

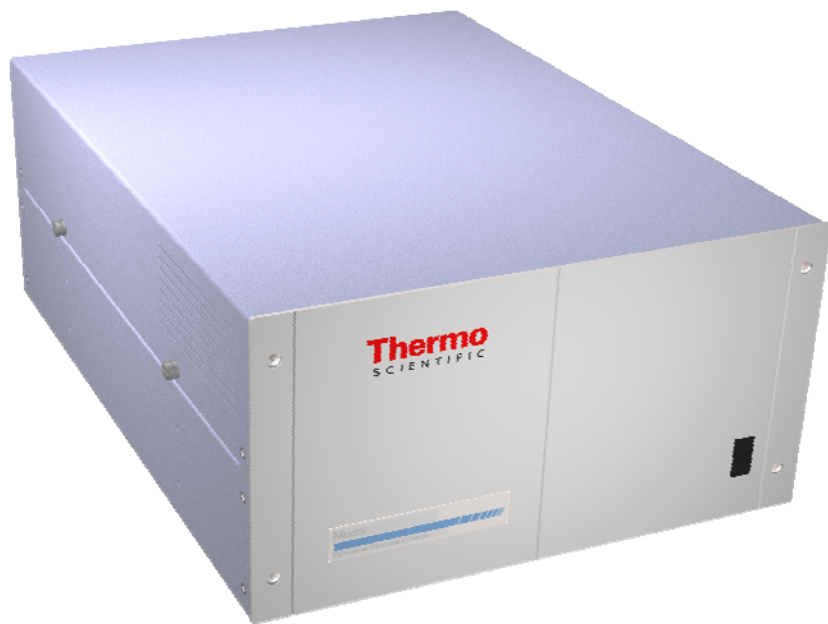
# Model 82i

## Instruction Manual

Hg Probe Controller

Part Number 103519-00

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# WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at: [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS).



# About This Manual





This manual provides information about installing, operating, maintaining, and servicing the Model 82*i* Probe Controller. It also contains important alerts to ensure safe operation and prevent equipment damage. The manual is organized into the following chapters and appendices to provide direct access to specific operation and service information.

- Chapter 1 “Introduction” provides an overview of the product features, describes the principle of operation, and lists the specifications.
- Chapter 2 “Installation” describes how to unpack, setup, and start-up the analyzer.
- Chapter 3 “Troubleshooting” presents guidelines for diagnosing analyzer failures, isolating faults, and includes recommended actions for restoring proper operation.
- Chapter 4 “Servicing” presents safety alerts for technicians working on the analyzer, step-by-step instructions for repairing and replacing components, and a replacement parts list. It also includes contact information for product support and technical information.
- Chapter 5 “System Description” describes the function and location of the system components, provides an overview of the software structure, and includes a description of the system electronics and input/output connections.
- Chapter 6 “Optional Equipment” describes the optional equipment that can be used with this analyzer.
- Appendix A “Warranty” is a copy of the warranty statement.



# Safety and Equipment Damage Alerts

This manual contains important information to alert you to potential safety hazards and risks of equipment damage. Refer to the following types of alerts you may see in this manual.

## Safety and Equipment Damage Alert Descriptions


Alert	Description
 <b>DANGER</b>	A hazard is present that will result in death or serious personal injury if the warning is ignored. ▲
 <b>WARNING</b>	A hazard is present or an unsafe practice can result in serious personal injury if the warning is ignored. ▲
 <b>CAUTION</b>	The hazard or unsafe practice could result in minor to moderate personal injury if the warning is ignored. ▲
 <b>Equipment Damage</b>	The hazard or unsafe practice could result in property damage if the warning is ignored. ▲

## Safety and Equipment Damage Alerts in this Manual

Alert	Description
 <b>WARNING</b>	<p>If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲</p> <p>The service procedures in this manual are restricted to qualified service personnel only. ▲</p> <p>The Model 82<i>i</i> is supplied with a three-wire grounding cord. Under no circumstances should this grounding system be defeated. ▲</p>
 <b>Equipment Damage</b>	<p>Do not attempt to lift the analyzer by the cover or other external fittings. ▲</p> <p>Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲</p> <p>This adjustment should only be performed by an instrument service technician. ▲</p> <p>Handle all printed circuit boards by the edges only. ▲</p>

## WEEE Symbol

The following symbol and description identify the WEEE marking used on the instrument and in the associated documentation.

Symbol	Description
	Marking of electrical and electronic equipment which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005. ▲

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## Where to Get Help

Service is available from exclusive distributors worldwide. Contact one of the phone numbers below for product support and technical information or visit us on the web at [www.thermo.com/aqi](http://www.thermo.com/aqi).

1-866-282-0430 Toll Free

1-508-520-0430 International





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# Chapter 1

## Introduction

The Model 82*i* Hg Probe Controller combines, easy to use menu-driven software, and advanced diagnostics to offer unsurpassed flexibility and reliability. The Model 82*i* has the following features:

- Menu-driven software via the Model 80*i*
- Totally self contained

For details of the probe controller's principle of operation and product specifications, see the following topics:

- "Principle of Operation" on page 1-1 describes the Model 82*i* operating principles.
- "Specifications" on page 1-4 lists the probe controller's performance specifications.

Thermo Fisher Scientific is pleased to supply this Hg probe controller. We are committed to the manufacture of instruments exhibiting high standards of quality, performance, and workmanship. Service personnel are available for assistance with any questions or problems that may arise in the use of this probe controller. For more information on servicing, see the "Servicing" chapter.

## Principle of Operation

The Model 82*i* Mercury (Hg) Probe Controller (**Figure 1-1**) is configured as one component of Thermo Fisher Scientific's integrated Hg Continuous Emission Monitoring System (CEMS). Thermo Fisher Scientific's Mercury Freedom™ System is comprised of the following:

- Hg analyzer (Model 80*i*)
- Hg calibrator (Model 81*i*)
- Hg probe controller (Model 82*i*)
- Hg probe (Model 83*i* or Model 83*i* GC)

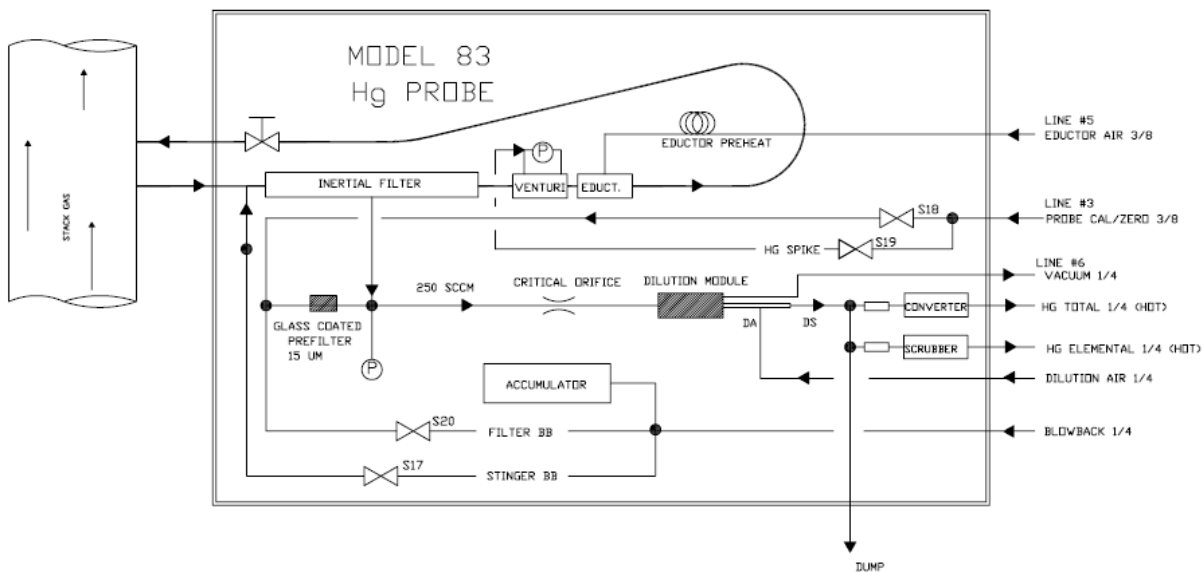
and additional peripheral components, such as, a zero air supply, compressed air supply, umbilical, and instrument rack. The Model 82*i* is not available as a stand-alone instrument.

## Pneumatics

Clean, dry, pressurized (~80 psig) air feeds two electro/pneumatic pressure transducers which adjust and maintain output pressure to the Model 83i probe eductor and blowback pneumatics (**Figure 1-1** and **Figure 1-2**).

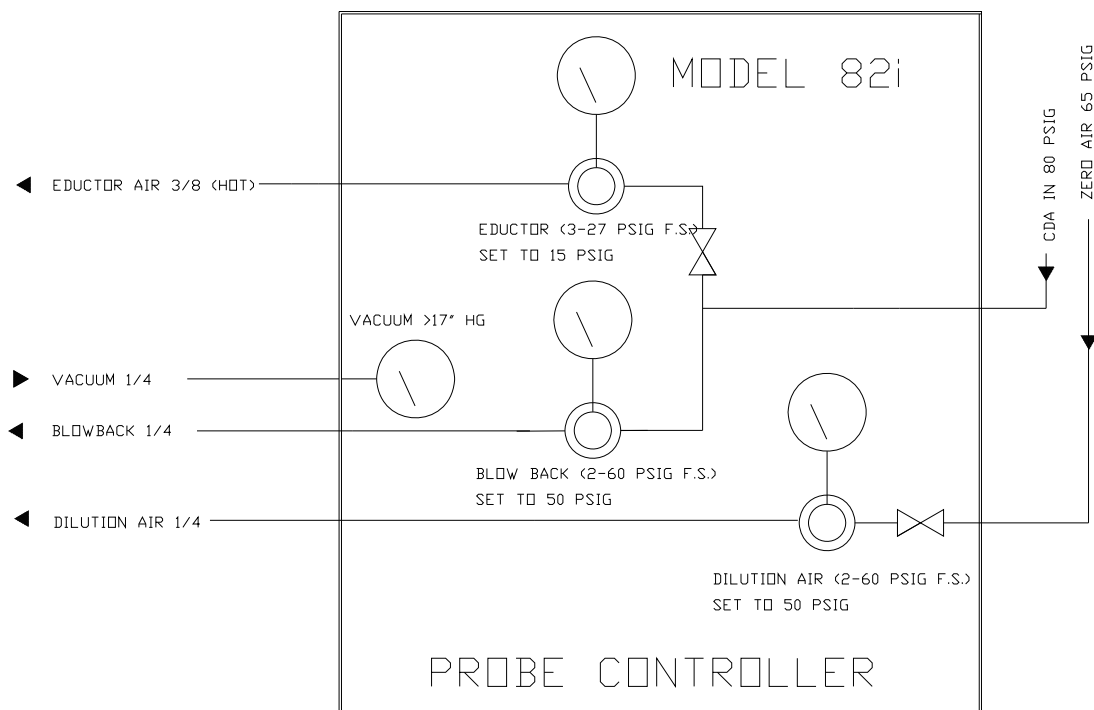
Pressurized (~80 psig) Hg-free zero air feeds a third electro/pneumatic pressure transducer which adjusts and maintains dilution air pressure to the Model 83i probe dilution module.

