HY-ALERTA

HYDROGEN SPECIFIC LEAK DETECTION

HY-ALERTA™ 2620

Explosion Proof Area Hydrogen Monitor

OPERATING MANUAL

H2scan

Hydrogen is the future, we can sense it! ™

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MISSION STATEMENT

Our Mission

Deliver unsurpassed value and optimize green initiatives with our one of a kind continuous hydrogen-specific sensing technology worldwide.

Our Value Propositions

Enable end-user customers to efficiently and effectively optimize:

- Electric utility power transformer fleet and other oil-filled assets (Grid)
- Petroleum refinery and other industrial process control
- Facility and equipment safety to minimize downtime

...at much lower total costs of ownership than the competition.

Our Strategic Objectives

H2scan's technology accepted as the new gold standard in hydrogen sensors.

H2scan's business recognized for innovation and ingenuity, high quality products and systems, application-specific solutions, and exceptional customer service and satisfaction.

H2scan's success result from teamwork, strategic partnerships and market leadership leading to sales growth and improved profitability.

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IMPORTANT NOTICES

Read and understand this operating manual before operating or servicing the monitor

LIMITATION OF LIABILITY

IN THE EVENT OF A DEFECT IN A PRODUCT, H2SCAN SHALL NOT BE RESPONSIBLE FOR ANY DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING THEREFROM, INCLUDING, BUT NOT LIMITED TO, LOSS OF REVENUE AND/OR PROFIT.

	Read and understand this operating manual before installing or using the monitor. Only use cables from H2scan with this monitor. If this equipment is used in a manner not specified by H2scan, the protection provided by this equipment may be impaired.
	Hydrogen is flammable at 4% in air. Take indications seriously and be prepared to take action. In the event of detection of 4% or higher of a hydrogen gas concentration there is a high probability of a hazard to safety. Inform local emergency response personnel immediately.
	The 2620 is meant to be a leak detector and is suitable for environment that does not typically contain hydrogen. Continuous hydrogen exposure could affect accuracy and require reconditioning.

Limitation of Liability: SELLER SHALL UNDER NO CIRCUMSTANCES BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, PUNITIVE, OR OTHER DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF BUSINESS OR PROFIT, PROMOTIONAL OR MANUFACTURING EXPENSES, INJURY TO REPUTATION, OR LOSS OF CUSTOMER, BASED ON ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILITY, BREACH OF CONTRACT, OR ANY OTHER LEGAL THEORY ARISING OUT OF THE USE, MISUSE, PURCHASE, SALE OR POSSESSION OF ITS GOODS OR ITS PERFORMANCE OF THIS CONTRACT TO THE EXTENT THAT SUCH LIABILITY EXTENDS SELLER'S OBLIGATIONS BEYOND THE PRICE PAID BY BUYER TO SELLER FOR THE ITEM ON WHICH SUCH CLAIM IS BASED. SELLER ADVISES BUYER TO PERFORM ACCEPTABLE TESTS ON ALL HARDWARE PRIOR TO DEPLOYMENT AND TO PERFORM MAINTENANCE AS DESCRIBED IN THE SELLER'S INSTRUCTION GUIDE. UNDER NO CIRCUMSTANCES SHALL THE EQUIPMENT PROVIDED HEREUNDER BE USED IN A MANNER WHERE IT IS THE SOLE PROTECTIVE SYSTEM FOR FACILITIES, EQUIPMENT AND PERSONNEL SAFETY; THE EQUIPMENT IS INTENDED FOR USE IN CONUNCTION WITH OTHER APPROPRIATE PROTECTIVE SYSTEMS.

LIMITED WARRANTY

H2scan Limited Warranty. Each hydrogen instrument ("Product") will conform, as to all substantial operational features, to the Product specifications set forth this Manual and will be free of defects which substantially affect such Product's performance for twelve (12) months from the ship date for such Product.

Must Provide Notice of Defect. If you believe a Product is defective, you must notify H2scan in writing, within ten (10) days of receipt of such Product, of your claim regarding any such defect.

Return Product to H2scan for Repair, Replacement or Credit. If the Product is found defective by H2scan, H2scan's sole obligation under this warranty is to either (i) repair the Product, (ii) replace the Product, or (iii) issue a credit for the purchase price for such Product, the particular remedy to be determined [by H2scan] on a case-by-case basis.

Voided Warranty. H2scan's 12 Month Limited Warranty is void for any of the following:

The monitor is opened and the manufacturing seal is broken

- Unauthorized repair work performed at the customer's location or carried out by anyone other than H2scan's factory trained technicians
- Equipment or parts that have been tampered with, misused, neglected, mishandled, improperly adjusted, or modified in any way without the written consent of H2scan.
- Equipment or parts that have been damaged due to shipping, misuse, accidents, mishandling, neglect, or problems with electrical power sources.
- Repair work performed during the warranty period does not prolong the warranty period past the original period.
- System operation in incorrect or inappropriate environments.
- Usage that is not in accordance with system guidelines or an operator's failure to follow manual instructions.

Limitation of Warranty: THE ABOVE IS A LIMITED WARRANTY AS IT IS THE ONLY WARRANTY MADE BY H2SCAN. H2SCAN MAKES NO OTHER WARRANTY EXPRESS OR IMPLIED AND EXPRESSLY EXCLUDES ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. YOUR SOLE REMEDY HEREUNDER IS REPAIR OR REPLACEMENT OF THE PRODUCT OR A CREDIT FOR THE PURCHASE PRICE FOR SUCH PRODUCT, THE PARTICULAR REMEDY TO BE DETERMINED BY H2SCAN ON A CASE-BY-CASE BASIS. H2SCAN SHALL HAVE NO LIABILITY WITH RESPECT TO ITS OBLIGATIONS UNDER THIS AGREEMENT FOR CONSEQUENTIAL, EXEMPLARY, OR INCIDENTAL DAMAGES EVEN IF IT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE STATED EXPRESS WARRANTY IS IN LIEU OF ALL LIABILITIES OR OBLIGATIONS OF H2SCAN FOR DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE DELIVERY, USE OR PERFORMANCE OF THE PRODUCTS.

2 DESCRIPTION

The HY-ALERTA™ 2620 Explosion Proof Area Hydrogen Monitor is designed to detect and/or measure hydrogen. The hydrogen specific solid-state sensing element is designed for ease of use, interface flexibility and true process control. The electronics contains all the circuitry necessary to operate the sensor and present calibrated hydrogen readings to an analog current output and an RS232 or RS422 digital output. .

3 SPECIFICATIONS

Sample Gas Flow Rate	0 to 50 slpm (1slpm is recommended)
Calibration Background Gas	Air
Temperature	Sensor Ambient Temperature: -20°C to + 55°C Storage: -40 to +80 °C Remote Ambient Temperature: -20 to +55C
Typical response time	t-90 of 60 seconds maximum
Input Power	90VAC to 240VAC, 15W, 50Hz to 60Hz
Analog Output	Isolated and self-powered 0-20mA, maximum load impedance: 650Ω
Relay Contacts	Three programmable SPDT relays with both normally open (N.O.) and normally closed (N.C.) contacts. 5A, 240VAC MAX, General Use
Accuracy - serial port output only.	± (0.03 x indication + 0.2) percent hydrogen by volume
Serial Communication	RS232 or RS422 19200 bps, No parity, 8 bit data, 1 stop bit, No flow control (preferred) or Xon/Xoff
Dimensions	See following figures
Weight	2.7kg (5.9lbs)
Sensor Module Certifications:	UL 1203 - STANDARD FOR EXPLOSION-PROOF AND DUST-IGNITION-PROOF ELECTRICAL EQUIPMENT FOR USE IN HAZARDOUS (CLASSIFIED) LOCATIONS Class 1, Division 1, Groups B, C, and D UL 508 - STANDARD FOR INDUSTRIAL CONTROL EQUIPMENT Fire and Shock Hazards DEMKO 11 ATEX 1107270 X II 2 G Ex d IIB + H2 T4 Gb CE 0359 EN 60079-0:2009 - ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES. PT. 0, GENERAL REQUIREMENTS EN 60079-1:2007 - ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES. PT. 1, FLAMEPROOF "d" IEC 60079-0 - ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES. PT. 0, GENERAL REQUIREMENTS - Edition 4 IEC 60079-1 - ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES. PT. 1, FLAME PROOF ENCLOSURES "d" - Edition 5 CENELEC EN 60079-0:2009 - EXPLOSIVE ATMOSPHERES - PART 0: EQUIPMENT - GENERAL REQUIREMENTS CENELEC EN 60079-1:2007 - EXPLOSIVE ATMOSPHERES - PART 1: EQUIPMENT PROTECTION BY FLAMEPROOF f ENCLOSURES "d"

Remote Certifications	UL 913 - STANDARD FOR INTRINSICALLY SAFE APPARATUS AND ASSOCIATED APPARATUS FOR USE IN CLASS I, II, III, DIVISION 1, HAZARDOUS (CLASSIFIED) LOCATIONS CSA C22.2 NO. 157 - INTRINSICALLY SAFE AND NON-INCENDIVE EQUIPMENT FOR USE IN HAZARDOUS LOCATIONS Class 1, Division 1, Groups A, B, C, and D DEMKO 11 ATEX 8175718 II 1G Ex ia IIC T4 Ex ia IIC T4 Ga -20ºC ≤ Ta ≤ 55ºC 0359 EN 60079-0:2009 - ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES. PT. 0, GENERAL REQUIREMENTS EN 60079-11:2007 - ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES. PT. 11, INTRINSIC SAFETY "i" EN 60079-26:2007 - EXPLOSIVE ATMOSPHERES – PART 26: EQUIPMENT WITH EQUIPMENT PROTECTION LEVEL (EPL) Ga

Safety Information
All cable entry devices, conduit sealing devices, and blanking elements shall be certified in type of explosion protection flameproof enclosure “d”, suitable for the conditions of use and correctly installed. Unused apertures shall be closed with suitable blanking elements. Field wiring shall be suitable for at least 80C. For ambient temperatures below –10C use field wiring suitable for minimum ambient temperature.

