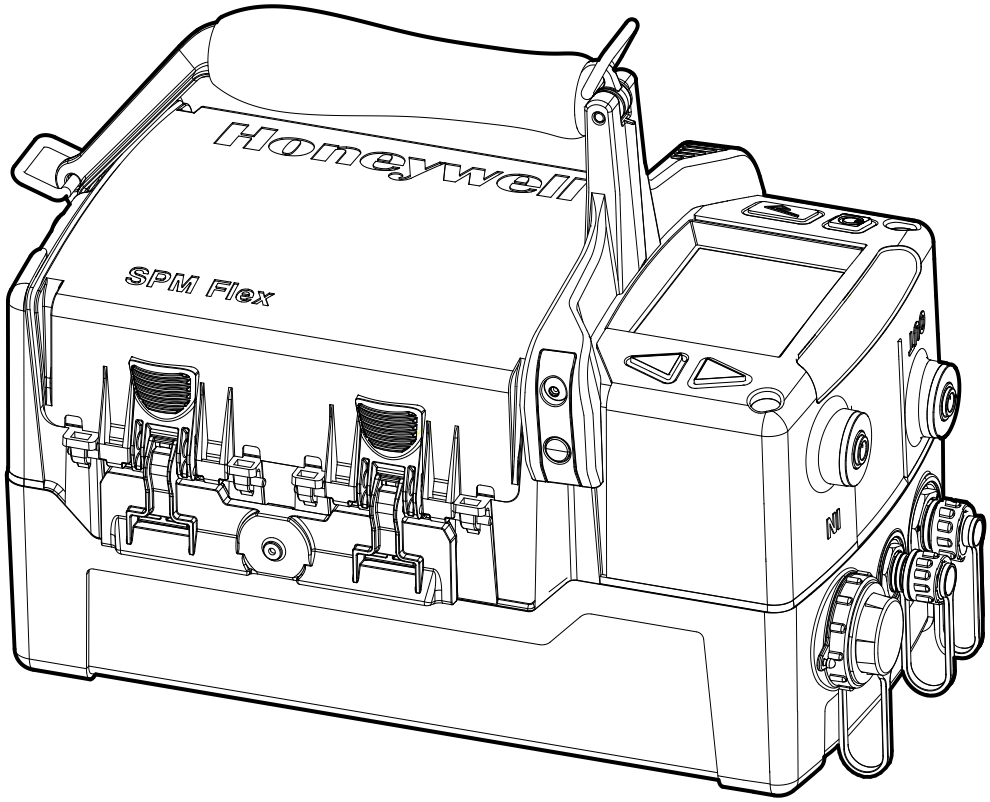
SPM Flex
Single Point Monitor Gas Detector



User's Manual

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 32ºF and 104ºF (0ºC and 40ºC) 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

⚠DANGER

Danger notices contain information that could prevent death or serious injury.

⚠WARNING

Warnings contain information that could prevent injury or equipment damage.

⚠CAUTION

Caution notices contain information that could prevent equipment damage.

NOTE

Notes contain helpful information.

Contact 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.
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 unit 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.
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 unit is supplied with a mounting bracket. If replacing an old SPM detector, a retrofit bracket is available (these are shown on pages 28 and 29). All units are supplied with a power adaptor[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 unit (save the packaging to re-use for service requests).
- Read the quick start guide and this manual.
- Remove the paper optics card from the gate

Portable detectors

- Connect the power adaptor (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
- Load a chemcassette
- Configure the detector and begin to monitor (see pages 15-16 for basic display usage)
- See detailed Operation (pages 32-41) and Optional accessories (pages 53-55)

Fixed detectors

- Install the wall-mount bracket and mount the detector to it (see pages 28-29)
- Wire in accordance with local electrical codes utilizing a trained electrician (see pages 19-25)
  - Input
    - Honeywell-supplied power adaptor (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
- Load a Chemcassette cartridge

1 FSP Group Model FSP135-AAAN rated 1 5.62A / 24V (UL Listed QQGQ (E190414))

- Configure the detector and begin to monitor (see pages 15-16 for basic display usage)
- See detailed Operation (pages 32-41) and Optional accessories (pages 53-55)

Additional accessories

- External dust filters (required on inlet) and/or tubing (can be used to reduce contamination as well as noise)
- Sampling wand
- Mating signal connectors for fixed installations

Battery operation

The SPM Flex gas detector is supplied with a power supply/charger than can connect the detector's power connection and a standard wall outlet. (Ensure that the correct power cable has been ordered for local operation.) The power supply/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 unit 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). The battery is designed for 1000 charge cycles. Honeywell Analytics recommends keeping the detector connected to the power supply/charger when not in use to keep the battery fully charged.

⚠WARNING

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

How to extend battery life

Power consumption is optimized to extend battery life when not in monitor mode. In addition, the unit 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.

The ports of a typical installation is shown in the figure below.

