

+4° & -30°
Enhanced Line
Refrigerator / Freezer
Service Manual
322173H01 Rev. 0



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2 Models Covered by this Manual

316070H01	316071H01	316072H01	316073H01	316074H01	316075H01	316076H01	316077H01	316078H01	316079H01	316080H01	
24'	24'	34'	48'	48'	74'	24'	24'	34'	34'	48'	
Freezer	Freezer	Freezer	Freezer	Freezer	Freezer	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	
13986223F	13986142	13986144	13986247F	13986147	13986274F	13986134	13986120	13986124	13986122	13986138	
13986223FA	13986142A	13986144A	13986247FA	13986147A	13986274FA	13986134A	13986120A	13986124A	13986122A	13986138A	
13999223F	13986142R	13986144R	13999247F	13986147R	13999274F	13986134RA	13986120R	13986124R	13986122R	13986138D	
13999223FA	13986142RA	13986144RA	13999247FA	13986147RA	13999274FA		13986120RA	13986124RA	13986122RA	13986138DR	
13999223FAO			13999247FAO		13999274FAO			13999124RA		13986138DRA	
13999223FR			13999247FR		13999274FR					13986138R	
					BAXFRZ3D					13986138RA	
										13999138D	
										13999138DR	
										13999138DRA	
316081H01	316082H01	316083H01	RFX40	RFX41	RFX42	RFX43	RFX44	RFX45	RFX46	RFX47	
48'	74'	74'	27'	27'	38'	44'	44'	45'	45'	72'	
Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	
13986126	13986132	13986130	13986127G	13986227R	13986138G	13986128S	13986145G	13986149G	13986249R	13986172G	
13986126A	13986132A	13986130A	13986127GA	13986227RA	13986138GA	13986128SA	13986145GA	13986149GA	13986249RA	13986172GA	
13986126R	13986132R	13986130RA	13986227G	13999227R	13986238G	13986128SR	13986245G	13986249G	13999249R	13986272G	
13986126RA	13986132RA		13986227GA	13999227RA	13986238GA	13986128SRA	13986245GA	13986249GA	13999249RA	13986272GA	
	13986140		13999127G	13999227RA3R	13999138G	13986136S	13999145G	13999149G	13999249RR	13986272GR	
	13986140A		13999127GA	13999227RAO	13999238G	13986136SA	13999145GA	13999149GA	CP13986249R	13999172G	
	13986140D		13999227G		13999238GA	13986136SR	13999245G	13999249G		13999272G	
	13986140DRA		13999227GA		13999238GAO	13986136SRA	13999245GA	13999249GA		13999272GA	
	13986140RA		13999227GA3R		CP13986138G		13999245GA3R	13999249GA3R		13999272GA3R	
	13999140D		13999227GAO		CP13986238G		13999245GAO	13999249GAO		13999272GAO	
	13999140DR		13999227GR				13999245GR	13999249GR		13999272GR	
	13999140DRA		CP13986227G				CP13986145G				
							CP13986245G				
316685H01		316686H01		316687H01		316688H01		316689H01		316690H01	
12'		23'		23'		23'		23'		27'	
Refrigerator		Refrigerator		Refrigerator		Refrigerator		Refrigerator		Refrigerator	
MR12PA-GAEE-TS		MR25PA-GAEE-TS		MR25PA-SAEE-TS		MR25SS-GAEE-TS		MR25SS-SAEE-TS		MR30SS-GAEE-TS	
MR12PA-GARE-TS		MR25PA-GARE-TS		MR25PA-SARE-TS		MR25SS-GARE-TS		MR25SS-SARE-TS		MR30SS-GARE-TS	
MR12PA-GAEE-FS		MR25PA-GAEE-FS		MR25PA-SAEE-FS		MR25SS-GAEE-FS		MR25SS-SAEE-FS		MH30SS-GAEE-TS	
MR12PA-GARE-FS		MR25PA-GARE-FS		MR25PA-SARE-FS		MR25SS-GARE-FS		MR25SS-SARE-FS		MH30SS-GARE-TS	
MR12PA-GAEE-CP		MR25PA-GAEE-CP		MR25PA-SAEE-CP		MR25SS-GAEE-CP		MR25SS-SAEE-CP		MR30SS-GAEE-FS	
MR12PA-GARE-CP		MR25PA-GARE-CP		MR25PA-SARE-CP		MR25SS-GARE-CP		MR25SS-SARE-CP		MR30SS-GARE-FS	
MR12PA-GAEE-CA		MR25PA-GAEE-CA		MR25PA-SAEE-CA		MR25SS-GAEE-CA		MR25SS-SAEE-CA		MH30SS-GAEE-FS	
MR12PA-GARE-CA		MR25PA-GARE-CA		MR25PA-SARE-CA		MR25SS-GARE-CA		MR25SS-SARE-CA		MH30SS-GARE-FS	
MR12PA-GAEE-SL		MR25PA-GAEE-SL		MR25PA-SAEE-SL		MR25SS-GAEE-SL		MR25SS-SAEE-SL		MR30SS-GAEE-CP	
MR12PA-GARE-SL		MR25PA-GARE-SL		MR25PA-SARE-SL		MR25SS-GARE-SL		MR25SS-SARE-SL		MR30SS-GARE-CP	
MR12PA-GAEE-VW		MR25PA-GAEE-VW		MR25PA-SAEE-VW		MR25SS-GAEE-VW		MR25SS-SAEE-VW		MH30SS-GAEE-CP	
MR12PA-GARE-VW		MR25PA-GARE-VW		MR25PA-SARE-VW		MR25SS-GARE-VW		MR25SS-SARE-VW		MH30SS-GARE-CP	
										MR30SS-GAEE-CA	
										MR30SS-GARE-CA	
										MH30SS-GAEE-CA	
										MH30SS-GARE-CA	
										MR30SS-GAEE-SL	
										MR30SS-GARE-SL	
										MH30SS-GAEE-SL	
										MH30SS-GARE-SL	
										MR30SS-GAEE-VW	
										MR30SS-GARE-VW	
										MH30SS-GAEE-VW	
										MH30SS-GARE-VW	

316691H01	316692H01	316693H01	316694H01	316695H01	316696H01
27'	45'	49'	49'	72'	72'
Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator	Refrigerator
MR30SS-S AEE-TS	MR45SS-G AEE-TS	MR49SS-G AEE-TS	MR49SS-S AEE-TS	MR72PA-G AEE-TS	MR72SS-G AEE-TS
MR30SS-S ARE-TS	MR45SS-G ARE-TS	MR49SS-G ARE-TS	MR49SS-S ARE-TS	MR72PA-G ARE-TS	MR72SS-G ARE-TS
MR30SS-S AEE-FS	MH45SS-G AEE-TS	MH49SS-G AEE-TS	MR49SS-S AEE-FS	MH72PA-G AEE-TS	MH72SS-G AEE-TS
MR30SS-S ARE-FS	MH45SS-G ARE-TS	MH49SS-G ARE-TS	MR49SS-S ARE-FS	MH72PA-G ARE-TS	MH72SS-G ARE-TS
MR30SS-S AEE-CP	MR45SS-G AEE-FS	MR49SS-G AEE-FS	MR49SS-S AEE-CP	MR72PA-G AEE-FS	MR72SS-G AEE-FS
MR30SS-S ARE-CP	MR45SS-G ARE-FS	MR49SS-G ARE-FS	MR49SS-S ARE-CP	MR72PA-G ARE-FS	MR72SS-G ARE-FS
MR30SS-S AEE-CA	MH45SS-G AEE-FS	MH49SS-G AEE-FS	MR49SS-S AEE-CA	MH72PA-G AEE-FS	MH72SS-G AEE-FS
MR30SS-S ARE-CA	MH45SS-G ARE-FS	MH49SS-G ARE-FS	MR49SS-S ARE-CA	MH72PA-G ARE-FS	MH72SS-G ARE-FS
MR30SS-S AEE-SL	MR45SS-G AEE-CP	MR49SS-G AEE-CP	MR49SS-S AEE-SL	MR72PA-G AEE-CP	MR72SS-G AEE-CP
MR30SS-S ARE-SL	MR45SS-G ARE-CP	MR49SS-G ARE-CP	MR49SS-S ARE-SL	MR72PA-G ARE-CP	MR72SS-G ARE-CP
MR30SS-S AEE-VW	MH45SS-G AEE-CP	MH49SS-G AEE-CP	MR49SS-S AEE-VW	MH72PA-G AEE-CP	MH72SS-G AEE-CP
MR30SS-S ARE-VW	MH45SS-G ARE-CP	MH49SS-G ARE-CP	MR49SS-S ARE-VW	MH72PA-G ARE-CP	MH72SS-G ARE-CP
	MR45SS-G AEE-CA	MR49SS-G AEE-CA		MR72PA-G AEE-CA	MR72SS-G AEE-CA
	MR45SS-G ARE-CA	MR49SS-G ARE-CA		MR72PA-G ARE-CA	MR72SS-G ARE-CA
	MH45SS-G AEE-CA	MH49SS-G AEE-CA		MH72PA-G AEE-CA	MH72SS-G AEE-CA
	MH45SS-G ARE-CA	MH49SS-G ARE-CA		MH72PA-G ARE-CA	MH72SS-G ARE-CA
	MR45SS-G AEE-SL	MR49SS-G AEE-SL		MR72PA-G AEE-SL	MR72SS-G AEE-SL
	MR45SS-G ARE-SL	MR49SS-G ARE-SL		MR72PA-G ARE-SL	MR72SS-G ARE-SL
	MH45SS-G AEE-SL	MH49SS-G AEE-SL		MH72PA-G AEE-SL	MH72SS-G AEE-SL
	MH45SS-G ARE-SL	MH49SS-G ARE-SL		MH72PA-G ARE-SL	MH72SS-G ARE-SL
	MR45SS-G AEE-VW	MR49SS-G AEE-VW		MR72PA-G AEE-VW	MR72SS-G AEE-VW
	MR45SS-G ARE-VW	MR49SS-G ARE-VW		MR72PA-G ARE-VW	MR72SS-G ARE-VW
	MH45SS-G AEE-VW	MH49SS-G AEE-VW		MH72PA-G AEE-VW	MH72SS-G AEE-VW
	MH45SS-G ARE-VW	MH49SS-G ARE-VW		MH72PA-G ARE-VW	MH72SS-G ARE-VW
316071H01	316072H01	316074H01	RFX40	RFX41	RFX42
24'	34'	48'	27'	27'	38'
Freezer	Freezer	Freezer	Refrigerator	Refrigerator	Refrigerator
MF25SS-S AEE-TS	MF34SS-S AEE-TS	MF49SS-S AEE-TS	MR30PA-G AEE-TS	MR30PA-S AEE-TS	MR38PA-G AEE-TS
MF25SS-S ARE-TS	MF34SS-S ARE-TS	MF49SS-S ARE-TS	MR30PA-G ARE-TS	MR30PA-S ARE-TS	MR38PA-G ARE-TS
MF25SS-S AEE-FS	MF34SS-S AEE-FS	MF49SS-S AEE-FS	MH30PA-G AEE-TS	MR30PA-S AEE-FS	MH38PA-G AEE-TS
MF25SS-S ARE-FS	MF34SS-S ARE-FS	MF49SS-S ARE-FS	MH30PA-G ARE-TS	MR30PA-S ARE-FS	MH38PA-G ARE-TS
MF25SS-S AEE-CP	MF34SS-S AEE-CP	MF49SS-S AEE-CP	MR30PA-G AEE-FS	MR30PA-S AEE-CP	MR38PA-G AEE-FS
MF25SS-S ARE-CP	MF34SS-S ARE-CP	MF49SS-S ARE-CP	MR30PA-G ARE-FS	MR30PA-S ARE-CP	MR38PA-G ARE-FS
MF25SS-S AEE-CA	MF34SS-S AEE-CA	MF49SS-S AEE-CA	MH30PA-G AEE-FS	MR30PA-S AEE-CA	MH38PA-G AEE-FS
MF25SS-S ARE-CA	MF34SS-S ARE-CA	MF49SS-S ARE-CA	MH30PA-G ARE-FS	MR30PA-S ARE-CA	MH38PA-G ARE-FS
MF25SS-S AEE-SL	MF34SS-S AEE-SL	MF49SS-S AEE-SL	MR30PA-G AEE-CP	MR30PA-S AEE-SL	MR38PA-G AEE-CP
MF25SS-S ARE-SL	MF34SS-S ARE-SL	MF49SS-S ARE-SL	MR30PA-G ARE-CP	MR30PA-S ARE-SL	MR38PA-G ARE-CP
MF25SS-S AEE-VW	MF34SS-S AEE-VW	MF49SS-S AEE-VW	MH30PA-G AEE-CP	MR30PA-S AEE-VW	MH38PA-G AEE-CP
MF25SS-S ARE-VW	MF34SS-S ARE-VW	MF49SS-S ARE-VW	MH30PA-G ARE-CP	MR30PA-S ARE-VW	MH38PA-G ARE-CP
			MR30PA-G AEE-CA		MR38PA-G AEE-CA
			MR30PA-G ARE-CA		MR38PA-G ARE-CA
			MH30PA-G AEE-CA		MH38PA-G AEE-CA
			MH30PA-G ARE-CA		MH38PA-G ARE-CA
			MR30PA-G AEE-SL		MR38PA-G AEE-SL
			MR30PA-G ARE-SL		MR38PA-G ARE-SL
			MH30PA-G AEE-SL		MH38PA-G AEE-SL
			MH30PA-G ARE-SL		MH38PA-G ARE-SL
			MR30PA-G AEE-VW		MR38PA-G AEE-VW
			MR30PA-G ARE-VW		MR38PA-G ARE-VW
			MH30PA-G AEE-VW		MH38PA-G AEE-VW
			MH30PA-G ARE-VW		MH38PA-G ARE-VW

RFX44	RFX45	RFX46
44'	45'	45'
Refrigerator	Refrigerator	Refrigerator
MR45PA-GAEE-TS	MR49PA-GAEE-TS	MR49PA-SAEE-TS
MR45PA-GARE-TS	MR49PA-GARE-TS	MR49PA-SARE-TS
MH45PA-GAEE-TS	MH49PA-GAEE-TS	MR49PA-SAEE-FS
MH45PA-GARE-TS	MH49PA-GARE-TS	MR49PA-SARE-FS
MR45PA-GAEE-FS	MR49PA-GAEE-FS	MR49PA-SAEE-CP
MR45PA-GARE-FS	MR49PA-GARE-FS	MR49PA-SARE-CP
MH45PA-GAEE-FS	MH49PA-GAEE-FS	MR49PA-SAEE-CA
MH45PA-GARE-FS	MH49PA-GARE-FS	MR49PA-SARE-CA
MR45PA-GAEE-CP	MR49PA-GAEE-CP	MR49PA-SAEE-SL
MR45PA-GARE-CP	MR49PA-GARE-CP	MR49PA-SARE-SL
MH45PA-GAEE-CP	MH49PA-GAEE-CP	MR49PA-SAEE-VW
MH45PA-GARE-CP	MH49PA-GARE-CP	MR49PA-SARE-VW
MR45PA-GAEE-CA	MR49PA-GAEE-CA	
MR45PA-GARE-CA	MR49PA-GARE-CA	
MH45PA-GAEE-CA	MH49PA-GAEE-CA	
MH45PA-GARE-CA	MH49PA-GARE-CA	
MR45PA-GAEE-SL	MR49PA-GAEE-SL	
MR45PA-GARE-SL	MR49PA-GARE-SL	
MH45PA-GAEE-SL	MH49PA-GAEE-SL	
MH45PA-GARE-SL	MH49PA-GARE-SL	
MR45PA-GAEE-VW	MR49PA-GAEE-VW	
MR45PA-GARE-VW	MR49PA-GARE-VW	
MH45PA-GAEE-VW	MH49PA-GAEE-VW	
MH45PA-GARE-VW	MH49PA-GARE-VW	

316697H01
20' Combo
MC20SS-SAEE-TS
MC20SS-SAEE-FS
MC20SS-SAEE-CP
MC20SS-SAEE-CA
MC20SS-SAEE-SL

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3 Decoder for New Models

Enhanced Line Model Numbers			example=	MR12SS-GARE-FS	Mtssff-dare-br		
Tier =	M	for Mid level (value white box vs. mid enhanced vs. high performance line)					
Type (t) =	R	for Refrigerator					
	F	for Freezer					
	H	for cHromatography					
	C	for Combo (1RF)					
Size (ss) =	12'	LV12					
	20'	1RF combo					
	25'	LV23 & HFS1					
	30'	LV27					
	34'	HFS1W					
	38'	LV38					
	45'	LV45					
	49'	LV49 & HFS2					
	72'	LV72Y					
Finish (ff) =	PA	for PAinted					
	SS	for Stainless Steel					
spacer "-"							
Door (d) =	G	for Glass					
	S	for Solid					
Alarm (a) =	A	all have Alarms now					
Recorder (r) =	R	for Recorder present					
	E	for recorder slot Empty					
spacer "-"							
Brand (br) =	CA	for Cardinal Health					
	CP	for Cole-Parmer					
	FS	for Fisher Scientific					
	SL	for So-Low					
	TS	for Thermo Scientific					
	VW	for VWR					

4 Introduction

This manual is intended to provide installation and operating instructions for general purpose and chromatography refrigerators.

Your satisfaction and safety are important to us, a complete understanding of this unit is necessary to attain these objectives.

As the ultimate user of this apparatus, it is your responsibility to understand its proper function and operational characteristics. This instruction manual should be thoroughly read and all operators given adequate training before attempting to place this unit in service. Awareness of the stated cautions and warnings, and compliance with recommended operating parameters - together with maintenance requirements - are important for safe and satisfactory operation. The unit should be used for its intended application; alterations or modifications will void the Warranty.



Warning

Warnings alert you to a possibility of personal injury.



Caution

Cautions alert you to a possibility of damage to the equipment.



Note

Notes alert you to pertinent facts and conditions.



Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.

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5 Safety Considerations

This manual must be carefully read and thoroughly understood before operating the unit, failure to follow directions or precautionary measures could result in serious adverse effects. This equipment must be used only as specified in these instructions. If used in a manner other than as specified, the protection provided by the equipment may be impaired.

- This equipment is intended for indoor use only.
- This equipment must be earth grounded for safe operation.
- Disconnect unit line cord from power source before performing any servicing or maintenance.
- Installation



Warning

As a routine laboratory precaution, always wear safety glasses when working with this apparatus.



DANGER:

RISK OF CHILD ENTRAPMENT. BEFORE YOU THROW AWAY YOUR OLD REFRIGERATOR OR FREEZER:

TAKE OFF DOORS
LEAVE THE SHELVES IN
THE PLACE SO THAT
CHILDREN MAY NOT
EASILY CLIMB



Warning

High voltage is supplied to PC board when key switch is OFF.



Caution

Risk of electric shock.



Warning

These refrigerators are not approved for the storage of blood or blood products!



Warning

This product is not intended, nor can it be used, as a sterile or patient connected device. In addition, this apparatus is not designed for use in

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6 Installation

6.1 Selecting a Location

Choose a location for the refrigerator that will provide at least three inches of clearance between the cabinet and any adjacent vertical surface at the sides and rear. Appropriate electrical power must be available. Locate the refrigerator within 6 feet of the power outlet so that no extension cord is required.

6.2 Leveling the Unit

The refrigerator must be level in order to provide adequate condensation drainage as well as proper door alignment and operation. The refrigerator should be in its final operating location and set so that it is firmly positioned on the floor.

There are four leveling screws, one on each corner. Level the cabinet front to rear and side-to-side using the corner leveling screws.

The front leveling screws are accessed by removing the base grille, as described below:

1. Remove the lower grille attachment screws.
2. Grasp the grille with both hands.
3. Lift the grille approximately 1/2".
4. Pull grille away from the refrigerator.



Note

The refrigerator must be level in order to provide adequate condensation drainage as well as proper door alignment and operation. The refrigerator should be in its final operating location and set so that it is firmly positioned

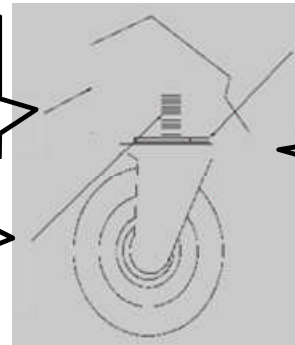
6.3 Installing and Leveling Casters

Refrigerators come with four casters, which thread into the base of the unit, one in each corner. Remove the leveling screws from the unit and use the wrench provided to thread the casters completely into the base of the unit.

Refrigerator
Base

Thread casters
directly into
base at four
corners

Tighten
Using
Wrench
Provided



Caution If the unit was tilted in excess of 30 degrees, level it and do not apply electrical power for a minimum of 12 hours.

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6.4 Lamps

Prior to applying power to the unit, verify that all of the internal lamps are properly installed and fully engaged in the lamp holders. Proper lamp engagement is achieved by rotating the lamp 90° from its insertion position until it “snaps” or “clicks” into place.



Caution

Since the lamps in this unit are protected by shields, it is necessary to physically verify that the lamp has been rotated and locked into place.

6.5 Door Removal

(Sliding Door Models Only)

Each door has its own closing spring located at the top of the door track.

Each spring is set for proper tension.

If doors do not close properly:

1. Check for cabinet level (see above).
2. Remove the door(s) by opening slightly and then lifting it. While maintaining upward pressure on the door, pull the bottom outward until it clears the bottom track.
3. Check that spring in top track moves freely and that bottom track is free of debris. Check that rollers on bottom of door rotate freely.



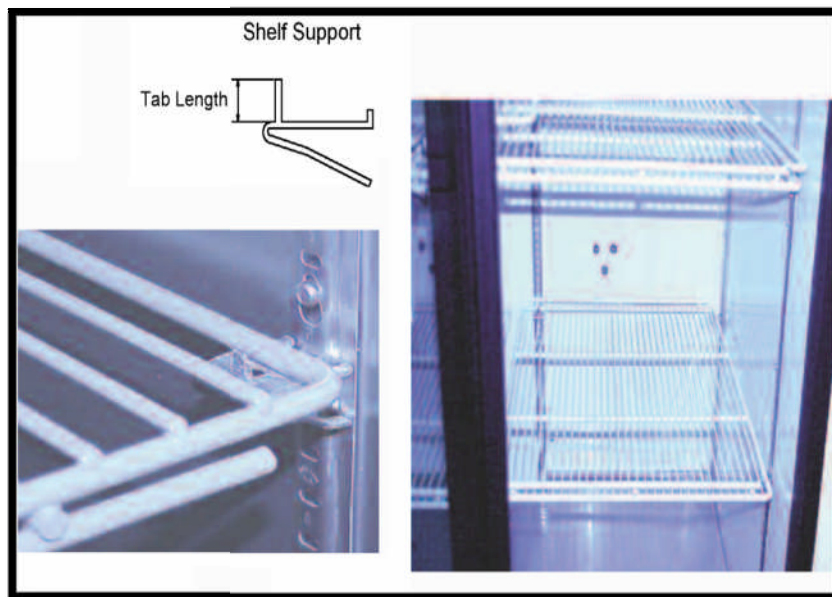
Caution

Improperly installed lamps may cause damage to the lighting circuit.

6.6 Shelves

Shelves are packed in plastic and shipped inside each cabinet along with a bag containing shelf supports.

Two different shelf supports are provided. The shorter tab length version is used on the front of the shelf. Shelf spacing is adjustable to suit user requirements. Insert four shelf supports for each shelf into the pilasters as shown. Place the shelf on the pilasters as shown below.



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6.7 Electrical Connection

The frequency and nominal voltage requirements for the unit are specified on the data plate, which is located on the interior upper left side. Only plug the unit into a power source that meets these requirements. Low line voltage is often the cause of service complaints. With the unit running, check that the line voltage is within $\pm 10\%$ of that specified on the data plate.

The power cord on most units has a three prong (grounding) plug (NEMA 5-15P). This plug mates with a standard three prong (grounding) wall receptacle (NEMA 5-15R) to minimize the potential of an electrical shock hazard. Where necessary, models are equipped with a line cord and NEMA 5-20P plug. This plug requires a NEMA 5-20R receptacle.

The customer should have the wall receptacle and circuit checked by a qualified electrician to verify the receptacle is properly grounded and meets power requirements specified on the data plate.

Where a two prong wall receptacle is encountered, it is the personal responsibility and obligation of the user to have it replaced with a properly grounded three prong receptacle.

During compressor start-up, the unit will momentarily draw more current than under normal running conditions. To avoid nuisance tripping of circuit breakers, it may be necessary to install an HACR rated breaker.



Warning

Insufficient line voltage is often the cause of compressor start-up failure. It is strongly recommended that a dedicated circuit, conforming to the National Electrical Code, Article 440, be used for powering the refrigerator.



Caution

Be sure that the power supply is the same voltage that is specified on the refrigerator's data plate.



Warning

For personal safety this unit must be properly grounded.



Warning

DO NOT under any circumstances cut or remove the third (ground) prong from the power cord. DO NOT use a two-prong adapter plug.



Warning

Do not use an extension cord. Use of an ungrounded cord or an overloaded circuit VOIDS the compressor warranty.

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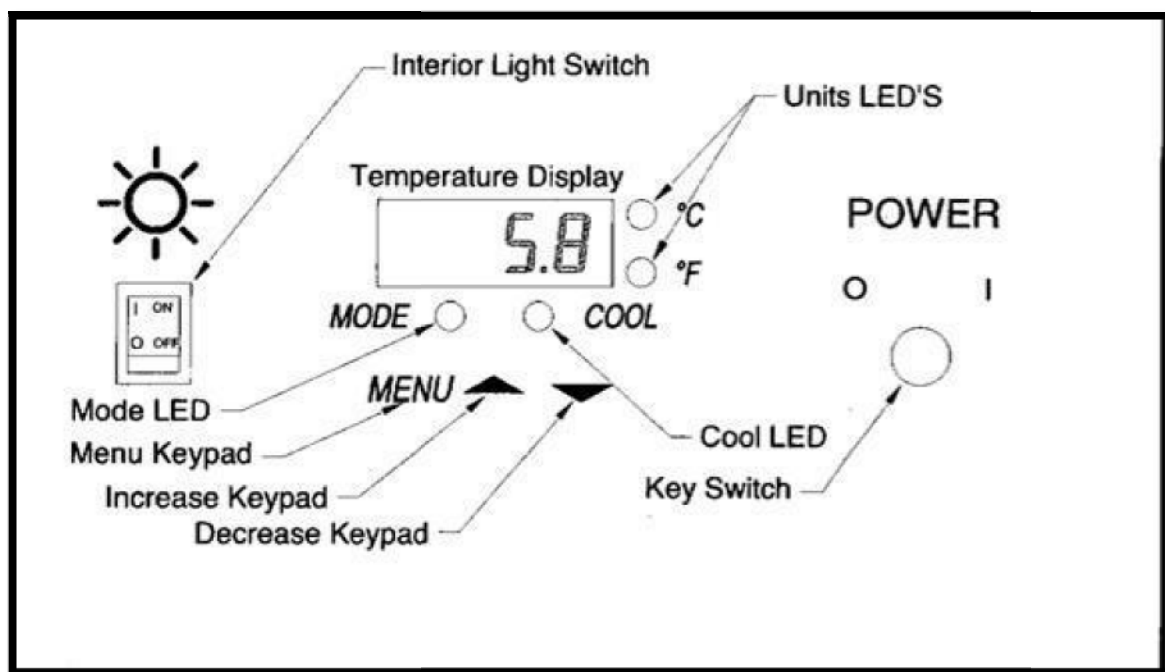
7 Controllers

The Chromatography and General Purpose refrigerators and freezers come equipped with one of three possible controllers.

