Honeywell

Manning Calibration Kit

Instruction and Calibration Manual

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Release H

Notices and Trademarks

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About This Document

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Sales Information

Contact us at detectgas@honeywell.com

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	**ATTENTION:** Identifies information that requires special consideration.
	**TIP:** Identifies advise or hints for the user, often in terms of performing a task.
	**REFERENCE-EXTERNAL:** Identifies an additional source of information outside of this bookset.
	**REFERENCE-INTERNAL:** Identifies an additional source of information within this bookset.
CAUTION	indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	**CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING:** Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING, Risk of electrical shock:** Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD:** Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	**PROTECTIVE EARTH (PE) terminal:** Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**FUNCTIONAL EARTH terminal:** Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.
	**EARTH GROUND - Functional Earth Connection:** This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**CHASSIS GROUND:** Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Contents

Serial number:

1 Introduction

This manual has been prepared to help in the calibration of Manning equipment. Please refer to the manual shipped with each piece of equipment for further information.

The calibration kit may contain either one or two disposable bottles filled with the dry gas appropriate for the sensor. Included in the kit is a calibration adapter, hose, valve, and flow meter.

Figure 1 shows the parts included in the Manning Calibration Kit, and Figure 2 shows how to hook up the span or zero gas to a typical sensor (in this case, the Manning EC-F2 sensor).

Be sure the calibration procedure matches the Manning equipment that is installed before proceeding with zero and span calibrations. Because calibration gas has a shelf life, each bottle has an expiration date printed on it. Do not use the calibration gas after the expiration date.

This manual must be carefully followed by all individuals who have or will have the responsibility for Manning equipment. Warranties made by Honeywell Analytics with respect to this equipment will be voided if the equipment is not used and serviced in accordance with the instructions in this manual. If in doubt about a procedure, please contact Honeywell Analytics before proceeding.

Please refer to the equipment instruction manuals for additional information

Figure 1: Parts included in the Manning Calibration Kit

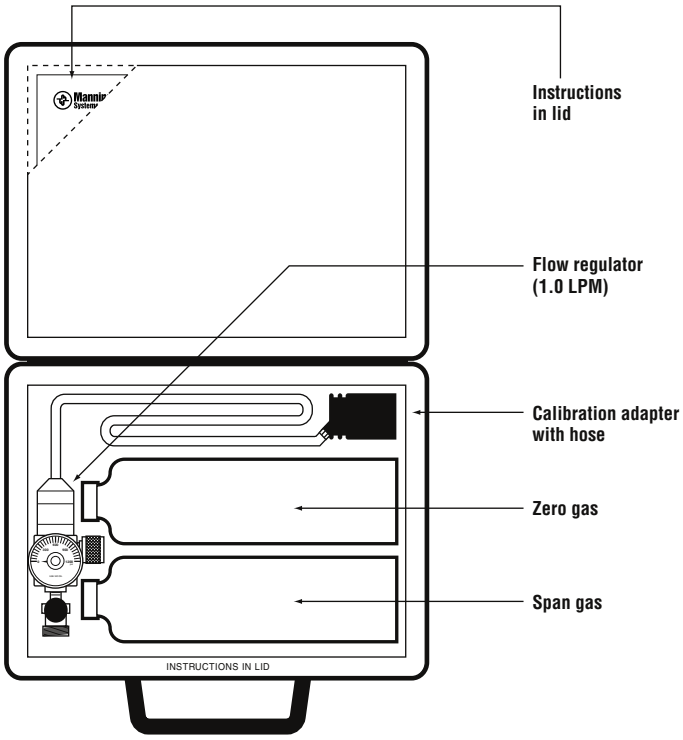
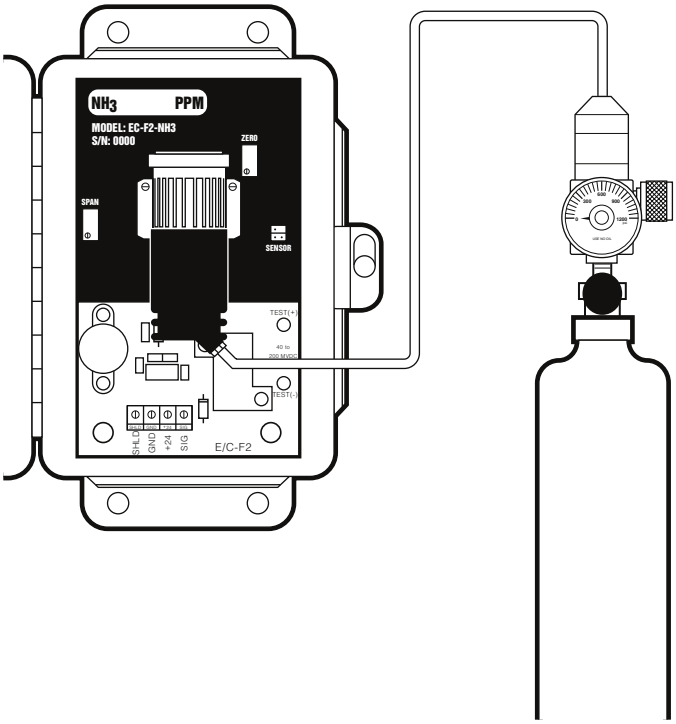


Figure 2: Typical calibration arrangement



2 EC-F2 Calibration Procedure

General Information

The Manning EC-F2 sensor should be calibrated a minimum of once every six months, or after exposure to a large concentration of gas. The Manning EC-F2 sensor generally becomes less sensitive with age, therefore regular calibration is critical to maintain the accuracy of the sensor.

Zero Calibration

After the unit is installed and has been powered up for a minimum of 24 hours, the unit should be zero calibrated by the following two procedures.

NOTE: If the sensor output is erratic immediately after the installation of a new cell, it may be a high gain (span) setting left over from a previous cell that was adjusted for aging.

- Be sure the unit is in clean air, or apply zero air at 1.0 L/min
- Adjust the zero pot (see Figure 3, Note 2) until the sensor outputs 4.0 mA (40 mV from Test [–] to Test [+]) (see Figure 3, Note 3).

Span Calibration

- Perform zero adjustment before spanning.
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range (ppm)	Span Gas (ppm)	Calibrated Signal Voltage (mV)
0–100	100	200
0–250	100	104
0–250	250	200
0–500	250	120
0–1,000	1,000	200

- Place calibration adapter firmly over the sensor.
- Apply span gas at 1.0 L/min (span gas must be in air, not nitrogen or other carrier).
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 3, Note 1).

For combinations not shown in the previous table, use the following formula to determine the output:

$$\text{Signal (mA)} = \left[\frac{\text{SGC}}{\text{SFSV}} \times 16\right] + 4$$

Where:

SGC = Span Gas Concentration,
SFSV = Sensor Full Scale Value.

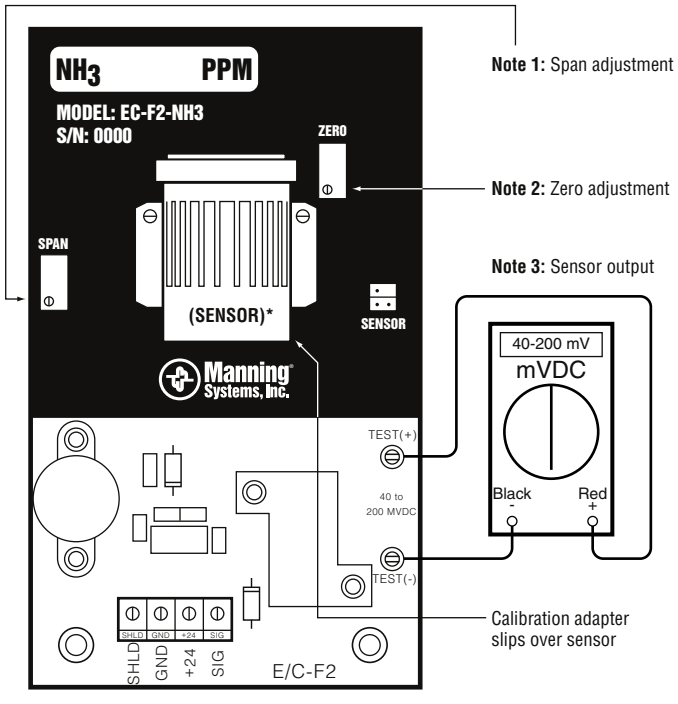
For example if 100 ppm SGC gas is used to calibrate a 250 ppm SFSV sensor, the signal would be as follows:

$$\text{Signal} = \left[\frac{100\text{ppm}}{250\text{ppm}} \times 16\right] + 4 = 10.4\text{ mA}$$

10.4 mA = 104 mV from TEST (–) to TEST (+)

If the correct output cannot be achieved, a replacement cell is required.

Figure 3: Zero and span adjustments on the Manning EC-F2 Sensor



*Sensor may be located externally

3 EC-F2 Replacement Cell Procedure

Instructions for Installation

- Slide ribbon cable out from under the retaining clip (see Figure 4).
- Unplug ribbon cable and remove cell from its holder. Discard old cell.
- Install the new cell, plugging in the ribbon cable. Take care to center the plug properly on the header. Notice that the ribbon cable exits the bottom of the plug and curls back over it.
- Slide ribbon cable under the retaining clip and pull it snug to insure plug cannot slide off (see Figure 5).
- Allow the new cell to run for a minimum of one hour, then calibrate the sensor with certified calibration gas.

TROUBLESHOOTING NOTE: If the sensor output is erratic immediately after the installation of a new cell, it may be a high gain (span) setting left over from a previous cell that was adjusted for aging.

