

SINCE 1889



## ULTRA LOW FREEZER

## ULF SERIES

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### MODEL

**ULF401U / ULF501U / ULF601U / ULF701U**

## INSTRUCTION MANUAL

- FIRST EDITION –

- Thank you for purchasing ULF Series Ultra Low Freezer of Yamato Scientific.
- To use this unit properly, read this "Instruction Manual" thoroughly before using this unit. Keep this instruction manual around this unit for referring at any time.



**WARNING:** Carefully read and thoroughly understand the important warning items described in this manual before using this unit.

**Yamato Scientific America Inc.  
Santa Clara, CA**

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# SYMBOLS AND STARTING INSTRUCTIONS

## Explanation

### MEANING OF ILLUSTRATED SYMBOLS

#### ILLUSTRATED SYMBOLS

Various symbols are used in this safety manual in order to use the unit without danger of injury and damage of the unit. A list of problems caused by ignoring the warnings and improper handling is divided as shown below. Be sure that you understand the warnings and cautions in this manual before operating the unit.



#### **CAUTION**

BLACK WITH YELLOW BACKGROUND  
LIGHTNING BOLT  
CAUTION, RISK OF ELECTRICAL SHOCK



#### **WARNING**

BLACK WITH YELLOW BACKGROUND  
EXCLAMATION POINT  
CAUTION, REFER TO ACCOMPANYING DOCUMENTS

### STARTING INSTRUCTIONS

1. Move the freezer to an indoor location, and plug the freezer into an appropriate outlet with an adequate power supply. Consult your maintenance department for additional information on the proper electrical configuration for this unit.
2. Once plugged in, the compressor(s) will start to operate and pull down to the setpoint on the temperature control.
3. Allow the freezer to reach the setpoint temperature. Depending on the size of the unit, this may take up to 12 hours.
4. Product can now be loaded into the freezer for storage.

# UNIT REQUIREMENTS

## Unit Information

### PRE-INSTALLATION INFORMATION

#### RANGE OF ENVIRONMENTAL CONDITIONS FOR WHICH THIS EQUIPMENT IS DESIGNED

1. Indoor use.
2. Altitude up to 2000m.
3. Ambient temperatures 15°C to 30°C (60°F TO 85°F)
4. Recommended humidity range of 30% to 90%.
5. Mains supply fluctuations up to -5% to +10% of the nominal voltage.
6. Transient over-voltages typically present on the mains supply (overvoltage category II). Pollution degree 1.



#### **WARNING**

THIS FREEZER IS PROVIDED WITH AN INPUT CIRCUIT PROTECTIVE DEVICE WHICH SHALL BE MAINTAINED AND SERVICED BY QUALIFIED PERSONNEL ONLY.



#### **CAUTION**

FUSES OR BREAKERS USED INSIDE PROTECTIVE DEVICE 15A OR 20A 250V TIME DELAY.



#### **CAUTION**

UNPLUG FREEZER BEFORE ANY TECHNICAL SERVICE IS PERFORMED ON THE UNIT.



#### **WARNING**

DO NOT POSITION EQUIPMENT SO IT IS DIFFICULT TO DISCONNECT FROM THE POWER SUPPLY.

# GENERAL SPECIFICATIONS

## Specifications

### TEMPERATURE SPECIFICATIONS


#### OPERATIONAL TEMPERATURE RANGE

**-40°C TO -85°C**

### ELECTRICAL SPECIFICATIONS

#### ELECTRICAL PLUG

- Plug the freezer into the proper outlet with an adequate power supply.
- This unit requires a **Dedicated Electrical Line**.

MODEL	VOLTAGE	AMPERAGE	PLUG
ULF401U ULF501U ULF601U ULF701U	<b>115 VOLTS</b> 60 HERTZ 1 PHASE	<b>20 AMP</b> <b>DEDICATED LINE</b>	 NEMA 5-20



#### **WARNING**

ONLY PLUG THIS UNIT INTO THE PROPER OUTLET. DO NOT ATTEMPT TO MODIFY PLUG IN ANY WAY. IMPROPER USE OF THE ELECTRICAL PLUG WILL VOID WARRANTY