7.1 Base Controller – Refrigerator 103508 PCB

7.1.1 Base Controller – User Interface

The digital temperature controller is located on the front of the unit. When the unit is initially turned on, the display will indicate current chamber temperature. The temperature units will be indicated by the °C or °F LED located just to the right of the temperature display. The refrigerator is factory set at 4°C. When the unit is first energized the evaporator fans will operate, however it will not immediately cool. A compressor delay time is programmed into the controller to verify the system pressure is low enough to activate the motor. When the delay time is over, the Cool LED will illuminate, the compressor will run and the chamber will cool.



7.1.2 Menus

By gently pressing the keypads shown in Controls Layout, the refrigerator can be set to operate anywhere in the 1.0 to 12.0°C (33.8 to 53.6°F) temperature range in units of °C or °F. When the MENU keypad is pressed, the MODE LED will illuminate, indicating the operating parameters, set point (SP), temperature offset (oS), hold-off time (Ho), or units (CF) can be set to the customer's preference.

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7.1.2.1 Temperature Set-Point

1. Press the MENU keypad once to bring up the set point menu.
2. The display will flash SP, followed by the last set temperature in units indicated by the Units LED.
3. Use the Increase or Decrease keypad to change the set temperature to the desired target temperature (1.0 to 12.0°C, 33.8 to 53.6°F).
4. Press the Menu keypad to enter the set temperature and bring up the units select menu.



While in any of the controller mode set ups (temp set, offset or units), the controller will wait 15 seconds for a new value to be entered. If there is no keypad input within 15 seconds, the controller window will automatically revert to the temperature display mode.

7.1.2.2 Units

Temperatures can be displayed in either °C or °F. The units select menu follows the set-point menu.

1. From the temperature display mode (default mode), press the menu key until the display flashes CF followed by a single C or F, which indicates the most recent units selected.
2. Use the Increase or Decrease keypad to change the units from °C to °F or vice versa.
3. Press the Menu keypad again to enter the desired units and return to the temperature display mode.
4. Once selected, the appropriate units LED should be lit.

7.1.2.3 Calibration

In the event the refrigerator needs to be calibrated, a simple routine is available to adjust the display and control point to a referenced standard. To set a temperature offset while in the temperature display mode (mode LED off):

1. Press and hold the Menu key for 5 seconds. The display will flash "oS" followed by the last temperature offset value. The factory setting is 0.0.
2. To change the offset value, press the Increase or Decrease keypad to the value which when algebraically added to the last displayed temperature, will agree with the reference temperature.
3. Next, press the Menu key two more times. The value shown in the display will be added to the previous temperature reading. 9.

For Example:

The display indicates 4°C but a reference thermometer in the refrigerator chamber indicates 6°C. The operator holds in the Menu KEY and changes the display value from 0.0 to 2.0. The Menu key is pressed two additional times so that the controller again displays chamber temperature. Now the display indicates a chamber temperature of 6°C and the controller begins to cool to the desired temperature of 4°C. Allow an additional 30 to 40 minutes for the refrigerator to again stabilize. If the display is still inaccurate, repeat the calibration offset procedure.

7.1.2.4 Hold Off Time

Following the offset menu is the hold-off (Ho) menu. The display will momentarily flash "Ho", followed by a number. The number shown is the delay time in minutes between compressor activations. Use the UP/DOWN keypads to change the value.

Increasing the hold-off time will allow additional time for the evaporator to defrost. This can reduce the chance of evaporator freeze-up during times of high humidity. Pressing the Menu keypad while in the Ho mode, enters the hold-off time displayed, and returns controller



INCREASING the offset value DECREASES the temperature at which the system controls. If the offset is set too high, the chamber temperature can fall below zero and cause the evaporator freeze-up.

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operation to the temperature display mode.

7.1.2.5 Temperature Excursions

By pressing the Increase keypad, the display will show the warmest temperature recorded since the unit was energized or the excursions values were reset. Pressing the Decrease keypad will display the coldest temperature recorded since the unit was energized or the digression values were reset.

1. To reset the temperature excursions values, press the Increase and Decrease keypads at the same time.
2. The display will show Clr, indicating the controller will begin recording new warm and cold digressions once more.

7.1.2.6 Error Codes

Error codes indicate when the controller is sensing a problem. A description of each is given below. See the Troubleshooting Table for additional information on error codes.

Error Code	Meaning
E1	Open sensor
E2	Under temperature. Temperature at sensor is less than -36°C.
E3	Over temperature. Temperature at sensor is greater than 37°C.

7.1.2.7 Interior Lighting

The interior lamp(s) is controlled next by a rocker switch located on the header panel. This light may be operated any time the cabinet power is turned on at the keyed power switch. If the interior lamp fails, replace with the same size and wattage lamp. DO NOT USE REDUCED WATTAGE LAMPS. The reduced wattage lamps generally fail to light below 60°F (15°C).

7.1.2.8 Convenience Outlet

(Chromatography Refrigerators Only)

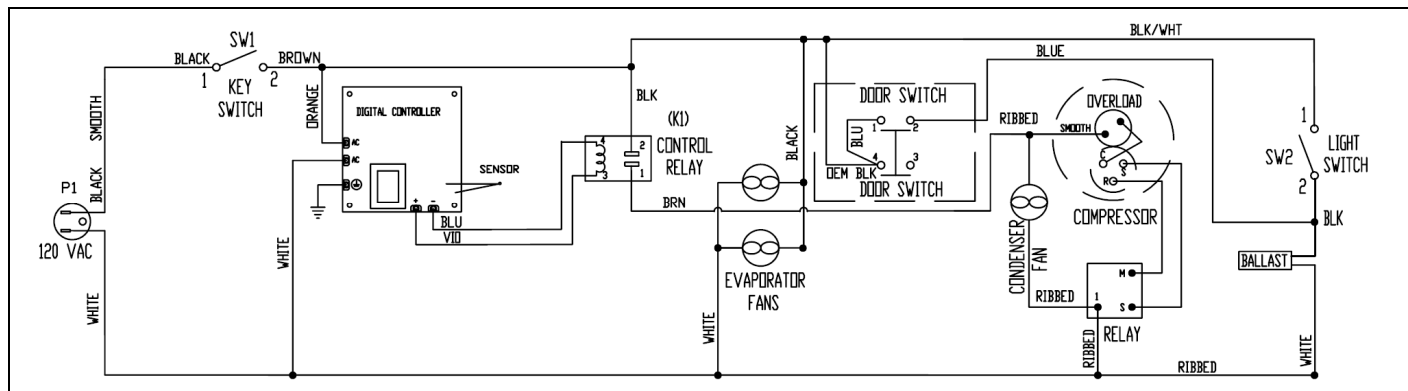
The Chromatography Refrigerators come equipped with a convenience outlet located in the center of the back wall. Models 140,141 (three doors) have two convenience outlets. The power to the outlets is protected by a circuit breaker. The breaker is located just below and to the right of the outlet. Pressing the breaker button resets the breaker after a fault.

7.1.3 Defrost System

The defrost heaters are controlled by a defrost timer. The timer is a 24 hr. dial timer located in a galvanized box behind the header panel. The timer is factory set to provide four defrost cycles per 24 hour period. The defrost heaters are deactivated by a thermal switch or by the defrost timer time limit.

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7.1.4.3 13986124



7.1.5 Replacement Parts

Parts lists are constantly revised. For the latest Replacement Parts lists go to the following location:

[Online Knowledge Base article # 298215.](#)

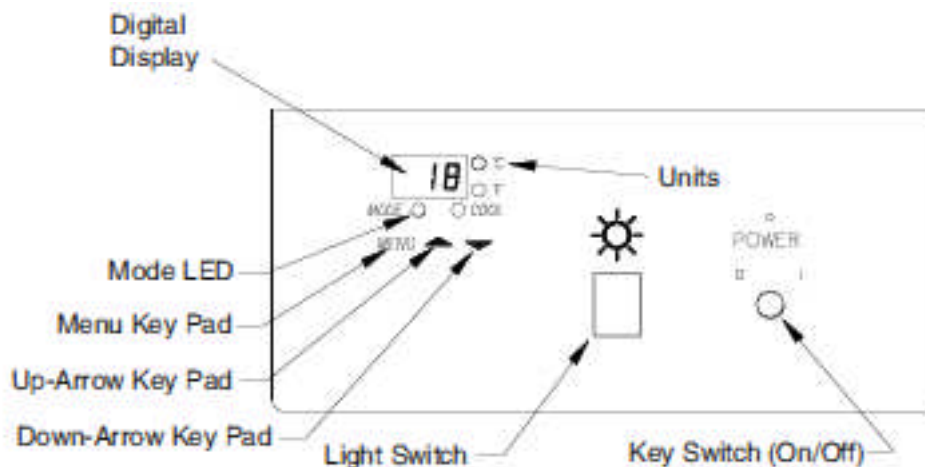
7.1.6 Specifications

7.1.6.1 Performance Characteristics

Temperature Range: 1° to 12°C (34° to 54°F)

Temperature Stability: $\pm 3^{\circ}\text{C}$

7.2 Base Controller – Freezer 103508 PCB



7.2.1 Temperature Controller

The digital temperature controller is located on the center of the header panel. When the unit is initially turned on, the display will indicate current chamber temperature. The temperature units will be indicated by the °C or °F LED located just to the right of the temperature display. The freezer is factory set to -15°C. A time delay is programmed

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into the controller to provide sufficient time for the system pressure to equalize. When the delay time is over, the Cool LED will illuminate, the compressor will run and the chamber will cool.

Note the compressor requires a time delay between activations. The unit will not cool during this delay. This delay time will also be in effect immediately after power-up.

7.2.2 Setting the Temperature

1. To change the set temperature, press and release the Menu keypad once.
2. The display will flash SP and the Mode LED will be illuminated. The last set temperature will then be shown in the display.
3. Press the UP or DOWN arrow key, to change the temperature setting.
4. The adjustable temperature range is 0 to -30°C (32 to -22°F).
5. When the desired set temperature is displayed, press the Menu keypad to enter the set temperature and activate the Units Select menu.

Note While in any of the controller mode setups (temp set, units or calibration offset), the controller will wait 15 seconds for a value to be entered. If there is no keypad operation within the 15-second time window, control will automatically revert to the temperature display mode and the Mode LED will turn off.

7.2.3 Units Select

The second menu selects the units. The freezer control displays temperature in °C or °F. The factory setting is °C.

1. From the temperature display mode (Mode LED off), press the Menu key twice to display the current temperature units.
2. To switch between units, press the UP or DOWN arrow key to change to the desired units, then press the Menu key to select.

The desired unit LED will be displayed on the right of the temperature display.

7.2.4 Calibration Offset

In the event the freezer needs calibration, a simple routine is available to adjust the display and control point to a reference standard.

1. To set the temperature offset, press and hold the Menu keypad for 5 seconds. The display will flash oS (offset) followed by the last temperature offset value. The factory setting is 0.
2. To change the offset value, press the UP or DOWN arrow key, then press the Menu key.
3. The value shown in the display will be added to the previous temperature reading. The maximum off-set value is $\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$).

For Example:

The freezer has been operating at -15°C for 30 minutes. The display indicates -15°C but a reference thermometer in the chamber indicates -17°C. The operator presses and holds the Menu keypad for 5 seconds and changes the offset value from 0 to -2. The Menu key is pressed until the Mode LED goes out. Now the display indicates a chamber temperature of -17°C and the system begins to control to the desired temperature of -15°C.

Allow an additional 30 to 40 minutes for the freezer to stabilize. If the display is still inaccurate, repeat the calibration offset procedure.

7.2.5 Hold-Off Time

Following the offset menu is the hold-off (Ho) menu. The display will momentarily flash “Ho”, followed by a number. The number shown is the delay time in minutes between compressor activations. Use the UP/DOWN keypads to change the value.

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Increasing the hold-off time will allow additional time for the evaporator to defrost during the off-cycle. This can reduce the chance of evaporator freeze-up during times of high humidity. Pressing the Menu keypad while in the Ho mode, enters the hold-off time displayed, and returns controller operation to the temperature display mode.

7.2.6 Error Codes

Error codes indicate when the controller is sensing a problem. A description of each is given below. See the Troubleshooting Table for additional information on error codes.

Error Code	Meaning
E1	Open sensor
E2	Under temperature. Temperature at sensor is less than -36°C.
E3	Over temperature. Temperature at sensor is greater than 37°C.

7.2.7 Interior Lights

Each cabinet has interior light(s) activated by a door switch(s). The lights are automatically turned on or off by opening or closing the door(s). Replace with 40 watt refrigerator grade bulb.

7.2.8 Defrost System

The defrost heaters are controlled by a defrost timer. The timer is a 24 hour dial timer located in a galvanized box behind the header panel. The timer is factory set to provide four defrost cycles per 24 hour period. The defrost heaters are deactivated by a thermal switch or by the defrost timer time limit.



Caution

Changes to the defrost cycle are not recommended and void the warranty.

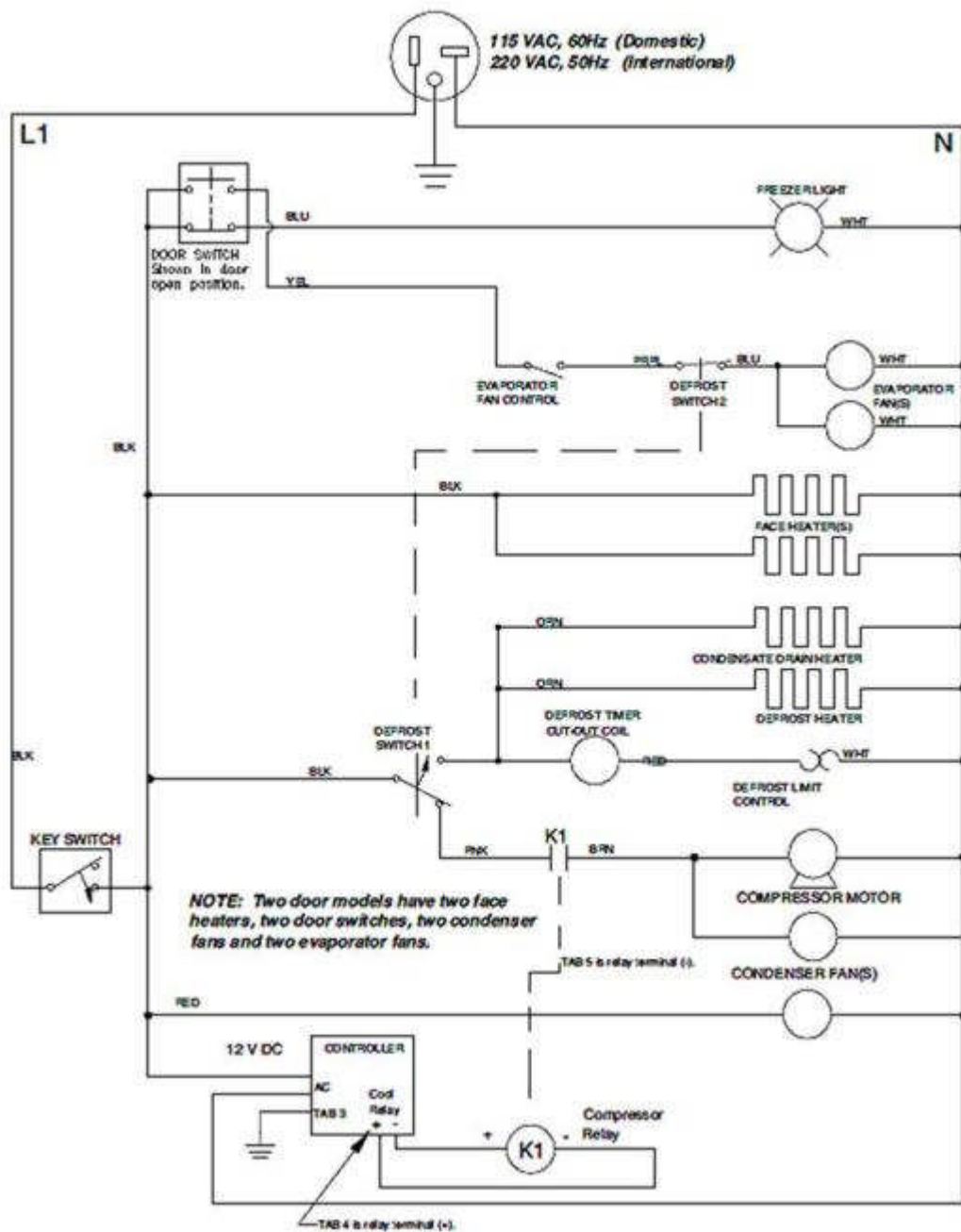


Note

The freezer will not cool while in the defrost mode, even if the *Cool* LED is illuminated.

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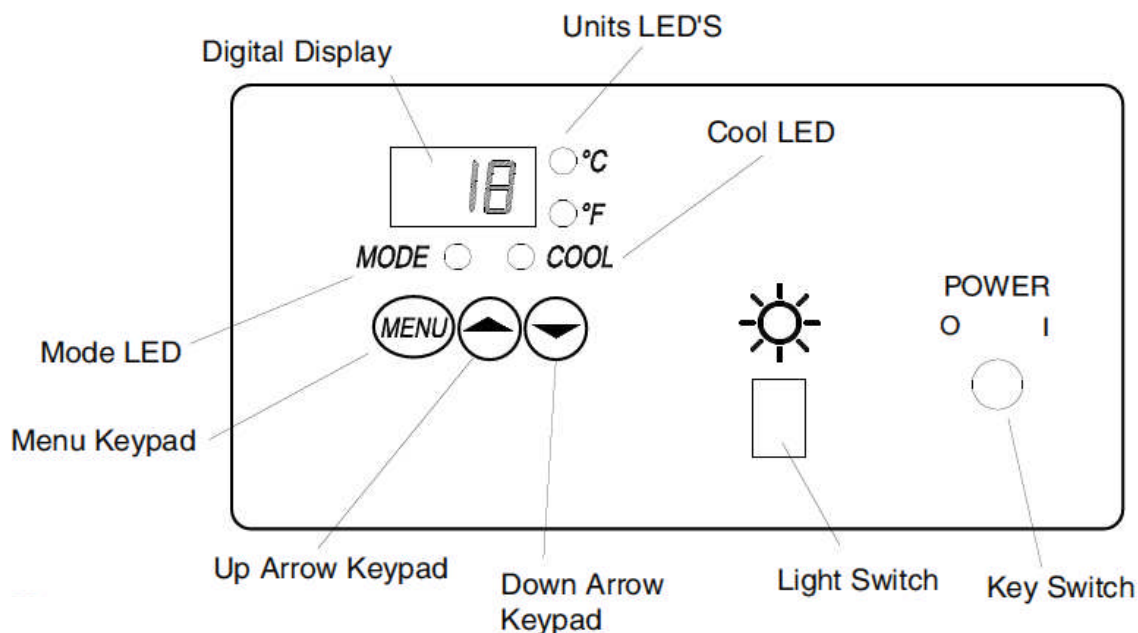
7.2.9 Wiring Diagrams



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7.3 Mid Range Controller – Refrigerator104161 PCB

7.3.1 Mid Range Controller – User Interface



7.3.1.1 Temperature Controller

The digital temperature controller is located on the left side of the header panel. When the unit is initially turned on, the display will indicate current chamber temperature. The temperature units will be indicated by the °C or °F LED located just to the right of the temperature display. The refrigerator is factory set at 4°C. When the unit is first energized the evaporator fans will operate however it will not immediately cool. A 3-minute compressor delay is programmed into the controller to provide sufficient time for the evaporator to defrost and to allow the system pressure time to equalize. When the delay time is over, the Cool LED will illuminate, the compressor will run and the chamber will cool.



The compressor requires a 3-minute delay time between activations. The unit will not cool during this delay. The delay is also activated when the controller is first energized.

7.3.1.2 Setting the Temperature

1. To change the set temperature, press and release the Menu keypad once.
2. The display will flash SP and the Mode LED will be illuminated. The last set temperature will then be shown in the display.
3. Press the UP or DOWN arrow key, to change the temperature setting.
4. The adjustable temperature range is 0 to -30°C (32 to -22°F).
5. When the desired set temperature is displayed, press the Menu keypad to enter the set temperature and activate the Units Select menu.

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7.3.1.3 Units Select

The second menu selects the units. The refrigerator control displays temperature in °C or °F. The factory setting is °C.

1. From the temperature display mode (Mode LED off), press the Menu key twice. The current temperature units are displayed.
2. To switch between units, press the UP or DOWN arrow key then press the Menu key to select. The unit LED will be displayed on the right of the temperature display.

7.3.1.4 Calibration Offset

In the event the refrigerator needs to be calibrated, a simple routine is available to adjust the display and control point to a referenced standard.

1. To set a temperature offset, press and hold the Menu keypad for 5 seconds. The display will flash oS followed by the last temperature offset value. The factory setting is 0.
2. To change the offset value, press the UP or DOWN arrow key, then press the Menu key.
3. The value shown in the display will be added to the previous temperature reading. The display will then flash Ho.

For Example:

The display indicates 4°C but a reference thermometer in the refrigerator chamber indicates 6°C. The operator presses and holds the Menu keypad for 5 seconds, then changes the display value from 0 to +2 by using the UP arrow key. Press the Menu key again. Now the display indicates a chamber temperature of 6°C and the controller begins to cool (as long as 3-min. delay period has expired) to the desired temperature of 4°C as shown on the reference thermometer.

Allow an additional 30 to 40 minutes for the refrigerator to again stabilize. If the display is still inaccurate, repeat the calibration offset procedure.

7.3.1.5 Hold Off Time

Following the offset menu is the hold-off (Ho) menu. The display will momentarily flash "Ho", followed by a number. The number shown is the delay time in minutes between compressor activations. Use the UP/DOWN keypads to change the value.

Increasing the hold-off time will allow additional time for the evaporator to defrost during the off-cycle. This can reduce the chance of evaporator freeze-up during times of high humidity. Pressing the Menu keypad while in the Ho mode, enters the hold-off time displayed, and returns controller operation to the temperature display mode.

The factory setting is 3.



Caution

Decreasing the hold off time below factory setting may result in decreased compressor life.

7.3.1.6 Error Codes

Error codes indicate when the controller is sensing a problem. A description of each is given below. See the Troubleshooting Table for additional information on error codes.

Error Code	Meaning
E1	Open sensor
E2	Under temperature. Temperature at sensor is less than -36°C.
E3	Over temperature. Temperature at sensor is greater than 37°C.

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7.3.1.7 Fluorescent Lamps

The interior lamp is controlled by a rocker switch on the header panel. This light may be operated any time the cabinet power is turned on at the keyed power switch. If the interior lamp fails, replace with the same size and wattage lamp. **DO NOT USE REDUCED WATTAGE LAMPS.** The reduced wattage lamps generally fail to light below 60°F (15°C).

Be sure that lamps are properly installed by inserting ends into sockets and rotating lamp 90°. Failure to install lamps properly may cause damage to the lighting circuit.

7.3.1.8 Convenience Outlet

(Chromatography Refrigerators Only)

Chromatography Refrigerators come equipped with a convenience outlet located on the back wall. The outlet(s) is protected by a circuit breaker located near the outlet. The breaker limits the current available through the outlet and will “trip” if the rated current is exceeded. Pressing the breaker button resets the breaker after a “trip”.



Warning

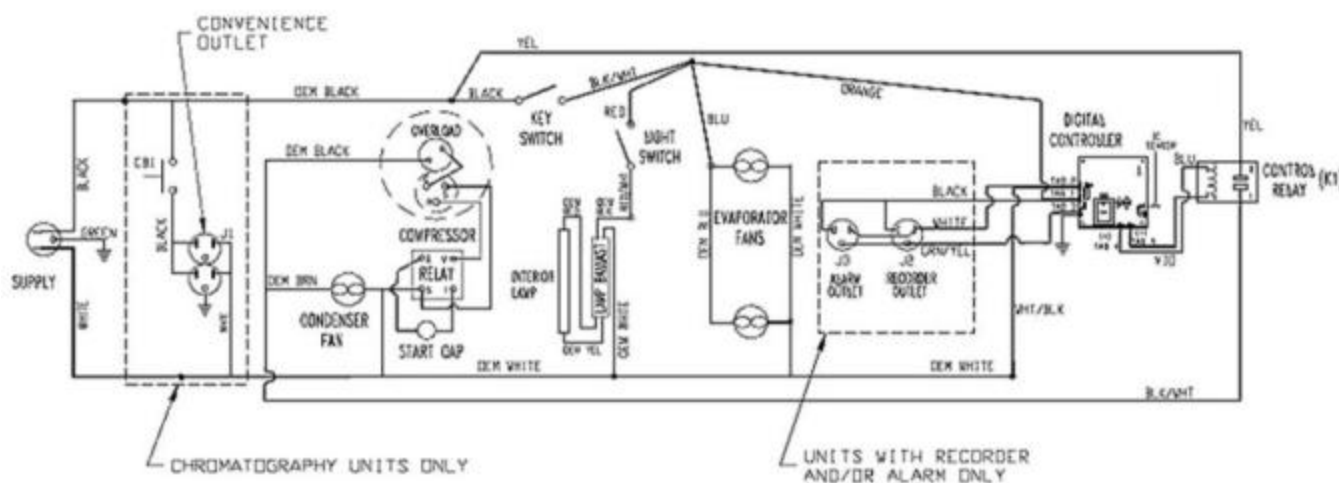
The convenience outlet is LIVE at any time the unit is connected to an electrical power source, regardless of the position of the key switch.

