

**8001 and 8002 Controllers**  
**Installation, Operation and Maintenance**  
**Instructions**  
**(for use with 8300 Compressor)**

**8040241**  
**Rev. 100 (7/2002)**

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June 14, 2005

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- Product Part Number
- Product Serial Number
- Product Application
- Specific Problem Area
- Hours of Operation
- Equipment Type
- Vacuum System Brand/Model/Date of Manufacture

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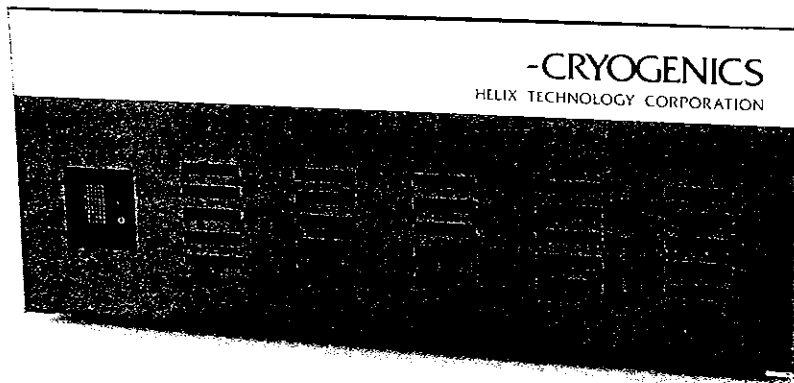


Figure 1-1: 8001 and 8002 Controller (8002 Controller Shown)

# Section 1: Introduction

<b>1.1 General</b> . . . . .	<b>1-1</b>
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## 1.1 General

This manual provides instructions for installing, operating and servicing the 8001 and 8002 Controllers, P/N 8052001 and P/N 8052002. If you are installing or operating a high-vacuum system, you should also have available the 8300 Compressor Manual (M8040242), and the Cryo-Torr® 100, 7, 8 and 8F Cryopump Manual (8040240).

The manuals cover three basic components: the cryopump, compressor, and the controller where applicable. Each manual presents information for installation, operation and servicing of that component. A manual is shipped with each system component (cryopump, compressor, and controller).

When you purchase a system, you will receive the three manuals necessary for system installation, plus a loose-leaf binder with index tab separators, allowing you to compile a complete indexed notebook.

The 8001/8002 Controller, shown in Figure 1.1, provides electrical control and interface functions between the 8300 Compressor and the Cryo-Torr 100, 7, 8 or 8F Cryopump.

The electrical differences between the 8001 and 8002 Controllers are as follows:

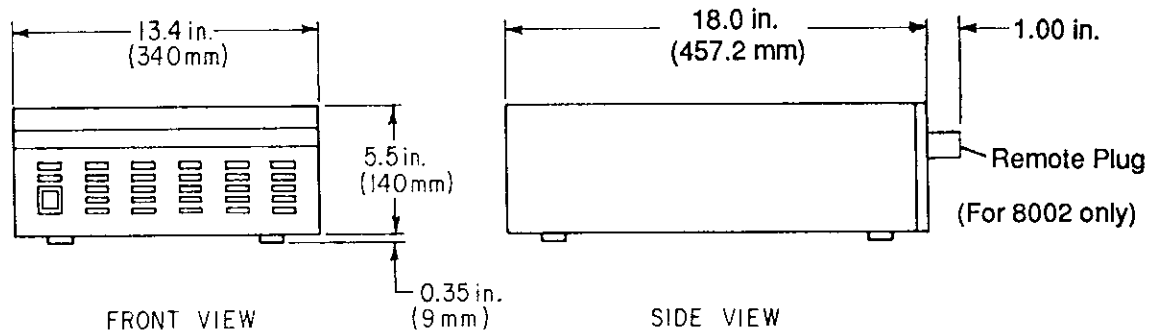
- The 8001 Controller operates on single-phase input power and has an electrical network for the operation of a single cryopump.
- The 8002 Controller operates on three-phase input power and has an electrical network for operation of two CT-100 cryopumps.

## 1.2 Installation, Operation and Servicing Instructions

Installation, Operation and Servicing Instructions for the 8001 and 8002 Controller provide complete and easily accessible information. All personnel with installation, operation, and servicing responsibilities should become familiar with the contents of these instructions to ensure safe, reliable, and efficient cryopump performance.

**Table 1.1 8001 and 8002 Controller Specifications**

**Dimensions**



**Weight**

CONTROLLER NO.	LBS	KG
8001	30	14
8002	47	21

**Power requirements (when operating Model 8300 Compressor)**

CONTROLLER NO.	POWER				OPERATING VOLTAGE RANGE (VOLTS)		INRUSH CURRENT (10 SECS. MAX.) (AMPS)	POWER CONSUMP. (KW)
	NOMINAL	HZ	PHASE	NOM. OPER. CURRENT (AMPS)	60 HZ	50 HZ		
8001	208/230	50/60	1	9.0	198-250	180-220	30	1.8
8002			3	9.0 (L1, L2) 1.5 (L3)				

**Interface**

Cold-head power receptacles: Mate with plugs on cold-head power cables.

(8001 Controller) Controller input-power receptacle: Mates with twist lock plug number NEMA: L6-15R (CTI-supplied).


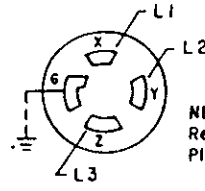
(8002 Controller) Controller input-power receptacle: Mates with twist lock plug number NEMA: L15-30R (CTI-supplied).

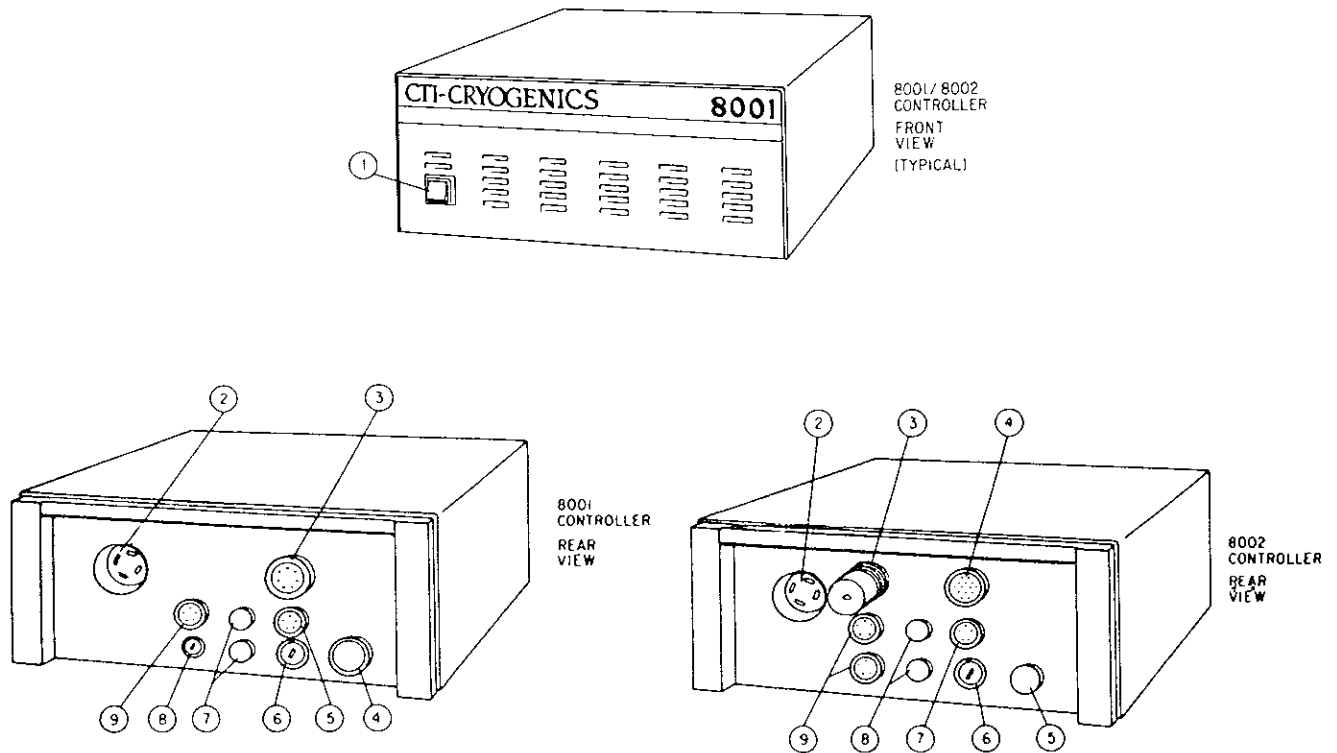
Controller power receptacle: Mates with plug on compressor power cable.

