AM-2252
Multi-Parameter
Dual Channel Controller

AM-2250
Multi-Parameter
Single Channel Controller

Installation and Operation Manual

Contents

1 Introduction

The AM-2252 multi-parameter controller is an upgraded third-generation controller built on the 30-year AquaMetrix legacy of durable and easy-to-use controllers. Many of the 2200 controllers sold those three decades ago are still in use today in some of the most hostile environments found in industry. Orders continue to come in today for 2200 pH, ORP, conductivity and flow models, years after they entered end-of-life status. The Shark controller (and Shark TX transmitter) combined all four parameters into one analyzer. Their bullet-proof design and construction continued the AquaMetrix legacy of durability. The AM-2250 series is the third generation of controllers and its models are the easiest-to-use, most flexible yet. All three generations have been single-input analyzers. The AM-2252 is the first two-input controller. It combines almost everything the user would need in a multi-input analyzer without the need to buy additional, expensive cards. The AM-2252 also accepts input from any 4-20 mA analog sensor.

2 Specifications

2.1 AM-2252 Technical Specs

Probe Parameters						
	pH	ORP	ISE	Conductivity	Flow	4-20 mA
Sensor	6-wire differential or combination	6-wire differential or combination	6-wire differential or combination	2-electrode with cell constants: from 0.01 to 50	Pulse output: Paddle-wheel Magnetic Flow	Any loop powered or
Temperature Elements	Pt: 100 RTD, 1000 RTD. NTC: 300Ω, 3000Ω, 10kΩ Manually or automatically detected with Auto Detect Feature				n/a	n/a
Sensor Input	-600 to 600 mV	-999 to 999 mV	-999 to 999 mV	0 to 9999 Ω	0 to 2000 Hz	4 to 20 mA
Measurement Range	0 – 14 pH -20 – 120 ^{0}C	-999 to 999 mV -20 to 120 ^{0}C	-999 to 999 mV -20 to 120 ^{0}C	0.055 to 500,000 µS/cm, depending on cell constant	0 to 9999 in any available units.	4 to 20 mA
Temperature Compensation	Automatic, manual or none	n/a	Automatic, manual or none	Automatic, manual or none	n/a	n/a
Calibration Mode	1, 2 or 3 points Automatic, manual.	Single point. Manual		Up to 16 points Wet or dry.	K-factor input	1-point
Outputs						
Analog	3 x fully scalable and optically isolated 4-20 mA. Max load: 800 Ω Temperature or process output. Optional PID control for process. Channel 3 can be configure for a ratio, sum or difference of two process values.					
Relays	5 independent relays: Relays 1 and 2: SPDT 5A @250 VAC Relays 3 and 4: SPST (NO) 5A @250 VAC or 5A @30 VDC (Resistive Load) 2A @250 VAC or 2A @30 VDC (Inductive Load) Alarm Relay SPST (NO) 5A @250 VAC or 5A @30 VDC (Resistive Load) 2A @250 VAC or 2A @30 VDC (Inductive Load)					

Relay Modes	Relays 1 and 2: Process/Temperature, Rising/Falling/Range mode, Cycle On/Off, Relay Delay, Overfeed Timer, Override Relays 3 and 4: Process/Temperature, Fail Safe, Rising/Falling/Range mode, Cycle On/Off, Relay Delay, Overfeed Timer, Override Relay 5: Up to 4 trigger conditions simultaneously (process 1&2, temperature 1&2) with acknowledgment and override option, each with a Rising/Falling/Range mode.
	Ratings
Ingress Protection	NEMA 4X
Max. Power Input	0.2 A @ 115 VAC or 15 W
Temperature	-20 to 70 ^{0}C
Humidity	0 to 90% Relative Humidity, non-condensing
	Physical
Mounting	Wall mount and panel mount with kit provided, pipe mount optional
Dimensions	Front cover: 5.5”x5.5” (14 cm x 14 cm). Depth: 5” (13 cm)
Power	110-240 VAC 60-50 Hz
Weight	2 lbs

2.2 AM-2250 Technical Specs

Probe Parameters					
	pH	ORP	ISE	Conductivity	Flow
Sensor	6-wire differential or combination	6-wire differential or combination	6-wire differential or combination	2-electrode with cell constants: from 0.01 to 50	Pulse output: Paddle-wheel Magnetic Flow
Temperature Elements	Pt: 100 RTD, 1000 RTD. NTC: 300Ω, 3000Ω, 10kΩ Manually or automatically detected with Auto Detect Feature				n/a
Sensor Input	-600 to 600 mV	-999 to 999 mV	-999 to 999 mV	0 to 9999 Ω	0 to 2000 Hz
Measurement Range	0 – 14 pH -20 – 120 ^{0}C	-999 to 999 mV -20 to 120 ^{0}C	-999 to 999 mV -20 to 120 ^{0}C	0.055 to 500,000 µS/cm, depending on cell constant	0 to 9999 in any available units.
Temperature Compensation	Automatic, manual or none	n/a	Automatic, manual or none	Automatic, manual or none	n/a
Calibration Mode	1, 2 or 3 points Automatic, manual.	Single point. Manual		Up to 16 points Wet or dry.	K-factor input
Outputs					
Analog					
Relays	3 independent relays: Relays 1 and 2: SPDT 5A @250 VAC Relays 3: SPST (NO) 5A @250 VAC or 5A @30 VDC (Resistive Load) 2A @250 VAC or 2A @30 VDC (Inductive Load)				
Relay Modes	Relays 1 and 2: Process only, Rising/Falling/Range mode, Cycle On/Off, Relay Delay, Overfeed Timer, Override Relays 3: Process/Temperature, Rising/Falling/Range mode, Cycle On/Off, Relay Delay, Overfeed Timer, Override				
Ratings					
Ingress Protection	NEMA 4X				
Electrical	TÜV SÜD (safety)				
Max. Power Input	0.2 A @ 115 VAC or 15 W				
Temperature	-20 to 70 ^{0}C				
Humidity	0 to 90% Relative Humidity, non-condensing				
Physical					
Mounting	Wall mount and panel mount with kit provided, pipe mount optional				
Dimensions	Front cover: 5.5"x5.5" (14 cm x 14 cm). Depth: 5" (13 cm)				
Power	110-240 VAC 60-50 Hz				
Weight	2 lbs				

3 Setup

3.1 AC Power Connection

Caution: This instrument uses 120 or 240 50/60Hz AC power. Opening the enclosure door exposes you to potentially hazardous line power voltage which may be present on the power and relay plugs. **Always remove line power before working in this area**. If the relay contacts are powered from a separate source from the line power, be sure to power off before proceeding. The flip-down door contains low voltage circuitry and is safe to handle. Figure 3-1 shows the controller power board and connectors.

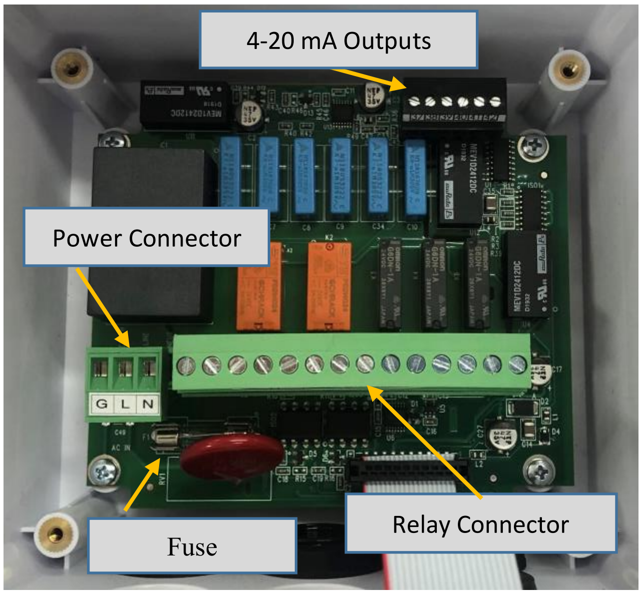


Figure 3-1 Power circuit board showing power and relay connectors.

To power the controller, remove the 3-pin power terminal block and connect the wiring as printed on the board and shown on Figure 3-2. There are no jumpers or switches to convert the controller between 120 VAC and 240 VAC; the controller automatically configures the correct voltage.

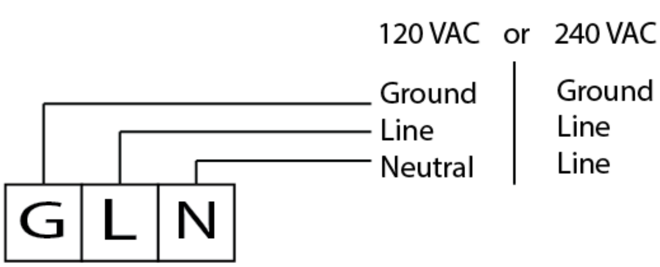


Figure 3-2 Power connection for AM-2252 Controller

3.2 Conduit Connection

The AM-2252 has six ½” (7/8” ID) conduit holes at the bottom of the enclosure. The unit is shipped with three conduit fittings and three holes plugged with liquid tight conduit seals. These must be left in unused holes to maintain the NEMA 4X integrity. Use approved conduit glands to ensure ingress protection.

Wire specification: size wire according to local electrical code. Maximum current not to exceed relay specifications when used to power auxiliary devices via internal connections.

3.3 Mounting

The AM-2252 controller can be mounted on a wall, panel or pipe. Figure 3-3 shows these options. All hardware for wall and panel mounting is included.

Pipe mounting (PN# 2250-PIPE-MNT) is available for sale. It can be used to mount the controller on pipes up to 2.3” OD.

