GE
Measurement & Control Solutions

Moisture

Moisture Image Series 1

Startup Guide

imagination at work

910-108U Rev. E
October 2010

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Appendix A. Program Information List

Information Paragraphs

- **Note** paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.
- **Important** paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.
- **Caution!** paragraphs provide information that alerts the operator to a hazardous situation that can cause damage to property or equipment.
- **Warning!** paragraphs provide information that alerts the operator to a hazardous situation that can cause injury to personnel. Cautionary information is also included, when applicable.

Safety Issues

WARNING! It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.

WARNING! Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

GE Measurement & Control Solutions is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2002/96/EC.

The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Visit **http://www.gesensing.com/environment/weee.htm** for take-back instructions and more information about this initiative.

Chapter 1. Installation

1.1 Introduction

Users typically install the Moisture Image Series 1 as part of a complex process system, which includes components such as filters, pumps, and pressure regulators. In such an environment, probes and other parts of the system may be subjected to environmental hazards, such as high temperature, pressure extremes, corrosive elements and mechanical vibrations.

This section contains information and instructions for installing the Series 1 into a process system taking into account all of the above factors. The following section describes how to set up and connect it.

If you have questions about applications or installation, call an applications engineer. See the rear cover for contact information.

WARNING! To ensure the safe operation of this unit, you must install and operate the Series 1 as described in this user's manual. In addition, be sure to follow all applicable safety codes and regulations for installing electrical equipment in your area.

1.2 Unpacking the Series 1

Before beginning the installation, unpack the unit and make sure all the parts and documentation listed on the packing slip are included.

The packing slip may not list the Calibration Data Sheet(s), which are usually packed in the plastic storage case with the moisture, oxygen, and pressure probes. You may also find the Calibration Data Sheet(s) in an envelope taped to the Series 1. There should be one Calibration Data Sheet for each probe. Staple the Calibration Data Sheets to the Program Information List supplied in Appendix A and store them in a safe place.

Be sure to inspect each piece of equipment, including the sample system, for evidence of mishandling. If anything has been damaged, report this to the carrier and to GE immediately. You should leave the plastic caps on the probes and the pressure transmitters when they are not installed in the process stream.

If anything is missing, contact GE immediately.

1.3 Checking the Delta F Oxygen Cell for Leakage

Before connecting the Delta F oxygen cell(s), you must check it for damage and/or leakage. Depending on the application, the oxygen cell may have a top drain or both a top and bottom drain for the electrolyte reservoir. It is important to identify which type of cell you have for the following procedure. Use Figure 1 below to identify your cell. To check the cell for leakage:

1. Remove the top of the electrolyte reservoir.

IMPORTANT: *If your cell also has a bottom drain, make sure that the electrolyte discharge valve, mounted on the rear of the oxygen cell, is closed (in the vertical position). See Figure 1 below.*

2. Add approximately three ounces (100 ml) of distilled water to the reservoir and replace the top.

3. Using the min/max window on the oxygen cell, check the water level (see Figure 2 on page 3).The water should cover about 60% of the window.

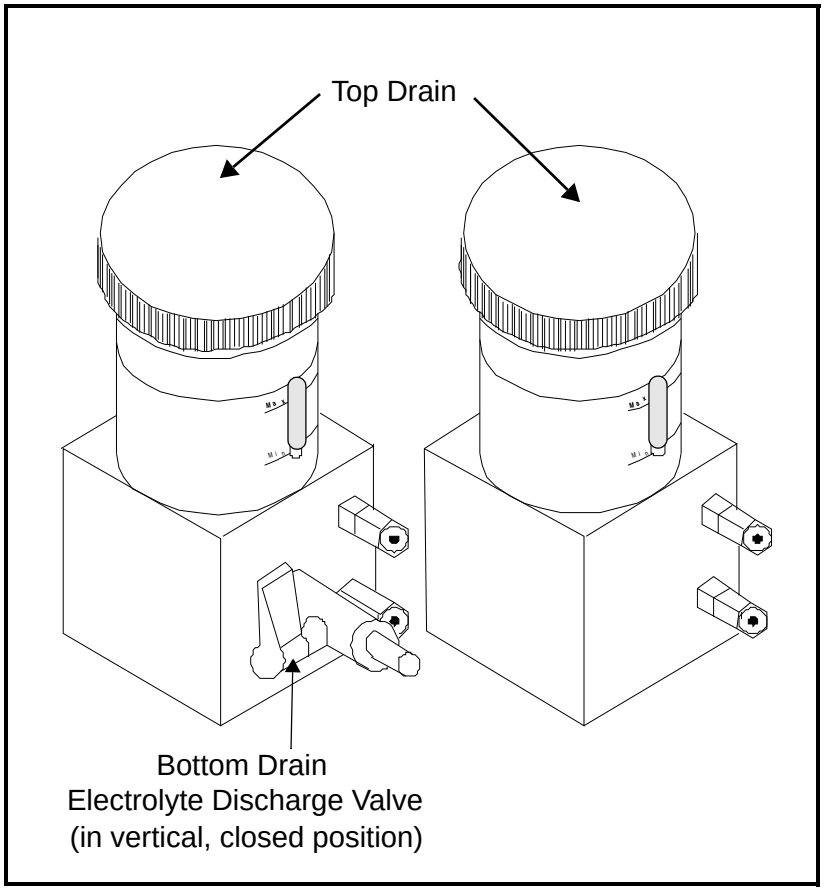


Figure 1: Delta F Oxygen Cell Drains

1.3 Checking the Delta F Oxygen Cell for Leakage (cont.)

4. Let the oxygen cell stand for about 6 hours; then check for any leakage.

5. If there is no leakage, drain the cell completely.

If the cell leaks, see the warranty information at the beginning of this manual.

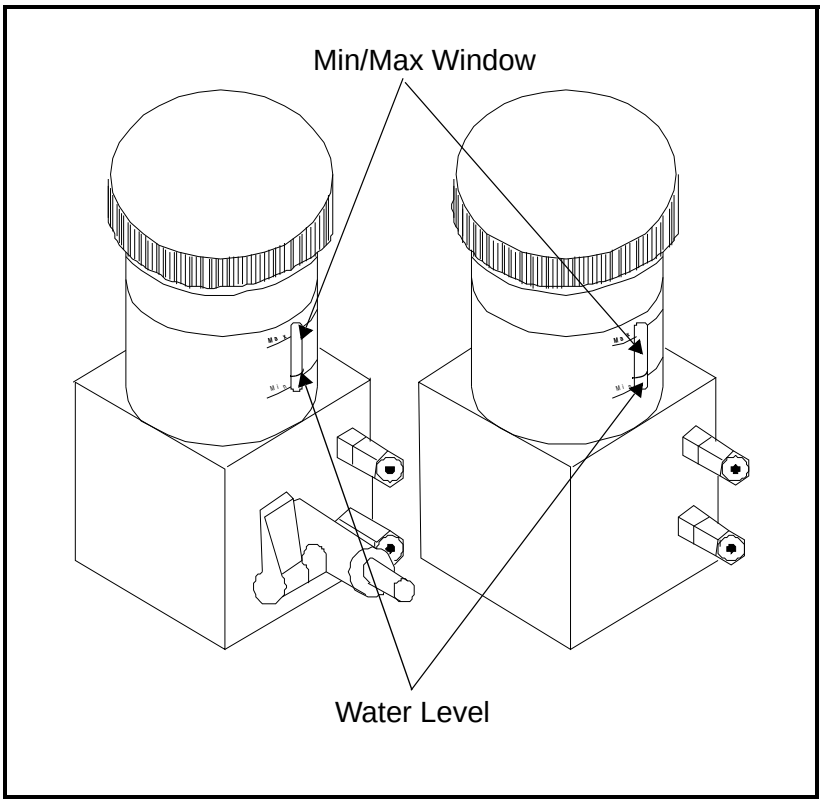


Figure 2: Delta F Oxygen Cell Water Level Window

1.4 Choosing a Site

You should have discussed environmental and installation factors with a GE applications engineer or field sales person by the time you receive the meter. The equipment should be suited to the application and installation site.

The Series 1 is available in rack, bench, or panel mounts that are suitable for most indoor installations. GE also provides weatherproof and explosion-proof housings for outdoor and hazardous area locations. See the drawings at the end of this chapter for an example of each enclosure.

Before installing the unit, read the guidelines below to verify that you have selected the best installation site.

1.4.1 Low Voltage Directive

To comply with the Low Voltage Directive, you must install a switch or circuit breaker on the input power line. For greatest safety, locate the circuit breaker or power switch near the electronics console.

WARNING! Division 2 applications may require special installation. Consult the National Electric Code for proper installation requirements. The analyzer must be configured in a suitable equipment enclosure and installed per the National Electric Code Article 500 applicable sections which pertain to the hazardous environment classification in which the electronics will be used.

1.4.2 BASEEFA Certification

Rack, bench, and panel Series 1 units, s/n 2000 and above, and WPF Series 1 units, s/n 2300 and above, are BASEEFA certified to supply intrinsically safe levels. Installation requires that the Series 1 be mounted in a general purpose area only. M Series, TF Series, and Moisture Image Series probes and Delta F oxygen cells are intrinsically safe when connected to the Series 1, allowing for sensor installation in IEC/CENELEC zone 0 areas.

1.4.3 CSA Certification

Newer versions of rack, bench, panel and WPF Series 1 units are CSA-NRTL certified intrinsically safe. Installation requires that the Series 1 be mounted in either a NEC CL.1, Div. 2, Group B, C or D hazardous area or a general purpose area. M Series, TF Series, and Moisture Image Series probes and Delta F oxygen cells are intrinsically safe when connected to the Series 1, allowing for sensor installation in NEC CL.1, Div. 1, Groups A, B, C and D hazardous areas.

Note: *Refer to certification labels on your instrument and installation drawing #752-158 to determine the applicable level of certification that your meter carries.*

1.4.4 General Guidelines for Choosing a Site

- Choose an installation site for the probes and sample systems that is as close to the process line as possible. Avoid long lengths of connecting tubing. If long distances are unavoidable, a fast sampling by-pass loop is recommended. Do not install any other components, such as filters, ahead of the probes or sample system unless instructed to do so by GE.
- Observe all normal safety precautions. Use the probes within their maximum pressure and temperature ratings.
- Although the Series 1 may not need to be accessed during normal operation, install the electronics unit at a convenient location for programming, testing and servicing. A control room or instrument shed are typical locations.
- Locate the electronics unit away from high temperatures, strong electrical transients, mechanical vibrations, corrosive atmospheres, and any other conditions that could damage or interfere with the meter operation. See Chapter 3, *Specifications,* for limits.
- Protect the probe cables from excessive physical strain (bending, pulling, twisting, etc.). In addition, do not subject the cables to temperatures above 65°C (149°F) or below -50°C (-58°F).
- Observe the proper cable restrictions for the probes. You can locate the Moisture Image Series probe up to 915 meters (3000 feet) away from the electronics unit with unshielded twisted pair cable. The M Series and TF Series probes require specially shielded cable. You can locate the M and TF probes up to 600 meters (2000 feet) from the unit. If you are measuring pressure with a TF probe, the cable length should not exceed 152 meters (500 feet).

1.5 Moisture/Temperature Probe Considerations

The M Series, TF Series, and Moisture Image Series probes consist of an aluminum oxide sensor mounted on a connector head. Standard probe mounts include a protective stainless steel shield.

The probe sensor materials and housing maximize durability and insure a minimum of water absorbing surfaces in the vicinity of the aluminum oxide surface. A sintered stainless steel shield is used to protect the sensor from high flow rates and particulate matter. The end cap should not be removed except upon advice from GE.

The sensor has been designed to withstand normal shock and vibration. You should make sure that the active sensor surface is never touched or allowed to come into direct contact with foreign objects, since this may adversely affect performance.

Observing these few simple precautions will result in a long and useful probe life. GE recommends that probe calibration be checked routinely, at 12-month intervals, or as recommended by our applications engineers for your particular application.

The probe will measure the water vapor pressure in its immediate vicinity; therefore, readings will be influenced by its proximity to the system walls, materials of construction, and other environmental factors.The sensor can be operated under vacuum or pressure, flowing or static conditions.

Observe the following environmental precautions.

1.5.1 Temperature Range

The standard probe is operable from –110°C to +70°C (–166°F to 158°F).

1.5.2 Moisture Condensation

Be sure the temperature is at least 10°C higher than the dew/frost point temperature. If this condition is not maintained, moisture condensation could occur on the sensor or in the sample system, which will cause reading errors. If this happens, dry out the probe following the procedures outlined in document #916-064, *Basic GE Sensing Hygrometry Principles*.

1.5.3 Static or Dynamic Use

The sensor performs equally well in still air or where considerable flow occurs. Its small size makes it ideal for measuring moisture conditions within completely sealed containers or dry boxes. It will also perform well under gas flow conditions as high as 10,000 cm/sec and liquid flow conditions to 10 cm/sec. Refer to document #916-064, *Basic GE Sensing Hygrometry Principles*, for maximum flow rates in gases and liquids.

1.5.4 Pressure

The moisture probe always senses the correct water vapor pressure regardless of the total ambient pressure. The moisture sensor measures water vapor under vacuum or high pressure conditions from as little as a few microns Hg to as high as 5000 psi total pressure.

1.5.5 Long-Term Storage & Operational Stability

Sensors are not affected by continuous abrupt humidity changes or damaged by exposure to saturation conditions even when stored. However, you should store probes in their original shipping containers in a clean, dry location. If the probe is saturated during storage, refer to *Moisture Condensation* on page 6 before installing the probe. For best performance, do not store probes longer than one to two years from their calibration date.

1.5.6 Freedom from Interference

The sensor is completely unaffected by the presence of a wide variety of gases or organic liquids. Large concentrations of hydrocarbon gases, Freon™, ozone, carbon dioxide, carbon monoxide, and hydrogen have no effect on sensor water vapor indications. The sensor will operate properly in a multitude of gaseous or non-conductive liquid environments.

1.5.7 Corrosive Materials

Avoid all materials that are corrosive or otherwise damaging to aluminum or aluminum oxide. These include strongly acidic or basic materials and primary amines.

1.6 Sample System Guidelines

A sample system is required for oxygen measurement and, although not mandatory, is highly recommended for moisture measurement. The purpose of a sample system is to condition or control a sample stream to within the specifications of a probe. The application requirements determine the design of the sample system. GE applications engineers will make recommendations based on the following general guidelines.

1.6.1 Moisture Sample Systems

Typically, sample systems should be kept very simple. They should contain as few components as possible and all or most of those components should be located downstream of the measurement probe. Figure 3 shows an example of a basic sample system consisting of an explosion-proof housing with a sample cell, a filter, a flowmeter, a vent valve and two-shut off valves, one at the inlet and one at the outlet.

The sample system components should not be made of any material that will affect measurements. A sample system may include a filter to remove particulates from the sample stream or a pressure regulator to reduce or control the pressure of the stream. However, most common filters and pressure regulators are not suitable for sample systems because they have wetted parts that may absorb or release components (such as moisture) into the sample stream. They may also allow ambient contamination to enter the sample stream. In general, you should use stainless steel material for all wetted parts. Contact GE for further instructions.

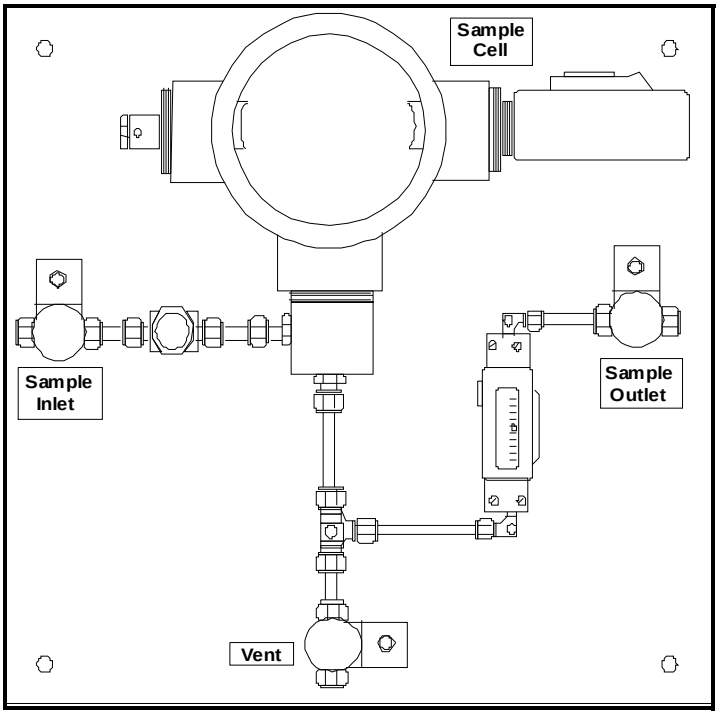


Figure 3: A Typical Moisture Sample System

Note: *The actual sample system design is dependent on the application requirements.*

1.6.2 Oxygen Sample Systems

Oxygen sample systems are required and can be ordered from GE for bench or wall mounting. You can also build your own sample system by using the following guidelines.

IMPORTANT: *The GE warranty will be voided if the sample system does not have a relief valve.*

The basic sample system requirements are as follows (see Figure 4):

1. The oxygen cell requires a sample gas flow of 2.0 to 2.5 SCFH.

2. The sample gas pressure in the cell must be between 0.0 and 1.0 psig. The pressure must not exceed 1.0 psig.

3. A 10 psig pressure relief valve installed upstream of the oxygen cell is required to prevent over-pressure.

4. A flow meter is required to measure the flow.

5. A pressure gage is required to measure the pressure.

6. A flow regulating or needle valve is required to regulate flow and should be located upstream of the cell.

7. A pressure regulator is required for sample gas supplies of 50 psig or greater.

If a sample pump is required to draw a sample to the oxygen cell, the pump should be installed downstream of the oxygen cell. This will also require you to install a vacuum relief valve set at 1.0 psig between the oxygen cell and the pump.

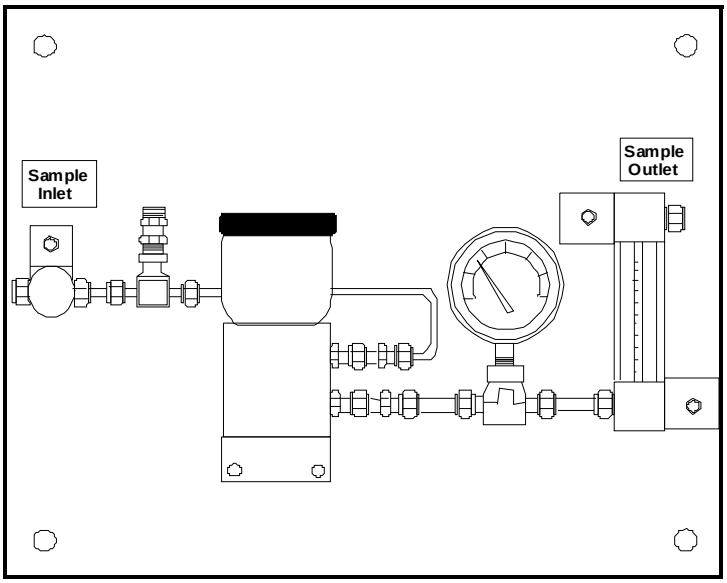


Figure 4: A Typical Oxygen Cell Sample System

Note: *The actual sample system design is dependent on the application requirements.*

1.7 Mounting the System

Mounting the hygrometer system consists of mounting the electronics unit, the probes, and the sample system(s).

1.7.1 Mounting the Electronics Unit

Use the outline and dimension drawings at the end of this chapter to mount the Series 1. These drawings provide clearance and other mounting dimensions needed to prepare the site for mounting.

IMPORTANT: *To comply with the Low Voltage Directive, you must install a switch or circuit breaker on the input power line. For greatest safety, locate the circuit breaker or power switch near the electronics console.*

Be sure to follow the guidelines outlined in *Choosing a Site* on page 4 before mounting the enclosure.

Note: *You may want to make probe, Delta F Oxygen Cell, recorder, and alarm connections before mounting the enclosure if the installation location does not provide enough room for these connections to be made easily after installation.*

1.7.2 Mounting the Sample System

The sample system is normally fastened to a metal plate that has four mounting holes. GE also provides the sample system in an enclosure if requested. In either case, fasten the sample system plate or enclosure with four bolts–one in each corner. If you ordered sample system outline and dimension drawings, they will be included in your shipment.

