NET SAFETY MONITORING INC.

COMBUSTIBLE GAS DETECTOR
USER MANUAL
UT-P^{+}-SC1100

ISO 9001:2000

QMI REGISTERED

Part Number: MAN-0006-00 Rev 2

Printed in Canada

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This manual is a guide for the use of a Combustible Gas Monitor and the data and procedures contained within this document have been verified and are believed to be adequate for the intended use of the monitor. If the sensor 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.

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Unit I GENERAL INFORMATION

DESCRIPTION

The Uni-Tran SC1100 micro-controller based LEL gas detector provides fast, accurate, continuous and cost effective monitoring of combustible gases in harsh industrial environments.

The SC1100 is a proven, poison resistant, pellistor sensor utilizing active and reference catalytic beads in a Wheatstone Bridge configuration. The Wheatstone Bridge generates a temperature compensated differential voltage, that is proportional to a gas concentration when exposed to a wide range of hydrocarbon gases.

The use of advanced micro-controller technology provides a user interface, that is comprehensive yet very simple to use. The full text LED display gives the user complete instructions for routine operation, calibration and relay configuration with no tools. Pellistor type, catalytic sensors are highly reliable, but in conventional systems the sensing element is damaged when exposed to high concentrations of combustible gas. SensorGuard is a proprietary technology that provides effective protection against this type of damage, thus reducing the need for frequent calibration and enhancing reliability.

FEATURES

- Widely proven Poison Resistant Catalytic Bead sensor technology
- SensorGuard software based protection
- Low power consumption that works with 12 or 24Vdc systems
- Easy, non-intrusive one person calibration
- Sensor can be remotely mounted up to 75 feet from the display module
- Scrolling alpha-numeric LED display available in English, French or Spanish
- Gas specific colour coded enclosure
- Microprocessor based smart transmitter
- Conformal coated circuit boards

TECHNICAL SPECIFICATIONS

Sensor Specifications

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

- Weight:
  0.1 Kg (0.2 lb)

- Enclosure Material:
  Aluminum (optional stainless steel)

- Certifications:
  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

- Range of Detection:
  0 to100% LEL of most hydrocarbons and hydrogen

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

- Response Time:
  <10 seconds to T50 <30 seconds to T90

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

Controller Specifications

- Operating Voltage Range:
  10.5 to 32 Vdc

- Power Consumption (at 24 Vdc):
  Nominal (160 mA, 3.8 Watts)
  Maximum (190 mA, 4.5 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:
  3.2 Kg (7.0 lb)

- Certifications:
  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:
  4-20 mA 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 Output:

