INSTALLATION AND SERVICE MANUAL

FOR THE

XPRT4-TD12

PRESSURE AND DEFROST CONTROLLER

ALTECH CONTROLS

1545 Industrial Drive
Missouri City, Texas 77489
(713) 499-5697
FAX: (713) 499-5504

REV 8/96

TABLE OF CONTENTS

INTRODUCTION i

SECTION A: GENERAL INFORMATION

System Features	A-1
Order Information	A-1

SECTION B: OPERATION

Display and Keypads	B-1
Quick Keys	B-1
Changing Settings	B-1
Display Contrast Adjustment	B-1
Suction Pressure Control Logic	B-1
Oil Pressure Logic	B-2
Condenser Fan Operation	B-2
Refrigeration Temperature Control	B-2
Defrost Control	B-2
Optimizer Control Logic	B-2
Status and Configuration Screens	B-2
XPRT4-TD12 Status and Settings Screens Quick Reference	B-3
XPRT4-TD12 Configuration Screens Quick Reference	B-7
Compressor and Fan Relay Operation	B-10
Refrigeration and Defrost Relays	B-11
Sensor Switching Relays	B-11

SECTION C: INSTALLATION

Controller Mounting and Wiring	C-1
Pressure Transducer Mounting	C-1
Pressure Transducer Wiring	C-2
TM-1 Temperature Sensors	C-2
Defrost Termination Thermostats	C-2
TM-1 Switching During Defrosts	C-3
Averaging Four TM-1 Temperature Sensors	C-3
Liquid Level Installation	C-3
Power Monitor (PEV) Installation	C-4
KWH Multiplier Selection	C-4
Compressor Wiring	C-5
Latched Compressor Wiring	C-6
Variable Speed Wiring	C-7
Condenser Fan Wiring	C-7
Local Alarm Installation	C-7
Refrigeration and Defrost Wiring	C-8
Un-Equal Compressor Programming Guide	C-9
Table C1: Standard Connector Assignments of the IO40 Board	C-10
System Start-Up Procedure	C-11
XPRT4-TD12 Configuration and Settings	C-12

SECTION D: SERVICING

General Systems Checkout	D-1
Service Part Numbers	D-2
Override Protection Procedure	D-3
CPU40 Field Replacement Procedure	D-3
IO40 Field Replacement Procedure	D-4
Memory Chip Field Replacement Procedure	D-4
Defective Part Replacement Procedure	D-6
Ordering Information	D-7

SECTION E: SPECIFICATIONS

XPRT4 Controller Specifications	E-1
CRX1 Relay Board	E-1
CRX4 Relay Board	E-1
CRX8 Relay Board	E-1
CRX8i Relay Board	E-2
CRX25 Relay Board	E-2
CRX25i Relay Board	E-2
Sensor Switching Relay	E-2
LPTX2 Low Pressure Transducer	E-3
HPTX2 High Pressure Transducer	E-3
TM-1 Temperature Sensor Specifications	E-3
PEV Power/Energy/Voltage Monitor Specifications	E-3
Current Transformer Specifications	E-3

APPENDIX 1: XPRT4 VARIABLE SPEED TECHNICAL DESCRIPTION 1-1

INTRODUCTION

Altech controls offers a family of XPRT Controllers which are microprocessor based and designed to control refrigeration applications ranging from single compressor systems to multiple suction parallel racks having up to 16 compressors. Condensor fan control and defrost control are available on certain models. All XPRT Controllers have remote communications capability and our XPRT1 has Altech's patented forced-time cycle control logic for energy saving suction pressure control. The following product matrix provides feature comparison of the XPRT family of controllers.

FEATURES	XPRT1	XPRT2	XPRT3				XPRT4		XPRT5
			STD	MPS	HVAC	DFRST	TD12	HVAC	TD32
Compressors	1	4	6	8	–	–	8	–	16
Condenser Stages	1	–	6	6	–	–	6	–	12
Defrost Circuits	1	–	–	–	–	8	12	–	32
Oil Failure/Auto Retry	1	–	–	–	–	–	Yes	–	Yes
Power Monitoring	–	Yes	Yes	Yes	Yes	–	Yes	Yes	Yes
Brownout Protection	–	Yes	Yes	Yes	Yes	–	Yes	Yes	Yes
Remote Communications	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
System Identifications	Yes	Yes	–	–	–	–	Yes	–	Yes
English Language Display Screens	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
History Log	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
#/Sensor	95	95	16	16	16	16	380	380	200
# of Sensors	5	7	16	16	16	16	32	32	64
Optimizer	–	2	3	3	–	–	12	–	32
Satellite Compressors	–	1	1	–	–	–	*	–	*
Temp Controllers/Defrost Circuits	1	–	–	–	–	8	12	–	32
Defrost Termination	Yes	–	–	–	–	Yes	Yes	–	Yes
Run Time Logs	Yes	Yes	Yes	Yes	–	–	Yes	–	Yes
Liquid Level Alarm	–	Yes	Yes	Yes	–	–	Yes	–	Yes
Download from PC	Yes	Yes	–	–	–	–	Yes	Yes	Yes
Output Override	–	–	–	–	–	–	Yes	Yes	Yes
Condenser Multiple Set Point	–	–	–	–	–	–	Yes	–	Yes
Suction Manifolds	1	1	1	3	–	–	1	–	3
Variable Speed Compressors	–	–	–	–	–	–	1	–	3
Variable Speed Fans	–	–	–	–	–	–	–	–	Yes
Alarm Dial Out	–	–	–	–	–	–	Yes	–	Yes
Remote Defrost Initialize	Yes	–	–	–	–	–	Yes	–	Yes

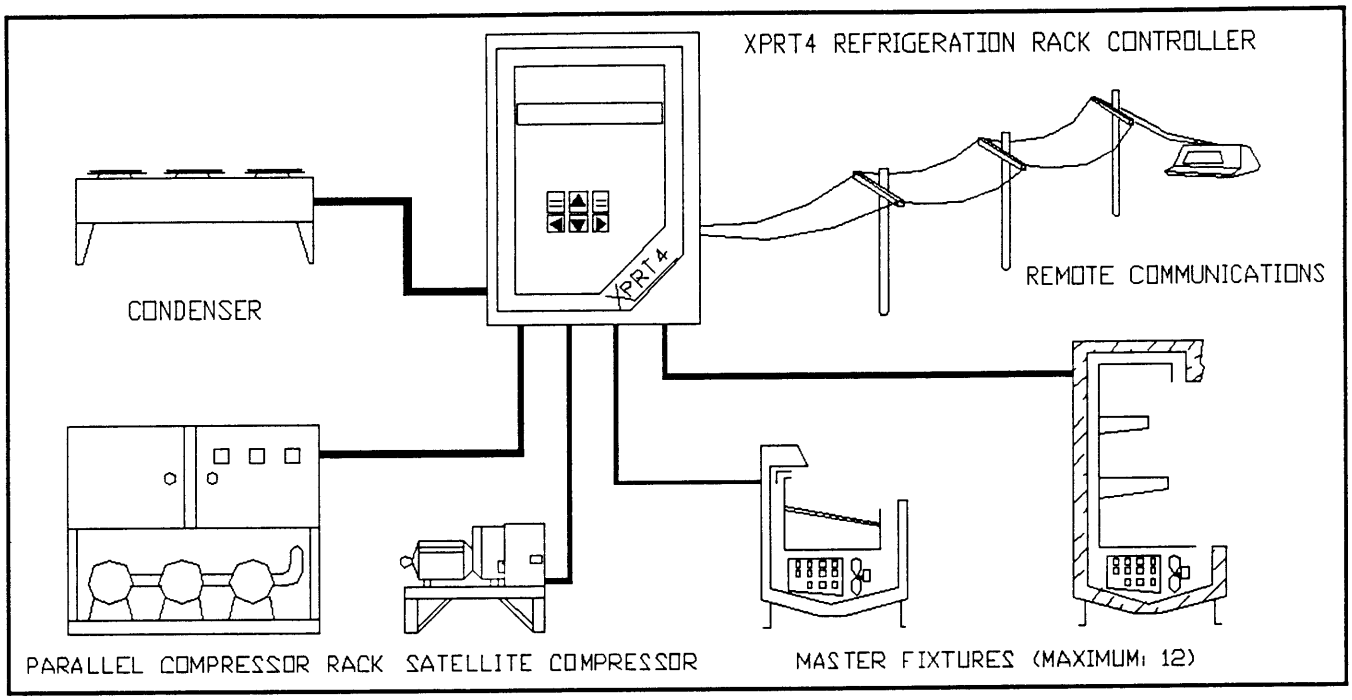
*Number determined by available temperature controllers

The XPRT family of controllers is covered by one or more of the following patents:

USA	4,531,376	Refrigerator Defrost Control
	4,535,602	Shift Logic Control Apparatus for Unequal Capacity Compressors in a Refrigeration Ssytem
	4,537,038	Method and Apparatus for Controlling Pressure in a Single Compressor Refrigeration System
	4,578,959	Method and Apparatus for Detecting and Controlling the Formation of Ice or Frost
	4,593,533	Method and Apparatus for Detecting and Controlling the Formation of Ice or Frost
	4,612,776	Method and Apparatus for Controlling Capacity of a Multi-Stage Cooling System
	4,628,700	Temperature Optimizer Control Apparatus and Method
	4,651,535	Pulse Controlled Solenoid Valve
	4,679,404	Temperature Responsive Compressor Pressure Control Apparatus and Method
	4,686,835	Solenoid Expansion Valve With Low Ambient Start-up
	4,697,431	Refrigeration System Having Periodic Flush Cycles
	4,735,060	Pulse Controlled Solenoid Valve with Food Detection
Canada	1,158,745	Method and Apparatus for Controlling Capacity of a Multi-Stage Cooling System
Australia	543,220	Method and Apparatus for Controlling Capacity of a Multi-Stage Cooling System
EPC	0,034,591	Method and Apparatus for Controlling Capacity of a Multi-Stage Cooling System
	0,082,144	Refrigeration Defrost Control
South Africa	4656/1980	

Other Patents Pending

SECTION A: GENERAL INFORMATION



The XPRT4-TD12 Pressure/Defrost Controller (TD12 indicates 12 temperature control circuits and 12 defrost control circuits) is a microprocessor based parallel refrigeration rack controller with the following features:

- History log for each sensor
- Compressor run time logs
- Defrost logs
- Oil failure logs
- Liquid level monitoring
- Ability to monitor rack power and voltage
- Manual initiation and termination of defrost
- "Easy-touch"™ four button display control
- Sensor type re-assignment
- Software overrides
- Remotely mounted control relays
- Option to factory configure controls
- One telephone modem for multiple XPRT controls
- Individual sensor/circuit names (16 characters)
- 40 character by 2 line English language display
- 24 VAC, Class 2 supply voltage

The XPRT4-TD12 performs the following:

- Controls up to eight parallel refrigeration compressors/unloaders based on:
  - Suction pressure
  - Condensing pressure
  - Oil pressure
  - Defrost status
  - Power line voltage
  - Minimum compressor ON and OFF times
  - Rotary logic or user customized unequal logic
  - Selectable unloader timing
  - Up to 12 master case temperatures (OPTIMIZERS)
- Control an inverter powering a standard compressor at variable speeds based on:
  - Suction pressure
  - Compressor oil pressure
  - Minimum compressor speed
- Control up to 6 condenser fans based on condensing pressure with 3 set points.
- Control defrost and temperature of up to 12 refrigeration or satellite circuits.
- Auto-dialed and local alarms

This manual covers only the TD12 version of the XPRT4 controller. Other versions, such as HVAC, have different part numbers and manuals.

SECTION B: OPERATION

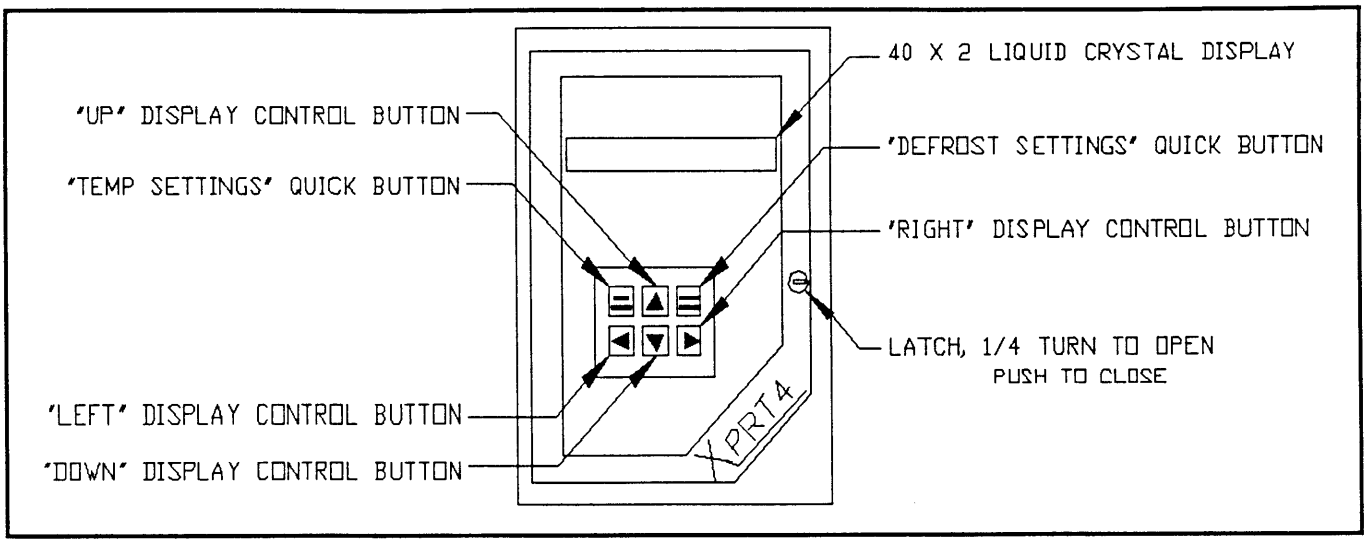


Figure B-1: XPRT4 Display and Keypad

DISPLAY AND KEYPAD

The XPRT4-TD12 is equipped with a 2 line by 40 character wide LCD display. Normally it displays the defrost status and the values of the temperature sensors of refrigeration circuits #1 – #8.

The amount of information that can be presented to the on-site user is too large to be displayed on a single "screen". Consequently, the XPRT4 has a series of information screens that can be visualized as being stacked below the main status screen. They are sequentially accessed by repetitive pressing of the "DOWN" key (See **Figure B-1**) when the blinking "< –" cursor on the display is in the far left position. If the previous screen is desired, pressing the "UP" key returns the display to the previous screen. A reference list of all the screens appears on **Pages B-3** through **B-5**.

QUICK KEYS

Due to the number of different screens, there are several quick methods for skipping directly to a particular screen. Some are accessed by pressing a dedicated key and others by pressing two keys at the same time. A summary:

"TEMP SETTINGS": Jumps to Temperature Setting screen
"DEFROST SETTINGS": Jumps to Defrost Setting screen
"LEFT" & "UP": Jumps to the Main Status screen
"LEFT" & "DOWN": Jumps to the Password screen

While the "< –" cursor is next to a setting:

"UP" & "RIGHT": Speeds the rate of increase for changing a setting
"DOWN" & "RIGHT": Speeds the rate of decrease for changing a setting

CHANGING SETTINGS

The four direction keys (See **Figure B-1**) – UP, DOWN, LEFT & RIGHT – are also used to change XPRT4 settings, such as the Cutin setting. The settings which can be adjusted using the keypad are indicated on the sample screens in this document by a "<" beside the value. In order to change a setting, move the blinking "< –" cursor from the far left position to the position beside the setting to be changed by pressing the "RIGHT" or "LEFT" key. Next, to increase or decrease the value, press the "UP" or "DOWN" key. Once the setting has been changed to the value desired, the cursor must be moved back to the far left position using "LEFT" key before the other screens can be accessed. All the settings are maintained in non-volatile memory which is retained indefinitely. A rechargeable power supply will hold the history logs and maintain correct time and date for 6 hours.

DISPLAY CONTRAST ADJUSTMENT

The XPRT4 has a contrast adjustment potentiometer to maximize the clarity of the display for a particular viewing angle. The potentiometer is located on the top of the CPU40 circuit board (See **Figure B-2**). The potentiometer has a total rotation of 300 degrees. DO NOT FORCE BEYOND THE STOPS!

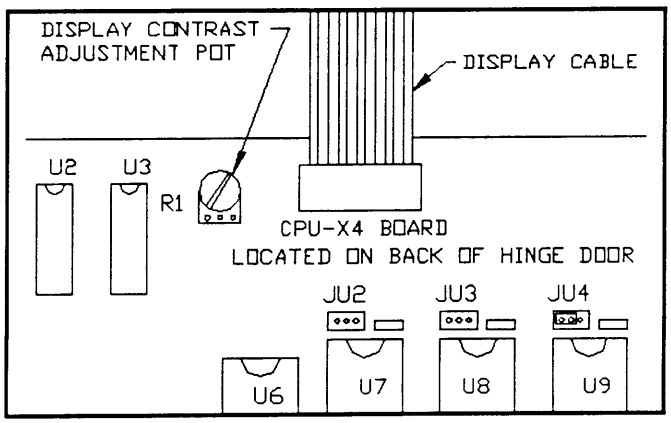


Figure B-2: Display / ContrastAdjustment

SUCTION PRESSURE CONTROL LOGIC

The XPRT4 controls up to eight compressors (or unloaders) to maintain the suction pressure between the Cutin and Cutout settings while limiting the frequency of the cycling. The rate that the compressor capacity is increased is dependent on how far the suction pressure is above the Cutin setting.

The compressors can be sequenced using either rotation logic or a user programmable logic which selects compressor (unloaders) combinations that provide different amounts of compressor capacity. In addition to the controlling of compressors to maintain the suction pressure between the Cutin and Cutout settings, the XPRT4 has special control logics for equipment protection. Compressors will be cycled if a suction pressure falls below the suction limit (normally a vacuum). Additional compressors will not be added if it detects a condensing pressure in excess of the maximum condensing pressure limit setting. ("HEAD LIMIT" in Configuration Screen C-1)

The XPRT4-TD12 also has the ability to control the #1 compressor as a variable speed compressor. In between the incremental changes in compressor capacity, the XPRT4 continually adjusts the speed in order to maintain the suction pressure settings within the proper range. The XPRT4 provides a 0 - 10 VDC signal to the inverter with the 10 VDC signal being maximum speed. The control logic will shift the speed of the variable speed compressor to halfway between maximum and minimum speed settings when extra compressor capacity is sequenced on or off. (See **Appendix 1** for a complete description)

The XPRT4's logic also incorporates a special logic that "shifts" the compressor capacity down (thereby causing the RPM of the variable speed compressor to increase) if the compressor's oil pressure (differential from the suction pressure) falls below a minimum setting.

OIL PRESSURE LOGIC

The XPRT4-TD12 has provisions for monitoring up to 6 individual compressor oil pressures and has logic to lock the compressor off if it's oil pressure is not maintained for a settable period of time. The XPRT4-TD12 logic also allows a selectable number of retries before locking the compressor off. Once locked off, the XPRT requires an operator to manually re-enable the compressor.

CONDENSER FAN OPERATION

Up to six condenser fans can be controlled based on condensing pressure. The condenser fans are cycled on and off using either sequence logic (FIRST ON LAST OFF) or rotation logic (FIRST ON FIRST OFF). The XPRT4-TD12 has provisions for three different condenser fan pressure settings – normal refrigeration, hot gas type defrosts and heat reclaim.

REFRIGERATION TEMPERATURE CONTROL

The XPRT4 can control the temperature in up to 12 refrigeration circuits via the liquid line solenoid valve, a pilot operated EPR or a suction stop. Each circuit has a master temperature sensor and individual temperature/time delay settings.

DEFROST CONTROL

The XPRT4 can initiate up to six defrosts per day for each of the 12 refrigeration circuits. The defrosts are time initiated and can either be temperature terminated or time terminated. The master circuit temperature sensor can be used for temperature termination, or a series of close-on-rise thermostats can be wired in with the master sensor to provide positive defrost in all fixtures. A drain time can also be added at the end of defrost.

