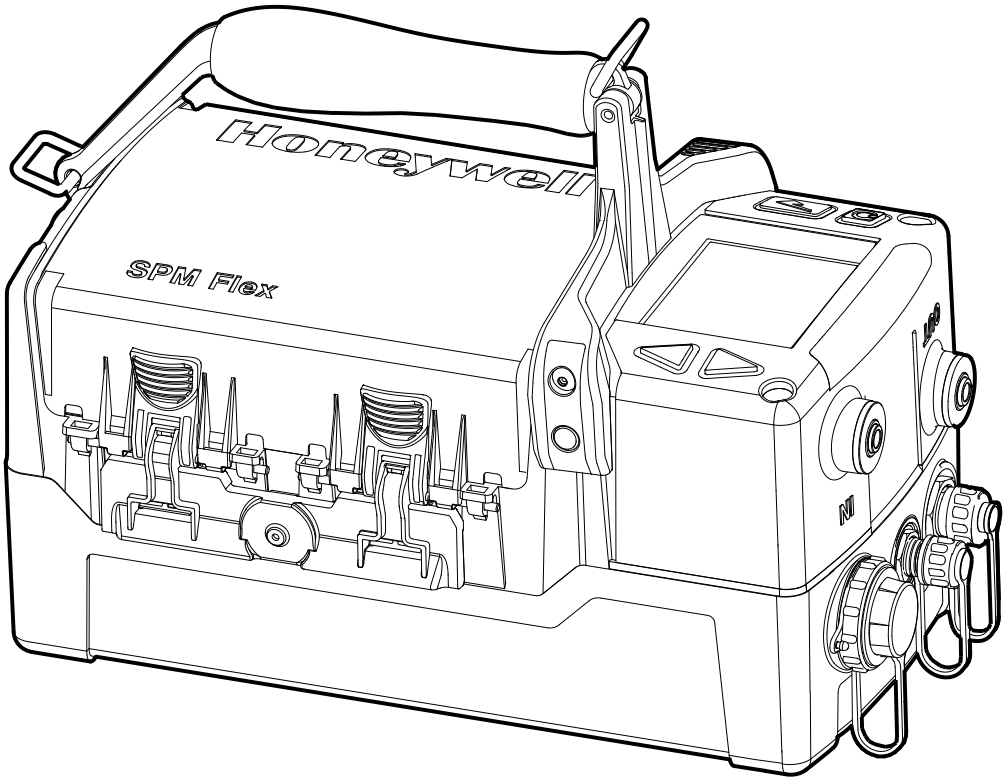
USER MANUAL

SPM FLEX

Single Point Monitor Gas Detector



Honeywell

Maintenance (continued)

Introduction

The SPM Flex gas detector is an extractive gas monitoring system that draws gas samples locally or from a remote point to a Chemcassette® tape-based optical gas detection system. A wide range of toxic gas Chemcassette cartridges are available that enable detection of gases used or generated in semiconductor manufacturing and industrial environments.

The SPM Flex gas detector, available in wall mounted and portable versions, locally displays gas concentration, alarm, fault and status information via its backlit color LCD and LEDs. A simple to use 4-button keypad adjacent to the display provides the ability to set-up, review, operate and make changes to the detector's configuration. The intuitive display and menu structure are designed to require minimal training. The SPM Flex has a local audio alarm with user-configurable output levels. The detector can be used both indoors and outdoors in a wide range of weather conditions.

The detector has flexible power and communications capabilities. These include 3 on-board relays, 4-20 mA analog output and Modbus/TCP outputs for signal and service connectivity. The gas detector is equipped with a USB port for configuration-sharing firmware updates and data downloads. For web-enabled devices, web pages are available via the Ethernet port.

Standard operation conditions

The SPM Flex gas detector is designed for use in temperatures between 32°F and 104°F (0°C and 40°C) and relative humidities between 0 and 100% (the relative humidities are limited by tape and calibration). The sample line will require additional hardware to remove moisture in high relative humidity conditions where condensing may occur (the sample must be non-condensing). Dry conditions may require humidification.

High-altitude applications

The SPM Flex pump is optimized for operation at altitudes between –1000 feet (–305 meters) and 3000 ft. (945 m) above sea level. At altitudes above 3,000 ft. (915 m), up to a maximum of 6,000 ft. (1,830 m), contact Honeywell Analytics for calibration. (At 6,000 feet, pump capacity is reduced 18% and a flow-system adjustment to the bypass valve is required. This must be performed by a Honeywell Analytics certified technician. Contact Customer Service.)

Safety Information

⚠ WARNING

Warnings contain information that could prevent injury or equipment damage.

⚠ CAUTION

Cautions contain information that could prevent equipment damage.

NOTICE

Notices contain helpful information.

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Glossary

Term	Description
4-20 mA loop	An analog communication method using a current loop to indicate concentration readings and fault status.
dB	Decibel, a unit of sound intensity
Chemcassette® cartridge	An easy-to-install case that carries Honeywell's Chemcassette tape. Cartridges are specific to different gas types/families.
Ethernet	Commonly used network technology for wired Local Area Networks.
In monitor	The detector is actively monitoring the specified gas or family of gases
Latching alarm or fault	When configured, the SPM Flex will hold the alarm or fault status active until the user performs an alarm/fault reset.
LCD	Liquid Crystal Display
LED	Light Emitting Diode
Modbus TCP	Communications protocol running over Ethernet that is commonly used for communicating with industrial devices.
Non-latching alarm or fault	An alert in which the SPM Flex will reset automatically when the condition is no longer present (i.e., the detector does not have to be reset by the user).
Out of monitor	The detector is on but idle
Relay	An electrical-operation output switch that can be used to indicate the presence of alarm and fault conditions.
RFID	Radio frequency identification; an RFID label encodes information that is readable using radio waves.
TWA	Time Weighted Average, the average exposure to a harmful gas, usually calculated over a period of eight hours (a the typical workday).
USB	Universal Serial Bus is an industry standard communications protocol and bus that is commonly available on personal computers.
VDC	Volts of Direct Current

Product Overview

The SPM Flex gas detector is available in two configurations, portable and fixed. The portable model is equipped with a handle assembly and a shoulder strap. The fixed model is supplied with a mounting bracket. If replacing an old SPM detector, a retrofit bracket is available (see "Backward-compatible mounting bracket" on page 32). All detectors are supplied with a power adaptor/charger[1] and cable, a CD containing the user manual, and a printed quick start guide.

⚠WARNING

Operate and service the SPM Flex gas detector only as specified in this manual and the accompanying quick start guide. Failure to do so may impair the protection provided by the detector and may also void the warranty.

Initial setup

Prior to use, the detector requires some minimal setup:

- Unpack the detector (save the packaging to re-use for service requests)
- Read the quick start guide and this manual
- For most gases, install a filter at the detector or at the end of a sample line (see "Detectable Gases" on page 64)

NOTICE

Retain the plugs that came in the push fittings. They will be needed when storing the detector and for certain maintenance procedures.

Portable detectors

- Connect the power adaptor/charger (in a dry, indoor location)
- Charge for at least 4 hours (the detector can be used while being charged)
- Open the detector's cover
- Remove the rocker switch cover
- Turn the rocker switch to the on position
- Replace the rocker switch cover
- Remove the paper optics card from the gate (save the card for later use)
- Install a chemcassette
- Configure the detector and begin to monitor (see "Operation" on page 38 for basic display usage)
- See "Operation" on page 38 and "Accessories and Parts" on page 67

1 CUI Inc., part number SD190-24-U-ST, listed under UL file #E210311

Fixed detectors

- Install the wall-mount bracket and mount the detector to it (see “Standard mounting bracket” on page 31)
- Wire in accordance with local electrical codes utilizing a trained electrician (see “Wiring and tubing” on page 20)
  - Input
    - Honeywell-supplied power adaptor/charger (indoor, dry location use only) or
    - 24 VDC power supply
  - Signal (as desired)
    - 4-20 mA
    - Relays
    - Ethernet
- Open the detector’s cover
- Remove the rocker switch cover
- Turn the rocker switch to the on position
- Replace the rocker switch cover
- Remove the paper optics card from the gate (save the card for later use)
- Install a Chemcassette cartridge
- Configure the detector and begin to monitor (see “” on page 14 for basic display usage)
- See “Operation” on page 38 and “Accessories and Parts” on page 67

Additional accessories

- External dust filters (required on inlet for most gases; see “Detectable Gases” on page 64.
- Tubing
- Sampling wand
- Mating signal connectors for fixed installations

The connectors and ports of a typical installation are shown in this illustration.

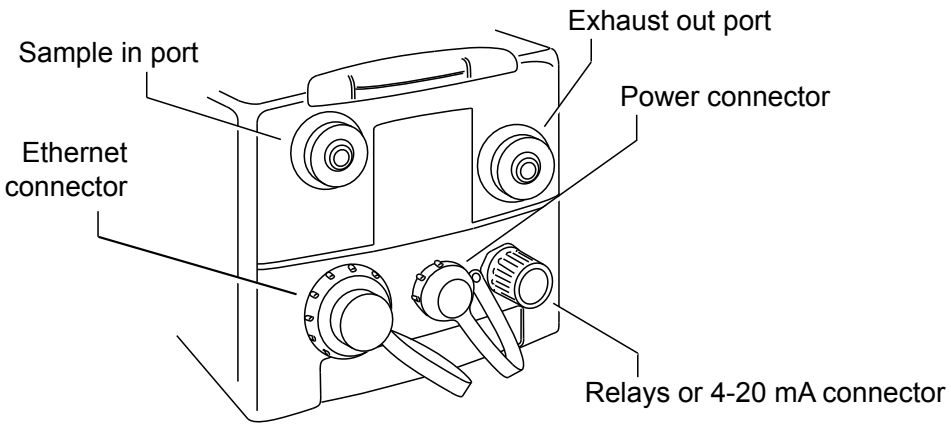


Figure 1. Connectors and ports

Battery operation

The SPM Flex gas detector is supplied with a power adaptor/charger than can connect the detector's power connection and a standard wall outlet. (Verify that the correct power adaptor/charger has been ordered for local operation.) The power adaptor/charger is designed for indoor, dry-location use only. The lithium-ion battery pack provides continuous operation of 6+ hours, depending on sampling conditions and detector configuration. The battery's charge time is typically 4 hours. The detector can be operated while its battery is being charged (this may increase the charge time). Because batteries discharge slowly when not in use, Honeywell Analytics recommends keeping the detector connected to the power adaptor/charger when not in use.

⚠WARNING

- The battery is not field-replaceable. Return the detector to Honeywell Analytics if a battery replacement is necessary.
- Risk of fire and burns. Do not open, crush, heat above 140°F (60°C), or incinerate the battery. Follow manufacturer's instructions.

Extending battery life

Power consumption is optimized to extend battery life when not in monitor mode. In addition, the detector should not be exposed to extreme temperatures which shortens battery life. The time before recharging is required can be extended by taking the detector out of monitor mode when it is not in use.

Recharging an overly-discharged battery

If the battery indicates 0% charge and does not appear to be charging when plugged into the power adaptor/charger, it may be overly discharged. Follow these steps:

1. Verify that the latest software has been installed. The detector's software version can be found by navigating to the *Software* option on the *Review* menu. If necessary, the current software can be downloaded from the SPM Flex section of the Honeywell Analytics website (see "Contact Information" on page 7). Install the new software from a USB flash drive by following the prompts in the *Update Program* option on the *Maintenance* menu.
2. Turn the detector off and then power it up again. This will reinitiate the charging circuit. Initially (until the battery reaches the normal charge range), the detector will slow charge. The process can take 6 hours.

The handle (portable model)

The detector can be conveniently carried with the optional handle, which is mounted onto the cover at three locations. If necessary, the handle can be removed by the user by removing two bolts. All of the detector's functions can be performed with the handle attached. The handle swings out of the way for access to the Chemcassette cartridge area.

Opening the cover

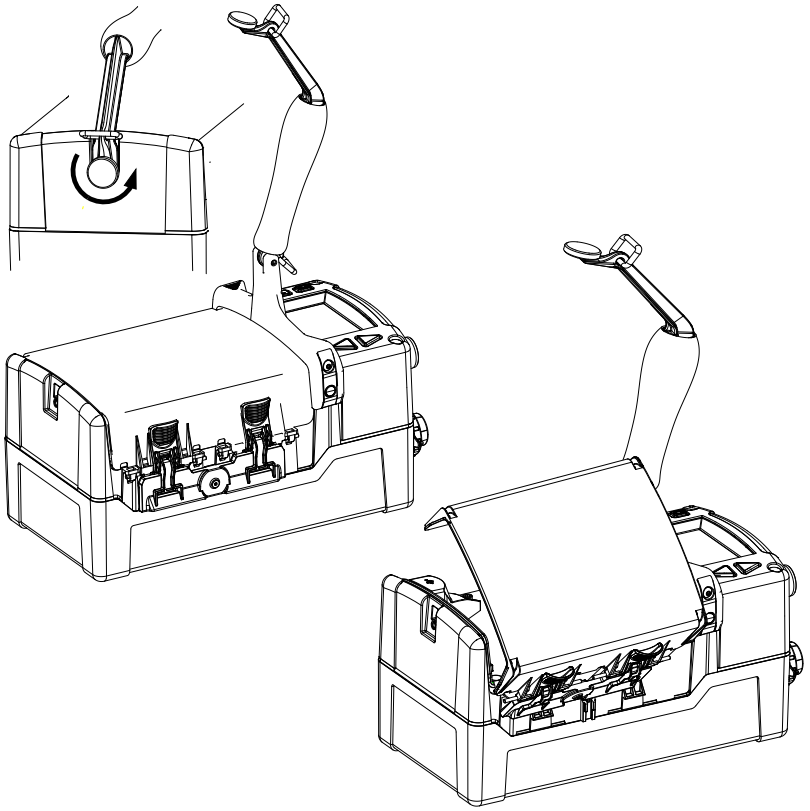


Figure 2. Opening the detector cover

Release the cover by first unscrewing the handle pin. Pivot the handle up as shown in the illustration and push down the four latches (two on each side). The detector cover will then be free to swing open, allowing a Chemcassette cartridge to be inserted or replaced, the power switch to be turned on or off, or the USB data port to be accessed.

Main power rocker switch

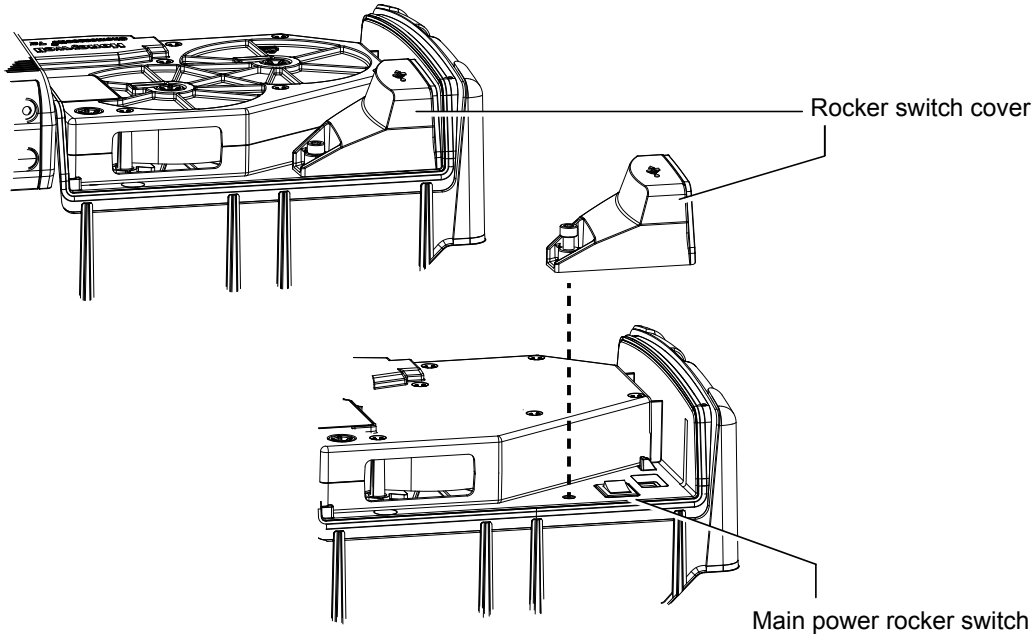


Figure 3. SPM Flex main power rocker switch

After the detector's cover is open, use a Phillips screwdriver to remove the rocker switch cover. Turn the main power rocker switch to the on position and replace the rocker switch cover.

The detector can now be turned on.

Turning the detector on and off

Press and hold the Power/Cancel button until the green LED begins blinking. The detector will begin a startup sequence that lasts about 30 seconds.

The four LEDs provide at-a-glance information about the current state of the detector:

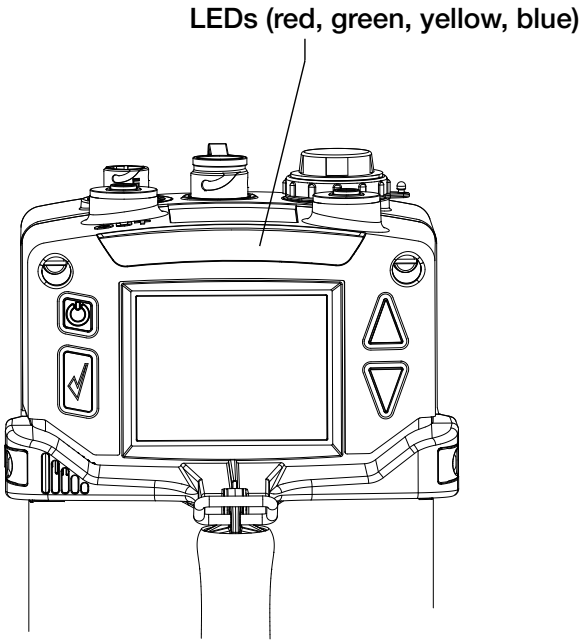


Figure 4. SPM Flex LEDs

LED		Description
Red	solid	Alarm 1
	blinking	Alarm 2
Green	blinking	The detector is active
Yellow	solid	Maintenance fault
	blinking	Instrument fault
Blue	solid	Connected to external power

To turn the detector off, press and hold the Power/Cancel button for 5 seconds or select “Power Off” from the menu. Leave the detector off at least 30 seconds before turning it on again.

Navigation

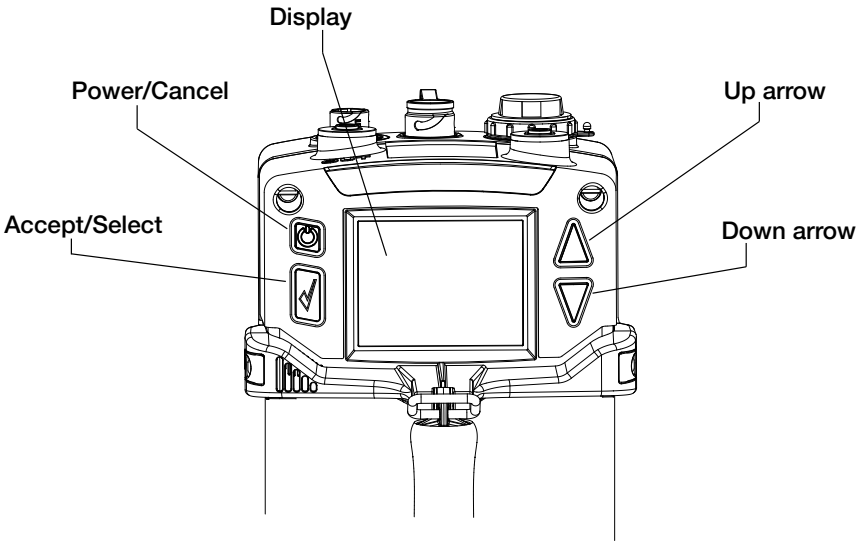


Figure 5. SPM Flex controls

All SPM Flex menus are navigated by the four buttons shown in Figure 5.

Pressing either of the arrows or the Accept/Select button will access the menu from the main display screen. The arrows also are used to scroll up and down through lists of options. The Accept/Select button is used to initiate a highlighted option. During navigation, the Power/Cancel button will cancel a command or, when pressed for more than 3 seconds, it will exit to the main display.

Display

Figure 6 shows the elements of the display that will be seen in various situations.

