Residential Modulating Heat Pump

Field Reference Guide

Updated August 2023

Johnson Controls

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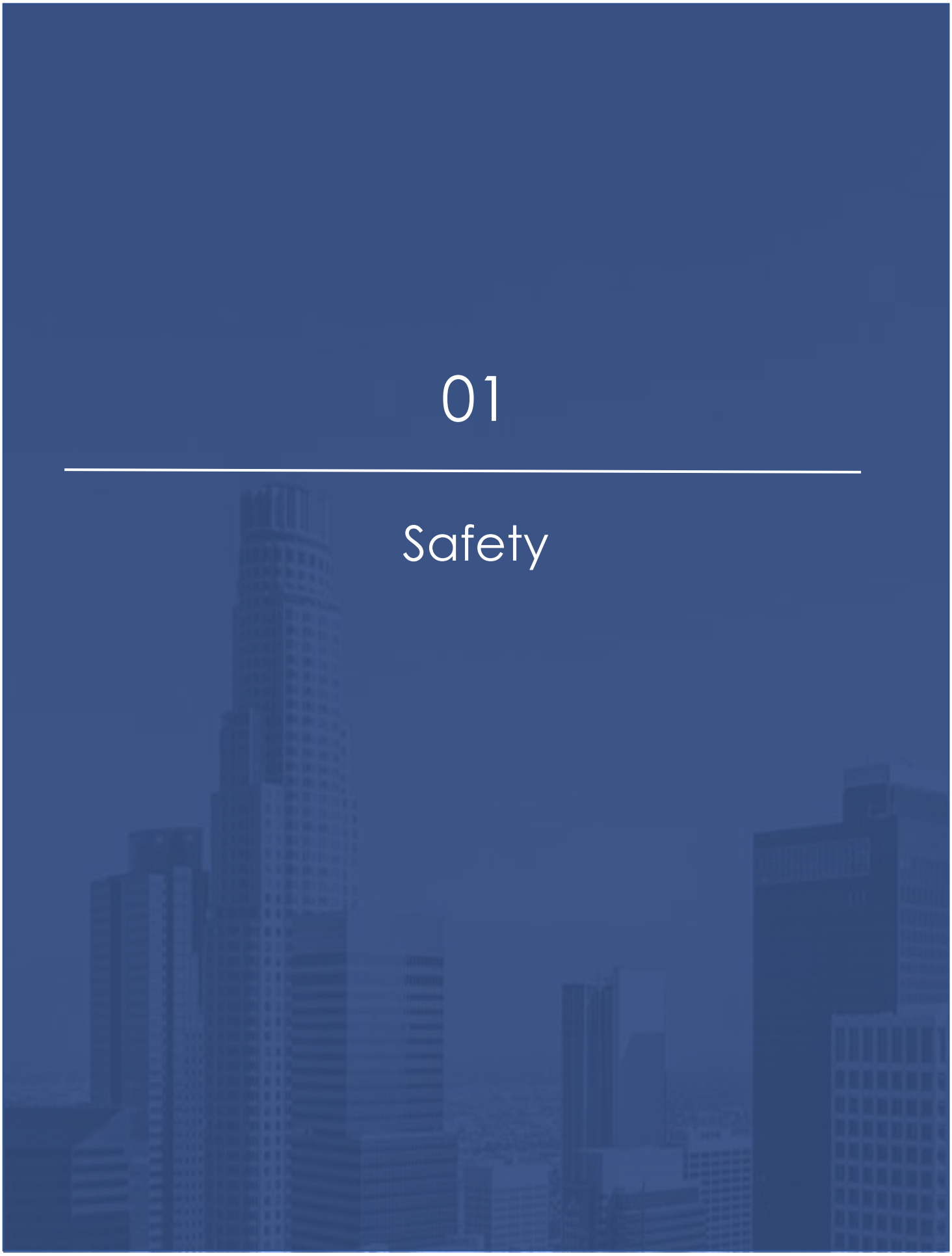
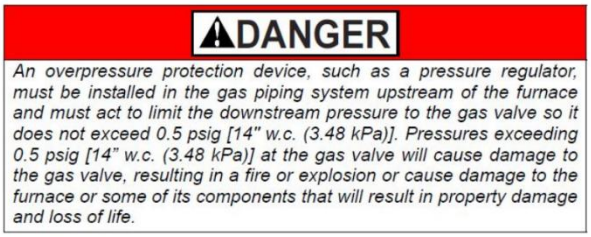


01

Safety

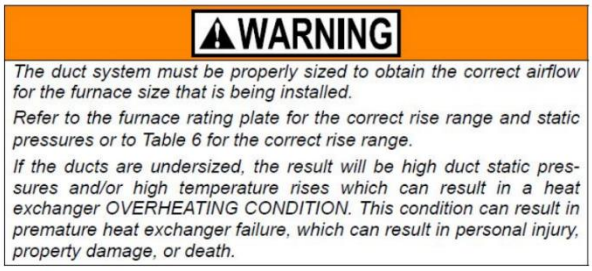
Safety Symbols

Reminder – use this manual in conjunction with the technical literature for each product. This manual Does Not Supersede the Installation Manual and Technical Guide provided with the equipment. Always read and follow all instructions before installing equipment. Understand and pay particular attention to the signal words **DANGER**, **WARNING** or **CAUTION**.



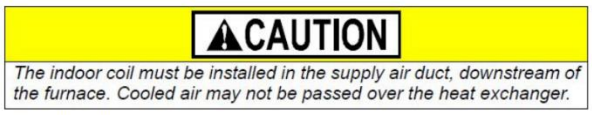
Sample Danger Label

DANGER indicates an imminently hazardous situation which could result in death or serious injury.



Sample Warning Label

WARNING indicates a potentially hazardous situation which could result in death or serious injury.



Sample Caution Label

CAUTION indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices and hazards involving only property damage.

Safety Specific Rules

Follow these specific safety rules for a safe application:

- Air conditioning systems utilizing gas heating can only use natural gas or propane (LP) gasses as an approved fuel. LP applications require installation of the appropriate LP conversion kit. Refer to the unit rating plate or Installation Manual for information on proper inlet and manifold pressures.
- Install air conditioning systems only in locations and positions as specified in the Installation Manual.
- Provide adequate clearances for service, combustion, and ventilation air to the unit. The recommended clearances are specified in the Installation Manual.
- Test for gas leaks as specified in the Installation Manual.
- Only connect the equipment to a duct system which has an external static pressure within the allowable range as specified in the Installation Manual.
- These unites are not to be used for temporary heating or cooling of buildings or structures under construction. Improper installation will shorten equipment life, reduce product efficiency, and void the warranty.
- Always install the systems to operate within the equipment's intended temperature and operating ranges.
- The size of the unit should be based on an acceptable and approved heat load calculation for the structure being conditioned.