OPTIMIZER CONTROL LOGIC

The XPRT4 can have up to 12 circuits defined as OPTIMIZER circuits. OPTIMIZER circuits are used to make automatic adjustments in the Cutin and Cutout suction pressure settings to maximize compression suction pressure. Increased suction pressure decreases compressor electrical consumption. All OPTIMIZER circuits must be at or below their respective ON settings before the suction Cutin and Cutout settings are allowed to be automatically set higher. If the temperature is 10°F warmer than its setting, that circuit is assumed to be in defrost.

The circuits that are to be used as OPTIMIZER circuits must be in sequence starting at circuit #1. If a satellite compressor is to be controlled, it should be located on a circuit after the last OPTIMIZER temperature probe. For all OPTIMIZER circuits, the master sensor temperature is compared to the respective circuit temperature setting.

Regardless of the temperature sensor's reading, the OPTIMIZER logic will not change the Cutin and Cutout settings beyond the maximum and minimum limits set by the operator.

STATUS AND CONFIGURATION SCREENS

The display screens are broken into two groups of screens Status and Configuration. The Status Screens (See **Pages B-3 – B-5**) contain information and settings that an on-site serviceman would normally need to know to perform service on the compressor rack. They contain the history logs, suction setting, refrigeration circuit settings, defrost settings and alarm information.

The Configuration Screens (See **Pages B-6 & B-7**) are used for setting the basic configuration, time delays, alarm parameters, communication parameters and limits on settings for the XPRT4. Once they are set for a given installation, generally there will be very little need for an on-site serviceman to view these screens.

The Status and Configuration Screens can be protected by a user selected password. The XPRT4 is shipped from the factory with the password set to "0 0 0". This allows the installer full access to all the screens during the initial setup. However, after the control is configured, a new password can be defined which restricts access only to those users who correctly enter the password.

Oil Pressure Failures (press ∧ to clear)
1-ok< 2-ok< 3-HL< 4-FL< 8-ok< 0-ok<

S0: OIL FAILURE STATUS SCREEN

This screen is placed above the initial system temperature screen and shows the current status of the oil failure logic and the assignment of the oil pressure transducers to the various compressor outputs. Each of the "<" symbols show the location that the cursor can be placed to implement some change in the control. The second line of this display shows the compressor output to which each of the six oil pressure transducers are assigned with "0" representing none and 1 through 8 representing the first through eighth compressor. If the compressor is operating normally an "ok" is indicated. An "HL" indicates the compressor is being held off for the hold-off time before it will attempt to restart. The "FL" indicates that a compressor has gone through the failure sequence for the number of retry times selected in the configuration section, has failed to reach the oil pressure setpoint and has been marked as failed. Any compressor that is in the hold-off period or has failed can be manually reset by moving the cursor to that particular transducer location and pressing the "UP" key on the controller. If that compressor is being called into use by the controller, it should come on and go through the oil failure sequence again. If "Oil Failures" is "Disabled" in Configuration Screen C17, this screen will not appear.

Temp	1 =	-20	2R	-10	3d	35	4D	12
	5 =	-5	6R	2	7R	6	8R	n-s

S1A: REFRIGERATION CIRCUIT STATUS SCREEN

Temp	5 =	-5	6R	2	7R	6	8R	n-s
	9d	n-s	10R	n-s	11R	n-s	12R	n-s

S1B: REFRIGERATION CIRCUIT STATUS SCREEN

These two screens show a summary of the temperatures and states of the twelve refrigeration systems. The "=" indicates that the temperature for that system has been satisfied and the appropriate refrigeration valve is positioned to allow the fixture to warm up. An "R" indicates that the temperature is not satisfied and the appropriate refrigeration valve is positioned to allow the fixture to be refrigerated. A "D" indicates a refrigeration circuit is in defrost. If a drain time is specified after a defrost, a "d" indicates that a circuit is in a drain period.

The number next to the system number is normally the master fixture discharge air temperature for that circuit. However, if thermostats are used to terminate defrost in conjunction with temperature control (as shown in wiring diagram **Figure C-4**), a temperature greater than 200°F will be displayed when the termination thermostats are made. In addition, if the sensor switching relay circuit shown in **Figure C-5** is used, the temperature displayed during defrost will be the coil temperature. If the controller detects an open circuit, the display will show an "n-s" indicating "no sensor" and the XPRT4-TD12 will bring on the refrigeration for that circuit. If both "System Temperatures" and "System Defrosts" are "Disabled" in Configuration Screen C17, these screens will not appear.

Suct 24	Stage 1 2 4 # 8	Opt # 7
Oil 35	Speed 1250 rpm 71 %	-4

S2A: VARIABLE SPEED RACK STATUS SCREEN

Suct 24	Stage 1 2 4 6 8	Opt # 7
Cond 190	Fans 1 2 4 5 6	-4

S2B: CONDENSER RACK STATUS SCREEN

Rack status screens show the status of the compressor outputs (P41-1 - P41-8) and all the Optimizer temperatures (if specified in Configuration Screen C5). If more than one optimizer is specified, the temperatures will be shown in sequence. If a compressor is being held off due to the oil logic, the compressor output number will alternate with a "#". In the above example, Compressor #6 shows this

The oil pressure shown in screen S2A is the pressure sensed by the oil pressure transducer connected to input P3. This assignment is fixed and is not changed by the Oil Pressure Transducer assignments in Configuration Screen C14. IF "Variable Speed" is "Disabled" in Configuration Screen C17, the Variable Speed Rack Status Screen (S2A) will not appear.

Screen S2B shows the status of the Condenser Fan Outputs (P42-1 - P42-6) in addition to the condensing pressure. The XPRT4-TD12 indicates which of the three different Condenser Fan pressure control settings it is using as follows:

Normal Operation will display "Cond";
Hot Gas Defrost will display "HtGs";
Heat Reclaim will display "HtRcl".

If input P29 senses a switch input, the control will switch to the Heat Reclaim condenser fan setting. When the controller is using the Heat Reclaim settings, "HtRcl" will appear in place of "Cond". Once in heat reclaim, the unit will remain in this mode for at least 5 minutes. If a Hot Gas Defrost ("HtGs") is also in progress, the higher setting will be used for control.

NOTE: By pressing the "RIGHT" and "LEFT" keys simultaneously, the suction and condenser pressures toggle to their equivalent evaporation temperature for the refrigerant selected in Configuration Screen C13.

Oil	Pressure	Value	Comp#	Status
<	P1<	35	2	on

S3: OIL PRESSURE STATUS SCREEN

This screen shows the oil pressure for the six oil pressure transducers (P3 - P8) and the status of the compressor (P41-1 - P41-8) to which they are assigned. In the example, oil pressure transducer connected to P4 indicates 35 psig and can shutdown compressor #2 which is currently running. If the oil transducer is not assigned, the status will indicate "Not assigned". The compressor output status can be "ON", "Off", "Oil Hold Off" or "Oil Failure". If "Oil Failures" is "Disabled" in Configuration Screen C17, this screen will not appear.

Systems In Defrost / time remaining
1/15 3/45 6/2

S4: DEFROST STATUS SCREEN

This screen shows the current systems in defrost and the remaining time of each defrost. If "System Defrosts" is "Disabled in Configuration Screen C17, this screen will not appear.

NORTH MLTDK	MEAT	Tmp	On	Off	Dly	Sns
Sys# 1<	Refg	-10	-10<	-12<	30<	P9

S5: TEMPERATURE SETTINGS SCREEN

This screen allows the refrigeration circuit temperature control parameters to be set and shows the name, control state, and current temperature of that circuit. "Dly" keeps the relay from On/Off cycling too often. If "System Temperatures" is "Disabled" in Configuration Screen C17, this screen will not appear.

Suction	Cutin	Cutout	Float	Cutin	Cutout
Psi	24<	18<		26	20

S6: SUCTION PRESSURE SETTINGS SCREEN

The compressor cutin and cutout settings are made in this screen. The values to the left are the initial Cutin and Cutout settings. The values to the right represent the current operating point due to the optimizer logic. The optimizer cannot move the cutin setting out of the range of the Max and Min cutin set in Configuration Screen C1. If a change is made to the cutin or cutout setting, the float values are set to match. Note that the original differential set between Cutin and Cutout will be maintained as the pressures are adjusted to the optimizer logic

Fans	Mode	Cutin	Cutout	Liquid
	Normal<	145<	135<	20%

S7: CONDENSER FAN SETTINGS SCREEN

The condenser cutin and cutout are set in this screen for each of the three modes: Normal, Hot Gas, Defrost, and Heat Reclaim. If a liquid level transducer is attached to P30, the percentage of liquid in the receiver is also displayed. If "Condenser Fans" is "Disabled" in Configuration Screen C17, this screen will not appear and the liquid level will be displayed in Screen S2B.

NORTH MD	MEAT	Tmp	Term	Time Left	Drn
Sys# 1<	Dfrst<	41	60	26	6

S8: DEFROST INITIATION & STATUS SCREEN

This screen displays the present defrost status for each system. This screen can also be used to initiate a manual defrost or terminate a defrost. By moving the cursor to select the desired system number, then moving to the right of the current state and pressing the "UP" key, the controller will display the message "Wait Changing Defrost State". After the state changes, the screen will reflect the new status. When a defrost is set in this manner, the defrost runs the full defrost length ("Term") and is not terminated by temperature. "Drn" is the current set drain time that starts after defrost termination. If "System Defrosts" is "Disabled" in Configuration Screen C17, this screen will not appear.

Systems in Defrost / time remaining
1/15 3/45 6/2

S9: DEFROST STATUS SCREEN (Repeat of S4)

This screen shows the status of the current systems in defrost. It is a repeat of Status Screen S4. If "System Defrosts" is "Disabled" in Configuration Screen C17, this screen will not appear.

NORTH MD	MEAT	Trm	Lnth	Drn	Dfrst	Type
Sys# 1<	P9	55<	60<	6<	HtGs<	Time<

S10: DEFROST SETTINGS SCREEN

This screen sets the defrost values for each of the systems. The "P9" sensor has been set to terminate defrost at 55°F. If defrost termination thermostats are used as shown in **Figure C-4**, set "Trm" to "ThmST" by raising "Trm" temperature to just above 80°F. The "Type" of defrost can be set for either "HtGs" or "Norm". When "HtGs" is specified, the XPRT4 will change the condenser fan control settings to the hot gas defrost settings.

"Norm" should be used for electric off-cycle defrosts. Presently, only "Time" initiated defrosts can be set. If "System Defrosts" is "Disabled" in Configuration Screen C17, this screen will not appear.

NORTH MD MEAT	Def #	Time
Sys# 1<	2< Totl 3	20:< 30<

S11: DEFROST SCHEDULE SCREEN

This screen sets the starting times for the defrosts. In the sample screen, the second of the 3 active defrost times (6 per day max) is shown as set to 8:30 P.M. (20:30 hrs). The value under time is displayed as "--:--" when that defrost number is inactive. If "System Defrosts" is "Disabled" in Configuration Screen C17, this screen will not appear.

Defrost	Sys#	Acum(M)	Lg#	Time/Date
Log	1<	125	7<	12:00 06/22/96

S12: DEFROST LOG SCREEN

This screen displays a log of the termination time of the last ten defrosts with the total accumulated defrost time since last reset in Configuration Screen C12. In this example, the log for System #1 shows the 7th to last defrost occurred at 12:00 P.M. This screen can be reset in Configuration Screen C12. If "System Defrosts" is "Disabled" in Configuration Screen C17, this screen will not appear.

Alarm #	Time On	Delay	Last Alarm
19 Low<	21	30	17:23

S13: ALARM STATUS LOG SCREEN

This screen presents the status of the high and low alarms for each of the 32 sensor inputs. In this example, Sensor 19 has been below the Low setting for 21 minutes. If it remains there for 30 minutes, the Alarm Relay will be set and the new time recorded in "Last Alarm". The settings are set in Configuration Screen C7.

Current Alarms : Push - > To Reset Alarms
1H 3L

S14: CURRENT ALARMS LOG SCREEN

This screen shows the current active alarms. Press the "RIGHT" key to reset them.

Snsr #	Log #	Value	Description
P9<	0<	-10	NORTH MLTDK MEAT

S15A: CURRENT SENSOR VALUE SCREEN

Snsr #	Log #	06:00	05:45	05:30	05:15
P9<	381<	-10	-12	-11	-10

S15B: SENSOR VALUE LOG SCREEN

This screen has a dual function. If the log number is set to zero, the current value and the description of the sensor are displayed (Screen S15A). When the log number is raised to "1", it will show the four most recent logged readings and the time. The "Log #" can be incremented by fours. There are 384 logged values for each sensor. The time increment between the logged values is set in Configuration Screen C13 for each sensor.

Load #	Days	Hr	Total Days	Hr	% ON
1<	1	3	2	4	50

S16: COMPRESSOR RUN TIME LOG SCREEN

This screen shows the total time each of the compressors have run and the total time since the last reset. In this example, Compressor #1 has been online for 1 day and 3 hrs. Since the last run time reset, the time elapsed is two days and 4 hrs. The run time can reset in Configuration Screen C12.

Oil Fail'r	Snsr	Comp Lg#	Time/Date
Log	P3	1<	12:00 06/22/96

S17: OIL FAILURE LOG SCREEN

This is a log of the oil failures for the six oil pressure transducers. The times and dates of the last ten oil failures for each sensor are kept in this log. This example is the log for the oil pressure transducer connected to Sensor Input P3 and in controlling Output #1 (Compressor #1). It shows the last failure at 12:00 on 06/22/96. If "Oil Failures" is "Disabled" in Configuration Screen C17, this screen will not appear.

	KWH	Power	Volts	Amps
<	2324	25	207	61

S18A: KWH POWER STATUS SCREEN

kwh	hr	kwh	Day	Demand
< 23	13<	315	27<	47

S18B: KWH POWER LOG SCREEN

Screen S18A shows the accumulated rack kwh, current rack power (kw), minimum phase to phase voltage and calculated amps. Screen S18B shows the power logs for the previous 24 hrs and for the last 31 days. The kwh to the left of "hr" is the accumulated kwh between noon and 1 PM.

The kwh to the left of "Day" is the accumulated kwh for February 27 (previous month). The value under "Demand" is the maximum power (kw) the controller has sensed since the last time the power logs were reset (Screen C12). If "Power Monitor" is "Disabled" in Configuration Screen C17, these screens will not appear.

Password	Time	Date	Day
< 0< 0< 0<	12:00<	06/22/96	Sat

S19: PASSWORD ENTRY SCREEN

This screen allows password entry and setting the time and date. If the protected setting option was set in the configuration section, the first two numbers of the password must match the configuration keyword to allow a mechanic to make changes in the settings screens. All three entries must match the key word in order to change the configuration screens.

XPRT™ 4-TD12 CONFIGURATION SCREEN QUICK REFERENCE

Cutin:Max / Min	Pump Down	Head Limit
50< 30<	13<	291<

C1: SUCTION LIMITS SCREEN

This is the first of the configuration setting screens. The maximum and minimum cutin settings limit the range of the cutin setting in Screen S6. These settings also limit the range in which the optimizer logic can control the cutin pressure. The Pump Down setting is the suction pressure at which all of the compressors are shut off. Exceeding the head limit will also turn compressors off.

NOTE: For those controls which have no high pressure transducer installed, the Head Limit will have to be set at 350 psi before any compressor will run.

Compressor Timer	Condenser	Timer (sec)
On 120< off 25<	On 15<	Off 60<

C2: COMPRESSOR AND FAN DELAY SCREEN

This screen sets the compressor and condenser timers by fixing the # of seconds of delay before the next compressor stage will come on (or off), thereby reducing equipment cycling. If "Condenser Fans" is "Disabled" in C17, only the compressor timer settings will be displayed.

Cfg Stage #	87654321	Decimal	Unloader
Prg< 3<	11 1	1<	No<

C3: COMPRESSOR CONFIGURATION SCREEN

This screen selects the logic which controls up to 8 compressors (or unloaders). If "Prg" is selected, a predetermined compressor sequence can be loaded at each stage (max. 32 stages). Typically, Stage 1 is set to have the smallest compressor (i.e. least HP) on. Each successive stage is set for increased capacity. The compressor combinations are set up by setting the stage number and the decimal. This is repeated until all stages are set. See **Section C, Unequal Compressor Programming Guide** for complete details.

If "Equal" is selected, set the total number of compressors. "Equal" indicates rotational logic (First on first off). If the stage involves only deenergizing or energizing an unloader solenoid, a short time delay such as "10" (sec.) may be selected under "Unloader". If a variable speed compressor is used, it must be connected to P41-1.

Fan Logic	Fan #
SEQ<	6<

C4: CONDENSER FAN CONFIGURATION SCREEN

This screen programs the fan logic as either Sequential (FIRST ON LAST OFF) or rotational (FIRST ON FIRST OFF). Up to 6 fans may be controlled. If "Condenser Fans" is "Disabled" in Configuration Screen C17, this screen will not appear.

Relay Type	Compressors	Condensers
	NC<	NC<

C5: RELAY CONFIGURATION SCREEN

This screen sets the output relay logic as normally open (NO) or normally closed (NC) contacts on the CRX4 or CRX8i boards for both compressors and condensers. If "Condenser Fans" is "Disabled" in C17, the Condenser relay logic is not displayed and cannot be set.

Alarm #	Set Point	Delay (min)
1 Low<	-18<	30<

C6: ALARM CONFIGURATION SCREEN

This screen sets high and low alarm points for all sensors. The alarm time is not incremented on temperature circuits during defrost. "Delay" is the time in minutes between the alarm event occurring and the alarm contact closing (See **Figures B-3 and C-13**). If "Delay" is set to zero, the alarm is disabled.

Set Password	Diagnostics	Settings
0< 0< 0<	0< 34	Unprotctd<

C7: SET PASSWORD SCREEN

This screen allows password selection for restricted access to the configuration screens and protection of the settings above the configuration screens.

Unit #	Baud Rate	Bits	Port
2<	1200<	8<	RS422<

C8: COMMUNICATION PARAMETERS SCREEN

This screen sets the communication parameters.

KWH Multiplier	Voltage	Low Voltage
20<	75 to 275v<	202<

C9: POWER MONITOR CONFIGURATION SCREEN

This screen sets the power monitoring parameters. If no PEV Power Transducer is installed, select "Disabled" under "KWH Multiplier". "Low Voltage" is the minimum phase to phase voltage below which the compressors will be turned off. If "Power Monitor" is "Disabled" in Configuration Screen C17, this screen will not appear.

Rate Up	Down	Oil	Speed%	Slope	Max Speed
20<	15<	20<	40<	10<	1750<

C10A: VARIABLE SPEED SETTINGS SCREEN

"Rate Up Down" values indicate the rpm change made during each speed change. The "Oil" value is the minimum oil pressure (differential from suction pressure) allowed. If the oil pressure stays below the value for the time period defined in the "Oil Time Out" screen (**C11B**), the XPRT4 will "shift down" to allow the variable speed compressor to run faster. "Speed %" indicates minimum speed allowed. "Slope" is the rate of change in speed. Typically, "10" will result satisfactory operation. "Max Speed" provides the means to convert "Speed%" to rpm. Set this value to the rated rpm (1750 shown here). The program assumes the inverter will provide 107% of rated speed at the maximum speed. To disable the variable speed logic, set "Slope" to "OFF". If disabled in this manner, this screen, **C11A**, will not appear.

Set Log Interval	Oil Timeout
15 mins<	15 secs<

C11: SET LOG INTERVAL SCREEN

This screen sets the Log interval and oil failure timeout

Refrigerant	(Units)	Temp	Pres
HP62		°F<	Psi<

C12: REFRIGERANT & UNITS SELECTION SCREEN

This screen selects the refrigerant type for the system as well as designating which units will be displayed.

Reset Accumulators
1< Push -> to reset Run Time

C13: CLEAR ACCUMULATORS SCREEN

This screen allows the run time, defrost, and the power accumulators to be individually reset.
Selecting 1 and pressing the "RIGHT" arrow key resets the Run Time displayed in Screen S16. Selecting 2 and pressing the "RIGHT" key resets the accumulated KWH displayed in screen S18A. Selecting 3 and pressing the "RIGHT" key resets the accumulated Defrost Times displayed in Screen S12.

