OPERATING INSTRUCTIONS FOR

Model 2240

Handheld Hydrogen Leak Detector

P/N M2240

2/29/08

DANGER
Toxic and explosive gases may be present in this monitoring system. Personal protective equipment may be required when servicing this instrument. Hazardous voltages exist on certain components internally when the battery charger is connected. Do not recharge battery in a hazardous environment. Only authorized personnel should conduct maintenance and/or servicing. Before conducting any maintenance or servicing, consult with authorized supervisor/manager.

Warranty

This equipment is sold subject to the mutual agreement that it is warranted by us free from defects of material and of construction, and that our liability shall be limited to replacing or repairing at our factory (without charge, except for transportation), or at customer plant at our option, any material or construction in which defects become apparent within one year from the date of shipment, except in cases where quotations or acknowledgements provide for a shorter period. Components manufactured by others bear the warranty of their manufacturer. This warranty does not cover defects caused by wear, accident, misuse, neglect or repairs other than those performed by Teledyne or an authorized service center. We assume no liability for direct or indirect damages of any kind and the purchaser by the acceptance of the equipment will assume all liability for any damage which may result from its use or misuse.

We reserve the right to employ any suitable material in the manufacture of our apparatus, and to make any alterations in the dimensions, shape or weight of any parts, in so far as such alterations do not adversely affect our warranty.

Important Notice

This instrument provides measurement readings to its user, and serves as a tool by which valuable data can be gathered. The information provided by the instrument may assist the user in eliminating potential hazards caused by his process; however, it is essential that all personnel involved in the use of the instrument or its interface, with the process being measured, be properly trained in the process itself, as well as all instrumentation related to it.

The safety of personnel is ultimately the responsibility of those who control process conditions. While this instrument may be able to provide early warning of imminent danger, it has no control over process conditions, and it can be misused. In particular, any alarm or control systems installed must be tested and understood, both as to how they operate and as to how they can be defeated. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of Teledyne at the time the order is placed.

Therefore, the purchaser must be aware of the hazardous process conditions. The purchaser is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that hazard warning devices and instrumentation are maintained and operated properly.

Teledyne Analytical Instruments, the manufacturer of this instrument, cannot accept responsibility for conditions beyond its knowledge and control. No statement expressed or implied by this document or any information disseminated by the manufacturer or its agents, is to be construed as a warranty of adequate safety control under the user's process conditions.

Specific Model Information

This instrument is specifically designed to measure hydrogen in air. Using this instrument to analyze any other gas mixture may result in serious error. Consult the factory for additional information for gas analysis not specified at the time of purchase.

Instrument Serial Number: _____

Instrument Range: _____

Calibrated for: _____

Background Gas: _____

Zero Gas: _____

Span Gas: _____

Safety Messages

Your safety and the safety of others is very important. We have provided many important safety messages in this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:

GENERAL WARNING/CAUTION: Refer to the instructions for details on the specific danger. These cautions warn of specific procedures which if not followed could cause bodily Injury and/or damage the instrument.

CAUTION: HOT SURFACE WARNING: This warning is specific to heated components within the instrument. Failure to heed the warning could result in serious burns to skin and underlying tissue.

WARNING: ELECTRICAL SHOCK HAZARD: Dangerous voltages appear within this instrument. This warning is specific to an electrical hazard existing at or nearby the component or procedure under discussion. Failure to heed this warning could result in injury and/or death from electrocution.

Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

No Symbol

NOTE: Additional information and comments regarding a specific component or procedure are highlighted in the form of a note.

CAUTION: THE ANALYZER SHOULD ONLY BE USED FOR THE PURPOSE AND IN THE MANNER DESCRIBED IN THIS MANUAL.

IF YOU USE THE ANALYZER IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, UNPREDICTABLE BEHAVIOR COULD RESULT POSSIBLY ACCOMPANIED WITH HAZARDOUS CONSEQUENCES.

This manual provides information designed to guide you through the installation, calibration operation and maintenance of your new analyzer. Please read this manual and keep it available.

Occasionally, some instruments are customized for a particular application or features and/or options added per customer requests. Please check the front of this manual for any additional information in the form of an Addendum which discusses specific information, procedures, cautions and warnings that may be peculiar to your instrument.

Manuals do get lost. Additional manuals can be obtained from Teledyne at the address given in the Appendix. Some of our manuals are available in electronic form via the internet. Please visit our website at: www.teledyne-ai.com.

Table of Contents

List of Figures

List of Tables

DANGER
COMBUSTIBLE GAS USAGE WARNING

The Model 2240 instrument is CE approved. This rating applies only to the equipment specified and installed in accordance with the information contained within this manual. It is the customer's responsibility to ensure safety especially when combustible gases are being analyzed since the potential of gas leaks always exist.

The customer should ensure that the principles of operating of this equipment is well understood by the user and that the instrument as well as any approved support equipment is properly installed. Misuse of this product in any manner, tampering with its components, or unauthorized substitution of any component may adversely affect the certification and the safety of this instrument.

Since the use of this instrument is beyond the control of Teledyne, no responsibility by Teledyne, its affiliates, and agents for damage or injury from misuse or neglect of this equipment is implied or assumed.

