Portable Model P-1000

H_2S Process Analyzer

Operator's Installation and Instruction Manual

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1.0 Introduction

The Detcon Model P-1000 H_2S Process Analyzer is a portable gas analyzer designed to provide accurate measurement of Hydrogen Sulfide gas concentrations. The portable battery powered instrument utilizes advanced electrochemical sensor technology and microprocessor based electronic control circuitry that includes a built in data logger. Stored data can be downloaded to a spreadsheet and used to create trend graphs. A universal signal conditioning circuit with an LED display and the Intelligent Transmitter Module allow multiple ranges of analysis, which includes 0-20ppm, 0-100ppm, and 0-1,000ppm. The analyzer sensor and control circuitry are mounted in a weatherproof enclosure with a built in battery supply and sample conditioning components. The Model P-1000-H_2S is capable of continuous operation for a period of approximately 30 days before battery recharge is required. A 12VDC Battery Charger/Power Source is supplied as part of the standard equipment. An optional pump can be added for better gas flow regulation.

NOTE: The optional flow pump may significantly reduce battery run time.

The analyzer requires a liquid-free, 5-10psig sample pressure, provided by the customer. The on-board gas sample conditioning system includes a stainless steel pressure gauge (0-30psig), a Rotameter with flow valve, and a Polycarbonate Coalescing Filter to provide the analyzer with condensing liquid protection. A 500cc/min sample flow rate should be delivered to the Model 100 H_2S Sensor for analysis. The H_2S sample flow is maintained by a control valve Rotameter. An Activated Carbon Scrubber is used to remove H_2S prior to venting. A 3-way valve provides for switching between sample monitoring and zero/span calibration.

1.1 Model 100 Sensor Description

Detcon Model DM-100 toxic gas sensors are designed to detect and monitor a wide range of toxic gases in air. Ranges of detection for toxic gases are from 0-1ppm up to 0-10,000ppm, typical ranges of detection used in the Portable Analyzer are 0-20ppm, 0-100ppm and 0-1000ppm.

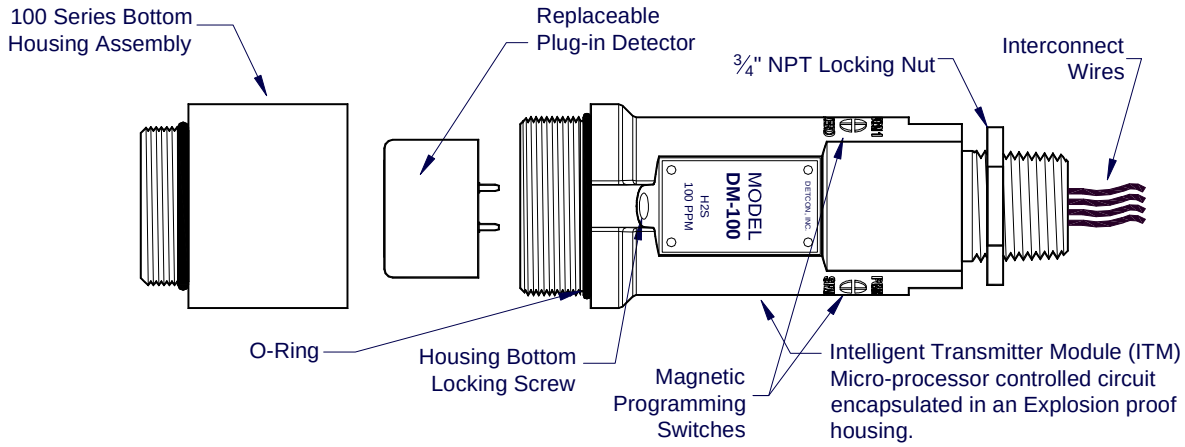

Figure 1 Model 100 ITM with Detector

The Model 100 gas sensor consists of three major components: 1) The Intelligent Transmitter Module (ITM) 2) The Replaceable Plug in Detector, which is set for the range of gas to be detected. 3) and the Display with Interconnect PCA.

Typical ranges of detection used in the P-1000 Analyzer are 0-20ppm, 0-100ppm and 0-1,000ppm. Other ranges are available. All ranges are covered by this manual.

1.1.1 Intelligent Transmitter Module (ITM)

The Intelligent Transmitter Module is a microprocessor-based package that is mounted on a bracket. Circuit functions include an intrinsically safe barrier, on-board power supply, microprocessor, magnetic programming switches, and a linear 4-20mA DC output. Magnetic program switches located on either side of the ITM are activated via a hand-held magnetic programming tool, thus allowing non-intrusive operator interface with the Transmitter Module. Electrical classifications are Class I, Division 1, Groups A, B, C, and D.

1.1.2 Replaceable Plug-in Detector

The Detcon family of electrochemical gas sensors are field proven and utilize plug-in detectors with over-sized gold-plated connections that eliminate corrosion problems. The Plug-in Detector can be accessed and replaced easily by releasing the locking nut, removing the sensor from the bracket, and unthreading the ITM from the bottom housing assembly. Detcon's family of toxic sensors and detectors have a long shelf life, and are supported by an industry-leading warranty.

Figure 2 Plug-in Detector

Sensor Technology

The sensors are electrolytic chemical cells. Each cell consists of three electrodes embedded in an electrolyte solution all housed beneath a diffusion membrane. Sensitivity to specific target gases is achieved by varying composition of any combination of the sensor components. The cells are diffusion limited via small capillary barriers resulting in long service life of up to 3 or more years. The sensor cell is an integral part of the plug-in detector, and cannot be accessed in the field.

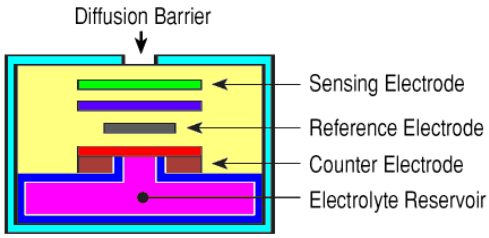

Figure 3 Construction of Electrochemical Cell

1.1.3 Display and Sensor Interconnect

The analyzer utilizes the Model 100 LED Display which provides a 4 digit display of the sensors activity. The Model 100 Terminal Board is utilized to interface the Model 100 ITM to the display and provide the 4-20mA needed for the HOBO Data logger.

1.1.4 Optional Pump

An optional 12V DC pump can be ordered with the unit that will aid the unit in obtaining the proper sample flow rate necessary to obtain accurate gas readings. The pump is an added load to the batteries, and will reduce normal battery operating time.

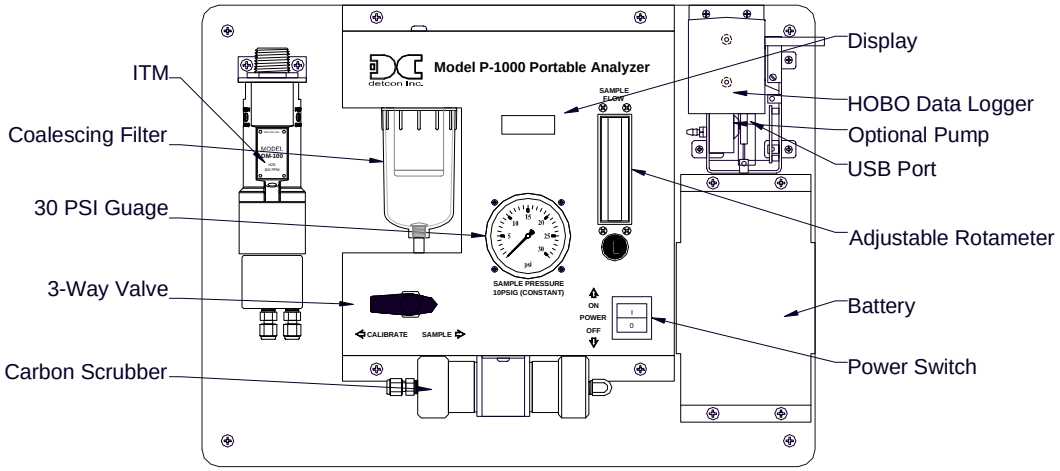

Figure 4 Overview

1.2 Principle of Operation

Sample gas is fed into the unit via the Process Sample Inlet port on the side of the unit. The flow of the gas is regulated by the Rotameter, and passed through the coalescing filter to remove moisture and condensation. The nominal flow rate should be 500cc/min. with a minimum flow rate of 200cc/min. and a maximum of 1000cc/min. The gas enters the ITM via the Flow-through Chamber where it is read by the sensor, and vented to the atmosphere via an Activated Carbon Scrubber to the Vent Port. H_2S gas diffuses through the capillary diffusion barrier of the cell where detection is made by an electrochemical reaction at the surface of an electrode called the sensing electrode. The controlling circuit maintains a small external operating voltage between the sensing and counter electrodes of the proper bias and magnitude so that no current flows to or from the reference electrode while its potential is maintained at the correct fixed voltage — usually ground. The electrochemical reaction creates a change in current flow from the counter electrode to the sensing electrode. This change in current is proportional to the gas concentration and is reversible. The quick response of the sensor results in continuous and reliable monitoring of H_2S concentration.

