High Performance Refrigerator & Freezer

+4°, +5°, -20°, and -30° C

TSX Series, Cardinal Series

Service Manual

313398H06 • Revision G • 7/1/2022

Important: Read this instruction manual. Failure to follow the instructions in this manual can result in damage to the unit, injury to operating personnel, and poor equipment performance.

Caution: All internal adjustments and maintenance must be performed by qualified service personnel.

Note: Material in this manual is for informational purposes only. The contents and the product described are subject to change without notice. Thermofisher Scientific makes no representations or warranties with respect to this manual. In no event shall Thermofisher Scientific be held liable for any damages, direct or incidental, arising from, or related to the use of this manual.

Press “Ctrl + Home” to return to top of Document

Contents

Models Covered 5
System Troubleshooting 7
Key Switch Circuit 10
Sensor Checking 10
FMS Unit Sensor Troubleshooting 12
327763H01 (External Relays 1 & 2) 327325H01 (K1 – K6 and Triac #1) 13
External Relay 1 – Aux. Relay on Distribution Board 13
External Relay 2 – Light Relay on Distribution Board 13
K1 Condenser Fan Relay – High Speed 13
K2 Inverter Relay on 100%, Controls the Compressor Speed Through RS-232 13
K3 Condenser Fan Relay – Low Speed 14
K4 Fan Relay, Evaporator 14
Triac 1 Perimeter Heater 14
K6 Defrost / Evaporator Pan Heater Relay 14
326300H01 CPU Board – DC Voltage Measurements at J12 Connector 15
327763H01 Distribution Board (External Relays 1 & 2) 16
327325H02 Relay Board (K1 – K6 and Triac 1) 16
327846G02 45W Power Supply 16.5 V DC adjustable 17
326300H01 CPU Board 18
TP1 “ADC0” – LM335-1 Drip Pan Sensor 19
TP2 “+5V” 19
TP3 “GND” 20
TP4 “VBAT” 20
TP5 “-5V” 20
TP6 “+4.5V” 20
TP7 “LM335-2” Lower Bottle sensor (yellow) 20
TP8 “+DC” 20
TP9 “LM335-3” Ambient sensor (white) 20
TP10 “ADC3” Cabinet Display sensor (green) 20
TP11 “ADC4” Defrost sensor (blue) 20
TP12 “ADC5” Control sensor (red) 21
TP14 “ADC7” AC Monitoring 21
TP16 “Batt Lo” 21
Position jumpers on the Control PCB: 21
Power on Reset 21

Press “Ctrl + Home” to return to top of Document

Alarm Clear / Reset....21
326300H01 CPU Board Silkscreen....22
326300H01 CPU Board Ladder Diagram....23
326301H01 Display Board....24
326301H01 Input / Output Summary....24
326276H01 Display Board Silkscreen....26
326276H01 Display Board Ladder Diagram....27
Cardinal Control Panel Overlays....28
TSX Thermo Scientific Overlays....28
Control Panel Information....29
+4° / +5° Refrigerator Alarm Functions....31
-20° / -30° Freezer Alarm Functions....32
Feature & Alarm Descriptions....33
Alarm Test....33
Audible Alarm....33
Battery Low Alarm....34
Cold Temperature Alarm....34
Display Low Bottle (Blood Banks only)....34
Door Ajar Alarm....34
Power Failure Alarm....35
Warm Temperature Alarm....35
Remote Alarm Contacts....35
Setpoint Security....36
Thermometer Gauge....36
Basic Functions....37
Programming Mode....37
Service Parameters....38
+4° / +5° Service Menu Functions....38
-20° Service Menu Functions....40
-30° Service Menu Functions....42
Firmware History....44
Parameter Defaults by Eprom Revision and Suffix....45
TSX Sensor Matrix (RoHS compliant)....55
Display Sensor and Controller Accuracy....56
Standard CPU Sensor / Harness Connections....58
+4°C Blood Bank Refrigerator....58

Press “Ctrl + Home” to return to top of Document

+5°C Pharmacy and General-Purpose Refrigerator 59
-30°C Freezer – CFg 00 Electric Defrost 60
-30°C Freezer – CFg 01, 04 Hot Gas Defrost 61
-20°C ColdWall Freezer – CFg 00 62
-20°C 23ft ColdWall Freezer w/Bottle Sensor – CFg 02, 03, 04 63
-20°C 30ft ColdWall Freezer w/Bottle Sensor – CFg 01, 02, 03, 04 64
Sensor Locations Inside of Various TSX Units 65
Inverter Information 69
Embraco High Performance (HP) 69
Embraco High Performance (HP) LED Codes 71
Maia Inverter (Started with some Suffix 17 Models) 72
Maia LED Codes 73
Condenser Fan 74
Electric Condensate Heater 328840H0X 75
Chromatography with Safety Outlet 76
HC Sensor PPM Sensativity Graph 79
Safety Circuit Wiring Diagram (328790H01) 80
Blood Bank Anti-Freeze Protection 81
Dixell Operating Manual 83
Anti-Tip Bracket Instructions 85
4-20mA Temperature Transmitter Information 86
4-20mA Option Numbers 89
4-20mA Temperature Transmitter Wiring Diagram (327987H01) 90
Wiring Diagram +4°C Refrigerator Suffix 17 / 18 328059H05 91
Wiring Diagram +5°C Refrigerator Suffix 17 / 18 328059H08 92
Wiring Diagram -20°C Coldwall Suffix 17 – 20 Freezer 328059H06 93
Wiring Diagram -30°C Suffix 17 / 18 Freezer 328059H07 94
Charge Information 95
Pressure and Amp Draw 96
Refrigeration Diagram +4°C / +5°C Suffix 17, 18 327990H04 99
Refrigeration Diagram -20°C ColdWall Suffix 17 - 20 327990H06 100
Refrigeration Diagram -30°C Suffix 17 / 18 327990H05 101
Touch Up Paint Information 102
Technical Service Bulletins of Note 103
Available Service Kits 104

Press “Ctrl + Home” to return to top of Document

Models Covered

TSX Models covered by this Service Manual

TSX1204BA	TSX2304BZ	TSX3004BY	TSX5004BV	TSX4505CD
TSX1204BD	TSX2305CA	TSX3004BZ	TSX5004BY	TSX4505CV
TSX1204BV	TSX2305CD	TSX3005CA	TSX5004BZ	TSX4505CY
TSX1204BY	TSX2305CV	TSX3005CD	TSX5005CA	TSX4505CZ
TSX1204BZ	TSX2305CY	TSX3005CV	TSX5005CD	TSX4505GA
TSX1205GA	TSX2305CZ	TSX3005CY	TSX5005CV	TSX4505GD
TSX1205GD	TSX2305GA	TSX3005CZ	TSX5005CY	TSX4505GV
TSX1205GV	TSX2305GD	TSX3005GA	TSX5005CZ	TSX4505GY
TSX1205GY	TSX2305GV	TSX3005GD	TSX5005GA	TSX4505GZ
TSX1205GZ	TSX2305GY	TSX3005GV	TSX5005GD	TSX2320HA
TSX1205PA	TSX2305GZ	TSX3005GY	TSX5005GV	TXS2320EA
TSX1205PD	TSX2305PA	TSX3005GZ	TSX5005GY	TXS2320ED
TSX1205PV	TSX2305PD	TSX3005PA	TSX5005GZ	TXS2320EV
TSX1205PY	TSX2305PV	TSX3005PD	TSX5005PA	TXS2320EY
TSX1205PZ	TSX2305PY	TSX3005PV	TSX5005PD	TXS2320EZ
TSX1205SA	TSX2305PZ	TSX3005PY	TSX5005PV	TXS2320FA
TSX1205SD	TSX2305SA	TSX3005PZ	TSX5005PY	TXS2320FD
TSX1205SV	TSX2305SD	TSX3005SA	TSX5005PZ	TXS2320FV
TSX1205SY	TSX2305SV	TSX3005SD	TSX5005SA	TXS2320FY
TSX1205SZ	TSX2305SY	TSX3005SV	TSX5005SD	TXS2320FZ
TSX1230FA	TSX2305SZ	TSX3005SY	TSX5005SV	TXS3020EA
TSX1230FD	TSX2330FA	TSX3005SZ	TSX5005SY	TXS3020ED
TSX1230FV	TSX2330FD	TSX3030FA	TSX5005SZ	TXS3020EV
TSX1230FY	TSX2330FV	TSX3030FD	TSX5030FA	TXS3020EY
TSX1230FZ	TSX2330FY	TSX3030FV	TSX5030FD	TXS3020EZ
TSX1230LA	TSX2330FZ	TSX3030FY	TSX5030FV	TXS3020FA
TSX1230LD	TSX2330LA	TSX3030FZ	TSX5030FY	TXS3020FD
TSX1230LV	TSX2330LD	TSX3030LA	TSX5030FZ	TXS3020FV
TSX1230LY	TSX2330LV	TSX3030LD	TSX5030LA	TXS3020FY
TSX1230LZ	TSX2330LY	TSX3030LV	TSX5030LD	TXS3020FZ
TSX2304BA	TSX2330LZ	TSX3030LY	TSX5030LV	
TSX2304BD	TSX3004BA	TSX3030LZ	TSX5030LY	
TSX2304BV	TSX3004BD	TSX5004BA	TSX5030LZ	
TSX2304BY	TSX3004BV	TSX5004BD	TSX4505CA	

Press “Ctrl + Home” to return to top of Document

CAX Models covered by this Service Manual

CH1204BA	CH2305PA	CH3005PA	CH5004PA
CH1204BD	CH2305PD	CH3005PD	CH5004PD
CH1205GA	CH2305SA	CH3005SA	CH5004SA
CH1205GD	CH2305SD	CH3005SD	CH5004SD
CH1205PA	CH2330FA	CH3030FA	CH5030FA
CH1205PD	CH2330FD	CH3030FD	CH5030FD
CH1205SA	CH2330LA	CH3030LA	CH5030LA
CH1205SD	CH2330LD	CH3030LD	CH5030LD
CH1230FA	CH2320EA	CH3020EA	CH4505CA
CH1230FD	CH2320ED	CH3020ED	CH4505CD
CH1230LA	CH2320FA	CH3020FA	CH4505GA
CH1230LD	CH2320FD	CH3020FD	CH4505GD
CH2304BA	CH3004BA	CH5004BA	
CH2304BD	CH3004BD	CH5004BD	
CH2305CA	CH3005CA	CH5005CA	
CH2305CD	CH3005CD	CH5005CD	
CH2305GA	CH3005GA	CH5004GA	
CH2305GD	CH3005GD	CH5004GD	

Press “Ctrl + Home” to return to top of Document

System Troubleshooting

Unit is Completely Non-Functional	• Check the circuit breaker on the back of the unit is in the ON position • Check power cord and outlet for proper line voltage • Check that the key switch position is in the On or Alarm positions • Check for shorted sensors – see Sensor Checking following this chart • Check for 16.5v DC at J12 pin 1 of CPU board – if not present, replace 45W Power Supply board • Check for PS15R DC return signal through the key switch – see "Key Switch Circuit" • Check for 5v DC at J12 pin 2 of CPU board – if not present, replace CPU board • Check for proper orientation of the EPROM (if power has been applied while the chip was inserted 180° out, replace the EPROM) • Replace CPU / Power Relay Board with appropriate kit. • Replace 45W Power Supply board • Replace Display board • Replace Distribution board
Unit does not operate; thermometer bulb is the only thing displayed	• System cannot aquire a good read from the cabinet sensor; cables are too close to power lines, fans, or other interference sources, or a strong RF source is nearby. Reroute sensor cables. • Check sensors for open / short – see Sensor Checking following this chart Replace CPU / Power Relay Board with appropriate kit.
Display reads all 8's	• Check connections between the CPU board and the display board • Replace RJ45 6 Pin cable Replace display board
Unit runs 100% and is warmer than set point	• Check refrigeration system if unit is not reaching set point • Check for a bad door gasket or port hole air leaks
Unit runs 100% and is colder than set point	• Check system calibration by comparing setpoint, display, and measured chamber temperature • Check for loose or open cabinet sensor – see Sensor Checking following this chart • Replace CPU / Power Relay Board with appropriate kit. • Replace 45W Power Supply board • Replace Distribution board
Compressor will not start even though cabinet temperature is warmer than setpoint	• Unit could be in short cycle period, wait 2 minutes for normal cycle and 7 minutes after a power failure to verify • If +4° / +5°C unit, check control probe reading in Service Mode – see 4° Operation • Verify HPCO jumper is installed on the Relay board if this is not a 3030, or 5030 freezer

Press "Ctrl + Home" to return to top of Document

"Err" Displayed	• "Err" indicates the CPU can not read an ADC channel – applies to sensors and line voltage reading – see Sensor Checking following this chart • If occurs during normal run mode, replace the display sensor (green) • If occurs while reading the lower bottle (blood banks only), replace lower bottle sensor (yellow) • If occurs while reading the defrost sensor in service mode, then replace the defrost sensor (blue) • If occurs while reading the control sensor in service mode, replace the control sensor (red) • If occurs while reading the ambient sensor in service mode, replace the ambient sensor (white) • If occurs while reading the drip pan sensor in service mode, calibrate R22, replace the drip pan sensor (black) • Replace CPU / Power Relay Board with appropriate kit.
Display will not respond to keypad inputs	• Loose or incorrect connection between front panel overlay and display board – harness off by one pin • Check J3 on display board – pin 4 (bottom) is ground; other three should be at +5v DC until a button is pressed; pressing "down arrow" should make pin 3 go to 0v; pressing center button should make pin 2 go to 0v, pressing "up arrow" should make pin 1 go to 0v. If any one does not work, replace the overlay • Replace the RJ45 6 Pin and 10 Pin cables • Replace the Display board • Replace CPU / Power Relay Board with appropriate kit.
Button on overlay is acting as if it is stuck	• Insulate the overlay cable strip from the front panel
Unit always times out of defrost	• Defective RTD defrost sensor, check valued in Service Menu, replace if "Err" or reading over 40°C • Replace CPU / Power Relay Board with appropriate kit.
Evaporator fan is not turning (with door closed and unit not in defrost)	• Check door switch operation; Normally Closed – held open by the door. Door harness at J9 on CPU board can be removed to simulate a closed door, if the fan comes on, check the door switch wiring and door alignment • Check defrost sensor reading in Service Mode, must be below –1°C for freezers • Check for line voltage at the fan motor(s) • Replace CPU / Power Relay Board with appropriate kit. • Replace the Distribution board
Unit does not go into Power Fail mode during loss of line voltage	• Weak battery – replace the battery. Limited shelf life of 6 months on 3.3 amp hour batteries. • Replace CPU / Power Relay Board with appropriate kit. • Replace 45W Power Supply Board
Unit goes into Power Fail mode, but there is no loss of line voltage	• Replace CPU / Power Relay Board with appropriate kit.

Press "Ctrl + Home" to return to top of Document

Interior lights do not illuminate with the front panel light switch on	• Check the light switch connections at the front panel • Check / replace the LED power supply • Check / replace the LED lights • Replace CPU / Power Relay Board with appropriate kit.
Interior lights work with the front panel switch, but do not illuminate with the door open	• Short CPU board J9 pins 1 & 2 to simulate an open door – if the lights illuminate, check door switch(s) and harness connections • Replace CPU / Power Relay Board with appropriate kit.
Interior lights stay on even with the door(s) closed and the front panel switch in the off position	• Check door alignment , may be sagging causing the switch to stay active • Check the light switch for a short • Replace CPU / Power Relay Board with appropriate kit.
Showing E01 on Display - Invalid Mode in the Code	• **New set of boards installed** and three parameters in the Service Menu need to be setup to identify what kind of unit you are working with before the software will run – update Type, Config, & Cab Size, exit service, then wait for the unit to reboot itself to accept the changes. • ***Do not go onto the following steps before the previous setup is confirmed by going back into the Service Menu*** • Replace the RJ45 cable between the CPU and Relay boards • Replace the RJ45 cables between the CPU and Display boards • Replace CPU / Power Relay Board with appropriate kit.
Showing E02 on Display - Control sensor failure	• Replace control sensor (red) • Replace CPU / Power Relay Board with appropriate kit.
Showing E03 on Display - Defrost sensor failure	• Replace defrost sensor (blue) • Replace CPU / Power Relay Board with appropriate kit.
Showing E05 on Display - Ambient sensor failure	• Replace ambient sensor (white) • Replace CPU / Power Relay Board with appropriate kit.
Showing E07 on Display - Compressor running more than 2 hours	• Check the PEP for air blockage • Defrost the coldwall unit
Showing "----" on Display- Lost Communications	• Check / Replace RJ45 cable between CPU and Distribution boards • Replace CPU / Power Relay Board with appropriate kit. • Replace Distribution board

Press "Ctrl + Home" to return to top of Document

Key Switch Circuit

With the unit plugged in, there should be 16.5v DC (signal named - **PS15**) at CPU **J12-8** provided by the 45w Power Supp board through Distribution Board **J9-3**.
Once the key switch is turned on, you should get 16.5v DC (**PS15R**) back on **J12-9,** which jumpers back to **J12-10** to power up the CPU board.
If you are not getting **PS15R** back, check along the path for an open circuit.

PS15 signal leaves the Distribution board **J9-3** to the CPU board **J12-8**; then out of the CPU board **J7-1** to the display board **J2-1**; then out of the display board **J4-4** to key switch terminal **#5**, then out key switch terminals **#7** or **#8** (depends if in the On or Alarm position) as **PS15R** back to display board **J4-5** and **J4-6**. **PS15R** leaves the display board **J2-10** to CPU board **J7-10**; then out of the CPU board **J12-9** to CPU board **J12-10.**

NOTE – the CPU and display boards just pass the signals **PS15** and **PS15R** through them, so an open circuit would most likely be at the connection point between the boards and harnesses, in one of the harnesses, or in the key switch.

Sensor Checking

Refer to the figures below for pin outs and the following RTD Temp/Ohms Chart for 1000 ohm sensors. 1000 ohm sensors are connected with redundant wires for reliability. **NOTE** - An easy way to read the pins on the sensors is to purchase a Cat 5 network jack from any electronics or home improvement store that handles networking products. The sensors use an 8 wire network cable, so the jack will extend the connections for easier access with meter leads.

309159H09 (Green 72")) +4°, +5°, -20° / -30° Cabinet sensor – pins 1,5,6 to 2,3,4 should be the RTD value, pins 7 to 8 should be a fixed resistor of 235 ohms +/- 20 ohms.

309159H10 (green 120") +4°, +5° , -30° Cabinet sensor – pins 1,5,6 to 2,3,4 should be the RTD value, pins 7 to 8 should be a fixed resistor of 235 ohms +/- 20 ohms.

326737H05 (blue) +4°, +5°, -30° defrost sensor – pins 1,5,6 to 2,3,4 should be the RTD value, pins 4 to 8 should be an open circuit.

326737H03 (red) +4, -20°, -30° Control sensors – pin 1,5,6 to 2,3,4 should be the RTD value, pin 7 & 8 should be open.

326737H04 (red) +4, -20°, -30° Control sensors – pin 1,5,6 to 2,3,4 should be the RTD value, pin 7 & 8 should be open.

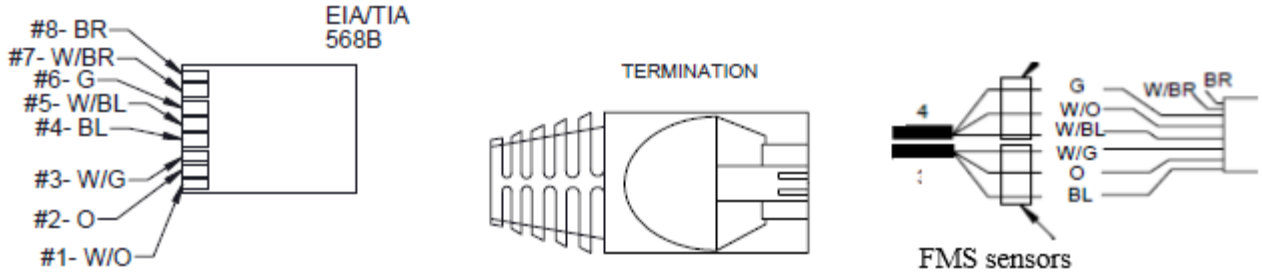
326739H01 (white) LM335 Ambient sensor can only be checked in an active circuit.

312096H06 (yellow) +4° lower bottle sensor can only be checked in an active circuit.

326739H03 (black) -30° drip pan sensor can only be checked in an active circuit – TP1

85089G10 (gray) 4-20mA and chart recorder sensors - wire 3 & 4 should be the **100** ohm RTD value. (you can still use the chart, just divide the 1000 ohm resistance value by 10 to give the approximate 100 ohm RTD value)

Press "Ctrl + Home" to return to top of Document



NOTE: Sensors with any connections between the RTD pins and pins with other devices (fixed resistor, shield ground or TE devices) are considered defective sensors.

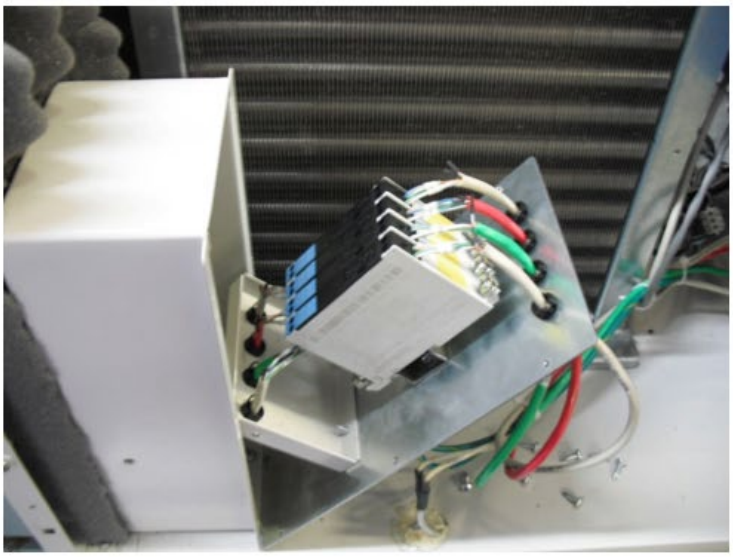
RTD Temperature in °C Vs. Resistance in Ohms

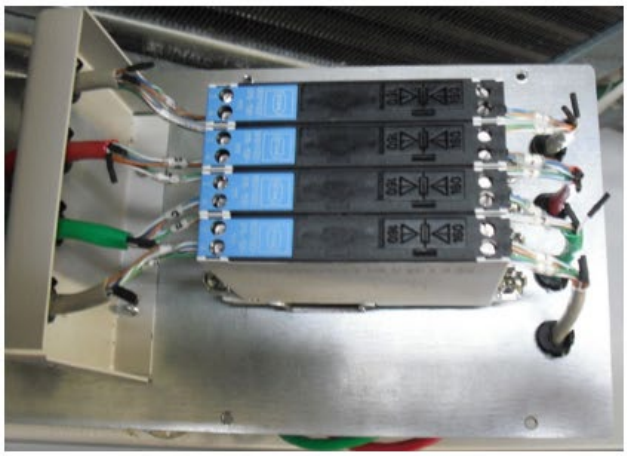
Temperature	Resistance	Temperature	Resistance	Temperature	Resistance
-50	803.07	-21	917.66	8	1031.22
-49	807.03	-20	921.59	9	1035.12
-48	811.00	-19	925.53	10	1039.02
-47	814.97	-18	929.46	11	1042.92
-46	818.93	-17	933.38	12	1046.81
-45	822.90	-16	937.31	13	1050.71
-44	826.86	-15	941.24	14	1054.60
-43	830.82	-14	945.16	15	1058.49
-42	834.78	-13	949.09	16	1062.38
-41	838.74	-12	953.01.	17	1066.27
-40	842.70	-11	956.93	18	1070.16
-39	846.66	-10	960.85	19	1074.04
-38	851.61	-9	964.77	20	1077.93
-37	854.57	-8	968.69	21	1081.81
-36	858.52	-7	972.61	22	1085.70
-35	862.47	-6	976.52	23	1089.58
-34	866.42	-5	980.44	24	1093.46
-33	870.37	-4	984.35	25	1097.34
-32	874.32	-3	988.26	26	1101.22
-31	878.27	-2	992.18	27	1105.10
-30	882.21	-1	996.09	28	1108.97
-29	886.16	0	1000.00	29	1112.85
-28	890.10	1	1003.90	30	1116.73
-27	894.04	2	1007.81	31	1120.61
-26	897.98	3	1011.71	32	1124.49
-25	901.92	4	1015.62	33	1128.37
-24	905.86	5	1019.52	34	1132.24
-23	909.79	6	1023.42	35	1136.12
-22	913.73	7	1027.32		

Press “Ctrl + Home” to return to top of Document

FMS Unit Sensor Troubleshooting

FMS (Flammable Storage) Units per UL requirements the sensors must be “Intrinsically Safe”. This introduced the need for Barriers in the sensor circuits. These barriers effect the sensor offsets and troubleshooting.





Wires and barriers are labeled 1 thru 4

Note: To do sensor checking the sensor needs to be disconnected from the intrinsic Barrier.

Press “Ctrl + Home” to return to top of Document

327763H01 (External Relays 1 & 2) 327325H01 (K1 – K6 and Triac #1)

External Relay 1 – Aux. Relay on Distribution Board

[4°, 5°, -20°, -30°] Under normal operation, this relay will provide power to the drain tube heater(if used). External Relay 1 should be on whenever there is power to the unit, the key switch is on, and the software has started.

External Relay 2 – Light Relay on Distribution Board

[4°, 5°] On if door is open. Off if door is closed. The front panel light switch forces this relay ON regardless of door position.

[-20°, -30°] Never turns on; no interior lights.

K1 Condenser Fan Relay – High Speed

[4°] Turns On if control probe (evaporator airflow) reads a temperature ≥ [Set point + 'UCL'] value and minimum off time requirement has been met. Turns on 10 seconds before the compressor. Fan control may revert to Low speed (K3 on at the same time) if that is all that is required to maintain cabinet temp.
Turns OFF when control probe reads a temperature < [Set point – 'LCL'] and the minimum on time requirement has been met. Minimum on time is approximately 3 minutes and is "hard coded" and is not adjustable. Minimum off time is approximately 6 minutes and is "hard coded" and is not adjustable to prevent short cycling. Turns off 10 seconds after the compressor has stopped.

[-20°, -30°] Turns On if red control probe reads a temperature ≥ [Set point + UCL] and minimum off time requirement has been met. Turns on 10 seconds before the compressor. Fan control may revert to Low speed (K3 on at the same time) if that is all that is required to maintain cabinet temp.
Turns Off if red control probe reads a temperature < [Set point – LCL] and minimum on time requirement has been met. Minimum on time is approximately 3 minutes. Minimum off time is approximately 4-6 minutes. Minimum values are "hard coded" and are not adjustable. Turns off 10 seconds after the compressor has stopped.

K2 Inverter Relay on 100%, Controls the Compressor Speed Through RS-232

[4°, 5°] Compressor turns On if control probe (evaporator airflow) reads a temperature ≥ [Set point + 'UCL'] value and minimum off time requirement has been met. Turns OFF when control probe reads a temperature < [Set point – 'LCL'] and the minimum on time requirement has been met. Minimum on time is approximately 2 minutes and is "hard coded" and is not adjustable. Minimum off time is approximately 6 minutes and is "hard coded" and is not adjustable to prevent short cycling.

[-20°, -30°] Compressor turn on if red control probe reads a temperature ≥ [Set point + UCL] and minimum off time requirement has been met. Turns Off if red control probe reads a temperature < [Set point – LCL] and minimum on time requirement has been met. Minimum on time is approximately 2 minutes. Minimum off time is approximately 4-6 minutes. Minimum values are "hard coded" and are not adjustable.

Press "Ctrl + Home" to return to top of Document

K3 Condenser Fan Relay – Low Speed

[4°, 5°] Turns On (along with K1) if control probe (evaporator airflow) reads a temperature ≥ [Set point + 'UCL'] value and minimum off time requirement has been met. Turns on 10 seconds before the compressor. Fan control may revert to just K1 on - High speed if that is required to maintain cabinet temp.
Turns OFF when control probe reads a temperature < [Set point – 'LCL'] and the minimum on time requirement has been met. Minimum on time is approximately 2 minutes and is "hard coded" and is not adjustable. Minimum off time is approximately 6 minutes and is "hard coded" and is not adjustable to prevent short cycling. Turns off 10 seconds after the compressor has stopped.

[-20°, -30°] On (along with K1) if red control probe reads a temperature ≥ [Set point + UCL] and minimum off time requirement has been met. Turns on 10 seconds before the compressor. Fan control may revert to K1 High speed if that is required to maintain cabinet temp. Turns Off if red control probe reads a temperature < [Set point – LCL] and minimum on time requirement has been met. Minimum on time is approximately 2 minutes. Minimum off time is approximately 4-6 minutes. Minimum values are "hard coded" and are not adjustable. Turns off 10 seconds after the compressor has stopped.

K4 Fan Relay, Evaporator

[4°, 5°] If there is power to the unit, the key switch is on and the software has started, this relay should always be on. Door openings will turn the fan off, but only for 6 minutes. Then the fan(s) turn back on regardless of door position.

[-20°] Never turns on; no evaporator fan on this model.

[-30°] Turns on once defrost probe reads a temperature < -20°C. Turns off during a defrost cycle; back on after the defrost cycle and when defrost probe reads a temperature < -20°C. Turns off if the door is open, but only for 6 minutes, then the fan(s) are forced back on regardless of door positions. Turns on once the door is closed, if the defrost probe reads a temperature < -20°C.
Note: The Firmware has built in hidden timers that operate in the following way:
They will start the fans at 60 minutes during pulldown or 10 minutes during normal cycling if there is an issue with the defrost probe reaching <-20°C. In the case of defrost probe failure the fans will start without waiting.

Triac 1 Perimeter Heater

[4°, 5, -20°, -30°] The perimeter heater is now controlled with pulse with modulation (percent on time). The heater percentage "on time" is preset based on the program default table found later in the service manuaul The setting is addustable through the Service Menu with a range of 20% to 100% on time.

K6 Defrost / Evaporator Pan Heater Relay

[4°, 5°, -20°] Never turns on; no heater on these models.

[-30°] Turns on approximately six hours after the last defrost cycle was terminated (six hour count is initiated at the termination of a defrost cycle or if unit is cycled off with the key). Turns off after 20 minutes or when defrost probe reads a temperature > +1°C.
NOTE: The Defrost parameters are now settable in the Service Menu if **Adaptive Defrost** is disabled, so those settings will alter Interval, Time out and Temp out.

