

INSTRUCTIONS

FOR

TSX REFRIGERATOR / FREEZER

**REPLACING
RELAY AND CPU BOARDS
AS A FIRMWARE SET**

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1.0 GENERAL INFORMATION

The first generation HPLRF TSX control system consisted of five PCB (Printed Circuit Board) assemblies; Control PCB (CPU), Display PCB, Distribution PCB, 45W H01 Power Supply and the H01 Relay PCB along with 302363G52 firmware. It was launched on 23' cabinets only. To determine if the unit should be running Blood Bank firmware (+4), Lab Refrigerator firmware (+5), Cold Wall firmware (-20) or Auto Defrost Freezer firmware (-30), there was a hardware jumper on the Relay board that was “read” during initial power up.

The second generation HPLRF TSX control system retains the five board setup, but is now using the H02 Relay PCB, 45W H02 Power Supply along with 302363G54 firmware. It is running on 12, 23, 30, 45, & 50' cabinets. To determine if the unit should be running Blood Bank firmware (+4), Lab Refrigerator firmware (+5), Cold Wall firmware (-20) or Auto Defrost Freezer firmware (-30), there are now three critical parameters in the Service Menu that have to be set correctly before the unit can reboot and run the appropriate firmware. The boards have to be told what type of unit (tyP = 4, 5, 20 or 30), what vintage / suffix of unit (CFg = 00, 01, or 02), and what size of cabinet (CuFt = 12, 23, 30, 45, or 50).

Both the CPU and Relay PCBs now contain firmware, so they must be installed as a set. Failure to replace them as a set will result in a miss match of code with will result in potential risk to the customer's product. A miss match can cause the unit to not work at all, the compressor to simply not run, or worse – appear to work at first, then fail after the customer has added product to the unit.

This instruction covers the replacement of the CPU and Relay PCBs as a set based on checksum values. Valid sets are shown in the following table (CPU/Relay):

Vintage	EPROM version	EPROM Checksum	Relay Checksum	Approximate Production Dates
Suffix 16	G52B	1AB1	4CE4	Nov 2016 to May 2018
Suffix 17	G54A	520E	3CA0	May 2018 to Apr 2019
Suffix 17	G54B	CF1B	DB6A	Apr 2019 to May 2019
Suffix 17/18	G54C	A678	9AC9	May 2019 to Feb 2020
Suffix 17/18/19	G54D	A901	D284/3429	Feb 2020 to Dec 2020 to May 2021
Suffix 17/18/19/20	G54E	36DE	9862	May 2021

These new components were designed as drop-in replacements. The new CPU and Relay PCBs mount in the same place. The H02 Relay board will come with a jumper harness for models that do not contain a HPCO, mainly models other than the 3030 & 5030. If the jumper is not installed on models that do not have a HPCO switch, the compressor will not run. All sensor harnesses plug into the CPU at the same place. Programming may include upgrades such as the “pull down offset” and “control offset” being displayed in Service mode which were not available in the 2016 release. Upgrading early suffix 17 units with newer suffix 17 firmware may result in the addition of the alarm self-test. Adjustable “door ajar” added along with 2320FMS model.

New Parts to Install:

Control PCB with latest G54 firmware (PN 326300G54)

Relay PCB (PN 327325G02) with the latest firmware

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2.0 SAFETY

Refrigerators and freezers are complex machines. Any attempt to repair them should be done with caution. Safety should be every persons concern and is every person's responsibility. Your personal safety begins with knowledge of the equipment on which you are working. We are concerned with your safety; therefore, we have provided a few ideas and safety reminders.

