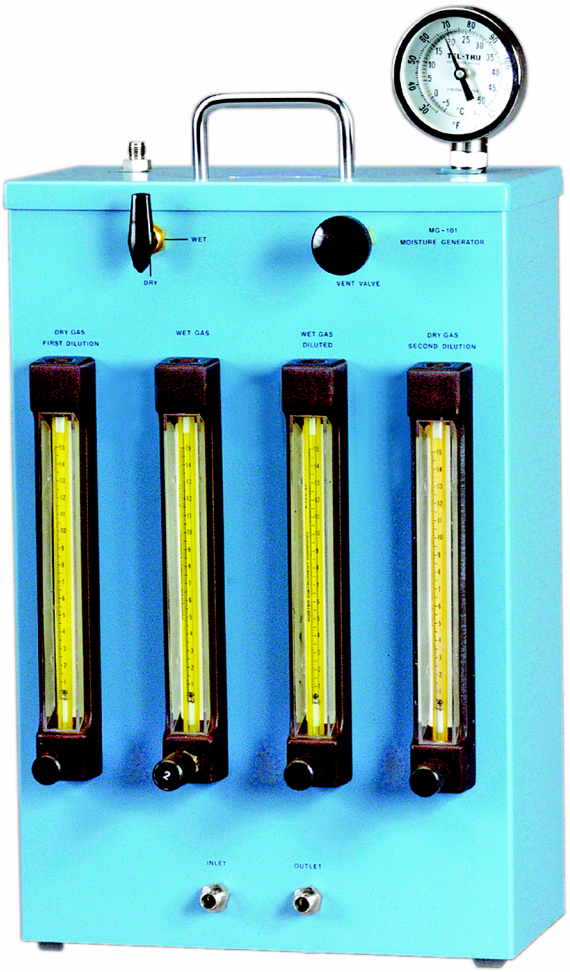
GE
Measurement & Control

Moisture

MG-101

User's Manual



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910-115 Rev. E
March 2012

GE
Measurement & Control

MG-101

Field Moisture Calibration System

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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 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.ge-mcs.com/en/about-us/environmental-health-and-safety/1741-weee-req.html** for take-back instructions and more information about this initiative.

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Chapter 1. General Information

1.1 Introduction

The *MG-101 Field Calibration System* is a portable moisture generator used for checking and, if necessary, recalibrating GE Sensing moisture probes. The MG-101 can generate dew/frost points in the range of -75 to +20°C (-103 to +68°F) dew/frost point temperature. It is a totally mechanical device requiring only a supply of dry nitrogen, and it is inherently explosion-proof. Although specifically designed for calibrating GE Sensing moisture probes, the MG-101 can be used for any application requiring accurate and repeatable moisture samples.

1.2 Theory Of Operation

Precise moisture concentrations are generated by passing dry nitrogen through a water saturator and mixing the resulting saturated stream with a dry nitrogen stream from the same source, for a first dilution.

This resulting first dilution is then further diluted in a second mixing stage, resulting in dew/frost point temperatures as low as -75°C (-103°F).

The MG-101 consists of the following components:

- Pressure regulator
- Four adjustable rotameters (flowmeters with valves)
- Saturator bottle
- Filter
- Temperature gauge
- Vent valve

See the diagram and explanation in *Figure 1 on page 2* for a description of how the MG-101 works.

1.2 Theory of Operation (cont.)

As shown in *Figure 1* below, dry nitrogen enters at the dry gas inlet **A**, passes through the fixed internal pressure regulator, and splits into the following three streams:

- **B** - dry gas *"first dilution"*
- **C** - wet gas
- **D** - dry gas *"second dilution"*

Stream **B** (the dry gas *"first dilution"*) is mixed with stream **C** (the wet gas) after it passes through the saturator bottles to form a *"Wet gas diluted"* mixture (stream **E**). This is then mixed with stream **D** (the *"dry gas second dilution"*) to generate the desired output mixture (stream **F**).

Obtaining an accurate output mixture requires careful adjustment of the rotameter valves as described in *"Setup and Operation" on page 5*. Calibration of all rotameters and the thermometer is traceable to NIST standards.

Note: *The rotameter scales are used in later steps to reference a lookup table. By themselves, they do not indicate units of flow.*

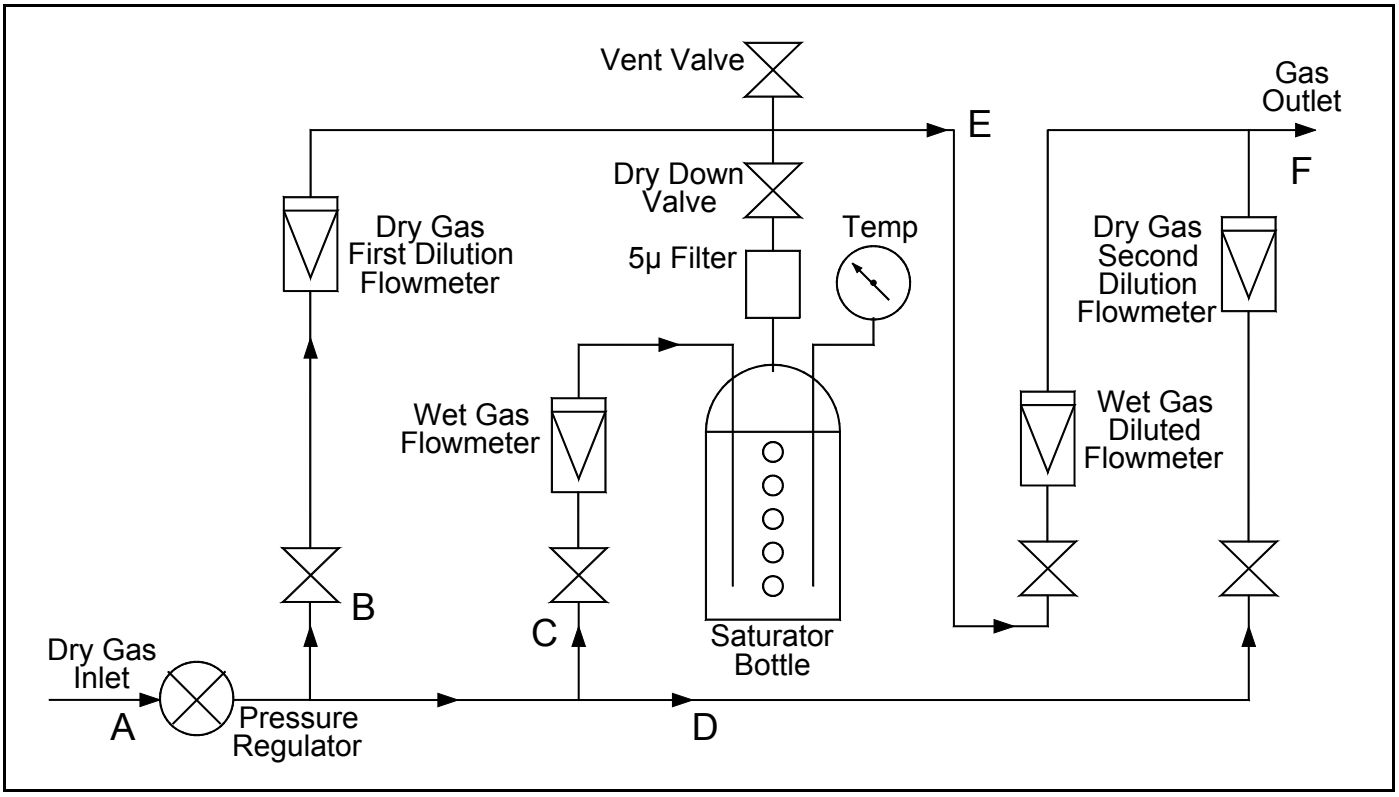

Figure 1: Flow Schematic

1.3 Initial Considerations

This section presents some general guidelines to ensure accurate results with the MG-101.

