Series F12

Toxic Gas Transmitter

With H10 Smart Sensor

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Product Warranty

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

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

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

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

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

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

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

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1 INTRODUCTION

1.1 Components

1.2 F12 Gas Transmitter

The F12 Gas Transmitter is used to monitor for gas leaks near storage cylinders, process piping, or gas feed equipment in nearly any type of industrial plant environment. It is housed in NEMA 4X, polycarbonate enclosure and features an H10 Smart Sensor, a non-intrusive four button user interface with a backlit transflective graphics display, three level alarms with three (optional) alarm relays, a high-resolution 4-20mA current loop output, real-time clock, data-logger, and optional HART™ or Modbus™ communication interface. In addition, the transmitter offers several optional D18 gas generators for automatic, timed testing of H10 sensors.

1.3 H10 Smart Sensor and D18 Gas Generator

H10 Smart Sensors and D18 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.

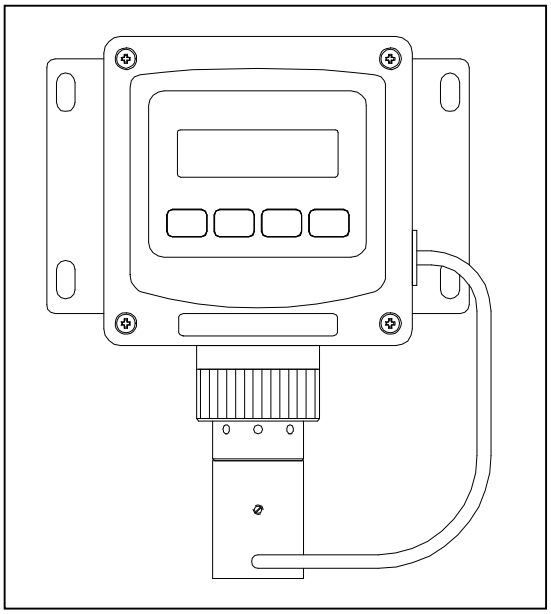


Figure 1. Transmitter, sensor, and optional gas generator

Sensors are inserted into the housing at the base of the transmitter. They are easily removed, and installation is simplified by way of an indexing groove that aligns the connector for a perfect fit. Once installed, a threaded port cap secures it in place.

Sensors are designed for use in ambient air at temperatures of -30° to +60° C, at a relative humidity between 20 and 98 %RH (some sensors are rated to -40° C, oxygen sensors are rated to -10° C). Operating sensors in extremely dry air, or in condensing gas streams, is not recommended.

Generators are inserted into the optional generator housing attached to the bottom of the sensor housing at the base of the transmitter. Installation of a generator is simplified by way of an indexing groove that aligns the connector for a perfect fit. Once installed apply a little pressure to the top of the generator, and tighten the set screw (using the ATI screwdriver) on the housing to provide a secure fit. An O-Ring in the sensor cap provides the mechanism for securing the generator to the transmitter. Simply press the generator into the bottom of the sensor cap until it is secure.

Table 1. 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	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

(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 D18 gas generator available for standard range of sensor, and lower.

1.4 Specifications

Table 2. Specifications

Sensor Type	Electrochemical cell
Gas Type	Select from list (see Table 1)
Range	User adjustable within limits of selected sensor (see Table 1)
Response Time	Sensor dependent
Accuracy	Generally ±10% of value, but limited by available calibration gas accuracy.
Repeatability	±1% (Electronic)
Linearity	±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 ohms max. at 24 VDC
Serial Interface	(Standard) Epson printer output for data log reports over the configurable RS232/485 port* (Optional) HART® digital signaling over the 4-20mA current loop (Optional) Modbus® digital signaling over the configurable RS232/485 port*
Power Requirements	(Standard and HART™ Option) Powered from 4-20mA loop, 12-30 VDC, 25 mA max. (Modbus Option) Requires regulated 10-28 VDC to power RS232/485. May be same supply as 4-20mA loop if not connected to loop receiver.
Alarm Relay Board Option	Powers transmitter, relays, and RS232/485 port; Requires Deep Case Three SPST relays (two with N/O contacts, one with N/C contacts) Each relay: 5A @ 230 VAC resistive; 5A @ 30 VDC resistive Coils are programmable as normally energized or normally de-energized
Additional Power Requirements	AC version powered from 115/230 VAC, 1W nominal DC version powered from 12-30VDC, 1W nominal
Enclosure	NEMA 4X, polycarbonate with stainless steel hardware. Weatherproof and corrosion resistant (Standard) HWD: 4.4”(112mm) x 4.4” (112mm) x 3.5” (89mm) (w/Optional) HWD: 4.9”(124mm) x 4.9” (124mm) x 5.5” (139mm)
Mounting	(Standard) Wall or pipe mount bracket. U-Bolts suitable for 1.5” or 2” I.D. (Optional) Panel mount kit available.
Auto-Test Option	Dependent on sensor gas type and full scale range (see Table 1)
Display	Graphics LCD, 96w x 32h, backlit, transflective
Controls	Four, dome-type push buttons; Remote alarm reset input (w/optional alarm relays only)
Operating Temp.	-30° to +60° C (Min. temp. for O_2 sensor is –10° C)
Weight	(Standard) 1lb (0.45kg) (w/Alarm Relay Board Option) 1.5lb (0.68kg)

2 MECHANICAL INSTALLATION

2.1 Transmitter Mounting

Threaded inserts in the rear of the enclosure permit the attachment of brackets for securing the transmitter to a wall or pipe. An optional bracket is also available for "flush mounting" the transmitter into a panel, so that only the front cover protrudes. (This option is available for Remote AC powered units **ONLY**.

Choose a location so the transmitter display is readily visible, and the panel buttons and sensor are accessible for calibrations. Consider the remote sensor option to locate the sensor closer to the source of a potential gas leak, or closer to the floor for gasses heavier than air.

2.2 Enclosure Dimensions

Dimensions and the conduit entry locations are detailed in Figure 2 and, below.

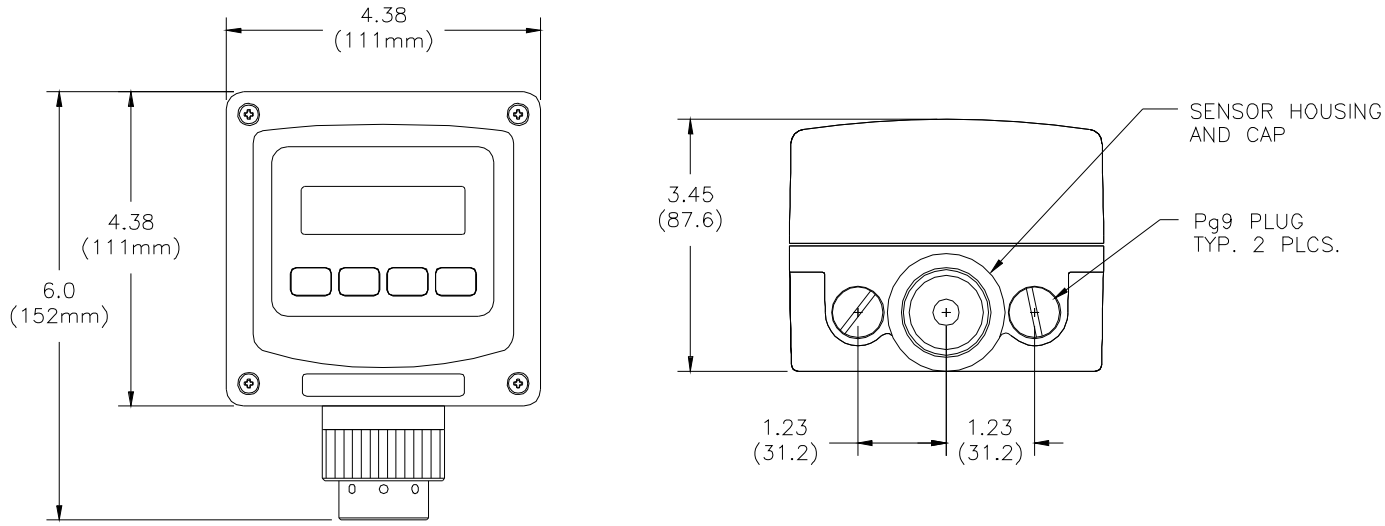


Figure 2. Enclosure dimensions, standard enclosure

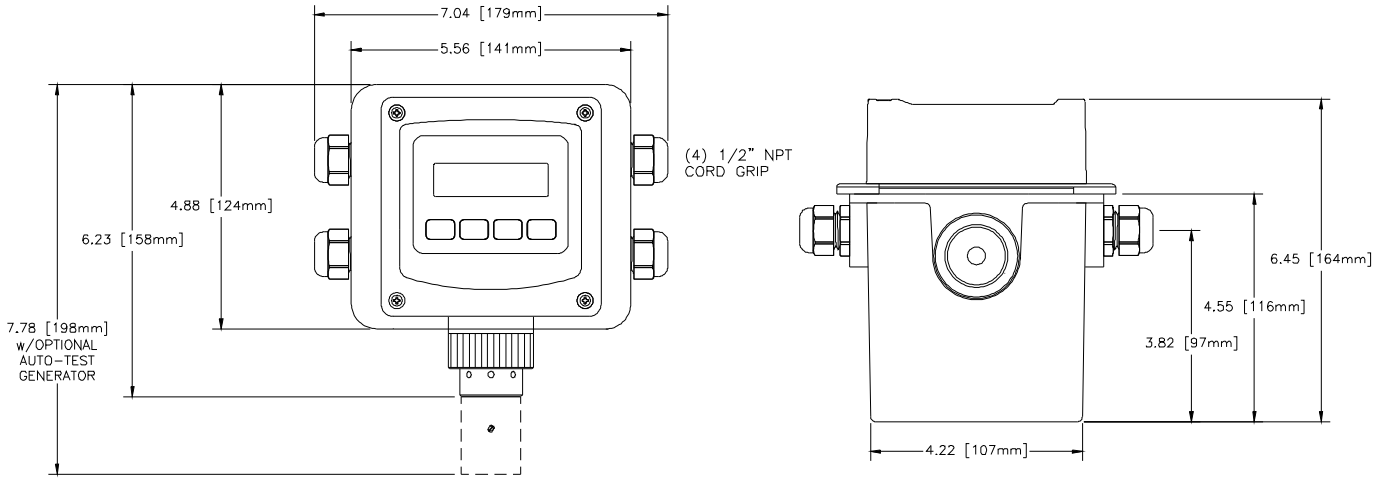


Figure 3. Enclosure dimensions, Deep Enclosure

2.3 Wall and Pipe Mounting

A PVC mounting bracket with attachment screws is supplied with the transmitter. The transmitter is attached to the bracket using four flat head screws, and the bracket is attached to a wall or pipe by way of the four slots in each corner. The slots will accommodate ¼" u-bolts designed for 1½"or 2" pipe. For 1 ½" pipe, type 304 stainless steel u-bolts with 2" I.D. are available from ATI (p/n 47-0005).

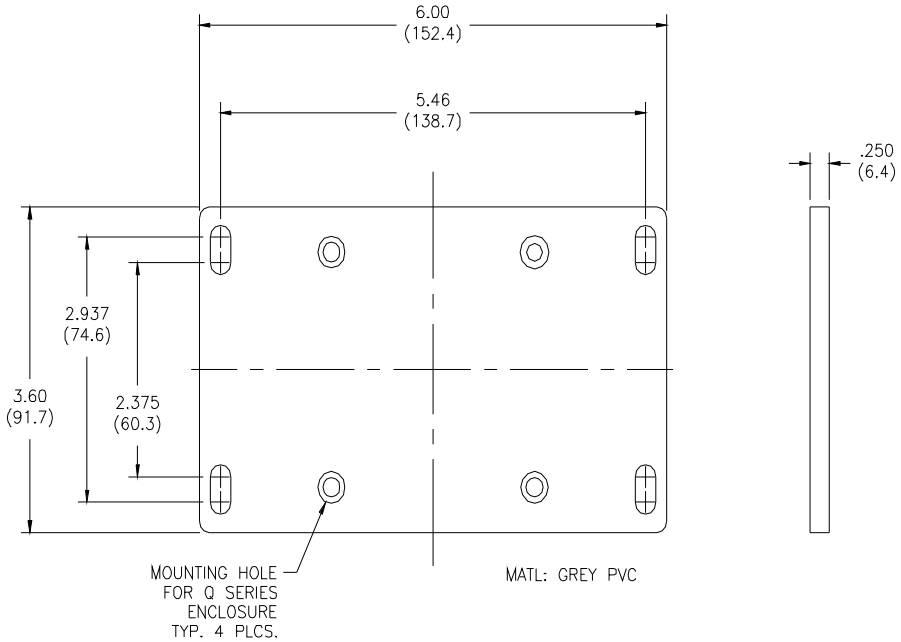


Figure 4. Wall/pipe mounting bracket

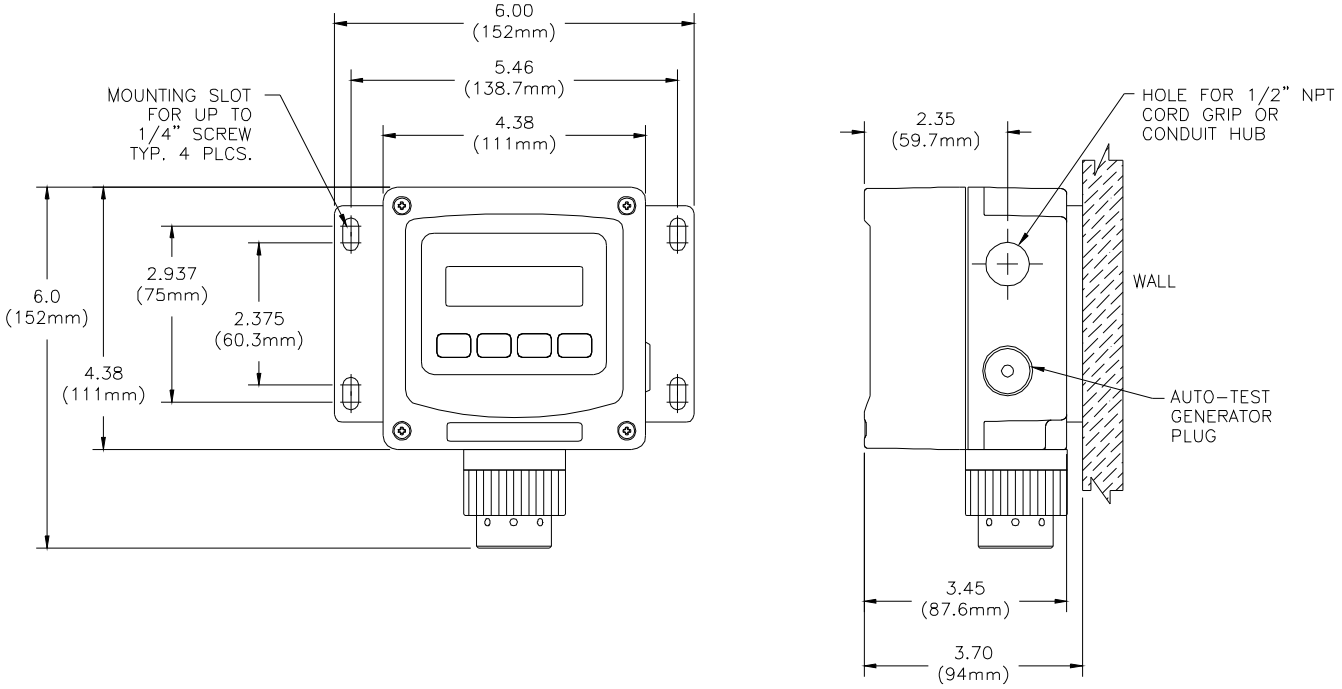


Figure 5. Wall mounting diagram

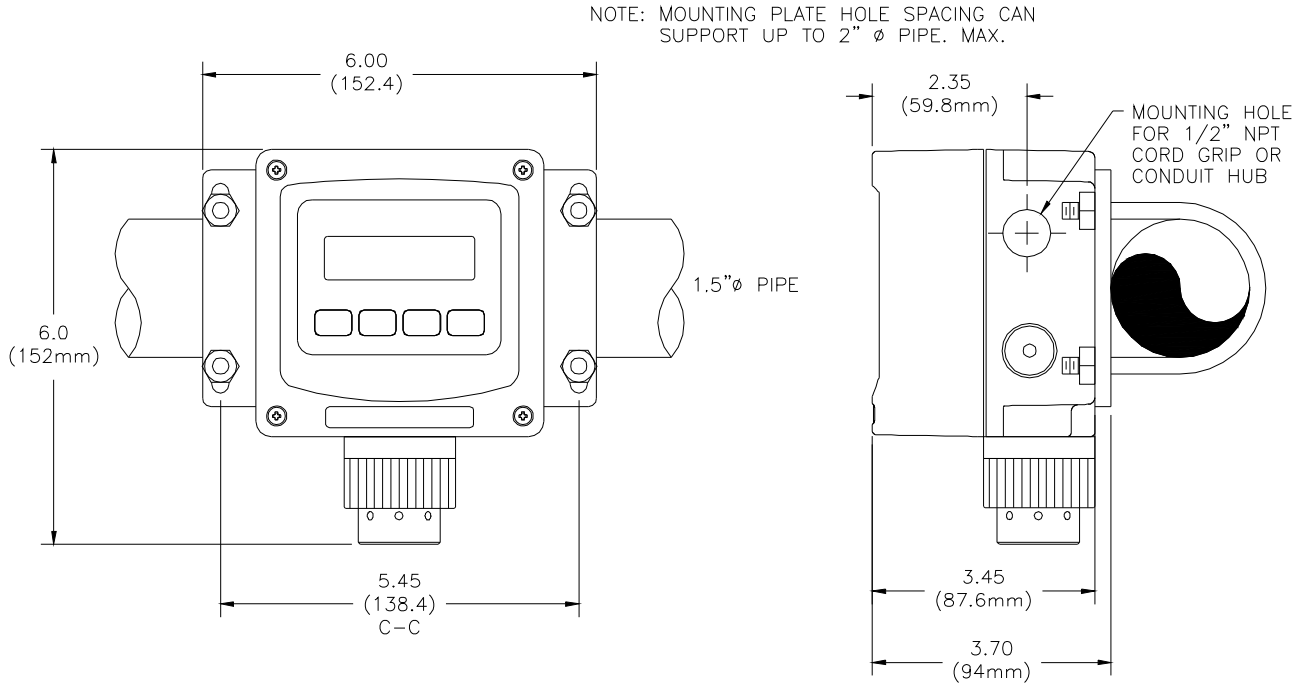


Figure 6. Pipe mounting diagram

2.4 Panel Mounting (Remote Systems Only)

Figure 7 depicts the details for panel mounting the deep case. For this, a bracket attaches to the rear housing, and when adjusted, pulls the transmitter's flange down against the adhesive side of the gasket supplied with the bracket (make certain to remove the protective paper first).

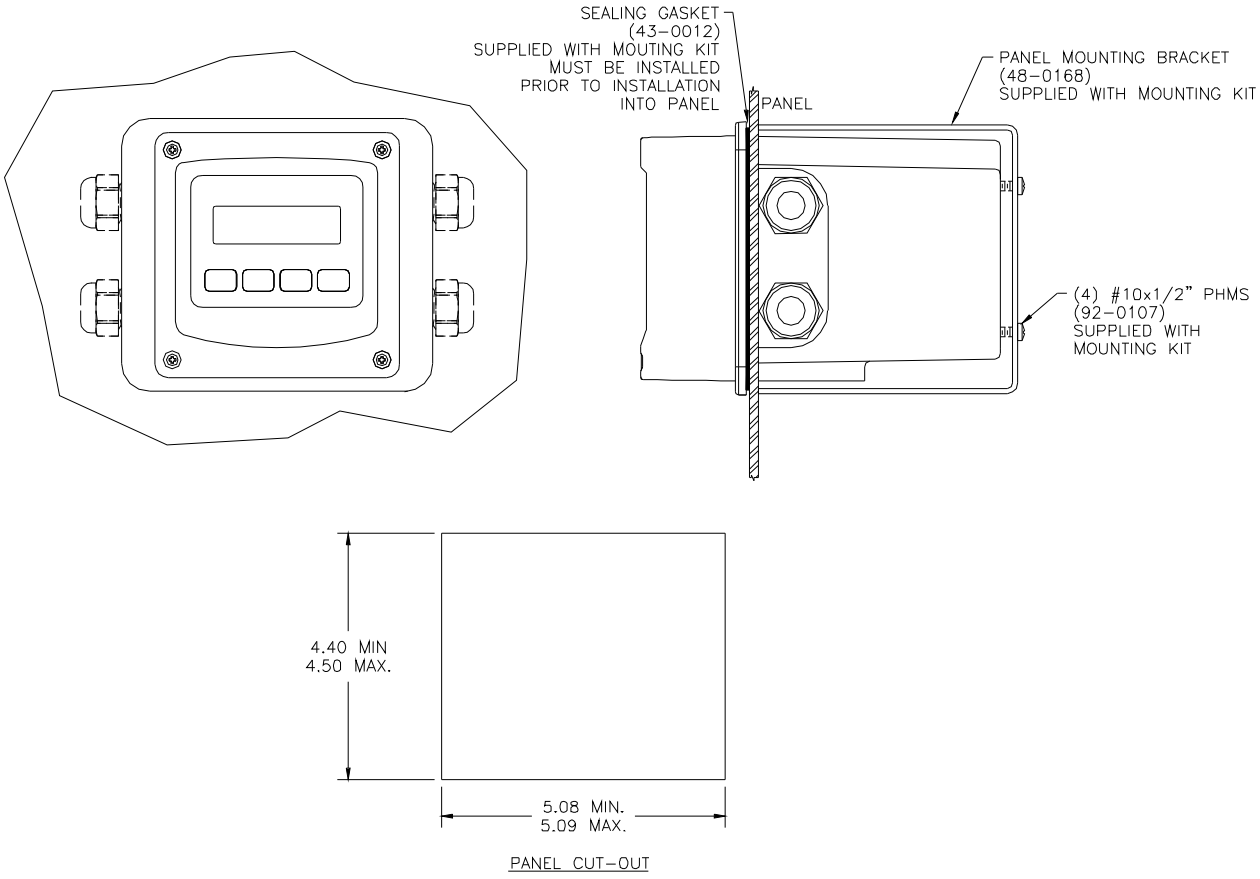


Figure 7. Panel mounting details [deep case]

2.5 Duct Sensor Mounting

The H10 sensor duct mount option allows 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 (Figure 8) that slides into the hollow duct mount adapter (Figure 10). The adapter has 1-1/2" 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 that 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. 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.

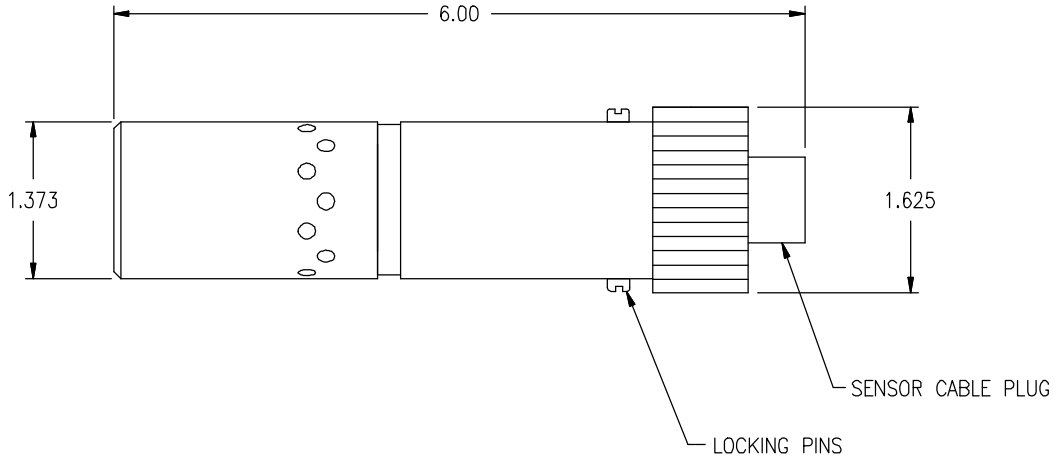


Figure 8. Duct-mount sensor holder

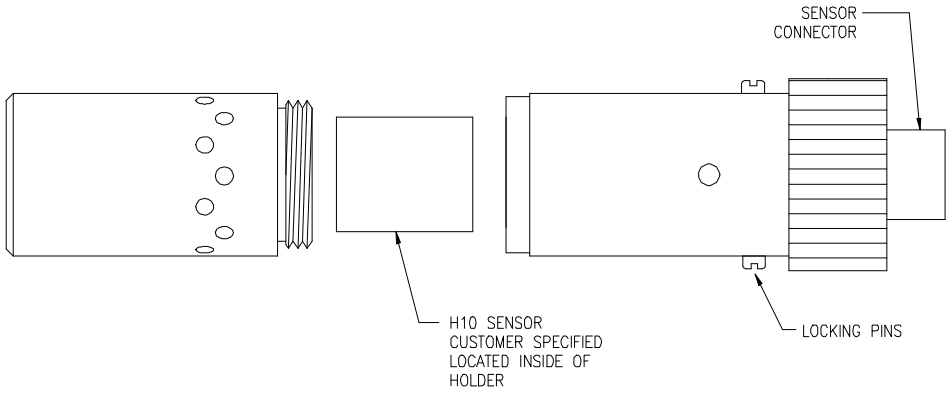


Figure 9 Duct Mount Sensor Exploded View

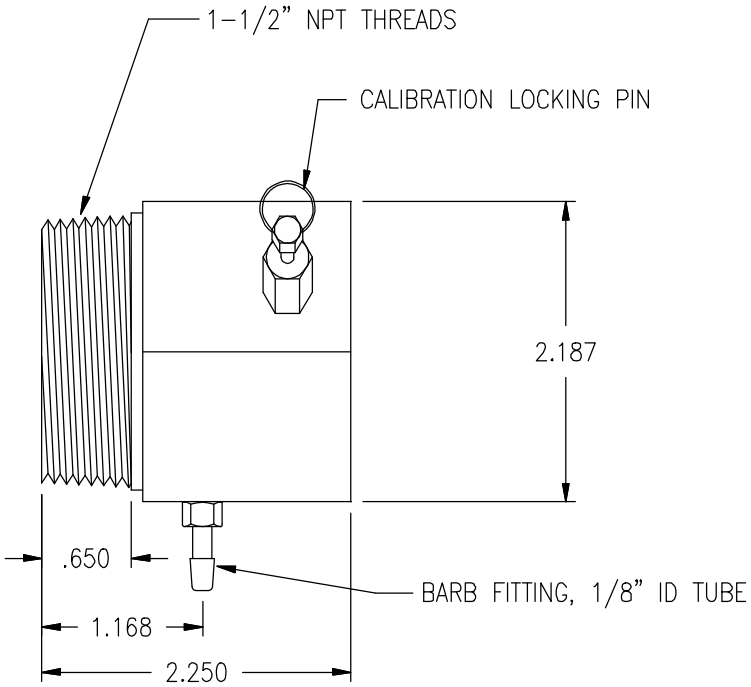


Figure 10. Duct-mount adapter (ATI-0670)

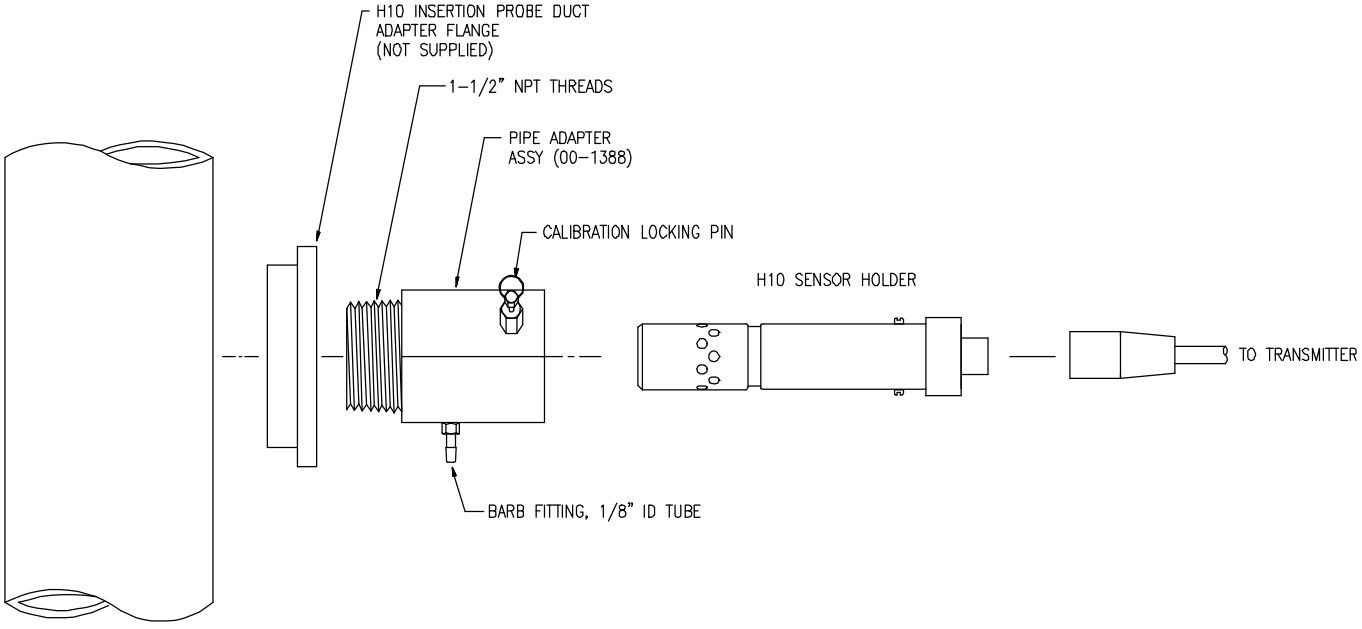


Figure 11. Duct-mount assembly

2.6 Generator Installation/Removal

Generators are inserted into the optional generator housing attached to the bottom of the sensor housing at the base of the transmitter. Before installing the generator, check to see that the set screw on the side of the holder is loose and does not contact the generator during installation. An indexing groove on the side of the generator aligns the connector for a perfect fit. Once installed apply a little pressure to the top of the generator, and tighten the set screw (using the ATI screwdriver) on the housing to provide a secure fit. If the set screw is not secure, the connector on the generator may disengage causing a "generator missing" error message on the display.

To remove the generator from the holder, loosen the set screw on the side of the holder and pull up on the outlet stem.

An O-Ring in the sensor cap provides the mechanism for securing the generator to the transmitter. Simply press the generator into the bottom of the sensor cap until it is secure.