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| <ol style="list-style-type: none">1. Know the location of the unit's circuit breakers or fuses. Ensure all breakers and/or fuses are clearly marked for quick identification and reference.2. Before servicing any unit, unplug the power cord. Do not perform any maintenance or remove an access panel on an energized unit. The replacement procedures require that the electrical power be disconnected until ready for calibration.3. Be careful when handling access panels, parts, or any components which may have sharp edges which may cause damage to wiring and electrical connections, not to mention personal injury.4. Always use the correct tool for a job and be sure those tools are in good condition. Ensure that tools to be used on electrical devices are well insulated, if applicable.5. Never interfere with or bypass the operation of any switch, component or feature of the unit. Interlocks, relays, and switches are designed with a specific purpose and should, therefore, not be altered.6. Use only approved replacement parts that are the correct size, rating, and capacity as the original part. If you have a question concerning replacement parts, call the Technical Services Department.7. When replacing any component, be sure any green ground wires are reconnected securely in their original positions to avoid danger of shock or short circuit.8. Never alter a power cord in order to make it fit an electrical outlet. The line cord must be plugged into a grounded, three-prong receptacle. Never cut or remove the third (ground) prong from the power cord connector. | <ol style="list-style-type: none">9. Before reconnecting the power supply, make sure no un-insulated wires or terminals are touching the cabinet, as this can lead to electrical shock, fires, and equipment damage. Electrical wiring and all grounds must be correctly reconnected and secured away from sharp edges, components and moving parts. All panels and covers should be reinstalled before the electrical power is connected.10. Never substitute ordinary wire for any internal wiring of a unit. The internal wiring of these units carry a special rating due to the somewhat high currents that they can be subjected to at times. This heavy current load generates heat, which can melt ordinary wire. It is vitally important that all connections are tight and secure.11. Throughout this service manual, additional safety precautions dealing with specific procedures may be presented. This information should be carefully read and observed.12. Throughout this service manual, additional safety precautions dealing with specific procedures may be presented. This information should be carefully read and observed.13. All <i>Electro Static Discharge</i> (ESD) precautions MUST be observed to prevent static from damaging the PCBs. |
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3.0 REPLACEMENT PROCEDURE

3.1 Record Original Data

The newest firmware may have more service parameters than the boards you are replacing, but it is recommended that if the unit you are working on is able to run enough to access the Program and Service menus, record as many of the old values as possible on the following list –

	System Parameter	Units	Display "text"	Value
PROG MODE	Set point	°C	na	
	Warm Alarm	°C	na	
	Cold Alarm	°C	na	
SERVICE MODE	"SER"	na	SEr	na
	Temp of Unit	°C	na	
	CPU Checksum	base 16 #	na	
	Relay Checksum	base 16 #	na	
	Model Type	coded #	tyP	
	Configuration	coded #	CFg	
	Cubic Foot	cu ft	CuFt	
	Pull Down Offset	°C	Pd oFSt	
	Control Offset	°C	Cnt oFSt	
	Display Offset	°C	diS oFSt	
	Control UCL	°C	Cnt ucl	
	Control Calibration	on/off	Ctr CAI	
	Control LCL	°C	Cnt lcl	
	Door Ajar	minutes	door ajar	
	Adaptive Defrost	on/off	AdP dEF	
	Defrost Interval	hours	dEF Int	
	Defrost Duration	minutes	dEF dur	
	Defr. Hi (temp out)	°C	dEF Hi	
	Drip Pan temp out	°C	Pan Hi	
	Quality Mode	on/off	qUA	
	BOT Request	on/off	bot	
	Perimeter Heater PWM	%	Per	
	Cntr.Probe	°C	Cnt Prb	
	Amb. Probe	°C	Anb Prb	
	Lower Display Probe	°C	d lo Prb	
	Defr.Prb	°C	dEF Prb	
	Drip Pan Probe	°C	PAn Prb	

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3.2 Access the Printed Circuit Boards

1. Turn the key switch to the Off position (fully CCW) and disconnect the unit from the electrical source.
2. Remove the back and top grills over the PCB area.

