SCALE-TRON
Automation, sensors and weighing systems

AQUAMIX 2270D
MOISTURE SENSOR

USER MANUAL

Firmware: 1.0.3
GUI Ver. 1.0.3
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Should you have any difficulty in installation, operation or maintenance of you AquaMix 2270D Moisture Sensor, our staff is available to help you during normal operating hours and at any other time by special arrangement.

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1 INTRODUCTION

1.1 Importance of Accurate Moisture Measurement

The proper ingredient proportions are needed to obtain a good quality mix. Water plays a major factor in the concrete's strength and workability if the proper proportions are not added correctly.

The AquaMix 2270 D mixer sensor provides an accurate measure of the moisture in the materials as they enter the mixer, informing the controller to add the required amount of water to obtain the desired results. Using microwave technology eliminates the errors associated with resistance and capacitance methods. The system is independent of impurities in the materials and does not require frequent recalibration. It is easily installed in the mixer floor and can be interfaced with either analog or digital systems.

Microwave energy is absorbed by the present water. By sending a microwave beam into moist aggregate and measuring the energy returned, the quantity of water in the material can be measured precisely. Accuracy is further enhanced by averaging the readings during the mixing cycle.

1.2 Faceplate Wear

The ceramic faceplate is made of a very strong material capable to withstand more than 10 thousand batches using abrasive aggregates.

The actual faceplate wear varies with the type of material and mounting position, but in general the life span is several to many years.

Wear in the faceplate results in an off-zero error, noticeable as an equal error at all moisture levels. It can be corrected by following the **Analog Output Offset** adjustment procedure in Section 3.2

All AquaMix parts are replaceable. The complete unit must be returned to us for replacement of the body, sensor, or faceplate.

1.3 Accuracy Checking

It is often desirable to know the measurement accuracy of the AquaMix sensor, in order to compare it with other sensors or to calculate the effects of errors on the process. This testing can give misleading results, however, and should never be used as proof of accuracy or to compare one system with another. The reason is that it is impossible to take a perfect sample every time. Material in the mixer may be wetter on one side than the other. The sensor measures material as it moves in the mixer and will average out the wetter & dryer material, giving a better average than the typical manual sample.

1.4 Calibration

The AquaMix is factory calibrated to give accurate readings, but may require re-calibration once installed, depending on the method of use.

The signal from the sensor is already conditioned and has a linear relationship to moisture. It should be scaled as necessary to provide the desired action when adding water. The water dosing controller, either stand alone or embedded in a batching computer, should perform the necessary scaling adjustments to the incoming signal.

Although not always necessary, changes to the calibration parameters are possible using the calibration screen. If any changes are required, they should preferably be made in the water dosing controller or batch computer. If acceptable results are not obtained after this, then changes to the internal calibration can be made to the unit itself.

Generally speaking, the only adjustment necessary is when the face plate wears sufficiently to cause a large offset change.

Refer to **Performing a Calibration** for a detailed procedure on calibrating your AquaMix sensor.

2 INSTALLATION

2.1 Mechanical

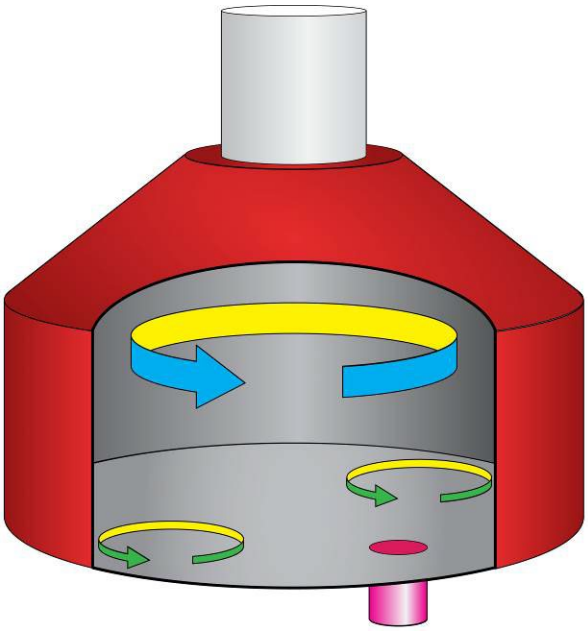
The AquaMix sensor can be installed in a variety of mixers. The installation is basically the same for each type, yet the location is critical for best results.

Ideally, the sensor should be located so that the sensor sees the material as it is mixed. Depending on the mixer type, the location will vary, but the basic installation is the same. We have detailed the location in the 3 typical mixer types; Pan, Ribbon, and Twin Shaft. Refer to the appendix, Section 6.0, for a drawing of each of these installations.

A hole is then cut, and the mounting flange welded to the mixer. The sensor is then installed, adjusted, and wired.

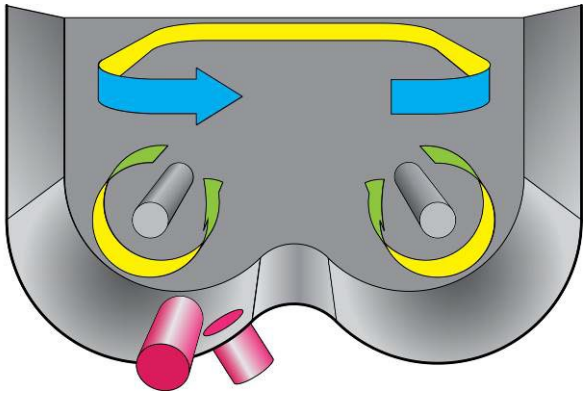
Refer to the diagrams in the appendix for additional aid.

2.1.1 Pan or Planetary mixer



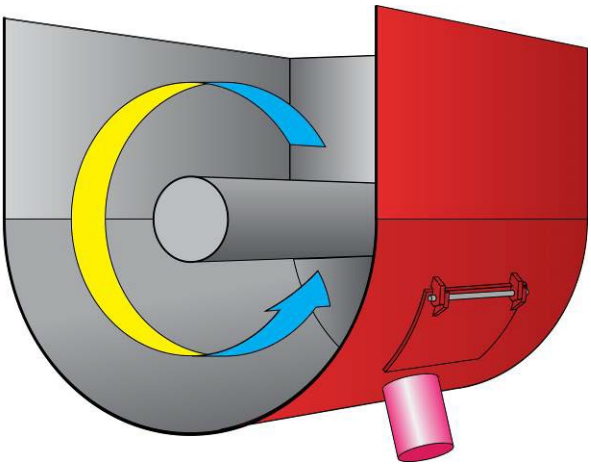
The AquaMix Sensor is typically installed in the floor of a pan type mixer. It should be placed so that it is away from walls, spray bars and material charging chutes. If possible, place it near or below an inspection hatch. It should be placed about 2/3rds of the distance from the center of the mixer to the outer wall.

2.1.2 Twin Shaft mixer



The AquaMix Sensor is typically installed in the end-wall of a twin shaft mixer, in the pressurized zone caused by the mixing process. It should be placed as low as possible on the end-wall.