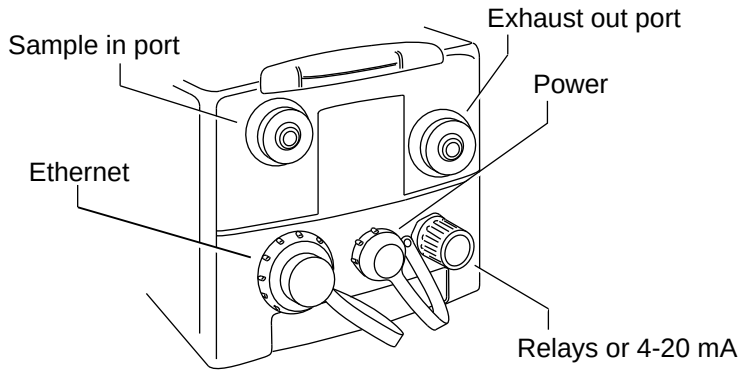


Figure 1. terminals and ports

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

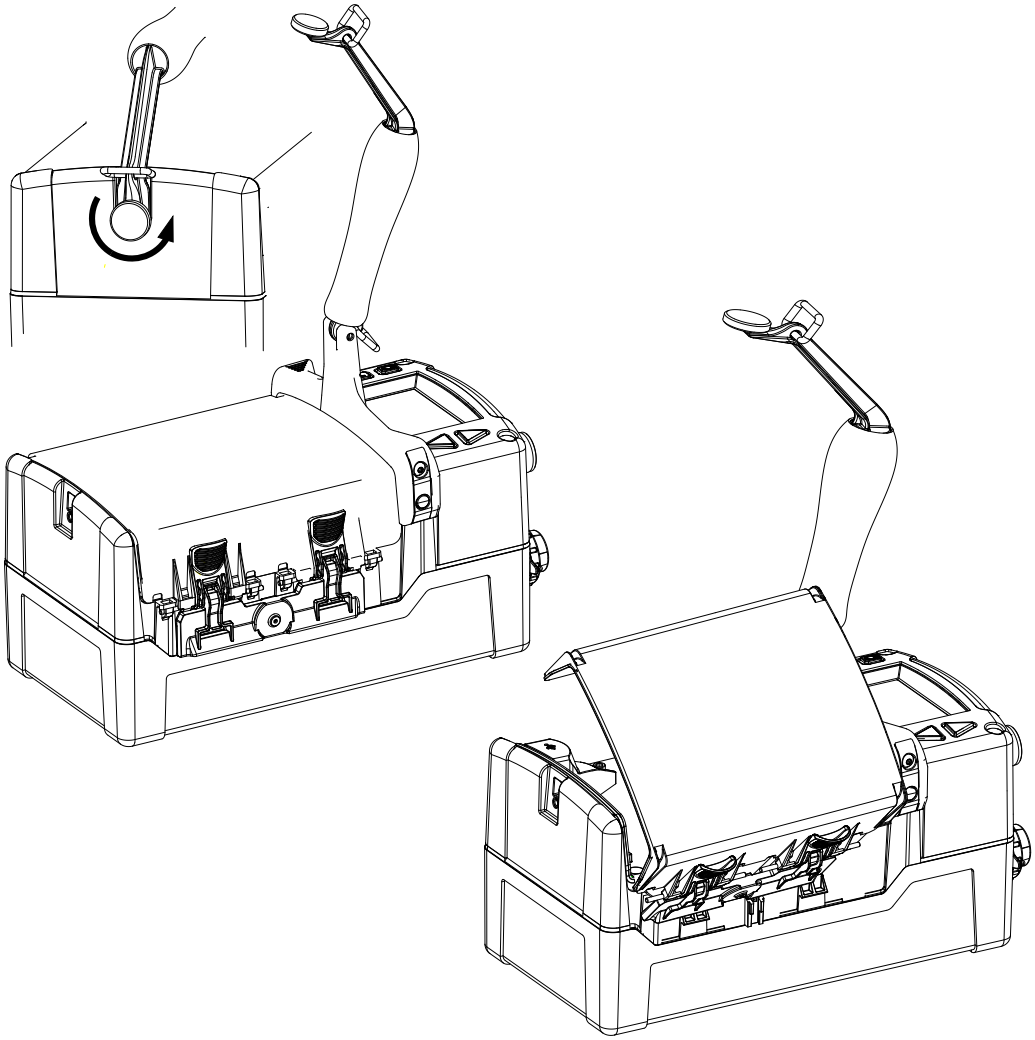


Figure 2. Opening the detector cover

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

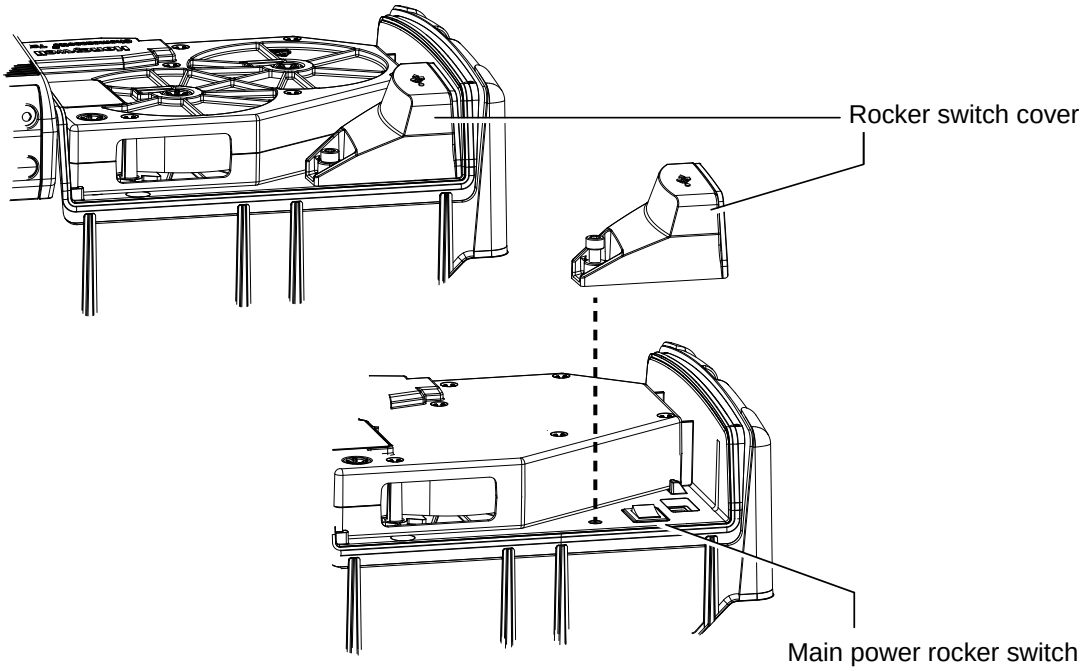