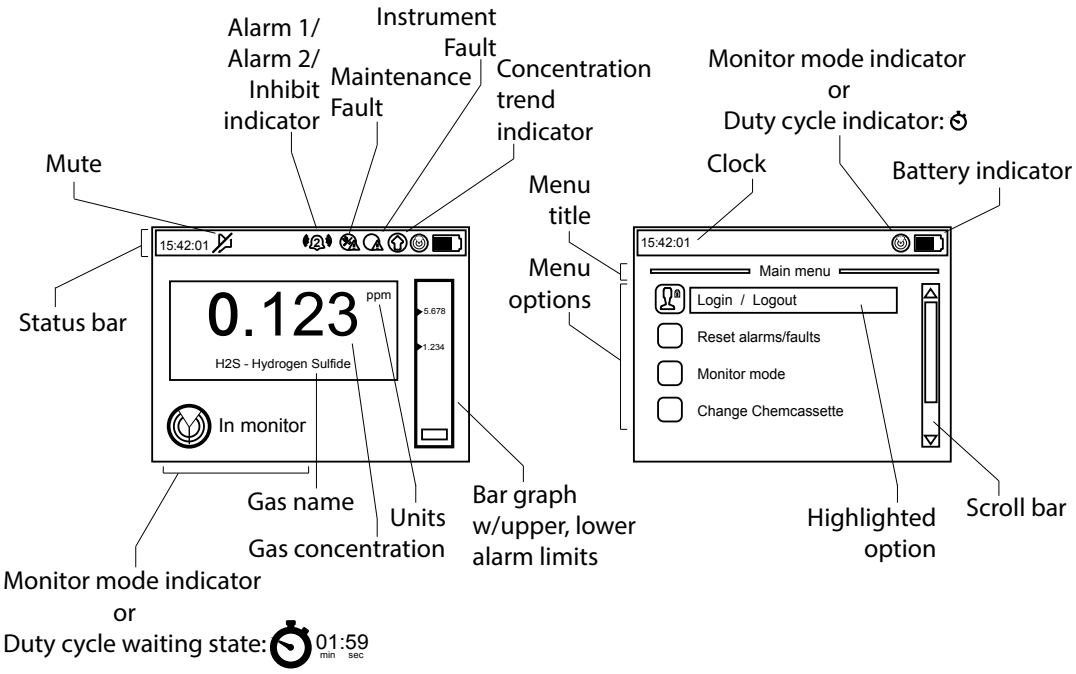


Figure 6. Elements of typical SPM Flex detector displays

The bar graph on the right shows the current concentration relative to the Alarm 1 and Alarm 2 setpoints. (The bar's range is relative to the alarm levels, not to the full scale of the selected gas).

The color of the status bar changes according to the system status (green = OK/ in monitor, yellow = fault, red = alarm, blue = Out of Monitor mode).

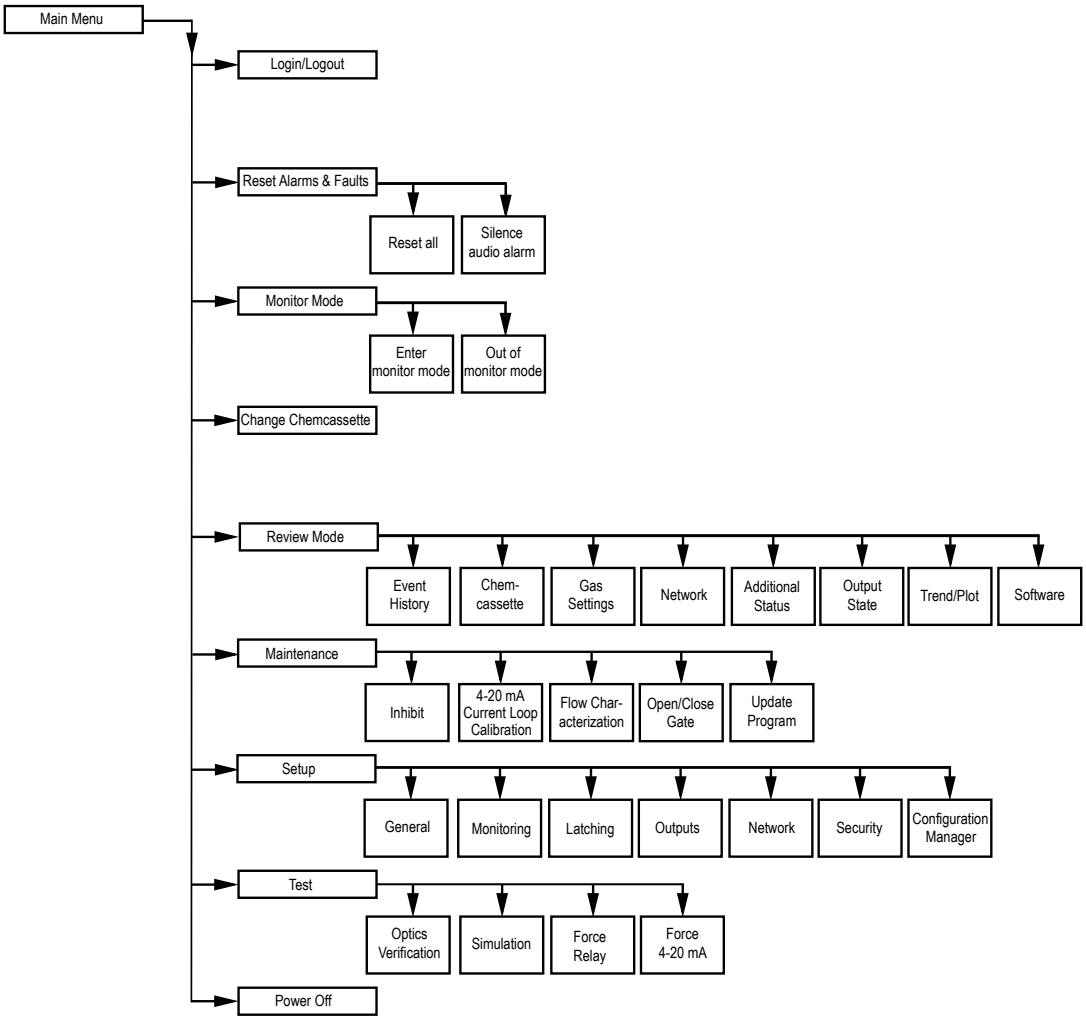
Display and navigation

Under normal operation the LCD and LED display system status, gas concentrations, and alarms. In set-up, review, calibration, and test modes, the LCD shows the relevant menu options and system status bar. The interface is navigated using the four buttons:

Control	Function
Up arrow	Scroll up through lists of options
Down arrow	Scroll down through lists of options
Accept/Select	Accept or select a highlighted option
Power/Cancel	Power/Cancel will turn the detector on if it's in the off state, will exit back to the previous menu level, and will enter Reset mode (quick press), or Power Off mode (long press and hold) from the main display.

In the main display mode, the display shows the current gas name and concentration, the monitoring states and faults and/or alarm status, if applicable.

Menu Map



The detector's menus are easily navigated. As an example, this is how a user could review the detector's gas settings when starting from the In Monitor screen:

1. Press the Up Arrow to open the Main Menu.
2. Press the Down Arrow 4 times to highlight the Review Mode option.
3. Press the Accept/Select button to enter Review Mode.
4. Press the Up Arrow or Down Arrow until the Gas settings option is highlighted.
5. Press the Accept/Select button to display the Gas Summary.

To return to the detector to the In Monitor display, press the Power/Cancel button three times to back out of the Main Menu options.

Installing a Chemcassette cartridge

Close the Chemcassette cartridge door before putting the detector into Monitor mode (this holds the Chemcassette cartridge in place). Take the detector out of Monitor mode before opening the door.

NOTE

Chemcassette cartridges must be stored according to the manufacturer's guidelines when not in use.

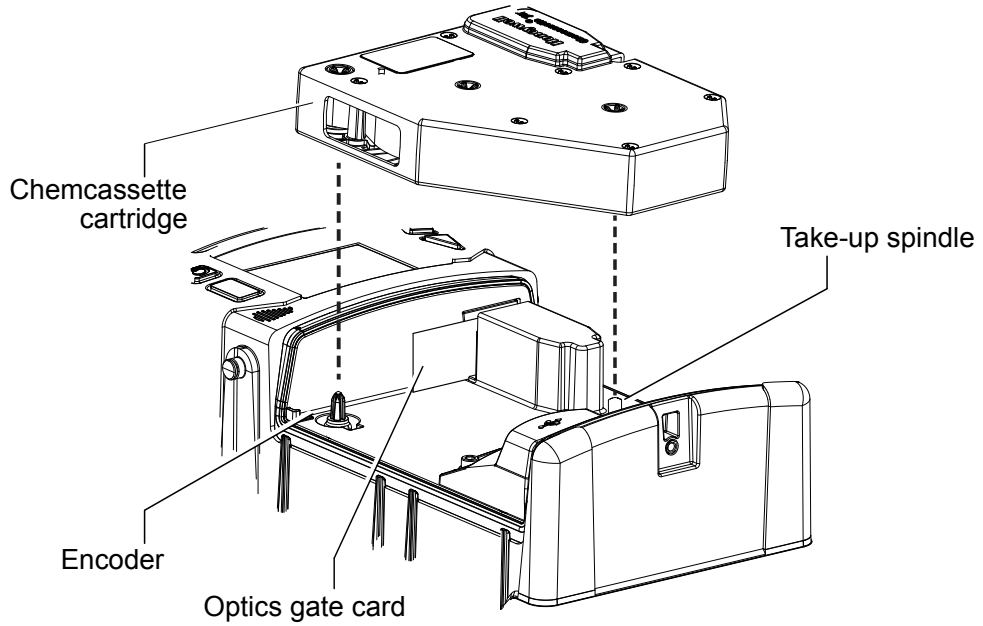


Figure 7. The optics gate card and Chemcassette cartridge

1. If the detector's handle is installed, release it by unscrewing the thumbscrew. For fixed installations, skip to Step 3.
2. Tilt the handle up as far as possible.
3. Unfasten the latches on the sides of the detector (two on each side) that secure the Chemcassette cartridge access cover.
4. The detector has slotted hinges. Lift up the cover slightly and then open it all the way to the right.
5. Select the Change Chemcassette menu option and follow the on screen instructions.
6. If required, remove the old cartridge. When prompted, snap the new Chemcassette cartridge into place. It will fit in only one orientation. The take-up spindle will rotate slightly to allow the cartridge to snap into place.
7. To close the cover, position it over the base and press so that it contacts the gasket uniformly.
8. Close the latches on the sides of the detector to secure the cover.

If there is an error (e.g., the same cartridge was reinserted, the new cartridge has expired, or an unqualified user is attempting to insert a cartridge that detects a different gas than the last one), an error message will be displayed and the installation will be canceled. If the installation is successful, a summary of the current configuration will be displayed and the user can then choose whether to enter Monitor Mode or exit the Change Chemcassette Mode out of monitor.

Removing a Chemcassette cartridge

1. Navigate to Maintenance > Open/Close gate.
2. Select “Open Gate.”
3. Remove the cartridge.
4. Insert the optics gate card.
5. Select “Close Gate.”

Changing the target gas within a gas family

Refer to “Detectable Gases” on page 64 for details about gas families.

1. If necessary, install a Chemcassette cartridge.
2. While out of monitor mode, navigate to Set-up > Monitoring > Gas.
3. Select “Current gas” and pick the desired gas from the selection box
4. Select “Save.”

Selecting a target gas from a different gas family

Refer to “Detectable Gases” on page 64 for details about gas families.

1. Remove the Chemcassette cartridge.
2. Clean the tape-contact surfaces (see “Cleaning the tape-contact surfaces” on page 62).
3. Install the new Chemcassette cartridge.
4. Select the desired target gas from the menu.

Entering monitor mode

From the main menu, navigate to the “Monitor Mode” option and select “Enter monitor mode.”

1. If a Chemcassette cartridge has been installed, the detector will enter Monitor Mode.
2. If a Chemcassette cartridge has not been installed, a user with the necessary passcode can inititate the Chemcassette wizard. Otherwise, the detector will not enter monitor mode.

Wiring and tubing

⚠CAUTION

- The safety of any system incorporating the SPM Flex gas detector is the responsibility of the assembler of the system.
- Position a permanently-installed SPM Flex gas detector so that it does not interfere with access to the dedicated circuit breaker.
- Use only the specified power adaptor/charger (see "Specifications" on page 65).
- Use the power adaptor/charger only in indoor applications.

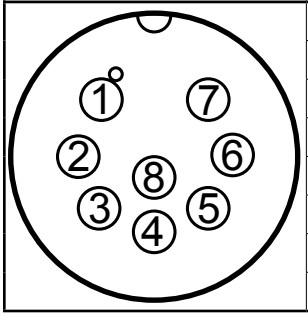
NOTE

Do not wire relays and 4-20 mA in the same wire bundle.

Typical fixed installation topologies

The SPM Flex gas detector has flexible installation options that allow the user to select the one most suitable for a specific application. The detector is supplied with weather-sealed connectors for power, Ethernet, and communications (for relays or 4-20 mA). The Ethernet port can be replaced with an appropriate connection in accordance with local codes (allowing the user to wire directly to the terminal block). Install each detector near a dedicated circuit breaker.

This table shows the default wiring configuration for the IP-rated communication connector when installed by Honeywell Analytics. The relays are labeled for the factory default but the configuration can be modified to have a single alarm and separate faults.

Relay/mA Terminal Connections					
Front View	No.	Color	Relay/mA Terminal Connections		
			mA Sink	mA Source	Isolated mA*
	1	Red	Alarm2 NO	Alarm2 NO	Alarm2 NO
	2	Black	Alarm2 COM	Alarm2 COM	Alarm2 COM
	3	White	Alarm1 NO	Alarm1 NO	Alarm1 NO
	4	Green	Alarm1 COM	Alarm1 COM	Alarm1 COM
	5	Brown	Fault NO	Fault NO	Fault NO
	6	Blue	Fault COM	Fault COM	Fault COM
	7	Yellow	24 VDC +	4-20 mA -	4-20 mA -
	8	White/Black	4-20 mA +	24 VDC -	4-20 mA +

*default pin configuration

Electrical connection is made via conduit directly to ports or via the connector (see Figure 1, "Connectors and ports" on page 10. The terminals used are suitable for conductors of 20 to 14 AWG (0.8 to 1.6 mm dia.).

The SPM Flex Ethernet connector is removable and can be replaced by the customer with a suitable conduit connector. The opening dimensions are shown in the following illustration. When selecting a conduit connector, consider its ability to seal to the SPM Flex case, the depth of the thread (enough to attach to case without interfering with internal components), and adequate space for the intended wiring. The IP rating can be maintained only with the original factory connectors.

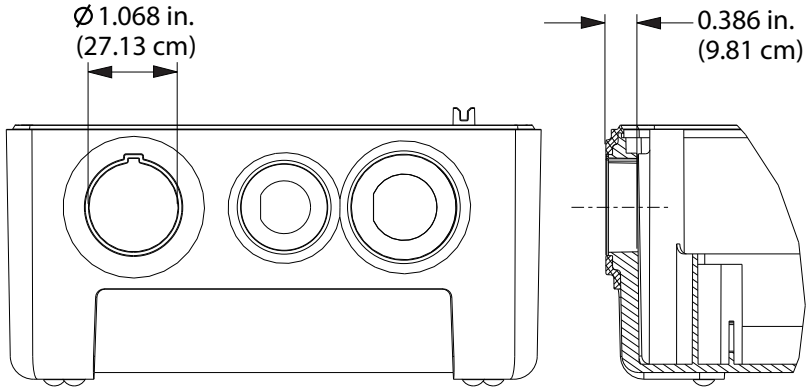


Figure 8. Ethernet opening dimensions

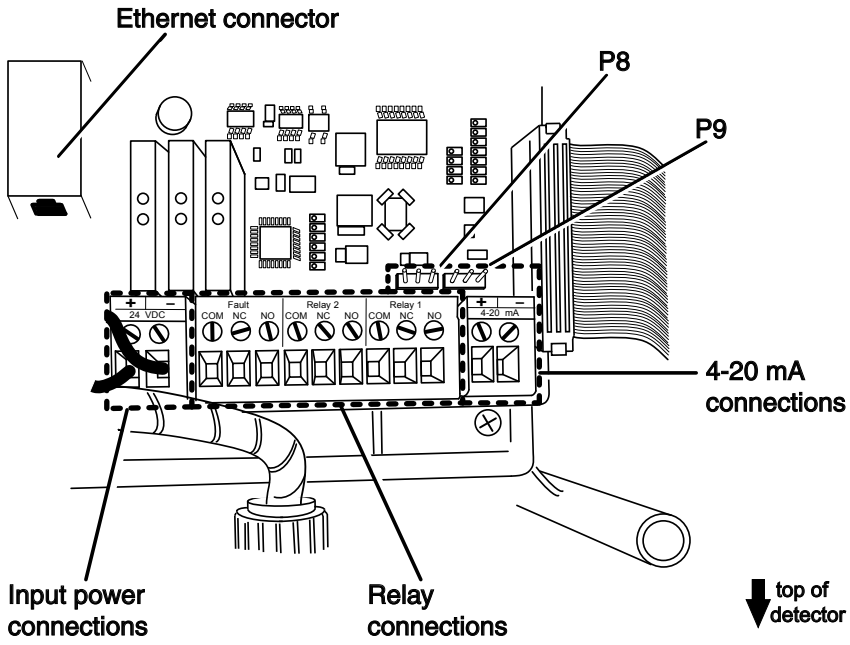


Figure 9. SPM Flex connections

Terminal Module

The terminal module is located on the main PCB inside the gas detector. All power, relay, and 4-20 mA connections to SPM Flex are made via this module. Wire entry to the terminal module area is via the cable entry/conduit entry located at the top of the detector.

Wiring diagrams

4-20 mA wiring

4-20 mA output can be either a two-wire or three-wire connection that is configurable as sink, source, or isolated (isolated is the default), as shown in these following figures. Use a 1.5 mm hex key to remove the wiring cover for access to the terminals. There must be a 200-600-ohm load on the 4-20 mA line.

To ensure adequate resolution to overcome tolerance in the 4-20 mA reading, set the full scale at an appropriate level. The SPM Flex issues a fault if the measured 4-20 mA reading is more than 0.8 mA (5% full scale) off from the expected drive value.

The detector is equipped with three relays which can be wired as normally closed or normally open. They can also be configured as normally energized or normally de-energized via software. By default, the relays are set to Alarm 1, Alarm 2, and Instrument Fault.

Sink configuration

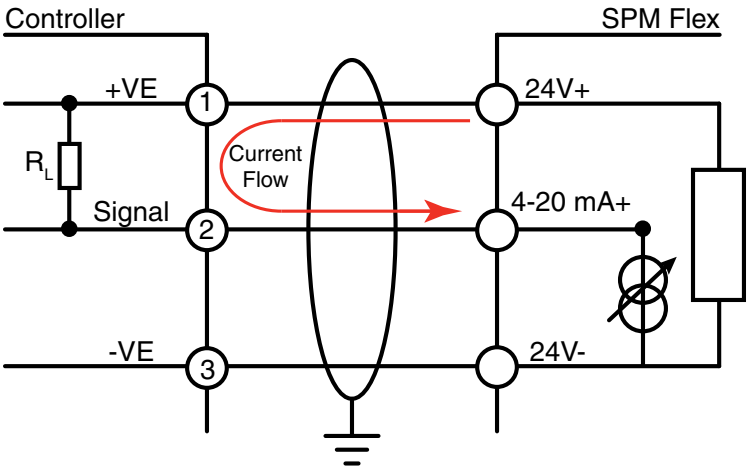


Figure 10. 4-20 mA sink wiring (available only when the adaptor/charger is connected))