Controller low voltage control receptacle: Mates with plug on compressor control cable.

**Table 1.1 8001 and 8002 Controller Specifications (Cont.)**

Controller input-power cable wiring (customer supplied) is to be installed to the CTI-supplied receptacle plug per the schematic below, ensuring compliance with all national, state and local standards.

CONTROLLER NO.	CTI-SUPPLIED RECEPTACLE P/N	CABLE MATERIAL (CUSTOMER)	SCHEMATIC
8001	NEMA: L6-15R	SO-3 Conductor, 600V Neoprene Jacket and 14-Gauge Wire	<p>2-POLE, 3-WIRE</p>  <p>NEMA Reference : Receptacle : L6 - 15 R Plug : L6 - 15 P</p>
8002	NEMA: L15-30R	SO-4 Conductor, 600V Neoprene Jacket and 12-Gauge Wire	 <p>NEMA Reference : Receptacle : L15 - 30R Plug : L15 - 30P</p>



### 8001 Controller

### 8002 Controller

1. System power ON/OFF.
2. Input power connector.
3. Power to compressor connector.
4. System circuit breaker reset.
5. Compressor low voltage control connector.
6. Power selector switch (S2).
7. Fuses (5FU upper, 6FU lower).
8. Frequency selector switch (S3).
9. Cold head cable connector.

1. System power ON/OFF.
2. Input power connector.
3. Remote cable connector (J4).
4. Power to compressor connector.
5. System circuit breaker reset.
6. Power selector switch (S2).
7. Compressor low voltage control connector.
8. Fuses (5FU upper, 6FU lower).
9. Cold head cable connectors (2).

**Figure 1.2 8001 and 8002 Controller - switches and connectors**

# Section 2: Inspection

**2.1 Packaging of the System . . . . . 2-1**  
**2.2 The Controller. . . . . 2-1**

## 2.1 Packaging of the System

A Cryo-Torr High-Vacuum Pump System is packaged in four separate cartons. Listed below are the carton labels and the contents of each carton. Note that an Installation, Operation, and Servicing Manual is included in the cartons for the high-vacuum pump, compressor, and controller; each manual covers the component packaged in that carton.

When installing a Cryo-Torr High-Vacuum Pump System, CTI recommends that as you unpack a component; you then perform an inspection and the necessary tasks for system installation for the component according to the manual (included with the component). Final system installation and operation will be performed following procedures in the cryopump manual (8040240).

## 2.2 The Controller

On receipt, remove the 8001 or 8002 Controller from its shipping carton and inspect the controller for evidence of damage by examining the overall exterior, the electrical connections and switches.

- Report damage to the shipper at once.
- Retain shipping carton for storage or return shipment.

CARTON LABEL	CRYO-TORR 100, 7, 8 OR 8F	MANUAL NO.
CRYO-TORR®	Cryo-Torr 100, 7, 8 and 8F High-Vacuum Pump System	8040240
Compressor	8300 Compressor	8040242
Accessories	Maintenance Tool Kit and Accessories, P/N 8032040G013	-----
Controller	8001 or 8002 Controller	8040241

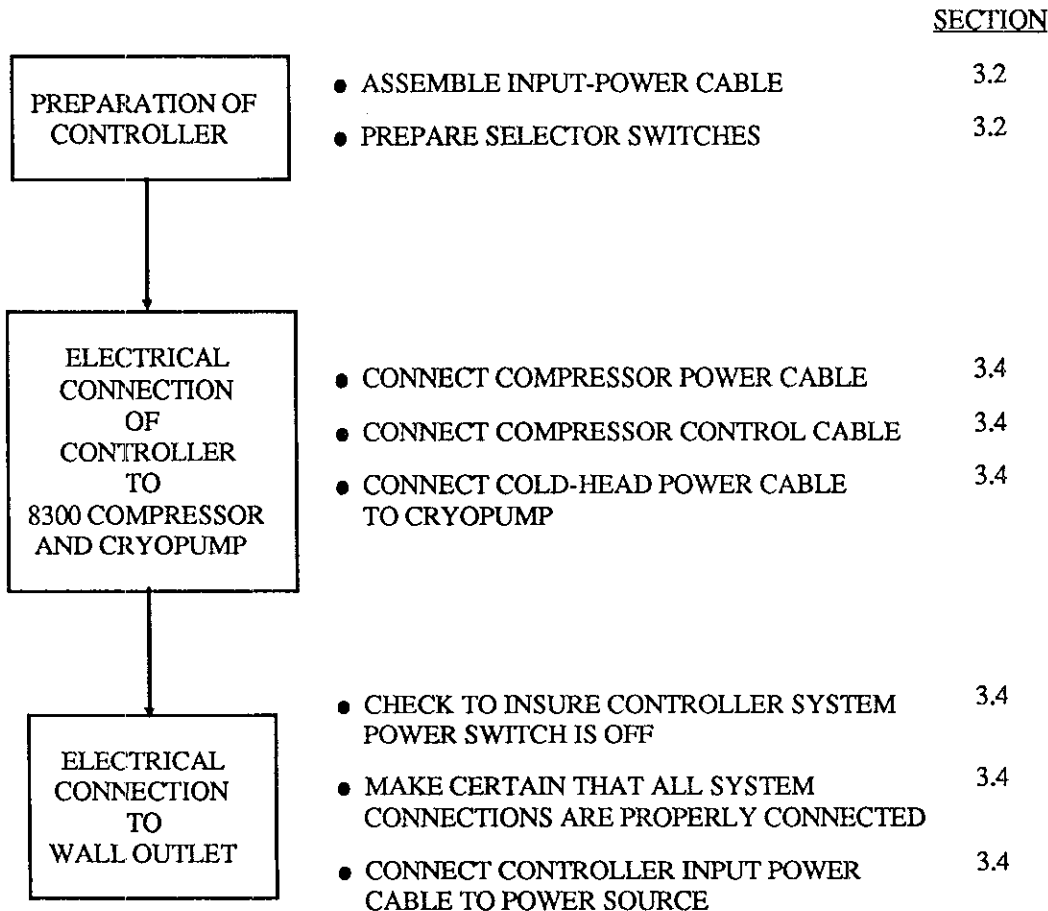


# Section 3: Installation

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3.3 Controller Positioning. . . . .	3-4
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## 3.1 General

Figure 3.1, is a block diagram of the major tasks required for controller installation as detailed in this section.