Press "Ctrl + Home" to return to top of Document

J12 Pin Number	Signal Name	Wire Color	Power Applied – Key Switch Off	Power Applied – Key Switch ON / Alarm	Notes
1	DC In	Red	16.5v DC	16.5v DC	From 45W Power Supply
2	+5v DC	Green	0v DC	5.0v DC	Supplied by CPU Board
3	NC		NA	NA	No Connection
4	NC		NA	NA	No Connection
5	NC		NA	NA	No Connection
6	NC		NA	NA	No Connection
7	NC		NA	NA	No Connection
8	PS15	Red	16.5v DC	16.5v DC	Power Supply to Key Switch
9	PS15R	Red / White	0v DC	16.2v DC	Jumper to Pin 10 (Return from Key Switch)
10	+12v DC	Red / White	0v DC	16.2v DC	Jumper to Pin 9 (Powers Up 12v Signal)
11	Ground	Brown	0v DC	0v DC	Should equal frame ground
12	NC		NA	NA	No Connection
13	NC		NA	NA	No Connection

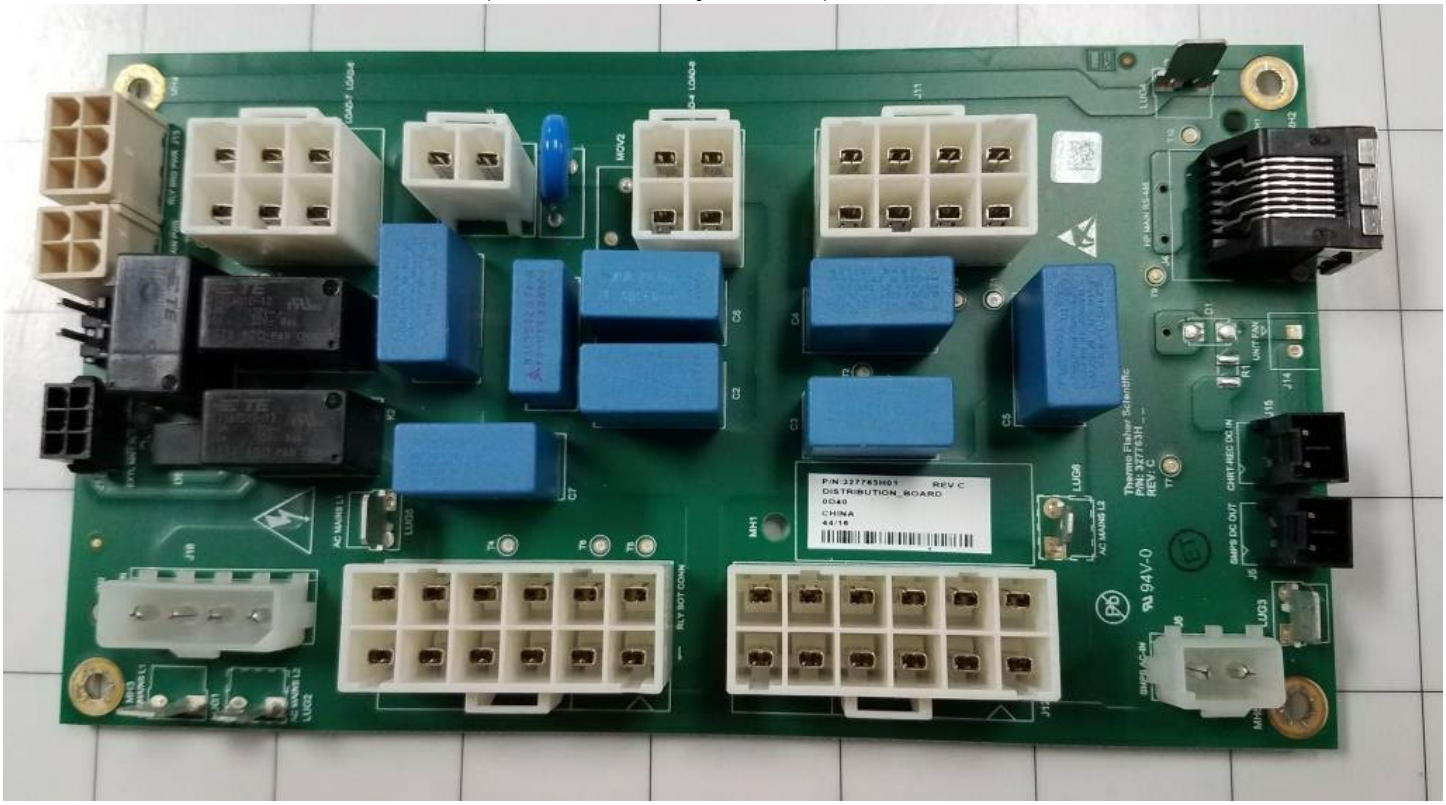
NOTE: Any time a unit is serviced, it should be made a practice to check that the nubbin is knocked off the upper left of each relay. This can be accomplished quickly & simply with a flat screwdriver. This provides ventilation for the relay, reducing hydrocarbon buildup, and ultimately increases the life of the relay.

|---------- Relays and Triac that reside on the Relay Bd ----------| |----Distribution BD ---|

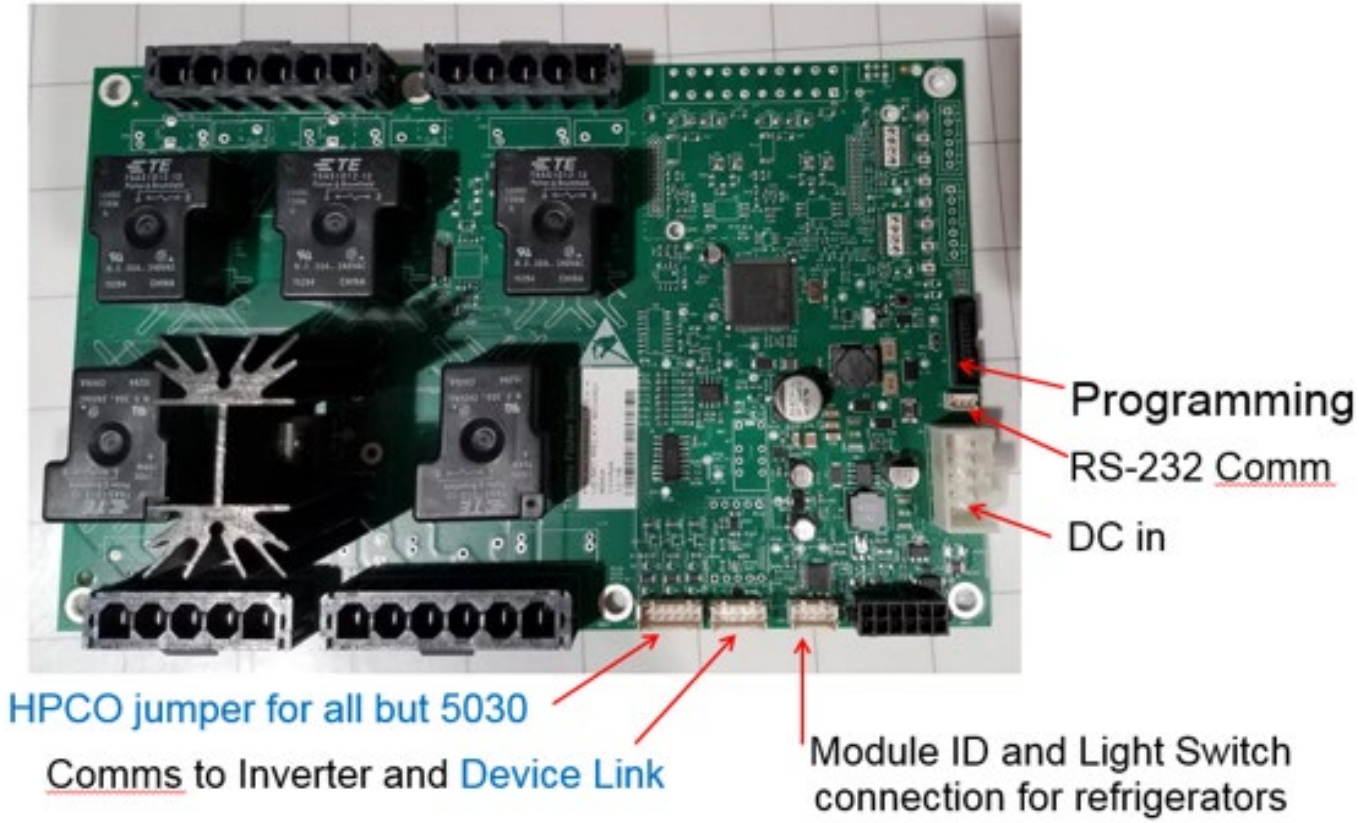
Model	K1 (Cond. Fan)	K2 (Inverter)	K3 (Cond. Fan Low Speed)	K4 (Evap Fan)	Triac -1 (Perimeter heater)	K6 (Defrost Heater)	Ext. Rly - 1 (Aux. ON)	Ext Rly - 2 (Light)
+4C	√	√	√	√	√	X	√	√
-20C	√	√	√	X	√	X	√	X
-30C	√	√	√	√	√	√	√	X

Press “Ctrl + Home” to return to top of Document

327763H01 Distribution Board (External Relays 1 & 2)



327325H02 Relay Board (K1 – K6 and Triac 1)



Press “Ctrl + Home” to return to top of Document

327846G02 45W Power Supply 16.5 V DC adjustable

Accepts input line voltage range of 90v to 264v AC 50/60 Hz.

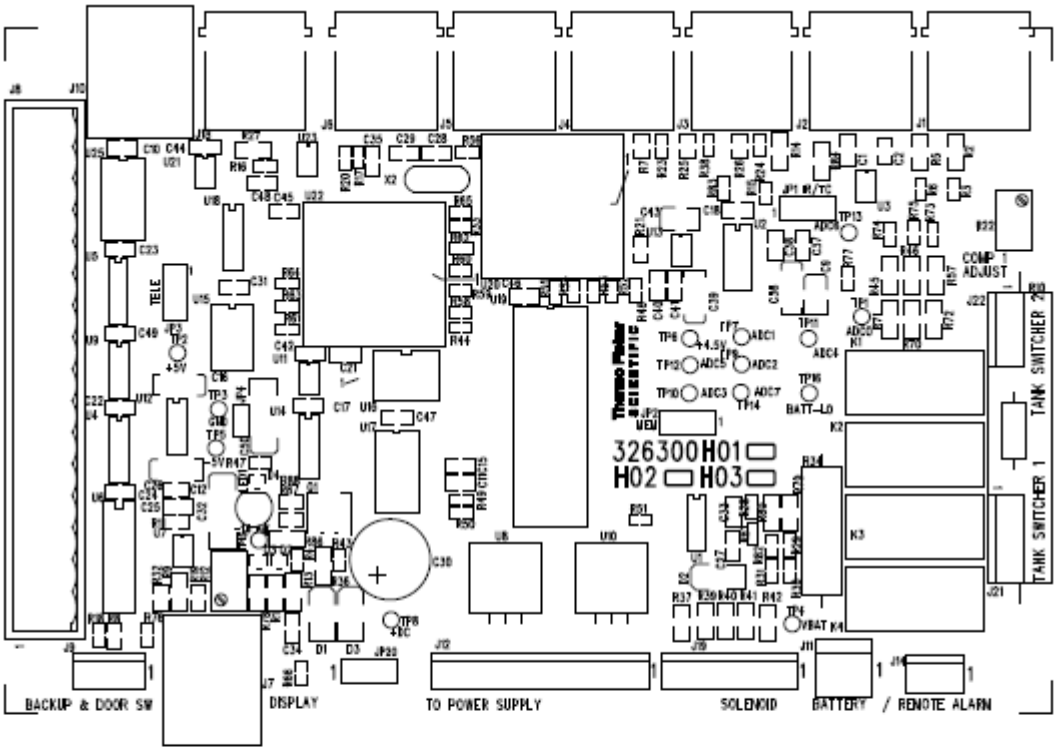
Basically a 15v DC supply that should be preadjusted to 16.5v DC.

Use 327846G02 S service kit to replace the former H01 boards. Kit contains the new H02 smaller supply, adapter plate to match the H01 mounting, and two harnesses.

Note: There are no static sensitive components on this board, so replacement may arrive without the typical anti static bag.

Press “Ctrl + Home” to return to top of Document

326300H01 CPU Board



Test Points (as labeled on the silkscreen)

TP1 ➔ "ADC0"
TP2 ➔ "+5V"
TP3 ➔ "GND"
TP4 ➔ "VBAT"
TP5 ➔ "-5V"
TP6 ➔ "+4.5V"
TP7 ➔ "ADC1"
TP8 ➔ "+DC"
TP9 ➔ "ADC2"
TP10 ➔ "ADC3"
TP11 ➔ "ADC4"
TP12 ➔ "ADC5"
TP13 ➔ "ADC6"
TP14 ➔ "ADC7"
TP15 ➔ "-1.6 Adj"
TP15 ➔ "Batt Lo"

General Overview

Test Point	Generic Description	H01 Application
TP1 "ADCO"	Voltage @ input to the A/D converter (channel 0). aka LM335-1	Drip Pan Sensor (Black)
TP2 "+5V"	5 VDC, regulator output.	5VDC
TP3 "GND"	Ground plane.	GND
TP4 "VBAT"	Positive terminal of the battery. Charging voltage under normal operation; battery voltage in backup.	VBAT
TP5 "-5V"	-5 VDC, regulator output.	Not Used
TP6 "4.5V"	+4.5VDC, regulator output.	+4.5VDC

Press "Ctrl + Home" to return to top of Document

Test Point	Generic Description	H01 Application
TP7 “ADC1”	Voltage @ input to the A/D converter (channel 1). aka LM335-2	Lower Bottle Sensor
TP8 “+DC”	12-15 Volt DC Input to the 5v DC regulator	Input to the 5v DC Regulator
TP9 “ADC2”	Voltage @ input to the A/D converter (channel 2). aka LM335-3	Ambient Sensor (White)
TP10 “ADC3”	Voltage @ input to the A/D converter (channel 3). aka RTD-1	Display Sensor (Green)
TP11 “ADC4”	Voltage @ input to the A/D converter (channel 4). aka RTD-2	Defrost Sensor (Blue)
TP12 “ADC5”	Voltage @ input to the A/D converter (channel 5). aka RTD-3	Control Sensor (Red)
TP13 “ADC6”	Voltage @ input to the A/D converter (channel 6).	Not Used (Was Line Voltage)
TP14 “ADC7”	Voltage @ input to the A/D converter (channel 7).	Monitor AC Input for Power Fail
TP15 “-1.6 Adj.”	Offset voltage adjustment specific to ULT T/C circuitry.	Not Used
TP16 “Battery Low”	Comparator circuit for batter level Low (~0.095v) = OK, High (~5v) = low battery	Used to Monitor the Battery Level

Note:

1. When observing the voltage on any A/D channel inputs, there will be a voltage ‘pulse’ that occurs. This is normal and should not cause alarm.
2. If ***any channel*** is found to be outside the limits of normal operation, 0 to 4.5 VDC, the reading of all channels will become suspect. For instance, if channel 7 is found to be 5.4 VDC, the readings on channels 0-6 may be corrupt. Check the sensor for the corresponding channel, if sensor is not bad, replace the CPU board.

TP1 “ADC0” – LM335-1 Drip Pan Sensor

Black sensor used to terminate pan heat after the defrost cycle is complete. Basically controls how long drip time is by temping out before the max of 5 minutes is up. Drip pan is also called the evaporator cover.

TP2 “+5V”

CPU board converts +DC (16.5v) voltage from Power Supply board into 5v DC to drive all of the chips on the CPU board. 5v not present will cause a “dead” system. Check between pins 10 & 11 of J12, if 12-15v DC is present, replace CPU board, otherwise, check harness / Power Supply board.

Press “Ctrl + Home” to return to top of Document

TP3 “GND”

Frame ground.

TP4 “VBAT”

When operating correctly, 14 – 16ish VDC is typically present when loaded with a battery. 17 – 19ish VDC will be present when unloaded.

TP5 “-5V”

For the -86°C TC circuit – NOT use in this application.

TP6 “+4.5V”

Reference voltage for the sensors. Incorrect voltage reading will effect RTD sensor readings. Since 4.5v is generated on CPU board – check for shorted sensors, then replace CPU board.

TP7 “LM335-2” Lower Bottle sensor (yellow)

Lower Bottle sensor (was 1000 ohm RTD), now requires an active circuit due to being a LM335 IC

TP8 “+DC”

DC voltage from the Power Supply board, will read in the 12 –15v range based on actual line voltage. Used to generate 5v DC and 4.5v reference. If the voltage is higher than 18v or less than 11v, check the voltage program jumpers on the Power Supply board. If the jumper is not set to match the actual line voltage, reposition it. Otherwise, replace the Power Supply board.

TP9 “LM335-3” Ambient sensor (white)

Ambient sensor changed from previous defrost role, but still requires an active circuit due to being a LM335 IC

TP10 “ADC3” Cabinet Display sensor (green)

Upper Cabinet 1000 ohm RTD sensor located in solution bottle (except minus 20 cold wall). Used for control / display on the –20° and –30° units. Used just for display on the +4° units. Should read in the 0.082v (freezers) to 0.095v (refrigerators) range. Open circuit will read in the 4.5v area. Short circuit will read in the 0v area.

TP11 “ADC4” Defrost sensor (blue)

Defrost sensor in the evaporator 1000 ohm RTD sensor. Open circuit will read in the 4.5v area. Short circuit will read in the 0v area.

Press “Ctrl + Home” to return to top of Document

TP12 “ADC5” Control sensor (red)

Control 1000 ohm RTD sensor located in the air in front of the defrost sensor inside the evaporator in refrigerators. Should read in the 0.095v area. Open circuit will read in the 4.5v area. Short circuit will read in the 0v area. On the side wall in -20 / -30° Freezers.

TP14 “ADC7” AC Monitoring

Used to monitor the AC power for power fail conditions. Should read in the 1.8v area.

TP16 “Batt Lo”

Output of the battery level comparator circuit attached to the VBatt signal. Normal operation while the battery is charging or at a voltage over 9.6V, the output will be less than 1v. When the battery is tested under load and the voltage drops below 9.6v, the output will change to greater than 4v.

Position jumpers on the Control PCB:

- **JP1** - not on NGC3 board set (was 50/60Hz setting)
- **JP2** - connect pins 1 & 2 for 256k PROM chip
- **JP3** - connect pins 1 & 2 for Telemode (display will be blank unless the jumper is placed in this configuration)
- **JP20** - connect pins 2 & 3 for 5891 over-ride not active

Power on Reset

Press Up and Down arrows together during power up sequence to reset the on-board NVRAM to factory default programming and service settings.

CAUTION

Power on Resets are necessary when changing EEPROMS, and sometimes used to correct service issues, but a Power on Reset **will overwrite** all settings customized to the unit (cut on, differential, etc.). **So, write them down first!**

Note:

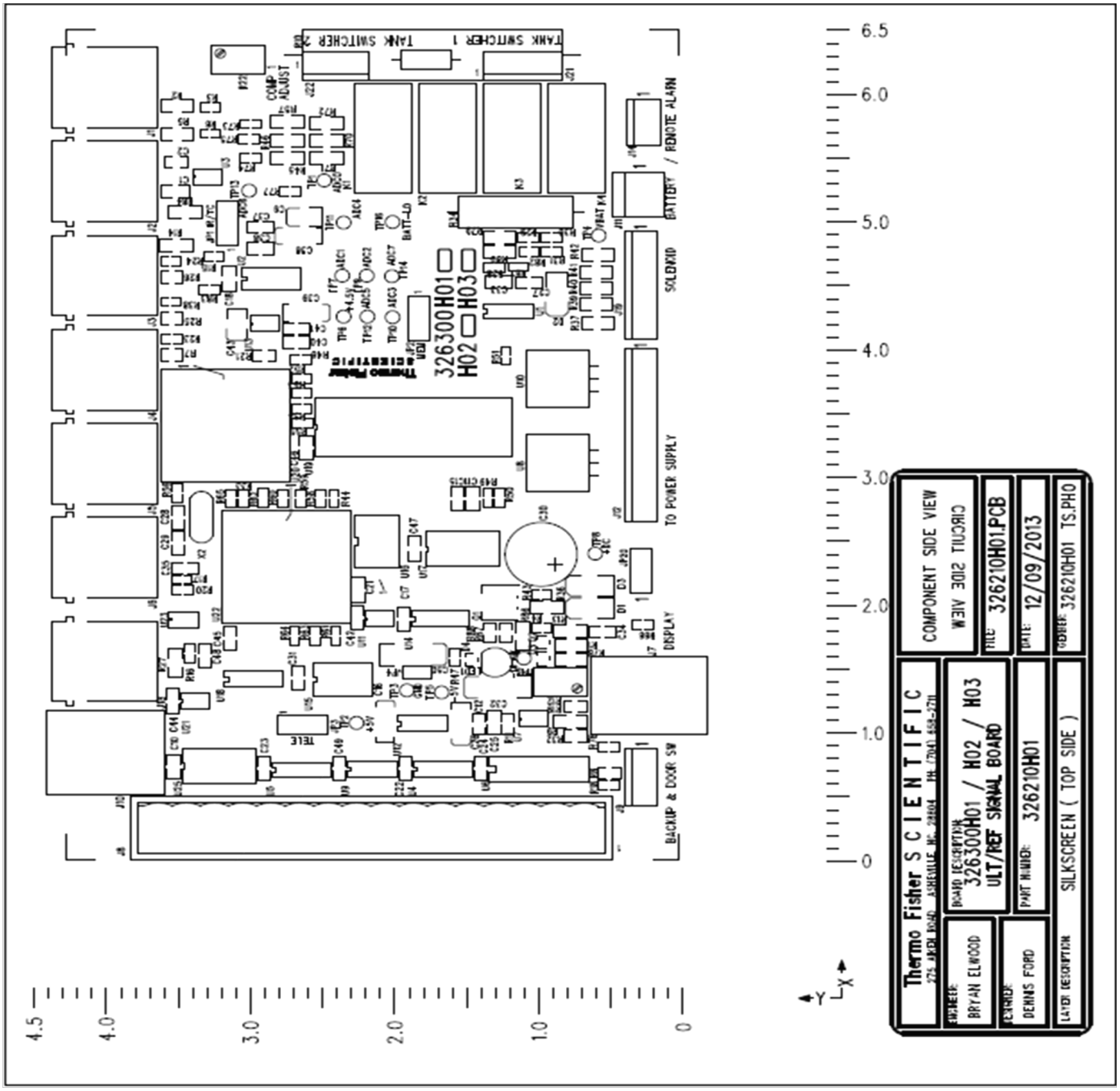
Changes to ***Type, Config, Cu ft*** parameters causes the software to reboot or POR. Reboot may take up to **3 minutes**.

Alarm Clear / Reset

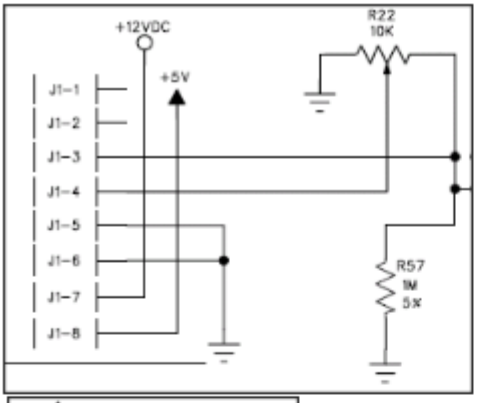
Hold up and down arrows together during normal operation to reset alarms, or “Has Been” Alarms, plus cold and warm temperature excursions (max/min) stored values. Alarm Ringback if it has not been corrected is 10 minutes.

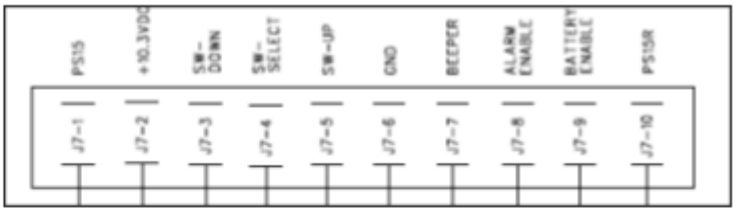
Press “Ctrl + Home” to return to top of Document

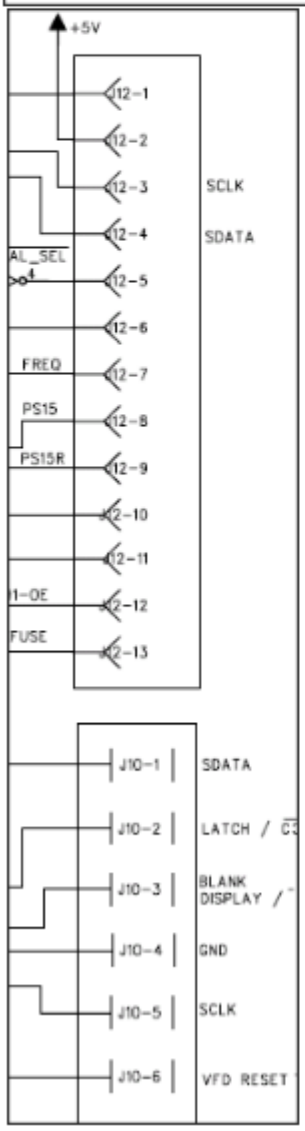
326300H01 CPU Board Silkscreen

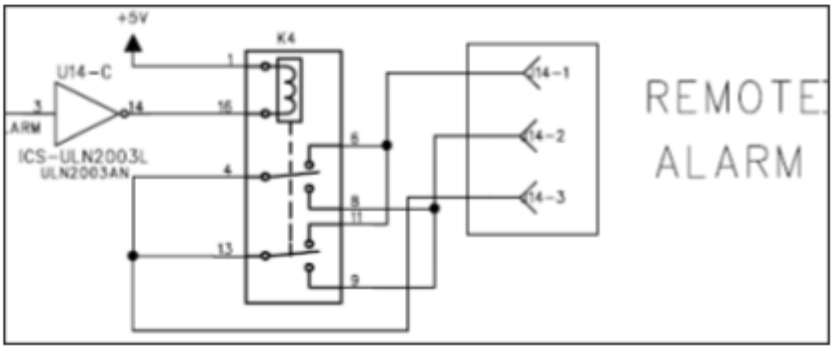


Press “Ctrl + Home” to return to top of Document



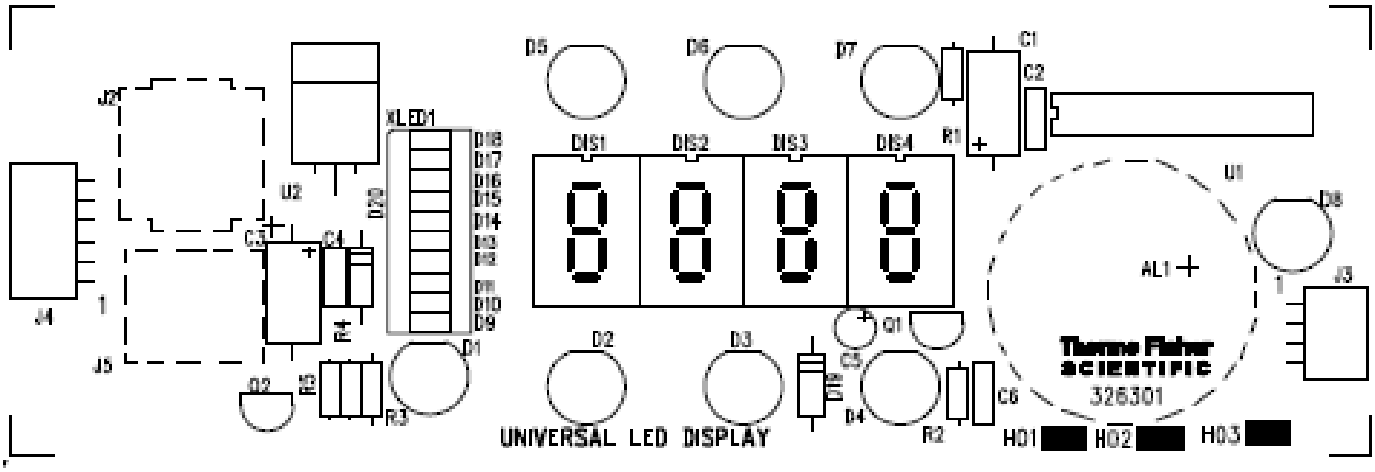






Press “Ctrl + Home” to return to top of Document

326301H01 Display Board



326301H01 Input / Output Summary

J2 – General I/O with CPU board

Pin 1 – "PS15" DC voltage supplied out to key switch. Refer to **J4** for troubleshooting.

Pin 2 – "+12V" DC voltage supplied to audio transducer (AL1), 5 volt regulator (U2), and the VFD in ULT applications. The voltage level at "+12V" should be one diode drop down from "+DC" (CPU board and Power Supply board). Typically, these will be 10.5ish VDC and 11.3ish VDC, respectively. Can also be check at '+' side of AL1 or U2 pin 1 (toward J5 & J2).

Pin 3 – "SW-DOWN" Keypad status passed to CPU board. See **J3** for troubleshooting.

Pin 4 – "SW-SELECT" Keypad status passed to CPU board. See **J3** for troubleshooting.

Pin 5 – "SW-UP" Keypad status passed to CPU board. See **J3** for troubleshooting.

Pin 6 – Ground

Pin 7 – "BEEPER" Signal from CPU board to activate an audible alarm. +5 VDC when active, measure at the anode (+) of D1 (pin away from audio transducer - AL1). Anode is also the side of the diode without a bar.

Pin 8 – "ALARM-EN" Output supplied to CPU board indicating that the key switch is in position 3. +5 VDC when active.

Pin 9 – "BATTERY-EN" Output supplied to battery charging circuit. Refer to **J4 pin 2 & 3** for troubleshooting.

Pin 10 – "PS15R" Secondary side of key switch. Refer to **J4** for troubleshooting.

Press "Ctrl + Home" to return to top of Document

J3 – Switch Input from Keypad

Pressing a keypad simply shorts it to ground. For instance, pressing the UP pad will cause pin 1 to short to pin 4. Pin 1 is toward the top of the board or R2/D1. **NOTE Pin 1 on a connector can frequently be identified by a square pad on the PCB.**

Pin 1 – "SW-UP" Input from UP keypad. Grounding this pin will simulate the 'up' pad being pressed.
Pin 2 – "SW-SELECT" Input from Mode/Mute/Select keypad. Grounding this pin will simulate the 'Mode/Mute/Select' pad being pressed.
Pin 3 – "SW-DOWN" Input from DOWN keypad. Grounding this pin will simulate the 'down' pad being pressed.
Pin 4 - Ground – common to one side of each of the keypads.

J4 – Input from Key Switch

For reference, wiring diagram 33530H37 provides a schematic depiction of the key switch and **J4**. Pin 1 is toward the top of the board, away from "J4" label.

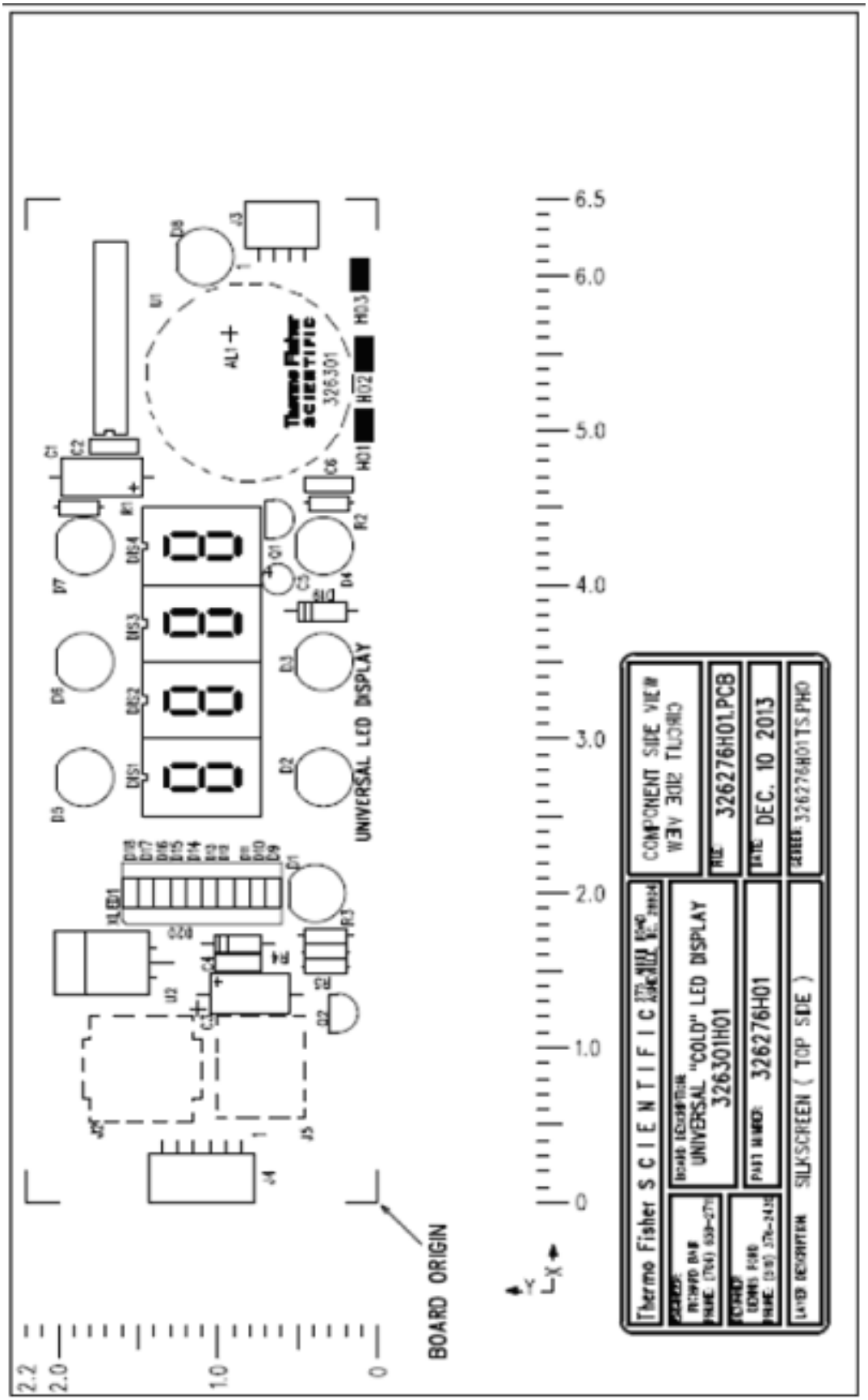
Pin 1 – "+5V" Output to key switch
Pin 2 – no label Enables battery charging circuit. When key is in position 2 (/), +5 VDC will be present. +4.3ish VDC (diode drop from +5) will be present on this pin when the key switch is in position 3.
Pin 3 – "ALARM-EN" Signal to CPU board that the key switch is in position 3 (-). Also enables battery charging circuit via a diode to Pin 2. +5 VDC will be present on this pin when active.
Pin 4 – "PS15" Primary DC voltage supplied to key switch. Typically, this will measure 11.7ish VDC. During normal operation, as long as line voltage is supplied to the unit, this should always be present. See additional information below.
Pin 5 & 6 – "PS15R" This is the signal that initiates a power up. When the key is in position 2 or 3 (/ or -), the DC voltage measured at pin 1 should be present here. See additional information on page 6.

J5 - Serial Communications in from CPU board

The signals at J5 can not be accurately measured with a typical DMM. Some activity maybe discerned with a DMM but an oscilloscope is really required to capture these signals. Plus, measuring points on the 326301H01 are essentially inaccessible. Troubleshooting is basically limited to swapping harnesses or assemblies.

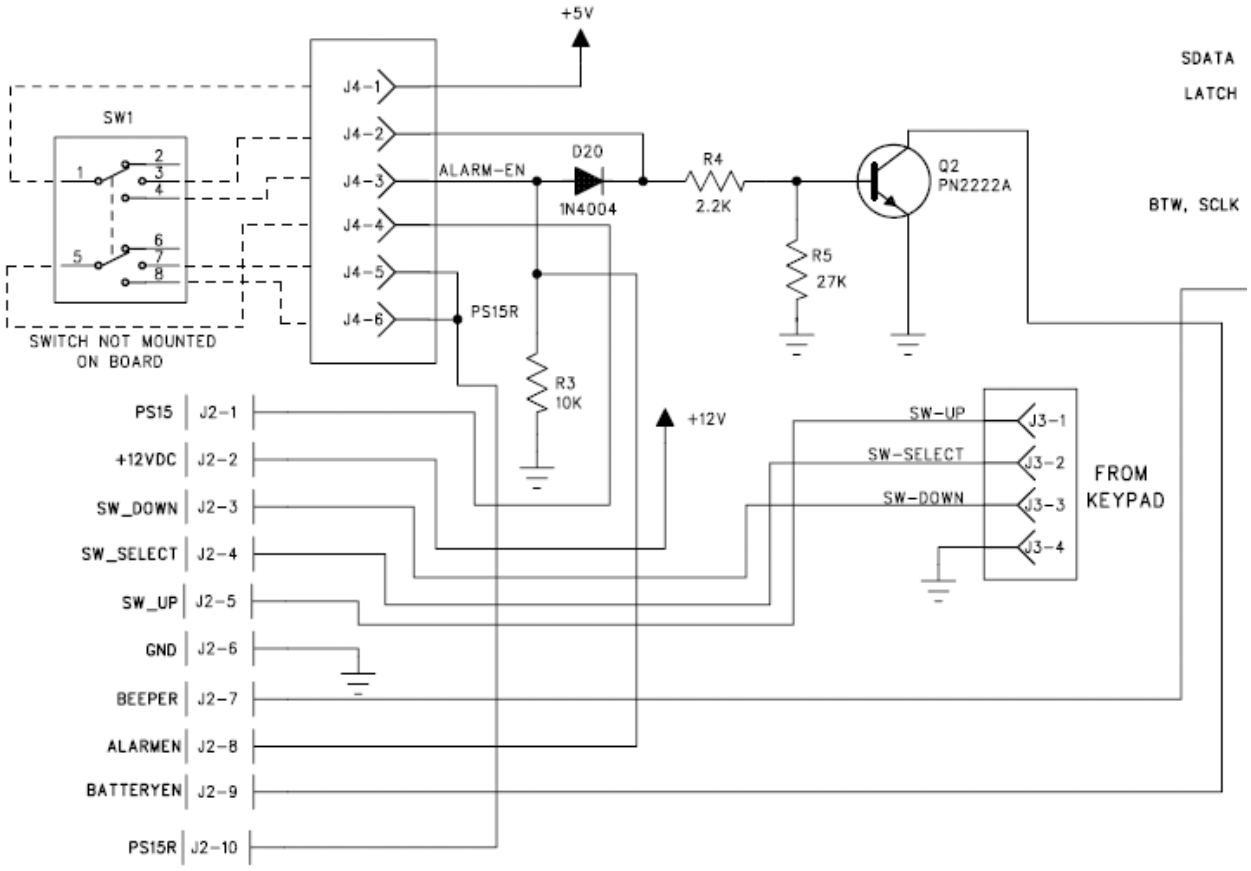
Pin 1 – Serial Data
Pin 2 – Latch
Pin 3 – Blank
Pin 4 – Ground
Pin 5 – Serial Clock
Pin 6 – Not used.