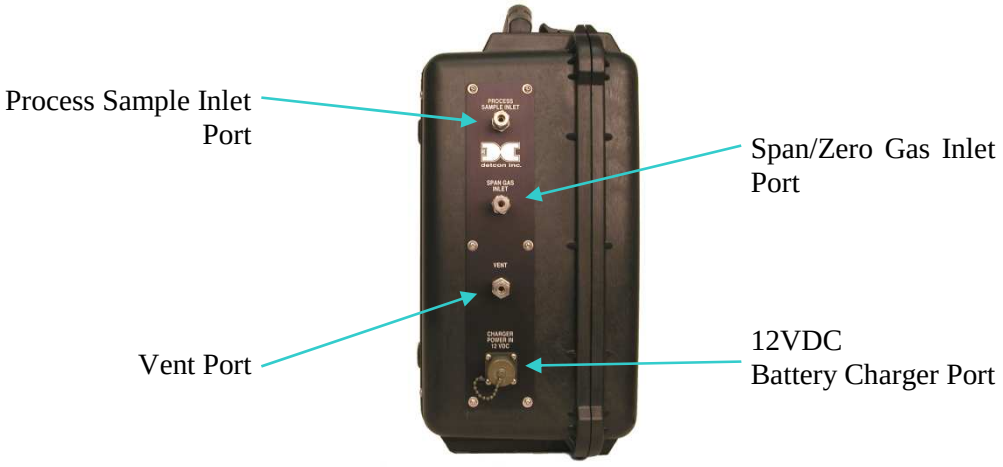

Figure 5 Gas Ports

Data from the sensor is exported from a HOBO Data Logger via a USB Port. The incorporation of the HOBOware™ Software and a PC or Laptop complete the unit and allow the user to record the data in graphic

format that can be viewed via the HOBOware™ software. For more information, refer to the HOBOware™ Users Guide.

During Calibration the 3-way valve is placed in the CALIBRATE position and Cal Gas is fed to the sensor via the Sample Gas Inlet Port.

1.2.1 Interference Data

Model 100 series electrochemical H_2S sensors are subject to interference from some gases. This interaction is shown in Table 1 as the relation between the amount of the interfering gas applied to the sensor, and the corresponding reading that will occur. All measurements are in ppm unless otherwise noted.

Table 1 Gas Interference

Gas Name	Symbol	Cross	Gas Name	Symbol	Cross
Acetyldehyde	C2H3O	n/d	Hydrocarbons	C-H's	n/d
Acetylene	C2H2	n/d	Hydrocarbons (unsat.)	C-H's (u)	n/d
Acrylonitrile	C3H3N	n/d	Hydrogen	H2	1%=<5
Alcohols	Alcohols	n/d	Hydrogen Bromide	HBr	n/d
Amines	Amines	n/d	Hydrogen Chloride	HCL	5=0
Ammonia	NH3	n/d	Hydrogen Cyanide	HCN	10=0
Arsenic Trifluoride	AsF3	n/d	Hydrogen Fluoride	HF	n/d
Arsenic Pentafluoride	AsF5	n/d	Hydrogen Selenide	HSe	n/d
Arsine	AsH3	n/d	Iodine	I2	n/d
Boron Triflouride	BF3	n/d	Isopropanol	C3H8O	n/d
Bromine	Br2	n/d	Methane	CH4	n/d
Butadiene	C4H6	n/d	Methanol	CH3OH	n/d
Buten-1	Buten-1	n/d	Methyl-ethyl-ketone	C4H8O	n/d
Carbon Dioxide	CO2	n/d	Methyl Mercaptan	CH3SH	2:1
Carbon Disulfide	CS2	n/d	Nitric Oxide	NO	35=<2
Carbon Oxide Sulfide	COS	n/d	Nitrogen	N2	n/d
Carbon Monoxide	CO	300≤-1.5	Nitrogen Dioxide	NO2	5=-0.5
Carbonyl Sulfide	COS	n/d	Oxygen	O2	n/d
Chlorine	CL2	1≈0.2	Ozone	O3	n/d
Chlorine Dioxide	CLO2	n/d	Phosgene	COCL2	n/d
Chlorine Trifluoride	CLF3	n/d	Phosphine	PH3	n/d
Diborane	B2H6	n/d	Phosphorous Trifluoride	PF3	n/d
Dimethyl Sulfide	C2H6S	n/d	Silane	SiH4	n/d
Disilane	Si2H6	n/d	Silicon	Si	n/d
Epichlorohydrin	C3H5OCL	n/d	Silicon Tetra Fluoride	SiF4	n/d
Ethanol	C2H5OH	n/d	Sulfur Dioxide	SO2	5=<1
Ethyl Mercaptan	C2H5SH	3=1	Tetrahydrothiophene	C4H8S	n/d
Ethylene	C2H4	100=0	Thiophane	C4H4S	n/d
Ethylene Oxide	C2H4O	n/d	Toluene	C6H5CH3	n/d
Fluorine	F2	n/d	Tungsten Hexafluoride	WF6	n/d
Formaldehyde	CH2O	n/d	Vinyl Acetate	C4H6O2	n/d
Germane	GeH4	n/d	Vinyl Chloride	C2H3CL	n/d
Hydrazine	N2H4	n/d			

n/d – no data available

Mercaptan compounds are the most commonly found cross interference gases found in natural gas samples. High alcohol concentrations should not affect readings except as transients during rapid concentration changes.

2.0 Installation and Start Up

Before the unit can be operated on the battery, the battery should be charged completely. The unit power switch should be in the "OFF" position during charging. The battery charger should be connected to the cannon plug labeled "Charger Power In 12VDC", on the side of the unit, and plugged into a 120/240VAC receptacle. The charger indicator will signal when the battery is fully charged by illuminating the Green LED on the charger. Although it may be possible to operate the unit with the battery charger 'plugged in', it is advised to charge the battery only when the unit is not operating. When the battery is fully charged remove the battery charger from the unit.

When it is determined that the battery is charged, apply power to the analyzer by placing the power switch in the 'ON' position. The unit will respond with the display coming on and if installed the pump will start to operate. A temporary upscale reading may occur as the sensor stabilizes. This upscale reading will decrease to 0ppm within 1-2 minutes of power-up, assuming there is no gas in the area of the sensor

Connect the gas sample to the "Process Sample Inlet Port" located on the side of the unit (Figure 5). Make sure that the 3-way valve is set to "Sample". Set the input gas sample to 5-10psig on the pressure gauge, and set the flow rate to 500cc/min. using the flow valve on the Rotameter. If applicable connect tubing to the Vent Port and vent the sample to a safe location.

NOTE: Maximum input pressure is 10pisg.

NOTE: The sample should be vented to a safe place at pressures of atmosphere ±1Psig.

NOTE: The unit must be placed in an upright position for the Rotameter to provide an accurate reading. Laying the unit down, or leaning the unit back will cause an inaccurate reading of gas flow and can cause the unit to operate inefficiently.

The displayed reading will increase to the sample level within a minute or two, and stabilize at the reading of the gas applied.

2.1 HOBOware™ Installation and setup

The unit provides the ability to log the data from the analyzer utilizing the HOBO Data Logger. This requires a PC or Laptop to interface with the HOBO Data Logger. The HOBOware™ Software package is provided to integrate the PC/Laptop with the analyzer. HOBOware™ is software for launching, reading, and plotting data from the HOBO® U-Series loggers.

