NET SAFETY MONITORING INC.

INFRARED COMBUSTIBLE GAS DETECTOR
Standard Premium
USER MANUAL
UT-SP-SIR100

ISO 9001 Certified Company

Part Number: MAN-0009-00 Rev 3

This manual is provided for informational purposes only. Although the information contained in this manual is believed to be accurate, it could include technical inaccuracies or typographical errors. Changes are, therefore, periodically made to the information within this document and incorporated without notice into subsequent revisions of the manual. Net Safety Monitoring Inc. assumes no responsibility for any errors that may be contained within this manual.

This manual is a guide for the use of a Infrared Combustible Gas Detector and the data and procedures contained within this document have been verified and are believed to be adequate for the intended use of the detector. If the detector or procedures are used for purposes other than as described in the manual without receiving prior confirmation of validity or suitability, Net Safety Monitoring Inc. does not guarantee the results and assumes no obligation or liability.

Net Safety Monitoring Inc. products, are carefully designed and manufactured from high quality components and can be expected to provide many years of trouble free service. Each product is thoroughly tested, inspected and calibrated prior to shipment. Failures can occur which are beyond the control of the manufacturer. Failures can be minimized by adhering to the operating and maintenance instructions herein. Where the absolute greatest of reliability is required, redundancy should be designed into the system.

Net Safety Monitoring Inc. , warrants its sensors and detectors against defective parts and workmanship for a period of 24 months from date of purchase and other electronic assemblies for 36 months from date of purchase.

No other warranties or liability, expressed or implied, will be honoured by Net Safety Monitoring Inc.

Contact Net Safety Monitoring Inc. or an authorized distributor for details.

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CAUTION: FOR SAFETY REASONS THIS EQUIPMENT MUST BE OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING OR SERVICING.

Unit I GENERAL INFORMATION

DESCRIPTION

Hydrocarbon gases absorb specific wavelengths of infrared energy. In the SIR100, modulated, broadband infrared energy is focused by means of a gold plated reflector and passed along an open measurement path to a sensing element tuned to a specific IR wavelength which is absorbed by most hydrocarbon gases. When a hydrocarbon gas diffuses into the infrared path, some of the energy is absorbed by the gas. The signal change detected by the tuned sensing element is proportional to the concentration of gas in the measurement path. The SIR100 utilizes this principle to give you a reliable and simple to use combustible gas detector. Through a unique and simple design that negates the need for mirrors and de-fogging heaters the SIR100 provides excellent performance in applications where reduced maintenance is the objective.

The Uni-Tran display unit provides a user friendly operator interface in plain text for calibration, gas level display, diagnostic messages and relay configuration.

FEATURES

- Scrolling alpha-numeric LED display highly visible in all lighting conditions
- Easy, one person, non-intrusive calibration
- Tolerant to high levels of vibration
- No mirrors to be fogged, fouled, misaligned or cleaned
- Calibration gas can be applied externally to simulate actual field conditions
- Entire optical path is protected from airborne contamination, mist, dust or oil
- Sensor can be remotely mounted more than 2000 feet from display unit
- Low power consumption that works with 12 or 24Vdc systems
- Microprocessor based smart transmitter
- Conformal coated circuit boards
- Gas specific colour coded enclosure

Technical Specifications

Sensor Specifications

- Operating Temperature Range:
  -40˚C to +75˚C (-40F to +167F)

- Range of Detection:
  0 to 100% LEL or 0 to 100% by volume (propane, methane, polypropylene, butane)*

- Accuracy:
  ±3% LEL up to 50% LEL ±5% LEL above 50% LEL

- Response Time:
  <30 seconds to T90

- Linearity/Repeatability:
  ±3% LEL / ±2% LEL

- Weight:
  0.9 Kg (2.0 lb)

- Enclosure Material:
  Aluminum (optional stainless steel)

- Certification:
  CSA and NRTL/C certified for hazardous locations. Class I, Division 1, Groups B, C and D. IEC Rating Ex d IIB+H2 T5, NEMA 3R. Performance certified to CSA 22.2 No. 152

* For other gasses please contact the factory.

UNI-TRAN Specifications

- Operating Voltage Range:
  10.5 to 32 Vdc

- Power Consumption (at 24 Vdc):
  Nominal (100 mA, 2.4 Watts) Maximum (200 mA, 4.8 Watts)

- Operating Temperature Range:
  -40˚C to +85˚C (-40F to +185F)

- Humidity Range:
  0 to 100% Relative humidity, non-condensing

- Enclosure Material:
  Copper Free Cast Aluminum

- Weight:
  2.3 Kg (5.0 lb)

- Certification:
  CSA and NRTL/C certified for hazardous locations. Class I, Division 1, Groups B, C and D, NEMA 4X and 7. IEC Rating Ex d IIB+H2 T5

  NOTE: Electronics only - CSA and NRTL/C certified for hazardous locations Class I, Division 2 Groups B, C and D pending.