  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 or Figure 2*

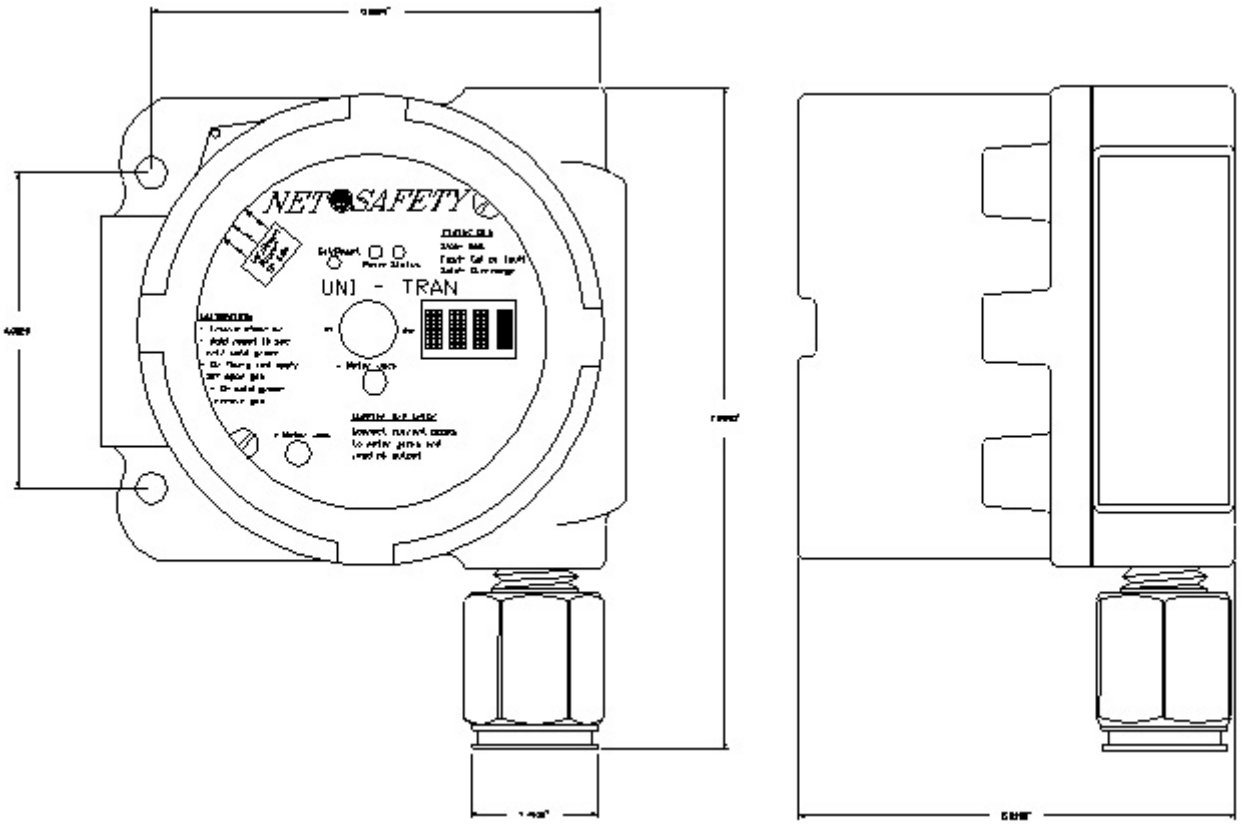


Figure 1 - Dimensions for Adalet Enclosure 4" (Premium Plus)

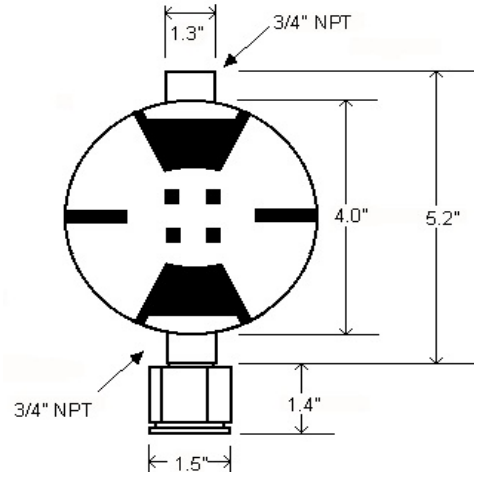


Figure 2 - Dimensions for JB2 and CB4 Sensor Separation Assembly with SC1100 (LEL) Sensor

UNIT II OPERATION OVERVIEW

SENSOR

The sensor uses catalytic oxidation technology designed to measure the concentration of combustible gases in air up to their lower explosive limit. Each sensor is a matched pair of detector and reference elements which are operated in a Wheatstone Bridge circuit. The active element, which comprises a coil of platinum wire embedded within a catalytic bead, is capable of oxidizing combustible gases while the inert reference element compensates for changes in ambient temperature and humidity. The heat generated during the oxidation of combustible gas increases the temperature and resistance of the detector element, producing an out-of-balance signal in the Wheatstone Bridge circuit proportional to the concentration of combustible gas.

Appendix C lists the theoretical 'K' factors by which the signal with a calibration gas should be multiplied to give the signal for other gases.

NOTE:

Figures in Appendix C are theoretical and may differ from sensor to sensor. For best results, each sensors should be calibrated with the gas it is intended to detect.

Unit III SYSTEM INSTALLATION

INSTALLATION

Location of Sensors

There are no absolute rules for determining the quantity and location of gas detection instruments within a particular facility, but care should be taken to locate the sensors in 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 desired. 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 Premium Plus is made up of two primary components. The housing and terminal board are a single assembly to which the input 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 discharge static electricity from your body by touching a grounded metal object before handling the module. Loosen the retaining screws and remove the module carefully from the housing by grasping the centre "pull" knob and pull straight away, then temporarily store it in a clean safe place until field wiring is connected to the terminal board located in the base of the housing.

Mounting

The housing should be oriented so that the sensor is on the underside 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 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.

NOTE

Before opening the particle detector enclosure or junction box, ensure that the area has been declassified, or remove power from the unit.

NOTE

The state of the normally open and normally closed contacts of the relays are reversed when the normally energized option is selected.

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

If the 4-20 mA signal is not being used, connect a jumper between the 4-20 terminal and the Common terminal.

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.

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. 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 drains and conduit 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.

Sensor Separation

The sensor can be installed and wired directly to the UNI-TRAN Premium Plus housing and terminal board as per the wiring diagram (*see Figure 3*) or it may be remotely mounted using a sensor separation kit (JB2 - 4 ASSY) which is composed of a junction box and terminal strip. The sensor and sensor separation kit are then connected to the UNI-TRAN Premium Plus allowing for separations up to 75 feet *(see Figure 4)*.