Press "Ctrl + Home" to return to top of Document



Press “Ctrl + Home” to return to top of Document

326276H01 Display Board Ladder Diagram

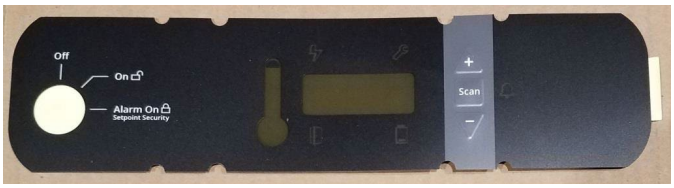


Press “Ctrl + Home” to return to top of Document

Cardinal Control Panel Overlays

LED Blue, 2010 design

314720H01 = +4/5° Glass door units with push button light switch.
314720H02 = +5° Solid door and all -20°/-30° units.

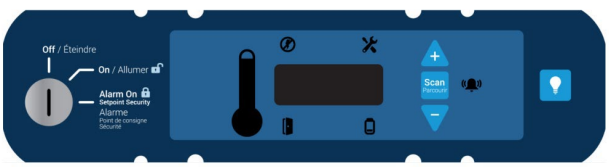


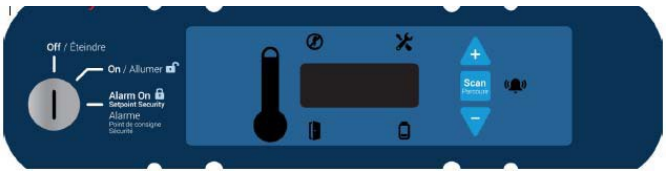
Black, 2018 design

327745H04 = +5° Solid door and all -20°/-30° units.
327745H05 = +4/5° Glass door units with integrated light switch.

TSX Thermo Scientific Overlays

327745H01 = +4/5° Glass door units with push button light switch.



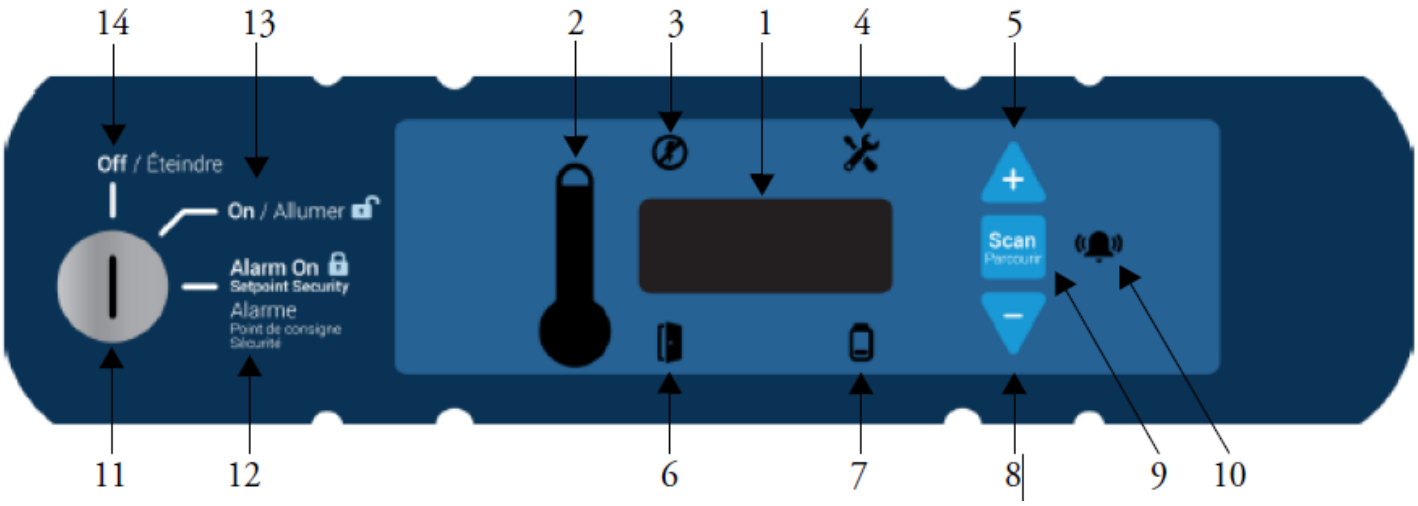


327745H02 = +5° Solid door and all -20°/-30° units.
327745H03 = +4/5° Glass door units with integrated light switch.

H02 and H03 includes Dual Language English and French

Press “Ctrl + Home” to return to top of Document

Control Panel Information



The control panel is located on the top right side of your freezer. You can use the three pushbuttons (#5, #8, and #9 in *Figure above*) to change the temperature display (#1) or to adjust temperature and alarm setpoints as given in. The thermometer display (#2) provides a quick visual indicator of current cabinet temperature and alarm conditions.

1. **Main temperature display** - during normal operation, shows cabinet temperature in degrees Celsius, as measured by the primary sensor inside the cabinet. You can use the buttons to display other values such as setpoints and highest and lowest recorded temperatures. The number in the main display flashes when the value can be modified.

2. **Thermometer** - shows cabinet temperature and alarm conditions. There are 10 horizontal bars: 9 are displayed during normal operation, the tenth (top) bar indicates a warm alarm condition. The number of bars illuminated indicates approximate cabinet temperature. With the default settings, 4 to 6 bars illuminated indicate that the cabinet is at desired setpoint. For example, suppose that the cabinet temperature setpoint is -30°C and that the cold and warm alarm setpoints are -35°C and -20°C. Then the number of bars illuminated indicates cabinet temperature as follows:

Refrigerator Bars Displayed	Temperature (°C)	Freezer Bars Displayed	Temperature (°C)
Bulb Only	2 (Cold Alarm)	Bulb Only	-35 (Cold Alarm)
1 Bar	2.6	1 Bar	-33.5
2 Bars	3.2	2 Bars	-32
3 Bars	3.8	3 Bars	-30.5
4 Bars	4.4	4 Bars	-29
5 Bars	5	5 Bars	-27.5
6 Bars	5.6	6 Bars	-26
7 Bars	6.2	7 Bars	-24.5
8 Bars	6.8	8 Bars	-23
9 Bars	7.4	9 Bars	-21.5
10 Bars	8 (Warm Alarm)	10 Bars	-20 (Warm Alarm)

Press “Ctrl + Home” to return to top of Document

When cabinet temperature exceeds the warm alarm setpoint, the top bar of the thermometer flashes. When temperature is lower than the cold alarm setpoint, the bulb flashes. When you are in programming mode the thermometer shows the setpoint value you are changing.

3. **Power failure** - illuminates when the main power supply is interrupted. In this case the audible alarm also sounds.

4. **Service mode** - illuminates when the controller is in service programming mode.

5. **Increase** - pushbutton used to increase setpoint values in programming mode and for various display functions.

6. **Door ajar** - illuminates when the freezer door is open longer than the duration specified in the service parameters table; default is approximately 3 minutes (when the alarm is activated and the key switch is turned to the alarm position).

7. **Battery low** - illuminates when the backup battery is low

8. **Decrease** - pushbutton used to decrease setpoint values in programming mode and for various display functions.

9. **Scan** - pushbutton used to change the main display and for various other functions.

10. **Audible alarm** - illuminates during warm and cold alarm conditions.

11. **Key Switch** - switch used to turn the power and alarms on and off for the unit.

12. **Alarm On** - Setpoint Security - when the key switch is in the alarm on position, the alarms are on and the setpoints cannot be modified.

13. **Power On** - when the key switch is in the on position, the unit power is on with no alarms active.

14. **Off** - when the key switch is in the off position, the unit is off.

Press “Ctrl + Home” to return to top of Document

+4° / +5° Refrigerator Alarm Functions

Alarm Description	Display Activity	Audible	Has Been	Remote Alarm Activated
Warm Alarm	Flash uppermost bar of thermometer, flash speaker icon	* Yes *	Yes - slowly flash speaker icon and uppermost bar of thermometer alternately	Yes
Cold Alarm	Flash thermometer bulb, flash speaker icon	* Yes *	Yes - slowly flash speaker icon and thermometer bulb alternately	Yes
Power Failure	Reduced display intensity, lightning bolt on (no flash), flash temperature display approximately every *3 seconds*	* Yes *	Yes - slowly flash speaker icon and lightning bolt alternately	Yes
Battery Low	Battery Icon On (no flash)	No	No	No
Door Ajar	Door Icon On (no flash)	No-if less than ~3 minutes.*Yes*-if more than 3 minutes	No	No
* Mute will silence audible alarm, with a ~10 minute ring back interval, display will remain flashing. If key switch is moved from position 3 to position 2, alarms will be disabled including remote alarms: audible and visuals will go away.				
"Err" occurs when the CPU cannot read the input channel - applies to sensors - see codes in System level troubleshooting for complete list				
To clear Has Been Alarms, press Up and Down buttons simultaneously				

Press “Ctrl + Home” to return to top of Document

-20° / -30° Freezer Alarm Functions

Alarm Description	Display Activity	Audible	Has Been	Remote Alarm Activated
Warm Alarm	Flash upper most bar of thermometer, flash speaker icon	* Yes *	Yes - slowly flash speaker icon and upper most bar of thermometer alternately	Yes
Cold Alarm	Flash therometer bulb, flash speaker icon	* Yes *	Yes - slowly flash speaker icon and thermometer bulb alternately	Yes
Power Failure	Reduced display intensity, lightning bolt on (no flash), flash temperature display approximately every 3 *seconds*	* Yes *	Yes - slowly flash speaker icon and lightning bolt alternately	Yes
Battery Low	Battery Icon On (no flash)	No	No	No
Door Ajar	Door Icon On (no flash)	No - if less than ~3 minutes. *Yes* - if more than 3 minutes	No	No
* Mute will silence audible alarm, with a ~10 minute ring back interval, display will remain flashing. If key switch is moved from position 3 to position 2, alarms will be disabled including remote alarms: audible and visuals will go away.				
"Err" occurs when the CPU cannot read the input channel - applies to sensors - see codes in System level troubleshooting for complete list				
	To clear Has Been Alarms, press Up and Down buttons simultaneously			

Press “Ctrl + Home” to return to top of Document

Feature & Alarm Descriptions

Refrigerator / Blood Bank / Freezer

Feature	Complete set of Features/Alarms
Temperature Display	*xxx*
Three Button Membrane	*xxx*
Cold/Warm Excursions	*xxx*
3 position Key switch	*xxx*
Light Switch (if applicable)	*xxx*
Power Failure Alarm	*xxx*
High Temperature Alarm	*xxx*
Low Temperature Alarm	*xxx*
Door Ajar Alarm	*xxx*
Audible Alarm	*xxx*
Display Low Bottle (BB only)	*xxx*
Remote Alarm Contacts	*xxx*
Alarm Test	*xxx*
Battery Low Alarm	*xxx*
Thermometer Gauge	*xxx*
Setpoint Security	*xxx*

Alarm Test

Alarm test is invoked by pressing the square button and increment at the same time:

- 4°, 5°units exercise the warm alarm first, then the cold alarm.
- -20° & -30° units exercise the warm alarm.
- If the alarm test is not successful within approximately 10 minutes after it is initiated, the service icon will be illuminated and the test is terminated.
- The excursion feature is disabled from the time that an alarm test is initiated until approximately 5 minutes after it is terminated.
- Unit returns to normal operation after termination whether test passes or fails.

Audible Alarm

Occurs for active warm alarm, cold alarm, and power failure. Pressing the square button will mute an audible alarm. If the alarm remains active, ring back occurs after approximately 10 minutes.

An audible alarm will occur if the door remains ajar for approximately 3 minutes, ring back occurs after approximately 10 minutes.

Press “Ctrl + Home” to return to top of Document

Battery Low Alarm

Battery voltage level is checked 4 hours after initial start up and every 8 hours thereafter. If the battery voltage level is found to be below approximately 9.8 volts DC, the battery icon will be illuminated.
NOTE: If the battery icon is illuminated and the battery is replaced, the icon will remain illuminated until the next test is performed (worst case 8 hours). Test for battery low cannot be performed by disconnecting the battery from the circuit, it must be tested with a discharged battery.

Estimated support time for the 3.3aH battery is 12 hours.

Cold Temperature Alarm

Alarm is invoked if the cabinet temperature (offset included), as measured in the upper bottle, exceeds the cold alarm setpoint. If this occurs, the following takes place:

- An audible alarm is invoked.
- The bulb of the thermometer, the displayed cabinet temperature, and the speaker icon flash every second.
- If the alarm condition disappears, the prior alarm will be displayed as a 'has been' alarm: the cabinet temperature will no longer flash, the bulb and the speaker icon will flash every other second and be out of phase from one another.

Display Low Bottle (Blood Banks only)

Lower bottle temperature is displayed by pressing the square button and decrement at the same time. When the buttons are released, the temperature displayed will default back to the upper bottle. Non Blood Banks show default "Err".

Door Ajar Alarm

Alarm is invoked if the door switch closes (door opens). If this occurs, the following takes place:

- The door icon is illuminated.
- The evaporator fans are disabled for 6 minuts only, then restart even it the door is not closed (except -20° units).
- An audible alarm will occur if the door remains open for approximately 3 minutes.

***NOTE – 45' sliders do not have door switches**

Press "Ctrl + Home" to return to top of Document

Power Failure Alarm

Feature is based on the detection of line frequency. If frequency is not detected, the following will take place:

- NVRAM is updated.
- All relays are turned off.
- Power Failure Icon is illuminated, if other alarm conditions are occurring, the associated icon will be illuminated. Bars of the thermometer are still active.
  NOTE: If a 'has been' alarm was occurring when the power failure takes place, the power failure alarm will supercede the 'has been' alarm (this may result in the top thermometer bar or bulb remaining illuminated during the alarm).
- An audible alarm is invoked.
- The display intensity is reduced by ~75%.
- The cabinet temperature is displayed every ~ three seconds.
  NOTE: user interface will still operate in a power failure mode: excursions, setpoints, etc. are still accessible.
- When line frequency is restored, the display will return to normal operation. The power failure icon and the speaker icon will flash every other second to convey a 'has been' condition.
- **The compressor will not restart for ~ 7 minutes.**

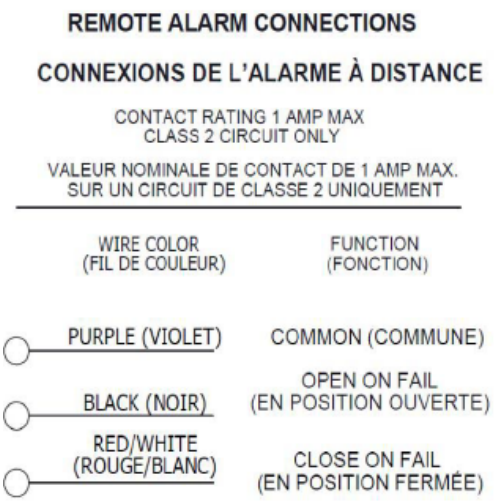
Warm Temperature Alarm

Alarm is invoked if the cabinet temperature (offset included), as measured in the upper bottle, exceeds the warm alarm setpoint. If this occurs, the following takes place:

- An audible alarm is invoked.
- The top bar of the thermometer, the displayed cabinet temperature, and the speaker icon flash every second.
- If the alarm condition disappears, the prior alarm will be displayed as a 'has been' alarm: the cabinet temperature will no longer flash, the top bar and the speaker icon will flash every other second and be out of phase from one another.

Remote Alarm Contacts

Only enabled while the key switch is in the third position. Contacts will switch states during an active temperature alarm or power failure alarm.



To install the remote alarm, make the following connections:

1. Connect the COMMON terminal on the cabinet switch to the COMMON wire on the alarm.

2a. To get an alarm when the switch contacts open, connect the OPEN ON FAIL terminal on the cabinet to the OPEN ON FAIL wire on the alarm.

2b. To get an alarm when the switch contacts close, connect the CLOSE ON FAIL terminal on the cabinet to the CLOSE ON FAIL wire on the alarm. The COMMON and CLOSE ON FAIL wires must be tied together in this application.

3. Plug the alarm system service cord into an electrical outlet. The contacts will trip in the event of a power outage, high temperature alarm or low temperature alarm.

Press "Ctrl + Home" to return to top of Document

- All units have factory-installed local alarm contacts that can be used for remote alarm systems.
- The maximum distance between a refrigerator and a remote alarm depends on the wire gauge used.
- Remote alarm terminals are located at the rear of the machine compartment. The three terminals are: COMMON, OPEN ON FAIL (Normally Closed), and CLOSE ON FAIL (Normally Open)

Wire Gauge	Total Wire Length (feet)	Distance to Alarm 1/2 Wire Length (feet)
20	530	265
18	840	420
16	1330	665
14	2120	1060
12	3370	1685

Setpoint Security

When the key is turned to the alarm position, the parameters are visible, but not adjustable. Parameters must be flashing to be settable (Alarm Off mode).

Thermometer Gauge

The number of bars illuminated within the thermometer is indicative of the cabinet temperature relative to the control setpoints. 4°/5° units and –20°/-30° are fundamentally different is this area of operation. The number of bars illuminated is determined in the following manner:

- 4° units

$$\#\text{ bars illuminated} = \frac{[\text{Cabinet Temperature} - \text{Low Alarm Setpoint}]}{[\text{Warm Alarm Setpoint} - \text{Low Alarm Setpoint}]} * 10\text{ (bars)}$$

- -20° & -30° units

If Cabinet Temperature < Setpoint,

$$\#\text{ bars illuminated} = \frac{[\text{Cabinet Temperature} - \text{Low Alarm Setpoint}]}{[\text{Setpoint} - \text{Low Alarm Setpoint}]} * 5\text{ (bars)}$$

If Cabinet Temperature > Setpoint,

$$\#\text{ bars illuminated} = \frac{[\text{Cabinet Temperature} - \text{Setpoint}]}{[\text{Warm Alarm Setpoint} - \text{Setpoint}]} * 5\text{ (bars)} + 5\text{ (bars)}$$

Press “Ctrl + Home” to return to top of Document

Basic Functions

Function	Meaning	Sequence	Display
Normal operation	Default display while freezer is running.		Temperature display and control panel thermometer icon show cabinet temperature.
Coldest logged temperature	Show coldest cabinet temperature since last startup or reset.	Press ▽	Display shows coldest logged temperature while button is pressed.
Warmest logged temperature	Show warmest cabinet temperature since last startup or reset.	Press △	Display shows warmest logged temperature while button is pressed.
Mute	Silence audible alarm for approximately 6 minutes.	Press Scan	Display and thermometer show cabinet temperature, alarm icon continues to flash.
Reset	Return to default display after alarm condition, clears temperature log.	Press and hold △ and ▽ simultaneously.	Excursion values are reset; temperature display shows cabinet temperature.
Alarm Test	Test by simulating warm alarm. Key switch must be in alarm mode.	Press △ and Scan simultaneously, hold for approximately 5 seconds.	First, the display will show "AtSt" to show entry of the test. Display and thermometer show simulated cabinet temperatures (warm), alarms flash and sound as appropriate. Alarms clear when test is completed.

Programming Mode

You can enter the programming mode by pressing the Scan button and holding for approximately 5 seconds. The display will then flash "Prg" to indicate that you have entered the programming mode. Use (UP) and (Down) buttons to modify the values and press the scan button to save the value and go to the next screen.

Note: If the alarms are enabled, all parameters are read only and cannot be edited. Programming Mode will time out after 30 seconds of inactivity.

Screen/Button		Function	Summary
1	Initial Screen	Unit Setpoint	The temperature that the unit is set to run
2	Press Scan (Scan)	Cold Alarm Temperature	The temperature that will actuate the cold alarm (if active)
3	Press Scan (Scan)	Warm Alarm Temperature	The temperature that will actuate the warm alarm (if active)
4	Press Scan (Scan)	Exit Program Mode	Returns to normal operating screen

Press "Ctrl + Home" to return to top of Document

Service Parameters

You can enter the service mode by pressing the Scan button and holding for approximately 10 seconds while in Programming mode. The display will then flash "SEr" to indicate that you have entered the service mode followed by the software checksum values flashing on the screen. The service icon will also illuminate. Use up, and down buttons to modify the values and press the scan button to save the value and go to the next screen.

Note: If the alarms are enabled, the unit will not enter Service Mode.

Resetting any of the following parameter values could adversely affect the performance of your unit. Be sure to understand your product requirements before making any adjustment to the service parameter values. These settings very rarely need to be changed from normal operation. Call technical support if you have any questions prior to making any adjustments to service parameter values.

+4° / +5° Service Menu Functions

Screen/Button		Display	Function	Summary
1	Initial Screen	SEr 05	Temp of unit	Allows the user to see what temperature the unit is designed to run.
		Varies	CPU Checksum	Shows the current checksum of the CPU board for validation.
		Varies	Relay Board Checksum	Shows the current checksum of the Relay board for validation.
		tyP	Model Type	Unit type 05 for +5 refrigerator. This parameter should never be changed.
2	Press Scan (Scan)	CFg	Type of unit	This parameter should only be changed by trained service personnel.
3	Press Scan (Scan)	CuFt	Size of the unit	Setting for size of the unit.
4	Press Scan (Scan)	Pd oFSt	Control Probe Pulldown Offset	The difference in temperature between the control probe value and the average compartment temperature that determines when the control system changes from pull down mode to steady state operation. This can be useful to adjust if the average compartment temperature has an undershoot or overshoot relative to setpoint during pull down mode. This offset is also used on some refrigerator models as a response to door openings.
5	Press Scan (Scan)	Cnt oFSt	Control Probe Offset	The difference in temperature between the control probe value and the average compartment temperature that is used to control the cooling system to the unit setpoint during steady state operation. This can be useful to adjust if there is a discrepancy between the unit setpoint and the average cabinet temperature.
6	Press Scan (Scan)	dIS oFSt	Display Probe Offset	The difference in temperature between the display probe value seen on the User Interface display and the average compartment temperature at the unit setpoint during steady state operation. This can be useful to adjust the display during unit calibration procedures.

Press "Ctrl + Home" to return to top of Document

Screen/Button		Display	Function	Summary
7	Press Scan ( )	Ctr CAl	Display Control Probe with Offset	(If present) Normally OFF (00). If ON (01), the Upper Bottle Temperature output on main display is replaced by the control probe temperature value with offset when exiting the service menu.
8	Press Scan ( )	Cnt ucl	Control Upper Hysteresis	The degree increase in temperature from the setpoint that will trigger the unit to begin cooling to prevent the unit from getting too warm.
9	Press Scan ( )	Cnt lcl	Control Lower Hysteresis	The degree decrease in temperature from the setpoint that will trigger the unit to stop cooling to prevent the unit from getting too cold.
10	Press Scan ( )	door AJAr	Door Alarm Time	The approximate time the door can remain open before the door ajar alarm activates in minutes.
11	Press Scan ( )	dEF Int	Defrost Interval	The time interval between defrost cycles in hours.
12	Press Scan ( )	dEF dur	Defrost Duration	The maximum amount of time the defrost cycle will run in minutes.
13	Press Scan ( )	dEF Hi	Defrost Temp Out	The maximum temperature that the defrost probe can reach before stopping the defrost cycle.
14	Press Scan ( )	qUA	Quality Mode	Normally OFF(00). Used for production line testing.
15	Press Scan ( )	bot	BOT Mode	Normally OFF(00). If ON(01), the unit is forced to run at coldest possible temperature for approximately 24 hours. Defrosts will still occur as scheduled.
16	Press Scan ( )	PEr	Perimeter Heater Duty Cycle	Controls the perimeter heater ON time (only applicable on swinging door models).
17	Press Scan ( )	Cnt Prb	Control Probe Temperature	Displays control probe temperature (Read only).
18	Press Scan ( )	Anb Prb	Ambient Probe Temperature	Displays ambient probe temperature in deck (Read only).
19	Press Scan ( )	d lo Prb	Lower Display Probe	Displays Err since this refrigerator does not have a lower display probe.
20	Press Scan ( )	dEF Prb	Defrost Probe Temperature	Displays defrost probe temperature (Read only).
21	Press Scan ( )	---	Enter Defrost Cycle	Pressing the Scan button after displaying the defrost probe temperature while not in an alarm mode will force the unit into a defrost cycle. To avoid defrost cycle, leave unit screen idle for approximately 30 seconds.

Press “Ctrl + Home” to return to top of Document

-20° Service Menu Functions

Screen/Button		Display	Function	Summary
1	Initial Screen	SEr -20	Temp of unit	Allows the user to see what temperature the unit is designed to run.
		Varies	CPU Checksum	Shows the current checksum of the CPU board for validation.
		Varies	Relay Board Checksum	Shows the current checksum of the Relay board for validation.
		tyP	Model Type	Unit type 20 for -20 Freezer. This parameter should never be changed.
2	Press Scan	CFg	Type of unit	This parameter should only be changed by trained service personnel.
3	Press Scan	CuFt	Size of the unit	Setting for Size of the unit.
4	Press Scan	Pd oFSt	Control Probe Pulldown Offset	The difference in temperature between the control probe value and the average compartment temperature that determines when the control system changes from pull down mode to steady state operation. This can be useful to adjust if the average compartment temperature has an undershoot or overshoot relative to setpoint during pull down mode. This offset is also used on some freezer models as a response to door openings.
5	Press Scan	Cnt oFSt	Control Probe Offset	The difference in temperature between the control probe value and the average compartment temperature that is used to control the cooling system to the unit setpoint during steady state operation. This can be useful to adjust if there is a discrepancy between the unit setpoint and the average cabinet temperature.
6	Press Scan	dIS oFSt	Display Probe Offset	The difference in temperature between the display probe value seen on the User Interface display and the average compartment temperature at the unit setpoint during steady state operation. This can be useful to adjust the display during unit calibration procedures.
7	Press Scan	Ctr CAl	Display Control Probe with Offset	(If present) Normally OFF (00). If ON (01), the Upper Bottle Temperature output on main display is replaced by the control probe temperature value with offset when exiting the service menu.
8	Press Scan	Cnt ucl	Control Upper Hysteresis	The degree increase in temperature from the setpoint that will trigger the unit to begin cooling to prevent the unit from getting too warm.

Press “Ctrl + Home” to return to top of Document

Screen/Button		Display	Function	Summary
9	Press Scan ( )	Cnt lcl	Control Lower Hysteresis	The degree decrease in temperature from the setpoint that will trigger the unit to stop cooling to prevent the unit from getting too cold.
10	Press Scan ( )	door AJAr	Door Alarm Time	The approximate time the door can remain open before the door ajar alarm activates in minutes.
11	Press Scan ( )	qUA	Quality Mode	Normally OFF(00). Used for production line testing.
12	Press Scan ( )	bot	BOT Mode	Normally OFF(00). If ON(01), the unit is forced to run at coldest possible temperature for approximately 24 hours.
13	Press Scan ( )	PEr	Perimeter Heater Duty Cycle	Controls the perimeter heater ON time.
14	Press Scan ( )	Cnt Prb	Control Probe Temperature	Displays control probe temperature (Read only).
15	Press Scan ( )	Anb Prb	Ambient Probe Temperature	Displays ambient probe temperature in deck (Read only).
16	Press Scan ( )	---	Exit Service Mode	Returns to normal operating screen.

Press “Ctrl + Home” to return to top of Document

-30° Service Menu Functions

Screen/Button		Display	Function	Summary
1	Initial Screen	SEr -30	Temp of unit	Allows the user to see what temperature the unit is designed to run.
		Varies	CPU Checksum	Shows the current checksum of the CPU board for validation.
		Varies	Relay Board Checksum	Shows the current checksum of the Relay board for validation.
		tyP	Model Type	Unit type 30 for -30 Freezer. This parameter should never be changed.
2	Press Scan ( )	CFg	Type of unit	This parameter should only be changed by trained service personnel.
3	Press Scan ( )	CuFt	Size of the unit	Setting for Size of the unit.
4	Press Scan ( )	Pd oFSt	Control Probe Pulldown Offset	The difference in temperature between the control probe value and the average compartment temperature that determines when the control system changes from pull down mode to steady state operation. This can be useful to adjust if the average compartment temperature has an undershoot or overshoot relative to setpoint during pull down mode. This offset is also used on some freezer models as a response to door openings.
5	Press Scan ( )	Cnt oFSt	Control Probe Offset	The difference in temperature between the control probe value and the average compartment temperature that is used to control the cooling system to the unit setpoint during steady state operation. This can be useful to adjust if there is a discrepancy between the unit setpoint and the average cabinet temperature.
6	Press Scan ( )	dIS oFSt	Display Probe Offset	The difference in temperature between the display probe value seen on the User Interface display and the average compartment temperature at the unit setpoint during steady state operation. This can be useful to adjust the display during unit calibration procedures.
7	Press Scan ( )	Ctr CAl	Display Control Probe with Offset	(If present) Normally OFF (00). If ON (01), the Upper Bottle Temperature output on main display is replaced by the control probe temperature value with offset when exiting the service menu.
8	Press Scan ( )	Cnt ucl	Control Upper Hysteresis	The degree increase in temperature from the setpoint that will trigger the unit to begin cooling to prevent the unit from getting too warm.

Press “Ctrl + Home” to return to top of Document

Screen/Button		Display	Function	Summary
8	Press Scan ( )	Cnt lcl	Control Lower Hysteresis	The degree decrease in temperature from the set point that will trigger the unit to stop cooling to prevent the unit from getting too cold.
9	Press Scan ( )	AdP dEF	Adaptive Defrost	Setting for adaptive defrost ON (01) or OFF (00).
10	Press Scan ( )	dEF Int	Defrost Interval	The time interval between defrost cycles in hours.
11	Press Scan ( )	dEF dur	Defrost Duration	The maximum amount of the time the defrost cycle will run in minutes. Value will be "nA" for units with hot gas defrost
12	Press Scan ( )	dEF Hi	Defrost Temp Out	The maximum temperature that the defrost probe can reach before stopping the defrost cycle.
13	Press Scan ( )	PAn Hi	Drip Pan Temp Out	Maximum temperature drip pan probe can reach before stopping the defrost drip time.
14	Press Scan ( )	qUA	Quality Mode	Normally OFF(00). Used for production line testing.
15	Press Scan ( )	bot	BOT mode	Normally OFF(00). If ON(01), the unit is forced to run at coldest possible temperature for approximately 24 hours. Defrosts will still occur at scheduled.
16	Press Scan ( )	PEr	Perimeter heater Duty Cycle	Controls the perimeter heater ON time.
17	Press Scan ( )	Cnt prb	Control Probe Temperature	Displays control probe temperature (Read Only).
18	Press Scan ( )	Anb prb	Ambient Probe Temperature	Displays ambient probe temperature in deck (Read Only).
19	Press Scan ( )	dEF Prb	Defrost Probe Temperature	Displays defrost probe temperature (Read Only).
20	Press Scan ( )	PAn Prb	Defrost Drip Pan Probe Temperature	Displays defrost drip pan probe temperature.
21	Press Scan ( )	---	Enter Defrost Cycle	Pressing the scan button after displaying the defrost Drip Pan probe temperature while not in an alarm mode will force the unit into a defrost cycle. To avoid defrost cycle, leave idle screen for approximately 30 seconds.

Press “Ctrl + Home” to return to top of Document

Firmware History

Vintage	EPROM version	EPROM Checksum	Relay Checksum	Approximate Production Dates	Notes
Suffix 16	G52B	1AB1	4CE4	Nov 2016 to May 2018	2330 Electric Defrost
Suffix 17	G54A	520E	3CA0	May 2018 to Apr 2019	Switch to Hot Gas Defrost, H02 Board Not Working on Rev A units.
Suffix 17	G54B	CF1B	DB6A	Apr 2019 to May 2019	Allow new H02 board to work on REVA units
Suffix 17/18	G54C	A678	9AC9	May 2019 to Feb 2020	Product Launch, Issue with ADP = 00 No Defrost on -30
Suffix 17/18/19	G54D	A901	D284	Feb 2020 to Nov 2020	Fixed ADP=00 Issue , added Door Ajar, Moved control sensor on CW's, so suffix 19 - Config 03
Suffix 17/19	G54D	A901	3429	Dec 2020 to May 2021	Production fix for 2330 only
Suffix 17-20	G54E	36DE	9862	May 2021 to current	Indroduction of the 2320HA FMS model; 2320 standerdize MAIA inverter 3020 Cond. unit, no Transformer; 2330 new compressor/inverter. 2304-5 Standardization

Icing Fix					
Vintage	**EPROM version**	**EPROM Checksum**	**Relay Checksum**	**Approximate Production Dates**	**Notes**
Suffix 17	G57A	DC38	F0DD	TSX 5030 Icing fix	Dec 2019, fix for 5030 units prior to 11-8-2019 Fix for Adaptive defrost of 00 equals no defrost at all ; also added Door Ajar
Suffix 17	G57B	1094	FE0C	Nov. 2020 fix for 1230, 2330, and 303	Nov 2020, fix for 1230, 2330, and 3030 in addition to 5030. Added Control Calibration (Ctr Cal) to the service menu

The new user manual states that the Type of Unit for the Config Parameter should not be changed. That is correct when the unit is produced but may not apply for service boards.

