



# DB7110U Universal Heat Pump Defrost Controller

## INSTALLATION INSTRUCTIONS

### APPLICATION

The DB7110U Universal Heat Pump Defrost Controller is a heat pump defrost control used in single stage heat pump appliances. This product replaces over 260 OEM and competitive controls and can be easily programmed to meet the requirements of virtually any single stage heat pump. See Table 2, "Compatibility Chart," on page 5.

### FEATURES

The DB7110U provides:

- Universal defrost control for single stage heat pumps
- LED display for easy setup and configuration
- Small, square footprint for easier installation
- Demand and timed defrost modes
- System status and fault indication
- Selectable reversing delay to limit noise when going in and out of a defrost cycle
- Fault history for easy troubleshooting

### SPECIFICATIONS

#### Electrical Ratings

**Input Voltage:** 24VAC, 60Hz

**Max. Input Current:** 200mA

**Compressor Contactor:** 1A @ 24VAC

#### Outdoor Fan:

1/2HP motor

5A full load, 30A locked rotor, 240VAC.

**Aux Heat:** 1A @ 24VAC

**Reversing Valve:** 1A @ 24VAC

**All outputs rated for 100,000 operations.**

**All terminals except FAN-IN and FAN-OUT are NEC Class 2 low voltage.**

#### Environmental Ratings

**Operating Temperature Range:** -40F to 150F

**Humidity Limits:** less than 95% (non-condensing)

### INSTALLATION AND CONFIGURATION

#### Overview

#### When Installing This Product...

1. Read these instructions carefully. Failure to follow instructions can damage the product or cause a hazardous condition.
2. Check ratings given in these instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. Use these instructions to check out the product operation after installation.

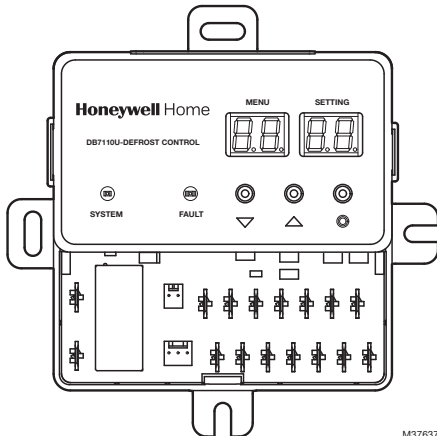


Fig. 1. DB7110U1000.

M37637



34-00032-01

## **⚠ WARNING**

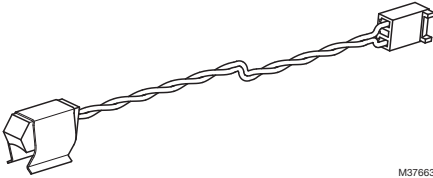
**Electrical Shock Hazard. Can cause severe injury, death or property damage.**

Disconnect power supply before beginning installation to prevent electrical shock or equipment damage. More than one disconnect may be involved.

## Control Location

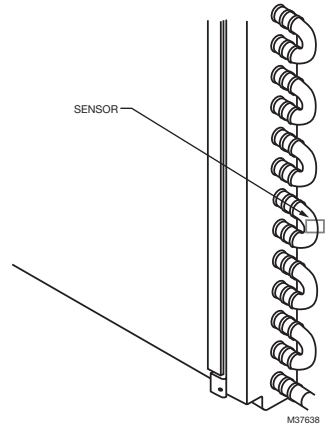
1. Before removing the old control, make note of the wire connections to ensure the wires will be connected to the correct terminals of the DB7110U.
2. Mount DB7110U inside the junction box on the outdoor unit using the two included self-drilling sheet metal screws.
3. Use the control as a template to drill new mounting holes if necessary.
4. If the mounting tabs interfere with other components in the junction box, break/cut off the unused mounting tabs prior to tightening the mounting screws.