1.3.1 Operating Range

While the driest dew/frost point temperature capability ***specified*** for the MG-101 is -75°C (-103°F), the actual limit is determined by the moisture content of the dry nitrogen source and by the ambient temperature.

The ***driest*** dew/frost point temperature the MG-101 can produce is the dew/frost point temperature of the dry nitrogen source plus 25°C (45°F). If dry nitrogen of this quality is not available, please contact GE Sensing for assistance. The ***wettest*** dew/frost point temperature that can be generated is determined by the ambient temperature, and it must be at least 10°C (18°F) below the ambient temperature.

1.3.2 Operating Environment

The MG-101 is designed to be used indoors or in an environment where ambient temperature changes are not extreme and where the instrument will not be subject to dramatic heating or cooling. It is important to ensure that the temperature of the calibrator and especially the saturator bottle will not change between the beginning and the end of the calibration cycle.

IMPORTANT: *Changes in the saturator bottle temperature after the calibration parameters have been established will cause errors in the generated dew/frost point temperature.*

CAUTION! **The MG-101 can be damaged by freezing. Do not operate it in freezing temperatures.**

1.3.3 Operating Requirements

You will need the following additional equipment to set up and operate the MG-101 calibrator:

- Nitrogen, preferably from a liquid source

Note: *Nitrogen gas cylinders may be used, but the supply gas must be at least 25°C (45°F) drier than the driest dew/frost point temperature to be generated. Two nitrogen cylinders connected in parallel and plumbed to the inlet of the MG-101, will increase the stability of the gas supply.*

- Stainless steel pressure regulator to set the inlet pressure to 55 psig
- 1/4” OD stainless steel tubing
- An appropriate test chamber

Note: *GE Sensing* Sample Cell #2830 *is preferred for M2 Type probes*

- A hygrometer to monitor the moisture sensor for either:
  - the dew/frost point reading, if simply verifying the moisture sensor performance, or
  - the sensor output signal, if generating a new calibration curve

Note: *The hygrometer used for the calibration can be either a dedicated instrument for use only with the moisture generator or the process instrument that will be used with the recalibrated sensor after the calibration is completed.*

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Chapter 2. Setup and Operation

2.1 Preliminary Setup

IMPORTANT: *Be sure you read and understand* "Initial Considerations" on page 3 *before proceeding.*

To prepare the MG-101 for operation, complete the following steps:

1. Remove the back panel by removing the two small screws at the bottom (see *Figure 2* below).

2. Fill the supplied plastic squeeze bottle with distilled (not deionized) water and connect it to the fill tubing at the bottom of the saturator bottle (see *Figure 2* below). This length of plastic tubing should be left permanently attached to the fitting at the bottom of the saturator bottle.

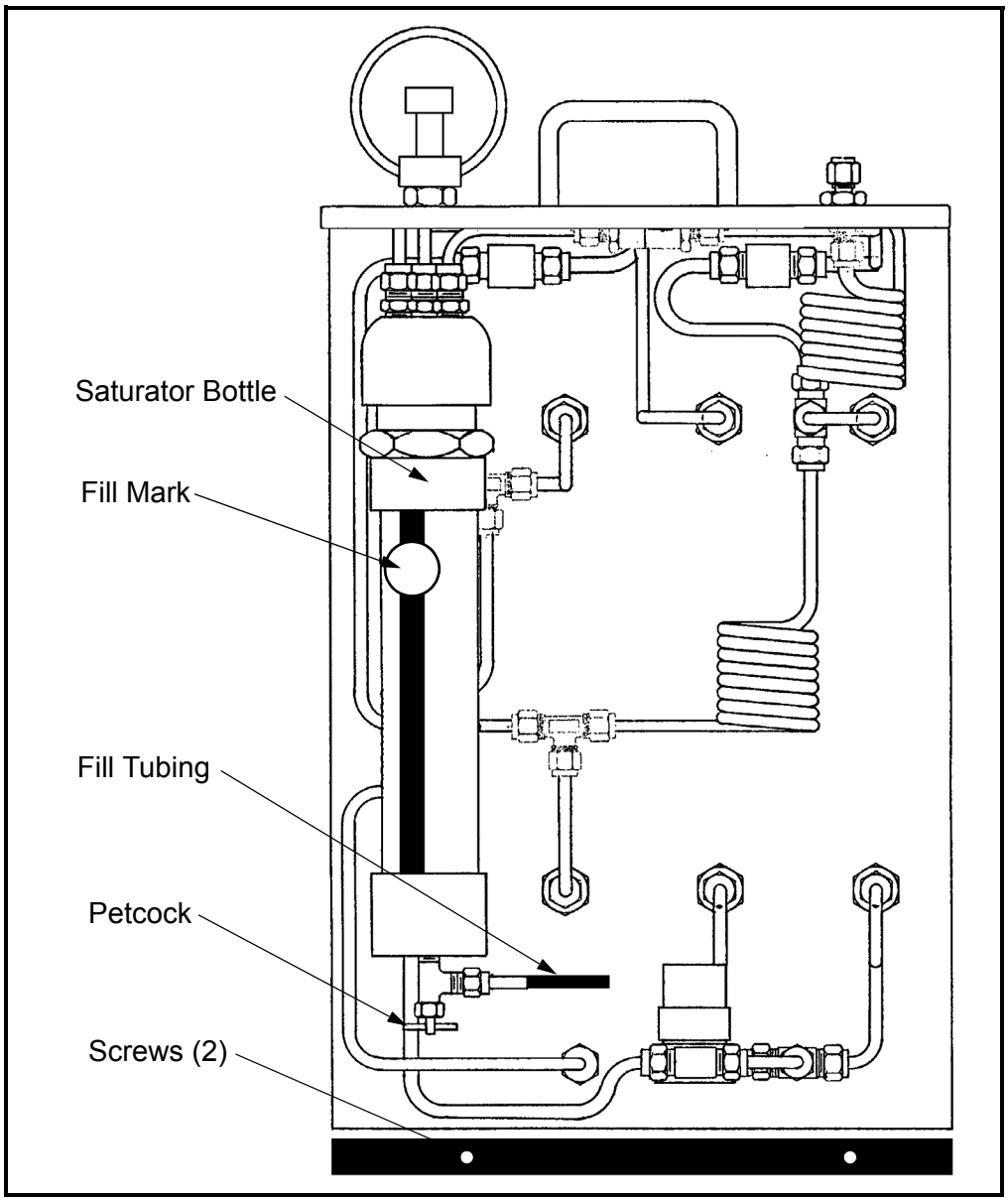

Figure 2: MG-101 Rear View with Panel Removed

2.1 Preliminary Setup (cont.)

3. Open the petcock.

4. *Fully* open the vent valve on the front panel by turning it counter-clockwise, and turn the **WET/DRY SELECTOR VALVE** to **WET** (see *Figure 3* below).

