



## O & M Manual



### Model Q45H-65 Portable Residual Chlorine Dioxide Measurement System

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## 6.64 Configuration Menu [CONFIG]

The Configuration Menu contains all of the general user settings:

- Entry Lock** This function allows the user to lock out unauthorized tampering with instrument settings. All settings may be viewed while the instrument is locked, but they cannot be modified. The Entry Lock feature is a toggle-type setting; that is, entering the correct code will lock the transmitter and entering the correct code again will unlock it. The code is preset at a fixed value. Press ENTER to initiate user entry mode and the first digit will flash. Use arrow keys to modify value. **See Page 80 for the Q45H lock/unlock code.** Press ENTER to toggle lock setting once code is correct. Incorrect codes do not change state of lock condition.
- Set Delay** The delay function sets the amount of damping on the instrument. This function allows the user to apply a first order time delay function to the chlorine dioxide measurements being made. Both the display and the output value are affected by the degree of damping. Functions such as calibration are not affected by this parameter. The calibration routines contain their own filtering and stability monitoring functions to minimize the calibration timing. Press ENTER to initiate user entry mode, and the value will flash. Use the arrow keys to modify value; range is 0.1 to 9.9 minutes. Press ENTER to store the new value.
- Contrast** This function sets the contrast level for the display. The custom display is designed with a wide temperature range, Super-Twist Nematic (STN) fluid.
- The STN display provides the highest possible contrast and widest viewing angle under all conditions. Contrast control of this type of display is generally not necessary, so contrast control is provided as a means for possible adjustment due to aging at extreme ranges. In addition, the display has an automatic temperature compensation network. Press ENTER to initiate user entry mode, and the value will flash. Use arrow keys to modify the value; range is 0 to 8 (0 being lightest). Press ENTER to update and store the new value.

<b>Main Units</b>	This function allows the user to select either PPM or mg/l for the chlorine measurement.
<b>Zero Filter</b>	This function forces the reading to zero when reading is below the entered value. For example, If the entered value were 0.0020 the display at 0.0019 would then indicate 0.0000. This feature is useful in blanking out zero noise.
<b>Main Display</b>	This function allows the user to change the measurement in the primary display area. The user may select between ozone, sensor temperature, or output current. Using this function, the user may choose to put temperature in the main display area and ozone on the secondary, lower line of the display. Press ENTER to initiate user entry mode, and the entire value will flash. Use the UP arrow key to modify the desired display value. Press ENTER to store the new value.
<b>*Iout#2 Mode</b>	This function sets analog output #2 for either temperature, chlorine dioxide or the optional pH.
<b>Temp Units</b>	This function sets the display units for temperature measurement. Press ENTER to initiate user entry mode, and the entire value will flash. Use the UP arrow key to modify the desired display value. The choices are °F and °C. Press ENTER to store the new value.
<b>pH Input</b>	<b>Not used on Portables</b>

## 6.65 Control Menu [CONTROL]

The Control Menu contains all of the output control user settings:

**Set 0V #1**  
**Set 2.5V #1**  
**Set 0V #2**  
**Set 2.5V #2**

These functions set the output range for each of the two instrument outputs. The value stored for the 0V point may be higher or lower than the value stored for the 2.5V point.

The entry values are limited to values within 20.00 ppm and must be separated by at least 1% of this range. Use the LEFT arrow key to select the first digit to be modified. Then use the UP and LEFT arrow keys to select the desired numerical value. Press ENTER to store the new value.

Output #1 will always be in units of ppm, as it is fixed to track chlorine dioxide. Output #2 will be in either units of ppm pH, or C/F, depending on whether chlorine dioxide, pH, or temperature is set for Out#2 in the CONFIG menu.

**NOTE: If the temperature units are changed between °C and °F (see Temp Units in this section), the default settings for this output will be stored (present data is not converted.)**

## 6.66 Diagnostics Menu [DIAG]

The diagnostics menu contains all of the user settings that are specific to the system diagnostic functions, as well as functions that aid in troubleshooting application problems.