Connect the sample system inlet and outlet to the process and return using the appropriate fittings or an appropriate NPT adapter.

CAUTION! Do not start a flow through the system until all probes and transmitters are properly installed.

1.7.3 Mounting the Oxygen Cell Assembly

If your oxygen cell is not mounted into a sample system, refer to Figure 28 on page 36 for dimensions to mount the cell.

1.8 Installing the Probes

After you mount the sample system, you must insert moisture probes into the sample cells. In addition, you must check, prepare, and connect the oxygen cells (if used) to the gas line.

1.8.1 Moisture Probes

GE Moisture Image Series, M Series, and TF Series moisture probes have 3/4 inch-16 straight threads with an O-ring to secure probes into the sample system or directly into the process line. Other fittings are available for special applications.

CAUTION! **If mounting the moisture probes directly into the process line, you must consult GE for proper installation instructions and precautions.**

Moisture probes are usually installed into a sample system. The sample system protects the probes from coming into contact with damaging elements in the process. Moisture probes are installed into a cylindrical shaped container, called the sample cell, that is included as part of your sample system. (The sample cell is labeled on the sample system plate.)

To install a moisture probe that has a 3/4 inch-16 straight thread, insert it into the sample cell so it is perpendicular to the sample inlet. Screw the probe in, making sure not to cross thread it. Tighten down securely. Figure 1-5 below shows a typical moisture probe orientation with the probe mounted in a GE sample cell. Install moisture probes with different fittings in the appropriate manner.

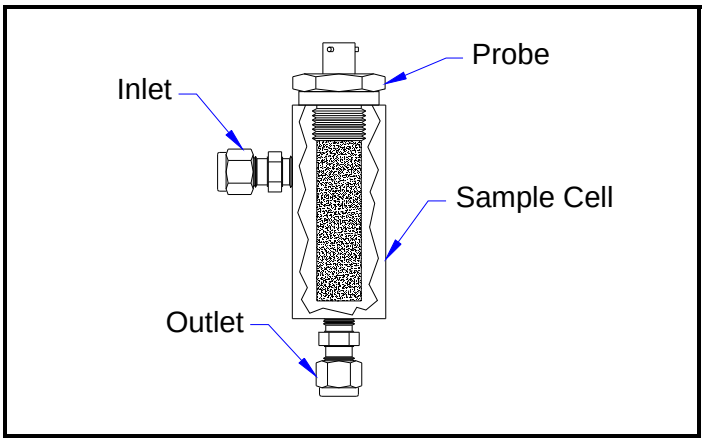


Figure 5: Moisture Probe Installed in a Sample Cell

Note: *Standard moisture probes have a sintered stainless-steel shield that protects the aluminum oxide sensor. Leave the shield in place for maximum protection.*

It is important to eliminate all leaks (whether in gas or liquid applications) for safety reasons and to be sure that measurements are not affected by ambient contamination. For gas applications, you should check for leaks using a soap bubble solution.

IMPORTANT: *Refer to the Calibration Data Sheets to connect the probes to their corresponding channels. If a probe is connected to the wrong channel, the meter will display incorrect data.*

1.8.2 Pressure Sensors

If a pressure measurement is required, and for some reason the TF or Moisture Image Series probe pressure option is not used, you can connect a separate pressure transmitter to an auxiliary input.

The Series 1 uses any type of 0/4 to 20-mA or 0 to 2-V pressure transducer or transmitter. GE offers two types of pressure transmitters: the P40 and P40X. The P40 has a 1/4-inch threaded NPTM fitting and the P40X has a 1/2-inch threaded NPTF fitting for mounting directly into the process line or into a sample system.

CAUTION! **If you are mounting the pressure transmitters directly into the process line, you must consult GE for proper installation instructions and precautions.**

Always mount the pressure transmitter directly downstream of the moisture probe in order to measure the pressure at the point of the moisture measurement.

1.8.3 Delta F Oxygen Cell

Although the Series 1 accepts other oxygen devices as auxiliary inputs, it is designed to accept oxygen inputs directly from the Delta F Oxygen Cell. There are three steps for installing the Delta F Oxygen Cell: preparing the oxygen cell for operation, calibrating the oxygen cell, and then connecting the cell to the gas line.

The Delta F Oxygen Cell is available mounted in various types of enclosures; however, the cell itself will look like either of the cells shown in Figure 6. The oxygen cell may have both a bottom and top drain or only a top drain. It is important to know which drain the cell has before you install it. Use Figure 6 to identify the type of cell you are using.

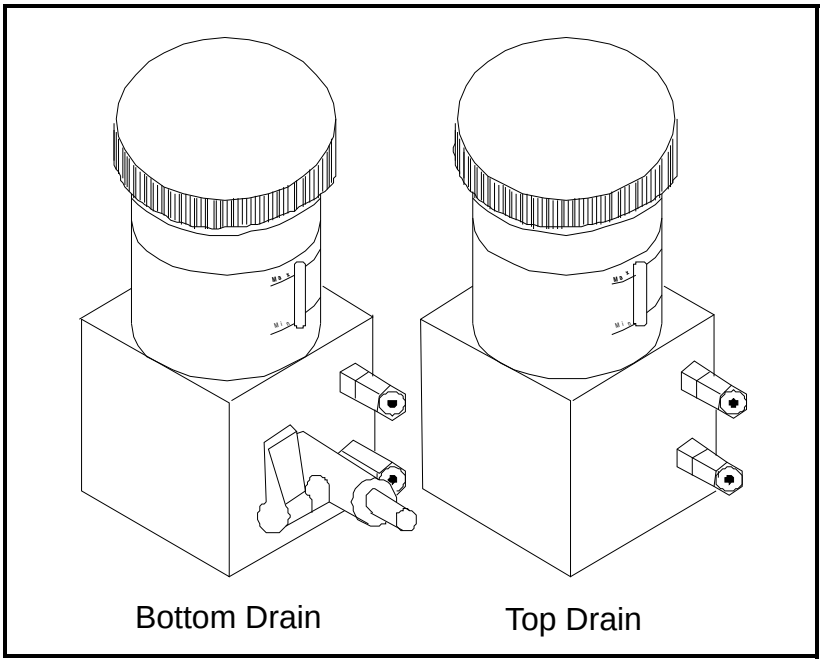


Figure 6: Delta F Oxygen Cell Drains

1.8.3a Preparing the Oxygen Cell

To prepare the oxygen cell for operation, you must fill it with the electrolyte that has been supplied in a plastic bottle.

WARNING! The electrolyte contains potassium hydroxide that is harmful if it comes in contact with eyes or skin. Consult your company safety personnel for proper procedures for handling the electrolyte.

1. Unscrew the top on the oxygen cell's reservoir. If you are using an explosion-proof cell, make sure its electrolyte discharge valve is in the vertical (closed) position (see Figure 7).

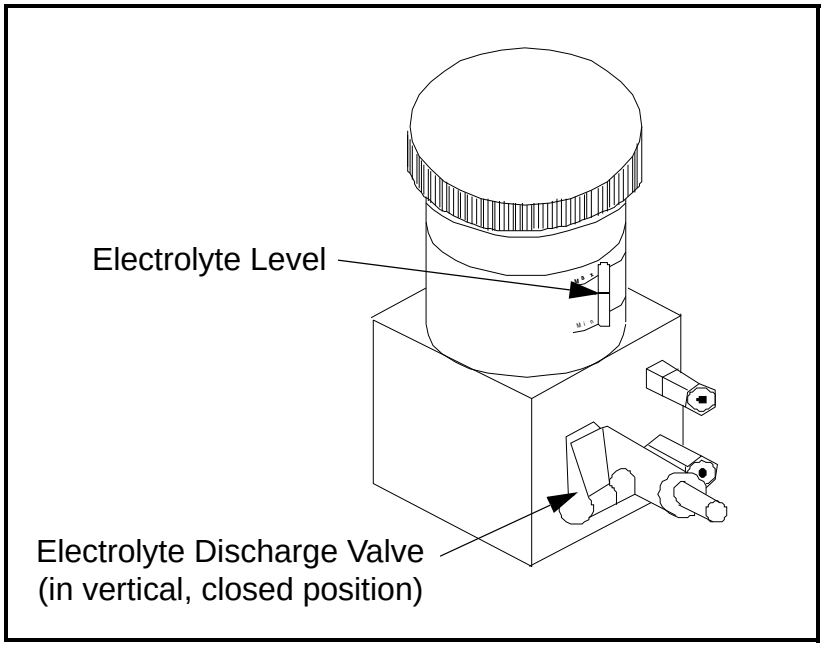


Figure 7: Delta F Oxygen Cell Electrolyte

2. Slowly add the entire contents of the bottle, approximately three ounces (90 ml), making sure not to spill any on the outside of the cell. Be especially careful that the electrolyte does not come in contact with any of the cell's electrical connections.

3. Using the min/max window on the oxygen cell, check the electrolyte level. The electrolyte should cover about 60% of the window (see Figure 7). The cell is now ready to be connected to the gas line.

4. Replace the top of the oxygen cell.

Note: *Once you add the electrolyte, DO NOT add additional electrolyte to the reservoir. If the level falls below the minimum level, refer to* Checking and Replenishing the Electrolyte in the Delta F Oxygen Cell *in Chapter 2 of the* Service Manual *to replenish the cell.*

5. Calibrate the oxygen cell as described in *Calibrating the Delta F Oxygen Cell* in Chapter 2 of the *Service Manual.* After you calibrate the cell, connect it to the gas line as described in the following section.

1.8.3b Connecting the Oxygen Sample System to the Gas Line

To connect the oxygen sample system to the process line, attach a 1/8 inch O. D. (outside diameter) tube to the 1/8 inch sample gas inlet fitting using a Swagelok® or equivalent mating connector. Avoid using plastic and rubber in any tubings or fittings that are included in the inlet gas lines.

CAUTION! Do not connect the oxygen cell outlet to flow restricting devices, pressure lines, or vacuum lines. Pressure differentials across the cell sensor in excess of 1 psig could be harmful or damage the cell.

If the gas being monitored does not create a safety hazard, vent it to atmosphere at the sample system outlet. If venting the gas to atmosphere causes a safety hazard, vent the gas to a safe location. Make sure the venting system does not create a back pressure to the oxygen cell.

The vented sample will not be corrosive if you install and operate the cell properly.

1.9 Making Electrical Connections

WARNING! **To ensure the safe operation of this unit, you must install and operate the Series 1 as described in this user's manual. In addition, be sure to follow all applicable safety codes and regulations for installing electrical equipment in your area.**

WARNING! **Turn off the Series 1 before making any connections.**

Make all connections to the back of the meter (see Figure 8 below). The larger panel is separated into six sections, one for each channel.

1.9.1 Making Channel Connections

Make connections by placing the press-lock lever into the desired terminal. One press-lock lever is supplied with each terminal block. Press and hold the lever against the terminal block and insert the stripped and tinned portion of the wire into the terminal. Release the lever to secure the connection.

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Proper connections and cabling are extremely important to accurate measurement. Use the correct cable type for each probe and make sure the cables are not damaged during installation. If the cable being used is not a GE-supplied cable or is a modified cable, see *Installing Optional Features* in Chapter 1 of the *Service Manual*. See the sections which follow for specific connections.

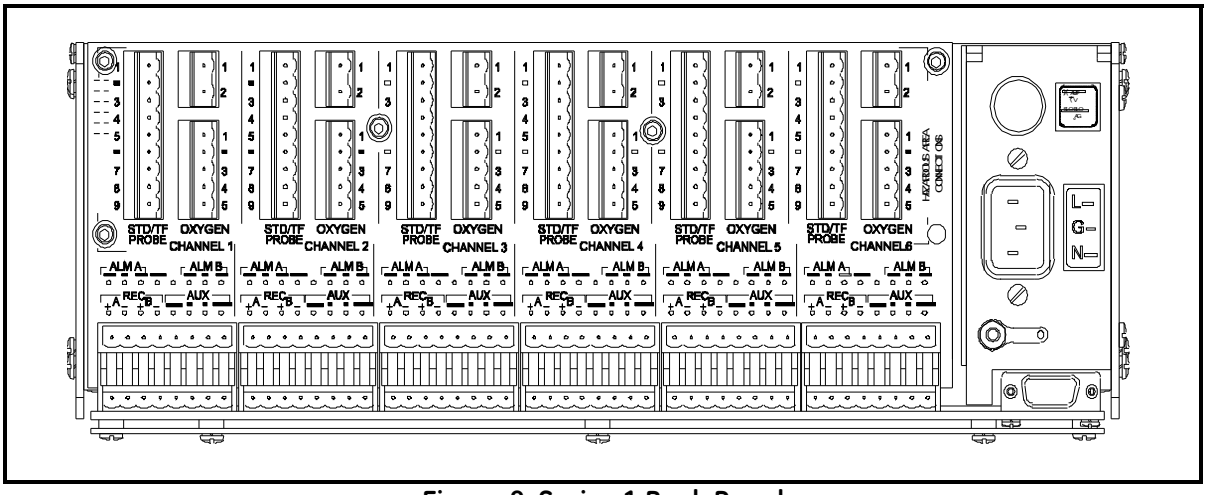


Figure 8: Series 1 Back Panel

1.9.2 Connecting the Power

WARNING! Division 2 applications may require special installation. Consult the National Electric Code for proper installation requirements. The analyzer must be configured in a suitable equipment enclosure and installed per the National Electric Code Article 500 applicable sections which pertain to the hazardous environment classification in which the electronics will be used.

Note: *The power line is the main disconnect device. However, GE does not provide power supply cords with CSA Div. 2 hygrometers.*

IMPORTANT: *For compliance with the EU's Low Voltage Directive (IEC 1010), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.*

1.9.3 Installation Instructions for CE Mark Conformity

CAUTION! In order to meet CE Mark requirements, you must install electrical cables as described below.

Note: *CE Mark compliance is required only for units used in EEC countries. To meet CE Mark compliance, shield and ground the electrical connections as shown in Table 1.*

Table 1: Wiring Modifications for CE Compliance

Connection	Termination Modification
Input/Output	Connect the shields to the nearest chassis ground using the shortest run of wire possible.

After all necessary electrical connections are made, seal the unused cable entry holes with standard conduit plugs or equivalent.

1.9.4 Connecting Moisture Probes

GE manufactures a variety of moisture probes for the Series 1. The most commonly used are the M Series, TF Series, and Moisture Image Series probes. If you ordered an M and/or TF Series probe(s), GE has entered the necessary probe setup data on a preassigned channel.

IMPORTANT: *See the Calibration Data Sheets, shipped with the probes, to connect the probes to their corresponding channels. If a probe is connected to the wrong channel, the meter will display incorrect data.*

Probes are identified on the Calibration Data Sheet by a serial number. The serial number is also engraved on the hex nut of the probe. Figure 9 shows a probe with the serial number on the hex nut.

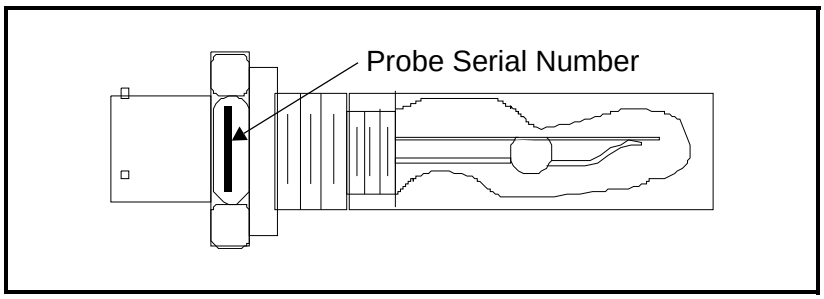


Figure 9: Moisture Probe Serial Number

The Moisture Image Series Probe does not require any preprogramming because it stores all the necessary setup data in its electronics module. Therefore, you can install the Moisture Image Series probe on any available channel. Once you install the probe, you must activate the probe on the installed channel, as described in *Activating and Changing Probes* in Chapter 2.

If you are using a combination of moisture probes, you should connect them in the following order:

- M Series probes
- TF Series probes
- Moisture Image Series probes

Use the following sections to properly connect probes.

1.9.4a M Series Probes

M Series probes are primarily used for moisture measurement, but can be ordered to measure temperature as well. If ordered, an optional temperature thermistor is included in the moisture probe and requires an additional connection.

Use a four-wire shielded cable with a bayonet-type connector to connect an M Series Probe to the electronics unit. The M Series Probe may be located up to 600 meters (2000 feet) from the Series 1.

Before making electrical connections, connect the cable to the probe by inserting the bayonet-type connector onto the probe and twisting the shell clockwise until it snaps into a locked position (approximately 1/8 inch of a turn). If you are not using a GE-supplied cable, refer to Figure 10 to make proper pin connections to a bayonet-type connector.

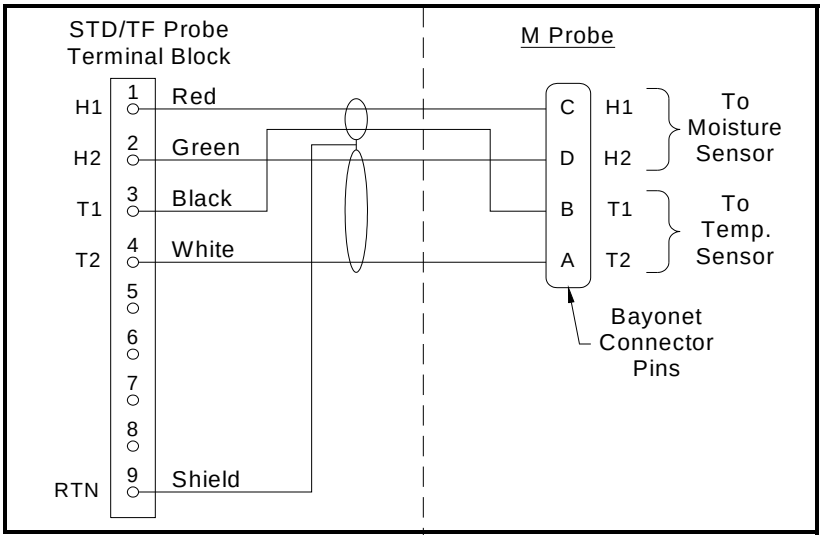


Figure 10: M Series Probe Cable Wiring Diagram

Use Table 2 on page 18 to connect the remaining end of the cable to the terminal block labeled STD/TF PROBE on the back of the electronics unit. See Figure 11 on page 18 for the terminal block location. You must make all the connections listed in the table even if you do not have the temperature option.

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

IMPORTANT: *See the Calibration Data Sheets, shipped with the probes, to connect the probes to their corresponding channels. If a probe is connected to the wrong channel, the meter will display incorrect data.*

1.9.4a M Series Probes (cont.)

If you connect a probe to the wrong channel, you can either reconnect the probe to the assigned channel, or reconfigure the current channel as described in *Verifying and Entering Setup Data* in Chapter 2.

WARNING! The M Series probe may not be capable of withstanding the 500 V insulation test required by clause 5.7 of EN50 020 when installed in the process media. This must be taken into account in any installation in which it is used. (See Cert. # Ex95C2002X in its entirety.) Copies of official BASEEFA documentation (certificates of compliance, licenses, etc.) are to be made in their entirety.

Table 2: M Series Probe Connections

Connect:	To STD/TF PROBE TB:
red wire (moisture H1)	pin #1
green wire (moisture H2)	pin #2
white wire (temperature T1)	pin #3
black wire (temperature T2)	pin #4
shield	pin #9

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

When you have connected the probe(s), perform a calibration test as described in *Performing an MH Calibration Test/Adjustment* in Chapter 1 of the *Service Manual* to check for small electrical offsets in the cable.

