

**Thermo Scientific AquaSensors™
AquaClear™ Low Range
Turbidimeter
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 AquaClear Turbidity 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 equipment 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 AquaClear Turbidity 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

Thank you for purchasing the AquaClear Drinking Water Turbidimeter.

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.
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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 AquaClear Turbidity System is used for continuous monitoring of low-range turbidity in drinking water applications. The system also measures water temperature.

Data is reported through a local display and a scalable 4-20 milliamp current output. Options include a second current output, up to 2 configurable relays and one of several digital protocols for remote monitoring, calibration, configuration and diagnostics.

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



A defective Turbidity 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 Turbidity 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 Turbidity System

Removal from Service

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

Correct Disposal of Unit

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

2. PRODUCT DESCRIPTION

The AquaClear Turbidity System is used for continuous monitoring of low-range turbidity in drinking water applications. The system also measures water temperature.

In the standard system configuration, data is reported through a local display and a scalable 4-20 milliamp current output. Options include a second current output, up to 2 configurable relays and one of several digital protocols for remote monitoring, calibration, configuration and diagnostics. All functions can be accessed through a digital network with or without a local display interface.

The AquaClear Turbidity System uses a pre-calibrated optical detector mounted in a sample chamber specifically designed to prepare water for low-range turbidity measurements. A collimated white light in the chamber lid is used to illuminate particles suspended in the water.

The chamber removes bubbles from the water so that solid particles can be accurately detected. The chamber lamp will provide collimated white light for up to two years and is easily changed from the top. Because the chamber volume is only 135 milliliters, it takes a very small amount of Formazin to perform EPA mandated calibrations.

Highlights:

- Meets USEPA Method 180.1
- Pre-calibrated Measurement
- Plug and Play Optical Detector
- 135 ml Sample Chamber
- 0.001 NTU Resolution
- Fast Response
- 2 year light source
- Compact mounting footprint
- Digital Networking Interface
- Local Interface with current loops and relays
- Low flow rate
- Temperature measurement included
- Plug and Play Industrial Communications Adapters

The AquaClear Drinking Water Turbidity system is part of the DataStick family of products. The DataStick can be used with any sensor head manufactured by Thermo Fisher Scientific and can communicate directly with industrial computer systems using any of the communications adapters offered. The Thermo Scientific AquaSensors AV38 local display is provided as standard equipment for the Turbidity System. It is however not required and any number of turbidity systems can be digitally networked to a single computer interface. Open protocol commands for calibration, configuration, diagnostics and measurement are available (consult the desired communications manual).

3. Mounting, Wiring and Plumbing

3.1. Mounting

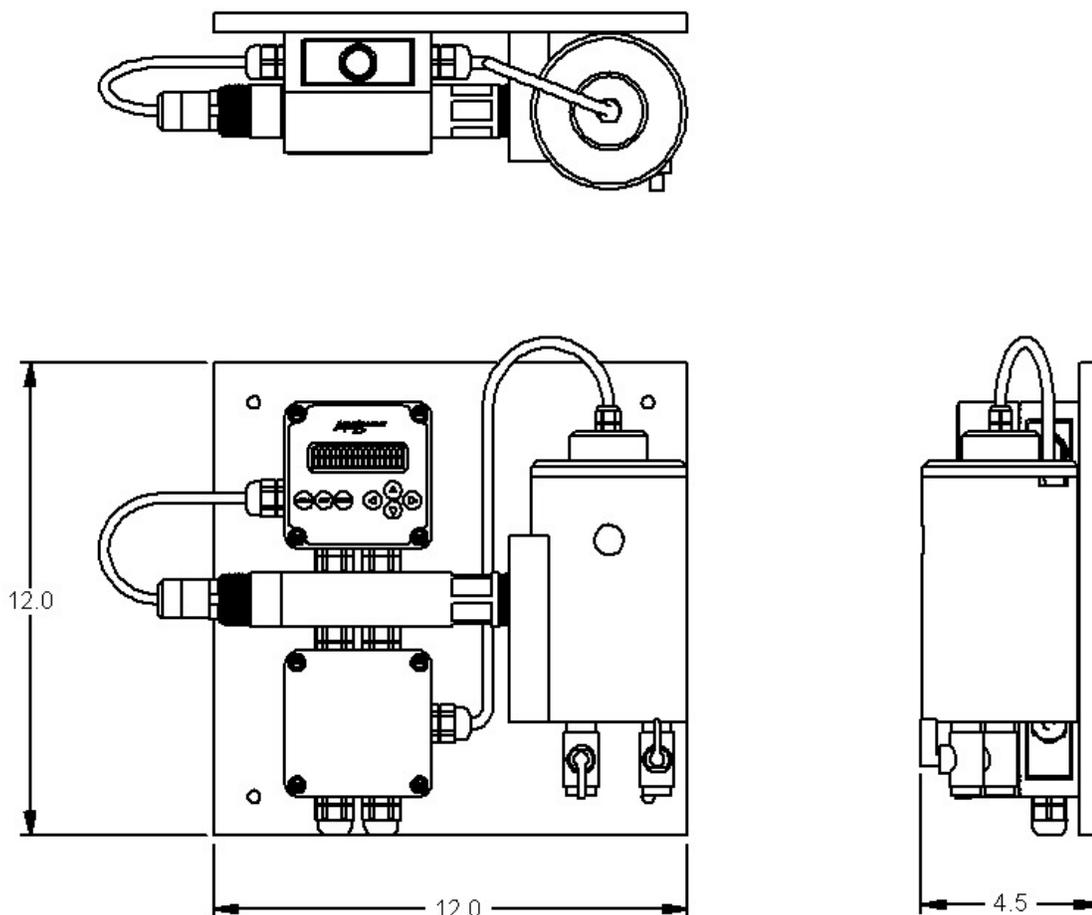


Figure 2.1: Wall mounting clearances

The Drinking Water Turbidity System is mounted on a 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. Make sure the sample chamber is level and plumb to insure proper water levels are maintained in the sample chamber. 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.

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 Mounting Instructions:

1. Place the 12x12 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 turbidity 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 turbidity system 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.

3.2. Plumbing

The Drinking Water Turbidity System has an INLET, an OUTLET and a DRAIN.

Barb fittings are provided for the INLET and OUTLET in the event that 3/8 inch ID tubing is used.

When piping is used instead of tubing, remove the barb fittings to install ¼ inch NPT threaded pipe for the INLET, OUTLET and DRAIN.

OUTLET and DRAIN Plumbing Recommendations: Use straight ¼ inch NPT threaded pipe that extends to a vented drain. Pipe restrictions that result in back pressure for OUTLET and DRAIN are not allowed.

INLET Plumbing Recommendations: Use 3/8 ID tube or ¼ inch NPT threaded pipe from sample source.

Flow rate 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. The turbidity sample chamber has an overflow weir that must not be restricted.

USER WIRING FOR: 1 Current Loop without Host Communications

Terminal	Wiring
1	24VDC from Power Supply
2	Ground from Power Supply
3	
4	
5	Earth Ground from Power Supply
6	Current Loop -
7	Current Loop +
8	
9	
10	
11	
12	

Note: Current Loop Requires 24 VDC supply. Options for second current loop and relays are available.