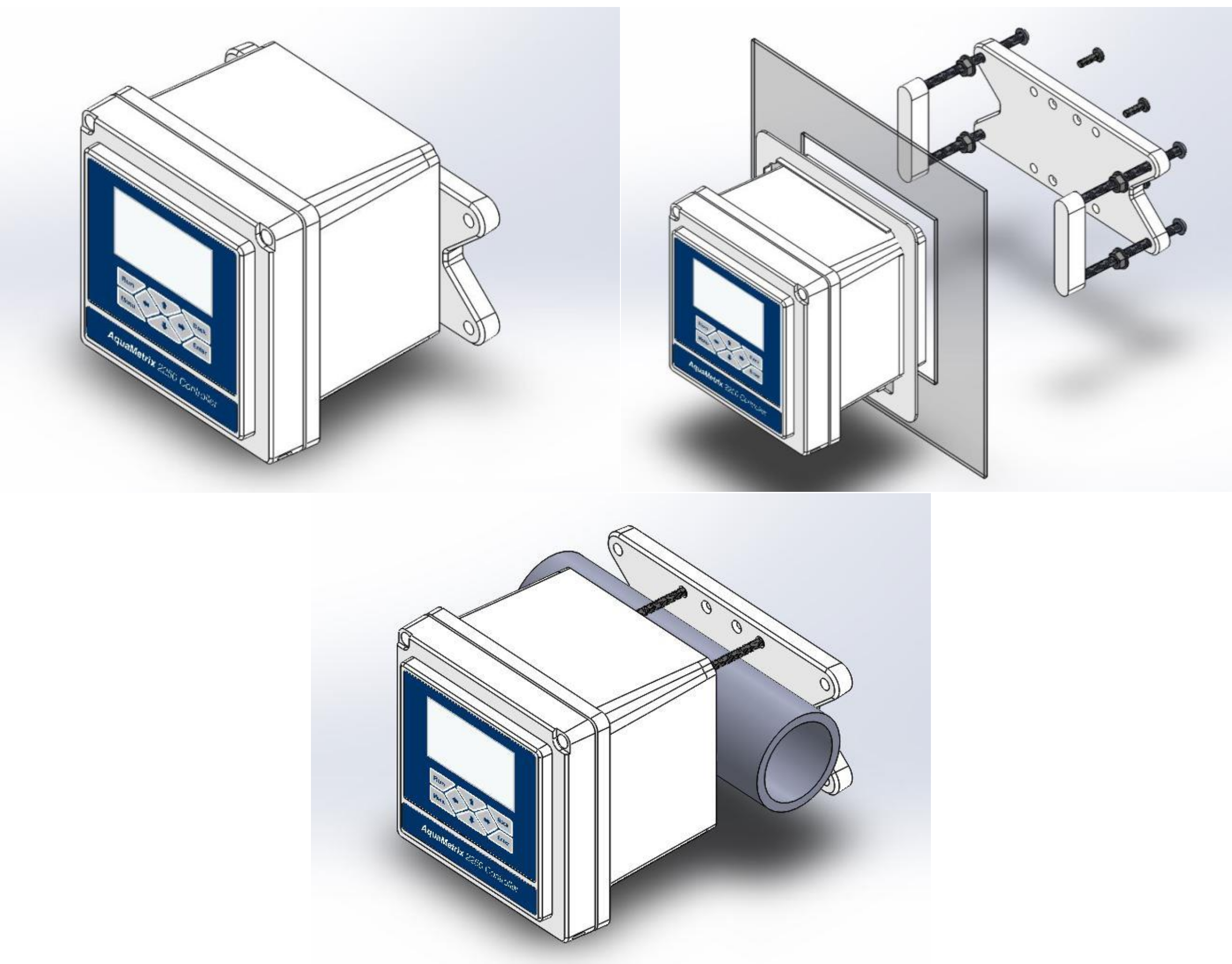


Figure 3-3 - Three mounting options: wall, panel, and pipe.

3.4 Connecting Probes

As shown in Figure 3-4, the cover of the AM-2252 swings open to reveal a connector block for connecting probes. A label inside the controller identifies the terminals so reference to this manual is unnecessary.

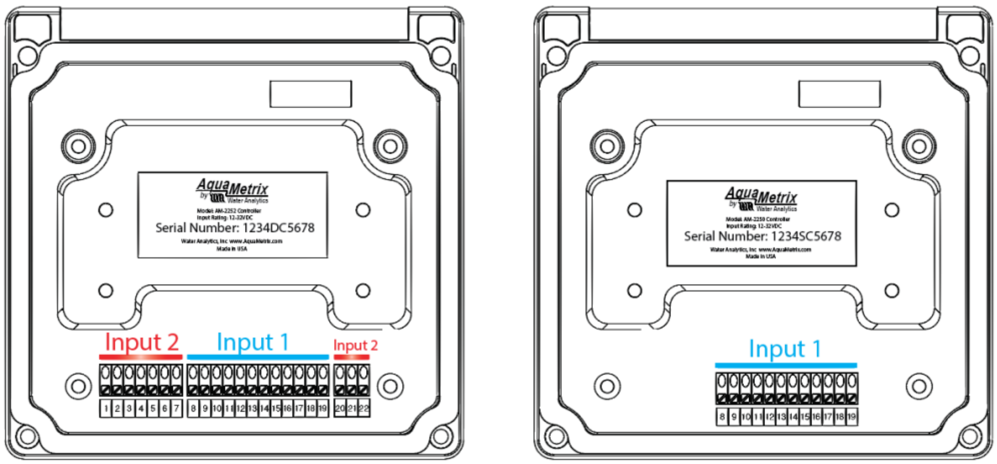


Figure 3-4 - This view of the inside of the front cover shows the connector for the probes. Blue indicates channel 1 and red indicates channel 2 (for AM-2252 only). Note that Input 2 for "raw" output sensors is on the left (1-7) and for the 4-20mA output sensors is on the right (20-22)

Figure 3-5 shows probe connections to the connector block. Please note that the AM-2250 only has Input 1.

The colors of the cells refer to the colors of the wires of the AquaMetrix probes. Color coding of AquaMetrix differential probes match that of Hach/GLI analog probes. Other manufacturers may use different colors.

Input channel #1

	RS485B	RS485A	pH/OPR/ISE (-)	GND	pH/OPR/ISE (+)	Thermistor	GND	Conductivity	+3VDC	Flow	-3VDC	Flow Reset
	8	9	10	11	12	13	14	15	16	17	18	19
Differential pH/ORP/ISE			Green	Black	Red	Yellow	Shield				White	
Combination pH/ORP/ISE			Jumper Green	 Black	Clear pH/ORP	White TC						
Contacting Conductivity				Green		Red	Black	White				
Flow (IP-series)									Red	White	Black	

Input channel #2

	Conductivity	GND	pH/OPR/ISE (-)	Thermistor	pH/OPR/ISE (+)	GND	-3VDC		24VDC (-)	Analog input	24VDC (+)
	1	2	3	4	5	6	7	...	20	21	22
Differential pH/ORP/ISE		Shield	Green	Yellow	Red	Black	White				
Combination pH/ORP/ISE			Jumper Green	 Black	Clear pH/ORP	White TC					
Contacting Conductivity	White	Black		Red		Green					
4-20 mA current sourcing									Black	Red	
4-20 mA current sinking										Black	Red

Figure 3-5 AM-2252 and AM-2250 (Input channel 1 only) sensor wiring.

The AM-2252 is a dual input controller that can work with almost all AquaMetrix sensors. Figure 3-6 shows which probes are compatible with each input.

Sensor Part #	Input #1 or AM-2250	Input #2
60-Series Sensors	✓	✓
65-Series Sensors	n/a	
500-Series Sensors	✓	✓
AS-Series Sensors	✓	✓
AM-Series Sensors	✓	✓
AM-TBR Turbidity Sensor		✓
Pulse Output Flow Sensors	✓	
AM-ODO-TX Dissolved Oxygen Sensor		✓
AM-FCL Free Chlorine Senor		✓
AM-ES-TX Wide range toroidal conductivity sensor with 4-20mA		✓
AM-ES1 Wide range toroidal conductivity Sensor	n/a	
PTX/RTX Smart pH/ORP Sensors	n/a	

Figure 3-6 Sensor compatibility chart

3.5 Analog (4-20 mA) Outputs

The AM-2252 has three adjustable and isolated 4-20 mA outputs. Each can be configured for either process or temperature. The 6-pin (for AM-2252) or 4-pin (for AM-2250) header is on the upper right of the power board, which is shown in Figure 3-1. Outputs are powered (current sourcing) with 24 VDC.

Besides the proportional 4-20 mA output, there are advanced output options. Simple PI allows the user to set a target value and a delay to compensate for process lag. For more sophisticated control, PID is available for process control (see section 6.4).

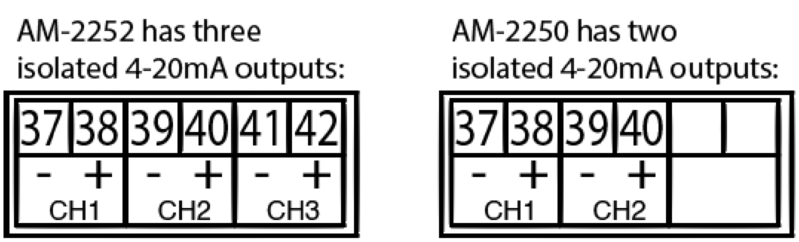


Figure 3-7 Analog Outputs of AM-2252 and AM-2250

3.6 Relays

The AM-2252 contains five dry contact relays. Relays 1 and 2 are SPDT, rated 5A @ 250 VAC. Relays 3 and 4 are SPDT, normally open, and rated 5A @250 VAC or 5A @30 VDC for a resistive load. For an inductive load they are rated 2A @ 250 VAC or 2A @30 VDC. Relay 5 is a normally open alarm relay. The alarm relay should not be used to run heavy industrial equipment as it does not feature snubber circuit protection.

The AM-2250 contains three dry contact relays. Relays 1 and 2 are SPDT, rated 5A @ 250 VAC. Relays 3 is SPDT, normally open, and rated 5A @250 VAC or 5A @30 VDC for a resistive load and 2A @ 250 VAC or 2A @30 VDC for an inductive load.

3.6.1 Wiring relays

Though these relays will work in most process control applications, we advise, for safety reasons, to use them as switches, i.e. low power DC relays that activate a second set of AC-powered relays separate from the controller.

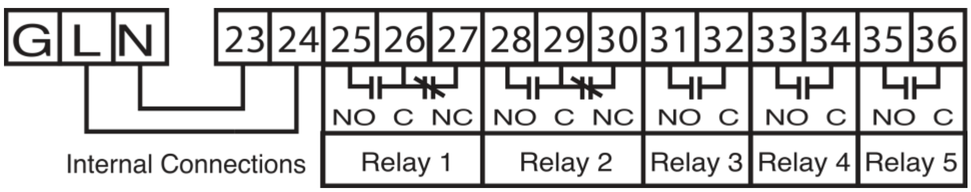


Figure 3-8 Wiring connections to the five relays. Pins 23 and 24 are powered via internal jumpers on PCB.

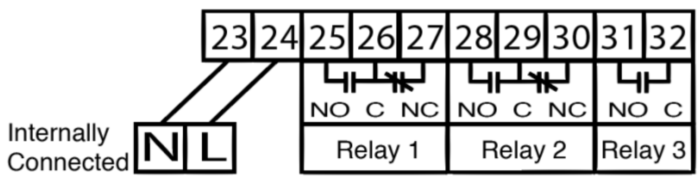


Figure 3-9 Wiring connections of the three relays of the AM-2250 controller. Pins 23 &24 are powered via internal jumpers on the PCB

All relays are dry contact, i.e. relay contacts do not supply voltage. For a wiring convenience, the first two pins of the relay connector are internally connected to the controller power input (GLN connector).

An example of the wiring 120/240VAC pump from the Relay 1 is shown below:

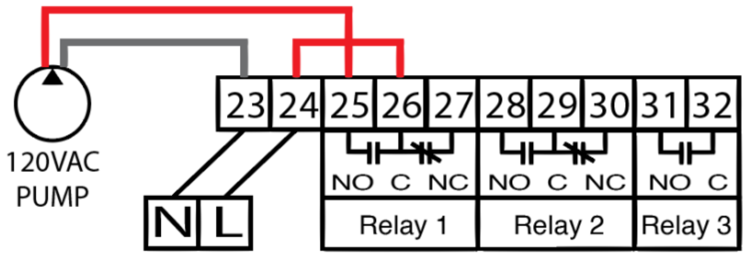


Figure 3-10 Wiring a pump to a normally open (NO) contact of the Relay #1 (AM-2250 controller). Jumper wire from pins 24 & 26 must be added to provide power to the relay.

4 Probe Setup

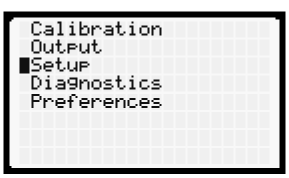
As discussed in section 3.4, the compatibility of probes differs between inputs. Both inputs support pH, ORP, ISE, and conductivity sensors. Flow sensors are exclusive to input channel #1, and sensors with 4-20 mA output are exclusive to channel #2.