If greater separations are required the UT-B-SC1100-100-R combustible transmitter can be connected directly to a UNI-TRAN Premium Plus *with a current input terminal board such as the UT-P+-ST1200-100-A (see Figure 5)*. **The UT-P+-SC1100-A does not accept a current input.** A UT-P+-ST1200 or current input terminal board is required.

Initial LED Status

With power applied, check that the green POWER LED is ON, there is a message scrolling on the display and the FAULT/CAL LED is flashing red. After 90 seconds the FAULT/CAL LED will change from flashing red to a short green flash every 2 seconds (confidence blip). During power up, the alphanumeric scrolling display scrolls the message **"Start Delay Uni-Tran Net Safety"**. The analog output will be 3.0mA during the start delay and will change to 4.0mA after the 90 second start delay.

If after the 90 seconds the current is at 2.5mA and a **"Neg. Drift"** message appears on the alphanumeric display or if the current output is any value other than 4.0mA, then the sensor requires calibration.

Observation of the LED status signals, scrolling alphanumeric display and output current levels aid the operator when calibrating the controller as described under CALIBRATION.

There are a variety of English language commands scrolled across the alphanumeric display to supplement

the LED sequences and aid the operator.

Start Delay Uni-Tran Net Safety:	power up delay in progress
Switch On:	magnetic reed switch is activated or manual reset switch is activated
Calibrate Sensor:	mode for calibrating the unit
Auto Cal:	automatic calibration mode
Sensor Fault:	fault present, sensor or sensor wiring failure
Zero Set:	calibration zero gas setting in progress
Apply 50% LEL:	apply 50% calibration gas
Setting Span:	span gas detected, automatic span gas setting in progress
Remove Gas:	remove calibration gas
Fail Span:	calibration span setting failed
Time Out:	calibration failed, no gas detected during calibration
Setting Zero:	setting zero level on controller
Neg. Drift:	excessive negative sensor drift
Set Relay Options:	mode for setting the alarm relay
Review Relay Settings:	mode for reviewing the alarm settings
Set Low:	set low alarm level
Set High:	set high alarm level
Coil Status:	set the coil status for relays
Energized:	relay is normally energized
De-Energized:	relay is normally de-energized
Latch Status:	set the latch status of relays on alarm condition
Latching:	relay latches at alarm condition
Non-Latching:	relay does not latch at alarm condition
Low Alarm Level:	low alarm relay is activated
High Alarm Level:	high alarm relay is activated
Cal. Complete:	Calibration completed successfully