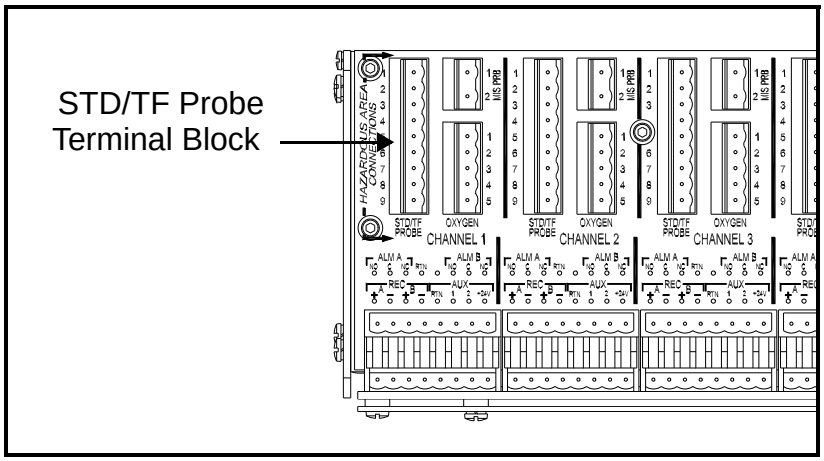


Figure 11: STD/TF Terminal Block Location

1.9.4b TF Series Probes

Using the special GE cable, connect the TF Series Probe to the designated terminal blocks on the back panel of the Series 1. You can locate the TF Series probes up to 600 meters (2000 feet) from the meter if you are measuring moisture and temperature only. If you are using pressure, the cable length should not exceed 152 meters (500 feet).

Before making electrical connections, connect the cable to the probe by inserting the connector onto the probe and securing it. If you are not using a GE-supplied cable, refer to Figure 12 to make proper pin connections to a bayonet-type connector.

IMPORTANT: *Refer to the Calibration Data Sheets to connect the probes to their corresponding channels. If a probe is connected to the wrong channel, the meter will display incorrect data.*

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Use Table 3 on page 20 to connect the remaining end of the cable to the terminal block labeled STD/TF PROBE on the back of the electronics unit. See Figure 13 on page 20 for terminal block locations.

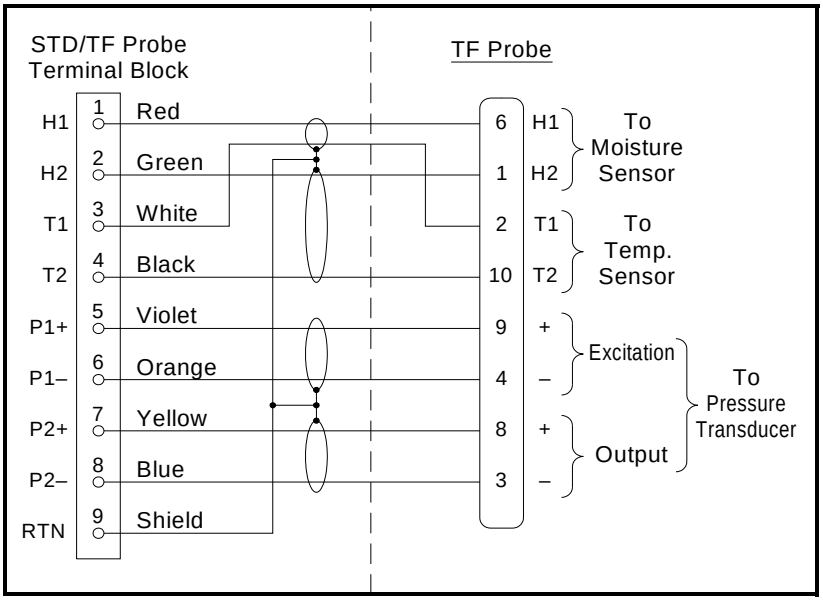


Figure 12: TF Series Probe Cable Wiring Diagram

1.9.4b TF Series Probes (cont.)

If you do connect a probe to the wrong channel, you can either reconnect the probe to the assigned channel, or reconfigure the channel (where the probe is connected) as described in *Verifying and Entering Setup Data* in Chapter 2 of this manual.

WARNING! The TF Series probe may not be capable of withstanding the 500 V insulation test required by clause 5.7 of EN50 020 when installed in the process media. This must be taken into account in any installation in which it is used. (See Cert. # Ex95C2002X in its entirety.) Copies of official BASEEFA documentation (certificates of compliance, licenses, etc.) are to be made in their entirety.

Table 3: TF Series Probe Connections

Connect:	To STD/TF PROBE TB:	Connect	To STD/TF Probe TB:
red wire (moisture H1)	pin #1	orange wire (IN –)	pin #6
green wire (moisture H2)	pin #2	yellow wire (OUT +)	pin #7
white wire (temperature T1)	pin #3	blue wire (OUT –)	pin #8
black wire (temperature T2)	pin #4	shield	pin #9
violet wire (IN +)	pin #5		

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Once you connect the probe(s), perform a calibration test as described in *Performing an MH Calibration Test/Adjustment* in Chapter 1 of the *Service Manual*, to check for small electrical offsets in the cable.

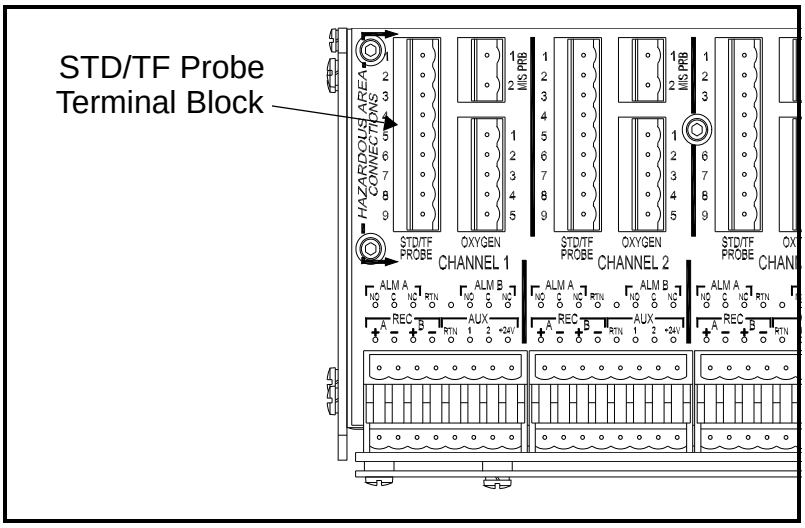


Figure 13: STD/TF Probe Terminal Block Location

1.9.4c Moisture Image Series Probes

Connect the Moisture Image Series probes to the Series 1 using a standard twisted-pair cable with a bayonet-type connector. You can locate the Moisture Image Series Probe up to 915 meters (3000 feet) from the electronics unit.

Before making any electrical connections, you must assemble the probe. The Moisture Image Series probes may be shipped in two parts: a probe and an electronics module, each of which has a serial number. Match the appropriate probe to the matching electronics module using the serial numbers that are listed on the Calibration Data Sheet. Insert the probe into the probe connector on the electronics module and turn counterclockwise (see Figure 14).

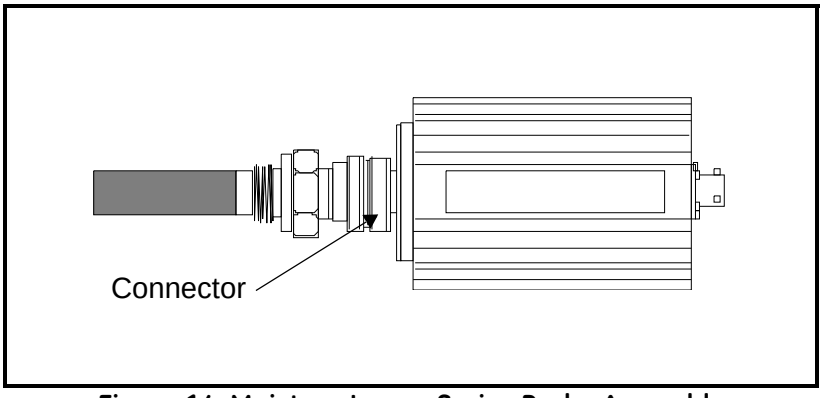


Figure 14: Moisture Image Series Probe Assembly

CAUTION! The MISP2 probe has an integral set of electronics that are permanently attached (see Figure 15). Do not attempt to separate the probe from the electronics.

Figure 15: MISP2 Probe

1.9.4c Moisture Image Series Probes (cont.)

If the Moisture Image Series probe required assembly, once the probe is assembled, connect the cable to the terminal block labeled MIS PRB on the back panel of the electronics unit (refer to Figure 16 and Table 4).

IMPORTANT: *DO NOT connect the cable to the Moisture Image Series Probe until you make the proper connections to the back of the meter.*

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

You can connect the Moisture Image Series Probe to any channel. However, if you are also using other sensors, such as the M and/or TF Series probes, be sure to connect the Moisture Image Series Probe to an open channel.

IMPORTANT: *Check the Calibration Data Sheets (of all the sensors) to determine which channels already have probe assignments.*

Table 4: Moisture Image Series Probe Connections

Connect:	To MIS PRB Term. Block:
positive wire (white)	pin #1
return wire (black)	pin #2

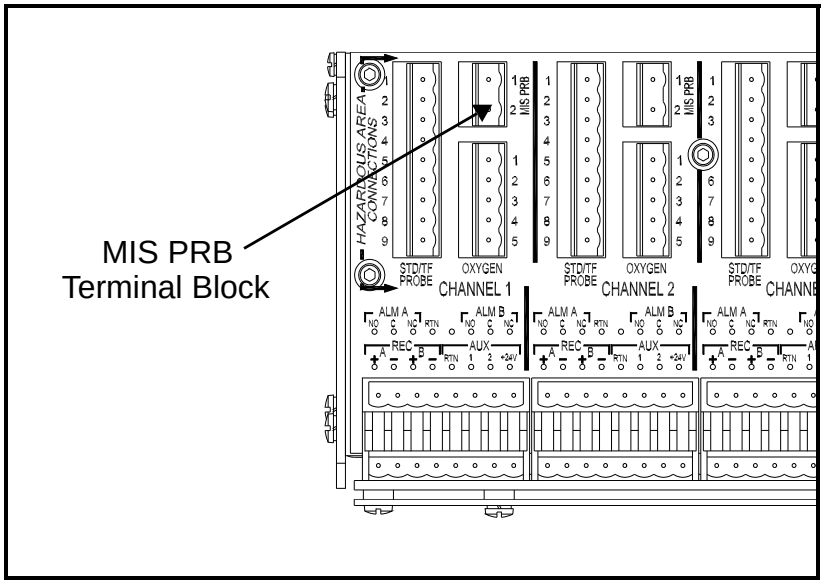


Figure 16: MIS PRB Terminal Block Location

1.9.4c Moisture Image Series Probes (cont.)

After you make the back panel connections, connect the remaining end of the probe cable to the probe electronics module by inserting the bayonet-type connector onto the module and twisting the shell clockwise until it snaps into a locked position (approximately 1/8 inch of a turn).

If you are not using a GE-supplied cable, see Figure 17 to make proper pin connections to a bayonet-type connector.

Once you complete connecting the Moisture Image Series Probe(s), you must activate the probe on the installed channel as described in *Activating and Changing Probes* in Chapter 2.

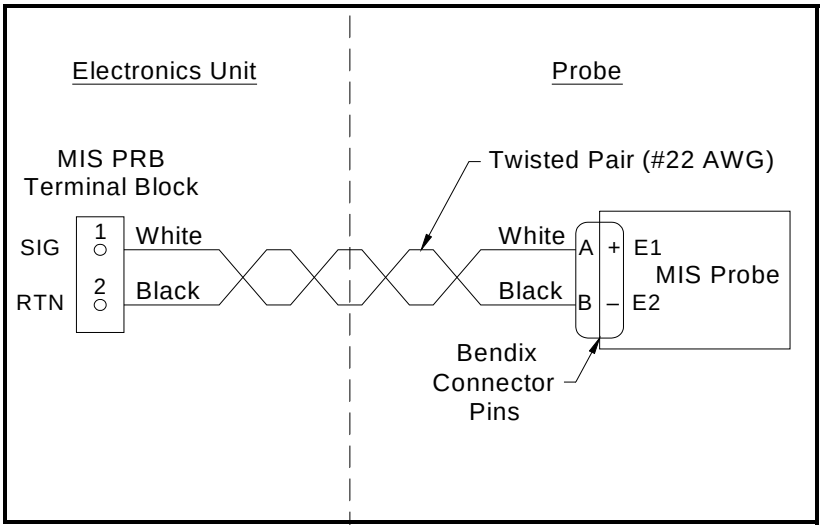


Figure 17: MIS Probe Cable Wiring Diagram

1.9.5 Connecting the Delta F Oxygen Cell

The Delta F Oxygen Cell is available in a general-purpose model with standard or VCR® fittings. The oxygen cell can also be mounted in a weatherproof enclosure (R4) for outdoor applications or an explosion-proof enclosure (R7) for hazardous areas.

CAUTION! Do not power up a Series 1 without establishing a flow through the Delta F Oxygen Cell (see page 29).

Each model of the oxygen cell has a set of sensing and secondary electrodes. Make connections from the electrodes on the cell to the terminal block labeled OXYGEN on the back of the electronics unit (see Figure 18 on page 25). For proper operation, make connections to each set of electrodes using a four-wire shielded cable. GE provides the "O" type cable with 22 AWG leads for the Delta F oxygen cells.

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Cable error is a function of cable resistance/foot, length of cable, and maximum sensor current output. Since higher range sensors have a greater current output, they have lower acceptable cable lengths. Larger gauge cable yields longer acceptable cable lengths. Use Table 5 to determine acceptable installation lengths.

Table 5: Acceptable Cable Lengths for Delta F Ranges

Delta F Sensor Range	Cable Gauge	Max Length
0-50 ppm and 0-100 ppm	22 AWG	1300 ft
0-1000 ppm	22 AWG	400 ft
0-10,000 ppm and greater	22 AWG	100 ft
0-50 ppm and 0-100 ppm	20 AWG	2100 ft
0-1000 ppm	20 AWG	630 ft
0-10,000 ppm and greater	20 AWG	160 ft
0-50 ppm and 0-100 ppm	18 AWG	3300 ft
0-1000 ppm	18 AWG	1000 ft
0-10,000 ppm and greater	18 AWG	250 ft
0-50 ppm and 0-100 ppm	16 AWG	6600 ft
0-1000 ppm	16 AWG	2000 ft
0-10,000 ppm and greater	16 AWG	500 ft

1.9.5 Connecting the Delta F Oxygen Cell (cont.)

Note: *Cable with 16 AWG wire is the largest cable size that can be easily installed into the instrument terminal blocks and the Delta F sensor terminal posts.*

Instructions for connecting each type of cell are described in the following sections. If you are installing the oxygen cell in an intrinsically safe area, you should refer to the following section for special installation requirements.

WARNING! The Delta F Oxygen Cell is BASEEFA approved for use in intrinsically safe areas when connected to a BASEEFA approved Series 1 Hygrometer. Install the apparatus so that the terminals are protected to at least the requirements of IP20. Copies of official BASEEFA documentation (certificates of compliance, licenses, etc.) are to be made in their entirety.

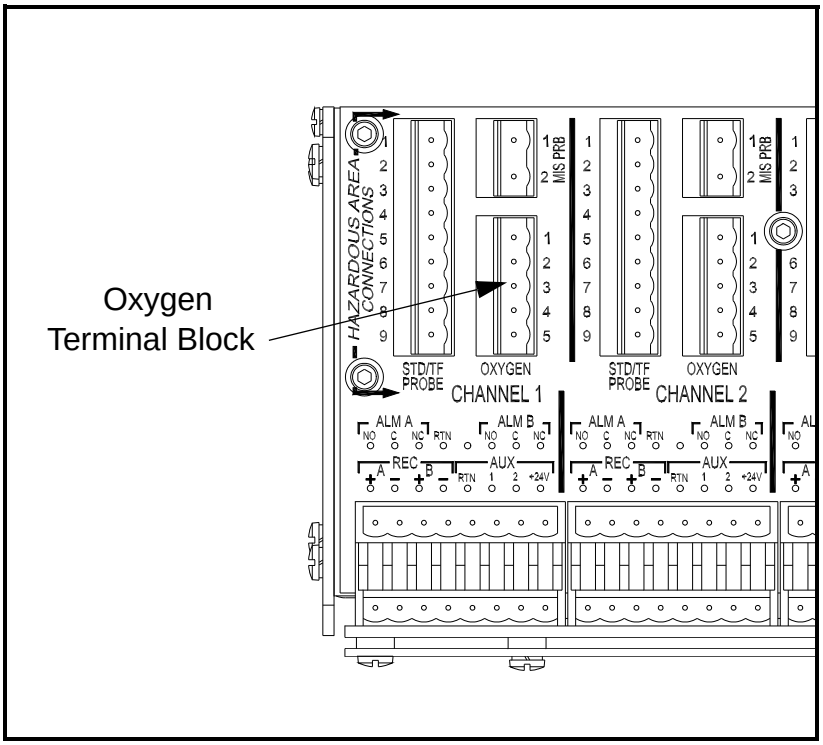


Figure 18: OXYGEN Terminal Block

1.9.5a Standard Delta F Oxygen Cells

Figure 19 shows the standard oxygen cell and identifies the sensing and secondary electrodes. Make oxygen cell connections from the electrodes on the oxygen cell to the OXYGEN terminal block on the back of the electronics unit. Use Table 6 to make oxygen cell connections.

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Table 6: Standard Delta F Oxygen Cell Connections

Connect:	To Delta F Oxygen Cell:	To Series 1 OXYGEN Terminal Block
red wire	+ sensing electrode	pin 1
green wire	– sensing electrode	pin 2
white wire	+ secondary electrode	pin 3
black wire	– secondary electrode	pin 4
shield	- - -	pin 5

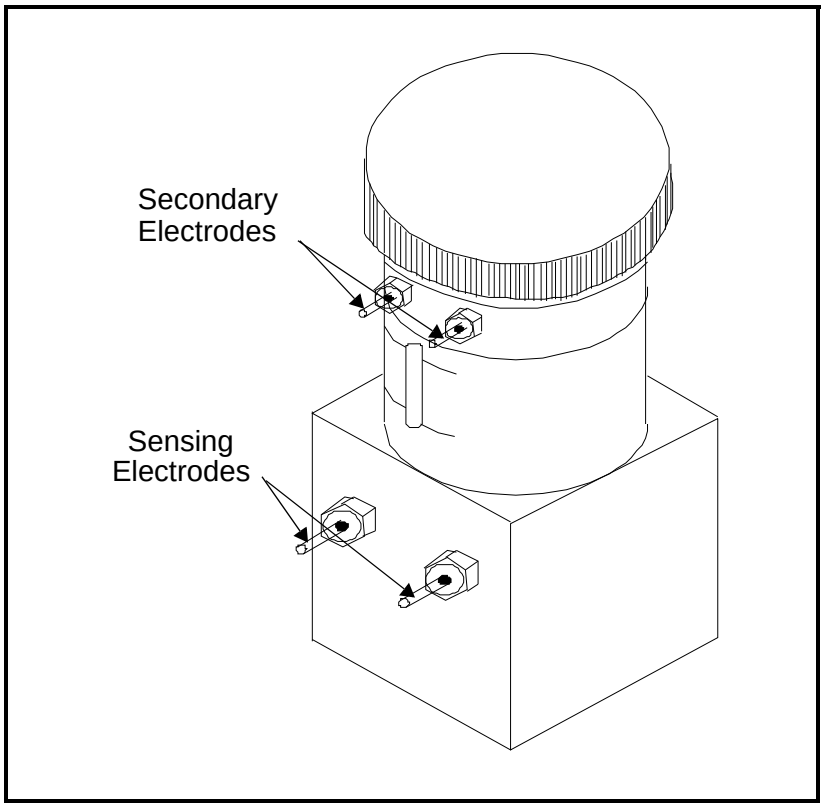


Figure 19: Standard Delta F Oxygen Cell

1.9.5b Weatherproof Delta F Oxygen Cells

Figure 20 shows the weatherproof oxygen cell. The oxygen cell has a set of sensing and secondary electrodes that are wired to a terminal strip in the weatherproof enclosure. Connect the weatherproof oxygen cell using a four-wire shielded cable with a mating bayonet-type connector. Fasten the bayonet-type connector to the mating connector on the bottom of the weatherproof enclosure. Connect the other end of the cable to the OXYGEN terminal block on the back of the electronics unit as shown in Table 7.