Figure 4: Manning EC-F2 Replacement Cell Closeup

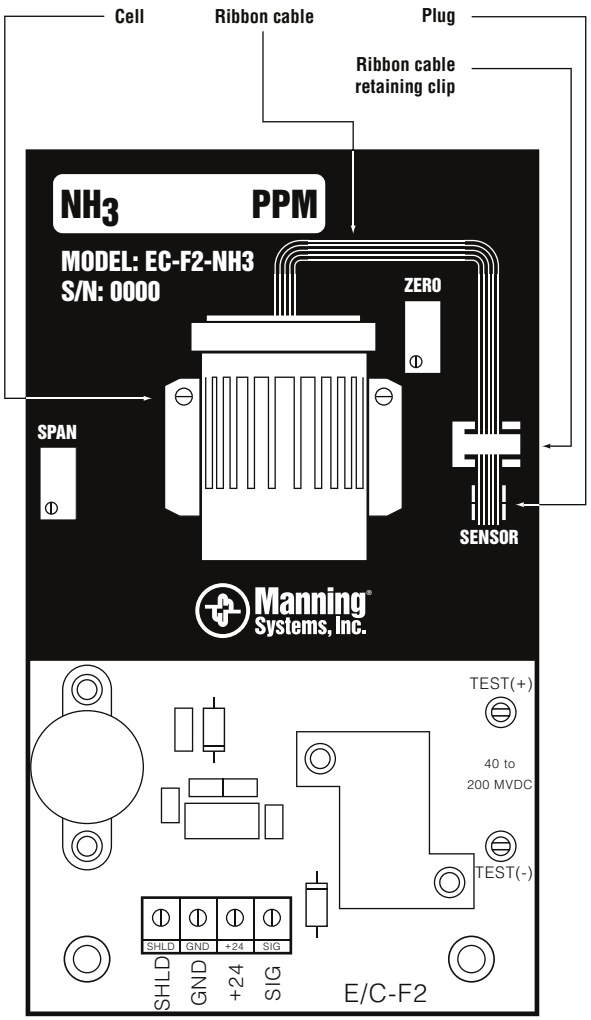
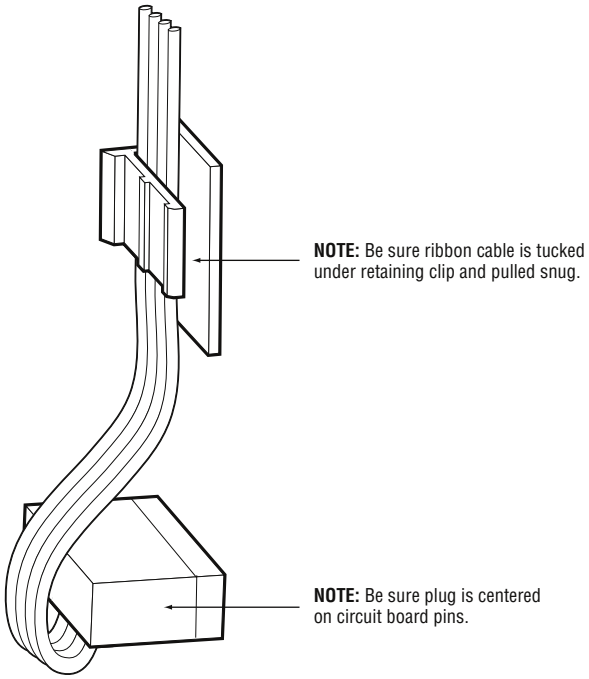


Figure 5: Ribbon Cable Orientation



4 EC-F1 Calibration Procedure

General Information

The Manning EC-F1 sensor should be calibrated a minimum of once every six months, or after exposure to a large concentration of gas. The Manning EC-F1 sensor generally becomes less sensitive with age, therefore regular calibration is critical to maintain the accuracy of the sensor.

Zero Calibration

After the unit is installed and has been powered up for a minimum of 24 hours, the unit should be zero calibrated by the following two procedures.

NOTE: If the sensor output is erratic immediately after the installation of a new cell, it may be a high gain (span) setting left over from a previous cell that was adjusted for aging.

- Be sure the unit is in clean air, or apply zero air at 1.0 L/min
- Adjust the zero pot (see Figure 6, Note 1) until the sensor outputs 4.0 mA (40 mV from Test [–] to Test [+]) (see Figure 6, Note 3).

Span Calibration

- Perform zero adjustment before spanning.
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range (ppm)	Span Gas (ppm)	Calibrated Signal Voltage (mV)
0–100	100	200
0–250	100	104
0–250	250	200
0–500	250	120
0–1,000	1,000	200

- Place calibration adapter firmly over the sensor.
- Apply span gas at 1.0 L/min (span gas must be in air, not nitrogen or other carrier).
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 6, Note 2).

For combinations not shown in the previous table, use the following formula to determine the output:

$$\text{Signal (mA)} = \left[\frac{\text{SGC}}{\text{SFSV}} \times 16\right] + 4$$

Where:

SGC = Span Gas Concentration,
SFSV = Sensor Full Scale Value.

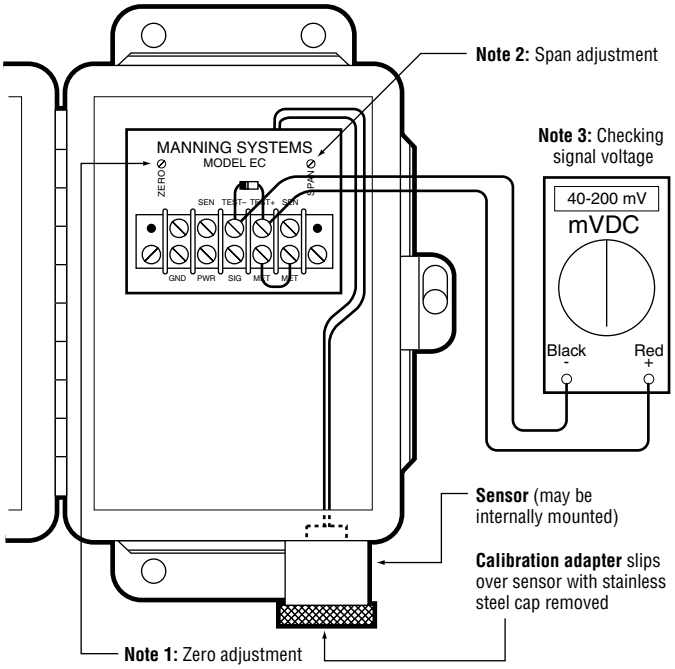
For example if 100 ppm SGC gas is used to calibrate a 250 ppm SFSV sensor, the signal would be as follows:

$$\text{Signal} = \left[\frac{100\text{ppm}}{250\text{ppm}} \times 16\right] + 4 = 10.4\text{ mA}$$

10.4 mA = 104 mV from TEST (–) to TEST (+)

If the correct output cannot be achieved, a replacement cell is required.

Figure 6: Checking signal voltage at the Manning EC-F1 Sensor



5 EC-F3 O_2 Calibration Procedure

General Information

The Manning EC-F3 oxygen sensor comes factory calibrated but may require a span adjustment upon installation to compensate for local altitude and barometric pressure conditions.

Effects of Barometric Pressure on Oxygen: The output of the Manning EC-F3-O_2 sensor is affected by changes in barometric pressure. If a unit is calibrated at a barometric pressure of 29.00 inches Hg in clean air to output 20.9 % O_2, and the barometric pressure changes to 28.00 inches Hg, the output will indicate 20.2 % O_2. Because of this, the installer should always perform a nominal calibration as described below when the unit is started up. After the nominal calibration is performed, the output will be expected to vary slightly with barometric pressure.

Nominal Calibration: After the unit is installed and has been powered up for a minimum of 8 hours, a nominal calibration will be achieved by the following method.

- Be sure the unit is in clean air with the area well ventilated.
- The sensor should indicate a concentration of approximately 20.9 %, which is the normal concentration of oxygen in clean air. This will vary depending on elevation and barometric pressure.
- Adjust the span pot until the sensor output indicates a concentration of 20.9 % (see Figure 7, Note 1). For the following ranges, the test signals should be:

Range 0-25%

0% = 4 mA or 40 mV (TP1-TP2)

20.9% = 17.37 mA or 173.7 mV (TP1-TP2)

Range 15-25%

15% = 4 mA or 40 mV (TP1-TP2)

20.9% = 13.44 mA or 134.4 mV (TP1-TP2)

Zero Calibration

DO NOT adjust the zero pot without certified calibration gas. If zero adjustment is required, the following procedure will zero the unit.

- Apply zero gas at 1.0 L/min (zero gas must be in nitrogen).
- After zero gas has been on sensor for two minutes, adjust the zero pot until the correct output is achieved, (see Figure 7, Note 2).