When powering up the 2252 the first screen presents options for configuration.

Figure 4-1 Initial start-up screen

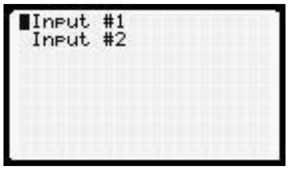
1. Use the ↑ and ↓ buttons to scroll through the menu.
2. Use the ← and → buttons to move the cursor left or right.
3. Press Enter to select or confirm a selection.
4. Press Back to return to the previous screen or cancel your choice.
5. Press Menu to return to the main menu.
6. Press Run to exit from any menu and display the run display.

The setup option in the top-level menu allows you to select your input, as seen below. Input one utilizes pins 8-19, and input two utilizes pins 1-7, and 20-22 of the sensor connector. Once the input is selected, you can configure the probe.

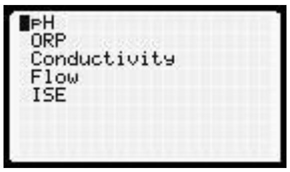


4.1 pH (Inputs 1 & 2)

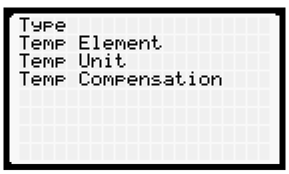
1. Scroll down the top-level menu to select Setup and press the Enter key.
2. Select the appropriate input



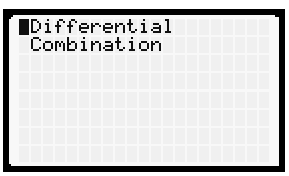
3. Press Probe Selection.



4. Select pH and Press Enter. (As the first item in the list is the default choice.)
5. The next menu lists the configuration options for the pH probe.



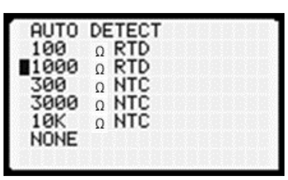
6. Type is either Combination or Differential.



   The 2252 will accept virtually any combination or differential sensor. Entering a probe as the wrong type will simply result in an artificial offset and may not cause any noticeable reading or error. Combination probes may consist of only two wires for the process and reference or four wires, which includes two leads for the temperature element. Differential probes always have five or six (Including the shield) wires.

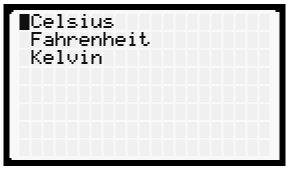
7. All differential probes and four-wire combination probes have a temperature element that must be selected correctly.

   Select Temp Element to bring up the choices of temperature element:



   AUTO DETECT recognizes most temperature devices. If it fails to properly configure the temperature device, check the temperature element wiring. The default element for AquaMetrix pH probes is the 1000 Ω RTD so that option is the default value.

8. Select the preferred units of temperature (Temp Unit):



9. Choose whether you want to keep temperature compensation.

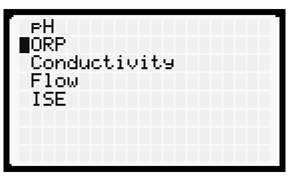
The default selection is On as most application requires pH slope to be corrected for temperature.

10. Press Run to confirm that controller displays pH units and reasonable temperature values.

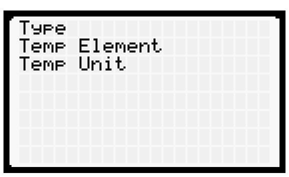
4.2 ORP (Inputs 1 & 2)

As with pH probes all differential ORP probes and four-wire combination probes contain temperature elements, however, ORP values are NOT temperature compensated. The temperature value is only for informational purposes.

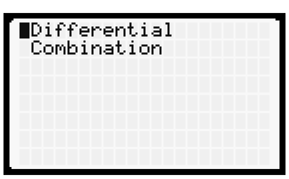
1. From the top-level menu select Setup and press the Enter key.
2. Press Probe Selection to choose the probe type, ORP.



3. This selection automatically brings up the next menu for defining the configuration of the ORP probe.

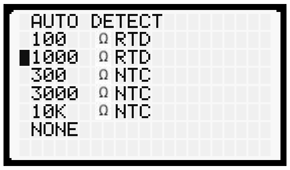


4. Type sets the probe as a Combination or Differential probe.



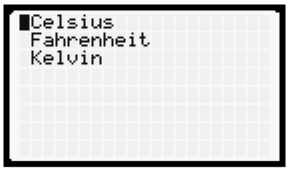
As with pH probes, the 2252 will accept just about any type of combination or differential ORP probe. Entering the wrong type will simply result in an artificial offset and should not cause any noticeable reading or error. Combination probes may consist of only two wires for the process and reference or four wires, which includes two leads for the temperature element. Differential probes always have five or six (with the shield) wires.

5. With the exception of the two-wire combination probe, the type of temperature element must be selected. Select Temp Element to bring up the choices of temperature elements:



AUTO DETECT recognizes most temperature devices. If it fails to properly configure the temperature device, check the temperature element wiring. The default element for AquaMetrix AM series probes is the 1000 Ω RTD so that option is the default value.

6. Select the preferred units of temperature (Temp Unit):

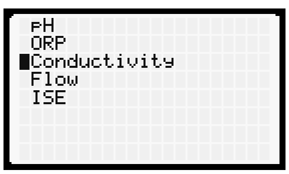


7. Press Run to confirm that the controller displays mV units and reasonable temperature values.

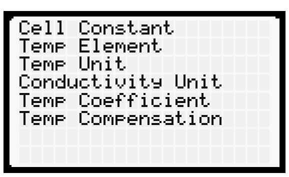
4.3 Conductivity (Inputs 1 & 2)

The AM-2252 only works with contacting conductivity sensors.

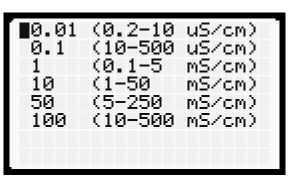
1. From the top-level menu select Setup and press the Enter key.
2. Select appropriate Input
3. Press Probe Selection to choose the probe type, Conductivity, and press the Enter key.



4. This next menu defines the configuration of the conductivity sensor.

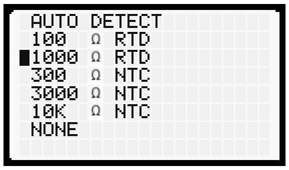


5. Cell constant selection.



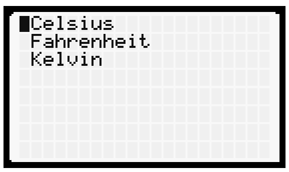
To enable the user to confirm that the cell constant is appropriate for his application, the 2252 menu for cell constants lists the approximate conductivity range for each cell constant. It's important to understand that, although you are free to choose any cell constant, you will get inaccurate readings unless you choose the correct one. For instance, if your probe has a cell constant of 1 and you choose 0.1 (perhaps in an effort to measure lower conductivity levels) your readings will be high by a factor of 10. The cell constant is typically written on a label attached to the cable.

6. Choose Temperature Element.

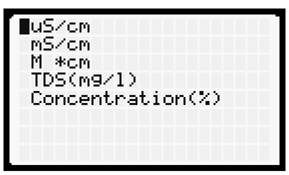


Conductivity readings are strongly influenced by temperature so nearly all conductivity probes have temperature elements. The same choices for temperature element for pH and ORP are present for conductivity. The default element for AquaMetrix AS- & AM-series probes is the 1000 Ω RTD so that option is the default value.

7. Select Temperature Unit. Choices are Fahrenheit (°F) Celsius (°C) or Kelvin (K).



8. Conductivity values span a range of a million to one so one unit for representing all possible values is impractical. The choices for Conductivity Unit are listed as:

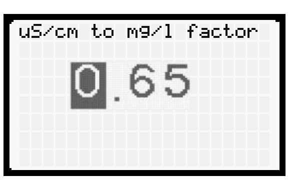


µS/cm: For clean, tap, surface or ground water this unit is the most common. RODI water typically has conductivity of 1 µS/cm or less. Tap water is around 300 µS/cm.

mS/cm: Salt solutions, acid and bases use the higher range. 1 mS/cm = 1000 µS/cm. Confusion between the two is responsible for nearly all problems selecting conductivity sensors and setting up the correct range.

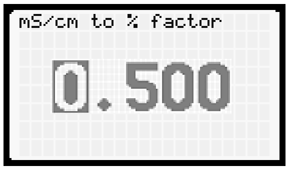
MΩ-cm: For very pure water many workers prefer to report resistivity units in place of conductivity units. One is the inverse of the other. Ultrapure water has a resistivity of 18.8 MΩ-cm (0.055 µS/cm). (Its finite resistance is the result of H^+ and OH^- ions.)

TDS (mg/l): The correlation between total dissolved solids (TDS) and conductivity varies with every sample of water. In order to display conductivity in terms of TDS units one must choose a conversion factor. The default value is 0.65 mg/l = 1 µS/cm. This menu selection allows you to select the conversion factor of TDS units to µS/cm units.

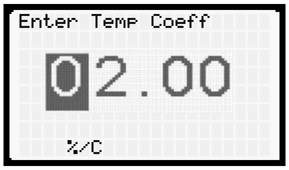


The only way to get an accurate conversion factor is to measure the TDS value by evaporating the water from a sample and weighing the leftover solids.

Concentration (%). This unit, in terms of weight per volume, is a TDS unit express as g/l. It is used for very high concentrations. It is typically used to characterize acids and bases. In order to display conductivity in terms of concentration units one must choose a conversion factor that converts mS/cm to %. The default value is 1 mS/cm = 0.5000 %.

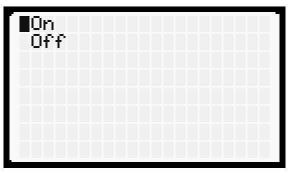


9. Temperature Coefficient. Over a limited temperature range the variation of conductivity with temperature is linear. Conductivity values are typically reported in the literature at 25 ^{0}C.



The default value for α is 2.00 per degree C or 1.10 per degree F.

10. Temperature compensation for most applications should always be On.



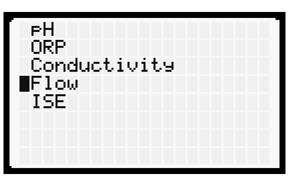
However, for diagnostic purposes and some isolated cases where you need to know the actual conductivity (and not the value at 25^{0}C) turn compensation Off.

11. Press Run to confirm that selected conductivity and temperature units are displayed correctly. Temperature may not be very accurate without calibration but should be close to expected value.

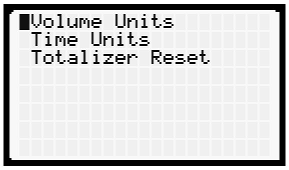
4.4 Flow (Input 1)

Any flow sensor that outputs a pulse will work with the AM-2252. This includes paddle wheel meters and magnetic flow meters (aka “magmeters”). The 2252 measures both instantaneous flow and totalized flow. The latter is a running total of the volume and is equal to the flow integrated over time.

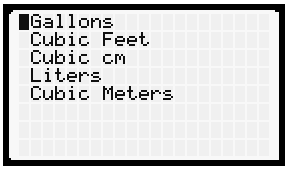
1. Scroll down the top-level menu to select Setup and press the Enter key.
2. Highlight Input #1 and press the Enter key.
3. Press Probe Selection to choose the probe type, Flow and press the Enter key.



