

**Thermo Scientific AquaSensors™
AquaChlor™ Free Chlorine
Monitor
User Guide**



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This publication supersedes all previous publications on this subject.

Preface

This instruction manual serves to explain the use of the Thermo Scientific AquaSensors Free Chlorine Measurement System and is written to cover as many applications as possible. Please do not hesitate to contact Thermo Fisher Scientific or an authorized representative with questions or concerns.

The information presented in this instruction manual is subject to change without notice as improvements are made, and does not represent any commitment whatsoever on the part of Thermo Fisher Scientific.

Thermo Fisher Scientific cannot accept any responsibility for damage or malfunction of the sensor due to improper use.

Contact Information

To contact Thermo Scientific AquaSensors Technical Support:

Within the United States call 1.800.225.1480 or fax 978-232-6015.

Outside the United States call 978.232.6000 or fax 978.232.6031.

In Europe, the Middle East and Africa, contact your local authorized dealer.

Visit us on the web at www.thermo.com/processwater

Safety Information



The Thermo Scientific AquaSensors Free Chlorine Measurement System shall be installed and operated only in the manner specified. Only a skilled, trained or authorized person should carry out installation, setup and operation of the sensor system.

Before using the system, make sure that is connected as specified. Failure to do so may result in permanent damage to the system of its components.

Protection against electric shock will be achieved only by observance of the corresponding installation rules.

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1. INTRODUCTION

1.1. General Information

The product is designed for continuous use in industrial process applications and complies with safety regulations currently in force. Improper use could lead to hazards for the user or a third-party, and/or adverse effects to the plant or other equipment.

Thermo Fisher Scientific does not accept any liability for damage that may arise if information in this manual is not followed. Therefore, the operating instructions and specifications must be read and understood by all persons involved in installation and operation of this equipment.

This manual identifies safety instructions and additional information by means of the following symbols:

	This symbol draws attention to safety instructions and warnings of potential danger , which if neglected, could result in injury to persons and/or damage to property.
	This symbol identifies additional information and instructions , which if neglected, could lead to inefficient operation and possible loss of production.

It is recommended that this manual be made accessible to everyone who may need it as a reference.
Please contact Thermo Fisher Scientific or an authorized representative with any questions.

1.2. Intended use

The Free Chlorine Measurement Systems are used for continuous monitoring of free chlorine in applications where the chlorine concentration is between 0.05 ppm and 5ppm or 0.05 ppm and 20 ppm. The systems also measure water temperature.

Any other use, or use not mentioned here, that is incompatible with the technical specifications is deemed inappropriate. The operator is solely responsible for any damage arising from such use.

Other prerequisites for appropriate use include:

- Observing the instructions, notes and requirements set out in this instruction manual.
- Observing all local safety regulations.
- Observing all warnings and cautions in the documentation regarding all products used in this measurement system, including the sensor, mounting hardware, AV38 electronics and cabling.
- Observing the prescribed environmental and operational conditions.
- Observing chemical compatibility with all wetted materials.

1.3. Safety Instructions



The Chlorine Measurement System should be installed and operated only by personnel familiar with the sensor and qualified for such work.

A defective Chlorine Measurement System should be returned to Thermo Fisher Scientific for repair or replacement. Contact Thermo Fisher Scientific to obtain a Return Material Authorization (RMA) number.

No modifications to the Chlorine Measurement System are allowed. The manufacturer/supplier accepts no responsibility for damage caused by unauthorized modifications. The risk is borne entirely by the user.

1.4. Removal from Service / Correct Disposal of the Chlorine Measurement System

Removal from Service

- Disconnect the cable wiring from the controller terminal block.
- Remove the Chlorine Measurement System from the mounting hardware.

Correct Disposal of Unit

- When the Chlorine Measurement System is taken out of service, observe the local environmental regulations for correct disposal.

2. PRODUCT DESCRIPTION

The Free Chlorine Measurement Systems are used for continuous monitoring of free chlorine in applications where the chlorine concentration is between 0.05 ppm and 5 ppm or 0.05 ppm and 20 ppm. The system also measures temperature from 0°C to 100°C.

The sensor head is pre-calibrated for span and the zero is factory set. The sensor retains calibration values and does not require a new calibration when the system is connected to a new AV38 Display Unit, PC, or PLC.

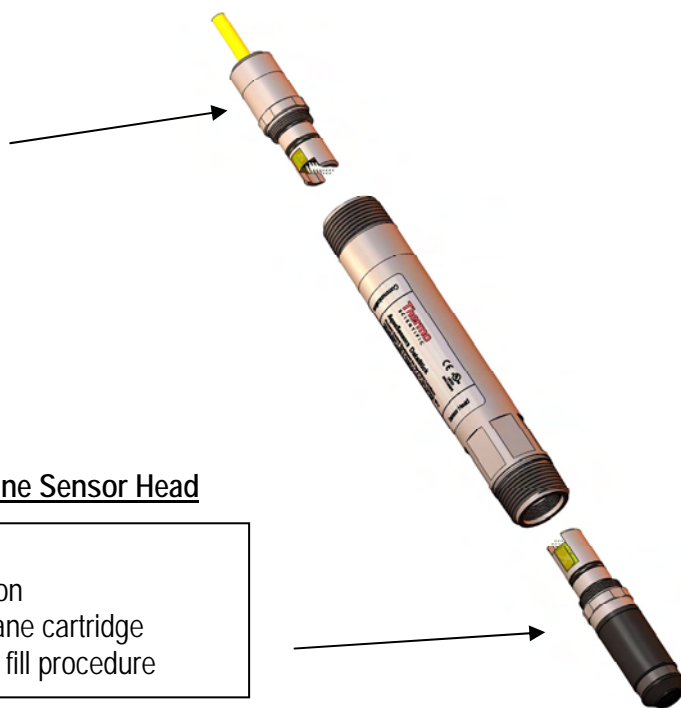
Any communications protocol that Thermo Fisher Scientific supports can be configured in this system by plugging in one of many types of cabled communications adapters. All Thermo Scientific AquaSensors communications adapters support measurement, calibration, configuration and diagnostics functions, which can be accessed locally or remotely without an analyzer or controller electronics box.

Plug-in Communications Adapters

- Modbus RTU
- Modbus 232
- Modbus TCP
- DeviceNet
- CANopen
- Ethernet/IP
- PCCC
- Web Browser
- USB
- RS-232

Plug-in Free Chlorine Sensor Head

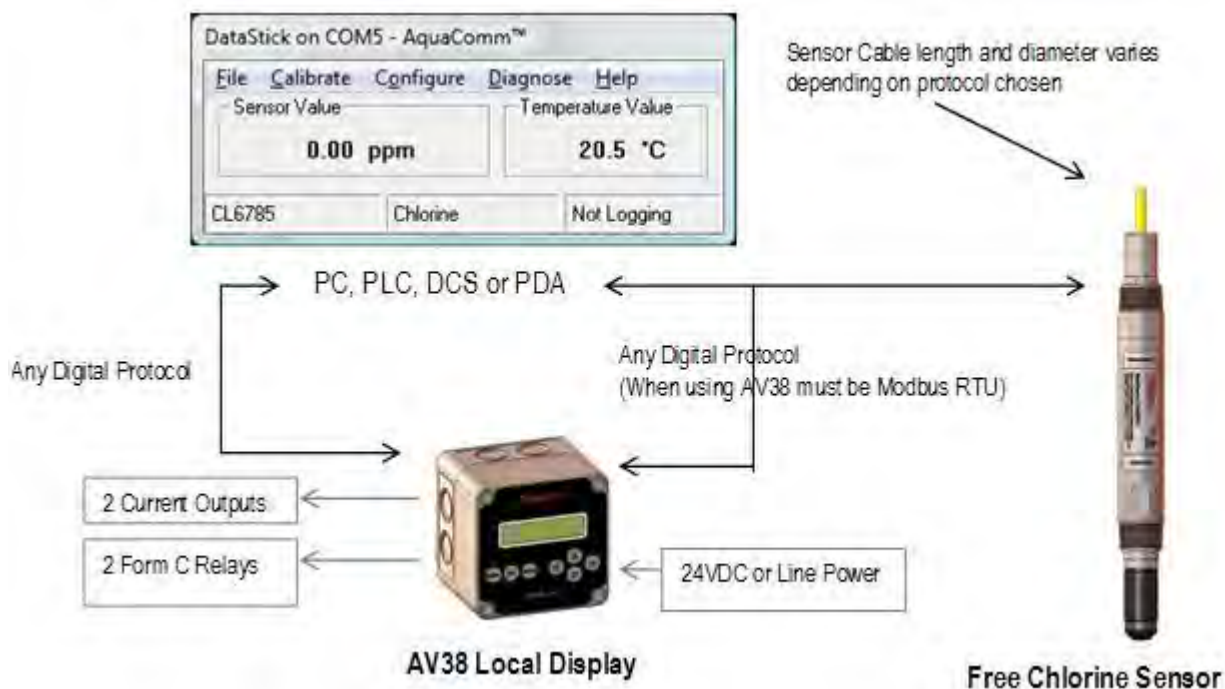
- Retained calibration
- Screw-on membrane cartridge
- Simple electrolyte fill procedure



The sensor in this system uses an amperometric measurement method with a gold cathode and a silver anode. The electrolyte and membrane are easily replaced with a pre-stretched screw-on membrane cap. Measurements are stable below 5 pH and are maintained in the pH window between 5 pH and 9 pH.