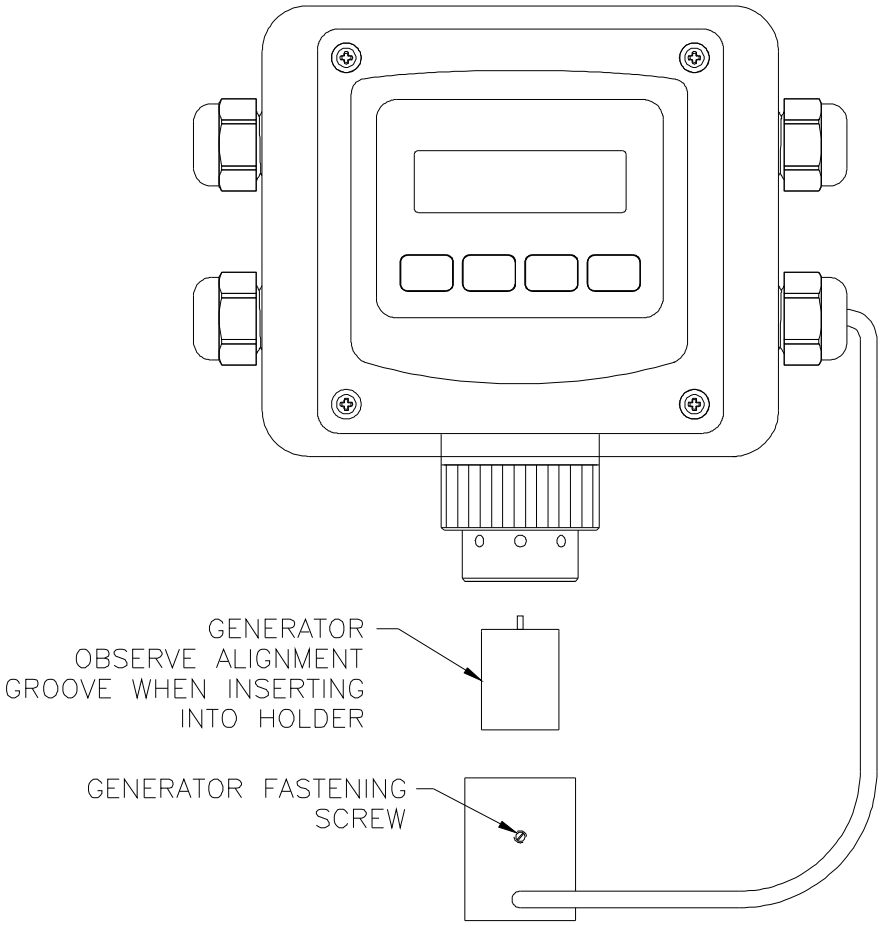


Figure 12 - Generator Exploded View

3 ELECTRICAL CONNECTIONS

3.1 Transmitter Connections

	SAFE PRACTICE **Follow national, state, and local, electrical codes.**	

To access the wiring terminals inside the transmitter, loosen the four screws in each corner of the housing's front cover. The front cover is hinged to the rear cover along its lower edge so it will swing down and stop at approximately 90°. The transmitter has limited space for wire; therefore, use the smallest gauge wire available that is compatible with electrical code and current requirements.

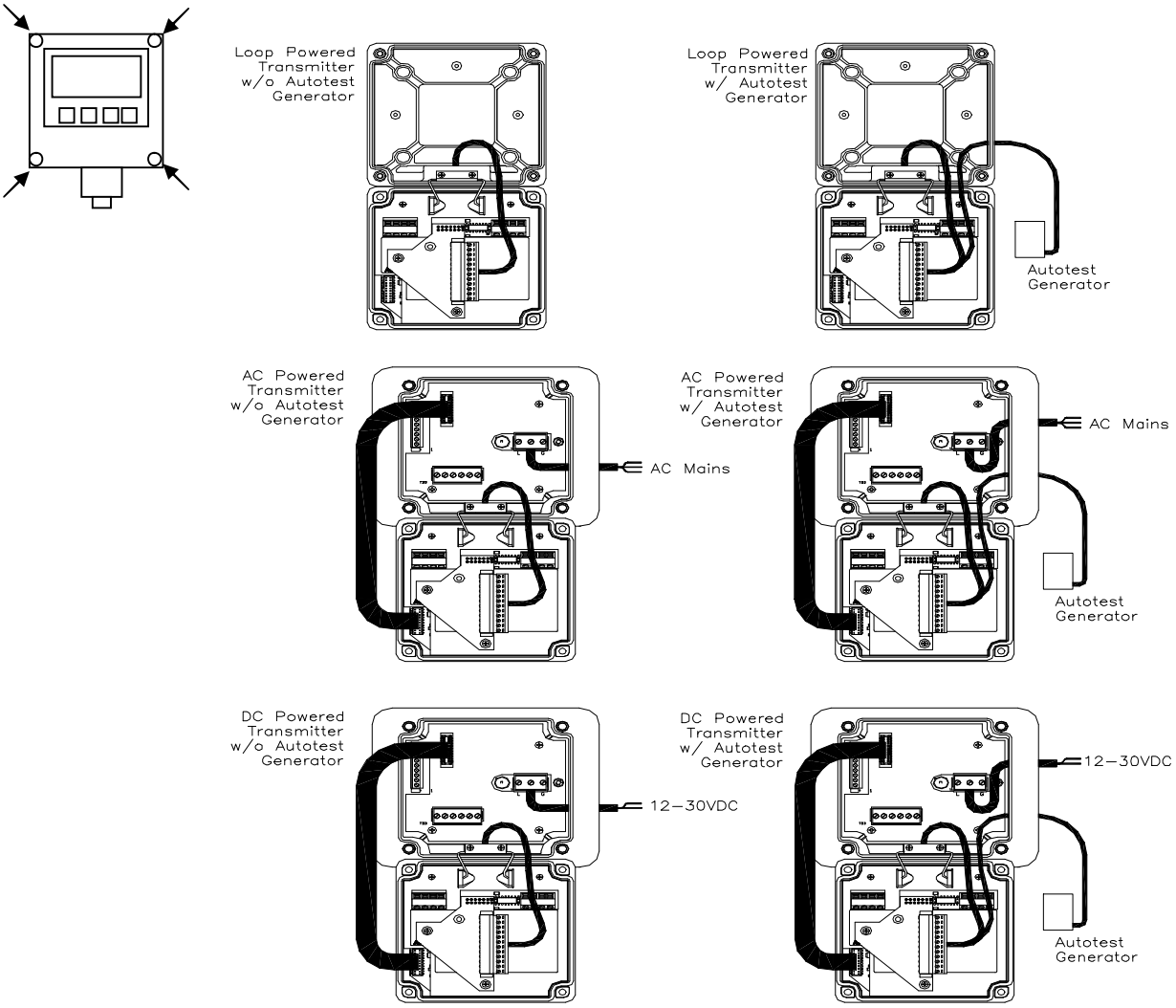


Figure 13. F12 Transmitter Configurations

3.2 Sensor Adapter Board

The Sensor Adapter Board provides a socket connector for the sensor plug and mates to a 14-pin header on the transmitter's Power Supply board. Wire assignments for the sensor plug are shown below.

The board does not normally need to be removed, but if necessary, unplug the sensor and remove the (2) retaining nuts and screw. Gently pull up until the connector is free from the pins on the Power Supply board.

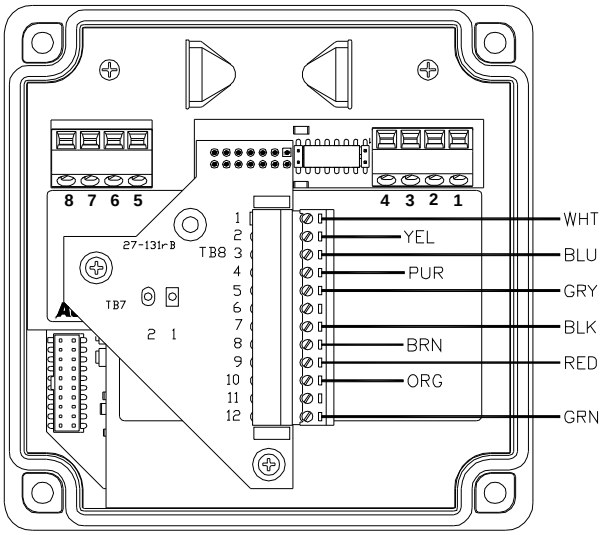
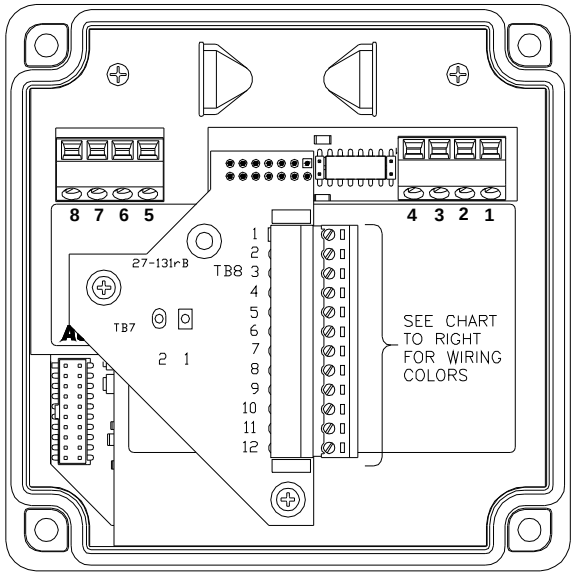


Figure 14. Sensor Adapter board wiring w/o Autotest Generator



CONDUCTOR COLORS

T/B POS.	SENSOR WIRES	GENERATOR WIRES
1	WHITE	
2	YELLOW	
3	BLUE	BLUE
4	PURPLE	WHITE
5	GRAY	
6		GREEN
7	BLACK	
8	BROWN	BLACK
9	RED	RED
10	ORANGE	ORANGE
11		WHT w/BLK
12	GREEN	

Figure 15. Sensor Adapter board wiring w/ Autotest Generator Power and Communication Terminals

3.3 Power Supply Board

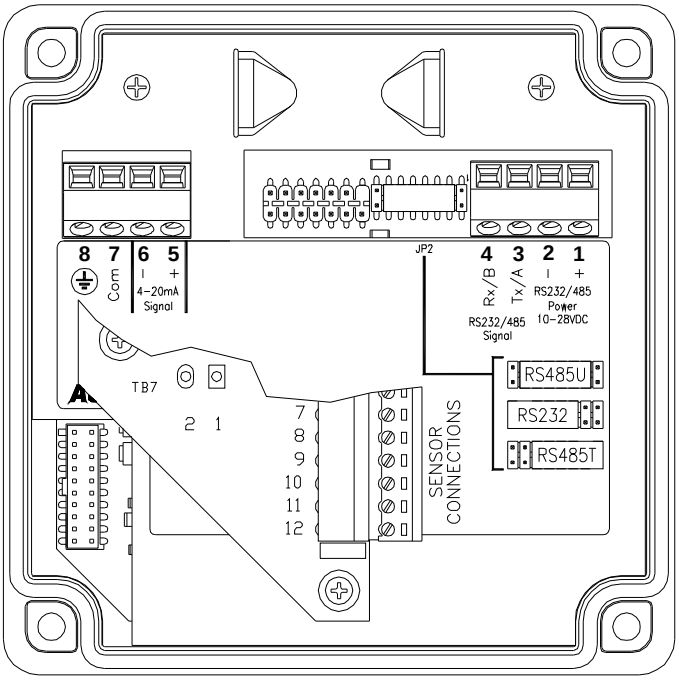
The Power Supply Board is located just below the metal shield in the front cover. It contains the power and communication terminals, and provides a header for connecting the Sensor Adapter board. In addition, the board has a jumper block for configuring the communication interface.

Two terminal blocks are provided on the transmitter's Power Supply board (hidden by the metal shield) to connect power and communication wires. The table below lists each terminal and its associated function.

The transmitter is powered in using terminals 5 and 6, commonly referred to as "two-wire mode". If the Alarm Relay Board option is installed, the terminals need not be powered unless current loop signaling is required (see Alarm Relay Board Option, below).

The RS232/485 interface requires additional power applied to terminals 1 and 2. If current loop signaling is not required, they may be wired to terminals 5 and 6, respectively. If current loop signaling is required, then a third wire will be needed (3-wire mode).

Connections to these terminals are covered in detail in Wiring Examples in section 3.15.



Power & Communication Terminals	
Terminal	Description
1	Communication interface supply (+), 10 to 28VDC. Required for RS232 and RS485 only, not HART.
2	Communication interface supply common (−)
3	RS232 Tx, RS485 A Signal
4	RS232 Rx, RS485 B Signal
5	Transmitter current loop output (−).
6	Transmitter current loop output (−).
7	Communication interface signal common (−).
8	Earth Ground

Figure 16. Power and communication terminals.

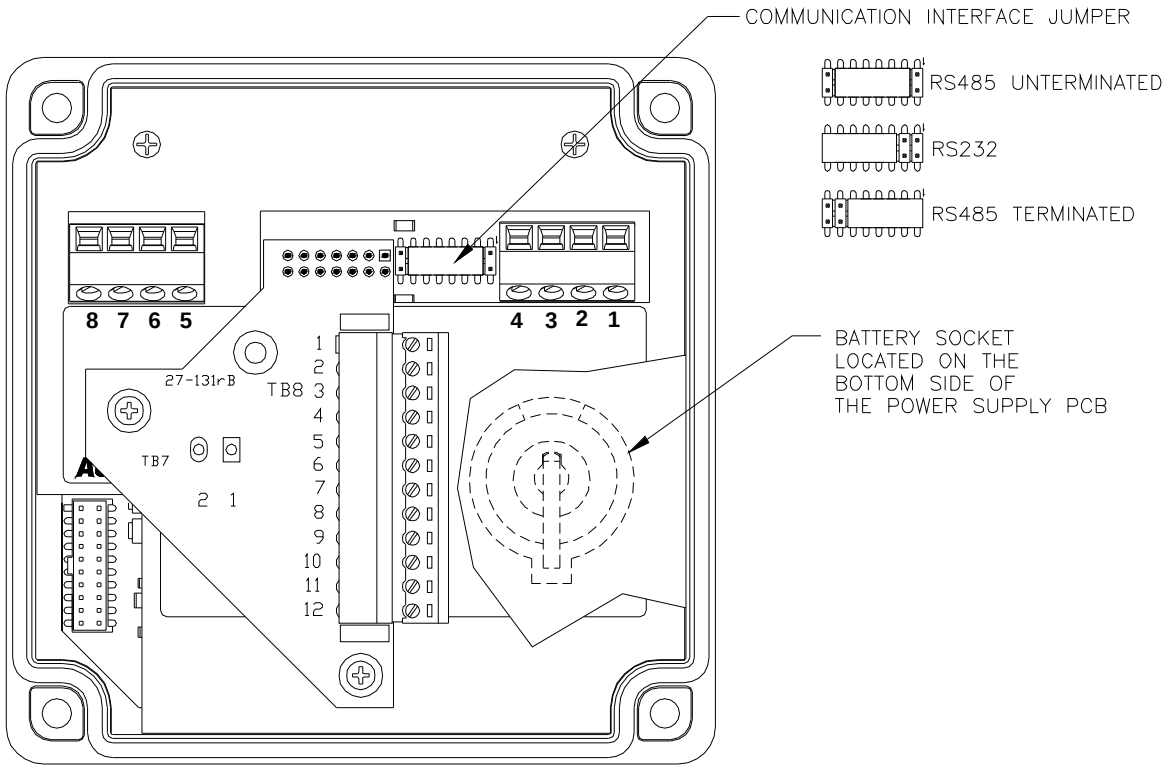


Figure 17. Power Supply Board (Sensor Adapter removed for clarity).

The board is mated to four PCB headers on the CPU board (located below it, in the front of the transmitter front cover), and is held in by three ¼" metal standoffs. Removal of the board is not normally required, other than to change the battery. To remove it, first unplug and remove the Sensor Adapter board, then loosen the three fasteners holding down the metal shield. Remove the metal shield, and then the standoffs. Pull up gently on the board, until it breaks free from the CPU board.

Note: If the Power Supply board is separated from the CPU board for longer than 10 minutes, you will need to reset the transmitter's real time clock (see section 4.19 *Real-time Clock*).

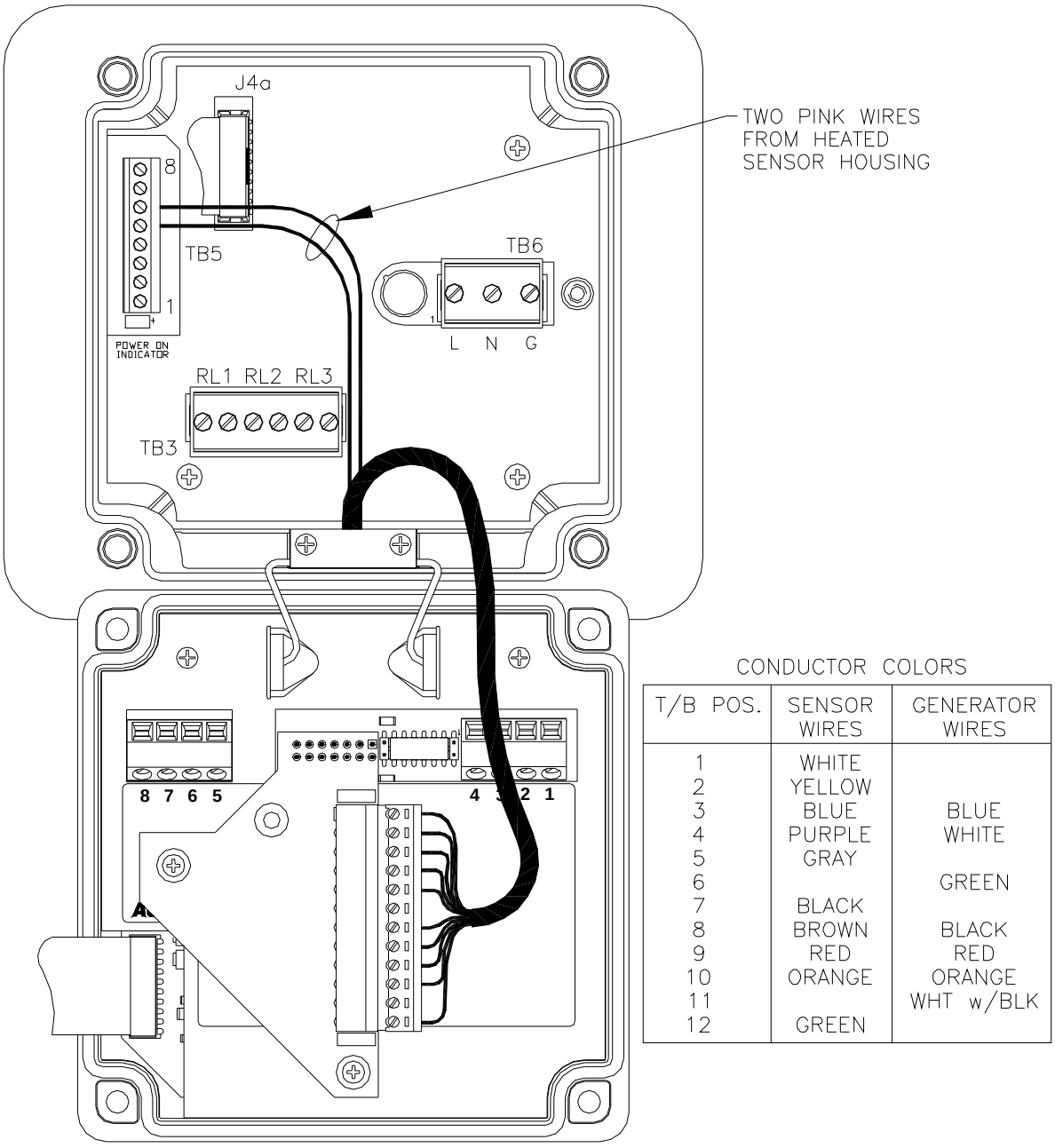
3.4 Communication Interface Jumper, JP2

The RS232/485 port interface is configured by the position of jumper block JP2, as shown in Figure 17. Use Table 3 to choose the appropriate block position according to the protocol, interface, and network configuration of the transmitter. For detailed information regarding Modbus protocol and interface requirements, request a copy of the "D/F12 Modbus Manual".

Table 3. Communication Interface Options

Protocol	Interface	Jumper Plug	Comments Position
HART	Bell 202	N/A	No plug required
Modbus	RS232	RS232	Use to connect one transmitter to a master device in a "point-to-point" configuration. See "D/F12 Modbus Manual" for details.
Modbus	RS485	RS485	Use to connect a single transmitter to a master device and provide bias and 120 ohm termination. Also use on transmitter at furthest end of bus for multi-drop network. See "D/F12 Modbus Manual" for details.
Modbus	RS485	RS485 Unterminated	Use to connect up to 31 transmitters to a master device in a "multi-drop" configuration. Transmitters are connected without adding bias or termination. Terminate transmitter at furthest end of mulit-drop bus. See "D/F12 Modbus Manual" for details.
ASCII	RS232	RS232	Use to connect one transmitter to a printer, or system terminal (see Data logging section).

3.5 Heated Sensor Housing Wiring (Intergral)



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5	GRAY	
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7	BLACK	
8	BROWN	BLACK
9	RED	RED
10	ORANGE	ORANGE
11		WHT w/BLK
12	GREEN	

Figure 18 - Heated Sensor Wiring Diagram

3.6 Remote Sensor Wiring

The remote sensor option permits the sensor to be mounted up to 50' (MAX) from the transmitter. Remote interconnect cable sold separately.

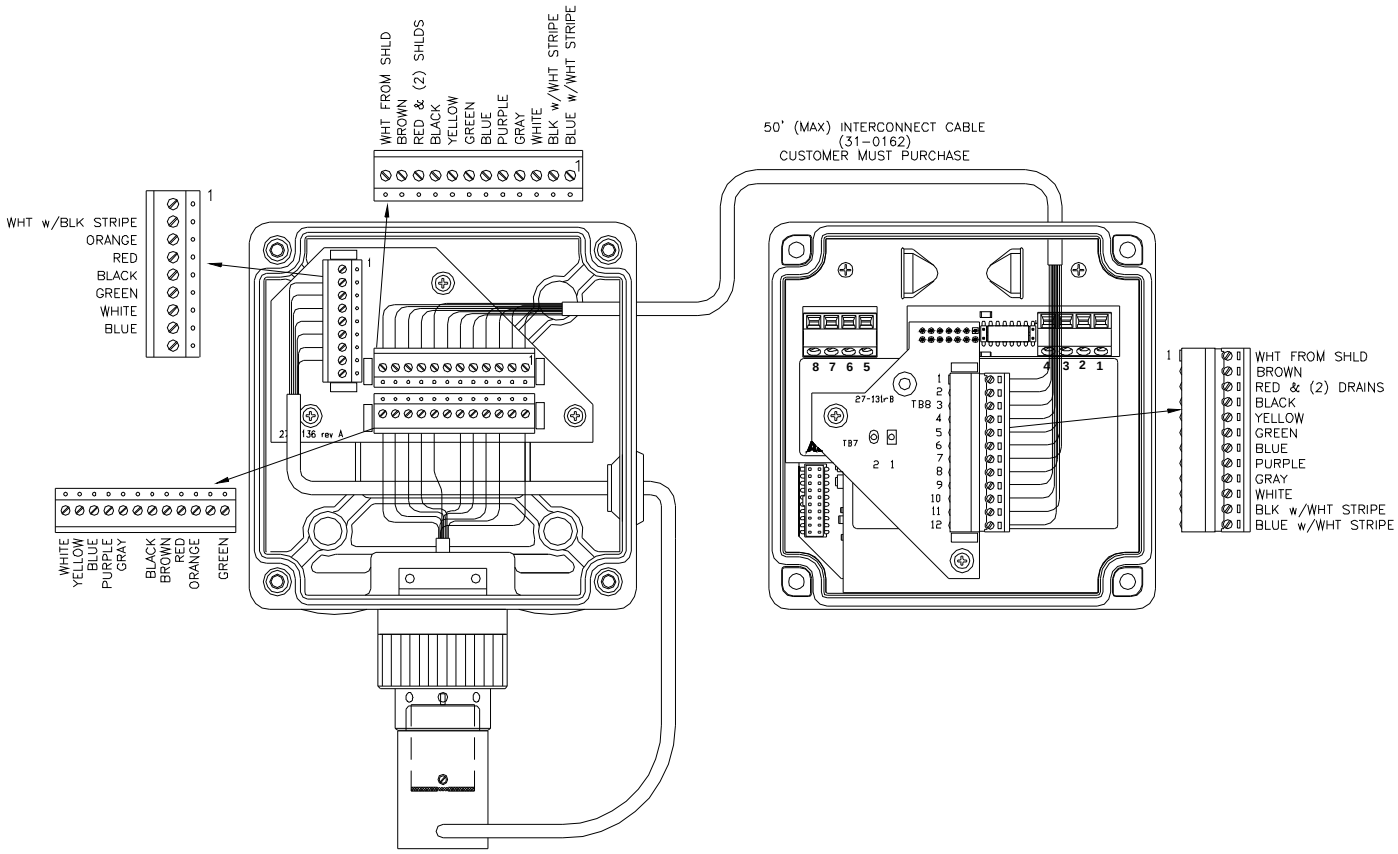
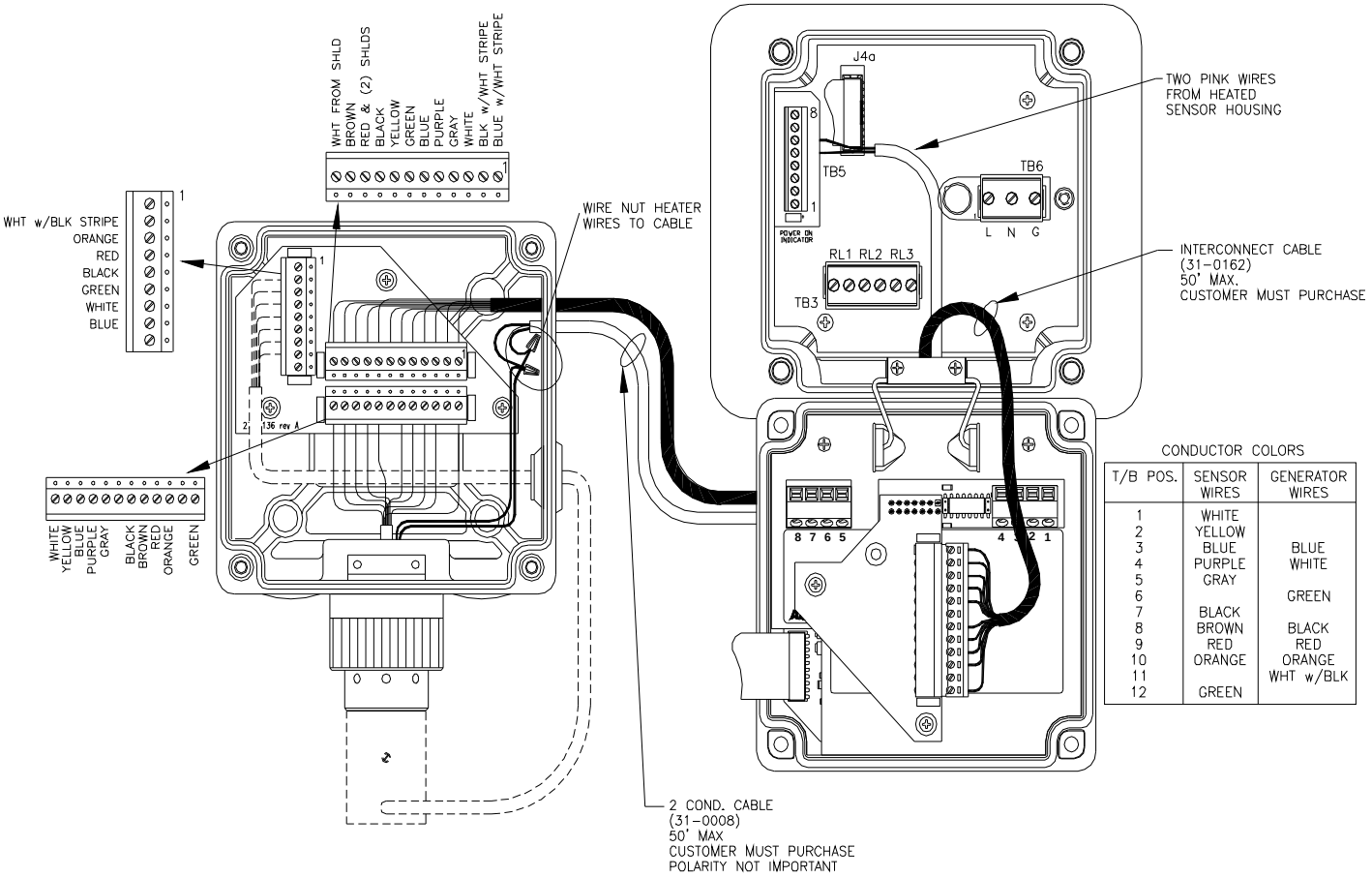


Figure 19. Remote sensor wiring w/Optional Auto-Test Generator

3.7 Heated Sensor Wiring (Remote)



CONDUCTOR COLORS

T/B POS.	SENSOR WIRES	GENERATOR WIRES
1	WHITE	
2	YELLOW	
3	BLUE	BLUE
4	PURPLE	WHITE
5	GRAY	
6		GREEN
7	BLACK	
8	BROWN	BLACK
9	RED	RED
10	ORANGE	ORANGE
11		WHT w/BLK
12	GREEN	

Figure 20. Remote Heated Sensor Wiring Diagram

3.8 Duct Mount Sensor Wiring

The Duct Mount Sensor option permits the sensor to be mounted into a process flowstream.