# REFRIGERATION SPECIFICATIONS

## REFRIGERATION SPECIFICATIONS

MODEL	CU. FT.	REFRIGERATION SYSTEM	HIGH STAGE REFRIGERANT	LOW STAGE REFRIGERANT
ULF401U	13	1 HP TECUMSEH	R404A – 23 oz.	R170 - 30" to 20 psi R508B - 130 psi
ULF501U	18	1 HP TECUMSEH	R404A – 24 oz.	R170 - 30" to 20 psi R508B - 130 psi
ULF601U	22	1 HP TECUMSEH	R404A – 24 oz.	R170 - 30" to 20 psi R508B - 130 psi
ULF701U	25	1 HP TECUMSEH	R404A – 25 oz.	R170 - 30" to 20 psi R508B - 130 psi

## PREVENTATIVE MAINTENANCE

### BEFORE PERFORMING MAINTENANCE

To reduce the risk of fire, electric shock or injury to persons using this freezer, read all instructions and follow basic safety precautions.



### CAUTION

DISCONNECT THIS UNIT FROM THE POWER SUPPLY BEFORE PERFORMING MAINTENANCE ON THE UNIT.

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### CLEANING PROCEDURE

- Wipe down the exterior of the freezer with a soft cloth and spray type polish.
- If frost builds up in the chamber, a bucket and ice-scraper can be used to remove the ice.
- If excessive ice builds up, the unit can be defrosted (see below).

### DEFROST PROCEDURE

1. Remove any product in the freezer and store it in a back-up freezer or elsewhere.
  2. Unplug the freezer and open the freezer front door / lid.
  3. Use a cloth to protect the control from dripping water.
  4. Air out the freezer for at least 12 hours, allowing the unit to reach room temperature.
  5. Take a rag and wipe up all the excess water in the unit (melted frost).
  6. Plug the unit in and set your temperature to the desired setpoint
  7. Once the desired temperature is reached, add product back into the unit.
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- 



### WARNING

IT IS RECOMMENDED TO SLOWLY RE-ADD YOUR PRODUCT INTO THE FREEZER TO PREVENT AN EXTREME LOAD ON THE COMPRESSORS, WHICH COULD SHORTEN FREEZER LIFE EXPECTANCY.

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## AUTOMATIC STARTING SYSTEM

The automatic starting system is provided on all freezer systems in case of power failure. If there is an electrical power interruption to the unit and power is not restored immediately, the unit will automatically start up whenever power is returned.

### AUTOMATIC COMPRESSOR STARTING TIMER

A timer will engage after power is restored to the unit, the low stage will start to operate and the automatic starting timer will not operate again until power is disconnected from the unit or the low stage system cycles off on high pressure control.



#### **WARNING**

ALWAYS LEAVE THE REFRIGERATION SWITCH IN ON POSITION, AS THIS WILL AUTOMATICALLY ACTIVATE THE AUTOMATIC STARTING SYSTEM.



#### **CAUTION**

COVER SCREEN ON BACK OF FREEZER MAY ONLY BE REMOVED BY AUTHORIZED PERSONNEL ONLY.

FOR CONNECTIONS TO THE EXTERNAL ALARM COVER SCREEN MUST BE REPLACED BEFORE PUTTING FREEZER INTO SERVICE.

FAILURE TO REINSTALL COVER COULD RESULT IN HAZARD.

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## HIGH-PRESSURE CONTROL

The high-pressure control is factory set to shut off the low stage system in case of high pressure. The control is set to cut-out at 298 P.S.I. The low stage system will automatically restart after a preset time delay.

## FDC 4000 CONTROL

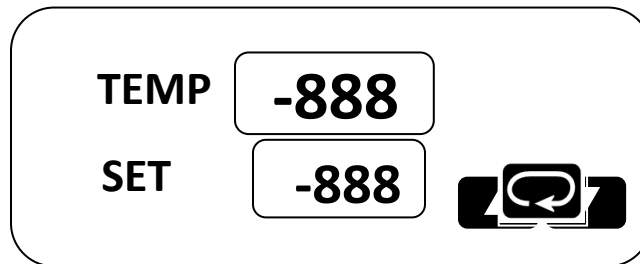
The temperature control is manually adjustable to the desired temperature in 1° C increments within the limits of the control range.

### TEMPERATURE SET POINT

The control has two displays, the upper display is the actual chamber temperature and the lower display is the temperature set point. The temperature set point has been pre-set at the factory.