**Figure 3.1 Block diagram for 8001 and 8002 Controller installation**

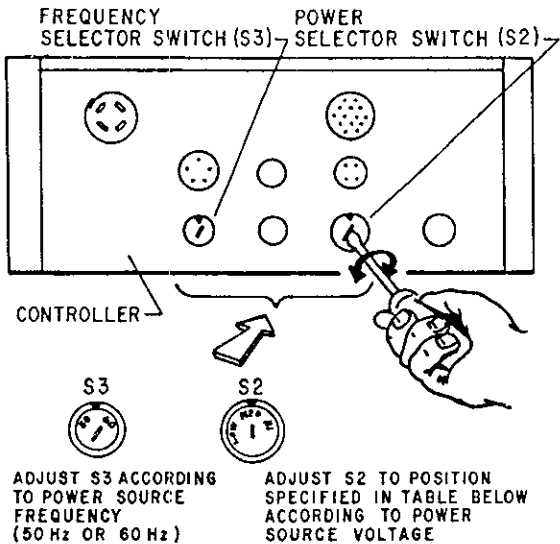
### 3.2 Preparing the Controller

Refer to Table 3.1, and prepare the controller for system installation.

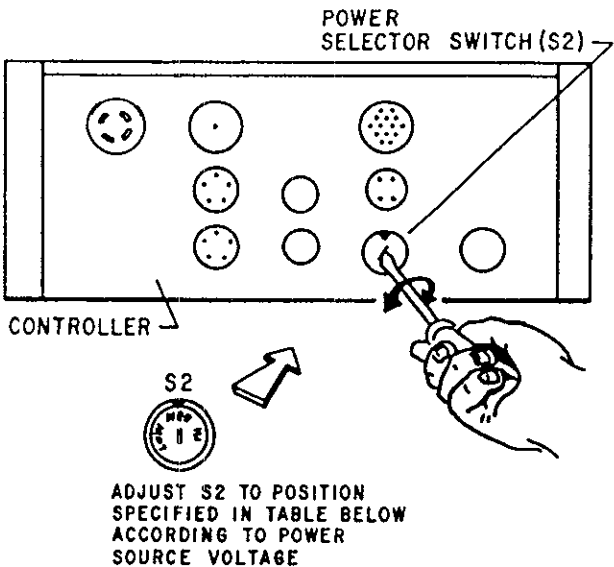
**Table 3.1 Preparing Controller for System Installation**

STEP	ACTION	PROCEDURE
1.	1. Assemble controller input-power cable.	1. Assemble the controller input-power cable using the CTI-supplied controller receptacle. Follow Table 1.1, page 1-3, being sure to comply with all national, state, and local codes. <i>Do not connect the controller to the power source at this time.</i> All of the preparation procedures must be completed before electrically connecting the controller.
2.	2. Prepare controller selector switch(es).  a. Prepare power selector switch (S2).  b. Prepare frequency selector switch (S3) (for 8001 Controller only).	2. Refer to Table 1.1, for electrical power requirements. Then, using a voltmeter measure the phase-to-phase voltage from the power source.  a. Follow Figure 3.2, and prepare power selector switch (S2).  b. Follow Figure 3.2, and prepare frequency selector switch (S3).

8001 Controller



8002 Controller



**PLEASE NOTE:** For CT-100 or CT-7 Cryopumps, always set the frequency selector switch (S3) to the 60 Hz position, regardless of whether the line frequency is 50 Hz or 60 Hz. Your unit will not function properly if switch (S3) is in the 50 Hz position.

For CT-8 or CT-8F Cryopumps, set switch (S3) to 50 Hz or 60 Hz, as appropriate.

POWER SELECTOR SWITCH (S2) POSITION	OPERATING VOLTAGE RANGE	
	60 HZ	50 HZ
LOW	198-220 VAC	180-210 VAC
MED	220-240 VAC	210-220 VAC
HI	240-250 VAC	NOT USED

