DET-TRONICS®

A UTC Fire & Security Company

Instructions 95-8532

U9500 Infiniti® Transmitter and
Metal Oxide Semiconductor (MOS) H_2S Gas Sensor

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INSTRUCTIONS

U9500B210X Infiniti® Transmitter and Metal Oxide Semiconductor (MOS) H_2S Gas Sensor

APPLICATION

The model U9500B Infiniti® Transmitter is designed for use with Det-Tronics Metal Oxide Semiconductor (MOS) sensors for detection of hydrogen sulfide gases and vapors.

Gas concentrations are displayed in ppm on an alphanumeric display. The transmitter provides a user selectable isolated/non-isolated 4 to 20 milliampere output signal that corresponds to the detected gas concentration. An optional relay package is available to provide contact outputs for alarm and fault conditions.

The electronics of the Infiniti transmitter is contained in an explosion-proof housing. The sensor is coupled directly to the Infiniti housing. The Infiniti offers non-intrusive calibration by actuating a magnetic reed switch with a hand-held magnet. It is not necessary to remove the housing cover to actuate the magnetic reed switch.

Typical Infiniti applications include:

- Confined spaces where gas/vapor leaks can concentrate.
- Known high risk leak locations.
- General open area coverage.

FEATURES

- User-friendly setup.
- Non-intrusive calibration using the internal magnetic reed switch, or an externally located pushbutton (not included).
- Automatic fault diagnostics and graphic message annunciation.
- Sensor sensitivity and end of sensor life indication.
- Optional relay package provides three alarm relays (high, low, and auxiliary) and one fault relay.
- Variety of multi-port enclosure configurations available.

SPECIFICATIONS

Transmitter

INPUT VOLTAGE—
24 vdc. Operating range is 16 to 32 vdc including ripple.

POWER CONSUMPTION WITH SENSOR—
Infiniti with alarm relays and sensor connected, with 24 Vdc input voltage:
3 watts nominal, 5 watts maximum.

CURRENT OUTPUT—
Linear 4 to 20 ma output.
Maximum loop resistance is 600 ohms at 20 to 32 vdc.
Selectable isolated or non-isolated operation.
Factory set 2.0 ma output indicates unit is in Calibration mode (field adjustable).
Less than 1.0 ma output indicates fault condition.

DISPLAY—
Eight character alphanumeric display indicates power on, gas concentration, alarm and fault conditions. It also enables field adjustment of alarm setpoints.

DETECTION RANGE—
0 to 100 ppm

RELAY CONTACTS (OPTIONAL)—
Three Alarm relays: Form C, 5 amperes at 30 vdc. Selectable normally energized or de-energized as a group; low and auxiliary alarm selectable together for latching or non-latching contacts, high alarm contacts are always latching.
One Fault relay: Form C, 5 amperes at 30 vdc. Normally energized for no fault condition with power applied to device.

TEMPERATURE RANGE—
Operating: –40°F to +167°F (–40°C to +75°C).
Storage: –67°F to +185°F (–55°C to +85°C).

WIRING—
18 AWG minimum is recommended for power wiring to the transmitter. Larger diameter wire may be required to maintain a minimum of 16 vdc at the transmitter for all operating conditions. Maximum wire size for terminals is 12 AWG.

CERTIFICATION—
CSA: Class I, Div. 1, Groups B, C, and D;
Class I, Div. 2, Groups A, B, C and D (T4A)
T_{amb} = –40°C to +75°C.

CENELEC/CE: CE 0539 Ex II 2 G
EEx d IIC T5-T6
DEMKO 02 ATEX 131327X
T6 (T_{amb} = –55°C to +60°C)
T5 (T_{amb} = –55°C to +75°C)
IP66.

ENCLOSURE MATERIAL—
Epoxy coated 356 alloy aluminum or 316 stainless steel. (Standard with two conduit entries.)

DIMENSIONS—
See Figure 1A.

SHIPPING WEIGHT (Transmitter and Junction Box)—
Aluminum: 4.15 pounds (1.88 kilograms).
Stainless steel: 10.5 pounds (4.76 kilograms).

Sensor

RESPONSE TIME—
T50 < 60 seconds.

ACCURACY (LINEARITY)—
±12 ppm.

TEMPERATURE RANGE—
Operating: 32°F to +167°F (0°C to +75°C).
Storage: –67°F to +257°F (–55°C to +125°C).

ZERO STABILITY—
±1 ppm over one year.

CALIBRATION CYCLE—
30 days.

CERTIFICATION—
CSA: Class I, Div. 1, Groups B, C and D;
Class I, Div. 2, Groups A, B, C and D;
T_{amb} = –40°C to +75°C.

CENELEC/CE: CE 0539 Ex II 2 G
EEx d IIC T4
DEMKO 03 ATEX 135937X
T4 (T_{amb} = –40°C to +70°C).

DIMENSIONS—
See Figures 1B and 1C.

WARRANTY—
2 years.

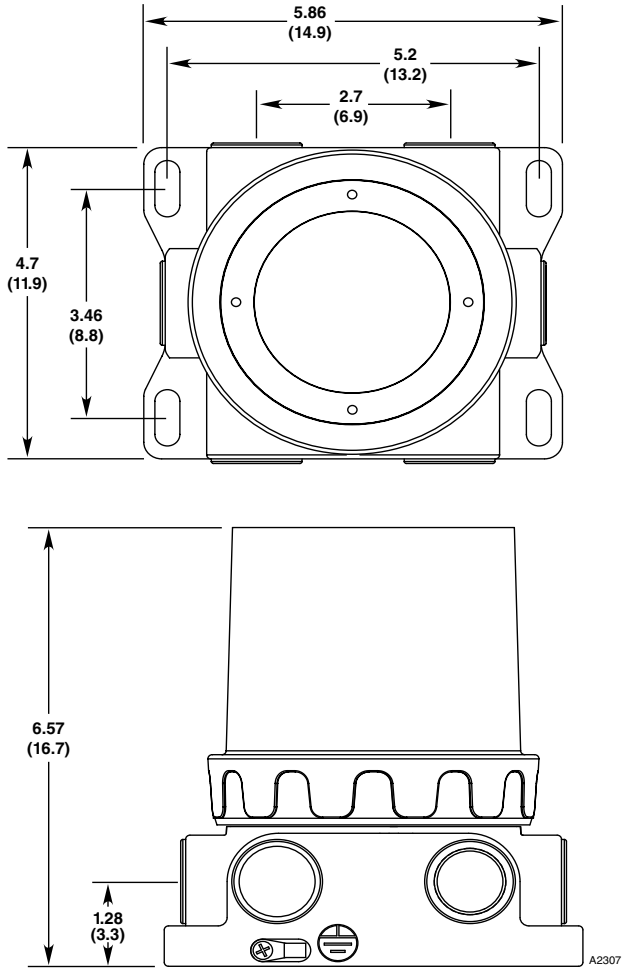


Figure 1A—Infiniti Transmitter Dimensions in Inches (Centimeters)

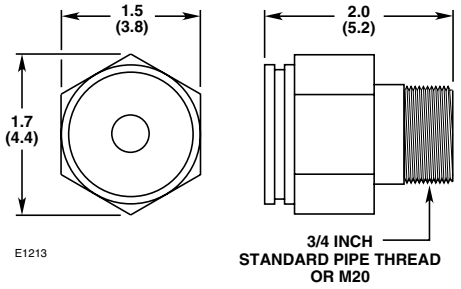


Figure 1B—Dimensions in Inches (Centimeters) of MOS H_2S Sensor (CSA)

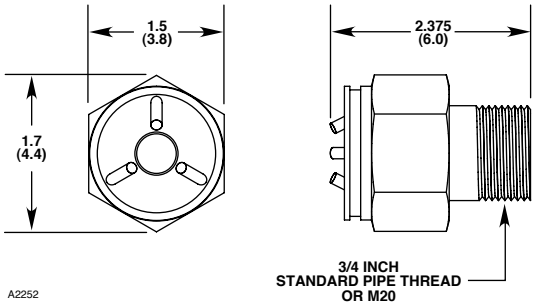


Figure 1C—Dimensions in Inches (Centimeters) of MOS H_2S Sensor (CSA/CENELEC)

IMPORTANT SAFETY NOTES

WARNING

Do not apply power to the system with the enclosure cover removed unless the area has been de-classified. Do not open the enclosure in a hazardous area when power is applied.

CAUTION

The wiring procedures in this manual are intended to ensure proper functioning of the device under normal conditions. However, because of the many variations in wiring codes and regulations, total compliance to these ordinances cannot be guaranteed. Be certain that all wiring complies with applicable regulations that relate to the installation of electrical equipment in a hazardous area. If in doubt, consult a qualified official before wiring the system.