Figure 3. SPM Flex main power rocker switch

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:

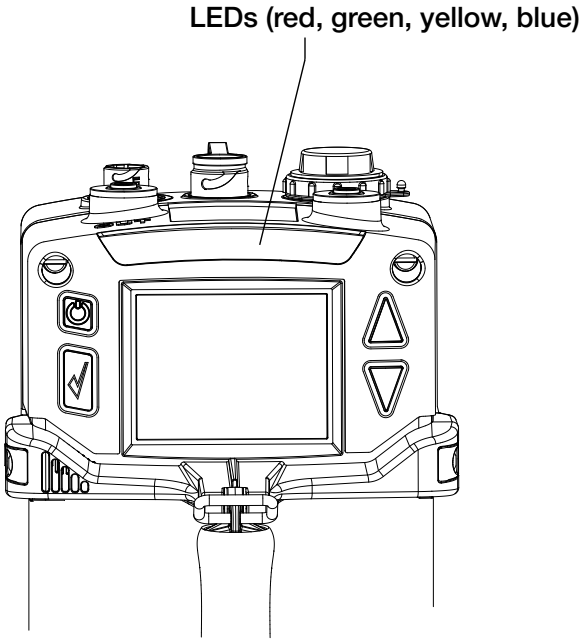


Figure 4. SPM Flex LEDs

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.

Navigation

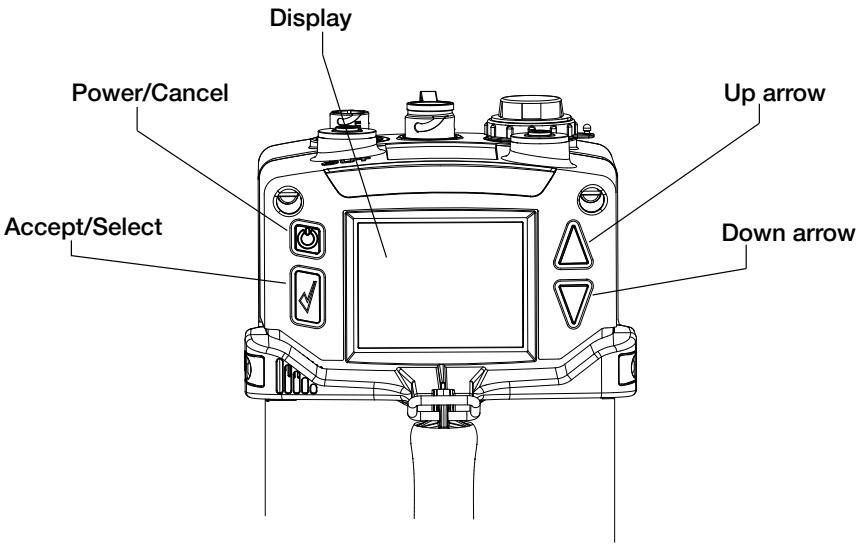
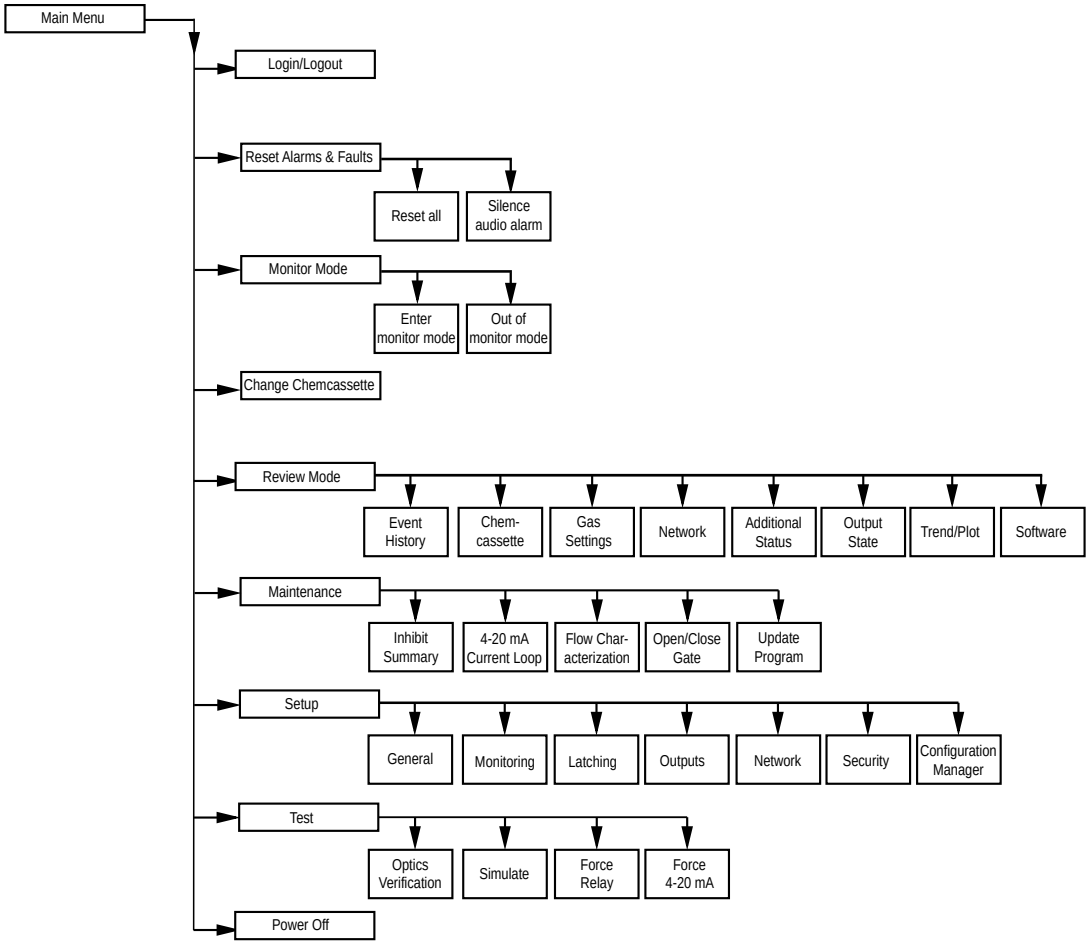