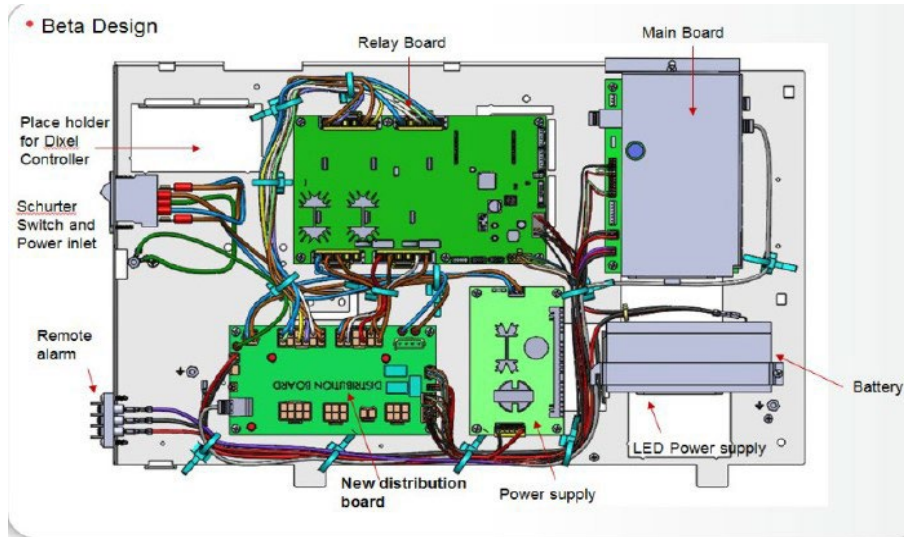


Figure 1: Board locations on the electrical deck.

3.3 Removing old components

CPU PCB and wiring.

1. Remove and save CPU cover (RF shield).
2. Disconnect any harnesses from CPU (Main board in the above drawing) noting their position and routing.
3. Remove and save 4 mounting screws for CPU PCB.

Relay PCB

4. Disconnect any harnesses from Relay PCB noting their position and routing.
5. Remove and save 6 mounting screws for Relay PCB.

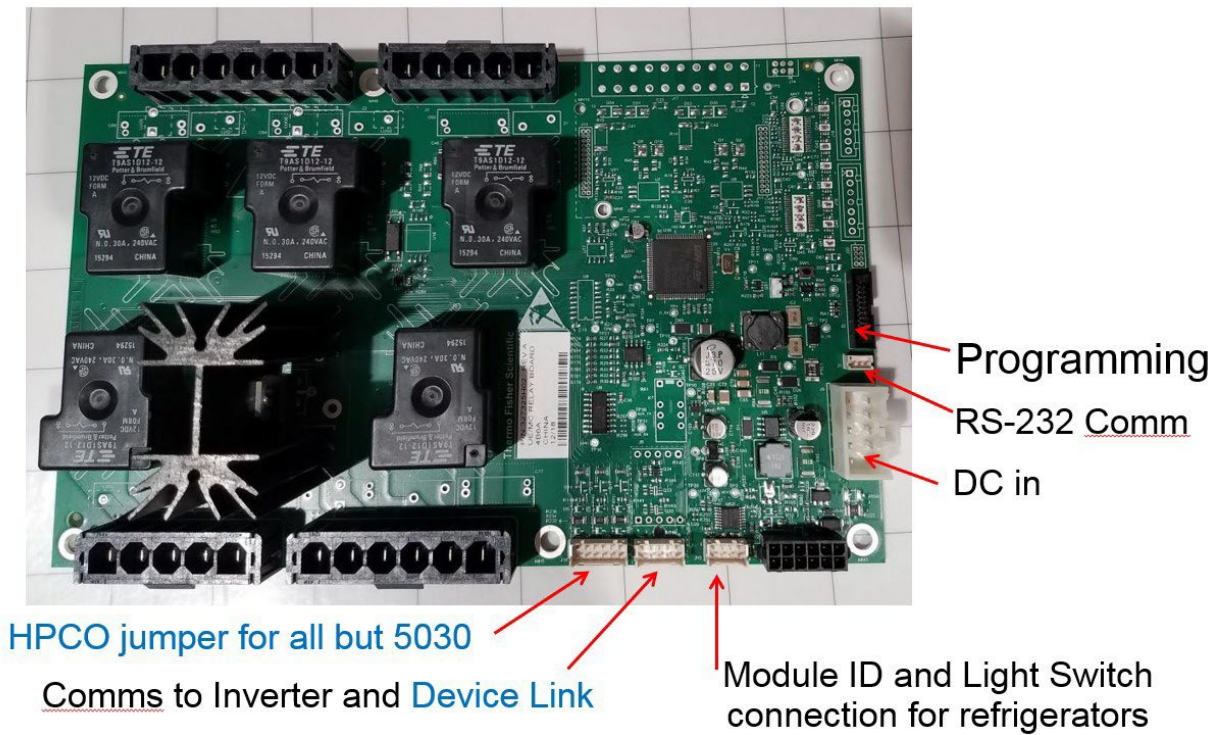
3.4 Install New Components

CAUTION PCBs are electrostatic sensitive; be sure to observe all applicable ESD precautions.