System Requirements:

- PC: Windows 7 (Pro, Ultimate and Home Premium), Windows XP Pro, Windows XP Home, Vista Business, Vista Home Premium.
- HOBOware supports 32 or 64-bit Windows operating systems.
- Sun Java Runtime Environment (JRE) 1.6. Please note that version 1.6, also known as Java 6*
- One of the following Internet browsers (version number listed is the highest major version we tested): Safari 4 or greater, Firefox 3 or greater, Microsoft Internet Explorer 8.0.
- Minimum screen resolution of 1024x768
- 256+ colors
- Minimum, a 1.8 GHz single-code processor, 1 GB of memory, and 300 MB of disk space.

The HOBO Data Logger utilizes 2 AA Batteries to operate. If the batteries have not been installed, install the batteries in the unit before continuing with the set-up of the HOBO. The HOBO Data Logger is installed in the unit with high strength Velcro, and can be removed by 'peeling" the HOBO's Velcro away from the Velcro in the unit. To install the batteries, remove the HOBO Data Logger from the unit, and open the battery compartment on the back of the HOBO. Install the batteries, replace the battery compartment cover, and re-install the HOBO in the unit. Refer to the HOBO Manual for more information.

Insert the CD in the computer's CD-ROM drive. The installation program should start automatically. If it does not, navigate to the CD drive in My Computer or Windows Explorer and double-click HOBOware™ Setup.exe to launch the HOBOware™ installer.

If the latest version of Java is not installed, the installer will install it. HOBOware™ will inform you if your Java version is not up to date.

Follow the screen prompts to install the HOBOware™ software.

HOBOware™ should open automatically when the installation is complete (unless the **Launch HOBOware™** box is un-checked on the Completing the HOBOware Setup Wizard dialog before clicking **Finish**). If it doesn't, double-click the HOBOware™ icon 

on the desktop or Quick Launch menu. Or, from the Start menu, select **Programs**, **Onset Applications**, **and HOBOware™**.

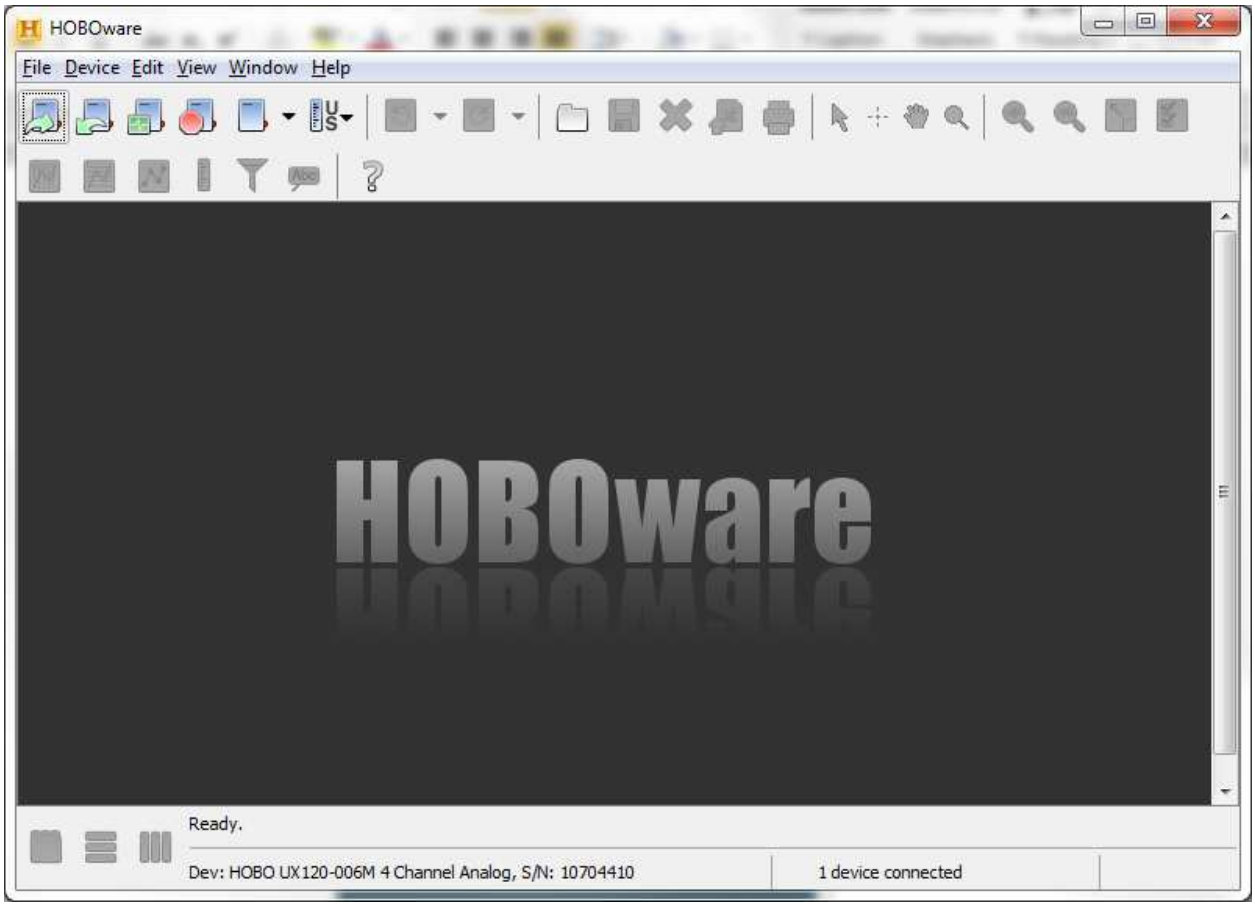

Figure 6 HOBO Opening Screen

2.2 Connecting a logger directly to a USB cable

1. Open the HOBOware™ software application.

2. Plug the USB interface cable into a USB port on the computer.

3. Plug other end of the USB interface cable into the port on the data logger. (Refer to the diagram and instructions that came with the logger if help is required in finding the port.)

4. If the data logger has never been connected to this computer before, it may take some time for the computer to detect the new hardware and report that it has connected successfully. One or more messages will appear, indicating that new hardware has been found, and there may be an audible chime.

NOTE: The computer may prompt to reboot before the data logger can be used. It is not necessary to reboot, but it is advised.

5. When the data logger is recognized by HOBOware™, the right side of the status bar at the bottom of the HOBOware window will update to reflect the number of data loggers connected. When the data logger is recognized, it is ready for use.

6. Wait for the status bar to update the number of data loggers before continuing.

7. Click the Launch icon  on the toolbar. This displays the data logger's Launch window. Launch windows vary for each type of data logger, but most should look similar to Figure 7.

8. Review the default Launch settings. Enter an appropriate name in the **Description** field, (Test1 in this example) and select Channel 1in the **Channels to Log** select box.

