



Gas Transmitter

D12 Toxic Gas Transmitter with H10 Smart Sensor



ATI-UM-04396-EN-02 (April 2026)

User Manual

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SAFETY

Read and understand this manual before installing, operating or maintaining the D12 gas 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.

Protection from hazards may be impaired if used in manners not specified in this manual.

Warnings

- 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.
- For AC powered units, buildings main circuit breaker to act as instrument disconnect for servicing.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- Recommended Power Cable 12–22 AWG 300V insulation breakdown voltage or better.
- The transmitter must be earthed/grounded for electrical safety and to limit the effects of radio frequency interference. An Earth ground point is provided inside the unit. To maintain EMI ratings, use shielded cable, connecting the shield/drain to the EARTH terminal in the unit, and the shield/drain to an Earth Ground at the power supply.
- Ground wire to be only Green or Green/Yellow stripe (independent from electrical code references). Green or Green/Yellow stripe may not be used for other purposes.
- 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.
- Instrument exterior and accessories may be cleaned using a damp cloth. Water Only!
- Any user provided plug or connector, should it be used should conform with the relevant IEC and local electrical code requirements.
- Electrostatic discharge hazard.
 - Take the necessary antistatic precautions if you: handle, install or use the device in potentially explosive atmospheres.
 - Do not install in a location (for example, near to ventilation systems) where the electrostatic charge can increase.
 - Do not clean plastic parts in a hazardous area.
- Use only Panasonic CR2032 batteries.

Hazardous Location Installation

The D12 gas transmitter is not rated for hazardous locations.

INTRODUCTION

General

D12 Gas Transmitter

The D12 Toxic Transmitter is used to monitor for gas leaks near storage cylinders, process piping or gas feed equipment in virtually any type of industrial plant environment. The transmitter housing is explosion proof and is rated for use in hazardous locations (see Specifications). The transmitter features an H10 Smart Sensor, a non-intrusive four button user interface with a back-lighted graphics display, three level alarm system with three (optional) alarm relays, high-resolution 4-20 mA current loop output, real-time clock, datalogger and optional HART™ or Modbus™ communication interface. In addition, the transmitter offers several optional H10 gas generators for automatic, timed testing of H10 sensors.

H10 Smart Sensor and C18 Gas Generator

H10 Smart Sensors and C18 generators contain non-volatile memory to store information about the target gas they were designed to monitor or generate. They contain general information about the target gas, such as the name, range, units, alarm settings, along with specific calibration information, such as response to gas, mA-Hr of usage and calibration history. Information is transferred into the transmitter at startup and whenever one of the components is inserted into a live transmitter. Because all calibration data is stored in the memory, sensor modules may be calibrated using a spare transmitter in the shop, and subsequently installed into a field transmitter, eliminating the need for field calibration.

Sensors are designed for use in ambient air at temperatures of -30 to 60 °C, at a relative humidity between 20–98% RH. (Some sensors are rated to -40 °C. Oxygen sensors are rated to -10 °C.)

NOTE: Operating sensors in extremely dry air or in condensing gas streams is not recommended.

Sensors and generators plug into the external housing at the base of the transmitter. They are easily removed, and installation is simplified by way of molded carrier that aligns each connector for a perfect fit. Once installed, a 1/4 turn locking ring secures the carrier in place. Simply install the sensor and generator into the carrier (1), slide it onto the alignment pins (2), and twist the ring 1/4 turn counterclockwise (3).

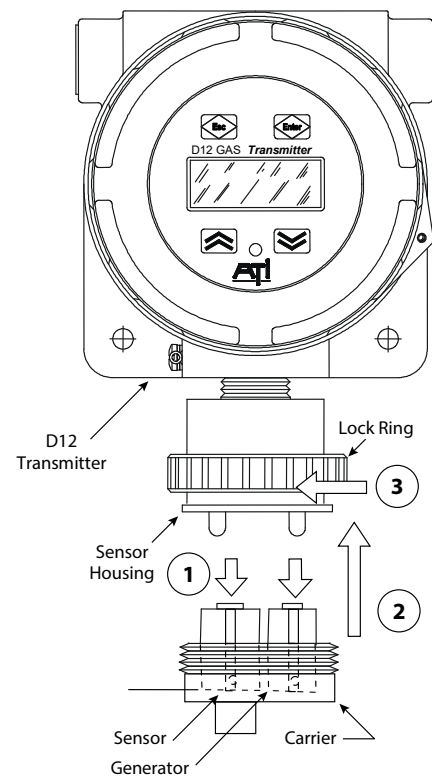


Figure 1: Transmitter with sensor and generator

H10 Smart Sensors

Gas	Part No.	Standard Range	Minimum Range	Maximum Range
GENERAL GASES				
Acetylene	00-1057	0–200 ppm	0–50 ppm	0–500 ppm
Alcohol	00-1043	0–200 ppm	0–50 ppm	0–500 ppm
Alcohol	00-1044	0–500 ppm	0–500 ppm	0–2000 ppm
Ammonia	00-1010*	0–100 ppm	0–50 ppm	0–500 ppm
Ammonia	00-1011	0–1000 ppm	0–500 ppm	0–2000 ppm
Carbon Monoxide	00-1012*	0–100 ppm	0–50 ppm	0–1000 ppm
Dimethylamine (DMA)	00-1450	0–100 ppm	0–100 ppm	0–200 ppm
Ethylene Oxide	00-1039*	0–20 ppm	0–20 ppm	0–200 ppm
Formaldehyde	00-1040*	0–20 ppm	0–20 ppm	0–200 ppm
Formaldehyde	00-1349	0–1000 ppm	0–500 ppm	0–2000 ppm
Hydrogen	00-1041	0–2000 ppm	0–500 ppm	0–2000 ppm
Hydrogen	00-1013	0–4%	0–1%	0–10%
Nitric Oxide	00-1021	0–100 ppm	0–50 ppm	0–500 ppm
NOx	00-1181	0–200 ppm	0–50 ppm	0–500 ppm
Oxygen	00-1014	0–25%	0–10%	0–25%
Phosgene	00-1015	0–1 ppm	0–1 ppm	0–5 ppm
Phosgene	00-1016	0–100 ppm	0–5 ppm	0–100 ppm
OXIDANT GASES				
Bromine	00-1000*	0–1 ppm	0–1 ppm	0–5 ppm
Bromine	00-1001*	0–10 ppm	0–5 ppm	0–200 ppm
Chlorine	00-1002*	0–1 ppm	0–1 ppm	0–5 ppm
Chlorine	00-1003*	0–10 ppm	0–5 ppm	0–200 ppm
Chlorine Dioxide	00-1004*	0–1 ppm	0–1 ppm	0–5 ppm
Chlorine Dioxide	00-1005*	0–10 ppm	0–5 ppm	0–200 ppm
Chlorine Dioxide	00-1359	0–1000 ppm	0–200 ppm	0–1000 ppm
Chlorine Dioxide	00-1425	0–1 ppm	0–1 ppm	0–5 ppm
Fluorine	00-1006*	0–1 ppm	0–1 ppm	0–5 ppm
Fluorine	00-1007*	0–10 ppm	0–5 ppm	0–200 ppm
Hydrogen Peroxide	00-1042*	0–10 ppm	0–10 ppm	0–200 ppm
Hydrogen Peroxide	00-1169	0–1000 ppm	0–200 ppm	0–2000 ppm
Iodine	00-1036*	0–1 ppm	0–1 ppm	0–5 ppm
Iodine	00-1037*	0–10 ppm	0–5 ppm	0–200 ppm
Ozone	00-1008*	0–1 ppm	0–1 ppm	0–5 ppm
Ozone	00-1009*	0–10 ppm	0–5 ppm	0–200 ppm
Ozone	00-1358	0–1000 ppm	0–200 ppm	0–1000 ppm

* Corresponding C18 gas generator is available for standard range of sensor and lower.

(continued on next page)

ACID GASES

Hydrogen Bromide	00-1455*	0–20 ppm	0–10 ppm	0–200 ppm
Hydrogen Chloride	00-1017*	0–10 ppm	0–10 ppm	0–200 ppm
Hydrogen Cyanide	00-1018*	0–10 ppm	0–10 ppm	0–200 ppm
Hydrogen Fluoride	00-1019*	0–10 ppm	0–10 ppm	0–200 ppm
Hydrogen Sulfide	00-1020*	0–50 ppm	0–10 ppm	0–500 ppm
Hydrogen Sulfide	00-1469	0–500 ppm	0–200 ppm	0–1000 ppm
Nitrogen Dioxide	00-1022*	0–10 ppm	0–10 ppm	0–200 ppm
Sulfur Dioxide	00-1023*	0–10 ppm	0–10 ppm	0–200 ppm
General Acid Gases	00-1038*	0–10 ppm	0–10 ppm	0–200 ppm

HYDRIDE GASES

Arsine	00-1024	0–1000 ppb	0–500 ppb	0–2000 ppb
Arsine	00-1025	0–10 ppm	0–10 ppm	0–200 ppm
Diborane	00-1026	0–1000 ppb	0–500 ppb	0–2000 ppb
Diborane	00-1027	0–10 ppm	0–10 ppm	0–200 ppm
Germane	00-1028	0–1000 ppb	0–500 ppb	0–2000 ppb
Germane	00-1029	0–10 ppm	0–10 ppm	0–200 ppm
Hydrogen Selenide	00-1030	0–1000 ppb	0–500 ppb	0–2000 ppb
Hydrogen Selenide	00-1031	0–10 ppm	0–10 ppm	0–200 ppm
Phosphine	00-1032	0–1000 ppb	0–500 ppb	0–2000 ppb
Phosphine	00-1033	0–10 ppm	0–10 ppm	0–200 ppm
Phosphine	00-1034	0–1000 ppm	0–200 ppm	0–2000 ppm
Silane	00-1035	0–10 ppm	0–10 ppm	0–200 ppm
Silane	00-1285	0–1000 ppb	0–500 ppb	0–2000 ppb

* Corresponding C18 gas generator available for standard range of sensor and lower.

Specifications

Sensor Type	Electrochemical cell
Gas Type	Sensor dependent (refer to list of available sensor types)
Range	User adjustable within limits of selected sensor (refer to list of available sensor types)
Response Time	Sensor dependent
Accuracy	Generally, $\pm 10\%$ of value, but limited by available calibration gas accuracy
Repeatability	$\pm 1\%$ (Electronic)
Linearity	$\pm 0.5\%$ (Electronic)
Zero Drift	Less than 2% full scale per month
Span Drift	Dependent on operating environment but generally less than 3% per month
Analog Output	4-20 mA, 600 Ω max. @24V DC
Serial Interface Options	HART® (1200 baud modem interface) Modbus 1200-9600, 14.4 k, 28.8 k – RS232 or RS485, user configurable
Power	Class 2 power source as follows: Regulated 12–30V DC; 25 mA max. in loop-powered mode or 250 mA max. in 3-wire mode
Alarm Relays	Three SPDT relays: 5 A @ 230V AC resistive 5 A @ 30V DC resistive
Relay Coil	Programmable either normally energized or normally de-energized
Enclosure	NEMA 4X (IP66), Powder-coated copper free aluminum, stainless steel hardware
Auto-Test Option	Dependent on sensor gas type and programmed range (see "H10 Smart Sensors" on page 7)
Display	Graphics LCD, 96 W \times 32 H, backlit in 3-wire mode
Controls	Four button, non-intrusive (magnetic switches) Remote alarm reset input
Operating Environment	–30 to 60 °C (Min. temp. for O ₂ sensor is –10 °C)
Weight	4 lb (1.8 kg)

MECHANICAL INSTALLATION

Transmitter Mounting

Figure 2 shows the dimensions for the transmitter enclosure and the location and size of the electrical conduit connection. In locations classified as hazardous, the transmitter housing must be earth grounded, and an explosion-proof seal must be installed as required by the local electrical code. The conduit or cable gland entry into the enclosure must be sealed. If conduit is used, it must also be sealed internally at the housing entry. This is required to prevent condensation from draining into the enclosure.

⚠ WARNING

CONNECT HOUSING TO EARTH GROUND. USE EXPLOSION-PROOF CONDUIT. SEAL CONDUIT INSIDE AND OUT TO KEEP OUT WATER. FOLLOW NATIONAL, STATE AND LOCAL ELECTRICAL CODES.

Secure the transmitter to a wall or flat surface through two mounting holes in the enclosure. See [Figure 2](#). If appropriate fasteners are used, the transmitter may be supported by conduit alone.

Dimensions and the conduit entry locations are detailed in [Figure 2](#).

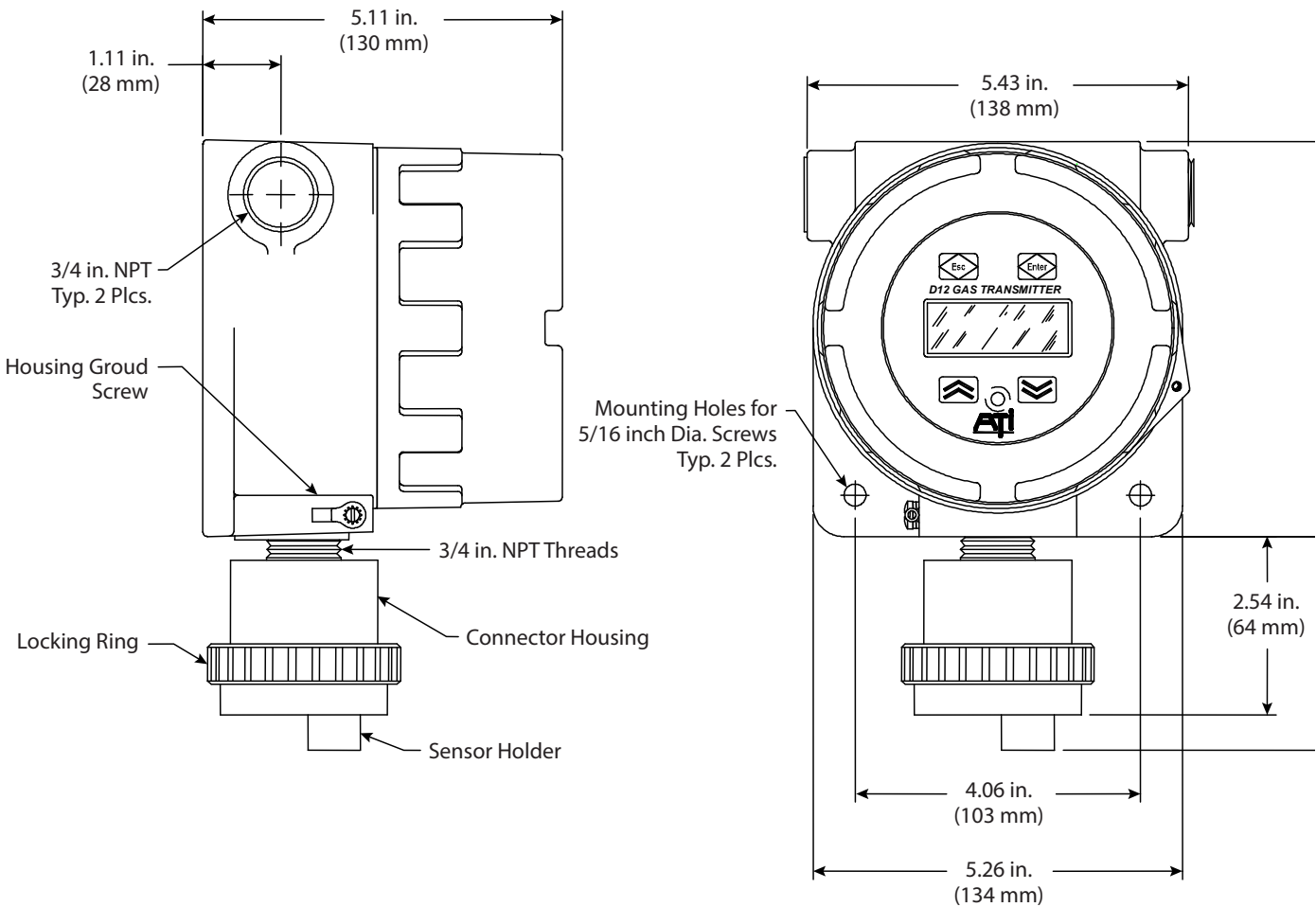


Figure 2: Overall dimensions

Duct Sensor Mounting

The H10 sensor duct mount option allows H10 smart sensors to be installed in a duct or pipe and provides easy access for service.

The assembly is comprised of a special H10 sensor holder (see [Figure 3](#)) that slides into the hollow duct mount adapter (see [Figure 4](#)). The adapter has 1-1/2 inch MNPT threads on the insertion end for securing it to the duct or pipe, and a barb fitting for supplying calibration gas to the sensor. An interface cable is provided to connect the sensor holder to the transmitter.

NOTE: A mating flange for securing the adapter is not provided.

Screw the adapter into the duct or pipe so the barb fitting is accessible to connect gas tubing. Refer to [Figure 5 on page 12](#). Once the adapter is in place, slide in the sensor holder, lock it in place, and connect the interface cable. It is recommended that the sensor not be installed in the holder until you are ready to start the transmitter. This is especially true during construction when excessive dust and dirt may be blowing through the duct system and be deposited on the sensor.

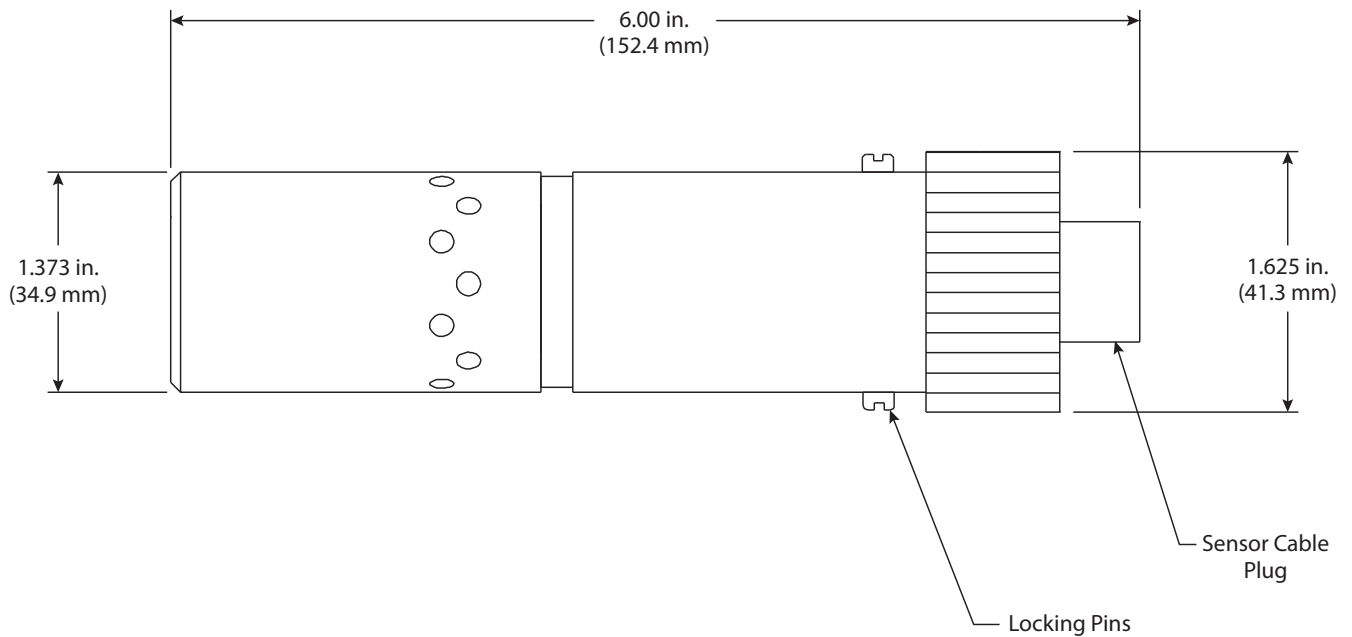


Figure 3: Duct mount sensor holder

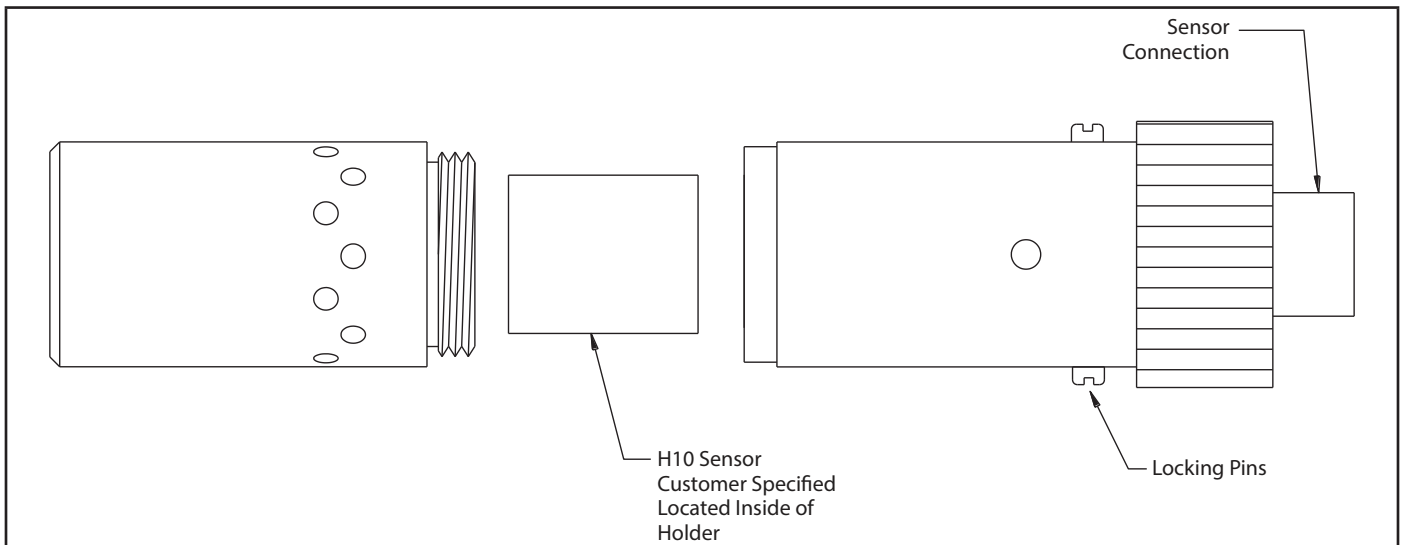


Figure 4: Duct mount sensor exploded view

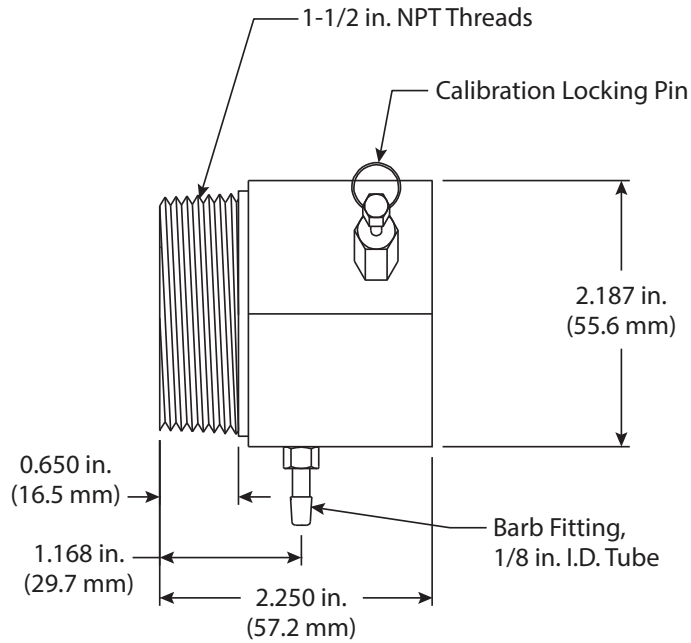


Figure 5: Duct mount adapter

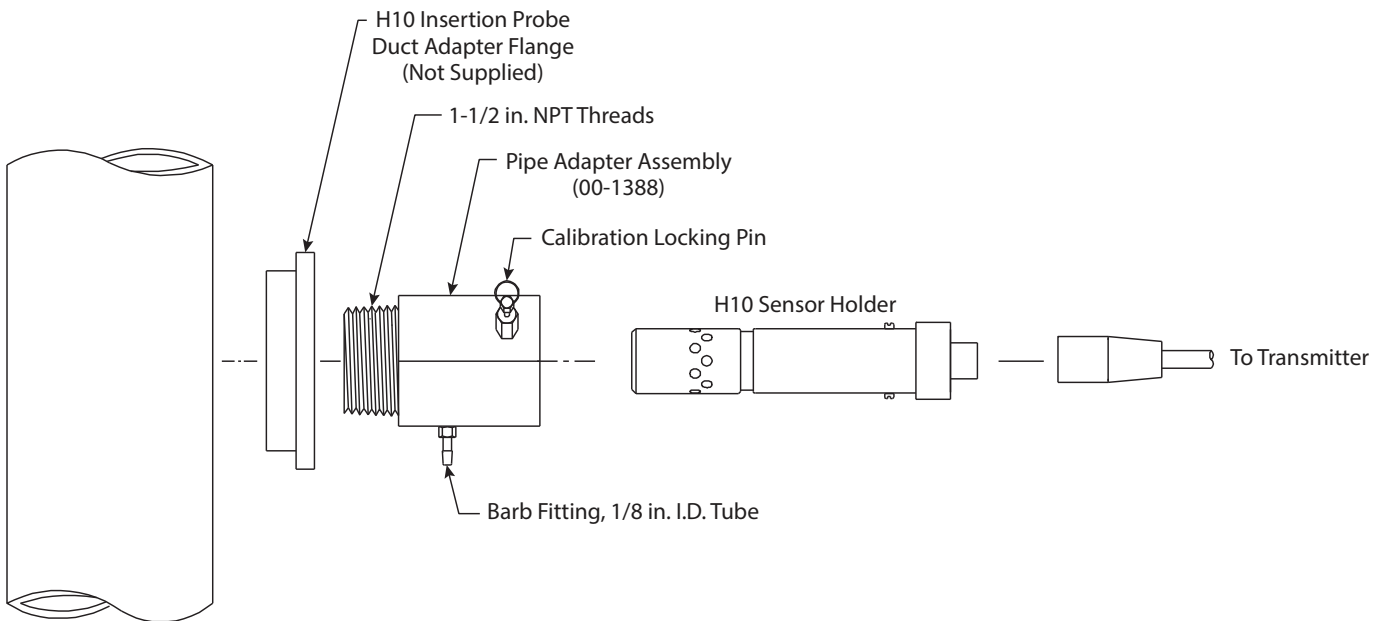


Figure 6: Duct mount assembly

ELECTRICAL CONNECTIONS

Board Stack

The transmitter consists of four circuit boards (display, CPU, isolation and power supply) and are collectively known as the "stack." The top three boards (display, CPU and isolation) are fastened together with metal standoffs and plug into the power supply board, which is fastened to the lower housing with similar metal standoffs. Because most external wiring connections are made to terminals on the power supply board, it is necessary to remove the top three boards. Refer to following steps and *Figure 7* to remove the boards.

1. Unscrew the transmitter housing cover and turn off power switch (SW5) located at the 12 o'clock position on the CPU board.
2. Grasp the outer edge of the metal faceplate covering the display board and gently rock it side to side, while pulling it up and away from the housing.
3. When the top boards come free, lift them out and disconnect the sensor ribbon cable. This connector is keyed for ease of reconnecting later.

NOTE: Please be aware of the hidden ribbon cable that connects the top three boards to the sensor. This cable is just long enough to permit the top boards to come free from the housing, but no further.

4. Set switch SW5 to **OFF** before removing the upper board stack from the transmitter.
5. Since SW5 does not disconnect power at the terminals of the power supply board, declassify hazardous areas prior to opening the transmitter housing.

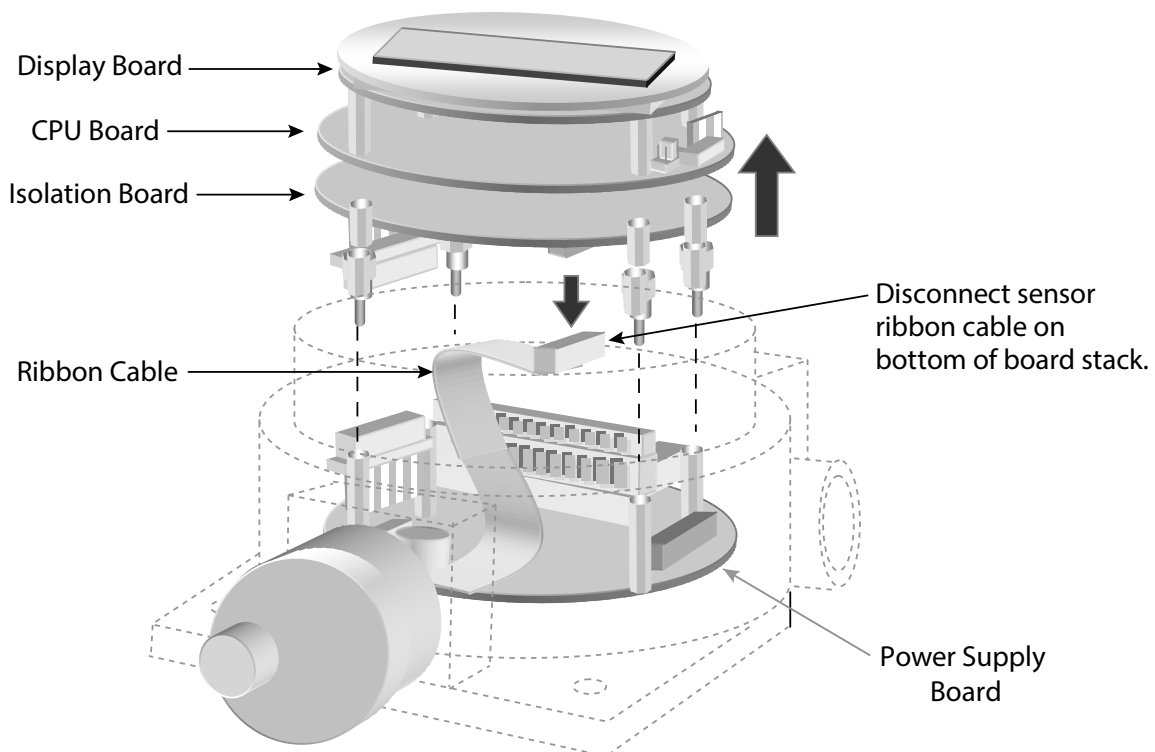


Figure 7: Separating the board stack

Power Supply Board Connections

Electrical connections are made to terminal blocks on the Power Supply board. Power, current loop, (optional) digital communications and remote alarm reset are connected at TB1. Connections to the three (optional) relays are made at TB2.