Introduction

1.1 Overview

The Model 2240 Hydrogen Analyzer is a handheld portable leak detector for sensing hydrogen gas in air. It employs two sensing elements on the same semiconductor die and can detect hydrogen leaks as low as 15 parts per million (ppm). It will not saturate or be destroyed when detecting hydrogen concentration up to 100%. It is battery powered and will operate for over 10 hours on a single charge. The included battery charger will recharge the internal lithium-ion battery in 4 hours.

As the operator moves a hydrogen probe over the area of interest, it senses the presence of hydrogen. Indicators in the probe tip alert the user to the presence of hydrogen and the concentration is displayed on the control unit display. The probe attaches to the controller with an extendable coiled cord that allows up to 47 inches of reach from the Controller. The thin probe and flexible cable allow sensing in areas inaccessible to most other tools.

1.2 Typical Applications

The Model 2240 analyzer is a versatile, lightweight instrument that can be brought to a process area for analysis. Typical applications for the analyzer include:

- Leak checking process lines for H_2 in air
- Analyzing the concentration of H_2 in an air stream
- H_2 safety monitoring
- Specific gas mixer and process control applications
- Semiconductor manufacturing
- Hydrogen process control
- Quality assurance

1.3 Features

The Model 2240 Hydrogen Analyzer is sophisticated yet simple to use. The following features are standard features for this instrument:

- High-impact plastic enclosure, dust-tight and protected against water spray from any direction.
- CE approved
- Large LCD alphanumeric display plus graphic bar graph indication.
- Long-lifetime Wide Range Sensor®
- Lithium-ion battery supplies power for over 10 hours without recharging
- Tri-color LED low battery indicator
- AC battery charger
- Sensor wand with coiled wire connection to controller.
- Additional LED indicators in probe for quick visual determination of hydrogen presence.
- Large front panel keypad interface for convenient operation

1.4 Operator Interface

The user interface is simple and easy to use. Figure 1-1 shows the Model 2240 with probe and coil attached.

The interface consists of:

- LCD Display
- OFF/ON button
- Battery status indicator
- Navigation buttons
- ENTER button

Figure 1-1: User Interface

Startup and Operation

2.1 Unpacking the Instrument

The Model 2240 is shipped with all the materials you need to install and prepare the system for operation. Carefully unpack the instrument and inspect it for damage. Immediately report any damage to the shipping agent. Figure 2-1 shows the items that are included in the package.

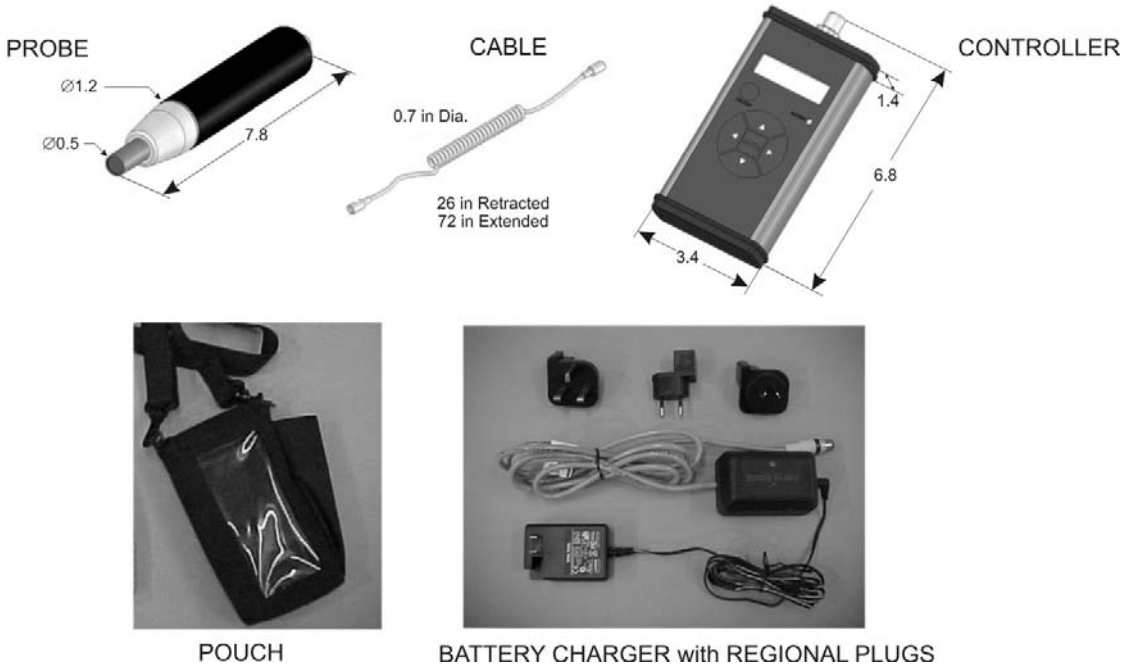

Figure 2-1: Analyzer Components

2.2 Setup

Insert the probe cable into the probe and the other end into the Controller. The cable has distinct connections that will only mate in the proper manner.

2.3 Startup

Power-up the Model 2240 by pressing and holding the **ON/OFF** button until the Controller LCD display indicates an operational message.

Note: Only power-up the instrument in a hydrogen-free environment.

