USER MANUAL

iTrans2

FIXED POINT SINGLE OR DUAL GAS MONITOR WITH DUAL ANALOG OUTPUTS

iTRANS 2

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USER MANUAL

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Warnings and Cautionary Statements

CAUTION: Failure to perform certain procedures or note certain conditions may impair the performance of the monitor. For maximum safety and performance, please read and follow the procedures and conditions outlined below.

- Oxygen deficient atmospheres may cause combustible gas readings that use catalytic LEL sensors to be lower than actual concentrations.
- Oxygen enriched atmospheres may cause combustible gas readings that use catalytic LEL sensors to be higher than actual concentrations.
- Calibrate the catalytic combustible gas sensor after each incident where the combustible gas content causes the instrument to enter in the OVER-RANGE alarm condition.
- The catalytic and IR sensors are factory configured to accurately monitor the gas for which they are designated. It should be noted, however, that the LEL sensors WILL respond to other combustible gases and are not gas-specific.
- Silicone compound vapors may affect the catalytic combustible gas sensor and cause readings of combustible gas to be lower than actual gas concentrations. If the sensor has been used in an area where silicone vapors were present, always calibrate the instrument before continued use to ensure accurate measurements.
- Sensor openings must be kept clean. Obstruction of the sensor openings may cause readings to be lower than actual gas concentrations.
- Sudden changes in atmospheric pressure may cause temporary fluctuations in the oxygen readings.
- Alarms relays are non-latching.
- When connecting 4-20 mA outputs to inductive loads, TELEDYNE OLDHAM SIMTRONICS recommends using an isolation barrier in line with the 4-20 mA signal.
- Interior grounding terminal is to be used for grounding, the exterior terminal is only to be used for bonding.
- iTrans2 Stand-Alone versions with on-board visible alarm are to be installed in ordinary locations only; however, remote sensors can be installed in hazardous locations (Gas dependent. Read **Agency Approvals** paragraph).

FOR IR SENSORS:

- The output of the IR sensors can be disrupted by sudden changes in temperature. If there is an excessive change in the ambient temperatures, gas sample temperature or flow rate, then the output signal will be momentarily frozen. Correct operation is restored when the effects of the transient have settled. Rates of change in the ambient temperature should be restricted to 2 °C/minute and gas flow rates kept below 0.6 L/minute.
- Extreme pressure variations will cause errors in readings. The unit should be recalibrated if the atmospheric pressure change is greater than 10% from the original pressure.
- Do not expose the sensor to corrosive gases such as Hydrogen Sulphide.
- Do not allow condensation to occur inside the sensor.
- Infrared combustible sensors are not CSA approved.

CALIBRATION ALERT: Gas detection instruments are potential life-saving devices. Recognizing this fact, calibration for the toxic and catalytic LEL sensors should be at least at quarterly intervals, while the infrared sensor should be calibrated on an annual basis with function test every 6 months.

Further, TELEDYNE OLDHAM SIMTRONICS recommends prudent testing and/or includes calibration after a gas alarm. All calibration service to sensors should be recorded and accessible.

CAUTION: For safety reasons, this equipment must be operated and serviced by qualified personnel only.

Waste Electrical and Electronic Equipment (WEEE directive)

European Union (and EEA) only. This symbol indicates that, in conformity with directive DEEE (2002/96/CE) and according to local regulations, this product may not be discarded together with household waste.

It must be disposed of in a collection area that is set aside for this purpose, for example at a site that is officially designated for the recycling of electrical and electronic equipment (EEE) or a point of exchange for authorized products in the event of the acquisition of a new product of the same type as before.

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1   Overview

1.1   Overview of the iTRANS·2 and iTR2SA Gas Monitor

The iTRANS·2 fixed gas monitor is an independent monitor capable of displaying one or two gas concentrations as well as sensor or instrument specific diagnostics.

The iTRANS·2 comes standard with independent 4-20 mA outputs for each channel, making it ideal for interfacing to control units. A digital ModBus RTU interface is also available, allowing the iTRANS·2 to interface to digital control systems. The iTRANS·2 is available with an optional relay board, allowing the unit to directly control external devices such as fans, pumps, alarm horns, or warning lights. Two of the relays can be programmed for alarm activation, while the third relay is a fault protection relay. Calibration, changing span gas concentration, and checking the instrument's configuration are easily accomplished using the non-intrusive magnetic wand.

The iTRANS·2 is powered with a 24 VDC (12-28 VDC) power supply and provides a 4-20 mA control signal for each sensor.

FIGURE1-1 Typical iTRANS·2 Gas Monitor with Single Gas Sensor (Stainless Steel Option)

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The iTR2SA fixed gas monitor is an independent monitor capable of displaying one or two gas concentrations as well as sensor or instrument specific diagnostics. It has a internal beacon and a sounder controlled by its internal relays.

The iTR2SA comes standard with independent 4-20 mA outputs for each channel, making it ideal for interfacing to control units. A digital ModBus RTU interface is also available, allowing the iTR2SA to interface to digital control systems. Calibration, changing span gas concentration, and checking the instrument's configuration are easily accomplished using the non-intrusive magnetic wand.

The iTR2SA is powered with a 24 VDC (12-28 VDC) power supply and provides a 4-20 mA control signal for each sensor. An external power supply is available in option.

FIGURE1-2 **Typical** iT**R2SA Gas Monitor with Single Gas Sensor**

1.2   Specifications

Specifications for the iTRANS·2 gas monitor are listed in Table 1-1.

Item	Description	
Enclosure	Cast aluminum, poly-bonded coating or 316 stainless steel. Both are explosion-proof, NEMA 4X, IP66 rated.	
Dimensions	5.0 × 6.0 × 5.0 inches (127 x 153 x 129 mm)	
Sensors	Combustible Gases: Catalytic bead	
	Carbon Dioxyde : Non-Dispersive Infrared (NDIR)	
	Oxygen/Toxic Gases: Electrochemical diffusion	
Input Voltage	12-28 VDC operating range (24 VDC typical)	
Input Current (Max)	Toxic Gas/Oxygen	150 mA@24 VDC (single gas)
		200 mA@24 VDC (single gas + HART)
	Combustible Gases (Catalytic)	250 mA@24 VDC, 0.8 A peak (single gas)
		300 mA@24 VDC, 0.8 A peak (single gas + HART)
	Combustible Gases (Infrared)	170 mA@24 VDC, 0.5 A peak (single gas)
		220 mA@24 VDC, 0.5 A peak (single gas + HART)

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Item	Description
Combined Catalytic/Infrared	350 mA@24 VDC, 1.2 A peak (two gas) 400 mA@24 VDC, 1.2 A peak (two gas + HART)
Display	Dual-channel split-screen LED display (4-digit, 7-segment arrangement per channel) provides simultaneous display of one or two gases.
Signal Outputs — Digital	ModBus RTU: RS485 digital communication with ModBus RTU software protocol system at 9600 baud. Three- or four-wire system accommodates over 200 devices in bus configuration. Address selection through on-board 8-position DIP switch. NOTE: ModBus is not to be used for CSA C22.2 No. 152 compliance.
Signal Outputs — Analog	4-20 mA (linear analog)
Alarm Relays — Quantity	3 alarm relays: Two user-programmable relays, SPST, N.O.; plus one fault relay, SPST, N.C.
Alarm Relays — Contact Capacity	5A @ 30 VDC 5A @ 30 VAC
Cable entries	3/4" NPT
Temperature Range	-40 ºC ~ +75 ºC (-40 ºF ~ +167 ºF)
Humidity Range	10% - 90% RH (non-condensing), typical
Pressure	Atmospheric pressure ±10%
Weight	2.9 Kg (6.4 lbs.)

Table 1-1 Specifications for ⓘTRANS·2 the Monitor

Specifications for the iTR2SA gas monitor are listed in Table 1-2.

Item	Description
Enclosure	Cast aluminum, poly-bonded coating. NEMA 4, IP65 rated.
Dimensions	8.5 × 6.5 × 5.0 inches (215 x 165 x 129 mm)
Sensors	Combustible Gases: Catalytic bead Carbon Dioxyde : Non-Dispersive Infrared (NDIR) Oxygen/Toxic Gases: Electrochemical diffusion
Input Voltage	12-28 VDC operating range (24 VDC typical)

Item		Description
Input Current (Max with beacon and sounder on)	Toxic Gas/Oxygen	200 mA@24 VDC (single gas)
		250 mA@24 VDC (single gas + HART)
	Combustible Gases (Catalytic)	300 mA@24 VDC, 0.85 A peak (single gas)
		350 mA@24 VDC, 0.85 A peak (single gas + HART)
	Combustible Gases (Infrared)	220 mA@24 VDC, 0.55 A peak (single gas)
		270 mA@24 VDC, 0.55 A peak (single gas + HART)
	Combined Catalytic/Infrared	400 mA@24 VDC, 1.25 A peak (two gas)
		450 mA@24 VDC, 1.25 A peak (two gas + HART)
Display		Dual-channel split-screen LED display (4-digit, 7-segment arrangement per channel) provides simultaneous display of one or two gases.
Signal Outputs	Digital	ModBus RTU: RS485 digital communication with ModBus RTU software protocol system at 9600 baud. Three- or four-wire system accommodates over 200 devices in bus configuration. Address selection through on-board 8-position DIP switch.
	Analog	4-20 mA (linear analog)
Alarm Relays	Quantity	3 alarm relays: Two relays, SPST, N.O: wired to activate the beacon and the sounder. One fault relay, SPST, N.C: available for the user.
	Contact Capacity	5A @ 30 VDC 5A @ 30 VAC
Beacon		LED, Red colour
Sounder		94 to 106dB(A)@1m – 32 tones
Cable entries		3/4" NPT
Temperature Range		-25 ºC ~ +70 ºC (-13 ºF ~ +158 ºF)
Humidity Range		10% - 90% RH (non-condensing), typical
Pressure		Atmospheric pressure ±10%
Weight		3.15 Kg (6.62 lbs.)

Table 1-2 Specifications for iTR2SA

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Sensor	Gas	Range/Resolution
Combustible Gases	LEL	0 -100% LEL in 1% increments
Hydrogen	H_2	0 - 999 ppm in 1 ppm increments
Oxygen	O_2	0 - 30.0% by Vol. in 0.1% increments
Ammonia	NH_3	0 - 500 ppm in 1 ppm increments
Carbon Monoxide	CO	0 - 999 ppm in 1 ppm increments
Carbon Monoxide/H2 Null	CO	0 - 999 ppm in 1 ppm increments
Hydrogen Sulfide	H_2S	0 - 500 ppm in 1 ppm increments
Sulfur Dioxide	SO_2	0.2 - 99.9 ppm in 0.1 ppm increments
Hydrogen Cyanide	HCN	0.2 – 30.0 ppm in 0.1 ppmincrements
Hydrogen Chloride	HCl	0.2 - 30.0 ppm in 0.1 ppmincrements
Phosphine	PH_3	0 - 1.00 ppm in 0.01 ppmincrements
Nitrogen Dioxide	NO_2	0.2 - 99.9 ppm in 0.1 ppmincrements
Nitric Oxide	NO	0 - 999 ppm in 1 ppm increments
Chlorine	Cl_2	0.2 - 99.9 ppm in 0.1 ppm increments
Chlorine Dioxide	ClO_2	0.02 - 1.00 ppm in 0.01 ppm increments
Carbon Dioxide (IR)	CO_2	0 – 0.50% Vol. in 0.01% increments
Carbon Dioxide (IR)	CO_2	0 – 5.00% Vol in 0.01% increments
Carbon Dioxide (IR)	CO_2	0 – 100% Vol in 1% Vol. increments

Table 1-3 Sensor Ranges

1.3 Agency Approvals

> ⚠️ **iTR2SA versions are not certified to use in Hazardous area.** however, remote sensors can be installed in hazardous locations (Gas dependent. Read **Agency Approvals** paragraph)

The ᴵᵀᴿᴬᴺˢ·² without infrared combustible sensors is certified by CSA, a NRTL laboratory, to the following US and Canadian Standards.

- UL Std No. 916-Energy Management Equipment

- UL Std No. 1203-Explosion-Proof and Dust-Ignition-Proof

- Electrical Equipment for Use in Hazardous (Classified) Locations

- UL Std No. 1604-Division 2 Hazardous Location Electrical Equipment

- ISA S12.13 Part I-2000-Performance Requirements, Combustible Gas Detectors (iTrans 2 with catalytic sensors only)

- CSA Std C22.2 No.30-M1986-Explosion-Proof Enclosures for Use in Class I Hazardous Locations

- CSA Std C22.2 No.142-**M1987**-Process Control Equipment

- CSA Std C22.2 No. 152-M1984-Combustible Gas Detection Instruments (iTrans 2 with catalytic sensors only)

- CSA Std C22.2 No. 213-M1987-Non-incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations

Marking: Transmitter   Class I, Div 1, Groups B, C, D – AEx d IIB + H2 T5
        Sensor*(gas dependent)*   [1]Class I, Div 1, Groups B, C, D – AEx d IIB + H2 T5
                       [2]Class I, Div 2, Groups A, B, C, D – AEx d IIB + H2 T5

The ᴵᵀᴿᴬᴺˢ·² is certified under the IECEx scheme to:

- IECEx 60079-0 – Explosive Atmospheres – Part 0: General requirements
- IECEx 60079-1 – Explosive Atmospheres – Part 1: Equipment protection by flameproof enclosures 'd'

Marking: Transmitter   Ex db IIB+H2 T5; IP66
        Sensor : **LEL, H₂, O₂, CO, H₂S, SO₂, HCN, PH₃, NO₂, NO, CO₂**
                 Ex db IIB+H2 T5 ; IP66
        Sensor : **Cl₂, HCl, NH₃, ClO₂** : NO ATEX-NO IECEx ; IP65

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[1] LEL, H_2, O_2, CO, H_2S, SO_2, HCN, PH_3, NO_2, NO, CO_2
[2] Cl_2, HCl, NH_3, ClO_2

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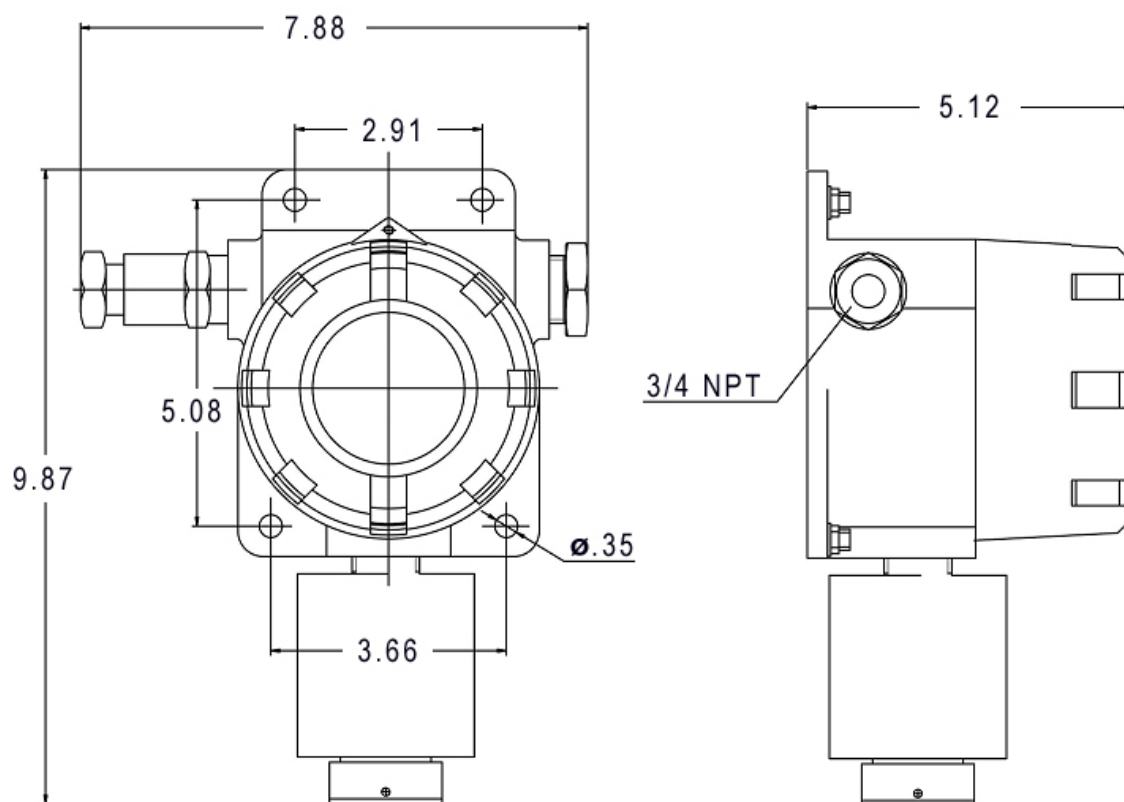
2   Hardware Overview

2.1   Main Electronics Unit (Housing)

The ⌐TRANS·2⌐ body is a cast aluminum housing that contains the electronics of the gas monitor. Details of a single-gas housing are shown in

FIGURE 2-1.

NOTE: Dimensions are in inches.

FIGURE 2-1 Details of a Single-Gas ⌐TRANS·2⌐ Gas Monitor

2.2   Sensor

Item	Descriptions
Sensor Housing Material	Aluminum, Anodized, Explosion-proof: Class I, Divisions 1 and 2, Groups B, C, D and Ex d IICT6 Gb (China) and Ex d IIB + H_2 T5 (IECEx)
	Aluminum, Anodized w/Gore-Tex Membrane: Class I, Division 2, Groups A, B, C, D (NOT ATEX and IECEx compliant)
Dimensions	3.0 × 3.0 inches (76 × 76 mm)
Accuracy	< ± 3% Toxic and Oxygen For Combustibles: For test gas concentrations up to and including 50% of full scale, the deviation shall not exceed ±3% of full scale gas concentration. For test gas concentrations above 50% of full scale, the deviation shall not exceed ±5% of full scale gas concentration.
Protection Class	IP 66 or NEMA 4X

Table 2-1 Sensor Specifications

2.3   Display

The iTRANS·2 gas monitor has a 4-digit, 7-segment LED display for each of 2 channels. A dual-gas iTRANS·2 sensor and sample display are shown in FIGURE2-2.
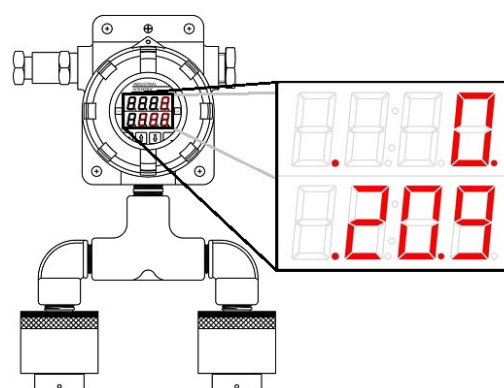
FIGURE2-2 The iTRANS·2 Display (Dual-Gas Monitor Shown)

2.4   Inputs – Intrusive and Non-Intrusive

The iTRANS·2 gas monitor can be configured using intrusive and non-intrusive means. Both methods of configuration are accomplished through physical inputs that are visible behind the glass panel of the gas monitor.

A set of four keys are used when intrusive programming is appropriate (i.e., when the enclosure can be removed and when the keys can be manually pressed). These keys are the mode, increment (+), decrement (-), and enter keys. Refer to

FIGURE 2-3.