7.3.2 Replacement Parts

Parts lists are constantly revised. For the latest Replacement Parts lists go to the following location:

Online Knowledge Base article # 298215.

7.3.3 Wiring Diagram



WIRING SCHEMATIC 115V

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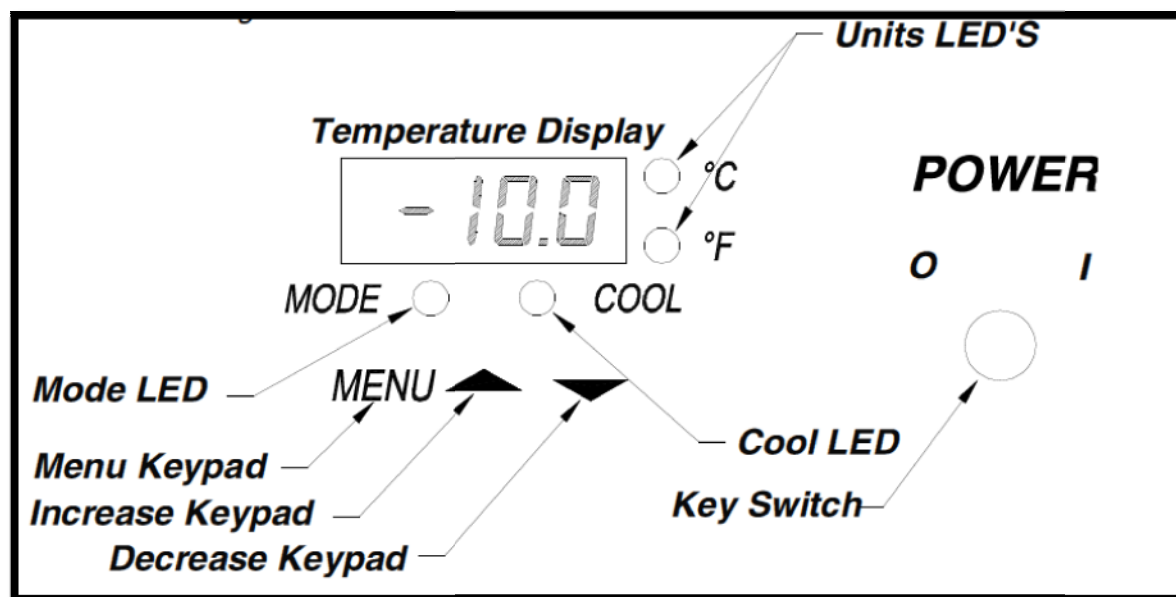
7.3.4 Specifications

7.3.5 Performance Characteristics

Temperature Range: 1° to 12°C (34° to 54°F)

Temperature Stability: $\pm 3^{\circ}\text{C}$

7.4 Mid Range Controller – Freezer 104161 PCB



7.4.1.1 Setting the Temperature Control Set point

1. To change the set temperature, press and release the Menu keypad once.
2. The display will flash SP and the Mode LED will be illuminated. The last set temperature will then be shown in the display.
3. Press the UP or DOWN arrow key, to change the temperature setting.
4. The adjustable temperature range is 0 to -30°C (32 to -22°F).
5. When the desired set temperature is displayed, press the Menu keypad to enter the set temperature and activate the Units Select menu.

7.4.1.2 Units Select

The second menu selects the units. The refrigerator control displays temperature in $^{\circ}\text{C}$ or $^{\circ}\text{F}$. The factory setting is $^{\circ}\text{C}$.

1. From the temperature display mode (Mode LED off), press the Menu key twice. The current temperature units are displayed.
2. To switch between units, press the UP or DOWN arrow key then press the Menu key to select. The unit LED will be displayed on the right of the temperature display.

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7.4.1.3 Calibration Offset

In the event the freezer needs to be calibrated, a simple routine is available to adjust the display and control point to a referenced standard.

1. To set a temperature offset, press and hold the Menu keypad for 5 seconds. The display will flash oS followed by the last temperature offset value. The factory setting is 0.
2. To change the offset value, press the UP or DOWN arrow key, then press the Menu key.
1. The value shown in the display will be added to the previous temperature reading. The display will then flash Ho. The maximum offset value is $\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$).

For Example:

The freezer has been operating at -15°C for 30 minutes. The display indicates -15°C but a reference thermometer in the refrigerator chamber indicates -17°C . The operator presses and holds the Menu keypad for 5 seconds and changes the offset value from 0 to -2. The Menu key is pressed again. Now the display indicates a chamber temperature of -17°C and the system begins to control to the desired temperature of -15°C (as long as the 3 min. time delay has expired).

Allow an additional 30 to 40 minutes for the freezer to again stabilize. If the display is still inaccurate, repeat the Calibration Offset procedure.

NOTE: While in any of the controller mode setups (temp set, units or calibration offset), the controller will wait 15 seconds for a value to be entered. If there is no keypad operation within the 15-second time window, control will automatically revert to the temperature display mode and the Mode LED will turn off.



Caution

INCREASING the offset value DECREASES the temperature at which the system controls.

7.4.1.4 Hold-Off Time

Following the offset menu is the hold-off (Ho) menu. The display will momentarily flash “Ho”, followed by a number. The number shown is the delay time in minutes between compressor activations. Use the UP/DOWN keypads to change the value.

Increasing the hold-off time will reduce the number of com-presser activations, thus decreasing the amount of ice build up on the evaporator and reduce the defrost time.

NOTE: Increasing the Hold-Off time should never substitute the automatic defrost cycle.

7.4.1.5 Temperature Excursions

By pressing the Increase keypad, the display will show the warmest temperature recorded since the unit was energized or the digression values were reset. Pressing the Decrease keypad will display the coldest temperature recorded since the unit was energized or the digression values were reset.

1. To reset the temperature excursions values, simply press the Increase and Decrease keypads at the same time.
2. The display will show Clr, indicating the controller will begin recording new warm and cold digressions once more. These values are also reset when power is turned off.

7.4.1.6 Automatic Defrost

All freezers are equipped with automatic defrost timers. The timers are factory set to complete four defrost cycles every 24 hour period. Each defrost cycle lasts approximately 40 minutes. During a defrost cycle, the evaporator heaters are energized and the chamber temperature increases. Also, the compressor motor is held off, even though the Cool LED is illuminated.

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7.4.1.7 Error Codes

Error codes indicate when the controller is sensing a problem. A description of each is given below. See the Troubleshooting Table for additional information on error codes.

Error Code	Meaning
E1	Open sensor
E2	Under temperature. Temperature at sensor is less than -36°C.
E3	Over temperature. Temperature at sensor is greater than 37°C.

7.4.1.8 Interior Lights

The interior lighting automatically turns on when the door is opened. If the interior lamp fails, replace with the same size and wattage lamp. DO NOT USE REDUCED WATTAGE LAMPS. The reduced wattage lamps generally fail to light below 60°F (15°C). All replacement lamps should be plastic coated.

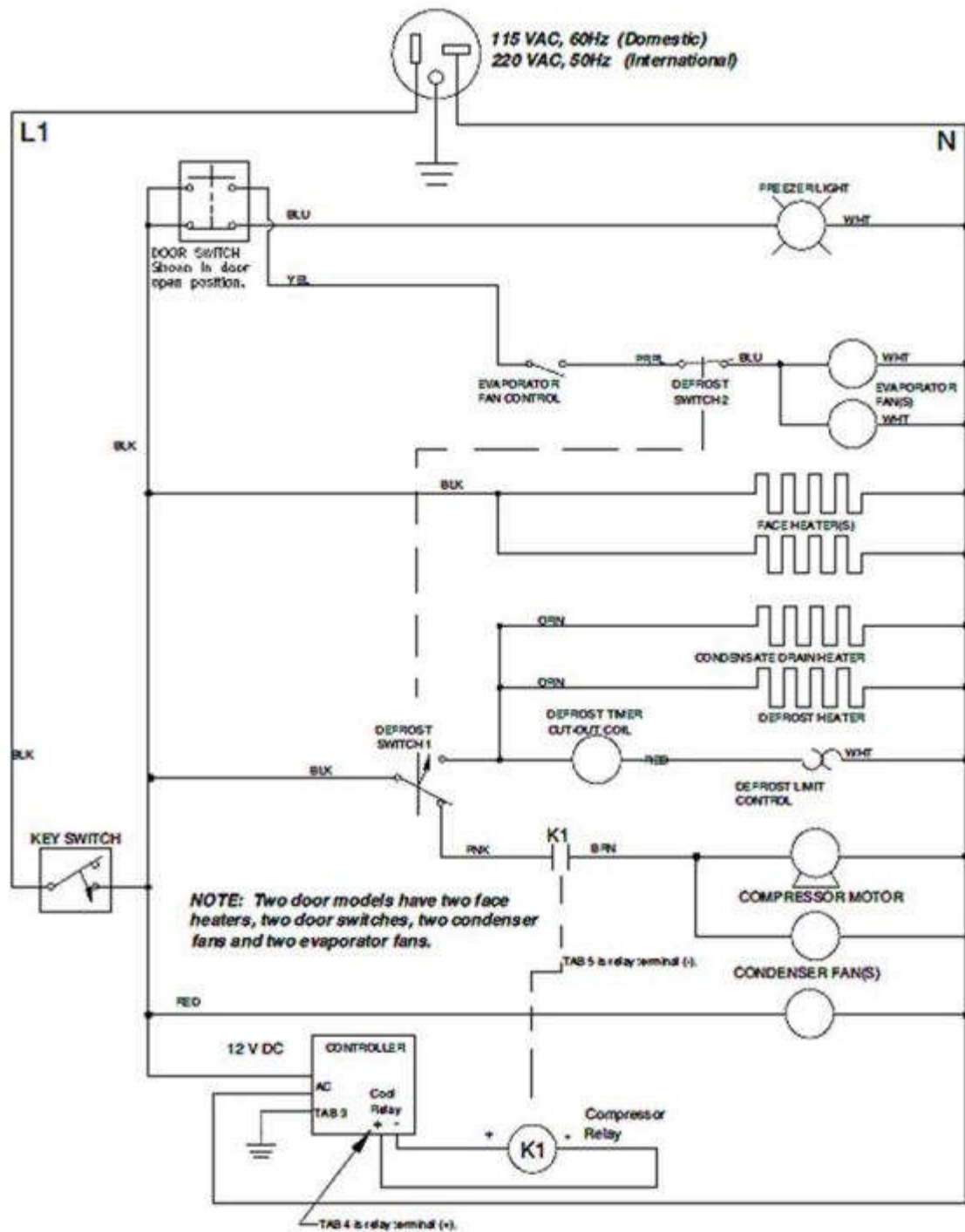
7.4.1.9 Replacement Parts

Parts lists are constantly revised. For the latest Replacement Parts lists go to the following location:

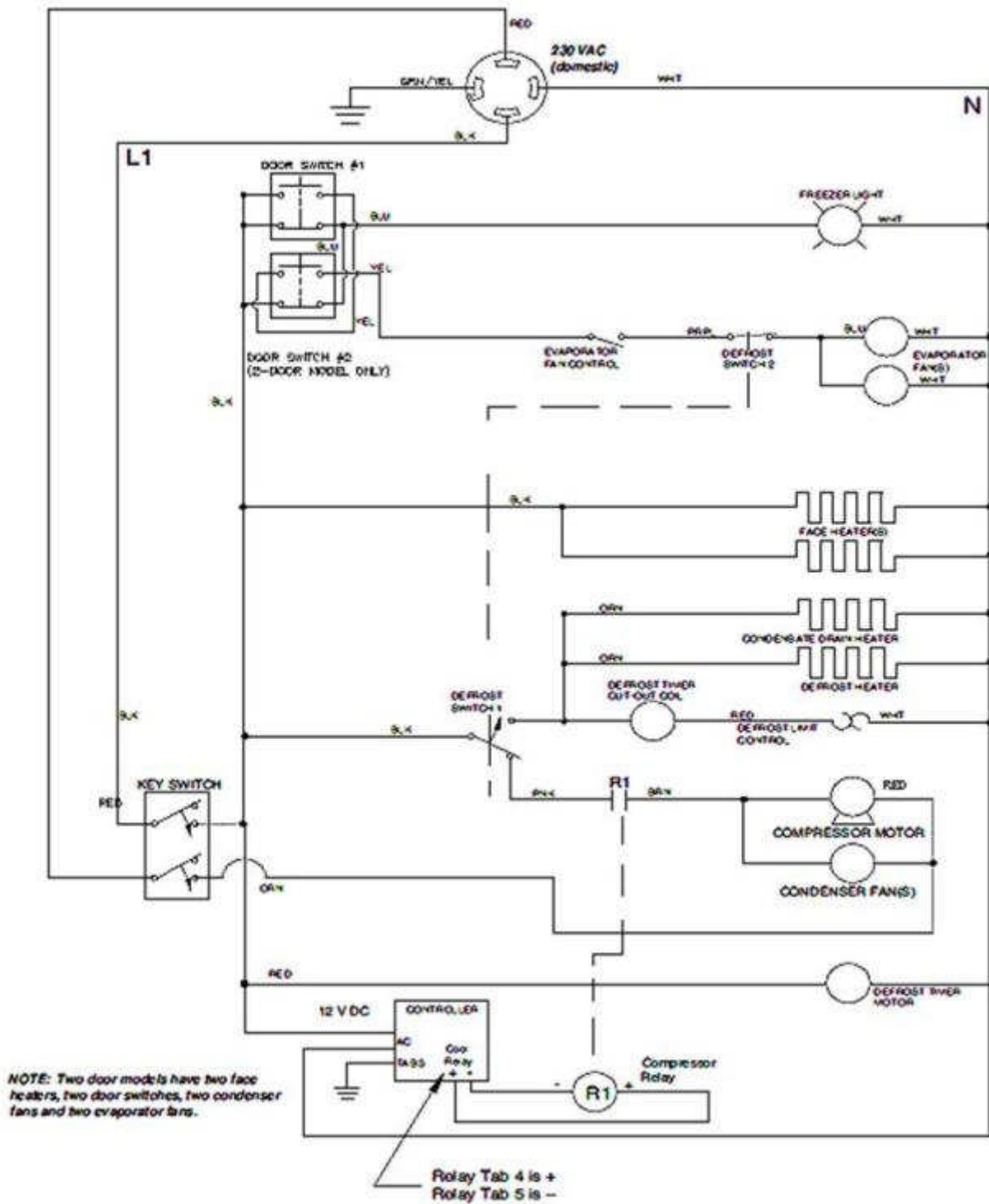
[Online Knowledge Base article # 298215.](#)

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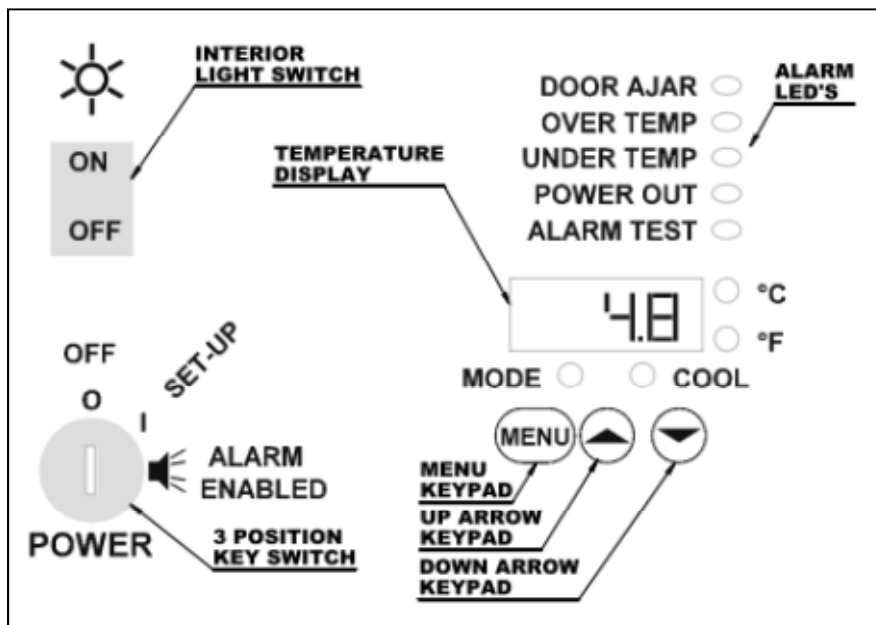
Wiring Diagrams



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7.5 High Controller – Refrigerators 104162 PCB, 316637H01 PCB, and 316637H02 PCB (MC Units)



7.5.1 Displays and Features

On the right side of the header panel is the key switch. The key switch has three positions, OFF (O), Set-up (I) and Alarm Enable (4). With the refrigerator plugged in and the key switch in the OFF position, the displays and refrigeration system are off. The control board remains energized in order to supply a charge to the battery.

7.5.2 Key Switch

Turning the key switch to the middle position energizes the circulation fans and the controller display. When the controller is in the Set Up mode, the menu items can be set to the desired values. See Controller Set Up for a description of each. Once all menu items are set, the refrigerator can then be switched to the Alarm Enable. While in the Alarm Enable position, the menu items can be viewed but not changed. The key can then be pulled to secure the values entered.

7.5.2.1 Temperature Display

The temperature display indicates chamber temperature while in the control mode of operation and menu titles and values while entering menu items (see Menus).

7.5.3 Units LED'S

The temperature display indicates chamber temperature in both °C and °F. The current units are indicated by the corresponding LED located to the right of the temperature display.

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7.5.3.1 Mode LED

The Mode LED is lit when the Menu keypad has been pressed. It indicates to the user that the controller is in the menu selection mode.

7.5.3.2 Cool LED

The Cool LED is lit when the controller calls for cooling. When this LED comes on the compressor should energize.

7.5.3.3 Alarm LED'S

- Door Ajar - This LED is illuminated when a refrigerator door(s) is opened. This feature is not used in the sliding glass door models, since the circulating fans run continuously and the doors are spring loaded.
- Over Temp – Indicates the current chamber temperature exceeds the high alarm temperature set point.
- Under Temp – Indicates the current chamber temperature is lower than the low alarm temperature set point.
- Power Out – Indicates AC power to the refrigerator is disrupted.
- Alarm Test – Indicates the controller is running an alarm test.

7.5.3.4 Keypads

- Menu Keypad – Pressing the Menu keypad enters the controller into the menu selection mode, designated by the illumination of the MODE LED. Repeatedly pressing the Menu keypad cycles through the list of menu items (see Menus). After the final menu, the controller returns to the control mode and the MODE LED turns off.
- Up Arrow Keypad – Increases or changes menu values.
- Down Arrow Keypad - Decreases or changes menu values.

7.5.4 Interior Light Switch

The interior lamp(s) is controlled by a rocker switch located on the header panel. This light may be operated any time the cabinet power is turned on at the keyed power switch. If the interior lamp fails, replace with the same size and wattage lamp. **DO NOT USE REDUCED WATTAGE LAMPS.** The reduced wattage lamps generally fail to light below 60°F (15°C).

Be sure that lamps are properly installed by inserting ends into sockets and rotating lamp 90°. Failure to install lamps properly may cause damage to the lighting circuit.

7.5.5 Controller Set up (Menus)

During normal operation (control mode), the refrigerator temperature is displayed on the 4-character display. The compressor cycles on and off to control the chamber temperature between 1.0° and 12.0°C (33.8 to 53.6°F), selectable by the user. The temperature set point, high and low alarm set-points, units and display offset can be changed while the key switch is in the setup (middle) position. These values can be viewed but not changed with the key switch is in the alarm position. The menu options are explained in the following sections.

There are 8 menus to select from; each can be accessed by pressing the Menu keypad. Pressing the Menu keypad once brings up the first menu, which is the temperature set point. The displays initially flash SP followed by the last set temperature value. Pressing the Menu keypad again, accepts the value and displays the next menu, units select (CF). Each menu value is entered this way. The menus can be changed only while the key switch is in the set up (I) position. They can be viewed but not changed while the key switch is in the alarm enable (4) position. The individual menus are described below.

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7.5.6 Temperature Set point

Temperature Set Point (SP) – Adjustable from

1.0 to 12.0°C or 33.8 to 53.6°F. Use the Up/Down Arrow keypads to change the temperature and the Menu keypad to enter the value and switch to the next menu.

7.5.7 Units

Units select (C,F) - Selects the desired temperature display units in °C or °F.

1. Use the Up Arrow keypad to change the units from C to F.
2. Use the Down Arrow keypad to switch from F to C.
3. Press the Menu keypad to enter the unit's value and continue.
4. The appropriate units LED will indicate the selected units.

7.5.8 High Alarm Set Point

High Alarm Set Point (AH) – Use the Up/Down Arrow keypad to adjust the value that triggers a high alarm condition if the chamber temperature rises above high alarm temperature range. The high alarm temperature range is from -33.0°C (-27.4°F) to 37.0°C (98.6°F).

NOTE: The High and Low alarm set points can be adjusted to be within 3.5°C (6.3°F) of one another and no closer.

7.5.9 Low Alarm Set Point

Low Alarm Set Point (AL) - Use the Up/Down Arrow keypad to adjust the value that triggers a low alarm condition. The low alarm condition occurs when the actual chamber temperature drops below the Low Alarm Set Point. The low alarm range is from -36.0°C (-32.8°F) to 34.0°C (93.2°F).

7.5.10 Alarm Silencing Menu

Alarm Silencing (AS) – During an alarm condition, while the key switch is in the Alarm Enable Mode, this menu allows the user to silence the audible alarm for 5 minutes. After the AS stops flashing, the display will show n, press the Up Arrow keypad to change the display to y. Press the Menu Keypad and the audible alarm will turn off for 5 minutes.

7.5.11 Alarm Test Menu

Alarm Test (At) -Use the Up Arrow keypad to change the n to H. By subsequently pressing the Menu Keypad the controller will perform a High Alarm Test (see Alarm Test in Alarms section). Use the Down Arrow Keypad to change the display to L. Pressing the Menu Keypad will activate the Low Alarm Test. Pressing the Menu Keypad while the display shows n returns the unit to control mode (MODE LED off).

NOTE: While in any of the above menu options, the controller will wait 15 seconds for a new value to be entered. If there is no keypad activity within 15-seconds, the refrigerator will automatically shift to the Control Mode and the Mode LED will turn off.

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7.5.12 Calibration Offset

The two final menu items, calibrations offset and hold-off time (oS and Ho), are not accessible from the main menu. In order to view and/or change them, the Menu keypad must be pressed and held for 5 seconds. The calibration offset (oS) menu will then be displayed briefly followed by the most recent offset value.

- Display Offset (oS) – Use the Up/Down Arrow keypads to adjust the offset value. (Adjustable to +/- 5.0°C (+/- 9.0°F). This value is added to the temperature display to correct for differences between actual and displayed chamber temperature. See Calibration... for details. Press the Menu keypad to enter the new value or to continue to the next menu

7.5.13 Hold-Off Time

- Hold-Off (Ho) – Use the Up/Down Arrow keypads to adjust the Hold-Off time in minutes (Adjustable from 3 to 10). This value represents the delay time between compressor activations. Increasing the Hold-Off time can help prevent evaporator freeze-up by increasing the defrost cycle time. Press the Menu keypad to enter the new value and return to temperature control mode.

7.5.14 Control Mode

The Control Mode of operation is indicated when the Mode LED is OFF. With the desired temperature set point and alarm values entered, the refrigerator will then begin to control to the set temperature. There is a time delay between compressor activations. This delay begins the moment the controller is energized or the moment the compressor turns off during normal operation. The delay is added to provide time for the system pressure to drop before the compressor tries to start again.

7.5.15 Loading

Follow the guidelines below in order to provide optimal refrigerator performance:

When loading with critical samples, verify all alarms and features are operating properly.

Space samples uniformly in the chamber.

Keep samples away from the back wall that may obstruct airflow.

It is best to load the refrigerator from bottom to top. Keeping the area next to the air intake and exhaust clear will help assure proper airflow.

7.5.16 Temperature excursions

By pressing the Increase keypad while the refrigerator is in the Control Mode, the display will show the warmest temperature recorded since the unit was energized or the digression values were reset. Pressing the Decrease keypad will display the coldest temperature recorded since the unit was energized or the digression values were reset.

1. To reset the temperature excursions values, simply press the Increase and Decrease keypads at the same time.
2. The display will show Clr, indicating the controller will begin recording new warm and cold digressions once more.

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7.5.17 Alarms

Alarm Version Refrigerators are equipped with audible and visual alarms. They also feature remote alarm contacts. The key switch must be in the Alarm Enable position for the audible alarm and remote alarm contacts to activate. Alarm messages are shown on both the temperature display and in the row of Alarm LED's located above the temperature display. The following conditions will trigger an alarm:

- Chamber temperature is greater than the high alarm set point.
- Chamber temperature is less than the low alarm set point.
- Door has been left open for 3 minutes or more.
- AC power has been interrupted to the ref refrigerator.
- Open sensor

NOTE: The Door Ajar Alarm is not available on the sliding glass door models.

7.5.18 Over Temp Alarm

If the refrigerator chamber temperature rises above the High Alarm Set Point, the display will alternately flash the refrigerator chamber temperature and “High”. The Over Temp LED will be lit, the audible alarm will sound and the remote contacts will change state.

7.5.19 Under Temp Alarm

If the refrigerator chamber temperature falls below the Low Alarm Set Point, the display will alternately flash the refrigerator chamber temperature and “Lo”. The Under Temp LED will be lit, the audible alarm will sound and the remote contacts will change state.

7.5.20 Door Ajar Alarm

Swinging door models only

When a swinging door is opened, the Door Ajar LED lights and the display alternately flashes between the refrigerator temperature and “door”. If a door is opened for 3 minutes, the audible alarm will sound and the remote alarm contacts change state.

7.5.21 Power Loss Alarm

When AC power is lost, the display will alternately flash between the current refrigerator temperature and “Pout”, the Power Out LED will light, the audible alarm will sound and the remote contacts will change state. When power is restored, the display will continue flashing the “Pout” message until it is cleared by the user by pressing any of the keypads.

7.5.22 Alarm Silencing

The audible alarm can be silenced by deactivating it at the Alarm Silence Menu (see section earlier in this manual). The audible alarm will silence for 5 minutes. It will sound again at the end of the 5 minutes if the alarm condition persists. Alarm silencing does not affect the visual alarms.