Safety Requirements

Follow these safety requirements for a safe application:

- All equipment should be installed in accordance with all national and local building/safety codes and requirements, local plumbing or wastewater codes, and other applicable codes. In the absence of local codes, install in accordance with the most recent National Electrical Code, National Fuel Gas Code and/or Natural Gas and Propane Installation Code (latest editions). Furnaces have been certified to the latest edition of standard ANSI and CSA standards.
- Only approved heat accessories shall be installed on these air conditioning units local.
- Refer to the unit rating plate for the equipment model number, and refer to the Installation Manual for proper air plenum dimensions.
- Provide clearances from combustible materials as listed under Clearances to Combustibles in the Installation Manual and the equipment rating plate.
- Provide clearances for servicing ensuring that service access is allowed for both the burners and indoor fan motor.
- Provides clearances for servicing.
- Failure to carefully read and follow all instructions in this manual and the equipment Installation Manual can result in equipment malfunction, death, personal injury and/or property damage.
- Check the rating plate and power supply to be sure that the electrical characteristics match. All commercial 15 through 25-ton units distributed in North America use nominal 208/230 volts AC, nominal 460 volts AC, or nominal 575 volts AC 3 Phase, 60-Hertz power supply. DO NOT CONNECT THIS APPLIANCE TO A POWER SUPPLY OR A VOLTAGE OTHER THAN THE RANGE SPECIFIED ON THE UNIT DATA TAG.
- The equipment shall be installed so the access panels are readily available, and the electrical components are protected from water infiltration.
- Installing and servicing HVAC equipment can be hazardous due to the electrical and mechanical components. Only trained and qualified personnel should install, repair, or service HVAC equipment. When working on equipment, observe precautions in the manuals and on the labels attached to the unit and other safety precautions that may apply.
- The Installation manual covers minimum requirements needed to conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances. These instructions are required as a minimum for safe installation and operation.

General Awareness

Safety is ALWAYS the primary concern for everyone. On the job injuries can be significantly reduced when proper guidelines are followed. Always be aware of all company, local, state and/or OSHA (Occupational Safety and Health Administration) regulations.

Jobsite Safety

Keeping the job site clean of trash, extra tools and equipment will significantly reduce the chance for injuries. Since each job is unique and has its own hazards, all new workers to the area should be made aware of the location of hire and first-aid equipment, fire escape routes, and other dangers.

Hazardous Materials

Many different chemicals and compounds are used in the service and installation of HVAC systems. Please read the directions and use caution along with PPDs whenever handling these materials. Read and understand the MSDS for all materials used.

Confined Spaces

Never enter or work in a confined space without taking the appropriate precautions. Have someone available outside the space ready to assist or summon help if necessary. Even spaces that seem relatively safe can quickly become hazardous if a pipe were to break and fill the space with refrigerant, steam, poisonous fumes or other gasses. Welding or brazing in a confined space is especially hazardous.

Pressure

High pressures have always been part of the HVAC profession. Wear the proper personal protective devices including safety glasses and gloves. Proper hose ratings and manifolds are required for high-pressure refrigerants.

Electrical Safety

Jewelry should be removed prior to any electrical work being performed. Ensure that the equipment disconnect switch removes the primary power source prior to taking resistance readings or disconnecting any wires or connections. Removal of system power should be verified with the voltage function of a multimeter. All electrical safety guidelines should be always followed. Only trained, qualified technicians should perform electrical maintenance, installation, inspections and troubleshooting of electrical equipment.

Electrocution occurs when a current as low as 6 to 200mA flows through the heart, disrupting its normal operation and causing death. Electrical shock is an injury that occurs because of exposure to an electrical current. Inspect all extension cords and power tools regularly. Fuses and circuit breakers are designed to protect equipment, not people. For personal electrical protection, GFCI or Ground Fault Circuit Interrupters are highly recommended.

Lock-Out Tag-Out

OSHA Standards cover the servicing and maintenance of machines and equipment, in which unexpected energizing or startup of the machines or equipment, or release of stored energy, could cause injury to employees.

These standards establish minimum requirements for the control of such hazardous energy. To ensure safety, put a lock that is tagged with the technician’s name on the electrical disconnect or breaker of the equipment or circuit which is being serviced.

Be aware of others who may be working on the same circuit or other circuits served by the same electrical panel. The technician should also be aware that other technicians may not have used the proper Lock-Out, Tag-Out procedures.

Fire Safety & Burns

While brazing, keep the area clear of combustible material or use a heat shield to help reduce risk of fire.

Check equipment regularly and never try to modify or repair regulators.

While servicing the refrigeration circuit, improper use of equipment and tools can result in serious burns that are associated with refrigerants. This may include frostbite, which is a deep tissue injury. Proper personal protection devices must be in use when servicing the refrigeration system.

Personal Safety

Personal safety always includes remaining aware of the surroundings, using properly maintained tools, and correct use of items designed for personal protection.

Personal Protection Devices (PPD)

- Hard Hat: Hard hats must be worn when there is a danger of head injury.
- Safety Glasses: Eye protection should be worn at all times while on a job site.
- Gloves: Assist in the prevention of serious injury to the hands from serious cuts as well as injuries from high-pressure gasses such as refrigerants. Rubber gloves can protect the technician's hands from chemicals when inspected and worn properly.
- Safety Shoes: Work shoes with steel toes for foot protection. There are also electrical safety shoes that can aid in protecting the technician against electrical shock and/or electrocution. At a minimum, leather work shoes with rubber soles are required.
- Respirator: Used in a confined space where the air can be dissipated by refrigerant which can cause asphyxiation.
- Safety Harness: Used when working above grade level. Ladders must be tied down. Ensure that PPDs provide the intended protection. They should be inspected regularly, used properly and never altered or modified in any way.

Clothing

Rotating and moving components pose a serious risk. Loose fitting clothing and ties should not be worn when servicing rotating equipment. If any clothing becomes entangled in moving parts, serious injury or death is a likely result.

Jewelry

Serious injury or death can result if jewelry contacts an energized circuit or is caught in moving parts. Leave jewelry at home or in your service bag or service vehicle.

Lifting

To avoid back injuries, always adhere to proper lifting techniques. Be aware of personal limitations and seek help with items that are too heavy to safely lift. A back support belt may provide additional protection.

02

Function Description

Modulating Heat Pump Outdoor Unit Description

Modulating heat pump outdoor units have specialized components that operate together for five-step capacity modulation.

- Inverter
- Speed-controlled compressor
- Speed-controlled outdoor fan motor
- Interface control board

Modulating heat pump outdoor units come in 2-, 3-, 4- and 5-ton capacities, each with their own compressor and fan motor speeds.