### **Set Hold**

The Set Hold function locks the current loop output values on the present process value, and halts operation of the PID controller. This function can be used prior to calibration, or when removing the sensor from the process, to hold the output in a known state. Once HOLD is released, the outputs return to their normal state of following the process input. The transfer out of HOLD is bumpless on the both analog outputs - that is, the transfer occurs in a smooth manner rather than as an abrupt change. An icon on the display indicates the HOLD state, and the HOLD state is retained even if power is cycled. Press ENTER to initiate

user entry mode, and entire value will flash. Use the UP arrow key to modify the desired value, selections are **ON** for engaging the HOLD function, and **OFF** to disengage the function. Press ENTER to store the new value.

**Note:** When the Relay Option Board is installed, the Set Hold function holds BOTH current levels, as well as ALL relay settings.

The Set Hold function can also hold at an output value specified by the user. To customize the hold value, first turn the HOLD function on. Press the ESC key to go to the DIAG Menu and scroll to Sim Output using the UP arrow key. Press ENTER. Follow the instructions under Sim Output (see following page).

## Fault List

The Fault List screen is a read-only screen that allows the user to display the cause of the highest priority failure. The screen indicates the number of faults present in the system and a message detailing the highest priority fault present. Note that some faults can result in multiple displayed failures due to the high number of internal tests occurring. As faults are corrected, they are immediately cleared.

Faults are not stored; therefore, they are immediately removed if power is cycled. If the problem causing the faults still exists, however, faults will be displayed again after power is re-applied and a period of time elapses during which the diagnostic system re-detects them. The exception to this rule is the calibration failure. When a calibration fails, no corrupt data is stored. Therefore, the system continues to function normally on the data that was present before the calibration was attempted.

After 30 minutes or if power to the transmitter is cycled, the failure for calibration will be cleared until calibration is attempted again. If the problem still exists, the calibration failure will re-occur. Press ENTER to initiate view of the highest priority failure. The display will automatically return to normal after a few seconds.

**Sim Out**

The Sim Out function allows the user to simulate the chlorine dioxide level of the instrument in the user selected display range. The user enters a ppm value directly onto the screen, and the output responds as if it were actually receiving the signal from the sensor. This allows the user to check the function of attached monitoring equipment during set-up or troubleshooting. Escaping this screen returns the unit to normal operation. Press ENTER to initiate the user entry mode, and the right-most digit of the value will flash. Use arrow keys to modify desired value.

The starting display value will be the last read value of the input. The output will be under control of the SIM screen until the ESC key is pressed.

*Note:* If the HOLD function is engaged before the Sim Output function is engaged, the simulated output will remain the same even when the ESC key is pressed. Disengage the HOLD function to return to normal output.

**Auto-Off**

Enables the automatic shut-off feature for the instrument. If ON, the instrument will automatically shut-off in 30 minutes after no keys are pressed to save power. If OFF, the meter will stay powered continuously until either the internal power switch on the battery board is turned OFF, or the battery voltage drops to the cut-off point (approximately 8-10 days on a standard 9 VDC alkaline battery.) Press ENTER to initiate user entry mode, and the entire value will flash. Use the UP arrow key to modify the desired display value. The choices are **OFF** and **ON**. Press ENTER to store the new value

**Backlight**

This function has three options. **ON** – On all the time, **OFF** – Off all the time, **AL** – Alarm (Default). This function flashes the backlight on and off whenever the Fail icon is displayed

**Default All**

The Default All function allows the user to return the instrument back to factory default data for all user settings. It is intended to be used as a last resort troubleshooting procedure. All user settings are returned to the original factory values. Hidden factory calibration data remains unchanged. Press ENTER to initiate user entry mode and the value **NO** will flash. Use the UP arrow key to modify value to **YES** and press ENTER to reload defaults.



# Part 7 – Calibration

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## 7.1 Chlorine Dioxide Calibration

Once power is applied, the sensor must be given time to stabilize. This is best done by following the zeroing procedure below. Establishing a stable zero is critical to the proper operation of the monitor. A complete calibration will include zeroing and spanning the sensor. It is generally unnecessary to set the zero at every calibration, however, it should be done during the initial installation.

### 7.11 Chlorine Dioxide Zero Cal

Chlorine dioxide sensors have extremely low offset currents at zero. For this reason, it is normally sufficient to simply leave the zero at the factory default of 0.0 nA. As an alternative, an electronic zero can be set by disconnecting the sensor from the cable and performing steps 1-5 below.