4. The following screen should appear



5. Set Volume Units. The choices are gallons, ft^3, cm^3, liters, and m^3.



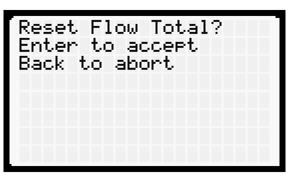
6. Set Time units.

7. Press Run to confirm that the selected flow unit is displayed correctly. Most flow sensors don't have a temperature device, so the total flow value replaces the usual temperature value.

4.4.1 Totalizer Reset.

There are two ways to reset the totalizer.

1. The first option is via software: Navigate to Menu > Setup > Input #1 >Probe Config >Totalizer reset. After confirming that you really do want to reset the totalizer it will start again at 0.



2. There is also an option to reset the flow totalizer using hardware: Short pins 18 and 19 of the probe connector.

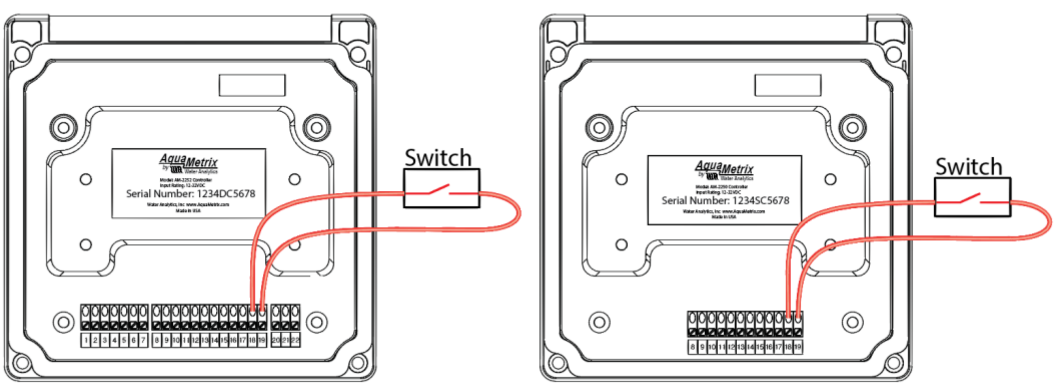


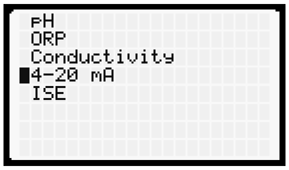
Figure 4-2 Flow Totalizer Reset using probe connector. Left AM-2252, right AM-2250.

This hardware reset can be done via an external button or switch. For automating daily totals, a mechanical or electrical timer can be used to short pins 18 and 19 at the start of each day.

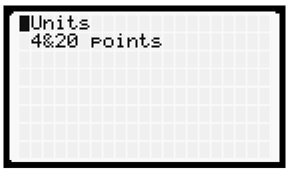
4.5 Sensors with 4-20 mA output (exclusive to Input 2)

Any sensor with 4-20 mA output can be connected. Both current sourcing and current seeking options are supported. Once 4-20 mA output is selected, you must identify the units. The default units are ppm, but all units are supported. If you do not see your units available to select, simply choose “NONE”. Once units have been set, input the value for 4 mA. Because 4-20 mA can only output one value, the temperature for input 2 will not be displayed.

1. Scroll down the top-level menu to select Setup and press the Enter key.
2. Highlight Input #2 and press the Enter key.
3. Press Probe Selection to choose the probe type, 4-20 mA and press the Enter key.

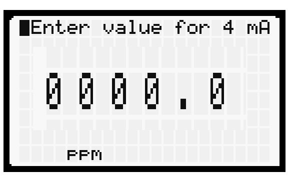


4. The following screen should appear



5. Set Units. Choices are ppm, mg/l, %, psi, NTU, in, ft, or NONE.

6. Set value for 4 mA



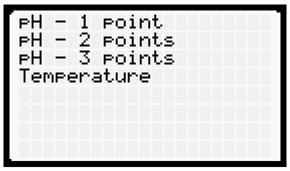
7. Repeat the process for the 20 mA point.
8. Press Run to confirm that the selected unit displays correctly.

5 Calibration

The Calibration menu automatically presents choices appropriate for the probe chosen. If the menu choices for calibration appears wrong, you probably chose the wrong probe.

Note: If you select the probe type and wish to immediately calibrate you must put the controller in Run mode first. You can press the Run button while in any menu.

5.1 pH Calibration



5.1.1 About pH Calibration

Most pH analyzers allow the user to calibrate a probe with only two points, using two of three standard calibration solutions: pH 4, 7 and 10. For two-point calibration use the two standards that are closest to your expected process values. For example, if your process is mostly acidic (< pH 7) then calibrate using standards pH 4 and pH 7.

For the pH readings that span a wide range encompassing neutral (7pH) the AM-2252 controller offers the option of three-point calibration. An algorithm uses linear least squares to calculate the slope and offset, as a result the error will be spread across the full pH range.

A pH probe that operates according to theory outputs 59.16 mV at 25^{0}C for every unit change in pH. The actual change in output for a real probe is likely to be different and is the **slope** for that probe. An ideal probe in pH 7 solution (at 25^{0}C) outputs 0 volts. The actual output is likely to be different and is the **offset**. The slope yields the **efficiency** of the probe. A probe that outputs 59.16 mV at 25^{0}C is 100% efficient. If the probe outputs, say, 57.34 mV then the efficiency is 57.34mV/59.16mV ≈ 96.9% efficient.

When a probe leaves the AquaMetrix factory it is tested three times to ensure that its offset and efficiency are within an acceptable tolerance (±50 mV and >90% slope, respectively). As probes age their efficiency decreases. Note that a probe with low efficiency will still be accurate but it will not be precise, i.e. its reading will have a large uncertainty. We recommend cleaning or replacing a sensor when its efficiency drops below 80%. Before discarding a probe showing low efficiency make clean it according the probe manual's instruction or the AquaMetrix video https://www.wateranalytics.net/home/support/training-videos/. A large offset usually indicates that the reference solution is contaminated and should be replaced.

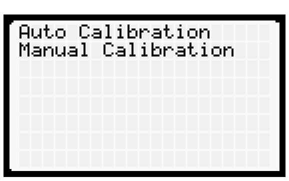
5.1.2 One-Point Calibration

While one-point calibration is offered as an option, it is not recommended if accuracy is desired. One-point calibration can be used as a correction for sensor error by introducing an offset. It will compare a tested sample to the desired value. It can be implemented when removing the probe is not practical or possible.

5.1.3 Two-Point Calibration

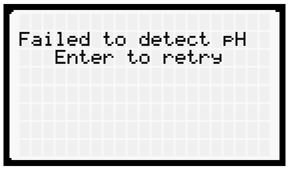
As stated above, use the two calibration standards that encompass the pH range of your process. If target reading is around pH7, then it is recommended to use pH4 and pH7 buffer standards.

There is a choice between auto and manual calibration.



5.1.3.1 Auto Calibration

In auto calibration the AM- 2252 reads the probe output when it is in a buffer and decides whether the buffer is pH 4, 7 or 10. Ideal voltages for these buffers are 177, 0 and -177 mV respectfully. If the output of the probe is within 59.16 mV (1 pH unit) from any of these values auto calibration assumes it "knows" the calibration standard in which the probe is immersed. If the output is greater than 59.16 mV auto calibration will fail.

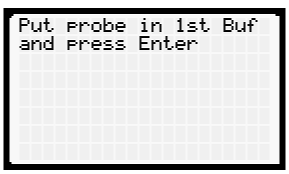


There are several reasons why this can happen:

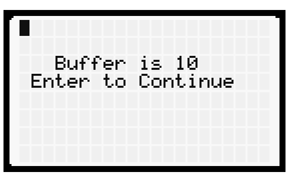
1. The offset of the probe is greater than 59 mV.
2. The efficiency of the probe is less than 67%
3. The buffer is non-standard (i.e. neither 4, 7 or 10).
4. The buffer has aged and is no longer at its nominal pH value.

To initiate auto calibration:

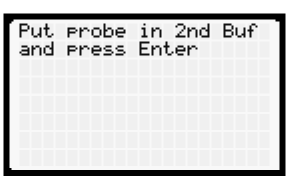
1. Select Auto Calibration
2. Follow the directions on the next screen and immerse the probe in the first calibration standard.



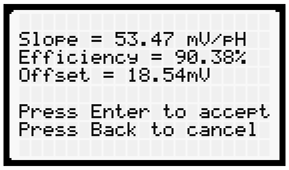
Press Enter. Allow at least one minute for the probe reading to settle down. It helps to swirl the probe around in the solution. After a minute or longer press the Enter key as instructed. (If you press the Enter key too soon the analyzer will accept an inaccurate probe reading and the efficiency is likely to be lower that it should.)



3. The screen will display Calibrating for a few seconds as it reads the probe output and stores the probe output value. The next screen will appear and will direct you to immerse the probe in the second calibration standard. (*Always rinse the probe in clean tap water before immersing it in a new buffer.*) As before, wait at least one minute before pressing Enter to record the probe output value of the second calibration solution.



4. The screen will again display Calibrating for a few seconds and will display the results of the calibration—the efficiency and offset. An example is:

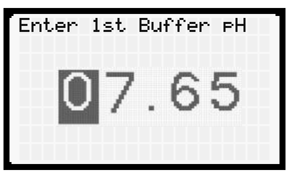


If you are satisfied with the measured efficiency and offset, press Enter to accept the calibration. If not press Back to repeat calibration. Pressing Menu brings you back to the top menu.

5.1.3.2 Manual Calibration

As explained above, manual calibration can be used if the probe has a very large offset, has low efficiency or is being calibrated with non-standard buffer solutions.

1. Select Manual Calibration
2. Place the probe in the first buffer. As opposed to auto calibration, it is okay to press Enter without waiting for the probe output to settle down. The next screen will display the current output reading of the probe.
3. When the reading settles down press Enter. The next screen allows you to change the value of the displayed pH value to correspond to the actual pH of the calibration solution. Use the ↑ and ↓ arrow buttons to change the value and the ← or → button to change the cursor position. Press the Enter key to lock in the correct value.



4. The results of the calibration (identical to the one shown for auto calibration) will display.
5. Place the probe in the second buffer. Again, there is no need to wait for the probe reading to settle down prior to pressing Enter.
6. When the reading settles down press Enter. Change the pH value display to equal the pH of the calibration standard.

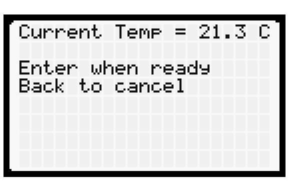
5.1.4 3-Point Calibration

The instructions for 3-point calibration are the same as for 2-point calibration with the obvious exception that three standards are used instead of two.

5.1.5 Temperature Calibration

Since all pH readings are temperature compensated, an accurate pH readings depend on an accurate temperature.

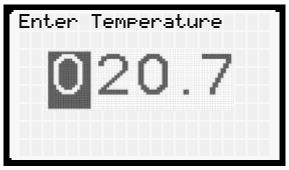
1. Select Temperature.



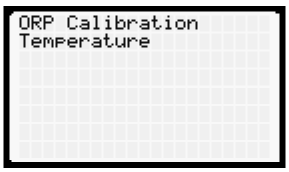
2. The screen displays the current temperature reading. Make sure the temperature reading has settled down. Keep in mind that most temperature elements in pH probes are encapsulated inside the probe,

which results in a temperature lag of several minutes for the element to equilibrate with the temperature of the solution.