Oil Fail'r	dP	Dly	Hld	Rtry	Snsr	Output
Setting	10<	60<	15<	3<	P3<	1<

C14: OIL FAILURE CONFIGURATION SCREEN

This screen sets the oil failure system parameters as follows:

- "dP" is the minimum oil pressure that must be maintained;
- "Dly" is the time (sec) that the compressor may operate when its oil pressure is below the "dP" setting;
- "Hld" is the time (min) that the compressor is held off before it is allowed to restart;
- "Rtry" is the number of times the compressor is allowed to restart when oil pressure is below minimum before it is marked as failed;
- "Snsr" selects oil pressure inputs P3 - P8;
- "Output" assigns the compressor output as "none" or "1" - "8" for the selected sensor.

If "Oil Failures" is "Disabled" in Configuration Screen C17, this screen will not appear.

Sensor #	Type	Description
P9<	Temp<	NORTH MLTDK MEAT<

C15: SENSOR CONFIGURATION AND NAME SCREEN

This screen allows the sensor type to be programmed as "Temp", "LPTX2 LOp","LPTX4 LOp", "HPTX2 HIp", "HPTX4 HIp", "LPTX2 OIL", "LPTX4 OIL", "DPTX OIL", "HPTX2 OIL", "HPTX4 OIL", "Humidity", "Voltage", "Liquid", "Dew Point", "Switch", "High Temp" or "Refrgrnt" and a 16 character description to be assigned to the sensor. Non-standard types of sensors may be selected for all 32 locations. For example, If P1 was changed for "LPTX2 LOp" to "Temp", the XPRT4 would expect a TM-1 temperature sensor to be installed on location P1 and the temperature settings would be the basis for controlling the 8 compressors. If "LPTX2 OIL" is selected for a sensor input (any except P1) that sensor assumes P1 is set up for "Low Pressure", and the values logged will be the difference between that sensor and P1. Any of the sensors P9 - P20 can be set to a low pressure sensor and control a satellite compressor using pressure settings in Screen S5 instead of temperature settings.

Output Port#	Ovrd P41<	L1 au<	L2 of<	L3 on<	L4 au<	L5 au<	L6 au<	L7 au<	L8 au<

C16: OVERRIDE STATUS SCREEN

This screen selects the state of each of the 8 output lines in the 5 output ports. "Port#" selects P41 - P45. L1 - L8 represent the 8 output lines of the chosen port and may be set as override on ("on"), off ("of") or in automatic ("au"). When in automatic, the output is set by the controller

Control function and display selection
1< Condenser Fans Enabled<

C17: CONTROL FUNCTIONS CONFIGURATION SCREEN

This screen enables or disables the following six functions:

1) Condenser Fans
2) System Temperatures
3) System Defrosts
4) Oil Failures
5) Power Monitor
6) Variable Speed

COMPRESSOR AND FAN RELAY OPERATION

Although a variety of relay boards is available, the CRX8i Relay Board is recommended for both compressors (unloaders) or condenser fans (See **Figures C-9** and **C-13**). However, it is possible to use the CRX8 Relay Board in place of the CRX8i Relay Board. The CRX8i has isolated Form-C contacts where the CRX8 has one common for all eight sets of contacts.

CRX8i Relay Boards shipped beginning 10/89 have jumpers to individually select the LED operation (Direct acting or reverse acting). See **Figure B-4** for details. (The CRX8 and original CRX8i boards did not have any adjustments or jumper selections. Each Status LED on the top of the circuit board is lit when the relay coil is de-energized. Since the Normally Closed contacts are typically used for controlling the compressors and condenser fans, the Status LED on each of the eight relays represents the actual status of the compressors or fans. If the Normally Open contacts are used, the LED will be reversed from the actual compressor or fan being controlled).

It is also possible to use the CRX4 (See **Figure B-3**) or CRX1 Relay Boards. The CRX4 Relay Board has four relays. Each of the four relays is individually addressable from Position 1 to 8 (Position 9 is not used with the XPRT4). The output which controls a particular relay is set by the jumper plug as shown in **Figure B-3**. USE A NEEDLE NOSE PLIERS TO POSITION THE JUMPER! If all the CRX relays are not being used, position the selector pin as shown in **Figure B-3**.

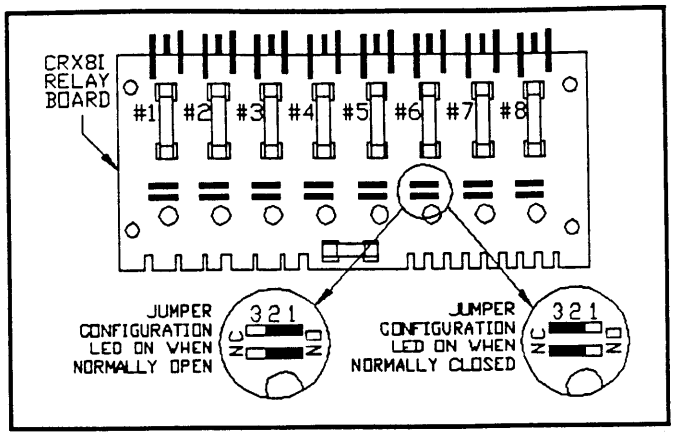


FIGURE B-4: CRX8i Jumper Selection

Each "NO/NC" Selector Jumper on the CRX4 (See **Figure B-3**) should be set to indicate which set of contacts will be closed when the Override switch is put into the OVRD position. The board is shipped from the factory in the "NC" position (NC contact closed) which causes the relay to be de-energized when overridden. If the "NO" position (NO contact closed) is selected, the relay will be energized by the override switch.

The Status LED's located on the CRX4 Relay Board reflect the status of the relay coil. The LED is lit when the coil is energized. If the NC contacts are used for control, the Status LED's will be the reverse of the controlled device.

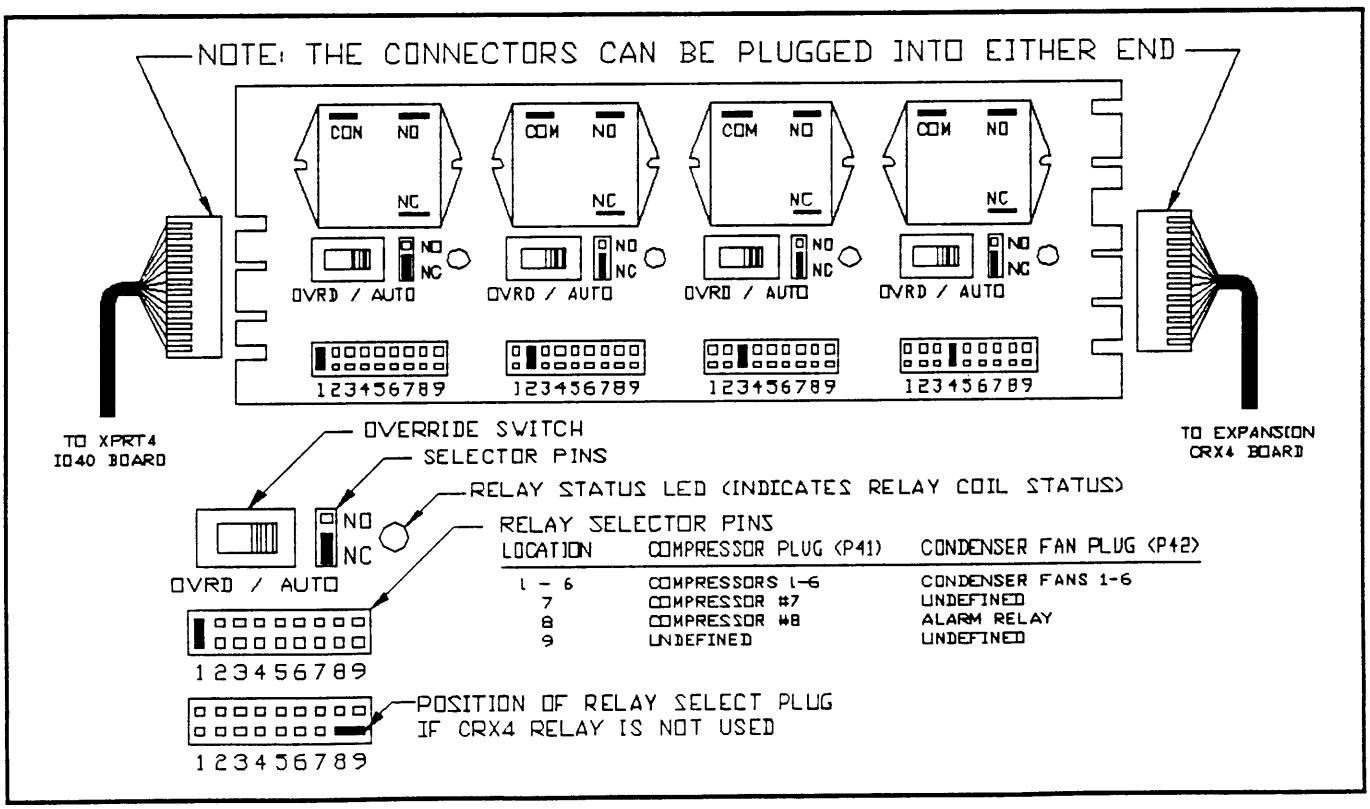


FIGURE B-3: Compressor and Fan Operation Using CRX4

The CRX1 Relay Board has a single relay. It can be programmed to operate from any one of the 8 outputs depending on which one of the dip switches s closed. **Figure B-5** shows relay action on the first output. Only one switch should be in the ON position! The CRX1 can be daisy chained from another relay board such as a CRX4 or another CRX1. The Status LED reflects the coil status. The LED is lit when the coil is energized. If the NC set of contacts are used for control, then the Status LED will be reverse that of the controlled device.

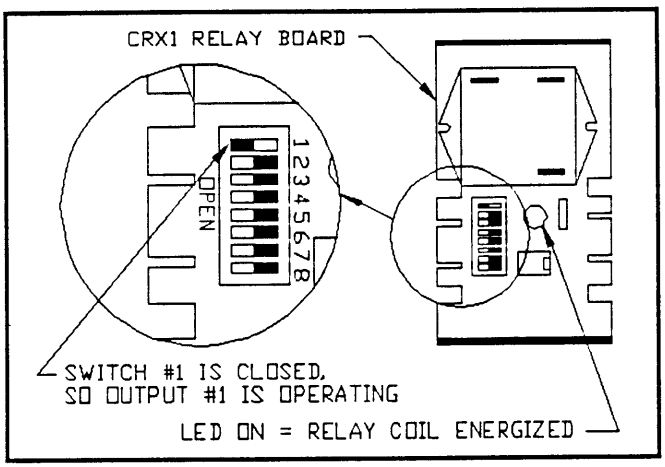


FIGURE B-5: CRX1 Using First Output

REFRIGERATION AND DEFROST RELAYS

The XPRT4-TD12 is designed to use the CRX25i or CRX25 Relay Board for controlling the liquid line solenoid and hot gas valves or electric defrost contactor for all 12 circuits. The refrigeration control relays use a Normally Closed contact and have a reverse acting Status LED. The Status LED is lit when the circuit is being refrigerated. The defrost control relays use a Normally Open contact and have a direct acting Status LED.

The CRX25i has isolated Form-C contacts. The CRX25 has one common connection for the temperature control relays and another for the defrost relays. Both the CRX25i and CRX25 boards have an additional relay that can be used to energize a head pressure valve or a liquid line differential valve when a hot gas defrost is in progress. This relay, located at the upper right corner of the CRX25i and CRX25 boards (See **Figure B-6**), will be energized when the selected circuits (using the 12 position dip switch) are in defrost.

SENSOR SWITCHING RELAYS

The Sensor Switching Relays are used to switch the master sensor from an air sensor used for temperature control to a coil mounted sensor for defrost termination when the evaporator fans are turned off during a hot gas or electric defrost. This is the case on many closed refrigeration fixtures such as reach-ins or walk-ins. These relays do not need to be used and the extra sensor wire does not need to be run if defrost termination thermostats are used as shown in the installation wiring diagram **Figure C-5**.

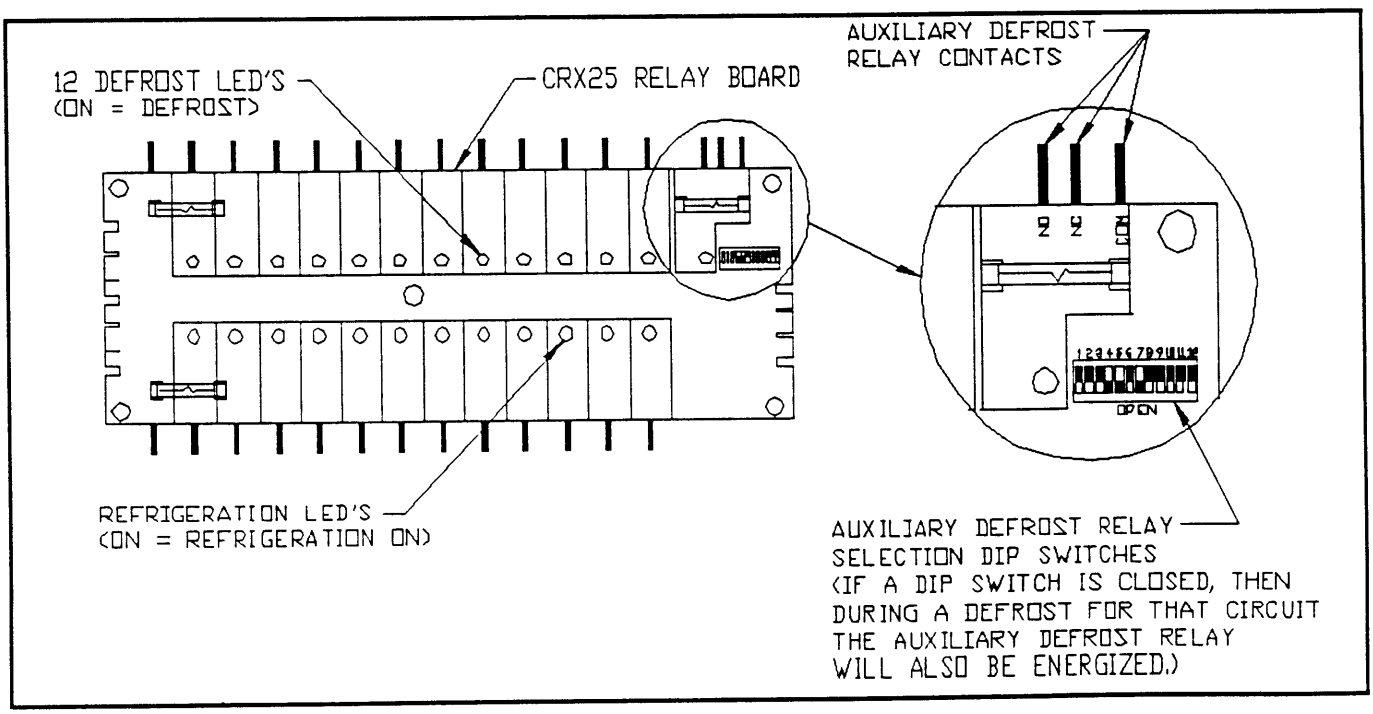


FIGURE B-6: CRX25i – Auxiliary Defrost Relay

SECTION C: INSTALLATION

CONTROLLER MOUNTING AND WIRING

The XPRT4 enclosure is designed to mount directly to the refrigeration rack. Select a location, mount and wire as follows:

- Locate at eye level, preferably.
- Locate where condensation from refrigeration lines will not drip onto it.
- Avoid locations in shadow (affects viewing of the display).
- Mount using the four mounting holes provided in the mounting flanges – DO NOT DRILL HOLES INSIDE THE ENCLOSURE!
- Mount and wire the transformer in accordance with all applicable codes.
- Wire as shown in **Figure C-1** (If the XPRT4 is mounted on a wall, verify that the enclosure is grounded).

CAUTION

- Installer must be a trained and experienced serviceman.
- Before performing any installation or service work on the line voltage components, remove power.
- Before performing any installation or service work on the XPRT4, disconnect the 24 VAC power.
- Failure to follow proper procedures could result in damage to the XPRT4.
- Always perform a complete check-out when the installation is complete.

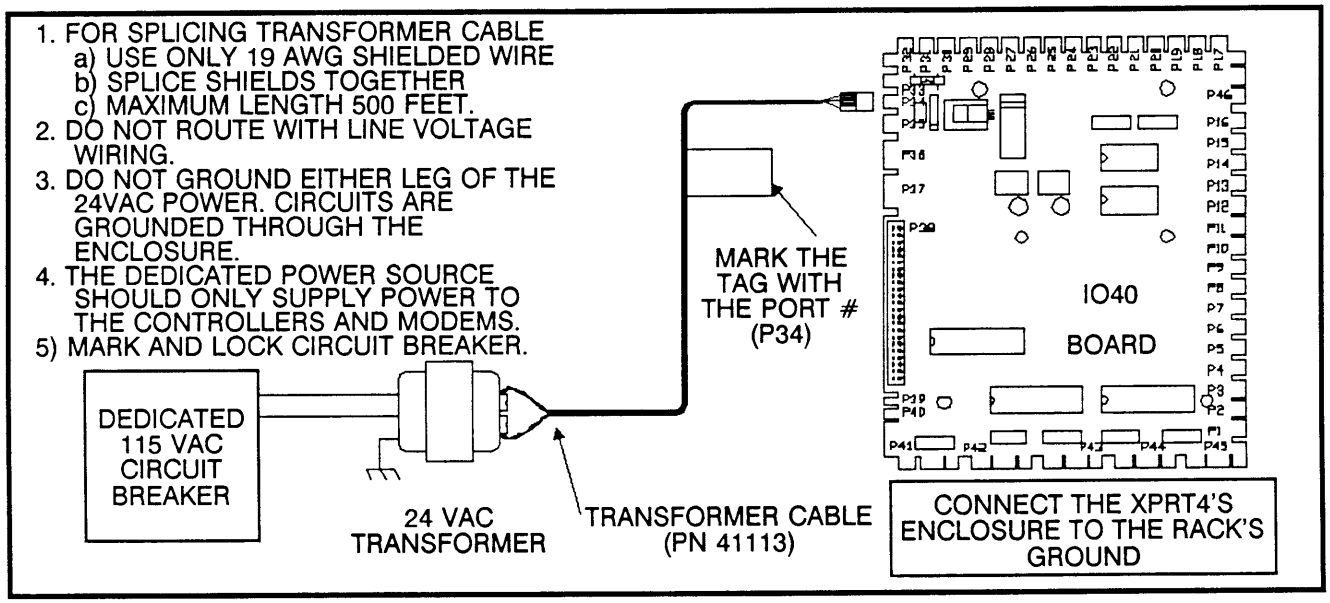


Figure C-1: Controller Mounting and Wiring

PRESSURE TRANSDUCER MOUNTING

Mount the pressure transducer into a 1/8" female pipe thread fitting positioned such that the transducer will not trap oil and is protected from excessive temperature.

- Locate suction pressure transducers where NO condensation or frost will form on the transducer's fitting.
- Install high pressure transducers such that they are not directly on the compressor or a discharge line where the transducer's fitting could exceed 150°F.
- Wrench only on the bottom part of transducer fittings! (See **Figure C-2**).
- A hand valve is not required for servicing. The transducer has a built-in flow restriction that allows removal of the top half of the transducer fitting with pressure on the system – the top half of the fittings (which includes the transducer) should be HAND TIGHTED ONLY!