- Current Output (4-20mA):
  Into a maximum loop impedance of 800 Ohms at 32 Vdc or 150 Ohms at 10.5 Vdc. Isolated or non-isolated loop supply.

- Relay Outputs:
  Form C contacts rated 1 Amp at 30 Vdc, 0.5 Amp at 125 Vdc. Selectable energized/de-energized, latching/non-latching. Configurable Fault, Low and High alarms.

- Dimensions:
  Refer to *Figure 1*

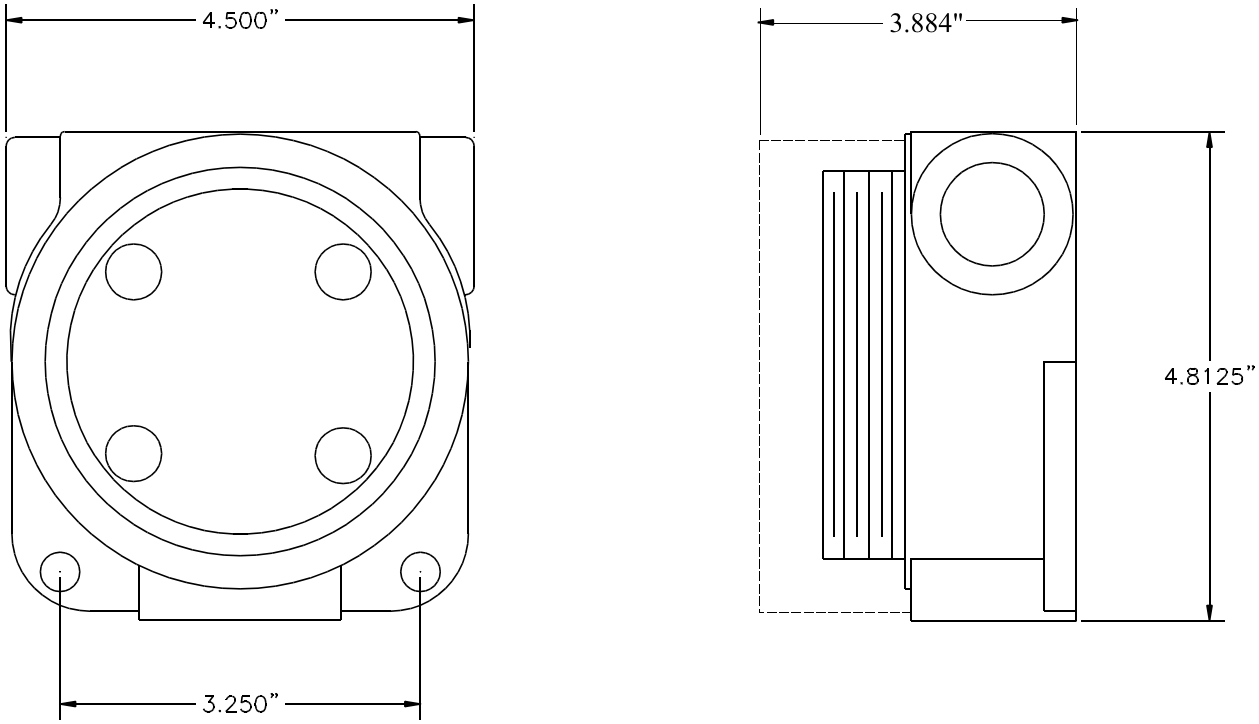

Figure 1 - Dimensions for Adalet Enclosure

Unit II SYSTEM INSTALLATION

INSTALLATION

Location of Sensors

There are no absolute rules for determining the quantity and location of gas detection heads to protect any particular facility. Locate the sensors carefully in all areas where gas escape may be expected and where it is desirable to detect the presence of unwanted gas. Use redundancy where enhanced protection or reliability is required. Light gases such as methane tend to rise while heavy gases such as propane tend to accumulate in low areas. Seek advice from experts who know the characteristics of the gas being detected, air movement patterns and the facility. Use common sense and refer to various publications that discuss general guidelines for your industry.

Unpacking

The UNI-TRAN-P SIR100 is made up of 2 primary components. The housing and terminal board are a single assembly to which the sensor is wired. The control module is a separate plug-in assembly. Since all modern electronic equipment can be damaged by static electricity discharge it is important to take precautions. Discharge static electricity from your body by touching a grounded metal object before

handling the module. Loosen the retaining screws, then remove the module carefully from the housing by grasping the centre "pull" knob and pull straight away (DO NOT un-screw the knurled knob), then temporarily store it in a clean and safe place until field wiring is connected to the terminal strip located in the base of the housing.

Mounting

The housing should be oriented so that the sensor is on the under-side of the housing. Use a conduit seal and conduit loop or trap on the field wiring side to prevent water or condensation from entering the housing through the conduit or its threaded connection.