## Coil Sensor Location



**Fig. 2. Coil Sensor.**

1. The outdoor coil sensor must be used. Without the coil sensor, the DB7110U cannot determine when to defrost. The coil sensor included with the DB7110U replaces the existing defrost thermostat or coil sensor installed on the unit.
2. Place the sensor on the coil where the OEM sensor/thermostat was located. If replacing a defrost thermostat, note the original settings for proper adjustment of the termination and enable temperatures on the DB7110U. They are often marked with their open and close points. A thermostat marked L60-25F for example would correspond to a Termination Temperature of 60degF and an Enable Temperature of 35degF (60deg-25deg).
3. If the location of the OEM sensor/thermostat is inaccessible or difficult to access, place the new coil sensor on the coil loop nearest the expansion valve where refrigerant is entering the coil during the heating mode. This location gives the largest temperature difference between the air.
4. Ensure the coil sensor is clamped tightly to the coil. It may be desirable to add insulation to the sensor to yield more accurate readings, although this is generally not needed.



**Fig. 3. Coil Sensor Mounting.**

## OUTDOOR AIR SENSOR LOCATION



**Fig. 4. Air Sensor.**

1. The outdoor air sensor is optional. Using the outdoor air sensor will enable the DB7110U to implement a more advanced defrost algorithm that determines to defrost based on the relationship between coil and air temperatures. Without the air sensor, the DB7110U defrosts when the coil temperature is below the Enable Temperature for the Defrost Cycle Time. It is advisable to use the air sensor if possible as it may reduce the number of unnecessary defrosts that are common among defrost timers.
2. Mount the air sensor such that the capsule is hanging in air near the outdoor coil.
3. Do not locate the air sensor too close to the coil that sensor readings are influenced by it.
4. Do not mount the air sensor in direct sunlight.
5. The air sensor capsule should not be in contact with metal or some other material that may change its readings.

## Wiring

### **⚠ WARNING**

**Electrical Shock Hazard. Can cause severe injury, death, or property damage.**

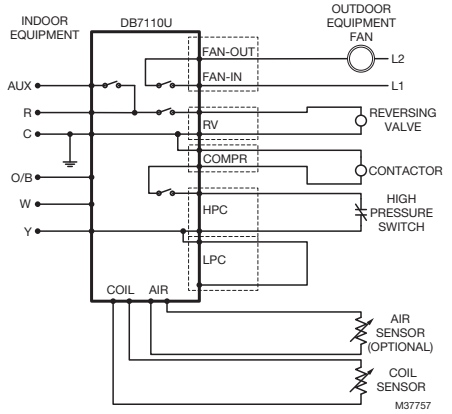
Disconnect power supply before beginning wiring to prevent electrical shock or equipment damage. More than one disconnect may be involved.

1. Make sure the wiring complies with all local codes and ordinances.
2. If the low voltage wiring is bare wire with no terminals, wire nut them to the included wiring pig-tails. Do not crimp terminals to solid wire.

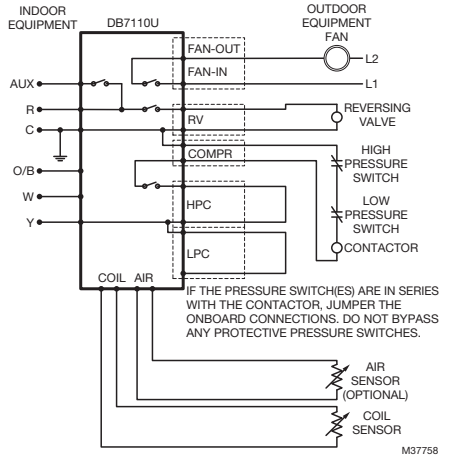
3. Check the line voltage connections on the fan relay to ensure they are tight, in good connection, and more than 1/4" away from any part of the appliance enclosure.
4. Plug in the outdoor sensor (if used) and the coil sensor.
5. Reference the wiring diagrams in Figs. 5 to 8 to aid in proper appliance wiring.