5. Using the squeeze bottle, fill the saturator bottle until the water level reaches the fill mark on the bottle (see *Figure 2 on page 5*).

6. Close the petcock and reinstall the back panel.

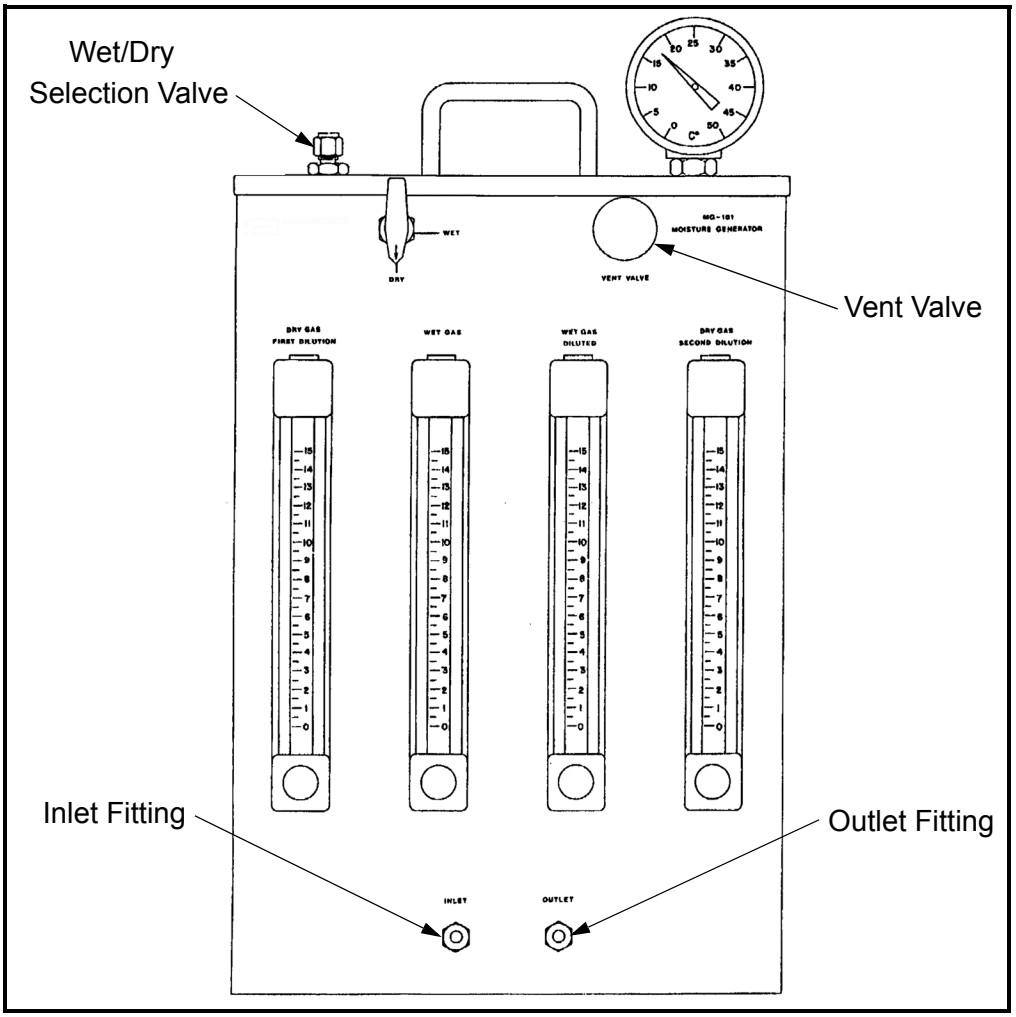

Figure 3: MG-101 Front Panel

2.1 Preliminary Setup (cont.)

7. Connect the nitrogen supply to the MG-101 inlet fitting via the stainless steel pressure regulator using, 1/4" OD stainless steel tubing (see *Figure 4* below).

Note: *Swagelok® fittings are preferred throughout the installation.*

8. Connect the calibration chamber to the MG-101 outlet fitting, using 1/4" OD SS tubing. Then, leak test the connection.

Note: *GE Sensing* Sample Cell #2830 *is the preferred calibration chamber for M2 Type probes*

9. At the outlet of the calibration chamber, connect at least 5 ft (1.5 m) of 1/4" OD tubing as a vent to atmosphere. The tubing may be coiled to save space.

10. Insert the sensor to be calibrated into the calibration chamber and tighten it sufficiently to ensure a leak-proof seal, but be careful not to over-tighten the sensor.

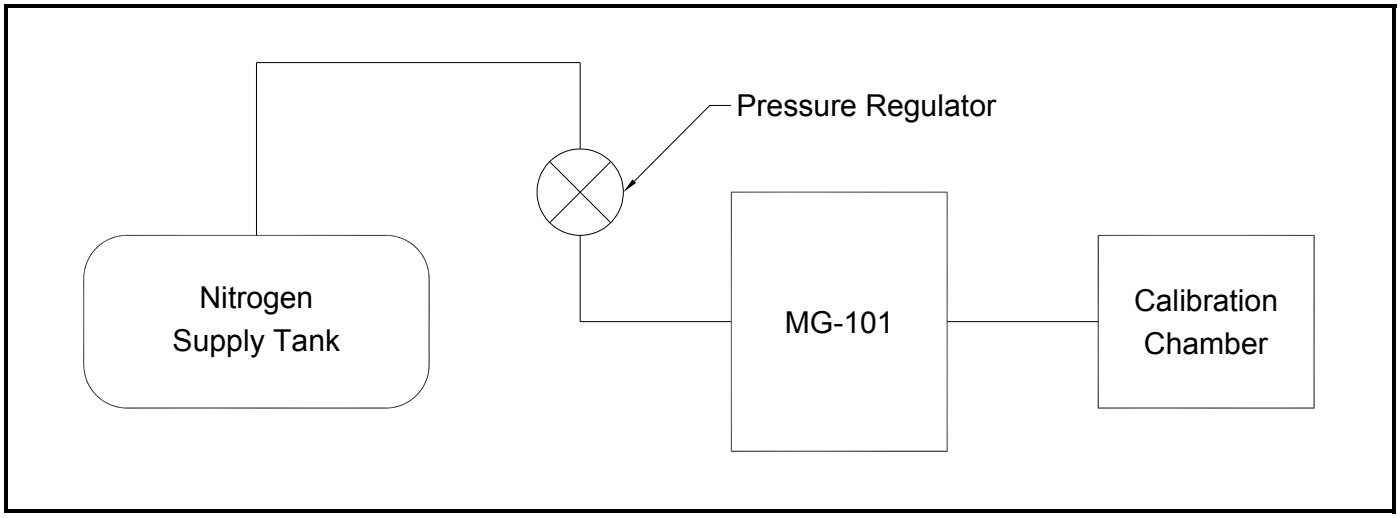

Figure 4: A Typical MG-101 Test Setup

2.2 Operating Procedure

To operate the MG-101, refer to *Figure 5* below and *Figure 6 on page 9* to complete the following steps:

1. *Fully close* all four rotameter valves by turning them clockwise.