Three electronic pressure transducers (**Figure 1-1** and **Figure 1-2**) associated with the individual regulators are also contained within the Model 82i, as well as, an electronic vacuum transducer monitoring the dilution module vacuum in the Model 83i.



**Figure 1-1.** Model 83i Probe Flow Diagram





**Figure 1–2.** Model 82i Probe Controller Flow Diagram

## Electronics

The Model 82*i* communicates with the Model 80*i* via a RS-485 link. The Model 80*i* acts as the master component in the Mercury Freedom™ System with both the Models 81*i* and 82*i* slaved to the analyzer. All commands are initiated by the Model 80*i*. The Model 82*i* receives commands and sends information to the analyzer.

The Model 82*i* also receives two 4-20 mA signals from the probe critical orifice pressure transducer and the fast loop venturi pressure transducer.

The Model 82*i* controls the temperatures of the probe, the heated umbilical line, and converter (located within the probe). These temperatures are set and recorded via the Model 80*i*.

## Electrical Power

The Model 82*i* provides both 220 and 110 AC voltage to the Model 83*i* Probe. The 220 VAC powers the probe's stinger heater and inertial filter/eductor heater. The 110 VAC powers the Total Hg converter as well as four probe solenoid valves for cal/zero gas, stinger blowback, filter blowback, and Hg spike.

The Model 82*i* has a dedicated 220 VAC feed to power the heated umbilical line.

## Specifications

**Table 1–1.** Model 82*i* Specifications

Operating temperature	0–45 °C in non-condensing environments. Performance specifications based on operation within 20-30 °C range.
Power requirements	115 VAC @ 50/60 Hz, 20 amp service 220-240 VAC @ 50/60 Hz, 20 amp service 220-240 VAC @ 50/60 Hz, 30 amp service line per 200 feet of hot wire
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 40 lbs.
Serial ports	RS-485 for connection to the Model 80 <i>i</i>

## Chapter 2

# Installation

Installing the Model 82*i* includes the following recommendations and procedures:

- “Lifting” on page 2-1
- “Unpacking and Inspection” on page 2-1
- “Setup Procedure” on page 2-2
- “Startup” on page 2-4

### Lifting

When lifting the instrument, use a procedure appropriate to lifting a heavy object, such as, bending at the knees while keeping your back straight and upright. Grasp the instrument at the bottom in the front and at the rear of the unit. Although one person can lift the unit, it is desirable to have two persons lifting, one by grasping the bottom in the front and the other by grasping the bottom in the rear.



**Equipment Damage** Do not attempt to lift the instrument by the cover or other external fittings. ▲

### Unpacking and Inspection

The Model 82*i* is shipped complete in one container. If there is obvious damage to the shipping container when you receive the instrument, notify the carrier immediately and hold for inspection. The carrier is responsible for any damage incurred during shipment.

Use the following procedure to unpack and inspect the instrument.

1. Remove the instrument from the shipping container and set it on a table or bench that allows easy access to both the front and rear.
2. Remove the cover to expose the internal components.
3. Remove any packing material.
4. Check for possible damage during shipment.

5. Check that all connectors and circuit boards are firmly attached.
6. Re-install the cover.

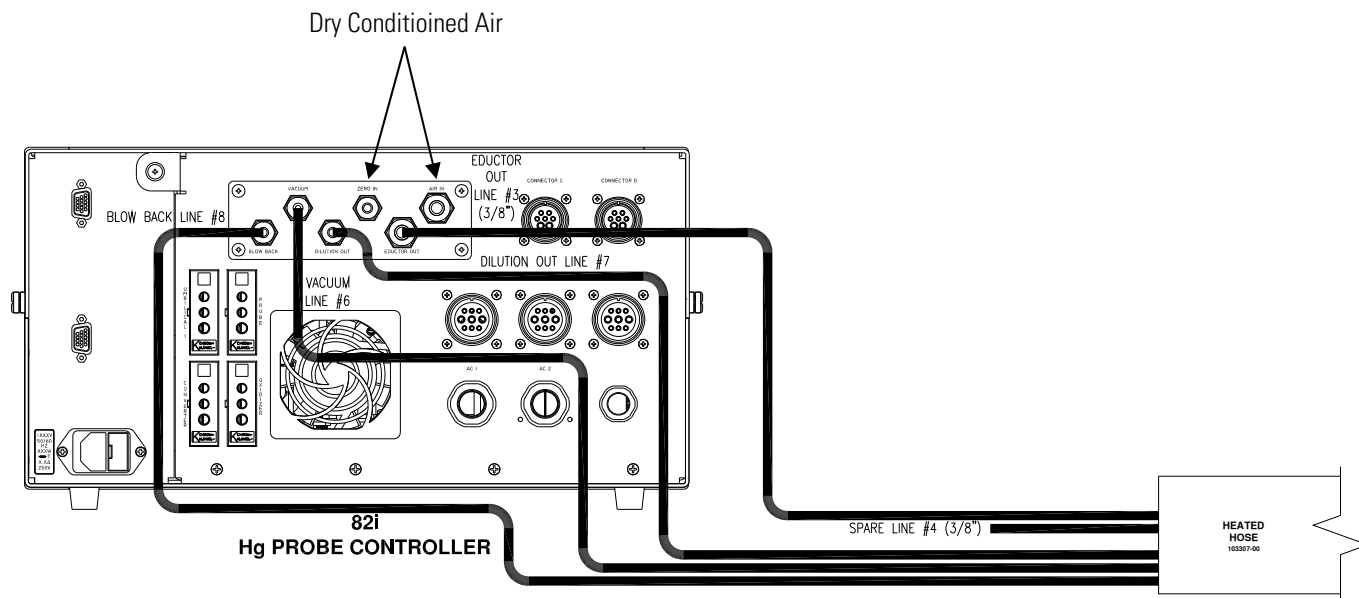
## Setup Procedure



Setup the Model 80*i* first, including parameter settings, before setting up the Model 82*i*. Use the following procedure to setup the Model 82*i*.

**WARNING** The Model 82*i* is supplied with a three-wire grounding cord. Under no circumstances should this grounding system be defeated. ▲

1. Verify that the five fuses are in place on the power distribution board. Refer to **Figure 4-2** in the “Servicing” chapter. Verify the two fuses are in place in the rear panel power receptacle.
2. Check all wire connections for tightness.
3. Put the circuit breaker (**Figure 4-2**) in the ON position so that the position indicator is red (toward the rear).
4. Connect 80 PSIG dry, conditioned air to the AIR IN bulkhead on the Model 82*i* (**Figure 2-1** and **Figure 2-2**).
5. Connect 80 PSIG dry, conditioned, Hg-free air to the ZERO IN bulkhead on the Model 82*i* (**Figure 2-1** and **Figure 2-2**).



**Figure 2–1.** Connecting the Heated Hose to the Model 82i

**Table 2–1.** Connecting Model 82i Umbilical Bundle to the Model 82i Rear Panel

Connection Type	Label	Connection
3/8-inch Teflon line	3	EDUCTOR OUT
1/4-inch Teflon line	6	VACUUM
1/4-inch Teflon line	7	DILUTION OUT
1/4-inch Teflon line	8	BLOW BACK
Canon Plug	A1	CONNECTOR A1
Canon Plug	B	CONNECTOR B
Canon Plug	C	CONNECTOR C
Canon Plug	D	CONNECTOR D
Thermocouple	TCA1	UMBILICAL (If temp controller is not used)
Thermocouple	TC1	CONVERTER
Thermocouple	TC2	PROBE
Thermocouple	TCSP1	OXIDIZER

6. Connect the AC INPUT power cord to a 20-amp, 208 VAC supply.
7. Connect the AC 1 power cord to a 30-amp, 208 VAC supply.

If the installation requires a second heated line, connect the AC 2 power cord to a 30-amp, 208 VAC supply.

8. Connect the UPS input power cord to a 15-amp, 120 VAC supply.



**CAUTION** Failure to provide a 30-amp supply may result in umbilical cord heater malfunction. ▲

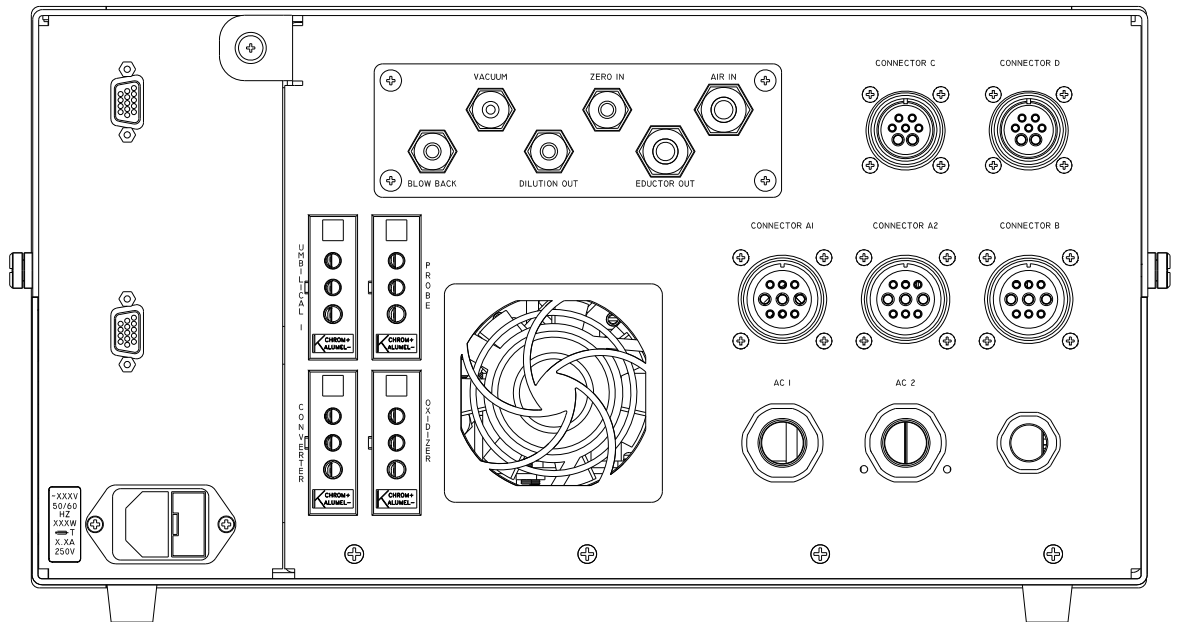


Figure 2–2. Model 82*i* Rear Panel

## Startup

Before starting the Model 82*i* make sure that the Model 80*i* parameters are set correctly.