UNI-TRAN PREMIUM PLUS TERMINAL CONNECTION DIAGRAMS

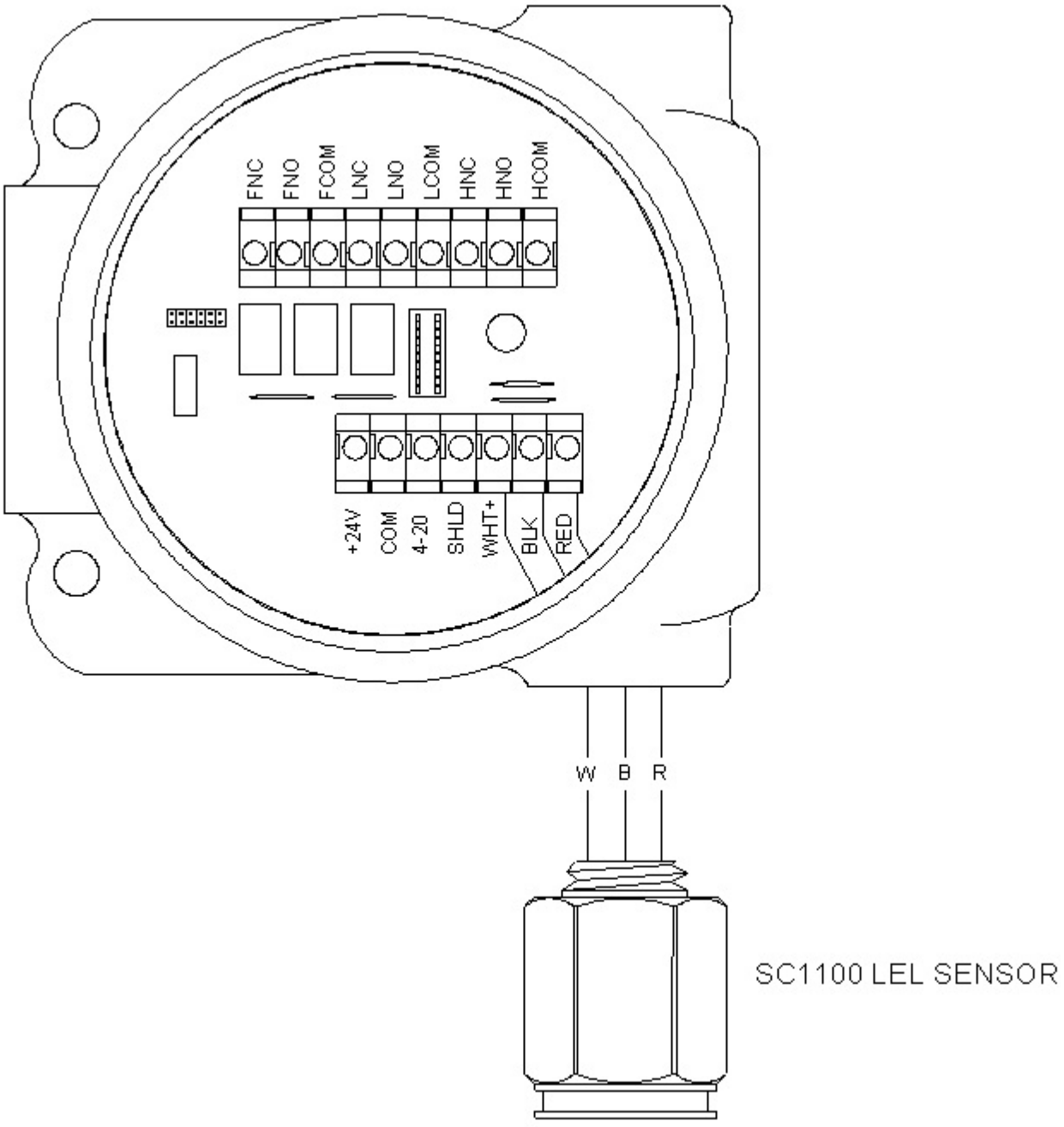


Figure 3 Uni-Tran Premium Plus connection diagram for SC1100 Sensor

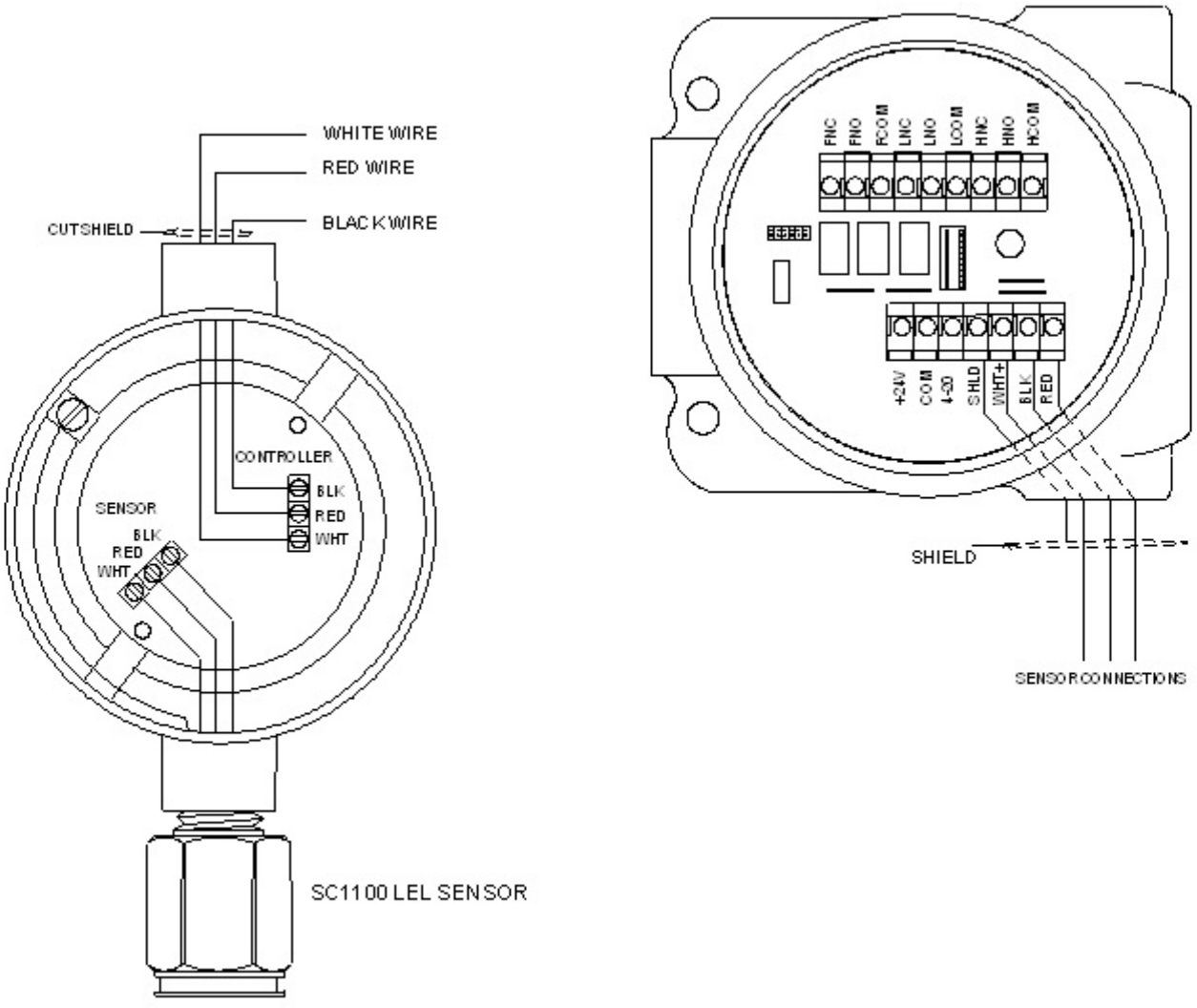


Figure 4 - UNI-TRAN Premium Plus SC1100 Remote Mounting using Sensor Separation

NOTE: **Use a minimum of 18AWG shielded copper instrument wire for separations up to 50 feet and 16AWG for separations up to 75 feet.**

Analog Output

The analog output is precisely controlled by the internal micro-processor and digital to analog converter. Digital control provides the means to include extra features such as automatic calibration and error checking.

The UNI-TRAN Premium Plus may be reset by any of the following four methods.

- Place the magnet on the side of the transmitter enclosure at the 10 o'clock position where marked for 1 second *(see Figure 6)*
- Press and hold the internal reset switch for 1 second
- Press and hold the external reset switch for 1 second
- Momentarily interrupt power to the unit

Sensor Drift

It is a normal characteristic of gas sensors to exhibit a slow drift from zero. When the amount of drift exceeds 10% since the last calibration, the analog output switches to a value of 2.5 mA, the fault relay is activated the alphanumeric display indicates "Neg. Drift" and the red LED flashes until manually reset and the system is re-calibrated. When switched to 2.5mA due to drift, the sensor will still respond and transmit reasonable analog signals if gas is present.

Sensor Life