The steps below assume that the sensor has been prepared in accordance with section 5.1, Chlorine Dioxide Sensor Assembly, earlier in this manual. Note that the 8 hour waiting time in step 2 below is not required if the monitor has been running for 24 hours prior to zeroing. If the unit has been running with the sensor connected, the sensor will normally return to a stable zero within 15 minutes.

1. Connect the sensor to the electronics by plugging the cable plug into the receptacle on the top of the sensor.
2. Place about an inch of water in a small beaker or other convenient container and immerse the tip of the sensor. The water used need not be distilled, but it must not contain chlorine dioxide. For submersible sensors, submerge the entire sensor in a bucket water that does not contain chlorine dioxide. Allow the sensor to sit undisturbed for at least 8 hours.
3. Scroll to the CAL menu section using the MENU key and press ENTER or the UP arrow key. **Cal ClO<sub>2</sub>** will then be displayed.
4. Press the ENTER key. The screen will display a flashing **1-Ref** for span calibration or a **2-Zer** for zero calibration. Using the UP arrow key, set for a **2-Zer** zero calibration and press ENTER.

The system now begins acquiring data for the sensor zero calibration value. As data is gathered, the units for sensor current in nanoamps (nA) and temperature may flash. Flashing units indicate that this parameter is unstable. The calibration data point acquisition will stop only when the data

remains stable for a pre-determined amount of time. This can be overridden by pressing ENTER. If the data remains unstable for 10 minutes, the calibration will fail and the message **Cal Unstable** will be displayed.

5. If accepted, the screen will display the message **PASS** with the new sensor zero reading (offset), then it will return to the main measurement display. If the calibration fails, a message indicating the cause of the failure will be displayed and the FAIL icon will be turned on. The range of acceptable value for sensor offset is -25 nA to +25 nA. Should a FAIL occur, carefully inspect the sensor for a tear in the membrane. It will probably be necessary to rebuild the sensor as described in section 5.4, Chlorine Dioxide Sensor Assembly. Should the offset value remain high and result in calibration failures, review the Service section of this manual, and then contact the service dept. at ATI for further assistance.

The sensor zero offset value in nA from the last zero calibration is displayed on the lower line of the Default Menu for information purposes.

## 7.12 Chlorine Dioxide Span Cal

Span calibration of the system must be done against a laboratory measurement on the same sample that the sensor is measuring. A sample should be collected from the inlet line feeding the flow cell and quickly analyzed for chlorine dioxide. When calibrating, it is best to have a reasonably high concentration of chlorine dioxide in the system. The higher the value, the smaller will be the calibration errors caused by errors in the laboratory analytical procedure. It is generally preferable to calibrate at values above 0.5 PPM to reduce calibration errors. If possible a laboratory titration should be used as the reference method. The chlorine dioxide monitor can be calibrated while operating on a sample stream in the flow cell assembly, using a portable test kit.

Start flow cell and calibrate system as follows:

1. Place the previously zeroed sensor into the sensor chamber of the flow cell assembly. The sensor is inserted into the side of the flow cell and is sealed in place with a double o-ring. The o-rings are lubricated at the factory to allow the sensor to slide smoothly into place. If insertion becomes difficult, use a small amount of silicon grease to lubricate the o-rings. If the low-volume flow cell is used, screw the sensor into the flow cell until the membrane cap bottoms out on the acrylic flow cell. Do not over-tighten
2. Turn on the inlet water flow to the flow cell and adjust the inlet flow rate so that water is overflowing from the inlet chamber. The best performance will

