

AV38 Local Display

INSTRUCTION MANUAL



Preface

This instruction manual serves to explain the use of the AquaSensors AV38 Local Display and is written to cover as many applications as possible. Please do not hesitate to contact AquaSensors or an authorized AquaSensors 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 AquaSensors.

AquaSensors cannot accept any responsibility for damage or malfunction of the product due to improper use.

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Safety Information



The AquaSensors AV38 Local Display 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 display, make sure that the sensor cable 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 AquaSensors AV38 Local Display.

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.

AquaSensors 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 AquaSensors or an authorized AquaSensors representative with any questions.

1.2. Intended use

The AquaSensors AV38 Local Display is used to monitor, configure, calibrate and diagnose any DataStick measurement system configured with a Modbus communications adapter in accordance with the technical product specifications in Section 2 of this manual.

Data is reported through a scalable 4-20 milliamp current output or through one of several digital protocols. Options include a second current output that can be configured for PID and up to 2 relays.

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 AV38 Local Display should be installed and operated only by personnel familiar with the sensor and qualified for such work.



A defective AV38 should be returned to AquaSensors for repair or replacement. Contact AquaSensors to obtain a Return Material Authorization (RMA) number.

No modifications to the AV38s 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 AV38 Local Display

Removal from Service

- Disconnect the cable wiring from the controller terminal block.
- Remove the AV38 from the mounting hardware.

Correct Disposal of Unit

- When the AV38 is taken out of service, observe the local environmental regulations for correct disposal.

2. PRODUCT DESCRIPTION

2.1. System Overview

The AV38 is a universal display interface for DataStick sensor systems. 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.



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 loops, two alarm/control 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 one of several DataStick sensors on the bus for display, current output reporting and relay alarms by selecting the desired station address. When there is no DataStick sensor connected at the selected network address, the measure screen will show dashed lines.

The AV38 can operate in “single sensor mode” with current outputs and relays, or it can be operated in “multi-sensor mode” with digital communications to a host computer. Host communication options include, Modbus, DeviceNet, RS-485 ASCII, Profibus and others. The host protocol is independent of the Modbus RTU protocol used by the AV38 to communicate with the DataSticks.

In the multi-sensor mode the AV38 can be used as a switch that allows a host computer to measure calibrate, configure and diagnose all DataSticks connected to the AV38. In this mode the AV38 measure screen displays the measure data that the host computer is currently asking for. If the menu key on the AV38 is pressed, control of the local network of DataSticks is transferred to the AV38. The host computer regains control after the user navigates back to the measure screen.

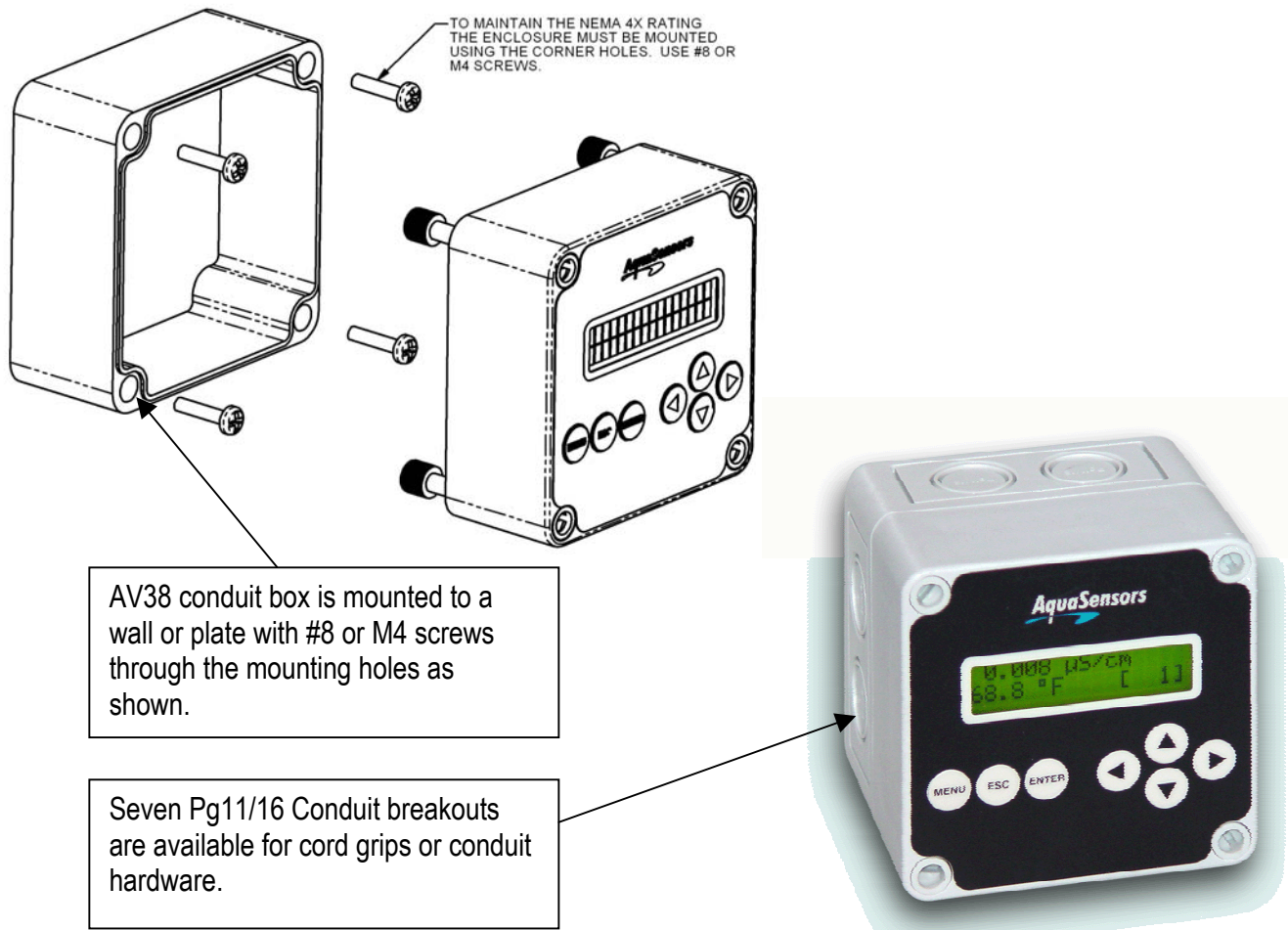
There are seven keys for menu navigation. The MENU key is used to toggle between the menu and the measure screen. Pressing the Menu key provides options for calibration, configuration, communications, outputs and relays.

2.2. Mounting

The AV38 can be mounted on a wall or panel mounted in 1/4DIN or 1/2 DIN forms. A gasket is built into the display for a NEMA 4X seal. Mounting instructions must be followed to maintain seals. The AV38 can be pipe mounted and panel mounted with optional mounting hardware.

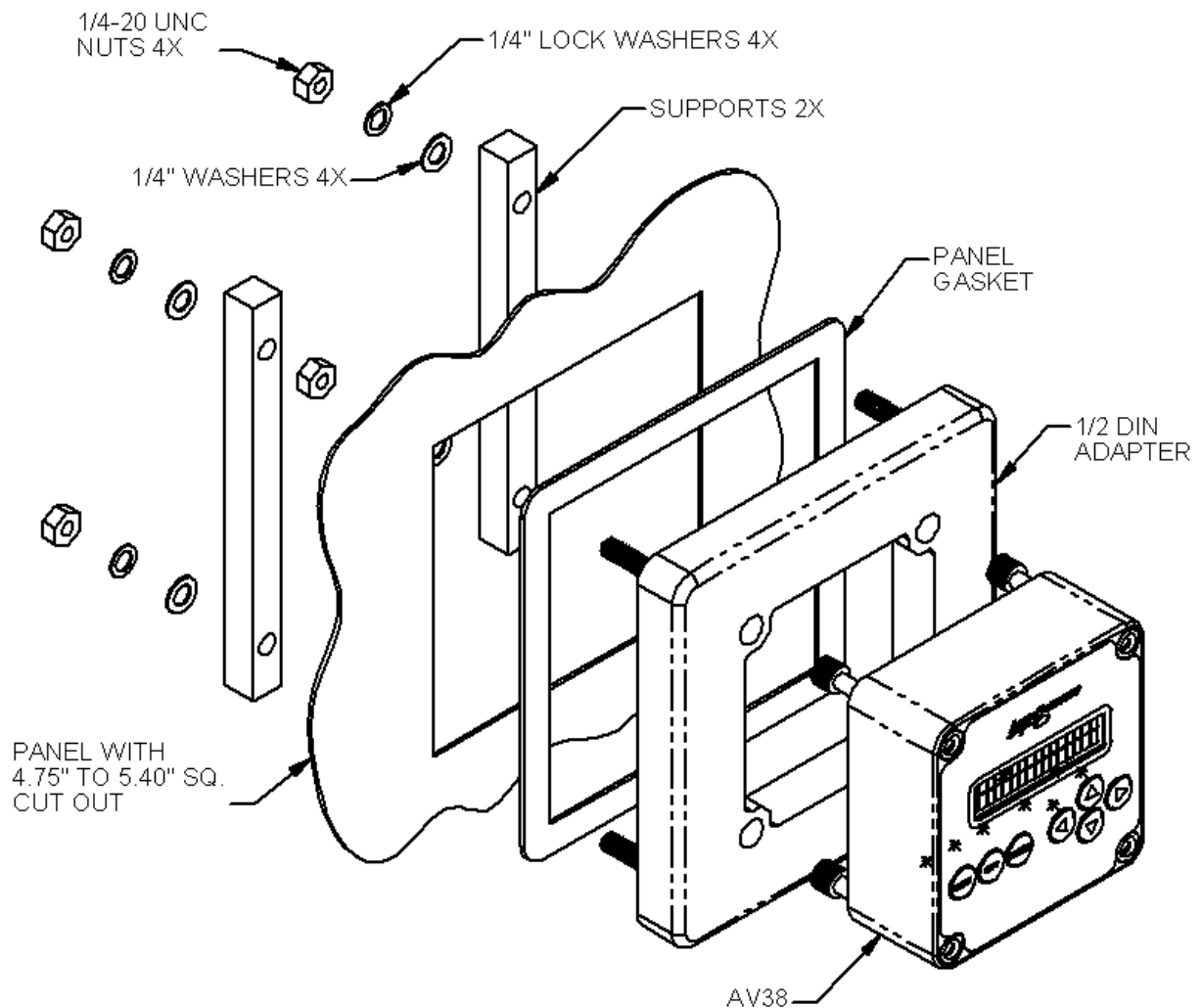
2.2.1. Conduit Box Wall Mount

The AV38 conduit box is mounted to a wall or plate with #8 or M4 screws through the mounting holes as shown. There are seven Pg11 and Pg16 knockouts in the conduit box. Two cord grips are supplied and it is recommended that they be used in the conduit holes on the bottom side of the box to prevent rain or moisture from settling at the conduit interface. It is also possible to mount the box using interior breakouts. Four plastic caps are provided to seal the interior mounting screws. Nema 4X ratings will be maintained only when the #8 mounting screws are used in the holes outside the conduit box gasket.