Sensor response normally deteriorates slowly over a period of several years, depending on exposure, until there is no longer sufficient signal. When this condition occurs, calibration will not be possible, the analog output will lock at 2.5mA, the red status LED flashes and "Sensor Fault" is displayed on the scrolling alphanumeric display. Install a new 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 Premium Plus is equipped with test jacks to facilitate convenient current loop measurements without opening the external current loop. To make current loop measurements use the following procedure:

- Insert the current meter leads into the test jacks
- Apply test gas and take meter readings. Set external devices to bypass if necessary to avoid unwanted alarm response
- Remove meter leads from test jacks

Unit IV SYSTEM SETTINGS

MAIN MENU

The main menu of the UNI-TRAN Premium Plus has three options:

- Calibrate Sensor
- Set Relay Options
- Review Relay Settings

In order to enter the main menu of the controller, place the curved side of the magnet on the side of the enclosure at the 10 o'clock position (see Figure 6) where marked to actuate the magnetic reed switch or press the manual CAL/RESET switch. Release the magnetic reed switch/CAL/RESET switch after the count-down timer has finished counting down from 10 to 0. In the main menu, the options are displayed and prompted for selection by displaying **"YES?"**. Momentarily activate the magnetic reed switch/CAL/RESET switch when the desired option is prompted for selection. If the magnetic reed switch/CAL/RESET switch is not activated the UNI-TRAN Premium Plus will scroll to the next option. When a selection has been made the selection is acknowledged with a flashing **"YES"**. If none of the three options are selected, the UNI-TRAN Premium Plus returns to normal operation mode.