Special Conditions of Safe Use (ATEX)
The flameproof cylindrical joint between the adapter and sensor tube has a maximum gap (i) of 0.10 mm and a minimum length (L) of 30.0 mm. The flameproof threaded joint between the adapter and base has a minimum of 7.5 threads engaged. The flameproof threaded joint between the base and cover has a minimum of 8 threads engaged. The sensor housing is not to be used with pressure lines containing gas which is capable of forming an explosive mixture with air and is at a pressure in excess of 1.1 times atmospheric pressure.

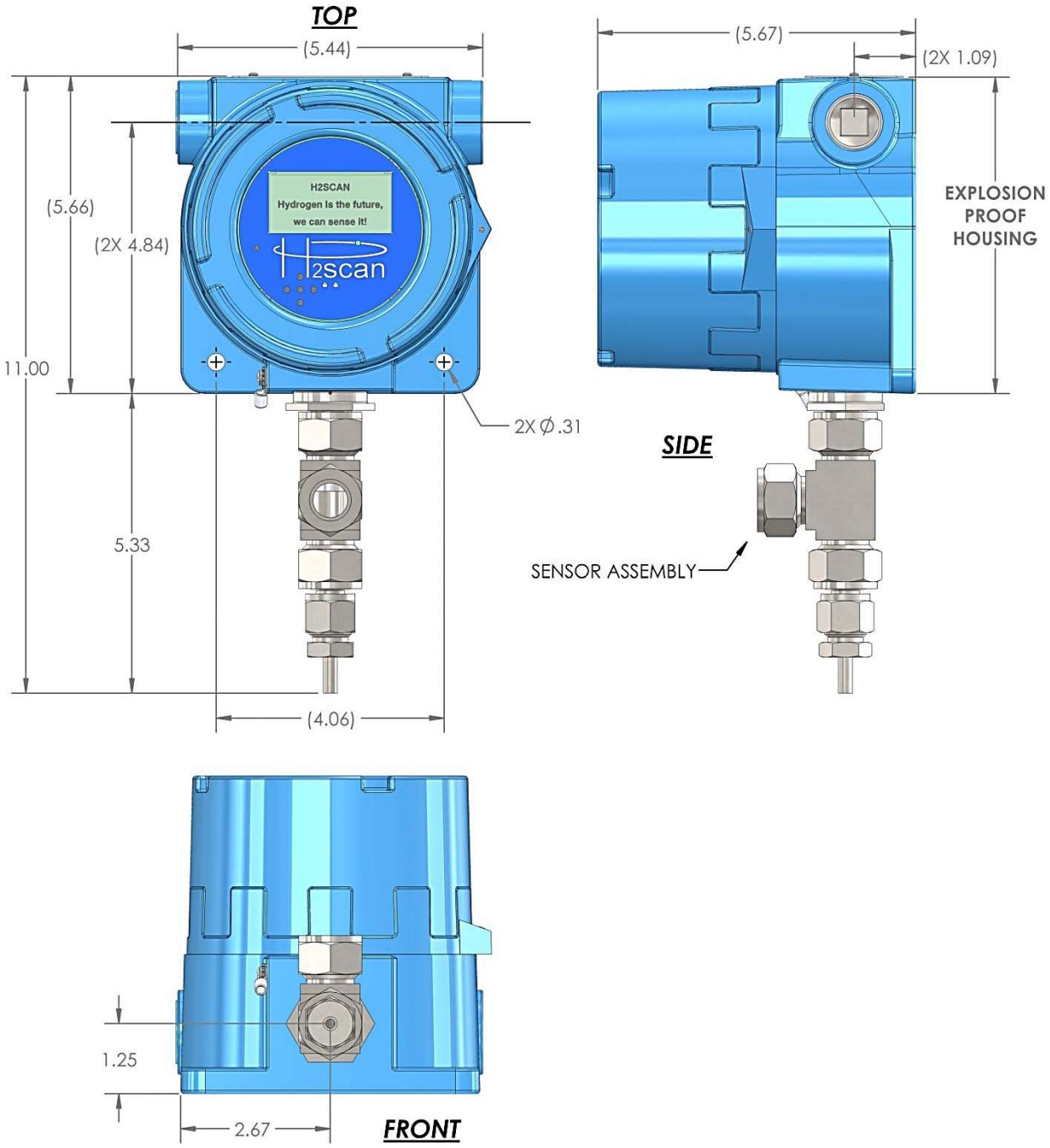


FIGURE 1: Monitor Module Dimensions

4 SETTINGS

The monitor's operational and output settings have been configured at the manufacturer as specified at the time of purchase. Settings may be changed through the serial port or the remote control.

WARNING: If settings are changed from those set by the manufacturer then it is the user's responsibility to understand the implications to the connecting equipment monitoring the monitor.

5 OPTIMUM MONITOR PERFORMANCE

Verify that all electrical connections are made as recommended in section 8. Switching the polarity can cause damage to the monitor.

Perform a Field Calibration after installation and conditioning steps described in the Start-up section are completed.

5.1 EFFECT OF PRESSURE

The monitor is hydrogen specific and sensitive to only the hydrogen partial pressure in the air. Since changes in total gas pressure will affect the hydrogen partial pressure, they will also affect the sensor readings. For instance, at one atmosphere pressure, a 2% H2 concentration will be reported as 2%. At 0.9 atm, the reading will decrease to 1.8%.

Normal atmospheric pressure fluctuations may also manifest as small hydrogen changes.

At the factory, the monitors are typically calibrated at one atmosphere pressure.

A field calibration will compensate for altitude induced pressure effects.

6 INSTALLATION

WARNING: IF THE MONITOR IS INSTALLED IN A CLASSIFIED LOCATION THEN IT IS THE RESPONSIBILITY OF THE USER AND INSTALLER TO MAKE CONNECTIONS TO RELATED EQUIPMENT IN A MANNER CONSISTENT WITH THE LOCATION CLASSIFICATION.

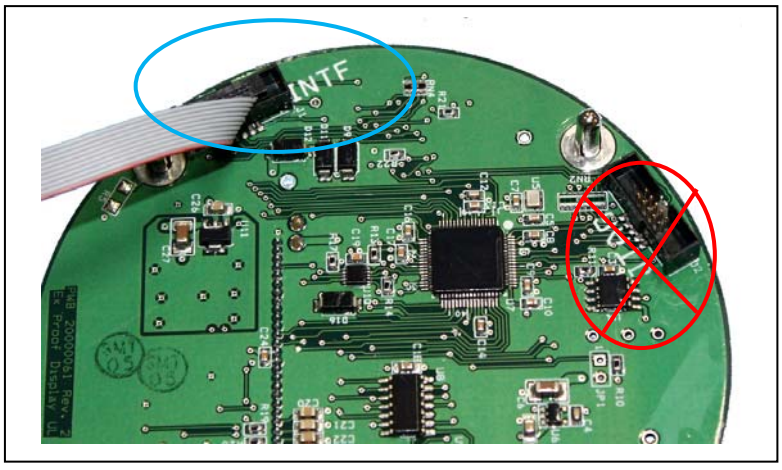
The Display Board connects with the Interface Board via a cable that allows the Display Board to be moved aside for wiring the monitor. No tools are required.

To remove it, simply pull it straight up from the posts. Plug it into another post to hold it in a convenient spot out of the way. **DO NOT unplug the cable**. If the cable is unplugged plug it into the connector marked "INTF". (See View 1) Plugging it into any other connector may damage the display board.

