

MODEL 8004 CONTROLLER

(FOR USE WITH ON-BOARD™ HIGH-VACUUM PUMPING SYSTEM)

Installation, Operation and Servicing Instructions

Revised August 1989

Helix Technology Corporation no longer manufactures this product.
Please contact Technical Support at 1-800-284-2796
(1-508-337-5551 outside the U.S.) for product upgrade options.

June 14, 2005

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Returning Equipment

Before returning any equipment to CTI-CRYOGENICS contact the Product Service Department in your area for instructions.

East Coast Service Center:

CTI-CRYOGENICS
266 Second Avenue
P.O. Box 9171
Waltham, Massachusetts 02254-9171, U.S.A.
Telephone (617) 622-5000
TELEX 92-3442
Telecopier/Fax (617) 622-5222

West Coast Service Center:

CTI-CRYOGENICS
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Santa Clara, California 95054, U.S.A.
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Obtain a Return Goods Authorization (RGA) number from the Product Service Department and indicate that number on all shipping cartons and correspondence.

Guaranteed Up-Time Support (GUTS)

For rapid response service (24 hours a day), dial

NATIONAL TOLL FREE

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367-4887

In U.S.A. and Canada.

For each item returned, preferably in its original shipping carton, include with the shipment:

Equipment Type _____

Purchase Date _____

Cryopump Serial No. _____

CTI-CRYOGENICS Sales Order No. _____

CTI suggests that you record this information when you receive your equipment.

Technical Inquiries

Direct your technical inquiries concerning installation, operation, or maintenance requirements to the Product Service Department of CTI-CRYOGENICS.

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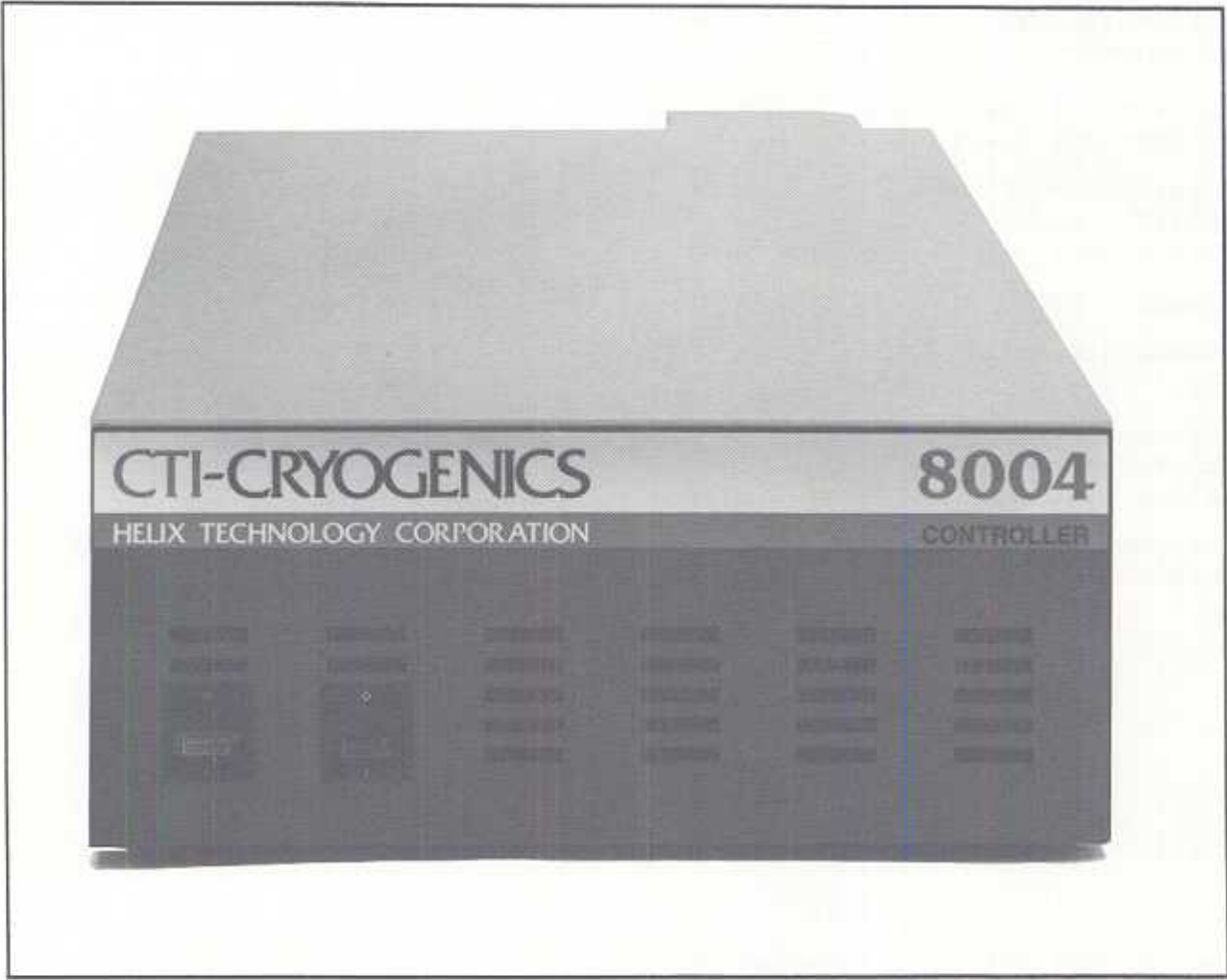


Figure 1.1 Model 8004 Controller

Section 1: Introduction

1.1 General. 1-1

1.2 Installation, Operation and Servicing Instructions. 1-1

1.1 General

The Model 8004 Controller, shown in Figure 1.1, is one of the three major components that make up the ON-BOARD™ High-Vacuum Pumping System. The other two components are the ON-BOARD High-Vacuum Pump and the Model 8300 Compressor. The Model 8004 mounts on top of the 8300 Compressor and provides electrical control and interface functions between the compressor and the high-vacuum pump.

