

SD1-NH3

SAMPLE-DRAW AMMONIA SENSOR
FOR INDOOR POULTRY AND LIVESTOCK MONITORING



Installation and Operation Manual

Warning

**Use this product only in the manner described in this manual.
If the equipment is used in a manner not specified by Calibration Technologies, the protection provided by the equipment may be impaired.**

This equipment should be installed by qualified personnel.

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General Description

The SD1-NH3 is a single-point sample-draw ammonia sensor. This design helps the sensor survive in continuous-exposure applications where other diffusion-type electrochemical sensors simply fail and die.

This ammonia sensor utilizes proven electrochemical sensor technology for accuracy. It is designed with special pump/valve sequencing to refresh the cell with clean air to prevent ammonia saturation and extend the cell life. An automatic reverse purge routine also helps self-clean the micron filter.

The SD1-NH3 has a 10-minute sampling rate, and the sample-draw cycle is as follows:

- 2-minute sample time from the room being monitored. At the end of the two minutes, the sample data is stored and held for the next 10 minutes also while being transmitted via 4-20 mA output to the controller or PLC.

- 2-minute fresh air purge from outside fresh air source.

- 6-minute pump shut-off phase.

The standard detection range (0-100 ppm) of the SD1-NH3 sensor provides monitoring of ammonia concentrations accurately down to 5 ppm without false alarms.

The SD1-NH3 sensor provides an industrial standard linear 4/20 mA output signal compatible with most gas detection systems and PLCs. The output signal is not affected by drastic temperature and moisture variations.

All circuit boards are sealed in potting compound, protecting sensitive electronic components and copper tracing from corrosion.

An external fresh-air sample tube and hardware are included with the SD1-NH3. Tube length provided is five feet.

Installation

Locating the SD1-NH3

An important consideration when installing the SD1-NH3 is that it must be easily accessible for occasional maintenance, and protected from physical damage (e.g. poultry, livestock). A cage or wire mesh may need to be constructed to protect the sensor and outdoor air sample tubing from damage.

For optimum ammonia monitoring of litter, mount the bottom of the sensor enclosure approximately two to three feet from the floor. Keep in mind, the indoor air sample port and filter are located at the bottom of the sensor enclosure.

The external fresh-air port should be mounted to and penetrate through an exterior wall. This will be the source of fresh outside air necessary for proper monitoring and longer cell life.

If using for livestock barns where stir fans (circulation fans) are being used, one SD1-NH3 sensor can adequately monitor 25,000 sq feet.

Installation Guidelines:

- Mount sensor on an exterior wall.
- Mount sensor on a solid surface with minimal vibration.
- Mount sensor thru the holes in the mounting flanges of the enclosure.
- Mount sensor in a general-purpose location only. Do not install in a hazardous environment.
- Mount sensor away from electromagnetic interference.
- Always mount sensor vertically with the sampling port at the bottom.
- Take air movement and ventilation patterns into account.
- Keep sensor and wire runs away from mercury vapor lights, variable speed drives, and radio repeaters to prevent electrical interference.
- More than one sensor should be installed for highly critical locations.

Installing the Fresh Air Port

If the SD1-NH3 is mounted as recommended on an outside wall, attach the fresh air port, tubing and hardware as follows: (see Figure 1)

1. Drill 1/2" hole through the exterior wall above and to the left of the sensor.
2. Remove covers from all of the conduit bodies.
3. Attach one end of flexible conduit to the interior fresh air port flange (B), and the other end to the LR conduit body attached to the bottom of the sensor (C). Cut to shorten the flexible conduit if necessary.
4. Center the external fresh air flange (A) over the 1/2" hole in the wall and attach. If the wall is thin, use long bolts to connect both flanges together.
5. Bend the flexible conduit around, center the internal fresh air flange (B) over the 1/2" hole and attach.
6. Feed the 1/4" black flexible tubing, starting from the top interior conduit body (B), until it comes out on the bottom (C).
7. Attach the tubing to the hose barb inside the LR conduit body attached to the bottom of the sensor (C).
8. Feed the tubing through the hole in the wall and attached to the hose barb inside the external fresh air flange conduit body (A). Cut to shorten the hose if necessary.
9. Replace all conduit body covers.