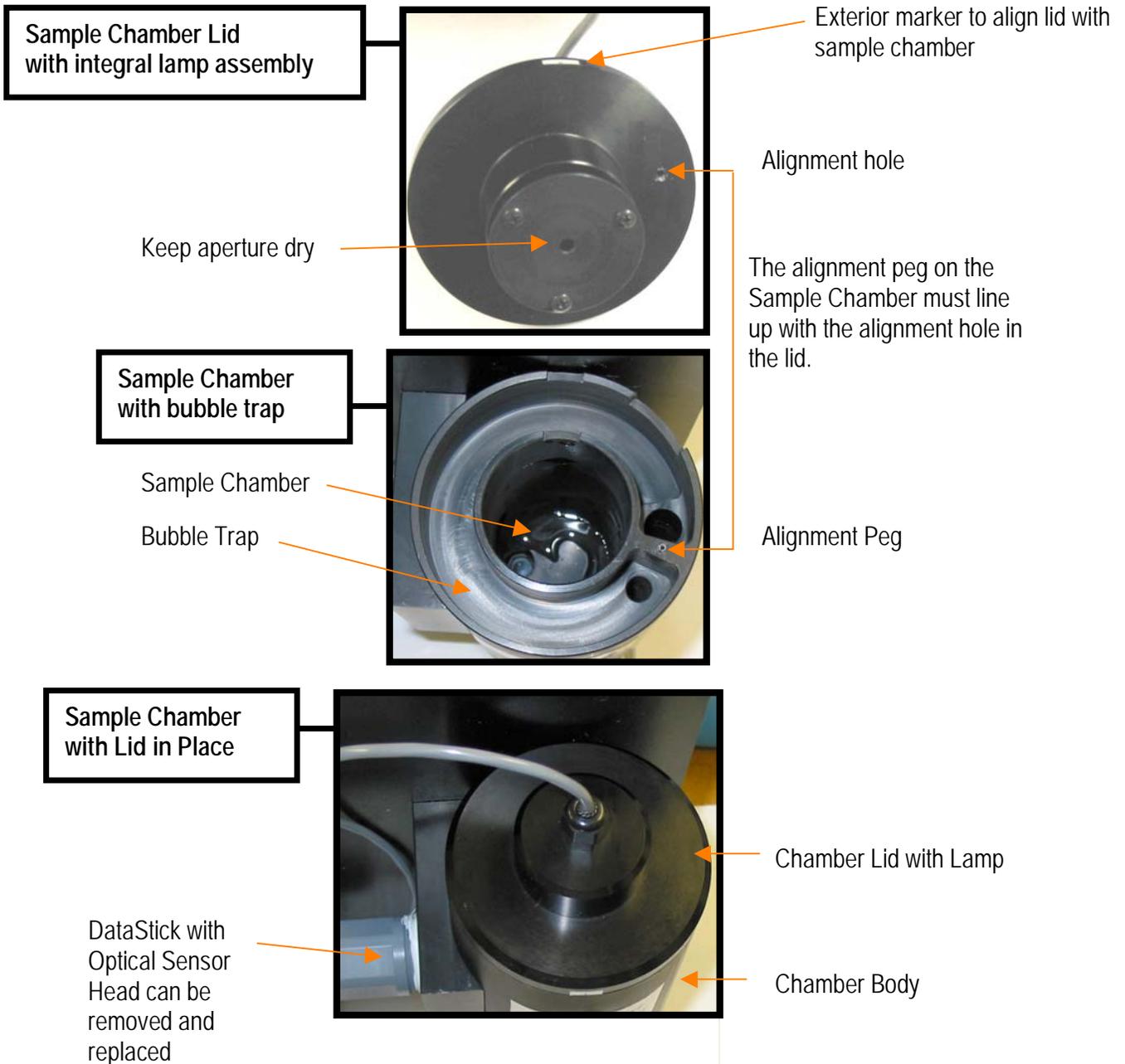
USER WIRING FOR: Digital Communications to Host Computer with 2 Outputs and Relay

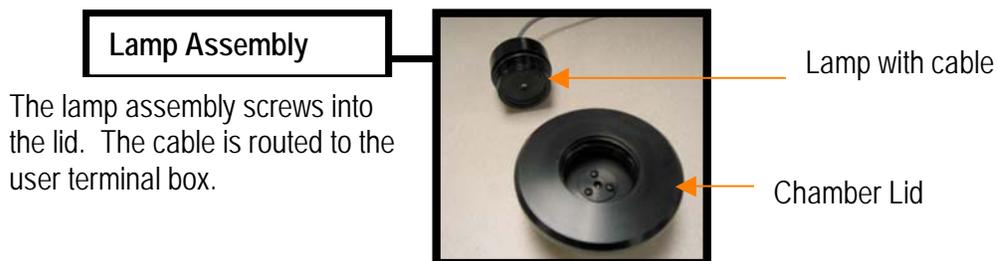
Terminal	Wiring
1	Red wire from Host Network (+24 VDC)
2	BLACK wire from Host Network (Network Ground)
3	White wire from Host Network
4	Blue wire from Host Network
5	Shield wire from Host Network
6	OUTPUT 1 (-)
7	OUTPUT 1 (+)
8	OUTPUT 2 (-)
9	OUTPUT 2 (+)
10	Relay – Normally Open Terminal
11	Relay – Common Terminal
12	Relay – Normally Closed Terminal

3.4. Sample Chamber Details

The Drinking Water Turbidity sample chamber is designed for easy access and maintenance.

The chamber lid is lifted to gain access to the sample chamber. Set it on top of the AV38 during chamber maintenance. When replacing the lid, it should be aligned using the exterior alignment markers on the front edge of the chamber and the lid.





4. MEASURE SCREEN OVERVIEW

The AV38 user interface is shown in Figure 3.1. 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).

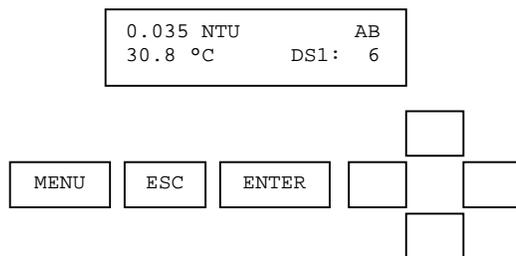


Figure 3.1: The elements of the measure screen

When the DataStick and communications adapter are connected to the AV38 display but the optical sensor head is absent, the measure screen indicates the fault as shown in Figure 3.2.

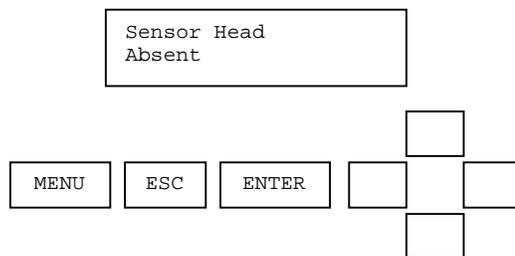


Figure 3.2: The measure screen when the Sensor Head is absent.

When the DataStick or communications adapter are not connected to the AV38 display, the measure screen indicates the fault as shown in Figure 3.2.

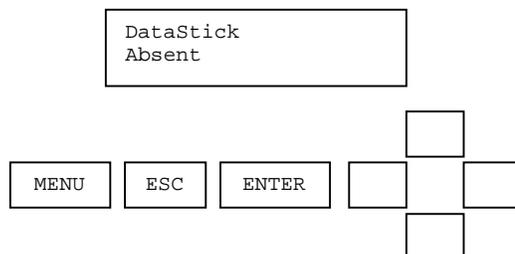


Figure 3.2: The measure screen when the DataStick is absent.

Refer to the AV38 Manual for detailed information on User Interface operation.

5. 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 4.1 shows all accessible functions including optional features.

Table 4.1: 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, HOCL or OCL ⁻ 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.

