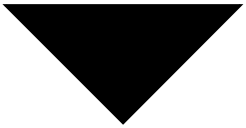
Safe T Net 2000
Operator's Manual



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NOTATION CONVENTIONS

Notices are used in this operator's manual to alert you to hazardous conditions to person or instrument and to notify you of additional information. This operator's manual uses the following notices.

WARNING

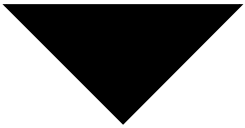
Notifies you of potential danger that can result in personal injury or death.

CAUTION

Notifies you of potential damage to equipment.

NOTE

Notifies you of additional or critical information.



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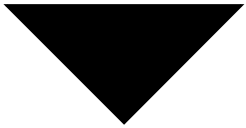

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Chapter 1

INTRODUCTION

Description

SafeT Net is a family of fixed-instrument, continuous-monitoring systems.

The Safe T Net 2000 is a two-channel, rack- or panel-mounted controller module that receives signals from remote gas transmitters, displays the gas concentrations, provides alarm, recorder, and relay outputs, uses 24 VDC power, and provides power to the remote transmitters, including sample-draw transmitters.

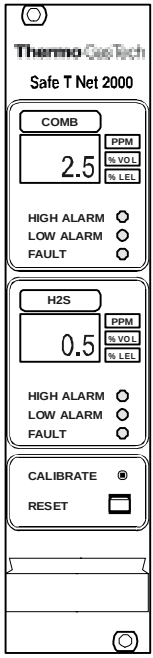


Figure 1-1 Front Panel

The Safe T Net 2000 is capable of detecting many gases. Appendix C, Transmitters, lists the transmitters you can order with your controller.

Features

- Accepts one or two channels of standard 4 to 20 mA analog input signals from remote 2- or 3-wire transmitters for detecting combustible gas, toxic gas, or oxygen concentrations.
- Simultaneously displays the current gas reading for both channels.
- Provides a 4 to 20 mA analog recorder output for each channel.
- Warns you of hazardous gas concentration conditions with audible and visual indications at two alarm setpoints for each channel.
- Fault circuit provides visual, audible, and relay indications to warn you of detector failure or other malfunctions.
- Provides a low and a high alarm relay for each channel.
- Is a slide-in module for a standard 4U rack assembly.
- Occupies one 8E width (1.60 inches).

Programmable Relay Operation

Each active channel has two relays: Low alarm and high alarm. A master fault relay activates if either channel is in a fail condition. You can program the relays for latching or self-resetting alarm logic, energizing or de-energizing relay activation (low and high alarm relays), activation on rising or falling signal levels, and time delay (0 to 30 seconds) to avoid false alarms due to radio frequency interference (RFI) or electromagnetic interference (EMI).

Specifications

Table 1-1 lists the specifications of the Safe T Net 2000. See Appendix C, Transmitters, for gas detection specifications.

Table 1-1 Safe T Net 2000 Specifications

Range	Adjustable to 999. Decimal can be set in any position.
Inputs	Two 24 VDC 4 to 20 mA analog signal inputs, source-type, two- or three-wire.
Analog recorder outputs	One 4 to 20 mA source for each channel, 1000 OHMS maximum at 24 VDC input.
Relay outputs	Low alarm relay (Form C) and high alarm relay (Form A) for each channel, programmable for latching/non-latching, and energized/de-energized. Common fault (Form B), normally energized, programmable for latching/non-latching. Each relay rated at 10 AMP/125 VAC.
Voltage input	24 VDC nominal (18-30 VDC).
Current consumption	0.25 Amp maximum. Fuse: 3AG-1, 250 V/1 Amp.
Low alarms	Independently adjustable from OFF to full scale. Audible and visual indication. Acknowledged using the RESET button. Programmable to activate on rising or falling level.
High alarms	Independently adjustable from OFF to full scale. Audible and visual indication. Programmable to activate on rising or falling level.
Common fault alarm	Programmable to activate at 3.7 mA, 3.2 mA, or 2.0 mA input signal. Can be disabled.
Calibration time out	Programmable from 0 (no time out) to 99 minutes.
Alarm delay	Programmable from 0 (no delay) to 99 seconds.
Operating temperature	-20° to +45°C (-5° to +115°F).
Operating humidity	0 to 95% RH non-condensing.
Module dimensions	1.60" (41 mm) (8E) W, 6.80” (173 mm) (4U) H, 9.45" (240 mm) D
Weight	Approximately 1.3 lbs (0.6 Kg).

Chapter 2

INSTALLATION AND START UP

WARNING

Perform all installation procedures in a fresh air environment (known to be free of combustible and toxic gas and having normal oxygen content). The Safe T Net 2000 is not in operation as a gas monitoring system until the start up procedure is complete.

Installation

The packing slip indicates the serial number of your Safe T Net 2000. The serial number is also on a label on the side of the Safe T Net 2000. Please record the serial number on the front of this manual.

The Safe T Net 2000 controller is suitable for mounting in a rack assembly using card-guides to support the main circuit board and the two captive screws at the front of the controller to secure it in place.

The Safe T Net 2000 controller can be used with any standard 2- or 3-wire 4 to 20 mA analog transmitter. When changing transmitter types, follow the instructions for programming the Safe T Net 2000 in the Programming section of this chapter.

The installation should be in a safe area, preferably near an entrance door where the fire department or other emergency response team can see the indication if an alarm has caused the building to be evacuated.

The wiring diagram for the Safe T Net 2000 is shown in Figure 2-1.

WARNING

The Safe T Net 2000 slides forward in its guides for access to the programming controls. Maintain a minimum 10cm (5 inch) service loop at the wiring connections.