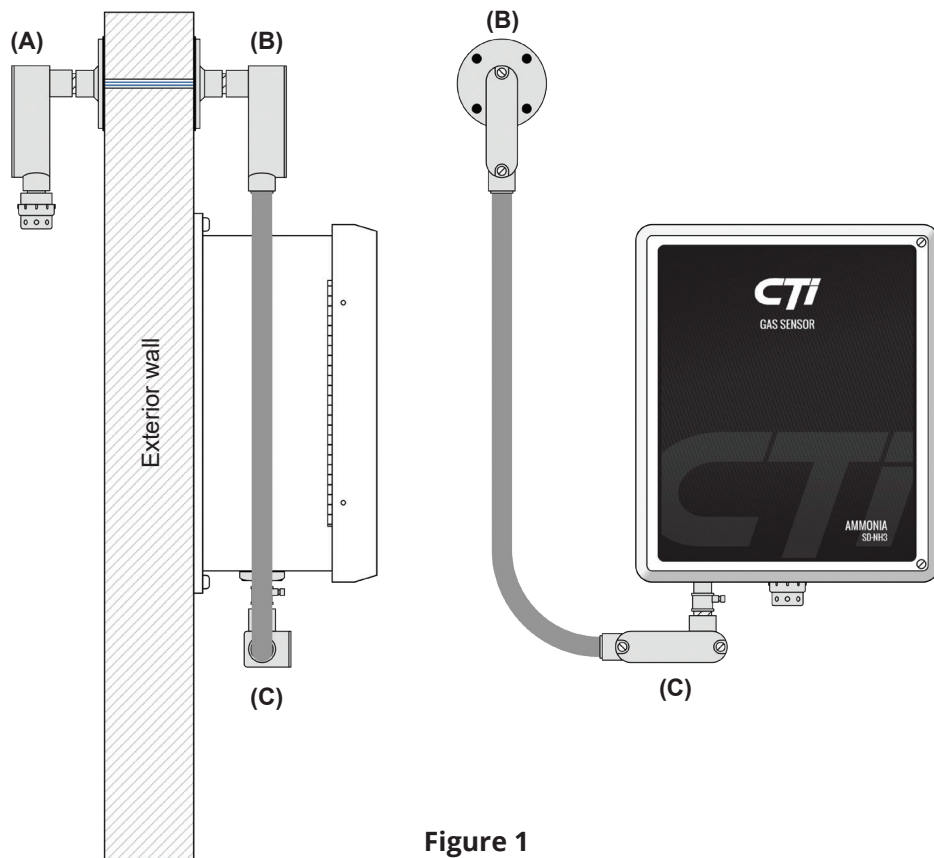


Figure 1

Wiring

Electrical wiring must comply with all applicable codes.

Electrical Power: 24 VDC regulated, 1A.

Output: Linear 4/20 mA output. Monitoring equipment may have a maximum input impedance of 700 ohms.

Cable Recommendation: 18/3 shielded, stranded cable (General Cable C2535A or equivalent). Length of cable to sensor should be no greater than 1,000 feet.

Monitoring: Monitoring equipment must be configured to indicate a fault if the signal is below 1 mA. All signals over 20 mA must be considered high gas concentrations.

Wiring Guidelines:

- Always use 3-conductor, insulated, stranded, shielded copper cable.
- Do not pull sensor wiring with AC power cables. This can cause electrical interference.
- If cable runs cannot be made without a splice, all splice connections should be soldered.
- Ground the shield at the main control panel. Connect the shield wire in the sensor terminal block labeled *SHLD*.
- Always disconnect power at the controller before performing any wiring at the sensor.
- To maintain NEMA/IP rating of the enclosure, conduit fittings of the same rating or better must be used.

