ANALYTICAL TECHNOLOGY, INC.

O & M Manual

Series D12 EX-IR

Gas Transmitter w/Smart IR Sensor

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ATI-UM-04407-EN-01

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SAFETY

Read and understand this manual before installing, operating, or maintaining the D12EX-IR Transmitter. Pay particular attention to the warnings and cautions below. All of the warnings and cautions shown here are repeated in the appropriate sections of the manual.

WARNINGS

- To prevent ignition of hazardous atmospheres, do not remove cover while circuits are live. KEEP ASSEMBLY TIGHTLY CLOSED WHEN IN OPERATION.
- Installation must be in accordance with the recognized standards of the appropriate authority in the country concerned.
- Servicing of this unit must be performed by trained personnel.
- Before servicing, ensure local regulations and site procedures are followed.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- The transmitter must be earthed/grounded for electrical safety and to limit the effects of radio frequency interference. An Earth ground points is provided inside the unit.
- Operate only in the specified temperature range.
- Verify transmitter after installation, after service events, and periodically to ensure the safety and integrity of the system.
- No User Serviceable Parts
- Flameproof joints are not permitted to be repaired.
- Do not place in service if damaged.

SPECIFIC CONDITIONS OF USE / SCHEDULE OF LIMITATIONS:

- To minimize the risk of electrostatic charge, provisions shall be made for adequate grounding and equipment shall be installed in such a manner so that accidental discharge shall not occur.
- The enclosure that features the Gas Sensor Housing must be properly mounted with the sensor opening facing downwards.
- Flameproof joints are not intended to be repaired.

MARKINGS

ANALYTICAL TECHNOLOGY, INC.
COLLEGEVILLE, PA 19426 USA
Model: D12EX-IR-a-b
Power: 12 - 30 VDC, 250 mA MAX
Tamb: -20°C to +60°C

CERTIFICATIONS

DEMKO 18 ATEX 2066X
CE 0539 Ⓔx II 2 G Ex db IIC T6 Gb
- EN 60079-0:2012+A11:2013
- EN 60079-1:2014

IECEx UL 18.0080X
Ex db IIC T6 Gb
• IEC 60079-0 (2011-06) + Corr.1 (2012-01) + Corr. 2(2013-12) + I-SH 01(2013-11) + I-SH 02 (2014-10)
• IEC 60079-1, 7th Edition (2014-06)

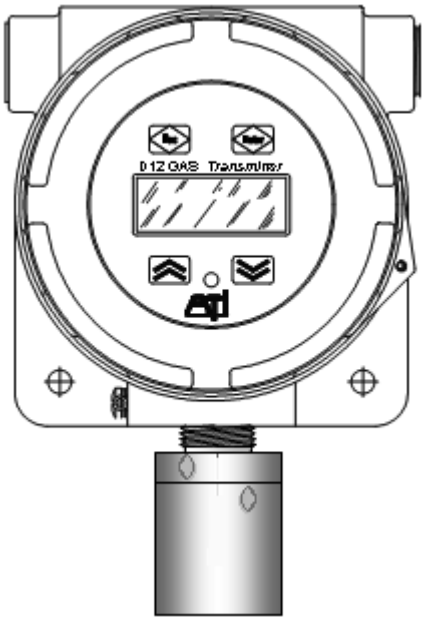
HAZARDOUS LOCATION INSTALLATION REQUIREMENTS (ATEX / IECEX)

• Read and understand this manual prior to installation and use.
• Use rated Ex db IIC Gb entry devices
• All un-used ports must be closed with blanking elements rated Ex db IIC Gb
• All fittings are 3/4" NPT.
• Mount transmitter with sensor housing facing down.

INTRODUCTION

D12*EX-IR* GAS TRANSMITTER

The D12Ex-IR gas transmitter is used to continuously monitor for leaks of combustible hydrocarbon gas in ambient air near process tanks, piping, or in enclosed spaces where gases may accumulate. Standard sensors are available for detecting methane and propane, and numerous other process and solvent gases like hexane and toluene. Sensors are also available for detecting CO2 with upper ranges of 5000 PPM, 5% by volume, and 100% by volume.



The transmitter features an easily replaceable NDIR (non-dispersive infrared) sensor "cell", a non-intrusive four button user interface with a back-lighted graphics display, three level alarm system with three (optional) alarm relays, high-resolution 4-20mA current loop output, real-time clock, data-logger, and optional HART™ or Modbus™ network interface. The housing is explosion proof, and is UL rated for use in hazardous locations (see specifications). The sensor may be located up to 100' from the transmitter using the optional remote junction box

Figure 1. D12Ex-IR Gas Transmitter

OPTIONS

The transmitter is available with options to meet the needs of most applications. The "Alarm Relay" option includes a special power supply board that provides power for three SPDT relays, the display backlight, and a selectable RS232/485 interface for Modbus™ and ASCII communication. The "HART" option provides a HART™ FSK interface and may be ordered with or without the Alarm Relay option. The table below summarizes the available options.

Table 1 Transmitter Options

Option	***Description***
Remote Sensor Junction Box	Permits the gas sensor to be located up to 100 feet from the transmitter using only 4 wires.
Alarm Relays	Provides (3) SPDT relays
Modbus RTU	Enables Modbus RTU protocol over RS232 and RS485
HART FSK	Enables HART device (includes the internal HART FSK modem) HART DDL available on the HART Foundation website.

IR SENSOR

The IR sensor consists of the IR cell mounted within an explosion-proof, stainless steel housing. The base of the housing is threaded into the transmitter, or (optional) remote housing, and connects the cell to the transmitter's electronics. The housing cover threads onto the base and is fitted with a flame arrestor, which permits gas to reach the cell while preventing ignition of any combustible atmosphere that could develop around the transmitter. The cover may be removed to replace the cell, if the need should arise.

Figure 2 Sensor Installed

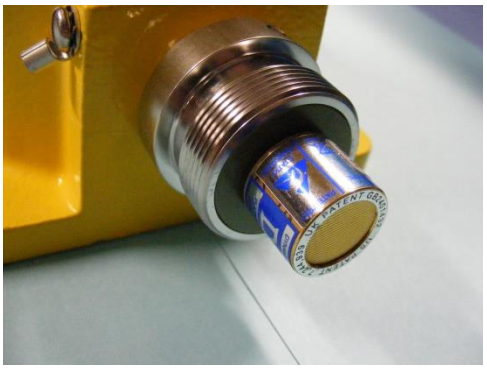


Figure 3 Sensor Housing Cover Removed

Figure 4 Sensor Housing Components

Figure 5 4 & 5 Pin IR Sensor Cells

IR Sensor Versions

The table lists the gas sensors available for the D12Ex-IR.
Sensors are not safe for monitoring acetylene.

Table 2. IR Sensor Versions.

Version	*Description*
HC	Low level hydrocarbon sensor for detecting methane, propane, and various other flammable gases in air, below their respective LEL. Also includes a high range setting for monitoring methane above its UEL.
HHC	High range hydrocarbon sensor for 0-100 %VOL concentrations of Propane, Butane, LPAGE, etc, for monitoring levels above the UEL.
CO2-L	Carbon dioxide sensor for lower ranges.
CO2-H	Carbon dioxide sensor for higher ranges.
N2O-L	Nitrous oxide sensor for lower ranges.

HC LEL Range Hydrocarbon Sensor

The HC version of the IR sensor is designed for detecting leaks of methane, propane, and other gases in locations where they might occur, but are not normally expected. The NDIR sensor does not distinguish one gas from another but is calibrated to report levels of the selected "target gas", much like a catalytic bead sensor. Unlike a catalytic bead sensor, compounds of silicon do not poison the sensor, nor does the output decrease when exposed to higher levels of gas. Although not entirely accurate above the target gas LEL, readings will not decrease when exposed to higher concentrations of the target gas. By default, the transmitter will alarm when the gas level rises to 20 and 50 percent of the LEL[1].

The HC sensor may also be used for monitoring high levels of methane in locations where it is normally expected. This is accomplished by selecting the "Methane-HR" setting, which should only be used for monitoring methane at levels above its UEL[2] (15 %VOL). Extreme care must be taken in these locations, since a leak of air could produce an explosive atmosphere.

Many hydrocarbon gases have absorption characteristics that are similar to propane. This allows gas readings to be produced by scaling the propane reading using a "k-factor". The transmitter exposes a collection of these gases for selection as the target gas and maintains the k-factor for each. When span calibrated to the target gas, the transmitter adjusts the k-factor.

[1] LEL (Lower Explosive Limit) of a gas or vapor is defined as the lowest percent by volume of that gas or vapor in air that is capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). Example: 100 %LEL of methane is 5 %VOL in air.

[2] Highest %VOL (percent by volume) concentration of a gas or a vapor in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

The transmitter also permits span calibration to propane as a "surrogate" gas, when the target gas is unavailable. The table below summarizes target gas selections available on the sensor.

Table 3 HC Sensor Target Gas Selections

(Parenthesis indicate default value)

Designed for monitoring combustible levels below the LEL (Lower Explosive Limit). Accuracy +/-2%LEL

Gas	LEL %VOL	UEL %VOL	Range %LEL	Alarms A/W/C %LEL	Relative Density	Propane Rdg[3] @100%LEL
Methane	5.00	15.0	20-(100)	50/20/-10	0.55	40
Propane	2.20	10.0	20-(100)	50/20/-10	1.55	100

Designed for monitoring various other hydrocarbon gases below the LEL, readings are produced by scaling the propane reading using a "k-factor". Accuracy is +/- 6%LEL [4]

Gas	LEL %VOL	UEL %VOL	Range %LEL	Alarms A/W/C %LEL	Relative Density	Propane Rdg @100%LEL	K Factor
Acetone	2.50	12.80	20-(100)	50/20/-10	1.2	35	3.280
Chloromethane	8.10	17.40	20-(100)	50/20/-10	1.7	74	4.970
Cyclopentane	1.10	8.70	20-(100)	50/20/-10	1.6	31	1.620
Dichloroethane	5.40	11.40	20-(100)	50/20/-10	1.2	29	8.570
Ethane	3.00	12.40	20-(100)	50/20/-10	1.05	135	1.010
Ethanol	3.30	19.00	20-(100)	50/20/-10	1.6	91	1.650
Ethyl acetate	2.00	11.50	20-(100)	50/20/-10	1.2	54	1.690
Ethylene	2.70	36.00	20-(100)	50/20/-10	0.98	43	2.837
Ethylene oxide	3.00	100.00	20-(100)	50/20/-10	1.5	161	0.845
Hexane	1.20	7.50	20-(100)	50/20/-10	1.3	68	0.872
MEK	1.40	11.40	20-(100)	50/20/-10	1.1	34	1.870
Methanol	6.00	36.00	20-(100)	50/20/-10	1.01	123	2.220
n-Butane	1.60	8.40	20-(100)	50/20/-10	2.11	75	0.970
Pentane	1.50	7.80	20-(100)	50/20/-10	1.8	72	0.950
Propanol	2.00	12.70	20-(100)	50/20/-10	1.02	64	1.430
Propylene	2.00	11.10	20-(100)	50/20/-10	1.5	54	1.690
Toluene	1.10	7.10	20-(100)	50/20/-10	1.01	42	1.180
Xylene	1.10	7.00	20-(100)	50/20/-10	1.02	33	1.510

Designed for monitoring methane levels above the UEL (Upper Explosive Limit). Can also "auto-range" with the high accuracy methane selection above. Accuracy is +/-2%VOL

Gas	LEL %VOL	UEL %VOL	Range %VOL	Alarms A/W/C %VOL	Relavite Density
Methane-HR	5.00	15.0	10-(100)	Disabled	0.55

"Methane-HR" is not designed to be used below 15%VOL

[3] Gas reading at the LEL level when propane is selected as the target gas. This is useful for choosing target gas in multi-gas enviroments (see "Multiple Gas Environments").

[4] These and other gases are available fully calibrated to within +/-2% by special order. Contact the ATi Sales department for more information.

%LEL Gases

For safety, when displaying concentrations in units of %LEL, the transmitter's *high-high* alarm, "Alarm" restricts its ***Type*** and ***Reset*** settings to **High** and **Manu**, respectively. The "Warning" and "Caution" alarms are not restricted, and no alarm may be set above 60 %LEL. The table below lists the alarm settings. For information about how these settings affect gas alarm operation, see Flammable and Toxic Gas Alarms on page 46.

Table 4 HC Sensor %LEL Gas Alarm Settings

Alarm Name	*Setting*	*Default Value*	*Setting Limits*
Alarm	**Type**	High	Not adjustable
	Set Level, Reset Level	50 %LEL	10 – 60 %LEL
	Set Delay	0s	0-10s
	Reset Delay	Not applicable[5]	Not applicable
	Reset (clear method)	Manual	Not adjustable
Warning	**Type**	High	High, Low, or None
	Set Level, Reset Level	20 %LEL	-15 to 60 %LEL
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual
Caution	**Type**	Low	High, Low, or None
	Set Level, Reset Level	-10 %LEL	-15 to 60 %LEL
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual

Methane-HR

The "Methane-HR" setting should be selected only for monitoring methane at levels above the UEL (Upper Explosive Limit), which is defined as the highest %VOL concentration of a gas or a vapor, in air, capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). For methane, the UEL is 15 %VOL. Extreme care must be taken in these locations, since any leak of air can produce an explosive atmosphere. The table below lists the alarm settings. For information about how these settings affect gas alarm operation, see Flammable and Toxic Gas Alarms on page 46.

This setting is not designed for use below the UEL of methane.

Table 5 HC Sensor Methane-HR Alarm Settings

Alarm Name	*Setting*	*Default Value*[6]	*Setting Limits*
(All)	**Type**	None	High, Low, None
	Set Level, Reset Level	50 %VOL	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual

[5] Reset delay is not applicable on manual reset alarms.
[6] Settings will not appear until the alarm type is changed to "High" or "Low"

Multiple Gas Environments

The hydrocarbon sensor features a number of target gas selections but it is important to remember that it cannot distinguish between them. The presence of a hydrocarbon gas that is not selected as the target is likely to produce a false reading. Monitoring for leaks of more than one gas should be avoided since, at best, it may lead to false alarms, and at worst, it can lead to a dangerous, undetected, explosive atmosphere.

Selecting the proper target gas will increase the likelihood of detecting a dangerous gas leak in multiple gas environments. Data for gases listed in Table 3 on page 6 includes the propane reading that would be observed if a 100%LEL mixture of the listed gas were present at the sensor. When leaks are possible from more than one gas species, choose the one with the lowest "Propane Rdg @ 100%LEL", as the target gas.

When leaks are possible from more than one gas species, choose the one with the lowest "Propane Rdg @ 100%LEL", as the target gas.

This way, an alarm will occur before any gas reaches an explosive level. A leak from any of the others will produce a "false alarm", but safety should be the primary goal.

HHC High Range HydrocarbonSensor

The HHC cell is similar to the HC sensor's "Methane-HR" setting. It is designed to monitor high concentrations of other hydrocarbon gases in locations where they are likely to exist normally. Extreme care must be taken in these locations, since any leak of air can produce an explosive atmosphere. Gas readings are reported in units of %VOL (percent by volume), and the range is adjustable from 20 to 100 %VOL. The tables below list the target gas selections and alarm settings. For information about how these settings affect gas alarm operation, see Flammable and Toxic Gas Alarms on page 46.

Table 6 HHC Sensor Target Gas Selections
(Parenthesis indicate default value)

Gas	*LEL %VOL*	*UEL %VOL*	*Range %VOL*	*Alarms A/W/C %VOL*	*Relative Density*
Propane	2.20	10.0	10-(100)	Disabled	1.55

Table 7 HHC Sensor Alarm Settings

Alarm Name	*Setting*	*Default Value*[7]	*Setting Limits*
(All)	**Type**	None	High, Low, None
	Set Level, Reset Level	50 %VOL	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual

This cell is not designed for use below the UEL of the target gas.

[7] Settings will not appear until the alarm type is changed to "High" or "Low"

CO2-L Low Range Carbon Dioxide Sensor

This sensor permits selection of lower CO2 ranges for reading accuracy. The tables below list the target gas selections and alarm settings. For information about how these settings affect gas alarm operation, see Flammable and Toxic Gas Alarms on page 46.

Table 8 CO2-L Sensor Target Gas Selections
(Parenthesis indicate default value)

CO2 Range	*Range*	*Alarms A/W/C*	*Relative Density*
CO2-5	1-5(2) %VOL	0.5/0.2/-0.1 %VOL	1.53
CO2-05	1000-5000(2000) PPM	5000/2000/-200 PPM	1.53

Table 9 CO2-L Sensor Alarm Settings

Alarm Name	*Setting*	*Default Value*	*Setting Limits*
Alarm	**Type**	High	High, Low, None
	Set Level, Reset Level	(see Table 8)	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	Not applicable	0-7200s (when Reset=Auto)
	Reset (clear method)	Manual	Automatic or Manual
Warning	**Type**	High	High, Low, None
	Set Level, Reset Level	(see Table 8)	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual
Caution	**Type**	Low	High, Low, None
	Set Level, Reset Level	(see Table 8)	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual

CO2-H High Range Carbon Dioxide Sensor

This sensor permits selection of a high range CO2 setting to improve the accuracy of readings for high and low concentrations of carbon dioxide. The tables below list the target gas selections and alarm settings. For information about how these settings affect gas alarm operation, see Flammable and Toxic Gas Alarms on page 46.

Table 10 CO2-L Sensor Target Gas Selections
(Parenthesis indicate default value)

CO2 Range	*Range*	*Alarms A/W/C*
CO2-50	10-(50) %VOL	Disabled
CO2-100	50-(100) %VOL	Disabled

Table 11 CO2-L Sensor Alarm Settings

Alarm Name	*Setting*	*Default Value*[8]	*Setting Limits*
(All)	**Type**	None	High, Low, None
	Set Level, Reset Level	50 %VOL	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual

N2O-L Low Range Nitrous Oxide Sensor

This sensor permits selection of two low N2O ranges. The tables below list the target gas selections and alarm settings. For information about how these settings affect gas alarm operation, see Flammable and Toxic Gas Alarms on page 46.

Compared to most other IR absorbing gases, N2O is relatively weak and the sensor may require an extended warmup period before obtaining a stable zero reading. For best results, operate the sensor continuously with minimal power interruptions, especially on the 1000 PPM range. If a sufficiently stable zero is not obtained, increase damping in the Sensor Range menu as required.

Table 12 N2O-L Sensor Target Gas Selections
(Parenthesis indicate default value)

N2O Range	*Range*	*Alarms A/W/C*	*Relative Density*
N2O-1	0.1-1(1) %VOL	0.5/0.2/-0.1 %VOL	1.69
N2O-1000*	1000(1000) PPM	500/200/-100 PPM	1.69

*Note: the applied gas for span calibration on this range must be greater than 100 ppm

Table 13 N2O-L Sensor Alarm Settings

Alarm Name	*Setting*	*Default Value*	*Setting Limits*
Alarm	**Type**	High	High, Low, None
	Set Level, Reset Level	(see Table 8)	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	Not applicable	0-7200s (when Reset=Auto)
	Reset (clear method)	Manual	Automatic or Manual

[8] Settings will not appear until the alarm type is changed to "High" or "Low"

Alarm Name	*Setting*	*Default Value*	*Setting Limits*
Warning	**Type**	High	High, Low, None
	Set Level, Reset Level	(see Table 8)	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual
Caution	**Type**	Low	High, Low, None
	Set Level, Reset Level	(see Table 8)	-15 to +120 %Range
	Set Delay	0s	0-10s
	Reset Delay	0s	0-7200s (when Reset=Auto)
	Reset (clear method)	Automatic	Automatic or Manual

SYMBOLS

The symbols below are used on the device and throughout this manual.

Symbol	*Description*
⎓	Direct current
~	Alternating current
⏚	Protective conductor terminal
	Caution, risk of danger (consult O&M manual)

SPECIFICATIONS

Table 14. Specifications

IR Sensor Types	LEL range hydrocarbon sensor for methane, propane, and more High-range hydrocarbon sensor for 100 %VOL propane, butane, LPG Low range carbon dioxide sensor with 5 %VOL and 5000 PPM ranges High range carbon dioxide sensor with 100 %VOL range Low range nitrous oxide sensor with 1% and 1000 PPM ranges (Optional rain shield and calibration adapter available)
Range	Adjustable within limits of selected sensor (see Table 1)
Response Time	T50<10 s, T90<30 s
Accuracy	±2% range for methane, propane, CO2, and most special orders +/-6% range for HC gases using k-factors
Repeatability	Zero: +/-0.05 %VOL methane; Span: +/-0.1 %VOL methane at 5%; +/-2 %VOL methane at 100%
Long Term Zero Drift	+/-0.05% volume methane per month
Analog Output	Isolated 4-20 mA, 675 ohm load max. with 24 VDC supply. Current sourcing. Linearity ±2% of gas reading
Serial Interface Options	HART® FSK 1200 baud modem interface, registered DLL file, or Modbus® with selectable RS232/485@9600,19.2k, and higher
Power	Class 2 power supply as follows: Regulated 12 – 30 VDC; 250 mA max, 3-wire connections.
Alarm Relay Option	Three SPDT relays. Contacts 5A @ 230 VAC ~ resistive; 5A @ 30 VDC ⎓ resistive Coils programmable as normally energized (failsafe) or normally de-energized.
Display	Backlighted, graphics 96x32 LCD.
Controls	Four button, non-intrusive (magnetic Hall effect switches); Remote alarm reset input
Operating Temp.	Transmitter: -20 °C to +60 °C; Standard sensor: -20 °C to +50 °C; Ext. temp. sensor: -20 °C to +60 °C
Enclosure	Flameproof, Zone 1, Group IIC
Weight	Transmitter with sensor housing: 7.25 lbs (3.29 kg);
Remote Sensor Option	Serial connection over shielded 4-wires, with drain, up to 100' from transmitter. Remote enclosure rated Explosion-proof, Class I, Div. 1, Groups B, C, and D. Remote junction box with sensor housing: 3.0 lbs (1.36 kg)
Location Certifications	ATEX: CE 0539 ⟨Ex⟩ II 2 G Ex db IIC T6 Gb IEC Ex: Ex db IIC T6 Gb

INSTALLATION

MECHANICAL MOUNTING

Hazardous Locations

In hazardous locations, all wiring must be run in metal conduit rated for the location. The conduit must be threaded into the housing, and a special sealing fitting must be installed no more than 18" from the entry. In the event of an explosion, this seal prevents hot gasses from propagating into other parts of the system. It also prevents condensation in conduit from draining into the enclosure. Cord grips and cable glands are not permitted in these areas.

Seal conduit entries.
Follow national, state, and local, electrical codes.

Gas Density Considerations

Most combustible gases have a relative density to air greater than 1. When targeting these gases in a confined space, locate the sensor close the floor using the remote sensor option. If the gas vapor has a density near that of air, locate the sensor approximately 5 feet above the floor. For methane, locate the sensor above the highest potential leak source. Sensors mounted outdoors should be located near anticipated leak sources (valves, flanges, and compressors) and the location will depend on normal wind patterns and anticipated employee activity areas.

Consult the target gas selection tables in the IR Sensor section starting on page 8 for information on gas densities relative to air.

Transmitter Mounting

Secure the transmitter to a wall or flat surface through two mounting holes in the enclosure. Alternately, the transmitter may be supported by rigid conduit. For safety, the housing should be bonded to earth ground using the grounding screw shown in Figures 2 and 3, which also details the enclosure dimensions, mounting holes, and conduit entries. The mounting method must be capable of supporting 20 pounds. For mounting to drywall ¼ inch molly bolts, or equivalent, **are required**.