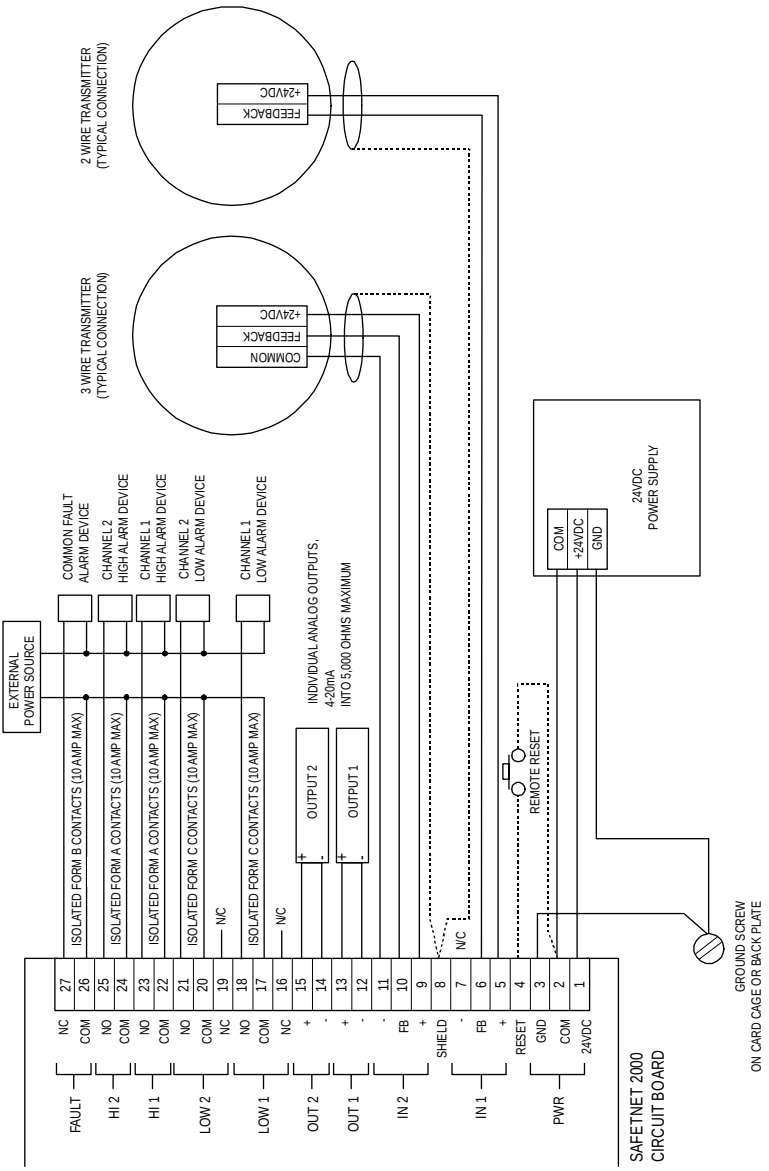


Figure 2-1 Wiring Diagram

Terminal Strips

The terminal strip, at the rear of the module, is composed of three connectors of nine terminals each. The connectors are removable to facilitate installation and service operations and keyed to prevent them from being interchanged. The 27 screw-type terminals accept wire up to 12 gauge.

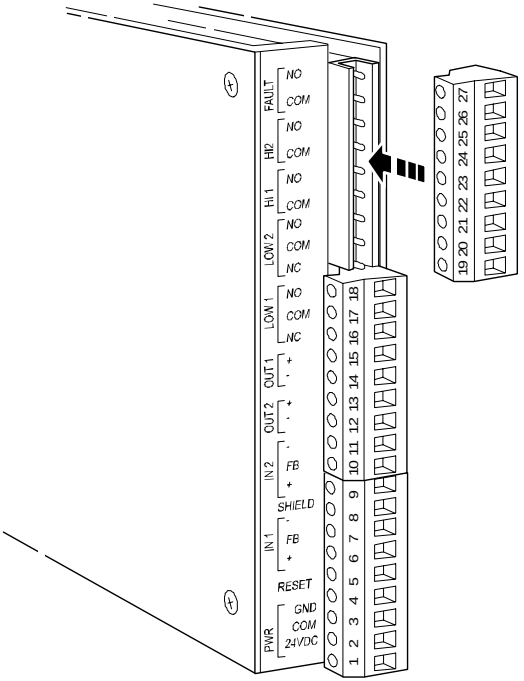


Figure 2-2 Terminal Strip

Table 2-1 Safe T Net 2000 Terminal Strip

Terminal Label	Terminal Number	Description	
NC	T27	Normally closed [1]	Common fault relay
COM	T26	Common	
NO	T25	Normally open [2]	Channel 2
COM	T24	Common	high alarm relay
NO	T23	Normally open [2]	Channel 1
COM	T22	Common	high alarm relay
NO	T21	Normally open	Channel 2
COM	T20	Common	low alarm relay
NC	T19	Normally closed	
NO	T18	Normally open	Channel 1
COM	T17	Common	low alarm relay
NC	T16	Normally closed	
+	T15	4 to 20 mA	Channel 2
-	T14	Common	4 to 20 mA analog recorder output
+	T13	4 to 20 mA	Channel 1
-	T12	Common	4 to 20 mA analog recorder output
-	T11	Common	Channel 2
FB	T10	Signal	4 to 20 mA analog signal
+	T9	+24 VDC	input
SHIELD	T8	Shield	
-	T7	Common	Channel 1
FB	T6	Signal	4 to 20 mA analog signal
+	T5	+24 VDC	input
RESET	T4	Remote reset	
GND	T3	Ground (chassis)	Power in
COM	T2	Common (circuit ground)	
24 VDC	T1	+24 VDC	

1. Fault relay factory setting is normally energized and de-energize in a fault condition such that contact closure occurs between C and NC in a fault condition.
2. Can be factory configured to be normally closed and open on alarm.

Programming

The Safe T Net 2000 can be programmed for any gas detection application supported by the 4 to 20 mA transmitters listed in Appendix C, Transmitters.

Using the programming switches and buttons along the bottom of the circuit board, the following parameters can be set for each channel:

- Channel settings:
  - Range
  - Decimal place
  - Indicated gas units (ppm, %LEL, %VOL)
  - Low and high alarm levels
- Gas alarm relays:
  - Latching or self-resetting
  - Normally energized or deenergized
  - Activated on rising or falling level
- Fault alarm:
  - Activation level
  - Relay latching or self-resetting
- Alarm buzzer enabled or disabled
- Calibration time out
- Alarm delay

Standard Settings

Table 2-2 Standard Factory Settings

Low Alarm	Form C Normally de-energized Latching (O_2 is self-resetting) Activated on a rising concentration (except oxygen)
High Alarm	Form A Normally de-energized Latching (O_2 is self-resetting) Activated on a rising concentration
Fault Alarm	Form B Normally energized Self-resetting Setpoint: 3.2 mA analog input signal (5% downscale drift)
Alarm Delay	OFF
Calibration time out	15 minutes
Buzzer	Enabled

The standard ranges for various transmitter types are listed in Appendix C, Transmitters.

CAUTION

The standard ranges provide optimum performance of each transmitter type. Contact Gas Tech before using a non-standard range.

Changing the Settings

The settings are made using the three DIP switches (U1, U9, U10) and three buttons, STEP, ▲ (UP), and ▼ (DOWN)) located at the bottom edge of the controller module circuit board.

On the DIP switches, ON is the switch position up away from the edge of the board and OFF is down toward the edge of the board.

NOTE

While the Safe T Net 2000 is in any of its set-up modes, the 4 to 20 mA analog recorder outputs fall to 1.5 mA.

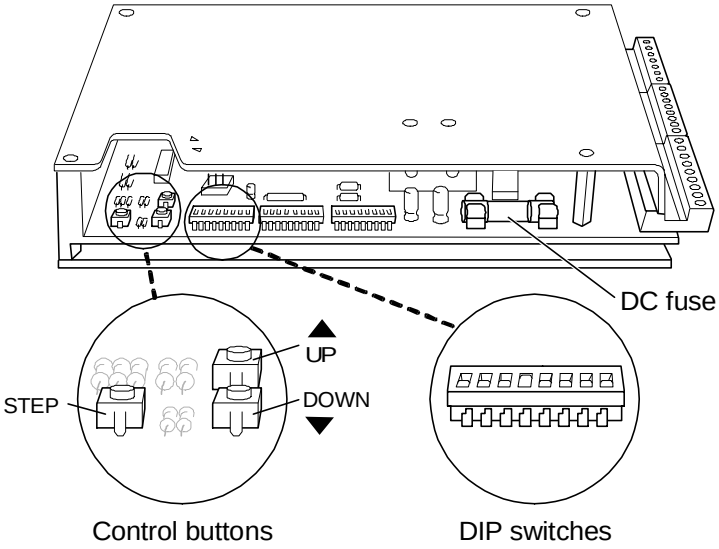


Figure 2-3 Controller Board Switches and Programming Buttons

DIP SWITCH U1 (COMMON SETTINGS)

U1 is the DIP switch closest to the front of the module (adjacent to the control buttons). The switches of U1 control the functions common to both channels.

