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<sup>&</sup>lt;sup>1</sup> Echelon is a U.S. Registered Trademark of Echelon Corporation. <sup>2</sup> Degree Master is a Trademark of Hill Phoenix.

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RC-2000 Line Power Filtering Requirements

Pressure Differential Board

<sup>3</sup> Demand Defrost is a Trademark of Demand Defrost Systems. <sup>4</sup> LON is a U.S. Registered Trademark of Echelon Corporation.

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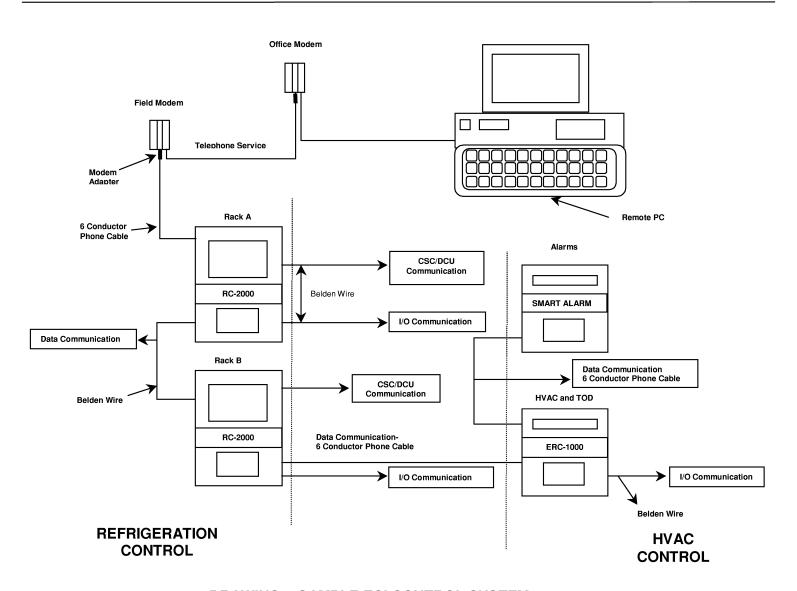
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## INTRODUCTION

The RC-2000 combines the latest hardware and software available for refrigeration and energy control. The RC-2000 can be either wall-mounted or rack-mounted.

The RC-2000 controls virtually all parameters of commercial refrigeration when networked with ECI Environmental Controls. The RC-2000 controls refrigeration. The ERC-1000 controls HVAC (heating, ventilation, and air-conditioning), light, anti-sweat heaters, and other miscellaneous loads.

By combining refrigeration and environmental control, ECI controls work together as an integrated system that reduces energy and maintenance costs, and safeguards products and equipment. Drawing 1 below shows the components that encompass a typical ECI Energy Control System, and demonstrates the capabilities within your RC-2000.



**DRAWING 1-SAMPLE ECI CONTROL SYSTEM** 

## **RC-2000 SPECIFICATIONS**

Power Requirements	230VAC @ ½ amp 110VAC @ 1 amp
Dimensions	
AMBIENT LIMITS Operating Temperature Humidity	32° to 110°F 0 to 95% RH, noncondensing
WIRING Power	3 wire, #18 awg, per local codes
RC-2000 to RC-2000	2 wire, 18 awg, shielded twisted pair, Belden 8760 or equivalent
RC-2000 to DCU	2 wire, 16 awg, unshielded twisted pair Belden 8471 non-plenum or equivalent; 85102 plenum or equivalent
Serial Module Communication	2 wire, 18 awg, unshielded twisted pair, Belden 8461 or equivalent
RC-2000 to Modem	6 conductor, flat phone cable, G-C Thorson 30-9965, or equivalent
MEMORY BACKUP	
Setpoint Backup	flash EEPROM
Battery Backup.	
FUNCTIONALITY	
Display	
User Interface	1 1 1 1
PC Access	
Programmability	
Usability	user-triendly
COMMUNICATION ABILITY	
RS232	
RS232	
RS485 Echelon Communication	
ECHCION COMMUNICATION	101 Case Controls

## RC-2000 HARDWARE SYSTEM OVERVIEW

The RC-2000 contains a Central Processing Unit (CPU) Base Unit, up to fifty nine Case Service Controllers (CSCs) or fifty nine Distributed Control Units (DCUs), and up to thirty two Serial Input/Output Modules.

On the CPU, a sturdy enclosure houses these components:

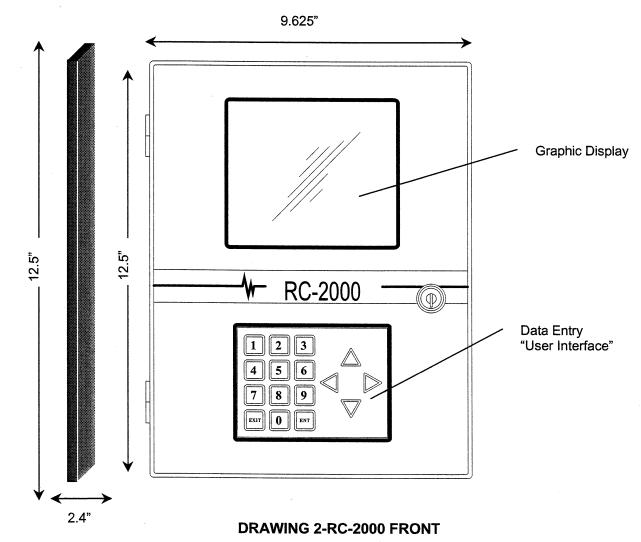
- Power supply
- Twenty-line by forty-character (20 x 40) backlit liquid crystal display
- Keypad
- CPU Board

The RC-2000 system provides these installation and maintenance features:

- Pilot holes for conduit fittings
- Removable keyed latch door

## **DISPLAY AND RUBBER KEYPAD**

The display and rubber keypad are found on the RC-2000 door; they provide you with a graphic means of firmware communication (see Drawing 2, below). The 20-line by 40-character LED backlit liquid crystal screen display uses power from the CPU Board power supply. Each screen provides clear menu choices that you can respond to via the number and arrow keys on the keypad. For more detail on the menu screens and programming capabilities of the RC-2000 system, refer to the RC-2000 Refrigeration Control Operations and Programming Manual, Form # 4464402800, shipped with this product.



## **POWER SUPPLY**

### **CAUTION**

USE a DEDICATED POWER SOURCE to power the RC-2000 whenever possible. FAILURE TO DO SO may cause EQUIPMENT DAMAGE.

The following RC-2000 power specifications are listed below. Refer to Drawing 3 below for a detailed illustration of the power supply and its components.

AC Input	internally fused at 1A
Voltage	115 or 230VAC
Power	50 or 60Hz
Operating Voltages	sent to CPU via ribbon
	cable
Voltages Supplied	+5VDC, +9VDC,
	+12VDC, -24VDC
	+9VDC battery backup
Battery Voltage	CPU informed when low

#### NOTE

ECI (Energy Controls International) recommends use of transient and surge protection.

When the RC-2000 system is in operation, the three red LEDs should always be lit.

## **RC-2000 BATTERY BACKUP**

The battery backup for the RC-2000 is found on the Power Supply Board in the enclosure. Refer to Drawing 3 below for a detailed illustration of the RC-2000 Power Supply and its components.

ECI ships the battery upside down and disconnected from the circuit. It is a standard 9V alkaline battery.

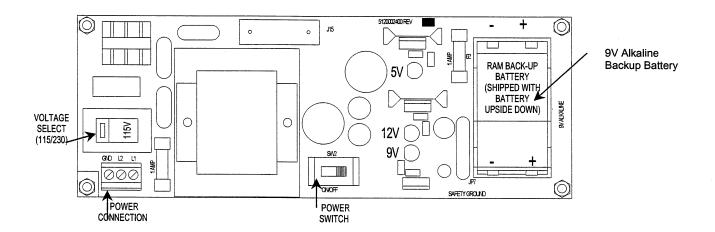
#### **IMPORTANT**

The battery should remain in the upside-down position until the unit is field started. **DO NOT ACTIVATE** the battery until the unit is field installed. Since all setpoint data is stored in non-volatile memory, the battery is not needed for memory backup.

## **NOTE**

This BATTERY backs up the time of day clock and logged information ONLY.

The FLASH EPROM backs up all setpoint data. The setpoint data backed up in FLASH EPROM is secure through a power loss.



**DRAWING 3-RC-2000 POWER SUPPLY** 

## **CPU BOARD**

A list of CPU Board features appears below:

V40 Microprocessor	10 MHz operation
Addressing capability	1 MB memory
RAM	512 kilobytes (KB)
Flash EPROM	2 or 4 MB

In addition, the CPU Board contains a watchdog timer circuit for processor lockup recovery, an eight position ID DipSwitch, 2 serial communication LEDs to show serial communication status, 1 LON communication LED to show CSC/DCU status, and 2 communication LEDs to show remote communication status. Refer to Drawing 4 below for a detailed illustration of the CPU Board and its features.

## **CPU BOARD SERIAL PORTS**

The CPU Board contains the following serial communication terminals and ports (see Drawing 4 below).

- 1. Serial terminal to I/O
- 2. RC-2000 RS485 terminal (3 pin)
- 3. Modem RS232 port
- 4. 1000 Series RS232 port
- 5. AUX RS232 port
- 6. The LON port (MIP Daughterboard)

## NOTE

The LON port is supplied on a removable daughter board. (This daughterboard contains the MIP chip, which operates the program to communicate from the V40 processor to the CSC or DCU units.)

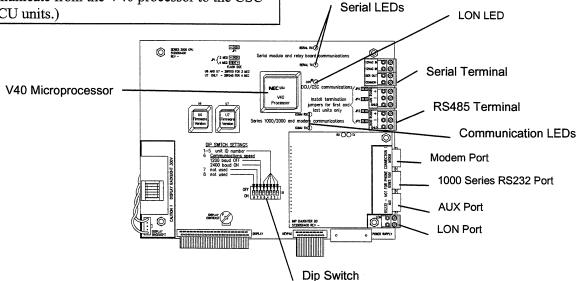
#### **CPU BOARD LEDs**

The CPU Board includes three sets of LEDs to show communication status (see Drawing 4 below).

The **Serial LEDs** are labeled Serial RX and Serial TX on the CPU Board. They are located in the upper right corner to the left side of the 12VAC termination connection. They will **flash continuously** to show **satisfactory serial communication** with the RC-2000. Serial LEDs that do not flash continuously indicate a serial communication problem. Refer to the Serial Communication Troubleshooting section of this manual for more information if you encounter a non-flashing LED.

The **LON LED** is labeled LON on the CPU Board. It is located toward the right side of the board just under the 12VAC termination connection. This LED blinks **rapidly** when the **MIP daughterboard** is installed and functioning correctly. (This information pertains to systems that have a MIP daughterboard installed for Echelon communications.)

The **Communication LEDs** are labeled COM RX and COM TX on the CPU Board. They are located to the center right side of the board. The Communication LEDs blink only when using remote communication or if the unit is dialing out. If you experience problems with RC-2000 remote communications, refer to the Troubleshooting Guide in this manual for troubleshooting information.



# INSTALLATION INSTRUCTIONS MOUNTING AND POWER CONNECTION

#### NOTE

All installation procedures must be performed in accordance with National Electric Code NFPA 70.

#### CAUTION

All RC-2000 units are shipped with the power supply switch in the 230V position. If powering with 120V, the switch must be moved to the 120V position for the unit to function.

## THE RC-2000 SYSTEM

## **UNPACKING**

Follow these steps upon receipt of your system:

- 1. Remove the RC-2000 from its shipping container and inspect it for shipping damage.
- 2. Review the container for content. You should receive:
  - a) RC-2000 Refrigeration Control Unit
  - b) RC-2000 Refrigeration Control Installation Manual, ECI Form # 4464402700
  - c) RC-2000 Refrigeration Control Operations and Programming Manual, ECI Form # 4464402800
  - d) Requested order of relay boards
  - e) Requested order of input boards
  - f) Requested order of transformers and power supply boxes

 Select a mounting area on the compressor rack system (uni-strut or other mounting base) or the compressor room wall. ECI recommends a middle rack eye-level location for easy viewing of the LCD.

## **PRECAUTION**

For optimum performance of your unit, ECI recommends the following mounting considerations:

## Do not mount your unit near areas of:

- possible water
- main air flow (because dirt could cause operation problems)
- electricity (i.e., noisy areas such as near contactors)
- high vibration
- close quarters (where it will get hot)
- 4. Mount the unit securely with two-inch mounting screws (you will find four keyed mounting holes inside the cabinet.) Refer to Figure 2, Equipment Mounting Specifications, in Appendix D.

## SYSTEM POWER CONNECTION

Follow the instructions below to power your RC-2000.

1. Locate the RC-2000's power supply board. Find the power switch, fuses, terminal block and voltage select switch (see Drawing 5 below).

## **NOTE**

The RC-2000 requires 115 or 230VAC, 50/60Hz power, which connects to the RC-2000 Power Supply Board.

The RC-2000 should have its own circuit to protect against power spikes. ECI recommends this circuit be protected with a breaker or fuse.

#### **IMPORTANT**

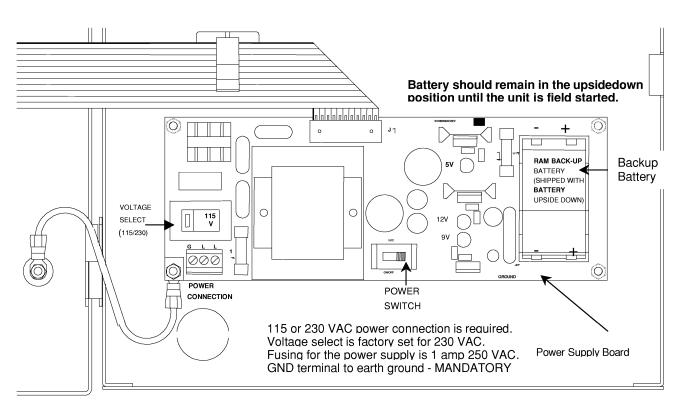
Power to the RC-2000 is switch-selectable. ECI ships the unit with the switch in the 230V position.

- 2. Move the slide switch found on the bottom center of the Power Supply Board to the left position to energize power to the RC-2000. (Refer to Drawing 5 below).
- 3. Verify receipt of RAM backup battery. It is a standard 9V alkaline battery that is shipped upside down.

#### NOTE

Do not activate the battery until the unit is field installed. Since all setpoint data is stored in non-volatile memory the battery is not needed for memory backup.

Refer to Figure 5 in Appendix D, Series 2000 Power and I/O Connection, for a full detailed installation diagram.



**DRAWING 5-RC-2000 POWER CONNECTION** 

## RC-2000 CPU COMMUNICATION

# CPU COMMUNICATION TERMINALS AND PORTS

## **SERIAL TERMINAL**

Use the Serial terminal to connect the Serial Input/Output Modules to the RC-2000. You will find this terminal on the top right half of the CPU Board. It is silk-screen labeled "Ser Out." Make the connection with a pair of non-shielded wires that are polarity sensitive (use Belden wire #8461, 2 wire, #18 unshielded twisted pair). Start the loop at the RC-2000; proceed to all the Serial Input/Output modules in a daisy chain configuration. See Drawing 6 on the following page and Figure 5 in Appendix D for a detailed diagram of this terminal and the CPU Board.

#### NOTE

Serial Input/Output modules that are remote mounted greater than 50 feet must have local power supplied.

## RC-2000 RS485 TERMINAL (3 PIN)

The RC-2000 RS485 terminal provides RC-2000 to RC-2000 communications. The RC-2000 terminal connects to the RC-2000s through a pair of polarity sensitive, shielded wires (use Belden wire #8760, 2 wire, #18 shielded twisted pair).

You will find this terminal on the middle of the CPU Board. It is silk-screen labeled. Use the plus (+), minus (-), and shield (shld) terminals for your connections. See Drawing 6 on the following page and Figure 5 in Appendix D for a detailed diagram of this terminal and the CPU Board.

## **CAUTION**

This shield should only be connected to one RC-2000 CPU Board in the communication loop.

If it is tied to more than one unit, the shield can create a ground loop.

#### **IMPORTANT**

Termination resistors must be used on the first and last RC-2000 in the loop.

Configure the termination resistors with jumpers JP2 and JP3 on the CPU Board.

Remove jumpers JP2 and JP3 for those units in the middle of the loop.

Install the jumpers on the first and last units in the loop.

## MODEM RS232 PORT AND SERIES 2000 TO 1000 RS232 PORT

The Modem port or the Series 2000 to 1000 port will connect the modem to the RC-2000. To make this connection, you will need special adapters and phone cable wiring. This port communicates to the RC-1000 via the RJ-11 plug (modem 6-Pin phone jack) and is located on the bottom right half of the CPU Board. It is silk-screen labeled.

These two ports are wired in parallel and can be used interchangeably for direct connect, modem, smart alarm, and RC-1000 communications. See Drawing 6 on the next page and Figure 5 in Appendix D for a detailed diagram of this port and the CPU Board.

## **AUX RS232 PORT**

The AUX Port provides remote communication from the Infrared Refrigerant Information System (IRIS) Leak Detector. To make this connection you will need special adapters and phone cable wiring. (Refer to the Communication Connection section on the next page.) The AUX RS232 Port is found on the bottom right corner of the CPU Board underneath the MIP daughterboard. It is silk-screen labeled. See Drawing 6 at the bottom of this page and Figure 5 in Appendix D for a detailed diagram of this port and the CPU Board.

## LON PORT (MIP DAUGHTERBOARD)

Use the LON port to connect the RC-2000 to the CSC or DCU controllers.

See Drawing 6 below and Figure 5 in Appendix D for a detailed diagram of this port and the CPU Board. Refer to the CSC Case Service Controller Installation and Operations Manual, ECI Form #4464402900, or DCU/ECC Distributed Control Unit/Electronic Case Control Installation and

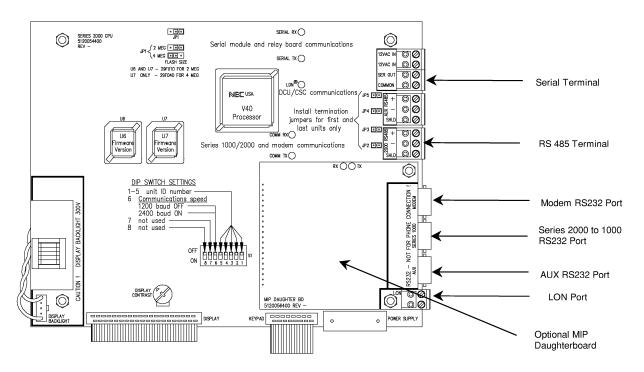
*Operations Manual*, ECI Form # 4464403200 for more information on LON port communications.

Make the connections through a pair of wires that aren't polarity sensitive (use PLENUM: Belden wire #85102, 2 wire, 16 awg, unshielded twisted pair, and NONPLENUM: Belden wire #8471, 2 wire, 16 awg, unshielded twisted pair).

## **NOTE**

RC-2000 CPU Part # 5120001400 has a LON port installed.

RC-2000 CPU Part # 5120054400 does not have a LON port installed. The LON port is installed on the optional MIP daughterboard, Part # CC\20056400. The MIP daughterboard is installed only if it is ordered to perform Echelon communications. This port is located on the bottom right half of the CPU Board on the MIP daughterboard. It is silk-screen labeled



**DRAWING 6-CPU BOARD WITH SERIAL PORTS** 

.

## **COMMUNICATION CONNECTIONS**

The right side of the RC-2000 CPU Board has a six-conductor phone jack that is used for modem serial communication. The CPU Board also contains another six-conductor phone jack that connects to ECI Series 1000 Controllers.

To use these ports you will need the following adapters:

- Modem Adapter ECI Part # CC/01665400 (25-PIN)
- PC Direct Connect Adapter
   ECI Part # CC/01686400 (25-PIN)
   Or
   ECI Part # CC/01687400 (9-PIN)

The RC/Modem Adapter connects a 25-pin RS232 port on the back of the modem to a six-conductor phone cable. This six-conductor flat phone cable connects the modem port on the RC-2000 CPU Board.

The PC Direct Connect Adapter connects the RS232 COM port on a computer directly to the modem port on the RC-2000 CPU Board by using a standard six-conductor flat phone cable.

### **NOTE**

This section details modem and PC direct store communications. For a detailed **diagram showing the connections discussed** on the following pages, see **Figure 17** in Appendix D.

## MODEM INSTALLATION

ECI offers a choice of modems for each installation. They are listed as follows:

- Practical Peripherals PMM14.4 MT 11 External
- U.S. Robotics, 33.6 or 56K Sportster

Minor software setup is required before initial use. Follow these steps to set the modems in the field.

- 1. Attach the modem to Unit #1 via a six-conductor phone cable to the modem port on the CPU board.
- 2. Enter [the second level access code] (default is 9876).

- 3. Press [Main Menu] to enter the system, press [Alarm Dial Out], then [Miscellaneous].
- 4. Add the appropriate string to the modem command line. See Tables 1, 1A, and 2 following.
- 5. Exit out to the banner screen and allow the unit to save to flash.
- 6. Turn the modem off and on to reset it.
- 7. Turn Unit #1 off, wait 15 seconds, and turn it back on. Unit #1 will now initialize the modem.

#### NOTE

Through this process, the modem send and receive lights will flash. This process takes about one minute.

8. Repeat steps 2-5 for each additional unit in the store.

## TABLE 1-MODEM COMMAND LINE SETTINGS FOR RC-2000 VERSION 4.40 AND LOWER AND ERC/EC-1000 VERSIONS 5.20/7.20 AND LOWER

BAUD RATE	MODEM	COMMAND LINE
2400/1200	Practical Peripherals 144	E0V0X1&C1&D2&Q6
2400/1200	Hayes Optima 24 (discontinued)	E0V0X1&C1&D2&Q6
9600	U.S. Robotics 33.6 or 56K Sportster	E0V0X1&M4&A0
2400	U.S. Robotics 33.6 or 56K Sportster	E0V0X1&M0&N3&U2
1200	U.S. Robotics 33.6 or 56K Sportster	E0V0X1&M0&N2
<b>Note</b> : The 0 in the command string represents zero.		

## TABLE1A-MODEM COMMAND LINE SETTINGS FOR RC-2000 VERSION 4.41 AND HIGHER AND ERC/EC-1000 VERSIONS 5.21/7.21 AND HIGHER

BAUD RATE	MODEM	COMMAND LINE
2400/1200	Practical Peripherals 14.4	&Q6
9600	Practical Peripherals 14.4	&Q5
9600	U.S. Robotics 33.6 or 56K Sportster	&M4&N6&U2&A0
2400	400 U.S. Robotics 33.6 or 56K Sportster &M0&N3&U2&A0	
1200 U.S. Robotics 33.6 or 56K Sportster &M0&N2&A0		
<b>Note</b> : The 0 in the command string represents zero.		

TABLE 2-U.S. ROBOTICS 33.6 or 56K SPORTSTER MODEM DIPSWITCH SETTINGS

SWITCH NUMBER	SWITCH SETTING	READING
1	UP	DTR Normal
2	UP	Numeric result codes
3	DOWN	Display result codes
4	DOWN	No echo offline commands
5	UP	Auto answer on first ring
6	UP	Carrier detect normal
7	DOWN	Load factory default
8	DOWN	Smart mode

# MAKING MODEM TO RC-2000 CABLES

To communicate between the RC-2000 and a modem, use a standard six-conductor communication cable with a modular RJ-11 jack on both ends. The cable must be assembled with the jacks crimped the same way on both ends. With the tab facing towards you install cable with the "white conductor on the right" for both ends. See Drawing 7 below for details.

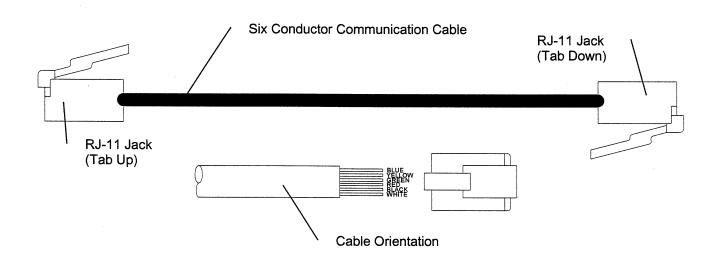
To make custom cable lengths or repair a cable, you will need a cable termination tool. This tool (Part # CC/CRIMP-1) and RJ-11 connectors (Part # CC/PCONN) are available from ECI. The drawing

below shows the standard cable assembly ECI uses. You may order a cable tester from ECI (Part # CC/60028400).

#### NOTE

ECI manufactured cables apply the **White on Right Rule**. They are assembled with the white wire on the right side of the connector. If one end needs to be shortened, make sure the proper connector orientation is maintained.

If the ends of the cable being tested can't physically be plugged into the same tester, then two testers will be needed to perform the test.



**DRAWING 7-COMMUNICATION CABLE ORIENTATION** 

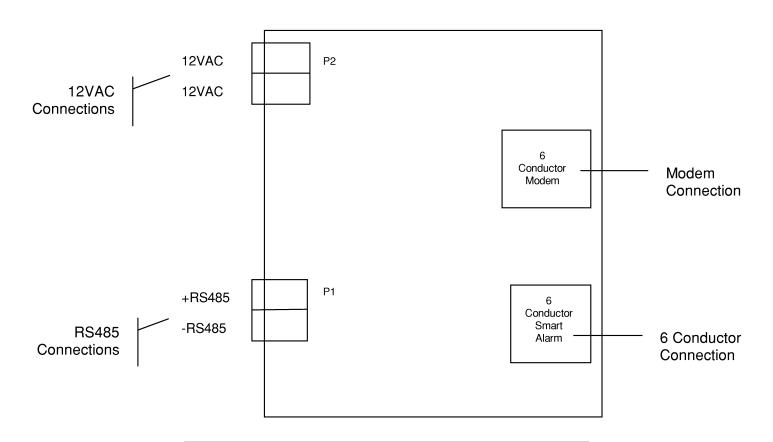
## **RS485 REPEATER BOARD**

The RS485 Repeater Board is used to increase the remote communication ability of the ECI controller. If the RC-2000 remote communication needs exceed the distances specified in the Field Wiring Reference Guide (Table 22, found in Appendix C), use this board to increase your maximum distance. Refer to Drawing 8 below and Drawing 9 on the next page for more information.

ECI offers two types of RS485 Repeater Board Configurations. **The RS485 Module Assembly** (without power supply [Part # CC/20104400]) and the **RS485 Enclosure Type with Power Supply** (Part # 01679407).

#### **IMPORTANT**

You will need a 12VAC power source to operate the Repeater Board.



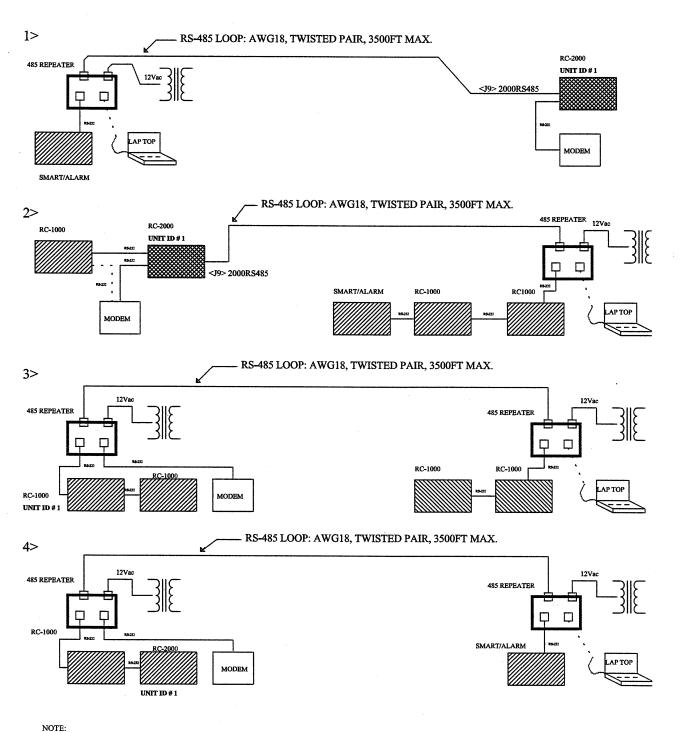
#### NOTE

The **12VAC** connections **are not** polarity sensitive. **P2** is silk-screened to the right of the 12VAC connections on your board.

The **RS485** connections **are polarity sensitive**. Observe the polarity of connection when installing.

**P1** is silk-screened to the right of the RS485 connections on your board.

## < RS-485 REPEATER CONFIGURATION >



- Do not exceed 100ft max on RS-232 cable. A laptop computer can be hooked up to the repeater (modem jack) via an adapter (ECI Part # 9P PC Direct).

## **DRAWING 9-RS485 REPEATER BOARD CONFIGURATION OPTIONS**

## SERIAL HARDWARE AND HOOKUP

## INTRODUCTION

Serial describes the data transfer method from I/O devices to the RC-2000. A non-shielded two wire serial connection made between the modules leads back to the RC-2000, and a 'Data Bit Stream' transfers the information through them (i.e., the digital signals follow each other much like a train of information). This type of information transfer requires a two-wire connection.

## SERIAL INPUT/OUTPUT MODULE POWER REQUIREMENTS

All ECI serial boards require a 12VAC power source. ECI's TF-6 transformer has a dual voltage, 120 or 230VAC primary with a 12VAC, 56VA secondary output for serial I/O power. The 56VA rating should not be surpassed as per Table 3 below. Make all 12VAC connections on the I/O boards as per the drawings in the sections ahead. All connections should be daisy chained through the 12VAC In and 12VAC Out connections on each I/O board. Refer to Table 3 below for voltage information. Refer to Drawings 10 and 11 on the following page or Figure 6 in Appendix D for TF-6 and TF-16 transformer configuration.

#### NOTE

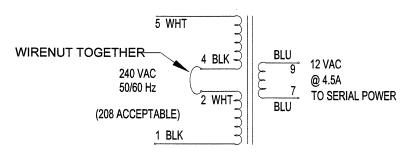
12VAC power is not to EXCEED a distance of 50 feet from the Serial Relay Boards or 100 feet for the Serial Modules.

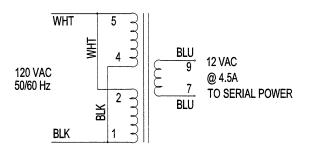
TABLE 3 - LOAD CHART (PAGE POWER REQUIREMENTS)		
TF6 Transformer, 56VA maximum current draw 4.5A		
TF16 Transformer, 40VA maximum current draw 3.3A		
SYSTEM COMPONENT	MULTIPLIER	
Each Serial Relay Board	.50 A	
Each Serial Input Module	.03A	
Temperature, 0-10V, Digital		
Each 16 Channel Input Module	.10A	
Each Serial Pressure Module	.10A	
Each Refrigerant Leak Transducer	.23A	
I/O Po	ower	
Total Less Than or Equal to 4.5A for TF6 transformers		
Total Less Than or Equal to 3.3A for TF16 transformers		
NOTE: To determine the SYSTEM AMP DRAV	W, perform the following calculations:	

- 1. Determine the current draw for each of your system components by using the following equation:
  - ( $\hat{\mathbf{r}}$  of each component)  $\mathbf{x}$  (multiplier) = System Current Draw (for that component)
- Next, add together all of the system component current draw results to determine the total System Amp draw.