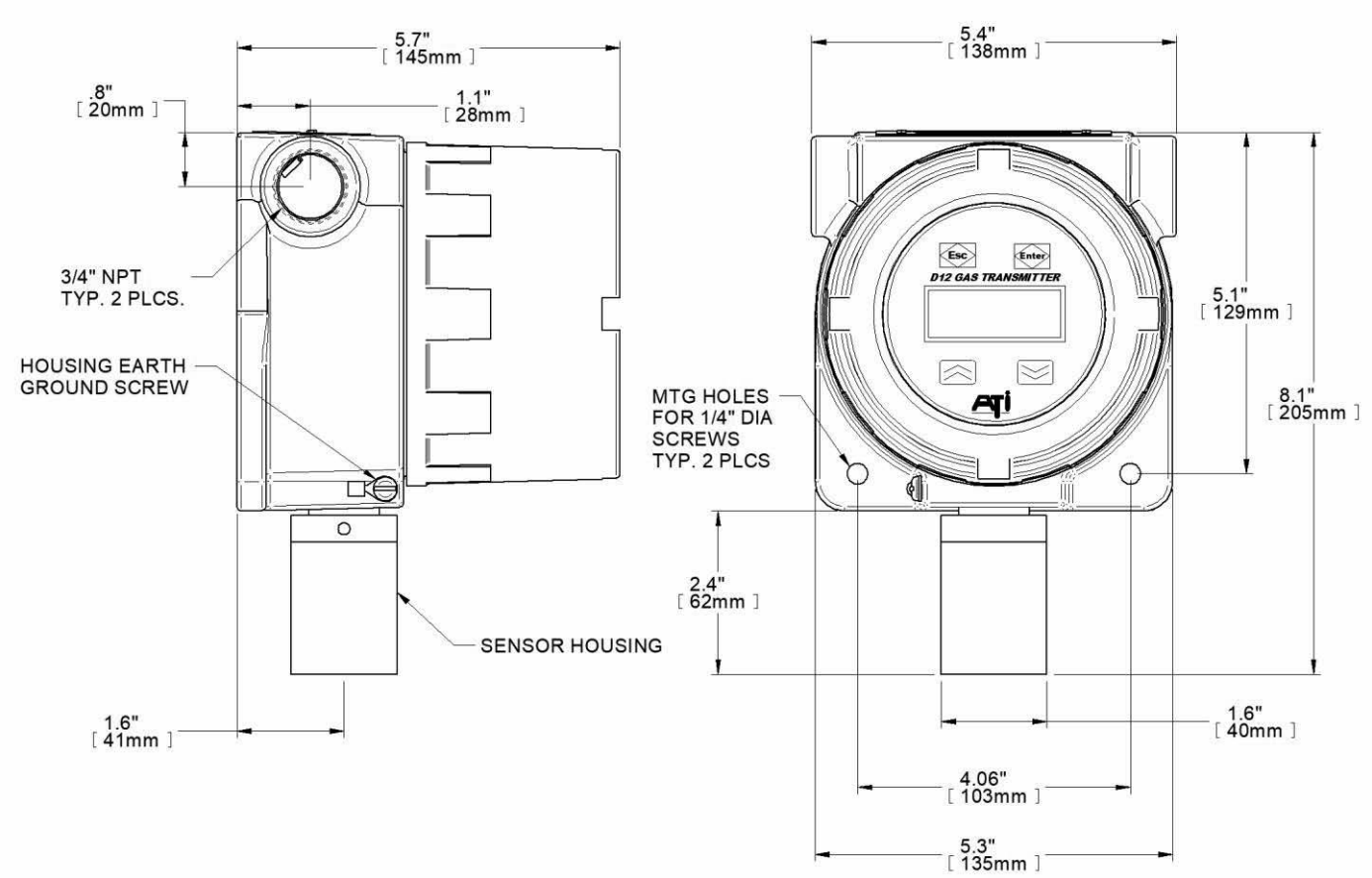


Figure 6. Overall dimensions

Remote Junction Box

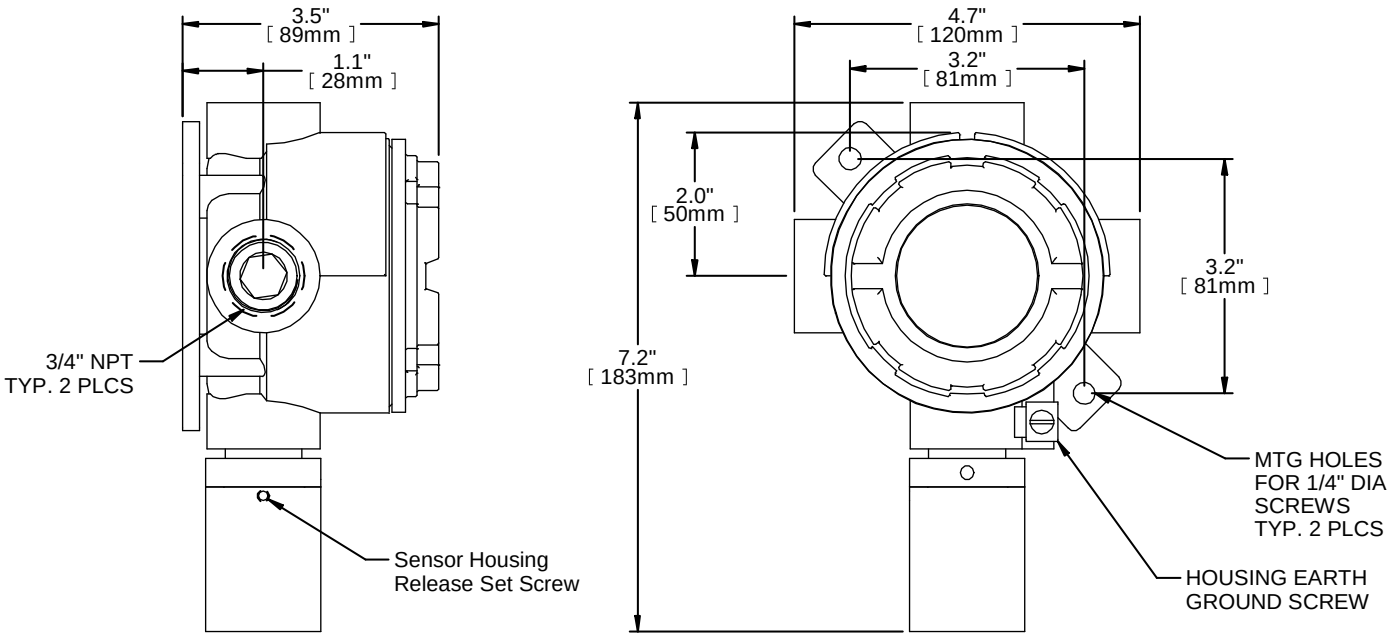


Figure 6b. Remote Sensor dimensions

Transmitter with Optional Rain Shield

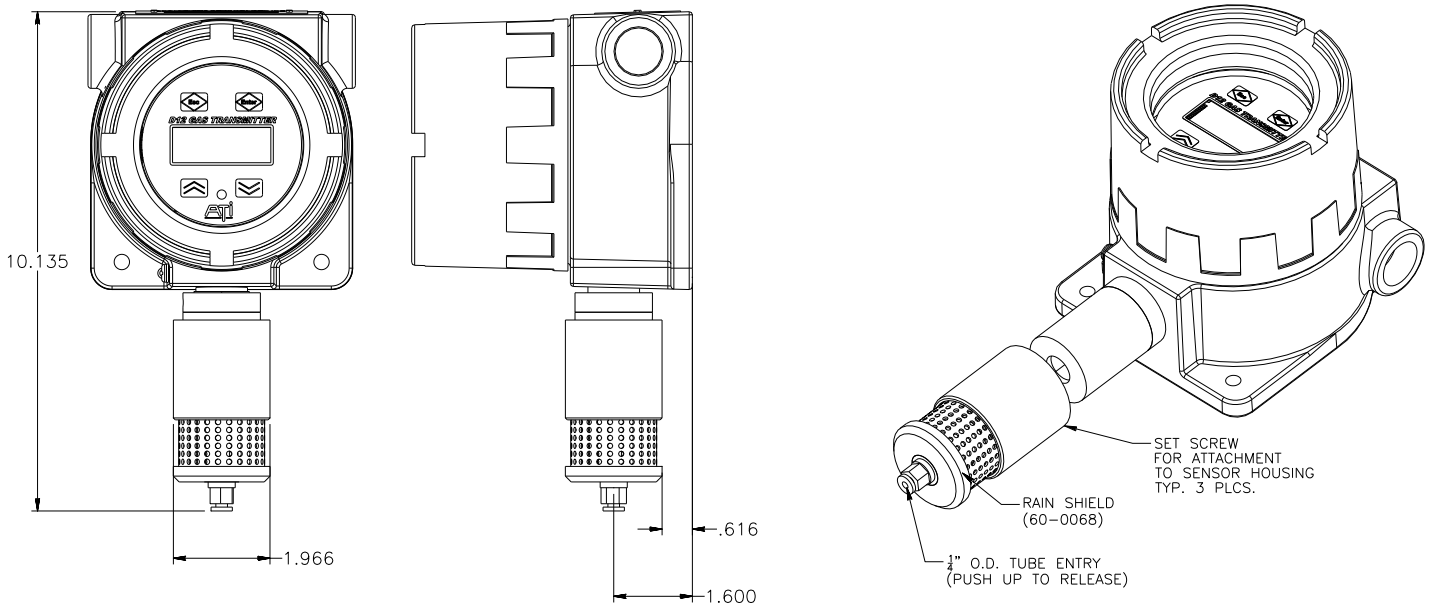


Figure 6c. Optional Rain Shield

Transmitter with Optional Calibration Adapter

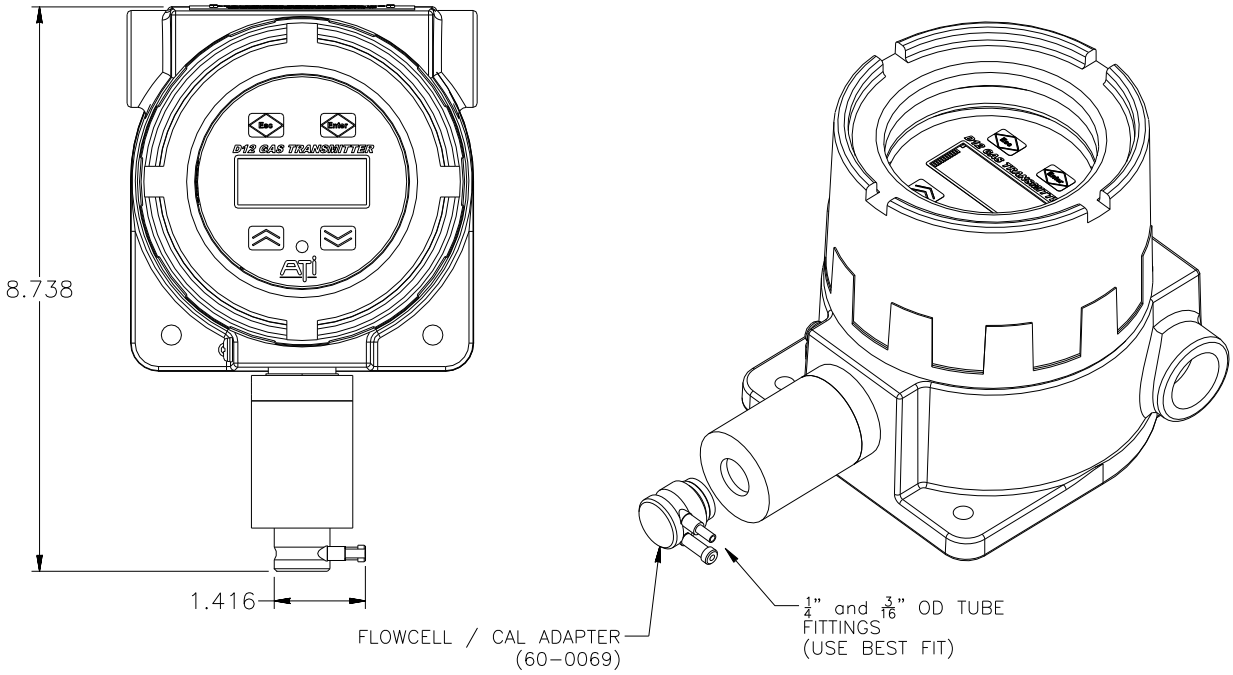


Figure 6d. Optional Calibration Adapter

ELECTRICAL CONNECTIONS

Board Stack

Disconnect the ribbon cable and sensor connector before removing the upper stack

The transmitter consists of three printed circuit boards composing a "board stack" mounted into the transmitter housing. From the top they are:

- Display Board
- CPU Board
- Power Supply Board

The power and i/o connections are on the power supply board in the bottom of the transmitter. To access them, remove the housing cover and disconnect the ribbon cable on the left side of the CPU Board. Slowly pull up on the edges of the metal faceplate while rocking it side to side. As the upper stack comes free, locate the sensor connector below the right side and pull it down to disconnect the sensor. Remember to reconnect these before replacing the housing cover.

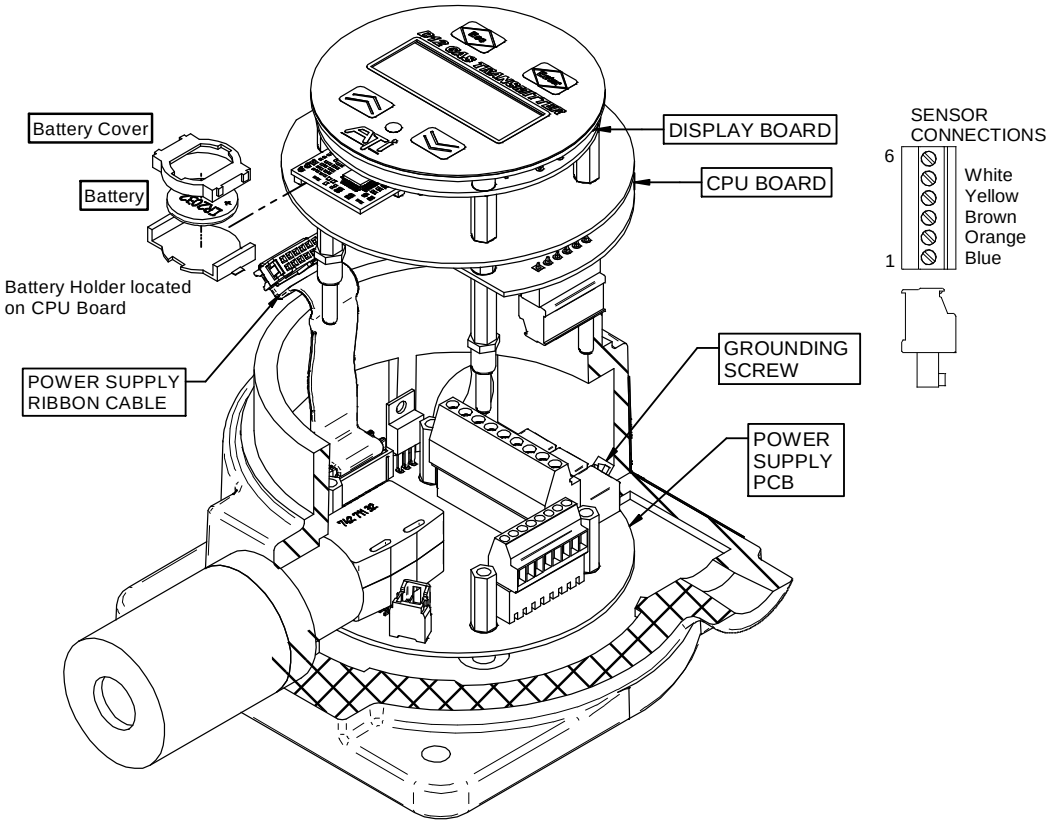


Figure 7. Electronic board stack

⚠ IMPORTANT SAFTETY INFORMATION

Battery Replacement

- Any replacement CR2032 battery must be **identical in size, type, and manufacturer** as the OEM original. Contact the factory for an exact replacement.
- When replacing the battery, make certain the **(+) side faces up** and **is visible** through the cover after installation.

Power Supply Board

Electrical connections are made to the Power Supply Board at terminal blocks TB1 and TB2. The 4-20mA current loop, optional digital communications, and remote alarm reset, are connected at TB1, and connections to the three optional relays are made at TB2. The transmitter may be powered from a 3-wire (ANSI/ISA Type III) or 4-wire (ANSI/ISA Type IV) connection. The transmitter cannot operate from a 2-wire, loop power (ANSI/ISA Type II) connection. It is recommended to power the transmitter, controls, and indicators from separate, uninterruptable supplies.

The transmitter cannot operate from a 2-wire, loop power (ANSI/ISA Type II) connection.

The transmitter requires primary power in the range of 12 to 30 VDC applied to pins 7 and 8 on TB1. Current loop operation requires power in the same range on pin 5 (mA+), from which the transmitter sources a positive, 4-20mA output on pin 6 (mA-).

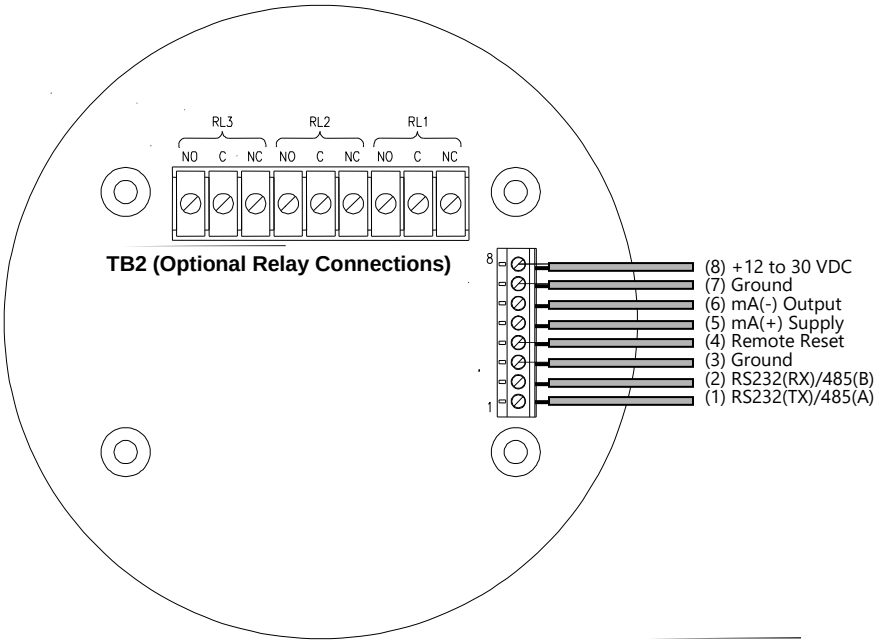


Figure 8. "Power Supply" board connections.

In 3-wire mode, the transmitter requires a maximum of 250 mA, with all relays active. Power supplies operating multiple units should be sized for twice the calculated current requirement to allow for inrush current during startup.

The transmitter housing has limited space for wire. Use the smallest gauge wire available that is compatible with electrical code and current requirements. When powering a group of transmitters from the same supply, 12 AWG wire is recommended for long runs, with smaller (higher gauge) wire drops to each transmitter. The temperature rating of the wiring must be rated the same as, or higher than, the transmitter.

⚠ **Wiring must be rated for at least 60°C**

Internal relays are best used as pilot relays if heavy load switching is desired. Use suitable arc suppression devices across loads switched through internal relays.

If the Remote Reset input is used, install a momentary switch between TB1-4 and TB1-6.

The transmitter housing may be grounded through explosion proof conduit. In the absence of such conduit, use a suitable grounding strap to bond the transmitter's housing to earth ground.

Communication Jumper

A communication jumper is required on JP4 to configure the serial interface.

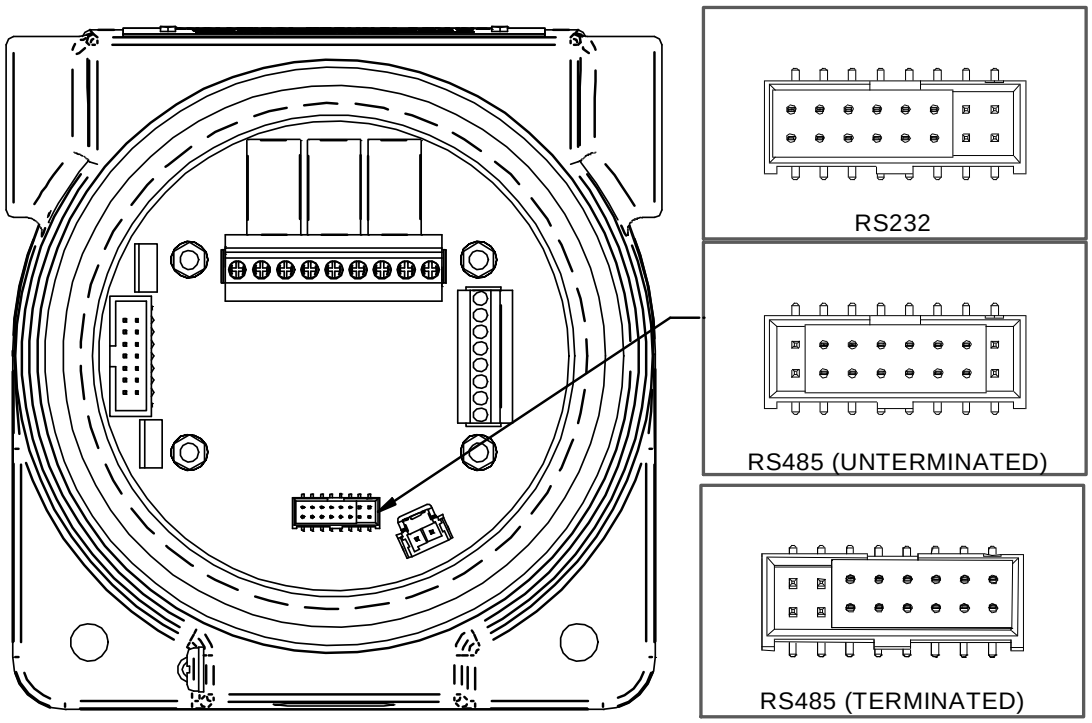


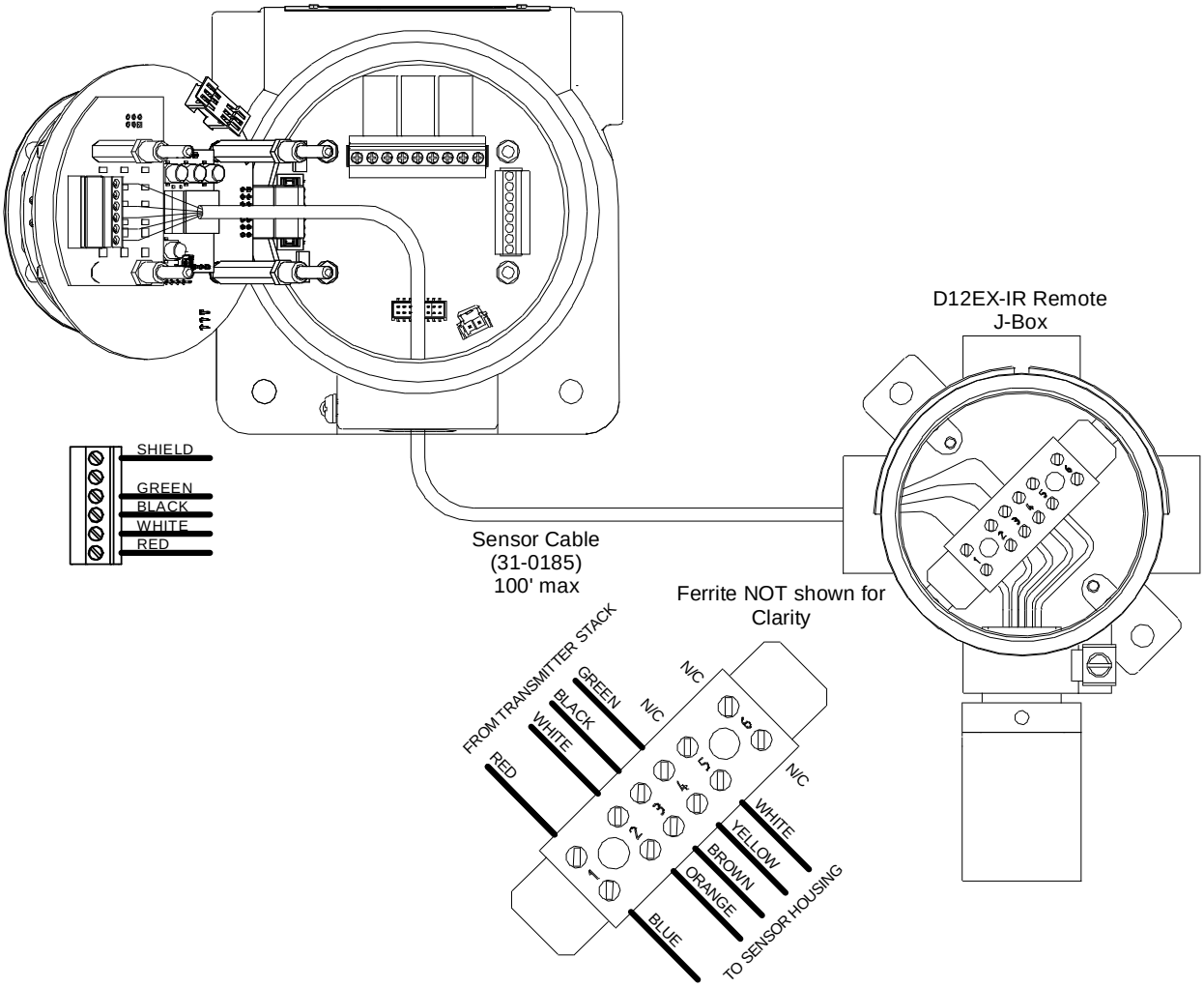
Figure 9. Comm.Configuration

Table 15. Communication option jumpers

Protocol	Interface	Jumper Plug Label	Comments
HART	Bell 202	N/A	No plug required (may leave in any position)
Modbus	RS232	"RS232"	Use to connect a single transmitter to a Modbus master's RS232 port.
Modbus	RS485	"RS485 Unterminated"	Use on multiple transmitters on a "multi-drop" bus, unless termination is required at the end of the bus. Transmitters are connected without adding bias or termination.
Modbus	RS485	"RS485"	Use on the transmitter at the end of a long RS485 "multi-drop" bus that requires termination. The jumper biases and terminates the bus.
ASCII	RS232	"RS232"	Use to connect a transmitter to a printer, or system terminal (see Data logging section).

Remote Sensor Option

The "Remote Sensor" option permits the gas sensor to be separated from the transmitter up to 100' using a 4-conductor cable. The sensor housing is installed into the D12Ex-IR junction box, from which the cable is routed back to the transmitter and fed through the conduit entry at the base. Figure 10 details these connections.



Notes
1

Figure 10. Remote Sensor Connections

Wiring Examples

Power Only, No 4-20mA Connection

The example below shows how transmitters may be powered to operate the transmitter without a 4-20mA connection. Size the power supply and wiring for the number of transmitters and the power required by each (see S on page 12). Voltage at the transmitter terminals must not drop below 12v under full load.