**Table 1. Class 2 Low Voltage Terminations, 24V 60Hz.**

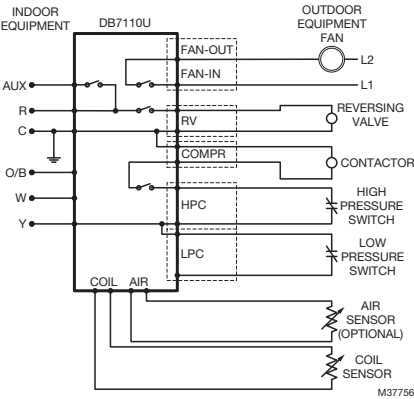
Name	Function
R (24V)	24V Hot
C (COM)	24V Common
W	Aux/emergency heat request from thermostat – W requests will cause the AUX output to be energized.
Y	Compressor request from thermostat – Y requests will cause the COMPR and FAN terminals to be energized.
O	Reversing valve request from thermostat – controls the status of the RV output.
HPC (2 Terminals)	High pressure cutout/switch – these terminals must be shorted for compressor operation. <b>Never bypass protective pressure switches.</b>
LPC (2 Terminals)	High pressure cutout/switch – these terminals must be shorted for compressor operation. <b>Never bypass protective pressure switches.</b>
AUX	Output to auxiliary/emergency heat – energized during a defrost cycle or when requested by W input.
COMPR (2 Terminals)	Output to compressor contactor – energized by Y request.
RV (2 Terminals)	Output to reversing valve – energized by O input and as required by a defrost cycle.



**Fig. 6. Wiring diagram for systems with no low pressure switch.**



**Fig. 7. Wiring diagram for systems with pressure switches in series with the contactor and no connection to the defrost control.**



**Fig. 5. Wiring diagram with pressure switches connected to defrost control.**

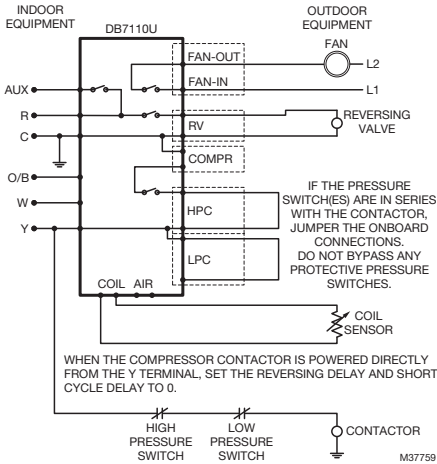


Fig. 8. Wiring diagram for simple timer applications.

## CONFIGURATION

1. Connect power.
2. On power up the display will briefly flash the software version of the DB7110U and then begin cycling between the normal operating screens showing the current mode and the values of the two temperature sensors. Note that there is brief startup delay following power up where compressor operation is prohibited.

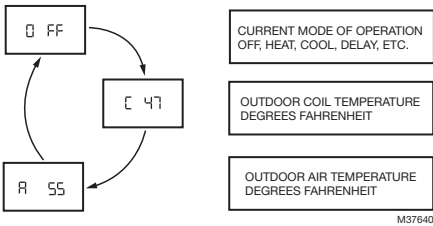


Fig. 9.

The displayed coil and air temperature readings can be very useful for optimizing and troubleshooting defrost performance.

3. There are several configurable options to optimize defrost performance. See "User Interface" on page 7 for a detailed description of each parameter/screen. Press the **select (o)** button advance through the various screens and **▲** and **▼** buttons to adjust the various parameters. Table 4 below describes each parameter.

## CHECKOUT

1. After the startup delay has expired, generate a request for heat by shorting R to Y (and R to O if configured as a "B" system, reversing valve energized in heating mode).
2. Verify the compressor, fan, and reversing valve (if applicable) are energized.
3. Press and hold the **▼** button until "tEst" appears on the display as shown below.

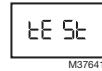


Fig. 10.

4. Verify the unit enters defrost mode



Fig. 11.

The reversing valve will change states and the aux heat will be energized. A few moments later the fan will be turned off. If Reversing Delay is enabled, the compressor will be turned off for the selected time, and then turn back on to reduce noise.

The DB7110U will remain in defrost for at least one minute. After one minute has elapsed, the DB7110U will exit defrost after the coil temperature has risen above the termination temperature or after the selected defrost time, whichever comes first.

Test mode can be terminated at any time by pressing and holding the **▼** button again.