After power is on the instrument automatically enters an Initialization mode that lasts approximately ten minutes. During this time the LCD displays a countdown to completion and the lighted indicator closest to the Probe Tip is orange (See Figure 2-2) until the following operations complete:

- Heat the Wide Range Sensor® to operating temperature.
- Perform system self-test.
- Zero the sensor reading.

Figure 2-2: Startup LED

Upon successful completion the instrument automatically switches to Normal operation and the Probe tip LED turns green. If an error is detected the instrument will display an Error Status (see Section 2.8).

Figure 2-3: Unit Ready LED

2.4 Shutdown

To power-down the unit press and hold the **ON/OFF** button for approximately 2 seconds until the Controller LCD display turns off.

2.5 Battery Level

After powering up the **BATTERY** LED indicates the current battery level: *(times may vary as battery ages)*

- GREEN – more than one hour of operation remaining
- ORANGE – approximately 15 to 60 minutes of operation remaining
- RED – less than approximately 15 minutes of operation remaining

2.6 Normal Operation

During Normal Operation the instrument is detecting and reporting hydrogen concentration near the Probe Tip Sensor. Hydrogen readings are displayed on the Controller LCD as well as on the Probe Tip LED bar graph array. Note that due to the extreme sensitivity of the sensor, it may take more than one minute to return to a near zero (less than

0.001%) reading after exposure to hydrogen. If the instrument doesn't return to an indication of less than 0.001% after 5 minutes in a hydrogen-free environment then invoke the Reset operation (See Section 2.9).

2.6.1 Hydrogen Concentration—LCD Display

The upper line of the Controller LCD indicates a numerical value or range for the percent hydrogen concentration or peak hydrogen value. The lower line is used to display the hydrogen meter, a logarithmic bar graph ranging from 0.001% (10 ppm) to 100% hydrogen by volume. An open box on the bar indicates the last peak value obtained and filled boxes indicate current value. Figure 2-4 shows how to interpret the hydrogen meter:

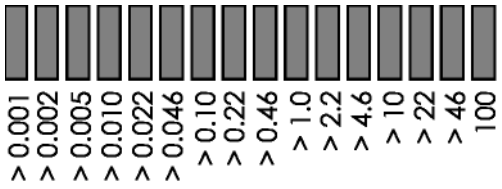

Figure 2-4: Lower Line LED Bar Graph

2.6.2 Hydrogen Concentration—Probe Tip

The Probe Tip LED Indicator can be used to show an increase or decrease in hydrogen concentration.

Leak detection is accomplished by watching the Probe Tip LED and moving the sensor around a potential hydrogen leak. During the leak check:

1. The Probe Tip LED turns red and remains red when the most recent peak hydrogen concentration is being detected.
2. The increase in hydrogen concentration will also be indicated by the increasing number of yellow LEDs powering on in the LED bar graph array.
3. When the Probe Tip LED turns orange, this indicates that there is still hydrogen present, but the hydrogen concentration is

decreasing and the sensor has moved away from the hydrogen leak.

4. Moving the sensor back towards the potential location of the hydrogen leak will cause the Probe Tip LED to turn red.
5. Continue moving the sensor into the area that causes the Probe Tip LED to turn red until the source of the hydrogen leak is located.

The color of the Probe Tip LED indicates:

GREEN: Unit ready, hydrogen concentration is less than 0.001% (10ppm)

ORANGE: System startup or hydrogen detected (0.001 to 100%)

RED: New peak hydrogen concentration detected

The number of yellow LEDs powered on in the Probe LED bar graph indicates hydrogen concentration as shown in Figure 2-5.

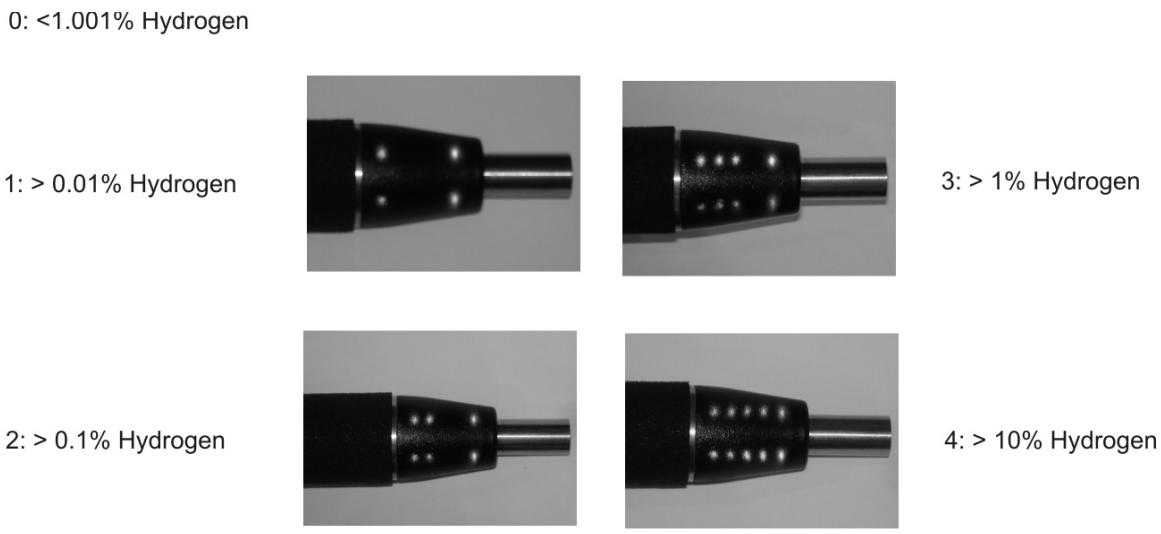

Figure 2-5: Hydrogen Concentration Indication at the Probe Tip

Figure 2-6 shows the Probe Tip indicating a peak hydrogen concentration detected greater than 10%. The Prob Tip LEDs will be red and four yellow bar graph LEDs will illuminate.