2.1.3 Ribbon or Spiral Blade mixer

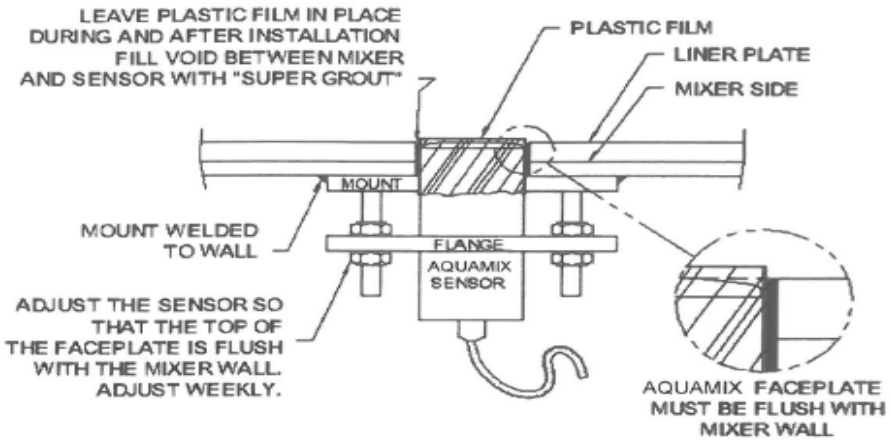


The AquaMix sensor is typically installed under the mixer's door location. It should be placed as close as possible to the door opening, while not impeding the material delivery from said door.

If not already done so, remove the AquaMix sensor from the mounting base. Take care, not to remove the plastic film affixed at the front of the sensor.

Once the location is decided, a hole must be cut, and a flange welded in place.

2.1.4 General



Before installing the sensor ensure that the hole through the liner plate & mixer floor, plus the mounting ring beneath, is clean and dry. Slide the sensor and securing flange into the hole, while aligning the four studs with the holes on the securing flange. Add the remaining four nuts to hold the AquaMix sensor in place. Take care, not to remove the plastic film affixed at the front of the sensor.

Place the mounting flange against the mixer body, so that the hole aligns with the desired sensor location. Ensure there is enough room around the flange to weld, and work comfortably.

Cut a 4” diameter hole at the desired location. Cut through both the mixer body, and the liner plate. Use a plasma cutter, laser cutter, or water jet to cut the hole in the liner plate.

Center the mounting flange over the hole, so that the hole in the mounting flange and hole in the mixer are concentric. Once placed, weld the mounting flange to the mixer. Weld all four sides of the mounting flange.

Each post should have one nut installed, at about 3” from the mounting flange.

Measure the distance from the inside face of the mixer liner plate to the front of the first nut. This will determine the securing flange placement.

If not already installed, install the securing flange (circular flange) to the AquaMix Sensor. Secure the flange so that the distance from the sensor’s face plate to the flange is the same as the distance from the mixer liner plate to nut distance, approximately as obtained above. Take care, not to remove the plastic film affixed at the front of the sensor.

The sensor needs to be properly positioned in the mixer. The faceplate must be flush with, or slightly below the level of the liner plates. This ensures the mixer paddles will not hit the sensor, while still ensuring the sensor faceplate is in contact with the material.

There is a gap between the sensor and the mixer body and liner plates. This gap is filled with the ‘Super Grout’ supplied. It is important to fill the gap between sensor & liner plate so that stone chips cannot lodge in the gap. These chips can damage the ceramic faceplate when they are hit by the mixer blades.

The epoxy grout supplied is a special blend of extremely hard materials which resist wear from the materials in the mixer, thus providing a flush surface right up to the faceplate edge. The mixer liner plate and gap between plate and sensor must be dry before applying the epoxy grout.

Ensure that the sensor is wrapped with at least 1 thickness of polyethylene film, secured with masking tape and install it in the mixer so that the edges of the faceplate are level with the surface of the liner plate. It should be dropped down after the epoxy is hardened to make the top of the faceplate level with the liner plate. Check that the polyethylene film extends down to the surface of the mounting ring so that no epoxy can come into contact with the sensor body.

Empty the contents of the small container into the large container and mix thoroughly for 2 minutes or more. Force the mixture into the gap between sensor & liner plate, pushing it down to fill the gap completely to the bottom. Using a wetted rubber glove or plastic bag, smooth the surface of the epoxy with a finger until it is smooth and flush.

Remove any excess from the sensor surface and liner plate, although the liner plate surface is not critical. Use the excess to fill other unwanted holes in the liner plate.

Check that the sensor can move inside the plastic film and allow to harden for 2 hours or longer. Trim the excess plastic film around the top of the sensor but leave it in the gap.

Reposition the sensor so that its highest point is level with the top surface of the liner plate; the edge should now be slightly below the edge of the epoxy grout.

The sensor's position can be adjusted with the 8 nuts on the four studs of the mounting flange. Adjust the sensor by loosening and tightening the nuts so that the faceplate is flush with, or slightly below the level of the liner plates. Once properly positioned, tighten the securing nuts.

The sensor is now ready for calibration and operation. At room temperature, the mixer can be filled 8 hours after the epoxy is applied. Gentle heat will speed the curing time, halving it for each 15°F (8°C) rise, approximately. Do not exceed 120°F (50°C) sensor temperature.

2.2 Electrical Connections

The AquaMix 2270 D microwave moisture sensor, is connected via a quick release connector and cable, to the batch controller or computer via a junction box.. It operates from 24 VDC and has analog and RS232/485 outputs. The standard cable length is 50ft, and other lengths are available.

The cable has 12 conductors (wires). Depending on the options chosen, and the intended use, various connections will be made. Make the connections only for your specific application.

Below is a table of the conductor and function:

TERM	CABLE WIRE COLOUR	FUNCTION
1	RED	Power, 24 VDC +
2	BLUE	Power, 24 VDC - (common)
3	BLACK	Digital I/O common
4	GREEN	Digital Input 1
5	ORANGE	Digital Output 1
6	WHITE	Common for RS232/485
7	RED/WHT	RS232 (Rx)
8	BLU/WHT	RS232 (Tx)
9	BLK/WHT	RS485 -
10	GRN/BLK	RS485 +
11	ORG/RED	Analog (4-20mA) common
12	WHT/BLK	Analog (4-20mA) output +
CASE	SHIELD	Ground

In all cases, ensure terminals #3 & 4 are jumpered together.

NOTE:

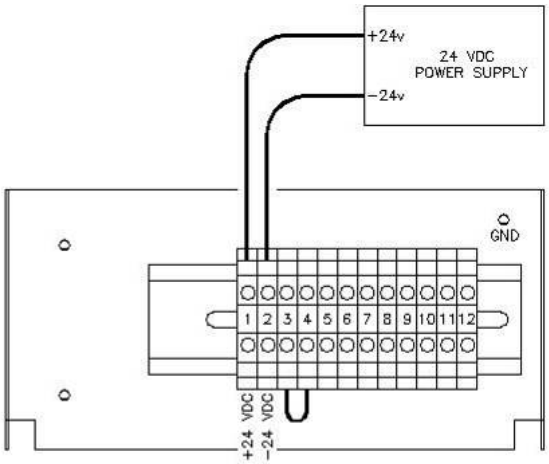
Care should be taken when grounding the AquaMix. Make sure a thick cable (at least #10 AWG) is run between the cabinet housing, the power supply for the AquaMix and the structure where the AquaMix is to be mounted, to assure a low impedance path for any power surge. Also, the ground from the AquaMix connection should be connected to the ground at its power supply.

2.2.1 Power connection

Regardless of the configuration & options present, the AquaMix sensor requires a 24VDC power source. Connect the red & blue conductors to a 24VDC power source:

RED to +24VDC

BLUE to -24VDC



2.2.2 Analog Output / Display

The AquaMix sensor may be connected to either a display or to the analog inputs of the controller. The display and controller may also be both connected at the same time, in series, as shown. The controller may need some re-programming to display the readings properly. Consult with your controller's manual.

Terminals 11 & 12 supply a 4-20 mA or 0-20 mA analog signal for either a display or a controller, or both.

By adding a 250 Ohm resistor across the + and – terminals (11 & 12), the signal is converted to 0-5 volts for use with voltage inputs (e.g. 0-5 volts). Use a 500 ohm resistor for 0-10 volts.