- be obtained when some water is always overflowing. This maintains constant flow and pressure on the sensor at all times.
3. Allow the system to operate undisturbed for 30-60 minutes. Assuming the water contains chlorine dioxide, the display will be reading positive sensor current values. If the system is stable, the value on the display will increase to some PPM value and remain at that level. At that point, calibration can continue.
  4. If the sensor is on-line, the user may want to set the output HOLD feature prior to calibration to lock out any output fluctuations.
  5. Scroll to the CAL menu section using the MENU key and press ENTER or the UP arrow key. **Cal ClO<sub>2</sub>** will then be displayed.
  6. Press the ENTER key. The screen will display a flashing **1-Ref** for span calibration or a **2-Zer** for zero calibration. Using the UP arrow key, set for a **1-Ref** span calibration and press ENTER.
  7. The system now begins acquiring data for the calibration value. As data is gathered, the units for ppm and temperature may flash. Flashing units indicate that this parameter is unstable. The calibration data point acquisition will stop only when the data remains stable for a pre-determined amount of time. This can be overridden by pressing ENTER. If the data remains unstable for 10 minutes, the calibration will fail and the message **Cal Unstable** will be displayed.
  8. The screen will display the last measured ppm value and a message will be displayed prompting the user for the lab value. The user must then modify the screen value with the arrow keys and press ENTER. The system then performs the proper checks.
  9. If accepted, the screen will display the message **PASS** with the new sensor slope reading, then it will return to the main measurement display. If the calibration fails, a message indicating the cause of the failure will be displayed and the FAIL icon will be turned on. The range of acceptable values for sensor slope is 20% to 500%. It may be necessary to rebuild the sensor as described in section 5.4, Chlorine Dioxide Sensor Assembly. Should the slope value remain out of range and result in calibration failures, review the Service Section of this manual, then contact the service dept. at ATI for further assistance.

The sensor offset value in % from the last span calibration is displayed on the lower line of the Default Menus for information purposes.

## 7.2 Temperature Calibration

The temperature calibration sequence is essentially a 1-point offset calibration that allows adjustments of approximately  $\pm 5$  °C.

The sensor temperature may be calibrated on line, or the sensor can be removed from the process and placed into a known solution temperature reference. In any case, it is critical that the sensor be allowed to reach temperature equilibrium with the solution in order to provide the highest accuracy. When moving the sensor between widely different temperature conditions, it may be necessary to allow the sensor to stabilize as much as one hour before the calibration sequence is initiated. If the sensor is on-line, the user may want to set the output HOLD feature prior to calibration to lock out any output fluctuations.

1. Scroll to the CAL menu section using the MENU key and press ENTER or the UP arrow key.
2. Press the UP arrow key until **Cal Temp** is displayed.
3. Press the ENTER key. The message **Place sensor in solution then press ENTER** will be displayed. Move the sensor into the calibration reference (if it hasn't been moved already) and wait for temperature equilibrium to be achieved. Press ENTER to begin the calibration sequence.
4. The calibration data gathering process will begin. The message **Wait** will flash as data is accumulated and analyzed. The °C or °F symbol may flash periodically if the reading is too unstable.
5. The message **Adjust value - press ENTER** will be displayed, and the right-most digit will begin to flash, indicating that the value can be modified. Using the UP and LEFT arrow keys, modify the value to the known ref solution temperature. Adjustments up to  $\pm 5$  °C from the factory calibrated temperature are allowed. Press ENTER.

Once completed, the display will indicate **PASS** or **FAIL**. If the unit fails, the temperature adjustment may be out of range, the sensor may not have achieved complete temperature equilibrium, or there may be a problem with the temperature element. In the event of calibration failure, it is recommended to attempt the calibration again immediately.

## Part 8 – System Maintenance

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### 8.1 General

The Q45H/65 Residual Chlorine Dioxide System will generally provide unattended operation over long periods of time. With proper care, the system should continue to provide measurements indefinitely. For reliable operation, maintenance on the system must be done on a regular schedule. Keep in mind that preventive maintenance on a regular schedule is much less troublesome than emergency maintenance that always seems to come at the wrong time.

### 8.2 Analyzer Maintenance

No unusual maintenance of the analyzer is required if installed according to the guidelines of this operating manual. If the enclosure door is frequently opened and closed, it would be wise to periodically inspect the enclosure sealing gasket for breaks or tears.

### 8.3 Sensor Maintenance

Sensor maintenance is required for accurate measurements. The primary requirement is simply to keep the sensor membrane clean. The membrane is a micro-porous polymer that is resistant to anything that will be encountered in water streams. However, deposits can form on the surface or in the pores of the membrane, and these deposits will reduce the sensitivity. Certain constituents in water, mainly iron and manganese can form a coating on the membrane.