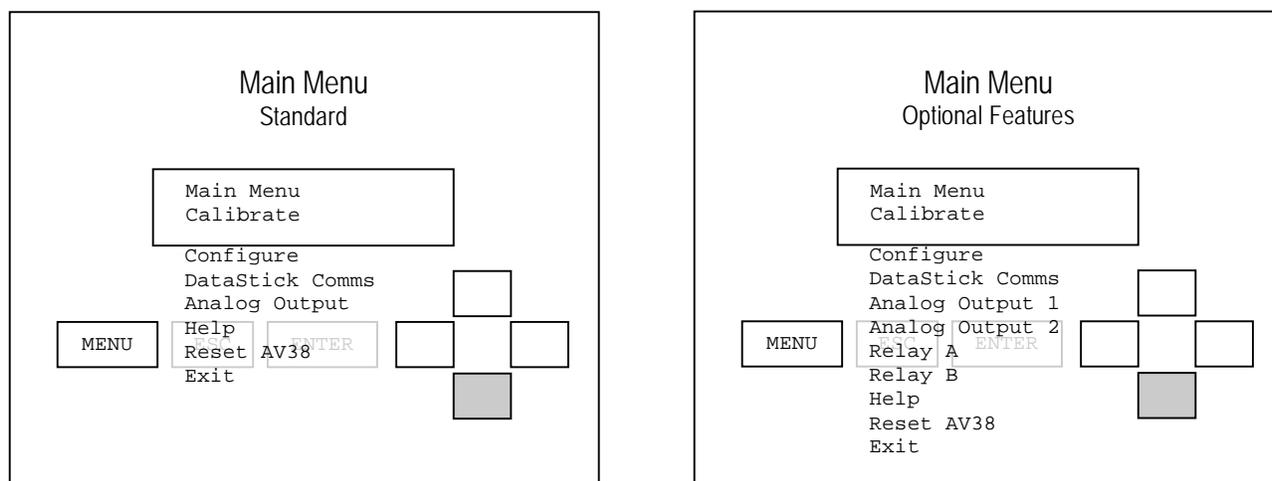


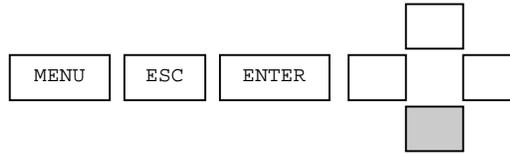
Figure 4.1: The main menu (standard and optional feature lists)

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.  .

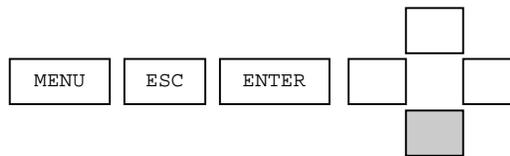
From the measure screen, press MENU to display the list of options. Generally, Calibration will be the first option. To select a calibration function, press ENTER. Press the down arrow to scroll through the list. Press ESC to return to the measure screen.

Main Menu
Calibrate



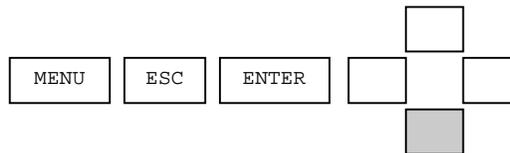
Pressing the down arrow from Calibration will display Configure. To select Configure functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.

Main Menu
Configure



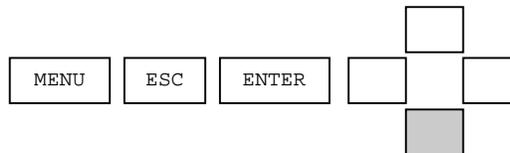
Pressing the down arrow from Configure will display DataStick Comms. To select DataStick Comms functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.

Main Menu
DataStick Comms

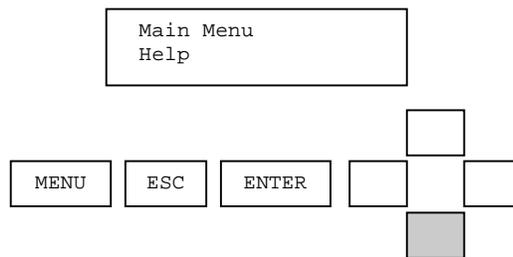


Pressing the down arrow from DataStick Comms will display Analog Output. To select analog output functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.

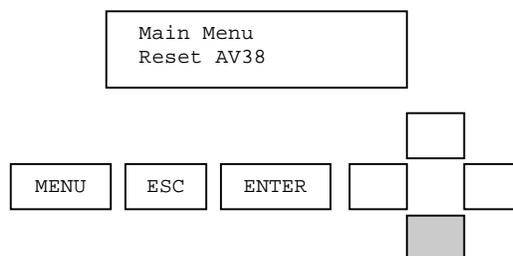
Main Menu
Analog Output



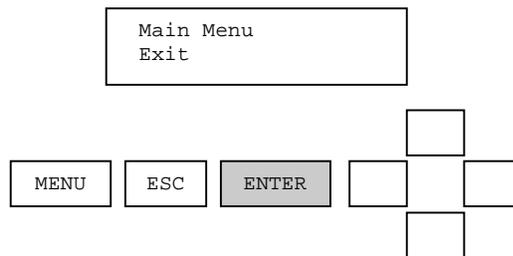
Pressing the down arrow from Analog Output will display Help. To select Help functions, press ENTER. To continue scrolling the list, press the down arrow. Press ESC to return to the measure screen.



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.



6. Calibration

6.1. Span Calibration

To calibrate the span for the Drinking Water Turbidity System:

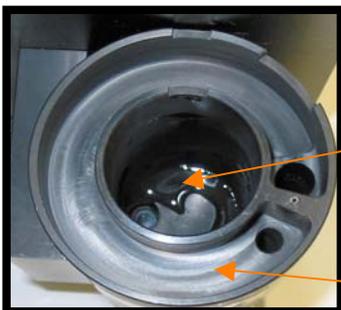
1. Drain the sample chamber.
2. Shut off flow to the sample chamber.
3. Remove the chamber lid and place it on top of the AV38.
4. Rinse the chamber with clean water and then with a small amount of calibration solution.
5. Shut off the Drain.

Drain Chamber, Shut off Inlet



Drain and Inlet are shut off: Ready to calibrate

**Sample Chamber
with Lid Removed**



Be careful to pour formazin directly into the SAMPLE CHAMBER. Do not pour formazin into the Bubble trap.

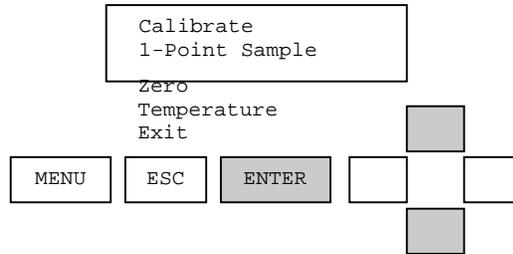
During this operation, water will remain in the BUBBLE TRAP and it is not necessary to remove it.

Sample Chamber

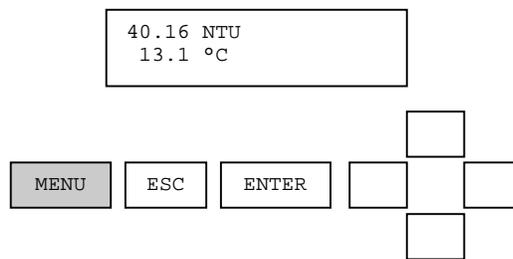
Bubble Trap

6. Fill the sample chamber with 40 NTU calibration solution. The formazin should overflow the OUTLET weir located about $\frac{3}{4}$ of the way to the top of the sample chamber. The 40 NTU calibration standard must be prepared from a stock solution of 4000 NTU and used within 24 hours. Refrigerate when stored.
7. After filling the sample chamber with formazin, wait for the reading to settle (less than a minute depending on the filter setting).
8. Perform a 1-point sample calibration as shown in the following menu tree.