Cfg = 00 is used for Suffix 16 models that were produced from 2016 to May 2018.

Cfg = 01 is for most 2018 and 2019 models.

Cfg = 02 is for the 2019 version of the coldwall units that had the addition of a display bottle and a PEP.

Cfg = 03 is for the 2020 version of the coldwall units that had a longer red control probe mounted to the lower left side wall with ULT sensor bracket.

Cfg = 04 for all units May 2021 to current; changes for the 2320 units with 3020 style condensing unit, and the addition of the new service parameter Control Calibration.

The 2019 menus now include offsets that were previously hidden and hard coded. Pull down offset and Control probe offset have default values based on cabinet size and temperature, but are now user settable for customers who have their own validation protocols that needed access to those settings.

Press “Ctrl + Home” to return to top of Document

Parameter Defaults by Eprom Revision and Suffix

Suffix 17 G54 Rev. A Paramters May 2018 - Apr. 2019											
"+4 Refrigerator"						"+5 Refrigerator"					
4	System Parameter	Units	Display "text"	Value	Range	5	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	4.0	3 to 7	PROG	Set point	°C	na	5.0	3 to 7
MODE	Warm Alarm	°C	na	5.5	(sp+1) to 15	MODE	Warm Alarm	°C	na	8.0	(sp+1) to 15
	Cold Alarm	°C	na	2.0	0 to (sp-1)		Cold Alarm	°C	na	2.0	0 to (sp-1)
	"SER"	na	SEr	na	na		"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	4	4,20,30,5	SERVICE	Temp of Unit	°C	na	5	4,20,30,5
MODE	CPU Checksum	base 16 #	na	520E	na	MODE	CPU Checksum	base 16 #	na	520E	na
	Relay Checksum	base 16 #	na	3CA0	na		Relay Checksum	base 16 #	na	3CA0	na
	Model Type	coded #	tyP	4	4, 20, 30, 5, 55, 66		Model Type	coded #	tyP	5	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01		Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	23, 50		Cubic Foot	cu ft	CuFt	(cab size)	23, 45, 50
	Display Offset	°C	oFSt	0.0	+/- 3.0		Display Offset	°C	oFSt	0.0	+/- 3.0
	Control UCL	°C	Cnt ucl	0.8	0 to 5		Control UCL	°C	Cnt ucl	0.8	0 to 5
	Control LCL	°C	Cnt lcl	-0.2	-5 to 0		Control LCL	°C	Cnt lcl	-0.2	-5 to 0
	Defrost Interval	hours	dEF Int	1	1 to 12		Defrost Interval	hours	dEF Int	1	1 to 12
	Defrost Duration	minutes	dEF dur	15	15 to 30		Defrost Duration	minutes	dEF dur	15	15 to 30
	Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15		Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15
	Quality Mode	on/off	qUA	00	00, 01		Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01		BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	35	20 to 100		Perimeter Heater PWM	%	Per	35	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading		Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading		Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading		Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading		Defr.Prb	°C	dEF Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17 G54 Rev. A Paramters May 2018 - Apr. 2019					
"-20 Freezer"					
20	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-20.0	-25 to -15
MODE	Warm Alarm	°C	na	-10.0	(sp+5) to -10
	Cold Alarm	°C	na	-25.0	-35 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	20	4,20,30,5
MODE	CPU Checksum	base 16 #	na	520E	na
	Relay Checksum	base 16 #	na	3CA0	na
	Model Type	coded #	tyP	20	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	23	23
	Display Offset	°C	oFSt	0.0	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	64	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading

"-30 Freezer"					
30	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-30.0	-35 to -15
MODE	Warm Alarm	°C	na	-20.0	(sp+5) to -10
	Cold Alarm	°C	na	-35.0	-40 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	30	4,20,30,5
MODE	CPU Checksum	base 16 #	na	520E	na
	Relay Checksum	base 16 #	na	3CA0	na
	Model Type	coded #	tyP	30	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	23, 50
	Display Offset	°C	oFSt	0.0	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Defrost Interval	hours	dEF Int	6	4 to 8
	Defrost Duration	minutes	dEF dur	20	20 to 30
	Defr. Hi (temp out)	°C	dEF Hi	1	1 to 10
	Drip Pan temp out	°C	Pan Hi	3	0 to 10
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	90	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading
	Drip Pan Probe	°C	PAn Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17 G54 Rev. B Paramters May 2018 - Apr. 2019											
"+4 Refrigerator"						"+5 Refrigerator"					
4	System Parameter	Units	Display "text"	Value	Range	5	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	4.0	3 to 7	PROG	Set point	°C	na	5.0	3 to 7
MODE	Warm Alarm	°C	na	5.5	(sp+1) to 15	MODE	Warm Alarm	°C	na	8.0	(sp+1) to 15
	Cold Alarm	°C	na	2.0	0 to (sp-1)		Cold Alarm	°C	na	2.0	0 to (sp-1)
	"SER"	na	SEr	na	na		"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	4	4,20,30,5	SERVICE	Temp of Unit	°C	na	5	4,20,30,5
MODE	CPU Checksum	base 16 #	na	CF1B	na	MODE	CPU Checksum	base 16 #	na	CF1B	na
	Relay Checksum	base 16 #	na	DB6A	na		Relay Checksum	base 16 #	na	DB6A	na
	Model Type	coded #	tyP	4	4, 20, 30, 5, 55, 66		Model Type	coded #	tyP	5	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01		Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	23, 50		Cubic Foot	cu ft	CuFt	(cab size)	23, 45, 50
	Display Offset	°C	oFSt	0.0	+/- 3.0		Display Offset	°C	oFSt	0.0	+/- 3.0
	Control UCL	°C	Cnt ucl	0.8	0 to 5		Control UCL	°C	Cnt ucl	0.8	0 to 5
	Control LCL	°C	Cnt lcl	-0.2	-5 to 0		Control LCL	°C	Cnt lcl	-0.2	-5 to 0
	Defrost Interval	hours	dEF Int	1	1 to 12		Defrost Interval	hours	dEF Int	1	1 to 12
	Defrost Duration	minutes	dEF dur	15	15 to 30		Defrost Duration	minutes	dEF dur	15	15 to 30
	Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15		Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15
	Quality Mode	on/off	qUA	00	00, 01		Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01		BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	35	20 to 100		Perimeter Heater PWM	%	Per	35	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading		Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading		Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading		Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading		Defr.Prb	°C	dEF Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17 G54 Rev. B Paramters May 2018 - Apr. 2019					
"-20 Freezer"					
20	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-20.0	-25 to -15
MODE	Warm Alarm	°C	na	-10.0	(sp+5) to -10
	Cold Alarm	°C	na	-25.0	-35 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	20	4,20,30,5
MODE	CPU Checksum	base 16 #	na	CF1B	na
	Relay Checksum	base 16 #	na	DB6A	na
	Model Type	coded #	tyP	20	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	23	23
	Display Offset	°C	oFSt	0.0	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	64	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading

"-30 Freezer"					
30	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-30.0	-35 to -15
MODE	Warm Alarm	°C	na	-20.0	(sp+5) to -10
	Cold Alarm	°C	na	-35.0	-40 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	30	4,20,30,5
MODE	CPU Checksum	base 16 #	na	CF1B	na
	Relay Checksum	base 16 #	na	DB6A	na
	Model Type	coded #	tyP	30	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	23, 50
	Display Offset	°C	oFSt	0.0	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Defrost Interval	hours	dEF Int	6	4 to 8
	Defrost Duration	minutes	dEF dur	20	20 to 30
	Defr. Hi (temp out)	°C	dEF Hi	1	1 to 10
	Drip Pan temp out	°C	Pan Hi	3	0 to 10
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	90	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading
	Drip Pan Probe	°C	PAn Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17 G54 Rev. C Paramters Apr. 2019 - Feb. 2020											
"+4 Refrigerator"						"+5 Refrigerator"					
4	System Parameter	Units	Display "text"	Value	Range	5	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	4.0	3 to 7	PROG	Set point	°C	na	5.0	3 to 7
MODE	Warm Alarm	°C	na	5.5	(sp+1) to 15	MODE	Warm Alarm	°C	na	8.0	(sp+1) to 15
	Cold Alarm	°C	na	2.0	0 to (sp-1)		Cold Alarm	°C	na	2.0	0 to (sp-1)
	"SER"	na	SEr	na	na		"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	4	4,20,30,5	SERVICE	Temp of Unit	°C	na	5	4,20,30,5
MODE	CPU Checksum	base 16 #	na	A678	na	MODE	CPU Checksum	base 16 #	na	A678	na
	Relay Checksum	base 16 #	na	9AC9	na		Relay Checksum	base 16 #	na	9AC9	na
	Model Type	coded #	tyP	4	4, 20, 30, 5, 55, 66		Model Type	coded #	tyP	5	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01		Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 50		Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 45, 50
	Pull Down Offset	°C	Pd oFSt	0.0	+/- 5.0		Pull Down Offset	°C	Pd oFSt	0.5	+/- 5.0
	Control Offset	°C	Cnt oFSt	0.2	+/- 5.0		Control Offset	°C	Cnt oFSt	0.0	+/- 5.0
	Display Offset	°C	oFSt	-1.4	+/- 3.0		Display Offset	°C	oFSt	-0.9	+/- 3.0
	Control UCL	°C	Cnt ucl	0.8	0 to 5		Control UCL	°C	Cnt ucl	0.8	0 to 5
	Control LCL	°C	Cnt lcl	-0.2	-5 to 0		Control LCL	°C	Cnt lcl	-0.2	-5 to 0
	Defrost Interval	hours	dEF Int	1	1 to 12		Defrost Interval	hours	dEF Int	1	1 to 12
	Defrost Duration	minutes	dEF dur	15	15 to 30		Defrost Duration	minutes	dEF dur	15	15 to 30
	Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15		Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15
	Quality Mode	on/off	qUA	00	00, 01		Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01		BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	35	20 to 100		Perimeter Heater PWM	%	Per	35	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading		Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading		Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading		Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading		Defr.Prb	°C	dEF Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17 G54 Rev. C Paramters Apr. 2019 - Feb. 2020					
"-20 Freezer"					
20	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-20.0	-25 to -15
MODE	Warm Alarm	°C	na	-10.0	(sp+5) to -10
	Cold Alarm	°C	na	-25.0	-35 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	20	4,20,30,5
MODE	CPU Checksum	base 16 #	na	A678	na
	Relay Checksum	base 16 #	na	9AC9	na
	Model Type	coded #	tyP	20	20, 30
	Configuration	coded #	CFg	02	00, 01, 02
	Cubic Foot	cu ft	CuFt	(cab size)	23, 30
	Pull Down Offset	°C	Pd oFSt	-7.0	+/- 10
	Control Offset	°C	Cnt oFSt	-3.0	+/- 10
	Display Offset	°C	oFSt	-2.2	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	65	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading

"-30 Freezer"					
30	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-30.0	-35 to -15
MODE	Warm Alarm	°C	na	-20.0	(sp+5) to -10
	Cold Alarm	°C	na	-35.0	-40 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	30	4,20,30,5
MODE	CPU Checksum	base 16 #	na	A678	na
	Relay Checksum	base 16 #	na	9AC9	na
	Model Type	coded #	tyP	30	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 50
	Pull Down Offset	°C	Pd oFSt	-2.0	+/- 5.0
	Control Offset	°C	Cnt oFSt	-0.5	+/- 5.0
	Display Offset	°C	oFSt	1.3	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Adaptive Defrost	on/off	AdP dEF	01	00, 01
	Defrost Interval	hours	dEF Int	6	4 to 8
	Defrost Duration	minutes	dEF dur	20	20 to 30
	Defr. Hi (temp out)	°C	dEF Hi	1	1 to 10
	Drip Pan temp out	°C	Pan Hi	3	0 to 10
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	90	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading
	Drip Pan Probe	°C	PAn Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17, 18, 19 G54 Rev. D Paramters Feb. 2020 - May 2021											
"+4 Refrigerator"						"+5 Refrigerator"					
4	System Parameter	Units	Display "text"	Value	Range	5	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	4.0	3 to 7	PROG	Set point	°C	na	5.0	3 to 7
MODE	Warm Alarm	°C	na	5.5	(sp+1) to 15	MODE	Warm Alarm	°C	na	8.0	(sp+1) to 15
	Cold Alarm	°C	na	2.0	0 to (sp-1)		Cold Alarm	°C	na	2.0	0 to (sp-1)
	"SER"	na	SEr	na	na		"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	4	4,20,30,5	SERVICE	Temp of Unit	°C	na	5	4,20,30,5
MODE	CPU Checksum	base 16 #	na	A901	na	MODE	CPU Checksum	base 16 #	na	A901	na
	Relay Checksum	base 16 #	na	D284 / 3429	na		Relay Checksum	base 16 #	na	D284 / 3429	na
	Model Type	coded #	tyP	4	4, 20, 30, 5, 55, 66		Model Type	coded #	tyP	5	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01		Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 50		Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 45, 50
	Pull Down Offset	°C	Pd oFSt	0.0	+/- 5.0		Pull Down Offset	°C	Pd oFSt	0.5	+/- 5.0
	Control Offset	°C	Cnt oFSt	0.2	+/- 5.0		Control Offset	°C	Cnt oFSt	0.0	+/- 5.0
	Display Offset	°C	oFSt	-1.4	+/- 3.0		Display Offset	°C	oFSt	-0.9	+/- 3.0
	Control UCL	°C	Cnt ucl	0.8	0 to 5		Control UCL	°C	Cnt ucl	0.8	0 to 5
	Control LCL	°C	Cnt lcl	-0.2	-5 to 0		Control LCL	°C	Cnt lcl	-0.2	-5 to 0
	Door Ajar	minutes	door ajar	3	1, 2, 3		Door Ajar	minutes	door ajar	3	1, 2, 3
	Defrost Interval	hours	dEF Int	1	1 to 12		Defrost Interval	hours	dEF Int	1	1 to 12
	Defrost Duration	minutes	dEF dur	15	15 to 30		Defrost Duration	minutes	dEF dur	15	15 to 30
	Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15		Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15
	Quality Mode	on/off	qUA	00	00, 01		Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01		BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	35	20 to 100		Perimeter Heater PWM	%	Per	35	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading		Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading		Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading		Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading		Defr.Prb	°C	dEF Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17, 18, 19 G54 Rev. D Paramters Feb. 2020 - May 2021					
"-20 Freezer"					
20	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-20.0	-25 to -15
MODE	Warm Alarm	°C	na	-10.0	(sp+5) to -10
	Cold Alarm	°C	na	-25.0	-35 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	20	4,20,30,5
MODE	CPU Checksum	base 16 #	na	A901	na
	Relay Checksum	base 16 #	na	D284 / 3429	na
	Model Type	coded #	tyP	20	20, 30
	Configuration	coded #	CFg	03	00, 01, 02, 03
	Cubic Foot	cu ft	CuFt	(cab size)	23, 30
	Pull Down Offset	°C	Pd oFSt	-2.0	+/- 10
	Control Offset	°C	Cnt oFSt	-0.8	+/- 10
	Display Offset	°C	oFSt	-2.2	+/- 10
	Control UCL	°C	Cnt ucl	0.1	0 to 5
	Control LCL	°C	Cnt lcl	-0.1	-5 to 0
	Door Ajar	minutes	door ajar	03	01, 02, 03
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	65	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading

"-30 Freezer"					
30	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-30.0	-35 to -15
MODE	Warm Alarm	°C	na	-20.0	(sp+5) to -10
	Cold Alarm	°C	na	-35.0	-40 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	30	4,20,30,5
MODE	CPU Checksum	base 16 #	na	A901	na
	Relay Checksum	base 16 #	na	D284 / 3429	na
	Model Type	coded #	tyP	30	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	01	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 50
	Pull Down Offset	°C	Pd oFSt	-2.0	+/- 5.0
	Control Offset	°C	Cnt oFSt	-0.5	+/- 5.0
	Display Offset	°C	oFSt	1.3	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Door Ajar	minutes	door ajar	3	1, 2, 3
	Adaptive Defrost	on/off	AdP dEF	01	00, 01
	Defrost Interval	hours	dEF Int	6	4 to 8
	Defrost Duration	minutes	dEF dur	20	20 to 30 or na
	Defr. Hi (temp out)	°C	dEF Hi	1	1 to 10
	Drip Pan temp out	°C	Pan Hi	3	0 to 10
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	90	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading
	Drip Pan Probe	°C	PAn Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17, 18, 19 G54 Rev. E Paramters May 2021 to Current											
"+4 Refrigerator"						"+5 Refrigerator"					
4	System Parameter	Units	Display "text"	Value	Range	5	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	4.0	3 to 7	PROG	Set point	°C	na	5.0	3 to 7
MODE	Warm Alarm	°C	na	5.5	(sp+1) to 15	MODE	Warm Alarm	°C	na	8.0	(sp+1) to 15
	Cold Alarm	°C	na	2.0	0 to (sp-1)		Cold Alarm	°C	na	2.0	0 to (sp-1)
	"SER"	na	SEr	na	na		"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	4	4,20,30,5	SERVICE	Temp of Unit	°C	na	5	4,20,30,5
MODE	CPU Checksum	base 16 #	na	36DE	na	MODE	CPU Checksum	base 16 #	na	36DE	na
	Relay Checksum	base 16 #	na	9862	na		Relay Checksum	base 16 #	na	9862	na
	Model Type	coded #	tyP	4	4, 20, 30, 5, 55, 66		Model Type	coded #	tyP	5	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	04	00, 01		Configuration	coded #	CFg	04	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 50		Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 45, 50
	Pull Down Offset	°C	Pd oFSt	0.0	+/- 5.0		Pull Down Offset	°C	Pd oFSt	0.5	+/- 5.0
	Control Offset	°C	Cnt oFSt	0.2	+/- 5.0		Control Offset	°C	Cnt oFSt	0.0	+/- 5.0
	Display Offset	°C	oFSt	-1.4	+/- 3.0		Display Offset	°C	oFSt	-0.9	+/- 3.0
	Control UCL	°C	Cnt ucl	0.8	0 to 5		Control UCL	°C	Cnt ucl	0.8	0 to 5
	Control LCL	°C	Cnt lcl	-0.2	-5 to 0		Control LCL	°C	Cnt lcl	-0.2	-5 to 0
	Door Ajar	minutes	door ajar	3	1, 2, 3		Door Ajar	minutes	door ajar	3	1, 2, 3
	Defrost Interval	hours	dEF Int	1	1 to 12		Defrost Interval	hours	dEF Int	1	1 to 12
	Defrost Duration	minutes	dEF dur	15	15 to 30		Defrost Duration	minutes	dEF dur	15	15 to 30
	Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15		Defr. Hi (temp out)	°C	dEF Hi	5	1 to 15
	Quality Mode	on/off	qUA	00	00, 01		Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01		BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	35	20 to 100		Perimeter Heater PWM	%	Per	35	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading		Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading		Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading		Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading		Defr.Prb	°C	dEF Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

Suffix 17, 18, 19 G54 Rev. E Paramters May 2021 to Current

"-20 Freezer"

20	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-20.0	-25 to -15
MODE	Warm Alarm	°C	na	-10.0	(sp+5) to -10
	Cold Alarm	°C	na	-25.0	-35 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	20	4,20,30,5
MODE	CPU Checksum	base 16 #	na	36DE	na
	Relay Checksum	base 16 #	na	9862	na
Starts here	Model Type	coded #	tyP	20	20, 30
	Configuration	coded #	CFg	04	00, 01, 02, 03, 04
	Cubic Foot	cu ft	CuFt	(cab size)	23, 30
	Pull Down Offset	°C	Pd oFSt	-2.0	+/- 10
	Control Offset	°C	Cnt oFSt	-0.8	+/- 10
	Display Offset	°C	oFSt	-2.2	+/- 10
	Control UCL	°C	Cnt ucl	0.1	0 to 5
	Control LCL	°C	Cnt lcl	-0.1	-5 to 0
	Door Ajar	minutes	door ajar	03	01, 02, 03
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	65	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading

"-30 Freezer"

30	System Parameter	Units	Display "text"	Value	Range
PROG	Set point	°C	na	-30.0	-35 to -15
MODE	Warm Alarm	°C	na	-20.0	(sp+5) to -10
	Cold Alarm	°C	na	-35.0	-40 to (sp-5)
	"SER"	na	SEr	na	na
SERVICE	Temp of Unit	°C	na	30	4,20,30,5
MODE	CPU Checksum	base 16 #	na	36DE	na
	Relay Checksum	base 16 #	na	9862	na
	Model Type	coded #	tyP	30	4, 20, 30, 5, 55, 66
	Configuration	coded #	CFg	04	00, 01
	Cubic Foot	cu ft	CuFt	(cab size)	12, 23, 30, 50
	Pull Down Offset	°C	Pd oFSt	-2.0	+/- 5.0
	Control Offset	°C	Cnt oFSt	-0.5	+/- 5.0
	Display Offset	°C	oFSt	1.3	+/- 10
	Control UCL	°C	Cnt ucl	0.5	0 to 5
	Control LCL	°C	Cnt lcl	-0.5	-5 to 0
	Door Ajar	minutes	door ajar	3	1, 2, 3
	Adaptive Defrost	on/off	AdP dEF	01	00, 01
	Defrost Interval	hours	dEF Int	6	4 to 8
	Defrost Duration	minutes	dEF dur	20	20 to 30 or na
	Defr. Hi (temp out)	°C	dEF Hi	1	1 to 10
	Drip Pan temp out	°C	Pan Hi	3	0 to 10
	Quality Mode	on/off	qUA	00	00, 01
	BOT Request	on/off	bot	00	00, 01
	Perimeter Heater PWM	%	Per	90	20 to 100
	Cntr.Probe	°C	Cnt Prb	°C	reading
	Amb. Probe	°C	Anb Prb	°C	reading
	Lower Display Probe	°C	d lo Prb	°C	reading
	Defr.Prb	°C	dEF Prb	°C	reading
	Drip Pan Probe	°C	PAn Prb	°C	reading

Press “Ctrl + Home” to return to top of Document

TSX Sensor Matrix (RoHS compliant)

Part Number	Description	Location	Sensor Color
309159H09	Display Sensor, (PT1000 Ohm RTD)	Refrigerator and Freezer Bottle	Green
309159H10	Display Sensor, (PT1000 Ohm RTD)	-20°C Freezer Bottle	Green
312096H06	Display Sensor, (LM335)	Blood Bank +4°C Lower Bottle	Yellow
326737H05	Defrost Sensor, (PT1000 Ohm RTD)	Refrigerator and Freezer Evaporator	Blue
326737H03	Control Sensor, (PT1000 Ohm RTD)	Refrigerator and Freezer Evaporator On Wall of Early -20°C Freezers	Red
326737H04	Control Sensor, (PT1000 Ohm RTD)	On Wall of -20°C Freezers	Red
326739H01	Ambient Sensor, (LM335)	Refrigerator and Freezer Electrical Deck	White
326739H03	Drip Pan Sensor, (LM335)	Freezer Evaporator Pan	Black
85089G10	100 Ohm RTD	4-20mA and Chart Recorder Sensor	Grey

Press “Ctrl + Home” to return to top of Document

Display Sensor and Controller Accuracy

Model	Component	Part Number	Description	Temperature Range	Accuracy Specification	Resolution
TSX1230	Display Temperature Probe	309159h09	Platinum RTD / 1000Ω	-150°C to 60°C	+/-0.30° C at 0° C, Tested to DIN EN 60751, Class B	Not Applicable
TSX2330						
TSX3030						
TSX5030		309159h10				
TSX2320						
TSX3020						
TSX1204		309159h09				
TSX2304						
TSX3004						
TSX5004		309159h10				
TSX1205		309159h09				
TSX2305						
TSX3005						
TSX4505		309159h10				
TSX5005						
All Models	Controller	304864H06	Microprocessor	+99.9°C to -99.9°C	± 0.5°C	0.1°C

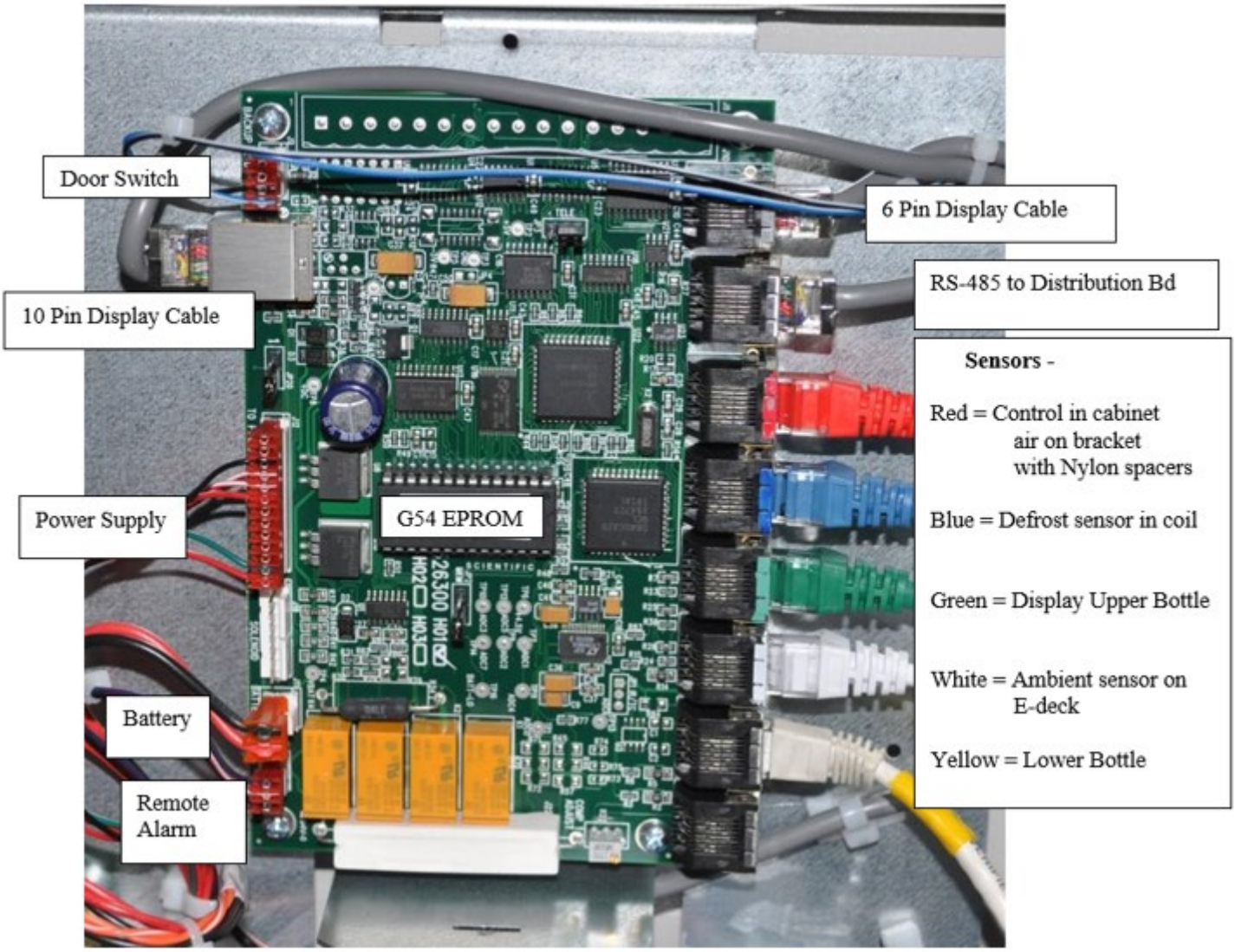
Press “Ctrl + Home” to return to top of Document

Model	Component	Part Number	Description	Temperature Range	Accuracy Specification	Resolution
TSX1230	Temperature Control Probe	326737H03	Platinum RTD / 1000Ω	-50°C to 300°C	+/-0.15° C at 0° C, Tested to DIN EN 60751, Class A	Not Applicable
TSX2330						
TSX3030						
TSX5030						
TSX2320		326737H04				
TSX3020						
TSX1204		326737H03				
TSX2304						
TSX3004						
TSX5004						
TSX1205						
TSX2305						
TSX3005						
TSX4505						
TSX5005						
All Models	Controller	304864H06	Microprocessor	+99.9°C to -99.9°C	± 0.5°C	0.1°C

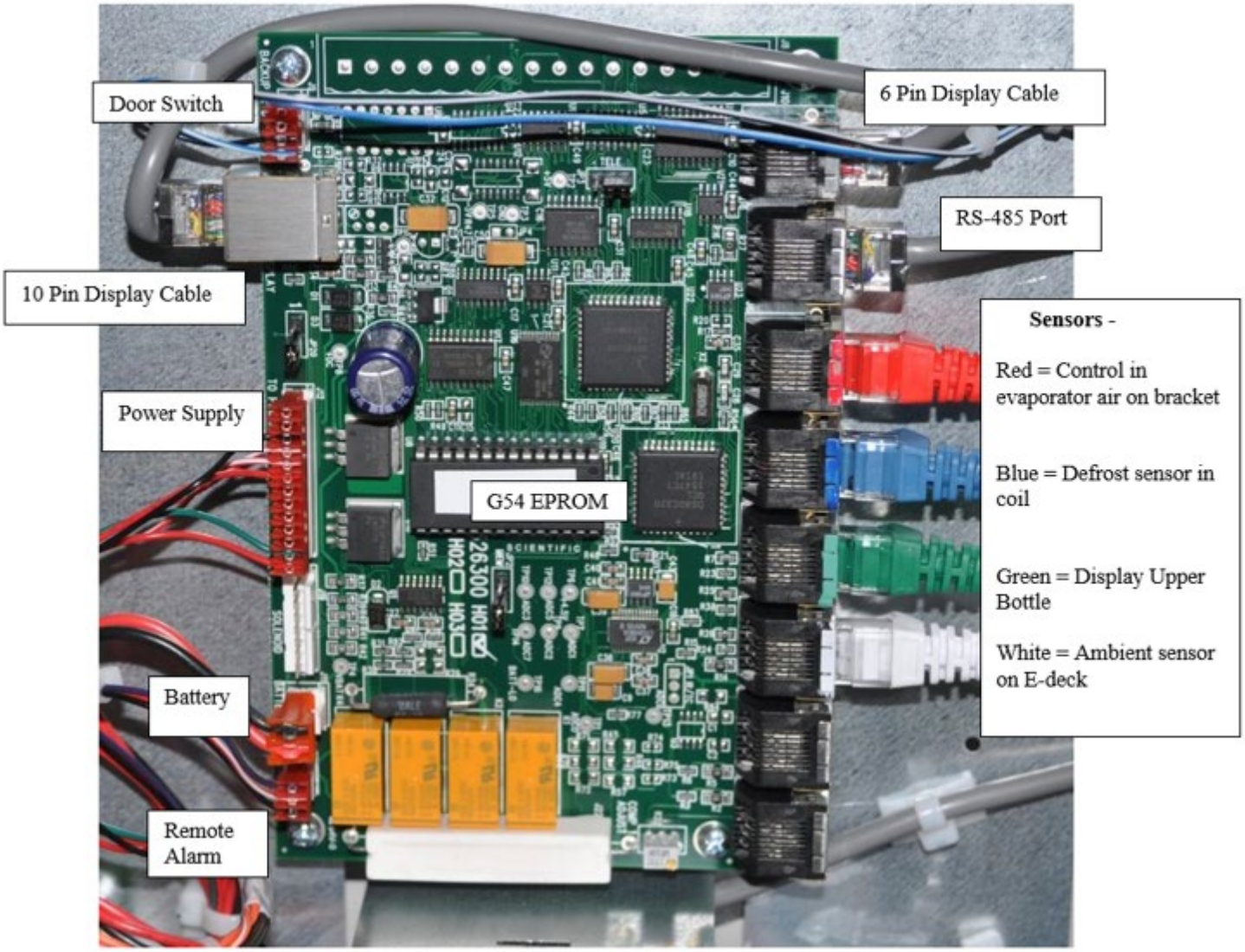
Press “Ctrl + Home” to return to top of Document