### CHANGING TEMPERATURE SETPOINT

The temperature set point can be changed by simply pressing the “up” arrow to raise or the “down” arrow to lower the temperature set point.



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### WARNING



CHANGING THE CONTROL PARAMETERS OUTSIDE OF THE MANUFACTURE RECOMMENDED RANGE, COULD SHORTEN THE LIFE-SPAN OF YOUR EQUIPMENT; OR CAUSE ISSUES RESULTING IN MECHANICAL FAILURE.

### WARNING



USE ONLY THE “UP” AND “DOWN” KEYS WHEN MAKING CHANGES ON THIS CONTROL. WARRANTY WILL BE VOID IF USED IN ANY OTHER WAY.

CONTACT FACTORY FOR ALL OTHER ADJUSTMENTS IN SETTINGS.

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## ALARM SYSTEM

Alarm will automatically activate when the freezer reaches set point or 8 hours after the unit has been first plugged in.

The alarm will not sound again until the temperature varies 12°C (20°F) from the temperature control set point.

Please note that the alarm will use battery power to sound if there is a power outage to the freezer.

### **ALARM SYSTEM BATTERY REPLACEMENT**

- Rechargeable batteries should be changed approximately every three years with lead acid rechargeable 1.2 Ah min, model PS-640F1 or equivalent.



### **WARNING**

ALARM SYSTEM SHOULD BE TESTED EVERY 30 DAYS.

### **DRY CONTACT RELAY**

The dry contact relay is a terminal strip located on the back of the freezer.

RATING OF THIS CONNECTION:

**2A 125 VAC**

**2A 30 VDC**

RED – NORMALLY CLOSED  
WHITE – COMMON  
BLUE – NORMALLY OPEN

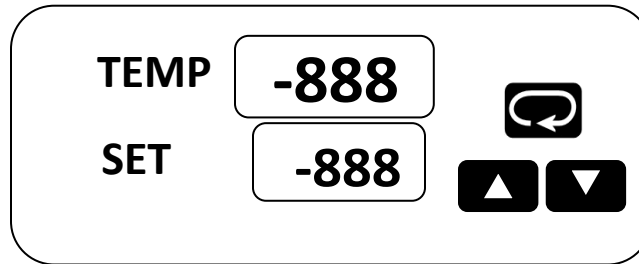







### **WARNING**

IF IT IS NECESSARY TO REMOVE METAL COVER SCREEN ON BACK OF FREEZER TO MAKE CONNECTIONS TO ALARM RELAY, COVER MUST BE REPLACED BEFORE FREEZER IS PUT INTO OPERATION

## CONTROL KEYS & DISPLAYS


The FDC-4000 controller is programmed by using three keys on the front panel. The available key functions are listed in following table. Note: Only use the tip of your finger to depress the keys. Using a rigid object such as a pen, screwdriver or even your finger-nail may permanently damage the keypad.




TOUCH KEYS	FUNCTION	DESCRIPTION
	Up Key	Press and release to increase the control set-point (while in normal control mode) or to change lower display program parameter (while in User Menu or Factory Mode). Press and hold to accelerate increment speed.
	Down Key	Press and release to decrease the control set-point (while in normal control mode) or to change lower display program parameter (while in User Menu or Factory Mode). Press and hold to accelerate decrement speed.
 Pressing key while in normal control mode	Scroll Key	Press and hold for at least 2 seconds and release (while in normal control mode) to access operator level parameters. Press and release to cycle through all user parameters. Press and hold for 2 seconds and release to silence audible alarm under normal power or on battery power. While unit is in an alarm condition, the external alarm relay contacts will remain energized until the alarm condition no longer exists. Press and hold to display chamber temperature while the controller is on battery power. Chamber temperature will be displayed until key is released. Alarm contact will remain energized while operating on battery power.
Press both keys  simultaneously	Current Power Reading	Displays current AC power (i.e. 110VAC) as long as keys are pressed. If power is 110VAC or 220VAC, unit will display 110. Mode is only active during normal control mode (when top display = PV, Lower display = SP). N/A on battery power.
Press both keys  simultaneously	Alarm Test	Energize audible alarm and alarm relay output as long as keys are pressed. Mode is only active during normal control mode (when top display = PV, Lower display = SP). N/A on battery power.

Note: When the controller is displaying temperature in normal control mode, press/release or press/hold the up/down keys to change the set-point value. This set-point mode does not apply to power off modes.