**Note** The correct startup sequence is to start the 82*i*, the 81*i*, and the 80*i*. If the 81*i* and the 80*i* are ON, turn them OFF before starting the 82*i*. ▲

Use the following procedure when starting the instrument.

1. Turn the power ON.
2. Allow 90 minutes for the instrument to stabilize.

# Chapter 3

## Troubleshooting

This instrument has been designed to achieve a high level of reliability. In the event of problems or failure, the troubleshooting guidelines, board-level connection diagrams, connector pin descriptions, and testing procedures presented in this chapter should be helpful in isolating and identifying problems.

The Technical Support Department at Thermo Fisher Scientific can also be consulted in the event of problems. See “Service Locations” at the end of this chapter for contact information. In any correspondence with the factory, please note both the serial number and program number of the instrument.

This chapter provides the following troubleshooting and service support information:

- “Safety Precautions” on page 3-1
- “Troubleshooting Guides” on page 3-1
- “Board-Level Connection Diagrams” on page 3-3
- “Connector Pin Descriptions” on page 3-3
- “Service Locations” on page 3-8

### Safety Precautions

Read the safety precautions in the Preface and the “Servicing” chapter before performing any actions listed in this chapter.

### Troubleshooting Guides

The troubleshooting guide presented in this chapter are designed to help isolate and identify instrument problems.

**Table 3–1** provides power-up troubleshooting information.

**Table 3–2** lists all the alarm messages you may see on the Model 80*i* graphics display and provides recommendations about how to resolve the alarm condition. See “Alarms Menu” in the Model 80*i* “Operation” chapter for detailed information.

**Table 3–1.** Troubleshooting - Power-Up Failures

<b>Malfunction</b>	<b>Possible Cause</b>	<b>Action</b>
Does not operate (The light on power switch does not come on.)	No power or wrong power configuration	Check the line to confirm that power is available and that it matches the voltage and frequency configuration of the instrument.
	Main fuse is blown or missing	Unplug the power cord, open the fuse drawer on the back panel, and check the fuses visually or with a multimeter.
	Bad switch or wiring connection	Unplug the power cord, disconnect the switch and check operation with a multimeter.
Fan does not come on.	DC power supply failure	Check the green LED on the back edge of the power supply. If the LED is off, the supply has failed.
	DC power distribution failure	Check surface mount LEDs labeled "24V PWR" on the interface board. If lit, power is OK.
	Communication failure	If possible, using the Model 80i check instrument function through RS-485 or Ethernet.  Contact Thermo Fisher Scientific Service Department.

**Table 3–2.** Troubleshooting - Alarm Messages

<b>Alarm Message</b>	<b>Possible Cause</b>	<b>Action</b>
Alarm - Temps	Converter temperature below set point	Check thermocouple connections.
	Heaters have failed	Check connector pins for continuity and fuses on power distribution board.  Check power relays.
Alarm - Pressures Orifice	High and low	Check flow system for leaks. Check the pump for a tear in the diaphragm, replace with pump repair kit if necessary.
Alarm - Flow	Flow low	Check probe critical orifii.
The following board related alarm only occurs during power up or reboot.		
Alarm - Interface Status	Internal cables not connected properly	Check that all internal cables are connected properly.
	Board is defective	Recycle AC power to instrument. If still alarming, change board.



## Board-Level Connection Diagrams

Figure 3–1 is a diagram of the probe controller board-level connections. This illustration can be used along with the connector pin descriptions in Table 3–3 to troubleshoot board-level faults.

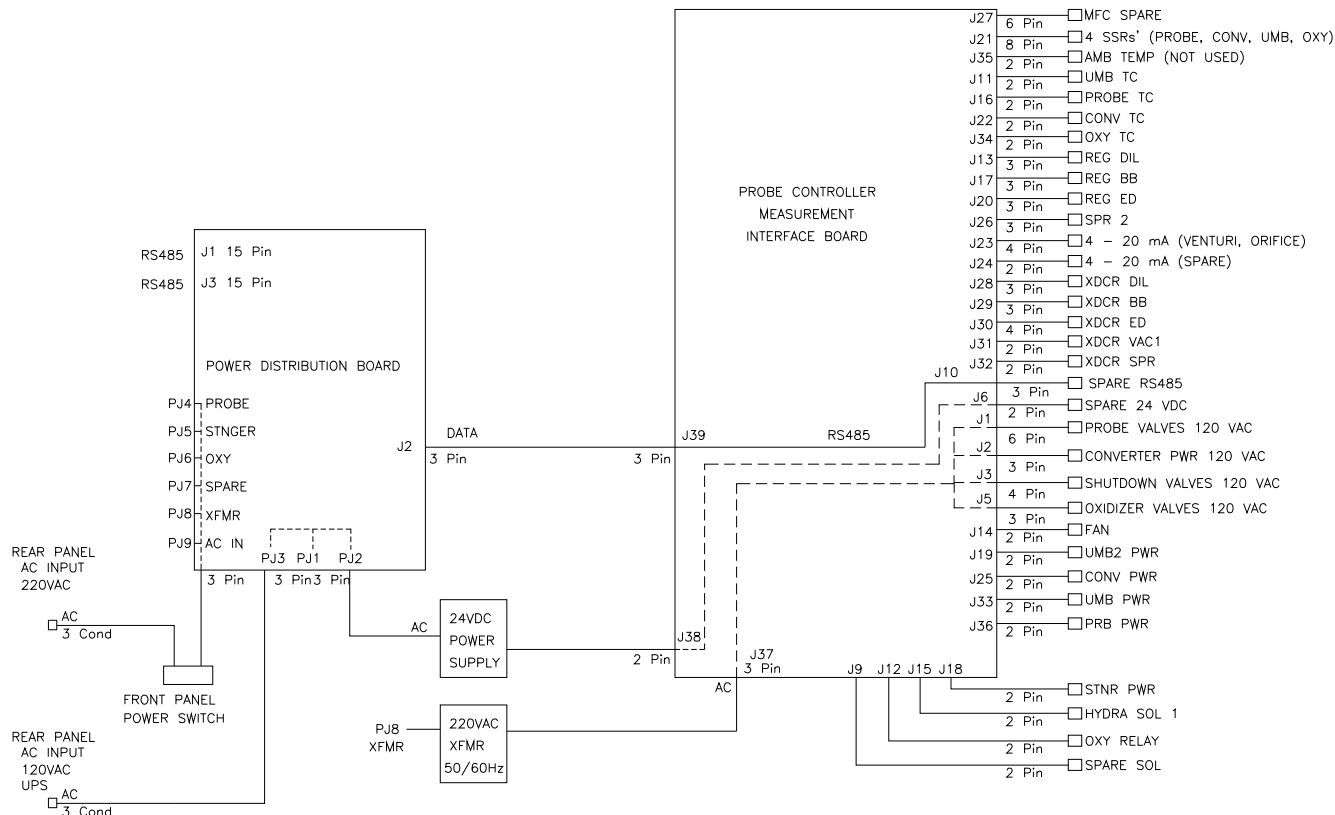


Figure 3–1. Board-Level Connection Diagram

## Connector Pin Descriptions

The connector pin descriptions in Table 3–3 and Table 3–4 can be used along with the board-level connection diagrams to troubleshoot board-level faults.

Table 3–3. Probe Controller Interface Board Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
MFC SPARE	J27	1	AIN_MASS_FLOW1
		2	AOUT_MASS_FLOW1
		3	GND
		4	+15V
		5	-15V
		6	GND
HEATERS	J21	1	UMBILICAL_RELAY

## Troubleshooting

### Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
		2	PROBE_RELAY
		3	CONVERTER_RELAY
		4	OXY_RELAY
		5	+15V
		6	+15V
		7	+15V
		8	+15V
AMB TEMP	J35	1	AMBIENT_THERM
		2	GND
UMB TC	J11	1	UMB_TC+
		2	UMB_TC-
PROBE TC	J16	1	PROBE_TC+
		2	PROBE_TC-
CONV TC	J22	1	CONV_TC+
		2	CONV_TC-
OXY TC	J34	1	SPARE_TC+
		2	SPARE_TC-
REG DIL	J13	1	AOUT_REG1_DILUTION
		2	GND
		3	GNDC
REG BB	J17	1	AOUT_REG2_BLOWBACK
		2	GND
		3	GNDC
REG ED	J20	1	AOUT_REG3_EDUCTOR
		2	GND
		3	GNDC
SPR 2	J26	1	AOUT_REG_SPARE
		2	GND
		3	GNDC
XDCR1&2 4-20 mA (venture, orifice)	J23	1	VENTURI+
		2	AIN_VENTURI_PRESS
		3	ORIFICE+
		4	AIN_ORIFICE_PRES

Connector Label	Reference Designator	Pin	Signal Description
XDCR3 4-20 mA (spare)	J24	1	OXYGEN+
		2	AIN_OXYGEN_CONC
XDCR DIL	J28	1	+5
		2	AIN_DILUTION_PRES
		3	GND
XDCR BB	J29	1	+5
		2	AIN_BLOWBACK_PRES
		3	GND
XDCR ED	J30	1	+5
		2	AIN_EDUCTOR_PRES
		3	GND
XDCR VAC1	J31	1	+5
		2	AIN_VACUUM_PRES
		3	GND
XDCR SPR	J32	1	+5
		2	AIN_SPARE_PRES GND
DATA	J39 (IPJ39)	1	GND
		2	+RS485
		3	-RS485
SPARE RS485	J10 (IPJ10)	1	GND
		2	+RS485
		3	-RS485
24 V IN	J38 (P38)	1	+24V
		2	GND
24 V OUT	J6 (PJ6)	1	+24V
		2	GND
AC	J37 (P37)	1	AC+
		2	AC-
		3	AC GND
CONVERTER PWR 120 VAC	PJ2	1	AC+
		2	AC-