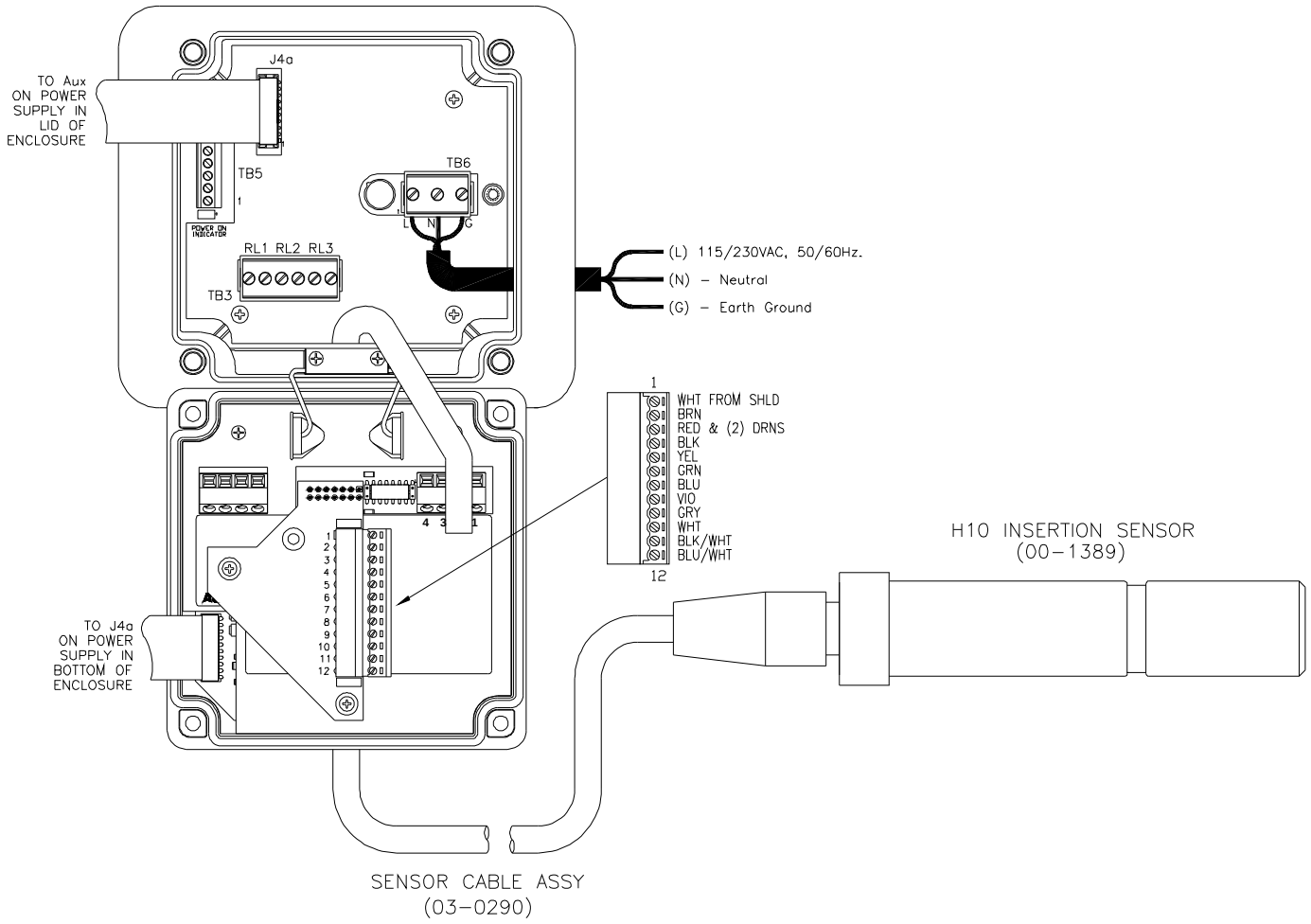


Figure 21 - Duct Mount Sensor Wiring

3.9 Sensor Connection w/6 ft. cable

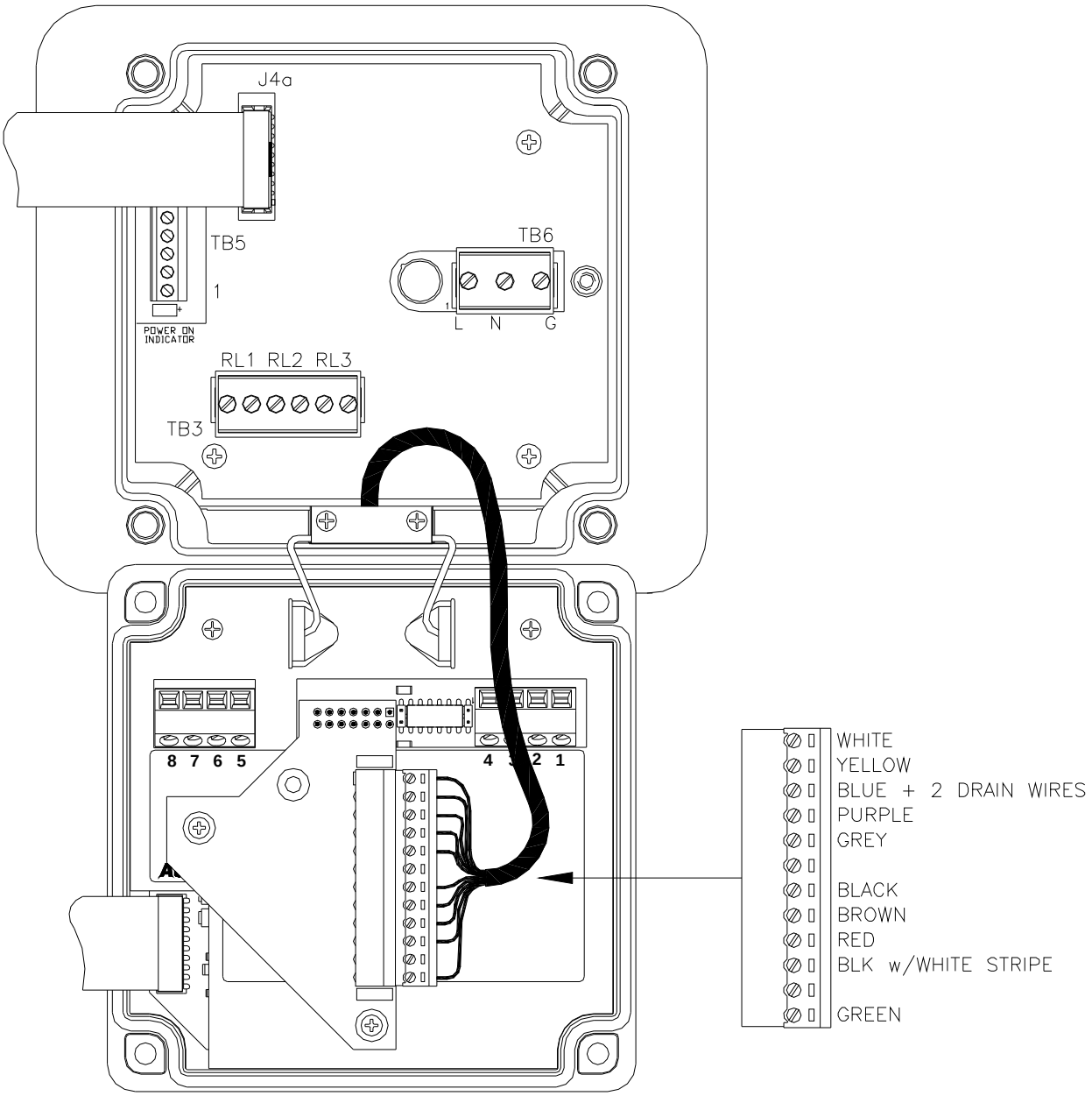


Figure 22 - Wiring Connections - 6ft. sensor cable

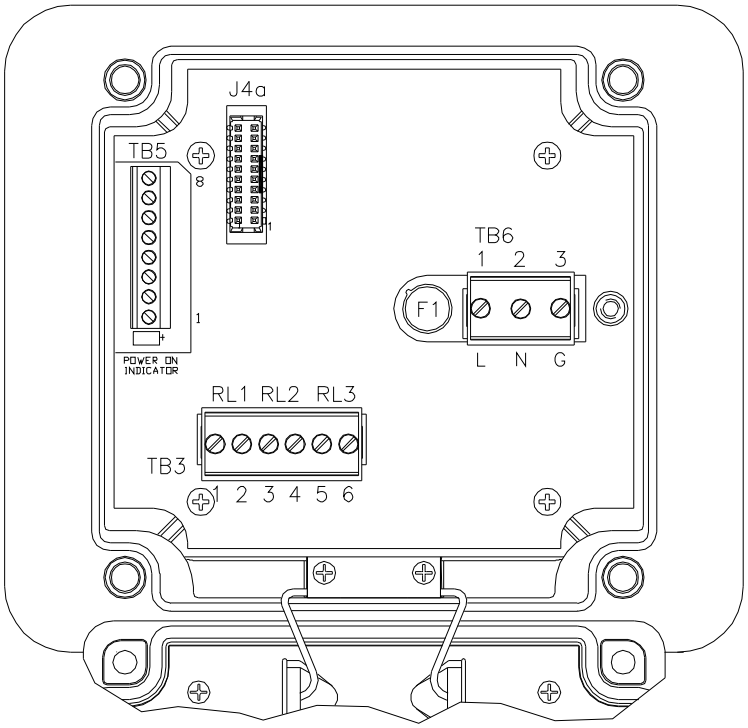
3.10 Alarm Relay Boards (Option)

The Alarm Relay board is available in both an AC powered and DC powered version. Each version features three SPST relays, an external remote alarm reset, and provides power to the transmitter and communication interface. A 20-conductor ribbon cable connects control signals and power between the transmitter and the relay board. Relay operation must be enabled through the operator interface.

Signaling on the 20mA current loop, including HART FSK, is still possible by connecting a separate power supply and current loop receiver to terminals 5 and 6 on the P/S Board.

3.11 AC Powered Alarm Relay Board (Option)

The AC powered version requires 115-230 VAC at 50-60Hz applied to TB6.



J4a
CONNECTS TO (AUX)
ON FRONT LID OF TRANSMITTER

TB3
1 – RL1 Contact NO
2 – RL1 Contact C
3 – RL2 Contact NO
4 – RL2 Contact C
5 – RL3 Contact NC
6 – RL3 Contact C

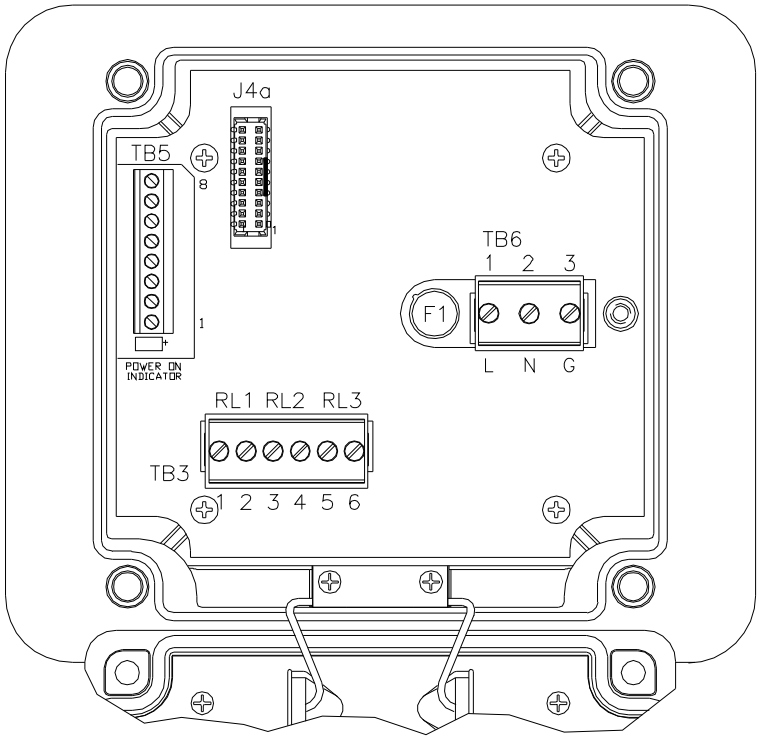
TB5
8 – Loop Power (–)
7 – Loop Power (+)
6 – Heater (Hi)
5 – Heater (Lo)
4 – Pwr–
3 – Pwr–
2 – RemRes
1 – Pwr+

TB6
1 (L) – 115/230VAC, 60/50 Hz.
2 (N) – Neutral
3 (G) – Ground

Figure 23 - AC Powered Alarm Relay board and cover

3.12 DC Powered Alarm Relay Board (Option)

The DC powered version requires 12-30 VDC applied to TB6.



J4a
CONNECTS TO (AUX)
ON FRONT LID OF TRANSMITTER

TB3
1 – RL1 Contact NO
2 – RL1 Contact C
3 – RL2 Contact NO
4 – RL2 Contact C
5 – RL3 Contact NC
6 – RL3 Contact C

TB5
8 – Loop Power (–)
7 – Loop Power (+)
6 – Heater (Hi)
5 – Heater (Lo)
4 – Pwr–
3 – Pwr–
2 – RemRes
1 – Pwr+

TB6
1 (+) – 115/230VAC, 60/50 Hz.
2 (–) – Neutral
3 (G) – Ground

Figure 24 - DC Powered Alarm Relay Board and cover

3.13 Relay Configuration

By default, RL1 and RL2 are under the control of the transmitter's gas concentration alarms. The C (common) and NO (normally open) contacts of relays RL1 and RL2 are jumpered to TB3 and are open when their respective coils are de-energized (i.e., no gas alarm or no power). In contrast, RL3 is under the control of the transmitter's fault alarm, which is programmed to keep the relay coil energized until a fault is detected (or power fails). The C and NC (normally closed) contacts of relay RL3 are jumpered to TB3 so it is closed when the coil is de-energized. The default configuration may be modified cutting and reconnecting jumpers on the Alarm Relay board, and by changing variables via the operator interface.

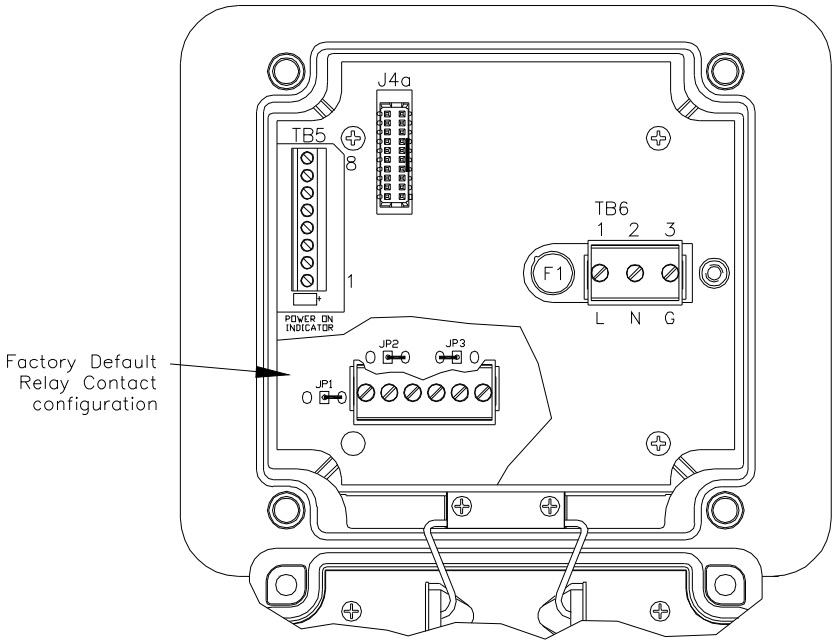


Figure 25 - Relay Configuration Jumper Location

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

3.14 Remote Reset Input

The remote reset inputs on pins 2 and 3 of TB5 are used to clear alarms requiring manual reset. The function is activated when the two contacts are momentarily shorted together.

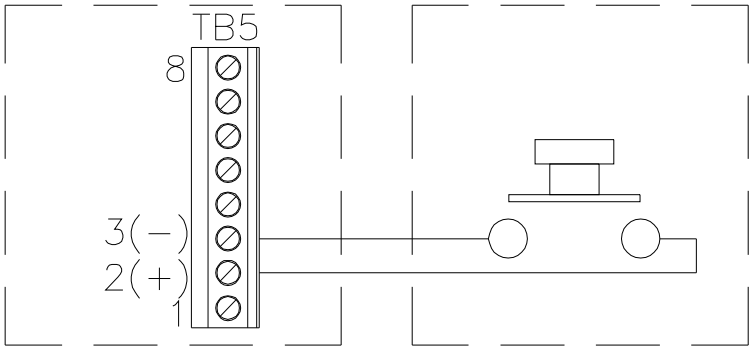


Figure 26 – Remote Reset Input

3.15 Wiring Examples

ATI A17/B14 Receiver(s)

Up to two transmitter/receivers may be connected to a single A17 power supply.

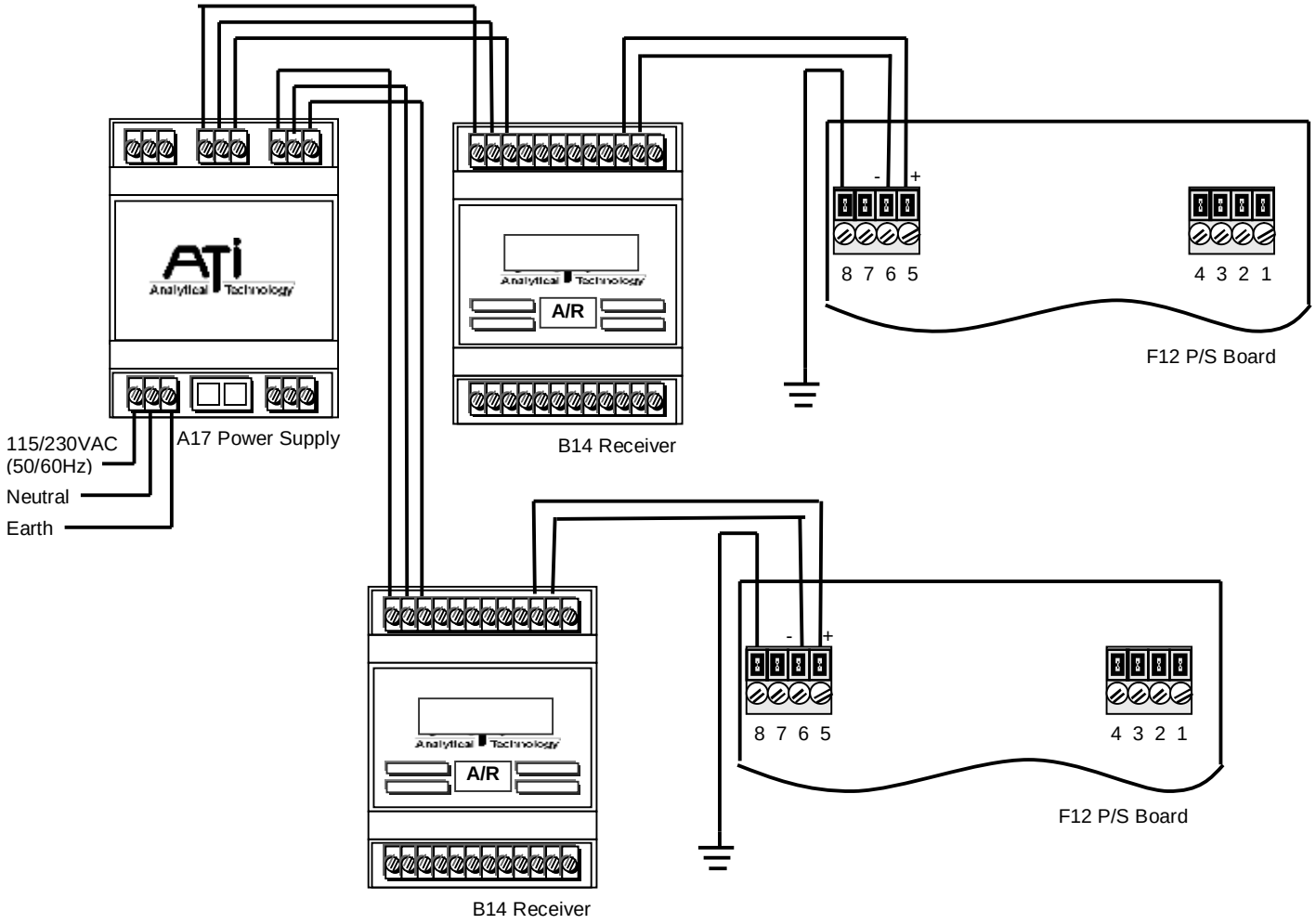


Figure 27 - ATI A17/B14 Receiver Modules

RS485 Transmitter with 4-20mA Signaling to A17/B14 Receiver

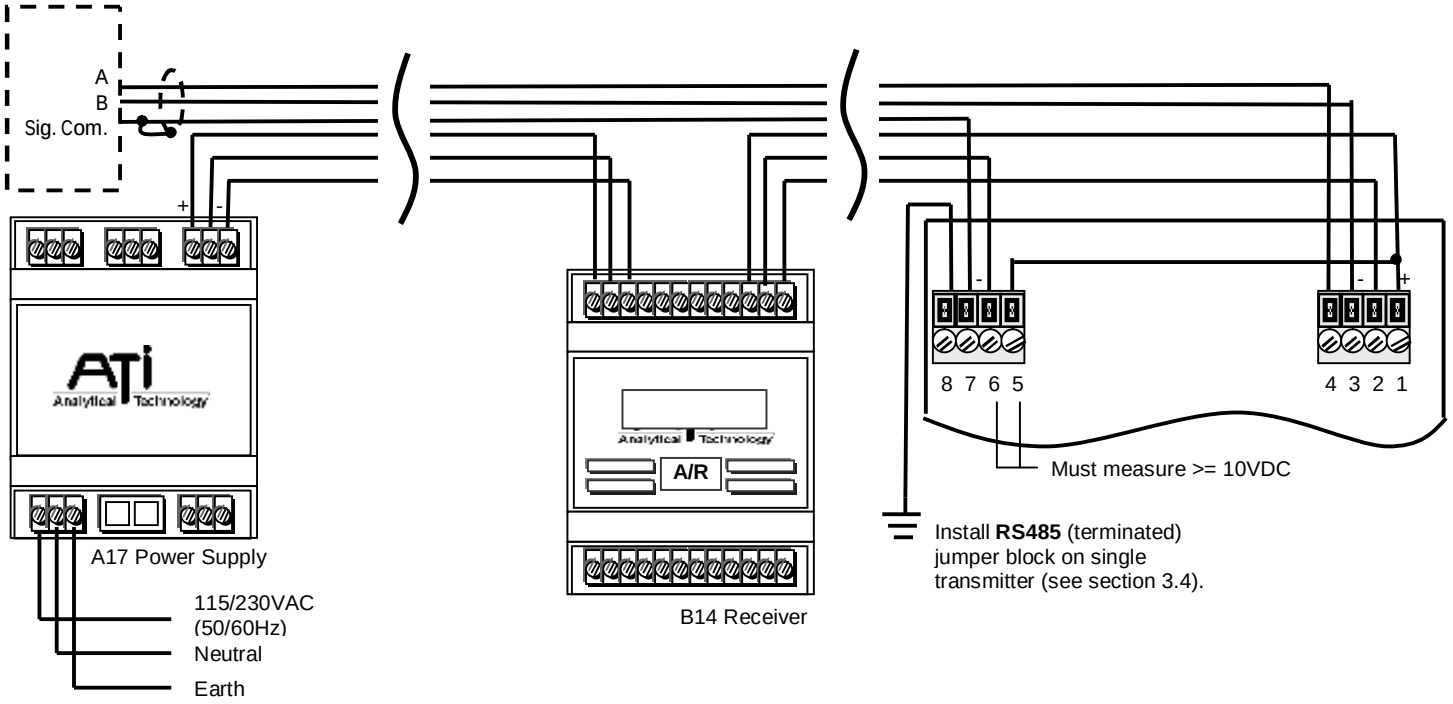


Figure 28 - RS485 Multidrop Network with 4-20mA signaling

\RS485 Multidrop Network without 4-20mA Signaling

The ATI A17 power supply module may be used to power up to four F12 transmitters connected in an RS485 network. Use an appropriate gauge wire to minimize supply voltage drops (must not drop below 10v at any transmitter).

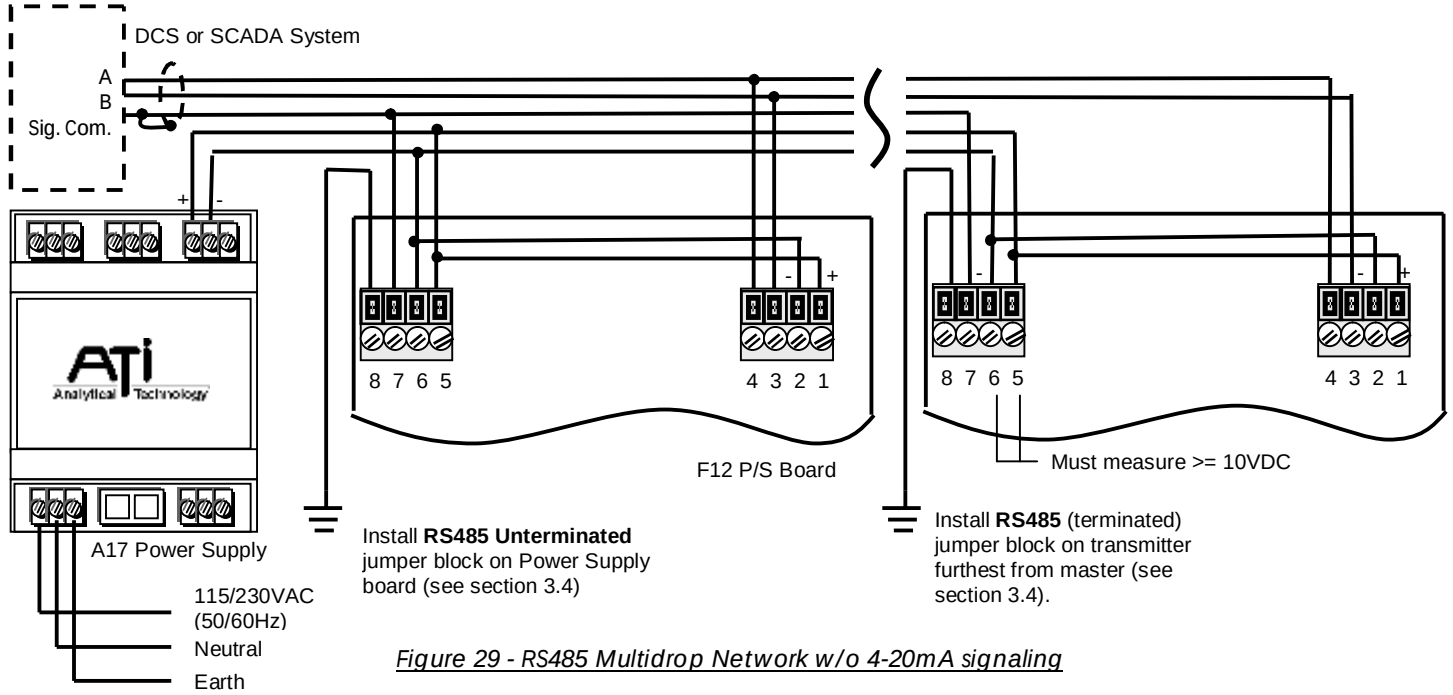


Figure 29 - RS485 Multidrop Network w/o 4-20mA signaling

3.16 AC Powered Alarm Relay Board Wiring

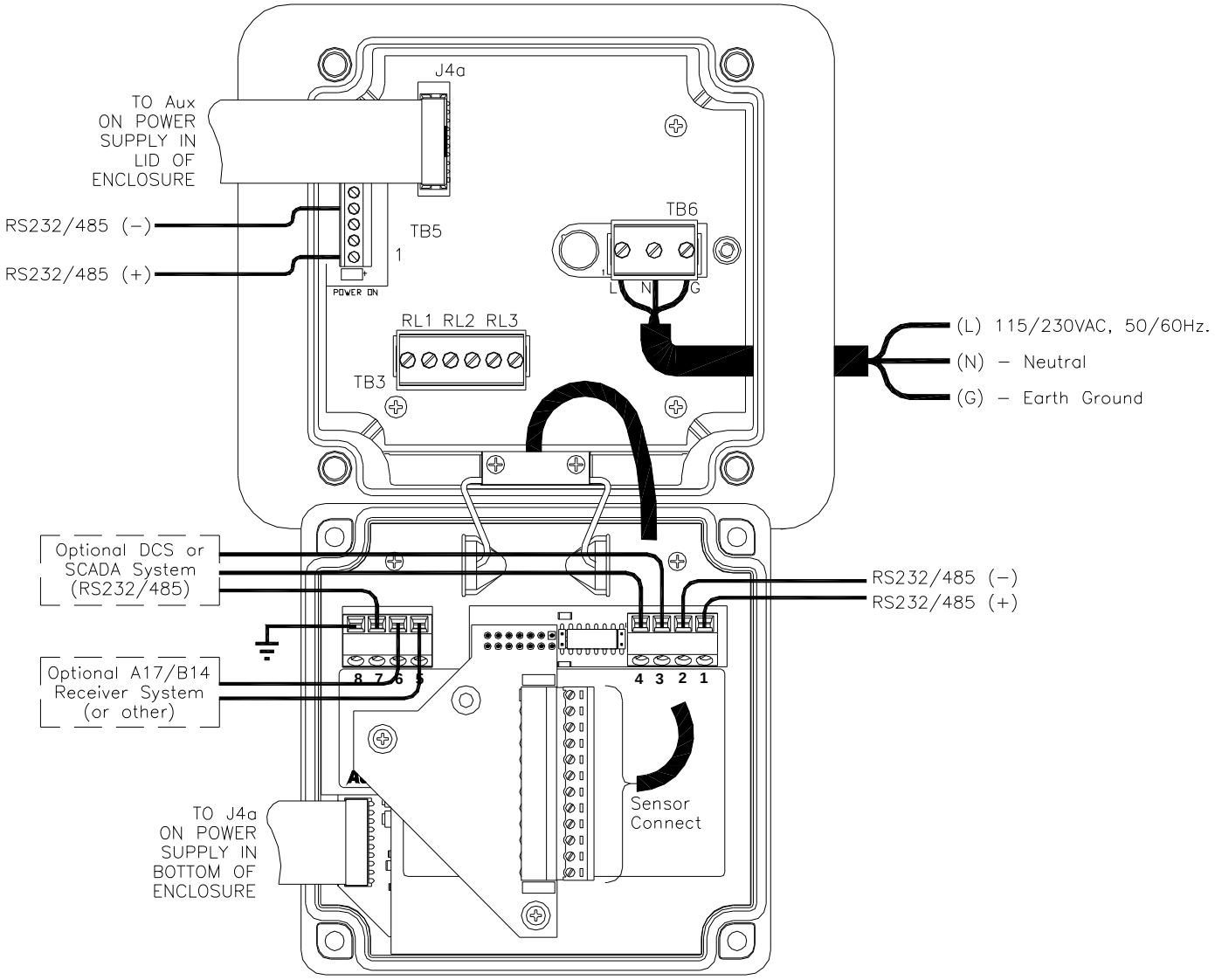


Figure 30 - AC Powered Alarm Relay Board Wiring

3.17 DC Powered Alarm Relay Board Wiring

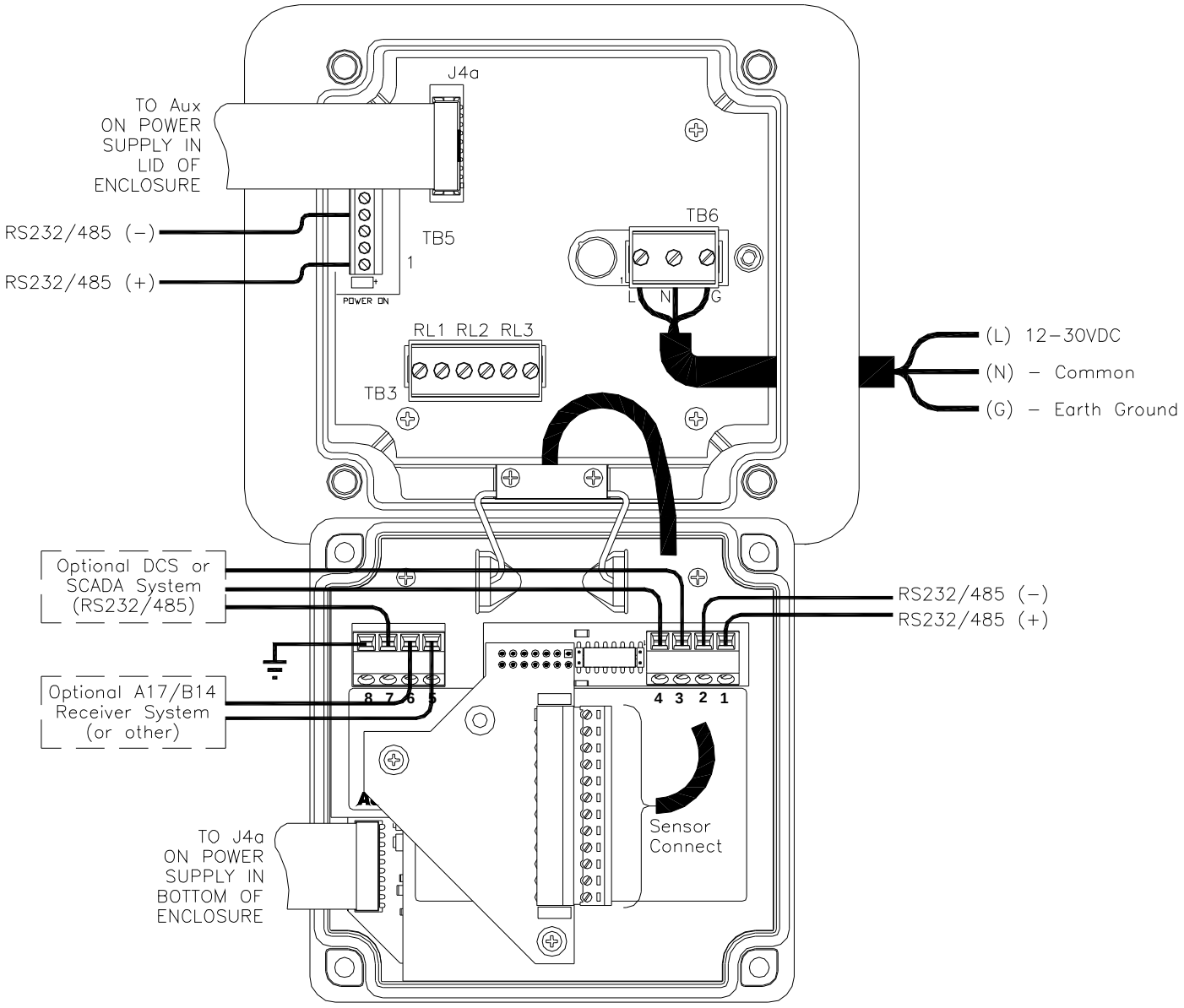


Figure 31 - DC Powered Alarm Relay Board Wiring

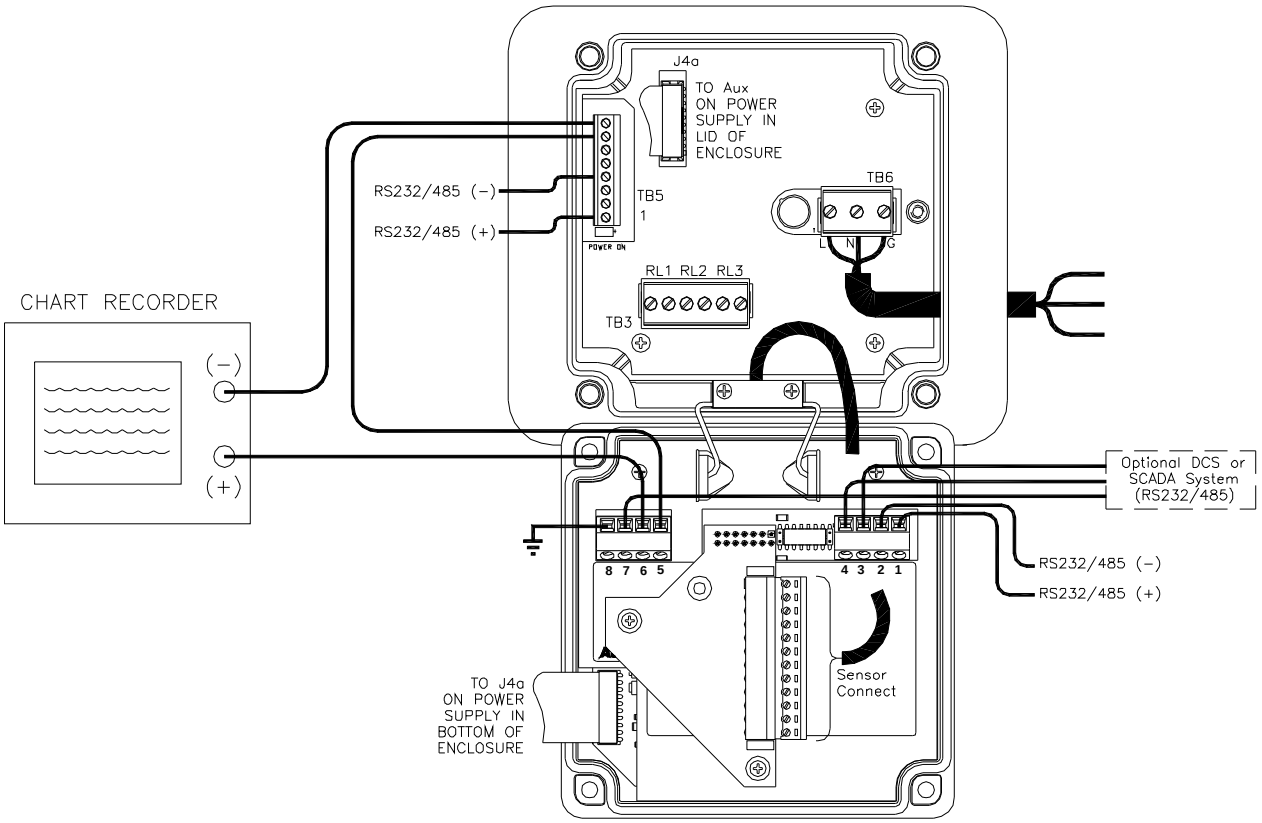


Figure 32 - Relay Option wiring (Non-Loop Power Devices)

3.18 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 and 1100 ohms; however, transmitter specifications restrict the maximum analog output resistance to a lower value (see Specifications). 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), and wire resistance. Wire resistance must not be allowed to drop the Primary Supply Voltage below 10V at the terminals of any transmitter. Hint: use at least 14 AWG wire on supply connections (shown in bold).