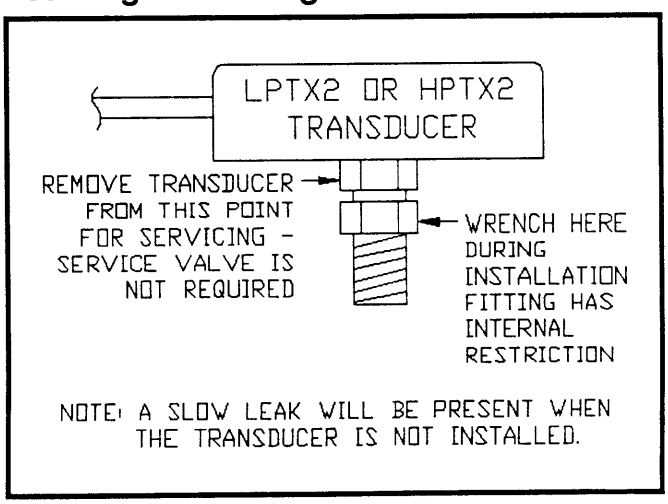


Figure C-2: Pressure Transducer

- Confirm which transducers are to be installed and verify that the proper transducer is being installed in that location:

P#	DESCRIPTION	XDCR TYPE
P1	Suction Pressure	LPTX2
P2	Condensing Pressure	HPTX2
P3	Oil Pressure Comp #1	LPTX2
P4	Oil Pressure Comp #2	LPTX2
P5	Oil Pressure Comp #3	LPTX2
P6	Oil Pressure Comp #4	LPTX2
P7	Oil Pressure Comp #5	LPTX2
P8	Oil Pressure Comp #6	LPTX2

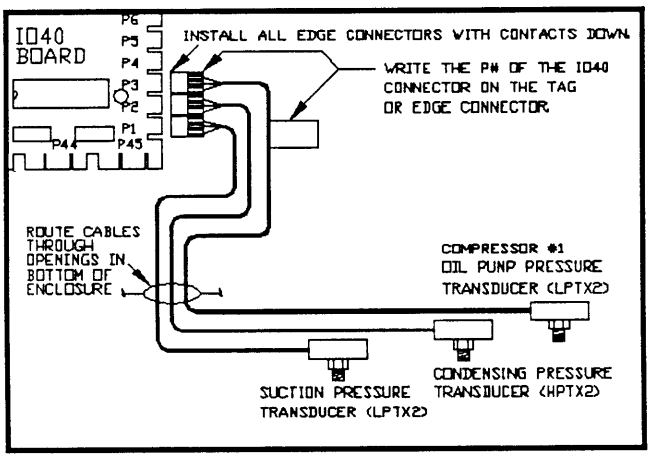


Figure C-3: Pressure Transducer Wiring

PRESSURE TRANSDUCER WIRING

The HPTX2 and LPTX2 pressure transducers should be connected to the IO40 Board as shown in **Figure C-3**. The 8 foot cable length for each transducer should be adequate to connect the transducer plugs directly to the IO40 Board without splicing.

- If a longer cable is required, splice with 22AWG stranded 4 conductor shielded cable. BE SURE TO SPLICE THE SHIELDS TOGETHER!
- To reduce the chance of mixing cables or plugging cables onto the wrong connector, Altech recommends that the IO40's connector number be written on the edge connector or tag as shown in **Figure C-3** (example: "P1", "P2", etc.).

TM-1 TEMPERATURE SENSORS

The XPRT4 uses TM-1 thermistor sensors for measuring fixture temperature. Connect the sensors to the IO40 Board as shown in **Figure C-4**.

- The TM-1 sensors are NOT polarity sensitive.
- DO NOT SPLICE THE SENSOR WIRE INSIDE A REFRIGERATED FIXTURE!
- Only shielded cable should be used for extending the sensor wiring. The maximum recommended length is 250 ft.
- DO NOT ROUTE WITH LINE VOLTAGE WIRING!
- Altech recommends writing the sensor location on the gray ID tag located near the edge connector (example: 1st meat case, center ice cream, etc.).
- To reduce the chance of mixing cables or plugging cables onto the wrong connector, Altech recommends writing the IO40's connector number directly on the edge connector (example: "P9", "P10", etc.).

P 9	System # 1	Master Fixture	TM-1
P10	System # 2	Master Fixture	TM-1
P11	System # 3	Master Fixture	TM-1
P12	System # 4	Master Fixture	TM-1
P13	System # 5	Master Fixture	TM-1
P14	System # 6	Master Fixture	TM-1
P15	System # 7	Master Fixture	TM-1
P16	System # 8	Master Fixture	TM-1
P17	System # 9	Master Fixture	TM-1
P18	System #10	Master Fixture	TM-1
P19	System #11	Master Fixture	TM-1
P20	System #12	Master Fixture	TM-1

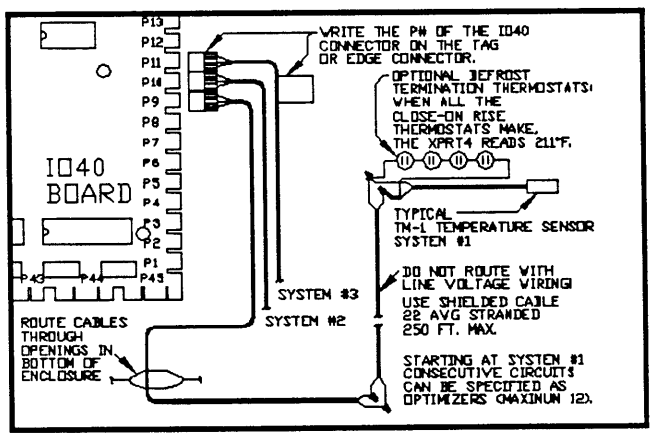


Figure C-4: TM-1 Wiring

DEFROST TERMINATION THERMOSTATS

If individual defrost termination thermostats are required in each fixture, as is the situation for some reach-in freezers, they can be wired as shown in **Figure C-4**. In operation, the XPRT4 will indicate a 211°F temperature when all thermostats are made. When this termination method is used, select "ThmSt" in the Defrost Termination Screen S-10 (See **Page B-4** of this manual). This causes the defrost to terminate only when all the termination thermostats are closed (211°F indicated) or if the indicated temperature is greater than 125°F.

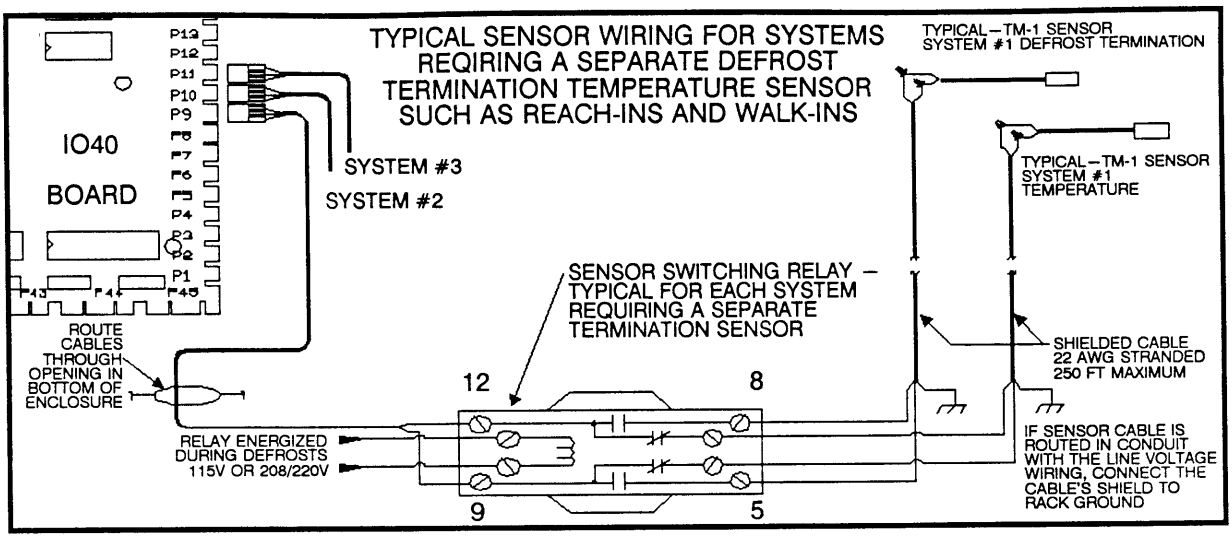


Figure C-5: TM-1 Switching during Defrosts

TM-1 SWITCHING DURING DEFROSTS

Discharge air temperature is not a satisfactory temperature to terminate defrost if a fixture has it's evaporator fans shut off during defrost. In this situation, two sensors can be installed – one in the discharge air and the other attached to the coil. The circuit shown in **Figure C-5** will switch from the discharge air sensor to the coil mounted sensor when a defrost is initiated.

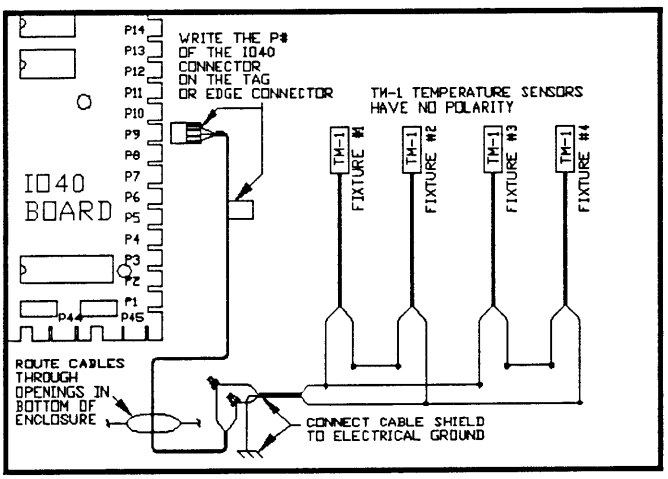


Figure C-6: Averaging Four TM-1 Sensors

AVERAGING FOUR TM-1 SENSORS

To have one of the XPRT4's temperature inputs represent the average of four TM-1 sensors, wire the sensors to the XPRT4 exactly as shown in **Figure C-6**. This wiring method will only work with exactly four sensors – 2, 3, 5 or more sensors will NOT work!

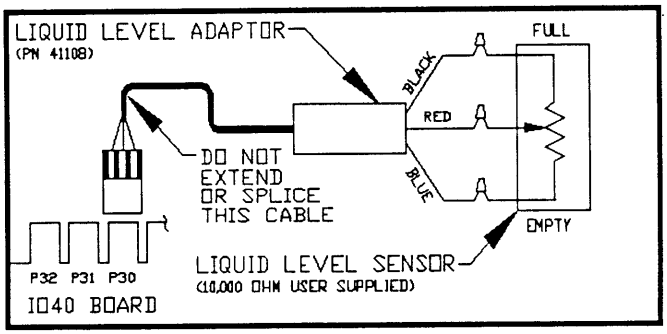


Figure C-7: Liquid Level Installation

LIQUID LEVEL INSTALLATION

A user-supplied liquid level sensor can be wired to the XPRT4's Liquid Level Adaptor Cable to provide remote sensing of the liquid level in the receiver. The liquid level sensor must be wired to the adaptor cable as shown in **Figure C-7**.

- The liquid level sensor is user-supplied. Note the tank diameter when ordering.
- The liquid level sensor must be a 10,000 ohm potentiometer.
  One source for a horizontal tank liquid level sensor is:
  Rochester Gauges, Inc.; P.O. Box 29242; Dallas, Texas 75229; (214) 241-2161; Model No. M7845 (Side mounted flange with 2 1/2" bolt circle)
- The Liquid Level Adaptor Cable is supplied with a 10 foot cable and SHOULD NOT BE SPLICED. If the distance between the liquid level sensor and the XPRT4 is greater than 10 feet, extend the wires between the sensor and the Liquid Level Adaptor.

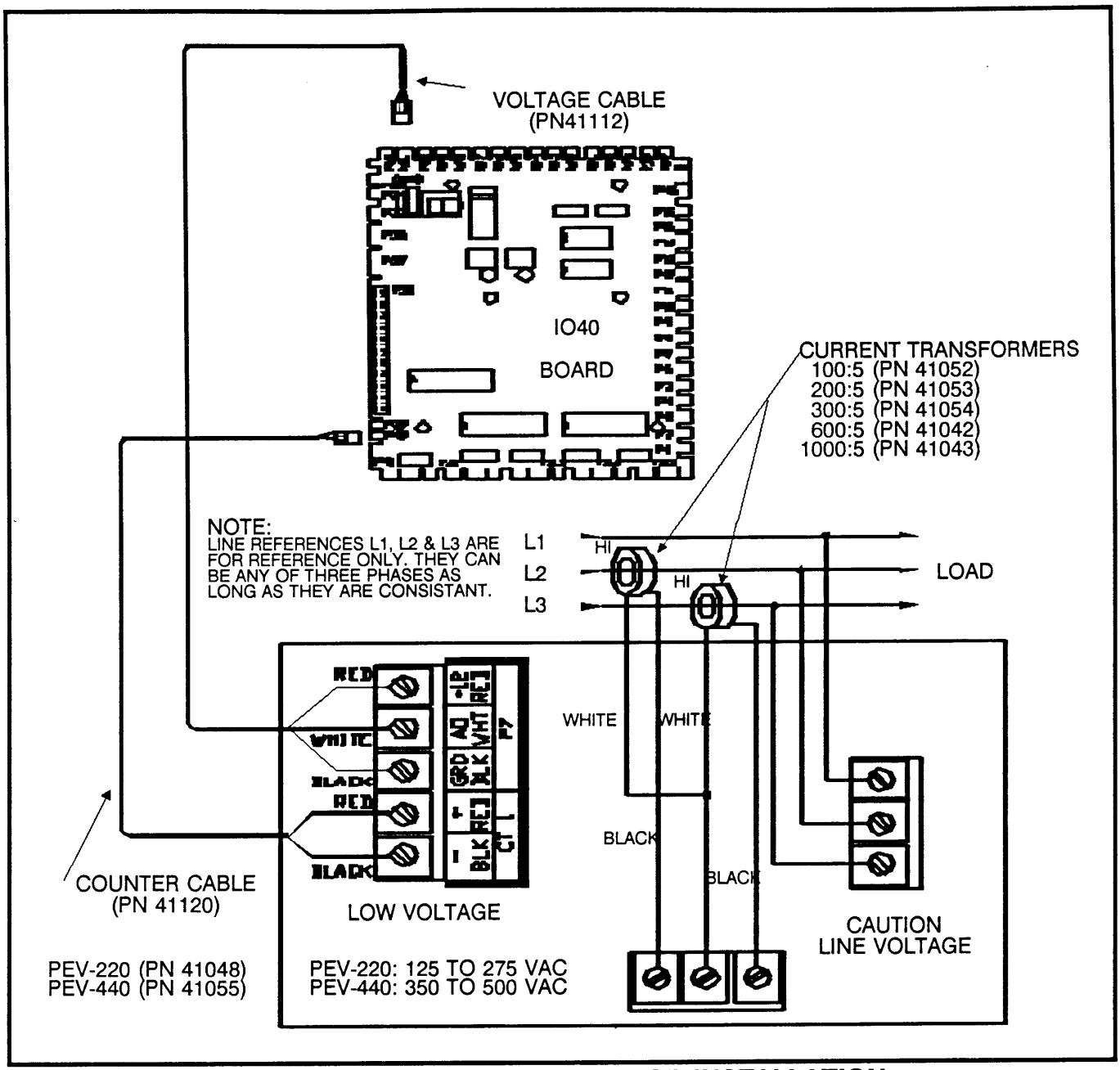


Figure C-8: PEV POWER MONITOR INSTALLATION

PEV POWER MONITOR INSTALLATION

Install and wire PEV Power Monitor as exactly shown in **Figure C-8**.

- Confirm that the PEV model is correct for the line voltage (208/240 or 440/480).
- IMPORTANT: Install each of the current transformers with it's marked "HI" side toward the incoming power.
- Connect the current transformer to the PEV BEFORE passing current through the current transformer.
- Incorrect installation of the current transformer on the PEV will cause the indicated power to be too low.
- Adhere to all applicable state and local codes.

KWH MULTIPLIER SELECTION

The Power Monitor Configuration Screen C-10 requires the entry of a "KWH MULTIPLIER". This value matches the current transformers to the XPRT4's power measuring software. The correct KWH multiplier for each size current transformer is:

Ratio Multiplier	KWH Multiplier
100:5	20
200:5	40
300:5	60
600:5	120
1000:5	200

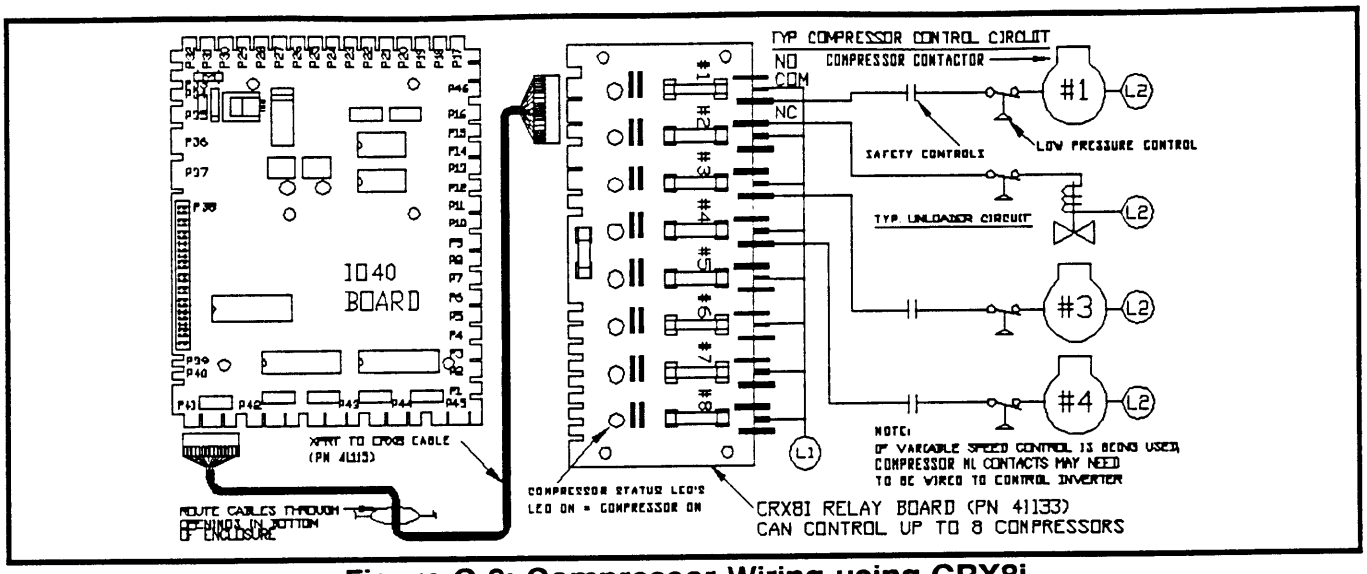


Figure C-9: Compressor Wiring using CRX8i

COMPRESSOR WIRING

The compressors are controlled by using one of the CRX relay boards (CRX1, CRX4 CRX8i or CRX8). A typical method for wiring the compressors with a CRX8i is shown in **Figure C-9**. The CRX8 could also be used if the common connector were routed to L1. A typical method for wiring the CRX4 is shown in **Figure C-10**. If the XPRT4 is being installed on an existing refrigeration rack, Altech recommends removing the low pressure controls from the control circuit or setting the Cutout at 0 psi level. Either action should preclude the old controls from interfering with normal XPRT4-TD12 operation.

Field splicing of the CRX cables is acceptable but not recommended. Custom length cables can be ordered from Altech in 25 foot increments. The maximum total length of cable between the XPRT4 and the CRX board is 100 feet.

- The two edge connectors on the CRX boards are the same allowing the CRX cable to be plugged into either end. The same is true for the CRX connection cables.
- Remove power from all circuits before wiring.
- Adhere to all applicable state and local codes.
- The wiring diagrams (**Figures C-9 and C-10**) assume that the compressor will be configured for NC contacts in the Configuration Screens.
- A typical method for wiring an unloader is shown in **Figure C-9**. Note that it uses the Normally Open (NO) contacts.