Figure 5 - Magnetic Reed Switch Activation (*Premium Plus Model)*

Summary of Main Menu

Enter Main Menu:	10 second timer count down
First Option:	**Calibrate Sensor**, followed by the **"YES?"** prompt for selection
Second Option:	**Set Relay Option**, followed by the **"YES?"** prompt for selection
Third Option:	**Review Relay Settings**, followed by the **"YES?"** prompt for selection
Exit:	**Return to normal** (if no option selected)

Unit V SYSTEM CALIBRATION

CALIBRATION

The UNI-TRAN Premium Plus **should always be calibrated when first installed in the field**. Response to the input should be checked and if necessary calibration should be performed whenever any of the following occur;

- excess sensor drift is indicated by 2.5mA or 4.4mA current output
- "**Neg. Drift**" is shown on the scrolling alphanumeric display
- when the sensor or transmitter supplying a signal to the UNI-TRAN Premium Plus is added or removed
- whenever the sensor is exposed to high concentrations of gas over full scale

It is necessary to calibrate the UNI-TRAN Premium Plus when it is used as a stand-alone device and connected to other monitoring equipment requiring a precise 4 to 20mA output signal. The following calibration procedure should be followed to ensure an accurate correlation between the 4 to 20mA output signal and the sensor input signal.

Calibration Procedure (use 50% certified calibration gas)

- Be sure the UNI-TRAN Premium Plus 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. It is recommended to flow certified ZERO AIR at a rate of 0.5 litres per minute through the barbed tubing connector on the end of the sensor calibration cup accessory for one minute to ensure clean air is present. If the input device is another transmitter, be sure that it is calibrated and that the input to UNI-TRAN Premium Plus is 4.0mA.

- To enter the main menu, activate the magnetic reed switch or CAL/RESET button. When the countdown from 10 to 0 is complete, remove the magnet from the magnetic reed switch or release the CAL/RESET push button.

- When prompted with **Calibrate sensor** "**YES?"** select the function by momentarily placing the magnet on the reed switch or depressing the CAL/RESET button. The selection is acknowledged with flashing "**YES"**. The controller starts calibration. The following instructions are scrolled across the display for calibration:

- **Setting Zero** - at this time input should be 4.0mA or ZERO gas applied to sensor (3.0mA output current level)

- **Apply 50% LEL** - at this time input should be 12.0mA or 50% span gas applied to sensor (3.3mA output current level)

- **Setting Span** - increasing input signal has been detected (3.3mA output current level)

- **Remove Gas** - at this time input should be reduced to 4.0mA by removing span gas from the sensor (3.6mA output current level)

- **Cal. Complete** - returns to normal operation (4.0mA output current)

NOTE:

If span setting does not complete successfully within ten minutes of starting the calibration sequence, the status LED alternates flashes of RED and GREEN, "Cal. Fail" is displayed on the alphanumeric display and the analog output changes back and forth from 3.0 to 3.3mA. The unit remains in this state until acknowledged by a manual Reset. After manual Reset the program will return to the normal operation mode using previous calibration values. Since the calibration was unsuccessful another attempt may be made or replace the sensor and re-try calibration.

Periodic Response Check

A periodic response check verifies system response and indicates if calibration is necessary.

Take precautions to prevent unwanted shut-downs, then apply calibration gas to the sensor. Observe the response of LEDs, display, analog output, relays and external monitoring equipment. If the UNI-TRAN Premium Plus response is within specified accuracy then it is not necessary to perform a calibration. For example, when 50% span is applied the response is expected to be between 11.5mA (47%) and 12.5mA (53%). Consider the accuracy tolerance of the calibration gas which may be plus or minus a few additional percent.

The UNI-TRAN Premium Plus is designed to provide many years of dependable service, however, sensor input characteristics can shift slightly over time depending on exposure to environmental factors. Under good conditions, initial calibration will be satisfactory for many months. Typically, companies perform response checks at a period of 1 to 6 months. The level of confidence will be proportional to the frequency of system response checks.

Relay Settings

Enter the main menu and activate the magnetic reed switch/CAL/RESET button when prompted for **"Set Relay Options"** with **"YES?"**. The selection is acknowledged with a flashing **"YES"**. The current output will drop to 3.0mA and the micro-processor begins the relay setting procedure. Alarm level, coil energization and latching options are set for each relay in sequence.

STEP 1. The low alarm level is set first. **"Set Low"** is scrolled across the screen followed by the alarm level setting which increases in increments of 5% every 2 seconds. Actuate the magnetic reed switch/CAL/RESET button when the desired level is displayed. The selection is acknowledged by flashing the selected level on the alphanumeric display. The range for the low alarm is 0 to 55. The value increases in increments of 5% from 5 through 55 until an alarm level is selected, or a 5 minute timer expires, in which case the unit returns to normal operation.