For applications that require non-intrusive manipulation, two magnetically-activated reed switches are used to accomplish programming without removing the cover. A magnetic wand is positioned over the appropriate reed switch (above the glass face plate) without the wand physically touching the reed switches. The locations of the reed switches are shown in

FIGURE 2-3.
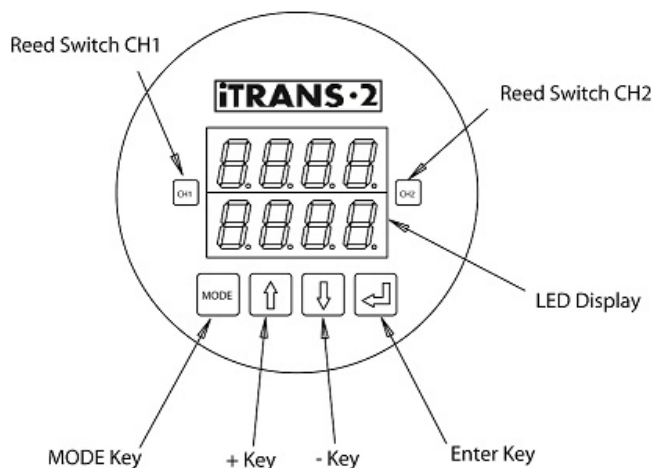
FIGURE 2-3 Locations of ⁱᵀᴿᴬᴺˢ·² Input Keys and Reed Switches

Programming the ⁱᵀᴿᴬᴺˢ·² gas monitor in both intrusive and non-intrusive modes is explained in detail in Chapter 5.

2.5   Electronics Modules

The electronics module of the ⁱᵀᴿᴬᴺˢ·² gas monitor contains connectors and jumpers for wiring and configuring the device. The electronics module for a main ⁱᵀᴿᴬᴺˢ·² unit is shown in FIGURE 2-4. The electronics module for a remote unit is shown in

FIGURE 2-5. Wiring details are explained in 4 System Wiring.
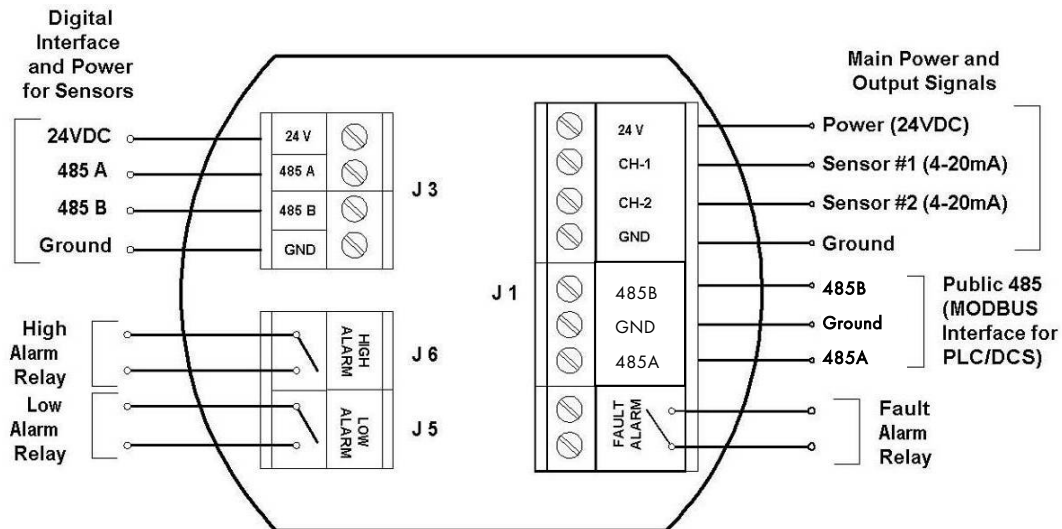
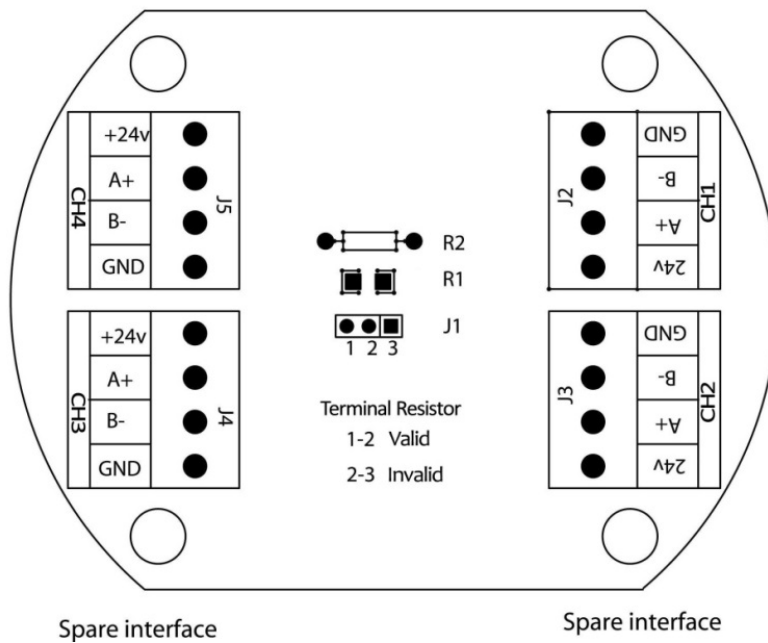FIGURE 2-4 Electronics Module for iTRANS·2 (Main Unit)

FIGURE 2-5 Electronics Board for iTRANS·2 Remote Sensor

3 Installation

3.1 Introduction

The ⟨iTRANS·2⟩ can be mounted in one of two ways. The unit can be wall-mounted using the wall mounting holes in the enclosure, or it can be mounted onto a column using U-bolts. Each of these options is discussed in this chapter. Be sure to review the installation considerations before mounting the ⟨iTRANS·2⟩ gas monitor.

3.2 Installation Considerations

Regardless of the installation type (wall mounting or column mounting), the ⟨iTRANS·2⟩ should be installed at or near the location of a possible leak or the source of emissions. Installation height depends on the density of the gas being monitored. Moreover, speed and direction of air flow, and relative position to potential leaking points should also be considered.

IMPORTANT: The ⟨iTRANS·2⟩ gas monitor must not be installed on vibrating or heat generating sources.

3.3 Wall Mounting

If your application is best addressed using a wall-mounted gas monitor, then use the four 8 mm mounting holes in the enclosure to secure the ⟨iTRANS·2⟩ to an appropriate location on the wall. Refer to FIGURE 3-1.

3.4 Column Mounting

If your application is best addressed using a column-mounted gas monitor, then use the four 8 mm mounting holes and two U-bolts to secure the ⟨iTRANS·2⟩ to an appropriately located segment of a target pipe or conduit. Refer to FIGURE 3-2.
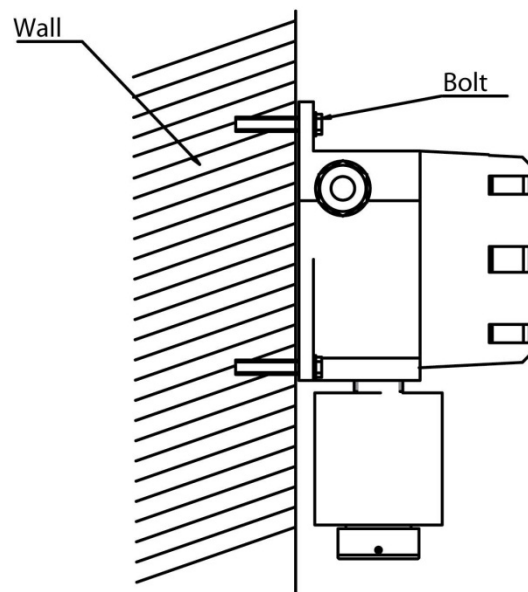
FIGURE 3-1 Mounting the iTRANS·2 Gas Monitor on a Wall
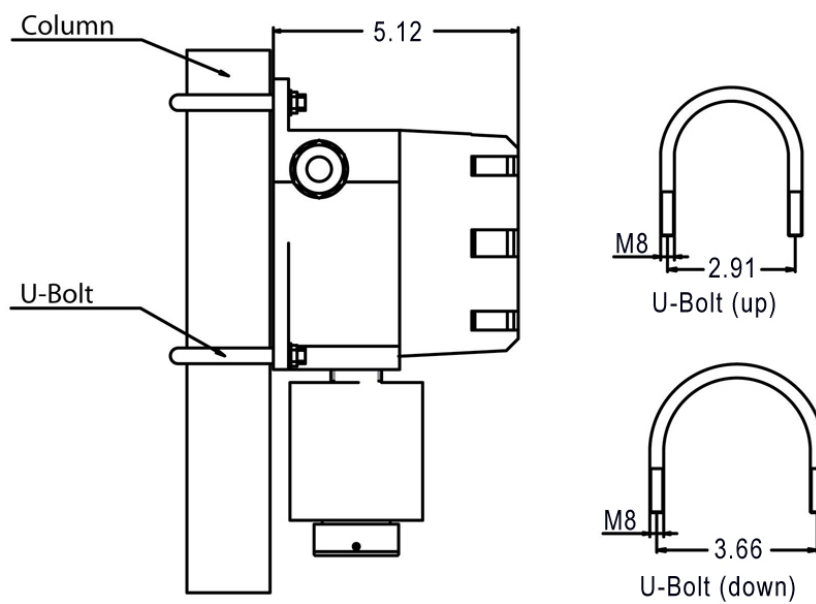
FIGURE 3-2 Mounting the iTRANS·2 Gas Monitor on a Column Using U-Bolts

4 System Wiring

4.1 Introduction

This chapter outlines the steps required for wiring the `ITRANS·2` gas monitor. These steps include the following:

- Wiring Preparation
- Sensor Wiring
- Alarm Relay Wiring
- Power and Output Wiring
- ModBus Interface Wiring

Each of these steps is outlined in the sections that follow.

IMPORTANT: Perform all wiring in accordance with local electrical codes and local authorities having jurisdiction.

IMPORTANT: DC signal and AC power should not be run in the same conduit.

NOTE: All field wiring colors are arbitrary (unless provided by TELEDYNE OLDHAM SIMTRONICS).

4.2 Wiring Preparation

1. Collect the appropriate types and lengths of wire.

   - For control wire, use #18 AWG (0.9 mm²) insulated, shielded cable.
   - For analog signal and power wire, use three-conductor (or four-conductor for dual channel) #18 AWG (0.9 mm²) insulated and shielded cable.
   - For digital ModBus signal and power, use a minimum of five-conductor #18 AWG (0.9 mm²) insulated and shielded cable.

2. Power down the unit.

3. Unthread the windowed top from the housing.

4. Gently pull out the electronics module and place it safely to the side of the unit.

5. Thread control, signal, and power wires into the transmitter housing.

6. Shielding from either the controller or remote sensors should be bonded to the enclosure screw located inside the `ITRANS·2`.

IMPORTANT: Use of this product in areas where it may be subject to large amounts of electromagnetic interference may affect the reliable operation of this device and should be avoided.

WARNING: Supply wire with a minimum rating of 90°C must be used for interconnection to the iTRANS·2 .

NOTE: For classified locations, a "poured" wire seal must be installed within 18 inches (457mm) of the main unit for both power entry and remote sensors.

NOTE: Remove power from the iTRANS·2 before making any wiring connections.

4.3 Alarm Relay Wiring (J1, J5, and J6)

To connect the iTRANS·2 control wires to the three relay terminals on the relay board, wire the unit to the connectors shown in FIGURE 2-4. The low alarm relay is activated when the low alarm threshold is met. This is a non-latching, Normally Open (NO) contact. The high alarm relay is activated when the high alarm threshold is met. This is a non-latching, Normally Open (NO) contact. The fault alarm relay is activated upon power-up of the iTRANS·2 . When the fault condition is met, the circuit opens. This is an Electronically closed (NC) contact. See FIGURE 4-1 for relay wiring.

NOTE: It is recommended that on-board relays should not be used to drive loads directly. On-board relays should be used to drive a secondary, higher-power relay which is connected to the control device (e.g., strobe, siren, exhaust fan, etc.).
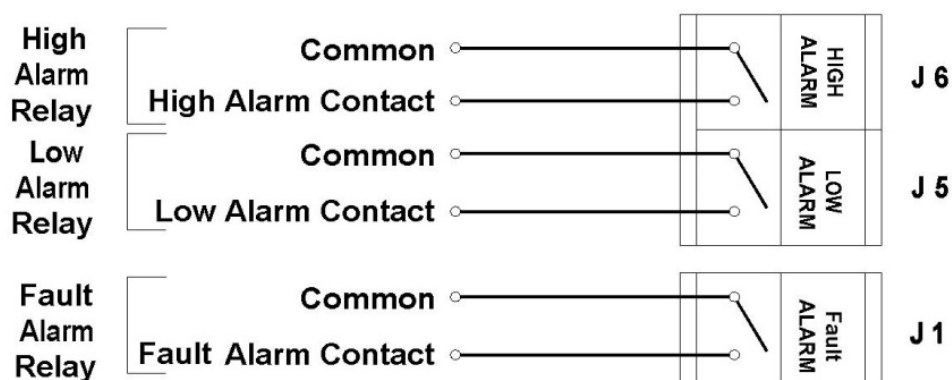
FIGURE 4-1 Alarm Relay Connectors J6, J5 and J1

4.4   Power and Output Wiring (J1)

Connect the ⓘTRANS·2 power and signal wires to the appropriate wiring terminals as follows.

- **24 V:**Connect 24 VDC (12-28 VDC) supply power
- **CH 1:**Channel 1, 4-20 mA output signal
- **CH 2:**Channel 2, 4-20 mA output signal
- **GND:**DC return
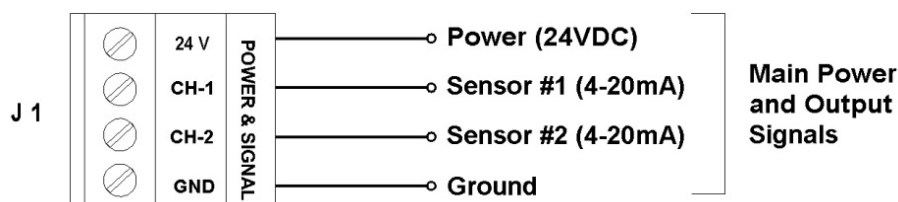
FIGURE 4-2 Power and Signal Connector J1 on the ⓘTRANS·2

NOTE: Use supplied green conductor for enclosure ground. Public 485 GND is to be used for ModBus digital ground.

NOTE: The ⓘTRANS·2 is a 3- or 4-wire 4-20 mA device. For dual sensor configuration you must have a second 4-20 mA signal wire pulled to the unit.

NOTE: When not using 4-20 mA outputs, use the supplied resistors to connect CH-1 and CH-2 to GND. If these resistors are not connected and the 4-20 mA outputs are not used, a "P" will appear on the display, indicating an open loop condition.

4.5   Sensor Wiring (J3)

Connect the ⓘTRANS·2 sensor wires (for on-board, remote or stand-alone) to the appropriate wiring terminals as follows.

- **24 V:**Red wire from sensor head
- **485A:**Yellow wire from sensor head
- **485B:**Black wire from sensor head
- **GND:**Green wire from sensor head

NOTE: Shielding from either the controller or remote sensors should be bonded to the enclosure screw located inside the ⓘTRANS·2.

NOTE: The 24 V terminal supplies 24 VDC to the sensor for power. This terminal should not be connected to the output of a 24 VDC power supply.
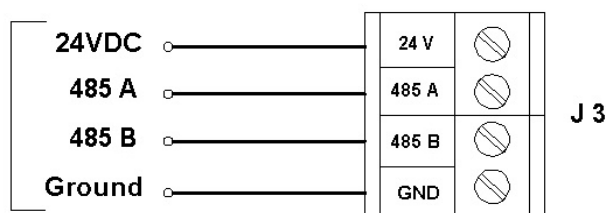
FIGURE 4-3 Sensor Connector J3 on the iTRANS·2

NOTE: For dual-sensor configurations, place both of the same colored wires in the appropriate terminal block and firmly tighten.

NOTE: Use #18 AWG (0.9 mm²) shielded cable for remote sensors. Maximum distance is 200 meters.

NOTE: When wiring remote sensors to the iTRANS·2, "485 B" on J3 should be connected to "B-" in the remote sensor enclosure, and "485 A" on J3 should be connected to "A+" in the remote sensor enclosure.

NOTE: For remote or standalone sensors, there are four terminal blocks located in the remote sensor housing. These terminal blocks are all tied together and follow the same wiring scheme mentioned above.
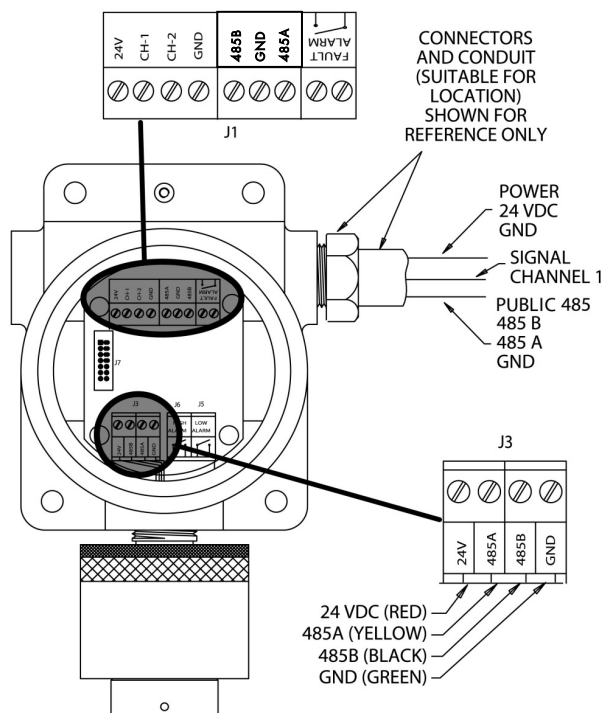
FIGURE 4-4 Wiring Diagram for a Single On-board Sensor
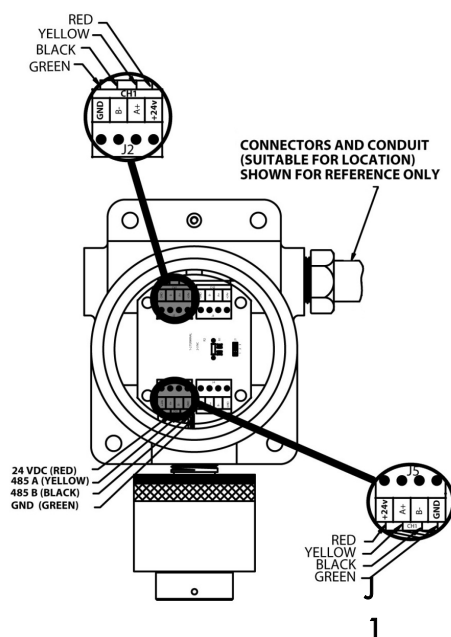
FIGURE 4-5 Wiring Diagram for a Remote Sensor (Stand Alone)

NOTE: When the remote sensor is at distances of 200 meters or further, and the sensor is not communicating, the jumper J1 may need to be moved to terminals 1-2.

NOTE: If using remote sensors and the ⌐TRANS·2⌐ does not recognize the sensor upon power up (displays a sensor fault), check the placement of this jumper. If the jumper J1 is on terminals 1-2, move the jumper to terminals 2-3.

For digital ModBus signal and power use a minimum of 4 conductors #18 AWG (0.9 mm²) insulated and **shielded** cable.