2. Set the **WET/DRY** selector valve to **DRY**.

CAUTION! **This valve must always be in the WET position before the "WET GAS" flowmeter valve is opened, and it must remain in the DRY position until the "WET GAS" flowmeter valve is closed.**

3. Set the pressure regulator on the nitrogen gas inlet line to approximately 55 psig.

4. Make sure the vent valve at the top of the front panel is *fully* open.

5. *Fully* open the valve on the **WET GAS DILUTED** rotameter.

Note: *The rotameters are dual-range, floating-ball types, each having both a steel ball and a glass ball. When reading the rotameters be careful to watch either the steel ball or the glass ball (see Figure 4 below) as directed (numbers in tables are followed by an* **S** *or a* **G** *to designate the ball material).*

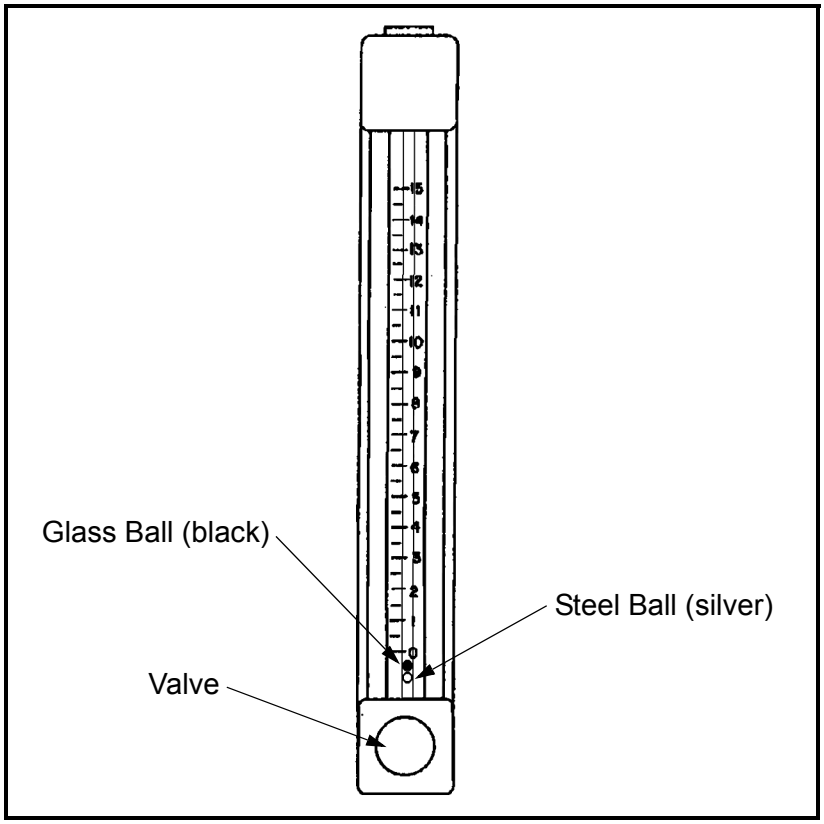

Figure 5: Rotameter Valve and Balls

2.2 Operating Procedure (cont.)

6. Open and adjust the valves on both the **DRY GAS FIRST DILUTION** and the **DRY GAS SECOND DILUTION** rotameters, so that the ***steel ball*** indicates approximately **"10"** on the rotameter scales.

7. Adjust the vent valve so that the ***steel ball*** on the **WET GAS DILUTED** rotameter also reads approximately **"10."**

IMPORTANT: *Leak test all connections from the nitrogen supply to the calibration chamber before proceeding.*

8. Allow the nitrogen to purge through the entire system at the rotameter settings defined in the previous steps. The calibration system will begin to dry down and eventually come to equilibrium with the dry nitrogen supply gas. The time required to achieve equilibrium will vary depending on the moisture level of the nitrogen (approximately 6 to 18 hours will be required).

9. After the calibration system has reached equilibrium, set the valve on the **WET/DRY** rotameter to the **WET** position.

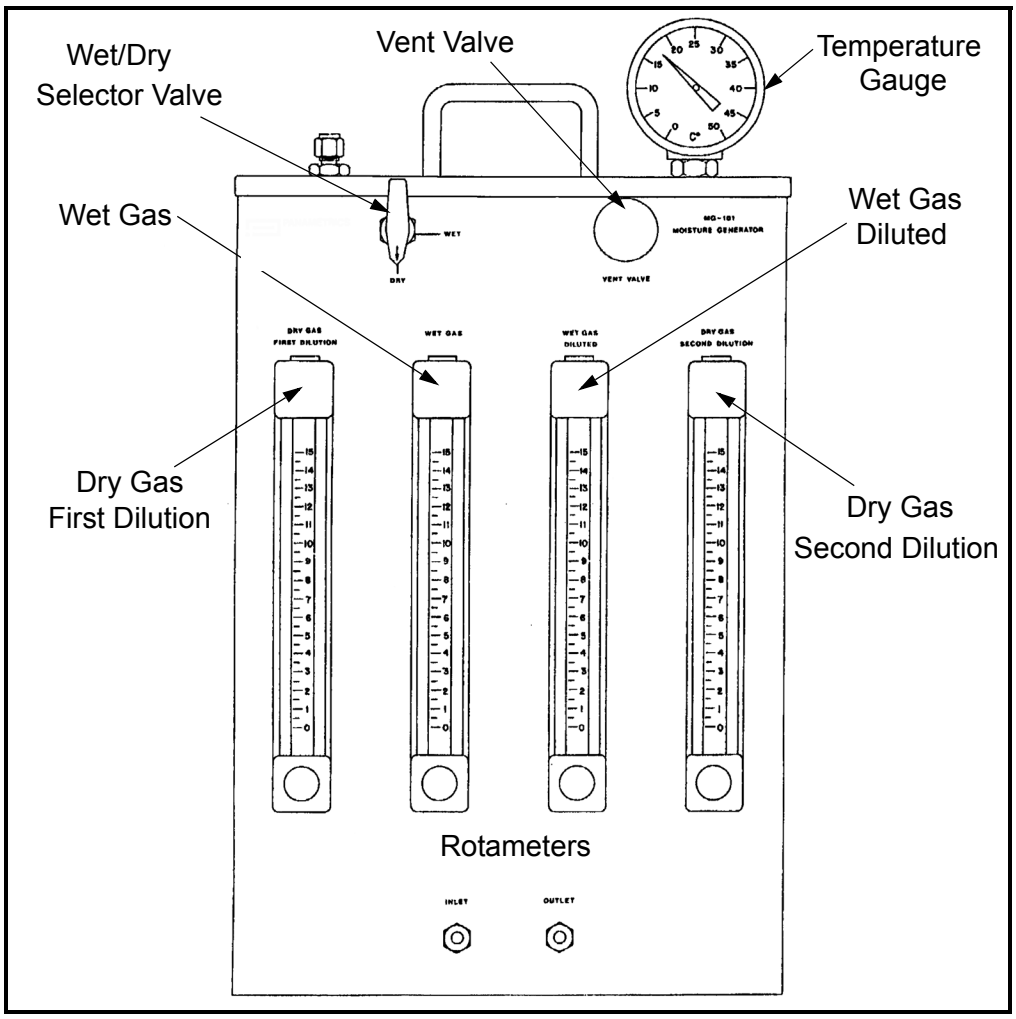

Figure 6: Rotameters and Valves

2.2.1 Calibrating the Moisture Samples

To generate calibrated moisture samples, proceed as follows:

Note: *Be sure to start with the* driest *calibration value and proceed to the wetter values, because you cannot readily go from a wetter valve to a drier value. Wetter to drier changes always require a longer equilibration period. For example, if you are calibrating a moisture probe over the range of -60°C dew/frost point temperature to +10°C dew/frost point temperature, start with the -60°C dew/frost point temperature.*

1. Check the saturator bottle temperature on the temperature gauge.

2. For each moisture calibration point you wish to generate, look at **Data Tables 2 and 3** (supplied with the MG-101). Above the line which reads ***"Generated Dew Points (Deg C),"*** is a row of values headed ***"Ambient Temperature (Deg C)."*** Find the column corresponding as closely as possible to the temperature measured in Step 1 above, and read down the column of dew/frost points (dew points) in the table below this temperature heading.

Note: *The moisture value you wish to generate may be in either* **Data Table 2** *or* **Data Table 3***. You will find that "drier" calibration points are in Data Table 3 while "wetter" values are in Data Table 2.*

At this point, the MG-101 operating procedure depends on which table contains your calibration point:

- If your calibration point is in **Data Table 3**, go to *"Using Data Table 3" on page 11*.
- If your calibration point is in **Data Table 2**, go to *"Using Data Table 2" on page 12*.

2.2.2 Using Data Table 3

For calibration points found in **Data Table 3**, refer to *Figure 6 on page 9* and proceed as follows:

1. *Fully* open the vent valve by turning it counter-clockwise.

CAUTION! **Make the following adjustments slowly, being careful not to overshoot the target value. NEVER ALLOW THE SYSTEM TO GO TO A VALUE WETTER THAN THE TARGET VALUE. If you overshoot a value in the wetter direction, you will have to allow the system to equilibrate (dry down) again before you can proceed.**

2. In **Data Table 3**, look below the body of the table for *Notes 1 and 2*. Adjust both the valves on the **DRY GAS FIRST DILUTION** and the **DRY GAS SECOND DILUTION** rotameters to the values listed.

IMPORTANT: *Be sure to read the steel ball or glass ball (***S** *or* **G***), as indicated in the table.*

3. Consult **Data Table 3** for the desired dew/frost point temperature and find the corresponding value in the column headed **WET GAS**. Adjust the **WET GAS** valve to obtain the value indicated in the table.

4. By referring to the desired dew/frost point temperature in **Data Table 3**, find the corresponding value in the column headed **WET GAS DILUTED**. Adjust the vent valve (but not the valve on the **WET GAS DILUTED** rotameter, which must remain fully open) to obtain the value indicated in **Data Table 3**.

After stabilizing, the system output will be at the selected dew/frost point temperature and it is ready for use. The stabilization period depends on the dew/frost point temperature you are using. In general, the following times are required:

- For dew/frost point temperatures of -60°C (-76°F) and drier, allow 2 hours
- For dew/frost point temperatures of -60°C (-76°F) to -40°C (-40°F), allow 1 hour
- For dew/frost point temperatures of -40°C (-40°F) and wetter, allow 30 minutes

After you have completed the calibration or other calibrated moisture operation at this dew/frost point temperature, either shut down the system (see *"System Shutdown" on page 12*), or repeat the steps in this section for the next calibration point.

2.2.3 Using Data Table 2

For calibration points found in **Data Table 2**, refer to *Figure 6 on page 9* and proceed as follows:

1. *Fully* close the vent valve by turning it clockwise.

CAUTION! **Make the following adjustments slowly, being careful not to overshoot the target value. NEVER ALLOW THE SYSTEM TO GO TO A VALUE WETTER THAN THE TARGET VALUE. If you overshoot a value in the wetter direction, you will have to allow the system to equilibrate (dry down) again before you can proceed.**

2. *Fully* close the **DRY GAS FIRST DILUTION VALVE** by turning it clockwise.
3. Consult **Data Table 2** for the desired dew/frost point temperature and find the corresponding value in the column headed **DRY GAS (SECOND DILUTION)**. Adjust the valve on the **DRY GAS SECOND DILUTION** rotameter to obtain the value shown in the table.

IMPORTANT: *Be sure to read the steel ball or glass ball (***S** *or* **G***), as indicated in the table.*

4. By referring to the desired dew/frost point temperature in **Data Table 2**, find the corresponding value in either the column headed **WET GAS** or the column headed **WET GAS DILUTED** (a given value appears in one column or the other, but not both). Adjust the valve on the **WET GAS** rotameter (but not on the **Wet Gas Diluted** rotameter, which must remain fully open) to obtain the reading indicated on either the **WET GAS** or the **WET GAS DILUTED** rotameter scales (whichever is indicated in the table).

IMPORTANT: *Be sure to read the steel ball or glass ball (***S** *or* **G***), as indicated in the table.*

After equilibrium has been established, the MG-101 will be delivering a calibration gas with the selected dew/frost point temperature.

After you have completed the calibration or other calibrated moisture operation at this dew/frost point temperature, either shut down the system (see *"System Shutdown"* below), or repeat the steps in this section for the next calibration point.

2.2.4 System Shutdown

If you are not planning another calibration run, you must shut the system down as follows:

1. *Fully* open the vent valve by turning it counter-clockwise.
2. *Fully* close the **WET GAS VALVE** by turning it clockwise.
3. *Fully* close the **DRY GAS FIRST DILUTION VALVE** by turning it clockwise.
4. *Fully* close the **DRY GAS SECOND DILUTION VALVE** by turning it clockwise.
5. Set the **WET/DRY VALVE** to **DRY**.