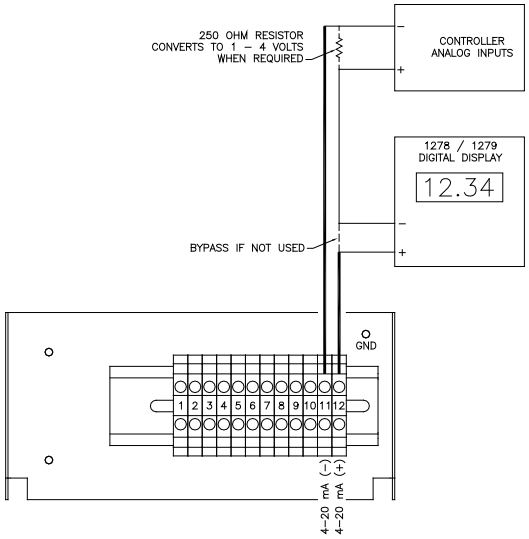


Figure 3: Analog connection

Power connections left out for clarity

2.2.3 Digital RS-232 Output & Programming Cable Connections

The AquaMix sensor is able to communicate via RS-232 connections. Connect to a PC or a controller as shown. This connection is used for programming and can be used for operation in single-drop mode. When multiple sensors are to be connected to a single port, use RS-485 mode.

Note: With RS-232, no hardware handshake connections are required, and the sensor must be at address #1.

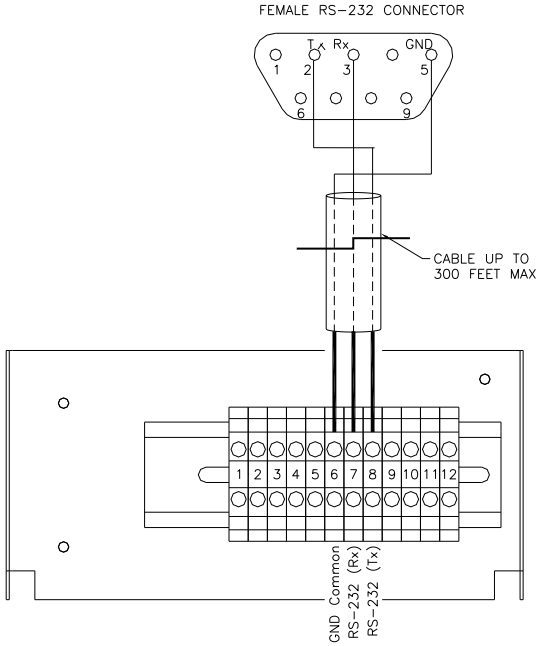


Figure 4: RS-232 output connections

Power connections left out for clarity

2.2.4 Digital RS-485 Output

The AquaMix sensor is able to communicate via RS-485 for long distances (up to 4000 feet) and multi-drop, up to 16 sensors on the same RS-485 cable.

The RS-485 connections cannot be used for set-up & calibration; use the RS-232 programming cable for this (see section 2.2.3)

Connect:
SHIELD to pin 5 on the RS-485 / RS-232 converter.
BLACK / WHITE to pins 1 & 3 on the RS-485 / RS-232 converter.
GREEN / BLACK to pins 2 & 4 the RS-485 / RS-232 converter.

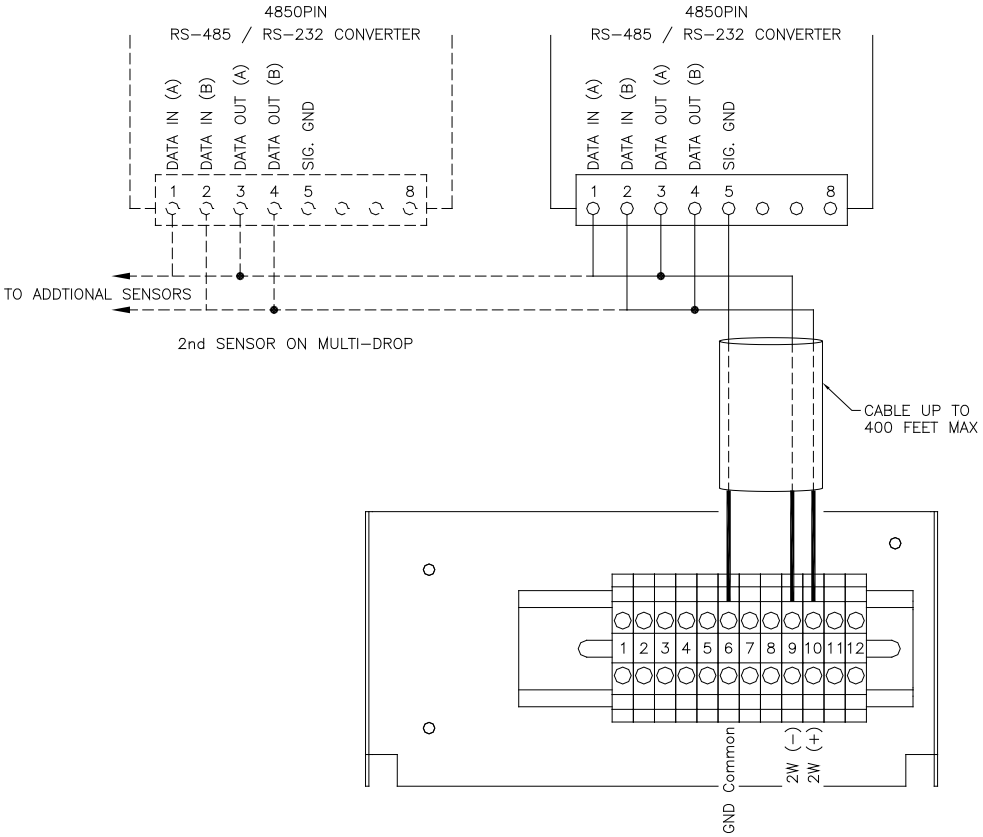


Figure 5: RS-485 output connections

Power connections left out for clarity

3 SOFTWARE & GUI INTERFACE

3.1 Initial Set-up

The following section describes the operation of each GUI screen/panel. The screens are organized in a manner similar to the tasks a user may perform.
Care was taken to make the screens as *User Friendly* as possible; however, the user must be aware of the features and mode of operation of the sensor in order to perform the desired task.

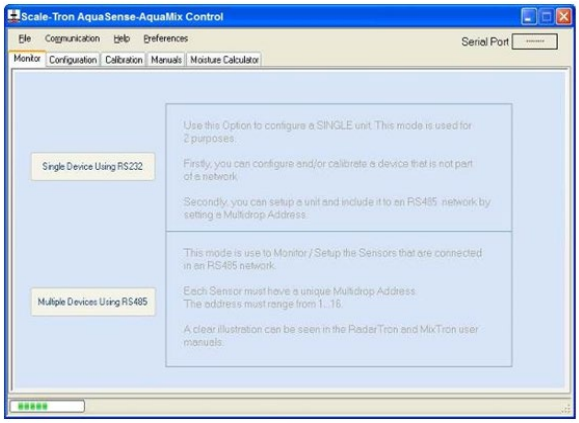
Insert the Flash drive into a USB port on your PC or Laptop and the AquaMix Initialization Setup application should start automatically.

Use the RS 232 protocol for the initial set-up.
Once the unit(s) are connected serially, and the cabling is verified, connect the RS232 or RS485 connector from the PC to the AquaMix.

3.1.1 Main Screen

Once the application is running, the Graphical User Interface (GUI) will appear. The screen is organized with a main menu and several Tabs.

The "Monitor" tab is used to enumerate and discover the sensors.