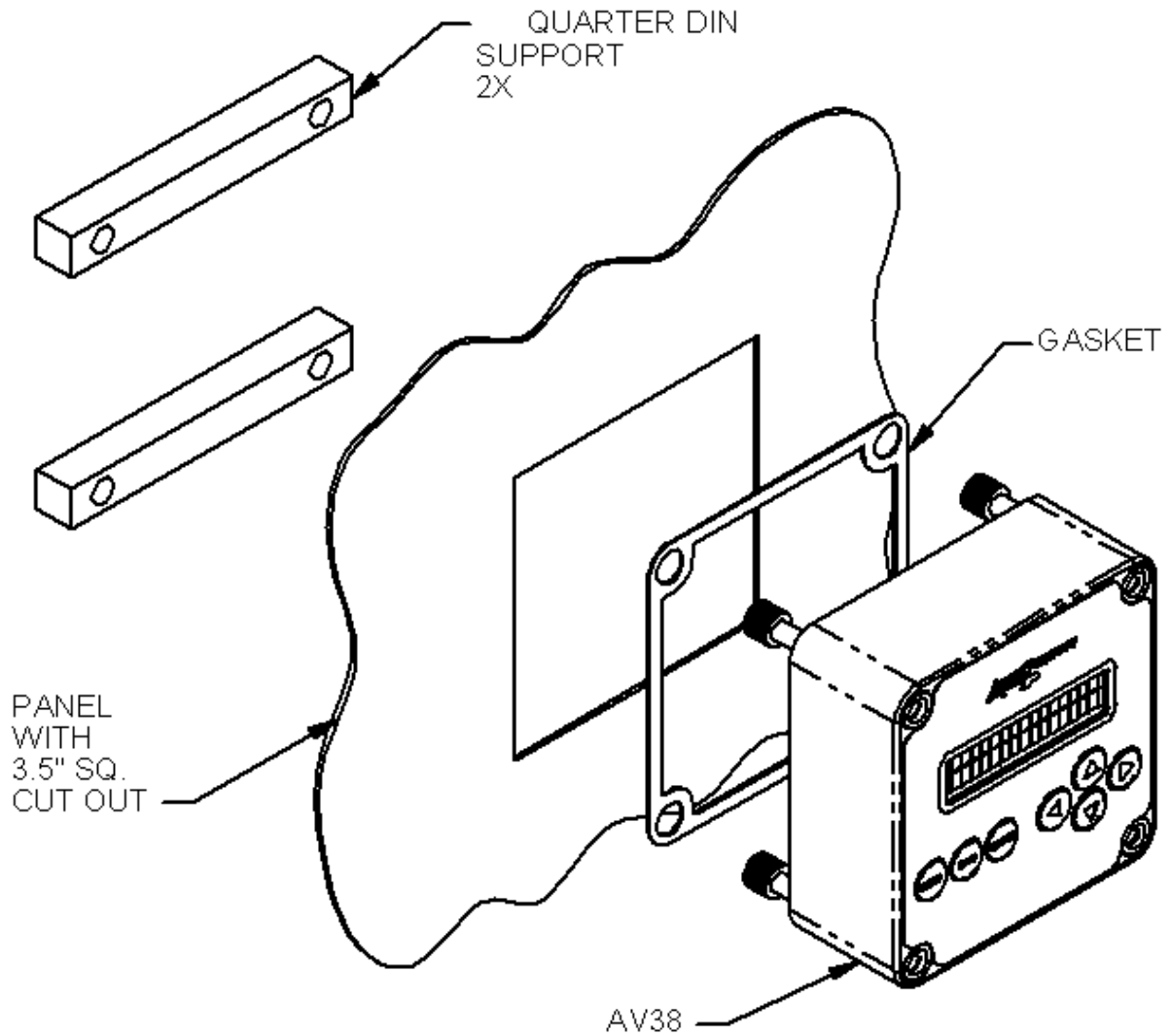
2.2.2. 1/2 DIN Panel Mount

A 1/2 DIN panel mount bezel and gasket can be ordered to fit the AV38 as shown. The AV38 display is tightened down to the bezel using the four captured screws in the AV38. The bezel is then mounted to a 1/2 DIN square opening with the hardware shown in the figure below.



2.2.3. 1/4 DIN Panel Mount

The AV38 Display can be mounted directly to a 1/4 DIN panel opening using the captive mounting screws in the AV38 and the 1/4 DIN supports as illustrated in the figure below. A 1/4 DIN bezel gasket can be provided to ensure a NEMA 4X seal on the panel.



2.3. Wiring

The AV38 Display comes with a single terminal block when ordered with one current output and/or host communications. If a second current output or relays are ordered a second terminal block is installed.

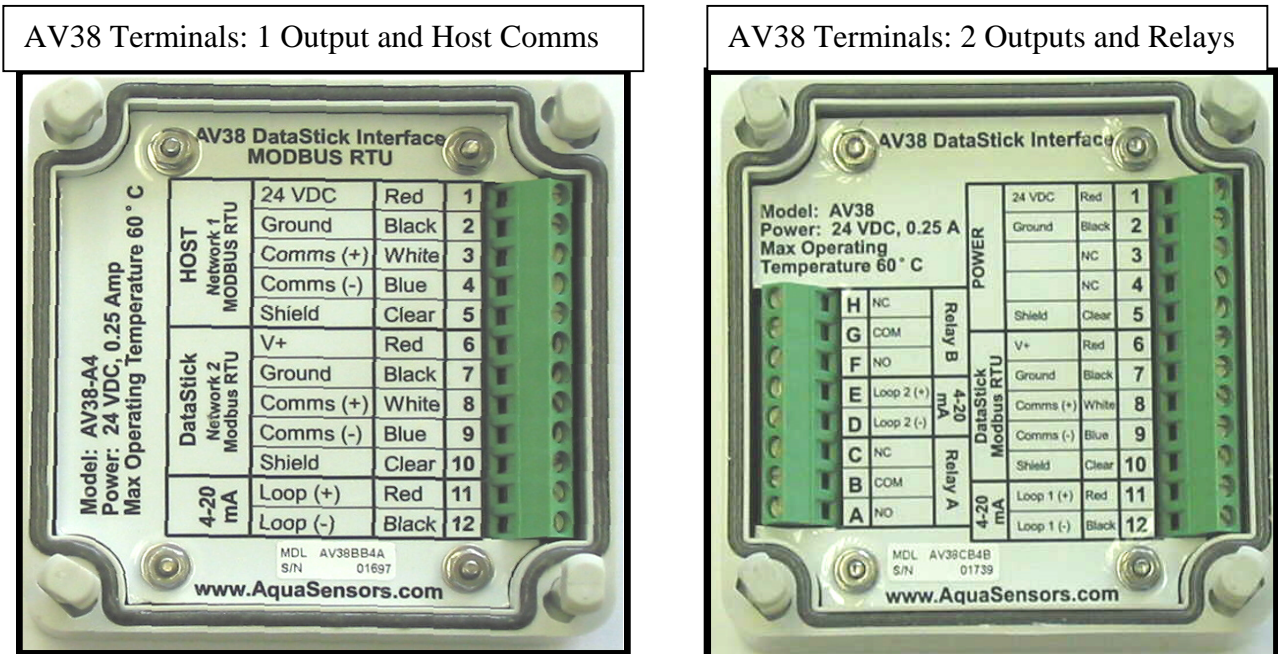


Figure 2.1: AV38 Wiring
One or Two Terminal Blocks Depending on Features

In either configuration:

1. 24VDC Power is wired to Pins 1 and 2 as shown above. The power supply should be rated to deliver 0.25 amps when the AV38 is used with one DataStick.
2. The DataStick(s) are wired to Pins 6 through 10 as shown above.
3. Current Loop 1 is wired to Pins 11 and 12.
4. When Host Comms are used they are wired to Pins 3, 4 and 5. Be sure that the communications ground is at the same potential as the 24 VDC power ground.

The AV38 wiring will vary depending on the options provided. Refer to the AV38 wiring illustration in Figure 2.1

Model AV38-xx0A: 1 Current Loop

Terminal	Wiring
1	24VDC from Power Supply
2	Ground from Power Supply
3	No connect
4	No connect
5	Earth Ground from Power Supply
6	Red wire from DataStick
7	Black wire from DataStick
8	White wire from DataStick
9	Blue wire from DataStick
10	Shield wire from DataStick
11	Current Loop + (Power provided by AV38)
12	Current Loop -

Model AV38-CB5C: DeviceNet Host, 2 Relays and 2 Outputs

Terminal	Wiring
1	24VDC from Power Supply
2	Ground from Power Supply and Network
3	DeviceNet Network CAN_HI: White Wire
4	DeviceNet Network CAN_LO: Blue Wire
5	Shield wire from Host Network
6	Red wire from DataStick cable
7	Black wire from DataStick cable
8	White wire from DataStick cable
9	Blue wire from DataStick cable
10	Shield wire from DataStick cable
11	Current Loop 1 (+)
12	Current Loop 1 (-)
A	Relay A: Normally Open Contact
B	Relay A: Common
C	Relay A: Normally Closed Contact
D	Current Loop 2 (+)
E	Current Loop 2 (-)
F	Relay B: Normally Open Contact
G	Relay B: Common
H	Relay B: Normally Closed Contact

2.4. Measure Screen Overview

The AV38 user interface is shown in Figure 2.2. 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).

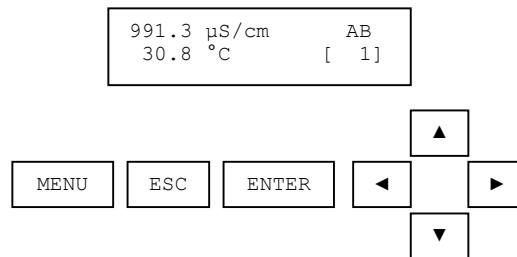



Figure 2.2: The elements of the AV38 user interface.

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

When a sensor head of the same type is replaced in a DataStick, current output and relay settings are maintained. If a sensor head of a new type is installed, relay settings are automatically set to default conditions. The current output settings are retained for each sensor type used.

The measure screen is the same for all parameters. It displays the sensor value on the top line and the temperature on the bottom line. In the lower right corner of the screen is a bracketed number [] that indicates the Modbus Station Number of the DataStick sensor data in the display. The AB indicators on the far right side of the top line indicate the state of the relays (when this option is installed). An uppercase letter indicates that the corresponding relay is energized. An underscore indicates that the corresponding relay is de-energized. The example in Figure 2.3 illustrates the display of a conductivity measurement at Station Address 1 with relays A and B energized.

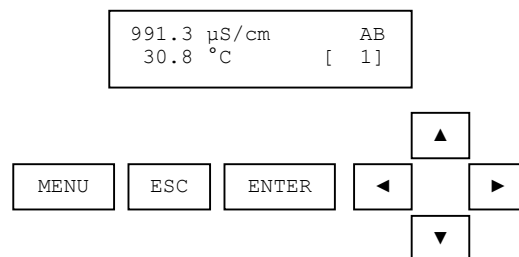


Figure 2.3: The measure screen. It shows the sensor value, sensor units, temperature value, and temperature units.

When the DataStick or the sensor head is absent, the condition will be indicated by dashes on the measure screen as shown in Figure 2.4. If the sensor is wired correctly and these dashes appear, be sure that the DataStick Sensor has the correct station number as indicated by the bracketed number in the measure screen. If that is correct, also check that baud rate and parity are set up correctly as explained in the DataStick Comms Menu.

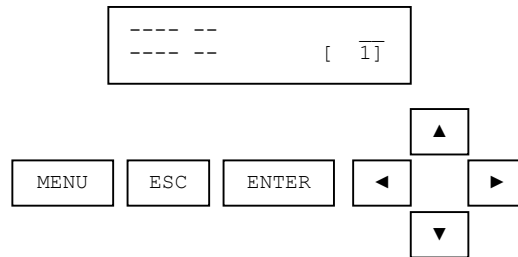


Figure 2.4: The initial measure screen when the DataStick is absent.

3. Menu Structure and Navigation

Menus are accessed by pressing the MENU key.

The menu structure is navigated using ENTER, UP/DOWN arrows, and ESC keys.

- Use the UP/DOWN arrow keys to scroll through the list of Menu options.
- Use the ENTER key to select an option.
- Use the ESC key to move up in the structure.

The end of the list of menu options is always the EXIT function. Pressing ENTER on the EXIT screen will bring up the MEASURE screen.

The (=) symbol is used to indicate that the user is in the menu structure. At the leaf of each branch of the menu structure, the user is able to enter a value or make a choice. The value to be entered or the choice to be made 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.

The right arrow symbol (▶) on the screen indicates that downward navigation through the menu structure is possible. The left arrow symbol (◀) on the screen indicates that upward navigation through the menu structure is possible.

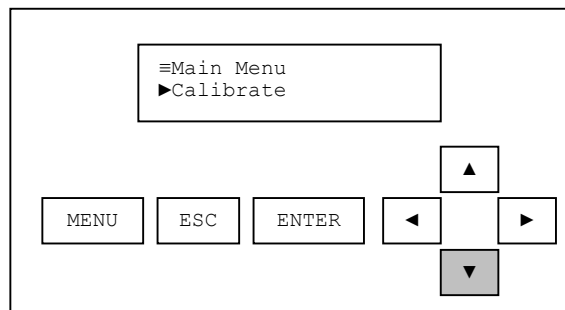
The items in the main menu are the same regardless of the type of sensor head that is installed in the DataStick. The items in the calibrate and configure menus depend on the type of sensor head that is installed in the DataStick. Main menu options are listed as follows:

Main Menu Option	Function
Calibration	Sensor calibration choices are automatically available for installed sensor head.
Configuration	Configuration choices are automatically available for the installed sensor head.
DataStick Comms	Set the station address, baud rate and parity for the Modbus DataStick of interest.
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 (option)	Set up PID control functions for analog outputs. Available with pH only.
Relay A (option)	Set wash, alarm, or control functions. (Optional)
Relay B (option)	Set wash, alarm, or control functions. (Optional)
Help	Indicates AV38 software version
Exit	Returns to the measure screen

MAIN MENU NAVIGATION

- Enter the Main Menu by pressing the MENU key.
- Scroll the listing with the UP/DOWN arrow keys.
- To select an option, press the ENTER key.

The AV38 remembers that last menu option used and will return to that menu option when re-entering the main menu from the measure screen. The list order is always the same so if pressing MENU displays current output and the desired operation is calibration; the UP arrow will be used to move to the Calibrate menu.