Standard CPU Sensor / Harness Connections

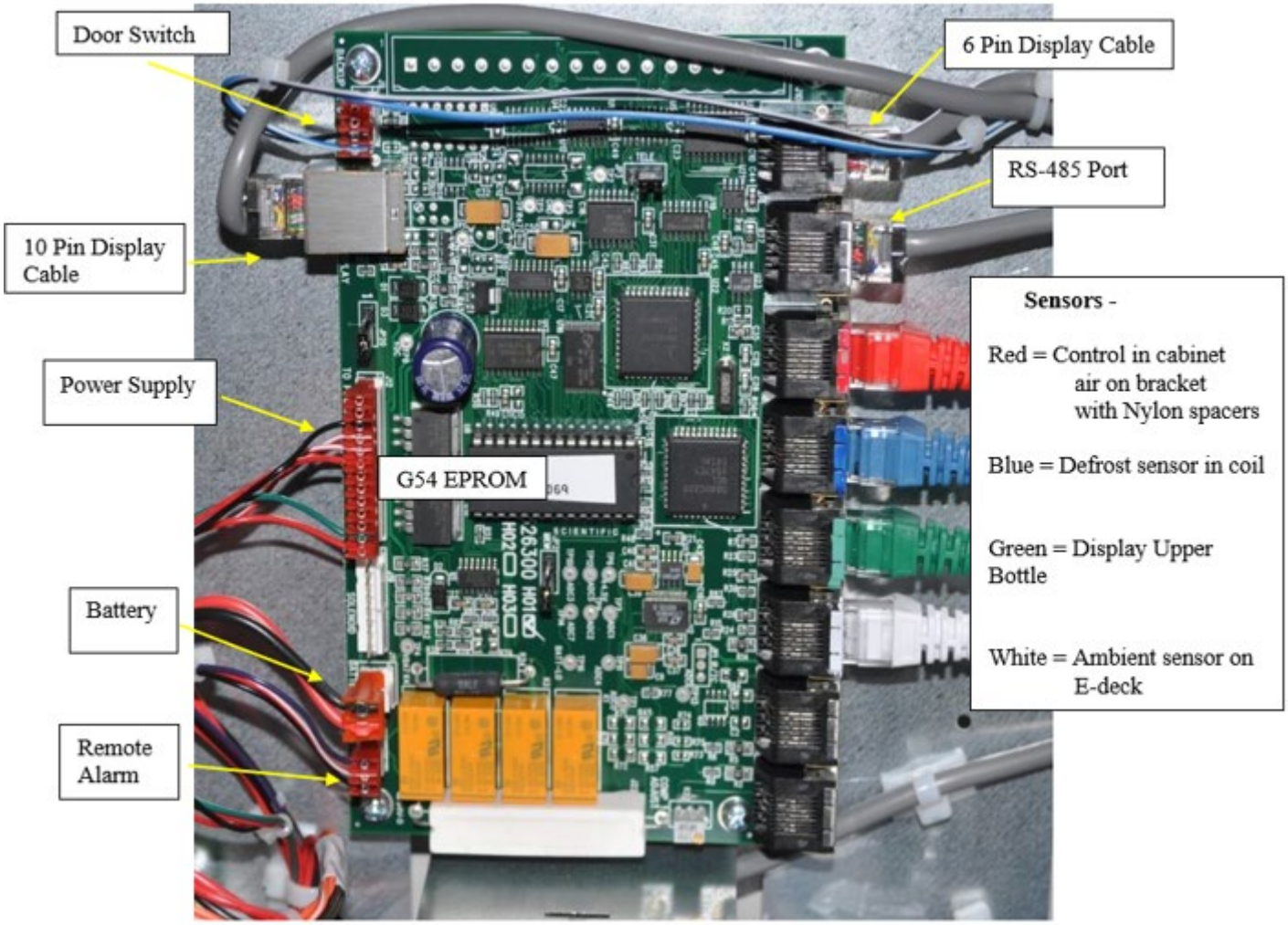
+4°C Blood Bank Refrigerator



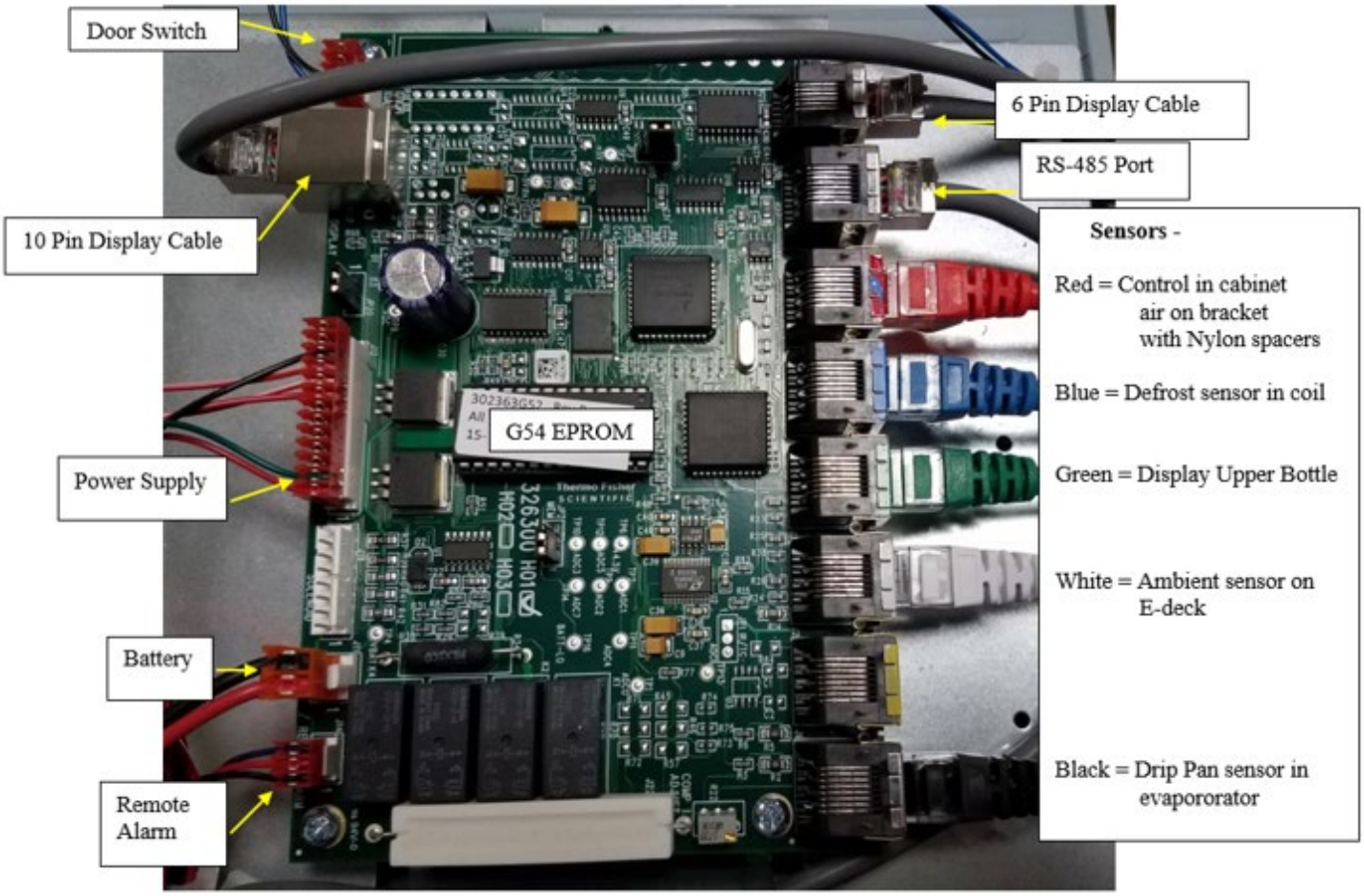
Press “Ctrl + Home” to return to top of Document



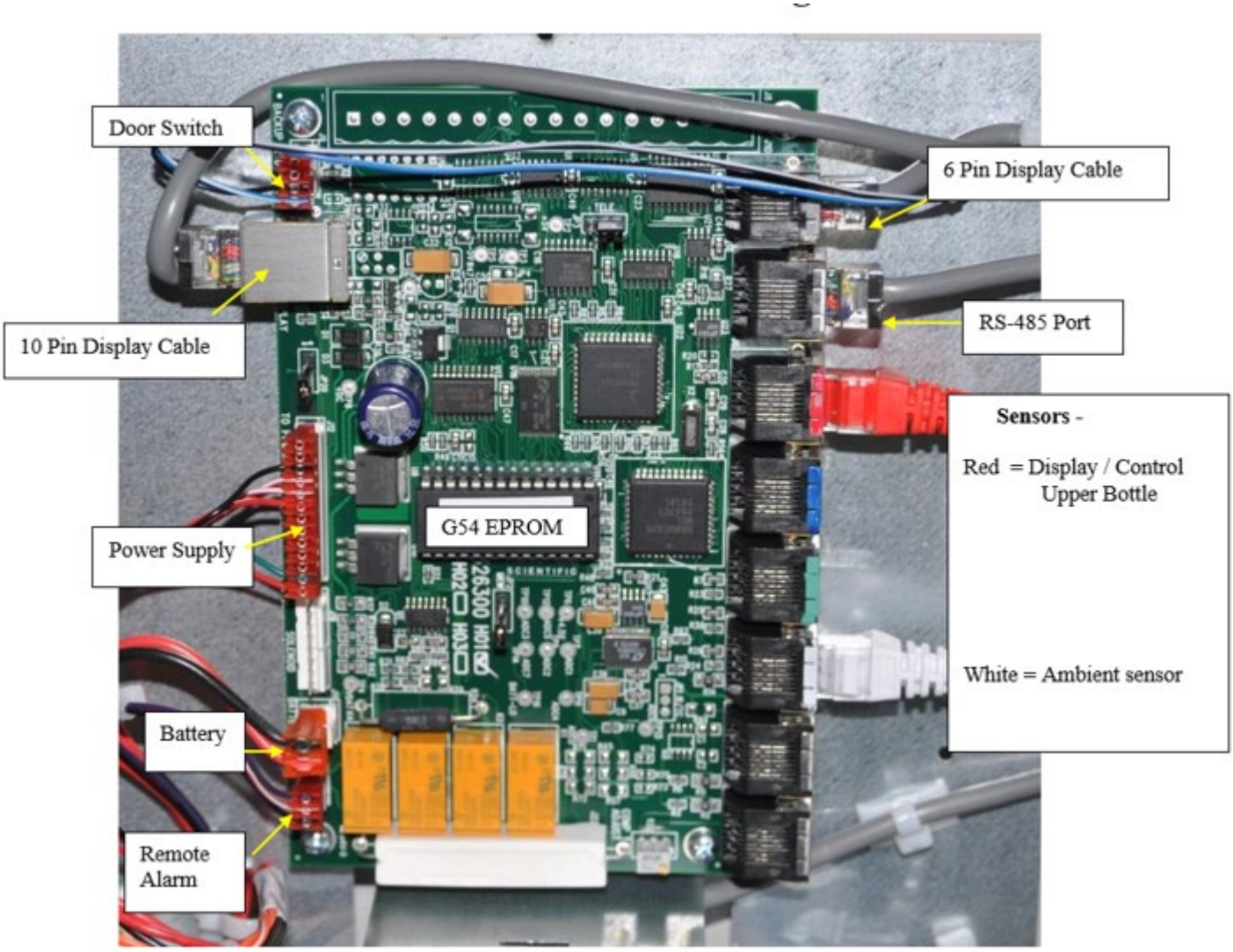
Press “Ctrl + Home” to return to top of Document



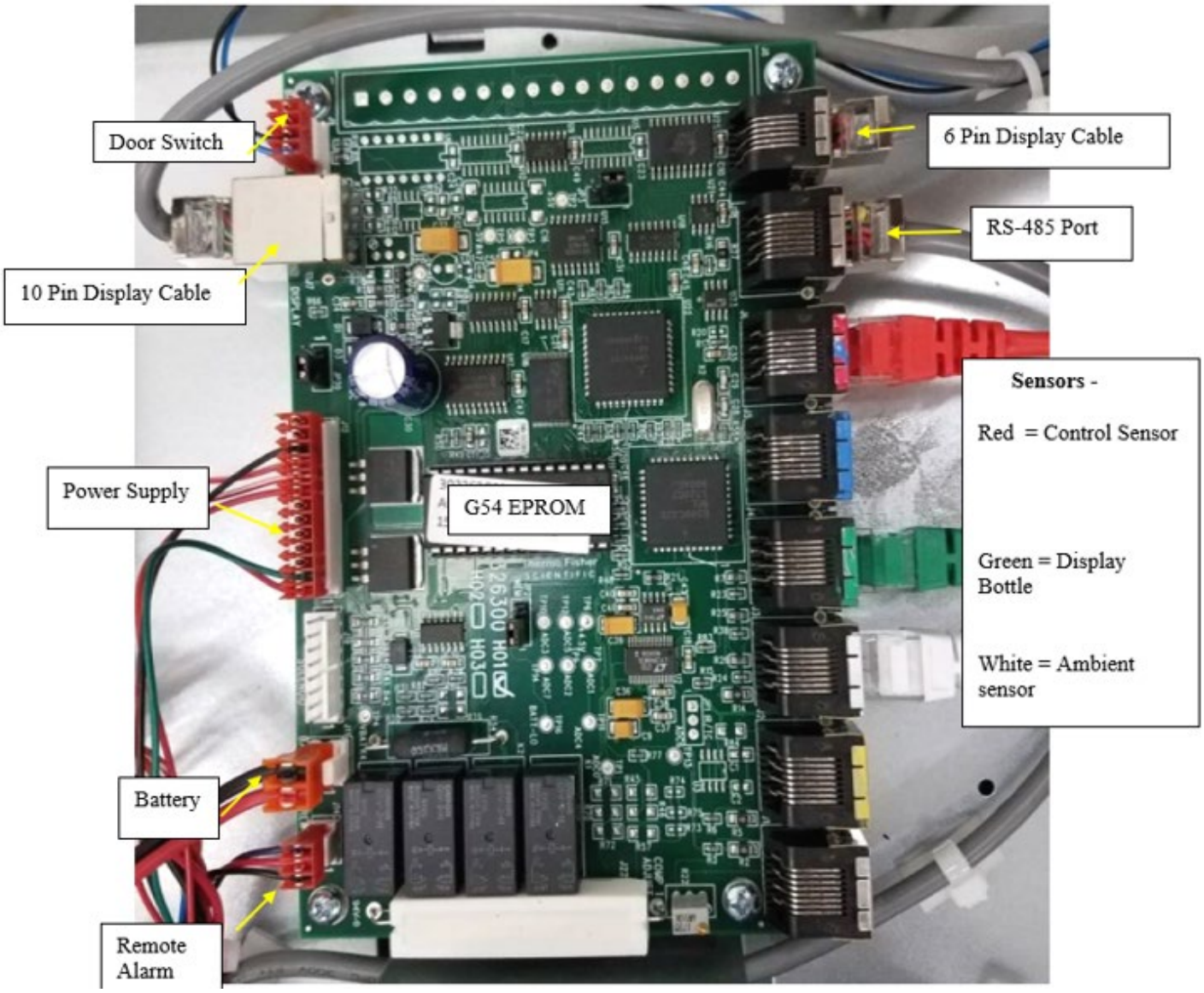
Press “Ctrl + Home” to return to top of Document



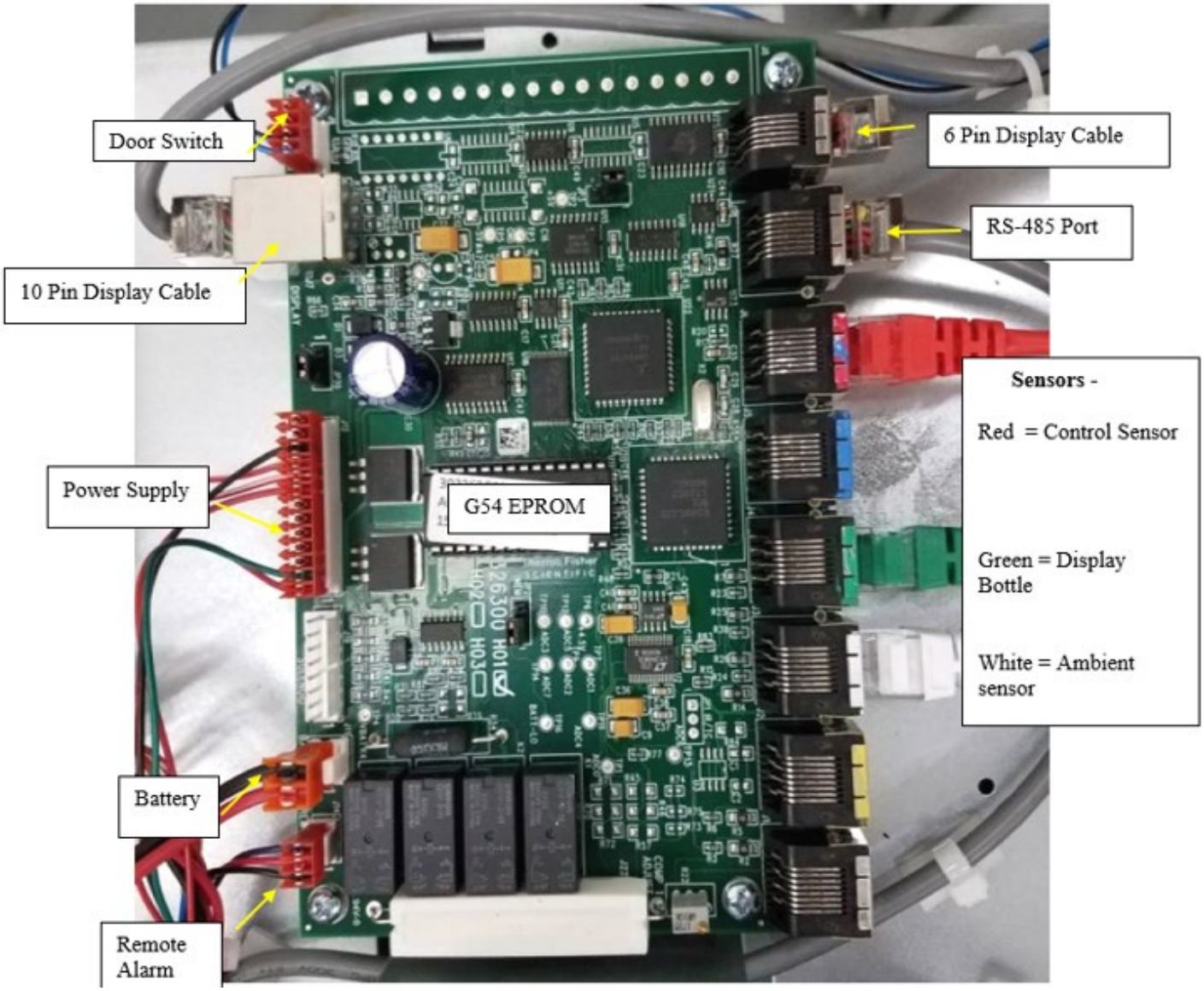
Press “Ctrl + Home” to return to top of Document



Press “Ctrl + Home” to return to top of Document



Press “Ctrl + Home” to return to top of Document

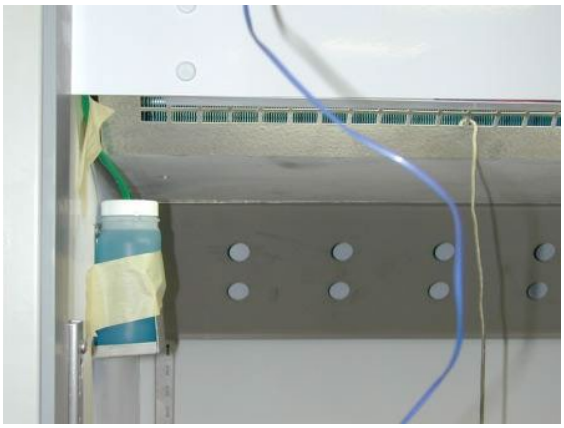


Press “Ctrl + Home” to return to top of Document

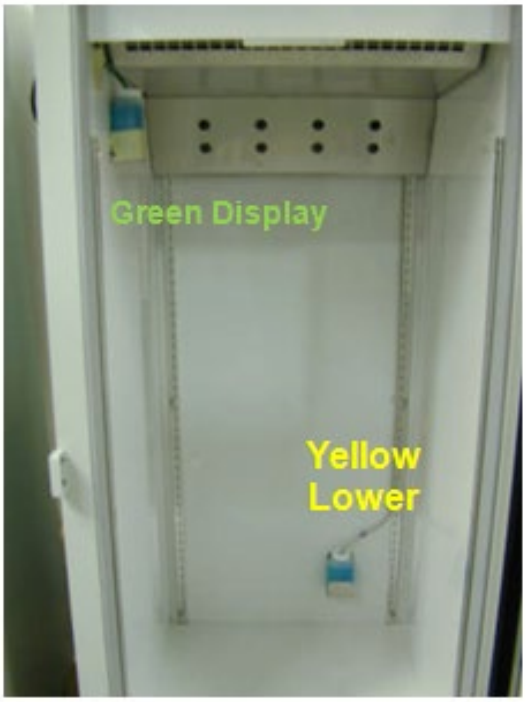
Sensor Locations Inside of Various TSX Units

Display Bottle: (green) all refrigerators and freezers except -20 cold wall, top left side wall.

Note: *Sensor bottle is now shipped with a solid cap to reduce spillage. The sensor must be installed by the customer or service tech.*

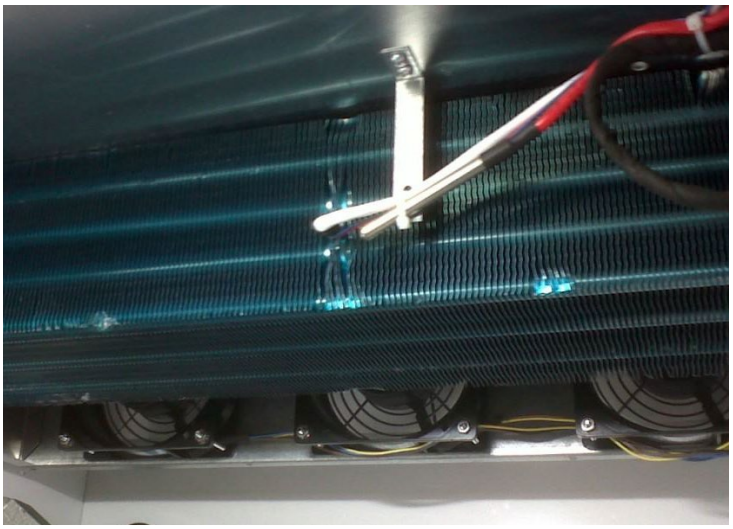


BB Display and Lower Bottle: (Green and Yellow) Blood banks only – lower right on the back wall. Also Dixell overcold protection sensor in the bottle with the Yellow sensor.

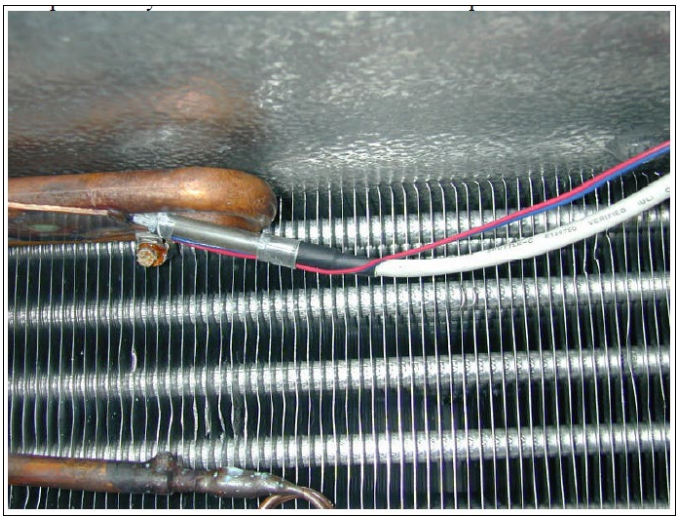


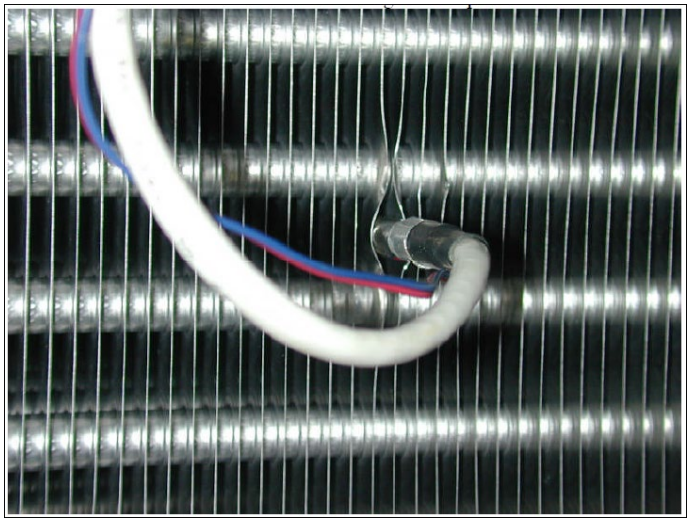
Press “Ctrl + Home” to return to top of Document

Refrigerator Control: (red) “L” bracket inside the evaporator in front of the coil.



Defrost: (blue) clamped to the evaporator outlet tube (varies with the different refrigerator / freezer evaporator sizes), or in high door opening cases, in the fins of the coil.





Press “Ctrl + Home” to return to top of Document

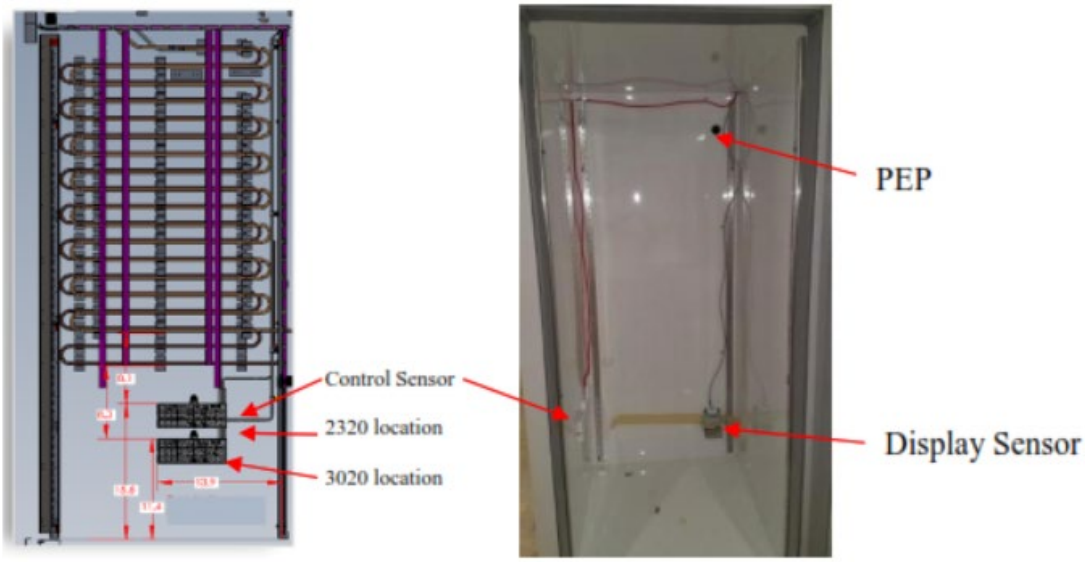
-20 Control: (red) mounted to the left side wall with a metal bracket. The bracket must be thermally isolated from the wall by nylon spacers.

Note: *in this picture, the normal spacers have been replaced by longer spacers to clarify their location.*

-20 Control Config = 03-04 Suffix 19 and later: (red) mounted to the Lower left side wall with a plastic bracket. The bracket must be thermally isolated from the wall by nylon spacers. Sensor mounting location is lower on 3020's than the 2320's due to the extra Evaporator loop.

Control sensor mounted inside the sensor cover.

CAD view of evap lines and sensor



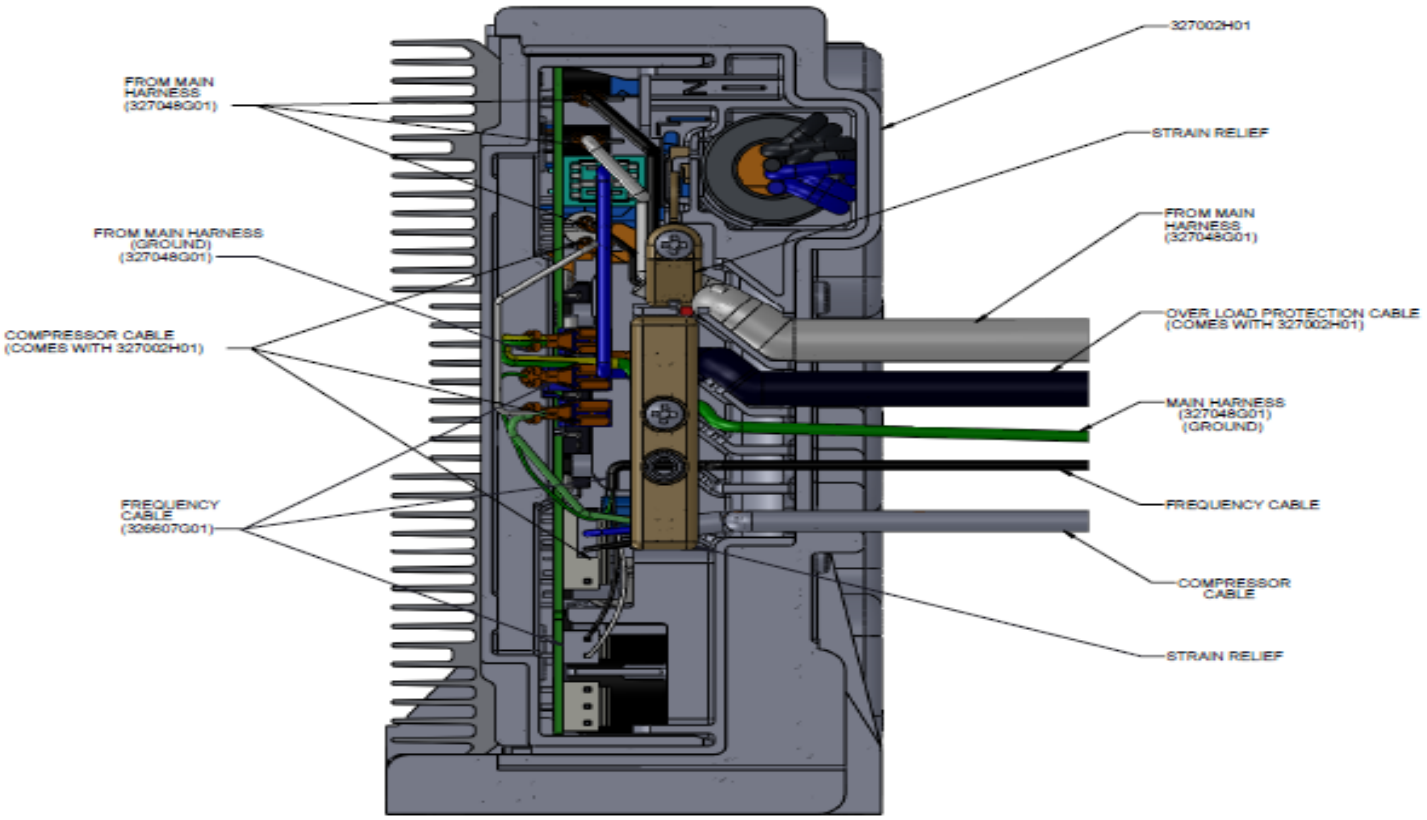
Press "Ctrl + Home" to return to top of Document

Note: This will not work, sensor(s) must be inserted into the bottle.

Press “Ctrl + Home” to return to top of Document

Inverter Information

Embraco High Performance (HP)



Press “Ctrl + Home” to return to top of Document

Inverter Technical Specifications	
Nominal input voltage range	220 VAC to 240 VAC (220 / 240 V model)
Operating input voltage range	150 VAC to 264 VAC (220 / 240 V model)
AC input frequency	50 Hz to 60 Hz
Speed range	2000 to 4500 rpm
Limits of ambient temperature	+43°C to -20°C
Maximum storage external relative humidity	85%
Air forced ventilation (min)	2 m/s

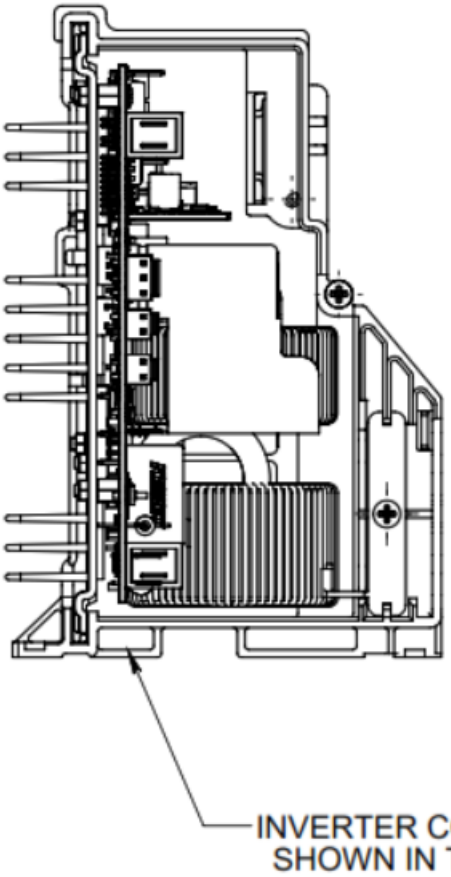
Press “Ctrl + Home” to return to top of Document

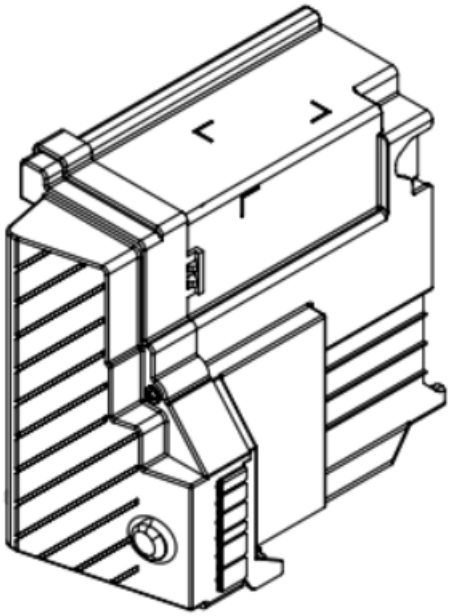
Embraco High Performance (HP) LED Codes

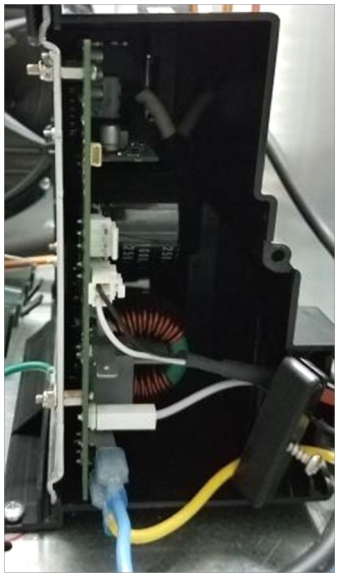
LED Status	LED Status Description
1 flash 15 seconds period	Normal operation
1 flash 0.5 seconds period	Over temperature limit
2 flashes 5 seconds period	Check control signal
3 flashes 5 seconds period	Check inverter
4 flashes 5 seconds period	Check compressor
5 flashes 5 seconds period	Input voltage (under 150 VAC or over 264 VAC)

Press “Ctrl + Home” to return to top of Document

Maia Inverter (Started with some Suffix 17 Models)







No Transformer on 2304 / 5 Refrigerators.