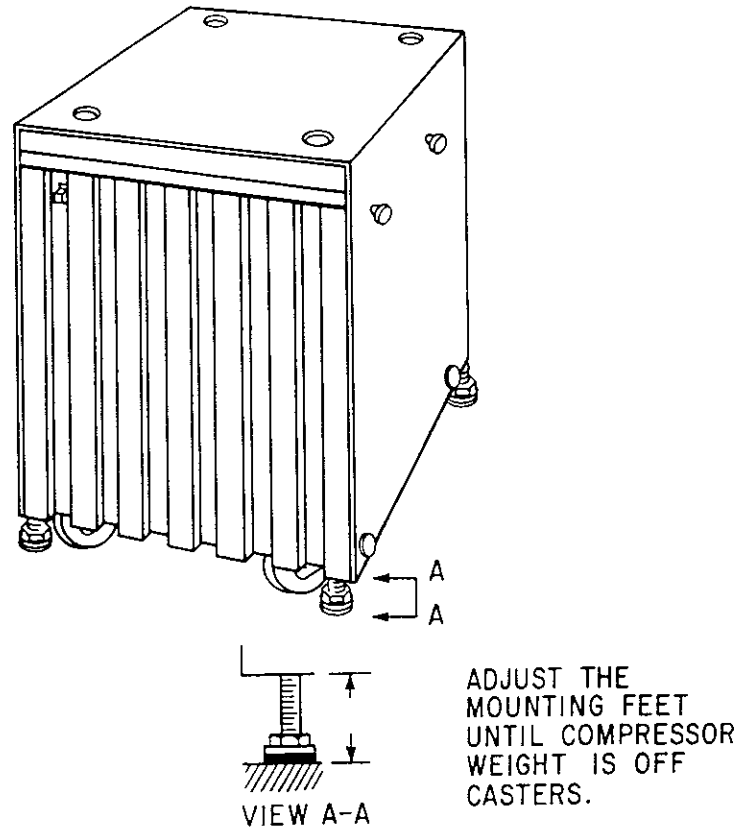
Figure 3.2 Preparing the controller

### 3.3 Controller Positioning

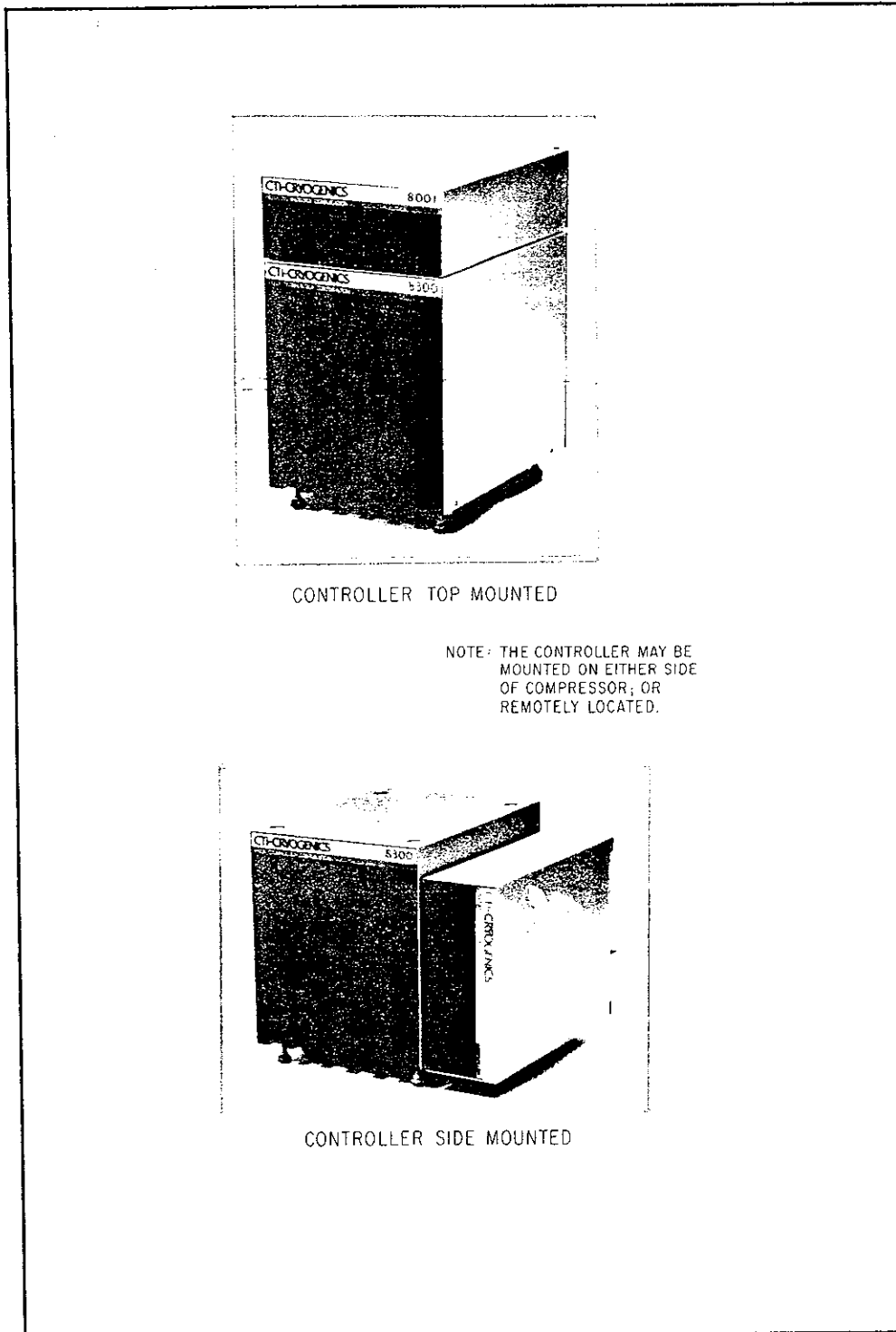
In typical configurations the controller as shown in Figure 3.4, is mounted on top of the compressor. Two shoulder screws provided with the compressor allow side mounting the controller to either side of the compressor for User convenience. The controller can also be remotely located on a bench top or equipment panel rack. (If panel racking is desired, order a panel mounting rack kit, P/N 8080280K003 which is available from CTI.)

If your installation requires side mounting the controller on the compressor (see Figure 3.4), then proceed as follows:

1. Remove the two shipping screws from the side of the compressor cover to which the controller is to be mounted. The shipping screws are installed on each side of the compressor cover, approximately six inches below the top.
2. Install the two shoulder screws (supplied with compressor) into the cover screw holes. Tighten screws securely.
3. Loosen jam nuts and extend the compressor mounting feet until weight of compressor is just off the casters. Tighten the jam nuts after establishing correct adjustments. See Figure 3.3.
4. Position and install the controller on the shoulder screws by aligning the cutouts on the bottom of the controller with the shoulder screws.




**Figure 3.3 Preparing compressor for controller side mounting**



**Figure 3.4 Typical controller installations**

### 3.4 Electrically Connecting the Controller

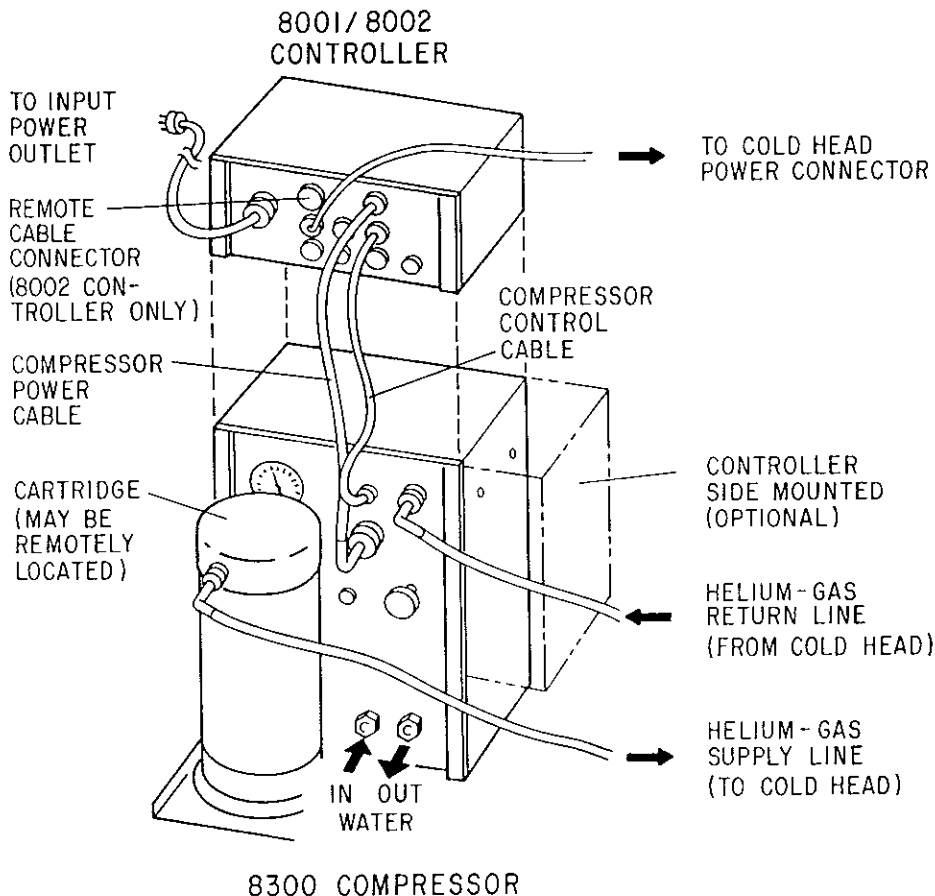


## WARNING

1. The system power switch on the front of the controller must be in the OFF position before making any and all electrical connections.
2. Do not connect the controller to the power source until all system connections have been made.

Refer to Figure 3.5 and electrically connect the controller to the system as follows:

1. Connect the compressor control cable to controller and compressor.
2. Connect the compressor power cable to controller and compressor.
3. Connect cold head power cable to controller and the cold head power connector.
4. Plug the controller input power cable into the power source.
5. Check to insure that all system connections are properly installed.
6. Your Cryo-Torr system is now ready for operation.



**Figure 3.5 Electrically connecting controller to system**

# **Appendix A**

## **Troubleshooting Procedures**

**A.1 Troubleshooting the Controller . . . . . A-1**

**A.2 Technical Inquiries . . . . . A-1**

### **A.1 Troubleshooting the Controller**

The controller troubleshooting procedures are summarized in Table A.1.

### **A.2 Technical Inquiries**

Please refer to page ii of this manual for a complete list of the CTI-CRYOGENICS' world wide customer support centers.

**Table A.1 Troubleshooting the Controller**

<b>Problem</b>	<b>Possible Cause</b>	<b>Corrective Action</b>
1) Cryopump makes growling noise.	1) Incorrect position of frequency selector switch and/or voltage selector switch.	1) a. Confirm incoming voltages and adjust power selector switch per Figure 3.2, page 3-3.  b. Check position of frequency selector switch. (8001 controller only).
2) Compressor/cold head fails to start.	1) Fuse blown.  2) Interconnecting cables to compressor are not connected.  3) Check main power in.  4) Controller circuit breaker open.	1) Check fuses and replace as required.  2) Check cables for proper connection.  3) Check source power, fuses or main circuit breaker.  4) Reset circuit breaker by pushing reset button on back of controller.