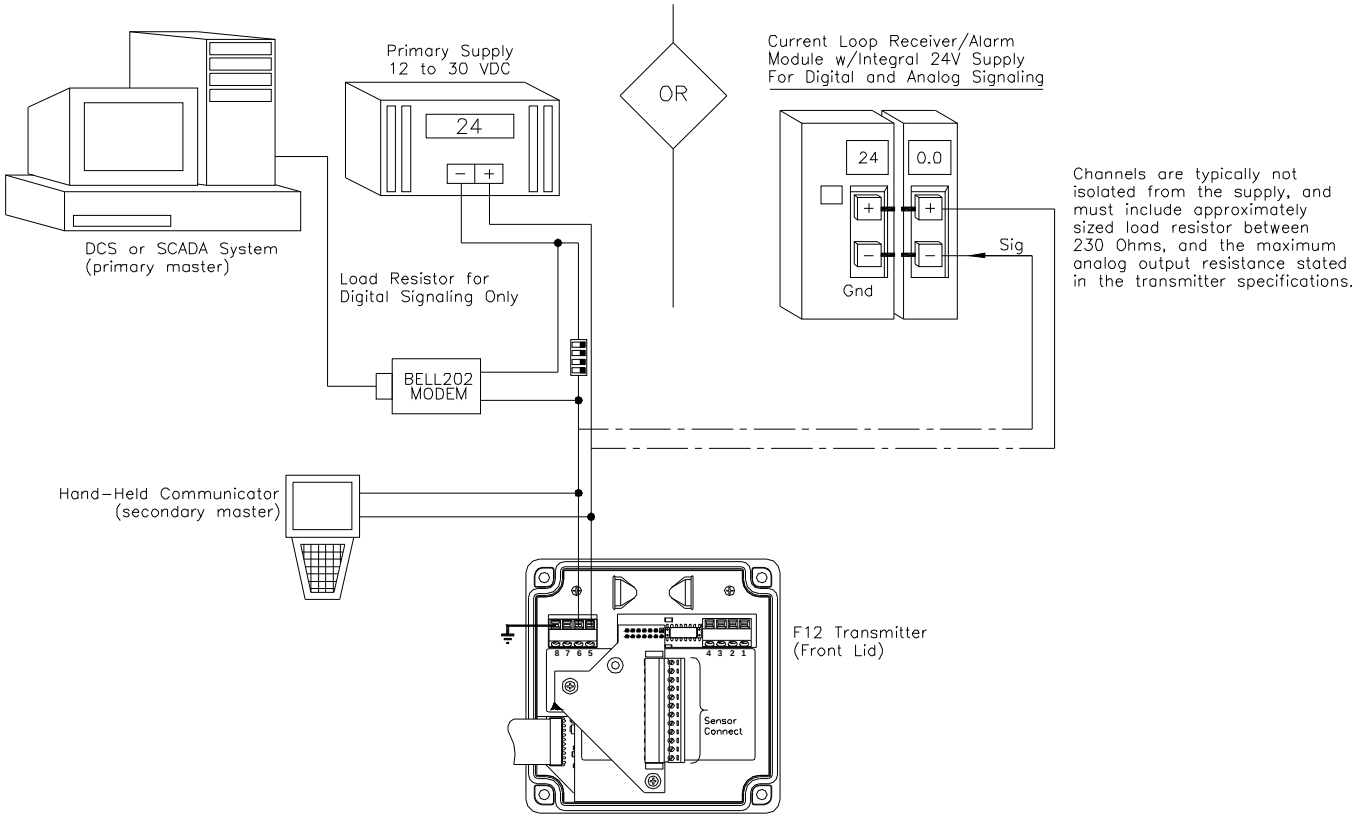


Figure 33 - HART Transmitter, Point-to-Point (2-Wire)

4 OPERATION

4.1 Interface Panel

The F12 operator interface is non-intrusive, so you do not have to remove the housing cover to view the display, configure the transmitter, or calibrate the sensor. It features a backlit transflective 96x32 dot LCD display, and four panel keys.

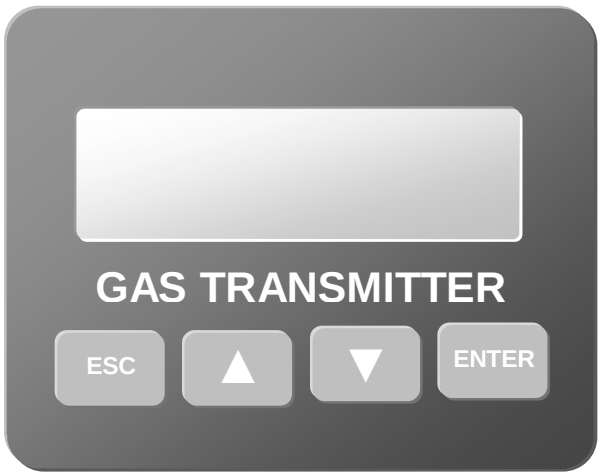


Figure 34 - Operator interface panel

The operator interface is organized into pages that consist mostly of text objects representing readings, indicators, variables, functions, and links to other pages. Navigating the pages of objects is simplified through the use of a "point-and-click" interface, using an arrow cursor that may be moved from one object to the next by pressing the up or down key. While the cursor is "pointing" at an object, pressing the Enter key is said to "select" the object. The action performed depends on the type of object. For instance, 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. Pressing the Esc key aborts the edit and restores the previous value. If not executing a function, or editing a variable, pressing the Esc key returns to the previous page.

4.2 Startup Review Sequence

When the transmitter starts, the display cycles through a series of pages 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 (17.4mA for Oxygen sensors). This state is maintained for 5 minutes to provide time for the sensor readings to stabilize.

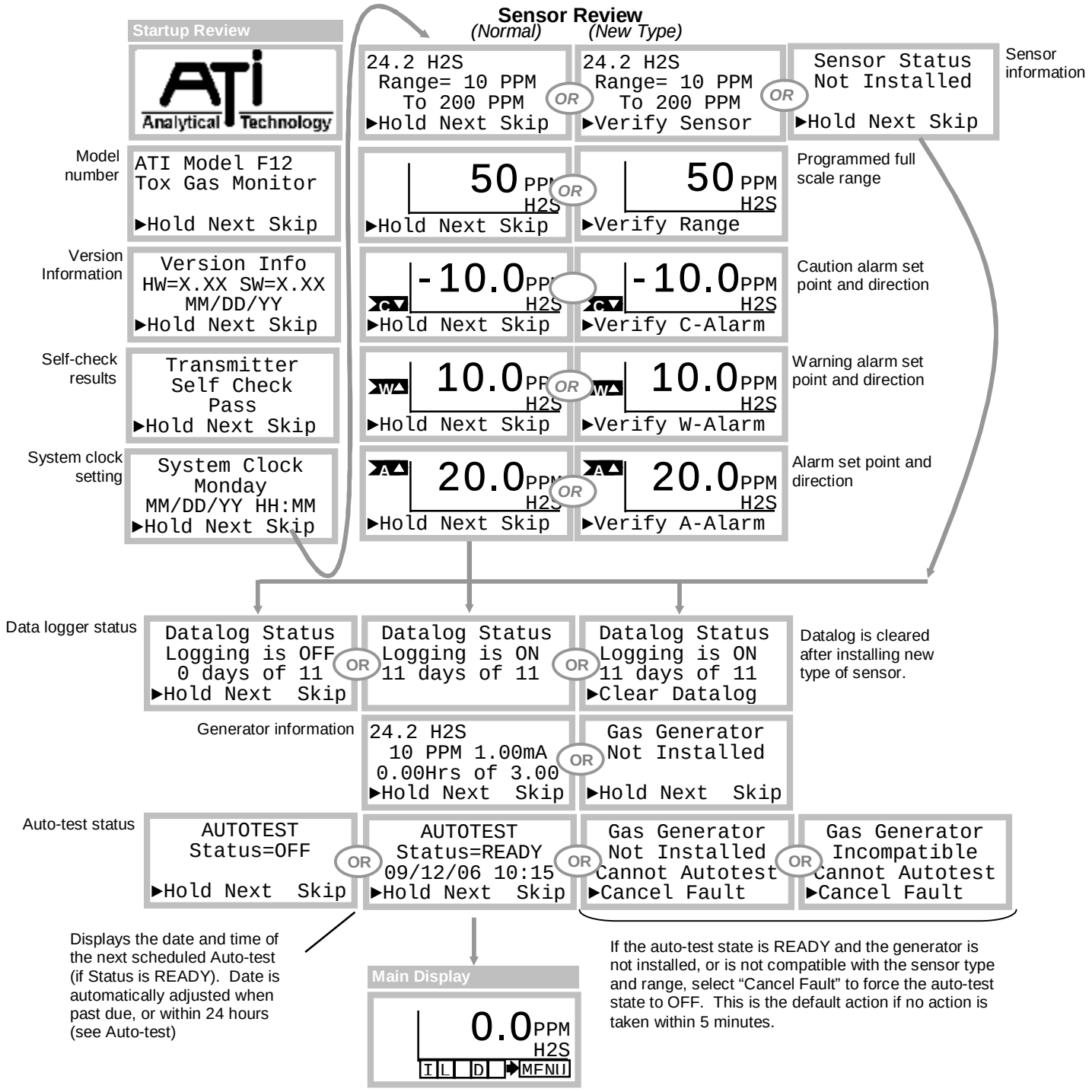


Figure 35 - Startup review sequence Main Display Page

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

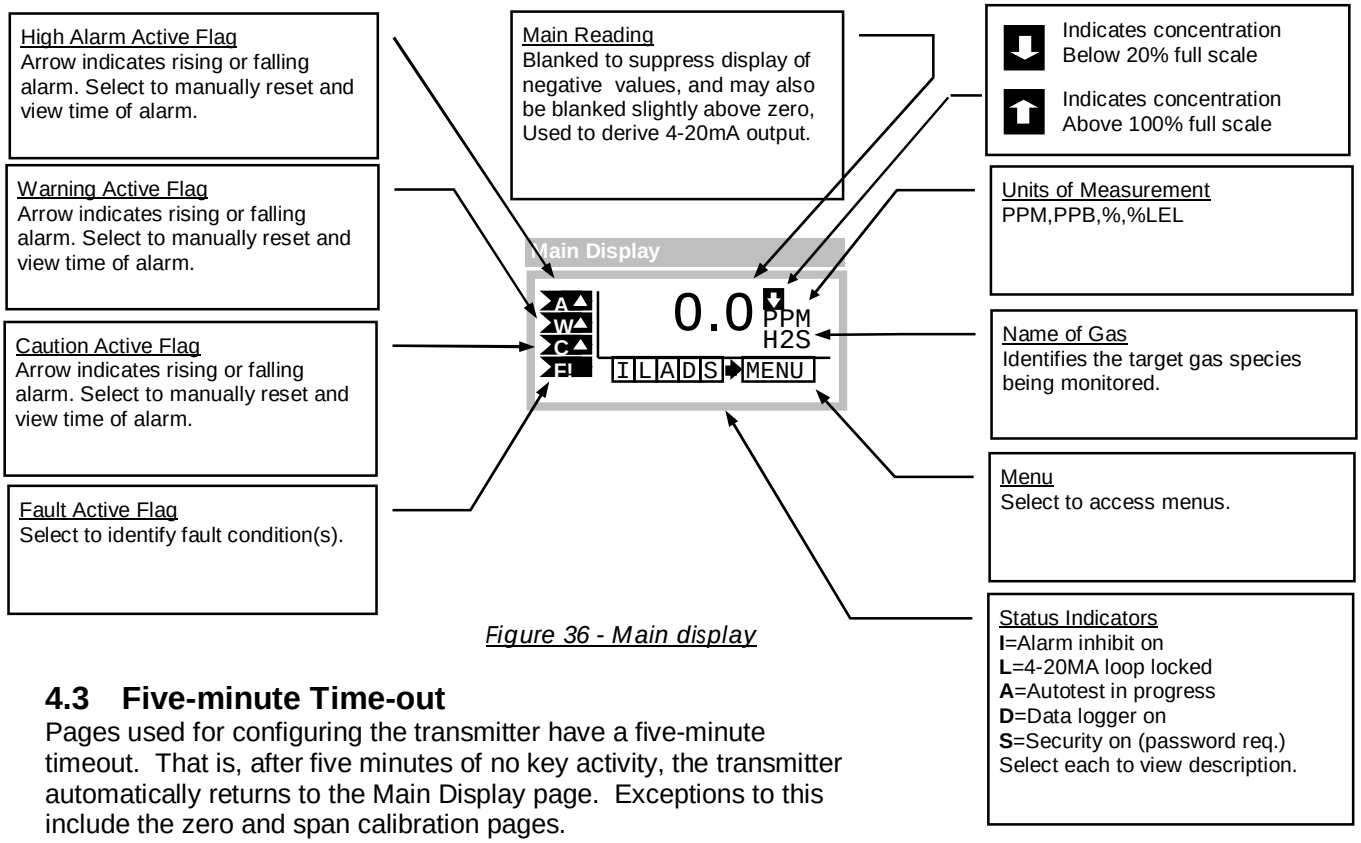
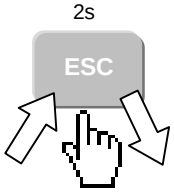


Figure 36 - Main display

4.3 Five-minute Time-out

Pages used for configuring the transmitter have a five-minute timeout. That is, after five minutes of no key activity, the transmitter automatically returns to the Main Display page. Exceptions to this include the zero and span calibration pages.



Esc Key Operation (Main Display Page)

Pressing the ESC key for 2 seconds, then releasing, toggles alarm inhibit mode on and off. If the alarm inhibit mode was off, it is turned on for 15 minutes (default value). If alarm inhibit was on, it is turned off immediately. Alarm inhibit mode is on when the "I" status indicator is visible.

4.4 Fault Indication (Main Display Page)

Faults are indicated on the Main Display Page as shown below.

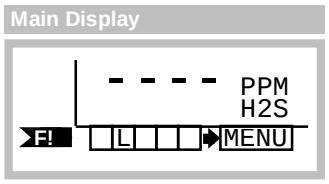
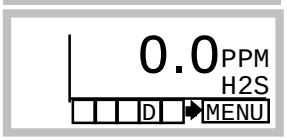


Figure 37 - Standard fault indication Main Reading

The main reading represents the gas concentration value and appears on the Main Display, along with the gas name, and units of concentration. It is reported on the 4-20mA output[1], and is the PV (Primary Variable) reported on the optional HART™ interface. It also appears at register 40043 (F12_SYS_CONCBL) on the optional Modbus interface.

Main Display



By default, the main reading is blanked to suppress the display of negative values. That is, the reading is reported as zero if the concentration should dip below zero, which can occur over time as a result of sensor aging. If the concentration falls to –20% of the full-scale range, a 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 Page*).

During zero and span calibration, the "un-blanked" gas concentration value is displayed, primarily to assess the amount of positive or negative drift. The "un-blanked" reading is also available on the Modbus interface (request "D/F12 Transmitter Modbus Interface Manual", for more information).

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

4.5 Variable Editing

When a variable is selected, the edit cursor appears. The shape of the cursor symbolizes the up-down scroll nature of the value being edited. To provide feedback about which key is being activated, the cursor changes to a solid up-arrow when pressing the Up key, and to a solid down-arrow when pressing the Down key. When the variable has been adjusted to the desired value, pressing the Enter key changes the cursor to an hourglass shape while the program is saving the new value (recalculating associated variables and updating non-volatile memories). Pressing the Esc key aborts the edit and restores the original value.

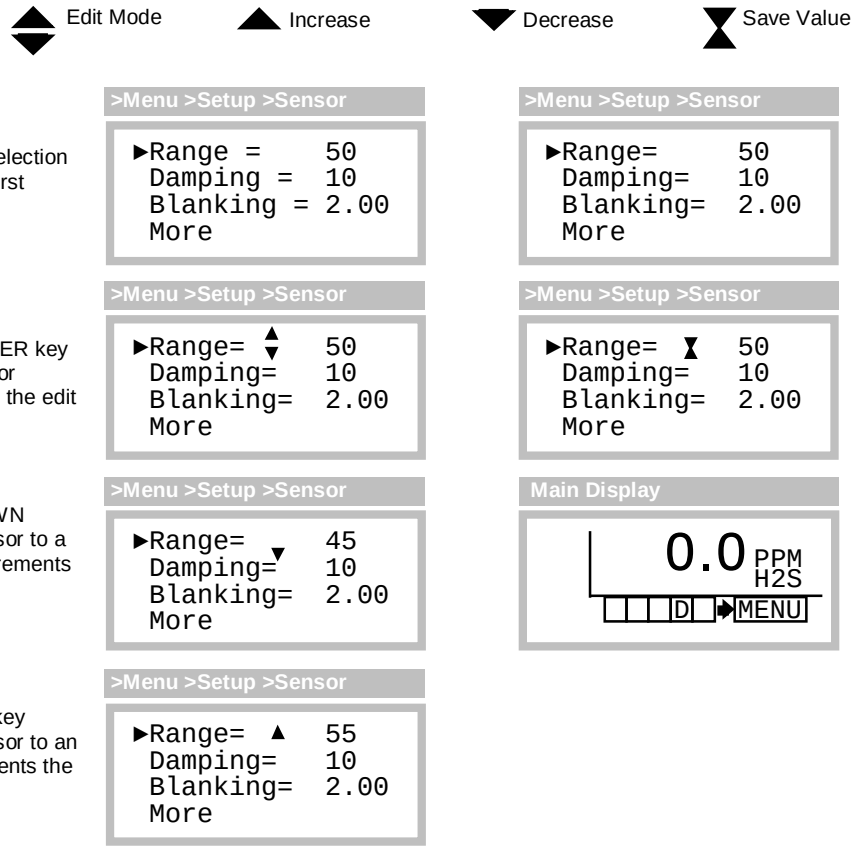


Figure 38 - Variable editing

4.6 Sensors and Generators

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

Sensor Setup Page

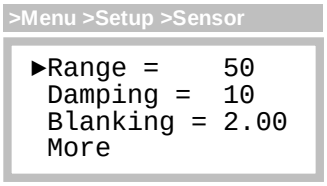


Figure 39 - Sensor setup page

Table 4. Sensor variables

Variables	Description
Range	The Range variable sets the 100% full-scale value of the transmitter, which corresponds to the 20mA output value. Changing the range value also changes the Blanking value, which is computed as a fraction of the range. In this version of the transmitter, Range limits vary from sensor to sensor.
Damping	The Damping variable allows minor adjustment of the transmitter's auto-damping feature, used to stabilize readings. It is a unit-less value from 1 to 100, where a value of 1 corresponds to a T90[2] response of approximately 20s, and 100 is a T90 of approximately 30s.
Blanking	The Blanking variable is used to force 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 to 5% of the full scale range. Note that the transmitter always performs negative blanking, even when Blanking is set to 0. The variable is recomputed when the Range variable changes, so that same fraction of range is maintained. Doubling, or halving the Range variable, doubles or halves the Blanking variable, respectively.
More	More is a link to an additional sensor information page (below).

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

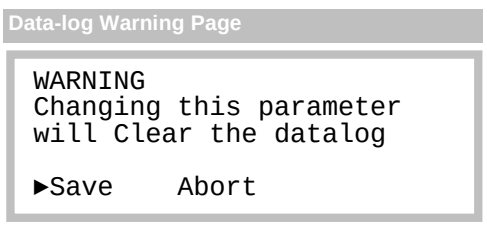


Figure 40 - Data-log warning page

[2] T90 is the time required for the transmitter to reach 90% of its final value, after a step change in gas concentration.

Sensor More Page

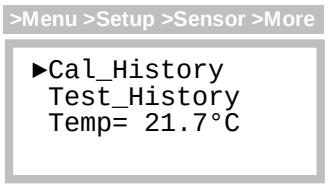


Figure 41 - Sensor "more" page

Table 5. Sensor "more" variables

Variables	Description
Cal_History	Cal_History is a link to the Calibration History page (see Sensor Calibration Records).
Test_History	Test_History is a link to the Auto-test History page (see *Auto-test History*)
Temp	The Temp variable is the sensor temperature reading in degrees Celsius, which may be adjusted up or down to achieve a temperature offset calibration.

4.7 Changing Sensors and Generators

H10 sensors and D18 generators may be "hot-swapped", that is, removed and replaced with power applied. To remove the sensor, unscrew the port cap and carefully pull down on the sensor body. To install, push it into the housing, and screw on the port cap.

Removing Sensors

Removing the sensor with powered applied starts a 60 second count down timer, during which alarms are inhibited, and the current loop output is fixed at 4.0mA (17.4mA for Oxygen sensors). This "immunity" period should be long enough 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 will occur if a sensor is not installed before the timer expires. Figure 42 illustrates the display sequence associated with removing the sensor.

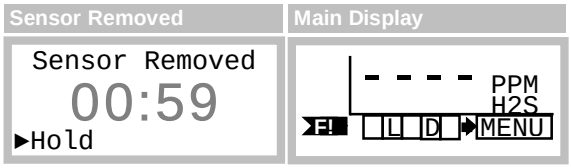


Figure 42 - Sensor removal page

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[3]. If they do not match, review halts and waits for the operator to verify the new sensor, full-scale range, and alarm settings[4]. The startup review is illustrated in Section 4.2 Startup Review Sequence.

[3] 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 will display the settings of the previously installed sensor, which might not match the field transmitter. Fortunately, this is not a real problem. The sensor may be calibrated as normal, and when it is eventually returned to the field, the field transmitter will restore its original settings. Always verify settings of field transmitters.

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

	Warning: **Changing sensor types will clear the data log.**	

If data logging is turned on (indicated by the "D" status indicator appearing on the Main Display), and a different type of sensor (different part number) is installed, you will be prompted to clear the data log during review.

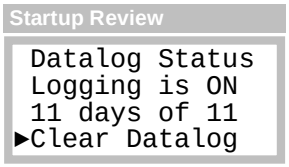


Figure 43 - Clear data log page

Once the sensor is installed, the transmitter executes a 5-minute (typical value) warm-up period, during which alarms are inhibited, the 4-20mA output is held at 4mA (17.4mA for Oxygen sensors), and Zero and Span calibration 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 count down 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 Section 4.2 Startup Review Sequence.

.

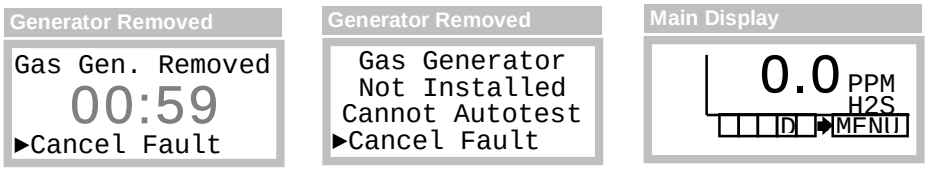


Figure 44 - Generator removal

Installing Generators

When a generator is installed, the transmitter sequences the startup review, beginning with the generator information, as depicted in Section 4.2 Startup Review Sequence.

. If problems with the gas type[5] or range[6] are detected, they are announced during review, and the auto-test control is set to OFF.

[5] Some generators produce a surrogate gas, instead of the sensor's target gas (see Auto-test)

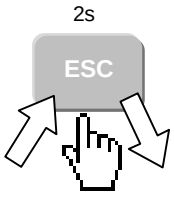
[6] Some generators may not produce enough gas to pass Auto-test on higher sensor ranges (see Auto-test.

4.8 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.

Reminder:
Inhibit alarms before bump-testing.

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



To quickly inhibit alarms…
Press the ESC key for 2 seconds, then release. This will toggle the alarm inhibit mode on for 15 minutes (default value), hold the current loop at 4mA (17.4mA for Oxygen sensors[7]), and cause the "I" and "L" status indicators to appear. Repeat the procedure when finished with the bump-test, and verify the flags disappear. See "Inhibiting Alarms" for more details.

[7] Oxygen sensors are usually exposed to air continuously, and do not require bump-testing.

4.9 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. ATI recommends bottled 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, but 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 ATI for many toxic gases. Contact ATI, or your local ATI representative, if you have questions about calibration gas kits or gas sources.

Indications During Sensor Calibration
The "un-blanked" gas concentration value is displayed during zero and span calibration, primarily to observe any slight amount of positive or negative drift. In addition, alarms are cleared and inhibited, and the 4-20mA output of the F12 transmitter is locked at 4.0mA (transmitters equipped with Oxygen sensors are locked at 17.4mA, representing normal, 20.9% atmospheric Oxygen). The 4-20mA output will not change when gas is applied and removed, and for 15 minutes thereafter (the default value). While viewing the calibration pages, the LCD display will indicate the changing gas concentration.

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

- Sensor removed, or in 5-minute[8] warm-up period
- Transmitter fault is active
- Auto-test is active ("A" status indicator appears on Main Display page)

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

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

4.10 Zero Calibration Procedure

Performing a zero calibration requires bottled "Zero-gas" with a 500 cc/min regulator, calibration adapter, and a convenient length of ¼" tubing. The gas used depends on the type of sensor installed. For example, an H_2S sensor may be zeroed with Zero-air, while Oxygen sensors 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 the factory if you are uncertain about which gas to use.

Referring to Figure 40, push 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.

From the Main Display, select Menu, then Zero_Sensor, as shown in Figure 451. This will clear and inhibit alarms at the transmitter, and hold the current loop output at 4mA (17.4mA for Oxygen sensors).

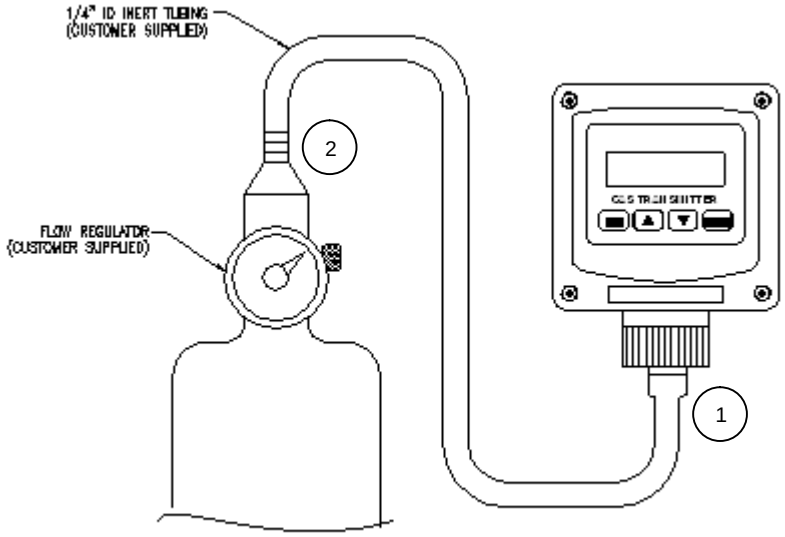


Figure 45 - Zero calibration

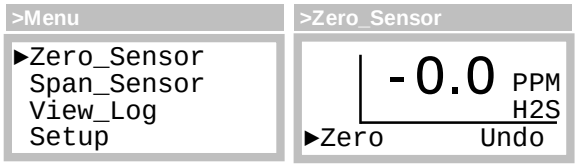


Figure 46 - Zero Sensor page

Open the regulator to flow Zero-gas to the sensor. After approximately four minutes, select Zero. The "Cal" message will appear briefly at the bottom of the page and the reading will be forced to 0, 0.0, or 0.00. Since the reading is not blanked, it may show a negative sign, like "-0.0", which is normal. The procedure may be cancelled by selecting Undo. The Undo function is only possible while remaining on the Zero_Sensor page. Leaving the page will disable the possibility of canceling the calibration.

Press the Escape key twice to leave the Zero_Sensor page and return to the Main page. By default, alarms will remain inhibited, and the current loop fixed for 15 more minutes (the default value).

4.11 Span Calibration Procedure

Span calibration* requires bottled "span-gas" with a 500 cc/min regulator, calibration adapter, and a convenient length of ¼" 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 47, 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.

From the Main Display, select Menu, then Span_Sensor, as shown in Figure 48. This will clear and inhibit alarms at the transmitter, and hold the current loop output at 4mA (17.4mA for Oxygen sensors).