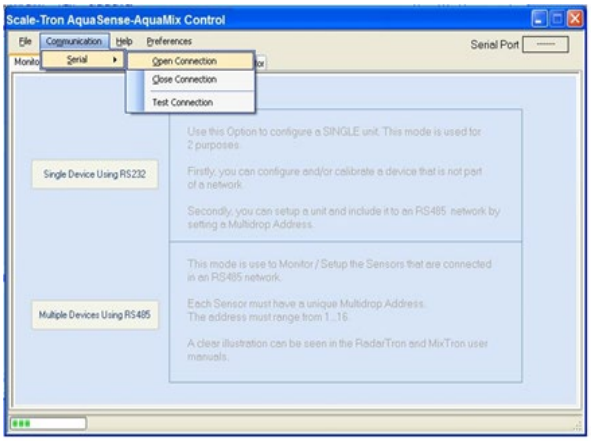


3.1.2 Opening a Connection

Before any communications can be performed, you must select the serial port that you will be using to configure/calibrate and monitor the sensors.

It is assumed that either an RS232 port (for a single unit) and/or an RS485 port (for multiple units), is available. Ensure they are connected & powered up.

If only a USB interface is available on the PC or Laptop, install a USB / RS232 or USB / RS485 adapter. Follow the instructions for the adapter. Or, contact us for further details.

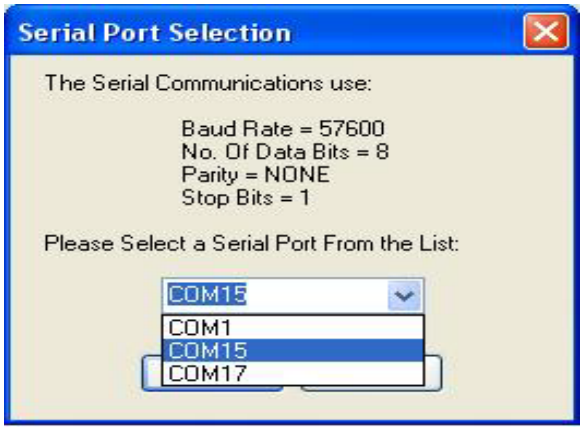


Notice that the GUI Panels are grayed out until communication is successfully established.

Select the COMMUNICATION menu tab and select OPEN CONNECTION to choose a com port.

A dialog box will appear, and a pull-down list of available ports will appear. Select the appropriate COM port for your particular application.

Both COM1 and COM17 are RS232 ports and either one could be used in the example below, depending on which port the cable is connected to.



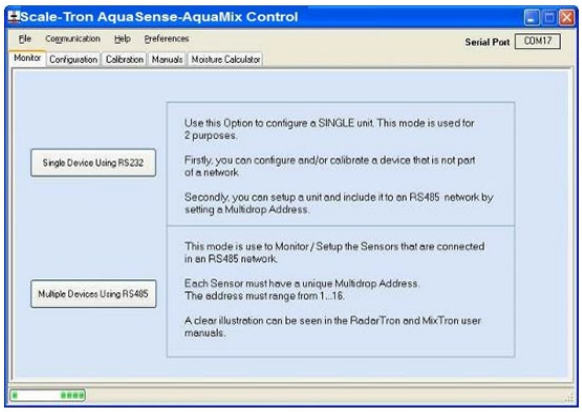
In this example COM15 is selected because the RS485 protocol is used and COM 15 is an RS485 port.

3.1.3 Main Screen Panel

Once the serial port is selected and the communications connection is opened, the main panel screen will become active.

At this point we are ready to discover the sensors. At this time, we will also assign address numbers to the sensors.

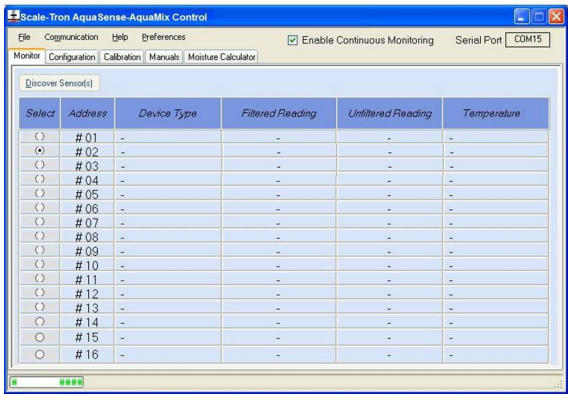
Since our examples show more than 1 sensor installed, the RS485 protocol is used, click the *Multiple Devices Using RS485* button. If you are using the RS232 protocol, select the 'Single Device Using RS232' button.



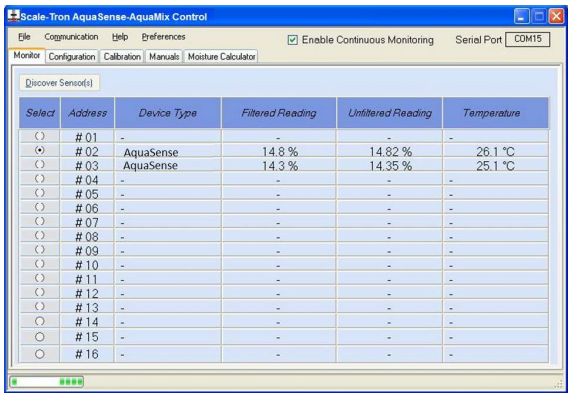
3.1.4 Start Discovery

A blank address list ranging from 1 to 16 is displayed. On initial set-up, it is unpopulated until the 'Discover Sensor(s)' button is pressed.

Press the *Discover Sensor(s)* button to start the discovery process.



The system will then look for the connected sensor(s). This may take some time depending on the number of sensors connected. On average, 16 connected sensors would take about 10 seconds. This time may vary depending on your particular system.

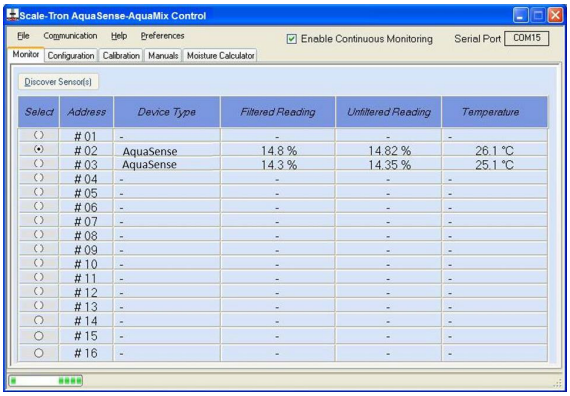


In the above example, 1 sensor has been discovered, identified, and is now ready for use.

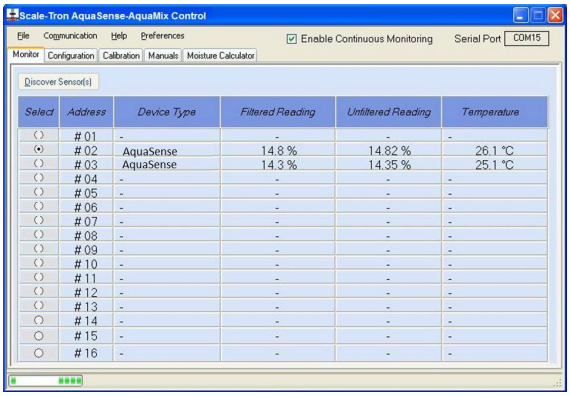
If the Device Type shows "BL-Vx.x", this indicates that the sensor is operating without the firmware, which must be loaded. See section 5 for instructions on firmware download.

3.1.5 Selecting a Sensor

In order to configure and calibrate each sensor, the sensor must be selected by clicking the radio button on the left of the sensor row. Only one sensor can be accessed at a time. When selected, the Configuration & Calibration tabs apply to only the selected sensor.



