Honeywell

Electrochemical Ammonia (NH_3) Leak Detector

EC-FX-NH3

Instruction and Installation Manual

Part No. 1998M0872
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Notices and Trademarks

Contact Us

Online

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Corporate	www.honeywell.com
Honeywell Analytics	www.honeywellanalytics.com

To return a product, contact *haservice.canada@honeywell.com* to obtain an RMA number.

For sales Information, contact *detectgas@honeywell.com.*

Telephone

Contact us by telephone at the numbers listed below.

<table>
<tr><th colspan="2">Organization</th><th>Phone Number</th></tr>
<tr><td rowspan="3">Americas</td><td>Honeywell Analytics Inc.
Lincolnshire, IL</td><td>1-800-538-0363
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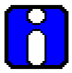
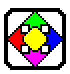
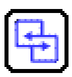
</table>

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 advice 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.

Introduction

This manual has been prepared to help in the use and installation of the EC-FX-NH3 (Electrochemical-Ammonia) Sensor. This manual will convey the operating principles of the sensor, ensure proper installation, and demonstrate start-up and routine maintenance procedures for the sensor.

ATTENTION: This manual must be carefully followed by all individuals who have or will have the responsibility for using or servicing the sensor.

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.

System Description

The EC-FX-NH3 leak detector is a three-wire 4/20 mA transmitter/sensor with RS-485 Modbus RTU communication. It is designed for low-level ammonia detection in industrial refrigeration, cold-storage environments, and engine rooms.

The detector exhibits excellent durability and precision, with negligible response to common interference gases and changes in relative humidity. The default alarm level is 25 ppm for the 0-100 ppm sensor. The unit exhibits extremely high reliability with no moving parts.

Monitoring equipment must be configured to indicate a fault if the signal is less than 1.5 mA. All signals over 20 mA must be considered high gas concentrations.

Specifications

Method: Electrochemical (diffusion)

Ranges: 0-100 PPM – Low range
0-200 PPM – Low range
0-250 PPM – Low range
0-500 PPM – High range
0-1000 PPM – High range

Output: Isolated 4/20 mA, 700 ohms max at 24 VDC. Signal output reduces to 0.5 mA to indicate a fault condition.

RS-485 Protocol: MODBUS RTU

Accuracy: ±5% of full scale range at temperature of calibration. Contact Honeywell Analytics for additional details.

Repeatability: <10% of full scale

Response Times (T_{90}): EC-FX-NH3-LR: <30 seconds, 90% full scale
EC-FX-NH3-HR: <75 seconds, 90% full scale

Sensor Viability Test: An internal microprocessor determines the sensor's electrical viability every 24 hours (SensorCheck™). Should the electrical viability test fail, a 0.5 mA signal will indicate a fault.

A red LED on the circuit board will indicate if a sensor is degraded electrically, depleted of electrolyte or disconnected.

4/20 mA Loop Viability Test: Internal monitoring of 4/20 mA output impedance.

Operating Humidity: 5%-100% RH (condensing). ATMOS equipped® enviro-adaptive technology option required for condensing conditions or refrigerated areas, and all outdoor applications.

Operating Temperatures: -50°F to +120°F (-45ºC to +50ºC).
ATMOS® equipped enviro-adaptive technology option required for refrigerated areas or outdoors.

Sensor Pressure Limits: Atmospheric ±10%

Power Source: 24 VDC (recommended), 0.5 amp max. 14-26 VDC acceptable.

Cable Recommendations:

4/20 output: #18/3 shielded cable (Belden #8770 or equal), cable runs <1,500 feet.

Modbus RTU (RS-485): For communication cable, use 24 AWG twisted pair, shielded (Belden #9841 or equal), cable runs up to 2,000 feet.

Power Cable Recommendations:

For power cable, use 14 AWG (Belden #5100UE or equal), cable runs up to 1,000 feet, for each power supply. Larger power cable and/or additional power supplies may be required for longer cable runs and/or increased number of sensors. Due to variables such as sensor current draw, line loss, and cable size, contact Honeywell Analytics for help with power requirements.

Gas Sampling: Diffusion method is standard.

Enclosure: NEMA 1, gasketed, #16-gauge steel (standard) or stainless steel models are available.

NOTE: The EC-FX is for use in non-classified areas only.

Weight: 3 lbs.

Dimensions: 6" high x 4" wide x 3.5" deep

Installation

A Locating the EC-FX-NH3 Sensor

Because each sensor is a point measurement, it is very important that the sensor be located properly.

One of the most important considerations when installing EC sensors is that they must be easily accessible for calibration and maintenance. As a general rule, locate sensors no closer than one foot from the ceiling.

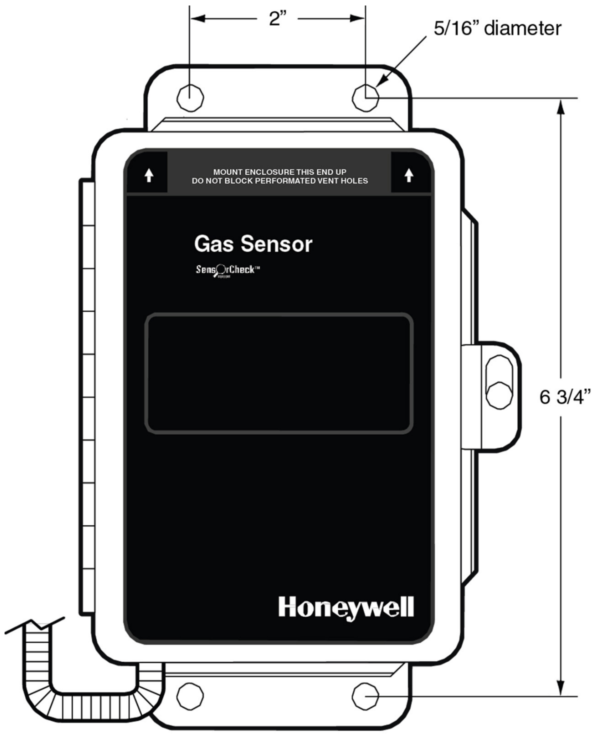
If the primary application is **personal protection** (representative concentration reading that an employee would be exposed to), mount the sensor at a height in the breathing zone of the employees. It would typically be about five feet off the ground, which also allows easy access.

If the primary application is the fastest possible leak detection, mount the sensor near the potential leak sources. In the case of ammonia, this is usually near the ceiling as ammonia vapor is lighter than air. In certain refrigeration applications, ammonia vapors from an NH_3 leak will remain at a low elevation. In these cases, leak detection will take longer if the sensor is mounted at high elevation and the indicated concentration will not be representative of personnel exposure. Higher mounting locations can also complicate access to the sensor for required calibration and maintenance. For more information on sensor mounting locations for different leak scenarios, please contact Honeywell Analytics.