When pH compensation is used in conjunction with an AV38 local display, Hypochlorous acid or free chlorine concentrations are automatically available when a chlorine sensor is connected.

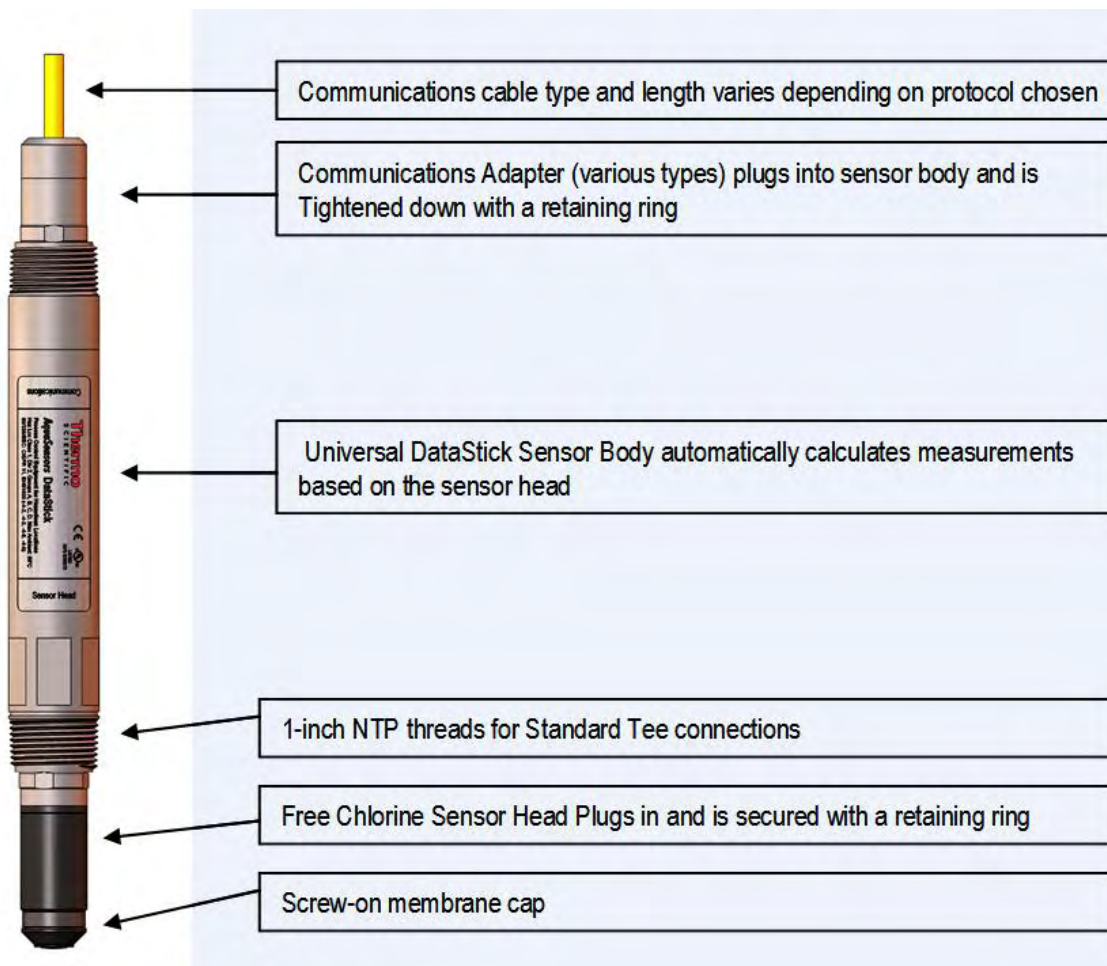
The free chlorine system can be connected directly to a digital network, an AV38 local display or a personal computer running AquaComm™ software. The following schematic illustrates:



Communications	Suggested Application	Standard Interface	Reference
USB ASCII	Laboratory PC, Field Laptop	AquaComm™, Hyper Terminal®	USB Adapter Manual
RS-232 ASCII	Laboratory PC	AquaComm™, Hyper Terminal®	ASCII Commands and Responses detailed in the appendix of the DataStick manual.
Modbus RTU	AV38 Local Display PLC with Modbus Network	AV38 Local Display Modbus PLC Tools	AV38 Local Display Manual Modbus Communications Manual
DeviceNet	PLC with DeviceNet Network	DeviceNet PLC Tools	DeviceNet Communications Manual
CANbus	PLC with CANbus Network	CANbus PLC Tools	CANbus Communications Manual
Ethernet/IP	DeviceNet over Ethernet	PoE Switch with DeviceNet Tools	Ethernet Manual
PCCC	Allen-Bradley SL/C 500 Series	PoE Switch with PCCC Tools	Ethernet Manual
Modbus/TCP	Modbus over Ethernet	PoE Switch with Modbus Tools	Ethernet Manual
TCP/IP	PC	PoE Switch with Internet Explorer	Ethernet Manual

Profibus DP connections are made through Thermo Scientific AquaSensors Profibus DP gateway which connects up to 30 DataSticks with integral Modbus RTU comms adapters.

The sensor is designed for continuous use and has 1-inch NPT mounting threads for union tee and sample chamber hardware. The parts of the sensor system are shown here:



Product Highlights:

- 0.05 to 5 ppm and 0.05 to 20 ppm Measurement Ranges
- Calibration stored in Sensor (Does not require recalibration after connection to Analyzer/Controller)
- 0.01 ppm Resolution
- Fast Response
- Simple membrane and electrolyte replacement
- Provides measurement, calibration, configuration and diagnostic functions without Analyzer/Controller
- Works with AV38 for local display, current output data reporting, and relay control
- Temperature measurement included
- Can be connected to Modbus, DeviceNet, Ethernet, USB, RS-232 and CANopen networks.

2.1. Sensor Care and Start-up

The chlorine sensor is shipped without electrolyte in the membrane cap and the end of the sensor is covered to protect the sensor membrane from physical damage. Before the system is installed, prepare the sensor as follows:

1: Remove the protective cover from the sensor head. Be careful not to damage the sensor membrane while removing the cover.



2: Unscrew the membrane cap from the sensor head.

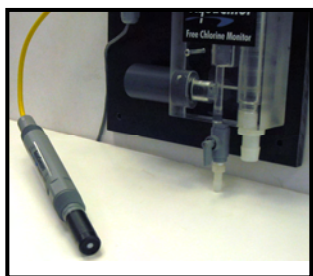
3: Wet the silicone rubber band near the end of the sensor with clean water. Apply light pressure to the band while turning the cap to break any adhesion between the band and cap. The band should be seated tightly in the groove on the cap, but it should not stick or adhere.



4: Fill the membrane cap with Free Chlorine Electrolyte (PN: RDOK9). Fill it up to the step just below the internal threads inside the membrane cap.



5: Assemble the membrane cap back onto the sensor head. Screw the cap on slowly until it seats against the gasket at the base of the sensor head. Some excess electrolyte will drip out of the top of the cap as it is threaded onto the sensor head.



6: Rinse the sensor head with clean water and dry it carefully. Inspect the sensor head to make sure the membrane is intact and does not leak electrolyte.

2.2. Sensor Installation and Calibration

After preparing the sensor as noted above, install the chlorine sensor in the appropriate hardware. Refer to section 3.1 of this manual for information on installing the sensor in an in-line tee or section 3.2 for information on installing the sensor in a bypass flow chamber. If necessary, refer to section 4 of this manual for instructions on wiring the sensor electronics. Begin process water flow through the system and adjust the flow rate as necessary.

The chlorine sensor has been polarized and tested prior to shipment but it will require time to re-polarize. After installation, leave the sensor powered for at least 12 hours in the process before calibration. The system should be configured for the desired pH compensation (see section 5.6) before calibrating the chlorine measurement.

If the installation uses a dedicated pH sensor for measurement compensation, calibrate the pH sensor (refer to user guide for the pH sensor for calibration instructions) and install it as required.

The chlorine sensor temperature measurement can be calibrated with a 1-point sample calibration. It is recommended to calibrate the temperature measurement before calibrating the free chlorine measurement because the chlorine reading is temperature compensated. Refer to section 5.4 of this manual for the temperature calibration procedure.

The chlorine measurement is also calibrated with a 1-point sample. Calibration should be done with a measured free chlorine reading (DPD colorimetric, etc.) that is in the normal measurement range. With this calibration, the current sensor reading can be set to a known value. Refer to section 5.3 of this manual for the chlorine calibration procedure.

Note: Be sure the AV38 is properly configured for either fixed or automatic pH compensation. If fixed compensation is selected, make sure the correct pH value has been entered.

3. Mounting Hardware

The Free Chlorine Measurement System should be installed in a union pipe tee or in an AquaChlor-style bypass sample chamber. In either case, care must be taken to insure constant flow and pressure at the membrane surface for accurate readings.

