

Phosphine Single Zone Monitor PHSZ

Installation / Operation / Maintenance

Rev. 2.3 February 2006

US
C  Certified



Complies with
UL 61010A-1 and
CSA 22.2 No. 1010.1



Declaration of Conformity

Supplier: Spectros Instruments, Inc.
Address: 4 Evergreen Lane, #12A
Hopedale, MA 01747
Product Name: Phosphine Monitor Single Zone Monitor (PH₃)

conforms to the following specifications:

- EMC Directive 89/336/EEC
 - Low Voltage Directive 73/23/EEC
 - EN61326-1 (Electrical Equipment for Measurement)
 - EN55081-2:1993 (Radiated Emission)
 - EN50082-1:1998 (Electrostatic Electromagnetic Immunity)
-

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Introduction

How to Use This Manual

Thank you for investing in a SPECTROS INSTRUMENTS PHOSPHINE gas single zone monitor (PHSZ).

This manual provides important information on how to install, operate, and service the PHSZ monitoring unit.

Please read this manual carefully before use.

If you have a working knowledge of infrared monitors, you will find this manual useful as a reference tool. If you are new to the use of infrared monitors, you can educate yourself about the principles of infrared gas detection and the proper operation of this device by reading this manual thoroughly.

THE PHSZ MONITOR IS NOT A WORKER SAFETY CLEARANCE DEVICE!

Warning Statements

The use of the word **WARNING** in this manual denotes a potential hazard associated with the use of this equipment. It calls attention to a procedure, practice, or condition, or the like, which if not correctly performed or adhered to, could result in injury or death of personnel using this instrument.

Caution Statements

The use of the word **CAUTION** in this manual denotes a potential hazard associated with the use of this equipment. It calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in damage to the instrument.

Hazard Symbols on Monitor



This symbol indicates the need to consult this operating instruction manual when opening the enclosure.

WARNING: A potential risk exists if the operating instructions are not followed.



This symbol indicates the presence of electric shock hazards when the enclosure is opened.

WARNING: To avoid risk of injury from electric shock, do not open the enclosure.

Safety Precautions

AC Power Supply

The PHSZ uses a universal power supply that is capable of accepting inputs of 100 to 240 VAC, 50/60 Hz, 15 Watts. It is highly suggested that the monitor be connected directly to the AC power source, preferably on its own circuit (with UPS or surge protection).

A switch or circuit breaker rated 1.0 A, 250 VAC, with 3.0 mm spacing must be attached to the monitor's AC power leads. This switch must be located in close proximity to the monitor, and be in easy reach of the operator. This switch should also be clearly marked as the monitor's main AC disconnect device.

Protective Grounding

Under no circumstances should the PHSZ be operated without connection to a protective ground. Doing so poses a potential shock hazard and is also a violation of electrical safety standards applicable to this type of equipment.

Explosive Atmosphere

Do not operate this equipment in the presence of flammable liquids, vapors or aerosols. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Proper Exhaust Venting

It is imperative that the exhaust port on this instrument be vented as described in this manual. Failure to do so may constitute a safety hazard.

Working Inside Monitor

Extreme care should be exercised when accessing the interior of this instrument. Only qualified electrical maintenance personnel should perform connections and adjustments. Always de-energize the power supply before working on the interior of the instrument.

Misuse and Modifications to Monitor

The protection provided by the monitor may be impaired if the monitor is used in a manner not specified by Spectros Instruments, Inc. Changes or modifications to this monitor, not expressly approved, will void the warranty.

In Case of Malfunction

Do not continue to use this equipment if there are any symptoms of malfunction or failure. In the case of such occurrence, de-energize the power supply and contact a qualified repair technician or the nearest Spectros Instruments Service Center. Use **ONLY** the provided knockouts for electrical and communication wiring. Drilling into the box will void the warranty.

Fusing

F1, F2: 1.0A, 250V, F

Installation Category

Installation Category II, Pollution Degree II, as defined by UL.

Altitude Limit

2,000 Meters

Cleaning

To clean the outside of the case, **DO NOT USE SOAP and WATER. USE a DRY CLOTH.**

Functional Overview

General Description

Infrared monitors are specified to support compliance to federal, state and local safety codes governing emissions. Proper implementation maintains equipment efficiency, promotes safety, and protects the environment.

THE PHSZ MONITOR IS NOT A WORKER SAFETY CLEARANCE DEVICE!

The Spectros Instruments PHSZ (Phosphine Gas Monitor Single Zone) is easily programmed to continuously monitor the level of phosphine. The PHSZ displays phosphine gas being monitored, along with displaying both the current gas level and the peak gas level detected in that area on its front panel LCD. The instrument retains a log of previous readings that can be easily accessed for analysis.

An audible alarm and front panel indicators are provided to signal alarm and fault conditions, and relay contacts are provided that can be used to trigger external alarm devices in the event of a system fault. The system also includes a 4-20 mA current loop interface that can be connected to remote monitoring equipment.

The PHSZ requires only minor periodic maintenance such as the occasional replacement of filters. The instrument incorporates active diagnostics that continuously monitor the system for proper operation. A front panel indicator is provided to alert an operator of system malfunctions, and fault codes are generated that enable the operator to identify the cause of the fault.

Understanding Monitoring Levels

Effective use of this monitor requires an understanding of what constitutes reasonable alarm set points for the phosphine gas being monitored. You can reduce nuisance alarms and needless service calls if the alarm levels are set at practical limits.

Setting the monitor at these recommended alarm levels will satisfy the needs of most users. However, the ppm levels generated by system leaks into the environment are greatly influenced by the volume of air in the sampling area, air circulation, size of the leak, distance to the monitoring point, and a host of other variables. In some cases the set points may need to be adjusted either up or down to achieve effective monitoring.

Response to the Presence of Phosphine

Technically speaking, the PHSZ is a level monitor, not a gas analyzer. You must program the instrument to test for a specific respondent, and it will only return accurate concentration readings for that particular gas. The monitor will respond equally to identical concentrations of phosphine. If a leak occurs of another interfering gas type, the instrument may return deceptive readings.