General Mounting Considerations:

- Should be easily accessible for calibration and maintenance.
- Mount the sensor close to a potential leak source.
- If personnel protection is the primary application, mount in the “breathing zone”.
- Protect sensor from water, excessive humidity, and wash-down.
- Take air movement and ventilation patterns into account.
- If mounting sensor outdoors, consider prevailing wind direction and proximity to the most likely source of leaks. Protect the sensor from sun and rain as much as possible.
- Never mount the sensor in CA (controlled atmosphere) rooms because normal atmospheric level of oxygen is required for operation.
- For highly critical locations, more than one sensor should be installed in each room.
- To prevent electrical interference, keep sensor and wire runs away from mercury vapor lights, variable speed drives, and radio repeaters.
- Protect sensor from physical damage (fork lifts, etc.).
- Do not mount the sensor over a door in a refrigerated area.

Figure 1. Mounting Dimensions



⚠CAUTION

- **Sensor must be mounted vertically.**
- **Never mount flat on a ceiling.**
- **Enter enclosure only through existing hole in bottom.**
- **Always make a drip loop in the conduit (see Figure 1).**

Blast Freezers: Never mount sensor above the coil. The ideal location, when possible, is below the bottom of the coil. Try to put in return air and protect the unit from being damaged by product loading and unloading. Keep it away from warm, moist air during defrost. Usually four or five feet off the ground is the best location.

Penthouses:

- **Multi-Coil (defrost one coil at a time):** In this case the best location is usually in the center of the penthouse four or five feet above the grate.
- **Single Coil (or when all coils defrost at the same time):** In this case high moisture conditions can occur and the sensor should be mounted one foot above the grate.

Engine Rooms: The sensor should be mounted in a cool part of the room, if possible. Keep the sensor away from hot air exhausting from electric motors or other machinery. Usually the best location is four or five feet above the floor in a location where the room exhaust fan will move air across the sensor from the potential leak source.

Ceiling-Hung Evaporators: When mounting Manning EC sensors near evaporators, mount the sensor no higher than two feet below the top of the evaporator coil. **DO NOT** mount in high air flow (1,200 feet/ minute maximum). **NEVER** mount the sensor on evaporators as vibration can damage the sensor.

Other Locations: When mounting Sensors in locations such as roof top air units, duct-work, attic spaces, makeup air intakes, etc., contact Honeywell Analytics for application assistance and recommendations.

B Wiring

Figure 2 on page 13 presents 4/20 mA output wiring information for the EC-FX-NH3 sensor. Figure 3 on page 15 presents RS-485 communication wiring information for the EC-FX-NH3 sensor.

Electrical wiring must comply with all applicable codes. Plant equipment that may be involved and operating conditions should be discussed with local operating personnel to determine if any special needs should be taken into account.

Almost all start-up problems are due to improper wiring or monitor configuration. Please follow these guidelines carefully.

⚠CAUTION

Do not pull sensor wiring with AC power cables. This will cause electrical interference. Be sure there are no breaks or splices in sensor wiring runs. If cable runs cannot be made without a splice, all connections must be soldered. Soldering should be done using a rosin flux to tie the connecting ends of sensor wires to ensure a positive and long-lasting contact.

Ground the shield at the main control panel. Connect the shield wire in the sensor terminal block labeled *SHLD*. Tape all exposed shield wire at the sensor to insulate it from the enclosure.

All penetrations into a refrigerated room should be sealed to prevent condensate from forming in the conduit and dripping into the sensor enclosure.

Make drip loops for cables going into sensor housings. When heated enclosures are used, follow the special mounting instructions on the enclosure
(*...This End Up*).

Mount sensor enclosures through the flange holes as shown in Figure 1, and *always mount vertically.*

4/20 mA output: Always use three conductor, insulated, stranded, shielded copper cable.

RS-485 output: Always use two conductor twisted pair, insulated, stranded, shielded copper cable for the communication cable. Use two conductor, insulated, stranded cable for sensor power.

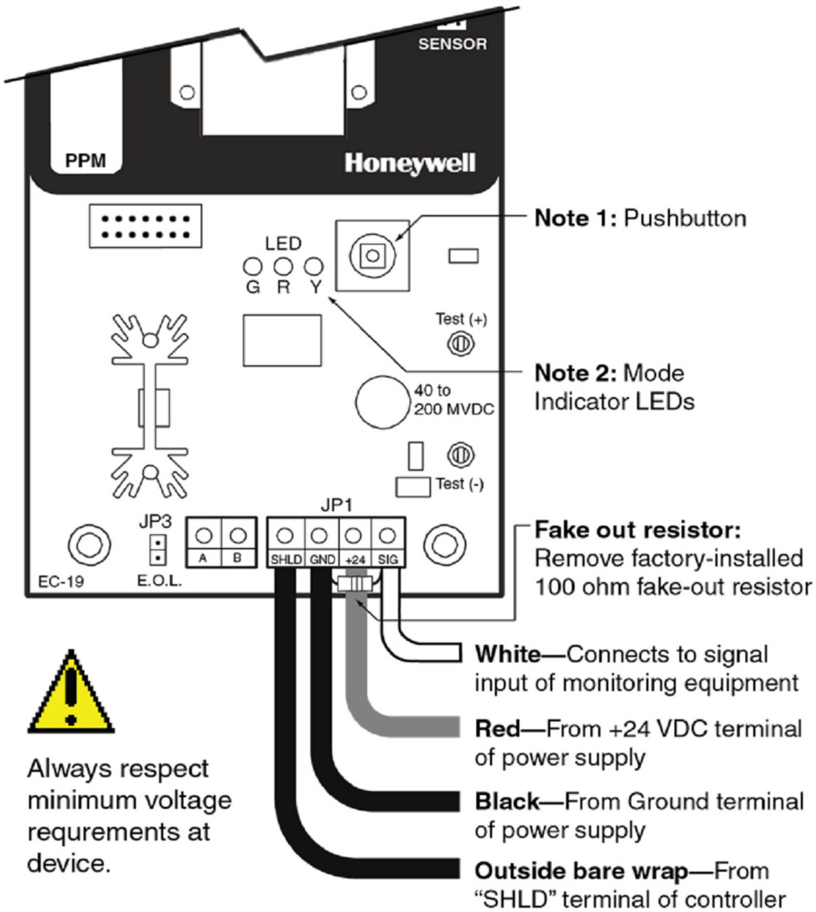
With RS-485, the communication cabling of the network is “daisy chained”, with multiple devices (sensors, relay modules, etc.) communicating along the same pair of wires. If used with the AirAlert™ 96d controller, up to 32 devices can be wired in series per channel (up to three channels).

Refer to the controller manual for specific wiring details.

⚠CAUTION

When many sensors are connected to one set of power cables, total current draw may exceed cable recommendations and/or cause considerable line-loss. Contact Honeywell Analytics for recommendations on power cable sizing and additional power supplies.

Figure 2. 4/20 mA Output Wiring Diagram



Electrical Power: 24 VDC regulated, 30 mA. With an ATMOS® equipped enclosure the current draw is 400 mA max.

Respect minimum voltage requirements.