After wiring is complete, plug it back into the posts. The legs are arranged in a symmetrical pattern so the board can be rotated into one of four different orientations when installed. In this way, the LCD will be displayed in the best position possible no matter how the monitor is mounted.

Further disassembling the monitor voids the warranty and could cause serious damage.

If it is necessary to pull wires through the



View 1

conduit to the monitor, install a device such as a pull box or pulling elbow near the monitor. Pull the wires through this then push them into the housing. The pull box and any conduit must be rated with the appropriate classification for the installation location and installed accordingly.

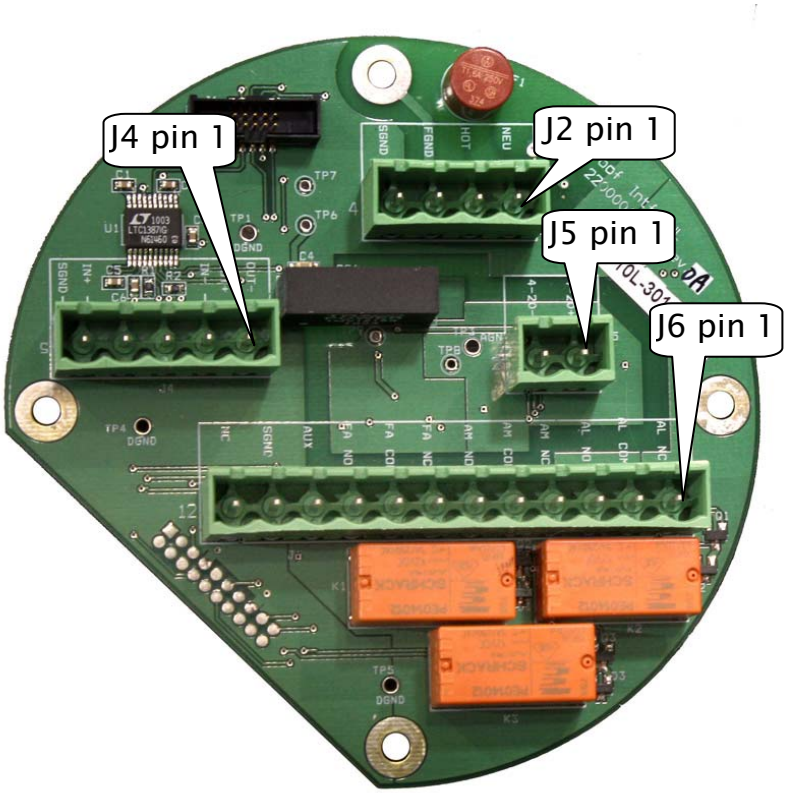
7 MOUNTING

Mounting is achieved with two ¼ inch screws through the mounting holes in the base of the explosion proof housing. ¾ inch solid conduit threaded into the enclosure will also serve as further structural support. The housing can be mounted in any orientation or position except with the sensor tube pointed up.

DISPLAY ORIENTATION

8 WIRING

All wiring is done with the Interface Board. The connectors are two piece designs in which the wires are screwed into a receptacle in standard terminal block style. This is plugged into the board.



INTERFACE BOARD SHOWING CONNECTORS

8.1 AC POWER WIRING

Power Board: J2 4-Pin Terminal Block for the Power Cable		
Pin Number	**Function**	**Description**
1	NEUTRAL	Alternating current return
2	LINE	Hot AC power
3	CHASSIS GROUND	Safety connection to ground
4	SIGNAL GROUND	Common ground for sensitive circuitry isolated from chassis ground.

8.1.1 Grounding

Some facilities have separate grounds for signal and AC power. If this is the case run the signal ground and chassis ground wires to the appropriate locations. If there is one ground, jumper the chassis ground and signal ground pins together in J2.

8.2 RELAY WIRING

Warning: do not exceed the maximum ratings of the relay contact specifications.

Interface Board: J6 12-Pin Terminal Block for Output Cable		
Pin Number	**Function**	**Description**
1	ALERT NC	SPDT Relay 1 for the Alert level of hydrogen
2	ALERT COM	
3	ALERT NO	
4	ALARM NC	SPDT Relay 2 for the Alarm level of hydrogen
5	ALARM COM	
6	ALARM NO	
7	FAULT NC	SPDT Relay 3 for fault conditions
8	FAULT COM	
9	FAULT NO	

8.3 OPTIONALPRESSURE SENSOR WIRING

Interface Board: J6 12-Pin Terminal Block for Output Cable		
Pin Number	**Marking**	**Description**
10	AUX IN	1 to 5V pressure sensor input
11	S GND	Return for pins 10 and 12
12	NC	+12VDC Output

8.4 4-20MA INTERFACE WIRING

Interface Board: J5 2-Pin Terminal Block for Output Cable		
Pin Number	**Function**	**Description**
1	4-20mA+	4-20mA analog output
2	4-20mA -	

8.5 SERIAL INTERFACE WIRING

Interface Board: J4 5-Pin Terminal Block for Serial Interface Cable		
J3 Pin	**Function**	**Description**
1	TxD- (Device Transmit, Negative)	RS422 – Data out – RS232 – Data Out
2	TxD+ (Device Transmit, Positive)	RS422 – Data out + RS232 – NC
3	RxD- (Device Receive, Negative)	RS422 – Data In – RS232 – Data In
4	RxD+ (Device Receive, Positive)	RS422 – Data In + RS232 - NC
5	SGND	Signal Ground

9 STARTUP

The monitor is designed to be exposed to an air background gas with no hydrogen most of the time. For optimal performance keep any hydrogen exposure to the sensor to less than one hour. If the hydrogen exposure exceeds this time, the sensor may need to be reconditioned by leaving it powered on in air for a few days.

9.1 OPTIONAL PRESSURE SENSOR

If the pressure sensor was not installed and configured at H2scan the "**PS**" command must be used to setup the pressure sensor. (*See section 14.10 PS COMMAND*)

If the sensor was setup at H2scan, and it is a psig sensor, and the serial port is available, the "**PS**" command may be used to enter the local atmospheric pressure. This will allow the proper display of the measured pressure from the serial port. The pressure is not displayed on the LCD. Generally a **PS** command is not needed if the pressure reading at the serial port will not be used to check accuracy of the pressure gauge. The pressure compensation function will still function accurately after the field calibration command is run at the final operational pressure settings.

A psia sensor setup by H2scan needs no special startup procedure.

The correction applied is based on the calculated pressure in atmospheres (atm). This value is calculated as shown in the following table.

PSIA	PSIG
$ATM = \frac{Measured\ psi}{14.696\ psi}$	$ATM = \frac{Measured\ psi + Local\ Atm.\ Press.}{14.696\ psi}$

9.2 FIELD CALIBRATION

After installation and conditioning a field calibration should be performed. This will correct for any differences between factory and final installation conditions such as pressure and temperature, and give more accurate measurements. (*See section 19 FIELD CALIBRATION*)

10 INTRINSICALLY SAFE INFRARED REMOTE CONTROL

A 5-button Intrinsically Safe Infrared Remote Control is used to access the Configuration Menus, change settings and initiate Calibration. If lost or damaged, spare remote controls can be purchased directly from H2scan.

10.1 INTRINSICALLY SAFETY REQUIREMENTS

Only replace the battery in a safe (non-hazardous) location.

Only the following batteries have been tested and approved for maintaining the intrinsic safety of the remote control:

Panasonic CR1632

Energizer CR1632

Renata CR1632

Using any other battery may impair the safety of the remote.

A lanyard or anything else attached to the remote while in hazardous locations must not have metallic parts.

10.2 BUTTONS

▲ or ▼ scrolls up through a numerical range or Moves the cursor up or down to make a menu selection.

◄ selects the previous menu.

► selects the next menu.

◄ and ► together returns to the Main Screen from any menu.

↵ (enter) selects the value or function.

11 RELAYS

There are three relays. *See Section 14.4 and 16*.

Relay	Usage
Alert	An early warning that the hydrogen values may drift out of range.
Alarm	An alarm that the hydrogen values have drifted out of range
Fault	One of the following faults has occurred: PCB temperature is too high H2 resistor value is out of range Data not valid Heater Off Error Power Failure (if enabled)

The Alert and Alarm relays can be programmed to respond at whatever hydrogen levels suit the installation. The Alarm relay should be programmed to react to a higher hydrogen level than the Alert relay.

The Fault relay has a Power Fail Indicator feature that may be enabled or disabled.

Selection	Usage
Enabled	Under normal conditions the fault relay is energized with NO connected to COM.
Disabled	Under normal conditions the fault relay is de-energized with NC connected to COM.

12 OPTIONAL PRESSURE SENSOR

The monitor may use an optional external pressure sensor to compensate for pressure changes in the process gas stream.

There are two types of pressure sensors, “Absolute” (psia), and “Gauge” (psig).