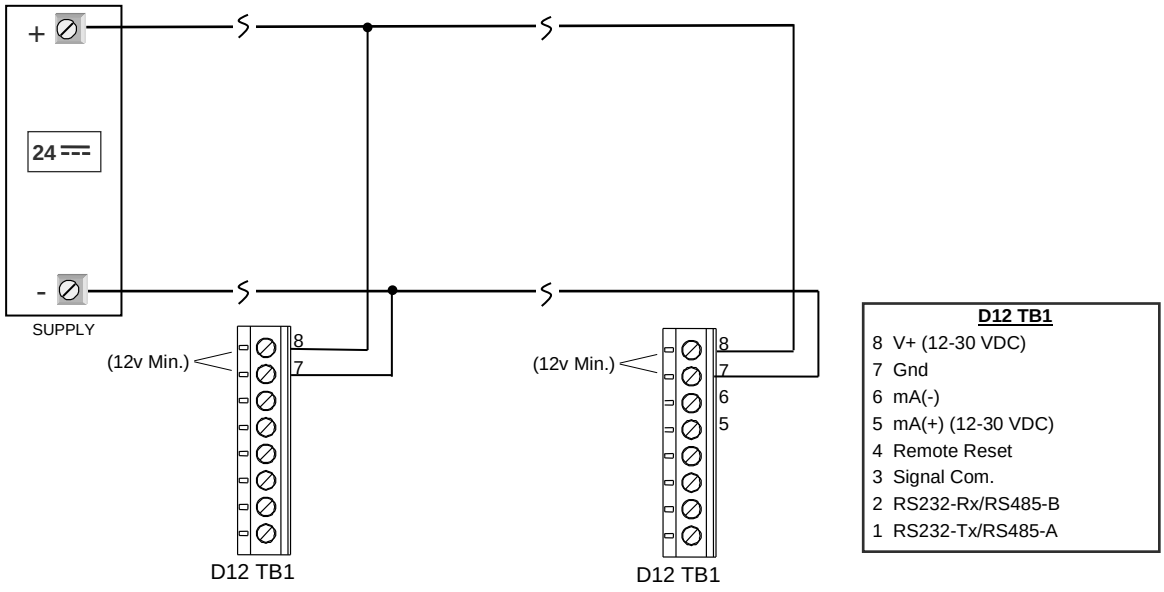


Figure 11. Example of power only, no 4-20mA connection

4-20mA 3-Wire Connection

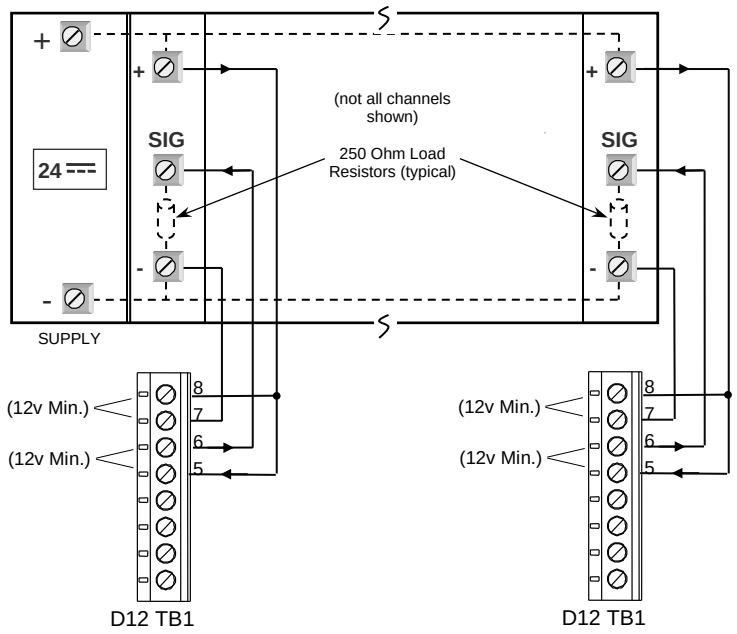
The example below shows how to power the transmitter from 3 wires when a 4-20mA connection is required. This is referred to as Type III, or "3-wire power". Size the supply and wiring according to the maximum power required by each transmitter (see S on page 12). Voltage at the transmitter terminals must not drop below 12v. Note: a single supply is usually sufficient to power one or two transmitters, however, if more power is required, see the next page about connecting two supplies.

D12 Current Sourcing

Typical multichannel gas receiver or PLC with integral 24v supply and load resistors connected to low side of supply

Channels are typically not isolated from supply

D12 TB1
8 V+ (12-30 VDC)
7 Gnd
6 mA(-)
5 mA(+) (12-30 VDC)
4 Remote Reset
3 Signal Com.
2 RS232-Rx/RS485-B
1 RS232-Tx/RS485-A



D12 Current Sinking

Multichannel gas receiver or PLC with integral 24v supply and load resistors connected to high side of supply (not typical)

Channels are typically not isolated from supply

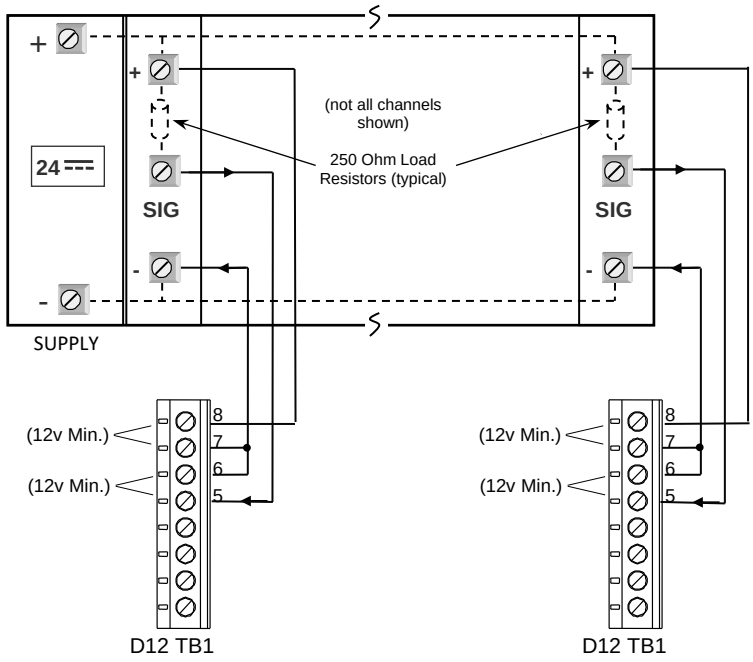


Figure 12. Example 4-20mA 3-wire connection

4-20mA 4-Wire Dual Supply Connection

To reduce the power requirement of a single supply, transmitters may be powered from an additional isolated supply. The example below shows the D12 connected to source current to the load resistor. The D12 can also be connected to sink current from the load resistor similarly to the loop connections shown in Figure 12 on page 22. Size each supply and wiring according to the maximum power required by each transmitter (see S on page 12). Voltage at the transmitter terminals must not drop below 12v.

Note

Power applied to pins 7 and 8 supplies the transmitter's relay drivers, LCD backlight, and communication interface. It does not source 4-20mA current loop. Therefore, this connection does not strictly conform to the ANSI/ISA definition for a Type IV (4-wire) 4-20mA connection. Powering the transmitter from a single supply requires a 3-wire connection (see Figure 12 on page 22).

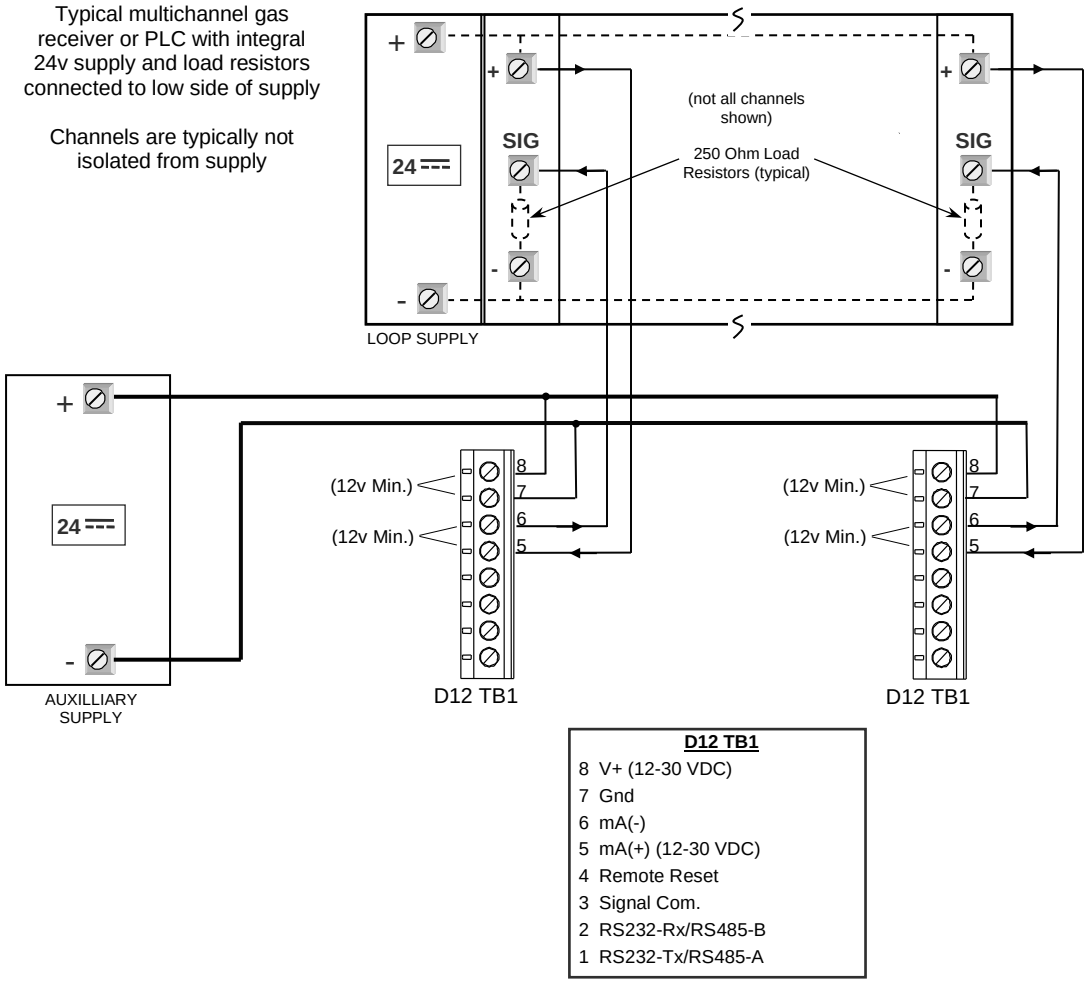


Figure 13. Example 4-20mA 4-Wire Dual Supply Connection

3-Wire Connection to ATI A17/B14 Receiver

The example below shows a Type III (3-wire) 4-20mA connection to an ATI A17/B14 receiver system. This type of connection enables operation of the alarm relays, LCD backlighting, and RS232/RS485 communication interface on transmitters with the Alarm Relay option.

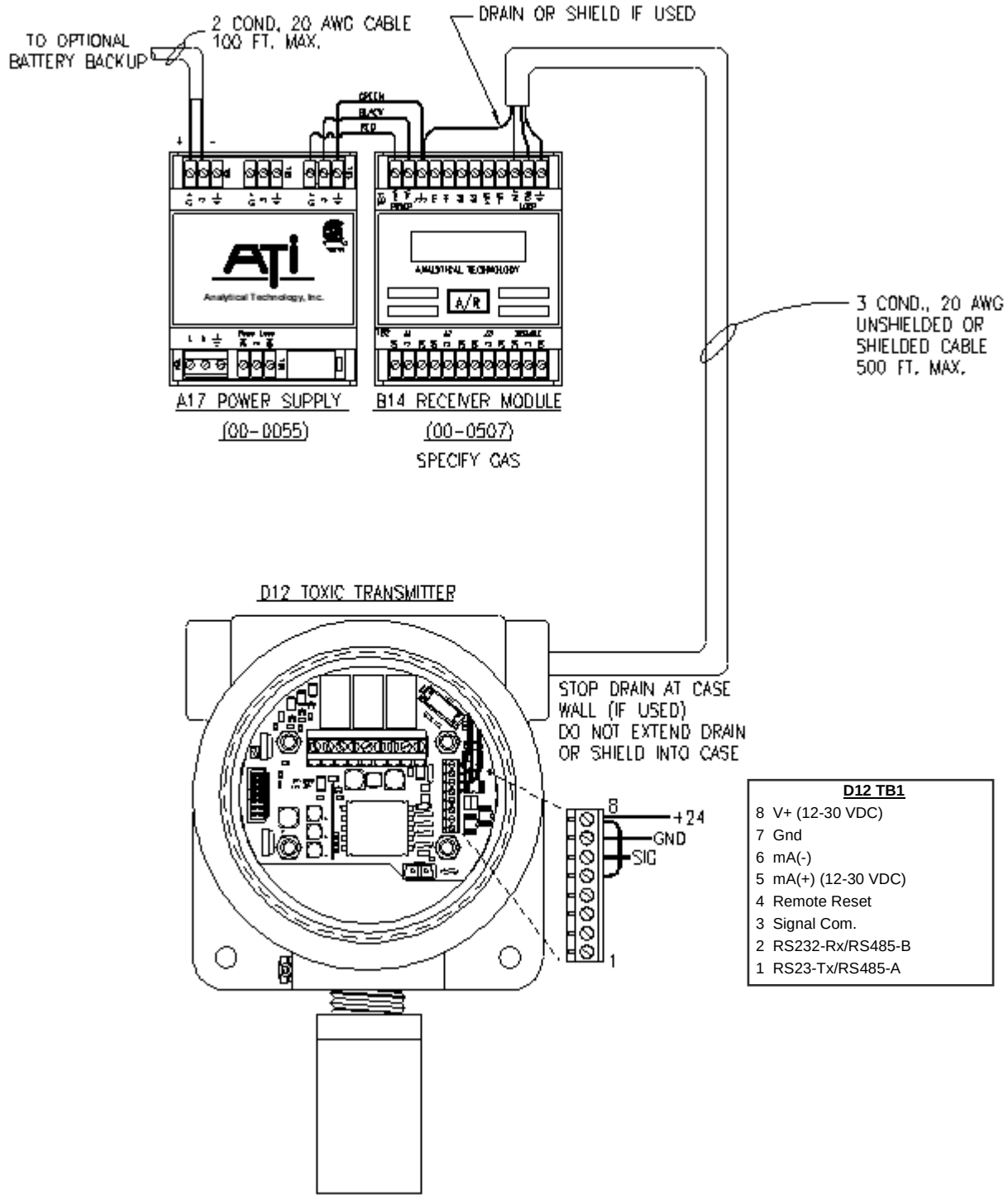
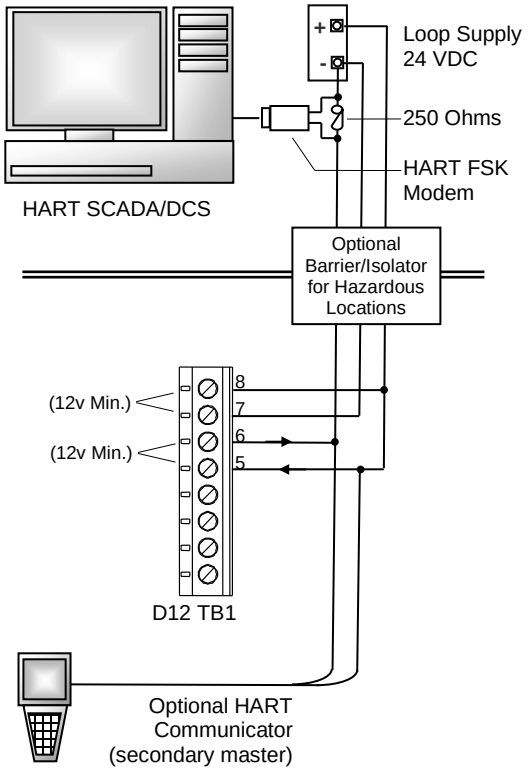


Figure 14. Example 3-wire to ATI A17/B14 receiver

HART 3-Wire Point-to-Point Connection

The HART 3-wire "point-to-point" connection (Type III) permits a transmitter with the HART FSK option to communicate digitally over the 4-20mA current loop (RS232/485 is disabled). According to HART specifications, the current loop must be terminated with a load resistor between 230 and 1100 ohms; however, transmitter specifications restrict the maximum total resistance (load resistor and wiring) to a lower value (see S on page 12). The position of communication jumper has (Figure 9 on page 19) has no effect on HART communication. Size the power supply and wiring for a maximum loop current of 25mA. Voltage at the transmitter's terminals must not drop below 12v. Note that the transmitter's polling address must be set to 0 to permit the current loop to report the gas concentration.

Digital Communication Only



D12 TB1
8 V+ (12-30 VDC)
7 Gnd
6 mA(-)
5 mA(+) (12-30 VDC)
4 Remote Reset
3 Signal Com.
2 RS232-Rx/RS485-B
1 RS232-Tx/RS485-A

Digital Communication with Analog Signaling

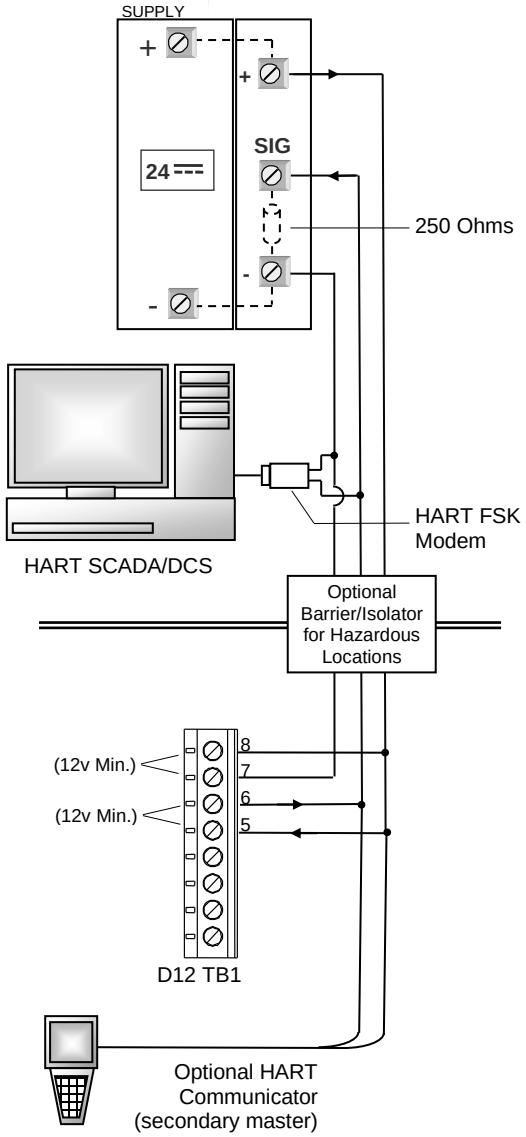


Figure 15. Example HART 3-wire "Point-to-Point"

HART Multidrop 3-Wire Connections

The HART multi-drop connection permits up to 15 transmitters to communicate digitally on the same bus, but without 4-20mA signaling. Setting the transmitter's polling address from 1 to 15 fixes the current loop output at 4mA. According to HART specifications, the current loop must be terminated with a load resistor between 230 and 1100 ohms; however, transmitter specifications restrict the maximum analog output resistance to a lower value (see Specifications). The position of communication jumper has (Figure 9 on page 19) has no effect on HART communication. Size the power supply and wiring according to the power required for each transmitter. Voltage at the transmitter's terminals must not drop below 12v.

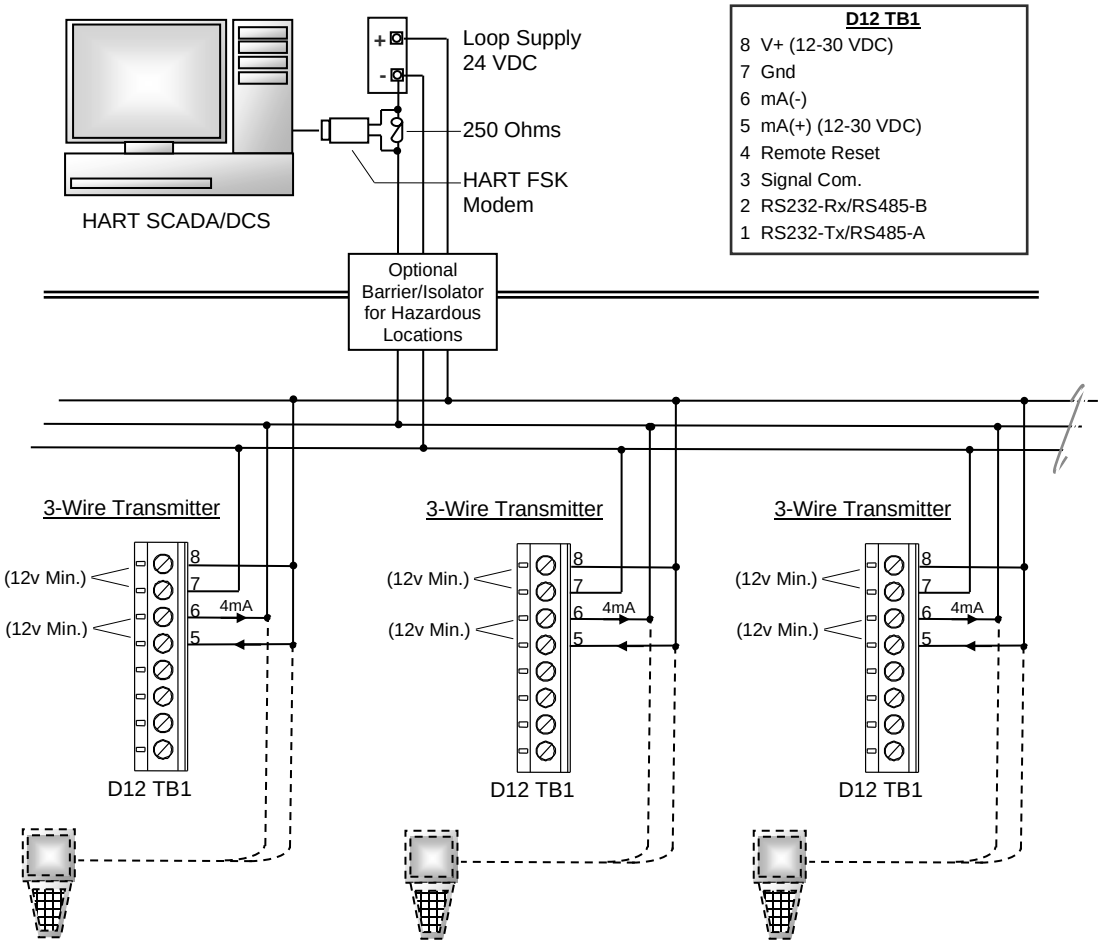
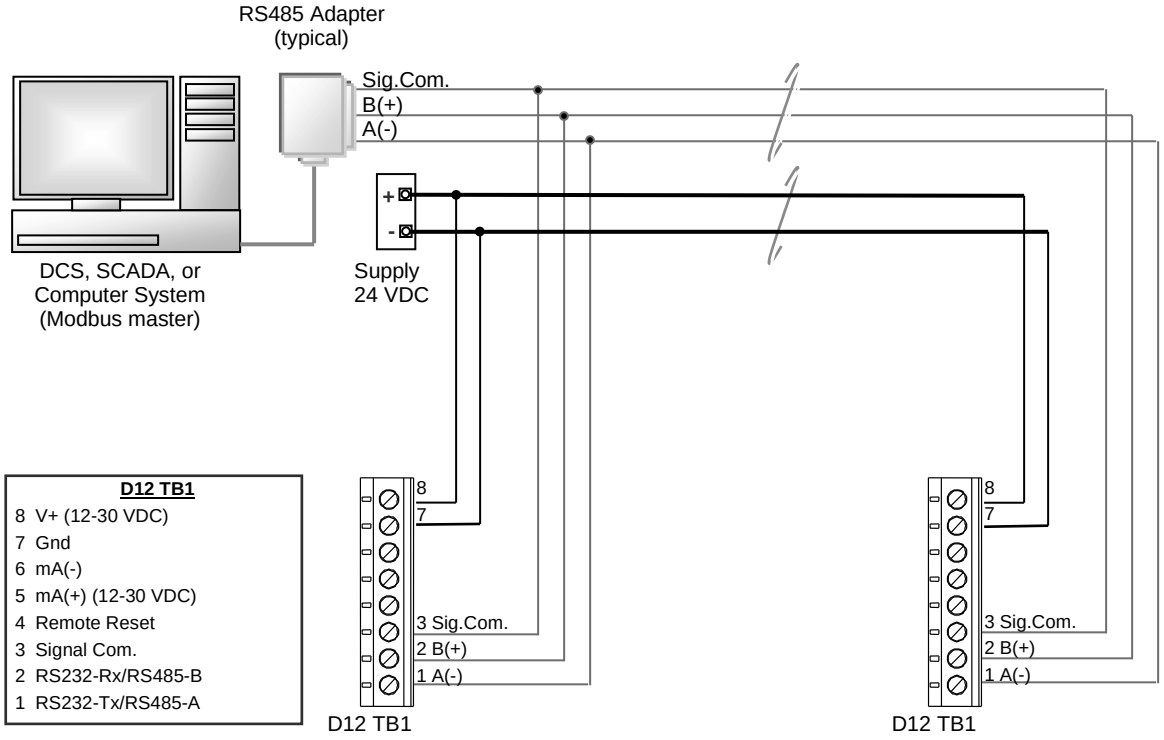


Figure 16. Example HART Multidrop 3-Wire

RS485 Multi-drop Connection

RS485 permits up to 32 devices to be connected on the same bus and can be used to connect a Modbus master to multiple transmitters. Size the power supply and wiring according to the power required for each transmitter. Voltage at the transmitter's terminals must not drop below 12v. This connection requires the communication jumper. See Figure 9 on page 19 for location and placement of the jumper. The Modbus polling address is set through the operator interface (see Modbus Menu on page 70).