Because membranes are micro-porous, they can be relatively difficult to clean effectively. Immersing the tip of the sensor in 1N nitric acid solution will sometimes remove deposits that cause low sensitivity, but this is not always the case. The recommended practice is to simply replace the membrane when it becomes fouled. To change a membrane, follow the Sensor Assembly procedure on page 14 of this manual. Do not reuse the electrolyte from the sensor when changing a membrane. Always refill with fresh electrolyte. The electrolyte is stable and does not have a limited shelf life.

Refer again to the explanation of the sensor slope number after an accepted span calibration on the lower MEASURE screen. In normal operation, the slope of the sensor output will decrease over time as the membrane becomes fouled. This reduction indicates that the sensor is losing sensitivity to chlorine dioxide. It is good practice to replace the membrane if the slope number falls to 30-40%. The value will not go below 20%.

Even if no buildup is apparent on the membrane, it should be changed on a regular schedule. The recommended membrane change interval is every 3 months. For high purity water applications, this can probably be extended if desired, but a more frequent changing interval is a small price to pay for avoiding membrane failure at the wrong time.

While the sensor is disassembled for membrane changing, examine the condition of the o-rings on both ends of the electrolyte chamber. If the o-rings show any signs of damage, replace them with new ones from the spare parts kit. It is good practice to change these o-rings once a year, regardless of their condition.

### 8.31 Sensor Acid Cleaning

Over an extended operating period, chlorine dioxide sensors can slowly accumulate deposits on the surface of the platinum electrode. Typically, this type of buildup occurs over years of operation, but can sometimes occur more quickly in high levels of manganese, iron, or other metals are dissolved in the water. The gold electrode can be “acid cleaned” using nitric acid solutions.

## WARNING

**THIS ACID CLEANING PROCEDURE INVOLVES THE USE OF HIGHLY CORROSIVE ACID SOLUTIONS. IT SHOULD ONLY BE COMPLETED BY TRAINED PERSONNEL USING PROTECTIVE EYEWEAR AND GLOVES. IF THERE IS ANY DOUBT ABOUT YOUR ABILITY TO SAFELY ACCOMPLISH THIS PROCEDURE, RETURN THE SENSOR TO ATI FOR FACTORY CLEANING!**

To acid clean the electrode assembly, remove the electrolyte chamber from the sensor so that the so that both electrodes are exposed. Then follow the procedure below.

1. Place a small amount of 50% nitric acid solution in a beaker. Put in just enough so that the gold tip of the sensor can be submerged without any contact with the silver coil.
2. Allow the sensor to soak in this acid solution for 2 minutes. Remove the sensor body and rinse the platinum tip thoroughly with distilled water. Discard the nitric acid safely and according to all environmental regulations.

3. Fill the beaker with distilled water to the level sufficient to submerge both the tip and the silver coil. Do not allow the connector at the back of the sensor to be submerged. Allow the electrodes to soak in distilled water for 30 minutes.
4. Put a new membrane and fresh electrolyte in the electrolyte chamber and reassemble the sensor. Connect to the chlorine dioxide monitor electronics and allow the sensor to stabilize for at least 24 hours. The sensor can be placed in the flow cell with water containing chlorine dioxide running through it during stabilization. However, the readings will not be useful for 24 hours.

#### **8.4 Flow Cell Maintenance**

The maintenance on the flow cell is simple cleaning. The flow cell is clear to make examination of the condition of the sensor easier without interfering with operations. The flow cell may be cleaned by wiping or by washing with detergents or dilute acids. Do not try to clean with solvents as the acrylic may craze or crack.

Change the o-ring in the flow cell yearly or if any damage is observed. If insertion of the sensor into the flow cell becomes difficult, use silicon grease to lubricate the o-rings that hold the sensor in place. Use only enough grease to provide surface lubrication. Excess grease could foul the sensor membrane.