The Infiniti contains semiconductor devices that are susceptible to damage by electrostatic discharge. An electrostatic charge can build up on the skin and discharge when an object is touched. Therefore, use caution when handling the device, taking care not to touch the terminals or electronic components. Observe the normal precautions for handling electrostatic sensitive devices.

To minimize the risk of damage, handle the transmitter module by the edges only. Do not touch the circuit board, or electronic components.

The fault detection circuitry does not monitor the operation of external response equipment or the external wiring to these devices. It is important that these devices be checked periodically to ensure that they are operational.

Exercise caution if an over-range reading is indicated, since a dangerous condition could exist. The hazardous area should be checked with a portable detection instrument to determine the actual level of gas present.

DESCRIPTION

The U9500B is a single channel gas signal transmitter. In addition to the standard 4-20 ma analog signal output, the U9500B offers 4 optional relay outputs for fault and alarm indications. The 4 outputs are: fault, high alarm, low alarm, and auxiliary alarm. The relays have form C (SPDT) contacts. The high alarm relay is always latching, while the user can select, as a group, whether the auxiliary and low alarm will also latch. During normal operation, the fault relay is non-latching, but for initialization faults, the fault relay latches. The alarm relays will also be selectable, as a group, for normally energized or de-energized with no alarms. The fault relay is always normally energized for no fault.

NOTE

Since the relays can be programmed to be either energized or de-energized on alarms, the term "actuate" is used to indicate that the output is in an alarm condition.

The U9500B provides an eight character, single line, alpha-numeric LCD display. The U9500B has four switches located on the display. The visible three switches are single pole, normally open push buttons, and are designated as: Setup\accept, increase, and decrease. The fourth switch is a magnetic reed switch, designated cal/reset, which is used by the customer for non-intrusive calibrations and for resetting of the U9500B.

Two additional options are available for resetting the transmitter. A user supplied switch can be wired to the transmitter terminal block and used to reset the device from a remote location. In addition, Detector Electronics offers a special optional enclosure with a pushbutton pre-installed within a multi-port electrical enclosure for customers who do not prefer magnetic switches.

The U9500B utilizes a serial EEPROM for storing configuration data, setpoints, and calibration data.

MODES OF OPERATION

The U9500B has three main operating modes:
- Normal
- Calibrate
- Setup (also called Configuration).

Normal mode is the default mode (no buttons pushed).

Three minor modes also exist:
- Setpoint display
- Reset
- Power up.

INSTALLATION

WIRING REQUIREMENTS

- Install per local installation practices and in accordance with local authority having jurisdiction.
- See Figure 2 for wiring size and maximum distance from the power supply to the transmitter.

IMPORTANT

Proper installation practices must be followed to ensure that condensation does not enter the junction box and interfere with the electronic circuitry. Refer to local installation codes.

WIRING PROCEDURE

The following procedure should be used for installing and wiring the Infiniti Transmitter.

NOTE

The U9500B with MOS sensor does not support sensor separation i.e. the sensor must be attached directly to the sensor housing.

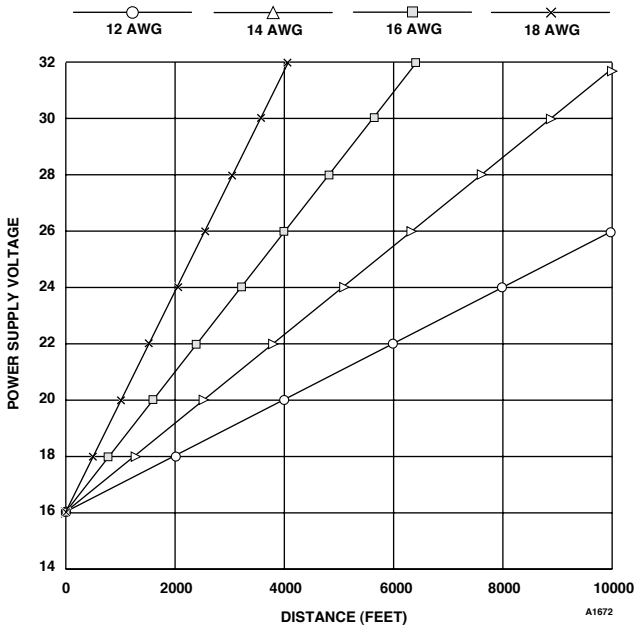


Figure 2—Wiring Requirements for Transmitters with Relays

1. Install the unit in a location that is best suited to cover the area to be protected. Whenever practical, the Infiniti should be placed where it is easily accessible for calibration. For proper operation, sensors should be pointing down. See Figure 1 for mounting dimensions.
2. Remove the transmitter from its packing material and note the location of the field wiring terminals.
3. Remove the cover from the enclosure. One conduit entry is used for mounting the sensor and the other is for field wiring. The transmitter module slides into the mounting bracket within the enclosure and all field and sensor wiring connects to this module. The sensor connects to a small plug on one side of the transmitter and all field wiring connects to terminals on the other side.

   The transmitter can be oriented either way within the bracket (180° difference) and the bracket can be rotated 90° to achieve the necessary orientation. See Figure 3 for left and right field wiring entry and corresponding bracket orientation. Make sure that the display is oriented correctly, then proceed with transmitter wiring.

4. Mount the transmitter enclosure and connect the field wiring conduit. The enclosure should be electrically connected to earth ground.

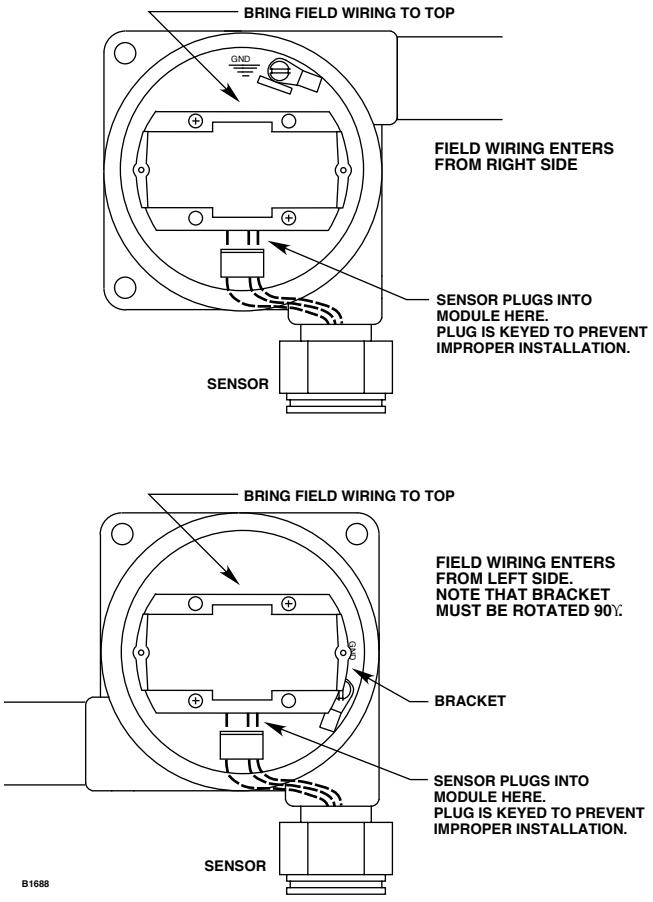


Figure 3—Field Wiring Entries and Transmitter Bracket Orientation

5. Attach the sensor to the other entry on the transmitter enclosure. First route the wires through the entry, then tighten the sensor to the enclosure to ensure an explosion-proof installation. **Do not overtighten.**

IMPORTANT

To ease maintenance, periodically apply a generous amount of silicone free grease (part number 005003-001) to the internal threads on the junction box cover using an application tool. DO NOT use other lubricants, since some materials can cause irreversible damage to the sensing element in certain gas sensors.

6. Slide the transmitter module into the bracket, being careful to route field and sensor wires to the appropriate location within the enclosure for easy connection to the transmitter module. Ensure that the transmitter display and pushbuttons (at the top) are oriented correctly.

CAUTION

Wires can become pinched between the cover and base if they are not properly tucked down inside the enclosure.

7. Fasten the transmitter module to the mounting bracket with the two captive screws located inside the notch on either side of the top of the transmitter. Remove the wire clip and set it aside.
8. See Figures 4 and 5 for field wiring terminal designation.

   Attach the sensor plug to the transmitter module on the side opposite the field wiring terminals.
9. Connect the power and current output leadwires to the screw terminals on the plug that is provided.

   See Figures 6 and 7 for examples of transmitter wiring.