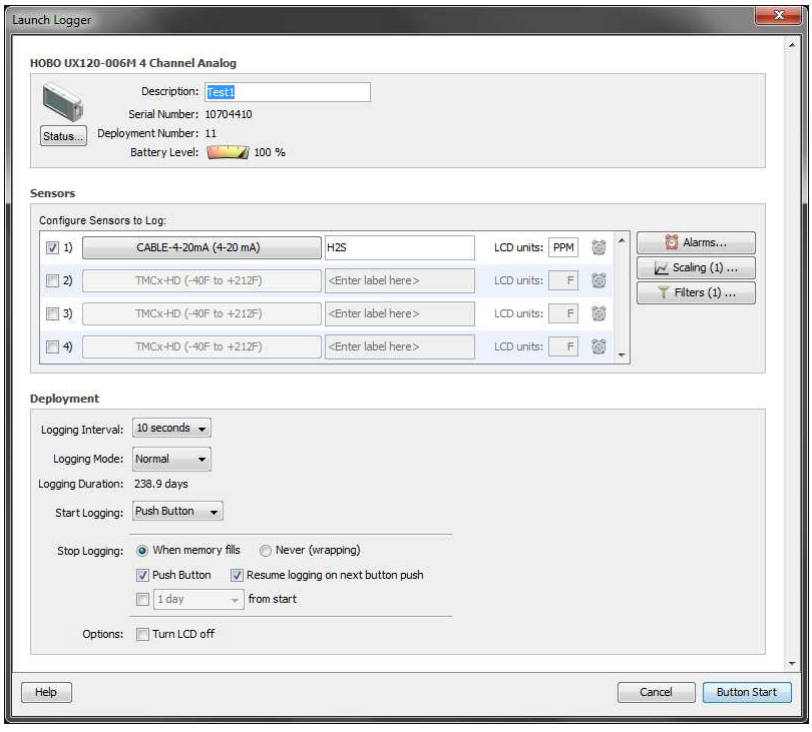

Figure 7 HOBO Launch Window

9. Select **Scaling** to open the Data Assistant Window (Figure).

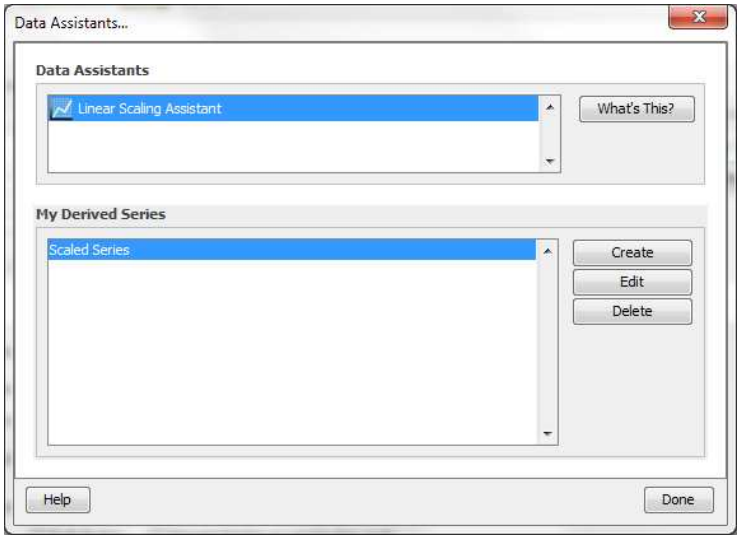

Figure 8 Data Assistant

10. Select **Edit** to open **Linear Scaling Assistant** Window (Figure 9).

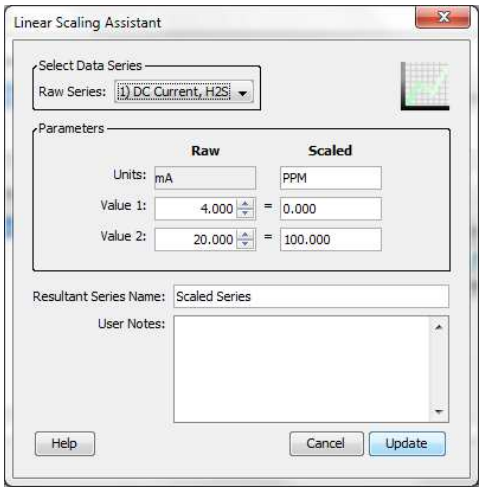

Figure 9 Linear Scaling Assistant

11. Give the channel an appropriate name, (H2S in this example) and set the scaling units to ppm with 4mA set for 0.0 and 20mA set for full scale. I.E. for 0-20ppm full scale would be 20ppm, or 20mA=20ppm. Select **Update, Done** to return to the Launch Logger Screen.

12. Almost any **logging Interval** can be set from 1 second to over 18 hours, it is suggested to set a 1 to 5 minute **Logging Interval**. Choose the **Now** launch option to immediately start-logging data, other options may be selected and are discussed in detail in the HOBOware™ User's Guide. Click **Start** to begin logging. HOBOware™ displays the progress of the launch and warns the user not to unplug the logger while it is being configured.

NOTE: Launch settings are discussed in depth in "Chapter 2: Working with loggers." in the HOBOware™ Users Guide.

13. To disconnect a logger, simply unplug it from the USB cable or the computer.

2.3 Analyzer Initial Operational Tests

After a warm-up period has been allowed for, the sensor should be checked to verify sensitivity to its target gas.

Material Requirements

- Span gas containing the target gas in air or nitrogen. It is recommended that the target gas concentration be 50% of scale at a controlled flow rate of 500 ml/min. For example, a Model DM-100-H_2S sensor in the range 0-100ppm would require a test gas of 50ppm H_2S. For a sensor with a range of 0-20ppm a test gas of 10ppm is recommended, etc.

a) Connect span gas to the "Span/Zero Inlet Port" and place the 3-way Valve in the "Calibrate" position.

b) Apply the span gas at a controlled flow rate of 500cc/min. Observe that the LED display increases to a level of 10% of the span level. I.E. if the sensor range is 0-100ppm and the span gas is 50ppm the reading should rise to within 5% of 50ppm (45-55ppm).

c) Remove the span gas, place the 3-way valve if the "Sample" position, and observe that the LED display increases/decreases to the expected process level.

Detcon H_2S gas sensors are calibrated prior to shipment, and should not require significant adjustment on start up. However, it is recommended that a complete calibration test and adjustment be performed within 24 hours of installation. Refer to calibration instructions in section 3.1.

2.4 HOBOware™ Operational Test

1. After initial test of Analyzer, if the data logger is not attached to the PC and the HOBOware software is not running, invoke the HOBO Software and connect the data logger to the PC/Laptop via the USB Cable.

2. When the logger is recognized by HOBOware, the right side of the status bar at the bottom of the HOBOware window will update to reflect the number of loggers connected. When the logger is recognized, it is ready for use.

3. Click the Readout icon  on the toolbar. Click Stop when HOBOware asks if you want to stop the logger before reading out.

Figure 10 Stop Logger

4. HOBOware™ will down load the information from the logger and prompt for a filename to save the file.

5. Save the file with an appropriate name for later recall. The Software will prompt for a Plot Setup.

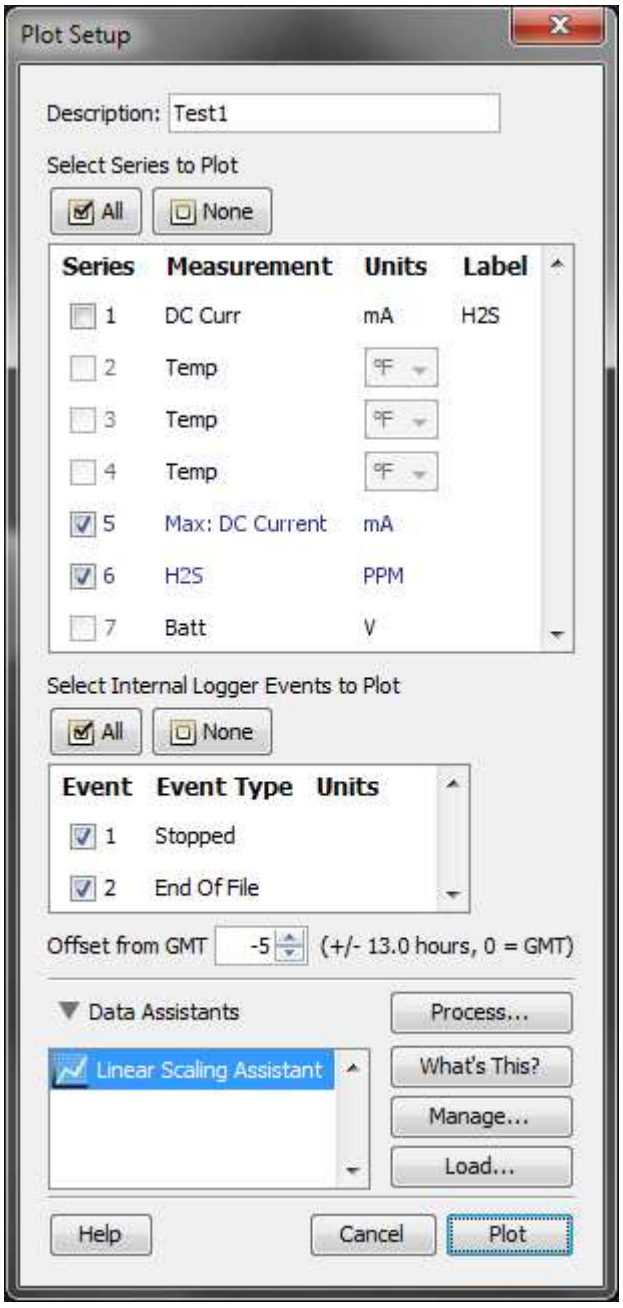

Figure 11 Plot Setup Screen

6. HOBOware™ will display a graph of the data logged during the Initial Operational Tests of the Analyzer.

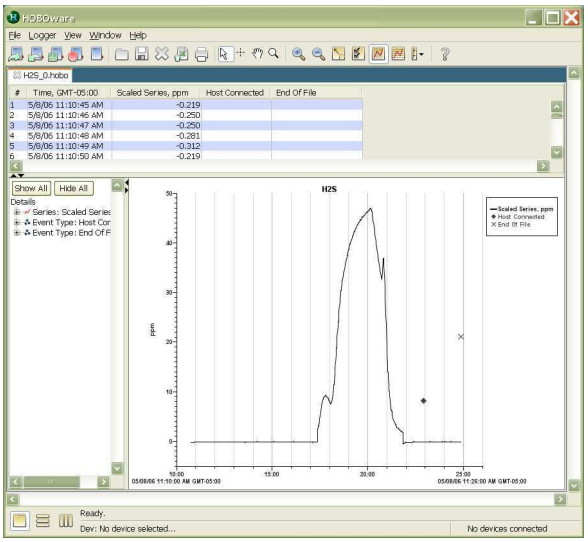

Figure 12 H2S graphic display

NOTE: the sample rate of Figure 12 was set to 1-second intervals for the purpose of clarity. The display acquired from your unit may look different from Figure 12, but should show the application of gas, the highest reading, and the removal of gas as shown here.