## CONTROL KEYS & DISPLAYS CONT.

A	A	E	E	I	I	N	n	S	S	X	
B	b	F	F	J	J	O	o	T	t	Y	y
C	C	G	G	K	Y	P	P	U	u	Z	
C	c	H	H	L	L	Q		V	<u>u</u>	?	?
D	d	h	h	M	N	R	r	W		=	=
 : Confused Character											

The upper display is used to show the process value or menu prompt. The lower display is used to show the set-point value or menu value. Both displays are blank while on battery power unless the  button is pressed to display the process value. Note: When operating on battery power, the battery status LED (labeled "BAT" on the front panel) will be lit.

## USER PARAMETER MODE

To enter the USER parameter mode, hold the scroll key for 2 seconds and release.



To enter the user parameter mode, hold the Scroll Button for 2 seconds and release.



To make changes in the user parameter mode, press the up or down arrows.



To exit the user parameter mode, press and release the Scroll Button.

## PROGRAM PARAMETER MODE

To enter the PROGRAM parameter mode, hold the scroll key until the screen changes to 'SPL', then release. This will take approximately 15 seconds.



To page through Parameters, Press and Release the scroll key



Please read the superscript instructions (bottom of page) for each Parameter value.

### THE FOLLOWING VALUES WERE SET WHEN THIS UNIT WAS SHIPPED

PARAMETERS	DESCRIPTION	°F	°C	ON	OFF
SPL <sup>3</sup>	Lower Setpoint	-148	-100		X
SPH <sup>3</sup>	Upper Setpoint	-40	-40		X
AI <sup>2</sup>	Alarm			X	
INV <sup>1</sup>	Temperature Scale	°F	°C		X
SHF <sup>1</sup>	Calibration				X
ASP <sup>1</sup>	Alarm Differential	22	12		X
AHY <sup>3,1</sup>	Alarm Hysteresis	1.8	1.0		X
OHY <sup>3,1</sup>	Output Hysteresis	3.6	2.0		X
RB <sup>1</sup>	Alarm Delay in Minutes		30		X
DoR <sup>4</sup>	Door Alarm				X
SP <sup>2</sup>	Setpoint			X	
IN2 <sup>4</sup>	N / A	N / A			

TO EXIT TAP SCROLL KEY REPEATEDLY UNTIL TEMPERATURE/SETPOINT SCREEN APPEARS

1) This parameter has been turned "on" by pressing either arrow key then make your changes in "user" mode.

THE VALUES TO BE CHANGED ARE DISPLAYED IN USER MODE ONLY, except SPL and SPH.

2) No values to change, either enable or disable by pressing the ▲ or ▼ arrow buttons.

3) Any changes made here without expressed permission from the manufacturer will VOID the warranty of the unit.

4) The parameter "DoR" and IN2 cannot be utilized at this time.

# CONTROL CALIBRATION

## CALIBRATION PROCEDURE

To calibrate the control, the calibration parameter must be turned on.

To enter the CALIBRATION mode, hold the scroll key until the screen changes to 'SPL', then release. This will take approximately 15 seconds.







Press and Release the scroll key to page through Parameters.