   Connect the shield to earth ground at the power supply. Under normal conditions, the panel or field end of the shield should not be grounded at the transmitter.
10. Refer to Figures 6 and 7 when connecting external loads to relay outputs.

IMPORTANT

Direct connection of 120/240 vac to the relay terminals inside the transmitter enclosure is not recommended, since switching relay contacts can induce electrical noise into the electronic circuitry, possibly resulting in a false alarm or other system malfunction. If the application requires that AC powered equipment be controlled by the transmitter, the use of externally located relays is recommended.

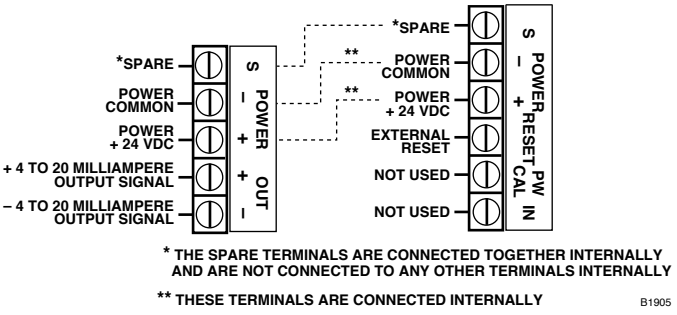


Figure 4—Field Wiring Terminals, Transmitter without Relays

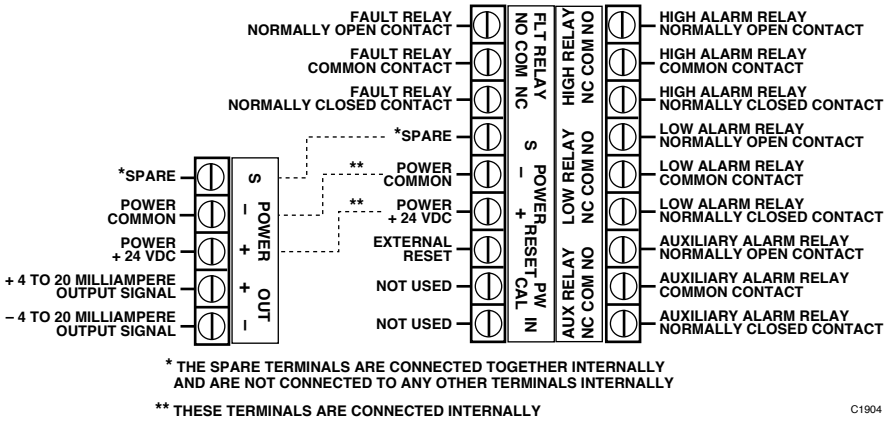


Figure 5—Field Wiring Terminals, Transmitter with Relays

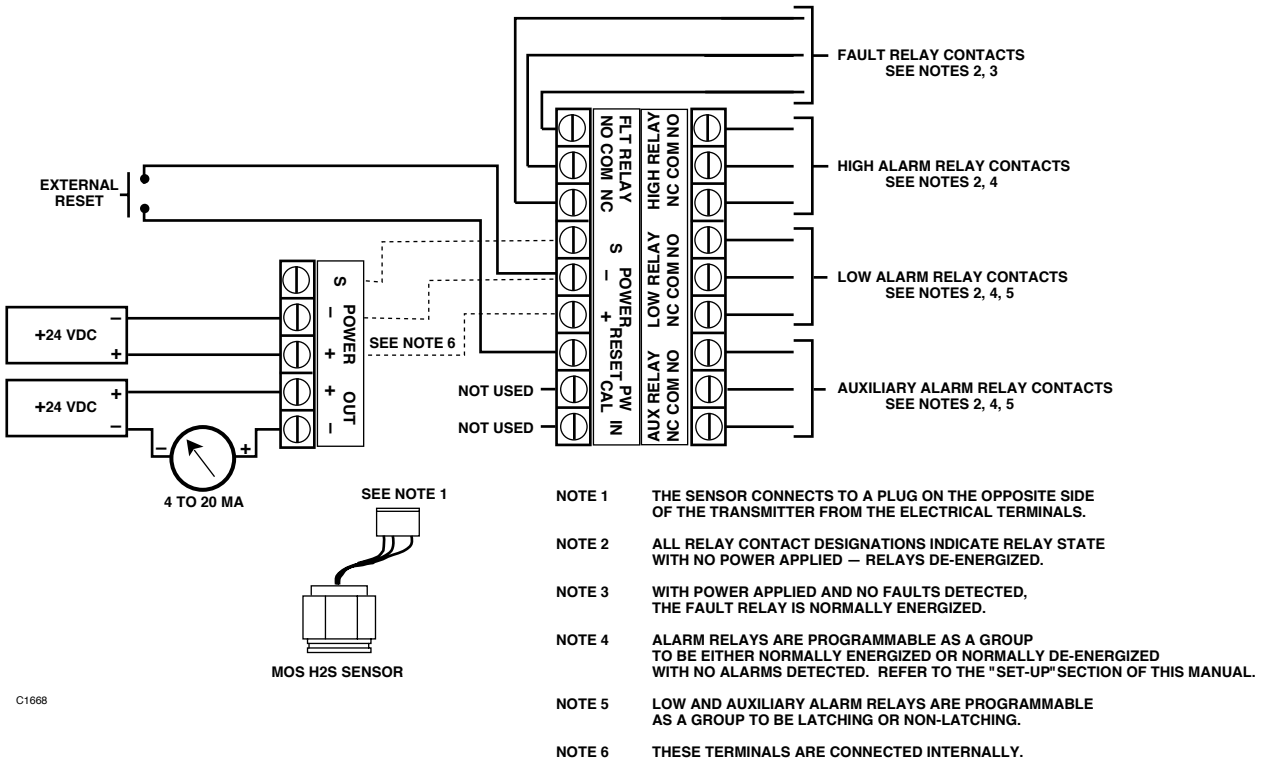
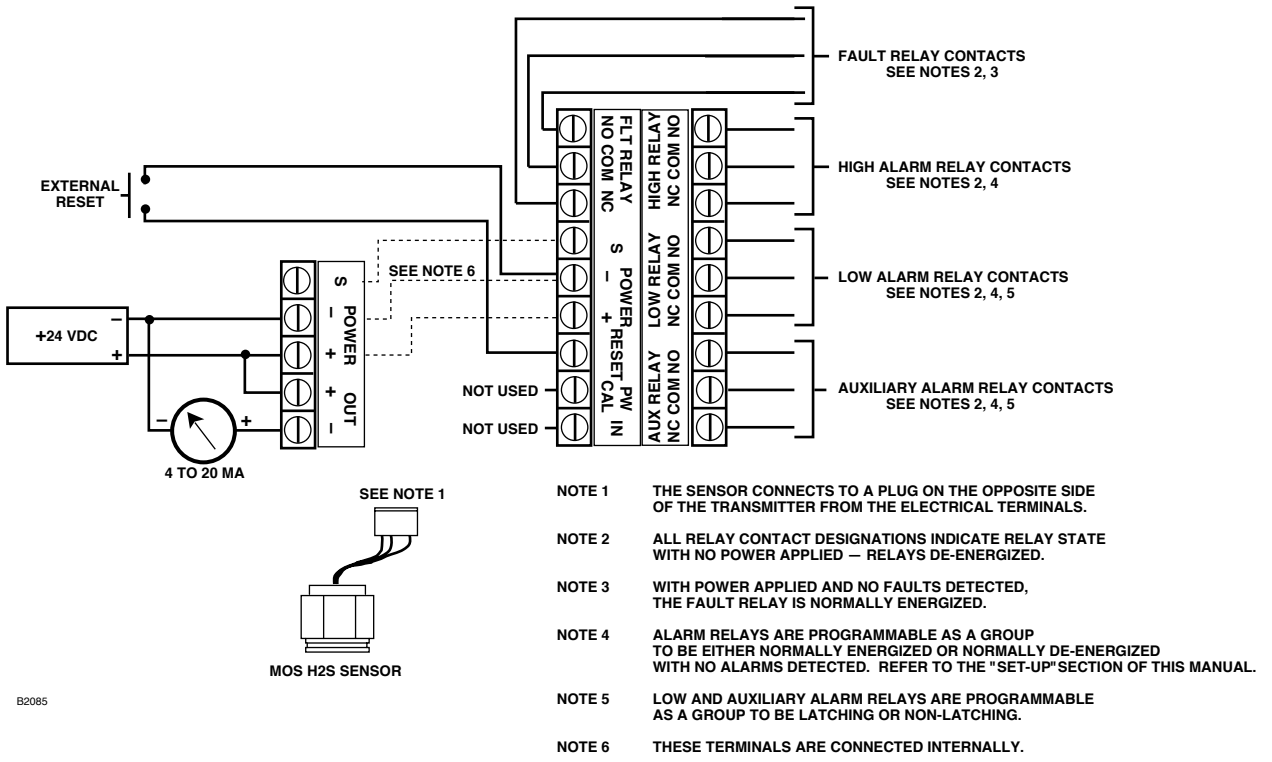


Figure 6—A Typical System - Infiniti Transmitter with Isolated Current Output and Relay Outputs



NOTE 1 THE SENSOR CONNECTS TO A PLUG ON THE OPPOSITE SIDE OF THE TRANSMITTER FROM THE ELECTRICAL TERMINALS.