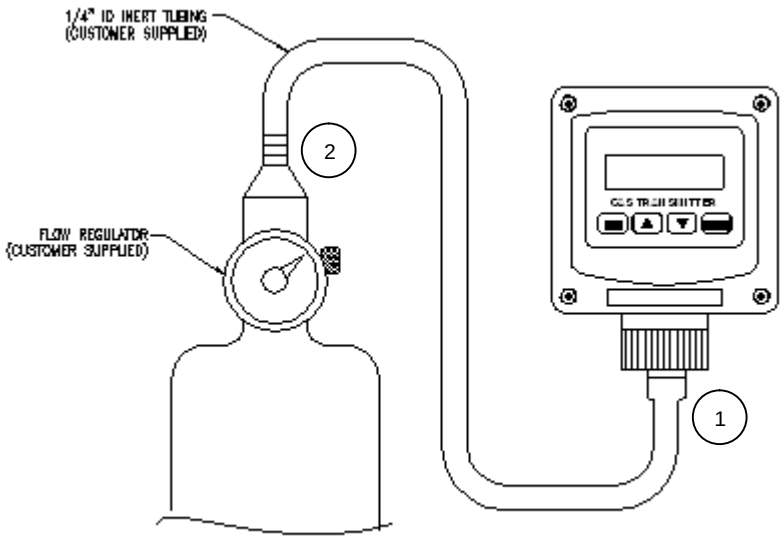


Figure 47 - Span calibration

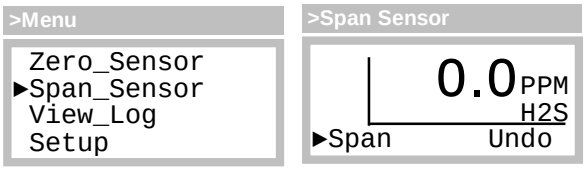
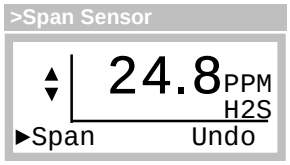
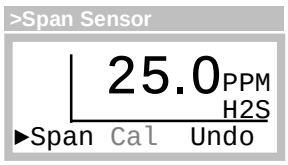


Figure 48 - Span Sensor page

Open the regulator and allow span gas to flow to the sensor. The displayed reading should begin to increase, and stabilize after 5 to 10 minutes, depending on the gas type and range of the sensor.



Select Span, the concentration reading will become fixed, and the blinking Up/Dn edit cursor will appear just to the left of the reading. Press the Up or Down key to correct the reading to match the known concentration of gas, then press Enter.



The 'Cal' message will appear briefly at the bottom of the page. The procedure may be cancelled by selecting Undo. The Undo function is only possible while remaining on the Span_Sensor page. Leaving the page will disable the possibility of canceling the span calibration.

Press the Escape key twice to leave the Span_Sensor page and return to the Main page. Disconnect the calibration adapter from the sensor and permit the readings to return to zero. By default, alarms will remain inhibited and the current loop fixed for 15 more minutes (the default value). Once the reading is below any of the alarm set points, you may terminate the alarm inhibit (and fixed loop output) using the Esc key on the Main Display, see *Esc Key Operation (Main Display Page)*.

4.12 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 will drop into place and automatically locate 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.

	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.	

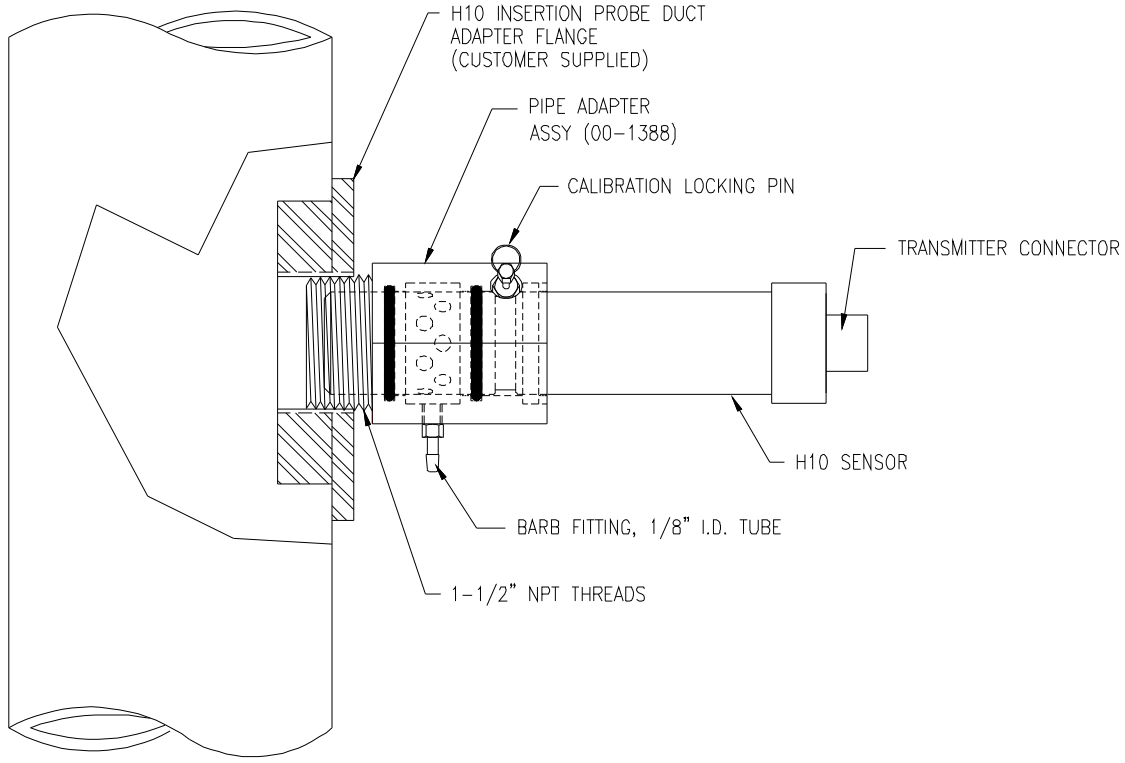


Figure 49 - Calibration of duct-mount sensors

4.13 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 page.

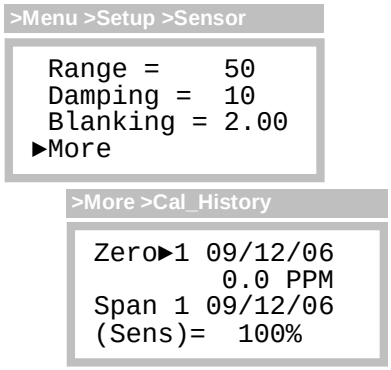


Figure 50 - Sensor calibration history page

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 µA/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 e.g., 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.

4.14 Auto-test

The Auto-test option verifies the serviceability of the transmitter on a prescribed schedule by exposing the sensor 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 fault 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 page.

The test is performed at a specific time of day, and may be scheduled to repeat every 1 to 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 D18 gas generator, which must be compatible with the installed sensor's gas type, and full-scale range.
Table 6 lists gas compatible generators and sensors. Contact the factory for a complete list.

Table 6. Compatible generators and sensors

D18 Generator Part No.	***Generator Type***	***Compatible H10 Sensors***			
		Sensor Type	***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
00-1243	H_2S	H_2S	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

Auto-test is controlled by the Status variable, which appears on the Auto-test page shown below.

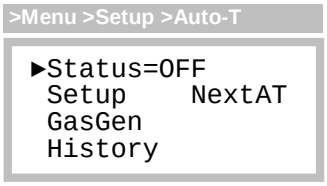


Figure 51 - Auto-test control page

Table 7. Auto-test control variables

Variables	Description
Status	The variable Status may be set to one of three values: OFF – Auto-test will not begin automatically READY – Auto-test will occur on a regularly scheduled basis START – Auto-test will run once after returning to the Main Display page, and does not affect the preset schedule. If a generator is not installed, Status will be forced to OFF, and may not be changed to READY or START until one is installed. Setting the Status variable to START will not begin a manual Auto-test until you return to the Main Display page. This is designed to permit changes to the setting, or other settings, before launching the Auto-test sequence.

Auto-test Setup

The Auto-test setup page configures the Auto-test schedule pass threshold, and options for various transmitter indications.

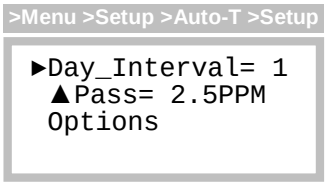
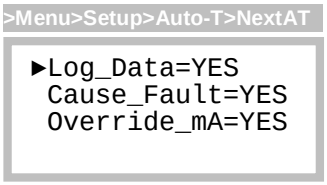


Figure 52 - Auto-test setup page

Table 8. Auto-test setup variables

Variables	Description
Day_Interval	The Day_Interval variable specifies the number of days between automatic tests. The default is 1, and the limit is 1 to 14 (the exact time of day for testing may be set on the NextAT page, see below).
▲Pass	*The delta-Pass variable specifies the amount by which the gas concentration must increase, in order to pass. Prior to starting the test, this amount is added to the "un-blanked" gas concentration reading to compute the pass threshold value that appears on the display (see Figure 56 - Gas Generator information page* *Auto-test Sequence*). This value is limited between 5%(default value), and 10% of the full-scale range (see Range in Table 4)
Options	Options is a link to the Auto-test Options page (below).

Auto-test Setup Options



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

Figure 53 - Auto-test setup options page

Variables	Description
Log_Data	The Log_Data variable controls values logged during Auto-test. When set to YES (default), the gas concentration (main reading) is logged as usual, including any increase caused by the gas generator. When set to NO, a code is logged that will display as, "TEST", on graphic and tabular report pages, and printouts.
Cause_Fault	The Cause_Fault variable determines if Auto-test failures cause transmitter fault alarms. When set to YES (default), a failure to pass Auto-test after the third attempt will cause a fault alarm, and force the 4-20mA output to the Fault_mA value, regardless of how the test was initiated (automatic or manual). When set to NO, Auto-test failures do not cause fault alarms (not recommended).
Override_mA	The Override_mA variable controls the 4-20mA output during Auto-test. When set to YES (default), the 4-20mA output will be forced to the Autotst_mA value to prevent receiver alarms (see *4-20mA Setup*). When set to NO, the output will increase as the gas concentration rises, and may cause receiver alarms (not recommended).

Next Auto-test

The date and time of the next scheduled Auto-test appears on the NextAT page. The time appearing on this page establishes the time of day for all future Auto-tests. After each Auto-test, the date will be incremented by the Day_Interval variable on the Auto-test Setup page (above). Note that if the Auto-test Status variable is set to READY, 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 Auto-test control page (above), and seeing the Status variable blinking START. At this point, you may change the control to OFF, change the system clock, then change the control back to READY.

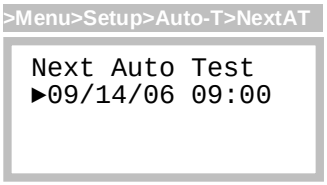
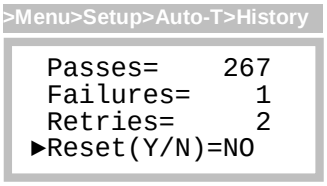


Figure 54 - NextAT page

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.

Auto-test History



The Auto-test History page provides a summary of passes, failures, and retries, which 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.

Figure 55 - Auto-test history page

The Reset function permits all counts to be zeroed by selecting Reset, and scrolling the value to YES. Clearing the counts is not recommended, since this information can prove useful over the lifetime of the sensor.

Gas Generator Information

The Gas Generator page lists information about the D18 gas generator. The top line contains the generator gas code and the chemical abbreviation of the gas. The second line shows the delta-Pass value (described on the ***Auto-test Setup***), and the amount of current required to generate that particular concentration. The third line displays the mAH consumption of the generator. Selecting the Exit function returns the display to the previous page.

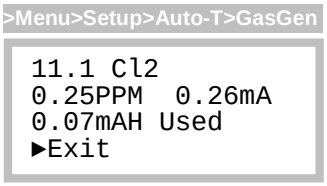


Figure 56 - Gas Generator information page

Auto-test Sequence

When the Auto-test starts (automatically or manually), alarms are inhibited and by default, the loop is fixed at 4mA (see ***4-20mA Setup***). The transmitter will then step 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 recovery period, will cancel the alarm inhibit and revert 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 4-20mA output will usually be 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.

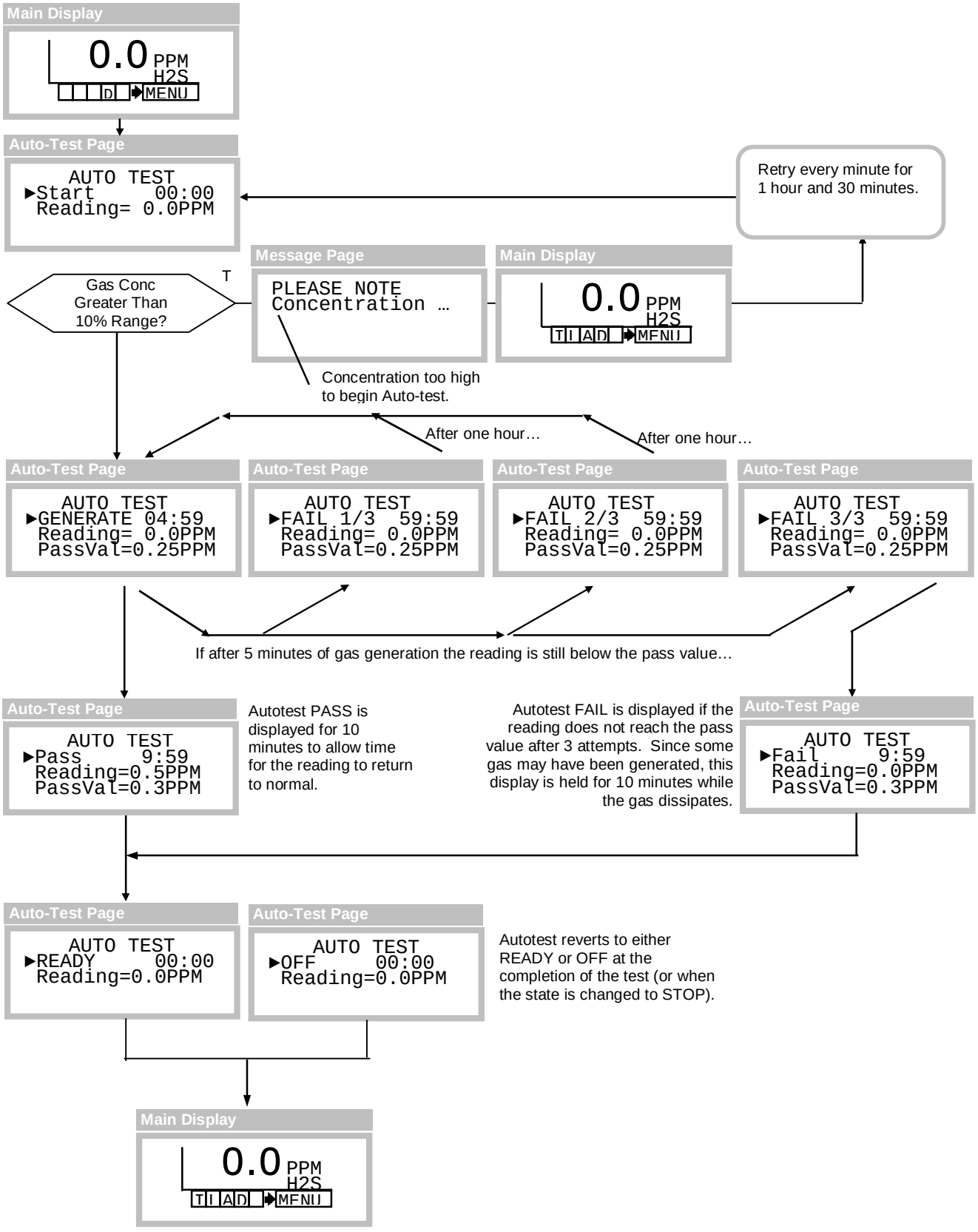


Figure 57 - Auto-test sequence pages

4.15 Alarms and Relays

Three gas concentration alarms and one fault alarm are standard in the F12 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 Relay*).

Gas Concentration Alarms

Gas concentration alarms are classified as "high level" (or "rising"), and "low level" (or "falling"), according to whether they are set to activate when too much gas is detected, or too little. The transmitter features three alarms labeled Caution, Warning, and Alarm. Although not strictly enforced, Alarm usually has the highest priority, followed by Warning and Caution. Figure 58 and Figure 59 depict the default priority relationships.

For toxic gas sensors, the typical default setting for the Warning alarm is the TLV (threshold limit value) of the target gas. Alarm is usually set to 2 or 3 times higher than the TLV, and Caution is typically used to alarm on negative drift of –10% range or more (a fault alarm occurs if the reading drifts to –20% range, or below).

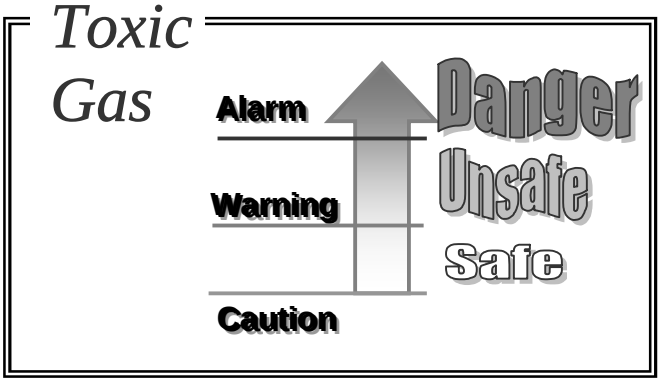


Figure 58 - Priority for high level (rising) alarms

Normal atmospheric oxygen is 20.9%. Oxygen sensor alarms default to: Warning 19.5%, Alarm 16%, and Caution 23%. Note that Caution is used to trap positive sensor drift.

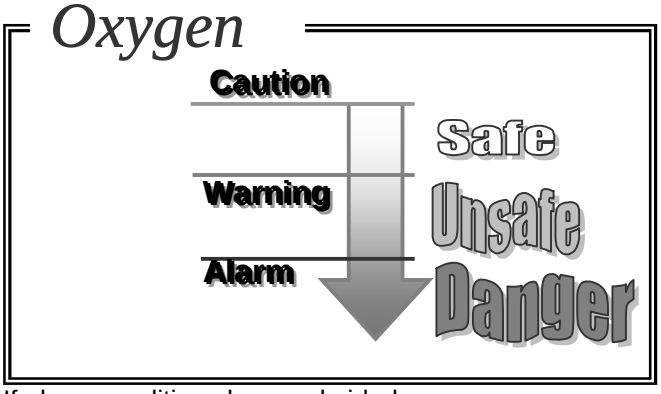


Figure 59 - Priority for low level (failing) alarms

Manual Alarm Reset

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 Main Display page. The Alarm Reset page appears and displays the date and time of the alarm. If alarm conditions have subsided, you may reset just the selected alarm (Reset), or all alarms (ResetAll). A link to the Alarm Inhibit page is provided for convenience.

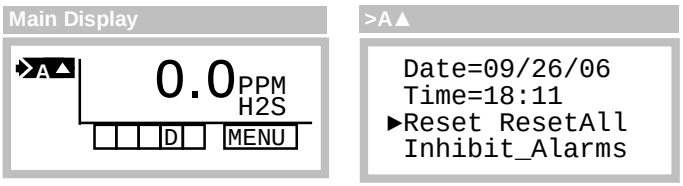


Figure 60 - Manual alarm reset page

Remote Alarm Reset

Closing the "Remote Reset" input on the Alarm Relay board (section 3.10) resets all latched alarms, if the respective alarm conditions have subsided.

Gas Alarm Operation

Figure 56 depicts relationships between variables associated with a high level, or rising, gas alarm, and how they function in the presence of a gas leak, and recovery.

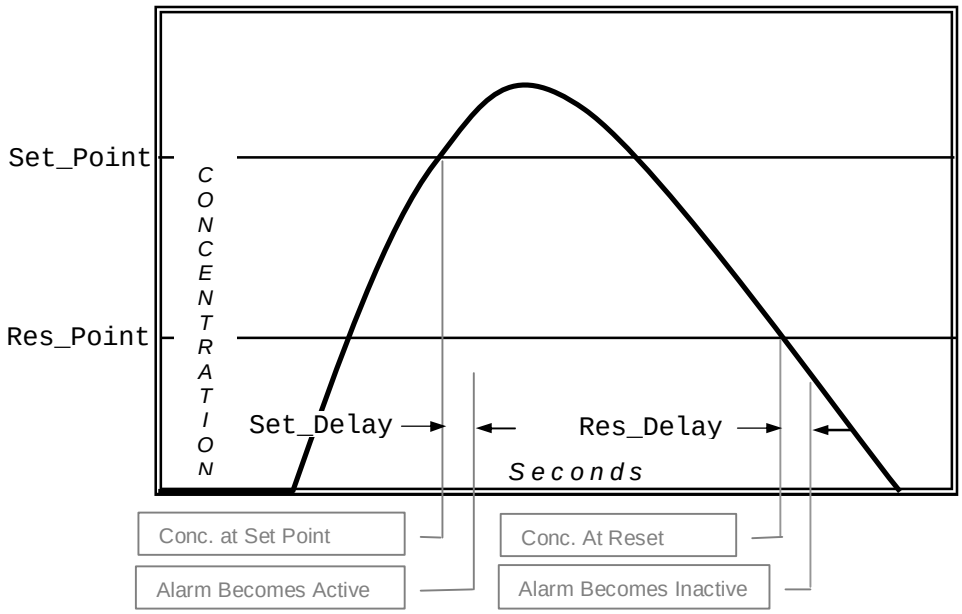


Figure 61 - High level (rising) alarm (Active = ABOVE SP, Reset = AUTO)

depicts relationships between variables associated with a low level, or falling, gas alarm (such as for Oxygen deficiency), and how they function in the presence of a gas displacement, and recovery.

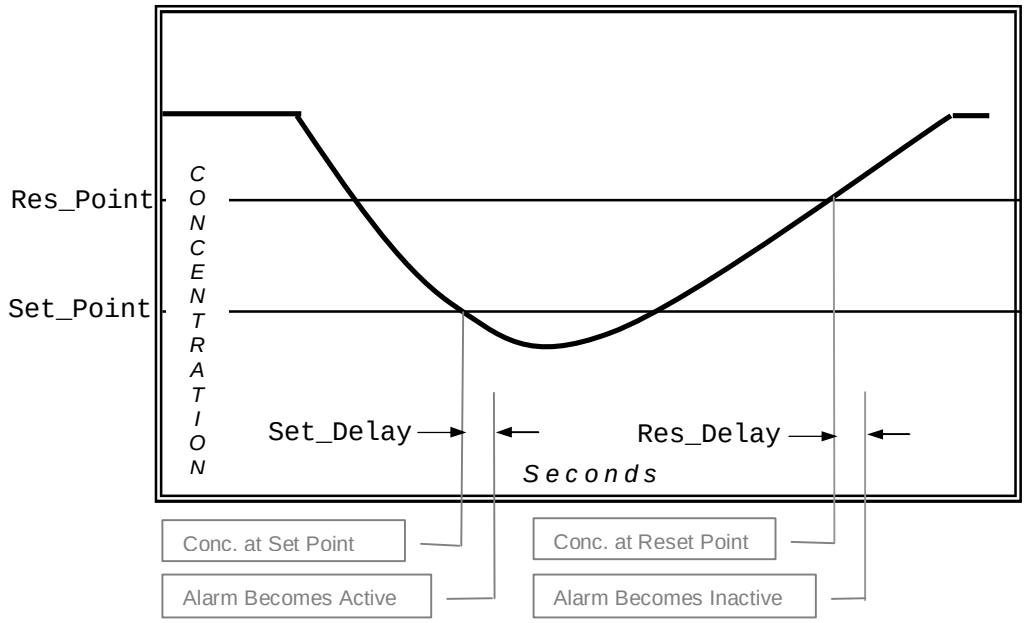


Figure 62 - Low Level (failing) alarm (Active = BELOW SP, Reset = AUTO)

Gas Alarm Setup

Table 9. Gas Alarm Setup

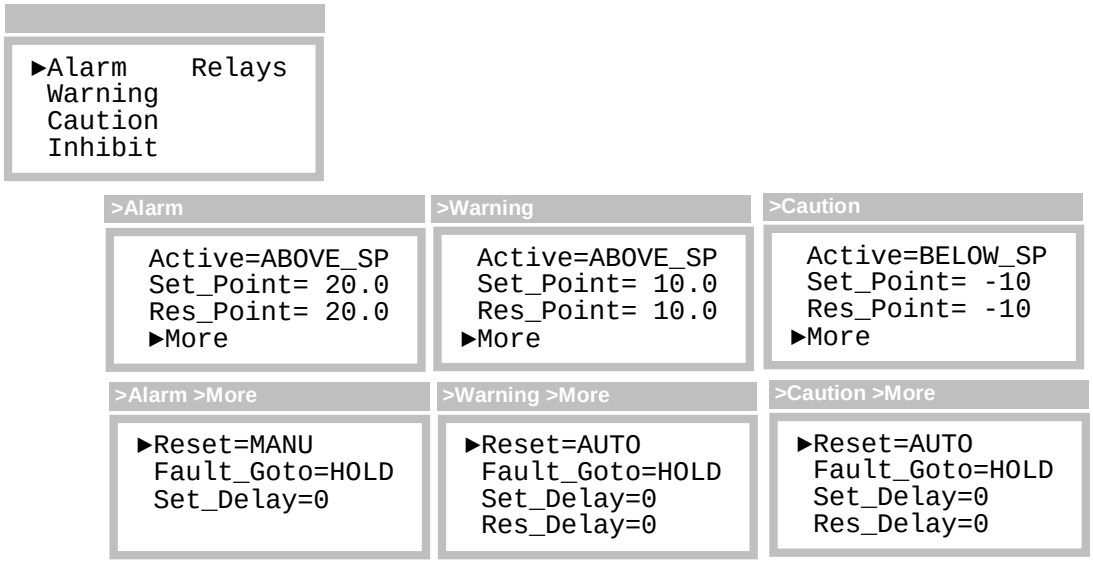


Figure 63 - Alarm setup pages

Table 10 Alarm Variables

Variable	Description
Active	The Active variable is used to specify the region of concentration where the alarm is active. When set to ABOVE_SP, the alarm becomes active at and above the set point (referred to as a high level, or rising alarm). When set to BELOW_SP, the alarm becomes active at and below the set point (referred to as a low level, or falling alarm). Setting the value to DISABLED permanently deactivates the alarm. The variable setting is stored in the sensor memory.
Set_Point	The Set_Point variable defines the concentration level that the alarm becomes active. The alarm becomes active immediately if the set delay variable is 0, otherwise, it becomes active at the expiration of the set delay period. When the set point is reprogrammed, the reset point value is also reprogrammed to the same value.
Res_Point	The Res_Point variable defines the concentration level that the alarm becomes inactive. Once the alarm is active, it will remain active until the concentration level reaches the reset point. The alarm then becomes inactive immediately if the set delay variable is 0, otherwise, the alarm becomes inactive at the expiration of the reset delay period (only if the reset variable is programmed as AUTO – see below). The limits for the reset point are defined below. Active=ABOVE_SP {High Alarm} Upper limit = current set point value Lower limit = lowest set point value Active=BELOW_SP {Low Alarm} Upper limit = highest set point value Lower limit = current set point value

	When the set point is reprogrammed, the reset point value is reprogrammed to the same value.
`Reset`	The Reset variable defines how the alarm is permitted to transition from active, to inactive. When the variable is set to AUTO, the alarm will transition 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 MANU, the alarm conditions must have subsided, and an operator must acknowledge the alarm manually, through the operator interface, the serial interface, or through the remote reset (see Electrical Connections, page 12). Note: Res_Delay is operational for AUTO only. Setting the Reset variable to MANU suppresses display of the Res_Delay variable.
`Fault_Goto`	The Fault_Goto variable specifies 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: HOLD - the transmitter will attempt to hold the alarm in its current state. If the alarm is active, it will remain active. If the alarm is inactive, it will be inhibited from becoming active until after 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`	The set delay variable is used to 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 (its default) and 10 seconds.
`Res_Delay`	The reset delay variable is only displayed when the Reset variable is set to AUTO. 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 set delay 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 (its default) and two hours (7200 seconds).

Fault Alarms

When a fault alarm occurs, the Main Display appears as shown below. 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 Alarms Setup pages). Faults are permitted to clear automatically, without operator intervention, if they do not persist.

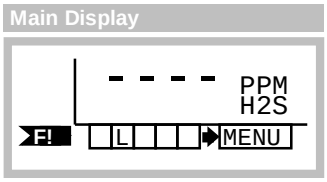


Figure 64 - Fault alarm on Main Display page

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 the Next function causes line 2 to display the next fault, if any.

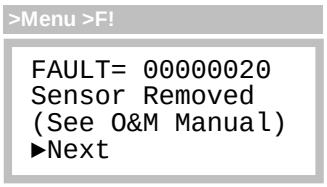


Figure 65 - Fault page

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 F12 Toxic Gas 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 4-20mA settings. Also note that swapping components may result in losing data log records, since the log is dependent on sensor part numbers, and the full-scale range.

Table 11 lists transmitter faults and corrective actions.

Table 11. Fault descriptions

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.	1. Cycle power off and on 2. Replace sensor 3. Replace transmitter
LCD Busy Error	The LCD driver chip cannot recover from an internal error.	1. Cycle power off and on 2. Replace transmitter
SPI Bus Error	Serial peripheral interface bus has faulted.	1. Cycle power off and on 2. Replace transmitter
ADC1 Read Error	The analog-to-digital converter channel assigned to the sensor's temperature output signal has failed, or is out of range.	1. Cycle power off and on 2. Replace sensor 3. Replace transmitter
Sensor (-)Range	The sensor has drifted -20% range (below zero).	1. Zero sensor 2. Replace sensor
Sensor Removed	The sensor cannot be detected.	1. Reinstall sensor 2. Cycle power off and on 3. Replace sensor 4. Replace transmitter
Sensor Mem Error	One or more configuration variables in the sensor memory do not pass checksum test.	1. Cycle power off and on 2. Replace sensor 3. Replace transmitter
Sensor Cfg Error	One or more sensor configuration variables are outside of expected range.	1. Cycle power off and on 2. Replace sensor 3. Replace transmitter
Gas Gen Removed	The generator cannot be detected.	1. Install generator 2. Cycle power off and on 3. Replace generator 4. Replace sensor 5. Replace transmitter
Gen Incompatible	The gas generator is not compatible with the installed sensor type or range.	1. Replace generator 2. Change sensor range 3. Replace sensor 4. Replace upper stack 5. Replace full stack
System Mem Error	A checksum error has been detected in the system setup memory.	1. Cycle power off and on 2. Replace transmitter

`Alarm Mem Error`	A checksum error has been detected in the alarm setup memory.	1. Cycle power off and on 2. Replace transmitter
`Operator Mem Err`	A checksum error has been detected in the operator setup memory.	1. Cycle power off and on 2. Replace transmitter
`HART Mem Error`	A checksum error has been detected in the HART setup memory.	1. Cycle power off and on 2. Replace transmitter
`Autotest Failed`	Auto-test failed after 3 attempts.	1. Replace generator 2. Replace sensor 3. Replace transmitter
`Use 3-Wire Power`	Relay option jumper is installed, but transmitter is powered from loop (2-wire).	1. If relays are not used, remove jumper. 2. Re-wire transmitter in 3- or 4-wire mode. 3. Replace transmitter
`Stack Overflow`	An internal error occurred in the CPU.	1. Cycle power off and on 2. Replace transmitter
`Factory Cal Err`	An error has been detected in the factory calibration memory.	1. Cycle power off and on 2. Replace transmitter
`UNCALIBRATED`	This appears on the Main Display, in place of the gas name, when the transmitter has not been factory calibrated, or the calibration memory has become corrupted.	1. Cycle power off and on 2. Replace transmitter
`Fault Alarm Test`	This is not a real fault. This occurs when the fault alarm is being tested locally, or remotely.	