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Table 7: Weatherproof Delta F Oxygen Cell Connections

Connect:	To Delta F Enclosure Terminal Block	To Series 1 OXYGEN Terminal Block
red wire (+)	pin 1	pin 1
green wire (–)	pin 3	pin 2
white wire (+)	pin 4	pin 3
black wire (–)	pin 5	pin 4
shield	pin 2	pin 5

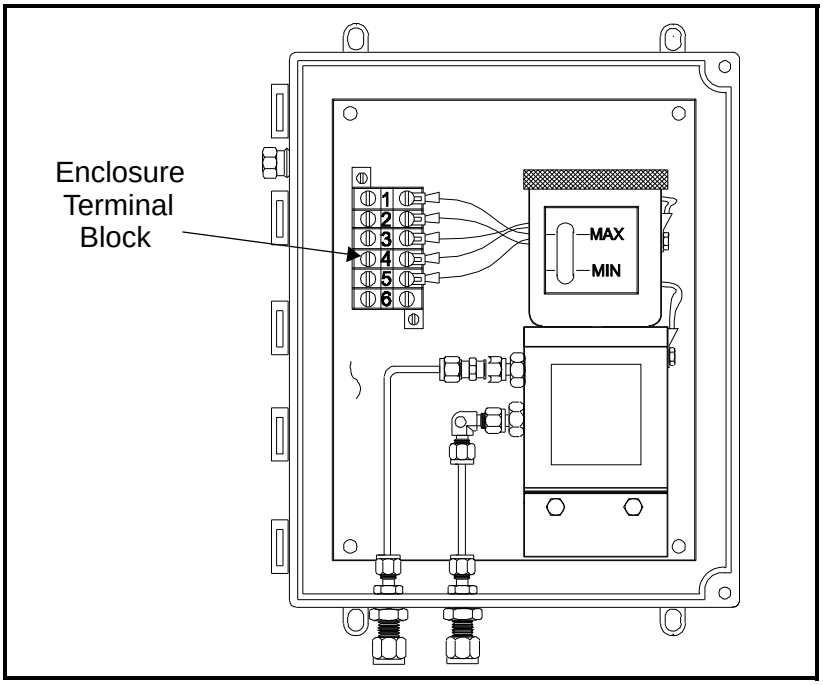


Figure 20: Weatherproof Delta F Oxygen Cell

1.9.5c Explosion-proof Delta F Oxygen Cells

Figure 21 shows the explosion-proof oxygen cell. The oxygen cell has a set of sensing and secondary electrodes that are wired to a terminal strip in the explosion-proof enclosure. Connect the explosion-proof oxygen cell using a four-wire shielded cable. Connect one end of the cable to the OXYGEN terminal block on the back of the electronics unit and the other end to the terminal strip in the oxygen cell enclosure. Feed cable wires through an opening in the side of the explosion-proof enclosure. Use Table 8 to make oxygen cell connections.

IMPORTANT: *To maintain good contact at each terminal block and to avoid damaging the pins on the connector, pull the connector straight off (not at an angle), make cable connections while the connector is away from the unit, and push the connector straight on (not at an angle) when the wiring is complete.*

Table 8: Explosion-proof Oxygen Cell Connections

Connect:	To Oxygen Cell Terminal Block	To Series 1 OXYGEN Terminal Block:
red wire (+)	pin 1	pin 1
shield	–	pin 5
green wire (–)	pin 2	pin 2
white wire (+)	pin 3	pin 3
black wire (–)	pin 4	pin 4

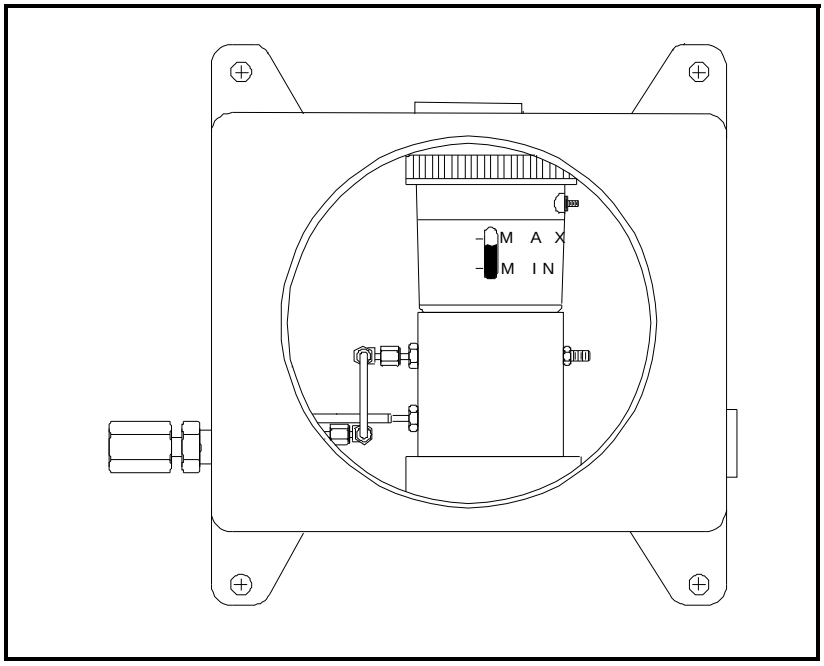


Figure 21: Explosion-proof Delta F Oxygen Cell

1.10 Establishing a Gas Flow Through the Oxygen Cell

CAUTION! **Establish a gas sample flow before you power up or damage may occur to the oxygen cell.**

If you are using an oxygen cell, you must establish a gas flow through the cell before powering up. If you are not using an oxygen cell, proceed to Chapter 2, *Initial Setup.*

The oxygen cell requires a flow rate of 2 to 2.5 SCFH through the cell. Oxygen cell inlet pressure should be between 0.2 and 1.0 PSIG. Refer to Figure 22 on page 30 when establishing a gas sample flow.

CAUTION! **Do not operate the Delta F oxygen cell for extended periods of time at oxygen concentrations that are over range. Trace and low percent range sensors may be damaged if exposed to high levels of oxygen, such as air, for long periods (>1 hour) while the Series 1 is on. If exposure is unavoidable, either disconnect the oxygen cell from the Series 1 or equip the sample system with a valve that allows the cell to be switched to purge gas.**

Close the flow control valve and adjust the upstream pressure as required. GE recommends about 2 to 10 PSIG upstream of the flow control valve, depending on which valve is installed in the sample system.

To safeguard against over pressurizing the oxygen cell, install a relief valve rated at 10 PSIG into the gas flow system. If the pressure exceeds 10 PSIG, the relief valve will open; therefore, there should be no restrictions downstream of the oxygen cell. Use 1/4 inch tubing or larger on the oxygen cell outlet and relief valve outlet. Both outlets should vent to atmosphere if possible.

CAUTION! **Do not tie the relief valve and oxygen cell outlet to a common outlet line smaller than 1/4 inch. This pressure restriction will damage the oxygen cell. In addition, a relief valve should be installed in the oxygen sample system. If either of these conditions are not met, the Delta F Oxygen Cell warranty will be voided.**

1.10 Establishing a Gas Flow Through the Oxygen Cell (cont.)

Slowly open the flow control valve until the recommended flow of 2 to 2.5 SCFH is established on the flow meter.

When the proper flow is achieved, make sure the relief valve is closed by placing an object (e.g., your finger, if the gas is non-corrosive) over the relief valve vent. Cover and uncover the relief valve vent and verify that the flow meter shows no change in the flow rate. Keep the relief valve closed during operation to minimize leakage in the sample system.

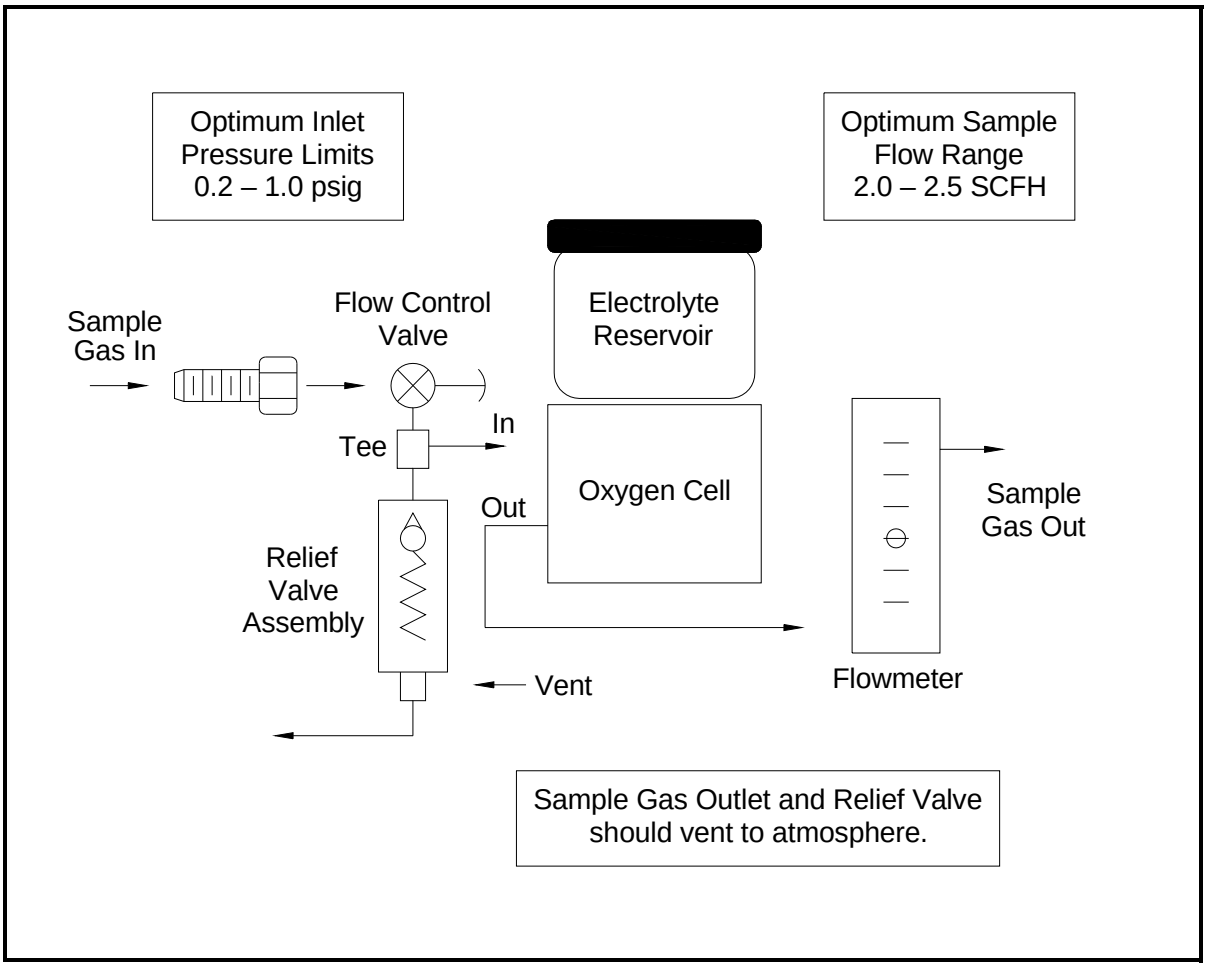


Figure 22: Gas Flow Schematic

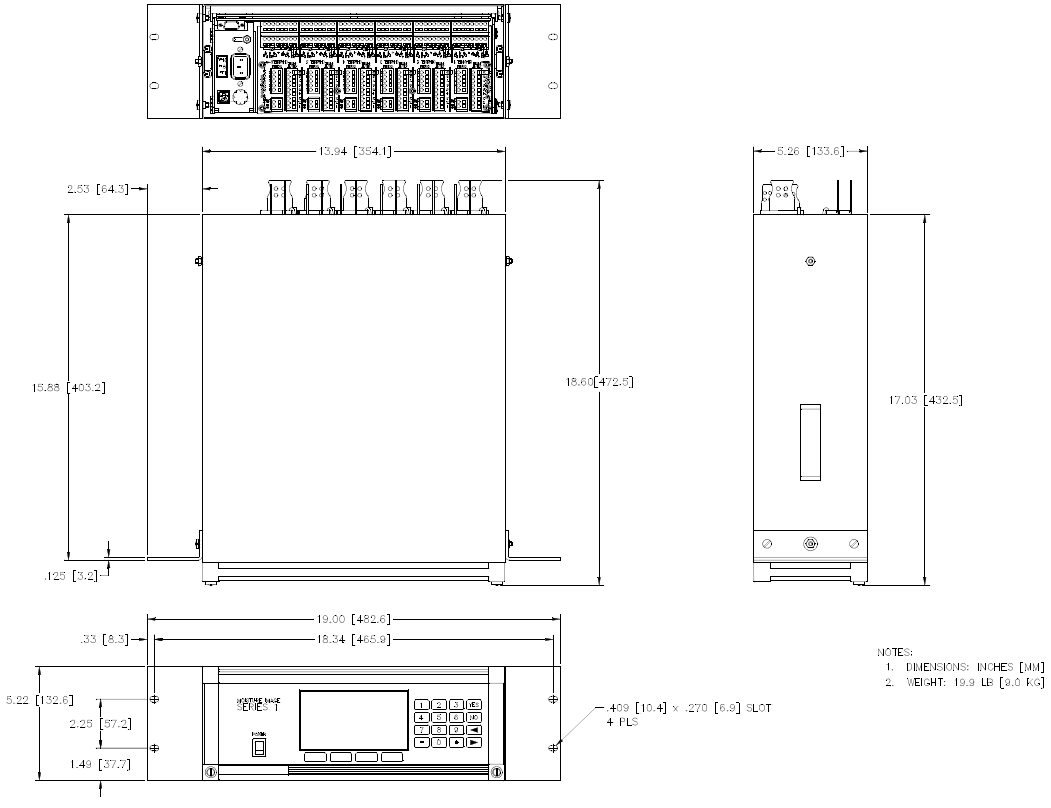


Figure 23: Moisture Image Series 1 Rack Mount Outline and Installation (Dwg. #712-233)

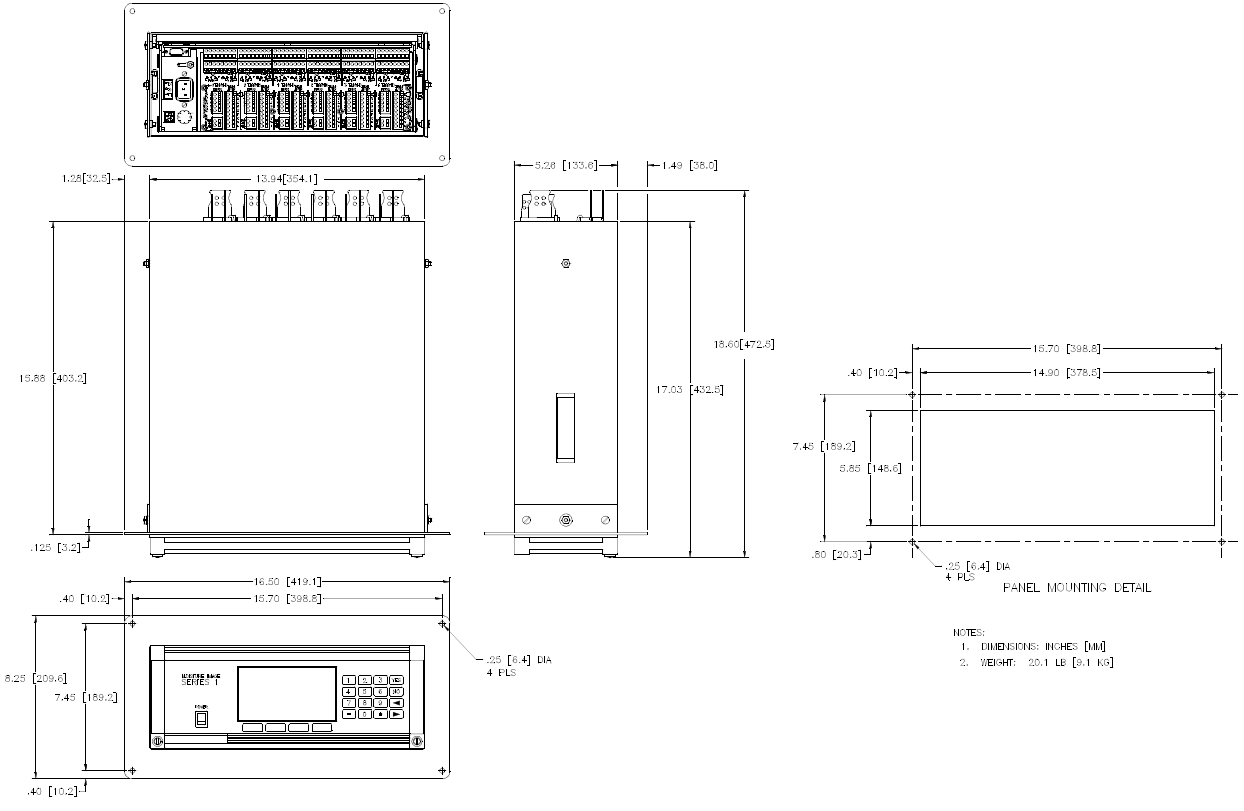


Figure 24: Moisture Image Series 1 Panel Mount Outline and Installation (Dwg. #712-234

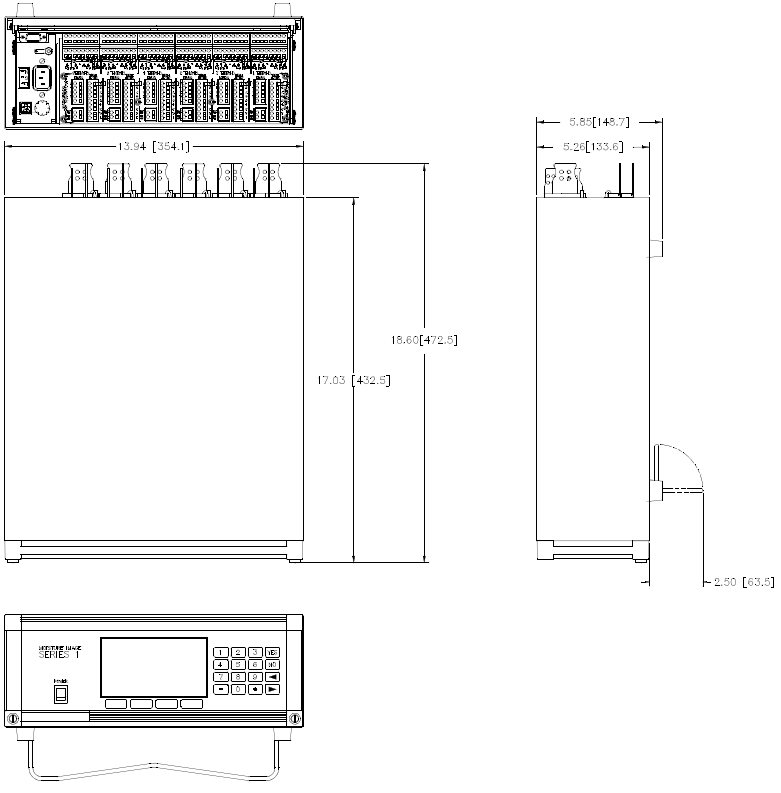


Figure 25: Moisture Image Series 1 Bench Mount Outline and Installation (Dwg. #712-235)