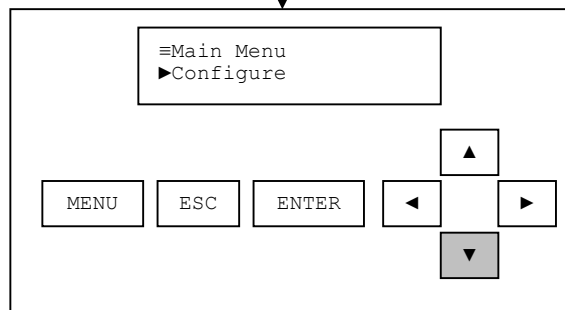


Select **CALIBRATE** with the ENTER key

- To calibrate the main parameter or temperature.

NOTE: Calibrate menus will be sensor specific.

Press the DOWN ARROW for next selection.

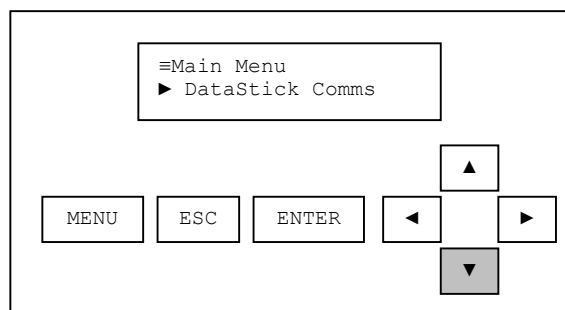


Select **CONFIGURE** with the ENTER key

- To display or change filters, units of measure, constants, tables and buffer standards

NOTE: Configure menus will be sensor specific.

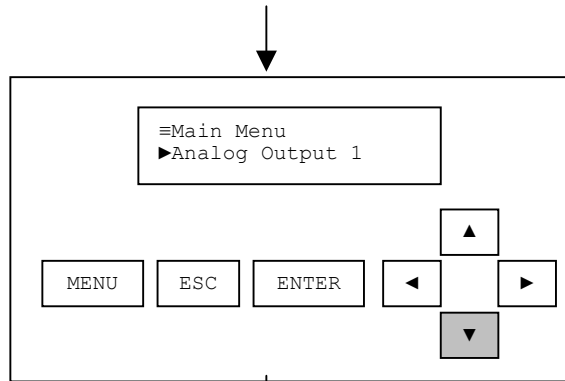
Press the DOWN ARROW for next selection.



Select **DATASTICK COMMS** with the ENTER key

- To set up station address, baud rate and parity for the DataStick that is to be displayed in the AV38 measure screen.

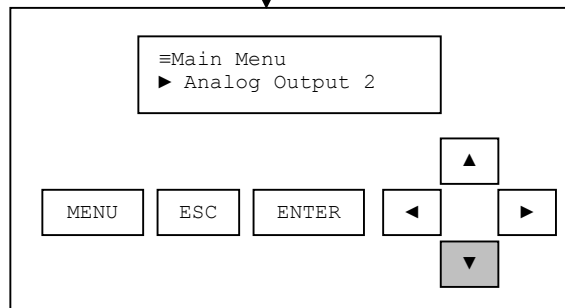
Press the DOWN ARROW for next selection.



Select **ANALOG OUTPUT 1** with the ENTER key

- To set up 4 to 20 mA Analog Output for sensor, temperature or PID (if Installed).

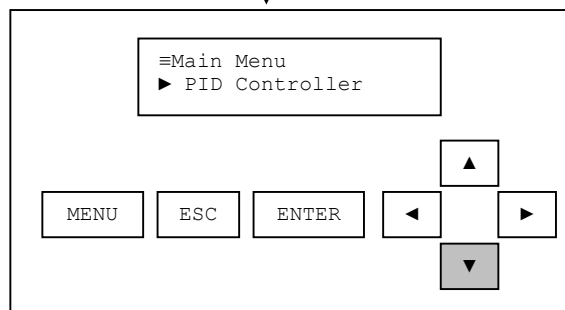
Press the DOWN ARROW for next selection.



Select **ANALOG OUTPUT 2** with the ENTER key

- To set up 4 to 20 mA Analog Output for sensor, temperature or PID (if Installed).

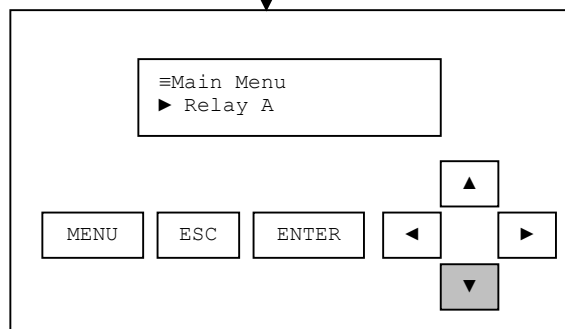
Press the DOWN ARROW for next selection.



Select **PID CONTROLLER** with the ENTER key

- To set up ISA or Velocity Algorithm, Full-Scale, Zero-Scale, Setpoint, Proportion Gain, Integral Gain, Derivative Gain, Transit time, manual reset and manual mode. (If installed – pH only).

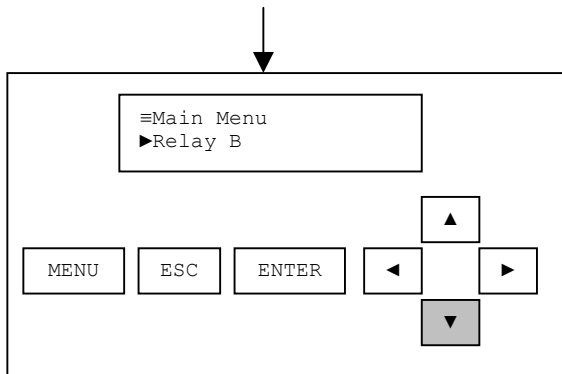
Press the DOWN ARROW for next selection.



Select **RELAY A** with the ENTER key

- To set up Relay A for Alarm, Control or Wash functions (if installed).

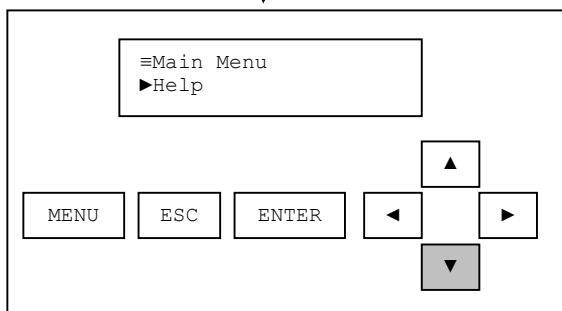
Press the DOWN ARROW for next selection.



Select **RELAY B** with the ENTER key

- To set up Relay B for Alarm, Control or Wash functions (if installed).

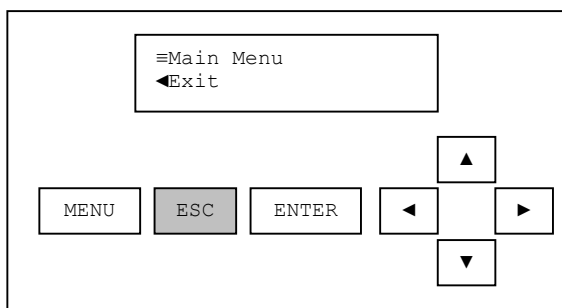
Press the DOWN ARROW for next selection.



Select **HELP** with the ENTER key

- To read the AV38 software version.

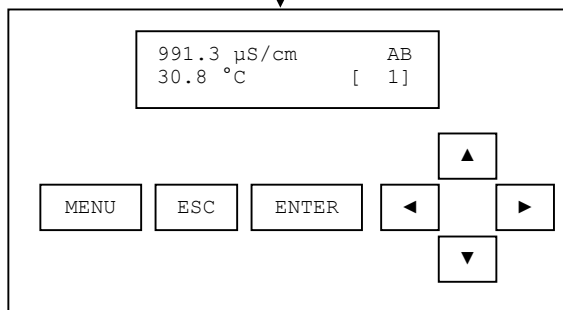
Press the DOWN ARROW for next selection.



Select **EXIT** with the ENTER key

- Return to the measure screen.

Press an UP ARROW to review the menu.
Press ESC for Measure (alternate method).



Measure Screen

Note: Station Address in lower right bracket and the relay activity indicators “AB” show that both Relay A and Relay B are energized.

4. Calibrate Menu

Calibration methods supported in the AV38 are automatically available depending on the sensor head connected to the DataStick. The supported calibration functions are listed below:

Calibration Type	Function	Sensors Supported
1 Point Sample	Set measured reading to desired reading. Changes offset. Best done at high end of range.	All
2 Point Buffer	Automatically sets measured readings to closest buffer standard. Two points separated by more than 2 pH units. Buffer standards are selected in the configuration menu. Changes span and offset.	pH
Zero	Set measured reading to zero. Measured reading must be close to zero.	Conductivity, Turbidity, Dissolved Oxygen, Ozone.
Air	Adjust measured reading to calculated reading of oxygen in air with pressure and salinity configuration settings as well as temperature reading. Assumes sensor head is placed in air.	Dissolved Oxygen, Ozone.
Temperature 1 Point	Set measured reading to desired reading. Changes offset. Best done at high end of range.	All
Exit	Returns to the measure screen	

Calibration functions that are not supported in the AV38 but are supported with the AquaSensors remote protocol include:

2 Point Sample	Sets measured reading to desired reading for two points separated by more than 2 pH units. Changes span and offset.	NOT Supported in AV38. However, the pH DataStick will support this calibration type with remote commands.
1 Point Buffer	Automatically sets measured pH reading to closest buffer standard point. Buffer standards are selected in the configuration menu. Changes offset.	NOT Supported in AV38. However, the pH DataStick will support this calibration type with remote commands.

Calibration choices vary depending on which sensor head is connected to the DataStick. For the pH sensor, calibration options are: 2-point Buffer, 1-point Sample and temperature as shown in Figure 4.1.

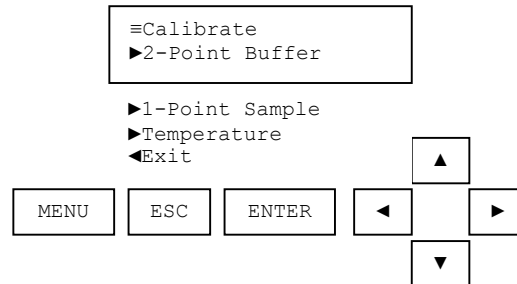


Figure 4.1: The complete calibrate menu for pH.

For the D.O. and Ozone sensors, calibration options are: Air, 1-Point Sample and Temperature as shown in Figure 4.2.

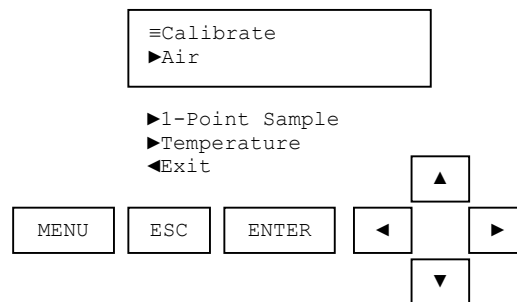


Figure 4.2: The complete calibrate menu for D.O and Ozone sensors.

For the Conductivity and Turbidity sensors, calibration options are: 1-Point Sample, Zero and Temperature as shown in Figure 4.3. ORP sensors have only the 1-point sample calibration and temperature.

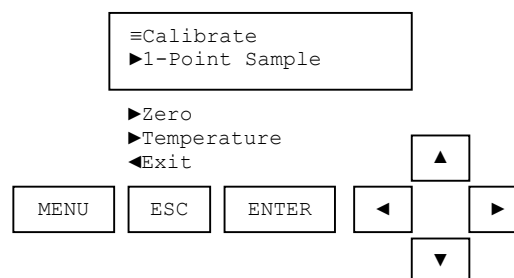
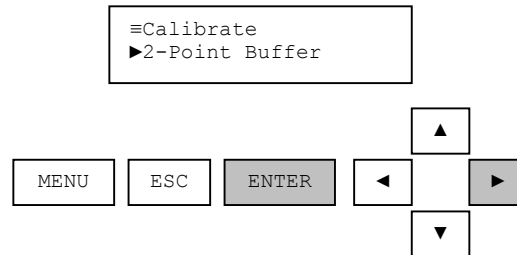


Figure 4.3: The complete calibrate menu for conductivity and turbidity sensors.

4.1. 2-Point Buffer Calibration (Sensor Type: pH)

Find the 2-Point Buffer Calibration in the CALIBRATE menu using the UP/DOWN arrows. Press ENTER to initiate this calibration process. Once the calibration has been initiated it can be aborted by pressing the escape key before the process is completed.



The sensor should be rinsed in DI water and wiped clean to remove any process solution that would otherwise contaminate the buffer solution. When the 2-point buffer calibration procedure is started, the analog output is placed into hold mode and the user is prompted to place the sensor in the first buffer solution. The sensor value is dynamically updated during this step as shown in Figure 4.4.