Table 2-3 DIP switch U1 - Setting Common to Both Channels

Switch	Position	Function
1 (left)	ON	Enable set-up mode 1 for both channels. See Set-Up Mode 1, in this chapter.
	OFF	Normal operation.
2	ON	Enable set-up mode 2 for both channels. See Set-Up Mode 2, in this chapter.
	OFF	Normal operation.
3	ON	Enable set-up mode 3 for both channels. See Set-Up Mode 3, in this chapter.
	OFF	Normal operation.
4	ON	Select channel 1 (set-up mode 3).
	OFF	Select channel 2 (set-up mode 3).
5	ON	Fault relay latched.
	OFF	Fault relay unlatched (self-resetting).
6	Switches 6 and 7 are used together to set the fault alarm level. See Fault Alarm Level, in this chapter.	
7		
8 (right)	ON	Enable alarm buzzer.
	OFF	Disable alarm buzzer.

DIP SWITCH U9 (CHANNEL 1 RELAYS)

U9 is the middle of the three DIP switches. The switches of U9 control the operation of the channel 1 low and high relays. Switch 7 turns the channel on and off.

Table 2-4 DIP switch U9 - Channel 1 Settings

Switch	Position	Function
1 (left)	ON	Channel 1 low relay latched
	OFF	Channel 1 low relay unlatched (self-resetting)
2	ON	Channel 1 low relay normally de-energized
	OFF	Channel 1 low relay normally energized
3	ON	Channel 1 low relay activated on falling level
	OFF	Channel 1 low relay activated on rising level
4	ON	Channel 1 high relay latched
	OFF	Channel 1 high relay unlatched (self-resetting)
5	ON	Channel 1 high relay normally de-energized
	OFF	Channel 1 high relay normally energized
6	ON	Channel 1 high relay activated on falling level
	OFF	Channel 1 high relay activated on rising level
7	ON	Channel 1 OFF [1]
	OFF	Channel 1 ON
8 (right)	Not used	Not used

1. When channel 1 is off, the display shows OFF, the status LEDs (HIGH ALARM, LOW ALARM, and FAULT) are off, the relays are held in the inactive state, the recorder output is 0 mA, and it cannot be placed in calibration mode.

DIP SWITCH U10 (CHANNEL 2 RELAYS)

U10 is the bottom DIP switch furthest from the front of the module. The switches of U10 control the operation of the channel 2 low and high relays. Switch 7 turns the channel on and off.

Table 2-5 DIP switch U10 - Channel 2 Settings

Switch	Position	Function
1 (left)	ON	Channel 2 low relay latched
	OFF	Channel 2 low relay unlatched (self-resetting)
2	ON	Channel 2 low relay normally de-energized
	OFF	Channel 2 low relay normally energized
3	ON	Channel 2 low relay activated on falling level
	OFF	Channel 2 low relay activated on rising level
4	ON	Channel 2 high relay latched
	OFF	Channel 2 high relay unlatched (self-resetting)
5	ON	Channel 2 high relay normally de-energized
	OFF	Channel 2 high relay normally energized
6	ON	Channel 2 high relay activated on falling level
	OFF	Channel 2 high relay activated on rising level
7	ON	Channel 2 OFF [1]
	OFF	Channel 2 ON
8 (right)	Not used	Not used

1. When channel 2 is off, the display shows OFF, the status LEDs (HIGH ALARM, LOW ALARM, and FAULT) are off, the relays are held in the inactive state, and it cannot be placed in calibration mode.

SET-UP MODE 1 (RANGES AND ALARM SETPOINTS)

Set-up mode 1 is used to set the channel 1 and channel 2 range, low alarm, and high alarm levels.

CAUTION

The standard ranges are listed in Appendix C, Transmitters of the Safe T Net 2000 Operator's Manual provide optimum performance of each transmitter type. Contact Gas Tech before using a non-standard range.

You can exit set-up mode 1 by setting switch 1 to OFF at any point in the procedure without losing your settings. In addition, range and alarm settings are retained by the Safe T Net 2000 even when power is removed. While the Safe T Net 2000 is in set-up mode 1, the 4 to 20 mA analog recorder outputs go to 1.5 mA.

1. Initiate set-up mode 1 by placing U1 switch 1 in the ON position (away from the edge of the board).
2. The channel 1 display, LOW ALARM LED, and HIGH ALARM LED ▼ (DOWN) buttons.
3. Press the STEP button to accept the current value and go to the next setting.
4. The channel 1 DISPLAY and LOW ALARM LED flash. Channel 1 low alarm level can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
5. Press the STEP button to accept the current value and go to the next setting.
6. The channel 1 DISPLAY and HIGH ALARM LED flash. Channel 1 high alarm level can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
7. Press the STEP button to accept the current value and go to the next setting.
8. The channel 2 display, LOW ALARM LED, and HIGH ALARM LED flash. Channel 2 range can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
9. Press the STEP button to accept the current value and go to the next setting.
10. The channel 2 DISPLAY and LOW Alarm LED flash. Channel 2 low alarm level can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
11. Press the STEP button to accept the current value and go to the next setting.

12. The channel 2 DISPLAY and HIGH ALARM LED flash. Channel 2 high alarm level can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
13. Return U1 switch 1 to OFF to resume normal operation.

SET-UP MODE 2 (GAS UNITS AND DECIMAL PLACE)

Set-up mode 2 is used to set the individual parameters for channel 1 and channel 2 decimal place, and indicated gas units (ppm, %LEL, %VOL).

1. Initiate set-up mode 2 by placing U1 switch 2 in the ON position (away from the edge of the board).
2. The channel 1 display flashes, showing full scale range. The channel 1 decimal place can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
3. Press the STEP button to accept the current value and go to the next setting.
4. The channel 1 display shows only the decimal point chosen; the selected gas units flash. The channel 1 gas units (ppm, %LEL, %VOL) can now be set using the ▲ (UP)and ▼ (DOWN) buttons.
5. Press the STEP button to accept the current value and go to the next setting.
6. The channel 2 display flashes, showing full scale range. The channel 2 decimal place can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
7. Press the STEP button to accept the current value and go to the next setting.
8. The channel 2 display shows only the decimal point chosen; the selected gas units flash. The channel 2 gas units (ppm, %LEL, %VOL) can now be set using the ▲ (UP)and ▼ (DOWN) buttons.
9. Return U1 switch 2 to OFF to resume normal operation.

While the Safe T Net 2000 is in set-up mode 2, the 4 to 20 mA analog recorder outputs go to 1.5 mA.

SET-UP MODE 3

Set-up mode 3 is a factory-only calibration that calibrates the signal input circuitry to recognize the 0 mA and 20 mA analog inputs.

CAUTION

Set-up Mode 3 is a factory adjustment and is not generally meant to be made by the user.

1. Initiate set-up mode 3 by placing U1 switch 3 in the ON position (away from the edge of the board).
2. Select channel 1 (switch 4 = ON) or channel 2 (switch 4 = OFF).
3. The selected display and status LEDs flash.
4. With no signal (0 mA) applied to the channel input terminals, press the ▼ (DOWN) button.
5. Apply 20.0 mA to the channel input terminals and press the ▲ (UP) button.
6. Return U1 switch 3 to OFF to resume normal operation.