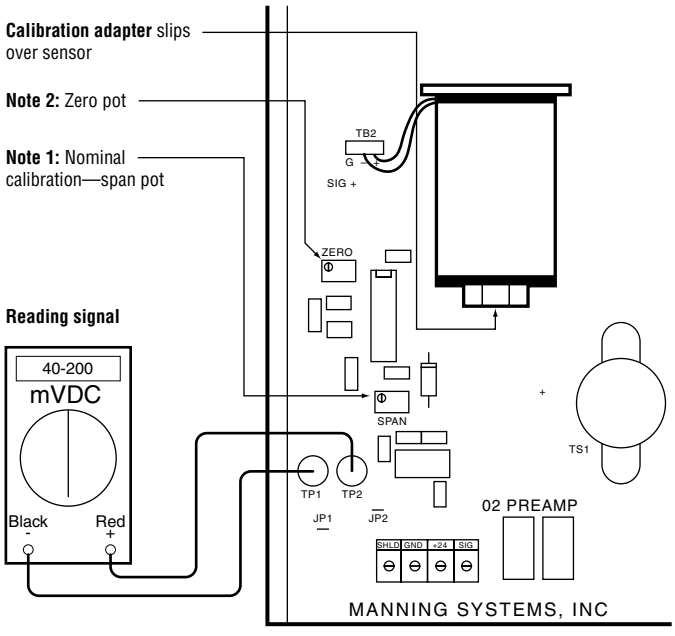
Span Calibration

Span calibration can be achieved by performing the nominal calibration described at the beginning of this section or by using calibration gas as follows:

- Perform zero adjustment before spanning.
- Apply span gas at 1.0 L/min (span gas must be in nitrogen).
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 7, Note 1).

Calibration kits are available from Honeywell Analytics.

Figure 7: Zero and span adjustments to the Manning EC-F3 O_2 Sensor



6 EC-F9-NH_3 Calibration Procedure

General Information

The Manning EC-F9 sensor should be calibrated a minimum of once every six months, or after exposure to a large concentration of gas. The Manning EC-F9 generally becomes less sensitive with age, therefore regular calibration is critical to maintain the accuracy of the sensor.

Refer to the Manning EC-F9 sensor manual for more in-depth calibration procedure details.

Zero Calibration

There is no zero pot as the pre-amp is factory zeroed and should not require any further adjustment.

Span Calibration

NOTE: If the sensor output is erratic immediately after the installation of a new cell, it may be a high gain (span) setting left over from a previous cell that was adjusted for aging.

- Confirm that the sensor is in clean air or there is no ammonia present. Output should not be more than 4.6 mA (46 mV from Test[–] to Test[+]) (see Figure 8, Note 2).
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range (ppm)	Span Gas (ppm)	Calibrated Signal Voltage (mV)
0–100	100	200
0–250	250	200
0–250	100	104
0–500	250	120
0–1,000	1,000	200

- Place calibration adapter firmly over the sensor.
- Apply span gas at 1.0 L/min (span gas must be in air, not nitrogen or other carrier).
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 8, Note 1).
- For combinations not shown in the previous table, use the following formula to determine the output:

$$\text{Signal (mA)} = \left[\frac{\text{SGC}}{\text{SFSV}} \times 16\right] + 4$$

Where:

SGC = Span Gas Concentration,
SFSV = Sensor Full Scale Value.

For example, if 100 ppm SGC gas is used to calibrate a 250 ppm SFSV sensor, the signal would be as follows:

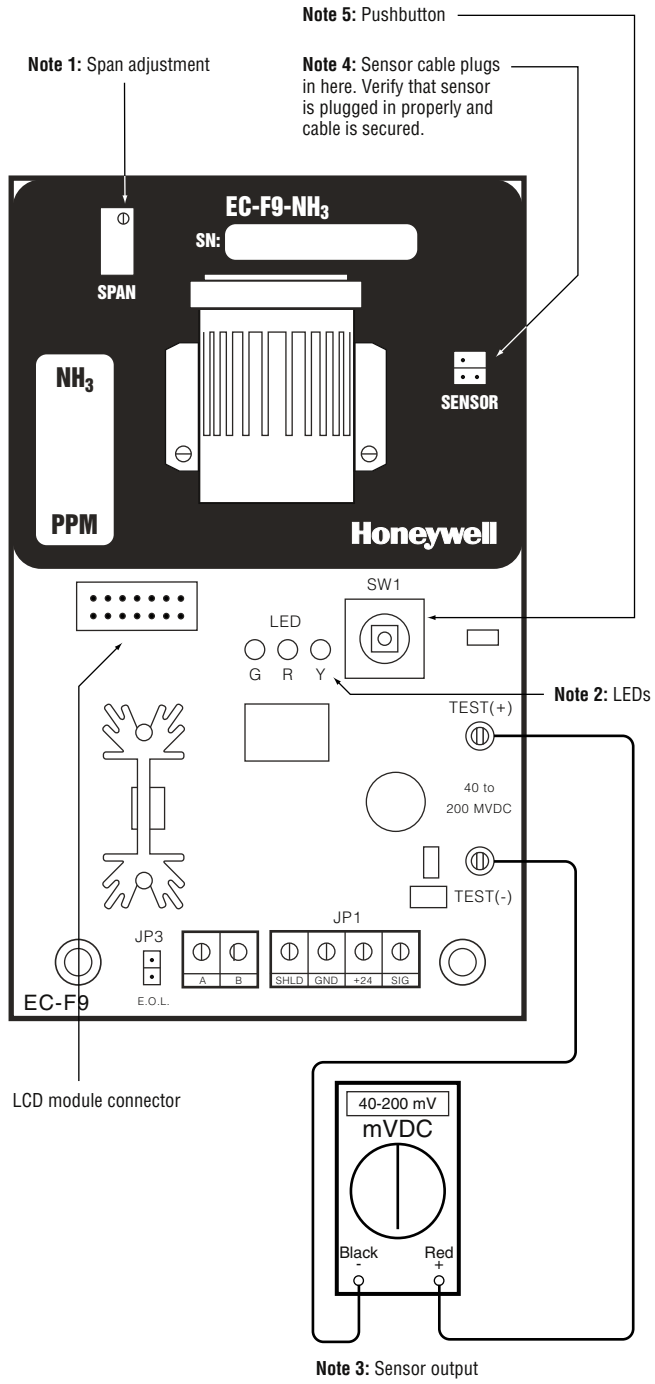
$$\text{Signal} = \left[\frac{100\ \text{ppm}}{250\ \text{ppm}} \times 16\right] + 4 = 10.4\ \text{mA}$$

10.4 mA = 104 mV from TEST (–) to TEST (+)

If the correct output cannot be achieved, a replacement cell is required.

6 EC-F9-NH_3 Calibration Procedure continued

Figure 8: Span adjustments on the Manning EC-F9 Sensor



7 SS Calibration Procedure

General Information

Manning SS solid state sensors have no adjustments at the sensor. All adjustments must be made by adjusting the alarm set point of the associated readout alarm unit. Calibration is accomplished by applying the concentration of gas that is wanted to trip the alarm unit. The peak signal voltage at the readout unit should be recorded during application of the calibration gas and the alarm setpoint at the readout unit should then be adjusted to this voltage.

Take care to dampen the supplied sponge with water when calibrating Manning SS sensors because the gas samples must be humidified.

NOTE: This sponge is only used for solid state sensors – never use the sponge for other sensor types.

See the appropriate sensor manual for typical responses to calibration gas.

NOTE: For calibrations at the Model 20 panel, see Figure 10. For the Model 21 panel, see Figure 11.

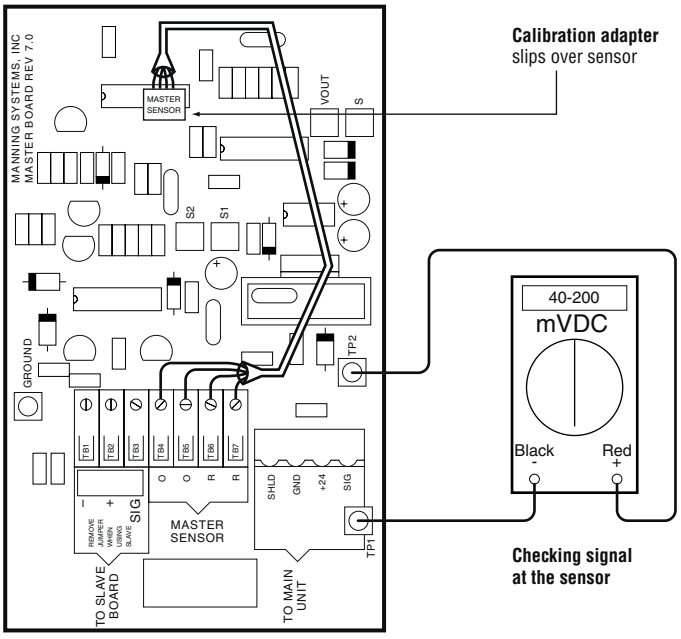
Zero Calibration

There are no adjustments at the sensor, so zero is simply the voltage when the sensor is in clean air (air free from interference gases).