## Troubleshooting

### Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
		3	AC GND
FAN	J14	1	+24V
		2	GND
UMB2 PWR	J19	1	+24V
		2	UMB2_RLY
CONV PWR	J25	1	+24V
		2	CONV_RLY
UMB PWR	J33	1	+24V
		2	UMB_RLY
PRB PWR	J36	1	+24V
		2	PRB_RLY
STNR PWR	J18	1	+24V
		2	STNR_RLY
HYDRA PWR	J15	1	+24V
		2	HYDRA_RLY
OXY PWR	J12	1	+24V
		2	OXY_RLY
SPARE SOL		1	+24V
		2	SPARE_SOL1

**Table 3–4.** Power Distribution Board Connector Pin Descriptions

Connector Label	Reference Designator	Pin	Signal Description
DATA	J2	1	GND
		2	RS485+
		3	RS485-
RS485	J1	1	RS485-
		2	RS485+
		3	NOT USED
		4	NOT USED
		5	NOT USED
		6	GND
		7	GND
		8	GND

Connector Label	Reference Designator	Pin	Signal Description
		9	NOT USED
		10	NOT USED
		11	NOT USED
		12	NOT USED
		13	NOT USED
		14	NOT USED
		15	NOT USED
RS485	J3	1	RS485-
		2	RS485+
		3	NOT USED
		4	NOT USED
		5	NOT USED
		6	GND
		7	GND
		8	GND
		9	NOT USED
		10	NOT USED
		11	NOT USED
		12	NOT USED
		13	NOT USED
		14	NOT USED
		15	NOT USED
AC IN	PJ9	1	HV+
		2	HV-
		3	GND
XFMR	PJ8	1	HV+ (F5, 3 AMP, SLO BLO)
		2	HV-
		3	GND
PROBE	PJ4	1	HV+ (F1, 4 AMP)
		2	HV-
		3	GND
STINGER	PJ5	1	HV+ (F2, 4 AMP)
		2	HV-
		3	GND

Connector Label	Reference Designator	Pin	Signal Description
OXY	PJ6	1	HV+ (F3, 3 AMP)
		2	HV-
		3	GND
SPARE	PJ7	1	HV+ (F4, 3 AMP)
		2	HV-
		3	GND
PWR UPS	PJ3	1	+ (F5, 2 AMP)
		2	-
		3	GND
24V PS	PJ2	1	+
		2	-
		3	GND
INTERFACE	PJ1	1	+
		2	-
		3	GND

## Service Locations

For additional assistance, Thermo Fisher Scientific has service available from exclusive distributors worldwide. Contact one of the phone numbers below for product support and technical information or visit us on the web at [www.thermo.com/aqi](http://www.thermo.com/aqi).

1-866-282-0430 Toll Free

1-508-520-0430 International

# Chapter 4

## Servicing

This chapter explains how to replace the Model 82*i* subassemblies. It assumes that a subassembly has been identified as defective and needs to be replaced (or is an “expendable” item not covered under warranty). Expendable items are indicated by an asterisk (\*) in the “Model 82*i* Replacement Parts” table.

For fault location information refer to the “Troubleshooting” chapter in this manual.

For additional service assistance, see “Service Locations” at the end of this chapter.

This chapter includes the following parts information and component replacement procedures.

- “Safety Precautions” on page 4-2
- “Model 82*i* Replacement Parts List” on page 4-3
- “Model 82*i* Cable List” on page 4-4
- “Removing the Tray and Lowering the Partition Panel” on page 4-5
- “Fuse Replacement” on page 4-7
- “Fan Replacement” on page 4-8
- “Power Distribution Board Replacement” on page 4-9
- “Power Relay (K) and Solid State (SSR) Relay Replacement” on page 4-9
- “Solenoid Replacement” on page 4-10
- “Feedback Transducer Replacement” on page 4-11
- “Electro/Pneumatic Transducer Replacement” on page 4-12
- “DC Power Supply Replacement” on page 4-13
- “Interface Board Replacement” on page 4-14
- “Service Locations” on page 4-15

## Safety Precautions

Read the safety precautions before beginning any procedures in this chapter.



**WARNING** The service procedures in this manual are restricted to qualified representatives. ▲

If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲

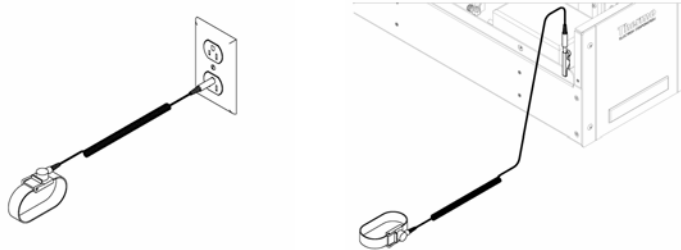


**CAUTION** Carefully observe the instructions in each procedure. Avoid contact with converted heated components.

Allow converter to cool to room temperature before handling converter components. ▲



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component (**Figure 4-1**). If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground.



**Figure 4-1.** Properly Grounded Antistatic Wrist Strap



## Model 82i Replacement Parts List

**Table 4–1** lists the replacement parts for the Model 82i major subassemblies. Refer to **Figure 4–2** to identify the component location.

**Table 4–1.** Model 82i Replacement Parts

Part Number	Description
103131-00	Interface Board Assembly
103370-00	Solenoid Valve Assembly
2136.335	Solenoid Valve, Blow Back, 115V
103271-00	Power Distribution Board Assembly
103213-00	Pneumatic Transducer Assembly
103211-00	Electronic Pressure Regulator, 2-60PSIG out
103211-01	Electronic Pressure Regulator, 3-27PSIG out
103218-00	Feedback Transducer Assembly, 100 PSIG
12118	Power Switch
103359-00	Power Cord Assembly, 220VAC
103487-00	Power Supply Assembly, 24VDC, w/Base Plate and Screws
100907-00	Fan, 24VDC
8630	Fan Filter*
103323-02	Power Relay Assembly
104235-00	Fuse Kit
103220-01	Pressure Transducer Assembly, 3-27 psig
103220-02	Pressure Transducer Assembly, 2-60 psig
103343-00	Mechanical Relay
103344-00	Solid State Relay, 25 Amp
103344-01	Solid State Relay, 50 Amp

\*Expendable item not covered by warranty.

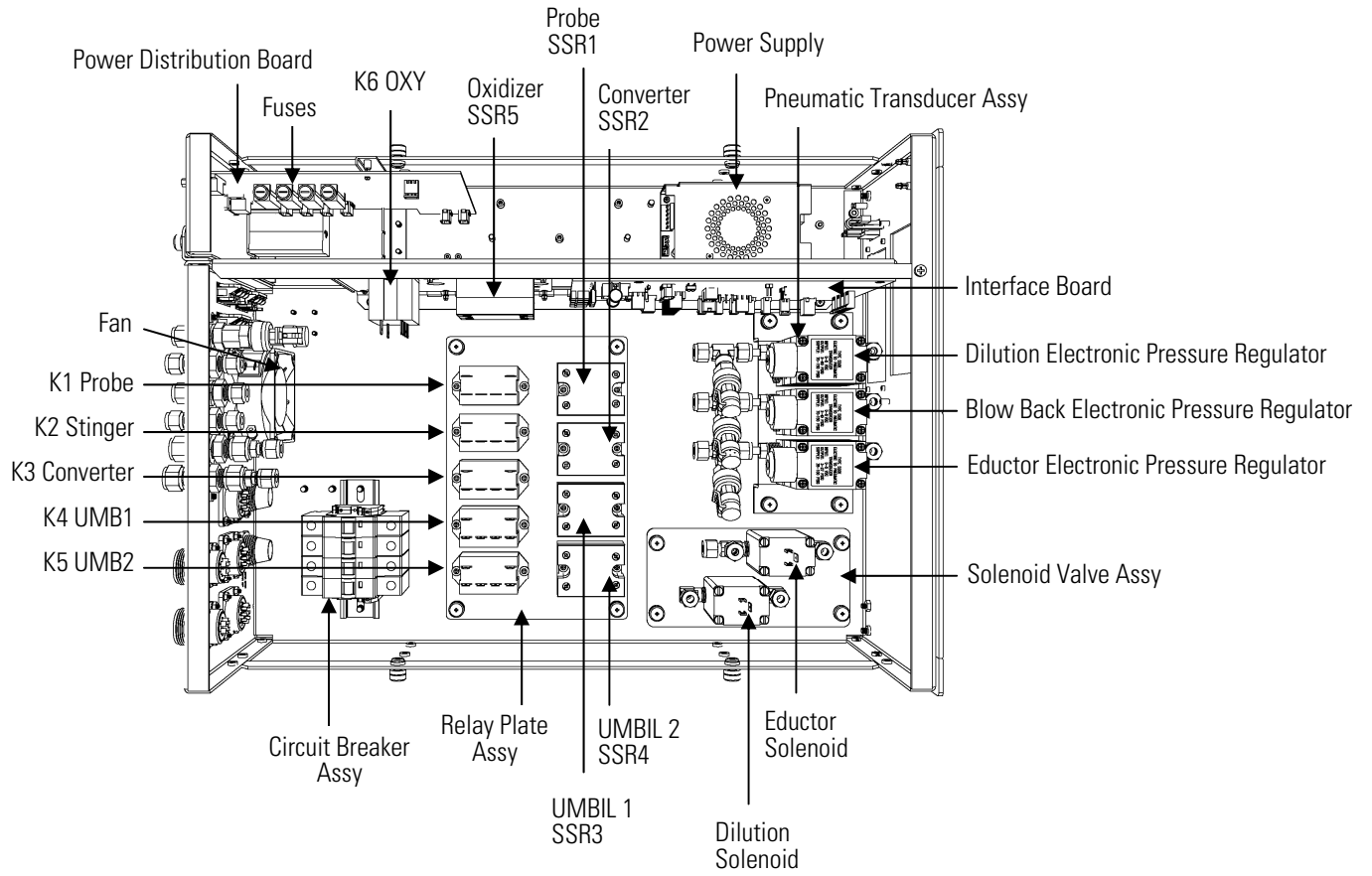
## Model 82i Cable List

**Table 4–2** describes the Model 82i cables. See the “Troubleshooting” chapter for associated connection diagrams and board connector pin descriptions.