Outputs:

ATTENTION: The detector is shipped with a 100 ohm, 1/4 watt resistor in the green, four position terminal block, across the Signal and Ground terminals (see Figure 3). This resistor is needed to "fake out" the 4/20 mA loop if using the Modbus RTU output. Only remove this resistor if using the 4/20 mA output.

- **4/20 mA:** Circuit board mounted sensor provides a linear 4/20 mA output. Monitoring equipment may have a maximum input impedance of 700 ohms.
- **RS-485:** MODBUS RTU communication protocol.

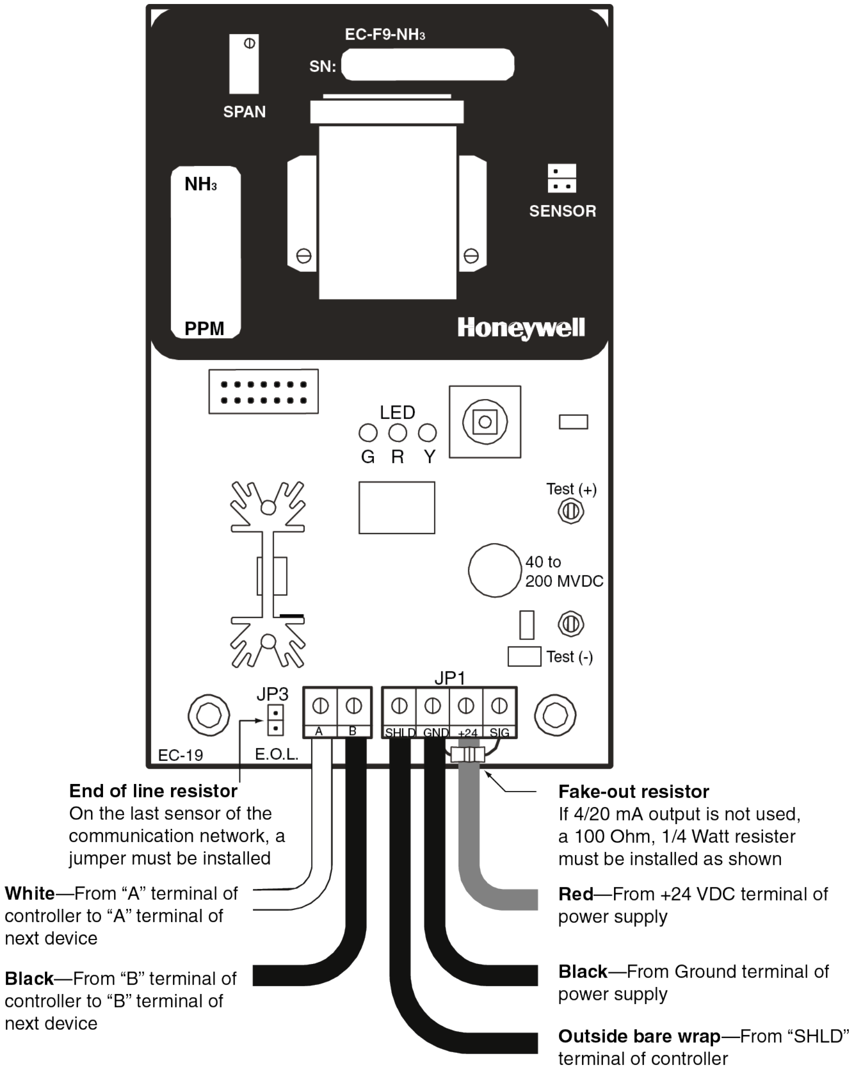
Cable Recommendation:

- **4/20 mA output:** Use #18/3 shielded cable (Belden #8770 or equivalent). Length of cable to sensor should be no greater than 1,500 feet.
- **RS-485 output:** For communication cable, use 24 AWG twisted pair, shielded (Belden #9841 or equal), cable runs up to 2,000 feet. Avoid “T-taps” if possible. Do not exceed 65 feet per T-tap. Do not exceed 130 feet total of all T-taps (per channel). For power cable, use 14 AWG (Belden #5100UE or equal), cable runs up to 1,000 feet, for each power supply. Larger power cable and/or additional power supplies may be required for longer cable runs and/or increased number of sensors. Due to variables such as sensor current draw, line loss, and cable size, contact Honeywell Analytics for help with power cable requirements.

Monitoring: The EC-FX-NH3 ammonia detector may be monitored by the GM-JR, AirAlert™ 96d, or other appropriately configured system. For 4/20 output, monitoring equipment must be configured to indicate a fault if the signal is below 1.5 mA. All signals over 20 mA must be considered a high gas concentration, *not* a fault condition.

NOTE for PLC applications: The signal output load can range from 0 to 700 ohms, where the maximum load resistor at a 24 VDC supply is 700 ohms and the maximum load resistor at a 10 VDC supply is 267 ohms. Any load outside these values will indicate a fast flash on the red LED while in operation or this test mode during normal operation. The error LED will blink fast at any time if the signal output cannot source the necessary current.

Figure 3. RS-485 Communication and Power Wiring Diagram



Operation

A Start-up Procedures

Before applying power, make a final check of all wiring for continuity, shorts, grounds, etc. It is usually best to disconnect external alarms and other equipment from the sensor until the initial start-up procedures are completed. SensorCheck™ is initiated each time the unit is powered up.

After power-up, allow 24 hours for the system to stabilize before testing the sensors. As sensors are typically located a distance from the controller or PLC, Honeywell Analytics recommends that the mA signal be calibrated with the control system.

Simple Start-Up Test:

- One person exposes each sensor to a small amount of ammonia.
- The second person stays at the control unit to determine that each sensor, when exposed to the gas fumes, is connected to the proper input and responds, causing appropriate alarm functions.

B Pushbutton Operation and LED Indicators

The EC-FX-NH3 has an internal pushbutton that is utilized for navigation of test functions and operating modes (see Figure 5, Note 5). It also has a group of LEDs (green, red, yellow — see Figure 3 on page 15) that blink in specific sequences to indicate sensor operation modes. A summary of sensor operation modes and corresponding LED blink sequences is shown in Figure 6. The pushbutton must be pressed the correct number of times and at the correct rate.

When a multi-press sequence must be performed, the button must be pressed rapidly and evenly, lifting one's finger completely from the actuator for each consecutive press.

- For press and hold activations, one's finger must always be applying a down pressure without disruption for the specified time in order to activate the desired mode.
- See complete details of each operation in other parts of the manual.

The EC-FX-NH3 has been designed with three distinct test mode procedures that are triggered by the appropriate push button action. These test modes include Manual SensorCheck™, Simple Zero Test, and 4/20 mA Loop Check.

The fourth operation puts the unit into Calibration Mode to allow for testing with a certified calibration gas standard and to provide information for appropriate span adjustments, if required.

Figure 4. LED Blink Sequence

SLOW BLINK	—— —— —— —— —— —— ——
MEDIUM BLINK	-- -- -- -- -- -- --
FAST BLINK	------------------------
CONTINUOUS ON	————————————————

Green LED

Solid ON — all modes except Cal. and 4/20 mA calibration.