Span Calibration

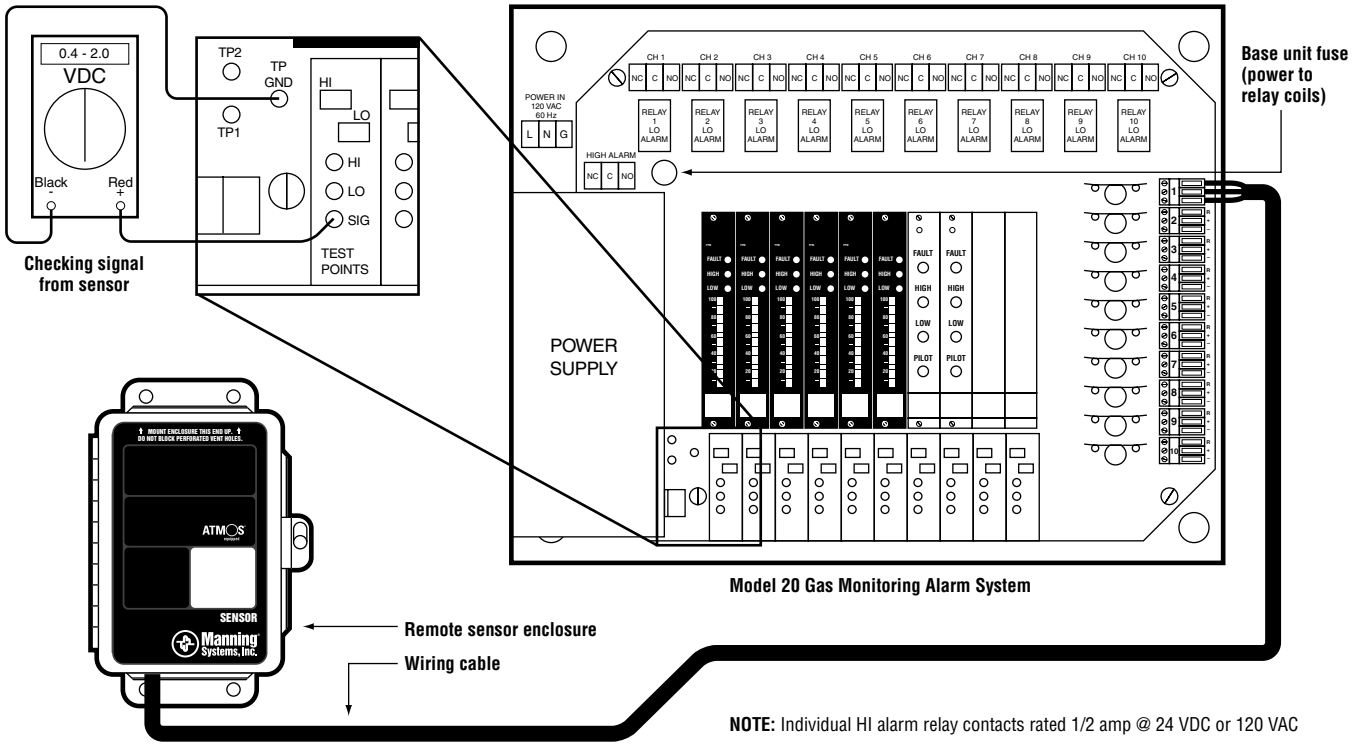
- Document the zero signal in clean air before spanning.
- Moisten the provided sponge with water, wring it out, and insert it into the calibration adapter. This humidifies the calibration gas sample which is critical for proper sensor response in solid state sensors.
- Apply 250 ppm ammonia/balance air at 1.0 L/min for two minutes.
- The peak signal voltage at the readout unit should be recorded during application of the calibration gas.
- The alarm setpoint at the readout unit should then be adjusted to the peak signal voltage.

Figure 9: Checking the signal at the Manning SS Sensor (Master)



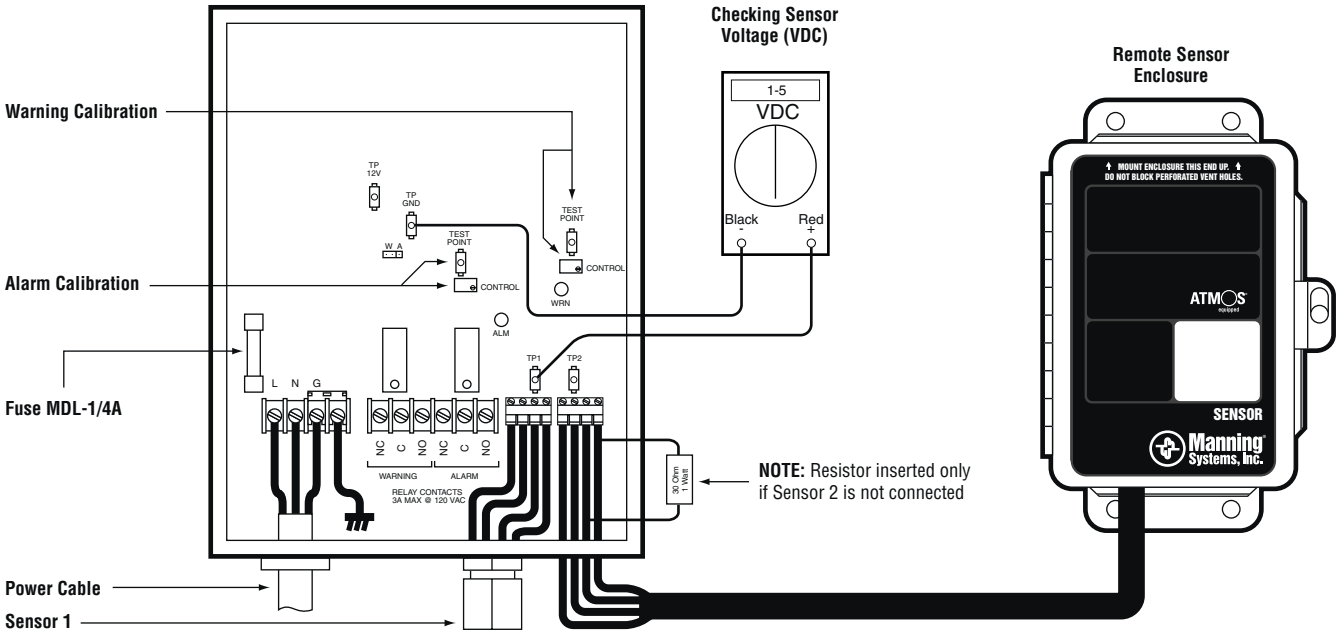
7 SS Calibration Procedure continued

Figure 10: Checking the signal at the Model 20 panel



NOTE: Individual HI alarm relay contacts rated 1/2 amp @ 24 VDC or 120 VAC

Figure 11: Checking the signal at the Model 21 panel



NOTE: Sensors may be remotely located

8 LSS Calibration Procedure

General Information

The Manning LSS sensor comes factory calibrated and should require minimal adjustments after installation. There are two pots on the preamp that are used for calibrations.

Zero Calibration

After the unit is installed and has been powered up for a minimum of 24 hours, the unit should be zero calibrated by the following:

- Be sure the unit is in clean air.
- Adjust the zero pot until the sensor outputs 4.0 mA (40 mV from Test [–] to Test [+]) (see Figure 12, Note 2 and 3).

Span Calibration

The unit is factory calibrated and normally does not need to be spanned upon initial installation. DO NOT ADJUST THE SPAN POT WITHOUT CERTIFIED CALIBRATION GAS! If span adjustment is required, the following procedure will span the unit:

- Perform zero adjustment before spanning (see Figure 12, Note 2).
- Place calibration adapter firmly over the sensor.
- Apply span gas at about 1.0 L/min (span gas must be in air, not nitrogen or other carrier).
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 12, Notes 1 and 3). After span adjustments, allow the sensor to clear out for two hours and perform zero calibration if necessary.
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range (ppm)	Span Gas (ppm)	Calibrated Signal Reading (mV)
0–200	200	200
0–2,000	1,000	120
0–2,000	2,000	200
0–3,000	3,000	200

For combinations not shown in the previous table, use the following formula to determine the output:

$$\text{Signal (mA)} = \left[\frac{\text{SGC}}{\text{SFSV}} \times 16\right] + 4$$

Where:

SGC = Span Gas Concentration,
SFSV = Sensor Full Scale Value.

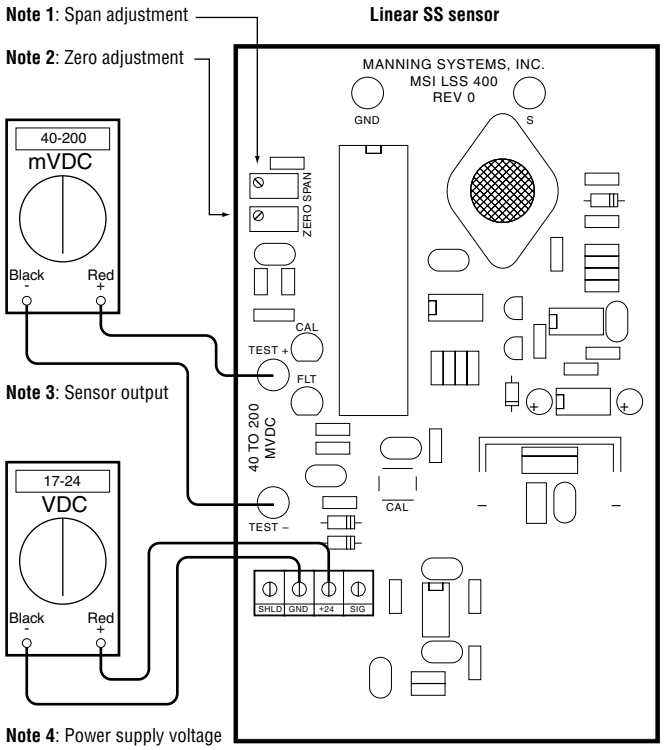
For example if 250 ppm SGC gas is used to calibrate a 500 ppm SFSV sensor, the signal would be as follows:

$$\text{Signal} = \left[\frac{1{,}000 \text{ ppm}}{2{,}000 \text{ ppm}} \times 16\right] + 4 = 12 \text{ mA}$$

12 mA = 120 mV from TEST (–) to TEST (+)

If the correct output cannot be achieved, a replacement sensor may be required. For technical assistance, please call Honeywell Analytics.