Press “Ctrl + Home” to return to top of Document

Maia Inverter Troubleshooting Flash Codes			
LED Status	**Period**	**Color**	**Description**
1 Flash	30 seconds	Green	Normal Operation
2 Flashes	5 seconds	Green	Communication Problem
3 Flashes	5 seconds	Red	Inverter Problem
4 Flashes	5 seconds	Orange	Compressor Problem
No Flash	-	-	No input power / Damaged inverter / Dixell cut off input power due to anti-freeze protection

MAIA flash sequences – normal is now 30 sec as oppoased to the HP 15 sec

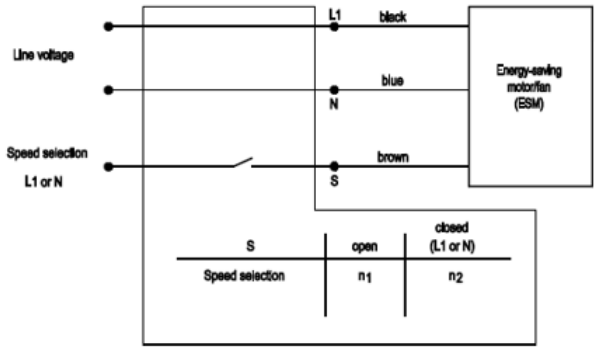
Press “Ctrl + Home” to return to top of Document

Condenser Fan

- This unit can operate the condenser fan at either Low Speed, or High-Speed.
- The fan speed is determined based on three conditions below:
  - Ambient temperature (Greater than 32°C sets the fan to high speed)
  - Temperature at ambient probe (Greater than 32°C for freezers, and 40°C for refrigerators sets the fan to High-Speed.
- The compressor speed (Greater than, or equal to 4600RPM will result in High-Speed fan operation.)

Current Speed	Scenario	New Speed
Low Speed	Ambient Temp >= Threshold	High Speed
High Speed	Ambient Temp < Threshold - Hysteresis	Low Speed

Note: If the Ambient Sensor fails the condenser fan will go to the High-Speed based on thresholds of 40°C for refrigerators, and 32°C for -20°, -30°C freezers.



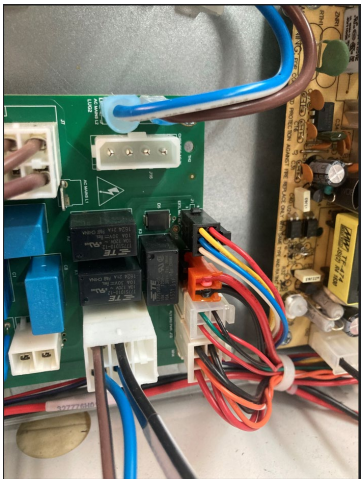
K1 = Line voltage, K3 = Low speed, n1=2100 rpm, n2 = 1500 rpm

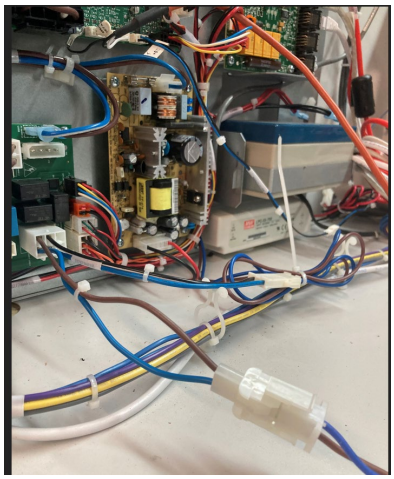
Press “Ctrl + Home” to return to top of Document

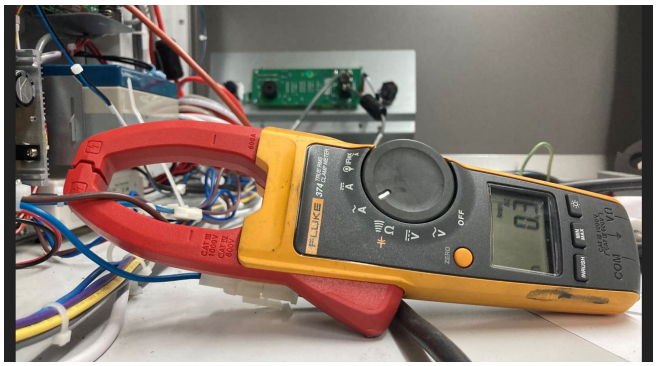
Electric Condensate Heater 328840H0X

Used on 12', 23', 30', 45' and 50' TSX units since 2019.

To test - check the amp draw without water, and then with water. It will start dry around .3 Amps, and will climb with water to around 1.1 amps.







Press "Ctrl + Home" to return to top of Document

Chromatography with Safety Outlet

Modified from the User Manual –

Chromatography Refrigerators are equipped with a convenience outlet located on the back wall. Power to the outlet is protected by a 5A circuit breaker. If there is a fault, the circuit can be reset by toggling the Chromatography Power Inlet Switch (Item B in *Figure 2*). The total load of the equipment using the convenience outlet shall not exceed 4 Amps.

WARNING: *The convenience outlet may be LIVE when the unit is connected to an electrical power source, regardless of the position of the key switch.*

The chromatography refrigerator outlet is also equipped with a safety circuit. In the event the safety circuit is tripped (the safety sensor senses a flammable gas), the power to the internal outlet will be discontinued and the user will need to manually reset the safety circuit assembly using the reset switch at the back of the unit before power is restored. To do this, toggle the switch labeled "Switch Chromatography Manual Reset" off and then on. There will be a power delay to the outlet for approximately 4 minutes where the red LED will be illuminated. When power is available at the outlet, the red LED will turn off and the green LED will illuminate. If the circuit trips from RED back to GREEN repeatedly or never turns GREEN, replace the two circuit boards

Flammable materials should not be stored in the refrigerator.

The safety circuit has two LEDs:

• **RED** (on the top) - When the red LED is ON, it indicates there is no power to the AC outlet inside the unit.

• **GREEN** (on the bottom) - When the green LED is ON, it indicates there is power to the AC outlet inside the unit.

For the US, the NEMA 5-15 GFCI Receptacle has a standard self-test feature with color indicators for status:

• **Solid Red** - Indicates the breaker has opened the circuit. If this occurs, unplug the equipment, check the circuit, and reset the circuit breaker.

• **Flashing Red** - Indicates "End of Life" and that the receptacle needs to be replaced.

• **Solid Green** - Indicates the outlet is functional.

NEMA 5-15 Receptacle Lights

Press "Ctrl + Home" to return to top of Document

The first-time power is applied to a chromatography unit with the NEMA 15 outlet installed as opposed to the European, British, or Chinese outlets, it will need the RESET button pressed in before the outlet will power up. This step should not be needed during sensor trips and switch position changes at the back of the unit.

The chromatography refrigerator has two power inlets at the back of the unit:

1. **Main Power Inlet (A)** - This is used to connect the AC mains power cord to the chromatography refrigerator.

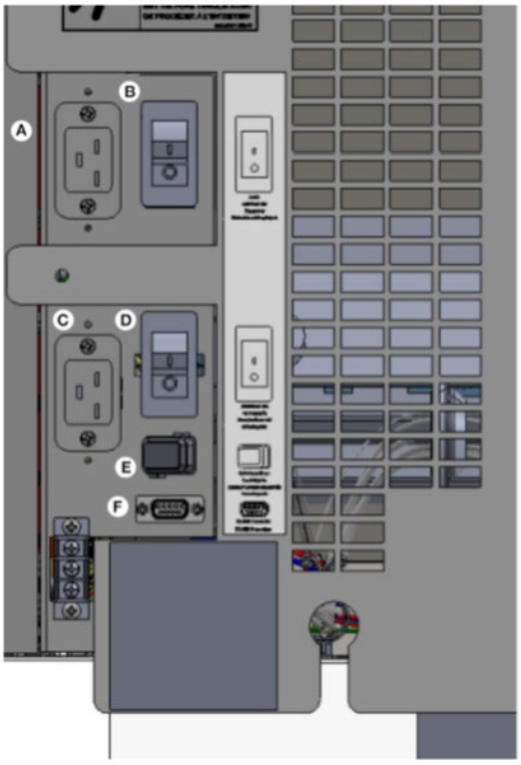
2. **Chromatography Power Inlet (C)** - This is used to connect the AC mains power cord to the chromatography outlet assembly inside of the cabinet.

The chromatography refrigerator has three switches at the back of the unit:

1. **Mains Power Inlet Switch (B)** - This is used to turn ON or OFF the AC supply to the refrigerator.

2. **Chromatography Power Inlet Switch (D)** - This is used to turn ON or OFF the AC inlet supply to the receptacle inside the refrigerator.

3. **Chromatography Manual Reset Switch (E)** - This is used to manually reset the safety circuit in the AC receptacle assembly after the LED turns Red from Green due to a safety trip event which disengages power to the outlet inside the refrigerator.



Chromatography Refrigerator Power Inlet and Switches

Refer to the label to the right of the switches at the back of the refrigerator for identification.

Press “Ctrl + Home” to return to top of Document

Due to the nature of new HC leak detecting sensor, there are additional considerations when cleaning a chromatography unit.

The refrigerator is designed to be cleaned using a mild detergent (such as Lysol® wipes (non-aerosol) or Formula 409®) and water. Lightly spray the interior storage components and wipe them dry with a soft cloth or spray the cloth first and then wipe interior surfaces. Do not spray directly on the center outlet column. Use a damp cloth to clean around the outlet. Use of other cleaners may contain chemicals that will turn off power to the outlet. If this occurs, continue to clean the refrigerator, and leave the doors open for approximately 5 minutes to allow any vapors to exit the refrigerator.

If the outlet power turns off due to chemicals, the red light will illuminate, and the user will need to manually reset the safety circuit using the "Switch Manual Reset Chromatography" at the back of the unit before power is restored. Sufficient time will be needed to dissipate the chemical vapors that tripped the sensor. The door can be opened to help dissipate the chemical vapors or an external fan can be used if the sensor is being tested before the unit is placed into normal operation. Toggling this switch off then on will restart the safety system and the green light should illuminate after approximately 4 minutes. If the light repeatedly changes from red to green or the red-light stays illuminated, ensure there are no chemical vapors present in the refrigerator and reset the system. If this continues, replace the boards in the outlet circuit.

The sensor can be tested with small amounts of R290 propane, but is also sensative to iso-butane and LPG. Other gases that may trip the sensor are LNG, alcohol and smoke.

Other reasons for replacing the outlet sensor:

1) The sensor needs replacement if the temperature goes below freezing in the cabinet. Use system alarms to ensure the temperature inside the unit is always above 0°C. If exposed to freezing conditions the sensor shall be replaced.
2) Simply time – **the sensor shall be replaced every five years**. This is due to life expectancy regardless of any exposure to freezing, unintentional or valid trips.

If the convenience outlet has no power :

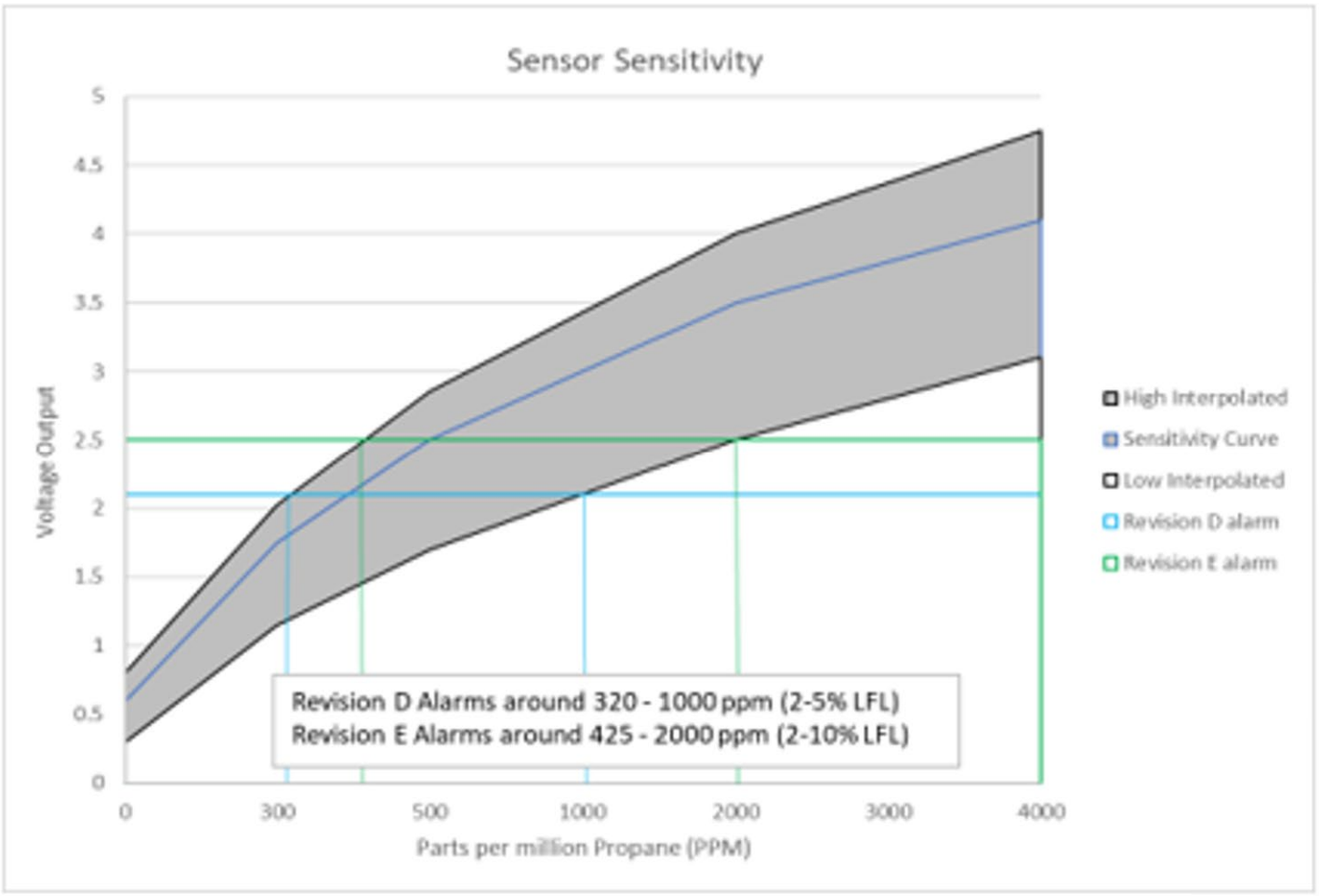
Check for all switches in the "ON" position ("1") on the rear of the unit (pg 75). Try cycling the Chromatography Manual Reset Switch and the Chromatography Power Inlet Switch to OFF and then ON. For units with the GFCI receptacle, make sure the RESET switch is pressed in.

If the sensor is tripped and the light is red, check for chemicals that the customer may have stored in the refrigerator in an unsealed container (ethanol or alcohol based). Leave the doors open for approximately 5 minutes to allow any vapors to exit the refrigerator and cycle the Chromatography Manual Reset Switch off and back on. Again, 4 minute delay before the light will go green.

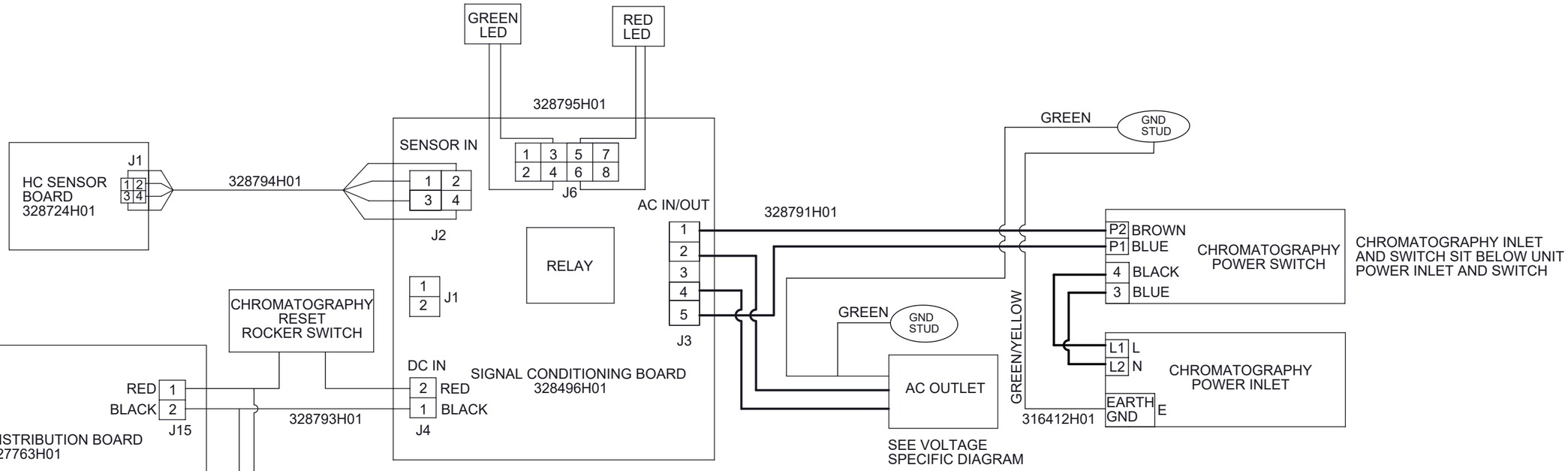
If the lights repeatedly change from red to green or the red lights stays illuminated after trying to reset, replace the sensor board before replacing the control board.

Press "Ctrl + Home" to return to top of Document

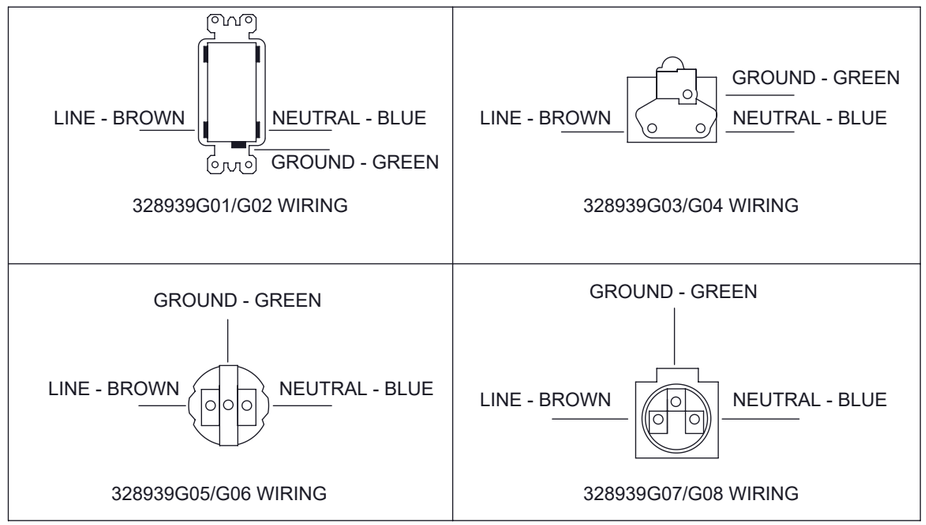
HC Sensor PPM Sensativity Graph



Press “Ctrl + Home” to return to top of Document



VOLTAGE SPECIFIC DIAGRAMS



NOTES:

1. FOR WIRE HARNESS CONSTRUCTION & SPECIFICATIONS SEE TFS 28305H01.
2. COMPONENTS AND WIRE ARE AS SPECIFIED OR AN EQUIVALENT APPROVED BY THERMOFISHER ENGINEERING.
3. ALL DARK LINES CONTAIN HIGH POTENTIAL VOLTAGE.

REV.	DCO #	DATE	DESCRIPTION
D	005511	2019-02-25	ADDED FRENCH NOTES IN SHEET-2
C	005144	2018-10-11	ADDED SHEET 2 WITH THE FRENCH LANGUAGE
B	004960	2018-07-25	UPDATED WITH CHROMATOGRAPHY CONNECTIONS
A	004585	2018-02-08	INITIAL RELEASE

REVISIONS

ThermoFisher SCIENTIFIC
275 AIKEN ROAD
ASHEVILLE, NC 28804

TITLE **HARNESS, HC SENSOR WIRING DRAWING**

ARTICLE OR MATERIAL MUST COMPLY WITH THE ENVIRONMENTAL COMPLIANCE SPECIFICATION TFS DRAWING 260111S01

3rd ANGLE PROJECTION

SIZE B | SHEET 1 OF 3

DWG. NO. 328790H01

SolidWorks 2007-10-25

Blood Bank Anti-Freeze Protection

1 Objective

Dixell XR02CX is installed with compressor relay contact in series with Relay Board compressor output. The Dixell is configured such that when the control probe temperature drops below 2.8C the compressor is interrupted until the control probe temperature recovers to above 4.0C. The evaporator probe and defrost function is disabled.

2 Dixell XR02CX Settings

The temperature set point is displayed by briefly pressing the SET button – record this value The

Probe Fail action is set up to stop the compressor on probe failure.

To access other parameters press the SET button and button until HY is displayed.
Release the buttons then press the SET button and button again until Pr2 is displayed.
The first parameter is HY; press SET to display its value then press SET again to move to the next parameter. Repeat until all parameters have been displayed and recorded.

To access the set point press the SET button until the units symbol "C" flashes then use the up and down buttons to change the value.

Set the parameters in the order listed in the table, changing the set point last.

Order	Parameter description	Label	Set	Meaning
27	Set point	**Set**	2.8	Output turns off below 2.8C
17	Differential	**HY**	1.2	Output turns on above 4.0C
18	Minimum set point	**LS**	-4.0	
19	Maximum set point	**US**	9.9	
20	Control probe calibration	**ot**	0.0	
21	Evaporator probe presence	**P2**	n	Probe not present
22	Evaporator probe calibration	**oE**	0.0	
23	Outputs delay at start up	**od**	0	
24	Anti-short cycle delay	**AC**	0	
25	Compressor ON with faulty probe	**CY**	0	USE THIS FOR PROBE FAIL = OFF
26	Compressor OFF time with faulty probe	**Cn**	30	USE THIS FOR PROBE FAIL = OFF
1	Temperature measurement unit	**CF**	C	
2	Resolution	**rE**	dE	
3	Probe displayed	**Ld**	P1	Control Probe
4	Display temperature delay	**dY**	0	Display is immediate no delay
5	Defrost termination temperature	**dE**	4.6	
6	Interval between defrost cycles	**id**	0	0 = Defrost disabled
7	Maximum length for defrost	**Nd**	0	0 = Defrost disabled
8	Displaying during defrost	**dF**	rt	Control probe
9	Maximum temperature alarm	**AU**	9.9	
10	Minimum temperature alarm	**AL**	-5.0	
11	Temperature alarm delay	**Ad**	15	
12	Delay of temperature alarm at start up	**dA**	99	
13	THIS PARAMETER IS NOT EXPLAINED	**tb**	Y	
14	Evaporator probe display	**d2**	nP	Read only – nP = Not Present
15	Parameter code table	**Pt**	5	Read only
16	Firmware release	**rL**	1.5	Read only

Press "Ctrl + Home" to return to top of Document

3 Operational Matrix

Control System Status	Dixell Status	Compressor	Unit
Normal	Normal	Cycling under normal control	Maintaining temperature setpoint of 4C
Relay stuck in closed state	Normal	Cycling under Dixell control	Maintaining temperature above 2C
Relay stuck in open state	Normal	Off	Temperature will rise to ambient
Normal	Probe failure – relay opens in failsafe mode	Off	Temperature will rise to ambient
Normal	General power failure – relay opens on power failure	Off	Temperature will rise to ambient
Normal	Relay stuck open state	Off	Temperature will rise to ambient
Normal	Relay stuck in closed state	Cycling under normal control	Maintaining temperature
Relay stuck in closed state	Relay stuck in closed state	On	Temperature drops to bottom out temperature

Press “Ctrl + Home” to return to top of Document

dIXEL — *Operating Manual* — 1598024510

DIGITAL CONTROLLER
XR02CX

1. CONTENTS

1. Contents 1
2. General warnings 1
3. General description 1
4. Regulation 1
5. Defrost 1
6. Front panel commands 1
7. Parameters 1
8. Installation and mounting 2
9. Electrical connections 2
10. How to use the hot key 2
11. Alarm signalling 2
12. Technical data 2
13. Connections 2
14. Default setting values 2

2. GENERAL WARNINGS

PLEASE READ BEFORE USING THIS MANUAL

- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.
- Check the application limits before proceeding.

SAFETY PRECAUTIONS

- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- Fit the probe where it is not accessible by the End User. The instrument must not be opened.
- In case of failure or faulty operation send the instrument back to the distributor or to "Dixell S.p.A." (see address) with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

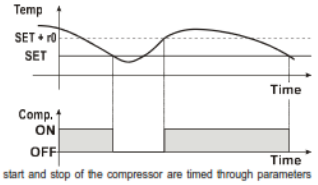
3. GENERAL DESCRIPTION

Model **XR02CX**, **format 32 x 74 x 50 mm**, is a digital thermostat with off cycle defrost designed for refrigeration applications at normal temperature. It provides a relay output to drive the compressor. It is also provided with 2 NTC probe input. The instrument is fully configurable through special parameters that can be easily programmed through the keyboard or the by HOTKEY.

4. REGULATION

THE REGULATION OUTPUT

The regulation is performed according to the temperature measured by the thermostat probe with a positive differential from the set point: if the temperature increases and reaches set point plus differential the compressor is started and then turned off when the temperature reaches the set point value again.



In case of fault in the thermostat probe the start and stop of the compressor are timed through parameters "**Cy**" and "**Cn**".

5. DEFROST

Defrost is performed through a simple stop of the compressor. Parameter "**id**" controls the interval between defrost cycles, while its length is controlled by parameter "**Md**".

6. FRONT PANEL COMMANDS

SET	To display target set point, in programming mode it selects a parameter or confirm an operation
❄	To start a manual defrost
∧	In programming mode it browses the parameter codes or increases the displayed value
∨ AUX	In programming mode it browses the parameter codes or decreases the displayed value

KEYS COMBINATION

∨ + ∧	To lock or unlock the keyboard
SET + ∨	To enter in programming mode
SET + ∧	To return to room temperature display

LED	MODO	SIGNIFICATO
❄	On	Compressore enabled
	Flashing	Anti short cycle delay enabled (AC parameter)
❄	On	Defrost in progress
	Flashing	Dripping in progress
°C	On	Measurement unit
	Flashing	Programming mode
°F	On	Measurement unit
	Flashing	Programming mode

HOW TO SEE THE SET POINT

1. Push and immediately release the **SET** key, the set point will be showed;
2. Push and immediately release the **SET** key or wait about 5s to return to normal visualisation.

HOW TO CHANGE THE SETPOINT

1. Push the SET key for more than 2 seconds to change the Set point value;
2. The value of the set point will be displayed and the "°C" or "°F" LED starts blinking;
3. To change the Set value push the o or n arrows within 10s.
4. To memorise the new set point value push the SET key again or wait 10s.

HOW TO START A MANUAL DEFROST (ONLY XR02CX)

Push the **DEF** ❄ key for more than 2 seconds and a manual defrost will start

HOW TO CHANGE A PARAMETER VALUE

To change the parameter's value operate as follows:
1. Enter the Programming mode by pressing the **SET+** ∨ keys for 3s (**"°C" or "°F"** LED starts blinking).
2. Select the required parameter. Press the "**SET**" key to display its value
3. Use ∧ or ∨ to change its value.
4. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET+** ∧ or wait 15s without pressing a key.
NOTE: the set value is stored even when the procedure is exited by waiting the time-out to expire.

HIDDEN MENU

The hidden menu includes all the parameters of the instrument.

HOW TO ENTER THE HIDDEN MENU

1. Enter the Programming mode by pressing the **SET+** ∨ keys for 3s (**"°C" or "°F"** LED starts blinking).
2. Released the keys, then push again the **SET+** ∨ keys for more than 7s. The L2 label will be displayed immediately followed from the Hy parameter.
   NOW YOU ARE IN THE HIDDEN MENU.
3. Select the required parameter.
4. Press the "**SET**" key to display its value
5. Use ∧ or ∨ to change its value.
6. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET+** ∧ or wait 15s without pressing a key.
NOTE1: if none parameter is present in L1, after 3s the "nP" message is displayed. Keep the keys pushed till the L2 message is displayed.
NOTE2: the set value is stored even when the procedure is exited by waiting the time-out to expire.

HOW TO MOVE A PARAMETER FROM THE HIDDEN MENU TO THE FIRST LEVEL AND VICEVERSA.

Each parameter present in the HIDDEN MENU can be removed or put into "THE FIRST LEVEL" (user level) by pressing **SET+** ∨. In HIDDEN MENU when a parameter is present in First Level the decimal point is on.

TO LOCK THE KEYBOARD

1. Keep pressed for more than 3s the ∧ and ∨ keys.
2. The "**OF**" message will be displayed and the keyboard will be locked. If a key is pressed more than 3s the "OF" message will be displayed.

TO UNLOCK THE KEYBOARD

Keep pressed together for more than 3s the ∧ and ∨ keys till the **"on"** message will be displayed.

7. PARAMETERS

REGULATION

Hy **Differential:** (0,1°C ÷ 25°C) Intervention differential for set point. Compressor Cut IN is SET POINT + differential (Hy). Compressor Cut OUT is when the temperature reaches the set point.
LS **Minimum SET POINT:** (-55°C÷SET/-58°F÷SET): Sets the minimum value for the set point..
US **Maximum SET POINT:** (SET÷99°C/ SET÷99°F). Set the maximum value for set point.
ot **First probe calibration:** (-9.9÷9.9°C) allows to adjust possible offset of the first probe.
P2 **Evaporator probe presence: n=** not present; **y=** the defrost stops by temperature.
oE **Second probe calibration:** (-9.9÷9.9°C) allows to adjust possible offset of the second probe
od **Outputs activation delay at start up:** (0÷99min) This function is enabled at the initial start up of the instrument and inhibits any output activation for the period of time set in the parameter.
AC **Anti-short cycle delay**: (0÷50 min) minimum interval between the compressor stop and the following restart.
Cy **Compressor ON time with faulty probe:** (0÷99 min) time during which the compressor is active in case of faulty thermostat probe. With Cy=0 compressor is always OFF.
Cn **Compressor OFF time with faulty probe:** (0÷99 min) time during which the compressor is OFF in case of faulty thermostat probe. With Cn=0 compressor is always active.

DISPLAY

CF **Measurement unit:** (°C÷°F) **°C** =Celsius; **°F** =Fahrenheit. **WARNING**: When the measurement unit is changed the SET point and the values of the parameters Hy, LS, US, oE, o1, AU, AL have to be checked and modified if necessary).
rE **Resolution (only for °C):**(dE ÷ in) **dE=** decimal between -9.9 and 9.9°C; **in=** integer;
Ld **Default display:** (P1 ÷ P2) P1= thermostat probe; P2= evaporator probe. SP=Set point
dy **Display delay:** (0÷15 min.) when the temperature increases, the display is updated of 1 °C/1°F after this time.

DEFROST

dE **Defrost termination temperature:** (-50÷50°C) if **ot=Y** it sets the temperature measured by the evaporator probe, which causes the end of defrost.

Press "Ctrl + Home" to return to top of Document

id **Interval between defrost cycles:** (0÷99 ore) Determines the time interval between the beginning of two defrost cycles.
Md **Maximum length for defrost:** (0÷99 min. with 0 no defrost) when **ot=n**, (not evaporator probe: timed defrost) it sets the defrost duration, when **ot = y** (defrost end based on temperature) it sets the maximum length for defrost.
dF **Display during defrost:** (rt / it / St / dF) rt= real temperature; it= start defrost temperature; St= SET-POINT; dF= label dF.

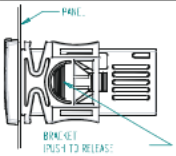
ALARMS

AU **Maximum temperature alarm:** (AL÷99°C) when this temperature is reached the alarm is enabled, after the "**Ad**" delay time.
AL **Minimum temperature alarm:** (-55÷AU°C) when this temperature is reached the alarm is enabled, after the "**Ad**" delay time.
Ad **Temperature alarm delay:** (0÷99 min) time interval between the detection of an alarm condition and alarm signalling.
dA **Exclusion of temperature alarm at startup:** (0÷99 min) time interval between the detection of the temperature alarm condition after instrument power on and alarm signalling.

OTHER

d2 **Evaporator probe display (read only)**
Pt **Parameter code table**
rL **Software release**

8. INSTALLATION AND MOUNTING



Instrument **XR02CX** shall be mounted on vertical panel, in a 29x71 mm hole, and fixed using the special bracket supplied.
The temperature range allowed for correct operation is 0÷60 °C. Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. The same recommendations apply to probes. Let air circulate by the cooling holes.

9. ELECTRICAL CONNECTIONS

The instrument is provided with screw terminal block to connect cables with a cross section up to 2,5 mm². Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the probe cables from the power supply cables, from the outputs and the power connections. Do not exceed the maximum current allowed on each relay, in case of heavier loads use a suitable external relay.

9.1 PROBES

The probes shall be mounted with the bulb upwards to prevent damages due to casual liquid infiltration. It is recommended to place the thermostat probe away from air streams to correctly measure the average room temperature. Place the defrost termination probe among the evaporator fins in the coldest place, where most ice is formed, far from heaters or from the warmest place during defrost, to prevent premature defrost termination.

10. HOW TO USE THE HOT KEY

10.1 HOW TO PROGRAM THE HOT KEY FROM THE INSTRUMENT (UPLOAD)

1. Program one controller with the front keypad.
2. When the controller is ON, insert the "Hot key" and push ∧ key; the **"uP"** message appears followed a by flashing "**En**"
3. Push "**SET**" key and the "**En**" will stop flashing.
4. Turn OFF the instrument remove the "Hot Key", then turn it ON again.

NOTE: the "**Er**" message is displayed for failed programming. In this case push again o key if you want to restart the upload again or remove the "Hot key" to abort the operation.

10.2 HOW TO PROGRAM AN INSTRUMENT USING HOT KEY (DOWNLOAD)

1. Turn OFF the instrument.
2. Insert a **programmed "Hot Key" into the 5 PIN receptacle** and then turn the Controller ON.
3. Automatically the parameter list of the "Hot Key" is downloaded into the Controller memory, the "**do**" message is blinking followed a by flashing "**En**".
4. After 10 seconds the instrument will restart working with the new parameters.
5. Remove the "Hot Key"..

NOTE: the "**Er**" message is displayed for failed programming. In this case push again o key if you want to restart the upload again or remove the "Hot key" to abort the operation.