# Appendix B

## Electrical Schematic and Location Information

FIGURE NO.	DESCRIPTION	PAGE NO.
B.1	Electrical schematic for 8001 Controller (RC Network)	B-3
B.2	Electrical schematic for 8002 Controller (Scott "T" Network)	B-5



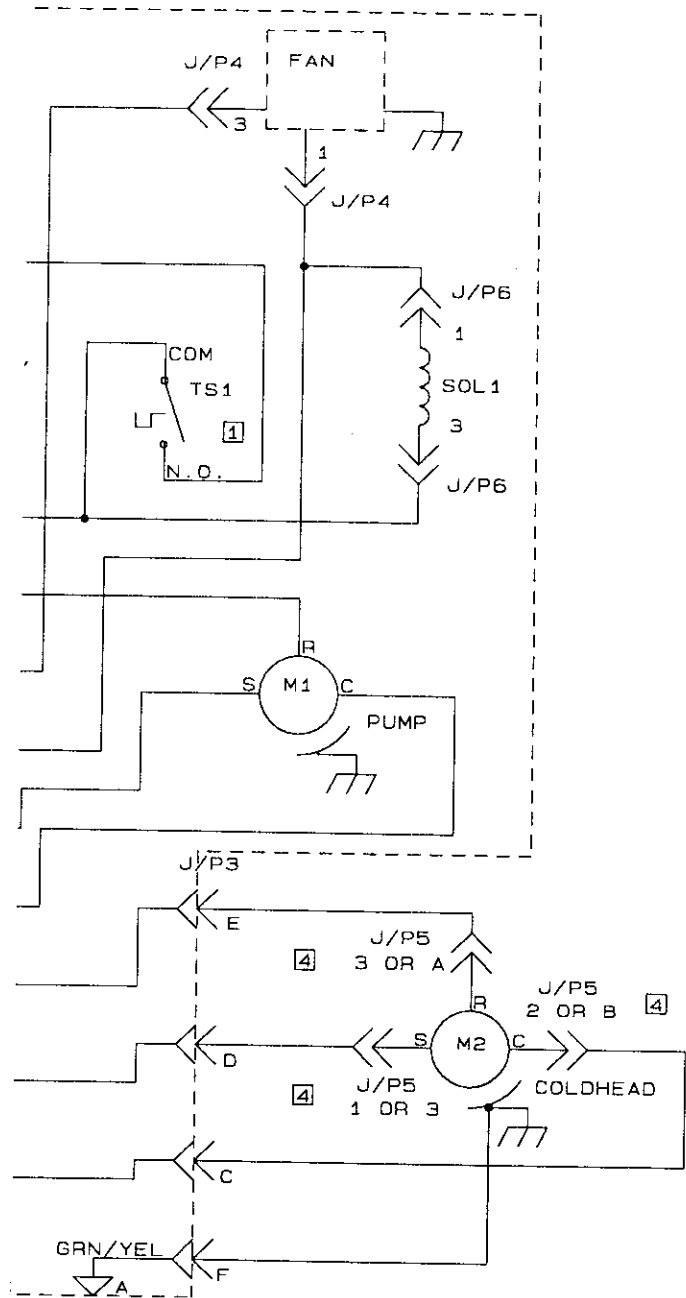
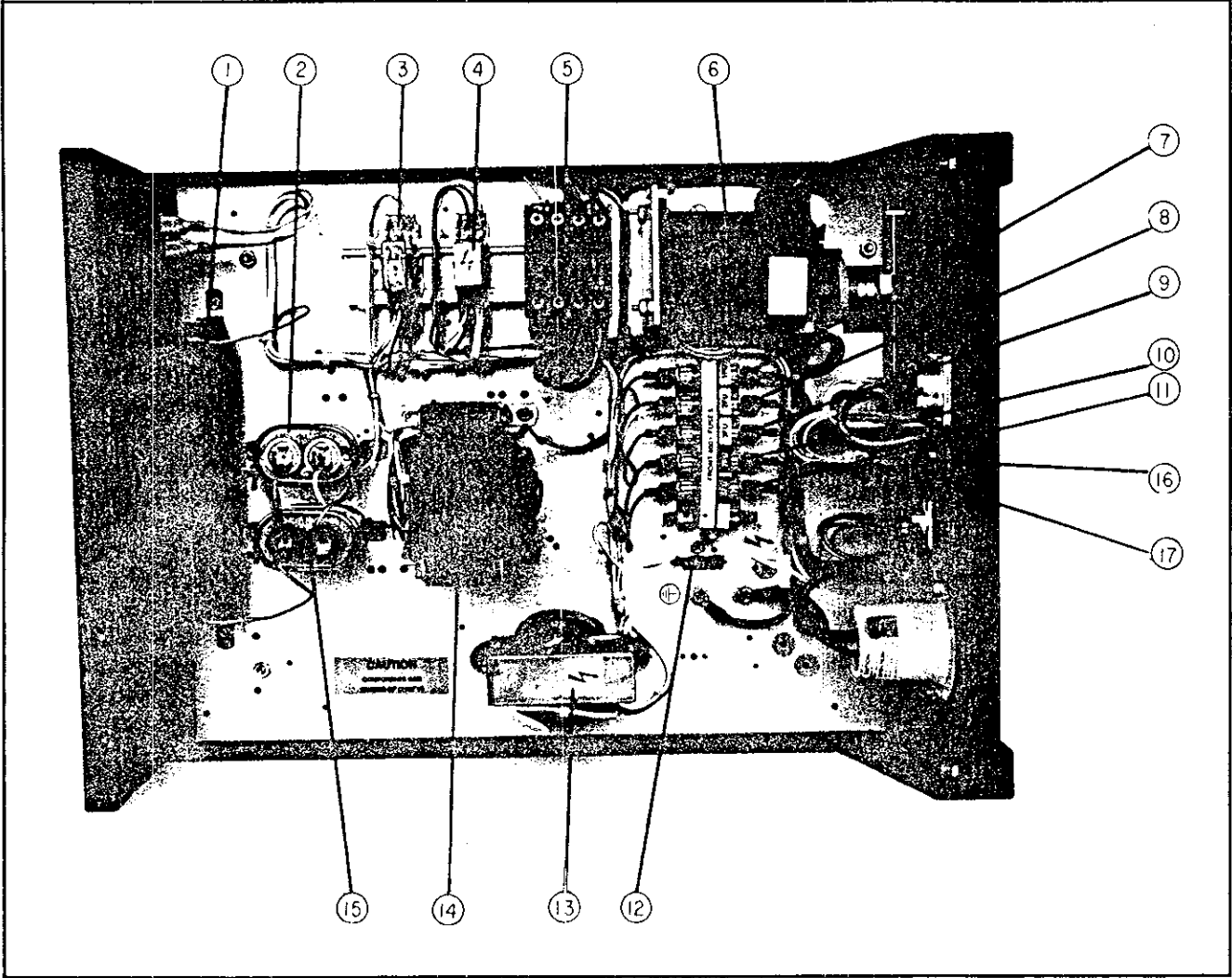


Figure B.1 Electrical schematic for Model SC Compressor, Drawing No. 8032539 Rev. A