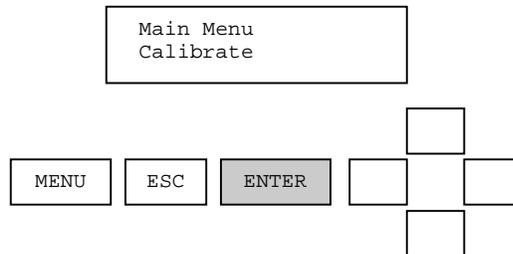
The complete calibrate menu for the turbidity and suspended solids is shown.



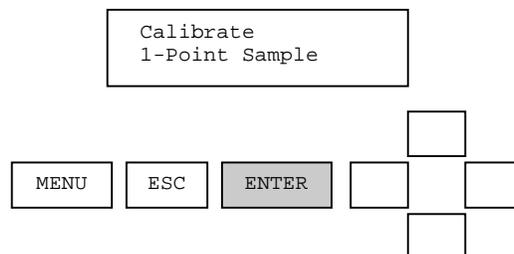
From the measure screen, press MENU.



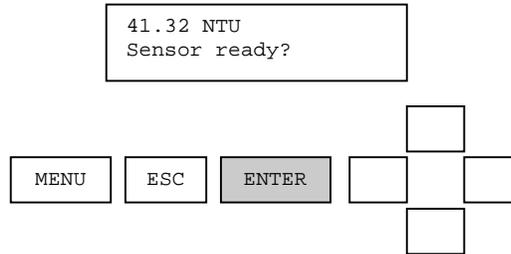
From the Main Menu, use the up/down arrows to select Calibrate. Then press ENTER.



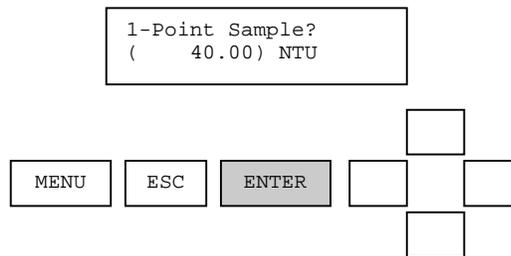
From the Calibrate Menu, use the up/down arrows to select 1-Point Sample. Then press ENTER.



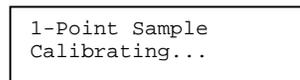
The current sensor value is dynamically displayed and asks the user to be sure the measurement is ready for calibration before proceeding. When ready, press the ENTER key.



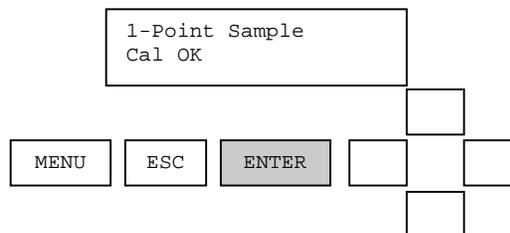
The calibration value can be adjusted with the arrow keys. Use the up/down arrows for fine adjust and the left/right arrows for course adjust. After the calibration value is adjusted to the desired value, press the ENTER key.



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 in value too quickly.

After Calibration:

1. Drain the sample chamber.
2. Pour clean water into the chamber and wipe interior surfaces with a clean rag.
3. Rinse with clean water.
4. Close the Drain valve.
5. Open the Inlet Valve to allow process water to fill the sample chamber.
6. Replace the sample chamber lid. Be sure that the alignment post in the chamber is properly inserted into the alignment hole in the lid.



Chamber Lid with Lamp

Chamber Body



Drain Chamber, Shut off Inlet



Measure: Close Drain, Open Inlet

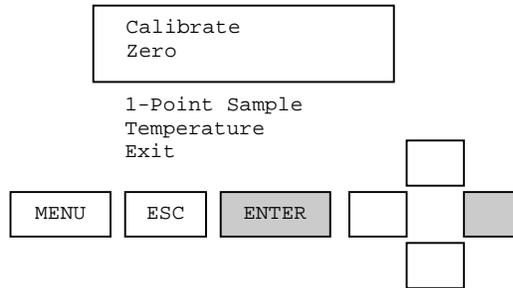
6.2. Zero Calibration

The zero calibration should not be adjusted unless the following criteria are met:

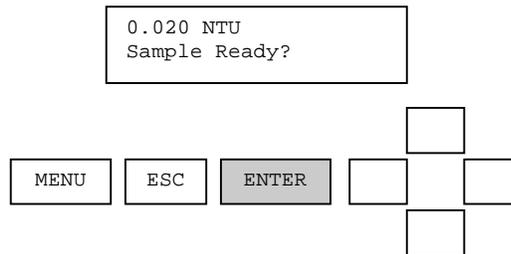
1. The chamber must be completely clean and free of particulates.
2. The inlet water must pass through a 0.2 micron filter.
3. There must be no air bubbles introduced through the inlet to the chamber.

In performing a zero calibration the 0.2 micron filtered water should remain flowing to drain and the reading should be close to 0.015 NTU before proceeding.

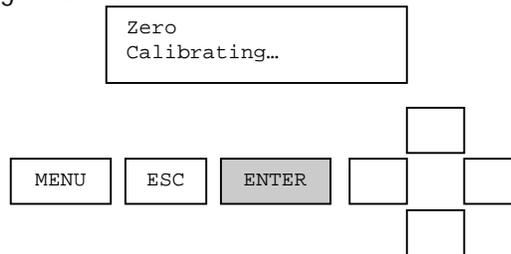
From the Calibrate menu, use the UP/DOWN arrows to display ZERO calibration. Press ENTER to select.



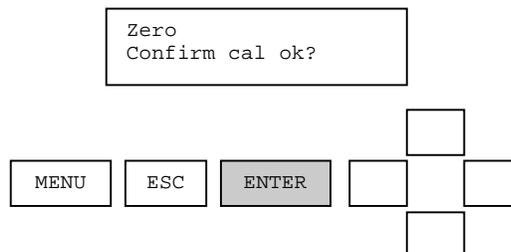
Be sure the filtered water has had an opportunity to flow for a few minutes to clean out any particles that may have been in the plumbing. Press ENTER to initiate zero calibration.



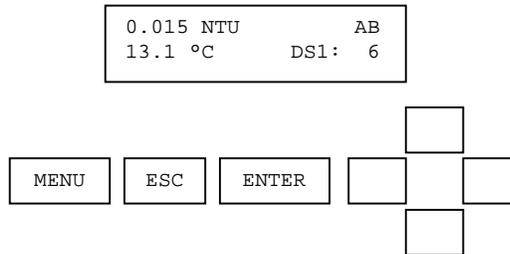
A zero calibration may take some time, as the zero must be calibrated over a wide dynamic range. During this process the calibrating... message is shown.



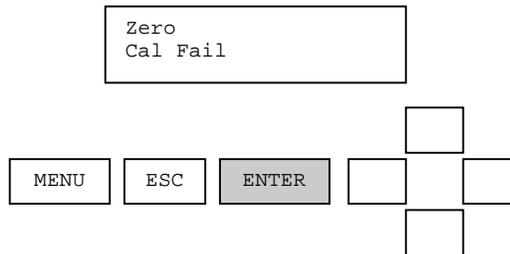
When the zero calibration is complete the user will be asked to confirm the result with the ENTER key.



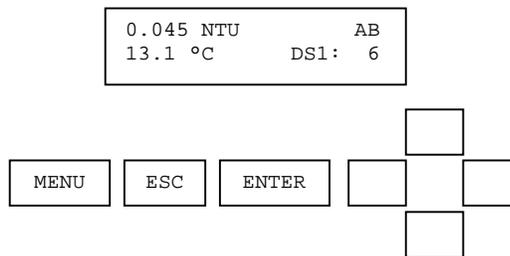
After pressing ENTER to confirm Calibration is okay, the Measure screen will be displayed.