## Part 9 – Troubleshooting

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### 9.1 General

The information included in this section is intended to be used in an attempt to quickly resolve an operational problem with the system. During any troubleshooting process, it will save the most time if the operator can first determine if the problem is related to the analyzer, sensor, or some external source. Therefore, this section is organized from the approach of excluding any likely external sources, isolating the analyzer, and finally isolating the sensor. If these procedures still do not resolve the operational problems, any results the operator may have noted here will be very helpful when discussing the problem with the factory technical support group.

### 9.2 External Sources of Problems

To begin this process, review the connections of the system to all external connections.

1. Do not run sensor cables or analog output wiring in the same conduits as power wiring. If low voltage signal cables must come near power wiring, cross them at 90° to minimize coupling.
2. Carefully examine any junction box connections for loose wiring or bad wire stripping. If possible, connect the sensor directly to the analyzer for testing.
3. Check sensor membrane for fouling. Look closely for signs of grease or oil which may be present. Replace membrane and electrolyte, allow to stabilize, and re-check. The procedure in Chlorine Dioxide Sensor Assembly, on page 17, must be followed when replacing the membrane.



### 9.3 Analyzer Tests

1. Disconnect power and completely disconnect all output wiring coming from the analyzer. Remove sensor wiring, relay wiring, and analog output wiring. Re-apply power to the analyzer.
2. Using the Simulate feature, check operation of outputs with a DMM.
3. Check cell drive circuit. With a digital voltmeter (DVM), measure the voltage between terminals 17 and 18 on the back of the monitor to verify that the millivolt value is actually -400 mV.
4. Check TC drive circuit. Place a wire-short between the GREEN and RED terminals. With a digital voltmeter (DVM), measure the voltage between the BLACK and GREEN terminals on the back of the monitor to verify that the TC drive circuit is producing about 4.8-5.1 VDC open circuit. Remove DVM completely and connect a 100 Ohm resistor from the BLACK to GREEN terminals. The temperature reading should display approximately 0°C and the chlorine dioxide reading should display approximately 0 ppm.

## 9.4 Display Messages

The Q45 Series instruments provide a number of diagnostic messages which indicate problems during normal operation and calibration. These messages appear as prompts on the secondary line of the display or as items on the Fault List.

MESSAGE	DESCRIPTION	POSSIBLE CORRECTION
<b>Max is 200</b>	Entry failed, maximum user value allowed is 200.	Reduce value to $\leq 200$
<b>Min is 200</b>	Entry failed, minimum value allowed is 200.	Increase value to $\geq 200$
<b>Cal Unstable</b>	Calibration problem, data too unstable to calibrate. Icons will not stop flashing if data is too unstable. User can bypass by pressing ENTER.	Clean sensor, get fresh cal solutions, allow temperature and conductivity readings to fully stabilize, do not handle sensor or cable during calibration.
<b>Out of Range</b>	Input value is outside selected range of the specific list item being configured.	Check manual for limits of the function to be configured.
<b>Locked!</b>	Transmitter security setting is locked.	Enter security code to allow modifications to settings.
<b>Unlocked!</b>	Transmitter security has just been unlocked.	Displayed just after security code has been entered.
<b>Offset High</b>	The sensor zero offset point is out of the acceptable range of -20 to +20 nA.	Check wiring connections to sensor. Allow sensor to operate powered a minimum of 12 hours prior to first zero cal.
<b>Sensor High</b>	The raw signal from the sensor is too high and out of instrument range.	Check wiring connections to sensor.
<b>Sensor Low</b>	The raw signal from the sensor is too low.	Check wiring connections to sensor.
<b>ClO<sub>2</sub> High</b>	The chlorine dioxide reading is greater than the maximum of the User-selected range.	The chlorine dioxide reading is over operating limits. Set measuring range to the next highest level.
<b>Temp High</b>	The temperature reading is $> 55^{\circ}\text{C}$ .	The temperature reading is over operating limits. Check wiring and expected temp level. Perform RTD test as described in sensor manual. Recalibrate sensor temperature element if necessary.
<b>Temp Low</b>	The temperature reading is $< -10^{\circ}\text{C}$	Same as "Temp High" above.
<b>TC Error</b>	TC may be open or shorted.	Check sensor wiring and perform RTD test as described in sensor manual. Check j-box connections.