Figure 12: Zero and span adjustments on the Manning LSS Sensor



9 IR-F4-NH_3 Calibration Procedure

General Information

There are only two pots on the pre-amp that are used for calibrations. All other pots are factory set and must never be adjusted. They can only be properly adjusted at the factory.

Zero Calibration

After the Manning IR-F4-NH_3 is installed and has been powered up for a minimum of 24 hours, the unit may be zero calibrated by the following:

- Confirm that no ammonia is present at the sensor location.
- Connect calibration gas hose to calibration port (see Figure 13, Note 5).
- Press the CAL button on the right side of the back board (see Figure 13, Note 3). The CAL LED should begin to flash.
- Adjust the zero pot (see Figure 13, Note 2) until the sensor outputs 4.0 mA, or 40 mV between TP1 and TP2 (see Figure 13, Note 1). **Make small adjustments and wait for output to respond as adjustment response is highly dampened.**
- Press the CAL button. The CAL LED should stop flashing. If the CAL button is not pushed, the unit will automatically leave the calibration mode after 10 minutes.

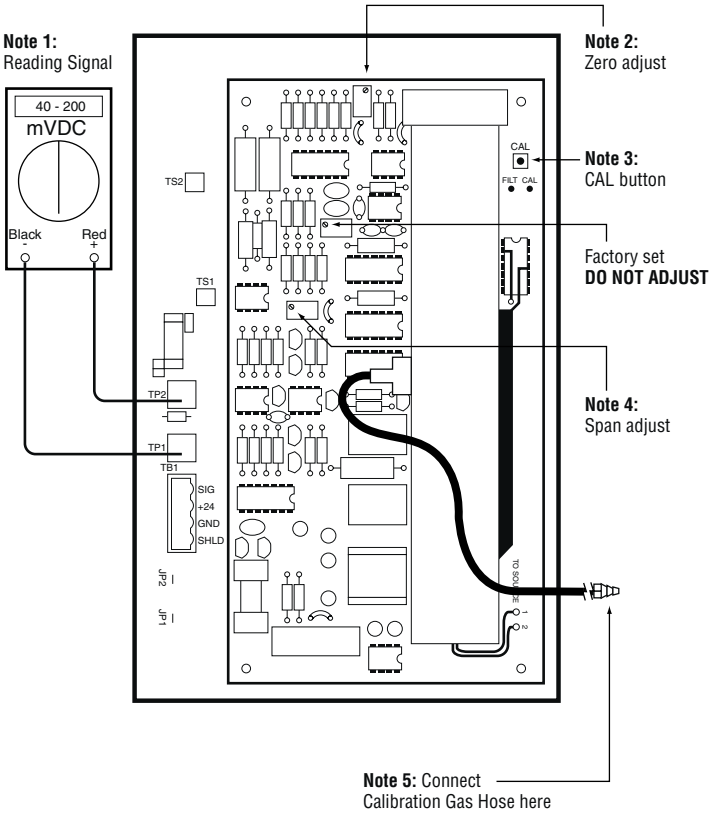
Span Calibration

- Perform zero adjustment before spanning. Leave the unit in “calibration mode” (CAL LED flashing).
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range (%)	Span Gas (%)	Calibrated Signal Reading (mV)
0–2	1	120
0–2	2	200

- Connect calibration gas hose to calibration port.
- Apply span gas at 1.0 L/min.
- After span gas has been on sensor for two minutes, adjust the span pot until the correct output is achieved (see Figure 13, Note 4).
- Push the “CAL” button again to take the unit out of calibration mode.

Figure 13: Zero and span adjustments on the Manning IR-NH_3 Sensor



10 IR-F4-CO_2 Calibration Procedure

General Information

There are only two pots on the pre-amp that are used for calibrations. All other pots are factory set and must never be adjusted. They can only be properly adjusted at the factory.

Note that normal, well-ventilated, indoor CO_2 levels due to human respiration are typically 0.05% to 0.07% (500-700 ppm). Normal outdoor CO_2 levels are typically 0.04% (400 ppm). Zero gas (nitrogen) is required for a proper zero adjustment.

Zero Calibration

After the Manning IR-F4-CO_2 is installed and has been powered up for a minimum of 24 hours, the unit may be zero calibrated by the following:

- Apply zero gas (pure nitrogen) at the calibration port at 1.0 L/min (see Figure 14, Note 3).
- Adjust the zero pot (see Figure 14, Note 3) until the sensor outputs 4.0 mA, or 40 mV between TP1 and TP2 (see Figure 14, Note 1). **Make small adjustments and wait for output to respond as adjustment response is highly dampened.**

Span Calibration

- Perform zero adjustment before spanning.
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range (%)	Span Gas (%)	Calibrated Signal Voltage (mV)
0–1	1	200
0–5	5	200

- Connect calibration gas hose to calibration port.
- Apply span gas at 1.0 L/min (span gas must be in nitrogen) at the calibration port.
- After span gas has been on sensor for two minutes, adjust the span pot (see Figure 14, Note 2) until the correct output is achieved.

For combinations not shown in the previous table, use the following formula to determine the output:

$$\text{Signal (mA)} = \left[\frac{\text{SGC}}{\text{SFSV}} \times 16\right] + 4$$

Where:

SGC = Span Gas Concentration,
SFSV = Sensor Full Scale Value.

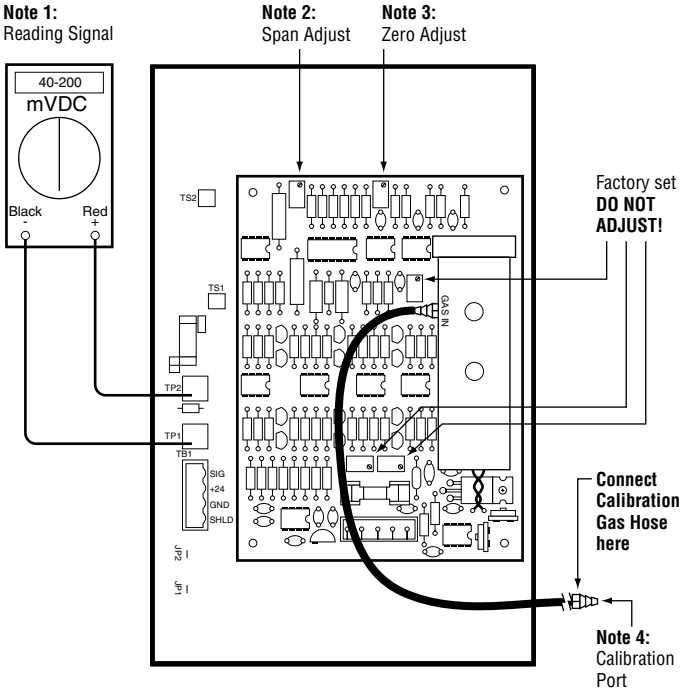
For example if 0.98% SGC gas is used to calibrate a 1.0% SFSV sensor, the signal would be as follows:

$$\text{Signal} = \left[\frac{0.98\ \%}{1.0\ \%} \times 16\right] + 4 = 19.68\ \text{mA}$$

19.68 mA = 196.8 mV from TP1 to TP2

For technical assistance or Calibration Kits, please call Honeywell Analytics.

Figure 14: Zero and span adjustments on the Manning IR-F4-CO_2 Sensor



11 IR-F4-R Calibration Procedure

General Information

There are only two pots on the pre-amp that are used for calibrations. All other pots are factory set and must never be adjusted. They can only be properly adjusted at the factory.

There are two versions of the Manning IR-F4-R. The later version has a calibration button which does not exist on the earlier version. During calibration of the earlier version, ignore the steps relating to the calibration button.

Full scale range of the IR-F4-R22 is 0-3,000 ppm. For convenience, all versions of the Manning IR sensor will be calibrated with 1,000 ppm R-22. Refer to the table under "Span Calibration" to determine the output voltage required for the desired target gas.

Zero Calibration

After the unit is installed and has been powered up for a minimum of 24 hours, the unit may be zero calibrated by the following:

- Press the calibration button to put the unit in "CAL" mode (see Figure 15, Note 3). The CAL LED will flash.
- Apply zero gas (pure nitrogen) at 1.0 L/min (see Figure 15, Note 5).
- Adjust the zero pot (see Figure 15, Note 2) until the sensor outputs 4.0 mA, or 40 mV between TP1 and TP2 (see Figure 15, Note 1). **Make small adjustments and wait for the output to respond because adjustment response is highly dampened.**

Span Calibration

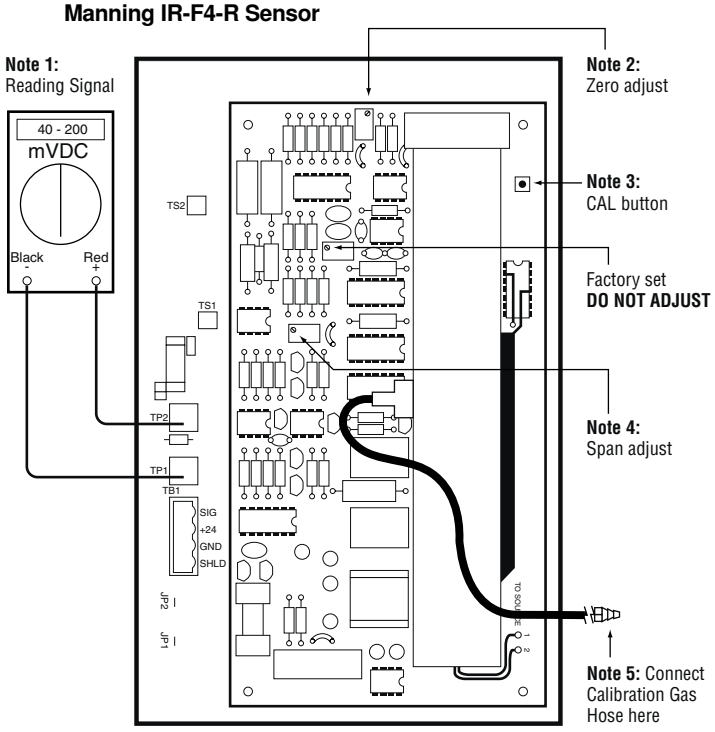
- The unit should be in calibration mode to perform the span adjustment.
- Perform zero adjustment before spanning.
- Apply span gas at 1.0 L/min.
- **The following table allows the calibration of the Manning IR-R sensor using 1,000 ppm R22 for any target gas listed:**

mVDC Signal using 1,000 ppm R22

Target Gas	Calibrated Signal Voltage (mV)
R-22	200 (using 3,000 ppm R-22)
R-22	93 (using 1,000 ppm R-22)
R-12	85
R-11	148
R-404a	84
R-507	84
R-125	91
R-21	146
R-134a	95
R-113	87
R-114	76
MP-39	69