Suggested Location of Sampling Point

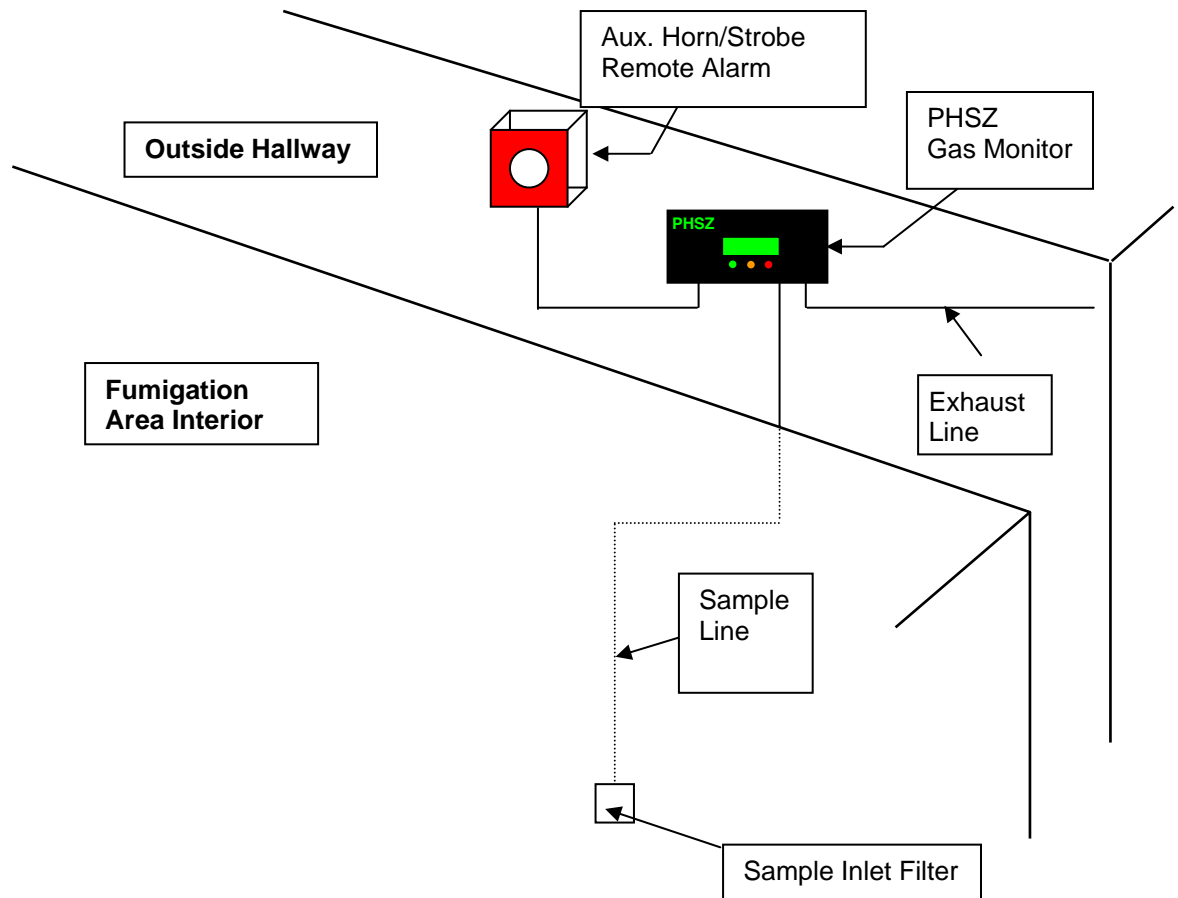
As phosphine is dispersed into the air, the gas molecules diffuse causing a dilution of the original concentration. The PHSZ measures the phosphine concentration at the point the sample is collected. Therefore, if the termination of the collection line is not at the exact point of the phosphine source, then the monitor will read a diluted mixture of the phosphine gas and air.

It should also be noted that phosphine gas is heavier than air and tends to collect below the point of the source. Therefore a sample taken near the floor will have a greater concentration of gas than that collected above the source.

The PHSZ should be mounted outside of the phosphine area. This is the “split architecture design” for safety of the operator. The monitor should be readily accessible for easy visual monitoring and servicing. If the area around the monitor is not well ventilated, then an optional exhaust line can be run to an outside location.

It may be necessary to perform a “smoke” test to determine the best monitoring point. The smoke test would provide the pattern of air currents present in the room.

PHSZ Gas Monitor Placement



Installation

Installation Considerations

Warnings and Cautions

WARNING: Drilling holes in the PHSZ enclosure will void the warranty. Please use knockouts provided for electrical connections.

WARNING: Do not mount the PHSZ in an area that may contain flammable liquids, vapors or aerosols. Operation of any electrical instrument in such an environment constitutes a safety hazard.

WARNING: Always disconnect AC power before working inside monitor.

CAUTION: The PHSZ contains sensitive electronic components that can be easily damaged. Be careful not to touch or disturb any of these components.

Inspection

The PHSZ has been thoroughly inspected and tested prior to shipment from the factory. Nevertheless, it is recommended that the monitor be re-checked prior to installation. Inspect the outside of the enclosure to make sure there are no obvious signs of shipping damage. Open the enclosure and inspect the interior of the monitor for loose components that may have become dislodged during shipment. If damage is discovered, please contact the nearest Spectros Service Center for assistance.

Locating the Monitor

Since the monitor uses ambient air to zero its gas sensor, the monitor should be located in an area that normally does not contain phosphine gas. An exhaust line is to return the gas sample to the fumigation gas chamber.

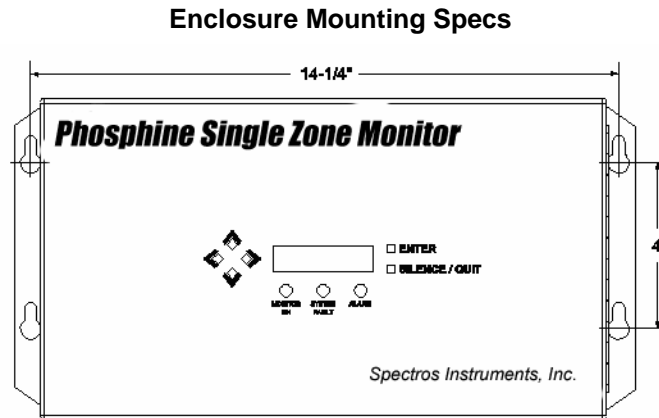
The PHSZ should be operated in an environment that is between 0 and 50 °C, has a relative humidity of between 5 and 90% non-condensing, and is at an altitude of no more than 2,000 meters. The area should also be relatively free of dirt, grease, and oils that could adversely affect the operation of the monitor.

The location should allow the monitor to be easily accessible for visual monitoring and servicing.

Mounting Instructions

The PHSZ should be installed plumb and level and securely fastened to a rigid mounting surface.

The enclosure utilizes keyhole mounting brackets designed for #12 pan head screws. Locate the four screws as shown in the diagram below and leave the screw heads protruding approximately 3/16".

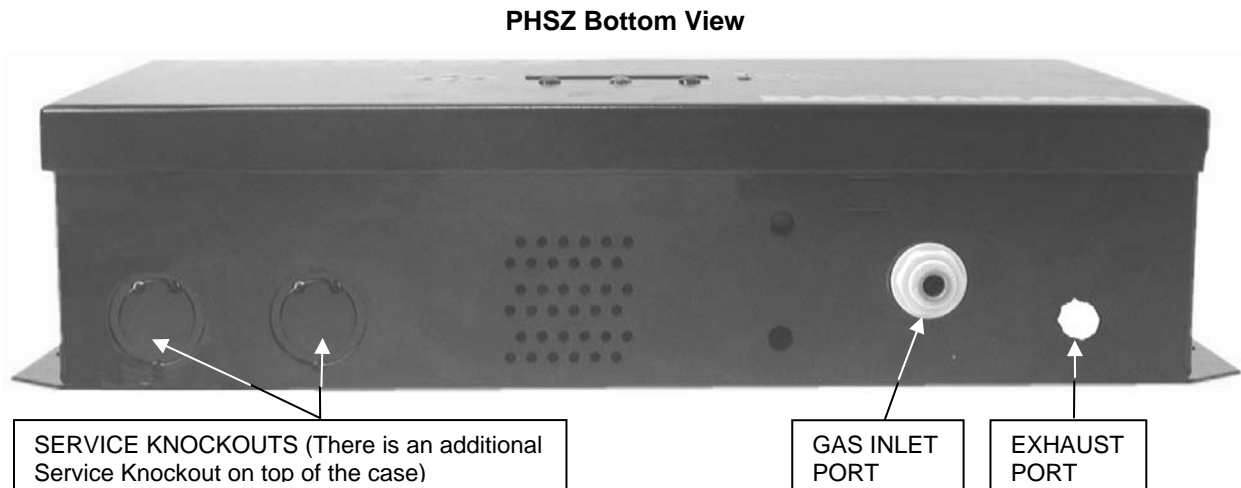


Hold the monitor flat against the mounting surface and allow it to slide down engaging the screw heads in the keyhole slots of the mounting brackets. Adjust the screws as necessary to hold the monitor securely against the mounting surface.

Connecting Gas Sample and Exhaust Lines

Overview

A single gas-sample line needs to be run from the PHSZ to the area of the facility to be monitored. An exhaust line is installed to return sampled phosphine gas from the monitor back to the chamber. All air-line connections are made on the bottom of the enclosure as shown in the illustration below.