# COMPATIBILITY CHART

**Table 2. Compatibility Chart.**

Amana	C64301-1	C6431001	
Arcoaire	32312-00	3232140	
Armstrong	39840B001	44614-0001	
	44614-002	46257-001	
	47181-001	R46257-001	
	R46614-002	R47181-001	
	39840B002	37967B001	
	37967B002	R46K6701	
	R44614-001	R44614-002	
Artesian	10321-00		
Carrier	150-83-6A	621-xxxx	
	CES0110063-00	CES0110063-01	
	CES0110063-02A	CES0130024-00	
	CES0130024-01	CES0130076	
	HK25SZ359A	HK32EA001	
	HK32EA003	HK32EA007	
	HK32EA008	HK32FA003	
	HK32FA006		
Coleman	3030A374	3030A364	
	3C30A374		
Comfortmaker	1029-2	34332100	
	34332101		
Evcon	9218-374		
Fast	1093410		
Goettl	305007		
Goodman	1084-03-2022	1084-200D	
	20293901	B1226006	
	B1226008	LR40061	
	PCBDM101	PCBDM130	
	PCBDM133	PCBDM160	
	PCBDM101S	PCBDM130S	
Heil Quaker	HQ1052727		
Heil/Tempstar	1087952	1087953	
	1173636	CEPL130524-01	
Honeywell	ST74A1004	ST74A1020	
	ST74A1038	ST74A1053	
	ST74C1002		
ICM	DFORB24A21300	ICM300C	
	DFORB-AB1004	DFORF	
	DFOSP24A2	ICM301C	
	ICM302C	ICM303C	
	ICM304	ICM307	
	ICM316	ICM317	
	ICM318	ICM319	
	ICM320	ICM321	
	ICM322	ICM323	
	W1001-4		
	ICP	1052757	1069364
	Interthem	6208800	

**Table 2. Compatibility Chart. (Continued)**

Lennox	100269-01	100269-02
	100269-04	100269-05
	11K17101	1507N170027
	29M0101	29M0201
	30W87	33G9501
	34M6301	46K67
	56M3701	68I2901
	68J8401	78H6801
	84W8801	86G1601
	97M81	LB-101263A
	LB-101263B	11K171
	97M8101	30W8701
	34M63	29M01
	56M37	HPXB15
68I84	68I29	
78H68		
Nordyne	620880	621301A
	621579B	621579C
	624519A	624608
	624626	624633
	624644	624656
	624700	917012
	917178	917178A
	920338	624644R
	6246440	624633R
	6246330	
Ranco	DT2	
Rheem	47-102684-01	47-102684-02
	47-102684-03	47-102684-04
	47-102684-07	47-102684-08
	47-102684-83	47-102685-01
	47-102685-02	47-102685-03
	47-102685-04	47-102685-05
	47-102685-06	47-102685-84
	47-21517-11	47-21517-13
	47-21517-14	47-21517-16
	47-21517-17	47-21517-18
	47-21517-22	47-21517-23
	47-21517-24	47-21517-82
	47-21517-88	47-21517-92
	47-21776-01	47-21776-06
	47-21776-86	DDL-013002-0RH
	DLL-013002-1RH	DDL-0131020-1RH
	DDL-017002-2RH	DDL-017102-1RH
	DDL-017702-1RH	DDL-117702-3RH
	DDL-122131-2RH	47-21517-12
47-21517-85	47-102685-87	
47-102684-09	47-102685-07	
47-21517-20		
Robertshaw	DT2-1000	TD-10
SnyderGeneral	1395-329	CEBD430524-04B