**Table 4–2.** Model 82i Cables

Part Number	Description
101036-00	DC Power Supply 24V Output
103497-00	Power Distribution Board to Interface Board
101048-00	RS-485/Data
101035-00	DC Power Supply AC Input
101033-00	AC from Receptacle
101377-00	AC to Power Switch
101267-00	Fan Power Cable
103212-00	Vacuum Transducer Assembly
103273-00	Power Module to Switch Cable
103274-00	Cable Switch to Power Module
103283-00	Power Supply to Power Distribution Board
103287-02	SSR Relay to Interface A2
103290-01	Relay K to Interface Board
103290-02	Relay K5 to Interface Board
103314-00	TC to Interface Board
103335-01	Interface to Connector D
103352-00	Interface (4-20 mA) to Connector C
103336-00	Connector A to Relay Plate Assembly
103381-01	Relay Power Distribution to Connector B/Heater
103421-00	Interface to K4
103462-00	Power (UPS)
103464-01	Circuit Breaker to Umbilical Relay, White
103464-02	Circuit Breaker to Umbilical Relay, Black
103465-01	Relay Interconnects, Black
103465-02	Relay Interconnects, Gray
103469-00	Shutoff Valves to Interface
103488-00	DC Out for Power Supply
103491-00	Relay Box to Distribution Board

Part Number	Description
103493-00	Interconnecting Wire Assembly
103495-00	220VAC Power Cord Assembly -Locking



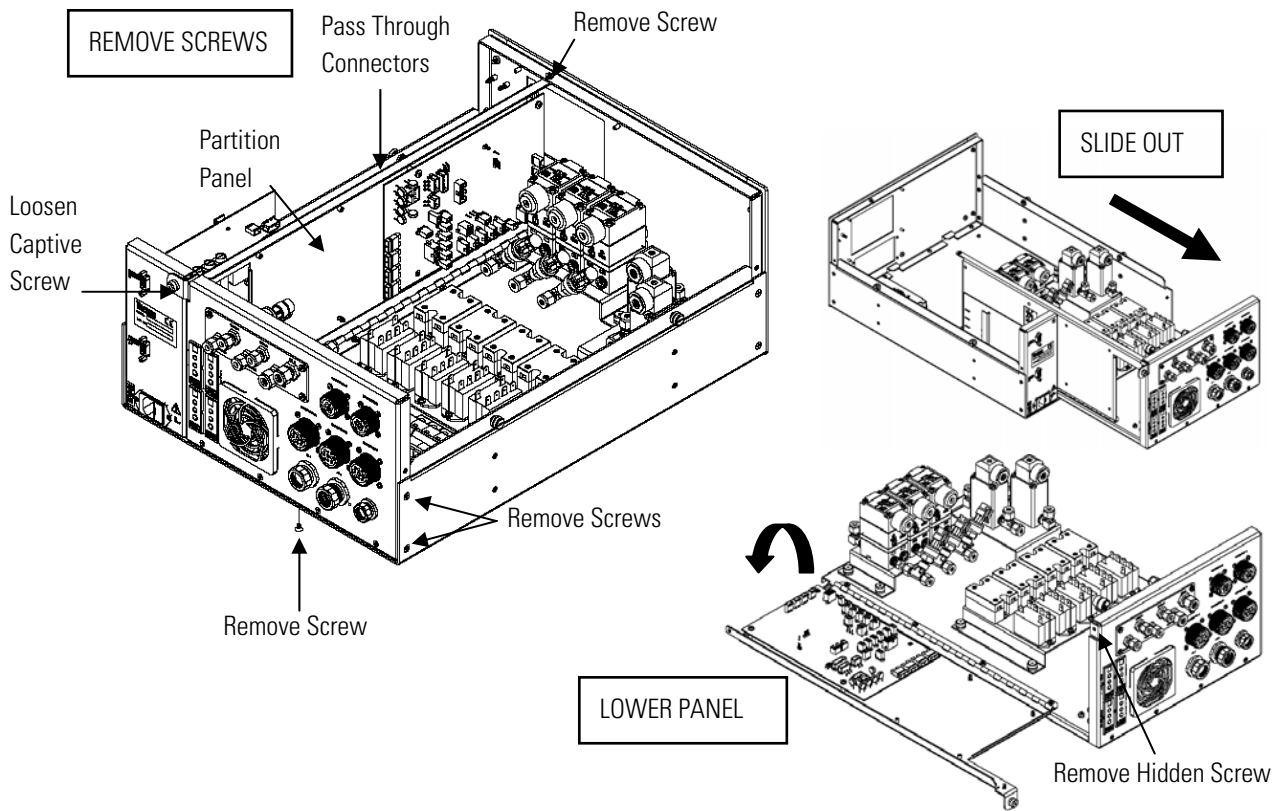
**Figure 4–2.** Model 82i Component Layout

## Removing the Tray and Lowering the Partition Panel

The electro/pneumatic tray can be removed and the partition panel can be lowered to improve access to connectors and components. Refer to the following steps when a procedure requires lowering the partition panel (see **Figure 4–3**).

## Servicing

### Removing the Tray and Lowering the Partition Panel



**Figure 4-3.** Removing the Electro/pneumatic tray and Lowering the Partition Panel

#### Equipment Required:

Philips screwdriver



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Turn instrument OFF and unplug the power cord.
2. If the instrument is mounted in a rack, remove it from the rack.

3. Remove the cover.
4. Disconnect the plumbing connections at the rear of the electro/pneumatic tray.
5. Disconnect the connectors that pass through the center of the partition panel.
6. Remove two screws from the left side of the case.
7. Remove one screw from the bottom rear of the case.
8. Remove one screw from the top front of the partition panel.
9. While holding the case securely, loosen the captive screw at the rear of the electro/pneumatic tray, and pull the electro/pneumatic tray from the rear of the case.
10. Remove the screw at the top rear of the partition panel securing the top of partition panel to the electro/pneumatic tray, and lower the panel being, careful not to put excessive tension on the cables.
11. Replace the electro/pneumatic tray by following previous steps in reverse.

## **Fuse Replacement**

Use the following procedure to replace the fuse.

Equipment Required:

Replacement fuses – refer to “Model 82*i* Replacement Parts List” on page 4-3.

1. Turn instrument OFF and unplug the power cord.
2. Remove fuse drawer, located on the AC power connector.
3. If either fuse is blown, replace both fuses.
4. Insert fuse drawer and reconnect power cord.

## Fan Replacement

Use the following procedure to replace the fan (**Figure 4-4**).

Equipment Required:

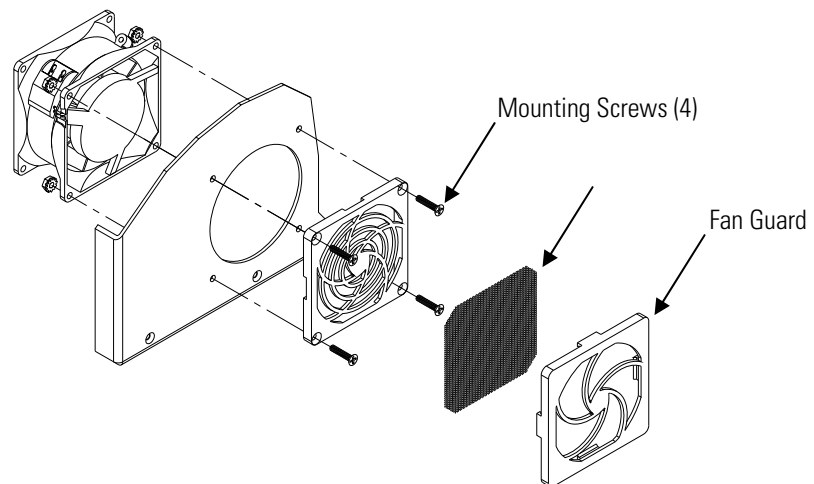
Fan

Philips screwdriver



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Turn instrument OFF, unplug the power cord, and remove the cover.
2. Remove the fan guard from the fan and remove the filter.
3. Pull the power connectors off the fan.
4. Remove the four fan mounting screws and remove the fan.
5. Install a new fan following the previous steps in reverse.



**Figure 4-4.** Replacing the Fan

## Power Distribution Board Replacement

Use the following procedure to replace the power distribution board (**Figure 4-2**).

Equipment Required:

Power distribution board



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Refer to “Removing the Electro/pneumatic Tray and Lowering the Partition Panel” in this chapter to lower the partition panel, then proceed to the next step.
2. Remove the four standoffs securing the power distribution board to the rear panel.
3. Snap the board off the mounting stud at the top of the board and pull the board out toward the front of the instrument.
4. To install a new board, follow the preceding steps in reverse order.

## Power Relay (K) and Solid State (SSR) Relay Replacement

Use the following procedure to replace a power relay (K1-K6) or a solid state relay (SSR1-SSR5). Refer to **Figure 4-2**.

Equipment Required:

Relay

#2 Philips screwdriver



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

## Servicing

### Solenoid Replacement

1. Turn instrument OFF, unplug the power cords, and remove the cover.
2. To facilitate reconnection, label the wires connected to the relay to be replaced.
3. Loosen the relay retaining screws (2) being careful not to damage the varistor and lift the relay out.
4. To install a new relay, follow the preceding steps in reverse order. Be sure that the voltage rating of the replacement relay is correct.

## Solenoid Replacement

Use the following procedure to replace the dilution solenoid or the eductor solenoid (**Figure 4-2**).

Equipment Required:

Dilution or eductor solenoid

Flatblade screwdriver



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Turn instrument OFF, unplug the power cords, and remove the cover.
2. To facilitate reconnection, label the pneumatic lines on the solenoids.
3. Remove the electrical connector from the solenoids to the SHTDN connector on the interface board.
4. Loosen the four captive screws and remove the solenoid valve assembly.
5. Remove the four screws and lock washers securing the defective solenoid to the mounting plate (underside) and remove the solenoid.
6. If necessary, remove fittings and install on new solenoid. Apply three wraps of Teflon tape to the fittings.



7. To install a new solenoid, follow the preceding steps in reverse order.

## Feedback Transducer Replacement

Use the following procedure to replace a feedback transducer (**Figure 4-2**).

Equipment Required:

Feedback transducer

Open-end wrench, 11/16-inch



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Turn instrument OFF, unplug the power cord, and remove the cover.
2. Refer to “Removing the Electro/pneumatic Tray and Lowering the Partition Panel” in this chapter to lower the partition panel, then proceed to the next step below.
3. Remove the electrical connector from the transducer to be replaced.
4. Use an 11/16-inch open end wrench to loosen the fitting connecting the feedback transducer to the electro/pneumatic transducer, and remove the feedback transducer.
5. To install a new feedback transducer, apply three wraps of Teflon tape to the fitting, and follow the preceding steps in reverse order.

## **Electro/Pneumatic Transducer Replacement**

Use the following procedure to replace an electro/pneumatic transducer (dilution, blow back, or eductor).

Equipment Required:

Dilution, blow back, or eductor transducer

#2 Philips screwdriver

Flatblade screwdriver



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Turn instrument OFF, unplug the power cords, and remove the cover.
2. Refer to “Removing the Electro/pneumatic Tray and Lowering the Partition Panel” in this chapter to lower the partition panel, then proceed to the next step below.
3. Label the pneumatic lines as appropriate to facilitate reconnection.
4. Disconnect electrical connections from the interface board.
5. Loosen the four captive screws and remove the pneumatic transducer assembly.
6. Remove the four screws and lock washers securing the defective electro/pneumatic transducer to the mounting plate (underside) and remove the electro/pneumatic transducer.
7. To install a new electro/pneumatic transducer, follow the preceding steps in reverse order. Apply three wraps of Teflon tape to fittings as appropriate.

