INFRARED HCFC & AMMONIA (NH3) REFRIGERANT SENSOR

User Manual

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TABLE OF CONTENTS

GENERAL

The non-dispersive IR refrigerant gas sensor was designed to detect for the presence of certain refrigerant gases within an enclosed space. The sensor is mounted within the space to be monitored and connected by cable to a monitoring device. Each sensor is calibrated to monitor for a specific refrigerant gas. There are three models of IR sensors for each gas depending upon the monitoring environments; machine room and low temperature refrigeration applications NEMA 3R Steel, water-tight ABS fiberglass housing for wash down protection (NEMA 3R), and Stainless Steel enclosure also available for special applications.

The IR sensor is a reliable method of monitoring for refrigerant gas leaks in environments that have air quality problems. The IR sensor will eliminate many false alarms in environments that contain gasoline, diesel and propane exhaust and fumes from solvents, paints, cleaners and others.

WARNING: The infrared sensor is not to be applied into all refrigerants storage applications where other toxic gases are used in the same room. Some installations are not suitable for infrared technology. Misapplication may result in damage to sensor. Contact factory for a specific list of approved applications.

APPLICATIONS

Typical applications include:

HVAC Chiller Equipment Rooms
Refrigeration Mechanical Rooms
Bakeries
Food Process Plants
Refrigeration Rooms
Wineries

SPECIFICATIONS

Enclosure Rating

NEMA3R Steel	12.75”x5.0”x2.75”
NEMA 3R ABS fiberglass	12.0”x7.5”x6.0”
NEMA 3R Stainless Steel	12.75”x5.0x2.75”

Operating Environment Temperature

Machine Room Model	32º to 100º F (0 to 43.3º C)
Freezer Room Model	-40º to 110º F (-40º to 43.3º C)

Power Input 12VDC, 0.4A

Output (standard)	4-20 mA (standalone sensor)
Outputs	0-10VDC (Contact Factory)
Effective Range	10 to 1031ppm
Sensitivity	±1ppm at 25º C, 45% RH
Resolution	1ppm
Accuracy	±5ppm plus 2% over Full Scale
Humidity	0 to 90% RH Non-Condensing
Calibration	Every 6 months
Ambient Air flow	Less than 3ft/sec
Warm Up Time	Readings will stabilize after 3 hours
Life Expectancy	3 to 5 years under normal conditions

MOUNTING INSTRUCTIONS

Sensor Placement

The IR Refrigerant Gas Sensor must be placed in locations that a refrigerant gas leak is likely to occur and where refrigerant gas is likely to concentrate so as to provide warning of a potential hazardous condition. Mounting locations are dependant upon the application and the refrigerant gas to be monitored. The housing has a ¾" conduit knockout hole in the bottom so the sensor must be mounted vertical.

All mounting locations must be a fixed well supported wall, pole or frame with little or no vibration. Sensors must be placed in locations that will prevent damage from fork trucks, carts and other moveable devices.

For Halocarbon Refrigerants such as R123 place the sensor 18 to 24 inches off the floor. For Ammonia, place the sensor near the ceiling.

HVAC/Refrigeration Machinery Room – prior to placement of the IR leak Sensor, the room air currents need to be determined. Air currents can be determined through the use of smoke candles or any other accepted filed-expedient method. The air currents of every potential condition should be analyzed. The maximum air flow rate past the sensor should not exceed 3 feet per second. Air velocity past the sensor can be determined by lighting a match close to the sensor. If the match is

blown out by the air current, mounting the sensor inside a pull box with knockouts opened slightly or some other method of damping the air must be used.

Exhaust Fan On – The air currents within the machinery room exhaust fan must be determined. Identify locations that are "downwind" of the potential leak source. Locate one sensor near the air intake duct of the exhaust fan, but not directly in the duct so the sensor is not subject to the full force of the duct air.

Exhaust Fan Off – In applications where machinery room exhaust fan can be shut off, identify air currents of the machine room with the fan off. Locate a position "downwind" of the potential leak source with the fan off. This location may be omitted if the exhaust fan is to be operated continually.