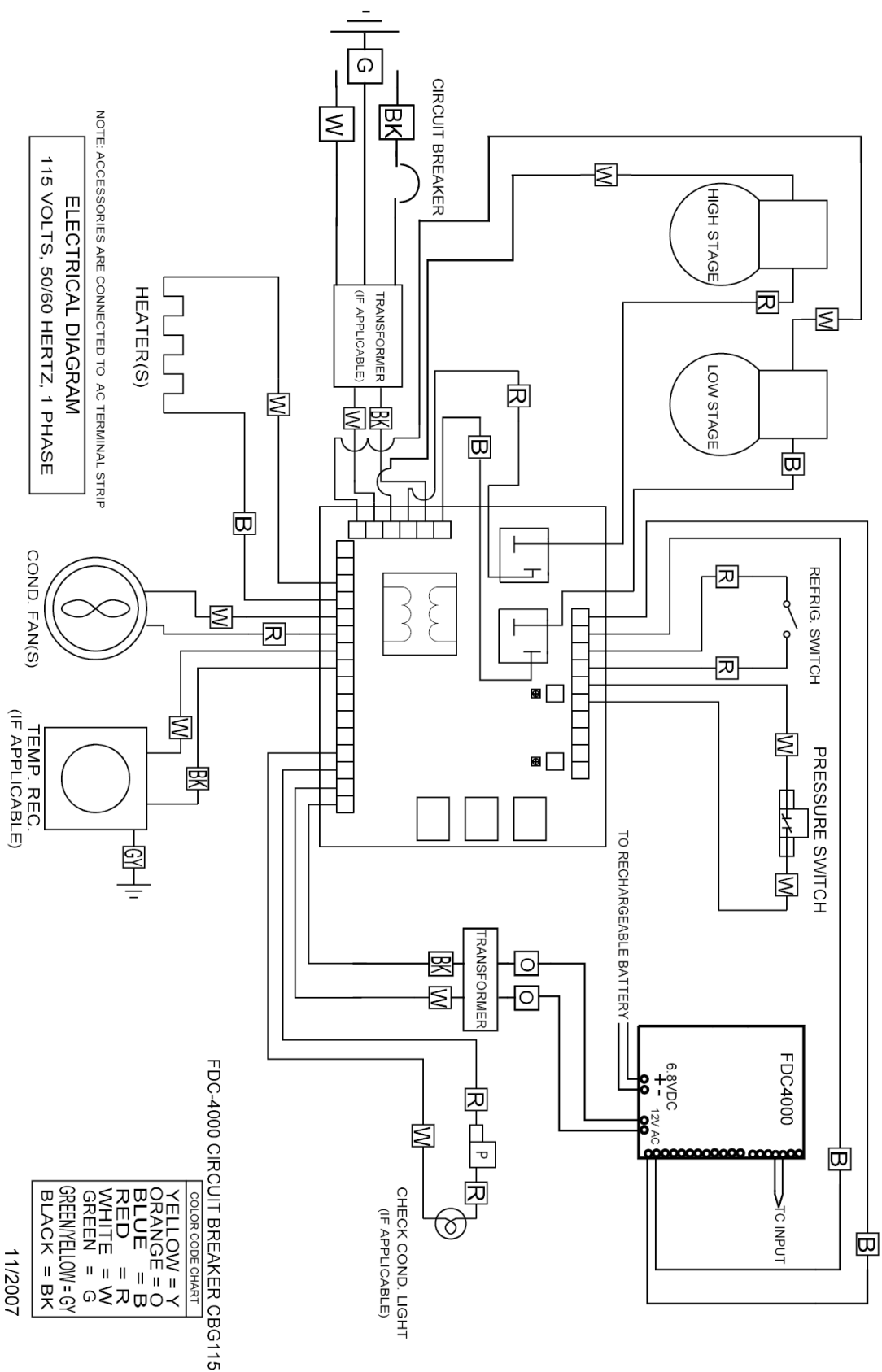
Once value SHF is shown, Use the or arrow keys to change value to ON.

PARAMETERS	DESCRIPTION	°F	°C	ON	OFF
SPL <sup>3</sup>	Lower Setpoint				
SPH <sup>3</sup>	Upper Setpoint				
AI <sup>2</sup>	Alarm				
INV <sup>1</sup>	Temperature Scale				
SHF <sup>1</sup>	Calibration			X	