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7.5.23 Alarm Test

The Alarm Test feature is used to verify proper alarm operation by simulating an increase or decrease in chamber temperature. The alarm test function will work for any value of high or low alarm set points. With the key switch in the Set Up Position the remote and audible alarms are not activated during an alarm test, as is the case in an actual alarm condition.

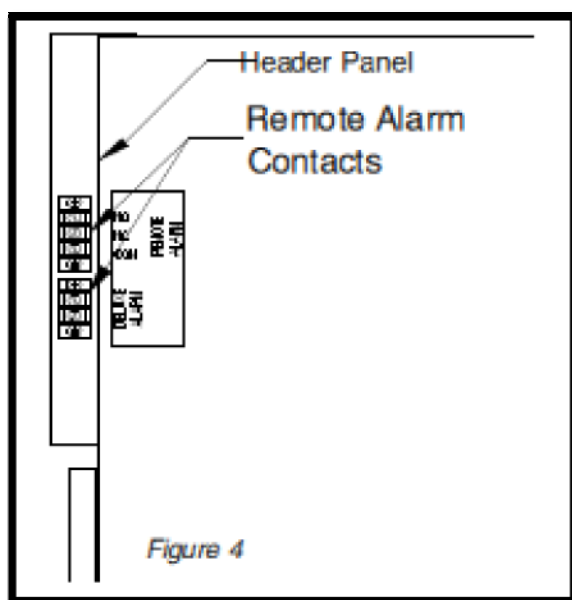
NOTE: The key switch should be in the Alarm Enable Position in order to test all alarm features.

Below, is the procedure for testing the alarms.

1. Press the Menu Keypad repeatedly until the display shows At (alarm test).
2. The display will change to **n**.
3. Press the Up Arrow Keypad to change the display from **n** to **H** in order to perform a high alarm test.
4. With the display showing **H**, press the Menu Keypad again and the temperature display will begin to rise until it reaches the High Alarm Set Point.
5. Once the set point is reached, both audible and visual alarms should be activated (with the key switch in alarm enable position) and the remote alarm contacts should change state.
6. To perform a low alarm, simply press the Down Arrow Keypad when the display shows **n**. The display will then show **L**. Press the Menu Keypad again in order to activate the low alarm test.

7.5.24 Remote Alarm Contacts

In addition to the audible and visual alarms, there are two sets of remote contacts on the side of the header panel, which change state during an alarm. The upper set of contacts provides both normally open and normally closed switching. The lower set of contacts is used for the Fisher Deluxe Remote Alarm System.



7.5.25 Contacts

All contacts are capable of switching up to 24 volts AC/DC @ 2 amps. The common (C) and normally closed (NC) contacts open during an alarm. The common (C) and normally open (NO) contacts close during and alarm. The contacts for the Deluxe Remote Alarm are normally closed and open during and alarm. Figure 4 shows the location of the remote and deluxe alarm contacts.

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Remote alarm contacts are active only with the key switch in the Alarm Enable position.

7.5.26 Open Sensor

When the controller is unable to read from the sensor, the display will show SnSr, indicating that a sensor error exists. The display will alternately flash SnSr and HigH. The audible alarm will sound, the remote alarm contacts will change state and the over temp LED will illuminate.

7.5.27 Battery Back Up

The Isotemp Plus Alarm Version Refrigerators are supplied with a rechargeable battery backup. The battery will continue to supply power to the controller and alarm features in the event of a power outage. A fully charged battery can continue powering the controller for up to 8 hours during a power failure. The battery is recharged by the temperature controller during normal operation. The battery should be checked every six months and replaced when necessary (see Replacement Parts). Check the battery by unplugging the refrigerator and monitoring the controller operation. If the controller does not properly activate the alarm features for 2 hours, replace the battery. Under normal operation, the battery backup should last up to four years or 200 charge/discharge cycles.

7.5.28 Calibration Using Temperature Offset

In the event the refrigerator needs to be calibrated, a simple routine is available to adjust the display and control point to a referenced standard. To set a temperature offset while in the Control Mode (mode LED off), simply press and hold the Menu key for 5 seconds. The display will flash oS followed by the last temperature offset value. The factory setting is 0.0. To change the offset value, press the Increase or Decrease keypad to the value which when algebraically added to the last displayed temperature, will agree with the reference temperature. Next, press the Menu key until the Mode LED turns off.

For Example:

The display indicates 4°C but a reference thermometer in the refrigerator chamber indicates 6°C. The operator presses and holds the Menu KEY until the display shows (oS) offset, then the value. Change the value from 0.0 to 2.0. The Menu key is then pressed repeatedly until the Mode LED turns off. Now the display indicates a chamber temperature of 6.0°C (approx.) and the controller begins to cool to the desired temperature of 4.0°C.

Allow an additional 30 to 40 minutes for the refrigerator to again stabilize. If the display is still inaccurate, repeat the calibration procedure.



Caution

INCREASING the offset value DECREASES the temperature at which the system controls. If the offset is inadvertently set too high, the chamber temperature can fall below zero and lead to evaporator freeze-up.

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7.5.29 Convenience Outlet

(Chromatography Refrigerators Only)

Chromatography Refrigerators are equipped with a convenience outlet located in the center of the back wall. Models 140A, 140RA, 141AAND 141 RA (three doors) have two convenience outlets. The power to the outlets is protected by a circuit breaker. The breaker is located just below and to the right of the outlet. Pressing the breaker button resets the breaker after a fault. The total load to one or both convenience outlets should not exceed 4 amps.



Warning

The convenience outlet is LIVE at any time the unit is connected to an electrical power source, regardless of the position of the key switch.

7.5.30 Replacement Parts

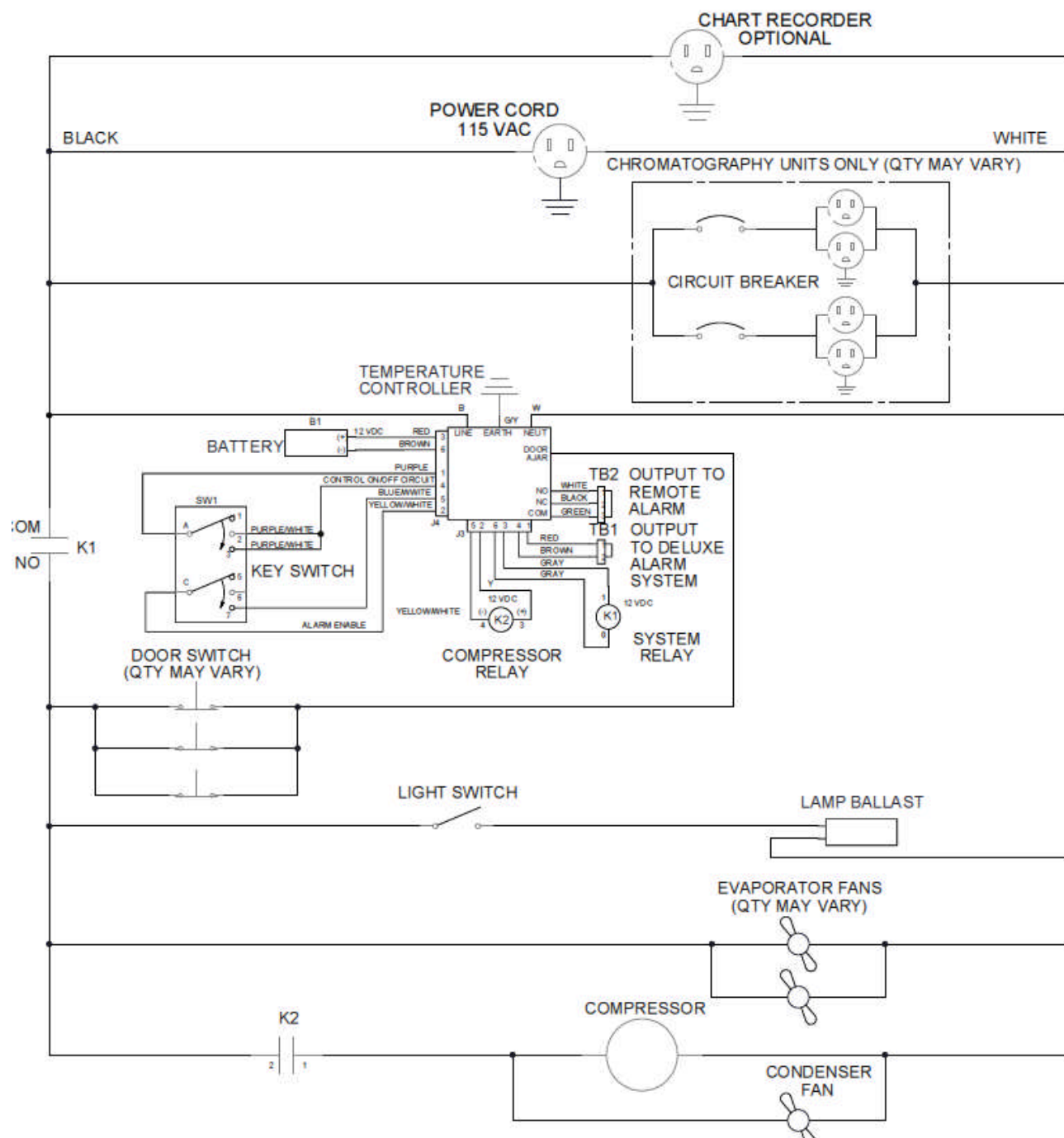
Parts lists are constantly revised. For the latest Replacement Parts lists go to the following location:

[Online Knowledge Base article # 298215.](#)

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7.5.31 Wiring Diagrams

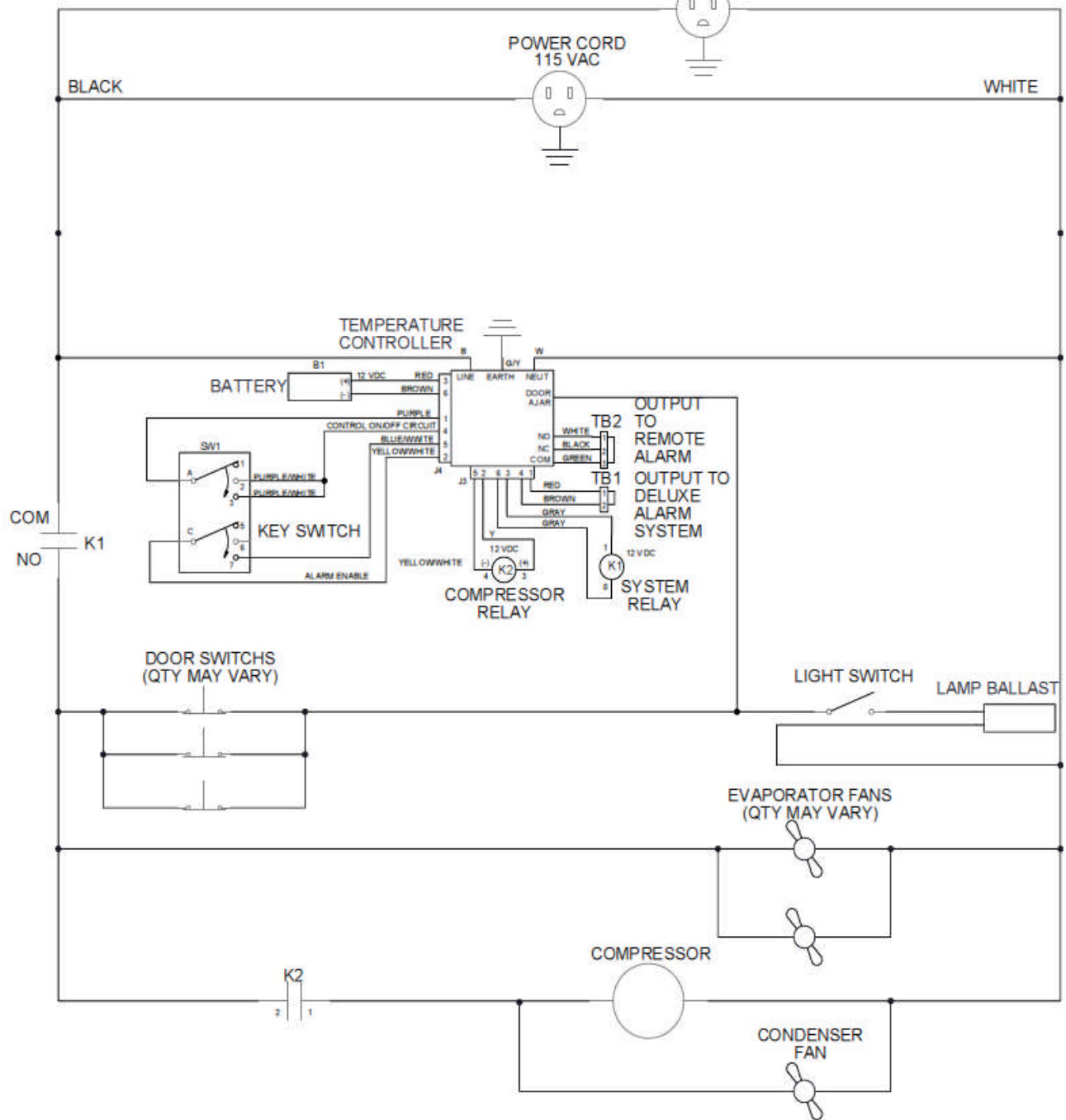
Hinged Glass Door Models



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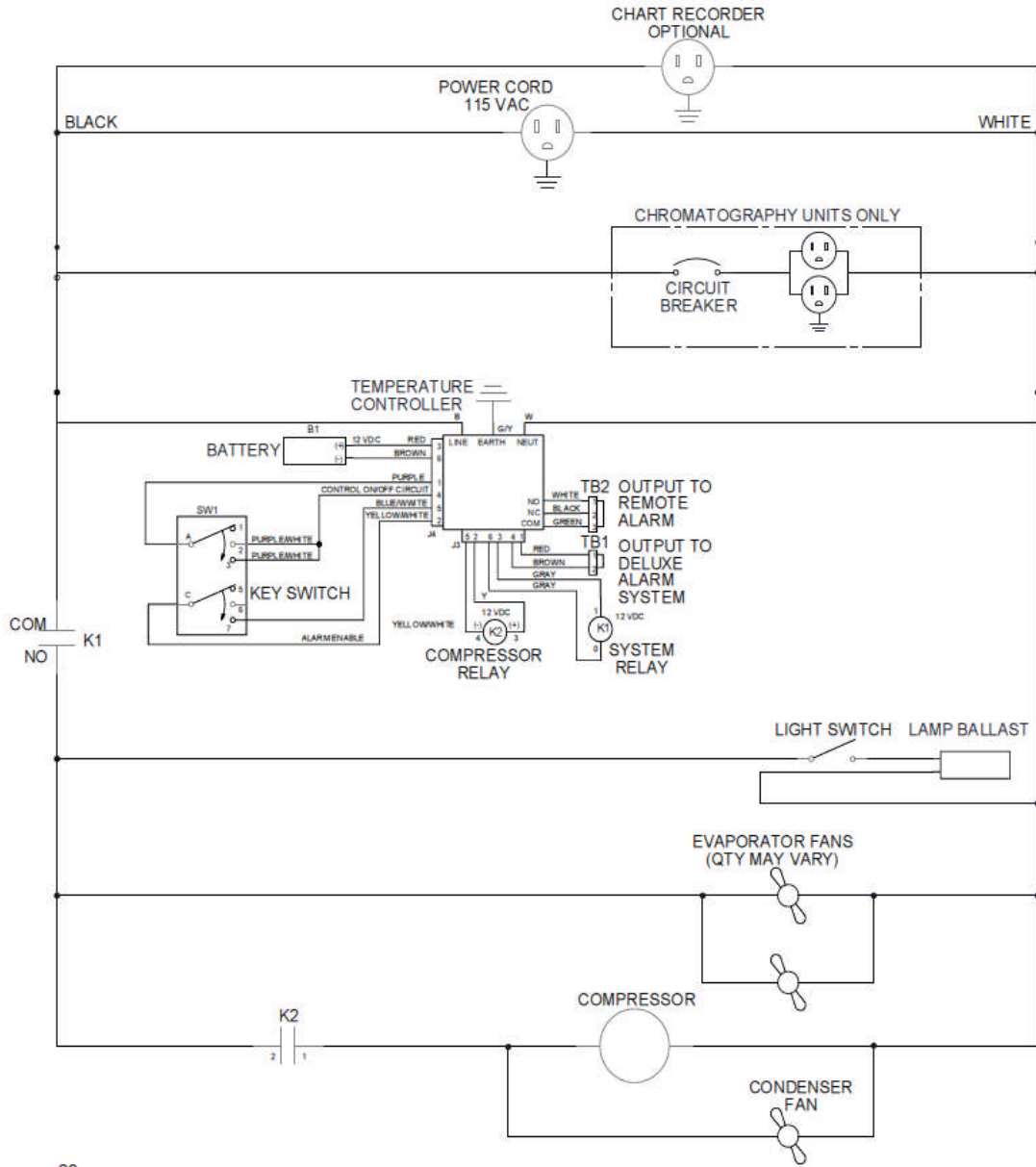
Hinged Solid Door Models

CHART RECORDER
OPTIONAL



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Sliding Glass Door Models

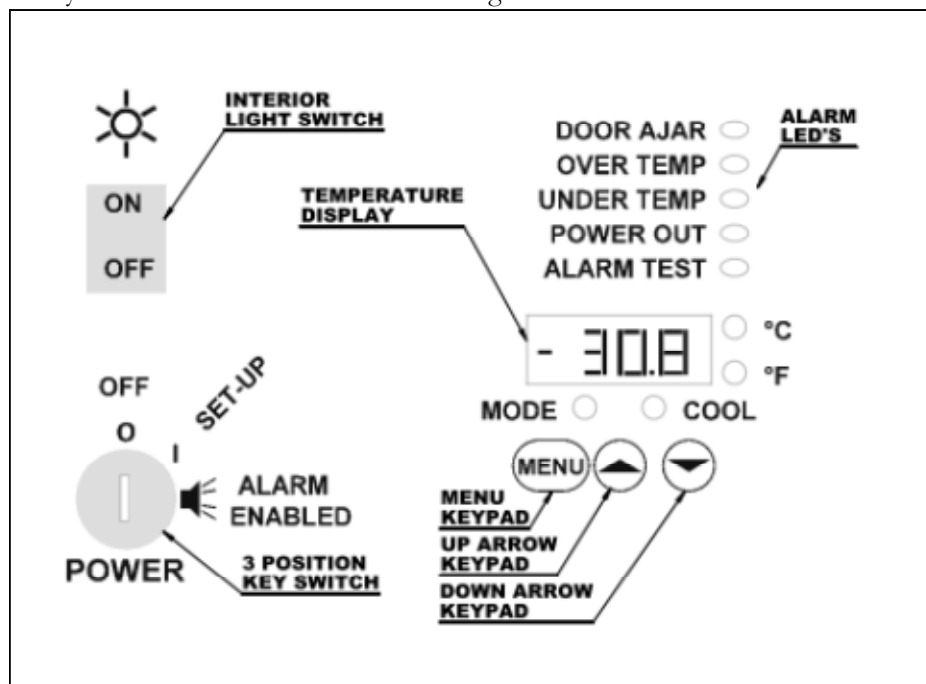


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7.6 High Controller – Freezers 104162 PCB and 316637H01 PCB

7.6.1 Displays and Features

Before operation, it is necessary to become familiar with the freezer controls. All the freezer controls are located on the header panel. A layout of the controller and LED's are given below.



7.6.2 Key Switch

On the right side of the header panel is the key switch. The key switch has three positions, OFF (O), Set-up (I) and Alarm Enable (X). With the freezer plugged in and the key switch in the OFF position, the displays and ref refrigeration system are off. The control board remains energized in order to charge the battery. Turning the key switch to the middle position (Set Up Mode) energizes the controller display. When the controller is in the Set Up mode, the menu items can be set to the desired values. See Controller Set Up for a description of each. Once all menu items are set, the freezer can then be switched to the Alarm Enable position. While in the Alarm Enable position, the menu items can be viewed but not changed. The key can then be pulled to secure the values entered.

7.6.3 Key Switch

On the right side of the header panel is the key switch. The key switch has three positions, OFF (O), Set-up (I) and Alarm Enable (X). With the freezer plugged in and the key switch in the OFF position, the displays and ref refrigeration system are off. The control board remains energized in order to charge the battery. Turning the key switch to the middle position (Set Up Mode) energizes the controller display. When the controller is in the Set Up mode, the menu items can be set to the desired values. See Controller Set Up for a description of each. Once all menu items are set, the freezer can then be switched to the Alarm Enable position. While in the Alarm Enable position, the menu items can be viewed but not changed. The key can then be pulled to secure the values entered.

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7.6.4 Temperature Display

The temperature display indicates chamber temperature while in the control mode of operation and menu titles and values while entering menu items (see Menus).

7.6.5 Unit's LED's

The temperature display indicates chamber temperature in both °C and °F. The current units are indicated by the corresponding LED located to the right of the temperature display.

7.6.5.1 Mode LED

The Mode LED is lit when the Menu keypad has been pressed. It indicates to the user that the controller is in the menu selection mode.

7.6.5.2 Cool LED

The Cool LED is lit when the controller calls for cooling. When this LED comes on the compressor should energize.

7.6.6 Alarm LED's

- Door Ajar - This LED is illuminated when a freezer door(s) is opened.
- Over Temp – Indicates the current chamber temperature exceeds the high alarm temperature set point.
- Under Temp – Indicates the current chamber temperature is lower than the low alarm temperature set point.
- Power Out – Indicates AC power to the freezer is interrupted.
- Alarm Test – Indicates the controller is running an alarm test.
- Menu Keypad – Pressing the Menu keypad enters the controller into the menu selection mode, designated by the illumination of the MODE LED. Repeatedly pressing the Menu keypad cycles through the list of menu items (see Menus). After the final menu, the controller returns to the control mode and the MODE LED turns off.
- Up Arrow Keypad – Increases or changes menu values.
- Down Arrow Keypad - Decreases or changes menu values.
- Interior Light Switch

7.6.7 Interior Light Switch

The interior lamp(s) is controlled by the door switch. If the interior lamp fails, replace with the same size and wattage lamp. DO NOT USE REDUCED WATTAGE LAMPS. The reduced wattage lamps generally fail to light below 60°F (15°C).

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7.6.8 Alarms

Alarm Version Freezers are equipped with audible and visual alarms. They also feature remote alarm contacts. The key switch must be in the Alarm Enable position for the audible alarm and remote alarm contacts to activate. Alarm messages are shown on both the temperature display and in the row of Alarm LED's located above the temperature display. The following conditions will trigger an alarm:

- Chamber temperature is greater than the high alarm set point.
- Chamber temperature is less than the low alarm set point.
- Door has been left open for 3 minutes or more.
- AC power has been interrupted to the freezer.

7.6.9 Over Temp Alarm

If the freezer chamber temperature rises above the High Alarm Set Point, the display will alternately flash the freezer chamber temperature and "High". The Over Temp LED will be lit, the audible alarm will sound and the remote contacts will change state.

7.6.10 Under Temp Alarm

If the freezer chamber temperature falls below the Low Alarm Set Point, the display will alternately flash the freezer chamber temperature and "Lo". The Under Temp LED will be lit, the audible alarm will sound and the remote contacts will change state.

7.6.11 Door Ajar Alarm

When a door is opened, the Door Ajar LED lights and the display alternately flashes between the freezer temperature and "door". If a door is opened for 3 minutes, the audible alarm will sound and the remote alarm contacts change state.

7.6.12 Power Loss Alarm

When AC power is lost, the display will alternately flash between the current freezer temperature and "Pout", the Power Out LED will light, the audible alarm will sound and the remote contacts will change state. When power is restored, the display will continue flashing the "Pout" message until it is cleared by the user by pressing any of the keypads.

NOTE: Power must be off for 30 seconds to activate an alarm.

Alarm Silencing

The audible alarm can be silenced by deactivating it at the Alarm Silence Menu (page 13). The audible alarm will silence for 5 minutes. It will sound again at the end of the 5 minutes if the alarm condition persists. Alarm silencing does not affect the visual alarms.

7.6.13 Alarm Test

The Alarm Test feature is used to verify proper alarm operation by simulating an increase or decrease in chamber temperature. The alarm test function will work for any value of high or low alarm set points. With the key switch in the Set Up Position the remote and audible alarms are not activated during an alarm test, as is the case in an actual alarm condition.

NOTE: The key switch should be in the Alarm Enable Position in order to test all alarm features.

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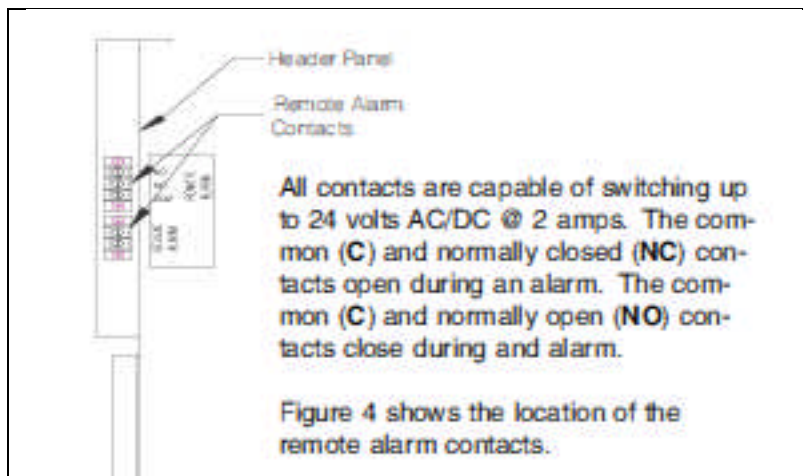
The procedure for testing the alarms is simple. Press the Menu Keypad repeatedly until the display shows At (alarm test). Momentarily, the display will change to n. Press the Up Arrow Keypad to change the display from n to H in order to perform a high alarm test. With the display showing H, press the Menu Keypad again and the temperature display will begin to rise until it reaches the High Alarm Set Point. Once the set point is reached, both audible and visual alarms should be activated (with the key switch in alarm enable position) and the remote alarm contacts should change state. To perform a low alarm test, simply press the Down Arrow Keypad when the display shows n. The display will then show L. Press the Menu Keypad again in order to activate the low alarm test.

During an Alarm Test, the Alarm Test LED is lit. The Alarm Test can be terminated at any time by pressing any of the keypads.

7.6.14 Remote Alarm Contacts

In addition to the audible and visual alarms, there are two sets of remote contacts on the side of the header panel, which change state during an alarm.

Remote alarm contacts are active only with the key switch in the Alarm Enable position.