When the sensor system is inserted into a Thermo Scientific AquaSensors bypass sample chamber, pressure is automatically regulated through an overflow weir.

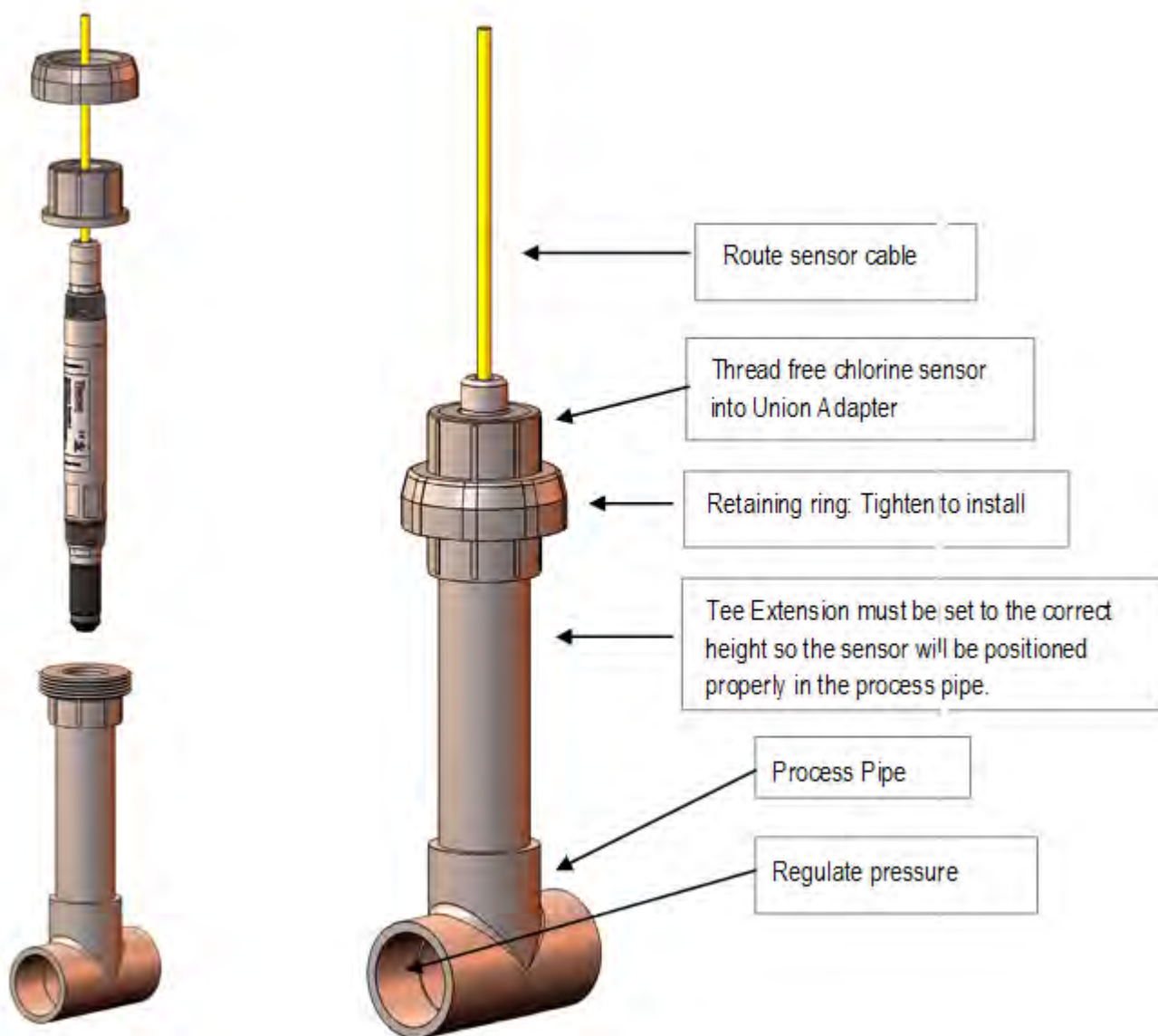
When using union tee mounting, care must be taken to regulate pressure for accurate measurement.

When configured with a plug-in communications adapter the sensor is 12.08 inches long from sensor tip to the end of the communications adapter body. The largest diameter of the sensor head is 1.35 inches.



3.1. Union Tee

The Free Chlorine System is threaded into the Union Tee adapter. The adapter is then set into the tee and the retaining ring is tightened down.



3.2. AquaChlor™ - Chlorine Sample Chamber

The AquaChlor™ sample chamber compensates for minor changes in sample pressure and flow. A flow regulator is recommended to adjust the inlet flow to approximately 250 ml/min (see installation instructions on pages 15 and 16). The chlorine sensor is inserted into the top of the flow chamber, into the port on the left-hand side of the chamber. For applications that require pH measurement, the pH sensor is inserted into the top of the flow chamber, into the port on the right hand side of the chamber.

The free chlorine sensor and optional pH sensor are connected to an AV38 local display. The AV38 calculates the concentration of free chlorine components. If an AV38 is not desired, the pH and chlorine DataStick systems can be connected directly to a digital network without the AV38 display and the compensation algorithm can be supplied and operated by a computer or PLC.



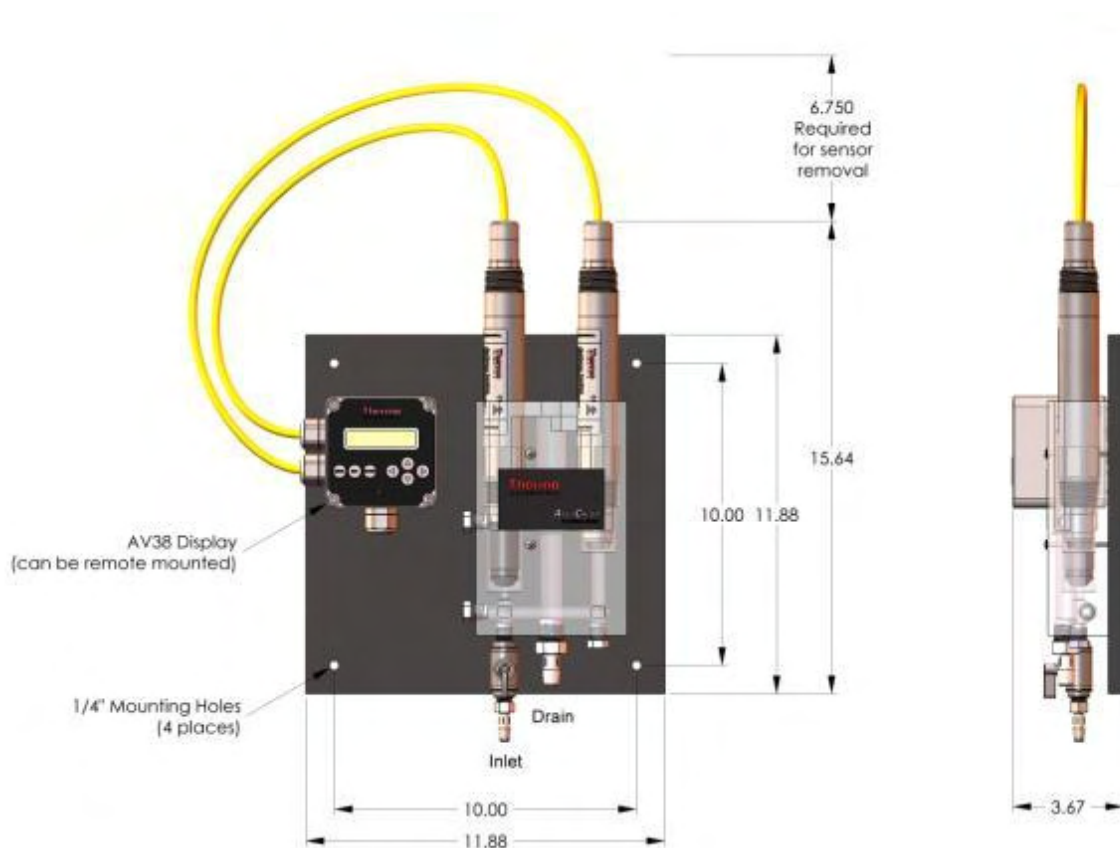
AquaChlor Free Chlorine Measurement System with pH compensation



AquaChlor Free Chlorine Measurement System without pH compensation

The AquaChlor™ measurement system is mounted on 12 inch x 12 inch panel with four ¼ inch mounting holes. Use ¼ inch bolts with washers to mount the panel to a wall, making sure the sample chamber is level and plumb. It is important to note that the system must be fixed securely to the wall to insure the chamber does not move when handled or touched.

To obtain a stable chlorine measurement, the flow through the chamber should be adjusted with the inlet valve. When properly adjusted, the right port (pH port) in the flow chamber should fill and overflow into the center drain, while the left port (chlorine port) should partially fill and flow through a small side orifice into the center drain. Note that the orifice connecting the chlorine port to the drain must be kept clear and not obstructed. If debris builds up in the orifice it can be accessed for cleaning by removing the clean-out plug in the side of the flow chamber.