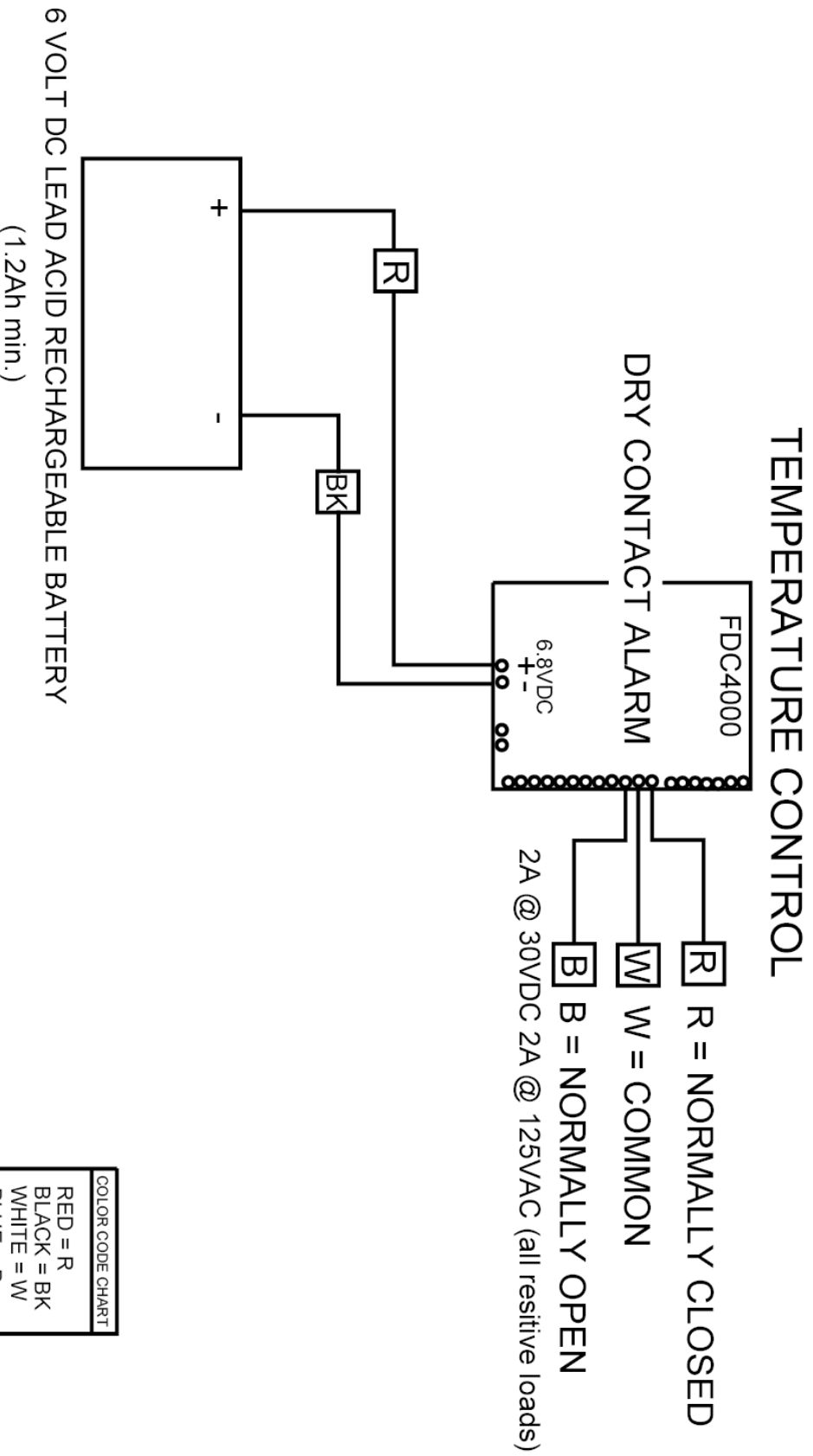
### ONCE THE CALIBRATION PARAMETER HAS BEEN TURNED ON

- Hold SCROLL KEY  for 2 seconds and release. SHF should appear in the top display and the current calibration value should appear in the bottom display.
- The value can now be changed with UP  or DOWN  arrow keys.
- Once finished, press and release the SCROLL KEY  to return to the main screen.