11. ALARM SIGNALLING

Mess.	Cause	Outputs
"P1"	Room probe failure	Compressor output according to "Cy" e "Cn"
"P2"	Evaporator probe failure	Defrost end is timed
"HA"	Maximum temperature alarm	Outputs unchanged
"LA"	Minimum temperature alarm	Outputs unchanged
"EA"	External alarm	Outputs unchanged
"CA"	Serious external alarm	All outputs OFF.
"dA"	Door Open	Compressor and fans restarts

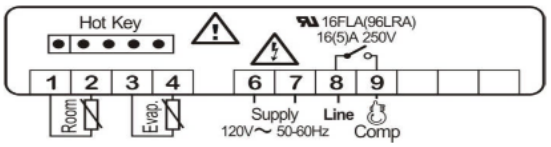
11.1 ALARM RECOVERY

Probe alarms **P1**" and "**P2**" start some seconds after the fault in the related probe; they automatically stop some seconds after the probe restarts normal operation. Check connections before replacing the probe. Temperature alarms "**HA**" and "**LA**" automatically stop as soon as the temperature returns to normal values.
Alarms **"EA"** and **"CA"** (with iF=bL) recover as soon as the digital input is disabled.

12. TECHNICAL DATA

Housing: self extinguishing ABS.
Case: frontal 32x74 mm; depth 60mm;
Mounting: panel mounting in a 71x29mm panel cut-out
Protection: IP20; **Frontal protection:** IP65
Connections: disconnectable terminal block ≤ 2,5 mm² wiring and 6.3mm fast-on
Power supply: according to the model ±10%; 230Vac ±10%, 50/60Hz, 110Vac ±10%, 50/60Hz
Power absorption: 3.5 VA max
Display: 2 digits, red LED, 14,2 mm high; **Inputs**: 2 NTC.
Relay outputs: compressor SPST 8(3) A, 250Vac; 20(8)A 250Vac
Data storing: on the non-volatile memory (EEPROM).
Kind of action: 1B; **Pollution grade:** 2; **Software class:** A.;
Rated impulsive voltage: 2500V; **Overvoltage Category**: II
Operating temperature: 0÷60 °C; **Storage temperature:** -30÷85 °C.
Relative humidity: 20÷85% (no condensing)
Measuring and regulation range: NTC -40÷110°C (-40÷230°F);
Resolution: 0,1 °C or 1°C or 1 °F (selectable); **Accuracy (ambient temp. 25°C)**: ±0,7 °C ±1 digit

13. CONNECTIONS



NOTE: Fast-on maximum current 16A

14. DEFAULT SETTING VALUES

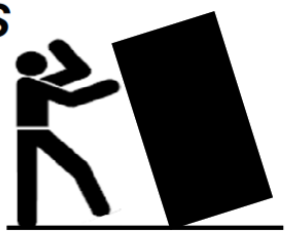
LBL	DESCRIPTION	RANGE	DEFAULT	LEVEL
REGULATION				
Hy	Differential	0.1 ÷ 25°C/1 ÷ 45°F	36 °F	L1
LS	Minimum Set Point	-55°C÷SET/-67°F÷SET	-40 °F	L2
US	Maximum Set Point	SET÷99°C/ SET÷210°F	99°F	L2
ot	First probe calibration	-9.9÷9.9°C/-18÷18°F	0.0	L2
P2	Second probe presence	n – Y	y	L2
oE	Second probe calibration	-9.9÷9.9°C/-18÷18°F	0.0	L2
od	Outputs activation delay at start up	0 ÷ 99 min	0	L2
AC	Anti-short cycle delay	0 ÷ 50 min	0	L1
Cy	Compressor ON time faulty probe	0 ÷ 99 min	15	L2
Cn	Compressor OFF time faulty probe	0 ÷ 99 min	30	L2
DISPLAY				
CF	Measurement units	°C - °F	°F	L2
rE	Resolution (only for °C)	dE – in	in	L1
Ld	Default Display	P1 - P2 - SP	P1	L2
dy	Display delay	0 ÷ 15 min	0	L2
DEFROST				
dE	Defrost termination temperature	-50÷50°C/-58÷122°F	46 °F	L1
id	Interval between defrost cycles	0 ÷ 99 hours	6	L1
Md	Maximum length for defrost	0 ÷ 99 min.	20	L1
dF	Display during defrost	rt – in – dE	it	L2
ALARMS				
AU	Maximum temperature alarm	ALL÷99°C / ALL÷210°F	99 °F	L2
AL	Minimum temperature alarm	-55°C÷ALU/-67°F÷ALU	-50 °F	L2
Ad	Temperature alarm delay	0 ÷ 99 min	15	L2
dA	Exclusion of temperature alarm at startup	0 ÷ 99 min	99	L2
OTHER				
d2	Evaporator probe display	Read Only	---	L1
Pt	Parameter code table	Read Only	---	L2
rL	Firmware release	Read Only	---	L2

dIXEL S.p.a.
Z.I. Via dell'Industria, 27 - 32010 Pieve d'Alpago (BL) ITALY
tel. +39 - 0437 - 98 33 - fax +39 - 0437 - 98 93 13
http://www.dixell.com E-mail: dixell@dixell.com

Press "Ctrl + Home" to return to top of Document

Anti-Tip Bracket Instructions

⚠ WARNING: SAFETY INSTRUCTIONS



- REFRIGERATOR/FREEZER MUST BE SECURED BY THE ANTI-TIP BRACKET SUPPLIED IN THIS BAG.
- UNLESS PROPERLY INSTALLED, REFRIGERATOR/FREEZER COULD TIP WHEN SHELVES/ DRAWERS ARE LOADED. INJURY AND DAMAGE TO EQUIPMENT AND CONTENTS MAY RESULT FROM REFRIGERATOR/ FREEZER TIPPING
- THIS REFRIGERATOR/FREEZER HAS BEEN DESIGNED TO MEET ALL RECOGNIZED INDUSTRY TIP STANDARDS FOR ALL NORMAL CONDITIONS.

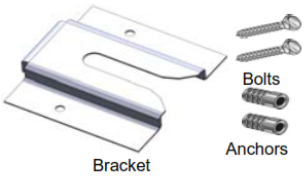
INSTALLATION INSTRUCTIONS:

Installation instructions are provided for wood and concrete floors. Any other type of construction may require special installation techniques as deemed necessary to provide adequate fastening of the Anti-Tip bracket to the floor. For installation on floors other than wood or concrete, please contact technical support.

The use of this bracket does not prevent the tipping of the Refrigerator/Freezer when not properly installed.

Materials Supplied

1. Anti-Tip Bracket (1)
2. 5/16" Lag Bolt (2)
3. Lag Screw Anchor (2), for concrete installation only
4. Bracket location template



Tools Required

Wood Floor	*Concrete Floor*
Flashlight	Flashlight
Tape Measure	Tape Measure
Drill	Hammer Drill
15/64" (6mm) Drill Bit	1/2" (13mm) Masonry Bit
1/2" (13mm) Wrench	1/2" (13mm) Wrench
3/4" (19mm) Wrench	3/4" (19mm) Wrench

Step 1
Locating the Bracket

a. Determine where you want the centerline of the refrigerator/freezer to be
b. Place the included template on the floor lined up with the centerline of the refrigerator/freezer and keep 6"-12" between the wall and the back of the unit
c. On the floor, mark the location of Hole #1 & Hole #2 (also Hole #3 & Hole #4 for $50ft^3$ & $75ft^3$ models).

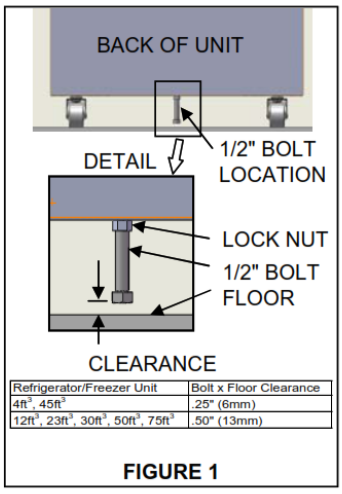
Step 2
Anti-Tip Bracket Installation

Wood Construction

a. Drill 15/64" (6mm) pilot holes in locations marked in step 1
b. Place bracket on floor aligned with holes
c. Use supplied lag bolts to attach bracket to floor

Concrete Construction

a. Drill 1/2" (13mm) holes in locations marked in step 1 with masonry bit
b. Slide Lag Screw Anchors into holes to be flush with floor surface
c. Place bracket on floor aligned with holes
d. Use supplied lag bolts to attach bracket to floor



Refrigerator/Freezer Unit	Bolt x Floor Clearance
$4ft^3$, $45ft^3$	.25" (6mm)
$12ft^3$, $23ft^3$, $30ft^3$, $50ft^3$, $75ft^3$	.50" (13mm)

FIGURE 1

Step 3
Adjusting Bolt in Refrigerator/Freezer

a. Locate 1/2" bolt attached to bottom of cabinet
b. Unscrew 1/2" bolt until there is the required clearance between floor and head of bolt as shown in Figure 1
c. Tighten lock nut against bottom of unit

Step 4
Refrigerator/Freezer Positioning

a. Line up 1/2" bolt installed in Step 3 with anti-tip bracket
b. Roll or slide Refrigerator/Freezer into position until bolt stops against bracket
c. Lock the casters

Step 5
Checking the Installation

a. Complete the installation of the Refrigerator/Freezer per the installation instructions provided with the product.
b. Check to see if the Anti-Tip bracket is installed properly by shining light under cabinet and confirming bolt in cabinet is secured by bracket on floor

Press “Ctrl + Home” to return to top of Document

4-20mA Temperature Transmitter Information

Testing of Self Powered 4-20mA Temperature Transmitter Options Option #'s 7203-AV, 7203FMS, 7204, 7205TA (or 4-20mA loops in general)

Main parts – 326518H01 through H04 TempTrans (Minco TT518), 327624H01 24v DC Power Supply or 16.5v DC Power Supply and a dummy load resistor (1/4w 5%) – 25 ohms or 250 ohms
Refer to instructional drawing #s 311977I02, 325436H01 FMS and wiring diagram #s 325439H01 FMS, 326861H01 General, and 327987H01 TSX.

Theory in general –

The power supply provides 24v DC to the loop. The acceptable voltage range is 8 to 30v DC for customers who supply their own power to the loop. The Minco TempTrans converts the sensor (RTD) reading into a milli Amp signal based on Ohm's Law (V=IR). 4mA represents the coldest end of the scale printed on the back of the TempTrans, and 20mA represents the warmest end of the scale.

For	326518H01 (Frzs -20/-30/-86s),	4mA = -100°C	& 20mA = 0°C
	326518H02 (Refrigerators),	4mA = 0°C	& 20mA = 40°C
	326518H04 (FMS 2320, & 2305),	4mA = -66°C	& 20mA = 54°C

Testing -

Testing can be done by current or voltage measurements. A dummy load resistor will need to be added temporarily across the terminal strip connections "TempTrans Neg" and "24v Supply Neg" or "16.5 Supply Neg" (see 311977I02 or 327987H01). The resistor simulates the customers test equipment (see wiring diagrams for "control room - R1"). The size of the resistor is limited based on maximum resistance of the loop formula:

R loop max = (V supply – 8v) / 0.023 amps, in our 24v case, R loop max = 696 ohms
Note: for HPLRF TSX, the supply is 16.5v, so R loop max = 370 ohms

Measurements only need to reflect that the transmitter is functioning near the expected range since actual readings will be dependent on additional factors at the customer's site. The best time to test is while the cabinet is operating within its TempTrans range, but for cabinets that are out of range (-86 at ambient), the TempTrans will show the "out of range" value of 3.5mA if the circuit is connected correctly.

Press "Ctrl + Home" to return to top of Document

Current Method

For current measurements, the size of the resistor just needs to be less than R loop max or the resistor can be replaced at the terminal strip by a DC ammeter. Break into the circuit with an Amp meter set to the mA DC scale. The current reading from the meter can be compared to the calculated expected value to confirm that it corresponds to the cabinet temperature. To calculate the expected value, use the formula:

Current for Tsensor = ((Tsensor – Tzero / Tspan – Tzero) *16mA) + 4mA Tsensor = the temp at the sensor

Tzero = the printed temp for 4mA (H02 = 0°C)

Tspan = the printed temp for 20mA (H02 = 40°)

For example: If a cabinet using 38197H02 is reading +4°C Then 4°C =

((4-0 / 40-0)*16) + 4 = 5.6mA

Or

A cabinet using H01 is reading –86°C
Then –86°C = ((-86+100 / 0+100)*16) + 4 = 6.24mA

Reduced °C formulas: for H01, current at Tsensor = (Tsensor * .16) + 4mA
for H02, current at Tsensor = (Tsensor * .4) + 4mA
for H04, current at Tsensor = (Tsensor * .1333) + 4mA

Voltage Method

For voltage measurements, the size of the resistor effects the voltage range. For example: a 250 ohm resistor will cause a voltage range of 1v to 5v DC, and a 25 ohm resistor will cause a range of .1v to .5v DC. Other values up to R loop max are acceptable but require recalculating with Ohms Law (V=IR) to generate the expected voltage range.
Place the meter leads across the dummy load resistor to read the voltage. To calculate the expected voltage, use the calculated current value times the resistor value.

For a 250 ohm resistor with H02, the voltage at the dummy load resistor of a refrigerator at +4°C = 5.6mA * 250 = 1.4v
and using a 250 ohm resistor with H01, the voltage at the dummy load resistor of a ULT at –86°C = 6.24mA * 250 = 1.56v

You can also use percentage approximation to tell if the TempTrans is working. Based on a 250 ohm resistor and the 1v to 5v range, temps at 50% of the range will read ~ 3v, 25% will read ~2v, 75% will read ~ 4v, etc. For example, a refrigerator at ambient will be in the 3.0v to 3.5v area, since 20°C = 3v and 25°C = 3.5v; and a refrigerator at normal operating temp should be in the 1.0v to 1.5v range since 0°C = 1v and 10°C = 1.5v.

Quick Reference Charts are available mapping out the TempTrans ranges with both 25 and 250 ohm resistors as are Resistance vs. Temperature charts for 100 PRTD with .385 coefficient.

Press “Ctrl + Home” to return to top of Document

Possible problems – other than a bad component, open/shorted circuits (low voltage or line voltage), reversed polarity on the power supply circuit, or R loop max being exceeded by the customer -

1) Power Supply accepts 100v to 240v AC as an input. Output should be 24v DC and the green LED should be on. In the 16.5v case, the TempTrans is piggybacking off of the units supply, so there is no green LED

2) The voltage across the TempTrans should read 24v (16.5) minus the voltage drop of the dummy load resistor (building system). When the TempTrans sees less than 8v, it will not be able to regulate the loop at the 20mA end, so mA values will start dropping off.

3) Reversing the 24v wires at the power supply or the TempTrans causes the voltage across the dummy load to read 0v.

Additional resource – www.minco.com

Press “Ctrl + Home” to return to top of Document

4-20mA Option Numbers

Non-RoHS Temp Transmitter Options (Blue)

4-20mA Thermo P/N (Transmitter Only)	Temp Range @ 4mA	Temp Range @ 20mA	Application	Loop Powered Transmitter and Sensor Option Number	Self Powered Transmitter and Sensor Option Number	Field install Loop Powerd	Field install Self Powerd	Minco Model Number
38197H01	-100°C	0.0°C	ULT Freezer	4706	7203-AV			TT111PD1EZ
38197H01	-40°C	0.0°C	-20°C / -30°C HPLRF Freezer	4706	7205TA			TT111PD1EZ
38197H02	0.0°C	40°C	+4°C Refrigerator	6907-1	7204			TT111PD1EG
38197H02	0.0°C	40°C	+4°C Refrigerator	6907-2	7204	6907-2		TT111PD1EG
38197H03	-185°C	-95°C	-140 / -150 Freezers	7261	N/A			TT111PD1KE
38197H04**	-66°C	54°C	FMS Refrigerator / Freezers	4706FMS	7203FMS			TT111PD1DB
38197H04	-20°C	100°C	BOD's / Incubators	7258	7259			TT111PD1DB

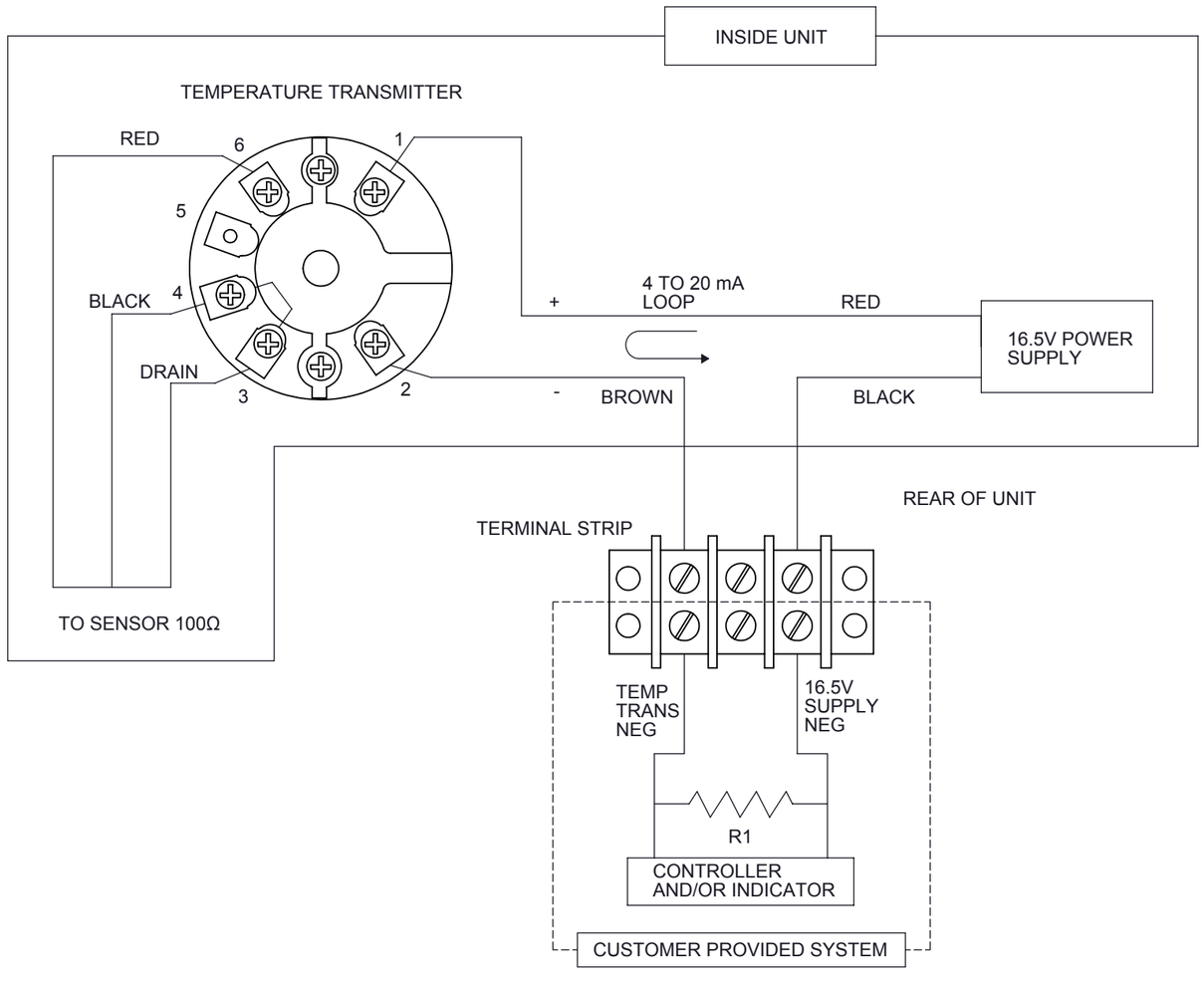
RoHS Temp Transmitter Options (Red Puck) July 2014 to Current

4-20mA Thermo P/N (Transmitter Only)	Temp Range @ 4mA	Temp Range @ 20mA	Application	Loop Powered Transmitter and Sensor Option Number	Self Powered Transmitter and Sensor Option Number	Field install Loop Powerd	Field install Self Powerd	Minco Model Number
326518H01	-100°C	0.0°C	ULT Freezer	4706	7203-AV	7209TA	7207TA	TT518PD(-100/0)C1Y
326518H01	-40°C	0.0°C	-20°C / -30°C HPLRF Freezer	4706	7205TA			TT518PD(-100/0)C1Y
326518H02	0.0°C	40°C	+4°C Refrigerator	6907-1	7204	7208TA	7206TA	TT518PD(0/40)C1Y
326518H02	0.0°C	40°C	+4°C Refrigerator	6907-2				TT518PD(0/40)C1Y
326518H04**	-66°C	54°C	FMS Refrigerator / Freezers	4706FMS	7203FMS			TT518PD(-20/100)C1Y

** Offset due to use of intrisically safe barrier with H04 Transmitter

Press “Ctrl + Home” to return to top of Document

WIRING DIAGRAM FOR 4-20mA POWERED TEMPERATURE TRANSMITTER



NOTES:

1. VERIFICATION OF ALL DIMENSIONS, SPECS, & NOTES REQUIRED FROM THE SUPPLIER AT THE TIME OF FIRST ARTICLE SUBMISSION. THIS SHALL INCLUDE MEASUREMENTS FROM THE FIRST ARTICLE SAMPLES.
2. SYMBOLS, DESIGNATIONS AND GENERAL DRAWING METHODS ENGWI002
3. BASIC DIMENSION TOLERANCE
   UNLESS OTHERWISE SPECIFIED:
   .XXX = .040" [1.00mm]
   .XX = .080" [2.00mm]
   ANGULAR 2°

REV.	DCO #	DATE	DESCRIPTION
A	003389	2016-07-29	INITIAL RELEASE

REVISIONS

ThermoFisher SCIENTIFIC
275 AIKEN ROAD
ASHEVILLE, NC 28804

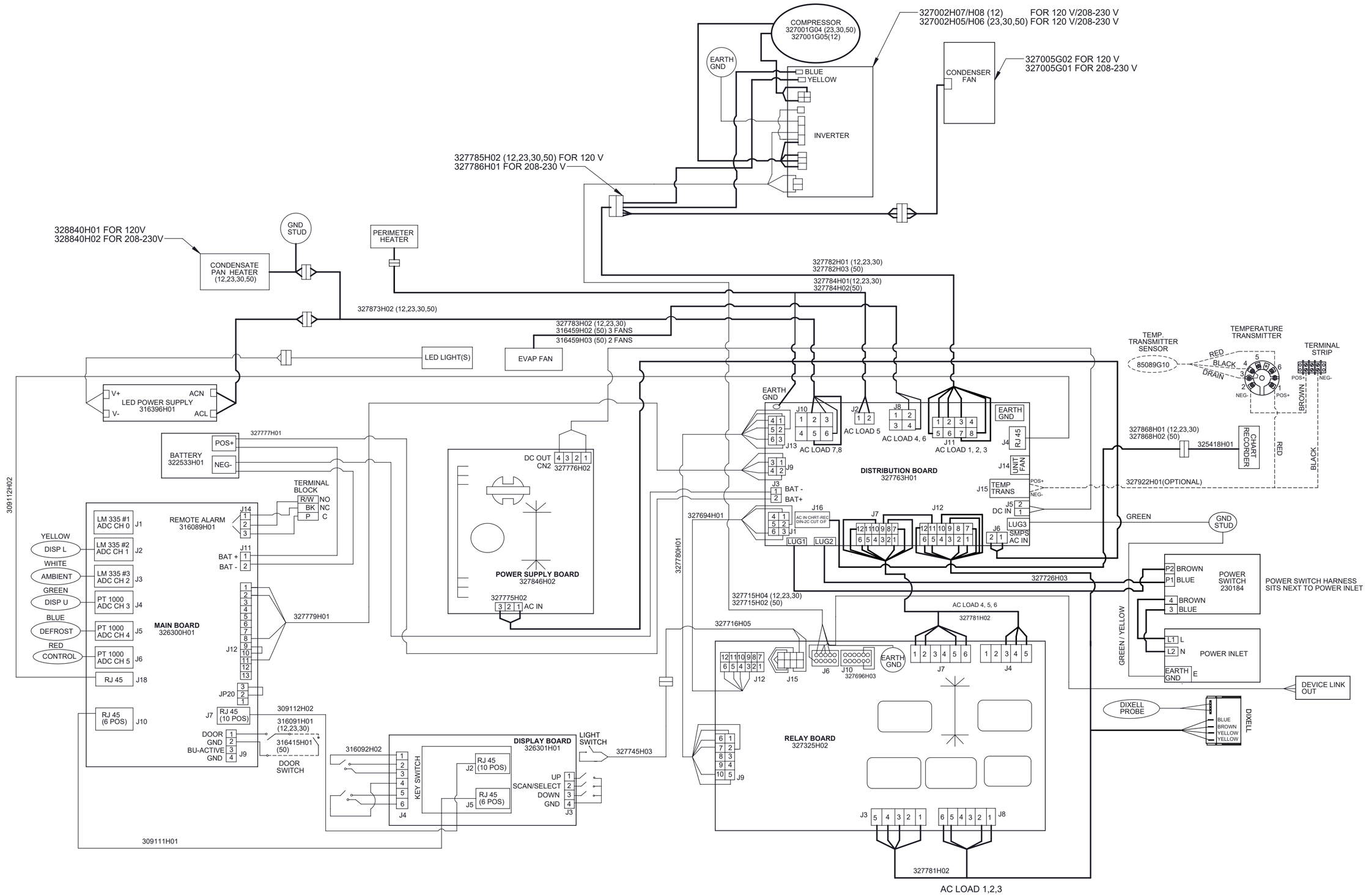
TITLE
DIAG, WIRING, 4-20mA POWERED TEMPERATURE TRANSMITTER

ARTICLE OR MATERIAL MUST COMPLY WITH THE ENVIRONMENTAL COMPLIANCE SPECIFICATION TFS DRAWING 260111S01

3rd ANGLE PROJECTION

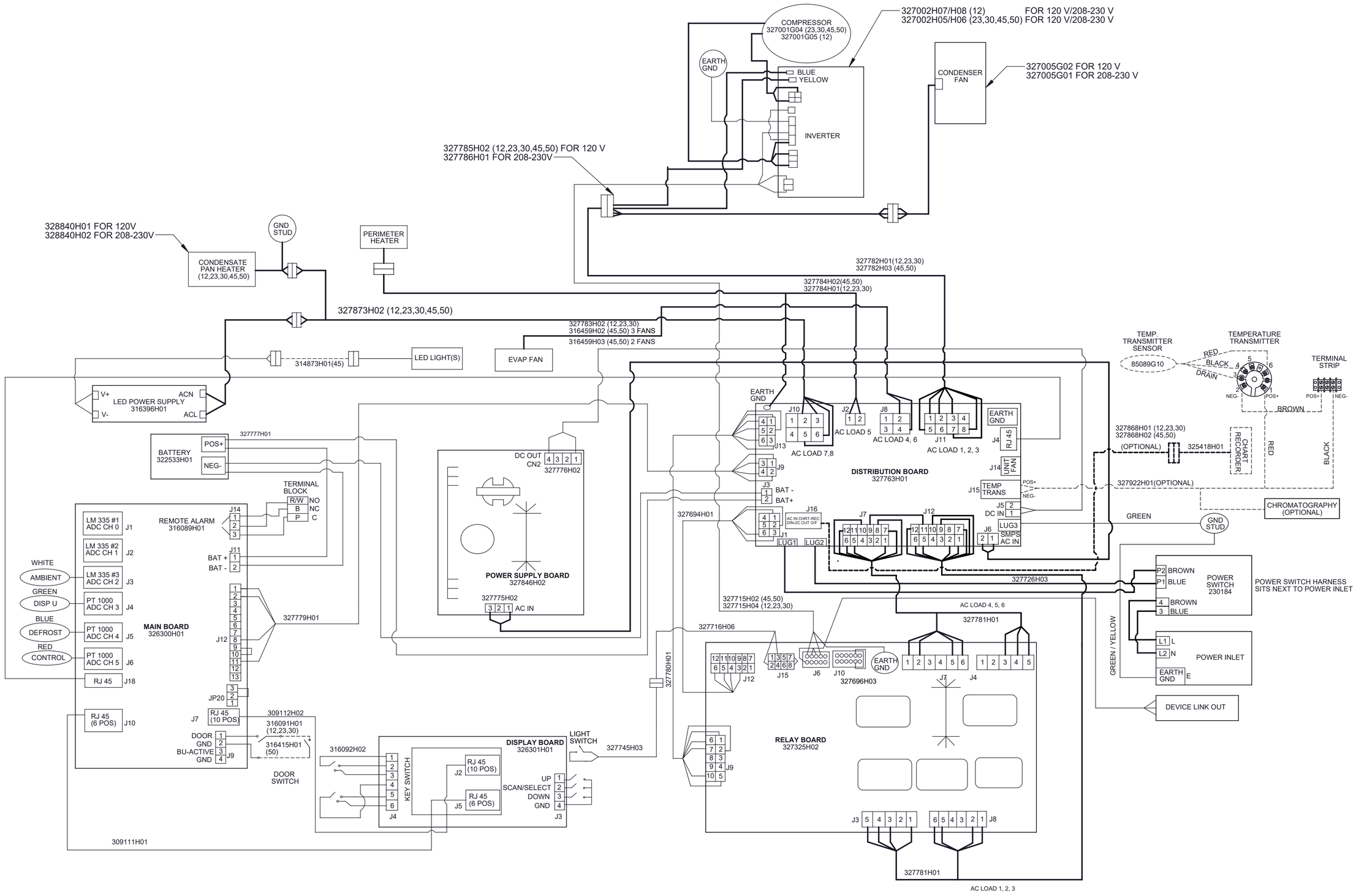
DWG. NO.
327987H01

SIZE B | SHEET 1 OF 1



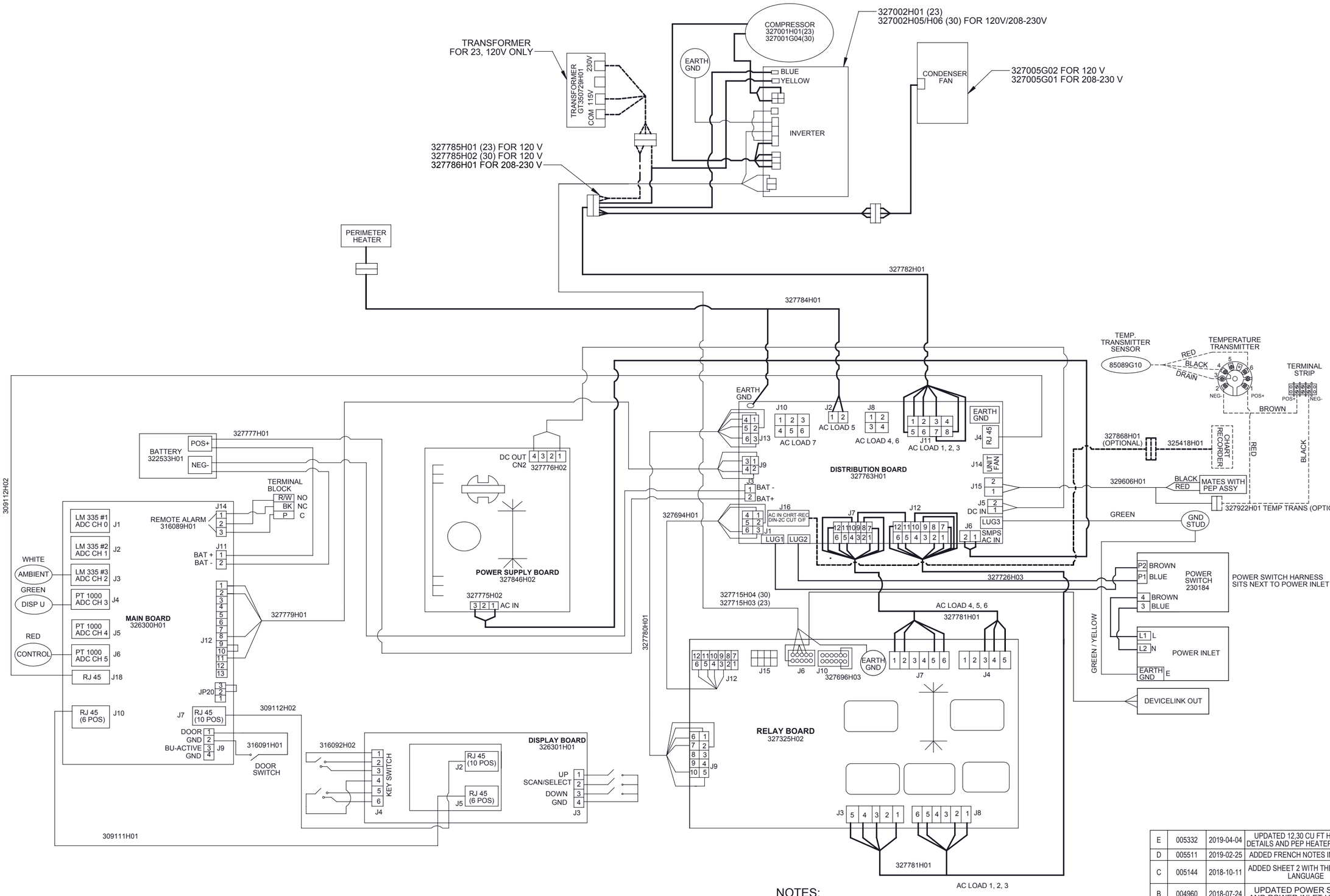
NOTES:

1. FOR WIRE HARNESS CONSTRUCTION & SPECIFICATIONS SEE TFS 28305H01.
2. COMPONENTS AND WIRE ARE AS SPECIFIED OR AN EQUIVALENT APPROVED BY THERMOFISHER ENGINEERING.
3. OPTIONS SHOWN WITH DASHED LINES.
4. ALL DARK LINES CONTAIN HIGH POTENTIAL VOLTAGE.



NOTES:

1. FOR WIRE HARNESS CONSTRUCTION & SPECIFICATIONS SEE TFS 28305H01.
2. COMPONENTS AND WIRE ARE AS SPECIFIED OR AN EQUIVALENT APPROVED BY THERMOFISHER ENGINEERING.
3. OPTIONS SHOWN WITH DASHED LINES.
4. ALL DARK LINES CONTAIN HIGH POTENTIAL VOLTAGE.