Absolute types measure the pressure relative to a fixed reference. One of these sensors would read 14.7 psi while at sea level and about 4.9 psi atop Mount Everest.

Gauge types measure the pressure relative to the local atmosphere. One of these sensors would read 0 psi at any elevation.

Absolute pressure types are preferable to gauge types, as they will prevent local barometric fluctuations from influencing the measurements.

The monitor is designed for use with pressure sensors that output a 1-5V signal. The pressure sensor can be powered either directly from the H2scan analyzer or from an external power source. 12 V DC is supplied from the monitor, and the selected pressure sensor needs to be compatible with this voltage to be powered from the monitor. If the pressure sensor is powered from an external source, the 12V restriction does not apply; any suitable pressure sensor and appropriate power supply can be selected.

The “**PS**” command is used to enable and configure the monitor for an external pressure sensor.

13 ANALOG OUTPUT

The analog output is derived from the final hydrogen value as shown on the serial display and is scaled to the hydrogen and current ranges desired. All of this is initially set to factory defaults as shown in the table

below or per customer specifications at the time of order. They can also be changed with the "**H**" and "**I**" commands or the remote control. See sections 14.8, 14.9 and 16.

Factory Default Values	
Description	**Value**
LowH2Current	4 mA
HighH2Current	20 mA
LowH2Range	0% H2
HighH2Range	5% H2

Use the following equation to calculate hydrogen from the analog output:

$$H2 = \frac{MeasuredCurrent - LowH2Current}{HighH2Current - LowH2Current} * (HighH2Range - LowH2Range) + LowH2Current$$

These values can be seen using the "**D1**"command.

See section 21 for Analog Output Trouble Shooting.

14 SERIAL COMMUNICATION

The monitor can be setup or controlled via serial communication. This is accomplished via the serial interface. *See section 8.5 for wiring.*

Refer to Appendix 1 for Serial Communication Troubleshooting

Refer to Appendix 4 for information about FoxTerm, a popular terminal emulator.

14.1 SOFTWARE

Software that communicates over the serial port is typically called a "terminal emulator". Any two-way terminal emulators (HyperTerminal, Telnet, etc.) or purpose-built software (using LabView, Visual Basic, C++, etc.) can be used to establish serial communication with the analyzer.

XP and previous versions of Windows came with a terminal emulator called "Hyper Terminal". Newer versions of Windows do not. These versions require installing a third-party program. There are many inexpensive or free programs available. FoxTerm, a free program, is used extensively by H2scan.

14.2 CONNECTION

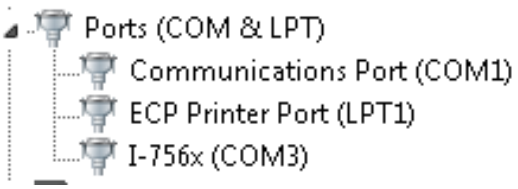
Connect the sensor to the serial port, using whatever adapters are required.

If a USB adapter is used, install the driver according to its instructions.

In Windows, look at the ports using the Device Manger.

A built-in port will be "COM1".

The port assigned to the USB adapter could be called something like "USB Serial Port (COM7)" or "I-756X (COM3)". Below is an example.



Note the port number that Windows has assigned.

WARNING: If commands are sent over the serial port, the display on the LCD will be unpredictable. To restore proper LCD operation, cycle the power.

14.3 COMMAND SUMMARY

Two communication modes are available:

Keystroke – This is the default mode which shows a continuous stream of output data until an ESC key is pressed. Then the H2scan prompt is displayed for the user to enter a command. After the command is finished the stream of output data continues.

Prompted – This mode is entered by executing =H2scan command at H2scan prompt. The monitor continues with the H2scan prompt after completing each command. Enter the =0 command to end this mode and continue the stream of output data.

Keystroke Commands while data steams	
Keystroke	**Description**
ESC	Stops continuous display to enter a password or command. If in level zero, the continuous display will resume after executing one command.
Sp (spacebar)	Pressing the Space key while the serial output is active will display a label line showing the heading for each column of data.
. (period)	Display current status.
‘ (single quote)	Append a user comment to the end of current line.
;	Add a user comment line to the serial stream.
C	Clear peak hydrogen value.

Prompted Commands @ H2Scan prompt	
Command	**Description**
=<password>	Enter the password to change security level. A null or invalid password returns to level 0. Level 0 password = “0” Level 1 password = “h2scan”
A	Modify the Alarm set points
CI	Calibrate the analog output.
D <page>	Display Product Information. Enter page number 0-1 or A for all pages, default is page 0. 0 – Product information 1 – User configuration
G	Go, resume sensor operation
H	Modify the hydrogen reporting range
I	Modify the DAC current output range
X	Clear field calibration data (returns to last factory calibration data).
F	Perform Field Calibration

14.4 A COMMAND

The A command is used to modify the alert and alarm set points that control the relays. In this example R1 is changed to 1%, R2 is changed to 4%, and R3 Power Fail Indication is changed to Enabled. Also available from display, see section 16.

```
H2scan: a

Current R1=2.00000%, R2=3.00000% Relay #3 Power Failure Indication disabled
  Enter new R1 value: 1
  Enter new R2 value: 4
  R3 Power Failure Indication disabled. Change (Y/N)? y

  Save these values (Y/N)? y
...Wait...SAVED – Done
```

14.5 CI COMMAND

Calibrate the analog output.

A calibrated current meter with at least 0.01mA resolution is required.

```
H2scan: CI
Calibrate 4-20mA output
  Set to 3.000000mA, Enter actual value: 2.99
  Set to 19.000000mA, Enter actual value: 18.98
m=1.000625, b=0.008130

Test the output
  Set to 3.000000mA, Is this good (Y/N)? y
  Set to 19.000000mA, Is this good (Y/N)? y
...wait...
```

14.6 D COMMANDS

Display Product Information. Enter page number 0-6 or A for all pages, default (no value) is page 0.

0 – Product information
1 – User configuration

```
H2scan: d0
H2scan hydrogen sensor
  Model Number:  2620
  Serial Number: A000001
  Sensor Board Firmware Rev:  2.24
  Display Board Firmware Rev:  1.16
  Table Version: 0.50
  Hardware Version: 1.00
  Latest Calibration
    Factory: 00/00/0000
    Field:   00/00/0000

H2scan: d1
User configuration is:
  Hydrogen reporting range .50000-5.0000% H2
  Isolated Output is enabled: 4.000 to 20.000 mAmps
    Error output is 3.000 mAmps
    Not-Ready output is 2.000 mAmps
  Voltage Output is disabled
  Relay #1 threshold is 1.00% Hydrogen
  Relay #2 threshold is 4.00% Hydrogen
  Relay #3 Power Failure Indication enabled
  Pressure compensation is disabled
```

14.7 G COMMAND

The G command is used to resume sensor operation and specify the arrangement of the data in columns. These columns are:

Header	Description
TimeSec	The time in seconds since power on.
PcbTemp	The internal electronics temperature.
SnsrTemp	The sensor temperature.
ResAdc	The raw hydrogen sensor measurement in ADC counts.
AdjRes	The adjusted sensor measurement: these adjustments include compensation for variations in sensor temperature, sensor electronics, and other parameters.
ResZero	Sensor reference value (not zero as implied).
H2	The final hydrogen measurement
%H2_Pk	The peak hydrogen measurement
%H2_Res	The hydrogen resistor measurement
HCurrent	The current used to heat the sensor element
Average	Average indicates that several samples are being averaged
PS_Volt	The voltage measurement of the If the pressure sensor, if enabled,
PS_psiA or psiG	The calculated psiA or psiG of the If the pressure sensor, if enabled,
PS_ATM	The calculated pressure in atmospheres of the If the pressure sensor, if enabled, This value is used for pressure compensation
Messages	Some messages are displayed in this column

To change display format press ESC followed by G <fmt>; where <fmt> is a 4 digit hexadecimal number. Some common formats are listed below:

<fmt>	Columns
	Use default
80B0	TimeSec %H2
B0C0	TimeSec PcbTemp SnsrTemp %H2 %H2_Pk
B0B0	TimeSec PcbTemp SnsrTemp %H2
B5C0	TimeSec PcbTemp SnsrTemp %H2 %H2_Pk PS_Volt PS_psiA PS_ATM
B4C0	TimeSec PcbTemp SnsrTemp ResAdc AdjRes ResZero %H2_Res %H2 %H2_Pk
F4F0	TimeSec PcbAdc TempAdc HCurrent ResAdc PcbTemp SnsrTemp ResAdc AdjRes ResZero %H2_Res %H2 %H2_Pk

14.8 H COMMAND

Modify the hydrogen reporting range. Also available from display section 16.

```
H2scan: h
Hydrogen reporting range 0.0000-5.0000% H2
Enter new H2 low range: 1
Enter new H2 high range: 25
New Hydrogen reporting range 1 - 25% H2
Save these values (Y/N)? y
SAVED - Done
```

14.9 I COMMAND

Modify the Isolated DAC output range. Also available from display section 16.

```
H2scan: i
DAC range is 4.0mA to 20.0mA, error output is 2.0mA, not ready output is 3.0mA
Enter new low H2 output current: 4
Enter new high H2 output current: 20
Enter new error output current: 3
Enter new not ready output current: 2
New DAC range is 4.0mA to 20.0mA, error output is 3.0mA, not ready output is 2.0mA
Save these values (Y/N)? y
SAVED – Done
```

14.10 PS COMMAND

Modify the external pressure sensor parameters.