# WIRING DIAGRAM



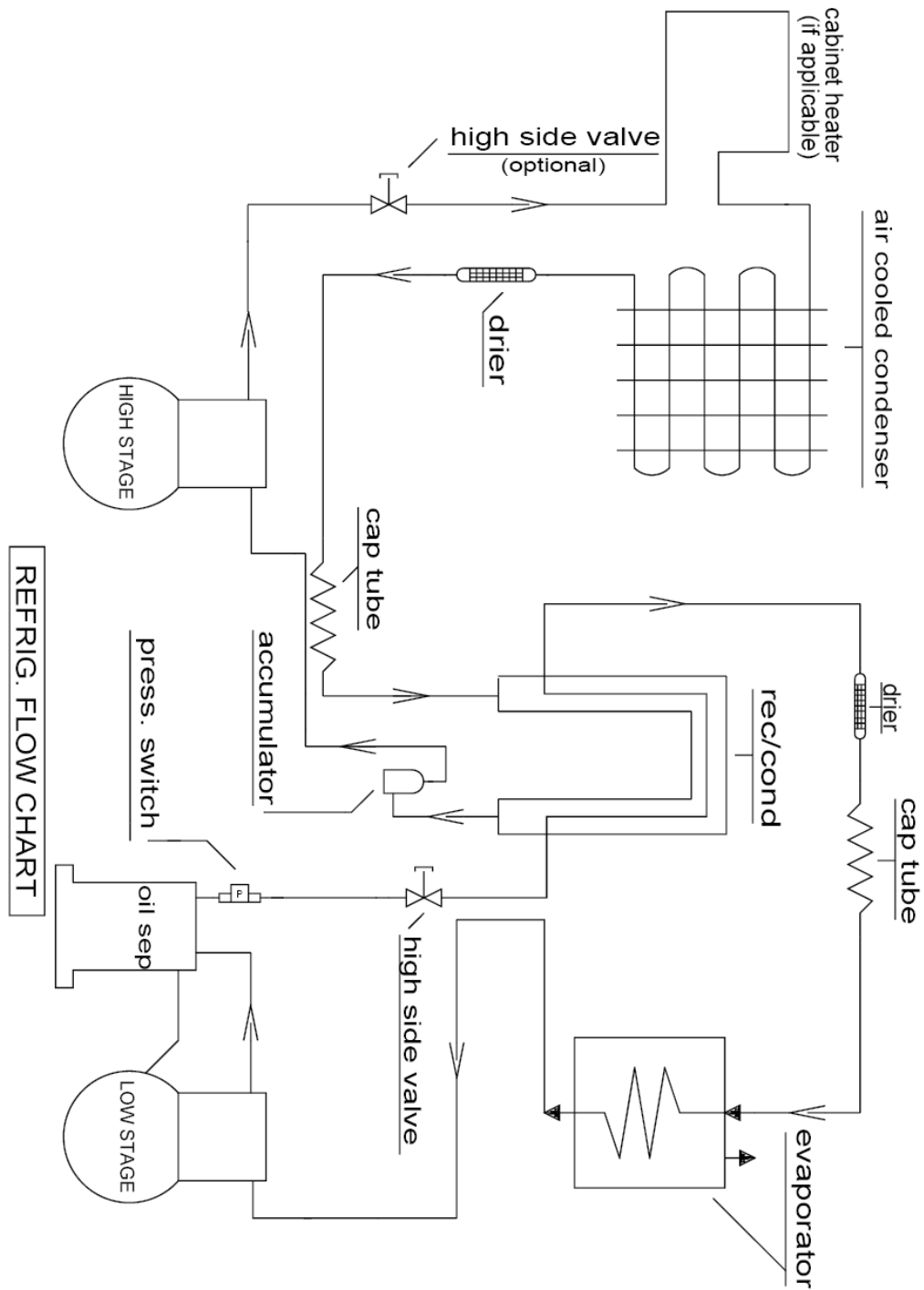
# ALARM DIAGRAM



COLOR CODE CHART	
RED = R	
BLACK = BK	
WHITE = W	
BLUE = B	

11-2007

# REFRIGERATION FLOW CHART



REFRIG. FLOW CHART

HOT GAS BYPASS CASCADE FLOW CHART

4-19-2010

# REPLACEMENT PARTS LIST

COMPRESSOR MODEL	HP	VOLTAGE	HERTZ	PHASE	PART #
TECUMSEH AJB2433ZXA	1	115	50/60	1	AJB24-115
TECUMSEH AJB2433ZXD	1	208/220/230	50/60	1	AJB24-208
EMBRACO FFI12HBX	1/3	115	50/60	1	FF12-115
DANFOSS SC15FTX	1/3	115	50/60	1	SC15-115
DANFOSS SC18FTX	1/2	208/220/230	50/60	1	SC15-208

TEMPERATURE CONTROL PARTS	PART #
FDC 4000	4000
FDC nCOMPASS	nCOMPASS

CASCADE ELECTRICAL PARTS	PART #
Heater Harness No. H-200	217-VOLTAGE
Refrigeration Switch No. 2X464	TOGGLE
Condenser Fan Motor No. GE-5411 - 115/60/1	500-115
Condenser Fan Motor No. GE-5421 - 230/50-60/1	500-VOLTAGE
Electrical Cord No. 8-3 (Please Specify Voltage)	PWRCRD-VOLTAGE
Control Board No. CECB2TUV (Please Specify Voltage)	231-VOLTAGE