Current loop operation requires 12–30V DC power supplied on the mA(+) terminal, from which the transmitter sources a 4–20 mA current loop output signal on the mA(–) terminal. The transmitter can operate from current loop power alone but without relays, LCD backlighting and RS232/RS485 communications.

Loop-powered operation requires a maximum current of 25 mA while transmitters wired in 3-wire mode require 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 startup in-rush current requirements.

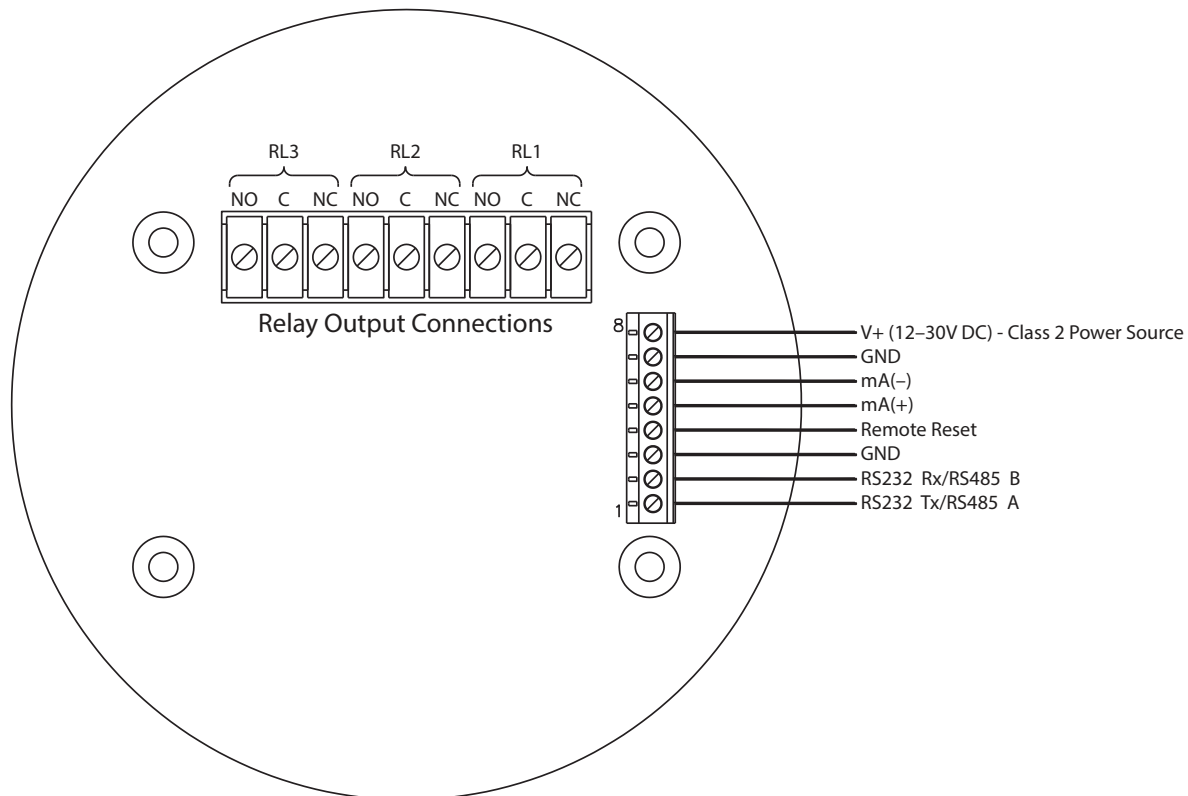


Figure 8: Power supply board connections

The transmitter 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 in 3-wire mode from the same power supply, 12 AWG wire is recommended for long runs with drops of higher gauge wire to each transmitter.

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.

The transmitter housing is normally 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.

NOTE: Always follow wiring practices governed by local, state and national electrical codes.

External Connections

A17/B14 Monitor(s), 2-Wire Mode

D12 (toxic gas) transmitters may be connected in 2-wire mode to an A17/B14 receiver system. In 2-wire mode, transmitters do not include alarm relays, LCD backlighting or RS232/RS485 communication options. Consult the [GasSens A17 Universal Power Supply User Manual](#) and the [B14 Receiver Module User Manual](#) to properly size power supply requirements.

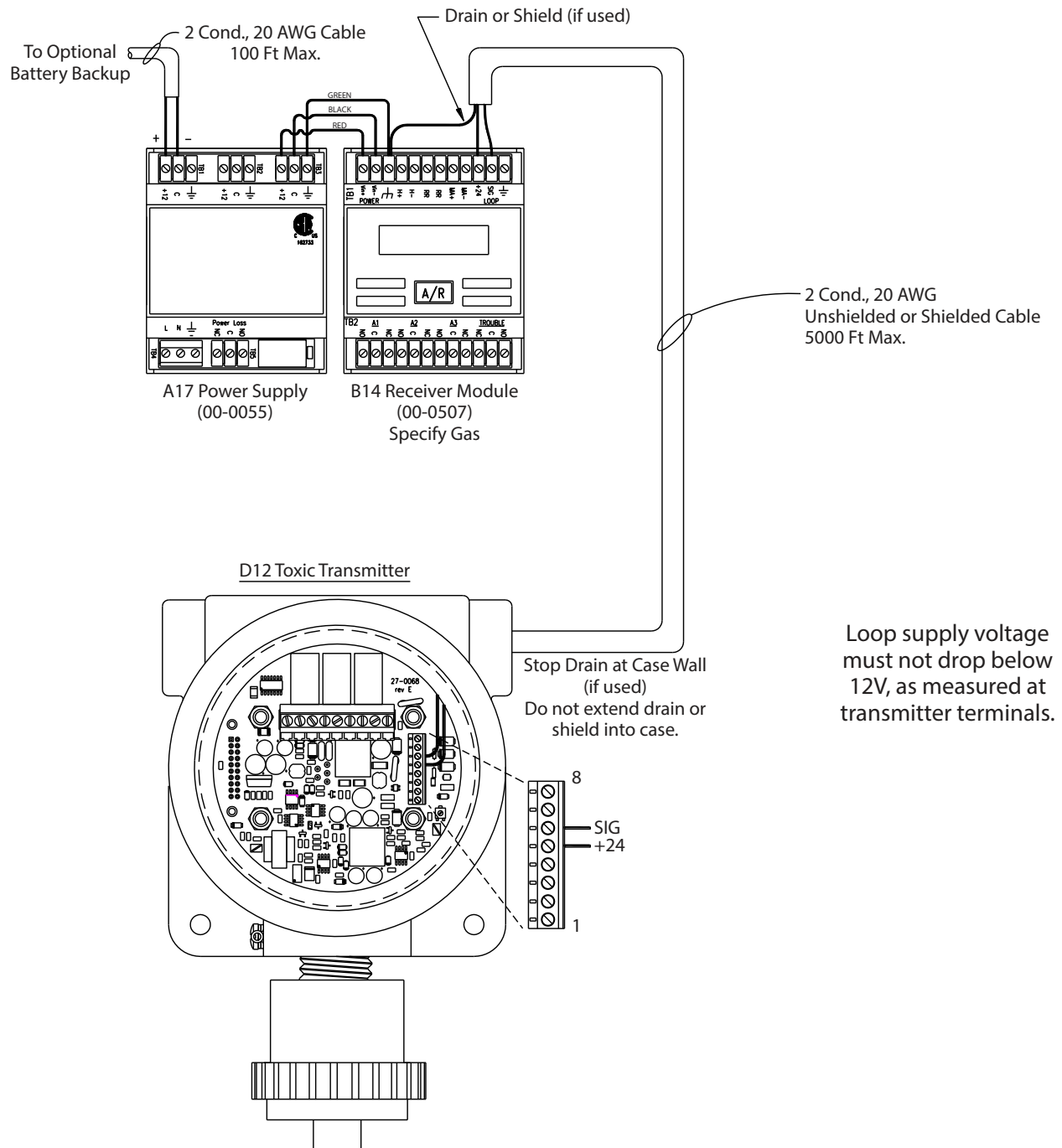


Figure 9: A17/B14 monitors, 2-wire

A17/B14 Monitor(s), 3-Wire Mode

D12 transmitters may be connected in 3-wire mode to an ATI A17/B14 receiver system. In 3-wire mode, transmitters include alarm relays, LCD backlighting and RS232/RS485 communication options. Consult the [GasSens A17 Universal Power Supply User Manual](#) and the [B14 Receiver Module User Manual](#) to properly size power supply requirements.

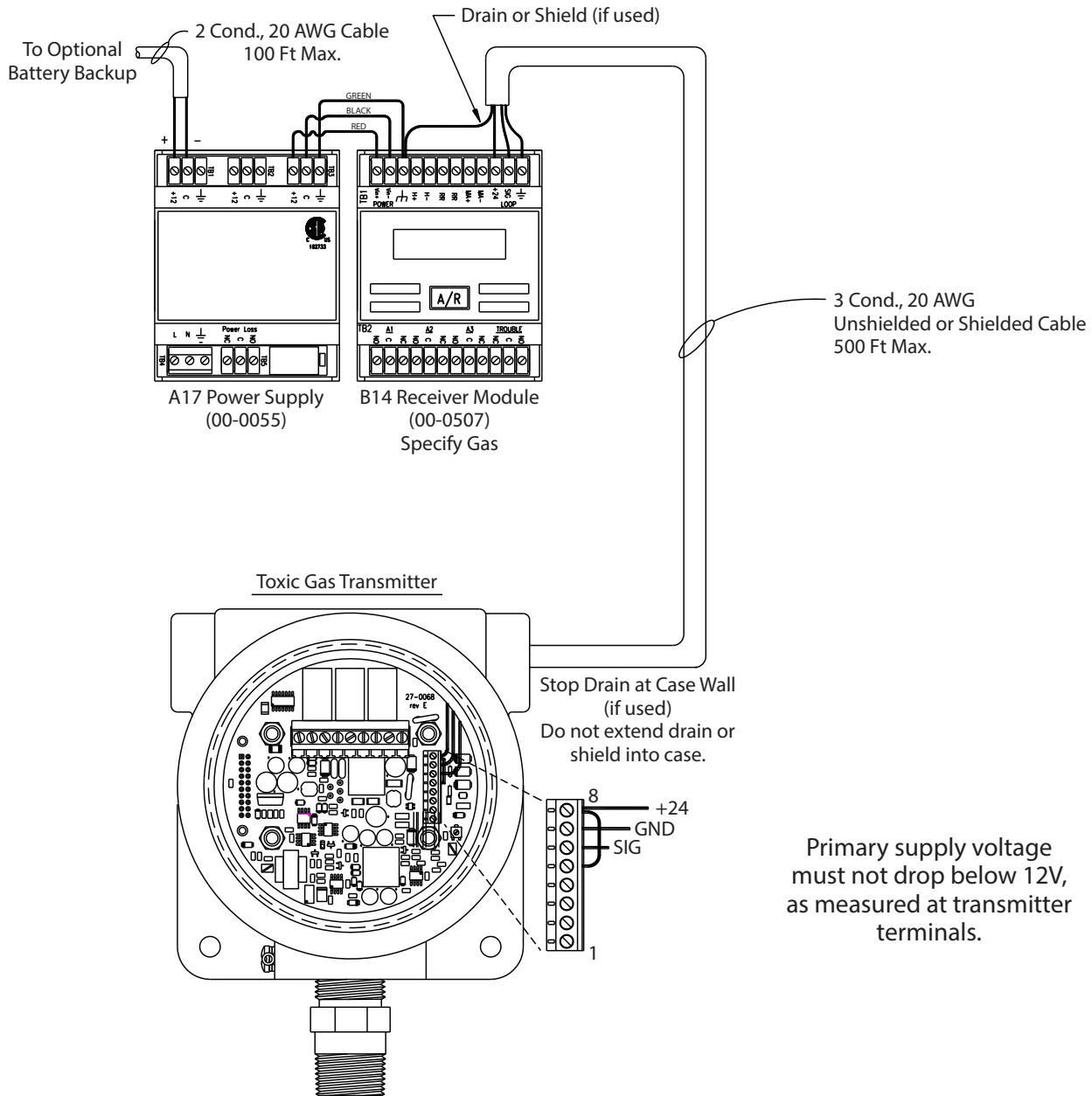


Figure 10: A17/B14 monitors, 3-wire

Power Only, No Output Options

If there are no output options, transmitters may be powered from a single, primary supply as shown in *Figure 11*. Size each power supply according to the number of transmitters, the current demand of each (see "*Specifications*" on page 9) and the wire resistance. The wire resistance must not be allowed to drop the primary supply voltage below 12V at the primary supply terminals of any transmitter.

NOTE: If possible, use 12–14 AWG wire on primary supply connections (shown in bold in the figure below), keep the number of transmitters low and verify the voltage on the transmitter furthest from the supply.

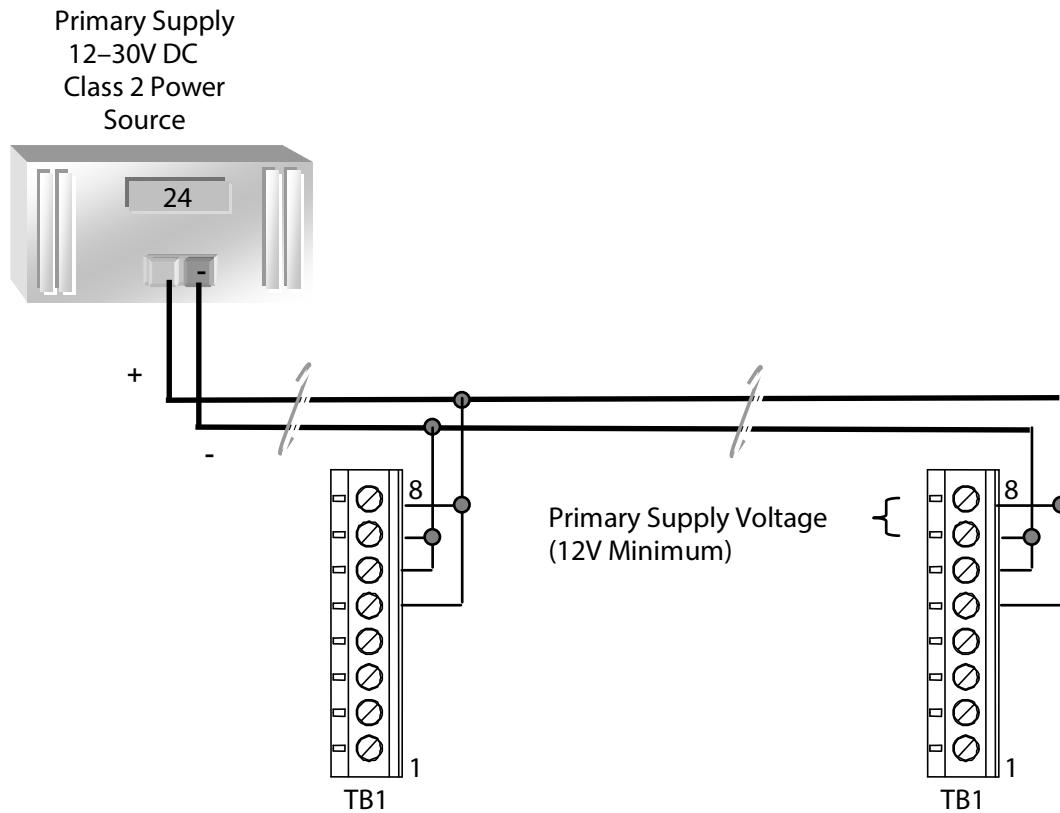


Figure 11: Power only, no output options

Current Loop Receiver, Single Supply (2-Wire Mode)

The transmitter sources current to a loop receiver in 2-wire mode as shown in *Figure 12*. A single power supply provides loop power, which is sufficient to power the transmitter alone without relays, LCD backlighting and RS232/RS485 communications. Size each power supply according to the number of transmitters, the loop powered current demand of each (see *"Specifications" on page 9*) and the wire resistance. The wire resistance must not be allowed to drop the loop supply voltage below 12V at the terminals of any transmitter.

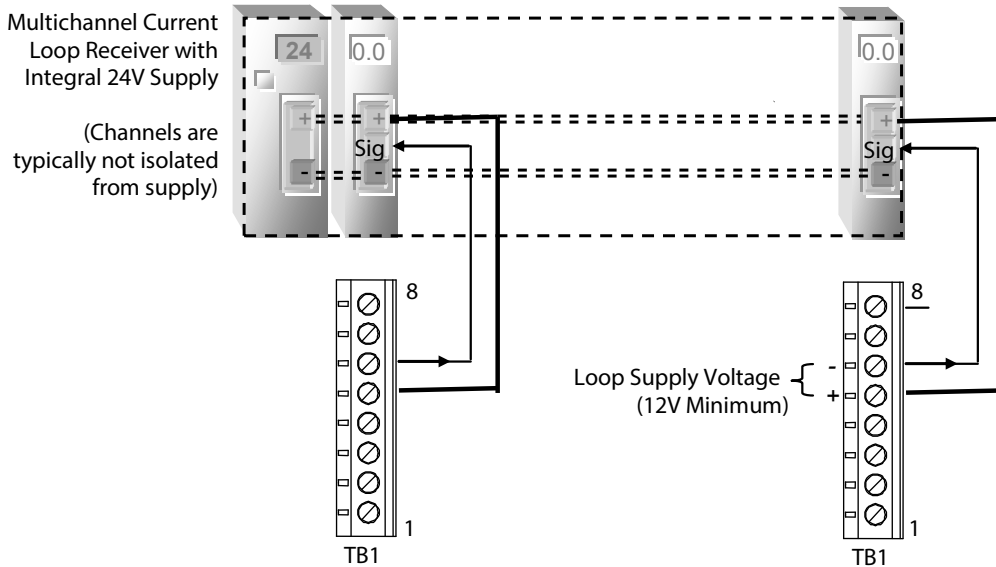


Figure 12: Current loop receiver, single supply (2-wire mode)

Current Loop Receiver, Single Supply (3-Wire Mode)

The transmitter sources current to a loop receiver as shown in *Figure 13*. A single power supply provides both primary and loop power to the transmitter. Size each power supply according to the number of transmitters, the current demand of each (see *"Specifications" on page 9*) and the wire resistance. The wire resistance must not be allowed to drop the Primary Supply Voltage below 12V at the terminals of any transmitter.

NOTE: If possible, use 12–14 AWG wire on primary supply connections (shown in bold in the figure below).

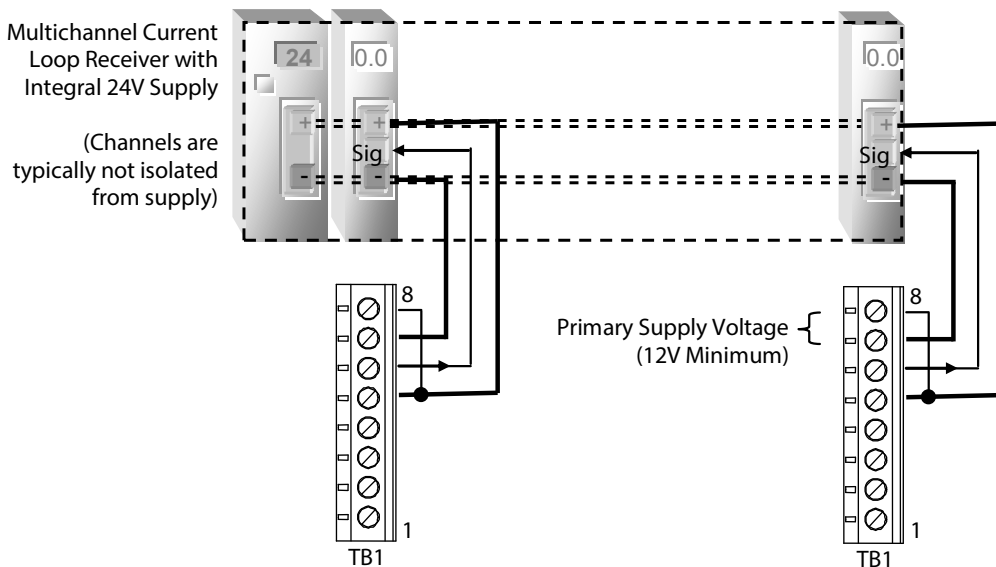


Figure 13: Current loop receiver, single supply (3-wire mode)

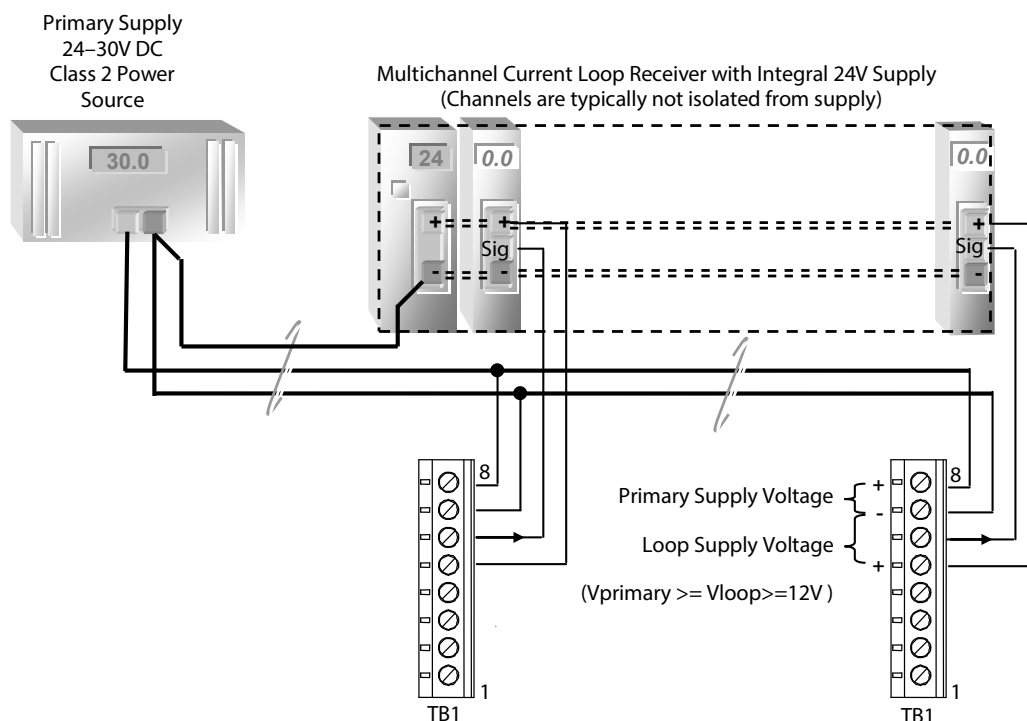
Current Loop Receiver, Dual Supplies (4-Wire Mode)

To reduce the power requirement of a single current loop supply, the transmitter may be powered from both a primary and loop supply, providing the following conditions are met.

- Supply grounds are directly connected to minimize ground loops, and
- The primary supply voltage is at least 12V, and must be equal to or exceed the loop supply voltage, as measured at instrument terminals.

Size each power supply according to the number of transmitters, the current demand of each (see "*Specifications*" on page 9) and the wire resistance. The wire resistance must not be allowed to drop the primary supply voltage below the loop supply voltage, which must be at least 12V as measured at the terminals of any transmitter.

NOTE: Select a primary supply with a higher voltage output than the loop supply, and use 12–14 AWG wire, if possible. Keep the number of transmitters supplied by the primary supply low, and verify the voltages at the terminals of the transmitter furthest from the primary supply.



<p>IMPORTANT Primary Supply Voltage must not drop below Loop Supply Voltage at terminals of any transmitter.</p> <p>NOTE: Use 12 AWG wire on Primary supply connections to minimize voltage drops.</p>	<p>1 Select a Primary Supply with a higher voltage output, and,</p>
	<p>2 Connect supply commons to minimize ground loops and voltage drops that might reduce the Primary Supply Voltage below the Loop Supply Voltage, at transmitter.</p>

Figure 14: Current loop receiver, dual supplies (4-wire mode)

HART Transmitter, Point-to-Point (2-Wire)

The HART Point-to-Point connection permits the transmitter to communicate digitally, while retaining the functionality of its 4–20mA current loop. Setting the transmitter’s polling address to 0 permits the current loop to function normally. According to HART specifications, the current loop must be terminated with a load resistor between 230–1100 Ohms; however, transmitter specifications restrict the maximum analog output resistance to a lower value (see *"Specifications" on page 9*). The term “active source” refers to a transmitter that is not loop powered and sources current from power applied to it on separate terminals. Size the power supply according to the number of transmitters, the current demand of each transmitter (see *"Specifications" on page 9*) and wire resistance. Wire resistance must not be allowed to drop the primary supply voltage below 12V at the terminals of any transmitter.

NOTE: Use at least 14 AWG wire on supply connections (shown in bold in *Figure 15*).

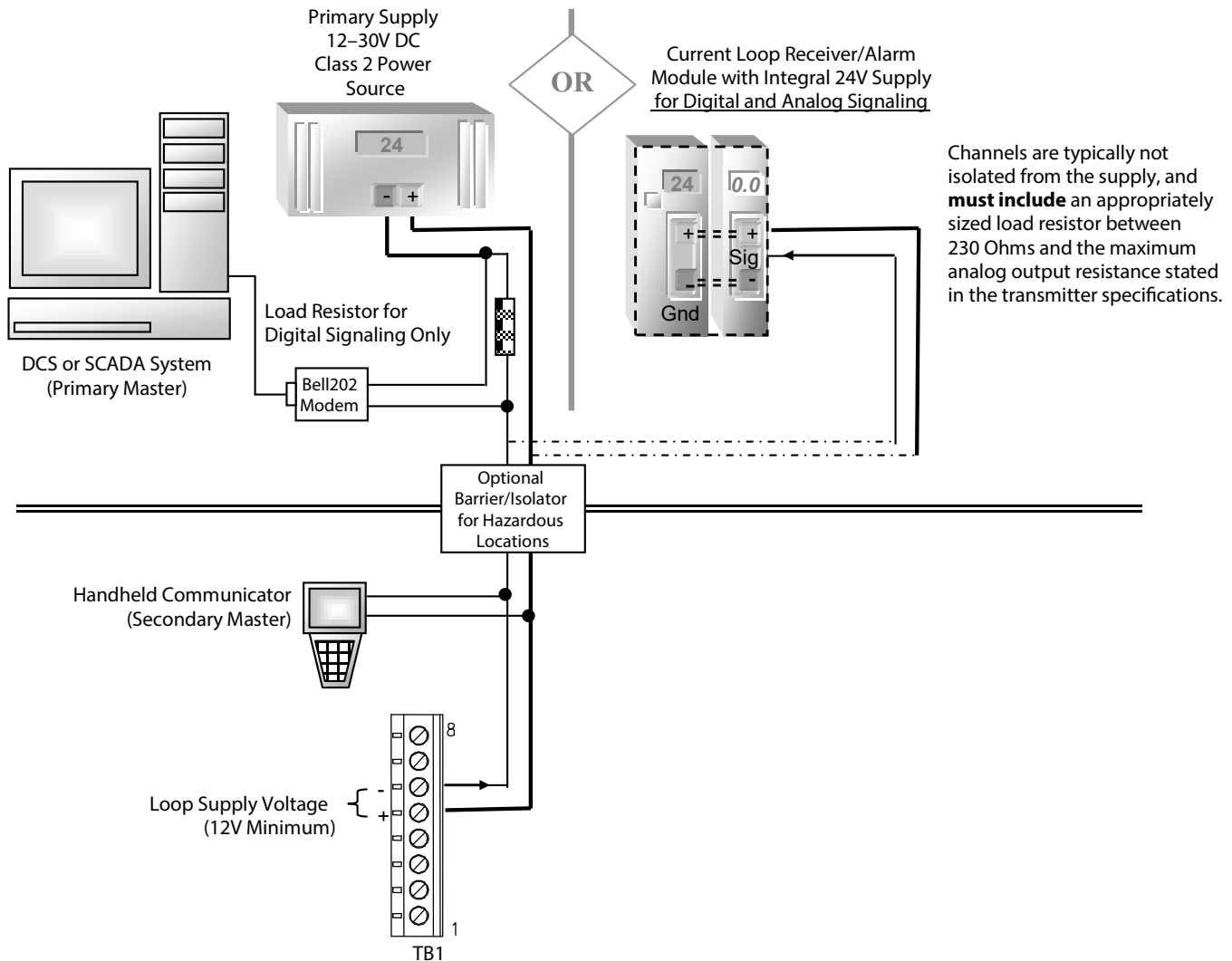


Figure 15: HART transmitter operation, point-to-point (2-wire)

HART Transmitter, Point-to-Point, Active Source (3-Wire)

The HART Point-to-Point connection permits the transmitter to communicate digitally, while retaining the functionality of its 4-20 mA current loop. Setting the transmitter's polling address to 0 permits the current loop to function normally. According to HART specifications, the current loop must be terminated with a load resistor between 230–1100 Ohms; however, transmitter specifications restrict the maximum analog output resistance to a lower value (see "*Specifications*" on page 9). The term "active source" refers to a transmitter that is not loop powered and sources current from power applied to it on separate terminals. Size the power supply according to the number of transmitters, the current demand of each transmitter (see "*Specifications*" on page 9) and wire resistance. Wire resistance must not be allowed to drop the primary supply voltage below 12V at the terminals of any transmitter.