The table below shows settings 0 – 30 psia and psig pressure sensors.

If gauge pressure is used, the monitor will prompt for the local atmospheric pressure in psi as shown below. This value can be measured, researched, or calculated based on altitude.

The filter constant determines how strong the moving average of the signal is. The allowed values are 0.0001 to 1. A value of 1 provides no averaging. 0.05 usually works well. A smaller number reduces measurement noise at the expense of slower reactions to pressure changes.

These parameters cannot be changed from the display. A serial connection is required.

Setup for PSIA	Setup for PSIG
H2scan: **ps** External pressure sensor is disabled Anything to Change (Y/N)? **y** Enable External pressure sensor (Y/N)? **y** Low pressure (psi): **0** High pressure (psi): **30** Use Absolute (A) or gauge (G) pressure? **A** using absolute pressure Filter constant (0.0001 to 1): **.05** ...Wait...	H2scan: **ps** External pressure sensor is disabled Anything to Change (Y/N)? **y** Enable External pressure sensor (Y/N)? **y** Low pressure (psi): **0** High pressure (psi): **30** Use Absolute (A) or gauge (G) pressure? **G** using gauge pressure Local Atmospheric Pressure (psi): **14.12** Filter constant (0.0001 to 1): **.05** ...Wait...

14.11 X COMMAND

Clear field calibration data (returns to last factory calibration setting). Also available from section 16.

```
H2scan: x
Clear field calibration values (Y/N)? y
```

14.12 F COMMAND

Perform a field Calibration. See the Field Calibration section 19 for more details.

15 MESSAGES

The last column in the display shows status messages.

In this section _XXX refers to a number.

"**ramp_up**" indicates the sensor temperature is ramping up to the operating temperature

"**Warmup_XXX**" is displayed when the sensor is turned on or reset. It will start at a time programmed at the factory and count down to 0.

"**Settle**" is displayed when the sensor is waiting for the die temperature to stabilize. The settling time varies depending on the sensor and local conditions and could take up to five minutes.

"**Wait_XXX**" usually appears counting down a delay. For example, during field calibration the sensor is expecting the gas to be applied for a certain length of time. In this case WAIT_XXX will appear counting down the remaining time.

"**Wait_100**" continuously displayed is a special case of "Wait_XXX". It appears when the sensor is waiting for an event that will not occur at a particular time. Once this event occurs it changes to a counter initialized to some value (Wait_XXX) and counts down from there.

If it is displayed for more than five minutes, cycle the power to the monitor. It should return to normal operation.

"**htroff**" could be caused by one of several error conditions that cause the monitor to turn off the sensor heater. Sometimes the error occurs because of a transient condition ("glitch"). If "htroff" is displayed, cycle the power to the monitor, or enter the soft reset command. It should return to normal operation. If the error is permanent, the monitor must be returned to H2scan for examination.

"**Error_XXXX**" displays a code number for any of several possible errors as shown in the following table. These codes are hexadecimal numbers representing 16 bits with each bit representing an error. If more than one error occurs concurrently, their values add. For example if the sensor temperature is out of range and there is a configuration error, the error code will be 4040. Many of these errors could lead to an "htroff" error.

Error	Code (hex)
PCB temperature is too high	8000
Sensor temperature is out of range	4000
H2 resistor value is out of range	2000
Data not valid	0800
Configuration error	0040

16 CONFIGURATION MENUS

The Keypad on the remote control is used to alter the display or initiate special functions from the Configuration Menus.

The following functions will be found in the Configuration Menus:

Information– model information

Sensor Firmware Rev – Sensor Board firmware revision

Display Firmware Rev – Display Board firmware revision

Product Serial Number – This monitor's serial number

Manufacturer's Calibration Date – date of the last factory calibration

Serial Port – The serial port type

Configure Relays – configure hydrogen levels where relays actuate

R1 Level – level of hydrogen detected where first relay will actuate; Alert Level (standard factory setting: 1% hydrogen by volume)

R2 Level – level of hydrogen detected where second relay will actuate; Alarm level (standard factory setting: 2% hydrogen by volume)

R3 – Select whether the Power Fail Indicator is enabled.

Set H2 Range – define hydrogen sensitivity range (standard factory setting: 0% to 5% hydrogen by volume)

Low H2 Range – lowest level of hydrogen (standard factory setting: 0% hydrogen by volume) to correspond with the low range IDAC setting

High H2 Range – highest level of hydrogen (standard factory setting: 5% hydrogen by volume typical) to correspond with the high range IDAC setting

Configure 4-20mA – define analog output range (standard factory setting: 4mA to 20mA)

Low Range – low level analog output (standard factory setting: 4mA) to correspond with lowest level of hydrogen range

High Range – high level analog output (standard factory setting: 20mA) to correspond with highest level of hydrogen range

Error – analog output (standard factory setting: 3mA) of error status

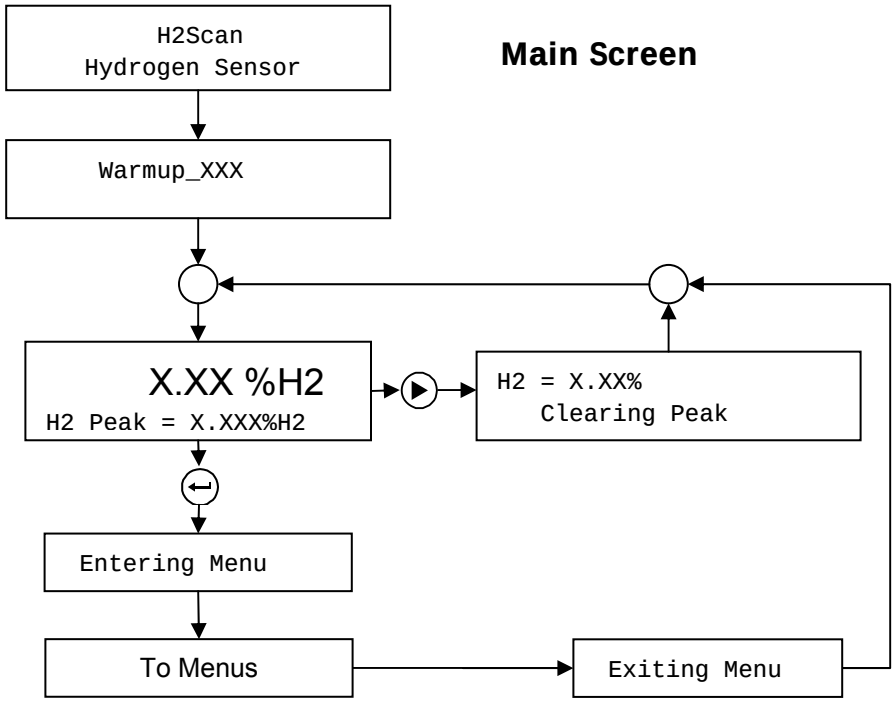
Not Ready –analog output (standard factory setting: 2mA) of self-diagnostic test