Terminal Block Plug (Field Wiring):

SHLD: To case (earth) ground of monitoring equipment

GND: To ground terminal of power supply

+24V: To +24V terminal of power supply

SIG: To signal input of monitoring equipment



Figure 2

Operation

Start-Up

Sensor can be response tested and/or span calibrated immediately after power up. Allow 60 seconds for power up time delay of sensor to end (green power LED will flash during power up).

Once the unit is powered up, the SD1-NH3 starts the 10-minute sampling rate, and the sample-draw cycle is as follows:

2-minute sample time from the room being monitored. At the end of the two minutes, the sample data is stored and held for the next 10 minutes also while being transmitted via 4-20 mA output to the controller or PLC.

2-minute fresh air purge from outside fresh air source.

6-minute pump shut-off phase.

LED Functions (see Figure 3 on page 8)

Calibration

The SD1-NH3 sensor comes factory calibrated and should require only minimal adjustment after installation. There are two pots on the preamp that are used for calibration (see Figure 3).

Note: Never measure sensor output in mA. Always use mVDC or VDC voltmeter settings.

Bottom back board calibration mode:

Since the sample data is stored and held for 10 minutes during the sample-draw cycle, the real-time 4-20mA signal is only accessible on the upper testpoints. Follow this procedure to output the real-time 4-20mA signal on the lower testpoints.

1. Locate zero adjustment pot on sensor backboard. It can be found on the left side below the pump and status LEDs. (see Figure 3)
2. Turn pot 1/4 turn clockwise and back again. Successful entry into calibration mode will be indicated by the Power (green) LED blinking twice per second and the real-time signal is now active and can be viewed on connected monitoring equipment or voltmeter connected to the lower testpoints. Real-time mode will time out after 4 minutes.

Zero Calibration: After the sensor is installed and has been powered up for a minimum of 8 hours, the unit can be zero calibrated by the following:

Note: Place bottom back board in calibration mode and connect voltmeter to lower testpoints (see Figure 3).

1. Be sure the unit is in clean air.
2. Adjust the zero pot on the bottom back board until the sensor outputs 40 mV from Test [-] to Test [+] (see Figure 3). **Note:** To zero the sensor immediately after power up or cell replacement, unplug cell from the transmitter and adjust signal to 40 mV.

Span Calibration: DO NOT ADJUST THE SPAN POT WITHOUT CERTIFIED CALIBRATION GAS! If span adjustment is required, use the following procedure:

Note: Place bottom back board in calibration mode and connect voltmeter to lower testpoints (see Figure 3).

1. Remove the ammonia cell from the aluminum housing. Wiggle cell back and forth while pulling upwards (see Figure 3).
2. Apply span gas at 0.5 to 0.8 L/min (span gas must be in air, not nitrogen or other carrier).
3. Sensor should react to gas within 15 seconds.
4. Once the output signal has peaked (or 2 minutes maximum) adjust the Span pot on the top sensor board until the correct output is achieved (see Figure 3). With full-scale span gas, the calculated span value is 200 mV. $((\text{span gas} / \text{sensor range} * 16 + 4) \text{ (mA output)})$
5. Reinsert ammonia cell back into its aluminum housing. Press downwards firmly until it snaps into place.

Note: Below are a few response characteristics which may be an indication that the gas sensor is at or near the end of its useful life. If any of these characteristics are observed, the cell should be replaced.

- Slow response to / recovery from calibration gas.
- Failure of the output to reach 50% of the calibration gas value prior to span adjustment.
- Unable to achieve correct output during span.

Figure 3

Top sensor board:**Fault (red) LED:**

- On steady if supply voltage is less than 10VDC.

Status (amber) LED:

- Blinks once per second if RFI is detected.