1. Remove the CPU PCB (326300G54) from the bag and install it in place of the original.
2. Remove the Relay PCB (327325G02) from the bag and install it in place of the original.
3. Connect the harnesses to both boards that were disconnected in the previous procedure paying careful attention to pin placement. Make sure the HPCO jumper is used on all models except 5030 and 3030 which will have a HPCO harness that will need to be reconnected.

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TSX Relay Board – 327325G02



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4.0 Programming the Control Parameters

To program the unit is to set the operating parameters of the unit. Programming should not be confused with calibration. Calibration insures the accuracy of the unit's sensors, while programming defines how the unit should operate. For example; "Your set point is -30", "Your high temp alarm is -25", etc...

NOTE The front panel key must be in position 1 (Alarm OFF) position before programming can occur.

4.1 Initial Setup

Press and hold the center button to enter Program Mode. At this point, you will see set point and alarm settings that do not work for any of our units. For example the set point will be +28°C, cold alarm will be +23°C, and warm alarm will be -10°C. Until the three critical parameters are setup in the Service Menu, there is no need to try to adjust the Program parameters at this time.

While in Program mode, press the center button again for 10 seconds. The display will flash SEr followed by the temperature of the unit, again an invalid number at this point. Advance through the Service Menu by pressing the center button after each parameter has been viewed / adjusted. Reminder, parameters that do not flash are not user settable. Next will be the firmware checksums. The next three parameters will need to be set before the unit can function.

- 1) The first is **Model Type** (tyP). The choices are 4, 20, 30, 5, 55 and 66. 4 represents the blood bank models with the lower bottle sensor. 20 is used for cold wall manual defrost units. 30 is used for -30 auto defrost units. 5 is used for all refrigerators other than the blood banks. 55 and 66 are for future use.
- 2) The second is **Configuration** (CFg). The choices are 00, 01, and 02. This may show 03 at first, but once one of the valid numbers is selected, you will not be able to get back to 03 at this time. 00 represents the original 23' designs from 2016, also known as Suffix 16 units. If you are working on units that were built in 2016 through May 2018, you will need to set this parameter to 00, especially for 2330 electric defrost units. 01 is for Suffix 17 units which includes all 12, 23, 30, 45, & 50' units built after May 2018 with the exception of cold wall units built after May 2019. 02 represents 2320 and 3020 cold wall units built after May 2019 with a bottle sensor for the display.
- 3) The third is **Cabinet Size** in cubic feet (CuFt). The choices are 12, 23, 30, 45 or 50 and represent the physical size of the unit.

Once the critical three parameters have been set, press the center button at least one more time and let the menu time out. Time out should occur in 30 seconds. Once the menu times out, wait for the unit to reboot. It will show 0.0 and then start running based on the default parameters for the selected temperature range and cabinet size. Default parameter tables can be found in the 313398H06 service manual. Double check that the settings in the Program menu are showing the proper set point. Enter the Service Menu to double check the cabinet type and size, then enter any other recorded values from paragraph 3.1 that weren't entered in paragraph 4.1. To write new parameters to memory, scroll completely through the service mode.

NOTE: If the unit is not given a chance to reboot on its own, or if a Power on Reset (POR) is performed immediately after the critical parameters are entered, the parameters can fail to be retained or the service menu may appear to be incomplete for the model you are working on. If this occurs, simply reenter the critical parameters and allow the system more time to reset itself before verifying that the new typ, cfg and cu ft settings have been saved in the service menu.

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5.0 SYSTEM CALIBRATION

The purpose of system calibration is to give the control system the most accurate information possible. The unit was shipped based on end of line testing with the cabinet running with its default offsets determined by extensive engineering testing. This operation gives a good baseline for operation but can be affected by shelf loading, ambient temperature swings and other unpredictable factors.

This instruction is provided to enable a qualified service provider to make a slight adjustment to the display should the center air and display differ by more than 0.5°C.

5.1 Control Offset adjustment

This adjustment is covered by KB article 345581, but is copied below

Step 1: Install an NIST thermometer or thermocouple into a 100ml solution bottle, filled with a 50/50 mixture of distilled water and glycerin, located in the geometric center of the cabinet. Allow the unit to reach set point, or as close as it will get, and then allow it to stabilize for at least 2-3 hours with no door openings.