3. The temperature calibration procedure is analogous that for manual pH calibration. It's not necessary to immerse the probe in solution. Knowing room temperature enables you to calibrate the probe in air. As with manual pH calibration, ensure that the temperature reading settles down prior to pressing Enter. The next screen allows you to change the temperature reading to match the actual temperature. Press Enter when done or Menu to go back to the top menu.



5.2 ORP Calibration



5.2.1 About ORP Calibration

ORP is a unique water quality parameter. For all other parameters a voltage, current or other electrical change corresponds to a value of the parameter and calibration determine that relationship. For instance, a pH probe generates a voltage that maps to a pH value. The ORP unit of measurement is different. It IS the actual output voltage of the probe. No translation to a dependent parameter takes place. An ORP analyzer is just a voltmeter. Therefore, no calibration is needed.

However, all voltmeters need to be calibrated. The only practical way of doing so for an ORP analyzer is to measure the offset of the voltmeter. This is called a **standardization**. This requires only one measurement. Though ORP calibration is strictly not a calibration we often refer to the standardization as a calibration. This manual follows this practice.

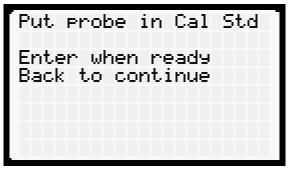
To "calibrate" an ORP probe simply immerse it in a calibration standard that produces a known voltage and adjust the reading of the analyzer until it matches the actual value of the solution.

There are no standard calibration solutions for ORP although Zobell's (228mV @25°C) and Light's (476mV @25°C) solutions are the most commonly used. AquaMetrix makes its own versions of these two solutions that are nominally 200 and 600 mV. ORP solutions are not buffered which means that their ORP values are not as stable as pH buffered standards are. Each calibration solution AquaMetrix is characterized by an ORP value that may vary within 20 mV of the nominal 200 or 600 mV value. The solution bottle will list the actual mV value. This value will change as chemicals in the solutions slowly oxidize, so ORP calibration solutions should be replaced at least every 6 months.

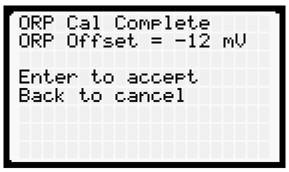
5.2.2 ORP Calibration

For reasons just stated, ORP calibration is a manual, one-point procedure.

1. Select ORP Calibration.
2. Place the probe in the calibration standard and press Enter. As in all manual calibrations there is no need to wait prior to pressing Enter.

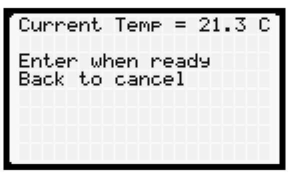


3. Observe the probe output reading and, when it has settled down, press Enter.
4. Adjust the value displayed in the next screen until it matches that of the calibration standard. Note that ORP standards can be negative so be careful to select the correct + or - sign.
5. As the screen instructions state, press Enter to accept the calibration or Back to repeat it. Pressing Menu brings you back to the top menu.

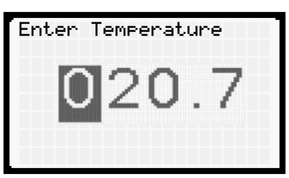


5.2.3 Temperature

1. Select Temperature.

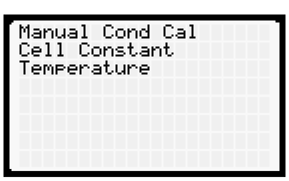


2. The screen displays the current temperature reading. Make sure the temperature reading has settled down. Keep in mind that most temperature elements in pH probes are encapsulated inside the probe, which results in a temperature lag of several minutes for the element to equilibrate with the temperature of the solution. As mentioned for pH probes, you can calibrate temperature in air—as long as you know room temperature.
3. Temperature calibration is similar to manual pH calibration. When the temperature reading settles down press Enter. The next screen allows you to change the temperature reading to the actual temperature. Press Enter when done or Menu to go back to the top menu.



5.3 Conductivity

The AM-2252 is only compatible with contacting conductivity sensors (AS- and AM-series).



5.3.1 About Conductivity Calibration

As with ORP calibration there are no recognized standard calibration standards so there is no auto calibration option. Also, as with ORP, conductivity calibration standards are not buffered and can change. Stability of the conductivity standard is only a problem for standards of very low conductivity, where introduction of impurities in the solution can induce large changes in conductivity. At conductivity standards below 5 µS/cm just carbon dioxide in the air can increase the actual conductivity.

In those cases where a conductivity standard is not available one may enter the cell constant of the probe as an approximate surrogate to calibration. Obviously, the calibration using the known cell constant is only as good as the cell constant is known. Usage of the probe will cause some scaling or fouling of the electrodes, which will result in an increased nominal cell constant. Therefore, calibration using real a real conductivity standard is always preferred.

Most conductivity analyzers employ a calibration routine that uses only one calibration standard. This is actually a two-point calibration routine since the other point is assumed to be zero, i.e. that the conductivity for a zero-conductivity sample is zero. The AM-2252 allows as many as 16 points. Though one point is sufficient for most applications the ability to calibrate over several points allows one to use conductivity measurements to determine acid and base concentrations. As the figure below shows conductivity as a function of acid/base concentration is very non-linear and, therefore, several points are needed to construct the curved relationship. Therefore, multi-point calibration also enables greater accuracy over a wider range of conductivities.

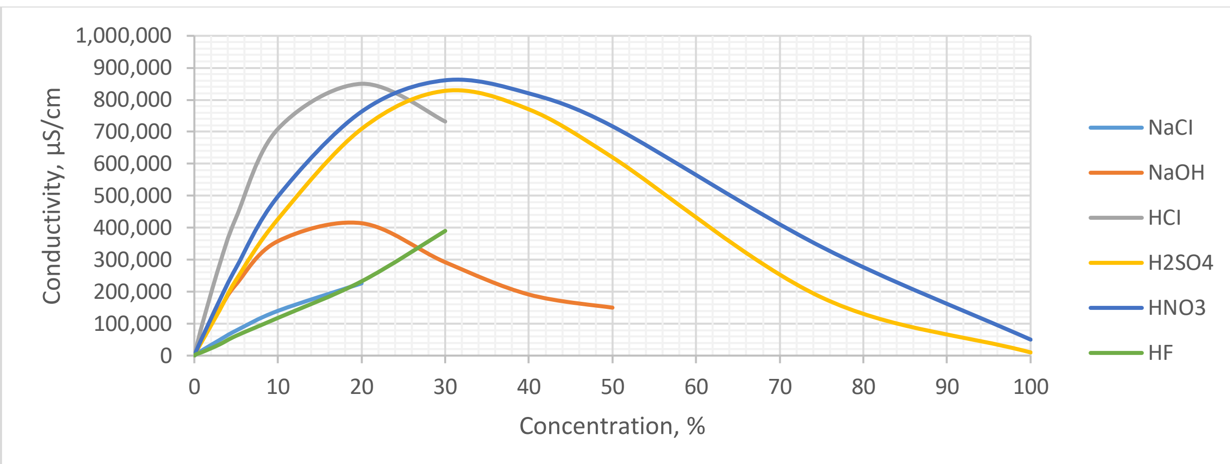
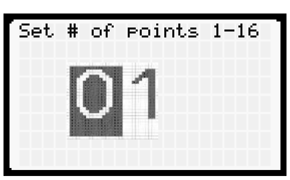


Figure 5-1 Relationship between Concentration of solution and conductivity (at 25° C)

5.3.2 Manual Conductivity Calibration or Wet Calibration

The procedure for manual conductivity calibration is similar to that for manual pH and ORP calibration. The only exception is that user can calibrate using as many as 16 points.

1. Select Manual Calibration.
2. Select the number of calibration standards to be used. In most cases choose 1. For greater accuracy choose 2 or 3. Only for measuring acid and base concentrations or conductivities over a wide range are more points needed. Press Enter to accept the number of points.



3. Immerse the probe in the first (or only) calibration standard. Press Enter.

4. The display will show the current conductivity reading. Adjust the conductivity reading to match the actual conductivity value of the standard.

5. Repeat for additional standards if there are any.

6. Press Enter to accept the calibration or Back to discard it.

5.3.3 Cell Constant

As explained above this procedure substitutes actual calibration with the input of the known cell constant. One might assume that this is the same cell constant value input during the Setup procedure. However, the actual cell constant of the probe is likely to be different from the nominal cell constant. For instance, the cell constant for a probe with nominal cell constant 1.0 cm^{-1} may actually be 1.05 cm^{-1}. If the actual cell constant is known, then this calibration option allows one to input it.

1. Select Cell Constant.

2. In the next screen enter the cell constant. Possible values are 0.01 to 999 cm^{-1}.

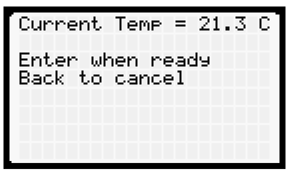
3. Press Enter when done.

4. Press Enter to accept or Back to cancel.

5.3.4 Temperature

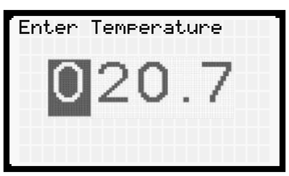
The temperature dependence of conductivity is more pronounced than it is with pH or ORP. Temperature calibration is therefore critical.

1. Select Temperature.

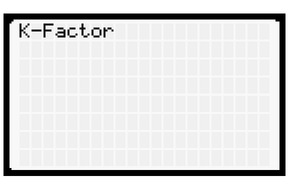


2. The screen displays the current temperature reading. Make sure the temperature reading has settled down. Keep in mind that most temperature elements in pH probes are encapsulated inside the probe, which results in a temperature lag of several minutes for the element to equilibrate with the temperature of the solution. As previously stated temperature calibration can be done in air.

3. Temperature calibration is similar to manual pH calibration. When the temperature reading settles down press Enter. Adjust the temperature reading to match the actual temperature. Press Enter when done or Menu to go back to the top menu.



5.4 Flow (Exclusive to Input 1)



5.4.1 About Flow Calibration

There is no actual calibration procedure for a flow meter. The K-factor supplied by the manufacturer sets the conversion between the meter's pulse frequency and velocity of water flowing past the probe. The latter is proportional to the flow rate, with the proportionality constant dependent on the cross-sectional area of the pipe. The inner diameter of the pipe therefore allows the flow sensor manufacturer to convert the fluid velocity (e.g. cm/sec) into a flow rate (e.g. cm^3/sec).

For most applications the K-factor supplied by the manufacturer and is sufficient to yield accuracy of better than 5%. For greater accuracy one can determine the actual K-factor by measuring the time it takes to fill a container with a known volume of water.

5.4.2 Flow Calibration

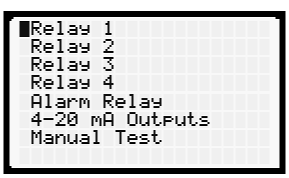
To input the K-factor:

1. Select Input #1 – Flow
2. Select K-factor
3. Enter the K-factor. It's important that the flow units of the K-factor are the same as the units selected during setup. If they are different then go back to Setup and change the units. Alternatively, one can perform unit conversion arithmetic to ensure that the K-factor entered has the units selected during setup.
4. Press Enter.
5. Press Enter again to accept the K-factor or Back to cancel.