Control Compartment

Modulating HP OD Unit Size	Operating Mode	Capacity Step	Compressor Speed	OD Fan Motor Speed
2 ton	Cooling	1	1800 RPM	970 RPM
		2	2400 RPM	
		3	3000 RPM	
		4	3600 RPM	
		5	3600 RPM	
	Heating	1	1800 RPM	
		2	2400 RPM	
		3	3000 RPM	
		4	3600 RPM	
		5	4800 RPM	
3 ton	Cooling	1	1800 RPM	850 RPM
		2	2400 RPM	
		3	2880 RPM	
		4	3600 RPM	
		5	3900 RPM	
	Heating	1	1800 RPM	
		2	2400 RPM	
		3	2880 RPM	
		4	3600 RPM	
		5	5100 RPM	
4 ton	Cooling	1	1800 RPM	1000 RPM
		2	2580 RPM	
		3	3360 RPM	
		4	4200 RPM	
		5	4800 RPM	
	Heating	1	1800 RPM	
		2	2580 RPM	
		3	3360 RPM	
		4	4200 RPM	
		5	4800 RPM	
5 ton	Cooling	1	1800 RPM	1000 RPM
		2	2580 RPM	
		3	3360 RPM	
		4	4200 RPM	
		5	4800 RPM	
	Heating	1	1800 RPM	
		2	2580 RPM	
		3	3360 RPM	
		4	4200 RPM	
		5	4800 RPM	

Warning: Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter:

- Allow at least two minutes to pass after the inverter is disconnected from AC line voltage.
- Ensure that the green and both the red LEDs on the inverter are not lit.
- Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow).
- Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W.
- Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

Inverter (Cover Removed)

Inverter programming and discrete part numbers are matched to modulating outdoor unit capacity. Mismatching an inverter to the outdoor unit is physically possible but will prevent unit function.

The inverter is mounted over a cutout in the unit control box. The fins of the heat sink on the back of the inverter extend into the outdoor fan air stream to dissipate heat from inverter operation. Several doughnut-shaped, iron core “chokes” are placed on the wiring connecting to the inverter. These chokes suppress electronic “noise” emissions inherent with inverter operation. A plastic cover over the front reduces the technician's risk of making inadvertent contact with high-voltage components of the inverter during unit service.

Before connecting to the inverter, the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is routed through a surface-mounted circuit breaker in the unit control box. This internal circuit breaker provides protection for the components of the modulating outdoor unit; proper electrical grounding, an external means of disconnection and line voltage circuit protection as listed in electrical codes remains applicable to modulating outdoor units.

The inverter and its on-board microprocessor controller are powered by the single-phase 208/230 volts AC applied to the L1 (black) and L2 (yellow) wires of the inverter. The green LED3 on the upper left of the inverter will be lit when 208/230 volts AC is present at L1 and L2.

Determined by communicated commands from the interface control board, the inverter switches the single-phase 208/230 volts AC to the compressor crankcase heater that is connected on the 2-wire (blue) harness at the right edge of the inverter.

The incoming single-phase 208/230 volts AC power is rectified to direct current (DC) by the large capacitors within the inverter. The red LED1 near the bottom-right corner of the inverter is lit when the compressor output circuit, terminals U, V and W, has a charge of 20 volts DC or more. The red LED2 near the left edge of the inverter sub-board is lit when the outdoor fan output circuit, pins R, S and T, has a charge of 20 volts DC or more. Independently for each output circuit, the direct current is manipulated by the inverter to produce a “sine-like” three-phase output of varying frequency and voltage that results in motor speed change.

Component Access with Control Panel Swung Away

The motors of the compressor and the outdoor fan are a brush-less direct current design compatible with the varying “sine-like” three-phase output of the inverter.

Motor starting, stopping and speed change functions are “ramped” by the inverter at a rate change of 1 motor rotation per second, examples:

- The 1000 RPM outdoor fan motor used in 4 ton and 5-ton units requires 16.7 seconds to reach full speed at start-up.
    - The motor is “ramped” from 0 rotations per second to 16.67 rotations per second.
- A capacity step 4 (4200 RPM) start-up of 4 ton and 5-ton units requires 70 seconds for the compressor to reach full speed.
    - The motor is “ramped” from 0 rotations per second to 70 rotations per second.
- As can occur with defrost operation of a 3-ton unit, a compressor speed change from capacity step 1 (1800 RPM) to capacity step 4 (3600 RPM) requires 30 seconds to be completed.
    - The motor is “ramped” from 30 rotations per second to 60 rotations per second.

Mechanically, all compressors used in modulating outdoor units are fully hermetic, have rotary pumping units and utilize R-410A refrigerant. The rotary compressor is directional and pumps only when motor rotation is correct. Inverter-based fault codes and the equalized pressures indication of a compressor not pumping will result if the inverter compressor output wiring is mis-wired.

Outdoor Fan Assembly

Two- and three-ton models use conventional fan blades. Four- and five-ton models use swept wing fan blades. The inverter performs a magnetic braking function at the initiation of each outdoor fan motor start where:

- Rotation induced by wind turning the fan blade of an idle outdoor fan motor is halted.
- It will be observed that there is some brief “rocking” rotation of the outdoor fan motor/blade.

Many inverters protective functions are based on monitoring of the output circuits. The voltage and current draw of the output circuits are measured. Phasing of the output circuits for proper motor rotational direction is confirmed. Through “back EMF” induced on the output circuits, information on motor speed is also received. The measurements and information are compared to a programmed profile of inverter/motor performance for determination of motor run permission, protective motor speed reduction and inverter-based fault codes.

Other inverter protective functions are based on temperature. Protective motor speed reduction/shutdown and inverter-based fault codes occur if the temperature of internal components becomes excessive. The inverter receives ambient temperature information through communication with the interface board. Maximum cooling mode motor speed limitations are initiated at ambient temperatures 109.4 degrees F (43 degrees C) and above. For heating mode, maximum compressor motor speed is increased to 6000 RPM at ambient temperatures below -4 degrees F (-20 degrees F).

The remaining inverter protective function is based on monitoring of the high-pressure switch circuit. The wiring harness of the high-pressure switch (open 650 PSIG/reset 450 PSIG) connects to the HPS pins near the upper-left corner of the inverter. Compressor operation is not permitted when this 12 volts DC circuit is tripped (open). The inverter communicates trips of the HPS circuit to the interface control board for determination of anti-short cycle delay for compressor re-start and lockouts.

The inverter-to-interface control board communication wiring harness connects to the A+, C and B pins near the upper-left corner of the inverter. C is the negative, B- is the lower positive and A+ is the higher positive of the DC communication circuit. With the inverter powered and the communication wiring harness removed (open circuit), field measurements of C pin to B- pin voltage will read approximately 2.43 volts DC and C pin to A+ pin voltage will read approximately 2.68 volts DC.

With the communication wiring harness in place and inverter-to-interface control board communication ongoing, field measurements of C to B- voltage will read 1.46 to 2.40 volts DC (pulsing) and C to A+ voltage will read 1.30 to 2.10 volts DC (pulsing). Inverter operation stops any time communication with the interface control board is lost for more than 60 seconds.