While the Safe T Net 2000 is in set-up mode 3, both 4 to 20 mA analog output signals go to 1.5 mA.

FAULT ALARM SETPOINT

The Safe T Net 2000 generates a fault alarm when either of the channel input signals drops below the 4.0 mA analog input signal zero point to the programmed fault alarm setpoint (refer to Table 2-6). (This feature can be disabled.) The setting applies to both channel inputs. When the fault alarm is triggered, the FAULT LED lights, the buzzer sounds, and the fault relay de-energizes and the contacts close.

Set the fault alarm setpoint by setting U1 switches 6 and 7 as follows:

Table 2-6 Fault Alarm Trigger Levels

Fault alarm analog input signal trigger level	U1 Switch 6	U1 Switch 7
2.0 mA	OFF	ON
3.2 mA (**factory setting**)	ON	OFF
3.7 mA	ON	ON

CALIBRATION TIME OUT

If calibration mode is not turned off manually, the Safe T Net 2000 automatically returns to normal operation from calibration mode after a preprogrammed time out from 0 (no time out) to 99 minutes

NOTE

The standard calibration time out setting is 15 minutes.

Program the calibration time out as follows:

1. While in normal operation, press the STEP and ▼ (DOWN) buttons simultaneously to initiate the calibration time out set-up mode.
2. The channel 1 LOW and HIGH ALARM LEDs are lit, the display shows the current calibration time out setting in minutes. The calibration time out can now be set using the ▲ (UP)and ▼ (DOWN) buttons.
3. Press the STEP button to accept the current value and resume normal operation.

CAUTION

The visual and audible alarm indications and relays are inactive during calibration time out and will not indicate any hazardous gas concentrations that may occur while calibration mode is enabled.

ALARM DELAY

The Safe T Net 2000 can be programmed to delay the operation of alarm relays and status LEDs for a pre-determined time after alarm levels have been exceeded. This feature allows you to prevent nuisance alarms caused by transient radio frequency interference (RFI). The alarm delay can be set from 0 (no delay) to 99 seconds.

NOTE

The standard alarm delay factory setting is zero seconds (no delay).

Set the alarm delay as follows:

1. While in normal operation, press the ▲ (UP) and ▼ (DOWN) buttons simultaneously to initiate the alarm delay set-up mode.
2. The channel 1 display shows the current alarm delay in seconds. The alarm delay can now be set using the ▲ (UP) and ▼ (DOWN) buttons.
3. Press the STEP button to accept the current value and resume normal operation.

Start Up

Complete the following procedures to place the Safe T Net 2000 in normal operation.

Preparing for Start Up

Perform the following steps when preparing for start up:

1. Complete the mounting and wiring procedures described earlier in this chapter.
2. Complete all installation procedures described in the Transmitters manual.
3. Verify that all wiring connections are correct and secure.

Introducing Power

Turn on the incoming power at the power source.

NOTE

The low alarm, high alarm, and fault circuits are not active for 1 minute after power is applied to the Safe T Net 2000. This time delay minimizes false alarms during transmitter warm-up.

Verifying Indicator Lights

1. Verify the displays are on.
2. If no light comes on during the startup sequence, the Safe T Net 2000 is not receiving power. Check the wiring connection, the power source, and the fuses. See Chapter 5, Maintenance, for detailed troubleshooting instructions.
3. Table 2-7 shows the conditions indicated by the status indicator lights during start up, and the suggested response for each condition.

Table 2-7 Start Up Indications

Indicators	Probable Status	Recommended Response
Lights on	Receiving power.	None.
FAULT	Below-zero reading.	Allow detector to warm-up. Zero the transmitter output. Replace detector if the below-zero reading continues. See the Troubleshooting section of Chapter 5, Maintenance.
	Detector, transmitter, or circuitry is broken, incomplete, or incorrect.	Verify transmitter and detector wiring is correct and secure. See the Troubleshooting section of the Transmitters manual.
ALARM	Above-zero reading	Zero detector after warm up.

Start up is complete and the Safe T Net 2000 is operating in normal mode.

Chapter 3

NORMAL OPERATION AND ALARMS

Normal Operation

Normal operation is any time the start up procedure is complete, no calibration or set-up procedures are in progress, and no alarm, or fault condition exists. During normal operation, the Safe T Net 2000 behaves as follows:

- The screens displays the current gas concentrations (channel 1 on the top screen, channel 2 on the bottom screen).
- The 4 to 20 mA analog recorder outputs at the terminal strip (T12 and T13 for channel 1, T14 and T15 for channel 2) correspond to the displayed gas readings.
- The HIGH ALARM, LOW ALARM, and FAULT lights and relays for both channels are deactivated.

Alarms

This section describes the Safe T Net 2000 indications for low alarm, high alarm, and fault conditions, including the standard relay action.

The Safe T Net 2000 activates visual, audible, and relay alarm indications when any of the programmed alarm setpoints are passed.

WARNING

The calibration mode feature of the Safe T Net 2000 allows you to disable the alarm LED's, buzzer, and relays during calibration procedures and response tests. When calibration mode is activated, the LED's, buzzer, and relays will not operate as described in this section.

- Table 3-1 shows the Safe T Net 2000's alarm indications. The table shows Gas Tech standard settings for alarm action and relay activation.
- The Standard Range and Alarm Setpoint table in each transmitter manual lists the standard low and high alarm setpoints for the transmitters supplied with your Safe T Net 2000.
- You can adjust the relay action using the set-up modes described in Chapter 2, Installation and Start Up.

Table 3-1 Audible and Visual Alarm Indications

Condition	Cause	Visual Indication	Buzzer, if activated
Normal	Start up complete; no gas alarm or fault conditions.	Display(s) on	None
Low Alarm	Increasing (or decreasing O_2) reading at alarm setpoint.	LOW ALARM light on	Pulsing
High Alarm	Increasing reading at high alarm setpoint.	HIGH ALARM light on	Pulsing
Fault	Incomplete, broken, or incorrect detector, amplifier, or circuitry; Below zero reading	FAULT LED on; Display flashes alternating with FLt.	Pulsing

Low Alarm

When the displayed gas concentration passes the programmed low alarm setpoint:

- The LOW ALARM LED lights.
- The buzzer pulses
- The low alarm relay activates.

If the alarm is set to trigger on a rising level, the indications continue, unless reset, until the concentration decreases below the setpoint.

If the alarm is set to trigger on a falling level, the indications continue, unless reset, until the concentration increases above the setpoint.

RESET: Press the RESET button on the front face of the controller to reset the alarm. This causes the low alarm relay to deactivate and the buzzer to silence. The LOW ALARM LED continues to flash until the alarm condition passes.

The operation of the RESET button can be duplicated using a remote reset switch. This switch must be a momentary contact N.O. switch connected across the remote reset and common terminals of the Safe T Net 2000.

Thermo GasTech sets the low alarm setpoints (except oxygen) for latching action. Oxygen channels low alarms are factory set programmed to be self-resetting. You can select latch or self-reset alarm action in the set-up modes described in Chapter 2, Installation and Start Up.

If the low alarm is latching: If the low alarm has been configured to be latching, and the alarm has not been acknowledged, the buzzer, LED, and relay remain active after the alarm condition has passed. These alarm indications must then be cleared by pressing the RESET button on the front face of the controller, or by initiating a remote reset.