Note: 4-20mA signaling is shown disconnected below, but may be operated concurrently if connected to a 4-20mA receiver using a 3-wire or 4-wire connection (see Figure 12 and Figure 13 on pages 22 and 23).



Not at End of Bus - Unterminated
Install the transmitter's communication jumper block in the "RS485 Unterminated" position if it *IS NOT* at the end of the bus (see Figure 9 on page 19).

End of Bus - Terminated
Install the transmitter's communication jumper block in the "RS485 Terminated" position if it *IS* at the end of the bus (see Figure 9 on page 19)

Figure 17. Example RS485 "Multi-drop" connections

RS232 COM Port Connection

RS232 permits a point-to-point connection to a master device for Modbus or ASCII protocol. Size the power supply and wiring according to the power required for each transmitter. Voltage at the transmitter's terminals must not drop below 12v. This connection requires the communication jumper. See Figure 9 on page 19 for location and placement of the jumper.

Note: 4-20mA signaling is shown disconnected below, but may be connected to a 4-20mA receiver using a 3-wire or 4-wire connection (see Figure 12 and Figure 13 on pages 22 and 23).

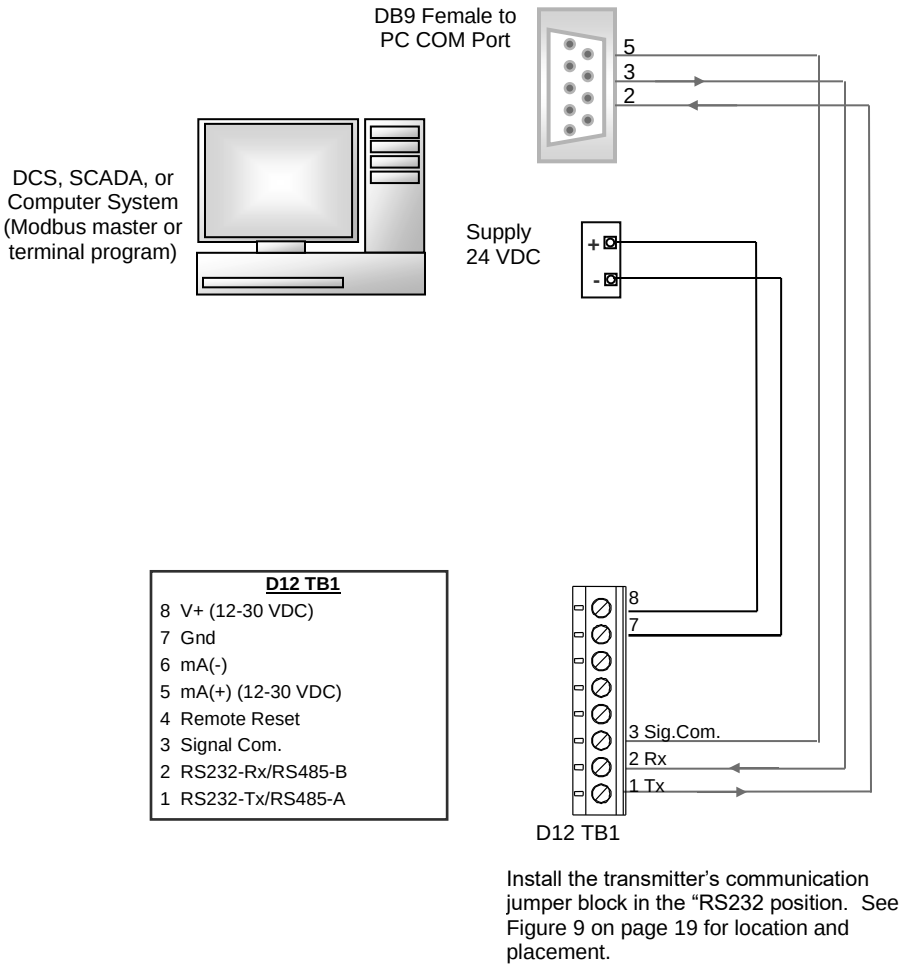


Figure 18. Example RS232 COM Port Connection

OPERATION

OPERATOR INTERFACE PANEL

The transmitter panel is non-intrusive, so it is not necessary to remove the housing cover to view the display and configure settings. The panel features a backlighted, 96x32 dot LCD display, and four magnetically sensitive "keys", as shown in Figure 19 below.

Touch Keys

The transmitter is supplied with a small screwdriver that features a powerful magnet embedded in the handle. The magnet is capable of activating the keys up to ¼" above the glass window. Placing the magnet squarely over a key, and then quickly removing it, is referred to as "touching" the key. Note that it is not necessary to contact the glass window.

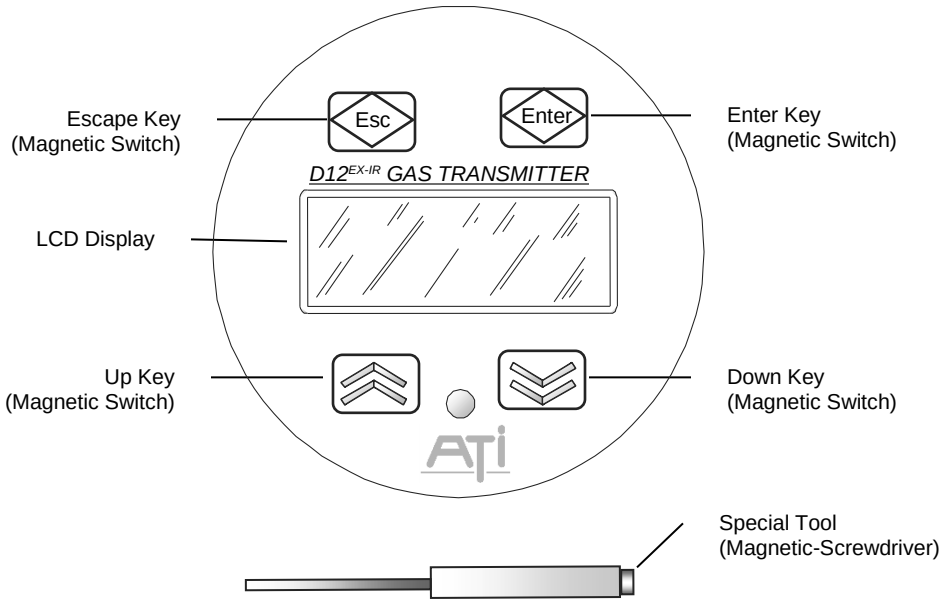


Figure 19. Operator interface panel

Menus and Settings

Items appearing on the display are most commonly text labels that identify the name of a menu or a setting. Menus are typically a single text label, like "Sensor", while settings are typically composed of a text label and a value field separated by an equal sign, like, "Range= 50.0".

Moving the Cursor and Selecting

The up (▲) and down (▼) keys are used to move the selection cursor (➧) between displayed items. The down key typically moves the cursor down, or to the right, while the up key moves the cursor up, or to the left. Touching the **Enter** key when the cursor is pointing at a menu label (i.e., is to the left of the label) causes the transmitter to display the new menu and position the cursor at the first item. Touching the **ESC** key at any item on the selected menu causes the transmitter to return to the previous display.

Editing Settings

A setting is selected for editing by moving the cursor to the left of the label and touching the **Enter** key, which causes the up-down edit cursor (⬍) to appear in front of the value. Touching the up key (▲) causes the value to increase or present the next list item, while touching the down key (▼) causes the value to decrease or present the previous list item. Once the setting has been adjusted to the desired value, touching the **Enter** key stores the new value and exits edit mode. Touching the **ESC** key restores the original value and exits edit mode.

While editing, the edit cursor changes its shape to provide feedback on which key is activate.

1	➧Range = 50.0	Move the selection cursor in front of the setting's label, and touch the **Enter** key.
2	Range⬍50.0	The up-down edit cursor appears.
3	Range▲ 50.1	Touching the ▲ key increases the value.
4	Range▼ 49.9	Touching the ▼ key decreases the value.
5	Range⧗ 100.0	Touching the **Enter** key saves the new value and exits edit mode.
6	➧Range = 50.0	Touching the **ESC** key restores the old value and exits edit mode.

Figure 20. Example Edit

STARTUP

Transmitter Review

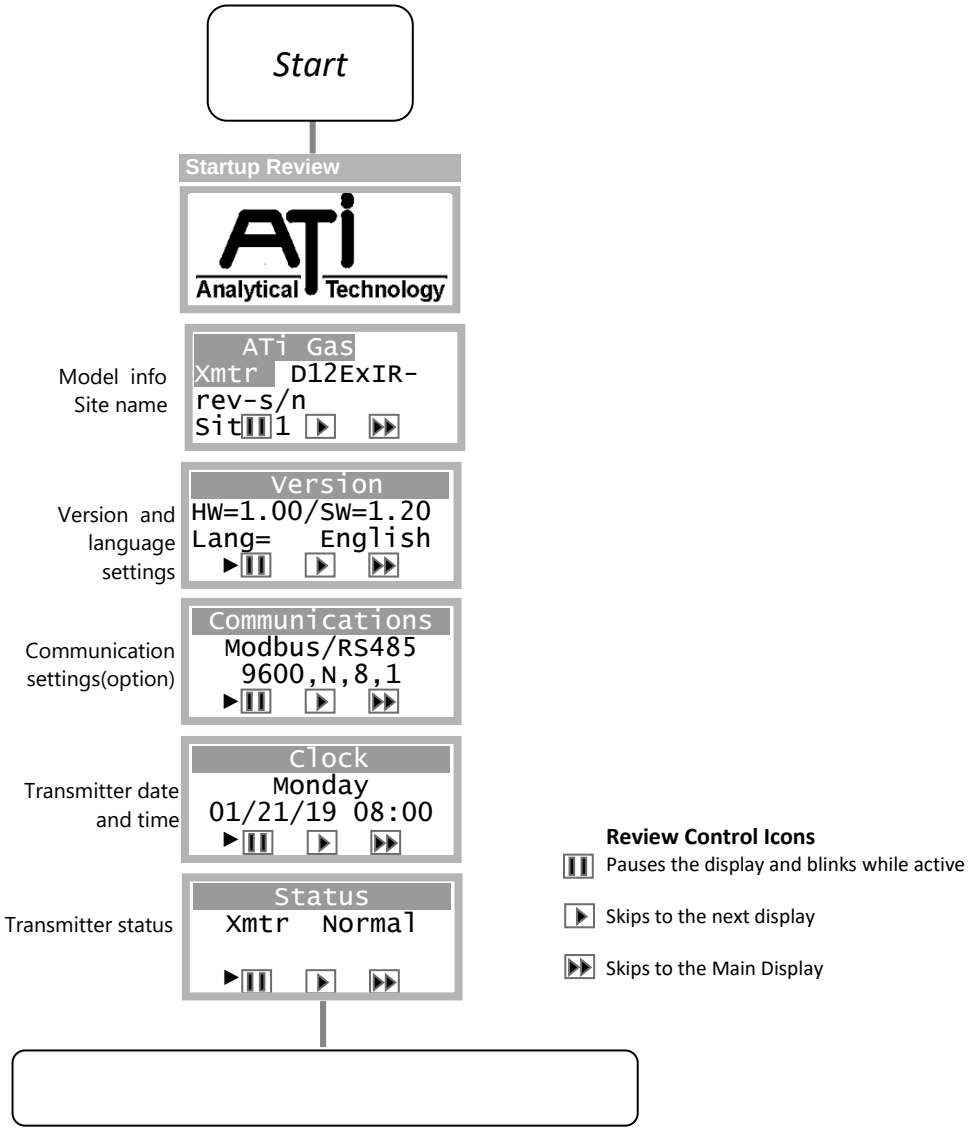


Figure 21. Transmitter Review Displays

Sensor Review

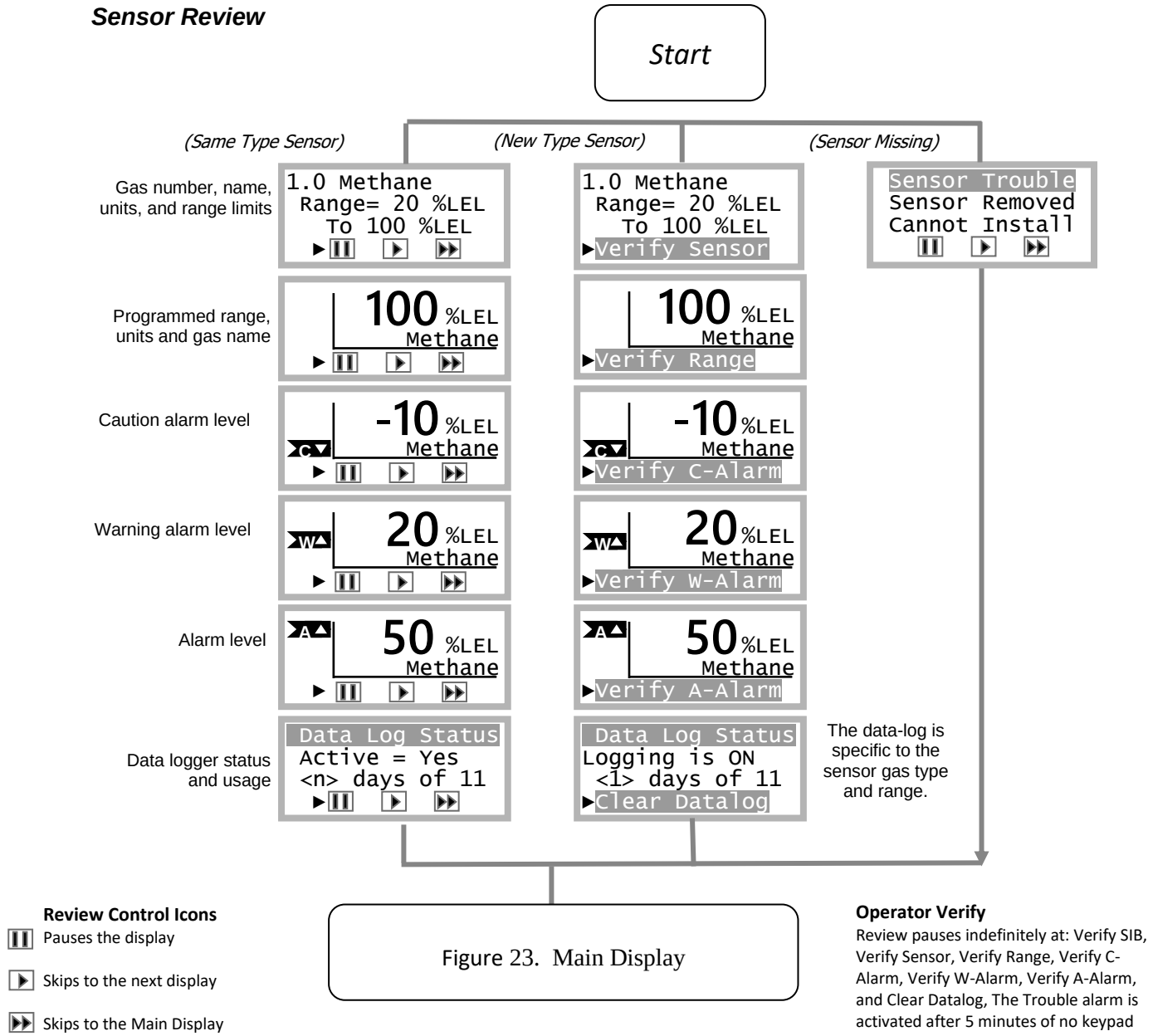


Figure 23. Main Display

Figure 22. Sensor Review Display

Main Display

The Main Display Page shows the name and concentration of the target gas, and units of measurement (PPM, PPB, %, or %LEL). Indicators on the left and below show alarm and operating status.

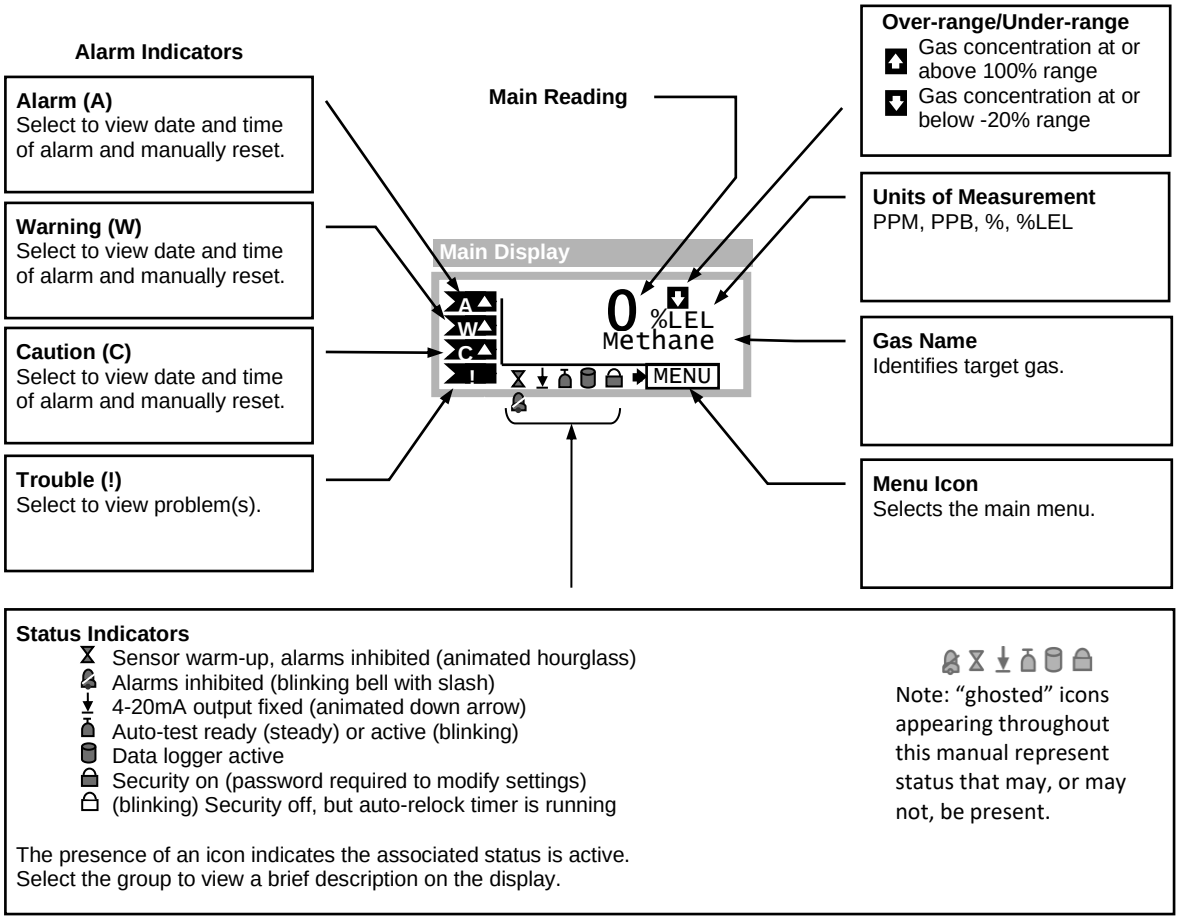


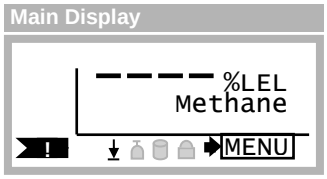
Figure 23. Main Display

Main Reading

The main reading represents the gas concentration value and appears on the Main Display, along with the gas name and units of concentration, and is reported on the 4-20mA output[9,10]. By default, it is blanked to suppress the display of negative values. That is, the reading is reported as zero if the concentration drifts below zero, which can occur over time as a result of sensor aging. If the concentration falls to –20% of the full-scale range, a trouble alarm is generated. Blanking is typically extended slightly above zero, as a means of stabilizing the reading in the presence of excessive external noise, or other environmental factors (see Sensor Settings Menu on page 38). During zero and span calibration, the "un-blanked" gas concentration value is displayed, primarily to assess the amount of positive or negative drift.

[9] The 4-20mA may not match the reading when the ↓ status indicator is visible on the Main Display, or when the output is in a physical limit.
[10] Throughout this manual, "ghosted" status icons are used to indicate status that may be present or not present.

Trouble Indication

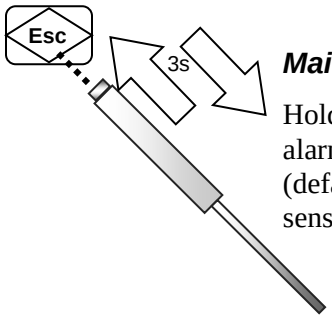


The Trouble alarm is indicated by four dashes appearing on the Main Display, along with the (!) flag in the lower left corner, and the 4-20mA status icon indicating that the 4-20mA output is fixed (default = 3.6mA).

Figure 24. Main Display Trouble Indication

Main Display Timeout

Menus and other pages used for configuring the transmitter and sensor return to the Main Display after 5 minutes of no key activity. Exceptions to this behavior include the zero and span calibration pages (30 minutes).



Main Display Alarm Inhibit Method

Holding the magnet over the **ESC** key for 3 seconds, then removing, toggles alarm inhibit mode. If alarm inhibit was off, it is turned on for 15 minutes (default value). If alarm inhibit was on, it is turned off, and in addition, the sensor warm up period is expired immediately (see status indicators above).

POP-UP DISPLAYS

Sensor Removed Display

Removing the gas sensor causes the Sensor Removed Display to appear (below), which displays a count-down timer. During this time, alarms are inhibited and the current loop output is fixed at 4.0mA (17.4mA for Oxygen sensors). A trouble alarm will occur if a sensor is not installed before the timer expires. This 60 second period is usually long enough to reinstall the sensor, or install a replacement, but if more time is needed, the count may be extended to 5 minutes by selecting "Reset". Selecting "Exit" forces expiration of the timer and exits to the Main Display, which will then indicate the Trouble alarm is active (see Figure 24 above).

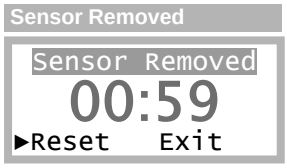


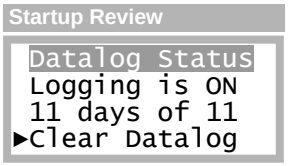
Figure 25. Sensor Removed Display

Sensor Installed

When a sensor is installed, the transmitter compares the type to the previously installed sensor. If they match, the previous sensor's settings are copied to the new sensor, if necessary[11]. The transmitter then starts the sensor review as shown in

Figure 22. If the types did not match, the review halts and waits for the operator to verify the new sensor's full-scale range, and alarm settings. After verifying the sensor, the transmitter copies the sensor settings to its local memory.

Sensor Install Effects on the Data Log



When the sensor is replaced with one of a different gas type (ie, a different part number), you are also prompted to clear the data log during review. Once the sensor is installed, the transmitter executes a 5-minute (typical value) warm-up period, during which alarms are inhibited, the 4-20mA output is held at 4mA (17.4mA for Oxygen sensors), and Zero, Span and Auto-test are not permitted.

MAIN MENU

Main Menu

The main menu provides direct access to the sensor calibration methods, data logger graph, and transmitter settings.

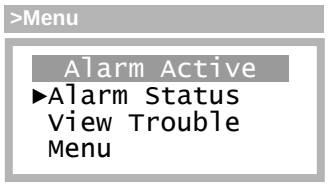
Item	*Select to …*
Zero	Calibrate the gas sensor zero reading (see Sensor Zero Calibration on page 43).
Span	Calibrate the gas sensor sensitivity (see Sensor Span Calibration on page 44)
Graph	View the contents of the logged data as a graph (see D on page 60).
Setup	View and configure transmitter settings (below).

Figure 26. Main Menu

[11] The transmitter sets the new sensor's range, blanking, damping, and alarms to match the previously installed sensor, which might cause confusion when transferring sensors from field transmitters to shop transmitters for calibration. During review, the shop transmitter will display the settings of the previously installed sensor, which might not match the field transmitter. Fortunately, this is not a real problem. The sensor may be calibrated as normal, and when it is eventually returned to the field, the field transmitter will restore its original settings. Always verify settings of field transmitters.

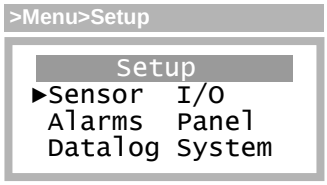
Alarm Active Menu

When a gas or trouble alarm is active, the following menu appears in place of the main menu.



Item	*Select to …*
Alarm Status	View the Alarm Status Menu and clear manual reset alarms. This item appears only if a gas alarm is active (see Figure 51. Alarm Status Menu on page 48).
View Trouble	View the Trouble Status Display This item appears only if the trouble alarm is active (see Figure 58. Trouble Status Display on page 54).
Menu	View the Main Menu (above).