Figure 5. SPM Flex controls

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.

Menu Map



The SPM Flex 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 return to 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.

The display

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

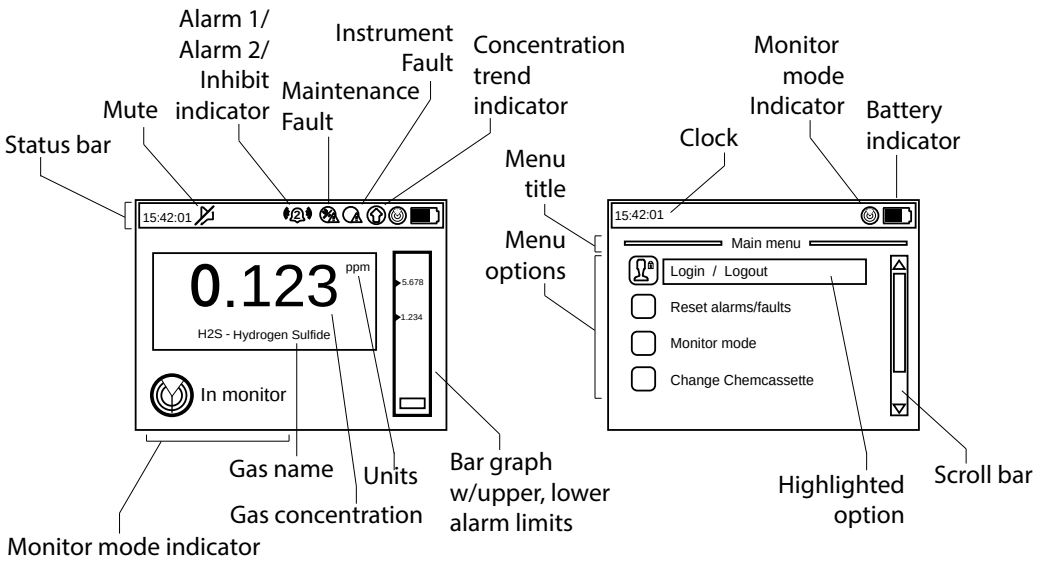


Figure 6. Elements of typical SPM Flex detector displays

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 unit 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.

Loading a Chemcassette cartridge

The Chemcassette cartridge door must be closed before putting the detector into monitor mode (this holds the Chemcassette cartridge in place). The detector must be taken out of monitor mode before opening the door.

