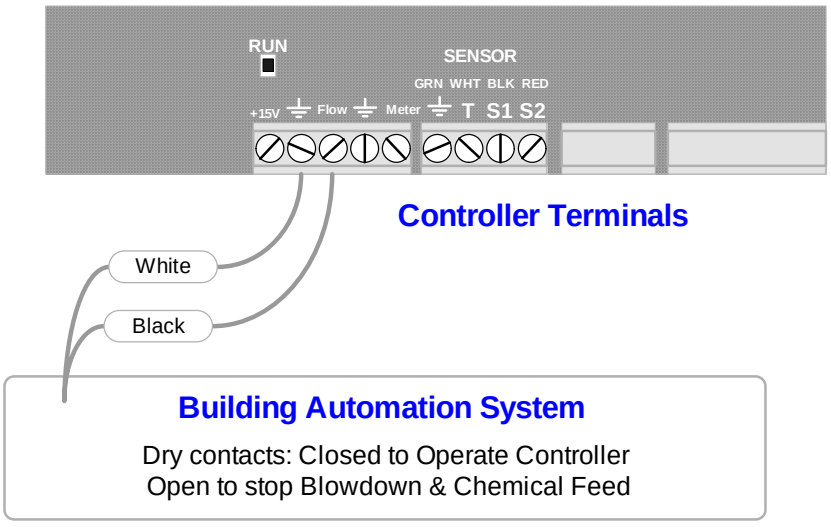
Selecting a **ReSample** time trades tight control for energy and chemical costs.
Frequent sampling costs the energy required to heat the boiler water sample and the chemicals required to treat the sample.
A lightly loaded boiler should be sampled infrequently, every 60 to 240 minutes.
Standby boilers may have Re-sample times of up to 720 minutes, every 12 hours.
A boiler under heavy load could be sampled as frequently as every 15 minutes, particularly if the conductivity increases rapidly under load. Boilers with low quality make-up or a low percentage of condensate return may require short Re-Sample times.

Too Short a ReSample Time

Sampling too frequently may prevent the boiler from cycling up to the **Blowdown** setpoint.
If you are concerned about detecting and responding to a load change, consider reducing the throttling valve setting instead of reducing the **ReSample** time. Check that the **Sample** time is long enough to purge the piping between boiler and sensor with the reduced throttle valve setting

Interlocking, Stopping Blowdown & Chemical Feed

If the boiler is only loaded during office or business hours, use the building automation system or a timer to stop the operation during the non-loaded hours. You may already be lowering the boiler firing rate during the off peak period. Use a separate dry contact set connected between the controller **Flow** & **Ground** terminals, which open during the time you wish to stop **Blowdown Valve** and **Inhibitor Pump** operation.



SlimFlex microFlex: HELP

254 Watching – Conductivity Sensor & Blowdown Diagnostic

Viewed at **Conductivity >ENTER> >UP> Sensor Watch >ENTER>**

```
Watching ?254
  2341 uS
```

Blowdown Valve CLOSED, boiler water conductivity rising
Key >EXIT> to end Watching

The **Sensor Watch** menu option is only available when **Blowdown mode** = **Sampling**

Displays the current value at the conductivity sensor, updated every second.

Blowdown Valve OPEN or CLOSED?
If you are at the controller but cannot see the state of the blowdown valve, open the controller enclosure and view the green **Bleed** light at the bottom, right of the controller enclosure. When the **Bleed** light is ON, the blowdown valve is open, blowing down the boiler.

If you are remote from the controller, using a browser, frequently select **Refresh View** to update the **Blowdown Valve** ON – OFF state.

Normal, correct operation

Blowdown valve first opens: Displays an increasing conductivity as the sensor is heated by the high temperature boiler water.

During Sampling or Blowdown: Displays a constant conductivity, indicating that the sample piping has been flushed and a new sample, representing the current boiler water conductivity is at the sensor.

Blowdown valve closes: Displays a falling conductivity as the sensor cools. The longer the blowdown valve is closed, the lower the displayed conductivity. Typically within 30 minutes the temperature at the sensor is less than 212F, 100C. The cooling rate declines and so does the drop in displayed conductivity.

Flashing
If the conductivity value drops below 200uS when the blowdown valve opens, you have a restriction upstream of the sensor which is flashing the boiler water to steam. The conductivity sensor is measuring a mix of water and steam.
If the conductivity displays a stable and declining conductivity as soon as the blowdown valve closes, a minimal flashing may not prevent accurate boiler conductivity control.
If the displayed conductivity is not repeatable; sometimes above the setpoint and sometimes below, flashing is preventing accurate conductivity control.
Ensure that manual valves upstream of the sensor are fully open and that unions upstream of the sensor do not have orifice plates installed.
Increases in piping size upstream of the sensor, may cause flashing.
In some cases decreasing the downstream throttling valve setting may prevent flashing. Typically this valve is set from 15% to 30% open.
Flashing upstream of the sensor and blowdown valve usually precipitates solids on the sensor and on the valve seals, causing maintenance problems & loss of blowdown control.

Blocked Surface Blowdown
If the displayed conductivity does not change when the blowdown valve opens, the surface blowdown line is blocked or valved OFF, upstream OR downstream of the sensor.
Correct this fault immediately!
The displayed conductivity is not the boiler conductivity.