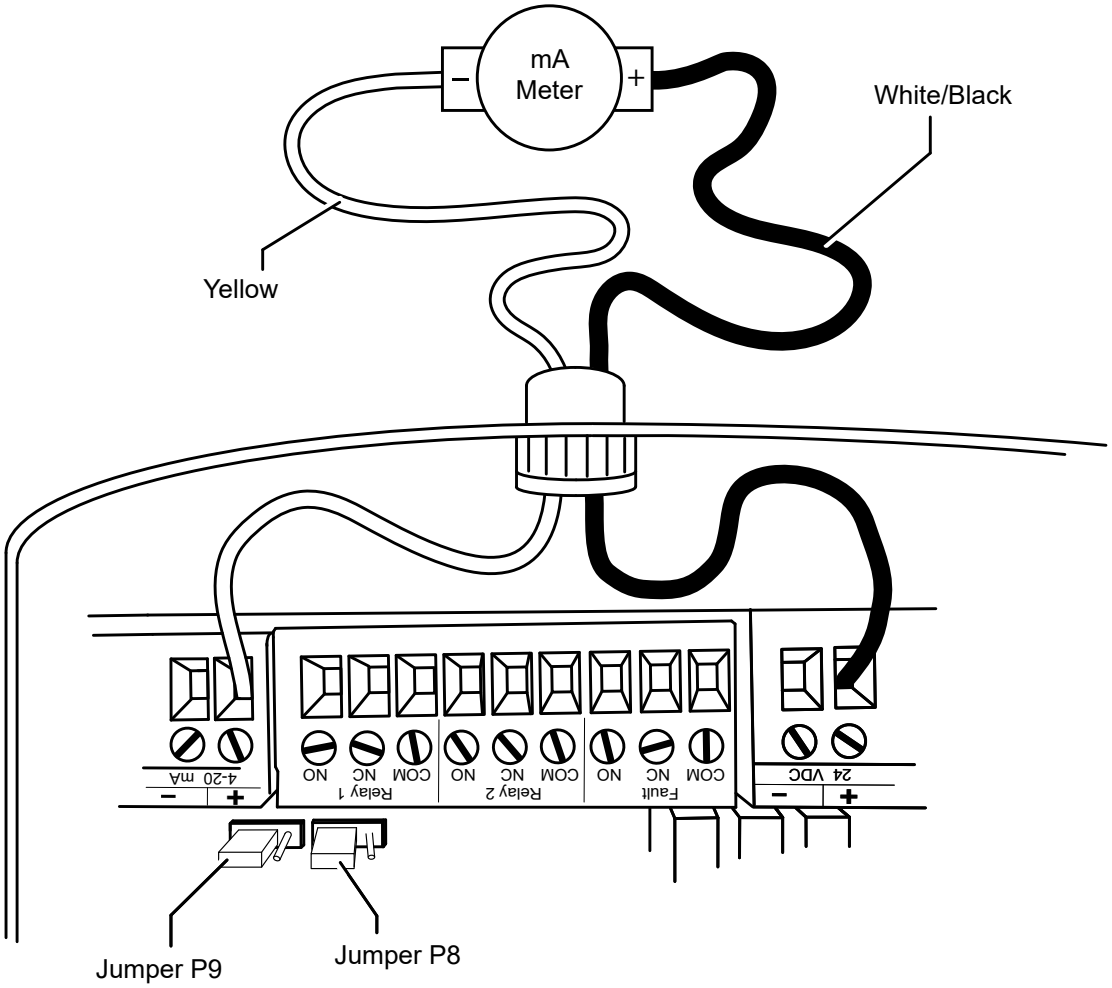


Figure 11. 24 volt wiring, sink configuration

Source configuration

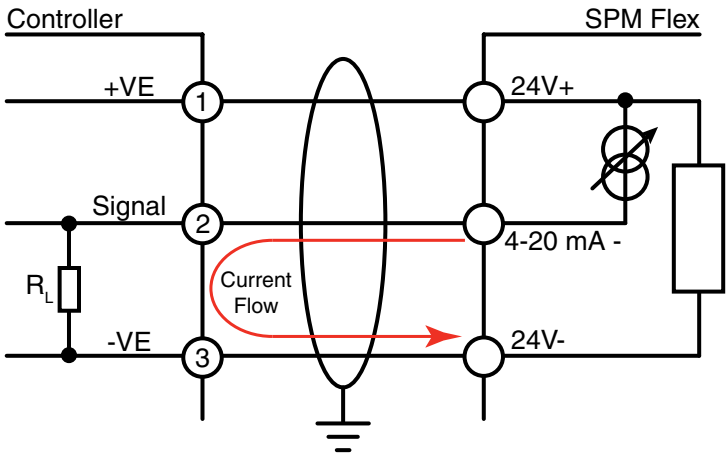


Figure 12. 4-20 mA source wiring

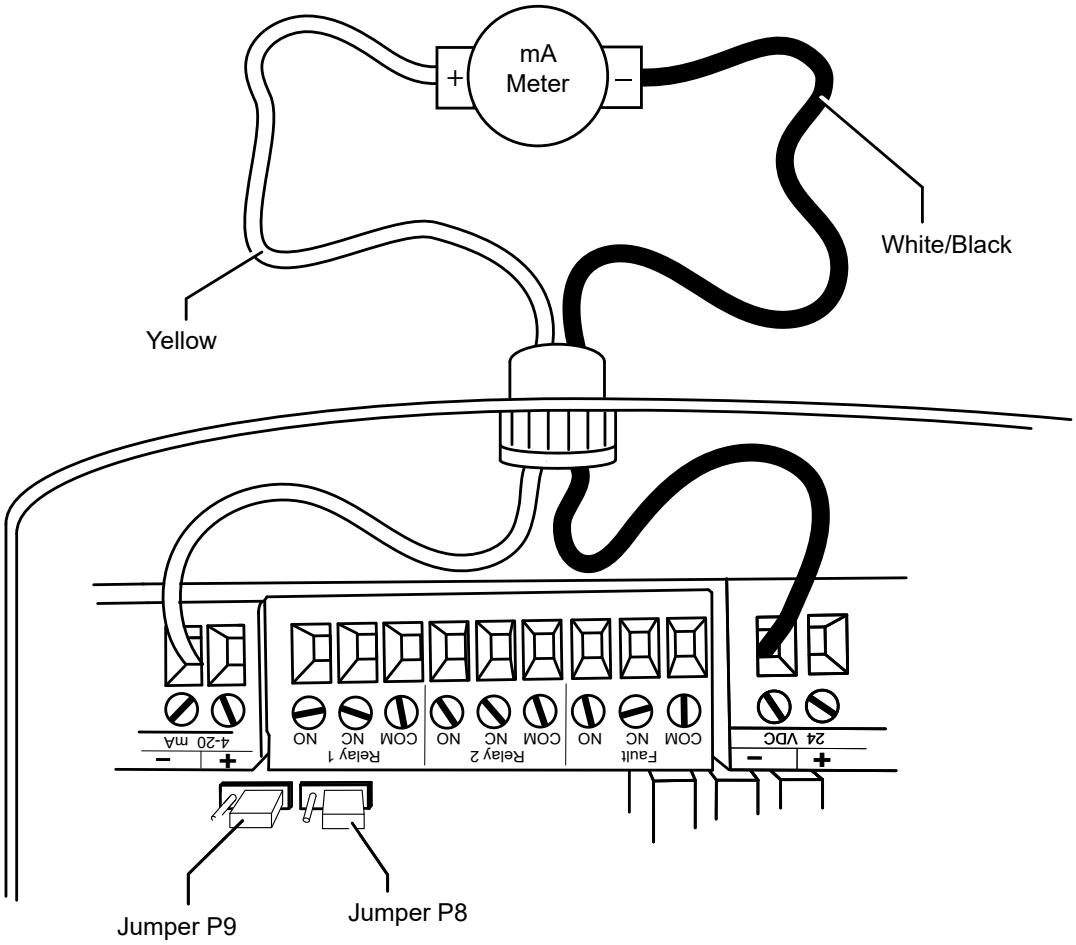


Figure 13. 24 volt wiring, source configuration

Isolated configuration

4-20 mA isolated is the detector's default configuration.

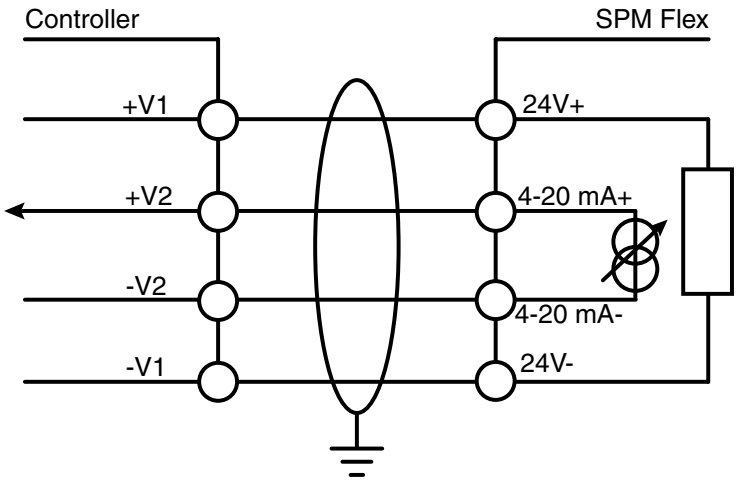


Figure 14. 4-20 mA isolated wiring

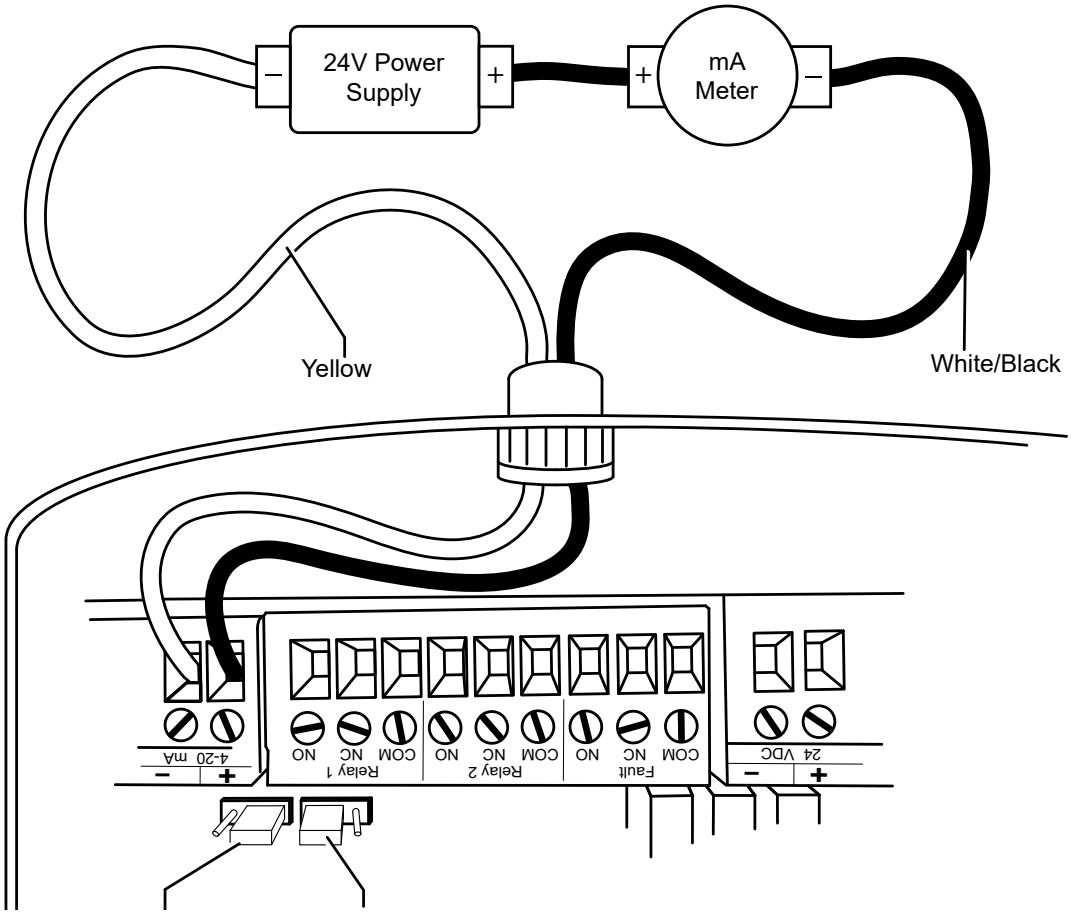


Figure 15. 24 volt wiring, isolated configuration

Modbus

The detector includes a Modbus/TCP server. Multi-word data is presented in big-endian format, as required by the Modbus standard. For example, 150.0 ppm is stored as 0x4316 in the low register of the pair and 0x0000 in the high register of the pair. As another example, the NH_3 gas abbreviation would be stored in registers 40007 to 40011 as shown in this table:

Modbus Holding Register Number	Description	Value if NH_3 selected
40007	Gas Abbr 1of5	0x4E48
40008	Gas Abbr 2of5	0x3300
40009	Gas Abbr 3of5	0x0000
40010	Gas Abbr 4of5	0x0000
40011	Gas Abbr 5of5	0x0000

More information about Modbus can be found at www.modbus.org

Modbus Register Definitions			
Register Address/Name	Bits	Description	Values
40001 System Status	0-2	Inhibit State	0: No Inhibit
			1: Inhibit Alarm
			2: Inhibit Fault
			3: Inhibit Alarm & Fault
			4: Inhibit All
	3	Instrument Fault	1 = Active
	4	Maintenance Fault	1 = Active
	5-6	Alarm State	0: No Alarm
			1: Alarm 1
			2: Alarm 2
	7	Monitor State	0: Not Monitoring
			1: Monitoring
	8	Conc Over Fullscale	1 = True
	9-10	Concentration Trend	0: Stable
			1:Rising
			2: Falling
	11	Alarm 1 Simulation	1 = Active
	12	Alarm 2 Simulation	1 = Active
	13	Instr. Fault Simulation	1 = Active
	14	Maint. Fault Simulation	1 = Active
	15	Unused	
40002 Lastest Active Fault Code	16 bit Integer (0 = No fault)		
40003-40004 Reported Concentration	32 bit Float		
40005-40006 Actual Concentration	32 bit Float		
40007-40011 Gas Abbreviation	9 byte string including terminator		
40012 Concentration Display Format	0-1	Units	0: PPB
			1: PPM
	2-3	Decimal Places	0, 1 or 2
	4-15	Unused	
40013-40014 Gas Table LDL	32 bit Float		
40015-40016 LAL	32 bit Float		
40017-40018 TLV	32 bit Float		
40019-40020 Fullscale	32 bit Float		
40021 Unused			
40022 Alarm Enable	0	Alarm 1 Enabled	1 = Enabled
	1	Alarm 2 Enabled	1 = Enabled
	2-15	Unused	
40023-40024 Alarm 1 Setpoint	32 bit Float		
40025-40026 Alarm 2 Setpoint	32 bit Float		
40027-40028 User LDL	32 bit Float		
40029-40030 4-20 mA Fullscale	32 bit Float		
40031 Chemcassette Code	16 bit Integer		
40032 Chemcassette Days Remaining	16 bit Integer		
40033 Flow	16 bit Integer		
40034 Battery Level	16 bit Integer		
40039 Heartbeat Counter	16 bit Integer (increments once per second)		

Tubing (optional)

Sample and exhaust tubing calculations

This table shows the flow rate, tubing length, transport time, and maximum pressure and vacuum at the inlet and exhaust points.

Allowable tubing lengths vary among gases (see "Detectable Gases" on page 64). If the pressure or vacuum on the inlet/exhaust lines does not meet the recommended values, the detector may encounter flow faults. The maximum total tubing length (inlet + outlet) is 100 ft. (30 m).

Sample Specifications					
Description		Value			
Inlet	Tubing length, ft. (m)	100 (30)	66 (20)	33 (10)	0
	Transport time (sec)	19	13	7	1
	Flow rate (cc/min.)	700-1200 (flow is set and controlled per calibration)			
	Tubing OD. in. (mm)	0.25 (6.35)			
	Tubing ID, in. (mm)	0.125 (3.18)			
Outlet	Tubing length, ft. (m)	100 (30)			
	Tubing OD, in. (mm)	0.25 (6.35)			
	Tubing ID, in. (mm)	0.188 (4.76)			

The overall maximum load on the pump between the inlet and the exhaust should not exceed 10 inches H_2O.

⚠CAUTION

Do not operate the detector in a positive-pressure environment. Refer to TechNote 1998-0195 R1 Sampling Point Guidelines.

An external filter must be installed on the detector's "in" line for most gases (see "Detectable Gases" on page 64). Filters can be placed either at the detector, for local monitoring, or at the end of the sampling line, for remote monitoring. A filter can also be installed on the exhaust port to reduce noise.

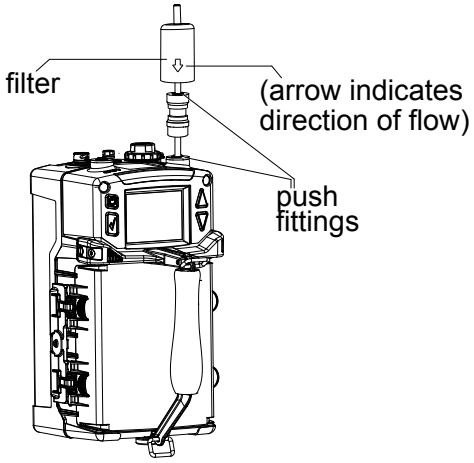


Figure 16. External filter

Setup

Installation drawing

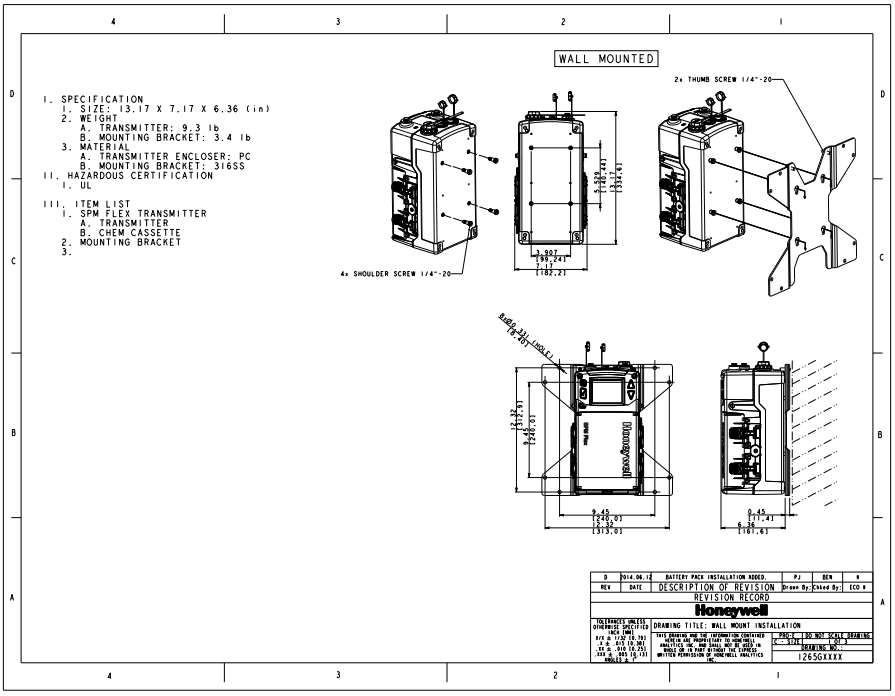


Figure 17. Installation drawing

Dimensions

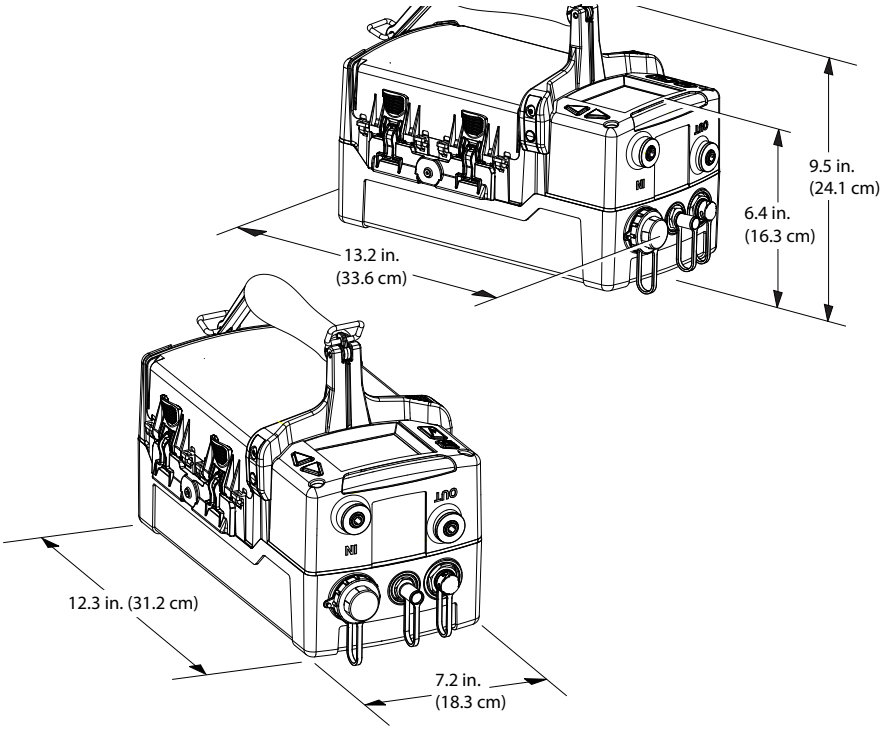


Figure 18. Dimensions of the detector

Mounting options

⚠CAUTION

The SPM Flex detector must be installed only by qualified professional personnel in accordance with local codes.

The SPM Flex gas detector has an optional mounting bracket assembly that is easily affixed to a suitable vertical surface such as a wall, tool housing, mounting plate on a pole etc.

Two mounting bracket options are available for fixed detectors: The standard kit is for typical/new applications in which the detector is to be mounted to, for example, a wall. A second option, a retrofit mounting, is a plate to be used when replacing a Honeywell Analytics SPM detector with the SPM Flex detector.

Mount the detector with at least two appropriate fasteners (e.g., concrete screws when mounting on concrete, etc.). The fastener combination must be capable of securely holding four times the detector's weight, approximately 40 lbs (18.2 kg). When mounting the detector on sheetrock, the fasteners must be attached to studs.

Standard mounting bracket

Figure 20 shows the detector's standard mounting bracket.

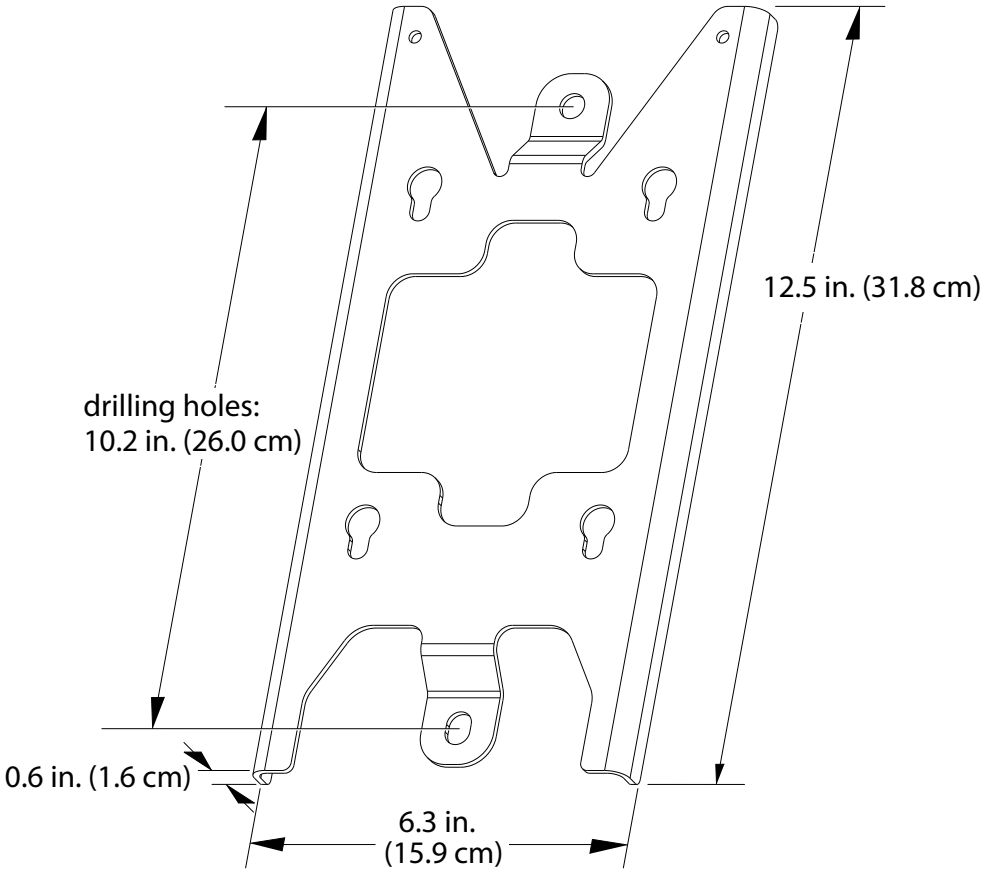


Figure 19. Standard mounting bracket

When installing the standard mounting bracket, use the bracket as a template for determining the location of the holes to be drilled. Use 2 screws to secure the bracket. See "Specifications" on page 65 for a description of appropriate screws.