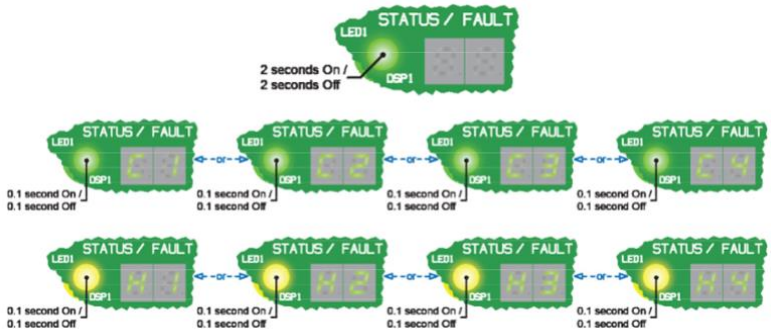
A summary of data exchanged through communication:

- Sent from the inverter to the interface control board.
  - Outdoor unit model information
  - Compressor output circuit information
    - Voltage, current draw and motor speed feedback
  - HPS circuit trip
  - Inverter-based fault codes
- Received by the inverter from the interface control board.
  - Compressor speed commands
    - Enable/disable, target speed and “ramping” (rate of RPM increase/decrease between modulation steps)
  - Outdoor fan speed commands
    - Enable/disable and target speed.
  - Compressor crankcase heater on/off command
  - “Clear Faults” command
  - Ambient temperature
  - Discharge line temperature (not currently used for inverter-based functions)

Inverter output with resulting motor speed/system capacity is determined by communicated commands from the interface control board and may be modified by inverter protective functions.

The interface control board is mounted in the lower portion of the control box below the inverter. Field-installed 24 volts AC control wiring connections to the modulating outdoor unit are made through the pigtail harness connected to the pins near the lower-left edge of the interface control board. Several doughnut-shaped “chokes” are placed on the wiring connecting to the interface control board. These chokes suppress electronic “noise” emissions inherent with inverter operation.

The interface control board is powered by 24 volts AC from the indoor unit transformer; the C pin is 24 volts AC common referenced to cabinet ground, the R pin is 24 volts AC hot. The STATUS/FAULT indicators on the upper-center, the tricolor LED1 and dual seven-segment DSP1 will be lit approximately 2 seconds after the interface control board is powered by more than 12.0 volts AC. The 5-minute compressor anti-short cycle delay also begins with interface control board power-up. The illustrations below are examples of STATUS/FAULT indicators at interface control board power-up when there are no faults active.

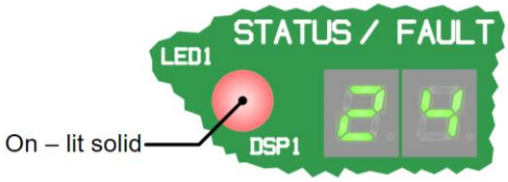


The STATUS/FAULT indication updates approximately 2 seconds after changes in operational status or fault occurrence.

Voltage to the C and R pins is also measured by the interface control board. If there is between 19.2 +/- 0.1 volts AC and 16.0 +/- 0.1 volts AC for a duration of 0.125 seconds or longer, the interface control board will not permit additional output. If between 19.2 +/- 0.1 volts AC and 16.1 +/- 0.1 volts AC to the C and R pins is maintained for a duration of 2 seconds or longer, the associated STATUS/FAULT indicator is displayed and enters the interface control board fault history. If there is between 16.0 +/- 0.1 volts AC and approximately 12.0 volts AC for a duration of 0.125 seconds or longer, the interface control board will not permit any output.

If between 16.0 +/- 0.1 volts AC and approximately 12.0 volts AC to the C and R pins is maintained for a duration of 2 seconds or longer, the associated STATUS/FAULT indicator is displayed and enters the interface control board fault history. Output operation and operational STATUS/FAULT indication can resume once there is more than 19.2 +/- 0.1 volts AC to the C and R pin for a duration of 0.125 seconds or longer and the output anti-short cycle delay (ASCD) timer expires.

In modulating heat pump outdoor units, the 24 volts AC thermostat first stage heating/first stage cooling call connects to the Y1 input pin, and the 24 volts AC second stage heating/second stage cooling call connects to the Y2 input pin. The 24 volts AC thermostat third stage heating/auxiliary heat call connects to the W input pin. The 24 volts AC thermostat call for reversing valve positioning must be configured to be energized for cooling mode and connects to the O input pin. The Y2OUT pin connects to the indoor unit so that indoor blower speed/airflow volume is increased when 24 volts AC output is present. The input pins are monitored so that errors in wiring result in STATUS/FAULT indication.



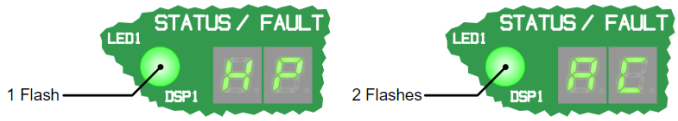
W1OUT and W2OUT pins provide 24 volts AC output for control of the auxiliary/supplemental heat of the heat pump system. In operating sequences that utilize the auxiliary/supplemental heat, W1OUT is energized first and W2OUT can only be energized after 15 minutes with W1OUT energized. The specific field-installed wiring connections for W1OUT and W2OUT depend on the indoor unit supplemental heat:

- Air handlers with single-stage electric heat accessories
  - The W1OUT pin connects to W1 of the air handler so that operation of electric heat is initiated when 24 volts AC output is present.
  - The W2OUT pin has no connection, and the wire of the pigtail harness is taped off
- Gas furnaces with two-stage heat control input
  - The W1OUT pin connects to W1 of the gas furnace so that operation of first stage gas heat is initiated when 24 volts AC output is present.
  - The W2OUT pin connects to W2 of the gas furnace so that operation of second stage gas heat is initiated when 24 volts AC output is present.

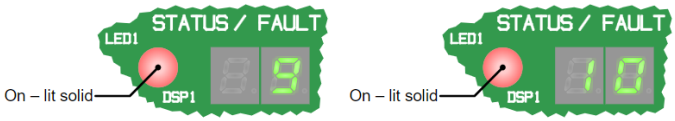
The wiring harness of outdoor unit components are connected to the pins near the left edge interface control board.

A “trace voltage” is utilized at the RVG and RV output pins for the 24 volts reversing valve coil of heat pump units. When the reversing valve coil (3500Ω or less) is connected to the RVG and RV pins at board power-up, the trace voltage drops to zero and the interface control board is configured for heat pump operation. When there is no connection (open circuit/more than 3500Ω) to the RVG and RV pins at board power-up, the trace voltage remains, and the interface control board is configured for air conditioning operation. The current configuration of the interface control board is displayed through the manually initiated TEST pin feature.

The RVG pin connects by circuit trace to the C pin to provide 24 volts AC common for the heat pump reversing valve coil. Switched from the R pin through an on-board relay, the RV pin provides 24 volts AC output to energize the heat pump reversing valve coil during cooling mode and the defrost cycle. It should be noted that, regardless of interface control board configuration, there will be RV output whenever there is input to the O pin.