Refrigerated Room – Determine the direction of the discharge air from the evaporator coil.

Halocarbon Refrigerant Systems – Mount the sensor on the wall near the return air vents of the evaporator coil or beneath the coil or within between ten to twenty feet of a doorway exiting the room to a space.

Ammonia Refrigeration System – Mount the sensor on the wall in a downward air path or the discharge air, at least 20 feet or more from the coil or on the wall on the opposite side of the room. Do not place the sensor closer than 10 feet from the coil or directly in the discharge air path to avoid reading fluctuations due to defrost and violent air velocity.

Mounting

The sensor must be mounted with the wire terminal blocks oriented to the lower right and sampling chamber in a vertical position. Failure to mount the sensor in this fashion may result in false or in accurate readings and can allow moisture to enter the housing and destroy the sensor.

For NEMA1 Housing

Wall Mount. Use locally available wall mounting hardware such as molly-bolts or toggle bolts to firmly affix the sensor to the wall. It is best to use standoffs so there is a slight air gap between the sensor and the wall. The sensor can be mounted using available screw holes or a combination of the keyhole and the two bottom screw holes.

Pole Mounting – The sensor can be mounted to a support pole by utilizing Uni-Strut C braces. Attach the C braces to the back of the housing, perpendicular to the sensing chamber direction. Attach clamps to the C brace and run stainless steel band straps around the pole and through the straps.

For NEMA 3R Housing

Wall Mount. Use locally available wall mounting hardware such as molly-bolts or toggle bolts to firmly affix the sensor to the wall. It is best to use standoffs so there is a slight air gap between the sensor and the wall. The sensor should be mounted using the mounting feet mounted on the back of the housing. Ensure all 4 sets of mounting feet are accessible. Hold down the mounting feet with locally available wall mounting hardware.

Pole Mounting – The sensor can be mounted to a support pole by utilizing Uni-Strut C braces. Attach the C braces to the back of the housing, perpendicular to the sensing chamber direction. Attach clamps to the C brace and run stainless steel band straps around the pole and through the straps.

Use only watertight fittings, either conduit fittings or cable retention fittings. Mount conduit on the bottom side of the housing to prevent moisture from dripping on the control board.

CABLE RUNS

All cabling must avoid running parallel to high voltage (48VDC or greater or any AC voltage wiring). Cable must be greater then 12 inches from high voltage wiring or conduit. Avoid running cable near all inductive loads such as motors, fluorescent fixtures, and transformers. Depending upon local codes, sensor cabling may be run loose or be placed into conduit used exclusively for low voltage control wiring.

Sensor cable shall have the minimum specifications:

- For Stand Alone sensor applications of any length - 18awg, 4 wire, 2 Pair, Twisted, Shielded (i.e. Belden 9552 or equivalent)

OPERATION

Components Description and Use

Dip Switches 1, 2 and 3 – Switches 1, 2 and 3 are for communications port addressing.

Dip Switch 4 – Switch 4 is for auto term offset compensation. It will re-calibrate up to 10ppm every 7 days. No more than 100ppm between manual calibrations. Disable for low level detection.

On Zero Compensation	SW4 = OFF
Disabled	SW4 = ON

Dip Switch 5 – Switch 5 is for field testing at set level

Normal	SW5 = OFF
Fixed 200ppm output	SW5 = ON

Dip Switch 6 – Switch 6 is for factory calibration

Normal	SW6 = OFF
Default Factory Setting	SW6 = ON

Dip Switch 7 – Switch 7 is used to tell the microprocessor on board the sensor that the sensor will be utilized as a stand-alone sensor. This is typically on for most applications.

Standalone (4-20mA)	SW7 = ON

Dip Switch 8 – Switch 8 is not used.

Push Buttons – Located just on either side of the DIP Switch.