1. Follow the established procedure for a low level combustible or toxic gas condition (or a decreasing oxygen condition). If a procedure is not in place, establish one that is appropriate for your application.
2. When the reading returns to normal, press the RESET button to silence the buzzer, turn off the LOW ALARM light, deactivate the alarm relay, and reset the alarm circuit.

If the low alarm is self-resetting:

1. Follow the established procedure for a low level combustible or toxic gas condition or a decreasing oxygen condition. If a procedure is not in place, establish one that is appropriate for your application.
2. After the reading returns to normal, the Safe T Net 2000 automatically silences the buzzer, turns off the LOW ALARM light, deactivates the applicable alarm relay, and resets the alarm circuit.

High Alarm

When the display level passes the programmed high alarm setpoint:

- The red HIGH ALARM LED lights.
- The buzzer continues to pulse.
- The high alarm relay activates.

If the alarm is set to trigger on a rising concentration, the indications continue until the reading decreases below the setpoint and, if the alarm is latching, the RESET button is pressed.

If the alarm is set to trigger on a falling concentration, the indications continue until the reading increases above the setpoint and, if the alarm is latching, the RESET button is pressed.

NOTE

Unlike the low alarm, you cannot reset the high alarm while the reading is at or above the high alarm setpoint.

Thermo GasTech sets the high alarms (except oxygen) for latch alarm action. Oxygen channels are set for self-reset alarm action for the high alarm. You can select latch or self-reset alarm action in the Set-up modes described in Chapter 2, Installation and Start Up.

If the high alarm is latching: If the high alarm has been configured to be latching, the buzzer, LED, and relay remain active after the alarm condition has passed. The high alarm indications can only be cleared by pressing the RESET button, or by initiating a remote reset.

1. Follow the established procedure for a high level combustible, toxic, or oxygen gas condition. If a procedure is not in place, establish one that is appropriate for your application.

NOTE

You cannot silence the buzzer while the Safe T Net 2000 is in a high alarm condition. The reading must decrease below the alarm setpoint before the buzzer will silence.

2. After the reading decreases below the high alarm setpoint, press the RESET button to turn off the HIGH ALARM light, deactivate the alarm relay, and reset the alarm circuit.

If the high alarm is self-resetting:

1. Follow the established procedure for a high level combustible, toxic, or oxygen gas condition. If a procedure is not in place, establish one that is appropriate for your application.

NOTE

You cannot silence the buzzer while the Safe T Net 2000 is in a high alarm condition. The reading must decrease below the high alarm setpoint before you can silence the buzzer.

2. After the reading decreases below the high alarm setpoint, the Safe T Net 2000 automatically turns off the HIGH ALARM light, de-energizes the high alarm relay, and resets the high alarm circuit.
3. When the reading decreases below the high alarm setpoint, the Safe T Net 2000 may still be in low alarm condition. Respond to the low alarm condition as appropriate.

Fault Condition

The fault alarm is activated when the 4 to 20 mA analog input from a transmitter falls below the 4 mA zero point to the programmed fault alarm setpoint. This can be caused by such factors as a drifting sensor input or a broken wire connection. When a fault alarm occurs, the indications are as follows:

- The FAULT LED lights.
- The display alternates between the gas reading and FLt.
- The buzzer and fault relay activate.

The fault relay is programmable to be latching or self-resetting. The fault relay is normally energized and de-energizes in fault condition.

The fault alarm setpoint can be changed using the programming controls. See the Fault Alarm Level section of Chapter 2, Installation and Start Up.

If a fault condition occurs:

1. Make sure the wiring connections at the Safe T Net 2000 terminal strip are correct and secure.
2. See the Troubleshooting section in Chapter 5, Maintenance.

Chapter 4

CALIBRATION

No calibration of the Safe T Net 2000 controller is required. Refer to the transmitter manual for instructions on setting the analog output signal from the transmitter.

Calibration Mode

To avoid unwanted alarms during the calibration procedure, either or both of the channels of the Safe T Net 2000 can be placed in calibration mode. In calibration mode, the alarm LEDs and relays of the channel remain inactive, the buzzer remains off, and the recorder output goes to 1.5 mA.

Activate calibration mode by pressing the CALIBRATE button through the opening marked CALIBRATE on the front face of the controller.
If you do not turn off calibration manually, it will turn off automatically when the calibration time-out has elapsed (standard factory setting is 15 minutes).

CAUTION

The visual and audible alarm indications and relays are inactive during calibration time out and will not indicate any hazardous gas concentrations that may occur while calibration mode is enabled.

Calibration mode has four settings (see to Table 4-1).

Table 4-1 Calibration Mode Setting

CALIBRATE button	Channel 1 Status	Channel 2 Status
Press 1 time	Calibration mode	Normal operation
Press 2nd time	Calibration mode	Calibration mode
Press 3rd time	Normal operation	Calibration mode
Press 4th time	Normal operation	Normal operation

1. Pressing the CALIBRATE button the first time puts channel 1 only into calibration mode:
   - The display for channel 1 flashes, alternating the gas reading with CAL.
   - Channel 1 LOW, HIGH and FAULT LEDs flash.
   - The channel 1 relays remain inactive and the recorder output falls to 1.5 mA.
   - Channel 2 remains in the normal monitoring mode.
   - The display for channel 1 can now exceed the alarm levels without activating the channel 1 alarm relays.
2. Pressing the CALIBRATE button a second time puts both channels into calibration mode:
   - The displays for both channels flash, alternating the gas readings with CAL.
   - The LOW, HIGH and FAULT LEDs for both channels flash.
   - The relays for both channels remain inactive and both recorder outputs fall to 1.5 mA.
   - The display for either or both channels can now exceed the alarm levels without activating the alarm relays.
3. Pressing the CALIBRATE button a third time returns channel 1 to the normal operation and puts channel 2 into calibration mode.
   - The display for channel 2 flashes, alternating the gas reading with CAL.
   - The channel 2 LOW, HIGH and FAULT LEDs flash.
   - The channel 2 relays remain inactive and the recorder output falls to 1.5 mA.
   - Channel 1 remains in the normal monitoring mode.
   - The display for channel 2 can now exceed the alarm levels without activating the channel 2 alarm relays.
4. Pressing the CALIBRATE button a fourth time returns both channels to normal operation.

Chapter 5

MAINTENANCE

WARNING

Perform all maintenance procedures described in this chapter in a non-hazardous environment.

Routine Maintenance

Routine maintenance of the Safe T Net 2000 consists only of periodic checks to ensure that the system remains on zero (20.9% for O_2) and is responsive to gas. The transmitters used with the Safe T Net 2000 must be calibrated at regular intervals following the procedures described in the tansmitter manual.

Interchangeability of Components

The Safe T Net 2000 controller can be used with any standard 2- or 3-wire 4 to 20 mA analog transmitter. When changing transmitter types, it may be necessary to change the range, decimal point, and alarm setpoints for the affected channel. Follow the instructions for programming the Safe T Net 2000 in Chapter 2, Installation and Start Up.

Troubleshooting

This troubleshooting manual describes symptoms, probable causes, and recommended actions for problems you may encounter with the Safe T Net 2000 (refer to Table 5-1). This guide covers the Safe T Net 2000 only, see the Troubleshooting section in the Transmitters manual, for problems you may encounter with the transmitters.