Tubing Considerations

1/4" outside diameter (0.040" wall) flex tubing is used for all air lines or equivalent. The tubing should be clean and free of moisture or other contaminants. The tubing should be cut cleanly with a sharp knife and care should be taken not to distort the tubing end.

Connecting the Gas-Sample Line

To connect the gas-sample line to the monitor, simply push the tubing into the Gas Inlet Port. All tubing bends should have a radius of no less than 5" to insure proper airflow. If kinks or obstructions occur in the line the instrument may not function properly.

Please refer to Section *Suggested Location of Sampling Point* (Page 4) to learn more about where to take a sample.

The end of this line should be positioned to reduce the possibility of mists, aerosols, oil, water, dust, or other contaminants being drawn into the instrument. A termination filter (should be attached to the end of the gas-sample line.

IMPORTANT: DO NOT plug the gas-sample line. Plugging the line will give the monitor a false indication during start-up.

CAUTION: The introduction of contaminants through the gas-sample line can result in serious and permanent damage to the monitor.

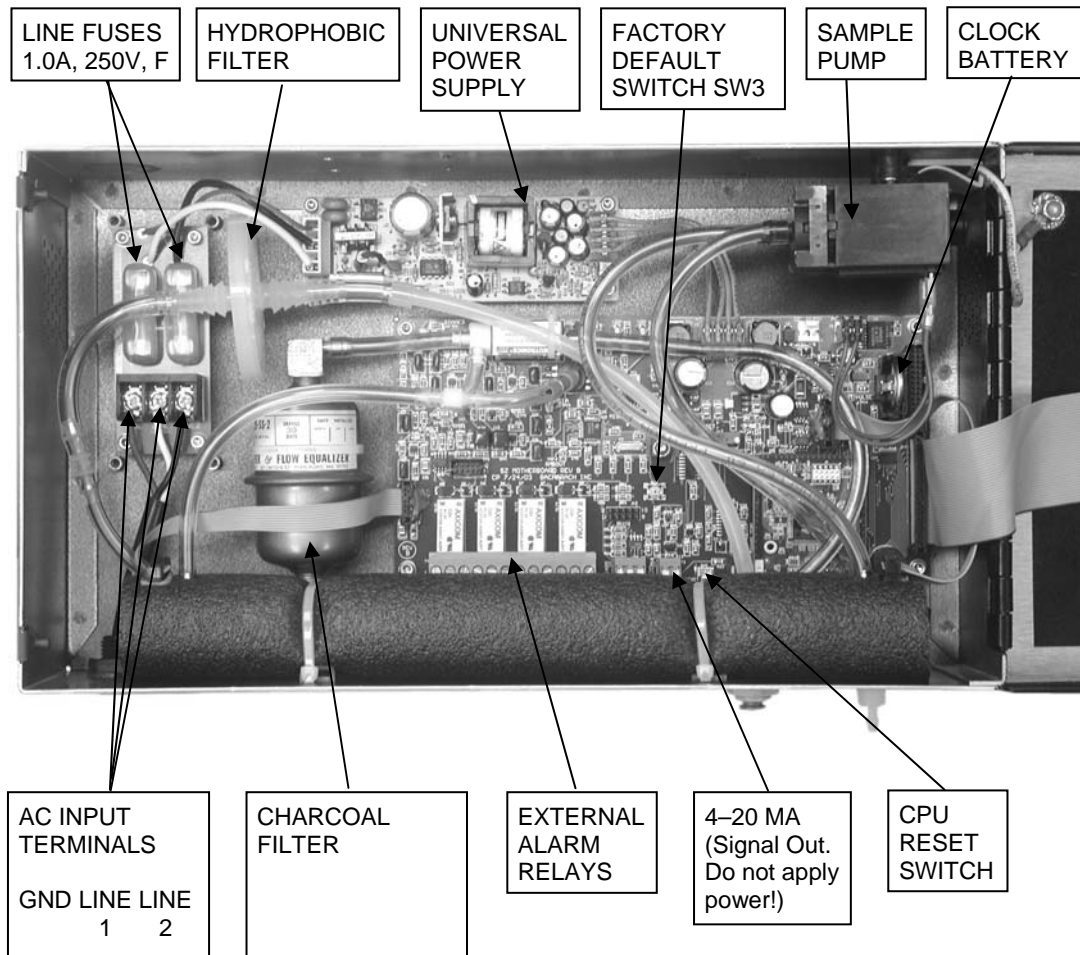
Connecting the Exhaust Line

An exhaust line is required.

The exhaust line functions to carry the exhausted gas sample away from the monitor and return it to the fumigation chamber. It should not exceed **100 feet** in length. Connect the exhaust line to the monitor by firmly pushing the tubing onto the Exhaust Port's barbed fitting. This line does not require a termination filter. Position the tubing so that no water or moisture can enter the line.

Interior Schematic

Interior Schematic



Electrical Wiring

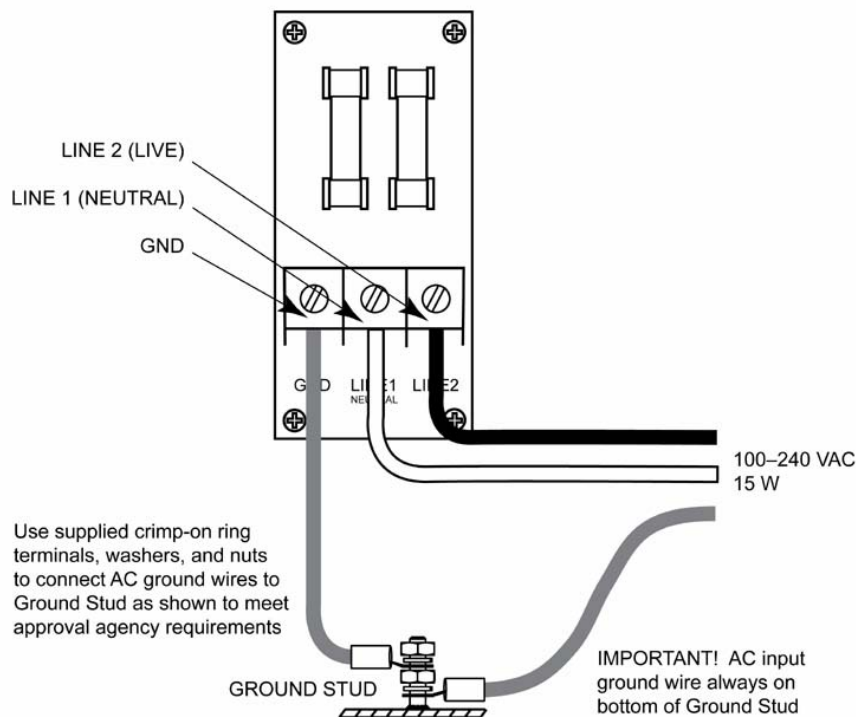
The PHSZ uses a universal power supply that is capable of accepting inputs of 100 to 240 VAC, 50/60 Hz, 15 Watts. The monitor should be connected directly to the AC power source, preferably on its own circuit. The connection should be completed with UL approved multi-conductor wire (14-18 AWG), rated 300 VAC, 105 °C.

Locate a convenient service knockout and install electrical conduit in the typical manner. Locate the AC Input Terminals on the inside of the monitor (Page 9) and secure the incoming AC power leads to the GND, LINE 1, and LINE 2 terminals as shown in the diagram below.

Using the supplied crimp-on ring terminals, washers, and nuts, connect the incoming AC power ground wire (green) to the monitor's AC Input Ground Stud, and then install a separate wire between the ground stud and the GND terminal.

A switch or circuit breaker rated 1.0 A, 250 VAC, with 3.0 mm spacing must be attached to the monitor's AC power leads. This switch must be located in close proximity to the monitor, and be in easy reach of the operator. This switch should also be clearly marked as the monitor's main AC disconnect device.