STEP 2. The coil condition is set under **NORMAL** status (no alarm present). **"Coil Status"** is scrolled across the alphanumeric display. The display then alternates between **"Energized"** and **"De-Energized"**, each time prompting the user with **"YES?"** for selection. Activate the magnetic reed switch/CAL/RESET button when the desired action is prompted. The selection is acknowledged by flashing **"YES"**.

STEP 3. The relay latching action is set for **ALARM** status. **"Latch Status"** is scrolled on the alphanumeric display. The display then alternates between **"Latching"** and **"Non-Latching"**, each time prompting the user with **"YES?"** for selection. Activate the magnetic reed switch/CAL/RESET button when the desired action is prompted. The selection is acknowledged by flashing **"YES"**. The alphanumeric display alternates between **"Latching"** and **"Non-Latching"** until one is selected, or a 5 minute timer expires, in which case the unit returns to normal operation.

STEP 4. Set the high alarm relay option. **The high alarm relay cannot be set to a value lower than the low alarm relay setting or higher than 55%LEL**. The high alarm level is displayed in increments of 5% greater than the low alarm level selected in step 1 to a maximum of 55% LEL. Activate the magnetic reed switch/CAL/RESET button when the desired level is displayed. The selection is acknowledged by flashing the selected level on the alphanumeric display.

Repeat steps 2 and 3 for setting the high alarm relay coil and latch status.

Review Relay Settings

Enter the main menu and activate the magnetic reed switch/CAL/RESET button when prompted for **"Review Relay Settings"** with **"YES?"**. After the magnetic reed switch/CAL/RESET button has been activated the selection is acknowledged by **"YES"**. The output current will drop to 3.0mA and the relay settings are displayed. First the fault alarm settings are displayed and these are **fixed** as normally **"Energized"** and **"Non-Latching"**, followed by the low alarm settings and high alarm settings. This is a **read-only mode**, thus changes cannot be made in this mode. The settings for all three alarm relays are displayed twice and then the unit returns to normal operation.

SENSOR POISONS AND INHIBITORS

The Net Safety sensor is manufactured with specific resistance to poisoning but any gas sensor may be adversely affected when exposure is prolonged or intense. Poisoning can be caused by compounds containing lead, sulphur, silicones and phosphates which can permanently reduce sensitivity of the sensor.

When a known exposure to poisons or inhibitors occurs, the sensor/transmitter should be checked for accurate response and **if necessary** re-calibrate.

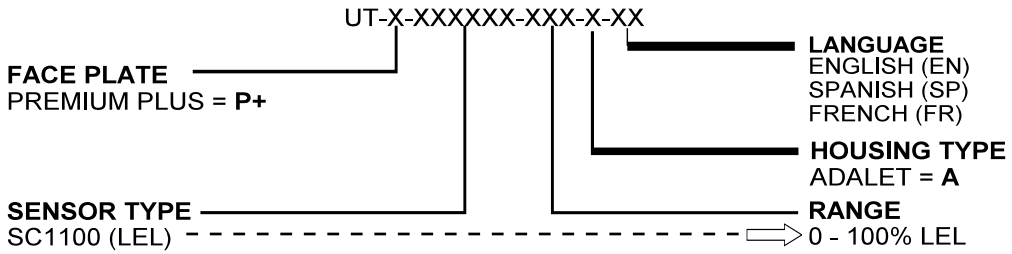
Table 1 - Table of Responses

CONDITION CODES	Current O/P (mA)	Status LED RED	Status LED GREEN	Alphanumeric display Premium Plus
Start-up delay	3	Slow Flash		START DELAY
White sensor lead open	2.5	Solid		SENSOR FAULT
Black sensor lead open	2.5	Slow Flash		SENSOR FAULT
Red sensor lead open	2.5	Slow Flash		SENSOR FAULT
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 of full scale span gas
Span is set, remove gas	3.6		Solid	REMOVE GAS

Return to normal operation	3.6		Solid	CAL COMPLETE
Normal	4		Blip/ blink	0
Gas Present	4.4 - 20.0	Blip/ blink		0 to 100 of full scale

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.

ORDERING INFORMATION



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.

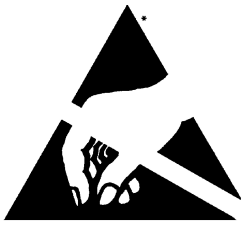
Electrostatic damage can occur in several ways. The most familiar is by physical contact. Touching an object causes a discharge of electrostatic energy that has built up on the skin. If the charge is of sufficient magnitude, a spark will also be visible. This voltage is often more than enough to damage 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	0.08	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.