NOTES:

1. FOR WIRE HARNESS CONSTRUCTION & SPECIFICATIONS SEE TFS 28305H01.
2. COMPONENTS AND WIRE ARE AS SPECIFIED OR AN EQUIVALENT APPROVED BY THERMOFISHER ENGINEERING.
3. OPTIONS SHOWN WITH DASHED LINES.
4. ALL DARK LINES CONTAIN HIGH POTENTIAL VOLTAGE.

REV	DCO #	DATE	DESCRIPTION
E	005332	2019-04-04	UPDATED 12,30 CU FT HARNESS DETAILS AND PEP HEATER HARNESS
D	005511	2019-02-25	ADDED FRENCH NOTES IN SHEET-2
C	005144	2018-10-11	ADDED SHEET 2 WITH THE FRENCH LANGUAGE
B	004960	2018-07-24	UPDATED POWER SWITCH AND POWER INLET HARNESS
A	004610	2018-03-06	INITIAL RELEASE

REVISIONS

ThermoFisher SCIENTIFIC
275 AIKEN ROAD
ASHEVILLE, NC 28804

TITLE

DIAGRAM, ELECTRICAL WIRING -20 CW

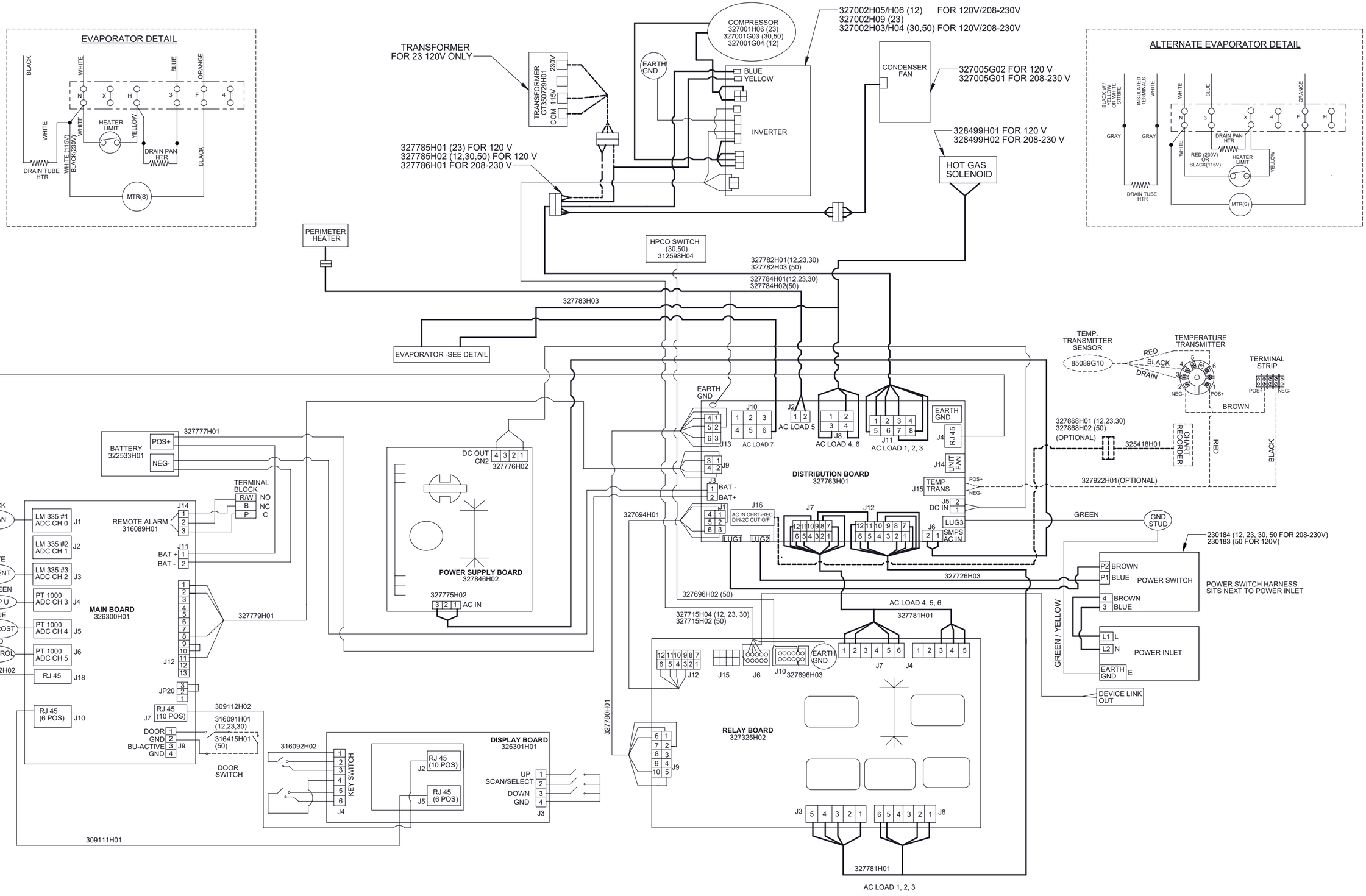
ARTICLE OR MATERIAL MUST COMPLY WITH THE ENVIRONMENTAL COMPLIANCE SPECIFICATION TFS DRAWING 260111S01

3rd ANGLE PROJECTION

DWG. NO. 328059H06

SIZE C SHEET 1 OF 2

SolidWorks 2007-10-25



NOTES:

1. OPTIONS SHOWN WITH DASHED LINES.
2. ALL DARK LINES CONTAIN HIGH POTENTIAL VOLTAGE.

Charge Information

TSX Charge Info					
Size CuFt	**Suffix**	**Temp °C**	**Lbs**	**Grams**	**Oz**
12	17	+4° / +5°	0.242	110	3.88
12	17	-30°	0.209	95	3.35
23	16 / 17	+4° / +5°	0.319	145	5.11
23	18	+4° / +5°	0.308	140	4.94
23	16 / 17 / 18 / 19	-20°	0.275	125	4.41
23	20	-20°	0.319	145	5.11
23	16	-30°	0.253	115	4.06
23	17 / 18	-30°	0.242	110	3.88
30	17	+4° / +5°	0.308	140	4.94
30	18 / 19	-20°	0.319	145	5.11
30	17, 18	-30°	0.286	130	4.59
45	17	+4° / +5°	0.319	145	5.11
50	17	+4° / +5°	0.319	145	5.11
50	17	-30°	0.297	135	4.76

Press “Ctrl + Home” to return to top of Document

Pressure and Amp Draw

TSX 23FT Model Pressure & Current Data (20C ambient cycle)

Model	Suffix	P1max(psig)	P1min(psig)	P2max(psig)	P2min(psig)	Unit Amps (compressor on)	Unit Amps (compressor off)
TSX2305A, TSX2304A	16 - 17	160	155	70.0	27.0	1.84	0.97
TSX2305D, TSX2304D	16 - 17	160	155	70.0	27.0	1.60	0.68
TSX2305V, TSX2304V	16 - 17	160	155	70.0	27.0	1.60	0.80
TSX2305A, TSX2304A	18						
TSX2305D, TSX2304D	18						
TSX2305V, TSX2304V	18						
TSX2320A	16-19	145	130	15.0	5.3	3.00	1.30
TSX2320D	16-19	145	130	15.0	5.3	1.60	0.55
TSX2320V	16-19	145	130	15.0	5.3	1.50	0.58
TSX2320A	20	125	120	6.7	3.7	3.00	1.30
TSX2320D	20	125	120	6.7	3.7	1.60	0.55
TSX2320V	20	125	120	6.7	3.7	1.50	0.58
TSX2330A	16						
TSX2330D	16						
TSX2330V	16						
TSX2330A	17, 18	140	137	7.0	2.5	4.50	1.40
TSX2330D	17, 18	140	137	7.0	2.5	2.20	0.57
TSX2330V	17, 18	140	137	7.0	2.5	2.15	0.60

Press “Ctrl + Home” to return to top of Document

TSX 45~50FT Model Pressure & Current Data (20C ambient cycle)

Model	Suffix	P1max(psig)	P1min(psig)	P2max(psig)	P2min(psig)	Unit Amps(compressor on)	Unit Amps(compressor off)
TSX5030A	17	145	138	10	4	8.70	1.80
TSX5030D	17	145	138	10	4	4.80	0.80
TSX5030V	17	145	138	10	4	4.40	1.00
TSX4505A	17	144	142	67	34	3.50	1.60
TSX4505D	17	144	142	67	34	1.90	1.00
TSX4505V	17	144	142	67	34	1.40	0.80
TSX5005A, TSX5004A	17	144	142	67	34	4.10	2.50
TSX5005D, TSX5004D	17	144	142	67	34	1.70	0.95
TSX5005V, TSX5004V	17	144	142	67	34	1.60	0.80

TSX 12FT Model Pressure & Current Data (20C ambient cycle)

Model	Suffix	P1max(psig)	P1min(psig)	P2max(psig)	P2min(psig)	Unit Amps(compressor on)	Unit Amps(compressor off)
TSX1205A, TSX1204A	17	152	143	64	38	2.30	1.40
TSX1205D, TSX1204D	17	152	143	64	38	1.40	1.00
TSX1205V, TSX1204V	17	152	143	64	38	1.30	0.95
TSX1230A	17	137	134	6.8	2.5	3.30	1.00
TSX1230D	17	137	134	6.8	2.5	1.65	0.60
TSX1230V	17	137	134	6.8	2.5	1.70	0.60

Press “Ctrl + Home” to return to top of Document

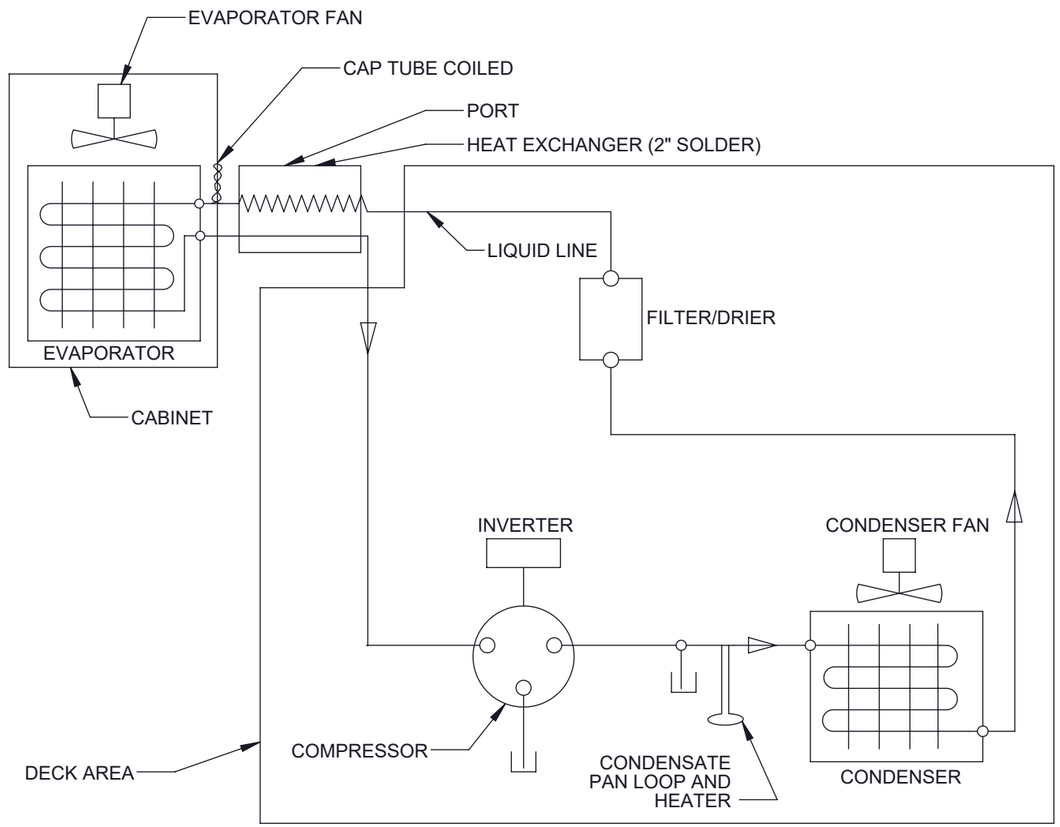
TSX 30FT Model Pressure & Current Data (20C ambient cycle)

Model	Suffix	P1max(psig)	P1min(psig)	P2max(psig)	P2min(psig)	Unit Amps(compressor on)	Unit Amps(compressor off)
TSX3005A, TSX3004A	17	134	130	65.3	37.3	3.50	1.70
TSX3005D, TSX3004D	17	134	130	65.3	37.3	1.60	0.80
TSX3005V, TSX3004V	17	134	130	65.3	37.3	1.60	0.90
TSX3020A	18 - 19	128	123	13.3	4.8	2.70	1.10
TSX3020D	18 - 19	128	123	13.3	4.8	1.60	0.60
TSX3020V	18 - 19	128	123	13.3	4.8	1.50	0.60
TSX3030A	17	135	126	6.8	2.5	3.90	1.20
TSX3030D	17	135	126	6.8	2.5	1.70	0.60
TSX3030V	17	135	126	6.8	2.5	2.00	0.70
TSX3030A	18						
TSX3030D	18						
TSX3030V	18						

Notes: P1max/P2max are maximum discharge/suction pressure when compressor is on(not in defrost cycle).
P1min/P2min are minimum discharge/suction pressure when compressor is on(not in defrost cycle).
Unit Amps data are collected when door frame heaters are on (except for 4505 models which are without door frame heaters)
Data are estimated pressure/current and for reference only.

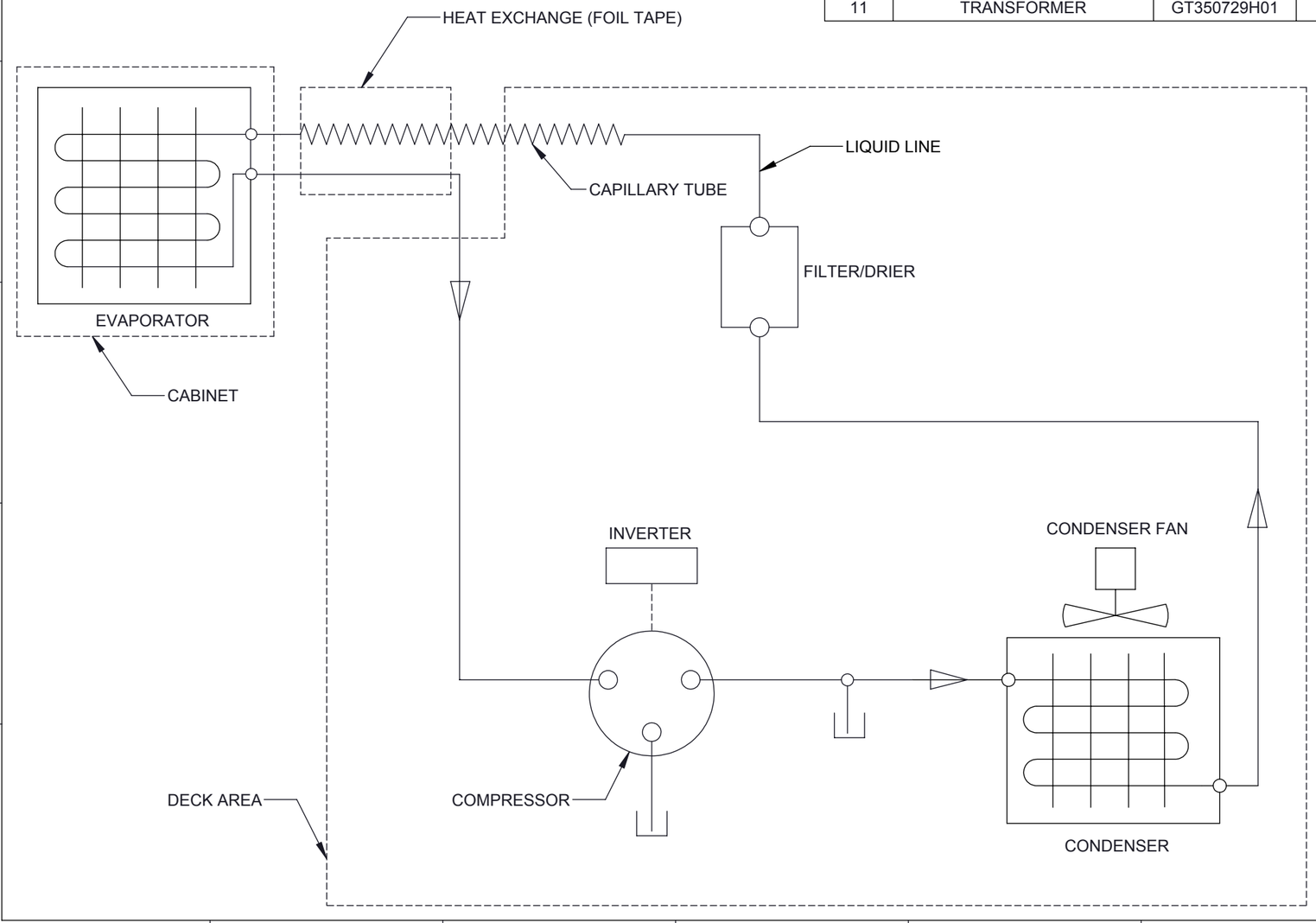
Press “Ctrl + Home” to return to top of Document

S. NO.	CATEGORY	12 Cu ft REF P/N			23 Cu ft REF P/N			30 Cu ft REF P/N			45/50 Cu ft REF P/N		
		120V/60Hz	230V/50Hz	208-230V/60Hz	120V/60Hz	230V/50Hz	208-230V/60Hz	120V/60Hz	230V/50Hz	208-230V/60Hz	120V/60Hz	230V/50Hz	208-230V/60Hz
1	COMPRESSOR ASSY	327001G05			327001G04								
2	INVERTER ASSY	327002H07	327002H08		327100G08	327100G09		327100G08	327100G09		327100G08	327100G09	
3	CONDENSER	328321H02			328321H01								
4	CONDENSER FAN ASSY	327005G02	327005G01		327005G02	327005G01		327005G02	327005G01		327005G02	327005G01	
5	FILTER/DRIER	75380H01											
6	RESTRICTOR	47417H106											
7	EVAPORATOR ASSY	29333G28	29333G29		29333G22	29333G23		29333G26	29333G27		60595H33	60595H34	
	ALTERNATE EVAPORATOR ASSY	NA									60595H43	60595H44	
8	EVAPORATOR FAN	313261H01									306637H01	307462H03	
	ALTERNATE EVAPORATOR FAN	NA									39693H01	39693H02	
9	PERIMETER HEATER	329588H01	329588H02		329588H03	329588H04		329588H05	329588H06		329588H03	329588H04	
10	CONTROL PROBE	326737H03											
11	DISPLAY PROBE	309159H09									309159H10		
12	EVAP COIL DEFROST SENSOR	326737H05											
13	AMBIENT PROBE	326739H01											
14	CONDENSATE PAN HEATER	328840H01	328840H02		328840H01	328840H02		328840H01	328840H02		328840H01	328840H02	



REF, 45/50 Cu ft: SHOWN
12, 23, 30 Cu ft: FOIL TAPE HEAT EXCHANGE
REPLACES 2" SOLDER HEAT EXCHANGE
*NO CONDENSATE PAN LOOP AND HEATER
FOR 12 Cu ft & 30 Cu ft

S. NO.	CATEGORY	23 Cu ft CW P/N			30 Cu ft CW P/N		
		120V/60Hz	230V/50Hz	208-230V/60Hz	120V/60Hz	230V/50Hz	208-230V/60Hz
1	COMPRESSOR ASSY.	327001H01			327001G04		
2	INVERTER ASSY.	327100G02	327100G03		327100G08	327100G09	
3	CONDENSER	GT350222H01			328321H01		
4	CONDENSER FAN ASSY.	327005G02	327005G01		327005G02	327005G01	
5	FILTER/DRIER	75380H01					
6	RESTRICTOR	47417H107					
7	PERIMETER HEATER	329588H03	329588H04		329588H05	329588H06	
8	CONTROL PROBE	326737H04					
9	DISPLAY PROBE [MODEL DEPENDENT]	309159H10					
10	AMBIENT PROBE	326739H01					
11	TRANSFORMER	GT350729H01	NA				



NOTES:

1. SYMBOLS, DESIGNATIONS AND GENERAL DRAWING METHODS ENGWI002.

REV	DCO #	DATE	DESCRIPTION
C	005332	2019-03-22	UPDATED TABLE; ADDED 30 Cu ft DETAILS
B	005144	2018-10-11	ADDED SHEET 2 WITH THE FRENCH LANGUAGE
A	004342	2018-03-28	INITIAL RELEASE

REVISIONS

Thermo Fisher SCIENTIFIC
275 AIKEN ROAD
ASHEVILLE, NC 28804

TITLE

DIAGRAM, REFRIGERATION, CW

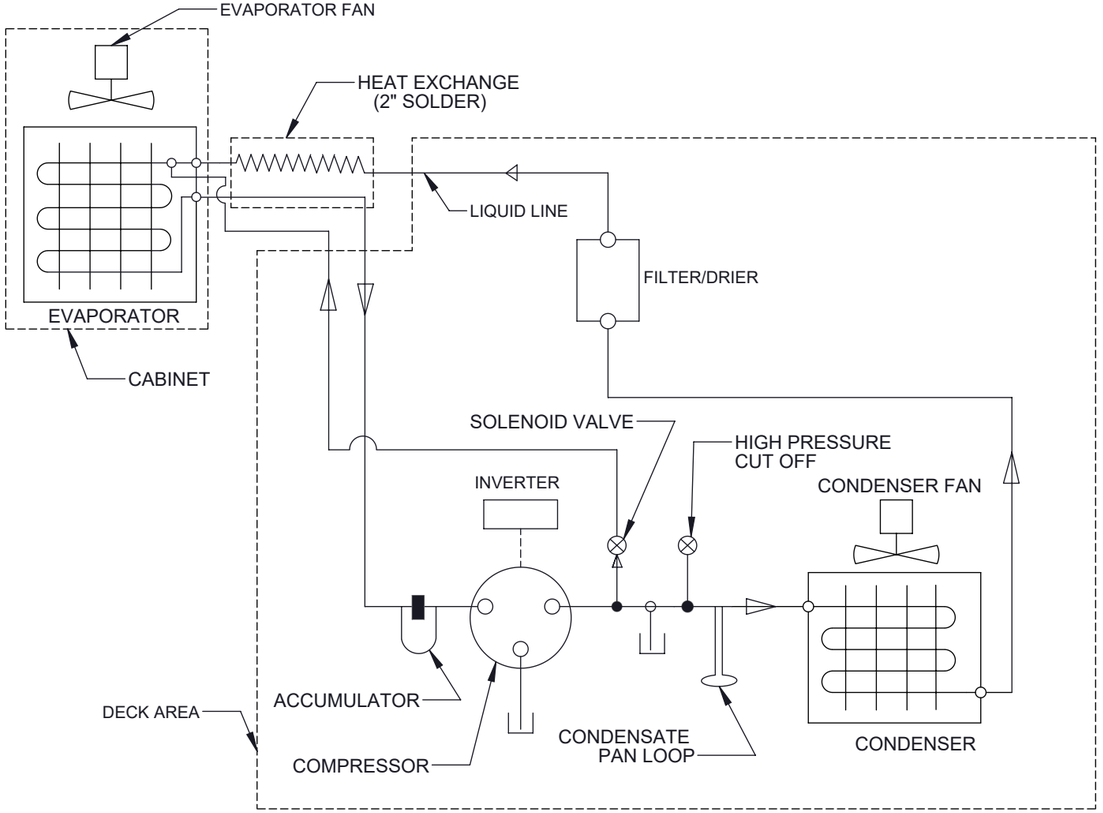
ARTICLE OR MATERIAL MUST COMPLY WITH THE ENVIRONMENTAL COMPLIANCE SPECIFICATION TFS DRAWING 260111S01

3rd ANGLE PROJECTION

SIZE B | SHEET 1 OF 3

DWG. NO. 327990H06

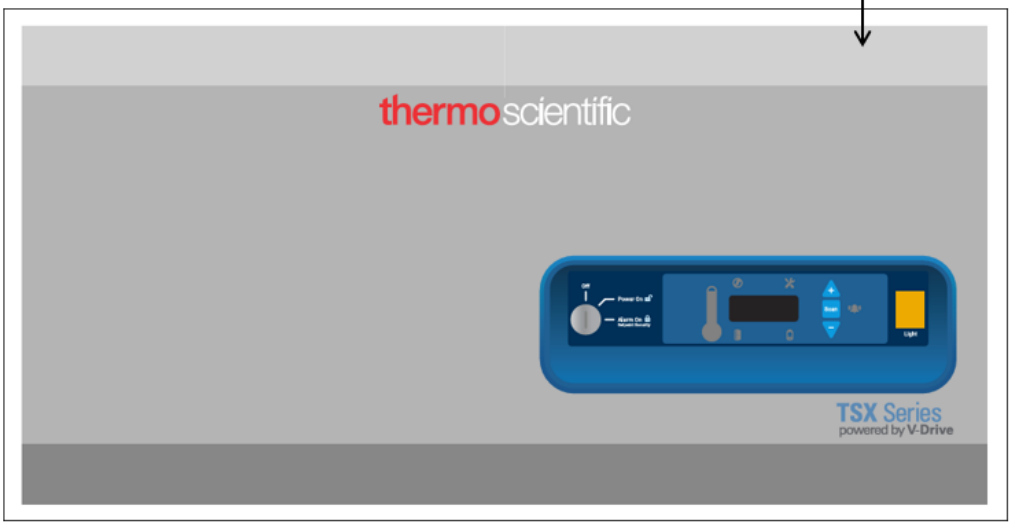
S. NO.	CATEGORY	12 Cu ft FRZ P/N			23 Cu ft FRZ P/N			30 Cu ft FRZ P/N			50 Cu ft FRZ P/N		
		120V/60Hz	230V/50Hz	208-230V/60Hz	120V/60Hz	230V/50Hz	208- 230V/60Hz	120V/60Hz	230V/50Hz	208-230V/60Hz	120V/60Hz	230V/50Hz	208-230V/60Hz
1	COMPRESSOR ASSY	327001G04			327001H06			327001G03					
2	INVERTER	327100G08	327100G09		327002H09			327100G06	327100G07		327100G06	327100G07	
3	CONDENSER	328321H02			GT350222H01			328321H01					
4	CONDENSER FAN ASSY	327005G02	327005G01		327005G02	327005G01		327005G02	327005G01		327005G02	327005G01	
5	FILTER/DRIER	75380H01											
6	RESTRICTOR	47417H107									87812H07		
7	EVAPORATOR ASSY	60595H37	60595H38		327738G03	327738G04		327738G03	327738G04		60595H35	60595H36	
	ALTERNATE EVAPORATOR ASSY	NA	NA		NA	NA		60595H39	60595H40		60595H41	60595H42	
8	EVAPORATOR FAN	39693H01	39693H02		306637H01	307462H03		306637H01	307462H03		306637H01	307462H03	
	ALTERNATE EVAPORATOR FAN	NA	NA		NA	NA		39693H01	39693H02		39693H01	39693H02	
9	DRAIN PAN HEATER	328269H05	328269H06		328269H03	328269H04		328269H03	328269H04		328269H01	328269H02	
10	DRAIN TUBE HEATER	311730H01	311730H02		311730H01	311730H02		311730H01	311730H02		311730H01	311730H02	
11	PERIMETER HEATER	329588H01	329588H02		329588H03	329588H04		329588H05	329588H06		329588H03	329588H04	
12	CONTROL PROBE	326737H03											
13	DISPLAY PROBE	309159H09									309159H10		
14	EVAP COIL DEFROST SENSOR	326737H05											
15	DRAIN PAN DEFROST SENSOR	326739H03											
16	AMBIENT PROBE	326739H01											
17	SAFETY THERMOSTAT	327883H01											
18	ACCUMULATOR	300367H01											
19	HOT GAS DEFROST VALVE	328498H01											
20	HOT GAS DEFROST SOLENOID	328499H01	328499H02		328499H01	328499H02		328499H01	328499H02		328499H01	328499H02	
21	TRANSFORMER	NA			GT350729H01	NA							
22	HIGH PRESSURE CUT OFF SWITCH	NA						312598H04					



FRZ, 50 Cu ft: SHOWN
12, 23, 30 Cu ft: FOIL TAPE HEAT EXCHANGE
REPLACES 2" SOLDER HEAT EXCHANGE

Touch Up Paint Information

- New TSX look with new colors
  - 45200H105 Facet Light Grey, Aerosol
  - 45200H106 Facet Light Grey, Liquid
  - 45200H108 Facet Grey, Aerosol
  - 45200H109 Facet Grey, Liquid



Press “Ctrl + Home” to return to top of Document

Technical Service Bulletins of Note

Description
1708-REF-AVL-0500 TSX Distribution board connections
1807-REF-AVL-0538 Launch of the TSX 45 & 50 ft units
1905-REF-AVL-0569 Launch of the TSX 12, 30 ft units
1909-REF-AVL-0579 -30C Defrost Disabled issue
2001-REF-AVL-0589 5030 defrost icing issues with note
2004-REF-AVL-0600 Audit Phase software release and new -20 config
2007-REF-AVL-0607 HPLRF 12ft missing counterweights
2011-REF-AVL-0616 TSX -30 defrost icing issues – 12, 23, & 30’
2106-REF-AVL-0634 2320HA FMS launch, and 2320 standardization
2203-REF-AVL-0669 Cardinal Anthony to CIG Glass Door Replacement
2202-REF-AVL-0664 TSX Anthony to CIG Glass Door Replacement
2205-REF-AVL-0675 TSX2304-05 and CH2304-05 Standardization Suffix 18
2206-REF-AVL-0681 TSX3030 Suffix 18 Change Heatcraft Evaporator to Peerless
2207-REF-AVL-0687 TSX5030 Shock Loop Compressor Version 2

Description
326300G94 Kit instructions for -30 icing issues
326300G96 Kit instructions for normal replacement board kit
TSX Display offset instructions
TSX Control offset instructions
HPLRF Master Parts list
HPLRF Parameter Tables with notes and examples

Press “Ctrl + Home” to return to top of Document

Available Service Kits

Compressor / Inverter Service Kits	
Kit Number	**Description**
303255G47	Service Assembly, Compressor, (VNEK207U, oil & filter dryer) 23’ ref
303255G49	Service Assembly, Compressor, (VNEU217U, oil & filter dryer) 30/50’ freezer
303255G50	Service Assembly, Compressor, (VEGT8U & filter dryer) 23/30/45/50’ ref & 1230 and 3020 freezers
303255G51	Service Assembly, Compressor, (FMFT406U, oil & filter dryer) 12’ ref
303255G52	Service Assembly, Compressor, (DSL - VNEU217U VER 2)

23' -30 & -20 HP to Maia Compressor Kits		
Kit Number	**Use**	**Kit Description**
100793G01	TSX2330 Suffix 16 A/D	TSX2330 Inver/Comp Suffix 16 A/D SER UPG Kit
100794G01	TSX2330 Non-Suffix 16 A w/327002H01 Inverter & 327001H01 Compressor	TSX2330 Inver/Comp A SER UPG Kit
100795G01	TSX2330 Non-Suffix 16 D w/327002H01 Inverter & 327001H01 Compressor	TSX2330 Inver/Comp D/V SER UPG Kit
327727G11 S	TSX2330 Non-Suffix 16 A w/327002H09 Inverter & 327001H06 Compressor	SRV ASY, COND UNIT FRZ A -30 HG
327727G12 S	TSX2330 Non-Suffix 16 D w/327002H09 Inverter & 327001H06 Compressor	SRV ASY, COND UNIT FRZ D/V -30
100796G01	TSX2320 Non-Suffix 20 D/V Volt	TSX2320 Inver/Comp A SER UPG Kit
100797G01	TSX2320 Non-Suffix 20 A Volt	TSX2320 Inver/Comp D/V SER UPG Kit
327727G07 S	TSX2320 Suffix 20 A	ASSY, COND UNIT, REF A, 45/50
327727G08 S	TSX2320 Suffix 20 D/V	SRV ASY, COND UNIT REF D/V 45/
100798G01	TSX2330 Non-Suffix 16 A w/327002H09 Inverter & 327001H06 Compressor	SRV ASY, COMPR, VNEK213U MAIA

Press “Ctrl + Home” to return to top of Document

Inverter Service Kits		
Kit Number	**Description**	**Use**
327100G04	ASSEMBLY, INVERTER, VNEK207U 115V	23’ Refrig
327100G05	ASSEMBLY, INVERTER, VNEK207U 230V	23’ Refrig
327100G06 S	ASSEMBLY, INVERTER, VNEU217U 115V	30 / 50’ Frz
327100G07 S	ASSEMBLY, INVERTER, VNEU217U 230V	30 / 50’ Frz
327100G08 S	ASSEMBLY, INVERTER, VEGT8U 115V	30/45/50’ Refrig, 1230 3020
327100G09 S	ASSEMBLY, INVERTER, VEGT8U 230V	30/45/50’ Refrig, 1230 3020

23' -30 & -20 HP to Maia Inverter Kits		
Kit Number	**Use**	**Kit Description**
100799G01	TSX2330 Non-Suffix 16 A w/327002H09 Inverter & 327001H06 Compressor	SRV INVERTR ASY, MAIA 213u 115V
100800G01	TSX2330 Non-Suffix 16 A w/327002H09 Inverter & 327001H06 Compressor	SRV INVERTR ASY, MAIA 213u 230V

Heatcraft to Peerless Upgrade Kits		
Kit Number	**Use**	**Kit Description**
100807G01	UPGD HC to Peerless EVAP 115v	Upgrade from Heatcraft to Peerless Evap. TSX3030
100808G01	UPGD HC to Peerless EVAP D/V	Upgrade from Heatcraft to Peerless Evap. TSX3030

Replacement CPU kits with the appropriate Gxx EPROM and matching Relay board code –	
Kit Number	**Description**
326300G94	PCB SERV KIT, TSX CPU/G57 and H02 Relay Board
326300G96	PCB SERV KIT, TSX CPU/G54 and H02 Relay Board

For a complete list of Service Parts, please reference the Knowledge Base for related articles including #330015 Parts List.

Press “Ctrl + Home” to return to top of Document

Thermo Fisher Scientific
275 Aiken Road
Asheville, NC 28804 U.S.A.
866.984.3766

Press “Ctrl + Home” to return to top of Document