## 240/208 VAC CONFIGURATION

## 120 VAC CONFIGURATION





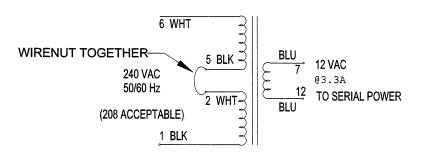
**TF-6 TRANSFORMER** 

**TF-6 TRANSFORMER** 

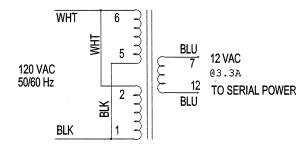
## **DRAWING 10-TF-6 TRANSFORMER WIRING**

## 240/208 VAC CONFIGURATION

## 120 VAC CONFIGURATION



**TF-16 TRANSFORMER** 



**TF-16 TRANSFORMER** 

## **DRAWING 11-TF-16 TRANSFORMER WIRING**

## SERIAL COMMUNICATION

Serial communication originates at the RC-2000 CPU and is supplied via a two-wire, 18 awg, unshielded twisted pair wire. Table 4 shows the wire size and length to use.

Each serial connection is done through the designated terminal strip on each particular board (see the drawings in the sections ahead).

Designated termination points are silk-screen labeled. There is generally an "in" for the signal into the board, and an "out" to continue the signal to the other boards in the system. An arrow marks a "common" termination point because this is a polarity sensitive circuit. If the termination connector is removed from a particular board, the continuity between the in and out signals will become an open circuit.

#### NOTE

With 12VAC power, the maximum distance is 50 feet. Distances greater than 50 feet will require a local power supply.

Firmware version 4.00 or greater will not establish serial communication with an I/O board until it is assigned within the program.

Serial communication is polarity sensitive.

#### **CAUTION**

Observe the polarity of serial connection when installing. Incorrect polarity will cause an inaccurate reading or no reading at all.

## RC-2000 CPU SERIAL CONNECTION

The CPU Board serial communications circuit is optically isolated and requires 12VAC power. Bring the power from one of the serial modules to the CPU Board serial terminal labeled "12VAC." (See Drawing 12 below.) See Table 4 below for appropriate communication wire size and length.

Two serial status LEDs are located to the left side of the board above the 12VAC termination connection. They are labeled Serial RX and Serial TX (see Drawing 12 below). A continuous flashing light indicates satisfactory communication with the RC-2000. A non-flashing light indicates a problem in the communication status. Refer to the Serial Module Troubleshooting section of this manual for more information if you encounter a non-flashing LED.

TABLE 4 – SERIAL COMMUNICATION WIRE SIZE AND LENGTH

Table 22 – Field Wiring Reference Guide

Serial Module Type:	Wiring Guidelines:	
Relay Board:	Maximum Length: 50 ft.	
-	<b>Belden #:</b> 8461 or equiv.	
	Gauge: 18 awg.	
Modules:	<b>Maximum Length:</b> 100 ft.	
	<b>Belden #:</b> 8461 or equiv.	
	Gauge: 18 awg.	
<b>Note:</b> For complete wiring specifications, refer to		

Serial Status LEDs

Serial

DRAWING 12-CPU SERIAL CONNECTION

## INPUT/OUTPUT MODULES

## INTRODUCTION

ECI offers the following types of Input/Output (I/O) modules:

In combination, they comprise your system, and can be setup for eight channel I/O addressing or sixteen channel universal addressing.

- 1. Digital Output 8 Channel
- 2. Analog Output 4 Channel
- 3. Digital Input 8 Channel
- 4. Analog Input 8 Channel
- 5. Universal Input 16 Channel

# 8 CHANNEL SYSTEM CAPABILITY

The original system, prior to the introduction of the 16 channel universal input boards, contained a group of eight boards per I/O type, (see Table 5 below).

TABLE 5-EIGHT CHANNEL I/O SYSTEM SETUP CAPABILITY

Analog/Outp (SAO4) (4 Channel)	(SR8)	(SAI8)	Digital/Input (SDI8) (8 Channel)
Board	Board	Board	Board
Address: 1	Address: 1	Address: 1	Address: 1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8

## NOTE:

**Serial Analog Output Module (SAO4):** 4 Outputs, each with a single board address 1-8.

**Serial Relay Board/Digital Output (SR8):** 8 Outputs, each with a single board address 1-8.

**Serial Analog Input Module (SAI8):** 8 Inputs, each with a single board address 1-8

**Serial Digital Input Module (SDI8):** 8 Inputs, each with a single board address 1-8.

The system as set up above will support:

- Maximum of 64 digital inputs
- Maximum of 64 analog inputs

- Maximum of 32 analog outputs
- Maximum of 64 digital outputs

# 16 CHANNEL UNIVERSAL SYSTEM CAPABILITY

The system has evolved with the capability to use a universal input 16 channel board (SUI16). If the SUI16 is added to the system, it replaces the capability to support the Serial Analog Input 8 Channel Module (SAI8) and the Serial Digital Input 8 Channel Module (SDI8) of the same board address. The SUI16 offers increased system capability because of the independent flexibility of each channel.

TABLE 6-SIXTEEN CHANNEL SYSTEM SETUP CAPABILITY

Analog/Output (SAO4) (4 Channel)	Digital/Output (SR8) (8 Channel)	Universal/Input (SUI16) (16 Channel)	
Board	Board	Board	
Address: 1	Address: 1	Address: 1	
2	2	2	
3	3	3	
4	4	4	
5	5	5	
6	6	6	
7	7	7	
8	8	8	

## NOTE:

Serial Analog Output Module (SAO4):

4 Outputs, each with a single board address 1-8.

Serial Relay Board/Digital Output (SR8):

8 Outputs, each with a single board address 1-8.

## **Serial Universal Input Module (UI16):**

Combines digital input and analog input. Gives you 16 channels that can be set up for any digital input or analog input on an individual per channel basis. Channels now are individual, not board dependent.

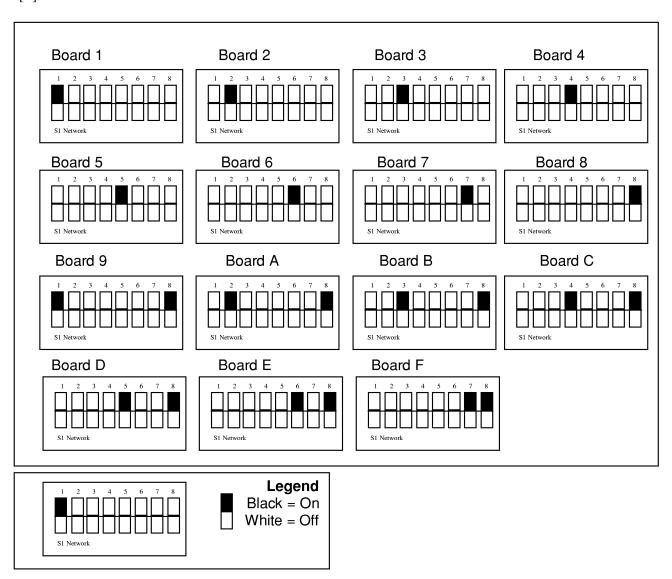
The system as shown in Table 6 (above) supports the following:

- Maximum of 128 inputs (analog or digital inputs, configured on a per channel basis)
- Maximum of 32 analog outputs
- Maximum of 64 digital outputs

# ADDRESSING FOR ADDITIONAL RELAY BOARDS

The RC-2000 Control Software, Version 4.50 and higher, supports fifteen Serial Relay Boards. They must be the Rev. 9 Serial Relay Board or higher. Each board contains eight digital outputs; totalling 120 digital outputs per system. They can be configured for either network or serial. The additional boards require a new addressing scheme: the first nine boards are numerically referenced [one] through [nine]; the next six boards are alphabetically referenced [A] through [F].

Drawing 13 illustrates the board switch settings that are required when setting up the system's serial relay boards.



DRAWING 13- SERIAL RELAY BOARD, REV.9 DIPSWITCH SETTINGS

# SERIAL RELAY BOARD/DIGITAL OUTPUT 8 CHANNEL (SR8)

The Serial Relay Board (SR8) contains all of the terminal strips for digital-output control circuit connections. The relay board snaps into a piece of snap track. Loads are hooked up to the removable terminal strips on the relay board. (See Figure 7 in Appendix D.)

## SERIAL RELAY BOARD FEATURES

For a detailed diagram of the SR8, refer to Drawing 14 below. Serial Relay Board features include:

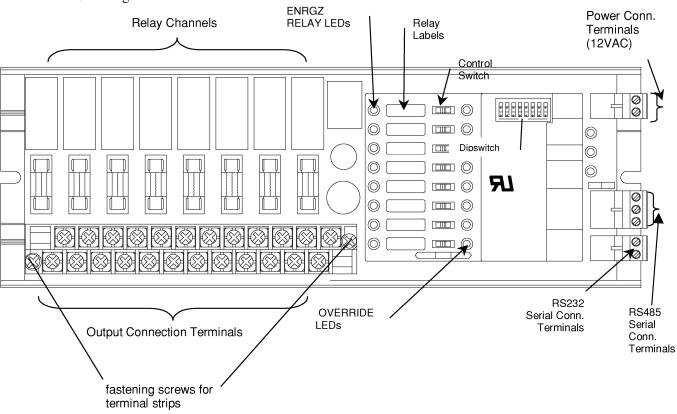
- Red LEDs for power/communication
- RS232 connection for serial comm.
- RS485 connection for serial comm. (for future use)
- Eight position ID Dipswitch (values are numeric)
- Plastic cover plate to shroud the board's low voltage side and provide a place to apply the relay labels
- Dimensions of 10" Long x 3.375" Wide x 1.85" High

### INSTALLATION CONSIDERATIONS

Relays	fused at 3amp,
•	250VAC/
	COM terminal
Relay rating	10amps/250VAC
	1/3 hp/240VAC

#### NOTE

The relay board should be placed in the electrical control panel because it interfaces to the various control circuits. The relay boards contain eight individual single-pole, double-throw (SPDT) relays



DRAWING 14-SERIAL RELAY BOARD (Part # CC/20087400)

### **POWER CONNECTIONS**

This board (SR8 Relay board) requires a 12VAC power supply and draws approximately 0.5A. **Power connection IS NOT polarity** sensitive and is done through a 12VAC connector at the top right corner of the board. This connection is marked on the silk-screen labeling on the board. Refer to Drawing 14 on the previous page for a diagram of the relay board.

#### NOTE

A power LED is located directly below the 12VAC connector. It will be lit when 12VAC power is applied to the board.

## **COMMUNICATION CONNECTIONS**

The serial communication IS polarity sensitive and is connected through the RS232 connection at the bottom right corner of the board. The silk-screen label on the board designates the polarity of the connections. The signal should connect at the 'In' and the common should connect at the 'common.' Once the connection is complete and the board is assigned one time to the program, the two LEDs below the power LED will light to show satisfactory communications (this applies only if the relay board has been assigned in Version 4 and above of the RC-2000).

#### **CAUTION**

Observe the **POLARITY** of the **SERIAL CONNECTIONS** when installing. Incorrect polarity of serial connections will cause an inaccurate reading or no reading at all.

**DO NOT USE** the **RS485 connection** located directly above the Serial RS232 connection on the right side of the board. The connection is **for future use**.

### **INDICATOR LIGHTS**

Three LEDs are located on the right center portion of the board:

- Power On
- Receive
- Transmit

The **top LED** labeled '**Power On**' indicates satisfactory application of the 12VAC when it stays lit. The **middle LED** labeled '**Receive**' indicates satisfactory serial communications when it blinks quickly, almost appearing continuously lit. The **bottom LED** labeled '**Transmit**' also indicates satisfactory serial communications when it blinks at a steady rate.

## **OUTPUT CONTROL CONNECTIONS**

Removable terminals are provided for common (C), normally open (NO), and normally closed (NC) relay operations. All relays are fused at three amps, 250VAC and 1/3 hp at 240VAC. Refer to Drawing 14 on the previous page for a detailed location of the output terminal connections.

### **SWITCHES**

Each relay has a three-position control switch and is marked as follows:

- ENRGZ (Energized)
- **AUTO** (Automatic)
- **DNRGZ** (De-energized)

When the ENRGZ or DNRGZ switch is on, the operational status of the relay bypasses the computer. When the system runs in AUTO, the RC-2000 runs the system.

If you desire manual control of your system, place the control switch in override. If you desire computer control of your system, place the control switch to AUTO.

## **SWITCHES** (continued)

#### NOTE

The positions ENRGZ and DNRGZ override the RC-2000's control of the relay's state.

If the red LED is lit, the RC-2000 or the "ENRGZ" override energizes the relay.

If the red LED is not lit, the RC-2000 or "DNRGZ" switch de-energizes the relay.

If the blinking yellow LED is lit, the control switch is moved from the "AUTO" position to either of the two override positions.

In the event of a system failure, the relays will fail in the DNRGZ position.

#### **SAFEGUARD**

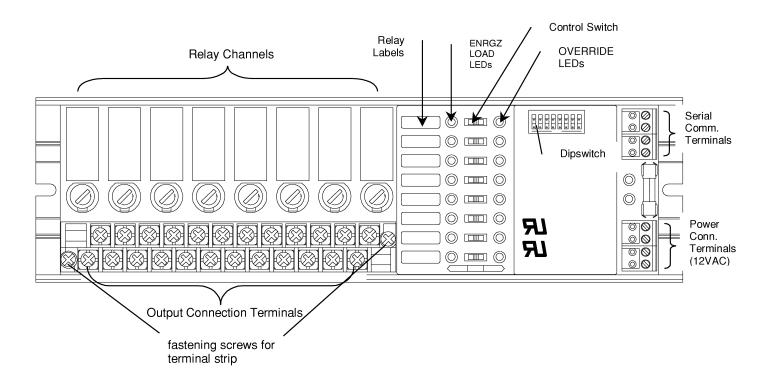
Label all relays with their correct function—this will assist any future troubleshooting or maintenance procedures.

## TABLE 7-TYPICAL SWITCH POSITION VERSUS LOAD STATE

	SWITCH POSITION	
LOAD TYPE	ENRGZ	DNRGZ
Case Refr	OFF	ON
Defrost	ON	OFF
Alarm	NO ALARM	IN ALARM
Compressor	OFF	ON
Condenser	OFF	ON
Fans		

## **SR8: 7500 SERIES**

Refer to the drawing below for an example of the 7500 series SR8. Most of the functionality is similar to the current SR8. The differences are found in the location of connections. Look at your board to determine its revision level, and compare it to the applicable drawing. Reference the location of connections in order to service this prior revision.



DRAWING 15-SERIAL RELAY BOARD/7500 Series (Part # CC/01707500)

## SERIAL ANALOG OUTPUT MODULE/4 CHANNEL (SAO4)

### **MODULE DESCRIPTION**

Refer to Drawing 16 below and Figure 16 in Appendix D for a diagram of a Serial Analog Output Module (SAO4). Serial Analog Output Module features include:

- Black case housing
- Dimensions of: 3.5" Wide x 5.2" Long x 2" High
- Two mounting holes
- Eight position DIP switch (values are numeric)
- Red LED for communication

Also, each SAO4 provides four channels for sending 0-10VDC control signals to other control systems (i.e., DC inverters for variable speed compressors or condensers).

## **SERIAL POWER CONNECTIONS**

The 12VAC serial power is connected through the 12VAC In connections and out through the 12VAC Out connections at the top left corner of the module. (Serial power connections ARE NOT polarity sensitive.)

#### **CAUTION**

The 12VAC power source is not to exceed 100 feet in distance from the modules.

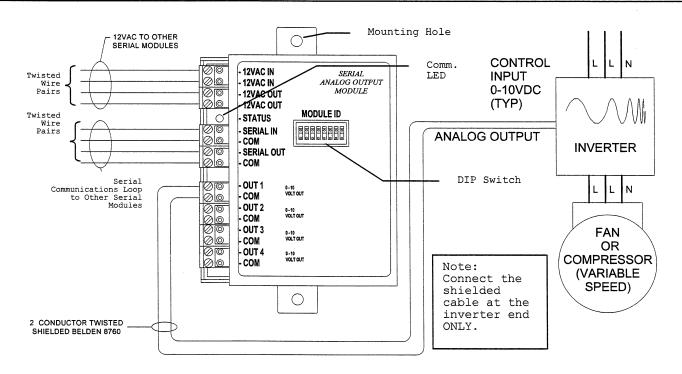
# SERIAL OUTPUT COMMUNICATION CONNECTIONS

The serial communication is connected to Ser In/COM and out through Ser Out/COM on the module, and **IS polarity sensitive**. This board supports four channels and common connections for the 0-10 volt output for analog control signals.

See Figure 16, Serial Analog Output 0-10V Inverter Wiring, in Appendix D for a diagram of this connection type.

#### **CAUTION**

Observe the **POLARITY** of **SERIAL COMMUNICATION** connection when installing. Incorrect polarity will cause an inaccurate reading or no reading at all.



# SERIAL DIGITAL INPUT MODULE/8 CHANNEL (SDI8)

### MODULE DESCRIPTION

Serial Digital Input Module (SDI8) features include:

- Black case housing
- Dimensions of 3.5" Wide x 5.2" Long x 2" High
- Two mounting holes
- Eight position DIP switch (values are numeric)
- Red communication LED

In addition each SDI8 provides eight channels of digital input (i.e., dry contact closures). These digital inputs include:

- Klixon defrost termination
- Demand Defrost<sup>TM</sup> initiation
- Phase-loss monitor
- Proof-of-run verification
- Any other digital input supported by the RC-2000 firmware such as:

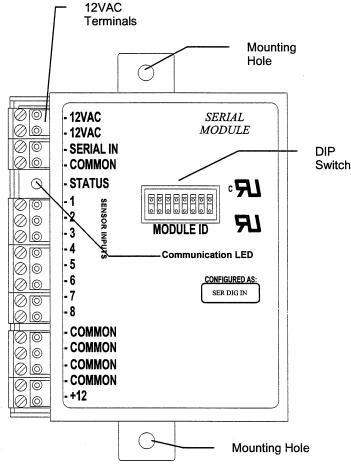
Oil Fail Liquid Level

### NOTE

When using a 16 channel universal/input board (SUI16) in your serial system, the board address of the SUI16 board will eliminate the capability to have a SDI8 board as the same number in the SDI8 system.

## **SERIAL POWER CONNECTIONS**

The SDI8 12VAC serial power connection (not polarity sensitive) is connected in and out through the one 12VAC connection at the top left corner of the board. The In and Out wires will be twisted and connected through one connector on this board.



DRAWING 17-SERIAL DIGITAL INPUT MODULE

# SERIAL COMMUNICATION CONNECTIONS

The serial communication (**polarity sensitive**) will connect in and out through the Ser In/COM connection on the board.

### NOTE

The 12VAC power source is not to exceed 100 feet in distance from the SDI8.

#### **CAUTION**

Observe the **POLARITY** of **SERIAL COMMUNICATION** connection when installing. Incorrect polarity will cause an inaccurate reading or no reading at all.

## **DIGITAL INPUT CONNECTIONS**

A channel input and a shared common connection comprise a digital input. These channels accept only dry contact closures. Table 8 below shows typical relay contact wiring settings.

**TABLE 8-DIGITAL INPUT WIRING** 

TYPICAL ALARM AND VERIFICATION RELAY CONTACT WIRING		
Liquid Level	Normally Open	
Oil Fail	Normally Closed	
Phase Loss	Normally Closed	
Run Verify	Normally Open	
Variable Speed Fault	Normally Open	

## **WARNING**

If voltage is introduced to these channels it may **DAMAGE** your module and **VOID** your **WARRANTY**!

For detailed digital input connection information, refer to the following diagram in Appendix D:

 Figure 14, Serial Digital Input Relay/High Voltage Verification

# HIGH VOLTAGE INTERFACE BOARD (HVIB)

The High Voltage Interface Board (HVIB) outputs a dry contact closure to the SDI8.

In order to use line voltage proofing, the line voltage must:

- 1. Either connect to the HVIB or
- 2. An interposing relay may be used to supply the dry contact closure to the SDI8.

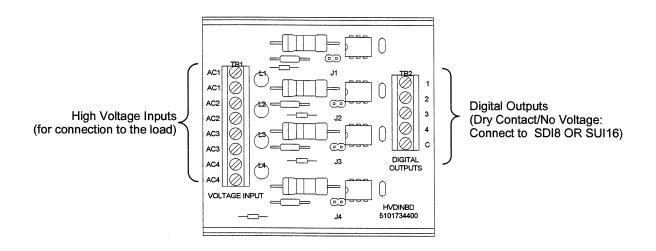
## **WARNING**

Do not connect high voltage to the SDI8. Serious damage can occur to the board or system if you connect high voltage to the SDI8, and your warranty will be voided.

This high voltage interface board accepts the following AC voltages:

- 24VAC
- 120VAC
- 240VAC

Refer to Drawing 17 for a diagram of a SDI8, and Figure 14 in Appendix D for an example of this connection type. Drawing 18, below, shows the High Voltage Interface Board (HVIB).



DRAWING 18-HIGH VOLTAGE INTERFACE BOARD

# SERIAL ANALOG INPUT MODULE/8 CHANNEL (SAI8)

The Serial Analog Input Module (SAI8) accommodates a wide temperature, pressure, and voltage range. For a detailed diagram of a SAI8, refer to Drawing 19. The SAI8 has seven different types within its group. They are listed below:

- 1. Low temperature TP-1L/TP-1C
- 2. High temperature TP-1H
- 3. Low temp TP-2L thermistor
- 4. High temp TP-2H thermistor
- 5. Pressure (1-6V)
- 6. 0-10V
- 7. 4-20mA

#### NOTE

The system can support any combination of the SAI8 types listed above, up to a maximum of eight SAI8 boards.

## MODULE DESCRIPTION

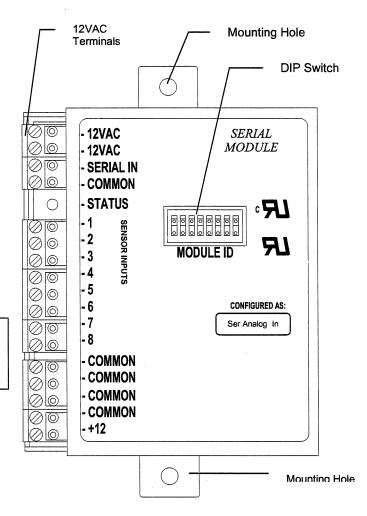
SAI8 features include:

- Black case housing
- Dimensions of:3.5" Wide x 5.2" Long x 2" High
- Two mounting holes
- An eight position DIP switch for addressing (DIP switch values are numeric)
- A red LED for communication

In addition each SAI8 is field changeable to any other module type, however, ECI recommends that the modules be specified at the time of purchase to ensure proper configuration.

## **IMPORTANT**

If it is necessary to change the configuration of a module, ECI recommends contacting its Field Service or Engineering Department for assistance.



## DRAWING 19-SERIAL ANALOG INPUT MODULE

## MODULE TEMPERATURE RANGE TP-1

The SAI8 accommodates a wide temperature range:

- The TP-1L and TP-1C (standard low temperature) SAI8 accommodates a temperature range from -30° to 97°F.
- The TP-1H (standard high temperature) SAI8 accommodates a temperature range from 0° to 255°F.

# MODULE TEMPERATURE RANGE TP-2

ECI offers two styles of thermistor boards dependent on temperature range selections:

Low range (TP-2L): (-30° to 97°F) thermistor; High range (TP-2H): (0° to 255°F) thermistor.

The low temperature range thermistors are generally used for subcooler monitoring and for coil in and coil out temperature monitoring. The high temperature range thermistors are generally used for rack-related monitoring.

#### **NOTE**

Check with your ECI representative to ensure that you set the correct temperature module for your application.

### **MODULE PRESSURE RANGE**

The standard pressure 1-6 Volt SAI8 supports the following types of sensors:

- 1. 0-100 PSI (SA-100D and SA-100A)
- 2. 0-500 PSI (SA-500D and SA-500A)
- 3. 1-6V Liquid Level Input

### 0-10V MODULE INPUT RANGE

The 0-10V SAI8 Board accepts a 0-10VDC or 0-1mA (milliampere) input. Possible uses for this board include:

- Refrigeration liquid level
- Compressor frequency and current feedback
- Refrigerant leak
- kW monitoring

#### NOTE

1-6Vand 0-10V sensors require 12VDC excitation voltage supplied from the (+12) connection at the bottom left corner of the board.

#### SERIAL POWER CONNECTIONS

The SAI8 12VAC serial power connection (not polarity sensitive) is connected in and out through the one 12VAC connection at the top left corner of the board. The In and Out wires will be twisted and connected through one connector on this board.

# SERIAL COMMUNICATION CONNECTIONS

The serial communication (polarity sensitive) will connect in and out through the Ser In/COM connection on the board.

#### NOTE

The 12VAC power is not to exceed 100 feet in distance from the SAI8.

#### **CAUTION**

Observe the **POLARITY** of **SERIAL COM-MUNICATION** connection when installing. Incorrect polarity will cause an inaccurate reading or no reading at all.

### SENSOR/INPUT CONNECTIONS

The SAI8 supports a wide variety of sensor types. These sensor types are referenced in the series of figures in Appendix D as listed below.

Be sure to refer to the following connection diagrams in Appendix D before installation:

- **Figure 6**, Serial Power and Communications Diagram
- **Figure 9**, Serial Analog Input Temperature Probe Wiring
- **Figure 10**, Serial Analog Input Pressure Equipment Wiring
- **Figure 11**, Serial Analog Input Pressure Equipment Wiring
- **Figure 12**, Serial Analog Input 0-10V Equipment Wiring

#### **CAUTION**

Observe the polarity of connection when installing. Incorrect polarity will cause an inaccurate reading or no reading at all.

# SERIAL 16 CHANNEL UNIVERSAL INPUT BOARD/(SUI16)

# BOARD DESCRIPTION (16 CHANNEL UNIVERSAL INPUT OPERATION)

The 16 Channel Universal Input Board features include:

- Snap-track mounting
- Dimensions of 10" Long x 3.4" Wide x 1.1.25" High
- Configuration in two operational modes:
   16 Channel Universal Input\*
   Dual 8 Channel Input

#### \*IMPORTANT

The **following** information on the **16 Channel Universal/Input board** assumes you are using 16 Channel Universal/Input operation.

**Dual 8 mode operation** of this board is discussed **later** in this section.

In 16 Channel Universal Input operation, any type of input can be assigned to any channel as listed below:

- 1. Low temperature (TP-1L)
- 2. High temperature (TP-1H)
- 3. Low temp (TP-2L) thermistor
- 4. High temp (TP-2H) thermistor
- 5. 1-6V Pressure
- 6. 0-10V
- 7. Digital Inputs

#### NOTE

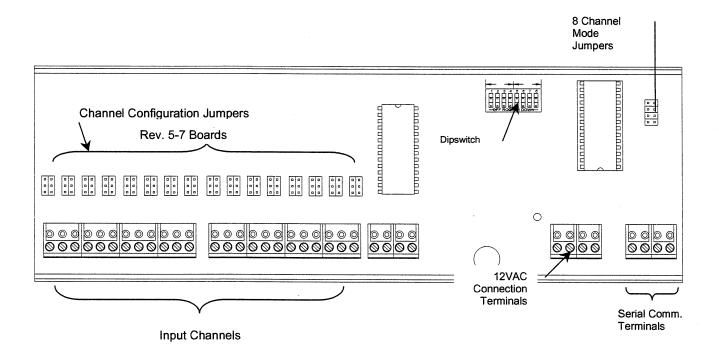
The UI-16 board doesn't support 4-20mA inputs.

The capabilities of the SDI8 and SAI8 are combined on the SUI16 board.

Any SUI16 board that is installed in the system will eliminate and replace the SAI8 and SDI8 of the same number. A RC-2000 will support a maximum of eight SUI16 boards; this equals 128 inputs.

### **IMPORTANT**

You must use RC-2000 Version 4.0 or higher software to operate in this mode.



DRAWING 20-SIXTEEN CHANNEL UNIVERSAL INPUT BOARD (REV 5-7)

### **SERIAL POWER CONNECTION**

The 12 VAC serial power is connected in through the 12VAC In connection and out through the 12VAC Out connection at the bottom right portion of the board. (12VAC serial power connection is not polarity sensitive.)

#### **NOTE**

Refer to the following connection diagrams in Appendix D before configuring this module:

**Figure 18A**, 16 Channel Analog Input Configuration (16 Channel Mode)/Rev. 5-7 boards **Figure 19A**, 16 Channel Analog Input Configuration (Dual 8 Channel Mode)/Rev. 5-7 boards

# SERIAL COMMUNICATION CONNECTION

The serial communication is connected in through the Ser In/COM and out through the Ser Out/COM on the bottom right portion of the board.

#### NOTE

Serial communication connections are polarity sensitive. Observe the polarity of connection when installing. Incorrect polarity will cause an inaccurate reading or no reading at all.

# 16 CHANNEL MODE OPERATION BOARD ADDRESS SETUP

In 16 channel universal mode operation, the board is addressed with one ID. The board address or ID setting is done via the Dipswitch block on the board with switches 1-4. They represent binary values. The sum of the switch values that are set to on will designate the board address. Switches 5-8 are set to a default mode (up is the on position).

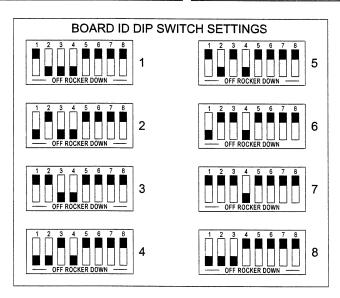
### **NOTE**

The numbers on the switch are not the binary value of the switch. Refer to Table 9 for the binary values of switches 1-4, and to Drawing 21 for the physical position of switches required for each board address.

# TABLE 9-BINARY VALUES FOR DIP-SWITCHES USED IN 16 CHANNEL MODE

SWITCH NUMBER	BINARY VALUE
1	1
2	2
3	4
4	8

**Note**: Switches 5-8 are not used when the board is configured for 16 channel operation. For 16 channel universal mode, switches 5-8 should be set to on for a default setting.