NOTE 2 ALL RELAY CONTACT DESIGNATIONS INDICATE RELAY STATE WITH NO POWER APPLIED — RELAYS DE-ENERGIZED.

NOTE 3 WITH POWER APPLIED AND NO FAULTS DETECTED, THE FAULT RELAY IS NORMALLY ENERGIZED.

NOTE 4 ALARM RELAYS ARE PROGRAMMABLE AS A GROUP TO BE EITHER NORMALLY ENERGIZED OR NORMALLY DE-ENERGIZED WITH NO ALARMS DETECTED. REFER TO THE "SET-UP" SECTION OF THIS MANUAL.

NOTE 5 LOW AND AUXILIARY ALARM RELAYS ARE PROGRAMMABLE AS A GROUP TO BE LATCHING OR NON-LATCHING.

NOTE 6 THESE TERMINALS ARE CONNECTED INTERNALLY.

Figure 7—A Typical System - Infiniti Transmitter with Non-Isolated Current Output and Relay Outputs

External relays, solenoids, motors, or other devices that can cause inductive transients should be transient suppressed. Place a diode across the coil for DC devices. See Figure 8.

11. An external reset switch can be wired as shown in Figures 6 and 7. The use of shielded wire is recommended for wiring the switch.
12. Check all field wiring to ensure that the proper connections have been made. Refer to local codes to be sure wiring and conduit seals are installed properly.

CAUTION

Wires can become pinched between the cover and base if they are not properly tucked down inside the enclosure. The wire clip will prevent this problem when installed correctly.

13. Replace the wire clip and place the cover back on the transmitter enclosure.

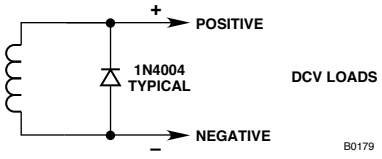


Figure 8—Transient Suppression for Inductive Loads

CONTROLLER/SIGNAL RECEIVER OPTIONS

The U9500B transmitter offers an analog 4 to 20 ma output, which is configurable for electrically isolated or non-isolated operation. The analog signal is capable of driving a maximum 600 ohm resistance load. The U9500B is typically used with R8471 Controllers. It is also acceptable to use the U9500B with other devices or systems capable of accepting 4 to 20 ma signal inputs. The following illustrations provide examples of recommended interconnecting wiring between the U9500B and analog signal receivers:

Figure 9 — A Typical System, Infiniti Transmitter Wired to R8471 Controller, Non-Isolated Current Output

Figure 10 — A Typical System, Infiniti Transmitter used with PLC Analog Input Module, Isolated/Non-Isolated Current Output

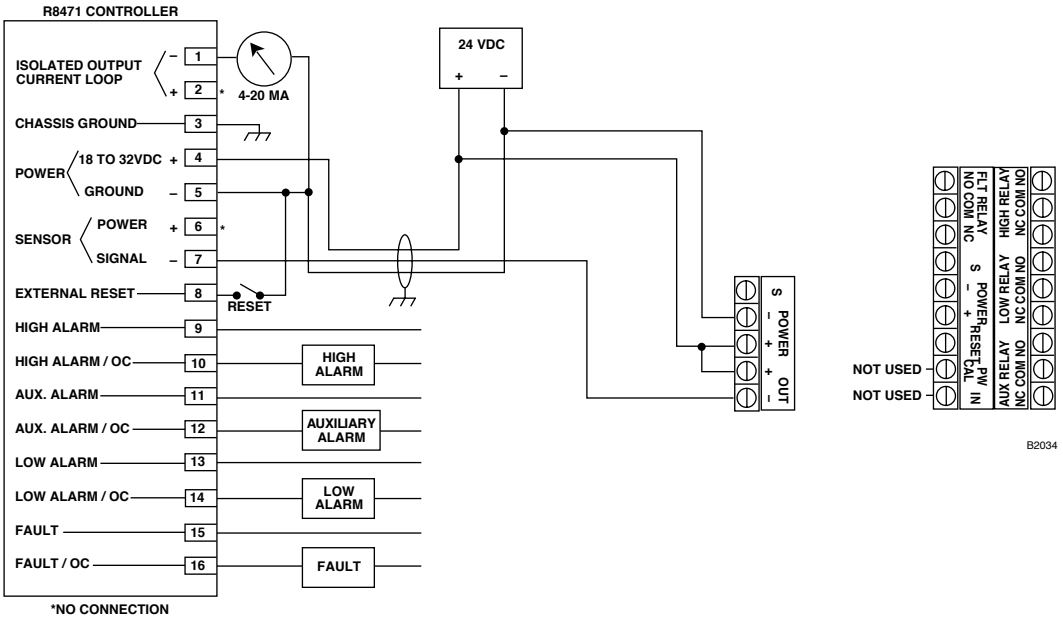


Figure 9—A Typical System, Infiniti Transmitter Wired to R8471 Controller, Non-Isolated Current Output

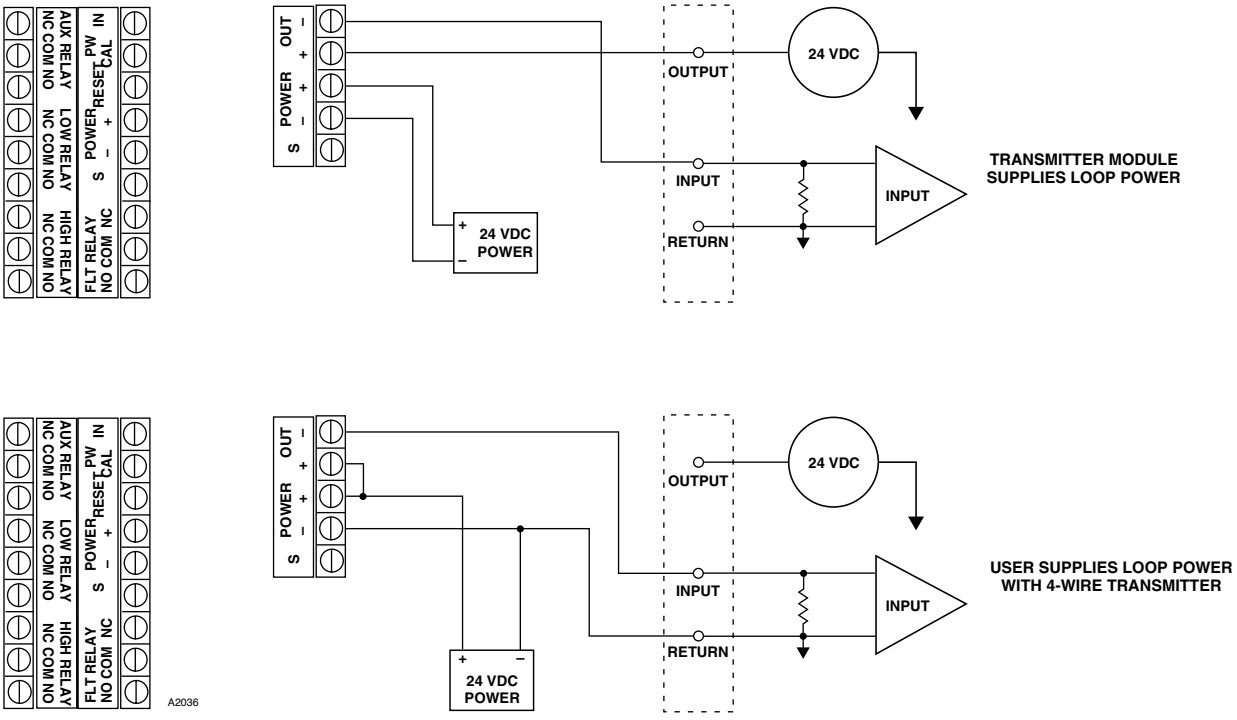


Figure 10—A Typical System, Infiniti Transmitter used with PLC Analog Input Module, Isolated/Non-Isolated Current Output

DISPLAY AND CONTROLS, OPTIONS, DEFAULTS

DISPLAY AND CONTROLS

The Infiniti uses an eight character display for identifying system status conditions and sensor input, a magnetic reed switch for resetting the unit and entering different operating modes, and pushbuttons for programming and calibrating the system. See Figure 11 for the location of indicators and pushbuttons and Tables 1 and 2 for descriptions.