AC Power Connector Board



WARNING: Drilling holes in the PHSZ enclosure will void the warranty. Please use knockouts provided for electrical connections.

WARNING: Electrical installation should be performed by a certified electrician, and should comply with all applicable NEC/CEC and local electrical safety codes.

WARNING: Connection of the mains wiring must be made to terminals LINE1, LINE2, and GND. Under no circumstances should this monitor be operated without a protective ground. Doing so poses a potential shock hazard, and is also a violation of electrical safety standards applicable to this type of equipment.

Connecting External Alarms

Overview

The monitor includes four SPDT relays whose contacts are rated 3 A at 240 VAC. These relays are used for the connection of external alarm or control devices that are activated when its associated relay is energized. The relays are factory assigned to energize under the following conditions:

Relay #1 Event 1

Relay #2 Event 2

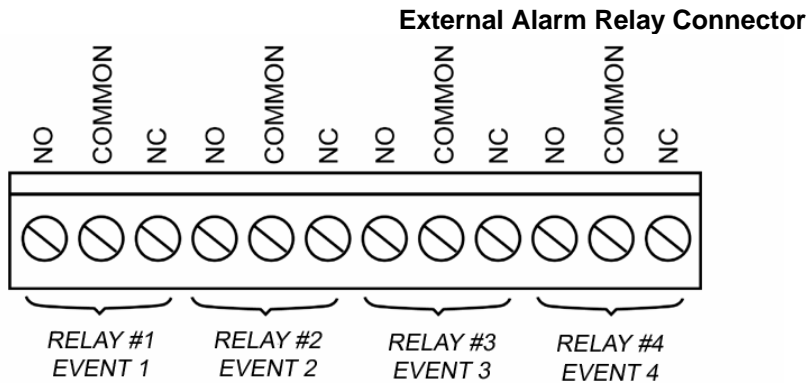
Relay #3 Event 3

Relay #4 Event 4

Connection

Use any of the service knockouts to gain cable access to the interior of the monitor. Locate the external alarm relay connector and remove it from the circuit board. Secure the leads from the external alarm device and its power source to the connector as shown in the diagram below. When you are through securing the connections, carefully plug the connector back onto the circuit board.

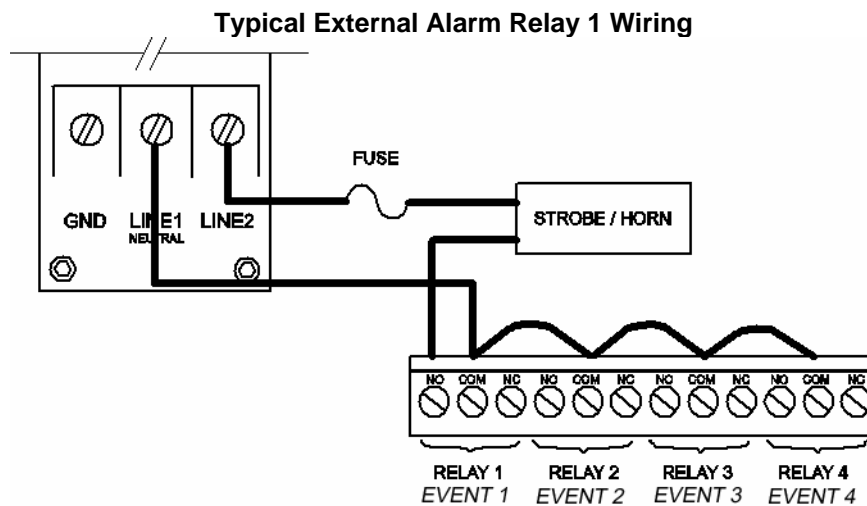
The second diagram on Page 11 shows a typical connection to Relay 1. Note how power to the alarm device is being tapped off the monitor's AC input.



Each relay may be connected as normally open (NO), or normally closed (NC).

The relay contacts are rated 3A at 250 VAC.

Power for the external alarm devices may be supplied from an external power source, or from the monitor's AC input terminal strip.



Jumper the 'Neutral' line of an external power source or the monitor's AC input to the 'Common' terminals on the relay connector.

Connect one end of the strobe or horn to the 'NO' terminal of whichever level of alarm is appropriate for the application.

The other end of the strobe or horn is connected to the other leg of the external power source. For protection, install an in-line fuse of the appropriate size and design for the external alarm device being used.

4–20 mA Current Loop Interface

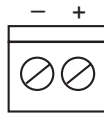
An external 4–20 mA monitoring device can be connected to the PHSZ using a shielded-twisted-pair cable. Use any of the service knockouts to gain access to the interior of the monitor. Locate the 4–20 mA connector (Page 9) and remove it from the circuit board. Secure the wire leads to the connector as shown in the diagram below. Check to make sure the polarity matches the wiring at the external device. When you are through securing the connections, carefully plug the connector back onto the circuit board.

IMPORTANT: A 100 ohm, $\frac{1}{4}$ W resistor must be connected to the 4–20 mA connector if no external monitoring device is used. Failure to install this resistor will cause loop-fault code 0010 to occur (Page 20).

The default current-to-ppm factor is set to $0.016 \text{ mA} = 1 \text{ ppm}$, providing a measurement range 0 ppm (4 mA) to 1000 ppm (20 mA). Note that the current-to-ppm factor can be changed using the monitor's **Loop Function** (Page 17).

To facilitate loop zero and span checking, note that when the **Loop Function** is selected the loop output is set to 20 mA, and upon exiting this function the loop output is set to 4 mA.

4–20 mA Current Loop Connector

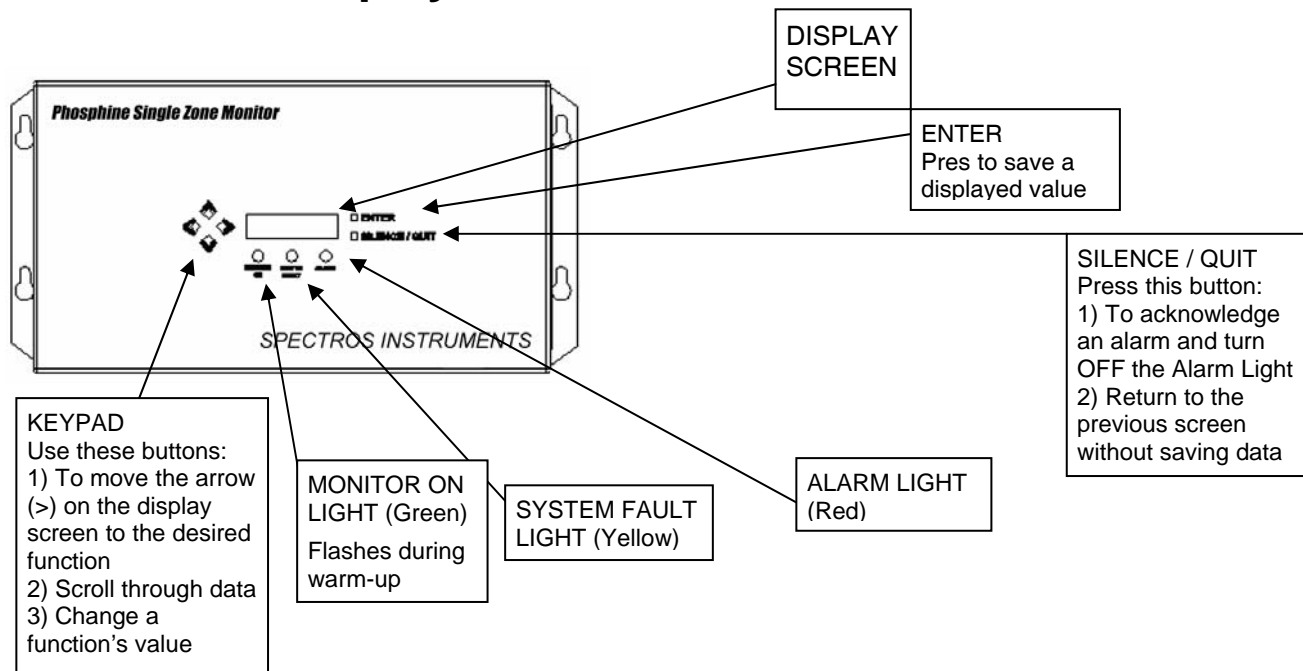


CAUTION: Never apply power to the 4–20 mA Current Loop Connector from an external power supply. Connect only a load resistor and/or a floating measurement device.