Shielding from either the controller or remote sensors should be bonded to the enclosure screw located inside the ⌐TRANS·2⌐.
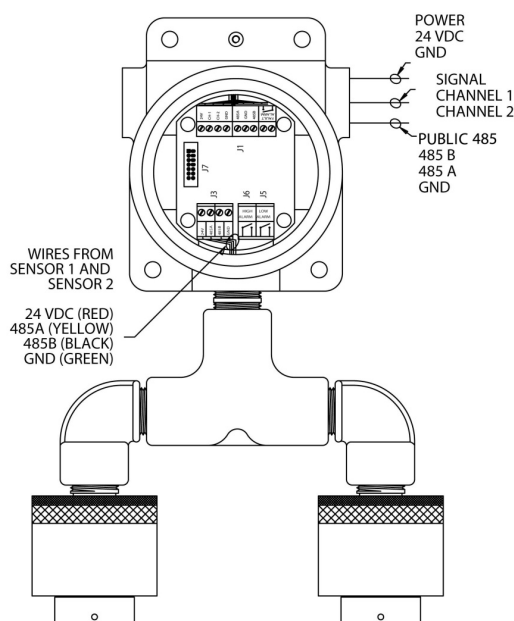
FIGURE 4-6 Wiring Diagram for Dual On-board Sensors
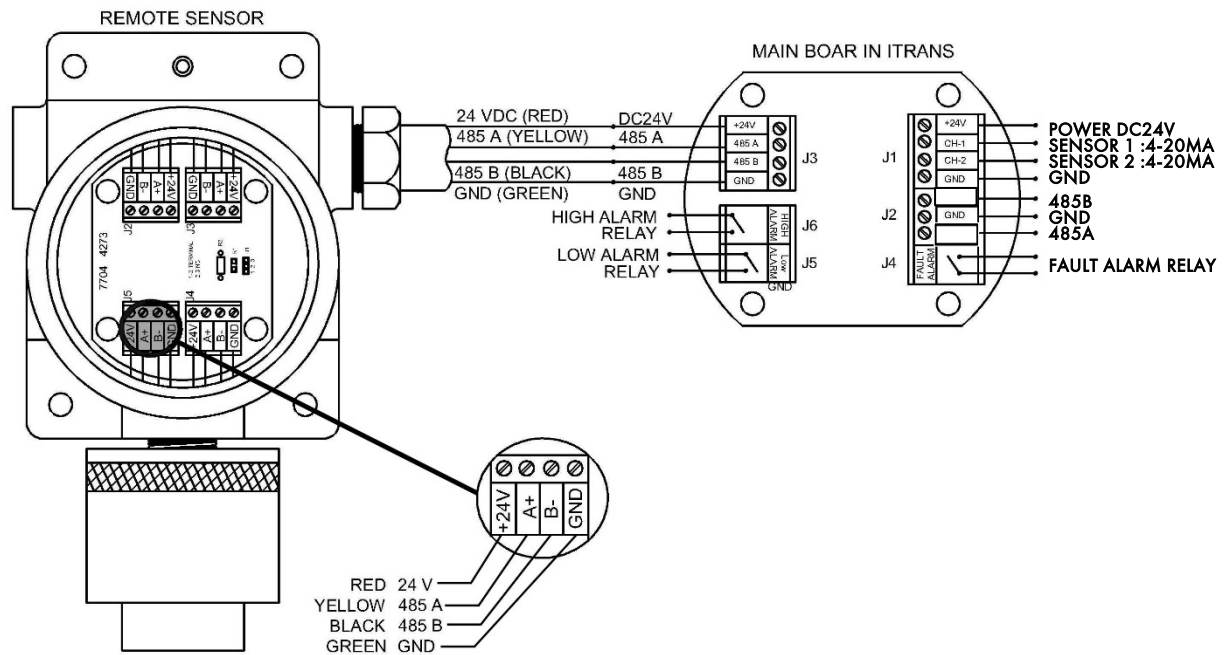
FIGURE 4-7 Wiring Remote Sensors Back to iTRANS·2
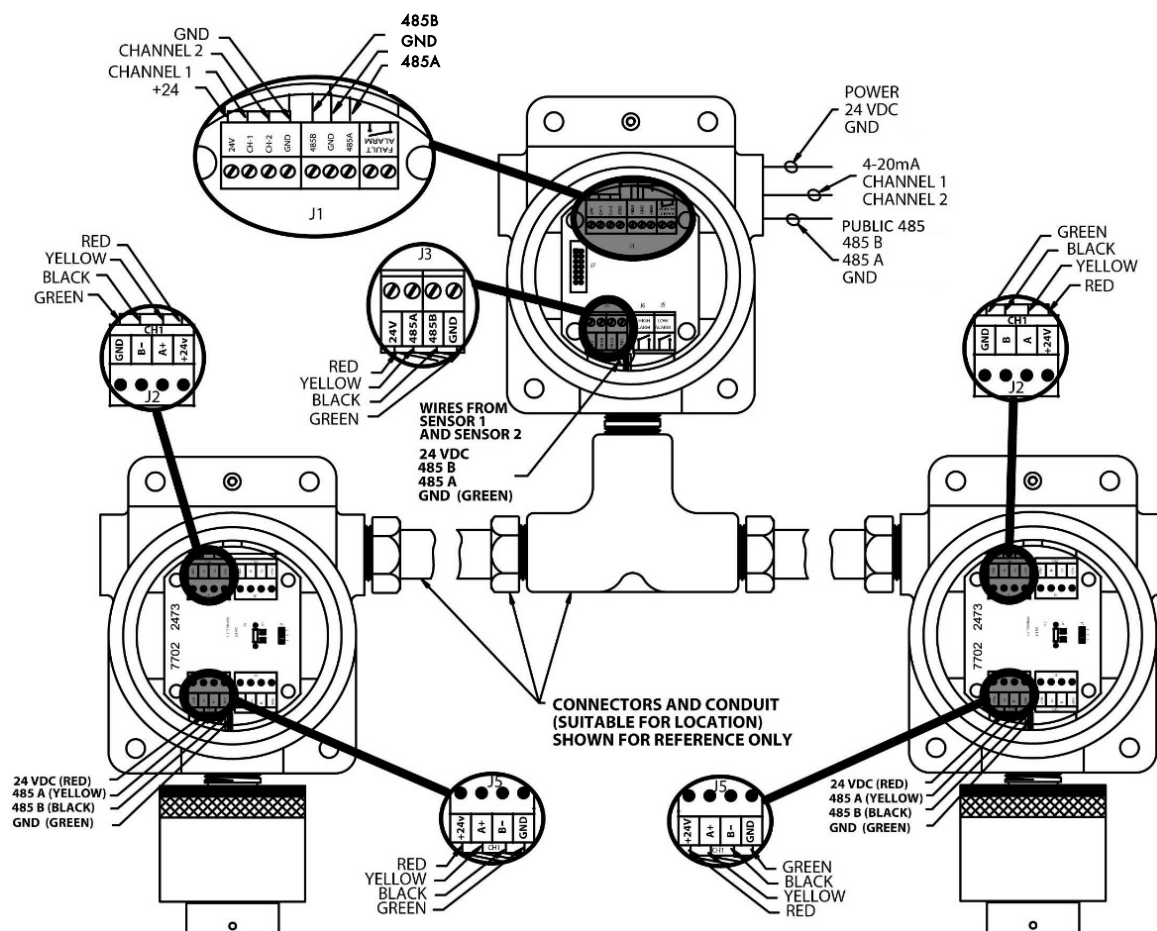
FIGURE 4-8 Wiring Dual Remote Sensors

4.6   Digital ModBus RTU Interface Wiring (J1)

4.6.1 ModBus Interface Wiring Overview

To interface the ⬚TRANS·2 to a digital controller, PLC, or HMI, connect the power and ground to the appropriate terminals mentioned above. The digital signals are wired into the RS485A and RS485B terminals on the board. See FIGURE 4-9.
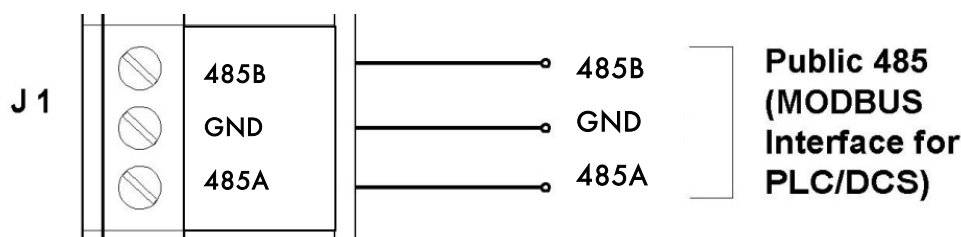
FIGURE 4-9 Wiring Diagram for the ModBus Interface

4.6.2 Setting the ModBus Address on the ⬚TRANS·2

Located on the back of the electronics module is an 8-position DIP switch. This switch bank is used to set the ModBus Slave Address for the ⬚TRANS·2 unit. The address can be set from 1 to 255. Use the DIP switches to set the binary representation of the desired address. 1 is bit zero, and 8 is bit 7. ON represents a 1, and OFF represents zero. Refer to Appendix B for hex-to-decimal equivalents.
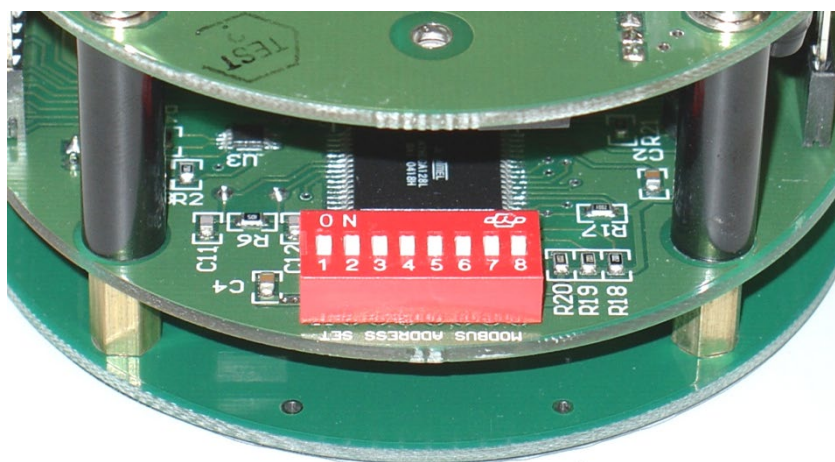
FIGURE 4-10 Switch Bank for Setting ModBus Slave Address
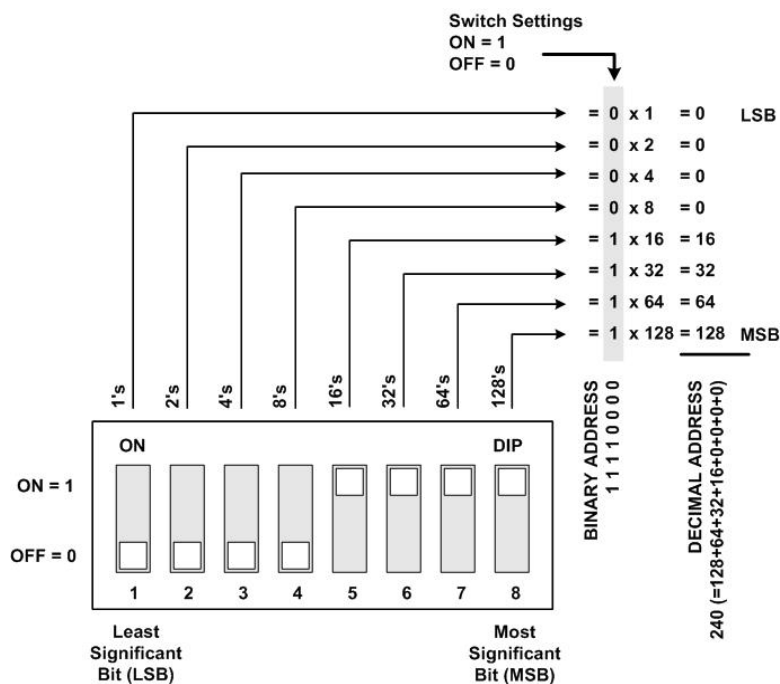
FIGURE 4-11 Setting the ModBus Address (Example Address of 240 Decimal)

4.6.3 Setting the ModBus Address for Stand-Alone Sensors

NOTE: This section is only necessary if you are connecting a sensor directly to a ModBus controller, PLC, or digital system.

For stand-alone sensor heads used in a ModBus network, the address is set in the same manner. Once the aluminum sensor head is removed with the sensor board, the sensor electronics module is exposed. On the back of the sensor electronics module is a small 8-position DIP switch. The address can be set from 10 to 255 in a similar manner as setting the ModBus address on the iTRANS·2 except pin 8 on the sensor's 8-position DIP switch is the least significant bit, and pin 1 is the most significant bit.
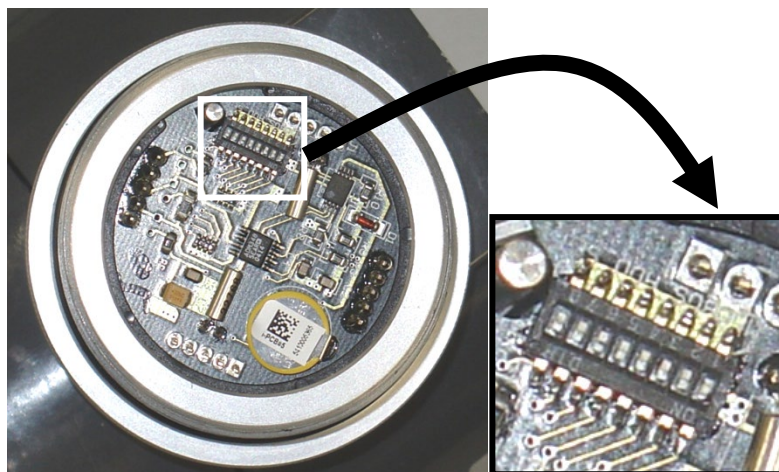
FIGURE 4-12 Location of Address DIP Switch on Sensor Electronics Module
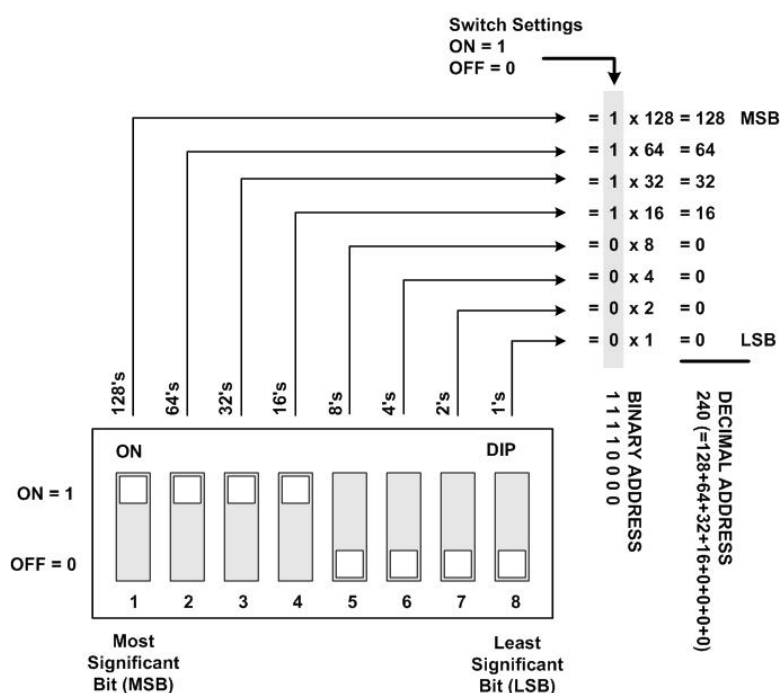
FIGURE 4-13 Setting the ModBus Address for a Stand-Alone Sensor

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NOTE: If adding a second sensor to an existing module, set the ModBus address to ↑↑↑↑↓↓↓↓ which represents 11110000 binary (and 240 decimal). See 6 for more information on the ModBus interface. (Note that DIP switches are pre-set at the factory for all dual-sensor units).

4.7   Wiring Conclusion

Once wiring is complete, place the ⬚TRANS·2 electronics module back in the housing by pressing the standoff banana jacks into the mating plugs. Be careful not to pinch any of the wiring. After the module is in place, secure the windowed top back on the housing and power up the unit.

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5   Operation

5.1   Initial Start-up

Once power is applied (12-28 VDC), the ⎡TRANS·2⎤ is operational. The LED display powers up, and the system enters a start-up period. During this start-up period, the ⎡TRANS·2⎤ identifies the sensors that are connected and then enters a three minute warm-up period.

5.2   Warm-up Period

During this warm-up period, the 4 20 mA outputs are limited to 3 mA (16 mA for oxygen). After the three minute warm-up, the unit will enter the Normal Operating Mode. If during the warm-up period, the unit fails a self test, the display will show a fault code, and the fault relay will be activated. Fault codes are located in 8.

FIGURE 5-1 Sample Fault Code Display

5.3   Normal Operating Mode

In Normal Operating Mode, the ⎡TRANS·2⎤ gas monitor will display the instantaneous readings for each sensor wired into the unit. The top of the ⎡TRANS·2⎤ display shows the gas reading for Sensor 1. Sensor 1 should have the internal dip switches set to 00 hex or 0F hex. The bottom row of the ⎡TRANS·2⎤ display shows the gas reading for Sensor 2. Sensor 2 should have the internal dip switches set to F0 hex.
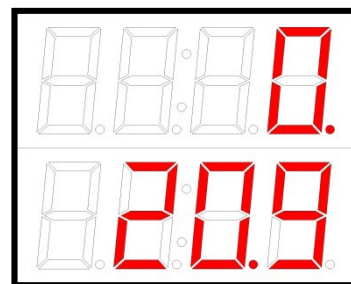
FIGURE 5-2 Sample Dual-Sensor Display

As gas concentrations increase, the respective channel's readings will respond accordingly. If low or high alarm levels are exceeded, an alarm indication will appear in the first digit of the display. An "L" indicates a low alarm while an "H" indicates a high alarm. If a 4-20mA fault occurs, either a "P" indicating an open loop, or an "U" indicating 4-20 over-range will be present. From the Normal Operating Mode, the iTRANS·2 can enter into the program mode in one of two ways.
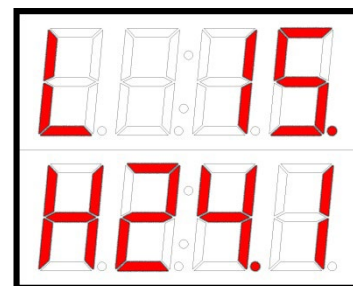
FIGURE 5-3 Sample Low and High Alarm Displays

To enter the Program Mode without opening the enclosure, pass over the embedded reed switch located under CH1 with the magnetic wand (see FIGURE 5-4). This will enter you into the non-intrusive program mode.

In this mode you can check sensor type, zero the unit, calibrate the unit, change the span gas value, and view sensor span. With the enclosure top removed, Program Mode can be entered using the "MODE" key. The available functions are listed in 8 Troubleshooting.
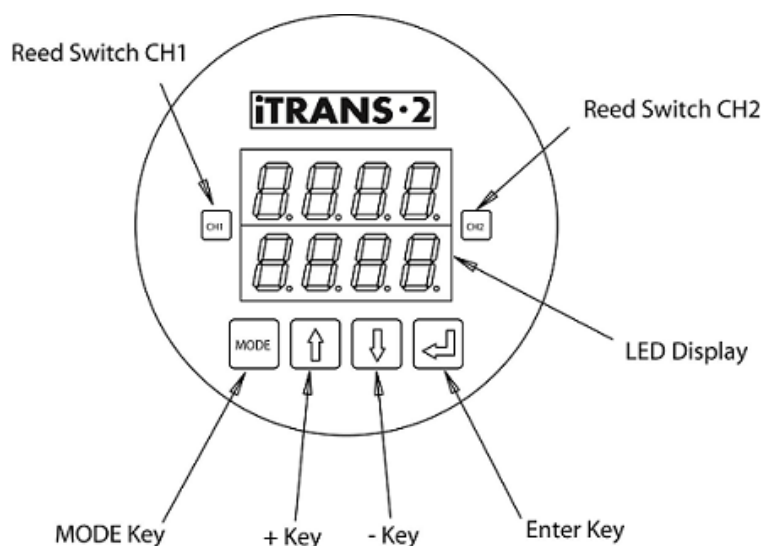
FIGURE 5-4 Locations of Reed Switches and Push Buttons

5.4 Programming Mode Overview

NOTE: Zeroing and calibrating the instrument can be accomplished one of two ways via programming mode. Zeroing and calibrating (as well as other programming options) can be entered either from the keypad or non-intrusively using the magnetic wand. Refer to the sections and subsections within this chapter for detailed information.