Wiring

NOTE

The control module (CPU board and Display Board) *with cable should never be totally removed from the Relay board and housing. If it is removed there are bright red alignment markings on the cable and on the Relay board for you to use when re-inserting the cable into the Relay Board connector.*

NOTE

Since all modern electronic equipment can be damaged by static electricity discharge it is important to discharge static electricity from your body by touching a grounded metal object before handling the module.

Refer to figure 3 and 4

The transmitter is made up of two assemblies. The enclosure / relay board are a single assembly to which the input is wired. The control module (CPU board and Display Board) is a separate assembly. To conduct wiring unscrew the two retaining screws from the front of the display board . **(the control module is attached to the relay board by a cable. Do not detach the cable during wiring)** Detach the module from the housing by grasping the centre (Pull Here) knob and pull straight away. gently hang the module from the cable while you conduct wiring.

NOTE*:*

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 use of shielded cable is highly recommended for any signal wires to protect against interference caused by extraneous electrical "noise". This includes power and current outputs; relay outputs do not require shielded cable. In applications where the wiring cable is installed in conduit, the conduit must not be used for wiring to other electrical equipment.

The maximum distance between the sensor and controller is limited by the resistance of the connecting wiring, which is a function of the gauge of the wire being used.
Refer to the manuals on the sensors used (and transmitters if used) for maximum wiring distances and wiring instructions.

NOTE:

The controller 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, taking care not to touch the terminals or electronic components. For more information on proper handling, refer to Appendix A.

Water-proof and explosion-proof conduit seals are recommended to prevent water accumulation within the enclosure. Seals should be located as close to the device as possible and not more than 18 inches (46 cm) away. Explosion-proof installations may require an additional seal where conduit enters a non-hazardous area. Always conform to local wiring codes.

When pouring a seal, use a fibre dam to assure proper formation of the seal. The seals should never be poured at temperatures below freezing.

The jacket and shielding of the cable should be stripped back to permit the seal to form around the individual wires. This will prevent air, gas and water leakage through the inside of the shield and into the enclosure.

It is recommended that explosion-proof conduit drains and breathers be used. In some applications, alternate changes in temperature and barometric pressure can cause 'breathing' which allows moist air to enter and circulate inside the conduit. Joints in the conduit system are seldom tight enough to prevent this 'breathing'.

Refer to applicable wiring codes when installing and wiring. After the field wiring has been carefully connected, check that the correct wires are connected to the corresponding terminals and that voltage levels do not exceed the specifications. When the wiring and voltages have been verified remove power form the system. Set the Display board back in place and tighten the two retaining screws.

It is necessary that reliable monitoring and indicating devices or systems be connected to the transmitter. These devices must be designed to produce clear visual and audible danger signals when high signal levels occur. Operating personnel must consider the area to be dangerous until a careful survey of the area has been conducted with a separate and reliable gas indicating device.

Sensor Separation

The SIR100 sensor can be installed and wired directly to the Uni-Tran housing and terminal board as per the wiring diagram or it may be remotely mounted using a sensor separation kit (CB4) which is composed of a junction box and terminal strips. The wiring includes two wires for power and two for the digital signal. The sensor and kit are then connected to the Uni-Tran. **Use two individually shielded pairs of 18AWG, shielded copper instrument wire for separations up to 2000 feet.** Consult factory if greater separations are required. *(See figure 7)*

Initial LED Status

With power applied, check that the green POWER LED is ON and the FAULT/ CAL LED is showing a slow red flash during the first 90 seconds which will then change to a short green flash every 2 seconds (confidence blip). During the first 90 seconds the analog output will be at 3.0 mA and then change to 4.0mA. If after the 90 seconds warm-up the current is at 2.5mA or any value other than 4.0mA then the sensor requires calibration and the calibration procedure must be initiated. Observation of the LED status signals and output current levels aid the operator when calibrating the sensor/transmitter as described

below under CALIBRATION.

The Premium version with alphanumeric display provides a variety of English language(other languages available) commands scrolled across the display to supplement the LED sequences and aid the operator. Please refer to the following list and see Table of Responses

START DELAY:	power up delay in progress
SWITCH ON:	magnetic reed switch is activated
SENSOR FAULT:	fault present, sensor or sensor wiring failure
SETTING ZERO:	calibration zero gas setting in progress
APPLY 50% LEL:	apply 50% of full span calibration gas
SETTING SPAN:	span gas detected, automatic span setting in progress
REMOVE GAS:	remove calibration gas
FAIL CAL:	calibration span setting failed
TIME-OUT:	calibration failed, no gas detected in calibration
SENSOR FAIL:	sensor or sensor connections failed
NEG DRIFT:	excessive negative sensor drift