**Figure 12 - Q45H Display Messages**

MESSAGE	DESCRIPTION	POSSIBLE CORRECTION
<b>ClO<sub>2</sub> Cal Fail</b>	Failure of chlorine dioxide calibration. FAIL icon will not extinguish until successful calibration has been performed, or 30 minutes passes with no keys being pressed.	Clean sensor redo zero and span calibration. If still failure, sensor slope may be less than 25% or greater than 250%. Perform sensor tests as described in section 8. Replace sensor if still failure.
<b>TC Cal Fail</b>	Failure of temperature calibration. FAIL icon will not extinguish until successful calibration has been performed, or 30 minutes passes with no keys being pressed.	Clean sensor, check cal solution temperature and repeat sensor temp calibration. TC calibration function only allows adjustments of +/- 6 °C. If still failure, perform sensor tests as described in section 8. Replace sensor if still failure. .
<b>EPROM Fail</b>	Internal nonvolatile memory failure	System failure, consult factory.
<b>Checksum Fail</b>	Internal software storage error.	System failure, consult factory.
<b>Display Fail</b>	Internal display driver fail.	System failure, consult factory.
<b>Range Cal Fail</b>	Failure of factory temperature calibration.	Consult factory.

***Figure 13 - Display Messages Cont'd***

## 9.5 Sensor Tests

1. Check the membrane condition. A membrane that is not stretched smoothly across the tip of the sensor will cause unstable measurements. If necessary, change membrane and electrolyte.
2. Residual chlorine dioxide sensors can be tested with a digital voltmeter (DVM) to determine if a major sensor problem exists. Follow the steps below to verify sensor integrity:
  - A. Disconnect the five sensor wires from the back of the chlorine dioxide monitor. Those wires are color coded white, brown, red, black, and green. Note that the brown wire may be replaced with an orange wire in some cables.
  - B. Remove the electrolyte chamber from the sensor and dry the electrodes with a paper towel.
  - C. Connect a DVM between the white and brown (or orange) wires. Reading resistance, you should find an open circuit value of infinite resistance. There must be no measurable resistance at all between these wires. Any resistance at all indicates either water in the cable connector or the breakdown in an electrode seal.
  - D. Connect a DVM between the red and white wires. The red wire is part of the RTD circuit and the white wire is part of the measuring cell. There should be no connection. Reading resistance, you should find an open circuit value of infinite resistance. Any resistance at all indicates either water in the cable connector or the breakdown in an electrode seal.
  - E. Connect the DVM between the red and black wires. These are the RTD leads, and you should find a resistance value that depends on the temperature. The table below lists the resistance values for various temperatures. Reading resistance between the red and green wires should give exactly the same values as between red and black.

Temperature °C	Resistance Ω
0	100.0
5	101.9
10	103.9
15	105.8
20	107.8
25	109.7
30	111.7
35	113.6
40	115.5
45	117.5
50	119.4

**Figure 14 - Pt100 RTD Table**

If you suspect that water has gotten into a cable connection on a flow type sensor or into the plug connection of a submersible sensor, disconnect the cable and allow the parts of the sensor to sit in a warm place for 24 hours. If water in the connector is the problem, it should dry out sufficiently to allow normal sensor operation. However, steps 4 and 5 above will have to be repeated after drying to see if the problem is gone.

3. Acid clean the sensor electrodes in accordance with the procedure on the previous page.

# Spare Parts

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<u>Part No.</u>	<u>Description</u>
07-0035	Portable monitor electronics assembly
07-0036	Portable monitor electronics assembly with data logger
00-0066	Residual Chlorine Dioxide sensor, flow type
00-0067	Residual Chlorine Dioxide sensor w/25' of cable, submersion type
02-0016	Sensing element body, (for #00-0066)
03-0029	Sensor interconnect cable with connector, 25 ft.
45-0007	Electrolyte chamber
48-0001	Membrane holder, type 316 stainless steel
45-0010	Membrane holder, noryl
05-0016*	Membranes, pkg. of 10
05-0004*	Spare Parts Kit, screw & o-ring (flow sensor)
05-0010	Spare Parts Kit, screw & o-ring (submersible sensor)
09-0015*	Chlorine Dioxide electrolyte, 4 oz (120 cc)
07-0087	pH Sensor with connector
09-0033	Reference Solution for pH sensor
05-0066	Salt bridge for pH sensor
00-0043	Constant-Head Flowcell assembly with mounting plate
42-0014	Flowcell o-ring (each)

**Note:** Instrument is supplied with sufficient spare parts for 6-12 months of operation. For 2 year spare parts inventory, 3 each of the items marked with an asterisk are required.