1.2 Installation, Operation and Servicing Instructions

Installation, Operation and Servicing Instructions for your Model 8004 Controller provide easily accessible information. All personnel with installation, operation, and servicing responsibilities should become familiar with the contents of these instructions to ensure high quality, safe, and reliable performance.

Table 1.1 Model 8004 Controller Specifications

See Figure 1.2 for location of controls and connections.

Dimensions

- 1** 19.18 inches (488 mm) Length
- 13.38 inches (340 mm) Width
- 5.85 inches (149 mm) Height

Weight

32 lbs (15 kg)

Power requirements (when operating Model 8300 Compressor)

8000 SERIES CONTROLLER	NOMINAL	HZ	PHASE	NOM. OPER. CURRENT (AMPS)	OPERATING VOLTAGE RANGE (VOLTS)		INRUSH CURRENT (10 SECONDS) (AMPS)	POWER CONSUMP. (KW)
					60 HZ	50 HZ		
8004	208/230	50/60	1 ϕ	11.0	198-250	180-220	30	2.2

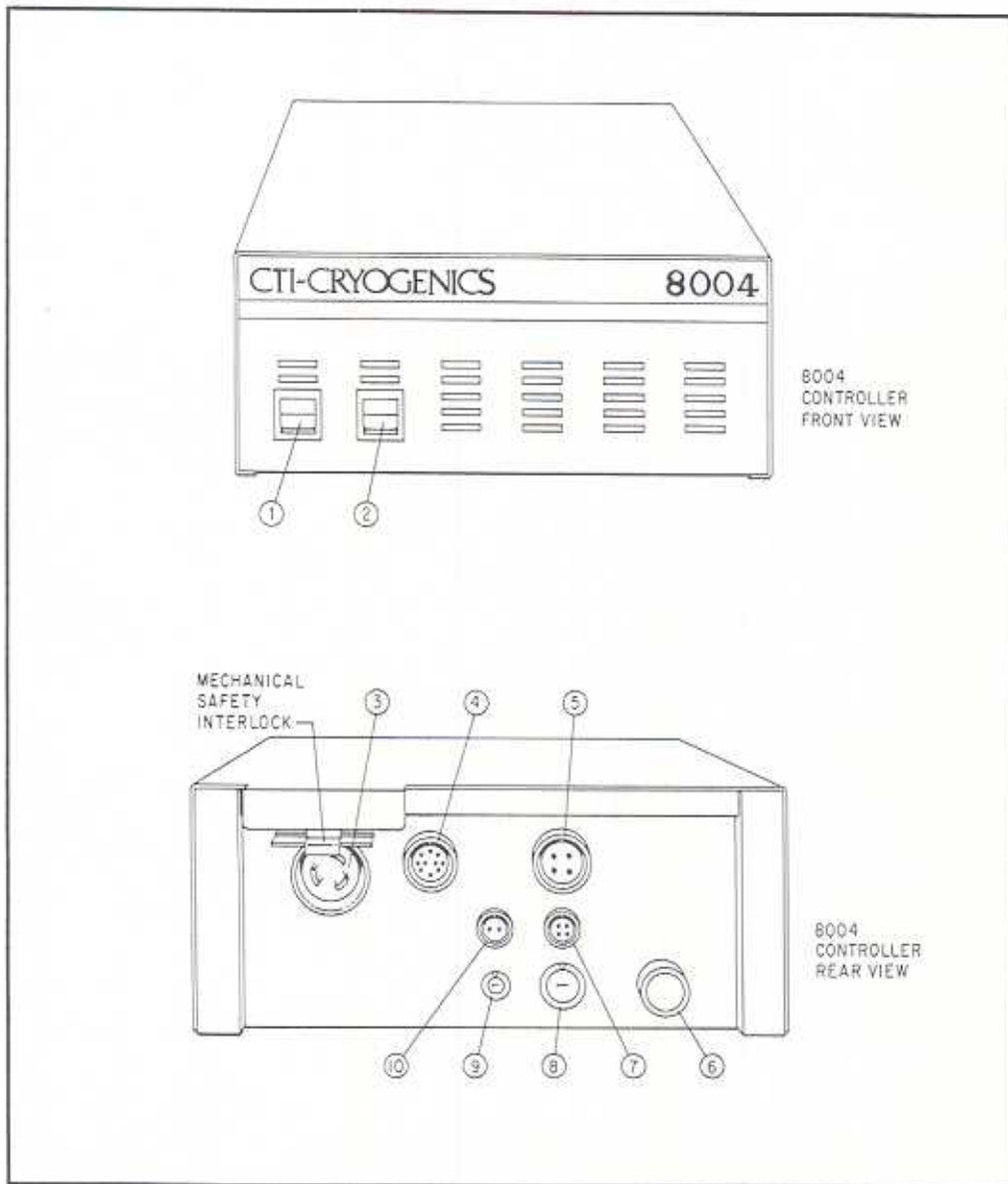
Customer-supplied electrical service must be in accordance with all local, state, and national codes and standards.

Controller input-power cable (customer supplied)

- Recommended Type SO-3 conductor, 600V, neoprene jacket and 14-gauge wire
- Install per Figure 3.2, page 3-2, schematic, ensuring compliance with all national, state and local standards.