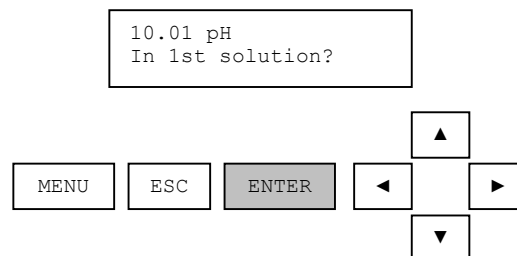
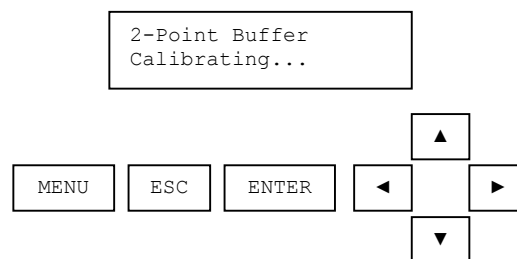


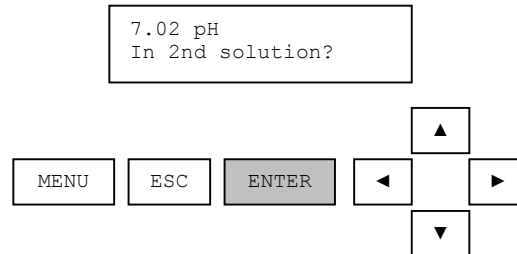
Figure 4.4 Sensor value is dynamically updated.

It is best to let the sensor value stabilize in the buffer solution before initiating the calibration. If the temperature of the sensor is very different from the temperature of the buffer sample, allow some time for the temperature to equilibrate before initiating the calibration. After the sensor is placed in the first buffer, the ENTER key is pressed to start the calibration of the first point.

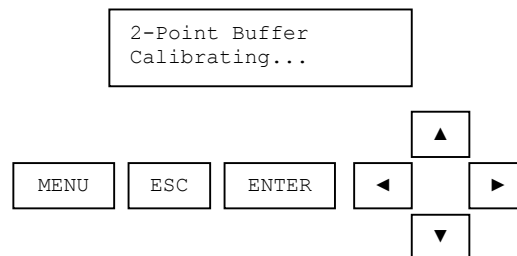


It takes between 5 seconds and two minutes depending on sensor and temperature measurement stability. Once the calibration has been initiated it can be aborted by pressing the escape key before the process is completed. See Section 4.2 for an example of an aborted calibration procedure.

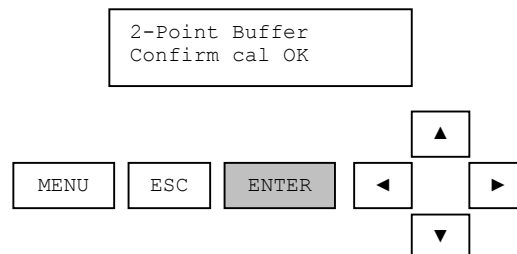
After the first calibration point has been stored, the user is prompted to place the sensor in the second buffer. The sensor should be rinsed in DI water and wiped clean before it is placed in the second solution.



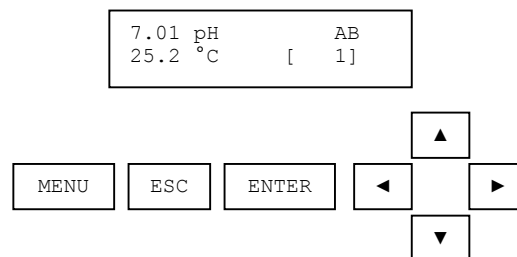
After the sensor is placed in the second buffer, the ENTER key is pressed to start the calibration of the second point.



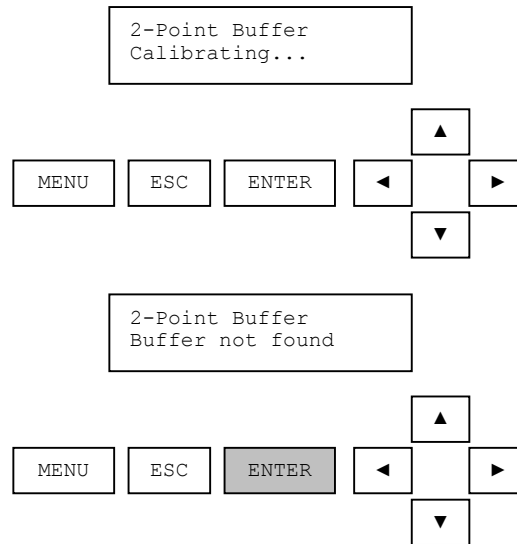
After the second calibration point has been stored, the user is prompted to confirm a successful calibration procedure.



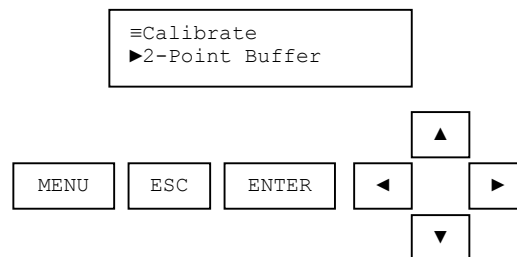
When the enter key is pressed to acknowledge that the calibration was successful, the analog output is placed into active mode and the monitoring of sensor and temperature values is resumed. This successfully completes the 2-point buffer calibration procedure.



If an error occurs during calibration that causes the procedure to fail, the reason for the failure is shown on the screen.

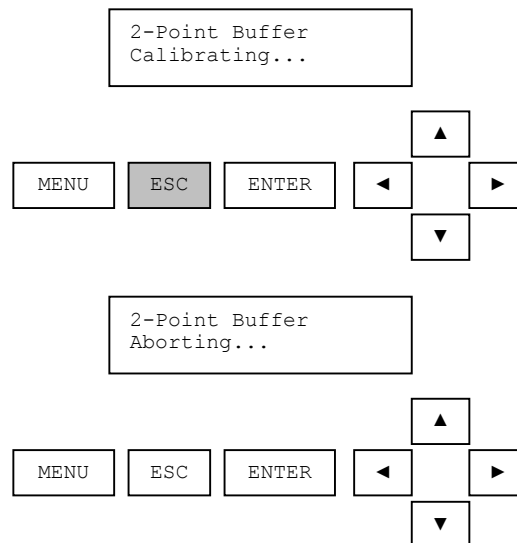


When the enter key is pressed, the calibrate menu is displayed. The analog output remains in hold mode. This ends the 2-point buffer calibration procedure. The user has the option of repeating the procedure if desired.

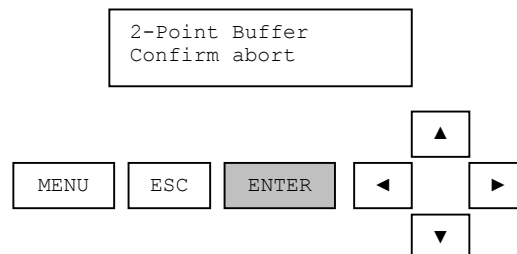


4.2. Aborted Calibration (Sensor Type: All)

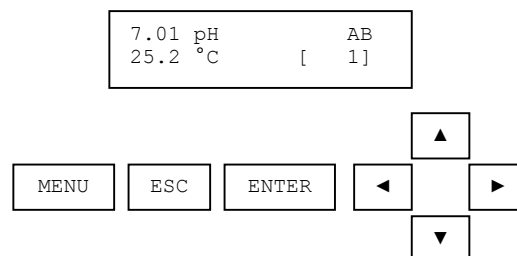
If the ESC key is pressed while calibration is in progress, the procedure is aborted. A calibration cannot be aborted if the calibration process has completed.



After the calibration procedure has been aborted, the user is prompted to confirm the abort.



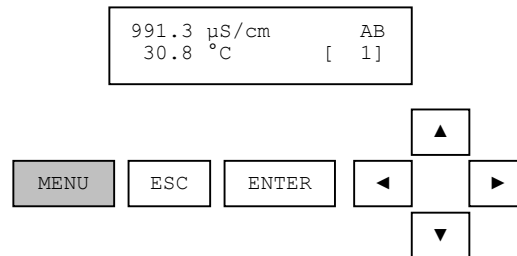
When the enter key is pressed, the analog output is placed into the active mode and the monitoring of sensor and temperature values is resumed. This ends the 2-point buffer calibration procedure.



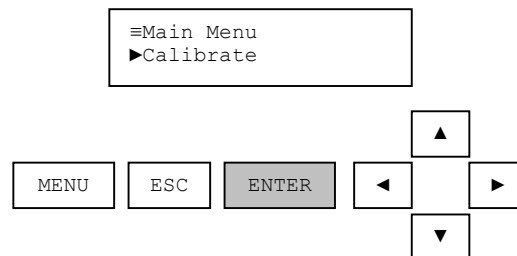
4.3. 1-Point Sample Calibration (Sensor Type: All)

The screen-by-screen example for a 1-point sample calibration is given for a conductivity sensor as shown in Figure 4.5. The same sequence is followed for any sensor type. Only the units of measure and span will change.

Press MENU from the Measure Screen:



Scroll to CALIBRATE with the UP/DOWN Arrows and press ENTER:



Scroll the list of CALIBRATE options with the UP/DOWN arrows and press ENTER to select 1-POINT SAMPLE.

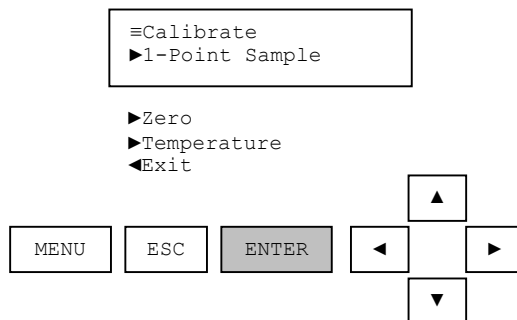
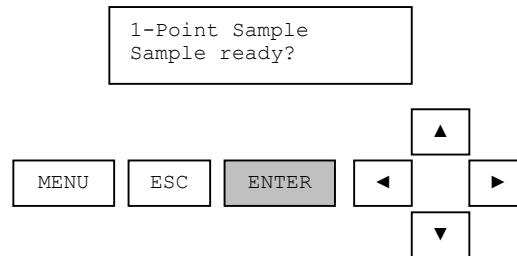


Figure 4.5: The complete calibrate menu for conductivity.

Be sure the sensor has been properly cleaned before calibration. Initiate the 1-point sample process by pressing ENTER.



The sensor value is dynamically displayed at this point in the calibration procedure as shown in Figure 4.6. When the reading has stabilized, press ENTER to initiate the calibration.

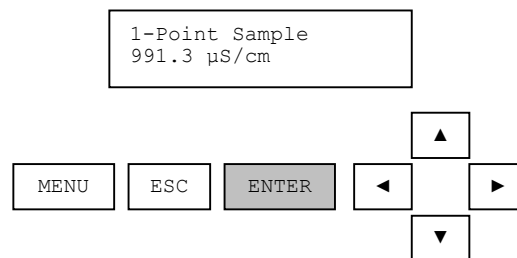


Figure 4.6: Dynamic display of the sensor value during calibration.

When the user presses enter, the current sensor value is captured and shown in the edit field of the next screen as shown in Figure 4.7.

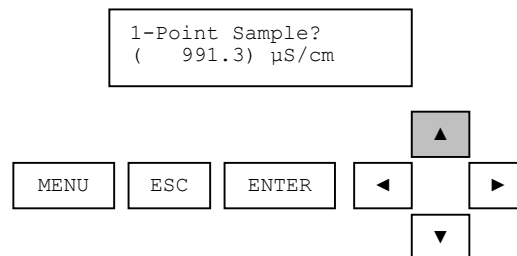


Figure 4.7: The calibration edit screen.

The calibration value can be adjusted with the up and down arrow keys. After the calibration value is adjusted, the enter key is pressed to calibrate the DataStick as shown in Figure 4.8.