NOTE: Use at least 14 AWG wire on supply connections (shown in bold in *Figure 16*).

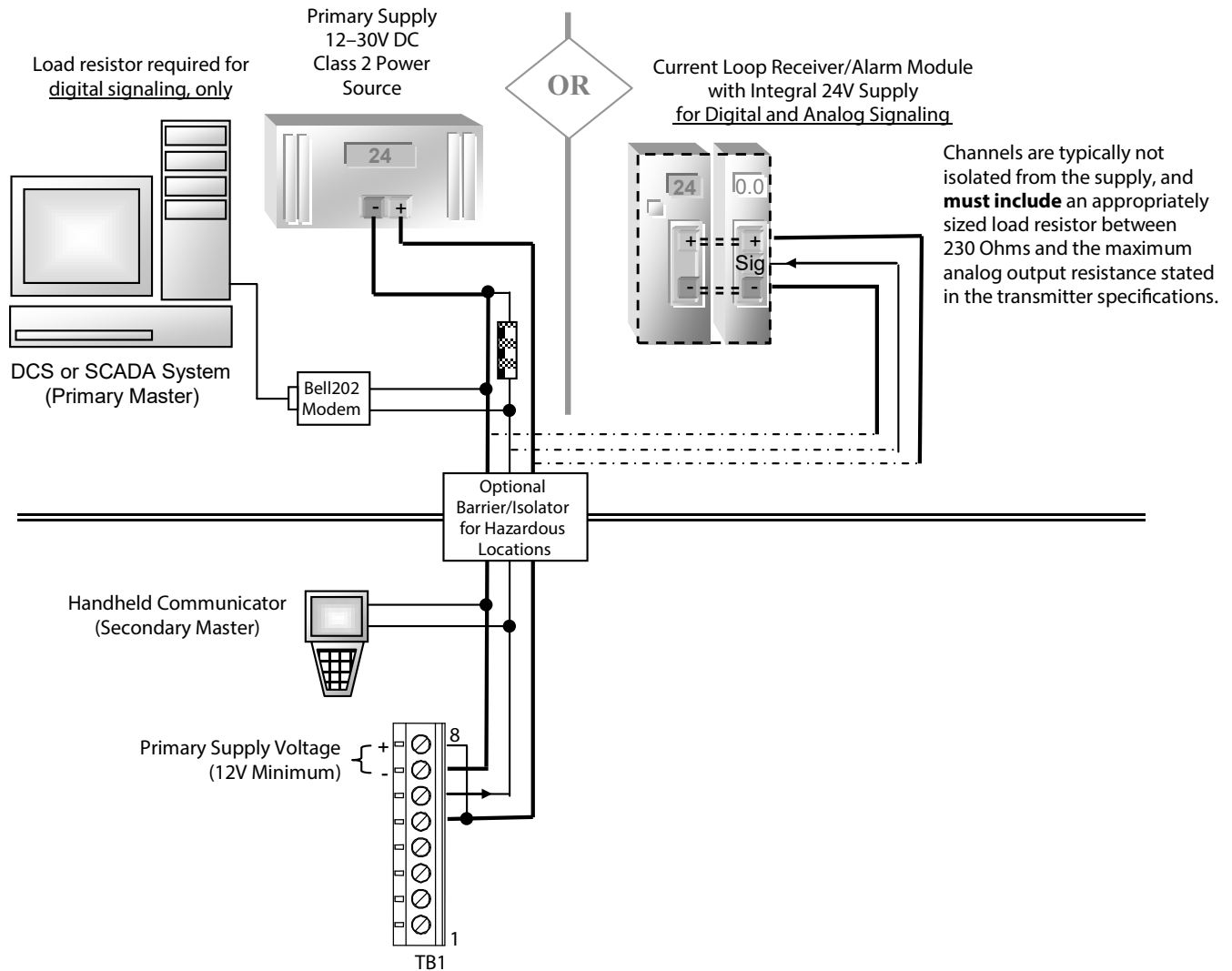


Figure 16: HART transmitter operation, point-to-point (3-wire)

HART Transmitter, Multi-drop Loop Powered (2-Wire) and Active Source (3-Wire)

The HART multi-drop connection permits up to 15 transmitters to communicate digitally on the same bus, but at the cost of analog current signaling. Setting the transmitter’s polling address from 1–15 fixes the current loop output at 4 mA. According to HART specifications, the current loop must be terminated with a load resistor between 230–1100 Ohms; however, transmitter specifications restrict the maximum analog output resistance to a lower value (see *"Specifications" on page 9*). The term “active source” refers to a transmitter that is not loop powered and sources current from power applied to it on separate terminals. Size the power supply according to the number of transmitters, the current demand of each transmitter (see *"Specifications" on page 9*) and wire resistance. Wire resistance must not be allowed to drop the primary supply voltage below 12V at the terminals of any transmitter.

NOTE: Use at least 14 AWG wire on supply connections (shown in bold in *Figure 17*).

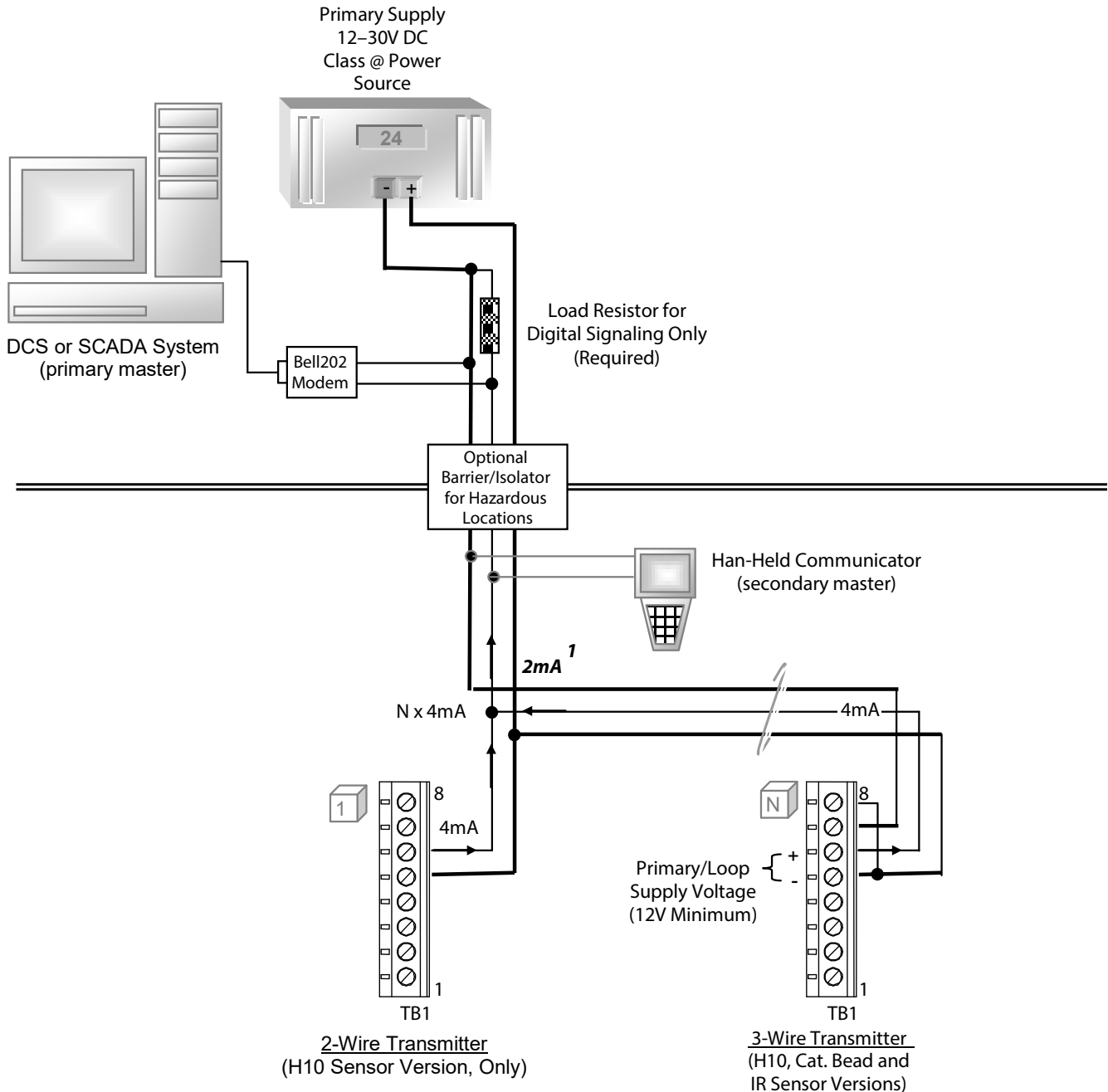


Figure 17: HART transmitter operation, multi-drop loop powered (2-wire) and active source (3-wire)

Modbus RS485 Multidrop

RS485 operation requires the transmitter to be wired in 3- or 4-wire mode. Modbus permits up to 247 devices to communicate digitally on the same bus; however, RS485 limits this to 32. Request the *D12 Transmitter Modbus Interface Manual* for complete details on the Modbus interface.

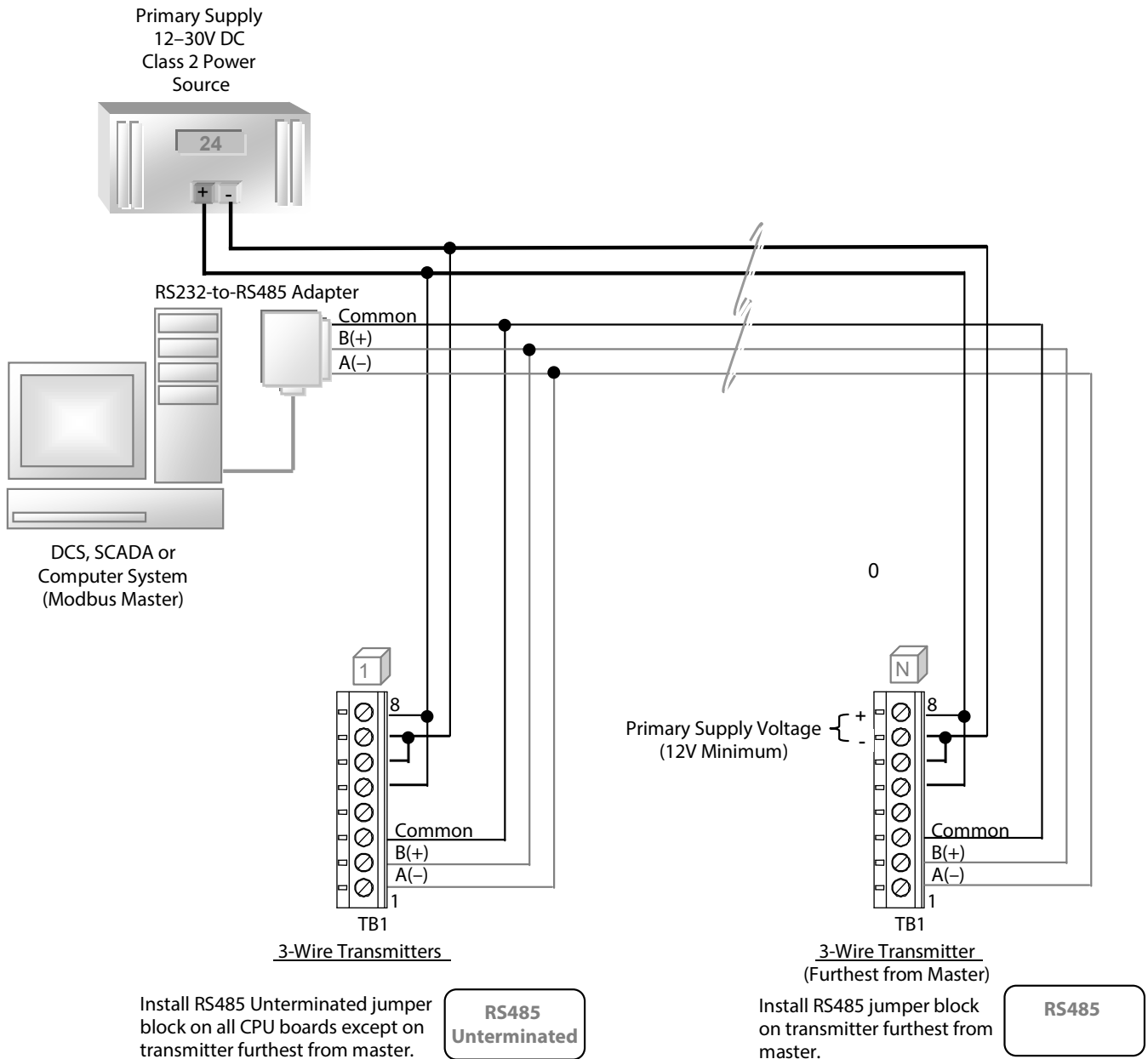


Figure 18: Modbus RS485 multidrop connections

Computer RS232

RS232 operation requires the transmitter to be wired in 3- or 4-wire mode. See *"Printing Datalog Reports"* on page 72 for details on sending the datalog to a printer or computer. Refer to the *D12 Transmitter Modbus Interface Manual* for complete details on the Modbus interface.

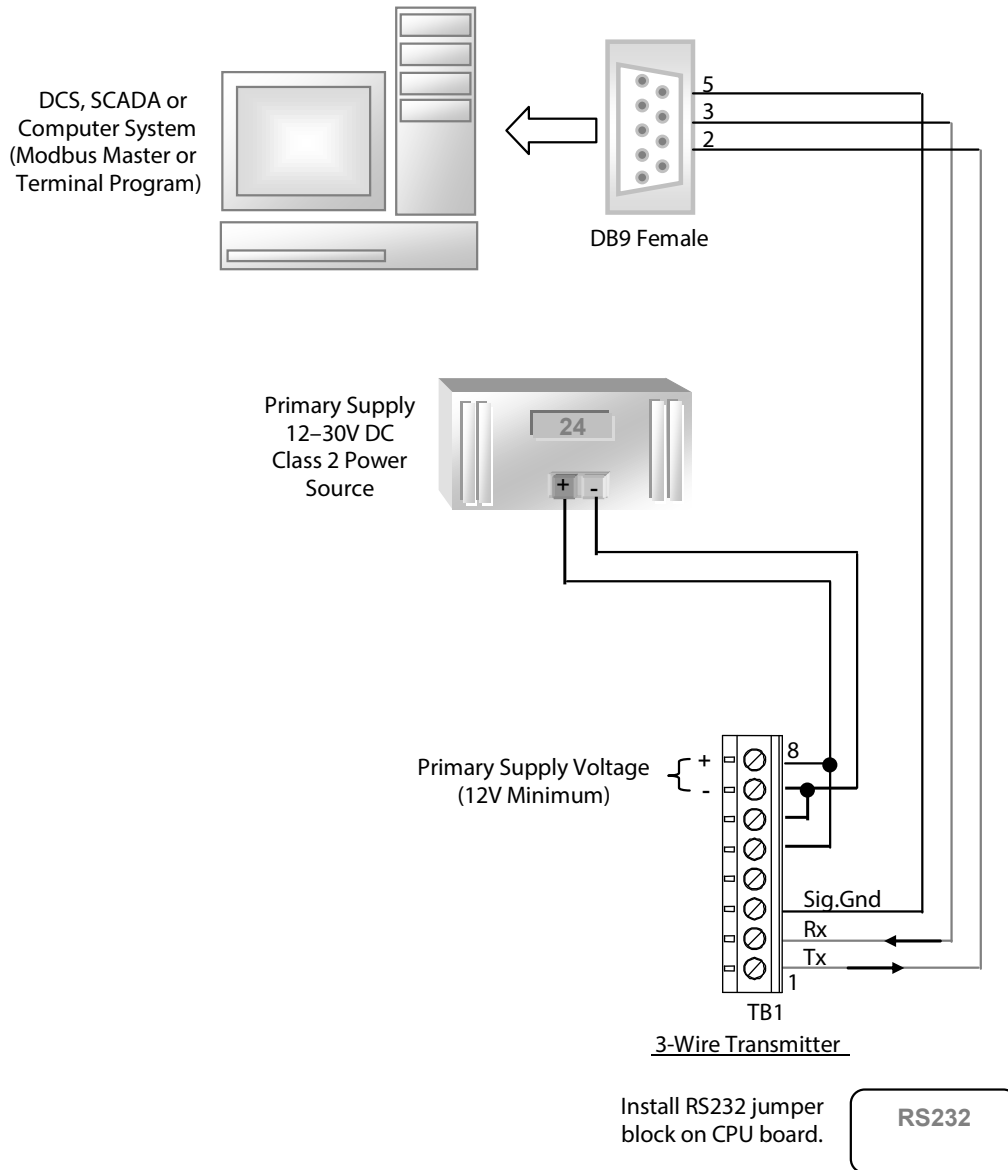


Figure 19: Computer RS232

Remote Sensor Wiring

Figure 20 shows the wiring of the remote sensor option, which allows separation of the transmitter and sensor by up to 50 feet. Interconnect cable is sold separately. Connections are made to terminal blocks in the transmitter and junction box (J-box) assembly. The sensor/generator housing is threaded into the J-box and connected to a 14-position header.

NOTE: Do not allow exposed wires contact each other, the printed circuit boards or any components.

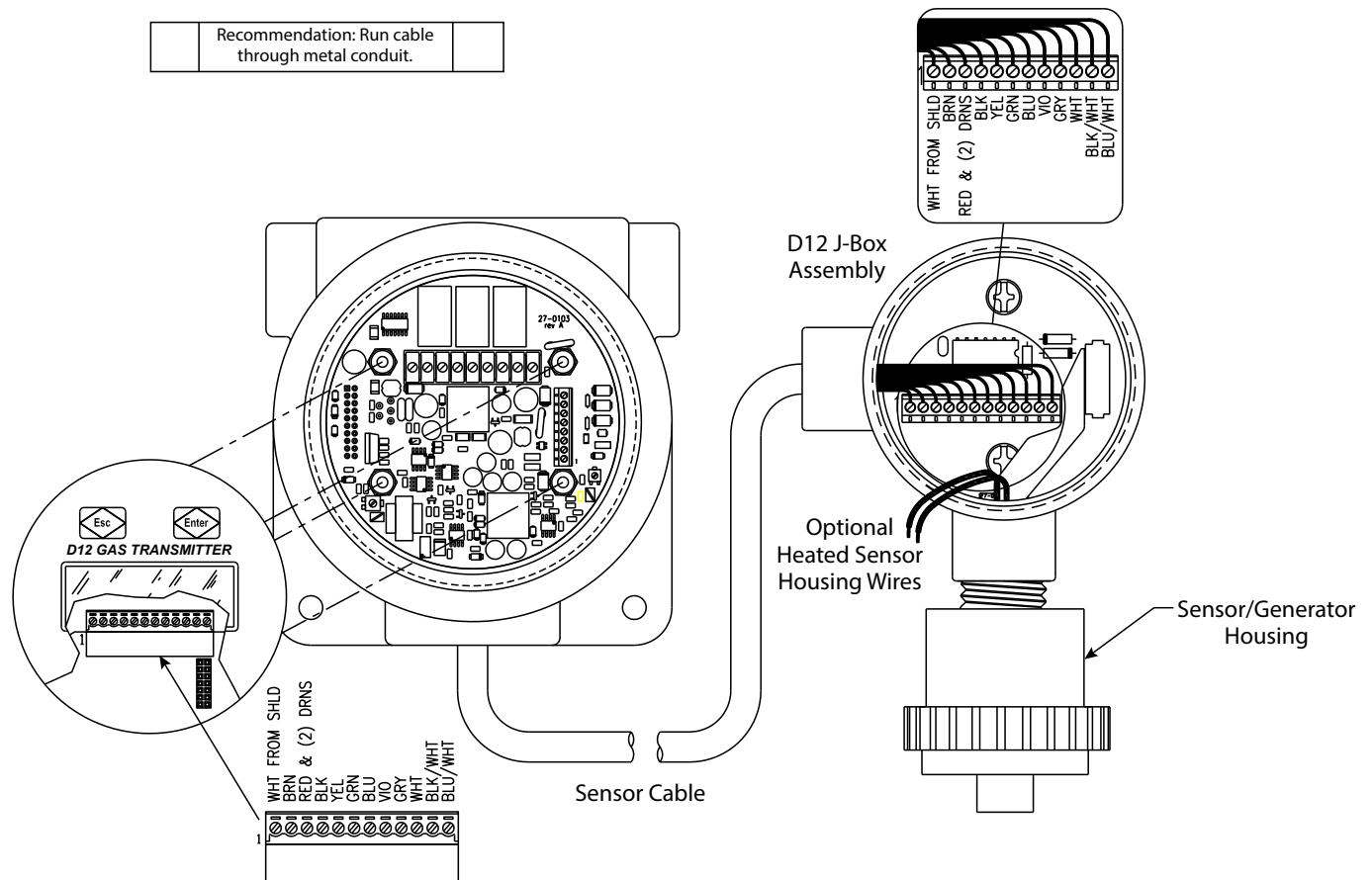


Figure 20: Remote H10 sensor wiring

NOTE: When an optional heated sensor housing is ordered, 2 Cond. Wire must be used to connect from J-box to transmitter or external 24V power source. Badger Meter can supply 2 Cond. 20 Awg wire (31-0008) sold as per foot, if requested. If connected as a 2-wire device, a customer supplied 24V power source must be used to supply voltage required to make heater circuit functional. A 3- or 4-wire device can be hooked to the transmitter. See [Figure 22 on page 27](#).

Duct Mount Sensor Wiring

Figure 21 shows the wiring of the sensor duct mount option, which allows the sensor to be installed inside of a duct or pipe. The cable plugs into the rear of the sensor holder and connects to a terminal block in the transmitter.

NOTE: Do not allow exposed wires contact each other, the printed circuit boards or any components.

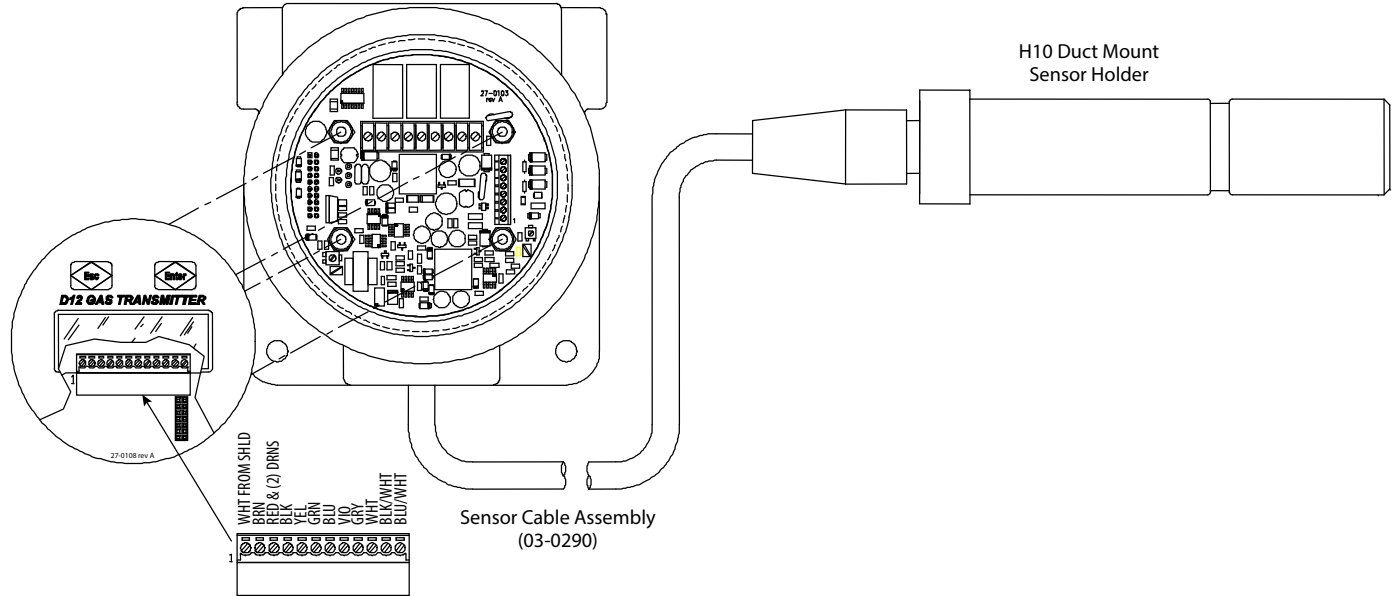


Figure 21: Duct mount wiring

Heater Option for Sensor/Generator Housing

The heater should be supplied with 24V DC to provide approximately 5.8 Watts to the housing. This may be derived from the transmitter supply in 3-wire mode (see [Figure 22](#)) or from a separate power supply. Heater leads are polarity insensitive.

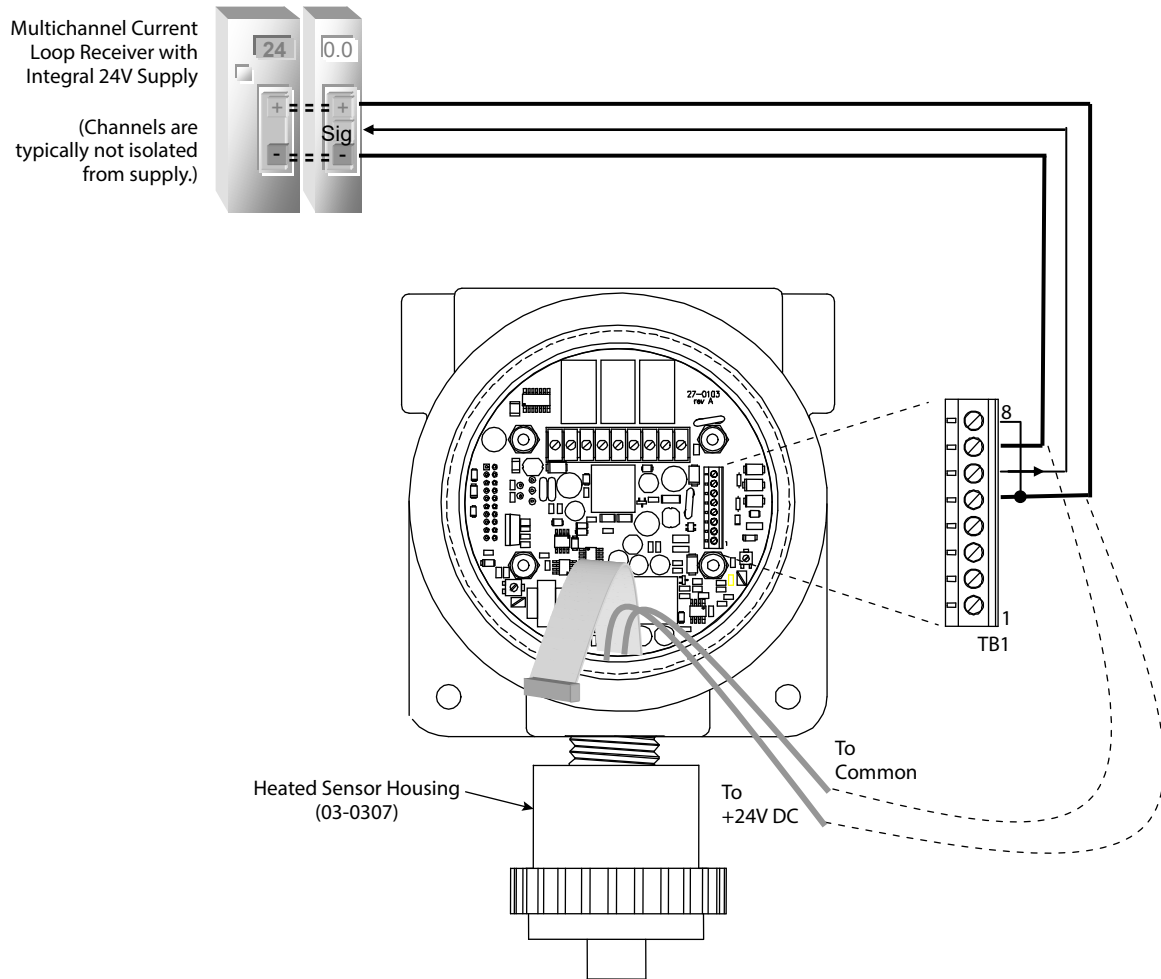


Figure 22: Optional heated sensor wiring

CPU Board Configuration

Install 1 jumper plug on JP4 as prescribed by communication interface.

If equipped with relays, install the relay option jumper on pins 3-4 of JP1.

Set switch SW5 to ON before replacing the housing cover.