When in the Programming Mode, either via the magnetic wand or keypad operation, the top line of the main display area shows a status bit and three data bits. The bottom line of the display shows the timers (see FIGURE 5-5). The decimals on the far right of each line of the display are channel indicators. The top decimal indicates channel 1 is being programmed, and the bottom decimal indicates channel 2.
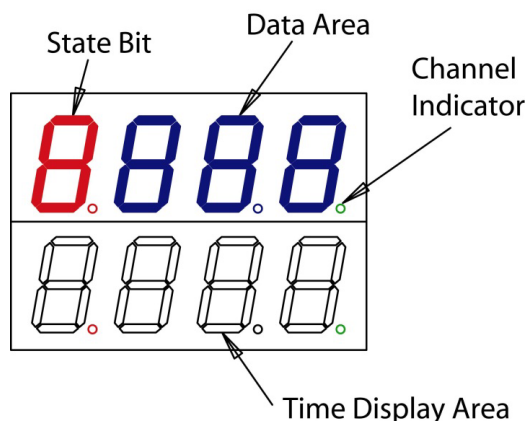
FIGURE 5-5 Components of the Display

5.5   Programming Mode – Non-intrusive Operation

5.5.1 Introduction

Non-intrusive calibration and programming is accomplished using a magnetic wand that comes with the ⌊TRANS·2⌋ unit. Placing the magnetic wand over the embedded reed switches located under the CH1 and CH2 designations (see FIGURE 5-4) of the faceplate will allow you to scroll through menus and enter the desired function. The functions available through non-intrusive operation are as follows.

- Sensor Type
- Zero
- Calibration
- Span Gas Value
- Span Reserve (in this order)

NOTE: Please see the 8 for a complete list of functions and function codes.

5.5.2 Sensor Type

To enter non-intrusive operation during the Normal Operating Mode, place the magnetic wand over the CH1 designation. The iTRANS·2 will display the sensor type for channel 1 for 5 seconds then enter in the Zero Menu.

NOTE: If you want to operate channel 2, place the magnetic wand on CH2 first to enter the setup menu.

Once non-intrusive mode is entered, placing the magnetic wand over CH1, will allow scrolling through all of the functions that are available. Once the desired function is reached, a 10-second timer will appear on the bottom row of the LED display. During this 10-second time out, if the magnetic wand is placed over CH2, that function is entered. Once a function is entered, a new timer will appear.
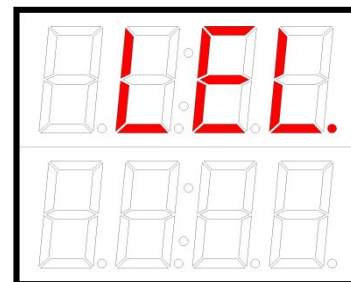
FIGURE 5-6 Sample Display Entering Non-Intrusive Mode

5.5.3 Zeroing

Zeroing is the first option in the setup menu. A "0 " is displayed in the status bit of the display to designate this function. A 10 second timer is displayed on the bottom line of the LED display. To initiate zeroing, place the magnetic wand over CH2 during the 10-second countdown. If you do not initiate zeroing during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode. To abort zeroing at any time, place the magnatic wand over CH1.

If you initiate zeroing, the status bit will start to flash. Once zeroing is complete, the unit will return to the Normal Operating Mode.
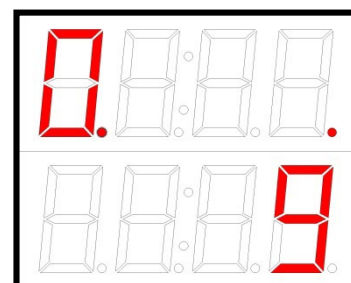
FIGURE 5-7 Sample Zeroing Display

5.5.4Calibration

Calibration is the next available option. Calibration is designated with a "C" in the status bit. A 10 second timer is displayed on the bottom line of the LED display. To initiate calibration, place the magnetic wand over CH2 during the 10-second countdown. If you do not initiate calibration during the 10-second countdown, the ⏻TRANS·2⏻ will return to the Normal Operating Mode. If you initiate calibration, the status bit will start to flash and the ⏻TRANS·2⏻ will enter the zeroing process.
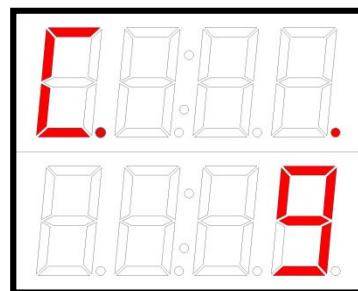
FIGURE 5-8 Sample Calibration Display

NOTE: Before the ⏻TRANS·2⏻ will calibrate, the unit will enter the zeroing process. Please make sure that you apply Zero Air to the instrument while it is zeroing.

The ⏻TRANS·2⏻ will automatically zero before calibration. Zeroing is designated with a flashing "0" in the status bit. Once zeroing is complete, the iTRANS·2 will automatically enter the calibration routine. Calibration is designated with a flashing "C" in the status bit.

After zeroing finishes, the ⏻TRANS·2⏻ is ready to calibrate. When the flashing "C" appears on the display, apply calibration gas. As the ⏻TRANS·2⏻ responds to the gas, the current reading will be displayed on the top line of the LED display. To abort calibration at any time, place the magnetic wand over CH1.
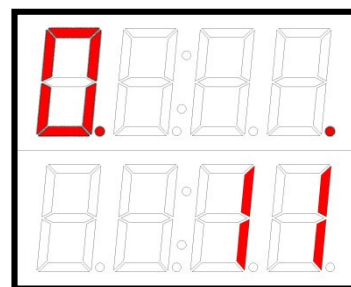
FIGURE 5-9 Sample Zeroing Display

NOTE: Check and verify span setting before starting a calibration.

NOTE: See Appendix D for a complete list of factory default span gases.
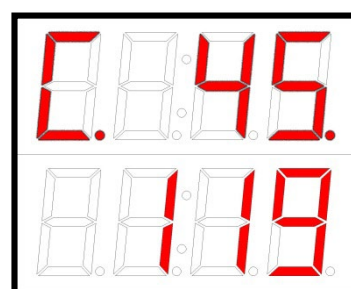
FIGURE 5-10 Apply CalGas Display

NOTE: Flow rate for calibration is 0.5 liter per minute (LPM) except for NH_3, ClO_2, Cl_2, NO_2, SO_2, and HCl which require 1.0 LPM.

5.5.5 Changing Span Gas Concentration

The option after calibration is Span Gas Concentration. The span option is designated with a flashing "S" in the status bit with the current span value next to it. To change the span value, place the magnetic wand over CH2 during the 10-second countdown. If you do not place the magnet over CH1 during the 10-second countdown, the ⌈iTRANS·2⌉ will return to the Normal Operating Mode. If you initiate the change span option, the status bit will start to flash and the ⌈iTRANS·2⌉ span value can now be changed.

The current span value is displayed on the top line of the LED display. To increment the span value, pass the magnetic wand over CH1. When the desired value is reached, pass the magnetic wand over CH2 to accept and save changes. Passing over CH1 or letting the timer count down to zero without saving the new value, will take you back into the Programming Mode.
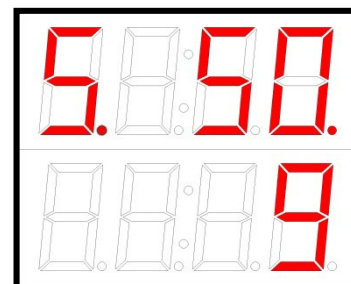
FIGURE 5-11 Sample Span Gas Concentration Display
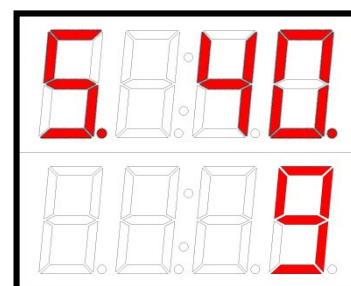
FIGURE 5-12 Flashing Status Bit

NOTE: Span Gas Concentration for combustibles can be set from 0% to 100%LEL. For the sake of resolution, the Span Gas Concentration should be set above 20% LEL.

5.5.6 Sensor Span Reserve

The last option available is viewing the sensor span reserve. ⌈iTRANS·2⌉ The span reserve option is designated with an "r" in the status bit. The current span reserve is displayed on the top line of the LED display.
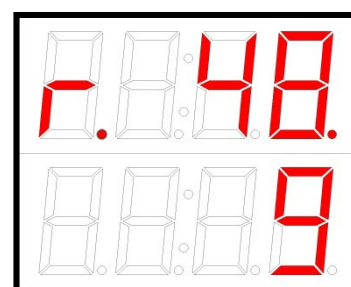
FIGURE 5-13 Sample Span Reserve Display

5.6 Programming Mode – Push Button Operation

5.6.1 Introduction

In a safe environment where the windowed top of the transmitter can be removed, there are more programming options available. These programming options include all of the functions available in the non-intrusive mode as well as a few others. ⒤TRANS·2 These items are password protected. To enter the programming options, press the "Mode" key. The access code is "Mode", "Up", "Down", "Up", "Enter". Once the correct password has been entered, the user will have to select a channel for programming but in case of wrong password or time out (10 second) the display will revert back to Normal Operating Mode
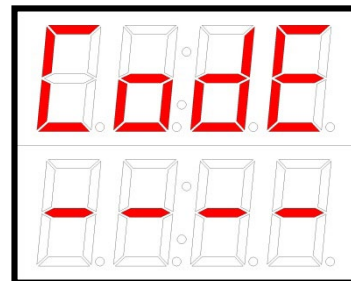
FIGURE 5-14 Sample Enter Password Display

NOTE: If display shows "iNet" confirm setting is "0" to ensure proper function of onboard relay.

NOTE: Please see 8 for a complete list of functions and function codes.

5.6.2 Entering Programming Mode and Selecting a Channel

On entering the correct password, the channel selection screen will be displayed on the LED display. Press the "Mode" button to switch between the available channels then press the "↵" button to confirm the channel selection.

Once a channel is selected, the gas type for that sensor is displayed on the top row of the LED display for 5-7 second. After that the LED display will show the list of available functions. Use the arrow keys to scroll through the list of functions available.
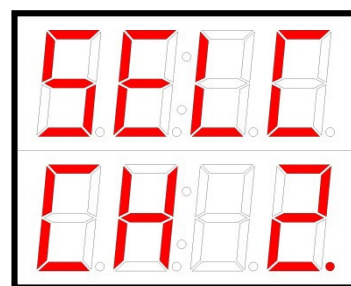
FIGURE 5-15 Sample Channel Selection Display

NOTE: If you have a dual-sensor unit, use the "Mode" button to switch between the channel.

5.6.3 Set Low Alarm

The low alarm setpoint is designated with an "L" displayed in the status bit and current low alarm value displayed next to it. To change the low alarm setpoint, press the "↵" button during the 10-second countdown. If you do not press "↵" during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode. If you initiate the low alarm option, the status bit will start to flash and the iTRANS·2 low alarm setpoint can be changed by using the "↑" and "↓" keys.

When the desired value is reached, press the "↵" key to accept and save the new value. If the value is not saved before the time-out, the iTRANS·2 will go back to the Programming Mode.
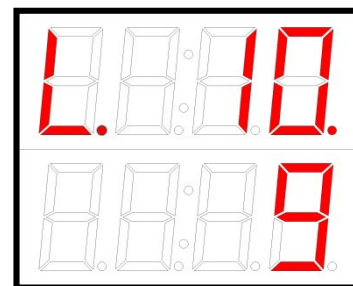
FIGURE 5-16 Sample Low Alarm Setpoint Display

5.6.4 Set High Alarm

The high alarm setpoint is designated with an "H" displayed in the status bit and the current high alarm value displayed next to it. To change the high alarm setpoint, press the "↵" button during the 10-second countdown. If you do not press "↵" during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode. If you initiate the high alarm option, the status bit will start to flash and the iTRANS·2 high alarm setpoint can be changed by using the "↑" and "↓" keys.

When the desired value is reached, press the "↵" key to accept and save the new value. If the value is not saved before the time-out, the iTRANS·2 will go back to the Programming Mode.
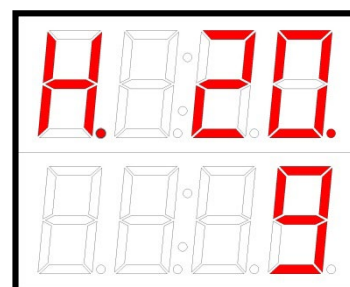
FIGURE 5-17 Sample High Alarm Setpoint Display

5.6.5 4-20 mA Analog Output Range

The range of 4-20 mA analog output is set to full range as factory default. For full range values, see Appendix D. If the user desires to change the output scaling of the 4-20 mA analog signal, they can do so.

NOTE: Only the upper end range can be changed. The low end is always set for 4 mA.

The 4-20 mA setpoint is designated with a "4" displayed in status bit and the current high end range next to it. To change the range, press the "↵" button during the 10 second countdown.

If you do not press "↵" during the 10-second countdown, the [TRANS·2] will return to the Normal Operating Mode. If you initiate the 4-20 mA range option, the status bit will start to flash and the [TRANS·2] range setpoint can be changed by using the "↑" and "↓" keys.

When the desired value is reached, press the "↵" key. If the value is not saved before the time-out, the [TRANS·2] will go back to the Programming Mode.
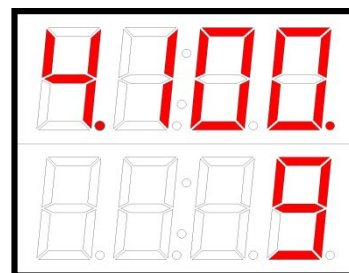
FIGURE 5-18 Changing the Analog Output Upper Value

5.6.6 Set System Time – Minute

The system's clock minute setting is designated with a "1" in the status bit and current value next to it. To change the minutes, press the "↵" button during the 10 second countdown. If you do not press "↵" during the 10-second countdown, the [TRANS·2] will return to the Normal Operating Mode. If you initiate the minutes option, the status bit will start to flash and the [TRANS·2] minute can be changed by using the "↑" and "↓" keys.
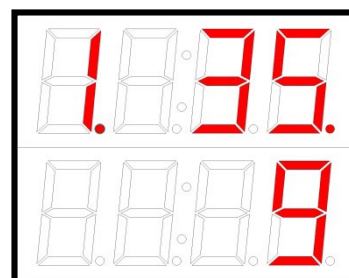
FIGURE 5-19 Setting System Time (Minutes)

When the desired value is reached, press the "↵" key. If the value is not saved before the time-out, the [TRANS·2] will go back to the Programming Mode.

5.6.7 Set System Time – Hour

The system's clock hour setting is designated with an "h" in the status bit and current value next to it. To change the hour, press the "↵" button during the 10 second countdown. If you do not press "↵" during the 10-second countdown, the [TRANS·2] will return to the Normal Operating Mode. If you initiate the hours option, the status bit will start to flash and the [TRANS·2] hour can be changed by using the "↑" and "↓" keys. When the desired value is reached, press the "↵" key. If the value is not saved before the time-out, the [TRANS·2] will go back to the Programming Mode.
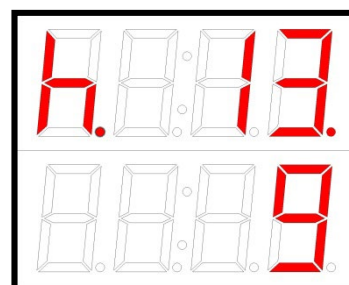
FIGURE 5-20 Setting System Time (Hour)

5.6.8 Set System Time – Day

The system's day of the month setting is designated with a "d" in the status bit and current value next to it. To change the day, press the "↵" button during the 10-second countdown. If you do not press "↵" during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode. If you initiate the days option, the status bit will start to flash and the iTRANS·2 day can be changed by using the "↑" and "↓" keys. When the desired value is reached, press the "↵" key. If the value is not saved before the time-out, the iTRANS·2 will go back to the Programming Mode.
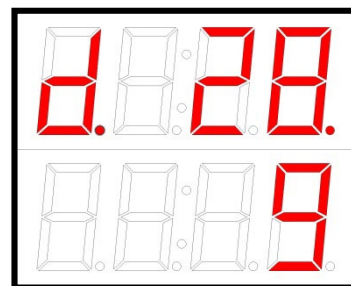
FIGURE 5-21 Setting System Day

5.6.9 Set System Time – Month

The system's month setting is designated with an "E" in the status bit and current value next to it. To change the month, press the "↵" button during the 10-second countdown. If you do not press "↵" during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode.

If you initiate the month option, the status bit will start to flash and the iTRANS·2 month value can be changed by using the "↑" and "↓" keys. When the desired value is reached, press the "↵" key. If the value is not saved before the time-out, the iTRANS·2 will go back to the Programming Mode.
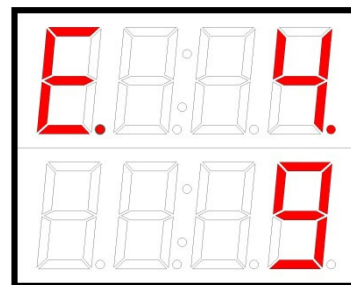
FIGURE 5-22 Setting System Month

5.6.10 Set System Time – Year

The system's month setting is designated with an "8" in the status bit and current value next to it. To change the year, press the "↵" button during the 10-second countdown. If you do not press "↵" during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode

If you initiate the month option, the status bit will start to flash and the iTRANS·2 month value can be changed by using the "↑" and "↓" keys. When the desired value is reached, press the "↵" key. If the value is not saved before the time-out, the iTRANS·2 will go back to the Programming Mode.

FIGURE 5-23 Setting System Year

5.6.11 Zeroing

Zeroing is an option available both through the keypad and non-intrusively. A "0 " is displayed in the status bit of the display to designate this function. A 10 second timer is displayed on the bottom line of the LED display. To initiate zeroing, press the "↵" key during the 10-second countdown. If you do not initiate zeroing during the 10-second countdown, the ⒤TRANS·2 will return to the Normal Operating Mode. If you initiate zeroing, the status bit will start to flash. Once zeroing is complete, the unit will return to the Normal Operating Mode. To abort zeroing at any time, press the "Mode" key.
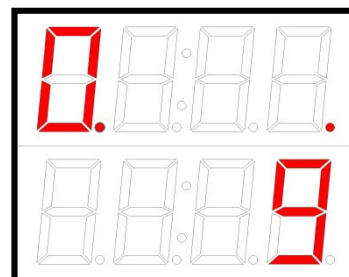
FIGURE 5-24 Sample Zeroing Display

5.6.12 Calibration

The calibration option is also available through the keypad. Calibration is designated with a "C" in the status bit. A 10 second timer is displayed on the bottom line of the LED display. To initiate calibration, press the "↵"key during the 10-second countdown. If you do not initiate calibration during the 10-second countdown, the ⒤TRANS·2 will return to the Normal Operating Mode. If you initiate calibration, the status bit will start to flash and the ⒤TRANS·2 will enter the zeroing process.
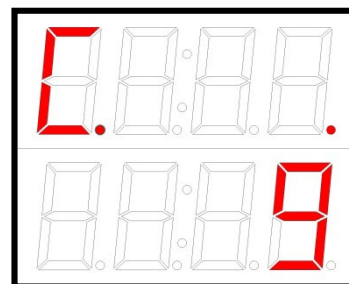
FIGURE 5-25 Sample Calibration Display

NOTE: Before the ⒤TRANS·2 will calibrate, the unit will enter the zeroing process. Please make sure that you do not apply gas to the instrument while it is zeroing.

The ⒤TRANS·2 will automatically zero before calibration. Zeroing is designated with a flashing "0" in the status bit. Once zeroing is complete, the ⒤TRANS·2 will automatically enter the calibration routine. Calibration is designated with a flashing "C" in the status bit.

After zeroing finishes, the ⒤TRANS·2 is ready to calibrate. When the flashing "C" appears on the display, apply calibration gas. As the ⒤TRANS·2 responds to the gas, the current reading will be displayed on the top line of the LED display. To abort calibration at any time, press the "Mode" key.