Sample Chamber Mounting tools and equipment:

- ½ inch Drill with drill bit for appropriate wall anchor.
- Four ¼ diameter bolts – 1.5 inches long.
- Four ¼ inch ID flat washers
- Wrench to turn bolts
- Level to insure the system is level when mounted

General Sample Chamber Mounting Instructions:

1. Place the 12 inch x 12 inch panel on the wall where it is to be mounted and mark the placement of the upper left hole.
2. Drill a mounting hole for the upper left corner with a masonry drill bit.
3. Mount the AquaChlor System with the upper left bolt.
4. Using a level, rotate the system until level, then mark the other three mounting holes.
5. Rotate the plate out of the way and drill the other three mounting holes.
6. Place all four bolts with washers and tighten. Use shims if necessary to insure the sample chamber is level.

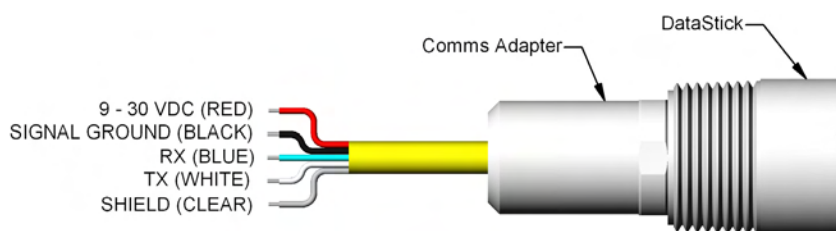
General Sample Chamber Plumbing Instructions:

1. The AquaChlor™ system has a water INLET and an OUTLET.
2. Barb fittings are provided for the INLET and OUTLET to accommodate 3/8 inch and 1/2 inch ID tubing respectively.
3. When the INLET is to be directly plumbed rather than using tubing, remove the barb fitting and install ¼ inch NPT threaded pipe to the INLET.
4. When the OUTLET is to be directly plumbed rather than using tubing, remove the barb fitting and install straight ½ inch NPT threaded pipe that extends to a vented drain. Pipe restrictions that result in back pressure to the OUTLET are not allowed.
5. The sample supply must be between 250 to 750 ml/min (4 to 12 gph). If the source is under pressure, use an appropriate flow or pressure valve to obtain consistent flow.
6. Turn on water flow into the flow chamber.
7. Adjust the flow rate through the system with the inlet valve on the flow chamber. If the right port in the flow chamber is not overflowing to the center drain, increase the flow through the system. If the left port in the flow chamber is overflowing to the center drain, decrease the flow through the system.

4. Wiring

Each communications adapter has a label printed at the end of the cable that indicates the supported protocol and the corresponding wiring chart. The standard cable length is 10 feet with the idea that the cable will terminate in a junction box. It is however possible to order the communications adapter with any length of cable up to the maximum allowed by the particular protocol being used. (Note: In the pre-packaged AquaChlor System configuration, both the free chlorine and pH sensors are supplied with 30 inch cables.) In practice all adapters have four wires and a shield. Any Class 2 DC power supply that provides 24VDC can be used.

For DeviceNet, Modbus and RS-232 cables, the RED and BLACK wires are for power, the BLUE and WHITE wires are for communications, and a bare shield wire is connected to EARTH GROUND for safety and electromagnetic immunity and emissions.



Color	DeviceNet	Modbus RTU	RS-232
RED	24 VDC	12 to 30 VDC	12 to 30 VDC
BLACK	Signal Ground	Signal Ground	Signal Ground
BLUE	CAN_L	Comms (-)	Rx
WHITE	CAN_H	Comms (+)	Tx
SHIELD	Earth	Earth	Earth

All Ethernet Adapters (Ethernet/IP, Modbus TCP, PCCC and TCP/IP) are terminated with an RJ45 connector that plugs in to any PoE switch or power injector.

All USB Adapters are terminated with a USB connector that plugs into most PC's. Power is supplied by the host computer.

When an AV38 local display is used, the sensor must be configured with a Modbus RTU communications adapter.

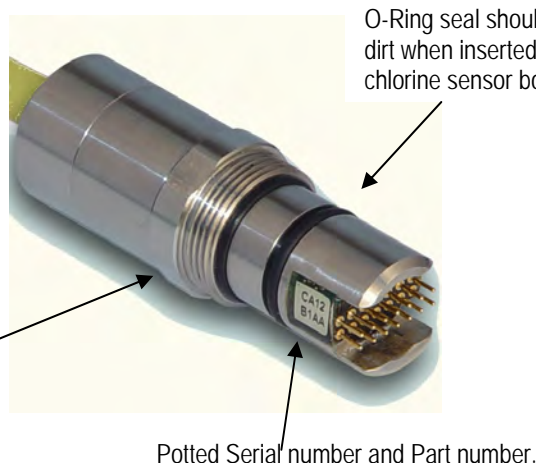
The communications adapters are keyed and plug into the end of the DataStick™ marked "Communication Adapter". Insert the communications adapter until it bottoms out. Rotate the adapter until it engages with the connector. Push in gently and then tighten the retaining ring with a 15/16-inch wrench.

Communications adapters can be inserted into the "Sensor Head" end of the DataStick™ but the adapter is not long enough to reach the internal connector. Likewise, any sensor head can be inserted into the communications adapter end of the DataStick™ but it will be too long for the retaining ring to be engaged.

Retaining Ring:

Insert the Adapter into the DataStick™ and rotated until it engages.

Tighten the retaining ring to lock down the adapter. Use a 15/16 inch (24mm) wrench. Rotate clockwise to tighten.



5. AV38 Local Display Interface

For detailed information on configuration of AV38 current outputs, relays, host communications, please refer to the AV38 manual (MAN018AV38). This manual will describe basic calibration, configuration and chlorine/pH compensation functions directly related to free chlorine measurements

The AV38 is a universal display interface for DataStick sensor systems that includes the free chlorine measurement. The enclosure has ¼ DIN dimensions for easy mounting and is rated NEMA 4X for outdoor use. It uses a liquid crystal display (LCD) with a high contrast backlight for best readability and is powered with 24 volts DC or optionally with line power (90 VAC to 240 VAC).



The AV38 automatically recognizes the type of DataStick connected to the system and provides the appropriate calibration, configuration and diagnostic menus. It has options for two 4-20 current outputs, two alarm/control/wash relays and network communications to a host computer. In addition, the AV38 can address up to 247 DataStick sensors.

DataStick sensors connected to the AV38 communicate via Modbus RTU. As such, the AV38 can be used to select any two of the DataStick sensors on the bus for display, current output reporting and relay alarms by selecting the desired station addresses. When there is no DataStick sensor connected at the selected network address, the measure screen will indicate "DataStick Absent".

There are seven keys for menu navigation. The MENU key is used to toggle between the menu and the measure screen. Pressing the Menu key provides options for calibration, configuration, communications, outputs and relays. Refer to the AV38 Manual for Details.

5.1. Measure Screen Overview

The AV38 user interface is shown in Figure 5.1. It consists of an LCD module that contains two lines of 16 alphanumeric characters and seven keys to navigate the menu. The contrast of the LCD module can be adjusted by simultaneously pressing the escape and up-arrow keys (for more contrast) or the escape and down-arrow keys (for less contrast).

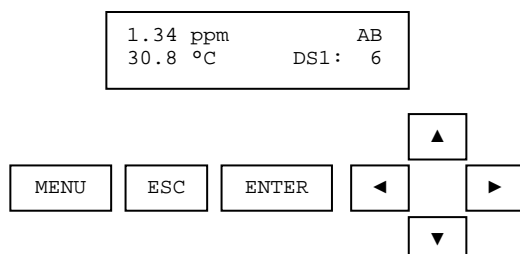


Figure 5.1: The elements of the measure screen

When the DataStick and communications adapter are connected to the AV38 display but the sensor head is absent, the measure screen indicates the fault as shown in Figure 5.2.

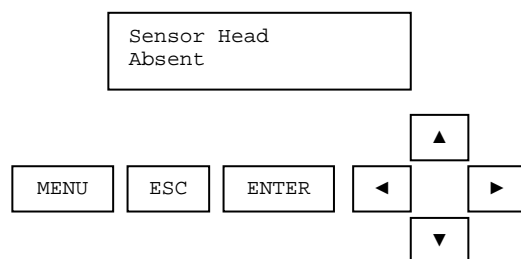


Figure 5.2: The measure screen when the Sensor Head is absent.

When the DataStick or communications adapter are not connected to the AV38 display, the measure screen indicates the fault as shown in Figure 5.3.

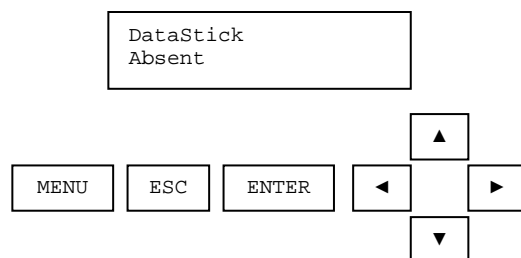


Figure 5.3: The measure screen when the DataStick is absent.