This screen is also used to monitor the sensors, once configured & calibrated. When enabled, this screen will display the data the sensors are receiving in real time. Click on the *Enable Continuous Monitoring* checkbox at the top of this screen for real time device monitoring. The sensor(s) will then poll (update) every 5 seconds.

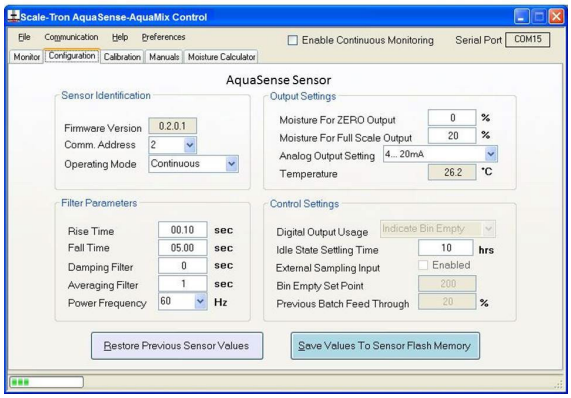


Note: If you move to another main tab, the auto-updating feature will reset and become disabled.

3.1.6 Configuration Screen

When one sensor is selected, clicking the Configuration tab will display the following screen where the main configuration parameters of the sensor can be setup/initialized.

For security, this screen is password protected. The password is **1515.** Enter this password when the dialog box appears.



Sensor Identification:

Firmware Version:
The version of the software that is programmed in the sensor's hardware.

Comm. Address:
Sixteen different addresses can be entered to identify each unit in a serial multi-drop configuration. These values are numbered from 1 to 16. When connecting several units on the same bus, make sure that the addresses of the connected units are all different. If 2 addresses are identical, communication will be subverted and the whole network will fail until the offending sensor is disconnected.

Operating Mode:
(Display Purpose Only)
Only the '**CONTINUOUS**' mode is available when used with the AquaMix sensor..

Output Settings:

% Moisture for Zero Output:
Select and enter the moisture value, in %, for which you want the analog and digital outputs to read zero. This will normally be 0.0% moisture but an offset can be created by entering a non-zero value. The digital output will respond with the value you enter here but this value will define the lower end of the measurement range.

% Moisture for Full Scale Output:
Select and enter the moisture value, in %, for which you want the analog and digital outputs to read full scale. This is normally 20.0% moisture for the mixture of materials used in concrete. The digital output will respond with the value you enter here but this value will define the high end of the measurement range.

Example: If you want to measure over a range of 20% to 40% moisture, enter 20% for the first value and 40% for the second value. The analog and digital signal will stay at "zero" output, which is either 0 mA on the 0-20 range or 4 mA on the 4-20 range, until the moisture value exceeds 20%. It will then rise in accordance with the moisture until the moisture reaches 40%, when it will read full scale (20mA) and not rise any further.

Analog Output Setting:
0-20mA, 0-5V, 0-10V.
4-20mA
Select your desired output range from the drop down menu.
Select a starting point of 0 mA, or 0V when using a termination resistor to create a voltage output (see section 2.2.2 for installation of the appropriate resistor).
Select the 4-20mA for the industrial standard current loop output (for use with PLCs and the 1278 / 1279 digital displays), or the equivalent in volts

Temperature:
Displays the current temperature of the material that the sensor is monitoring. Note that this is approximate and has a time delay of over 1 minute because the temperature sensor is inside the body of the moisture sensor.

Filter Parameters:

Rise time:
First filter rise time delay in seconds. This value should normally be 0.4 seconds.

Fall Time:
First filter fall time delay in seconds. This value should normally be 5.0 seconds.

Damping Filter:
This is a "pseudo-averaging" filter, similar to a hardware R-C filter, and gives a higher weight to the most recent readings and lower weight to past readings. Rise time in seconds is set by this parameter.
Default: 2 (seconds)

Averaging Filter:
The moisture signal must be smoothed to obtain a stable and usable reading. This is done in two stages by this parameter and **Damping** Filter (next). Averaging takes a running average over the selected number of readings at 0.1 second intervals. .The data is entered in seconds form 00.0 to 10.0.
Default: 2 (seconds)

Power frequency:
Switches between 50Hz and 60Hz. Select whichever is appropriate at your location.

3.2 Calibration Screen

When one sensor is selected for calibration, selecting the Calibration tab will display the following screen. The main calibration parameters of the sensor can be setup/initialized using this Screen.

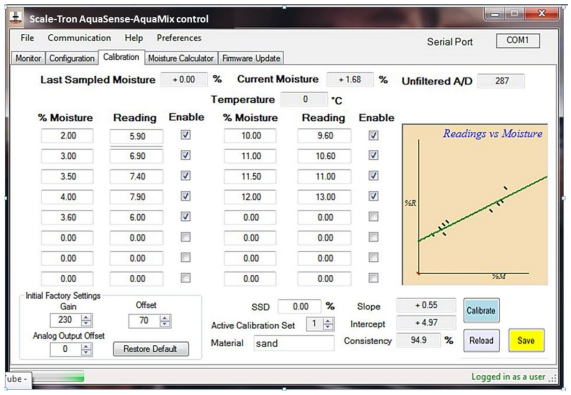
For security, this screen is password protected. The default password is **1515.** Enter this password when the dialog box appears.

In order to activate the *Calibration Screen* you must first select an active sensor. Refer to section 3.1.5 to select the sensor.

You can set/use up to 8 calibration pairs (sets) for use with different materials. For use with only one material, use the default set 1. To change calibration sets, use the pull down menu.

The column on the left is considered the 'low' moistures values, while the right are considered the 'high' moisture values. When samples are tested, their tested moisture values can be added to the appropriate field and saved. Click on the box, and enter the low moisture value from the test in the '%Moisture' box, then add the 'Current Moisture %' value from the 'Current moisture' box on the screen to the 'Reading' box. Repeat as often as required to obtain a good set of calibration pairs.

These values can be enabled or disabled depending on their consistency. Disable any that seriously reduce the consistency, since they are likely in error.



Use the mouse or tab key to navigate through the fields.

Last Sampled %M: Indicates the latest moisture value recorded during normal use, prior to entering calibration mode.

Current %M: Is the value of the moisture currently in contact with the faceplate and is continuously updated.

Unfiltered A/D: This is the raw analog value from the sensor. In normal use, this should be within the range of 0 – 1023. This value is for factory presetting purposes only.

Temperature: Current temperature of the probe / material in which it is inserted. Temperature is displayed in °Celsius

Initial Factory Settings group:
Gain, **Offset**, and **Analog Output Offset** values are preset at our factory, and should not be modified. They determine how the internal analog circuitry is adjusted. If these values are changed, and the unit produces undesired results, press the **Restore Defaults** button to reset these values back to the factory settings.

The **Analog Output Offset** can be used to adjust the Analog Output so that the Analog Meter Reading matches the last moisture value displayed by the software.

SSD: This is the internal moisture value used to compensate for material absorption. The entered value will be subtracted from the calculated moisture value, giving a displayed value that is lower than the bulk moisture value by the entered amount on all subsequent readings.

SSD (Saturated Surface Dry) is defined as the condition of an aggregate where the interior of the particles are "saturated" (i.e. absorption would no longer take place) but the surface of the particle is otherwise dry. In this condition, the aggregate will not affect the free water content of a composite material. The aggregate will not lose water or gain water in the mix.