Notes:

Operation

Front Panel Display and Control



General Operation

Once installed, set up, and powered ON, the PHSZ will make measurements in the area being sampled for phosphine gas without further operator intervention. The results of those measurements are displayed on the front panel display.

```
MEASURE  005pk
          3ppm
```

In the example shown above, **MEASURE** indicates that the monitor is actively measuring for phosphine gas, and that currently 3 ppm of phosphine gas is being detected. This display also indicates that a peak measurement of 5 ppm has made.

An operator can reset the peak value to zero by pressing the **ENTER** button.

A log of up to 200 previous measurements can be viewed using the **PPM LOG** screen (Page 16).

If a system fault occurs (see Fault Code list on Page 20), the monitor responds by turning ON the front panel **SYSTEM FAULT** (yellow) light and energizing the fault relay. If the internal audible alarm is turned ON, it too will activate. An optional external alarm device can be connected to the fault relay to alert personnel that a system fault has occurred. The **SYSTEM FAULT** light will turn OFF only after the cause of the fault has been eliminated.

If the detected gas level exceeds the preset alarm point, then the monitor responds by turning ON the front panel **ALARM** (red) light and energizing the corresponding alarm relay. If the internal audible alarm is turned ON, it too will activate. Optional external alarm devices can be connected to the alarm relays to alert personnel that an alarm condition has occurred. Pressing the front panel **SILENCE / QUIT** button will acknowledge an alarm and turn OFF all alarm indicators. The alarm circuit will reactivate, however, if the alarm condition is not cleared within 5 minutes.

A log of the fault and alarm events can be viewed using the monitor's **ALARMS** and **FAULTS Functions** (Pages 16 & 17).

Display Screens

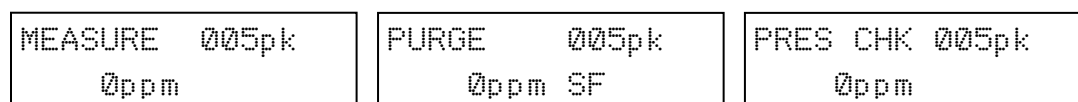
Initial Power Up

When first powered up all front panel lights are turned ON, and a splash screen appears showing the monitor's firmware revision level. After a brief moment the **Warm Up** screen is display along with the front panel **MONITOR ON** light (green) blinking.



The monitor takes 15 minutes to warm up; after which, the **MONITOR ON** light glows steady and the **Main Operating** screen is displayed.

Main Operating Screen



During normal operation, the **Main Operating** screen will be displayed as the monitor performs the following three functions:

MEASURE indicates that the monitor is actively measuring for phosphine gas. In the example screens shown above, the monitor is currently detecting 0 ppm of phosphine gas, and that a peak measurement of 5 ppm has occurred.

To reset the peak value to zero, press the **ENTER** button.

PURGE is displayed when the monitor is resetting its infrared detector to a baseline of 0 ppm using ambient air as the gas sample. This purging process is performed on an “as needed” basis, which is normally once every 6 to 8 minutes.

Note that a charcoal filter (Page 9) is present in the purge-air stream to filter out any phosphine gas that would otherwise cause the baseline level to be something other than 0 ppm.

PRES CHK is displayed when the monitor is performing an atmospheric pressure check, which is done to ensure the accuracy of the gas measurement under varying atmospheric conditions. This pressure check is performed every 30 minutes.

Function Screens

The **Function** screens are used to display stored data and set up the monitor.

To select a function, use the **Keypad** buttons to move the arrow (>) next to the desired function, and then press the **ENTER** button to select that function.

Use the **Keypad** to scroll through the displayed data or to change a parameter associated with that function. Press **ENTER** to save newly entered parameters. Press the **SILENCE / QUIT** button to return to the previous screen without saving.

If no buttons are pressed within 90 seconds the monitor returns to the **Main Operating** screen.

>PPM LOG FAULTS ALARMS DIAGNOS	>GASTYPE SPILLVL LEAKLVL EVACLVL	>LOG INT AUDALRM LOOP CLOCK
>SILENCE ZONETMP SQUELCH CAL	>P-CHK CUST K2 CUST K1 CUST K3	

PPM LOG – Contains records of the last 200 measurements made by the monitor. Each record shows the measurement's date, time, and ppm level. Note that the interval at which the measurements are logged is determined by the **LOG INT Function**.

```
#025      005PPM @  
11/07/03  15:35
```

Use the **Keypad Up** and **Down** buttons to change the record number by a factor of 1. Use the **Right** and **Left** buttons to change the record number by a factor of 10. Press **SILENCE / QUIT** to return to the previous screen.

The example of record #025 shows that a level of 005 ppm was measured on 11/07/03 at 15:35.

ALARMS – Contains records of the last 30 alarm events. The most recent alarm is displayed when the **Alarm** screen is first displayed. After 30 events have been recorded, the newest record overwrites the oldest. Each record displays the date and time the alarm occurred. Use any of the **Keypad** buttons to scroll through the other alarm records. Press **SILENCE / QUIT** to return to the previous screen.

```
#03      ALARM @  
11/10/03  15:06
```

The example of record #03 shows a fault event that occurred on 11/10/03 at 15:06.

FAULTS – Contains records of the last 30 fault events. The most recent fault is displayed when the **Fault** screen is first displayed. After 30 events have been recorded, the newest record overwrites the oldest. Each record lists an event's numeric fault code (refer to *Working with System Faults* on Page 19) plus the date and time the fault occurred. Use any of the **Keypad** buttons to scroll through the other fault records. Press **SILENCE / QUIT** to return to the previous screen.

```
#15 <1000> @  
11/10/03  12:37
```

The example of record #15 shows that a Purge Flow Fault <1000> occurred on 11/10/03 at 12:37.

DIAGNOS – Displays the monitor’s two diagnostic screens. Use the **Up Arrow Keypad** button to toggle between the two screens. Refer to *Working with the DIAGNOS Function* (Page 21).

```
4.26500v <0000>
24.5cD 14.00psi
```

```
0.4ppm 0.00
0.00002au 4.260v
```

SILENCE – Used to enter the time period the internal audible alarm and external alarm/fault devices are turned OFF when the front panel **SILENCE** button is pressed. The factory default 300 seconds (5 minutes). Use the **Keypad** to enter the desired time period, and then press **ENTER** to save that value and return to the previous screen.

```
SILENCE TIMEOUT
0300 sec
```

ZONETEMP – Used to enter the temperature of the area being monitored in °C, thus giving a more accurate ppm reading. The factory default is 25 °C. Use the **Keypad** to enter the desired temperature, and then press **ENTER** to save that value and return to the previous screen.

```
TEMP AT ZONE =
25 degC
```

SQUELCH – Sets a value of between 0.0 and 99.9 ppm that prevents the display of measurements below that value. Factory default is 0 ppm. For example, if the squelch setting is set to xxx ppm, then the monitor will not display measurements that are below xxx ppm. Use the **Keypad** to enter the desired value, and then press **ENTER** to save that value and return to the previous screen.

```
SQUELCH BELOW
xxxppm
```

CAL – Used to change a calibration factor for a specific gas. This function is to be used ONLY with instructions from a Spectros Service Center. Factory default is 1.000.

```
MB CALFACTOR
1.000
```

LOG INT – Sets the interval at which measurements are logged to memory from 1 to 9999 minutes. Factory default is 10 minutes. Note that the logged measurements can be viewed using the **PPM LOG Function**. Use the **Keypad** to enter the desired value, and then press **ENTER** to save that value and return to the previous screen.

```
LOG INTERVAL IS
0010 min
```

LOOP – Use to adjust the loop factor of the 4–20 mA current loop. Factory default is 0.016 mA per ppm, which provides an output range of 0 ppm (4 mA) to 1000 ppm (20 mA). Use the **Keypad** to set the desired loop factor, and then press **ENTER** to save that value and return to the previous screen.

```
EDIT LOOP FACTOR
0.016 ma/PPM
```

To facilitate loop zero and span checking, note that when the **Loop Function** is selected the loop output is set to 20 mA, and upon exiting this function the loop output is set to 4 mA.