TERMINAL CONNECTIONS

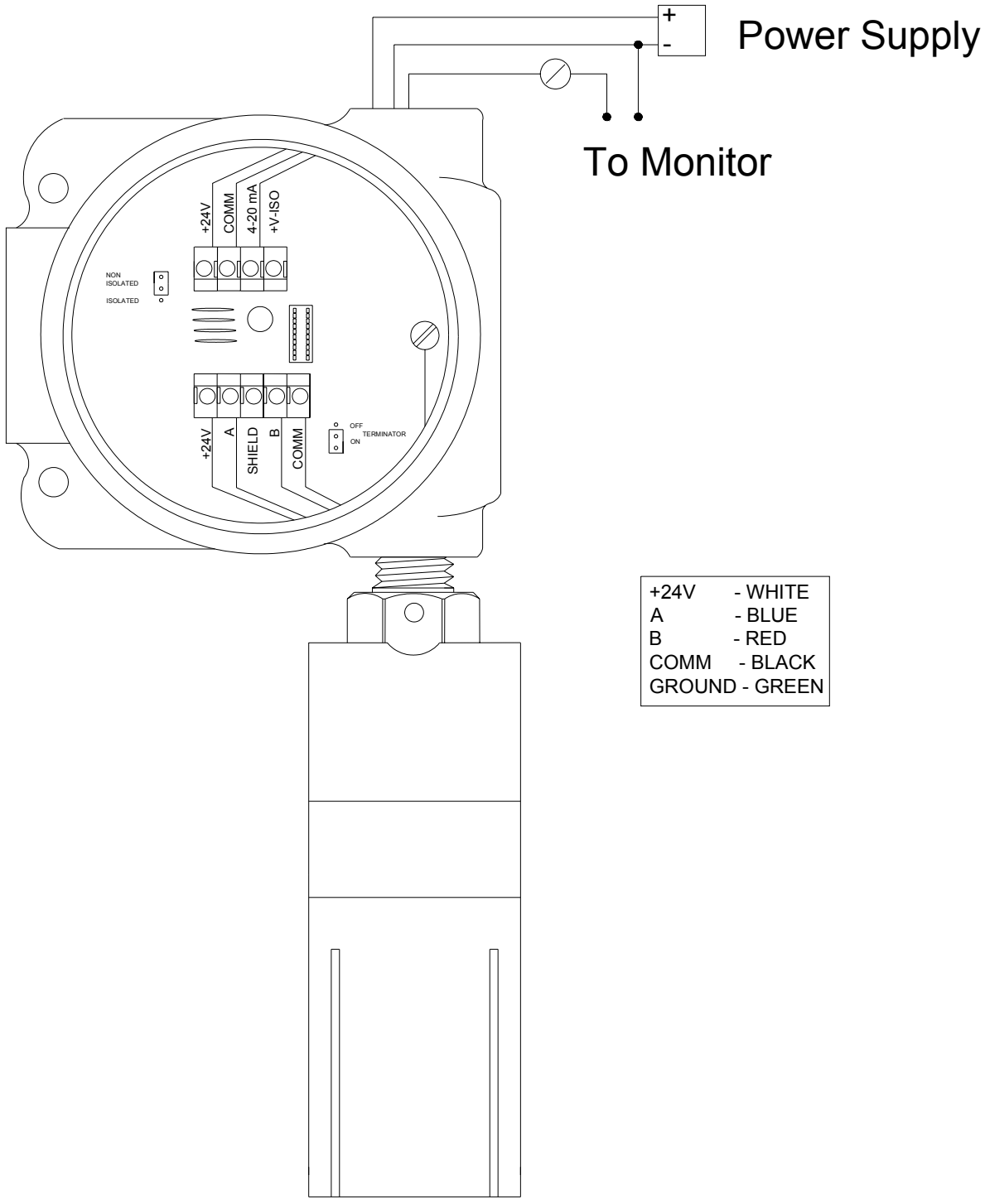

Figure 2 Wiring for NON-Isolated current output

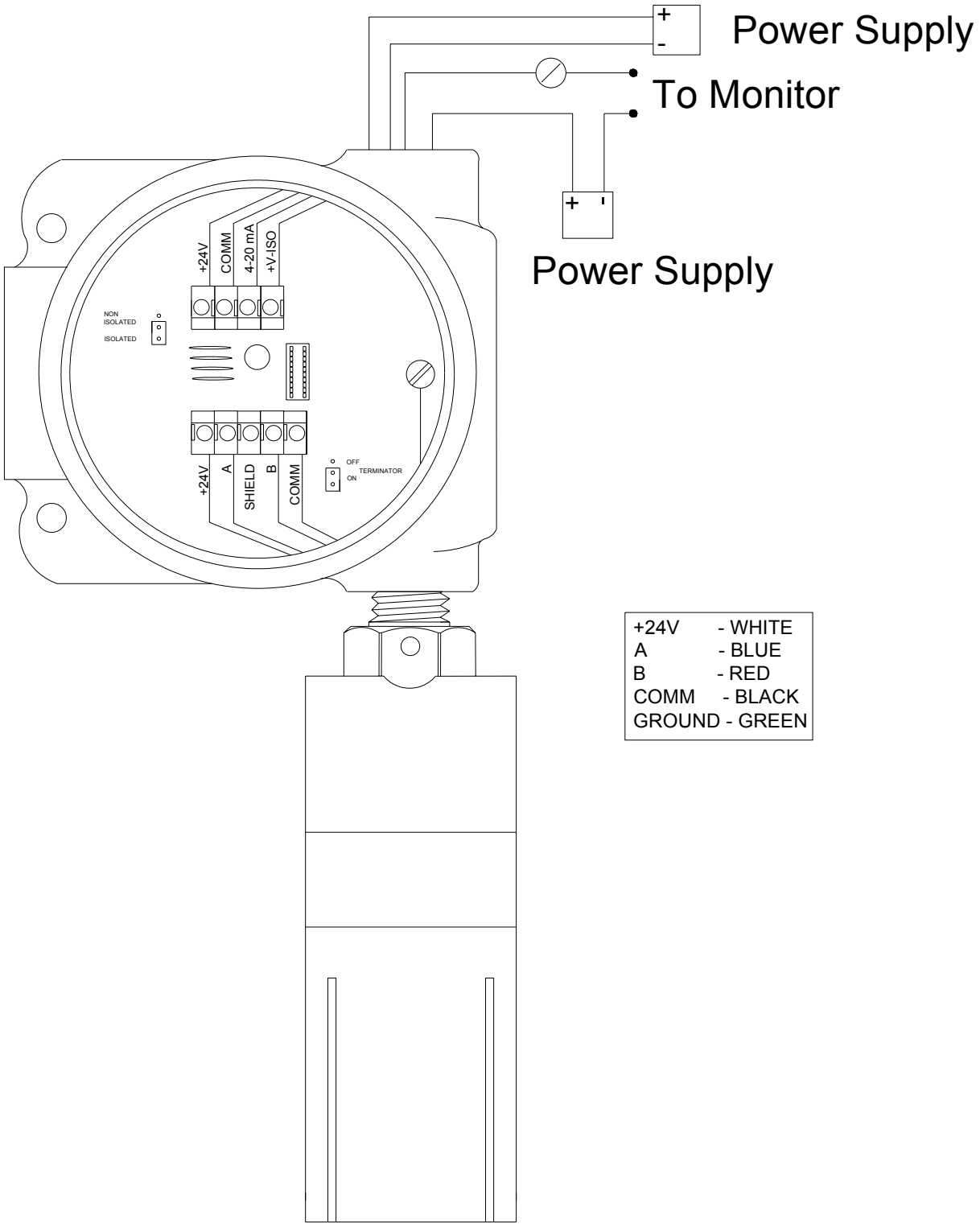

Figure 3 Wiring for Isolated current output

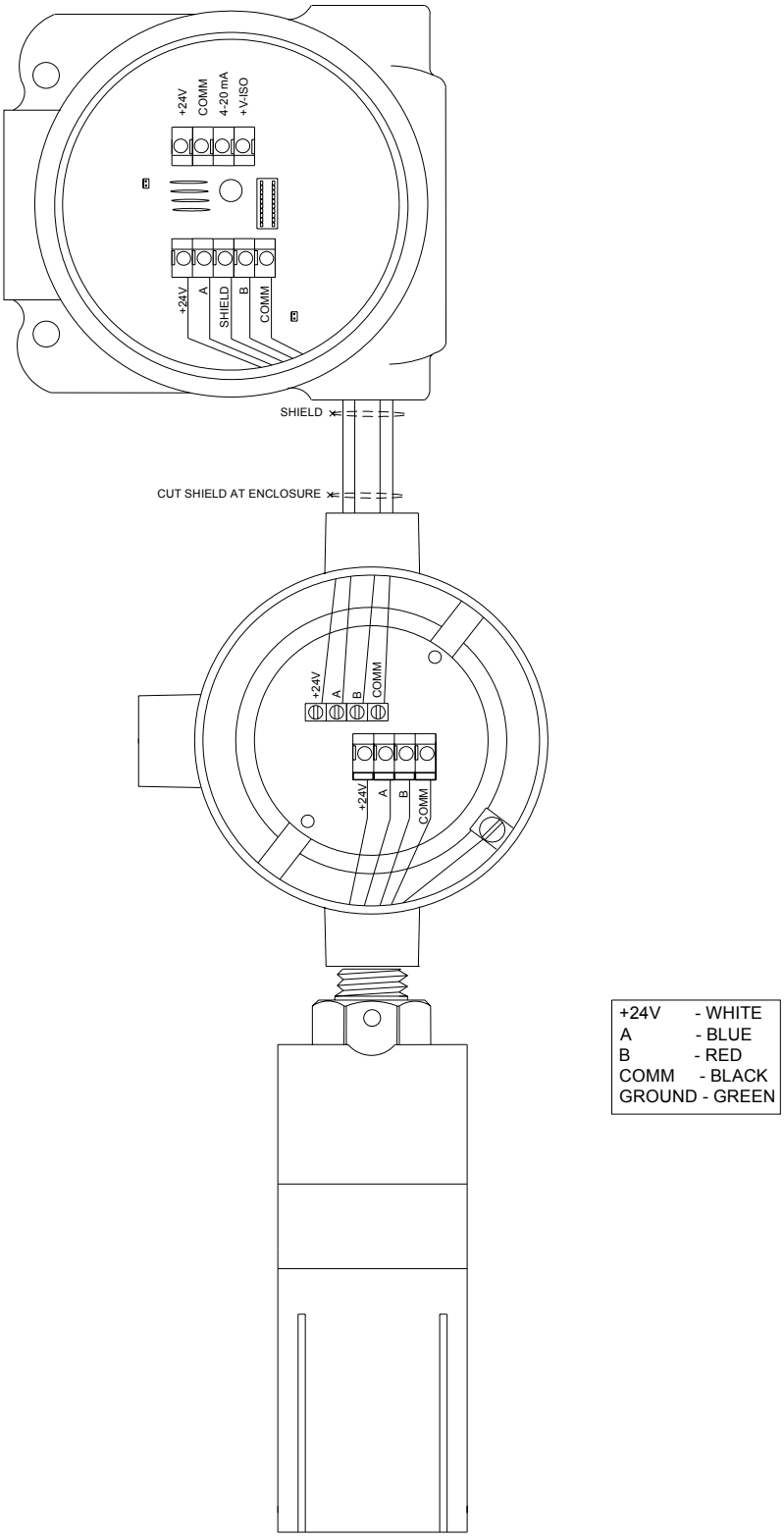

Figure 4 Wiring with sensor separation

JUMPER LOCATION FOR NON-ISOLATED/ISOLATED CURRENT OUTPUT.

The UNI-TRAN Premium models are capable of providing an isolated current output. A jumper must be moved to select between isolated, or non-isolated current output on the terminal board. Refer to the *Figures 5 and 6* for proper setting and connections.