7.6.15 Open Sensor

When the controller is unable to read from the sensor, the display will show SnSr, indicating that a sensor error exists. When a sensor error occurs, the controller will delay before activating a High Alarm condition. The High Alarm follows the sensor (SnSr) error since the temperature of an open sensor is interpreted as a temperature too high for the controller to read. The display will then alternately flash “SnSr” and “High”.

7.6.16 Battery Back Up

The Alarm Version Freezers are supplied with a rechargeable battery backup. The battery will continue to supply power to the controller and alarm features in the event of a power outage. A fully charged battery can continue powering the controller for up to 6 hours.

The battery backup is charged by the temperature controller during normal operation. The battery should be checked every six months and replaced when necessary. Check the battery by unplugging the freezer and monitoring the controller operation. If the controller does not properly activate the alarm features for 2 hours, replace the battery. Under normal operation, the battery backup should last up to four years or 200 charge/discharge cycles.

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7.6.17 Calibration Using Temperature Offset

In the event the freezer needs to be calibrated, a simple routine is available to adjust the display and control point to a referenced standard. To set a temperature offset while in the Control Mode (mode LED off), simply press the Menu key twice. The display will flash oS followed by the last temperature offset value. The factory setting is 0.0. To change the offset value, press the Increase or Decrease keypad to the value which when algebraically added to the last displayed temperature, will agree with the reference temperature. Next, press the Menu key until the Mode LED turns off.

For Example:

The display indicates -4°C but a reference thermometer in the freezer chamber indicates -6°C. The operator presses the Menu KEY twice and changes the offset (oS) display value from 0.0 to -2.0. The Menu key is pressed repeatedly until the Mode LED turns off. Now the display indicates a chamber temperature of -6.0°C (approx.) and the controller begins to cool to the desired temperature of 4.0°C. Allow an additional 30 to 40 minutes for the freezer to again stabilize. If the display is still inaccurate, repeat the calibration procedure.



Caution

DECREASING the offset value INCREASES the temperature at which the system controls. If the offset is inadvertently set too low, the chamber temperature can rise above freezing when attempting to control at 0.0°C.

7.6.18 Defrost Timer

All freezers come equipped with a 24 hour defrost timer. The timer will trigger a defrost cycle 4 times per 24 hours. When a defrost cycle begins, the display will alternately flash dfSt and the current chamber temperature. The defrost cycle typically lasts for 30 minutes or so, depending on the last freezer temperature. When a defrost cycle begins, the High Alarm is disabled for a period of 2 hours. This is to provide enough time for the defrost cycle to occur and for the freezer temperature to drop below the high alarm set point after the defrost period has ended.

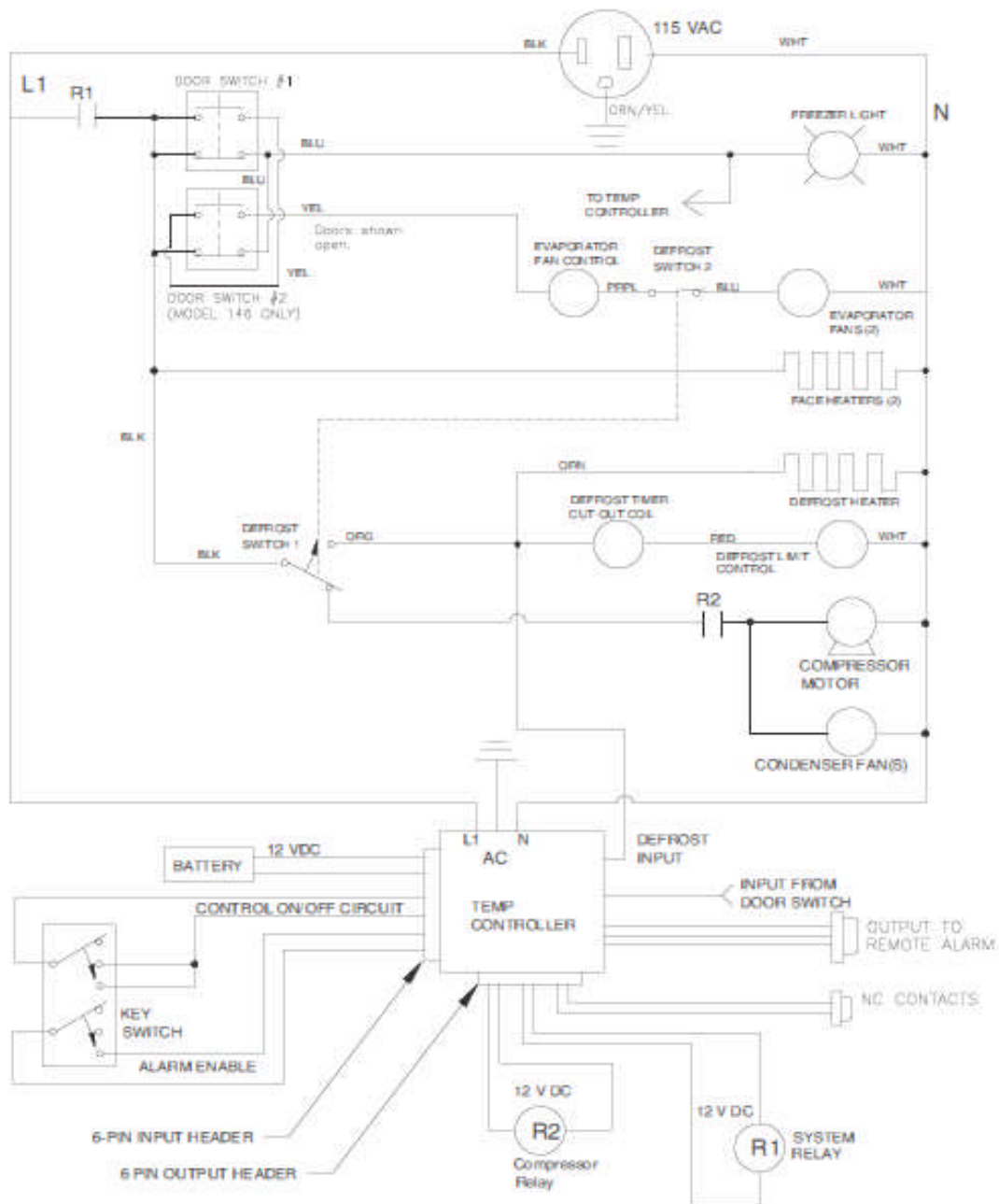
7.6.19 Parts Replacement

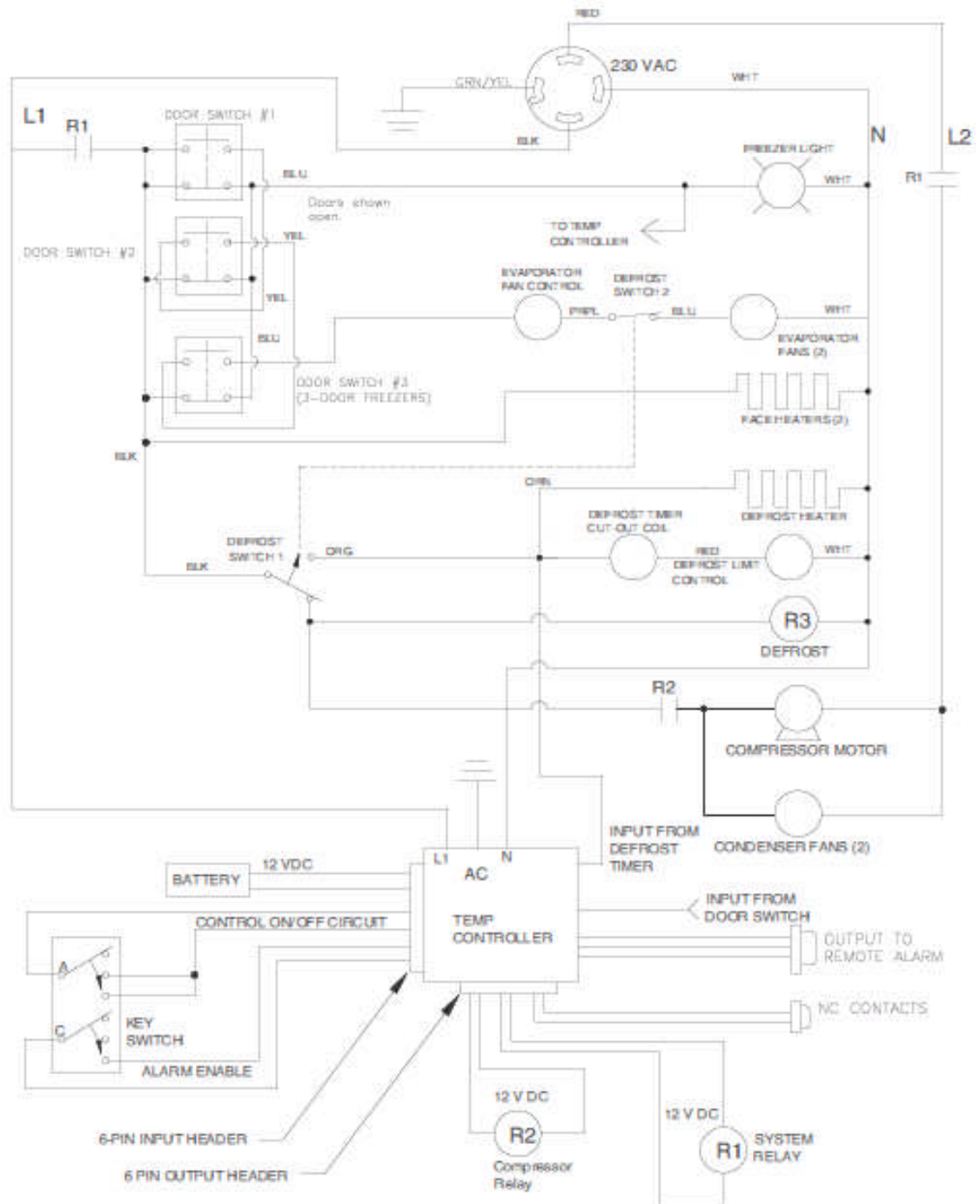
Parts lists are constantly revised. For the latest Replacement Parts lists go to the following location:

[Online Knowledge Base article # 298215.](#)

Wiring Diagrams

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8 Trouble Shooting

8.1 Basic Troubleshooting

This table is intended to assist in resolving user-correctable refrigerator problems by relating symptoms to their likely causes. If service beyond the scope of this table is required, contact Thermo Scientific Service Department at 1-800-438-4851.

Symptom	Probable Cause	Action
Does not run.	Unit unplugged. Blown fuse or tripped circuit breaker.	Plug in unit. Check fuse or circuit breaker at breaker box.
Runs continuously.	Frost buildup on refrigeration coils	Turn unit off and allow it to defrost. Note: Evaporator freeze-up can be caused by improper offset (oS) value.
Clicking sound.	The compressor is equipped with a thermal protector. This device shuts off the compressor when it becomes too hot. A clicking sound occurring about every 30 seconds indicates this protector is working.	Disconnect power and allow unit to sit for about an hour, and then retry. If condition persists, call for service.
Insufficient cooling.	Set temp is too high. Offset (oS) value is too low. Condenser coil dirty Relay (R1) is not functioning	Reduce temperature setting, verify <i>Cool</i> LED is on. Increase offset value. Clean condenser coil with a vacuum cleaner. Replace relay
Unit frosted.	Defrost unit.	
Evaporator frozen.	Verify internal circulating fans are operating.	

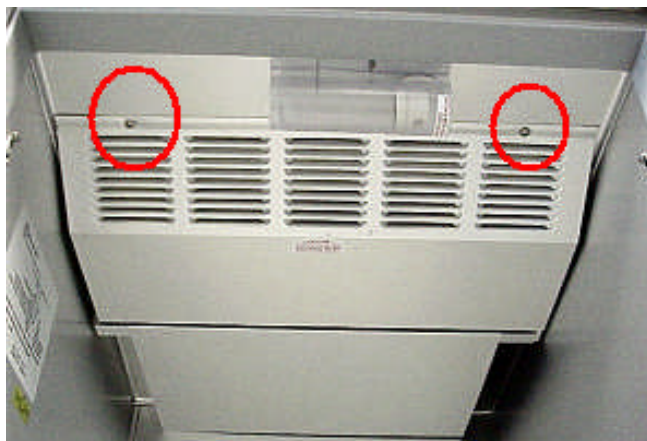
8.2 Advanced Trouble Shooting - Freezers

PRODUCT: Isotemp General Purpose Freezers	REV: B
CATALOG NUMBERS: 13-986-142 A/R/RA, -143 A/R/RA, -144 A/R/RA, -146 A/R/RA, -147 A/R/RA and 13-986-223F A/R, -247F A/R, 274F A/R.	ISSUED BY: MTM
SERIAL NUMBERS: na	ISSUE DATE: 1-21-04

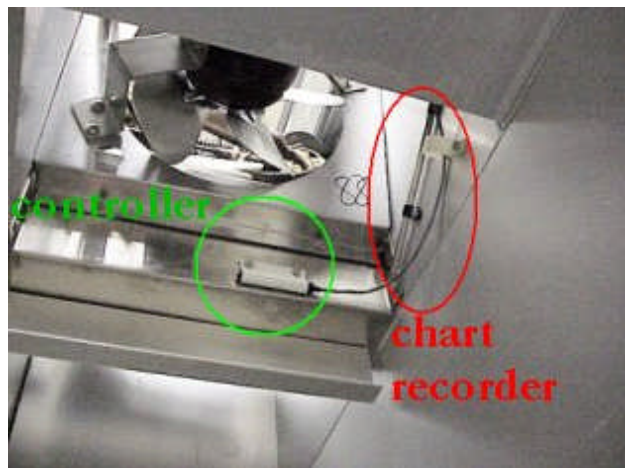
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DETAILS: This document is intended to assist customer/technical service, technicians, and customers in troubleshooting Isotemp General Purpose freezers based on the EF cabinet.

Note: In the event that the chamber ceiling panel needs to be removed,
Take out the 2 screws shown here:



Location of Temperature Sensor(s):



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compressor is not starting

x check whether cooling light is on. If not, suspect controller

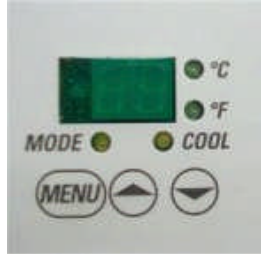
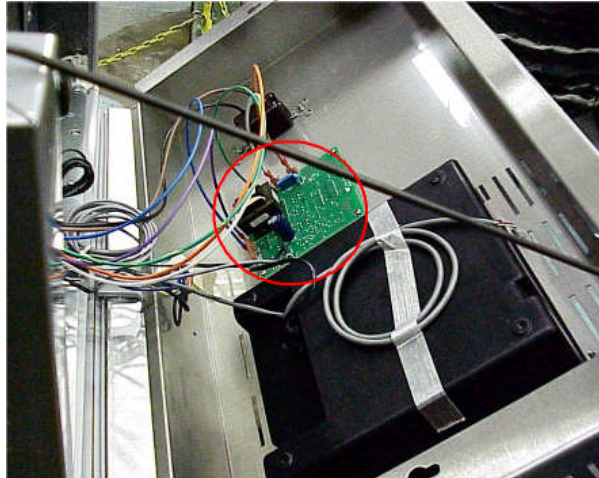
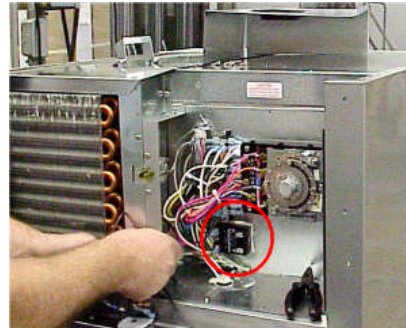


Figure 1.

x if cooling LED is ON, check voltage from controller to K1 relay

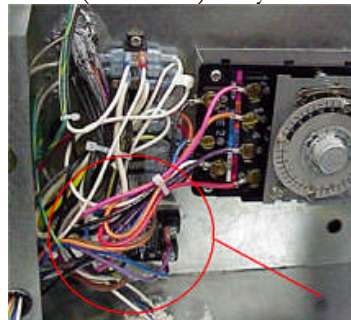


2. controller



3. controller relay

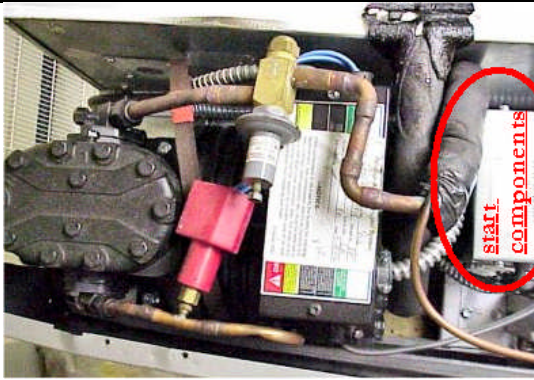
x check voltage from K1(controller) relay to start components



4. controller relay

x check compressor start components

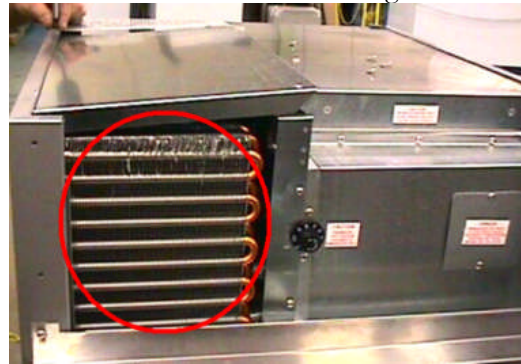
5. compressor and start components



- x check voltage at the compressor. Should be at least 110V.
- x check compressor windings

unit runs but chamber isn't getting cold (enough)

- x make sure condenser is free of dust and foreign material

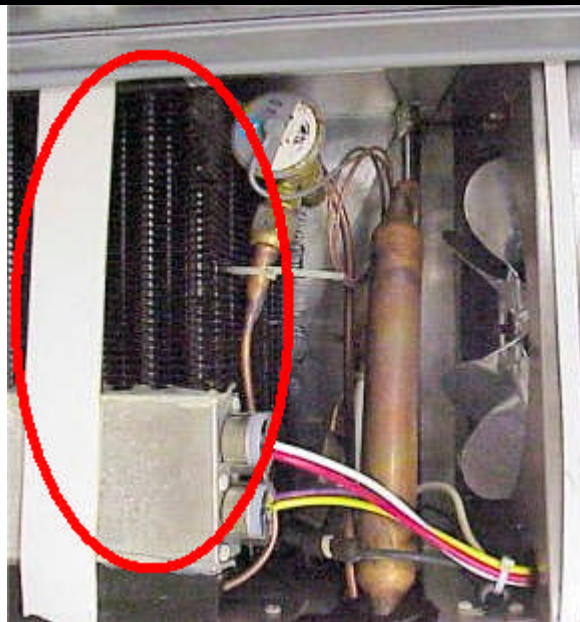


6. condenser

- x check for ice build-up in evaporator



7. evaporator lid



8. evaporator

x check for refrigerant leak

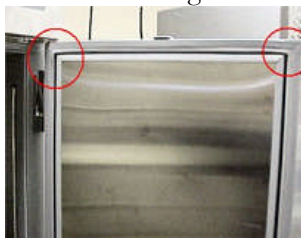
freezer getting too cold, keeps running after setpoint is achieved

x measure internal temperature with a NIST traceable thermometer or temperature sensor to verify that the display reading is accurate. If display does not agree with measured chamber temperature, follow procedure in manual for calibration offset.

x check controller relay (Figs. 3 & 4)

condensation forming on the outside front walls of freezer

x check that door gaskets are sealing properly



9.

x check grey plastic trim (breaker strips) around edges of the door opening. Verify that strips are aligned and flush with the face of the cabinet, so that there is no path for air leakage when door is closed.



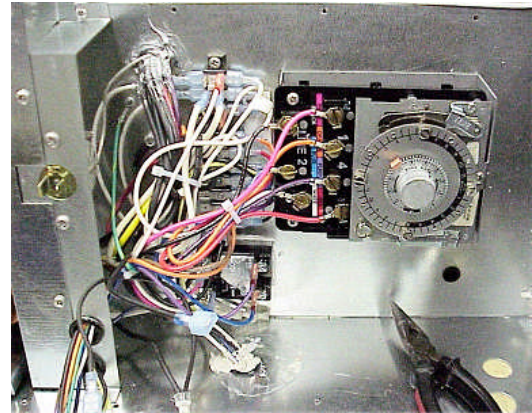
11.

x check face heater

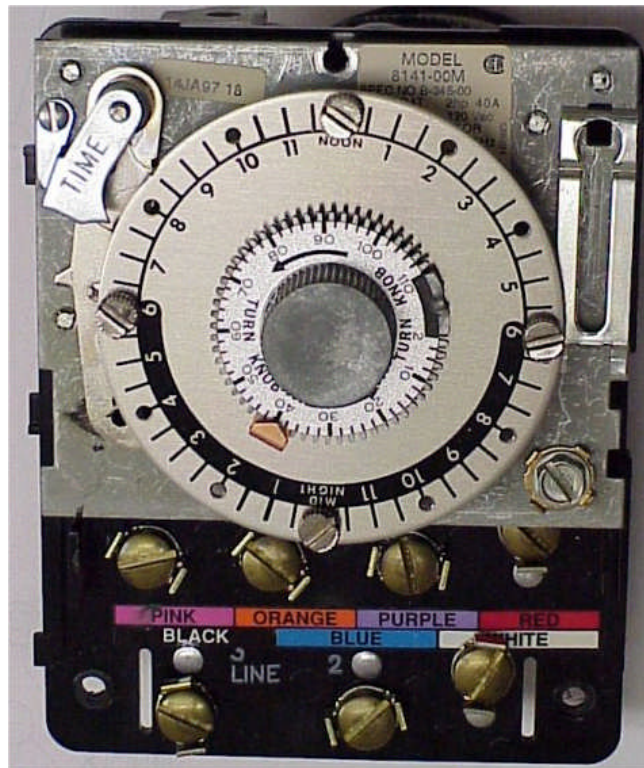
*UNITS SHOULD BE OPERATED IN AN AIR CONDITIONED ENVIRONMENT TO REDUCE THE AMOUNT OF HUMIDITY WITHIN THE OPERATIONAL AREA

defrost cycle running too long
(chamber gets too warm every 6
hours)

x check defrost timer



12. defrost timer (on right)



13.

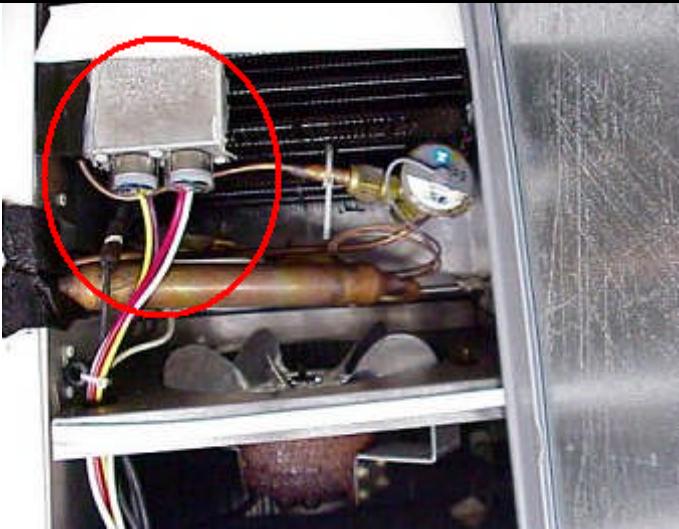
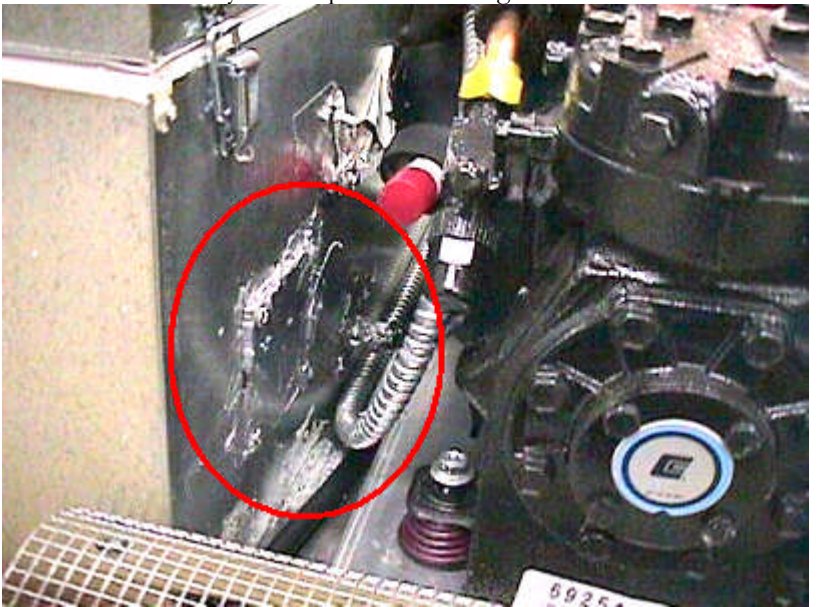
Setting Defrost Timer :

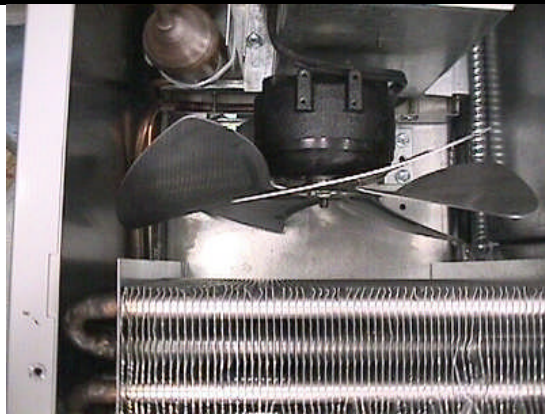
Verify that the four pins are present (thumb screws with a slot for a flat blade screw driver). Also check the defrost time setting (centerknob). The photo is set at 40 minutes.