Use the left and right arrow keys to see the data acquired from the selected DataSticks. Refer to the AV38 Manual for detailed information on User Interface operation.

5.2. Menu Structure

Pressing the menu key while a measure screen is displayed accesses the main menu. The items in the main menu are the same regardless of the type of sensor head that is installed in the DataStick. Table 5.1 shows all accessible functions including optional features.

Table 5.1: AV38 Main Menu Functions

Main Menu Option	Function
Calibrate (Station Number)	Sensor calibration choices are automatically available for installed sensor head. Enter the MENU from the measure display of interest – station in lower right.
Configure (Station Number)	Configuration choices are automatically available for the installed sensor head. Enter the MENU from the measure display of interest – station in lower right.
DataStick Comms	Set the station address, baud rate and parity for the Modbus DataStick of interest.
Chlorine Configure	Select total free chlorine or HOCL concentration for output. Select pH compensation – manual set or active measure. (Only when Chlorine DataStick Present).
Hold Outputs	Holds the 4-20 mA and Relay outputs
Analog Output 1	Set 4 mA and 20 mA values. Calibrate and test the current output with a meter.
Analog Output 2 (option)	Set 4 mA and 20 mA values. Calibrate and test the current output with a meter.
PID Controller	Set up PID control functions for analog outputs. Available with pH or Conductivity.
Relay A (option)	Set timer, alarm, or control functions. (Optional)
Relay B (option)	Set timer, alarm, or control functions. (Optional)
Help	Indicates AV38 software version
Reset AV38	Resets AV38 configuration to default current output, relay and PID settings.
Exit	Returns to the measure screen

The main menu is navigated using the up/down arrows to display a desired function. The (≡) symbol is used to indicate main menu choices.

To select a menu choice, press the ENTER key when the desired choice is displayed.

To return to the measure screen, press the ESC key.

When ever there is a value to be entered or a choice to be made, the second line of the display will be surrounded by parentheses (). The name of the value being entered or choice being made will appear on the upper line of the screen and be appended with a question mark (?) to indicate that the user is to provide input. Figure 4.1 shows the list of standard menu choices and optional menu choices in the context of the AV38 display presentation.

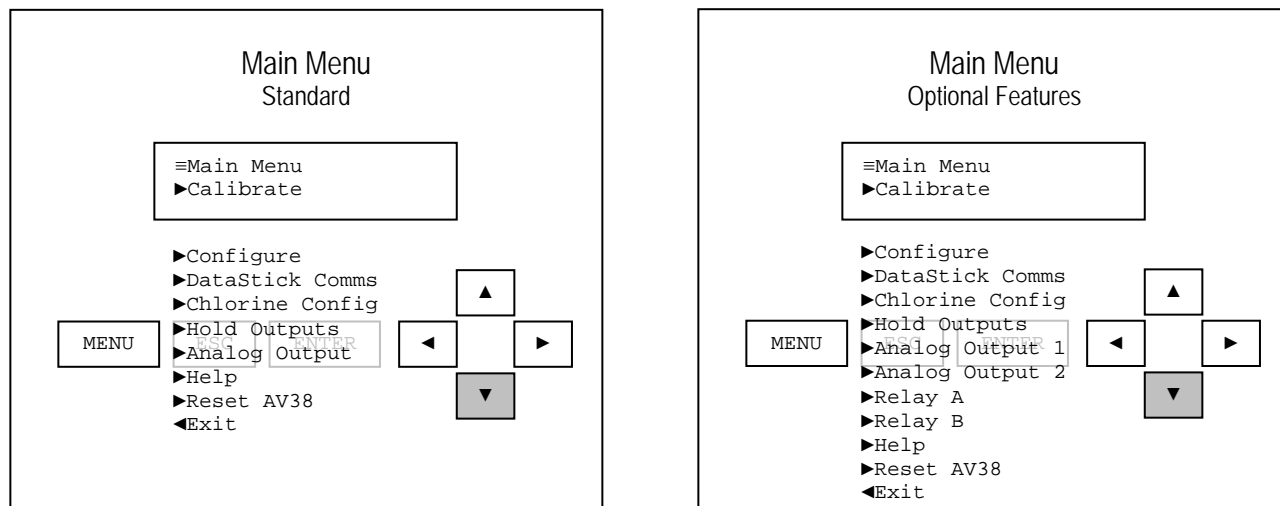

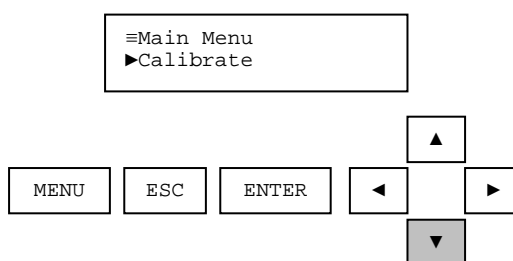


Figure 4.1: The main menu (standard and optional feature lists)

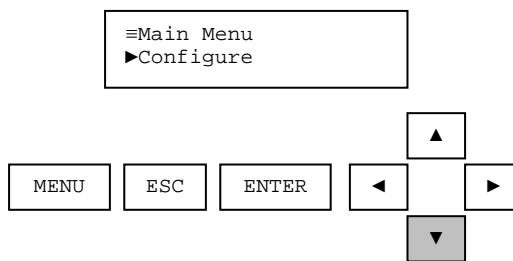
To illustrate navigation through the main menu the following sequence of down arrow key presses is shown. The up arrow can always be used to scroll up through the list.

A pressed key is identified by a gray background, e.g., .

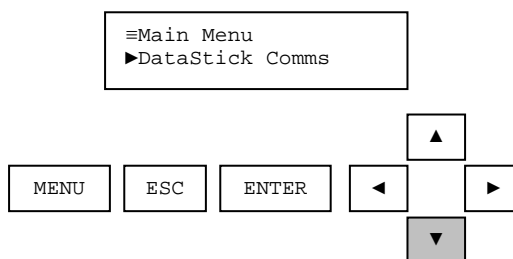
From the measure screen, press MENU to display the list of options. Generally, Calibration will be the first option. To select a calibration function, press ENTER. Press the down arrow to scroll through the list. Press ESC to return to the measure screen.



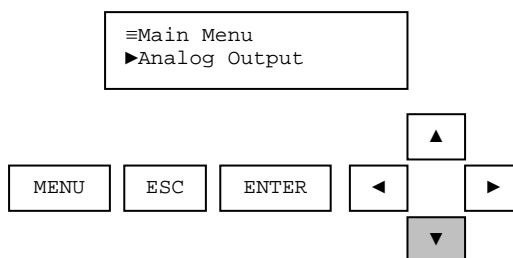
Pressing the down arrow from Calibration will display Configure. To select Configure functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.



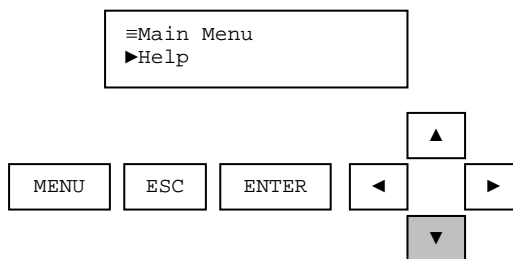
Pressing the down arrow from Configure will display DataStick Comms. To select DataStick Comms functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.



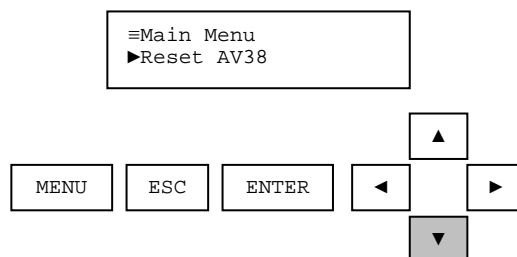
Pressing the down arrow from DataStick Comms will display Analog Output. To select analog output functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.



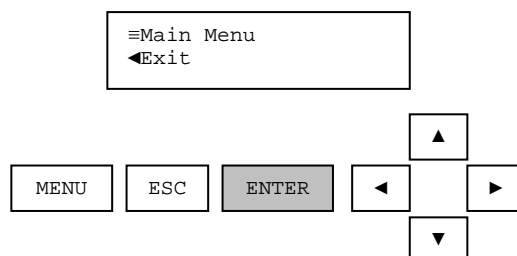
Pressing the down arrow from Analog Output will display Help. To select Help functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.



Pressing the down arrow from Help will display Reset AV38. To select Reset functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.



To return to the measure screen press ENTER when in the EXIT screen. Pressing ESC from any screen will take the user up one level. In this example ESC will also take the user to the measure screen. Since this screen is at the bottom of the main menu list, the down arrow will not work here. The up arrow can be used to go back through the list.