Alarm Relays

The Alarm Relay Board provides three optional SPST mechanical relays rated for 5 amps, non-inductive loads at 250VAC. 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 will have electrical continuity between its C and NO contacts (while the transmitter is powered on), and will be open between its C and NC contacts. Conversely, a normally de-energized relay will have continuity between its C and NC contacts, and will be open between its C and NO contacts. Figure 66 illustrates the function of alarm and relay variables on the operation of the relays.

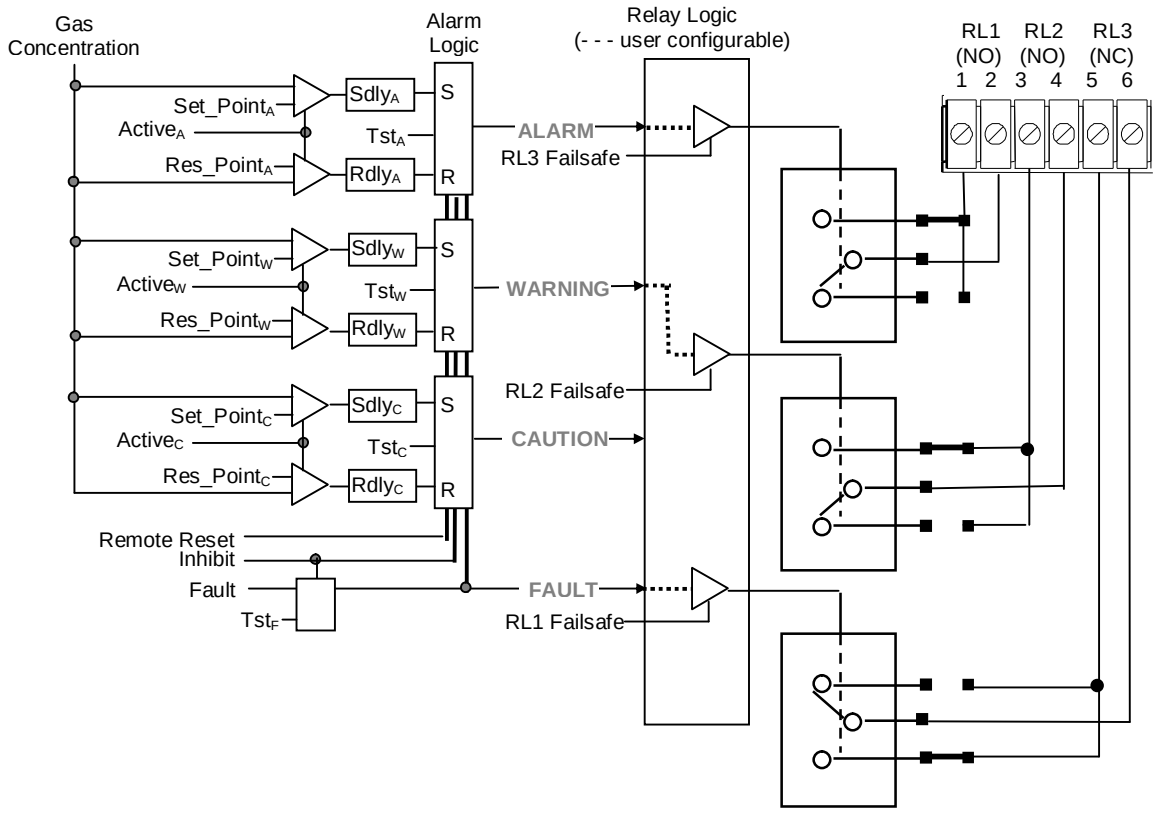


Figure 66 - Alarm relay diagram (normal runtime state)

Alarm Relays Setup

Relays are enabled and configured through the Relays Menu page.

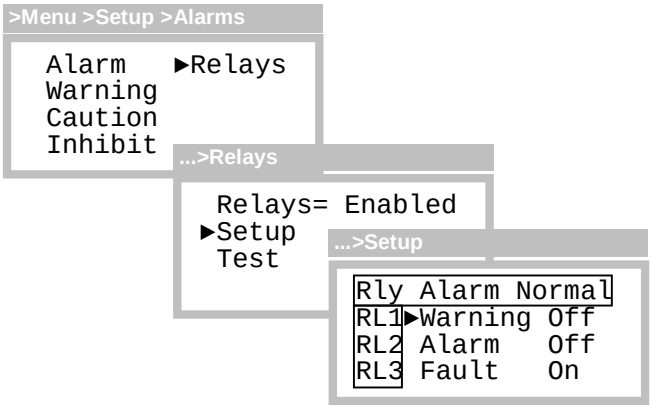


Figure 67 - Relays setup page (example)

The Alarm Relay board is operational only when "Relays" is set to "Enabled".

Use the setup page to select the alarm trigger source (Alarm, Warning, Caution, Fault), and failsafe property (Normal-On or Normal-Off).

Testing Alarm Relays

Relays are tested by triggering (simulating) their assigned alarms on the Relay Test page. 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 pressing the Enter key, and move 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. "Any key to Stop" will replace "Start", and pressing any key will end the test.

Relay Test Page

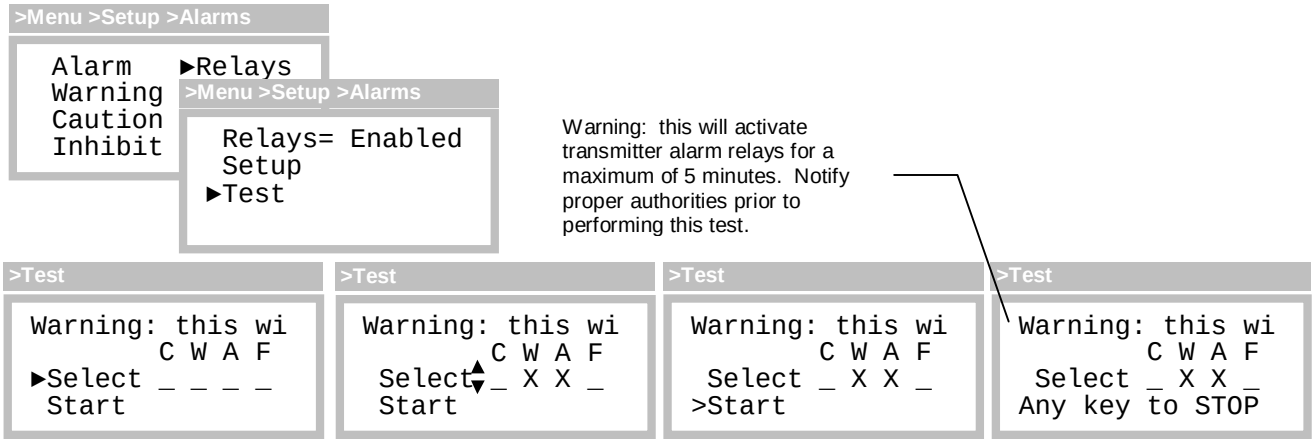


Figure 68 - Relay test page (example)

Inhibiting Alarms

Alarms should be inhibited to prevent false activation, such as done 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 will toggle the alarm inhibit mode on for 15 minutes, which will clear and inhibit alarms, hold the current loop at 4mA (17.4mA for Oxygen sensors), and cause the "I" and "L" status indicators to appear. Repeating the procedure toggles alarm inhibit mode off immediately, restores the current loop to normal operation, and clears the "I" and "L" status indicators. Both the inhibit duration, and loop output, are programmable and may be accessed on the Alarm Inhibit setup page (see below).

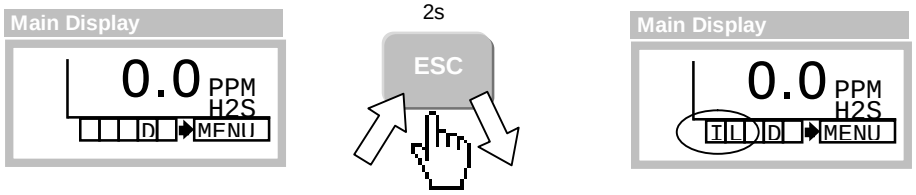


Figure 69 - Inhibiting alarms from the Main Display

Alarm Inhibit Setup

Variables and controls associated with the alarm inhibit mode are accessible on the Alarm Inhibit setup page (below), and are detailed in Table 12.

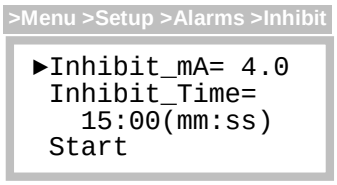


Figure 70 - Alarm inhibit setup page

Table 12. Alarm inhibit variables and controls

Variables	Description
Inhibit_mA	The Inhibit_mA variable is output on the current loop during alarm inhibit. It ranges from 3.5 to 22.0 mA (this is the same value that appears on the 4-20mA Setup page).
Inhibit_Time	Alarm Inhibit Off The Inhibit_Time variable is the duration of the alarm inhibit mode, and is programmable from 00:00 to 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 Enter is pressed, counting resumes from the new value. If Esc is pressed, 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 4mA (17.4mA for Oxygen sensors), causes the "I" and "L" status indicators to appear, and starts the Inhibit_Time variable to begin ticking down. The label then changes to "Stop", and selecting it again turns off alarm inhibit, restore the current loop to normal operation, clears the "I" and "L" status indicators, and restores the Inhibit_Time variable to its programmed value.

4.16 4-20mA Output

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

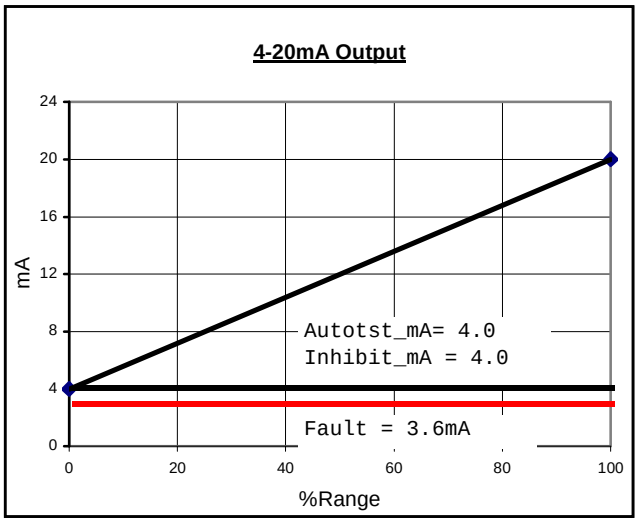


Figure 71 - Current loop output plot

Output Overrides

By default, the output is forced to 3.6mA to signal fault alarms to the receiver. During alarm inhibit and auto-test modes, the loop is fixed at 4.0mA (17.4mA for Oxygen sensors) to prevent false alarms at the receiver. These are the default values, which may be changed on the 4-20mA Setup page shown below.

4-20mA Setup

Variables listed on this page are described in Table 13.

```
>Menu >Setup >4-20mA

►Autotst_mA= 4.0
 Inhibit_mA= 4.0
 Fault_mA=   3.6
 More
```

Figure 72 - 4-20mA setup page

Table 13. 4-20mA variables

Variables	Description
Autotst_mA	The Autotst_mA variable is the mA value output during Auto-test mode – to prevent false alarms at the receiver. The default is 4.0mA (17.4mA for Oxygen sensors), and is limited between 3.5[9] and 22.0 mA.
Inhibit_mA	The Inhibit_mA variable is the mA value output during the Alarm Inhibit mode – to prevent false alarms at the receiver. The default is 4.0mA (17.4mA for Oxygen sensors), and is limited between 3.5[2] and 22.0 mA.
Fault_mA	The Fault_mA variable is the mA value output during Fault alarms. The default is 3.6mA, and is limited between 3.5mA[2] and 22.0mA. The value should be recognized as a fault by the loop receiver.
More	More is a link to the 4-20mA control page.

[9] Since the transmitter may be powered from the current loop, 3.5mA is the lower limit for all settings.

4-20mA Control

The 4-20mA Control page 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.

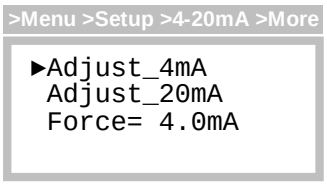


Figure 73 - 4-20mA control page

Table 14. 4-20mA control variables

Variables	Description
Adjust_4mA	The Adjust_4mA variable is used to adjust the 4mA level on the 4-20mA output.
Adjust_20mA	The Adjust_20mA variable is used to adjust the 20mA level on the 4-20mA output.
Force	The Force variable is used to force the 4-20mA 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 and 22.0 mA.

Loop Adjustment

Loop adjustment consists of adjusting the 4 and 20 mA levels (order does not matter) by scrolling the corresponding DAC[10] value. This may be accomplished by reading a current meter connected across the 4-20mA (+) and (-) terminals on the transmitter's P/S Board, or reading the display of a calibrated, current loop receiver.

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

Select Adjust_4mA or Adjust_20mA and observe the following displays. Select DAC_Value and scroll the displayed value up and down to achieve the desired output level, and press Enter to save, or Esc to exit without saving.

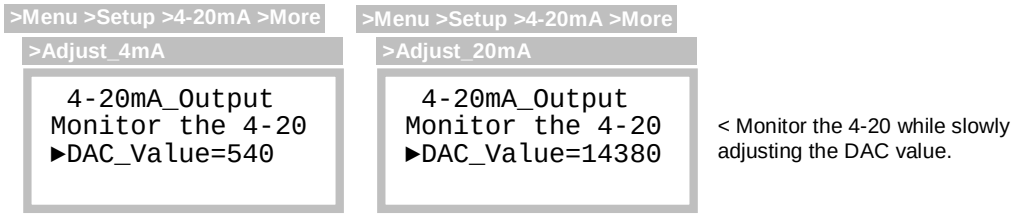


Figure 74 - Loop adjustment pages (DAC_values shown may not match)

[10] Digital-to-Analog-Converter value ranging 0 to 16383 (14-bits). Adjustment is performed at factory, values will vary from transmitter to transmitter. This range may increase on future versions.

4.17 Data-log

The transmitter logs gas concentrations in one of 12 discrete intervals ranging from 1 to 60 minutes, providing data from 11 to 474 days. Table 15 details sampling intervals and the associated metrics.

Table 15. Data-log sampling metrics

Sampling (Minutes)	Samples/Day	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 (see Table 15) is recorded as an instantaneous value, and is not averaged or filtered in any way. When the data log memory is filled, new records will overwrite older ones.

Data-log Access

The Data Log Access page provides links to the setup, review, and print pages, which are described below.

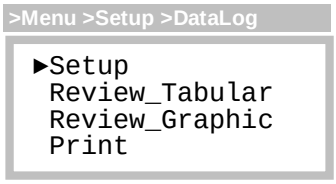
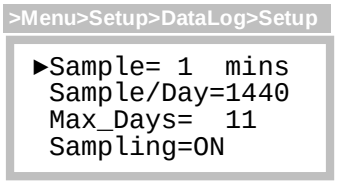


Figure 75 - Data Log access page

Data-log Setup



Variables on the Data Log Setup page select one of the 12 discrete sampling intervals listed in Table 15, and control starting, stopping and clearing of the data-log.

Figure 76 - Data Log setup page

Table 16. Data-log setup variables

Variables	Description
Sample, Sample/Day, Max_Days	These variables are used to select one of the 12 sampling intervals listed in Table 15. Each variable functions identically, and scrolling any one of the variables updates the other two. Warning: changing the sampling interval will clear the data-log.
Sampling	The Sampling variable is used to control data recording, which starts when set to ON, and stops when set to OFF. The data-log is cleared when set to CLR, after which the control is returned to its previous value (ON or OFF).

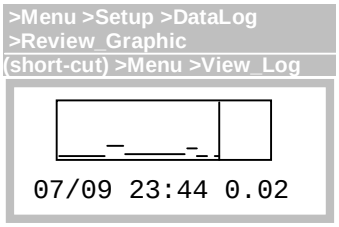
Data may be displayed on the LCD graphically, or in a tabular report format. Data may also be output to a terminal, terminal program, or serial printer. Dates formats are configurable as MM/DD or DDMMM (see System Clock), and samples are displayed in the concentration units shown on the Main display.

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

Table 17. Data log special text

Special Text	Description
----	Sample unavailable (transmitter powered off, or sample not yet recorded)
FFFF	Fault alarm active at time of sample
TEST	Auto-test active at time of sample (if Log_Data=NO, see *Auto-test Setup Options*)
****	Data is corrupted, or unreliable

Data-log Graphic Report

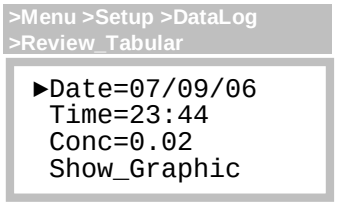


The Graphic Report page plots samples on the LCD from left to right, where older samples are on the left, and newer samples are to the right. Pressing the Up and Down keys moves the vertical cursor line right and left, respectively, while updating the date, time, and sample data text on the bottom line.

Figure 77 - Data Log graphic report page

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 will show "- - - -", not sampled yet). Pressing the Enter key switches to the Tabular Report page, shown below, and pressing the Esc key returns to the Menu page. Data is not plotted while viewing the page.

Data-log Tabular Report



The Tabular Report page displays samples in the text field labeled "Conc" (gas concentration) and provides direct access to data by scrolling to an exact date and time.

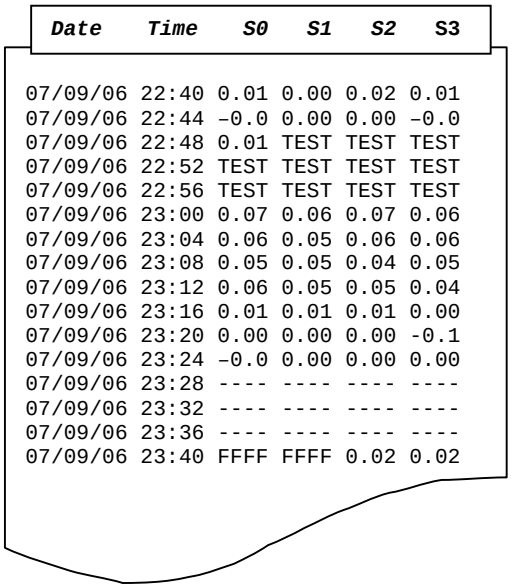
Figure 78 - Data log tabular report page

Upon entry, the Date, Time, and Conc variables are set to the most recent sample. Scrolling the Time variable up increments it by the sampling interval, and causes the next, successive sample to be displayed at Conc. Scrolling Time down displays the previous sample time, and value. Scrolling Time up and down will cause a date rollover at midnight. Scrolling the Date variable up increments it by one day, while holding the Time variable fixed. This is an expedient method to access specific data, and is useful for examining samples recorded at the time of day.

Once the date and time are set, select the Show_Graphic link to switch to the Graphic Report page. Data is not updated while viewing the page.

Data-log Printout

Data-log reports may be sent to serial printer, terminal, or terminal emulation program, such as Microsoft Hyperterminal®. See Appendix A. details on how to setup and print reports.



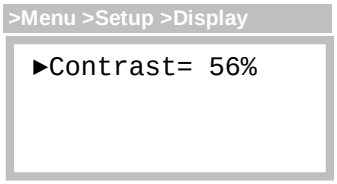
Date	Time	S0	S1	S2	S3
07/09/06	22:40	0.01	0.00	0.02	0.01
07/09/06	22:44	–0.0	0.00	0.00	–0.0
07/09/06	22:48	0.01	TEST	TEST	TEST
07/09/06	22:52	TEST	TEST	TEST	TEST
07/09/06	22:56	TEST	TEST	TEST	TEST
07/09/06	23:00	0.07	0.06	0.07	0.06
07/09/06	23:04	0.06	0.05	0.06	0.06
07/09/06	23:08	0.05	0.05	0.04	0.05
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	-0.1
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 79 - Data Log printout (example)

4.18 Display

The transmitter features a transflective, 96w x 32h graphics LCD, and permits adjustment of the contrast to improve readability at various viewing angles.

Display Setup



Variables on the Display Setup page are used to control the display contrast, and manage the backlight.

Figure 80 - Display setup page

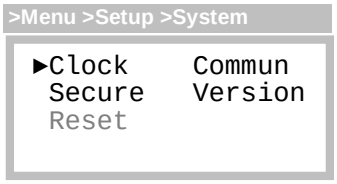
Table 18. Display page variables

Variables	Description
Contrast	The Contrast variable is used to adjust the LCD contrast. Scroll the variable up to increase contrast (darker text), or down to decrease it (lighter text). The variable is adjustable between 0 and 100%.

4.19 System

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

System Access

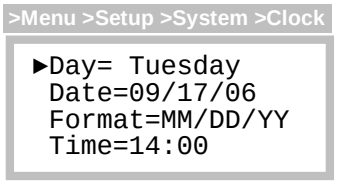


The System Access page provides links to the clock, security, communications, and version pages (the Reset link has been removed on transmitters beginning with version 2.23).

Figure 81 - System access page

Real-time Clock

Clock Setup



The Clock Setup page is used to set the transmitters real-time clock, which is referenced during sensor calibrations and data logging, and used to trigger Auto-test.

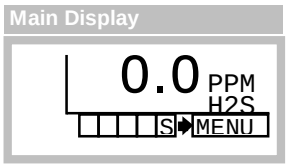
Figure 82 - Clock setup page

Variables	Description
Day	Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday
Date	Used to configure the month, date, and year, in the format specified by the Format variable (below). Built-in support for leap year.
Format	Selects the date format: MM/DD/YY, example: 09/19/06 DDMMMYY, example: 09Sep06
Time	24-hour format, 00:00 to 23:59

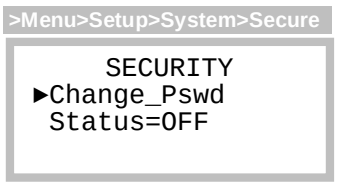
Note that the clock will need to be reset whenever the P/S Board is disconnected from the CPU Board.

Security

The transmitter protects its configuration using a 4-digit, numeric password, from 0000 to 9999. When security is active, the "S" (secure) status indicator appears on the Main Display, variables may be read, but not modified, and functions will not execute, including the sensor verification function during startup review.



Security Control



Security is off by default, and may be toggled on and off by entering the 4-digit password.

Figure 83 - Security control page

Activating Security

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

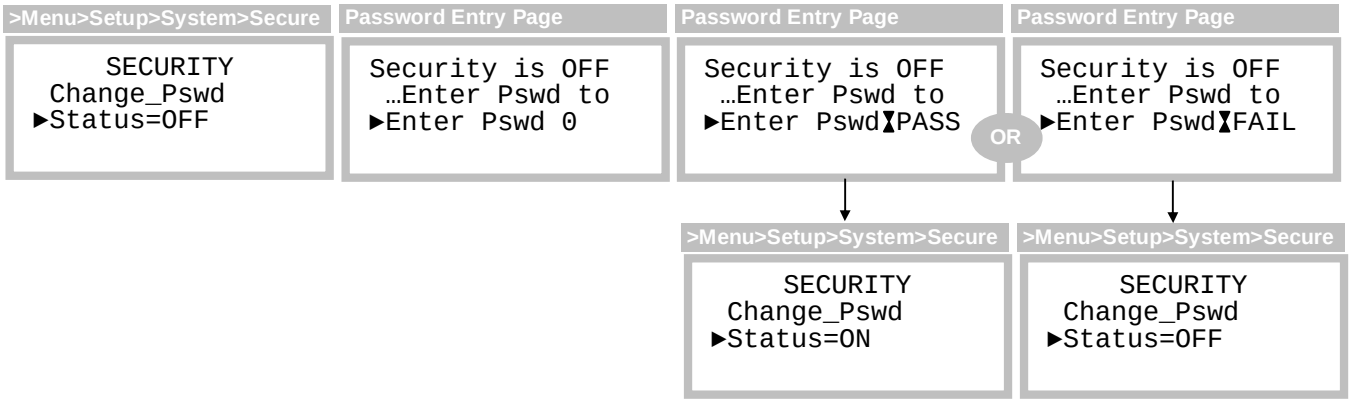


Figure 84 - Activating security

Deactivating Security

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

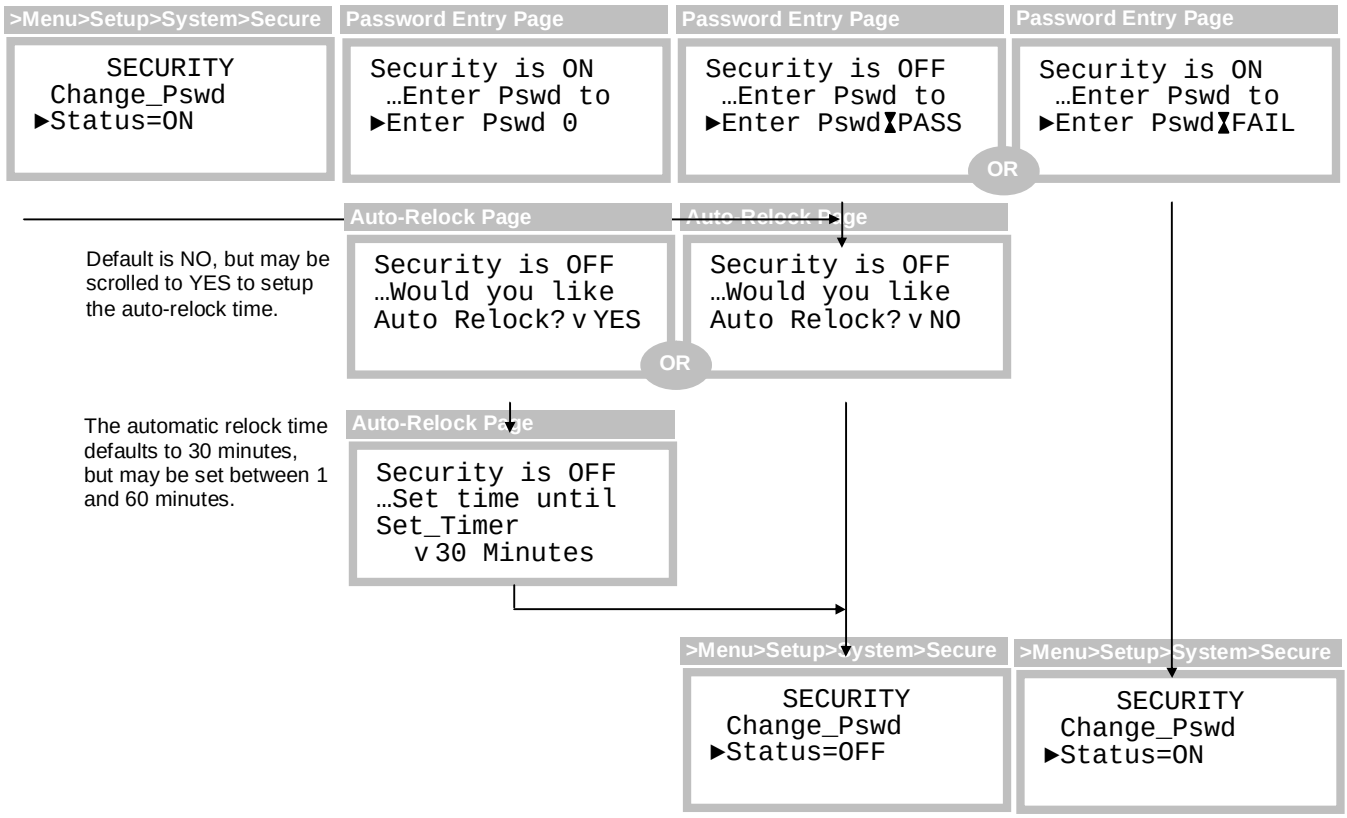


Figure 85 - Deactivating security

Changing the Password

The security password is changed by selecting Change_Pswd from the Security Control page. Start by entering the old password, the enter the new one, and repeat it.

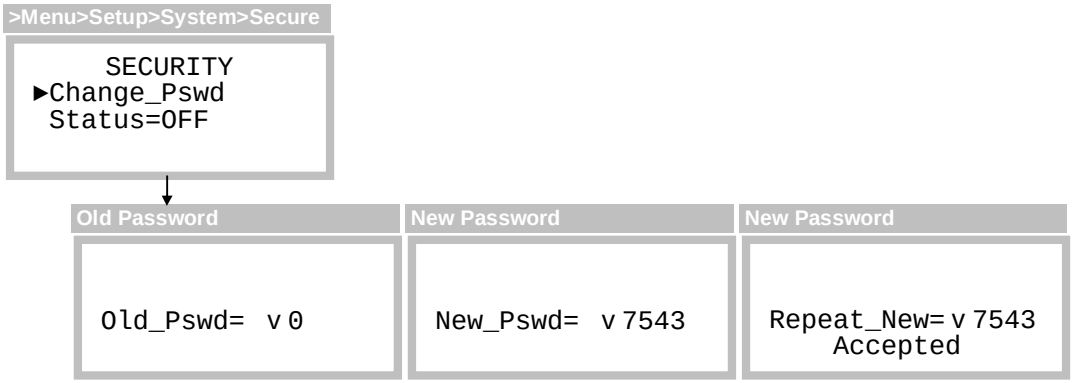
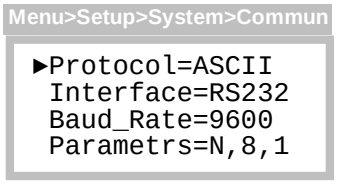


Figure 86 - Changing the password

4.20 Communications

The transmitter supports ASCII, HART 5, and Modbus communications. ASCII is the default protocol if the HART or Modbus option is not ordered.

Communication Setup



Communication Setup page variables are used to configure the protocol and settings of the physical communication interface. The protocol selection is performed at the factory, and may not be changed. Settings for the physical communication interface may be changed for ASCII and Modbus protocols, however, they are restricted for the HART protocol).

Figure 87 - Communication setup page

Table 19. Communication setup variables

Variables	Description
Protocol	The Protocol variable identifies the installed protocol driver: • None • ASCII (default) • Modbus (option) • HART (option)
Interface	The Interface variable selects the physical communication interface that the transmitter will control during transmit and receive functions: • RS232 (available for ASCII or Modbus, not for HART) • RS485 (available for ASCII or Modbus, not for HART) • MODEM (available for HART only) The transmitter must be wired in accordance with this selection (see Table 3. Communication Interface Options).
Baud_Rate	The Baud_Rate variable is used to configure the baud rate of the transmitter's UART, and may be set to: 300,600,1200,2400,4800,9600,14.4k, or 28.8k The value is fixed at 1200 for HART protocol, and defaults to 9600 for Modbus and ASCII.
Parametrs	The Parametrs variable is used to configure parity, the number of data bits, and number of stop bits of the transmitter's UART: • N,8,1 …no parity, 8 data bits, 1 stop bits • N,8,2 …no parity, 8 data bits, 2 stop bits • E,8,1 …even parity, 8 data bits, 1 stop bit • O,8,1 …odd parity, 8 data bits, 1 stop bit The value is fixed at O, 8,1 for HART protocol, and defaults to N, 8,1 for Modbus and ASCII.

Protocol specific settings are configured on separate pages that are accessible from links on the Setup page, and are discussed below.

ASCII

ASCII is used for sending the data log to a serial printer, terminal, or terminal program, using RS232 (RS485 might be used under certain conditions). Handshaking is XON/XOFF only, and the Communication Setup page may be used to configure the interface, baud rate, and communication variables. See Table 3. Communication Interface Options for 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 4-20mA loop. Modulation is performed by a modem that conforms to the BELL 202 standard, which uses FSK (frequency shift keying), where 1200Hz represents a logic 1, and 2200Hz 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 4mA. See HART Transmitter connection examples in Wiring Examples, or consult the HART Foundation (www.hartcomm.org) for details on how to connect HART transmitters.

When the HART protocol driver is installed, a link to the HART Setup page appears on the main Setup page.