REFRIGERATION HIGH STAGE PARTS	PART #
Air Cooled Condenser No. 3CZ0602B	254
Drier No. C-053-S	256H
Capillary Tube	HS-17, HS-20
Oil Separator, Temprite Series 900 (If Applicable)	900

REFRIGERATION LOW STAGE PARTS	PART #
Pressure Control No. 20PS01-0039	259
Receiver Condenser	RCN-LS
Drier No. CO-52S-S	256L
Capillary Tube	LS-28, LS-31
Oil Separator, Temprite Series 900 (If Applicable)	900

HARDWARE PARTS	PART #
Latch No. METL-L1-99	REX37L1-3
Chest Hinge	59-928M
Upright Hinge No. Polar 109-LH	59-928U
Cabinet Gasket	NX504B1
Lid or Door Gasket	PSOS
Grill No. 650H	356F, 356S
Sub-Lids (Must have Model Number)	SL-MODEL NUMBER
Inner Door (Must have Model & Serial Number)	357-MODEL NUMBER-SERIAL NUMBER
Clips & Rollers for Inner Doors (Quantity 10 minimum)	405
Shelves for Freezer (Must have Model Number)	4015-MODEL NUMBER

## WARRANTY POLICY

Yamato Scientific America warrants, from the date of shipment from warehouse in Cincinnati, Ohio, U.S.A., for a period of one (1) year. All products, parts and materials shall be free of defects in material and workmanship under normal use consistent with the product instructions. This product warranty does not apply to products purchased from unauthorized resellers/distributors.

Yamato reserves the right to inspect the product under claim before having an obligation to repair or replace the defective unit covered by this warranty. All costs of shipping to Yamato for inspection shall be borne solely by the purchaser. Products repaired or replaced under the terms of the warranty may be refurbished or new product will be provided at the discretion of Yamato.

### **Warranty Conditions**

This warranty shall have force and effect only if all items are used with proper circuits, voltages, and frequencies and the operation thereof is in accordance with instructions furnished by the manufacturer.

This warranty shall not extend to such parts as refrigerants, finishes, belts, and dryers.

This warranty shall not extend to ordinary wear and tear, or ordinary refrigeration service and refrigeration adjustments, unless specifically included in the equipment purchase contract.

This warranty does not apply to equipment or parts which fail because of abuse, accident, alteration, misuse, erosion, improper installation, or improper replacement of a repaired item.

The buyer assumes all risks for results obtained from these products, whether used alone or in combination with other items. It is expressly understood that we are not responsible and will not be held liable for damage and/or injury caused using our products.

## WARRANTY POLICY CONTINUED

### Product Return Policy

If you are not satisfied with your purchase and wish to make a return, contact our customer service to inquire about a Return of Merchandise Authorization Number (RMA). Merchandise returned without an RMA number will not be accepted and will be returned to the sender. Return requests must be made within 15 days of the customer's receipt of the merchandise.

All returns must be unused and in unopened original packaging and include all items and manuals originally shipped.

The purchaser is responsible for the shipping cost of return shipment. Insurance on the return shipment is required. Damage or loss of merchandise during shipping is the responsibility of the sender. Returned shipments that arrive damaged will be returned to the sender, and credit will not be rendered.

All returned products, parts and materials are subject to a 25% restocking fee. Shipping and handling cost are non-refundable. All retrofitted, customized and special order item sales are final and non-returnable.

### In Case of Request for Repair

If the failure occurs, stop the operation, turn OFF the power switch, and unplug the power plug. Please contact the sales agency that this unit was purchased, or Yamato Scientific's sales office.

### < Check following items before contact >

- ◆ Model Name of Product
- ◆ Serial Number
- ◆ Purchase Date
- ◆ Issue (as detailed as possible)

### Responsibility

Please follow instructions in this document when using this unit. Yamato Scientific has no responsibility for accidents or breakdown of device due to failure to comply. Never conduct what this document forbids as unexpected accidents or breakdown may result.

**Yamato Scientific America Inc.**  
925 Walsh Ave, Santa Clara, CA 95050  
Tel: 1-800-292-6286 / 408-235-7725  
<http://www.yamato-usa.com>

**For customer service:**  
Email: [customerservice@yamato-usa.com](mailto:customerservice@yamato-usa.com)  
**For technical support:**  
Email: [technical@yamato-usa.com](mailto:technical@yamato-usa.com)