NOTE: Check and verify span setting before starting a calibration.

NOTE: Please refer to Appendix D for a complete list of factory default span gases.

NOTE: Flow rate for calibration is 0.5 liter per minute (LPM) except for NH_3, ClO_2, Cl_2, NO_2, SO_2, and HCl which require 1.0 LPM.

5.6.13 Changing Span Gas Concentration

The span option is designated with a flashing "S" in the status bit with the current span value next to it. ⓘTRANS·2 To change the span value, press the "↵" key during the 10-second countdown. If you do not press the "↵" during the 10-second countdown, the ⓘTRANS·2 will return to the Normal Operating Mode.

If you initiate the change span option, the status bit will start to flash and the ⓘTRANS·2 span value can now be changed. The current span value is displayed on the top line of the LED display. Use the "↑" and "↓" keys to change the span value. When the desired value is reached, press the "↵" key to save changes. Pressing the "Mode" key or letting the timer count down to zero without saving the new value, will take you back into the Programming Mode.
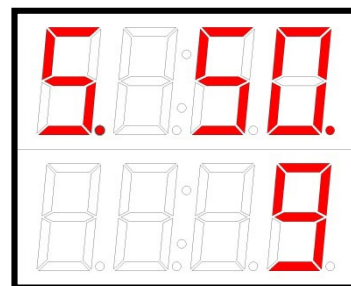
FIGURE 5-26 Sample Span Gas Concentration Display
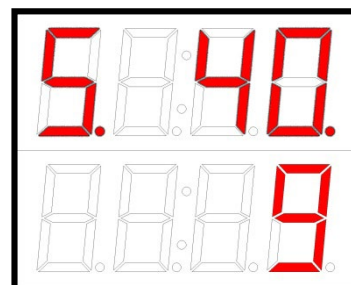
FIGURE 5-27 Flashing Status Bit

NOTE: If the "↵" key is not pressed, the new span value will not be saved.

NOTE: Span Gas Concentration for combustibles can be set from 0% to 100%LEL. For the sake of resolution, we suggest that Span Gas Concentration should be set above 20% LEL.

5.6.14 Sensor Span Reserve

The span reserve option is designated with an "r" in the status bit. The current span reserve is displayed on the top line of the LED display.
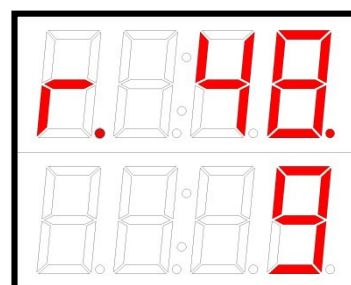
FIGURE 5-28 Sample Span Reserve Display

5.6.15 Last alarm – Day

The day of last alarm is designated with an "2" in the status bit. The day of last alarm is displayed on the top line of the LED display. This information can't be editable.
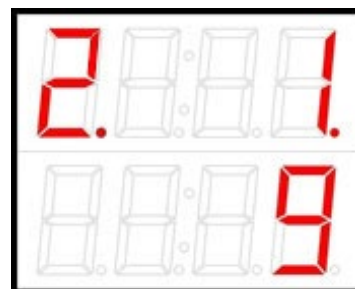
FIGURE 5-29 Day of last alarm Display

5.6.16 Last alarm- Mouth

The mouth of last alarm is designated with an "3" in the status bit. The day of last alarm is displayed on the top line of the LED display. This information can't be editable.
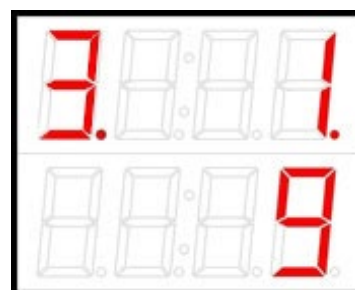
FIGURE 5-30 Mouth of last alarm

5.6.17 Last calibration – Day

The day of last calibration is designated with an "6" in the status bit. The day of last calibration is displayed on the top line of the LED display. This information can't be editable.
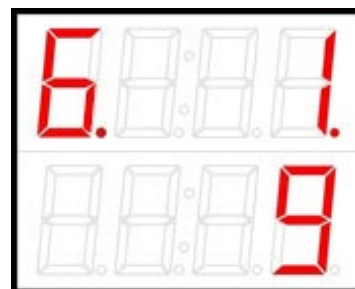
FIGURE 5-31 Day of last calibration Display

5.6.18 Last calibration – Month

The month of last calibration is designated with an "7" in the status bit. The mouth of last calibration is displayed on the top line of the LED display. This information can't be editable.
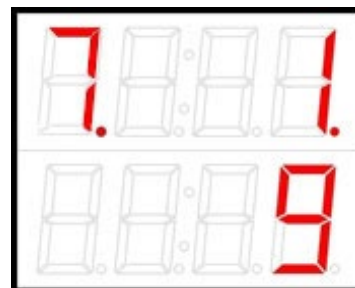
FIGURE 5-32 Month of last calibration Display

5.6.19 Last calibration– Year

The year of last calibration is designated with an "9" in the status bit. The year of last calibration is displayed on the top line of the LED display. This information can't be editable.
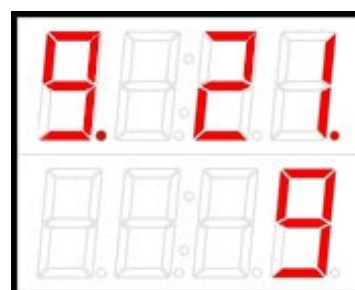
FIGURE 5-33 Year of last calibration Display

5.6.20 Reset

To activate the reset, set, press the "↵" button during the 10-second countdown. If you do not press "↵" during the 10-second countdown, the iTRANS·2 will return to the Normal Operating Mode

FIGURE 5-34 Reset Display

6 Modbus Interface

6.1 Introduction

IMPORTANT: The ⌊iTRANS·2⌋ device with public Modbus interface can also be configured to operate with a MX43 controller from TELEDYNE OLDHAM SIMTRONICS. Please follow the procedure given below to enable MX43-compatibility mode on ⌊iTRANS·2⌋.

Set the Modbus ID of ⌊iTRANS·2⌋ using dip-switches as shown in FIGURE 4-10 according to MX43 configuration (for details please see the user manual of MX43 controller). The MX43-compatibility menu on ⌊iTRANS·2⌋ is password protected. To enter MX43-compatibility menu, remove the front cover of ⌊iTRANS·2⌋ and press "Enter" key. The access code is "Enter", "Up", "Down", "Up", "Mode".
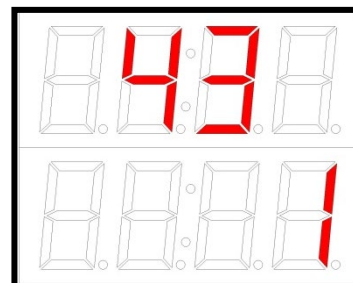
FIGURE 6-1 MX43-compatibilty Menu

Once the correct access code has been entered then the user can select to enable (1) or disable (0) the MX43-compatibility mode on ⌊iTRANS·2⌋ using "Up" or "Down" key then the selection is confirmed by pressing the "Enter" key.When programming the ModBus ID address on the ⌊iTRANS·2⌋ electronics module or on the smart sensor board, use the binary reference chart on the following page. A "1" represents "ON" on the switch bank, and position 1 of the switch bank represents the right most binary digit (LSB). ModBus characteristics for the ⌊iTRANS·2⌋ are listed below.

Characteristic	Description
Hardware	2-wire mode (not 4-wire)
Baud Rate	9600
Electrical Standard	TIA/EIA-485
Transmission Mode	RTU mode (not ASCII)
Message Coding System	8-bit
Start Bits	1
Data Bits	8 (LSB sent first)
Parity Bits	0
Stop Bits	1

Table 6-1 ModBus Characteristics for the ⌊iTRANS·2⌋ Gas Monitor

IMPORTANT: When commissioning master and slave units on a ModBus network, it is critical to ensure that every device on the ModBus network must have a unique address. Otherwise, abnormal behavior of the entire serial bus can occur.

6.2   Sample Gas Reading via ModBus Network

To get a gas reading for Channel 1, you must read register 40102. This register holds the gas reading in ppm.

- Example: Gas reading of 5 ppm = register value of $0005.
- Example: Gas reading of 20.9% = register value of $0209.

For Channel 2 you can access the gas reading by looking at register 40202.

For a full list of ModBus commands and registers that are accessible on the iTRANS·2, refer to the next section.

6.3   ModBus Register List

ModBus register addresses are provided in Table 6-1.

Addr	Inst R/W	Host R/W	Range	Description

40101	R/W	R/W	MSB = $01 to $FF
			LSB = $01 to $F7
				Sensor Type
				Holds the sensor instrument type code and ModBus address. The most significant byte (MSB) holds a value indicating the type of instrument (see below). The least significant byte (LSB) holds a value which is the ModBus address of the sensor.
				MSB = Instrument type code $01 to $FF
				        $03 = IR (infrared)
				        $04 = TOX (toxic)
				        $05 = OXY (oxygen)
				        $06 = AAW (toxic)
				        $07 = CAT (catalytic)
				LSB = MODBUS sensor address $01 to $F7 (1 to 247)

40102	W	R	$0000 to $FFFF	Gas Reading Holds the gas reading in ppm or percent depending upon the sensor in the instrument. The range is from $0000 to $FFFF and represents a signed decimal value range from -32768 to +32767. Examples: +5 ppm = register value of 00005_{10} = $0005 -5 ppm = register value of 65531_{10} = $FFFB
40103	R*	R*	MSB = $01 to $FF LSB = $01 to $FF	Gas Type Holds the decimal place holder and the gas type code. The most significant byte (MSB) holds the number of decimal places to be used in calculations for this gas. This decimal locator applies to all subsequent values of gas readings within other registers. This can be read by the instrument. The least significant byte (LSB) holds a code which identifies the gas type. This can be read by the host. MSB = Decimal place holder $01 to $FF LSB = Gas type code $01 to $FF $01 CO Carbon Monoxide $02 H_2S Hydrogen Sulfide $03 SO_2 Sulfur Dioxide $04 NO_2 Nitrogen Dioxide $05 Cl_2 Chlorine $06 ClO_2 Chlorine Dioxide $07 HCN Hydrogen Cyanide $08 PH_3 Phosphine $09 H_2 Hydrogen $0B CO_2 Carbon Dioxide $0C NO Nitric Oxide $0D NH_3 Ammonia $0E HCl Hydrogen Chloride

Addr	Inst R/W	Host R/W	Range	Description
				$14 O$_2$ Oxygen $15 CH$_4$ Methane $16 LEL Lower Explosive Limit (Combustible Gases) $17 C$_6H_{14}$ Hexane $1A C$_5H_{12}$ Pentane $1B C$_3H_8$ Propane $4D C$_2H_6$O Ethanol $50 C$_2H_4$ Ethylene $6F C$_3H_6$ Propylene $C9 C$_4H_{10}$ Butane Examples: $0107 = 1 decimal place for gas type HCN $0002 = 0 decimal places for gas type H$_2$S $0206 = 2 decimal places for ClO$_2$
40105	W	R/W	$0000 to $FFFF	**Instrument Mode** Holds code for current mode of instrument. Possible working modes of instrument are listed below. $0001 Normal $0002 Calibration $0003 Warm-up $0006 Zeroing $0008 Fault $0009 Reset Examples: Sensor in zero fault = $0008 Sensor zeroing = $0006
40106	W	R	$0000 to $FFFF	**Status Bits** Holds 16 bits of status for various parameters in the instrument. A bit value of "1" indicates that the associated fault condition is present. Bit 15 = current loop open Bit 14 = current loop shorted Bit 13 = power fault Bit 12 = 5 volt fault Bit 11 = missing sensor Bit 10 = *(not defined)* Bit 6 = configuration fault Bit 5 = zero fault Bit 4 = calibration fault Bit 3 = over-range Bit 2 = failed sensor Bit 1 = high alarm Bit 0 = low alarm Examples: Missing sensor = Bit 11 is set = $0800 Power fault and failed sensor = Bits 13 and 2 set= $2004
40115	W	R		**Last Alarm Date (mmdd)** Holds the month and day when the instrument had the last alarm. High byte = $01 to $0C Low byte = $01 to $1F Examples: Dec 25 is represented as $0C19 June 31 is represented as $061F
40116	W	R		**Last Alarm Date (00yy)** Holds the last two digits of the year when the instrument was last in alarm. The first two digits are assumed to be "20". High byte = $00, Low byte = $02 to $63 Examples: 2002 is represented by $02

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Addr	Inst R/W	Host R/W	Range	Description
				2099 is represented by $63
40117	R	R/W	MSB=$01 to $0C, LSB=$01 to $1F	RTC Month and Day Holds the month and day to which the real time clock (RTC) calendar should be set. The most significant byte (MSB) represents the month from $01 to $0C (1-12). The least significant byte (LSB) represents the day of the month from $01 to $1F (1-31). Examples: December 25 = $0C19 June 30 = $061E
40118	R	R/W	$0002 to $0063	RTC Year (00yy) Holds the year to which the real time clock (RTC) should be set. The most significant byte (MSB) is always $00. The least significant byte (LSB) represents the two-digit year (within the 21st century), from $02 (which represents 2002) to $063 (which represents 2099). Examples: 2002 = 02 (+ base year of 2000) = $0002 2010 = 10 (+ base year of 2000) = $000A 2099 = 99 (+ base year of 2000) = $0063
40119	R	R/W	MSB=$00 to $18, LSB=$00 to $3C	RTC Hours and Minutes Holds the hours and minutes to which the RTC should be set. The most significant byte (MSB) represents the hour from $00 to $18 (00-24). The least significant byte (LSB) represents the minutes from $00 to $3C (00 to 60). Note that the seconds default to zero ($00) each time the hours and minutes are set. Examples: 13:05 = $0D05 24:00 = $1800
40124	R	R/W	$0000 to $FFFF	Low Alarm Display Setting Holds the value of the gas reading at which the low alarm display will activate.
40125	R	R/W	$0000 to $FFFF	High Alarm Display Setting Holds the value of the gas reading at which the high alarm display will activate.
40126	R	R/W	$0000 to $03E8	Cal Gas Value Holds the value of the calibration gas to be used on the instrument. The range is from $0000 to $03E8 (0 to 1000_{10}).
40127	R/W	R	$0000 to $FFFF	Loop High Scaling Holds a value which indicates the gas reading represented by a 20 mA loop output signal. The range is from $0000 to $FFFF.
440102	R	R	$0000 to $FFFF	WX Scaled Reading Use with WX series controller.

Table 6-2 ModBus Registers

NOTE: To get the ModBus reading, register 40103 must be read as well as register 40102. Register 40103 specifies where the decimal should be placed.

6.4 ModBus Resources

ModBus is a public protocol that can be freely adopted by any developer or manufacturer desiring to implement it. While a detailed discussion of ModBus protocol is beyond the scope of this manual, there are a number of up-to-date resources available on the internet for those wishing to investigate ModBus further. The most complete resource is www.modbus.org.

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6.5 Termination

When putting devices on the ModBus network, a terminating resistor may be required for the last device on the network (please see www.modbus.org for more details). iTRANS·2 The iTRANS·2 has a blue jumper on the "public" jumper that can be used to jumper in a 120-Ohm terminating resistor. By default, this jumper is not in place. TELEDYNE OLDHAM SIMTRONICS does not recommend changing the placement of any of the other jumpers on this board.
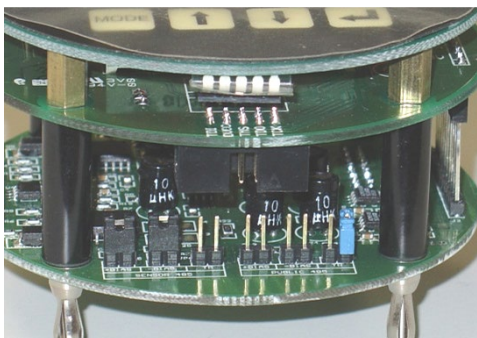
FIGURE 6-2 Location of Jumpers

7 Maintenance

7.1 Introduction

Sensors have a variable life dependent on the sensor and the environment in which they operate. Oxygen sensor life is about 2 years and toxic gas sensor life is normally 2 years or greater. The catalytic combustible gas sensors normally operate in excess of 3 years, while the infrared sensors have a MTBF greater than 5 years.

Sensors have baseline drift and their characteristics change with time. Thus, the ⌐iTRANS·2⌐ must be calibrated on a regular basis. Gas detection instruments are potential life-saving devices. In recognition of this fact, calibration for the toxic and catalytic LEL sensors should be at least at quarterly intervals, while the Infrared sensor should be calibrated on an annual basis with functional tests every 6 months.

Further, TELEDYNE OLDHAM SIMTRONICS recommends prudent testing and/or calibration after a gas alarm. All calibration/service to the sensors should be recorded and accessible.

NOTE: Other than regular calibrations, the ⌐iTRANS·2⌐ require no other routine maintenance.

NOTE: Take special care with handling and storing sensors. They are delicate and can be damaged by storage in environments outside the specified temperature, pressure, and humidity limits.

NOTE: Sensors are susceptible to damage from high pressure or low pressure, especially if the change is sudden. Also, sensors should not be operated at pressures that are 10% above or below atmospheric pressure.

NOTE: If sensors and the surrounding environment must be washed down at any time, cover the opening of the sensor housing to protect it from water or excess moisture. Remove cover when wash down is complete. An optional splashguard is available for continuous protection.

7.2   Sensor Replacement

Sensor replacement must be done by qualified personnel. To replace the sensor, shut down power to the unit. Un-thread the sensor-housing cap from the sensor housing. There is a set screw that secures the cap to the housing. Once the cap is removed, remove the old sensor and sensor board.

When installing the new sensor/sensor board make sure you line up the notch in the board with the alignment pin. After the new sensor is in place, screw the sensor cap back on to the housing and secure the set screw.

Once the new sensor is in place and has time to settle out, it should be zeroed and calibrated for accuracy.

7.3   Zero and Calibration

Zeroing and calibrating the instrument can be accomplished one of two ways. These routines can be entered either from the keypad or non-intrusively using the magnetic wand. See 5 Operation for step-by-step procedures for zeroing and calibrating the iTRANS·2 using the magnetic wand. 5 also contains information on keypad zeroing and calibration.

8 Troubleshooting

8.1 Introduction

This chapter provides troubleshooting information for the ⌐ITRANS·2⌐ gas monitor.

8.2 Diagnosing Common Problems

Symptom	Problem	Solution
LED display does not light up.	Input voltage is too low Electronics module has failed	Check for presence of input voltage.
Output outside 4-20 mA range	Unit in calibration mode Electronics module has failed	Exit calibration mode. Replace electronics module.
Output does not change when gas concentration changes	Electronics module has failed	Replace electronics module.
Cannot calibrate SPAN	Sensor has failed Electronics module has failed	Replace sensor and calibrate. Replace electronics module and calibrate.
Reading drifts by 10 counts over a short time period (in a stable temperature environment)	Sensor has failed Electronics module has failed	Replace sensor and calibrate. Replace electronics module and calibrate.
In calibration, LED displays wrong value.	Sensor has failed Electronics module has failed	Replace sensor and calibrate. Replace electronics module and calibrate.
Reed Switch does not work	Electronics module has failed Reed Switch is damaged	Replace electronics module and calibrate. Replace the reed switch.
"P" appears on the display	Open loop on a 4-20 mA channel	Place a 100-Ohm load resistor from the mA output pin to ground.
"U Or" appears on the display	4-20 mA signal goes into over range for about 5 seconds before settling at 1mA	Ensure the sensor is working properly via a second ary gas detection source and the 4-20 mA is scaled correctly.