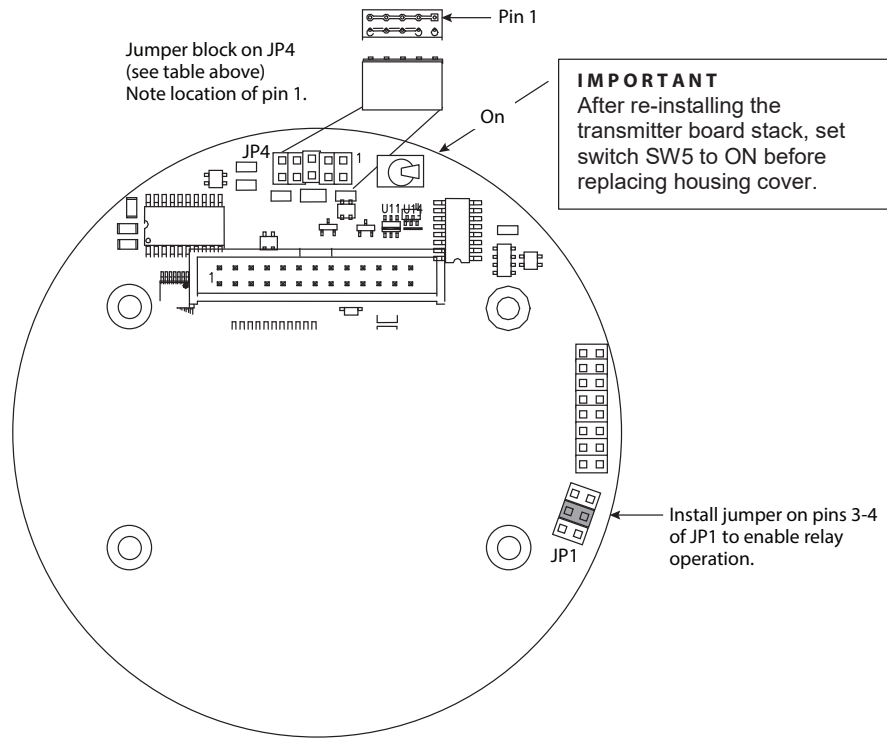


Figure 23: CPU board configuration

Protocol	Interface	Jumper Plug Label	Comments
HART Modbus	Bell 202 RS232	N/A "RS232"	No plug required (okay to install any). Use to connect one transmitter to a master device in a point-to-point configuration. See D12 Transmitter Modbus Interface Manual for details.
Modbus	RS485	"RS485"	Use to connect up to 4 transmitters to a master device in a multidrop configuration. Each transmitter connection biases and terminates the transmission line, as shown below. See D12 Transmitter Modbus Interface Manual for details.
Modbus	RS485	"RS485 Unterminated"	Use to connect more than 4 transmitters to a master device in a multidrop configuration. Transmitters are connected without adding bias or termination. Install one (terminating) RS485 jumper plug on transmitter at furthest end of transmission line. See the D12 Transmitter Modbus Interface Manual for details.
ASCII	RS232	"RS232"	Use to connect one transmitter to a printer or system terminal. Refer to "DataLog Menus" on page 57 .

OPERATOR INTERFACE

Interface Panel

The D12 operator interface is non-intrusive—you do not have to remove the housing cover to view the display, configure the transmitter or calibrate the sensor. It features a backlitged 96 × 32 dot LCD display and four “keys”. The keys are implemented as four magnetic switches, each centered below a graphic icon and activated when a magnet is held approximately 1/4 inch above the icon. The transmitter is provided with a powerful, magnetic-screwdriver that is designed specifically for activating the switches through the housing’s thick glass window.

NOTE: Backlighting on the LCD display is only available in 3- or 4-wire mode.

IMPORTANT

Throughout this manual, activating keys in this manner is referred to as “touching” the keys, even though it is not necessary to make physical contact.

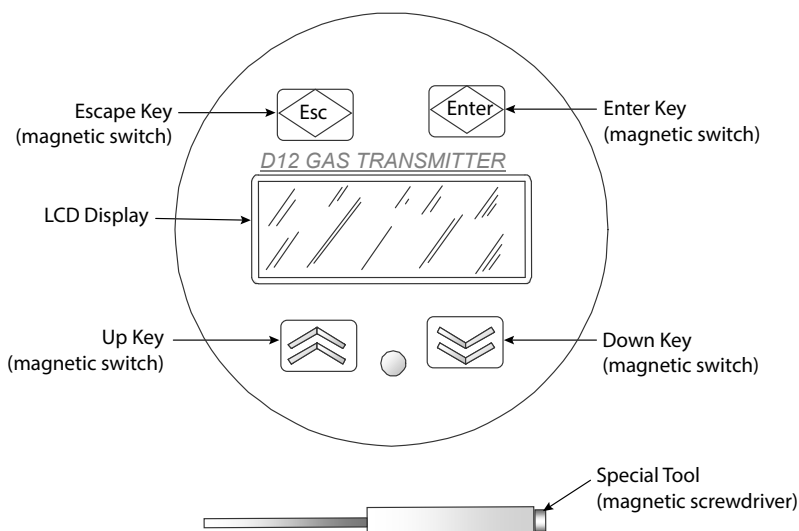


Figure 24: Operator interface panel

The operator interface is organized into menus that consist mostly of text objects representing readings, indicators, variables, functions and links to other menus. Navigating the menus of objects is simplified through the use of a “point-and-click” interface. The point-and-click interface uses an arrow cursor to depict the selection and may be moved from one object to the next by “touching” the *Up* and *Down* keys. While the cursor is “pointing” at an object, touching the magnet to the *Enter* key “selects” the object—the action performed depends on the type of object selected. If the object is a function, the *Enter* key executes the function. If a variable is selected for editing, the *Up* and *Down* keys change its value, and the *Enter* key saves it. Touching the *Esc* key aborts the edit and restores the previous value. If you are not executing a function or editing a variable, touching the *Esc* key returns to the previous page.

Startup Review Sequence

When the transmitter starts, the display cycles through a series of menus to review the configuration of the transmitter, sensor and generator. Alarms are inhibited and the output of the transmitter is held at 4.0 mA (17.4 mA for oxygen sensors). This state is maintained for 5 minutes to provide time for the sensor readings to stabilize.

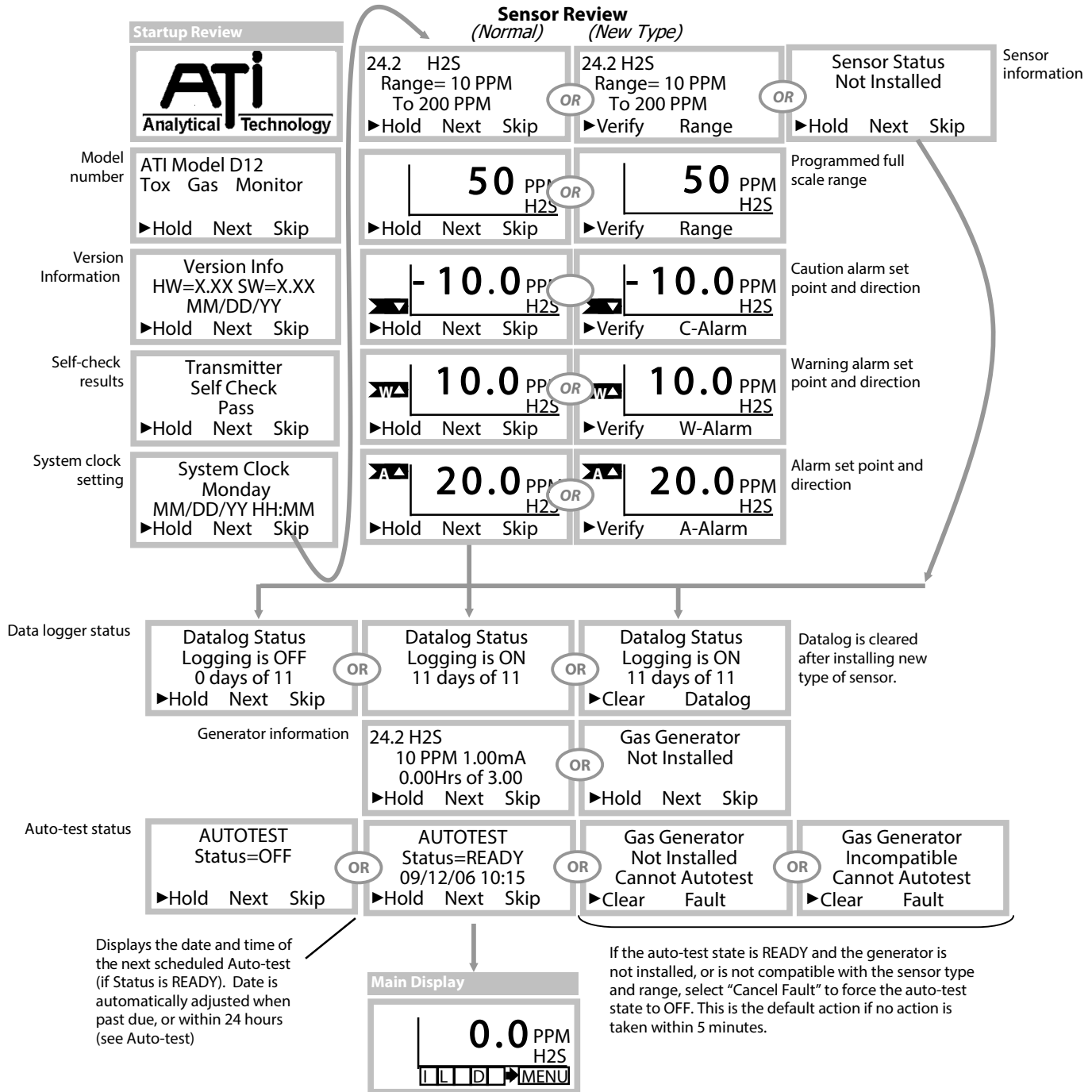


Figure 25: Startup review sequence

Main Display Screen

The *Main Display* screen shows the name and concentration of the target gas and the units of measurement (ppm, ppb, %...). Indicators on the left side and below show alarm and operating status. See [Figure 26](#) for information about each indicator.

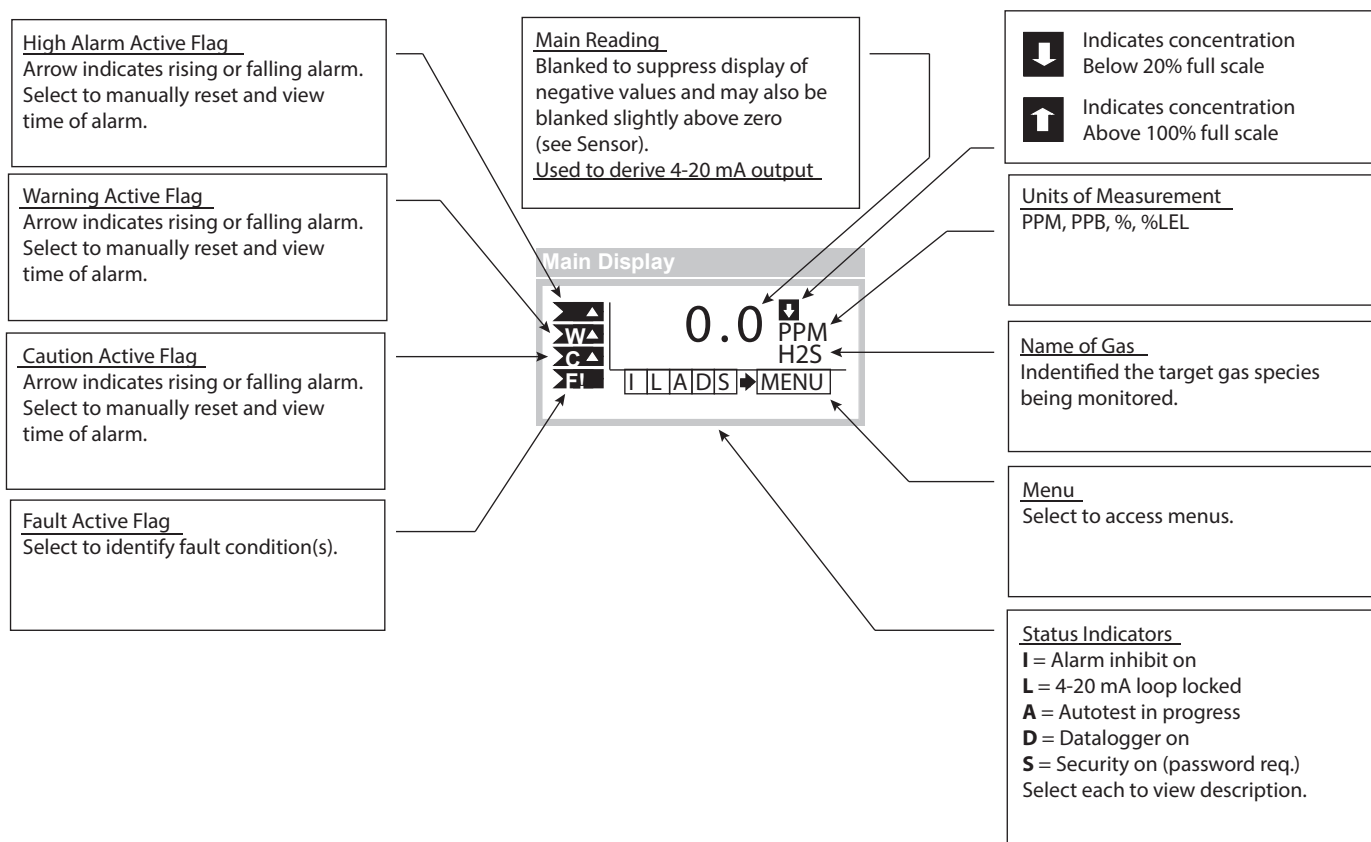


Figure 26: Main display screen

5 Minute Timeout Rule

Most menu screens are used for configuring the transmitter and sensor, and they have a 5 minute timeout rule so that after 5 minutes of no key activity, the transmitter automatically returns to the *Main Display* screen. Exceptions to this rule include the *Zero Calibration* and *Span Calibration* screens.

Esc Key Operation (Main Display Screen)

Holding the magnet over the *Esc* key for 2 seconds, then removing, toggles *Alarm Inhibit* mode on and off. If *Alarm Inhibit* mode was off, it is turned on for 15 minutes (default value). If *Alarm Inhibit* mode was on, it is turned off immediately. *Alarm Inhibit* mode is on when the "I" status indicator is visible.

Fault Indication (Main Display Screen)

Faults are indicated on the *Main Display* screen (see [Figure 28](#)).

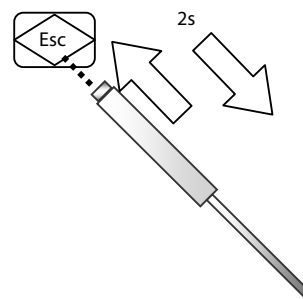


Figure 27: Esc key operation

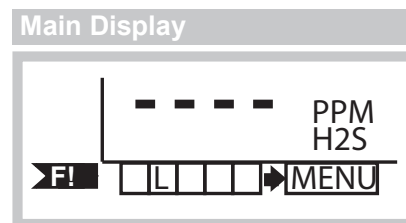


Figure 28: Standard fault indication

Main Reading

The main reading area on the *Main Display* screen (shown in [Figure 29](#)) displays the gas concentration value along with the gas name and units of concentration. It is reported on the 4-20 mA output¹ and is the PV (Primary Variable) reported on the optional HART™ interface. It also appears at the *Main Display* register 40043 (D12_SYS_CONCBL) on the optional Modbus interface.

¹ The 4-20 mA may not match the reading when the "L" status indicator is visible on the *Main Display* screen or when the output is in a physical limit.

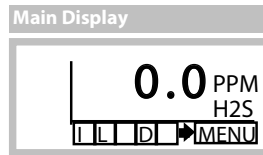


Figure 29: Main reading area on main display screen

By default, the main reading is "blanked" to suppress the display of negative values. Blanking means that the reading is reported as zero if the concentration dips below zero. This can occur over time as a result of sensor aging. If the concentration falls to -20% of the full-scale range, a fault alarm is generated. Blanking is typically extended slightly above zero as a means of stabilizing the main reading in the presence of excessive external noise or other environmental factors (see "[Sensor Setup Variables](#)" on page 33).

During zero and span calibrations, the unblanked gas concentration value is displayed primarily to assess the amount of positive or negative drift. The unblanked reading is also available on the Modbus interface (refer to the [D12 Transmitter Modbus Interface Manual](#) for more information).

Variable Editing

When a variable is selected using the selection cursor (▶), the edit cursor appears. The shape of the cursor symbolizes the up-down scroll nature of the value being edited (see [Figure 30](#) for cursor types). To provide feedback about which key is being activated, the cursor changes to a solid Up arrow when the magnet is touching the *Up* key, and to a solid Down arrow when the magnet is touching the *Down* key. When the variable has been adjusted to the desired value, touching the magnet to the *Enter* key changes the cursor to an hour-glass shape while the program is saving the new value (recalculating associated variables and updating non-volatile memories). Touching the magnet to the *Esc* key discards the edited value and restores the original value. See [Figure 30](#).

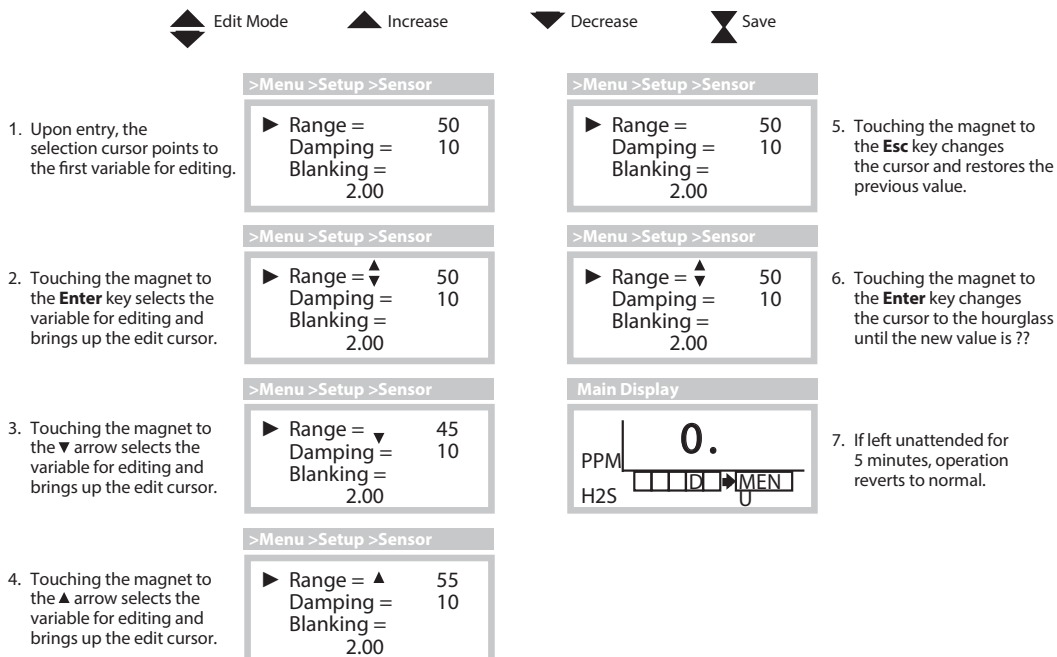


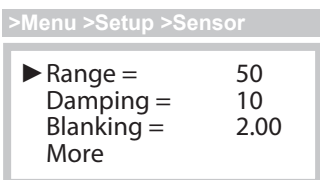
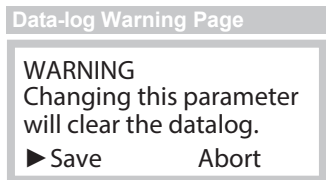
Figure 30: Variable editing

SENSORS AND GENERATORS

Configuring the Sensor and Transmitter


The D12 transmitter accepts a wide variety of H10 smart sensors that configure the transmitter with the name of the gas, the full-scale range, units of concentration, blanking, damping, alarm settings and data to assist the transmitter with transforming the sensor's output signal into a representation of gas concentration. For this reason, it is important to make certain the sensor and transmitter are properly configured for your particular application.

Sensor Setup Variables

Display	Variable	Description
 <p>Figure 31: Sensor range variable</p>	Range	<p>The <i>Range</i> variable sets the 100% full-scale value of the transmitter, which corresponds to the 20 mA output value. Changing the <i>Range</i> variable also changes the <i>Blanking</i> variable which is computed as a fraction of the range. Range limits vary from sensor to sensor.</p> <p>If datalogging is turned on, adjusting the <i>Range</i> variable triggers a warning message prior to saving the new value. Select Save to save the new <i>Range</i> variable, or select Abort to leave it unchanged.</p>  <p>Figure 32: Datalog warning</p>
	Damp. (Damping)	The <i>Damping</i> variable allows minor adjustment of the transmitter's auto-damping feature that is used to stabilize readings. It is a unitless value from 1–100, where a value of 1 corresponds to a T_{90}^2 response of approximately 20s and 100 is a T_{90}^2 of approximately 30s.
	Blank (Blanking)	<p>The <i>Blanking</i> variable forces the main reading to zero whenever the gas concentration is below the programmed value. In this version of the transmitter, blanking limits vary from sensor to sensor but are typically 0–5% of the full scale range. Note that the transmitter always performs negative blanking, even when the <i>Blanking</i> variable is set to 0.</p> <p>The variable is recomputed when the <i>Range</i> variable changes so that same fraction of range is maintained. Doubling, or halving the <i>Range</i> variable, doubles or halves the <i>Blanking</i> variable, respectively.</p>
	More	Goes to an additional sensor information screen. See " Sensor More Menu " below.

² T_{90} is the time required for the transmitter to reach 90% of its final value after a step change in gas concentration.

Sensor More Menu

Display	Link/Variable	Description
 <p>Figure 33: Sensor more menu</p>	Cal_History	<i>Cal_History</i> is a link to the <i>Calibration History</i> screen. See " Sensor Calibration Records " on page 40.
	Test_History	<i>Test_History</i> is a link to the <i>Auto-test History</i> screen. See " Auto-test History Menu " on page 43.
	Temp	The <i>Temp</i> variable is the sensor temperature reading in degrees Celsius. The variable can be adjusted up or down to achieve a temperature offset calibration.

Changing the H10 Sensors and C18 Generators

H10 sensors and C18 generators may be removed and replaced with power applied. To remove, rotate the sensor housing locking 1/4 turn clockwise (when viewing from the bottom), slide the molded carrier down and carefully pull down on the sensor and/or generator body. To install, reload the carrier, push it into the housing and rotate the locking 1/4 turn counterclockwise (when viewing from the bottom).

Removing Sensors

Removing the sensor with power applied starts a 60 second count down timer. During this time, the alarms are inhibited and the current loop output is fixed at 4.0 mA (17.4 mA for oxygen sensors). The 60 seconds should give you enough time to reinstall the sensor or install a replacement sensor. If more time is needed, the count may be stopped indefinitely by selecting **Hold**, which causes it to blink. A *Sensor Removed* fault occurs if a sensor is not installed before the timer expires. [Figure 34](#) illustrates the display sequence associated with removing the sensor.

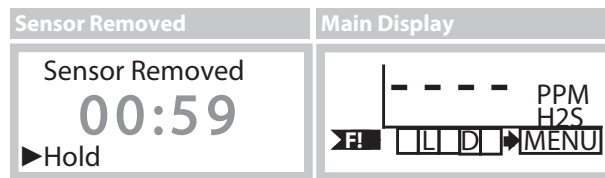


Figure 34: Sensor removal display sequence

Installing Sensors

The transmitter maintains a copy of the previously installed sensor and compares the part numbers of the new sensor with the old. If the part numbers match, the transmitter sequences the startup review as normal, beginning with the sensor information. If they do not match, the review halts and waits for the operator to verify the new sensor, full-scale range and alarm settings. The startup review is shown in [Figure 25 on page 30](#).

NOTE: As a convenience during field replacement, the transmitter sets the new sensor's full-scale range, blanking, damping and alarms to match the previously installed sensor. This could cause confusion when transferring sensors from field transmitters to shop transmitters for calibration. During review, the shop transmitter displays 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 restores its original settings. Always verify field transmitter settings.

After verifying the sensor, the transmitter copies the sensor settings to its local memory.

NOTE: Changing sensor types clears the log.

If datalogging is turned on (indicated by the "D" status indicator appearing on the *Main Display*), and the sensor is replaced by one with a different part number, you are prompted to clear the datalog during review. See [Figure 35](#).

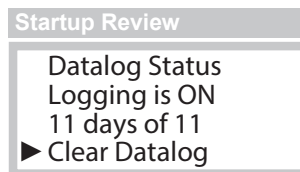


Figure 35: Clear the datalog

After the sensor is installed, the transmitter executes a 5-minute (typical value) warm-up period. During this time, alarms are inhibited, the 4-20 mA output is held at 4 mA (17.4 mA for oxygen sensors) and zero and span calibrations are not permitted.

NOTE: Sensors can take as long as 12 hours to stabilize (bias) if not previously stored in the sensor keeper.

Removing Generators

When a gas generator is removed and the Auto-test control is *READY*, the transmitter displays a countdown page similar to that for the sensor. Although the generator is not critical to the normal operation of the transmitter, attempting to Auto-test without a generator would certainly fail. Selecting **Cancel Fault** forces the Auto-test control to *OFF*, which occurs by default on expiration of the timer. The Auto-test control must be changed back to *READY* when a new generator is eventually installed. The display sequence associated with removing the gas generator is illustrated in [Figure 36](#).

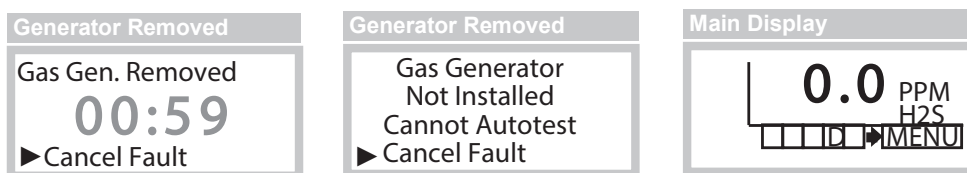


Figure 36: Generator removal display sequence

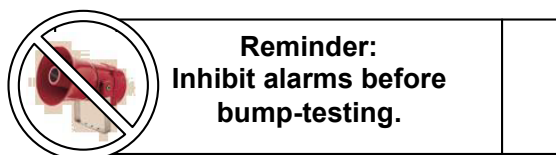
Installing Generators

When a generator is installed, the transmitter sequences the startup review, beginning with the generator information as shown in [Figure 25 on page 30](#). If problems with the gas type or range are detected, they are announced during review and the Auto-test control is set to *OFF*.

NOTE: Some generators produce a surrogate gas instead of the sensor's target gas. And some generators may not produce enough gas to pass the Auto-test on higher sensor ranges. For more information, refer to ["Auto-test" on page 41](#).

Bump-testing

"Bump-testing" refers to a test whereby the sensor is briefly exposed to gas in order to verify the reading moves upscale from zero. It is recommended that it be performed at least once a month using a small amount of bottled span gas.



Exposing the sensor to any reactive gas could cause false alarms. This can be avoided by temporarily inhibiting the alarms. The most convenient method for doing so is from the *Main Display* screen, using the *Esc* key. This also allows you to view the transmitter reading to verify the sensor's response.

Hold the magnet over the *Esc* key for 2 seconds and then remove it (see [Figure 37](#)). This toggles the *Alarm Inhibit* mode on for 15 minutes (default value), holds the current loop at 4 mA (17.4 mA for oxygen sensors, which are usually exposed to air continuously and do not require bump-testing) and causes the "I" and "L" status indicators to appear. Repeat this procedure when finished with the bump-test, and then verify the flags disappear. Refer to ["Inhibiting Alarms" on page 54](#) for additional information.

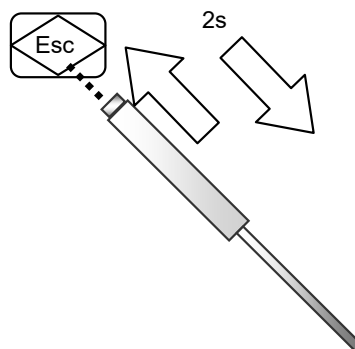


Figure 37: Magnet over *Esc* key

Calibration

Calibration Frequency

While the transmitter itself requires no periodic calibration, H10 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.

Zero Calibration

As the name implies, zero calibration corrects the transmitter reading to zero in the absence of any reactive gas. During zero calibration, the transmitter offset error is stored and subsequently subtracted from future readings. It is recommended to bottle zero gas as a source, which should be selected based on the type of sensor. For example, bottled zero air may be used to zero chlorine sensors, while oxygen sensors require bottled nitrogen gas.

Span Calibration

The role of span calibration is to correct the transmitter reading to a known concentration of target gas (the gas for which the sensor was designed to monitor). During span calibration, the transmitter effectively stores the slope of the error and divides it out of subsequent readings. Sensors for most gases, such as ammonia, require a bottled “span gas” source. This applies even to oxygen sensors, where the span gas source is bottled zero air.

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.

Calibration Kits

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

Indications During Sensor Calibration

The unblanked gas concentration value is displayed during zero and span calibration, primarily to observe any slight amount of positive or negative drift. In addition, alarms are cleared and inhibited, and the 4-20 mA output of the D12 transmitter is locked at 4.0 mA (transmitters equipped with oxygen sensors are locked at 17.4 mA (representing normal) and 20.9% atmospheric oxygen). The 4-20 mA output does not change when gas is applied and removed, and for 15 minutes thereafter (the default value). While viewing the calibration screens, the LCD display indicates the changing gas concentration.

Calibration Exceptions

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

- Sensor removed or in 5-minute warm-up period (typical value, may vary by sensor gas type)
- Transmitter fault is active
- Auto-test is active (“A” status indicator appears on *Main Display* screen)

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

Sensor Zero Calibration

Performing a zero calibration requires a bottled zero-gas with a 500 cc/min regulator, a calibration adapter and a convenient length of 1/4 inch tubing. The gas used depends on the type of sensor installed. For example, an H₂S sensor may be zeroed with Zero-air, meanwhile, **an oxygen sensor must be zeroed with nitrogen**. In some cases, a sensor may be zeroed directly to the atmosphere but only when it is known to be free of reactive gasses. Check with Badger Meter if you are uncertain about which gas to use.

Referring to [Figure 38](#), push the calibration adapter onto the exposed end of the sensor and connect one end of the tubing (1), and connect the other end of tubing to the cylinder's regulator (2).