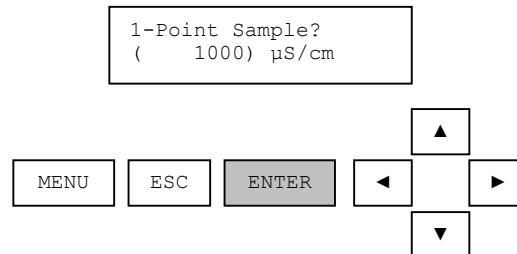
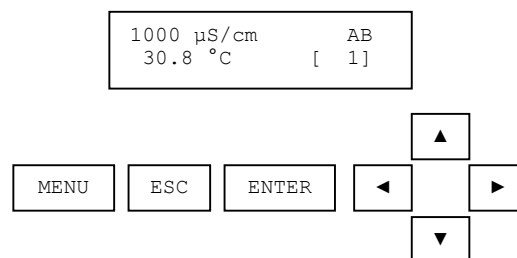
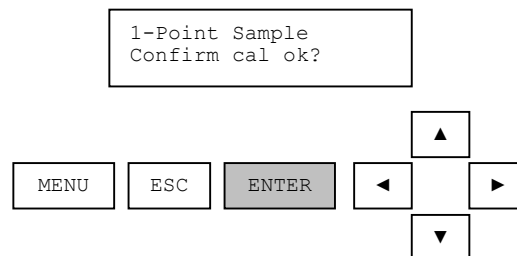
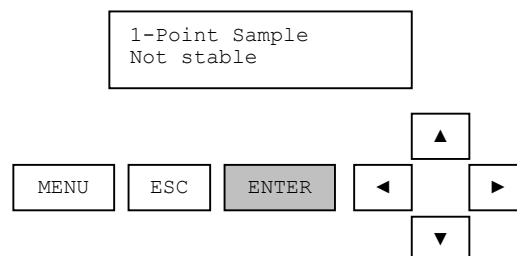


Figure 4.8: Entering the calibration value.

After the calibration process is complete, the user is asked to confirm the result before releasing the current outputs, relays and measure screen.



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



4.4. Zero Calibrate Menu (Sensor Type: Conductivity, DO, Turbidity)

The complete zero calibration menu for conductivity is shown in Figure 4.9. The same calibration sequence also applies to turbidity, suspended solids, dissolved oxygen and ozone.

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

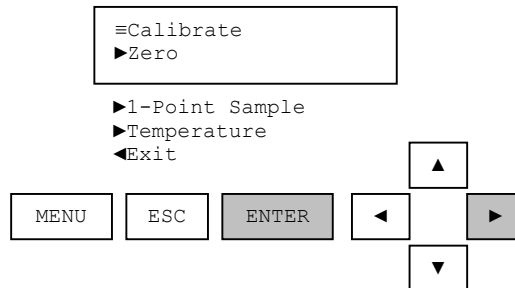
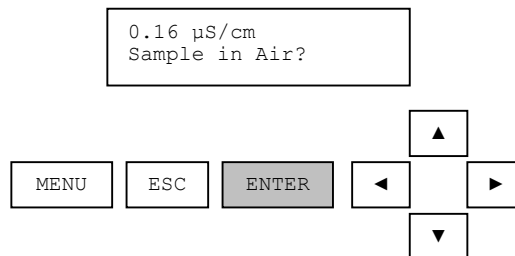


Figure 4.9: The complete zero menu for conductivity

Be sure conductivity sensors are dry and suspended away from objects that could affect the measurement in air. 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 in Figure 4.10.

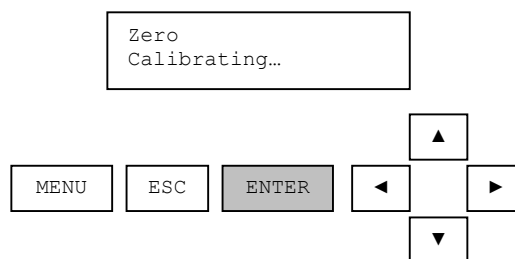
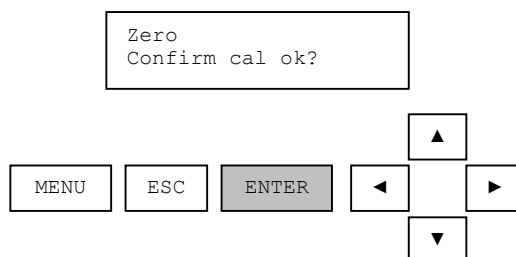
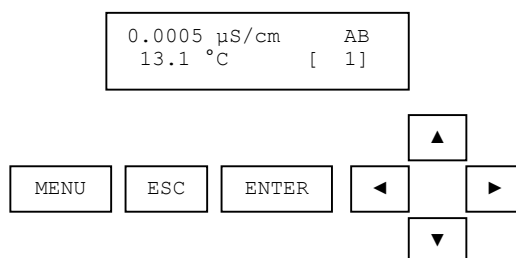


Figure 4.10: Zero is Calibrating....

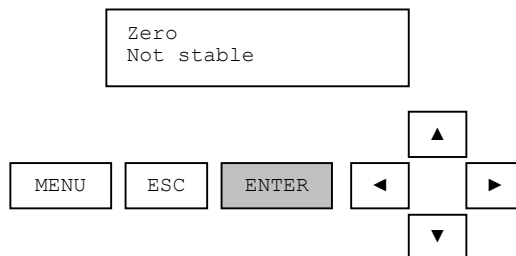
When the zero calibration is complete the user will be asked to confirm the result with the ENTER key.



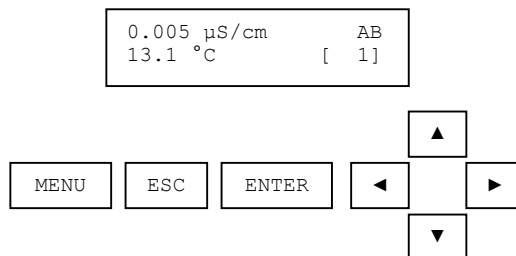
After pressing ENTER to confirm Calibration is okay, the Measure screen will be displayed.



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.



4.5. Air Calibration (Sensor Type: D.O. or Ozone)

An AIR CALIBRATION computes the oxygen content measured in air based on the setting for PRESSURE, SALINITY and the measured temperature. View or change the Pressure and Salinity settings in the CONFIGURE menu.

Initiate the AIR CALIBRATION process by pressing ENTER.

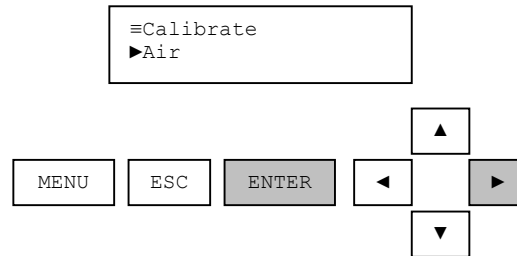


Figure 4.11: Air calibrate menu for D.O.

When the air calibration procedure is initiated, the analog output is placed into hold mode. The user is prompted to place the sensor in air as shown in the Figure 4.12.

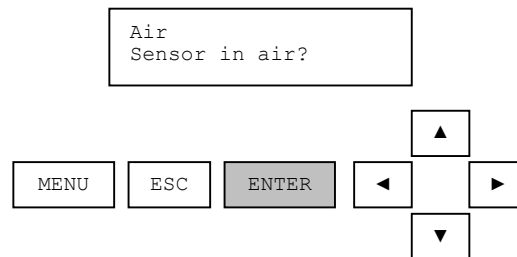
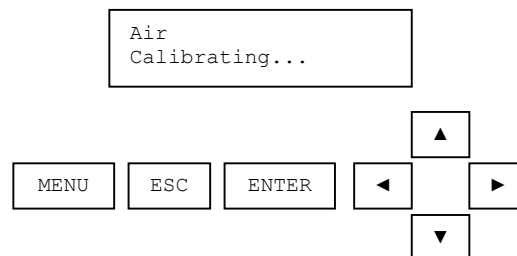


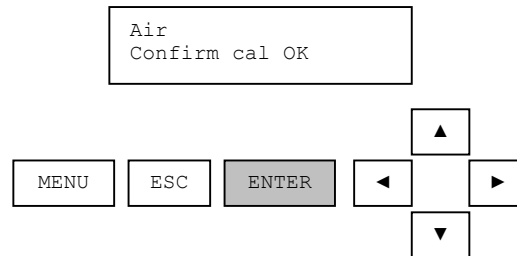
Figure 4.12 The user is prompted to place the sensor in air.

After the sensor is placed in air, press the ENTER key to start the calibration.

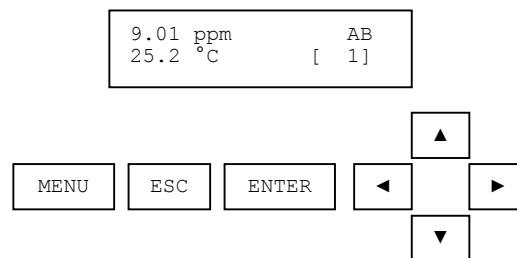


It takes between 5 seconds and two minutes depending on sensor and temperature measurement stability. During this time, the calibration procedure can be aborted by pressing the escape key. See Section 4.2 for an example of an aborted calibration procedure.

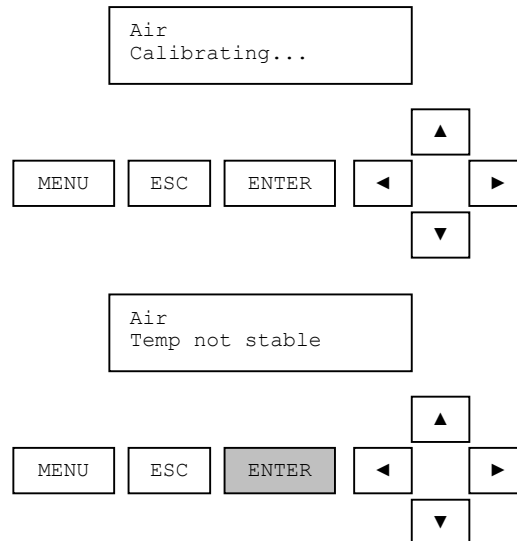
After the air calibration point has been stored, the user is prompted to confirm a successful calibration procedure.



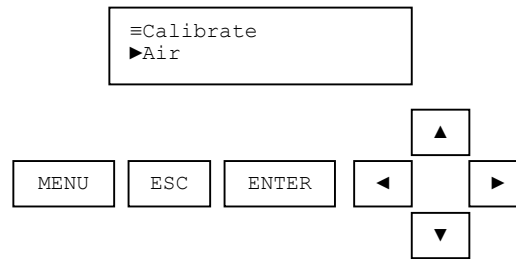
When the enter key is pressed, the analog output is placed into active mode and the monitoring of sensor and temperature values is resumed. This successfully completes the air calibration procedure.



If an error occurs during calibration that causes the procedure to fail, the reason for the failure is shown on the screen.

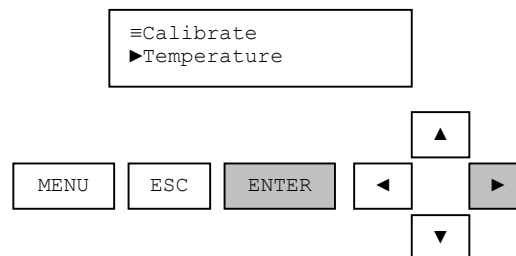


When the enter key is pressed, the calibrate menu is displayed. The analog output remains in hold mode. This ends the air calibration procedure. The user has the option of repeating the procedure if desired.



4.6. Temperature 1-Point Sample 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 as shown in Figure 4.13.

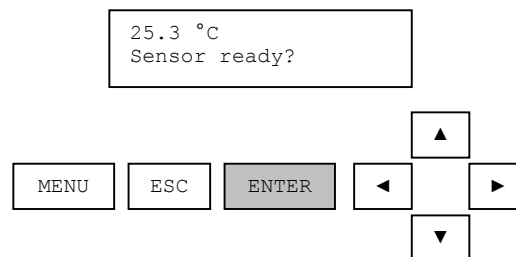


Figure 4.13: The temperature value is dynamically updated while the user is prompted to prepare the sensor.

When the sensor is ready, the ENTER key is pressed and the user is presented with a calibration value for editing as shown in Figure 4.14. Please note that it is best to calibrate temperature with the sensor head in an aqueous solution. Response time for calibration in air is slower.

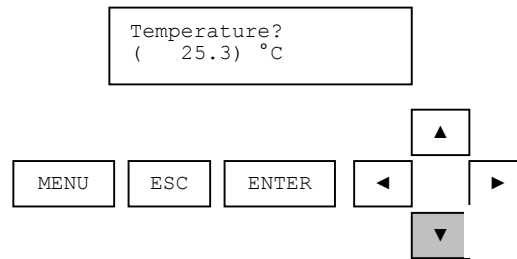
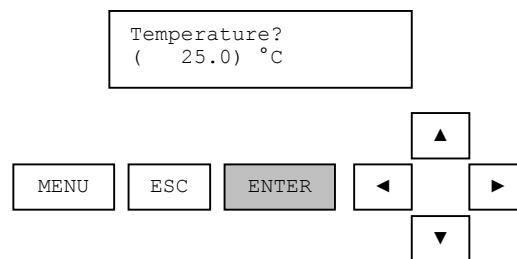
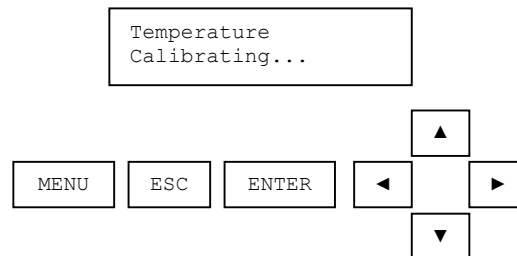


Figure 4.14: The calibration value is presented for editing.