Table 8-1 Common Problems

8.3 Fault Codes

Fault Display	Status Bit	4-20 mA Output	Description
0.FFF	Flashing	1 mA	Zeroing error – Recover after calibrating
C.FFF	Flashing	1 mA	Calibration error – Recover after calibrating or replacing the sensor
1.FFF	Flashing	1 mA	SMART sensor error
2.FFF	Flashing	1 mA	Sensor error
U-Or	Flashing	1mA	Sensor under-range
U Or	Flashing	22mA for ~5 seconds then settled at 1mA	Sensor over-range

Table 8-2 Fault Codes

8.4 Function Codes

| Function Code | LED Display | | Description |
	Status Bit	Data Area	
L	L.	Low Alarm	Set the relay low alarm value
H	H.	High Alarm	Set the relay high alarm value
4	4.	Range of 4-20 mA	Set the range of 4-20 mA output
1	1.	Minute	Set system time – minute
H	h.	Hour	Set system time – hour
D	d.	Date	Set system time – date
E	E.	Month	Set system time – month
8	8.	Year	Set system time – year
0	0.		Zeroing
C	C.		Calibration
S	S.	Span Gas Concentration	Set span gas concentration
R	r.	Sensor Span Reserve	Check the span reserve
2	2.	Date	The latest alarm time-date
3	3.	Month	The latest alarm time-month
6	6.	Date	The latest calibration time-date
7	7.	Month	The latest calibration time-month
9	9.	Year	The latest calibration time-year

Table 8-3 Function Codes

9 Warranty

9.1 Warranty

TELEDYNE OLDHAM SIMTRONICS fixed system products are warranted to be free from defects in material and workmanship for a period of twenty-four (24) months from the date of shipment.

The above warranty does not include consumables such as pumps, or filters, all of which are warranted to be free from defects in material and workmanship for one year from the date of shipment, except where otherwise stated in writing in TELEDYNE OLDHAM SIMTRONICS literature accompanying the product.

In addition, TELEDYNE OLDHAM SIMTRONICS warrants sensors to be free from defects in material and workmanship for the indicated periods below from the date of shipment, except where otherwise stated in writing in TELEDYNE OLDHAM SIMTRONICS literature accompanying the product.

- Infrared sensors: three (3) years
- Catalytic, CO and H_2S sensors: two (2) years
- O_2 sensors: eighteen (18) months
- Other sensors: twelve (12) months

9.2 Limitation of Liability

TELEDYNE OLDHAM SIMTRONICS makes no other warranties, either expressed or implied, including, but not limited to the warranties of merchantability or fitness for particular purpose.

Should the product fail to conform to the above warranty, buyer's only remedy and TELEDYNE OLDHAM SIMTRONICS's only obligation shall be, at TELEDYNE OLDHAM SIMTRONICS's sole option, replacement or repair of such non-conforming goods or refund of the original purchase price of the non-conforming goods. In no event will TELEDYNE OLDHAM SIMTRONICS be liable for any other special, incidental or consequential damages, including loss of profit or loss of use, arising out of the sale, manufacture or use of any products sold hereunder whether such claim is pleaded in contract or in tort, including strict liability in tort.

It shall be an express condition to TELEDYNE OLDHAM SIMTRONICS's warranty that all products be carefully inspected for damage by buyer upon receipt, be properly calibrated for buyer's particular use, and be used, repaired, and maintained in strict accordance with the instructions set forth in TELEDYNE OLDHAM SIMTRONICS's product literature. Repair or maintenance by non-qualified personnel will invalidate the warranty, as will the use of non-approved consumables or spare parts. As with any other sophisticated product, it is essential and

a condition of TELEDYNE OLDHAM SIMTRONICS's warranty that all personnel using the products be fully acquainted with their use, capabilities and limitations as set forth in the applicable product literature. Buyer acknowledges that it alone has determined the intended purpose and suitability of the goods purchased. It is expressly agreed by the parties that any technical or other advice given by TELEDYNE OLDHAM SIMTRONICS with respect to the use of the goods or services is given without charge and at buyer's risk; therefore, TELEDYNE OLDHAM SIMTRONICS assumes no obligation or liability for the advice given or results obtained.

SPECIFICATIONS SUBJECT TO CHANGE

Appendix A.   HART Interface

A.1   Introduction

IMPORTANT: This portion of the instruction manual is only applicable if your iTRANS·2 unit has been shipped HART Enabled.

The iTRANS·2 fixed-point gas monitor is designed to provide continuous monitoring of hazardous gases in the workplace. The iTRANS·2 is capable of displaying one or two gas concentrations as well as sensor or instrument specific diagnostics.

The HART supported iTRANS·2 comes with a channel-1 4-20mA output equipped with standard FSK HART interface capability. The channel-1 HART output can be used to access the process variables on digital control systems or a HART handheld device can be used to access process variables of iTRANS·2 from anywhere in the 4-20mA loop as long as the handheld device is on the modem side of the 250 ohm load. iTRANS·2 parameterization can also be accomplished through HART interface.
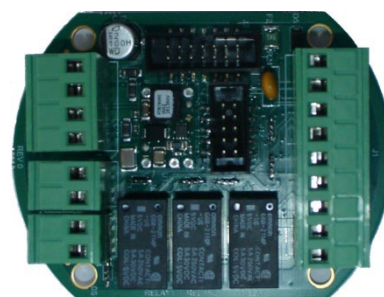
Figure A - 1 iTRANS·2 **HART Board**

iTRANS·2 channel-2 has a standard 4-20mA output. iTRANS·2 is available with an optional relay board, allowing the device to directly control external devices such as fans, pumps, alarm horns, or warning lights. Also there are three onboard relays available; two of the relays can be programmed for alarm activation, while the third relay is a fault protection relay.

The iTRANS·2 is powered with a 24 VDC (12-28 VDC) power supply and provides a 4-20mA control signal for each sensor.

For more details on iTRANS·2 specifications, supported sensor types, agency approvals and EU, please see 1.

IMPORTANT: In 1, under "Specifications" section the "Signal Outputs" specification is replaced with Table A - 1.

Items		Description
Signal Outputs	Digital	4-20mA FSK HART (HCF Compliant)
	Analog	4-20mA (linear analog)

Table A - 1 HART Supported iTRANS·2 Signals

A.2　　Hardware Overview

For details please see 2.

IMPORTANT: In 2, the "Electronic Modules" section is replaced with the following section.

Electronics Modules

The electronics module of the iTRANS·2 gas monitor contains connectors and jumpers for wiring and configuring the device. The electronics module for a iTRANS·2 main unit is shown in the figure. The electronics module for a remote sensors unit is shown in the figure. The wiring details of iTRANS·2 main unit electronics module are explained in "System Wiring" section of this appendix and for the wiring details of iTRANS·2 remote sensors unit electronic module please see 4.
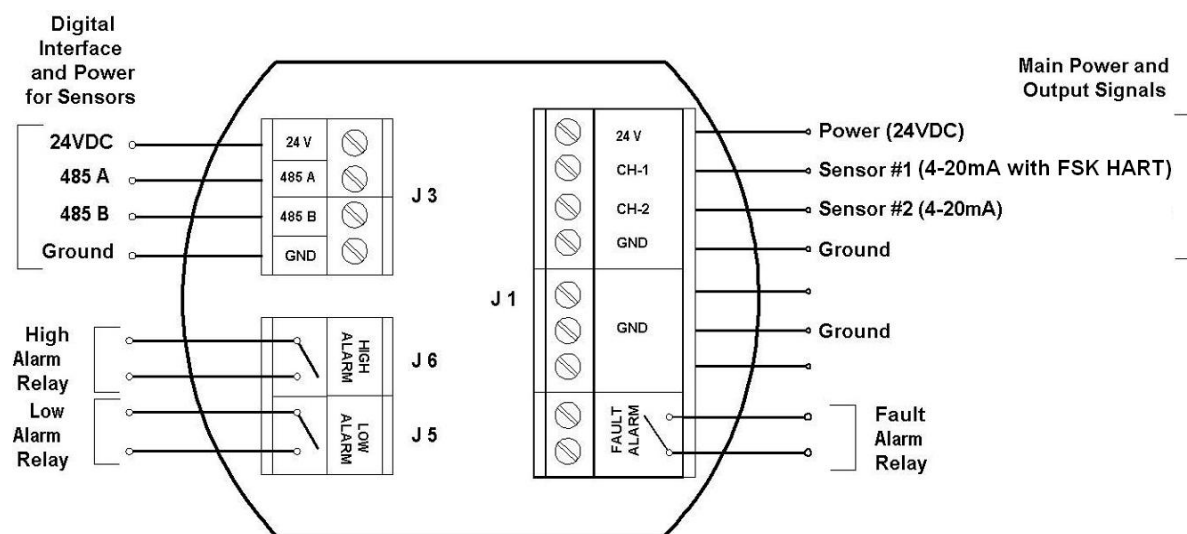
Figure A - 2 Electronics Module for HART Supported iTRANS·2 (Main Unit)
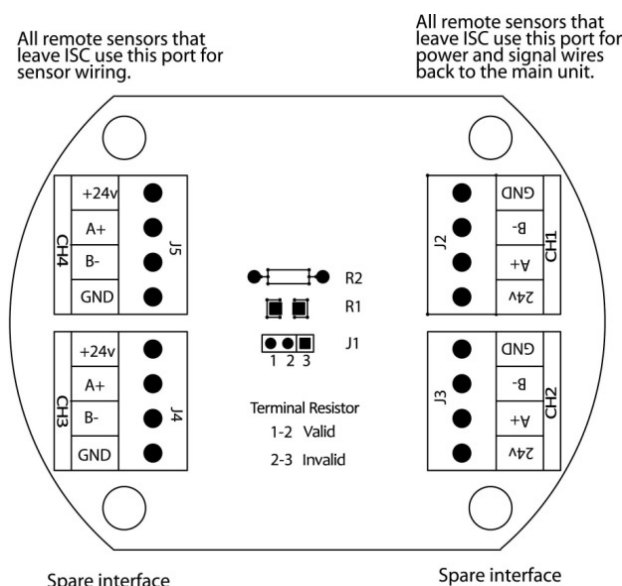
Figure A - 3 Electronics Board for iTRANS·2 **Remote Sensor Unit**

A.3   Installation

For details please see 3.

A.4   System Wiring

For details please see 4.

IMPORTANT: In 4, the "Power and Output Wiring (J1)" section is replaced with the following section.

Power and Output Wiring (J1)

In most applications the power is supplied from the controller that is receiving the 4-20mA output. In these applications only three wires are required in case of single sensor unit and only four wires are required in case of dual sensor unit since common is shared.

If the 4-20mA output is going to another device other than the one that is powering it, or the transmitter has its own local power supply, another connection from GND must be extracted for the 4-20mA loop to function.

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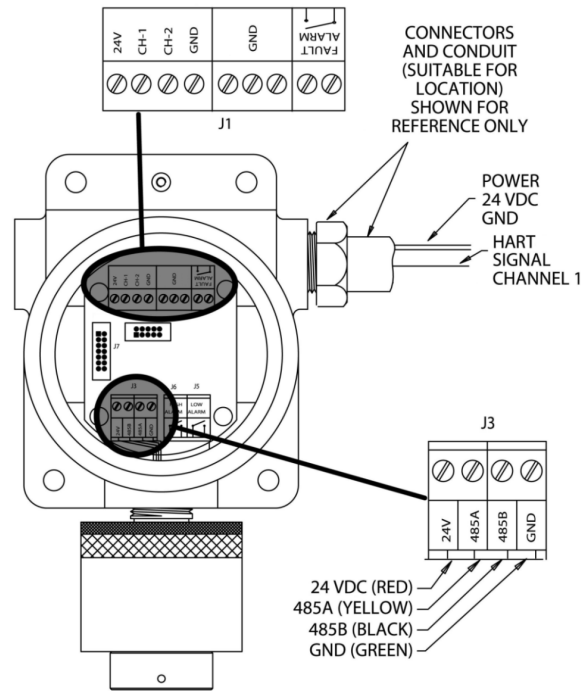
Figure A - 4 Wiring Diagram of Single Sensor HART Supported iTRANS·2
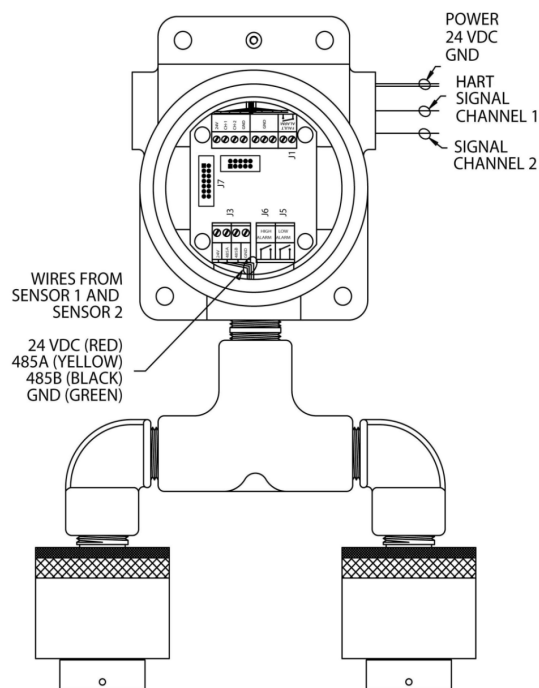
Figure A - 5 Wiring Diagram of Dual Sensor HART Supported iTRANS·2

Connect the iTRANS·2 power and signal wires to the appropriate wiring terminals as follows.

- **24 V:**Connect 24 VDC (12-28 VDC) supply power
- **CH-1:**Channel 1, HART 4-20 mA output signal
- **CH-2:**Channel 2, 4-20 mA output signal
- **GND:**DC return

Figure A - 6 Power and Signal Connector J1 on HART Supported ⁱTRANS·2

HART 4-20mA Wiring (CH-1)

CH-1 and GND on J1 connector are used as HART 4-20mA interface terminals. The HART 4-20mA output must be loaded with at least 250 ohms of impendence to properly establish the HART communication. Some devices receiving the 4-20mA output already have a large enough terminating resistor installed from the factory, but others may need additional resistance to be added. This is accomplished by adding a resistor in series with the output from HART board, preferably at the controller end of the 4-20mA current loop. Adding the additional resistor at the controller allows the HART handheld device to be connected anywhere in the loop, because it must have the full 250 ohm load after its connection point to function properly. If the additional resistor is added at the transmitter, in CH-1, the HART handheld device will only be able to access variables locally, at the transmitter.

The Figure A - 7 shows a 150 ohm resistor added to the output loop since the controller has a 100 ohm terminating resistor installed from the factory.
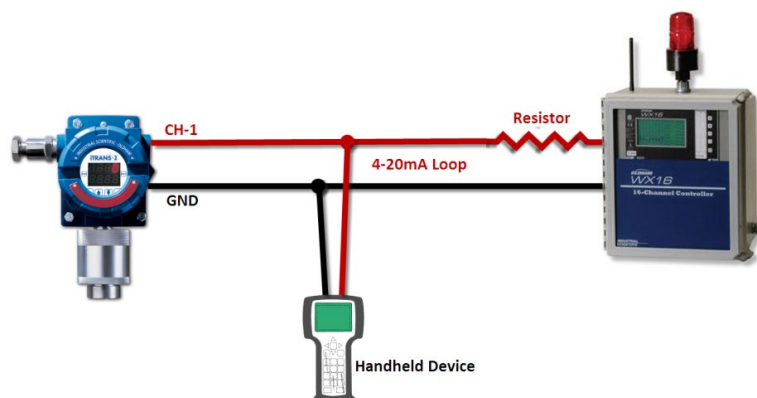
Figure A - 7 Example of HART Supported ⁱTRANS·2 **Wiring**

NOTE: Use supplied green conductor for enclosure ground.

NOTE: The ⁱTRANS·2 is a 3- or 4-wire 4-20mA device. For dual sensor configuration you must have a second 4-20mA signal wire pulled to the unit.

NOTE: When not using isolated 4-20mA or HART 4-20mA outputs, use the supplied resistors to connect CH-1 and CH-2 to GND. If these resistors are not connected and the 4-20mA outputs are not used, a "P" will appear on the display, indicating an open loop condition.

IMPORTANT: In 4, the "Digital ModBus RTU Interface Wiring" section is not applicable for HART supported iTRANS·2 as ModBus interface is not available on HART supported unit.

A.5 Operation

For details please see 5.

IMPORTANT: All the details given in 5 regarding the operation of the iTRANS·2 are valid for a HART supported unit. This section only provides the details on operation of HART interface.

Initial Start-up

The HART 4-20mA interface is disabled during the initial start-up after the iTRANS·2 is powered up. During the initial start-up, the connected sensors are detected and initialized. The initial start-up mode lasts for approximately 45 seconds.
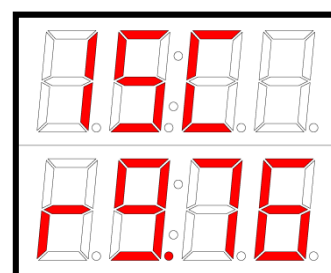
Figure A - 8 Main Unit Start-up Display

Warm-up Mode

After the initial start-up, the iTRANS·2 enters the warm-up mode which lasts for three minutes. During the warm-up mode, all gas reading related alarms are disabled, the current on the HART 4-20mA channel remains fixed at 3mA (16mA for oxygen sensor) and the HART interface is enabled for communication.
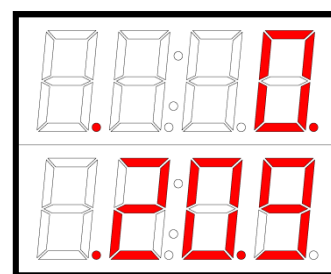
Figure A - 9 Warm-up Display

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Normal Mode

After the warm-up mode, the ⟦iTRANS·2⟧ enters the normal gas reading mode, During the normal mode, all gas reading related alarms are enabled and the current on the HART 4-20mA channel linearly follows the sensor 1 gas reading between zero reading to measurement range with 4mA and 20mA being the corresponding current values. In case of an under range or an over range reading the channel current value is fixed at 1mA. HART interface is enabled throughout the normal mode.
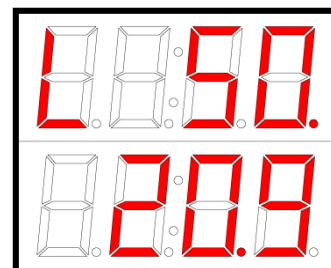
Figure A - 10 Normal Mode Display

Calibration and Zeroing Modes

The ⟦iTRANS·2⟧ enters the calibration or zeroing mode when the user selects the corresponding operation on sensor 1 through intrusive/non-intrusive programming screen or through HART 4-20mA interface. During both of zeroing and calibration modes the HART channel current remains fixed at 3mA (16mA for oxygen sensor). A successful zeroing or calibration operation is followed by a warm-up mode and an unsuccessful operation is followed by a corresponding fault mode.