Appendix C K Factor for Various Gases

$$\text{Signal} = (\%\text{LEL being measured}) \times \frac{(\text{K for gas of interest})}{(\text{K for gas used in calibration})}$$

Example: For an instrument calibrated with Methane and used to detect Propane.

$K_{METHANE} = 112.0$ $K_{PROPANE} = 61.8$

Signal shown for 50%LEL Propane is calculated as follows: Signal = 50% x 61.8 / 112.0 = 27.6%

GAS	K	GAS	K	GAS	K
Acetaldehyde	67.3	n-Decane	36.7	Dimethyl Ether	70
Acetic Acid	60.8	Diethylamine	54.6	Methylethylether	49.3
Acetic Anhydride	51.5	Dimethylamine	64.7	Methylethylketone	46.2
Acetone	57.8	2,3-Dimethylpentane	44.6	Methyl Formate	75
Acetylene	63.6	2,2-Dimethylpropane	44.4	Methylmercaptan	67.9
Alkyl Alcohol	57.1	Dimethylsulphide	48.6	Methylpropionate	57.2
Ammonia	141.7	1,4-Dioxane	50	Methyl n-propylketone	45.4
n-Amyl Alcohol	36.6	Ethane	75.8	Naphthalene	38.1
Aniline	44.1	Ethyl Acetate	57.4	Nitromethane	64.8
Benzene	45.6	Ethyl Alcohol	81.5	n-Nonane	35.2
Biphenyl	28	Ethylamine	58.9	n-Octane	41.9
1,3-Butadiene	62.5	Ethyl Benzene	39.9	n-Pentane	51.3
n-Butane	65.5	Ethylcyclopentane	44.4	iso-Pentane	51.9
iso-Butane	57.8	Ethylene	79.1	Propane	61.8
Butene-1	50.8	Ethyleneoxide	57.9	n-Propyl Alcohol	52.7
cis-Butene-2	54.2	Diethyl Ether	51.8	n-Propylamine	54.1
trans-Butene-2	56.7	Ethyl Formate	49.5	Propylene	57.7
n-Butyl Alcohol	38.4	Ethylmercaptan	62.8	Propyleneoxide	51.2
iso-Butyl Alcohol	59.2	n-Heptane	43.2	iso-Propylether	48.8
tert-Butyl Alcohol	83.1	n-Hexane	41.2	Propyne	46.5
n-Butyl Benzene	35.2	Hydrazine	50.4	Toluene	45.2
iso-Butyl Benzene	35.8	Hydrogencyanide	53.4	Triethylamine	44.6
n-Butyric Acid	42.5	Hydrogen	85.8	Trimethylamine	54.3
Carbon Disulphide	19.8	Hydrogen Sulphide	45.6	Vinylethylether	46.9
Carbon Monoxide	84.4	Methane	112	o-Xylene	40.1
Carbon Oxysulphide	104.6	Methyl Acetate	55.6	m-Xylene	43.8
Cyanogen	99.9	Methyl Alcohol	96.2	p-Xylene	43.8
Cyclohexane	46	Methylamine	86.5		
Cyclopropane	69.7	Methylcyclohexane	49.4		

NOTE:

These figures are theoretical and may differ from sensor to sensor. For best results, each sensors should be calibrated with the gas it is intended to detect.

Return Equipment

A Material Return Authorization number is required in order to return equipment. Please contact Net Safety Monitoring at (403) 219-0688 before returning equipment or consult our Service Department to possibly avoid returning equipment.

If you are required to return equipment, include the following information:

1. A Material Return Authorization number (provided over the phone to you by Net Safety).
2. A detailed description of the problem. The more specific you are regarding the problem, the quicker our Service department can determine and correct the problem.
3. A company name, contact name and telephone number.
4. A Purchase Order, from your company, authorizing repairs or request for quote.
5. Ship all equipment, prepaid to:

Net Safety Monitoring Inc
2721 Hopewell Place NE
Calgary, Alberta, Canada
T1Y 7J7

6. Mark all packages: **RETURN for REPAIR**

Waybills, for shipments from outside Canada, must state:

Equipment being returned for repair
All charges to be billed to the sender

Also, please ensure a duplicate copy of the packing slip is enclosed inside the box indicating item 1-4 along with the courier and account number for returning the goods.

All Equipment must be Shipped prepaid. Collect shipments will not be accepted.

Pack items to protect them from damage and use anti-static bags or aluminum-backed cardboard as protection from electrostatic discharge.

NET SAFETY MONITORING INC.

Distributed By:

2721 Hopewell Place NE

Calgary, Alberta, Canada T1Y 7J7

Telephone: (403) 219-0688 Fax: (403) 219-0694

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