## DC Power Supply Replacement

Use the following procedure to replace the DC power supply (**Figure 4–5**).

Equipment Required:

DC power supply

Flat blade screwdriver

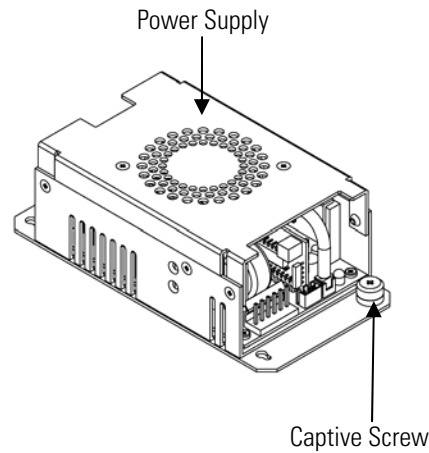


**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Turn instrument OFF, unplug the power cord, and remove the cover.
2. Disconnect all the power supply electrical connections. Note connector locations to facilitate re-connection.
3. Loosen the captive screw securing the power supply to the chassis plate and lift out the power supply.
4. To install the DC power supply, follow the previous steps in reverse.

## Servicing

### Interface Board Replacement



**Figure 4–5.** Replacing the DC Power Supply

## Interface Board Replacement

Use the following procedure to replace the interface board (**Figure 4–6**).

Equipment Required:

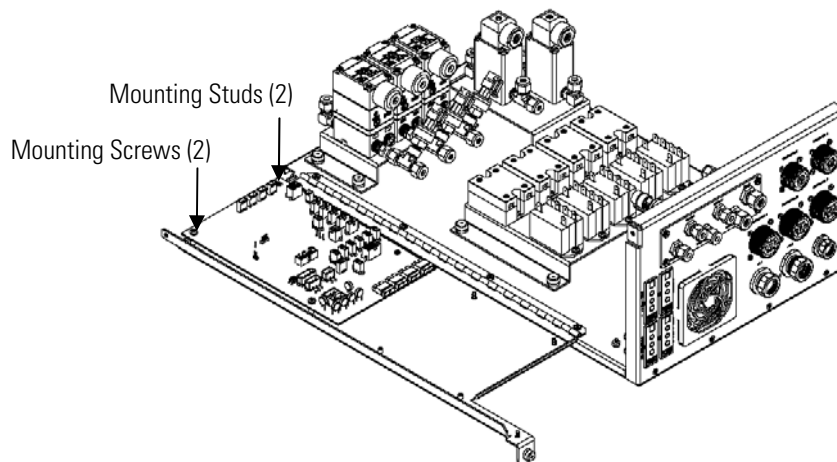
Interface board

Philips screwdriver



**Equipment Damage** Some internal components can be damaged by small amounts of static electricity. A properly ground antistatic wrist strap must be worn while handling any internal component. If an antistatic wrist strap is not available, be sure to touch the instrument chassis before touching any internal components. When the instrument is unplugged, the chassis is not at earth ground. ▲

1. Lower the partition panel, then proceed to the next step below. Refer to “Removing the Electro/pneumatic Tray and Lowering the Partition Panel” on page 4-6 in this chapter.
2. Unplug all connectors. Note the locations of the connectors to facilitate reconnection.
3. Unscrew the two screws at the top of the board, pop the board off the two mounting studs, and remove the board (**Figure 4–6**).
4. To install the interface board, follow previous steps in reverse.
5. Re-install the electro/pneumatic tray.



**Figure 4–6.** Replacing the Interface Board

## Service Locations

For additional assistance, Thermo Fisher Scientific has service available from exclusive distributors worldwide. Contact one of the phone numbers below for product support and technical information or visit us on the web at [www.thermo.com/aqi](http://www.thermo.com/aqi).

1-866-282-0430 Toll Free

1-508-520-0430 International



# Chapter 5

## System Description

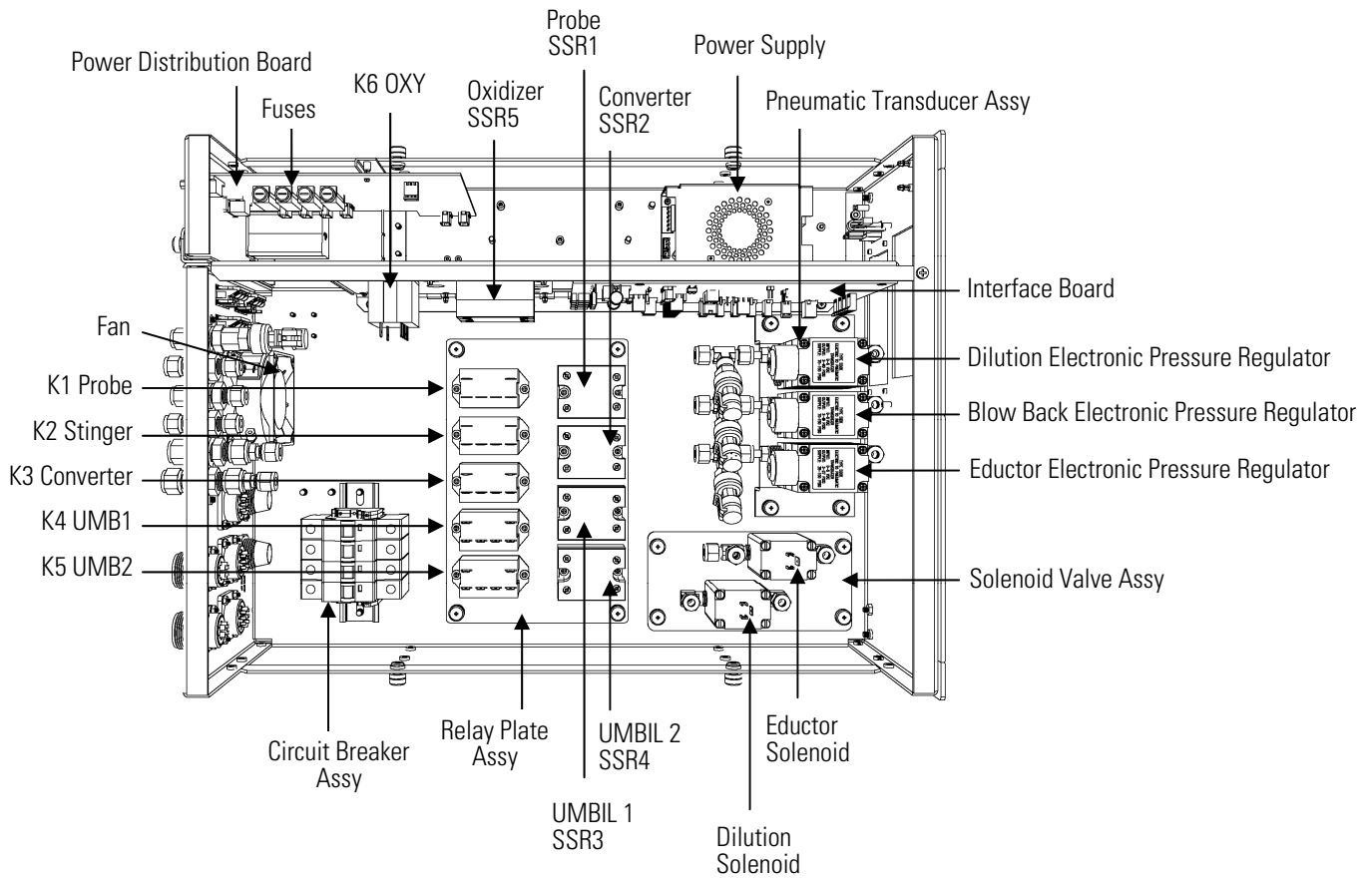
This chapter describes the function and location of the system components, provides an overview of the software structure, and includes a description of the system electronics and input/output connections and functions.

- “Hardware” on page 5-1
- “Software” on page 5-3
- “Electronics” on page 5-4
- “RS-485 Connection” on page 5-5

### Hardware

Model 82*i* hardware components (**Figure 5–1**) include:

- Power distribution board
- Power relays
  - K1 probe
  - K2 stinger
  - K3 converter
  - K4 UMB1
  - K5 UMB2
  - K6 OXY
- Solenoid valves assembly
  - Dilution solenoid
  - Eductor solenoid
- Electro/pneumatic pressure transducer assembly
  - Dilution transducer
  - Blow back transducer
  - Eductor transducer
  - Pressure transducers
- Fan



**Figure 5–1.** 82*i* Hardware Components

## Power Distribution Board

The power distribution board supplies power provided at the rear panel to the Model 82*i* and Model 83*i*.

## Power Relays

The K1 probe relay applies AC power to controlling circuitry.  
The K2 stinger relay applies AC power to the heater.  
The K3 converter relay applies AC power to controlling circuitry.  
The K4 UMB1 relay applies AC power to controlling circuitry.  
The K5 UMB2 relay applies AC power to controlling circuitry.  
The K6 OXY relay applies AC power to controlling circuitry.



## **Solenoid Valves Assembly**

The dilution solenoid provides air to the dilution electronic pressure regulator.

The eductor solenoid provides air to the eductor electronic pressure regulator.

## **Electro/Pneumatic Transducer Assembly**

The electro/pneumatic assembly provides regulated output pressure to the Model 83i dilution module, blow-back pneumatics, and eductor pneumatics. The electro/pneumatic assembly includes a dilution electronic pressure regulator, a blow-back electronic pressure regulator, and an eductor electronic pressure regulator.

## **Dilution Electronic Pressure Regulator**

The dilution electronic pressure regulator adjusts and maintains output pressure to the Model 83i dilution module with Hg-free zero air.

## **Blow-Back Electronic Pressure Regulator**

The blow-back electronic pressure regulator adjusts and maintains output pressure to the Model 83i blow-back pneumatics with clean, dry air.

## **Eductor Electronic Pressure Regulator**

The eductor electronic pressure regulator adjusts and maintains output pressure to the Model 83i eductor pneumatics with clean, dry air.

## **Fan**

The rear panel fan provides cooling air for Model 82*i* internal components.

## **Software**

The processor software tasks are organized into the following areas:

- Instrument control and service
- Monitoring signals and diagnostics

## Instrument Control and Service

Low-level embedded processors are used to control the various functions on the boards, such as pressure regulation and heater control. These processors are controlled over a RS485 line which connects to the Model 80i. The low-level processors all run common firmware that is bundled with the high-level firmware and loaded on power-up if a different version is detected.