External Reset

The default reset input terminal, when grounded momentarily, initiates a reset only. However, if the "EXT" "CAL" option is programmed "YES" during the Infiniti setup procedure, the external reset duplicates the magnetic reed switch (Cal Magnet) and can be used to perform calibration.

PROGRAMMING OPTIONS

Operating Range

The operating range limits and the corresponding default setpoints and calibration gases are as follows:

Measurement Range:	0 to 100	
High Alarm	10 to 90	Default = 20
Low Alarm	5 to 50	Default = 10
Auxiliary Alarm	5 to 90	Default = 20
Calibration Gas	40	Default = 40*

*Calibration gas is not selectable.

The default setting for relay operation is normally de-energized with non-latching contacts (except fault, which is normally energized with no faults, and high alarm, which is always latching). The default setting for the optional External Reset Pushbutton is "No External Cal" enabled. The default setting for calibration mode (automatic or manual) is automatic mode.

IMPORTANT

The range setting of the transmitter must match the output range of the sensor being used or the system will fail to operate correctly. For a MOS H_2S sensor, the range setting for the transmitter must be 0 to 100 ppm.

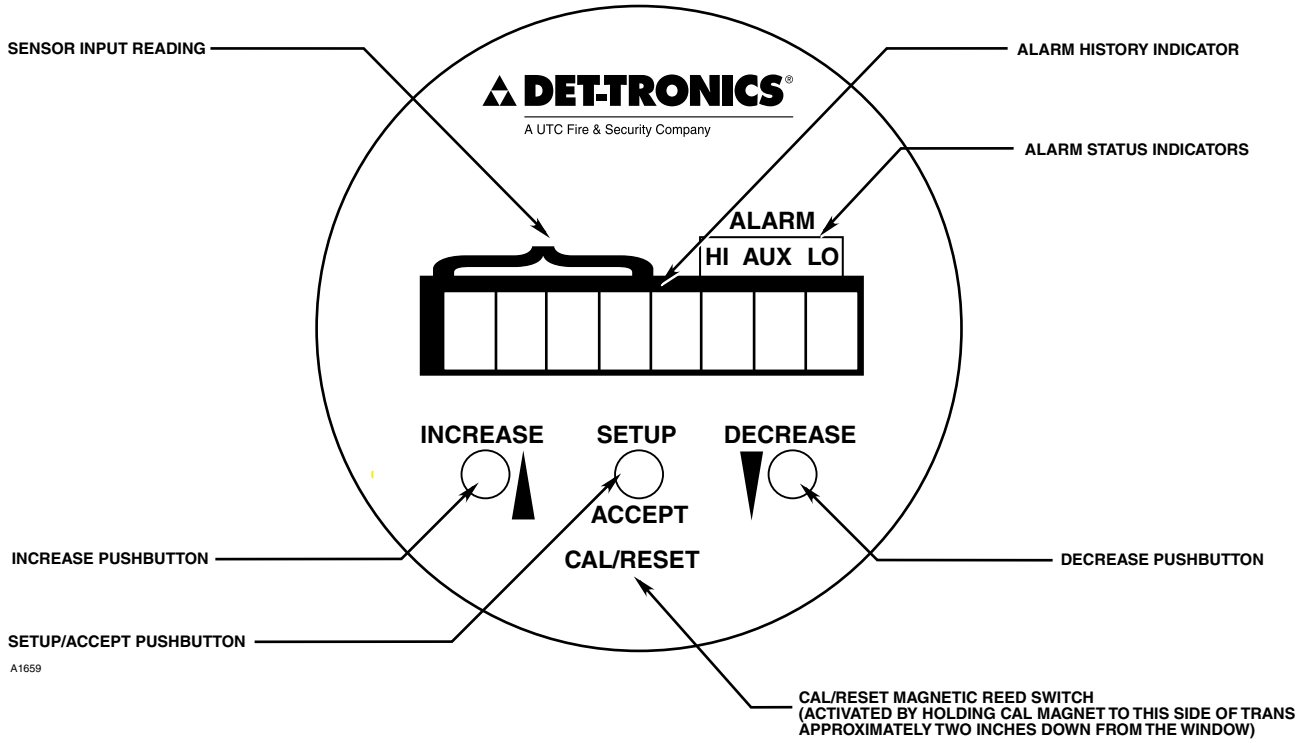


Figure 11—Infiniti Transmitter Controls and Indicators

Table 1—Display And Controls

Display/Indicator		Description
	PPM	This display is always on and functions as a power indicator. The display provides a continuous reading of the sensor input in both the Normal and Calibrate modes. In the event of a fault, it identifies the nature of the fault with a fault message. In other operating modes it shows the alarm setpoints and programmed calibration gas concentration. A negative zero drift condition is indicated by a minus (–) sign in the left hand digit. In the event of an over-range condition, the display will continue to track the sensor output as long as the over-range condition exists.
*	Alarm History Indicator	Asterisk indicates an alarm (any one) has activated since last reset. Blank indicates no alarm has energized since last reset.
■	High Alarm Status Indicator	Solid black square indicates that the high alarm threshold has been exceeded. For relay models, this means that the relay output has activated. Blank indicates no alarm.
■	Auxiliary Alarm Status Indicator	Solid black square indicates that the auxiliary alarm threshold has been exceeded. For relay models, this means that the relay output has activated. Blank indicates no alarm.
■	Low Alarm	Solid black square indicates that the low alarm threshold has been exceeded. For relay models, this means that the relay output has activated. Blank indicates no alarm.
	INCREASE ❍▲	Used to move to next higher setting during system programming.
	SETUP ❍ ACCEPT	Used to initiate Setup routine, to accept reading displayed, and cycle to the next programming step during Setup (system programming).
	DECREASE ▼❍	Used to move to next lower setting during system programming.
	CAL/RESET	Used for non-intrusive calibration and transmitter reset. Activated by Cal Magnet from outside the Infiniti enclosure.

Table 2—CAL/RESET Switch and Calibration Magnet Function

Duration of CAL/RESET Switch Activation	Function
1 Second	Resets the Infiniti transmitter
2 - 3 Seconds	Enters the Setpoint Display Mode
7 Seconds	Enters the Calibration Mode

Setpoints

The Infiniti Transmitter has three independent alarm outputs (low, high and auxiliary), with field selectable setpoints. For both relay and non-relay models, these setpoints correspond to the HI, AUX, and LO ALARM indicators on the display.

Calibration Gas Concentration

The calibration gas concentration is displayed but is not adjustable. The Det-Tronics 40 ppm Ampoule Calibration Kit should be used to ensure proper calibration.

IMPORTANT

40 ppm H_2S in air must be used for calibrating the MOS H_2S sensor. Compressed H_2S gas cylinders are not recommended.

Latching or Non-latching Relays

The Low and Auxiliary alarm relays are programmable as a group for either latching or non-latching operation. "LATCH" indicates that they will latch upon alarm and the unit must be reset to clear. "nonLATCH" indicates that they will automatically clear when the alarm clears. The High alarm relay is always latching.

Alarm Relays Normally Energized or Normally De-Energized

The three alarm relays (High, Low and Auxiliary) are programmed as a group. "DE-ENERG" indicates that the three alarm relays will be normally de-energized and will energize upon alarm. "ENERG" indicates that the three alarm relays will be normally energized and will de-energize upon alarm.

External Calibration

Calibration procedures are normally initiated and executed using the Cal Magnet to activate the CAL/RESET switch. Choose "EXTCAL YES" during the setup procedure to allow the additional use of the external reset input terminal for initiating and executing a calibration procedure.

4-20 Milliampere Calibration

The 4 to 20 ma current loop is factory calibrated. Perform the "4-20 CAL YES" function in the Setup procedure if a current loop output other than 4 to 20 ma is required. The calibrated 4 to 20 ma output remains linear.

Calibration Current

The current output during Calibration and while in the Setup mode is factory set for 2 ma. Perform the "SET CAL CURRENT" function in the Setup procedure if an output current other than 2 ma is required.

Refer to the "Setup Procedure" section for complete instructions.

INFINITI OUTPUTS

Refer to Table 3 for a description of Infiniti standard 4 to 20 ma outputs and relay output programming options.

MODES OF OPERATION

Refer to Table 4 for a description of Infiniti modes of operation.