NOTE

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

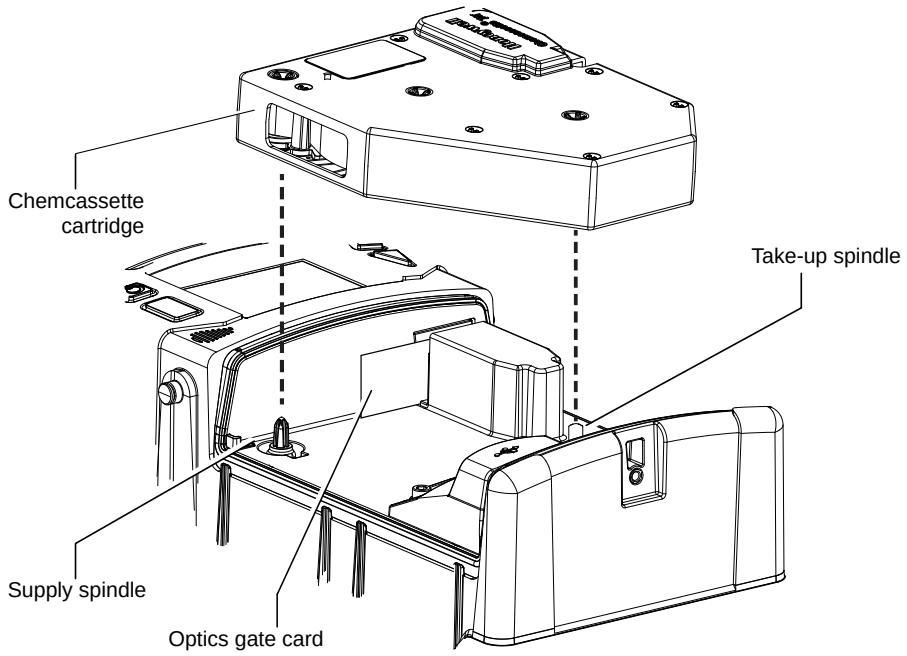


Figure 7. The optics gate card and Chemcassette cartridge

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 Chemcassette cartridge. When prompted, snap the new Chemcassette cartridge into place. It will fit in only one orientation. The takeup spindle will "flutter" back and forth to allow easy installation.
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 (i.e., 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. Select “Close Gate.”

Changing the selected gas

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

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

Typical fixed installation topologies

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

⚠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.

Electrical connection is made via conduit directly to ports or via the connector (see Figure 1 on page 10). The terminals used are suitable for conductors of 24 to 14 AWG (0.5 to 1.8mm Dia.). The use of 16 AWG (1.5 mm dia.) conductors is recommended.

⚠CAUTION

Use the supplied power adaptor/connector only. (The adaptor is rated for indoor use only.)

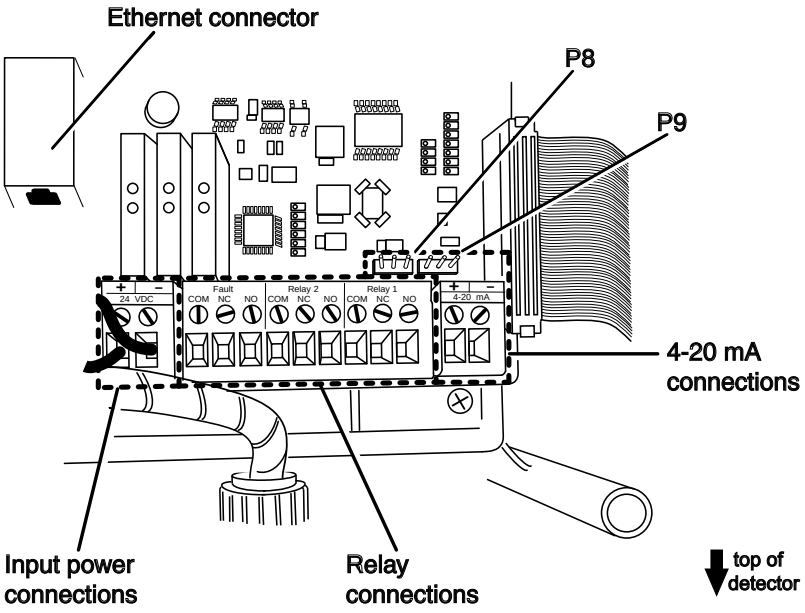


Figure 8. SPM Flex connections

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.

This table shows the default wiring configuration for the 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 Terminal Connections		
No.	**Color**	**Assign to Relay**
1	Brown	Alarm2 COM
2	Red	Alarm2 NO
3	Orange	NC
4	Yellow	Alarm1 COM
5	Green	Alarm1 NO
6	Blue	NC
7	Purple	Fault COM
8	Gray	Fault NO
9	White	NC
10	Black	NC

For 4-20 mA wiring, wires 1 through 8 would be disconnected and wires 9 and 10 would be used. Do not run 4-20 mA signals and relay signals in the same cable bundle.