Field Calibrate

Calibrate Sensor – Field Calibration procedure

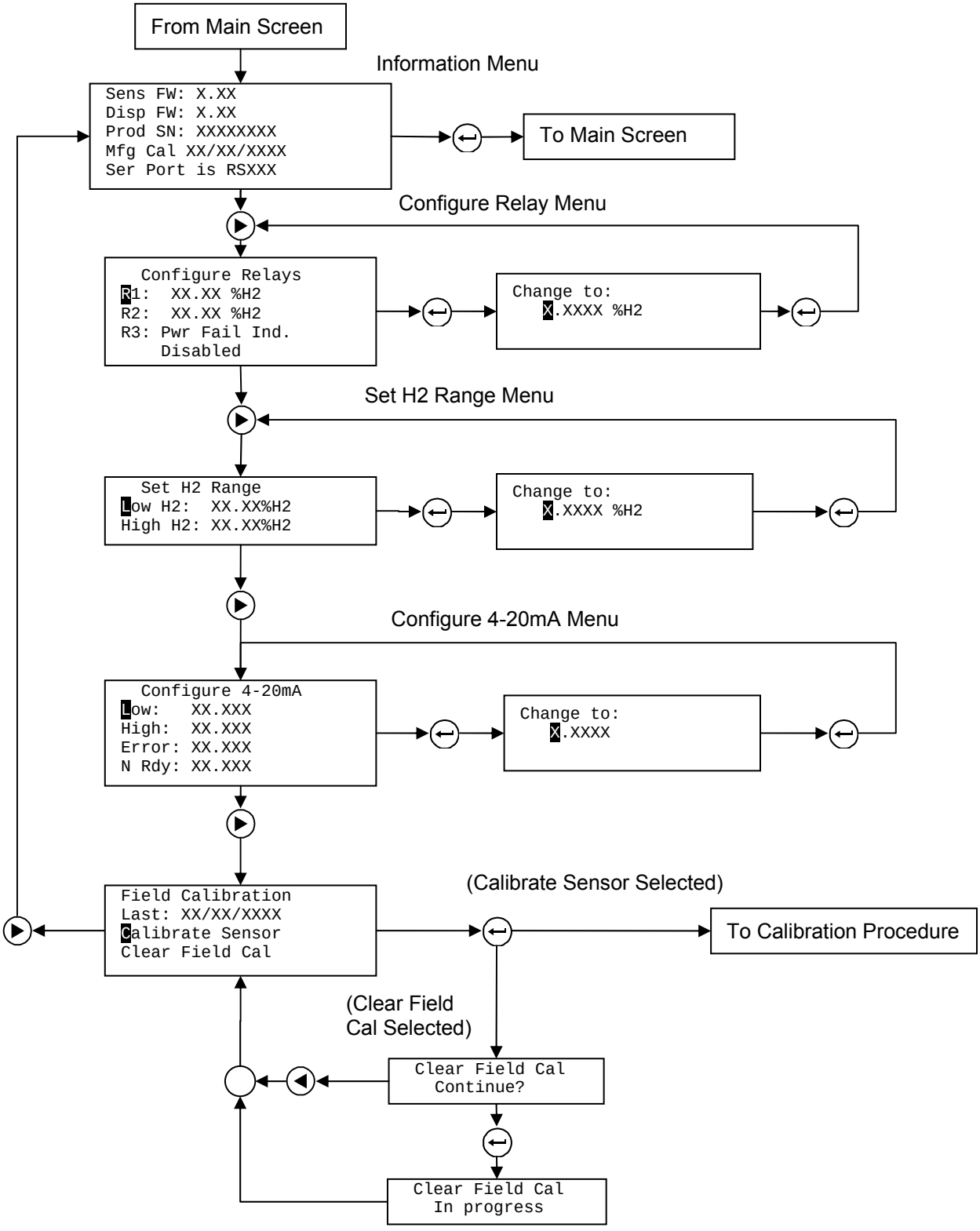
Clear Field Cal - restores the monitor to the last factory calibration

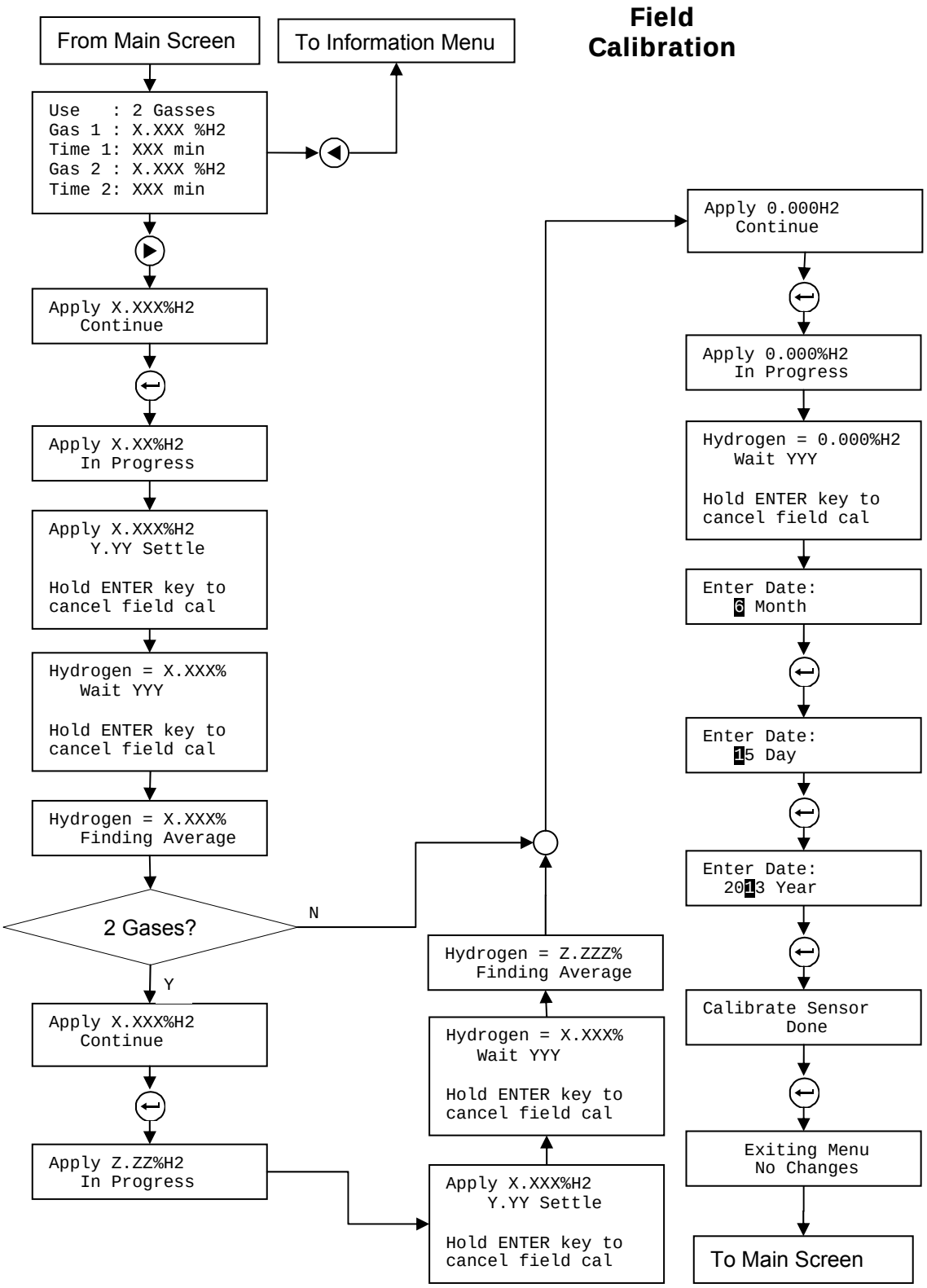
Exit – Exit Configuration Menu to standard display output setting


H2Scan
Hydrogen Sensor
Main Screen
Warmup_XXX
X.XX %H2
H2 Peak = X.XXX%H2
H2 = X.XX%
Clearing Peak
Entering Menu
To Menus
Exiting Menu

Top Menus

Menus


From Main Screen
Information Menu
Sens FW: X.XX
Disp FW: X.XX
Prod SN: XXXXXXXX
Mfg Cal XX/XX/XXXX
Ser Port is RSXXX
To Main Screen
Configure Relay Menu
Configure Relays
R1: XX.XX %H2
R2: XX.XX %H2
R3: Pwr Fail Ind.
Disabled
Change to:
X.XXXX %H2
Set H2 Range Menu
Set H2 Range
Low H2: XX.XX%H2
High H2: XX.XX%H2
Change to:
X.XXXX %H2
Configure 4-20mA Menu
Configure 4-20mA
Low: XX.XXX
High: XX.XXX
Error: XX.XXX
N Rdy: XX.XXX
Change to:
X.XXXX
Field Calibration
Last: XX/XX/XXXX
Calibrate Sensor
Clear Field Cal
(Calibrate Sensor Selected)
To Calibration Procedure
(Clear Field
Cal Selected)
Clear Field Cal
Continue?
Clear Field Cal
In progress


Field Calibration
From Main Screen
To Information Menu
Use : 2 Gasses
Gas 1 : X.XXX %H2
Time 1: XXX min
Gas 2 : X.XXX %H2
Time 2: XXX min
Apply X.XXX%H2
Continue
Apply X.XX%H2
In Progress
Apply X.XXX%H2
Y.YY Settle
Hold ENTER key to
cancel field cal
Hydrogen = X.XXX%
Wait YYY
Hold ENTER key to
cancel field cal
Hydrogen = X.XXX%
Finding Average
2 Gases?
N
Y
Apply X.XXX%H2
Continue
Apply Z.ZZ%H2
In Progress
Hydrogen = Z.ZZZ%
Finding Average
Hydrogen = X.XXX%
Wait YYY
Hold ENTER key to
cancel field cal
Apply X.XXX%H2
Y.YY Settle
Hold ENTER key to
cancel field cal
Apply 0.000H2
Continue
Apply 0.000%H2
In Progress
Hydrogen = 0.000%H2
Wait YYY
Hold ENTER key to
cancel field cal
Enter Date:
6 Month
Enter Date:
15 Day
Enter Date:
2013 Year
Calibrate Sensor
Done
Exiting Menu
No Changes
To Main Screen

17 MAINTENANCE

17.1 CLEANING

If the monitor is exposed to process streams containing debris, condensates or other material that may collect over the sensor tip then the monitor should be removed from the stream periodically and the tip cleaned by a gentle wiping with a clean lint-free cloth or paper.