2.2.5 Preparation for Shipping

To ship or to move the MG-101, refer to *Figure 7* below and empty the saturator bottle as follows:

1. Remove the rear panel by removing the two small screws at the bottom.

2. Fully open the vent valve by turning it counter-clockwise.

3. Place the end of the fill tubing in a container below the level of the saturator bottle and open the petcock.

4. When the saturator bottle is completely empty, close the petcock and the vent valve, and reinstall the rear panel.

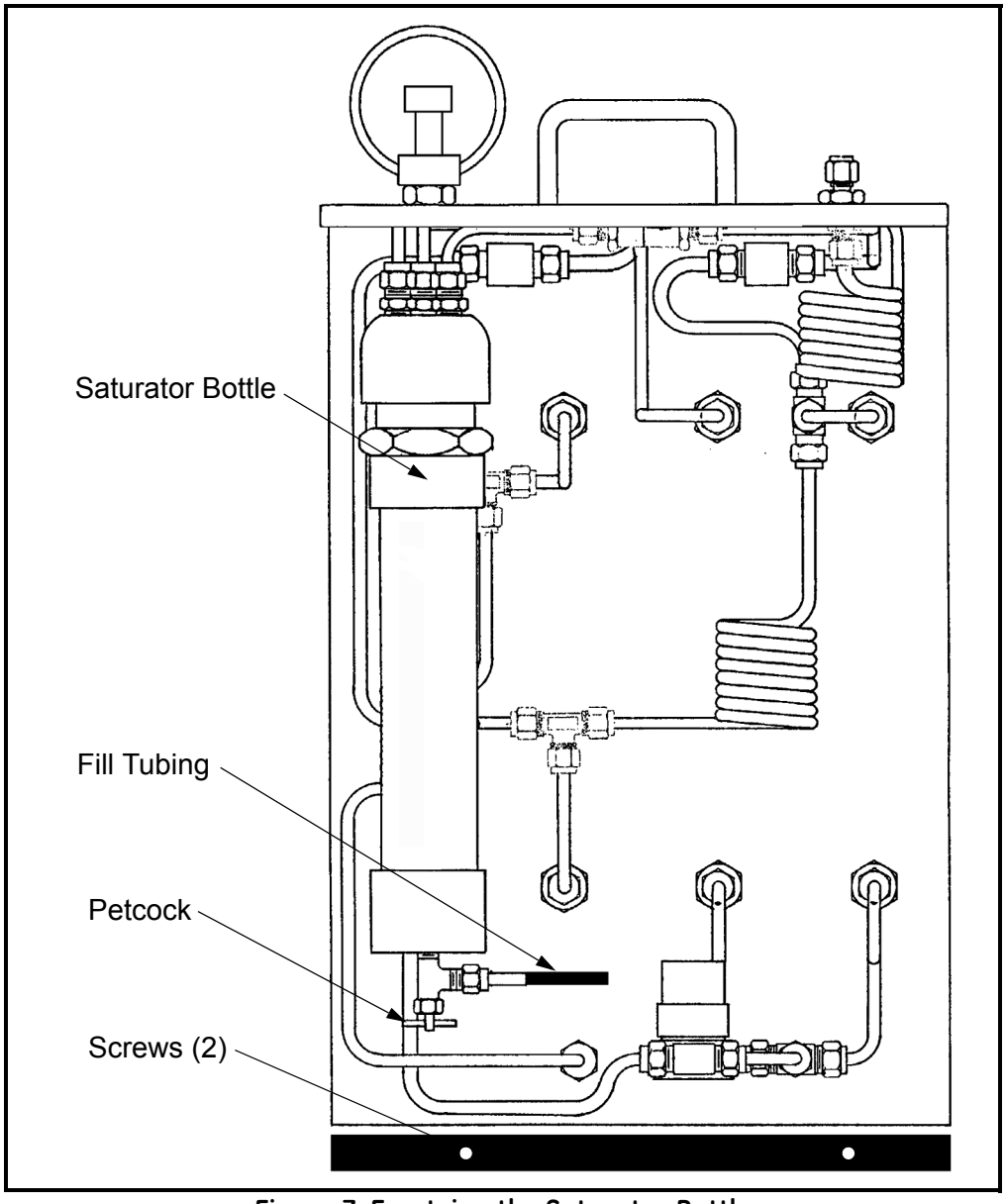

Figure 7: Emptying the Saturator Bottle

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Chapter 3. Specifications

3.1 Performance Specifications

Generated Dew/Frost Point Temperature Range	-75°C (-103°F) up to 10°C (18°F) below ambient temperature
Accuracy	±1°C (±1.8°F)

3.2 Operating Specifications

Inlet Gas Supply	Must be a minimum of 25°C (45°F) drier than the driest sample to be generated
Flow Rate	9.2 liters/minute (19.6 SCFH), maximum
Inlet Pressure	55-60 psig
Outlet Pressure	Ambient pressure
Power Requirements	None

3.3 Physical Specifications

Dimensions (W x H x D)	12" x 18" x 6" (304.8 mm x 457.2 mm x 152.4 mm)
Inlet and Outlet Connections	1/4" Swagelok® tube fittings