Active Calibration Set:
This is the identifier for each of the 10 sets of calibration parameters (slope, intercept, and moisture absorption). The default is 01, for use with one mixture of materials (mix design or formula). Should you need to calibrate for more than one mixture, enter the new calibration set number before entering the new moisture values by scrolling onto it and entering a number between '01' and '10'. Two digits must be entered for the new set to become active. Some values may already exist; however, when calibrating for a new mixture / formula, all entries should be disabled, erased or overwritten with new values to prevent them from affecting the new calibration.

Material:
This label can be changed / renamed to suit the mixture / formula. Click the text field to change the name.

Slope and Intercept: These are the calibration parameters which are updated during the calibration procedure. There is a set of two parameters for each "calibration set"; normally only one calibration is required, but there are 10 sets of calibration parameters available. These additional sets can be selected if more than one mixture / formula is used. See Active Calibration set number.

Consistency: This value is a measure of goodness-of-fit of the calibration points. A value closer to 100% means that points chosen (by enabling them in column "E") are a better choice to be used in recalculating the new calibration parameters.

Note: This value drops quickly if even one set of values is inconsistent with the others. In this case, check the values and determine which one(s) are scattered and disable them (by entering zero under the "E" column). A value of 85% or higher will give acceptable results in general.

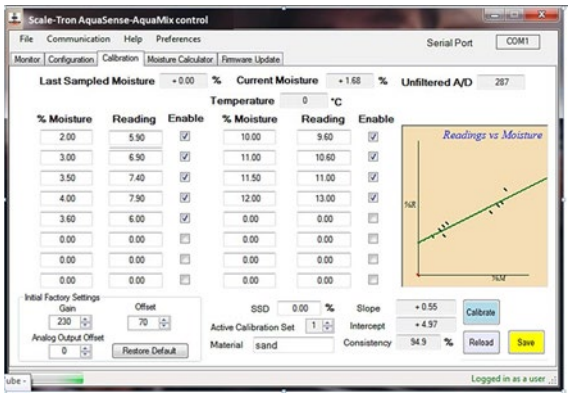
3.3 Performing a Calibration

Calibration Values: 8 sets of calibration values can be entered to calibrate the unit. Each set can be enabled / disabled at any time by checking on or off on the corresponding "**E**" column for each set.

Columns are grouped as **%Moisture, Reading** and **Enable**.

"%Moisture" is the actual moisture of the material (from oven dry or similar tests), and **"Reading"** is the reading of the sensor. "**Enable**" is used to enable or disable the two values.

Select the row or rows of sampled values you wish to use, if already entered, or enter them by scrolling onto the proper fields.

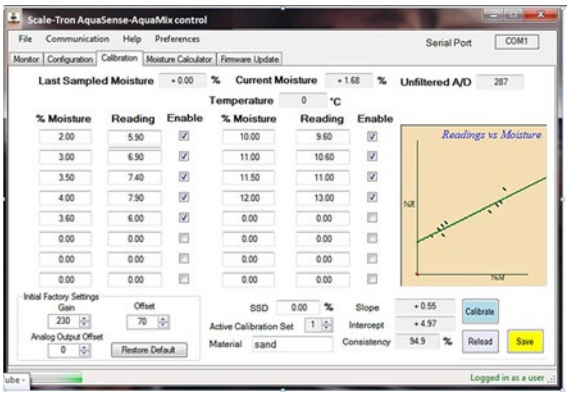


This enable/disable feature allows you to store sample information in the permanent sensor memory, for future use. For example, samples can be taken and entered over a period of several days but no calibration needs to be performed until enough readings have accumulated.

Example: A moisture sample is taken and a moisture of 4.55% was obtained in the lab. At the time this calibration sample was taken, the reading of the sensor was 5.15%. Under "%M" in the first row, enter the moisture of 4.55, and under "Reading", enter 5.15. If you wish this value to be included for calculating calibration parameters, check the enable column entry to activate the row.

Repeat for each set of actual moisture values and sensor readings, over as wide a moisture range as possible.

Enter at least two sets of values, but preferably at least five for best accuracy. Once the values are entered check the consistency value. If under 90%, identify the reading with the greatest error, furthest from the slope and disable it by clicking the "Enable" check box. It is usually possible to view the set of values and see one set that appears to be out of place (for example, the difference between the %Moisture and Reading values is greater than for the other sets). The more sets of values entered the better it will be, as more statistical data is used to calculate. Watch the new consistency value every time a value is entered and enabled.



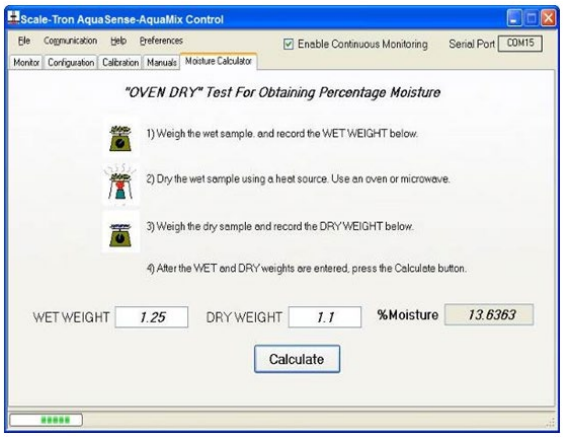
Note: when calibrating for a new mixture / formula name, all existing entries should be disabled, erased or overwritten with your new values to prevent them from affecting the new calibration. The calibration will be accurate only over the range of measurements that have been taken.

If unsure that the calibration is correct, do not save the values. If there is uncertainty about the calibration, you can retrieve the previous calibration parameters by pressing the "read Sensor Values" button. This will restore the original calibration, provided you have not saved them in permanent memory.

4 "Oven Dry" Test (To obtain Percentage Moisture)

Periodically, it may be required to perform an actual test to determine the moisture content of the various materials being used. The AquaMix GUI offers a tab to quickly calculate the % moisture based on "before and after" samples. These results can then be added to the calibration set to further refine the calculated moisture.

Click on the "Oven Dry" tab for calculating the percent moisture. The screen will display the 4 basic steps to obtaining the moisture content.



EQUIPMENT REQUIRED:
Scale, capacity 1 to 10 kg x 1 g graduations.
Baking tray 12" square.
Stove, microwave oven or heater.

In a concrete plant, the best time to obtain samples in during the batching cycle. Before starting, note the moisture display reading as displayed on the indicator or batch controller. Prepare a clean container (a bucket is ideal) and use a scoop to take as many scoopfuls as possible from the mixer, typically at the end of the mixing cycle. The objective is to get a homogeneous sample at the time when the mixture is expected to be thoroughly mixed.

Remove and bag a quantity suitable for the test.

Ideally, follow the ASTM standard moisture test. If this is not possible, proceed as follows:

- Place the baking tray on the scale and tare it (adjust the weight to zero).
- Weigh 1 to 2 lb (500 to 1000g) of material into it, taking care to be accurate.
- Place the tray on the stove or microwave oven and heat the material until totally surface dry, stirring frequently. Be very careful to ensure that no material is spilled during stirring; place a paper under the heater if possible and return spills to the tray. It is not necessary or desirable to bake the sand to red heat; merely boil off the surface moisture to approximate "saturated, surface dry" conditions. You can test for emission of steam by holding a cold glass plate over the tray; When it fails to mist, no steam is present and saturated surface dry conditions have been obtained.
- When cool, return the tray to the scale and re- weigh. Calculate the true "Dry Weight" moisture from the following formula:

$$\%\ \text{MOIST.} = \frac{\text{WET WEIGHT - DRY WEIGHT}}{\text{DRY WEIGHT}} \times 100$$

EXAMPLE:

If WET WEIGHT = 2.000 kg, DRY WEIGHT = 1.815 kg,

$$\%\ \text{MOIST.} = \frac{2.000 - 1.815}{1.815} \times 100 = 10.2\ \%$$

5 Part Numbers and Accessories

Below is a list of parts, for replacement, and assorted accessories available for you AquaMix unit.