Each board has a specific address that is used to identify to the firmware what functions are supported on that board. This address is also used for the communications between the low-level processors and the high-level processor.

Every tenth of a second the frequency counters, analog I/O, and digital I/O are read and written to by the low-level processor. The counters are accumulated over the past second and the analog inputs are averaged over that second. The high-level processor polls the low-level processors once per second to exchange the measurement and control data.

## Monitoring Signals and Diagnostics

Signals are gathered from the low-level processors once per second, and then processed by the high-level processor to produce the final measurement values. The one-second average of the analog inputs are reported directly (no additional signal conditioning is performed by the high-level processor).

## Electronics

All electronics operate from a universal switching supply, which is capable of auto-sensing the input voltage and working over the entire operating range.

An ON/OFF switch controls power to the probe heaters, and is accessible on the front panel.

The UPS controls the power to the electronics and converter. On models with internal transformer and power distribution board (Rev. C), the front panel switch removes all power to the probe.

## Probe Controller Interface Board

The probe controller interface board serves as a central connection area electronics in the instrument. It contains interface circuitry for sensors and control devices in the measurement system. Refer to **Figure 3-1** for a diagram that illustrates the probe controller interface board connections.

## Power Distribution Board

The power distribution board supplies power provided at the rear panel to the Model 82*i* and Model 83*i* (refer to **Figure 3–1**). It has four 220 VAC power outputs for the heaters, and a 120 VAC UPS for the electronics and converter. On models with internal transformer and power distribution board (Rev. C), the front panel switch removes all power to the probe.

## RS-485 Connection

The RS-485 connection is intended for interfacing to the Model 80*i*. It uses a three-wire RS-485 configuration. Refer to **Table 5–1** for the DB15 connector pin configuration.

**Table 5–1.** RS-485 DB15 Connector Pin

DB15 Pin	Function
1	RS485 -
2	RS485 +
6, 7, 8	ground



## Chapter 6

# Optional Equipment

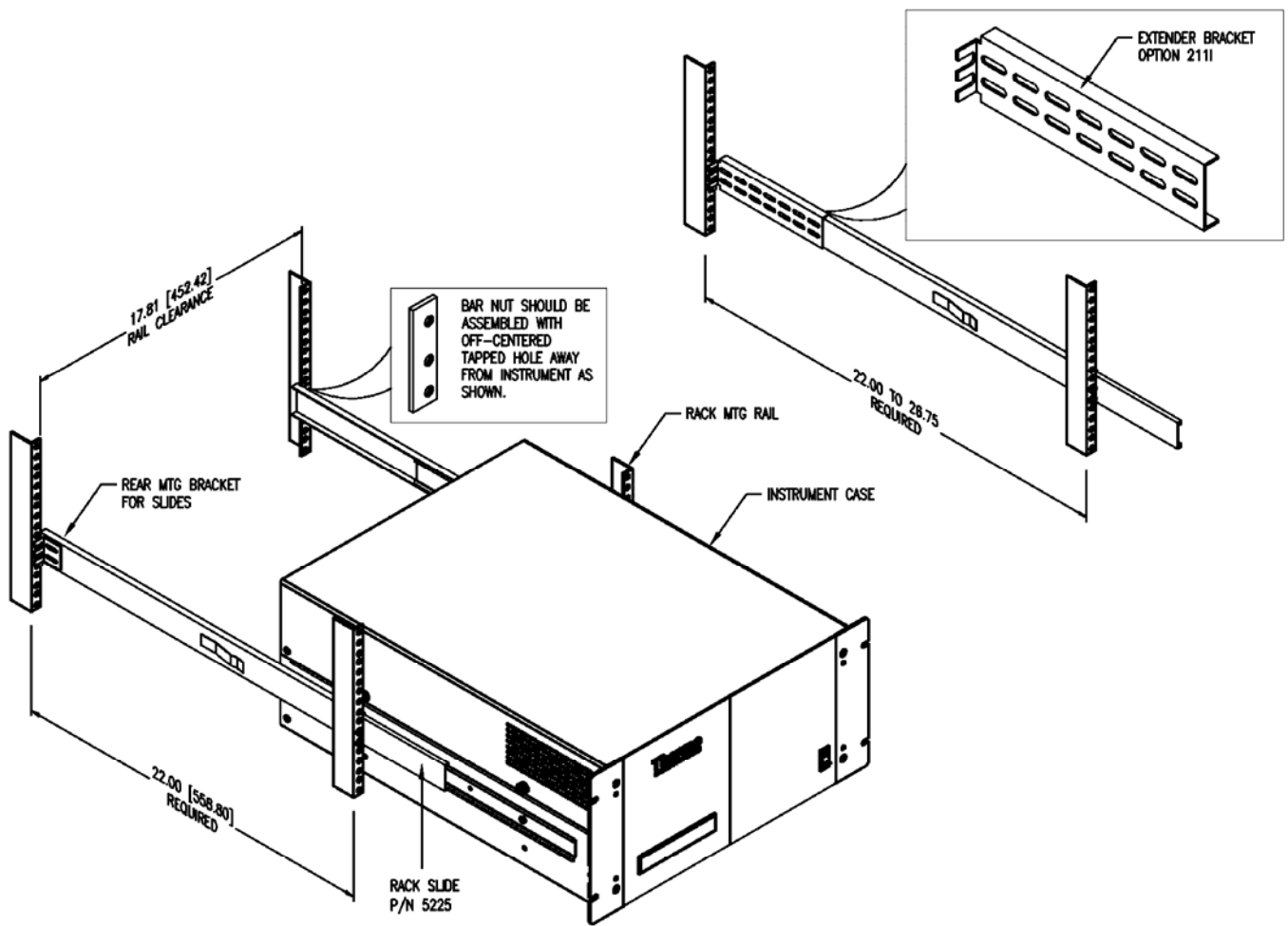
### Mounting Options

The Model 82*i* Probe Controller s can be installed in the configurations described in **Table 6–1** and shown in **Figure 6–1** through **Figure 6–4**.

**Table 6–1.** Mounting Options

Mounting Type	Description
Bench	Positioned on bench, includes mounting feet, and front panel side-trim handles.
EIA rack	Mounted in an EIA-style rack, includes mounting slides, and front panel EIA-rack mounting handles.
Retrofit rack	The rail mounting location is lower on the case and the front mounting screw slots are in non-standard EIA locations.

**Optional Equipment**  
Mounting Options



**Figure 6-1.** Rack Mount Option Assembly

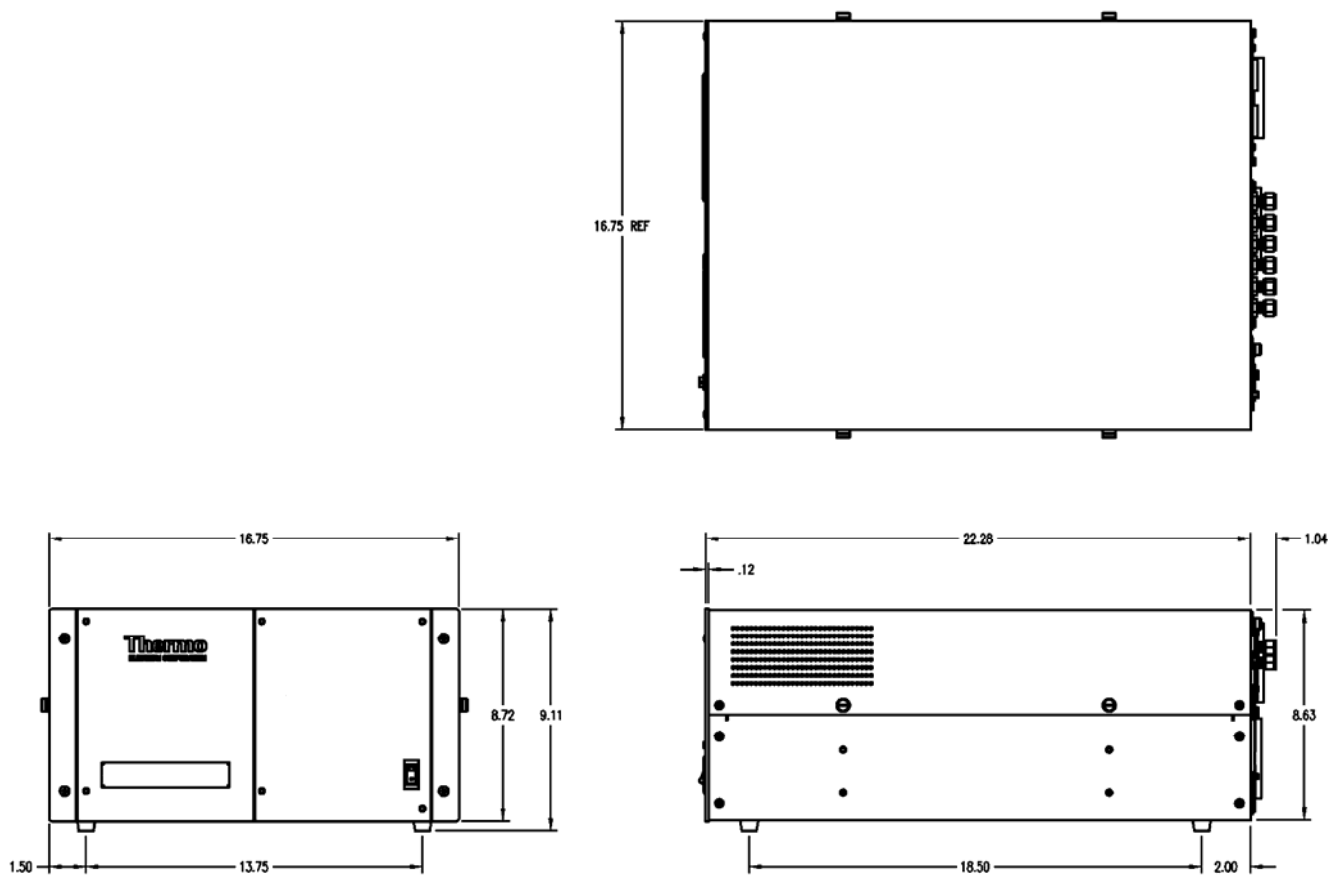
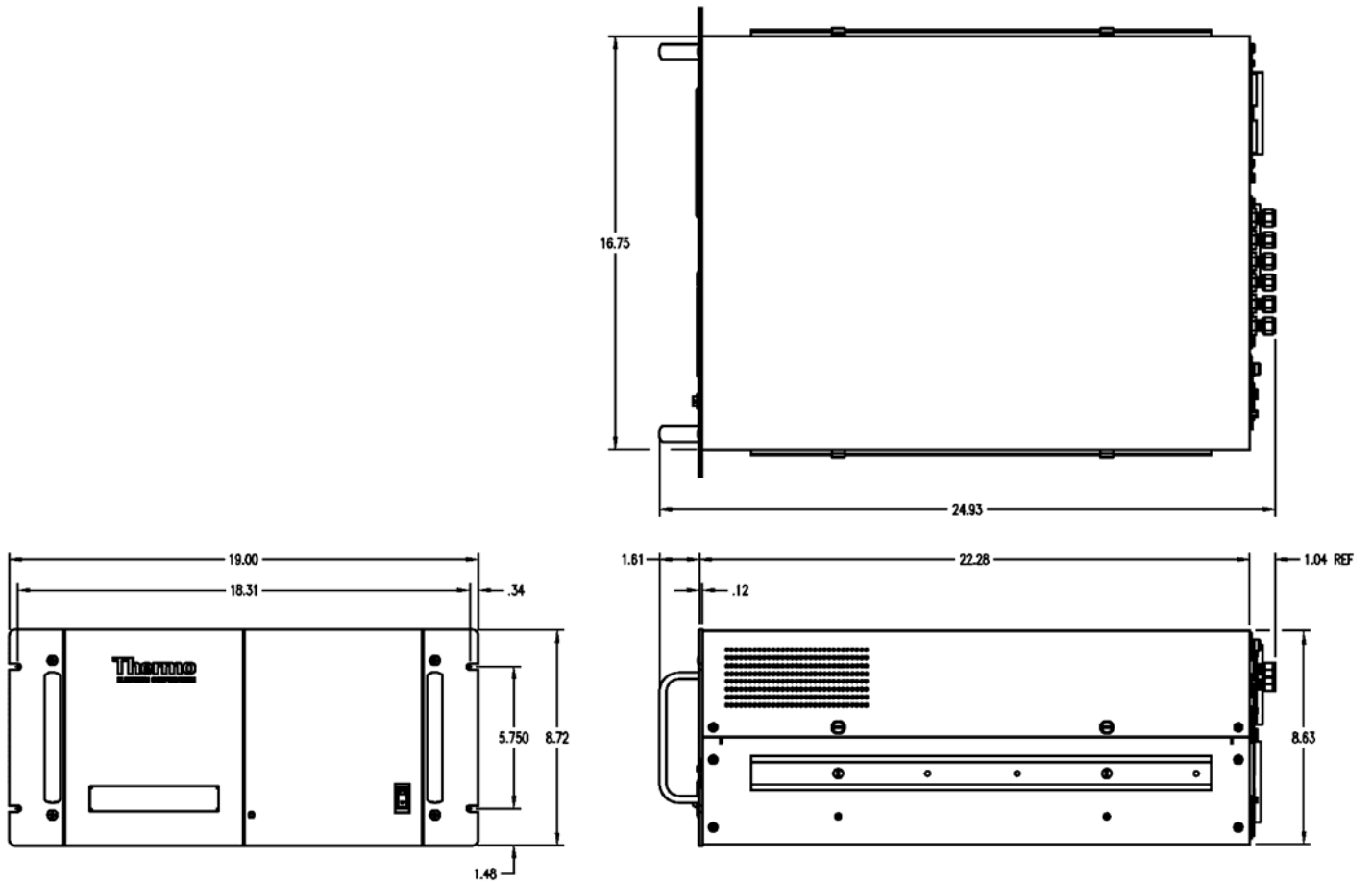