HART interface is enabled throughout the zeroing and calibration modes.
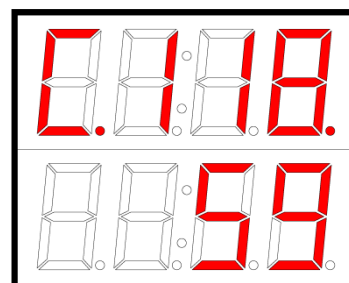
Figure A - 11 Calibration Display

Fault Mode

The ⟦ ⟧ enters the fault mode whenever it is not able to provide the gas reading to the user interface. There are different types of sensor faults which have been listed in the Table A - 2. The fault detection is enabled throughout the ⟦ ⟧ operation after the device is powered on, and the fault codes are indicated on the ⟦ ⟧ display after the initial start-up mode. During the fault mode on sensor 1 the HART 4-20mA channel current remains fixed at 1mA and HART interface is enabled throughout fault mode.
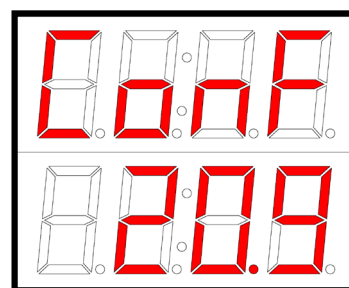
Figure A - 12 Fault Mode Display

Fault Code	Fault Type	4-20mA Output	Description
1FFF	Failed Sensor	1 mA	Smart sensor communication error
2FFF	Missing Sensor	1 mA	Sensor board communication error
ConF	Sensor Configuration	1mA	Sensor internal parameters error – Recover after factory configuration of sensor
CFFF	Calibration Failed	1 mA	Calibration error – Recover after calibrating or replacing the sensor
0FFF	Zeroing Failed	1 mA	Zeroing error – Recover after zeroing or calibrating

Table A - 2 Fault Code Description

Open Loop Condition

When any of the 4-20mA channels is not being used it should be terminated by inserting the specifically provided (250 ohms for HART CH-1 and 100 ohms for isolated CH-2) resistor between the respective channel output terminal and ground terminal.In case an unused channel is not terminated with the provided resistor, a 'P' will appear at the status bit indicating the open loop condition. Also in case the channel output is being used but one of the connecting wires is damaged or disconnected, same condition will be displayed to let the user know about the disconnection in the wiring. HART communication cannot be established with a physical disconnection under this condition.
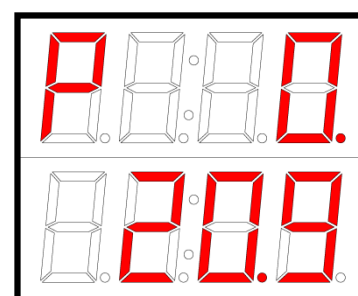
Figure A - 13 Sensor 1 Open Loop Condition Display

A.6   HART Interface

Electronic Device Descriptor (EDD)

An Electronic Device Descriptor (EDD) is available for ⌐TRANS·2¬ which is easiest and the quickest way to access all the process variables of ⌐TRANS·2¬.The EDD can be either loaded on a PC host simulator or on a handheld unit.

Figure A - 14 shows the ⌐TRANS·2¬ EDD loaded using a PC host simulator.
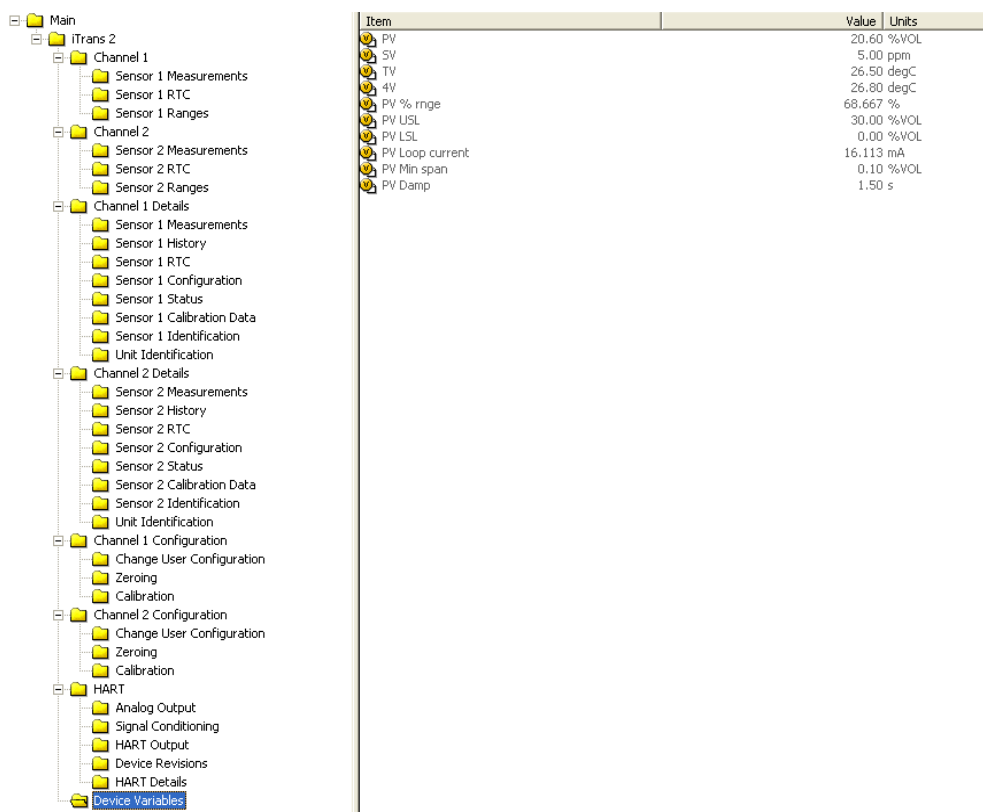
Figure A - 14 iTRANS·2 **EDD Menus List View**
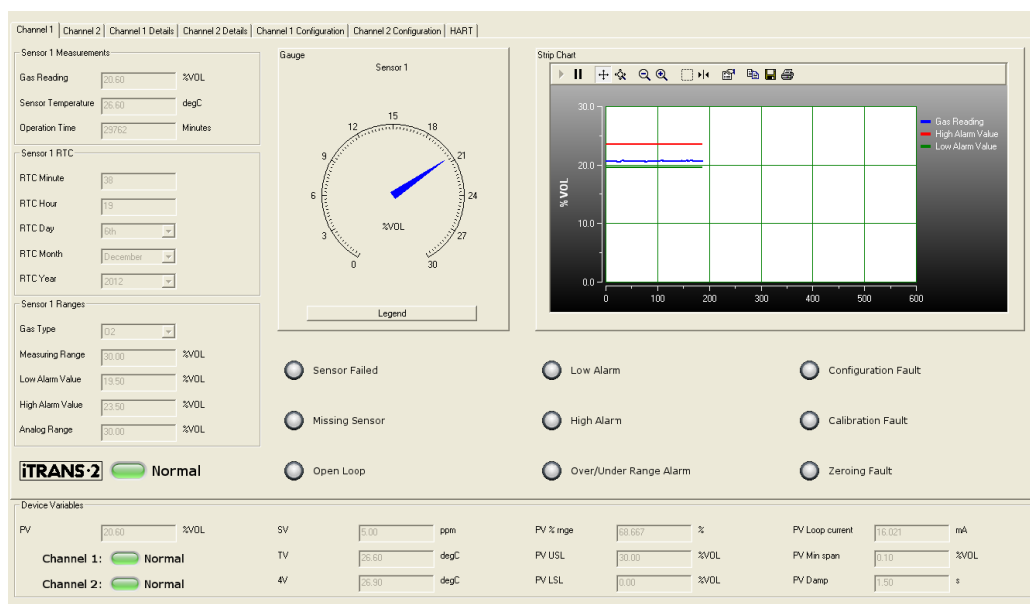
Figure A - 15 iTRANS·2 **EDD GUI View**

Figure A - 16 shows the connection diagram of iTRANS·2 to a PC.
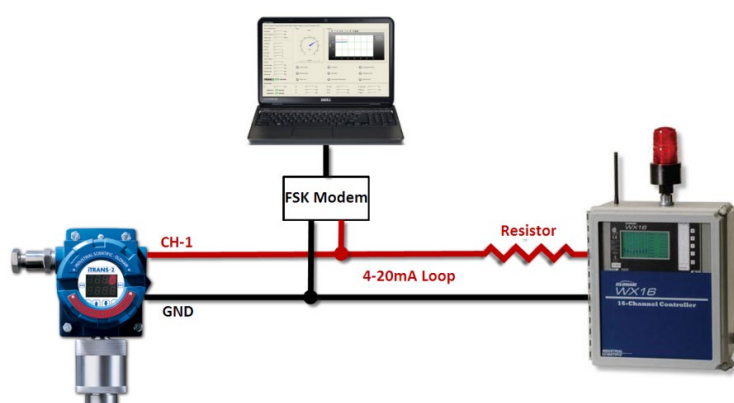
Figure A - 16 PC to HART Interface Wiring Diagram

A.7   User Commands

iTRANS·2 supports all the standard universal HART commands. This section only provides the details of the device-specific commands.

Read Commands

All read commands are dispatched without any request data and the response data is then translated to get the requested process variables. In case of a single sensor iTRANS·2 the parameters of disconnected sensor are uninitialized and a warning is indicated in the response code of the command. The translation/parsing details along with response length of the commands are given in the Table A - 3.

Command 128 – Read Firmware Revision – Response Length: 8 Bytes		
Byte Number	Parsing	Parameter
0-1	Unsigned-16	iTrans HART Board Firmware Version
2-3	Unsigned-16	iTrans Main Unit Firmware Version
4-5	Unsigned-16	Sensor 1 Firmware Version
6-7	Unsigned-16	Sensor 2 Firmware Version

Command 129 – Read Live Channels Gas Data – Response Length: 24 Bytes		
Byte Number	Parsing	Parameter
0-3	Float IEEE 754	Gas Reading Channel 1
4-7	Float IEEE 754	Temperature Reading Channel 1
8-9	Unsigned-16	Channel 1 Mode
10-11	Unsigned-16	Channel 1 Status
12-15	Float IEEE 754	Gas Reading Channel 2
16-19	Float IEEE 754	Temperature Reading Channel 2
20-21	Unsigned-16	Channel 2 Mode
22-23	Unsigned-16	Channel 2 Status

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Command 130 – Read Real Time Clock – Response Length: 18 Bytes		
Byte Number	Parsing	Parameter
0	Unsigned-8	RTC Minute Channel 1
1	Unsigned-8	RTC Hour Channel 1
2	Unsigned-8	RTC Day Channel 1
3	Unsigned-8	RTC Month Channel 1
4	Unsigned-8	RTC Year Channel 1
5-8	Unsigned-32	Total Operation Time (In Minutes) Channel 1
9	Unsigned-8	RTC Minute Channel 2
10	Unsigned-8	RTC Hour Channel 2
11	Unsigned-8	RTC Day Channel 2
12	Unsigned-8	RTC Month Channel 2
13	Unsigned-8	RTC Year Channel 2
14-17	Unsigned-32	Total Operation Time (In Minutes) Channel 2

Command 131 – Read User Configuration – Response Length: 36 Bytes		
Byte Number	Parsing	Parameter
0-3	Float IEEE 754	Low Alarm Threshold Channel 1
4-7	Float IEEE 754	High Alarm Threshold Channel 1
8-11	Float IEEE 754	Analog Output Range Channel 1
12-15	Float IEEE 754	Cal Gas Value Channel 1
16-17	Unsigned-16	Calibration Interval In Days Channel 1
18-21	Float IEEE 754	Low Alarm Threshold Channel 2
22-25	Float IEEE 754	High Alarm Threshold Channel 2
26-29	Float IEEE 754	Analog Output Range Channel 2
30-33	Float IEEE 754	Cal Gas Value Channel 2
34-35	Unsigned-16	Calibration Interval In Days Channel 2

Command 132 – Read Live Channels Information – Response Length: 26 Bytes		
Byte Number	Parsing	Parameter
0-3	Float IEEE 754	User Peak Channel 1
4-5	Unsigned-16	Previous OR Channel 1
6	Unsigned-8	Last Alarm Day Channel 1
7	Unsigned-8	Last Alarm Month Channel 1
8	Unsigned-8	Last Alarm Year Channel 1
9-10	Unsigned-16	Max Temperature Channel 1
11-12	Unsigned-16	Min Temperature Channel 1
13-16	Float IEEE 754	User Peak Channel 2
17-18	Unsigned-16	Previous OR Channel 2
19	Unsigned-8	Last Alarm Day Channel 2
20	Unsigned-8	Last Alarm Month Channel 2
21	Unsigned-8	Last Alarm Year Channel 2
22-23	Unsigned-16	Max Temperature Channel 2
24-25	Unsigned-16	Min Temperature Channel 2

Command 133 – Read Live Channels Identifier – Response Length: 66 Bytes		
Byte Number	Parsing	Parameter
0	Unsigned-8	Sensor Type Code Channel 1
1	Unsigned-8	Gas Type Code Channel 1
2	Unsigned-8	Decimal Place Channel 1
3-4	Latin-1 ASCII	Sensor ID Byte Channel 1
5-6	Latin-1 ASCII	Sensor ID Number Channel 1
7-16	Latin-1 ASCII	Sensor Part Number Channel 1
17-32	Latin-1 ASCII	Sensor Serial Number Channel 1
33	Unsigned-8	Sensor Type Code Channel 2
34	Unsigned-8	Gas Type Code Channel 2
35	Unsigned-8	Decimal Place Channel 2
36-37	Latin-1 ASCII	Sensor ID Byte Channel 2
38-39	Latin-1 ASCII	Sensor ID Number Channel 2
40-49	Latin-1 ASCII	Sensor Part Number Channel 2
50-65	Latin-1 ASCII	Sensor Serial Number Channel 2

Command 134 – Read Instrument Identifier – Response Length: 50 Bytes		
Byte Number	Parsing	Parameter
0-1	Latin-1 ASCII	Instrument Config Map Version
2-17	Latin-1 ASCII	Instrument Part Number
18-33	Latin-1 ASCII	Instrument Serial Number
34-37	Latin-1 ASCII	Technician Initials
38-43	Latin-1 ASCII	Instrument Job Number
44-49	Latin-1 ASCII	Manufacture Date

Command 135 – Read Calibration Data – Response Length: 18 Bytes		
Byte Number	Parsing	Parameter
0-3	Float IEEE 754	Span Reserve Value Channel 1
4	Unsigned-8	Last Cal Day Channel 1
5	Unsigned-8	Last Cal Month Channel 1
6	Unsigned-8	Last Cal Year Channel 1
7-8	Unsigned-16	Next Cal Due In Days Channel 1
9-12	Float IEEE 754	Span Reserve Value Channel 2
13	Unsigned-8	Last Cal Day Channel 2
14	Unsigned-8	Last Cal Month Channel 2
15	Unsigned-8	Last Cal Year Channel 2
16-17	Unsigned-16	Next Cal Due In Days Channel 2

Table A - 3 Read Commands

Write Commands

All write commands are dispatched with specific number of data bytes which are written to specified parameters after parsing process. In case of a single sensor ⬛TRANS·2 the parameters of disconnected sensor are also included in the request data although those can be set at 0. The response of a write command is the same as the request. The details are provided in the Table A - 4.

Command 140 – Write Real Time Clock – Response/Request Length: 18 Bytes		
Byte Number	Parsing	Parameter
0	Unsigned-8	RTC Minute Channel 1
1	Unsigned-8	RTC Hour Channel 1
2	Unsigned-8	RTC Day Channel 1
3	Unsigned-8	RTC Month Channel 1
4	Unsigned-8	RTC Year Channel 1
5-8	Unsigned-32	Total Operation Time (In Minutes) Channel 1
9	Unsigned-8	RTC Minute Channel 2
10	Unsigned-8	RTC Hour Channel 2
11	Unsigned-8	RTC Day Channel 2
12	Unsigned-8	RTC Month Channel 2
13	Unsigned-8	RTC Year Channel 2
14-17	Unsigned-32	Total Operation Time (In Minutes) Channel 2

Command 141 – Write User Configuration – Response/Request Length: 36 Bytes		
Byte Number	Parsing	Parameter
0-3	Float IEEE 754	Low Alarm Threshold Channel 1
4-7	Float IEEE 754	High Alarm Threshold Channel 1
8-11	Float IEEE 754	Analog Output Range Channel 1
12-15	Float IEEE 754	Cal Gas Value Channel 1
16-17	Unsigned-16	Calibration Interval In Days Channel 1
18-21	Float IEEE 754	Low Alarm Threshold Channel 2
22-25	Float IEEE 754	High Alarm Threshold Channel 2
26-29	Float IEEE 754	Analog Output Range Channel 2
30-33	Float IEEE 754	Cal Gas Value Channel 2
34-35	Unsigned-16	Calibration Interval In Days Channel 2

Table A - 4 Write Commands

Operation Commands

Operation commands are similar to write commands where specific values are written on specific sensor to get the desired operation done. The details are enlisted in the Table A - 5.

Command 150 – Start/Abort Selected Live Channel Calibration – Response/Request Length: 2		
Byte Number	Parsing	Parameter
0	Unsigned-8	Selected Sensor ("1 = Sensor 1" and "2 = Sensor 2")
1	Unsigned-8	Calibration Condition ("1 = Abort" and "2 = Start")

Command 151 – Start/Abort Selected Live Channel Zeroing – Response/Request Length: 2		
Byte Number	Parsing	Parameter
0	Unsigned-8	Selected Sensor ("1 = Sensor 1" and "2 = Sensor 2")
1	Unsigned-8	Zeroing Condition ("1 = Abort" and "6 = Start")

Table A - 5 Operation Commands

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Appendix B.   Acronyms and Abbreviations

This appendix contains acronyms and abbreviations that are used within this document.

Abbr	Definition
A	Ampere
ABS	acrylonitrile butadiene styrene
ASCII	American Standard Code for Information Interchange
bit	binary digit
bps	bits per second
C	centigrade
C2H4	ethylene
C2H6O	ethanol
C3H6	propylene
C3H8	propane
C4H10	butane
C5H12	pentane
C6H14	hexane
C2H4	ethylene
CALI	calibration
CAT	catalytic
Ch	channel
CH4	methane
chem	chemical
Cl2	chlorine
ClO2	chlorine dioxide
CO	carbon monoxide
CO2	carbon dioxide
CSA	Canadian Standards Association
DC	direct current
DCS	distributed control system
DIP	dual in-line package
DISP	display
F	Fahrenheit
FAQ	frequently asked questions
FAUL	fault
FIFO	first-in-first-out
GND	ground
H_2	hydrogen

Abbr	Definition
H_2S	hydrogen sulfide
HCl	hydrogen chloride
HCN	hydrogen cyanide
LED	light emitting diode
LEL	lower explosive limit (combustible gases)
LSB	least significant bit
mA	milliampere
mm	millimeter
MSB	most significant bit
NC	normally closed
NDIR	non-dispersive infrared
NEMA	National Electrical Manufacturers Association
NH_3	ammonia
NO	normally open, Nitric Oxide
NO_2	nitrogen dioxide
NOR	normal mode
NRTL	nationally recognized testing laboratory
O_2	oxygen
OXY	oxygen
PH3	phosphine
PLC	programmable logic controller
ppm	parts per million
REST	restart
RH	relative humidity
RTC	real time clock
RTU	remote terminal unit
SO_2	sulfur dioxide
SPST	single-pole, single-throw
TOX	toxic
V	Volts

Table B - 1 Acronyms and Abbreviations

Appendix C.   Decimal, Binary, And Hex Equivalents

This appendix lists the hexadecimal and binary equivalents of decimal numbers. ModBus device addresses are entered in hexadecimal format. This table provides a cross reference if only decimal addresses are known. Hexadecimal numbers are shown in 0x00 format on the left. Decimal equivalents are shown on the right. Refer to Table C - 1. Decimal and binary equivalents are shown in Table C - 2.