AUDALRM – Allows the monitor’s internal audible alarm to be associated with any function of the monitoring system. Factory default is OFF. Use the **Keypad** to select the desired audible alarm function, and then press **ENTER** to save that value and return to the previous screen.

```
AUDIBLE ALARM IS
OFF
```

Audible Alarm Settings: OFF, ANY ALARM, SYSTEM FAULT, LEAK ALARM, SPILL ALARM, EVAC ALARM, MONITOR STOPPED

NOTE: MONITOR STOPPED indicates there is a critical system fault, and the monitor is no longer functioning correctly.

CLOCK – Sets the monitor’s date and time. Use the **Keypad** to enter the correct date and time, and then press **ENTER** to save those values and return to the previous screen. Note that time is displayed in a 24 hour format, while the date is displayed as mm/dd/yy.

```
SET DATE & TIME
11/10/03 15:30
```

GASTYPE – Phosphine (PH₃)

```
PHSOPHINE
```

P-CHK – This **Pressure Check Function** displays the current manifold pressure and the stored ambient pressure in psia, along with the difference between these two pressures and the current fault code. Refer to *Working with the P-CHK Function* (Page 23).

```
14.07 * AMB14.05
-0.02dif <1000>
```

CUST K1, K2 & K3 – Used to enter custom calibration data for a blend of phosphine gases that is not part of the monitor’s standard calibration. Before using this function, the operator must contact the factory and provide information about the blend of phosphine to be monitored. Custom calibration data will then be supplied to enable the PHSZ to accurately monitor that particular blend of gases.

```
CUSTOM CAL K^1
XXXX.XXX
```

```
CUSTOM CAL K^2
YYYY.YYY
```

```
CUSTOM CAL K^3
ZZZZ.ZZZ
```

Working with Gas Alarms

Functional Overview

If the phosphine ppm level in the area being monitored exceeds its preset **ALARM LEVEL** external alarm device may activate and the monitor’s internal audible alarm may sound if those features have been enabled (Pages 11 & 17).

Once the alarm circuit has been activated, it will remain active even if the detected phosphine level drops below all alarm levels.

Silencing a Gas Alarm

To silence a gas alarm, press the **SILENCE / QUIT** button. This causes the internal audible alarm and all external alarm devices that are connected to the alarm relays to turn OFF for a period of time as set by the **Silence Function** (Page 17). The front panel **ALARM** indicator remains ON as an indication that an alarm condition still exists. The alarm circuit will reactivate at the end of the silence period if the detected Phosphine level is still above the Alarm set point.

Viewing the Gas Alarm Log

From the **Main Operating** screen, use the **Keypad** buttons to place the arrow (>) on the display next to the **ALARMS Function**. Then press **ENTER** to display the alarm log.

The alarm log shows the type of alarm, plus the date and time it occurred. If **CLEAR** is displayed, this indicates that an alarm was acknowledged at the date and time shown.

Immediately after selecting the **ALARM Function**, the most recent alarm event is displayed. In the example below, record #03 shows that an Alarm occurred on 11/10/03 at 15:06. Note that if more than 30 alarm events have occurred, then the newest event overwrites the oldest.

```
#03      ALARM @
11/10/03 15:06
```

Working with System Faults

Functional Overview

If a system malfunction occurs, the PHSZ will detect the problem and light the front panel **SYSTEM FAULT** indicator. Additionally, an external alarm device may activate and the monitor's internal audible alarm may sound if those features have been enabled (Pages 11 & 17).

The **SYSTEM FAULT** indicator will continue to flash until the fault is cleared. The cause of the fault must be cleared before the monitor can resume normal operation.

Silencing a Fault Alarm

To silence a fault alarm, press the **SILENCE / QUIT** button. This causes the internal audible alarm and the external alarm device that is connected to the fault alarm relay to turn **OFF** for a period of time as set by the **Silence Function** (Page 17). The front panel **SYSTEM FAULT** indicator remains **ON** as an indication that a fault condition still exists. The alarm circuit will reactivate at the end of the silence period if the cause of the fault condition has not been corrected.

Viewing the Fault Log

From the **Main Operating** screen, use the **Keypad** buttons to place the arrow (>) on the display next to the **FAULTS Function**. Then press **ENTER** to display the fault log.

Immediately after selecting the **FAULTS Function**, the most recent fault event is displayed. The fault log identifies the type of fault, plus the date and time it occurred. In the example below, record #03 shows that a Zone Flow Fault (fault code <0800>) occurred on 11/12/03 at 08:17.

```
#03 <0800> @
11/12/03 08:17
```

The cause of the fault is identified by a numeric fault code. Pressing the **ENTER** button will convert the fault code into a text description of that fault. Use the **Keypad** buttons to scroll through the 16 possible fault descriptions. If the fault code is a combination of two or more faults, then each of the individual fault text descriptions will be displayed. For example the fault code <1800> represents the combination of both a Zone Flow Fault <0800> and a Purge Flow Fault <1000>. The following two fault descriptions will then be displayed:

```
FAULT CODE<1800>
12     ZONE FLOW
```

```
FAULT CODE<1800>
13     PURGE FLOW
```

Fault Codes

<0001> Box Temperature Fault: Enclosure temperature is outside normal range (or IR detector has failed). Check the installation to verify that the monitor is not being subjected to extreme temperatures. Verify that the ventilation holes are not obstructed. Use the **DIAGNOS Function** to check the Box Temperature.

<0002> Bench Temperature Fault: Optical bench is outside normal operating range (or IR detector has failed). Check the installation to verify that the monitor is not being subjected to extreme temperatures.

<0004> - Manifold Pressure Fault: The manifold pressure is outside normal operating range (or IR detector has failed). Enter the **DIAGNOS Function** and record ALL data. Call the factory with this information for further instructions.

<0010> Loop Fault: The 4–20 mA current loop is open, or there is a high resistance in the circuit. Check the wiring to the load/monitoring circuit. If this feature is not being used, a jumper wire must be connected to the 4–20 mA connector (Page 12).

<0100> Zero Filter Fault: A purge filter failure has occurred.

<0200> Gain Set Fault: The digipot autotune sequence has failed. This fault will only occur on first boot up or after a firmware upgrade. Call the factory for further instructions.

<0400> A/D Fault: A fault has occurred in the analog-to-digital circuitry. Contact the factory with this information for further instructions.

<0800> Zone Flow Fault: Check for a kinked gas-sample line or a blockage in the line-end filter. Also check for a failed pump.

<1000> Purge Flow Fault: Check that the internal charcoal filter inlet (Page 9) is not blocked. Once the blockage has been cleared, the monitor will return to normal operation after the monitor completes a purge cycle.

<4000> Zero Fault: The IR detector's output voltage is out of tolerance. Enter the **DIAGNOS Function** and record ALL data. Call the factory with this information for further instructions.

<8000> Clipping Fault: The detector voltage may be out of tolerance. Use the **DIAGNOS Function** to check the IR detector voltage. Call the factory with this information for further instructions.