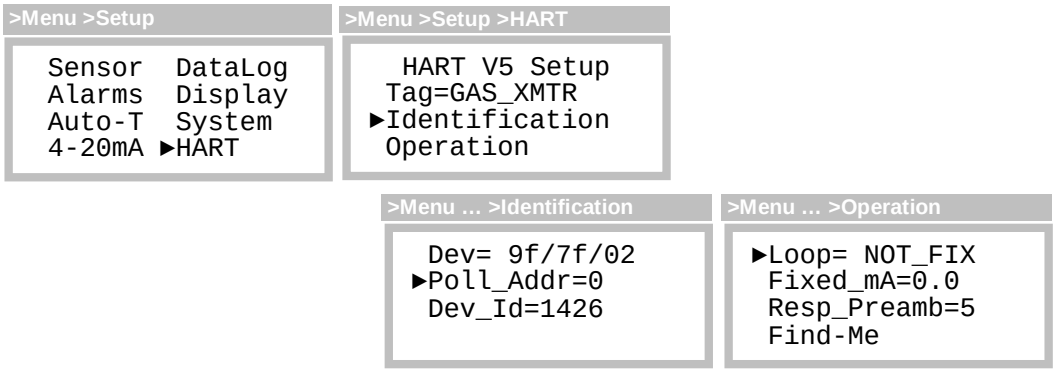


Figure 88 - Hart setup pages

Table 20. HART setup variables

Variables	Description
Tag	The Tag variable can be used as a unique identifier for communicating to the transmitter. The variable is read only at the operator interface, but may be modified using HART network management commands.
Dev	The Dev variable displays read-only device information used in long-frame address commands, and by devices capable of utilizing the transmitter's DDL (device description language) file. The format of the information is, MFG_ID/DEV/REV. The MFG_ID is 9f, and identifies Analytical Technology, Inc as the manufacturer. DEV is 7f, and identifies the device as a F12 transmitter. REV is the revision level of the transmitter, currently set at 2 (may increment in the future).
Poll_Addr	The Poll_Addr variable sets the polling address of the transmitter. The default value is 0, which allows the transmitter to communicate digitally, while preserving the function of the 4-20mA output. The value may be set from 1 to 15, which fixes the

	output at 4mA, and disables analog signaling.
`Dev_Id`	The Dev_Id 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 setting is not recommended.
`Loop`	The Loop variable specifies the operation of the 4-20mA output. When the HART polling address is 0, the value is NOT_FIX and loop functions as normal. When the address is set to 1 or higher, the value is FIXED and the output is fixed at 4mA. The ability to alter this behavior is reserved for future use, and changing this setting is not recommended.
`Fixed_mA`	The Fixed_mA variable provides direct access the associated HART network management variable. The value is adjustable only when the Loop variable is FIXED, and may be adjusted between 3.5 and 22 mA.
`Resp_Preamb`	The Resp_Pream variable provides direct access to the associated HART network management variable, which determines the number of preamble characters (FF hex) transmitted at the beginning of each message. The default value is 5, and may be set from 3 to 20. Changing this setting is not recommended.
`Find-Me`	The Find-Me function places the transmitter into the Find-Me mode, where a master device can issue a command to positively identify the physical location of the transmitter.

Selecting the Find-Me function presents the special page that remains until the master device issues a "Find-Me" command to the transmitter, at which point the display changes to the "Device Found" page.

Figure 89 = Hart a) Find-me and b) Device found pages

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. The Communication Setup page may be used to configure the interface, baud rate, and communication variables. See Wiring Examples for connection details.

When the Modbus protocol driver is installed, a link to the Modbus Setup page appears on the main Setup page.

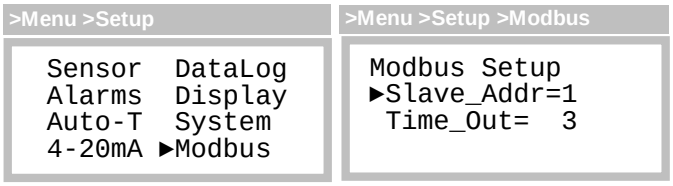


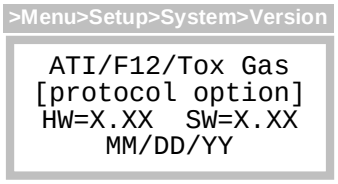
Figure 90 - Modbus setup page

Table 21. Modbus setup variables

Variables	Description
Slave_Addr	The Slave_Addr variable is the transmitter's slave address, which may set from 1 (default) to 247.
Time_Out	The Time_Out variable belongs to the data-link layer of the protocol and defines the number of 1.5 character timeouts used to frame messages. This variable is reserved for future use and changing it is not recommended.

Transmitter Version

The Transmitter Version page displays transmitter information:



Line 1: model and version name
Line 2: protocol option (if any)
Line 3: hardware and software version numbers
Line 4: software build date

Figure 91 - Transmitter version page

Restart
The Restart function will cause the transmitter to start up, just as it does during a power-on-reset.

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.

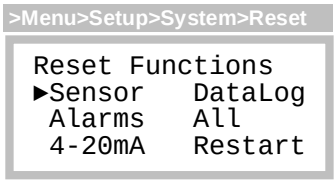


Figure 92 - System reset page

Table 22. Reset functions (do not use except for troubleshooting).

Function	Description
Sensor	Resets zero and span calibration, restarts transmitter. 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 transmitter.
4-20mA	Resets 4-20mA calibration, loop must be recalibrated, restarts transmitter.
DataLog	Clears the data log history, restarts transmitter.
All	Resets entire transmitter to factory defaults, excluding sensor, restarts transmitter. Requires full transmitter setup.
Restart	Restarts transmitter, only.

5 SPARE PARTS

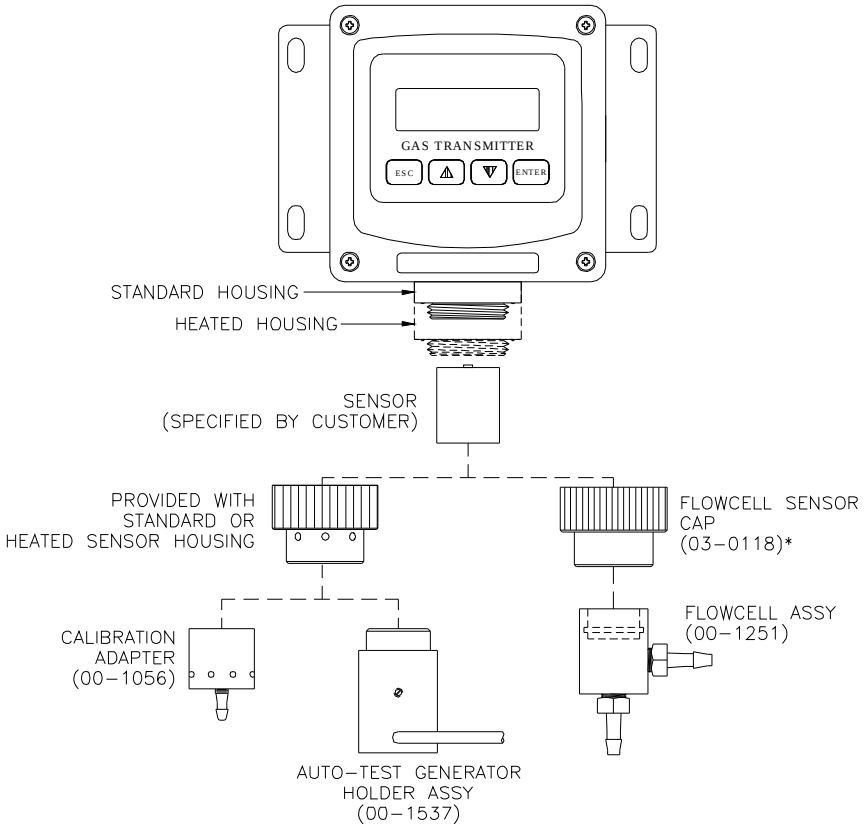


Figure 93 - Exploded View

Part No.	Description
03-0355	F12 Transmitter Front Lid Assembly
01-0278	Sensor Terminal Board Assembly
03-0331	F12 Sensor Holder Assembly
03-0332	Sensor Cap
00-1537	Auto-Test Generator Holder Assembly
01-0294	Power Supply / Relay Board Assy, AC Version
01-0316	Power Supply / Relay Board Assy, DC Version
01-0297	Power Supply Circuit Protection Cover
31-0173	Ribbon Cable, P/S to Front Lid, 20 conductor
29-0007	Battery
00-1056	Calibration adapter
00-1251	* Flowcell Assembly
03-0118	Flowcell Sensor Cap
00-1546	Complete Junction Box with Sensor Holder
01-0295	Remote Sensor PCB Assy
31-0162	Remote Interconnect Cable, specify length, max. 50 ft.
00-1547	6' Sensor Housing Assembly
00-1571	Heated Sensor Housing Assembly

*Requires Flowcell Sensor Cap (03-0118)

Table 23. H10 sensor modules

Part No.	Description
00-1057	Acetylene, 0-50/500 PPM (0-200 PPM Standard)
00-1038	Acid gases, 0-10/200 PPM (20 PPM Standard)
00-1043	Alcohol, 0-50/500 PPM (200 PPM Standard)
00-1044	Alcohol, 0-500/2000 PPM (2000 PPM Standard)
00-1010	Ammonia, 0-50/500 PPM (200 PPM Standard)
00-1011	Ammonia, 0-500/2000 PPM (1000 PPM Standard)
00-1025	Arsine, 0-10/200 PPM (10 PPM Standard)
00-1024	Arsine, 0-500/2000 PPB (1000 PPB Standard)
00-1000	Bromine, 0-1/5 PPM (2 PPM Standard)
00-1001	Bromine, 0-5/200 (20 PPM Standard)
00-1012	Carbon monoxide, 0-50/1000 PPM (200 PPM Standard)
00-1004	Chlorine dioxide, 0-1/5 PPM (2 PPM Standard)
00-1005	Chlorine dioxide, 0-5/200 (20 PPM Standard)
00-1425	Chlorine dioxide, 1/5 PPM (low Cl2 response)
00-1359	Chlorine dioxide, 200/1000 PPM (1000 PPM Standard)
00-1002	Chlorine, 0-1/5 PPM (2 PPM Standard)
00-1003	Chlorine, 0-5/200 (20 PPM Standard)
00-1027	Diborane, 0-10/200 PPM (10 PPM Standard)
00-1026	Diborane, 0-500/2000 PPB (1000 PPB Standard)
00-1450	Dimethylamine (DMA), 100/200 PPM (100 PPM Standard)
00-1039	Ethylene oxide, 0-20/200 PPM (20 PPM Standard)
00-1006	Fluorine, 0-1/5 PPM (2 PPM Standard)
00-1007	Fluorine, 0-5/200 (20 PPM Standard)
00-1040	Formaldehyde, 0-20/200 PPM (20 PPM Standard)
00-1349	Formaldehyde, 500/2000 PPM (1000 PPM Standard)
00-1029	Germane, 0-10/200 PPM (10 PPM Standard)
00-1028	Germane, 0-500/2000 PPB (1000 PPB Standard)
00-1455	Hydrogen bromide, 10/200 PPM (20 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)
00-1042	Hydrogen peroxide, 0-10/100 PPM (20 PPM Standard)
00-1169	Hydrogen peroxide, 200/2000 PPM (500 PPM Standard)
00-1031	Hydrogen selenide, 0-10/200 PPM (10 PPM Standard)
00-1030	Hydrogen selenide, 0-500/2000 PPB (1000 PPB Standard)
00-1020	Hydrogen sulfide, 0-10/200 PPM (50 PPM Standard)
00-1469	Hydrogen sulfide, 200/1000 PPM (500 PPM Standard)
00-1013	Hydrogen, 0-1/10% (4% Standard)
00-1041	Hydrogen, 0-500/2000 PPM (2000 PPM Standard)
00-1036	Iodine, 0-1/5 PPM (2 PPM Standard)
00-1037	Iodine, 0-5/200 PPM (20 PPM Standard)
00-1021	Nitric oxide, 0-50/500 PPM (200 PPM Standard)
00-1022	Nitrogen dioxide, 0-10/200 PPM (20 PPM Standard)
00-1181	NOx, 50/500 PPM (200 PPM Standard)
00-1014	Oxygen, 0-5/25% (25% Standard)
00-1008	Ozone, 0-1/5 PPM (2 PPM Standard)
00-1009	Ozone, 0-5/200 PPM (20 PPM Standard)
00-1358	Ozone, 200/1000 PPM (1000 PPM Standard)
00-1015	Phosgene, 0-1/5 PPM (2 PPM Standard)
00-1016	Phosgene, 0-5/100 PPM (100 PPM Standard)
00-1033	Phosphine, 0-10/200 PPM (10 PPM Standard)
00-1034	Phosphine, 0-200/2000 PPM (1000 PPM Standard)
00-1032	Phosphine, 0-500/2000 PPB (1000 PPB Standard)
00-1035	Silane, 0-10/200 PPM (10 PPM Standard)

00-1285	Silane, 500/2000 PPB (1000 PPB Standard)
00-1023	Sulfur dioxide, 0-10/500 PPM (20 PPM Standard)

Table 24. E18 gas generators

Part No.	Description
00-1239	Chlorine
00-1240	Ammonia
00-1241	Carbon Monoxide
00-1243	Hydrogen Sulfide
00-1244	Sulfur Dioxide

Table 25. Duct mount sensor accessories

Part No.	Description
00-1388	H10 Duct Mount Adapter
00-1389	H10 Duct Mount Sensor Holder
46-0003	Sensor Gasket for (00-1389)
03-0290	Duct Mount Cable Assembly

6 APPENDIX A

6.1 Printing Data Log Reports

Serial Connection

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

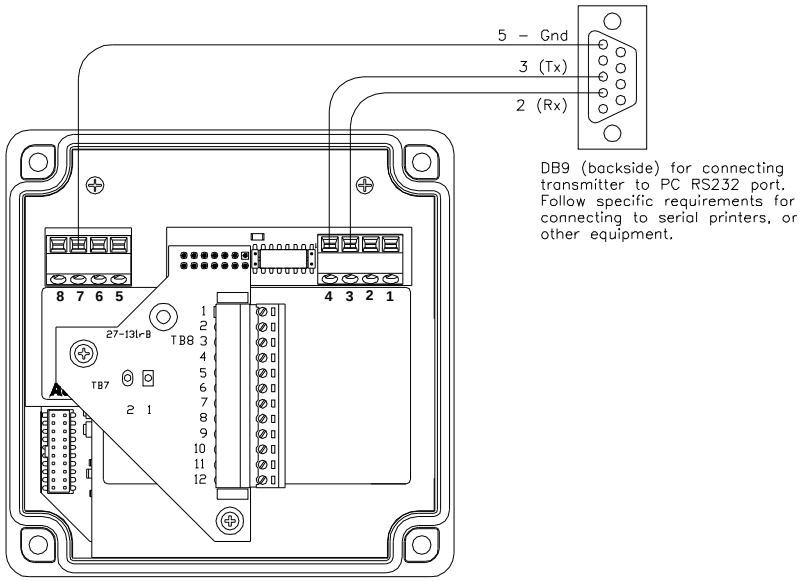


Figure 94 - RS232 Communications wiring

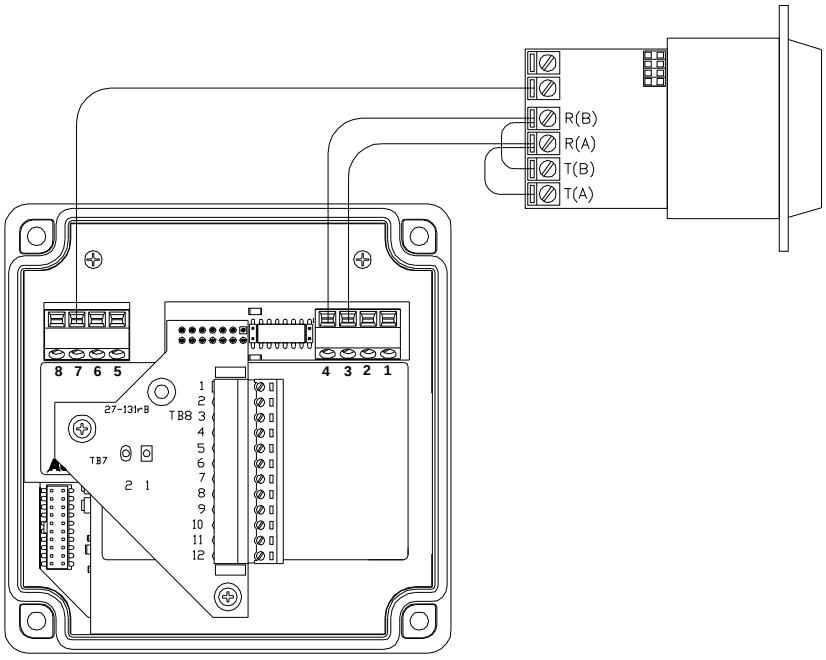
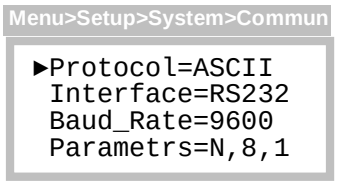


Figure 95 - RS485 Communication wiring

Communication Setup Page



The communication interface, baud rate, parity, number of data bits, and number of stop bits are configured on the Communication Setup page.

Flow Control

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

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

A receiving device will send the XOFF character when its buffer is nearly full. Some older dot-matrix printers will send an XOFF because they have a small receive buffers and cannot process characters while the head is returning to start a new line. 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 transmitter features an additional method to help avoid losing data due to buffer overflow problems on receiving devices that lack XON/XOFF capability (or have the capability but are using an RS485 connection). A programmable time delay of up to 10s may be inserted at the end of each report line. This permits the receiver time to process more characters in its buffer and avoid an overflow. However, this may be a method of trial and error until the proper delay setting is determined so that no characters are missing from the report.

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 -0.1
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 to 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 will take less time to print because the date and time fields will be 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 following values.

Samples …	**Are forced to…**
Less than –999	*-999*
Greater than 9999	*9999*

Symbols may appear in place of sample values, and are defined as follows.

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 Log_Data variable in the Menu/Setup/Auto-T/Setup menu is set to “NO”.	
****	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 will show four dashes (----) in place of samples.

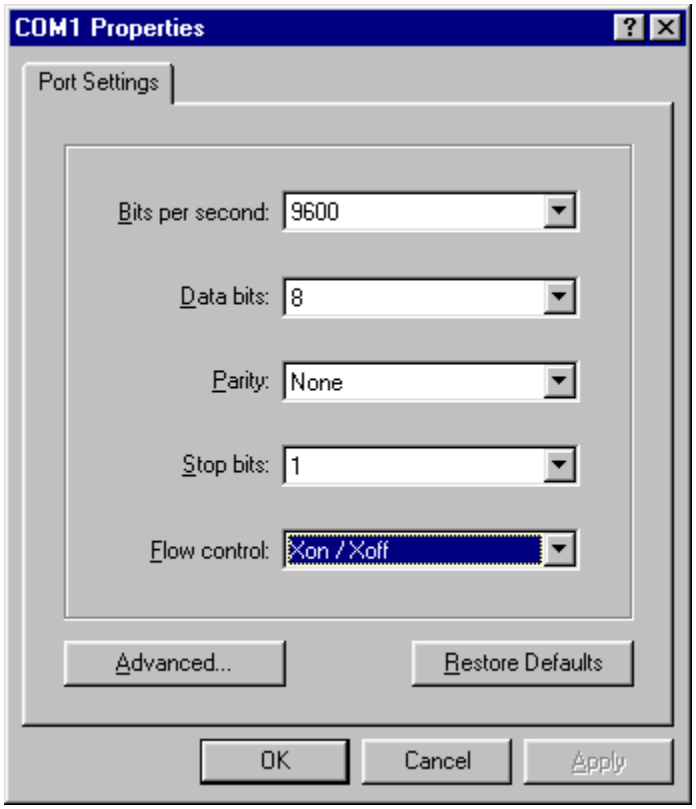
6.2 Example: Charting a Data Log Report

Start HyperTerminal by clicking **Start**, pointing to **Programs**, pointing to **Accessories**, pointing to **Communications**, clicking **HyperTerminal,** and then double-clicking **Hypertrm.exe**.

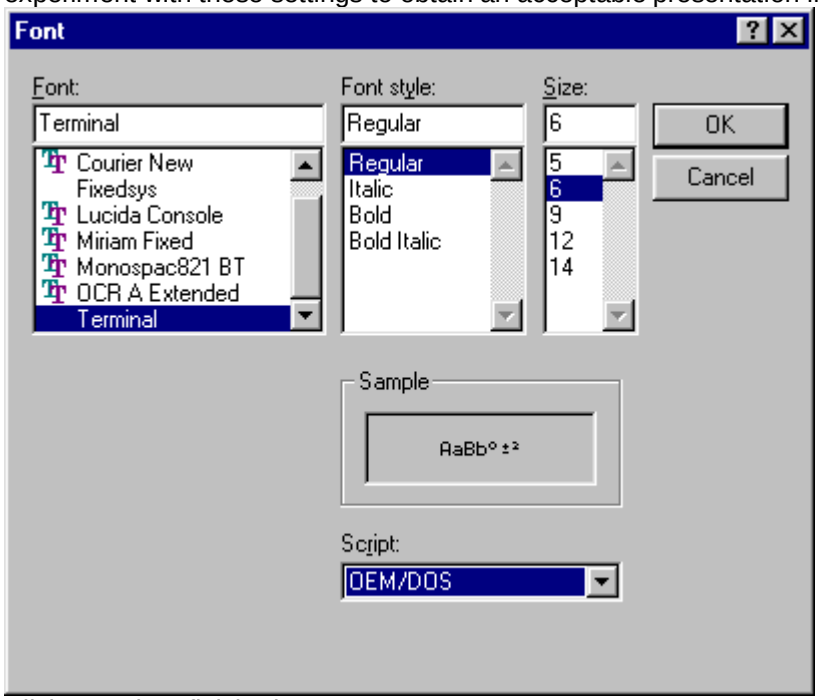
When the **Connection Description** dialog box appears, type in **Connect to F12**. If you wish, choose an icon by sliding the horizontal scroll bar over and clicking one of the selections. Click **OK** when ready.

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**.

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

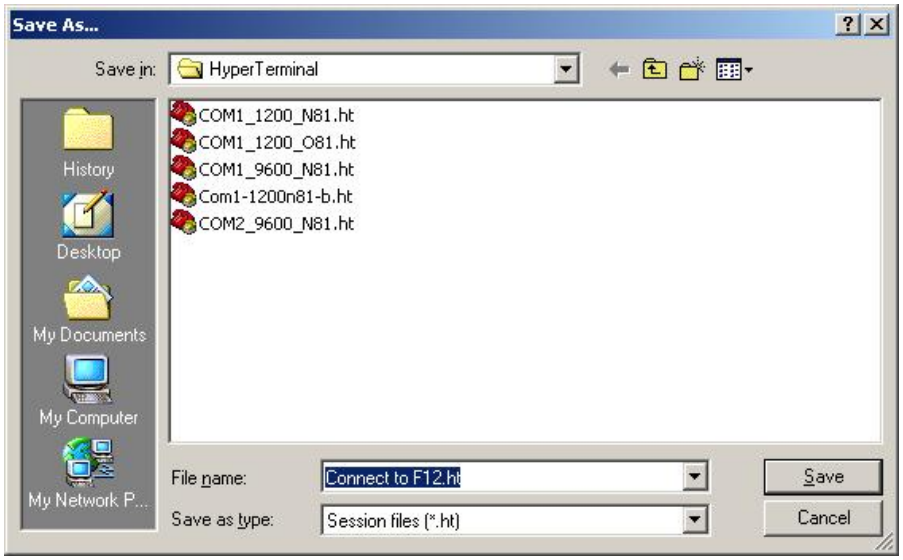


Click **View**, then click **Font** and configure the font settings as shown. This will insure that the data is presented in the terminal window without wrapping from line to line. You may need to experiment with these settings to obtain an acceptable presentation in the terminal window.

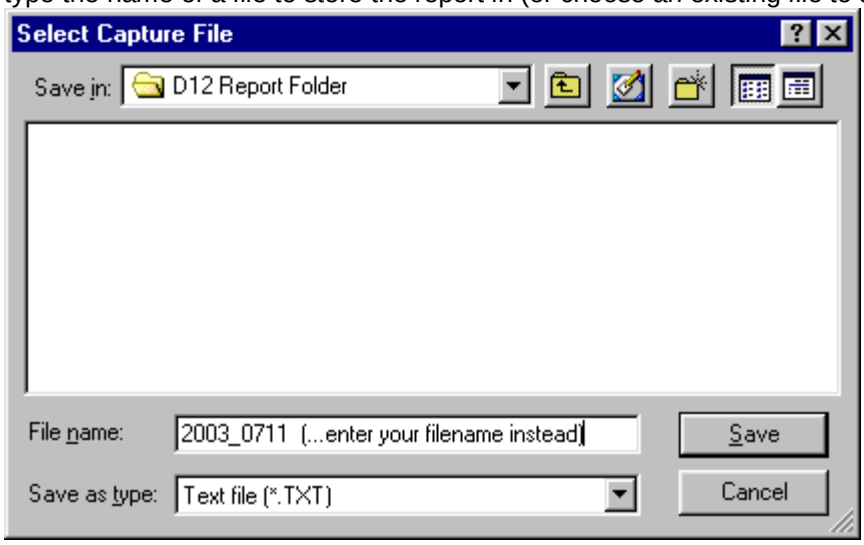


Click **OK** when finished.

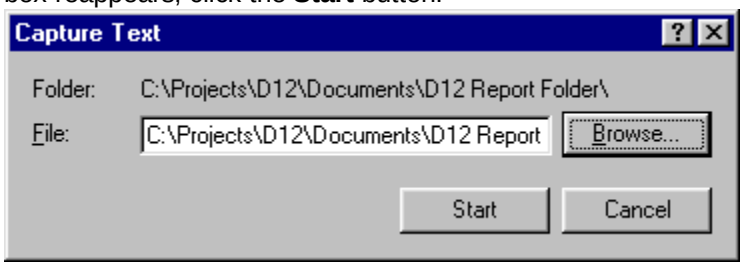
Click **File**, then click **Save As**, and click the **Save** button to store the settings as a HyperTerminal session file named Connect to F12.ht (the filename should automatically appear). You may later place this file on your desktop and simply click it to get this point automatically.



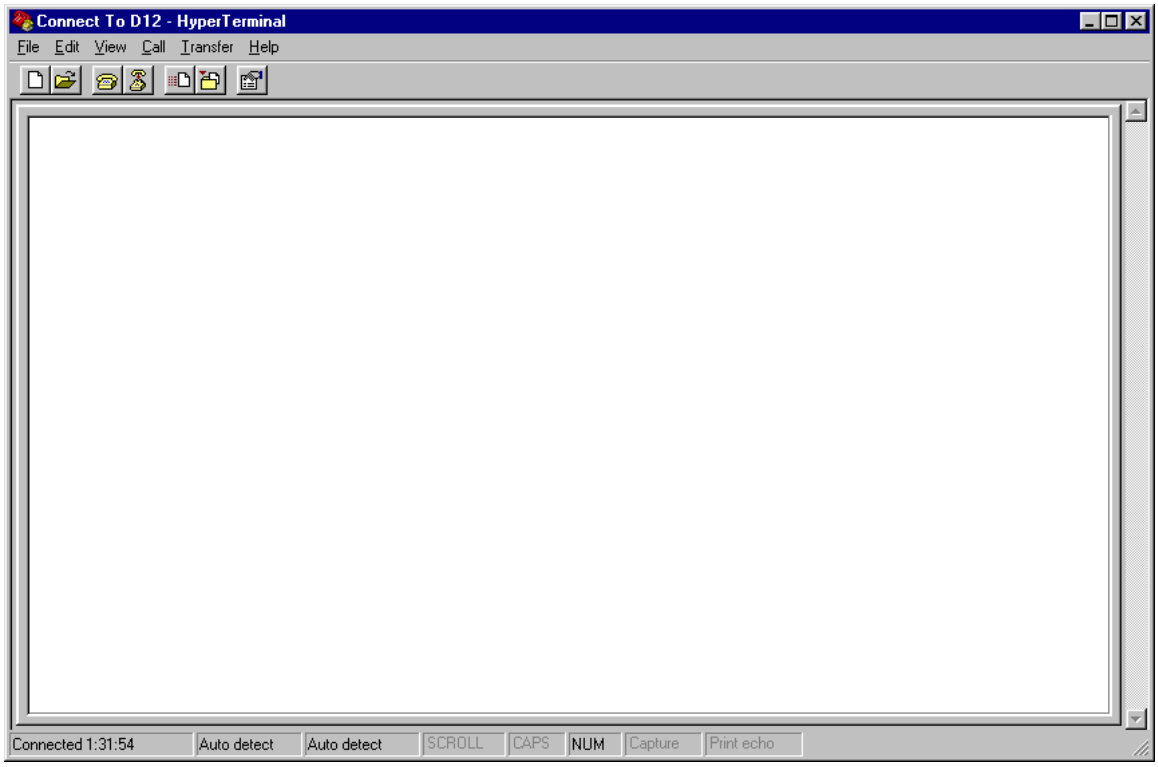
In order to chart the report data, it must be "captured" in a file and given a name. Click **Transfer** on the menu bar, click **Capture Text,** and then click the **Browse** button. Navigate to a folder and type the name of a file to store the report in (or choose an existing file to append the new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



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



HyperTerminal is now ready to accept a report from the F12 transmitter and save it in a file. Note that data may appear in the terminal window (shown below) if the Connect to F12 session has been run previously, but this data will not appear in the file just opened.



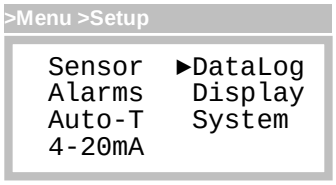
Starting the Report

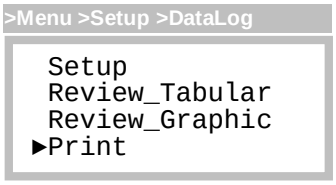
Prior to sending a report to the computer, the system clock should be set and the data logger turned on to record at least one sample. In addition, the Log_Data variable (in the Menu/Setup/Auto-T/Setup menu) should be set to NO if you prefer to see the symbol TEST and not gas concentration values during auto-test.

Configure the communication variables as shown below. Note that 9600 is the highest baud rate common to the F12 transmitter and the Hyperterminal program.

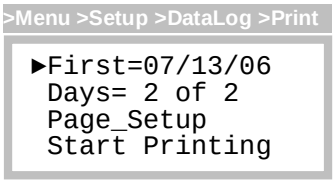
```
Menu>Setup>System>Commun

►Protocol=ASCII
 Interface=RS232
 Baud_Rate=9600
 Parametrs=N,8,1
```

Navigate to the DataLog page and select Print. You will not be allowed access if there are no samples in the log.

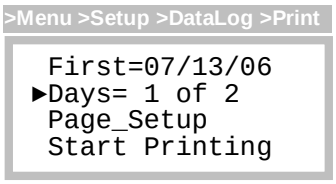




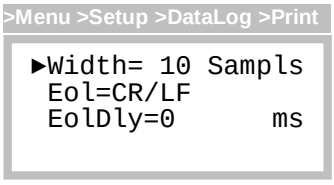
Select the first (starting) date. This will automatically re-compute the maximum number of days shown of the report (variable values will most likely differ from yours).



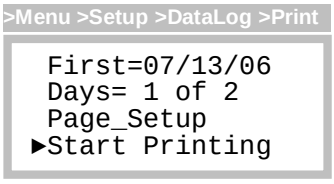
Edit the Days variable if you prefer to reduce the length of the report, otherwise the entire report will be printed.