NOTE: Do not open the gas valve until instructed below.

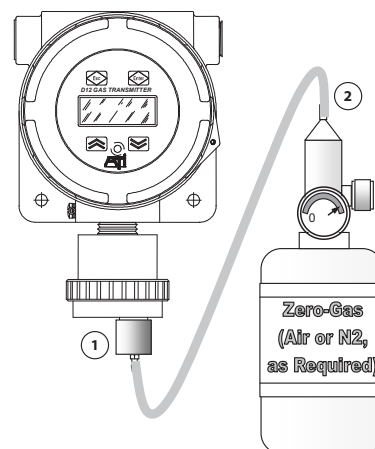


Figure 38: Sensor zero cal setup

Select the **Zero_Sensor** method from the *Sensor Calibration* menu,⁶ as shown in [Figure 39](#). This clears and inhibits alarms at the transmitter and holds the current loop output at 4 mA (17.4 mA for oxygen sensors) for up to 30 minutes of no key activity.



Figure 39: Sensor zero calibration menus

Open the regulator to flow gas to the sensor. After approximately four minutes, select **Zero**. “Cal” appears briefly at the bottom of the page and the reading is 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 Display* screen. Alarms remain inhibited, and the current loop is fixed for 30 minutes after calibration.

Sensor Span Calibration

Span calibration* requires a bottled “span-gas” with a 500 cc/min regulator, calibration adapter and a convenient length of 1/4 inch tubing. The gas type and concentration used depends on the type of sensor installed. Check with the factory if you are uncertain about which gas to use.

Referring to [Figure 40](#), slip the calibration adapter onto the exposed end of the sensor and connect one end of the tubing (1), connect the other end of tubing to the cylinder’s regulator (2). Do not open the gas valve until instructed below.

* Perform the zero calibration prior to the span calibration.

Select the **Span** method from the *Sensor Calibration* menu, as shown in [Figure 41](#). This clears and inhibits alarms at the transmitter and holds the current loop output at 4 mA (17.4 mA for oxygen sensors) for up to 30 minutes of no key activity.

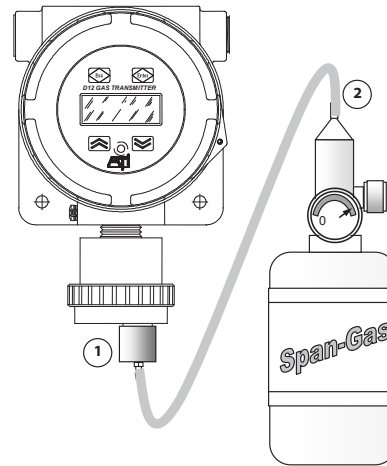


Figure 40: Sensor span cal setup

<div style="display: flex; justify-content: space-between;"> <div style="border: 1px solid gray; padding: 5px; width: 45%;"> <p>>Menu</p> <ul style="list-style-type: none"> Zero_Sensor ▶ Span_Sensor View_Log Setup </div> <div style="border: 1px solid gray; padding: 5px; width: 45%;"> <p>>Span_Sensor</p> <div style="text-align: center; font-size: 2em; font-weight: bold;">- 0.0</div> <p style="text-align: center;">PPM H2S</p> <p>▶ Span Undo</p> </div> </div> <div style="border: 1px solid gray; padding: 5px; width: 45%;"> <p>>Span_Sensor</p> <div style="text-align: center; font-size: 2em; font-weight: bold;">24.8</div> <p style="text-align: center;">PPM H2S</p> <p>▶ Span Undo</p> </div> <div style="border: 1px solid gray; padding: 5px; width: 45%;"> <p>>Span_Sensor</p> <div style="text-align: center; font-size: 2em; font-weight: bold;">25.0</div> <p style="text-align: center;">PPM H2S</p> <p>▶ Span Cal Undo</p> </div>	<p>Open the regulator and allow gas to flow to the sensor. The displayed reading should begin to increase and stabilize after 5–10 minutes, depending on the gas type and range of the sensor.</p> <p>Select Span. the concentration reading becomes fixed, and the blinking Up/Dn edit cursor appears just to the left of the reading. Press the up ▲ or down ▼ key to correct the reading to match the known concentration of gas.</p> <p>Touch the Enter key to perform the calibration. “Cal” appears briefly at the bottom of the page.</p>
---	--

Figure 41: Sensor Span Cal. menus

Touch the **Esc** key twice to return to the *Main Display* screen. Disconnect the calibration adapter from the sensor and permit the readings to return to zero. Alarms remain inhibited and the current loop is fixed for 30 minutes after calibration. Once the reading is below any of the alarm set levels, you may terminate the alarm inhibit (and fixed loop output) using the **Esc** key on the *Main Display* screen. See ["Inhibiting Alarms" on page 54](#).

Calibration of Duct-Mount H10 Sensors

To zero and span calibrate a duct-mounted H10 sensor, pull the sensor out of the duct until the calibration locking pin clicks into the retaining slot. By pulling back slowly, the retaining pin drops into place and automatically locates the sensor just behind the gas inlet port. Connect a length of tubing from the gas regulator to the barb fitting, and then follow the zero and span calibration procedures detailed earlier.

NOTE: For best results, pressure in the pipe or duct should be neutral or slightly negative. Positive pressure may restrict the flow of calibration gas to the sensor, resulting in an inaccurate calibration.

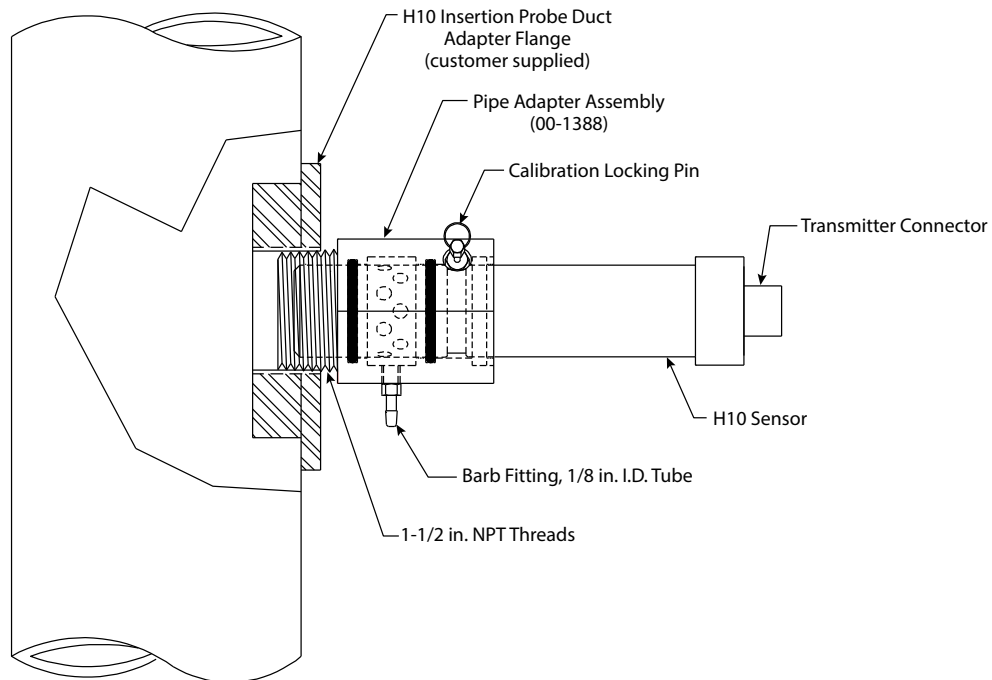


Figure 42: Duct-mount H10 sensor calibration

Sensor Calibration Records

A calibration record is written into the sensor memory each time a zero or span calibration is performed, and when a calibration Undo is performed. Enough memory is reserved for 63 zero calibrations and 63 span calibrations. Zero and span calibration records are accessed on the *Cal_History* menu.

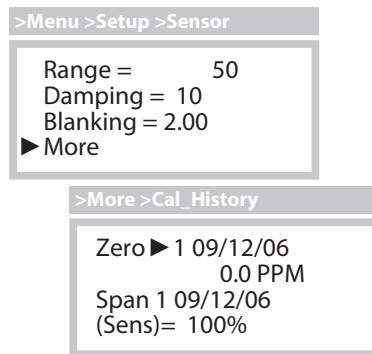


Figure 43: Sensor calibration history page

Zero calibration records are accessed on line 1 and are composed of an index number, date and the concentration reading just prior to performing the calibration. The concentration reading can be thought of as the sensor "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 accessed on line 3 and include an index number, date and the relative sensitivity of the sensor, in percent. 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. Span calibrations record the deviation from the reference sensitivity and display it in units of percent. Sensitivity is a measure of the sensor output for a given exposure to gas. More specifically, it is defined as the ratio of the signal output to the gas concentration and is often measured in $\mu\text{A}/\text{ppm}$. During manufacture, the sensitivity of the sensor is recorded and used as a reference. A value of 100% signifies that the sensitivity has not changed from the reference (Example: the sensor calibration is the same at it was when the system was calibrated at the factory). Lower values indicate a decreased sensitivity and, although not typical, higher values indicate increased sensitivity.

Auto-test

Auto-test verifies the serviceability of the transmitter on a prescribed schedule by exposing it to a small amount of gas and verifying a minimum response. Three attempts per test are made, and if the sensor does not respond on the third attempt, a temporary trouble alarm is triggered (may be optionally disabled). A summary of pass, fail and retry counts are maintained in the sensor memory and may be viewed on the *Auto-test History* menu.

The test is performed at a specific time of day and may be scheduled to repeat every 1–14 days. The date and time of the next test is available for editing, and the test may be triggered manually at any time without affecting the preset schedule.

During startup, the transmitter examines the date and time of the next scheduled Auto-test. If the scheduled time and date has past, or if it is scheduled to occur within the next 24 hours, the transmitter moves the date by one day to provide a minimum of 24 hours before the first (or next) test is performed. This is done to allow sensors an additional “settling time” and to avoid confusion to installers during the commissioning period. Set the system clock to local time before scheduling the Auto-test time of day.

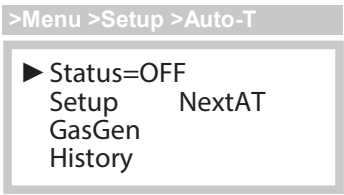
The Auto-test option requires a C18 gas generator that is compatible with the installed sensor’s gas type and full-scale range. For more information, see the table below.

C18 Generator Part No.	Generator Type	Compatible H10 Sensors			
		Sensor Type Range	Part No.	Min. Range	Max. Range
00-1239	Cl ₂	Br ₂	00-1000 00-1001	1 ppm 5 ppm	5 ppm 20 ppm
		Cl ₂	00-1002 00-1003	1 ppm 5 ppm	5 ppm 20 ppm
		ClO ₂	00-1004 00-1005	1 ppm 5 ppm	5 ppm 20 ppm
		F ₂	00-1006 00-1007	1 ppm 5 ppm	5 ppm 20 ppm
		O ₃	00-1008 00-1009	1 ppm 5 ppm	5 ppm 20 ppm
		HF	00-1019	10 ppm	20 ppm
		NO ₂	00-1022	10 ppm	20 ppm
		I ₂	00-1036 00-1037	1 ppm 5 ppm	5 ppm 20 ppm
		Acid Gas	00-1038	10 ppm	20 ppm
00-1240	NH ₃	NH ₃	00-1010	50 ppm	100 ppm
		DMA*	00-1450	100 ppm	100 ppm
00-1241	CO	CO	00-1012	50 ppm	100 ppm
		ETO	00-1039	20 ppm	50 ppm
		HCOH	00-1040	20 ppm	50 ppm
00-1243	H ₂ S	H ₂ S	00-1020	10 ppm	100 ppm
		HCl	00-1017	10 ppm	100 ppm
00-1244	SO ₂	SO ₂	00-1023	10 ppm	20 ppm
		HCN	00-1018	10 ppm	20 ppm

* DMA (Dimethylamine) compatible on one range only.

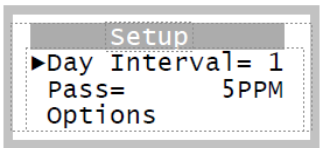
Auto-test Controls Menu

Auto-test is controlled by the *Status* variable that appears on the *Auto-test* menu.

Display	Item	Select to ...
 <p>>Menu >Setup >Auto-T</p> <p>► Status=OFF Setup NextAT GasGen History</p> <p>Figure 44: Auto-test control menu</p>	Status	<p>Change the Auto-test state:</p> <p>OFF – Auto-test does not start automatically.</p> <p>READY – Auto-test occurs on a regularly scheduled basis.</p> <p>START – Runs Auto-test once and returns to the original state. Does not affect the preset schedule.</p> <p>If a generator is not installed, <i>Status</i> is forced <i>OFF</i> and may not be changed to <i>READY</i> or <i>START</i> until one is installed.</p> <p>Setting the <i>Status</i> to <i>START</i> does not begin a manual Auto-test until you return to the <i>Main Display</i> screen. This is designed to permit changes to the setting or other settings before launching the Auto-test sequence.</p>

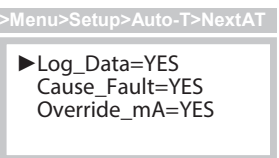
Auto-test Setup Menu

The *Auto-test Setup* menu configures the Auto-test schedule pass threshold and the options for various transmitter indications.

Display	Item	Select to ...
 <p>Figure 45: Auto-test Setup menu</p>	Day Interval	Specify the number of days between automatic tests. The default is 1, and the limit is 1–14 (the exact time of day for testing may be set on the <i>NextAT</i> menu).
	Pass	Specify the amount the gas concentration must increase in order to pass. Prior to starting the test, this amount is added to the “unblanked” gas concentration reading to compute the pass threshold value that appears on the display (see “Auto-test Sequence” on page 44). This value is limited between 5% (default value) and 10% of the sensor range (see <i>Range</i> in “Sensor Setup Variables” on page 33).
	Options	Link to the <i>Auto-test Setup Options</i> menu (below).

Auto-test Setup Options Menu

The *Auto-test Setup Options* menu variables control the behavior of the transmitter during Auto-test.

Display	Item	Select to ...
 <p>Figure 46: Auto-test Setup Options menu</p>	Log_Data	Control values logged during Auto-test. When set to <i>YES</i> (default), the gas concentration (main reading) is logged as usual, including any increase caused by the gas generator. When set to <i>NO</i> , a code is logged that displays as TEST on graphic and tabular report pages and printouts.
	Cause_Fault	Determine if Auto-test failures cause transmitter fault alarms. When set to <i>YES</i> (default), a failure to pass Auto-test after the third attempt causes a fault alarm and forces the 4-20 mA output to the <i>Fault_mA</i> value, regardless of how the test was initiated. When set to <i>NO</i> , Auto-test failures do not cause fault alarms (not recommended).
	Override_mA	Control the 4-20 mA output during Auto-test. When set to <i>YES</i> (default), the 4-20 mA output is fixed at the Auto-test mA value to prevent receiver alarms (see Figure 65 on page 55). When set to <i>NO</i> , the output increases as the gas concentration rises and may cause receiver alarms (not recommended).

Auto-test NextAT Menu

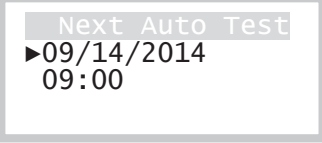
	<p>The date and time of the next scheduled Auto-test appears on the <i>NextAT</i> menu. The time appearing on this page establishes the time of day for all future Auto-tests. After each Auto-test, the date is incremented by the <i>Day_Interval</i> variable on the <i>Auto-test Setup</i> menu.</p> <p>If the variable is set to <i>READY</i>, and the next Auto-test setting is deliberately (or unintentionally) scheduled in the past, an Auto-test is immediately scheduled. This is apparent upon returning to the <i>Auto-test Control</i> menu and seeing the <i>Status</i> variable blinking <i>START</i>. At this point, you may change the control to <i>OFF</i>, change the system clock then change the control back to <i>READY</i>.</p> <p>During startup, the transmitter examines the date and time of the next scheduled Auto-test. If the scheduled time and date has past, or if it is scheduled to occur within the next 24 hours, the transmitter moves the date by one day to provide a minimum of 24 hours before the first (or next) test is performed. Set the system clock to local time before scheduling the Auto-test time of day.</p>
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Figure 47: Auto-test Next AT Menu

Gas Generator Display

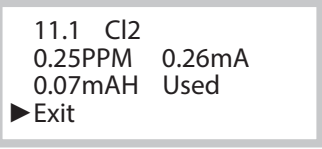
Display	Item	Select to ...
	(line 1)	View the generator gas code and the chemical abbreviation of the gas
	(line 2)	Show the delta-Pass value (described on the <i>Auto-test Setup</i> menu) and the amount of current required generate that particular concentration.
	(line 3)	Display the mAH consumption of the generator.
	(line 4)	Return to the display to the previous menu.

Figure 48: Gas generator display

Auto-test History Menu

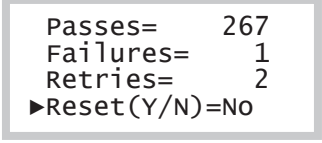
	<p>The <i>Auto-test History</i> menu provides a summary of passes, failures and retries that are maintained in the sensor memory. Since three attempts are made, there are always two retries before a failure is recorded. The total number of tests is the sum of the passes and failures, and the number of gas generations is the sum of all three values.</p> <p>The Reset function permits all counts to be zeroed. This is done by selecting Reset, and scrolling the value to <i>YES</i>. Clearing the counts is not recommended, since this information can prove useful over the lifetime of the sensor.</p>
---	---

Figure 49: Auto-test history menu

Auto-test Sequence

When the Auto-test starts (automatically or manually), alarms are inhibited and by default, the loop is fixed at 4 mA (see "Auto-test Setup Options Menu" on page 42 and "4-20 mA Output Menus" on page 55). The transmitter then steps through a series of displays representing the test sequence.

Alarm relays are inhibited during Auto-test and for up to 10 minutes afterwards during the recovery period. If a gas leak occurs during the recover period, alarm inhibit is cancelled and reverts to normal operation. A gas leak is presumed when the concentration rises to 50% of the full-scale range or higher.

While the alarms are inhibited during Auto-test, the 4-20 mA output is usually at a fixed level (*Override_mA=YES*). The output override may be disabled by setting *Override_mA=NO*, however, steps should be taken to disable receiver alarms in the control room.

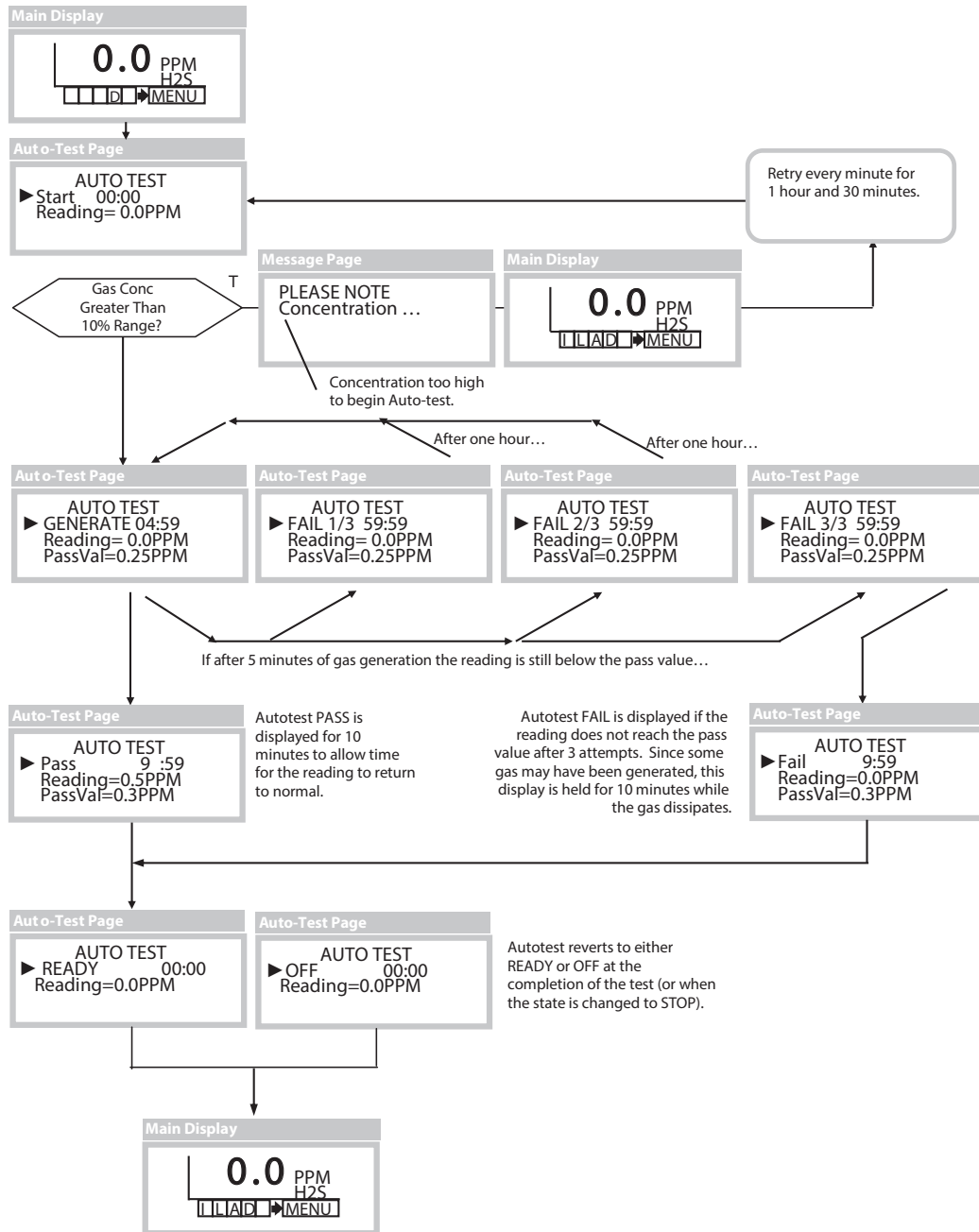


Figure 50: Auto-test status display sequence

ALARMS AND RELAYS

Three gas concentration alarms and one fault alarm are standard in the D12 transmitter. Alarm status flags appear on the *Main Display*, and *Status* is available over the optional serial interface. Alarms may be assigned to activate one or more of three optional relays (see *"Alarm Relays"* on page 52).

Gas Concentration Alarms

The gas alarms are labeled Caution, Warning and Alarm, and although not strictly enforced, Alarm usually has the highest priority, followed by Warning and Caution. *Figure 51* depicts the default relationship between each alarm.

For toxic gas sensors, Alarm is a high-high alarm and the default setting for Alarm is normally 2 or 3 times higher than the TLV (threshold limit value) of the target gas. The Warning alarm is a high alarm and normally set to the TLV. Caution is a low alarm and set to activate on negative drift of -10% of the sensor range (a trouble alarm occurs if the reading drifts to -20% of the sensor range).

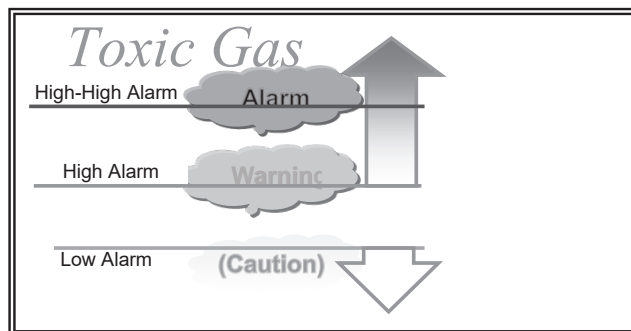


Figure 51: Toxic gas alarms

For oxygen sensors, Alarm is a low-low alarm set to 16%, Warning is a low alarm set to 19.5%, and Caution is a high alarm set to 23%. *Figure 52* depicts the relationships of these alarms.

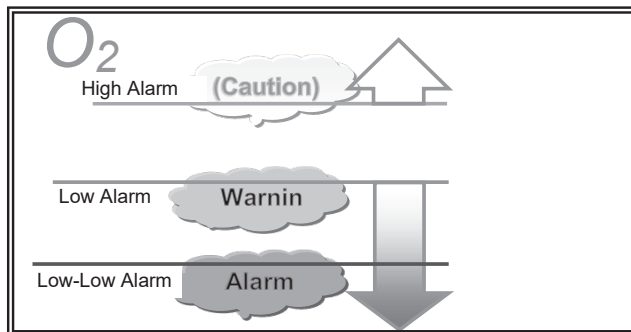


Figure 52: Oxygen deficiency alarms

Manual Alarm Reset

	<p>Alarms programmed for manual reset (see below) are held active, or latched, even after alarm conditions have subsided and are reset by selecting the respective flag (A,W or C) on the <i>Main Display</i> screen. The <i>Alarm Reset</i> screen appears and displays the date and time of the alarm. If alarm conditions have subsided, you may reset just the selected alarm (<i>Reset</i>) or all alarms (<i>ResetAll</i>). Refer to the <i>"Inhibiting Alarms"</i> on page 54.</p>
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Figure 53: Manual alarm reset

Remote Reset

Activating the "Remote Reset" input resets all latched alarms, but only if the respective alarm conditions have subsided. See *Figure 8* on page 14.

Gas Alarm Operation

Figure 54 illustrates relationships between variables associated with a rising gas alarm, how they function in the presence of a gas leak, and recovery.

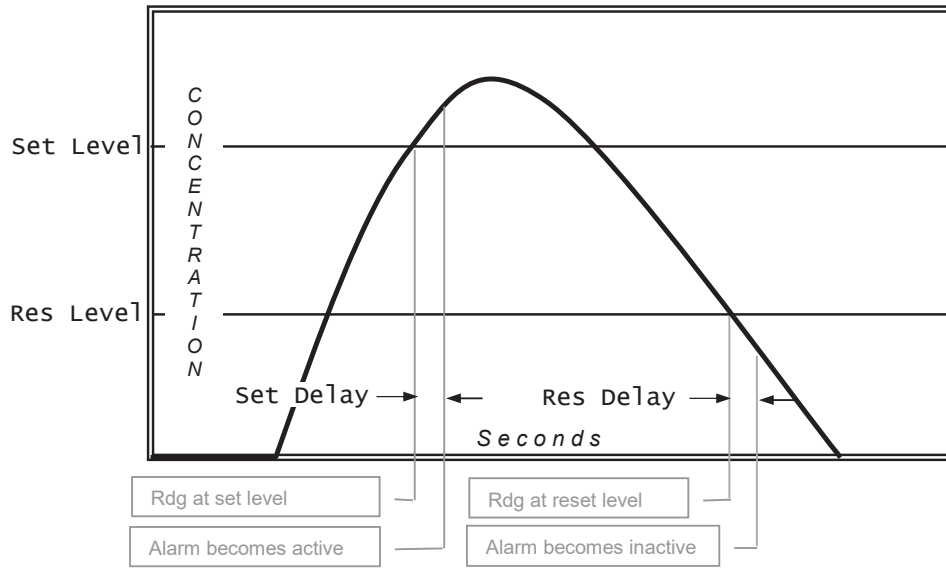


Figure 54: Rising alarm (Active=ABOVE SP, Reset=AUTO)

Figure 55 illustrates relationships between variables associated with a falling gas alarm (such as for oxygen deficiency), how they function in the presence of a gas displacement, and recovery..

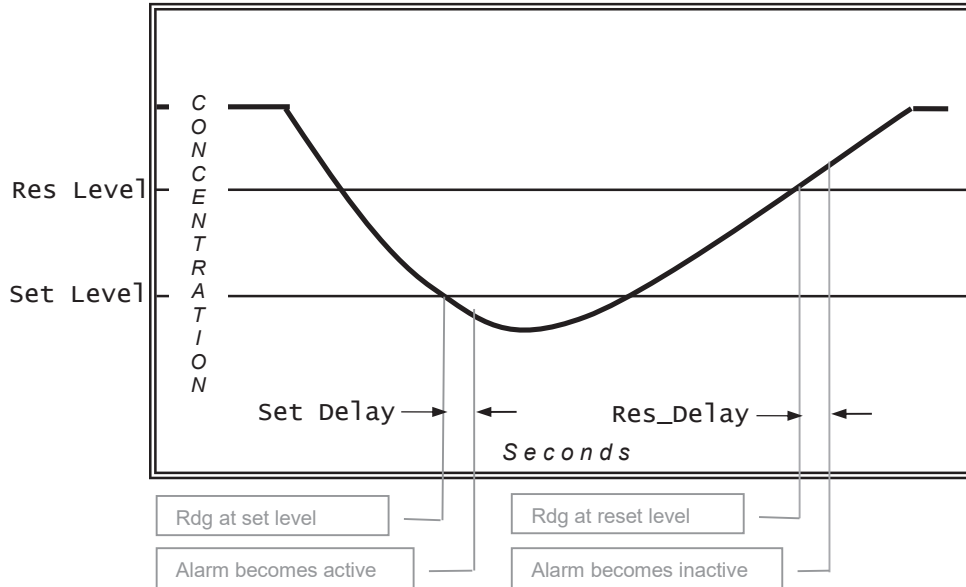


Figure 55: Falling alarm (Active=BELOW SP, Reset=AUTO)

Gas Alarm Setup

Variables for the gas alarms are configured on the respective menus as shown in *Figure 56*. Refer to the table below for alarm variable descriptions.