As the defrost timer rotates, each pin moves the pointer (labeled "TIME") and begins the defrost event. This can be done manually to verify its operation.

x check defrost limit switch

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14.		
freezer keeps tripping the breaker	- x verify that line voltage and breaker rating are adequate - x check that unit is on a circuit by itself - x check that the power at the compressor is 110V or greater - x check compressor start components (Fig. 5)	
evaporator keeps icing up	- x was door left open recently? - x check door gasket (Fig. 9) - x check breaker strips around door opening (Fig. 11) - x check defrost timer (Fig. 12 & 13) - x check defrost termination switch (Fig. 14) - x check the defrost heater (wraps around evaporator) - x check for air leaks, especially around the evaporator lid gasket and around vacuum vent assembly on evaporator housing.	
15.		
Freezer making rattling/vibrating, etc noise	If it seems to be coming from outside the chamber: x check condenser fan	



16.

x check around compressor for shipping materials, etc that could be vibrating



17.

x check for cable ties, etc that may be hitting fan blade

x check compressor

If it seems to be from inside the chamber, near the top:

x check evaporator fan



18.

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8.3 Advanced Troubleshooting - Refrigerators

DETAILS: This document is intended to assist customer/technical service, technicians, and customers in troubleshooting Isotemp General Purpose refrigerators based on the MT cabinet.



Chamber ceiling with lighting fixture -This must be removed to gain access to the evaporator coils.



Evaporator pan -must also be removed to access evaporator coils.

Checking a refrigerator door seal*

1. *Open the door.*
2. *Insert a strip of paper (a couple of inches wide) between the door gasket and the cabinet and close the door.*
3. *Slowly pull the paper strip from the outside. You should feel some resistance.*
4. *Repeat this test at 4-inch intervals around the door.*

If the door does not seal properly on a level refrigerator, either replace the gasket or adjust the door(s).

*For swinging door models also check that the doors are positioned correctly with respect to the cabinet opening. This can be done by tracing around the outside of the door seal with a marker. Adjustment for this is done at the hinges.

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compressor is not starting

x Check whether cooling light is on. If not, suspect controller.

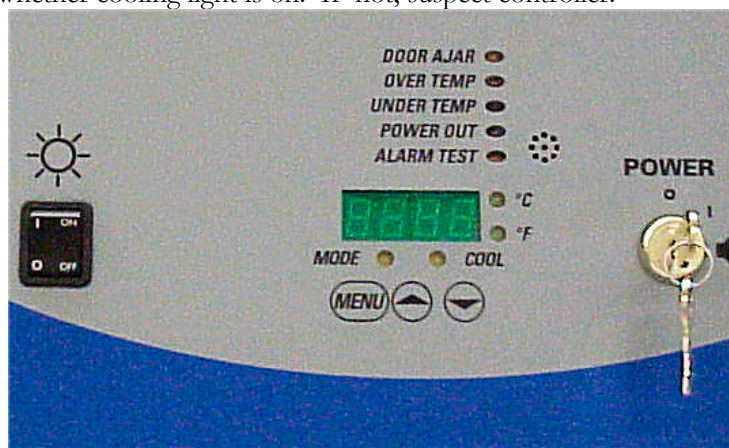


Figure 1.

x If cooling LED is ON, check voltage from controller to K1 relay

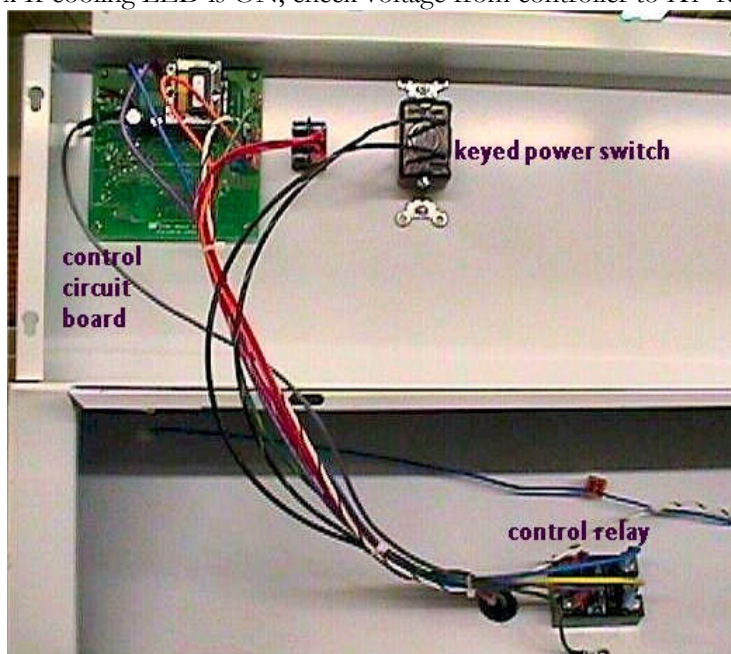


Figure 2. controller, control relay, and power switch

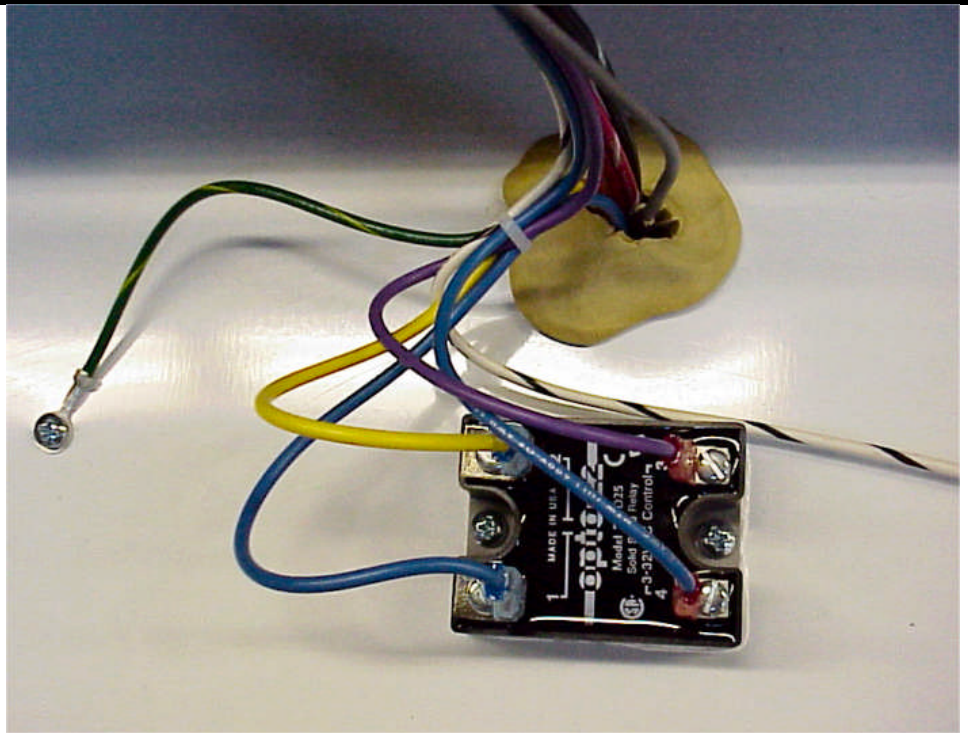


Figure 3. controller relay

x Check voltage from K1(controller) relay to start components

x Check compressor start components

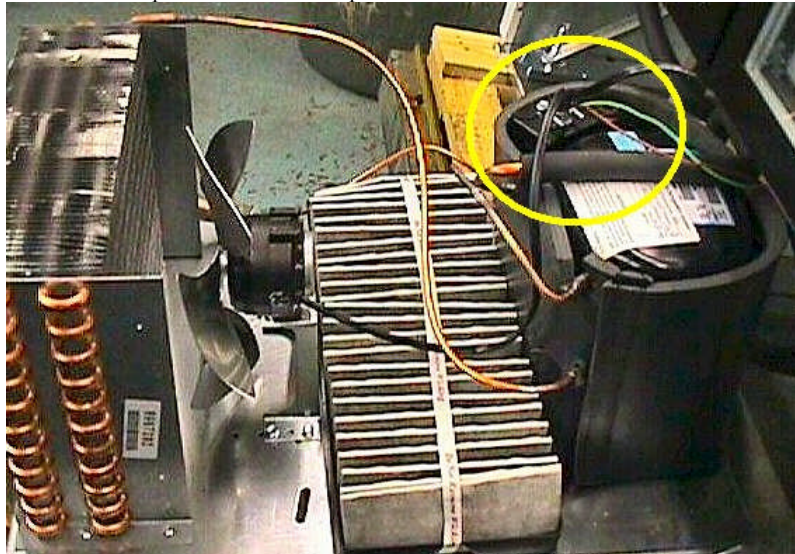


Figure 4. compressor and start components

x Check voltage at the compressor. -should be at least 110V

x Check compressor windings

unit runs but chamber isn't getting cold (enough)

x Make sure condenser is free of dust and foreign material

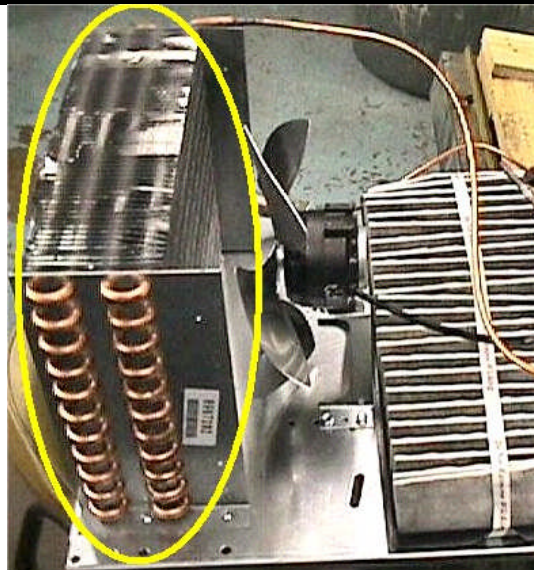


Figure 5. condenser

x Check for ice build-up in evaporator

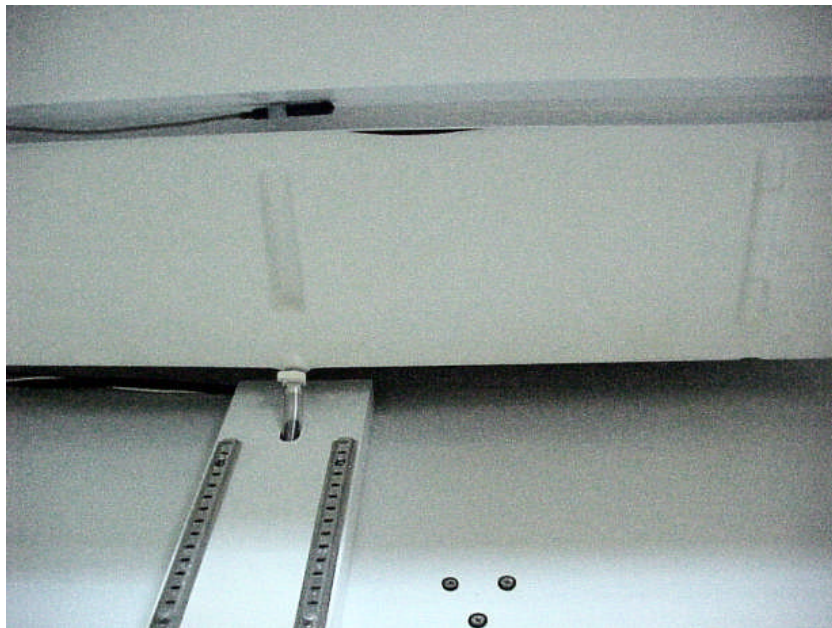


Figure 6. Evaporator pan, drain tube, and temperature sensor.



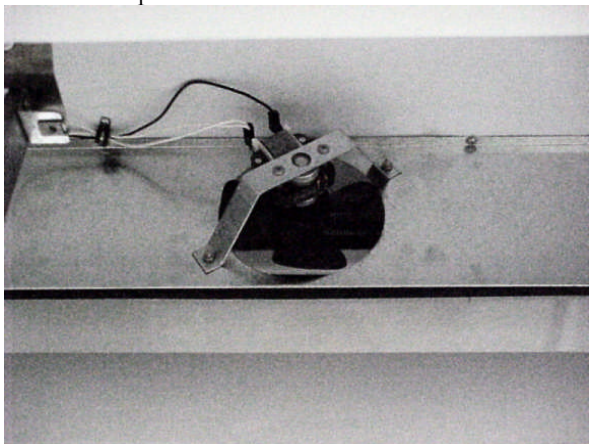
Figure 7. with ceiling panel & evaporator pan removed

x Check for refrigerant leak.

refrigerator gets too cold / too warm
before shutting off / turning on.

x Observe control panel. Does cooling LED turn off before the
chamber cools down to setpoint? Or does the cooling LED stay
on after setpoint temperature is met? If yes to either question:
x Measure internal temperature with a NIST traceable thermometer
or temperature sensor to verify that the display reading is accurate.

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	If display does not agree with measured chamber temperature, follow procedure in manual for calibration offset. x Check controller relay
condensation forming around the outside of door(s)	x Check that door gaskets are sealing properly: x Check plastic trim (breaker strips) around edges of the door opening. Verify that strips are aligned and flush with the face of the cabinet, so that there is no path for air leakage when door is closed. *UNITS SHOULD BE OPERATED IN AN AIR CONDITIONED ENVIRONMENT TO REDUCE THE AMOUNT OF HUMIDITY WITHIN THE OPERATIONAL AREA
refrigerator keeps tripping the breaker	x Verify that line voltage and breaker rating are adequate x Check that unit is on a circuit by itself x Check that the power at the compressor is 110V or greater x Check compressor start components
evaporator keeps icing up	x Was door left open recently? x Check door gaskets x Check breaker strips around door opening
refrigerator making rattling/vibrating, etc noise	If it seems to be coming from outside the chamber: x Check condenser fan x Check around compressor for shipping materials, etc that could be vibrating x Check for cable ties, etc that may be hitting condenser fan blade x Check compressor If it seems to be from <i>inside</i> the chamber, near the top: x Check evaporator fan  Figure 8. evaporator fan
water collecting on floor around refrigerator	x Make sure the drain tube is emptying into the condensate pan.

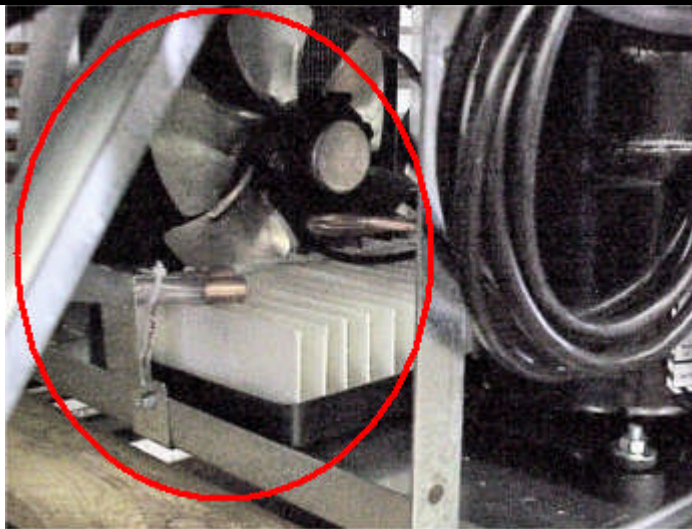


Figure 9. drain tube and condensate pan wicks

x Switch condenser fan to **manual** position. This will cause the fan to operate continually, evaporating the water from the condensate pan more quickly.



Figure 10. condenser fan switch (located on chamber ceiling)

Excessive water condensation inside refrigerator

NOTE: When warm, moist air from the room enters the refrigerator chamber water will condense on the cold interior surfaces. Thus, some amount of condensation is inevitable, and will be more likely during the summer months when ambient temperatures and humidity levels are elevated. If the amount of condensation seems excessive, there are some things which should be checked:

1. Has the shipping bracket been removed?

x check to see that the shipping bracket has been removed from each of the doors. This bracket is attached to the bottom of the door to support it during shipping. If it is not removed, it will not allow the door to completely close.

2. Is the refrigerator level?

x To make leveling adjustments back the legs/casters in or out until the unit is level and resting on all four legs/casters. The refrigerator must be level in order to provide proper door alignment and operation. There should not be any evidence of gaps around the perimeter of the door.

3. Are the doors sealing properly?

x check the door seal

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8.4 Addendum to Frig/Freezer Replacement Controllers

SUBJECT: *Controller jumper configuration for freezers and added menu items.*

CONTROLLER PN'S: SPN103508, SPN104161, SPN104162, SPN106564, SPN105402,
SPN106700, SPN107367, 316637H01, 316637H02

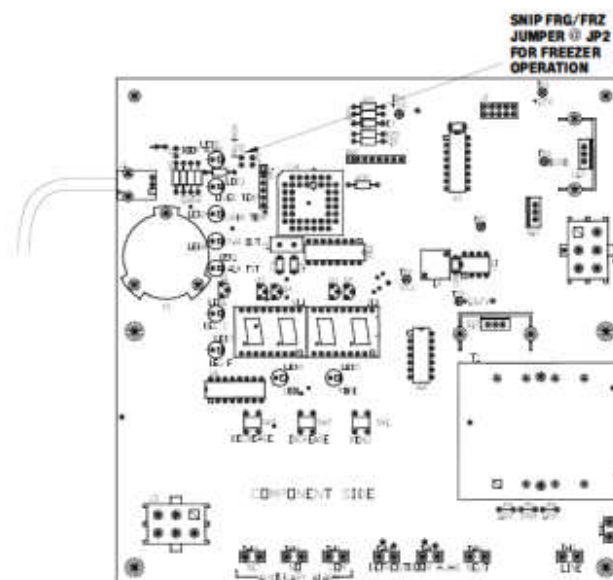
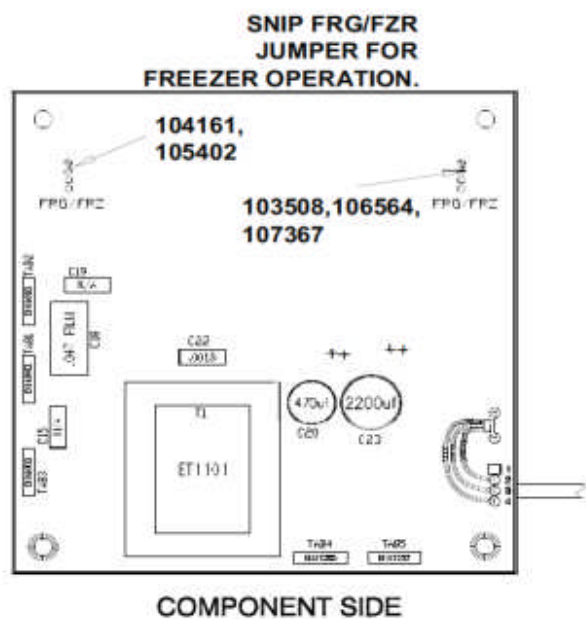
ADDENDUM PN: 105198, REV E, 3/27/09

Before installing a replacement controller PCB into a **freezer**, the FRG/FRZ jumper must be cut and removed. The location of the jumper is shown below. NOTE: Refrigerators require no alteration.

WARNING: If you are not certain if the jumper should be cut and removed, please obtain the model number and call technical support at 1-800-438-4851.

Freezers requiring PN:
SPN103508, SPN105402, SPN104161,
SPN107367 or SPN106564.

Freezers requiring PN:
SPN104162 or SPN106700
316637H01 or 316637H02



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An additional menu item has been added to the following controller revisions and is standard on controllers with later revisions.

PN	Rev.
103508	E
104161, 105402	B
104162	A
316637H01	1
316637H02	0

NOTE: The revision level is indicated on the transformer side of the controller in the white box.

The added menu item is called the hold-off menu (Ho). It can be accessed by pressing and holding the menu keypad for 5 seconds. The first menu that comes up is the offset (oS) menu. Press the menu keypad again and the hold-off (Ho) display will appear, followed by a number. The number designates a time in minutes for the compressor to be held off. Use the up/down arrow keys to change the hold-off time to 6 minutes, and then press the menu keypad to enter the value. Increasing the hold-off time provides more time for refrigerator evaporators to defrost during the *off-cycle*. In times of high humidity, increasing the hold-off time can help prevent evaporator freeze-up. If a hold-off time of 6 minutes results in poor performance, consult your user manual or call Technical Service for the recommended setting.

9 Chart Recorder Operation and Maintenance

The recorder is installed to provide air temperature readings inside the unit. The recorder will swing up and down with the unit's air temperature. The customer is responsible for evaluating the normal swings of the unit for suitability for samples stored in the unit. The average temperature in the unit is in the middle of the band for the temperature swings, units with automatic defrost will have a spike during the defrost cycle. The sample mass will determine the actual swing of the sample. (Small samples will swing more than large samples.)



Caution

It is important to read these instructions before operating the instrument. Keep these instructions on file for future reference.

9.1 Chart Recorder Power Supply

The recorder functions from AC power when the unit is operating normally. The recorder is also equipped with a backup battery, installed in the bracket just inside the door of the recorder. In the event of an AC power interruption the battery backup will allow the recorder to continue to operate. The green LED will begin "flashing" to indicate that there is an interruption in the main power supply. In normal operating mode, the green LED is illuminated continuously.



Note

Units are factory equipped with a 9VDC Alkaline battery, however, the battery is not connected electrically. Please refer to battery location and replacement instructions for information on locating and connecting the battery upon unit installation.

9.2 Changing the Chart Paper

Press and hold the "chart change" button (#3) for approximately one second until the pen begins to move to the left of the chart and then release the button. Wait until the pen has moved completely off of the chart. To remove the chart paper, unscrew (counter-clockwise) the chart "hub" knob at the center of the chart. Remove the old chart paper and position the new one so that the correct time line coincides with the time line groove on the chart plate. Refer to Figure 7 for the location of the time line groove. Re-attach the chart "hub" knob and screw securely (by hand) against the chart. Press and hold the "chart change" button (#3) again for approximately one second until the pen begins to move back onto the chart and then release the button. Check to make sure that the pen is marking on the chart paper. If it is not, then carefully adjust the pen arm to establish contact with the paper.



Warning

The chart recorder battery backup feature does not supply the refrigeration system with required power for continuous operation. Precautions should be taken to prevent any sample loss.

9.3 Replacement of Pen

9.3.1 Recorders Equipped with Fiber Tipped Cartridge

Marking Systems: Mark-A-Matic II Inking System

This type of pen consists of a self-contained ink reservoir with a porous plastic stylus, which is snapped around the outer edge of the metal pen arm.

A pen cap is provided to extend the life of the ink pen during shipping or when the recording unit is not in service. To remove the pen cap, gently lift the pen arm away from the chart paper. Remove the black plastic pen cap to expose the fiber tip of the ink pen and gently place the pen back onto the chart paper. Do not let the pen arm "snap" back onto the chart paper. This will flatten the fiber tip of the pen and will no longer give you a fine line marking on the chart paper. Place the pen cap in a safe place for future use.



Note

As the pen ink supply runs out, the pen color will become lighter. This indicates that the pen should be replaced.

If the stylus does not touch the chart, adjustment can be made by slightly bending the metal pen arm in the center towards the chart paper. Do not use more pressure than is necessary to create a fine line marking on the chart paper.

9.3.2 Recorders Equipped with Fiber Tipped Cartridge

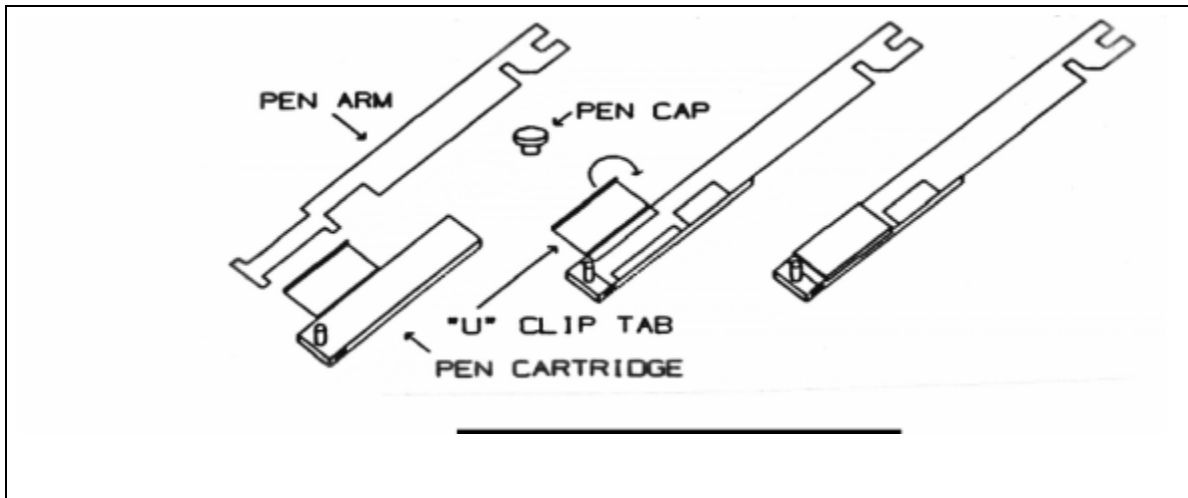
The pen cartridge is securely fastened to the metal pen arm using a special "U" clip tab. For ease of replacement, it is suggested that the two screws that hold the pen arm be loosened and the pen cartridge and metal pen arm to be removed as an assembly. Refer to Figure 7 for the location of the pen arm screws. Unsnap the plastic "U" clip tab of the pen cartridge from the metal pen arm, remove and discard the old pen cartridge. Replace the new cartridge by opening the hinge and snapping it securely around the metal pen arm.

9.4 Pen Arm Calibration

When the unit is first powered on, the pen arm(s) will move off of the chart and then move back onto the chart briefly stopping at the outer most temperature graduation ring of the chart paper. If the pen does not stop exactly at this location on the chart, it can be adjusted or “calibrated” by using the left (#1) or right (#2) arrow buttons (refer to Figure 6). When the pen moves back onto the chart and briefly stops, you will have approximately five seconds in which to adjust the pen’s position using the left and right arrow buttons of Figure 6.

To check and/or adjust the pen’s alignment to the outer most temperature graduation ring, press and hold the chart change (#3) button until the pen begins to move off of the chart. Once the pen(s) has moved off of the chart, again press and hold the chart change (#3) button until the pen begins to move back onto the chart. The pen will briefly stop at the outer most temperature graduation ring before continuing onto the chart to begin recording.

Each time the chart paper or fiber tip pen cartridge is changed; you should make sure that the pen stops at the outer most temperature graduation ring of the chart paper. Otherwise, this pen offset will cause the unit to record an incorrect temperature on the chart.