DRAWING 21-BINARY DIPSWITCH SETTINGS FOR 16 CHANNEL INPUT BOARD SETUP

### **CHANNEL TYPE SETUP**

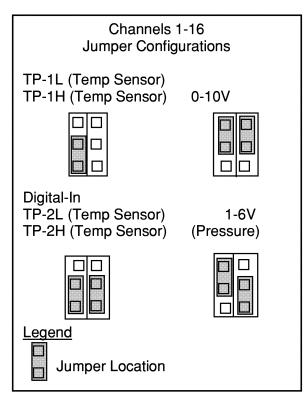
The SUI16 in this universal mode has the capabilities for each channel to be set up as a different type. The channel setup is done with a combination of hardware and jumper configurations and software setup via the RC-2000. Each channel has two jumpers that need to be set to indicate desired channel type prior to software setup via the RC-2000. Please see Drawing 22 for jumper position reference or the silk-screen on SUI16 boards Rev. 5 or higher.

### NOTE

For this channel type setup, you must use the RC-2000 Version 4.00 or higher. For software setup, see the RC-2000 Programming Manual.

Eight channel mode jumpers JX, JY, J1 and J2 need to be removed in Universal 16 mode. Refer to Drawing 20 (the Rev. 5 board), these jumpers are located at the top right corner of the Rev. 5 boards.

If a jumper position is changed, ECI recommends removing the 12VAC connector from the board for a period of ten seconds. When 12VAC power is reconnected, the software setup is initiated [indicated by flashes on the serial LED (D103)].



DRAWING 22-SIXTEEN CHANNEL INPUT BOARD SILK-SCREEN JUMPER LABELS FOR 16 CHANNEL-TYPE SETUP

# QUICK REFERENCE 16 CHANNEL REV. 5 INPUT BOARD SETUP

ECI's 16 Channel Modules must be configured in the field per your application needs; hence, this setup procedure for 16 Channel Rev. 5 Input Boards follows. You can set up the ECI 16 Channel Board as a 16 Channel Universal Input Board or as a Dual Addressed 8 Channel Input Board. The following setup procedure is for the 16 Channel Rev. 5 Board.

 Set the Dipswitches for communication ID. Refer to Drawing 21 for an example of these settings.

#### NOTE

This is a binary setting. Set switches 5-8 to the "ON" position for 16 Channel Mode.

2. Remove the four 8 Channel Jumpers from the top right corner of the board.

#### **NOTE**

These jumpers are: J1, J2, JX, JY

- 3. Terminate all serial wiring at the bottom right corner labeled "Serial." **Ensure correct polarity**. Terminate the common wire into the connection labeled "COM."
- Terminate 12VAC power at the bottom right corner labeled "12VAC."

#### **NOTE**

Make sure the voltage wiring is paired in either the "In" or "Out" position (NOT POLARITY SENSITIVE).

5. Set each input with two jumpers.

#### NOTE

You will find the Channel Number label below the appropriate Jumpers 1-16 from left to right.

- 6. Set the jumpers according to their silk-screen label (found above the jumper) as per their channel type. Refer to Drawing 22 on the previous page for an example of the board's silk-screen labels.
- 7. Terminate the sensors at the terminal strip at the bottom of the board. Terminate the input signal at the channel number and the common at the "COM."

#### NOTE

There is not a common connection for each signal input. All common terminals are connected together for use with any channel.

- 8. Attach the positive load to the terminal strip labeled +12V UNREG at the bottom center of the board for any sensor requiring 12V power (e.g., pressure transducer, etc.).
- 9. Remove 12VAC for approximately 15 seconds after all channel jumpers are set and reconnect the power.
- 10. Assign the board number to the RC-2000 (Version 4.0 or higher). The red LED serial light will now blink.

#### NOTE

The red LED serial light will not blink until the board number is assigned into the RC-2000 (Version 4.0 or higher).

# **DUAL 8 MODE OPERATION**

The SUI16 board has another mode of operation referred to as Dual 8. This mode is supported because it operates with older versions of the RC-2000 (firmware versions prior to 4.00). This mode sets the board as two separate eight channel groups on one SUI16 board. Each group accepts only one type of input (i.e., digital, TP-1, 1-6V, etc.). In this mode the SUI16 operates similar to two eight channel input modules.

#### NOTE

In the Dual 8 Mode the RC-2000 system will support the following:

- four SUI16 boards set up as groups of analog inputs, and
- four SUI16 boards set up as groups of digital inputs.

The input types for Dual 8 channel mode can be as follows:

- 1-6 Volt (pressure)
- TP-1L
- TP-1H (group 2 only)
- 0-10 Volt (**group 1 only**)
- Digital Input

## **BOARD ADDRESS SETUP**

In Dual 8 channel mode, the channels cannot be configured on a per channel basis, but must be configured as groups of eight, each of the same type of input. The board type setup in this mode is done through hardware and jumper configuration. Please refer to Drawing 20-Sixteen Channel Universal Input Board (Rev. 5-7) and Drawing 23 and 24 for Dipswitch settings and jumper configurations.

The SUI16 board in Dual 8 mode is addressed with two separate IDs. The switches represent binary values. Switches 1-4 are used to address Dual 8 group one (channels 1-8). Switches 5-8 are used to address Dual 8 group two (channels 9-16). Address the groups via a **binary-code** Dipswitch setting. The sum of the switch values that are set to on will designate the board address (1-4, group one; and 5-8, group two). Refer to Table 10 for the binary values of the switches.

#### NOTE

The numbers on the Dipswitch are not the binary value of the switch. Refer to Drawing 23 for the physical position of the switches per each group address.

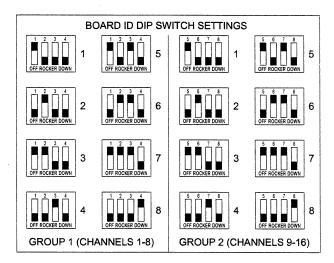
A SUI16 board in Dual 8 mode is actually addressed as two 8 channel boards in the RC-2000 system.

The serial LED (D103) will double blink. This double blink will indicate satisfactory PSI communication to each group on the board.

# TABLE 10- BINARY VALUES FOR DIP-SWITCHES USED IN DUAL 8 CHANNEL MODE

GRO	JP #1	GRO	UP #2
SWITCH	BINARY	SWITCH	BINARY
NUMBER	VALUE	NUMBER	VALUE
1	1	5	1
2	2	6	2
3	4	7	4
4	8	8	8

**Note:** Switches 5-8 are only used in the two group 8 mode.



# DRAWING 23-DIPSWITCH SETTINGS FOR DUAL 8 CHANNEL REV. 5 BOARD SETUP

#### **BOARD/CHANNEL TYPE SETUP**

The SUI16 board in this Dual 8 mode requires that each group is set up with the same channel type within the group. The setup is done with a combination of hardware jumper configuration and software setup via the RC-2000.

### **8 CHANNEL MODE JUMPER**

Each group has a pair of 8 channel jumpers. Refer to Drawing 24, below for their location. These jumpers will setup the input type of each group on the SUI16 board. Set J1 and J2 for group one (channels 1-8), and JX and JY for group two (channels 9-16). Drawing 24 shows a depiction of the correct jumper setting positions.

#### **CHANNEL JUMPERS**

Each channel has two jumpers that need to be set to indicate the desired channel type. Each channel in a group (group one, channels 1-8; and group two, channels 9-16) needs to be set to the same input type. This common channel type of each group also needs to match the eight channel mode jumpers setting for that group. Please see Drawing 24 or the silk-screen on your Rev. 5 or higher board for correct jumper settings.

### **IMPORTANT**

The SUI16 board in Dual 8 mode WILL ACCEPT **0-10V** input type on **GROUP ONE**, **channels 1-8 ONLY**.

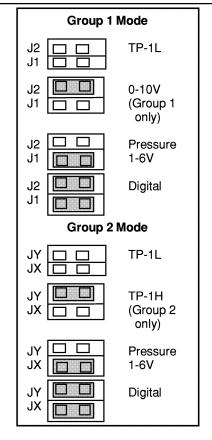
The SUI16 board in Dual 8 mode WILL ACCEPT **TP-1H** input type on **group two**, **channels 9-16 ONLY**.

TP-2 and TP-2H ARE NOT an optional input type in Dual 8 mode.

Channels 1-16 Jumper Configurations	
TP-1L (Temp Sensor) TP-1H (Temp Sensor)	0-10V
Digital-In TP-2L (Temp Sensor) TP-2H (Temp Sensor)	1-6V (Pressure)
<u>Legend</u>	

**Denotes** 

**Jumper Location** 



DRAWING 24- JUMPER CONFIGURATIONS FOR DUAL 8 CHANNEL REV. 5 BOARD SETUP

# QUICK REFERENCE DUAL 8 CHANNEL REV. 5 INPUT BOARD SETUP

ECI's 16 Channel Modules must be configured in the field per your application needs; hence, this setup procedure for 16 Channel Rev. 5 Input Boards follows. You can setup the ECI 16 Channel Board as a 16 Channel Universal Input Board or as a Dual Addressed 8 Channel Input Board. The following setup procedure is for the Dual 8 Channel Rev. 5 Board.

1. Set the Dipswitches for communication ID. Refer to Drawing 23 for an example of the Dipswitch settings.

### NOTE

This is a binary setting. Set switches 1-4 for Channels 1-8. Set switches 5-8 for Channels 9-16.

2. Set the four 8 Channel Jumpers to identify the input type of each 8 Channel group (see Drawing 24).

### For example:

Set J-1 and J-2 for Channels 1-8. Set JX and JY for Channels 9-16.

- 3. Terminate all serial wiring at the bottom right corner labeled "Serial." **Ensure correct polarity**. Terminate the common wire into the connection labeled "COM."
- 4. Terminate 12VAC power at the bottom right corner of the board labeled "12VAC."

### **NOTE**

Make sure the voltage wiring is paired in either the "In" or "Out" position (NOT POLARITY SENSITIVE).

5. Set each input with two jumpers.

#### NOTE

You will find the Channel Number label below the appropriate Jumpers 1-16 from left to right.

6. Set the jumpers according to their silk-screen label (found above the jumper) as per their channel type. Drawing 24 on the previous page shows an example of eight channel mode jumper configurations.

#### NOTE

In Dual 8 Mode, set all Channels 1-8 and 9-16 as a group of the same input.

The input type for each group must match the setup for the 8 Channel mode jumpers (refer to step 2).

7. Terminate the sensors at the terminal strip at the bottom of the board. Terminate the input signal at the channel number and the common at the "COM."

#### NOTE

There is not a common connection for each signal input. All common terminals are connected together for use with any channel.

- 8. Attach the positive load to the terminal strip labeled +12V UNREG at the bottom center of the board for any sensor requiring 12V power (e.g., pressure transducer, etc.).
- 9. Remove the 12VAC for approximately 15 seconds after all channel jumpers are set, and reconnect the power.
- 10. Assign the board number to the RC-2000, Version 4.0 or higher. The red LED serial light will now blink.

### **NOTE**

The red LED serial light will not blink until the board number is assigned into the RC-2000 (Version 4.0 or higher).

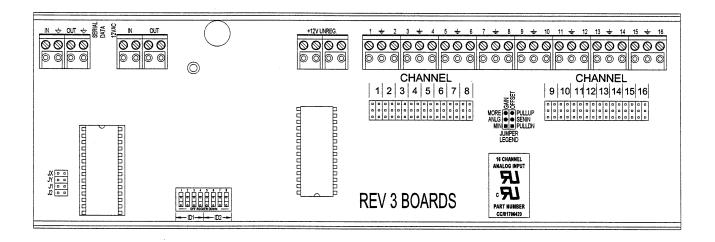
# REV. 3 UNIVERSAL 16 CHANNEL INPUT BOARD

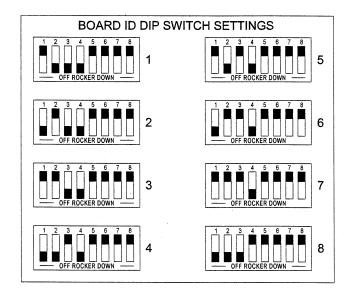
The early release of the universal input sixteen channel board was a Rev. 3 version. The Rev. 3 version follows all the setup rules discussed for the Rev. 5 board; however, the location and the settings of the jumpers are different. Please refer to Drawing 25 below for the correct jumper location and Dipswitch settings on this board

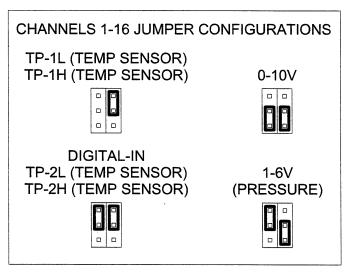
when operating in 16 channel mode. For an example of the Dipswitch and jumper settings for the Rev. 3 board when operating in Dual 8 mode, reference Figure 19 in Appendix D at the back of this manual.

### **IMPORTANT**

Prior to setting up a SUI16 board, ensure that you are referencing the proper rev. number.







DRAWING 25-SIXTEEN CHANNEL REV. 3 BOARD WITH DIPSWITCH AND JUMPER SETTINGS FOR THE SIXTEEN CHANNEL MODE

# **ECI SENSOR TYPES**

ECI offers the following sensor types: temperature sensors, pressure transducers, light level sensors, dew point sensors, liquid level sensors, refrigerant leak sensors, and kW transducers. Table 11 below lists the different sensor types, their temperature ranges, and their functions.

### SENSOR APPLICATION INFORMATION

For detailed sensor application information, refer to the following diagrams at the back of this manual:

Figure 8, Case Sensor Installation

**Figure 9**, Serial Analog Input Temperature Probe Wiring

**Figure 10**, Serial Analog Input Pressure Equipment Wiring

**Figure 11**, Serial Analog Input Pressure Equipment Wiring

**Figure 12**, Serial Analog Input 0-10V Equipment Wiring

Figure 15, Serial Digital Input Demand

Defrost Sensor Wiring

**TABLE 11 - ECI SENSOR TYPES** 

Temperature Sensors	Connection	Range	Appendix D Figure Reference
TP1C (Plastic Capsule) (Replaced by CC\26001000)	Regular Temp. or TP-1	-40° to 127°F (+/- 2°) <sup>a</sup>	
TP1L (Metal Capsule) (Replaced by CC\26001000)	Regular Temp. or TP-1	-40° to 127°F (+/- 2°)	9
TP1H (Metal Capsule) <sup>b</sup> (Replaced by CC\26002000)	TP-1H	0° to 255°F (+/- 2°)	9
TP2L (Small rectangular brass case) (Replaced by CC\27001500)	TP2L	-40° to 127°F (+/- 1°)	
TP2H (Small rectangular brass case)	ТР2Н	0° to 255°F (+/- 1°)	
Pressure Transducers		Range	
SA-100D and SA-100A <sup>c</sup>	Pressure 1-6V	0 to 100 PSI	10
SA-500D and SA-500A	Pressure 1-6V	0 to 500 PSI	10
Miscellaneous Sensors	Connection	Range	
Relative Humidity	0-10V	0-100%	
Dew Point	TP-1 via Dew point Interface Board	0 to 97°F	9
Liquid Level	0-10V or 1-6V (dependent on style)	0 to 100%	10, 11, 12
Refrigerant Leak	0-10V	0 to 1250 ppm	12
kW transducers	0-10V	Variable (dependent upon installation)	13

<sup>a</sup>Note: Temperature ranges displayed in this table represent equipment limitations. Application software may impose more restricted limitations.

**bNote**: Old style TP-1H High Temp. Sensors have a red tip. Newer replacement TP-1 parts are color-coded by wire attachments. The low temperature sensor (CC\26001000) is outfitted with red and white wires, and the high temperature sensor (CC\26002000) is outfitted with black and white wires.

<sup>c</sup>Note: ECI pressure transducers are compliant with ammonia systems.

# **RC-2000 POWER MONITORING**

# WATT TRANSDUCERS

The RC-2000 uses a watt transducer (a monitoring device) to monitor power usage. The watt transducer "deduces" instantaneous power usage, and sends a proportional signal to your energy management equipment (i.e., your RC-2000 Controller).

The watt transducer works (i.e., determines watts) by measuring current inputs from current transformers (CTs), and by sensing voltage readings directly via it's internal circuitry. CT input signals must range from 0 to 5 amps AC on ECI transducers. The voltage is application and transducer specific. The output signal to the RC-2000 is from 0 to 10VDC.

The RC-2000 generates a kW reading by comparing the input signal to the software configuration scale factor.

For example:

If the scale factor is 1000 and the input reading is 5VDC, the kW reading will display as 500 kW.

#### **IMPORTANT**

The scale factor equals the maximum kW. Refer to Table 25 in Appendix C for CT scale factor values.

# POWER SYSTEM ENVIRONMENTS

The two most common power systems found in a supermarket environment are a 208V/120V system or a 480V/277V system.

In the 208V/120V system, 208V is the phase-to-phase voltage and 120V is the phase-to-neutral. In the 480V/277V system, 480V is the phase-to-phase voltage, and 277V is the phase-to-neutral voltage.

Depending on the application of power monitoring, each watt transducer can have a different number of elements. The number of elements required is dependent on your application. Each element in a transducer requires the following inputs for a correct output:

- One CT input
- One voltage measurement input

The two types of power systems used with ECI applications are three-phase, four-wire systems, and three-phase, three-wire systems.

# THREE-PHASE, FOUR-WIRE SYSTEMS (HOUSE POWER MONITORING)

This system is generally used to monitor house power in conjunction with ECI's HVAC/TOD controls (e.g., EC-1000). Four wires typically come into a building (three phases and one neutral). This system is referred to as a 3-phase, 4-wire system.

This type of system monitors loads that vary from phase to phase. This application uses three CTs to accurately sum the current usage. In addition, at least two voltage measurements are required (phase to neutral). This type of power monitoring requires a  $2\frac{1}{2}$  element transducer.

A third voltage measurement (i.e., a three element transducer) is only required on systems that have unbalanced voltage on each leg. ECI recommends a 2½ element transducer in this situation.

# THREE-PHASE, THREE-WIRE SYSTEMS (RACK POWER MONITORING)

Three wires usually come into a typical refrigeration rack. The neutral is not required; hence the term 3-phase, 3-wire system.

A 3-phase, 3-wire system requires only two CTs because the third phase can be considered the return and therefore the sum of the other two. This type of power monitoring requires a two element transducer, which requires two phase-to-phase inputs.

### **CURRENT TRANSFORMERS**

A current transformer senses the high amount of current running through a primary electrical conductor and transforms the reading into an isolated low current signal that is read by a watt transducer. The ratio of a CT refers to the dividing factor associated with it. ECI supplies a wide range of CTs for different amp requirements. All ECI CTs have a standard five amp output ratio factor.

For example:

A 1600:5 CT puts out 5 amps when it senses a 1600 amp current through its field.

Two types of CTs are available:

- 1. **Split core CTs** can be taken apart and reassembled around the bus bar or cable.
- 2. **Toroidal CTs** must be slipped over the conductor before cable termination. You cannot take them apart.

#### CAUTION

To avoid a **POTENTIAL EXPLOSION** if **power** is not shut down:

**ALWAYS** short the output signal wires of the CT to each other before installation or service of the CT or watt transducer.

If power is not shut down, the CT will strive to output the current ratio as described above. Eventually, it will break down the insulation or air between the terminals.

### **EXPLOSION MAY OCCUR!**

The following pages make connection reference to each ECI Watt Transducer. Ensure the connection diagram used matches the model number of the watt transducers. If you have questions, contact an ECI representative.

IMPROPER INSTALLATION CAN RESULT IN SERIOUS INJURY!

### **ECI WATT TRANSDUCERS**

ECI has introduced new kW watt transducers. They differ from the previous models in this way: they produce a true 0-10VDC output, so they DO NOT need a 22K ohm resistor installed across the output to the 0-10VDC. The new part numbers are cross referenced with the previous part numbers in the chart below.

#### NOTICE

The previous part numbers are now obsolete and the new ones serve as direct replacements.

# TABLE 12: ECI WATT TRANSDUCERS MODEL NUMBER CHANGE NOTICE

PREVIOUS PART NUMBER (obsolete)	NEW PART NUMBER	MODEL DESCRIPTION
CC/A12080Y	CC/20106400	208V, 3 Phase, 3 Wire
CC/A12081Y	CC/20106401	480V, 3 Phase, 3 Wire
CC/A12083Y	CC/20106402	208V, 3 Phase, 4 Wire
CC/A12084Y	CC/20106403	480V, 3 Phase, 4 Wire

# WATT TRANSDUCER TWO ELEMENT CONNECTIONS

HOOKUP CONSIDERATIONS
KW WATT TRANSDUCER MODEL #:
CC/20106400: 3 PHASE, 3 WIRE SYSTEM, 208V
APPLICATION: RACK POWER

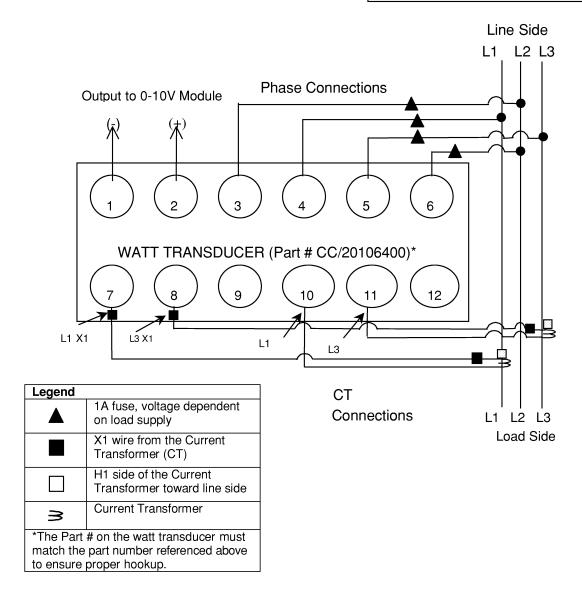
If power is not removed from the load, follow this procedure to avoid a **POTENTIAL EXPLOSION: ALWAYS short** the CT terminals **BEFORE** disconnecting the CT wires from the watt transducer.

Refer to the drawing below and note the following information about two element connections:

- 1. The H1 side of the Current Transformer (CT) should always face the line side of the load.
- 2. The X1 terminal must correspond with the black box in the drawing below.
- 3. Phase connections at Terminals 3, 4, 5, and 6 must adhere to the connections shown in the drawing below.

#### NOTE

If polarity of connection (as indicated in the drawing below) is not followed, the transducer output reading will be incorrect.



DRAWING 26 - kW WATT TRANSDUCER (MODEL # 20106400) TWO ELEMENT CONNECTION

# WATT TRANSDUCER TWO ELEMENT CONNECTIONS

## HOOKUP CONSIDERATIONS KW WATT TRANSDUCER MODEL #:

CC/20106401: 3 PHASE, 3 WIRE SYSTEM, 480V APPLICATION: RACK POWER

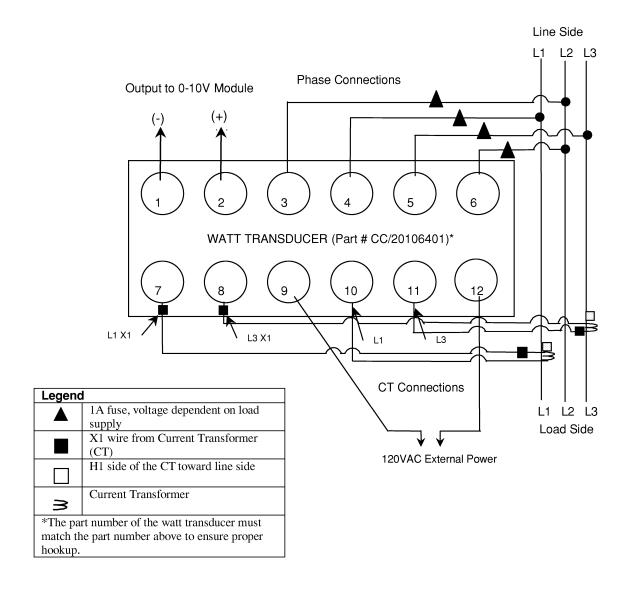
If power is not removed from the load, follow this procedure to avoid a **POTENTIAL EXPLOSION**: ALWAYS short the CT terminals BEFORE disconnecting the CT wires from the watt transducer.

Refer to the drawing below and note the following about two element connections with this transducer model:

- 1. The H1 side of the Current Transformer (CT) should always face the line side of the load.
- 2. The X1 terminal on the CT must correspond with the black box in the drawing below.
- 3. Phase connections at Terminals 3, 4, 5, and 6 must adhere to the connections shown in the drawing below.
- 4. Make sure a 120VAC external power supply is provided to Terminals 9 and 12.

#### NOTE

If polarity of connection (as indicated in the drawing below) is not followed, the transducer output reading will be incorrect.



DRAWING 27 - kW WATT TRANSDUCER (PART # CC/20106401) TWO ELEMENT CONNECTION

# WATT TRANSDUCER TWO AND ONE HALF ELEMENT CONNECTIONS

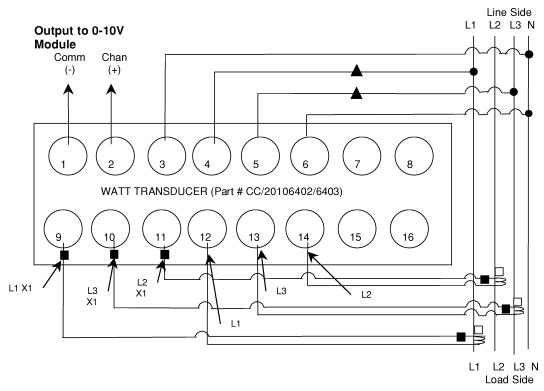
# HOOKUP CONSIDERATIONS/ KW WATT TRANSDUCER MODEL #s:

CC/20106402: 3 PHASE, 4 WIRE SYSTEM, 208V CC/20106403: 3 PHASE, 4 WIRE SYSTEM, 480V APPLICATION: HOUSE POWER

If power is not removed from the load, follow this procedure to avoid a **POTENTIAL EXPLOSION: ALWAYS short** the CT terminals **BEFORE** disconnecting the CT wires from the watt transducer.

Refer to the drawing below and note the following information about two and one half element connections:

- 1. The H1 side of the Current Transformer (CT) should always face the line side of the load.
- 2. The X1 terminal on the CT must correspond with the black box in the drawing below.
- 3. Phase connections at Terminals 3, 4, 5 and 6 must adhere to the connections shown in the drawing below.
- 4. Make sure that the line supplied neutral wire is connected to Terminals 3 and 6.
- 5. Follow the polarity of connection (as indicated in the drawing below) is not followed, the transducer output reading will be incorrect.



Legend	Legend		
<b>A</b>	1A fuse, voltage dependent on		
	load supply.		
	X1 wire from Current		
	Transformer (CT)		
	H1 side of the CT toward line		
Ш	side		
3	Current Transformer		
*The part number of the watt transducer			
must match the part number above to			
ensure proper hookup.			

DRAWING 28- KW WATT TRANSDUCER (PART #s 20106402/20106403) TWO AND ONE HALF ELEMENT CONNECTION

# **ECHELON INTEROPERABILITY**

# ECHELON INTERFACE WITH THE DANFOSS INVERTER

The RC-2000 Version 4.10 and higher incorporates an Echelon Interface with the Danfoss Inverter. This feature eliminates the need for several analog and digital connections between these two devices. This information will be transferred via the Echelon network (16 gauge non-shielded twisted pair Belden #8471).

### HARDWARE REQUIREMENTS

The Danfoss Inverter will need to be equipped with an Echelon  $^{\text{\tiny TM}}$  Option card. Please refer to your Danfoss manual for further information. For a detailed connection diagram, please refer to Figure 20 in Appendix D.

The RC-2000 requires a "new-style" CPU (part # 5120001400) equipped with a MIP daughterboard. The firmware must be level 4.10 or higher. The network wiring follows the Echelon network termination rules for an FTT-10 transceiver (free-topology). The Danfoss Inverter has a switch on the option card for network termination. These switches should be set according to the Echelon termination guidelines (on is up, and off is down).

When configuring for this mode, **DO NOT MAKE** THE CONNECTIONS between the **DANFOSS INVERTER** and the **RC-2000** LISTED BELOW:

Analog Output:	Speed control (0-10V)
Digital Input:	Fault Input
Digital Input:	Inverter Run Verify
Digital Output:	Reset Relay
Analog Input:	Frequency Status
Analog Input:	Current (Amps) Status

When configuring in this mode, the following connections are required between the Danfoss Inverter and the RC-2000:

Echelon	(Will replace all connections
communication:	previously listed)
Digital Output:	Switchover Relay
Digital Output:	Control relay for compressor
	(has an auxiliary connection
	for the start command to the
	inverter)

The interface will still require a hardware connection for the start command to the inverter. Make this connection with a series circuit through the auxiliary contact on the variable speed compressor contactor (ECI control relay for the inverter) and the switchover relay. The condenser fans should have a hardware start wired in series through the ECI inverter control relay and the switchover relay. The condenser fans should have a hardware start wired in series through the ECI inverter control relay and the switchover relay.

The Danfoss Inverter will be set to require a hardware and a software start to run forward. By placing the switchover relay in override, the interface will be able to be placed in hard override. If the switchover relay is placed in hard override, the RC-2000 will recognize the override condition and will not transmit control word via the Echelon Network.

### SOFTWARE REQUIREMENTS

This interface has many similarities to the case control interface being done via the Echelon Network. Each Danfoss Inverter is assigned a node address number for network identification. This node address number can be the same number as one that is used for case controls or other devices because each device type resides on an individual subnet.

#### **IMPORTANT**

Danfoss Inverters connected to the same RC-2000 should not be assigned duplicate node addresses.

Set the software interface as follows:

- Configure the variable speed option in the Rack Configuration Screen as done in previous versions. You may select condensers, compressors, or both as needed for your application.
- 2. Select the polarity of the switchover relay (if you are using it in the application) in the rack configuration screen.

#### **IMPORTANT**

If the **POLARITY** is set IMPROPERLY, the Danfoss Inverter will NOT RECEIVE the START COMMAND and the interface will **FUNCTION INCORRECTLY!** 

3. You should only assign the inverter address to a setpoint in the variable speed section of the rack setpoint screen when you are using the ECHELON DANFOSS INTERFACE. This setpoint renders some setpoints unnecessary; they will display as N/A. Actual control of the device per these setpoint assignments occurs when the binding process is completed; however they can be assigned before then.

# **IMPORTANT**

ECI recommends setting the inverter address setpoint assignments at: 01, 02, 03, etc.; these assignments are dependent on the number of inverters being controlled.

- 4. After you assign the inverter address, you have only two more setpoints to assign: the control relay, and the switchover relay.

  Assign them now to fit the individual application.
- 5. Next, bind with or node address the device via the main menu. Press [8 LON Network]. The screen will look like this:

### **LON NETWORK**

**Device Type:** Danfoss Inverter **Select Action:** Install Node

**Start Node ID:** 001 (Dependent on the

desired address)

End Node ID: 001 Start Now?: Yes

**Current Node Status:** This will prompt user

that the RC-2000 is ready for the inverter to

be addressed.