Required for heat pump operation, the ambient (outdoor air temperature) sensor is mounted to the exterior of the outdoor unit cabinet and connects to the AMBIENT pins. The Type 3, negative temperature coefficient thermistor ambient sensor has an increase in resistance as the sensed temperature decreases. With the upper pin negative and the lower pin positive of the 0 to 5.25 volts DC circuit, the interface control board measures voltage through the sensor at the AMBIENT pins to determine ambient temperature for use in operating sequences. Refer to the sensor temp/VDC/ resistance table (on the following page) for the range of interface control board pin-to-pin voltage readings per sensor temperature and sensor fault thresholds.



Residential Modulating Heat Pump

Sensor Temperature vs. Volts DC vs. Resistance

Note for Field usage: expect reading variances up to +/- 5% due to inherent accuracy tolerances of test instruments.

Temperature °F	Pin-to-Pin Volts DC	Resistance Ω	Temperature °F	Pin-to-Pin Volts DC	Resistance Ω
Open Circuit	5.25	Infinite	120	1.43	3757
-45 or less	5.10 or more	35000 or more	1.25	1.33	3381
			1.30	1.23	3047
-25	5.00	196871	135	1.13	2750
-20	4.95	165487	140	1.05	2487
-15	4.90	139576	145	0.96	2251
-10	4.84	118108	150	0.89	2041
-5	4.77	100260	155	0.82	1854
0	4.70	85371	160	0.76	1686
5	4.62	72910	165	0.70	1535
10	4.53	62449	170	0.64	1400
15	4.43	53640	175	0.59	1278
20	4.32	46200	180	0.55	1168
25	4.20	39898	185	0.51	1069
30	4.07	34545	190	0.47	980
35	3.94	29986	195	0.43	899
40	3.80	26092	200	0.40	826
45	3.65	22758	205	0.37	760
50	3.49	19896	210	0.34	700
55	3.34	17434	215	0.32	646
60	3.18	15310	220	0.30	596
65	3.01	13474	225	0.27	551
70	2.85	118883	230	0.25	510
75	2.69	10501	235	0.24	470
80	2.53	9299	240	0.22	438
85	2.37	8250	245	0.20	406
90	2.22	7334	250	0.19	377
95	2.07	6531	255	0.18	351
100	1.93	5827	260	0.17	327
105	1.80	5208	360 or more	0.05 or less	90 or less
110	1.67	4663			
115	1.55	4182	Short circuit	0.00	0

Open circuit fault for AMBIENT, COIL and DIS sensors.

Short circuit fault for AMBIENT and COIL sensors.

Short circuit fault for DIS sensor.

Also required for both air conditioning and heat pump operation, the low-pressure switch is mounted to the suction line of the outdoor unit and connects to the LPS pins. The low-pressure switch opens at 7 PSIG and resets at 22 PSIG. With the lower pin 24 volts AC hot from the R pin and the upper pin the input through the low-pressure switch, the interface control board receives information on low suction pressure for use in compressor protective functions.

The interface control board does not utilize (“ignores”) the LPS input under the following conditions:

- When there is no compressor operation
- The first 120 seconds (about 2 minutes) following the initiation of compressor operation.
- During the heat pump defrost cycle
- The first 120 seconds (about 2 minutes) following the completion of the heat pump defrost cycle.
- When the sensed ambient temperature is below 15°F
- During TEST mode

Either a soft lockout or hard lockout low pressure fault is initiated when input through the low-pressure switch is lost (there is less than 12.0 volts AC to the upper LPS pin) for more than 5 seconds with compressor operation outside of the above circumstances. Details of soft lockout and hard lockout conditions and interface control board responses are discussed in a later section.

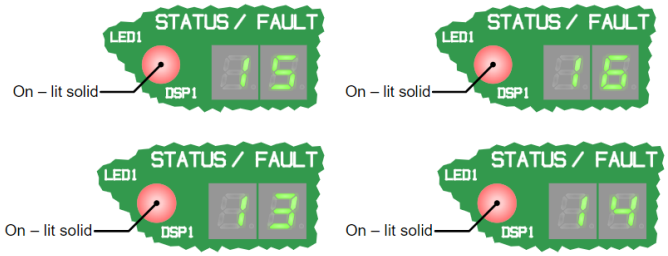
Factory-included for heat pump outdoor units, the discharge sensor is mounted to the discharge line near the compressor and connects to the DIS pins. The functions and fault indications associated with the discharge sensor are only utilized when it is present.

The interface control board considers a discharge sensor present if at any time following power-up there is a resistance of 350,000Ω or less between the DIS pins. The Type 3, negative temperature coefficient thermistor discharge line sensor has an increase in resistance as the sensed temperature decreases.

With the upper pin negative and the lower pin positive of 0 to 5.25 volts DC, the interface control board measures voltage through the sensor at the DIS pins to determine discharge line temperature for use in compressor protective functions. Either a soft lockout or hard lockout discharge temperature fault is initiated under the following circumstances:

- Discharge line temperature is more than 248°F for a continuous 30 second period during compressor operation.
- Following the first 8 minutes of compressor operation, discharge line temperature is less than 70°F for a continuous 60-minute period during compressor operation.
- Following the first 15 minutes after the completion of the heat pump defrost cycle, discharge line temperature is less than 70°F for a continuous 60-minute period during compressor operation.

Details of soft lockout and hard lockout conditions and interface control board responses are discussed in a later section. Refer to the sensor temp/VDC/resistance table for the range of interface control board pin-to-pin voltage readings per sensor temperature and sensor fault thresholds.

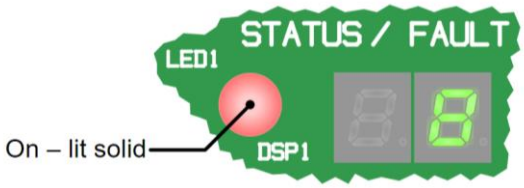


Required for heat pump heating mode operation, the outdoor coil liquid temperature sensor is mounted to the outdoor coil heating mode liquid entrance circuitry and connects to the COIL pins. The Type 3, negative temperature coefficient thermistor coil sensor has an increase in resistance as the sensed temperature decreases.

With the upper pin negative and the lower pin position of the 0 to 5.25 volts DC circuit, the interface control board measures voltage through the sensor at the COIL pins to determine outdoor coil temperature for use in heat pump defrost sequences. Refer to the sensor temp/VDC/resistance table for the range of interface control board pin-to-pin voltage readings per sensor temperature and sensor fault thresholds.

The inverter-to-interface control board communication wiring harness connects to the A+, C, and B- pings near the upper-left corner of the interface control board. C is the negative, B- is the lower positive and A+ is the higher positive of the DC communication circuit. With the interface control board powered and the communication wiring harness removed (open circuit), field measurements of C pin to B- pin voltage will read approximately 2.50 volts DC and C pin to A+ pin voltage will read approximately 2.75 volts DC.

With the communication wiring harness in place and inverter-to-interface control board communication ongoing, field measurements of C to B- voltage will ready 1.30 to 2.10 volts DC (pulsing) and C to A+ voltage will read 1.46 to 2.40 volts DC (pulsing). Inverter operation stops any time communication with the interface control board is lost for more than 60 seconds. The interface control board displays the associates STATUS/FAULT indicator any time communication with the inverter is lost for more than 60 seconds.