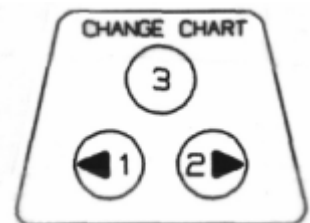


9.5 Temperature Recorder

9.5.1 Calibration Check

This recorder has been accurately calibrated at the factory. Before making any adjustments, this instrument should be in service for 24 hours. Thereafter, if any adjustment is required, perform the following procedure:

1. Place a Certified Test Thermometer(s) in a solution bottle(s) alongside the recorder’s sensor probe(s).
2. Once the temperature has leveled out, compare the position of the pen on the recorder to the test thermometer’s reading.
3. If an adjustment is required, use the left (#1) and right (#2) arrow pushbuttons on the recorder to calibrate (or move) the pen’s position on the chart to correspond to the temperature of the solution. The arrow buttons must be held for approximately five seconds before the pen will begin to move.



9.5.2 Chart Rotation Speed

To change the chart rotation speed, first unplug the unit from the main power supply and disconnect the battery (if the recorder

has the optional battery back-up feature). Next, press and hold the “chart change” button (#3) and re-connect the recorder to the main power supply. Once power to the recorder has been established, release the "change chart" button (#3). NOTE: The pen(s) will not be moving if this step is successfully completed. The LED will begin flashing in sequence to show the current chart rotation speed that is configured for the recorder:

Flash 1 time – 24 Hour Flash 2 times – 7 Day

To change the chart rotation speed (of the current range only), press and release the left button (#1) to select 24 hour rotation and press and release the right button (#2) to select 7 day rotation.

The LED will flash the appropriate number of times to show the chart rotation speed that is selected. To permanently save the chart rotation speed that has been selected, press and release the “chart change” button (#3) and the recorder will resume normal operation.

9.6 Battery Back-Up

The LED remains a constant green color indicating that both the battery and the main power to the unit are good. Refer to Figure 7 for the location of the LED. If the AC power were to fail or the battery becomes weak, then the LED will begin “flashing” indicating that either you have lost the main power to the unit or it is time to replace the battery. Having a 9 volt DC battery back-up in place will allow the recorder to continue to function normally for approximately 24 hours in the event of a power failure. (Alarming units will drain battery much quicker).



Warning

The chart recorder battery backup feature does not supply the refrigeration system with required power for continuous operation. Precautions should be taken to prevent any sample loss.

9.6.1 Battery Location and Replacement

To replace the battery, first open the recorder case door. The battery will be located in the upper right hand corner of the unit. Remove the battery from the holder clips. Disconnect the battery strap. Install a NEW 9 volt alkaline replacement battery.

9.7 Optional Alarm/Control Relay

(For all models equipped with panel mounted chart recorder **with alarm feature**)

9.7.1 Connection to the Relay

Recorders with the optional alarm relays provide two outputs. First a built in audible 85 db alarm and second a cable to connect to a set of NO/NC relay contacts for connecting to a central system. Proper maintenance/electrician should be consulted to connect these contacts.

The toggle switch mounted on the chart plate turns the alarm on or off. Toggle the switch up to turn alarms on. Toggle the switch down to turn the alarms off.

The relays that are used in this recording unit are latching type relays. That is the contacts of the relay will remain either closed or open (even when there is no power applied to the recorder) until the relay is pulsed with a signal from the recorder to change the position of the contacts.

Alarm contacts are available through a 3-conductor cable on the back of the recorder. Due to the many models the recorder is installed, the details of removing the panel is not included here. A visual inspection should define several screws to remove first. Models which the screws are removed and the panel does not come loose carefully push up about 1/2” and release keyhole type screws.

The black wire is the common. The red wire is the normally open side of the relay contact. The white wire is the normally closed side of the relay contact.

The relays are rated for the following maximum values: 2.0AMP at 30V DC

0.6 AMP at 30VAC

9.8 Setting the Alarms

To set the alarms, follow these instructions:



Warning

DO NOT ATTEMPT to make relay connections while the unit is connected to the main AC power supply. To avoid the risk of possible electric shock, unplug or disconnect the unit from the main power supply before attempting to access the alarm cable assembly. Disconnect the 9 Volt battery to avoid damaging the recorder and draining the battery.

Press and hold the “chart change” button (#3) until the pen arm begins to move off of the chart and then release the button. Wait until the pen has moved completely off of the chart. When the “chart change” button (#3) is pressed again, the pen will begin to move back onto the chart briefly stopping at the edge of the chart. (Verify the pen is on the edge of the chart.)

The pen arm will then move to the first control point position and the green LED will turn off. The pen will remain at this position for a period of approximately five seconds during which time high-alarm point can be adjusted using the left arrow (#1) or the right arrow (#2) push buttons.

Refer to Figure 6 for a diagram of the pushbuttons. When the time has expired for adjusting the high alarm point, the green LED will turn back on and move to the low alarm point. The pen will remain at this position for a period of approximately five seconds during which time the low alarm point can be adjusted using the left arrow (#1) or the right arrow (#2) push buttons. The LED will turn solid green and the pen arm will move to indicate the probe’s temperature and the unit will begin recording.

9.9 Chart Range Selection

If the recorder has a range sticker (that lists several temperature ranges) mounted on the front of the chart plate, under the chart, then the following section will apply to you.

This recording unit has the option for the user to select from several temperature ranges that are programmed into the recorder.

NOTE: The chart paper that is used on the recording unit must match the *range* that is selected for the recorder. Otherwise, the pen’s position on the chart paper will not correspond to the temperature that is measured.

Also, if the pen moves to the center of the outer edge of the chart and remains there while the unit is powered on, then this may be an indication that the current range selected for the unit is incorrect. The recorder has a built in safety mechanism that will always move the pen to the highest temperature on the chart when the current temperature that is measured is not within the selected range.

To select from the ranges available, press and hold the “change chart” button (#3) while in normal operating mode, until the pen arm begins to move off the chart. Once the pen has moved off the chart, press and hold the left arrow (#1) or right arrow (#2) button for approximately five (5) seconds and then release the button.

The green LED light will begin flashing one time if range #1 is selected or will flash two times if range #2 is selected and so on. Press the left arrow key (#1) to increase the range number or press the right arrow button (#2) to decrease the range number that is selected for the recorder. When finished selecting the range, press and hold the “chart change” button (#3) until pen begins to move back onto the chart and the selected range will be saved into the recorder’s permanent memory.



Note The cable runs to J2 on the recorder PCB. Wires are connected top to bottom as White (NC), Black (COM), and Red (NO).



Caution
Damage to the recording unit may result if the ratings for the relays are exceeded.



Note

The recorder alarms will activate when the recorder temperature is outside the high and low alarm points explained above. Do not activate the alarm until the temperature inside the equipment is between the adjustable limits.

9.10 Recorder Specifications

9.10.1 Input

- Nominal Input Voltage: Single Phase 115/230VAC. Nominal Input Current: 0.40mA/0.20mA
- Nominal Input Frequency: 50-60 Hz.

9.10.2 Battery

- Battery Type: 9 Volt Alkaline Low Battery Signaling: Flashing LED

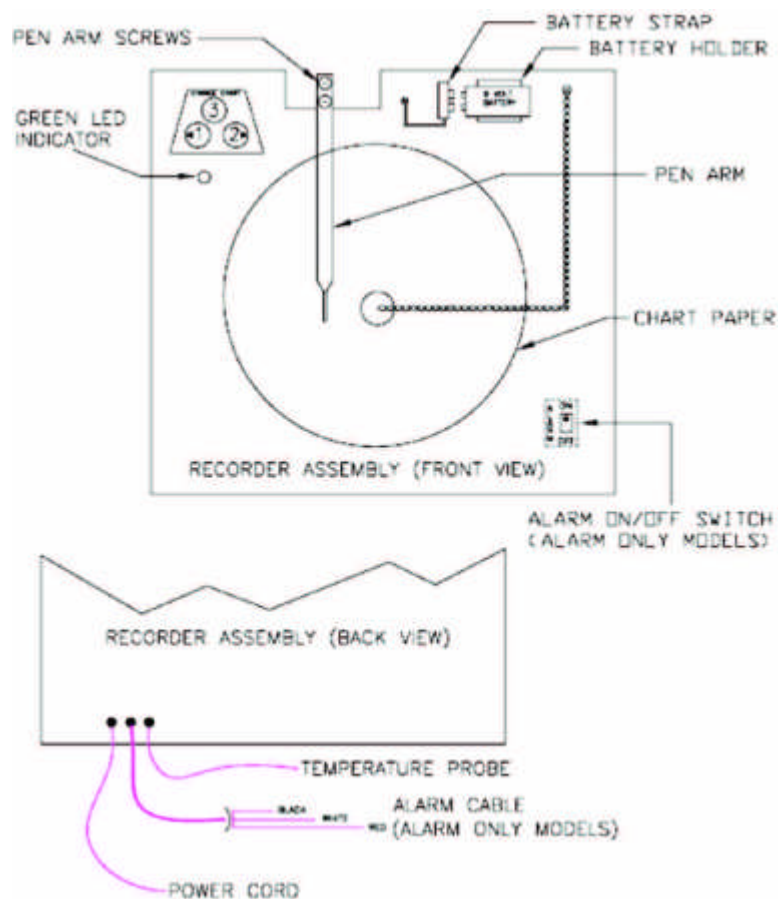
9.10.3 Replacement Parts

Parts lists are constantly revised. For the latest Replacement Parts lists go to the following location:

[Online Knowledge Base article # 298215.](#)

9.10.4 Operating Environment

0°C-40°C (32°F-104°F); 0-95% RH, Non-condensing



10 T°Sentry 4 Multi-Point Digital Alarm

10.1 Introduction

The T°Sentry4 (TS4) is a microprocessor-based temperature monitoring and alarm device with user programmable high-low alarm set points and alarm delay time. A maximum of four temperature probes are used.

A single pole double-throw relay contact, rated for 0.5 amps at 12 volts, allows hookup to normally-open or normally-closed external alarms. The relay goes to alarm state a specified time after the start of an alarm condition, or on loss of line power.

The internal 9-volt NiCad battery, with charger, allows keep-alive operation for approximately 100 hours. In battery mode the temperature display and most of the circuitry is turned off to conserve power. The alarm relay goes to the alarm state (drops out), and the unit periodically emits a short beep and LED flash to indicate that it is alive, but in a sleep mode. Pressing the red button fully activates the display for about 30 seconds.

Operating parameters, such as alarm limits, are stored in non-volatile memory, and are maintained even with power off.

Special options include thermocouple input; serial RS232 output to a host computer such as a CMS or Dataplex-32; small dedicated 2-color 40-column printer.

This manual covers only the standard TS4 - supplements for programming and use of the special options are shipped with the special units as needed.

10.2 Panel

The °C Display is an 8-character alphanumeric liquid crystal display (LCD) with backlighting.

DISPLAY ANGLE is a screwdriver adjustment to optimize the display for viewing angle / contrast.

The bicolor indicator lights the immediate status of the four channels - green means normal and red means out-of-range. Each channel blinks off as it is sampled, indicating normal computer activity. Channel 1 is the top LED, 4 is the bottom.

There are four square pushbuttons, three black and one red: STEP, LOW / DECR, HIGH / INCR and MUTE / PROGRAM, for setting up the operating parameters for the unit, displaying the set points, and stepping through channels.

The small black ALM TEST pushbutton in the lower right of the panel interrupts line power, to test operation of the battery and the alarm relay.

Alarm condition is indicated by the bright red ALARM indicator LED and the beeper.

10.3 Installation

The unit is normally shipped with probes connected and battery disabled. Remove the tagged screw in the side of the TS4 box to enable the battery. Assume the battery to be discharged, and allow to charge for at least 24 hours to ensure full capacity.

10.4 Channels/Probes

Probes are individually calibrated to +/- 0.1°C, by means of a small board carrying the calibration components - the probe and its associated board are coded by 3- digit serial numbers on the two-pin connectors, and must be interchanged only assets.

The four channels of the TS4 are color coded, with the probe wire color matching the activity LED labels to help installation and tracing. These are the channel colors:

Channel #1 -- Red Channel #2 -- Orange Channel #3 -- Yellow Channel #4 -- Green

10.5 Basic Operation

In normal operation the display shows channel number and temperature, looking something like this: [1 25.5]. The upper (yellow) labels indicate the button functions to change the display as follows:

- STEP to next channel [2 3.6]
- LOW set point display [2L 1.0]
- HIGH set point display [2H 6.0]

The TS4 checks the temperature reading of each channel against the set points for out of range conditions, defined as "equal to or beyond the set point". If, for instance, the low set point is 0.0, then the reading is out of range for 0.0 and anything below. The bicolor activity LED for each channel blinks off as the channel is read, and its current state is indicated by green for normal, red for out-of-range.

An out-of-range condition must persist for a specified time (alarm delay), for an alarm condition to be declared. This time is individually set for each channel, and is intended to prevent transient nuisance alarms.

Once the alarm condition is reached, the beeper and LED will start. Pressing the MUTE button will stop the beeper for a preset mute period, changing the sound to short 'chirps'. (MUTE is also used to enter Program mode, page 5.)

The MUTE button only affects the current alarm condition, that is, for the channels in alarm at the time the button is pressed. If a new channel enters the alarm state, the beeper will start up again, even if the mute time is not completed. The MUTE is reset (turned off) when the alarm condition goes away, that is, there are no out-of-range readings for 30 seconds.

The alarm relay is activated a designated time after the beeper starts (relay-delay), and is in the alarm position until the alarm state is cleared. If the alarm condition does not last long enough for the relay-delay to time out, the relay will not go into its alarm position.

Relay status is not affected by mute or by the beeper or LED activity.

10.6 Programming

The MUTE button is also used to exit the RUN mode for the PROGRAM mode. If the alarm is beeping, the first push of the red button will mute the beeper, the second will step to PROGRAM.

Programming of the TS4 is divided into three major sections: limits, delay times and set point test. Pressing the PROGRAM button moves the display from normal run mode through the three program sections, returning to the run mode.

Within each program section, pressing the STEP button brings up individual items, wrapping around from the last item to the first:

10.6.1 Limits sequence

1L (ch1 low) / 1H (ch1 high) / 2L / 2H / 3L / 3H / 4L / 4H / 1L / 1H / etc. [press PROGRAM button to move to Times]

10.6.2 Times sequence

1D (ch1 delay-to-alarm) / 2D / 3D / RD (relay delay from alarm beeper) / MT (mute time) / 1D / 2D / etc.

[press PROGRAM button to move to Set point Test]

10.6.3 Set point Test sequence

1T (ch1 test display) / 2T / 3T / 4T / 1T / etc.

Note that the set point test does not change any stored parameters, merely acts during the test time.

[press PROGRAM button to move to Normal Run]

The DECR/INCR buttons are used to decrease / increase the program parameters. Note that the displayed parameter values blink while in the program mode.

10.6.4 Programming Details

Here is a more detailed description of the programming process:

On entering the program mode, the first parameters to be set are the alarm limits. The buttons, left to right, have these functions as indicated by the red lettering:

STEP to next parameter. The channel 1 low set point is the first to be displayed. Pushing STEP will cycle through the set points in this order:

- 1L 1H 2L 2H 3L 3H 4L 4H 1L 1H etc.
- DECR (decrement) the value. A momentary push changes the value by -0.1, and a longer push changes the value by -1.0
- INCR (increment) the value. A momentary push changes value by +0.1, and a longer push changes value by +1.0
- PROGRAM to move on to next function: delay time set, set point test, return to RUN mode.
- Press the PROGRAM button to move to the delay time program function.
- The delay time program mode allows setting of the timers, the first being the channel 1 delay to alarm ; STEP sequence is channel 2, 3 and 4 delay to alarm, relay delay, mute, and back to delay to alarm.
- Delay to Alarm - time in minutes from when a reading passes high or low set point to when beeper starts.
- Range is 0-30 minutes, and each channel has its own value, designated as 1D, 2D, 3D and 4D.
- (DECR/INCR steps are 1 and 10 for short/long.)

10.6.4.1 Typical display: [1 D 1 m]

- Relay Delay - time in minutes from when the beeper starts to when the alarm relay drops out.
- Range is 0-30 minutes. One value, designated RD, applies to all channels. (DECR/INCR steps are 1 and 10 for short/long.)

10.6.4.2 Typical display: [RD 10m]

- Mute Time - time in minutes that the beeper is muted, from when the MUTE button is pressed.
- Range is 5-120 minutes. One value, designated MT, applies to any/all channels out of range during the alarm.
- (DECR/INCR steps are 1 and 10 for short/long.)

10.6.4.3 Typical display: [MT 15m]

- Press the PROGRAM button to move to the set point test function.
- Set point Test - adds a digital offset to the temperature reading for the selected channel. This simulates a falling or rising input to check the response of the unit to an alarm condition.
- The set point test does not produce any changes in stored parameters.
- Display designations are 1T, 2T, 3T, 4T, and the display is the actual reading plus the test offset. Use the STEP button to step through the channels; use the
- DECR/INCR buttons cause the offset to fall/rise. Pushing both DECR/INCR buttons resets the test offset to zero.
- Press the PROGRAM button to move to the normal run mode.

10.6.5 Special Functions

- Software Version - displays the microprocessor software version number in this unit:
- Press PROGRAM to enter the program mode.
- Press and hold STEP; press DECR.

10.6.6 Reset/Alarm Test

Holding the red button for about three seconds will cause the unit to reset. This is provided for the rare situation when the computer might lock up, as might happen in the case of hooking up the battery while power is off. Reset is automatic at powering up.

The reset also activates the alarm condition, and can be used as a test of the beeper and alarm LED - use the red MUTE button to shut off the beeper and LED.

Note that use of the reset while in the program mode could result in improper parameter storage.

10.6.7 Power Failure Test

To simulate a power failure, press the small ALM TEST button next to the MUTE button to disconnect the primary AC line power supply. This will check that the battery is operational, and drop out the alarm relay to activate any remote alarms. This is a standard feature, but can be deleted as a factory modification.

Summary of Button Functions

10.6.8 Normal Display Mode

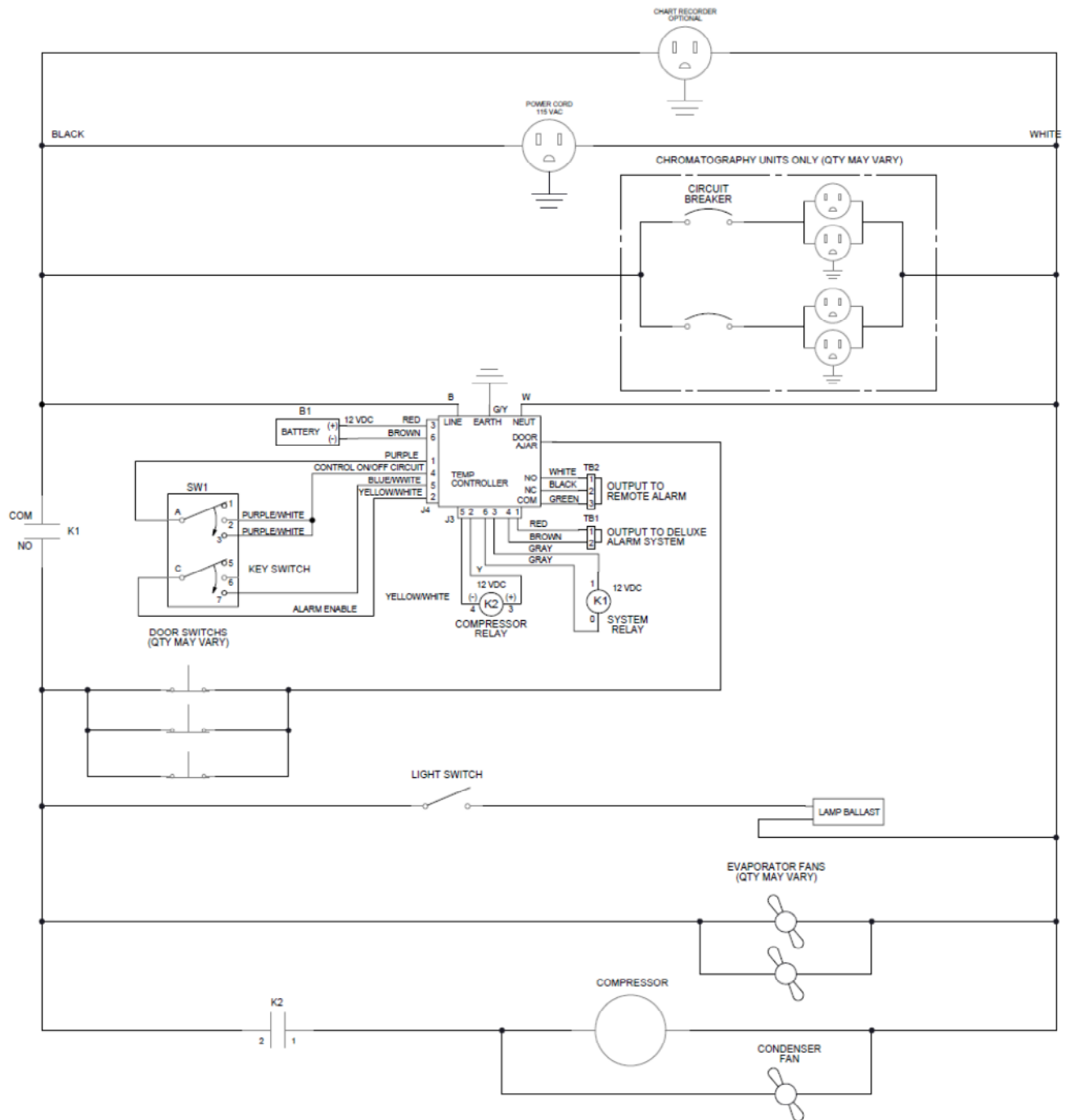
- MUTE If alarm is beeping, pushing the red button initiates the mute period.
- PROGRAM If alarm is still, pushing the red button brings up the program mode.
- STEP Step through the channels on display.
- LOW Display the low limit for channel on display.
- HIGH Display the high limit for channel on display.

10.7 Program Mode

- PROGRAM Move to next program section.
- STEP Step through items in section.
- DECR Decrease the displayed parameter.
- INCR Increase the displayed parameter.

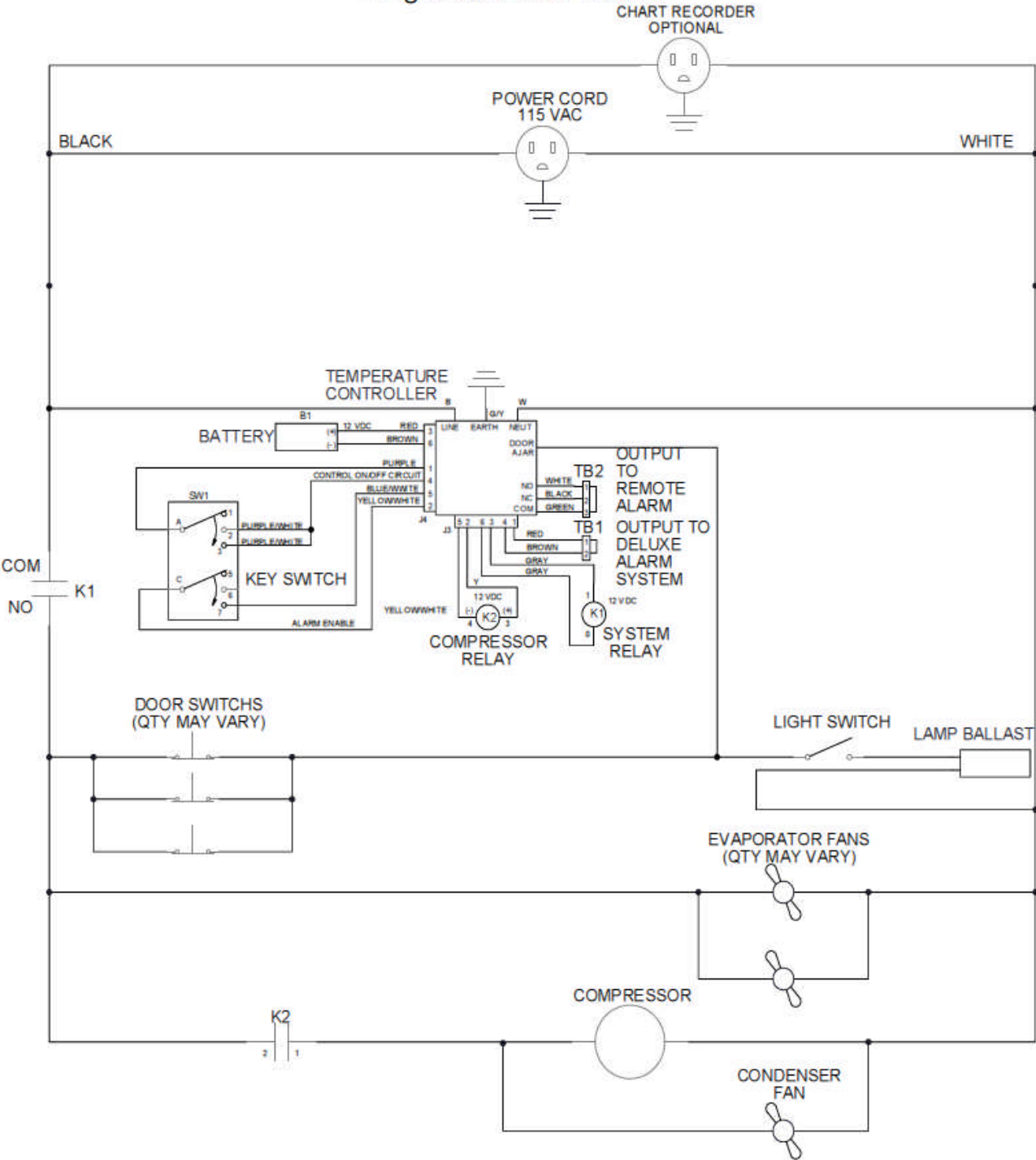
11 Wiring Diagrams:

MR / MH units -



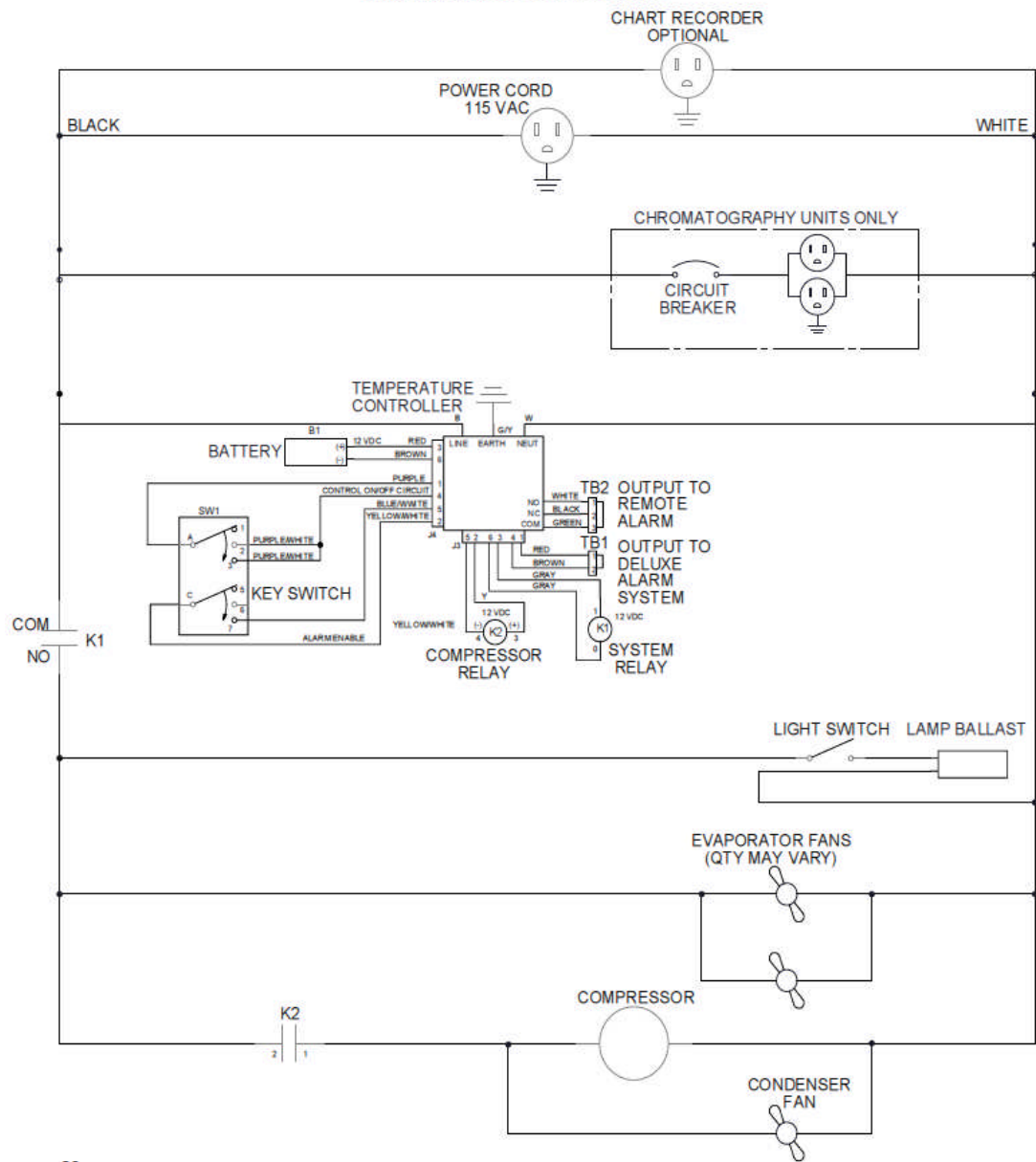
MR units -

Hinged Solid Door Models

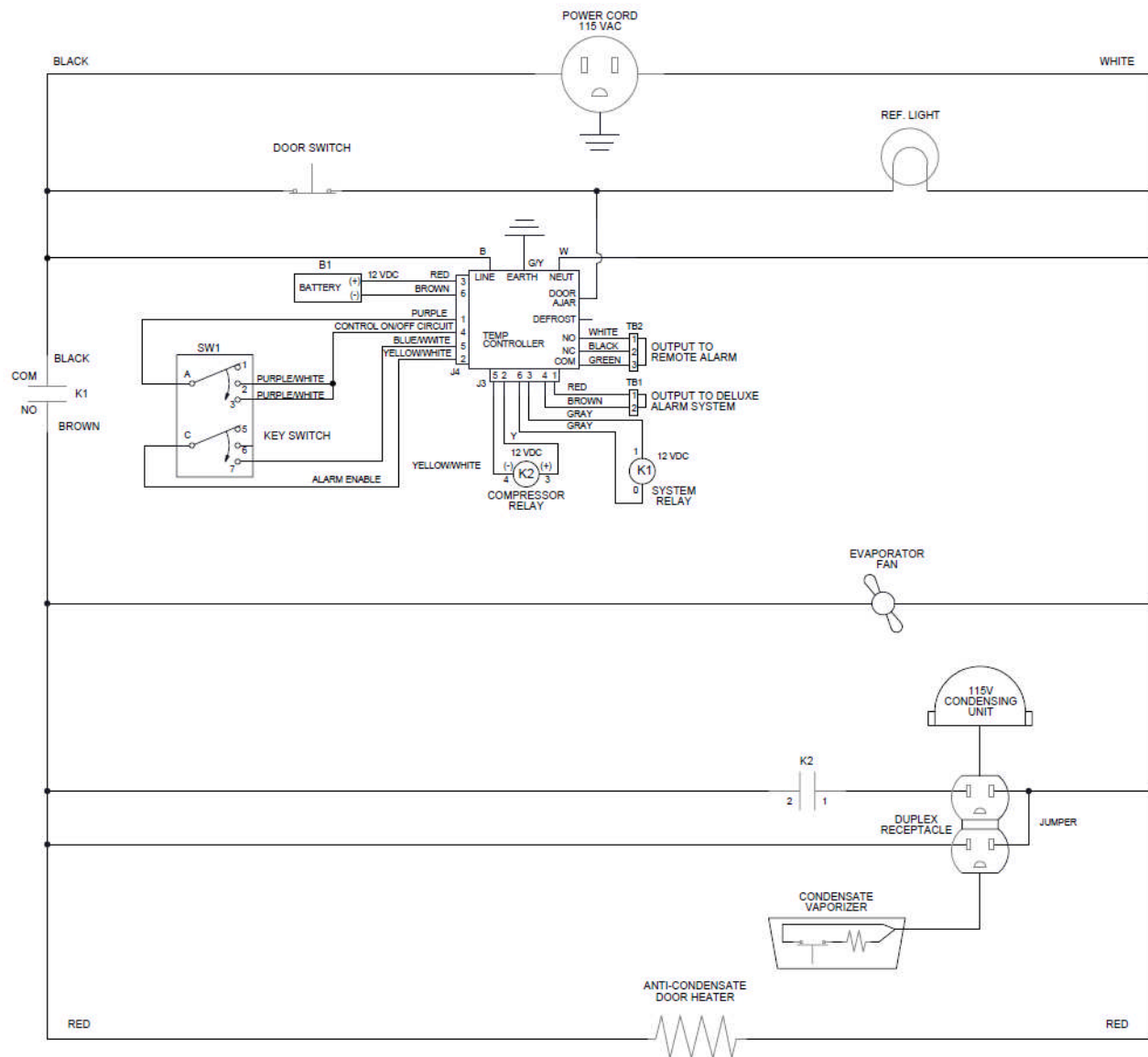


MR / MH 38 & 45 units -

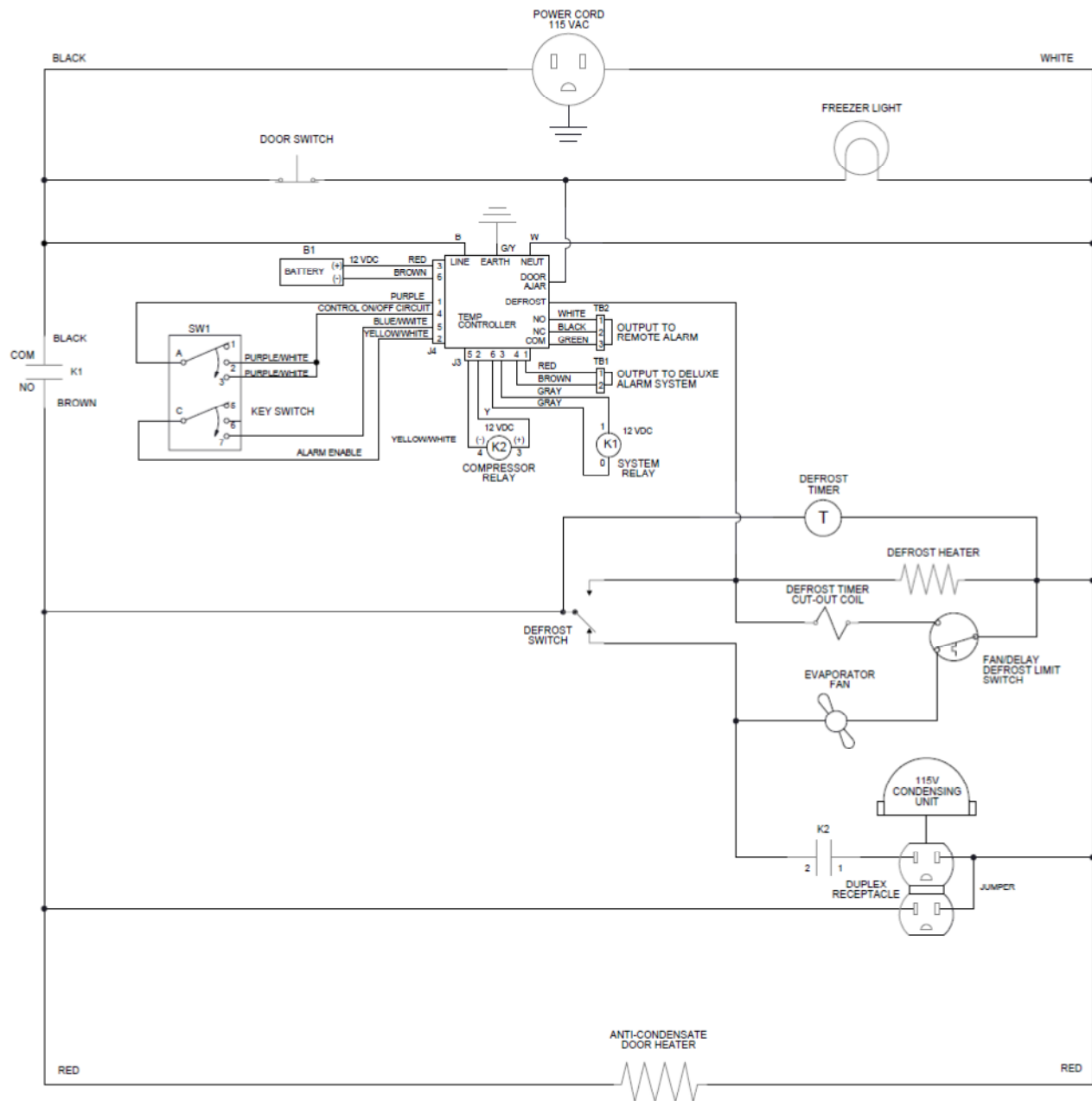
Sliding Glass Door Models



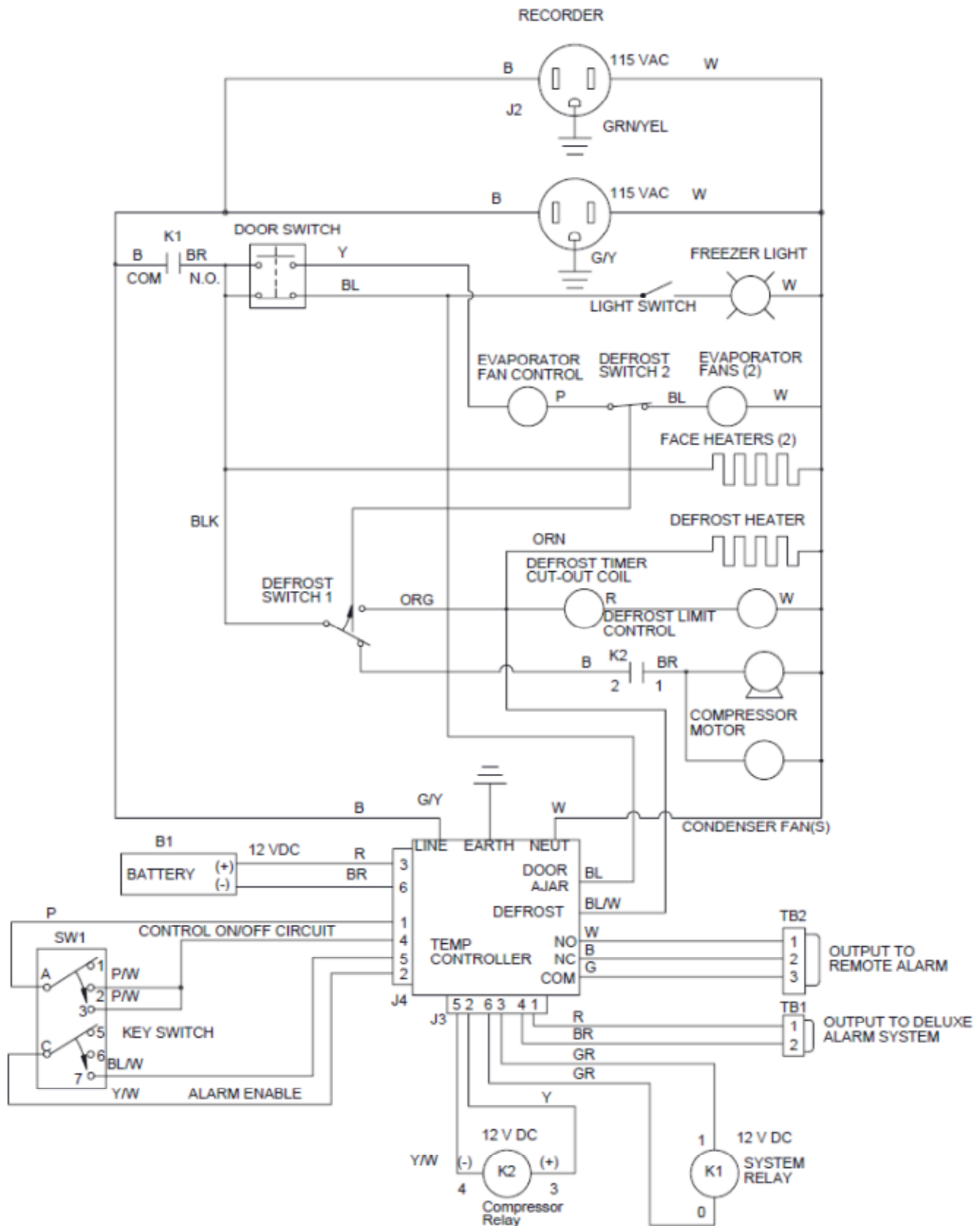
MC20 – Refrigerator section -



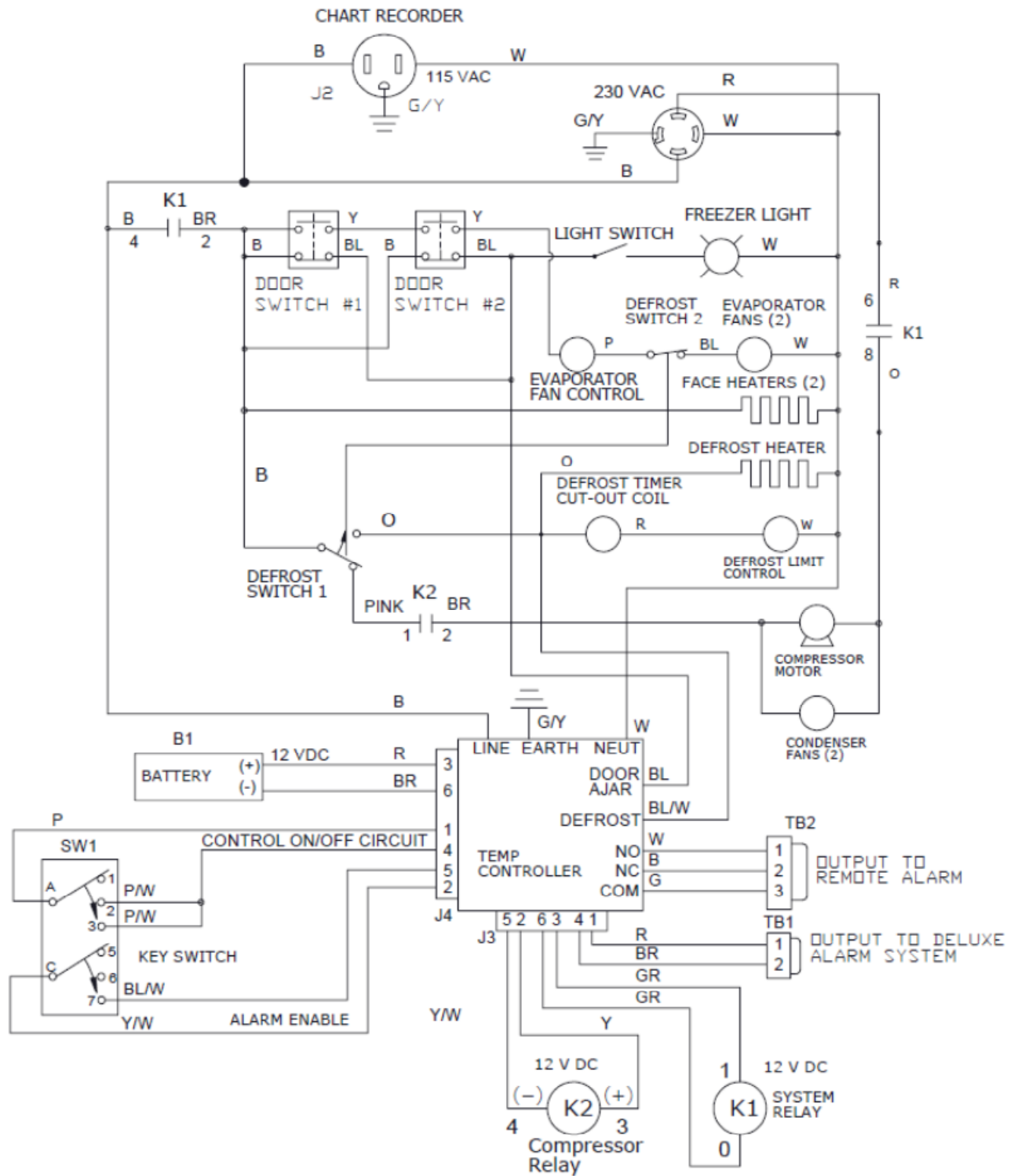
MC20 – Freezer section -



MF Single Door –



MF Double Door –



12 Appendix – Charging Table

Recommendation – recharge based on the unit's data plate, use the table for reference only.

Model	MR12	MR25	MR30	MH30
# - Base Model	LV12	LV23	LV27	LV27
# - Compressor Manufacturer	Tecumseh	Danfoss	Tecumseh	Tecumseh
# - Compressor Designation	AEA3425YXA	NF8.4FX.2	TPB9423Y	TPB9423Y
V	115	115	115	115
Frequency	60	60	60	60
Total A	5.0	5.8	8.8	12.8 (+)
Refrigerant, Type	R134a	R134a	R134a	R134a
Amount (oz)	7.5	7.0	7.0	7.0
Design Pressure				
High Side, psig	330	330	330	330
Low Side, psig	250	250	250	250
LRA	24.0	28.0	44.5	44.5

- For Engineering Use Only

(+) – Includes 4 A GFCI receptacle

10-1A Cord-Connected Models (Continued)

Model	MR38	MH38	MR45
# - Base Model	LV38	LV38	LV45
# - Compressor Manufacturer	Tecumseh	Tecumseh	Tecumseh
# - Compressor Designation	TPB9423Y	TPB9423Y	TPB9423Y
V	115	115	115
Frequency	60	60	60
Total A	8.8	12.8 (+)	8.8
Refrigerant, Type	R134a	R134a	R134a
Amount (oz)	10	10	10
Design Pressure			
High Side, psig	415	415	415
Low Side, psig	250	250	250
LRA	44.5	44.5	44.5

- For Engineering Use Only

(+) – Includes 4 A GFCI receptacle

Model	MH45	MH49	MR49
# - Base Model	LV45	LV49	LV49
# - Compressor Manufacturer	Tecumseh	Tecumseh	Tecumseh
# - Compressor Designation	TPB9423Y	TPB9423Y	TPB9423Y
V	115	115	115
Frequency	60	60	60
Total A	12.8 (+)	12.8 (+)	8.8
Refrigerant,Type	R134a	R134a	R134a
Amount (oz)	10	10.0	10.0
Design Pressure			
High Side, psig	415	415	415
Low Side, psig	250	250	250
LRA	44.5	44.5	44.5

- For Engineering Use Only

(+) – Includes 4 A GFCI receptacle

10-1A Cord-Connected Models (Continued)

Model	MH72PA	MR72PA	MR72SS MR72PA	MH72SS MH72PA
# - Base Model	LV72	LV72	LV72Y	LV72Y
# - Compressor Manufacturer	Tecumseh	Tecumseh	Embraco	Embraco
# - Compressor Designation	AKA4476YXA	AKA4476YXA	NT6215Z	NT6215Z
V	115	115	115	115
Frequency	60	60	60	60
Total A	16 (+)	12	9.9	13.9 (+)
Refrigerant,Type	R134a	R134a	134a	134a
Amount (oz)	14.5	14.5	15.5	15.5
Design Pressure				
High Side, psig	335	335	335	335
Low Side, psig	250	250	250	250
LRA	58.8	58.8	44.0	44.0

- For Engineering Use Only

(+) – Includes 4 A GFCI receptacle

Date Code - The serial number incorporates the date code. The date code is YYMM where YY is the year (e.g. 94) and MM is the month (e.g. 11) followed by a sequential serial number.

10-1A Cord-Connected Models

Model	MF25	MF34	MF49
# - Base Model	HFS1-1S	HFS1W-1S	HFS2-5S
# - Compressor Manufacturer	Tecumseh	Tecumseh	Tecumseh
# - Compressor Designation	AJB2433ZXA	AJB2433ZXA	AWA2450ZXD
V	115	115	208-230
Frequency	60	60	60
Total A	9.7	10.4	7.6
Refrigerant, Type	R404A	R404A	R404A
Amount (oz)	7.75	9.0	19.5
Design Pressure			
High Side, psig	500	500	400
Low Side, psig	250	250	250
LRA	67	67	56

Amount (oz./unit)	CAT #	Coolant	Amount (oz./unit)	CAT #	Coolant	Amount (oz./unit)	CAT #	Coolant	Amount (oz./unit)
19.5	13-999-223FA	R404A	13.5	13-986-136SA	R134A	17	13-999-227R	R134A	12.5
19.5	13-999-223FAO	R404A	13.5	13-986-136SRA	R134A	17	13-999-227RA	R134A	12.5
19.5	13-999-247F	R404A	20	13-986-137SA	R134A	17	13-999-238GAO	R134A	15
19.5	13-999-247FA	R404A	20	13-986-138	R134a	14	13-999-245G	R134A	15
19.5	13-999-247FR	R404A	20	13-986-138A	R134a	14	13-999-245GA	R134A	15
19.5	13-999-272G	R404A	24	13-986-138D	R134a	14	13-999-245GAO	R134A	15
19.5	13-999-272GA	R404A	24	13-986-138DR	R134a	14	13-999-245GR	R134A	15
19.5	13-999-272GAO	R404A	24	13-986-138DRA	R134a	14	13-999-249G	R134A	15
19.5	13-999-274FA	R404A	34	13-986-138RA	R134a	14	13-999-249GA	R134A	15
19.5	13-999-326F	R404A	12.5	13-986-139	R134a	14	13-999-249GAO	R134A	15
19.5	13-999-327LA	R404A	22	13-986-139A	R134A	14	13-999-249RA	R134A	15
13.5	13-999-425F	R404A	12.5	13-986-145G	R134A	15	13-999-450RA	R134A	15
13.5	13-999-426R	R404A	8.5	13-986-145GA	R134A	15	44250-00	R134A	2.5
13.5	13-986-106A	R134A	3.75	13-986-148	R134A				
14.5	13-986-106AX	R134A	3.75	13-986-148ES	R134A				
14.5	13-986-116	R134A	4.8	13-986-149	R134A				
14.5	13-986-120	R134a	6	13-986-149G	R134A				
20	13-986-120A	R134a	6	13-986-149GA	R134A				
20	13-986-120R	R134A	6	13-986-150	R134A				
20	13-986-120RA	R134A	6	13-986-152	R134A				
20	13-986-121	R134a	6	13-986-153	R134A				
24	13-986-122	R134a	6	13-986-154	R134a				
24	13-986-122A	R134a	6	13-986-154ES	R134a				
13.5	13-986-122R	R134a	6	13-986-154LK	R134a				
13.5	13-986-122RA	R134a	6	13-986-227G	R134A				
13.5	13-986-123	R134a	6	13-986-227GA	R134A				
20	13-986-124	R134a	6	13-986-227GR	R134A				
20	13-986-124A	R134a	6	13-986-227R	R134A				
24	13-986-124R	R134a	6	13-986-227RA	R134a				
24	13-986-124RA	R134a	6	13-986-227RR	R134A				
24	13-986-126	R134a	14	13-986-238G	R134a				
34	13-986-126A	R134a	14	13-986-245G	R134A				
34	13-986-126RA	R134a	14	13-986-245GA	R134A				
12.5	13-986-127	R134a	14	13-986-245GR	R134A				
12.5	13-986-127G	R134a	12.5	13-986-249G	R134A				
22	13-986-127GA	R134a	12.5	13-986-249GR	R134A				
22	13-986-127GR	R134a	12.5	13-986-249RA	R134A				
22	13-986-127RA	R134a	14	13-986-249RR	R134A				
12.5	13-986-128SA	R134A	17	13-986-450R	R134a				
12.5	13-986-128SRA	R134A	17	13-986-450RA	R134a				
12.5	13-986-129SA	R134A	17	13-986-450RR	R134a				
8.5	13-986-130	R134a	18.5	13-999-106A	R134A				
8.5	13-986-130A	R134a	18.5	13-999-127G	R134A				
8.5	13-986-130RA	R134a	18.5	13-999-138DR3A	R134A				
9	13-986-131	R134a	18.5	13-999-149G	R134A				
12.5	13-986-131RA	R134A	18.5	13-999-227G	R134A				
20	13-986-134	R134a	6	13-999-227GA	R134A				
24	13-986-134A	R134a	6	13-999-227GAO	R134A				
13.5	13-986-134RA	R134a	6	13-999-227GR	R134A				