Slow Blink — Calibration mode.

Red LED

Solid ON — Possible catastrophic failure on the circuit board. The 4/20 mA signal will vary depending on the exact failure. In the event of corrupted data, calibration values and Modbus ID may be lost but the gas sensor and 4/20 mA output circuit would still be operational. In the event of a CPU failure, a 0.5 mA fault signal is output from the sensor. All other functions and devices would be inoperable (optional LCD, network, pushbuttons, etc.). Contact Honeywell Analytics for technical support.

Slow Blink — Near death, possible dried up or disconnected sensor. A 0.5 mA fault signal is output from the sensor during this error event. A replacement sensor should be ordered at this time.

Medium Double Blink — Possible weak sensor. Sensor is nearing the end of its useful life. Although the sensor may pass the span calibration or detect the presence of ammonia, frequent attention and increased calibration checks are strongly recommended until the sensor is replaced.

Fast Blink — Possible 4/20 mA loop failure or load resistance too high. Check output impedance and ensure it is between 10Ω and 700Ω referenced to ground. In addition, ensure power supply voltage is within specified operating range.

Yellow LED

Solid ON — During Sensor Check™.

Medium Double Blink — During 4/20 mA (0.5 mA low) test.

Fast Blink — During 4/20 mA (22 mA high) test and during failed (22 mA high) test.

Green — ON, Red — Fast Blink, Yellow — Fast Blink

4/20 mA loop test failed the 22 mA high extremity. Check output impedance and ensure it is between 10Ω and 700Ω referenced to ground. In addition, ensure power supply voltage is within specified operating range.

Figure 5. EC-FX-NH3 Detector Components

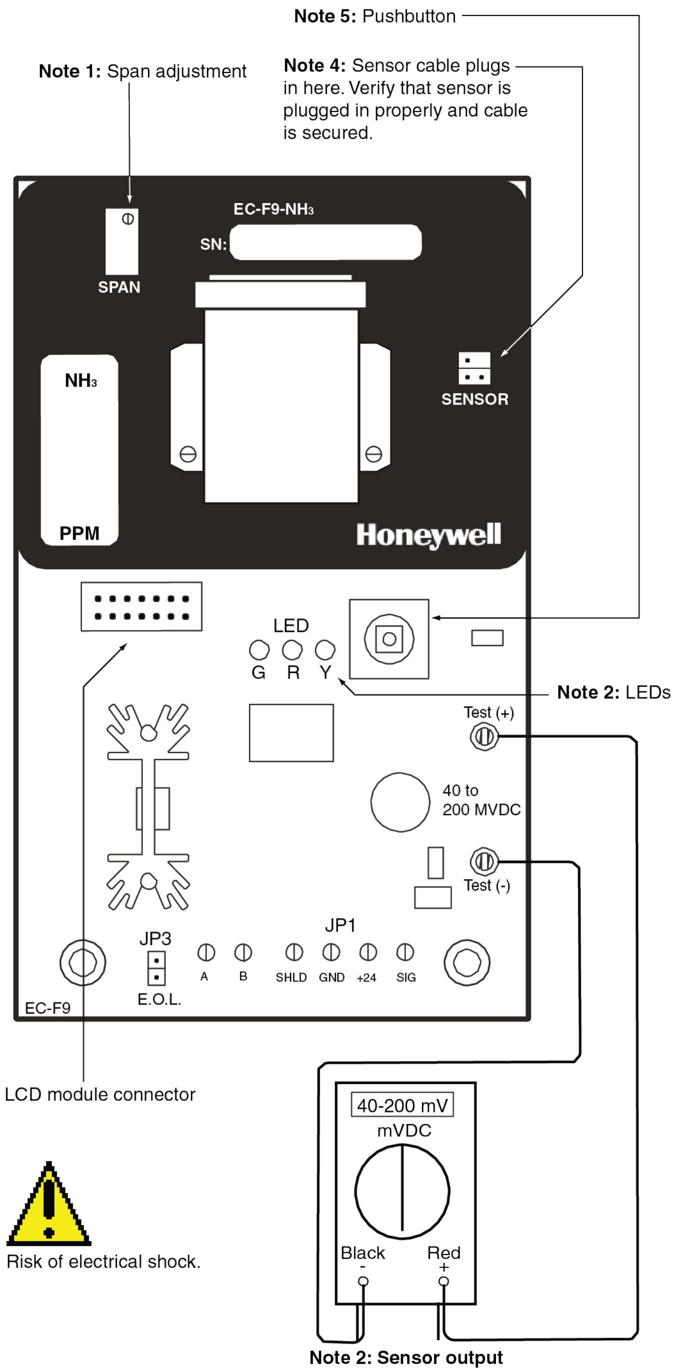


Figure 6. LED Sequence Indicator and Operation Summary

MODE	Ⓖ GREEN LED (left)	Ⓡ RED LED (center)	Ⓨ YELLOW LED (right)	NOTE
Normal Run Mode	────────────			
↓ During Span Calibration Mode	─── ─── ───			3
During Simple Zero Test	─── ─── ───			
↓ Factory Calibration Mode	------------------------			
↓ During 4/20 mA Calibration	─── ─── ───	─── ─── ───	─── ─── ───	
↓ Manual SensorCheck	────────────		────────────	1
Weak Cell	────────────	-- -- -- -- --		
Failed or Disconnected Cell	────────────	─── ─── ───		2
Hardware failure		────────────		2
↓ During 4/20 mA Loop Test (22 mA high)	────────────		------------------------	
Failed Loop Test (22 mA high)	────────────	------------------------		
↓ During 4/20 mA Loop Test (.5 mA low)	────────────		-- -- -- -- --	
Failed Signal Output	────────────	------------------------		4
↓ Auto "Zero" Calibration	────────────		─── ─── ───	

Notes:

1. Electronic bump test automatically every 24 hours. Manual test can be initiated.
2. Unit will output 0.5 mA.
3. Exits mode after 10 minutes or if pushbutton is pressed for one second.
4. Occurs due to wiring problem or incorrect load value.

↓ = Initiated by button press.

SensorCheck™

SensorCheck™ is a microprocessor-based technology that monitors and predicts the electrical viability of its electrochemical and infrared ammonia sensors by testing every 24 hours. If the sensor becomes depleted or is disconnected, SensorCheck™ sends an indication that can be detected by a gas detector or PLC.

The red LED will indicate if a sensor starts to degrade electrically causing marginal operation requiring frequent attention and increased calibration checks. Should the electrical viability test fail, the unit outputs a 0.5 mA signal to indicate this fault condition.

The SensorCheck™ electrical viability test is not, however, meant to replace adherence to the factory-recommended calibration schedule. SensorCheck™ is an internal electrical test that is not capable of verifying physical aspects such as blockage of the sensor membrane by dirt, flour, grease, water, paint, etc.