Step 2: Once the unit / added bottle has stabilized without any door openings, check the temperature of the T-type thermocouple. If the thermocouple temperature is different than the set point, you can adjust the control offset so that the reading from the T-type thermocouple in the geometric center of the cabinet is within 0.5 degree C of the set point.

Step 3: To adjust the control offset, press and hold the center button for ~5 seconds until "PRG" (program mode) is shown. Once in program mode, release the button and press the center button and hold for ~10 seconds again until "SER" (service mode) is displayed. The initial readout will be the temperature program that is running, typically 4, 5, 20 or 30. Continue to use the center button to scroll through the service menu with a single press and release. The next parameters will be the check sums, program configurations and offsets. Scroll until you get to the parameter "Cnt oFSt". The number flashing will be the control offset. Adjust this number to make the cabinet temperature change to the desired operation temperature. (See example below on how you should adjust the control offset.) Once changes have been made, press and release the center button to save. If no buttons have been pressed in 30 seconds, the unit will time out of service mode and go back to the normal display. After adjusting the offset, the temperature display will slowly change over a period of 5 to 10 minutes. Allow the display some time to remain constant before checking again. Adjust the control offset again if need be. Once the unit is operating at the desired temperature, check and or adjust the display offset as needed so that the display matches the geometric center air temperature per the instruction sheet on the Knowledge Base article # 345318.

Example: If the display is reading 5.0°C and the weighted T-type thermocouple is reading 5.9°C the control offset will need to be -0.9°C lower than the existing offset.

If the control offset is -0.2°C, use the down arrow to change -0.2°C to -1.1°C. If the control offset is -2.0°C, use the down arrow to change -2.0°C to -2.9°C. Once changes have been made, press the center button again to save.

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5.2 To calibrate display to center air.

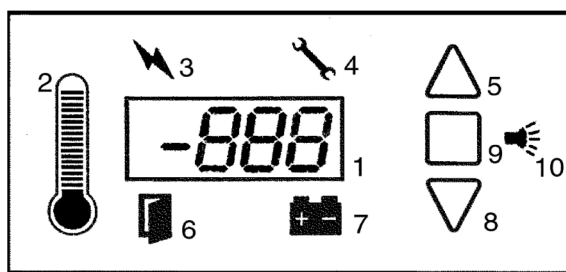
Step 1: Install an NIST thermometer or thermocouple into a 100ml solution bottle, filled with a 50/50 mixture of distilled water and glycerin, located in the geometric center of the cabinet. Allow the unit to reach set point and then stabilize for at least 2-3 hours with no door openings.

Step 2: Once the unit is at cycle temp and the bottle has stabilized for at least 2 to 3 hours without any door openings, check the temperature of the T-type thermocouple. If the display temperature is different than the center air reading from the T-type thermocouple the display will need to be calibrated. Refrigerators should be checked for stable temperature at their normal operating temperature range. For -20 & -30 freezers, it is better to calibrate their temperature at bottom out temperature of an empty cabinet as opposed to their normal set point / cycle temperature. Check calibration on freezers once the freezer reaches bottom out and is stable for at least 2 to 3 hours.

Step 3: To calibrate the display, press and hold the center button for ~5 seconds until “PRG” (program mode) is shown. Once in program mode, release the button and press the center button and hold for ~10 seconds again until “SER” (service mode) is displayed. The initial readout will be the temperature program that is running, typically 4, 5, 20 or 30. Continue to use the center button to scroll through the service menu with a single press and release, no hold necessary. The next parameters will be the check sums, program configurations and control offsets. Scroll until you get to the parameter “diS oFSt”. The number flashing will be the temperature offset / display calibration offset. When this number is changed the reading on the display will match the actual temperature of the unit. (See example below on how you should adjust the temperature offset.) Once changes have been made, press and release the center button to save. If no buttons have been pressed in 30 seconds, the unit will time out of service mode and go back to the normal display. After adjusting the offset, the temperature display will slowly change over a period of 5 to 10 minutes. Allow the display some time to remain constant before checking again.