Part Number	Description	
1X3-2270D	AquaMix Unit (Just the sensor, no flange, power supply, junction box, etc..)	
1X3-2270-FLANGE	Mounting Flange – to mount to the weld flange	
1X3-2270D-WF	Weld Flange – With studs, to fit Mounting Flange, welds onto Mixer to mount AquaMix Unit	
R-2316	Power Supply, to power up to 10 AquaMix Sensors (110 – 240VAC)	
1X3-1278	Indicator Display, in enclosure	
1IN-1279	Indicator display for panel mounting	
1X3-2268-232	RS-232 Programming Cable	
1X3-2268-485	RS-485 Programming Cable	
1MO-BB-9SPOP2	RS-232 Isolator (9-pin adapter, self powered)	
1MO-BB-485OI9TB	RS-485/232 Converter (Includes power supply)	
1MO-BB-232USB	RS-232/USB Converter (Connects to USB port)	
1MO-BB-NSOTL4	RS-485/USB Converter (Connects to USB port)	
1X3-2257	Junction Box, No Options	
The above Junction box require a connection cable, as described below		
1X3-2256-10	Connection Cable – 10ft	
1X3-2256-20	Connection Cable – 20ft	
1X3-2256-50	Connection Cable – 50ft	
1X3-2256-XX	Connection Cable – XXft, Substitute the XX for the # of feet required	
All Above connection cables come with connector installed.		

6 APPENDIX

6.1 Features

- Analog 0-20 mA, 4-20 mA, 0-10V, digital RS232 & RS485 multidrop outputs.
- Calibration via RS232/RS485 connection to Windows software on external control computer, laptop, etc.
- Multiple material calibrations allow different material to be used in the same bin with same sensor.
- Special silicon nitride ceramic faceplate lasts for over 10 years in most materials..
- Waterproof, sealed body and connector.
- Simple one-hole mount.
- Pre-calibrated for your chosen material, to allow immediate use with fair results in most cases. Note that calibration is always required for best results, since all natural materials differ from place to place.
- Software ignores erratic readings from loose material and averages readings, eliminating errors due to dry or wet spots. Advanced 3-stage filter gives fast settling.
- Temperature of material available through digital output.

6.2 Specifications

Measuring range: 0 – 20% moisture, calibrated for concrete. Other ranges and materials on request.

Sensing volume: 2" X 2" X 4" at 4% moisture.

Analog output: 0-20mA, 4-20mA, 0-10V etc. by use of external resistor.

Digital RS232 & RS485 connection:
Bidirectional, industry standard protocol and command structure supports up to 16 sensors on the same RS485 line.

RS232/RS485 Display & setup:
Windows software displays readings, and allows access to setup and calibration menus.

Material calibration storage:
Up to 10 separate sets of material calibration parameters.

Power: 11 - 30VDC, 100mA

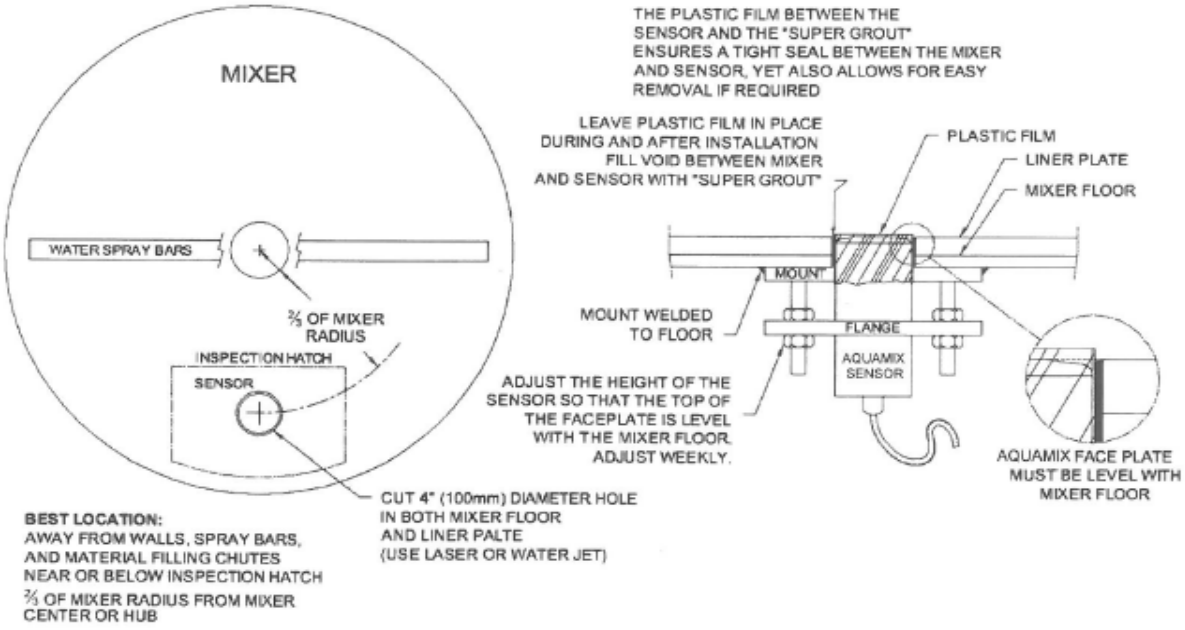
Temperature range:

Full accuracy: 0-50°C (32-120°F)
Reduced Accuracy: 0-80°C (32-175°F)

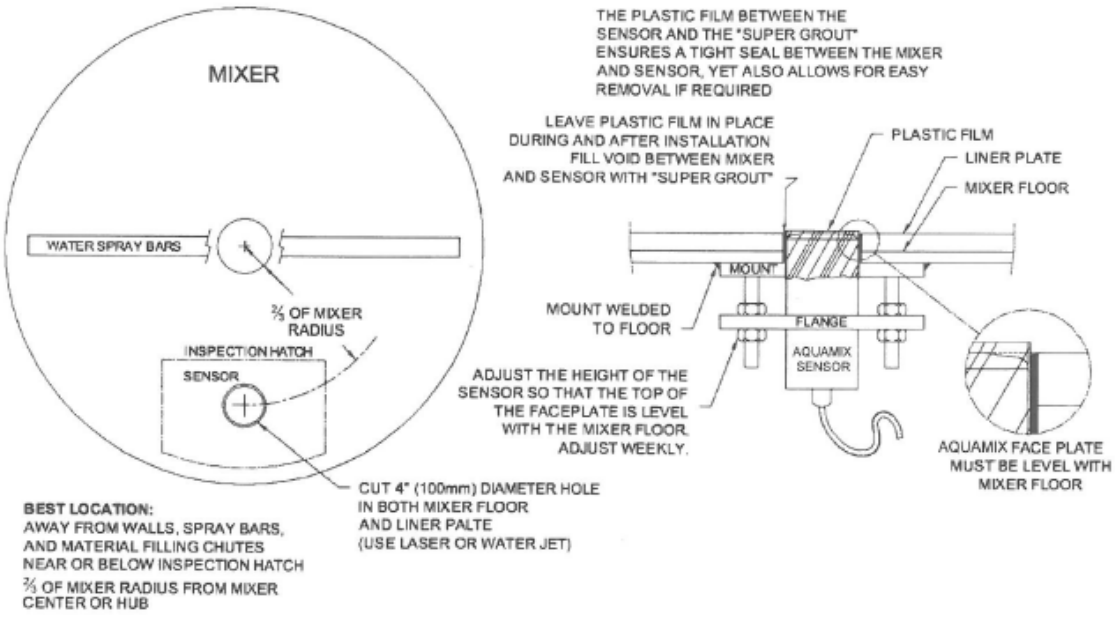
Construction: 304 stainless steel body and flange with shatterproof extra hard silicon nitride ceramic faceplate.