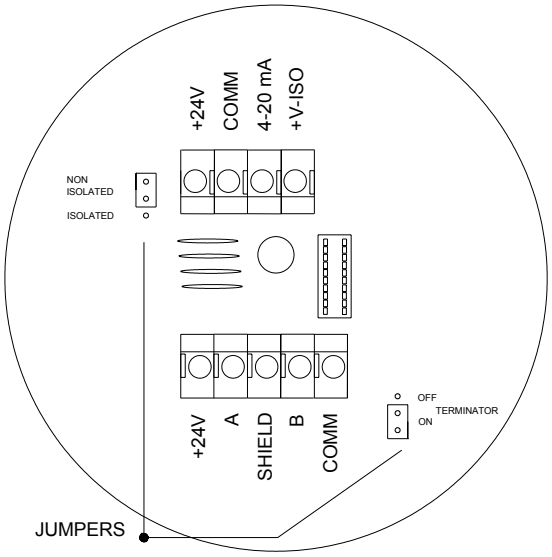

Figure 5 - Jumper Setting for NON- Isolated Current Output Terminator ON (Default)

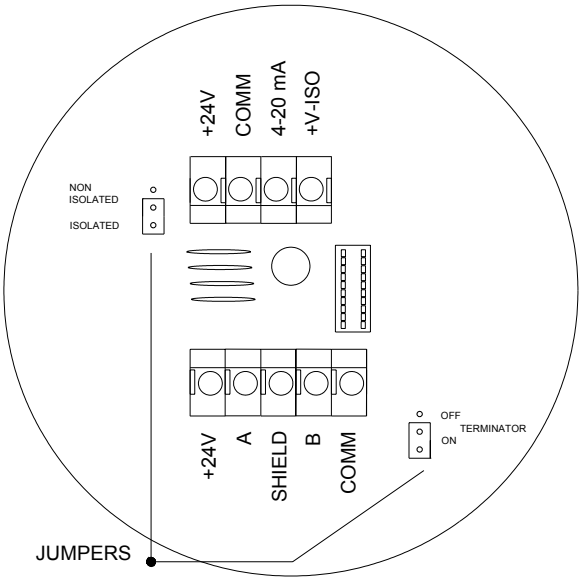

Figure 6 - Jumper Setting for Isolated Current Output
Terminator ON (Default)

ANALOG OUTPUT

The analog output is precisely controlled by the internal micro-processor and digital-to-analog converter. The standard 4 to 20ma signal is proportional to gas concentration of 0 to 100% LEL. Additional stepped levels below 4mA provide various diagnostic signals.

SENSOR LIFE

Sensor life of the SIR100 can be expected to exceed 5 years.

Sensor response may deteriorate very slowly over a period of years, depending on exposure to environmental factors. ***If calibration becomes impossible for any reason, the analog output will switch repeatedly between 3.0mA and 3.3mA mA.*** The status LED flashes red/green. Install a new SIR100 sensor and re-calibrate. The calibration function automatically adjusts span amplifier gain across a broad range without any need for manual adjustment of potentiometers or jumpers.