Table 5-1 Safe T Net 2000 Troubleshooting

Problem	Symptoms	Probable Cause	Recommended Action
No Power	No readings or messages on the display screens.	• Incomplete or incorrect power circuit.	1. Verify that power is on. 2. Verify correct connections at the power sources. 3. Verify that the wiring connections at the terminal strip are complete and correct. 4. Check the continuity of the fuse, and replace if necessary. (Fuse is 3AG-1, 250 Volts/1 Amp.) 5. If power failure continues, contact **Thermo** GasTech for further instruction.
Frequent or Suspect Alarms	Frequent or suspect alarms. No change in zero reading.	• False readings due to RFI or EMI.	1. Increase the alarm delay setting using the setup procedures described in Chapter 2, Installation and Start Up. 2. Make sure that the transmitter wiring to the Safe T Net 2000 is properly shielded. See the Installation section of the Transmitters manual. 3. If alarm difficulties continue, contact **Thermo** GasTech for further instruction.
No Audible Alarm	Buzzer does not sound appropriate audible alarm. Audible alarm sounds weak or broken.	• Calibrate mode is on. • Buzzer is disabled. • Buzzer is malfunctioning.	1. Turn off calibrate mode as described in Chapter 4, Calibration. 2. Enable the buzzer. See the DIP switch U1 section of Chapter 2, Installation and Start Up. 3. If the buzzer continues to fail, contact **Thermo** GasTech for further instruction.

Table 5-1 Safe T Net 2000 Troubleshooting (Continued)

Problem	Symptoms	Probable Cause	Recommended Action
Distorted Display	Letters or numbers on the display screens are missing or distorted.	• Display screen malfunction.	1. Contact **Thermo** GasTech for further instruction.
Incorrect Signal Reading	Feedback signal does not correspond with the reading at the display.	• Inadvertently pushed buttons.	1. Initiate setup mode 3 by placing U1 switch 3 in the ON position (away from the edge of the board). 2. Select channel 1 (switch 4 = ON) or channel 2 (switch 4 = OFF). 3. The selected display and status LEDs flash. 4. With no signal (0 mA) applied to the channel input terminals, press the (DOWN) button. 5. Apply 20.0 mA to the channel input terminals and press the (UP) button. 6. Return U1 switch 3 to OFF to resume normal operation.

While the Safe T Net 2000 is in setup mode 3, the 4 to 20 mA analog recorder outputs go to 1.5 mA.

Replacing Components

Replacing the Fuse

The fuse is the only replaceable component on the Safe T Net 2000 (refer to Figure 5-1).

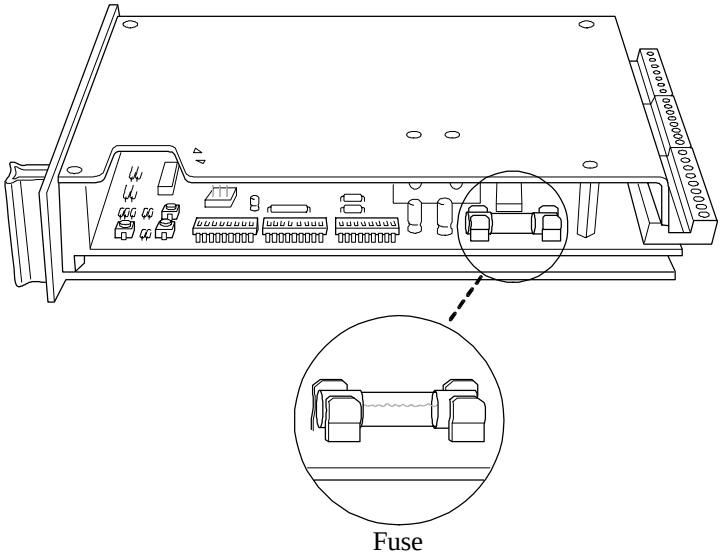


Figure 5-1 Safe T Net 2000 Fuse

The fuse, located at the bottom of the main circuit board near the rear, protects the power circuit to the Safe T Net 2000 electronics and to the transmitters. To replace the fuse:

1. Disconnect power to the Safe T Net 2000 and unplug the three socketed connectors from the terminal strip.
2. Loosen the two screw fasteners on the front of the Safe T Net 2000 and pull the controller from the rack.
3. Locate the fuse on the controller circuit board and remove it from its spring clips using a screwdriver.
4. Replace the fuse with the same type (see Parts List, Appendix A).
5. Reinstall the Safe T Net 2000 into the rack.
6. Plug the three connectors back into the terminal strip. The connectors are keyed to preserve the order: number 1 at the bottom, number 27 at the top. Reconnect power to the Safe T Net 2000.

Appendix
A

PARTS LIST

Table A-1 Safe T Net 2000 Parts List

Part No.	Description
21-4054	Card cage, full rack (19-inch, 10 slots)
21-4055	Card cage, half rack (4 slots)
22-0077	Blank panel, 4E (full rack)
22-0078	Blank panel, 8E (full rack)
22-0079	Blank panel, 10E (half rack)
22-0098	Panel mount trim plate (half rack)
22-0099	Panel mount trim plate (full rack)
23-0241	Replacement card guide
29-0019	Gas type label, front panel (set includes one label for each gas type)
43-4140	Fuse, 250 Volts/1 Amp (3AG-1)
49-0072	Power supply, 24 VDC 150W out, 100 to 230 VAC in, for 9 controllers with 18 transmitters (full rack)
49-0079	Power supply, 24 VDC 75W out, 100 to 230 VAC in, for 4 controllers with 8 transmitters (half rack)
71-0019	Operator's Manual, Safe T Net 2000
73-0001	Safe T Net 2000 two-channel controller

See Appendix C for transmitter part numbers.

Appendix
B

ACCESSORIES

Table B-1 lists the standard and optional accessories for the Safe T Net 2000. See Appendix A, Parts List, for part numbers.

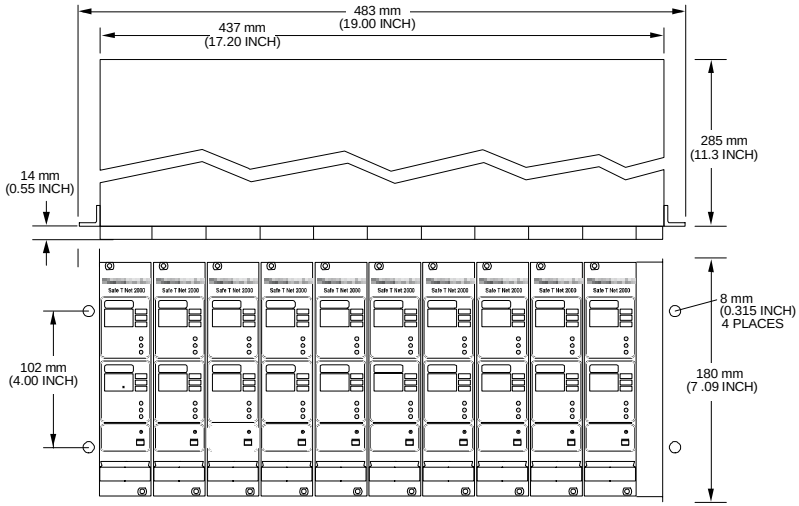
Table B-1 Standard and Optional Accessories

Accessory	Description
Safe T Net 2000 Operator's Manual [1]	Includes detailed installation, operation, maintenance, and calibration procedures for the Safe T Net 2000.
Card cages	Mounting structure for the Safe T Net 2000 modules and power supply.
Power supplies	Supply 24 VDC to the Safe T Net 2000 module, transmitters, and sample draw adapters.
Panel mounting trim plates	Cover the edges of the cut outs for panel mounting installations.