**Lock/Unlock Code: 1456**

# PRODUCT WARRANTY

Analytical Technology, Inc. (Manufacturer) warrants to the Customer that if any part(s) of the Manufacturer's equipment proves to be defective in materials or workmanship within the earlier of 18 months of the date of shipment or 12 months of the date of start-up, such defective parts will be repaired or replaced free of charge. Inspection and repairs to products thought to be defective within the warranty period will be completed at the Manufacturer's facilities in Collegeville, PA. Products on which warranty repairs are required shall be shipped freight prepaid to the Manufacturer. The product(s) will be returned freight prepaid and allowed if it is determined by the manufacturer that the part(s) failed due to defective materials or workmanship.

This warranty does not cover consumable items, batteries, or wear items subject to periodic replacement including lamps and fuses.

Gas sensors carry a 12 months from date of shipment warranty and are subject to inspection for evidence of misuse, abuse, alteration, improper storage, or extended exposure to excessive gas concentrations. Should inspection indicate that sensors have failed due to any of the above, the warranty shall not apply.

The Manufacturer assumes no liability for consequential damages of any kind, and the buyer by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the Customer, his employees, or others. A defect within the meaning of this warranty is any part of any piece of a Manufacturer's product which shall, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment.

This warranty is in lieu of all other warranties ( including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations or liabilities expressed or implied by the Manufacturer or its representatives and by statute or rule of law.

This warranty is void if the Manufacturer's product(s) has been subject to misuse or abuse, or has not been operated or stored in accordance with instructions, or if the serial number has been removed.

Analytical Technology, Inc. makes no other warranty expressed or implied except as stated above.

## WATER QUALITY MONITORS

Dissolved Oxygen  
Free Chlorine  
Combined Chlorine  
Total Chlorine  
Residual Chlorine Dioxide  
Potassium Permanganate  
Dissolved Ozone  
pH/ORP  
Conductivity  
Hydrogen Peroxide  
Peracetic Acid  
Dissolved Sulfide  
Residual Sulfite  
Fluoride  
Dissolved Ammonia  
Turbidity  
Suspended Solids  
Sludge Blanket Level

**MetriNet** Distribution Monitor

## GAS DETECTION PRODUCTS

NH <sub>3</sub>	Ammonia
CO	Carbon Monoxide
H <sub>2</sub>	Hydrogen
NO	Nitric Oxide
O <sub>2</sub>	Oxygen
CO	Cl <sub>2</sub> Phosgene
Br <sub>2</sub>	Bromine
Cl <sub>2</sub>	Chlorine
ClO <sub>2</sub>	Chlorine Dioxide
F <sub>2</sub>	Fluorine
I <sub>2</sub>	Iodine
H <sub>x</sub>	Acid Gases
C <sub>2</sub> H <sub>4</sub> O	Ethylene Oxide
C <sub>2</sub> H <sub>6</sub> O	Alcohol
O <sub>3</sub>	Ozone
CH <sub>4</sub> Gas)	Methane (Combustible
H <sub>2</sub> O <sub>2</sub>	Hydrogen Peroxide
HCl	Hydrogen Chloride
HCN	Hydrogen Cyanide
HF	Hydrogen Fluoride
H <sub>2</sub> S	Hydrogen Sulfide
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Oxides of Nitrogen
SO <sub>2</sub>	Sulfur Dioxide
H <sub>2</sub> Se	Hydrogen Selenide
B <sub>2</sub> H <sub>6</sub>	Diborane
GeH <sub>4</sub>	Germane
AsH <sub>3</sub>	Arsine
PH <sub>3</sub>	Phosphine
SiH <sub>4</sub>	Silane
HCHO	Formaldehyde
C <sub>2</sub> H <sub>4</sub> O <sub>3</sub>	Peracetic Acid
DMA	Dimethylamine