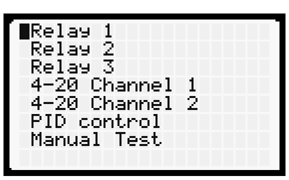
6 Output

The AM-2252 has two output modes:

1. Five dry contact relays, one of which is the alarm relay
2. Three isolated 4-20 mA outputs



The AM-2250 has three dry contact relays and two isolated 4-20mA outputs.

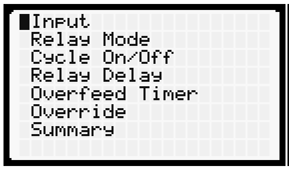


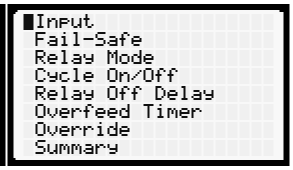
6.1 Relays

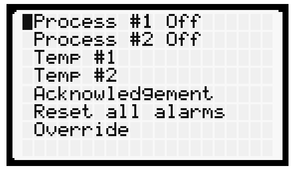
The AM-2252 is equipped with five relays. Three relays give users the capability of controlling four processes and a physical alarm.

Note: All instructions assume a relay is wired as normally open (NO). If a relay is wired normally closed (NC) then activate or open should be reversed, i.e. deactivate or close.

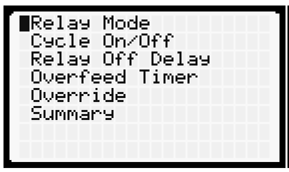
AM-2252: Relay 1, 2 Relays 3, 4 Relay 5

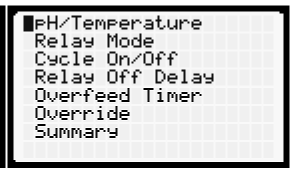






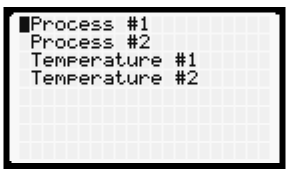
Am-2250: Relay 1, 2 Relay 3





6.1.1 Input (Relays 1, 2, 3, and 4 of AM-2252)

Allows you to select which input is controlling the relay. The options are:



Only one can be selected.

6.1.2 Relay mode

There are three relay mode available: rising, falling and range alarm:

1. A rising process is one that triggers a relay when the process value rises above the set-point.
2. A falling process triggers a relay when the process value drops below the set-point.
3. A range alarm is triggered when the process value is (a) either above the high set-point or below the low set-point or (b) inside the two set-points. In most applications it is an out-of-range alarm.

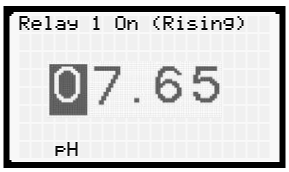
For rising and falling setpoint there is a second setpoint at which the relay deactivates. The gap between the set-point and the deactivation point is the dead-band. For instance, if you may be controlling a process whose pH naturally rises. If you want to lower the pH when it reaches pH 9 then set the relay set-point to 9. Presumably, at pH 9, a relay closes and starts a pump, which dispenses acid to bring the pH back down below 9. The pH value at which the relay opens again must be less than 9. If it is too close to 9.0, e.g. 8.9, the chemical pump will cycle on and off too frequently. Even more problematic is the relay activating before the pH has a chance to equilibrate. The result is that the process is never stabilizes. For these reasons the relay deactivation must be sufficiently below the activation, e.g. pH 8.0 in this menu figure below.

For obvious safety reasons, the relays of every new 2252 are deactivated. The menu selection, None, signifies this choice. Selecting None is the fastest way to remove an unwanted relay setting. The following describes the process for setting a relay in one of the three possible modes in the Relay menu.

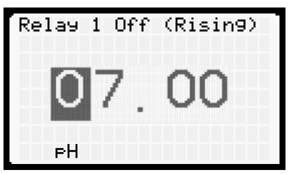
6.1.2.1 Rising Process

1. Select Rising. A relay cannot be set for a rising process AND a falling process. If you previously set a relay for a falling process and you set it again for a rising process, then the falling process mode automatically turns off.

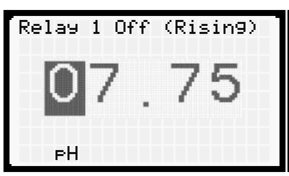
2. Enter the value of the process variable (e.g. pH) at which the relay turns on, i.e. the set-point. Press Enter to accept this value.

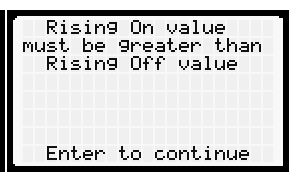


3. Enter the value of the set-point at which the relay turns off. Press Enter to accept this value. As explained above the off-value must be lower than the on value.

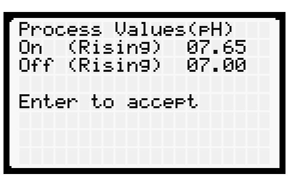


4. If you choose an off-value that is higher than the set-point the following warning message appears.





5. Confirm by pressing Enter.



6.1.2.2 Falling Process

The configuration process is identical to rising process (section 6.1.2.1) except that the on setpoint must be lower than the off setpoint. As stated above, a relay cannot be set for a rising process AND a falling process. If you previously set a relay for a rising process and you set it again for a falling process, then the rising process mode automatically turns off.

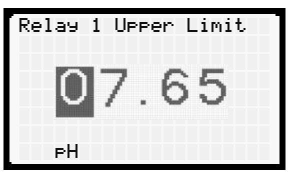
6.1.2.3 Range Alarm

The Range Alarm mode setting is used—as the name implies—typically as an alarm which is activated if the process value is either **outside** a specified range or **inside** it. In most applications it will be used for out-of-range process values. When the relay is normally open (NO) the range alarm is out-of-range. When the relay is normally closed (NC) the range alarm is in-range.

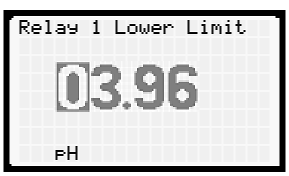
Unlike rising or falling processes there are no “off” set-points. To prevent an excessively frequent cycling of the relay consider configuring Relay Off Delay (Section 6.1.5)

1. Select Range Alarm.

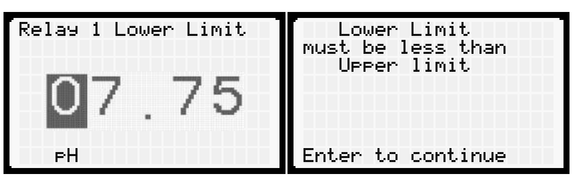
2. Enter the value of the upper set-point. Press Enter to accept this value.



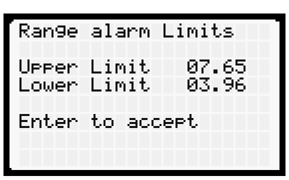
3. Enter the value of the lower set-point. Press Enter to accept this value. The lower value must be lower than the upper value.



4. If your lower value is higher than your lower value the following warning message appears.



5. Confirm by pressing Enter.



6.1.3 Fail-safe (Relay 3,4 of AM-2252)

Fail-safe revert NO contact such that one can use relays 3 and 4 in NC configuration so long as there is power. Please note, that input power is lost or disconnected, the relay will be held in NO position.

6.1.4 Cycle On/Off

The cycle on/off parameter is very useful for preventing overshoot of a process controlling action—usually the dispensing of a chemical. If the response time of the process to the added chemical is slow compared to the rate at which the chemical is being introduced, then the process variable will overshoot its target (as described in Section 6.1.1 for a rising process).

Choosing set-points for activating and deactivating the relay is a first line defense against overshoot. The cycle on/off feature is a second line defense. As Figure 6-1 shows, the duty cycle is expressed as the duration over which the relay is activated divided by the total time of the complete on-off cycle. If the relay is on for 10 seconds and off for 30 seconds, then the complete cycle is 40 seconds and the duty cycle is 25%. The slower the response time of the process to the added chemical (or other process control mechanism) the lower the duty cycle or time-on should be.

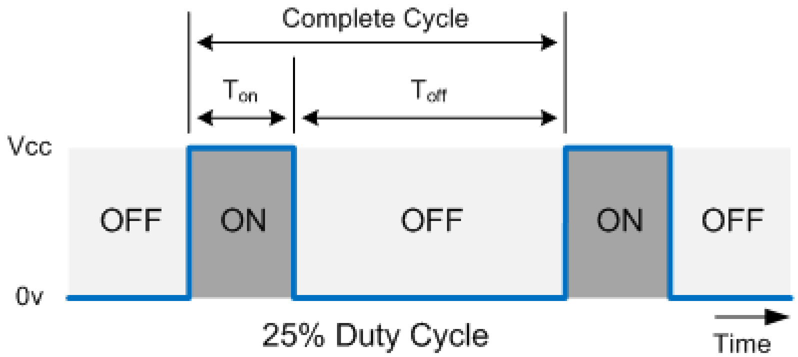
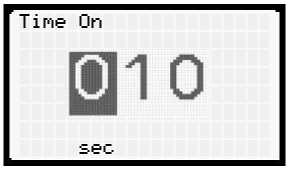


Figure 6-1 Duty cycle with the On cycle being ¼ of the complete cycle. An example of a duty cycle expressed in seconds is 10 seconds on and 30 seconds off.

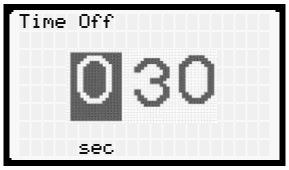
6.1.4.1 Configuring Cycle

The controller ships with cycle on/off deactivated.

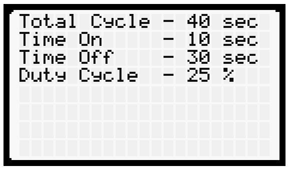
1. Select On.
2. Enter the value for the amount of time, in seconds, the relay is on (activated). Press Enter to accept this value.



3. Enter the value for the amount of time, in seconds, the relay is off (deactivated). Press Enter to accept this value.



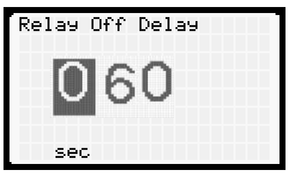
4. Press Enter to confirm the displayed value or cancel by pressing Back



6.1.5 Relay Off Delay

There are instances in which a process value can initially spike upon addition of a chemical. An example is acid that is dispensed very close to a pH sensor such that, when the acid is first dispensed the probe pH drops precipitously and then rises as the acid is mixed. This is the opposite of a problem that occurs if the probe is far from the injection point such that there is a long delay in the change in pH and that calls for cycle on/cycle off control. Placing the sensor in the correct position would preempt the need for a relay delay but, for systems that are not easily modified, this option is a good solution.

1. Select On.
2. Enter the value for Relay Off Delay, the amount of time the relay is off (deactivated), in seconds. Press Enter to accept this value.

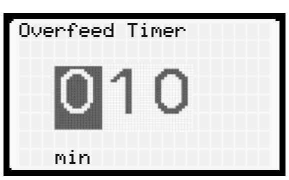


6.1.6 Overfeed Timer

If a probe malfunctions it is possible for a relay to activate and stay permanently activated. Using the above example of a relay connected to an acid dispenser: The relay is programmed to activate at 9 and deactivate at 8. If the probe failed and remained stuck at pH 8 or higher, then the chemical pump that dispenses the acid would operate until it emptied out the entire container of acid. Perhaps worse is that the actual pH of the process would drop to a dangerously low level and cause serious damage to the processing equipment.