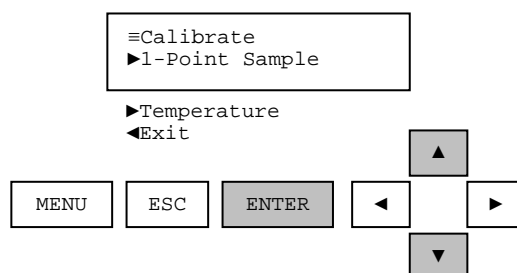


5.3. 1-Point (Span) Calibration

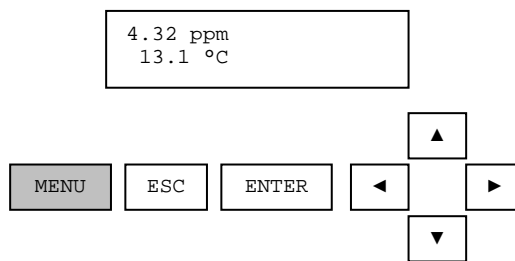
To calibrate the span for the Free Chlorine System:

1. Draw a sample with a syringe from the process water in the sample chamber and check the concentration with a lab meter. For the most accurate calibration the reading should be above 1 ppm.
2. Perform a 1-point sample calibration using the reading from the lab meter.

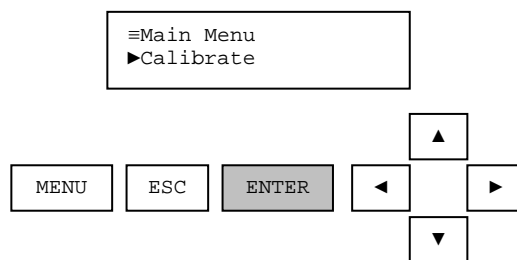
The complete calibrate menu for free chlorine is shown.



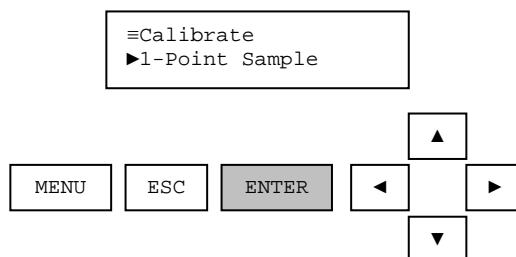
From the measure screen, press MENU.



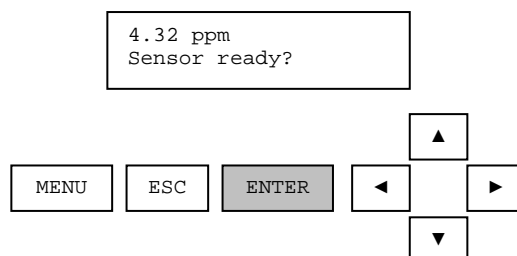
From the Main Menu, use the up/down arrows to select Calibrate. Then press ENTER.



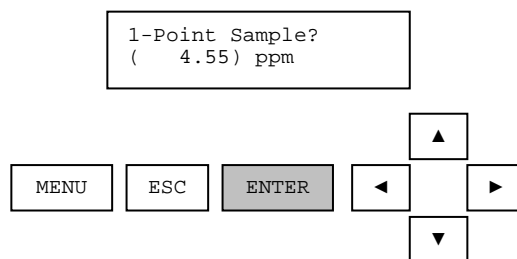
From the Calibrate Menu, use the up/down arrows to select 1-Point Sample. Then press ENTER.



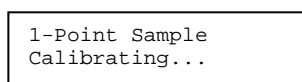
The current sensor value is dynamically displayed and asks the user to be sure the measurement is ready for calibration before proceeding. When ready, press the ENTER key.



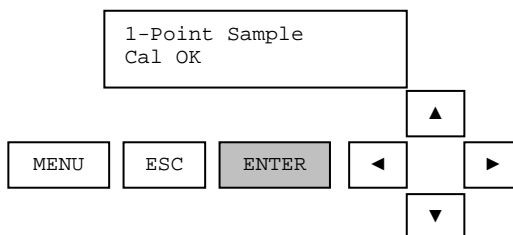
The calibration value can be adjusted with the arrow keys. Use the up/down arrows for fine adjust and the left/right arrows for course adjust. After the calibration value is adjusted to the desired value, press the ENTER key.



Once the actual 1-point sample calibration has been initiated, the display will indicate that a calculation is progressing. During this calculation it is important that nothing disturb the measurement sample. To abort the calibration during this calculation, press ESC.



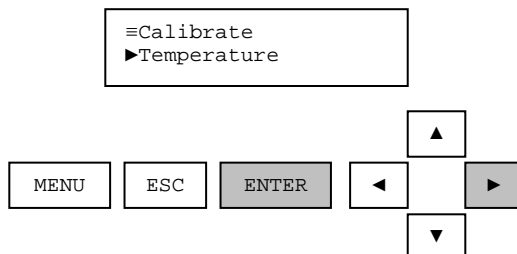
When the calibration calculation is complete, the result will be displayed on the second line of the display. If the calibration is successful, the message will be CAL OK. If the calibration is not successful, the message will be CAL FAIL. In either case, press ENTER to continue.



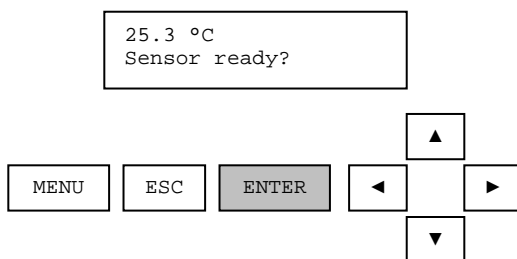
If the calibration is successful, pressing ENTER will return to the measure screen. If the calibration is not successful, pressing ENTER will return to the beginning of the 1-point sample calibration. Reasons for calibration failure include a sample that is not in the correct measurement range or is changing too quickly.

5.4. Temperature Calibration

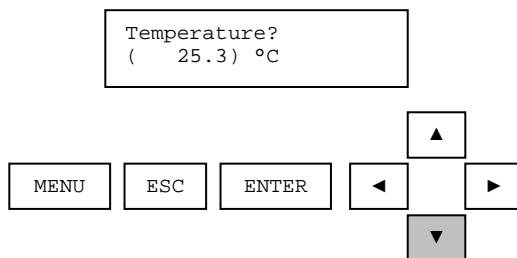
Press the ENTER key from the TEMPERATURE calibration menu to initiate the calibration process.



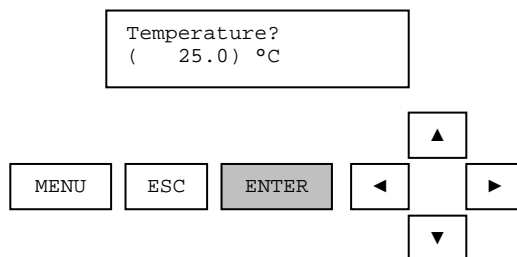
When the temperature calibration procedure is started, the analog output is placed into hold mode. The user is prompted to prepare the sensor. The sensor value is dynamically updated during this step.



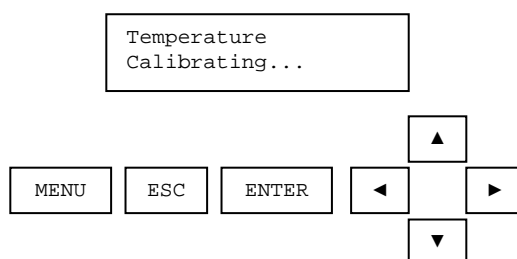
When the sensor is ready, the ENTER key is pressed and the user is presented with a calibration value for editing. Please note that it is best to calibrate temperature when the sample chamber is full of flowing process water.



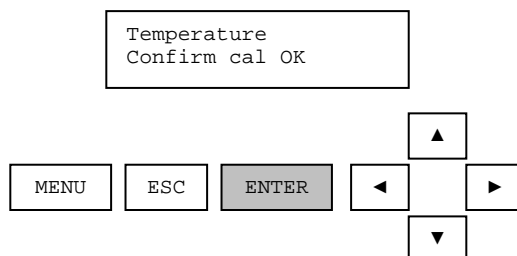
When the value has been edited as desired, the enter key is pressed and the calibration of the point is started.



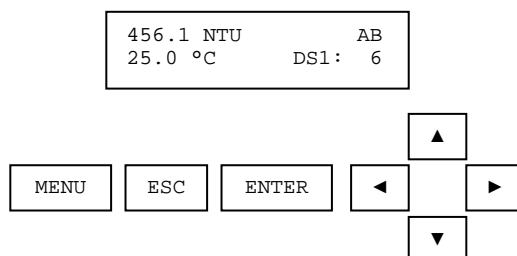
During this time, the calibration procedure can be aborted by pressing the escape key.



After the calibration point has been stored, the user is prompted to confirm a successful calibration procedure.

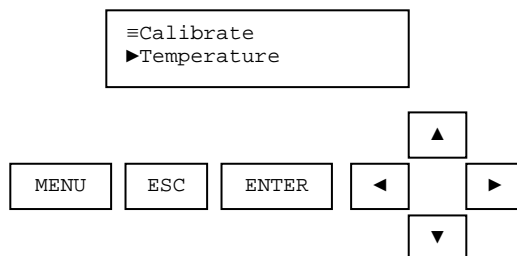


When the enter key is pressed, the analog output is placed into active mode and the monitoring of sensor and temperature values is resumed. This successfully completes the temperature calibration procedure.