FAULT CODES ARE ADDITIVE. For example: A fault code of <1800> indicates that both a Purge Flow Fault <1000> and a Zone Flow Fault <0800> have occurred.

Clearing the PPM Log, Alarm & Fault Data

Up to 200 phosphine gas ppm measurements, and 30 alarm and fault events are stored by the monitor. This stored data can be viewed by the operator using the **PPM Log, Alarms and Faults Functions** (Page 16).

To clear ALL stored data, press the **Keypad Right Arrow** button while holding down the **ENTER** button.

Reset to Factory Default Settings

NOTE: Performing this function wipes out all program parameters, alarms, faults, and ppm log files.

Cycle the AC power OFF then ON. Listen for beep and then release switch. If needed, reprogram the PHSZ to the desired settings.

Factory Default Settings

Parameter	Factory Default
4–20 mA Factor	0.016 mA/ppm
Bench Voltage	4.200
Calibration Factor	1.000
Evacuate Alarm	5 ppm customer define
Gas Type	Phosphine
Leak Alarm	ppm customer defined
Log Interval	10 minutes
Silence Timeout	300 seconds (5 minutes)
Alarm Level.....	ppm customer defined
Squelch.....	0 ppm
Zone Temperature	25 °C

Working with the DIAGNOS Function

Overview

The **DIAGNOS Function** displays sensor data and status information useful to a service technician for troubleshooting various fault conditions. Explanations of the data shown in these screens are given below.

Keypad Functions

From the **Main Operating** screen, use the **Keypad** buttons to place the arrow (>) on the display next to the **DIAGNOS Function**. Then press **ENTER** to display the first of two **Diagnostic** screens.

Press the **Keypad Up Arrow** button to toggle between the **First** and **Second Diagnostic** screen.

First Diagnostic Screen

0. 4ppm 0. 00	PPM Level	µMole/Liter
0. 00002au*4. 250v	Avg. Absorption Unit	Detector Voltage

PPM Level – Parts Per Million Level is the current detected gas level, and is the volume concentration referenced to standard temperature and pressure.

Average Absorption Unit – This is the optical absorbency. In the absence of phosphine the absorbency is 0.00000 au. When sampling phosphine, its value varies proportionally with the phosphine concentration.

μMoles/Liter – This is the absolute concentration in micro-moles per liter of phosphine.

Detector Voltage – This is a running average of the IR detector’s bench voltage as displayed in the second Diagnostic screen.

Purge Valve – The purge valve can be opened and closed by pressing the **Left Arrow Keypad** button. An asterisk appears on the display when the purge valve is open.

Second Diagnostic Screen

4.26500v <0000> 24.5cD* 14.00psi	Bench Voltage Detector Temperature °C	Fault Code Pressure Reading
-------------------------------------	--	--------------------------------

Toggle between displaying the Bench Voltage and the Noise value, and the Detector Temperature and Box Temperature by pressing the **Keypad Right Arrow** button.

0.00250n <0000> 29.5cB* 14.00psi	Noise Box Temperature °C	Fault Code Pressure Reading
-------------------------------------	-----------------------------	--------------------------------

Bench Voltage – This is the current peak-to-peak output of the IR detector. In the absence of phosphine this value can range from 3.90000V to 4.50000V.

Noise –The Noise value is a 16 point running average of the noise portion of the IR detector’s output. This reading is valuable mainly when phosphine is NOT present.

Detector Temperature – This is the current detector temperature in °C.

Box Temperature – This is the current internal enclosure temperature in °C.

Fault Code – Current fault code. A value of <0000> indicates that no faults are being detected.

Pressure Reading – This is the pressure as measured every purge cycle with the sample pump off and the gas-sample inlet open. Its value is weather and altitude dependent and can range from 10.0 to 15.5 PSIA.

Purge Valve – The purge valve can be opened and closed by pressing the **Left Arrow Keypad** button. An asterisk appears on the display when the purge valve is open.

Working with the P-CHK Function

Overview

The **P-CHK Function** (Pressure Check Function) (Page 18) is useful to a service technician for troubleshooting a flow fault problem. The monitor will trigger a flow fault if the pressure drop from ambient is less than 0.2 psi during a purge cycle, and 0.5 psi during a measurement cycle.

Keypad Functions

The **Left Arrow Keypad** button toggles the purge valve open and closed. Note that an asterisk (*) appears when the purge valve is open (purging).

The **Down Arrow Keypad** button toggles the pump ON and OFF.

Pressing the **ENTER** button stores the current manifold pressure shown on the left to the ambient pressure shown on the right (must be done with the pump OFF).

Screen Display

14.07 * AMB14.05	Current Manifold Pressure	Stored Ambient Pressure
-0.02dif <1000>	Pressure Difference	Fault Code

Current Manifold Pressure – Current manifold pressure in psia.

Stored Ambient Pressure – Stored ambient pressure in psia.

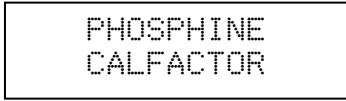
Pressure Difference – The difference between the current manifold pressure and the stored ambient pressure.

Fault Code – Current fault code (Page 19).

Working with the Calibration Function

Adjusting Calibration Factor

From the **Main Operating** screen, use the **Keypad** buttons to place the arrow (>) on the display next to the **CAL Function**. Then press **ENTER** to display the **Calibration** screen.



PHOSPHINE
CALFACTOR

With the **Calibration** screen displayed, use the **Keypad** buttons to enter the new calibration factor.

Press **ENTER** to save this value.

Notes:

Maintenance

Warnings and Cautions

WARNING: Always disconnect AC power before working inside the instrument.

CAUTION: When working inside the instrument, be very careful not to dislodge any electrical wiring or pneumatic tubing. The PHSZ contains sensitive electronic components that can be easily damaged. Be careful not to touch or disturb any of these components.

Charcoal Filter

The charcoal filter (Page 9) removes phosphine gas from the purge-air stream during the purging process. Replace the charcoal filter about every 6 months, or after the monitor itself has been exposed to unusually high levels of phosphine gas, such as after an evacuation alarm.

Hydrophobic Filter

The hydrophobic filter prevents water from entering the IR detector. A flow fault will occur (fault code <2000>) if this filter should become blocked. Replace the hydrophobic filter as required.

Servicing Air Lines

System air line(s) should be checked periodically for obvious signs of kinks, damage, and contamination. Replace the tubing as required.

The air line termination filters should be checked periodically and replaced when there are obvious signs of contamination. To service the filter simply remove it from the line and replace it with a new one.

Fuses

The PHSZ is protected from electrical damage by two, 1A, 250V, type F fuses (Page 9). Carefully remove the fuses from their fuse clips and visually inspect each fuse for damage. Replace the fuses as required.

Clock Battery

The clock battery (Page 9) maintains the correct date and time when AC power is not applied to the monitor. Replace this battery about every 2 years.

Sample Pump

The sample pump (Page 9) draws the gas sample into the monitor, through the IR detector, and discharges the sample out the monitor's exhaust port. When replacing the pump, remove its inlet and outlet tubing, disconnect the AC power wires from the pump itself, and remove pump from monitor. Install a new sample pump.

Replacement Parts & Optional Accessories

Replacement Parts

Item Description

Battery, Panasonic BR2032, 3 V
Charcoal Filter
Fuse, 1.0A, 250V, F
Hydrophobic Filter
Pump
Termination Filter (gas-sample line)
Tubing, ¼" OD (specify length when ordering)

* **WARNING:** To preserve agency approvals and maintain the safety integrity of the monitor, the battery must be replaced with the specified Spectros replacement part.

Optional Accessories

Item Description

120VAC Surge Protector
230VAC Surge Protector
4–20 mA Surge Protector
Audible Alarm, 120VAC
Audible/Visual Alarm, 120VAC
Visual Alarm, 120VAC

Appendix

Notice Regarding Phosphine & Alarm Settings

There is a danger of serious damage to health by prolonged exposure through inhalation of Phosphine.