- After span gas has been on sensor for two minutes, adjust the span (see Figure 15, Note 4) pot until the correct output voltage is achieved (see table above). For example, if the target gas in the table above is R404a, apply 1,000 ppm R-22 and adjust the signal voltage to 84 mV. **Make small adjustments and wait for the output to respond because adjustment response is highly dampened.**
- Press the "CAL" Button again to take the unit out of calibration mode.

Figure 15: Zero and span adjustments on the Manning IR-F4-R Sensor



12 IR-F9-RXX Calibration Procedure

General Information

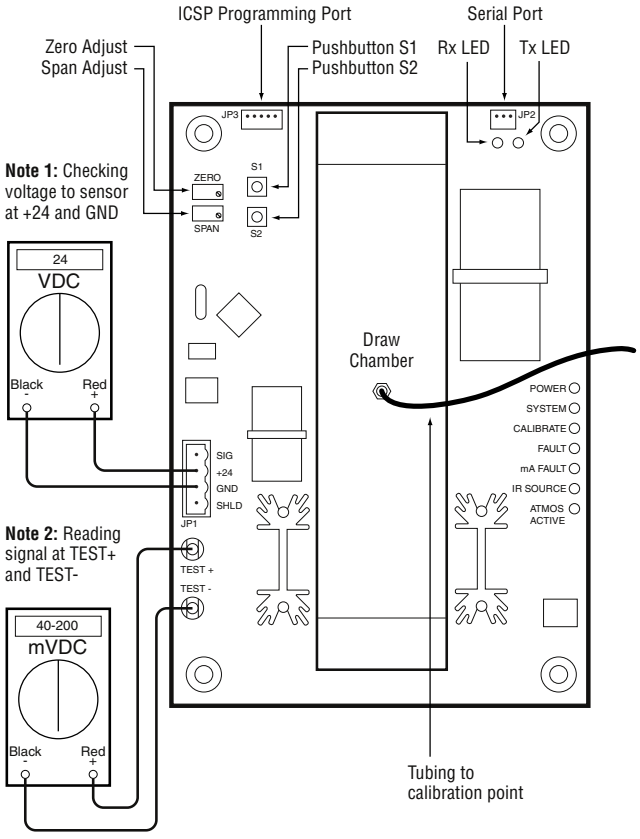
There are only two pots on the pre-amp that are used for calibrations. All other pots are factory set and must never be adjusted. They can only be properly adjusted at the factory.

Refer to the Manning AirScan™iR instruction manual for more in-depth calibration procedure details.

Zero Calibration

STEP 1

Start: Press and hold both the "zero" (S1) and "span (S2) buttons simultaneously for one second or until the "system" LED begins to blink slowly. See example to the right. Refer to figure below for switch location.



LED	SEQUENCE
POWER (G)	———
SYSTEM (Y)	— —
CALIBRATE (Y)	OFF
FAULT (R)	OFF
mA FAULT (R)	OFF
SOURCE (G)	- -
ATMOS (G)	N/A

STEP 2

Start: Apply **pure nitrogen** (N_2) into the calibration port at a rate of 1.0 L/min. for at least 45 seconds (OR until output signal is within ± .02 mA of signal deviation/change).

- Press and hold the "zero" button (S1) for approximately 1 second or until the yellow "calibrate" LED is continuous ON.
- When yellow calibration LED is continuous ON, release the "zero" button. The "calibrate" LED will turn off and the unit will be zeroed.

"Zero" programming calibration mode

LED	SEQUENCE
POWER (G)	———
SYSTEM (Y)	N/A
CALIBRATE (Y)	———
FAULT (R)	OFF
mA FAULT (R)	OFF
SOURCE (G)	N/A
ATMOS (G)	N/A

12 IR-F9-RXX Calibration Procedure continued

Exit: System will automatically resume previous mode. This indicates the parameters are now programmed into memory.

Place multi-meter leads on Test(+) and Test(–) and ensure the output is steadily resting between 3.9 to 4.1 mA. If this isn't the case, initiate the auto "zero" procedure once again.

Finish: Press and hold both the "zero" (S1) and "span" (S2) buttons simultaneously for one second or until the yellow "system" LED will be ON solid. See the following example. End of zero procedure.

LED	SEQUENCE
POWER (G)	———
SYSTEM (Y)	———
CALIBRATE (Y)	OFF
FAULT (R)	OFF
mA FAULT (R)	OFF
SOURCE (G)	- -
ATMOS (G)	N/A

Span Calibration

This procedure sets the "span" or concentration level that would depict a 20 mA reading for full-scale target gas on the 4/20 mA output.

NOTE: This procedure should only be performed if the zero procedures are successfully completed.

Start: Set meter to mV DC, place meter leads on Test(+) and Test(–) respectively.

- Press and hold the "span" button (S2) for 1 second or more until the yellow "calibrate" LED blinks fast and the yellow "system" LED is blinking slowly (see the following example). See figure on previous page for switch and potentiometer location.

LED	SEQUENCE
POWER (G)	———
SYSTEM (Y)	— —
CALIBRATE (Y)	- - - - - - - - - -
FAULT (R)	OFF
mA FAULT (R)	OFF
SOURCE (G)	N/A
ATMOS (G)	N/A

- Ensure the output rests between 3.9 and 4.1 mA (39.0 to 41.0 mV). If this is not the case, perform the "zero" procedure again.
- Once the output is within the required range with nitrogen flowing, apply **full-scale** target gas into the calibration port at a rate of 1.0 L/min for 1 minute immediately following the nitrogen flow.
- If the signal is 20 mA or greater, adjust the "span" potentiometer counter-clockwise until the signal is near 20 mA. If the output signal is less than 20mA, adjust the "span" potentiometer clock wise until the signal is near 20mA. **Because there is a slight delay in potentiometer movement, make small adjustments and wait for the output to change because adjustment response is delayed between source pulses.**
- Wait until the output signal has stabilized to within ± .02 mA of signal deviation/change. Adjust the "span" potentiometer again until the output reads around 20 mA.

Exit: Press and hold the "span" button (S2) for one second or more until the yellow "calibrate" LED turns off.

13 SB Calibration Procedure

General Information

There are only two pots on the pre-amp that are used for calibrations. All other pots are factory set and must never be adjusted. They can only be properly adjusted at the factory.

Zero Calibration

After the Manning SB sensor is installed and has been powered up for a minimum of 48 hours, the unit should be zero calibrated by the following:

- Be sure the unit is in clean air.
- Adjust the zero pot until the zero indicator green LED lights (see Figure 16, Note 4).
- Depending on the environment, background gases, etc., the zero may slowly drift upward with age. Periodically logging the sensor signals will determine whether an upward trend exists which would indicate that periodic zeroing is necessary.

Span Calibration

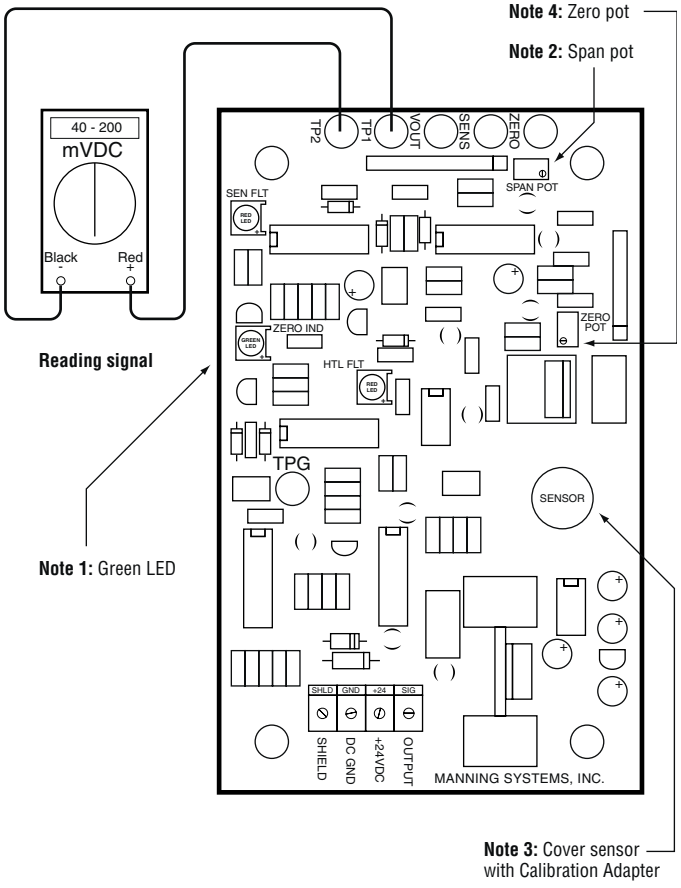
- Perform zero adjustment before spanning.
- The table below shows what span gas to use and what the signal should be for various sensor ranges:

Sensor Range	Span Gas	Calibrated Signal Reading
0–1%	1%	200mV
0–2%	1%	120mV
0–2%	2%	200mV

- Apply span gas at 1.0 L/min (see Figure 16, Note 3). Span gas must be in air, not nitrogen or other carrier.
- After span gas has been on sensor for three minutes, adjust the span pot until the correct output is achieved (see Figure 16, Note 2).