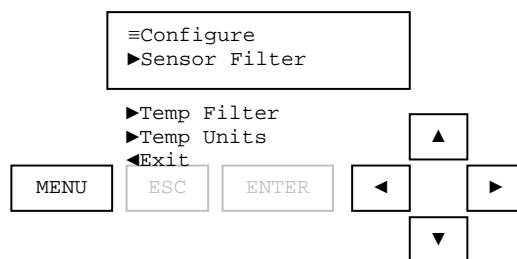
If an error occurs during calibration that causes the procedure to fail, the reason for the failure will be shown.

When the enter key is pressed, the calibrate menu is displayed. This ends the temperature calibration procedure. The user has the option of repeating the procedure if desired.

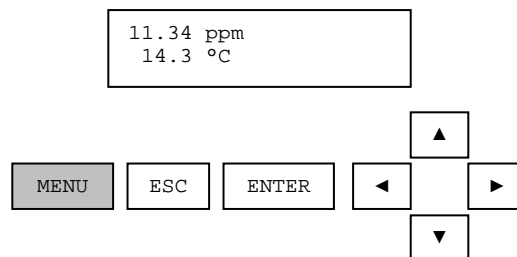


5.5. Configuration

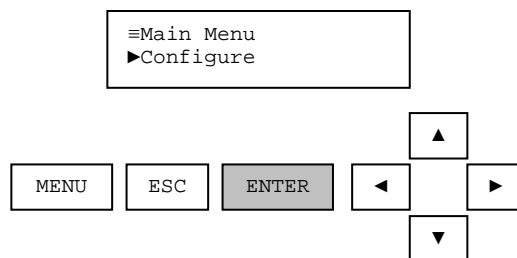
The complete configure menu for Free Chlorine is shown.



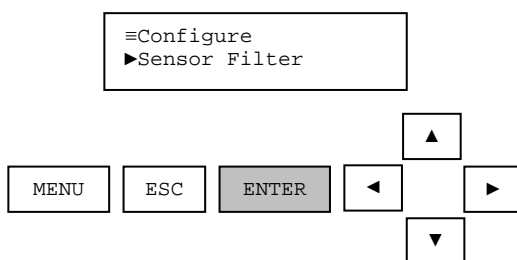
From the measure screen, press MENU.



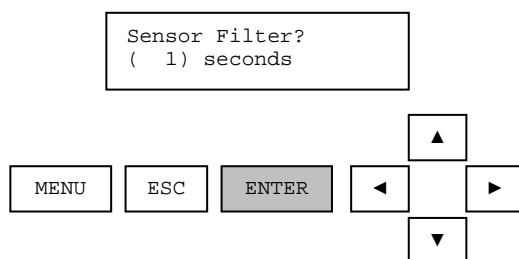
From the Main Menu, use the up/down arrows to select Configure. Then press ENTER.



From the Configure menu, use the up/down arrows to select Sensor Filter. Then press ENTER.



Edit the sensor filter with the up/down arrows. Press ENTER to select a new filter value. Press ESC to abort the new sensor value. The temperature filter edit screen works the same way.

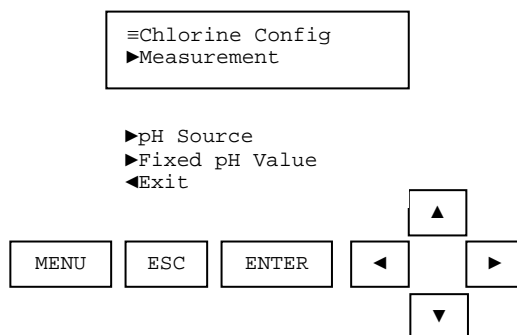


The Temperature units selection offers °C and °F in the edit screen.

5.6. Chlorine Config (pH Compensation)

When configuring an AV38 for Chlorine measurement, the chlorine DataStick can be connected to channel 1 (DS1) or channel 2 (DS2). If a pH DataStick is to be used for compensation, it must be connected to the other channel. For example, if a chlorine DataStick is connected to channel 1, then the pH DataStick must be connected to channel 2.

A Chlorine DataStick connected at channel 1, will bring up a Chlorine Configuration selection in the main menu. It will allow the measurement value to be selected as free chlorine or HOCL concentration. If free chlorine concentration is selected, then the pH must be known. If the pH value of the process is constant, the Chlorine Config menu provides a means to enter a fixed value for pH. If the pH value varies, then the pH can be measured with a second DataStick sensor connected to the AV38. If a pH DataStick is present, then the derivation of the free chlorine can be made by the AV38 using the HOCL concentration and temperature measurements from the Chlorine DataStick, and the pH measurement from the pH DataStick. This is done by selecting "pH DataStick" in the pH Source screen (under Chlorine Config). If a pH DataStick is not detected by the AV38, the only option under pH Source will be Fixed pH, where the value of the pH can be entered manually.



The “Measurement” screen provides a selection of Free Chlorine or HOCL concentration.

Measurement?
 (ppmFCL2)

(ppmHOCL)

The “pH Source” screen provides a way to select the source of the pH value in the chlorine calculation. If a pH DataStick is detected by the AV38, this selection becomes available. If a pH DataStick is detected by the AV38, then “pH DataStick” can also be selected. When this is done, the measured pH value is used to calculate the selected concentration.

Note: If a pH DataStick is used to calculate the concentration, the sensor units must be pH. If they’re not, then the concentration calculation will be done using the value entered through the Fixed pH Value screen.

pH Source?
 (Fixed pH)

The “Fixed pH Value” screen provides a way to set a fixed pH value that can be used to calculate free chlorine concentration from the HOCL measurement. This single fixed entry can be used when a pH DataStick is not present or when the process pH is tightly controlled to a known value. The default value is 7.00 pH.

5.7. Analog Output Overview

The analog output menu is used to set up the 4 milliamp to 20 milliamp analog output in the AV38. This function allows the following assignments:

- **Parameter:** Assign either pH, free chlorine, HOCL or temperature to the output.
- **4mA Value:** Assign the lowest value to be reported.
- **20mA Value:** Assign the highest value to be reported.
- **Calibrate:** Use an external ammeter to calibrate the output for precise current readings.

When the AV38 is configured with two current outputs then the main menu list shows “Analog Output 1” and “Analog Output 2”. The menu system for each output is identical.

Note: During calibration, the analog output is held at its present value.

Refer to the AV38 Manual for detailed current output operation and setup.

5.8. Relay Function Overview

Relay A and Relay B are optional features on the AV38. Relays are Form C with normally open and normally closed contacts – 120 Volts, 3 Amps. Connections are made with the optional terminal block on the left side of the back panel.

When installed, configuration of relay action is accessed through the “Relay A” and “Relay B” in the main menu.

Top-level configuration of the relays is as follows:

- **Set Function:** Sets the relay function for alarm, control or wash operation.
- **Parameter:** Assigns either pH, free chlorine, HOCL or temperature to the relay function.
- **Activation:** Configures the relay activation setpoints, deadbands and on/off delays settings.

The activation parameters depend on which function is selected.

- When set for ALARM the relays will activate based on the settings of low and high limits.
- When set for CONTROL the relays will activate based on the settings of phase and a single setpoint.
- When set for WASH the relay will activate based on programmed interval, duration and off-delay.

Alarm and Control settings allow fine-tuning of activation criteria with deadband and delay functions. Activation parameters for Alarm, Control and Wash functions are listed in the Table 9.1

ALARM	CONTROL	WASH
Set Low Alarm	Set Phase	Set Interval
Set High Alarm	Set Setpoint	Set Duration
Set Low Deadband	Set Deadband	Set Off-Delay
Set High Deadband	Set Off-Delay	Exit
Set Off-Delay	Set On-Delay	
Set On-Delay	Exit	
Exit		

Refer to the AV38 Manual for detailed relay operation and setup.

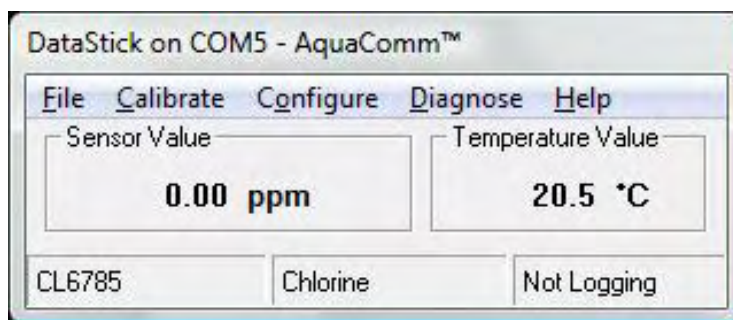
6. AquaComm™ Interface

AquaComm™ is an application software package that runs on computers with Microsoft Windows operating systems. Refer to the USB Comms Adapter manual for installation and setup.

When the Free Chlorine sensor is connected AquaComm™ will automatically recognize the sensor type and display chlorine concentration and temperature.

To calibrate, configure, diagnose or create data log files, select the pull-down menus.

Multiple AquaComm™ windows may be opened for as many unique communications ports that are supported on the computer.