Backward-compatible mounting bracket

Figure 21 shows the detector's backward-compatible mounting bracket (used when replacing an SPM detector with an SPM Flex detector).

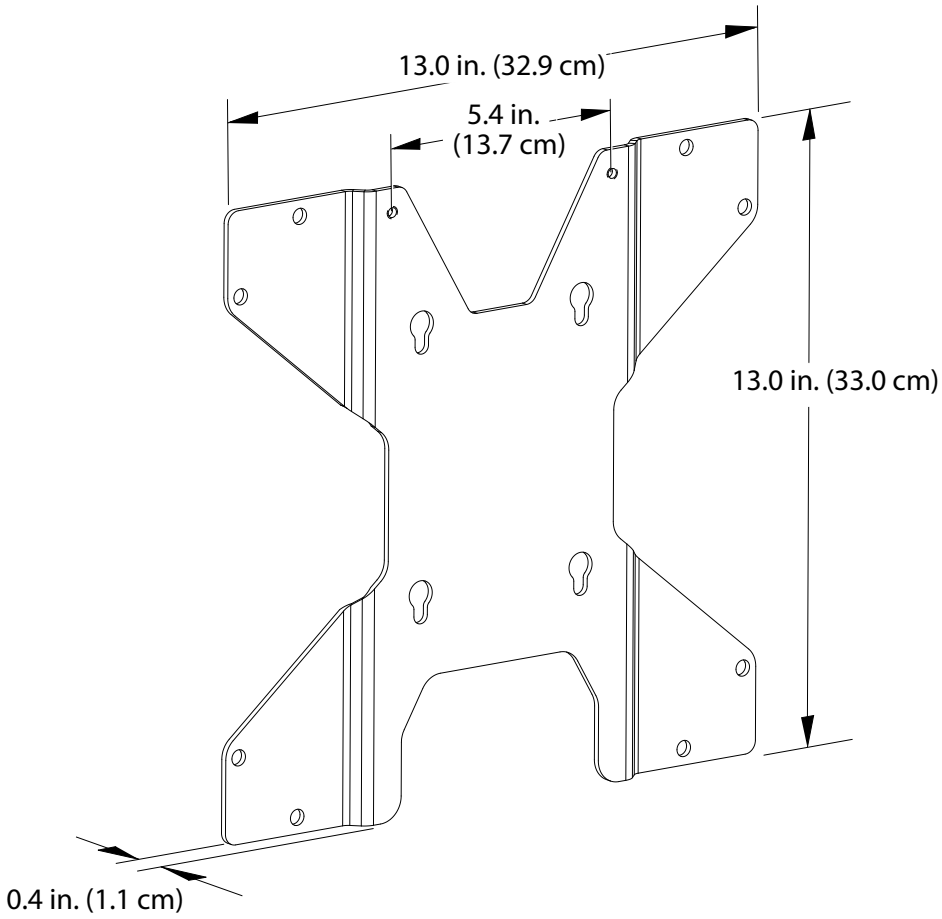


Figure 20. Backward-compatible mounting bracket

Use 4 screws when mounting the backward-compatible bracket in the location of a current SPM installation. See "Specifications" on page 65 for a description of appropriate screws.

Sun shield

Figure 22 shows the sun shield for outdoor applications. The shield has three sides, which protect the detector from the elements. It is designed to facilitate convenient servicing of the detector. (The shield is not necessary for the detector's IP 65 rating.)

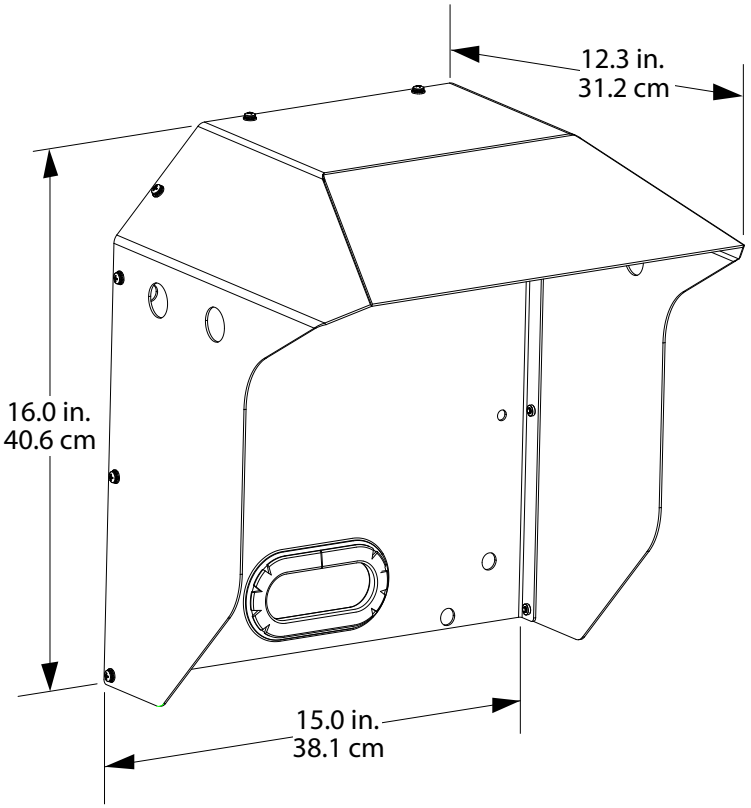


Figure 21. Sun shield

The detector, a standard bracket, and the sun shield can be mounted to a wall using a minimum of 6 screws. If the backward-compatible mounting bracket is used, at least 4 screws are necessary. When using either of the brackets, insert the screws through the bracket, then through the inside of the sun shield, and then into the wall. See "Specifications" on page 65 for a description of the appropriate screws.

The optional sun shield can be used with either mounting plate.

The flip-screen function

If desired, the detector can be installed with the inlet/outlet ports at the bottom as shown in Figure 23. The display must then be flipped to be legible.

1. Navigate to Main menu > Set up > Outputs > Display > Rotation.
2. Press the Accept button.
3. Use the arrow keys to highlight either “0 degrees rotation” or “180 degrees rotation.”
4. Press the Accept button.
5. Press the down arrow key to highlight “Save.”
6. Press the Accept button. The image will be inverted and the functions of the arrow buttons will be reversed.

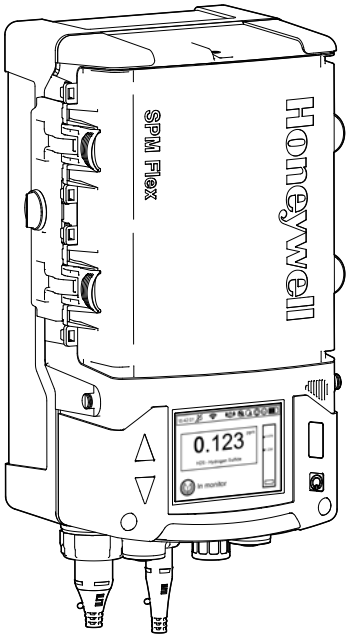


Figure 22. Screen-flip function

Converting a detector from fixed to portable

A fixed-installation SPM Flex gas detector can be converted for portable applications following this procedure:

1. Remove the detector from its mounting bracket (see "Standard mounting bracket" on page 31 or "Backward-compatible mounting bracket" on page 32).

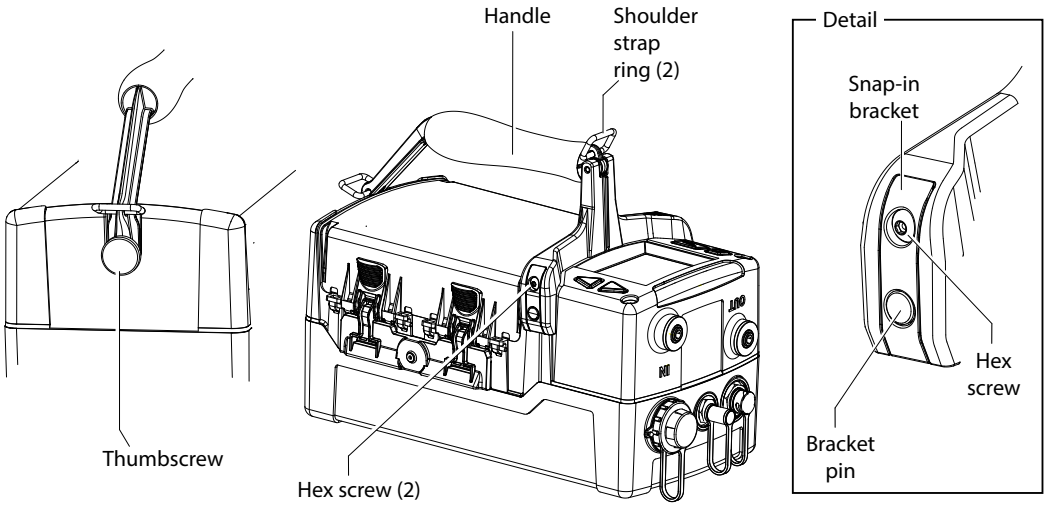


Figure 23. Handle removal

2. Slide the handle into place as shown above.
3. Secure the snap-in bracket on the bracket pin with one of the 1/8-inch hex screws, as shown in the detail illustration.
4. Repeat on the other side of the detector.
5. The handle is hinged to allow access to the Chemcassette cartridge compartment. Lower the handle and secure it with the thumbscrew.
6. If the optional shoulder strap is to be used, attach its spring clips to each of the rings on the detector's handle. The strap must be laundered before use in clean-room applications.

In-line filters

For most gases, it is imperative to use an external filter to protect the tubing and the detector from contamination. Use particulate filter part number 780248 for non-corrosive gases. Use filter 1991-0147 for corrosive gases. Refer to "Detectable Gases" on page 64 for specific gases. Replace the filters after every 3 to 6 months of operation, depending on the cleanliness of the installation environment. Note that filters are not used with diisocyanates, hydrazine, ozone, or hydrogen peroxide so regular maintenance cleaning is especially important for detectors exposed to those gases.

Optional sampling wand

The sampling wand is connected to the inlet port and used to detect toxic gas at specific locations. Do not use the sampling wand with these gases:

- diisocyanates
- hydrazines
- hydrogen peroxide
- ozone
- sulfuric acid

Do not use the sampling wand in highly humid conditions with these gases:

- boron trifluoride
- hydrogen bromide
- hydrogen chloride
- hydrogen fluoride
- nitric acid

An inlet filter is installed in the grip to prevent debris from entering the detector. All gas-wet surfaces are either coated with or made of materials selected to be compatible with sticky corrosive gases. Use an appropriate filter for the gas type being monitored. Refer to "Detectable Gases" on page 64 for appropriate filters and maximum tubing lengths. The sampling wand is supplied with the mounting bracket and required hardware. The wand is connected to the detector with the supplied coiled tube. The wand and the coiled tube are connected with push fittings. To ensure a proper connection, simultaneously push and twist the tubing into the fitting until it is fully seated, about one inch (2.5 cm).

If the system uses the sampling wand or sample tubing, verify that the tubing is correctly seating in the detector's push fitting as shown in this illustration.

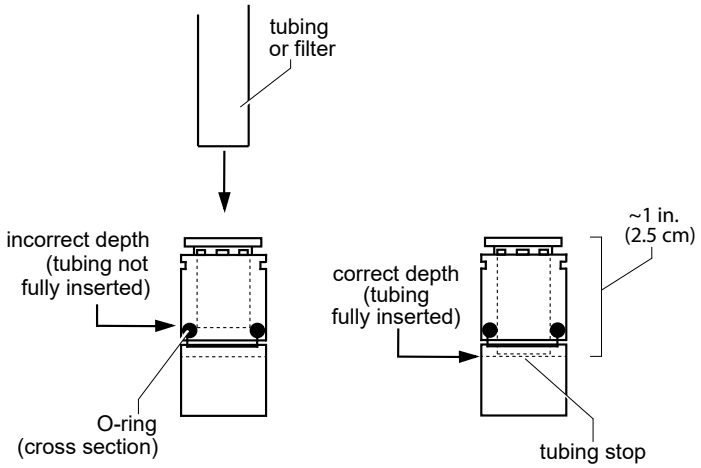


Figure 24. Properly seating tubing in the push fitting

CAUTION

Use only Honeywell approved parts with this detector (see "Accessories and Parts" on page 67).

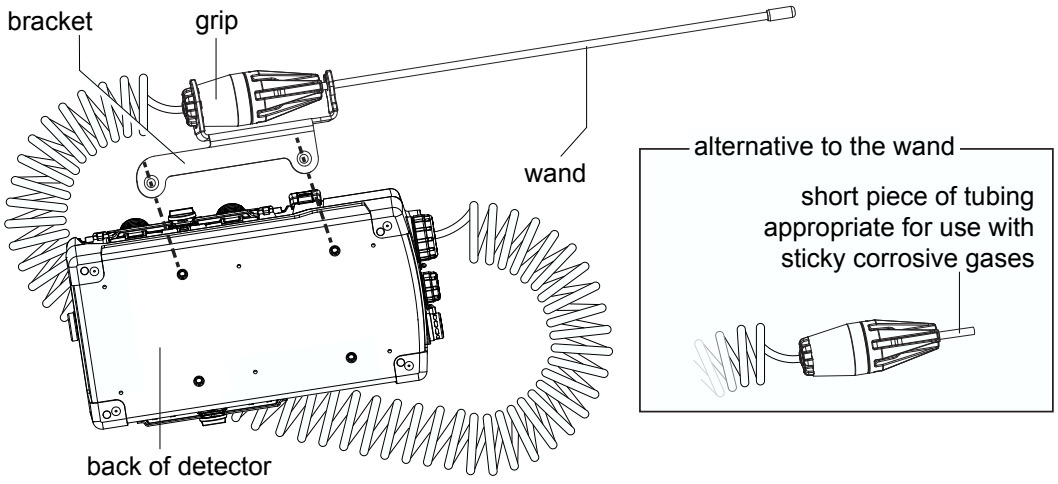


Figure 25. Attaching the sampling wand bracket to the detector

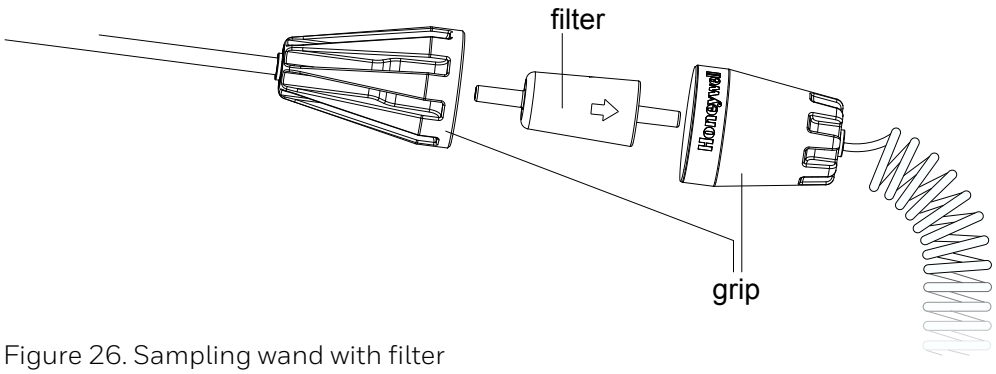


Figure 26. Sampling wand with filter

The sampling filter is replaced by unscrewing the halves of the wand's grip. It will fit in only one orientation.

⚠CAUTION

For accurate readings, do not sample gases without either the sampling wand or longer tubing fully inserted into the grip. For applications in which the filter wand is too long, a short piece of the appropriate tubing must be firmly inserted into the grip. Sampling with only the grip will yield inaccurate readings. Do not use the sampling wand for those gases with recommended sample tubing lengths of less than 16 feet (5 meters) and no recommended sample line filter. See "Detectable Gases" on page 64 for maximum tubing lengths and filter recommendations.

Operation

⚠WARNING

- Protection afforded by the SPM Flex gas detector may be impaired if it is not used according to the manufacturer's instructions.
- Operate two-way radios at least 18 inches (46 cm) from the detector.
- When the detector is in monitor mode and is moved between environments with large differences in temperatures or humidity, condensation on the optics may cause it to report a false low gas concentration reading. Allow the detector to stabilize in the new environment before monitoring gas levels.

Power

Before operation, verify that external power is present (the blue LED will be on) or that the internal battery is charged. The physical power switch, located under the Chemcassette access door, should be on. Typically, the physical switch is left in the on position unless transporting/shipping the detector where there is a possibility of it accidentally being turned on with the Power/cancel button.

When the detector's startup sequence ends, an "In Monitor," or "Out of Monitor" display, depending on how it is configured in the Setup menu. The default startup mode can be configured under Power Options (Setup/General).

Most options will require acknowledgment (i.e., pressing the Select button). Those that don't will be displayed for 3 seconds. Pressing the Power/cancel button briefly will return the user to the previous screen.

⚠CAUTION

Do not power up the detector with a flash drive attached. Use the flash drive only for configuration, maintenance, or data transfer (always out of monitor).

To turn the detector off, hold the Power button for 5 seconds while on the main display. This will bring up the power off options. Alternately, the power off mode can be accessed via the menu. The user must have the appropriate security level to access.

The detector can be used intermittently as long as the Chemcassette cartridge is removed and stored according to manufacturer's guidelines.

Controls

The arrows are used to scroll up and down through lists of options, highlighting one at a time. The Select button is used to select a highlighted selection. During operation, the power button will cancel a command or, when pressed for more than 3 seconds, will display the main menu.

The Open/Close Gate function (see *"Maintenance" on page 55*) can be used to open the gate and remove the cartridge for storage.

The detector provides tactile and visual feedback (clicks and the detector's LCD display) to all key presses. The display reflects key presses by illuminating icons representing each of the buttons.

The blinking green LED indicates that the detector is on. The green LED blink rate is faster during bootup. The yellow LED indicates a fault; it blinks during instrument faults and is steady during maintenance faults. The red LED indicates alarms; a steady light indicates an Alarm 1, a blinking LED indicates and Alarm 2. The blue LED indicates that the detector is receiving external power.

The concentration level of the gas is displayed with the name of the gas below the left side of the display and the units of concentration below its right side.

⚠CAUTION

Do not leave the optics gate of fixed detectors open. Doing so may allow pressurized gases to escape through the tubing into the detector and then into the local environment.

Time

There is a real-time clock in the header bar. The real-time clock also verifies that the detector is active.

Audible alarm

The alarm can be configured for high, medium, and low sound levels. The sound can also be turned off. Low is approximately 75 dB at 1 meter (for office/lab use), Medium is approximately 85 dB at 1 meter (for light industrial use), and High is greater than 90 dB at 1 meter (for heavy industrial use).

Monitoring icons

A round green icon in the lower left of the display indicates that the detector is on and detecting. "In monitor" is shown next to the icon and the current gas concentration is displayed. The icon changes to indicate that the detector is out of monitor mode, or is in a fault or alarm state. Alarms and faults can be present simultaneously (the alarm will supercede fault notification on the main display and status bar color). When the detector is not detecting, "Out of monitor" is displayed and 4 dashes are shown instead of a gas concentration. When the detector is out of monitor mode, the status bar will change to blue. When a gas concentration exceeds the limit, "Over limit" is displayed and the gas concentration is preceded by the greater-than symbol (">").

Battery

The detector's battery level is indicated from 0 (fully discharged) to 100% (fully charged). The battery icon displays the approximate battery level on the status bar, while a more accurate value can be found in the Review mode under Additional Status. If the battery's charge is too low for safe operation, a "Critically low battery!" message will be displayed and the detector will turn off.

Bar graph

The bar graph displays the concentration reading up to double the Alarm 2 value for the gas being monitored. The Alarm 1 and Alarm 2 values are indicated numerically on the bar graph.

The display can be configured for different backlight and dimming options. By default the backlight will dim after a few minutes of no activity. The display can be configured to turn off the backlight entirely after a set period of time.

Inhibit

When the detector is in inhibit mode, it will show a bell icon with a red slash through it.