1. Standard accessory

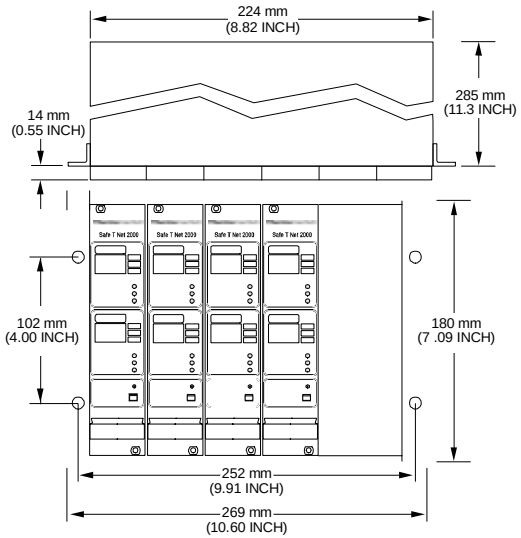
Card Cages

Figures B-1 through B-4 provide mounting and panel cutout dimensions for the full rack and the half-rack card cages..



NOTE: THE FULL RACK CAN ACCOMODATE UP TO 10 SAFE-T-NET CONTROLLERS. (20 POINTS OF DETECTION) OR 9 SAFE-T-NET 2000 CONTROLLERS (18 POINTS OF DETECTION) WHEN A POWER SUPPLY IS INSTALLED.

Figure B-1 Safe T Net 2000 Full Rack Mounting Dimensions



NOTE: THE HALF RACK CAN ACCOMODATE UP TO 4 SAFE-T-NET CONTROLLERS. (8 POINTS OF DETECTION) WITH OR WITHOUT A POWER SUPPLY.

Figure B-2 Safe T Net 2000 Half Rack Mounting Dimensions

Power Supplies

Twenty-four VDC power must be supplied to each Safe T Net 2000 controller module. The controller module, in turn, supplies 24 VDC power to the transmitters and sample draw adapters connected to it.

Two power supplies are available from **Thermo** GasTech for the Safe T Net 2000:

- 24 VDC 150W out, 100 to 230 VAC in,
  for 9 controllers with 18 transmitters, used with the full 19-inch rack card cage
- 24 VDC 75W out, 100 to 230 VAC in,
  for 4 controllers with 8 transmitters, used with the half-rack card cage

See Appendix A, Parts List, for part numbers.

Installing the Power Supply

When a 150W power supply is installed in the full 19-inch rack card cage, it occupies the space of one controller module. Only nine controller modules can be installed in the full 19-inch rack card cage when a power supply is installed.

The half-rack card cage will accommodate four Safe T Net 2000 controller modules with or without a 75W power supply installed.

The power supply occupies the rightmost position looking from the front in either the full 19-inch rack card cage or the half-rack card cage. The power supply is mounted to the right wall of the card cage by means of four screws (full rack) or two screws (half rack).

To install the power supply:

1. Position the power supply inside the card cage with the terminal strip toward the rear of the card cage and the panel with the mounting holes against the right wall of the card cage.
2. Align the mounting holes in the power supply with the corresponding mounting holes in the wall of the card cage.
3. Fasten the power supply to the card cage using four screws (full rack), or two screws (half rack).

Figure B-3 shows how to connect the incoming AC power leads to a 150W power supply and the 24 VDC power leads from a 150W power supply to the Safe T Net 2000 controller modules.

Figure B-4 shows how to connect the incoming AC power leads to a 75W power supply and the 24 VDC power leads from a 75W power supply to the Safe T Net 2000 controller modules.

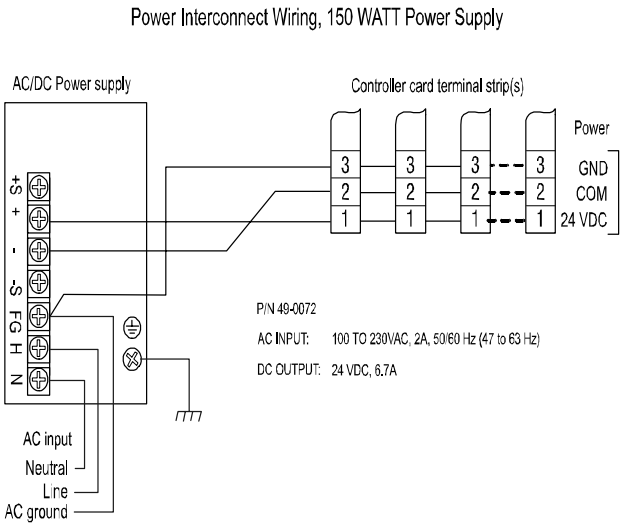


Figure B-3 Connecting the 150 WATT Power Supply

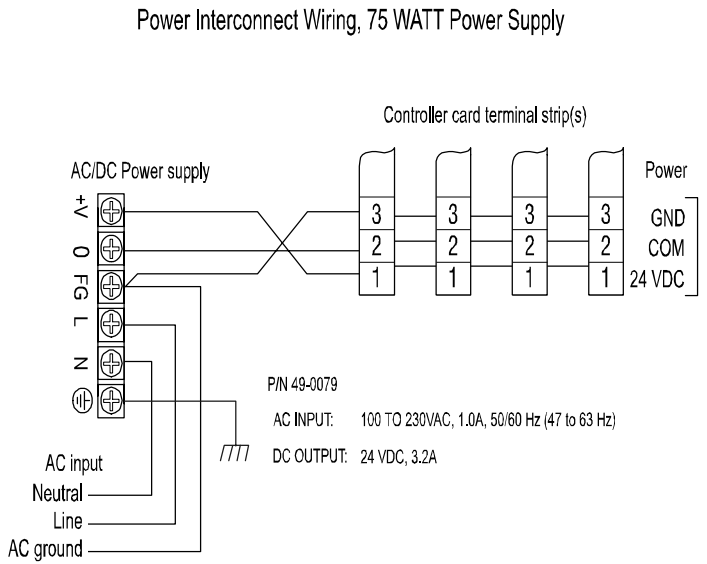


Figure B-4 Connecting the 75 WATT Power Supply

Appendix C

TRANSMITTERS

Each transmitter includes an manual describing the 4 to 20 mA analog gas transmitters you ordered with your Safe T Net 2000 gas monitoring controller. A transmitter comes with the following:

- The transmitter assembly, including:
  - Amplifier
  - Housing
  - Detector
- Transmitter Operator’s Manual

The inserts for the transmitters you originally ordered with your Safe T Net 2000 are included with your Safe T Net 2000 Operator's Manual.

4 to 20 mA analog gas transmitters are available for diffusion or sample-draw applications for most gases. Diffusion transmitters have the 67- prefix and sample-draw transmitters have the 68- prefix. Tables C-1 thru C4 lists the transmitters offered for the Safe T Net 2000.