If an error occurs during calibration, the reason for the failure is shown.

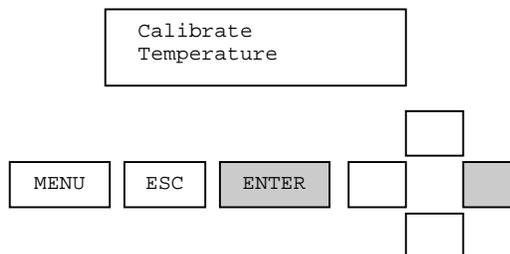


Press ENTER to acknowledge the calibration failure and return to the measure screen.

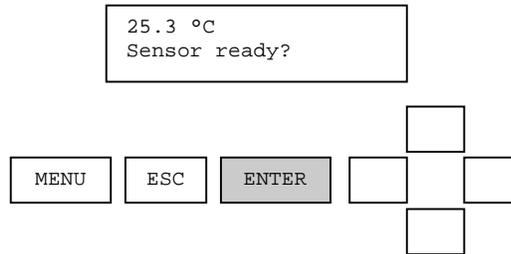


6.3. Temperature Calibration

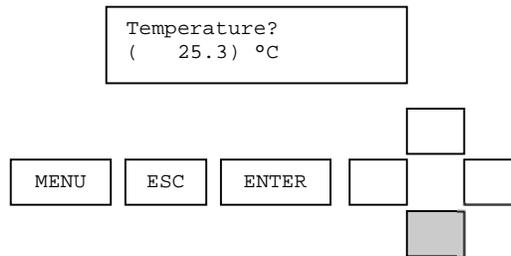
Press the ENTER key from the TEMPERATURE calibration menu to initiate the calibration process.



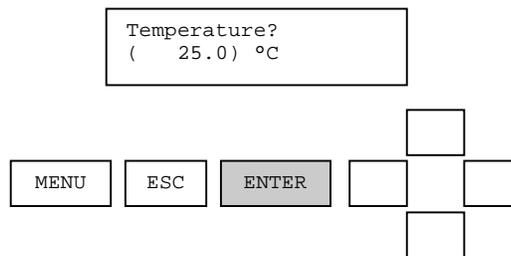
When the temperature calibration procedure is started, the analog output is placed into hold mode. The user is prompted to prepare the sensor. The sensor value is dynamically updated during this step.



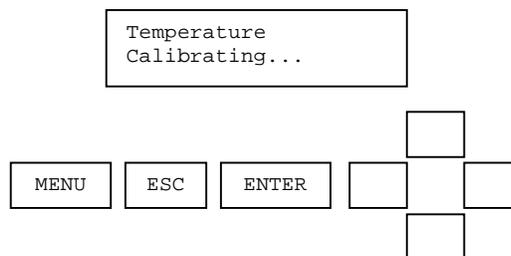
When the sensor is ready, the ENTER key is pressed and the user is presented with a calibration value for editing. Please note that it is best to calibrate temperature when the sample chamber is full of flowing process water.



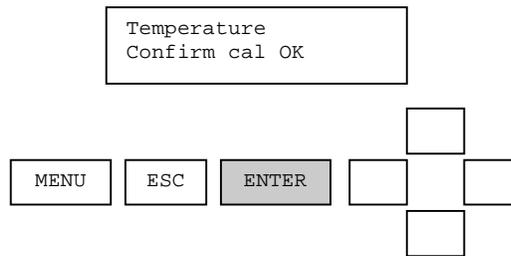
When the value has been edited as desired, the enter key is pressed and the calibration of the point is started.



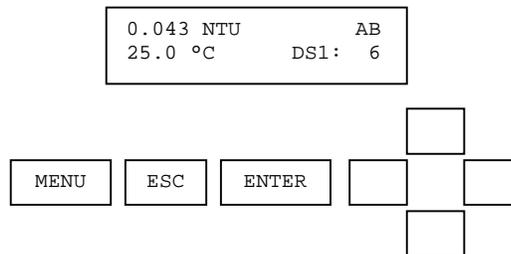
During this time, the calibration procedure can be aborted by pressing the escape key.



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

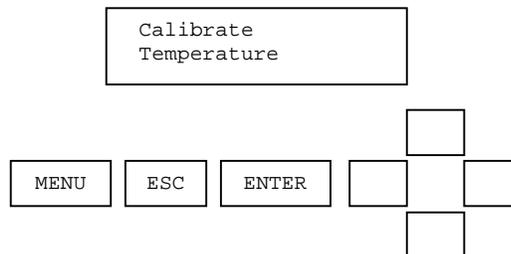


When the enter key is pressed, the analog output is placed into active mode and the monitoring of sensor and temperature values is resumed. This successfully completes the temperature calibration procedure.



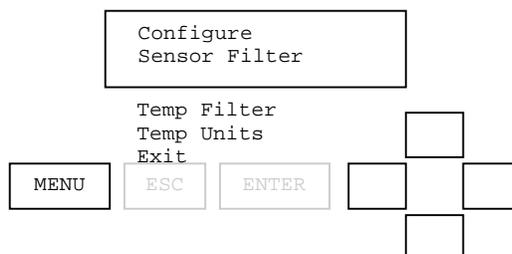
If an error occurs during calibration that causes the procedure to fail, the reason for the failure will be shown.

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.

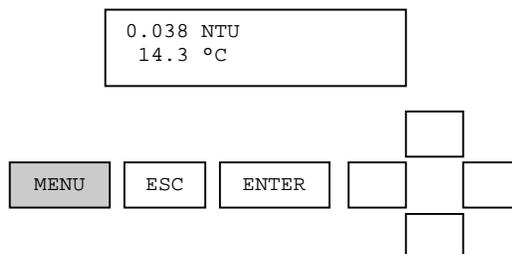


7. Configuration

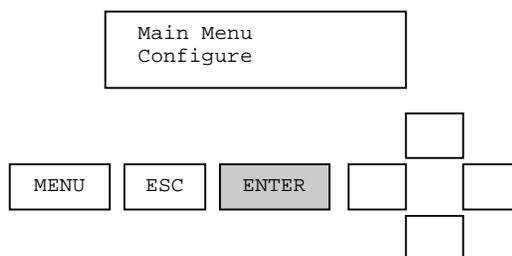
The complete configure menu for turbidity is shown.



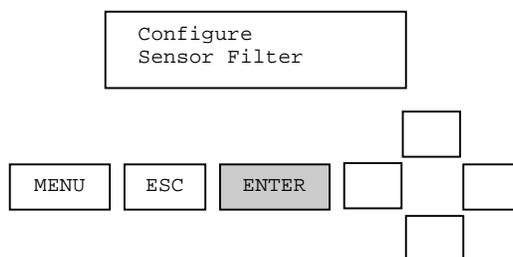
From the measure screen, press MENU.



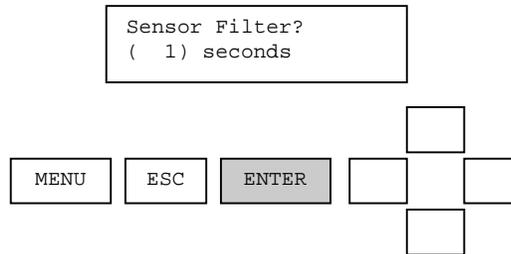
From the Main Menu, use the up/down arrows to select Configure. Then press ENTER.



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.

8. DataStick Comms Menu

It is recommended that the data in this menu not be changed unless the user clearly understands how to connect multiple DataSticks into a single AV38.