Calibration kits are available from Honeywell Analytics.

Figure 16: Zero and span adjustments to the Manning SB Sensor



14 CGT Calibration Procedure

General Information

The Combustible Gas Transmitter can be spanned with 1.00% Methane / balance air. The following table allows the calibration of the Manning CGT using 1.00% Methane / balance air for any target gas.

Table
(Signal using 1.00% Methane/bal air)

Gas	mV	mA	% LEL
Methane	72	7.2	20
Propane	96	9.6	35
n-Butane	96	9.6	35
n-Pentane	104	10.4	40
n-Hexane	120	12.0	50
Hydrogen	88	8.8	30
Methanol	88	8.8	30
Ethanol	104	10.4	40
Isopropyl Alcohol	128	12.8	55
Acetone	120	12.0	50
Methyl Ethyl Ketone	120	12.0	50
Benzene	128	12.8	55
Toluene	136	13.6	60
Di-ethyl Ether	56	5.6	10
Ammonia	64	6.4	15

Zero Calibration

After the unit is installed and has been powered up for a minimum of 24 hours, the unit may be zero calibrated by the following:

- Apply zero air at 1.0 L/min (see Figure 17, Note 4).
- Adjust the zero pot (see Figure 17, Note 3) until the sensor outputs 4.0 mA, or 40 mV between Loop "–" and "+" test points (see Figure 17, Note 1).

Span Calibration

- Perform zero adjustment before spanning.
- Apply 1% Methane / balance air at 1.0 L/min. (see Figure 17, Note 4).
- After span gas has been on sensor for two minutes, adjust the span pot (see Figure 17, Note 2) until the correct output is achieved (see table at left).

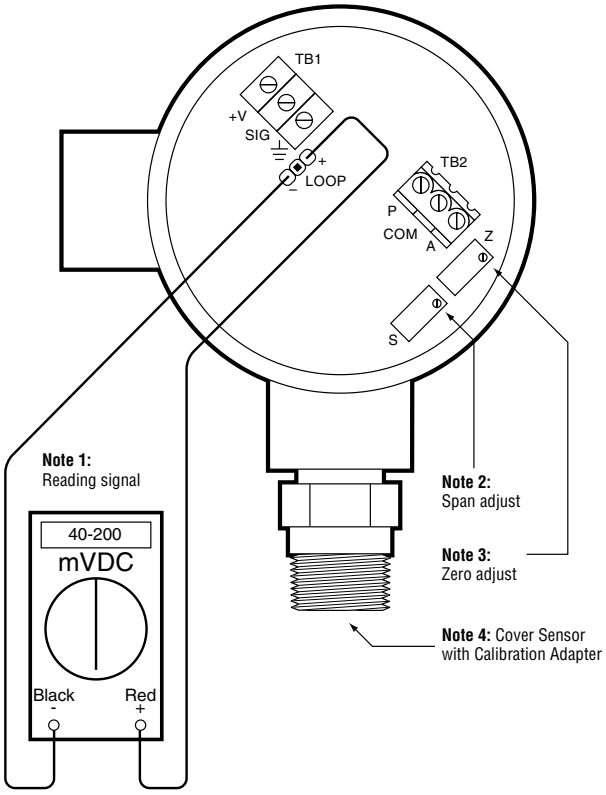
For example, if Hydrogen is the target gas, apply the 1.00% methane to the Manning CGT sensor. From the table:

Gas	mV	mA	% LEL
Hydrogen	88	8.8	30

Adjust the span pot until the meter reads 88 mV (8.8 mA). This is equivalent to 30% of the LEL for Hydrogen.

If the correct output cannot be achieved, a replacement element is required. For technical assistance, please contact Honeywell Analytics.

Figure 17: Zero and span adjustments to the Manning CGT Sensor



15 EC-P1 Calibration Procedure

General Information

Calibration is recommended every six months in normal use, or after exposure to a large concentration of gas. Span gas should be specific to the sensor.

The *ZERO* and *SPAN* potentiometers used during calibration are located inside the detector behind the front panel (see Figure 18). Remove the four screws in the corners of the front panel and remove the panel.

The calibration procedure requires the use of a bypass tee to allow a span gas to be drawn into the flow cell, and to allow span gas to flow past the sample inlet without creating variable pressure or dilution problems. **Calibration gas cannot be fed into the flow cell under pressure from any outside source.**

Zero Calibration

Be sure the unit is in clean air. With the unit off, press and hold the instrument switch until the display reads *CAL/MODE*. Then release the switch. The display will change to *XXX PPM/WARN SP*. Press and release the switch twice more. The display should now read *±XXX/CAL*.

After two minutes use a small screw driver to adjust the *ZERO* potentiometer until the display reads *0* (see Figure 19, Note 2).

If you do not intend to span the unit, press and hold the switch until the display reads *DONE*. Release the switch and the unit will revert to the normal operating mode.

Span Calibration

- Perform a Zero Adjustment prior to making any span adjustments.
- Using the bypass tee as shown in Figure 19, apply span gas and check to make sure there is a positive flow reading in the vent rotometer. This guarantees that the pump is not drawing in air and diluting the calibration gas sample.
- After two minutes adjust the *SPAN* potentiometer (see Figure 19, Note 1) until the display reads the value of the span gas.
- Press and hold the instrument switch until the display reads *DONE*. Then release and the unit will switch to the normal operating mode.

Honeywell Analytics provides a rapid turnaround factory calibration service that includes a Certificate of Calibration. Contact Honeywell Analytics for details.

Figure 18: Potentiometers

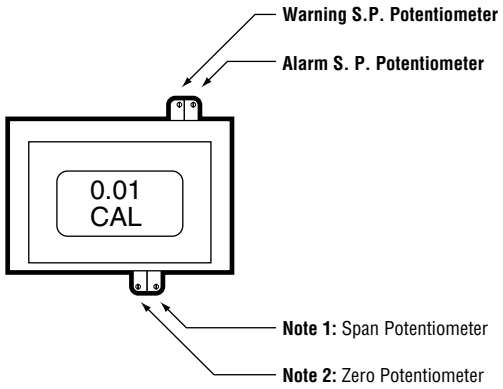
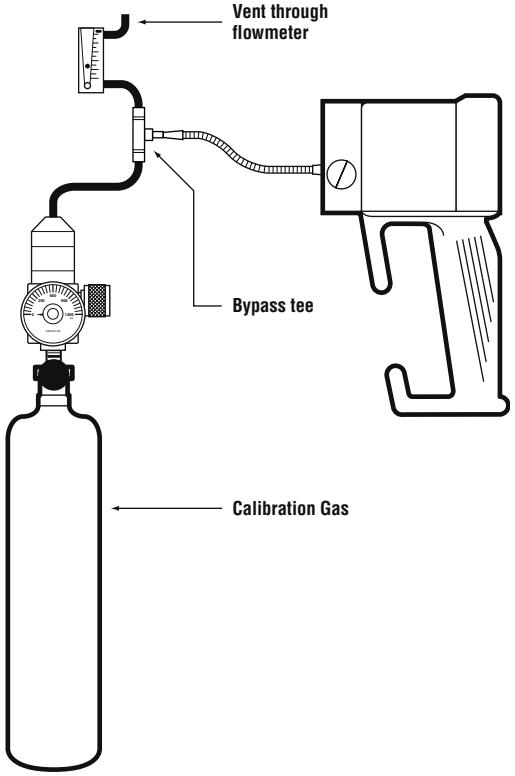


Figure 19: Zero and calibration flow configuration



16 EC-P2 Calibration Procedure

General Information

Calibration is recommended every six months in normal use. Each SMART-CELL stores its calibration and alarm setpoint information on its own internal memory chip. When the SMART-CELL is plugged into the Manning EC-P2, this information is used by the EC-P2. The SMART-CELL can be field calibrated by the user or returned to Honeywell Analytics for factory calibration.

The calibration procedure requires the use of a bypass tee to allow the gas to be drawn into the flow cell without creating variable pressure or dilution problems. **Calibration gas cannot be fed into the flow cell under pressure.**

When applying calibration gas, use the bypass tee as shown in Figure 20. The flowrate of calibration gas should be high enough that at least 0.5 SCFH is flowing out of the calibration tee. This can be measured with the supplied flowmeter and insures that air is not being drawn into the unit and diluting the calibration gas.

The unit may be zeroed without spanning it; however, never span the unit without first zeroing it.

Entering Zero/Span Mode

- Push power button to turn unit on. Wait for power up sequence to finish (30 seconds).
- Push and hold the unnamed button (second from left) first, then push and hold the MENU button. Hold both buttons until the screen goes blank (2 seconds). Release both buttons and the unit is now in Programming Mode.
- Push the SENS button and the unit is now in the zero/span mode.