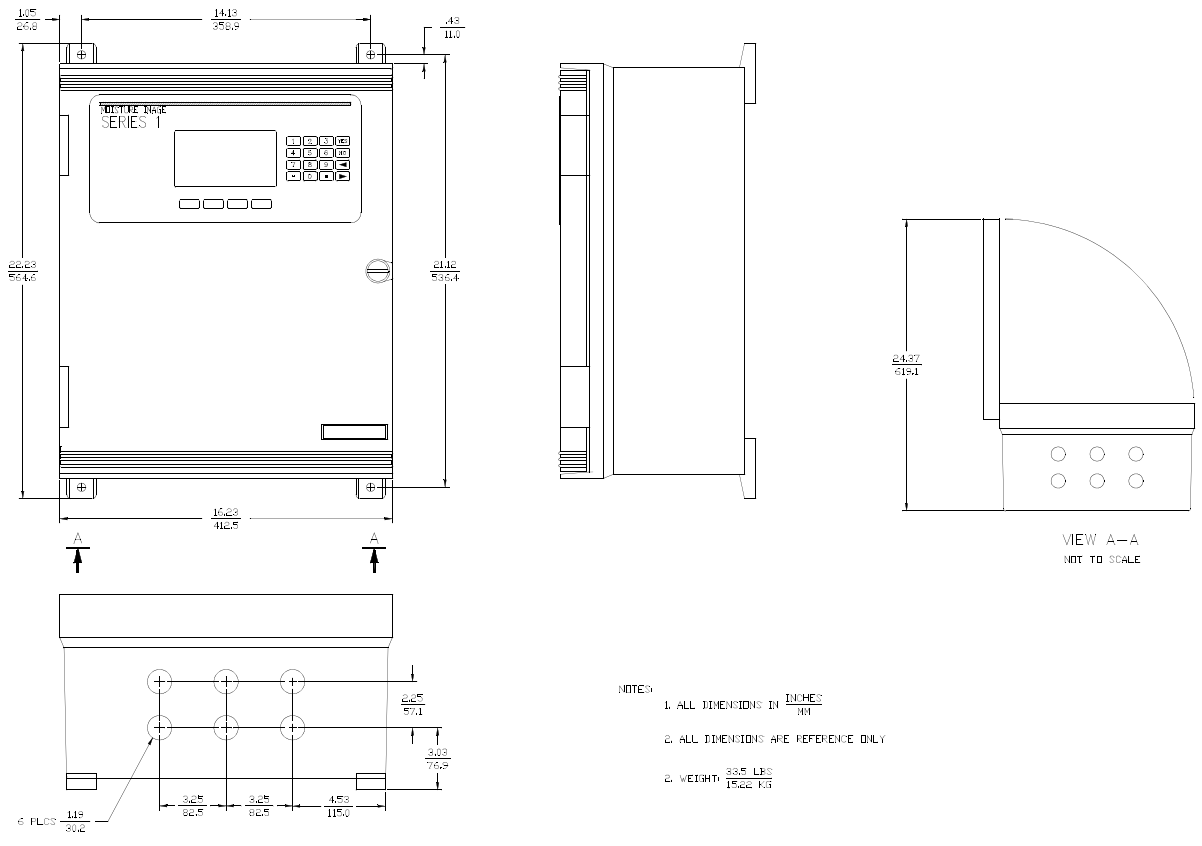
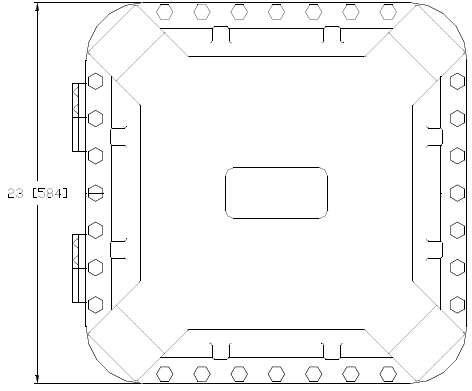
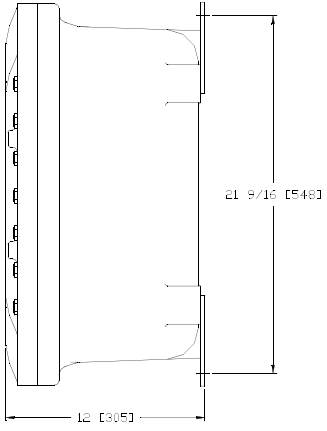
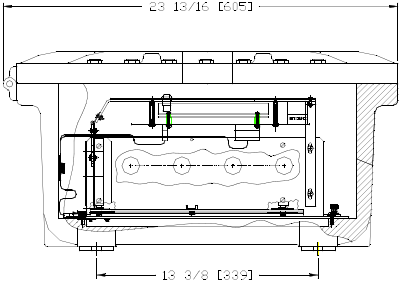


Figure 26: Moisture Image Series 1 Weatherproof Version Outline and Installation (Dwg. #712-1064)







To wire the power line to the disconnect device:

1. Make sure the disconnect device is not energized, by placing the switch in the OFF position and cutting the main power source.

2. Run the appropriate cable between the disconnect device and the electronics enclosure.

3. Wire the cable end at the disconnect device as described in the instructions provided with that device.

4. Plug the socketed end of the cable into the appropriate socket inside the Series 1 enclosure.

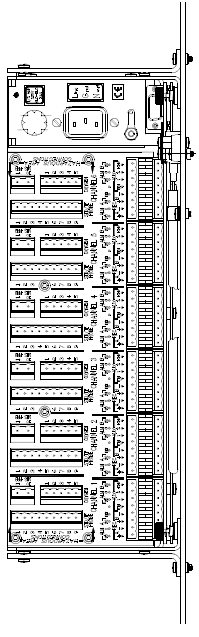
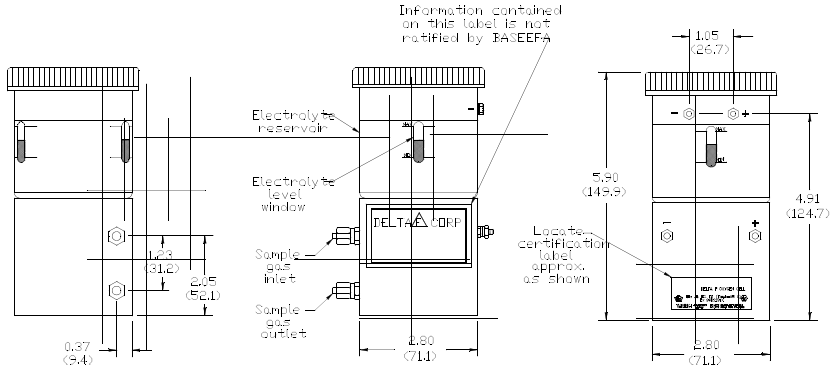


Figure 27: Moisture Image Series 1 Explosion-proof Version Outline and Installation (from Dwg. #705-874



NOTES:

1. OXYGEN CELL IS MANUFACTURED BY DELTA F CORP. (MODEL NO. SF OR SP)
2. DIMENSIONS: INCHES (MM)
3. ENCLOSURE MATERIAL IS PLASTIC.
4. ALL EXPOSED METALWORK CONTAINS LESS THAN 6% MAGNESIUM BY WEIGHT.
5. CERTIFICATION LABEL MATERIAL IS ULTRA DESTRUCTIBLE TYPE.

CHANGES TO THIS DRAWING REQUIRE PRIOR AUTHORIZATION FROM BASEEFA

Figure 28: Delta F Oxygen Cell (Dwg. 752-064)

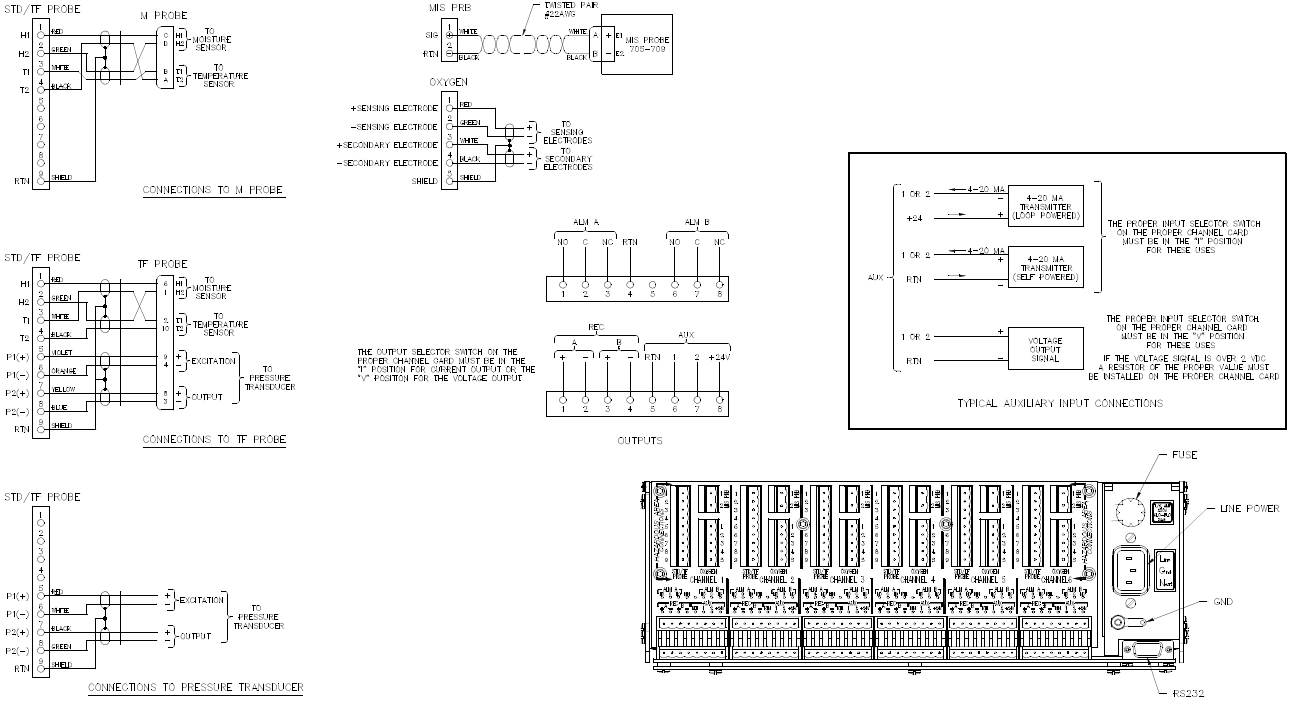
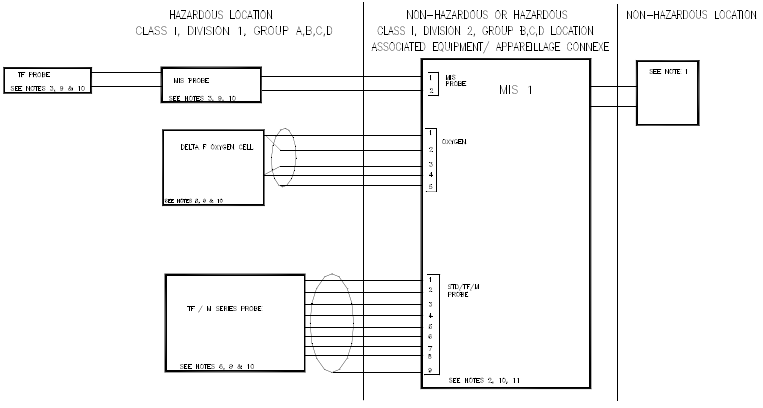


Figure 29: Moisture Image Series 1 Interconnection Diagram (Dwg. #702-190)



CSA CONTROLLED DOCUMENT DO NOT ALTER WITHOUT CSA AUTHORIZATION

NOTES:

1. APPARATUS WHICH IS UNSPECIFIED EXCEPT THAT IT MUST NOT USE OR GENERATE MORE THAN 250VRMS OR 250VDC FOR DIVISION 2 APPLICATIONS POWER TO THE MIS 1, MIS 2 OR MIS 3 MUST BE SUPPLIED IN ACCORDANCE WITH DIVISION 2 WIRING METHODS AS DOCUMENTED IN THE CEC.
2. FOR CLEARITY PURPOSES ONE OUTPUT CHANNEL IS SHOWN, MIS 1 HAS THE OPTION FOR CONNECTION OF 6 OUTPUT OPTIONS AS DESCRIBED.
3. A SINGLE TF PROBE MAY BE CONNECTED TO EACH OF THE MIS PROBE SOCKETS.
4. A SINGLE MIS PROBE MAY BE CONNECTED TO EACH OF THE 6 MIS PROBE TERMINALS OF THE MIS 1.
5. A SINGLE DELTA F OXYGEN SENSOR MAY BE CONNECTED TO EACH OF THE OXYGEN TERMINALS OF THE MIS 1.
6. A SINGLE TF OR M SERIES PROBE MAY BE CONNECTED TO EACH OF THE STD/TF TERMINALS OF THE MIS 1.
7. REFER TO CANADIAN ELECTRICAL CODE FOR ALLOWABLE CABLE PARAMETERS AND LENGTHS AND ALL INSTALLATIONS MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE PART 1.
8. WARNING – SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
   AVERTISSEMENT – LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.
9. TF/M SERIES PROBE, MIS PROBE AND THE DELTA F OXYGEN SENSOR ARE INTRINSICALLY SAFE FOR USE IN CLASS I, DIVISION 1, GROUP A,B,C,D HAZARDOUS LOCATIONS WHEN INSTALLED IN ACCORDANCE WITH THIS DRAWING
10. OPERATING AMBIENTS:

TF/M SERIES PROBES	70°C	T4
MIS PROBE	80°C	T4
DELTA F OXYGEN SENSOR	50°C	T5
MIS 1, MIS 2 & MMS 3	50°C	T5

11. DO NOT CONNECT OR DISCONNECT INPUT POWER OR REMOVE FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR IF AREA IS KNOWN TO BE NON-HAZARDOUS.
12. "WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2" and, "AVERTISSEMENT – RISQUE D'EXPLOSION – LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIAL INACCEPTABLE POUR LES EMPACEMENTS DE CLASSE I, DIVISION 2."

    "WARNING – EXPLOSION HAZARD – DO NOT REPLACE FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS" and "AVERTISSEMENT – RISQUE D'EXPLOSION – COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX AVANT DE REPLACER LE FUSE.

    "WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS" and "AVERTISSEMENT – RISQUE D'EXPLOSION – AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX."

Figure 30: DeMoisture Image Series 1 Intrinsically Safe Diagram (from Dwg. #752-138)

Chapter 2. Initial Setup

2.1 Introduction

The Moisture Image Series 1 is a highly advanced and versatile instrument. Because of this, operation ranges from basic to advanced functions. This chapter is designed to provide a step-by-step guide to getting the meter up and running as quickly as possible. Additional programming options provide access to the more advanced features of the meter, but this information is not required to begin taking measurements.

Note: *See the* Programming Manual *for information on those User Program options not covered in this chapter.*

2.2 Using the Front Panel to Access Data

This section explains how to use the front panel for viewing and entering data. It includes the following:

- powering up the unit
- entering data into the user program
- screen and key functions
- entering the passcode

Read the following sections carefully to properly set up and operate your instrument.

WARNING! **TO ENSURE THE SAFE OPERATION OF THIS UNIT, YOU MUST INSTALL AND OPERATE THE SERIES 1 AS DESCRIBED IN THIS STARTUP GUIDE. IN ADDITION, BE SURE TO FOLLOW ALL APPLICABLE SAFETY CODES AND REGULATIONS FOR INSTALLING ELECTRICAL EQUIPMENT IN YOUR AREA.**

IMPORTANT: *You must install a switch or circuit breaker on the input power line. For greatest safety, locate the circuit breaker or power switch near the electronics console. To comply with the Low Voltage Directive, you must install an external current protection device.*

2.2.1 Powering Up

The Series 1 has a universal power supply that automatically adjusts to line voltages from 90 to 260 VAC. After making electrical connections (including grounding) as described in Chapter 1, *Installation,* press the power switch to power up the meter.

Note: *The AC power cord is the main disconnect device.*

IMPORTANT: *For compliance with the EU's Low Voltage Directive (IEC 1010), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.*

CAUTION! **Do not operate the Delta F oxygen cell for extended periods of time at oxygen concentrations that are over range. Trace and low percent range sensors may be damaged if exposed to high levels of oxygen, such as air, for long periods (>1 hour) while the Series 1 is on. If exposure is unavoidable, either disconnect the oxygen cell from the Series 1 or equip the sample system with a valve that allows the cell to be switched to purge gas.**

If the unit passes its self-test, the screen begins displaying measurements in a matrix format similar to the one shown in Figure 31.

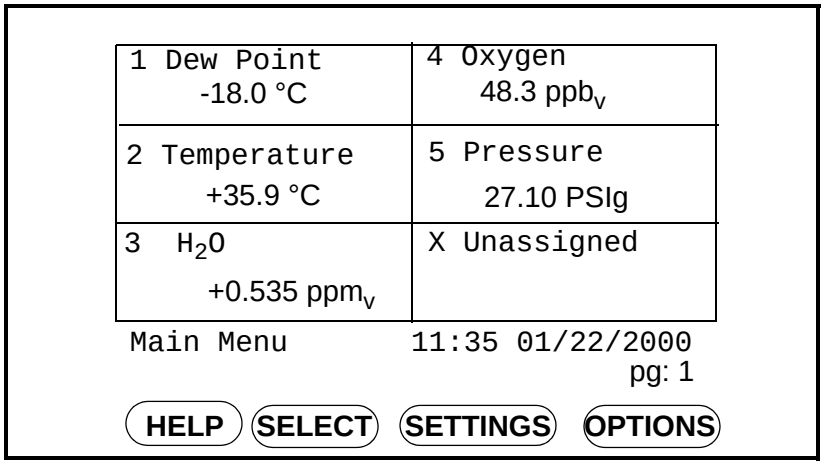


Figure 31: Screen Matrix Format After Power Up

2.2.2 Entering Data into the User Program

The Series 1 has a user program that enables you to enter data to set up alarms, recorders, and probes, as well as its other features. This program consists of the following four main menus (refer to Figure 43 on page 63 and Figure 44 on page 64 for menu maps of the user program):

- HELP - provides on-line help for the various menus of the user program.
- SELECT - lets you select the type of measurement and units to display.
- SETTINGS - enables you to set up recorders and alarms, as well as enter probe data for basic operation. (To enter this menu you must enter the passcode. See page 43.)
- OPTIONS - enables you to set up the screen to display measurements in text or graphical form. It is also used to perform advanced functions.

You can use the screen, four menu keys, and the keypad to enter data into the meter (see Figure 32).

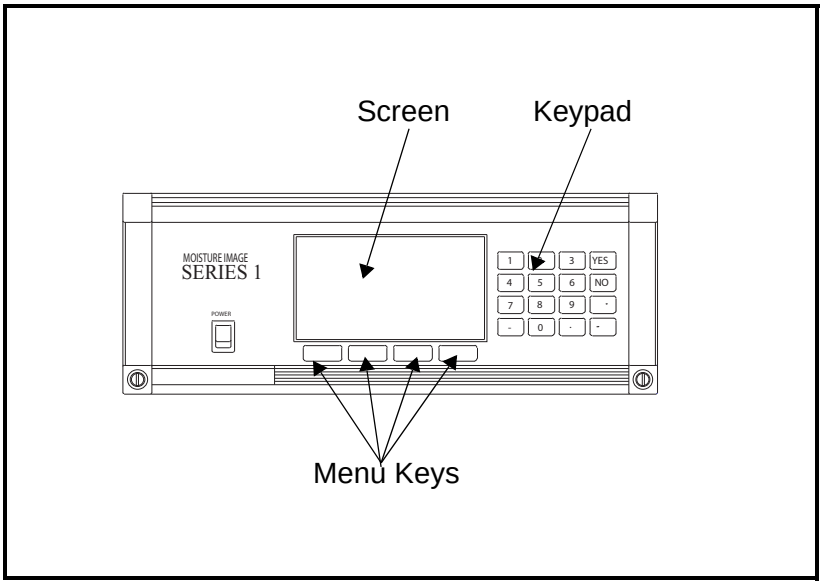


Figure 32: The Moisture Image Series 1 Front Panel

2.2.3 Screen and Key Functions

The screen displays measurements, up to four menu options, system messages, and a **pointer**. The pointer acts as a measurement indicator, as well as a guide during data entry.

While the meter displays measurements in the matrix format, the pointer moves sequentially from box to box to indicate measurement updates. However, while in the user program, you can use the arrow keys to move the pointer to the desired location for data entry.

The menu options appear at the bottom of the screen. Below the screen are the corresponding menu keys (refer to Figure 33). Each **menu key** corresponds to each of the menu options in the user program. Up to four new menu options appear each time you enter a menu.

The line above the menu options is the **message line** (see Figure 33). The message line displays the menu title, the time, and the date. The message line also displays a list of selections depending on the menu option you enter.

The **page indicator** is located in between the message line and the menu keys. Since the meter is capable of displaying up to six pages of data, the page indicator displays the currently selected page.