Push Button 1 – (Status LED) It is used for testing the sensor with a 200ppm false signal. Dip switch 5 can be used for the same function. (Located to the right of the Dip Switch)

Push Button 2 – It is used for sensor calibration and is used in conjunction with LED 2. (Located to the left of the Dip Switch)

Light Emitting Diodes

LED L1 – (Status LED) LED L1 will indicate if the sensor microprocessor is operating and if the sensor is in test mode. When the microprocessor goes through a start-up, it will turn on L1 and keep it on unless switch 5 is on or pushbutton 1 is depressed.

Status	**Condition**
OFF	Sensor is not powered up
	Microprocessor detects an error in the sensor hardware
	Microprocessor failure
ON Steady	Sensor is operating properly
ON Flashing	Switch 5 is set to on or pushbutton 1 is depressed or microprocessor error.

LED L2 – (Calibration LED) LED L2 is used for zero calibration. When pushbutton 2 is pressed, LED 2 will light after 8 seconds and turn off once the button is released.

Status	Condition
OFF	Normal Operation
ON Steady	Factory Calibrated setting. Turn switch 6 off
ON Flashing	Microprocessor error. Call Factory

Potentiometers – The IR Sensor contains seven (7) potentiometers labeled POT 1 through POT 7. POTS are utilized during factory calibration and testing and should not be adjusted unless instructed to do so by a factory authorized service technician or engineer.
They are located inside the main part of the housing and there should be no need to open the sensor. It is not recommended to do this as it could void the warranty

Stand-Alone Sensor – In this configuration the IR Sensor has an effective sensing range of 0 to approximately 1031ppm

4-20mA Sensor -	0-3.95mA	-	sensor malfunction
	4mA	-	0ppm
	19.5mA	-	1000ppm

The performance equation is: **MA reading = ppm * 0.01551 + 4.0**

CALIBRATION

Prior to shipment all sensors are factory calibrated. The calibration method will set the base level (or zero Level) and gain (or Slope). As the sensor gets older or the ambient condition changes drastically, the Zero Level may drift upward or downward. The Gain (Slope) will not normally change.

Adjustments to the calibration are necessary to ensure that the sensor is reading accurately. This should be done every 6 months. Press the Calibration Push Button (L2) on the sensor located to the left of the dip switch for 10 seconds. LED L2 will light up after 8 seconds and turn off once the button is released.

Measured Gas Calibration

Equipment required

One Refrigerant Sensor calibration and test kit which includes:

a) Flow regulating valve - 1 liter per minute
b) Calibration gas cylinder - 79.1% Nitrogen/20.9% oxygen by volume (Zero Gas)

c) Calibration gas cylinder – Nitrogen balance/Measured quantity of Refrigerant Gas (Span Gas)
d) Vinyl tubing for IR sensor
e) Potentiometer screwdriver

The measured gas calibration procedure may be used as a double check of sensor accuracy and only needs to be done if there are questions of whether or not the sensor is working. It is not necessary to use measured gas to calibrate the infrared sensor. This procedure involves changing the air currents drastically inside the sensing chamber, so please use the procedure listed below as a test. Since the gas is forced into the sensor the reading will not be as accurate as a normal reading. At the factory we allow for normal airflow that would occur in a real leak when we calibrate the sensor and set the zero gas measured gas because of the unusual air currents involved.

1) Place the plastic tube that comes with the calibration kit over the inlet valve on the right of the sensing tube and connect the other end to the calibration gas canister.
2) Run 20.9% O2 gas into the sensor for about 5 minutes AND WAIT FOR THE READING TO SETTLE. Press the push button on the sensor right above the dipswitch for 10 seconds. This will be the artificial zero level.
3) Next run the measured refrigerant gas into the sensor for about 5 minutes. The difference between the artificial measured gas reading and the artificial zero level should be close to the measured gas concentration however the way the gas is pumped in will create errors in the accuracy of the reading.
4) Once the measured gas testing is complete and no gas is present and the sensor is mounted in normal conditions, do the push calibration once again to remove any artificial readings that were introduced during measured gas calibration.

QUICK START INSTRUCTIONS

1. Mount the Sensor and Control Panel/Unit

The sensor and control must be mounted in a fixed location and in the proper orientation. (See **Mounting Instructions** for more information).