For more information on the HOBOware™ Software, refer to the HOBOware™ User's Guide.

3.0 Analyzer/Sensor Operation

The Operator Interface of the Model 100 Series gas sensors is accomplished via two internal magnetic switches located on the left and the right of the sensor (Figure 14). The two switches, labeled “PGM1” and “PGM2”, allow for complete calibration of the sensor.

Figure 13 Magnetic Programming Tool

The magnetic programming tool (Figure 13) is used to operate the magnetic switches. Switch action is defined as momentary contact and 3-second hold. Hold time is defined as the time from the point when the magnet is placed in close proximity with the switch. For momentary contact the programming magnet is briefly held over a switch location. The location of “PGM1” and “PGM2” are shown in Figure 14.

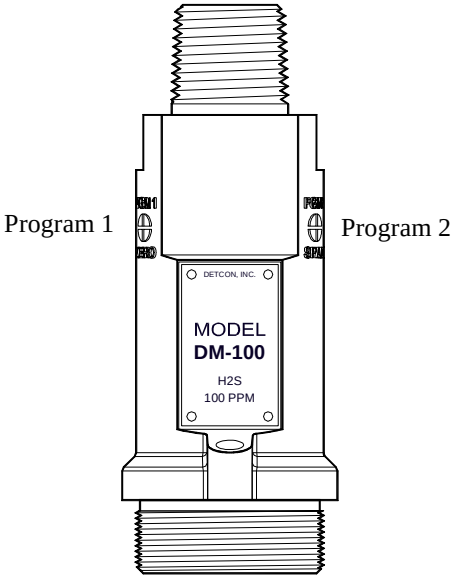

Figure 14 Magnetic Programming Switches

In normal operation, the mA output will be the current sensor reading. In normal operation, the 4-20mA current output linearity corresponds with the full-scale range. The Model 100 LED Display continuously shows the current sensor reading in ppm, which will normally appear as “0”. If the sensor is actively experiencing any diagnostic faults, the Model 100 LED Display will display ‘Fxx’ to signify a fault (where ‘xx’ is a number between 01 and 12. See Section 5.0 for more details).

3.1 Calibration

Zero and span calibration should be performed on a routine basis (quarterly minimum) to ensure reliable performance. If a sensor has been exposed to any de-sensitizing gases, or to very high over-range combustible gas levels, re-calibration should be considered. Unless otherwise specified, span adjustment is recommended at 50% of the full scale range.

3.1.1 Zero Calibration

The zero calibration is used to zero the sensor. Zero calibration should be performed periodically or as required. Zero calibration should be considered after periods of over-range target gas exposure. Local ambient air can be used to zero calibrate a toxic gas sensor as long as it can be confirmed that it contains no target or interference gases. If this cannot be confirmed then a zero air or N_2 cylinder should be used.

Material Requirements:

-Detcon PN 327-000000-000 Programming Magnet
-Detcon PN 942-001123-000 Zero Air cal gas (or use ambient air if no target gas is present).

NOTE: connect Zero Air cal gas or ambient air source to the calibration source input at a rate of 200-500cc/min. (500cc/min is recommended.

1. For toxic sensors, if the ambient air is known to contain no target gas content, then it can be used for zero calibration. If a zero gas cal cylinder is going to be used, attach the calibration adapter and set flow rate of 200-500cc/min (500cc/min is the recommended flow rate) and let sensor purge for 1-2 minutes before zeroing the sensor.

2. From Normal Operation, hold the programming magnet over PGM1 for 3 seconds. The display will flash 'CAL' three times, and should then zero itself. The reading should display '0.0' at a rate of once per second.

3. Observe the reading for a minute or so to ensure that the reading does not drift.

4. At the end of about one minute, the display will again flash 'CAL' three times, and return to normal operation. If zero gas was used, remove the gas from the sensor.

3.1.2 Span Calibration

Span Calibration is used to adjust the span of the sensor. Span calibration should be performed periodically or as required. Span calibration should be considered after periods of over-range target gas exposure. Unless otherwise specified, span adjustment is recommended at 50% of range.

Material Requirements:

-Detcon PN 327-000000-000 Programming Magnet
-Detcon Span Gas (See Detcon for Ordering Information). Recommended span gas is 50% of range with target gas. Other suitable span gas sources containing the target gas in air or N_2 balance are acceptable.

NOTE: Contact Detcon for Ordering Information on Span Gas cylinders.

NOTE: A target gas concentration of 50% of range is strongly recommended. This should be applied at a controlled flow rate of 200 to 500cc/min, with 500cc/min being the recommended flow rate. Other concentrations can be used if they fall within allowable levels of 10% to 100% of range.

NOTE: It is generally not advised to use other gases to cross-calibrate for span. Cross-calibration by use of other gases should be confirmed by Detcon.

Span consists of applying the correct gas concentration at the correct flow rate, and adjusting the sensor for the proper output. The recommendation for span gas concentration is 50% of range. If a span gas containing the recommended concentration is not available, other concentrations may be used as long as they fall between 10% and 100% of range.

1. From Normal Operation, hold the programming magnet over PGM2 for greater than three seconds. The display should flash 'CAL' three times, and begin flashing the current reading at a rate of about once per second.

2. Apply the span calibration test gas for toxic gas sensors at a flow rate of 200-500cc/min (500cc/min is the recommended flow rate).

3. The display should remain at a reading of 0.0 for about 2 minutes. The display will then increase to a reading that corresponds to the level of gas the plug-in sensor is detecting.

> **NOTE:** There is a 30 second period to decide if the reading needs to be adjusted. If the reading matches the level of gas applied skip the next step.

4. To adjust the reading, hold the programming magnet over PGM2. The display will start to increase. Continue to hold the programming magnet over PGM2 to make the reading increase, or hold the magnet over PGM1 to make the reading decrease. Use PGM1 and PGM2 to adjust the output to match the target gas set-point.

5. When the correct adjustment has been made, wait 15 seconds without holding the programming magnet over either PGM1 or PGM2. The display (if connected) will flash "CAL" three times and return to the target reading. This indicates that the span calibration point has been successfully saved. If a lack of proper signal level change is internally detected the sensor will immediately go into fault. The display will show "Fxx" (where 'xx' is a number between 01 and 12. See Section 5.0 for more details). Only a successful re-calibration will clear this fault.

6. Remove the span gas. The display will report a live reading as the sensor clears toward "0". On the DVM, the reading will fall from the reported span level to 4mA (40mV). The sensor now allows 5 minutes for the reading to clear below 10% of full scale range (5.6mA). If the reading does not meet the clearing test criteria the sensor will go into fault. The display will show "Fxx" (where 'xx' is a number between 01 and 12. See Section 5.0 for more details). Only a successful re-calibration will clear this fault. If an error code occurs, and the error code is "F08", it would be advised that zero gas be applied to clear the span gas from the unit after the span gas canister is removed.

7. Span calibration is complete. If the Splash Guard was removed for calibration, re-install the Splash Guard.

3.2 Fault Diagnostic/Failsafe Feature

If the ITM should incur a fault, the display will display an error code. This can occur if the ITM detects a problem with the sensor, detects that there is no sensor connected, or if the ITM has an internal fault. Error Codes can be found in Section 5.0.