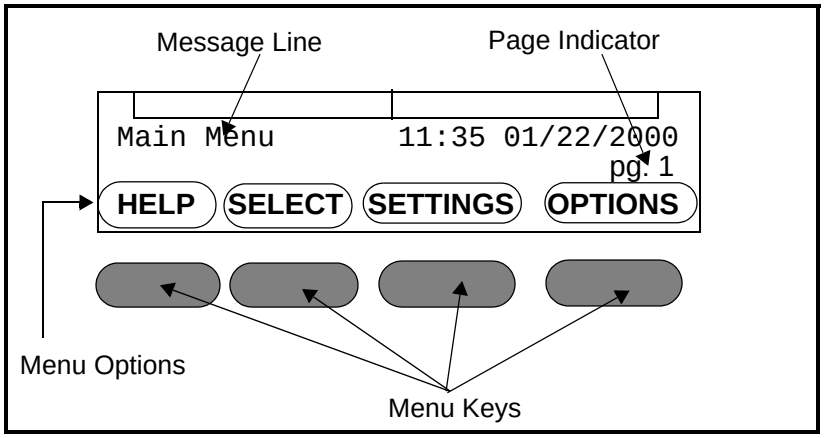


Figure 33: Screen Components

2.2.3 Screen and Key Functions (cont.)

The keypad to the side of the screen consists of 16 keys, including the [.] and [–] symbols, two arrow keys, and two response keys: [YES] and [NO]. The numeric keys are for numeric entry only; however, the arrow and response keys have more than one function.

The arrow keys perform two functions:

- Use either arrow key to move the screen pointer to the desired location for data entry.
- Use the left arrow key as a backspace during number entry.

The response keys perform three functions:

- Use either the [YES] or [NO] key to respond to questions.
- Use the [NO] key to erase data.
- Press [YES] to confirm a number entry or after erasing data to retrieve the previous number.

2.2.4 Entering the Passcode

The Settings Menu is the only menu that requires a **passcode**. The passcode is a four-digit number that enables only authorized users to enter setup data. The Series 1 prompts you to enter the passcode when you enter the Settings Menu. See the end of this chapter for your default passcode.

2.3 Verifying and Entering Setup Data

Before the meter can make measurements, it must have the proper setup data entered into its memory. GE has entered all or most of the setup data for each probe before delivery; however, you should verify that all the data is correct and entered into your unit.

Note: *If you want to switch a probe from one channel to another, you must re-enter some or all of the setup data as described in this section.*

Verifying setup data consists of three steps:

- Verify that probes are properly activated in the Probe Configuration Menu as described on page 45.
- Verify that calibration data for all necessary probes is properly entered in the System Calibration Menu as described on page 49.
- Verify that applicable high and low reference values for the Series 1 measurement circuitry are properly entered into the Reference Menu as described on page 54.

CAUTION! **All high and low reference values are factory set and normally do not need adjustment. However, the factory may instruct you to adjust the high and low moisture reference values. If necessary, you should do so as described in *Performing an MH Calibration/Adjustment Test* in Chapter 1 of the *Service Manual*.**

Use the following sections to properly verify and enter setup data.

IMPORTANT: *While you are reviewing data, you should take the time to record it on the Program Information List supplied in Appendix A, or on a separate sheet of paper.*

2.3.1 Activating and Changing Probes

Although the probes are physically connected to the back of the electronics unit, you must "tell" the electronics what type of measurements the probe is capable of making. In addition, if you want to use a constant value rather than a live input, you must "tell" the electronics that you are using a constant value.

If you do not activate probes, or if you activate them incorrectly, the meter will display No Probe or other error messages.

Once you verify and/or change configuration data, refer to *Entering Calibration Data* on page 49.

2.3.1a Verifying Probe Configuration Data

IMPORTANT: *You should record this data on the Program Information List supplied in Appendix A, or on a separate sheet of paper, and keep it in a safe place.*

1. Enter the Probe Configuration Menu. (See Figure 44 on page 64 for a menu map.) A screen similar to Figure 34 appears.

Table 9: Entering the Probe Configuration Menu

Press the Main Menu key:	To enter the:
SETTINGS*	Settings Menu
SYSTEM	System Settings Menu
CONFIG	Probe Configuration Menu

*The Settings Menu will prompt for a passcode (see page 43).

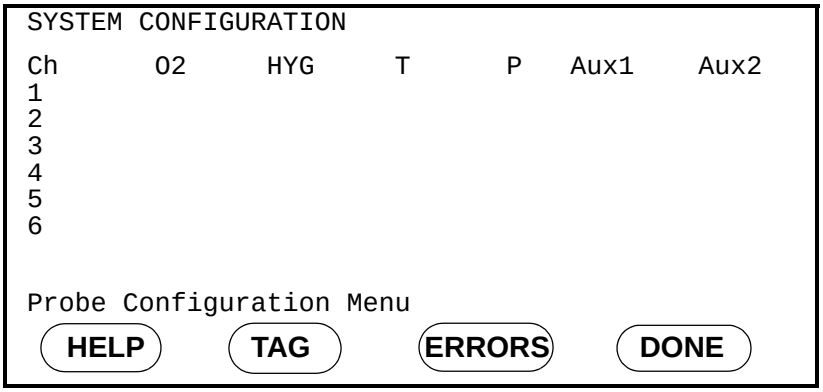


Figure 34: Probe Configuration Menu

2.3.1a Verifying Probe Configuration Data (cont.)

2. Verify that the correct probe types have been activated for each channel. To do this, make sure a probe is activated for each measurement it is capable of taking. For example, if a Moisture Image Series Probe with the temperature and pressure functions is connected to channel 1, “MIS” must be selected in the hygrometry, temperature, and pressure columns as shown in Figure 35.

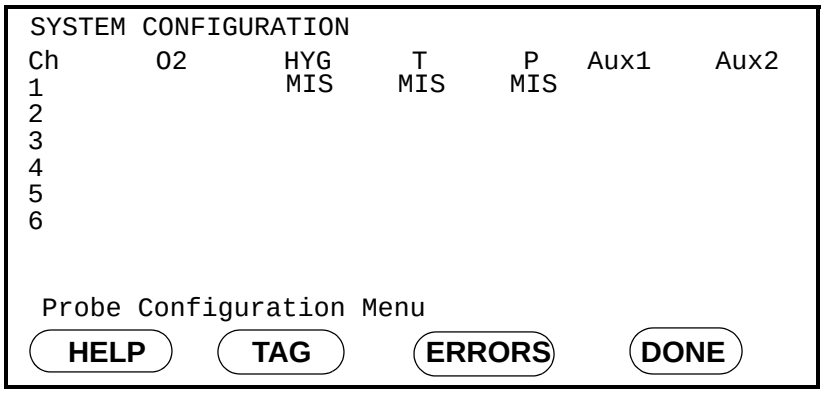


Figure 35: MIS Probe Configuration on Channel 1

If the optional auxiliary inputs are installed and active, you only need to select whether the input is current or voltage. If you do not select current or voltage, the meter defaults to current.

Note: *If you are using an auxiliary input to measure pressure, activate Au1 (or Au2 depending on which input you are using) in the pressure column for the desired channel; then activate current or voltage in the Aux 1(or Aux 2) column.*

In addition, if you connect a pressure transducer to the STD/TF PROBE terminal block, you must activate the TF probe in the pressure column for that channel.

If you need to change any data in the Probe Configuration Menu refer to the following section, *Entering or Changing Probe Configuration Data* on page 47.

2.3.1b Entering or Changing Probe Configuration Data

See Figure 44 on page 64 for a menu map.

1. From the Probe Configuration Menu (Table 9 on page 45), move the pointer to the channel and probe you want to select. The arrow will only move to installed channels.
2. Press [YES].
3. The possible probe types appear on the message line at the bottom of the screen. Table 10 on page 48 shows the available probe types.

If you choose to enter a constant for moisture (Kh), temperature (Kt), or pressure (Kp), you must enter a constant value in the User Constant Menu. See *Entering Constants and User Functions* in Chapter 3 of the *Programming Manual* for instructions.

4. Move the brackets to the correct probe type, then press [YES]. The selected probe type displays.
5. Repeat Steps 1 through 4 for each channel.
6. To exit, press the DONE menu key until Main Menu appears on the message line.

Note: *You can only select probes for an installed channel.*

If you are only using Moisture Image Series probes, proceed to *Displaying Measurements* on page 59. If you are using any other type of input device, proceed to *Entering Calibration Data* on page 49.

2.3.1b Entering or Changing Probe Configuration Data (cont.)

Table 10: Probe Types

Measurement Mode	Probe Type
OXY (Oxygen)	– (None) % (Percent) ppM (Parts per Million) ppB (Parts per Billion)
HYG (Hygrometry)	– (None) MIS (MIS Probe) TF (Three-Function Probe) Mxx (M Series Probe) Kh (Constant Dew Point)
T (Temperature)	– (None) MIS (MIS probe) TF (Three-Function probe) Mxx (M-Series probe) Kt (Constant Temperature)
P (Pressure)	– (None) MIS (MIS probe) TF (Three-Function probe) Au1 (Auxiliary 1) Au2 (Auxiliary 2) Kp (Constant Pressure)
Aux1 (Auxiliary 1)	– (None) I (Current) V (Voltage)
Aux2 (Auxiliary 2)	– (None) I (Current) V (Voltage)

2.3.2 Entering Calibration Data

The Series 1 needs calibration data for moisture and oxygen probes. GE has already entered calibration data for probes; however, you should verify this data before startup. You will need to enter this data if you:

- sent the probes back to the factory for calibration
- use a different probe
- use a non-GE input

To enter, verify, or change calibration data for any probe type, you must enter the System Calibration Menu as described in Table 11. (See Figure 44 on page 64 for a menu map.)

Table 11: Entering the System Calibration Menu

Press the Main Menu key:	To enter the:
SETTINGS*	Settings Menu
SYSTEM	System Settings Menu
CALIB	System Calibration Menu

*The Settings Menu will prompt for a passcode (see page 43).

Refer to the appropriate section that follows to verify or enter calibration data for:

- Moisture Probes, page 50
- Delta F Oxygen Cell, page 52

Be sure you have the **Calibration Data Sheets** that are supplied with each GE probe. Each Calibration Data Sheet consists of a list of data points that you will need to enter or verify. Each Calibration Data Sheet lists its corresponding probe serial number, as well as the preassigned channel number. Calibration Data Sheets are usually packed inside the probe cases.

IMPORTANT: *Staple Calibration Data Sheets to the Program Information List (Appendix A) and store them in a safe place. If they are lost, contact GE for a duplicate. If you alter any of the calibration data, make sure you make the change on the Calibration Data Sheet.*

2.3.2a Entering Moisture Probe Calibration Data

You need to enter calibration data only for M and TF Series probes. It is not necessary to enter calibration data for the Moisture Image Series Probe unless you send the probe back to GE for calibration without its electronics module. If this is the case, enter the calibration data for the recalibrated probe as described in this section. The Series 1 will automatically download the new calibration data into the Moisture Image Series Probe electronics module.

Note: *You do not need to enter calibration data for the Moisture Image Series Probe because it is stored in the probe's electronics module. The Moisture Image Series Probe uploads the calibration data into the Series 1 memory when needed.*

CAUTION! The electronics module does not detach from the MISP2 Probe. Do not attempt to disconnect the module from the probe.

Use the procedure below to enter the following data:

- the probe serial number
- the number of data points
- the dew point and MH (or FH, depending on the probe) reading for each data point

Procedure for Entering Moisture Probe Calibration Data

Referring to the Calibration Data Sheets, enter calibration data separately for each probe on the designated channel as described below. See Figure 44 on page 64 for a menu map.

Note: *If you want to enter a constant value, refer to* Entering Constants and User Functions *in Chapter 3 of the* Programming Manual. *It is not necessary to enter the calibration data if you are using a constant.*

2.3.2a Entering Moisture Probe Calibration Data (cont.)

1. At the System Calibration Menu (see Table 11 on page 49), press the PROBE menu key until the Moisture Probe Calibration screen appears. See Figure 36.

2. Use the CHANNEL menu key to cycle to the desired channel. The channel number is indicated in the top right-hand corner of the screen.The screen will only display installed channels.

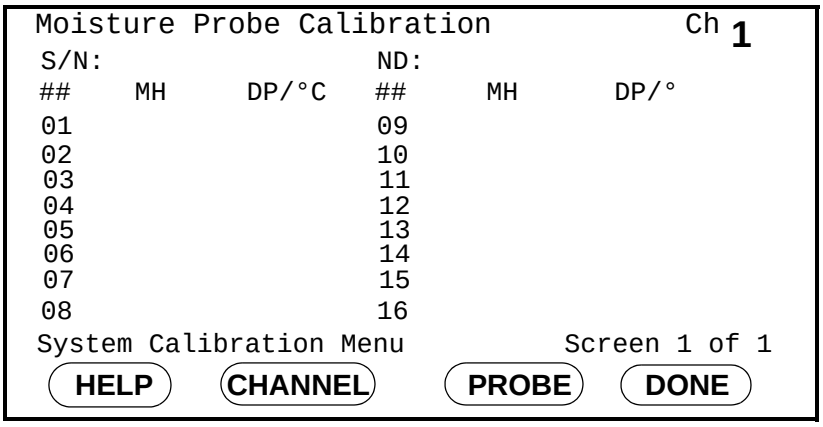


Figure 36: System Calibration Menu for Moisture

3. Move the pointer to S/N and press [YES].

4. Enter the probe serial number from the Calibration Data Sheet, and press [YES]. (The serial number is also scribed on the hex nut of the moisture probe.) The pointer automatically jumps to ND. Press [YES] again.

5. Enter the number of data points indicated on the Calibration Data Sheet and press [YES]. (There are typically 2-16 data points for each probe.) The pointer automatically jumps to the first data point.

6. Move the pointer to 1 and enter the MH (or FH) values and dew point (in °C) for each data point. Make sure you press [YES] after you enter each value.

7. Repeat Step 6 for each data point.

8. Repeat Steps 2 through 7 to enter moisture probe calibration data for the remaining channels.

To enter calibration data for other probes, refer to the following sections. To exit, press the DONE menu key until Main Menu appears on the message line. Then refer to *Entering High and Low Reference Values* on page 54.

2.3.2b Entering Delta F Oxygen Cell Calibration Data

Note: *The information in this section applies to Delta F oxygen cells only. If you are using some other type of oxygen input, refer to* Entering Auxiliary Input Calibration Data *in Chapter 2 of the Programming Manual.*

Your Delta F cell has been factory calibrated using nitrogen as the reference background gas. If you want to use the oxygen cell with a different background gas than the cell was calibrated for, refer to the section *Background Gas Correction Factors for the Delta F Oxygen Cell* in Chapter 2 of the *Service Manual*, to determine the correct oxygen current multiplier.

Use the procedure below to enter the following data:

- the probe serial number
- the zero and span range in microamps (µA)
- the zero and span range in parts per million by volume (ppm_v) ppb_v, or percent (%)

Note: *Oxygen cells can be ordered to measure in ppm, ppb or percent. Select the proper oxygen cell units in the Probe Configuration Menu. The units you select will automatically appear in the second column.*

Procedure for Entering Delta F Cell Calibration Data

Referring to the Calibration Data Sheets, enter calibration data separately for each probe on the designated channel as described below. See Figure 44 on page 64 for a menu map.

IMPORTANT: *Staple Calibration Data Sheets to the Program Information List (Appendix A) and store them in a safe place. If they are lost, contact GE for a duplicate. If you alter any of the calibration data, make sure you make the change on the Calibration Data Sheet.*

1. At the System Calibration Menu (see Table 11 on page 49), press the PROBE menu key until the Oxygen Probe Calibration screen appears. See Figure 37 on page 53.
2. Use the CHANNEL menu key to cycle to the desired channel. The channel number is indicated in the top right-hand-corner of the screen. The screen will only display installed channels.
3. Move the pointer to the S/N line and press [YES].
4. Enter the probe serial number from the Calibration Data Sheet, and press [YES]. The serial number is also on the side of the oxygen cell.

2.3.2b Entering Delta F Cell Calibration Data (cont.)

5. Move the pointer to the Zero µA line and press [YES].

6. Enter the microamp (µA) value and press [YES].

7. Move the pointer to the Zero ppm (or %) line and press [YES].

8. Enter the zero range value, and press [YES]. The range units will be either ppm, ppb or %, depending on the cell type/model selected in the Probe Configuration Menu.

9. Repeat Steps 5 through 8 to enter the microamp (µA) and range value for the span line.

IMPORTANT: *Leave the O2 Current Multiplier at 1.00 unless you are using a background gas other than nitrogen. See the section* Background Gas Correction Factors for the Delta F Oxygen Cell *in Chapter 2,* Troubleshooting and Maintenance, *of the* Service Manual.

Repeat Steps 1 through 9 to enter oxygen calibration data for the remaining channels.

To enter calibration data for moisture probes, refer to *A. Entering Moisture Probe Calibration Data*, page 50. (For other types of probes, see Chapter 2 of the *Programming Manual*.) To exit, press the DONE menu key until Main Menu appears on the message line. Then refer to *Entering High and Low Reference Values* on page 54.

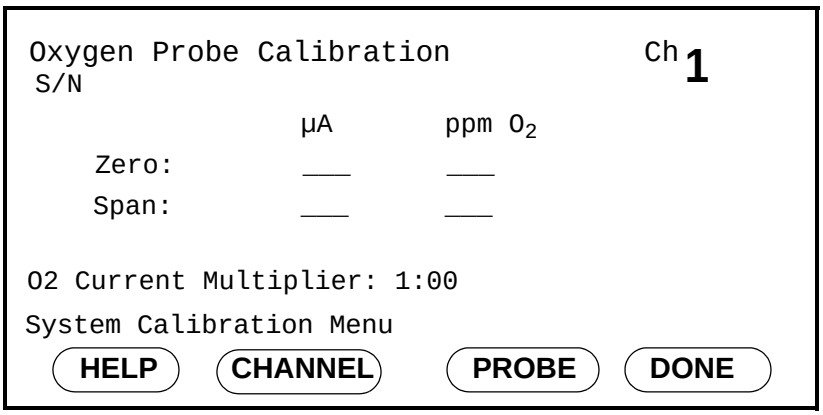


Figure 37: System Calibration Menu for Oxygen Cell

2.3.3 Entering High and Low Reference Values

The last step in setup is entering high and low reference values. The Series 1 requires reference values for its measurement circuitry for moisture and oxygen inputs. The references are factory calibration values that are specific to each channel card. Reference values are located on a label placed on the side or front of the unit.

Note: *If you receive a channel card replacement or change the instrument program, you need to re-enter the reference data for that channel.*

Table 12 shows the key sequences for entering the Reference Menu. (See Figure 44 on page 64 for a menu map.)

Table 12: Entering the Reference Menu

Press the Main Menu key:	To enter the:
SETTINGS*	Settings Menu
SERVICE	System Service Menu
REFS	Reference Menu

* The Settings Menu will prompt for a passcode (see page 43).

Use the appropriate section that follows to verify or enter reference values for the probes. Once you verify and/or enter reference data for each input, refer to *Displaying Measurements* on page 59.

IMPORTANT: *You should record this data on the Program Information List in Appendix A, or on a separate sheet of paper, and keep it in a safe place.*

2.3.3a Entering Moisture Reference Values

Use the steps below to change the reference values for moisture inputs. (See Figure 44 on page 64 for a menu map.)

CAUTION! **If you modified the supplied cables or are not using GE-supplied cables for moisture probes, you may be required to adjust the moisture reference data as described in *Performing an MH Calibration/Adjustment Test* in Chapter 1 of the *Service Manual*.**

IMPORTANT: *You should record reference data on the Program Information List supplied in Appendix A, or on a separate sheet of paper, and keep it in a safe place.*

1. At the Reference Menu (see Table 12 on page 54), press the PROBE menu key until the Moisture Reference Table appears. See Figure 38.

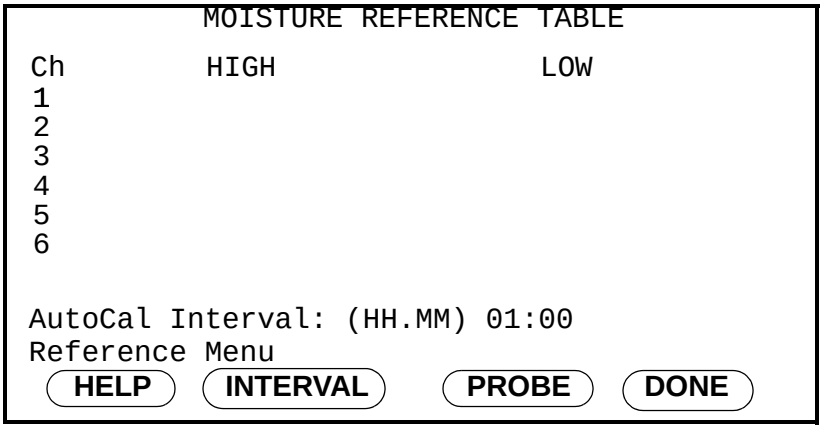


Figure 38: Reference Menu for Moisture

2. Compare the data on the screen to the reference data printed on the label placed on the side or front of the unit, or supplied with a replacement channel card. If the data is incorrect, use the procedure below to correct it. If the data is correct, do one of the following:

- continue to enter reference values for oxygen cell and pressure inputs as described in the following sections.
- press the DONE menu key until Main Menu appears on the message line; then refer to *Displaying Measurements* on page 59. When you exit, the Series 1 automatically calibrates each channel.