Wiring diagrams

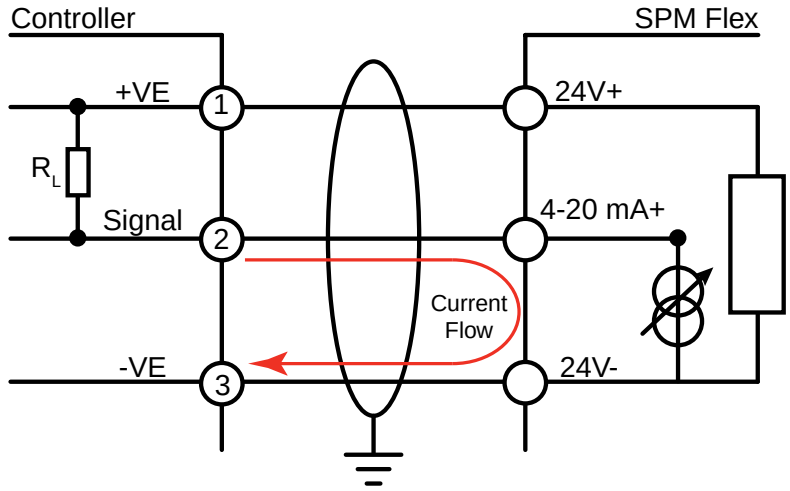


Figure 9. 4-20 mA sink wiring diagram

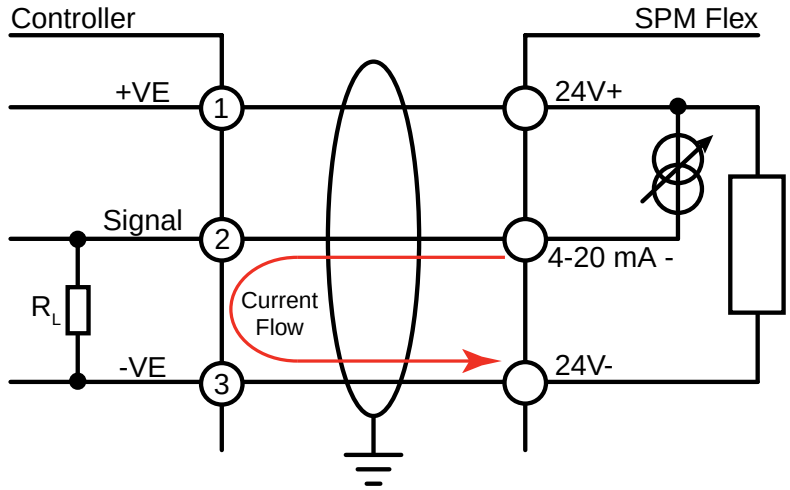


Figure 10. 4-20 mA source wiring diagram

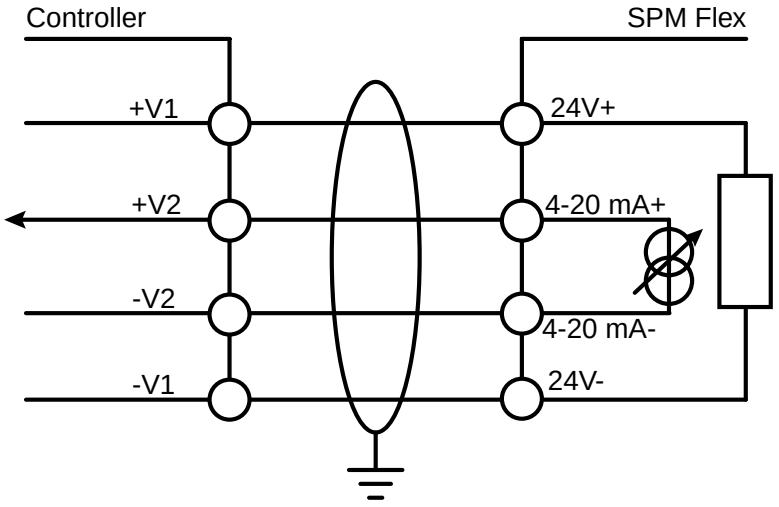


Figure 11. 4-20 mA isolated wiring diagram

4-20 mA wiring

4-20 mA output is a three-wire connection that is configurable as sink, source, or isolated, as shown in these following figures. Use an Allen wrench 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.

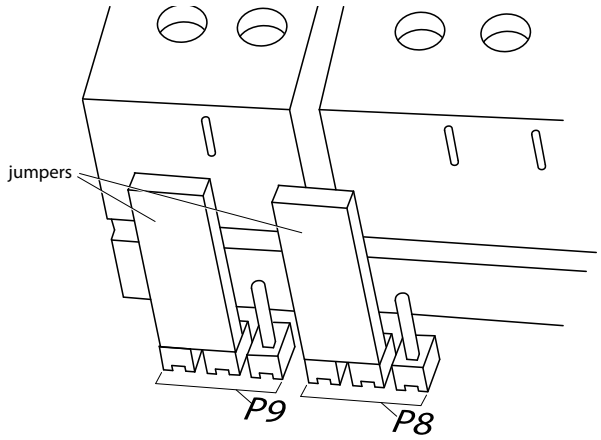


Figure 12. 4-20 mA sink configuration

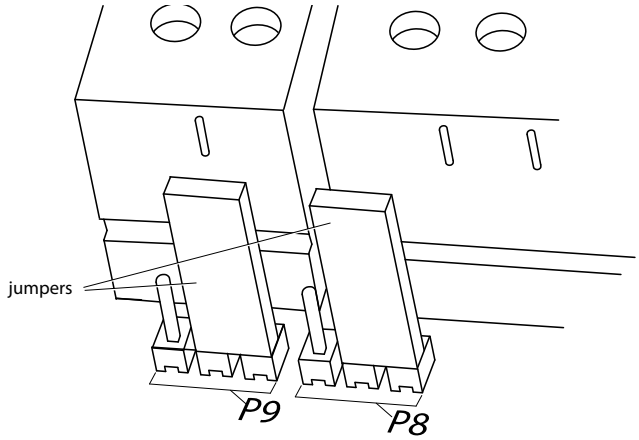


Figure 13. 4-20 mA source configuration

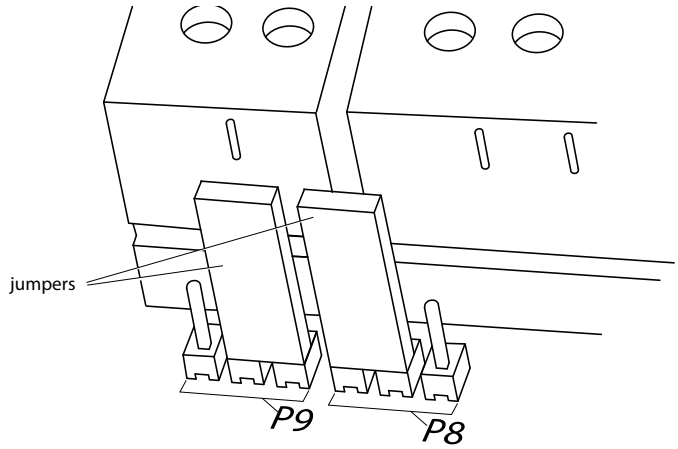


Figure 14. 4-20 mA isolated configuration

Relays

The detector is equipped with three relays. Connect the unit as shown in this figure.