1. Use the [Up] or [Down] buttons to select the "Inhibit" on the Maintenance menu.
2. Press the [Accept] button.
3. The Inhibit Type menu or the Time Out menu can then be selected. Possible inhibit types are none, alarms only, faults only, alarms and faults, and all, as shown in the following table). The Time Out options (the time until the detector exits inhibit mode and returns to active monitoring) are from 1 to 60 minutes.
4. To take the detector out of inhibit mode, select "None" from the Inhibit Type menu and press the [Accept] button twice to return to the Maintenance menu.

NOTE

If the inhibit times out before the inhibit state is returned to "none," maintenance fault code M17 will be displayed.

Inhibit Modes						
	Parameter	**Inhibit - None**	**Inhibit - Alarms Only**	**Inhibit - Faults Only**	**Inhibit - Alarms & Faults**	**Inhibit - All**
4-20 mA Operation [1]	Concentration > Full Scale	Over-range Level	Over-range Level	Over-range Level	Over-range Level	Inhibit Level
	Concentration Above Alarm Threshold	Concentration Level	Concentration Level	Concentration Level	Concentration Level	Inhibit Level
	Instrument Fault	< 1 mA	< 1 mA	#N/A	#N/A	#N/A
	Non-Zero Concentration	Concentration Level	Concentration Level	Concentration Level	Concentration Level	Inhibit Level
	Maintenance Fault	Maint Fault Level	Maint Fault Level	#N/A	#N/A	#N/A
	Simulated Instrument Fault	< 1 mA	< 1 mA	#N/A	#N/A	#N/A
	Simulated Maintenance Fault	Maint Fault Level	Maint Fault Level	#N/A	#N/A	#N/A
	Zero Concentration	4 mA	Inhibit Level	Inhibit Level	Inhibit Level	Inhibit Level
	Out Of Monitor	4 mA	Inhibit Level	Inhibit Level	Inhibit Level	Inhibit Level
Other I/O Behavior [2]	Red LED	Yes	Yes	Yes	Yes	Yes
	Yellow LED	Yes	Yes	Yes	Yes	Yes
	Alarm 1 Relay	Yes	No	Yes	No	No
	Alarm 2 Relay	Yes	No	Yes	No	No
	Any Alarm Relay	Yes	No	Yes	No	No
	Maintenance Fault Relay	Yes	Yes	No	No	No
	Instrument Fault Relay	Yes	Yes	No	No	No
	Any Fault Relay	Yes	Yes	No	No	No
	Buzzer	Yes	Yes [3]	Yes [4]	No	No
	LCD - Alarm	Yes	Yes	Yes	Yes	Yes
	LCD - Fault	Yes	Yes	Yes	Yes	Yes
	LCD - Concentration	Yes	Yes	Yes	Yes	Yes
	Web - Alarm	Yes	Yes	Yes	Yes	Yes
	Web - Fault	Yes	Yes	Yes	Yes	Yes
	Web - Concentration	Yes	Yes	Yes	Yes	Yes
	MODBUS/TCP - Alarm	Yes	No	Yes	No	No
	MODBUS/TCP - Fault	Yes	Yes	No	No	No
	MODBUS/TCP - Concentration	Yes	Yes	Yes	Yes	No
	Event History	Yes	Yes	Yes	Yes	Yes

[1] Conditions are listed with the highest priority at the top. The 4-20 mA output will take the state of the highest priority applicable condition that is present.

[2] Yes = operates normally
Yes with conditions = active only under some conditions
No = not active

[3] For real and simulated faults only

[4] For real and simulated alarms only

Review menu

Event History

The detector's history can be reviewed from the Review menu. It can be searched by event (alarms, faults, alarms and faults, or all events) or by a range of dates. The results of a search can be displayed as a list of events. Results of searches can be sorted by oldest event first or most recent event first. An event can be highlighted and selected with the check button to get extended details about the event, including the data field. The results can also be exported to a USB flash drive to be accessed by another device such as a PC, as shown in Figure 27. Refer to Figure 3 ("Main power rocker switch" on page 13) for removal of the switch cover.)

The web interface can also be used to view and export events.

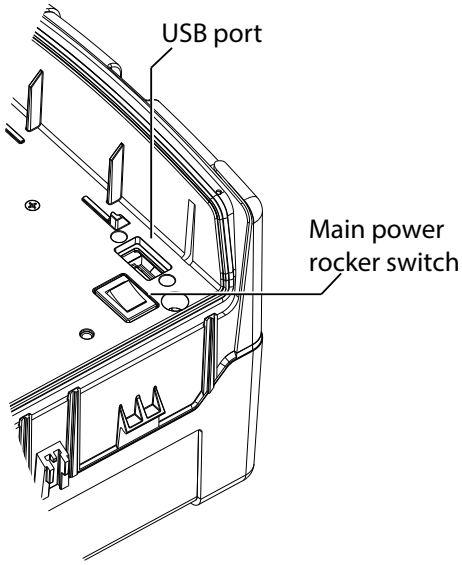


Figure 27. Locations of the USB port and the main power rocker switch

NOTE

FAT32 is the default file system of the SPM Flex detector. The detector does not read or write NTFS disks.

Chemcassette

The Chemcassette review screen displays the Chemcassette type, its serial number, expiration date, and the days remaining before it must be changed. The expiration date of the ChemCassette when viewed in Review Mode is based on the date it was installed in the gas detector. (The date on the Chemcassette's label is for a properly-stored Chemcassette cartridge in its sealed package.)

Gas Settings
The gas being detected, its abbreviation, the CAS number, the LDL, the full scale, the Alarms 1 and 2 setpoints, and the 4-20 mA full scale can be seen on the Gas Settings review screen.

Network
The Network Summary option displays the IP address, the Subnet mask, the Gateway, and the MAC address.

Additional Status
The flow rate of the gas, the battery level, and the pump drive can be found on the Additional Status Summary screen.

Output State
The detector's relay assignment (i.e., Alarm 1, Alarm 2, or Instrument Fault), the current relay states (e.g., off, off, on), the current mA output (driven value and measured value), and the current inhibit state are displayed in the Output State Summary.

Trend/Plot
The Trend/Plot review screen shows the date, time, and time range selection. A trend plot over the specified time range can be displayed. The data can be exported to a flash drive via the USB port as a .csv file.

Software
The Software summary screen displays the number of the current version numbers of the software, the user interface, the gas detection algorithm, the optics algorithm, and the RFID algorithm.

⚠ WARNING

Calibration, set-up, and test modes are intended for use by trained personnel or service engineers only. Access to these modes can be passcode protected.

Maintenance menu

Inhibit

Alarms or alarms and faults can be inhibited from the Maintenance menu. The timeout period (the length of time before inhibit mode is exited and monitoring resumes) can also be configured here. The range is 1 to 60 minutes. The default timeout period is 30 minutes. A timeout period of 0 minutes means that the feature is disabled.

4-20 mA current loop calibration

This feature allows the detector's output to match an external monitoring device.

Flow characterization

Flow characterization is an optional function. When utilized, it allows a flow system to be optimized with a certain type of Chemcassette cartridge. This allows the SPM Flex detector to quickly reach the correct flow rate.

Open/close gate

The gate can be opened and closed manually (from the Maintenance menu). For intermittent use, this allows Chemcassette cartridges to be conveniently removed and stored.

Update program

Through the *Update program* option, the new firmware can be loaded via the USB port.

Factory service mode
For Honeywell Analytics service personnel only.

Setup menu

Many of the functions of the SPM Flex detector can be configured from the Setup menu.

General
The backlight intensity and timeout period are chosen from this menu as well. The power-up options are chosen from this menu. The detector can be programmed to be in monitoring mode or out of monitoring mode when powered up. Out of monitoring mode is the default state. It can also be programmed to power up in the state it was in when it was powered down. Finally, if languages other than English are loaded in the detector's software, the language can be chosen from the General menu.

The detector IDs ("unit IDs"), either short (up to 20 characters) or long (up to 35 characters) and an idle timeout period of from 1 to 60 minutes (20 minutes default) can also be entered from the General menu. An idle timeout period of 0 minutes will disable the idle timeout function.

Monitoring

The available gases are displayed and can be selected from the Gas menu. Alarms 1 and 2 can be enabled or disabled and their respective setpoints can be adjusted. The LDL can also be enabled or disabled and user-defined LDL limits can be entered. The minimum and maximum values for the 4-20 mA full scale can be entered.

The TWA mode can be set for either a fixed start time or a floating start time at the TWA menu. The default is 08:00 but another time can be entered by the user. In this case, the detector will calculate the second time (8 hours later) and third time (16 hours later).

NOTE

The detector's continuous monitoring algorithm enables a fast response and high sensitivity. It also rapidly indicates trends. However, in some cases, this algorithm can cause the decay time to be substantial, especially with gases having slow stain development, specifically low level AsH_3 and GeH_4. In the absence of gas, it may be necessary to continue monitoring for several minutes before zero concentration is reported.

Latching

The SPM Flex detector's alarms and faults can be either latching or non-latching, depending on the settings on the Latching menu. The default for both is latching.

Outputs

The detector's display characteristics (e.g., brightness, time to dim/time to off) are set at the Display menu. The volume of the alarms (silent, low, medium, or high) are chosen from the Audio menu options. Parameters set from the Relays menu are relay assignments, that alarm relay's normal state (energized or de-energized), and the maintenance fault's normal state (energized or de-energized). Three parameters can be set from the 4-20 mA Levels menu: the inhibit level from 1.5 mA to 3.5 mA (the default is 2.0 mA), the maintenance fault level from 1.5 mA to 3.5 mA (the default is 3 mA), and the overrange level from 21.0 mA to 22.0 mA (the default is 21.5 mA). The mA levels are adjusted in 0.5 mA increments.

Network

The Ethernet mode can be set for either auto or manual. The Modbus TCP menu can also be enabled or disabled (disabled is the default). To enable the Ethernet connection:

1. Connect the Ethernet cable to the detector's connector (see "Connectors and ports" on page 10).
2. Navigate to Main Menu > Set up > Network > Ethernet > Accept.
3. Select Mode > Auto > Accept > Accept. (Alternatively, instead of following the Auto setup procedure, Enter Select Mode and scroll down to manually enter the IP address, Subnet mask, and Default Gateway.)
4. To return to the Main menu, press Cancel twice.

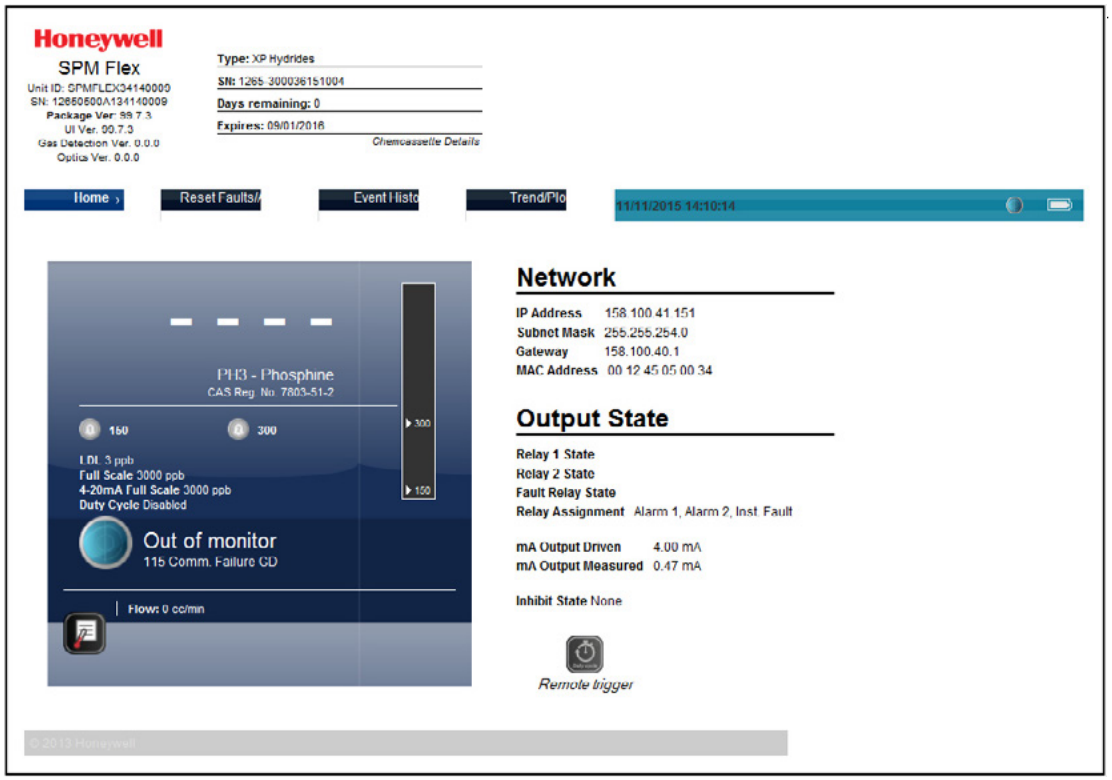


Figure 28. Typical Ethernet web server screen

This web server screen displays details about the detector and its Chemcassette cartridge. Faults and alarms can also be reset, a history of the detector's activity can be filtered and reviewed, and a graph of recent activity can be created and exported.

NOTE

The web server is designed for no more than ten simultaneous connections. (Responses will be slower with more connections.)

Security

⚠WARNING

Follow local and site procedures when working with the SPM Flex gas detector. If needed, verify that the associated control panel is inhibited in order to prevent false alarms. The following procedures must be followed carefully and performed only by suitably trained personnel.

When enabled, the detector has five security levels, summarized in this table. Passcodes are entered at the login menu beginning with the highest level first (e.g., set the 4 Admin passcode, then the 3 Power User passcode, then the 2 Advanced Maintenance passcode, etc.). Store the Admin passcode in a secure location; if it is forgotten, the detector's security can be reset only by a Honeywell Analytics service technician.

Access Rights	Security Levels					
	0 Not Logged In	1 Routine Maintneance	2 Advanced Maintneance	3 Power User	4 Admin	5 Factory Service
Log in/log out	●	●	●	●	●	●
Reset alarms and faults	●	●	●	●	●	●
Review mode	●	●	●	●	●	●
Limited maintenance access		●	●	●	●	●
Change Chemcassette (to same type)		●	●	●	●	●
Testing			●	●	●	●
Maintenance			●	●	●	●
Limited setup			●	●	●	●
Full setup				●	●	●
Change Chemcassette (to any type)				●	●	●
Security					●	●
Program update					●	●
Factory service menu (Honeywell personnel only)						●

Configuration Manager

Access to options for up to five internal flash slots can be chosen from the Configuration Manager menu. Information can also be imported to or exported from the detector via the USB option.

Test menu

The detector's optical system can be checked from the Optics Verification screen (using the verification card.) Alarms 1 and 2, maintenance faults, and instrument faults can be tested from the Simulate menu. The alarms and faults can also be reset from the Simulate menu. The Force Relays and Force 4-20 mA options are also available through the Test menu.

Power off

Select "Power off" to shut off the detector. Selecting this option has the same effect as pressing and holding the power button for 5 seconds.

Duty cycle

This function allows the user to extend the duration of the tape advance interval. This is useful in applications in which a background level of gas is expected in normal operation. This interval can be configured for up to seventeen minutes.

When in monitor mode, if the detector reaches its maximum concentration for that window, it will hold and display a countdown informing that it is waiting for the duty cycle to expire.

The Duty Cycle menu can be found at Main menu > Set up > Monitoring > Duty Cycle.

⚠CAUTION

The detector does not monitor gas levels while the duty cycle is counting down.

K-factor

K-factor is a feature that allows gases' cross-sensitivity to be employed to measure a target gas after calibrating the detector with a different gas. The advantage for the user is that a small number of calibration gases can be used to calibrate a detector for a wide range of target gases. The detector's readings are modified by the known relationship between the two. For example, a 5 ppm concentration of Gas A is seen by the detector as the same as a 5.8 ppm concentration of Gas B. The K-factor is 1.2 (5.8 ÷ 5 = 1.16 = 1.2 when rounded to one decimal place). Therefore, the detector with a Gas A Chemcassette cartridge can be used to accurately detect Gas B by multiplying the Gas A reading by 1.2.

The feature can also be used to compensate for diluted samples. For example, when reading a gas that has been diluted 5:1, the K-factor feature will will enable the detector to yield a reading of the undiluted gas.

K-factor conversions are performed by the detector automatically. The K-factor is at Main menu > Set up > Monitoring > Gas.

If desired, an alternative name can be assigned to the K-factor target gas. This would be useful if, for example, a certain dilution of a gas was being detected. With K-factor enabled, navigate to Setup > Monitoring > Gas > K-factor > Alt. gas name > Edit. A name with up to eight characters can be entered from that screen. Save the name by pressing the Accept button.

Stale tape feature

When a Chemcassette cartridge is installed, the detector reads information about it, including the Allowable Days After First Use from its RFID tag (see "Detectable Gases" on page 64). By default, the detector will issue a Stale Tape maintenance fault after that number of days. For situations in which the cartridge will be used for a short period of time and then properly stored in its Chemcassette cartridge bag, the user may turn off the maintenance fault. If a cartridge is installed and in Monitor mode and then reaches the Stale Tape date or the Expired Tape date, it will continue monitoring. (While the "CAUTION: Chemcassette is XXX days past recommended use" screen is displayed, press the Accept button to acknowledge the maintenance fault and continue using the cartridge.) The cartridge can then be used past the Stale Tape date (but not past the Expired Tape date). A history event is created for all expiration faults.

Troubleshooting

Symptom	Cause	Corrective Action
No blue light	No power to the detector	Turn the circuit breaker on Check the power cable
Detector does not appear on the network	Incorrect network connection	Check cable connection to Ethernet port System is for internal use only
	Detector not configured for the network	Verify that network configuration is enabled
		Use the "Auto..." setting
Detector won't turn on	No external power (blue light)	Check external connection Verify that the power adaptor/charger is plugged in Check circuit breaker
	Battery too low	Plug SPM Flex in to recharge the battery or use external power supply. Confirm that the blue light is present in the LED status bar. If the battery pack is overly discharged the detector will not turn on unless plugged in to the external power. When fully discharged, the battery pack will initially charge at a slower rate than normal until it reaches a minimum voltage. Keep portable detectors plugged into the charger when not in use.
	Blue light present but won't turn on	Check physical power switch (located in Chemcassette cartridge bay) is in the on position. Press and hold the on switch on the top left of the display until you see activity.
No display	Faulty connection	Verfiy that the ribbon cable is properly seated
	Broken display or interface board	Replace display/interface board. Contact HA
	Detector is not powered on	See section for turning detector on and troubleshooting power issues
Detector is not on Ethernet network	Physical connection issue	Check correct CAT5 cable is used. Check cable is properly connected at both ends. Confirm network port is active.
	Incorrect configuration	If possible, use Auto detect configuration to automatically get IP configuration from network. Otherwise, check IP configuration is correct. Reboot.
Cannot get Modbus TCP data over network	Incorrect configuration	Confirm network configuration for detector and target device. Confirm target device is on the same network/subnet. Confirm detector IP address on Review/Network Summary.
Detector does not communicate via USB	Faulty connection	Check the connection
Detector cannot provide a 4-20 mA output	Faulty connection	Check the cable connection
Relay not activated although detector reports that it has been	Faulty connection	Check the cable connection
No date or time	Real-time battery expired	Replace the real-time battery
		Contact Honeywell Analytics
Chemcassette cartridge will not install properly	Shipping tab still in place	Confirm that the red shipping tab has been removed from the payout spool
	Gate closed	Use Change Chemcassette wizard to open gate and guide you through the process
	Security lockout	Confirm log-in in using an account with appropriate security level to change Chemcassette cartridges
Detector will not read Chemcassette	Defective RFID chip	Replace Chemcassette

continued...