2.3.3a Entering Moisture Reference Values (cont.)

1. Move the pointer to HIGH for the desired channel, and press [YES].

2. Enter the high reference value for that channel and press [YES].

3. The pointer automatically moves to LOW for the same channel. Press [YES].

4. Enter the low reference value for that channel, and press [YES].

5. Repeat steps 1 through 4 to enter the high and low reference values for the remaining channels.

Note: *You may also enter the Auto-Cal Interval while in the Reference Menu. Simply press the INTERVAL menu key and enter the desired interval. See Chapter 3 of the* Programming Manual *for more information.*

To enter reference values for oxygen cell inputs, refer to the following section. To exit, press the DONE menu key until Main Menu appears on the message line. Then refer to *Displaying Measurements* on page 59. When you exit, the Series 1 automatically calibrates each channel.

2.3.3b Entering the Delta F Oxygen Cell Reference Values

IMPORTANT: *The instructions in this section apply to entering reference data for the Delta F oxygen cell only.*

Use the steps below to change the reference values for oxygen cell inputs. (See Figure 44 on page 64 for a menu map.)

CAUTION! Do not adjust oxygen cell reference data unless instructed to do so by the factory.

IMPORTANT: *You should record this data on the Program Information List supplied in Appendix A, or on a separate sheet of paper, and keep it in a safe place.*

1. At the Reference Menu (see Table 12 on page 54), press the PROBE menu key until the Oxygen Cell Reference Table appears. See Figure 39.

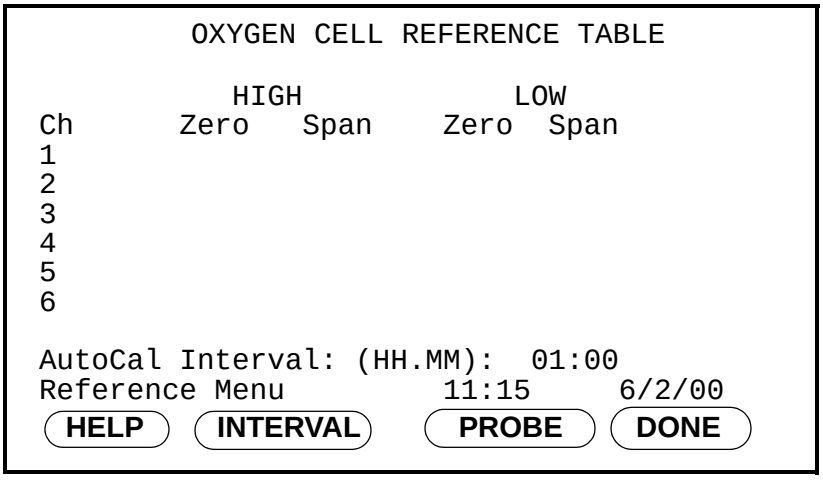


Figure 39: Reference Menu for the Delta F Cell

2. Compare the data on the screen to the reference data printed on the label placed on the side or front of the unit. If the data is incorrect, use the following procedure to correct it. If the data is correct, do one of the following:

- continue to enter reference values for moisture inputs as described in *A.Entering Moisture Reference Values*, page 55. (For other types of probes, see Chapter 2 of the *Programming Manual*.)
- press the DONE menu key until Main Menu appears on the message line; then refer to *Displaying Measurements* on page 59. When you exit, the Series 1 automatically calibrates each channel.

2.3.3b Entering Delta F Oxygen Cell Reference Values (cont.)

1. Move the pointer to the Zero line for the high reference for the desired channel and press [YES].
2. Enter the zero value for the high reference for that channel and press [YES]. The pointer automatically proceeds to the Span line for the high reference for the same channel. Press [YES] again.
3. Enter the span value for the high reference for that channel and press [YES].
4. Move the pointer to the Zero line for the low reference for the desired channel and press [YES].
5. Enter the zero value for the low reference for that channel and press [YES].
6. Move the pointer to the Span line for the low reference for the desired channel and press [YES].
7. Enter the span value for the low reference for that channel and press [YES].

Repeat steps 1 through 7 to enter the high and low reference values for the remaining channels.

To enter reference values for moisture inputs, refer to *A. Entering Moisture Reference Values*, page 55. (To enter reference values for other inputs, refer to Chapter 2 of the *Programming Manual*.) To exit, press the DONE menu key until Main Menu appears on the message line. Then refer to *Displaying Measurements* on page 59. When you exit, the Series 1 automatically calibrates each channel.

2.4 Displaying Measurements

The Series 1 can display measurements in a matrix format or a line graph. The first time you power it up, the screen will display measurements in the **matrix format**. The matrix format has six pages, and each page consists of six boxes, as shown in Figure 40. You can program each box to display any measurement for any channel.

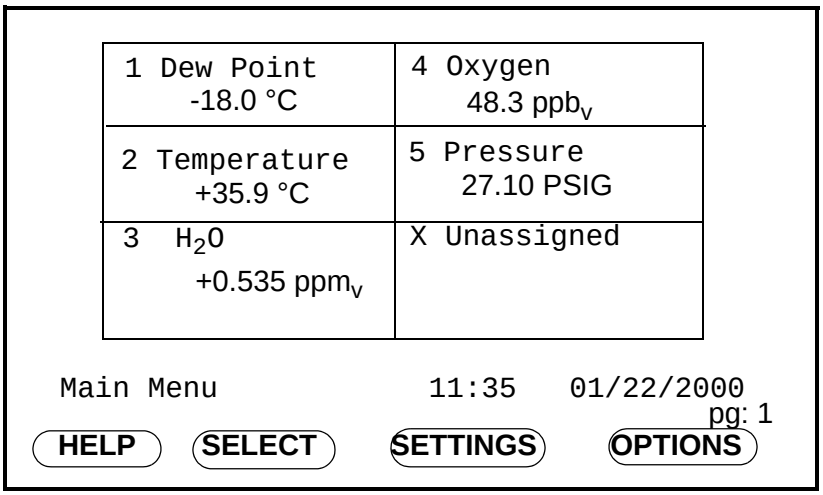


Figure 40: Series 1 Matrix Format Screen

Each box in the matrix format is either assigned or unassigned. An **assigned box** displays a channel number, measurement mode, units, and a value. An **unassigned box** displays no data. See Figure 41 on page 60 for examples of each type of box.

2.4 Displaying Measurements (cont.)

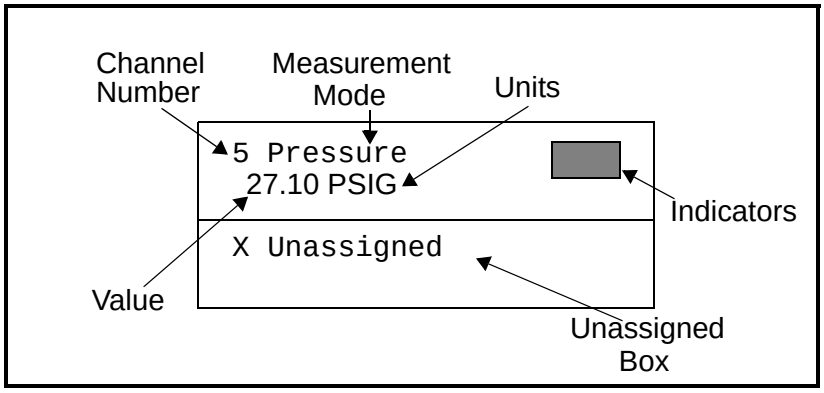


Figure 41: Assigned and Unassigned Boxes

The channel number is from 1 to 6, depending on how many channel cards are installed in the unit. Additional channel cards can be purchased separately and installed later (see *Installing a Channel Card* in Chapter 2 of the *Service Manual).*

The **measurement mode** is the parameter currently being measured by the Series 1. There are a variety of units for each measurement mode. Table 13 on page 61 shows a list of the measurement modes and a description of the units for each. The table also shows the measurement modes and units as they are displayed on the screen. An example of a measurement is shown in Figure 42.

The shaded area in Figure 41 represents the **indicator** area. When you program the meter with constants or use Enhanced Response, a symbol appears in this area. A “K” indicates a constant is being used in the measurement and an “E” indicates the Series 1 is using Enhanced Response to determine the measurement. An example of a measurement using a constant and Enhanced Response activated is shown in Figure 42.

The value is expressed in the units selected for a desired measurement mode.

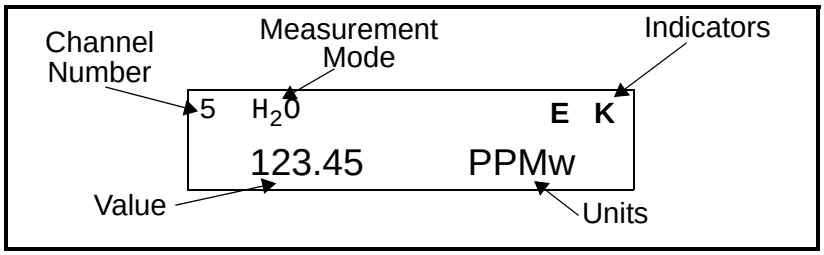


Figure 42: Example of a Displayed Measurement

Table 13: Measurement Modes and Units for the Series 1

Selected Meas. Mode	Description of Units	Displayed Meas. Mode	Displayed Units
Oxygen	O_2%= Percent Oxygen *default*	Oxygen	%
	O_2/ppM = Parts Per Million	Oxygen	ppm_v
	O_2/ppB = Parts Per Billion	Oxygen	ppb_v
	O_2/µA = Microamps (Diagnostic Mode)	Oxygen	µA
	O_2/DVM = Digital Voltmeter (Diagnostic Mode)	Oxygen DVM	VDC
Hygrometry	DP/°C = Dew/Frost Point *default*	Dew Point	°C
	DP/°F = Dew/Frost Point °F	Dew Point	°F
	DP/K = Dew/Frost Point K (Kelvin)	Dew Point	K
	%R.H. = Relative Humidity	Rel. Humidity	%
	H/ppMv = Parts per Million of Water by Volume	H_2O	ppm_v
	H/ppMw = Parts per Million of Water by Weight (for liquids only)	H_2O	ppm_w
	H/ppBv = Parts per Billion of Water by Volume	H_2O	ppb_v
	MCF/IG = Pounds of Water per Million Std. Cubic Feet in Ideal Gas	H_2O/MMSCF NG	lbs
	MCF/NG = Pounds of Water per Million Std. Cubic Feet in Natural Gas	H_2O/MMSCF NG	lbs
	ppMv/NG = Parts Per Million by Volume in Natural Gas	H_2O (Nat. Gas)	ppm_v
	mmHg = Vapor Pressure	Vapor Pressure	mmHg
	Pas = Vapor Pressure	Vapor Pressure	Pas
	MH = MH* (Diagnostic Mode)	H_2O	MH
	H/DVM = Digital Voltmeter (Diagnostic Mode)	Moisture DVM	VDC
	FH = FH* (Diagnostic Mode)	MIS Probe	FH
Temperature	T/°C = Degrees Celsius default	Temperature	°C
	T/°F = Degrees Fahrenheit	Temperature	°F
	T/K = Kelvin	Temperature	K
	T/DVM = Digital Voltmeter (Diagnostic Mode)	Temp DVM	VDC
Pressure	PSIg = Pounds per Square Inch Gauge default	Pressure	PSIg
	Bars = Bars	Pressure	Bars
	mbs = Millibars	Pressure	mbs
	mm/Hg = Millimeters of Mercury	Pressure	mmHg
	Pa(g) = Pascal, gauge	Pressure	Pas
	kPas(g) = KiloPascal, gauge	Pressure	kPas
	P/mV = Pressure in millivolts	Pressure	mV
	P/DVM = Digital Voltmeter (Diagnostic Mode)	Pressure DVM	VDC
	FP = FP** (Diagnostic Mode)	MIS Probe	FP
Auxiliary 1	Aux1/V = Volts default	Aux1	VDC
	Aux1/I = Milliamps	Aux1	mA
	Aux1/User = Function (Displays Aux Label)	Aux1 (Aux Label)	none
Auxiliary 2	Aux2/V = Volts default	AuxX	VDC
	Aux2/I = Milliamps	Aux2	mA
	Aux2/User = Function (Displays Aux Label)	Aux2 (Aux Label)	none
Volt Reference	Vref = Volts default (Diagnostic Mode)	Voltage Reference	VDC
Signal Ground User	Vgnd = Volts default (Diagnostic Mode)	Signal Ground	VDC

*The MH and FH values are the moisture sensors' response values and are the values that are recorded during calibration.
**The FP value is the MIS Probe's response value for pressure and is the value recorded during calibration.

Your passcode is 2719.

Please remove this page and put it in a safe place for future reference.

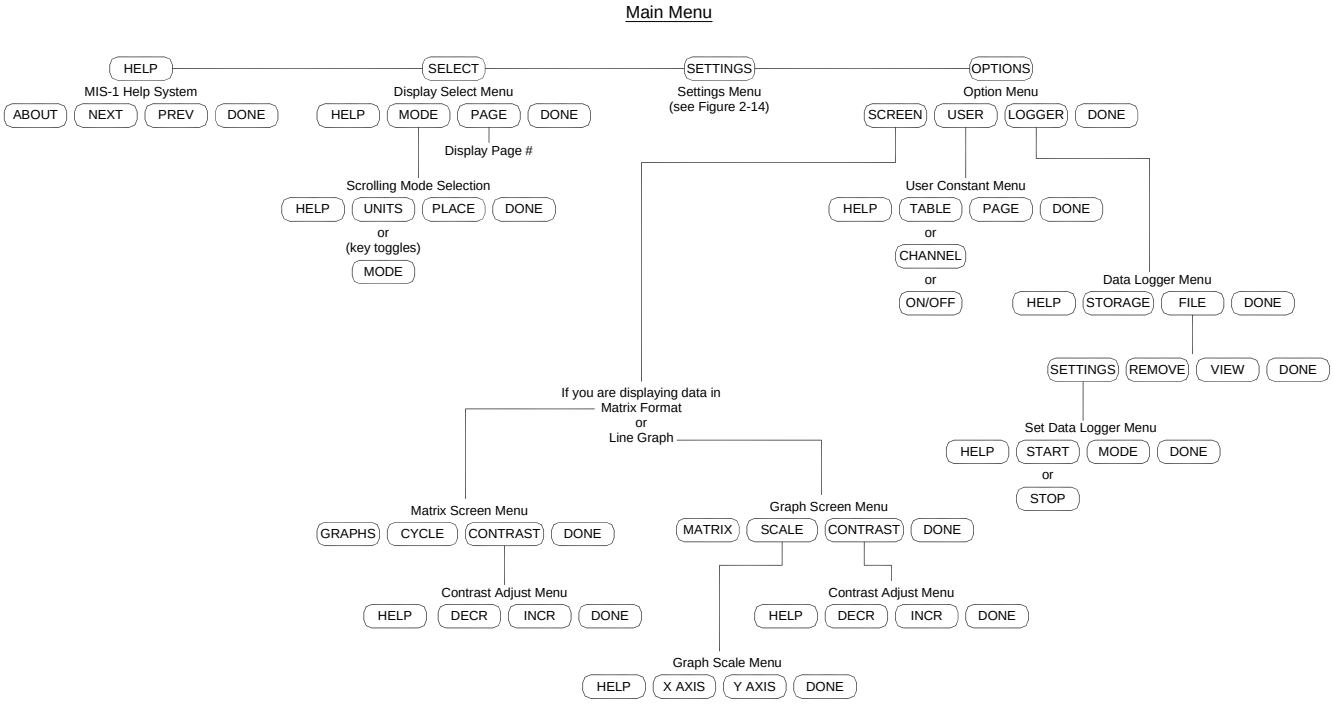


Figure 43: Help, Select and Options Menu

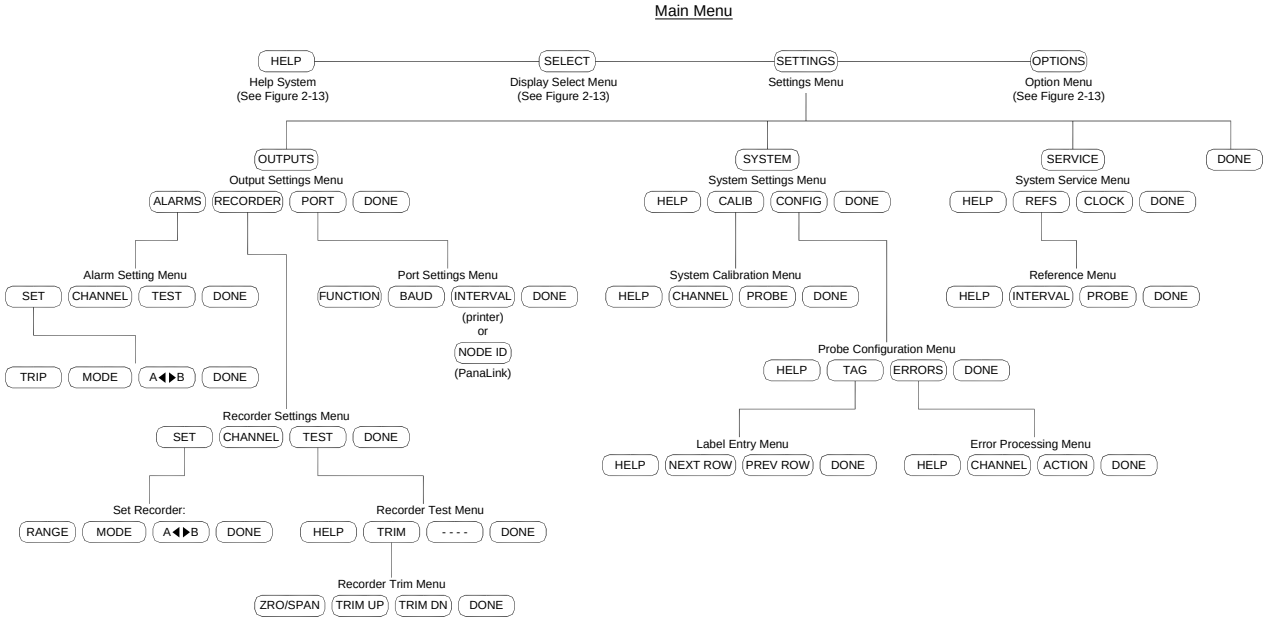


Figure 44: Settings Menu

Chapter 3. Specifications

3.1 Overall Specifications

General

Motorola 68332-based, one- to six-channel, aluminum oxide, absolute humidity/oxygen analyzer system.

Power

Universal power supply adjusts automatically from 100 to 240 VAC, 50/60 Hz, 50 Watts maximum power.

Note: *Power cord is the main disconnect device.*

Fuses

1/2 Amp, Slo-Blo 3AG.

Configuration

Rack, Bench, Panel, Type-4 Weatherproof, and Type-7 Explosion-proof.

Dimensions

Rack Mount: 5.22 H × 19 W × 17.03” D
Bench Mount: 5.85 H × 13.9 W × 17.03” D
Panel Mount: 8.25 H × 16.5 W × 17.03” D

Parameters

Up to six channels may be programmed to measure any of the following parameters with appropriate probes: moisture, temperature, pressure, and oxygen.

European Compliance

This unit complies with EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC (Installation Category II, Pollution Degree 2).

3.2 Moisture Measurement

Sensor Type

Thin-film aluminum oxide moisture sensor probe.

Moisture Probe Compatibility

Compatible with all GE aluminum oxide moisture probes.

Traceability

All moisture probe calibrations are traceable to National Institute of Standards and Technology (NIST) standards or National Physical Lab, U.K. (NPL) as accredited by Irish National Accreditation Board (INAB).