The overfeed timer option prevents this. By specifying the maximum amount of time that a relay can remain activated, the damage caused by a faulty probe signal is contained. Although this feature is turned off by default, we strongly recommend always setting this option.

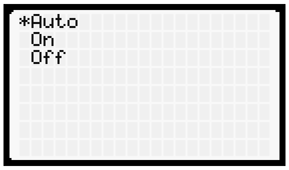
1. Select On.
2. Enter the value for the maximum time, in minutes, the relay can remain activated.



3. Press Enter to accept this value.

6.1.7 Override

This simple control manually forces the relay on or off. It can be used as a switch to turn the process control function off and on and is normally used for either testing or emergency purposes.



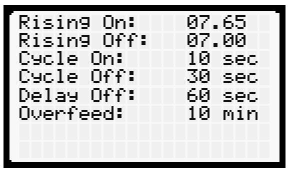
Auto: Disable override so that the relay behaves as set up.

On: Activate the relay.

Off: Deactivate the relay.

6.1.8 Summary

The Summary menu item lists only configured relay parameters described in this section



Press Back or Enter to continue.

6.1.9 Relay 5 (Alarm relay)

The alarm relay is quite different from other four relays. The main difference is that it can be configured for more than one input, i.e. you can trigger the relay with Process #1 and Temperature #1 and Process #2 and Temperature #2.

Each input is configured individually and there is an easy way to clear all alarms without erasing other settings – just click on "reset all alarms".

Acknowledgement option allows to lock alarm until an operator clear it manually. There are two ways to acknowledge the alarm:

1. From the keypad
2. Using a totalizer reset switch (see page 18 for wiring)

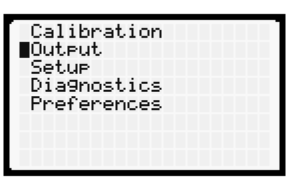
6.2 4-20 mA Output Channel Configuration

The AM-2252 hosts three 4-20 mA outputs on the power circuit board. Channel outputs can be configured linearly for process or temperature in pH, ORP, or conductivity mode.

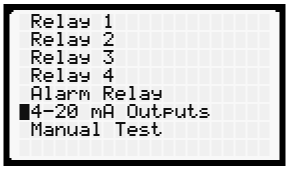
For either output the 4 mA and 20 mA values can be set to any value. Customizing the range maximizes the accuracy of the 4-20 mA signal.

6.2.1 Configuring Channels for Linear Process

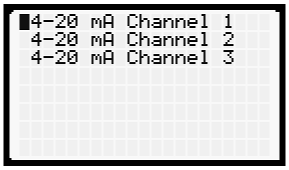
1. From the main menu select Output



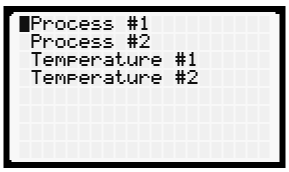
2. Select 4-20 mA Outputs



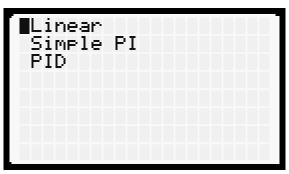
3. Select the channel you wish to configure



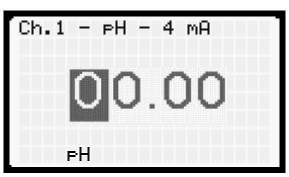
4. Select Input



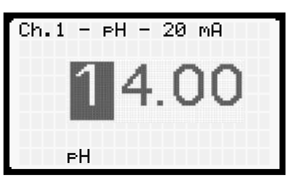
5. Select Linear



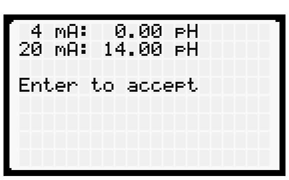
6. Enter the value of the process variable that corresponds to 4 mA.

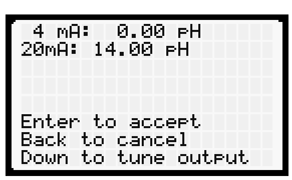


7. Enter the value of the process variable that corresponds to 20 mA. This is usually the highest value you expect to observe. Its default value depends on the setup parameters for the probe.



8. The next screen summarizes your choice of 4 and 20 mA values

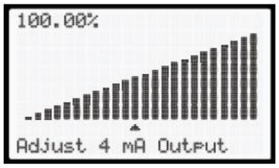




9. Press Enter to accept this value or Back to start over

Note that the 4 mA value can be higher than the 20 mA value. This simply reverses the direction of the 4-20 mA signal as the process variable changes.

10. If for some reasons the 4-20mA output is not measured accurately on the measuring device (PLC or datalogger), one can adjust the factory 4-20 mA calibration by pressing Down Arrow (↓) button on the previous screen.



11. Once in the "Tune output" screen, the controller is set to the fixed 4.00 mA output. Use Left or Right arrow buttons to decrease or increase the mA output while comparing it to the measurement on the measuring device (PLC or datalogger).
12. Repeat the process for the 20.00mA point.
13. Press Enter to store both the linear output configuration and the tuned 4-20mA output setting.

6.2.2 Configuring Channels for Temperature

Steps for temperature will remain the same as 6.2.1. Instead of being in terms of pH, enter data for temperature.

6.2.3 Proportional Control

Some pumps, especially metering pumps, can be controlled by a continuously variable 4-20 mA input from a transmitter. This type of control is called **proportional control** because the magnitude of the current output is proportional to the difference between the set-point of the process value and the actual process value, aka the **error**.

Take the case of the process whose pH naturally rises and is controlled by dispensing acid (see Figure 6-2 below). For control by a relay described in Section 6.1.1 the relay-on pH value was set at 9.0 (red line) and the relay-off value was set at pH 8.0 (green line). The process would thus cycle between pH 8.0 and 9.0. Although this is the most common way to control, it is not the most efficient one. In the example below the pH reaches 9.0, which starts the acid pump at maximum output. The acid takes time to dose and mix and, as a result, the pH value decreases gradually. As it approaches pH 8.0 the pump is still working at maximum output and results in chemical overdose (yellow area). This effect could be minimized by using the Cycle and Relay Off Delay features, described in sections 6.1.3 and 6.1.5.

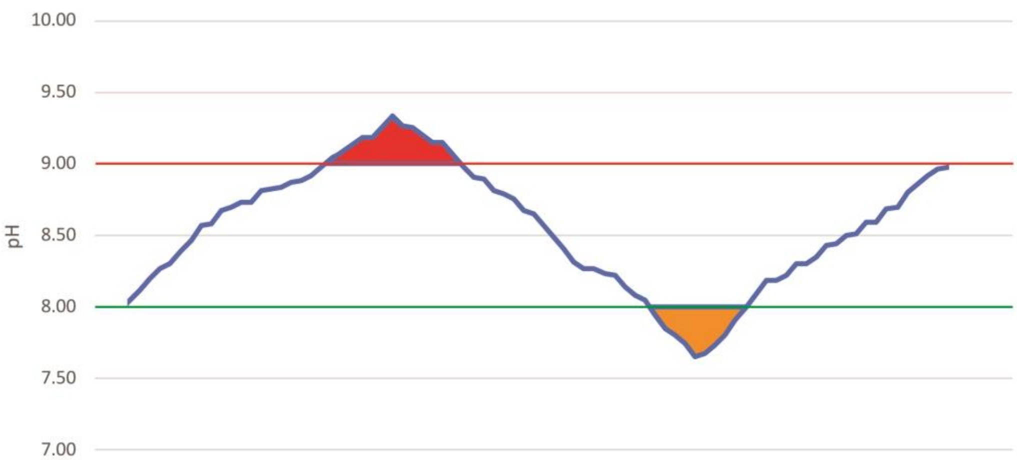


Figure 6-2 Example of pH control using relay.

Proportional control ensures that the process value reaches the set-point in the most time efficient manner. Using the pH example above: The pH set-point is 9.0. As the pH rises above 9.0 the error increases and the corresponding current output increase proportionally. At 9.01 the output might be 4.01 mA. At 12.0 the output might be 20 mA. The chemical pump therefore changes it delivery rate according to the difference between the process value and set-point.

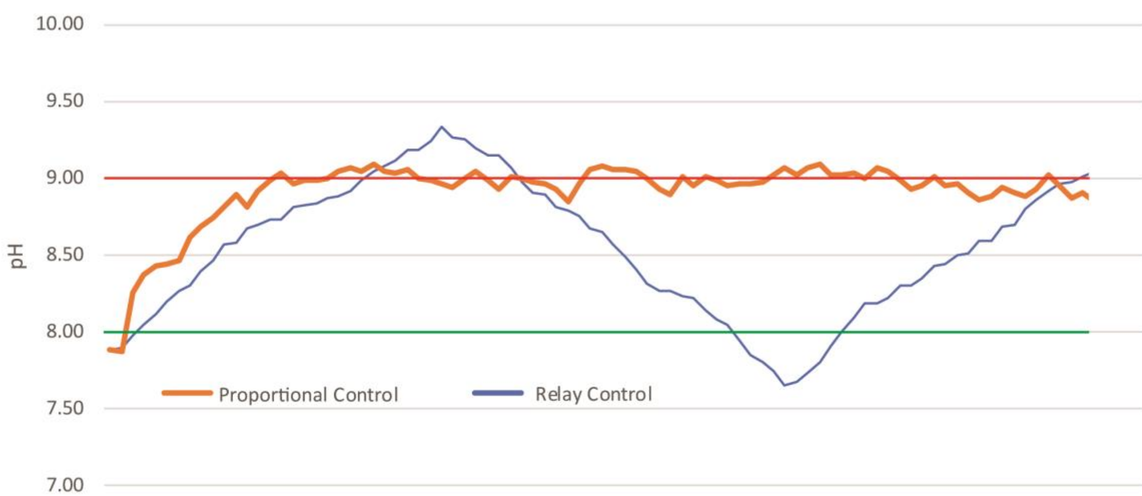


Figure 6-3 Example of proportional control

Note: The proportional control can only use one dispensing device (either acid or base). If process can naturally vary both directions consider using second 4-20 mA output or a pair of relays.

6.3 PID Control

PID is only available for process outputs. PID control extends proportional control to include two additional terms. PID stands for Proportional-Integral-Derivative which are defined as follows:

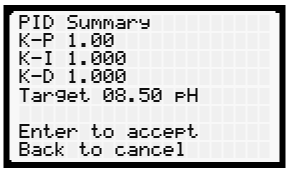
- **Proportional**. This component of the current output is proportional to the process error, difference between the current process value and the target.

- **Integral**. This component of the current output is proportional to the integral of the error. This is roughly equivalent to the sum of the error going back in time.
- **Derivative**. This component of the current output is proportional to the instantaneous change in error.

You can choose one to three of the three components for P, PI, PD or PID control. Leaving out one of the three terms requires setting the desired coefficient for that that term to zero.

To set up PID control requires setting values for the three coefficients to the three terms:

1. Turn PID control On.
2. Set the value for K_P. Press Enter to accept it.
3. Set the value for K_I. Press Enter to accept it.
4. Set the value for K_D. Press Enter to accept it.
5. Set the value for the PID target, which is the desired value of the parameter (in the example above, 8.5).
6. Confirm PID summary screen by pressing Enter.