4.0 Service and Periodic Maintenance

Calibration Frequency

In most applications, monthly to quarterly span calibration intervals will assure reliable detection. However, industrial environments differ. Upon initial installation and commissioning, close frequency tests should be performed, weekly to monthly. Test results should be recorded and reviewed to determine a suitable calibration interval.

4.1 Visual Inspection

Periodically, at least every six months, the unit should be wiped down with a clean damp cloth to remove dust and dirt from all surfaces.

The Analyzer and Sensor should be inspected annually. Inspect for signs of corrosion, pitting, and water damage. The plumbing should be inspected to ensure that there are no blockages. Inspect the Head Line Coalescing filter for moisture or debris that may cause blockage. Inspect the electronics and wiring for signs of deterioration or corrosion. For H2S Sensor assemblies, inspect 100 Series Bottom Housing Assembly with integral filter (P/N 602-003552-100) for blockage of filter material.

4.2 Leak Test

Check for leaks periodically. At least once a year the unit should be checked for leaks to ensure the integrity of the unit plumbing.

1) Check all fittings for tightness
2) Cap the exhaust Vent for testing.
3) Place the 3-Way Valve to 'SAMPLE'.
4) Remove the customer tubing feeding 'Sample Port' on the Moisture Knockout Filter.
5) From a regulated gas cylinder, apply 10 psig dead-ended pressure (Air or N2) to the 'SAMPLE Port'.
6) When the Pressure Gauge reads 10psig, turn off the pressure regulator.
7) Monitor the Pressure Gauge for 5 minutes. At the end of 5 minutes the Pressure Gauge should read above 7psig.
8) If the pressure is <7psig, perform a 'Leak Test' and correct any problems found:
    a. Reapply the inert gas and set to 10 psig. Do not remove the gas.
    b. Use Leak Test Liquid and slowly check the entire plumbing to locate the leak.
    c. Fix any applicable leaks and continue until the entire unit has been checked.
    d. Re-apply the gas and continue at step 4
9) Clean all fittings as necessary.
10) Re-install the customer tubing feeding the 'Sample Port' to apply the proper sample gas.

4.3 Condensation Prevention Packet

A moisture condensation packet should be placed in the case of the analyzer. The moisture condensation prevention packet will help prevent the internal volume of the analyzer from condensing and accumulating moisture due to day-night humidity changes. This packet provides a critical function and should be replaced annually. Detcon's PN is 960-202200-000.

4.4 Replacement of Plug-in Sensor

NOTE: It is not necessary to remove power while changing the plug-in toxic gas sensor in order to maintain area classification, since it is intrinsically safe.

NOTE: Only replace the plug-in sensor with an authorized DM-100 family of gas sensors.

1. Use a 1/8" Allen wrench to release the locking cap head screw that locks the ITM and Splash Guard Adapter together (One turn will suffice - Do not remove cap head screw completely).
2. Unthread and remove the Splash Guard Adapter and Splash Guard from the ITM.
3. Gently pull the plug-in sensor out of the ITM. Orient the new plug-in sensor so that it matches with the female connector pins. Use the alignment marks provided to assure alignment is correct. When properly aligned, press the sensor in firmly to make the proper connection.
4. Thread the Splash Guard Adapter onto the ITM to a snug fit and tighten the locking cap head screw using the 1/8" Allen wrench. Reinstall the Splash Guard.
5. Check and perform zero calibration and span calibration as per Section 3.1.

4.5 Replacement of ITM

1. Remove the power source to the sensor assembly. Disconnect all sensor wire connections at the smaller terminal block, taking note of the wire connections.
2. Loosen and remove the Locknut from the mounting bracket holding the ITM in position.
3. Use a 1/8" Allen wrench to release the locking cap head screw that locks the ITM and Bottom Housing Assembly together (One turn will suffice - Do not remove setscrew completely).
4. Unthread and remove the ITM from the Bottom Housing Assembly.
5. Gently remove the plug-in toxic gas sensor from the old ITM and install it in the new ITM. Orient the plug-in sensor so that it matches the female connector pins on the new ITM and press the sensor in firmly to make proper connection.
6. Thread the ITM into the Bottom Housing Assembly until snug and tighten the locking cap head screw.
7. Feed the sensor assembly wires through the Mounting bracket hole and thread the locknut onto the ITM. Position the ITM to face forward, and tighten the locknut to hold the ITM in position
8. Check and/or perform Zero Calibration and Span Calibration per sections 3.1.

4.6 Replacement of the Model 100 Display

1. Remove the Front Panel screws from the back panel in the analyzer.
2. Rotate the front panel forward over the Carbon Filter to expose the display.
3. Un-plug the display from the terminal board.
4. Install the new display.
5. Apply power and check operation of sensor assembly. (see section 2.0)

4.7 Replacement of the Model 100 Terminal Board

1. Remove the Front Panel screws from the back panel in the analyzer.
2. Rotate the front panel forward over the Carbon Filter to expose the display.
3. Un-plug the display from the terminal board.
4. Remove the J6 and J7 from the terminal board. (J6 goes to TB1, and J7 goes to the HOBO Data Logger.

5. Remove the four 6-32 screws holding the terminal board to the base of the junction box and remove the terminal board.
6. Install the new terminal board using the four 6-32 screws removed in step 5.
7. Ensure that the jumper on the terminal board is set between terminals 2 and 3 (JP1 2-3).
8. Re-connect the connectors removed in step 4.
9. Re-install the display.
10. Apply power and check operation of sensor assembly. (see section 2.0)

4.8 HOBO Data logger Battery Replacement

Periodically check the battery level of the HOBO Data Logger, and if necessary replace the batteries. The batteries should last about 1 year, dependent on usage. The HOBO utilizes 2 AA Batteries. Check and replace as needed.

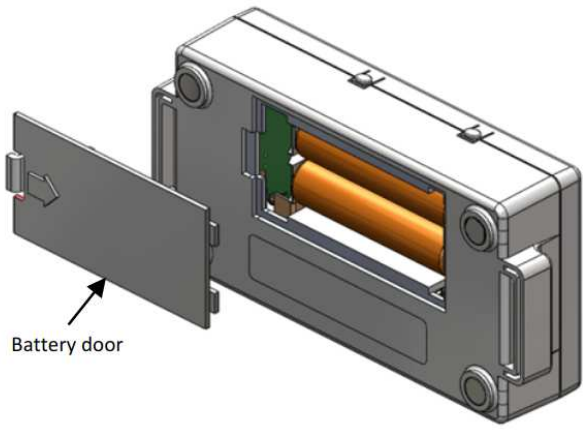

Figure 15 Battery Installation

To install or replace the batteries:

1. Open the battery door on the back of the logger.
2. Remove any old batteries.
3. Insert two new batteries observing polarity.
4. Reinsert the battery door and snap it back into place.

5.0 Troubleshooting Guide

If the ITM detects any functional errors the display will show an error code. Error codes are displayed as "Fxx" where xx is the actual error code.

The Display Error Codes are:
F01 Auto Span Fault
F02 Temperature Fault
F03 4-20mA Fault
F04 Input Voltage Fault
F05 ITM Memory Fault
F06 Processor Fault
F07 Clearing Fault
F08 Stability Fault
F09 Range Fault
F10 Sensor Fault
F11 Zero Fault
F12 Sensor Fault 2

Under-Range problems (F11)

Probable Cause: Sensor Baseline drifted lower, Interference gases,
Perform Zero Calibration. Use Zero Air or N_2 source. (Section 3.1.1 Zero Calibration)
Allow more time for zero stabilization if this is a biased sensor type.
Execute successful Span Calibration. (Section 3.1.2 Span Calibration)
Replace plug-in sensor if error continues.

Stability problems (F08)

Probable Causes: Failed Sensor, empty or close to empty Cal Gas Cylinder, problems with cal gas and delivery
Check validity of span gas using pull tube or other means (check MFG date on cal gas cylinder).
Use proper cal gas regulators and tubing for highly corrosive gases
Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). H2S sensors assemblies use a bottom housing assembly (P/N 602-003581-000). Clean or replace filter as necessary. Replace the plug-in toxic sensor.