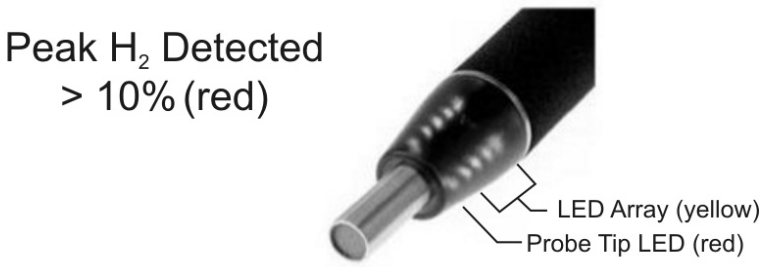

Figure 2-6: Peak Hydrogen Detected LED

2.7 Keypad

The keypad is used to alter the display or initiate special functions as follows:

- Pressing ▲ (up arrow button) will display the peak hydrogen reading.
- Pressing ▼ (down arrow button) will display the current percent hydrogen concentration.
- Pressing ► (right arrow button) will clear the peak hydrogen value.
- Pressing and holding ◄ (left arrow button) will invoke the Zero Operation (see Section 2.10).
- Pressing and holding ◄ ► (left and right arrow buttons simultaneously) will invoke the Reset operation (see Section 2.9).
- Pressing and holding the **ENTER** button will invoke the Configuration Menu (see Section 2.11).

2.8 Controller LCD Error Status

The following Error Messages can appear on the display:

Sensor Error – Unit has detected a failure to communicate with the Probe.

broken – Unit has detected a unit internal failure

See Section 5.4 for troubleshooting

2.9 Reset Operation

The Reset Operation is used to speed recovery from hydrogen exposure. This operation can be invoked from the keypad during Normal Operation by Pressing and holding ◄ ► (left and right arrow buttons simultaneously) or from the Configuration Menu (see Section 2.11). Once invoked the user is asked to confirm the operation by pressing the ENTER key, pressing any other key will abort the operation.

Note: The instrument must be in a hydrogen free environment with the LCD indicating less than 0.1% hydrogen before invoking the Reset operation.

During Reset the LCD indicates a countdown to completion and the Probe tip LED will be yellow.

2.10 Zero Operation

The Zero Operation is used to zero the hydrogen reading if the instrument is reporting low levels (0.001% to 0.01%) of hydrogen when no hydrogen is present. This operation can be invoked from the keypad during Normal Operation by pressing and holding ◄ (left arrow button) or from the Configuration Menu (see Section 2.11). Once invoked, the user is asked to confirm the operation by pressing the ENTER key, pressing any other key will abort the operation.

Note: The instrument must be in a hydrogen free environment with the LCD indicating less than 0.1% hydrogen before invoking the Zero operation.

2.11 Configuration Menu

The Configuration Menu is used to display and modify instrument settings and can be entered by pressing and holding the **ENTER** button. The configuration parameters are summarized below with details in the

following sections. The keypad is used to navigate the menu as shown in Table 2-1.

Table 2-1: Navigation Button Functions

Key	Navigation	Editing Values	Query Answer
ENTER	Enter submenu	Select Value	Yes
▲	Previous Menu	Increase Value	No
▼	Next Menu	Decrease Value	No
►	Enter Submenu	Move Cursor Right	No
◄	Exit Submenu (Back)	Move Cursor Left	No
◄ ►	Exit Configuration	Undo Changes	No

The functions accessible from the Configuration Menu are:

- Information Display
- Reset Sensor
- Zero Sensor
- Field Calibrate
- Exit

These functions are described in the following sections. Figure 2-7 shows how to navigate through the Configuration Menu.