Once you set the LON NETWORK screen, you need to toggle the service pin switch (SW2) on the Danfoss Echelon Option Card. (The switch will be set in the normal or up position, move it to the down position and then back to normal.) Once the node address is successfully installed, the current node status line will clear and the controller will be ready for the next address.

6. Once the node address is complete, the Danfoss Inverter is on-line and ready to be controlled. At this point, the frequency and current displays at the RC-2000 Rack Status screen will be live status.

# SAFETY CONSIDERATIONS AND SETTINGS

You should be aware of the following settings in order to benefit from the safety or switchover benefits of the interface:

 When the binding process is complete, the Danfoss Inverter is set for a THREE-MINUTE MAXIMUM receive time. The inverter defaults to a predetermined state if no messages are sent to it from the RC-2000 within this three-minute time interval.

Set this predetermined state on **Parameter 824 TIME-OUT F** in the Danfoss Inverter. **ECI recommends MAXIMUM** as the setting because it will default the inverter to a 100% run if communication is terminated.

- 2. If a technician needs to service the system, or if software upgrades require extensive code downloads to case controls, the SWITCH-OVER RELAY should be placed into OVER-RIDE until the work is finished. Once the switchover relay is placed in override, communication to the inverter will stop. The inverter will receive a stop command via hardware and the variable speed compressor will cycle as a fixed capacity (on/off).
- 3. The Danfoss Inverter can be configured for software or hardware start/stop commands. The present interface requires that Parameter 506 START be set to "AND." By setting this parameter to "AND" the inverter requires a software and hardware start prior to a RUN condition. This will ensure that an override can always be accomplished when you put an ECI control point in hardware or software override.
- 4. This interface doesn't use a reset relay. The inverter has it's own reset function that will attempt a reset prior to sending a fault condition to the RC-2000. Once a Fault condition is recognized, the RC-2000 will immediately go to a switchover state (No Delay) and the fault will be entered into the alarm log. Once the fault is entered into the alarm log, the inverter will not receive transmissions until the fault condition is reset manually.

5. This interface is a communication protocol, therefore ECI recommends that a boolean statement be installed into the RC-2000 for fail-safe back up. This statement should reference the operating pressures and if they exceed safe ranges, the switchover should be shut down and an alarm should be generated. Refer to the RC-2000 Programming manual, or contact your ECI representative for further details.

#### NOTE

When **OPERATING** a split suction group rack with a common condenser, **BE AWARE** that **HIGH PRESSURE CONDENSER SAFETIES** need **INSTALLED** for **BOTH SUCTION GROUPS**.

# PARAMETER SETTINGS FOR THE DANFOSS INVERTER

PARAMETER	SETTING
506 "START"	AND
*824 "TIME-OUT F"	MAX
*927 "ACC PARA W"	WITH LONWORKS
*928 "ACC PROC C"	WITH LONWORKS
*Parameter Crouns 800	and 000 are ONLV

\*Parameter Groups 800 and 900 are ONLY AVAILABLE when the OPTION CARD is installed and initialized.

# ECHELON INTERFACE WITH THE ENCORE ESC-200 BITZER SCREW COMPRESSOR MODULE

The RC-2000 Version 4.10 and higher incorporates an Echelon interface with the Encore ESC-200 Bitzer Screw Compressor Module. The Echelon Network will send Alarm status information to the RC-2000 via the Echelon Network (16 gauge, non-shielded twisted pair, Belden # 8471).

Each Bitzer Screw Compressor has an individual ESC-200 module assigned for control, alarm safeties and long term alarm logging. This interface will allow each individual ESC-200 module to send any alarm status to the RC-2000 when it occurs and send an OK when the alarm clears. The RC-2000 will recognize the compressor number (as assigned to the RC-2000) and the alarm type. This information will be logged and will dial out as required by the application.

This interface will eliminate the need for several interposing relays that were previously required to signal different alarm conditions. It also adds the ability to recognize individual alarm types on individual compressors and to reset the alarm condition without requiring a visit to the site.

### HARDWARE REQUIREMENTS

The ESC-200 module will need to be equipped with a compatible Echelon chip and transceiver. Please refer to your Encore manuals for more complete information.

The RC-2000 will require a "new-style" CPU (Part # 512001400) that must be equipped with a MIP daughterboard (Part # CC/20056400). The firmware will have to be at a 4.10 level or higher. The network wiring will follow the Echelon network termination rules for an FTT-10 transceiver using a 16 gauge, non-shielded twisted pair, Belden #8471. For a detailed connection diagram, refer to Figure 21 in Appendix D.

### **CONTROLLER INTERFACE**

The ESC-200 uses a hardware Dipswitch setting to initially set the board address. This is marked as Dipswitch #2 (SW2). This switch should be set prior to performing the install node function.

Follow the procedures listed below and on the following page when installing an ESC-200 on the RC-2000 Echelon network.

 The ESC-200 module needs to have a controller address assigned to its associated compressor. This setpoint can be assigned in the rack setpoint screen directly below the compressor relay setpoints as follows:

Compr: 1
Relay: 0-0
Capacity: 010
Unloaders: 0
Ctrl Addr: 00

#### NOTE

The variable speed compressor also has a setpoint field for a Controller Address assigned to the variable speed compressor. This will require configuring for variable speed control and entering the setpoint screen. The top line of the variable speed setpoints will have fields for Invertr Addr and Ctrl Addr in this listed order from left to right. The ESC-200 will be assigned to the Ctrl Addr as listed above.

#### **IMPORTANT**

Make certain that the number assigned to the control address matches the switch selection made on Dipswitch #2 on the ESC-200 module.

 $(over \rightarrow)$ 

2. Set the Install Node function. This is done from the main menu by selecting number [8 LON NETWORK]. Set the screen as follows:

### LON NETWORK

**Device type:** ESC-200 **Select Action:** Install Node

Start Node ID: 001 (Dependent on the

desired address)

End Node ID: 001 Start Now?: Yes

Current Node Status: This will prompt you

that the RC-2000 is ready for the module to

be addressed.

3. When this is set there is an alarm reset button that will need to be pressed on the ESC-200 module. This is SW3 located to the right of the Dipswitches on the ESC-200. This button will need to be depressed for approximately five seconds for the node to be installed.

There is an amber service LED "I16" located at the bottom left corner of the ESC-200 module. When the node is initialized, this light will illuminate. This light will also be in a blinking state if the module is not configured prior to node installation. Once this process takes place, the Current Node Status line on the RC-2000 will clear, displaying the success of the install process.

#### NOTE

The rack status screen will display a "\_" below the associated compressor unit, noting an ESC-200 is assigned to that unit.

If this module is in alarm, it will display an "A" in the above mentioned space and enter the alarm into the alarm log.

#### **ALARM STATUS**

The ESC-200 does not honor any alarm time delays. If the module is in alarm it will be entered into the log without delay. The RC-2000 has a dialout capability for each of these alarms and the alarm relay assigned to the suction alarm will deenergize if an ESC-200 is in alarm.

The alarms received from the ESC-200 will be as follows:

MOTOVR	Motor Overload
OIL FLW	Oil Flow
OIL LVL	Oil Level
GAS TMP	Discharge Gas Temp.
PHASE	Phase Failure
ROTATE	Rotation Failure
RUN PRF	Run Proof

For Example:

The RC-2000 will log the following "Run Proof" alarm like this:

01-01	00:11	Rack A	C2RunPrf

It displays the date, time, and rack assignment. The C2 represents the compressor number and the alarm type.

This information will conclude that on Jan. 1 at 12:11 a.m., Rack –A compressor #2 went off on the Run Proof Alarm.

#### NOTE

The RC-2000 will dialout the above information for each alarm.

The RC-2000 logs the following as an event:

FILTER	Dirty Filter

# ECHELON-EQUIPPED KYSOR-WARREN INTERFACE CONTROL

The Kysor-Warren Interface Control (KWIC) incorporates all relays, circuit breakers, and control switches into one centralized output control device. This device allows for centralized mounting of all circuit and compressor output modules. The KWIC assembly replaces the need for a large portion of the control circuit installation process. The centralized rack mount, a hallmark of the KWIC, holds a maximum of four circuit modules per enclosure, and reduces control panel wiring by 40 percent, thus lowering wiring application mistakes.

The KWIC is a networked refrigeration control device. To accomplish output control, the KWIC chassis assembly includes an engine with processor, a processor interface board (PIB), and a buss board. A maximum of four control output modules can be connected to the buss board. One KWIC assembly controls a maximum of 16 refrigeration and defrost circuits.

The control output module includes circuit breakers, rocker switches, relays, and status LEDs for each controlled circuit.

See Figure 22 in Appendix D for a more detailed description of the KWIC assembly installation.

### **NOTE**

Refrigeration and defrost relays on the control output module share one circuit breaker and rocker switch, but are designed with a hardware interlock to ensure that both do not energize simultaneously.

#### **DUAL CHASSIS CONNECTION**

Two KWIC Chassis Assemblies can be connected together for increased control capability. This connection creates a *driver and expansion assembly* relationship. The driver chassis assembly includes the engine board with processor. The processor on the driver controls output for the driver and expansion chassis.

#### **IMPORTANT**

The expansion assembly does not have an engine board. The driver chassis engine board controls output for both assemblies.

The expansion chassis receives control instruction via the driver chassis assembly. These driver/expansion assemblies may be linked with other KWIC driver/expansion assemblies on an Echelon or RS-485 network.

#### NOTE

Limitations of the KWIC network are specific to the refrigeration control that manages the interface with the KWIC assemblies.

For a complete parts description and installation procedure for the KWIC module, please reference the ECI *KWIC* (*Kysor-Warren Interface Control*) *Installation and Operations Manual*, part # CC/4464400010.

# **CASE CONTROLLERS**

### **ECI DISTRIBUTED CONTROL UNIT**

The ECI Distributed Control Unit (DCU) is a micro-controller-based unit. Networked with the RC-2000, the DCU becomes part of an integrated control system.

The DCU controls sensors, valves and refrigeration at the case level. The following valves may be in place in a DCU-controlled system:

- Refrigeration solenoid
- Pulse-type Electronic Expansion Valve
- Electronic Evaporator Pressure Regulator (EEPR)

Fully programmable, the DCU accommodates:

 Ten universal inputs; programmable to accept either ECI TP1 or TP2 temperature sensors

Or

- Low-voltage, dry-contact digital inputs
- 4-20mA sensor inputs

Inputs may be programmed to include:

- Coil-in
- Coil-out
- Discharge air
- Return air
- Alarm sensors
- Digital defrost termination inputs

The DCU also controls and monitors case energy consumption.

The Case Power Module (CPM) is an output control device used with the DCU. It includes a high current relay for electric defrost. The CPM connects to the DCU via an eight wire interconnect cable, which provides power from the CPM to the DCU. The cable also provides the control signals from the DCU to the CPM. The CPM has been designed to fit on top of, or under, cases easily.

The CPM has two main functions:

1. It supplies power to the DCU motherboard.

### NOTE

ECI offers a version of the DCU that contains a transformer, making it a complete stand-alone controller.

2. It controls fans, lights, anti-sweat heaters, and electric defrost loads.

The DCU stores application code and setpoint data in non-volatile memory. The application code may be downloaded from the RC-2000, eliminating the need for EPROM changes at the DCU.

### **NOTE**

The DCU may be programmed through a handheld terminal at the case or at the RC-2000 Unit.

### **IMPORTANT**

Although the RC-2000 is not used for basic DCU control operation, it is required for initial store installation of DCUs, DCU data logging, and application program downloading.

Remote setpoint programming of the DCU is also possible from the RC-2000.

ECI's electronic case control components (the DCU and the CPM) also work together in line-up control. For line-up control, daisy chain multiple CPMs together with one DCU and combine them with either a suction or liquid solenoid at the case.

For more information about ECI's electronic case control components, please reference the ECI document, *DCU/ECC*, *Distributed Control Unit*, *Electronic Case Control Installation and Operations Manual*, part #4464403200.

#### HILL PHOENIX DEGREE MASTER

The Hill Phoenix Degree Master load center is a stand-alone control able to interface with the RC-2000. One base unit load center is used per case. The unit has a built-in transformer, which derives power from the case. The Degree Master load center possesses five universal inputs and includes control relays for fans, lights, and basic refrigeration solenoids. Optional expansion boards provide additional control relays for electric defrost, anti-sweat heaters, and electronic valve (EEPR or EEV) control.

Degree Master inputs may be programmed to include:

- Coil-in
- Coil-out
- Discharge air
- Return air
- Product temp
- Alarm sensors
- Digital defrost termination inputs

The Degree Master is programmable with a handheld remote control unit. A local display connects into the load center to view status and programming changes. The display has a scrolling screen and minimal functionality via two buttons at the side of the screen. The buttons enable a small subset of functions directly from the display, such as a change in mode of operation. LED lights on the display indicate:

- Refrigeration status
- Defrost status
- Alarm status

The Degree Master stores application code and setpoint data in non-volatile memory. The application code may be downloaded from the RC-2000, eliminating the need for EPROM changes at the Degree Master.

#### NOTE

Although an RC-2000 is not used for basic Degree Master operation, it is required for initial store installation of load centers, data logging, and application program downloading. The Echelon-capable RC-2000 may provide installation functions and continue to serve as an interface to a system of Degree Master load center controls.

Remote setpoint programming of the Degree Master load center is also possible from the RC-2000.

Refer to Figures 23 and 24 in Appendix D of this manual for Degree Master wiring diagrams.

# **ECHELON NETWORK SPECIFICATIONS**

# INTRODUCTION

ECI uses the Echelon FTT-10 Network for case controller applications. To ensure the integrity of the Echelon communication network, follow the specifications below.

# **ECHELON NETWORKS**

Echelon specifies cable type and distance limits for its existing networks. This section specifies cable type and distance limits for two Echelon-supported network configurations: the Free Topology and the Doubly Terminated Bus Topology. ECI recommends the FTT-10 Free Topology Star Configuration Network because it offers more configuration flexibility. Be aware that whichever network you choose will require cable type and distance compliance with the Echelon-specified guidelines.

### **IMPORTANT**

To ensure network reliability, you need to comply with cable type and distance limits. ECI strongly advises that installation drawings reflect the network layout and that installation contractors adhere to them.

#### SUGGESTION

A copy of the installation drawing(s) should be displayed onsite; this will assist with network troubleshooting.

# NETWORK RESISTOR TERMINATION

The network requires that a termination resistor be installed within the network loop. The value and location of the resistor depends on the loop configuration.

# ECHELON FTT-10 NETWORK FREE TOPOLOGY STAR CONFIGURATION

The Free Topology Star Configuration (optional) Network branches out in different directions. Each of these branches is wired in a daisy chain type configuration in succession from one case to another.

### **IMPORTANT**

ECI specifies a maximum of four branches from one network hub.

#### NOTE

Limited exceptions to this general recommendation may be made if the existing conduit does not support this daisy chain configuration. Contact ECI Engineering for details.

The Free Topology Star Configuration requires that the hub of the star be located within ten feet of the network management device. This requirement ensures easy isolation of the individual star lengths, which makes it easier to diagnose network problems with an ohmmeter or a LAN test meter (TDR). Table 13 below lists the Free Topology Network Specifications.

### **IMPORTANT**

Be sure to document the configuration layout PRIOR to installation. This gives you an installation guide and network configuration reference document.

### **SUGGESTION**

Post the layout configuration document within the store for maintenance personnel.

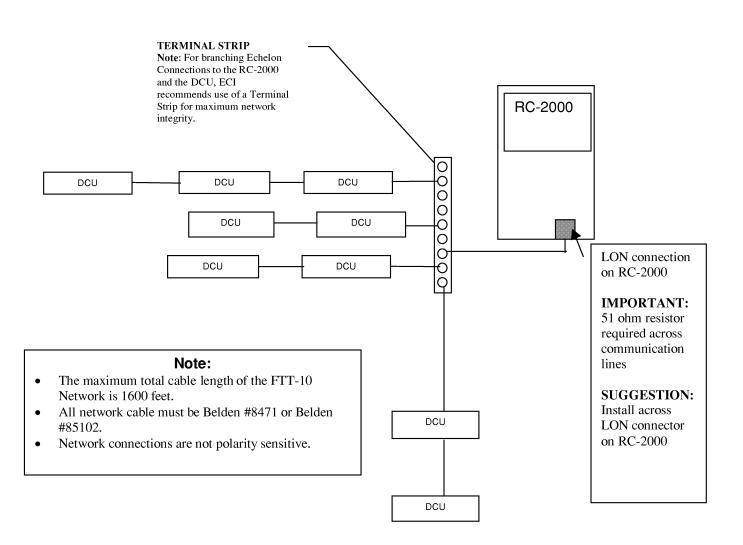
CABLE TYPE	MAXIMUM TOTAL WIRE LENGTH	MAXIMUM NODE TO NODE DISTANCE*
Belden #8471, 16 awg, non-plenum	1600 feet (500 meters)	1300 feet (400 meters)
Belden #85102, 16 awg, plenum	1600 feet (500 meters)	1300 feet (400 meters)
*A Repeater Board (ECI Part #200554	00) may be used to strengthen ar	nd extend the network signal

capability.

TABLE 13 – ECHELON FREE TOPOLOGY NETWORK SPECIFICATIONS

# SINGLE TERMINATED NETWORK (FTT-10 NETWORKS ONLY)

A single terminated network (star type configuration) requires that one (1) 51ohm ¼ watt resistor connects across the communication lines. This resistor should be at a central location (i.e., at the network manager or the hub of the communications). Drawing 29 below shows an example of this type of network termination.



DRAWING 29 - SINGLE TERMINATED NETWORK (FTT-10 ONLY)

# DOUBLE TERMINATED DAISY CHAIN CONFIGURATION/ FTT 10 NETWORK

The Double Terminated Daisy Chain Network restricts installation to a daisy chain configuration.

This network configuration provides greater distance capability. The signal strength is greater because of the limited signal reflection in a daisy chain configuration.

### **NOTE**

This type of network allows for convenient isolation of the network segments.

The network routing should always be documented and posted within the store for maintenance personnel.

Table 14 below lists the Echelon specifications for the double terminated daisy chain network configuration. Be sure to adhere to these guidelines when installing this network.

CABLE TYPE	MAXIMUM TOTAL WIRE LENGTH	MAXIMUM NODE TO NODE DISTANCE
Belden #8471, 16 awg, non-plenum	8800 feet (2700 meters)	2200 feet (400 meters)
Belden #85102, 16 awg; plenum	8800 feet (2700 meters)	1600 feet (500 meters)

TABLE 14 – ECHELON SPECIFICATIONS/DOUBLE TERMINATED DAISY CHAIN NETWORK CONFIGURATION

### **IMPORTANT**

The physical connection should be checked for the following conditions to verify integrity of the network:

- 1. Ensure that connections do not have any stray strands of wire that are not properly inserted into the connector. (A stray strand touching across the conductors can cause a cross talk problem).
- 2. After the connection is made, hold the connector and apply a firm tug on the cable ends to ensure the connector crimp on the cable is secure.
- 3. Verify that the proper Network Termination is installed within the network.

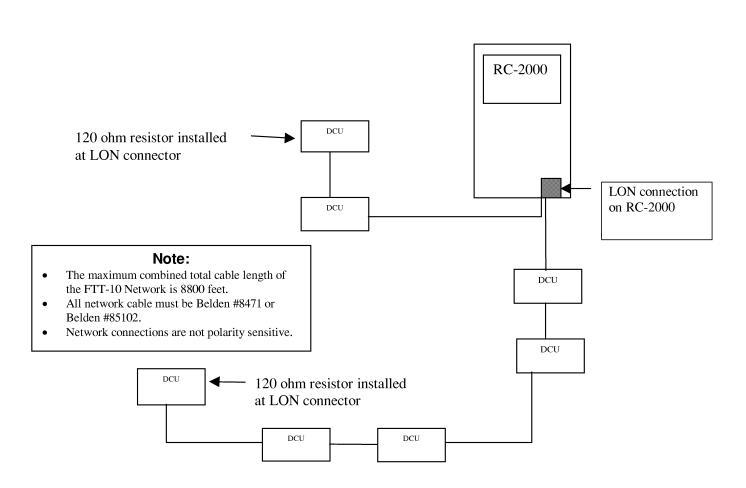
# DOUBLE TERMINATED NETWORK (FTT-10 NETWORK)

This type of network MUST be a strict daisy chain configuration and requires that two (2) 120 ohm ¼ watt resistors connect at each physical end of the loop. Drawing 30 below shows an example of a double terminated buss network on a daisy chain configuration.

### **IMPORTANT**

Use double termination network on a daisy chain configuration ONLY.

The double terminated buss configuration WILL NOT WORK on a Free Topology Star Network.

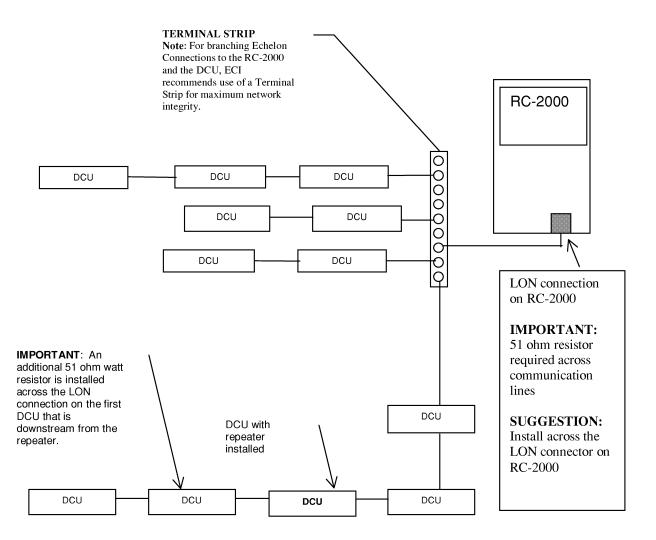


**DRAWING 30 – DOUBLE TERMINATED NETWORK (FTT-10)** 

### REPEATER BOARD

When the specified distance limits are exceeded, network strength is degraded. An ECI Repeater Board (Part #20055400) preserves network strength when specified distance limits are exceeded. This board connects in series into a section of the network. A network operating with

a repeater board requires additional termination to the network segment downstream from the repeater board. Treat the downstream portion of the network as a new network and apply the network termination rules accordingly. Drawing 31 below shows an example of network termination with a repeater board.



### **NOTE:**

- The maximum length of the FTT-10 Network is 1600 feet (combined total cable length); this distance can be exceeded with the use of a repeater board.
- For all network cable connections, use Belden #8471 or Belden #85102. (These are not polarity sensitive connections.)

# DRAWING 31 - FTT-10 NETWORK WITH REPEATER BOARD

# TROUBLESHOOTING GUIDE

If you experience the following types of problems with your RC-2000 system:	Turn to this page:
Data	58, 59
Display	60
System Power	61, 62
Serial Communication	62, 63
CPU	62
Serial Input Modules	62, 63, 64, 65
Serial Relay Boards (Digital Output)	62, 63, 64, 65, 66
I/O	62, 63, 64, 65, 66
Temp Sensor	67
Pressure Transducer	<b>6</b> 8
kW Power Monitoring	69, 70
kW Watt Transducers	69, 70
Current Transformers (CTs)	69, 70
Kysor-Warren Interface Control	71-77

# **TROUBLESHOOTING**

# INTRODUCTION

This section will guide you in problem identification and corrective procedures when your RC-2000 system malfunctions. System part failures are addressed from a hardware standpoint; those discussed include: the RC-2000 Screen Display, Keypad, Power System, Serial Communication, Serial Modules, Relay Boards, Temperature Sensors, and Pressure Transducers.

### DATA CORRUPTION

Corrupt data (i.e., scrambled sensor names, strange characters such as ♦: >\*, etc.) will cause your RC-2000 system to malfunction. If this happens, your system has a Master Clear function. Perform a Master Clear if your data is corrupted.

#### **IMPORTANT**

The Master Clear function DESTROYS all existing data in RAM. Use the Master Clear function as a last resort.

#### MASTER CLEAR PROCEDURE

Follow the ten steps listed below to perform a Master Clear of your data in RAM.

- 1. Press [ENTER] from the Banner Screen.
- 2. Press [your Level 2 Access Code] to access the Main Menu.
- 3. Press [7] (System).
- 4. Press [8] (Master Clear).
- Press [ENTER], the screen will display a "→ No Action" message.
- 6. Press [ENTER] again. The "N" will start to blink.
- 7. Press the  $[\uparrow \text{ or } \downarrow]$  arrow until "Master Clear" appears.
- 8. Press [ENTER] when you reach "Master Clear" to confirm your choice.
- 9. Press [EXIT].
- 10. Wait a few seconds for your RC-2000 to Master Clear.

#### Master Clear

Select the Reset Function:

No Action Reset CPU Master Clear Clr Alarm

### **EEPROM DATA RETRIEVAL**

The RC-2000 automatically backs up all setpoints in EEPROM. Automatic saves occur when you make changes to setpoints and then exit to the Banner Screen.

#### **EEPROM DATA RESTORATION**

To restore the setpoints saved in EEPROM after a Master Clear, follow these steps:

- 1. Go to the Master Clear screen. (For the path to this screen, see the "Master Clear Procedure" steps listed previously in this section.
- 2. Press the [↑ or ↓] arrow until you reach "Reset CPU."
- 3. Press [ENTER] to confirm your choice.
- 4. Press [EXIT].
- 5. Wait a few seconds for your RC-2000 to reset. All setpoints will be restored.
- 6. The Banner screen will display "Retrieving Setpoints From Flash."

### **EEPROM DATA DESTRUCTION**

To destroy the setpoints saved in EEPROM (for a complete clear) after a Master Clear, follow these steps:

- 1. Enter [your Level 2 access code].
- 2. Press [2] (Racks).
- 3. Press [6] (Configuration).
- 4. Press [ENTER] two times.
- 5. Press [EXIT] to the Banner Screen.

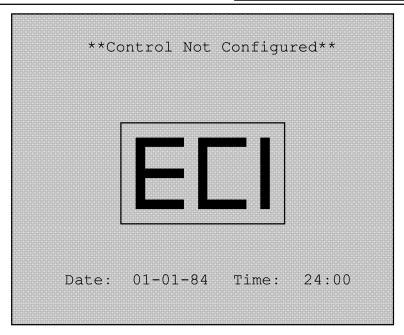
# **BANNER SCREEN**

Your RC-2000 will default to the Banner Screen if:

- 1. The RC-2000 is a new unit that has never been configured or programmed.
- 2. The internal 'Watchdog' circuit has received non-conforming internal data and has initiated a complete master clear.
- 3. You have initiated a manual master clear.

#### NOTE

Once you assign new setpoints or retrieve data from Flash EEPROM, the "Control Not Configured" message on the Banner Screen will disappear.



**DRAWING 33-RC-2000 BANNER SCREEN** 

## **DISPLAY SCREEN**

Your display screen may not always present your data in an easy-to-view manner. Some problems you may experience with your screen include: a rolling display, a blank display, or an unlit display.

## **ROLLING DISPLAY SCREEN**

**Possible Cause:** The display screen may roll because the jumper JP1 is not set correctly on the RC-2000 CPU.

**Corrective Procedure**: Correct the JP1 Jumper settings. Set them at:

- 4 meg if Version 4 or greater
- •2 meg if Version 3 or less

### **BLANK DISPLAY SCREEN**

**Possible Cause:** The display screen may look blank because the contrast is not set.

**Corrective Procedure:** Adjust the contrast knob (it is located on the lower half of the CPU).

**Possible Cause:** The 25 Pin Blue Ribbon Cable that connects the CPU to the display is not connected correctly.

**Corrective Procedure:** Reconnect the cable correctly.

### **IMPORTANT**

On earlier hardware versions, make sure the display ribbon cable double row is plugged into the top of both the CPU and the display. On the ribbon cable, use both tops or both bottoms.

Proper connection is silk-screened on the CPU board.

### **UNLIT DISPLAY**

**Possible Cause:** CPU is not providing power for the backlight display. (Before following the corrective procedures, check the voltages on the connector U41 (labeled backlight display). The two outside pins should read 350VAC.

# CAUTION HIGH VOLTAGE!

Because of the high voltage level, use caution when checking the CPU voltage. This voltage level is high enough to electrocute.

If the voltage readings are incorrect:

Corrective Procedure: Change the CPU.

**Possible Cause**: The backlight is burned out if the CPU passes a voltage check.

Corrective Procedure: Change the display.

# **POWER SYSTEM FAILURE**

The RC-2000 Power Supply Board contains three red LEDs. In normal power system operation, these LEDs are always lit. They show the condition of the following power supply voltages:

- •D11 represents 5VDC
- •D12 represents 12VDC
- •D13 represents 9VDC

An unlit LED indicates power system malfunction.

### **POWER SYSTEM CHECKS**

When you experience power system malfunction, go through the steps below to determine the problem.

- 1. Make sure that the power switch on the Power Supply Board is turned on.
- 2. Check and measure the incoming 115/230VAC supply to the Power Supply Board.
- 3. Disconnect the power at the power switch.
- 4. Check the fuse for continuity with an ohmmeter.
- 5. Remove the black plastic cover off the connector on J15 of the power board.

### **NOTE**

You may have to disconnect the ribbon cable to remove the plastic cover from the connector.

6. Reconnect the power at the power switch.

7. Measure the DC voltages on J15 as follows; use pin 12 as a Gnd reference.

### **WARNING**

Accidental shorting may occur when checking the voltages. This may DAMAGE your system.

#### NOTE

Pin one corresponds with the red side of the cable.

PIN NUMBER	DC VOLTAGE
1	-24VDC
2	+9VDC
3	+5VDC
4	Gnd
5	+5VDC
6	Gnd
7	+12VDC
8	Gnd
9	+12VDC
10	+9VDC
	(battery)
11	+13VDC
	(watch dog)
12	Gnd

8. If the voltage is incorrect, disconnect the power cable from the CPU and measure all voltages again.

# **IMPORTANT**

If you have performed all of the above checks, and your RC-2000 is still in power failure, call ECI Field Service at 410-403-4000 ext. 3238 for assistance.

9. If the voltage is still incorrect, you have a problem with your power supply, change it.

# SERIAL COMMUNICATION FAILURE

## **SERIAL COMMUNICATION STATUS**

A red blinking LED on each serial module shows normal communication status. A red LED that does not blink indicates a serial communication problem. The information below about normal communication will help you determine where your system may need adjustment. ECI recommends performing the general communication checks listed below. If you still experience serial communication failure, proceed to the specific board sections, and perform the recommended checks listed there.