Table C-1 Standard Transmitters for Safe T Net Controllers

Gas Type	Part Number	Manual Insert P/N	Gas Transmitter	Detection Range
Ammonia (NH_3)	67-0027-09 68-0020-09	71-0090 71-0114	Diffusion type Sample draw	0 to 100 ppm
Arsine (AsH_3)	67-0027-13 68-0020-13	71-0090 71-0114	Diffusion type Sample draw	0 to 1 ppm
Carbon monoxide (CO)	67-0027-01 68-0020-01	71-0090 71-0114	Diffusion type Sample draw	0 to 500 ppm
Chlorine (Cl_2)	67-0027-04 68-0020-04	71-0090 71-0114	Diffusion type Sample draw	0 to 10 ppm
Chlorine dioxide (ClO_2)	67-0027-16 68-0020-16	71-0090 71-0114	Diffusion type Sample draw	0 to 2 ppm
Combustible gases	65-5001 68-0020-19	71-0024-01 71-0114	Diffusion type Sample draw	0 to 100% LEL
Diborane (B_2H_6)	67-0027-18 68-0020-18	71-0090 71-0114	Diffusion type Sample draw	0 to 1 ppm
Fluorine (F_2)	67-0027-07 68-0020-07	71-0090 71-0114	Diffusion type Sample draw	0 to 10 ppm
Hydrogen chloride (HCl)	67-0027-05 68-0020-05	71-0090 71-0114	Diffusion type Sample draw	0 to 30 ppm

Table C-1 Standard Transmitters for Safe T Net Controllers (Continued)

Gas Type	Part Number	Manual Insert P/N	Gas Transmitter	Detection Range
Hydrogen cyanide (HCN)	67-0027-08 68-0020-08	71-0090 71-0114	Diffusion type Sample draw	0 to 50 ppm
Hydrogen fluoride (HF)	67-0027-06 68-0020-06	71-0090 71-0114	Diffusion type Sample draw	0 to 10 ppm
Hydrogen sulfide (H_2S)	67-0027-02 68-0020-02	71-0090 71-0114	Diffusion type Sample draw	0 to 100 ppm
Nitric oxide (NO)	67-0027-14 68-0020-14	71-0090 71-0114	Diffusion type Sample draw	0 to 100 ppm
Nitrogen dioxide (NO_2)	67-0027-15 68-0020-15	71-0090 71-0114	Diffusion type Sample draw	0 to 20 ppm
Oxygen (O_2)	67-0027-03 68-0020-03	71-0090 71-0114	Diffusion type Sample draw	0 to 30% VOL
Ozone (O_3)	67-0027-12 68-0020-12	71-0090 71-0114	Diffusion type Sample draw	0 to 1 ppm
Phosphine (PH_3)	67-0027-10 68-0020-10	71-0090 71-0114	Diffusion type Sample draw	0 to 1 ppm
Silane (SiH4)	67-0027-11 68-0020-11	71-0090 71-0114	Diffusion type Sample draw	0 to 20 ppm
Sulfur dioxide (SO_2)	67-0027-17 68-0020-17	71-0090 71-0114	Diffusion type Sample draw	0 to 20 ppm

Table C-2 FX-SMT Transmitters for Safe T Net Controllers

Gas Type	Part Number	Manual Insert P/N	Gas Transmitter	Detection Range
Ammonia (NH_3)	67-0024-09	71-0085	Diffusion type	0 to 100 ppm
Arsine (AsH_3)	67-0024-13	71-0085	Diffusion type	0 to 1 ppm
Carbon monoxide (CO)	67-0024-01	71-0085	Diffusion type	0 to 500 ppm
Chlorine (Cl_2)	67-0024-04	71-0085	Diffusion type	0 to 10 ppm
Chlorine dioxide (ClO_2)	67-0024-16	71-0085	Diffusion type	0 to 2 ppm
Combustible (LEL)	67-0021-01	71-0085	Diffusion type	0-100% LEL
Diborane (B_2H_6)	67-0024-18	71-0085	Diffusion type	0 to 1 ppm
Fluorine (F_2)	67-0024-07	71-0085	Diffusion type	0 to 10 ppm
Hydrogen chloride (HCl)	67-0024-05	71-0085	Diffusion type	0 to 30 ppm
Hydrogen cyanide (HCN)	67-0024-08	71-0085	Diffusion type	0 to 50 ppm
Hydrogen fluoride (HF)	67-0024-06	71-0085	Diffusion type	0 to 10 ppm
Hydrogen sulfide (H_2S)	67-0024-02	71-0085	Diffusion type	0 to 100 ppm
Nitric oxide (NO)	67-0024-14	71-0085	Diffusion type	0 to 100 ppm
Nitrogen dioxide (NO_2)	67-0024-15	71-0085	Diffusion type	0 to 20 ppm
Oxygen (O_2)	67-0024-03	71-0085	Diffusion type	0 to 30% VOL
Ozone (O_3)	67-0024-12	71-0085	Diffusion type	0 to 1 ppm
Phosphine (PH_3)	67-0024-10	71-0085	Diffusion type	0 to 1 ppm
Silane (SiH_4)	67-0024-11	71-0085	Diffusion type	0 to 20 ppm
Sulfur dioxide (SO_2)	67-0024-17	71-0085	Diffusion type	0 to 20 ppm

Table C-3 FX-SMTn Transmitters for Safe T Net Controllers

Gas Type	Part Number	Manual Insert P/N	Gas Transmitter	Detection Range
Ammonia (NH_3)	67-0025-09	71-0085	Diffusion type	0 to 100 ppm
Arsine (AsH_3)	67-0025-13	71-0085	Diffusion type	0 to 1 ppm
Carbon monoxide (CO)	67-0025-01	71-0085	Diffusion type	0 to 500 ppm
Chlorine (Cl_2)	67-0025-04	71-0085	Diffusion type	0 to 10 ppm
Chlorine dioxide (ClO_2)	67-0025-16	71-0085	Diffusion type	0 to 2 ppm
Diborane (B_2H_6)	67-0025-18	71-0085	Diffusion type	0 to 1 ppm
Fluorine (F_2)	67-0025-07	71-0085	Diffusion type	0 to 10 ppm
Hydrogen chloride (HCl)	67-0025-05	71-0085	Diffusion type	0 to 30 ppm
Hydrogen cyanide (HCN)	67-0025-08	71-0085	Diffusion type	0 to 50 ppm
Hydrogen fluoride (HF)	67-0025-06	71-0085	Diffusion type	0 to 10 ppm
Hydrogen sulfide (H_2S)	67-0025-02	71-0085	Diffusion type	0 to 100 ppm
Nitric oxide (NO)	67-0025-14	71-0085	Diffusion type	0 to 100 ppm
Nitrogen dioxide (NO_2)	67-0025-15	71-0085	Diffusion type	0 to 20 ppm
Oxygen (O_2)	67-0025-03	71-0085	Diffusion type	0 to 30% VOL
Ozone (O_3)	67-0025-12	71-0085	Diffusion type	0 to 1 ppm
Phosphine (PH_3)	67-0025-10	71-0085	Diffusion type	0 to 1 ppm
Silane (SiH_4)	67-0025-11	71-0085	Diffusion type	0 to 20 ppm
Sulfur dioxide (SO_2)	67-0025-17	71-0085	Diffusion type	0 to 20 ppm

Table C-4 FX-IR Transmitters for Safe T Net Controllers

Gas Type	Part Number	Manual Insert P/N	Gas Transmitter	Detection Range
Methane	67-0022-01	71-0084	Diffusion type	0-100% LEL
Propane	67-0022-02	71-0084	Diffusion type	0-100% LEL
Hexane	67-0022-03	71-0084	Diffusion type	0-100% LEL