**Table 2. Compatibility Chart. (Continued)**

Tempstar/ICP	1084-100	1084-83-1008
	1087562	
Therm-O Disc	26E-09	
Trane	21C14501G18	21C1450127
	21C1450136	21C1450137
	21C1450138	21C1450142
	21C1450144	21C1450145
	21C1450153	21C1450154
	21C1450155	21C1450160
	21C14282G01	CNT01106
	CNT01108	CNT01129
	CNT01152	CNT01431
	CNT01510	CNT01642
	CNT01923	CNT01924
	CNT01926	CNT02514
	CNT02515	CNT02516
	CNT02920	CNT02935
	CNT03715	CNT03716
	CNT04362	CNT04363
	CNT04364	CNT04366
	CNT04368	CNT04695
	CNT05001	CNT05008
	CNT05009	CNT05010
CNT05482	CNT05875	
CNT1108	CNT01693	
Weatherking	840-4-5548	
White-Rodgers	840-4-5548	47D40-801
	47D43-101	47D43-111
	47D43-11102	47D43-811
	90-621	47D01U-843
York	031-00872-001	031-00872-002
	031-00872-002	031-00872-701
	031-00872-702	031-00872-703
	031-01222-000	031-01251-000
	031-01268-000	031-01954-000
	031-01975-000	031-09104-000
	031-09170-000	331-01975-001
	331-01975-102	331-09139-000
	9218-3741	S1-03100872701
	S1-03109170000	S1-33101954000
	S1-33101975102	

## USER INTERFACE

The user interface consists of three buttons, two LED's, and 4 7-segment digits. The two left digits generally represent the category of what is being displayed while the two right digits represent the value or setting of the category. The exception is in the event a value requires 3 digits such as a temperature higher than 99F as shown below with two "termination temperature" values of 90F and 100F.





**Fig. 12. Two example values of configuration option 2 (Termination Temperature).**

The "o" button advances to the next screen while the ▲ and ▼ buttons are used to adjust the value of each parameter.

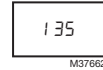
Note that after one hour without a button press, the 7-segment display will turn off to save power. A button must be pressed to turn the display on again.

**Table 3. Status Screens.**

Display	Description
	Current Fault(s) Present. Right digits blank if there is no fault. ▲ and ▼ to scroll through active faults.
	Fault History ▲ and ▼ to scroll through history. Press and hold ▲ for more than two seconds to clear all inactive faults.

The configuration screens are numbered parameters where numbered parameter has a selectable value according to the table below.

For example, would represent Parameter 1 (Defrost Enable Temperature) set to 35 (degF).



**Table 4. Configuration Screens.**

Display	Description	Range	Default
1	Defrost Enable Temperature Coil temperature where defrost functionality is active.	30degF-36degF	35degF
2	Termination Temperature. Coil temperature where defrost is terminated.	70degF-100degF	70degF
3	Defrost Cycle Time Time the coil temperature is below the Defrost Enable Temperature before a defrost is triggered if in timed mode (no outdoor air sensor present).	30-120 minutes	30 minutes
4	Short Cycle Delay Time Minimum off time between compressor cycles.	0-5 minutes	3 minutes
5	Reversing Valve System Type O = reversing valve energized in cool. B = reversing valve energized in heat.	O or B	O

**Table 4. Configuration Screens. (Continued)**

<b>Display</b>	<b>Description</b>	<b>Range</b>	<b>Default</b>
6	Reverse Delay Compressor off time when switching between heating and defrost modes. Setting this to 0 will shorten the overall defrost time, but may result in objectionably loud noises when entering/exiting defrost (depending on compressor type).	0-30 seconds	30 seconds
7	Maximum Defrost Time The maximum amount of time a defrost cycle can last. A defrost cycle may be terminated earlier if the coil reaches the Termination Temperature, but a defrost cycle should never last longer than this time.	8-14 minutes	14 minutes
8	Aux Heat Lockout Temperature W requests will be ignored if the outdoor temperature is higher than this temperature. The Aux heat output will still function normally during a defrost cycle regardless of this setting. Do not set this temperature below the Compressor Lockout Temperature or there will be a range of temperatures with no heating operation.	0degF-40degF	No Lockout (OF)
9	Compressor Lockout Temperature Y requests will be ignored if the outdoor temperature is lower than this temperature. Do not set this temperature above the Aux Heat Lockout Temperature or there will be a range of temperatures with no heating operation.	-10degF-40degF	No Lockout (OF)

Green LED: Indicates system power and operation.

Red LED: Indicates a fault is currently present and the user should inquire with the 7-segment display for more information.



# TROUBLESHOOTING AND MAINTENANCE

## IMPORTANT

Due to the potential hazard of line voltage, only a trained experienced service technician should perform the troubleshooting procedures. This control contains no field-serviceable parts. Do not attempt to take it apart. Replace the entire control if operation is not as described.