A summary of data exchanged through communication:

- Sent by the interface control board to the inverter
  - Compressor speed commands
    - Enable/disable, target speed and “ramping” (rate of RPM increase/decrease between modulation steps)
  - Outdoor fan speed commands
    - Enable/disable and target speed
  - “Clear Faults” command
  - Ambient temperature
  - Discharge line temperature (not currently used for inverter-based functions)
    - Enable/disable and target speed
  - Compressor crankcase heater On/Off command
- Received by the interface control board from the inverter
  - Outdoor unit model information
  - Compressor output circuit information
    - Voltage, current draw, and motor speed feedback
  - Outdoor fan output circuit information
    - Voltage, current draw, and motor speed feedback
  - HPS circuit trip
  - Inverter-based fault codes

The HOT HEAT PUMP pins with jumper-tab near the bottom-center of the interface control board allow selections for the point where the Y2OUT output is energized in heat pump heating mode sequences. With the HOT HEAT PUMP jumper-tab in the OFF position or not connected, the Y2OUT output is energized to increase indoor blower speed/airflow volume when the compressor operates in heating mode at capacity step 3 or greater. With the HOT HEAT PUMP jumper-tab in the ON position, the Y2OUT output is energized to increase indoor blower speed/airflow volume when the compressor operates in heating mode at capacity step 4 or greater.

The DEFROST TEMP pins with jumper-tab near the bottom-center of the interface control board allow selections for the heat pump defrost termination temperature.

The defrost termination temperature will be 50 degrees F if the DEFROST TEMP jumper-tab is not connected. Detailed in a later section, attention to an application appropriate DEFROST TEMP selection should be made since the conditions of defrost cycle termination determine the initiation of the successive defrost cycle.

The TEST MODE pins with jumper-tab, the TEST pins, Last Error Button and STATUS/FAULT indicators of the interface control board allow technician interaction for startup and service procedures. Technician interaction with the interface control board is detailed in a later section.

03

Application Guidelines

Application Guidelines

There are several application considerations for modulating heat pump outdoor units that differ from conventional single-speed compressor outdoor units.

Prior to installation, the homeowner should be informed that systems with modulating heat pump outdoor units have extended run times compared to those with conventional single-speed compressor outdoor units. The extended run times at reduced capacity and reduced power consumption will typically result in more consistent comfort.

Modulating heat pump outdoor units are not intended for high ambient cooling applications. Modulating heat pump outdoor units utilize an inverter and protective functions to prevent excessive temperature at internal inverter components are introduced at **109.4°F (43°C)** ambient temperature. The inverter protective functions reduce or limit compressor and outdoor fan motor speed during high ambient cooling operation. Compared to a conventional system, this results in more significant reductions in system cooling capacity at high ambient temperatures.

Modulating Heat Pump Outdoor Units	95°F Ambient	115°F Ambient	125°F Ambient
2-Ton Unit Indoor conditions 750 CFM 80°F	24,100 BTUs	18,000 BTUs	15,000 BTUs
3-Ton Unit Indoor conditions 1200 CFM 80°F DB/67°F WB	36,700 BTUs	25,000 BTUs	19,300 BTUs
4-Ton Unit Indoor conditions 1600 CFM 80°F DB/67°F WB	48,000 BTUs	34,500 BTUs	27,900 BTUs
5-Ton Unit Indoor conditions 2000 CFM 80°F DB/67°F WB	58,000 BTUs	42,500 BTUs	34,800 BTUs

The inverter utilized in modulating heat pump outdoor units requires a utility-generated quality electric power supply; it is not recommended to power modulating heat pump outdoor units from local, gas-powered generators.

Also, the modulating heat pump outdoor unit must not be powered from the “wild leg” (having 190 volts AC to ground) in locations that have delta-wound three-phase power transformers.

Modulating heat pump outdoor units have measures to suppress electronic “noise” emission and reception at the inverter. Additional suppression measures may be required in applications that are sensitive to electronic “noise” or in applications that have high levels of ambient electronic “noise”.

Modulating heat pump outdoor units have requirements and provisions to properly operate with the remainder of the split system.

Only listed indoor equipment matches are approved for use with a modulating heat pump outdoor unit. Either a standard ECM or a Premium ECM indoor blower motor is utilized in all listed gas furnace and air handler indoor equipment matches. Modulating heat pump outdoor units require appropriately matched thermal expansion valves be used at the indoor coil.

As detailed in the unit Installation Instructions, the field-installed refrigerant lines connecting the modulating outdoor unit to the indoor coil must be properly sized for the needs of a modulating capacity system.

Modulating heat pump outdoor units require 24 volts AC power from the indoor unit transformer, 2-stage heating/cooling heat pump thermostat inputs and provide control outputs for heating staging and indoor fan speed.

Modulating heat pump outdoor units with gas furnace indoor unit **(dual-fuel)** applications require a thermostat, typically with outdoor temperature sensor, to provide switching for heat pump-to-gas heat changeover during heating mode operation.

04

Operation

Introduction

Along with air conditioning or heat pump configuration determined by absence or presence of reversing valve coil connection to the RVG and RV pins, the thermostat inputs normally received by the interface control board determine the operating mode. The normal operating modes are:

- Standby
- Cooling
- Compressor Heating
- Auxiliary/supplemental Heating
- Emergency Heating

Additional sequences within the normal operating modes are detailed later in this Operation section.

- Low Ambient Cooling operation occurs with Cooling mode operation at ambient (outdoor air) temperatures 60°F and below.
- High Ambient Cooling operation occurs with Cooling mode operation at ambient temperatures 109.4°F and above.
- Low Ambient Compressor Heating operation occurs with Compressor Heating and Auxiliary/supplemental Heating mode operation at ambient (outdoor air) temperatures of minus 5°F and below.
- Operation of the defrost cycle is available in heat pump configuration with Compressor Heating and Auxiliary/supplemental Heating operating modes.

The interface control board response to abnormal thermostat inputs is also detailed later in this Operation section.

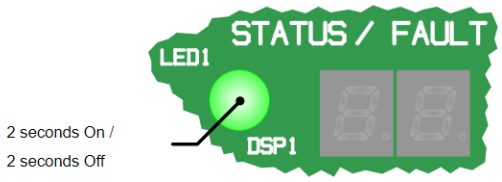
The operating mode descriptions in this section are with the **TEST MODE** jumper-tab in the N (“normal”) position or not connected. The functions with other **TEST MODE** jumper-tab positions are detailed in the later Service Features -TEST MODE jump-tab section.

Standby Mode Operation

The interface control board is powered by 24 volts AC from the indoor unit transformer to the C and R pins, there may be 0 thermostat input but there are no other heating/cooling thermostat inputs to the interface control board and no faults active.