Table 3—Infiniti Outputs

Output	Description
4 to 20 Milliamperes (Standard)	• The linear 4 to 20 ma output: – corresponds to the field-programmed gas range. – can be calibrated in the field for maximum accuracy. – is user selectable for isolated or non-isolated use. Refer to the “Setup ” section for programming information.
Relay (Optional) • Option includes a set of four relays: – High Alarm – Low Alarm – Auxiliary Alarm – Fault • Includes 4 to 20 ma output.	• The High, Low and Auxiliary Alarm relays are programmable as a group for either normally energized or normally de-energized operation. • High Alarm relay is always set for latching operation. • Low Alarm and Auxiliary Alarm relays are programmable as a group for either latching or non-latching operation. • Fault relay is normally energized with no faults. Faults are generally non-latching, but faults that occur during calibration and warmup must be reset. • Latching relays are reset using either the Cal magnet or an external reset switch (field installed, user supplied).

Table 4—Infiniti Modes of Operation

Operating Mode	Description
Warmup	• When power is applied to the transmitter, it enters a Warmup mode to allow the sensor output to stabilize before beginning normal operation. During this time the: – Fault relay is de-energized. – Alarm relays go to non-alarm state (either energized or non-energized, as programmed) – Display alternates between "WARM-UP" and "MOS H_2S." – Current output indicates a fault condition (less than 1.0 ma). • The transmitter will stay in the Warmup mode for at least six seconds. – If the detected gas at the end of the six second warmup period is higher than the lowest alarm setting or if faults are present, the transmitter will remain in the Warmup mode until the detected gas falls below the lowest alarm setting and no faults are present, or five minutes, whichever is shortest. – If an alarm condition exists at the end of the five minute warmup, the transmitter will enter the Normal operating mode and the alarm(s) will be annunciated. – If a fault is present after the five minute warmup, the transmitter will indicate the fault, the fault relay will remain de-energized, and the current output will be less than 1.0 ma. • At the end of the warmup period with no faults or alarms present, the transmitter automatically enters the Normal operating mode (fault relay energizes, alarm relays remain in non-alarm state), and the current output will rise to 4.0 ma.
Normal	• **In Normal operating mode with no alarm condition:** – Display is on and indicates the detected gas concentration. – Alarm relays (on relay models) are in their normal state (energized or de-energized as programmed). – 4 to 20 ma output signal level corresponds to the detected gas concentration. – Fault relay (on relay models) is energized. • **In the Normal operating mode with an alarm condition occurring:** – Display indicates the detected gas concentration. – Low, Auxiliary or High display shows a black square, indicating alarm condition. – Affected relay changes state (on relay models). – 4 to 20 ma output signal level corresponds to the detected gas concentration. – Fault relay output energized (on relay models). – Relay History Indicator display shows an asterisk to indicate an alarm was activated. • **When the signal decreases below setpoint:** – Display and 4 to 20 ma output continues to track the detected gas concentration. – With latching operation programmed, no change to display indication or to alarm relay outputs. – With non-latching operation programmed, low and/or Auxiliary display goes blank and Alarm relay outputs return to their normal state. The High alarm will always latch. – Asterisk in Alarm History Indicator display stays on to indicate an alarm since last reset. • **In the event of a system fault:** – The normally energized Fault output is de-energized and the corresponding fault message is displayed. – 4 to 20 ma output drops to less than 1.0 ma. • **In the event of an alarm condition and a system fault both occurring:** – In most cases, the first condition that occurs will be indicated by the current and relay outputs and on the display. – The exceptions are "CAL ABORTED" and "SENSOR E.O.L." faults which both may occur during the calibration procedure. If an alarm occurs with these faults, the alarm will over-ride the fault and will be indicated.

Table 4—Infiniti Modes of Operation (Continued)

Operating Mode	Description
Reset	The Reset mode is entered by holding the Cal magnet to the side of the transmitter enclosure next to CAL/RESET on the display face of the unit. • Standard – When the Cal magnet is held there for **less than one second**, the alarm indicators turn off and all relay outputs return to their normal condition if no alarms or faults are occurring. • Forced – When the Cal magnet is held there **for 1 to 2 seconds**, the alarm indicators turn off and the relay outputs return to their normal condition even if an alarm or fault condition still exists. • Remote – Activating the remote reset switch for less than 2 seconds initiates a forced reset. If "EXT CAL YES" was selected during the setup procedure, the external reset input initiates the setpoint display cycle when activated for over two seconds.
Setpoint Display	When the Cal magnet is held to the side of the transmitter enclosure next to CAL/RESET for more than two seconds, the transmitter enters the Setpoint Display mode. Once in this mode, the Cal magnet can be removed. The Setpoint Display sequence will complete automatically. (The external reset input terminal can also be used to initiate the setpoint display and calibration mode if "EXT CAL YES" was selected during the setup procedure.) In this mode: • The display sequentially shows the alarm setpoints, calibration gas concentration, as well as sensor sensitivity and other information. Refer to "Table 5-Setpoint Display Cycle" for additional information. • Each value is displayed for approximately 1.5 seconds. • After completing the sequence, the transmitter automatically returns to the Normal operating mode if the Cal magnet is no longer being held to the unit (or the external reset input is not activated). *NOTE* *If the CAL/RESET switch (or external reset input) is still activated at the end of this cycle, the transmitter automatically enters the Calibrate mode. If a calibration is not performed, a CAL ABORTED fault will occur. To exit the Calibrate mode without performing the calibration, cycle power or wait for the calibration fault message, then reset the unit.* The Setpoint Display mode only **displays** the setpoints. Use the "Setup" mode for **changing** setpoints.
Auto Calibration	• Auto Cal is an automatic calibration procedure that requires no adjustments by the operator. The Calibrate mode is entered by holding the Cal magnet to the CAL/RESET magnetic switch until completion of the "Setpoint Display" sequence described above (approximately 7 seconds). (The external reset input terminal can also be used to enter the calibrate mode if "EXT CAL YES" was selected during the Setup procedure. Activate the input until completion of the "Setpoint Display" sequence.) • The transmitter performs the Zero adjustments, then signals the operator when to apply and also when to remove the calibration gas. Upon completion of a successful calibration, the transmitter automatically returns to the Normal operating mode. • If the operator fails to complete the calibration procedure, if an error in calibrating occurs, or if a successful calibration cannot be completed, the transmitter will automatically return to the Normal mode and continue to use the previous calibration data (after 10 minutes or when the gas level drops below the lowest alarm setpoint). A fault indication will be displayed until a reset occurs. • If the microprocessor determines that the sensor cell is approaching the end of its useful life, the message "SENSOR" "AT E.O.L." will be indicated on the display. A fault indication will be displayed until a reset occurs. • While in the Calibrate mode, all transmitter outputs are inhibited and the dc current output goes to a preset level (adjustable from 0 to 20 ma, with a default value of 2.0 ma). See "Setup" section for complete calibration procedure.
Setup	In the setup mode, the range (for some gases), alarm setpoints, calibration gas level, current loop levels, relay operation (latching/non-latching, energized/de-energized), and calibration mode (auto/manual) are programmed into the transmitter. *NOTE* *When using MOS H_2S sensors, only 40 ppm H_2S in air may be used for span calibration. The transmitter will not read accurately if other concentrations are used.*

INSTALLATION CHECKLIST

The following checklist is provided as a means of checking the system to be sure that all phases of system installation are complete and have been performed correctly.

1. Enclosure is securely mounted and sensor is pointing down.
2. Ensure that local wiring and installation codes are met.
3. Power wiring is installed and power source is operational.
4. Wiring to external loads and/or monitoring devices is properly connected.
5. All cable shields are properly connected.
6. Optional sensor accessories (dust/splash guards, sample draw devices, etc.) are installed, clean, and in good condition.
7. O-ring is in good condition and the junction box cover is tightly installed.
8. Monitoring devices and/or response equipment is operational.

STARTUP PROCEDURE

1. Remove power from all output devices to prevent actuation.
2. Apply power to the system. If the proper “type of sensor” indication does not appear in the display during warmup, consult the factory.
3. When the warmup period is completed, perform the Setup procedure.
4. Perform the Calibration procedure.
5. Restore power to the output devices.

SETPOINT DISPLAY MODE

In this mode the display sequentially shows various operating parameters, including programmed alarm setpoints and calibration gas concentration, then returns to the Normal operating mode (see Table 5). Remove power from all output devices to prevent actuation.