Clearing problem (F07)

Probable Causes: Failed Sensor, Cal Gas not removed at appropriate time, problems with cal gas and delivery, Background of Target Gas.
The sensor must recover to < 5% of range in < 5 min after Span calibration is complete
Use bottled air (zero air or N_2) if there is a known continuous background level.
Check validity of span gas using pull tube or other means (check MFG date on cal gas cylinder).
Use proper cal gas regulators and tubing for highly corrosive gases
Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). H2S sensors assemblies use 100 Series Bottom Housing Assembly (P/N 602-003581-000). Clean or replace if necessary.
Replace the plug-in toxic sensor.

Poor Calibration Repeatability (F09)

Probable Causes: Failed Sensor, use of wrong Cal Gas or problems w/ cal gas and delivery, Interference Gases
Check validity of span gas with regulator and sample tubing in place using pull tube or other means (check MFG date on cal gas cylinder).
Use proper cal gas regulators and tubing for highly corrosive gases (HF, HCI, Cl2, NH3, HBR, F2, etc.)
Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). H2S sensors assemblies use a bottom housing assembly (P/N 602-003581-000). Clean or replace if necessary.
Replace the plug-in toxic sensor.

Unstable Output/ sudden spiking (F03, F04)

Possible Causes: Unstable power supply, inadequate grounding, or inadequate RFI protection.
Verify Power source is stable.
Verify field wiring is properly shielded and grounded.
Contact Detcon to optimize shielding and grounding.
Add Detcon's RFI Protection Circuit accessory if problem is proven RFI induced.

Nuisance Alarms

Check condulet for accumulated water and abnormal corrosion on terminal board.
If nuisance alarms are happening at night, suspect condensation in condulet.
Add or replace Detcon's Condensation Prevention Packet P/N 960-202200-000.
Investigate the presence of other target gases that are causing cross-interference signals.
Determine if cause is RFI induced.

Unreadable Display

If due to excessive sunlight, install a sunshade to reduce glare.
Replace Display PCA
Replace 100 Series Display.

Blank or incorrect reading on Display

ITM has an internal fault, problem with display.
internal fault, problem with display.
Swap with a known-good ITM to determine if ITM is faulty.
Replace 100 Series Display.

Transmitter not responding (F05, F06)

Verify condulet has no accumulated water or abnormal corrosion.
Verify required DC power is applied to correct terminals.
Swap with a known-good ITM to determine if ITM is faulty.

Faulty 4-20mA Output (F03)

Check that wiring is properly connected at terminal board and through to controller inputs.
Swap with new ITM to determine if the ITM is faulty.

6.0 Warranty

6.1 Customer Support and Service Policy

Detcon Headquarters
Shipping Address: 4055 Technology Forest, Suite 100, The Woodlands Texas 77381
Mailing Address: P.O. Box 8067, The Woodlands Texas 77387-8067
Phone: 888.367.4286, or 281.367.4100
Fax: 281.292.2860

- www.detcon.com
- service@detcon.com
- sales@detcon.com

All Technical Service and Repair activities should be handled by the Detcon Service Department via phone, fax or email at contact information given above. RMA numbers should be obtained from the Detcon Service Department prior to equipment being returned. For on-line technical service, customers should have ready the model number, part number, and serial number of product(s) in question.

All Sales activities (including spare parts purchase) should be handled by the Detcon Sales Department via phone, fax or email at contact information given above.

6.2 Service Policy

Detcon Inc. warrants, under normal intended use, each new intelligent plug-in sensor per the period of 2 years and under the conditions described as follows: The warranty period begins on the date of shipment to the original purchaser. The sensor element is warranted to be free of defects in material and workmanship. Should any sensor fail to perform in accordance with published specifications within the warranty period, return the defective part to Detcon, Inc., 3200 A-1 Research Forest Dr., The Woodlands, Texas 77381, for necessary repairs or replacement.

Terms & Conditions
- The original serial number must be legible on each sensor element base.
- Shipping point is FOB the Detcon factory.
- Net payment is due within 30 days of invoice.
- Detcon, Inc. reserves the right to refund the original purchase price in lieu of sensor replacement.

ITM Electronics and Display Warranty
Detcon Inc. warrants, under intended normal use, each new Model 100 ITM, interconnect PCA and Display Assembly to be free from defects in material and workmanship for a period of two years from the date of shipment to the original purchaser. All warranties and service policies are FOB the Detcon facility located in The Woodlands, Texas.

Terms & Conditions
- The original serial number must be legible on each ITM.
- Shipping point is FOB the Detcon factory.
- Net payment is due within 30 days of invoice.
- Detcon, Inc. reserves the right to refund the original purchase price in lieu of ITM replacement.

7.0 Specifications

Sensor Type:	Continuous diffusion/adsorption type Plug-in Replaceable Type
Sensor Life:	2 years typical
Measuring Ranges:	0-1ppm up to 0-10,000ppm (Toxic Gases)
Accuracy/ Repeatability:	±2% of full-range (other Toxic Gases) ±1% of full-range (O_2)
Response Time:	T90 < 30 seconds typical (See Sensor Table)
Operating Temperature:	-40°C to +50°C typical
Storage Temperature:	-35°C to +55°C typical
Operating Humidity:	10-95% RH Continuous Duty
Input Voltage:	10-28 VDC
Operating Pressure:	Inlet: 5~10psi Outlet Vent: Ambient ±1psig
Sensor Power Consumption:	Normal operation = 4 mA (0.1 watts @ 24VDC); Maximum = 20 mA (0.5 watts @ 24VDC; 0.23 watts @ 11.5VDC)
Output:	Linear 4-20mA. Data logging via HOBO
Electrical Classification:	General purpose NEMA4X
Warranty:	Electronics – 2 years