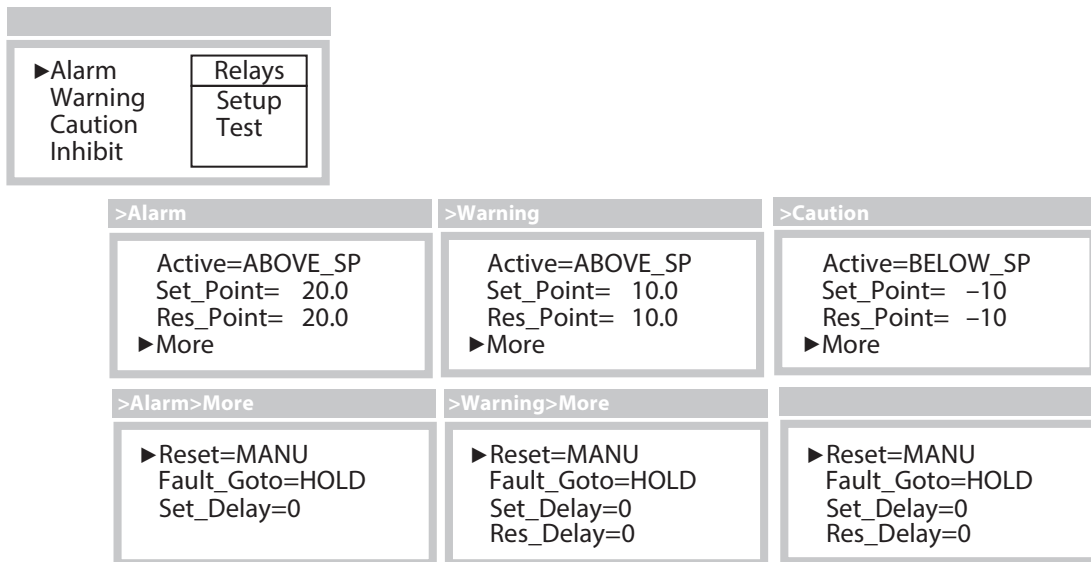
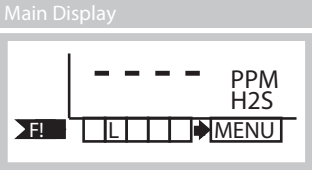
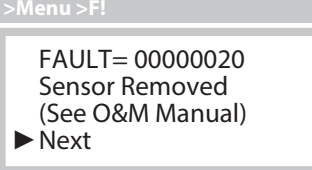


Figure 56: Alarm setup menus

Variable	Select to...
Active	Specify the region of concentration where the alarm is active. When set to <i>ABOVE_SP</i> , the alarm becomes active at and above the set point (referred to as a rising alarm). When set to <i>BELOW_SP</i> , the alarm becomes active at and below the set point (referred to as a falling alarm). Setting the value to <i>DISABLED</i> permanently deactivates the alarm. The variable setting is stored in the sensor memory.
Set_Point	Define the concentration level that the alarm becomes active. The alarm becomes active immediately if the <i>Set Delay</i> variable is 0, otherwise, it becomes active at the expiration of the set delay period. NOTE: When the <i>Set Point</i> variable is reprogrammed, the <i>Reset Point</i> variable is also reprogrammed to the same value.
Res_Point	The <i>Res_Point</i> variable defines the concentration level that the alarm becomes inactive. Once the alarm is active, it remains active until the concentration level reaches the reset point. The alarm then becomes inactive immediately if the <i>Set Delay</i> variable is 0, otherwise, the alarm becomes inactive at the expiration of the reset delay period (only if the <i>Reset</i> variable is programmed as AUTO). The limits for the reset point are defined below. Active= <i>ABOVE_SP</i> <ul style="list-style-type: none"> Upper limit = current set point value Lower limit = lowest set point value Active= <i>BELOW_SP</i> <ul style="list-style-type: none"> Upper limit = highest set point value Lower limit = current set point value NOTE: When the set point is reprogrammed, the <i>Reset Point</i> variable is reprogrammed to the same value.

Variable	Select to...
Reset	<p>Define how the alarm is permitted to transition from active to inactive. When the variable is set to <i>AUTO</i>, the alarm transitions without operator intervention as soon as conditions permit (concentration reaches the reset point and the reset delay period expires). When the variable is set to <i>MANU</i>, the alarm conditions must have subsided, and an operator must acknowledge the alarm manually, either through the operator interface, the serial interface or through the remote reset (see "Electrical Connections" on page 13).</p> <p>NOTE: <i>Reset Delay</i> variable is operational for <i>AUTO</i> only. Setting the <i>Reset</i> variable to <i>MANU</i> suppresses display of the <i>Reset Delay</i> variable.</p>
Fault_Goto	<p>Specify alarm behavior during transmitter faults and overrides all other alarm settings. If the fault alarm should become active, you may program the concentration alarm to behave in one of three ways:</p> <ul style="list-style-type: none"> • HOLD – the transmitter attempts to hold the alarm in its current state. If the alarm is active, it remains active. If the alarm is inactive, it is inhibited from becoming active until after the fault is cleared. • SET – activates the alarm immediately (the set delay period is ignored). This feature permits the alarm to signal both concentration and fault conditions. • RESET – deactivates the alarm immediately (the reset delay period is ignored).
Set_Delay	<p>Configure the amount of time in seconds that the concentration must be in the alarm active region before becoming active. It may be used to avoid triggering alarms on relatively short gas exposures. Also, it may be used to help prevent alarm relay chattering when the concentration level is varying between the set point and reset point. The variable may be programmed between 0 (default) and 10 seconds.</p>
Res_Delay	<p>Display the <i>Reset Delay</i> variable when the <i>Reset</i> variable is set to <i>AUTO</i>. It is used to configure the amount of time in seconds that the concentration must be in the alarm inactive region before becoming inactive. Like the <i>Set Delay</i> variable, it may be used to help prevent alarm relay chattering and is preferred over using set delay. The variable may be programmed between 0 (default) and 2 hours (7200 seconds).</p>

Fault Alarms

 <p>Figure 57: Fault alarm (main display)</p>	<p>When a fault alarm occurs, the <i>Main Display</i> appears as shown in Figure 57. By default, new alarms are inhibited and active alarms are held so that relays controlling lights, sirens and fans may continue to operate (this behavior may be modified on the <i>Alarms Setup</i> menus). Faults are permitted to clear automatically and without operator intervention, if they do not persist.</p>
 <p>Figure 58: Fault menu</p>	<p>Selecting the fault alarm flag causes the transmitter to display the fault code on line 1 and a description of the problem(s) on line 2. Selecting <i>Next</i> causes line 2 to display the next fault, if any exists.</p>

Corrective Actions

Transmitter faults may be caused by improper wiring, ground loops, power supply sizing, current loop receivers and other external factors.

1. At power on, transmitters can demand 2 or 3 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 using switch SW5 on the CPU board.
2. Check that each transmitter has the proper supply voltage at TB1 on its power supply board. The D12 transmitter requires at least 12V in all wiring modes.
3. When troubleshooting, it is permissible to temporarily swap sensors, generators and board stacks with other transmitters. When finished, you **MUST RE-VERIFY** all transmitter settings, especially sensor, alarm and 4-20 mA settings. Note that swapping components may result in losing datalog records, since the log is dependent on sensor part numbers and the full-scale range.

Fault Messages

This table describes the fault messages and lists the corrective actions.

Fault	Description	Corrective Action(s)
ADC0 Read Error	The analog-to-digital converter channel assigned to the sensor's gas concentration output signal has failed or is out of range.	<ul style="list-style-type: none"> • Cycle power off and on • Replace sensor • Replace upper stack • Replace full stack
LCD Busy Error	The LCD driver chip cannot recover from an internal error.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace full stack
SPI Bus Error	Serial peripheral interface bus has faulted.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace full stack
ADC1 Read Error	The analog-to-digital converter channel assigned to the sensor's temperature output signal has failed or is out of range.	<ul style="list-style-type: none"> • Cycle power off and on • Replace sensor • Replace upper stack • Replace full stack
Sensor (-) Range	The sensor has drifted -20% range (below zero).	<ul style="list-style-type: none"> • Zero sensor • Replace sensor
Sensor Removed	The sensor cannot be detected.	<ul style="list-style-type: none"> • Reinstall sensor • Cycle power off and on • Replace sensor • Replace upper stack • Replace full stack
Sensor Mem Error	One or more configuration settings in the sensor memory do not pass checksum test.	<ul style="list-style-type: none"> • Cycle power off and on • Replace sensor • Replace upper stack • Replace full stack
Sensor Cfg Error	One or more sensor configuration settings are outside of their expected range.	<ul style="list-style-type: none"> • Cycle power off and on • Replace sensor • Replace upper stack • Replace full stack
Gas Gen Removed	The generator cannot be detected.	<ul style="list-style-type: none"> • Install generator • Cycle power off and on • Replace generator • Replace sensor • Replace upper stack • Replace full stack
Gen Incompatible	The gas generator is not compatible with the installed sensor type or range.	<ul style="list-style-type: none"> • Replace generator • Change sensor range • Replace sensor • Replace upper stack • Replace full stack
System Mem Error	A checksum error has been detected in the system setup memory.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace full stack
Alarm Mem Error	A checksum error has been detected in the alarm setup memory.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace full stack
Operator Mem Error	A checksum error has been detected in the operator setup memory.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace full stack

Fault	Description	Corrective Action(s)
HART Mem Error	A checksum error has been detected in the HART setup memory.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace full stack
Auto-test Failed	Auto-test failed after 3 attempts.	<ul style="list-style-type: none"> • Replace generator • Replace sensor • Replace upper stack • Replace full stack
Use 3-Wire Power	Relay option jumper is installed, but transmitter is powered from loop (2-wire).	<ul style="list-style-type: none"> • If relays are not used, remove jumper. • Re-wire transmitter in 3- or 4- wire mode. • Replace upper stack • Replace full stack
Stack Overflow	An internal error occurred in the CPU.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace the full stack
Factory Cal Err	An error has been detected in the factory calibration memory.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack
UNCALIBRATED	This appears on the <i>Main Display</i> , in place of the gas name, when the transmitter has not been factory calibrated or the calibration memory has become corrupted.	<ul style="list-style-type: none"> • Cycle power off and on • Replace upper stack • Replace the full stack
Fault Alarm Test	This is not a real fault. This occurs when the fault alarm is being tested locally, or remotely.	

Alarm Relays

The D12 transmitter provides three optional SPDT mechanical relays rated for 5 amps, non-inductive loads at 250V AC. These relays 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 is assigned to one of the four alarms and may be programmed as normally energized (failsafe) or normally de-energized. A normally energized relay has electrical continuity between its C and NO contacts (while the transmitter is powered on) and is open between its C and NC contacts. Conversely, a normally de-energized relay has continuity between its C and NC contacts and is open between its C and NO contacts. *Figure 59* illustrates the function of alarm and relay variables on the operation of the relays.

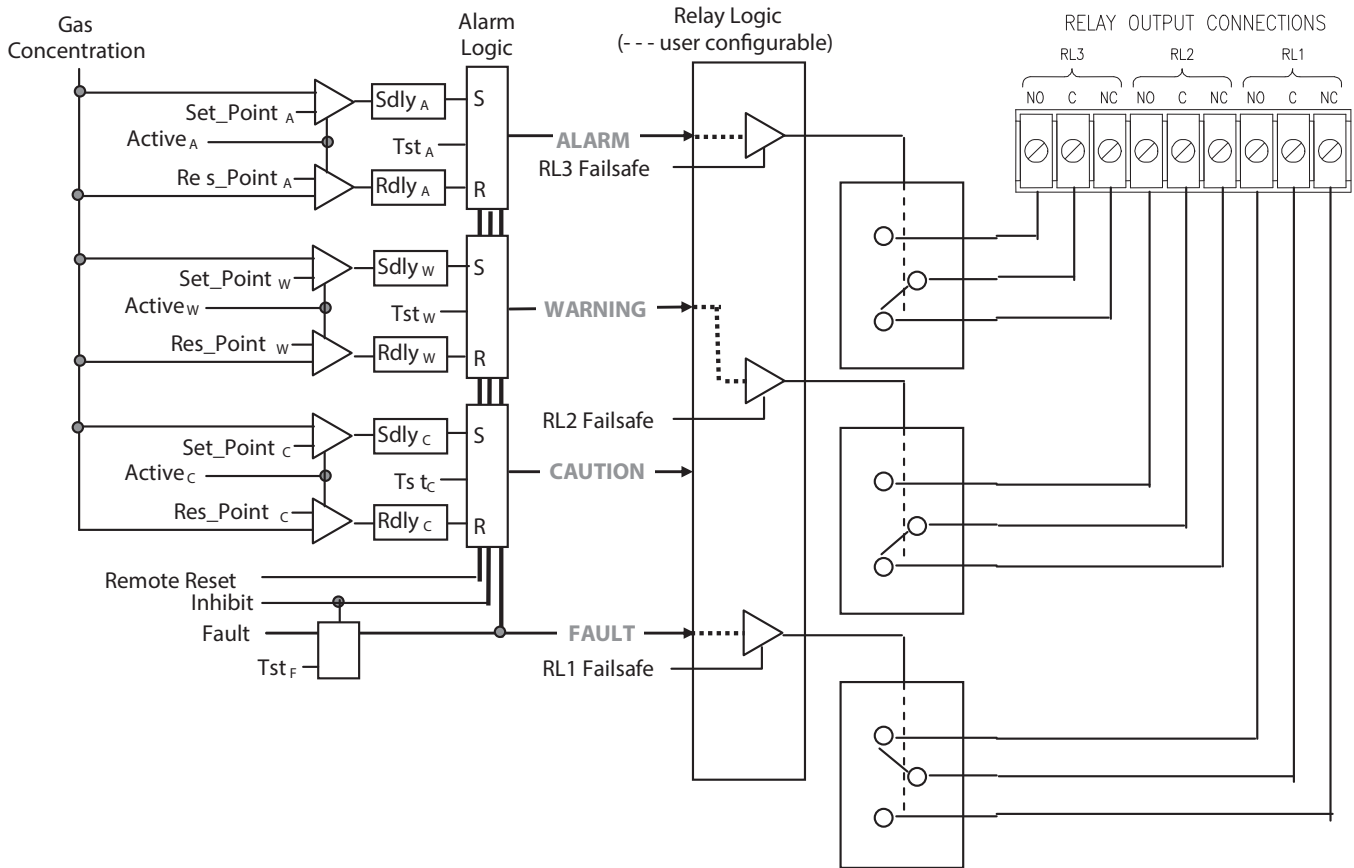


Figure 59: Alarm relay schematic (default – no alarms active)

Relays Setup

>Menu >Setup >Alarms

Alarm	Relays
Warning	▶ Setup
Caution	Test
Inhibit	

>Setup

Rly Alarm Normal	
RL1	▶ Fault On
RL2	Warning Off
RL3	Alarm Off

Relays are configured in the *Relays Setup* menu. Select the alarm trigger source (*Alarm, Warning, Caution* or *Fault*) and the failsafe property (*Normal-On* or *Normal-Off*).

Figure 60: Relay setup menu

Testing Alarm Relays

Relays are tested by triggering (simulating) their assigned alarms on the *Relay Test* menu. To trigger an alarm, scroll the *Select* variable up and down until an *X* appears below the letter representing the alarm. Save the selection by touching **Enter** and moving the cursor to the function labeled "Start".

CAUTION

DEVICES WIRED TO THE RELAYS MAY ACTIVATE WHEN START IS SELECTED. BE SURE TO INFORM PROPER PERSONNEL BEFORE PERFORMING THE TEST.

When ready, select **Start** to begin the test. "Start" message is automatically replaced by "Any key to Stop" message and touching any key ends the test.

Relay Test Page

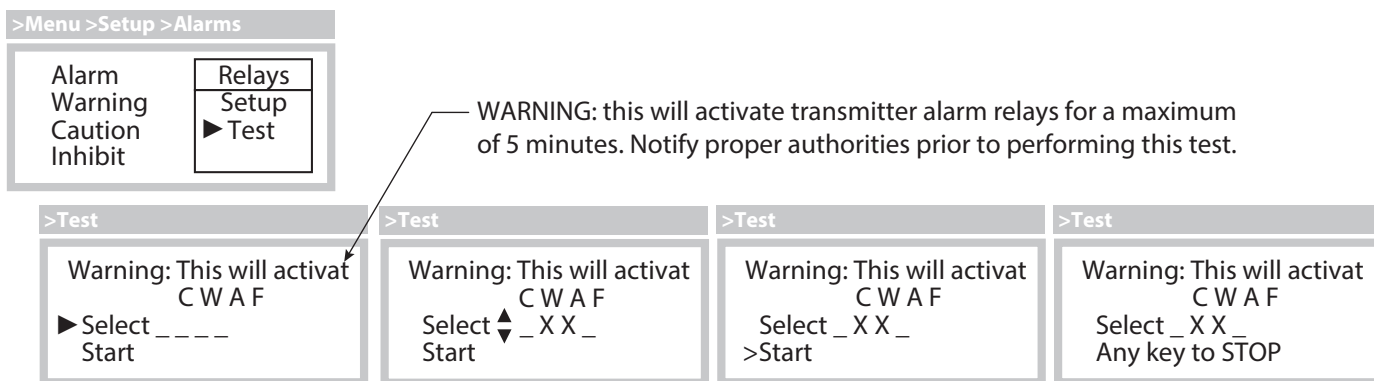


Figure 61: Example of relay test menu

Inhibiting Alarms

Alarms should be inhibited to prevent false activation (for example, just prior to “bump-testing” the sensor).

The most convenient method for temporarily inhibiting alarms is from the *Main Display*. Hold the magnet over the **Esc** key for 2 seconds and remove it. This toggles the *Alarm Inhibit* mode *On* for 15 minutes and clears and inhibits alarms; holds the current loop at 4 mA (17.4 mA for oxygen sensors); and causes the “I” and “L” status indicators to appear. Repeat the procedure to toggle the *Alarm Inhibit* mode *Off* immediately, restore the current loop to normal operation, and clear the “I” and “L” status indicators. Both the inhibit duration and loop output are programmable and may be accessed on the *Alarm Inhibit* menu (refer to [Figure 63](#)).

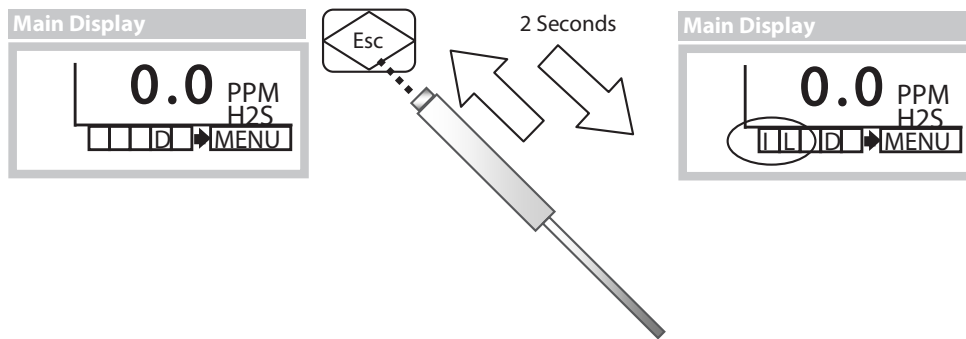


Figure 62: Inhibiting alarms from the main menu

Alarm Inhibit Menu

Variables and controls associated with the *Alarm Inhibit* mode are accessible on the *Alarm Inhibit Setup* menu.

Display	Variable	Description
<div style="border: 1px solid black; padding: 5px;"> ▶Inhibit mA= 4.0 Duration= 15:00(mm:ss) Start </div> <p>Figure 63: Alarm inhibit menu</p>	Inhibit_mA	The <i>Inhibit_mA</i> variable is output on the current loop during alarm inhibit. It ranges from 3.5–22.0 mA (this is the same value that appears on the <i>4-20 mA Setup</i> menu).
	Inhibit_Time	Alarm Inhibit Off: The <i>Inhibit_Time</i> variable is the duration of the alarm inhibit mode and is programmable from 00:00–99:59 (mm:ss). Alarm Inhibit On: The variable counts down from its programmed duration. Selecting it temporarily freezes the count and permits it to be scrolled up and down. If <i>Enter</i> is touched, counting resumes from the new value. If <i>Esc</i> is touched, counting resumes at the previous value. These changes are temporary and are not saved as the programmed value.
	Start (Stop)	The Start function turns on alarm inhibit, which clears and inhibits alarms, holds the current loop at 4 mA (17.4 mA for oxygen sensors), causes the “I” and “L” status indicators to appear and starts the <i>Inhibit_Time</i> variable to begin ticking down. The label then changes to “Stop.” Selecting it again turns off alarm inhibit, restores the current loop to normal operation, clears the “I” and “L” status indicators and restores the <i>Inhibit_Time</i> variable to its programmed value.

4-20 MA OUTPUT MENUS

The 4-20 mA output normally sources positive current to a receiver, proportional to the main reading. The output is 4 mA at zero and rises to 20 mA at the full-scale range (see *Range* variable in *Sensor Setup* menu) and may go as high as 24 mA (125% Range) in case of gas flooding. Since the reading is blanked below zero, the output should never go below 4 mA in the course of normal operation.

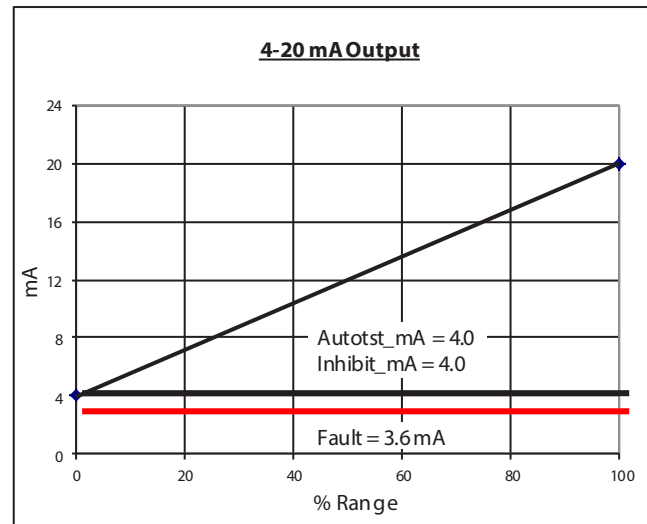


Figure 64: Current loop output plot

4-20 mA Menu

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

Display	Variable	Description
<pre>>Menu >Setup >4-20mA ▶ Autotst_mA = 4.0 Inhibit_mA = 4.0 Fault_mA = 3.6 More</pre> <p>Figure 65: 4-20 mA menu</p>	Autotst_mA	The <i>Autotst_mA</i> variable is the mA value output during <i>Auto-test</i> mode – to prevent false alarms at the receiver. The default is 4.0 mA (17.4 mA for oxygen sensors) and is limited between 3.5–22.0 mA.
	Inhibit_mA	The <i>Inhibit_mA</i> variable is the mA value output during the <i>Alarm Inhibit</i> mode – to prevent false alarms at the receiver. The default is 4.0 mA (17.4 mA for oxygen sensors) and is limited between 3.5–22.0 mA.
	Fault_mA	The <i>Fault_mA</i> variable is the mA value output during Fault alarms. The default is 3.6 mA and is limited between 3.5–22.0 mA. The value should be recognized as a fault by the loop receiver.
	More	More is a link to the 4-20 mA Control menu.

4-20 mA Control Menu

The 4-20 mA Control menu permits adjustment of the analog output and provides a method for manually forcing it to a fixed value to overcome leakages, verify linearity or test receiver alarms.

Display	Variable	Description
<pre>▶ Adjust 4mA Adjust 20mA Force = 4.0mA</pre> <p>Figure 66: 4-20 mA control page</p>	Adjust_4mA	The <i>Adjust_4mA</i> variable is used to adjust the 4.0 mA level on the 4-20 mA output.
	Adjust_20mA	The <i>Adjust_20mA</i> variable is used to adjust the 20.0 mA level on the 4-20 mA output.
	Force	The <i>Force</i> variable is used to force the 4-20 mA output to a fixed value. While the variable is not selected, the displayed value is updated to show the real-time output level. The loop is fixed at the instant the variable is selected, and the value may be scrolled up and down as desired, between 3.5–22.0 mA.

4-20 mA Loop 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 across the mA(+) and mA(-) terminals for TB1 on the transmitter's power supply board or by reading the display of a calibrated current loop receiver.

* Digital-to-Analog Converter value ranging from 0–1023 (10-bits). Adjustment is performed at the factory so values will vary from transmitter to transmitter. This range may increase on future versions.

⚠ WARNING

DISABLE CURRENT LOOP RECEIVER ALARMS BEFORE PROCEEDING.

Display	Description
	<p>Select Adjust_4mA or Adjust_20mA and observe these displays. Select DAC_Value and scroll the displayed value up and down to achieve the desired output level. Touch Enter to save or Esc to exit without saving.</p> <p>NOTE: Monitor the 4-20 while slowly adjusting the <i>DAC_Value</i>.</p>

Figure 67: Loop adjustment menu

DATALOG MENUS

The D12 transmitter datalog records gas concentrations in one of 12 discrete intervals ranging from 1–60 minutes, providing data from 11–474 days. The table below details sampling intervals and the associated metrics.

Datalog Sampling Metrics Table

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 datalog memory is filled, new records overwrite older ones.

DataLog Access Menu

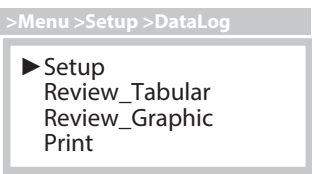
	<p>The <i>DataLog Access</i> menu provides links to setup, review and print menus. Refer to the following menus.</p>
---	--

Figure 68: DataLog access menu

DataLog Setup Menu

Settings on the *DataLog Setup* menu select one of the 12 discrete sampling intervals listed in the "*Datalog Sampling Metrics Table*" on page 57, and control starting, stopping and clearing of the datalog.

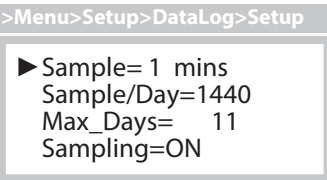
Display	Item	Select to ...
	Sample Sample/Day Max_Days	Set the sampling interval to one of the 12 values listed in the " <i>Datalog Sampling Metrics Table</i> ". Changing one automatically changes the other two. NOTE: Changing the sampling interval clears the datalog.
	Sample Sample/Day Max_Days	Control data recording, which starts when set to <i>ON</i> and stops when set to <i>OFF</i> . The datalog is cleared when set to <i>CLR</i> , after which the control is returned to its previous value (<i>ON</i> or <i>OFF</i>).

Figure 69: DataLog Setup menu

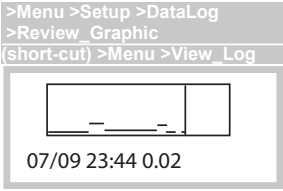
Data may be displayed on the LCD graphically or in a tabular report format. Data may also be output to either a terminal, terminal program or serial printer. Date formats are configurable as *MM/DD* or *DDMMM* (see "*Clock Menu*" on page 60), and samples are displayed in the concentration units shown on the *Main Display* screen.

In place of numeric data samples, a report may display special text to indicate samples were either unavailable, not yet sampled or some condition prevented sampling.

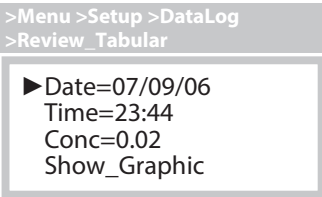
DataLog Special Codes Table

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, see "Auto-test Setup Options Menu" on page 42)
****	Data is corrupted or unreliable

DataLog Graphic Report Screen

Display	Description
 <p>Figure 70: DataLog graphic report</p>	<p>The <i>DataLog Graphic Report</i> screen plots samples on the LCD from left to right, where older samples are on the left and newer samples are to the right. Touching the Up and Down arrow keys moves the vertical cursor line right and left, respectively, while updating the date, time and sample data text on the bottom line.</p> <p>Upon entry, the cursor is parked at the most recent sample. Moving the cursor left displays the date, time and values of earlier samples (moving it right displays "--", not sampled yet). Touching the Enter key switches to the <i>Tabular Report</i> menu (see Figure 71), and touching the Esc key returns to the <i>DataLog Menu</i>. Data is not plotted while viewing the page.</p>

DataLog Review Tabular View Menu

Display	Description
 <p>Figure 71: DataLog tabular view menu</p>	<p>The <i>DataLog Review Tabular View</i> menu displays samples in the text field labeled "Conc" (gas concentration) and provides direct access to data by scrolling to an exact date and time.</p> <p>Upon entry, the <i>Date</i>, <i>Time</i> and <i>Conc</i> variables are set to the most recent sample. Scrolling the <i>Time</i> variable up increments it by the sampling interval, and causes the next successive sample to be displayed at <i>Conc</i>. Scrolling the <i>Time</i> variable down displays the previous sample time and value. Scrolling <i>Time</i> up and down causes a date rollover at midnight. Scrolling the <i>Date</i> variable up increments it by one day while holding the <i>Time</i> variable fixed. This is an expedient method to access specific data and is useful for examining samples recorded at the time of day.</p> <p>Once the date and time are set, select Show_Graphic to switch to the <i>Graphic Report</i> screen. Data is not updated while viewing the page.</p>

DataLog Print Menu

Datalog reports may be sent to serial printer, terminal or terminal emulation program, such as Microsoft Hyperterminal®. Refer to ["Appendix A" on page 72](#) for details on how to setup and print reports.

Date	Time	S0	S1	S2	S3
07/09/06	22:40	0.01	0.00	0.02	0.01
07/09/06	22:44	-0.0	0.00	0.00	-0.0
07/09/06	22:48	0.01	TEST	TEST	TEST
07/09/06	22:52	TEST	TEST	TEST	TEST
07/09/06	22:56	TEST	TEST	TEST	TEST
07/09/06	23:00	0.07	0.06	0.07	0.06
07/09/06	23:04	0.06	0.05	0.06	0.06
07/09/06	23:08	0.05	0.05	0.04	0.05
07/09/06	23:12	0.06	0.05	0.05	0.04
07/09/06	23:16	0.01	0.01	0.01	0.00
07/09/06	23:20	0.00	0.00	0.00	-0.0
07/09/06	23:24	-0.0	0.00	0.00	0.00
07/09/06	23:28	----	----	----	----
07/09/06	23:32	----	----	----	----
07/09/06	23:36	----	----	----	----
07/09/06	23:40	FFFF	FFFF	0.02	0.02

Figure 72: DataLog printout (example)

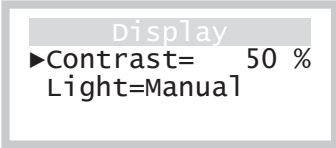
DISPLAY MENU

The D12 transmitter features a backlit, 96 × 32 inch graphics LCD.