Standby mode operation:

- The RV output, and reversing valve in this heat pump unit, is energized if there is 0 input.
- Through communicated command from the interface control board to the inverter, the compressor crankcase heater is cycled on 10 minutes/off 10 minutes when the compressor has been off for a period of 20 minutes or more and ambient temperature is below 55°F.
- If available and the conditions described in Cooling Operation of Compressor Heating Operation sections permit, data from the previous cooling or compressor heating cycle is stored.
    - The compressor capacity step at the end of the operation cycle is stored.
    - The “load” indicator for the operating cycle is stored.
    - Overall cooling or compressor heating cycle runtime is stored.
- The STATUS/FAULT will display the Standby indicator.



Cooling Mode Operation

The interface control board is powered by 24 volts AC from the indoor unit transformer to the C and R pins, there is 0, Y1, and/or Y2 thermostat input to the interface control board, ambient temperature is more than 60°F but less than 109.4°F, and there are no fault codes active.

The interface control board determines the compressor capacity step at the initiation of cooling mode operation based on stored data from the previous cooling cycle, Y1 and/or Y2 thermostat input and ambient temperature. A calibration cooling cycle occurs when the stored data from the previous cooling cycle is empty (cleared).

Intended to assure the cooling demand is satisfied, only capacity step increase is allowed during cooling mode operation. When conditions permit, capacity step decrease is implemented at the initiation of the next cooling cycle.

During the cooling cycle, the interface control board records and stores the following data:

- Cooling capacity step runtime
- Overall cooling cycle runtime

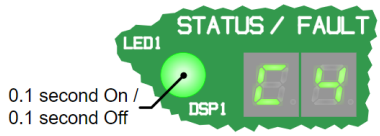
Calibration Cooling Cycle

The purpose of calibration cooling cycle is to gather data for the next cooling cycle initiation. A calibration cooling cycle occurs when the stored data from the previous cooling cycle is empty (cleared). The interface control board empties (clears) the stored data from the previous cooling cycle when either:

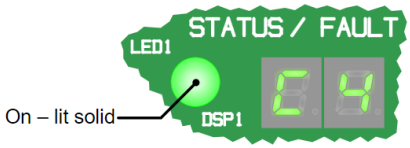
- Following interface control board power-up.
- The 0-thermostat input is removed from the interface control board (heat pump configuration).

Calibration Cooling Cycle operation from initiation of Y1 and/or Y2 thermostat input:

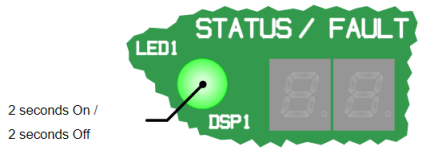
- The RV output, and reversing valve in heat pump units, is energized with 0 thermostat input.
- The Y2OUT output is energized for increased indoor blower speed/airflow volume.
- Recording of overall cooling cycle runtime begins.
- The compressor anti-short cycle delay (ASCD) is active if less than 5 minutes have elapsed since interface control board power-up or since previous compressor heating operation ended.
    - The STATUS/FAULT will display the cooling mode ASCD indicator with compressor capacity step 4 indicator.



- With the compressor ASCD expired, the interface control board sends an outdoor fan speed command to the inverter.
    - The inverter brakes, starts and ramps the outdoor fan motor to the commanded speed.
        - The inverter sends outdoor fan motor speed feedback information to the interface control board.
    - The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator.



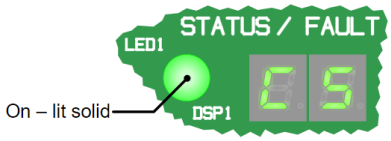
- With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
    - The inverter starts and ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
    - Recording of cooling capacity step 4 runtime begins.
- If Y1 and Y2 thermostat inputs are removed before capacity step 4 runtime reaches 60 minutes.
    - The interface control board sends a compressor off command to the inverter.
        - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
    - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
        - The inverter ramps down and stops the outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board. With both the compressor and outdoor fan motor confirmed to be stopped.
    - Capacity step 4 at the end of the operating cycle is stored.
    - A “low load” indicator for the operating cycle is stored.
    - Overall cooling cycle runtime is stored.
    - The Y2OUT output is de-energized.
    - The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
    - The interface control board enters. Standby mode and the STATUS/FAULT will display the Standby mode indicator.



- If capacity step 4 runtime reaches 60 minutes or more with AMBIENT temperature more than 110° F
    - Cooling capacity step 4 operation continues (with High Ambient Cooling compressor motor speed limitations)
        - If Y1 and Y2 thermostat inputs are then removed. The interface control board sends a compressor off command to the inverter.
    - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
        - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
    - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board.
        - With both the compressor and outdoor fan motor confirmed to be stopped:

1. Capacity step 4 at the end of the operating cycle is stored.
2. A “low load” indicator for the operating cycle is stored.
3. Overall cooling cycle runtime is stored.
4. The Y2OUT output is de-energized.
5. The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
6. The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.

- If capacity step 4 runtime reaches 60 minutes with AMBIENT temperature 110 degrees F or less
  - The interface control board sends compressor capacity step 5 command to the inverter.
    - The inverter ramps the compressor motor to the commanded speed. The inverter sends compressor motor speed feedback information to the interface control board.
    - The inverter continues to operate the outdoor fan motor at the commanded speed.
  - With proper compressor operation confirmed.
    - Cooling capacity step 4 runtime data is cleared.
    - Recording of cooling capacity step 5 runtime begins.
    - Recording of overall cooling cycle runtime continues.
    - The Y2OUT output remains energized for increased indoor blower speed/airflow volume.
    - The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 5 indicator.

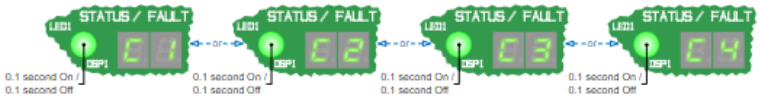


- If Y1 and Y2 thermostat inputs are then removed.
  - The interface control board sends a compressor off command to the inverter.
    - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
  - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
    - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board. With both the compressor and outdoor fan motor confirmed to be stopped.
  - Capacity step 5 at the end of the operating cycle is stored.
  - A “high load” indicator for the operating cycle is stored.
  - Overall cooling cycle runtime is stored.
  - The Y2OUT output is de-energized.
  - The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
  - The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.