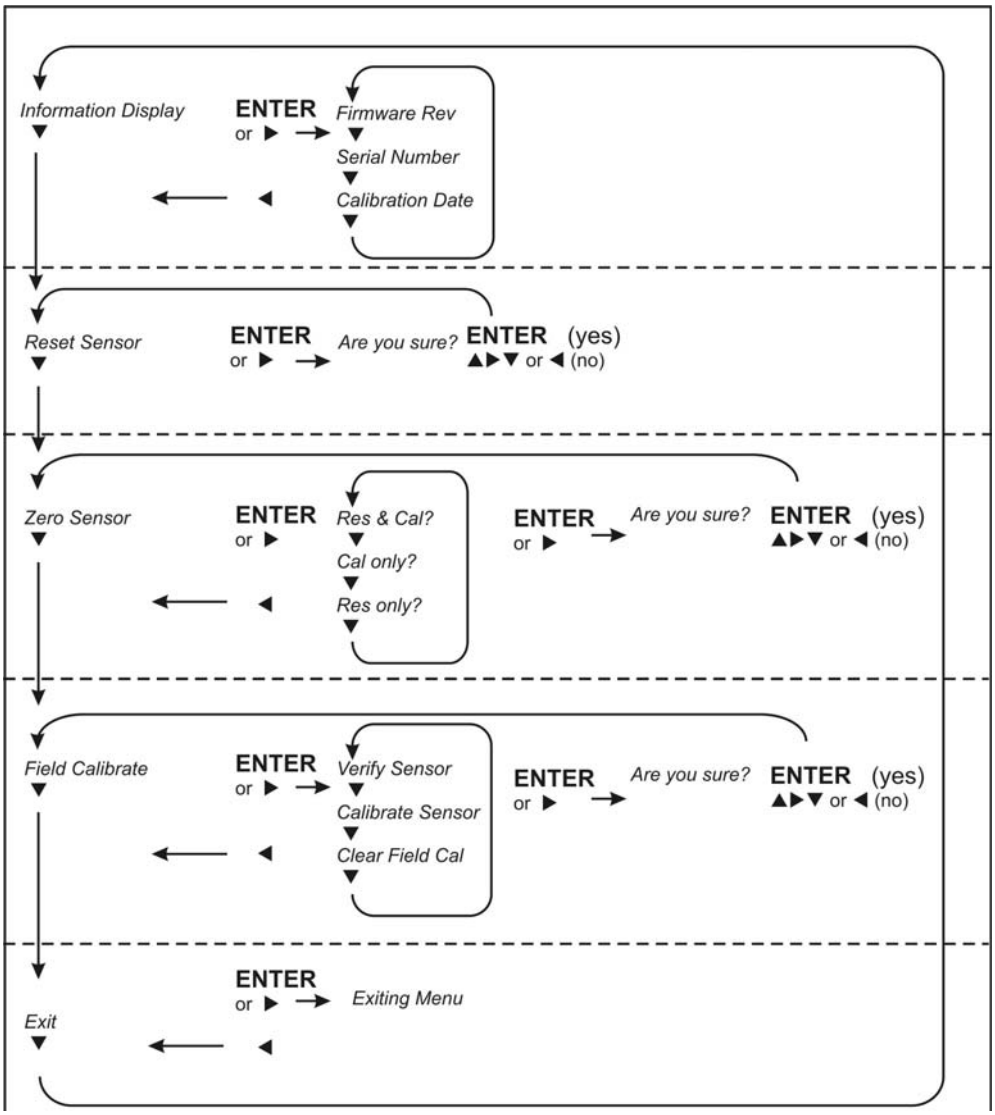

Figure 2-7: Configuration Menu Navigation

2.12 Information Display

The Information Display (Information Disp.) menu allows the user to view useful information about the instrument including firmware revisions, serial number, and calibration date.

Firmware Rev: Displays the sensor pod and controller firmware. The left most number preceded by an 'S' is the

Probe firmware revision. The right most number preceded by a 'C' is the Controller firmware revision. For example: *S 1.23 C2.34* for Probe firmware version 1 .23 and Controller firmware version 2.34

Serial Number: Displays the product serial number. For example: *50123*

Calibration Date: Displays the date of last factory calibration, MM/DD/YY. For example: *5/8/06* for 8 May 2006.

2.13 Reset Sensor

The Reset Sensor menu is used to invoke the Reset Operation as described in Section 2.9.

2.14 Zero Sensor

The Zero Sensor menu is used to invoke the Zero Operation as described in Section 2.10.

2.15 Field Calibrate

The Field Calibrate menu shows the date of the last field calibration and allows the user to invoke the Verify, Calibrate, and Clear functions.

Verify Sensor: Press ENTER to invoke the Verify function (see Section 3.4).

Calibrate Sensor: Press ENTER to invoke the Calibrate function (see Section 3.5).

Clear Field Cal: Press ENTER to invoke the Clear function (see Section 3.6).

Field Verification and Calibration

3.1 Gases

Verification or calibration requires the availability of the following certified gases:

- 2.00% hydrogen by volume in air (20,000 ppm)
- 0.1% hydrogen by volume in air (1000 ppm)
- Zero grade, hydrogen-free air, ambient air can be used instead of certified zero grade air if the user has high confidence that it is a hydrogen-free environment.

3.2 Gas Connection

Gases are applied to the unit thru the use of the Calibration Cup Assy. (P/N 50000009) available from manufacturer.

3.3 Numerical Changes

In the following sections when queried to change a numeric value the ▲ (up arrow) and ▼ (down arrow) keys are used to increment/decrement the value based on the selected digit. If the ones digit is selected the value will increment/decrement by one (9 increments to 10, 10 decrements to 9). The ◄ (left arrow) and ► (right arrow) keys are used to select another digit. To change a value of 0 to 100 first select the hundreds digit then press the ▲ up arrow. Pressing ◄ ► (the left and right arrows simultaneously) will clear any changes made and restore the previous value. Once the correct value is displayed press the ENTER key to save it.