Size: 3-1/2" (89mm) diameter, 8" (203mm) long with 6" (152mm) adjustable flange for correct positioning

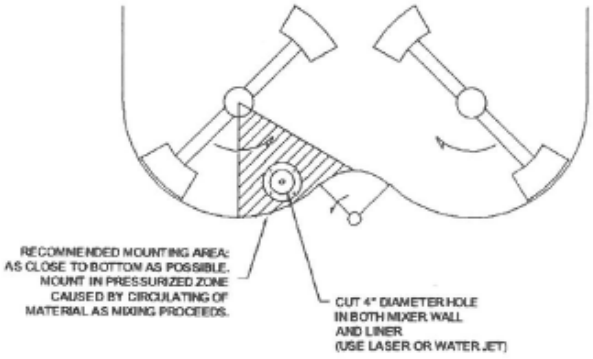
6.3 Pan and Planetary Mixer Installation

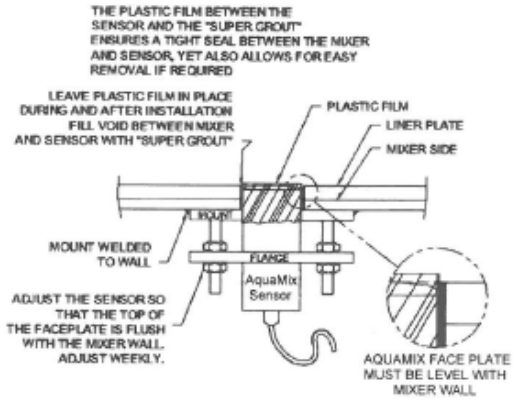


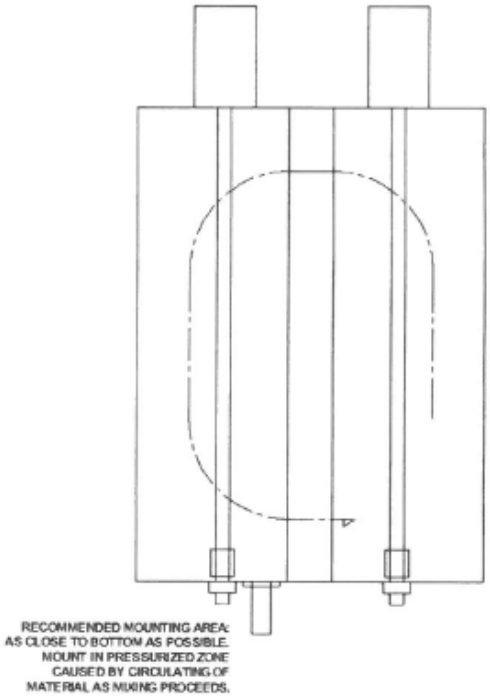
6.4 Ribbon or Spiral Blade Mixer Installation:



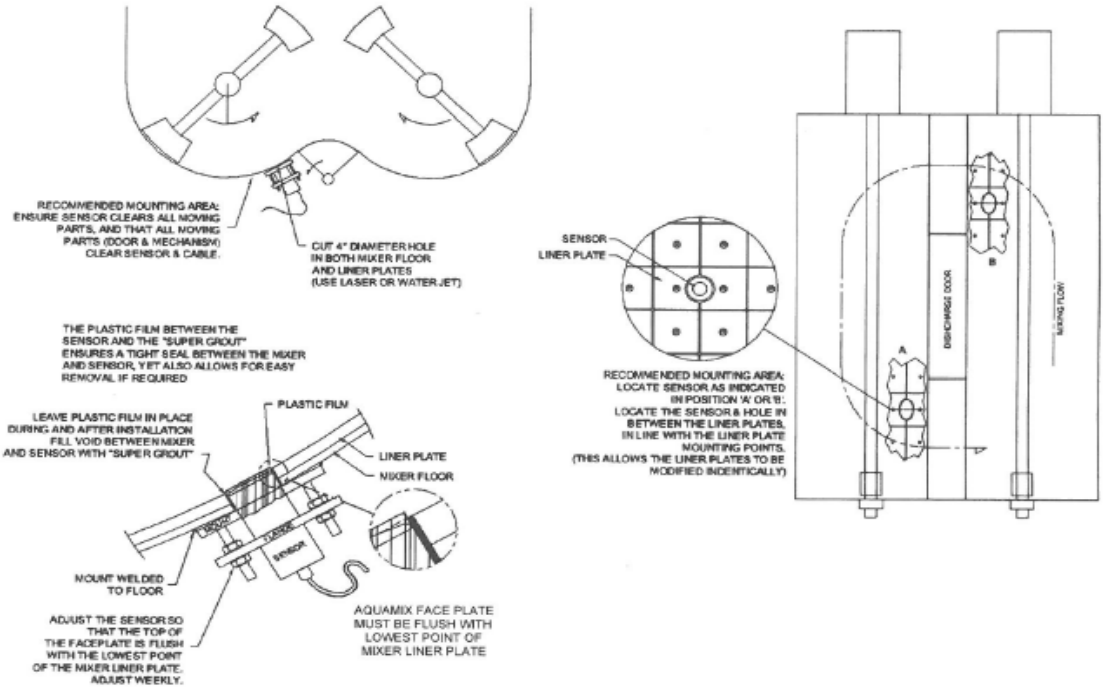
6.5 Twin Shaft Mixer Installation:







6.6 Twin Shaft Mixer Installation – Reduced discharge Door



MOISTURE SENSOR CALIBRATION CERTIFICATE

Sensor Serial No._____ Date: _____

Calibrated in Material Type:_____

Requested Moisture Range of Operation: _____% to _____%

Moisture based on "DRY" Method:

$$\text{Moisture\%} = \frac{100\text{x (Weight Wet – Weight Dry)}}{\text{Weight Dry}}$$

Results of Lab Tests:

SATISFACTORY ERRATIC READINGS NON-LINEAR

INSUFFICIENT SENSITIVITY REQUIRES RECALIBRATION DURING OPERATION

Comments: _____

_____

Output Range:

Minimum Limit: 0_____% Moisture gives output of	4.0mA	Default ☐
	0.0V	Default ☐
	_____	Default ☐
Maximum Limit: 20____% Moisture gives output of	20.0mA	Default ☐
	10.0V	Default ☐
	5.0V	Default ☐
	_____	Default ☐

Display Unit Model 1278 / 1279 Supplied with Sensor

0_____% Moisture at an input of 4.0mA

20_____% Moisture at an input of 20.0mA

Tested and Certified by: _____

SCALE-TRON INC.
AQUAMIX GUARANTEE

BREAKDOWN

Scale-Tron Inc. hereby guarantees that any AquaMix product which fails electrically 10 years after purchase, will be repaired or replaced at no charge to the owner. (Excluding shipping)

WEAR

Scale-Tron Inc. also guarantees that should the body, faceplate or flange, fail due to excessive wear within 10 years after purchase, it will be rebuilt or replaced at no charge to the owner.

This guarantee is valid only if the installation instructions in the owner's manual are followed and the unit is not installed under a charging chute which allows hard objects to fall onto the faceplate or allowed to protrude above the mixer liner. Units must be properly protected for shipping and shipped prepaid to our St. Laurent plant, together with the name of the owner's representative and a description of the fault. Scale-Tron Inc. is not responsible for damage caused by shipping, if not packed properly or shipped in the original or equal container.

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