# Appendix C

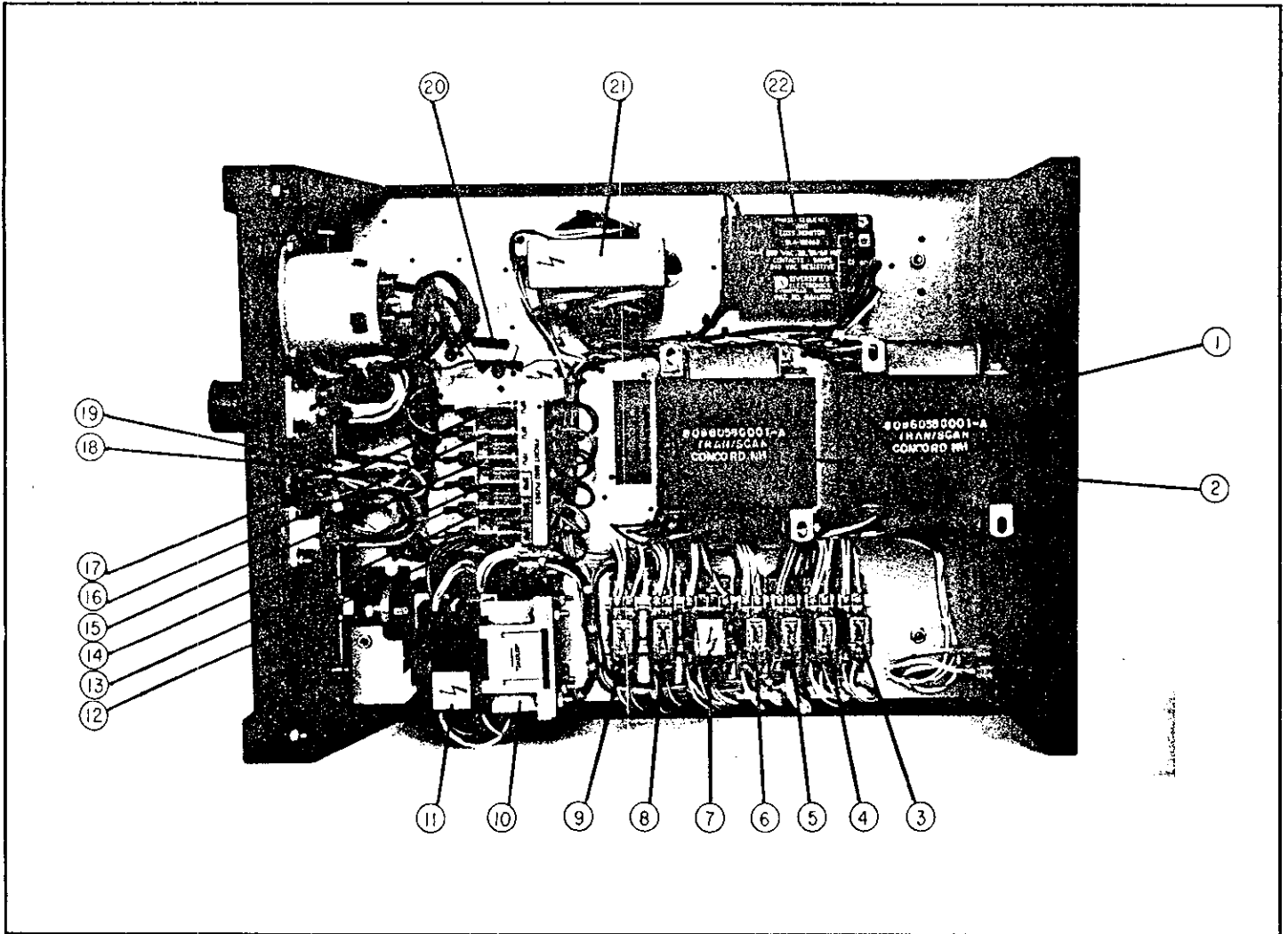
## Component Diagram



- |  |      |                                  |    |
|--|------|----------------------------------|----|
| 1. Cold-Head Drive Resistor - 150 $\Omega$ , 100 W | R1   | 10. Fuse, 1A, Slow-Blow          | F7 |
| 2. Capacitor, 2 $\mu$ f, 330V                      | C4   | 11. Fuse, 1A, Slow-Blow          | F8 |
| 3. Compressor Safety Relay                         | K5   | 12. Resistor, 150 $\Omega$ , 5 W | R2 |
| 4. Voltage Select Relay                            | K3   | 13. Control Transformer, 24 VAC  | T3 |
| 5. Motor Starter                                   | M1   | 14. Cold-Head Drive Transformer  | T4 |
| 6. Compressor Overload Protector                   | M10L | 15. Capacitor, 6 $\mu$ f, 330V   | C3 |
| 7. Fuse, 0.5A, Slow-Blow                           | F1   | 16. Fuse, 1A, Slow-Blow          | F5 |
| 8. Fuse, 0.5A, Slow-Blow                           | F2   | 17. Fuse, 1A, Slow-Blow          | F6 |
| 9. Fuse, 2A, Slow-Blow                             | F3   |                                  |    |

Figure C.1 Components in the 8001 Controller





- |                                 |      |                                    |     |
|---------------------------------|------|------------------------------------|-----|
| 1. Cold Head Drive Transformer  | T1   | 12. Fuse, 0.5A, Slow-Blow          | F1  |
| 2. Cold Head Drive Transformer  | T2   | 13. Fuse, 0.5A, Slow-Blow          | F2  |
| 3. Phase Monitor Relay          | K11  | 14. Fuse, 2A, Slow-Blow            | F3  |
| 4. Voltage Select Relay         | K6   | 15. Fuse, 2.5A, Slow-Blow          | F7  |
| 5. Compressor Safety Relay      | K5   | 16. Fuse, 2.5A, Slow-Blow          | F8  |
| 6. Remote ON/OFF Relay          | K4   | 17. Fuse, 2.5A, Slow-Blow          | F9  |
| 7. Voltage Select Relay         | K3   | 18. Fuse, 2A, Slow-Blow            | 5FU |
| 8. Cold Head No. 2 Remote Relay | K2   | 19. Fuse, 2A, Slow-Blow            | 6FU |
| 9. Cold Head No. 1 Remote Relay | K1   | 20. Resistor, 150 $\Omega$ , 5 W   | R2  |
| 10. Compressor Motor Starter    | M1   | 21. Controller Transformer, 24 VAC | T3  |
| 11. Motor Overload Protector    | MIOL | 22. Phase Monitor                  | PM1 |

Figure C.2 Components in the 8002 Controller



# Appendix D

## Remote Cryo-Torr High-Vacuum Pump Operation Using 8002 Controller

### Remote Operation

An electrical schematic is provided, see Figure D.1, for fabrication of an external switching circuit. This feature provides the capability for remote ON/OFF switching of the complete system (compressor and all cold heads) and for individual switching of electrical power to each of the cold head connectors J2 and J3. It is not mandatory that both remote switching features be utilized simultaneously. The switching circuit is connected into the control module of the compressor by means of the 14-pin system remote connector J4, which is located at the rear of the control module. Note that a P4 jumper connector is installed on the compressor as shipped. Refer to Figure 1.2, page 1-4, for location of the connector.

### Assembling the Switching Circuit

Assemble the remote switching circuit to suit your installation requirements as follows:

1. Uncouple the P4 jumper connector from the compressor. Wire the remote connector using 18-gauge stranded copper wire and a remote switch or relay contact with a minimum rating of 150mA at 24 VAC. Follow the schematic in Figure D.1, ensuring compliance with all national, state and local standards.