TEST JACKS

The UNI-TRAN-SIR100 is equipped with test jacks to facilitate convenient current loop measurements without opening the external current loop. To make measurements use the following procedure;

1. Attach the current meter leads to the test jacks.

2. Apply test gas and take meter readings. Set external controller to Bypass if necessary to avoid unwanted alarm response.

3. Remove meter leads from test jacks.

NOTE: The UNI-TRAN-SIR100's 4 to 20 mA current output must be connected to a load device in order to facilitate the use of the test jacks (ie. 100 Ohm resistor must be connected between the 4 to 20mA signal output and the common terminal if the unit is being bench tested prior to field installation).

UNIT III SYSTEM CALIBRATION

CALIBRATION

The UNI-TRAN-P SIR100 LEL was calibrated before shipping from the factory and *may* not require adjustment, however, accurate response to gas must be verified prior to using the device in service.

When used with an external Net Safety controller/monitor it *may* not be necessary to calibrate the UNI-TRAN analog output since system calibration can be accomplished at the controller which accepts and adjusts to a range of deviations in a nominal 4 to 20mA signal.

System response should be checked on a 3 to 6 month interval and *if necessary* calibration can be performed.

If it is necessary to calibrate the UNI-TRAN SIR100 LEL or if it is used as a stand-alone device connected to other monitoring equipment requiring a precise 4 to 20 mA signal then the following calibration procedure should be followed to ensure an accurate correlation between the 4 to 20 mA signal and the gas concentration at the sensor.

CALIBRATION PROCEDURE (use 50% LEL, certified calibration gas)

- Be sure the UNI-TRAN-P SIR100 LEL is powered-up and is not indicating a fault; FAULT/CAL LED is showing a short green flash every 2.0 seconds. (Confidence blip)
- Ensure that the sensor is in a clean air environment before beginning the calibration procedure.

Figure 7 Magnetic Reed Switch Activation

- Place the curved side of the magnet on the side of the enclosure at the 10 O'clock position (Fig 8) where marked *(Orient the "cylinder" shape of the magnet perpendicular to the "cylinder" shape of the housing)* to actuate the reed switch or press the internal Reset switch and hold it there for 10 seconds to begin the CALIBRATION sequence. The output current will drop to 3.0mA, the FAULT/CAL LED will be GREEN steady. Remove the magnet or release the Reset switch and the micro-controller immediately begins its calibration sequence. **The calibration flow cover must be placed over the SIR100 sensor housing prior to starting the calibration procedure**. It is recommended to flow certified ZERO AIR at a rate of 2.0 to 3.0 litres per minute through the tubing connector on the end of the sensor to ensure clean air is present at the sensor while the UNI-TRAN -P-SIR100 sets Zero. When zero readings are complete the output current rises to 3.3mA and the LED will flash fast RED to indicate readiness to start the flow of SPAN gas.

- At 3.3mA and a fast RED flash rate, begin flowing 50% LEL of the correct calibration gas (span gas) at 2.0 to 3.0 litres per minute through the tubing connector at the end of the sensor. Within 3 to 4 minutes the FAULT/CAL LED stops flashing and is steady green. The output current rises to 3.6mA indicating the micro-controller has completed setting the current output level to 12mA representing 50% LEL. for the applied span gas.

- When the status LED is solid green and the analog output switches to 3.6 mA span setting is complete. Stop the flow of calibration gas, remove the calibration flow cover and disconnect the tubing connector on the end of the SIR100 sensor. When the sensor response level falls to 12% LEL (6.0mA), the output current is restored to normal operation and the LED is returned to it normal confidence blip; Blip/Blink red flash every two(2) seconds changing to blip blink green when sensor response returns to zero (4mA).

The Uni-Tran Premium gives exact Calibration instructions which are scrolled across a bright LED alphanumeric display.

During Calibration, the Uni-Tran Premium tells you;

- Setting Zero (3mA output current level)
- Apply 50% LEL (3.3mA output current level)
- Setting Span (3.3mA output current level)
- Remove Gas (3.6mA output current level) When sensor response level falls to about 12% LEL
- Cal Complete (3.6mA), the output current is restored to normal operation)

NOTE:

If calibration becomes impossible for any reason, the analog output will switch repeatedly between 3.0mA and 3.3mA mA.

SENSOR POISONS and INHIBITORS

The Net Safety SIR100 digital infrared sensor is not affected by poisons or inhibitors that may affect catalytic sensors.