0x00 = 000	0x20 = 032	0x40 = 064	0x60 = 096	0x80 = 128	0xA0 = 160	0xC0 = 192	0xE0 = 224
0x01 = 001	0x21 = 033	0x41 = 065	0x61 = 097	0x81 = 129	0xA1 = 161	0xC1 = 193	0xE1 = 225
0x02 = 002	0x22 = 034	0x42 = 066	0x62 = 098	0x82 = 130	0xA2 = 162	0xC2 = 194	0xE2 = 226
0x03 = 003	0x23 = 035	0x43 = 067	0x63 = 099	0x83 = 131	0xA3 = 163	0xC3 = 195	0xE3 = 227
0x04 = 004	0x24 = 036	0x44 = 068	0x64 = 100	0x84 = 132	0xA4 = 164	0xC4 = 196	0xE4 = 228
0x05 = 005	0x25 = 037	0x45 = 069	0x65 = 101	0x85 = 133	0xA5 = 165	0xC5 = 197	0xE5 = 229
0x06 = 006	0x26 = 038	0x46 = 070	0x66 = 102	0x86 = 134	0xA6 = 166	0xC6 = 198	0xE6 = 230
0x07 = 007	0x27 = 039	0x47 = 071	0x67 = 103	0x87 = 135	0xA7 = 167	0xC7 = 199	0xE7 = 231
0x08 = 008	0x28 = 040	0x48 = 072	0x68 = 104	0x88 = 136	0xA8 = 168	0xC8 = 200	0xE8 = 232
0x09 = 009	0x29 = 041	0x49 = 073	0x69 = 105	0x89 = 137	0xA9 = 169	0xC9 = 201	0xE9 = 233
0x0A = 010	0x2A = 042	0x4A = 074	0x6A = 106	0x8A = 138	0xAA = 170	0xCA = 202	0xEA = 234
0x0B = 011	0x2B = 043	0x4B = 075	0x6B = 107	0x8B = 139	0xAB = 171	0xCB = 203	0xEB = 235
0x0C = 012	0x2C = 044	0x4C = 076	0x6C = 108	0x8C = 140	0xAC = 172	0xCC = 204	0xEC = 236
0x0D = 013	0x2D = 045	0x4D = 077	0x6D = 109	0x8D = 141	0xAD = 173	0xCD = 205	0xED = 237
0x0E = 014	0x2E = 046	0x4E = 078	0x6E = 110	0x8E = 142	0xAE = 174	0xCE = 206	0xEE = 238
0x0F = 015	0x2F = 047	0x4F = 079	0x6F = 111	0x8F = 143	0xAF = 175	0xCF = 207	0xEF = 239
0x10 = 016	0x30 = 048	0x50 = 080	0x70 = 112	0x90 = 144	0xB0 = 176	0xD0 = 208	0xF0 = 240
0x11 = 017	0x31 = 049	0x51 = 081	0x71 = 113	0x91 = 145	0xB1 = 177	0xD1 = 209	0xF1 = 241
0x12 = 018	0x32 = 050	0x52 = 082	0x72 = 114	0x92 = 146	0xB2 = 178	0xD2 = 210	0xF2 = 242
0x13 = 019	0x33 = 051	0x53 = 083	0x73 = 115	0x93 = 147	0xB3 = 179	0xD3 = 211	0xF3 = 243
0x14 = 020	0x34 = 052	0x54 = 084	0x74 = 116	0x94 = 148	0xB4 = 180	0xD4 = 212	0xF4 = 244
0x15 = 021	0x35 = 053	0x55 = 085	0x75 = 117	0x95 = 149	0xB5 = 181	0xD5 = 213	0xF5 = 245
0x16 = 022	0x36 = 054	0x56 = 086	0x76 = 118	0x96 = 150	0xB6 = 182	0xD6 = 214	0xF6 = 246
0x17 = 023	0x37 = 055	0x57 = 087	0x77 = 119	0x97 = 151	0xB7 = 183	0xD7 = 215	0xF7 = 247
0x18 = 024	0x38 = 056	0x58 = 088	0x78 = 120	0x98 = 152	0xB8 = 184	0xD8 = 216	0xF8 = 248
0x19 = 025	0x39 = 057	0x59 = 089	0x79 = 121	0x99 = 153	0xB9 = 185	0xD9 = 217	0xF9 = 249
0x1A = 026	0x3A = 058	0x5A = 090	0x7A = 122	0x9A = 154	0xBA = 186	0xDA = 218	0xFA = 250
0x1B = 027	0x3B = 059	0x5B = 091	0x7B = 123	0x9B = 155	0xBB = 187	0xDB = 219	0xFB = 251
0x1C = 028	0x3C = 060	0x5C = 092	0x7C = 124	0x9C = 156	0xBC = 188	0xDC = 220	0xFC = 252
0x1D = 029	0x3D = 061	0x5D = 093	0x7D = 125	0x9D = 157	0xBD = 189	0xDD = 221	0xFD = 253
0x1E = 030	0x3E = 062	0x5E = 094	0x7E = 126	0x9E = 158	0xBE = 190	0xDE = 222	0xFE = 254
0x1F = 031	0x3F = 063	0x5F = 095	0x7F = 127	0x9F = 159	0xBF = 191	0xDF = 223	0xFF = 255

Table C - 1 Hexadecimal and Decimal Equivalents

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Dec	Binary	Dec	Binary	Dec	Binary	Dec	Binary
0	00000000	64	01000000	128	10000000	192	11000000
1	00000001	65	01000001	129	10000001	193	11000001
2	00000010	66	01000010	130	10000010	194	11000010
3	00000011	67	01000011	131	10000011	195	11000011
4	00000100	68	01000100	132	10000100	196	11000100
5	00000101	69	01000101	133	10000101	197	11000101
6	00000110	70	01000110	134	10000110	198	11000110
7	00000111	71	01000111	135	10000111	199	11000111
8	00001000	72	01001000	136	10001000	200	11001000
9	00001001	73	01001001	137	10001001	201	11001001
10	00001010	74	01001010	138	10001010	202	11001010
11	00001011	75	01001011	139	10001011	203	11001011
12	00001100	76	01001100	140	10001100	204	11001100
13	00001101	77	01001101	141	10001101	205	11001101
14	00001110	78	01001110	142	10001110	206	11001110
15	00001111	79	01001111	143	10001111	207	11001111
16	00010000	80	01010000	144	10010000	208	11010000
17	00010001	81	01010001	145	10010001	209	11010001
18	00010010	82	01010010	146	10010010	210	11010010
19	00010011	83	01010011	147	10010011	211	11010011
20	00010100	84	01010100	148	10010100	212	11010100
21	00010101	85	01010101	149	10010101	213	11010101
22	00010110	86	01010110	150	10010110	214	11010110
23	00010111	87	01010111	151	10010111	215	11010111
24	00011000	88	01011000	152	10011000	216	11011000
25	00011001	89	01011001	153	10011001	217	11011001
26	00011010	90	01011010	154	10011010	218	11011010
27	00011011	91	01011011	155	10011011	219	11011011
28	00011100	92	01011100	156	10011100	220	11011100
29	00011101	93	01011101	157	10011101	221	11011101
30	00011110	94	01011110	158	10011110	222	11011110
31	00011111	95	01011111	159	10011111	223	11011111
32	00100000	96	01100000	160	10100000	224	11100000
33	00100001	97	01100001	161	10100001	225	11100001
34	00100010	98	01100010	162	10100010	226	11100010
35	00100011	99	01100011	163	10100011	227	11100011
36	00100100	100	01100100	164	10100100	228	11100100
37	00100101	101	01100101	165	10100101	229	11100101

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Dec	Binary	Dec	Binary	Dec	Binary	Dec	Binary
38	00100110	102	01100110	166	10100110	230	11100110
39	00100111	103	01100111	167	10100111	231	11100111
40	00101000	104	01101000	168	10101000	232	11101000
41	00101001	105	01101001	169	10101001	233	11101001
42	00101010	106	01101010	170	10101010	234	11101010
43	00101011	107	01101011	171	10101011	235	11101011
44	00101100	108	01101100	172	10101100	236	11101100
45	00101101	109	01101101	173	10101101	237	11101101
46	00101110	110	01101110	174	10101110	238	11101110
47	00101111	111	01101111	175	10101111	239	11101111
48	00110000	112	01110000	176	10110000	240	11110000
49	00110001	113	01110001	177	10110001	241	11110001
50	00110010	114	01110010	178	10110010	242	11110010
51	00110011	115	01110011	179	10110011	243	11110011
52	00110100	116	01110100	180	10110100	244	11110100
53	00110101	117	01110101	181	10110101	245	11110101
54	00110110	118	01110110	182	10110110	246	11110110
55	00110111	119	01110111	183	10110111	247	11110111
56	00111000	120	01111000	184	10111000	248	11111000
57	00111001	121	01111001	185	10111001	249	11111001
58	00111010	122	01111010	186	10111010	250	11111010
59	00111011	123	01111011	187	10111011	251	11111011
60	00111100	124	01111100	188	10111100	252	11111100
61	00111101	125	01111101	189	10111101	253	11111101
62	00111110	126	01111110	190	10111110	254	11111110
63	00111111	127	01111111	191	10111111	255	11111111

Table C - 2 Decimal and Binary Equivalents

Appendix D.   Ordering Matrix

This appendix provides an ordering matrix for the ⁅TRANS·2⁆ and iTR2SA gas monitor.

⁅TRANS·2⁆ Base part number iTrans2-ABCDEFG

Single or dual on-board or remote toxic, combustible and oxygen sensors with dual 4-20 mA outputs (one per sensor) or ModBus RTU outputs. Remote sensor capable of operation up to 200 meters from main transmitter. Operating temperature range $-20°C$ to $+50°C$.

Example: *iTrans2-1C21241 =On-board LEL (4-20 mA scale 0-100) and remote mount H2S (4-20 mA scale 0-500) with relays*

A = Sensor 1 Configuration	**E** = Sensor 2 Configuration
BC = Gas sensor & 4-20 mA output scale for sensor 1	**FG** = Gas sensor 2 & 4-20 mA output scale for sensor 2
D = Optional on-board relays	

A - Sensor 1	E – Sensor 2
	0 = No sensor
1 = Explosion Proof / On-board	1 = Explosion Proof / On-board
2 = Explosion Proof / Remote	2 = Explosion Proof / Remote
3 = Non-hazardous Remote/Duct Mount	3 = Non-hazardous Remote/Duct Mount
6 = Stainless Steel / On-board	7 = Stainless Steel / Remote
7 = Stainless Steel / Remote	

BC - Gas & Range sensor 1	FG – Gas & range sensor 2
10 = Carbon Monoxide (CO) 0-999ppm	10 = Carbon Monoxide (CO) 0-999ppm
22 = Nitric Oxide (NO) 0-999ppm	20 = Nitric Oxide (NO) 0-999ppm
31 = Ammonia (NH_3) 0-500ppm	31 = Ammonia (NH_3) 0-500ppm
41 = Hydrogen Sulfide (H_2S) 0-500ppm	41 = Hydrogen Sulfide (H_2S) 0-500ppm
52 = Sulfur Dioxide (SO_2) 0-100ppm	52 = Sulfur Dioxide (SO_2) 0-100ppm
62 = Nitrogen Dioxide (NO_2) 0-100ppm	62 = Nitrogen Dioxide (NO_2) 0-100ppm
72 = Chlorine (Cl_2) 0-100ppm	72 = Chlorine (Cl_2) 0-100ppm
87 = Chlorine Dioxide (ClO_2) 0-1ppm	87 = Chlorine Dioxide (ClO_2) 0-1ppm
94 = Hydrogen Cyanide (HCN) 0-30ppm	94 = Hydrogen Cyanide (HCN) 0-30ppm
A4 = Oxygen (O_2) 0-30%vol.	A4 = Oxygen (O_2) 0-30%vol.

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B2 = LEL Catalytic Plug-In (factory Methane calibration) 0-100%	B2 = LEL Catalytic Plug-In (factory Methane calibration) 0-100%
C2 = LEL Catalytic Plug-In (factory Pentane calibration) 0-100%	C2 = LEL Catalytic Plug-In (factory Pentane calibration) 0-100%
H2 = LEL Catalytic Plug-In (factory Hydrogen calibration) 0-100%	H2 = LEL Catalytic Plug-In (factory Hydrogen calibration) 0-100%
D0 = Carbon Monoxide - Hydrogen Null (CO - H_2) 0-999ppm	D0 = Carbon Monoxide - Hydrogen Null (CO - H_2) 0-999ppm
F4 = Hydrogen Chloride (HCl) 0-30ppm	F4 = Hydrogen Chloride (HCl) 0-30ppm
K7 = Phosphine (PH_3) 0-1ppm	K7 = Phosphine (PH_3) 0-1ppm
L0 = Hydrogen (H_2) 0-999ppm	L0 = Hydrogen (H_2) 0-999ppm
VA = Carbon Dioxide (0-5% CO_2) W2 = Carbon Dioxide (0-100% CO_2)	VA = Carbon Dioxide (0-5% CO_2) W2 = Carbon Dioxide (0-100% CO_2)
XB = Carbon Dioxide (0-0.5% CO_2)	XB = Carbon Dioxide (0-0.5% CO_2)

D – Optional On-Board Relays
0 = No Relay Module (Modbus)
1 = With Optional On-Board Relays (Modbus)
2 = No Relay Module (HART)
3 = With Optional On-Board Relays (HART)

iTR2SA Base part number ITR2SA-ABCDEFG

Single or dual on-board or remote toxic, combustible and oxygen sensors with dual 4-20 mA outputs (one per sensor) or ModBus RTU outputs. Remote sensor capable of operation up to 200 meters from main transmitter. Operating temperature range –20°C to +50°C.

Example: *ITR2SA2-1C210 =On-board LEL (4-20 mA scale 0-100) with beacon and sounder, supplied with an external power supply.*

A = Sensor 1 Configuration	**E** = Sensor 2 Configuration
BC = Gas sensor & 4-20 mA output scale for sensor 1	**FG** = Gas sensor 2 & 4-20 mA output scale for sensor 2

D = power supply

A - Sensor 1	E – Sensor 2
	0 = No sensor
1 = Explosion Proof / On-board	1 = Explosion Proof / On-board
2 = Explosion Proof / Remote	2 = Explosion Proof / Remote
3 = Non-hazardous Remote/Duct Mount	3 = Non-hazardous Remote/Duct Mount
6 = Stainless Steel / On-board	7 = Stainless Steel / Remote
7 = Stainless Steel / Remote	

BC - Gas & Range sensor 1	FG – Gas & range sensor 2
10 = Carbon Monoxide (CO) 0-999ppm	10 = Carbon Monoxide (CO) 0-999ppm
22 = Nitric Oxide (NO) 0-999ppm	20 = Nitric Oxide (NO) 0-999ppm
31 = Ammonia (NH_3) 0-500ppm	31 = Ammonia (NH_3) 0-500ppm
41 = Hydrogen Sulfide (H_2S) 0-500ppm	41 = Hydrogen Sulfide (H_2S) 0-500ppm
52 = Sulfur Dioxide (SO_2) 0-100ppm	52 = Sulfur Dioxide (SO_2) 0-100ppm
62 = Nitrogen Dioxide (NO_2) 0-100ppm	62 = Nitrogen Dioxide (NO_2) 0-100ppm
72 = Chlorine (Cl_2) 0-100ppm	72 = Chlorine (Cl_2) 0-100ppm
87 = Chlorine Dioxide (ClO_2) 0-1ppm	87 = Chlorine Dioxide (ClO_2) 0-1ppm
94 = Hydrogen Cyanide (HCN) 0-30ppm	94 = Hydrogen Cyanide (HCN) 0-30ppm
A4 = Oxygen (O_2) 0-30%vol.	A4 = Oxygen (O_2) 0-30%vol.
B2 = LEL Catalytic Plug-In (factory Methane calibration) 0-100%	B2 = LEL Catalytic Plug-In (factory Methane calibration) 0-100%
C2 = LEL Catalytic Plug-In (factory Pentane calibration) 0-100%	C2 = LEL Catalytic Plug-In (factory Pentane calibration) 0-100%
H2 = LEL Catalytic Plug-In (factory Hydrogen calibration) 0-100%	H2 = LEL Catalytic Plug-In (factory Hydrogen calibration) 0-100%
D0 = Carbon Monoxide - Hydrogen Null (CO - H_2) 0-999ppm	D0 = Carbon Monoxide - Hydrogen Null (CO - H_2) 0-999ppm
F4 = Hydrogen Chloride (HCl) 0-30ppm	F4 = Hydrogen Chloride (HCl) 0-30ppm

K7 = Phosphine (PH$_3$) 0-1ppm	K7 = Phosphine (PH$_3$) 0-1ppm
L0 = Hydrogen (H$_2$) 0-999ppm	L0 = Hydrogen (H$_2$) 0-999ppm
VA = Carbon Dioxide (0-5% CO$_2$)	VA = Carbon Dioxide (0-5% CO$_2$)
W2 = Carbon Dioxide (0-100% CO$_2$)	W2 = Carbon Dioxide (0-100% CO$_2$)
XB = Carbon Dioxide (0-0.5% CO$_2$)	XB = Carbon Dioxide (0-0.5% CO$_2$)

D – Optional power supply
0 = Comes without external power supply
1 = Comes with an external power supply

Appendix E. Factory Default Settings

This appendix lists factory default ⟨TRANS·2⟩ and iTR2SA settings based on the individual sensor(s) used. Refer to Table E - 1.

Sensor Name	Range	Resolution	Cal Gas	Default Low Alarm	Default High Alarm
CO	0-999 ppm	1 ppm	100 ppm	35 ppm	70 ppm
H_2S	0-500 ppm	1 ppm	25 ppm	10 ppm	20 ppm
SO_2	0-99.9 ppm	0.1 ppm	5 ppm	2.0 ppm	4.0 ppm
NO_2	0-99.9 ppm	0.1 ppm	5 ppm	1.0 ppm	2.0 ppm
Cl_2	0-99.9 ppm	0.1 ppm	10 ppm	0.5 ppm	1.0 ppm
ClO_2	0-1.00 ppm	0.01 ppm	0.90 ppm	0.30 ppm	0.50 ppm
HCN	0-30.0 ppm	0.1 ppm	10 ppm	5.0 ppm	10.0 ppm
PH_3	0-1.00 ppm	0.01 ppm	1.0 ppm	0.30 ppm	0.60 ppm
CO/H_2 NULL	0-999 ppm	1 ppm	100 ppm	35 ppm	70 ppm
NO	0-999 ppm	1 ppm	25 ppm	25 ppm	50 ppm
NH_3	0-500 ppm	1 ppm	25 ppm	25 ppm	50 ppm
HCl	0-30.0 ppm	0.1 ppm	10 ppm	5.0 ppm	10.0 ppm
H_2	0-999 ppm	1 ppm	100 ppm	50 ppm	100 ppm
O_2	0-30% Vol.	0.1% Vol.	20.9%	19.5%	23.5%
Catalytic Bead, LEL Methane	0-100% LEL	1% LEL	50% LEL	10% LEL	20% LEL
Catalytic Bead, LEL Pentane	0-100% LEL	1% LEL	25% LEL	10% LEL	20% LEL
Catalytic Bead, LEL Hydrogen	0-100% LEL	1% LEL	50% LEL	10% LEL	20% LEL
CO_2	0-0.05% Vol.	0.01% Vol.	0.25%Vol.	0.10% Vol	0.20% Vol
CO_2	0-5.00% Vol.	0.01% Vol.	2.50% Vol.	1.00% Vol	2.00% Vol
CO_2	0-100% Vol.	1% Vol.	50% Vol.	10% Vol	20% Vol

Table E - 1 Factory Default Settings

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Appendix F.   LEL Correlation Factors

The following chart outlines LEL correlation factors for combustible catalytic gas sensors installed in iTrans2.

	Methane	Pentane	Hydrogen
Acetone	2.24	1.03	
Acetylene	1.91	0.88	
Ammonia	0.79	0.36	
Benzene	2.45	1.13	
n-Butane	2.16	0.99	
Ethane	1.47	0.68	
Ethanol	1.37	0.63	
Ethylene	1.41	0.65	
n-Hexane	2.48	1.14	
HFO-1234yf	1.25	0.55	
Hydrogen			1.00
Isopropanol	1.84	0.85	
JP-4	3.28	1.51	
JP-5	3.33	1.53	
JP-8	3.48	1.60	
Methane	1.00		
Methanol	1.27	0.58	
n-Pentane	2.17	1.00	
Propane	1.90	0.87	
Styrene	2.13	0.98	
Toluene	2.26	1.04	
Xylene	2.80	1.29	

Example:

The instrument has been calibrated on methane and is now reading 10% LEL in a pentane atmosphere. To find actual %LEL pentane, please multiply by the number found at the intersection of the methane column (calibration gas) and the pentane row (gas being sampled)...in this case, 2.17. Therefore, the actual %LEL pentane is 23% (10x2.17).

Calibration gases available from TELEDYNE OLDHAM SIMTRONICS.

iTRANS 2

FIXED POINT SINGLE OR DUAL GAS MONITOR
WITH DUAL ANALOG OUTPUTS
USER MANUAL

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