NOTE: Backlighting operates in 3- or 4-wire mode only ("[External Connections](#)" on page 15).

Display Menu

The transmitter features a backlit 96 W × 32 H graphics LCD. The display menu is used to control the display contrast and manage the backlight.

Display	Item	Select to ...
 <p>Figure 73: Display menu</p>	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 0–100%.
	Light	Control when the LCD backlight is turned on and off: MANUAL On when any key is pressed Off when no key pressed for 5 minutes AUTO On when any key is pressed or alarm is active Off when no key pressed for 5 minutes, and no alarms active NEVER ON Off permanently ALWAYS ON On permanently (not recommended)

SYSTEM MENUS

System menus are used to access and configure the internal clock, security, reset functions, communication protocols and version information.

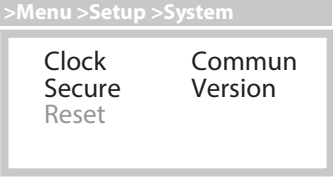
Display	Variable	Select to ...
 <p>>Menu >Setup >System</p> <p>Clock Commun Secure Version Reset</p>	Clock	Set or update the transmitter's real-time-clock.
	Secure	Protect the configuration using a 4-digit, numeric password from 0000–9999.
	Reset *	Restart the transmitter or change all user settings to default values.
	Commun	Configure the protocol and settings of the physical communication interface.
	Version	Display transmitter and sensor version information.

Figure 74: System menu

* The Reset link has been removed on transmitters beginning with Version 2.23.

Clock Menu

The *Clock* menu is used to set the transmitter's real-time clock, which is recorded during sensor calibration and datalogging, and is used to trigger Auto-test starts.

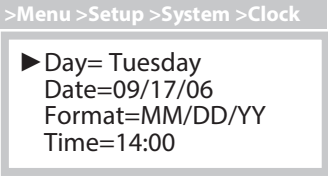
Display	Variable	Select to ...
 <p>>Menu >Setup >System >Clock</p> <p>► Day= Tuesday Date=09/17/06 Format=MM/DD/YY Time=14:00</p>	Day	Change the day of the week: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday
	Date	Configure the month, date, and year, in the format specified by the <i>Format</i> setting. Built-in support for leap year.
	Format	Select the date format: MM/DD/YY, example: 09/20/14 DDMMYY, example: 20Sep14
	Time	Change the time of day (24-hour format, 00:00 to 23:59)

Figure 75: Clock menu

Security Menu

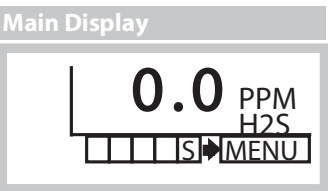
 <p>Main Display</p> <p>0.0 PPM H2S</p> <p>■■■■ S ■■■■ MENU</p>	The transmitter protects its configuration using a 4-digit, numeric password, from 0000–9999. When security is active, the "S" status indicator appears on the <i>Main Display</i> . Variables may be read but not modified, and functions do not execute, including the sensor verification function during startup review.
--	--

Figure 76: Security menu

Security Control Menu

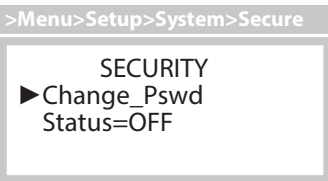
 <p>>Menu>Setup>System>Secure</p> <p>SECURITY ► Change_Pswd Status=OFF</p>	Security is <i>OFF</i> by default and may be toggled <i>ON</i> and <i>OFF</i> by entering the 4-digit password.
---	---

Figure 77: Security control menu

Activating Security

Select the **Status** variable on the *Security Control* menu, which doubles as a link to the *Password Entry Page* menu. When the menu appears, select **Enter Pswd**, scroll to the password value (0 by default), and touch **Enter**. If successful, "PASS" appears briefly and you are returned to the *Security Control* menu where the *Status* variable is set to ON. If not successful, "FAIL" appears and *Status* remains OFF.

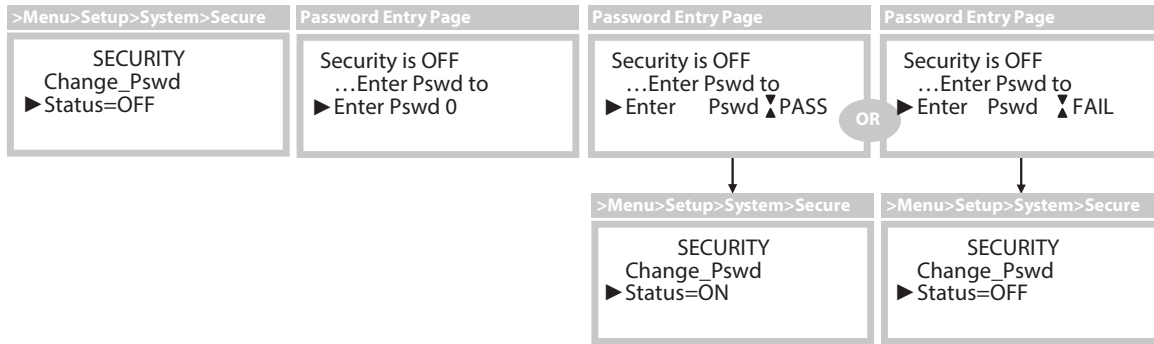


Figure 78: Activating security

Deactivating Security

The procedure to deactivate security is identical to that used for activating it. If successful, the transmitter presents an option to automatically reactivate it after a timed interval.

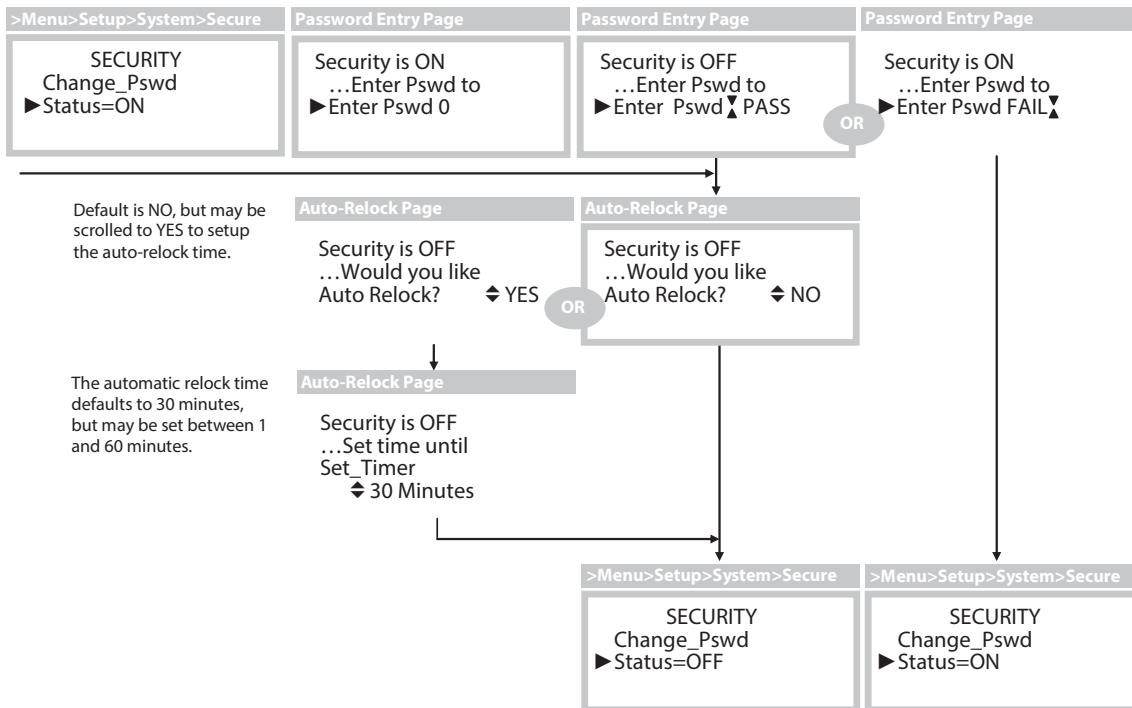


Figure 79: Deactivating security

Changing the Password

The security code is changed by selecting **Change_Pswd** from the *Security Control* menu. See [Figure 80](#).

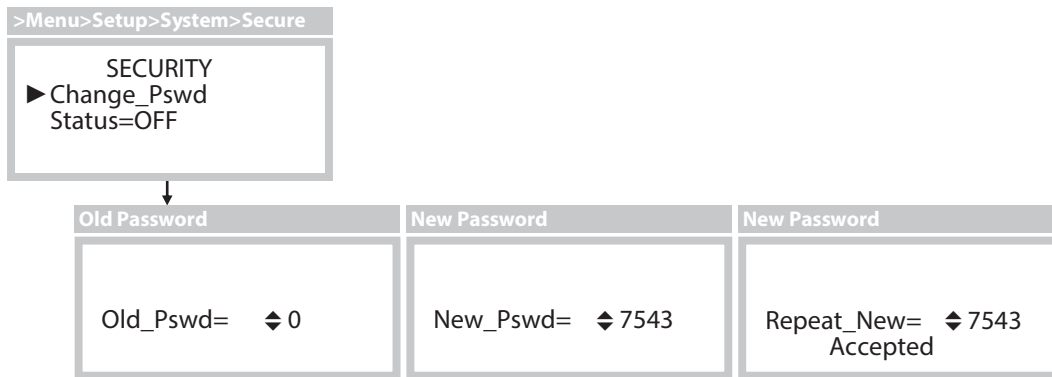


Figure 80: Changing the password

Communication (COM) Menus and Settings

The D12 transmitter supports ASCII, HART and Modbus communications that are configured through the *COM* menu.

NOTE: ASCII is the default protocol if neither the HART or Modbus option is ordered.

COM Setup Menu

The *COM Setup* menu is used to select the protocol and configure the transmitter's connection settings.

Display	Variable	Select to ...
Menu>Setup>System>Commun ▶Protocol=None	Protocol	Change the slave protocol. <ul style="list-style-type: none"> • None • ASCII (default) • Modbus (option) • HART (option)
Menu>Setup>System>Commun ▶Protocol=ASCII Interface=RS232 Baud Rate=9600 Parameters=N, 8, 1		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.
Menu>Setup>System>Commun ▶Protocol=HART Interface=FSK Baud Rate=1200 Parameters=0, 8, 1	Interface	Change the physical communication interface that the transmitter controls during transmit and receive functions: <ul style="list-style-type: none"> • RS232 (available for ASCII or Modbus, not for HART) • RS485 (available for ASCII or Modbus, not for HART) • MODEM (FSK) (available for HART only)
Menu>Setup>System>Commun ▶Protocol=Modbus Interface=RS485 Baud Rate=9600 Parameters=N, 8, 1		The transmitter must be wired in accordance with this selection. See "External Connections" on page 15 .
	Baud Rate	Change the baud rate of the transmitter's UART. May be set to: 300, 600, 1200, 2400, 4800, 9600, 14.4 k or 28.8 k The value is fixed at 1200 for HART protocol and defaults to 9600 for ASCII and Modbus.
	Parameters	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 ASCII and Modbus.

Figure 81: COM Setup menu

ASCII

ASCII is used for sending the datalog to a serial printer, terminal or terminal program using RS232 (RS485 might be used under certain conditions). Handshaking is XON/XOFF only, and the *COM Setup* menu is used to configure the interface, baud rate and parameters. See ["Computer RS232" on page 24](#) for connection details. There are no additional pages for protocol variables.

HART

HART is a master/slave protocol that supports 1 or 2 masters, and up to 15 slave devices. Devices communicate digitally at an effective rate of 1200 baud by modulating the 4-20 mA loop. Modulation is performed by a modem that conforms to the BELL 202 standard, which uses FSK (frequency shift keying), where 1200 Hz represents a logic 1, and 2200 Hz represents logic 0, and does not affect the loop's DC level. Connections are typically point-to-point, which enables bi-directional digital communication and preserves the transmitter's analog output signal. Up to 15 devices may be connected in a multi-drop configuration for digital communication but requires each device to fix its output at 4 mA. See HART Transmitter connection examples beginning on [page 20](#) or consult the HART Foundation (fieldcommgroup.org) for details on how to connect a HART transmitter.

HART Menu

When the HART protocol driver is installed, a link to the *HART Setup* menu appears on the *Main Setup* menu. See [Figure 82](#).

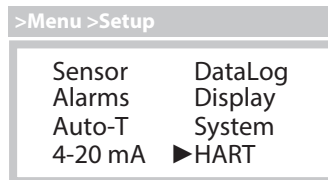


Figure 82: Main setup menu

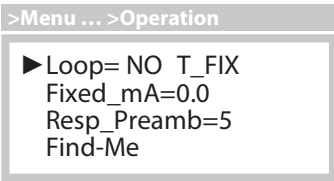
The *HART* menu appears by selecting **HART** from the *COM Setup* menu shown in [Figure 81 on page 63](#).

Display	Variable	Select to ...
<p>The image shows a terminal-style menu titled '>Menu >Setup >HART'. It contains four lines of text: 'HART V5 Setup', 'Tag=GAS_XMTR', '► Identification', and 'Operation'. A right-pointing arrow is positioned to the left of the 'Identification' option.</p>	Tag	This variable 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 <i>HART Identification</i> menu.
	Operation	View the <i>HART Operation</i> menu.

Figure 83: HART menu

Display	Variable	Select to ...
<p>The image shows a terminal-style menu titled '>Menu ... >Identification'. It contains three lines of text: 'Dev= 9f / 7f / 02', '► Poll_Addr=0', and 'Dev_Id=1426'. A right-pointing arrow is positioned to the left of the 'Poll_Addr=0' option.</p>	Device	This variable 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 Badger Meter 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 4-20 mA output. The value may be set from 1–15, which fixes the output at 4 mA and disables analog signaling.
	Dev Id	This variable 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 variable is not recommended.

Figure 84: Hart identification menu

Display	Item	Description
 <p>>Menu ... >Operation</p> <p>▶ Loop= NO T_FIX Fixed_mA=0.0 Resp_Preamb=5 Find-Me</p> <p><i>Figure 85: HART operation menu</i></p>	Loop	This variable specifies the analog operating mode of the 4-20 mA 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 4 mA. The ability to alter this behavior is reserved for future use, and changing this setting is not recommended.
	Fixed mA	This variable 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 3.5–22 mA.
	Resp Preamb	This variable 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 3–20. 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 described in " HART Find Device " 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."

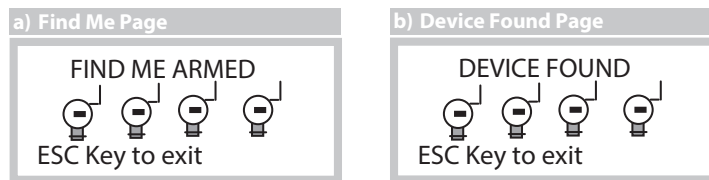


Figure 86: HART find device display

Modbus

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: The 4-20 mA output is fully functional even when using the transmitter’s Modbus interface.

When the Modbus protocol driver is installed, a link to the *Modbus Setup* menu appears on the *Main Setup* menu. See [Figure 87](#).

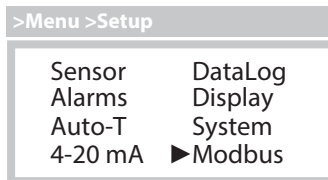


Figure 87: Main setup menu

The *Modbus* menu appears by selecting **Modbus** from the *COM Setup* menu shown in [Figure 81 on page 63](#).

Modbus Menu

The Modbus Menu appears by selecting Modbus from the "*COM Setup Menu*" on page 63.

Display	Variable	Description
<p>The image shows a menu titled '>Menu >Setup >Modbus'. It contains the text 'Modbus Setup', '▶ Slave_Addr=1', and 'Time_Out= 3'.</p>	Slave_Addr	This variable controls the address to which the transmitter responds to queries from the host (1–247, default =1).
	Time_Out	This variable belongs to the data-link layer of the protocol and defines the number of character bits used to frame Modbus RTU messages. This setting is reserved for future use and changing it is not recommended.

Figure 88: Modbus menu

Transmitter Version

The *Transmitter Version* display is accessed on the *System* menu (see [Figure 74 on page 60](#)) and it displays the transmitter information.

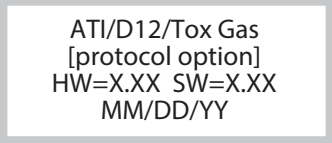
Display	Item	Description
>Menu>Setup>System>Version	Line 1	Model and version name
	Line 2	Protocol option (if any)
	Line 3	Hardware and software version numbers
	Line 4	Software built date

Figure 89: Transmitter version display

Restart

The *Restart* function causes the transmitter to start up, just as it does during a power on reset.

IMPORTANT

This function replaces the Reset menu beginning with version 2.23 of the D12 Toxic Gas Transmitter.

Resets

The *Reset* page provides functions for resetting configuration memories and restarting the transmitter, which may prove useful for correcting specific faults. **These functions should not be used unless they are specified in troubleshooting procedures or directed by authorized factory personnel.**

IMPORTANT

The Reset menu has been removed on software versions 2.23, and higher.

Function	Description
Sensor	Resets zero and span calibration and restarts the transmitter. The sensor must be completely recalibrated. On LEL transmitters, calibration and Auto-test history are cleared.
Alarms	Resets alarm set/reset points, options, delays and inhibit_mA. Restarts the transmitter.
4-20 mA	Resets 4-20 mA calibration. Loop must be recalibrated. Restarts the transmitter.
DataLog	Clears the datalog history and restarts the transmitter.
All	Resets entire transmitter to factory defaults, excluding sensor. Restarts the transmitter. Requires a full transmitter setup.
Restart	Restarts transmitter only.

SPARE PARTS

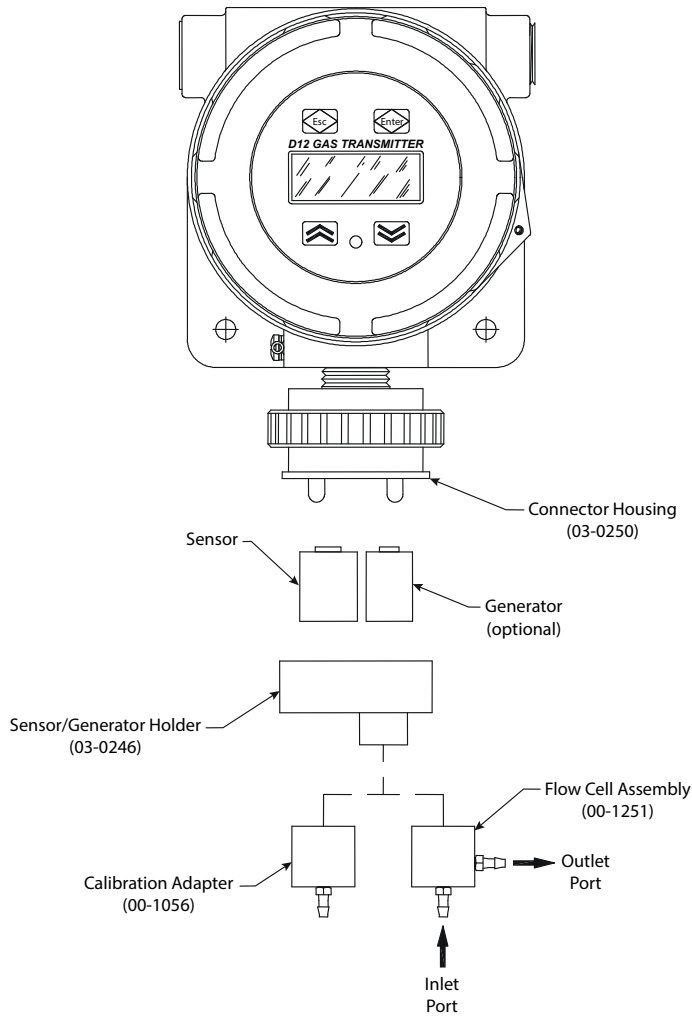


Figure 90: Spare parts exploded view

Transmitter Parts

Part No.	Description
03-0275	PCB stack assembly w/o relays
03-0276	PCB stack assembly with relays
03-0279	Remote PCB stack assembly w/o relays
03-0280	Remote PCB stack assembly with relays
03-0250	Connector housing assembly
03-0307	Connector housing assembly with heater
03-0246	Sensor/generator holder
31-0162	Remote interconnect cable (25 ft standard)
80-0066	Transmitter explosion-proof housing
46-0003	Sensor gasket (non Auto-test version)
46-0002	Sensor/generator gasket (non Auto-test version)
00-1056	Calibration adapter
00-1251	Flow cell assembly
29-0007	Battery
55-0004	Magnetic screwdriver

H10 Sensor Modules

Part No.	Description
00-1000	Bromine, 0–1/5 PPM (2 PPM standard)
00-1001	Bromine, 0–5/200 (20 PPM standard)
00-1002	Chlorine, 0–1/5 PPM (2 PPM standard)
00-1003	Chlorine, 0–5/200 (20 PPM standard)
00-1004	Chlorine dioxide, 0–1/5 PPM (2 PPM standard)
00-1005	Chlorine dioxide, 0–5/200 (20 PPM standard)
00-1006	Fluorine, 0–1/5 PPM (2 PPM standard)
00-1007	Fluorine, 0–5/200 (20 PPM standard)
00-1008	Ozone, 0–1/5 PPM (2 PPM standard)
00-1009	Ozone, 0–5/200 PPM (20 PPM standard)
00-1010	Ammonia, 0–50/500 PPM (200 PPM standard)
00-1011	Ammonia, 0–500/2000 PPM (1000 PPM standard)
00-1012	Carbon monoxide, 0–50/1000 PPM (200 PPM standard)
00-1013	Hydrogen, 0–1/10% (4% standard)
00-1014	Oxygen, 0–5/25% (25% standard)
00-1015	Phosgene, 0–1/5 PPM (2 PPM standard)
00-1016	Phosgene, 0–5/100 PPM (100 PPM standard)
00-1017	Hydrogen chloride, 0–10/200 PPM (20 PPM standard)
00-1018	Hydrogen cyanide, 0–10/200 PPM (20 PPM standard)
00-1019	Hydrogen fluoride, 0–10/200 PPM (20 PPM standard)
00-1020	Hydrogen sulfide, 0–10/200 PPM (50 PPM standard)
00-1021	Nitric oxide, 0–50/500 PPM (200 PPM standard)
00-1022	Nitrogen dioxide, 0–10/200 PPM (20 PPM standard)
00-1023	Sulfur dioxide, 0–10/500 PPM (20 PPM standard)
00-1024	Arsine, 0–500/2000 PPB (1000 PPB standard)
00-1025	Arsine, 0–10/200 PPM (10 PPM standard)
00-1026	Diborane, 0–500/2000 PPB (1000 PPB standard)
00-1027	Diborane, 0–10/200 PPM (10 PPM standard)
00-1028	Germane, 0–500/2000 PPB (1000 PPB standard)
00-1029	Germane, 0–10/200 PPM (10 PPM standard)
00-1030	Hydrogen selenide, 0–500/2000 PPB (1000 PPB standard)
00-1031	Hydrogen selenide, 0–10/200 PPM (10 PPM standard)
00-1032	Phosphine, 0–500/2000 PPB (1000 PPB standard)
00-1033	Phosphine, 0–10/200 PPM (10 PPM standard)
00-1034	Phosphine, 0–200/2000 PPM (1000 PPM standard)
00-1035	Silane, 0–10/200 PPM (10 PPM standard)
00-1036	Iodine, 0–1/5 PPM (2 PPM standard)
00-1037	Iodine, 0–5/200 PPM (20 PPM standard)
00-1038	Acid gases, 0–10/200 PPM (20 PPM standard)
00-1039	Ethylene oxide, 0–20/200 PPM (20 PPM standard)
00-1040	Formaldehyde, 0–20/200 PPM (20 PPM standard)
00-1041	Hydrogen, 0–500/2000 PPM (2000 PPM standard)
00-1042	Hydrogen peroxide, 0–10/100 PPM (20 PPM standard)
00-1043	Alcohol, 0–50/500 PPM (200 PPM standard)
00-1044	Alcohol, 0–500/2000 PPM (2000 PPM standard)
00-1057	Acetylene, 0–50/500 PPM (0–200 PPM standard)
00-1169	Hydrogen peroxide, 200/2000 PPM (500 PPM standard)

Part No.	Description
00-1181	NOx, 50/500 PPM (200 PPM standard)
00-1285	Silane, 500/2000 PPB (1000 PPB standard)
00-1349	Formaldehyde, 500/2000 PPM (1000 PPM standard)
00-1358	Ozone, 200/1000 PPM (1000 PPM standard)
00-1359	Chlorine dioxide, 200/1000 PPM (1000 PPM standard)
00-1425	Chlorine dioxide, 1/5 PPM (low Cl ₂ response)
00-1450	Dimethylamine (DMA), 100/200 PPM (100 PPM standard)
00-1455	Hydrogen bromide, 10/200 PPM (20 PPM standard)
00-1469	Hydrogen sulfide, 200/1000 PPM (500 PPM standard)

C18 Gas Generators

Part No.	Description
00-1239	Chlorine
00-1240	Ammonia
00-1241	Carbon monoxide
00-1243	Hydrogen sulfide
00-1244	Sulfur dioxide
00-1610	Hydrogen cyanide

Duct Mount Sensor Accessories

Part No.	Description
00-1388	H10 duct mount adapter
00-1649	H10 duct mount sensor holder
46-0003	Sensor gasket for 00-1649
03-0290	Duct mount cable assembly

APPENDIX A

Printing Datalog Reports

Serial Connection

The datalog report may be sent to a printer or a computer over an RS232 connection, or in some cases, an RS485 connection.

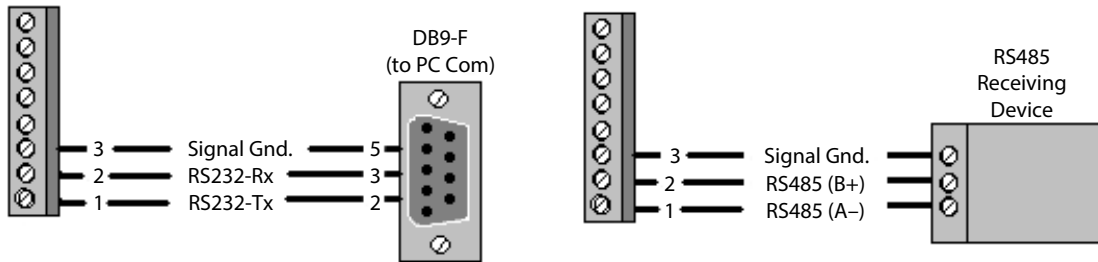


Figure 91: Serial connections for RS232 and RS485

COM Setup Menu

The communication interface, baud rate, parity, number of data bits and number of stop bits are configured on the *COM Setup* menu. Refer to "[Communication \(COM\) Menus and Settings](#)" on page 63 for more information.

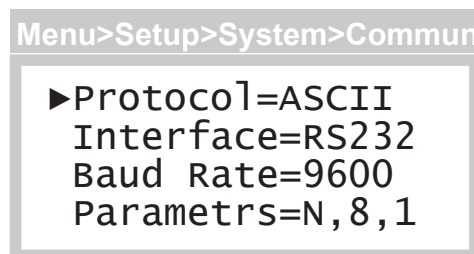


Figure 92: COM setup menu

Flow Control

The transmitter uses XON/XOFF flow control while sending a report, meaning once the data stream has begun, it continues until the XOFF character (19) is received. After sitting idle, the report stream begins 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 sends the XOFF character when its buffer is nearly full. Some older dot-matrix printers send an XOFF because they have a small receive buffers and cannot process characters while the head is returning to start a new line. On the other hand, most computers have comparatively large buffers and can easily accept the report stream without sending an XOFF. Therefore, an RS485 connection may work for sending reports to a computer.

The D12 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.

Report Format

The format of the report is suitable for import into most spreadsheet programs and consists of a date column, a time column, and 1–30 columns for sample values. Each line of the report shows the date and time of the first sample. Samples appearing in subsequent columns (left to right) were recorded at equal sampling intervals.

In the top line of the example below, the first sample (S0) occurred at 22:40. The next sample to the right (S1) occurred at 22:41, followed by the next (S2) at 22:42 and so on. This pattern is repeated throughout the report.

Date	Time	S0	S1	S2	S3
07/09/06	22:40	0.01	0.00	0.02	0.01
07/09/06	22:44	-0.0	0.00	0.00	-0.0
07/09/06	22:48	0.01	TEST	TEST	TEST
07/09/06	22:52	TEST	TEST	TEST	TEST
07/09/06	22:56	TEST	TEST	TEST	TEST
07/09/06	23:00	0.07	0.06	0.07	0.06
07/09/06	23:04	0.06	0.05	0.06	0.06
07/09/06	23:08	0.05	0.05	0.04	0.05
07/09/06	23:12	0.06	0.05	0.05	0.04
07/09/06	23:16	0.01	0.01	0.01	0.00
07/09/06	23:20	0.00	0.00	0.00	-0.0
07/09/06	23:24	-0.0	0.00	0.00	0.00
07/09/06	23:28	----	----	----	----
07/09/06	23:32	----	----	----	----
07/09/06	23:36	----	----	----	----
07/09/06	23:40	FFFF	FFFF	0.02	0.02

The transmitter permits selection of either a CR (carriage return) or CR/LF (carriage return/line feed) as the EOL (end-of-line) characters. 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 columns appearing across the page is programmable from 1–30. This is designed so that a report may be directed to either a small carriage printer or to a wider format device. A wider report takes less time to print because the date and time fields are printed less frequently.