- 1. The serial module or relay board must be assigned in the program at least once before the RC-2000 will try to communicate.
- 2. Starting at the RC-2000, proper polarity of the serial communication wires must be maintained through every serial module in the loop.
- 3. Starting at the RC-2000, 12VAC power must be supplied through every module in the loop.
- 4. The transformer supplying the 12VAC can't be loaded down (do a load chart to make sure it is not; refer to Table 3 in this manual for load chart information).

#### NOTE

Remotely mounted boards will require the 12VAC power to be supplied locally.

5. Each serial module must have a unique address within its particular family.

# SERIAL COMMUNICATION SYSTEM CHECKS

If you verify all of the above, unhook the serial communication wires from the RC-2000, and check the following components of Serial Communication for operation failure:

- The CPU
- The Serial Input Module(s)(8 Channel Analog and Digital Input)
- The Relay Board(s) (Digital Output)

Follow the troubleshooting procedures recommended in the corresponding sections that follow.

### **CPU OPERATION FAILURE**

**Possible Indication:** On the RC-2000 CPU, the Serial Tx (transmit) and Serial Rx (receive) LEDs should blink back and forth.

# Corrective Procedure: If they do not blink, the communication problem may be in the serial

wires. Remove the 12VAC and Serial Communication connectors (the J1 connector) at the top right corner of the board. Turn the board off for 15 seconds, and then turn it back on. The red Serial Tx (transmit) will blink; this indicates a communication attempt. If it doesn't blink, your CPU may be damaged. Contact an ECI representative for further information

### **NOTE**

In the RC-2000 Version 4.00 or higher, the I/O point must be assigned in the program for the red Serial Tx (transmit) to blink.

Corrective Procedure: If they do blink, but you still experience serial communication failure, the communication problem may be in the serial modules. To determine this, remove all of the I/O boards from the loop and start wiring them in one at a time until you find the one that is causing the serial LEDs to stop blinking.

### **BOARD STATUS SCREEN**

The Board Status Screen (see below) in the RC-2000 will help troubleshoot any serial communication problems. The RC-2000 scans each serial module for correct communication and shows the status of the serial modules connected to the RC-2000. This screen displays the following status messages:

- On Line
- Off Line
- Unused
- Need Cnfg
- Checksum

On Line indicates the module is responding correctly.

**Off Line** indicates the module is assigned in the setpoints, but is not responding.

**Unused** indicates the module is not assigned in the setpoints program.

**Need Cnfg** indicates a board is assigned as one type, but the hardware is configured for another.

**Checksum** indicates that the board assigned is communicating with a lot of errors.

This status data will aid in troubleshooting serial communication, and help you identify specific board problems.

For example,

The Board Status screen will display a "NeedCnfg" message if a board is assigned as one type but the hardware is configured for another.

It will also display a **checksum** message if the board assigned is communicating with a lot of errors. (This is possibly caused by high voltage.)

To access this screen from the Banner Screen:

- 1. Press [ENTER].
- 2. Press [your level 2 access code], or [ENTER] again.
- 3. Press [7] (System).
- 4. Press [5] (I/O List).
- 5. Press [5] (Board Status).

Anlg In	Dig In	Anlg Out	Dig Out
1 On Line 2 On Line 3 Off Line 4 Unused 5 Unused 6 Unused 7 Unused 8 Unused	Off Line Unused Unused Unused Unused Unused Unused Unused	Unused Unused Unused Unused Unused Unused Unused	On Line On Line Off Line Unused Unused Unused Unused Unused

### **DRAWING 34-BOARD STATUS SCREEN**

### **DEBUG FEATURE**

The Debug feature will also help you track down a problem I/O Board.

To use the Debug feature:

- 1. Press [ENTER] from the Banner Screen.
- 2. Press [your level 2 access code].
- 3. Press [7] (System).
- 4. Press [9] (Debug).

The Debug Menu will appear.

### **PSI ERROR SCREEN**

This screen is choice 4 of the Debug Menu. This screen will also help you troubleshoot serial module communication problems in your RC-2000. It lists each board with the number of communication errors. A high error count may lead you to the problem I/O Board.

#### NOTE

To access this screen you need a Level 2 access code.

To access the Psi Error Screen, follow the path listed for the Debug Menu. Once you are in the Debug Menu:

1. Press [4] (Psi Errors).

# Debug 1 Debug Setup 4 Psi Errors 2 Debug Display 5 Stack Check 3 Free Memory 6 Memory Dump

### **DRAWING 35-DEBUG SCREEN**

Psi Errors						
Reset err	or? No					
Anls In 1 000 2 000 3 000 4 000 5 000 6 000 7 000 8 000	Dig In 000 000 000 000 000 000 000	Anls Out 000 000 000 000 000 000 000 000 000	Dig Out 000 000 000 000 000 000 000			

### SERIAL INPUT MODULE FAILURE (8 CHANNEL ANALOG INPUT/DIGITAL INPUT)

A red blinking LED on each serial module shows normal communication status. If a red LED is not blinking, you should follow the list of checks below to ensure normal communication.

- 1. Verify communication status. If the red LED is not blinking, communication status is not normal.
- 2. Verify the board has a unique address within its family.
- 3. Verify the input assignment in the program.
- 4. Verify 12VAC power to the module.
- 5. Verify the DC inputs with nothing attached. They should read:

Temperature: 5VDC
Pressure: 6VDC
0-10V: 10VDC
Digital Input: 5VDC

If the DC inputs are incorrect, check the configuration of the modules. If the module configuration appears correct, most likely the module is bad. Change the module.

### SERIAL RELAY BOARD FAILURE (8 CHANNEL DIGITAL OUTPUT)

A red blinking LED on each relay board shows normal communication status. If a red LED is not blinking, note the information below about normal communication.

- 1. 12VAC power must be applied to the relay board.
- 2. The relay must be assigned correctly in the program.
- 3. Normally Open and Normally Closed contacts must be connected correctly. Check the 3 amp, 250VAC fuse on the common leg of each relay.
- 4. You may override relay operation. The red LEDs indicate the relay is energized. Blinking yellow LEDs indicate the relay is in an override state (i.e., either energized or de-energized.)

### **NOTE**

When a relay board fails, all relays fail to normally closed status.

### **DIGITAL OUTPUT LIST SCREEN**

You can view the current RC-2000 relay assignments board-by-board through the Digital Output List Screen. Accessing this screen requires no access code.

The title line consists of the board number and screen title. Each line describes a relay by the following:

- 1. Channel number
- 2. Number of times the relay is assigned
- 3. Type of output to which the relay is assigned
- 4. User-defined name of the output associated with the relay
- 5. Polarity of the relay EOFF = Energized Off EON = Energized On
- 6. Number of times the load is currently being called for.

### **NOTE**

A load that is being called for more than it is assigned indicates scrambled (corrupt) data. For more information refer to the Master Clear information in this section.

Typically, loads that are EON are wired N/O and loads that are EOFF are wired N/C.

Follow this path to access this screen from the Banner Screen:

- 1. Press [ENTER].
- 2. Press [ENTER] again.
- 3. Press [7] (System).
- 4. Press [5] (I/O List).
- 5. Press [4] (Digital Output).

Boar			7	Digital	Jutputs		-
1-1	1	_		RACK A			1
1-2	1	Compr	2	RACK A		EOFF	1
1-3	1	Compr	3	RACK A		EOFF	1
1 - 4	1	Compr	4	RACK A		EOFF	1
1-5	1	Compr	5	RACK A		EOFF	1
1-6	1	Compr	6	RACK A		EOFF	1
1-7	1	Compr	7	RACK A		EOFF	1
1-8		Compr	8	RACK A		EOFF	1

**DRAWING 37-DIGITAL OUTPUT LIST SCREEN** 

### TEMPERATURE SENSOR FAILURE

If you suspect temperature sensor failure, follow the system checks listed below to determine problem areas:

- 1. Measure the DC voltage from the sensor number to the common terminal.
- 2. Convert the voltage to a temperature with the conversion chart listed in Appendix A or calculate the conversion with this equation:

### Temperature = $(V \text{ measured} - 2.554) \times 180$

3. Compare the temperature to the display.

If the temperature does agree, the problem is probably in one of three areas:

- ⇒ **The Sensor**. It is either offset, or it needs to be replaced.
- $\Rightarrow$  The Connection Wire.
  - ♦ Check for continuity on the cable run.
  - ♦ Make sure the cable is clear of high voltage.
  - ♦ Verify connection at sensor.

#### **NOTE**

With the cable connected at the module end, and no sensor attached, the voltage reading should be 5VDC at the sensor end.

**The Sensor Placement**. If it is placed in discharge or return, etc., make sure the sensor is in airflow.

If it is strapped to an evaporator or other pipe, make sure it is insulated.

If you are reading the air temperature, insulate the sensor from metal surfaces.

### PRESSURE TRANSDUCER FAILURE

If you suspect pressure transducer failure, perform the following checks in an effort to identify the problem area:

1. Measure the voltage between the +12VDC terminal and the common terminal on the Serial Analog Input Module. The voltage should read 13-16VDC at the bottom of the module.

#### If it does not:

The module is bad, or the module is not receiving proper power.

2. Check the status LED on the serial module. It should be blinking.

#### If it is not:

You may be experiencing serial communication failure. Refer to the Serial Module information of this Troubleshooting section.

- 3. With the transducer attached, measure the voltage between the sensor number terminal and the common terminals on the module.

  Use the conversion tables in Appendix A or the pressure to voltage equations provided to determine if the pressure reading in the display agrees with the measured reading.
- 4. Check the module configuration to make sure it is a pressure module.

### PRESSURE TO VOLTAGE CONVERSION EQUATIONS

**Suction Pressure** =  $(V \text{ measured - 1}) \times 20$ **Head Pressure** =  $(V \text{ measured -1}) \times 100$ 

For variable speed operation only, use the following equations:

### Oil Pump Output Pressure =

(V measured - 1) x 20

### **Display Oil Pressure =**

(Oil Pump Pressure) – (Suction Pressure)

#### NOTE

- ⇒ If the reading is 0VDC, the white wire or transducer is shorted or the black/red wires may be open.
- ⇒ If the reading is 12VDC or greater, the transducer is defective.
- ⇒ If the calculated pressure does not agree with the RC-2000 display, the module is out of calibration or there is a problem with the CPU. Check for a sensor offset in the RC-2000. You may need to replace the input module.
- ⇒ If the calculated pressure agrees with the display, the transducer is out of calibration. If the transducer is only out (+) or (-) 5 lbs., the sensor can be offset in the program. If the sensor is out more than (+) or (-) 5 lbs., replace the transducer.

### **kW WATT TRANSDUCER OPERATION FAILURE**

### KW WATT TRANSDUCER TROUBLESHOOTING EQUIPMENT

- 1. Digital multimeter (DMM)
- 2. Calculator
- 3. Test clip leads
- 4. Phase rotation analyzer
- 5. Clamp on ammeter

### CURRENT TRANSFORMER (CT) CHECKS

- ⇒ Check for the correct installation orientation of the CT (i.e., H1 toward line).
- ⇒ Check for the correct wire connection and termination at the transducer (e.g., each connection of a CT should have a wire connected and terminated at the transducer).
- ⇒ Make sure the "pig tailed" wire or shorting blocks are not shorting out the CT secondaries.
- ⇒ Make sure you are using the correct CT ratio.

### **NOTE**

Label this value on the switchgear cabinet for a quick and accurate reference.

#### **KW WATT TRANSDUCER CHECKS**

- ⇒ Make sure incoming voltages are properly fused.
- ⇒ Make sure you are using an applicable transducer model number for the application.
- ⇒ Make sure you are using the correct voltage and the CT is wired correctly.

### KW WATT TRANSDUCER TROUBLESHOOTING PROCEDURES

- 1. Check the phase rotation for proper labeling and hookup.
- 2. Disconnect the wires for the output voltage from the transducer. All readings will be done from the DMM.

- 3. Set the meter on the 10VDC scale (or next highest range), and connect to the watt transducer. Terminal 1 is negative and Terminal 2 is positive.
- 4. Ensure that the voltage reading on the DMM is positive. If not, go directly to the kW Watt Transducer Troubleshooting Checks section.
- 5. Verify the maximum CT value and calculate the maximum kW at 10VDC (per the example below).

Use this equation to determine the maximum CT value:

### [(the CT scale factor\*) x (the CT max\*\*) = (the max. CT value)]

For example:

With 3000:5 current house power @ 208V,

multiply the following per the equation above:

 $(.36 \times 3000) = 1080$ 

to determine: a 1080 kW at 10VDC yield or 108 kW/volt (the max, kW @ 10VDC).

\*For a list of CT scale factors, see Table 19 in Appendix C.

\*\*The CT max is the first number in a standard CT ratio rating (i.e., for a ratio of 3000:5, use 3000 for the CT max value).

6. Multiply the voltage reading on the DMM by the kW/V value.

For example:

For a voltage reading on the DMM of 3.3 VDC output and a kW/V value of 108:

multiply

(3.3VDC output x 108 kW/V = 356.4 kW) for a yield of 356.4 kW.

 $(over \rightarrow)$ 

- 7. Evaluate the kW value calculated and displayed on the controller for correctness. Follow these procedures to do this:
  - ⇒ Call the store operations personnel for a normal operational kW value. This will verify if the value is in the "ball park." If the store is equipped with monitoring devices (such as a power meter with a kW readout), use this to find an accurate value for comparison purposes.
  - ⇒ Use external monitoring equipment (Dranetz or Esterline Angus) if available, to find an accurate value for comparison purposes.
  - ⇒ For rack loads, a fairly accurate reading can be obtained by using a voltmeter and clamp on ammeter.
  - ⇒ Take current readings on each phase and multiply it by the voltage to neutral of that phase. Add all three phase values together. This will give a volt-amp value that is close to the kW usage. This doesn't take into account power factor, but will be a good working value in the absence of other more exact methods.

### **kW WATT TRANSDUCER TROUBLESHOOTING CHECKS**

- 1. Check the fuses.
- 2. Check the voltages at the watt transducer for the correct value.
- 3. Check the CT secondary currents at the watt transducer. They should be less than 5 amps AC.
- 4. Verify that the correct scale factor is used on the controller.

### **NOTE**

### Typically:

If one CT is reversed, the output will be positive, but reduced.

If two CTs are reversed, the output will be as above, but negative.

If all three CTs are reversed, the output magnitude will be correct, but will be negative.

A good indication of mixed CT hookup includes:

Sparking when shorting or unshorting the CTs (while connected to the transducer).

#### NOTE

A CT, if connected to the proper terminals, WILL NOT do any sparking when shorted.

### **KWIC TROUBLESHOOTING**

TABLE 15 – PIB STATUS LED (DS100) CHECKS/KWIC ECHELON CHASSIS ASSEMBLY

STATE OF STATUS LED 'DS100'	CONDITION
ON THE PIB BOARD	
Steady On	Configured with satisfactory operation
Fast Blink	Alarm condition in KWIC processor
	Note: Try to configure the node again
Steady Off (after the Install Node	KWIC in Fail Safe (no active communications)
and Configure Node functions)	
Steady Off (Before Configure Node	Need to install and configure the KWIC Assembly
has been performed.)	

### ECHELON HARDWARE VISUAL CHECK

The status LED will indicate certain conditions on the KWIC Echelon Assembly. Table 15 shows the status checks you can perform via this LED's properties.

### ALARM CONDITION STEPS AT THE KWIC ECHELON ASSEMBLY

If the status LED on the PIB fast blinks (see Table 15 above), your KWIC device may be in an alarm condition. If you suspect the KWIC Assembly is in alarm condition, perform a Check Node to try to determine the Echelon Error Code (see Table 16). Follow the Troubleshooting Procedure listed in Table 16 for the Error Code you have determined.

The list that follows catalogs the most common reasons you may find the system in an alarm condition:

- If an Output Module on a KWIC Assembly is replaced with a different type of output module after the original Configure Function was performed.
- 2. If a KWIC Echelon Assembly is configured without all programmed Output Modules installed at the time of configure.
- 3. If a KWIC Echelon Assembly is configured without the Expansion Assembly connected to the Echelon Assembly via the interconnect cable at the time of configuration.

- 4. If the RC-2000 is reconfigured to modify the number of Network Digital Output boards within the system (either adding or removing a Network Output Module after the KWIC Assembly was already configured).
- 5. If an Output Module on a KWIC Assembly has malfunctioned.

### NOTE

Hot Swappable Output Modules on a KWIC Output Module may be removed and replaced with the same type of module without reconfiguring the KWIC Assembly.

### KWIC/ECHELON HARDWARE CHECKS

Improper hardware hookup will cause the KWIC device to malfunction. To determine if the KWIC device's hardware is hooked up correctly make sure the following is done:

*Make sure* **24VAC POWER** is present at the **J105 connector's top two pins**.

**Remove** the first output module from the Kysor assembly to see the **channel group selector switch (SW200) on the Buss board**. The switch should be set as follows:

- "Up:" 1-4 (for the Assembly with the Echelon Engine) and
- "Down" 5-8 (for the KWIC Assembly used for expansion)

*Make sure* all output modules are connected to both the driver assembly and the expansion assembly.

*NOTE:* If **ALL** output modules are not installed, **reconfigure** the KWIC assembly.

When using a KWIC **EXPANSION** Assembly,

<u>make sure</u> it is **CONNECTED** to the KWIC **Driver** Assembly in the Expansion port with ECT Chassis Interconnect cable (Part # 5025014400-02, -04, or -20).

*Check* the cable connection for the Echelon communication at the P1 connection on the Echelon Engine and at the LON connector on the MIP Daughterboard on the RC-2000.

*IMPORTANT:* The Echelon communication at the P1 connection on the Echelon Engine must be secure for the device to communicate properly.

*Check* that one 510hm ½ watt resistor is connected across the connector at either the P1 connection on the KWIC Echelon engine or the LON connector at the MIP Daughterboard at the RC-2000.

*IMPORTANT:* No more than one 510hm resistor should be installed on a single network.

*Make sure* that the yellow LON LED (LD1) is lit on the RC-2000.

**Suggestion:** If it is not lit, reset the RC-2000 by interrupting the power.

**Check** the status. If the status does not end with the four digits [0000], then refer to Table 5 for a description of specific error codes. If the error code is not listed, then perform the node check procedure found in the software setup section of this manual.

*IMPORTANT:* The digital output interface setup shouldn't have more outputs allocated than the KWIC assemblies have modules to support.

### RC-2000/KWIC ECHELON ASSEMBLY COMMUNICATIONS

To determine if the KWIC malfunction is the result of improper communication setup follow the procedures listed below.

**Look** at the red status LED, DS100 on the PIB. Make sure it is lit steady on.

*Place* the programmed relays in override at the RC-2000 via the software.

All KWIC relay light indicators should react according to override.

*Enter* the Board Status screen in the RC-2000.

The KWIC modules and all programmed KWIC boards for Digital Output should display as **ONLINE**.

To access the Board Status Screen, follow this path:

- a. Press [EXIT] until you arrive at the Main Menu.
- b. Press [7], System.
- c. Press [5], I/O List.
- d. Press [5], Board Status.

### **IMPORTANT**

The system status LED should be lit if the above checks are verified.

If it is not, the KWIC may be malfunctioning because of a hardware problem.

*Check* Dipswitches S1 and S2 on the Echelon Engine.

ALL SWITCHES should be set to OFF.

TABLE 16 – RC-2000-KWIC ERROR MESSAGES

ECI								
ERROR CODE #	MEANING	TROUBLESHOOTING PROCEDURE						
1	KWIC Assembly has lost reliable communications with RC-2000.	<ol> <li>Check the Dig Out Interface Screen.</li> <li>Make sure boards are assigned as Network.</li> </ol>						
2	Switch Block S2, Switches 1 through 5 (no. of relays per relay board) are set incorrectly.	All switches on Switch Blocks S1 and S2 should be off for the RC-2000.						
3	Switch Block S2 Switches 1 through 5 (no. of relays per relay board) are set incorrectly.	All switches on Switch Blocks S1 and S2 should be off for the RC-2000.						
4	KWIC Assembly does not have enough control points installed to support all control point assignments assigned in RC-2000.	<ul> <li>A malfunctioning module was installed.         OR</li> <li>More modules need to be installed.</li> </ul>						
17	Module installed in Channel 1 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned,	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>						
18	Module installed in Channel 2 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>						
19	Module installed in Channel 3 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>						
20	Module installed in Channel 4 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>						
21	Module installed in Channel 5 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>						

ECI ERROR CODES	MEANING	TROUBLESHOOTING PROCEDURE
22	Module installed in Channel 6 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>
23	Module installed in Channel 7 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new one.</li> </ol>
24	Module installed in Channel 8 of KWIC Driver Chassis Assembly has  • been removed,  • been replaced with a  • different type of module, or  • has malfunctioned.	<ol> <li>First, replace any removed modules.</li> <li>If problem still exists, verify the module is the correct type (i.e., circuit or compressor).</li> <li>Otherwise, replace the malfunctioning module with new on.</li> </ol>
25	Switch Block S2, Switches 1 through 5 (no. of relays per relay board) are all off.	This is a WARNING, not an error. This warning is common during installations and after power resets.  NOTE  For the RC-2000 this message is normal during installation and after power resets.
26	Switch Block S1, Switches 1 through 8 (subnet address) are set incorrectly.	All switches on Switch Blocks S1 and S2 should be off for the RC-2000.
27	Switch Block S2, switches 6 through 8 (node address) are set incorrectly.	All switches on Switch Blocks S1 and S2 should be off for the RC-2000.

### KWIC/RS485 ASSEMBLY TROUBLESHOOTING

To determine if the KWIC malfunction is the result of improper RS485 communication setup, follow the procedures listed below:

Look at the green status LED (LD2) on the RS485 Engine Board. Upon power up it goes on, and remains on during the power up procedure (approximately 15 seconds). After power-up, however, the green light should go off.

If the status LED remains on AFTER the power-up procedure, a problem has been detected in either the program or hardware.

### **KWIC/RS485 HARDWARE CHECKS**

Perform the following checks to determine if the KWIC malfunction is the result of a hookup error:

- 1. Check the wiring of the P1 connector on the RS485 Engine Board. This connector is for the RS485 network connections. Observe the polarity on this connection to make sure it is correct throughout the loop.
- 2. Check connector J105 on the PIB Engine Board, this connector is for power connection. Make sure that 24VAC is applied at the J105 connector's top two pins.

- 3. Remove the first output module from the Kysor Assembly to see the channel group selector switch (SW200) on the Buss Board. The switch should be set as follows:
  - "Up:" 1-4 for the KWIC RS485 Assembly
  - "Down:" 5-8 for the KWIC Expansion Assembly
- 4. Make sure all output modules are connected to both the Driver Assembly and the Expansion Assembly.

#### NOTE

If ALL Output modules are not installed, remap the KWIC Assembly.

- 5. When using a KWIC Expansion Assembly, make sure it is connected to the KWIC Driver Assembly in the Expansion port with ECT Chassis Interconnect cable (Part # 5025014400-02, -04, or -20).
- 6. On the RS485 Engine Board, verify that Switch Block 1 is properly set for board addressing.
- 7. On Switch Block 1, Dipswitches 6 & 7, verify that the baud rate setting is correct, as compared to the other I/O boards, and the CPC controller.
- 8. On Switch Block 2, check Dipswitches 1 & 2 for uniform polarity settings within the RS485 communication loop.

TABLE 17 - PIB STATUS LED (DS100) CHECKS/KWIC RS485 CHASSIS ASSEMBLY

STATE OF STATUS LED 'DS100' ON THE PIB BOARD	CONDITION
Steady On	Installed with satisfactory operation
Fast Blink	Alarm condition in KWIC processor
	Note: Try to remap the system again
Steady Off (after the installation and	KWIC in Fail Safe (no active communications)
remap)	
Steady Off (Before Installation has	Need to install and remap the system
been performed.)	

### START UP/REMAP PROCEDURE

If the system is not responding to commands, it may need to be remapped.

#### NOTE

You must perform the remap/initialization process upon initial KWIC Device start up or KWIC Device configuration changes.

You do not have to perform the remap process for Dipswitch changes or to replace failing modules of the same type.

### **REMAP SYSTEM STEPS**

Follow the steps below if the system needs to be remapped.

- 1. Power down the KWIC Device by disconnecting the J105 24VAC connector on the PIB Board.
- 2. Set all Dipswitches on Switch Blocks S1, S2, and S3 as per the system guidelines.
- 3. Set Switch 8 on Switch Block 1 (S1) to the up 'ON' position.
- 4. Power up the KWIC Device by reconnecting the J105 24VAC connector on the PIB Board. [Upon restart of the KWIC Device, wait for the green LED (LD1 'ST') on the RS485 Engine board to go out (approximately 15 seconds).]
- 5. Push the Cnfg/Svc Switch on the PIB Board until the status light on the PIB Board lights.
- 6. Set Switch 8 on Switch Block 1 (S1) to the down 'OFF' position.
- 7. Watch for the green LED (LD1 ST) on the RS485 Engine to go off (when the green LED goes off, the remap process is finished. The system is ready for operation).

#### NOTE

If any switch is changed, the change will not take effect until power is removed and reapplied.

The malfunction within the unit may be the result of the software programming if:

- hardware settings check out okay,
- the system does not need remapped,
- after performing the remap process, the KWIC Device still does not respond to commands.

If you think this may be the case, consult an authorized service technician.

# APPENDIX A RC-2000 CONVERSION TABLES

TABLE 18- PRESSURE TO VOLTAGE CONVERSION: SA-100D & SA-100A

PRESSURE	VOLTAGE	PRESSURE	VOLTAGE		PRESSURE	VOLTAGE
0	1.00	34	2.70		68	4.40
1	1.05	35	2.75		69	4.45
2	1.10	36	2.80		70	4.50
3	1.15	37	2.85		71	4.55
4	1.20	38	2.90	1	72	4.60
5	1.25	39	2.95		73	4.65
6	1.30	40	3.00	1	74	4.70
7	1.35	41	3.05		75	4.75
8	1.40	42	3.10		76	4.80
9	1.45	43	3.15		77	4.85
10	1.50	44	3.20		78	4.90
11	1.55	45	3.25		79	4.95
12	1.60	46	3.30		80	5.00
13	1.65	47	3.35	1	81	5.05
14	1.70	48	3.40		82	5.10
15	1.75	49	3.45	1	83	5.15
16	1.80	50	3.50	1	84	5.20
17	1.85	51	3.55	1	85	5.25
18	1.90	52	3.60	1	86	5.30
19	1.95	53	3.65		87	5.35
20	2.00	54	3.70		88	5.40
21	2.05	55	3.75		89	5.45
22	2.10	56	3.80		90	5.50
23	2.15	57	3.85		91	5.55
24	2.20	58	3.90		92	5.60
25	2.25	59	3.95		93	5.65
26	2.30	60	4.00		94	5.70
27	2.35	61	4.05		95	5.75
28	2.40	62	4.10		96	5.80
29	2.45	63	4.15		97	5.85
30	2.50	64	4.20		98	5.90
31	2.55	65	4.25		99	5.95
32	2.60	66	4.30		100	6.00
33	2.65	67	4.35	]		

PRESSURE         VOLTAGE         PRESSURE         VOLTAGE         PRESSURE           0         1.00         34         1.34         68           1         1.01         35         1.35         69           2         1.02         36         1.36         70           3         1.03         37         1.37         71	1.68 1.69 1.70
1     1.01       2     1.02       3     1.03         35     1.35       36     1.36       37     1.37       71	1.69
2     1.02       3     1.03       36     1.36       37     1.37       71	
3 1.03 37 1.37 71	1.70
	1.71
4 1.04 38 1.38 72	1.72
5 1.05 39 1.39 73	1.73
6 1.06 40 1.40 74	1.74
7 1.07 41 1.41 75	1.75
8 1.08 42 1.42 76	1.76
9 1.09 43 1.43 77	1.77
10 1.10 44 1.44 78	1.78
11 1.11 45 1.45 79	1.79
12 1.12 46 1.46 80	1.80
13 1.13 47 1.47 81	1.81
14 1.14 48 1.48 82	1.82
15 1.15 49 1.49 83	1.83
16 1.16 50 1.50 84	1.84
17 1.17 51 1.51 85	1.85
18 1.18 52 1.52 86	1.86
19 1.19 53 1.53 87	1.87
20 1.20 54 1.54 88	1.88
21 1.21 55 1.55 89	1.89
22 1.22 56 1.56 90	1.90
23 1.23 57 1.57 91	1.91
24 1.24 58 1.58 92	1.92
25 1.25 59 1.59 93	1.93
26 1.26 60 1.60 94	1.94
27 1.27 61 1.61 95	1.95
28 1.28 62 1.62 96	1.96
29 1.29 63 1.63 97	1.97
30 1.30 64 1.64 98	1.98
31 1.31 65 1.65 99	1.99
32 1.32 66 1.66 100	2.00
33 1.33 67 1.67 101	2.01

PRESSURE	VOLTAGE	PRESSURE	VOLTAGE		PRESSURE	VOLTAGE
				-		
102	2.02	136	2.36	ł	170	2.70
103	2.03	137	2.37		171	2.71
104	2.04	138	2.38		172	2.72
105	2.05	139	2.39		173	2.73
106	2.06	140	2.40		174	2.74
107	2.07	141	2.41		175	2.75
108	2.08	142	2.42		176	2.76
109	2.09	143	2.43		177	2.77
110	2.10	144	2.44		178	2.78
111	2.11	145	2.45		179	2.79
112	2.12	146	2.46		180	2.80
113	2.13	147	2.47		181	2.81
114	2.14	148	2.48		182	2.82
115	2.15	149	2.49		183	2.83
116	2.16	150	2.50		184	2.84
117	2.17	151	2.51		185	2.85
118	2.18	152	2.52		186	2.86
119	2.19	153	2.53		187	2.87
120	2.20	154	2.54		188	2.88
121	2.21	155	2.55		189	2.89
122	2.22	156	2.56		190	2.90
123	2.23	157	2.57		191	2.91
124	2.24	158	2.58		192	2.92
125	2.25	159	2.59	1	193	2.93
126	2.26	160	2.60	1	194	2.94
127	2.27	161	2.61	1	195	2.95
128	2.28	162	2.62	1	196	2.96
129	2.29	163	2.63	1	197	2.97
130	2.30	164	2.64	1	198	2.98
131	2.31	165	2.65	1	199	2.99
132	2.32	166	2.66	1	200	3.00
133	2.33	167	2.67	1	201	3.01
134	2.34	168	2.68	1	202	3.02
135	2.35	169	2.69	1	203	3.03
	:			1		2.02