Up to 247 DataSticks can be connected to a single AV38. Any two of them can be selected for local display, current loop reporting and relay control. The DataStick station number that is selected is displayed in the lower right corner of the measure screen. If "DataStick Absent" is displayed in the measure screen, it is likely that the DataStick connected to the AV38 is set up for the wrong station number, Baud rate or parity.

The default communications settings for all Modbus Communications Adapters are:

1. DS1 Station set to Modbus Station 1
2. DS2 Station set to Modbus Station 1
3. Data Type of Little Endian Word Swap, 12
4. Baud rate of 19.2 kbps
5. Parity is ODD

To change the Station Number, Data Type, Baud rate or Parity in a DataStick, refer to the MODBUS Communications Adapter User's Manual (PN: MAN021CA-4). Thermo Fisher Scientific will provide custom settings at the factory on request. This is useful when more than one DataStick is being connected to the AV38.

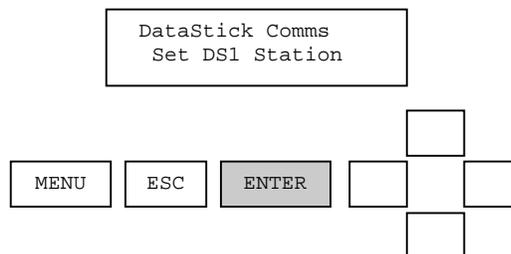
The AV38 DataStick Communications menu is used to set the parameters that the AV38 uses to communicate with the DataStick. The complete DataStick Comms menu is shown.

```
DataStick Comms
Set DS1 Station

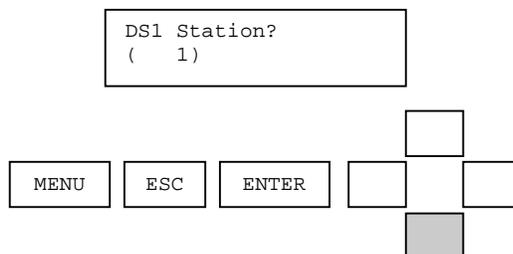
Set DS2 Station
Data Type
Set Baud
Set Parity
Exit
```

8.1. Setting DataStick Station Number

The DataStick Station Number used by the AV38 is displayed in the lower right corner of the MEASURE screen. It can be viewed or changed in the DataStick Comms Menu by selecting "SET DS1 Station " or "Set DS2 Station" with the ENTER key. The default Station Number for both measure screens is 1.

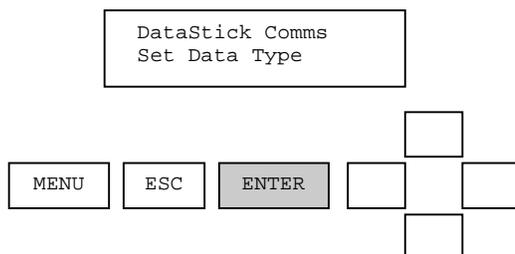


Edit the Station number in parentheses using the up and down arrows. Select a new number with the ENTER key. To be sure that a new number is NOT selected, press the ESC key to leave the station number unchanged. The station number selected must match the number programmed into the Modbus Comms Adapter of the DataStick wired to the AV38.

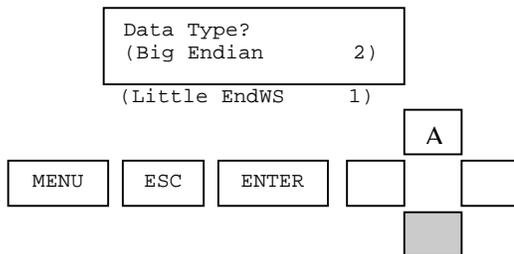


8.2. Setting Data Type

All DataSticks connected to the AV38 must be set up with the same Data Type. To view or edit the current AV38 Data Type setting, press ENTER on the Data Type screen as shown. The default setting is Big Endian 2.



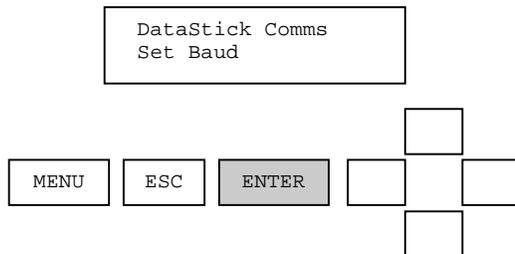
Use the UP/DOWN arrows to edit the AV38 Data Type. Big Endian and Little Endian/ Word Swap are the two data types supported in the AV38. The default data type is Little Endian Word Swap, 1 as it is most commonly used. If measurement data is displayed but does not make sense then it is very likely that the Data Type should be switched.



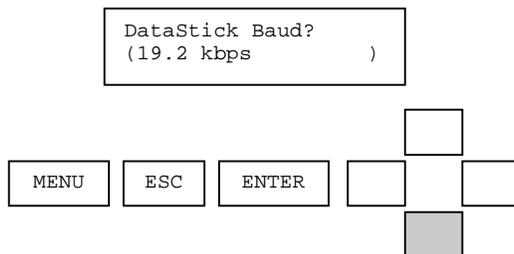
Select a new data type with the ENTER key. To be sure that a new data type is NOT selected, press the ESC key to leave the data type unchanged. The data type selected must match the data type programmed into the Modbus Comms Adapter of the DataStick wired to the AV38.

8.3. Setting DataStick Baud Rate

All DataSticks connected to the AV38 must be set up with the same Baud rate. To view or edit the current AV38 Baud rate setting, press ENTER on the SET BAUD screen as shown. The default setting is 19.2 kbps.

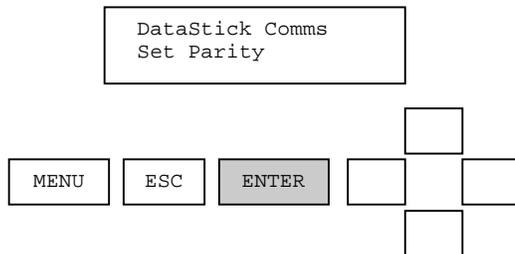


Use the UP/DOWN arrows to edit the AV38 Baud rate. Baud rate options include the following (kbps): 1.2, 2.4, 4.8, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2 and 230.4. The Baud rate selected in the AV38 must match the Baud rate programmed in all connected DataSticks. Press ENTER to select a new value. Press ESC to leave the Baud rate unchanged.



8.4. Setting DataStick Parity

All DataSticks connected to the AV38 must be set up with the same parity. To view or edit the current AV38 parity setting, press ENTER on the SET PARITY screen as shown. The default setting is ODD.



Use the UP/DOWN arrows to edit the AV38 parity. Parity options include: ODD, EVEN and NONE. The parity selected in the AV38 must match the parity programmed in all connected DataSticks. Press ENTER to select a new value. Press ESC to leave the parity unchanged.

9. Analog Output(s)

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

- Parameter: Assign either turbidity or temperature to the output.
- 4mA Value: Assign the lowest value of turbidity or temperature to be reported.
- 20mA Value: Assign the highest value of turbidity or temperature 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.

The complete analog output menu is shown in Figure 8.1.