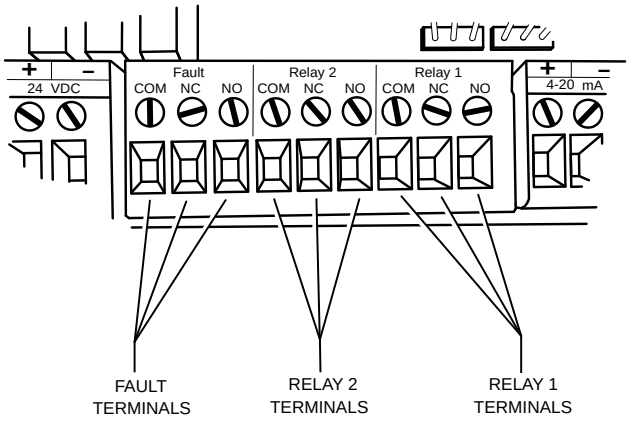


Figure 15. Relay configuration

The detector can be wired as normally closed or normally open. It can also be configured as normally energized or normally de-energized via software.

NOTE

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

By default, the relays are set to Alarm 1, Alarm 2, and Instrument Fault.

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.

Tubing lengths vary among gases. If the pressure or vacuum on the inlet/exhaust lines does not meet the recommended values, the detector may encounter flow faults.

Sample Specifications					
Description		Maximum			
Inlet	Tubing length, m (ft)	30 (100)	20 (66)	10 (33)	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 (in.)	6.35 (0.25)			
	Tubing ID in mm (in.)	3.18 (0.125)			
Outlet	Tubing Length, m (ft)	30 (100)			
	Tubing OD, mm (in)	6.35 (0.25)			
	Tubing ID, mm (in)	4.76 (0.188)			

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

NOTE

Use Teflon Fluorinated Ethylene Polymer (FEP) tubing to ensure proper sample transport.

Optional external filters can be installed to reduce noise or to monitor for gas at the location of the detector. To do this an inline filter is simply connected to the gas inlet port. The area around the detector is then being monitored as opposed to a sample being drawn from a remote location.

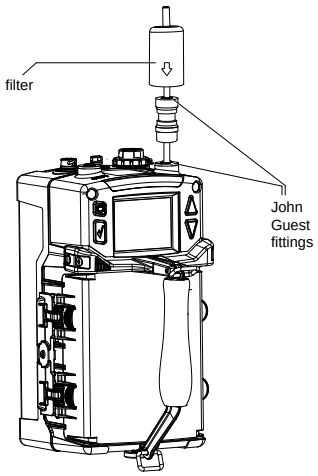


Figure 16. External filter

Setup

Installation drawing

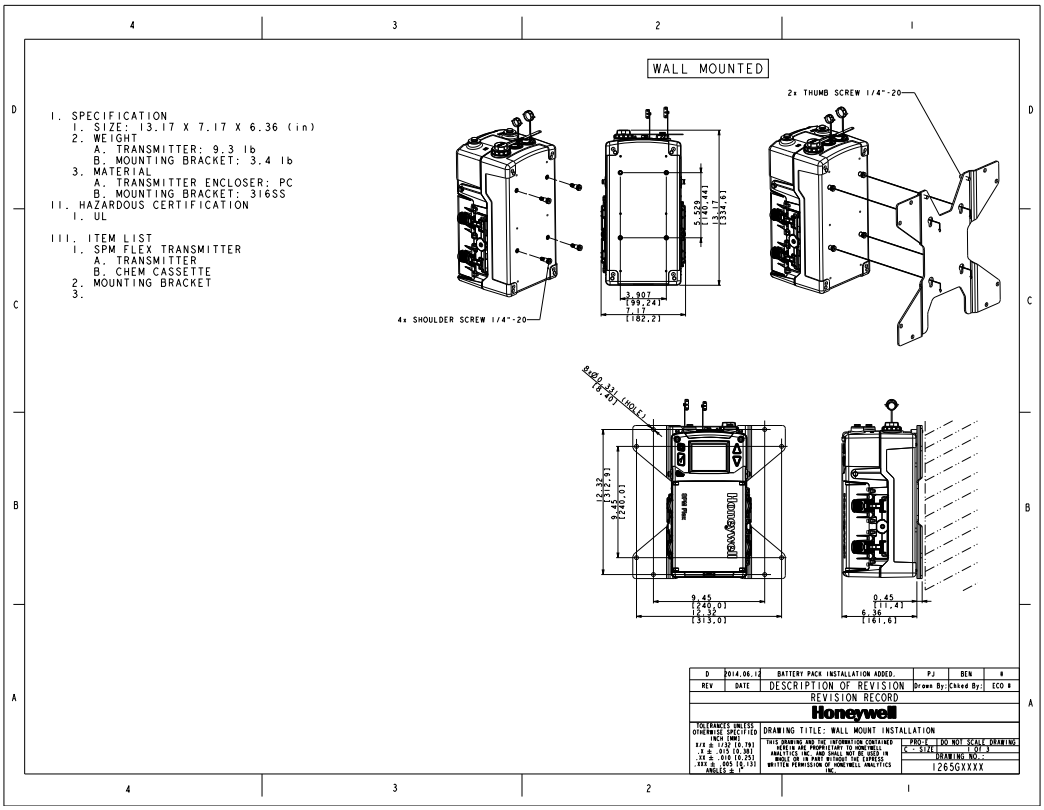


Figure 17. Installation drawing

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 units: 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.