Physical blockage is rare, but does occasionally happen, especially in many harsh processing environments.

NOTE: SensorCheck™ is not intended to measure or indicate the chemical viability of a sensor operating in high or continuous concentration of NH_3.

Although SensorCheck™ is performed automatically every 24 hours, at any time a manual sensor check can be performed.

To perform a manual SensorCheck™, follow the procedure below:

Start: Press button (see Figure 4, , Note 5) three times within two second time limit (test takes about 15 seconds). During test, green and yellow LED's are both continuous ON.

G	————————	Continuous ON
Y	————————	Continuous ON

Exit: Unit resumes normal mode automatically after about 20 seconds. Green LED remains continuous ON and yellow LED is unlit.

G	————————	Continuous ON
Y		LED is OFF

4/20 mA Loop Test

NOTE: This test is recommended especially for PLC operations (non-Honeywell readout/alarm unit).

NOTE: This test will *not* automatically time out. You must force the unit into normal operation.

- **Full Scale Test:** This test will verify that the full-scale output of the sensor is also achieved at the PLC.

Start: Place meter leads on Test (+) and Test (—). Press button five times within a two- or three-second period of time. The voltmeter should read approximately 220 mV (equal to 22.0 mA output). Verify full-scale signal at PLC. **NOTE:** some PLCs limit input to 20 mA. Blink sequence will be:

G		Continuous ON
Y		Fast blink

- **Signal Fault Test:** This test will simulate one of many sensor fault conditions in which the transmitter will send 0.5 mA to the control panel. To check for downscale fault verification, press button for one second (voltmeter should read approximately 5 mV (equal to 0.5 mA output). Verify downscale fault indication at PLC. Blink sequence will be:

G		Continuous ON
Y		Medium blink

PLC and monitoring equipment should indicate Fault at this extremely low signal output, (i.e., Honeywell Analytics recommends fault indication on any signal below 1.5 mA.)

Exit: Press and hold button for one second. Sensor will exit test and return to normal operation.

G		Continuous ON

NOTE: This test will *not* automatically time out. You must force the unit into normal operation.

Simple Zero Test

Start: With meter set to mVDC, place leads on Test (+) and Test (—) (see Figure 4). Press and hold button for one second to enter the Calibration Mode.

Ⓖ	— — — — — — —	Slow blink

- Unplug the sensor from the pre-amp.
- Observe the 4/20 mA signal which should be approximately 4.0 mA (40 mV on meter). Range should be 39.4 to 40.6 mV. If sensor output is not in this range, contact Honeywell Analytics.
- Plug sensor back into pre-amp. Wait for sensor to stabilize at approximately 4.0 mA.

Exit: Press and hold button for one second (places unit in Normal Operation Mode).

Ⓖ	————————————	Continuous ON

PLC and monitoring equipment should indicate Fault at this extremely low signal output, (i.e., Honeywell Analytics recommends fault indication on any signal below 1.5 mA.)

Exit: Press and hold button for one second. Sensor will exit test and return to normal operation. Blink sequence will be:

Ⓖ	————————————	Continuous ON

Span Calibration Mode

NOTE: If using the Modbus RTU output with the AirAlert™ 96d controller, while in calibration mode, alarms A, B, and C will not be activated during calibration of the sensor.

NOTE: When replacing an aged or non- responsive sensor, the new sensor may cause an erratic or jumpy signal, sometimes causing false alarms. This is usually caused by excessive gain leftover from adjusting the span pot (increasing the sensitivity) for the old sensor. Once the span calibration is performed on the new sensor, the gain will be decreased to match the sensitivity of the new sensor, reducing the jumpiness of the new sensor.

The EC-FX-NH3 detector is factory calibrated but it must also be calibrated at start-up. The sensor performs best when calibrated in the environment in which it will be used. Calibrate only with the recommended full scale calibration gas mixed with air. (The oxygen in air is necessary for the sensor to properly respond to ammonia). Do not place the sensor in a controlled-atmosphere environment where oxygen is depleted, which can lower its accuracy. One pot on the preamp is used for Span calibration (see Figure 4Figure 4, Note 1). There is no zero pot as the pre-amp is factory zeroed and should not require any further adjustment. A common exception to using full-scale cal gas is when calibrating 500 ppm sensors. Typically 250 ppm cal gas is used and the span is adjusted to 12 mA vs. 20 mA.

Calibration Kits are available from Honeywell Analytics. See page 32 for kit part numbers and descriptions. Calibration gas must be ordered separately; refer to the *Refrigeration Price Book* for ranges and prices.

Span Calibration

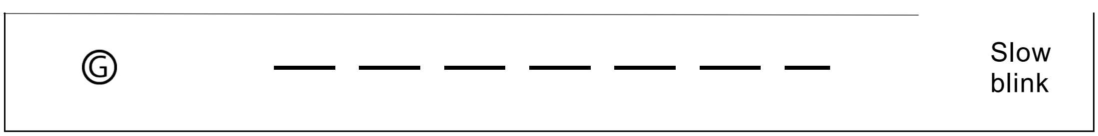
The unit is factory calibrated but must be spanned at initial installation. Do not adjust the span pot without certified calibration gas.

For span calibration, follow this procedure:

Start:

1. With meter set to mVDC, place leads on Test (+) and Test (-).
2. Make sure signal is resting at 40 mV ±5 mV (or 4.0 mA ±0.5 mA). If the sensor is not outputting 4.0 mA, see *Troubleshooting* on page 27. In some cases, opening doors changes the temperature, environment, and ambient air flow to the sensor which impacts its stability during this procedure.
3. Place the unit in calibration mode by pressing the button for 3 seconds until the green LED flashes slowly or, for units equipped with the LCD option, initiate the calibration mode using the front panel push buttons.

NOTE: After 10 minutes, the unit will automatically revert to run mode.



NOTE: Keep hands away from the sensor in order for a stable output to be achieved. Moisture, air flow, and the ammonia normally emitted by the human body can affect the sensor's stability and change its signal slightly.

4. Place the EC-FX calibration adaptor (EC-FX-CA) on the sensor and ensure that it is fully-seated and aligned. Gas with full-scale span gas NH_3 mixed in air @ 0.3 L/min until the 4-20 mA output signal rise appears to slow down to around 0.1 mA/sec. If the output signal rises above 20 mA, immediately begin adjusting the span pot counter-clockwise to lower the mA output signal as the maximum output is 26 mA. The rise in 4-20 mA output signal will begin to slow down around 10 to 30 seconds after gas is applied as it begins to approach a peak value. Turn the span pot until output reaches 20 mA ±0.5 mA (200 mV ± 5 mV) even though the signal may be slowly changing. Remove the calibration adaptor and shut off the gas. Do not gas the sensor for more than 2.5 minutes. If the mA output signal begins to drop quickly during the gassing phase, (0.2 mA/sec.) too much gassing time has passed and the process must be repeated. For 500 ppm units, 250 ppm span gas is typically used. The span should be 12 mA ±0.5 mA (120 mV ±5 mV).