Table 2 TABLE OF RESPONSES

CONDITION	Current O/P (mA)	Status LED RED	Status LED GREEN	Alphanumeric display Premium model
Start-up delay	3	Slow Flash		START DELAY
Excess drift (>10%)	2.5	Blip/ blink		NEG DRIFT
Auto Zero set	3		Solid	SETTING ZERO
Apply calibration gas	3.3	Fast Flash		APPLY 50% LEL
Span is set, remove gas	3.6		Solid	REMOVE GAS
Return to normal operation	3.6		Solid	CAL COMPLETE
Normal	4		Blip/ blink	00%
Gas Present	4.4 - 20.0	Blip/ blink		00% to 100% LEL
Calibration Failed	Current output toggles between 3.0mA & 3.3mA	Flashes between Red & Green	Flashes between Red & Green	FAIL CAL

Appendix A Net Safety Monitoring Inc. Electrostatic Sensitive Device Handling Procedure

With the trend toward increasingly widespread use of microprocessors and a wide variety of other electrostatic sensitive semiconductor devices, the need for careful handling of equipment containing these devices deserves more attention than it has received in the past.

Electrostatic damage can occur in several ways. The most familiar is by physical contact. Touching an object causes a discharge of electrostatic energy that has built up on the skin. If the charge is of sufficient magnitude, a spark will also be visible. This voltage is often more than enough to damage some electronic components. Some devices can be damaged without any physical contact. Exposure to an electric field can cause damage if the electric field exceeds the dielectric breakdown voltage of the capacitive elements within the device.

In some cases, permanent damage is instantaneous and an immediate malfunction is realized. Often, however, the symptoms are not immediately observed. Performance may be marginal or even seemingly normal for an indefinite period of time, followed by a sudden and mysterious failure.

Damage caused by electrostatic discharge can be virtually eliminated if the equipment is handled only in a static safeguarded work area and if it is transported in a package or container that will render the necessary protection against static electricity. Net Safety Monitoring Inc. modules that might be damaged by static electricity are carefully wrapped in a static protective material before being packaged. Foam packaging blocks are also treated with an anti-static agent. If it should ever become necessary to return the module, it is highly recommended that it be carefully packaged in the original carton and static protective wrapping.

Since a static safeguarded work area is usually impractical in most field installations, caution should be exercised to handle the module by its metal shields, taking care not to touch electronic components or terminals.

In general, always exercise all of the accepted and proven precautions that are normally observed when handling electrostatic sensitive devices.

A warning label is placed on the packaging, identifying those units that use electrostatic sensitive semiconductor devices.

*Published in Accordance with E1A standard 471

Appendix B Wire Resistance In Ohms

Distance (Feet)	AWG #20	AWG #18	AWG #16	AWG #14	AWG #12	AWG #10	AWG #8
100	1.02	0.64	0.40	0.25	0.16	0.10	0.06
200	2.03	1.28	0.80	0.51	0.32	0.20	0.13
300	3.05	1.92	1.20	0.76	0.48	0.30	0.19
400	4.06	2.55	1.61	1.01	0.64	0.40	0.25
500	5.08	3.20	2.01	1.26	0.79	0.50	0.31
600	6.09	3.83	2.41	1.52	0.95	0.60	0.38
700	7.11	4.47	2.81	1.77	1.11	0.70	0.44
800	8.12	5.11	3.21	2.02	1.27	0.80	0.50
900	9.14	5.75	3.61	2.27	1.43	0.90	0.57
1000	10.20	6.39	4.02	2.53	1.59	1.09	0.63
1250	12.70	7.99	5.03	3.16	1.99	1.25	0.79
1500	15.20	9.58	6.02	3.79	2.38	1.50	0.94
1750	17.80	11.20	7.03	4.42	2.78	1.75	1.10
2000	20.30	12.80	8.03	5.05	3.18	2.00	1.26
2250	22.80	14.40	9.03	5.68	3.57	2.25	1.41
2500	25.40	16.00	10.00	6.31	3.97	2.50	1.57
3000	30.50	19.20	12.00	7.58	4.76	3.00	1.88
3500	35.50	22.40	14.10	8.84	5.56	3.50	2.21
4000	40.60	25.50	16.10	10.00	6.35	4.00	2.51
4500	45.70	28.70	18.10	11.40	7.15	4.50	2.82
5000	50.10	32.00	20.10	12.60	7.94	5.00	3.14
5500	55.80	35.10	22.10	13.91	8.73	5.50	3.46
6000	61.00	38.30	24.10	15.20	9.53	6.00	3.77
6500	66.00	41.50	26.10	16.40	10.30	6.50	4.08
7000	71.10	44.70	28.10	17.70	11.10	7.00	4.40
7500	76.10	47.90	30.10	19.00	12.00	7.49	4.71
8000	81.20	51.10	23.10	20.20	12.70	7.99	5.03
9000	91.40	57.50	36.10	22.70	14.30	8.99	5.65
10 000	102.00	63.90	40.20	25.30	15.90	9.99	6.28

NOTE: RESISTANCE SHOWN IS ONE WAY. THIS FIGURE SHOULD BE DOUBLED WHEN DETERMINING CLOSED LOOP RESISTANCE.

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