Example: If the display is reading 4.6°C and the weighted T-type thermocouple is reading 3.9°C the offset will need to be -0.7°C. If the temperature offset is 0.0°C, use the down arrow to change 0.0°C to -0.7°C. If there have already been offset adjustments programmed, adjust it accordingly. If the offset is set at +0.5° C from previous calibrations then use the arrows change the offset to -0.2°C. Once changes have been made, press the center button again to save.

Figure 2
Control panel

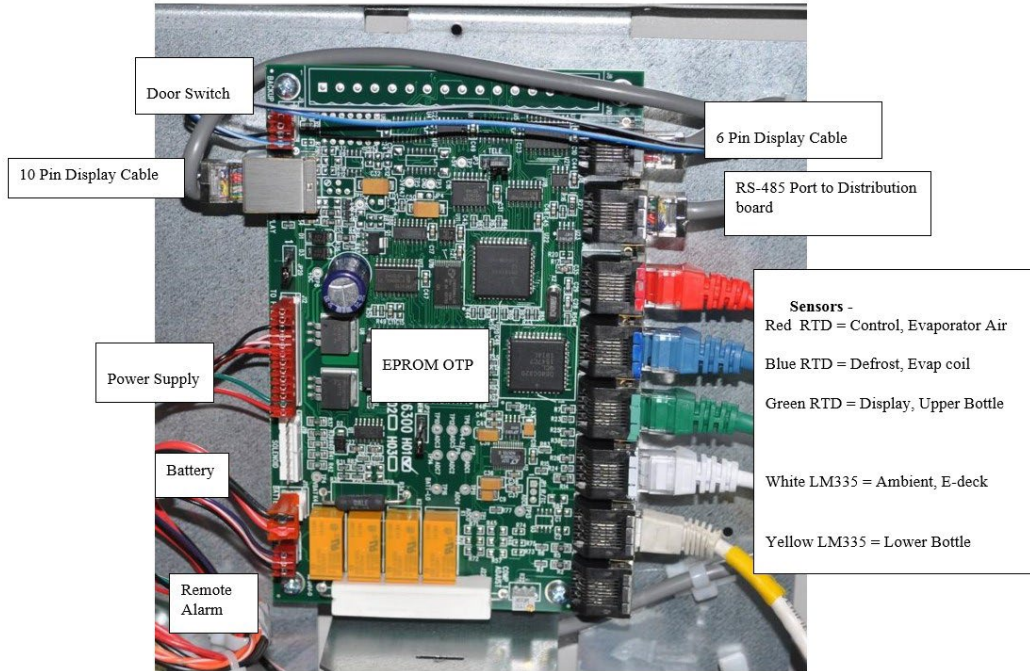


9 equals center / select button

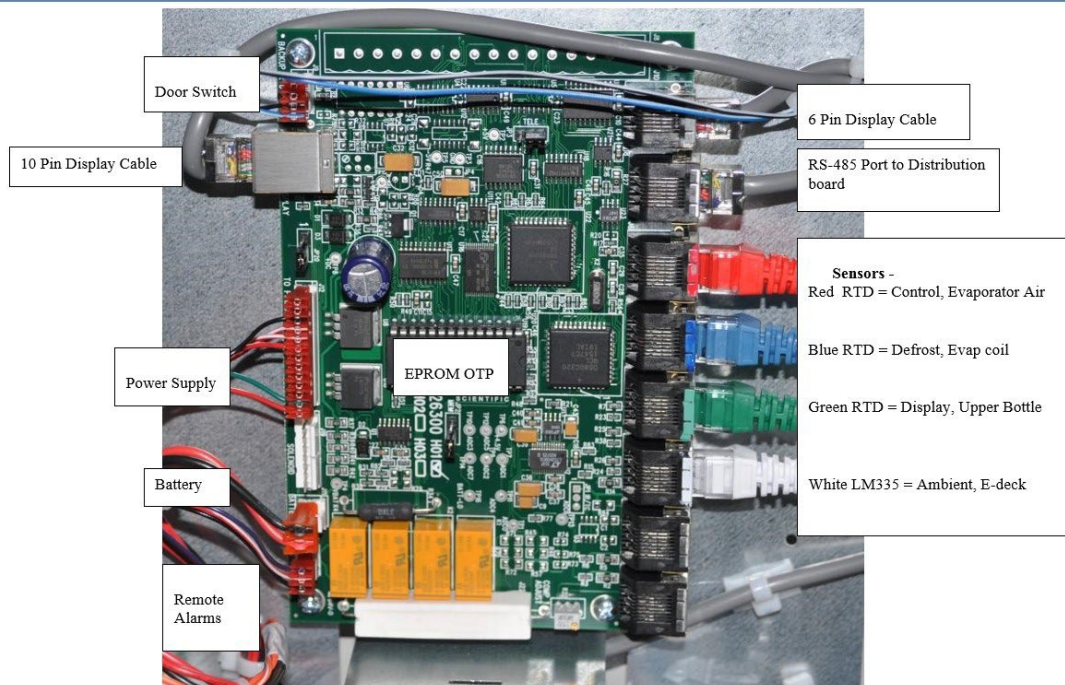
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6.0 Standard CPU Sensor / Harness Connections