2. After fabricating and checking the remote switching circuit, connect it to the system remote connector J4.
3. Ensure that the system power ON/OFF switch on the compressor is off, and that all the remote switches are off before connecting the input power cable to the power source. The system power ON/OFF switch and circuit breaker safety features on the compressor will remain operational even with the remote switching circuit being utilized.
4. Turn the system power ON/OFF switch on the compressor module to the ON position and check for proper operation of the remote switching circuit.
5. If the use of the remote control switching circuit is to be discontinued, then simply disconnect the remote control switching circuit from J4 and reinstall the P4 jumper connector.

*Note:* The cryopump system will not operate if the jumper connector is not reinstalled.

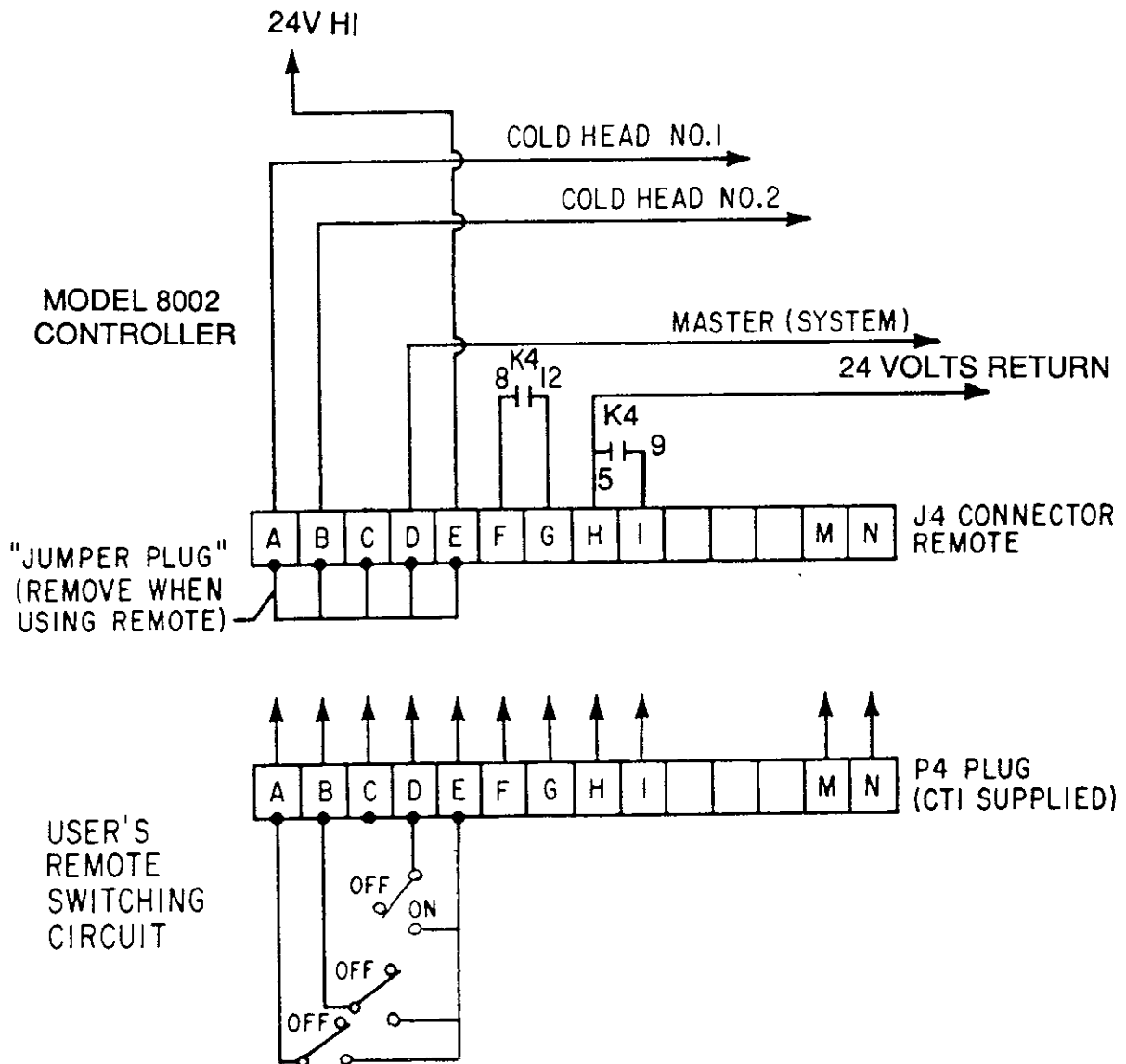
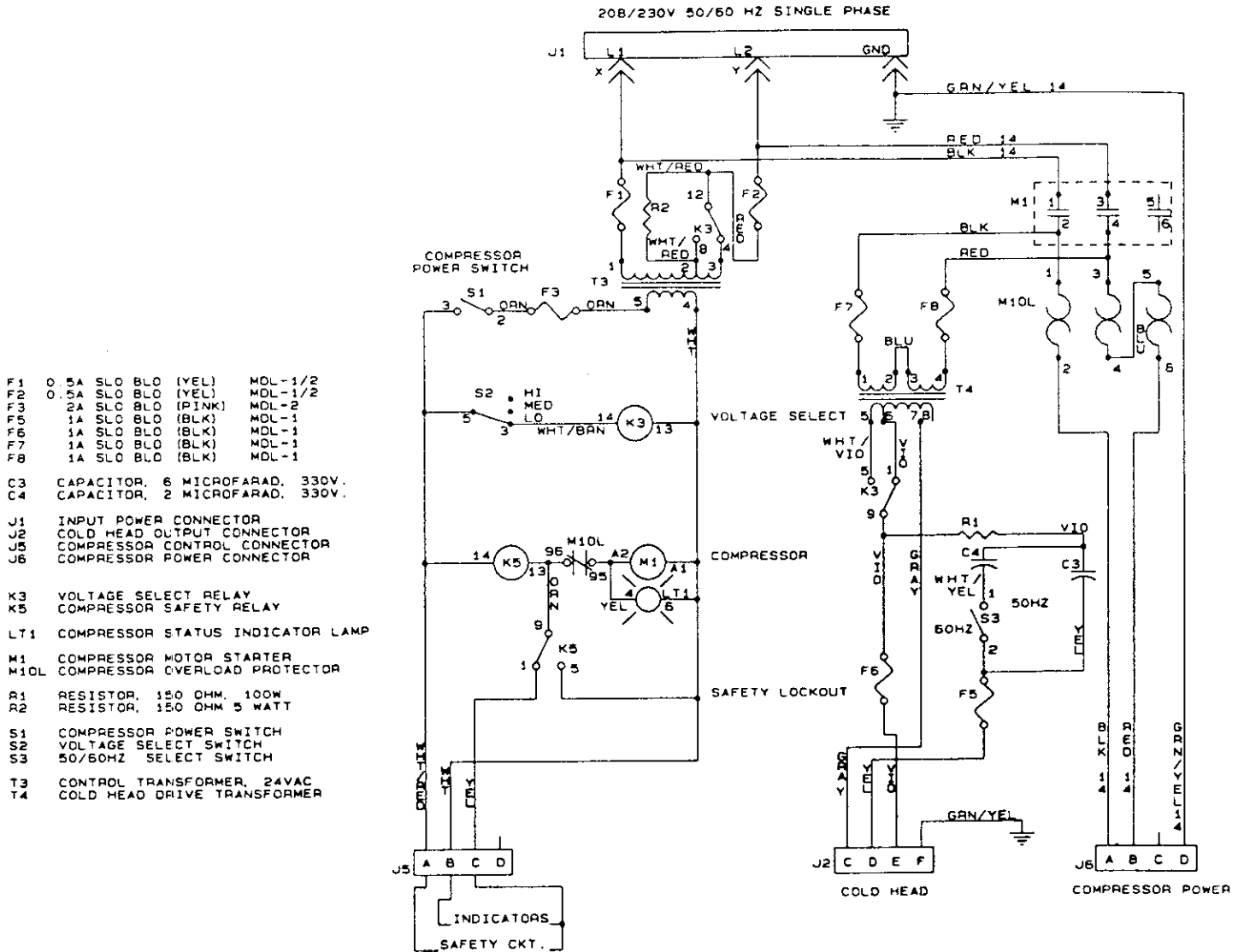