18 FACTORY CALIBRATION

Contact H2scan to make arrangements for a comprehensive Factory Calibration using high accuracy gases by H2scan's factory trained technicians. A NIST traceable certificate is available upon request. An annual Factory Calibration is advisable to optimize performance.

19 FIELD CALIBRATION

Field calibration is only valid at one pressure. If the pressure is changed a new field calibration may be required to restore accuracy.

19.1 CALIBRATION INTERVAL

Calibration is used to correct any error that exists between the sensor output and a known hydrogen concentration. Calibrations do not cause any wear on the sensor and can be performed as often as desired.

H2scan recommends that calibration be performed every three months. However, the calibration interval depends solely on the desired tolerance in a specific application.

In the event the Field Calibration procedure seems to not be effective, the monitor should be shipped back to the factory for a comprehensive evaluation and Factory Calibration.

19.2 GASES

Field Calibration requires the availability of one or two certified gases with a nominal hydrogen value by volume in a balance of air. The flow rate required is 1 ± 0.2 slpm. One gas will correct any offset error while two gasses will also correct any gain error. It is recommended to use two gasses to obtain superior calibration accuracy.

DO NOT use 0% H2 as the lower calibration gas. Instead use hydrogen concentration that is slightly lower than the expected lowest hydrogen concentration. For the second calibration gas use a concentration that is slightly higher than the expected maximum H2 concentration.

Custom Field Calibration Kits are available from H2scan.

The accuracy of the gas bottle concentration will directly affect the measured accuracy of the monitors. During factory calibration, the monitors are calibrated with high accuracy gases (as high as +/- 0.02%). Similar high accuracy gases should be used to maintain the highest accuracy.

The last step of calibration requires 0%H2 air. This may be purchased, or ambient air may be used if it is hydrogen-free.

19.3 CALIBRATION PROCEDURE

Wait at least 30 minutes after power-up for maximum accuracy.

During calibration the previously completed field calibrations are still used for calculating the hydrogen values.

Calibration can be performed through the serial port or the LCD. The displays are slightly different.

During field calibration the analog output is at the "Not ready" value, and the relays are frozen at their last positions before calibration began. .

To calibrate using the LCD interface, follow the Calibration Procedure flow chart on page 24.

To calibrate using the serial interface, follow the sequence below:

Press “Esc” to get to get the monitor to the command prompt “H2scan:”

Type “f” then hit “Enter” and follow prompts to field calibrate the sensor. They will be similar to those of the LCD.

20 APPENDIX 1 - SERIAL COMMUNICATION TROUBLESHOOTING

This trouble shooting guide assumes the ICP DAS model 7561 USB adapter and FoxTerm terminal emulation program are used. More information can be found on-line at www.icpdas.com. It is important that the RxD, TxD, and Gnd connections for RS-232 communication are made correctly. Gnd must be connected to J3 Pin 5. Avoid using a USB-Serial adaptor that has a long cable between the two ends as it can easily pick up electrical noise that will interfere with communications.

FoxTerm Error 015: The port 'COMx' does not exist: Determine which COM port is available for use.

Garbage Characters: If strange characters are seen in the FoxTerm window, either on their own or in response to pressing **`Enter`** then **ESC**, verify the serial connections and FoxTerm Settings.

No H2scan: Prompt: If pressing **`Enter`** then **ESC** does not show the H2scan: prompt, and FoxTerm is connected to the correct COM port, refer to the Sensor Command Line section for further instructions.

No Response to Pressing Enter: If the H2scan: prompt is present and command characters are echoed but pressing **`Enter`** has no affect then confirm the Newline Behavior setting for FoxTerm is “CRLF”.

USB Adapter not recognized: If a USB adapter is used, Administrator Rights may be required for the computer to install and use it. Contact your network administrator to resolve this issue.

20.1 CONNECTIONS

Review the wiring connections between the sensor, power supply, and USB Adapter as indicated in the operation manual. Then confirm that the power supply is on and within specifications with a voltmeter, and the LED is on. An amber LED immediately after turning on power is normal. The LED may change to green or red after the warm up period depending on hydrogen concentration.

20.2 COM PORT NUMBER

Administrator rights for the computer are required to examine or setup a COM port connection with the sensor. Open Device Manager by right clicking on My Computer icon, selecting Manage and then choosing the Device Manager option in the left pane. In the right pane select Ports (COM & LPT) and determine which COM port is connected to the sensor (e.g. COM6). The COM port should be labeled as I-756x (COM__). Make note of the COM port number shown in parenthesis for use in setting up FoxTerm. Note that the COM port number may be different when your computer is reconnected to the sensor. For best results always use the same USB adapter and plug-in location on your computer.

To confirm that a particular COM port is actually connected to the sensor: Open Device Manager; disconnect the USB connector from your computer and verify that the COM port disappears; then reconnect the USB connector and verify that the COM port re-appears. If the COM port is not displayed in Device Manager, unplug the USB cable and look for changes in Device Manager. Plug in the USB cable and see if a new COM port is added to the Ports (COM & LPT) section. If so, this is the COM port to use with FoxTerm.

20.3 USB ADAPTOR DEVICE DRIVER:

If the COM port is not correctly displayed in the Device Manager then look for yellow warning symbols that indicate a device is not working correctly under the Universal Serial Bus (USB) controllers section. If this warning symbol goes away and returns as the USB cable is disconnected and reconnected then the device driver for the USB adapter is not installed correctly. To re-install the device driver double click on the Warning line to bring up the properties window for the device; select the Driver tab and click on the Uninstall button. After the Uninstall is complete unplug the USB cable and reboot your computer. Re-install the driver from the CD (or internet) then plug in the USB cable and confirm that a new device is found and the driver is loaded without error. Go to the beginning of this section and determine which COM port has been assigned for the sensor.

20.4 REBOOTING:

Sometimes when the connection between the Computer and the COM port cannot be established even after following the above procedures, the problem may be that the Computer has not released

the COM port from a previous use. Reboot your computer and then use the above procedure in identifying the correct COM port number. In such cases it is best to avoid disconnecting and reconnecting the USB adaptor until the entire data download activity is complete.

20.5 TERMINAL PROGRAM

Problems with FoxTerm are best resolved by opening FoxTerm then issue a (File|Close Session) command from the menu bar. This closes all open terminal windows and prepares FoxTerm to setup a new COM port connection. If prompted to **Save** the session select **No**. The next step is to issue the (File|New COM Port Connection…) command from the menu bar. Now fill out the New Connection dialog box with the correct COM port and settings. Click the OK button to open the terminal window. The title bar for the window shows the COM port and indicates whether it is Connected or Not Connected. If Not Connected there is something wrong with the COM port connection on the computer, or another program is using the COM port. Confirm the correct COM port is being used. Reboot the computer if the Not Connected message does not disappear. If the terminal window is connected continue to the next section to get an H2scan prompt.

20.6 SENSOR COMMAND LINE

The sensor is sending data to the serial port as measurements are made which is typically every second.

Pressing the **Enter** then **ESC** keys should show the H2scan prompt. Sometimes the **ESC** key needs to be pressed twice to get the prompt.

If the sensor does not respond turn off power for 10 seconds before turning it back on. A Power-on-Reset message should be displayed in the terminal window when power is applied.

User commands like “**D0**” are issued from the H2scan prompt. These commands are followed by the **Enter** key to initiate the operation.

21 APPENDIX 2 - ANAOG OUTPUT TROUBLESHOOTING

Sometimes the analog output shows unexpected values, such as negative hydrogen. Negative hydrogen values are never reported.

21.1 VERIFY THE HYDROGEN VALUES

Check the **%H2** column of the serial port output to read the actual hydrogen measurement. The analog output is derived from this hydrogen value. If the actual hydrogen measurement is OK, but the analog output analog output does not agree with the **%H2** column check the following items.

21.2 VERIFY THE H2 RANGE

If the H2 range is set much wider than the operating range used, errors and noise can be exaggerated. Check the range with the **D1** command.

```
User configuration is:
  Hydrogen reporting range 0.0000-5.0000 %H2
  Isolated Output is enabled: 4.000 to 20.000 mAmps
    Error output is 3.000 mAmps
    Not-Ready output is 2.000 mAmps
```

In this example 4mA = 0ppm and 20mA=5%. This is an appropriate range if the hydrogen values of concern are between 0 and 5%. This would not be an appropriate range if the hydrogen values range from 1.5 to 3%.