THE PHSZ MONITOR IS NOT A WORKER SAFETY CLEARANCE DEVICE!

PHSZ Monitor provides an accurate, real-time phosphine concentration measurement. Only qualified and trained operators are, with proper use of the PHSZ Monitor able to determine real time fumigation concentrations.

Proper use of the PHSZ Monitor and certified training is always required.

Occupational Safety & Health Administration Standards (29CFR 1910) details the TWA for phosphine exposure limits

The PHSZ monitor is not intended nor will it confirm or disprove any phosphine concentration levels for structural clearance.

WARRANTY and SERVICE

Warranty

Subject to the terms herein, Seller warrants the original equipment cataloged or manufactured by the Seller and furnished hereunder is free from defects in material and workmanship, and will be of the kind and quality designated or described on the quotation. The Seller will warrant the original equipment for 12 months from the date of shipment from the manufacturing facility unless different or additional conditions are specified and shall be binding through a written contract signed by an officer of the Seller.

Seller also warrants that certain consumable parts as hereunder identified, have a one (1) year warranty period from the date of shipment and will be free from all defects in material during that period. Seller does not warrant these parts however, beyond the initial installation due to variables associated with normal usage. These certain consumable parts include, but are not limited to, the air flow filters.

If within 12 months of the date of shipment, the equipment does not meet the warranties specified above, and Purchaser notified Seller of this promptly, Seller shall there upon correct any such defects or any non-conformance to the specifications within a reasonable time period. Material found to be defective shall be returned to the seller freight prepaid. At the Seller's option, the defective material shall be repaired or replaced and returned to the purchaser via the lowest freight rate available. **Any repairs or alternations made by unauthorized personnel will automatically void warranty.**

Labor cost for warranty service at the manufacturing facility is the Seller's responsibility for a period of 90 days following date of shipment. Beyond 90 days, Purchaser is responsible for all labor costs. Purchaser must contact the Seller's Service Department prior to shipment and obtain a Return Authorization (RA) number. The package must be clearly marked with the assigned RA number. Purchaser may elect to have Seller's Service Department repair the equipment at Purchaser's facility. Parts will be free under the above terms, but there will be a charge for labor and travel expenses from Seller's facility.

The conditions of any tests or equipment hereunder alleged to be defective shall be mutually agreed upon and Seller shall be notified of, and may be present or represented at all tests that may be made. Seller's liability to Purchaser or that of Seller's Agent/Representative, arising out of the supplying of the equipment or its use, whether based on warranty, contract, or negligence shall not in any case, exceed the cost of correcting defects in the equipment as herein provided but shall, in all events, be limited to a maximum of the purchase price. Upon the expiration of the applicable warranty period mentioned above, all such liability shall terminate. The foregoing shall constitute Purchaser's sole remedy and Seller's sole liability. **IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

**Register Your Warranty by Visiting
www.SpectrosInstruments.com**

Service

Pursuant to the stated warranty, Spectros Instruments, Inc. warrants the products to be free of manufacturers defect for one (1) year from the date of shipment or installation and will replace any part free of charge during that period. Labor beyond ninety (90) days of shipment or installation is subject to charge. **FAILURE TO LOCATE THE PHSZ IN A LOCATION COMPATIBLE WITH THE CRITERIA SET FORTH IN THIS MANUAL CONSTITUTE ABUSE OF THE EQUIPMENT AND MAY VOID THE WARRANTY.** Shipments are tracked by the factory and the purchaser will be responsible for providing acceptable documentation to prove the installation date. **FAILURE TO NOTIFY THE FACTORY WITHIN TWO (2) WEEKS OF INSTALLATION OF THE EQUIPMENT WILL VOID THE COVERAGE OF THE LABOR SPECIFIED IN THE WARRANTY.** Should any of the products covered (refer to following section - Products Covered under Warranty and Service Policy) incur a failure or damage contact the factory service department and request instructions.

Return Procedure

To return equipment to the factory for repair a Return Authorization (RA) number should be requested from the factory. Normal factory repair time is approximately two (2) weeks, unless special provisions have been pre-negotiated prior to the issuance of an RA number. Equipment will not be received without an RA number. Returned equipment should be sent to the factory at the following address:

Spectros Instruments, Inc.
4 Evergreen Lane, #12A
Hopedale, MA 01747
Attn: PHSZ Gas Monitor Service Department

Field Repair

Field repair of equipment will be considered after all reasonable attempts to diagnose and rectify the problem via phone or fax have been exhausted or if return of the equipment to the factory is not practical. To initiate warranty service in the field, a customer purchase order must be issued, prior to dispatch, for the estimated travel time, expenses and applicable service fees for a Spectros representative to travel to the site. Spectros will bill expenses to the customer at actual cost. The customer will be invoiced for all applicable charges for parts, labor and expense at the non-warranty rates. If it has been determined that the failure is a result of abuse of the equipment, improper installation, or failure to thoroughly read and comply with the instructions provided in the Operations and/or Service Manuals. Scheduling of all field servicing is at the discretion of the Factory Service Department and will be based upon customer need and the availability of personnel. Warranty field service shall be limited to the continental United States.

Spectros Instruments, Inc. is not liable for any charges, from the customer, purchaser or any third party that may be acting on the behalf of the purchaser, customer or end user, resulting from non-warranty field service, field upgrades, preventative maintenance, etc. Spectros Instruments, Inc. is not liable for any charges, from the customer, purchaser or any third party that may be acting on the behalf of the purchaser, customer or end user, resulting from warranty field service or repair activities unless prior approval is granted by an authorized member of Spectros Instruments, Inc. prior the dispatch and performance of the field service or repair activity. This is to include but not limited to: manpower requirements for Spectros Instruments, Inc. and/or non-Spectros personnel to perform or assist with the field service or repair activity.

Specifications

- Product Type..... Phosphine gas monitoring system for continuous monitoring of Phosphine gases.
- Coverage..... Single zone
- Monitoring Distance..... up to 100 meters
- Front Panel 3 Indicator lights:
MONITOR ON – Green light ON when the unit is operating normally, or flashing during warm-up
SYSTEM FAULT – Yellow light ON when there is a system fault
ALARM – Red light ON when the gas level is above an alarm setting
- Alarms..... Four SPDT relays are provided (rated 3A, 240VAC):
 three assigned to ppm level alarms – one assigned to system faults
 Internal audible alarm programmable for any of the following conditions: system fault, leak alarm, spill alarm, evict alarm, monitoring stopped or off
- Detector Type..... Infrared, Non-Dispersive
- Response Time/Flow Rate... Dependent on gas-sample line length; 0.25" OD x 0.17" ID tubing:
- | Gas-Sample Line (Feet) | Response Time (Seconds) | Flow Rate (ml/min) |
|------------------------|-------------------------|--------------------|
| 0 | 9 | 675 |
| 10 | 13 | 664 |
| 20 | 17 | 653 |
| 30 | 22 | 642 |
| 40 | 26 | 631 |
| 50 | 30 | 620 |
- Temperature Drift..... $\pm 0.3\%$ of reading per degrees C
- System Noise Less than 40dB (A) at 10 feet
- Conditioned Signal 4–20 is current loop
- Power Safety Mode..... Fully automatic system reset; all programmed parameters retained
- Operating Temp..... 32 to 122 °F (0 to 50 °C)
- Ambient Humidity..... 5% to 90% RH (non-condensing)
- Altitude Limit 2000 Meters
- AC Power..... 100 – 240 VAC
- Power Consumption 15 Watts
- Size/Weight 14"H x 18"W x 4.7"D / 7 lbs.
- Certification UL 61010A-1, CSA 22.2, CE Mark (see inside front cover)
- Warranty..... 1 Year from date of shipment

Spectros Instruments, Inc.
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Website: www.SpectroInstruments.com