Figure 27. Alarm Active MenuSetup Menu



Item	*Select to …*
Sensor	Configure sensor settings, auto-test, and calibration methods (see Sensors, below).
Alarms	Configure the three gas alarms (see Alarms on page 46)
Datalog	View the data log graph (see Data-log on page 58).
I/O	Configure the 4-20mA output, serial communications, and relay operation (see I/O on page 64).
Panel	Configure the display contrast and backlighting, and panel security (see Panel on page 73).
System	Set the real-time-clock, site name, and view version information (see System on page 77).

Figure 28. Setup Menu.

SENSORS

IR Sensor Cells

The heart of the sensor is an IR cell, which is a tiny CPU connected to an infrared source, detector, and temperature sensor. The source is a thin wall, tungsten filament lamp with an MTBF of over 5 years. It is pulsed at 2 Hz to provide excitation to the each detector, and as a side benefit, warms the components of the sensor. This helps to prevent water vapor from condensing on the interior surfaces of the sensor, which could lead to excessive drift, or even false alarms.

The detector is a dual element, pyroelectric design. The elements, labeled "active" and "reference", are piezo crystals that distort when heated, and generate a small charge in response to radiation pulses emitted by the lamp. Specially designed, optical filters cover each element. The active element is covered by an optical filter that passes radiation in a band that will be absorbed by a target gas, such as Methane. Its output will decrease in amplitude when the gas is in the path of the lamp's radiation. The "reference" element has an optical filter whose pass-band is outside of the active element's filter, and is unaffected by the presence of the target gas. It is used primarily to compensate for slight variations of lamp intensity, humidity, and other environmental factors.

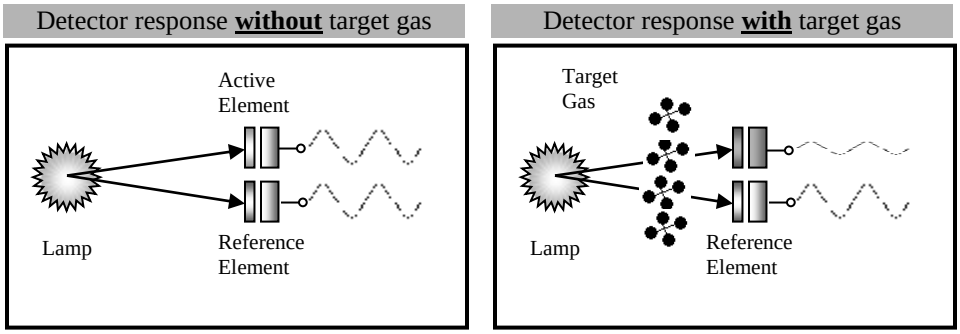


Figure 29. Signal outputs with and without gas.

The signal output of an element is proportional to the amount of filtered radiation reaching it. When an IR absorbing gas enters the optical path, it reduces the radiation reaching the active element by an amount that is a function of the gas type, and concentration. The figure below illustrates the absorption spectra of both Methane and Propane at identical concentrations, overlaid with the filter pass-bands of the Standard LEL Hydrocarbon sensor (P/N 00-1375). To the right of each spectrum is a graph of the sensor's relative, fractional absorption (FA) plotted over the same concentration range.

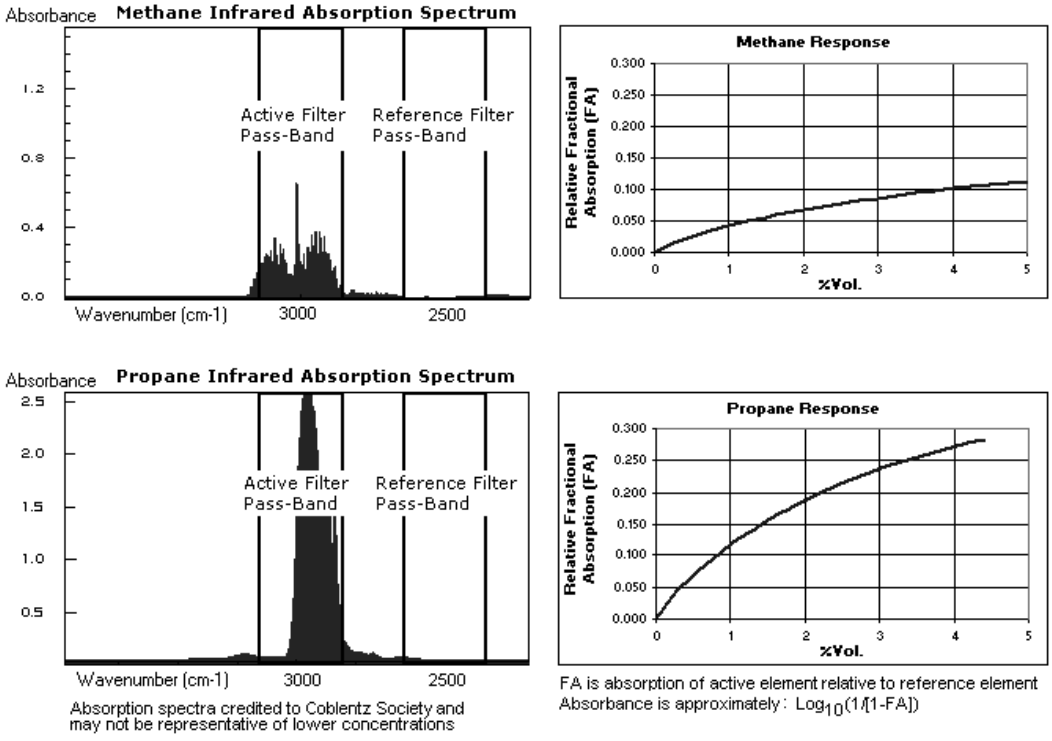
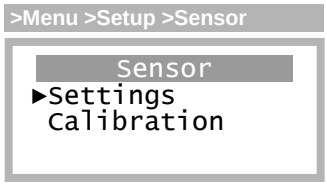


Figure 30. Absorption spectrum and sensor response

Sensor Menus

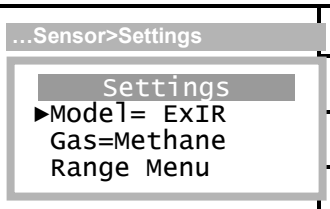


Item	*Select to …*
Settings	Configure the sensor range, damping, and blanking (see Sensor Settings, below).
Calibration	Maintain the accuracy of the gas sensor (see Sensor Calibration on page 41)

Figure 31. Sensor Menu.

Sensor Settings Menu

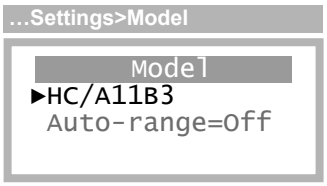
The transmitter accommodates a variety of sensors that automatically configure the transmitter with the gas name, range, units, and other settings, and contain calibration data to convert the sensor analog output to a gas concentration reading. Some of these settings can be changed by the transmitter and it is important to make sure they are configured properly for the site.



Item	*Select to …*
Model	View the specific sensor model name and change any associated settings.
Gas	Change and configure the ***target gas***.
Range Menu	View and adjust the sensor's upper range, blanking, and damping settings (below)

Figure 32. Sensor Settings Menu

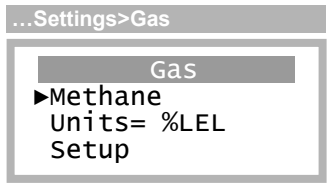
Sensor Model Menu



Item	*Select to …*
Line 1	Sensor model name (read only)
Auto-range	Improve accuracy by enabling the sensor to automatically select a lower or higher range. Appears when high range methane "Methane-HR" is selected as the target gas.

Figure 33. Sensor Model Menu

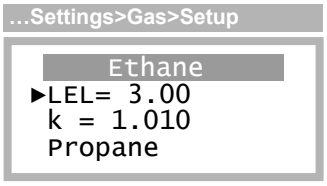
Sensor Target Gas Menu



Item	*Select to …*
Line 1	Change the ***target gas*** (Note: this will clear any logged data)
Units	Units of measurement of the target gas (read only).
Setup	View the target gas setup menu.

Figure 34 Sensor target gas menu

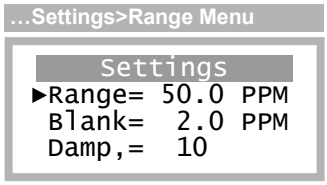
Sensor Target Gas Setup Menu



Item	*Description …*
Line 1	Target gas name (read only)
LEL	Select to change the "**Lower Explosive Limit**" value of the target gas by up to +/- 5% of the default value (see Table 3). This setting is designed to accommodate small differences in the accepted international standards.
k	The "k-factor" is the value used to scale readings from the gas named on line 4 (read only).
Line 4	Gas used to scale readings for the target gas named on line 1 (read only).

Figure 35 Sensor target gas setup menu

Sensor Range Menu



Item	*Select to …*
Range	Sets the gas concentration value corresponding to the 20mA output value. Changing this value also changes the blanking value (below), which is maintained as a fraction of the range. Setting limits vary among sensors. Changing this setting invalidates data stored in the data logger (see below.
Blank (Blanking)	Force the main reading to zero whenever the gas concentration is below this setting. The limits vary from sensor to sensor but are typically 0 to 5% of Range. Note that the transmitter always reports negative readings as 0 (except on calibration displays), without regard to this setting. The setting is recomputed when the Range setting changes, so that the same fraction of range is maintained. Doubling, or halving the Range setting, doubles or halves the Blanking setting, respectively.

	Damp. (Damping)	Helps to stabilize the gas sensor readings. It is a unit-less value from 1 to 100 that controls a s/w lag filter. The setting has an approximate effect on the T90[12] response time, as shown ***Damping*** / ***T90 time*** 1 / 6 s 10 / 10 s 100 / 50 s

Figure 36. Sensor Range Menu

Effect of the Range Setting on the Data Logger

The data-logger records readings as a fraction of the sensor range. If data-logging is turned on (as indicated on the Main Display), changing the Range setting causes a warning message to appear prior to saving the value. Select "Save" to save the new Range setting, or "Abort" to leave it unchanged.

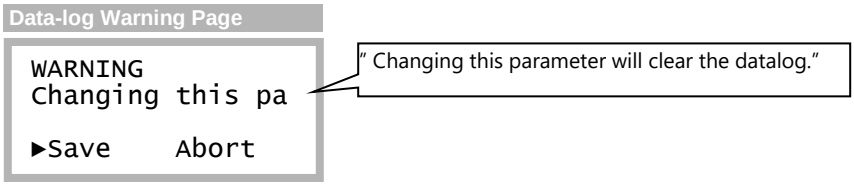


Figure 37. Data-log Warning Message

[12] T90 is the approximate time required for the transmitter to reach 90% of its final value after a step change. The values given in the table do not include gas flow time or the actual response time of the sensor.

Sensor Calibration

Calibration Frequency
While the transmitter itself requires no periodic calibration, sensors should be "zero" and "span" calibrated every 3-6 months, based upon environmental factors. Sensors frequently exposed to dirt, oil mist, vapors, or very dry air, may require more frequent calibration.

Calibration Terminology
The zero calibration is referred to as, "zero", "zeroing", and "zeroed". Likewise for the span calibration, which appears as, "span", "spanning", and "spanned". As with most instruments, zero calibration should be performed before span.

Zero Calibration
Zero calibration corrects the reading in the absence of IR absorbing gas. During zero calibration, the reading is stored in the sensor and subsequently subtracted from future readings. A suitable zero calibration gas is required, based on the type of sensor. Atmospheric air is usually acceptable for hydrocarbon gas sensors, but not for CO2 sensors. Bottled "Zero Air" is acceptable for most IR sensors.

Span Calibration
Span calibration corrects the sensor's sensitivity to a known concentration of target gas (the gas for which the sensor was designed to monitor). Bottled calibration gas is available for many hydrocarbon and CO2 gases. When target gas readings are scaled from propane (using a k-factor), propane may be selected as a "surrogate" gas.

Calibration Kits
Calibration kits, containing zero and span bottle gas sources, are available from ATI for many toxic gases. Contact ATI, or your local ATI representative, if you have questions about calibration gas kits or gas sources.

Indications During Calibration
The "un-blanked" gas concentration value is displayed during zero and span calibration, primarily to observe any slight amount of positive or negative drift. Alarms are cleared and inhibited, and the 4-20mA output is locked at 4.0mA (transmitters equipped with Oxygen sensors are locked at 17.4mA, representing normal, 20.9% atmospheric Oxygen). The 4-20mA output will not change when gas is applied and removed, and for 15 minutes thereafter (the default value). While viewing the calibration pages, the LCD display will indicate the changing gas concentration.

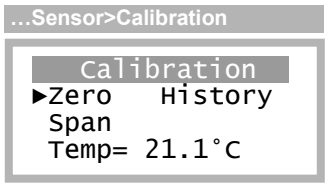
Calibration Exceptions
Zero and span calibration are not allowed during the following conditions:

- Sensor removed, or in 5-minute [13] warm-up period
- Trouble alarm active
- Auto-test active (status indicator appears on Main Display page)

To help prevent errors, zero and span are not allowed if the sensor output, or span value entered, is too high or too low. If detected, memory errors are reported while updating the sensor or transmitter memory.

[13] Typical value, may vary by sensor gas type.

Sensor Calibration Menu



Item	*Select to …*
Zero	Calibrate the gas sensor zero reading (below). Note – this item also appears in the Main Menu (see Figure 26)
Span	Calibrate the gas sensor sensitivity (below). Note – this item also appears in the Main Menu (see Figure 26).
Temp	Adjust the gas sensor's temperature reading offset. Note: this reading may be slightly higher than ambient temperature due to self-heating. Contact the factory before adjusting.
History	View the transmitter calibration records.

Figure 38. Sensor Calibration Menu

Sensor Zero Calibration

The gas used for "Zero" depends on the type of sensor installed. For example, a methane, propane, or other hydrocarbon sensor may be zeroed with zero-air, however, CO2 sensors must be zeroed with nitrogen. In some cases, a hydrocarbon sensor may be zeroed directly to the atmosphere, but only if the air is known to be dry and free of infrared absorbing gasses. Additional time must be allowed for the air to completely diffuse through the sintered metal flame arrestor on the sensor housing (at least ½ hour). Check with the factory if you are uncertain about which gas to use or how to proceed.

When a bottled source is used, it is required to regulate the flowrate at approximately 500cc/min. If the optional Rain Shield is installed (not shown), it is recommended that you remove it and install the Calibration Adapter (shown). This will reduce the time required to reach full saturation of the sensor housing.

Referring to Figure 39, push the Calibration Adapter into the exposed end of the sensor and connect a convenient length of tubing from one of the fittings to the cylinder's regulator. Do not open the gas valve until instructed below.

Select the Zero method from the Sensor Calibration menu, as shown in Figure 40[14]. This will clear and inhibit alarms at the transmitter and hold the current loop output at 4mA for up to 30 minutes of no key activity.

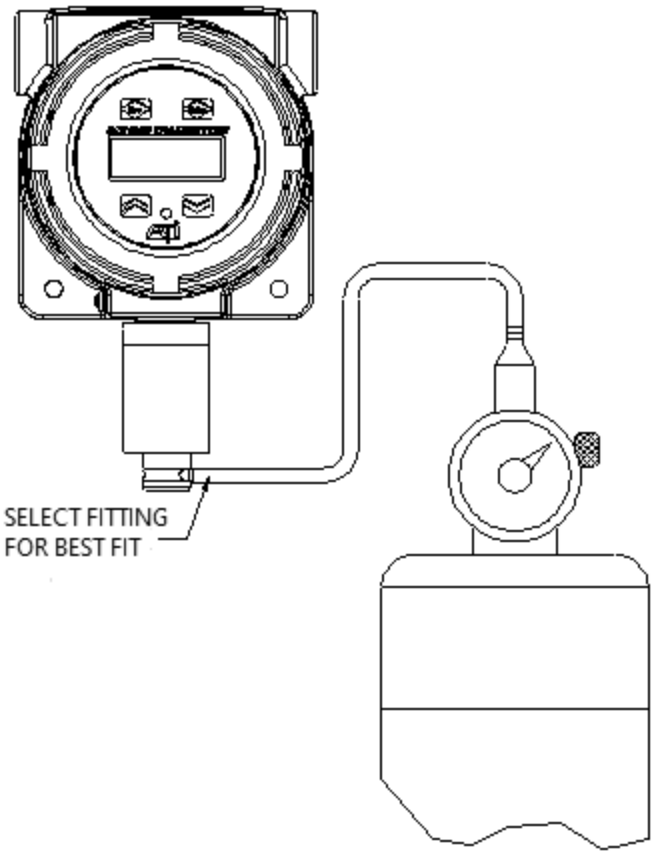


Figure 39. Sensor Zero Cal. Setup

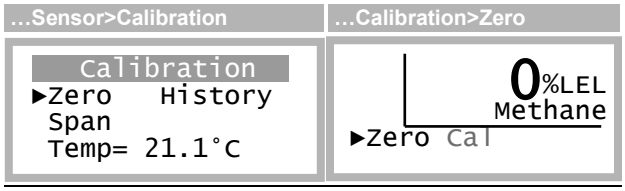


Figure 40. Sensor Zero Cal.Menus

Open the regulator to flow (zero) gas to the sensor. After approximately four minutes, select Zero. "Cal" will appear briefly at the bottom of the page and the reading will be forced to 0, 0.0, or 0.00. Since the reading is not blanked, it may show a negative sign, like "-0.0", which is normal. Touch the **Esc** key twice to return to the Main page. Alarms will remain inhibited, and the current loop will be fixed for 30 minutes after calibration. you may end the alarm inhibit using the **Esc** key on the Main Display (see Main Display Alarm Inhibit Method on page 34).

[14] The zero method is also directly accessible from the main menu.

Sensor Span Calibration

The gas type and concentration used for "Span" depends on the type of sensor installed (see IR Sensor Versions on page 5). Check with the factory if you are uncertain about which gas to use.

IR sensors require a bottled gas source for span with a regulated flowrate of approximately 500 cc/min. If the optional Rain Shield is installed (not shown), it is recommended that you first remove it and install the Calibration Adapter (shown). This will reduce the time required to reach full saturation of the sensor housing.

Referring to Figure 41, push the Calibration Adapter into the exposed end of the sensor and connect a convenient length of tubing from one of the fittings to the cylinder's regulator. Do not open the gas valve until instructed below.

* Perform the Zero calibration prior to the Span calibration.

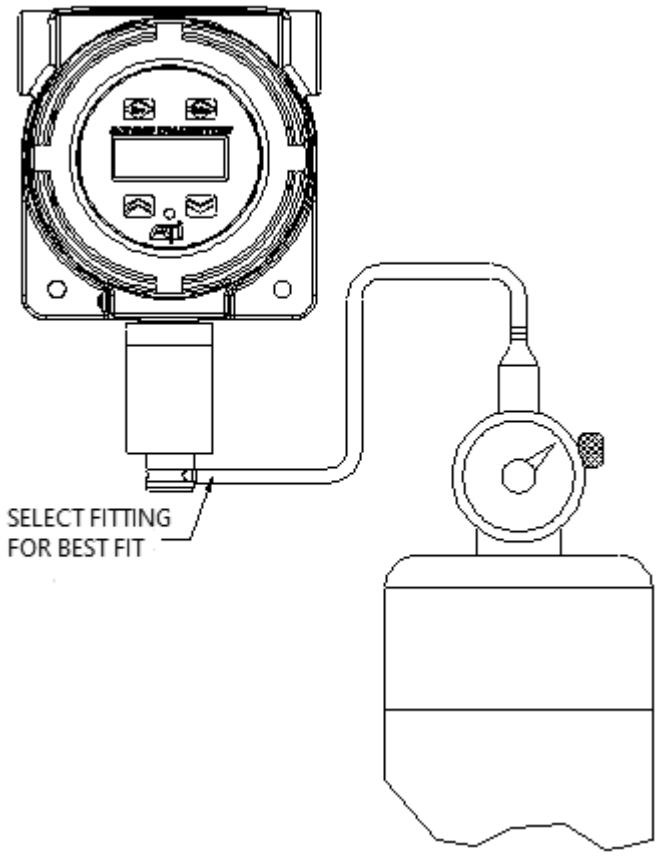


Figure 41 Sensor Span Cal. Setup

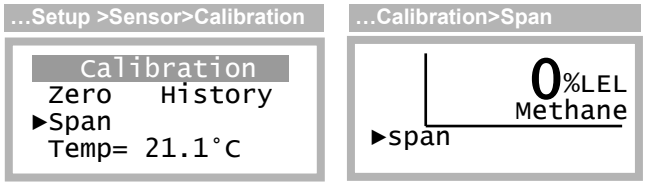


Figure 42. Sensor Span Cal. Menus

Select the Span method from the Sensor Calibration menu, as shown in Figure 42 [15]. This will clear and inhibit alarms at the transmitter and hold the current loop output at 4mAfor up to 30 minutes of no key activity.

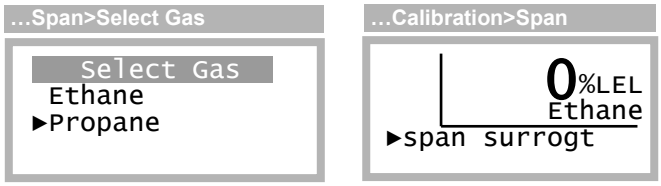


Figure 43 Span to Surrogate Gas.

If a target gas, like ethane, uses a propane k-factor, you will have the option of spanning to either the target gas or to propane. In this case, propane is considered to be a "surrogate" gas.

Open the regulator and allow gas to flow to the sensor. The displayed reading should begin to increase and stabilize after approximately four minutes, depending on the gas type and range of the sensor.

[15] The span method is also directly accessible from the main menu.

Once it has stabilized, select "Span" and adjust the reading to match the applied gas, and then touch "Enter". "Cal" will appear briefly at the bottom of the page to signal the procedure was successful.

Disconnect the calibration adapter from the sensor and permit the readings to return to zero. Touch the **Esc** key repeatedly to return to the Main page. Alarms will remain inhibited and the current loop will be fixed for 30 minutes after calibration. Once the reading is below the "Warning" alarm level, you may end the alarm inhibit using the **Esc** key on the Main Display (see Main Display Alarm Inhibit Method on page 34).

Sensor Calibration History

A calibration record is written into the sensor memory each time a zero or span calibration is performed. Enough memory is reserved for 63 zero calibrations and 63 span calibrations. Zero and span calibration records are accessed on the Sensor Calibration History page.

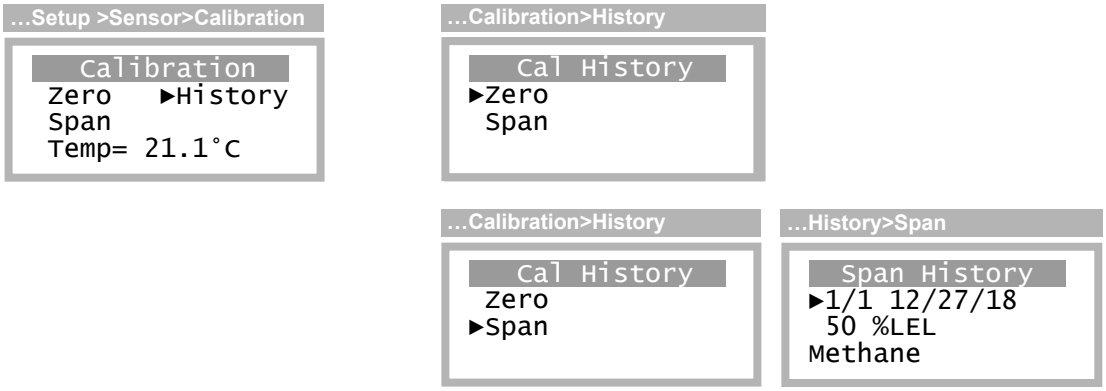


Figure 44. Sensor Calibration History Menus

Zero calibration records are composed of an index field (ie, record number/total records), date, concentration reading, and gas name. The reading is recorded just before applying the correction, and can be thought of as "drift" from the previous zero calibration. Upon entry, the index number is set to the most recent calibration and may be scrolled down to view earlier calibration records.

Span calibration records are composed of an index field, date, and the concentration of the applied gas. Like the zero records, the index number is set to index the most recent calibration and may be scrolled down to view earlier calibration records.

ALARMS

The transmitter features three gas level alarms - **Alarm**, **Warning**, and **Caution**, as well as a **Trouble** alarm. Gas level alarms are automatically configured when a gas sensor is installed, and are retained between changes of the same type sensor. The alarm status is indicated on the Main Display and is used to activate the three optional relays (see Relay Operation, Menus, and Settings on page 71). It is also available over the serial interface.

Flammable and Toxic Gas Alarms

High alarms are required when monitoring for leaks or other unintentional accumulations of flammable gases like methane, and toxic gases like CO2. Figure 45 illustrates the default relationship of alarms for flammable and toxic gases. The default settings for each target gas are given in IR Sensor Versions starting on page 5.

- **Alarm** High-high alarm
- **Warning** High alarm
- **Caution** Negative drift alarm
    - Normally set to activate on negative drift of –10 %FSR (full scale range).
- Trouble alarm occurs if reading drifts to –20 %FSR (cannot be disabled).