				 D α SA-SUUA	·
PRESSURE	VOLTAGE	PRESSURE	VOLTAGE	PRESSURE	VOLTAGE
204	3.04	238	3.38	272	3.72
205	3.05	239	3.39	273	3.73
206	3.06	240	3.40	274	3.74
207	3.07	241	3.41	275	3.75
208	3.08	242	3.42	276	3.76
209	3.09	243	3.43	277	3.77
210	3.10	244	3.44	278	3.78
211	3.11	245	3.45	279	3.79
212	3.12	246	3.46	280	3.80
213	3.13	247	3.47	281	3.81
214	3.14	248	3.48	282	3.82
215	3.15	249	3.49	283	3.83
216	3.16	250	3.50	284	3.84
217	3.17	251	3.51	285	3.85
218	3.18	252	3.52	286	3.86
219	3.19	253	3.53	287	3.87
220	3.20	254	3.54	288	3.88
221	3.21	255	3.55	289	3.89
222	3.22	256	3.56	290	3.90
223	3.23	257	3.57	291	3.91
224	3.24	258	3.58	292	3.92
225	3.25	259	3.59	293	3.93
226	3.26	260	3.60	294	3.94
227	3.27	261	3.61	295	3.95
228	3.28	262	3.62	296	3.96
229	3.29	263	3.63	297	3.97
230	3.30	264	3.64	298	3.98
231	3.31	265	3.65	299	3.99
232	3.32	266	3.66	300	4.00
233	3.33	267	3.67	301	4.01
234	3.34	268	3.68	302	4.02
235	3.35	269	3.69	303	4.03
236	3.36	270	3.70	304	4.04
237	3.37	271	3.71	305	4.05

PRESSURE	VOLTAGE	PRESSURE	VOLTAGE		PRESSURE	VOLTAGE
306	4.06	340	4.40	1	374	4.74
307	4.07	341	4.41		375	4.75
308	4.08	342	4.42		376	4.76
309	4.09	343	4.43		377	4.77
310	4.10	344	4.44		378	4.78
311	4.11	345	4.45		379	4.79
312	4.12	346	4.46		380	4.80
313	4.13	347	4.47		381	4.81
314	4.14	348	4.48		382	4.82
315	4.15	349	4.49		383	4.83
316	4.16	350	4.50		384	4.84
317	4.17	351	4.51		385	4.85
318	4.18	352	4.52		386	4.86
319	4.19	353	4.53		387	4.87
320	4.20	354	4.54		388	4.88
321	4.21	355	4.55		389	4.89
322	4.22	356	4.56		390	4.90
323	4.23	357	4.57		391	4.91
324	4.24	358	4.58		392	4.92
325	4.25	359	4.59		393	4.93
326	4.26	360	4.60		394	4.94
327	4.27	361	4.61		395	4.95
328	4.28	362	4.62		396	4.96
329	4.29	363	4.63		397	4.97
330	4.30	364	4.64		398	4.98
331	4.31	365	4.65		399	4.99
332	4.32	366	4.66		400	5.00
333	4.33	367	4.67		401	5.01
334	4.34	368	4.68		402	5.02
335	4.35	369	4.69		403	5.03
336	4.36	370	4.70		404	5.04
337	4.37	371	4.71		405	5.05
338	4.38	372	4.72		406	5.06
339	4.39	373	4.73		407	5.07

IADEL 19-1	HESSONE TO
PRESSURE	VOLTAGE
408	5.08
409	5.09
410	5.10
411	5.11
412	5.12
413	5.13
414	5.14
415	5.15
416	5.16
417	5.17
418	5.18
419	5.19
420	5.20
421	5.21
422	5.22
423	5.23
424	5.24
425	5.25
426	5.26
427	5.27
428	5.28
429	5.29
430	5.30
431	5.31
432	5.32
433	5.33
434	5.34
435	5.35
436	5.36
437	5.37
438	5.38
439	5.39
440	5.40
441	5.41

DETAGE CON	PERSION: SA
PRESSURE	VOLTAGE
442	5.42
443	5.43
444	5.44
445	5.45
446	5.46
447	5.47
448	5.48
449	5.49
450	5.50
451	5.51
452	5.52
453	5.53
454	5.54
455	5.55
456	5.56
457	5.57
458	5.58
459	5.59
460	5.60
461	5.61
462	5.62
463	5.63
464	5.64
465	5.65
466	5.66
467	5.67
468	5.68
469	5.69
470	5.70
471	5.71
472	5.72
473	5.73
474	5.74
475	5.75

PRESSURE	VOLTAGE
476	5.76
477	5.77
478	5.78
479	5.79
480	5.80
481	5.81
482	5.82
483	5.83
484	5.84
485	5.85
486	5.86
487	5.87
488	5.88
489	5.89
490	5.90
491	5.91
492	5.92
493	5.93
494	5.94
495	5.95
496	5.96
497	5.97
498	5.98
499	5.99
500	6.00

### TABLE 20-TEMPERATURE TO VOLTAGE CONVERSION: TP-1 (C, L, H)

TFI	MP.	VOLTAGE		MP	VOLTAGE		MP.	VOLTAGE
°F	°C	10217102	°F	°C	, volinal	°F	°C	•0217.62
-30	-34.4	2.387	2	-16.7	2.565	34	1.1	2.743
-29	-33.9	2.393	3	-16.1	2.571	35	1.7	2.748
-28	-33.3	2.398	4	-15.6	2.576	36	2.2	2.754
-27	-32.8	2.404	5	-15.0	2.582	37	2.8	2.760
-26	-32.2	2.410	6	-14.4	2.587	38	3.3	2.765
-25	-31.7	2.415	7	-13.9	2.593	39	3.9	2.771
-24	-31.1	2,421	8	-13.3	2.598	40	4.4	2.776
-23	-30.6	2.426	9	-12.8	2.604	41	5.0	2.782
-22	-30.0	2.432	10	-12.2	2.610	42	5.6	2.787
-21	-29.4	2.437	11	-11.7	2.615	43	6.1	2.793
-20	-28.9	2.443	12	-11.1	2.621	44	6.7	2.798
-19	-28.3	2.448	13	-10.6	2.626	45	7.2	2.804
-18	-27.8	2.454	14	-10.0	2.632	46	7.8	2.810
-17	-27.2	2.460	15	-9.4	2.637	47	8.3	2.815
-16	-26.7	2.465	16	-8.9	2.643	48	8.9	2.821
-15	-26.1	2.471	17	-8.3	2.648	49	9.4	2.826
-14	-25.6	2.476	18	-7.8	2.654	50	10.0	2.832
-13	-25.0	2.482	19	-7.2	2.660	51	10.6	2.837
-12	-24.4	2.487	20	-6.7	2.665	52	11.1	2.843
-11	-23.9	2.493	21	-6.1	2.671	53	11.7	2.848
-10	-23.3	2.498	22	-5.6	2.676	54	12.2	2.854
-9	-22.8	2.504	23	-5.0	2.682	55	12.8	2.860
-8	-22.2	2.510	24	-4.4	2.687	56	13.3	2.865
-7	-21.7	2.515	25	-3.9	2.693	57	13.9	2.871
-6	-21.1	2.521	26	-3.3	2.698	58	14.4	2.876
-5	-20.6	2.526	27	-2.8	2.704	59	15.0	2.882
-4	-20.0	2.532	28	-2.2	2.710	60	15.6	2.887
-3	-19.4	2.537	29	-1.7	2.715	61	16.1	2.893
-2	-18.9	2.543	30	-1.1	2.721	62	16.7	2.898
-1	-18.3	2.548	31	-0.6	2.726	63	17.2	2.904
0	-17.8	2.554	32	0.0	2.732	64	17.8	2.910
1	-17.2	2.560	33	0.6	2.737	65	18.3	2.915

TABLE 20-TEMPERATURE TO VOLTAGE CONVERSION: TP-1 (C, L, H) [continued]

	MP.	VOLTAGE	_		MP.	VOLTAGE	•		<u>, , [s</u> MP.	VOLTAGE
°F	°C			°F	°C			°F	°C	
66	18.9	2.921		98	36.7	3.098		130	54.4	3.276
67	19.4	2.926		99	37.2	3.104		131	55.0	3.282
68	20.0	2.932		100	37.8	3.110		132	55.6	3.287
69	20.6	2.937		101	38.3	3.115		133	56.1	3.293
70	21.1	2.943		102	38.9	3.121		134	56.7	3.298
71	21.7	2.948		103	39.4	3.126		135	57.2	3.304
72	22.2	2.954		104	40.0	3.132		136	57.8	3.310
73	22.8	2.960		105	40.6	3.137		137	58.3	3.315
74	23.3	2.965		106	41.1	3.143		138	58.9	3.321
75	23.9	2.971		107	41.7	3.148		139	59.4	3.326
76	24.4	2.976		108	42.2	3.154		140	60.0	3.332
77	25.0	2.982		109	42.8	3.160		141	60.6	3.337
78	25.6	2.987		110	43.3	3.165		142	61.1	3.343
79	26.1	2.993		111	43.9	3.171		143	61.7	3.348
80	26.7	2.998		112	44.4	3.176		144	62.2	3.354
81	27.2	3.004		113	45.0	3.182		145	62.8	3.360
82	27.8	3.010		114	45.6	3.187		146	63.3	3.365
83	28.3	3.015		115	46.1	3.193		147	63.9	3.371
84	28.9	3.021		116	46.7	3.198		148	64.4	3.376
85	29.4	3.026		117	47.2	3.204		149	65.0	3.382
86	30.0	3.032		118	47.8	3.210		150	65.6	3.387
87	30.6	3.037		119	48.3	3.215		151	66.1	3.393
88	31.1	3.043		120	48.9	3.221		152	66.7	3.398
89	31.7	3.048		121	49.4	3.226		153	67.2	3.404
90	32.2	3.054		122	50.0	3.232		154	67.8	3.410
91	32.8	3.060		123	50.6	3.237		155	68.3	3.415
92	33.3	3.065		124	51.1	3.243		156	68.9	3.421
93	33.9	3.071		125	51.7	3.248		157	69.5	3.426
94	34.4	3.076		126	52.2	3.254		158	70.0	3.432
95	35.0	3.082		127	52.8	3.260		159	70.6	3.437
96	35.6	3.087		128	53.3	3.265		160	71.1	3.443
97	36.1	3.093		129	53.9	3.271		161	71.7	3.448

TABLE 20-TEMPERATURE TO VOLTAGE CONVERSION: TP-1 (C, L, H) [continued]

	MP.	VOLTAGE	_		MP.	VOLTAGE	-		<u>, г., <b>г</b>о</u> MP.	VOLTAGE
°F	°C			°F	°C			°F	°C	
162	72.2	3.454		194	90.0	3.632		226	107.8	3.810
163	72.8	3.460		195	90.6	3.637		227	108.3	3.815
164	73.3	3.465		196	91.1	3.643		228	108.9	3.821
165	73.9	3.471		197	91.7	3.648		229	109.5	3.826
166	74.5	3.476		198	92.2	3.654		230	110.0	3.832
167	75.0	3.482		199	92.8	3.660		231	110.6	3.837
168	75.6	3.487		200	93.3	3.665		232	111.1	3.843
169	76.1	3.493		201	93.9	3.671		233	111.7	3.848
170	76.7	3.498		202	94.5	3.676		234	112.2	3.854
171	77.2	3.504		203	95.0	3.682		235	112.8	3.860
172	77.8	3.510		204	95.6	3.687		236	113.3	3.865
173	78.3	3.515		205	96.1	3.693		237	113.9	3.871
174	78.9	3.521		206	96.7	3.698		238	114.5	3.876
175	79.5	3.526		207	97.2	3.704		239	115.0	3.882
176	80.0	3.532		208	97.8	3.710		240	115.6	3.887
177	80.6	3.537		209	98.3	3.715		241	116.1	3.893
178	81.1	3.543		210	98.9	3.721		242	116.7	3.898
179	81.7	3.548		211	99.5	3.726		243	117.2	3.904
180	82.2	3.554		212	100.0	3.732		244	117.8	3.910
181	82.8	3.560		213	100.6	3.737		245	118.3	3.915
182	83.3	3.565		214	101.1	3.743		246	118.9	3.921
183	83.9	3.571		215	101.7	3.748		247	119.5	3.926
184	84.5	3.576		216	102.2	3.754		248	120.0	3.932
185	85.0	3.582		217	102.8	3.760		249	120.6	3.937
186	85.6	3.587		218	103.3	3.765		250	121.1	3.943
187	86.1	3.593		219	103.9	3.771		251	121.7	3.948
188	86.7	3.598		220	104.5	3.776		252	122.2	3.954
189	87.2	3.604		221	105.0	3.782		253	122.8	3.960
190	87.8	3.610		222	105.6	3.787		254	123.3	3.965
191	88.3	3.615		223	106.1	3.793		255	123.9	3.971
192	88.9	3.621		224	106.7	3.798				
193	89.5	3.626		225	107.2	3.804				

### APPENDIX B

## WARRANTY, REPLACEMENT PARTS, AND REPAIR PROCEDURE

### WARRANTY INFORMATION

ECI (Energy Controls International) offers the following warranty for its products: ECI will correct any defect in workmanship or material for 15 months from the date of shipment from ECI. The corrective measures are limited to repair or replacement of the unit, which is ECI's option. (Note: The warranty period on TP-2 temperature sensors is 3 years from the date of shipment from ECI.)

This limited warranty does not apply to equipment that has been subjected to negligence, accident, or damage by operation, maintenance, or storage or abnormal use or service. This limited warranty does not cover reimbursements for transportation, removal, installation, or repair or replacement, except as may otherwise be specifically agreed upon in writing by ECI.

The foregoing is in lieu of all other warranties expressed or implied, and all other obligations or liabilities whether arising under contract, negligence or otherwise, on the part of ECI. In no event shall ECI be liable for consequential or special damages, including, but not limited to loss of use, loss of income, loss of profit or cost of replacement.

### TRADEMARK INFORMATION

Echelon<sup>®</sup>, LON, <sup>®</sup> and 3150<sup>®</sup> are U.S. registered trademarks of Echelon Corporation.

LONWORKS™ is a trademark of Echelon Corporation.

Demand Defrost  $^{TM}$  is a trademark of Demand Defrost Systems.

Degree Master  $^{\text{TM}}$  is a trademark of Hill Phoenix.

### **RC-2000 REPLACEMENT PARTS LIST**

### **TABLE 21-REPLACEMENT PARTS LIST**

	ACEMENT PARTS LIST
PART NUMBER	DESCRIPTION
5420010400	20 x 40, Backlit Display Assembly
5401623400	Keypad Assembly
5120054400	RC-2000 CPU Board
CC/20056400	DCU MIP Daughterboard
5120056401	CSC MIP Daughterboard
5120126400	RC-2000 Power Supply Board
4464402700	RC-2000 Installation Manual
4464402800	RC-2000 Programming Manual
CC/01706400	Serial Temperature Module
CC/01706401	Serial Hi Temperature Module
CC/01706402	Serial Pressure Module
CC/01706404	Serial 0-10V Module
CC/01706403	Serial Digital IN Module
CC/01706420	16 Channel Universal Input Board
CC/20087400	Serial Relay Board
CC/01707500	Serial Relay Board: 7500 Series
CC/20104400	RS485 Module Assembly (Repeater Board)
CC/01679407	RS485 Enclosure Type with Power Supply
	(Repeater Board)
CC/01687400	9 Pin P.C. Direct Adapter
CC/01686400	25 Pin P.C. Direct Adapter
CC/01665400	25 Pin Modem Adapter
CC/RJ-11 CONN	Phone Connector
CC/26001000	-40° to 127° Nickel-Plated Temperature Probe (10 ft.
	Lead)
	(Supersedes obsolete part #'s TP-1L, TP-1C)
CC/26002000	0° to 255° Nickel-Plated High Temperature Sensor
	(Supersedes obsolete part # TP-1H)
CC/27001500	-40° to 127° Temperature Probe
	(Supersedes obsolete part # TP-2L-5)
TP-2H	0° to 255° Temperature Probe
CC/01719100	0-100 lbs. Pressure Transducer
CC/01719101	0-500 lbs. Pressure Transducer
1661601300	9V Battery
CC/01684500	Liquid Level Sensor
CC/TF-5	
	115/230 to 12VAC Transformer, 30VA
CC/01731400	115/230 to 12VAC Transformer, 54VA
CC/01731400	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6)
CC/01731400 CC/01680402	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style)
CC/01731400 CC/01680402 CC/01680401	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22)
CC/01731400 CC/01680402 CC/01680401 CC/01706408	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22) Serial Analog Output Module
CC/01731400 CC/01680402 CC/01680401 CC/01706408 CC/MOD-8	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22) Serial Analog Output Module Modem
CC/01731400 CC/01680402 CC/01680401 CC/01706408 CC/MOD-8 CC/01665400	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22) Serial Analog Output Module Modem Modem Adapter
CC/01731400  CC/01680402  CC/01680401  CC/01706408  CC/MOD-8  CC/01665400  CC/01706405	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22) Serial Analog Output Module Modem Modem Adapter Serial Analog In (TP-2L Style)
CC/01731400  CC/01680402  CC/01680401  CC/01706408  CC/MOD-8  CC/01665400  CC/01706405  CC/01706406	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22) Serial Analog Output Module Modem Modem Adapter Serial Analog In (TP-2L Style) Serial Analog In (TP-2H Style)
CC/01731400  CC/01680402  CC/01680401  CC/01706408  CC/MOD-8  CC/01665400  CC/01706405	115/230 to 12VAC Transformer, 54VA (Supersedes obsolete part # CC/TF-6) Refrigerant Leak Transducer (HP-62 Style) Refrigerant Leak Transducer (R-22) Serial Analog Output Module Modem Modem Adapter Serial Analog In (TP-2L Style)

### REPAIR PROCEDURE

If any part of your system requires repair, please use the following procedure:

- 1. Call ECI at 410-403-4000, ext. 3289 between 8:30 A.M. and 4:30 P.M. Eastern time for a Repair Order (R.O.) Number.
- 2. Have the following information ready:
  - a) Purchase Order # for each unit to be repaired.
  - b) As much information as possible regarding the nature of the equipment problem
  - c) Serial number of unit/Date of purchase
  - d) Previous repair history, if applicable
- 3. Send impaired item to:

ECI (Energy Controls International) 10946 Golden West Drive, Suite 130 Hunt Valley MD 21031

- 4. The R.O. Number should be clearly marked on the outside of the shipping carton. Include all applicable paperwork with the shipment **INSIDE** the carton.
- 5. The warranty on repaired units will be 90 days from the date of shipment from ECI.

### **ADVANCE SHIPMENT**

- a) If necessary, ECI will "ADVANCE SHIP" the replacement component or parts, under certain circumstances, provided that a Purchase Order # is issued for such. The customer will bear responsibility for excess freight charges and agrees to return the defective component or parts WITHIN 15 DAYS upon receipt of the "Advance Shipment."
  - b) After ECI receives the defective component/system/parts, they will be repaired and upgraded to current operational standards (i.e., ECI will restore them to "LIKE NEW" condition). The customer will be billed for this restoration work at the Standard Repair Charge rate.

### **APPENDIX C**

## FIELD WIRING REFERENCE GUIDE SERIAL MODULE CONFIGURATION

## **KW TRANSDUCER CONNECTION INFORMATION, AND SCALE FACTORS**

CURRENT TRANSFORMER (CT) MODELS, AND POWER RATIO INFORMATION

### **TABLE 22-FIELD WIRING REFERENCE GUIDE**

Product	Wiring Guide
Serial Loop Communication Wiring for Serial	Maximum length: 2000 feet
Modules	2 wire, 18 awg, unshielded twisted pair; Belden
1,10dates	#8461 or equivalent
Serial Loop Power Wiring for Serial Modules	Serial Relay Board:
Serial Boop I ower willing for Serial Modules	Maximum length: 50 feet
	2 wire, 18 awg, unshielded twisted pair;
	Belden #8461 or equivalent
	Bolden no for or oquivalent
	Serial Modules:
	Maximum length: 100 feet
	2 wire, 18 awg, unshielded twisted pair;
	Belden #8461 or equivalent
RC-2000 to RC-2000 (RS-485)	Maximum length: 1000 feet
	2 wire, 18 awg, shielded twisted pair;
	Belden #8760 or equivalent (see Note 1)
RC-2000 to CSC or DCU: (Double Termination)	Maximum length = 8800 feet; double
RC-2000 to CSC (TP78) or DCU (FTT-10)	termination
	2 wire, 16 awg, unshielded twisted pair;
	Belden #8471 or equivalent
RC-2000 to DCU (FTT-10): (Single Termination)	Maximum length = 1600 feet; free topology
	single termination
	2 wire, 16 awg, unshielded twisted pair;
	Belden #85102 (plenum)
	2 wire, 16 awg, unshielded twisted pair;
	Belden #8471 (non-plenum)
	(see Note 2)
RC-2000 to RC-1000 or EC-1000 or Modem	Maximum length = 100 feet
	6 conductor flat phone cable;
	G-C Thorson 30-9965 or equivalent
Sensor Wiring: Temperature, Thermistor, kW,	Maximum length = 500 feet
Digital Inputs, and Analog Outputs	2 wire, 18 awg, shielded twisted pair;
	Belden #8760 or equivalent (see Note 1)
Pressure Transducer and 0-10 Volt input wiring	Maximum length = 500 feet
	3 wire, 18 awg, shielded wire;
	Belden #8770 or equivalent
Dewpoint, Refrigerant Leak Sensor Wiring	Maximum length = 500 feet
	4 wire, 18 awg, shielded wire;
	Belden #9418 or equivalent
	11 COLDCIACED D

**NOTE 1**: Lengths and signal strength may be increased by using an ECI RS485 Repeater Board, Part # 20078400.

**NOTE 2**: Length and signal strength may be increased by using an ECI DCU/FTT-10 Repeater Board, Part # 20055400.

### SERIAL MODULE CONFIGURATION

This module can be set up for the following configurations by changing the Jumpers and Resistor packages as detailed below in Table 23, and Drawing 38.

**TABLE 23-SERIAL MODULE CONFIGURATION** 

MODULE TYPE	J1	J2	J3	J4	RS-1	RS-8	PART NUMBER
SAI8/Reg. Temp.	OFF	OFF	OFF	OFF	IN	OUT	CC/01706400
(-30°F to 97°F)							
SAI8/High Temp.	OFF	OFF	OFF	ON	IN	OUT	CC/01706401
(0°F to 255°F)							
SAI8 2.25K Temp.	OFF	ON	ON	OFF	IN	OUT	CC/01706405
(TP-2L,-30°F to 97°F)							
SAI8/5K Temp.	OFF	OFF	ON	ON	IN*	OUT	CC/01706410
(0°F to 255°F)							
SAI8/10K Temp.	OFF	OFF	ON	ON	IN	OUT	CC/01706406
(TP-2H, 0°F to 255°F)							
SDI8/Digital Input	ON	ON	OFF	OFF	IN	OUT	CC/01706403
SAI8/Pressure (1-6V)	ON	OFF	ON	OFF	OUT	IN	CC/01706402
SAI8/0-10V	OFF	OFF	ON	OFF	OUT	IN	CC/01706404
SAI8/4-20mA	Not Field Changeable					CC/01706407	
(Special)							
N.T. 4							

#### **Notes:**

RS-1 is a 2.2K resistor network designated with 1-222 (note RS-1 pin location in the drawing below).

RS-8 is a 8.2K resistor network designated with 1-822 (note RS-8 pin location in the drawing below).

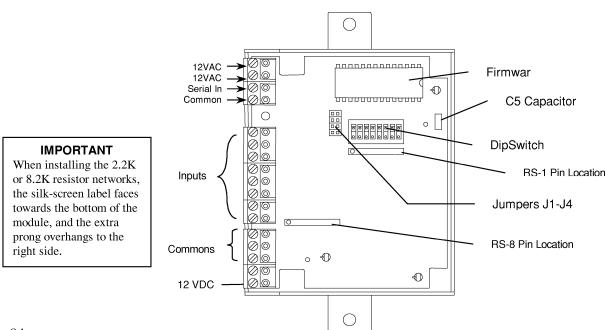
\*For 5K Temperature, a second 2.2K is attached to RS-1.

2.25K, 5K, 10K Temperature Modules require capacitor C5 to be cut out.

Firmware ID Code is 71296.

Analog output is a 4 channel module that is not interchangeable

(Part Number: CC/01706408).



### RC-2000 COMPATIBLE WATT TRANSDUCER MODELS

Several different types of watt transducers may be used with the RC-2000 controller. The following table lists them.

TABLE 24-RC-2000 COMPATIBLE WATT TRANSDUCER MODEL NUMBERS

TRANSDUCER	SYSTEM	MEASURED VOLTAGE	ELEMENTS		
MODEL					
NUMBER					
A12080/Y	3 phase, 3 wire	208V	2		
A12081/Y*	3 phase, 3 wire	480V	2		
A12083/Y	3 phase, 4 wire	120V	2 ½		
A12084/Y	3 phase, 4 wire	277V	2 1/2		
*NOTE: The A12081Y requires 120VAC external power.					

### CT SELECTION, CONNECTION & SCALE FACTOR COMPUTATIONS

Selection, connection, and scale factor computations are listed below.

TABLE 25-CT, CONNECTION, AND SCALE FACTOR VALUES

SYSTEM	APPLICATION	PART	СТ	VOLTAGE	SCALE	
		NUMBER	NUMBER	MEASUREMENT	FACTOR	
208V, 3p, 3w	Rack	A12080/Y	2	208 phase-phase	.36 x (CT Max*)	
480V, 3p, 3w	Rack	A12081/Y	2	480 phase-phase	.83 x (CT Max*)	
208V, 3p, 4w	House	A12083/Y	3	120 phase-neutral	.36 x (CT Max*)	
480V, 3p, 4w	House	A12084/Y	3	277 phase-neutral	.83 x (CT Max*)	
*NOTE: The CT	*NOTE: The CT Max is the first number in a standard CT ratio rating (i.e., 1600:5, use 1600).					

### CT PART NUMBER, RATIO, AND APPLICATION

### **CAUTION**

TO AVOID POTENTIAL EXPLOSION WHEN INSTALLING OR SERVICING A CURRENT TRANSFORMER ON A LIVE CONDUCTOR:

**ALWAYS** short the secondary wires to each other prior to connecting or disconnecting when installing or servicing a CT on a live conductor. The CT will strive to output the ratioed current and eventually it will break down the insulation or air between the terminals.

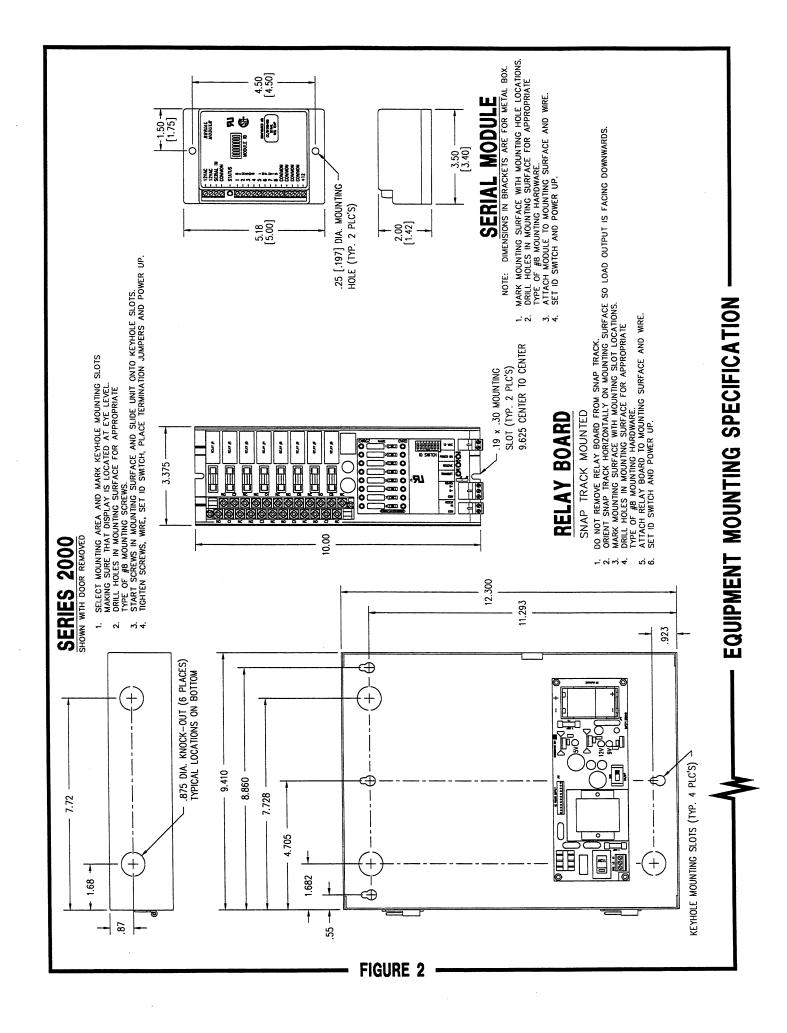
AN EXPLOSION MAY OCCUR!