Chemcassette gate won't open	Gate open command not sent	Use either Change Chemcassette wizard or Maintenance / Open/Close gate.
	Gate motor is broken	Replace gate motor or contact HA
Chemcassette tape will not advance	No power	Check the cable connection

Symptom	Cause	Corrective Action
Chemcassette tape continues to advance	Encoder	Check the cable connection
	Hall effect sensor	Check the cable connection
Chemcassette gate will not open	No power	Check the cable connection
Cannot remove Chem-cassette cartridge	Gate open command not sent	Use either Change Chemcassette wizard or Maintenance / Open/Close gate.
Chemcasette cartridge door will not latch closed	Door is not properly closed or aligned	Make sure Chemcassette cartridge is fully seated. Make sure USB stick is not interfering with door. Make sure door is fully seated on both sides – latches should hook under the tabs on the side of the case easily. Make sure all four latches are properly secured.
Pump will not turn on	No power	Check the cable connection
Cannot achieve target flow rate	Inlet or outlet tube is blocked	Confirm inlet and outlet tube are free of restrictions or kinks, and that all filters are clean.
	Gate is not sealing correctly	Confirm Chemcassette cartridge is fully seated. Exit and enter monitor to pull a fresh part of the tape.
	Pump is old	Replace pump. Contact HA.
	Filters are clogged	Check filters (internal and external) and replace as needed
	Tubing connections are not properly seated	Confirm all tubing connections are properly seated (internal and external).
Detector will not connect properly or stay on mounting plate	Incorrectly installed mounting plate	Make sure the mounting plate is installed the correct direction so that the mounting heads on the back of the SPM Flex can slot in and slide down to secure.
	Mounting screws not installed	Confirm the mounting screws have been installed on the back of the SPM Flex
Gas readings are not as expected	Flow system issue	Confirm all tubing connections are properly inserted. Confirm correct filter type is used for the target gas. (Refer to "Detectable Gases" on page 64.) Confirm target flow rate is achieved.
	Chemcassette cartridge issue	Confirm correct Chemcassette cartridge is selected for the target gas. Confirm Chemcassette cartridge is within operating age, sampling conditions, and has been correctly stored. If generating a gas bump test gas to confirm performance, refer to gas generation document located in the online High Tech Technical Library. Refer to individual Chemcassette type technical notes for specific performance information.
Buzzer does not activate	No power	Check the cable connection
Detector won't turn off	Power button on top left / menu option not available	Verify that the user is logged in with the correct security level
Detecttor unintentionally turns on during transport	Physical power switch is on, unintentionally pushing power switch by display	Put the physical power switch located behind the Chemcassette door in the off position. Place switch back in the on position when ready to use again.
Detector will not charge	Faulty connection	Check the cable connection

*corrective actions vary with different security levels

Instrument Fault/Maintenance Fault/Information Codes						
Type	**Sub-type**	**Display String**	**Technical Description**	**Meaning of Parameter**	**Probable Cause**	**Corrective Action**
Instrument Faults	101	Flow Failure	Flow failure	Flow, cc/min	Pump failure -Flow line obstruction -Positive pressure	Replace pump Check flow lines Check for positive pressure
	103	Gate Motor Failure	Gate timeout	N/A	Gate motor failure -Gate motor sensor failure	Replace
	104	Tape Advance Failure	Tape advance timeout	N/A	Broken tape -Tape drive motor failure -Encoder failure	Replace
	105	High Background	optics counts too low after multiple pulls	N/A	Tape issue	Check, replace
	106	Gas Table Invalid	Gas table invalid	error code	CC RFID issue	Replace, contact HA
	107	Comm. Failure RFID.	comm. fail to RFID reader	N/A	RFID PCB failure	Replace
	108	Chemcassette Read Failure	RFID read failure	N/A	CC RFID issue	Replace, contact HA
	109	Temperature Too High	overtemperature	Temperature, C	Environment is over recommended temperature	Improve ventilation/cooling
	110	Temperature Too Low	undertemperature	Temperature, C	Environment is below recommended temperature	Bring environment to correct temperature
	111	Optics Error	value of LED drive or reference detector signal out of range	N/A	Optics PCB failure	Replace
	112	Low Voltage Fault	DC input voltage low	voltage in Volts	Faulty power circuit	Contact HA
	113	Chemcassette Expired	Now>LifeInBag+Mfg or Now>LifeOutOfBag+FirstUse	1.0 or 2.0 for two causes	Chemcassette cartridge has expired	Replace
	114	Optics Subsystem Fail	no comm. to optics block	N/A	Optics cable disconnected -Optics PCB failure	Reconnect, replace
	115	Comm. Failure GD	no comm. to GD	N/A	Main PCB failure	Contact HA
	117	NV Memory Corrupt	CRC error	code to which test failed.	PCB failure	Replace
	118	mA Output Mismatch	Feedback ADC mismatches DAC	Error magnitude in mA.	Faulty circuit Incorrect external wiring Bad calibration	Contact HA check wiring Perform mA calibration
	119	Ethernet Fail	Ethernet hardware in UI failed to initialize	N/A	External connection issue Main PCB failure	Check external Ethernet connection Replace
	120	Battery Very Low	Battery critically low, shutting down	Battery level	Low battery	Charge detector
Maintenance Faults	1	Flow Warning	Flow is unregulated	Flow, cc/min	Flow out of control range	Check Chemcassette Check sample tube
	2	Chemcassette Low	Tape will run out in 24 hrs	N/A	Low tape	Replace
	3	Idle Timeout	out of monitor too long	N/A	Out of monitor	Put in monitor and reset fault
	4	Low Voltage Warning	DC input voltage low	voltage in Volts		
	5	Comm Failure SPI	no SPI comm. to UI	N/A		Contact HA
	6	File System Error	File system error in NAND or USB.	N/A		Contact HA
	7	Comm. Invalid GD	Invalid SPI parameter data from GD.	N/A		Contact HA
	8	Warn CC Expiring	A stored tape will expire in 7 days; if enabled, the same fault will be issued for cartridges in use.	N/A	Old tape	Replace
	9	Software Error	catch all	error code		Contact HA
	10	Optics Adjust Fail	Calibration failure	error code	Calibration failure	Perform calibration again, Check the calibration setup, Contact HA
	11	Flow Cal Fail	Calibration failure	error code	Calibration failure	Perform calibration again, Check the calibration setup, Contact HA
	12	Inhibit Timeout	Timed out	N/A	Detector has been left in inhibit mode longer than timeout warning	No action required
	13	Force mA Timeout	Timed out	N/A	Detector has been in force mode too long	No action required
	14	Force Relay Timeout	Timed out	N/A	Detector has been in force mode too long	No action required
	15	Battery Low	Battery Low	Battery level	Battery is low	Charge battery

continued...

Instrument Fault/Maintenance Fault/Information Codes						
Type	**Sub-type**	**Display String**	**Technical Description**	**Meaning of Parameter**	**Probable Cause**	**Corrective Action**
Information	1	SPM Energized	The microprocessor booted	N/A	N/A	N/A
	2	Monitoring Started	Monitoring started	N/A	N/A	N/A
	3	Monitoring Stopped	Monitoring stopped	N/A	N/A	N/A
	4	Tape Advanced	A new windows was pulled. (remove for production)	N/A	N/A	N/A
	5	Force mA Requested		zero	N/A	Start force relay
	6	mA Output Forced	current loop forcing started	zero	N/A	N/A
	7	mA Output Released	current loop forcing ended.	N/A	N/A	N/A
	8	User Login	User logged-in successful.	User level which just logged in, 0 is lowest level	N/A	N/A
	9	User Logged Out	User logged out manually or by timeout.	User level which just logged out, 0 is lowest level	N/A	N/A
	10	Alarm/Fault Reset Request	UI requests alarm/fault reset.	N/A	N/A	N/A
	11	Silent Buzzer Request	UI requests to shut off buzzer through Alarm/fault reset menu.	N/A	N/A	N/A
	12	Enter Monitor Request.	UI requests to enter monitor	N/A	N/A	N/A
	13	Exit Monitor Request	UI requests to out of monitor	N/A	N/A	N/A
	14	Change CC Started	UI initialize change CC sequence	N/A	N/A	N/A
	15	Inhibit Started	UI initializes inhibit.	which type of inhibit.	N/A	N/A
	16	Inhibit End Request	UI request to end inhibit.	N/A	N/A	N/A
	17	4-20mA Calibration Started	UI initializes 4-20 calibration.	N/A	N/A	N/A
	18	Flow Characterization Started	UI initializes flow char	N/A	N/A	N/A
	19	Update Program Started	User chose an update file to perform program update.	N/A	N/A	N/A
	20	Update Program Failed	Update program failed	N/A	N/A	N/A
	21	Update Program Success	Update program success	N/A	N/A	N/A
	22	Gas Related Configuration.	Gas related set up changed by UI.	N/A	N/A	N/A
	23	Non Gas Related Configuration.	Non-gas set up changed by UI.	N/A	N/A	N/A
	24	Security Set Up Configuration	Security set up changed	N/A	N/A	N/A
	25	Optics Verification Started	UI initialized optics verification sequence	N/A	N/A	N/A
	26	Simulation Started	UI requests to start simulation.	N/A	N/A	N/A
	27	Force Relay Started	UI started force relay.	N/A	N/A	N/A
	28	Force Relay End Request	UI exited force relay function.	N/A	N/A	N/A
	29	Time Changed	UI time set	N/A	N/A	N/A
	30	Optics Auto Adjust Requested		N/A	N/A	Start optics auto-adjust
	31	Optics Auto Adjust Success	Optics Auto-Adjust Success.	LED drive counts	N/A	N/A
	32	Optics Corrected	LED output dropped unexpectedly	1 – first SLDE 2 – second SLDE 3 – Reference Photodiode Shift	N/A	N/A
	33	Mfg Service Mode	UI has received commands to go into manufacturing service mode	None	N/A	N/A
	34	Electrical Noise	Optics block reports signal is noisy	Failure code	N/A	N/A

Maintenance

Perform maintenance activities according this schedule. Use only Honeywell Analytics replacement parts. Use appropriate static discharge mitigation while servicing the interior of the detector to avoid damage.

Maintenance Intervals (months)			
Description	**3**	**6**	**12**
Authorized Honeywell preventive maintenance			●
Replace the end-of-line filter	●		
Check pump			●*
Check for system leaks		●	
Verify optic system response	●**		
Replace internal filters			●
Check stepper motor	as needed		
Check gate motor	as needed		
Clean the exterior surfaces	as needed		
Replace real-time coin battery	3 years or as needed		
Replace main battery	return the detector to Honeywell Analytics		

*or as needed

**optional --the optics system is self-monitoring but for additional confidence or when the detector is used without filters, quarterly verification can be performed with the optional optics card (see "Accessories and Parts" on page 67)

Authorized Honeywell preventive maintenance

In addition to the standard maintenance schedule performed by the owner, Honeywell recommends that detectors be returned periodically to the factory for comprehensive inspection, cleaning, and systems tests. While not required, users are encouraged to have this service performed every one to three years depending on usage, site conditions, and gases monitored.

Replacing the end-of-the-line filter

Hold down the locking ring on the push fitting, as shown in Figure 29, to release the filter. Gently press the new filter into the fitting until it locks. An arrow is printed on the filter to show the gas's proper direction of flow.

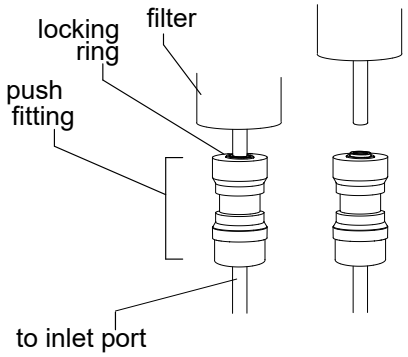


Figure 29. Removing the filter from a push fitting

Checking the pump

The detector will display an instrument fault in the event of a pump malfunction. See “Instrument Fault/Maintenance Fault/Information Codes” on page 53.

Verifying optic system response

Using the optional optics test card, perform the optics verification test.

From the Test menu, select the Optics verification option and follow the instructions on the display. If the “Optics verification success!” message is displayed, the optic system is functioning normally. If the “Optics verification failed! Please remove card and put Chemcassette back” message is displayed, return the detector the Honeywell Analytics for service.

Replacing internal filters

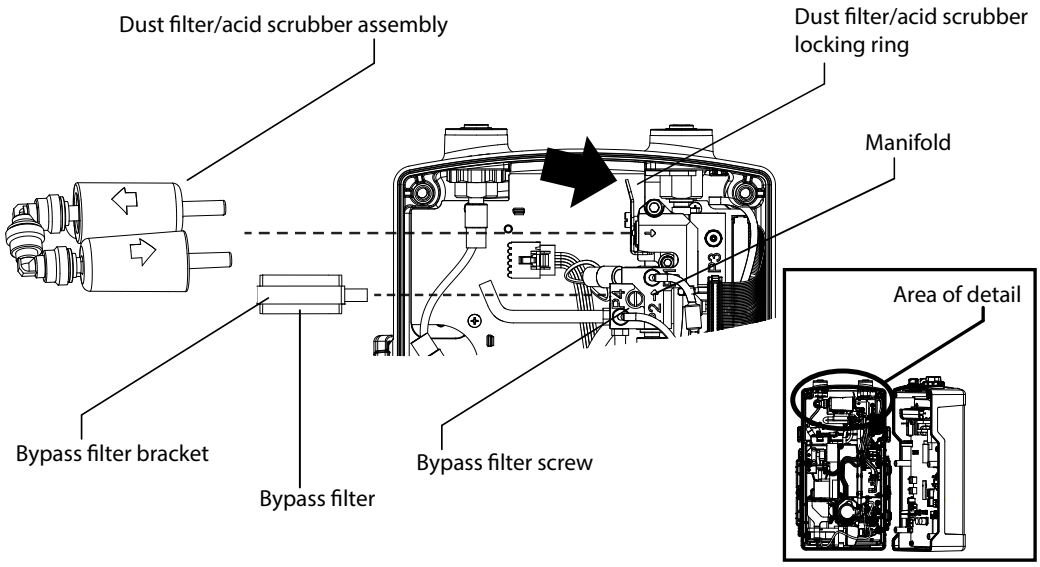


Figure 30. Removing the internal filters

The dust filter and acid scrubber are attached to a single manifold. Press and hold the locking ring on the fitting firmly in the direction of the arrow and lift the filter assembly out together. Replace the filters in the manifold and reattach the assembly by gently pressing it into the push fittings until it locks.

To free the bypass filter, remove the bypass filter screw and pull out the bracket-filter assembly. Disconnect the black bypass tube. Attach the tube to the new filter-bracket assembly, insert it in the manifold, and tighten the bypass filter screw.

Perform a leak test after every filter replacement (see “Checking for system leaks” on page 63).

Replacing the pump

When the pump issues a flow fault that cannot be cleared, replace the pump.

Tools required: PH1 Phillips screwdriver, 5/16-in. flat-blade screwdriver, jeweler's screwdriver, wire cutters, three 4-in. standard plastic tie wraps (UL62275, UL94V2)

Time required: 10 minutes

1. If there is a ChemCassette cartridge in the detector, remove it.
2. Remove the rocker switch cover.
3. Turn the rocker switch to the off position.
4. Loosen the 6 captive case screws completely.

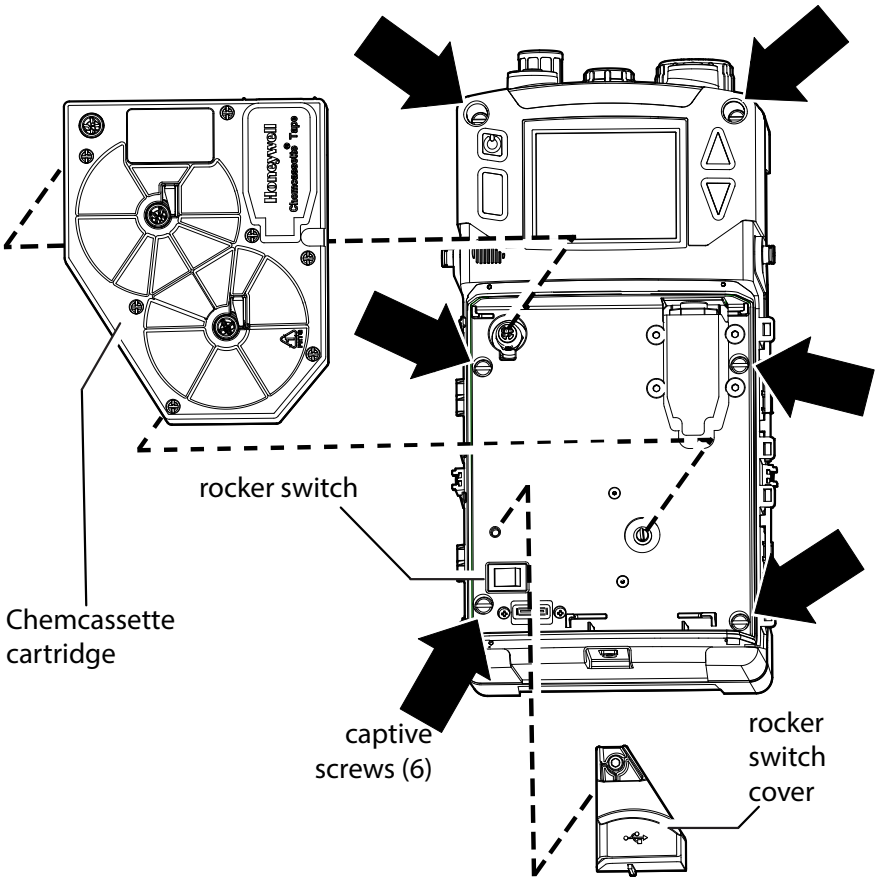


Figure 31. Location of the captive case screws

5. Open the case. The pump assembly is shown in this illustration.

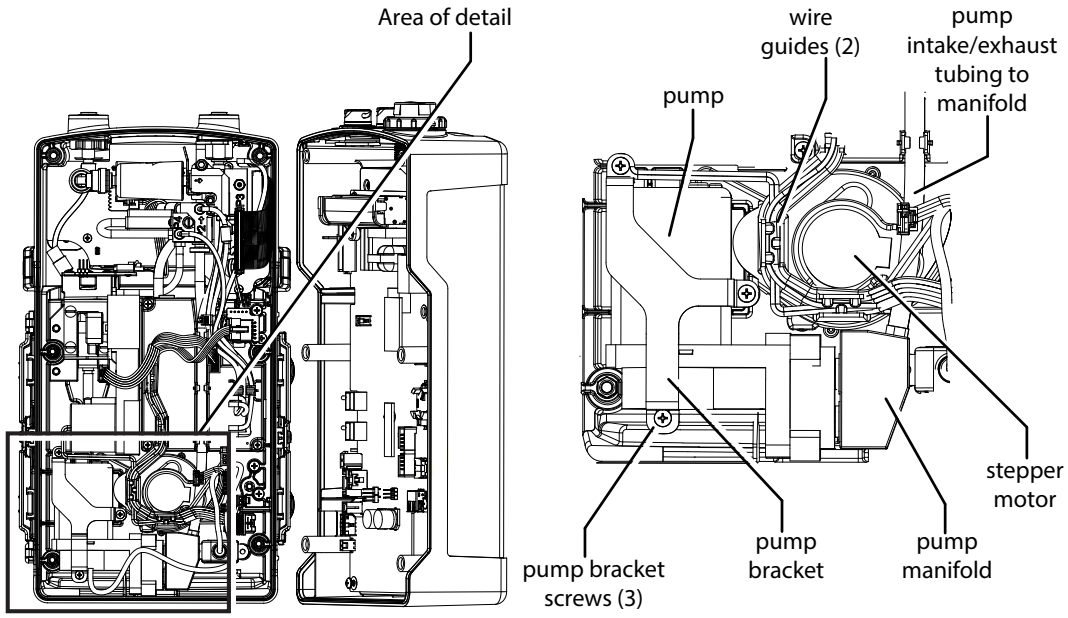


Figure 32. Location of the pump assembly

6. Cut and remove the three wire ties from the bundle containing the pump wires. Take care not to damage any of the wires.

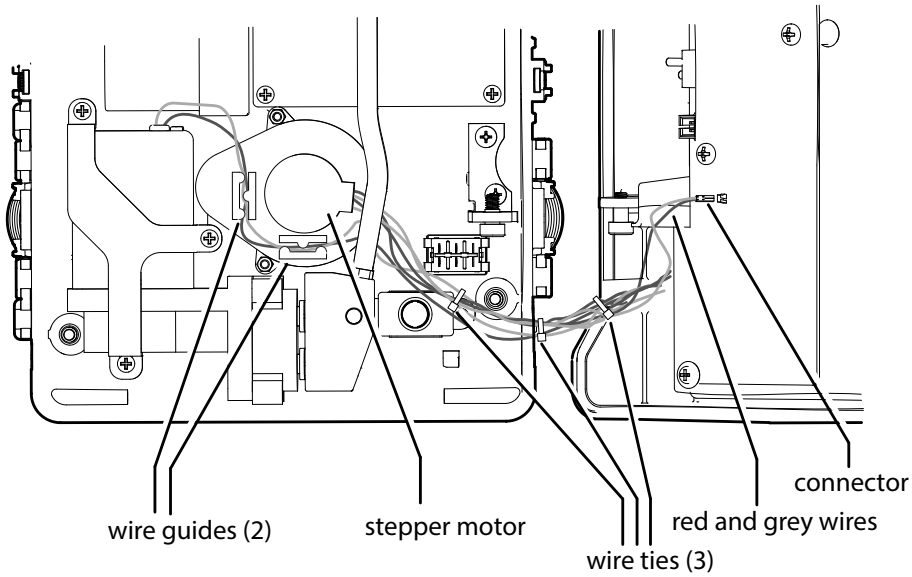


Figure 33. Pump wiring.

7. Remove the wire bundles from the guides around the stepper motor.

8. Remove the pump from the case.

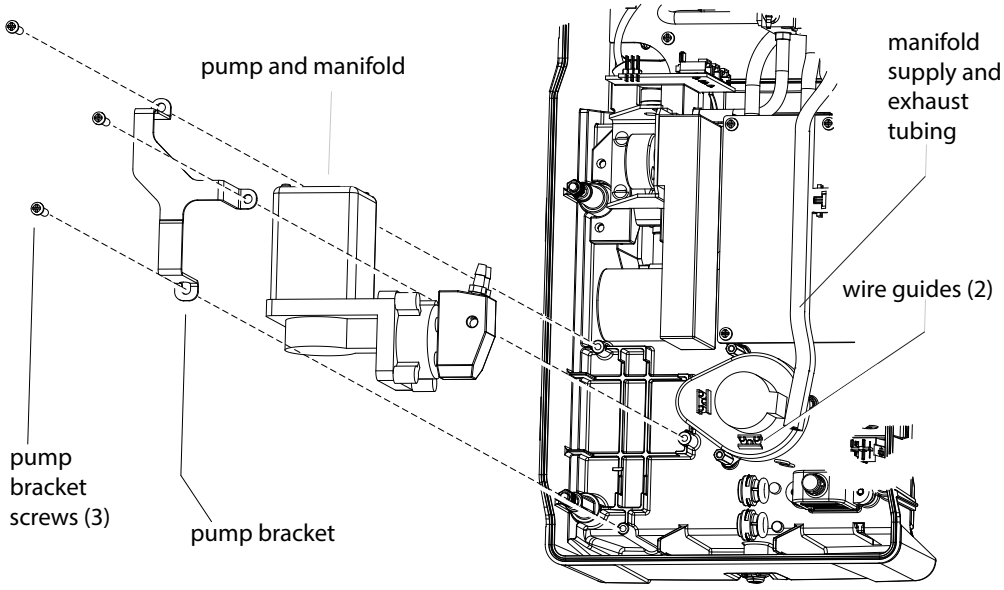


Figure 34. Pump assembly (detail, shown without wires for clarity)

9. Separate the pump manifold from the pump. Disconnect the two push fittings by gently twisting the jeweler's screwdriver as shown in Figure 35.