+4°C Blood Bank Refrigerator – TSX New

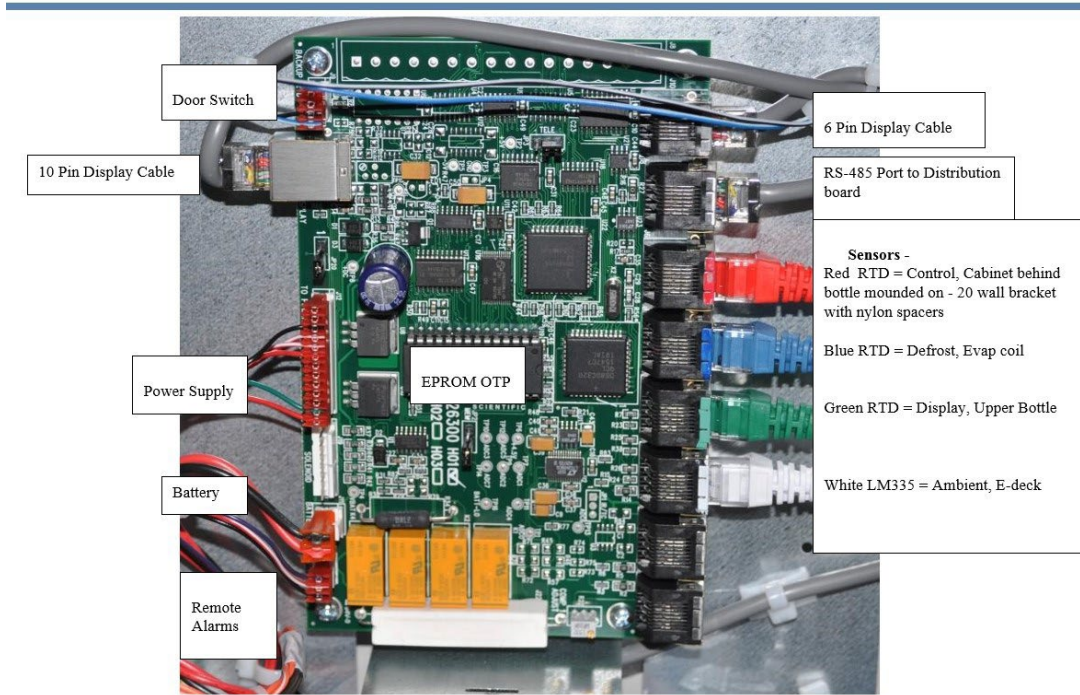


+5°C Refrigerator – TSX New

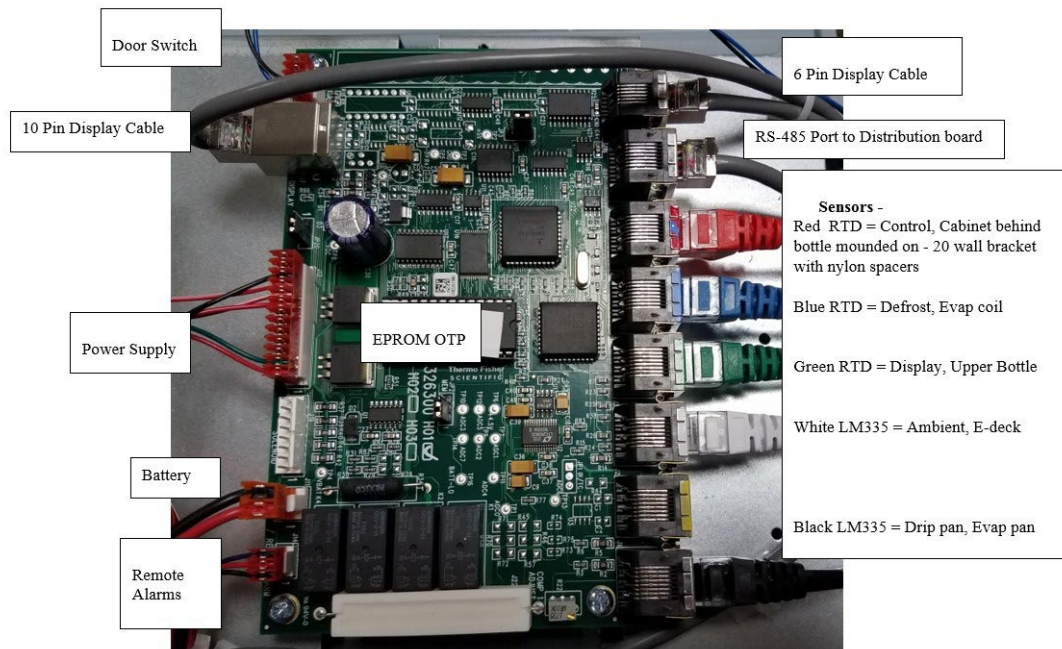


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-30°C Freezer – TSX suffix 16

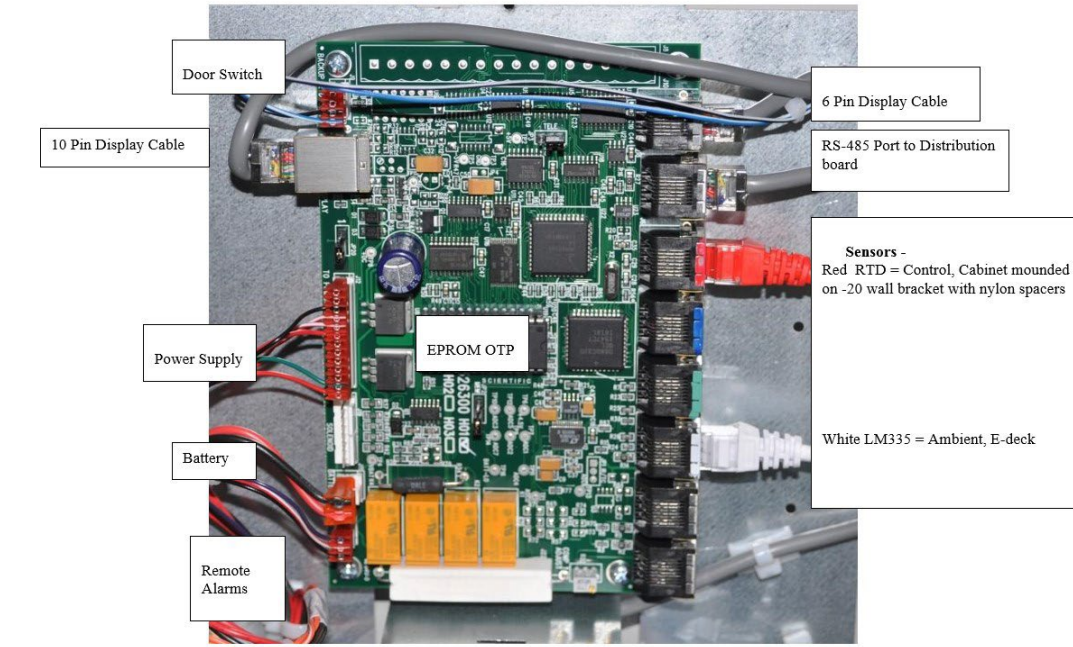


-30°C Freezer – TSX suffix 17



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-20°C Freezer – TSX suffix 16/CFG=00 & suffix 17/CFG=01



Below configuration now includes suffix 20/CFG=04 and TSX2330HA models -20°C Freezer – TSX suffix 18/CFG=02 & suffix 19/CFG=03