Zero Calibration

- Be sure the unit is in clean air or apply zero air for two minutes.
- Push ZERO button.
- Push SAVE button to save the new zero calibration.

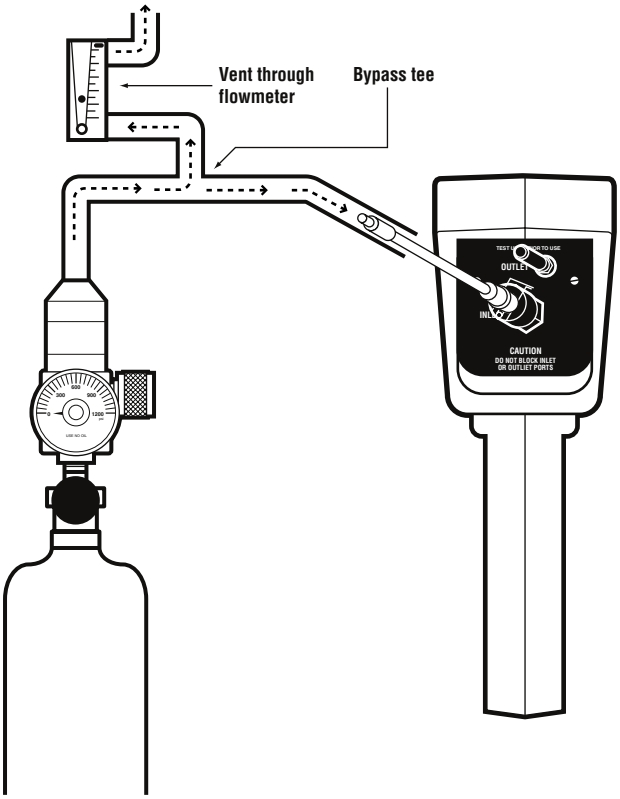
Span Calibration

- Push SPAN button.
- Apply span gas for two minutes.
- Push INC button (increase) or DEC button (decrease) until the display matches the span gas concentration.
- Push SAVE button to store new span calibration.

Exiting Zero/Span Mode

- Push DONE button twice slowly to get back into normal operation mode.

Figure 20: Calibration of the Manning EC-P2 Sensor using a bypass tee



17 GT Gas Tracker Calibration Procedure

General Information

Calibration is recommended every six months in normal use. Span gas must be 10,000 ppm NH_3 (1%) and must be balanced in air, not nitrogen.

The *SPAN* potentiometer (see Figure 21, Note 2) is used during calibration and is located on the small board next to the battery pack.

The calibration procedure requires the use of a bypass tee to allow a span gas to flow past the sample inlet without creating variable pressure or dilution problems. **Calibration gas cannot be fed into the flow cell under pressure from any outside source.**

Zero Calibration

Each unit is factory zeroed. Zero adjustment should not be made in the field.

Span Calibration

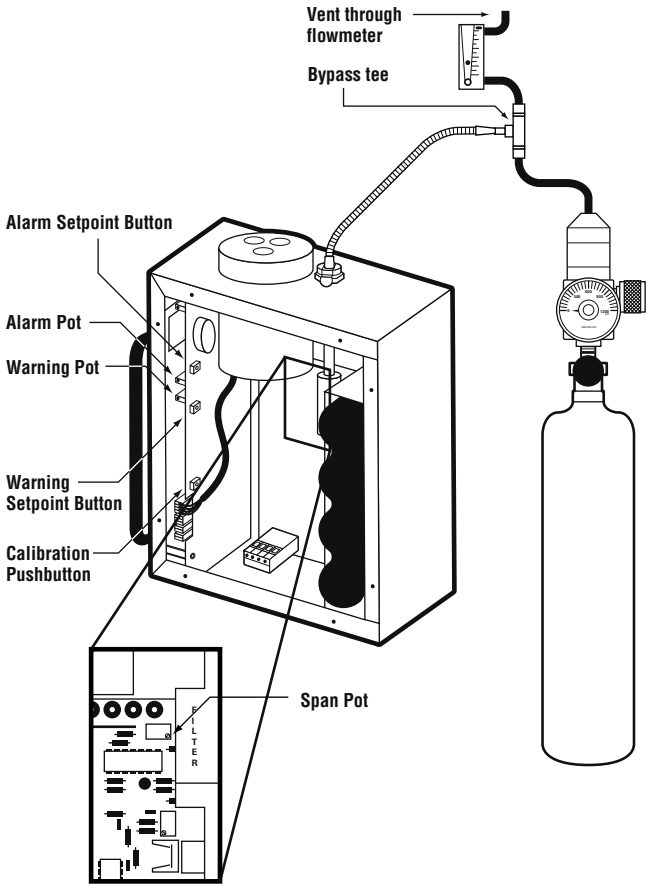
Do not attempt to span the instrument without certified calibration gas.

- Run the unit for at least 10 minutes prior to calibration.
- Push the *CALIBRATION PUSHBUTTON* to put the unit in *CAL MODE* (see Figure 21, Note 1).
- Using the bypass tee as shown in the figure, apply 10,000 ppm span gas for 2 minutes. The flow rate of span gas should be high enough that at least 0.5 L/min is flowing out of the calibration tee. This can be measured with the supplied flowmeter and insures that air is not being drawn into the unit and diluting the calibration gas.
- After 2 minutes adjust the *SPAN* potentiometer (see Figure 21, Note 2) until the display reads 10,000 ppm.
- Push the *CALIBRATION PUSHBUTTON* to return the unit to normal operating mode.

Honeywell Analytics provides a rapid turnaround factory calibration service that includes a Certificate of Calibration. Contact Honeywell Analytics for details. For technical assistance, please call Honeywell Analytics.

Calibration kits are available from Honeywell Analytics.

Figure 21: Zero and span adjustments to the Manning GT



18 Field Testing of Vent Line Sensors

General Information

The Manning VL vent line sensor is factory calibrated and normally does not need to be spanned. Testing of the VL sensor is normally done in the field by removing the small 3/4" plug and injecting a small amount of propane/butane from an *unlit* plumber's torch. Using this simple method, the sensor is challenged with a gas sample and the proper outputs and alarms are observed. (The challenge gas must cause a proper alarm trip.) Refer to the vent line sensor manual for more information.

In a vent line, the recommended trip point level is no lower than 12 mA. Lower setpoints can result in false trips.

Contact Honeywell Analytics to discuss techniques in calibration and testing depending on how the Manning VL sensor is mounted.

19 Replacement Parts Ordering Guide

Manning Replacement Parts and Calibration Gas Quick Reference

Part Number	Order Number	Description
29 Liter Gas Bottles		
10566	RB-NH3/50	Cylinder of 50 ppm Ammonia, Balance Air
10518	RB-NH3/100	Cylinder of 100 ppm Ammonia, Balance Air
10517	RB-NH3/250	Cylinder of 250 ppm Ammonia, Balance Air
10559	RB-NH3/1000	Cylinder of 1,000 ppm Ammonia, Balance Air
10528	RB-NH3/1%	Cylinder of 1% Ammonia, Balance Air
10520	RB-NH3/2%	Cylinder of 2% Ammonia, Balance Air
17 Liter Gas Bottles		
10556	RB-CH4/1%	Cylinder of 1% Methane, Balance Air
10748	RB-CH4/4%-Bal N2, 17L	Cylinder of 4% Methane, Balance N2
10560	RB-CO2/1%	Cylinder of 1% Carbon Dioxide, Balance N2
10561	RB-CO2/5%	Cylinder of 5% Carbon Dioxide, Balance N2
10661	RB-CO-200	Cylinder of 200 ppm Carbon Monoxide, Balance Air
10574	RB-N2	Cylinder of N2
10558	RB-O2/15%	Cylinder of 15% Oxygen, Balance N2
10562	RB-O2/20.9%	Cylinder of 20.9% Oxygen, Balance N2
10564	RB-R22/3000	Cylinder of 3,000 ppm R22, Balance Air
10977	RB-R404a/3000	Cylinder of 3,000 ppm R404a, Balance Air
10557	RB-ZA	Cylinder of Zero Air
Replacement Parts		
10049	EC-F2-NH3-RC	Replacement Ammonia Cell for EC-F2 & EC-F9
10050	EC-F2-NH3-HR-RC	Replacement Ammonia Cell for High Range EC-F2 & EC-F9
10091	EC-F3-O2-RS	Replacement Oxygen for EC-F3 Sensor
10813	EC-F1-NH3-RC	Replacement Ammonia Cell for EC-F1
10111	SS-NH3-RS	Replacement Solid State Ammonia Sensor
10117	VL-F7-NH3-RA	Replacement Vent Line Ammonia Sensor
10135	EC-P1-NH3-RC	Replacement Ammonia Cell for EC-P1
10168	EC-P2-NH3-0/500-SC	Replacement Smart Cell for EC-P2 for Ammonia 0/500 ppm
10169	EC-P2-NH3-0/2000-SC	Replacement Smart Cell for EC-P2 for Ammonia 0/2,000 ppm
10244	CK-A	Calibration Adaptor with 3 feet of tubing
10248	CK-T	Portable Calibration Tee
10597	CK-R-1LPM-518	*Regulator 1.0 LMP #518 (for 58/103L cylinders)
10687	CK-R-1LPM-418	*Regulator 1.0 LPM #418 (for 17/34L steel cylinders)

*Note: Honeywell Analytics has discontinued the sale of the Flowmeter Assembly and replaced it with the #418 & #518 1-liter-per-minute fixed flow regulators.