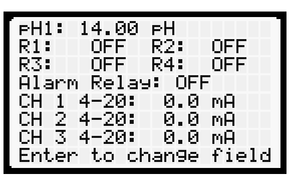


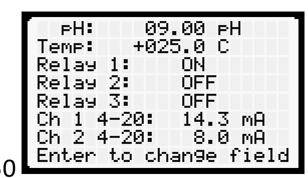
Setting up PID control takes considerable skill and should not be done by "amateurs." Choosing the wrong PID parameters can cause a process to overshoot wildly and never reach equilibrium.

6.4 Manual Test

Manual Test allows you to ensure that the outputs operate as intended without requiring the probe to deliver the actual output needed to test a relay or 4-20 mA output. For instance, if you set a relay for a rising process that activates when the pH reaches 9.0 you might test it by immersing it in pH 9.1 solution and verifying that the relay activates. Manual testing enables this test to be done without the solution. Simply dial in the pH value to 9.0 and observe the state of the relay on the screen. Temperature values can also be simulated. Press Enter to switch inputs between two processes and two temperatures.

The Manual Test screen also displays 4-20 mA output values. In the example below (right screen for AM-2250) Relay 1 was set to activate at pH 9.0. Relays 2 or 3 were either set to activate at a higher pH, a falling process below 9.0 or were not turned on at all. The Channel 1 4-20 mA corresponding to pH 9.0 is 14.3 mA (based on the 4-20 range corresponding to 0 to 14). The 4-20 Channel 2 mA corresponds to the temperature (Based on the 4-20 range corresponding to 0 to 100C).

AM-2252 

AM-2250 

Note: Manual Test cannot simulate Relay Cycle, Relay Off Delay, Overfeed, PID.

If the 4-20mA have not been configured, the output will be 0 mA.

7 Operation

7.1 Run Mode

Press Run from just about any menu to set controller in operation mode. The screen for “Run” mode shown on Figure 7-1 below.

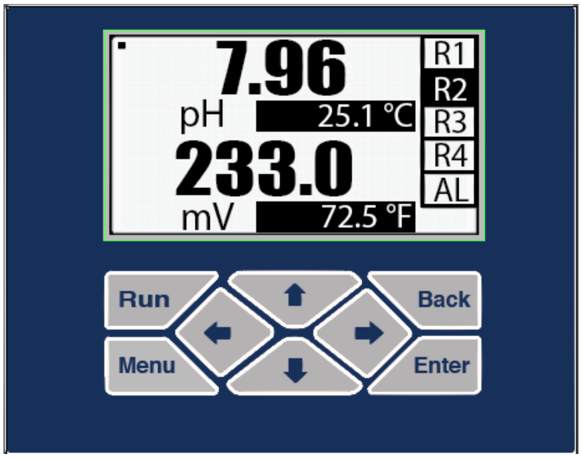


Figure 7-1 AM-2252 in "run" mode

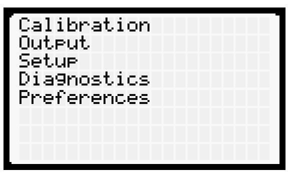
7.2 Display Features

The screen refreshes every second. A blinking dot in the top left corner indicates that measurements are occurring. The blinking dot also confirms that the controller is operating even though the process and temperature values may be so stable that they appear to be “frozen.” (if the process value changes too frequently consider increasing “Damping”.

The process values are displayed in the middle. The font size and number of decimal points are set to minimize user error. The temperature reading is displayed under process values in the user’s selected units. All units of measure will contain one decimal point. The AM-2252 also displays relay indicators on the right side: if a relay has not been activated an empty box is displayed, as shown for R1,R3, R4 and AL in Figure 7-1 above. If a relay has been activated the box appears solid, as shown for R2 on Figure 7-1.

7.3 Maintenance

To perform a calibration or change the probe configuration press the Menu button.



As soon as main menu appears on the screen the controller automatically activates “Hold” mode. While you are in menu screen:

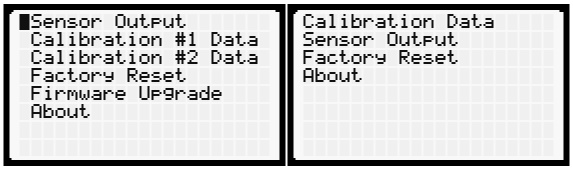
- Process and temperature measurements are paused.
- Activated relays are deactivated.

- 4-20 output(s) freeze on the last reported value.

Placing relays on hold during calibration is essential as calibration standards might activate their target (usually a pump). If, however, a relay must be kept activated during calibration/maintenance time activate Override (described in section 6.1.7)

8 Diagnostics

The Diagnostics menu has five (AM-2252) or four (AM-2250) options.



8.1 Calibration Data

This menu has one screen, which displays the results of the latest calibration.

- **pH**: Number of calibration points (2 or 3), slope, offset, efficiency and calibration temperature.
- **ORP**: Offset and calibration temperature.
- **ISE**: Number of calibration points, slope, and offset.
- **Conductivity**: Number of calibration points (1 – 16), measured cell constant, calibration temperature and temperature coefficient.
- **Flow**: K-factor.
- **4-20mA**: display 4mA and 20mA points.

8.2 Sensor Output

This Diagnostic screen displays the raw signal coming from a probe. It is invaluable for diagnosing probe problems.

- **pH**. A pH probe outputs a voltage. The temperature element (if present) outputs a resistance. For diagnosing a problematic pH probe the voltage output should be (7.0 – pH) x 59 mV within about 50 mV. A smaller value indicates a low efficiency, which may be ameliorated by cleaning the electrode, changing the reference solution or changing the salt bridge. If the probe output does not change upon changing from one calibration solution to another then the probe is dead.

  The resistance of the temperature element should be close to the nominal resistance, which is usually 1100Ω (for a pt1000RTD). A resistance reading far removed from its nominal value is indicative of a defective element or the improper selection of the element

- **ORP**. An ORP probe also outputs a voltage. The temperature element (if present) outputs a resistance. Unlike a pH probe the ORP value is not temperature compensated.

  The resistance of the temperature element should be close to the nominal resistance, which, depending on the element is usually 1100Ω (for a pt1000RTD). A resistance reading far removed from its nominal value is indicative of a defective element.

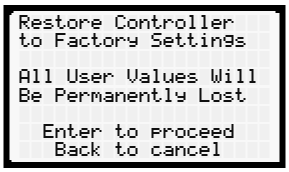
- **ISE.** An ISE probe also outputs a voltage. The temperature element (if present) outputs a resistance.
- **Conductivity**. A conductivity sensor measures resistance (which is inversely proportional to conductance). The temperature element outputs resistance as well.

The resistance of the temperature element should be close to the nominal resistance, which, depending on the element is usually 1100Ω (for a pt1000RTD). A resistance reading far removed from its nominal value is indicative of a defective element.

- **Flow**. A paddle-wheel or magnetic flow meter outputs a pulse train. The raw output is the pulse frequency. There is no temperature measurement.
- **4-20mA.** This type of sensor is expected to change its output between 4 and 20 mA. The current mA reading will be displayed. Temperature is disabled for this type of sensor.

8.3 Factory Reset

This feature restores the controller to its factory default state. It resets all user calibrations, 4-20 outputs, tuning, and relay setpoints values.



8.4 About

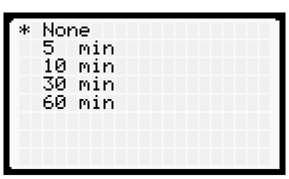
This feature displays the current firmware version and its release date. If you experience issues with your analyzer you will want to know the firmware version running before contacting us.

9 Preferences

The Preferences menu has three options that only affect the user experience.

9.1 Auto Return

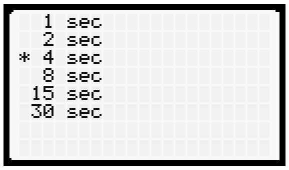
This feature allows you to return the 2250 to Run mode if you walk away from the 2250 while exercising a menu item. The choices are:



If you choose “None” then the menu which was active when you left will be active indefinitely. If you choose one of the other options, e.g. 10 min, then the screen will revert to the run screen after 10 minutes of inactivity. This feature is invaluable if the 2250 is transmitting data to a PLC or SCADA. While a menu item is being exercised the controller ceases to send data, which can cause an undue alarm or relay at the PLC or SCADA.

9.2 Damping

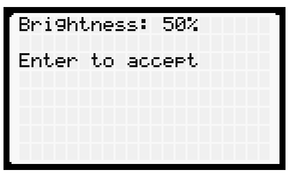
Signal averaging, aka "damping," smooths fluctuating process values—both on the display and on the 4-20 mA output. The options are shown here:



The signal averaging is a rolling average. For example, if damping is set to 4 seconds, then each process value data point equals the average of the preceding four points. The default value is 4 seconds.

9.3 Backlight

This option allows you to change the brightness level of the LCD screen. It is useful for matching the screen brightness to the ambient brightness. For darkened interiors, turning down the brightness helps prevent eye strain. Adjustment is done by pressing the ↑ or ↓ buttons while in that menu screen. Press Enter to confirm or Back to cancel.



10. Certifications

10.1 TÜV Certificate:

TÜV certification ensures that the product follows safety and quality criteria on the international level. TÜV SÜD America Inc. is an OSHA recognized NRTL (Nationally Recognized Testing Laboratory), which is a widely recognized trademark that ensures trust and quality in a product. These tests check thoroughly for defects or potentially dangerous materials.

Test specification:

IEC 61010-1:2010 (Third Edition), EN 61010-1:2010/AMD1:2019, UL 61010-1:2012/ + R:2015-07 + R:2016-04 + R:2018-11-16 + R:2018-11-21 + R:2019-07, CAN/CSA-C22.2 No. 61010-1:2012/ + U1:2015-07 + U2:2016-04 + A1:2018-11

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OSHA NRTL

TÜV SÜD America

CERTIFICATE

No. U8 087429 0003 Rev. 00

Holder of Certificate: **Water Analytics, Inc.**
100 School Street
Andover MA 01810
USA

Certification Mark: C TÜV SÜD US

Product: Electrical equ. for measurement, control and laboratory use
Multi-Parameter Input Controller

This product was voluntarily tested to the relevant safety requirements referenced on this certificate. It can be marked with the certification mark above. The mark must not be altered in any way. This product certification system operated by TÜV SÜD America Inc. most closely resembles system 3 as defined in ISO/IEC 17067. Certification is based on the TÜV SÜD "Testing and Certification Regulations". TÜV SÜD America Inc. is an OSHA recognized NRTL for USA and a Standards Council of Canada ISO/IEC 17065 accredited Certification body for Canada.

Test report no.: 72167445-000

Date, 2022-03-10

(Glenn H. McLaughlin)

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OSHA NRTL

TÜV SÜD America

CERTIFICATE

No. U8 087429 0003 Rev. 00

Model(s):	**AM-2252 Dual Input Controller** **AM-2250 Controller**
Brand Name:	**AquaMetrix by Water Analytics**
Tested according to:	CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11 UL 61010-1:2012/R:2019-07

Parameters:

Rated Input Voltage:	110-240 VAC
Rated Frequency:	50-60 Hz
Rated Input Power:	3W max
Degree of Protection:	IPX4

Model Differences:

- The AM-2250 is electrically identical as the AM-2252 except that the main PCB is not fully populated.

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