Dew/Frost Point Temperature

Overall Calibration Range Capability: –110° to 60°C (–166° to 140°F)

Available Calibration Range Options:
Standard: –80° to 20°C (–112° to 68°F) with data to –110°C (–166°F)
Ultra-Low: –110° to -50°C (–166° to -58°F)
Extended High: –80° to 60°C (–112° to 140°F) with data to -110°C (-166°F)

Accuracy:
±2°C from -65 to 60°C (-85 to 140°F)
±3°C from -110 to -66°C (-166 to -87°F)

Repeatability:
±0.5°C from -65 to 60°C (-85 to 140°F)
±1.0°C from -110 to 66°C (-166 to -87°F)

Note: *All dew/frost point outputs are available in °C, °F or K.*

Other Moisture Parameters

(Calculated using moisture and temperature or pressure inputs) Relative Humidity (RH)
Parts per Million by Volume (PPM_v) in a gas
Parts per Billion by Volume (PPB_v) in a gas
Parts per Million by Weight (PPM_w) in a liquid
Pounds per Million Standard Cubic Feet of Natural Gas or Ideal Gas (#/MMSCF)
Vapor Pressure (mmHg)
Vapor Pressure (Pascals)

Contact GE for the availability of other special measuring modes.

3.3 Pressure Measurement

Type

Optional transducer built into TF or Moisture Image Series moisture probes.

Range

30 to 300 PSIG
50 to 500 PSIG
100 to 1000 PSIG
300 to 3000 PSIG
500 to 5000 PSIG

Accuracy

±1% of span

3.4 Temperature Measurement

Type

Optional thermistor built into M, TF, or Moisture Image Series moisture probes.

Range

–30° to 70°C (–22° to 158°F)

Accuracy

±0.5°C at –30°C (0.9°F at –22°F)

Note: *All temperature outputs available in °C or °F.*

3.5 Oxygen Measurement

Type

Delta F, non-depleting electrochemical cell (optional). Also compatible with other GE oxygen analyzers such as TMO2, TMO2D, and Series 350.

Range

0-500 PPB_v
0-10,000 PPM_v in four ranges
0-25% in three ranges

Accuracy

±1% full scale (ranges >0-2.5 PPM_v)
±5% full scale (ranges <0-2.5 PPM_v)

3.6 Electronic Specifications

Display

Graphic/text Liquid Crystal Display (LCD) with backlight 256 × 128 pixels.

Display Functions

Display up to six channel/parameter combinations simultaneously using text and/or graphics.

Operating Temperature

0°C to 60°C (32°F to 140°F)

Storage Temperature

-30°C to 70°C (-22°F to 158°F)

Memory Retention

Moisture, temperature, and pressure calibration data is stored in a 512-KB battery-backed SRAM.

Auto-Calibration

Occurs on power up and at user-selectable time intervals.

Warm-up Time

Meets specified accuracy within 5 minutes of turn-on.

Data Logging

Up to six simultaneous logs per storage device, with up to 12 parameters each. Stored in 512-KB battery-backed SRAM (64kB) or on optional PCMCIA card.

Modem Board

Optional

3.7 Output Specifications

Analog

Two per channel
Internally optically isolated
12 bit (0.025% Resolution)

Standard Switch-Selectable Outputs

- 0 to 2 V, 10K ohm minimum load resistance
- 0 to 20 mA, 400 ohm maximum series resistance
- 4 to 20 mA, 400 ohm maximum series resistance

Each output can correspond to any one parameter on that channel. Zero and span are user-programmable within the range of the instrument and the corresponding sensor.

Digital Outputs

Choice of RS232 serial communications port or PanaLink packet protocol; information is transmitted as ASCII characters at these baud rates:

- 300
- 1200
- 2400
- 4800
- 9600
- 19,200
- 38,400
- 57,600

Alarm Relays

2 Optional Form C relays per channel SPDT, rated for 2 amps at 28 VDC/28 VAC. Available for high and low limits on each channel. The relay contacts can be set to trip at any numerical level within the range of the instrument. Optional hermetically sealed relays are available for applications in Division 2 hazardous areas.

Output Updating

The microprocessor samples, processes data, and calculates values for each channel sequentially. The minimum update time is 0.5 seconds depending on configuration and mode. Channels are updated sequentially.

Computer Enhanced Response

Standard

3.8 Input Specifications

Capability

1 to 6 channels moisture
1 to 6 channels temperature
1 to 6 channels pressure
1 to 6 channels oxygen
2 auxiliary inputs per installed channel
May be used for 0/4 to 20-mA and 0-2 V devices such as Oxygen Analyzers, Thermal Conductivity Analyzers, Flowmeters, Pressure Transmitters, Temperature Transmitters, etc.

Note: *Contact the factory for a higher voltage input.*

Resolution

16 bits

Moisture Sensor Probes

GE types: M Series, TF Series, and Moisture Image Series.

Temperature Sensor

Thermistor (optionally supplied as part of the moisture probe assembly).

Pressure Transmitter

A pressure transducer is optionally available for TF and Moisture Image Series probes. GE P40, P40X, or equivalent 4-20 mA, current-transmitting, pressure transducer; scale factors are entered as part of the user-program sequence.

Intrinsic Safety

Built-in intrinsic safety provided for all inputs per drawing #752-138 excluding auxiliary inputs. BASEEFA and CSA-NRTL approved.

Note: *GE does not provide power supply cords with CSA Div. 2 hygrometers.*

3.9 Probe Specifications

3.9.1 Moisture Image Series Probe

Type

Aluminum oxide moisture sensor probe and electronics module.

Calibration

Each sensor is individually computer calibrated against known moisture concentrations, traceable to National Institute of Standards and Technology (NIST) or National Physical Lab, U.K. (NPL) as accredited by Irish National Accreditation Board (INAB).

Process Temperature

–110°C to 70°C (–166°F to 158°F) dew/frost point temperature

Storage Temperature

70°C (158°F) maximum

Operating Pressure

5 microns of Hg to 5000 PSIG

Flow Range

Gases: Static to 10,000 cm/sec linear velocity at 1 atm

Liquids: Static to 10 cm/sec linear velocity at 1 g/cc

Response Time: <5 seconds for 63% step change in moisture content in either wet up or dry down cycle.

Moisture Image Series Probe/Analyzer Separation

915 meters (3000 feet) with AWG 22 twisted-pair cable.

Moisture Image Series Probe/Analyzer Cable

Unshielded, twisted pair, maximum loop resistance of 100 ohms

Built-in Temperature Sensor (optional)

Type: Thermistor network

Operating Range: –30°C to 70°C (–22°F to 158°F)

Accuracy: ±0.5°C overall

Response Time: 1 second in well-stirred oil
10 seconds in still air for a 63% step change in increasing or decreasing temperatures.

3.9.1 Moisture Image Series Probe (cont.)

Built-in Pressure Sensor (optional)

Type: Solid state/piezoresistive

Available Ranges:
30 to 300 PSIG
50 to 500 PSIG
100 to 1000 PSIG
300 to 3000 PSIG
500 to 5000 PSIG

Accuracy: ±1% of span

3.9.2 TF Series Probe

Type

Aluminum oxide moisture sensor probe (patented).

Input voltage

1 VAC

Impedance Range

50 kΩ to 2 MΩ at 77 Hz, depending on water vapor pressure.

Calibration

Each sensor is individually computer calibrated against known moisture concentrations, traceable to National Institute of Standards and Technology (NIST) or National Physical Lab, U.K. (NPL) as accredited by Irish National Accreditation Board (INAB).

Operating Temperature

-110°C to 70°C (-166°F to 158°F)

Storage Temperature

70°C (158°F) maximum

Operating Pressure

5 microns Hg to 5000 PSIG

3.9.2 TF Series Probe (cont.)

Flow Range

Gases: Static to 10,000 cm/sec linear velocity at 1 atm

Liquids: Static to 10 cm/sec linear velocity at 1 g/cc

Response Time: <5 seconds for 63% step change in moisture content in either wet up or dry down cycle.

TF Probe/Analyzer Separation

Up to 600 meters (2000 feet) for moisture and temperature
(Consult GE for distances up to 1200 meters.)
Up to 152 meters (500 feet) for pressure
Consult GE about longer lengths.

Probe/Analyzer Cable

8-Conductor, individually shielded conductors

Built-in Temperature Sensor (optional)

Type: Thermistor network

Operating Range: –30° to 70°C (–22° to 158°F)

Accuracy: ±0.5°C overall

Response Time: 1 second in well-stirred oil
10 seconds in still air for a 63% step change in increasing or decreasing temperatures.

Built-in Pressure Sensor (optional)

Type: Solid state/piezoresistive

Available Ranges:
30 to 300 PSIG
50 to 500 PSIG
100 to 1000 PSIG
300 to 3000 PSIG
500 to 5000 PSIG

Accuracy: ±1% of span

3.9.3 M Series Probe

Type

Aluminum oxide moisture sensor probe (patented).

Impedance Range

50 kΩ to 2 MΩ at 77 Hz (depending on vapor pressure of water).

Calibration

Each sensor is individually computer-calibrated against known moisture concentrations. Calibrations are traceable to the National Institute of Standards and Technology (NIST).

Operating Temperature

–110° to 70°C (–166° to 158°F)

Storage Temperature

Maximum of 70°C (158°F)

Operating Pressure (depends on mount)

M1: 5 microns Hg to 75 PSIG
M2: 5 microns Hg to 5000 PSIG

Flow Range

Gases: From static to 10,000 cm/sec linear velocity at 1 atm

Liquids: From static to 10 cm/sec linear velocity at density of 1 gm/cc

Response Time: Less than 5 seconds for 63% of a step change in moisture content in either wet up or dry down cycle.

Built-in Temperature Sensor

Type: Non-linear thermistor

Range: –30 ° to 70°C (–22° to 158°F)

Accuracy: ±0.5°C (± 0.33F) overall

Response Time: Maximum 1 second in well stirred oil.
10 seconds in still air for a 63% step change in increasing or decreasing temperature.

3.9.4 Delta F Oxygen Cell

Type

Non-depleting electrolytic oxygen sensing cell.

Available Cells

PPB_v O_2 Range:
L: 0 to 500 ppb_v/5 ppm_v/50 ppm_v
Ranges for each cell are software selectable in GE analyzers.

PPM_v O_2 Ranges:
A:0 to 1/10/100 ppm_v
B:0 to 10/100/1000 ppm_v
C:0 to 100/1000/10,000 ppm_v
D:0 to 50/500/5000 ppm_v
Ranges for each cell are software selectable in GE analyzers.

Percent O_2 Ranges:
A: 0 to 5%
B: 0 to 10%
C: 0 to 25%

Accuracy

±1% full scale (ranges > 0 to 2.5 ppm_v)
±5% full scale (ranges < 0 to 2.5 ppm_v)

Sensitivity

< 5 ppb (0 to 500 ppb_v range)

Response Time

Sensor responds instantaneously to O_2 change.
Equilibrium time is application specific.

Ambient Temperature

0° to 49°C (32° to 120°F)

Background Gas Compatibility

Standard Cell: Ultra-pure inert gases

STAB-EL™ Cell: All gas compositions including those containing “acid” gases such as CO_2, H_2S, Cl_2, NO_x, SO_2, etc.

3.9.4 Delta F Oxygen Cell (cont.)

Sample Requirements

Temperature: –18° to 66°C

Inlet Pressure:
<-0.5 psig (use compressor)
-0.5 psig to 0.2 psig (use pump)
0.2 to 1.0 psig (standard range)
1.0 to 60 psig (use valve or regulator)
>60 psig (use pressure regulator)

Flow Rate: 0.5 to 1.5 liters per minute

Moisture: No limits (avoid condensation)

Oil/Solvent Mist:
<0.5 mg/feet^3 (standard range)
>0.5 mg/feet^3 (use filter)

Solid Particles:
<2.0 mg/feet^3(standard range)
>2.0 mg/feet^3 (use filter)

Note: *STAB-EL™ cell is a registered trademark of the Delta F Corporation.*

3.9.5 External Pressure Transmitter (optional)

P40

General purpose

P40X

For Class I, Group D, Division 1 locations.

Transducer

P40 - solid state piezoresistive-silicon sensor in stainless steel housing; on-board zero and span trim.
P40X - capacitive-sensor in explosion-proof housing; on-board zero and span trim.

Range

Choice of:

- 0 - 100 PSIG
- 0 - 300 PSIG
- 0 - 1000 PSIG
- 0 - 3000 PSIG

Accuracy

P40 ±1.0% of span
P40X ±0.25% of span

Operating Temperature

P40 –18° to +100°C
P40X –40° to +85°C

Pressure Connection

P40 1/8-27 NPTM
P40X 1/2-14 NPTF

Over-pressure Limits

P40 150% of maximum span
P40X 200% of maximum span

[no content intended for this page]

Appendix A. Program Information List

This list provides a space to enter program data that is stored in the Moisture Image Series 1 memory. If for any reason data is lost, use this list to re-program your unit. Store this sheet and any other related documents in a safe place for future reference.

Notes:

Date:

Serial Number:

Application Description:

Location:

Step	Data

Activating or Changing Probes (page 45)

Press:

:

SETTINGS

SYSTEM

CONFIG

PROBE CONFIGURATION TABLE						
CH	**OXY**	**HYG**	**T**	**P**	**AUX1**	**AUX2**

Calibration Data (page 49)

Press:

:

SETTINGS

SYSTEM

CALIB

Refer to the Calibration Data Sheets for the following:

- Moisture Probes
- Oxygen Cells
- Pressure Transmitters

Enter the calibration data for each probe on the corresponding channels. If you make changes to the calibration data, make sure you record the changes on the Calibration Data Sheet.

Note: *In order to keep all programming data together, you should staple the Calibration Data Sheets for all probes to the back of this page.*

Reference Values (page 54)

Press:

SETTINGS

SERVICE

REFS

PROBE

Reference values are printed on a sticker on the side of Series 1 chassis. Record these reference values in the spaces provided below.

MOISTURE REFERENCE TABLE		
CH	**HIGH**	**LOW**
1		
2		
3		
4		
5		
6		

PRESSURE REFERENCE TABLE		
CH	**HIGH**	**LOW**
1		
2		
3		
4		
5		
6		

OXYGEN CELL REFERENCE TABLE				
CH	**HIGH**		**LOW**	
	Zero	**Span**	**Zero**	**Span**
1				
2				
3				
4				
5				
6				

Auto-Cal Interval
Programming Manual

Press:

SETTINGS

SERVICE

REFS

INTERVAL

Automatic calibration should be performed at least every eight hours (480 minutes). Enter an Auto-Cal Interval between 0 and 1440 minutes (0 to 1 day).

The Auto-Cal Interval is set at the following: _____

Recorder Setup
Programming Manual

Press:

:

SETTINGS

OUTPUTS

RECORDER

RECORDER OUTPUT SETTINGS		
CH	**RECORDER A**	**RECORDER B**
1	**Mode:**	**Mode:**
	Range:	**Range:**
	Zero:	**Zero:**
	Span:	**Span:**
2	**Mode:**	**Mode:**
	Range:	**Range:**
	Zero:	**Zero:**
	Span:	**Span:**
3	**Mode:**	**Mode:**
	Range:	**Range:**
	Zero:	**Zero:**
	Span:	**Span:**
4	**Mode:**	**Mode:**
	Range:	**Range:**
	Zero:	**Zero:**
	Span:	**Span:**
5	**Mode:**	**Mode:**
	Range:	**Range:**
	Zero:	**Zero:**
	Span:	**Span:**
6	**Mode:**	**Mode:**
	Range:	**Range:**
	Zero:	**Zero:**
	Span:	**Span:**

Alarm Setup
Programming Manual

Press:

:

SETTINGS

OUTPUTS

ALARMS

ALARM SETPOINT TABLE				
CH	**HIGH**	**UNITS**	**LOW**	**UNITS**

User Constants
Programming Manual

Press:

:

OPTIONS

USER

		USER CONSTANT TABLE		
CH	**Kh**	**Kt**	**Kp**	**K**

User Constants
Programming Manual

Press:

OPTIONS

USER

Compound:__________
Channel #:__________

#	Temp	Cs
1		
2		
3		
4		
5		
6		

Compound:__________
Channel #:__________

#	Temp	Cs
1		
2		
3		
4		
5		
6		

Compound:__________
Channel #:__________

#	Temp	Cs
1		
2		
3		
4		
5		
6		

Compound:__________
Channel #:__________

#	Temp	Cs
1		
2		
3		
4		
5		
6		

Compound:__________
Channel #:__________

#	Temp	Cs
1		
2		
3		
4		
5		
6		

Compound:__________
Channel #:__________

#	Temp	Cs
1		
2		
3		
4		
5		
6		

Error Processing
Programming Manual

Press:

SETTINGS

SYSTEM

CONFIG

ERRORS

Error Processing Configuration		
Error	**Low Range**	**High Range**
High Alarm		
Low Alarm		
Recorder A		
Recorder B		

[no content intended for this page]

M (cont.)

N

O

P

P (cont.)

R

S

S (cont.)

T

U

V

W

Y

[no content intended for this page]

Warranty

Each instrument manufactured by GE Sensing is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of GE Sensing. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If GE Sensing determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If GE Sensing determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by GE Sensing, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a GE Sensing instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify GE Sensing, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, GE Sensing will issue a RETURN AUTHORIZATION NUMBER (RAN), and shipping instructions for the return of the instrument to a service center will be provided.
2. If GE Sensing instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, GE Sensing will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If GE Sensing determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

GE Infrastructure
Sensing

ATEX COMPLIANCE

We,

GE Infrastructure Sensing, Inc.
1100 Technology Park Drive
Billerica, MA 01821-4111
U.S.A.

as the manufacturer, declare under our sole responsibility that the product

Moisture Image Series 1 Analyzer

to which this document relates, in accordance with the provisions of ATEX Directive 94/9/EC Annex II, meets the following specifications:

CE 1180 Ex **II 1 G EEx ia IIC (-20°C to +50°C)**
BAS01ATEX7097

Furthermore, the following additional requirements and specifications apply to the product:

- Having been designed in accordance with EN 50014 and EN 50020, the product meets the fault tolerance requirements of electrical apparatus for category "ia".
- The product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate. The installation must be carried out in accordance with all appropriate international, national and local standard codes and practices and site regulations for flameproof apparatus and in accordance with the instructions contained in the manual. Access to the circuitry must not be made during operation.
- Only trained, competent personnel may install, operate and maintain the equipment.
- The product has been designed so that the protection afforded will not be reduced due to the effects of corrosion of materials, electrical conductivity, impact strength, aging resistance or the effects of temperature variations.
- The product cannot be repaired by the user; it must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or by an approved repairer.
- The product must not be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation and the instruction manual.
- The product contains no exposed parts which produce surface temperature infrared, electromagnetic ionizing, or non-electrical dangers.

GE
Sensing

DECLARATION OF CONFORMITY

DOC-0020, Rev. A

We,

GE Sensing
1100 Technology Park Drive
Billerica, MA 01821
USA

declare under our sole responsibility that the

Moisture Image™ Series 1 Moisture Analyzer
Moisture Monitor™ Series 3 Moisture Analyzer

to which this declaration relates, are in conformity with the following standards:

- EN 60079-0: 2007
- EN 60079-11: 2007
- EN50281-1-1: 1998
- II 1 GD EEx ia IIC, Baseefa01ATEX7097 (Baseefa, Buxton, Derbyshire, UK - NoBo 1180)
- EN 61326-1: 2006, Class A, Table 2, Industrial Locations
- EN 61326-2-3: 2006
- EN 61010-1: 2001, Overvoltage Category II, Pollution Degree 2

Other standards Used:

- EN 50014: 1997 +A1, A2:1997
- EN 50020: 2002

following the provisions of the 2004/108/EC EMC, 2006/95/EC Low Voltage and 94/9/EC ATEX Directives.

Where products were initially assessed for compliance with the Essential Health and Safety Requirements of the ATEX Directive 94/9/EC using earlier harmonized standards, a subsequent review has determined that "technical knowledge" is unaffected by the current harmonized standards listed above.

The units listed above and any ancillary equipment supplied with them do not bear CE marking for the Pressure Equipment Directive, as they are supplied in accordance with Article 3, Section 3 (sound engineering practices and codes of good workmanship) of the Pressure Equipment Directive 97/23/EC for DN<25.

Billerica - August 2010
Issued

Mr. Gary Kozinski
Certification & Standards, Lead Engineer

CE

TÜV USA
Member of TÜV NORD Group

Customer Support Centers

U.S.A.

The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: sensing@ge.com

Ireland

Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 (0)61 470291
E-mail: gesensingsnnservices@ge.com

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