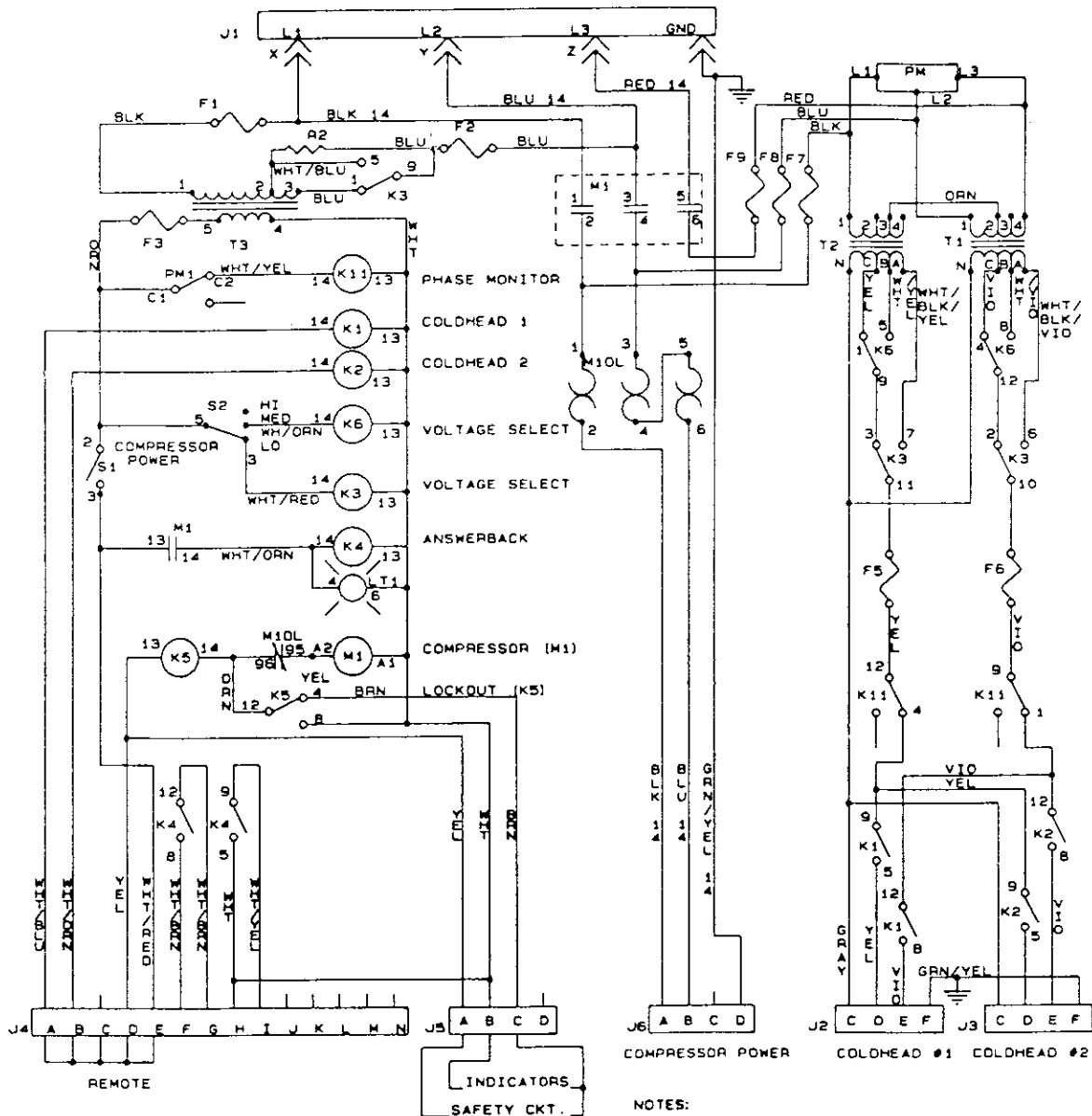
Figure D.1 Remote high-vacuum pump switching schematic



NOTES:

1. FOR WIRING HARNESS SEE 8052072.
2. ALL WIRES ARE 18 AWG, UNLESS OTHERWISE SPECIFIED.

Figure B.1 Electrical schematic for Model 8001 Controller (RC Network):  
Drawing 8052076 Rev. C



NOTES:  
1. FOR WIRING HARNESS SEE 8052073.  
2. ALL WIRES ARE 18 AWG, UNLESS OTHERWISE SPECIFIED.

- |    |                     |           |
|----|---------------------|-----------|
| F1 | 0.5A SLO BLO (YEL)  | MDL-1/2   |
| F2 | 0.5A SLO BLO (YEL)  | MDL-1/2   |
| F3 | 2A SLO BLO (PINK)   | MDL-2     |
| F4 | 2A SLO BLO (PINK)   | MDL-2     |
| F5 | 2A SLO BLO (PINK)   | MDL-2     |
| F6 | 2A SLO BLO (PINK)   | MDL-2     |
| F7 | 2A SLO BLO (WHT.)   | MDL-2 1/2 |
| F8 | 2.5A SLO BLO (WHT.) | MDL-2 1/2 |
| F9 | 2.5A SLO BLO (WHT.) | MDL-2 1/2 |
- 
- |    |                                     |
|----|-------------------------------------|
| J1 | INPUT POWER CONNECTOR               |
| J2 | COLD HEAD OUTPUT CONNECTOR          |
| J3 | COLD HEAD OUTPUT CONNECTOR          |
| J4 | REMOTE CABLE CONNECTOR              |
| J5 | COMPRESSOR CONTROL OUTPUT CONNECTOR |
| J6 | COMPRESSOR POWER OUTPUT CONNECTOR   |
- 
- |     |                         |
|-----|-------------------------|
| K1  | COLDHEAD 1 RELAY        |
| K2  | COLDHEAD 2 RELAY        |
| K3  | VOLTAGE SELECT RELAY    |
| K4  | REMOTE ON/OFF RELAY     |
| K5  | COMPRESSOR SAFETY RELAY |
| K6  | VOLTAGE SELECT RELAY    |
| K11 | PHASE MONITOR RELAY     |

- |      |                                     |
|------|-------------------------------------|
| LT1  | COMPRESSOR STATUS INDICATOR LAMP    |
| M1   | COMPRESSOR MOTOR STARTER            |
| M1OL | COMPRESSOR MOTOR OVERLOAD PROTECTOR |
| PM1  | PHASE MONITOR                       |
| R2   | RESISTOR, 150 OHM 5 WATT            |
| S1   | SYSTEM SWITCH                       |
| S2   | VOLTAGE SELECT SWITCH               |
| T1   | COLD HEAD DRIVE TRANSFORMER         |
| T2   | COLD HEAD DRIVE TRANSFORMER         |
| T3   | CONTROL TRANSFORMER, 24VAC          |

**Figure B.2 Electrical schematic for 8002 Controller (Scott "T" Network):  
Drawing 8052077 Rev. C**