Power (green) LED:

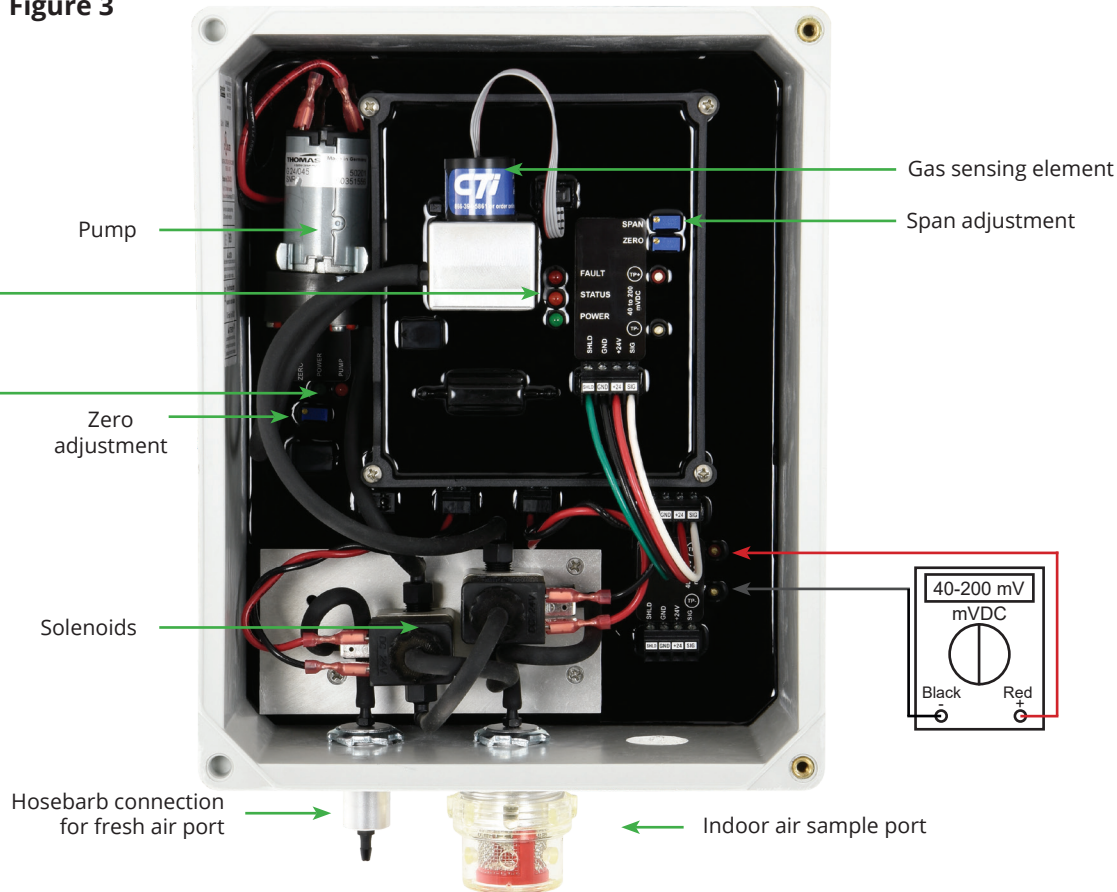
- On steady to Indicate Power.
- Blinks once per second for 60 seconds during power-up.
- Blinks once per second continuously if supply voltage is too low.

Bottom back board:**Status (amber) LED:**

- On steady during room sample
- Blinks once per second during fresh air purge.

Power (green) LED:

- On steady to Indicate Power.
- Blinks once per second for 60 seconds during power-up.
- Blinks once per second continuously if supply voltage is too low.
- Blinks twice per second in calibration mode (4 minute timeout delay).



Maintenance

The SD1-NH3 sensor is designed for long life and minimal maintenance.

The sensor should be calibrated with certified calibration gas once every six months. At this interval, all functions and outputs should be tested and verified. Keep an operation log of all maintenance and calibrations.

To clean the controller, use a mild cleaning solution and soft cloth.