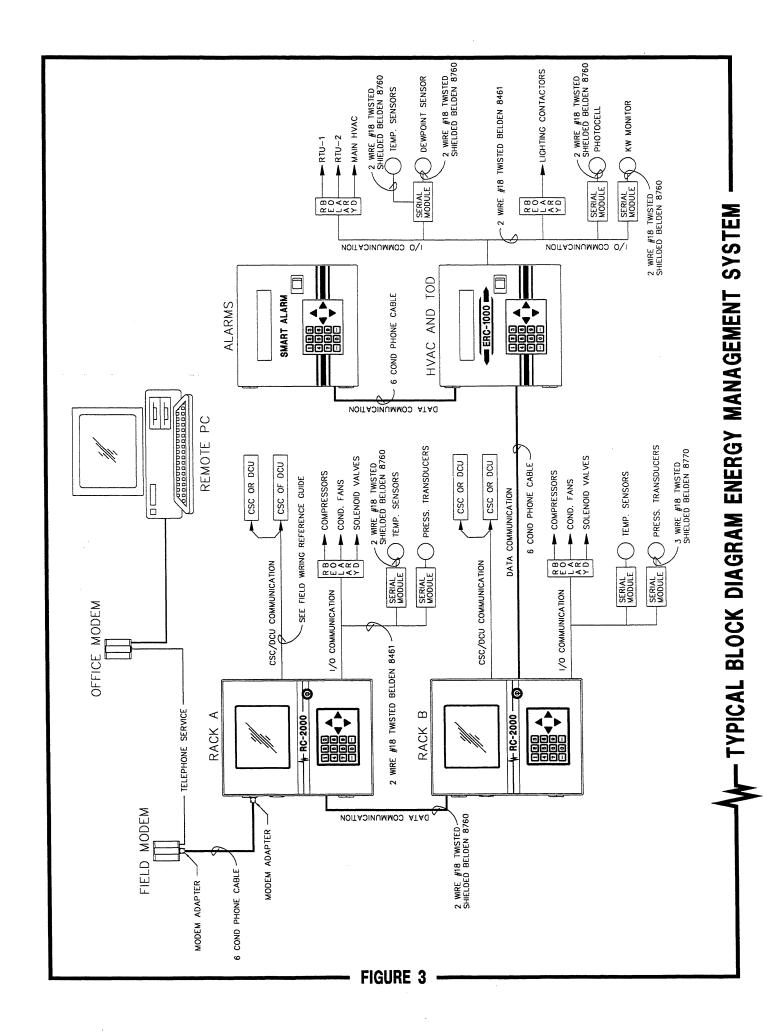
TABLE 26-CT PART NUMBER, RATIO, AND APPLICATION INFORMATION

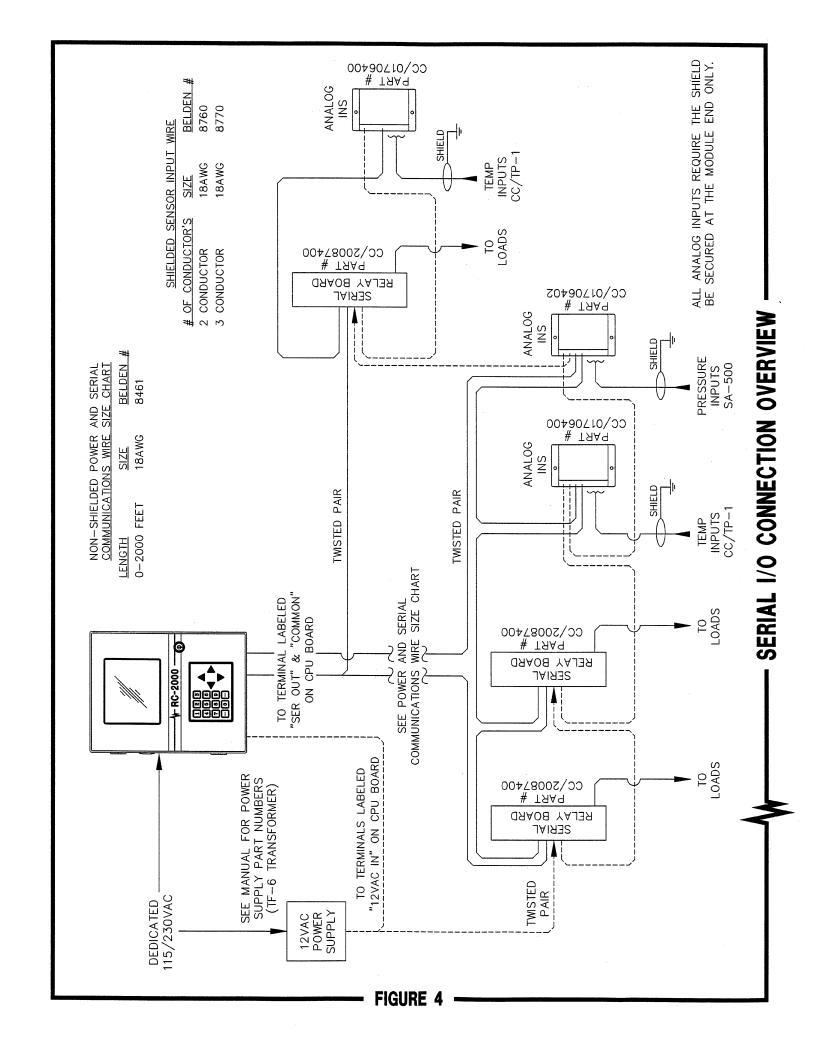
PART NUMBER	RATIO	APPLICATION
CT-2	Multi Ratio	House kW
	(Split Core)	
	1600, 2000, 2500:5	
CT-3	Split Core	House kW
	1600:5	
CT-4	Torroidal	Rack kW
	500:5	
CT-5	Torroidal	Rack kW
	300:5	
CT-8	Torroidal	Rack kW
	400:5	
CT-14	Split Core	House kW
	600:5	
CT-15	Split Core	House kW
	800:5	
15RT101	Torroidal	Rack kW
	100:5	
15RT500	Torroidal	Rack kW
	50:5	
NOTES NOTES		~m !! !!

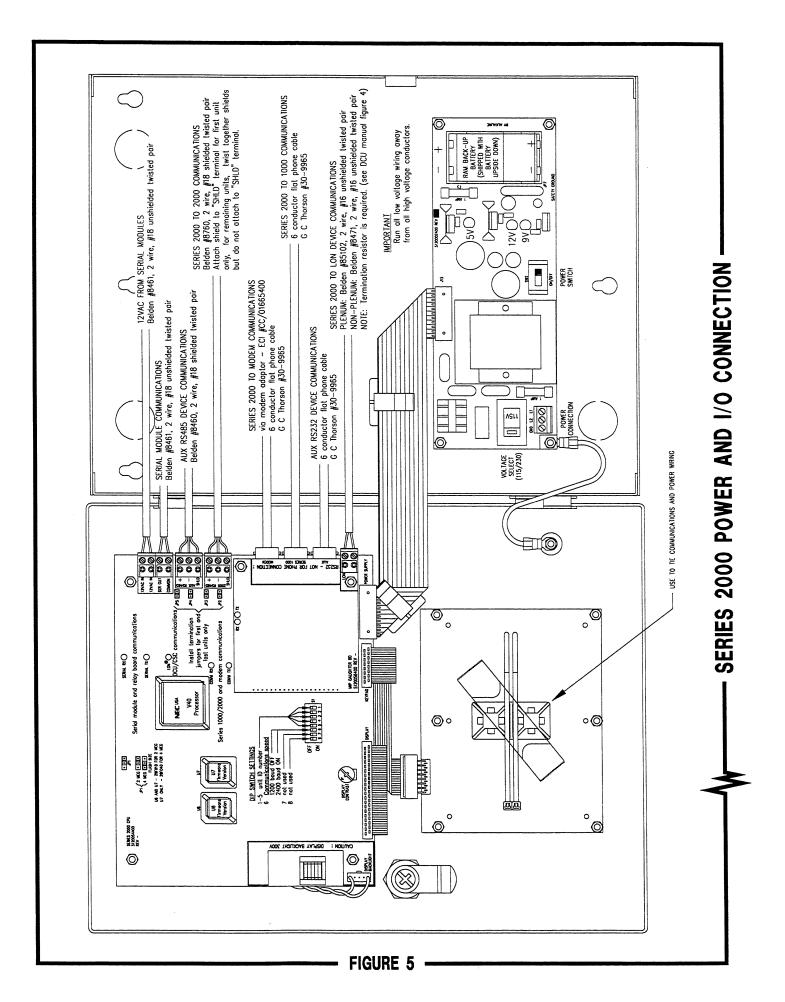
**NOTE:** Many other sizes of the torroidal CTs are available upon request.

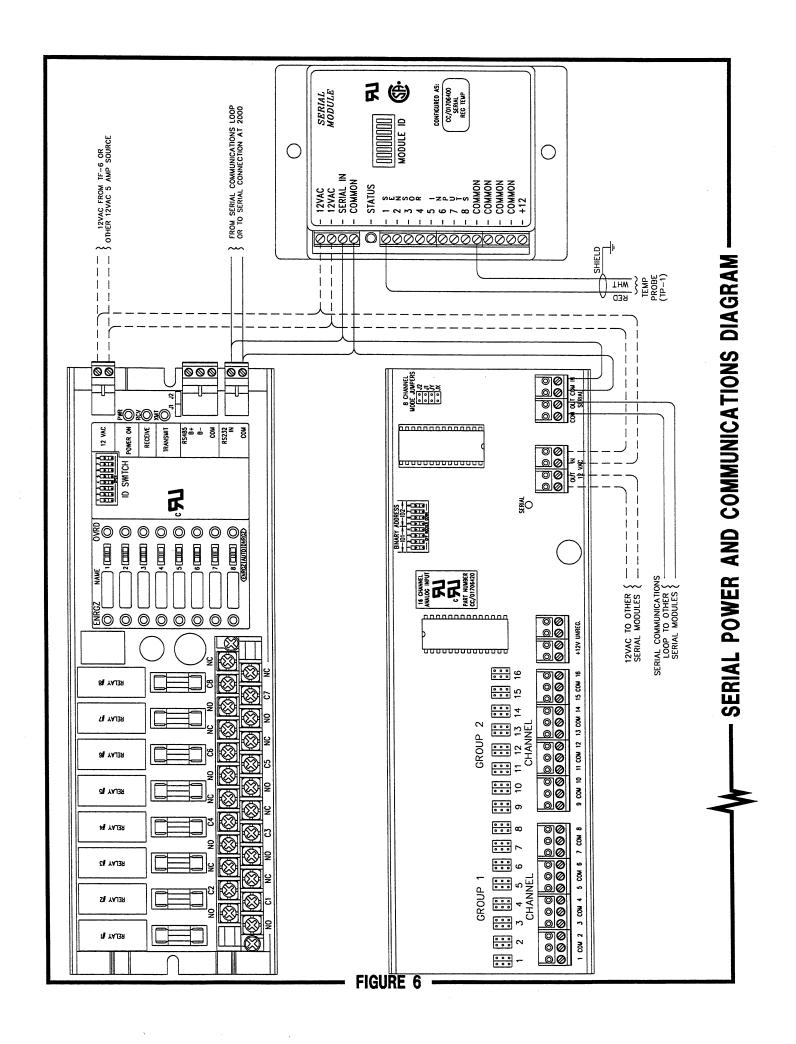
# APPENDIX D INSTALLATION DIAGRAMS

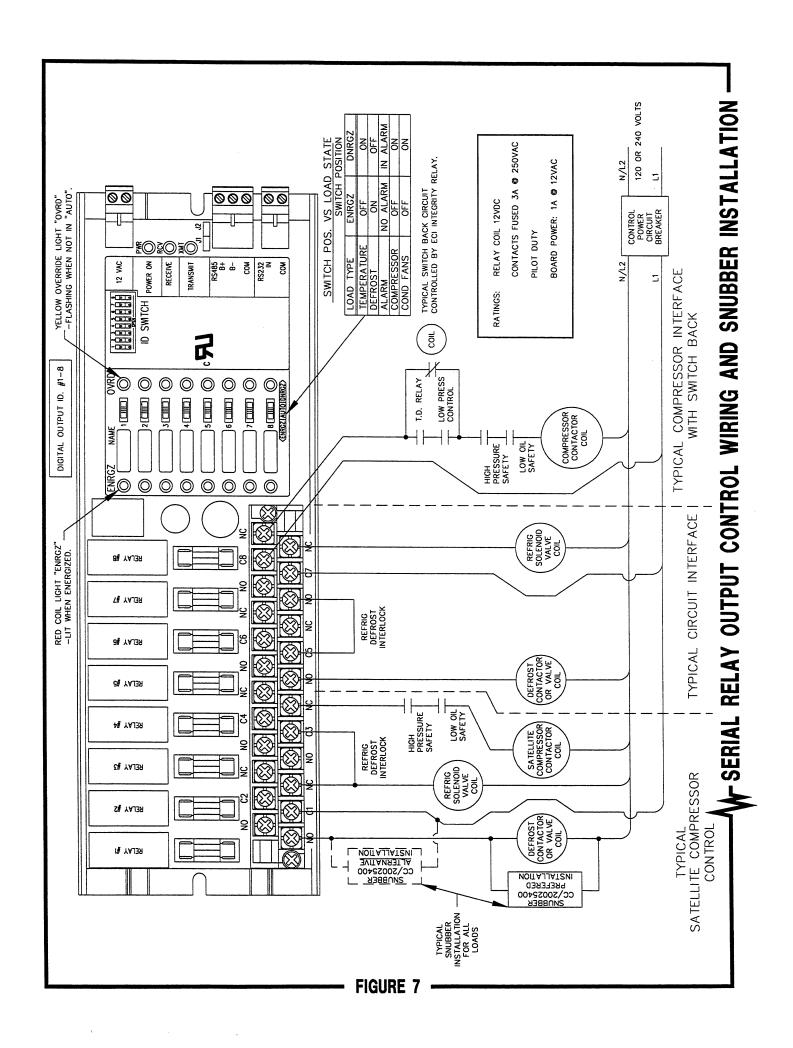






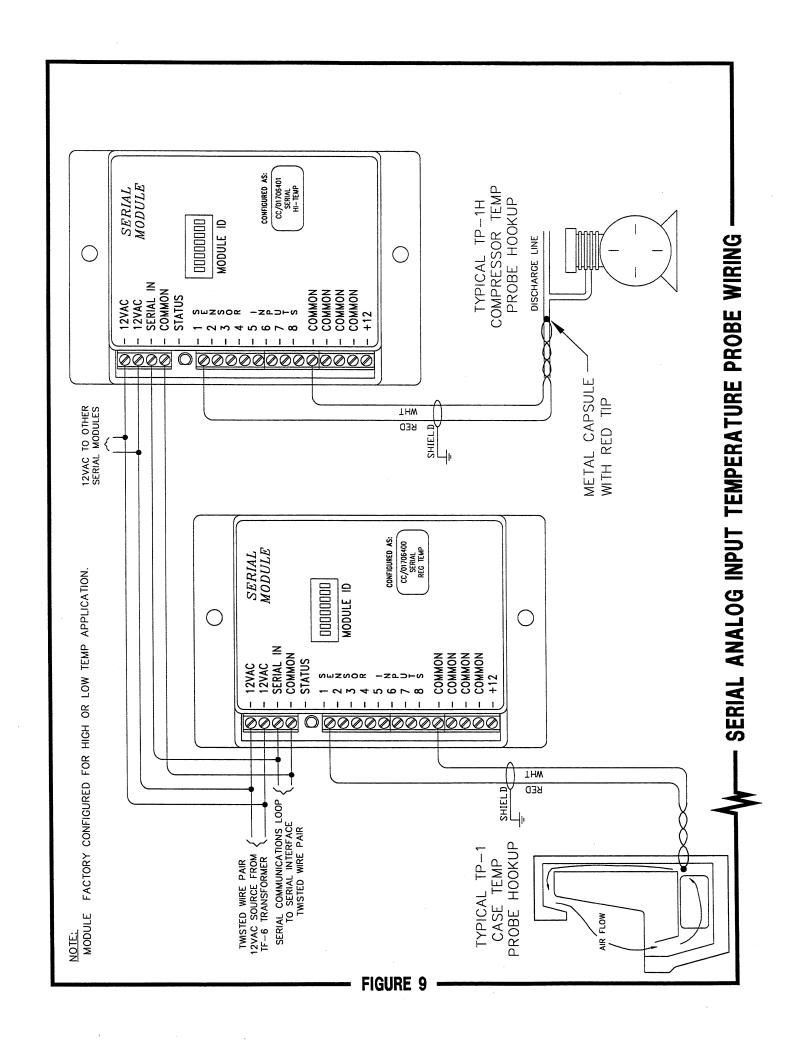


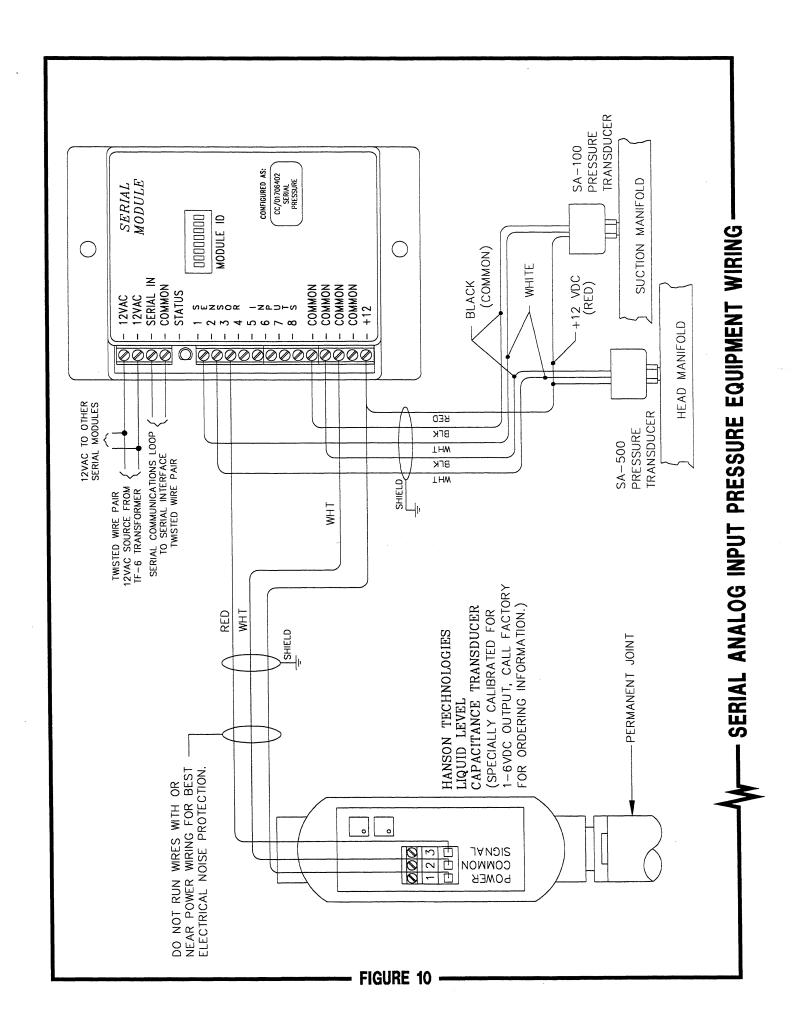




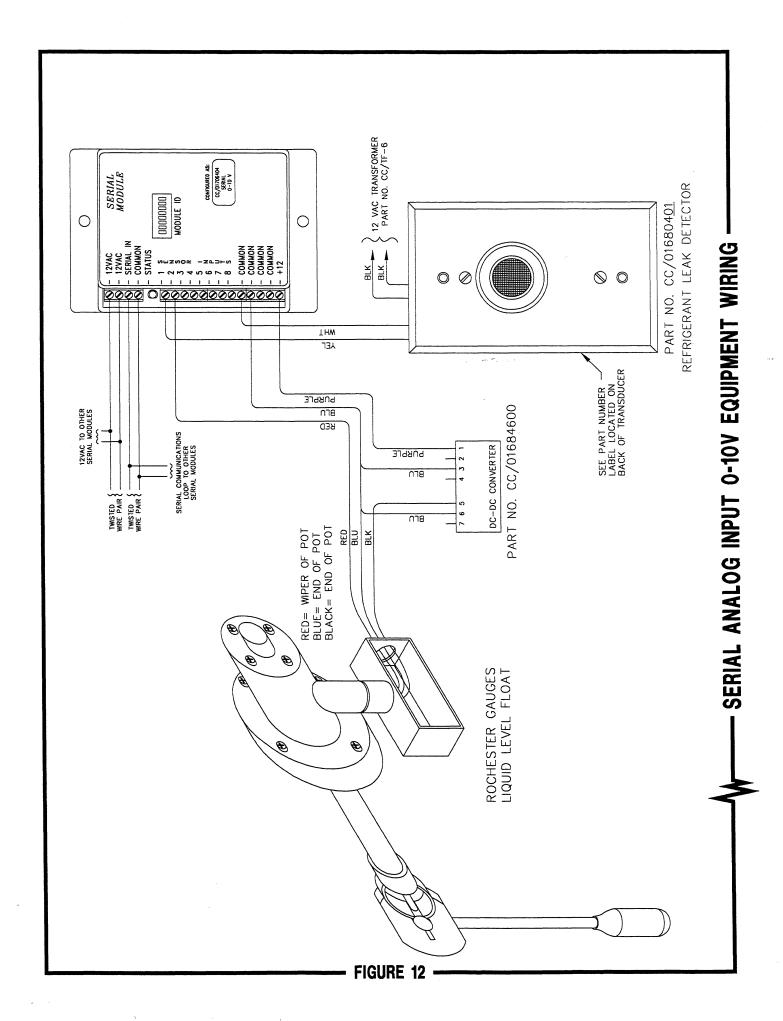
**FIGURE** 

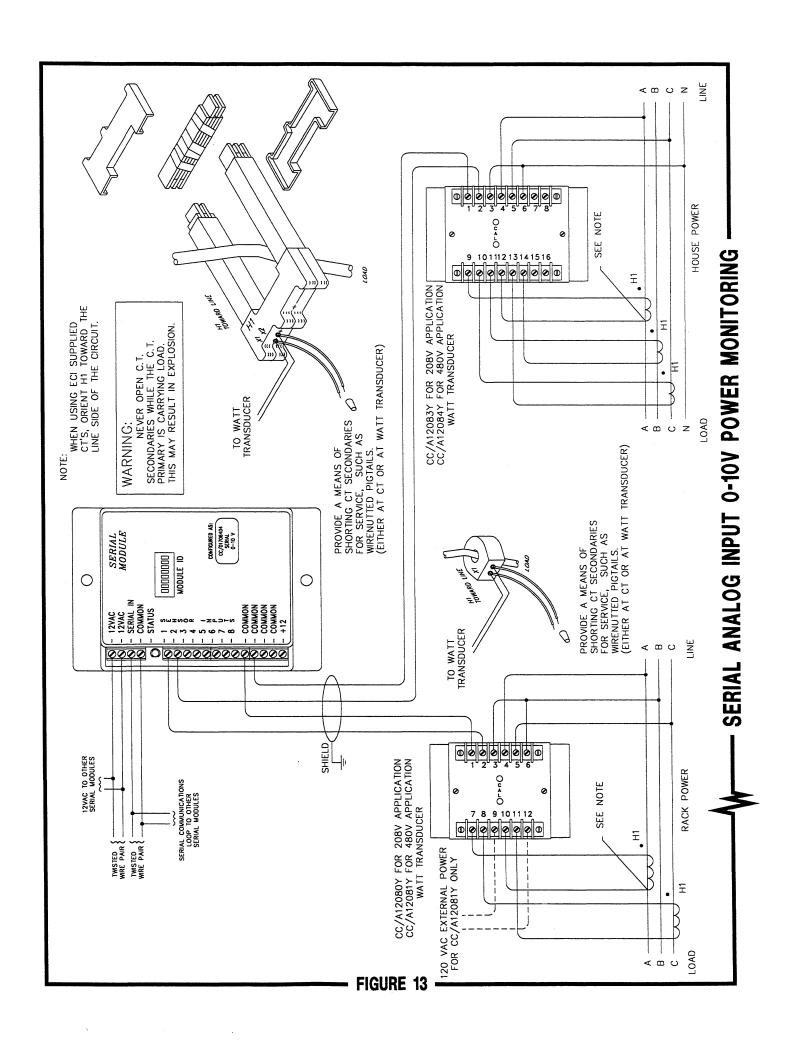
8

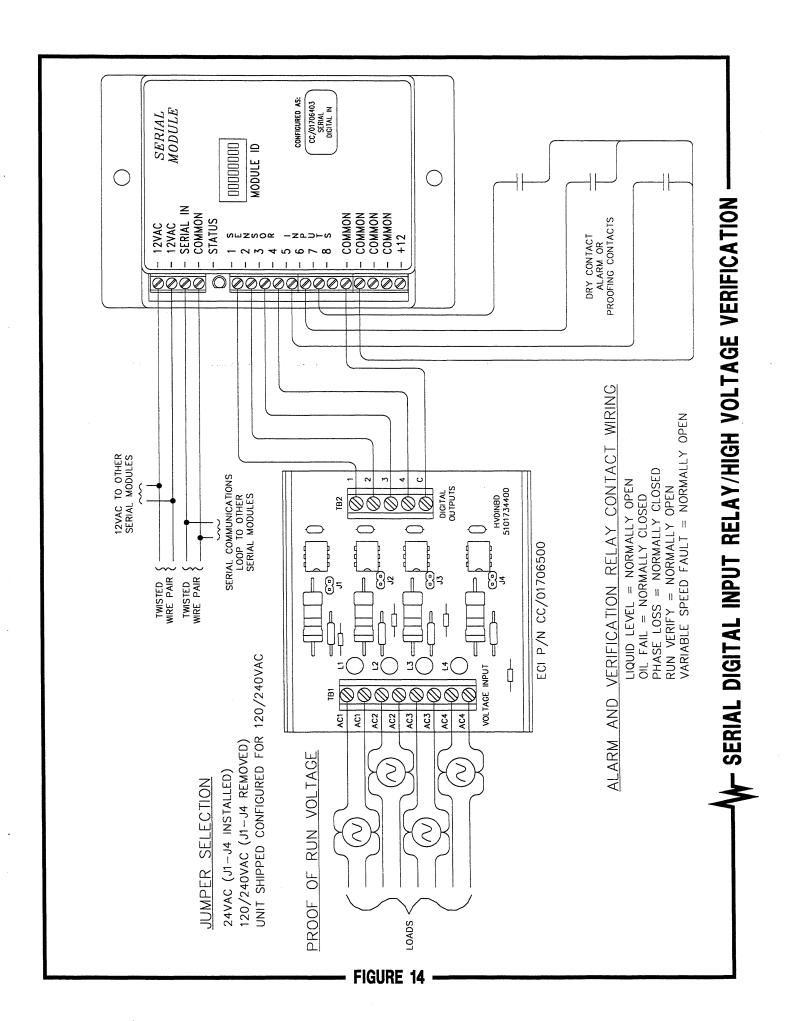


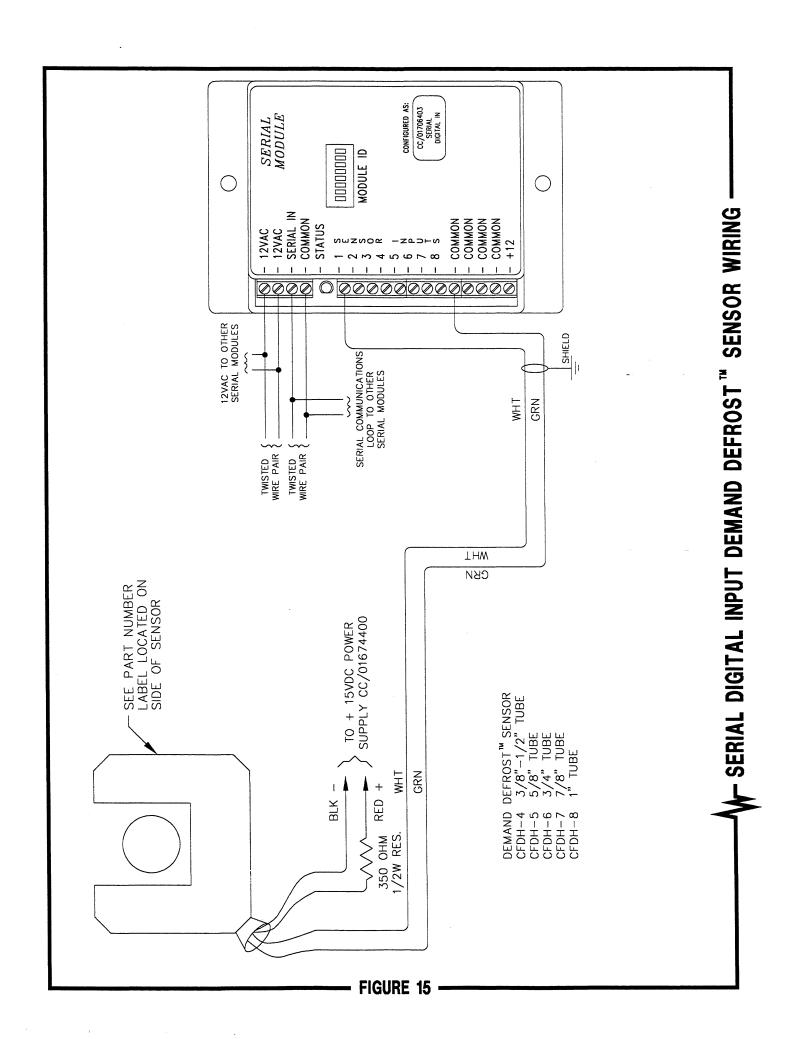


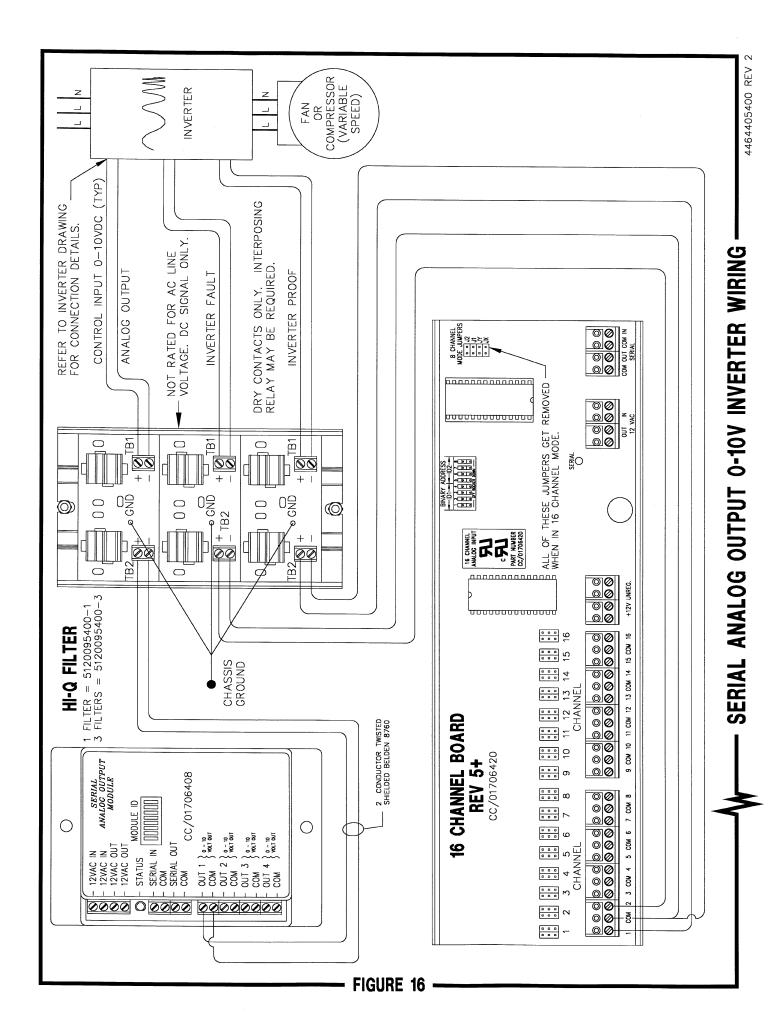
# CC/01706402 SERIAL PRESSURE SERIAL MODULE 000000000 MODULE 10 0 SPECIFICATIONS: 1VDC OFFSET 6VDC AT 100% 50MV PER PERCENT LIQUID LEVEL - SERIAL ANALOG INPUT PRESSURE EQUIPMENT WIRING $\bigcirc$ | 12VAC | 12VA RED ВГК 12VAC TO OTHER SERIAL MODULES СКИ SERIAL COMMUNICATIONS LOOP TO OTHER SERIAL MODULES ECI ELECTRONIC LIQUID LEVEL TRANSDUCER TWISTED { TWISTED { RECEIVER GRN BLK RED — ROCHESTER GAUGES LIQUID LEVEL FLOAT FIGURE 11