Interface

- ON-BOARD power receptacles: Mates with plugs on ON-BOARD power cables.
- Controller input-power connector: Mates with twist lock receptacle number NEMA: L6-15R (supplied).
- Compressor power receptacle: Mates with plug on compressor power cable.
- Compressor low voltage control receptacle: Mates with plug on low voltage control cable.



1. Compressor power ON/OFF switch.
2. ON-BOARD power ON/OFF switch.
3. Input power connector.
4. Cryopump/ON-BOARD power connector.
5. Power to compressor connector.
6. Motor overload breaker reset.
7. Compressor low voltage control connector.
8. Voltage selector switch (S3).
9. Frequency selector switch (S4).
10. Remote ON/OFF connector.

Figure 1.2 Model 8004 Controller - switches and connectors

Section 2: Inspection

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2.4 Packaging of the ON-BOARD Cryopump System	2-1

2.1 General

On receipt, inspect the 8004 Controller for evidence of damage as described in the following sections.

Report damage to the shipper at once.

Retain shipping cartons for storage or return shipment.

2.2 Interconnecting Electrical Cables

Inspect the electrical cables for damage for examining the overall exterior.

2.3 The Compressor Controller

Inspect the controller for damage by examining the overall exterior electrical connectors, and switches.

2.4 Packaging of the ON-BOARD Cryopump System

The ON-BOARD Cryopump System is packaged in four separate cartons. There is one each for the Installation and Scheduled Maintenance Tool Kit, the ON-BOARD Cryopump, the Model 8004 Controller, and the Model 8300 Compressor. Listed below is the contents of the controller carton.

Model 8004 Controller, P/N 8052206.

1. Power Cable, P/N 8052050G001.
2. Control Cable, P/N 8052051G001.
3. Compressor/Controller remote start connector.
4. Input Power Connector.
5. Spare Fuses
6. Compressor Controller Manual, P/N M8040217.
7. Compressor Manual, P/N M8040216.

Section 3: Installation

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3.1 Model 8004 Controller Installation

Figure 3.1, is a block diagram of the major tasks that are detailed in this section required for 8004 Controller installation.