Table 5. Troubleshooting.

Condition	Procedure	Control Status	Corrective Action
<b>System does not start with a call for heat or cool</b>	Observe display for current operational mode.	Display shows OFF	<ul style="list-style-type: none"> <li>Verify call for heat or cool is present.</li> <li>Check the wiring from thermostat and indoor equipment</li> <li>Measure input terminals (W, Y, O) for proper voltage.</li> <li>Verify cold weather compressor lockout isn't active. Adjust "Compressor Lockout Temperature" if necessary.</li> </ul>
		Control displays HEAT or COOL but the system is not operating.	<ul style="list-style-type: none"> <li>Check wiring to outdoor equipment.</li> <li>Check contactor</li> <li>Measure output terminals for proper voltage. <b>WARNING:</b> fan terminals are line voltage.</li> <li>Verify system pressure switches. The onboard HPC and LPC terminals must be shorted to run. <b>Never bypass protective pressure switches.</b></li> <li>Check coil sensor, the system will not run without a coil sensor.</li> </ul>
		Control displays DLY	<ul style="list-style-type: none"> <li>The system is in a startup delay due to short cycle protection, powerup, or low voltage. Wait for the delay to expire.</li> </ul>
<b>Compressor does not stop when the call for heat or cool ends</b>	Observe display for current operational mode.	Control displays current mode; OFF, HEAT, or COOL.	<ul style="list-style-type: none"> <li>If HEAT or COOL is shown after the call ended, investigate thermostat wiring.</li> </ul>
		Unplug Y wire from control	<ul style="list-style-type: none"> <li>Display shows OFF, compressor turns OFF</li> <li>Investigate thermostat wiring to ensure all wires are on the proper terminals.</li> </ul>
		Display shows OFF but compressor remains ON	<ul style="list-style-type: none"> <li>Check the wiring between the control and contactor.</li> <li>Check for a failed/stuck contactor.</li> <li>Unplug the COMPR wires and measure voltage across the two COMPR terminals. If they measure 24V while the display says OFF, replace control.</li> </ul>
<b>System operates in wrong mode, heating when cooling is requested or vice versa</b>	Check O/B setup	Display continues to show shows HEAT or COOL	<ul style="list-style-type: none"> <li>Replace the control.</li> </ul>
		Control displays current configuration:	<ul style="list-style-type: none"> <li>O means the control will be in COOLING mode when there's 24V on the O terminal.</li> <li>B means the control will be in HEATING mode when there's 24V on the O terminal. In most cases this will only apply to Rheem units.</li> </ul>





Table 5. Troubleshooting. (Continued)

Condition	Procedure	Control Status	Corrective Action
<b>System does not defrost at all</b>	Observe operational mode while heating.	Display shows COOL	<ul style="list-style-type: none"> <li>O/b configured incorrectly. Verify proper setting of O/b input for reversing valve control. The control won't defrost if it "thinks" it's in cooling mode.</li> </ul>
		Display shows HEAT, but no defrost is triggered.	<ul style="list-style-type: none"> <li>Verify sensor placement and readings are correct.</li> <li>Increase the "Enable Temperature" to trigger defrost sooner. Defrost will never be triggered if the coil temperature does not fall below the Enable Temperature. If the Enable Temperature is too high, the system may defrost when it's not necessary.</li> </ul>
<b>System does not defrost completely</b>	Observe defrost cycle	Defrost starts too late. Too much ice is built up before starting a defrost cycle.	<ul style="list-style-type: none"> <li>Verify sensor placement and readings are correct.</li> <li>Increase the "Enable Temperature" to trigger a defrost sooner.</li> <li>Lower the "Defrost Cycle Time" to trigger a defrost sooner. Note this parameter has no effect if an outdoor air sensor is installed as the decision would be made based on the temperature difference between coil and air.</li> </ul>
		Defrost cycle ends too soon. Not all the ice is removed.	<ul style="list-style-type: none"> <li>Verify sensor placement and readings are correct.</li> <li>Increase the "Termination Temperature" to allow the coil to get hotter before a defrost cycle is terminated.</li> <li>Increase the "Maximum Defrost Time" to allow a defrost cycle to run longer.</li> </ul>
<b>System defrosts too much</b>	Observe defrost cycle	Defrost triggers too frequently, even with little or no ice buildup.	<ul style="list-style-type: none"> <li>Verify sensor placement and readings are correct.</li> <li>Decrease the "Enable Temperature" to force the coil to get colder before a defrost is triggered. Increasing this parameter too much can result in not triggering a defrost at all. Verify coil readings with respect to this parameter.</li> <li>Increase the "Defrost Cycle Time" to delay triggering a defrost. Note this parameter has no effect if an outdoor air sensor is installed.</li> </ul>
		Defrost cycle lasts too long. Ice is melted long before the cycle ends.	<ul style="list-style-type: none"> <li>Verify sensor placement and readings are correct.</li> <li>Decrease the "Termination Temperature" to allow the defrost cycle to end with a cooler coil temperature.</li> <li>Decrease the "Maximum Defrost Time" to force the defrost cycle to end sooner.</li> </ul>
<b>No Auxiliary/Emergency Heat</b>	Check configuration parameters	Active W request with no Aux heat output	<ul style="list-style-type: none"> <li>Verify warm weather aux heat lockout isn't active. Adjust "Aux Heat Lockout Temperature" if necessary.</li> <li>Check wiring</li> <li>Replace control</li> </ul>
		No Aux heat output during defrost cycle	<ul style="list-style-type: none"> <li>Check wiring</li> <li>Replace control</li> </ul>