2. Wire the Sensor to the Control Panel/Unit

Use only approved wire and double check for proper and secure connections. (See **Wiring Diagram** for recommended cable).

3. Turn on Power to the Sensor and allow warm up time

Check power in and polarity, it should be 12 Volts DC. Warm up time is important to allow time for sensor to acclimate to the environment. A 3 hour warm up is recommended.

4. Calibration and Zeroing of Sensor

The Infrared Sensor is factory calibrated, however the temperature and air quality and other variances make it necessary to calibrate and zero out the sensor at the time of set up in the field and every 6 months (See **Push Button Calibration and Zero Calibration**)

5. Test the Sensor (optional)

The sensor may be tested by activating Dipswitch 5 (See **OPERATION**) or by using a measured gas calibration test kit.

MAINTENANCE SCHEDULE

It is recommended that infrared sensors are zero calibrated every 6 months to insure accuracy. Most of the time push button calibration and control calibration is all that is needed to re zero the sensor and keep it from false alarming. (See **QUICK START INSTRUCTIONS** Step 4 for more). Measured gas calibration should only be necessary for testing accuracy and if the sensor fails to pick up a leak and is suspected of being damaged or faulty.

The sensors life expectancy is approximately 3 to 5 years under normal conditions.

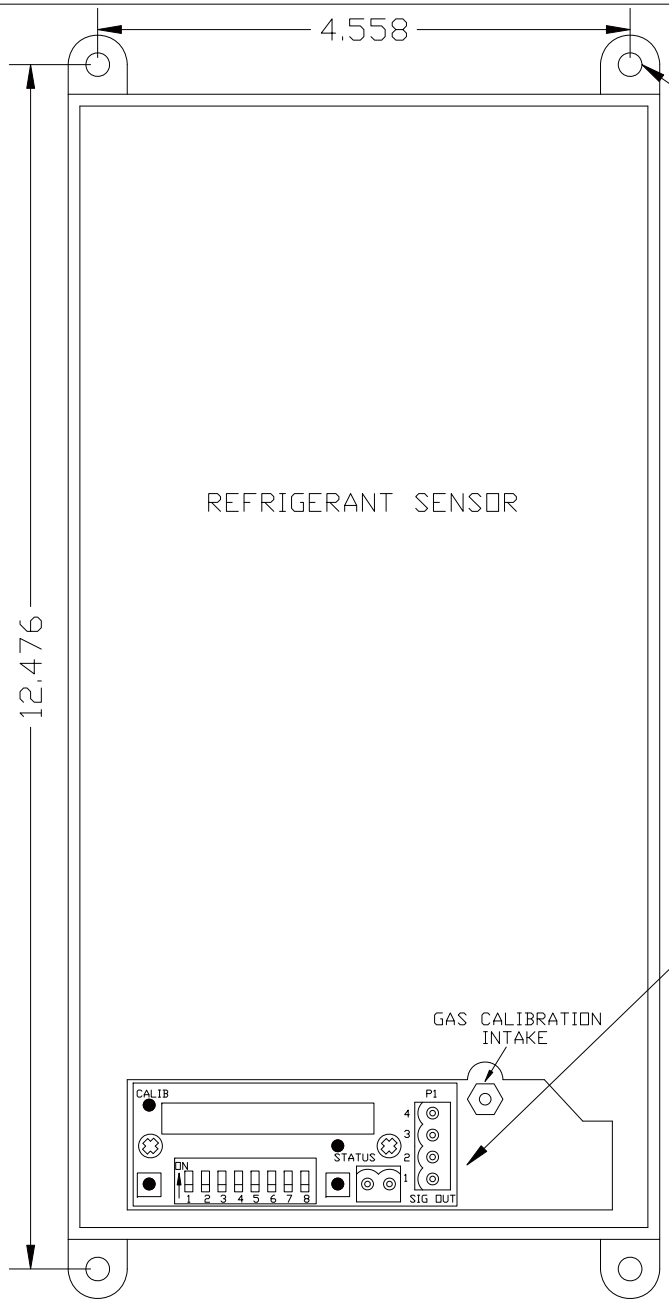
TROUBLESHOOTING

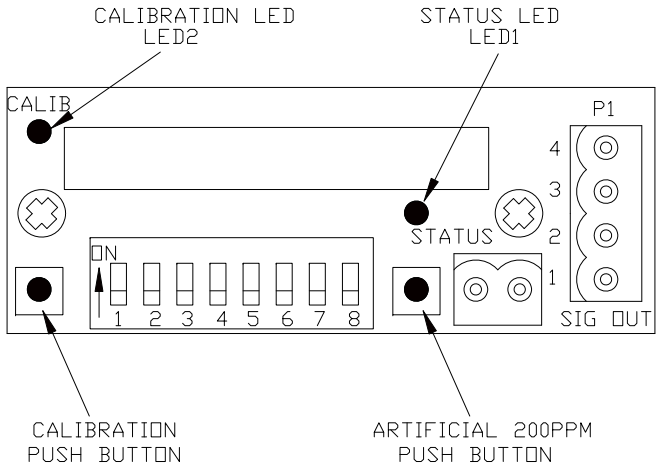
LED L1 – LED L1 will indicate if the sensor microprocessor is operating and if the sensor is operating in the correct temperature environment. When the microprocessor goes through start up, it will turn on L1 and keep it on unless the microprocessor detects a failure of any sensor components or detects an incorrect temperature range.

LED L2 – LED L2 is used for calibration of the sensor and is normally off. When the Push Button Calibration is done, L2 will turn on in about 4 seconds then turn off when the push button is released.