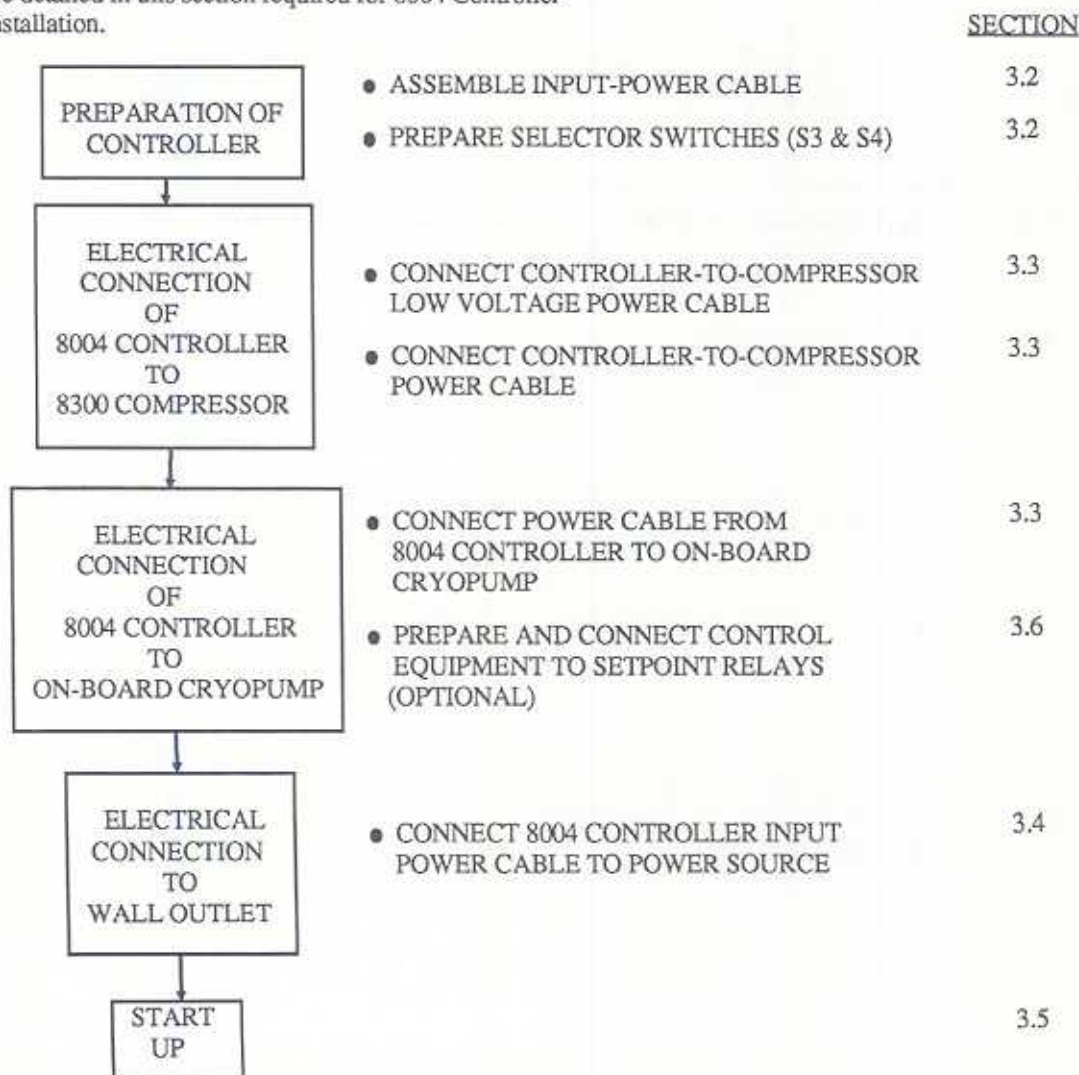


Figure 3.1 Block diagram for Model 8004 Controller installation

3.2 Preparing the Model 8004 Controller

1. Assemble the controller input-power cable using the CTI-supplied controller receptacle. Follow Figure 3.2, being sure to comply with all national, state, and local codes. Do not connect the controller to the power source at this time. All of the preparation procedures must be completed before electrically connecting the controller.
2. Refer to Table 1.1, page 1-2, for electrical power requirements. Then, using a voltmeter measure the phase-to-phase voltage from the power source. Follow Figure 3.3, and prepare power selector switch (S3) and 50/60 Hz selector switch (S4) on the controller.

3


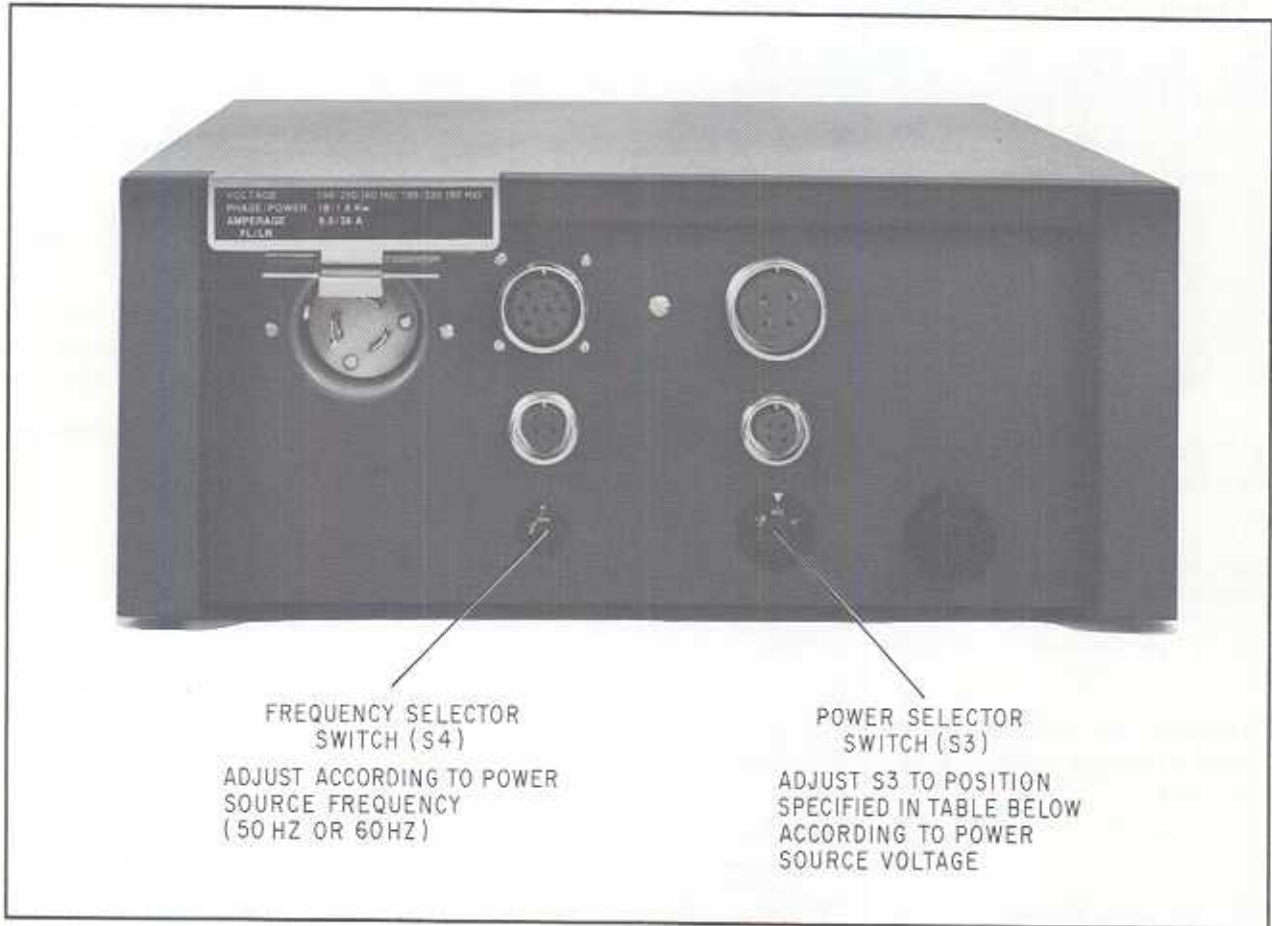
CONTROLLER MODEL NO.	CTI-SUPPLIED RECEPTACLE P/N	CABLE MATERIAL (CUSTOMER)	SCHEMATIC
8004	NEMA: L6-15R	SO-3 Conductor, 600-V Neoprene Jacket and 14-Gauge Wire	<p>2-POLE, 3-WIRE</p>  <p>NEMA Reference: Receptacle: L6-15R Plug: L6-15P</p>

Figure 3.2 Wiring requirements for Model 8004 Controller input-power cable



SWITCH S3 POSITION	OPERATING VOLTAGE RANGE	
	60 HZ	50 HZ
LOW	198-220 VAC	180-210 VAC
MED	220-240 VAC	210-220 VAC
HI	NOT USED	

Figure 3.3 Preparing the controller

3.3 Electrically Connecting the ON-BOARD System

⚠ WARNING

1. The switches on the front of the controller must be in the OFF position before making any and all electrical connections.
2. Do not connect the compressor controller to its power source until all connections have been made between the components of the ON-BOARD system.