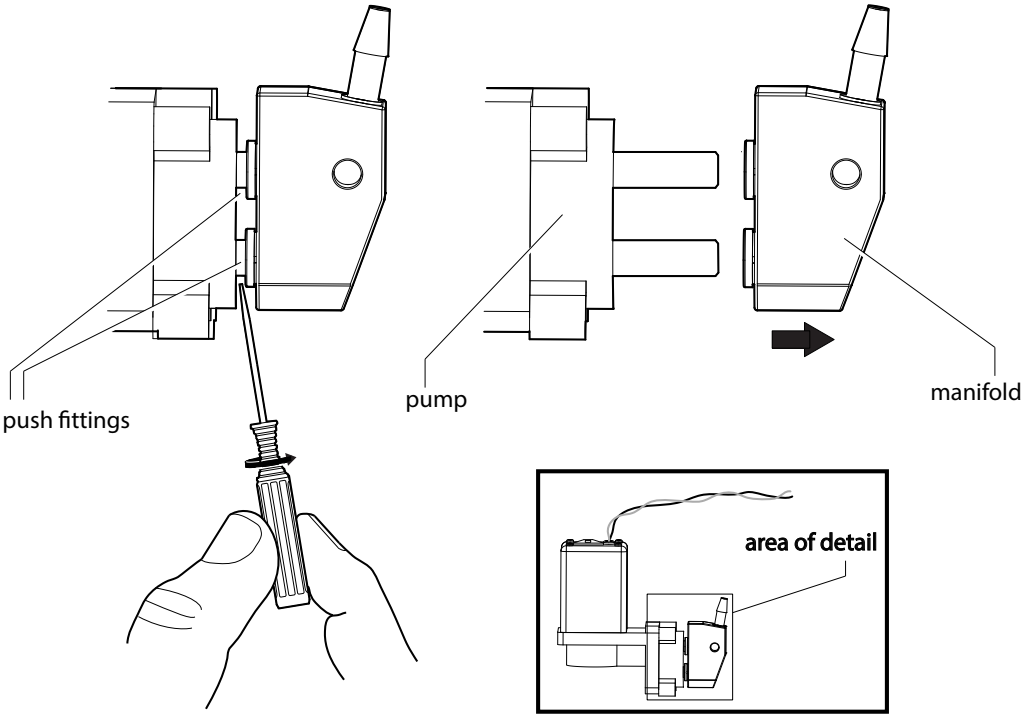


Figure 35. Disconnecting the push fittings

10. Disconnect the pump wiring connector from the PCB. Six connectors are supplied by that wire bundle. The pump's connector is the small black one with the red and grey wires.
11. Reverse this procedure to install the new pump.
12. Replace the wire ties and dress the bundle in the wire guides.
13. Close the case. To maintain the detector's IP rating, tighten the captive screws [torque to 6.9 lbf-in ±0.4 (8kgf x cm ±0.5)] in the order shown in this illustration.

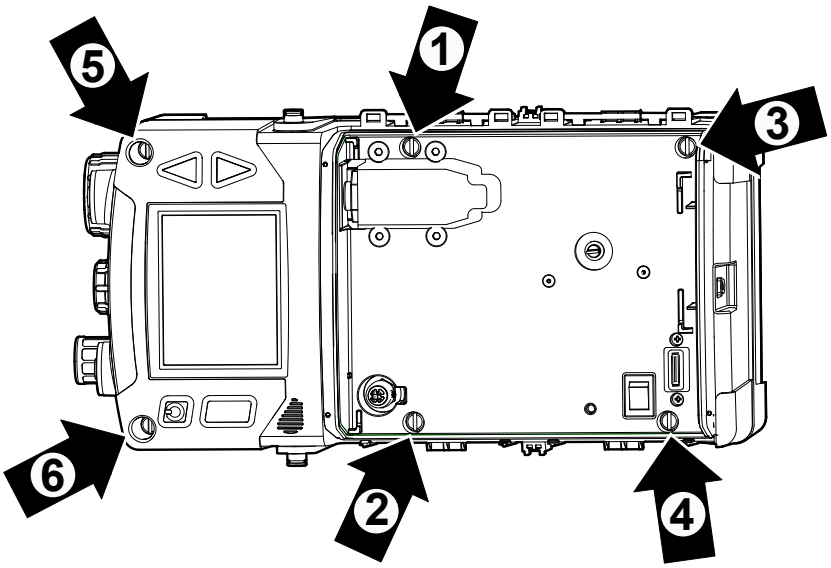


Figure 36. Case screws tightening order.

14. Reset all fault codes (Main menu > Reset Alarms & Faults > Reset All).
15. Install a Chemcassette cartridge (see "Installing a Chemcassette cartridge" on page 18).
16. Navigate to Monitor mode. Depending on the gas being detected, the target sample analysis flow rate should be between 250 cc/min and 500 cc/min (see "Detectable Gases" on page 64).
17. Navigate to Review mode > Additional Status. The flow and pump drive values will be displayed.
18. Verify that the target flow has been reached. If it cannot be reached, a full flow calibration must be performed. Contact Honeywell Analytics.
19. Verify that the pump drive value is between 0-65%. If the pump drive value is not within that range, contact Honeywell Analytics.

Checking the stepper motor

The detector will display an instrument fault in the event of a stepper motor malfunction. See “Instrument Fault/Maintenance Fault/Information Codes” on page 53.

Checking the gate motor

The detector will display an instrument fault in the event of a gate motor malfunction. See “Instrument Fault/Maintenance Fault/Information Codes” on page 53.

Replacing the real-time coin battery

The battery can be removed by gripping it firmly with needle-nose pliers and pulling straight out. Gently press the new battery with the positive (+) side facing out until it snaps into place.

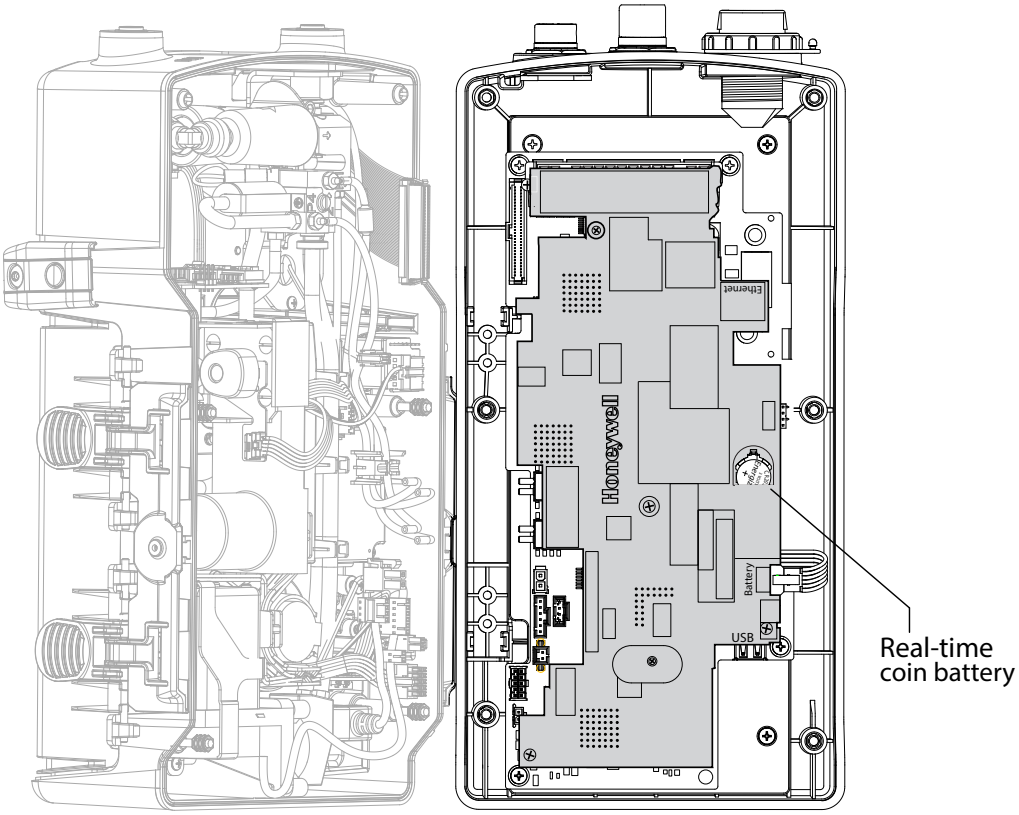


Figure 37. Coin battery location

Cleaning the exterior surfaces

Exterior surfaces of the detector can be cleaned with a soft cloth moistened with water or with 6% IPA alcohol wipes. Plug the detector's ports when washing the case.

Cleaning the tape-contact surfaces

Over prolonged monitoring periods, the chemical components of some Chemcassette cartridges can be deposited on the detector's tape transport surfaces. When replaced by a cartridge with a different target gas, these deposits may cause stains on the Chemcassette tape that are falsely interpreted as gas concentrations. This chemical incompatibility has been particularly noted in the combinatons in this chart.

Chemical Incompatibilities			
When this Chemcassette cartridge...		**...is replaced by this Chemcassette cartridge:**	
Gas family	**Part number**	**Gas family**	**Part number**
F_2/O_X	1265-3004 or 1265-4004	Hydrazine	1265-3008 or 1265-4008
XP Cl_2	1265-3002 or 1265-4002		
O_3	1265-3011 or 1265-4011		
XP Hydrides	1265-3000 or 1265-4000	XP Mineral Acids	1265-3001, 1265-4001, 1265-3012, or 1265-4012

To prevent these false readings, whenever changing a Chemcassette cartridge to one of a different gas family, thoroughly clean all of the detector's tape transport surfaces (the entire area of the optics gate) with methanol or 6% IPA alcohol using cotton swabs or a similar non-abrasive cloth[2].

2 Refer to TechNote 971304 *Hydrazine/Oxidizer Gas Monitoring Applications*

Checking for system leaks

1. Put the detector in Monitor mode.
2. Put the detector in Inhibit mode.
3. The detector was shipped with push fitting plugs inserted in the inlet and outlet ports. Insert one of these plugs securely in the inlet port as shown in Figure 38.

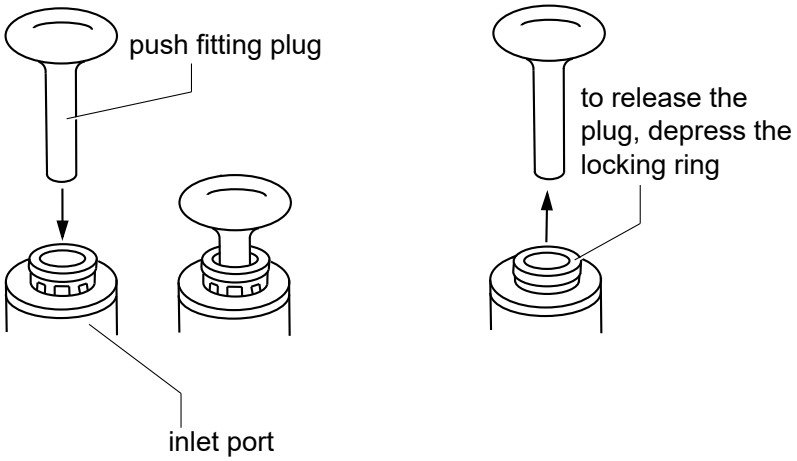


Figure 38. Inserting and removing the push fitting plug

If there is no system leak, the detector will display a fault within two minutes. If it does not, there probably is a leak. Contact Honeywell Analytics' Service Department.

Storing the detector

Before storing the detector following a gas event, purge the flow system by operating the detector in clean air until it returns to zero. If the case must be wiped down, install push fittings in the Sample In/Out ports to prevent fluids from entering the detector.

When storing the detector with the power adaptor/charger plugged in, the rocker switch can be left in the on position; the battery will continue charging. The detector can also be charged with the rocker switch off.

When storing the detector without being plugged into the power adaptor/charger, turn the rocker switch off. This will minimize the power loss. This is the recommended setting for long-term storage or for transporting the detector. Charge the detector at least four hours every three months.

Storing Chemcassette® cartridges

Follow the instructions on the cartridge label for acceptable storage temperatures and expiration dates.

Recycling

At the end of its usable life, return the detector to Honeywell Analytics for recycling.

Detectable Gases

Family	Gas	Range	TLV[1]		LAL	Default Alarm		Response Time (T50) at 2 TLV Gas Concentr'n. (sec)	Max. Sample Tubing Length (m)[12]	Sample Line Particulates Filter[2, 12]	Sample Analysis Flow Rate (cc/min ±10%)	ChemCassette[10]					Optimum Temp Range (°C)	Optimum % RH Range for Best Accuracy[7,8]
						A1	A2					Name	Part Number (14d)	Part Number (30d)	Part Number (90d)	Allowable Days After First Use[11]		
Hydrides	Arsine (AsH_3)	0.5-500ppb	5 ppb		1 ppb	2.5 ppb	5 ppb	55	30	A	250	Flex CC XP Hydrides	1265-4000	n/a	1265-3000	90	0-40	10-70% RH [4,6]
	Phosphine (PH_3)	3-3000 ppb	300 ppb	1 ppm STEL (2017 NIC; 50 ppb, STEL-C 150 ppb)	5 ppb	150 ppb	300 ppb	6										30-70% RH [4,6]
	Diborane (B_2H_6)	5-1000 ppb	100 ppb		10 ppb	50 ppb	100 ppb	14										30-70% RH [4,6]
	Silane (SiH_4)	0.03 - 50 ppm	5 ppm		0.05 ppm	2.5 ppm	5 ppb	13										34-50% RH [4,6]
	Germane (GeH_4)	50-2000 ppb	200 ppb		100 ppb	100 ppb	200 ppb	245										40-50% RH [4,6]
	Hydrogen Selenide (H_2Se)	2-500 ppb	50 ppb		5 ppb	25 ppb	50 ppb	14										10-60% RH [4,6]
	Hydrogen Sulphide (H_2S)	0.001-9.999 ppm	1 ppm	5 ppm STEL	0.005 ppm	0.5 ppm	1 ppm	7										10-75% RH [4,6]
Mineral Acids	Hydrogen Fluoride (HF)	0.02-20 ppm	0.5 ppm	2 ppm STEL-C	0.03 ppm	1 ppm	2 ppm	7	5	B, C	500	Flex CC XP Mineral Acids	1265-4001	n/a	1265-3001	90	0-35	15-75% RH [5,6]
	Hydrogen Chloride (HCl)	0.02-20 ppm	2 ppm	STEL-C	0.03 ppm	1 ppm	2 ppm	5										30-50% RH [5,6]
	Hydrogen Bromide (HBr)	0.02-10 ppm	2 ppm	STEL-C	0.03 ppm	1 ppm	2 ppm	5										20-50% RH [5,6,9]
	Boron Trifluoride (BF_3)	0.05-10 ppm	0.1 ppm	0.7 ppm STEL/C	0.1 ppm	0.5 ppm	1.0 ppm	5										15-60% RH [5,6]
	Nitric Acid (HNO_3)	0.02-20 ppm	2 ppm	4 ppm STEL	0.05 ppm	1 ppm	2 ppm	15	3									40-50% RH [4,6]
	Sulfuric Acid (H_2SO_4)	5-750 ppb	50 ppb	0.2mg/m³	10 ppb	25 ppb	50 ppb	2000	0.1	no filter								40-50% RH [4,6,9]
	Hydrogen Iodide (HI)	0.02-10 ppm	n/a	(2 ppm) PAC-1 = 1 ppm AEGL-1 = 1 ppm	0.03 ppm	1 ppm	2 ppm	15	0.1	no filter								35-55% RH [5,6,9]
Mineral Acids (export unrestricted)	Hydrogen Fluoride (HF)	0.4-20 ppm	0.5 ppm	2 ppm STEL-C	0.4 ppm	1 ppm	2 ppm	7	5	B, C	500	Flex CC-U XP Mineral Acids	1265-4012	n/a	1265-3012	90	0-35	15-75% RH [5,6]
	Hydrogen Chloride (HCl)	0.02-20 ppm	2 ppm	STEL-C	0.03 ppm	1 ppm	2 ppm	5										30-50% RH [5,6]
	Hydrogen Bromide (HBr)	0.02-10 ppm	2 ppm	STEL-C	0.03 ppm	1 ppm	2 ppm	5										20-50% RH [5,6,9]
	Boron Trifluoride (BF_3)	0.05-10 ppm	0.1 ppm	0.7 ppm STEL/C	0.1 ppm	0.5 ppm	1.0 ppm	5										15-60% RH [5,6]
	Nitric Acid (HNO_3)	0.02-20 ppm	2 ppm	4 ppm STEL	0.05 ppm	1 ppm	2 ppm	15	3									40-50% RH [4,6]
	Sulfuric Acid (H_2SO_4)	5-750 ppb	50 ppb	0.2 mg/m³	10 ppb	25 ppb	50 ppb	2000	0.1	no filter								40-50% RH [4,6,9]
	Hydrogen Iodide (HI)	0.02-10 ppm	n/a	(2 ppm) PAC-1 = 1 ppm AEGL-1 = 1 ppm	0.03 ppm	1 ppm	2 ppm	15	0.1	no filter								35-55% RH [5,6,9]
Oxidizers	Bromine (Br_2)	0.01-1 ppm	0.1 ppm	0.2 ppm STEL	0.02 ppm	0.05 ppm	0.1 ppm	35	10	no filter	460	Flex CC Hydrogen Peroxide	1265-4010	1265-3010	n/a	30	0-40	40-50% RH
	Chlorine (Cl_2)	0.005-5 ppm	0.5 ppm	1 ppm STEL (2017 NIC; TLV 0.1 ppm, STEL 0.4 ppm)	0.02 ppm	0.25 ppm	0.5 ppm	7	30	B, C	500	Flex CC XP Chlorine	1265-4002	n/a	1265-3002	90	0-40	30-55% RH [4,6]
	Chlorine (Cl_2)	0.01-5 ppm	0.5 ppm	1 ppm STEL (2017 NIC; TLV 0.1 ppm, STEL 0.4 ppm)	0.05 ppm	0.25 ppm	0.5 ppm	9	30	B, C	250	Flex CC Fluorine/Oxidizers	1265-4004	1265-3004	n/a	30	0-40	5-75% RH
	Fluorine (F_2)	0.01-10 ppm	1 ppm	0.1 ppm OSHA PEL	0.05 ppm	0.5 ppm	1.0 ppm	5	10									0-85% RH
	Nitrogen Dioxide (NO_2)	0.03-10 ppm	0.2 ppm		0.05 ppm	0.1 ppm	0.2 ppm	56	30									10-70% RH [5,6]
	Chlorine Dioxide (ClO_2)	20-1000 ppb	100 ppb	0.3 ppm STEL	25 ppb	50 ppb	100 ppb	36	10									5-90% RH
Amines	Ammonia (NH_3)	0.01-150 ppm	25 ppm	35 ppm STEL	0.05 ppm	12.5 ppm	25 ppm	5	30	B, C	250	Flex CC XP Ammonia	1265-4003	n/a	1265-3003	90	0-35	0-90% RH [4]
	Dimethylamine (DMA, C_2H_7N)	0.5-50 ppm	5 ppm	15 ppm STEL	0.1 ppm	2.5 ppm	5 ppm	10										5-90% RH [4]
	Tetrakis (Dimethylamido) Titanium (TDMAT, $C_8H_{24}N_4Ti$)	0.01-20 ppm	n/a		0.05 ppm	1 ppm	2 ppm	14										5-90% RH [4]
	Trimethylamine (TMA, C_3H_9N)	0.03-50 ppm	5 ppm	15 ppm STEL	0.05 ppm	2.5 ppm	5 ppm	10										1-90% RH [4]
Phosgene	Phosgene ($COCl_2$)	2-2000 ppb	100 ppb		5 ppb	50 ppb	100 ppb	15	30	A	500	Flex CC XP Phosgene	1265-4007	n/a	1265-3007	90	0-40	1-95% RH
	Ethylchloroformate (ECF, $C_3H_5ClO_2$)	0.02-30 ppm	n/a	PAC-1=1 ppm, AEGL-2=0.2 ppm (8hr), ERPG-2=5 ppm (AIHA)	0.02 ppm	0.5 ppm	1 ppm	6 (@ 2 ppm)										5-90% RH
	Methylchloroformate (MCF, $C_2H_3ClO_2$)	0.03-30 ppm	n/a	PAC-1=0.2 ppm, AEGL-2=0.7 ppm (8hr), ERPG-2=2 ppm (AIHA)	0.03 ppm	0.1 ppm	0.2 ppm	10 (@ 0.4 ppm)										1-95% RH
Diisocyanates	Toluene Diisocyanate (TDI, $C_9H_6N_2O_2$)	0.5-200 ppb	1 ppb	5 ppb STEL	0.6 ppb	1 ppb	2 ppb	10	0.15	no filter	460	Flex CC Diisocyanates	1265-4006	1265-3006	n/a	30	0-40	5-65% RH [4]
	Methylene Bisphenyl Isocyanate (MDI, $C_{15}H_{10}N_2O_2$)	0.5-200 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	10										5-80% RH [9]
	Hexamethylene Diisocyanate (HDI, $C_8H_{12}N_2O_2$)	0.5-150 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	30										15-85% RH [4]
	Hydrogenated Xylene Diisocyanate (H6XDI, $C_{10}H_{14}N_2O_2$)	0.5-150 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	15										25-85% RH [4]
	Methylene bis-(4-cyclohexylisocyante) (HMDI, $C_{15}H_{22}N_2O_2$)	0.5-100 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	15										20-65% RH [4,9]
	Isophorone Diisocyanate (IPDI, $C_{12}H_{18}N_2O_2$)	0.5-150 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	15										5-90% RH
	Xylene Diisocyanate (XDI, $C_{10}H_8N_2O_2$)	0.5-200 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	10										5-85% RH
	p-Phenyl Diisocyanate (PPDI, $C_8H_4N_2O_2$)	0.5-200 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	10										5-80% RH
	1,4-Cyclohexylene diisocyanate (CHDI, $C_8H_{10}N_2O_2$)	0.5 - 200 ppb	5 ppb		0.6 ppb	2.5 ppb	5 ppb	26										15-75% RH [4]
	Tetraisocyanate Silane (TICS, $Si(NCO)_4$)	300 - 6000 ppb	n/a	Internal TLV set at 500ppb	400 ppb	400 ppb	500 ppb	48										5-95% RH
Hydrazines	Hydrazine (N_2H_4)	3-1000 ppb	10 ppb		5 ppb	5 ppb	10 ppb	220	3	no filter	500	Flex CC Hydrazines	1265-4008	1265-3008	n/a	30	0-40	15-90% RH
	Monomethyl Hydrazine (MMH, CH_6N_2)	3-2000 ppb	10 ppb		5 ppb	5 ppb	10 ppb	110	5									20-75% RH [4,6]
	Dimethyl Hydrazine (UDMH, $C_2H_8N_2$)	3-2000 ppb	10 ppb		5 ppb	5 ppb	10 ppb	110	5									10-70% RH [4]
Hydrogen Cyanide (HCN)		0.2-30 ppm	4.7 ppm	STEL/C	0.5 ppm	2.4 ppm	4.7 ppm	15	30	A	250	Flex CC Hydrogen Cyanaide	1265-4009	n/a	n/a	15	0-30	15-70% RH [4]
Sulphur Dioxide (SO_2)		10-2500 ppb	250 ppb	STEL	25 ppb	120 ppb	250 ppb	12	30	B, C	250	Flex CC Sulfur Dioxide	1265-4005	1265-3005	n/a	30	0-40	25-90% RH [4]
Ozone (O_3)		20-1000 ppb	100 ppb		25 ppb	50 ppb	100 ppb	55	5	no filter	250	Flex CC Ozone	1265-4011	1265-3011	n/a	30	0-40	15-90% RH
Hydrogen Peroxide (H_2O_2)		0.1-3 ppm	1 ppm		0.2 ppm	0.5 ppm	1.0 ppm	27	5	no filter	460	Flex CC Hydrogen Peroxide	1265-4010	1265-3010	n/a	30	0-40	35-50% RH [4]