**Table 6. Fault Code Information.**

<b>Fault No.</b>	<b>Description</b>	<b>Corrective Action</b>
1	Internal Communication Fault	<ul style="list-style-type: none"> <li>• Replace control</li> </ul>
2	Internal Fault	<ul style="list-style-type: none"> <li>• Replace control</li> </ul>
3	Low 24V	<ul style="list-style-type: none"> <li>• Measure 24V (R &amp; C). There may be something in the system loading the 24V transformer excessively. If voltage is normal while the fault is currently active, replace the control.</li> </ul>
4	Corrupt Memory	<ul style="list-style-type: none"> <li>• Reset configuration options. Replace the control if the fault persists.</li> </ul>
5	High Pressure Lockout – HPC opened 3 times on a single request.	<ul style="list-style-type: none"> <li>• Investigate refrigerant charge</li> <li>• Check indoor coil for blockage</li> <li>• Check outdoor coil for blockage</li> </ul>
6	Low Pressure Lockout – LPC opened 3 times on a single request.	<ul style="list-style-type: none"> <li>• Investigate refrigerant charge</li> </ul>
7	High Pressure Cutout is currently open	<ul style="list-style-type: none"> <li>• Investigate refrigerant charge</li> <li>• Check indoor coil for blockage</li> <li>• Check outdoor coil for blockage</li> </ul>
8	Low Pressure Cutout is currently open	<ul style="list-style-type: none"> <li>• Investigate refrigerant charge</li> </ul>
9	Coil Sensor Open Circuited	<ul style="list-style-type: none"> <li>• Check the sensor hasn't become unplugged.</li> <li>• Check sensor wiring</li> <li>• Replace sensor</li> </ul>
10	Coil Sensor Shorted	<ul style="list-style-type: none"> <li>• Check for pinched wires</li> <li>• Replace sensor</li> </ul>
11	Air Sensor Open Circuited	<ul style="list-style-type: none"> <li>• Check the sensor hasn't become unplugged.</li> <li>• Check sensor wiring</li> <li>• Replace sensor</li> </ul> <p>Note that this fault will only present itself if the sensor opens after it has been detected. It will be cleared on a reset or power cycle. Running without an air sensor causes the control to operate in a timed defrost mode, which may be desired operation.</p>
12	Air Sensor Shorted	<ul style="list-style-type: none"> <li>• Check for pinched wires</li> <li>• Replace sensor</li> </ul>

**Table 7. Sensor Diagnostics.**

<b>Display</b>	<b>Description</b>
 M37655	Air sensor open circuit or unplugged
 M37656	Air sensor shorted
 M37657	Coil sensor open circuit or unplugged
 M37658	Coil sensor shorted



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