7. Direct PLC Connections

When a Free Chlorine system is connected directly to a computer network, all measurement, calibration, configuration and diagnostic functions are accessible by any user interface that is also connected to the network.

Refer to the appropriate Thermo Scientific AquaSensors communications manual to set up an interface.

Modbus uses a register map of floating point, integer and ASCII measure, calibrate and configure commands.

Ethernet communications adapters allow access to all functions through a Web browser.

DeviceNet and CANopen use an electronic file that is loaded for access to all functions.

Contact Thermo Fisher Scientific if assistance is needed in setting up an integrated interface to all DataStick measurement systems through a PLC network.

8. Specification

Measurement

Ranges: 0 to 5 ppm or 0 to 20 ppm

pH Compensation: over pH 4 to 9 range

Resolution: 0.01 ppm

Operational Environment

Water Temperature Range: -5°C to 50°C

Air Temperature Range: -20°C to 60°C

Power Requirements

Voltage Range: 24 VDC or optional 90-240 VAC

Note: Class II DC power supply required

Construction

Sensor Head Material: Noryl

Sensor Membrane Material: PTFE

Weight: 1.2 lbs

Units of Measure

Measurement Units: ppm

Temperature Units: °C, °F

Calibration

Sample (Span): 1 point

Temperature: 1 point

9. Free Chlorine System Order Matrix and Accessories

DataStick™ Free Chlorine Sensor Head

Model Number CL31 Free Chlorine Sensor Head plugs into any DataStick sensor body and provides factory-calibrated measurement. Integral temperature. Replaceable Membrane Cap.		
Sensor Tip Options B Process Flat (without face seal) C Face Seal (for flow chamber mounting)		
Measurement Range 1 0 to 5 ppm 2 0 to 20 ppm		

CL31		
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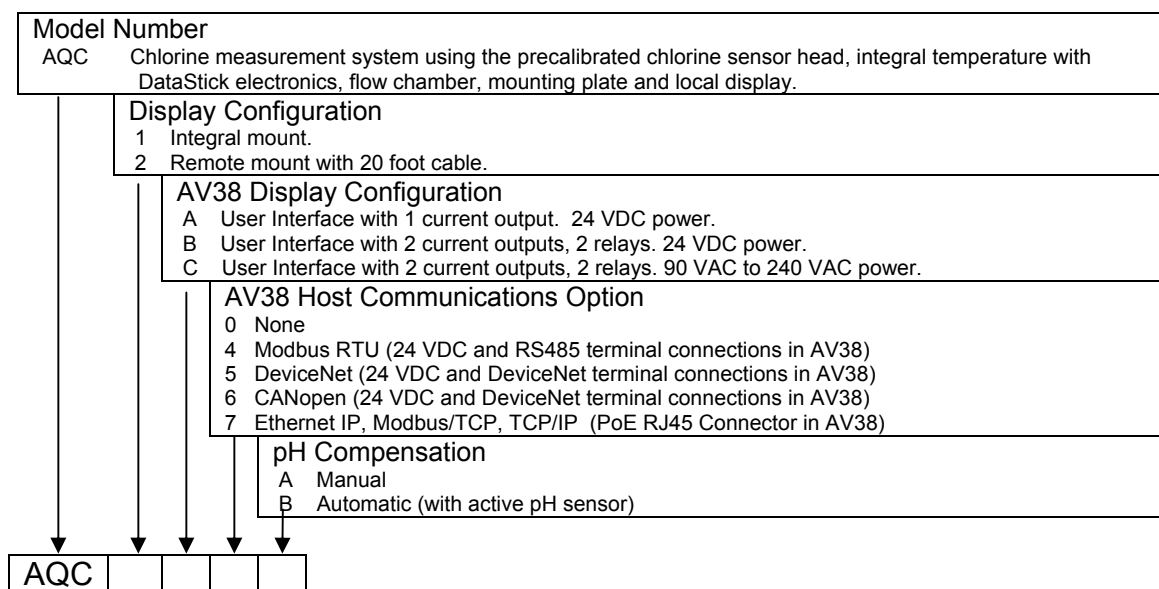
DataStick Components	Description	Part Number
Universal Sensor Body	316 Stainless Steel 1" sensor body CPVC 1-inch sensor body PEEK® 1-inch sensor body	DS11 DS21 DS31
Communications Adapter	CPVC Modbus RTU with 10 foot cable	CA22B1A
Profibus / DataStick Gateway	Modbus RTU DataSticks connect to Profibus DP	CA26R

Local Interface	Description	Part Number
AV38 Display	One 4-20mA output, PID. 24VDC. Two 4-20mA outputs, PID, 2 Relays, Modbus Host, 24VDC.	AV38BB0A1 AV38CB4A1

Mounting Hardware	Description	Part Number
1.5" Union Mount Assembly	Stainless Steel CPVC	MH1041 MH1042
1.5" Tee	Schedule 40, Stainless Steel Schedule 80, CPVC	MH3011 MH3022
Flow Chamber Assembly	Flow Chamber with mounting plate w/ fittings. Dual Flow Chamber with mounting plate w/ fittings.	FC001 FC003
Junction box Extension Cable	For extension cables. Terminal strip included. DataStick Extension cable	JBOXX01 DSECxx; xx=ft

Product	Description	Part Number
Chlorine Electrolyte	Electrolyte in the PPM range. – 60ml bottle	RDOK9
Membrane Assembly	Chlorine Membrane Cap with pre-stretched membrane	DMR09
Protective Cap	To keep stored membrane wet when stored.	SBC01

AquaChlor™ Free Chlorine Measurement System



1. Limited Warranty

AV38 WARRANTY/REPLACEMENT PLAN

Thermo Fisher Scientific warrants its products against material and workmanship defect for a period of one year from the date of shipment.

In the event that a defect is discovered during the warranty period, Thermo Fisher Scientific agrees, at its option, to repair or replace the defective product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products associated with this product including, but not limited to, chemical reagents and salt bridges.

Products may not be returned without authorization from Thermo Fisher Scientific. To obtain authorization, please call Thermo Fisher Scientific for a return material authorization number.

Limitations:

This warranty does not cover:

1. Damage caused by misuse, neglect (lack of appropriate maintenance), alteration, accident or improper application or installation.
2. Damage caused by any repair or attempted repair not authorized by Thermo Fisher Scientific.
3. Any product not used in accordance with the instructions furnished by Thermo Fisher Scientific.
4. Damage caused by acts of God, natural disaster, acts of war (declared or undeclared), acts of terrorism, work actions, or acts of any governmental jurisdiction.
5. Freight charges to return merchandise to Thermo Fisher Scientific.
6. Travel fees associated with on-site warranty repair.

This warranty is the sole expressed warranty made by Thermo Fisher Scientific in connection with its products. All other warranties, whether expressed or implied, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

The liability of Thermo Fisher Scientific shall be limited to the cost of the item giving rise to the claim. In no event shall Thermo Fisher Scientific be liable for incidental or consequential damages.

This warranty is the sole and complete warranty for Thermo Fisher Scientific. No person is authorized to make any warranties or representations on behalf of Thermo Fisher Scientific.

Thermo Fisher Scientific reserves the right to change or modify this warranty at any time.

10. Terms and Conditions

Terms and Conditions of Sale

The following terms and conditions will be presumed acceptable unless changes are made in writing and accepted by both parties in a reasonable amount of time.

Any standard or boilerplate terms and conditions supplied with a written purchase order will not be applicable unless accepted in writing by both parties.

Quotations: All quotations shall be in writing. Written quotations shall be valid for 30 days from the date issued. Verbal quotations or price lists are not valid.

Pricing: All pricing is in **US Dollars**. Thermo Fisher Scientific reserves the right to change pricing without notice.

Terms: Payment terms are **net 30 days** from the date of invoice with approved credit. Thermo Fisher Scientific reserves the right to deny credit or revoke previously extended credit. Past due accounts are subject to interest charges. Other acceptable payment terms are cash, certified check, money order, credit card or letter of credit confirmed by any United States of America bank. Other payment terms are not valid unless accepted in writing.

Sales taxes shall be included on the invoice unless a valid tax exemption certificate is supplied.

Return Material Authorization: Contact Thermo Fisher Scientific Customer Service for a Return Material Authorization (RMA) number. Items returned without an RMA number will be rejected.

All returned merchandise must be in unused, resalable condition, and must not be contaminated with hazardous materials.

Cancelled orders must be returned within 30 days of the date on the invoice and shall be subject to expenses incurred that may include, but are not limited to, inspection and restocking fees. Items returned within 60 days shall be subject to a restocking charge that is equal to 15% of the purchase price. Items returned after more than 60 days shall be subject to a restocking charge equal to 25% of the purchase price. Thermo Fisher Scientific reserves the right to reject any return that is not under warranty after 60 days. Non-stock items are normally not returnable.

Transportation: Orders are shipped FOB Thermo Fisher Scientific, or factory, by the most efficient means available. Appropriate charges, such as freight and insurance will be added to invoices. All shipments will be insured. Goods damaged in shipment must be reported by the recipient to the freight carrier for claims.

Thermo Fisher Scientific

Environmental Instruments

Process Water Instruments



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