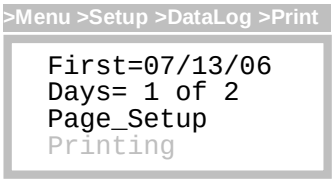


Select Page_Setup and configure the Width, Eol, and EolDly variables as shown. The Width variable controls the number of sample columns printed and is settable from 1 to 30. Since the Hyperterminal display is 80 characters wide, set this to 10 columns so that data does not wrap around to the next line.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

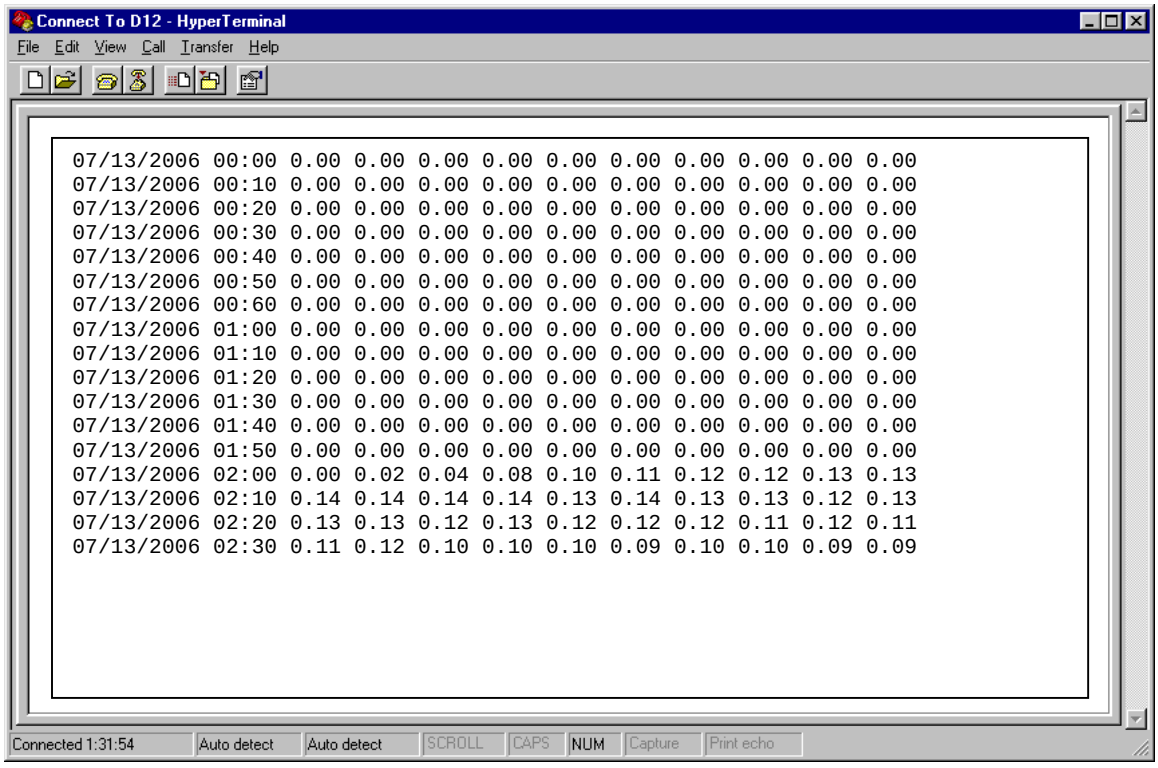


Escape from Page_Setup and select Start_Printing. "Printing" will begin flashing, and you may stop at any time by pressing the Esc key.





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



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

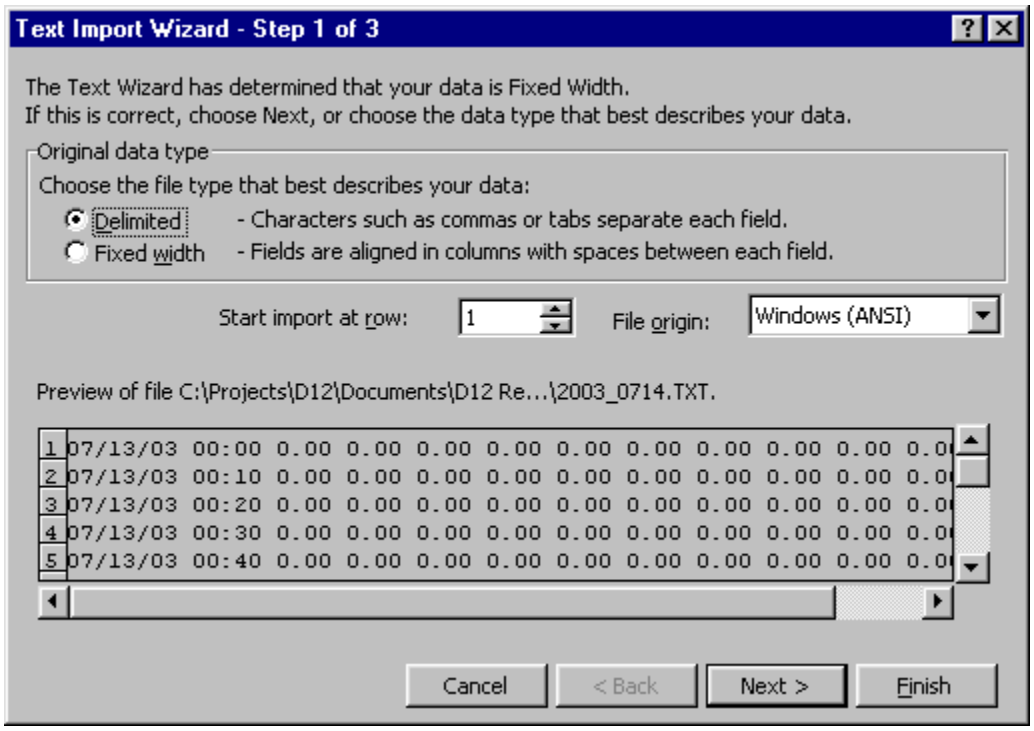
Charting with Microsoft Excel

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

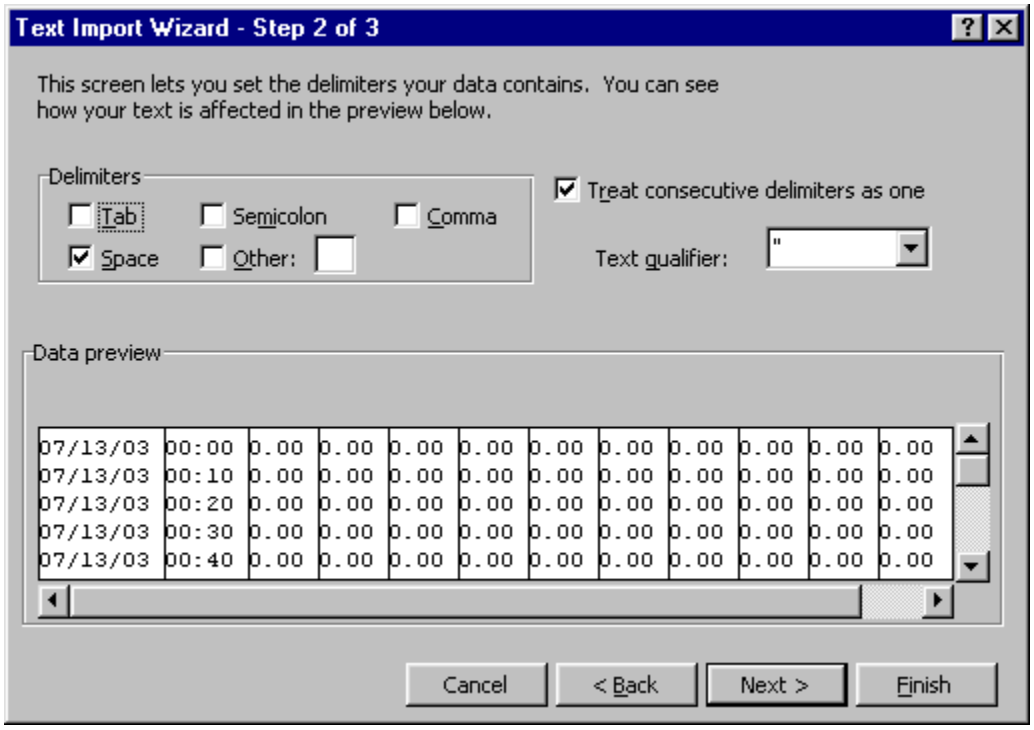
Start Excel by clicking **Start**, pointing to **Programs**, and clicking **Microsoft Excel.**

When Excel opens, click **File** and then click **Open.** Navigate to the data log report file you wish to chart and click **Open**. Excel will recognize the report as a text file and offer some configuration options.

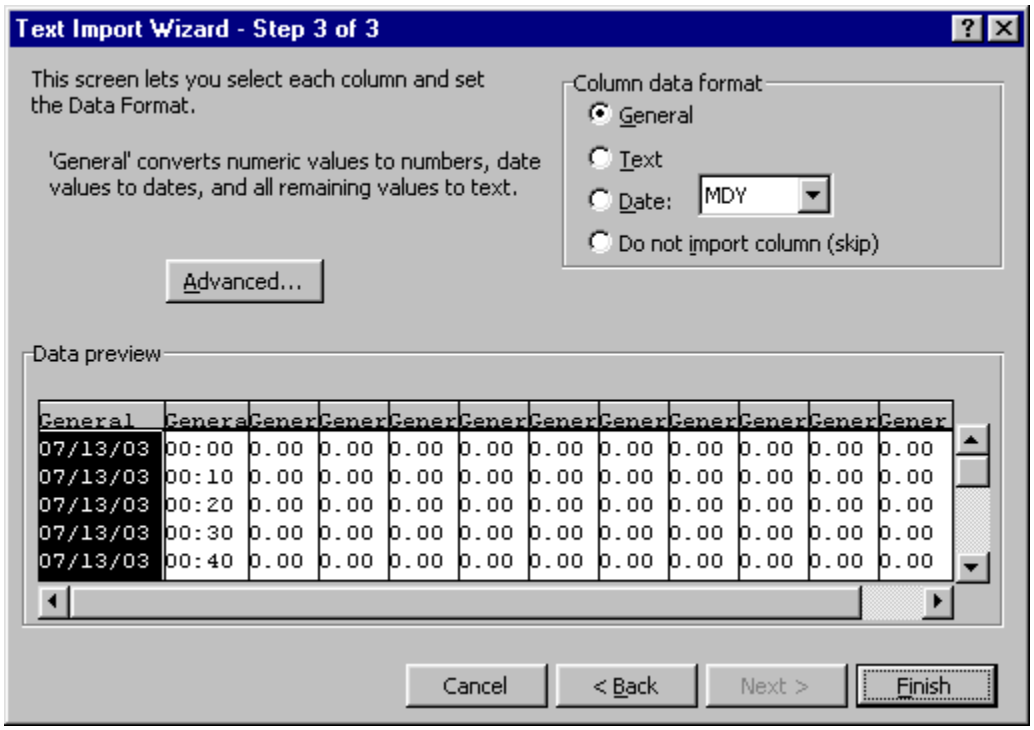
When the **Text Import Wizard – Step 1 of 3** appears, configure the settings as shown below and click **Next**. (Note that the values in your report file will be different than those shown below.)



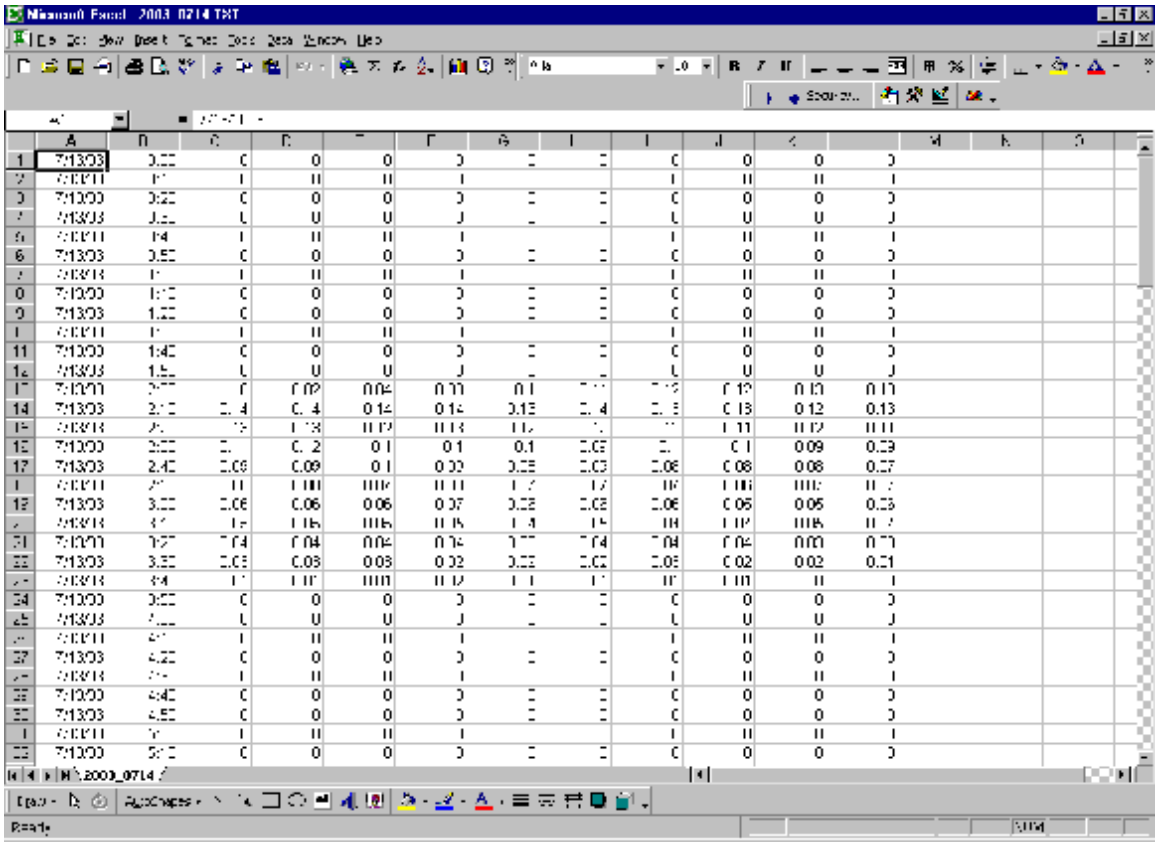
When the **Text Import Wizard – Step 2 of 3** appears, configure the settings as shown below and click **Next**.



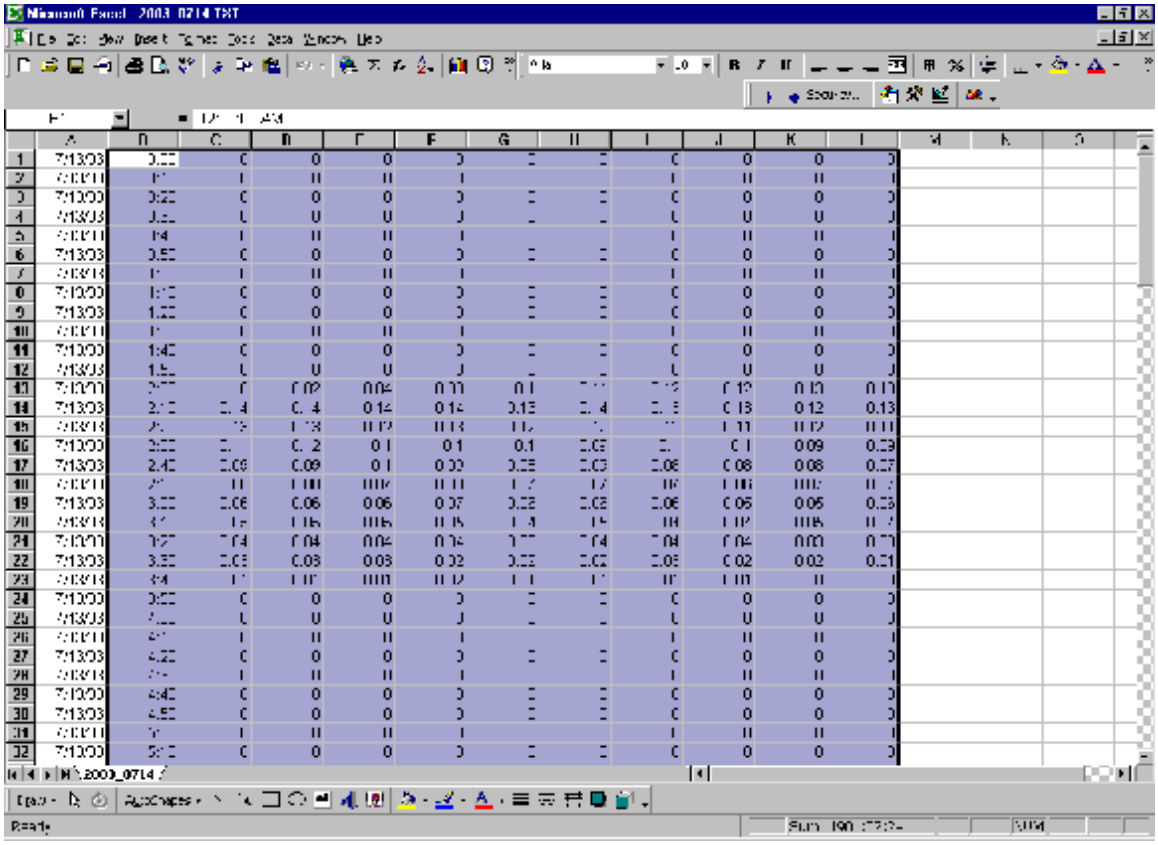
When the **Text Import Wizard – Step 3 of 3** appears, click **Finish**.



The report should appear as a spreadsheet resembling the format shown below. Of course the dates, times, and values will be different.

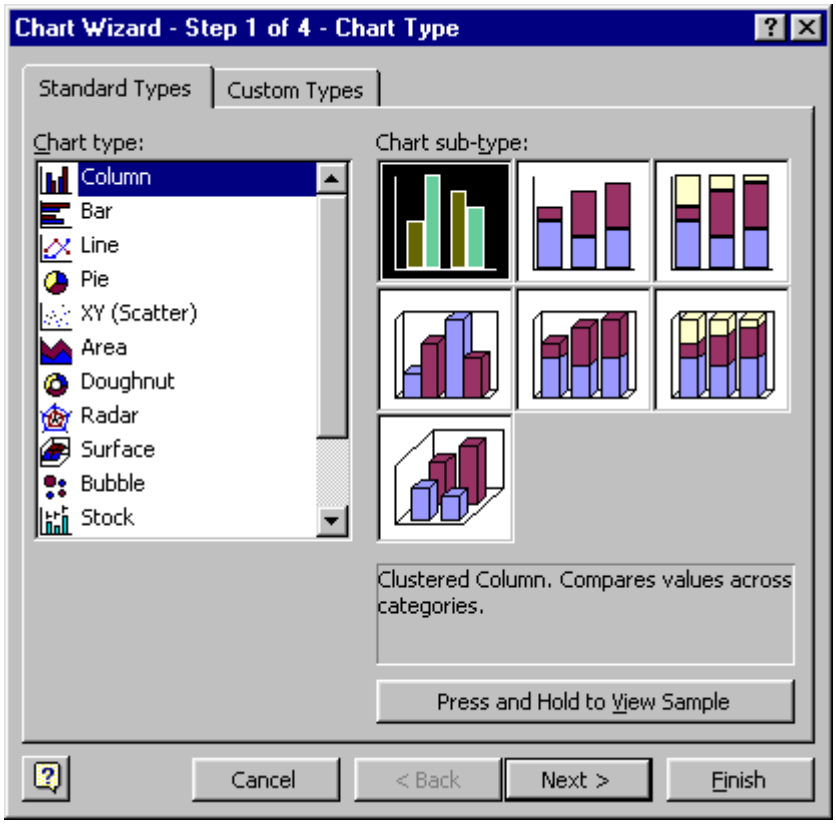


To chart the report, select one full day of data by dragging the mouse cursor over the region to be charted. Notice that this region begins in the time of day column and extends across each of the sample columns.

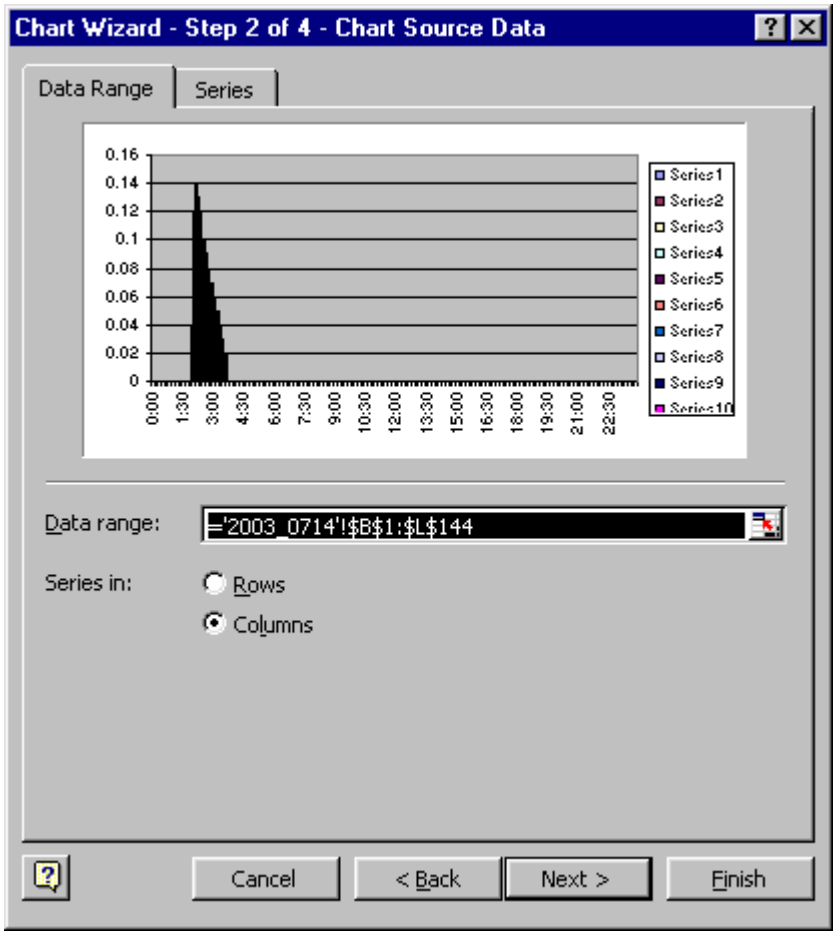


After selecting the region, click Insert and then Chart (or click the Chart icon directly from the toolbar).

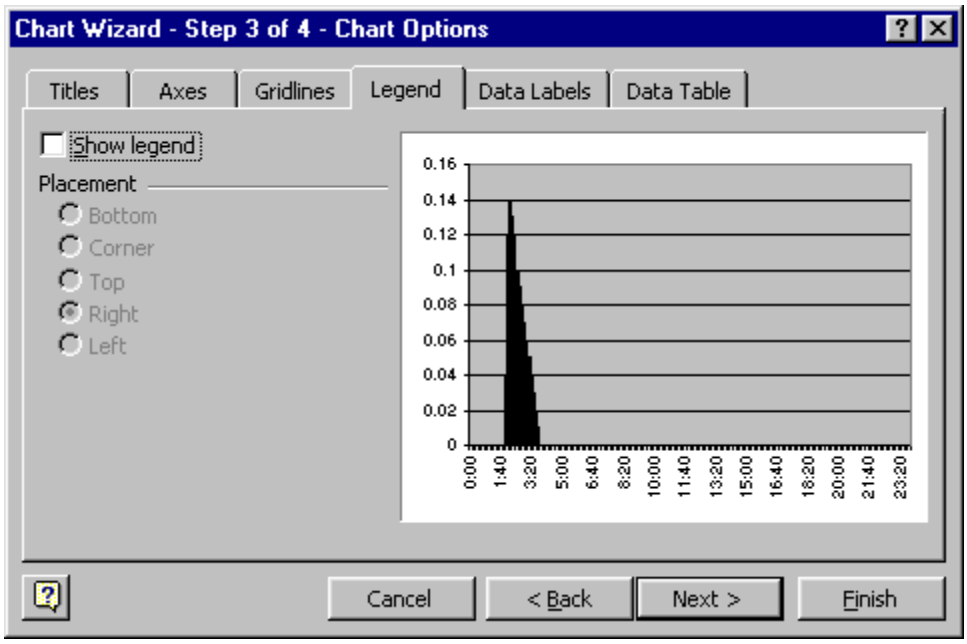
When the **Chart Type** dialog appears, click on **Column,** and click **Next.**



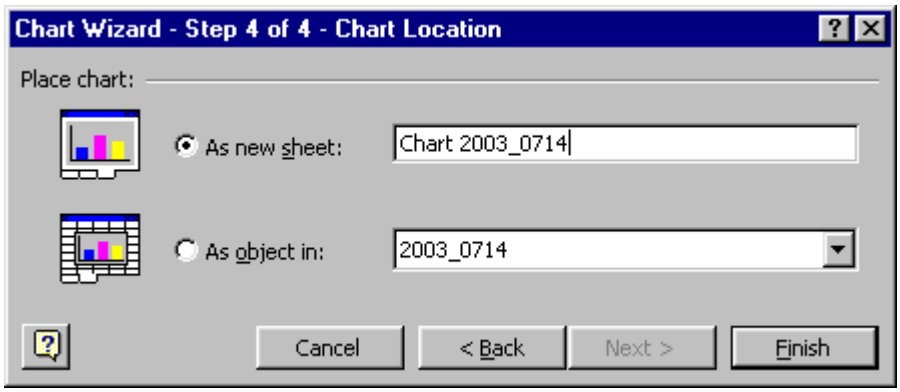
When the **Chart Source Data** dialog appears, click **Next**.



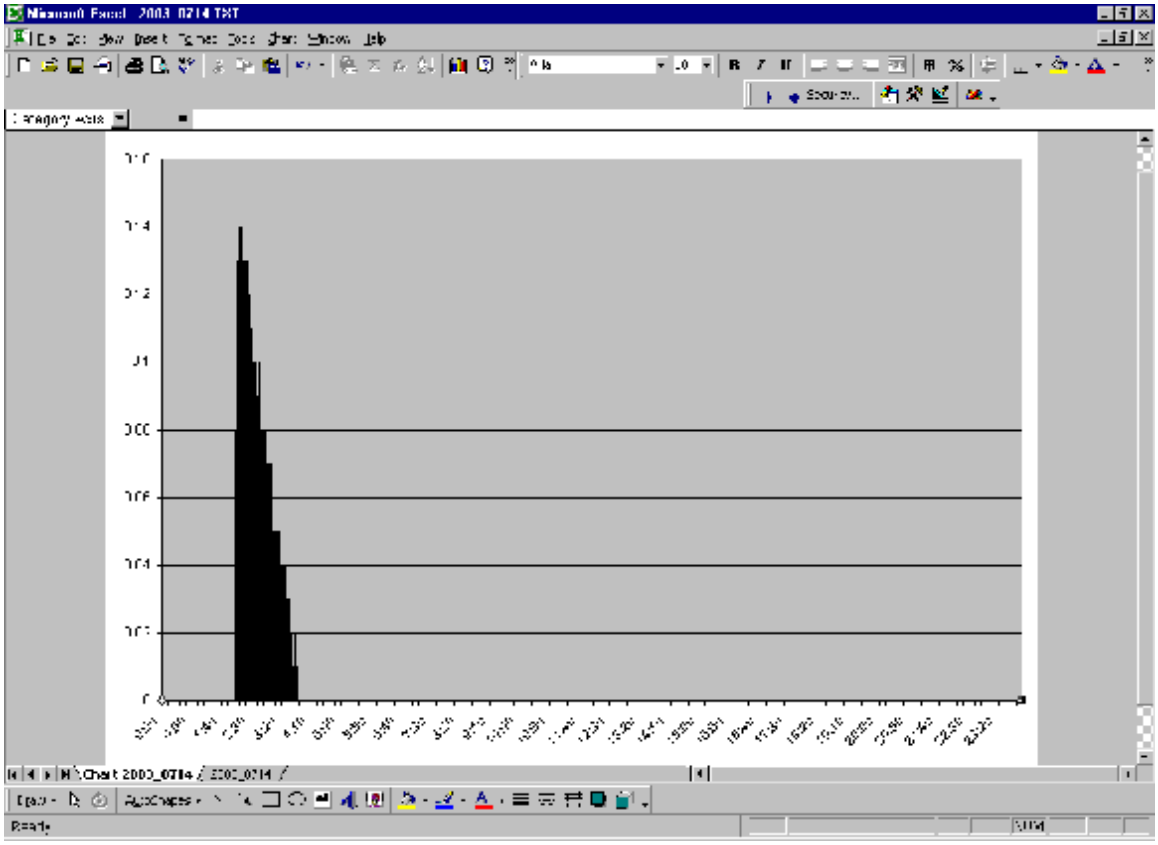
When the **Chart Options** dialog appears, click off the **Show legend** option, and click **Next**.



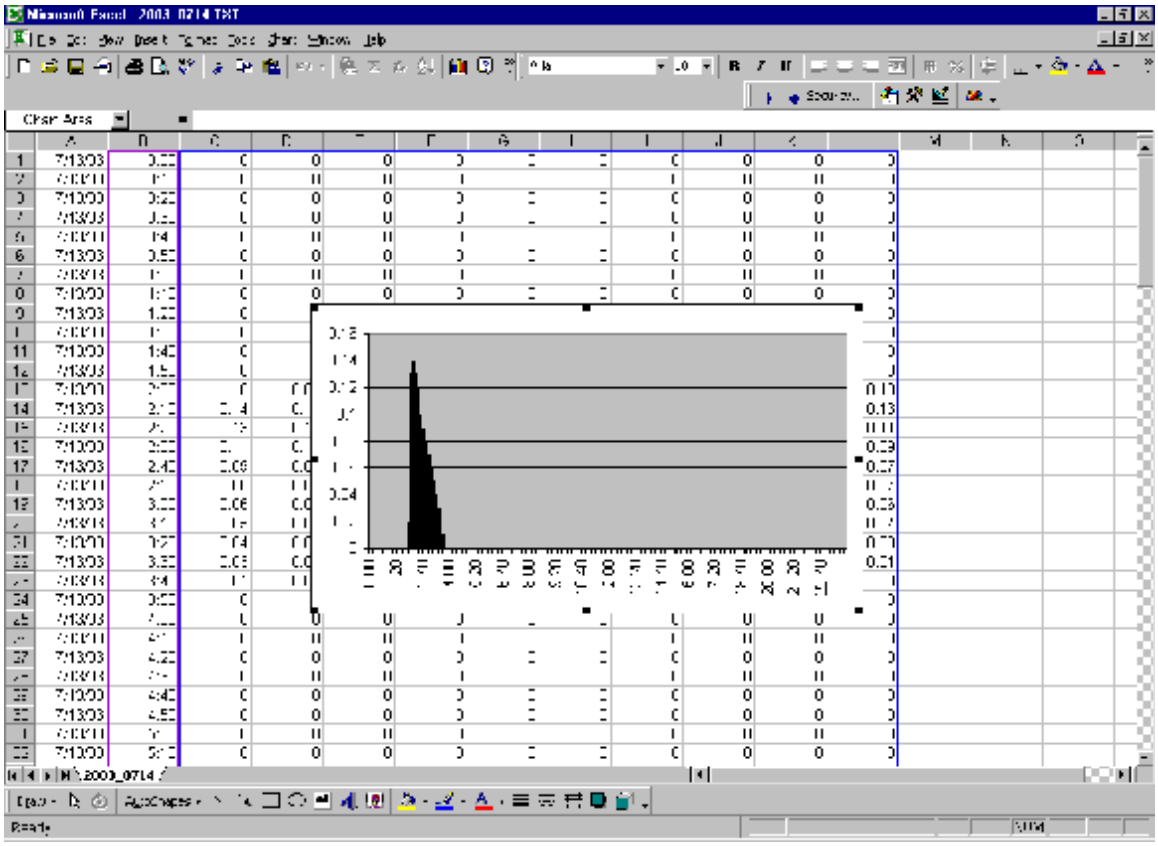
When the **Chart Location** dialog appears, click the **as new sheet** radio button and enter the name of a new sheet to store the chart in. Alternately, you may click the **As object in** radio button to place the chart onto the sheet you have just created.



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



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



Finally, click **File**, then **Save** to store the chart.

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