Table 5—Setpoint Display Cycle

Display Indicates	Description
Normal Mode	To enter the Setpoint Display mode, activate the CAL/RESET magnetic switch for 2 to 3 seconds (hold the Cal magnet to the side of the transmitter enclosure next to CAL/RESET). If “EXT CAL YES” was selected during the “Setup Procedure,” the external reset input can also be used to initiate the Setpoint Display Cycle when activated for 2 to 3 seconds.
Low	Low alarm setpoint is indicated.
High	High alarm setpoint is indicated.
Auxiliary	Auxiliary alarm setpoint is indicated.
Span	This number indicates the relative sensitivity of the sensor.
Gain	For factory use only.
GTBL	For factory use only.
Ver	Firmware version.
Cal	Calibration gas concentration is displayed.
Normal Mode	Remains in Normal mode until another mode is activated.

SETUP PROCEDURE

1. Determine the required settings such as alarm setpoint levels, normally energized/de-energized relays, latching/ non-latching relays, and auto/man calibration.

NOTE

Operating range and calibration gas concentration for Infiniti with the MOS H_2S sensor are preset and cannot be changed.

2. Remove the enclosure cover to access the transmitter display and controls.

CAUTION

While in the Setup Mode, the current loop output will drop to less than 1 ma. For models without relays, this is the only remote indication that the unit is not in the Normal operating mode. For models with relays, the fault relay indicates a fault. In either case, the transmitter will remain in the Setup mode until Setup is complete. The transmitter must be manually stepped through the sequence below in order to return to the Normal operating mode.

3. Press and hold the SETUP/ACCEPT button for 1 second using a small screwdriver, then release. This initiates the Infiniti Setup Mode. Refer to Table 6 to perform setup. Once a programming option has been accepted, the transmitter will automatically cycle to the next option.

Table 6—Infiniti Setup

Display	Function	Description/Action
Left portion displays the low alarm setpoint. Right portion displays alternating: "LO" "SET"	Select the Low Alarm Setpoint	• Press the INCREASE button to increase the setpoint or the DECREASE button to decrease the setpoint. • When the desired setting is displayed, press the SETUP/ACCEPT button to program the setpoint into the transmitter.
Left portion displays the high alarm setpoint. Right portion displays alternating: "HI" "SET"	Select the High Alarm Setpoint	• Press the INCREASE button to increase the setpoint or the DECREASE button to decrease the setpoint. • When the desired setting is displayed, press the SETUP/ACCEPT button to program the setpoint into the transmitter.
Left portion displays the auxiliary alarm setpoint. Right portion displays alternating: "AX" "SET"	Select the Auxiliary Alarm Setpoint	• Press the INCREASE button to increase the setpoint or the DECREASE button to decrease the setpoint. • When the desired setting is displayed, press the SETUP/ACCEPT button to program the setpoint into the transmitter.
"LATCH" or "NonLATCH"	Select Non-Latching or Latching Relays	• Press INCREASE or DECREASE to change the setting. • When the desired setting is displayed, press the SETUP/ACCEPT button to program the setting into the transmitter.
"DE-ENERG" or "ENERG"	Select De-Energized or Energized relays.	• Press INCREASE or DECREASE to change the setting. • When the desired setting is displayed, press the SETUP/ACCEPT button to program the setting into the transmitter. Factory default setting is for de-energized operation.

Table 6—Infiniti Setup (Continued)

Display	Function	Description/Action
"YES EXT" "YES CAL" or "NO EXT" "NO CAL"	Option to allow external reset button to be used for calibration in addition to or instead of Cal Magnet. When "Yes" is selected, the external reset input functions exactly like the Cal Magnet.	• Press INCREASE or DECREASE to change the setting. • When the desired setting is displayed, press the SETUP/ACCEPT button to program the setting into the transmitter. Factory default setting is for no - external reset button is not used for calibration.
"4-20 CAL" "NO"	Option to select a Current Loop Output other than factory calibrated 4 to 20 ma.	• Press the SETUP/ ACCEPT button to bypass the 4 to 20 ma calibration procedure and exit the SETUP mode. • Press DECREASE or INCREASE to change the display to read "4-20 CAL" "YES." • Press the SETUP/ACCEPT button to program the current loop.
IMPORTANT *A dc current meter capable of measuring 4 to 20 ma must be connected to the current loop output for the following three current loop adjustments. This can be accomplished by connecting a dc ammeter in series with the load or by connecting a digital dc voltmeter across a known load resistance and calculating the current flow using the formula: current (I) = voltage/load resistance.* *Do not press INCREASE or DECREASE pushbuttons during Current Loop Cal without a current meter or voltmeter connected to the current loop output as described above. Doing so will result in an uncalibrated current loop.*		
"SET 4mA" "CURRENT"	Set the current output zero level.	• Press the INCREASE or DECREASE button to change the zero level current output (indicated on the dc current meter). • When the desired output is indicated, press the SETUP/ACCEPT button to program the setting into the transmitter.
"SET 20mA" "CURRENT"	Set the current output full scale level.	• Press the INCREASE or DECREASE button to change the full scale current level output (indicated on the dc current meter). • When the desired output is indicated, press the SETUP/ACCEPT button to program the setting into the transmitter.
"SET CAL" "CURRENT"	Set the current output during calibration and setup modes.	• Press the INCREASE or DECREASE button to change the calibration current level output (indicated on the dc current meter). • When the desired output is indicated, press the SETUP/ACCEPT button to program the setting into the transmitter.

CALIBRATION

FREQUENCY OF CALIBRATION

The MOS H_2S sensor is typically utilized to protect human life. For this reason, a frequent calibration inspection is recommended. The specific frequency required in different applications can vary depending upon the amount of background gas, concentration of exposed H_2S, and ambient environmental conditions.

Calibration **must** be performed:

- When a new system is initially put into service.
- When the sensor is replaced.
- Periodically to verify proper performance.

To ensure optimum performance, the recommended frequency of calibration for MOS H_2S sensors is:

- After a one hour warm-up period.
- After 24 hours.
- After one week.
- Every 90 days.

IMPORTANT

To ensure adequate protection, the H_2S detection system must be calibrated on a regularly scheduled basis.

CALIBRATION GAS

The U9500B/MOS H_2S sensor must be calibrated using only Det-Tronics 40 ppm H_2S ampoules. All ampoule calibrations must be performed using Det-Tronics calibration bottle with thumb screw ampoule breaker and internal mixing fan. **Do not** use bottled 40 ppm H_2S in nitrogen.

AUTO CALIBRATION PROCEDURE

The Infiniti with MOS H_2S sensor is calibrated using the Automatic Calibration sequence. All adjustments are made automatically by the transmitter once calibration has been initiated. Refer to Table 7 for the Automatic Calibration Procedure.

IMPORTANT CALIBRATION NOTES

- Ensure that only clean air is present at the sensor prior to entering the calibration mode. If the possibility of background gases exists, purge the sensor with clean air to ensure accurate calibration.
- If the calibration procedure is not completed or if the sensitivity of the sensor has deteriorated to the extent that calibration cannot be successfully completed, a fault will be generated and the system will automatically revert back to the former calibration settings (after 10 minutes or when the gas level drops below the lowest setpoint). If a successful calibration cannot be accomplished, replace the sensor and re-calibrate.
- Inspect the sensor. Loss of sensitivity can be caused by various factors. One common cause is by clogging of the hydrophobic or sintered filter by dirt, oil, paint, etc. Problems of this nature will not be detected by the transmitter's diagnostic circuitry. If the filter or the sensor are dirty or plugged, they should be replaced.

Table 7—Automatic Calibration Procedure

Description	Display	Operator Action
Normal operation/no gas present	Indicates the detected gas concentration	• If the possibility of background gases exists, purge the sensor with clean air to ensure accurate calibration.
Initiate calibration	Sequences through the Setup settings Enters the Calibration mode - Display shows detected gas concentration and alternating message: "ZERO" "CAL"	• Hold the Cal magnet to the CAL/RESET magnetic switch for 7 seconds. See Figure 11 for CAL/RESET switch location. (The external reset input can also be used to enter the calibration mode if "EXT CAL YES" was selected during Setup procedure).
Zero calibration complete	Display shows detected gas concentration and alternating message: "APLY" "GAS"	• Apply the calibration gas to the sensor. Ensure proper H_2S ampoule is inserted into ampoule holder within calibration bottle. Place cal bottle over MOS sensor. Break ampoule by tightening thumb screw. Rotate mixing fan by slowly rotating the external lever 360°.
Span calibration	Display shows rising gas concentration and alternating message: "GAS" "ON"	• Continue slowly rotating the mixing fan.
Span calibration complete	Display shows decreasing gas concentration when gas is removed and alternating message: "CAL" "OK" then "RMV" "GAS" then, if the calibration is successful: "XXXX SPAN"	• Remove the calibration gas. When the gas level falls below the lowest alarm setpoint, and if no faults are present, the transmitter automatically exits the Calibrate mode. • Upon completing of calibration, a 4-digit number preceeding the word "span" is displayed (for only 7 seconds). This value represents overall sensor sensitivity and should be noted by the operator and logged for future reference. (This number is used for trending purposes only.) Any reading over 100 indicates that the sensor is good. • At the successful completion of the calibration, all outputs and indicators return to normal operation. • If faults are present, the unit will exit after the remainder of 10 minutes.
Calibration fault indication	Display shows alternating messages indicating the fault, then "RMV" "GAS"	• If a fault occurs, remove the gas and correct the fault. After the fault has been cleared, begin calibration again. See Table 8 - Fault Messages, Explanations and Corrective Action.