3

Referring to Figures 1.2, 3.3, and 3.4, connect the following three cables supplied with your ON-BOARD system.

1. The control cable from the compressor controller to the compressor.
2. The power cable from the compressor controller to the compressor.
3. The power cable from the cold head connector on the compressor controller to the ON-BOARD cryopump.

3.4 Connecting to the Power Source

Connect the compressor controller to the power source that supplies the proper power as described in Table 1.1, page 1-2.

3.5 Turning the System On

The system is turned on by means of the two switches on the front of the compressor controller (Figure 1.2, page 1-3).

1. The compressor power ON/OFF switch turns on the compressor and makes power available for the ON-BOARD cryopump cold head motor.
2. The ON-BOARD power ON/OFF switch turns on the ON-BOARD microprocessor and makes power available for the valves and heater.

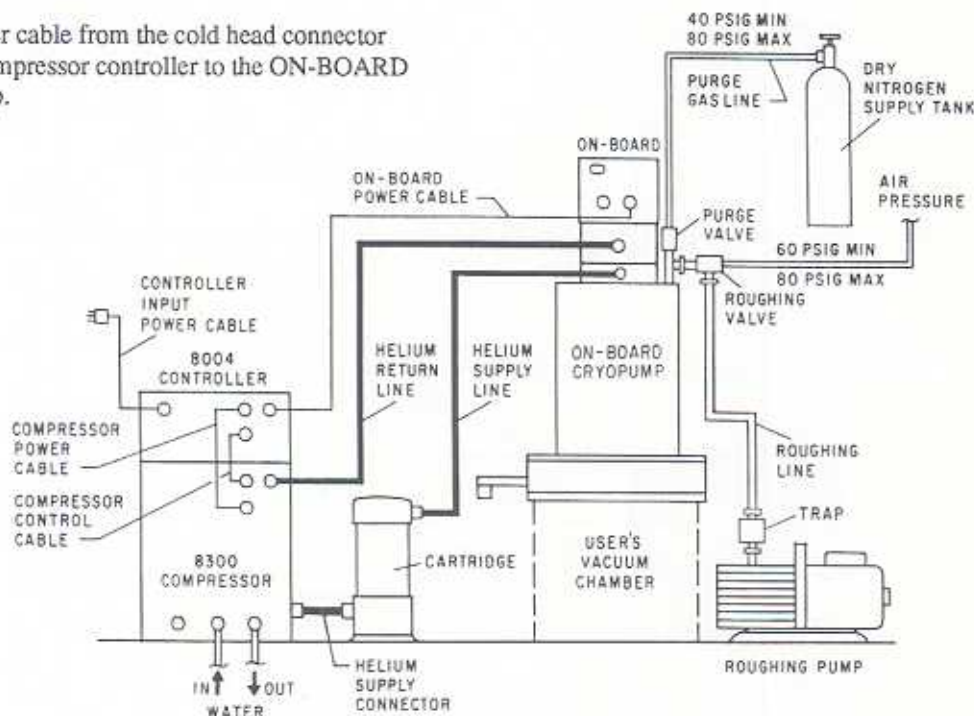


Figure 3.4 ON-BOARD installation setup

3.6 Automatic ON/OFF Control of the 8300 Compressor Using the ON-BOARD Setpoint Relays

The 8300 Compressor remote start feature can be used with one of the ON-BOARD setpoint relays to automatically turn the compressor on when the cryopump is turned on and turn it off when the cryopump is turned off. Disconnect the jumper on the loose remote connector supplied, and connect the pins as follows:

ON-BOARD RELAY CONNECTOR	8004 REMOTE CONNECTOR
Pin #8	A
Pin #6	B

Now program Relay #1 to the cryopump function as described below.

Press the relay function key. Select Relay 1 by pressing 1. Press the next key until the display reads CRYOPUMP. Press Enter and the display should read **FNC = CRYOPUMP** (function is cryopump operation). Press the CONTROL function key and the programming is complete.

Caution --

Be sure that the compressor switch is off before connecting or disconnecting the remote connector.

Section 4: Troubleshooting Procedures

4.1 General 4-1
4.2 Contacting the Product Service Department. 4-1

4.1 General

The problems in the Troubleshooting Table are followed by several possible causes and corrective actions. The causes and corresponding actions are listed in their order of probability of occurrence. 1) is most likely, 2) is next most likely, etc.

The controller troubleshooting procedures are summarized in Table 4.1.

4.2 Contacting the Product Service Department

Should your Cryo-Torr cryopump high-vacuum system develop problems not corrected by following the troubleshooting procedures summarized in Table 4.1. Contact the nearest Product Service Department by calling the service hot line.

East Coast Service Center:

CTI-CRYOGENICS
266 Second Avenue
P.O. Box 9171
Waltham, MA 02254-9171, U.S.A.
(617) 622-5000
TELEX 92-3442
Telecopier/Fax (617) 622-5222

West Coast Service Center:

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3350 Scott Boulevard #13
Santa Clara, CA 95054, U.S.A.
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Telecopier/Fax (408) 988-6630

NATIONAL TOLL FREE

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367-4887
In U.S.A. and Canada.

Table 4.1 Controller Troubleshooting Procedures

⚠ WARNING

Disconnect input power before performing any troubleshooting procedure internal to the controller.