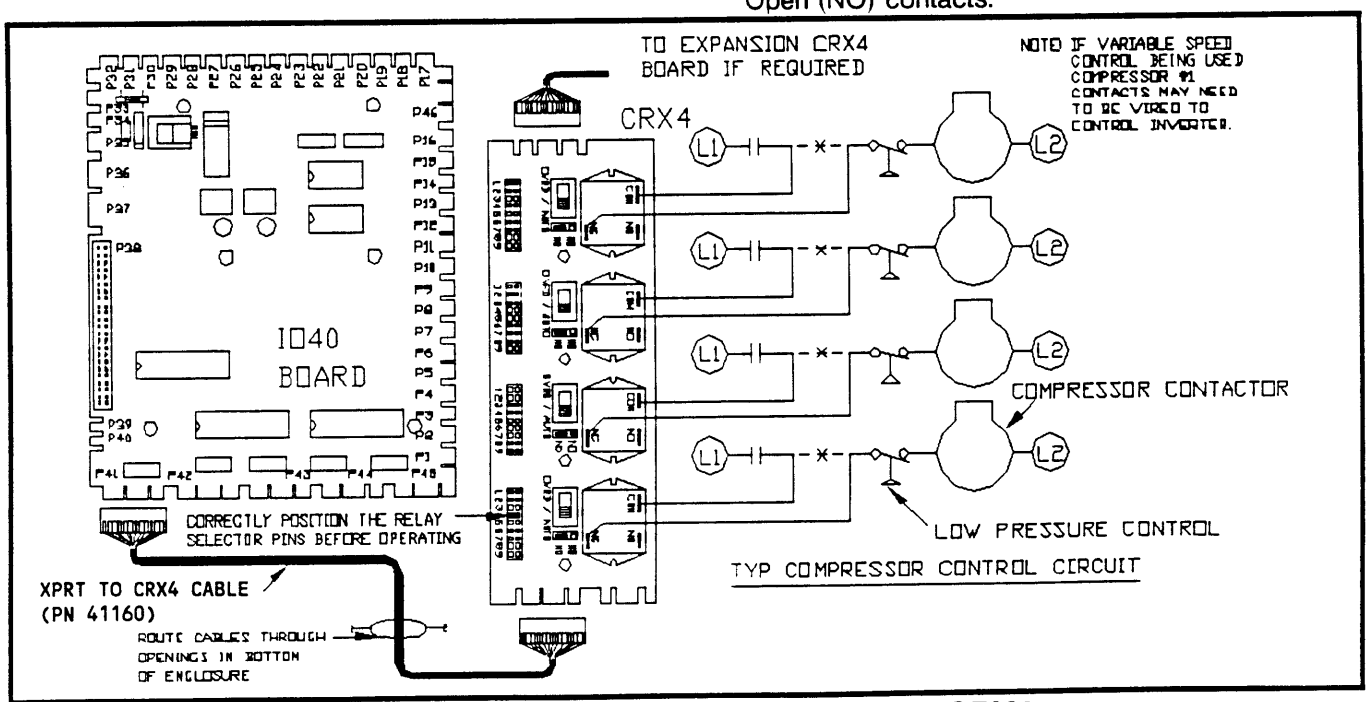


Figure C-10: Compressor Wiring using CRX4

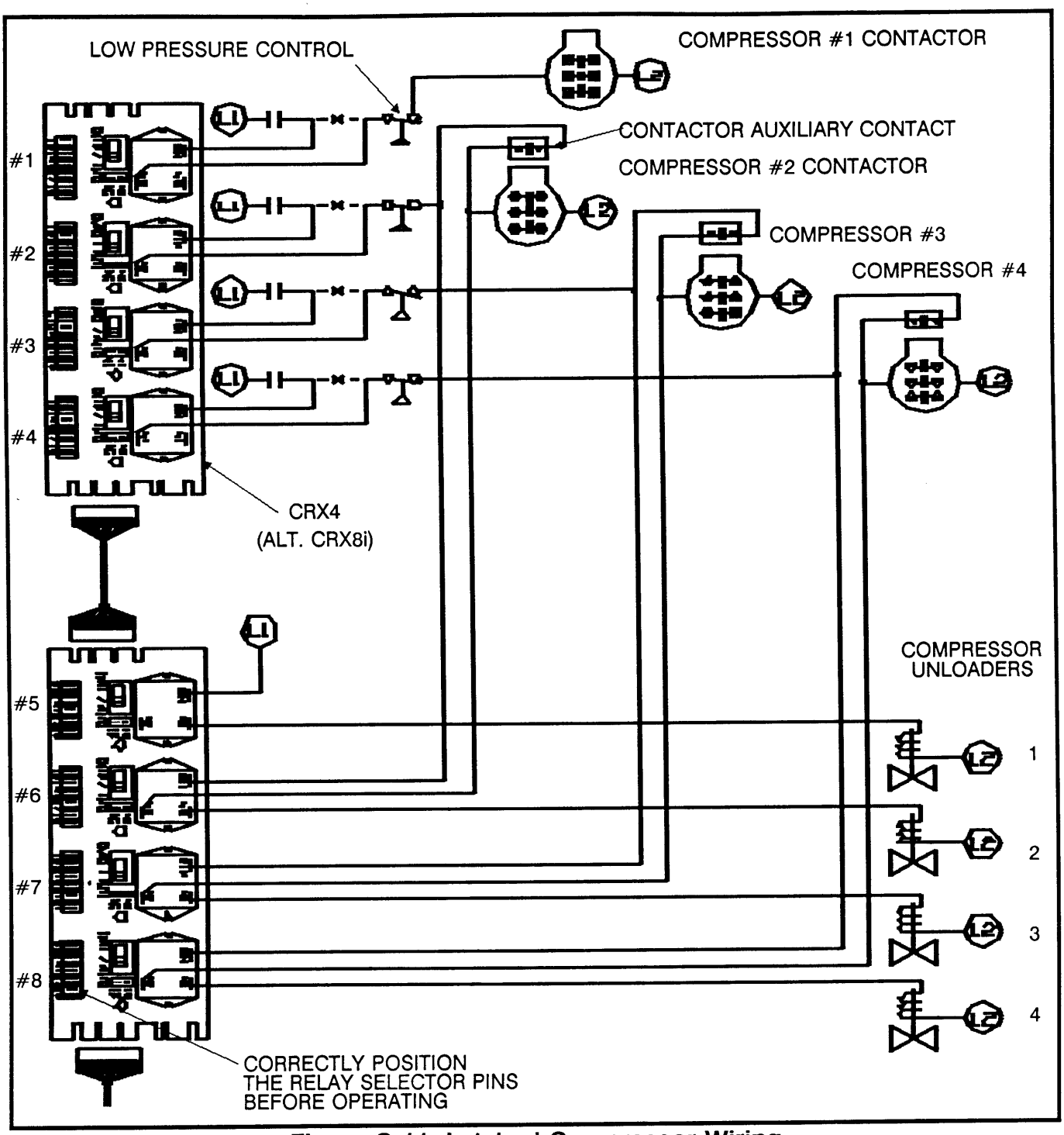


Figure C-11: Latched Compressor Wiring

LATCHED COMPRESSOR WIRING

Compressors equipped with unloaders to be latched on when the load requires, then allow the unloaders to cycle in order to maintain the proper suction pressure use an 8 step Sequence Logic (FIRST ON LAST OFF) for control of 4 compressors and 4 unloaders (shown in **Figure C-11**) and described below.

Compressor #1 and Unloader #1 are controlled directly by their respective output relays (#1 and #5). Each of the other compressors (#2, #3 and #4) is latched on when its respective unloader (Relay #6, #7 or #8) is turned on. After the compressors are latched on, these relays will only cycle the unloader. Each of the compressors is turned off when its respective compressor enable relay (#2, #3 or #4) is turned off.

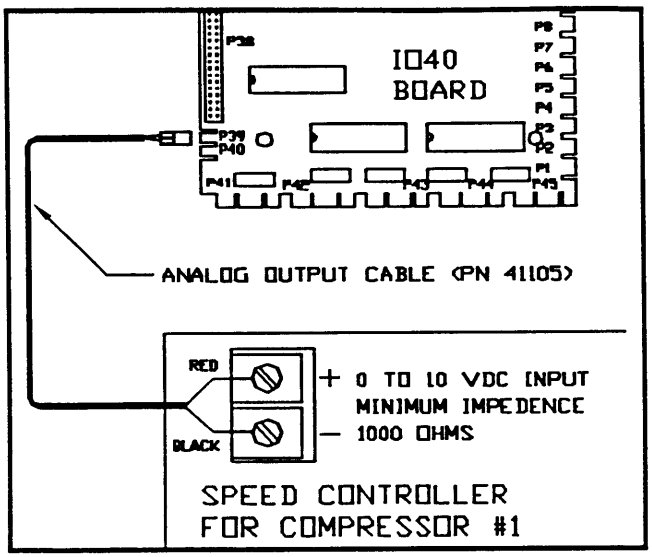


Figure C-12: Variable Speed Wiring

VARIABLE SPEED WIRING

The XPRT4 can control an inverter that is driving a standard compressor at variable speeds. The variable speed compressor ON/OFF status must be controlled by the XPRT4's compressor Output #1 on P41. The inverter is in turn controlled by a 0-10 VDC voltage provided from P39 on the IO40 Board as shown in **Figure C-12**.

- The inverter must accept a 0-10 VDC signal (10 VDC = maximum speed).

CONDENSER FAN WIRING

A typical method of controlling the condenser fans is using the CRX8i Relay Board wired as shown in **Figure C-13**. If the XPRT4 is being installed on an existing condenser, Altech recommends removing the existing temperature or pressure controls from the control circuit or setting them at a safety level which would preclude them from interfering with XPRT4 operation. A CRX4 or CRX8 could be used in place of the CRX8i Relay Board.

- Field splicing of the CRX cables is acceptable but not recommended. Custom length cables can be ordered from Altech in 25 foot increments. The maximum total length of cable between the XPRT4 and the CRX board is 100 feet.
- The two edge connectors on the CRX boards are the same allowing the CRX cable to be plugged into either end.
- Remove power from all circuits before wiring.
- Adhere to all applicable state and local codes.

LOCAL ALARM INSTALLATION

Figure C-13 also shows the typical wiring for a local alarm. The local alarm can be a light or an automatic dialer instead of a bell as shown in **Figure C-13**.

- The XPRT4-TD12 also has the ability to auto-dial alarms to a alarm printer if equipped with a telephone modem.
- Since the alarm relay uses the NC contact, a loss of power to the XPRT4 will trigger an alarm.
- Isolated alarm contacts are made possible by inserting a CRX1 Relay Board between the CRX8i Board and the IO40 Board using another CRX to CRX cable. Configure the switch on the CRX1 relay for Output #8.
- The installation of the Silence Timer is optional but recommended. Suggested vendor for a 12 hour timer (with NC contacts) is Mark Time #90002 (Mfg: Rhodes 203/673-3281). A stocking distributor for this timer is Minarik – (818) 507-6500.

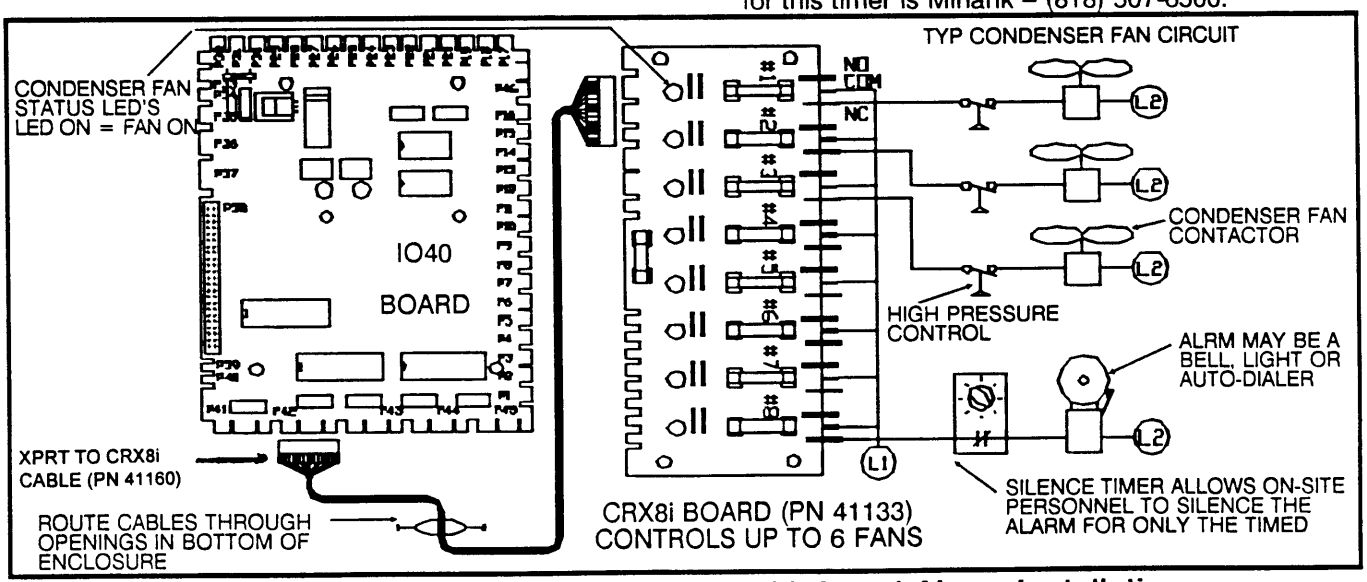


Figure C-13: Condenser Fan Wiring with Local Alarm Installation

REFRIGERATION AND DEFROST WIRING

A typical method for controlling liquid line solenoids and defrost valves is using the CRX25i Relay Board as shown in **Figure C-14**. If the XPRT4 is being installed as a retrofit, Altech recommends removing the existing defrost clock to preclude it from interfering with XPRT4 operation. The CRX25 Relay Board can be used in place of the CRX25i if circuit isolation is unnecessary. Other types of refrigeration control can be used instead of liquid line solenoids, such as pilot operated EPR's or suction solenoids. The actual wiring to the CRX25i or CRX25 Board will need to be adjusted to match the control methods to be used on the rack.

- Field splicing of the CRX cable is acceptable but not recommended. Custom length cables can be ordered from Altech in 25 foot increments. The maximum total length of the CRX cable is 100 feet.
- Remove power from all circuits before wiring.
- Adhere to all applicable state and local codes.
- The XPRT4 to CRX25i cables must be installed as shown in **Figure C-14** for the circuits to be controlled correctly. The IO40 outputs have the following assignments: P43: Defrost Circuits 1 – 8, P44: Refrigeration Control Circuits 1 – 8 and P45: Defrost and Refrigeration Control Circuits 9 – 12 (See **Table C-1**).

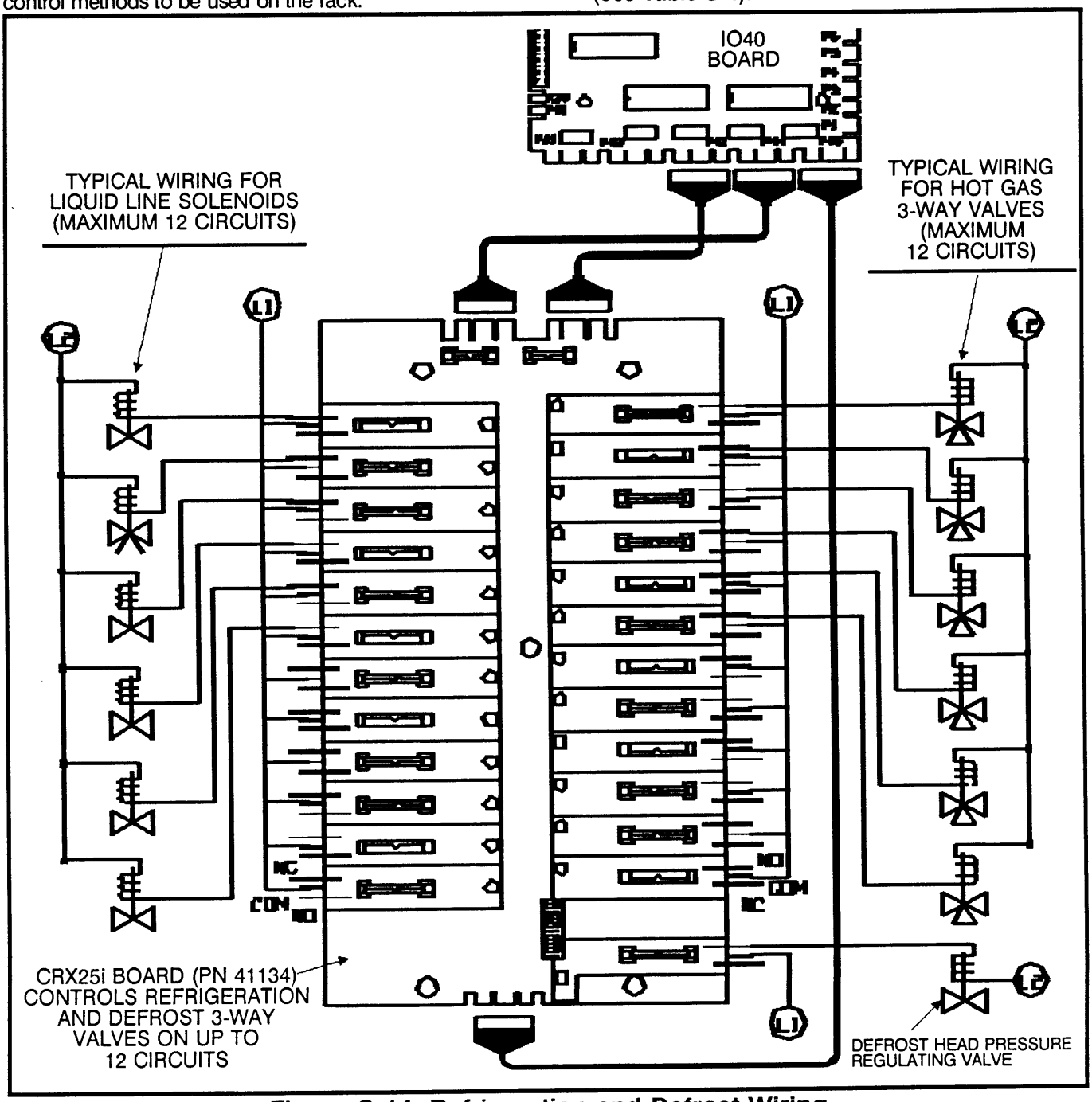


Figure C-14: Refrigeration and Defrost Wiring

UN-EQUAL COMPRESSOR PROGRAMMING GUIDE

Comp Cfg	Stage#	87654321	Decimal	Unloader
Prog<	3<	101	5<	No<

Example C-1: Configuration Screen C-3

If "Prog" is selected under "Comp Cfg", then the XPRT4 must be programmed by the user to designate which compressors are operating at each capacity stage. Combinations of the 8 compressor outputs can be programmed to provide up to 32 capacity stages; the only requirement is that each higher numbered stage have increased refrigeration capacity. The stage number is selected by positioning the cursor to the right of the number under the heading "Stage #", then using the "UP" and "DOWN" keys to select the stage to be programmed. Next, position the cursor under the "Decimal" heading. Use the "UP" and "DOWN" keys to increase or decrease the value. The compressor status for that value of "Decimal" is automatically indicated under "87654321" by a series of blanks, 1's, or 0's. In the example above, the decimal "5" would call for compressors #1 and #3 to be ON with all the others OFF. The highest Stage is indicated by setting the next higher stage to a "Decimal" value of "0" as shown in the examples below.

NOTES:

- The "Decimal" value does not need to increase with each higher stage. (See **Example C-2**)
- If Compressor #1 is to be controlled at variable speed in a capacity stage, it must be shown to be ON. (See **Example C-2**)
- The value under "Unloader" is the time in seconds that this stage will come on and go off. This time can be shorter than the time normally allowed by the Compressor Times set in Configuration Screen C-2. It is intended to be a stage only to de-energize an unloader from the next lower Stage. (See **Example C-3**)
- When the cursor is moved away from the far left position to change or review the compressor configuration or capacity steps, all the compressors will be turned OFF. They will stay off until you leave the screen.

Example C-2: Programmable Configuration – Compressor #1 is Variable Speed

Output #1 = 10.0 HP Compressor (Variable Speed)
Output #2 = 10.0 HP Compressor
Output #3 = 5.0 HP Compressor

Stage	87654321	Decimal	Unloader	Horsepower
0	0000	0	No	0
1	0001	1	No	5 – 10
2	0101	5	No	10 – 15
3	0011	3	No	15 – 20
4	0111	7	No	20 – 25
5	0000	0	No	0

NOTE: Typically the compressor manufacturers do not want their compressors to operate slower than 50% of normal RPM. In order to have full range control, the variable speed compressor size should be twice the largest difference between the other compressor sizes.