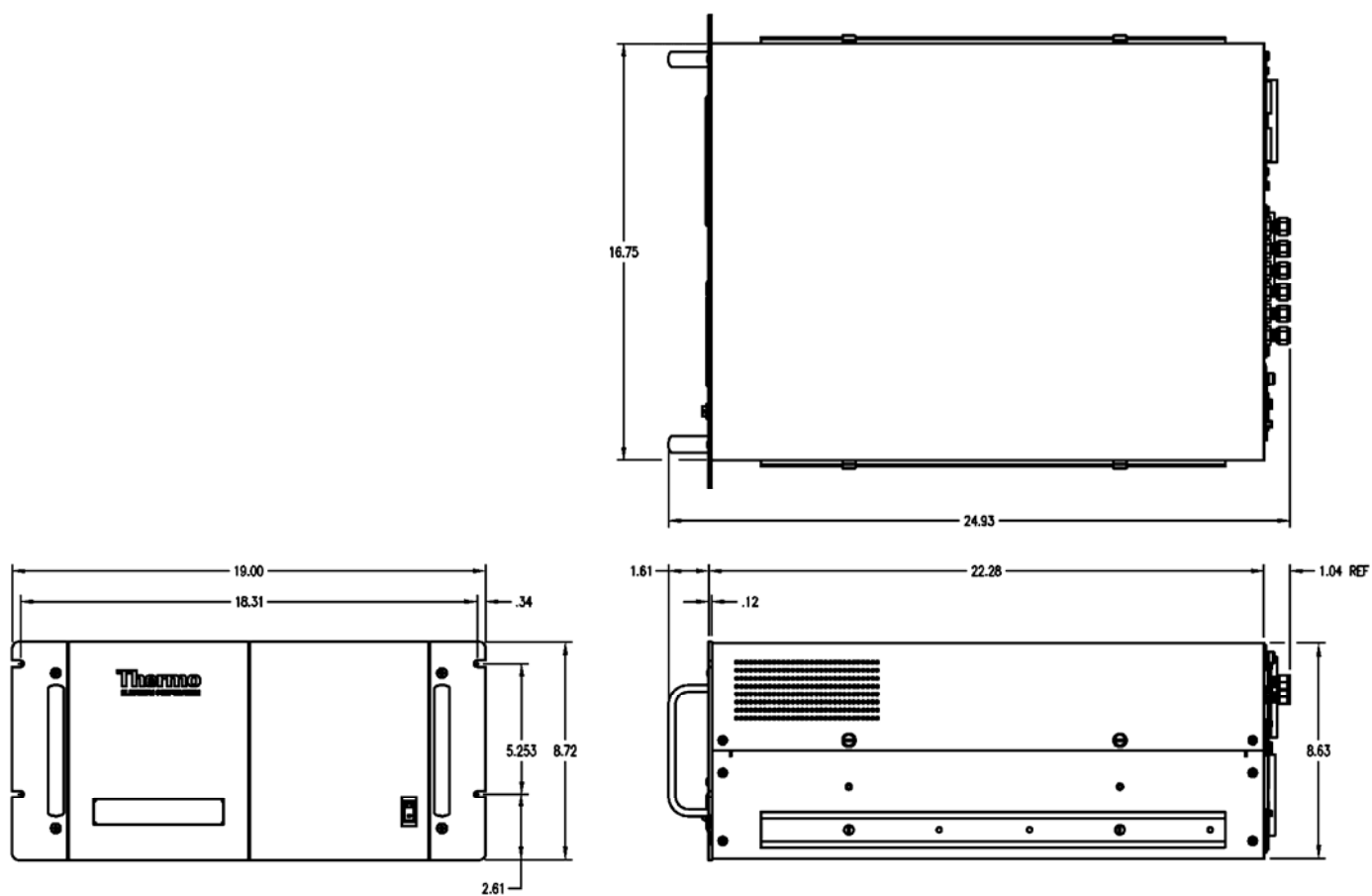
Figure 6–2. Bench Mounting

**Optional Equipment**  
Mounting Options



**Figure 6-3.** EIA Rack Mounting





**Figure 6–4.** Retrofit Rack Mounting



# Appendix A

## Warranty

Seller warrants that the Products will operate or perform substantially in conformance with Seller's published specifications and be free from defects in material and workmanship, when subjected to normal, proper and intended usage by properly trained personnel, for the period of time set forth in the product documentation, published specifications or package inserts. If a period of time is not specified in Seller's product documentation, published specifications or package inserts, the warranty period shall be one (1) year from the date of shipment to Buyer for equipment and ninety (90) days for all other products (the "Warranty Period"). Seller agrees during the Warranty Period, to repair or replace, at Seller's option, defective Products so as to cause the same to operate in substantial conformance with said published specifications; provided that (a) Buyer shall promptly notify Seller in writing upon the discovery of any defect, which notice shall include the product model and serial number (if applicable) and details of the warranty claim; (b) after Seller's review, Seller will provide Buyer with service data and/or a Return Material Authorization ("RMA"), which may include biohazard decontamination procedures and other product-specific handling instructions; and (c) then, if applicable, Buyer may return the defective Products to Seller with all costs prepaid by Buyer. Replacement parts may be new or refurbished, at the election of Seller. All replaced parts shall become the property of Seller. Shipment to Buyer of repaired or replacement Products shall be made in accordance with the Delivery provisions of the Seller's Terms and Conditions of Sale. Consumables, including but not limited to lamps, fuses, batteries, bulbs and other such expendable items, are expressly excluded from the warranty under this warranty.

Notwithstanding the foregoing, Products supplied by Seller that are obtained by Seller from an original manufacturer or third party supplier are not warranted by Seller, but Seller agrees to assign to Buyer any warranty rights in such Product that Seller may have from the original manufacturer or third party supplier, to the extent such assignment is allowed by such original manufacturer or third party supplier.

In no event shall Seller have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of the Products in a manner for

## Warranty

which they were not designed, (v) causes external to the Products such as, but not limited to, power failure or electrical power surges, (vi) improper storage and handling of the Products or (vii) use of the Products in combination with equipment or software not supplied by Seller. If Seller determines that Products for which Buyer has requested warranty services are not covered by the warranty hereunder, Buyer shall pay or reimburse Seller for all costs of investigating and responding to such request at Seller's then prevailing time and materials rates. If Seller provides repair services or replacement parts that are not covered by the warranty provided in this warranty, Buyer shall pay Seller therefor at Seller's then prevailing time and materials rates. ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN SELLER WITHOUT SELLER'S PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY SELLER, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS.

THE OBLIGATIONS CREATED BY THIS WARRANTY STATEMENT TO REPAIR OR REPLACE A DEFECTIVE PRODUCT SHALL BE THE SOLE REMEDY OF BUYER IN THE EVENT OF A DEFECTIVE PRODUCT. EXCEPT AS EXPRESSLY PROVIDED IN THIS WARRANTY STATEMENT, SELLER DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO THE PRODUCTS, INCLUDING WITHOUT LIMITATION ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE PRODUCTS ARE ERROR-FREE OR WILL ACCOMPLISH ANY PARTICULAR RESULT.

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