Problem	Possible Cause	Corrective Action
1) No ON-BOARD display.	1) Loss of one or both 12V lines from controller.	1) Check condition of fuses 1FU, 2FU, 4FU, 5FU, 6FU, 7FU, and 8FU. Contact the Product Service Department.
2) Cryopump fails to cool down.	1) Loss of cold head power.	1) See Corrective Action, problem 3. 2) Check condition of fuses 11FU, 12FU, 14FU, and 15FU. Contact the Product Service Department.
3) The cold head makes a growling noise.	1) Incorrect position of frequency select switch S4, or of the voltage select switch S3.	1) a. Confirm correct settings as described in Figure 3.3, page 3-3. b. Measure and confirm incoming voltages with values in Table 1.1, page 1-2.
4) System power ON/OFF switch remains latched on but the compressor will not run.	1) Loss of input power.	1) Check source fuses, circuit breakers, etc. Confirm that power source voltage between 180 and 250 volts is constant and steady. 2) Check condition of fuses 1FU, and 2FU. Contact the Product Service Department.

4

Appendix A

Electrical Schematic and Location Information

CONTROLLER

1FU THROUGH 15FU - (ALL SLOW-BLOW TYPE)

FUSE DESIGNATION	AMP RATING	BUSSMAN* PART NO.
1FU (WHT)	20	MDA20
2FU (WHT)	20	MDA 20
4FU (YEL)	1/2	MDL 1/2
5FU (YEL)	1/2	MDL 1/2
6FU (PINK)	2	MDX 2
7FU (PINK)	2	MDX 2
8FU (PINK)	2	MDX 2
9FU (PINK)	2	MDX 2
10FU (PINK)	2	MDX 2
11FU (BRN)	3/4	MDL 3/4
12FU (BRN)	3/4	MDL 3/4
14FU (GRN)	1 1/4	MDX 1 1/4
15FU (GRN)	1 1/4	MDX 1 1/4

C3 - CAPACITOR - 6 MICROFARADS, 330V
 C4 - CAPACITOR - 2 MICROFARADS, 330V
 J1 - INPUT POWER CONNECTOR
 J4 - REMOTE ON/OFF CONNECTOR
 J5 - COMPRESSOR CONTROL OUTPUT CONNECTOR
 J6 - COMPRESSOR POWER OUTPUT CONNECTOR
 J10 - ON-BOARD POWER OUTPUT CONNECTOR
 K1 - CRYOPUMP HEATER RELAY
 K2 - ON-BOARD POWER RELAY
 K3 - VOLTAGE SELECT RELAY
 K4 - REMOTE ON/OFF RELAY
 K5 - COMPRESSOR START RELAY
 LT1 - COMPRESSOR STATUS INDICATOR LAMP
 LT3 - ON-BOARD STATUS INDICATOR LAMP
 M1 - MOTOR STARTER
 OL1 - MOTOR OVERLOAD PROTECTOR

R1 - COLD HEAD DRIVE RESISTOR - 150 OHMS, 100W
 R2 - RESISTOR - 150 OHM, 5W
 R3 - RESISTOR - 100K OHM, 2W
 S1 - COMPRESSOR POWER SWITCH
 S2 - ON-BOARD POWER SWITCH
 S3 - VOLTAGE SELECT SWITCH
 S4 - FREQUENCY SELECT SWITCH
 T3 - CONTROL TRANSFORMER, 24V
 T4 - COLD HEAD DRIVE TRANSFORMER
 TD1 - TIME DELAY RELAY

*Replacement parts must be Bussman type only.

COMPRESSOR

10FU - FUSE, 0.125A, 3AG-FB**
 C1 - COMPRESSOR RUN CAPACITOR, 35 MICROFARADS, 370 VAC
 C2 - COMPRESSOR START CAPACITOR, 108-130 MICROFARADS, 330 VAC
 CR1 - COMPRESSOR STARTING RELAY
 ETM- ELAPSED TIME METER
 J7 - COMPRESSOR HARNESS INTERCONNECT CONNECTOR
 J8 - COMPRESSOR CONTROL CONNECTOR
 J9 - COMPRESSOR POWER CONNECTOR
 LT2 - COMPRESSOR STATUS INDICATOR LAMP
 R3 - RESISTOR - 15K OHMS, 2 WATTS
 S5 - SAFETY INTERLOCK SWITCH
 SOL1 - SOLENOID VALVE - GAS FLOW
 SOL2 - SOLENOID VALVE - OIL FLOW
 TSI - THERMAL PROTECTIVE SWITCH - WATER FLOW