Example C-3: Programmable Configuration – Using Unloaders

Output #1 = 5.0 HP Compressor
Output #2 = 50% Unloader (5 HP Compressor)
Output #3 = 7.5 HP Compressor

Stage	87654321	Decimal	Unloader	Horsepower
0	0000	0	No	0.0
1	0001	1	No	2.5
2	0011	3	15	5.0
3	0100	4	No	7.5
4	0101	5	No	10.0
5	0111	7	15	12.5
6	0000	0	No	0.0

Table C-1: Standard Connector Assignments of the IO40 Board

CONNECTOR	DESCRIPTION	CONNECTOR	DESCRIPTION
P1	Suction pressure	P25	Miscellaneous Monitoring[1]
P2	Condensing Pressure	P26	Miscellaneous Monitoring[1]
P3	Oil Pressure Compressor #1	P27	Miscellaneous Monitoring[1]
P4	Oil Pressure Compressor #2	P28	Miscellaneous Monitoring[1]
P5	Oil Pressure Compressor #3	P29	Heat Reclaim Switch
P6	Oil Pressure Compressor #4	P30	Liquid Level Adaptor
P7	Oil Pressure Compressor #5	P31	Power Monitor Voltage
P8	Oil Pressure Compressor #6	P32	Humidity Sensor
P9	System #1 Master Fixture TM-1[3]	P33	DC Supplies
P10	System #2 Master Fixture TM-1[3]	P34	24 VAC Input
P11	System #3 Master Fixture TM-1[3]	P35	RS232 Local Printer
P12	System #4 Master Fixture TM-1[3]	P36	RS422 Network Communication
P13	System #5 Master Fixture TM-1[3]	P37	RS232 Network Communication
P14	System #6 Master Fixture TM-1[3]	P38	CPU Board
P15	System #7 Master Fixture TM-1[3]	P39	Variable Speed Compressor Output
P16	System #8 Master Fixture TM-1[3]	P40	Power Monitor KWH Input
P17	System #9 Master Fixture TM-1[3]	P41	Compressor Outputs (#1–#8)
P18	System #10 Master Fixture TM-1[3]	P42	Condenser Fan/Alarm Outputs (#1–#8)
P19	System #11 Master Fixture TM-1[3]	P43	Systems 1–8 Defrost Control Outputs
P20	System #12 Master Fixture TM-1[3]	P44	Systems 1–8 Refrigeration Control Outputs
P21	Miscellaneous Monitoring[1]	P45	Systems 9–12 Refrigeration and Defrost Control Outputs
P22	Miscellaneous Monitoring[1]	P46	Analog Expansion
P23	Miscellaneous Monitoring[1]		
P24	Miscellaneous Monitoring[1]		

NOTES:

1) May monitor Compressor Head Temperature or Suction Line Temperature, etc. – user's descretion.

2) Connectors not in use are available for user's descretion.

3) Optimizers must be connected to the lowest numbered connectors starting at P9 and continuing in sequence.

SYSTEM START-UP PROCEDURE

1) Before applying power to the XPRT4, it is best to mark each edge connector attached to P41, P42, P43, P44 and P45 with its respective connector number. Then remove the CRX cables from the IO40 Board. This will prevent incorrect operation of compressors, fans or valves during the configuration and set-up stage. Normally, the relay contacts are selected to allow compressors and fans to operate and circuits to refrigerate when power is removed from the CRX boards. If remote communications are to be used, connect the control to the network now.

2) On the following pages are the settings forms to fill out before inputing settings. Altech recommends copies of these forms be placed in the pocket inside the control cabinet in the control room for future reference when changing chips or CPU Boards.

3) The fastest, most convenient way to input settings, sensor names and the defrost schedule into the XPRT4 is with an IBM PC using the Altech communication software. The settings can be loaded directly into the EEPROM (E Squared PROM) by the computer on site or remotely through a modem.
Alternately, the chip can be set up on a demonstration XPRT4 at the user's home office, and the programmed chip inserted into the job site's XPRT4. Observe the chip insertion and removal procedure in the Service Section of this manual! Only the time and date will not be transferred using this procedure. The memory chip is placed in location U6 on the CPU40 Board (See **Figure D-1**).
   - The Revision level on the TD12 Software (Chips U7 and U8) must be compatible between the two controllers in order for this procedure to work reliably. See **Section D, Memory Chip Field Replacement Procedure** for additional information.
   - For the user's convenience, Altech can supply a factory configured XPRT4-TD12, if the user will send in the completed TD12 Settings and Configuration Forms. Be sure to include instructions on how Altech is to mark the XPRT4.

4) Apply power to the XPRT4. Go through all the Configuration Screens starting with C-1, modifying as required. In Screen C-17, "Disable" the control functions not being used. Refer to **Pages B-6** and **B-7** in this manual for screen explanations. If unequal sized compressors are being controlled, refer to the **Unequal Compressor Programming Guide** in this section for instructions. If the control is connected to the XCOM network, all configuration can be done remotely except setting the relay types in Screen C-6 and the communication parameters in Screen C-9.

5) Go through all the Status Screens starting at S-0 (if oil failure logic is enabled), adjusting the settings as required for the application. Set the time and date in Screen S-19. Refer to **Pages B-3, B-4 and B-5** in this manual for screen explanations. If the control is connected to the XCOM network, all the settings can be entered remotely.

6) Review all the Status Screens starting at S-0 (if oil failure logic is enabled), verify all the pressure, temperature and other sensor readings to secure their accuracy and that each sensor location is correct.

7) Remove the 24 VAC power at P34 to "POWER DOWN" the XPRT4, then reconnect the CRX cables to the IO40 Board at P41 – P45. Reconnect power at P34, then compare the status of the compressors, condenser fans, refrigeration and defrost outputs on the Status Screens to the actual operation of the contactors and solenoids. If the status displayed on the XPRT4 does not agree with the actual operation of the contactor or solenoid, make appropriate changes in the configuration of the XPRT4 or CRX Relay wiring to correct the problem.

8) After one hour of operation, review the operation of the system by looking at the pressures and fixture temperatures in the history logs. Adjust the settings as required.

9) Review the operation the next day on site or via the telecommunications. Adjust as required.

If the XPRT4-TD12 is not operating optimally, please call Altech at the number on the title page of this manual.

XPRT4-TD12 CONFIGURATION AND SETTINGS

SYSTEM NAME: _____ UNIT #: _____ BAUD _____

CONTROL FUNCTIONS XPRT4-TD12
1. Condenser Fans: Yes No
2. System Temps: Yes No
3. System Defrost: Yes No
4. Oil Failures: Yes No
5. Power Monitor: Yes No
6. Variable Speed: Yes No

COMPRESSORS _____ Control: Rotation ☐ Prog ☐ Contacts: NO ☐ NC ☐
CutIn:_____ Psi Cutin: Max _____ Min:_____ Pump Down:_____
CutOut:_____ Turn-On Time:_____ Turn-Off Time:_____ High Head:_____

OIL FAILURE Delta-P:_____ Delay:_____ sec Hold:_____ min Retrys:_____
Comp Assignment P3:_____ P4:_____ P5:_____ P6:_____ P7:_____ P8:_____

VARIABLE SPEED SETTINGS: Max:_____ rpm Min:_____
Slope:_____ Rate Up:_____ Oil:_____
Down:_____ Timeout:_____ sec

CONDENSER Normal HotGas Ht-Rclm SEQ ☐ ROT ☐ _____ Fans: NO ☐ NC ☐
Cutin (Psi): _____ _____ _____ Turn-On Time: _____ sec
Cutout: _____ _____ _____ Turn-Off Time: _____ sec

OPTIMIZERS Total #:_____ (STARTING AT #1) Time: _____

PROGRAMMABLE LOGIC CONFIGURATION

Stage #	Compressors 1 2 3 4 5 6 7 8	Decimal	Unload Time	HP
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				

MISC
Log Interval:

Temp Units: °F ☐ °C ☐
Press Units: PSI ☐ Bar ☐ KPa ☐

Password: _____
Settings Protected: Yes No

Refrigerant: _____

POWER MONITOR
Multiplier: _____
Voltage: _____ to _____
Low Volt: _____ VAC

DESCRIPTION OF COMPRESSOR OUTPUTS:
P41-1: _____
P41-2: _____
P41-3: _____
P41-4: _____
P41-5: _____
P41-6: _____
P41-7: _____
P41-8: _____

SYSTEM NAME: _____ UNIT #: _____

Sys#	Name	Temperature On	Off	Dly	Trm	Lth	Drn	Defrost #1	#2	#3	#4	#5	#6
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													

Snsr	SENSOR CONFIGURATION Type	Name(16 characters)	ALARMS LoSet	Dly(mins)	HiSet	Dly(mins)
P1						
P2						
P3						
P4						
P5						
P6						
P7						
P8						
P9						
P10						
P11						
P12						
P13						
P14						
P15						
P16						
P17						
P18						
P19						
P20						
P21						
P22						
P23						
P24						
P25						
P26						
P27						
P28						
P29						
P30						
P31						
P32						

DIALOUT SETTINGS

Site Description (16 character):_____

Redial Interval:_____min

#	Phone#	Ena		LF	
1	_____	Yes	No	Yes	No
2	_____	Yes	No	Yes	No
3	_____	Yes	No	Yes	No
4	_____	Yes	No	Yes	No

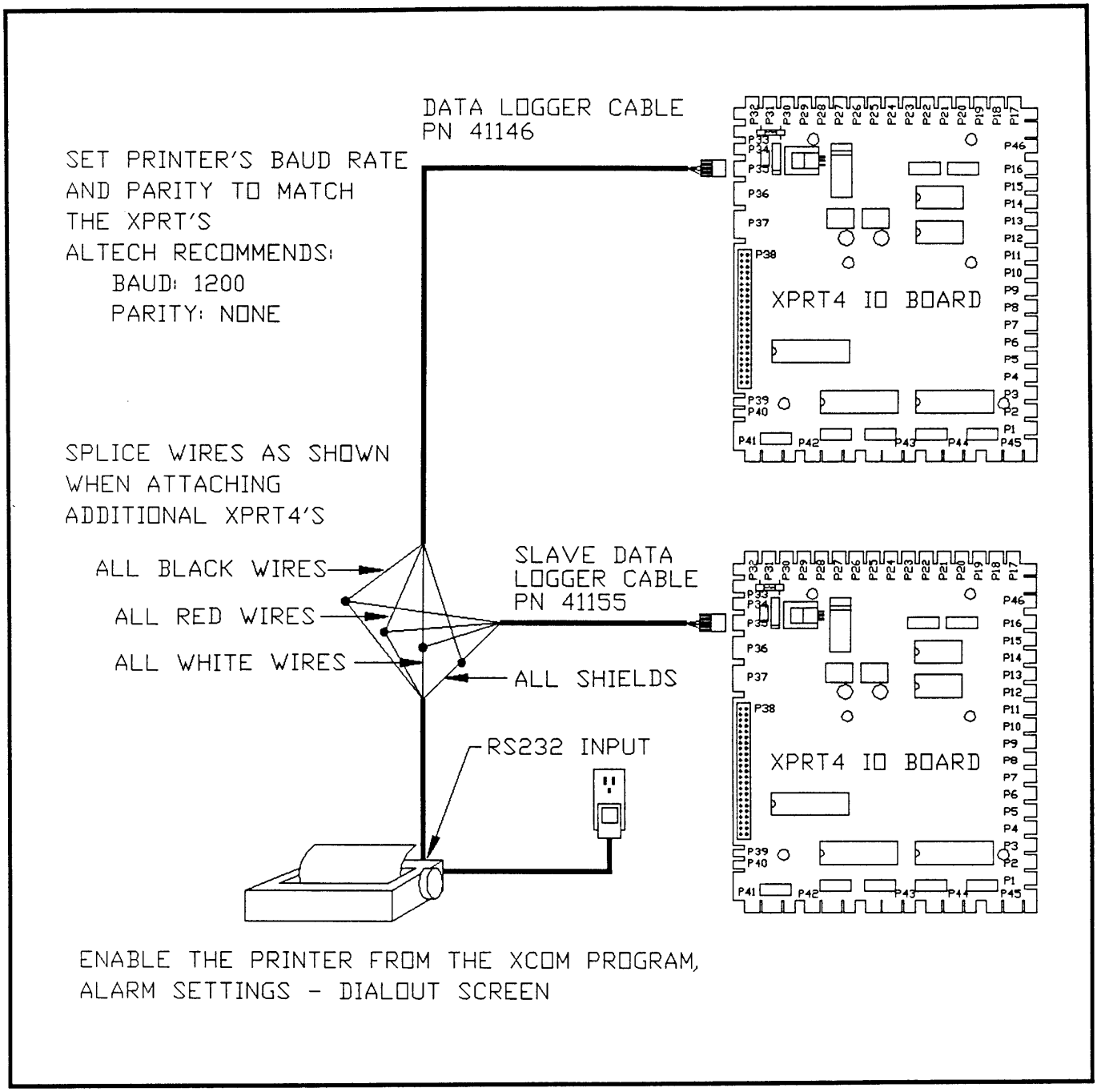


Figure C-15: Local Alarm Printer Wiring

SECTION D: SERVICING

GENERAL SYSTEM CHECKOUT

1) **Before Attempting to Service:**
Review all sections of this manual to become familiar with the operation, specifications, and application requirements of the XPRT4 controller.

2) **Is the Power at the Correct Level?**
The supply voltage on the IO40 Board at P34 should be between 22 and 26 VAC.

3) **Is the Fuse Blown?**
The IO40 Board requires a 3Amp 32V fuse (F1). Exchange only with exact replacement: Littelfuse #303 003 – 7AG 3Amp 32V.

4) **Determine If the Problem Is in the Hardware, Application or System:**
One clue is to compare the indicated compressor, condenser fan, liquid line and defrost valve positions with their respective statuses indicated on the display. When the displayed status and the actual status agree, the problem is likely due to mis-application, improper configuration or incorrect settings. If the statuses disagree, hardware problems are indicated.
Another clue is to compare the indicated system pressures and fixture temperatures from the display with actual pressures and temperatures. As above, when these agree, the problem is likely due to mis-application, improper configuration or incorrect settings. If they disagree, the problem may lie in the hardware.

5) **Mis-Application, Improper Configuration or Incorrect Settings Type Problems:**
Some screens to check are:

Oil Failures in S-0
Compressor Cutin Setting in S-6
Suction Head Limit in C-1
Compressor Turn-On Time in C-2
Compressor Configuration in C-3
Relay Contact Type in C-6
Low Voltage Protection in C-9
Variable Speed Settings in C-11A
Override Status in C-16
Disabled Functions in C-17

6) **Some Typical Hardware Problems:**

a) Check connectors!

- Verify that cable connectors are properly seated in their headers and that Pin 1 of the cable connector is in the Pin 1 position of the header for the following cables:

CPU40 (P1) to Display (header-right side of board)
CPU40 (P2) to IO40 (P38)

b) The actual compressor status does not match the status displayed on the screen:

- Confirm that the compressor and/or condenser fan relays are wired correctly to operate from normally open (NO) or normally closed (NC) contacts on the board (See **Section C** of this manual). Check that the Relay Configuration Screen C-6 agrees.
- Check that the P# is written on each CRX Relay Cable's Connector and that each is in its correct location on the IO40 Board (See **Table C-1**). Next, to isolate a faulty cable, temporarily replace each, one at a time, with a known good cable. If the cables are all right, temporarily replace each CRX Relay Board, one at a time, until the defective part is isolated.

c) Pressure and temperature readings are incorrect:

- Disconnect all transducers and temperature sensors, then reconnect them one at a time to determine if they are still reading incorrectly.
- If only one pressure transducer or temperature sensor is incorrect, try that item at another location of the same type. If the item is faulty, it will not work in the new location and must be replaced. Transducers can not be re-calibrated in the field. Pressure transducers should be returned without their cables cut off for warranty credit. If the transducer or sensor works, the problem is elsewhere in the XPRT4.
- The TM-1 thermistor temperature sensor will read approximately 3000 ohms at 77°F. Its resistance will increase in a non-linear manner with a decrease in temperature. Its resistance at 32°F will be approximately 10,000 ohms. Other readings indicate the TM-1 is faulty and requires replacement.

d) Problems within the XPRT4:

- Use the swapping method to determine if the CPU40 Board (located on door) or the IO40 Board (located in the bottom of the XPRT4 enclosure) is defective (See the **CPU40** and **IO40 Board Field Replacement Procedures** that follow). Each board can be swapped, one at a time, with a known good board to determine if the problem follows the circuit board or stays with the original XPRT4. The IO40 Board has the power supply, the analog to digital circuitry, the relay driving circuits and the analog output voltage circuit. All other functions are performed by the CPU40 Board.

7) **Trouble Diagnosing the Problem?**
Contact Altech at the number on the title page of this manual. If a modem is connected, we may contact the problem XPRT4 directly through our communications software. Before calling us, please have the following information available:

- The modem's telephone number
- The communication parameters:
  Unit #
  Baud rate
- The password
- The date code of the XPRT4's control program. (Found on the memory chips located at U7 and U8 of the CPU40 Board.)

8) **If a Part is Defective:**
Contact Altech to arrange for a replacement. When returning a part, be sure to follow the **Defective Part Replacement Procedure** later in this section.

SERVICE PART NUMBERS

Service part numbers correspond to new part numbers but are preceded by an "R". These parts may be re-manufactured. The following are supplied only as repair parts:

42025	CPU40 Circuit Board (with TD12 Software installed)
42026	IO40 Circuit Board (mounted on aluminum plate)
42029	LCD Display (40 Character by 2 line)
41119	TD12 Software EPROM set (for insertion at U7 & U8 on the CPU40)

NOTE: The following **Field Replacement Procedures** require removing the power from the XPRT4 for approximately 5 minutes while the boards or chips are being replaced. No special jumpering is required if the compressor operation is not critical during the shutdown period of 5 minutes. For critical applications, the **Override Protection Procedure** below will maintain compressor operation. Otherwise, all compressor outputs will be energized, if normally closed (NC) contacts are used, or de-energized, if normally open (NO) contacts are used.

OVERRIDE PROTECTION PROCEDURE

To maintain refrigeration during the shutdown period of 5 minutes, observe the compressors that are currently running and override the system to maintain those compressors' operation.

1) If the compressor contactors are powered from the NC contacts on the CRX Board, remove the control lines from those relays for any compressor that will be off during the shutdown period.

2) If the compressors are powered from the NO contacts on the CRX Board, remove the control lines from the NO contact. Place them onto the NC contact ONLY FOR THOSE COMPRESSORS WHICH NEED TO CONTINUE OPERATION during the shutdown period.

CPU40 FIELD REPLACEMENT PROCEDURE

1) Remove 24 VAC power from the XPRT4 by disconnecting the edge connector at P34 on the IO40 Board. This will remove power to all the CRX Relay Boards as well.

2) Be sure all cables are properly identified with the P# on the connector or tag. Then remove all the XPRT to CRX Relay Cables connected to the IO40 Board at locations P41, P42, P43, P44 and P45.

3) Remove the 60 conductor flat ribbon cable connector from it's mating connector (P38) on the IO40 Board (left side). CAUTION: Pull evenly so as not to bend the pins when the connector releases from the board.

4) Remove the 14 conductor flat ribbon cable connector from its mating connector on the Display Board (right side).

5) Remove the 4 screws holding the CPU40 Board to the hinged door.

6) Attach the new CPU40 Board to the hinged door by loosely installing two diagonally opposed corner screws. Adjust the board's position, aligning the other two mounting holes before inserting their mounting screws. The board may bow slightly when the mounting screws are tightened.

7) Reinstall both the 60 and 14 conductor flat ribbon cables to their respective connectors (see Steps 3 & 4 above).

8) Restore 24VAC power to the XPRT4 by replacing the connector at P34 on the IO40 Board.

9) The XPRT4 should be operating correctly.

10) Configuration Settings can be retained from the old CPU40 if the EPROMs are compatible – that is, the old U6 memory chip compatible with the new U7 and U8 memory chips. Check the paperwork from the new CPU40 Board for compatibility eligibility.

   a) If the old U6 memory chip is compatible, gently and carefully swap the U6 chips according to the guidelines in the **Memory Chip Field Replacement Procedure** later in this section. Keep in mind, this is not a difficult task, but it is a delicate one!

      Restore power to the XPRT4 (see Step 8 above).

      If the display shows System Temperatures after a minute or so, the program is running properly and the previous Configuration Settings have been retained.

   b) If the memory chips are incompatible, your Configuration Settings must be reinstalled.

      i) Retrieve your Configuration and Settings Forms from the pocket inside the control cabinet in the control room.

      ii) Press the "DOWN" key until the display reads "Initializing EEPROM". Release the "DOWN" key.

      iii) Wait 2 minutes or so until the display reads "Complete". Screen S-1 will appear and settings may be reinstalled. Refer to your Configuration and Settings Forms and Section B of this manual for screen explanations.

11) Verify all the settings.

12) Remove 24 VAC power from the XPRT4 (see Step 1 above). Reconnect all the CRX Relay Cables to their correct location on the IO40 Board (note the P# on each cable's connector or tag).