⚠CAUTION

Cal gas flow must be in the direction of the arrow shown on the EC-FX calibration adaptor. Connect the regulator hose to the “Inlet port” side of the adaptor according to the air flow direction arrow molded into the plastic housing. (Inlet side) ○→○ (Exit port side).

NOTE: The rise in 4-20 mA output signal will typically begin to slow down around 30 seconds after gas is applied as it approaches a peak value. If the 4-20 mA signal peaks then begins to drop, quickly adjust the span pot to 20 mA ±0.5 mA. Do not gas for more than 2.5 minutes. If a signal peak is not reached within 2 minutes, the sensor may need additional time to stabilize, the adaptor may not be properly seated on the sensor with the O-ring, or there may be other issues specific to the site or the application. For 500 ppm units, 250 span gas is typically used. The span should be 12 mA ±0.5 mA.

NOTE: In some cases, the signal may begin to drop quickly after it peaks, adjust the span pot until the output reaches 20 mA ±0.5 mA even though the signal may begin to drop slowly.

NOTE: For an EC-FX-NH3 detector with the LCD option, once cal mode is initiated, “Apply gas” will show on the display. For best accuracy, the span pot should be adjusted during the 2 minute timer. Begin adjusting the span pot when the NH3 reading begins to slow down to 0.1mA/sec (1mV/sec). This will likely take place before the 2 minute timer will expire. Use a meter as described on page 21 for mA output readings during calibration, not ppm levels as shown on the LCD display. Once cal gas begins to flow, a 2 minute reference timer will indicate when the sensor has reached the maximum allowed gassing time. If the signal has not peaked or slowed down to 0.1 mA/sec. within this time, the sensor may need additional time to stabilize or there may be other issues per note above. After 2 minutes of gassing has occurred, the display will indicate “Spansnsr”. If the sensor is not ready to span or peaked in signal level when the “Spansnsr” is shown on the display, the sensor may need additional time to stabilize or the adaptor may not be properly seated on the sensor. If the sensor was able to span within the 2 minute time period, this mode can be exited at any time by pressing the “scroll” then “accept” button.

5. Remove the calibration adaptor and shut off the gas.

6. Ensure that the output decreases to a stable 4 mA ±0.2 mA. This should take about 5 to 15 minutes. It may take longer under certain conditions (e.g., high wind speed and >30% RH over a 60-minute period).

NOTE: If the output doesn't decline to 4mA ±0.2 mA, an internal offset procedure may be necessary. This procedure can be found in the troubleshooting section of this manual (see page 27). In addition, if low level signals appear to be surfacing occasionally slightly above 4mA, the internal offset setting may be the issue, especially for differences in gain settings that have occurred over time.

Press the button for 2 seconds to return the unit to run mode. The green LED will glow steadily or, for units with the LCD option, exit from calibration mode using the front panel push buttons. **Exit:** Press and hold the button for 1-2 seconds. The green (left) LED glowing steadily means normal operation.

G	————————————	Continuous ON

NOTE: The Span Calibration Mode will automatically time out after 10 minutes.

Span Signal Formula

Normal span gas is full scale. To achieve maximum accuracy, full-scale span gas must be used. If the span gas is not full scale, use this formula:

$$\text{Signal (mA)} = \left[\!\left[\frac{\text{A S G C}}{\text{S F S V}}\right]\!\right] \text{x } 16 + 4$$

Where:

ASGC = Available Span Gas Concentration
SFSV = Sensor Full Scale Concentration Value

Example: If 100 ppm ASGC gas is used to calibrate a 250 ppm SFSV sensor, the signal would be as follows:

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

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

If the correct output cannot be achieved, a replacement sensor may be required.

MODBUS Address Change

NOTE: To view or change the Modbus address, the Manning LCD Module is required. Contact Honeywell Analytics to obtain the module.

NOTE: No two devices on the network can have the same address. Each device needs to have a unique address.

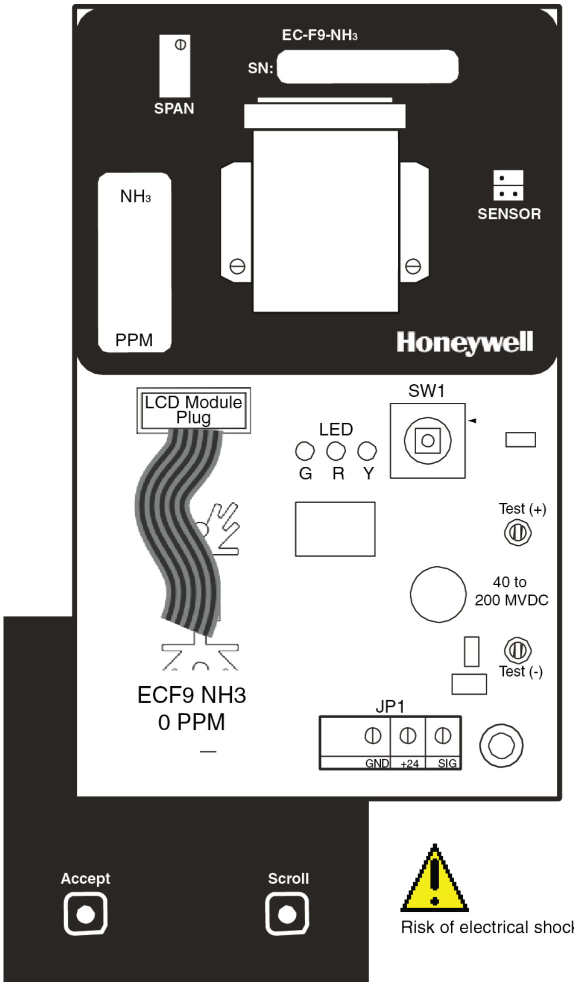
Each device requires an address to communicate with the controller on the network. The Modbus address normally comes factory programmed and does not require to be programmed at startup. If it is determined that the Modbus address needs to be **using the LCD module to view or change the Modbus address**: The LCD module has two push-buttons; *Accept* and *Scroll*, which will be utilized for this procedure (see Figure 7).

NOTE: To display the Modbus address, press the *Scroll* button anytime during normal operating mode.

1. Plug in the LCD module to the LCD port on the PCB (see Figure 7 on page 26).
2. This module will power-up immediately and will display the normal (idle) operating display.
3. Press the *Accept* button.
4. You will then be prompted for a password. The password is *MA*.
5. Use the *Scroll* button to change the first letter to *M*. Then press the *Accept* button.
6. You will then be prompted to change the second letter. If it is already set to *A*, press the *Accept* button.
7. If the correct password is entered, you will be sent to the MAIN MENU.
8. In the MAIN MENU, scroll until the *ModbsID?* screen is displayed.
9. Press *Accept* to enter Modbus Address Change menu. The current programmed Modbus address will be displayed (if not programmed at the factory, the default address is 001).
10. If the Modbus address is correct, keep pressing the *Accept* button until you are prompted to accept the current Modbus address. You will then be returned to the MAIN MENU.
11. If the Modbus address is not correct, using the *Accept* and *Scroll* buttons, change the Modbus address the correct value.
12. You will then be prompted to save the changes. Press *Accept* to save, and *Scroll* to abort. You will then be returned to the MAIN MENU.
13. Use scroll button to navigate through the main menu. To exit the menu, scroll until the LCD displays *Quit?* and press the *Accept* button. This will return you to normal operating mode. The LCD module can be unplugged at this time.