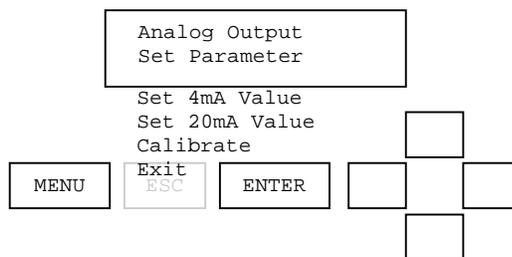
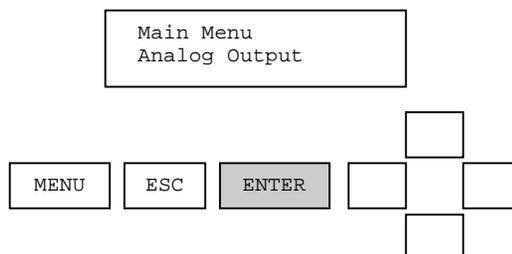
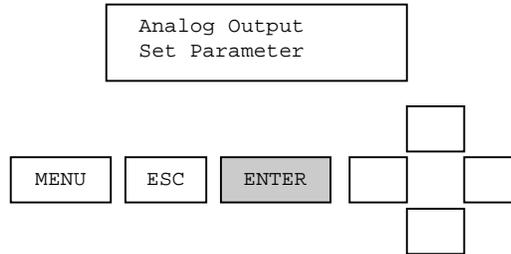


Figure 8.1 Analog output menu.

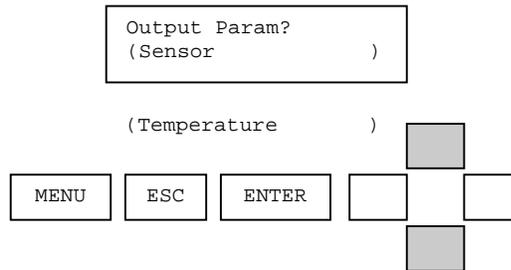
To configure the Analog Output, select it from the main menu by pressing ENTER.



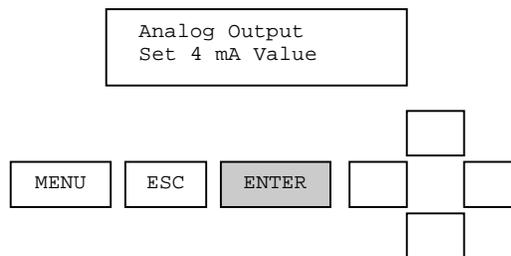
To view or reassign the parameter driving the output (turbidity or temperature), select "Set Parameter" with the ENTER key.



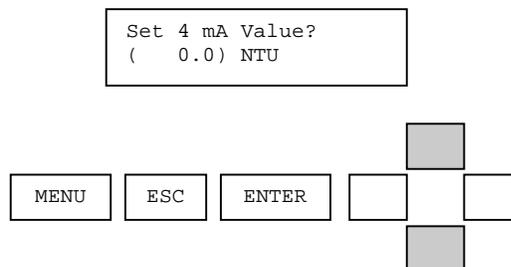
To view or reassign the parameter driving the output (turbidity or temperature) use the up/down arrows to select Sensor or Temperature. Accept the displayed parameter with the ENTER key. Exit without changing by using the ESC key.



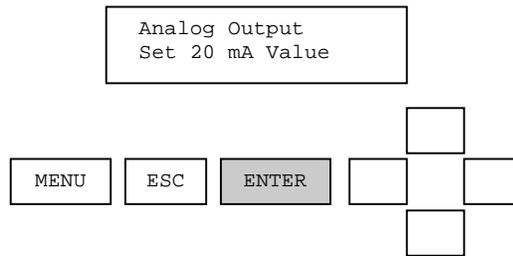
To set the 4 milliamp value select "Set 4 mA Value" with the up/down arrows and the ENTER key.



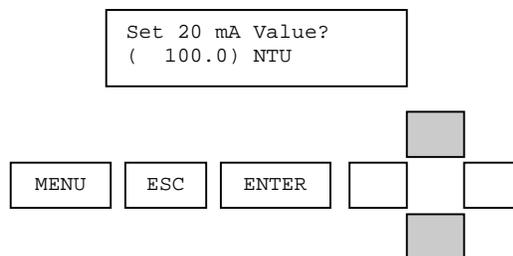
Use the up/down arrows for fine adjustment of the low sensor or temperature value. Use the left/right arrows for course adjustment. Accept the displayed value with the ENTER key. Exit without changing by using the ESC key.



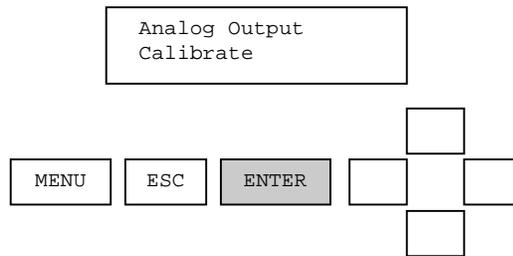
To set the 20 milliamp value select "Set 20 mA Value" with the up/down arrows and the ENTER key.



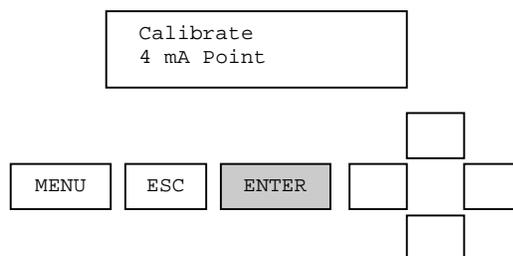
Use the up/down arrows for fine adjustment of the low sensor or temperature value. Use the left/right arrows for course adjustment. Accept the displayed value with the ENTER key. Exit without changing by using the ESC key.



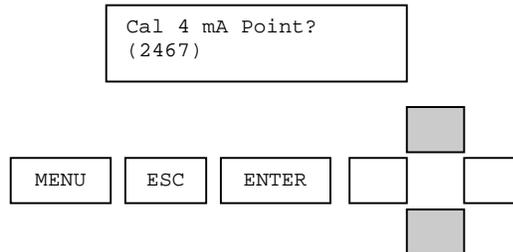
To **calibrate the current for the current output function** select “Calibrate” in the Analog Output sub-menu with the up/down arrows and the ENTER key. This is a maintenance function and is only used when the expected current at the 4 and 20 milliamp points needs to be adjusted. To use the function, remove all current loop wiring and connect an ammeter to the current output terminal blocks.



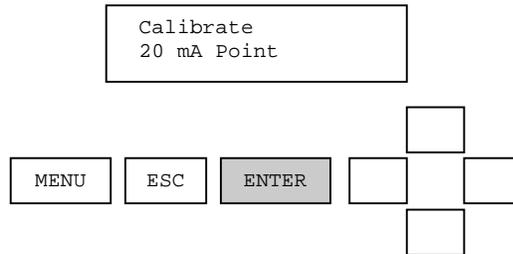
To **calibrate the 4 mA Point**, select the “4 mA Point” display with the up/down arrows and press ENTER.



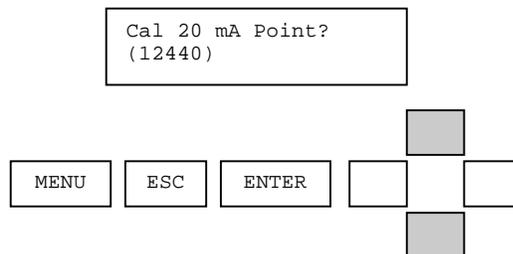
Remove all wiring to the analog output terminals and connect a calibrated ammeter to those terminals. Adjust the displayed count value with the up/down arrows until the meter reads exactly 4.000 mA. Accept the displayed value with the ENTER key. Exit without changing by using the ESC key.



To **calibrate the 20 mA Point**, select the "20 mA Point" display with the up/down arrows and press ENTER.



Remove all wiring to the analog output terminals and connect a calibrated ammeter to those terminals. Adjust the displayed count value with the up/down arrows until the meter reads exactly 20.000 mA. Accept the displayed value with the ENTER key. Exit without changing using the ESC key.



10. Relay (Option)

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 sensor (turbidity) 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.