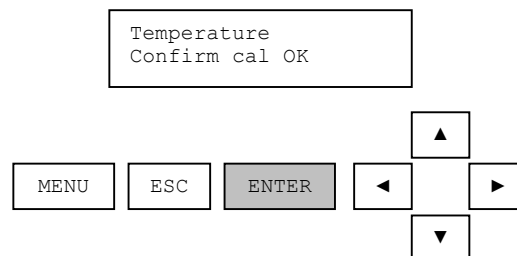
When the value has been edited as desired, the enter key is pressed and the calibration of the point is started.



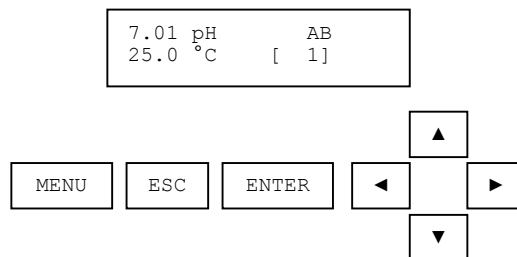
During this time, the calibration procedure can be aborted by pressing the escape key. See Section 4.2 for examples of an aborted calibration procedure.



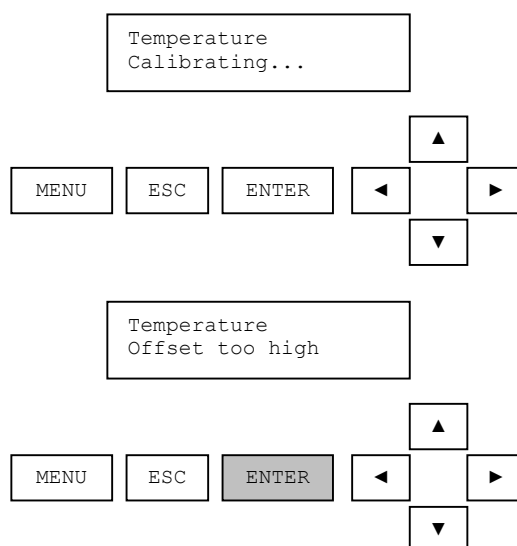
After the calibration point has been stored, the user is prompted to confirm a successful calibration procedure.



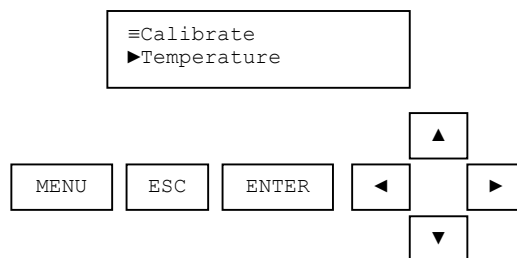
When the enter key is pressed, the analog output is placed into active mode and the monitoring of sensor and temperature values is resumed. This successfully completes the temperature calibration procedure.



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. Configure Menu

The configuration menu allows viewing and editing of sensor constants and will depend on the type of sensor head that is installed in the DataStick.

Configuration Type	Function	Sensors Supported
Sensor Filter	Filter main parameter in seconds. Set zero seconds for no filter. Set up to 100 seconds for time to reach 90% of final value. 1 to 5 seconds should be optimal for most applications.	All
Sensor Units	PH: pH or mV ORP: mV Conductivity: uS/cm, %, TDS, MΩ•cm D.O./Ozone: ppm, % Turbidity: NTU	All
Temperature Filter	Filter temperature in seconds. Set zero seconds for no filter. Set up to 100 seconds for time to reach 90% of final value. 1 to 5 seconds should be optimal for most applications. The temperature filter value should generally be set to the same value as the sensor filter.	All
Temperature Units	Select Centigrade or Fahrenheit.	All
Buffer Standard	Select 4, 7, 10 pH or DIN Standard (1.09, 4.65, 6.79, 9.23 and 12.75).	pH
Cell Constant		Conductivity
Reference Temperature	Conductivity reference temperature is set from 0°C to 100 °C	Conductivity
Comp Slope	Slope is set from 0 to 9.9%/°C	Conductivity
Salinity	Salinity compensation set from 0 to 999.9mS/cm	D.O., Ozone
Pressure	Pressure set from 539.2 to 792.4 mmHg	D.O., Ozone
Concentration Table	Not supported in AV38. However, supported in AquaSensors open protocol.	Conductivity
Exit	Returns to the measure screen	

5.1. Main Configure Menus

Configure menus dynamically change depending on the DataStick sensor type connected. Generally, all configure screens allow viewing and editing values in parentheses. Examples of top-level menus for conductivity, pH, DO and Turbidity are shown below.

The complete configure menu for Conductivity is shown in Figure 5.1.

```
≡Configure
▶Sensor Filter

▶Sensor Units
▶Temp Filter
▶Temp Units
▶Cell Constant
▶Reference Temp
▶Comp Slope
◀Exit
```

Figure 5.1: The complete configure menu for conductivity.

The complete configure menu for pH is shown in Figure 5.2.

```
≡Configure
▶Sensor Filter

▶Sensor Units
▶Temp Filter
▶Temp Units
▶Buffer Standard
◀Exit
```

Figure 5.2: The main configure menu for pH.

The complete configure menu for D.O. is shown in Figure 5.3.

```
≡Configure
▶Sensor Filter

▶Sensor Units
▶Temp Filter
▶Temp Units
▶Salinity
▶Pressure
◀Exit
```

Figure 5.3: The main configure menu for D.O.

The complete configure menu for turbidity is shown in Figure 5.4.

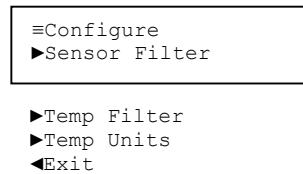
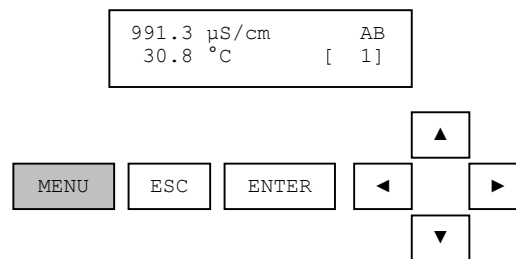


Figure 5.4: The main configure menu for turbidity.

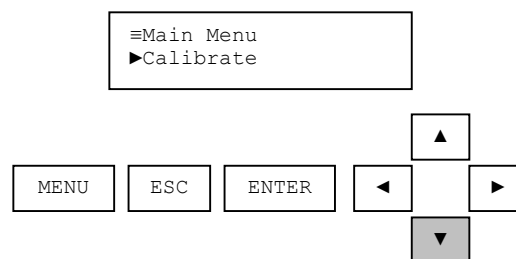
5.2. Navigating Sensor Filter Configuration

The following sequence shows how the sensor filter configuration is viewed and set. The gray key is pressed to move to the next screen. This sequence is an example for all configuration menus.

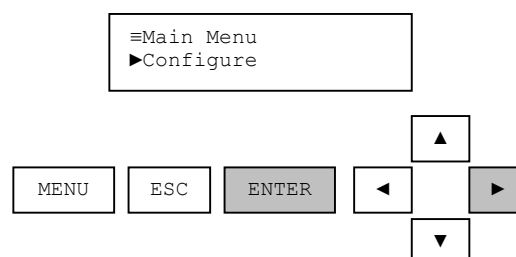
From the Measure Screen, Press the MENU key:



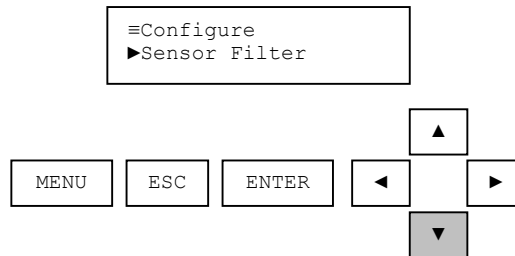
Scroll to the CONFIGURE Menu with the up and down arrows:



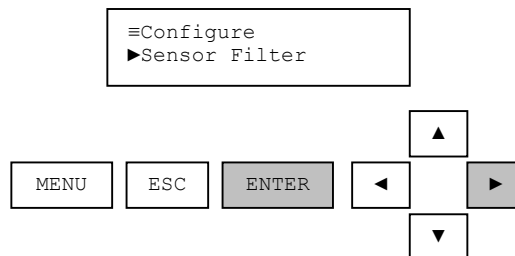
Select ENTER when CONFIGURE is displayed:



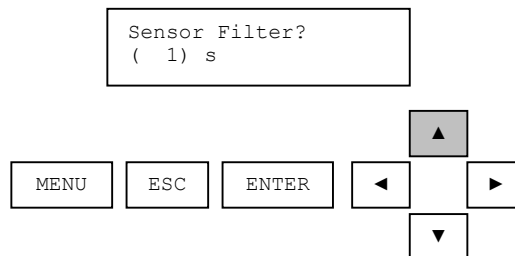
Scroll to SENSOR FILTER using the up and down arrows:



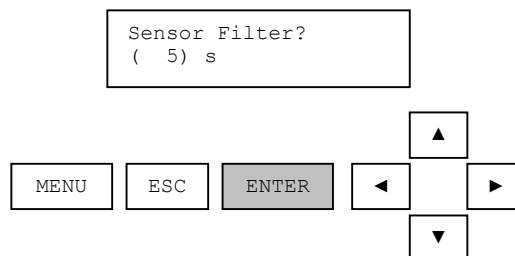
Select SENSOR FILTER using the ENTER key:



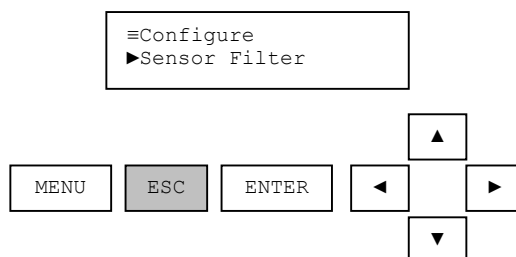
Use the up and down arrow keys to change the number in parentheses to the desired sensor filter (in seconds):



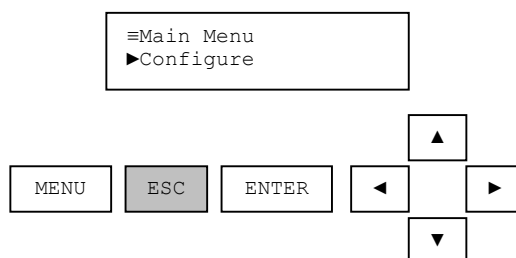
Press the ENTER key to keep the filter setting currently in parentheses. Or press the ESC key to leave the filter setting unchanged.



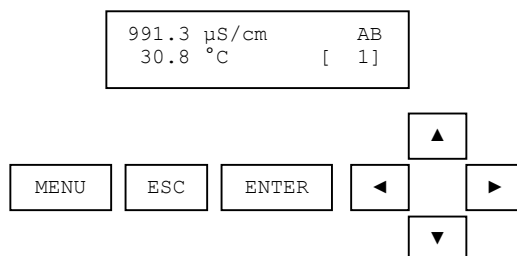
After editing or viewing the filter setting return to the Main Configure screen with the ESC key.



When finished with MENU functions return to the Main Configure screen with the ESC key.



Observe the response time of the measurement. The temperature filter should also be changed to the same filter value.



6. Host Communications

The AV38 can be set up to communicate with a Host Computer system in a variety of protocols. The protocol selected is independent of the Modbus protocol used for the DataSticks. When using Host Communications, please refer to the selected communications manual for specific protocol setup and use.

Host Protocol	Reference Manual to Set up Address, Baud Rate and Parity
Modbus RTU	Modbus Communications Adapter Users Manual (MAN021CA-4)
DeviceNet	DeviceNet Communications Adapter Users Manual (MAN022CA-2)
RS-232	DataStick Instruction Manual (MAN011DS-3): 9600 bps, no parity, 8 data bits, 1 stop bit
Profibus	Special AV38 menu software is installed to select HOST address, baud rate and parity.
Other	Look for addendums on setting up other protocols that may be configured.

When the Host Communications feature is used, the AV38 can communicate with up to 247 DataSticks on the local AV38 network. When used in the mode, the current output and relay functions are not recommended, as they will be driven by the current DataStick selected.

7. DataStick Communications Setup

Up to 247 DataSticks can be connected to a single AV38. Only one of them can be selected for local display, current loop reporting and relay control. The DataStick station number that is selected is displayed in brackets [] in the lower right corner of the measure screen. If dashes are 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.

All DataSticks are shipped with a Station number of 1, a Baud rate of 19.2 kbps and a parity of ODD. To change the station number, Baud rate or parity in a DataStick, refer to the MODBUS Communications Adapter User's Manual (PN: MAN021CA-4).