**FB = Fast-Blow

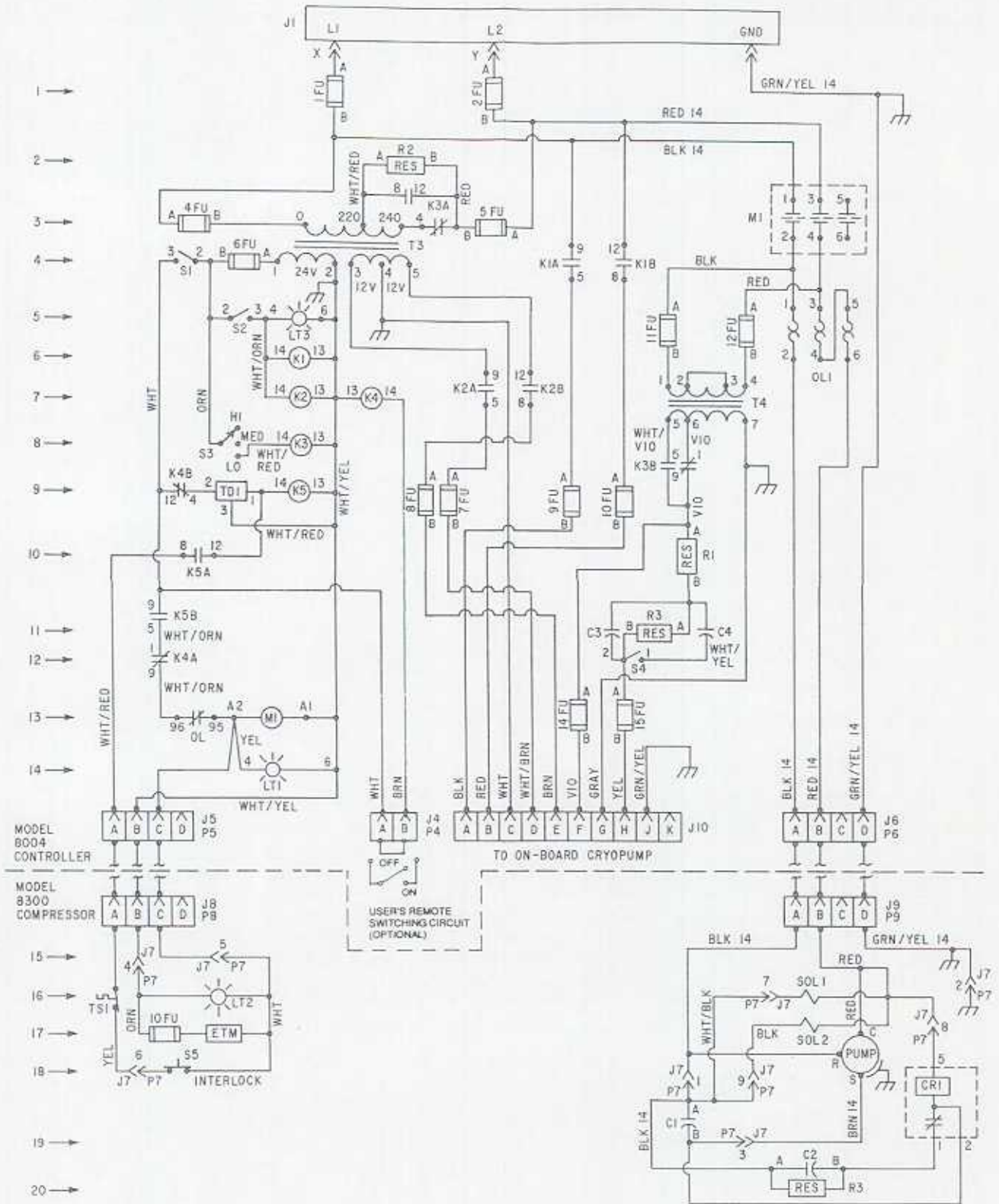
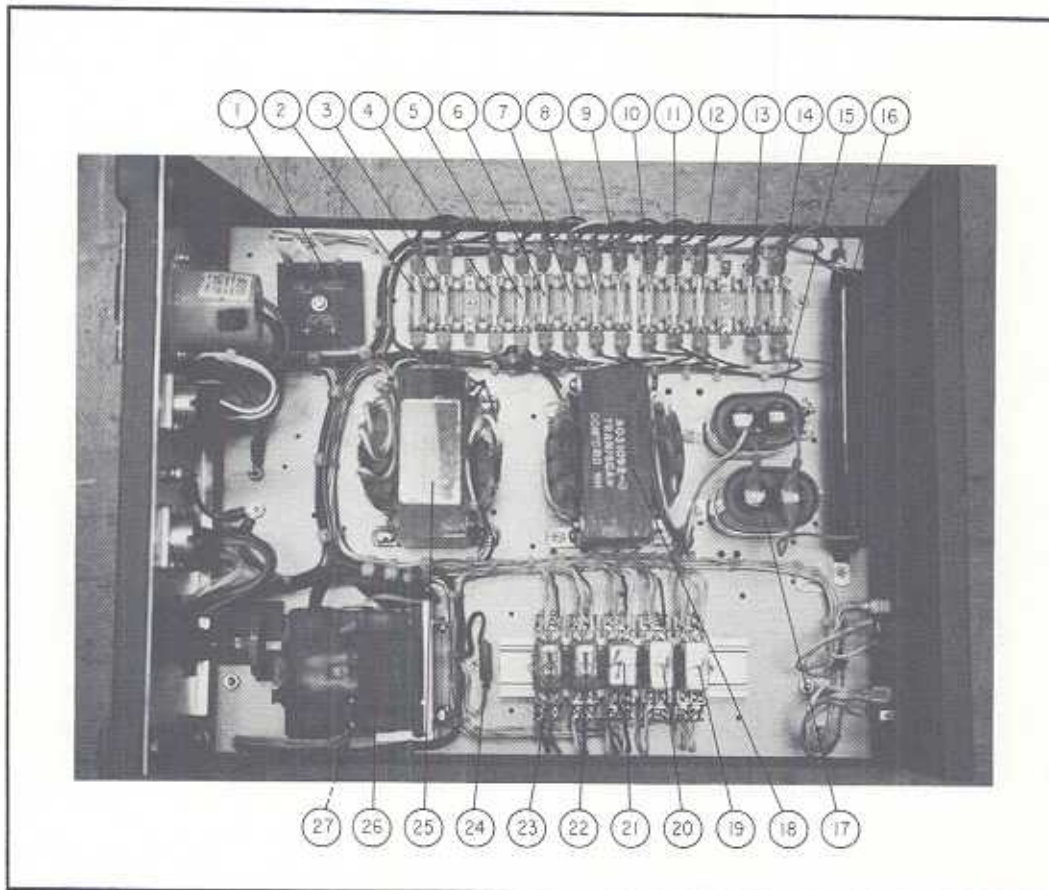