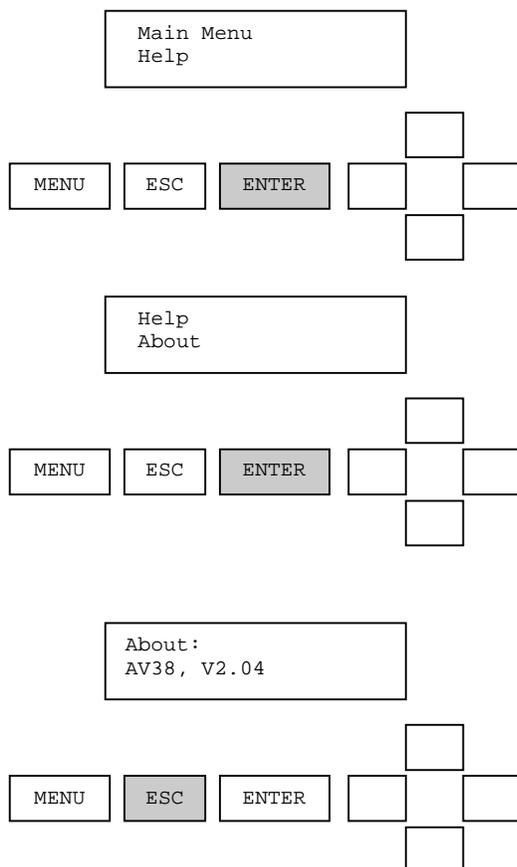
Alarm and Control settings allow fine-tuning of activation criteria with deadband and delay functions. Activation parameters for Alarm, Control and Wash functions are listed in the Table 9.1

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.

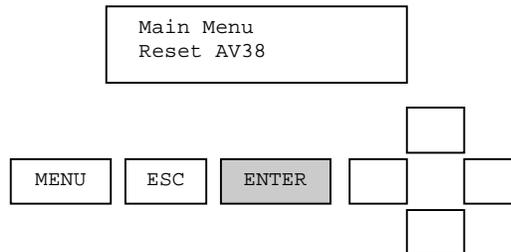
11. Help Menu

The help menu displays the product name and the firmware version. To view the current software version of the AV38, press ENTER at each screen level as shown in the diagrams below.

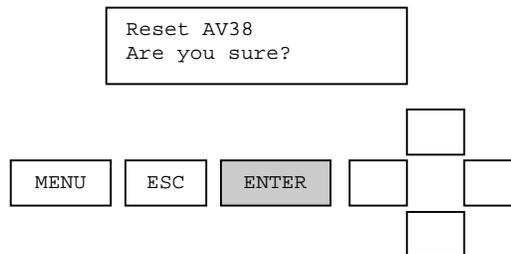


12. RESET AV38

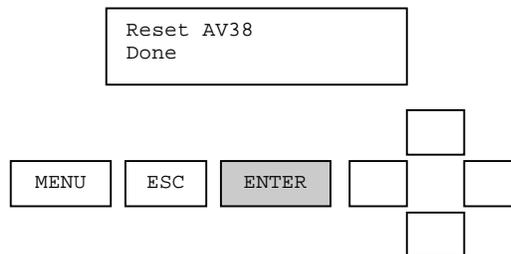
To reset all configuration information to default values, select "Reset AV38" from the main menu.



The AV38 will ask the question, "Are you sure?" to notify the user that they are about to make changes to the system. Press ENTER to initiate a reset. Press ESC to abort the reset.



When the reset is done, the AV38 will require that the Enter key is pressed to be sure the user acknowledges that a reset has been done.



13. Performance Specification

Measurement

Range: 0 to 100 NTU (Can range to 200 NTU when necessary).

Resolution: 0.001 NTU

Accuracy: +/-2% of reading or +/-0.015 NTU whichever is greater. +/-5% of reading above 40 NTU.

Operational Environment

Water Temperature Range: -5°C to 50°C

Air Temperature Range: -20°C to 60°C

Maximum Flow Rate: 500 ml/min (7.9 gal/hr)

Minimum Flow Rate: 250 ml/min (4 gal/hr)

Power Requirements

Voltage Range: 24 VDC (Line power option available)

Maximum Power: 8W with AV38 and Light Source

Typical Power: 6W with AV38 and Light Source

Note: Class II DC power supply required

Construction

Light Source: White Light (Tungsten)

Sample Chamber Material: ABS plastic

Sample Chamber Volume: 135 ml

Light Source Housing Material: Anodized Aluminum

Mounting Plate: 12x12 inches, 4 mounting holes

Sensor Head Material: Quartz Glass, Anodized Aluminum

Weight: 5.6 lbs

Units of Measure

Measurement Units: NTU

Temperature Units: °C, °F

Calibration

Sample (Span): 1 point

Zero: 1 point

Temperature: 1 point

Interface

Display: 2 lines, 16 characters, 7 key menu navigation

Current Loops: 1 loop standard. Second loop optional

Relays: 1 or 2 optional Form C.

Interface

Sensor Filter: 0 to 100 Seconds

Temperature Filter: 0 to 100 Seconds

14. Turbidity System Order Matrix and Accessories

AquaClear™ Low Range Turbidity Measurement System – With Local Display

Model Number			
AQT	Drinking water turbidity measurement system. 0 to 200 NTU Range. Precalibrated sensor, temperature measurement, sample chamber with bubble trap, lamp, junction box, mounting plate and local display.		
Display Configuration			
	1	Integral	
	2	Remote with 20 foot extension cable	
AV38 Display Configuration			
	A	User Interface with 1 current output. 24 VDC power.	
	B	User Interface with 2 current outputs, 2 relays. 24 VDC power.	
	C	User Interface with 1 current output. 90 VAC to 240 VAC power.	
	D	User Interface with 2 current outputs, 2 relays. 90 VAC to 240 VAC power.	
AV38 Host Communications Option			
	0	None	
	4	Modbus RTU (24 VDC and RS485 terminal connections in AV38)	
	5	DeviceNet (24 VDC and DeviceNet terminal connections in AV38)	
	6	CANopen (24 VDC and DeviceNet terminal connections in AV38)	
	7	Ethernet IP, Modbus/TCP, TCP/IP (PoE RJ45 Connector in AV38)	

AQT			
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AquaClear™ Low Range Turbidity Measurement System – No Local Display

Model Number			
AQT	Drinking water turbidity measurement system. 0 to 200 NTU Range. Precalibrated sensor, temperature measurement, sample chamber with bubble trap, lamp, junction box, mounting plate and a 20 foot network connection cable for interactive computer measurement, calibration, configuration and diagnostic.		
Reserved Category			
	Reserved Category		
DataStick Communications			
	4	Modbus RTU. 20-foot cable to network.	
	5	DeviceNet. 20-foot cable to network.	
	6	CANopen. 20-foot cable to network.	
	7	Ethernet IP, Modbus TCP, TCP/IP. 20 ft cable to PoE Switch. RJ45 connection.	

AQT	3	E	
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Replacement Hardware	Description	Part Number
Replacement Lamp assembly	Bulb and cable assembly (Requires snap ring tool)	TDWLS00
	Exchange of old lamp assembly with new lamp assembly	TDWLS01
	Bulb preassembled into housing with cable	TDWLS02
Sample Chamber Lid	Sample chamber lid without lamp	TDWCC01
Turbidity Detector	Detector sensor head	DW21
Sample Chamber	Replacement sample chamber	TDWSC01
CalStick	For measurement verification	TDWCAL01
Junction box	For extension cables. Terminal strip included.	JBOX01
Extension Cable	DataStick Extension cable	DSECxx; xx=ft

15. 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. Thermo Fisher Scientific warrants the turbidity lamp to illuminate for a period of 2 years.

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.

16. 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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