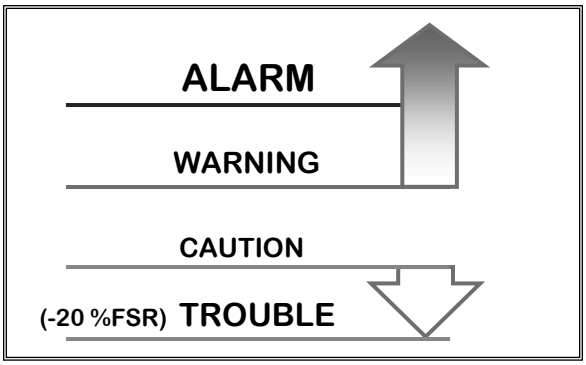


Figure 45. Flammable and Toxic Gas Alarms.

Process Low Alarms

Low alarms can be used to monitor gas levels that might decrease as the result of a leak or process malfunction. An example of this might be when monitoring normally high levels of CO2 or methane above its UEL of 15%VOL[16]. Note that the transmitter normally disables the gas level alarms for high-range hydrocarbon and CO2 sensors. The default settings for each target gas are given in IR Sensor Versions starting on page 5.

- **Alarm** Low-low alarm
- **Warning** Low alarm
- **Caution** Positive drift alarm
    - Can be set to activate on a positive drift of +10 %FSR (full scale range).
- Trouble alarm occurs if reading drifts to –20 %FSR (cannot be disabled).

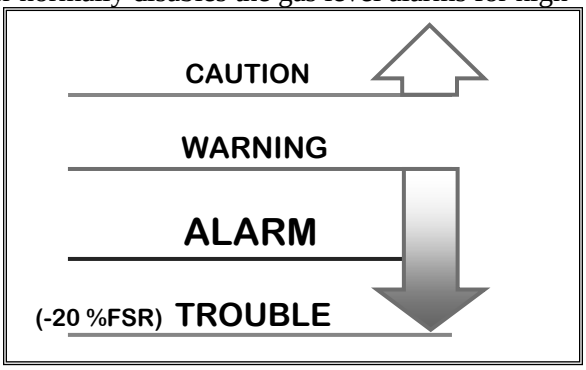


Figure 46 Process Low Alarms

[16] Extreme care must be taken in these locations, since a leak of air could produce an explosive atmosphere.

Gas Alarm Operation

Figure 47 illustrates the operation of a high (rising) gas level alarm used for monitoring gases below their LEL and TLV limits.

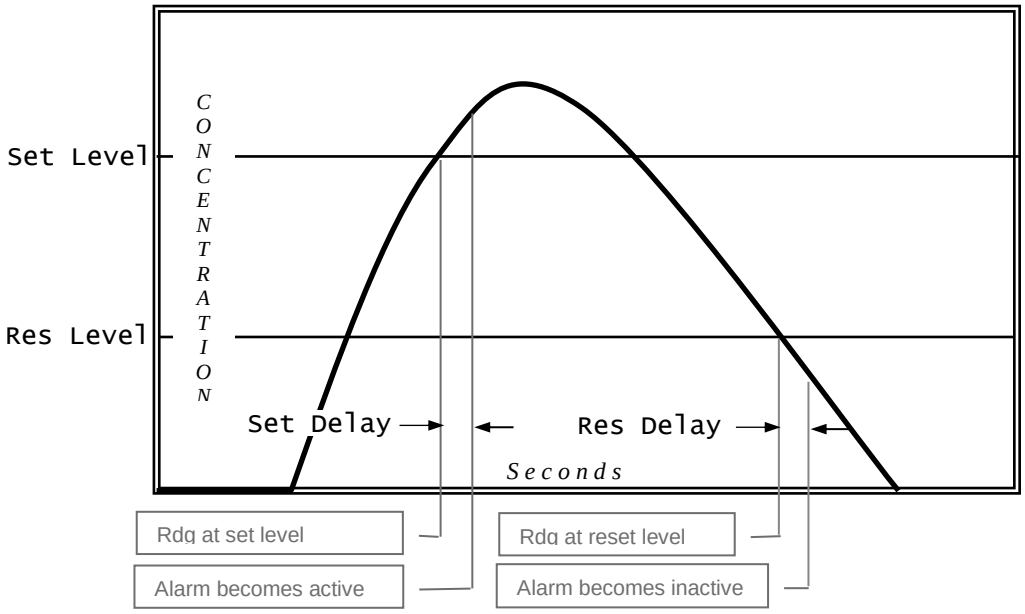


Figure 47. High Alarm Operation

Figure 48 illustrates the operation of a low (falling) gas level alarm that might be used for monitoring gases above their UEL.

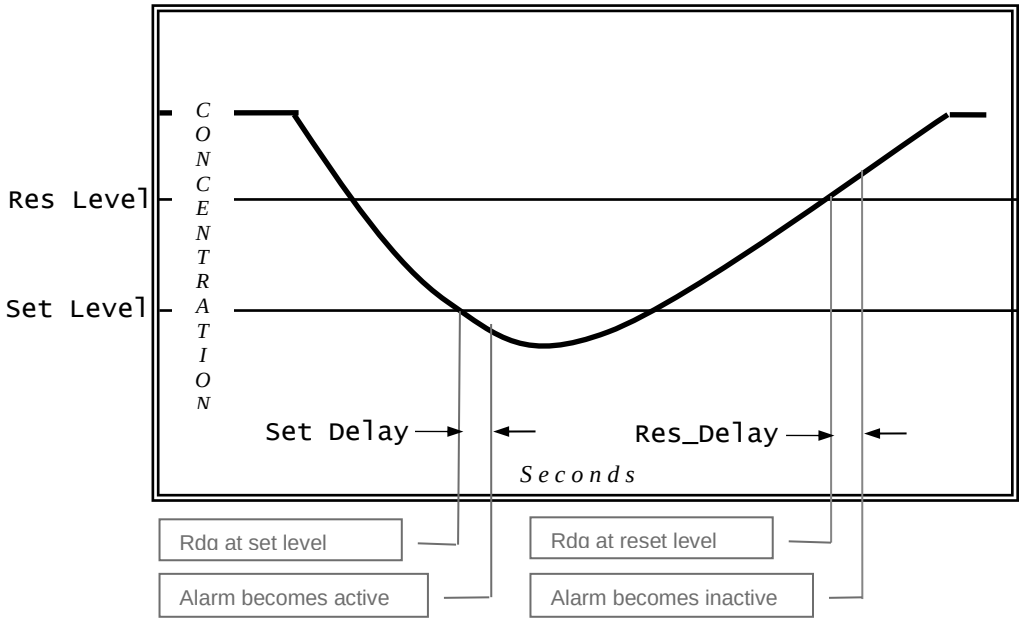
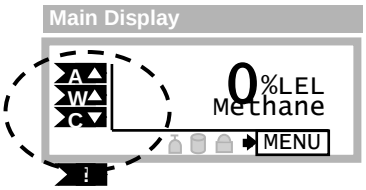


Figure 48. Low Alarm Operation

Alarm Indicators

Alarms are indicated by four flags on the left side of the Main Display. Each flag contains a letter to identify the alarm. Gas alarms also have an arrow indicating the alarm type - high (rising) alarm, or low (falling) alarm.

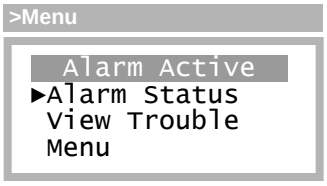


A▲	Alarm	A
W▲	Warning	W
C▼	Caution	C
!	Trouble	!

Figure 49. Alarm Indicator Flags

Alarm Active Menu

When a gas or trouble alarm is active, the following menu appears by selecting Menu from the Main Display.

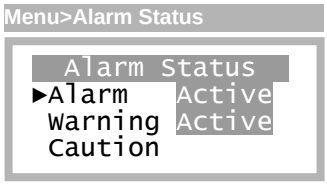


Item	*Select to …*
Alarm Status	View the Alarm Status Menu and clear manual reset alarms. This item appears only if a gas alarm is active (see Figure 51 on page 50).
View Trouble	View the Trouble Status Display This item appears only if the trouble alarm is active (see Figure 58 on page 56).
Menu	View the Main Menu (above).

Figure 50. Alarm Active Menu

Alarm Status Menu

The Alarm Status Menu appears by selecting Menu from the Main Display when an alarm is active Alarm Active Menu (see page 36). The menu lists the three gas alarms and the word, "Active", if the alarm is currently active. Selecting an active alarm displays the specific Alarm Reset Menu, below.

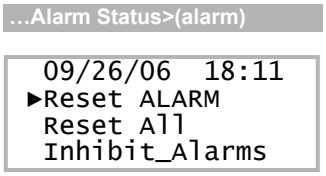


Item	*Select to …*
Alarm	View the time and date of Alarm and manually reset it, if required.
Warning	View the time and date of the Warning alarm and manually reset it, if required.
Caution	View the time and date of the Caution alarm and manually reset it, if required.

Figure 51. Alarm Status Menu

Alarm Reset Menu

The Alarm Reset Menu appears by selecting an active alarm from the Alarm Status Menu, or by selecting an alarm indicator flag from the Main Display. The menu presents the date and time of when the alarm became active, and permits manual reset, along with the other options are listed below.



Item	*Select to …*
(line 1)	Date and time of alarm event.
Reset (alarm)	Manually reset the alarm selected on the Alarm Status Menu above. Reset is performed only if the alarm conditions have subsided, and the alarm is programmed for manual reset (see Figure 54. Alarm Setting on page 50),
Reset All	Manually reset all manual-reset alarms, once alarm conditions have subsided.
Inhibit Alarms	Temporarily resets and inhibits gas level and Trouble alarms (default is 15 minutes, see Alarm Inhibit on page 52).

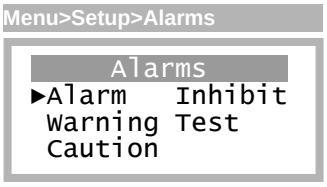
Figure 52. Alarm Reset Menu

Remote Reset

Momentarily activating the "Remote Reset" input (see Power Supply Board on page 18) clears all manual reset alarms, but only if the respective alarm conditions have subsided.

Alarms Menu

The Alarms Menu is the main entry point for configuring, inhibiting, and testing gas level alarms.



Item	*Select to …*
Alarm	Configure the Alarm settings to indicate a dangerous condition (see Alarm Setting Menus on page 50).
Warning	Configure the Warning settings to indicate an unsafe condition (see Alarm Setting Menus on page 50).
Caution	Configure the Caution settings (normally used to indicate excessive sensor drift - see Alarm Setting Menus on page 50).
Inhibit	Configure or activate the manual alarm inhibit period (see Alarm Inhibit on page 52)
Test	Test operation of the alarm indicators and relays (see Alarm Test Menu on page 53)

Figure 53. Alarms Menu

Alarm Setting Menus

The Alarm Setting Menus are accessed from the Alarms Menu and are used to configure the three gas level alarms.

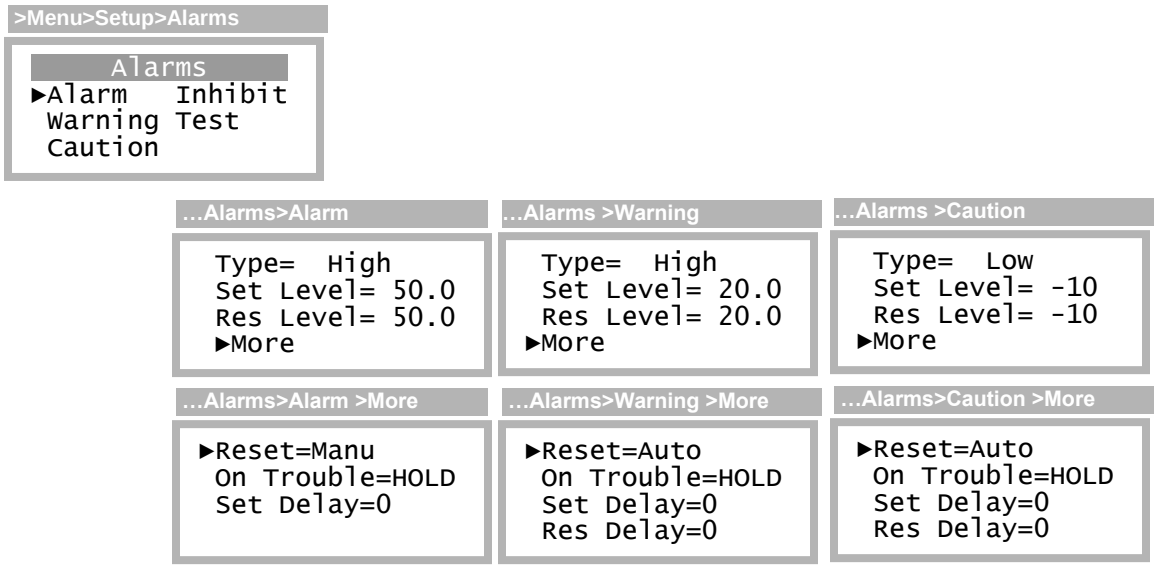


Figure 54. Alarm Setting Menus

Item	*Select to…*
Type	Set the type of alarm as High, Low, or None. When set to High, the alarm becomes active *at and above* the Set Level. When set to Low, the alarm becomes active *at and below* the Set Level. Setting the value to None permanently deactivates the alarm. The setting is stored in the sensor memory.
Set Level	Set the gas concentration level at which the alarm becomes active. The alarm then becomes active at the expiration of the Set Delay period. Changing Set Level changes Res Level to the same value. Limits for the Set Level are maintained in the gas sensor memory.

Res Level	Set the gas concentration level at which the alarm becomes inactive. The alarm then becomes inactive after expiration of the Res Delay period, and only if the Reset setting is programmed as Auto – see below. The limits for the Res Level depend on the alarm Type setting. Type = High Upper limit = Set Level Lower limit = lowest Set Level Type = Low Upper limit = highest Set Level Lower limit = Set Level Changing Set Level changes Res Level to the same value.
Reset	Select how the alarm is reset as Manu or Auto. When set to Auto, the alarm will reset (clear) without operator intervention, as soon as conditions allow (concentration reaches Res Level, and the Res Delay period expires). When set to Manu, the operator must reset the alarm manually after conditions subside, through the operator interface, the serial interface, or through the remote reset (see Power Supply Board on page 18). Note: Res Delay is meaningful only when Reset= Auto. Setting Reset to Manu suppresses display of the Res Delay setting.
On Trouble	Specify the alarm state during Trouble alarms. This setting specifies alarm behavior during transmitter faults, and overrides all other alarm settings. If the trouble alarm should become active, you may program the concentration alarm to behave in one of three ways: Hold - the transmitter will attempt to hold the alarm in its current state. If the alarm is active, it will remain active. If the alarm is inactive, it will be inhibited from becoming active until after Trouble is cleared. Set - activates the alarm immediately (the Set Delay period is ignored). This feature permits the alarm to signal both concentration and trouble conditions. Reset – deactivates the alarm immediately (the Res Delay period is ignored).
Set Delay	Configure the amount of time, in seconds, that the gas concentration must be at or above a high alarm set level, or at or below a low alarm set level, before the alarm becomes active. This is used to avoid triggering alarms on relatively short gas exposures. The setting may be programmed between 0 (its default) and 10 seconds.
Res Delay	Configure the amount of time, in seconds, that the gas concentration must be below a high alarm reset level, or above a low alarm reset level, before the alarm becomes inactive. The setting is typically used to keep relays energized to maintain exhaust fans after a gas leak. The setting is displayed only when Reset is set to Auto,and may be programmed between 0 (default) and two hours (7200 seconds).

Alarm Inhibit

Alarms are inhibited to temporarily disable (false) activation and should be re-enabled as soon as possible to maximize the safety of the area. The duration of inhibit period depends the method used to activate it. For example, alarm inhibit occurs automatically during zero and span calibration and expires after 30 minutes. The table below summarizes the duration of the alarm inhibit periods for each method used to initiate it.

Table 16. Alarm Inhibit Periods

Method	*Alarm Inhibit Period*
Start up	(same as Sensor Install below)
Zero,Span	Set immediately on entering the method Then for up to 30 minutes after touching a key while in the method
Sensor Auto-test	5 minutes during gas generation attempt 10 minutes during recovery period
Sensor Removal	60 seconds, then Trouble alarm active
Sensor Install	Alarm inhibit active during sensor warm-up (usually 5 minutes)
Manual activation from Main Display using Esc key	Duration value in Alarm Inhibit Menu
Manual activation by Start in Alarm Inhibit menu	Duration value in Alarm Inhibit Menu

The Main Display indicates when alarms are inhibited (see Status Indicators in Figure 23 on page 33), and the 4-20mA output is fixed at the Inhibit mA (see below).

The most convenient method for manually starting alarm inhibit is from the Main Display. For more information on that method, see Main Display Alarm Inhibit Method on page 34. Alarm inhibit may also be started through the Alarm Inhibit Menu, shown below.

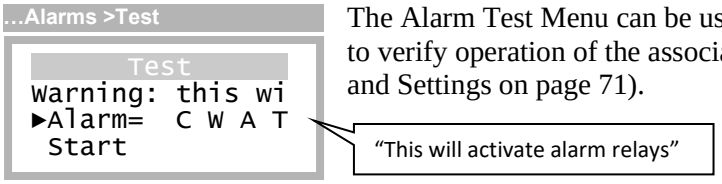
Alarm Inhibit Menu

The Alarm Inhibit Menu exposes the manual alarm inhibit start and stop control, and the duration and fixed 4-20mA setting.

>Menu >Setup >Alarms >Inhibit	*Item*	*Select to …*
▶Inhibit mA= 4.0 Duration= 15:00(mm:ss) Start	**Inhibit_mA**	Set the fixed value of the 4-20mA output during alarm inhibit (3.5 to 22.0 mA). This is normally 4mA for toxic gas sensors, and 17.4mA for oxygen sensors.
	Duration	When alarm inhibit is **off**: Set the manual alarm inhibit period (0-60, default=15 minutes). When alarm inhibit is **on**: Adjust the amount of time remaining.
	Start (Stop)	Start (or stop) alarm inhibit

Figure 55. Alarm Inhibit Menu

Alarm Test Menu



The Alarm Test Menu can be used to test the gas level and Trouble alarms to verify operation of the associated relays (see Relay Operation, Menus, and Settings on page 71).

Note

Devices wired to the relays may activate when "Start" is selected. Inform all personnel before performing the test.

Display	*Instructions*
...Alarms >Test Test Warning: this wi ►Alarm= - - - - Start	1. Select Alarm
...Alarms >Test Test Warning: this wi ►Alarm= ▲- - A - ▼ Start	2. Scroll up or down to specify which alarms to test - C, W, A, T, and save the selection by touching the Enter key. 3. (C=Caution, W=Warning, A=Alarm, T=Trouble)
...Alarms >Test Test Warning: this wi Alarm= - - A - >Start	4. Select Start to begin the test.
...Alarms >Test Test Warning: this wi Alarm= - - A - Any key to STOP	5. Touch any key to end the test. The test stops automatically after 5 minutes.

Figure 56. Test Alarm Menu

Trouble Alarm

The Trouble alarm is presented on the Main Display as shown below. When active, new level alarms are inhibited, and (by default) active alarms are held so that relays controlling lights, sirens, and fans may continue to operate (this behavior may be modified on the Alarms (see page 49). Certain Trouble alarm causes, like a temporary bus fault, may clear automatically without operator intervention. Others, such as a missing sensor, will not clear until corrected.

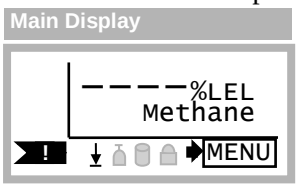


Figure 57. Trouble Indication on Main Display

Trouble Status Display

The Trouble Status Display appears by selecting the Trouble indicator from the Main Display. It may also be viewed by selecting `MENU` from the Main Display when the Trouble alarm is active, then selecting `View Trouble`. The 8-digit hex code on line 2 represents all active faults and is useful when obtaining help from the factory. Select `Next Problem` to view a description of each problem in succession on line 3. Some problems listed in Table 18 (on page 55) are cleared after touching **Esc** to return to the previous display.

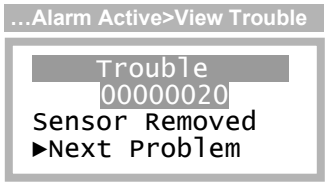


Figure 58. Trouble Status Display

Corrective Actions

Prior to opening the transmitter housing:

- **Declassify the hazardous area** - if the transmitter is located in a hazardous location.
- Check connections and wiring **outside of** the transmitter for shorts or opens.
- Unplug the sensor and generator modules and inspect the connectors for bent or recessed contacts.

After the transmitter housing is open:

- Start by checking connections inside the housings in the order listed under "Corrective Actions".
- If none of the listed corrective actions solve the problem, replace the transmitter board electronics.

After replacing the sensor, generator, or SIB board:

- **Review, verify, and restore all Sensor and Auto-test settings.** This includes the critical sensor settings like `Range` and `Blank`, and the Auto-test Status setting (`Status` must set to `READY` for automatic operation).

After replacing the CPU board:

- **Review, verify, and restore all transmitter settings**.

General Trouble

The table below lists troubles for which no message is displayed.

Table 17. General Trouble

Problem	*Corrective Action*
Transmitter won't start.	1. At power on, transmitters powered in 3-wire or 4-wire mode demand 2 times the normal amount of supply current. If the supply is not sized properly, transmitters may not power on, or may produce a fault in the external power supply. If this is suspected, try starting transmitters one at a time. 2. Check that each transmitter has at least 12VDC between pins 5(+) and 6(-) of TB1 on its Power Supply board. This is more easily done using *temporary* lead wires from the connector.
Gas reading unstable, drifting.	Ground loops are a common cause of unstable readings, and may represent a dangerous condition. A ground loop occurs most often when a drain wire, cable shield, DC supply (-), or any other wire makes contact to two or more transmitter housings, remote sensor housings, receivers, power supplies, or metal cable conduits. Metal housings must be bonded to earth ground for safety, and any difference in earth potential between the two points will cause current to flow in the wire or shield. This current might then cause errors in the transmitter's high-gain analog input, or possibly exceed the rating of the conductor.

Trouble Messages

Table 18 describes the trouble messages and lists the corrective action codes, which are listed below.

Table 18. Trouble Messages

Trouble	*Description*	*Corrective Action(s)*
Gas Signal Err	The analog-to-digital converter channel assigned to the sensor's gas concentration output signal has failed, or is out of range.	1-3,4,6,9
LCD Busy Error	The LCD driver chip cannot recover from an internal error.	1-3,7,8
SPI/I2C Bus Error	An internal CPU bus has faulted.	1-3,7,8
Tmp. Signal Err	The analog-to-digital converter channel assigned to the sensor's temperature output signal has failed, or is out of range.	1-3,4,6,8
Sensor (-)Range	The sensor has drifted -20% range (below zero).	Zero calibrate the sensor 4,6,8
Sensor Removed	The sensor cannot be detected.	2-4,6,8
Sensor NVM Err	One or more configuration settings in the sensor memory do not pass checksum test.	4,6,8
Sensor Config	One or more sensor configuration settings are outside of their expected range.	4
Generator NVM	The generator's non-volatile memory is corrupt.	5,6,8

Trouble	*Description*	*Corrective Action(s)*
Auto-test Fail With Gen. Config Err	Auto-test is enabled (Status=READY) and a problem has been detected with the gas generator, or the gas generator is not compatible with the sensor's type or range. This problem is reported on the display during startup, when a sensor is installed, and when a generator is removed or installed.	4,5, or disable Auto-test (set Status to OFF)
NVM1 User CRC	An error has been detected in the user settings stored in the transmitter's primary non-volatile memory.	2,3, otherwise, reset the user memory defaults (see Reset Menu on page 78) If the problem persists, replace the CPU board.
NVM1 Fact CRC	An error has been detected in the factory settings stored in the transmitter's primary non-volatile memory.	2,3,7
NVM2 User CRC	An error has been detected in the transmitter's secondary non-volatile memory.	Not applicable on this transmitter
NVM2 Fact CRC	An error has been detected in the transmitter's secondary non-volatile memory.	Not applicable on this transmitter
Auto-test Fail Without Gen. Config Err	Auto-test failed after three attempts (and the Auto-test Trouble is set to YES).	5,4,6
3W Pwr Required	Relays or RS232/485 communication is enabled, but transmitter does not have 3-wire power applied.	Connect the transmitter in 3-wire power mode
Xmtr Uncal	The transmitter's factory calibration data has become corrupted.	2,3,7
CPU Trouble	A stack overflow or other internal error occurred in the CPU.	2,3,7
Fault Test	Trouble alarm is being tested, not an actual fault.	
Gas Sensor Uncal	The gas sensor appears to be uncalibrated, which occurs after resetting its memory.	Not applicable on this transmitter
No User Verify	A setting was not verified at the panel (within 5 minutes).	Restart the transmitter (2) and verify all settings.
Hardware Fault	The real-time-clock, a non-volatile memory, or some other component has faulted or been corrupted. The transmitter will restart upon exit from the Trouble Status Display (page 54), or automatically from the Main Display after 5 minutes.	1,3,7,8

Trouble	*Description*	*Corrective Action(s)*
Sensor Mismatch	The connected sensor or SIB is not compatible with the transmitter. Transmitters supply power differently to toxic gas sensors than to IR or combustible versions. This fault is designed to detect mistakes that could lead to unsafe operation.	2,3,6,9
Sensor COM TmOut	The sensor is not responding.	2,3,6,7,9
Sensor COM Error	The sensor is responding with physical communication errors.	2,3,6,7,9
Sensor Proto Err	The sensor is responding with protocol errors (ie, bad CRC). This could be caused by physical communication errors.	2,3,6,7,9
Sensor Reply Err	The sensor is responding with bad information.	2,3,6,7,9
Sensor CPU Trble	The sensor is reporting a stack overflow or other internal error occurred in its CPU.	2,3,6,7,9
Sensor H/W Error	The sensor is reporting a non-volatile memory or other hardware component has faulted.	2,3,6,7,9
Sensor NVM1 CRC	The sensor is reporting an error has been detected in the user or factory settings stored in its primary non-volatile memory.	2,3,6,7,9
Sensor NVM2 CRC	The sensor is reporting an error has been detected in the user or factory settings stored in its secondary non-volatile memory.	Not applicable on this transmitter.