13) If the **Override Protection Procedure** was followed, restore the CRX Boards to thier original wiring to remove the override protection.

14) Restore power to the XPRT4 (see Step 8 above). If the controller is not operating properly, please call Altech at the number on the title page of this manual.

15) Carefully pack the old CPU40 Board. Be sure the memory chips you are not using are placed in their correct sockets at U6, U7 and U8 on the board being returned. Follow the **Memory Chip Field Replacement Procedure** for seating them in their sockets. Use the same package in which the new CPU40 Board was shipped and return it to Altech for credit as soon a possible within 30 days.

IO40 FIELD REPLACEMENT PROCEDURE

1) Remove 24 VAC power from the XPRT4 by disconnecting the edge connector at P34 on the IO40 Board. This will remove power to all the CRX Relay Boards as well.

2) Remove the 60 conductor flat ribbon cable connector from it's mating connector (P38) on the IO40 Board (left side). CAUTION: Pull evenly so as not to bend the pins when the connector releases from the board.

3) Be sure all cables are properly identified with the P# on the connector or tag. Then remove all cables from the IO40 Board.

4) Remove the 4 large screws holding the ALUMINUM MOUNTING PANEL to the bottom of the XPRT4 enclosure.

5) Replace the old IO40 assembly with the new IO40 assembly.

6) Reinstall the 60 conductor cable and all other cables except P34 to their correct positions (note the P# on the connector or tag).

7) Restore 24VAC power to the XPRT4 by replacing the connector at P34 on the IO40 Board. The control's display should show the top screen of your software within 10 seconds. The time, date and all the settings should not be affected by this board change.

8) If the **Override Protection Procedure** was followed, restore the CRX Boards to thier original wiring to remove the override protection.

9) Restore power to the XPRT4 (see Step 7 above). If the controller is not operating properly, please call Altech at the number on the title page of this manual.

10) Carefully pack the old IO40 Board using the same package in which the new IO40 Board was shipped and return it to Altech for credit as soon a possible within 30 days.

MEMORY CHIP FIELD REPLACEMENT PROCEDURE

There are three memory chips, U6, U7 and U8, mounted in sockets on the CPU40 Board which define the personality of the controller. The memory chips at locations U7 and U8 (See **Figure D-1**) store the program which the CPU40 runs. Periodically the program will change to improve operation or add features. These program changes can be added to existing controllers by changing the memory chips at U7 and U8. The label on each EPROM chip has the name of the program stored within (XPRT4-TD12 A or B), the location (U7 or U8) and the revision date. The later the date, the more current the revision.

The third memory chip located at U6 (See **Figure D-1**) is an EEPROM (E Squared PROM). It stores the settings, schedules, configuration, communication parameters and sensor names entered by the user of the XPRT4 controller. Since this chip does not need power to retain the stored values, it may be moved from one XPRT4-TD12 to another XPRT4-TD12 with a compatible revision level to transfer the settings. Check the paperwork from the new memory chips for compatibility eligibility. This feature is also very useful when starting up a controller lacking communications. See **Section C, System Start-Up Procedure**.

Please keep in mind, chip removal and replacement are not a difficult tasks, but they are delicate ones!

1) Remove 24 VAC power from the XPRT4 by disconnecting the edge connector at P34 on the IO40 Board. This will remove power to all the CRX Relay Boards as well.

2) The legs of the memory chip are slightly wider than the socket holes to ensure contact when installed. Therefore, care must be taken when placing the chip into or out of its socket to avoid breaking or bending the legs. Also, it is best to remove and install one location at a time to avoid incorrect placement on the CPU40 Board.

   a) To remove a chip from its socket:

      i) Before removing, note the chip's location in its socket on the board. The chip in U6 is a 24 pin chip in a 28 pin socket and will be placed in its socket as shown in **Figure D-1**. The chips in U7 and U8 are 28 pin chips in 28 pin sockets as shown in **Figure D-1**.

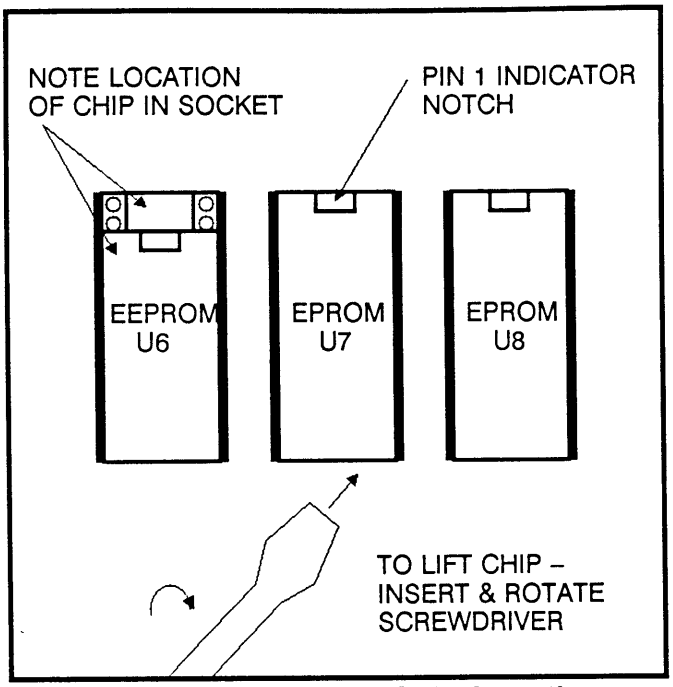


Figure D-1: Memory Chip Location

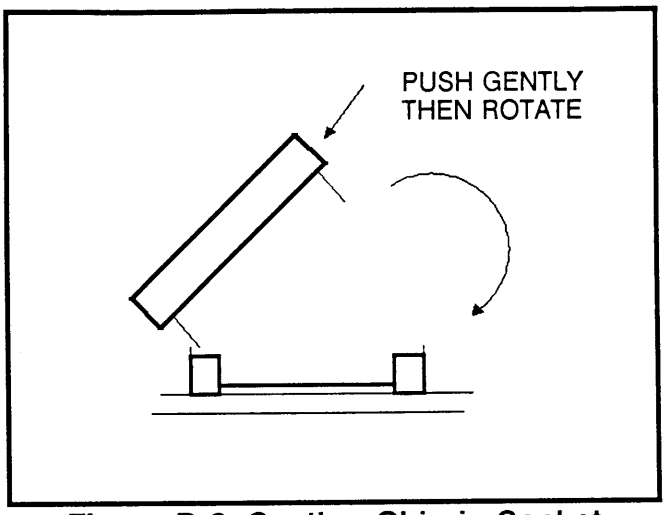


Figure D-2: Seating Chip in Socket

ii) To gently and evenly pry the chip from its socket, insert a screwdriver under the chip. Use a single rotating motion to lift the chip. Repeat this action, alternating at the top and bottom of the chip, until the chip is free.

b) To seat a chip into its socket:

i) Place the chip over the socket with the Pin 1 Indicator notch (see **Figure D-1**) at the top.

ii) Line up the legs of the left side of the chip with the holes on the left side of the socket. Be sure the bottom leg is aligned with the bottom socket hole for correct Pin-to-Pin location (remember U6 is a 24 pin chip in a 28 pin socket).

iii) Very gently press the legs against the side of the socket so the legs on the right side will insert easily. (See **Figure D-2**)

iv) Lower the right side onto the socket with a slight rotating motion.

v) After verifying that all legs are in the proper socket holes, gently and evenly press the chip into the socket.

3) If chips are being changed as part of the **CPU40 Field Replacement Procedure** return to that procedure at this time.

4) Restore 24VAC power to the XPRT4 by replacing the connector at P34 on the IO40 Board. Verify that the XPRT4 is running properly.

5) If the **Override Protection Procedure** was followed:

a) Remove 24VAC power from the XPRT4 (see Step 1 above).

b) Restore the CRX Boards to thier original wiring to remove the override protection.

c) Restore power to the XPRT4 (see Step 4 above). If the controller is not operating properly, please call Altech at the number on the title page of this manual.

6) Carefully pack the old chips. Use the same package in which the new chips were shipped and return them to Altech for credit as soon as possible within 30 days.

DEFECTIVE PART REPLACEMENT PROCEDURE

When ordering parts from Altech for warranty or non-warranty service, the procedure below must be followed to assure expeditious handling.

1) Call Altech at the number on the title page of this manual. Request a RETURN MATERIAL ORDER (RMO) number. Please have the following information ready:

   - Original Purchaser
   - Model Number (Part Number)
   - Store Name & Address
   - Billing & Shipping Address
   - Service Company involved
   - Date of installation
   - Name & Phone Number of an individual for Altech to contact
   - Purchase Order Number

2) After Altech authorizes a return, for warranty or non-warranty items, Altech must receive the defective part within **30 DAYS** from the date of shipment of the replacement part. Otherwise, an invoice will be generated at the new price for that part. An RMO tag must be attached to each item returned for warranty or service replacement.

   - Please include a brief but detailed description of the problem or your major complaint with the defective part. "Defective" or "Bad" is not enough information to properly repair the item.

ORDERING INFORMATION

The XPRT4-TD12 Controller is ordered as separate components. To use any of the controller's software features, the appropriate transducers, sensors, relay boards, and cables must be ordered. See the **Installation Section** for details on which parts are required for a specific installation.

For a typical system with six compressors, four condenser fans, and twelve circuits of temperature/defrost control, order the following:

41100 XPRT4-TD12 Pressure/Defrost Controller	
41069 LPTX2 Low Pressure (& Oil) Transducer	1 Ea
41070 HPTX2 High Pressure Transducer	1 Ea
41061 TM-1 Temperature Sensor	12 Ea
41133 CRX8i Eight Position Isolated Relay Board	2 Ea
41134 CRX25i Isolated Temp/Defrost Relay	1 Ea
40057 24 VAC Transformer, Class 2, 115 V, 40 VA	
40058 24 VAC Transformer, Class 2, 208/240 V, 40 VA	
41113 IO40 Transformer Connection Cable (8 ft.)	1 Ea
41160 XPRT to CRX8i Cable (8 ft.)	2 Ea
41160 XPRT to CRX25i Cable (8 ft.)	3 Ea
41085 XPRT4-TD12 Installation & Service Manual	

Other parts, cables, and accessories are:

41004 CRX4 Four Position Control Relay Board
41116 CRX8 Eight Position Non-Isolated Relay Board
41117 CRX25 Non-Isolated Temp/Defrost Relay Board
41135 CRX1 Single Control Relay Board
41151 Sensor Switching Relay 115V
41152 Sensor Switching Relay 240V
41153 Sensor Switching Relay Socket
41154 Sensor Switching Relay Mounting Rail
40211 Cable, 1 Shield Pair (sold by foot) (TM-1 Sensor)
41108 XPRT4 Liquid Level/ Adapter Cable (10 ft.)
41103 Digital Input (Defrost Inhibit) Cable
41160 XPRT to CRX4 (& CRX1) Cable (8 ft.)
41159 CRX to CRX Cable (1 ft.)
41160 CRX4 to CRX4 (& CRX1) Cable (8 ft.)
41105 Analog Output Cable (Variable Speed)

41009 XPRT Communications Program Diskette
41086 Network Connection Cable (3 ft.)
41066 Modem to Network Interface (RS422 to RS-232)
41046 XPRT Communications Manual

41048 PEV Power Monitor 208/240 VAC, 60 Hz
41055 PEV Power Monitor 440/480 VAC, 60 Hz
41052 Current Transformer 100:5
41053 Current Transformer 200:5
41054 Current Transformer 300:5
41042 Current Transformer 600:5
41043 Current Transformer 1000:5
41112 PEV to IO40 Voltage Cable (8 ft.)
41120 PEV to IO40 Counter Cable (8 ft.)
41130 PEV Power Monitor 208/240 VAC, 50 Hz
41129 PEV Power Monitor 440/480 VAC, 50 Hz

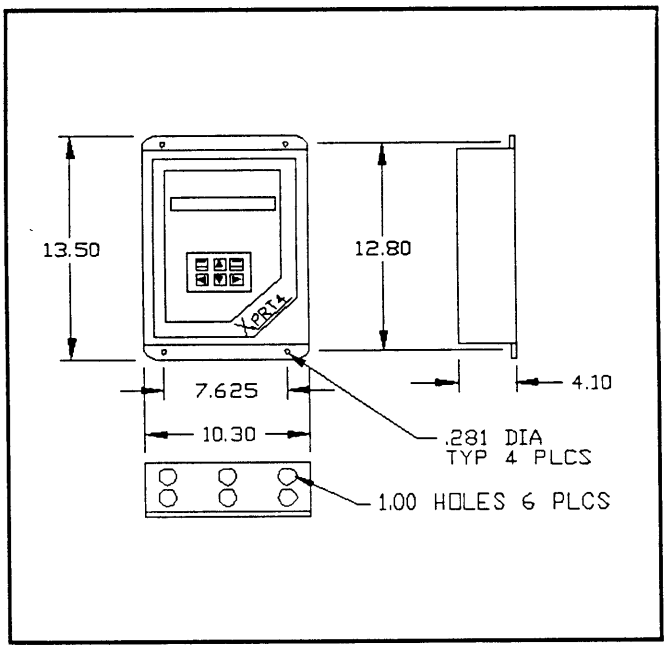
SECTION E: SPECIFICATIONS

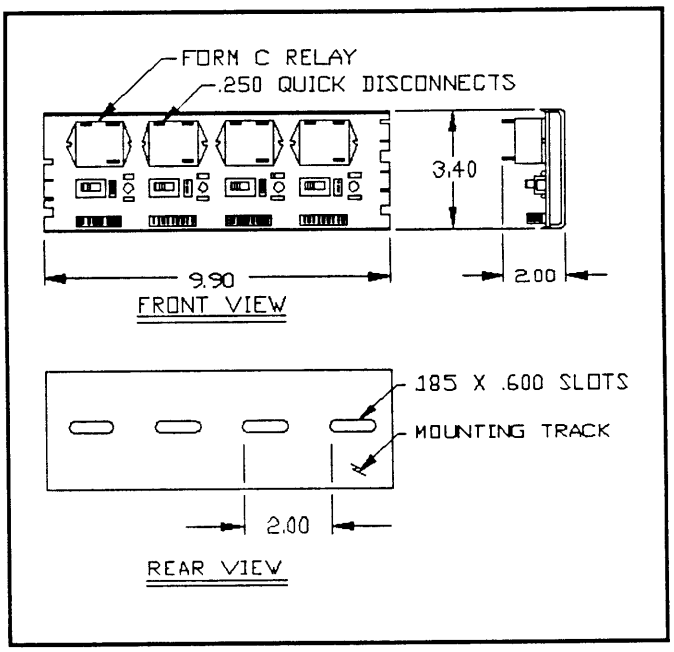
XPRT4 CONTROLLER SPECIFICATIONS

Ambient Temperature:	35 to 125 °F
Ambient Humidity:	0 to 90 %RH
Controller Input Voltage:	22-26 VAC
Controller Power:	50 VA
Communication Ports:	1 RS-422 1 RS-232
Weight:	8.0 lb
Enclosure:	Aluminum

CRX4 RELAY BOARD SPECIFICATIONS

Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	.5 lb
Number of Relays:	4 Each
Contact Arrangement:	1 Form C per Relay
UL Contact Rating (NC):	10 Amp Inductive Load @ 240V 1/2 HP @ 240 VAC



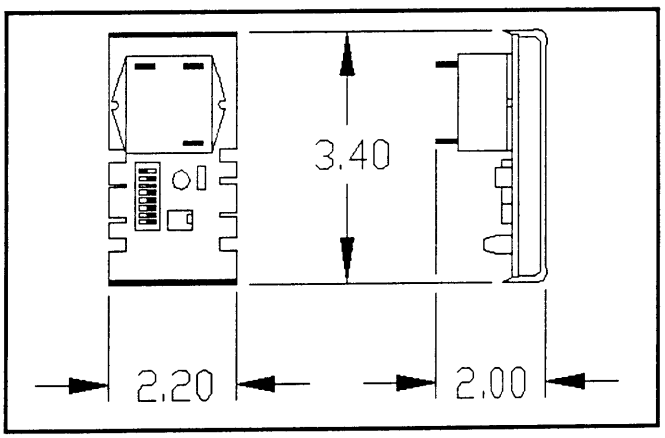


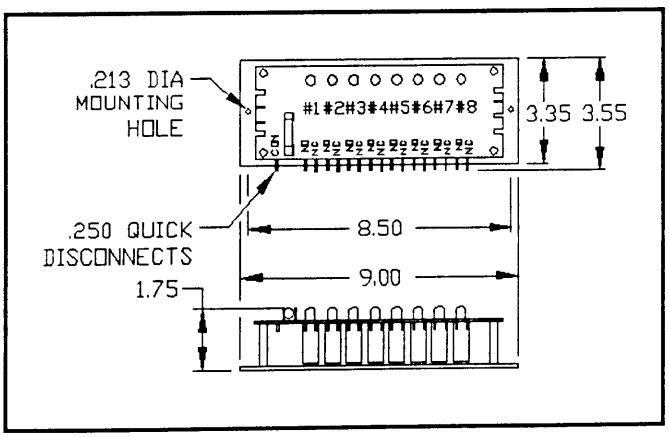
CRX1 RELAY BOARD SPECIFICATIONS

Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	.2 lb
Number of Relays:	1 Each
Contact Arrangement:	1 Form C per Relay
UL Contact Rating (NC):	10 Amp Inductive Load @ 240V 1/2 HP @ 240 VAC

CRX8 RELAY BOARD SPECIFICATIONS

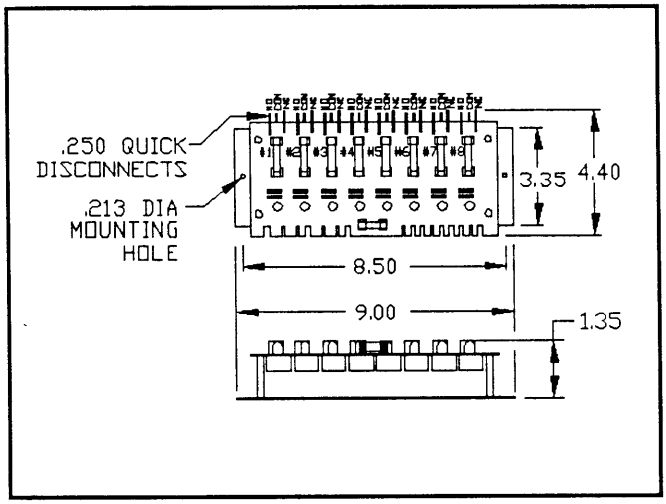
Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	1.5 lb
Number of Relays:	8 Each
Contact Arrangement:	1 Form C per Relay
Contact Rating:	50 VA @ 240 VAC Pilot Duty
Fuse Size:	5 A Common for 8 Relays





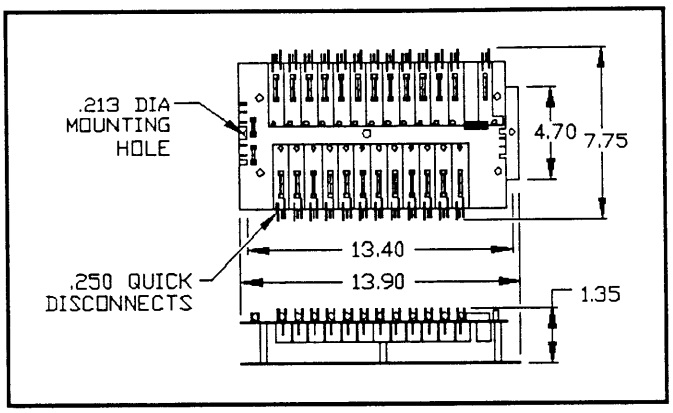
CRX8i RELAY BOARD SPECIFICATIONS

Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	1.5 lb
Number of Relays:	8 Each
Contact Arrangement:	1 Form C per Relay
Contact Rating:	50 VA @ 240 VAC Pilot Duty
Fuse Size:	1 A per Relay