3.4 Verify Sensor

The Verify function allows the user to check the instrument's calibration. If Verify is successful then the user is asked to enter the new

verification date. If Verify fails the field calibration values are erased, restoring the last factory calibration.

To perform the verify test:

Table 3-1: Verify Calibration Procedure

Step	Display	User Response
1	*Hydrogen <0.001% H2*	Press **ENTER**.
2	*Information Disp.*	Press ▼
3	*Reset Sensor*	Press ▼
4	*Zero Sensor*	Press ▼
5	*Field Calibrate XX/XX/XX*	Press **ENTER** or ►
6	*Verify Sensor*	Press **ENTER**
7	*Verify Sensor Are you sure?*	Press **ENTER** to verify sensor, or any other key to exit.
8	*Verify Sensor in Progress*	Verify Test begins
9	*Apply 0.000% H2 Are you sure?*	With the Calibration Cup that accompanies the instrument, apply hydrogen-free, ultra-zero air to the Probe sensor. The Probe Tip LED will remain Green. Press **ENTER**.
10	*Apply 0.000% H2 In Progress*	0% Verify Test starts
11	*Apply 0.000% H2 Settle*	Checking sensor temperature.
12	*Apply 0.000% H2 Wait xxxx*	Wait for sensor reading to stabilize, until xxxx = 0.
13	*Apply 0.000% H2 Finding Average*	Measuring sensor response to test gas.
14	*Apply 0.100% H2 Are you sure?*	With the Calibration Cup, apply 0.1% hydrogen (balance air) to the Probe sensor. The Probe Tip LED will change from Green to Red. One (or two) yellow LEDs in the LED Bar Graph Array will turn on. Press **ENTER**.
15	*Apply 0.100% H2 In Progress*	0.1% Verify Test starts

Step	Display	User Response
16	*Apply 0.100% H2* *Settle*	Checking sensor temperature.
17	*Apply 0.100% H2* *Wait xxxx*	Wait for sensor reading to stabilize, until xxxx = 0.
18	*Apply 0.100% H2* *Finding Average*	Measuring sensor response to test gas.
19	*Apply 2.000%H2* *Are you sure?*	With the Calibration Cup, apply 2.0% hydrogen (balance air) to the Probe sensor. The Probe Tip LED will remain Red. Three yellow LEDs in the LED Bar Graph Array will turn on. Press **ENTER**.
20	*Apply 2.00% H2* *In Progress*	2.00% Verify Test starts
21	*Apply 2.00% H2* *Settle*	Checking sensor temperature.
22	*Apply 2.00% H2* *Wait xxxx*	Wait for sensor reading to stabilize, until xxxx = 0.
23	*Apply 2.00% H2* *Finding Average*	Measuring sensor response to test gas.
24	*Enter Date:* *1.0000 M*	Enter the current month (1-12) using the▲ (up arrow) and▼ (down arrow) keys.
25	*Enter Date:* *1.0000 D*	Enter the current day (1-31) using the▲ (up arrow) and▼ (down arrow) keys.
26	*Enter Date:* *6.0000 Y*	Enter the current year (7=2007, 12=2012, etc.) using the▲ (up arrow) and▼ (down arrow) keys.
27	*Verify Sensor* *Passed*	Verify is complete, press any key.

Note the following:

1. If the unit passes verification, calibration is not required at this time. The Verify Function stops at this point.
2. If the unit fails verification, TAI recommends calibration. Continue with the following steps.

Step	Display	User Response
28	*Verify Sensor Error:*	The Verify Test has failed. Calibration is recommended. With the Calibration Cup, apply hydrogen-free, ultra-zero air to the Probe sensor. Wait for the LED Bar Graph array in the Probe to show only one (or zero) yellow LEDs. Press **ENTER**
29	*Field Calibrate XX/XX/XX*	Press ▼
30	*Exit*	Press ▼
31	*Information Disp.*	Press ▼
32	*Reset Sensor*	Carry out the Reset function to speed the recovery from hydrogen exposure to move on to Calibration. Press **ENTER.**
33	*Reset Sensor Are you sure?*	Press **ENTER**
34	*Reset Sensor In Progress*	During Reset, the Probe Tip LED will be orange.
35	*Reset Sensor Done*	Press **ENTER**
36	*Reset Sensor*	Press ▼
37	*Zero Sensor*	Press ▼
38	*Field Calibrate XX/XX/XX*	Press **ENTER** or ►
39	*Verify Sensor*	Press ▼
40	*Calibrate Sensor*	Press **ENTER** to perform field calibration. Go to Step 8 of Section 3.5.

3.5 Calibrate Sensor

The Calibrate function allows the user to perform a field calibration of the instrument. After Field Calibration TAI recommends running the Verify Function. To carry out a Field Calibration follow the procedure listed in Table 3-2.