7.1 Flow Diagram

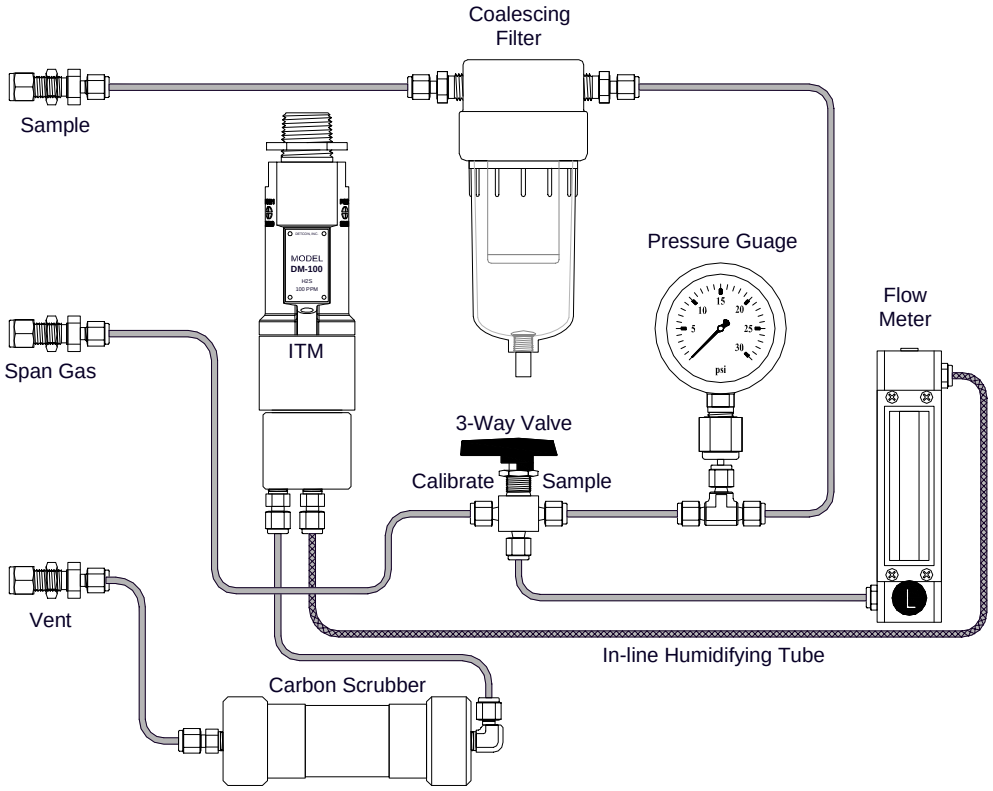

Figure 16 Flow Diagram

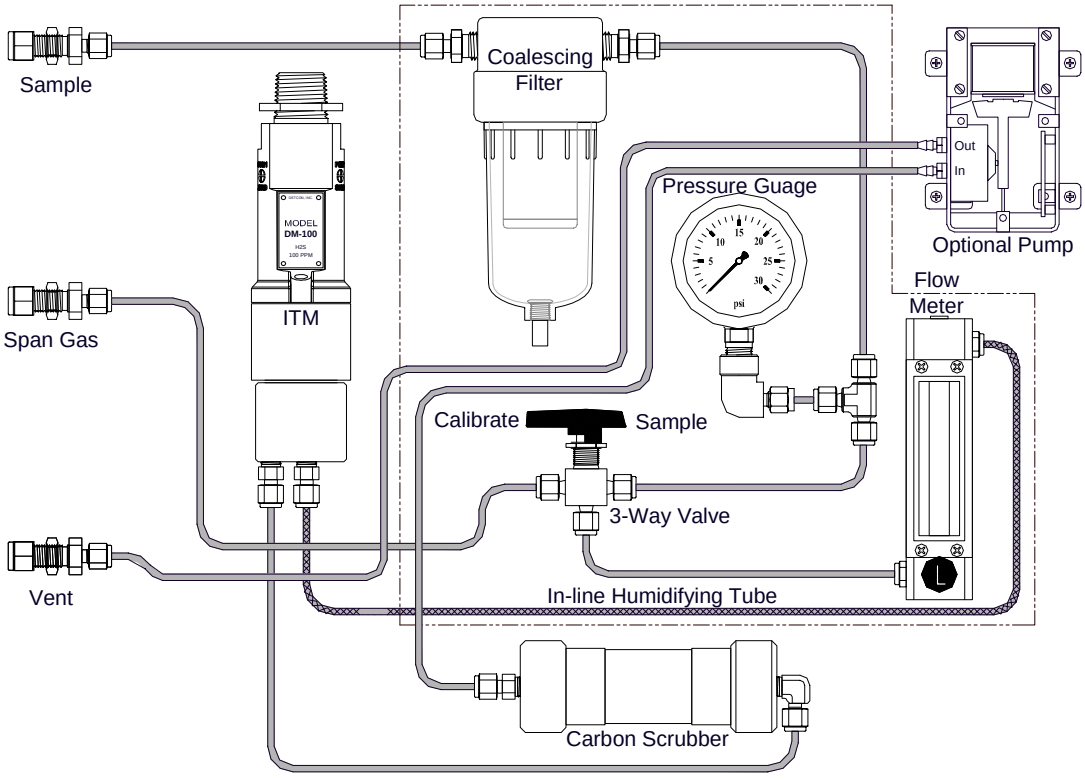

Figure 17 Flow Diagram with Optional Pump

7.2 Wiring Diagram

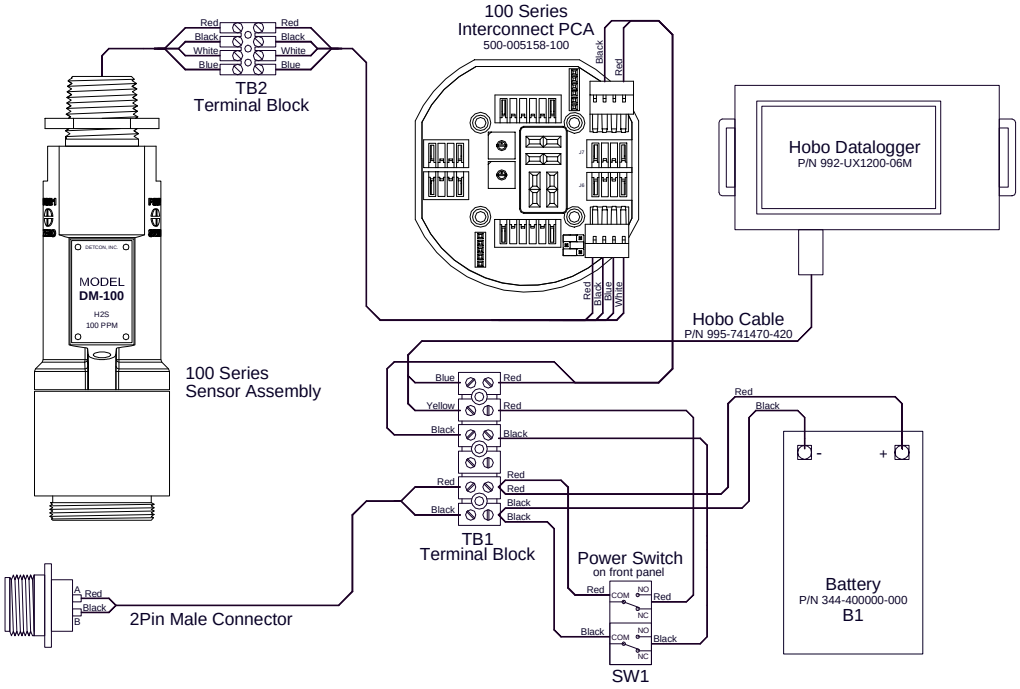

Figure 18 Wiring Diagram

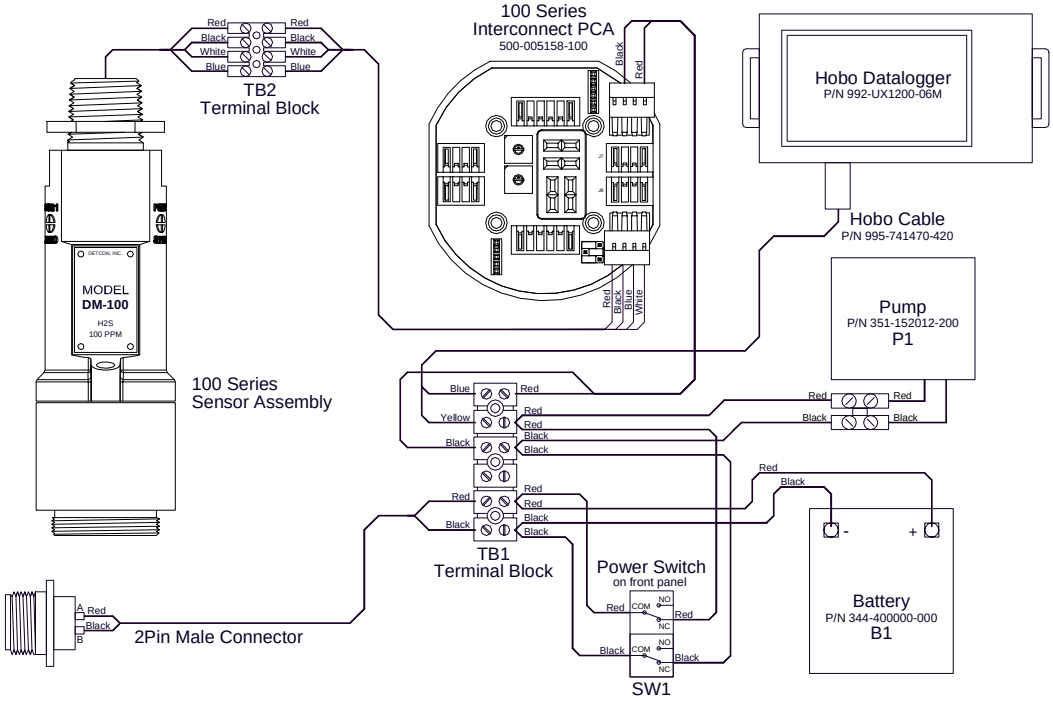

Figure 19 Wiring Diagram with Optional Pump

7.3 Spare/Replacement Parts

327-000000-000	Programming Magnet
351-152012-500	Optional 12VDC flow pump
921-245400-000	Intelligent Transmitter Module
975-P10110-240	Battery Charger
344-400000-000	12V 7Ah Battery
370-242400-xxx	Plug-in Detector (xxx=Range, I.E. 020=20ppm100=100ppm, 01K=1000ppm)
500-005158-100	100 Series Display Terminal Board
500-005160-100	100 Series Display
992-UX1200-06M	Hobo Dataloger

7.4 Revision Log

Revision	Date	Changes made	Approval
1.0	08/24/07	Initial Release	RJM
2.0	07/29/11	Changed to Model 100 ITM and LED Display	LBU
2.1	02/05/13	Add optional flow pump	LBU
3.0	06/22/15	Change the Hobo Data logger	LBU