After 5 minutes of inactivity, the LCD returns to the normal (idle) operating display.

Figure 7. LCD Module



Risk of electrical shock.

C Troubleshooting

If low-level signals appear to be surfacing occasionally slightly above 4mA, the internal offset setting may be the issue, especially for differences in gain settings that have occurred over time, or small offsets that have developed over time from aging or the introduction of contaminants.

INTERNAL OFFSET PROCEDURE:

1. Place the EC-FX detector in Cal. Mode.
2. Unplug the sensor from the main board so that it is not electrically connected to the EC-FX detector.
3. For units equipped with an LCD option, unplug the LCD ribbon cable from the main board (the same board the sensor is connected to). This allows the onboard button to function.
4. Press the button 8 times quickly without pausing between presses; the yellow LED will blink slowly for 1 minute. If the yellow LED doesn't turn on, the button press timing was too erratic; repeat the 8 button presses again until the yellow LED blinks slowly.

   NOTE: If at any time in step 4 all three LEDs simultaneously blink slowly, the 4-20mA calibration was initiated accidently because the button presses were too slow or not consistent. To exit this mode, press the button for 1 second until the unit reverts back to "run" mode, or when the LEDs stop blinking and the green LED is on solid. Place the detector back in factory calibration mode and repeat step 4.

5. After the yellow LED turns off, check the mA output and ensure it is 4mA ±0.05mA.

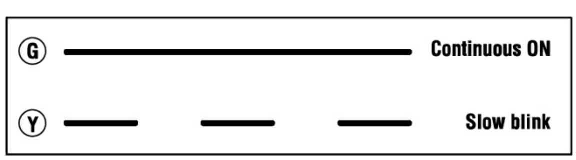
   NOTE: If the mA reading is not in range, the 4-20mA output may need to be re-calibrated. It is not necessary to perform the internal zero procedure again unless the gain pot was adjusted more than 5 turns.

Risk of electrical shock.

   To re-calibrate the mA loop output, refer to page 21.

6. Plug the sensor back into the main board and verify that the output eventually stabilizes at 4 mA ±0.2 mA. If this range is not achieved after several hours or small spikes occur around 4.6 mA to 5.5 mA in response to changing environments shortly after calibration (or later), "zero" the sensor *with the cell connected*. Repeat steps 3 and 4 with the sensor plugged into the main board. Allow sufficient time for it to stabilize (30-60 minutes) until the 4-20 mA output readings are no longer drifting steadily in one direction. The mA output should be stable or fluctuate no more than ±0.01 mA/sec. Ensure that the ambient air has no traces of ammonia present. Keep hands and breath away from the sensor as this will cause the signal to change slightly (the human body emits ammonia). After step 4 is complete with the cell connected, the output should be 4mA ±0.15mA.

The LEDs will give visual indication of several sensor and transmitter conditions. Placing the unit in "auto zero" mode will begin a slow blink that will last 60 seconds. The unit must first be in "cal" mode or "factory cal" mode to activate "auto zero" mode.



If the sensor output is 0 mA: First, verify +24 VDC at the sensor terminal block (see Figure 8, Note 2).

Second, check voltage between Test (—) and Test (+) (see Figure 8, Note 3). Voltage should be in the range of 40 mV to 200 mV corresponding to an actual current flow of 4 mA to 20 mA. If this voltage is 0 mV, the signal has no path to ground. Check monitoring equipment connections and configuration.

If the sensor output is 0.5 mA: Indicates a fault condition has occurred.

- Most common — failed or disconnected sensor
- Hardware failure (pre-amp)

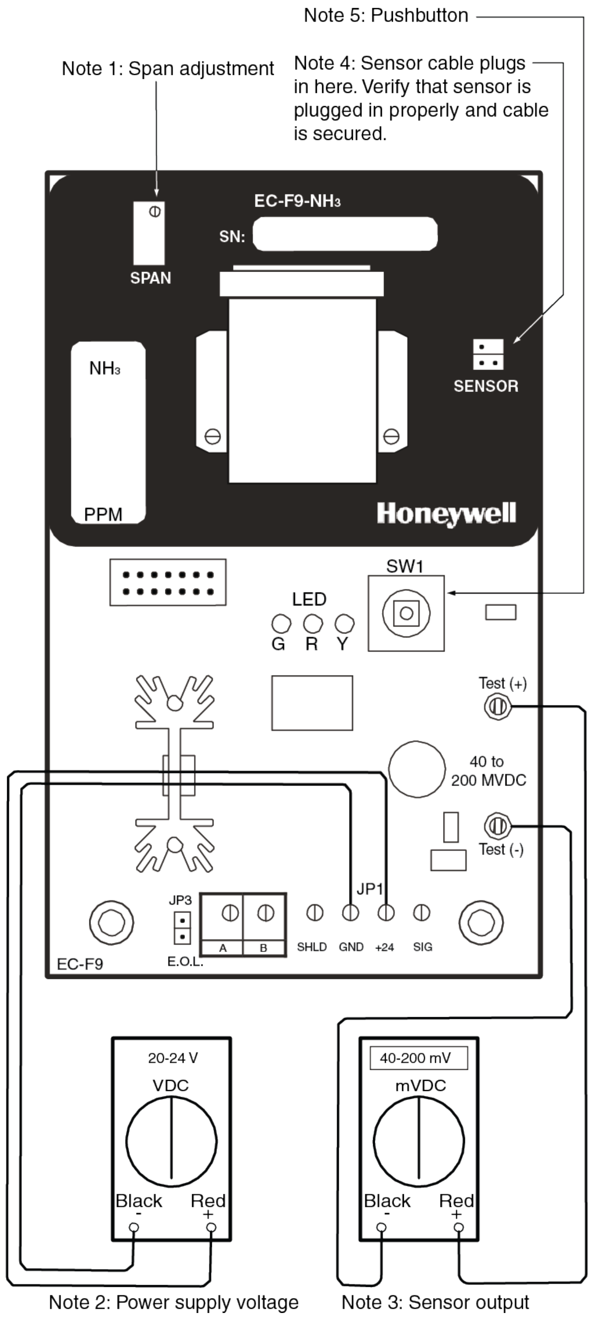
If the sensor output is erratic: Make sure that the unit is in clean, ammonia-free air.

The detector has been factory zeroed and spanned. If the zero has become unstable, and there are no interference gases, the most likely problem is a depleted sensor or a new sensor with high gain left over from a previous sensor that was adjusted for aging. If span calibration has not been performed with the new sensor, turn span pot down (see Figure 7, Note 1 on page 26), or counterclockwise, 3 full turns. This will decrease the sensitivity and reduce the zero calibration of the new sensor. Calibration is required after this adjustment.