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 in Figure 7.1

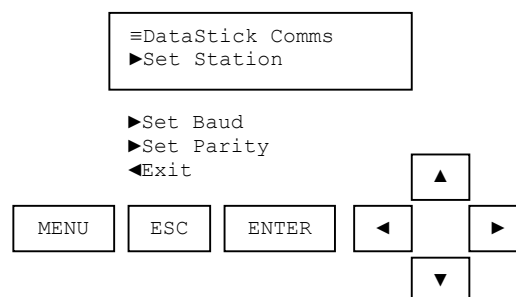
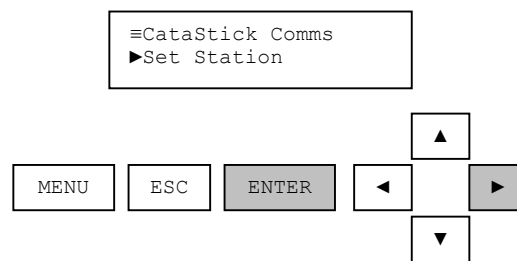


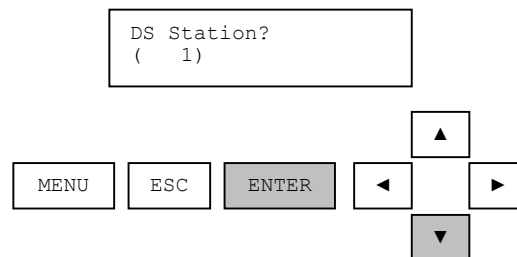
Figure 7.1 The DataStick Comms menu.

7.1. Setting DataStick Station Number

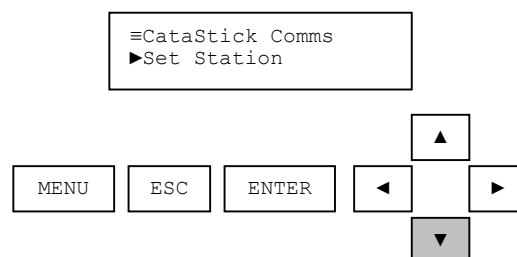
The DataStick Station Number used by the AV38 is displayed in the lower right corner of the MEASURE screen. It can be viewed or changed in the DataStick Comms Menu by selecting "SET STATION" with the ENTER key.



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.

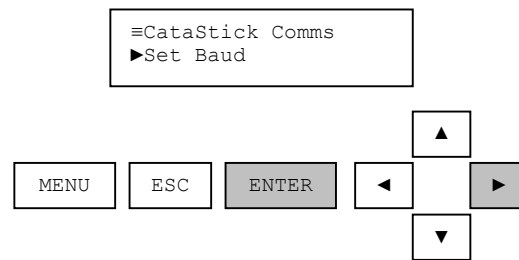


After editing or viewing the station number, the main DataStick Comms menu is displayed. To view or edit DataStick Baud Rate or Parity, use the Up/Down arrows.

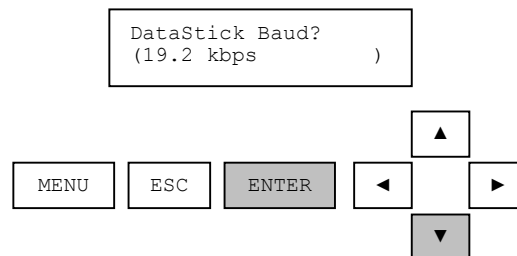


7.2. Setting DataStick Baud Rate

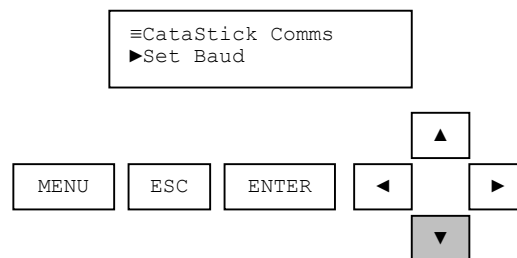
All DataSticks connected to the AV38 must be set up with the same Baud rate. To view or edit the current AV38 Baud rate setting, press ENTER on the SET BAUD screen as shown. The default setting is 19.2 kbps.



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.

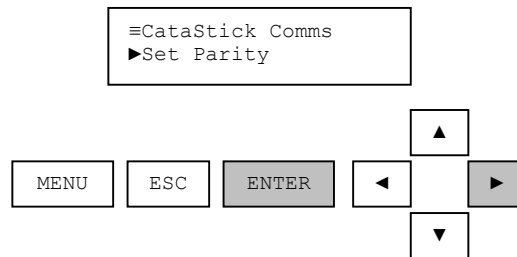


After editing or viewing the Baud rate the main DataStick Comms menu is displayed. To view or edit DataStick Parity, use the Down arrow.

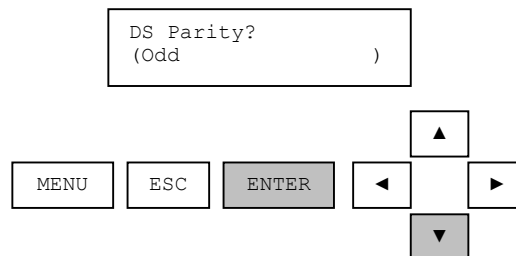


7.3. Setting DataStick Parity

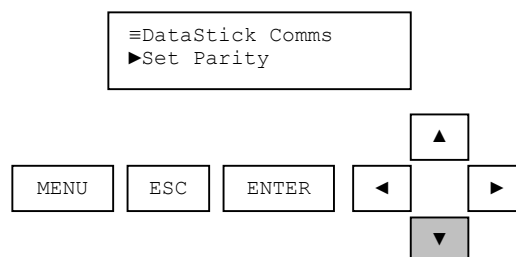
All DataSticks connected to the AV38 must be set up with the same parity. To view or edit the current AV38 parity setting, press ENTER on the SET PARITY screen as shown. The default setting is ODD.



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.



After editing or viewing the parity, the main DataStick Comms menu is displayed. To view or edit DataStick Communications parameters, use the UP/DOWN arrows. To go to the parent Menu, press ESC.



8. Analog Output Menus

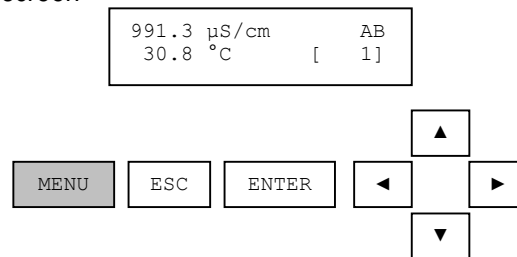
Up to two 4 to 20 milliamp analog outputs are provided for traditional data reporting. The selectable features in the analog output menus are the same regardless of the type of sensor head that is installed in the DataStick. While the AV38 is being used to calibrate the DataStick, its analog output is held at its present value.

The analog output menu is used to scale the analog output in the AV38. The following selections are available for each output:

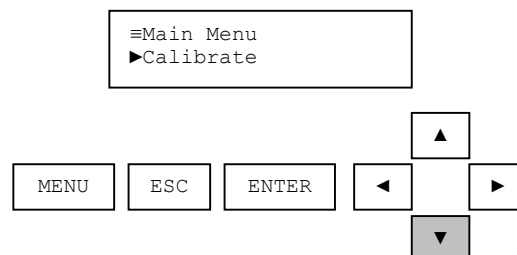
- PARAMETER is used to select SENSOR, TEMPERATURE or PID CONTROLLER (if installed with pH sensor) to drive the current loop. Note that if PID is selected, setting up 4 mA and 20 mA values is not necessary or available. Settings for PID are set up separately in the PID section of the main menu.
- SET 4 mA VALUE is used to edit the lowest sensor or temperature value to be reported. The default value will be the lowest possible reading for the parameter selected.
- SET 20 mA VALUE is used to edit the highest sensor or temperature value to be reported. The default value will be the highest possible reading for the parameter selected.
- The CALIBRATE feature is used to fine-tune the milliamp readings when necessary. An ammeter is connected in series with the load for adjustment of the 4 mA value and the 20 mA value.

8.1. Assigning 4 mA and 20 mA parameter values

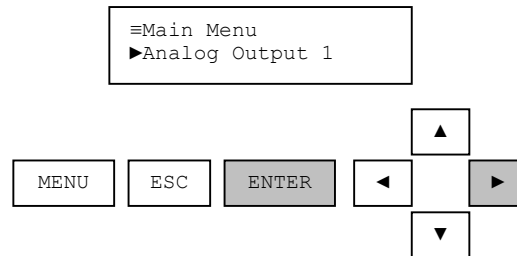
Press MENU from the Measure screen



Use the UP/DOWN arrows to select Analog Output (or Analog Output 1, Analog Output 2 depending on hardware options).



Use the ENTER key to configure the Analog Output of choice. In this example Analog Output 1 is shown.



Use the UP/DOWN arrows to scroll through the Analog Output configuration options of Set 4 mA Value, Set 20 mA Value and Calibrate.

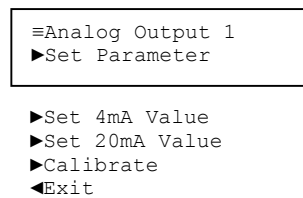
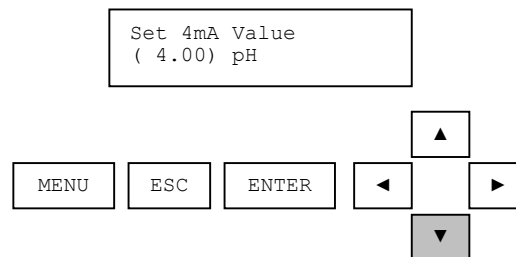
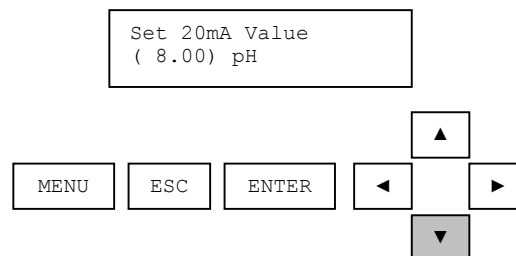


Figure 8.1: The complete analog output menu.

Select SET 4 mA option with the ENTER key. Adjust the parameter value with the UP/DOWN arrow keys. Press ENTER to accept the value in parentheses. Press ESC to leave the value unchanged.

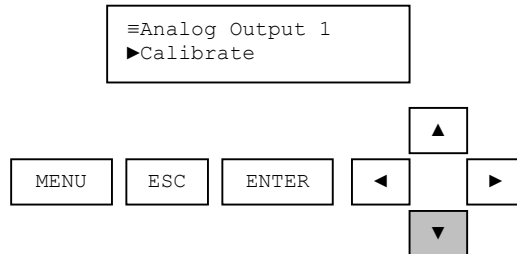


Select SET 20 mA setting with the ENTER key. Adjust the parameter value with the UP/DOWN arrow keys. Press ENTER to accept the value in parentheses. Press ESC to leave the value unchanged.

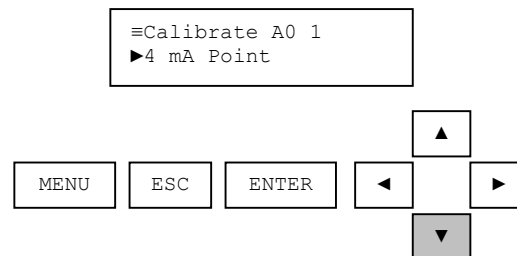


8.2. Calibrating Output Current

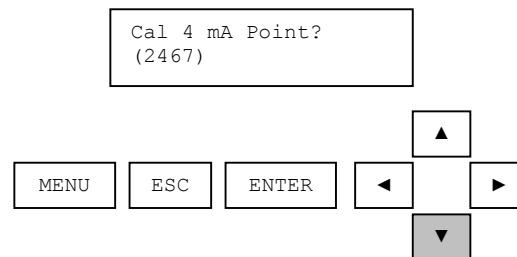
To make adjustments to the 4 mA and 20 mA values, find the CALIBRATE option with the UP/DOWN arrow keys in the Analog Output menu and press ENTER to select it.



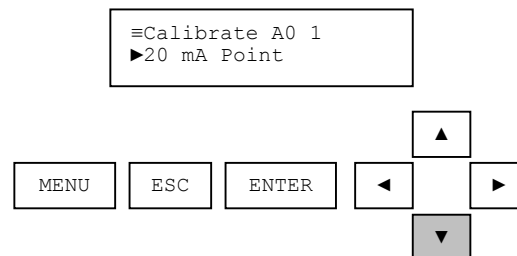
Connect an ammeter in series with the load and Select 4 mA Point with the ENTER key.