Table 3-2: Field Calibrate Procedure

Step	Display	User response
1	*Hydrogen <0.001%H2*	Press **ENTER**
2	*Information Disp*	Press ▼
3	*Reset Sensor*	Press ▼
4	*Zero Sensor*	Press ▼
5	*Field Calibrate XX/XX/XX*	Press **ENTER** or ►
6	*Verify Sensor*	Press ▼
7	*Calibrate Sensor*	Press **ENTER**
8	*Calibrate Sensor Are you sure?*	Press **ENTER** to Calibrate sensor, any other key to exit.
9	*Calibrate Sensor In Progress*	Calibration begins.
10	*Apply 0.000%H2 Are you sure?*	With the Calibration Cup that accompanies the instrument, apply hydrogen-free, ultra-zero air to the Probe sensor. The Probe Tip LED will remain Green. Press **ENTER**.
11	*Apply 0.000%H2 In Progress*	0% Calibration starts.
12	*Apply 0.000%H2 Settle*	Checking sensor temperature.
13	*Apply 0.000%H2 Wait xxxx*	Wait for sensor reading to stabilize until xxxx = 0.
14	*Apply 0.000%H2 Finding Average*	Measuring sensor response to test gas.

Step	Display	User response
15	*Apply 0.100%H2 Are you sure?*	With the Calibration Cup, apply 0.1% hydrogen (balance air) to the Probe sensor. The Probe Tip LED will change from Green to Red. One (or two) yellow LEDs in the LED Bar Graph Array will turn on. Press **ENTER**.
16	*Apply 0.100%H2 In Progress*	0.1% Calibration starts.
17	*Apply 0.100%H2 Settle*	Checking sensor temperature.
18	*Apply 0.100%H2 Wait xxxx*	Wait for sensor reading to stabilize until xxxx = 0.
19	*Apply 0.100%H2 Finding Average*	Measuring sensor response to test gas.
20	*Apply 2.000%H2 Are you sure?*	With the Calibration Cup, apply 2.0% hydrogen (balance air) to the Probe sensor. The Probe Tip LED will remain Red. Three yellow LEDs in the LED Bar Graph Array will turn on. Press **ENTER**.
21	*Apply 2.000%H2 In Progress*	2.0% Calibration starts.
22	*Apply 2.000%H2 Settle*	Checking sensor temperature.
23	*Apply 2.000%H2 Wait xxxx*	Wait for sensor reading to stabilize until xxxx = 0.
24	*Apply 2.000%H2 Finding Average*	Measuring sensor response to test gas.
25	*Calibrate Sensor Done*	Calibration is complete. Press **ENTER**.
26	*Field Calibrate XX/XX/XX*	Press ▼
27	*Exit*	Press ▼
28	*Information Disp*	Press ▼
29	*Reset Sensor*	Carry out the Reset function to speed the recovery from hydrogen. Press **ENTER**.

Step	Display	User response
30	*Reset Sensor Are you sure?*	With the Calibration Cup, apply hydrogen-free, ultra-zero air to the Probe sensor. Wait for the LED Bar Graph array in the Probe to show only one (or zero) yellow LEDs. Press **ENTER**.
31	*Reset Sensor In Progress*	During Reset, the Probe Tip LED will be orange.
32	*Reset Sensor Done*	Press **ENTER**
33	*Reset Sensor*	Press ▼
34	*Zero Sensor*	Press ▼
35	*Field Calibrate XX/XX/XX*	Press **ENTER** or ►
36	*Verify Sensor*	With a successful calibration, TAI recommends that the user run the Verify Test. Press **ENTER**. Go back to Section 3.4, Step 7.

If a "Calibrate Sensor Error" message appears, continue with the steps below:

Step	Display	User response
37	*Calibrate Sensor Error*	Calibration failed. With the Calibration Cup, apply hydrogen-free, ultra-zero air to the Probe sensor. Wait for the LED Bar Graph array to show only one (or zero) yellow LEDs. Press ENTER.
38	*Field Calibrate XX/XX/XX*	Press ▼
39	*Exit*	Press ▼
40	*Information Disp.*	Press ▼
41	*Reset Sensor*	Carry out the Reset function to speed the recovery from hydrogen exposure. Press **ENTER.**
42	*Reset Sensor Are you sure?*	Press **ENTER**
43	*Reset Sensor In Progress*	During Reset, the Probe Tip LED will be orange.

Step	Display	User response
44	*Reset Sensor Done*	Press **ENTER**
45	*Reset Sensor*	Press ▼
46	*Zero Sensor*	Press ▼
47	*Field Calibrate XX/XX/XX*	Press ENTER or ►
48	*Verify Sensor*	Press ▼
49	*Calibrate Sensor*	Press **ENTER** to repeat Field Calibration. Go back to *Step 8* of *Section 4.5.*

3.6 Clear Field Calibration

The Clear function restores the instrument to the last factory calibration. Once entered into the Clear function (see Section 2) the user is prompted thru the verification routine as follows:

Table 3-3: Clear Function Procedure

Step	Display	User response
1	Clear Field Cal Are you sure?	Press ENTER to clear field calibration values, any other key to exit.

Hydrogen Sensing Considerations

From any given source, hydrogen gas disperses rapidly and generally upward due to the very low density of hydrogen compared to air. Understanding this behavior allows the operator to more effectively search for hydrogen leaks.

If the sensor element is near (and above) the leak, the concentration will likely be higher but the leak may be difficult to locate. As hydrogen dissipates (generally above the leak) the concentration decreases. Generally, greater distances will increase the chance of intercepting the leak stream, but if the sensor is too far away, the response may be too weak to detect.

When drafts or air currents are present, hydrogen will tend to be dispersed. Testing for hydrogen leaks downwind of the leak area may increase the chance of detecting the leak.