Figure A.1 Electrical schematic for Model 8004 Controller and Model 8300 Compressor

Rev. B (8/89)

Appendix B

Component Diagram



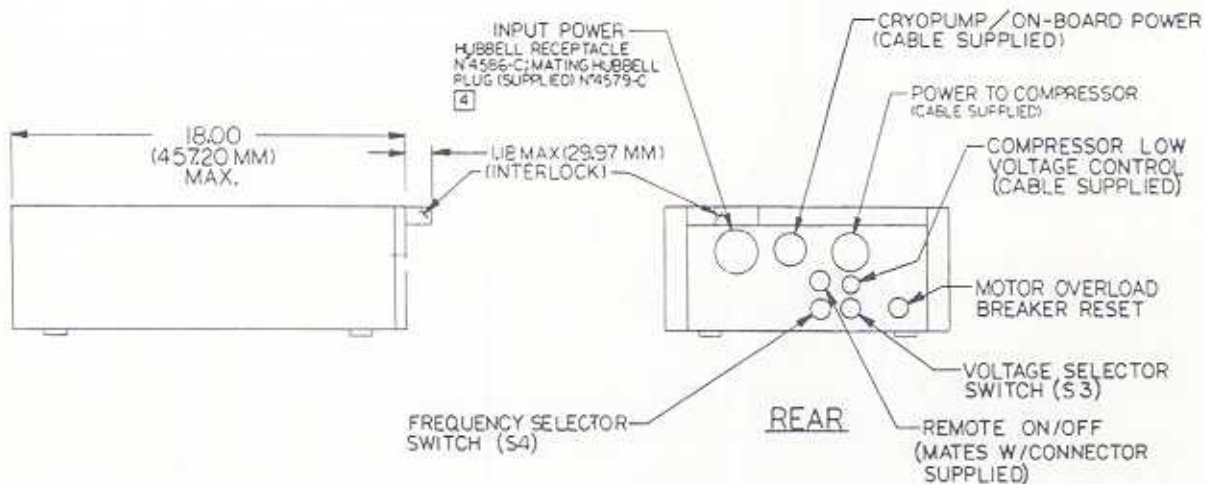
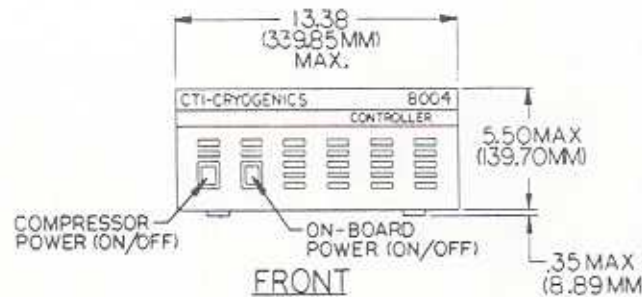
B

1. Time Delay Relay	TD1	15. Capacitor - 2 Microfarads, 330V	C4
2. Fuse - 20A, Slow-Blow	1FU	16. Cold-Head Drive Resistor - 150 ohms, 100 watts	R1
3. Fuse - 20A, Slow-Blow	2FU	17. Capacitor - 6 Microfarads, 330V	C3
4. Fuse - 0.5A, Slow-Blow	4FU	18. Cold-Head Drive Transformer	T4
5. Fuse - 0.5A, Slow-Blow	5FU	19. Compressor Start Relay	K5
6. Fuse - 2A, Slow-Blow	6FU	20. Remote ON/OFF Relay	K4
7. Fuse - 2A, Slow-Blow	7FU	21. Voltage Select Relay	K3
8. Fuse - 2A, Slow-Blow	8FU	22. ON-BOARD Power Relay	K2
9. Fuse - 2A, Slow-Blow	9FU	23. Cryopump Heater Relay	K1
10. Fuse - 2A, Slow-Blow	10FU	24. Resistor, 150 Ohms, 5 Watts	R1
11. Fuse - 0.75A, Slow-Blow	11FU	25. Control Transformer	T3
12. Fuse - 0.75A, Slow-Blow	12FU	26. Motor Starter	M1
13. Fuse - 1.25A, Slow-Blow	14FU	27. Overload Relay	OL1
14. Fuse - 1.25A, Slow-Blow	15FU		

Figure B.1 Components in the Model 8004 Controller

Appendix C

Controller Installation/Interface Drawing



NOTES:

1. WEIGHT = 32 LBS (15 KG)
2. ELECTRICAL POWER REQUIREMENTS (WHEN OPERATING 8300 COMPRESSOR):
 NOMINAL ELECTRICAL REQUIREMENTS - 208/230 VAC; 1ø; 50/60 HZ; 2.2 KW.
 REQUIRED VOLTAGE - 198-250 VAC @ 60 HZ; 180-220 VAC @ 50 HZ.
 RUN CURRENT - 11 AMPS NOMINAL,
 INRUSH CURRENT - 30 AMPS FOR TEN SECONDS.
3. AMBIENT TEMPERATURE 50°F TO 100°F (10°C to 38°C).
4. RECOMMENDED CABLE FOR WIRING MATING HUBBELL PLUG IS 50-3 CONDUCTOR - NEOPRENE JACKET 14 GAUGE WIRE.
5. ADAPTABLE FOR STANDARD 19 INCH RACK MOUNTING.

**INSTALLATION/INTERFACE
8004 CONTROLLER
Drawing 8052206**