If the range needs adjustment, use the "**H**" command, section 14.8 or 16 and follow the prompts as shown below.

```
Hydrogen reporting range 0-0.2000 %H2
  Enter new H2 low range: 1.5
    Enter new H2 high range: 3
New Hydrogen reporting range 1.5000-3.000 %H2
  Save these values (Y/N)? Y
```

In this example the range was changed so 4mA=1.5% and 20mA=3%.

21.3 VERIFY THE ANALOG OUTPUT

Disconnect the analog wires from the SCADA system. Using a calibrated meter, verify the current is correct. The equation is:

$$I = \frac{(H2read - H2low)}{(H2high - H2low)} * AoutHigh + AoutLow$$

where H2high is the H2 value at 20mA, H2low is the H2 value at 4mA, AoutLow is the lowest measurement analog output, AoutHigh is the highest measurement analog output, and H2read is the hydrogen measurement.

For example, for H2high=2%, H2low=0%, and H2read=1%, the current should be 12mA +/- 0.01mA.

21.4 VERIFY THE SCADA ANALOG INPUT

If the current from the sensor is correct, perhaps the analog input channel is measuring it incorrectly.

Inject a current from a calibrated source and verify the SCADA analog channel measures it correctly.

If it does not measure the current correctly, see the SCADA manual for information regarding calibration and adjustment.

21.5 CALIBRATE THE ANALOG OUTPUT

If the range is correct and the analog output is inaccurate, it may require calibration. Use the "**ci**" command. See section 14.5.

22 APPENDIX 3 - SPARE PARTS

PART NUMBER	DESCRIPTION
52000137	Retainer, Cover
61000306	Masking tape - adhesive on both sides, 1/4" wide
52000128	Standoff, 1.50" x ø.25", female-female, aluminum
61000209-10	Spacer, .14” id x ø.25”, .625” long, unthreaded aluminum
61000443	Stud, 6-32 x 2½", fully threaded, stainless steel
61000209-2	Spacer, .14” id x ø.25”, .125 long, unthreaded aluminum
61000297	Union tee, ¾” ø tube
25000327	Flat ribbon cable assy, 10 pos. double row, female IDC
51000076	Connector terminal block 2 pos. , plug, 5.08mm, 180°
51000075	Connector terminal block 4 pos. , plug, 5.08mm, 180°
51000074	Connector terminal block 5 pos. , plug, 5.08mm, 180°
51000073	Connector terminal block 12 pos. , plug, 5.08mm, 180°
50000046	Remote control
61000462	3/4" to 1/2" Tube Reducing Port Connector
61000463	1/2" to 1/4" Reducing Tube Fitting

23 APPENDIX 4 - FOXTERM SETUP

23.1 FOXTERM INSTALLATION

These instructions refer to FoxTerm, but the concepts are the same in all terminal emulators.

Download FoxTerm from www.foxterm.net.

Create a folder in “My Documents” called “H2scan”.

Unzip the FoxTerm files into the H2scan folder.

23.2 FOXTERM SETUP

Start FoxTerm

Close the default session window (if needed).

Open a new session window.

Select the correct port as determined above (COM3 in this example).

Setup the session as shown below

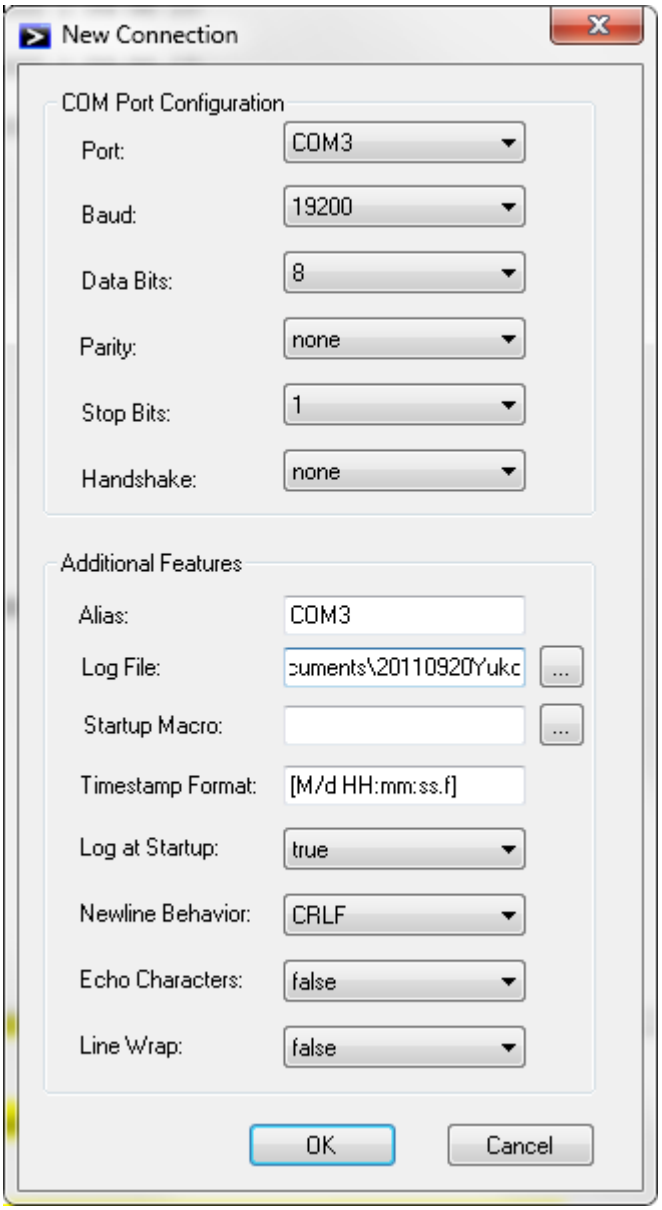
Select a log file name and location. The file name should start with the current date (YYYMMDD) followed by any particular information required. This way, the files will be easy to sort. For example “20110920Yukon6.log” would be the file name for the “Yukon6” sensor that had logging started September 20th, 2011. The “.log” extension is the default, but any extension could be used.

Newline Behavior must be set to “CRLF”.

Click OK.

Save the session as “H2scan.xml” in the FoxTerm program location.

The setup should look similar to that shown.



24 APPENDIX 5 – OPTIONAL FIELD CALIBRATION FITTING

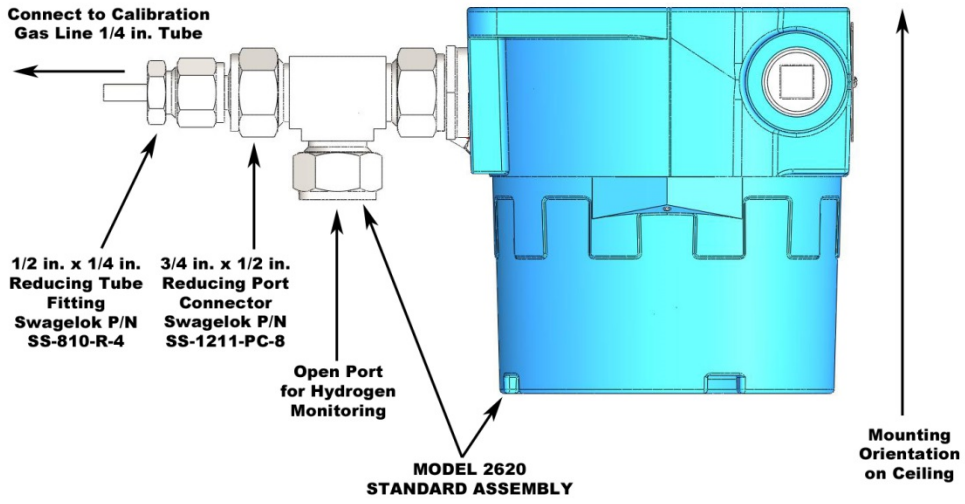
24.1 FIELD CALIBRATION FITTING

The monitor can be installed with the optional field calibration fitting permanently attached to the standard Tee fitting attached to the sensor tube.

This configuration allows for permanent plumbing of a field calibration gas supply system to the sensor.

When mounting on the ceiling as shown below or on the wall, the Tee should be oriented with the opening pointing down so that hydrogen in the ambient atmosphere can diffuse into the fitting.

With appropriate gas supply bottles, flow meters, plumbing, and shut-off valves, the flow of calibration gas to the sensor can be properly controlled during field calibration.

The field calibration procedure remains unchanged. A gas flow rate of 1-2.0slm (2scfh-4scfh) is recommended when field calibrating the monitor using permanent field calibration plumbing.

TYPICAL CEILING INSTALLATION OF MODEL 2620 WITH ADAPTER FITTINGS