MAINTENANCE

A routine maintenance schedule is recommended to ensure that the detector is in peak operating condition at all times. To ensure top performance, service the device as follows.

VISUAL INSPECTION

A visual inspection of the detector approximately once per week is recommended to ensure that physical obstructions such as trash, debris, mud, snow, or oil have not blocked or impeded hazardous gas access to the sensor. This includes visually inspecting the sintered metal filter on the sensor.

RESPONSE TEST

It is acceptable to perform a detector response verification test in lieu of a complete calibration if the detector output in clean air appears stable and the device has been calibrated recently. This test involves simply applying calibration gas to the detector while in normal operating mode and confirming that the detector output is proportional to the applied gas concentration. It is the operator's responsibility to bypass any and all system alarm output devices, if necessary, prior to conducting the detector response test. If the response test results are not acceptable, a complete calibration must be performed.

NOTE

Fault detection circuitry continuously monitors for problems that could prevent proper system response. It does not monitor external response equipment or the wiring to these devices. It is important that these devices be checked initially when the system is installed, as well as periodically during the ongoing maintenance program.

The system must be checked periodically in the Normal mode to ensure that those items not checked by the transmitter diagnostic circuitry (such as output relays) are functioning properly.

CALIBRATION

Calibrate the detector following the schedule in the "Calibration" section of this manual.

SINTERED METAL FILTER

H_2S gas enters the sensor through the sintered metal filter on the front of the sensor housing. A dirty filter can significantly reduce the amount of H_2S gas that is able to reach the sensing element, thereby impairing the ability of the system to respond to a hazardous condition. If the filter becomes dirty and cannot be properly cleaned or if it is damaged, the sensor must be replaced.

NOTE

If the detector cannot be calibrated or responds slowly to the calibration gas, check the condition of the filter before replacing the sensor.

SENSOR REPLACEMENT

The MOS sensor is not field repairable. If calibration can no longer be properly performed, the sensor must be replaced.

The area must be de-classified or power to the detector should be removed prior to replacing the sensor in a hazardous area.

Follow the procedure below to replace the sensor.

1. Remove power to the transmitter prior to replacing the sensor.
2. Remove the transmitter cover and the wire shield within the transmitter.
3. Unplug the sensor from the transmitter module and unscrew it from the conduit entry.
4. Thread the wires for the replacement sensor through the conduit entry, then screw the sensor into the conduit entry and plug it in. Replace the wire shield.
5. Replace the junction box cover.
6. Re-apply power. Allow time for the unit to warm up and stabilize (approximately 24 hours for best results), then calibrate.

An adequate supply of spare sensors should be kept on hand for field replacement. For maximum protection against contamination and deterioration, they should not be removed from the original protective packaging until the time of installation. To ensure maximum storage life, sensors should be stored at a temperature between 32°F and 68°F (0 to 20°C) and a relative humidity between 15 and 90 percent. Always calibrate after replacing the sensor.

TROUBLESHOOTING

Automatic Diagnostics and Fault Messages

The transmitter features self-testing circuitry that continuously checks for problems that could prevent proper system response. When power is applied, the microprocessor automatically tests the unit. If a fault is detected during this warmup mode, it will be indicated on the display and must be reset to clear. In the Normal operating mode, it continuously monitors the input signal from the sensor to ensure proper functioning.

In the event of a system fault:

- The display identifies the nature of the fault using a fault message. Refer to Table 8 for an expanded explanation of the messages.
- The normally energized Fault relay (on relay models) is de-energized.
- The DC current output drops to less than 1.0 ma.

NOTE

The fault message will be shown for about 1.5 seconds out of every 3 seconds. The gas concentration at the sensor will be displayed during the remaining time. If more than one fault should occur, the highest priority fault will be displayed. (Table 8 lists the faults in order of priority.)

In the event of an alarm condition and a system fault both occurring:

- In most cases, the first condition that occurs will be indicated by the current and relay outputs and on the display.
- The exceptions are “CAL ABORTED” and “SENSOR E.O.L.” faults, which can occur during the calibration procedure. If an alarm occurs with these faults, the alarm will over-ride the fault and will be indicated.

Prioritized Faults

The faults are prioritized, with the highest fault being the only one displayed (see Table 8 for a prioritized listing). If an additional fault exists, it will be displayed after the higher priority fault has been cleared.

Clearing Faults

Generally, faults that occur while in the normal mode are self-clearing once the fault condition has been corrected. Faults that occur while in the warmup and calibration modes require a manual reset to clear (using either an externally connected reset switch or the Cal magnet). After the fault condition has been corrected, the fault relay automatically switches to the normal (energized) state, the DC current output returns to normal, and the fault message turns off.

CAUTION

The fault detection circuitry does not monitor the operation of external response equipment or the wiring to these devices. It is important that these devices be checked periodically to ensure that they are operational.

NOTE

The sensor must be periodically inspected and calibrated following prolonged exposure to contaminating gases and vapors.

SPARE PARTS

- Electronic Module - Specify gas sensor type (MOS H_2S) and with or without optional relay package when ordering.
- Sensors - Specify MOS H_2S, with CSA Approval or CSA/CENELEC Approval
- H_2S Ampoule Calibration Kits
- Spare 40 ppm H_2S Ampoules
- Lubriplate grease for threads
- Other accessories are available. Contact your local representative or the factory for information.

DEVICE REPAIR AND RETURN

Prior to returning devices, contact the nearest local Detector Electronics office so that a Service Order number can be assigned. A written statement describing the malfunction must accompany the returned device to expedite finding the cause of the failure.

Pack the unit properly. Use sufficient packing material in addition to an antistatic bag or aluminum-backed cardboard as protection from electrostatic discharge.

Return all equipment transportation prepaid to the factory in Minneapolis.

Table 8—Fault Messages, Explanations And Corrective Action

Fault Message Display	Explanation and Corrective Action
Blank Display	EEPROM sumcheck failure. Cycle power to clear fault. If fault persists, return the unit to the factory for repair.
"COMPUTER" "FAILURE"	RAM or processor failure. Cycle power to clear fault. If fault persists, return the unit to the factory for repair.
"WDT" "FAILURE"	Watchdog timer failure. Cycle power to clear fault. If fault persists, return the unit to the factory for repair.
"EEPROM" "FAILURE"	Activate the Cal/Reset switch using the Cal Magnet, then perform Setup and Calibration procedures. If fault persists, return the unit to the factory for repair.
"EXT RSET" "PROBLEM"	External reset button has been activated for 15 seconds or longer. Self-clearing when button is released.
"24V P.S." "FAILURE"	External 24 volt power supply is not in the 15 to 32 volt range. Check and correct input voltage. During normal operating mode, this fault is self clearing when the fault is corrected. If fault occurs during warmup or calibration modes, activate the Cal/Reset switch using the Cal Magnet.
"5V P.S" "FAILURE"	Internal 5 volt analog power supply is not in the 4.75 to 5.35 volt range. During normal operating mode, this fault is self clearing when the fault is corrected. If fault occurs during warmup or calibration modes, activate the Cal/Reset switch using the Cal Magnet. If fault persists, return the unit to the factory for repair.
"SENSOR" "PROBLEM"	Sensor input fault. In normal operating mode, the unit automatically goes through Warmup when this fault clears. If this fault occurs at the end of the warmup period or calibration procedure, recalibrate the sensor. If fault persists, check sensor condition and wiring.
"REPLACE" "SENSOR"	(In calibration mode) sensor is defective. Replace sensor and perform calibration procedure.
"CAL" "ABORTED"	(Cal Message) Time ran out while waiting for the gas reading to stabilize. Activate the Cal/Reset switch using the Cal Magnet.
"SENSOR" "E.O.L."	(Cal Message) Sensor reaching End Of Life. Consider replacement of the sensor in the next 1 or 2 calibrations.
"ZERO" "DRIFT"	Negative zero drift. Sensor input is –9% full scale or lower. Perform sensor calibration.

X3301 Multispectrum
IR Flame Detector

PointWatch Eclipse®
IR Combustible Gas Detector

Eagle Quantum Premier®
Safety System

Eagle Logic Solver
Safety System

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