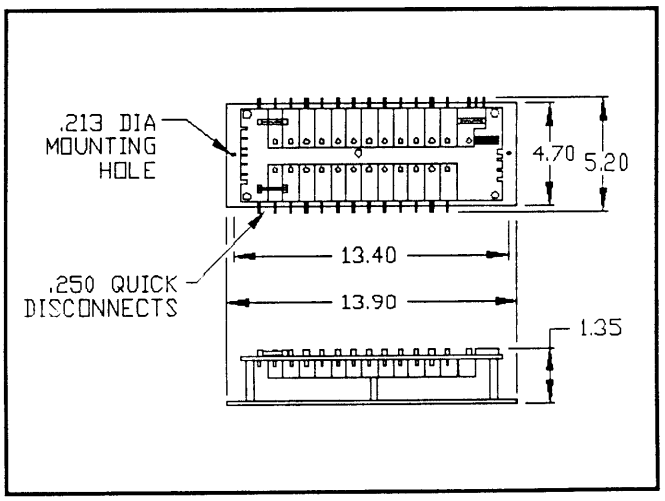
CRX25i RELAY BOARD SPECIFICATIONS

Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	2.5 lb
Number of Relays:	12 Temperature Control – (N.C. Contact) 12 Defrost Control – (N.O. Contact) 1 Defrost Inhibit (Form C Contacts)
Contact Rating:	50 VA @ 240 VAC Pilot Duty
Fuse Size:	1/4 A (Slow Blow) per Relay



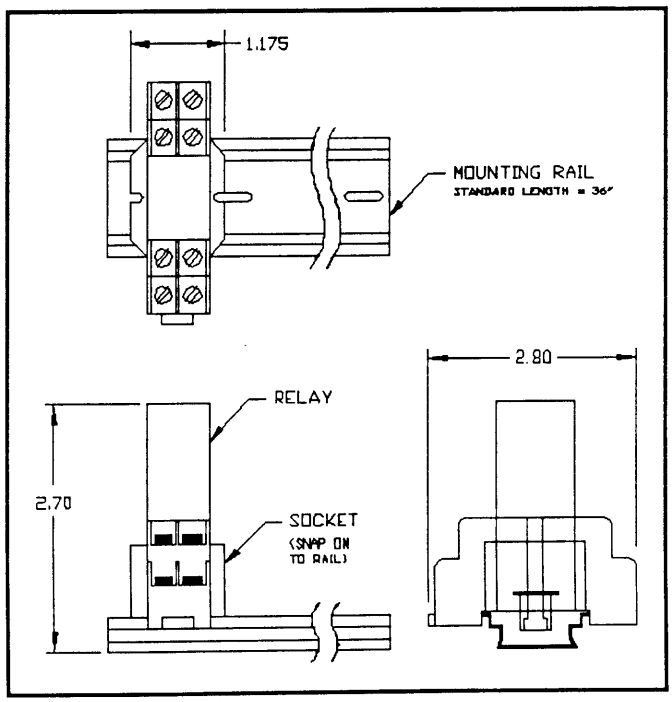
CRX25 RELAY BOARD SPECIFICATIONS

Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	2.5 lb
Number of Relays:	12 Temperature Control – (N.C. Contact) 12 Defrost Control – (N.O. Contact) 1 Defrost Inhibit (Form C Contacts)
Contact Rating:	50 VA @ 240 VAC Pilot Duty
Fuse Size:	5A Common for 12 Temp Circuits 5A Common for 12 Defrost Circuits 5A Auxiliary Defrost Contact



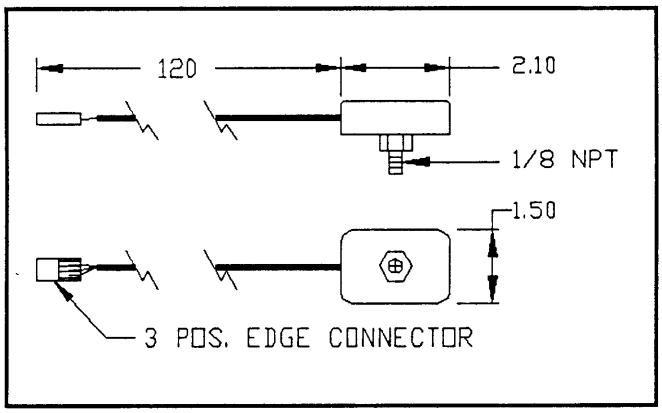
SENSOR SWITCHING RELAY

Ambient Temperature:	45 to 125 °F
Ambient Humidity:	0 to 90 %RH
Weight:	.1 lb
Contact Arrangement:	2 Form C per relay
UL Contact Rating (NC):	5 Amp Inductive Load @ 240V 1/2 HP @ 240 VAC



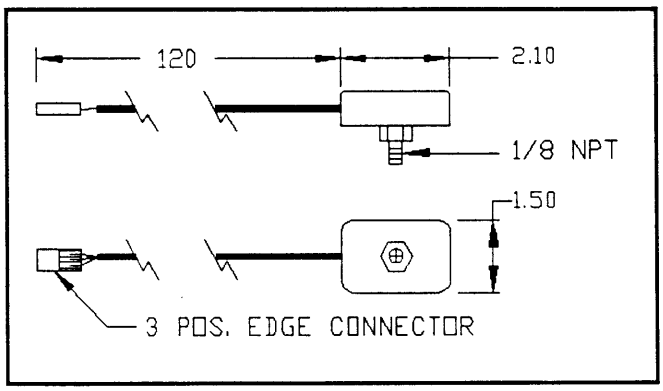
LPTX2 LOW PRESSURE TRANSDUCER SPECIFICATIONS

Measurement Range:	0 to 100 PSIG
Maximum Pressure:	200 PSIG
Operating Ambient:	35 to 115 °F
Ambient Humidity:	0 to 95 %RH
Fitting Material:	Brass
Weight:	0.6 lb
Leads:	22 AWG Shielded PVC (300 V)
Refrigerants:	R12, R22 and R502



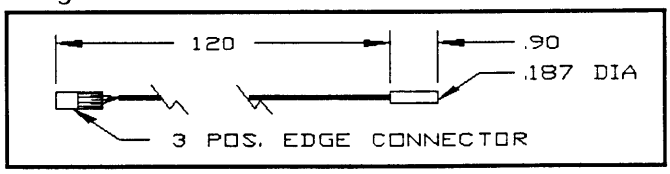
HPTX2 HIGH PRESSURE TRANSDUCER SPECIFICATIONS

Measurement Range:	0 to 350 PSIG
Maximum Pressure:	450 PSIG
Operating Ambient:	35 to 115 °F
Ambient Humidity:	0 to 95 %RH
Fitting Material:	Brass
Weight:	0.6 lb
Leads:	22 AWG Shielded PVC (300 V)
Refrigerants:	R12, R22 and R502



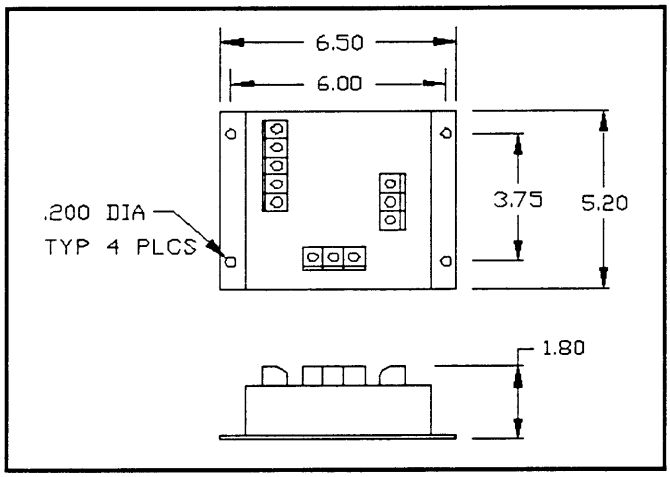
TM-1 TEMPERATURE SENSOR SPECIFICATIONS

Ambient Temperature:	–60 to 180 °F
Ambient Humidity:	0 to 100 %RH
Tube Material:	Brass
Weight:	0.1 lb
Leads:	24 AWG PVC (300V)
Sensor Type:	Thermistor (3K-OHMS @77F)
Range:	–40 to 180 °F



PEV POWER/ENERGY/VOLTAGE MONITOR SPECIFICATIONS

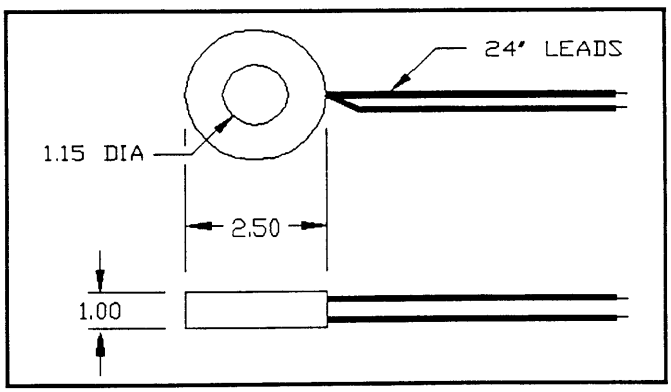
Ambient Temperature:	–60 to 125 °F
Weight:	1.5 lb
Sensed Voltage:	125 to 275 VAC (PEV-220) 350 to 500 VAC (PEV-480)



CURRENT TRANSFORMER SPECIFICATIONS

Insulation Voltage Class 600 VAC

Current Ratio: 100:5 (PN 41052)
200:5 (PN 41053)
300:5 (PN 41054)
600:5 (PN 41042)
1000:5 (PN 41043)



APPENDIX 1: XPRT4 VARIABLE SPEED TECHNICAL DESCRIPTION

The variable speed control in the XPRT4 is developed around the Proportional/Integral (or PI) strategy common in the process control industry. The PI control strategy takes the product of an error signal and the "Slope" setting, adds the accumulation of the product of error values (previous and current) and the "Rate" settings to produce the output voltage to control the variable speed compressor. The "Slope" and "Rate" settings change the effect of the proportional and integral function on the control strategy respectively. The error calibration (ec) is a unit that is approximately .5 psi. The unit calibration of the Slope is in rpm/ec, and the Rate settings are in rpm/ec/delta-t. An example of this follows.

If the cutin setting were at 20 psi and the suction pressure at 30, there would be a net pressure error of 10 psi or, to the variable speed calculation, the error signal would be a value of 20.

If P represents the proportional error and A the accumulated integral error, then the following equations represent the variable speed output.

$$V = G*(P + A) \qquad \text{Eq.1}$$

where: V is the variable speed control voltage, and
G is an instrument gain converting rpm to volts

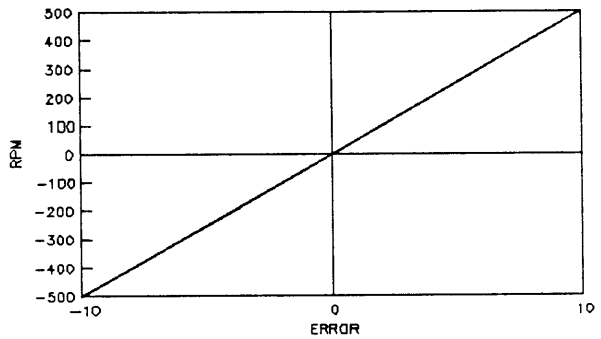


Figure 1a: Variable Speed - Slope

P = S * err **Eq. 2**

where: S is the variable speed Slope setting,
and err is the error as described above

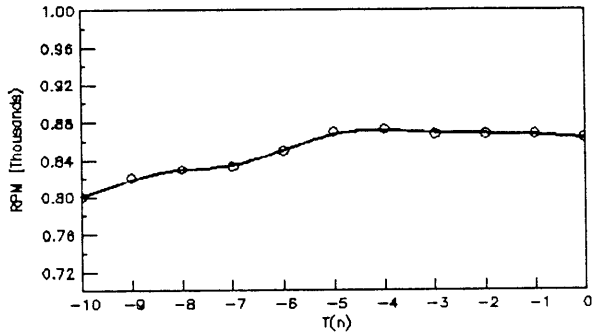


Figure 1b: Variable Speed - Integral

A(n) = A(n-1) + (R * err * dt) **Eq. 3**

where: A(n-1) is the previous accumuated integral error, R is the Rate setting, and
dt is a delta time (approximately 2 seconds)

vspeed (Minimum %) 50%								
COMP# HP	1 7.5	2 10.0	3 15	4 20	Fixed 47.5	Variable 5	Total 52.5	CAPACITY HP
STEP#								STEP#
0	OFF	OFF	OFF	OFF	0.0	0	0.0	0
1	OFF	50%	OFF	OFF	5.0	5	10.0	1
2	ON	50%	OFF	OFF	12.5	5	17.5	2
3	OFF	50%	ON	OFF	20.0	5	25.0	3
4	OFF	50%	OFF	ON	25.0	5	30.0	4
5	ON	50%	ON	OFF	27.5	5	32.5	5
6	ON	50%	OFF	ON	32.5	5	37.5	6
7	OFF	50%	ON	ON	40.0	5	45.0	7
8	ON	50%	ON	ON	47.5	5	52.5	8

Table 1: Variable Speed - 10Hp Compressor Configuration

vspeed (Minimum %) 50%								
COMP# HP	1 7.5	2 10	3 15	4 20.0	Fixed 42.5	Variable 10	Total 52.5	CAPACITY HP
STEP#								STEP#
0	OFF	OFF	OFF	OFF	0.0	0	0.0	0
1	OFF	OFF	OFF	50%	10.0	10	20.0	1
2	ON	OFF	OFF	50%	17.5	10	27.5	2
3	OFF	ON	OFF	50%	20.0	10	30.0	3
4	OFF	OFF	ON	50%	25.0	10	35.0	4
5	ON	ON	OFF	50%	27.5	10	37.5	5
6	ON	OFF	ON	50%	32.5	10	42.5	6
7	OFF	ON	ON	50%	35.0	10	45.0	7
8	ON	ON	ON	50%	42.5	10	52.5	8

Table 2: Variable Speed - 20Hp Compressor Configuration

The capacity of a compressor rack is programmable and is dependent on the sizes of the compressors used. An example is shown in Tables 1 and 2 using 7.5, 10, 15, and 20 horsepower compressors. Table 1 is calculated for the variable speed on the 10 Hp compressor with a 50% minimum speed. You will notice that there is no overlapping of the capacity from one step to the next. For example, the maximum capacity at step #1 is 10 Hp and the minimum capacity at step #2 is 12.5 Hp. Other gaps exist in the capacity between steps 2 and 3, 6 and 7, and 7 and 8. On the other hand, Table 2 shows the compressors configured with the variable speed on the 20

Hp compressor. Each step in this configuration overlaps the next so the rack can meet any capacity demand from 10 to 52.5 horsepower. A graphical representation of the data is shown in Figures 2a and 2b.

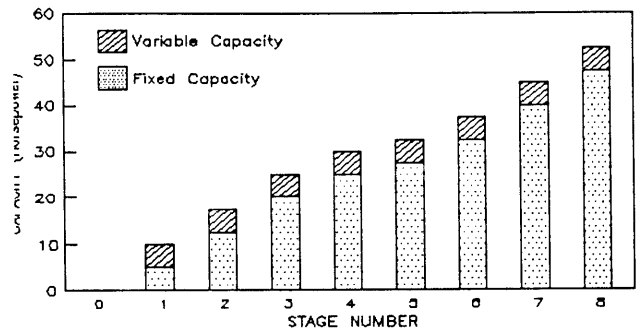


Figure 2a: Programmable - 10Hp Compressor Configuration

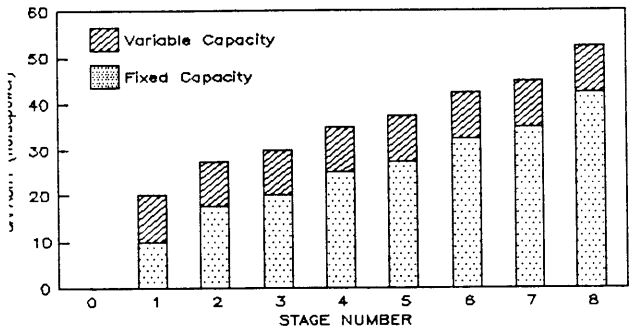


Figure 2b: Programmable - 20Hp Compressor Configuration

The capacity demand from the refrigeration systems connected to the rack continually changes with time as the load on each system changes. The object of the control strategy is to make the capacity of the rack match the demand of the systems so the suction pressure can be maintained. If the control cannot react quickly enough to a sudden change in demand, the suction pressure will have wide variations. At the same time, the compressors capacity will be unstable if the control over reacts to capacity changes. The selection of the Slope and Rate functions allow the control to react to capacity changes in the desired fashion. The settings for the control strategy will have to be adjusted depending on the percent of the rack capacity that is variable. So there is no one setting of the variable speed parameters that will meet all compressor configurations.

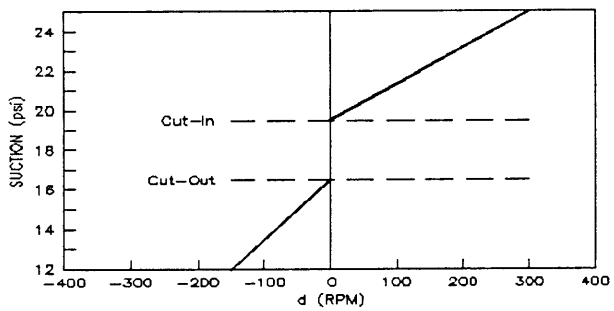


Figure 3a: Variable Speed - Rate Up/Rate Down

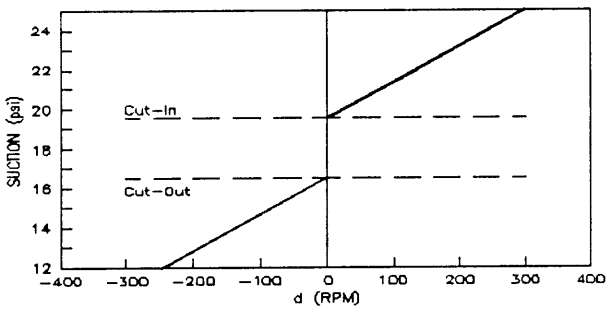


Figure 3b: Variable Speed - Slope

The control has a range of suction pressure between the cutin and cutout settings that is considered to be within the control setpoint. The control strategy allows the cutin and cutout settings to be closer to each other than most other controls (2 to 6 psi vs 10 to 20 psi). This allows the compressors to operate at a higher average suction pressure thus conserving energy by increasing the coefficient of performance. The functional relationship between the variable speed settings and the cutin and cutout settings is shown in Figures 3a and 3b. The adjustable Slope function is the same above the cutin setting as it is below the cutout setting with a dead band between the two. The Rate adjustment in the integral control has two settings, one effective above cutin and the other below cutout. By having lower Rate value above cutin and a higher value below cutout, the control will react more quickly to decreasing demand than to increasing demand thus conserving energy. Figures 4 and 5 show a typical response to a step function in demand. The demand goes from 80% of capacity to 40%. Figures 4a and 5a show a good response to this demand change. Figures 4b and 5b result when the Rate is set to high and the control over compensates for the change in demand which then reflects in the suction pressure. If the Rate is too low and the Slope is too high, the reaction in Figures 4c and 5c shows a slow response to the demand change and a long recovery time of the suction pressure.

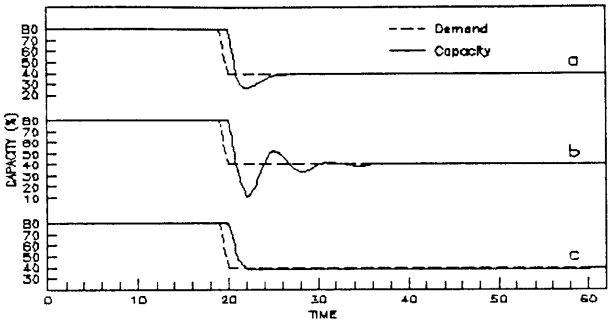


Figure 4: Programmable -
Compressor Capacity Response

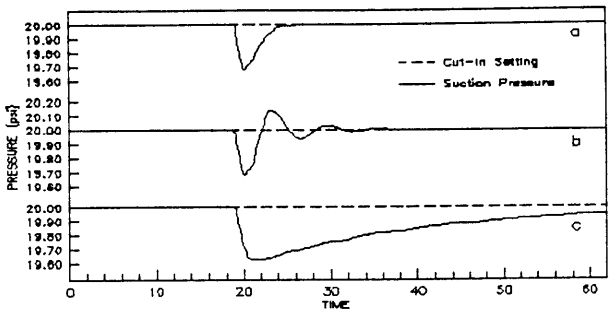


Figure 5: Programmable -
Rack Suction Pressure Response