1 Source: ACGIH 2017 TLVs and BELs.
2 A = 780248 (disposable particulate filter), B = 1830-0055 (filter membrane 0235-1072 must be replaced every 30 days), C = 1991-0147 (disposable filter for corrosive gases)
Outside of RH range:
3 Tends to have lower response at higher humidities.
4 Tends to increase sensitivity at higher humidities (due to the chemistry of the reaction).
5 Tends to under-report at higher humidities (typically >75% RH) due to the gas characteristics to adhere or decompose on contact with water/moisture. The response seems to be lower but the actual gas concentration under these high humidity conditions will be lower than expected.
6 Tends to under-report in dry conditions (<25-30% RH).
7 Depending on the combination of temperature and humidity, even within the ranges specified above, a detector's performance efficiency can be influenced due to condensation, physical tape material changes, or optical changes. Consult Honeywell Analytics' Service Department.
8 Refer to TechNotes 971131 (Chemcassette'-based Instrument Accuracy and Precision) and 1998-0219 (Protocol for Testing Gas Detectors).
9 Slow recovery: Prolonged exposure to high levels of gas/vapor (2x TLV or above) can condense in the system and may require purging with dry clean air or inert gas.
10 For information about the expiration date of the Chemcassette, refer to "Chemcassette" on page 42 (Review menu).
11 The number of days from the installation date that the Chemcassette cartridge can be used. When the allowable-days limit is reached, or if the absolute expiration date (printed on cartridge) is reached, the detector will issue an Expired Chemcassette Cartridge fault. The type of expiration is found in the event history data field for the fault (either 1 [stale] or 2 [expired]). Replace the cartridge when this fault is issued. The only exception is if the cartridge was used only briefly and then removed from the detector and properly stored in the sealed bag at the recommended temperature. In this case, the cartridge can be used past the stale-tape date (but not past the absolute expiration date) by clearing the stale-tape fault before going into monitor mode. Advance the tape manually about five inches before installing the cartridge and entering monitor mode.

12 Do not use the optional sampling wand for those gases with recommended sample tubing lengths of less than five meters and no recommended sample line particulate filter.

Specifications

Description			Value
Detection technique			Chemcassette®-cartridge-based with advanced self monitoring optics design and K-factor multiplier options
Dimensions			See "Dimensions" on page 29
Weight			9.1 lbs. (4.1 kg)
Interface			Four buttons, 3.5" Color LCD TFT display, web server
USB			2.0 or later
Installation	Mounting screws	Concrete	5/16 in x 2 in vibration-resistant stud anchor for concrete (McMaster-Carr 94475A185 or equivalent), add 0.25 in. to length when mounting bracket with sun shield
		Wood	5/16 in. x 2 in. flange head lag screw for wood (McMaster-Carr 95526A375 or equivalent), add 0.25 in. to length when mounting bracket with sun shield
	Ventilation requirements		Mount with no obstructions within 4 in. (10 cm) of either side or within 2 in. (5 cm) above or below the detector
Environmental	Operating temperature		0 °C to 40 °C for most gases and applications
	Operating humidity		0-100% RH for detector (sample RH limited per tape/calibration). Sample line requires additional hardware to remove moisture in high RH conditions where condensing may occur. The sample must be non-condensing. Dry conditions may require humidification.
	Indoor/outdoor use		Both (the power adaptor/charger is indoor only)
	Ingress protection rating		IP65
	Operating altitudes	-1,000 to 3,000 ft. above sea level	Standard
		3,000 ft. to 6,000 ft. above sea level	Requires factory adjustment by Honeywell Analytics
	Flow system		Automatic flow control with bypass system, higher flow at inlet to reduce sample time (internal bypass system); sample up to 100 ft.; refer to "Detectable Gases" on page 64 for specific gases.
Local alarms/ status	Visual		LEDs for alarm, normal condition, fault, and external power
	Audible		User-selectable: Off, Low ~75 dB at 1 m, Medium ~85 dB at 1 m, High >90 dB at 1 m
Data logging			Rolling 3 months (15 sec. with no gas reading, 1 sec. when reading gas), event history (1500 events, approximately 1 year)
Maximum inlet/outlet pressure differential			The overall maximum load on the pump between the inlet and the exhaust should not exceed 10 inches H_2O
Electrical	Power supply		Universal line powered (90-260 VAC 50/60 Hz) for battery charger and non-classified use
	Power input (from the power adaptor/charger or direct-wired)		24 VDC ±10%, 3.75 amps
	Power consumption		~1.9 A at 24 VDC ±10% (including battery-charging current)
	Battery type		Lithium ion
	Battery life		~70% of original capacity after 300 full charge/discharge cycles; 6+ hours under typical operating conditions
	Power adaptor/ charger	Input	90~264 VAC, 1.2 A, 47-63 Hz
		Output	24 VDC, 3.75 A max
		Environmental use	Indoor only
	Wire gauges	Minimum	24
		Maximum	14
	External switch or circuit breaker requirement (description and location)		Meets or exceeds all local codes and regulations
	Relays		250 V, 6 A maximum
Communications	Options		Relays: Alarm 1, Alarm 2, Fault (user configurable for normally open/closed) 4-20mA Ethernet (with Modbus TCP/IP and web server) USB port (for flash drive configuration/data transfer) Communications connector and optional communications cable: 60 V, 5 A maximum
4-20 mA output defaults and ranges	Inhibit		2 mA, programmable from 1.5-3.5 mA in 0.5 mA increments
	Maintenance		3 mA, programmable from 1.5-3.5 in 0.5 increments
	Instrument fault		1 mA or less, not programmable (will be driven under 1 mA)
	Over-scale		21.5 mA, programmable 21-22 mA
	4-20 mA configurations		Sink, source, isolated
Storage conditions	Detector		32 °F to 104 °F (0 °C to 40 °C), 0-100% RH non-condensing
	Chemcassette cartridges		See the label on the Chemcassette cartridge for storage conditions
Consumables	Chemcassette cartridges		14-, 30-, or 90-day cartridges for seven specific family gases
	Duty cycle options		Duty cycle option to conserve Chemcassette tape in high background applications
	RFID labels		Smart RFID labels affixed to the cartridge for error-proof use and quick gas selection; ChemKey no longer required.
	Filters		Some gases require a filter. Refer to "Detectable Gases" on page 64 for filter requirements.

Description		Value
Certifications	Detector	UL 61010-1, 3rd Edition, 2012-05 (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - Part 1: General Requirements
		CAN/CSA-C22.2 No. 61010-1, 3rd Edition, 2012-05, (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - Part 1: General Requirements)
		IEC 61010-1:2010, 3rd Edition
		FCC approval for RFID board, IC, RED, CMIT, IDA, CCAB, CTIC
	Battery	UL/cUL Recognition to UL 2054 + 60950-1
		IEC 62133 1st Edition CB Certification
		UN Test Report to UN 38.3
	Self-declared European CE Mark on detector for:	EMC, LVD, ROHS, WEEE

Labels

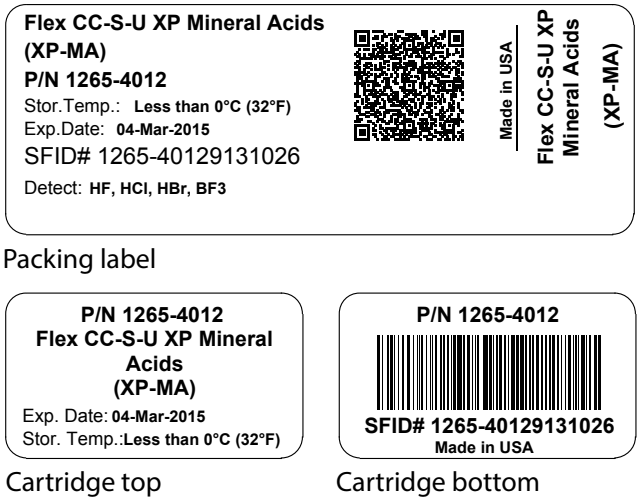


Figure 39. Chemcassette packing and cartridge labels

The cartridge's bottom label contains the RFID tag.

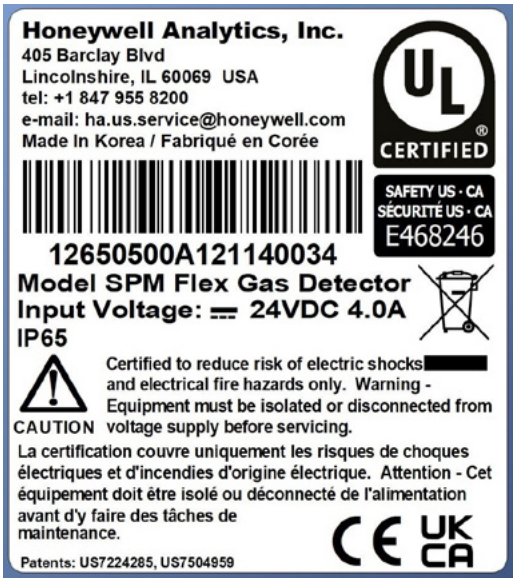


Figure 40. The detector's nameplate

Accessories and Parts

⚠WARNING

Use only accessories and parts meeting or exceeding Honeywell Analytics' specifications.

Description		Part No.
SPM Flex base detectors	SPM Flex base detector	1265-0500
SPM Flex fixed detectors[1]	Australia	SPMF-F1AU
	Switzerland	SPMF-F1CH
	Denmark	SPMF-F1DK
	Europe	SPMF-F1EU
	Great Britain	SPMF-F1GB
	Japan	SPMF-F1JP
	North America	SPMF-F1US
SPM Flex portable detectors[2]	Australia	SPMF-P1AU
	Switzerland	SPMF-P1CH
	Denmark	SPMF-P1DK
	Europe	SPMF-P1EU
	Great Britain	SPMF-P1GB
	Japan	SPMF-P1JP
	North America	SPMF-P1US
Accessories	Shoulder strap for portable base detector (made from clean-room-compatible materials; the strap must be properly laundered and stored for clean room use)	SPMF-STRP
	Inlet sampling wand	SPMF-WAND
	Optics packaged test card assembly	1265-2014
	Power battery	factory-replaceable only
	Energizer CR2032 coin battery	0140-0013

continued...

Description			Part No.
Parts	Power	Universal power adaptor/charger, for indoor use only (no cord)	SPMF-PWRS
		North America (120VAC) power cord	874333
		Australia	874557
		Great Britain	874558
		Denmark	874559
		Switzerland	874560
		Europe	874561
		Japan (100VAC)	1874-0112
	Cables and Connectors	Ethernet cable with weatherproof connector	SPMF-ECON
		Communication cable with weatherproof connector	SPMF-CCON
	Spare handle for portable base detector		SPMF-HNDL
	Dust covers	For Ethernet port	SPMF-DCET
		For communication port	SPMF-DCCO
		For power port	SPMF-DCPO
	Tubing	Tubing 1/4" O.D x 1/8" I.D. FEP - for sample inlet, price per foot	102599
		Tubing 1/4" O.D x 3/16" I.D. FEP - for sample exhaust, price per foot	100440
		Union fitting - use to connect disposible end of line filter to tubing	0235-0095
		(Optical) fitting tube assembly	1265A0412
	Mounting brackets	Standard mounting bracket for fixed detector (for SPM Flex only)	SPMF-MBST
		Retro-fit mounting bracket for fixed detector (compatible with original SPM)	SPMF-MBRF
	Filters[3]	Bypass filter	871134
		Disposable microfibre dust filter	780248
		Particulate filter	1830-0055
		Membrane for filter 1830-0055 (must be replaced every 30 days)	0235-1072
		Acid scrubber filter	710235
		Line filter for corrosive gases	1991-0147

continued...

Description			Part No.
Chemcassette cartridges	Long --up to 90 days (XP) or 30 days (standard) of continuous monitoring	SPM Flex CC XP Hydrides	1265-3000
		SPM Flex CC XP Mineral Acids (may require an export license)	1265-3001
		SPM Flex CC XP Chlorine	1265-3002
		SPM Flex CC XP Ammonia	1265-3003
		SPM Flex CC Fluorine Oxidizers	1265-3004
		SPM Flex CC Sulfur Dioxide	1265-3005
		SPM Flex CC Diisocyanates	1265-3006
		SPM Flex CC XP Phosgene	1265-3007
		SPM Flex CC Hydrazine	1265-3008
		SPM Flex CC Hydrogen Peroxide	1265-3010
		SPM Flex CC Ozone	1265-3011
		SPM Flex CC-U XP Mineral Acids (No export restriction - LDL limited above 366 ppb for HF)	1265-3012
	Short --up to 2 weeks of continuous monitoring	SPM Flex CC-S XP Hydrides	1265-4000
		SPM Flex CC-S XP Mineral Acids (may require an export license)	1265-4001
		SPM Flex CC-S XP Chlorine	1265-4002
		SPM Flex CC-S XP Ammonia	1265-4003
		SPM Flex CC-S Fluorine Oxidizers	1265-4004
		SPM Flex CC-S Sulfur Dioxide	1265-4005
		SPM Flex CC-S Diisocyanates	1265-4006
		SPM Flex CC-S XP Phosgene	1265-4007
		SPM Flex CC-S Hydrazine	1265-4008
		SPM Flex CC-S Hydrogen Cyanide	1265-4009
		SPM Flex CC-S Hydrogen Peroxide	1265-4010
		SPM Flex CC-S Ozone	1265-4011
		SPM Flex CC-S-U XP Mineral Acids (No export restriction - LDL limited above 366 ppb for HF)	1265-4012

1 Includes a standard wall mounting bracket, a battery, a power adaptor/charger (for indoor use only), a manual on CD, a printed quick start guide, and a power cord appropriate for the region.

2 Includes an Ethernet connector, a power connector, a handle accessory kit, a clean-room-safe shoulder strap, a user manual on CD, a printed quick start guide, and a power adaptor/charger with a plug and cable appropriate for the region. (The shoulder strap must be properly laundered and stored for clean room use.)

3 Use an external filter to protect the tubing from contamination (the particulate filter for non-corrosive gases, the corrosive filter for corrosive gases). For multiple-gas applications or if the correct filter is not known, use the corrosive filter. Replace the filter every 3 months. Refer to "Detectable Gases" on page 64 for information on specific gases. Note that filters are not used with diisocyanates, hydrazine, ozone, or hydrogen peroxide so regular maintenance cleaning is especially important for detectors exposed to those gases.

Certifications

Global certificates for safety, EMC, and radio frequency transmission are available on the Honeywell Analytics website (www.sps.honeywell.com).

FCC

Incorporates FCC: Part 15 Subpart B Class A

Note:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Safety Notice

This device meets the government's requirements for exposure to radio waves. This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S. Government and Canadian Government.

Avis de sécurité RF

Ce dispositif respecte les exigences du gouvernement en matière d'exposition aux ondes radio. Ce dispositif est concu et fabrique de manière a ne pas depasser les limites d'emission pour l'exposition a l'energie de radiofrequence (RF) etablies par la Commission federale des communications des gouvernements americain et canadien.

Warranties

SPM Flex warranty

All products are designed and manufactured to the latest internationally recognized standards by Honeywell Analytics under a Quality Management System that is certified to ISO 9001.

As such, this instrument (including the pump) is warranted under proper use, to the original end-user purchaser, against any defects in materials or workmanship related failures for a period of 12 months from the date of first turn-on or 18 months from delivery from Honeywell Analytics to the customer, whichever is less. Separate warranty conditions apply to the Chemcassette cartridges limited as indicated below. During this period, Honeywell Analytics will repair or replace defective parts on an exchange basis, F.O.B. to approved service centers on a global basis.

This warranty does not cover damage caused by accident, abuse, or abnormal operating conditions.

Defective equipment must be returned to Honeywell Analytics for repair. Before returning materials for repair or replacement, the Customer must obtain a Service Event Number (SE#) by contacting Honeywell Analytics Service in advance; include a detailed report stating the nature of the defect and ship the equipment prepaid to Honeywell Analytics' factory. If no detail report is included, Honeywell Analytics reserves the right to charge an investigative fee (prices available upon request) before any repair or replacement is performed. Returned goods must detail the Service Event Number (SE#) clearly on the package.

Service in the field or at the customer's premises is not covered under these warranty terms. Time and travel expenses for on-site warranty services will be charged at Honeywell Analytics' normal billing rates. Contact your Honeywell Analytics representative for information on available Service Contracts.

Honeywell Analytics shall not be liable for any loss or damage whatsoever or howsoever occasioned which may be a direct or indirect result of the use or operation of the Contract Goods by the Buyer or any Party.

This warranty covers the gas detector and parts sold to the Buyer only by authorized distributors, dealers and representatives as appointed by Honeywell Analytics. This warranty does not cover defects attributable to improper installation, repair by an unauthorized person or the use of unauthorized accessories/parts on the product. A warranty claim will only be accepted if a proof of purchase is submitted and all conditions obtained within this Warranty are met.

Honeywell Analytics reserves the right to validate any warranty claim prior to processing. Upon acceptance of a warranty claim, Honeywell Analytics will repair or replace the defective product free of charge. The initial warranty period is not extended by virtue of any works carried out there after.

Instruments which have been repaired or replaced during the warranty period are warranted for the remainder of the unexpired portion of the original warranty period. Honeywell Analytics is released from all obligations under its warranty in the event repairs or modifications are made by persons other than its own authorized personnel, unless such work is authorized in writing by Honeywell Analytics. Honeywell Analytics is released from all obligations under its warranty in the event that detection substrates other than Honeywell Analytics' Chemcassettes® have been installed and used in Honeywell Analytics' instruments.

Honeywell Analytics reserves the right to change this policy at any time. Contact Honeywell Analytics for the most current warranty information.

Chemcassette® cartridge warranty

All Chemcassette cartridges® are warranted for a period not to exceed the Chemcassette® cartridge expiration date printed on each package and tape reel.

Index

SPM Flex Gas Detector User Manual
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Honeywell