Corrective Action Codes

1. Restart the transmitter (Menu>Setup>System>Reset>Restart)
2. Toggle power off and on
3. Replace the sensor
4. Replace the generator
5. Replace the SIB
6. Replace the CPU Board
7. Replace the Power Supply Board
8. Replace the Display Board
9. Replace Sensor Interface Board

DATA-LOG

The transmitter records gas concentrations in one of 12 intervals ranging from 1 to 60 minutes, providing data from 11 to 474 days. Table 19 details the sampling intervals, and the samples/day and totals days for each interval.

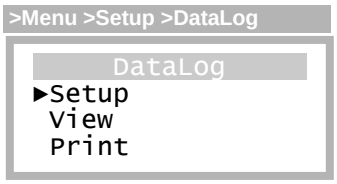
Table 19. Data-log sampling metrics

Sampling (Minutes)	*Samples/Day*	*Total Days*
1	1440	11
2	720	22
3	480	32
4	360	43
5	288	54
6	240	64
10	144	104
12	120	124
15	96	152
20	72	196
30	48	278
60	24	474

The gas concentration reading is recorded as an instantaneous value and is not averaged or filtered in any way. When the data log memory is filled, new records overwrite older ones.

Data Log Menu

The Data Log Menu permits access to configuration, review, and print menus.

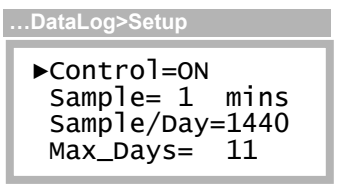


Item	*Select to …*
Setup	Configure the data log settings (see Data Log Setup Menu below).
View	View the logged data as a graph or single text records.
Print	Send a tabular ASCII report to the device connected to the COM port (see Data Log Print on the next page). Note: only available on transmitters with an RS232 or RS485 interface. The data log must not be empty, and the COM protocol must be set to ASCII. Otherwise, the transmitter will display an exception message.

Figure 59. Data Log Menu

Data Log Setup Menu

Settings on the Data Log Setup page select one of the 12 discrete sampling intervals listed in Table 19, and control starting, stopping and clearing of the data-log.

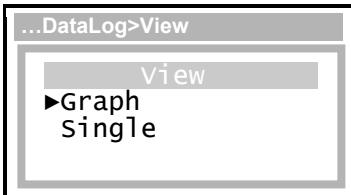


Item	*Select to …*
Control	Turn data logging on or off, or clear stored data.
Sample **Sample/Day** **Max_Days**	Set the sampling interval to one of the 12 values listed in Table 19. Changing one automatically changes the other two. Warning: changing the sampling interval will clear the data-log.

Figure 60. Data Log Setup Menu

Data Log View Menu

Data is presented as a gas concentration reading at a specific date and time and may be viewed collectively as points on a graph (Graph), or individually as a single text record (Single). In Graph view, readings are presented sequentially in time when scrolling the up and down keys. In Single view, both the date and time may be scrolled to provide a pseudo random-access method. Since the two views are connected, it is possible to navigate directly to the date and time of interest using the Single view, and then switch to the Graph view to see more readings around a particular time. Conversely, the view can be switched from Graph to Single to view readings taken around the same time on different days.



Item	*Select to …*
Graph	View multiple points of data as a graph (sequential selection).
Single	View single records (pseudo random-access selection)

Figure 61. Data Log View Menu

Samples reported are assumed to be in units of PPM, PPB, %, or %LEL as determined by the gas concentration units appearing on the Main Display. Sample values outside of printing limits are forced to the following values.

Samples …	*Forced to…*
Less than –999	*-999*
Greater than 9999	*9999*

Readings in both views are displayed in the same units and decimal precision as those on the Main Display, and the date format is consistent [17] with the format selected in the (see page 77). Both views also display special codes to indicate samples were unavailable. The table below summarizes the special codes.

Table 20. Data Log Special Codes

Special Code	*Description*
----	Sample unavailable (transmitter powered off, or sample not yet recorded)
FFFF	Trouble alarm active at time of sample
TEST	Auto-test active at time of sample (if Log_Data=NO)[18]
****	Data is corrupted, or unreliable

Data-log Graph View

The Graph view plots a sample as a vertical line, the height of which corresponds to the gas reading as a percentage of the sensor's range (ie, height = 100*reading/range). Samples are plotted from left (oldest) to right (newest). On entry, a vertical cursor appears over the most recent sample (or sample of interest), and the corresponding date, time, and gas reading or special code (see above) are displayed on the lower line. These values are updated as the cursor is moved left and right by touching the up and down keys. Note: the gas reading on the lower line is in the same units that appear in the Main Display and Sensor menus.

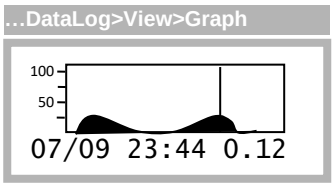


Figure 62. Data Log Graph View

New data is not plotted while viewing the page. Touching the **Enter** key presents the Data Log Menu shown below, touching the **Esc** key returns to the previous menu.

Data Log Graph View Menu

The Data Log Graph View Menu is appears by touching the **Enter** key while viewing the Data Log Graph View (above).

[17] Dates presented in the Graph view are shortened to just the month and date, the year is not presented.
[18] Auto-test is not available on the D12Ex-IR version.

…DataLog>View >Graph ,Enter ►Single Print	*Item*	*Select to …*
	Single	View single records (pseudo random-access selection) starting at the cursor position.
	Print	Send a tabular ASCII report to the device connected to the COM port (see Data Log Print on the next page). Note: only available on transmitters with an RS232 or RS485 interface. The data log must not be empty, and the COM protocol must be set to ASCII. Otherwise, the transmitter will display an exception message.

Figure 63. Data Log Graph View Menu

Data Log Single View

The Data Log Single View Menu allows scrolling to an exact date and time for viewing a single sample. Selecting Graph then presents the Graph view at the selected date and time.

…DataLog>View>Single ►Date= 12/09/18 Time= 03:30 Conc= 0.12 Graph	*Item*	*Select to …*
	Date	Scroll to a specific sample date.
	Time	Scroll to a specific sample time.
	Conc	View the gas reading when sample was recorded (not selectable).
	Graph	View the Graph at the specified date and time.

Figure 64. Data Log Single View Menu

Data Log Print Menus, Methods, and Settings

For transmitters with an optional RS232/RS485 interface, a data log report may be sent to a serial printer, or "captured" to a file using a terminal emulation program. Many terminal emulation programs exist for both Microsoft Windows® and non-Windows platforms. See **Error! Reference source not f ound.** for a detailed example of how to capture and chart a report.

The report consists of a series of lines, each containing a date and time, followed by up to 30 gas readings. All fields on the line are separated by a TAB character (ASCII 9), which serves to keep the fields aligned in columns. This format is suitable for most Epson protocol printers and for import into most spreadsheet programs after capture. The date and time apply to the first gas reading on the line following the time. Readings appearing in subsequent columns to the right were recorded at the programmed sampling interval after the first reading. The format of the gas readings appear as described in Data Log View Menu on page 59. A report example is shown below.

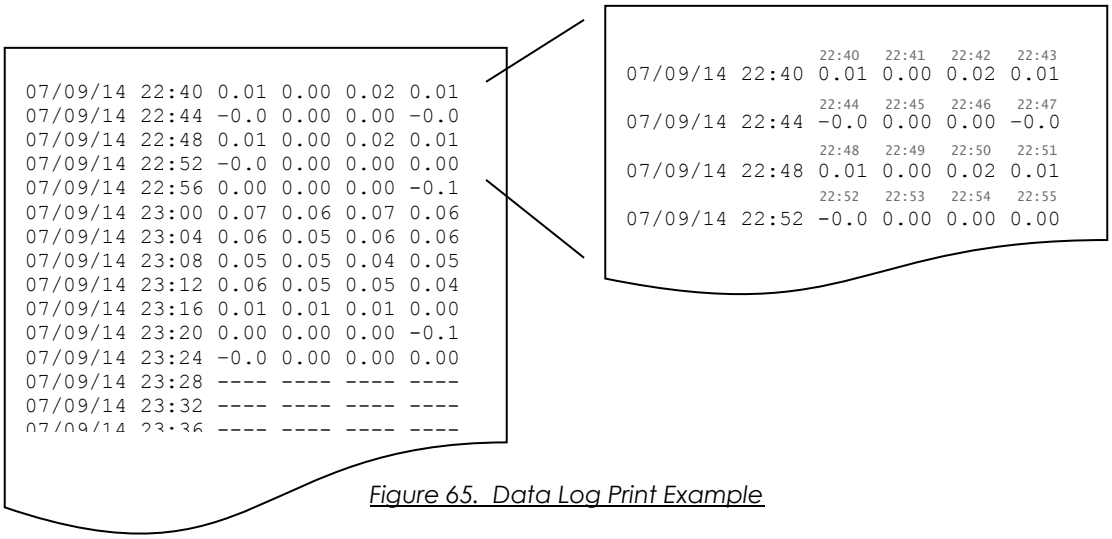
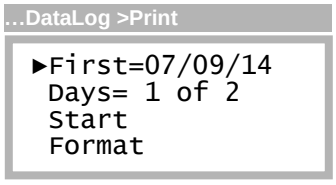


Figure 65. Data Log Print Example

In the example above, the first sample occurred at 22:40. The next sample to the right occurred at 22:41, followed by the next at 22:42, and so on. This pattern is repeated to the end of the line, and then repeats on the line below.

Data Log Print Menu

The Data Log Print Menu appears by selecting `Print` from the Data Log Menu (page 59). The data log must not be empty, and the communication protocol must be set to ASCII before entry (see COM Menus on page 66), or an exception message will be displayed. The transmitter's real time clock should also be set to the correct date and time.



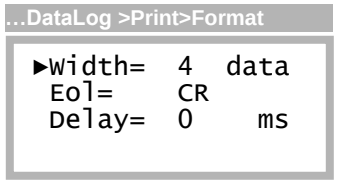
Item	*Select to …*
First	Set the first date to print in the report. Scrolling this date automatically updates the Days field.
Days	Set the number of days of data to include in the report.
Start	Send the report to the device connected to the transmitter's COM port.
Format	Configure the report format for the connected device.

Figure 66. Data Log Print Menu

To send the report, set the start date (`First`) and number of days to print (`Days`), and select `Start`. The line will blink `Printing` until the report is done. The report always begins at 00:00 on the start date, and continues for the number of days specified. If no data has yet been logged, the report will show four dashes (----) in place of samples.

Data Log Print Format Menu

The Data Log Print Format Menu appears by selecting `Format` from the Data Log Print Menu (above) and is used to control the appearance of the report, and the interaction of the transmitter with the device.



Item	*Select to …*
Width	Change the number of data samples (gas readings) printed on each line.
Eol	Toggle the ASCII control code(s) transmitted at the end of each line from CR to CR/LF (more on this below).
Delay	Add up to a 10 second delay at the end of each line.

Figure 67. Data Log Print Format Menu

The transmitter adds a CR (ASCII 13) or CR/LF (ASCII 13 and 10) at the end of each line. If the lines of the report appear to be printing over each other, choose the CR/LF option. If the lines appear to be double spaced, choose the CR option.

The number of sample data samples (gas readings) appearing across the page is programmable from 1 to 30. This is designed to allow reports to fit on small thermal printers, and on conventional sized printers. A wider report takes less time to print because the date and time fields are printed less frequently.

A delay of up to 10 seconds can be added after each line is transmitted to help prevent buffer overflows on printers without XON/XOFF protocol. This is sometimes required to allow slow printers enough time to perform carriage return. If characters appear to be missing, increase the setting.

Flow Control

The transmitter uses XON/XOFF flow control while sending a report. That is, once the data stream has begun, it will continue until the XOFF character (19) is received. After sitting idle, the report stream will begin again upon reception of the XON character (17).

An RS232 connection can support full duplex communication and is perfectly suited for XON/XOFF flow control. However, an RS485 connection is only half duplex. It cannot receive while it is transmitting and might miss the XOFF character, resulting in a buffer overflow at the receiving device.

A receiving device will send the XOFF character when its buffer is nearly full. Some older dot-matrix printers will send an XOFF because they have a small receive buffers and cannot process characters while the head is returning to start a new line. By comparison, most computers have comparatively large buffers and can easily accept the report stream without sending an XOFF, so an RS485 connection may work in those cases.

The transmitter features an additional method to help avoid losing data due to buffer overflow problems on receiving devices that lack XON/XOFF capability (or have the capability but are using an RS485 connection). A programmable time delay of up to 10s may be inserted at the end of each report line. This permits the receiver time to process more characters in its buffer and avoid an overflow. However, this may be a method of trial and error until the proper delay setting is determined so that no characters are missing from the report.

I/O

The transmitter features a collection of physical inputs and outputs including a 4-20mA (loop) output, serial interface, and three SPDT relays.

I/O Menu

The I/O menu is shown below and appears by selecting I/O from the Main Menu (page 35).

Menu>Setup>I/O

```
      I/O
▶4-20mA
 COM
 Relays
```

Item	*Select to …*
4-20mA	Configure and adjust the 4-20mA output.
COM	Configure the RS232/RS485 serial interface (option).
Relays	Configure the three transmitter relays (option).

Figure 68. I/O Menu

4-20mA Output

The transmitter sources (or sinks) a 4-20mA current that is proportional to the gas reading on the Main Display (see Main Reading on page 33) . The current is normally 4 mA at zero and 20mA at the programmed range of the sensor (see Range in Sensor Settings Menu on page 38). Since the Main Reading is blanked below zero, the output should never go below 4mA in the course of normal operation. In the event of gas flooding, the current and *may* go as high as 25mA (125% Range).

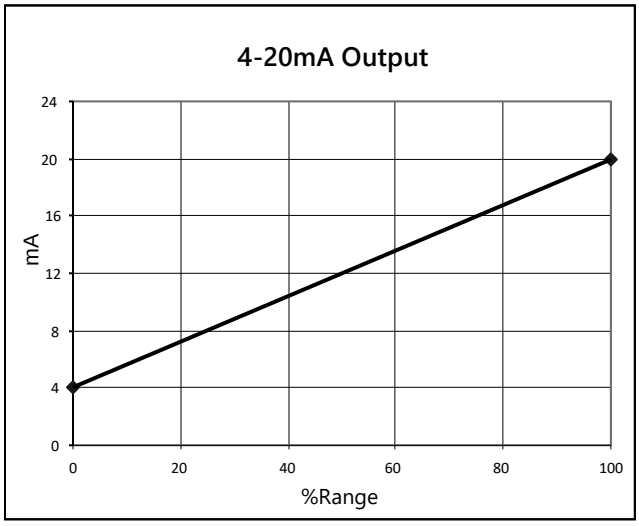


Figure 69. Graph of 4-20mA Output

4-20mA Menu

During alarm inhibit and Auto-test, the 4-20mA output is fixed at 4.0mA (17.4mA for oxygen sensors) to prevent false alarms at the receiver. The output is forced to 3.6mA to signal a Trouble alarm to the receiver. These are the default values, which may be changed in the 4-20mA Menu, below.

…I/O>4-20mA

```
▶Autotst mA= 4.0
 Inhibit mA= 4.0
 Trouble mA= 3.6
 Adjust
```

Item	*Select to …*
Autotst mA	Set the fixed output level during Auto-test (4.0 to 22.0 mA). This is normally 4.0mA to prevent alarms at the receiver[19].
Inhibit mA	Set the output level to indicate alarms are not enabled (4 to 22 mA). This is normally 4.0mA to prevent alarms at the receiver.

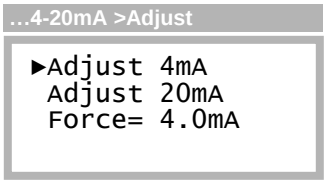
[19] Auto-test is not available on the D12Ex-IR transmitter.

	Trouble mA	Set the output level to indicate the Trouble alarm (3.5 to 3.8 mA). Note: 3.5mA not allowed on 2-wire 4-20mA connection.
	Adjust	Adjust the 4mA and 20mA levels, or force the output for testing.

Figure 70. 4-20mA Menu

4-20mA Adjust Menu

These methods permit adjustment of the 4-20mA output and provide a way to force it to a fixed value to test receiver alarms. They do not affect the computed gas concentration reading.



Item	*Select to …*
Adjust 4mA	Adjust the 4mA analog output level.
Adjust 20mA	Adjust the 20mA analog output level.
Force	Force the 4-20mA output to a fixed level between 3.5 and 22.0 mA. Displays the real time value when not selected.

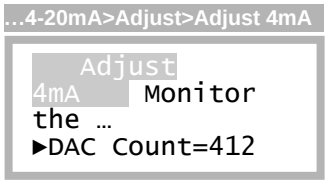
Figure 71. 4-20mA control page

4-20mA Adjustment

Loop adjustment consists of adjusting the 4 and 20 mA levels (order does not matter) by scrolling the corresponding DAC value. This may be accomplished by reading a calibrated current meter connected in series with the transmitter's 4-20mA output, reading a calibrated volt meter across a precision load resistor in series with the transmitter's 4-20mA output, or reading the display of a calibrated, current loop receiver[20].

	Warning: **Disable current loop receiver alarms before proceeding.**	

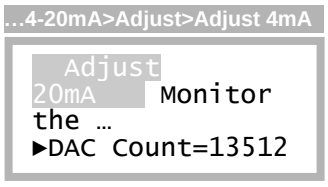
Adjust 4mA Menu



Item	*Select to …*
DAC Count	Scroll the DAC (digital-to-analog converter) count up to increase or down to decrease the analog output to 4.00mA. Note The displayed value is "as left" by the previous adjustment.

Figure 72. Adjust 4mA Menu

[20] When using a current loop receiver, make certain the reading is not limited to 20mA by hardware or programming. If so, adjust the reading first to 19.5mA, then slowly increase it to 20.0mA.



Item	*Select to …*
DAC Count	Scroll the DAC (digital-to-analog converter) count up to increase or down to decrease the analog output to 20.0mA. Note The displayed value is "as left" by the previous adjustment. When selected, however, the DAC count changes to the factory calibrated value of 20.0mA. This is to help prevent adjustment errors caused by 4-20mA receivers that limit readings to 20mA.

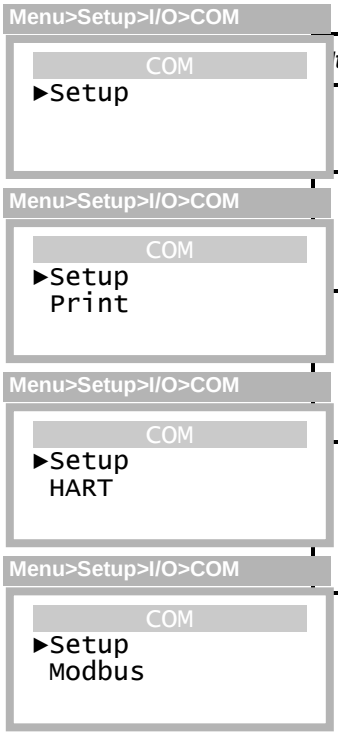
Figure 73. Adjust 20mA Menu

COM Menus and Settings

The transmitter supports ASCII, HART, and Modbus communications, which are configured through the COM Menu below.

COM Menu

The is COM Menu used to configure the protocol and connection settings of the serial COM interface, and varies slightly, depending on the factory configured protocol.



Item	*Select to …*
Setup	Configure the connection settings (only selection when Protocol is None).
Print	Print the data log (appears only when the Protocol is ASCII, see Data Log Print Menu on page 62). Note that the transmitter must have an RS232 or RS485 interface.
HART	Configure the HART protocol settings (appears only when Protocol is HART). Note that the transmitter must have a HART FSK modem interface, and be ordered with the HART FSK stack option.
Modbus	Configure the Modbus protocol settings (appears only when Protocol is Modbus). Note that the transmitter must have an RS232 or RS485 interface, and be ordered with the optional Modbus protocol stack option.

Figure 74. COM Menu

COM Setup Menu

The Com Setup Menu is used to select the protocol and configure the transmitter's connection settings.

	Item	Select to …
…COM>Setup ►Protocol=None …COM>Setup ►Protocol=ASCII Interface=RS232 Baud Rate=9600 Settings= N,8,1	**Protocol**	Change the slave protocol. • ASCII (default) • Modbus (option) • HART (option) • None Protocol selection is performed at the factory and may not be changed. Settings for the ASCII and Modbus protocols may be changed, but are restricted for the HART protocol.
…COM>Setup ►Protocol=HART Interface=FSK Baud Rate=1200 Settings= O,8,1	**Interface**	Change the physical communication interface that the transmitter will control during transmit and receive functions: • RS232 (available for ASCII or Modbus, not for HART) • RS485 (available for ASCII or Modbus, not for HART) • FSK (HART only)
…COM>Setup ►Protocol=Modbus Interface=RS485 Baud Rate=9600 Settings= N,8,1	**Baud Rate**	Change the baud rate of the transmitter's UART. May be set to: 300, 600,1200, 2400, 4800, 9600, 14.4k, 19.2k, 28.8k, 38.4k, 57.6k, 115.2k, 230.4k, and 460.8k. The value is fixed at 1200 for HART FSK, and defaults to 9600 for Modbus and ASCII.
	Settings	Change the parity, number of data bits, and number of stop bits of the transmitter's UART: • N,8,1 …no parity, 8 data bits, 1 stop bits • N,8,2 …no parity, 8 data bits, 2 stop bits • E,8,1 …even parity, 8 data bits, 1 stop bit • O,8,1 …odd parity, 8 data bits, 1 stop bit The value is fixed at O,8,1 for HART protocol, and defaults to N,8,1 for Modbus and ASCII.

Figure 75. COM Setup Menu

HART

The following applies to transmitters that have the HART FSK modem interface and HART FSK firmware option.

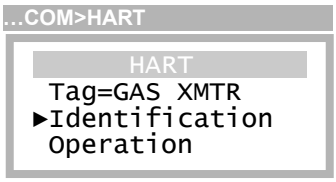
A HART "point-to-point" connection permits simultaneous digital and analog communication between one or two masters and one slave device. A HART multi-drop connection permits one or two masters and up to 15 devices to communicate digitally, but prohibits analog communication by requiring each slave device to fix its output at its lowest level (4mA). For more information, see the HART Transmitter connection examples in Wiring Examples on page 21, or consult the HART Foundation (www.hartcomm.org) for details on how to connect a HART transmitter.

HART FSK devices communicate digitally by imposing a 1mA pk-pk waveform on the 4-20mA output using a technique called Frequency-Shift-Keying. FSK interprets binary 0 as one cycle at 2200 Hz, and binary 1 as one cycle at 1200 Hz. Since each cycle increases the output by ½ mA and then decreases it

by ½ mA, it FSK does not affect the average analog level. This allows a HART FSK device to use both analog and digital communication on a single connection.

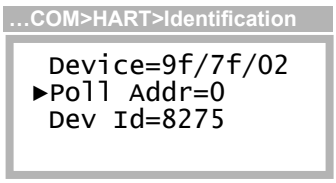
HART Menu

The HART Menu appears by selecting HART from the COM Menu (page 66).



Item	*Select to …*
Tag	This setting is read-only and can be used as a unique identifier for communicating to the transmitter. The setting is read only at the operator interface, but may be modified using HART network management commands.This field is assigned by the HART master.
Identification	View the HART Identification Menu
Operation	View the HART Operation Menu

Figure 76. HART Menu



Item	*Description*
Device	This setting is read-only and displays device information used in long-frame address commands, and by devices capable of utilizing the transmitter's DDL (device description language) file. The format of the information is, MFG_ID/DEV/REV. The MFG_ID is 9f, and identifies Analytical Technology, Inc as the manufacturer. DEV is 7f, and identifies the device as a D12 transmitter. REV is the revision level of the transmitter, currently set at 2 (may increment in the future).
Poll Addr	Use this to change the polling address of the transmitter. The default value is 0, which allows the transmitter to communicate digitally, while preserving the function of the 4-20mA output. The value may be set from 1 to 15, which fixes the output at 4mA, and disables analog signaling.
Dev Id	This setting is used to form a unique identifier in the HART long frame address. This value is set at the factory and appears on a label attached to the transmitter. Changing this setting is not recommended.

Figure 77. Hart Identification Menu

...COM >HART>Operation	*Item*	*Description*
▶Mode= Not-Fixed Fixed mA= 0.0 Resp Preamb= 5 Find-Me	**Loop**	This setting specifies the analog operating mode of the 4-20mA output. When the HART polling address is 0, the value is Not-Fixed and analog signaling functions normally. When the address is set to 1 or higher, the value is Fixed and the analog output is fixed at 4mA. The ability to alter this behavior is reserved for future use, and changing this setting is not recommended.
	Fixed mA	This setting provides direct access the associated HART network management setting. The value is adjustable only when the Loop setting is FIXED, and may be adjusted between 3.5 (4mA on 2-wire power) and 22 mA.
	Resp Preamb	This setting provides direct access to the associated HART network management setting, which determines the number of preamble characters (FF hex) transmitted at the beginning of each message. The default value is 5, and may be set from 3 to 20. Changing this setting is not recommended.
	Find-Me	This method places the transmitter into a mode that causes the transmitter to respond to the Find Device command. This is used by personnel identify transmitter in the field. The method is describe below.