Note: *See* Figure 8 on page 16 *for a dimensional drawing of the MG-101.*

3.3 Physical Specifications (cont.)

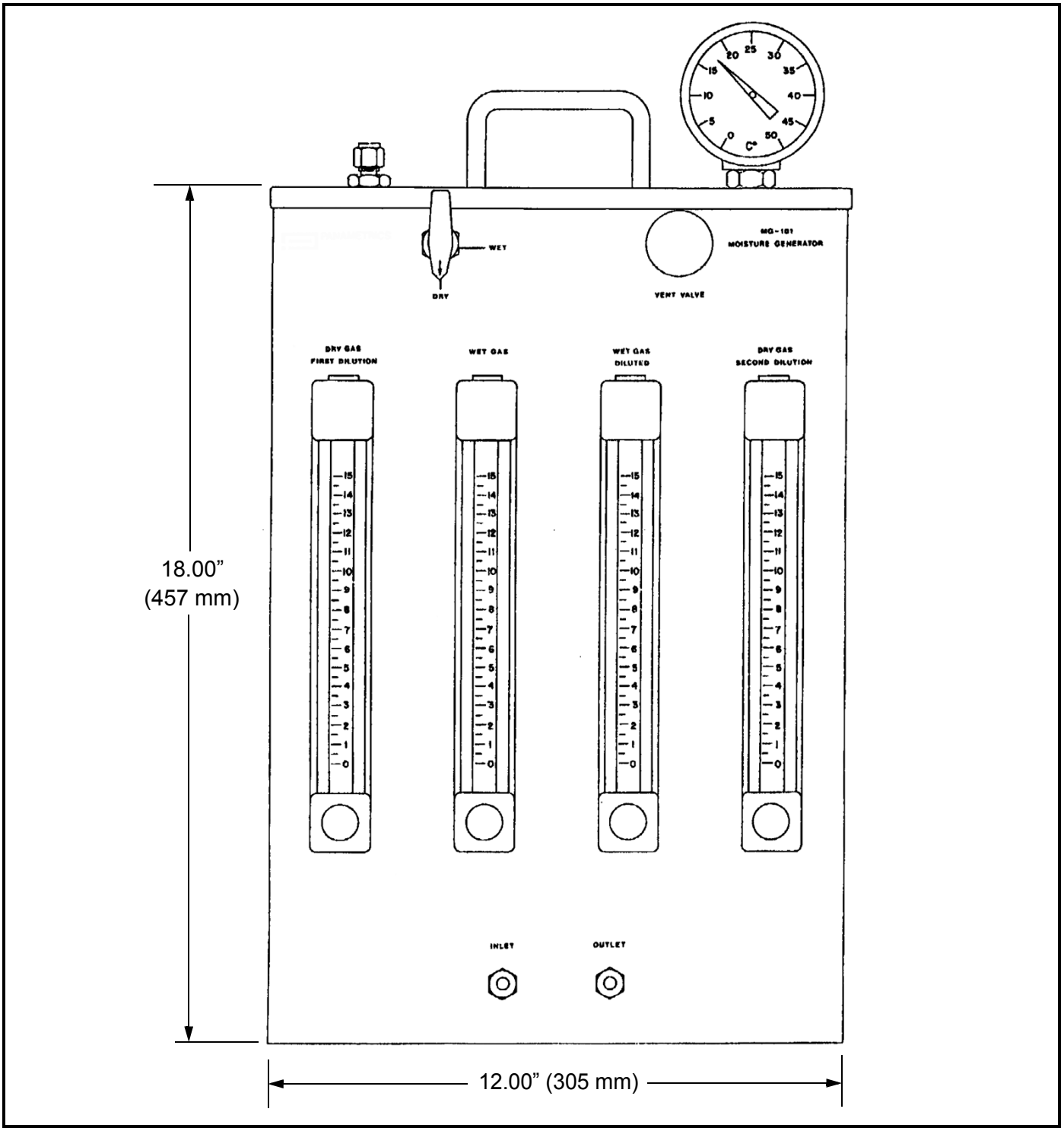

Figure 8: MG-101 Moisture Generator Outline Dimensions

Appendix A. Supplemental Information

A.1 Formulas

The moisture content generated by the MG-101, as determined by the water vapor pressure, is calculated with the following equation:

$$P_w = \frac{F_w\left(\frac{P_s F_{w1} + P_{d1} F_{d1}}{F_{w1} + F_{d1}}\right) + P_d \times F_d}{F_w + F_d} \quad (1)$$

where:

P_w = the generated vapor pressure of water
P_s = the saturation vapor pressure of water as determined by the water temperature of the saturator
P_d = the vapor pressure of water in the dry nitrogen stream
F_w = the flow rate of the wet gas diluted stream
F_{w1} = the flow rate of the wet gas stream
F_d = the flow rate of the dry gas second dilution stream
F_{d1} = the flow rate of the dry gas first dilution stream

In general, $P_d F_d << P_s F_w$ and $P_{d1} F_{d1} << P_s F_{w1}$. Thus, *Equation 1* above simplifies to:

$$P_w = \left(\frac{F_w}{F_w + F_d}\right)\left(\frac{F_{w1}}{F_{w1} + F_{d1}}\right) P_s \quad (2)$$

The value of P_s and the dew point (from the calculated value p_w) are determined from a chart of vapor pressure of water as a function of temperature (see *Table 1 on page 19*). *Equation 1* above produces an error of less than 2°C (3.6°F) dew/frost point temperature at the lowest generated dew/frost point temperatures, and virtually no error at higher dew/frost point temperatures. The advantage of *Equation 2* above is that a precise determination of the dew/frost point temperature of the gas supply is not necessary. It is good practice, however, to use the hygrometer to determine an approximate dew/frost point temperature of the dry gas supply. To obtain the lowest dew/frost point temperatures within the specified accuracy, the dry gas supply should not exceed 3% of the desired mixture concentration.

A.2 Typical Examples

The following examples show typical calculations based on the equations presented on the previous page.

A.2.1 Example 1

Data Table 2 is provided with the MG-101 to enable you to use the field calibration system to check sensor probe calibration without calculating the value of p_w. **Data Table 2** was compiled by calculating p_w and thus, the dew/frost point temperature by *Equation 2* on the previous page. To use **Data Table 2**, set the rotameters per the columns headed *"Dry Gas Setting"* and either *"High Wet Gas Setting"* or *"Low Wet Gas Setting."* Moving horizontally across the table, read the generated dew/frost point temperature under the appropriate temperature reading.

Note: *The term "*Flowmeter*" used in the data tables and is equivalent to the word* "rotameter" *used in this manual.*

A.2.2 Example 2

To determine generated dew/frost point temperatures other than those listed in **Data Table 2**, *Equation 2* on the previous page must be used, as shown in the following example. If,

Dry Gas first dilution flowmeter setting F_{d1} = 4,500 cc/min
Dry Gas second dilution flowmeter setting F_d = 4,500 cc/min
Wet Gas flowmeter setting = 20 cc/min F_{w1} = 140 cc/min
Wet Gas diluted flowmeter setting F_w = 347 cc/min
Thermometer reading T = 20°C

and, P_s = 17.535 mm Hg at 20°C (from *Table 1 on page 19*),

Then,

$$P_w = \left(\frac{F_w}{F_w + F_d}\right)\left(\frac{F_{w1}}{F_{w1} + F_{d1}}\right)P_s \quad (3)$$

$$P_w = \left(\frac{347cc/min}{347cc/min + 4500cc/min}\right)\left(\frac{140cc/min}{140cc/min + 4500cc/min}\right) \cdot (17.353mmHg) \quad (4)$$

And, Pw = 0.0375 mm Hg, which is equivalent to a dew/frost point temperature of 48°C (by interpolation).

A.3 Vapor Pressure and Calibration Tables

Table 1 on page 19 is the vapor pressure of water as a function of temperature.

IMPORTANT: *Two tables not included in this manual,* **Data Tables 2 and 3***, are sets of calibrations generated at the factory for each MG-101. These tables are supplied with the unit, and you must use these tables to operate the MG-101. Since each table is specific to your instrument, you cannot use tables from another unit. If you lose these tables, contact the factory and duplicates will be provided.*

Table 1: Vapor Pressure of Water

Note: *If the dew/frost point is known, the table yields the partial water vapor pressure (P_W) in mm of Hg. If the ambient or actual gas temperature is known, the table yields the saturated water vapor pressure (P_S) in mm of Hg.*

Water Vapor Pressure Over Ice

Temp. (°C)	0	2	4	6	8
-90	0.000070	0.000048	0.000033	0.000022	0.000015
-80	0.000400	0.000290	0.000200	0.000140	0.000100
-70	0.001940	0.001430	0.001050	0.000770	0.000560
-60	0.008080	0.006140	0.004640	0.003490	0.002610
-50	0.029550	0.023000	0.017800	0.013800	0.010600
-40	0.096600	0.076800	0.060900	0.048100	0.037800
-30	0.285900	0.231800	0.187300	0.150700	0.120900
Temp. (°C)	0.0	0.2	0.4	0.6	0.8
-29	0.317	0.311	0.304	0.298	0.292
-28	0.351	0.344	0.337	0.330	0.324
-27	0.389	0.381	0.374	0.366	0.359
-26	0.430	0.422	0.414	0.405	0.397
-25	0.476	0.467	0.457	0.448	0.439
-24	0.526	0.515	0.505	0.495	0.486
-23	0.580	0.569	0.558	0.547	0.536
-22	0.640	0.627	0.615	0.603	0.592
-21	0.705	0.691	0.678	0.665	0.652
-20	0.776	0.761	0.747	0.733	0.719
-19	0.854	0.838	0.822	0.806	0.791
-18	0.939	0.921	0.904	0.887	0.870
-17	1.031	1.012	0.993	0.975	0.956
-16	1.132	1.111	1.091	1.070	1.051
-15	1.241	1.219	1.196	1.175	1.153
-14	1.361	1.336	1.312	1.288	1.264
-13	1.490	1.464	1.437	1.411	1.386
-12	1.632	1.602	1.574	1.546	1.518
-11	1.785	1.753	1.722	1.691	1.661
-10	1.950	1.916	1.883	1.849	1.817
-9	2.131	2.093	2.057	2.021	1.985
-8	2.326	2.285	2.246	2.207	2.168
-7	2.537	2.493	2.450	2.408	2.367
-6	2.765	2.718	2.672	2.626	2.581
-5	3.013	2.962	2.912	2.862	2.813
-4	3.280	3.225	3.171	3.117	3.065
-3	3.568	3.509	3.451	3.393	3.336
-2	3.880	3.816	3.753	3.691	3.630
-1	4.217	4.147	4.079	4.012	3.946
0	4.579	4.504	4.431	4.359	4.287

Table 1: Vapor Pressure of Water (cont.)