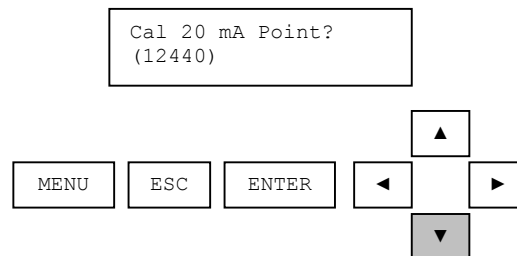
The ammeter should read exactly 4.00 mA. If not, adjust the value displayed on the meter using the AV38 UP/DOWN arrow keys. The number displayed in parentheses is in "counts" and should be within 20% of 2500. Press ENTER to accept the value in parentheses. Press ESC to leave the value unchanged.



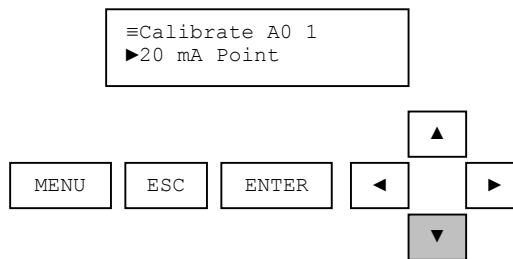
From the Analog Output Calibrate Menu, use the UP/DOWN arrows to display the 20 mA Point. Select with the ENTER key.



The ammeter should read exactly 20.00 mA. If not, adjust the value displayed on the meter using the AV38 UP/DOWN arrow keys. The number displayed in parentheses is in “counts” and should be within 20% of 12,500. Press ENTER to accept the value in parenthesis. Press ESC to leave the value unchanged.

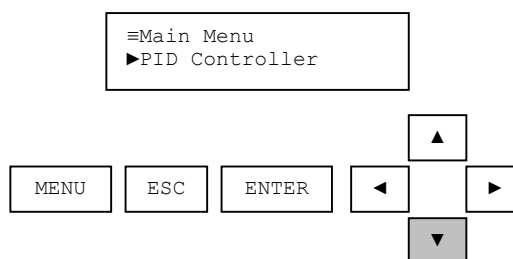


From the Analog Output Calibrate Menu, Press ESC to move back up the MENU tree to the Measure screen.

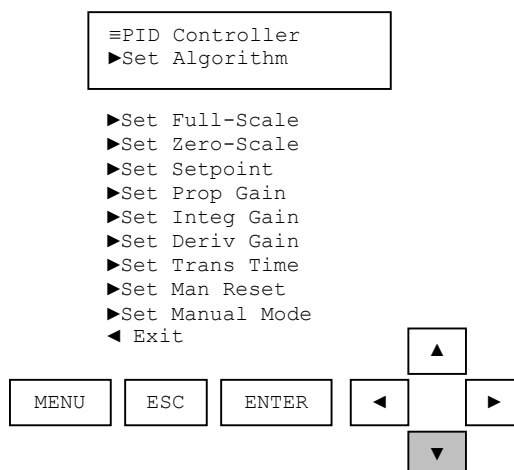


9. PID Controller

If the PID option is installed on the AV38 and a pH DataStick is connected, the PID Controller menu will be available for setup in the Main Menu list. Press ENTER to select PID CONTROLLER.



Use the UP/DOWN arrows to scroll the list of PID Controller options for viewing and editing.



Each of the PID options used to configure and tune the loop is shown below.

PID Function	Edit Range	Default Setting
Set Algorithm	ISA or Velocity	ISA
Set Full-Scale	0 to 14 pH	14 pH
Set Zero-Scale	0 to 14 pH	0 pH
Set Setpoint	0 to 14 pH	7 pH
Set Proportional Gain	-99.99 to +99.99	0.00 (+ is direct action, - is reverse action)
Set Integral Gain	0.00 to 50.00 reps/min	0.00 reps/min
Set Derivative Gain	0.00 to 10.00 seconds	0.00 seconds
Set Transit Time	0 to 9999 seconds	0 seconds
Set Man Reset	0.0% to 100%	0.0%
Manual Mode	Control: 0.0% to 100%	0.0% (Process value is displayed)

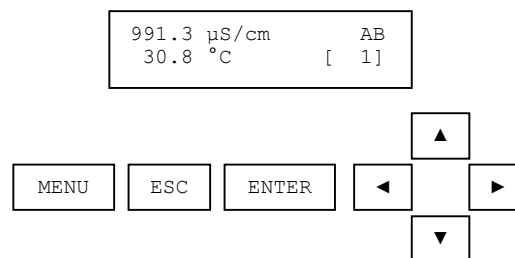
Scroll through these configuration and tuning options with UP/DOWN arrows. Press ENTER to select an option and view or edit the setting. Press ENTER to change setting or ESC to leave a setting unchanged. Note that in the Manual Mode, the present pH value is displayed in the top line and the Control Adjustment is made in the second line.

When the configuration and tuning settings are made, select PID as the Parameter for current loop 1 or current loop 2.

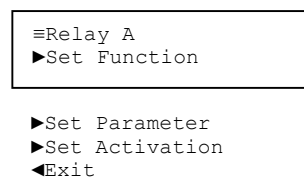
Integral gain can be disabled by entering "0.00" to provide only PD controller action.

10. Relay Menus

Up to two Form C relays with normally open and normally closed contacts are available with the AV38. When relay A is energized or activated, an "A" will appear in the upper right corner of the measure display. If relay B is energized a "B" will appear as shown:



The selectable features in the relay menus are the same regardless of the type of sensor head that is installed in the DataStick. While the AV38 is being used to calibrate the DataStick, the relay is held in its present state. Use the UP/DOWN arrows to scroll the relay option list. Press ENTER to select. Press ESC to move up a level in the menu system.



The SET FUNCTION menu is used to configure a relay for ALARM, CONTROL or WASH functions. When ALARM is selected, the relay activation is determined by low and high limits of the chosen measured parameter. When CONTROL is selected, the relay activation is determined by a single set point. WASH is a timer function and does not depend on the sensor or temperature measurements.

- First select the desired relay function: ALARM, CONTROL or WASH.
- Next, select the PARAMETER (Sensor or Temperature) that drives the relay if either Alarm or Control is selected. If Wash is selected, the relay operates as a timer.

If ALARM is selected, the following activation options can be programmed in the ACTIVATION menu.

ALARM Function	Edit Range	Default Setting
Set Low Alarm	Min to Max scale	Zero or most negative reading
Set High Alarm	Min to Max scale	Highest reading
Set Low Deadband	0 to 14 pH	0 pH
Set High Deadband	0 to 14 pH	0 pH
Set Off-Delay	0 to 999 seconds	0 seconds
Set On-Delay	0 to 999 seconds	0 seconds

If CONTROL is selected, the following activation options can be programmed in the ACTIVATION menu.

ALARM Function	Edit Range	Default Setting
Set Phase	High or Low	High
Set Setpoint	Min to Max scale	Highest reading
Set Deadband	0 to 14 pH	0 pH
Set Off-Delay	0 to 999 seconds	0 seconds
Set On-Delay	0 to 999 seconds	0 seconds

If WASH is selected, the following activation options can be programmed in the ACTIVATION menu.

ALARM Function	Edit Range	Default Setting
Set Interval	0.0 to 999.9 minutes	0.0 minutes
Set Duration	0 to 999 seconds	10 seconds
Set Off Delay	0 to 999 seconds	0 seconds

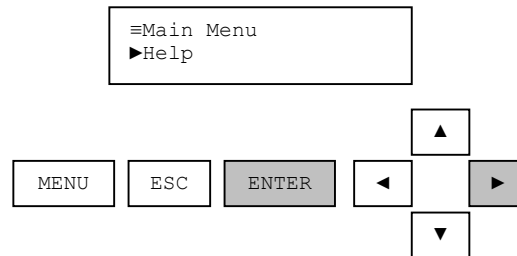
Navigation from the Measure Menu:

1. Press MENU to display the Main Menu.
2. Scroll with the UP/DOWN arrows to view RELAY, RELAY A or RELAY B.
3. Press ENTER to select the desired relay.
4. Scroll with the UP/DOWN arrows to view FUNCTION
5. Press ENTER to select Function and use the UP/DOWN arrows to select Alarm, Control or Wash.
6. Press ENTER to select Alarm, Control or Wash. Press ESC to leave the setting unchanged.
7. Scroll with the UP/DOWN arrows to SET PARAMETER (unless Wash was selected).
8. Press ENTER to select SET PARAMETER and use the Up/DOWN arrows to select SENSOR or TEMPERATURE to drive the relay.
9. Press ENTER to select Sensor or Temperature. Press ESC to leave the setting unchanged.
10. Scroll with the UP/DOWN arrows to SET ACTIVATION.
11. Press ENTER to select SET ACTIVATION and use the UP/DOWN arrows to scroll the list of activation options. Select an option with the ENTER key. Edit the selected option with the UP/DOWN arrows. Press ENTER to select the edited option or press ESC to leave the option unchanged.

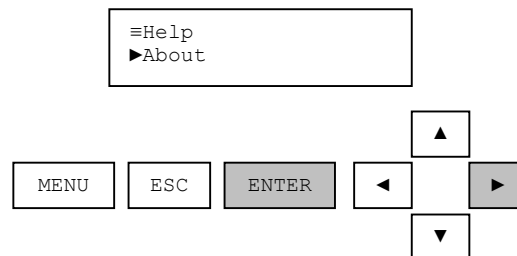
11. Help Menu

The help menu displays the product name and the firmware version of the AV38.

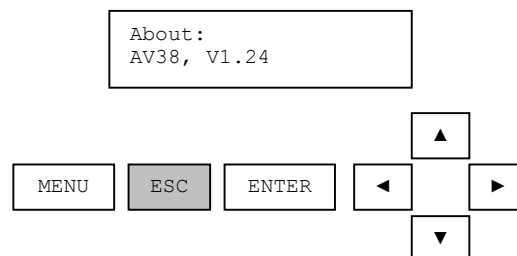
Enter the Menu with the MENU key. Scroll the menu options with the UP/DOWN arrows. The Help menu is second to last. Press ENTER to select the HELP menu.



Press ENTER again to select the “About” menu.



View the AV38 software version number.



12. AV38 Operating Modes

The AV38 has three operating modes; measure, eavesdrop, and menu. These modes allow the AV38 to keep its local display updated with current DataStick readings whether the AV38 is communicating with a host or not. They also permit a user to communicate with the DataStick via the user interface to perform operations such as calibration and configuration.

Measure Mode

In measure mode the AV38 sends “get” commands to the DataStick and updates its local display based on the responses.

When the AV38 is powered up, it enters measure mode.

If the AV38 receives a command from the host while in measure mode, it forwards the command to the DataStick and switches to eavesdrop mode.

If the menu key is pressed while in measure mode, the AV38 switches to menu mode.

Eavesdrop Mode

In eavesdrop mode the AV38 acts as a transparent conduit for communications between the host and up to 247 DataSticks. If the AV38 receives a command from the host while in eavesdrop mode, it forwards the command to the DataStick whose Station Address appears within the square brackets on the lower line of the display. The response from the DataStick is forwarded to the host, and its local display is updated with the information.

The sensor and temperature values on the local display become stale in the absence of “get” commands from the host. If there are no commands for 30 seconds while in eavesdrop mode, then the AV38 switches to measure mode.

As long as commands are received from the host at a rate of at least one every 30 seconds, the AV38 remains in eavesdrop mode. If the menu key is pressed while in eavesdrop mode, the AV38 switches to menu mode.

Menu Mode

In menu mode the user is navigating the AV38’s menu structure, e.g., inspecting the station address or calibrating the DataStick.

While in this mode, the AV38 ignores commands from the host and communicates with the DataStick as required. When the user’s navigation returns to the measure screen, the AV38 switches to measure mode. The AV38 will remain in menu mode until such time as the user navigates back to the measure screen.

13. Limited Warranty

AV38 WARRANTY/REPLACEMENT PLAN

AquaSensors, LLC warrants its AV38 Local Display 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, AquaSensors, LLC 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 AquaSensors, LLC. To obtain authorization, please call AquaSensors, LLC 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 AquaSensors, LLC.
3. Any product not used in accordance with the instructions furnished by AquaSensors, LLC.
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 AquaSensors, LLC.
6. Travel fees associated with on-site warranty repair.

This warranty is the sole expressed warranty made by AquaSensors, LLC 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.

AquaSensors' liability shall be limited to the cost of the item giving rise to the claim. In no event shall AquaSensors be liable for incidental or consequential damages.

This warranty is the sole and complete warranty for AquaSensors, LLC. No person is authorized to make any warranties or representations on behalf of AquaSensors, LLC.

AquaSensors, LLC reserves the right to change or modify this warranty at any time.

14. 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. AquaSensors reserves the right to change pricing without notice.

Terms: Payment terms are net 30 days from the date of invoice with approved credit. AquaSensors 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 AquaSensors 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. AquaSensors 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 AquaSensors, LLC, 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.

Control Number: TC1001 Rev: 9/04