HART Find Device

Selecting Find-Me presents a special page that remains until the master device issues a "Find Device" command to the transmitter, at which point, line 1 of the display changes from "FIND ME ARMED" to "DEVICE FOUND".

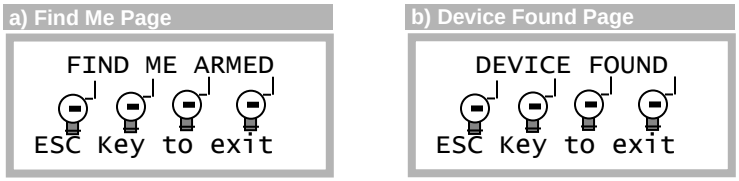


Figure 78. Hart Find-Device Display

Modbus

The following applies to transmitters that have an RS232 or RS485 COM interface and the Modbus firmware option.

Modbus is a master/slave protocol that supports a single master, and up to 247 slave devices on a common bus. The RS485 interface physically limits this number to 32 (1 master, 31 slaves), and RS232 restricts communication to a master and a single slave. Note that the 4-20mA output is fully functional even when using the transmitter's Modbus interface.

Modbus Menu

The Modbus Menu appears by selecting Modbus from the COM Menu (page 66).

Menu>Setup>I/O>COM>Modbus	*Item*	*Description*
Modbus ▶Poll Addr= 1 Timeout= 35	**Poll Addr**	This setting controls the address to which the transmitter responds to queries from the host (1-247, default =1).
	Timeout	This setting belongs to the data-link layer of the protocol and defines the number of character bits used to frame Modbus RTU messages. The protocol specifies the silent interval as 3.5 characters, which corresponds to 35 bit-times at 10 bits per character. This setting is reserved for future use and changing it is not recommended.

Figure 79. Modbus Menu

More information about configuring the Modbus connection can be found in the table below.

More Information…	*Where to find…*
Connect to a master using an RS485 multi-drop connection.	Figure 17 on page 27
Connect to a master using an RS232 connection.	Figure 18 on page 28
Select Modbus protocol and configure the communication settings.	COM Setup Menu on page 67
Modbus register map	The transmitter's Modbus interface is robust and maintained in a separate document. Download or request a copy of, "D12/F12 Series Modbus Interface Manual".

Relay Operation, Menus, and Settings

The following applies to D12 transmitters ordered with 3 SPDT (Form C) relays.

The Alarm Relay option provides three SPDT (Form C) mechanical relays on the Power Supply board. The relays are rated for 5 amps, non-inductive loads at 250VAC, and are suitable for switching small loads, such as horns and warning lights, but should not be used to switch motors or other high current, inductive loads.

Each relay coil may be assigned to one of the four alarms and operate as normally energized (`Norm`=1, also called "fail-safe"), or normally de-energized (`Norm`=0). Selecting normally energized (1) allows the relay to indicate an alarm, or a power failure. This selection is made in the Relay Setup Menu on page 73.

The table below details the contact states for the two selections in the no-alarm, alarm, and power fail conditions.

Table 21. Relay Coil "Norm" Setting

	No-Alarm	*Alarm*	*Power Failure*
0 (normally de-energized)			
Coil	De-energized	Energized	De-energized
Open Contacts	C-NO	C-NC	C-NO
Closed Contacts	C-NC	C-NO	C-NC
1 (normally energized, "fail-safe")			
Coil	Energized	De-energized	De-energized
Open Contacts	C-NC	C-NO	C-NO
Closed Contacts	C-NO	C-NC	C-NC

Figure 80 illustrates the alarm and relay operation.

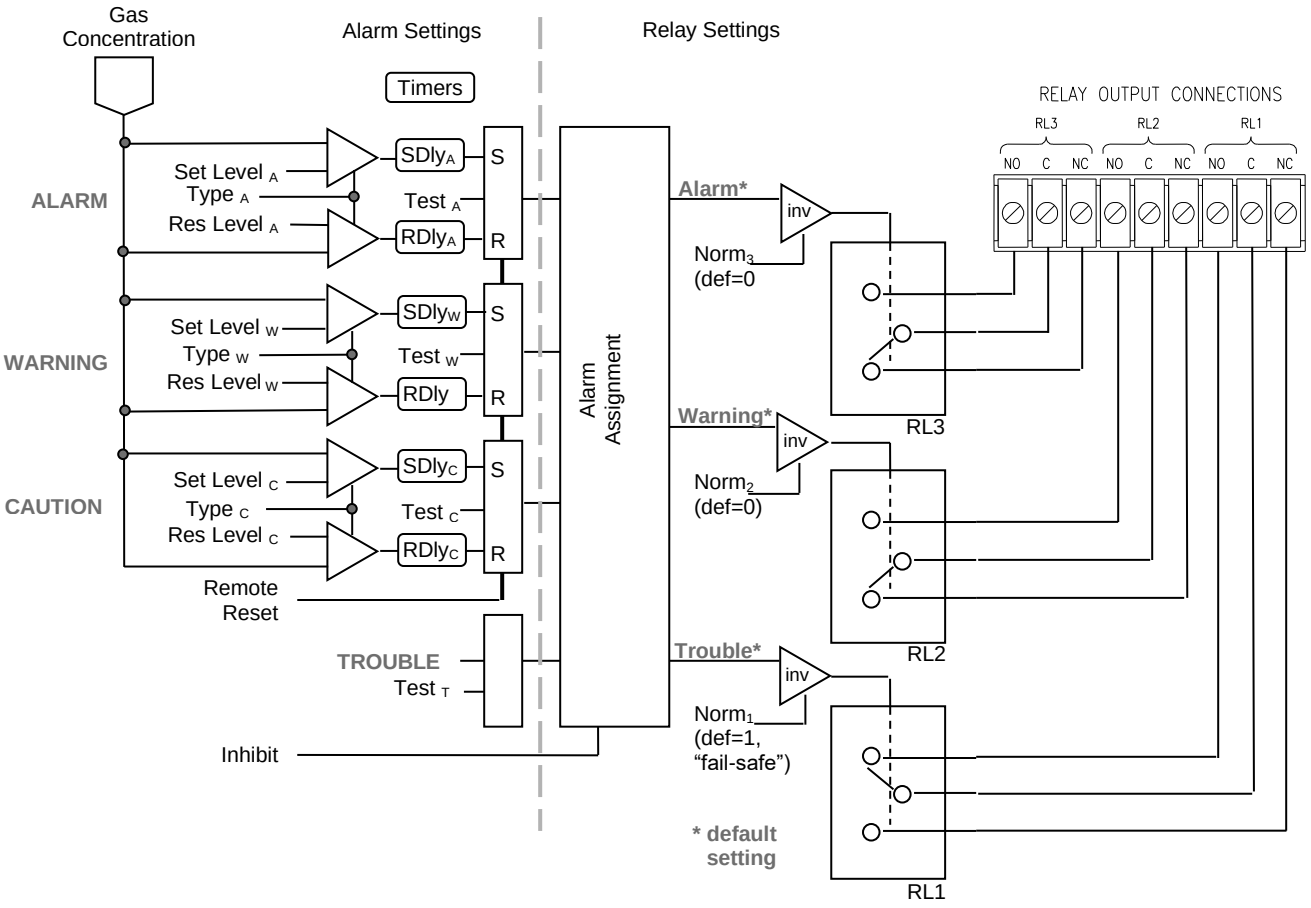
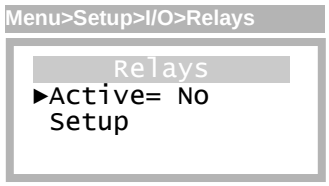


Figure 80 Alarm Relay Diagram

Relays Menu

The Relays Menu appears by selecting Relays from the I/O Menu (see page 64) .

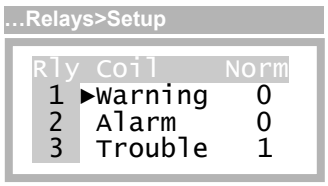


Item	*Select to …*
Active	Permanently enable or disable operation of .the relays.
Setup	Assign each relay to an alarm and select the normal state of its coil.

Figure 81. Relays Menu

Relay Setup Menu

The Relay Setup Menu appears by selecting Setup from the Relays Menu, above.



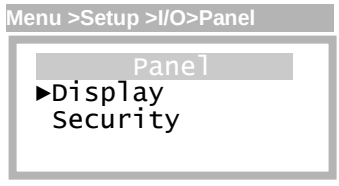
Item	*Select to …*
Coil	Change the alarm assigned to the relay coil. Selections are ALARM, WARNING, CAUTION, or TROUBLE.
Norm	Change the normal (no-alarm) state of the coil to: 0 normally de-energized 1 normally energized ("fail-safe") See ***Table 21*** on page 71.

Figure 82. Relay Setup Menu

PANEL

The transmitter includes functions to control the front panel display and provide configuration security.

Panel Menu

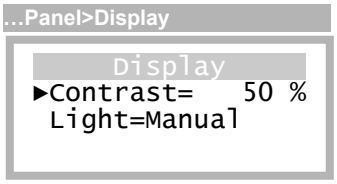


Item	*Select to …*
Display	Adjust the display contrast or when the backlight comes on. Note: backlight operates only when powered in 3 or 4 wire mode.
Security	Lock or unlock the transmitter panel or change the password.

Figure 83. Panel Menu

Display Menu

The transmitter features a backlighted, 96w x 32h graphics LCD. The Display menu is used to control the display contrast and manage the backlight.

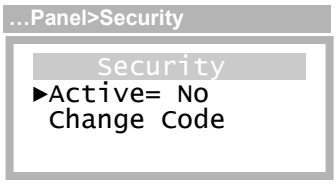


Item	*Select to …*
Contrast	Adjust the LCD contrast. Scroll the setting up to increase contrast (darker text), or down to decrease it (lighter text). The default value is 50% and is adjustable between 0 and 100%.
Light*	Control when the LCD backlight is turned on and off* : Manual On when any key is touched Off when no key touched for 5 minutes Auto On when any key is touched or alarm is active Off when no key touched for 5 minutes, and no alarms active Never On Off permanently Always On On permanently (not recommended)

Figure 84. Display Menu

Security Menu

The transmitter can guard against unauthorized changes to its configuration through the front panel. When security is active, settings may be read, but not modified, and methods will not execute, including verifications during Sensor Review (see page 32). To make changes, security must be disabled, either permanently or temporarily, by entering the correct 4-digit code. Panel security status is indicated on the Main Display as shown on page 33.



Item	*Select to …*
Active	Activate or deactivate panel security. You must enter the panel code in either case. See Figure 86. Activating Security and Figure 87. Deactivating Security, below.
Change Code	Change the panel code.

Figure 85. Security Menu

Activating Security

The following display sequence appears when attempting to activate panel security.

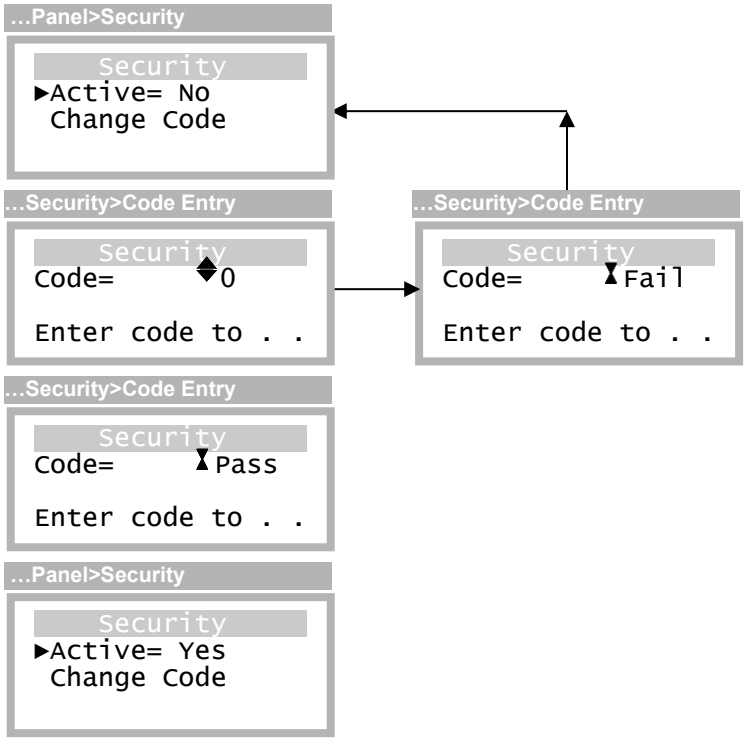
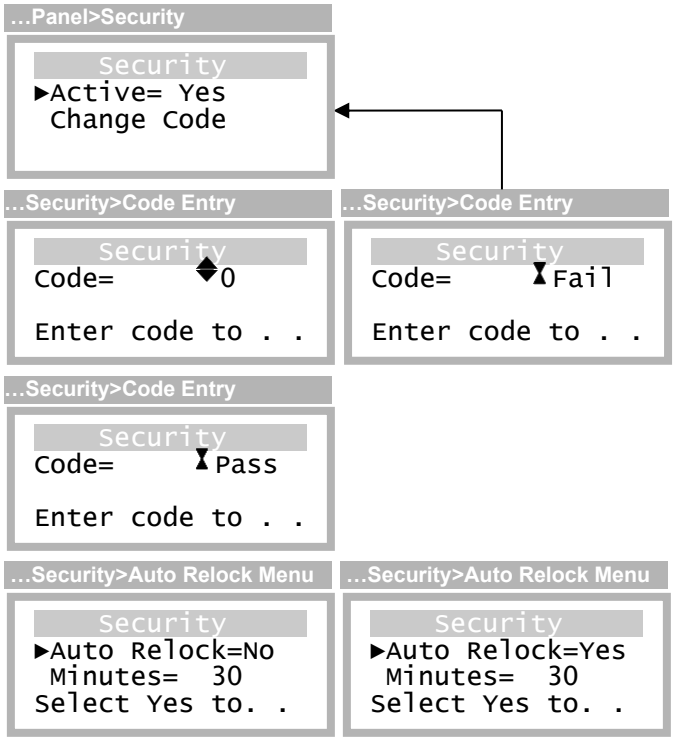


Figure 86. Activating Security

Deactivating Security

The following display sequence appears when attempting to deactivate panel security. Note the option for automatically relocking the panel after a timed period.



The automatic relock time defaults to 30 minutes, but may be extended up to 60 minutes.

Touch the Esc key to exit the Relock display.

The panel re-lock timer is displayed on line 4, but is fixed to prevent relocking while viewing this display. You may select Relock to return to the Auto Relock Menu to extend the period, if necessary.

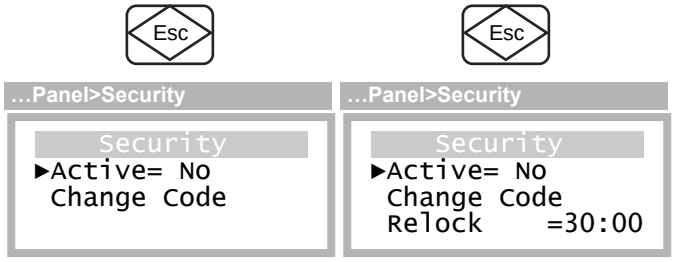
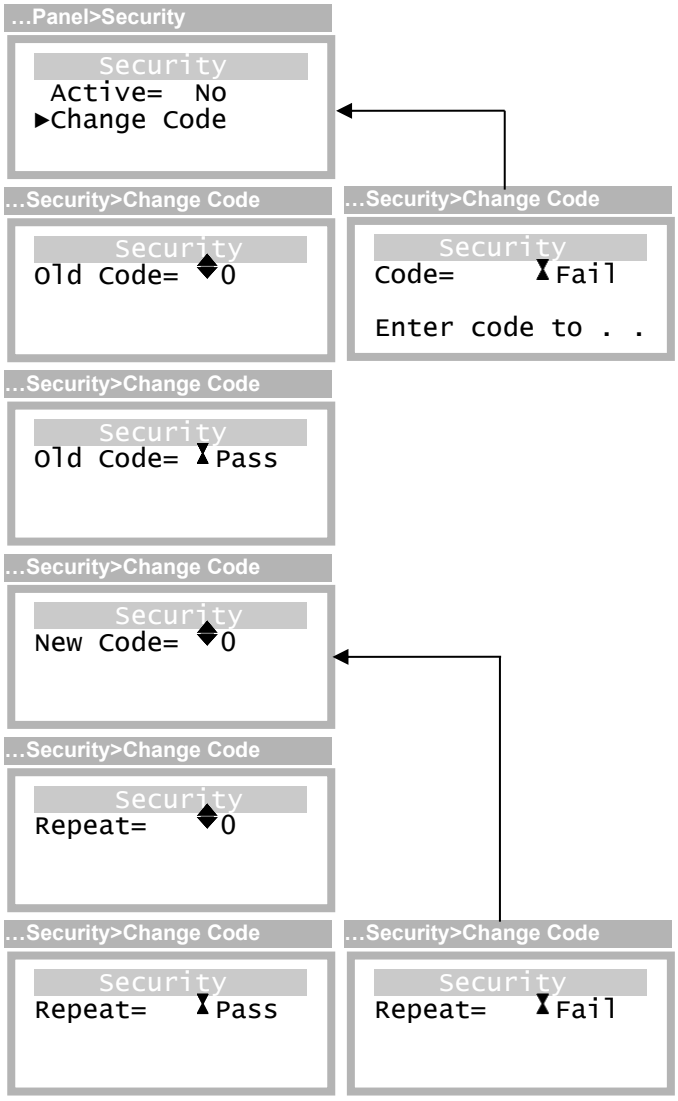


Figure 87. Deactivating Security

Changing the Security Code

The security code is changed by selecting `Change Code` from the Security Menu above.



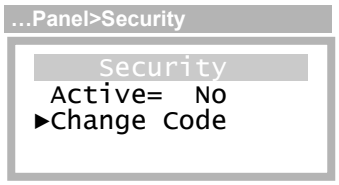
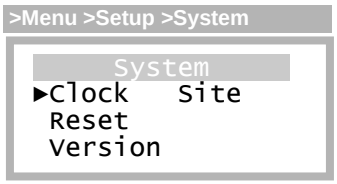


Figure 88. Changing the Security Code

SYSTEM

System Menu

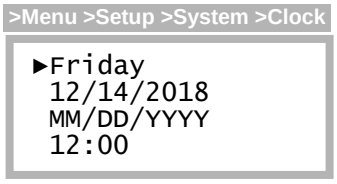


Item	*Select to …*
Clock	Set or update the transmitter's real-time-clock.
Reset	Restart the transmitter or change all user settings to default values.
Version	Display transmitter and sensor version information.
Site	Change the site name displayed during startup review.

Figure 89. System Menu

Clock Menu

The Clock Menu is used to set the transmitter's real-time clock, which is recorded during sensor calibration and data logging, and is used to trigger Auto-test starts



Item	*Select to …*
Line 1	Change the day of the week: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday
Line 2	Configure the month, date, and year, in the format specified by the Format setting (below). Built-in support for leap year. Note: you may select and adjust the year separately.
Line 3	Change the date format: MM/DD/YYYY, example: 12/14/2018 DD/MM/YYYY, example: 14/12/2018
Line 4	Change the time of day (24-hour format, 00:00 to 23:59)

Figure 90. Clock Menu

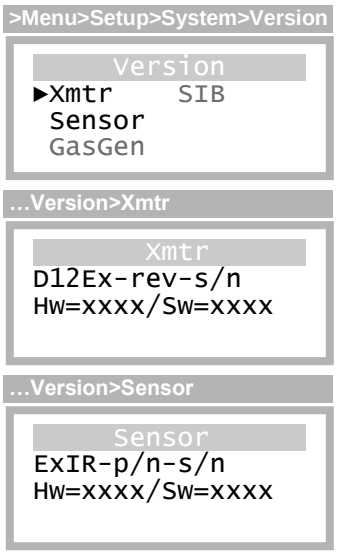
Reset Menu

Item	*Select to …*
Restart	Restart the transmitter without cycling power.
UserMem	**Reset all user settings to default values**. **NOTE**: this method is provided to recover from a corrupted user memory. It does not affect calibration of the sensor or transmitter analog inputs or outputs. After running this method, you will be required to manually restore all of the transmitter alarm, data logger, i/o (communications, relays, and 4-20mA), panel (display and security), settings, as well as the transmitter's real-time clock.

Figure 91. Reset Menu

Version Menu

The Version Menu appears by selecting `Version` from the System Menu above and lists the major components of the transmitter as menu entries.



Item	*Select to …*
Xmtr	View the transmitter version information.
Sensor	View the sensor version information.
GasGen, SIB	Not applicable on this transmitter version
Abbreviations **p/n** **s/n** **rev** **Hw** **Sw**	 Part number Serial number Revision number Hardware revision – revision level of the electronics Software revision – revision level of the software

Figure 92. Version Menu

SPARE PARTS

Components

03-0529	D12EX-IR Upper PCB Stack, no COM
03-0529M	D12EX-IR Upper PCB Stack with Modbus
03-0530	D12EX-IR Upper PCB Stack with HART FSK
03-0533	D12EX Power Supply Board with Relays
01-0356	D12EX Power Supply Board without Relays
48-0228	Sensor Housing Assembly
31-0184	Interconnect Ribbon Cable Assy
31-0185	Remote 4 Conductor Shielded Interconnect Cable
80-0066	Transmitter explosion-proof housing
60-0068	Rain Shield with Test Port
60-0069	Calibration Adapter
29-0013	CR2032 Battery (for safety, this battery must be identical size, type, and manufacturer as OEM original)
30-0218	CR2032 Battery Cover

Sensors

00-1903	CO2-H	High range carbon dioxide (100%)
00-1904	CO2-L	Dual low range carbon dioxide (5000 PPM, 5%)
00-1905	HC	Triple range hydrocarbon (5% methane, 100% methane, 2% propane)
00-1906	HHC	High range hydrocarbon (100% propane)
00-1997	N2O-L	Dual low range nitrous oxide (1000 PPM, 1%)

Note: These are the maximum selectable ranges of the sensor. Analog output full scale can be set lower in each selected range.

PRODUCT WARRANTY

Analytical Technology, Inc. (Manufacturer) warrants to the Customer that if any part(s) of the Manufacturer's products prove to be defective in materials or workmanship within the earlier of 18 months after the date of shipment or 12 months after the date of start-up, such defective parts will be repaired or replaced free of charge. Inspection and repairs to products thought to be defective within the warranty period will be completed at the Manufacturer's facilities in Collegeville, PA. Products on which warranty repairs are required shall be shipped freight prepaid to the Manufacturer. The product(s) will be returned freight prepaid if it is determined by the manufacturer that the part(s) failed due to defective materials or workmanship.

This warranty does not cover consumable items, batteries, or wear items subject to periodic replacement including lamps and fuses.

Gas sensors, except oxygen sensors, are covered by this warranty, but are subject to inspection for evidence of extended exposure to excessive gas concentrations. Should inspection indicate that sensors have been expended rather than failed prematurely, the warranty shall not apply.

The Manufacturer assumes no liability for consequential damages of any kind, and the buyer by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the Customer, his employees, or others. A defect within the meaning of this warranty is any part of any piece of a Manufacturer's product which shall, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment.

This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations or liabilities expressed or implied by the Manufacturer or its representatives and by statute or rule of law.

This warranty is void if the Manufacturer's product(s) has been subject to misuse or abuse or has not been operated or stored in accordance with instructions or if the serial number has been removed.

Analytical Technology, Inc. makes no other warranty expressed or implied except as stated above.

WATER QUALITY MONITORS

Dissolved Oxygen
Free Chlorine
Combined Chlorine
Total Chlorine
Residual Chlorine Dioxide
Potassium Permanganate
Dissolved Ozone
pH/ORP
Conductivity
Hydrogen Peroxide
Peracetic Acid
Dissolved Sulfide
Residual Sulfite
Fluoride
Dissolved Ammonia
Turbidity
Suspended Solids
Sludge Blanket Level
MetriNet Distribution Monitor

GAS DETECTION PRODUCTS

NH_3	Ammonia
CO	Carbon Monoxide
H_2	Hydrogen
NO	Nitric Oxide
O_2	Oxygen
CO	Cl2 Phosgene
Br_2	Bromine
Cl_2	Chlorine
ClO_2	Chlorine Dioxide
F_2	Fluorine
I_2	Iodine
H_X	Acid Gases
C_2H_4O	Ethylene Oxide
C_2H_6O	Alcohol
O_3	Ozone
CH_4	Methane (Combustible Gas)
H_2O_2	Hydrogen Peroxide
HCl	Hydrogen Chloride
HCN	Hydrogen Cyanide
HF	Hydrogen Fluoride
H_2S	Hydrogen Sulfide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
SO_2	Sulfur Dioxide
H_2Se	Hydrogen Selenide
B_2H_6	Diborane
GeH_4	Germane
AsH_3	Arsine
PH_3	Phosphine
SiH_4	Silane
HCHO	Formaldehyde
$C_2H_4O_3$	Peracetic Acid
DMA	Dimethylamine