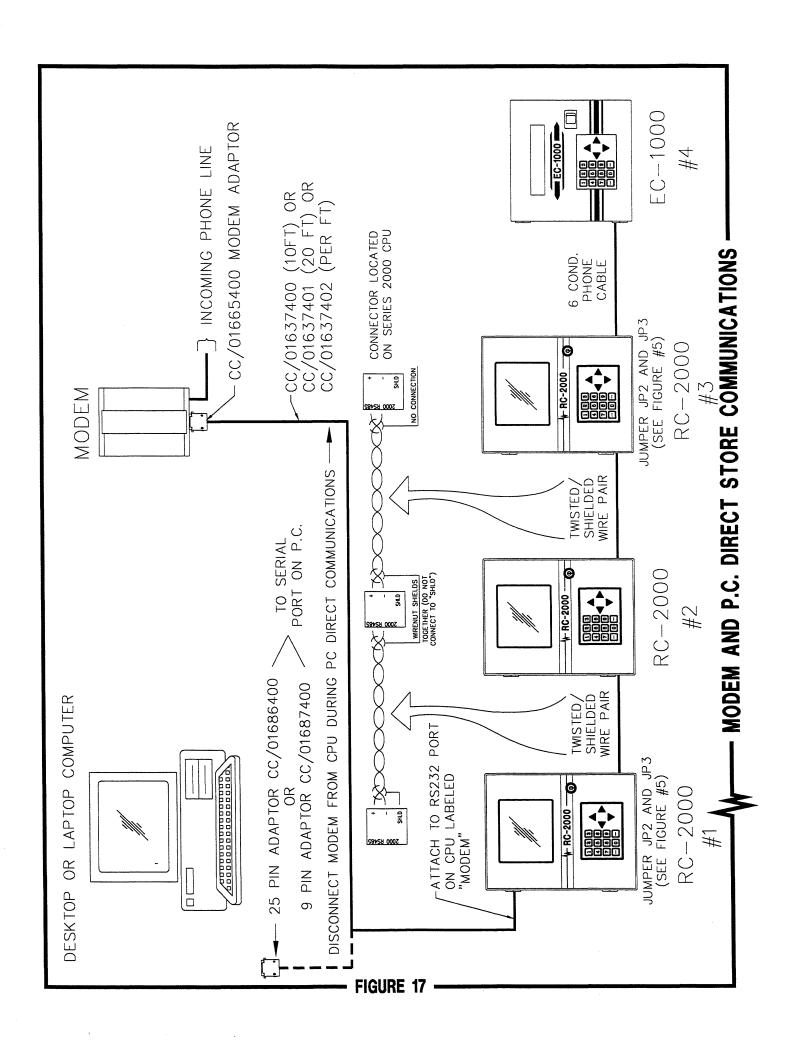


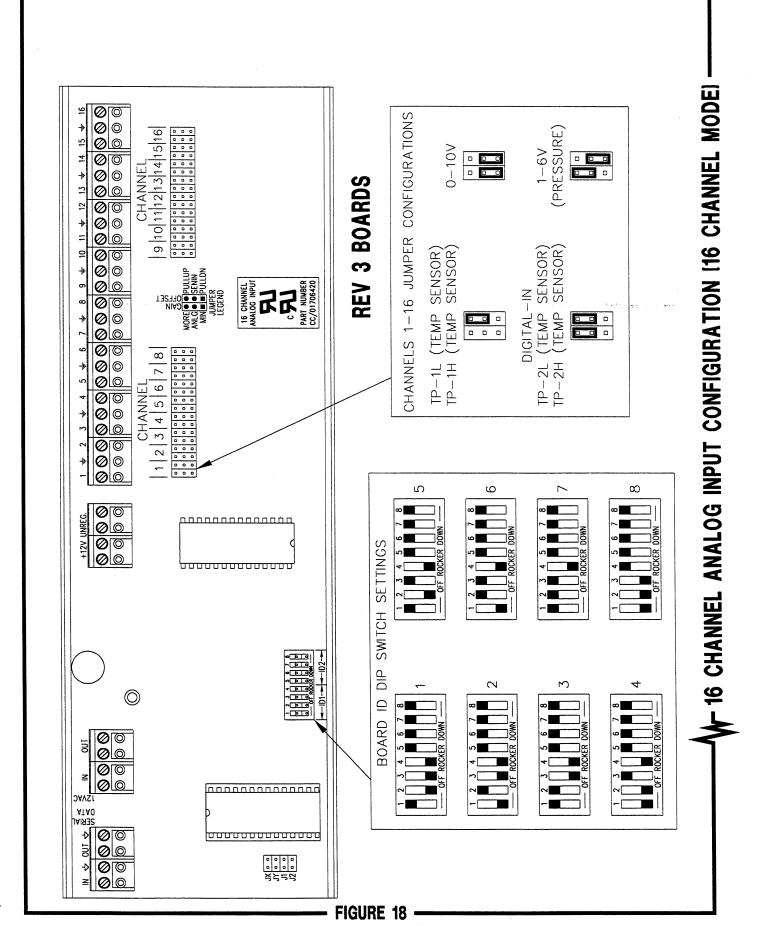


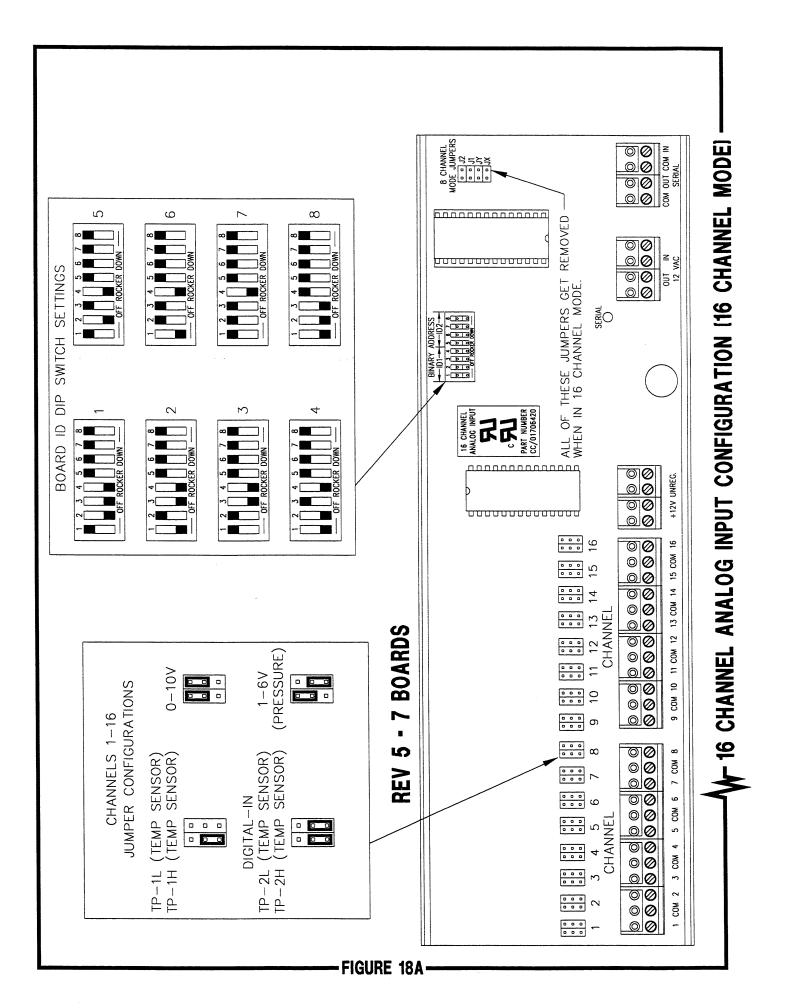


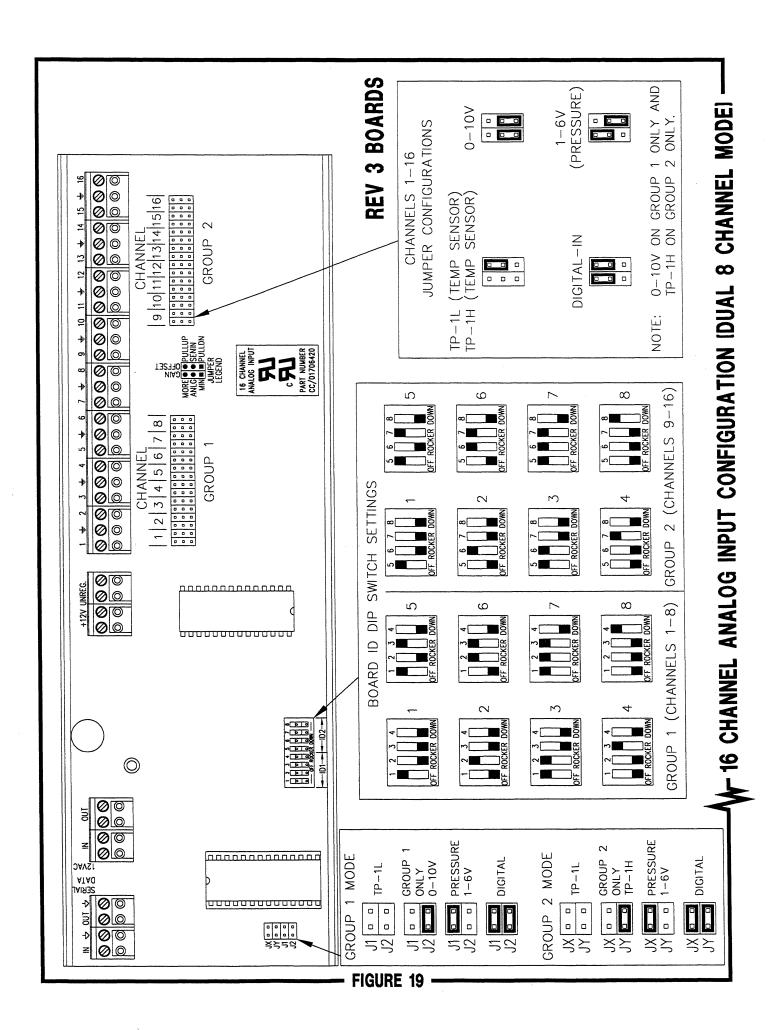


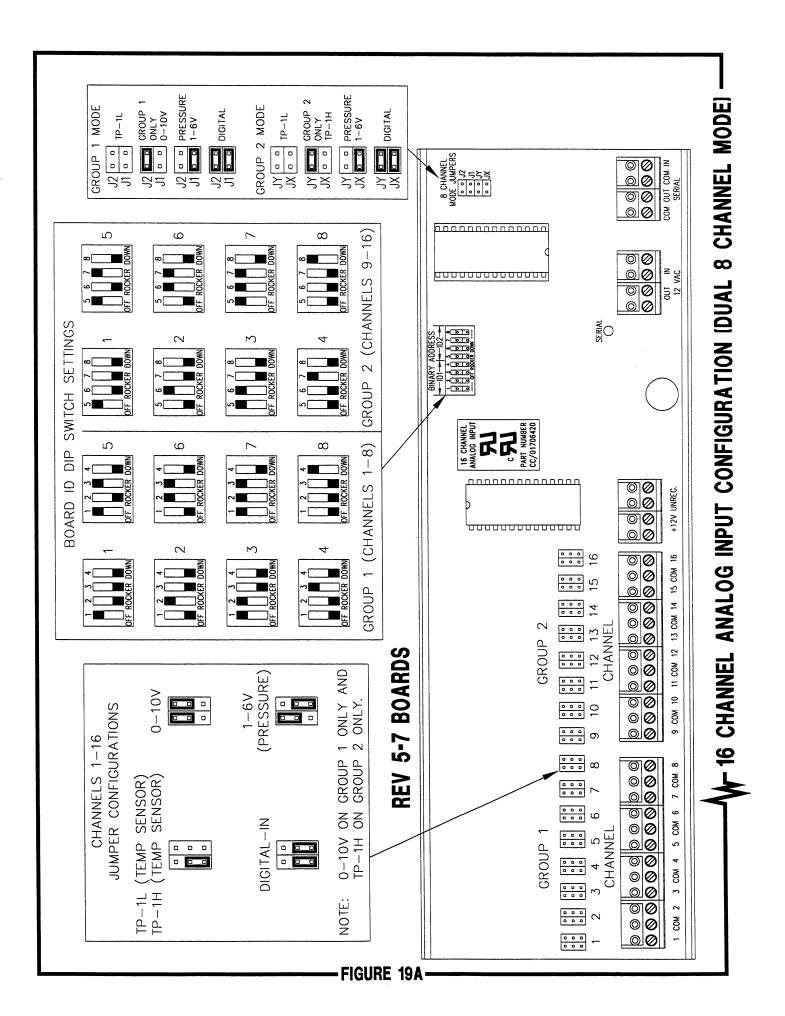




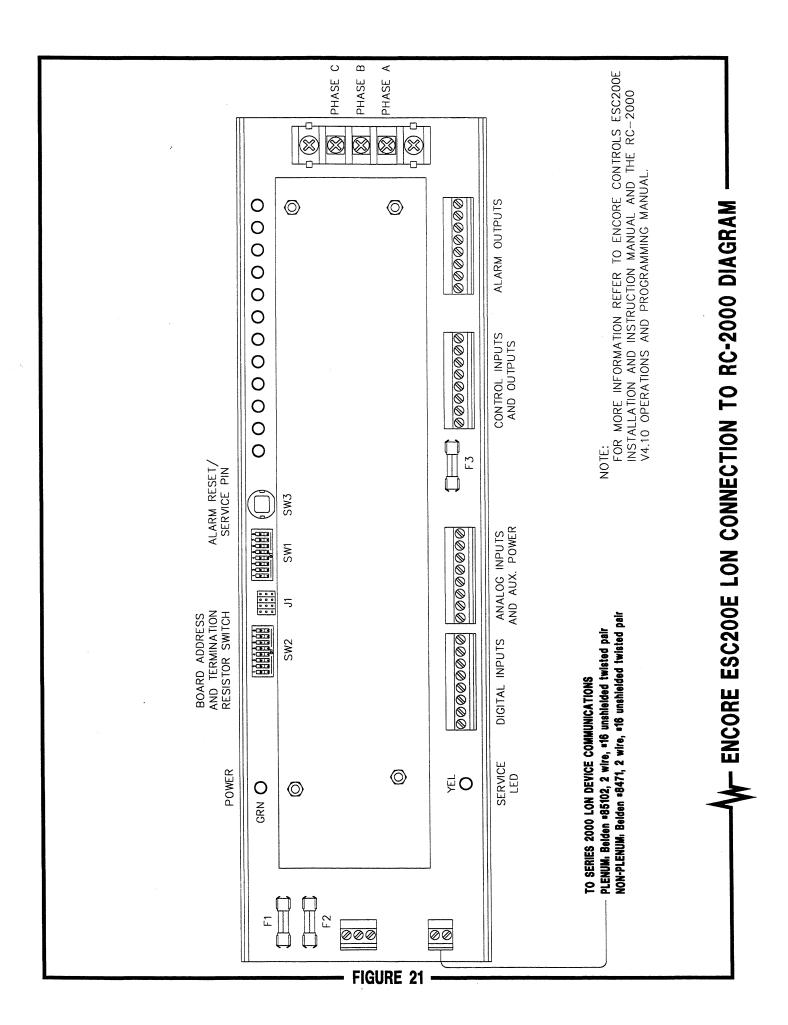


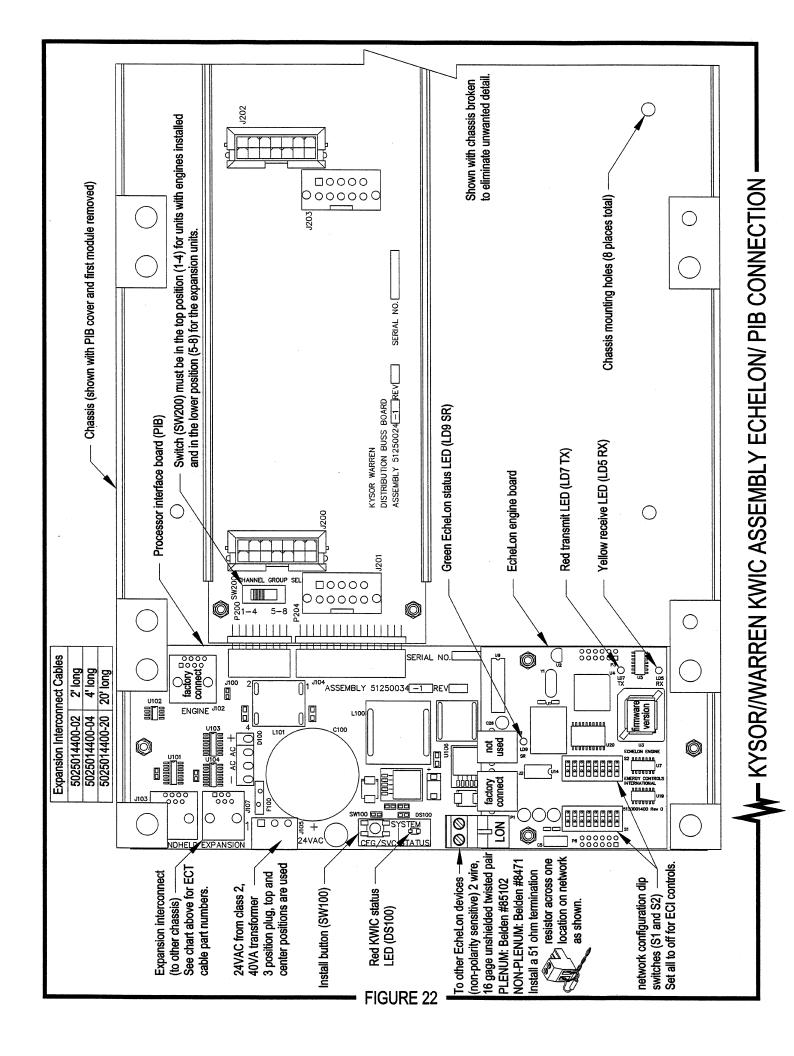


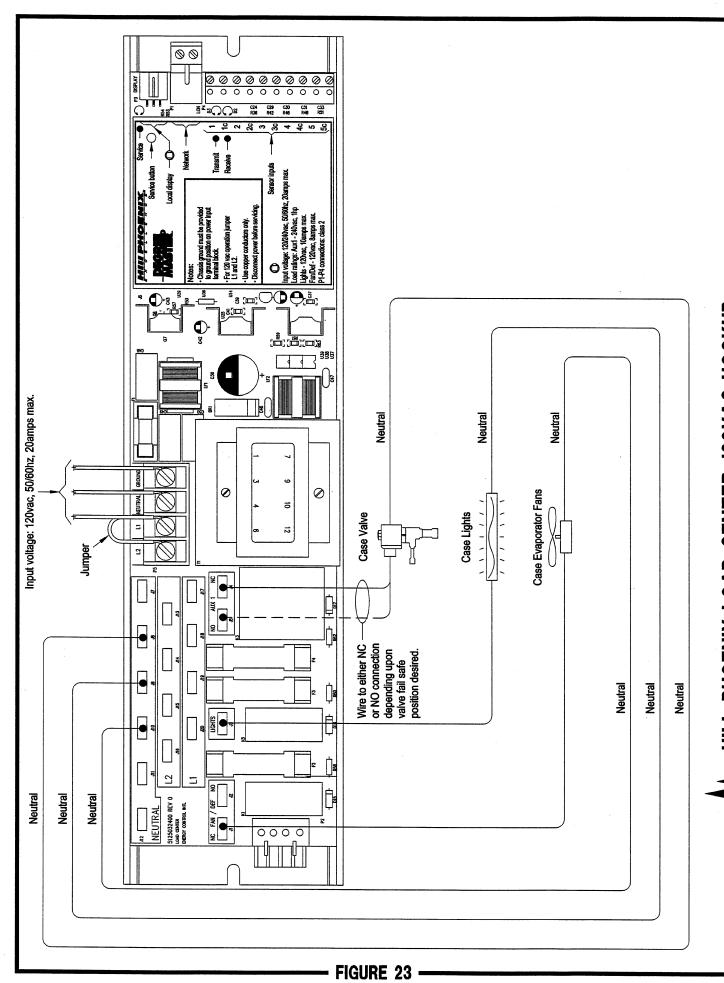




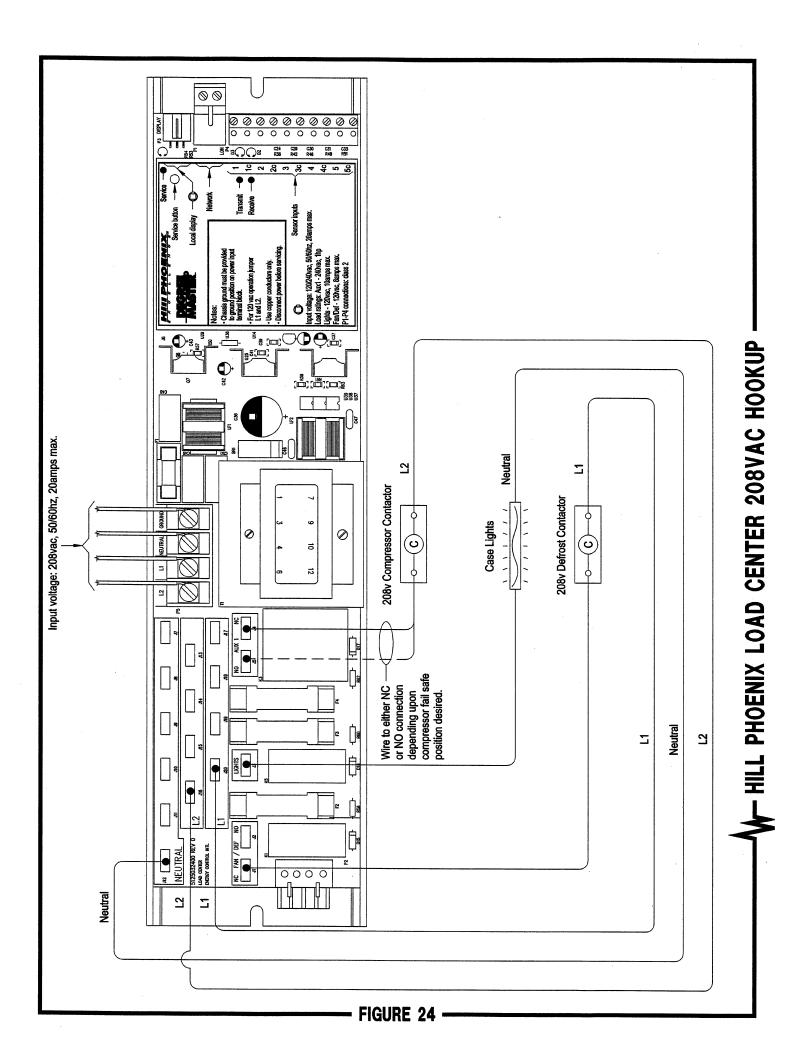
# A-DANFOSS VLT INVERTER LON CONNECTION TO RC-2000 DIAGRAM EVEN TERMINATION SWITCH - O SERVICE HOST 000 - GREEN . □ RED NON-PLENUM. Beiden \*8471, 2 wire, \*16 unshielded twisted pair NOTE. CONNECT TO 'NETA & NETB" TERMINALS, NO CONNECTION TO "SHIELD". DANFOSS FTT INTERFACE CARD SERVICE SWITCH SERVICE LED STATUS LED PLENUM, Beiden \*85102, 2 wire, \*16 unshielded twisted pair FOR MORE INFORMATION REFER TO DANFOSS VLT 3000 AND SERIES 3500 LONWORKS OPTION CARD INSTRUCTION MANUAL AND THE RC-2000 V4.10 OPERATIONS AND PROGRAMMING MANUAL. TO SERIES 2000 LON DEVICE COMMUNICATIONS DANFOSS VLT SERIES INVERTER 900 FIGURE 20







# HILL PHOENIX LOAD CENTER 120VAC HOOKUP



# **ADDENDA**

RC-2000 Line Power Filtering Requirements

Pressure Differential Board



### Addendum to Form No. 4464402700

RC-2000 Refrigeration Control Installation Manual

Date: February 15, 1999

Part Description: RC-2000 Power Supply Part Number: 5120105400

# \_\_\_\_\_

# RC-2000 LINE POWER FILTERING REQUIREMENTS

### INTRODUCTION

The ECI RC-2000 Power Supply has been redesigned. Additional filtering for the line power and improved transformer mounting are now part of the power supply.

### NOTICE

Since September 1998, all RC-2000 units were shipped with two line power filters (ECI Part # 2112810400). These line power filters were to be installed at the following locations in the RC-2000 system:

- 1. Line power to the RC-2000
- 2. Line power to the I/O transformer

The new RC-2000 power supply (Part # 5120105400) eliminates the need to install a line filter for the RC-2000 line power.

# INSTALLATION REQUIREMENTS/ RC-2000 POWER SUPPLY, Part # 5120105400

Be aware that all future shipments of the RC-2000 will include ONLY ONE line power filter.

The line power filter that arrives with the RC-2000 shipment should be installed to filter the primary supply voltage for the I/O transformer (ECI Part # TF-6).

# **IMPORTANT**

Any RC-2000 unit with power supply #5120102400 will require a line power filter to be installed at the RC-2000 line power. Details of the connection are provided within Applications Engineering Notice #1024, Rev. C.

# SERIAL I/O PRIMARY LINE POWER FILTERING

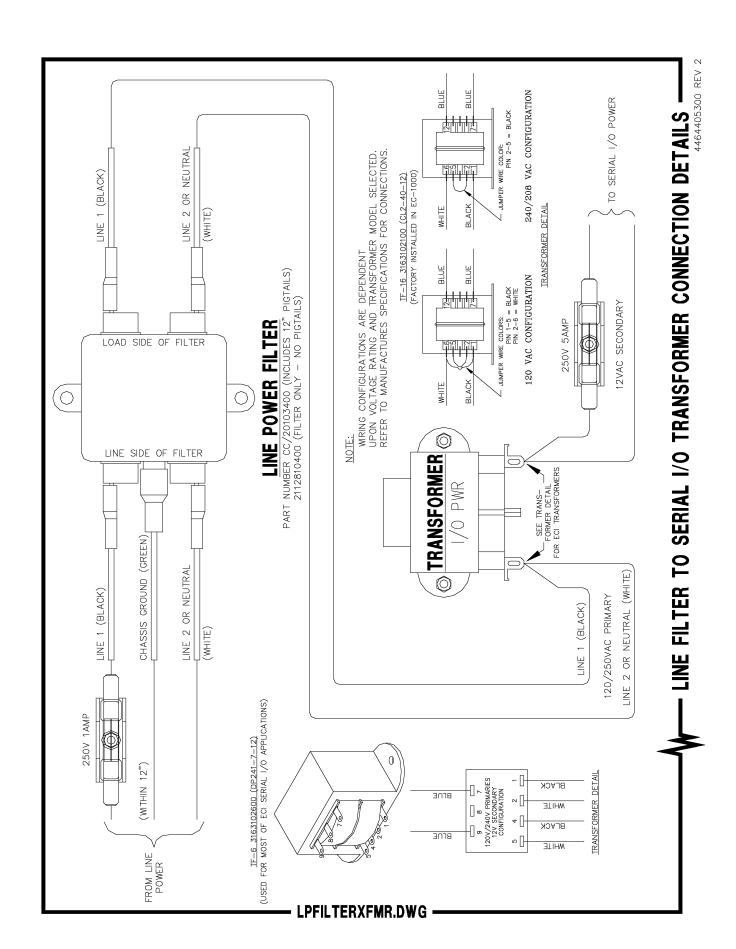
Each primary line power feed to ECI transformers will need to have a line filter installed within 12" of the transformer. This requirement applies to all RC-2000s, regardless of which power supply is installed.

# NOTE

The RC-2000 includes one (1) line filter for the I/O power transformer as part of the original part number.

Any remotely mounted I/O will require a line filter to be installed within 12" of the local transformer as per the connection diagram on the back of this sheet. These line filters may be ordered via ECI line filter Part # 2112810400.

Please address any questions about these installation revisions to the ECI Applications Engineering Department at 410-403-4000 between the hours of 7:00 A.M. and 4:00 P.M. Eastern Time, Mondays-Fridays, or to your local ECI Sales Engineer.





## Addendum to Form No. 4464402700;

RC-2000 Refrigeration Control Installation Manual

Date: February 15, 1999

Part Description: Pressure Differential Board

Part Number: 5120118400

# PRESSURE DIFFERENTIAL BOARD

# INTRODUCTION

ECI now offers a Pressure Differential Board that translates the differences of two pressure inputs into a differential output. The new Board provides outputs for the higher operating pressure, the lower operating pressure, and the difference between them, whereas a standard pressure differential transducer only provides output for the differential pressure. By using all three pressures, the new Board offers more refrigeration control flexibility.

Upon receiving the pressure readings, the Pressure Differential Board outputs the higher operating pressure, the lower operating pressure, and the difference between them to an ECI Sixteen Channel Universal Input Module (SUI16). For correct operation, ECI recommends following the connection requirements listed below and referring to Figure 1, attached to this addendum.

# **CONNECTION REQUIREMENTS**

1. **Both pressure transducers** connected to the Pressure Differential Board **MUST BE** the same ECI Part Number. Table 1, below lists the ECI Pressure Transducers.

**TABLE 1 – ECI Pressure Transducers** 

Part #	Part Description
01719000	0-100 (PSI)
01719001	0-500 (PSI)

# Transducer-Pressure Differential Board Connections:

- Connect the transducer reading the higher operating pressure at J1 on the Pressure Differential Board: Table 2 lists the connections.
- 2. **Connect** the **transducer** reading the lower operating pressure at J2 on the Pressure Differential Board; Table 2 lists the connections.

# Table 2 – ECI Pressure Transducer to Pressure Differential Board Connection Points

Pressure Transducer Wire Color:	J1 & J2 Pressure Differential Board Connection:
White connects to $\rightarrow$	SIG
Black connects to →	СОМ
Red connects to →	+12

# Pressure Differential Board-SUI16 Connections:

- 1. **Connect** J4 (+12 input power) on the Pressure Differential Board **to** the (+) 12V unreg connection on the SUI16.
- 2. **Connect** J4 (COM) on the Pressure Differential Board **to** one of the common input connections (labeled "COM") on the SUI16.
- 3. Connect J3 (High, Low, and Diff) on the Pressure Differential Board to a signal input connection (labeled 1-16) on the SUI16. (Signal input connections 1-16 are the signal for the respective pressure as labeled on the Pressure Differential Board.)

### NOTE

Figure 1 (on the other side) shows the Pressure Differential Board, the pressure transducers, and the SUI16.