Maintenance Guidelines:

- The sensor is shipped with a factory calibration.
- Sensor should be calibrated 6 months from purchase date.
- Calibrate the detector at least once every 6 months.
- Calibration should be performed with certified calibration gas. Calibration kits and replacement cylinders are available from Calibration Technologies.
- All calibrations should be logged.
- During every calibration interval, disassemble the inlet filters and clean with compressed air.
- Always disconnect power at the controller before performing any wiring at the sensor.
- Remove power from unit when not in use to extend sensor and pump life.

Sensor Life: The electrochemical cells are extremely reliable but they get less sensitive over time, and require calibration to regain sensitivity.

When the cell becomes depleted, the unit will give no indication of failure other than the sensor will not respond. For this reason, it is essential that the sensor be calibrated on a regular basis. Typical cell life is 2 to 3 years. When the cell becomes depleted, a replacement cell can be obtained from Calibration Technologies. Simply unplug the cell's ribbon cable from the transmitter, pull the old cell from the aluminum sensor housing, discard the old cell and replace with a new one.

The new cell can be span-calibrated immediately. However, an 8 hour warm-up period is required before zeroing, if necessary.

Specifications

Input Power: +24 VDC, 1A

Detection Principle: Electrochemical

Detection Method: Sample-draw

Gases: Ammonia (NH₃)

Ranges: 0/100 (standard)

Output Signal: Linear 4/20 mA (max input impedance: 700 Ohms)

Response Time:

T50 = less than 30 seconds

T90 = less than 60 seconds

Accuracy: +/- 5% of full-scale, but dependent on calibration gas accuracy and time since last calibration

Zero Drift: Less than 0.1% of full-scale per month, non-cumulative

Span Drift: Application dependent, but generally less than 3% per month

Linearity: +/- 0.5% of full-scale

Repeatability: +/- 1% of full scale

Power (green) LED: Blinks once per second for 60 seconds during power-up.

If supply voltage is too low (<10 VDC) or improperly grounded, green LED will blink once per second continuously. Stays steady on to indicate power.

Blinks twice per second in calibration mode (4-minute timeout delay)

Status (amber) LED: Blinks once per second if RFI (radio frequency interference) is detected

Fault (red) LED: Stays on steady if supply voltage is too low (<10 VDC)

Wiring Connections: 3-conductor, shielded, stranded, ≥ 18 AWG cable (General Cable C2535A or equivalent) up to 1000 ft

Terminal Block Plug (Field Wiring): 26-12 AWG, torque 4.5 lbs-in

Enclosure: Fiberglass Reinforced Polyester NEMA 4X, IP 66, with polyurethane gasket. Continuous stainless steel hinge. Captive screws in lid. For non-classified areas.

Temperature Range: 32 °F to +122 °F (0 °C to +50 °C)

Humidity Range: 5% to 100% condensing

Dimensions: 9.5" high x 6.7" wide x 3.8" deep

Weight: 10.0 lbs

Limited Warranty & Limitation of Liability

Calibration Technologies, Inc. (CTI) warrants this product to be free from defects in material and workmanship under normal use and service for a period of 2 years, beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. CTI's warranty obligation is limited, at CTI's option, to refund of the purchase price, repair, or replacement of a defective product that is returned to a CTI authorized service center within the warranty period. In no event shall CTI's liability hereunder exceed the purchase price actually paid by the buyer for the product.

This warranty does not include:

- a) routine replacement of parts due to the normal wear and tear of the product arising from use;
- b) any product which in CTI's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation, handling or use;
- c) any damage or defects attributable to repair of the product by any person other than an authorized dealer or contractor, or the installation of unapproved parts on the product

The obligations set forth in this warranty are conditional on:

- a) proper storage, installation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of CTI;
- b) the buyer promptly notifying CTI of any defect and, if required, promptly making the product available for correction. No goods shall be returned to CTI until receipt by the buyer of shipping instructions from CTI; and
- c) the right of CTI to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CTI SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT OR RELIANCE OR ANY OTHER THEORY.



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