If hydrogen is rising in an enclosed building (where there may be a layer of hot air near the ceiling) the hot air near the ceiling may have a lower density and act to retard the hydrogen from continuing to rise as rapidly as it did in lower layers of air. Thus, sensing hydrogen near ceiling areas with high temperatures present may not be as effective.

Low temperatures can also affect the behavior of hydrogen. Hydrogen stored in a liquid state is at an extremely low temperature. The low temperature of any escaping hydrogen will be of a higher than normal density and may initially move downward. As the hydrogen warms, it will begin to rise upward. When checking for a leak in areas where liquid hydrogen is stored, check both above and below the area of concern.

Maintenance

5.1 Routine Maintenance

Aside from normal cleaning and battery charging, routine maintenance is limited to calibration verification and recalibration. For verification and calibration procedures, refer to Sections 3.4 and 3.5. There are no user-serviceable items inside the instrument.

5.2 Battery Charging

To recharge the unit's battery:

1. Ensure the unit is powered OFF. Allow batteries in an extreme temperature to warm or cool to within 10-45 °C.
2. Disconnect the coiled cord from the Controller.
3. Connect the battery charger to the Controller.
4. Using the appropriate A/C plug adapter for the region of use, plug the battery charger into the A/C supply.
5. The battery charger indicator light will illuminate according to charge status as follows:
   - OFF: No battery
   - FLASHING GREEN: Fast charging
   - STEADY GREEN: Fully charged
   - STEADY ORANGE: Standby
   - FLASHING RED: Error

Note: Complete charging may take up to 4 hours for a fully discharged battery.

5.3 Cleaning

If the unit becomes soiled, clean the unit with a lint-free cloth. Use special care when cleaning the handheld probe assembly. Small debris or other material may collect over the sensor tip. Clean the tip with a gentle wiping using a clean lint-free cloth or paper.

5.4 Troubleshooting

The following table offers guideline for diagnosing and correcting common problems associated with the Model 2240.

Table 5-1 Troubleshooting

Symptom	Action
Controller LCD indicates *Sensor Error* after power on	Turn off the instrument and verify that the Probe is properly connected to the Controller.
Controller LCD indicates *broken*	Then turn off the instrument and verify that the Probe is properly connected to the Controller and that there isn't any damage to the unit.
BATTERY LED is red	Charge the battery completely; see Section 5.2.

Appendix

A.1 Specifications

Range: 0.0015% (15ppm) to 100% hydrogen by volume in air.

Response Time: Indication of hydrogen within seconds. Stabilization to final value depends on concentration.

Temperature: Ambient Operating: -0 to +40 °C
Storage: -20 to +50 °C

Power: Internal rechargeable Lithium Ion battery yields over 10 hours of operation. Battery recharge time: 4 hours with included charger.

Calibration Period: Recommended user verification on a 3 month basis and calibration on a 12 month basis.

Dimensions: See following figures (dimensions in inches).

Weight: 975 g (2.15 lb.) unit and carrying pouch
2.2 kg (5 lb.) shipping weight (unit with accessories)

Water Ingress Protection: IP64 (Dust-tight, protected against water spray from any direction).

Approvals and Ratings: CE 31 May 2007

Product Life Expectancy: 10 years

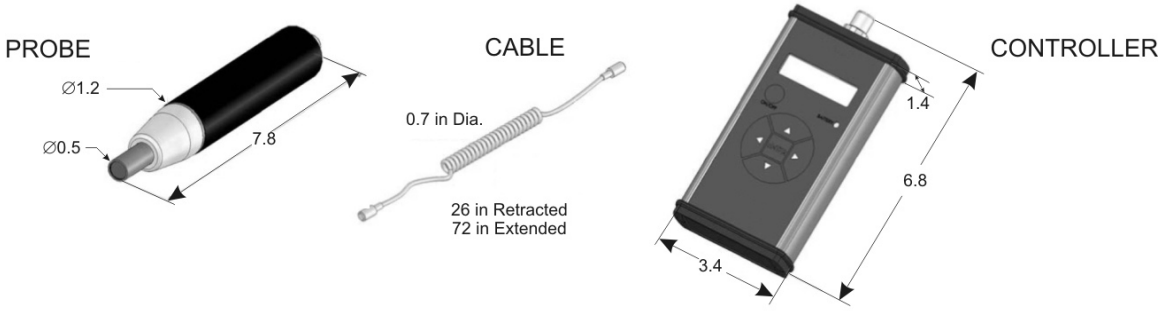

Figure A-1: Dimensions

A-2 Recommended Spare Parts

Qty.	Part Number	Description
1	P1529	Probe Assembly
1	CP2705	Controller Assembly
1	CP2706	Coiled Probe Cable
1	CP2707	Battery Charger
1	P1530	Detector Pouch
1	CP2708	Sensing System Case

A minimum charge is applicable to spare parts orders.

Note: Orders for replacement parts should include the part number (if available) and the model and serial number of the instrument for which the parts are intended.

Orders should be sent to:

TELEDYNE Analytical Instruments

16830 Chestnut Street
City of Industry, CA 91749-1580

Phone (626) 934-1500, Fax (626) 961-2538

Web: www.teledyne-ai.com
or your local representative.

Index