Dimensions

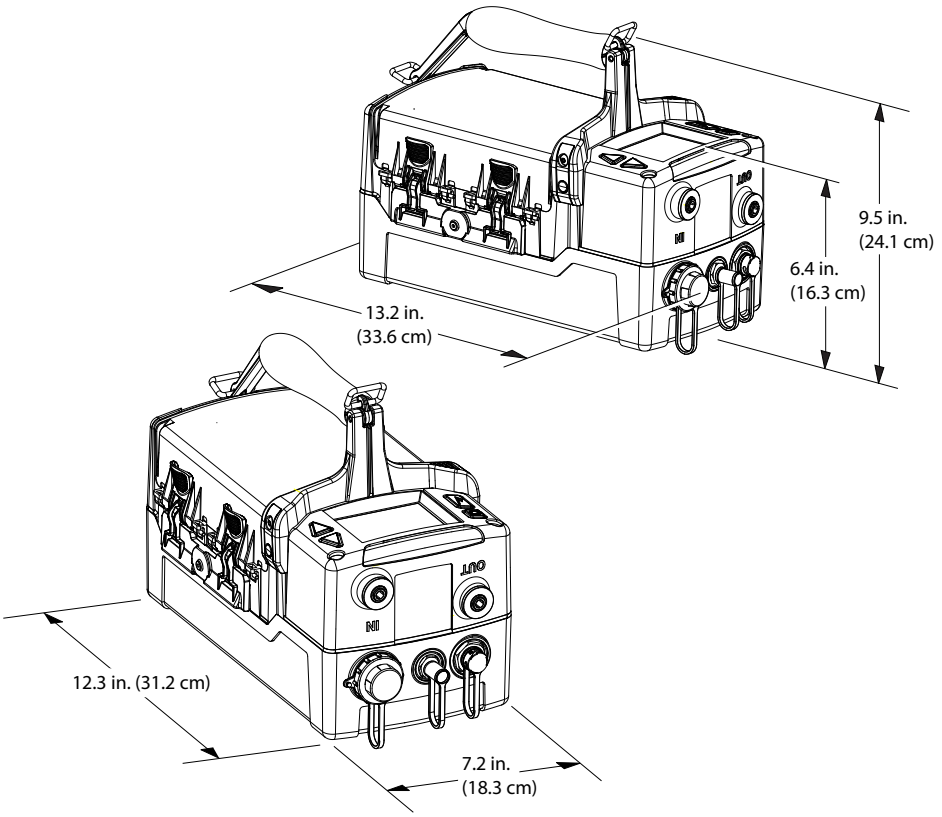


Figure 18. Dimensions of the SPM Flex Gas Detector

Standard mounting bracket

Figure 19 shows the detector's standard mounting bracket.

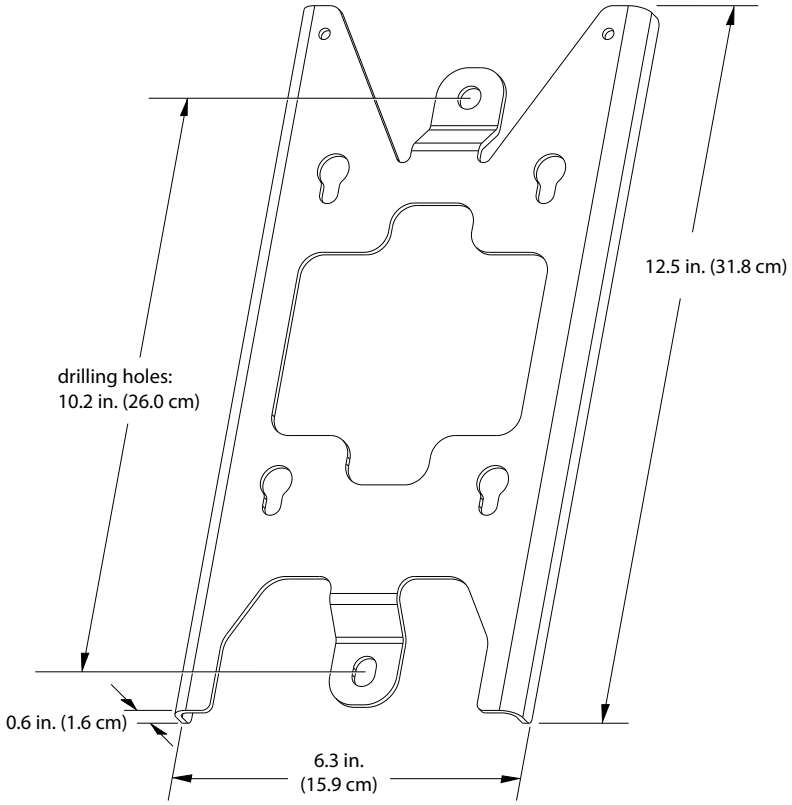


Figure 19. Standard mounting bracket

At least 2 screws must be used when mounting the standard bracket to a wall. Use the bracket as a template for determining the location of the holes to be drilled in the wall. See the Specifications section on page 52 for a description of the appropriate screws.