Aqueous Vapor Pressure Over Water					
Temp. (°C)	0.0	0.2	0.4	0.6	0.8
0	4.579	4.647	4.715	4.785	4.855
1	4.926	4.998	5.070	5.144	5.219
2	5.294	5.370	5.447	5.525	5.605
3	5.685	5.766	5.848	5.931	6.015
4	6.101	6.187	6.274	6.363	6.453
5	6.543	6.635	6.728	6.822	6.917
6	7.013	7.111	7.209	7.309	7.411
7	7.513	7.617	7.722	7.828	7.936
8	8.045	8.155	8.267	8.380	8.494
9	8.609	8.727	8.845	8.965	9.086
10	9.209	9.333	9.458	9.585	9.714
11	9.844	9.976	10.109	10.244	10.380
12	10.518	10.658	10.799	10.941	11.085
13	11.231	11.379	11.528	11.680	11.833
14	11.987	12.144	12.302	12.462	12.624
15	12.788	12.953	13.121	13.290	13.461
16	13.634	13.809	13.987	14.166	14.347
17	14.530	14.715	14.903	15.092	15.284
18	15.477	15.673	15.871	16.071	16.272
19	16.477	16.685	16.894	17.105	17.319
20	17.535	17.753	17.974	18.197	18.422
21	18.650	18.880	19.113	19.349	19.587
22	19.827	20.070	20.316	20.565	20.815
23	21.068	21.324	21.583	21.845	22.110
24	22.377	22.648	22.922	23.198	23.476
25	23.756	24.039	24.326	24.617	24.912
26	25.209	25.509	25.812	26.117	26.426
27	26.739	27.055	27.374	27.696	28.021
28	28.349	28.680	29.015	29.354	29.697
29	30.043	30.392	30.745	31.102	31.461
30	31.824	32.191	32.561	32.934	33.312
31	33.695	34.082	34.471	34.864	35.261
32	35.663	36.068	36.477	36.891	37.308
33	37.729	38.155	38.584	39.018	39.457
34	39.898	40.344	40.796	41.251	41.710
35	42.175	42.644	43.117	43.595	44.078
36	44.563	45.054	45.549	46.050	46.556
37	47.067	47.582	48.102	48.627	49.157
38	49.692	50.231	50.774	51.323	51.879
39	52.442	53.009	53.580	54.156	54.737
40	55.324	55.910	56.510	57.110	57.720
41	58.340	58.960	59.580	60.220	60.860

Table 1: Vapor Pressure of Water (cont.)

Aqueous Vapor Pressure Over Water (cont.)					
Temp. (°C)	0.0	0.2	0.4	0.6	0.8
42	61.500	62.140	62.800	63.460	64.120
43	64.800	65.480	66.160	66.860	67.560
44	68.260	68.970	69.690	70.410	71.140
45	71.880	72.620	73.360	74.120	74.880
46	75.650	76.430	77.210	78.000	78.800
47	79.600	80.410	81.230	82.050	82.870
48	83.710	84.560	85.420	86.280	87.140
49	88.020	88.900	89.790	90.690	91.590
50	92.51	93.50	94.40	95.30	96.30
51	97.20	98.20	99.10	100.10	101.10
52	102.09	103.10	104.10	105.10	106.20
53	107.20	108.20	109.30	110.40	111.40
54	112.51	113.60	114.70	115.80	116.90
55	118.04	119.10	120.30	121.50	122.60
56	123.80	125.00	126.20	127.40	128.60
57	129.82	131.00	132.30	133.50	134.70
58	136.08	137.30	138.50	139.90	141.20
59	142.60	143.90	145.20	146.60	148.00
60	149.38	150.70	152.10	153.50	155.00
61	156.43	157.80	159.30	160.80	162.30
62	163.77	165.20	166.80	168.30	169.80
63	171.38	172.90	174.50	176.10	177.70
64	179.31	180.90	182.50	184.20	185.80
65	187.54	189.20	190.90	192.60	194.30
66	196.09	197.80	199.50	201.30	203.10
67	204.96	206.80	208.60	210.50	212.30
68	214.17	216.00	218.00	219.90	221.80
69	223.73	225.70	227.70	229.70	231.70
70	233.70	235.70	237.70	239.70	241.80
71	243.90	246.00	248.20	250.30	252.40
72	254.60	256.80	259.00	261.20	263.40
73	265.70	268.00	270.20	272.60	274.80
74	277.20	279.40	281.80	284.20	286.60
75	289.10	291.50	294.00	296.40	298.80
76	301.40	303.80	306.40	308.90	311.40
77	314.10	316.60	319.20	322.00	324.60
78	327.30	330.00	332.80	335.60	338.20
79	341.00	343.80	346.60	349.40	352.20
80	355.10	358.00	361.00	363.80	366.80
81	369.70	372.60	375.60	378.80	381.80
82	384.90	388.00	391.20	394.40	397.40
83	400.60	403.80	407.00	410.20	413.60

Table 1: Vapor Pressure of Water (cont.)

Aqueous Vapor Pressure Over Water (cont.)					
Temp. (°C)	0.0	0.2	0.4	0.6	0.8
84	416.80	420.20	423.60	426.80	430.20
85	433.60	437.00	440.40	444.00	447.50
86	450.90	454.40	458.00	461.60	465.20
87	468.70	472.40	476.00	479.80	483.40
88	487.10	491.00	494.70	498.50	502.20
89	506.10	510.00	513.90	517.80	521.80
90	525.76	529.77	533.80	537.86	541.95
91	546.05	550.18	554.35	558.53	562.75
92	566.99	571.26	575.55	579.87	584.22
93	588.60	593.00	597.43	601.89	606.38
94	610.90	615.44	620.01	624.61	629.24
95	633.90	638.59	643.30	648.05	652.82
96	657.62	662.45	667.31	672.20	677.12
97	682.07	687.04	692.05	697.10	702.17
98	707.27	712.40	717.56	722.75	727.98
99	733.24	738.53	743.85	749.20	754.58
100	760.00	765.45	770.93	776.44	782.00
101	787.57	793.18	798.82	804.50	810.21

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.

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Customer Support Centers

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www.ge-mcs.com

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