Electrical Interference: This sensor has been designed to be highly resistant to EMI/RFI using multiple stages of filtering and protection. However, in extreme environments, some noise pickup can occur directly through the sensor. Ensure that the bare shield wire of the instrument cable is connected to the terminal block marked *SHLD* at the sensor (not touching the metal enclosure) and properly grounded at the readout unit.

Interference Gases: The EC-FX-NH3 is designed to be quite specific to ammonia. However, some other gases can affect the reading. Phosphene, methyl mercaptan, and hydrogen can give a slight upscale indication. Bromine, ozone, fluorine, chlorine, and nitrogen dioxide can give a slight down-scale indication. Contact Honeywell Analytics if any of these gases are present in your application.

Figure 8. Troubleshooting



D Maintenance

For proper operation it is essential that the test and calibration schedule be followed. Honeywell Analytics recommends the following maintenance schedule:

- Calibration should be performed with certified calibration gas every six months. After exposure to a major leak, stabilize the sensor at its operating temperature in a clean air environment. Calibration kits are available from Honeywell Analytics. See *Replacement Parts* on page 30.
- Response test once between calibrations, i.e., at three month intervals. Expose sensor to ammonia/water solution to verify proper sensor response and alarm functions. Test more frequently in highly critical applications. The response test is not required if multiple electro-chemical sensors are installed in the same room.

Log all tests and calibrations.

Sensor Life: These electrochemical sensors are extremely reliable, but several things can cause the sensor electrolyte to become depleted including:

- time
- prolonged exposure to high temperatures
- exposure to varying concentrations of the target gas
- exposure to some VOCs
- exposure to high moisture for extended periods without proper sensor enclosure.

⚠CAUTION

Although SensorCheck™ tests the sensor's electrical viability every 24 hours, it is absolutely essential that these units be exercised with a gas sample on a regular and timely basis.

Typical sensor life in a refrigerated area will be three to four years. Typical life in a non-refrigerated area will be two to three years. Exposure to high levels of ammonia will shorten these times. In addition to timely response checks, a preventative maintenance program of periodic sensor replacement should be implemented.

When the sensor becomes depleted, a replacement sensor can be obtained from Honeywell Analytics. Simply unplug the ribbon cable from the pins labeled Sensor, pull the old sensor from the spring clip, discard the old sensor and replace it with a new one.

The sensor should be checked according to the following procedure after a five-minute warm-up period.

Note: Typical Electrochemical sensor technology tends to exhibit a slight output shift downward when there is a small leak or a continuous NH_3 background surrounding the sensor. For example in a 100ppm unit it is important to investigate small momentary signal changes that occur above the 4.6 mA threshold (5ppm) on the EC-FX output and below the first alarm level of 25 ppm (8 mA). This could be an early warning that a small leak or breach in the NH_3 system could have occurred in which a constant background of NH_3 is present. False alarms or brief activation of alarm 1 may also be an indicator of the presence of background or low level NH_3.

If it is discovered that the EC-FX was exposed to a continuous leak of NH_3 (for more than 6 hours), it is recommended to allow the sensor to stabilize in clean air for 48 hours and re-calibrate.

EC Sensor Replacement Procedure

- Remove the old EC sensor.
- Plug in new EC sensor, making sure connector pins are positioned correctly. Be sure ribbon cable is snug under plastic clip (see Figure 8, Note 4 on page 28).
- Allow sensor to stabilize until output reaches 4 mA ±0.5 mA.
- Perform manual SensorCheck™ using the procedure in the SensorCheck™ section.
- Follow the span calibration procedure on page 23.

Honeywell Analytics' recommendation is to check the calibration of all new sensors with certified calibration gas. Follow the procedure in the Calibration section of this manual.

Replacement Parts

For replacement parts, contact Honeywell Analytics. Be sure to have the model number and serial number of the unit.

Replacement sensors:

EC-FX-NH3-LR	Replacement ammonia (NH_3) cell, 0-100/200/250 ppm
EC-FX-NH3-HR	Replacement ammonia (NH_3) cell, 500-1000 ppm

Calibration parts:

EC-FX-CK	ECFX cal kit 17/34L .300LPM reg
EC-FX-CK1	ECFX cal kit 29L .300LPM reg
EC-FX-CK2	ECFX cal kit 58/103L .300LPM reg
EC-FX-CA	Calibration Adaptor for EC-FX

Limited Warranty

Limited Warranty

Honeywell Analytics, Inc. warrants to the original purchaser and/or ultimate customer ("Purchaser") of the EC-FX-NH3 leak detector ("Product") that if any part thereof proves to be defective in material or workmanship within three years of the date of shipment by Honeywell Analytics, such defective part will be repaired or replaced, free of charge, at Honeywell Analytics' discretion if shipped prepaid to Honeywell Analytics at 405 Barclay Blvd., Lincolnshire, IL 60069, in a package equal to or in the original container. The Product will be returned freight prepaid and repaired or replaced if it is determined by Honeywell Analytics that the part failed due to defective materials or workmanship. The repair or replacement of any such defective part shall be Honeywell Analytics' sole and exclusive responsibility and liability under this limited warranty.

Exclusions

If gas sensors are part of the Product, the gas sensor is covered by a three-year limited warranty of the manufacturer.

The use of any non-Honeywell parts in the Product voids the warranty.

If gas sensors are covered by this limited warranty, the gas sensor is subject to inspection by Honeywell Analytics for extended exposure to excessive gas concentrations if a claim by the Purchaser is made under this limited warranty. Should such inspection indicate that the gas sensor has been depleted rather than failed prematurely, this limited warranty shall not apply to the Product.

This limited warranty does not cover consumable items, such as batteries, or items subject to wear or periodic replacement, including lamps, fuses, valves, vanes, sensor elements, cartridges, or filter elements.

Warranty Limitation and Exclusion

Honeywell Analytics will have no further obligation under this limited warranty. All warranty obligations of Honeywell Analytics are void if the Product has been subject to abuse, misuse, negligence, or accident or if the Purchaser fails to perform any of the duties set forth in this limited warranty or if the Product has not been operated in accordance with instructions, or if the Product serial number has been removed or altered.

Disclaimer of Unstated Warranties

The warranty printed above is the only warranty applicable to this purchase. All other warranties, express or implied, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose are hereby disclaimed.

Limitation of Liability

It is understood and agreed that Honeywell Analytics' liability, whether in contract, in tort, under any warranty, in negligence or otherwise shall not exceed the amount of the purchase price paid by the purchaser for the product and under no circumstances shall Honeywell Analytics be liable for special, indirect, or consequential damages. The price stated for the product is a consideration limiting Honeywell Analytics' liability. No action, regardless of form, arising out of the transactions under this warranty may be brought by the purchaser more than one year after the cause of actions has occurred.