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 of the transmitter. Sample values outside of printing limits are forced to the values listed in the following table.

Samples...	Are forced to...
Less than -999	-999
Greater than 9999	9999

Symbols may appear in place of sample values. They are defined in the following table.

Symbol	Description
----	No sample recorded. The transmitter was not on to record the sample or has not yet recorded the sample.
FFFF	The transmitter was in fault during the sample.
TEST	The transmitter was in Auto-test during the sample. This symbol appears only if the <i>Log_Data</i> variable in the <i>Menu/Setup/Auto-test Setup</i> menu is set to <i>NO</i> .
****	Data in the log is corrupted or unreliable.

Report Control

The start date and length of the report may be controlled from the operator interface. The length of the report is limited to the number of days actually stored in the log. The report always begins at 00:00 on the start date and continues forward for the number of days specified. If no data has yet been logged, the report shows four dashes (----) in place of samples.

Example of Charting a Datalog Report

1. Click **Start** and point to Programs> Accessories> Communications. Click **HyperTerminal**, and then double-click **Hypertrm.exe**.

When the *Connection Description* dialog box appears, type in "Connect To D12." If desired, choose an icon by sliding the horizontal scroll bar over and clicking one of the selections. Click **OK** when ready.

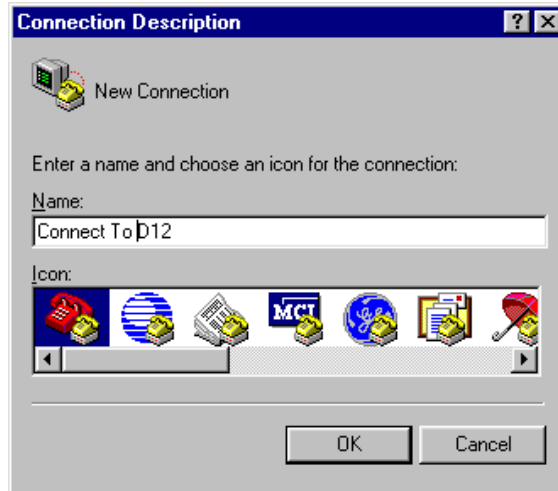


Figure 93: Connection description screen

2. When the *Connect To* dialog appears, set *Connect using:* to **Direct to Com1** (or Direct to Com2 if you are using COM2) and click **OK**.



Figure 94: Connect to screen

3. When the *COM1 Properties* dialog box appears, configure the *Port Settings* tab as shown below and click **OK**.

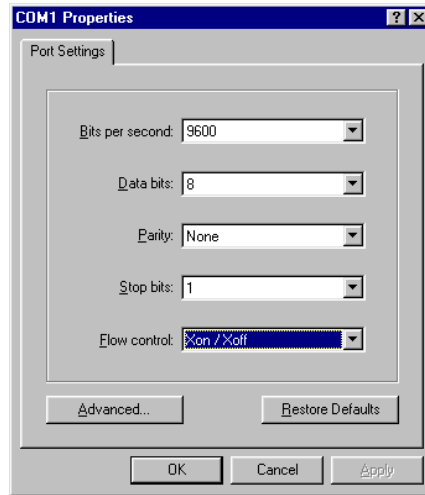


Figure 95: COM1 properties screen

4. Click **View**, then click **Font** and configure the font settings as shown in [Figure 96](#). This ensures that the data is presented in the terminal window without wrapping from line to line. You may need to experiment with these settings to obtain an acceptable presentation in the terminal window. Click **OK** when finished.

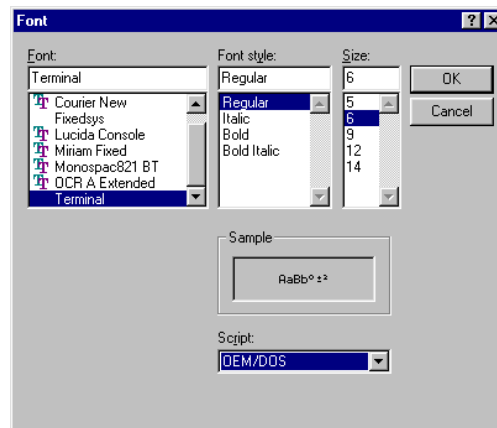


Figure 96: Font selection screen

5. Click **File**, click **Save As**, and then click **Save** to store the settings as a HyperTerminal session file named "Connect To D12.ht" (the filename should automatically appear). Place the file on your desktop for easy access.

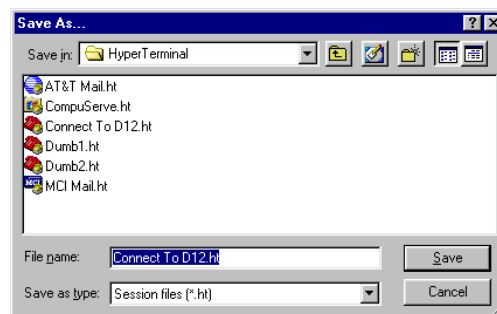


Figure 97: Save as screen

- In order to chart the report data, it must be “captured” in a file and given a name. Click **Transfer** on the menu bar, click **Capture Text**, and then click the button. Navigate to a folder and type the name of a file to store the report in (or choose an existing file to append the new report).

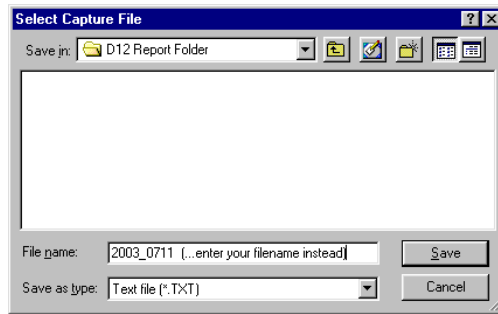


Figure 98: Select capture file screen

- Click **Save** to return to the *Capture Text* dialog box. When the *Capture Text* dialog box reappears, click **Start**.

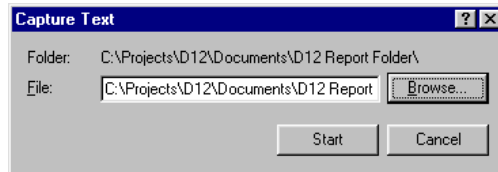


Figure 99: Capture text screen

- HyperTerminal is now ready to accept a report from the D12 transmitter and save it in a file. Note that data may appear in the terminal window (shown below) if the Connect To D12 session has been run previously, but this data does not appear in the file just opened.

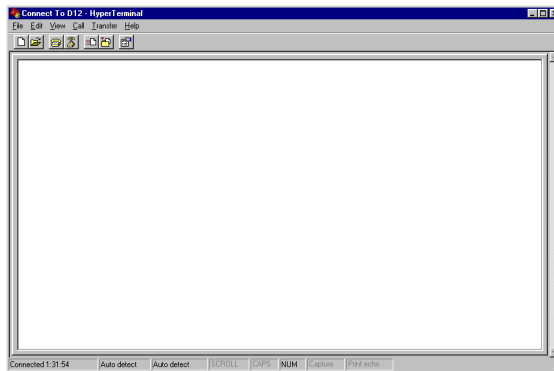


Figure 100: Hyperterminal screen

- Prior to sending a report to the computer, the system clock should be set and the datalogger turned on to record at least one sample. In addition, the *Log_Data* variable (in the *Menu/Setup/Auto-T/Setup* menu) should be set to *NO* if you prefer to see the symbol TEST and not gas concentration values during Auto-test.
- Configure the *Communication* variables as shown below. Note that 9600 is the highest baud rate common to the D12 transmitter and the Hyperterminal program.

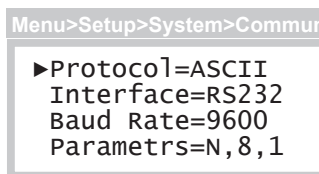


Figure 101: Highest common baud rate

11. Navigate to the *DataLog* menu and select **Print**. You are not allowed access if there are no samples in the log.

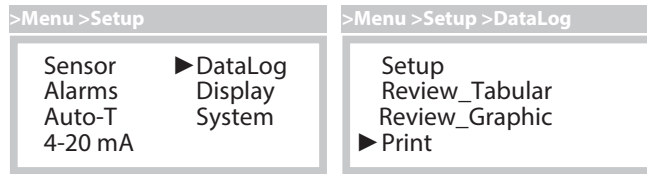


Figure 102: Select print on datalog screen

12. Select the **First** (starting) date. This automatically re-computes the maximum number of days shown of the report (variable values most likely differ from yours).

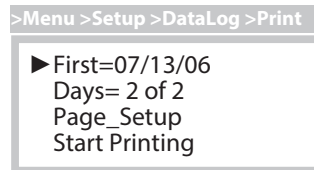


Figure 103: Start printing screen

13. Edit the *Days* variable if you prefer to reduce the length of the report, otherwise the entire report prints.

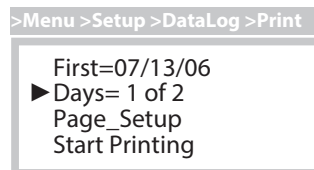


Figure 104: Edit days on printing screen

14. Select *Page_Setup* and configure the *Width*, *Eol* and *EolDly* variables as shown. The *Width* variable controls the number of sample columns printed and is settable from 1–30. Since the Hyperterminal display is 80 characters wide, set this to **10** columns so that data does not wrap around to the next line. Set *Eol* for **CR/LF**, and *EolDly* to **0**.

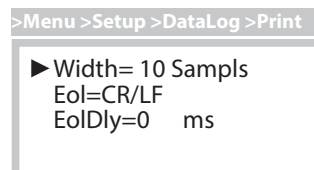


Figure 105: Configure width, Eol and EolDly

15. Touch **ESC** to leave *Page_Setup* and select **Start_Printing**. "Printing" begins flashing, and you may stop printing at any time by touching the *Esc* key.

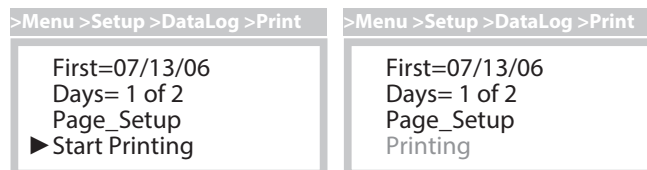


Figure 106: Printing status screen

The HyperTerminal terminal window should now begin to fill with lines from the report.

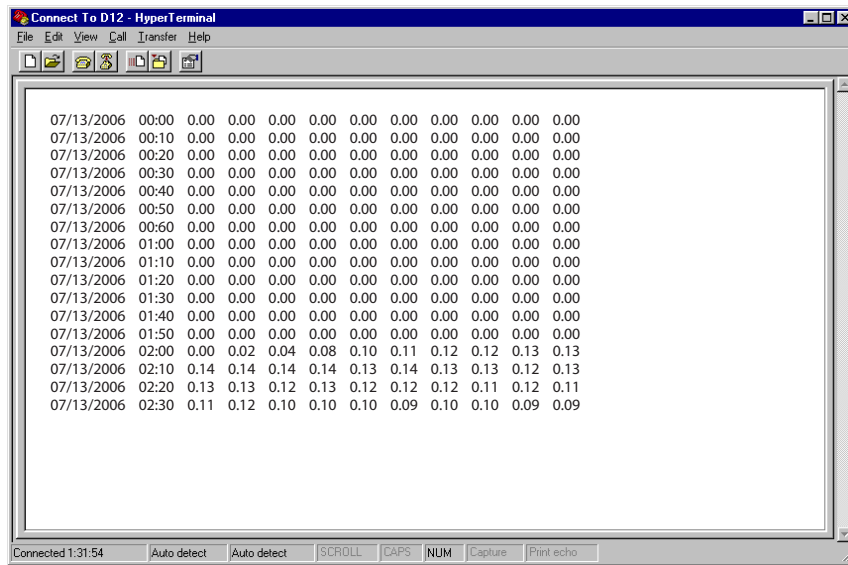


Figure 107: Hyper terminal report screen

16. When the transmitter has stopped printing (displays "Start_Printing"), click **Transfer**, move down to *Capture Text* and click **Stop**. This closes the report file so that it may be opened by another program.

Charting with Microsoft Excel

Microsoft Excel can be used to import datalog reports and create useful and informative charts.

Text Import Wizard

1. Start Excel by clicking **Start**, pointing to *Programs*, and clicking **Microsoft Excel**.
2. When Excel opens, click **File** and then click **Open**. Navigate to the datalog report file you wish to chart and click **Open**. Excel recognizes the report as a text file and offers some configuration options.
3. When the *Text Import Wizard – Step 1 of 3* screen appears, configure the settings as shown in [Figure 108](#) and click **Next**. Note that the values in your report file will be different than those shown in the figure.

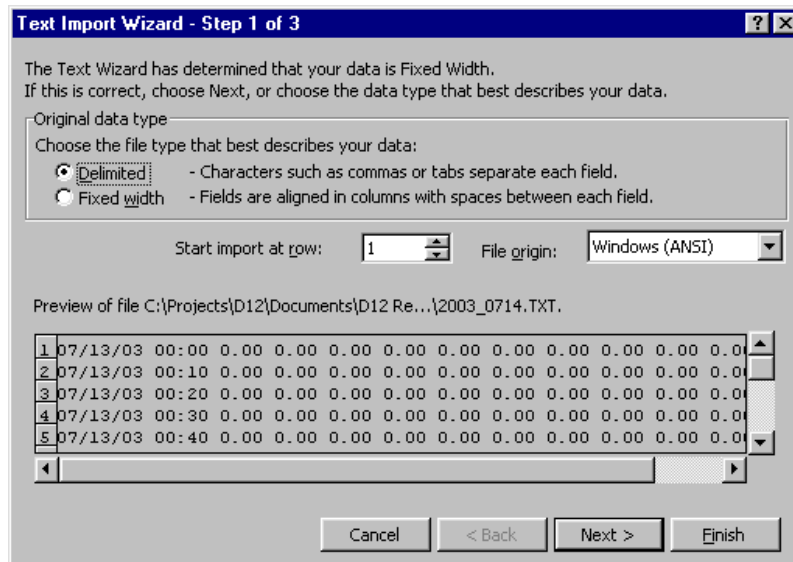


Figure 108: Step 1 - text import wizard

4. When the *Text Import Wizard – Step 2 of 3* screen appears, configure the settings as shown in [Figure 109](#) and click **Next**.

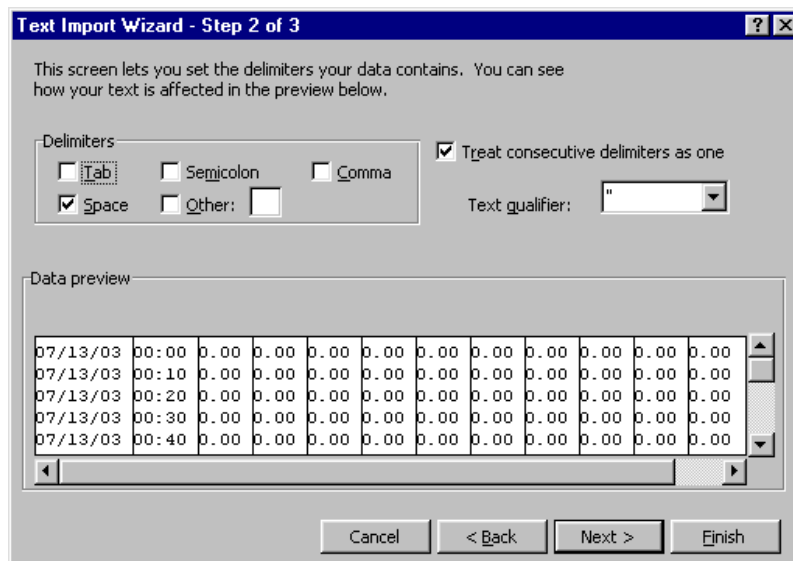


Figure 109: Step 2 - text import wizard

- When the *Text Import Wizard – Step 3 of 3* screen appears, click **Finish**.

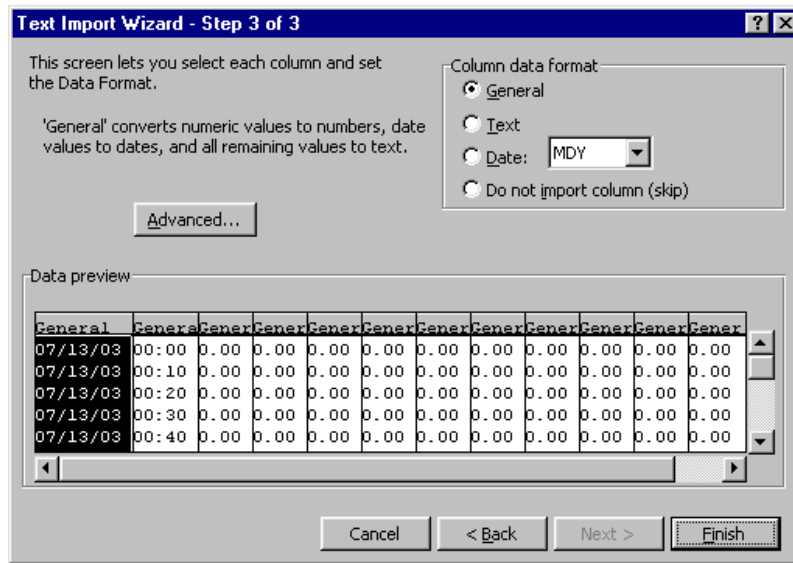


Figure 110: Step 3 - text import wizard

The report should appear as a spreadsheet resembling the format shown in [Figure 111](#). Note that dates, times, and values will be different.

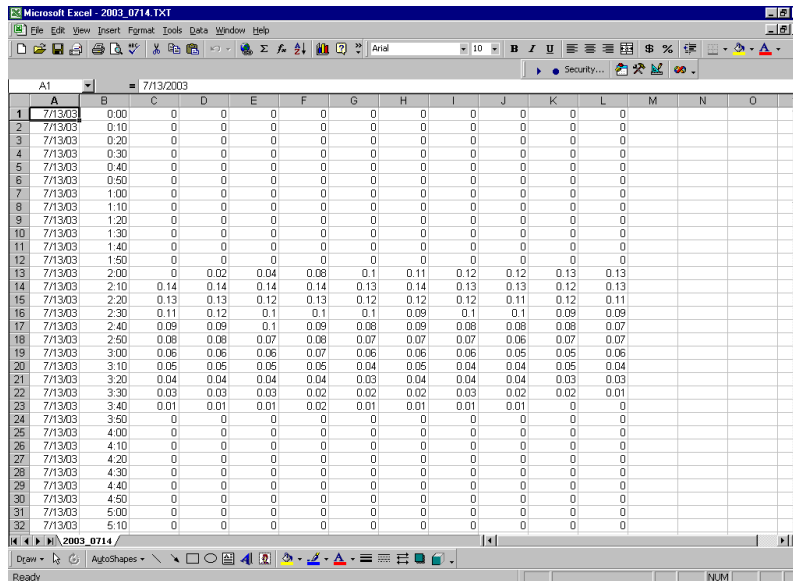


Figure 111: Imported report

Chart Wizard

1. To chart the report, select one full day of data by dragging the mouse cursor over the region to be charted. Notice that this region begins in the time of day column and extends across each of the sample columns.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	7/13/03	0:00	0	0	0	0	0	0	0	0	0	0	0		
2	7/13/03	0:10	0	0	0	0	0	0	0	0	0	0	0		
3	7/13/03	0:20	0	0	0	0	0	0	0	0	0	0	0		
4	7/13/03	0:30	0	0	0	0	0	0	0	0	0	0	0		
5	7/13/03	0:40	0	0	0	0	0	0	0	0	0	0	0		
6	7/13/03	0:50	0	0	0	0	0	0	0	0	0	0	0		
7	7/13/03	1:00	0	0	0	0	0	0	0	0	0	0	0		
8	7/13/03	1:10	0	0	0	0	0	0	0	0	0	0	0		
9	7/13/03	1:20	0	0	0	0	0	0	0	0	0	0	0		
10	7/13/03	1:30	0	0	0	0	0	0	0	0	0	0	0		
11	7/13/03	1:40	0	0	0	0	0	0	0	0	0	0	0		
12	7/13/03	1:50	0	0	0	0	0	0	0	0	0	0	0		
13	7/13/03	2:00	0	0.02	0.04	0.08	0.1	0.11	0.12	0.12	0.13	0.13			
14	7/13/03	2:10	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.13	0.12	0.13			
15	7/13/03	2:20	0.13	0.13	0.12	0.13	0.12	0.12	0.12	0.11	0.12	0.11			
16	7/13/03	2:30	0.11	0.12	0.1	0.1	0.1	0.09	0.1	0.1	0.09	0.08			
17	7/13/03	2:40	0.09	0.09	0.1	0.09	0.08	0.09	0.08	0.08	0.08	0.08			
18	7/13/03	2:50	0.08	0.08	0.07	0.08	0.07	0.07	0.07	0.07	0.06	0.07			
19	7/13/03	3:00	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.05	0.06			
20	7/13/03	3:10	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.05			
21	7/13/03	3:20	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.03			
22	7/13/03	3:30	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.01			
23	7/13/03	3:40	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0			
24	7/13/03	3:50	0	0	0	0	0	0	0	0	0	0			
25	7/13/03	4:00	0	0	0	0	0	0	0	0	0	0			
26	7/13/03	4:10	0	0	0	0	0	0	0	0	0	0			
27	7/13/03	4:20	0	0	0	0	0	0	0	0	0	0			
28	7/13/03	4:30	0	0	0	0	0	0	0	0	0	0			
29	7/13/03	4:40	0	0	0	0	0	0	0	0	0	0			
30	7/13/03	4:50	0	0	0	0	0	0	0	0	0	0			
31	7/13/03	5:00	0	0	0	0	0	0	0	0	0	0			
32	7/13/03	5:10	0	0	0	0	0	0	0	0	0	0			

Figure 112: Selecting the charting area

2. After selecting the region, click **Insert** and then **Chart** (or click the *Chart* icon directly from the toolbar). When the *Chart Wizard - Step 1 of 4 - Chart Type* dialog appears, click on **Column** and then click **Next**.

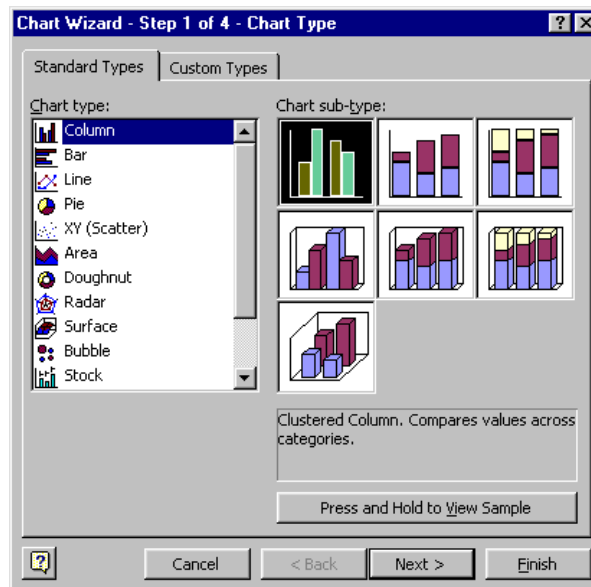


Figure 113: Step 1 - chart wizard

- When the *Chart Wizard - Step 2 of 4 - Chart Source Data* dialog appears, click **Next**.

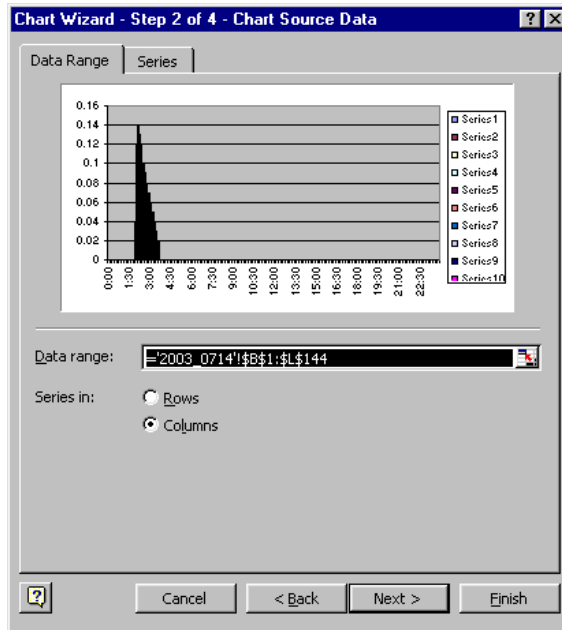


Figure 114: Step 2 - chart wizard

- When the *Chart Wizard - Step 3 of 4 - Chart Options* dialog appears, unselect the *Show legend* option and click **Next**.

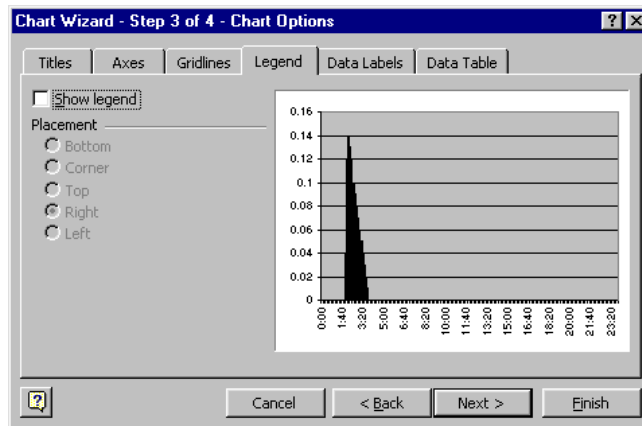


Figure 115: Step 3 - chart wizard

- When the *Chart Wizard - Step 4 of 4 - Chart Location* dialog appears, click the **As new sheet** radio button and enter the name of a new sheet to store the chart in. Alternately, you may click the **As object in** radio button to place the chart onto the sheet you have just created.

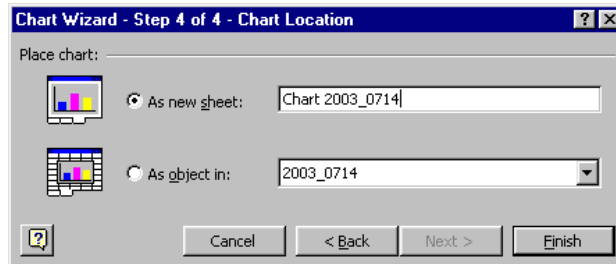


Figure 116: Step 4 - chart wizard

- If you have previously clicked the *As new sheet* radio button, the chart appears on the new sheet. You may now move between the new sheet and the old sheet by clicking the sheet tabs that appear just below the chart display.

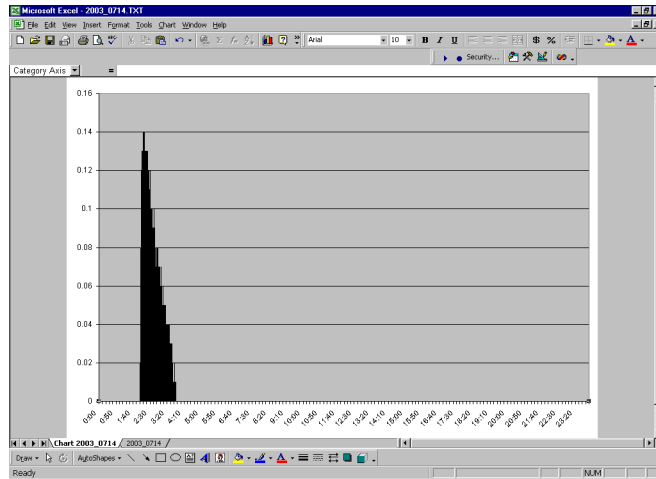


Figure 117: New sheet

If you have previously clicked the *As object in* radio button, the chart appears on the existing sheet.

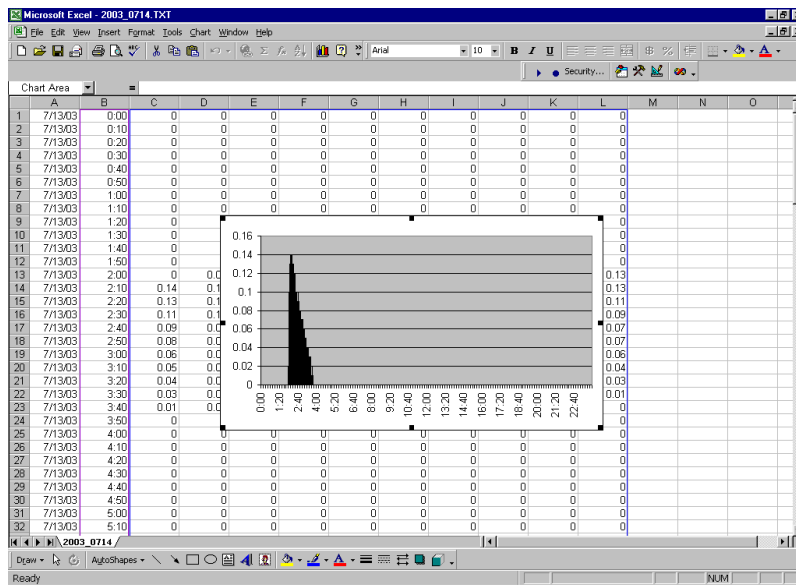


Figure 118: Existing sheet

- Click **File** and then **Save** to store the chart.

Once the chart has been created, you may wish to re-scale, give it a title and print it. These features are detailed in Microsoft Excel Help and are beyond the scope of this document.