LED Status	Condition	Solution
L1 Off	Sensor is not powered up	Check power connector. Ensure that the sensor is being powered by 12 Volts DC. Ensure that the wire connects are secure and are correct polarity.

		Microprocessor detects an error in the sensor hardware or Microprocessor Failure. Call factory.
L1 On Steady	Sensor is operating properly	
L1 On Flashing	Switch 5 is on and there is a 200PPM reading on the sensor	Switch Dip Switch SW5 to other position
	Microprocessor detects Error in the sensor signal	If Switch SW5 does not work, call factory.
L2 Off	Sensor is operating properly	
L2 On Flashing	Microprocessor failure	Call factory
L2 On Steady	Sensor is on factory	Turn Dip Switch 6 off and wait at 1 minute for L2 to turn off and do Push Button calibration again.
	Sensor Reading shows the presence of gas	Was the calibration followed. First attempt Push Button procedure. Check area around sensor with a hand held leak detector for a leak. If no leak, move sensor to another location or swap positions with another sensor. If readings move with sensor call factory. If reading stay at original location, check for wiring problems or the presence of gas. How old is the sensor?
	Sensor output indicates a full scale reading.	Check for wiring problems. Turn Dipswitch 5 to on. If the control reads about 200 there could be a sensor problem and contact factory. If it still reads full scale double check for proper wiring. How old is sensor?





GAS TYPE	PART #
R123	E90654
R134A	E90654A
R22	E90654B
R11	E90654C
R12	E90654D
NH3	E90654E

CONNECTOR P1

	4-20 MillAmp
P1-4	V return
P1-3	V+ in (10-36VDC)
P1-2	MA return
P1-1	MA output

REV	DATE	DESCRIPTION	CHK'D	APP'D
3	8/22/07	Updated connector P1 description		
2	7/24/05	Removed note "R123/NH3"		
1	7/17/06	Added Ammonia Series		

REVISIONS

ARJAY ENGINEERING LIMITED

PROJECT:

DWG. STATUS	BY	DATE D	M	Y
DRAWN	V.H.	07	03	05
CHECKED				
APPROVED				

TITLE: REFRIGERANT&AMMONIA SENSOR PART # E90654 SERIES

SCALE	REF. DWGS.	DWG. NO.	SHT.	REV.
N.T.S.		20050122	1	3