Normal Cooling Cycle

A “normal” cooling cycle occurs when stored data from the previous cooling cycle is available. “Normal” Cooling Cycle operation from initiation of Y1 and Y2 thermostat input:

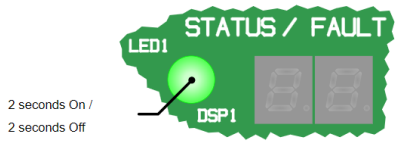
- The interface control board determines the compressor capacity step at the initiation of the “normal” cooling cycle based on the capacity step stored at the end of the previous operating cycle and the presence of Y1 and Y2 thermostat input.
    - The initiation capacity step is reduced by one step from the capacity step stored at the end of the previous operating cycle if both.
        - There is only Y1 thermostat input.
        - A “low load” indicator was stored for the previous operating cycle. Capacity step 4 is the minimum decrease possible at the initiation of the compressor operating cycle.
    - The initiation capacity step is the same as the capacity step stored at the end of the previous operating cycle if both.
        - There is only Y1 thermostat input.
        - A “high load” indicator was stored for the previous operating cycle. Exception: If capacity step 5 was stored at the end of the previous operation cycle, capacity step 4 is the maximum allowed at the initiation of the compressor operating cycle.
    - The initiation capacity step is increased by one step from the capacity step stored at the end of the previous operating cycle if both.
        - There is Y2 thermostat input within 2 seconds from when Y1 thermostat input was received or there is only Y2 thermostat input.
        - A “low load” indicator was stored for the previous operating cycle. Capacity step 4 is the maximum increase allowed at the initiation of the compressor operating cycle.
    - The initiation capacity step is increased by two steps from the capacity step stored at the end of the previous operating cycle if both.
        - There is Y2 thermostat input within 2 seconds from when Y1 thermostat input was received or there is only Y2 thermostat input.
        - A “high load” indicator was stored for the previous operating cycle. Capacity step 4 is the maximum increase allowed at the initiation of the compressor operating cycle.
- The RV output, and reversing valve in heat pump units, is energized with 0 thermostat input.
- The Y2OUT output is energized for increasing indoor blower speed/airflow volume if compressor cooling capacity steps 3 or 4 are determined for initiation of the “normal” cooling cycle.
- Recording of overall cooling cycle runtime begins.
- The compressor anti-short cycle delay (ASCD) is active if less than 5 minutes have elapsed since previous compressor operation ended.
    - The STATUS/FAULT will display the cooling mode ASCD indicator with compressor capacity step indicator determined for initiation of the “normal” cooling cycle.



- With the compressor ASCD expired, the interface control board sends an outdoor fan speed command to the inverter.
    - The inverter brakes, starts and ramps the outdoor fan motor to the commanded speed.
        - The inverter sends outdoor fan motor speed feedback information to the interface control board.
    - The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step indicator determined for initiation of the “normal cooling cycle.

- With proper outdoor fan motor operation confirmed, the interface control board then sends the determined initiation compressor capacity step command to the inverter.
    - The inverter starts and ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
- With proper compressor motor operation confirmed.
    - The interface control board sends a compressor crankcase heater off command to the inverter.
        - If not already off from Standby operation, the inverter switches off the compressor crankcase heater.
    - Recording of the current cooling capacity step runtime begins.
- Capacity step 4 increase during the “normal” cooling cycle due to capacity step runtime:
    - If capacity step 1 through 3 is in operation and the capacity step runtime reaches 15 minutes during the “normal” cooling cycle.
        - The interface control board sends an increased by one step compressor capacity step command to the inverter. The inverter ramps the compressor motor to the commanded speed.
    - The inverter sends compressor motor speed feedback information to the interface control board.
        - The inverter continues to operate the outdoor fan motor at the commanded speed.
        - With AMBIENT temperature more than 110° F, capacity step 4 is the maximum increase allowed during the compressor operating cycle (with High Ambient Cooling compressor motor speed limitations).
    - If capacity step 4 is in operation at an AMBIENT temperature of 110° F or less and capacity step 4 runtime is 30 minutes or more, the interface control board sends a compressor capacity step 5 command to the inverter.
        - The inverter ramps the compressor motor to the commanded speed. The inverter sends compressor motor speed feedback information to the interface control board.
        - The inverter continues to operate the outdoor fan motor at the commanded speed.
    - With proper compressor and outdoor fan motor operation confirmed.
        - The previous cooling capacity step runtime data is cleared.
        - Recording of the newly increased cooling capacity step runtime begins.
        - Recording of overall cooling cycle runtime continues.
        - The Y2OUT output is energized for increased indoor blower speed/airflow volume if compressor cooling capacity steps 3, 4 or 5 are in operation.
        - The STATUS/FAULT of the interface control board will display the newly increased cooling mode compressor capacity step 3 indicator.

- If at any time during the “normal” cooling cycle Y2 thermostat input is removed and Y1 thermostat input remains present.
    - There is no change in the interface control board compressor capacity step command, recording of cooling capacity step runtime and overall cooling cycle runtime continues.
- If at any time during the “normal” cooling cycle both Y1 and Y2 thermostat inputs are removed.
    - The interface control board sends a compressor off command to the inverter.
        - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
    - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
        - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board. With both the compressor and outdoor fan motor confirmed to be stopped.
    - The capacity step at the end of the operating cycle is stored.
    - A “low load” indicator for the operating cycle is stored if overall cooling cycle runtime is less than the previous cycle.
    - A “high load” indicator for the operating cycle is stored if overall cooling cycle runtime is equal to or more than the previous cycle.
    - Overall cooling cycle runtime is stored.
    - The Y2OUT output is de-energized if previously energized for compressor cooling capacity steps 3, 4 or 5 operations.
    - The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
    - The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.



Compressor Heating Mode

The interface control board is powered by 24 volts Ac from the indoor unit transformer to the C and R pins, there is Y1 and/or Y2 thermostat input to the interface control board, ambient temperature is more than -4° F but less than 109.4° F, and there are no fault codes active.

The interface control board determines the compressor capacity step at the initiation of compressor heating mode operation based on stored data from the previous compressor heating cycle, Y1 and/or Y thermostat input and ambient temperature. A calibration compressor heating cycle occurs when the stored data from the previous compressor heating cycle is empty (cleared).

Intended to assure the heating demand is satisfied, only capacity step increase is allowed during compressor heating mode operation. When conditions permit, a capacity step decrease is implemented at the initiation of the next compressor heating cycle.

During the compressor heating cycle, the interface control board records and stores the following data:

- Compressor heating capacity step runtime.
- Overall compressor heating cycle runtime.

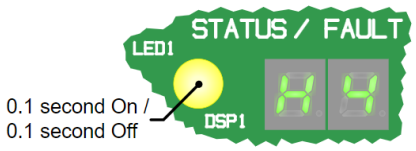
Calibration Compressor Heating Cycle

The purpose of a calibration compressor heating cycle is to gather data for the next compressor heating cycle initiation. A calibration compressor heating cycle occurs when the stored data from the previous compressor heating cycle is empty (cleared). The interface control board empties (clears) the stored data from the previous compressor heating cycle when either:

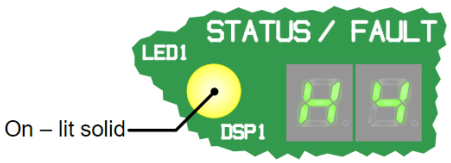
- Following interface control board power-up
- The interface control board receives 0 thermostat input.

Calibration Compressor Heating Cycle operation from initiation of Y1 and/or Y2 thermostat input:

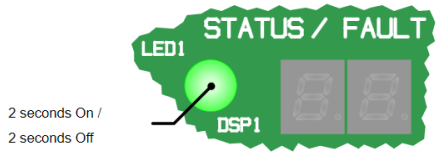
- The RV output, and reversing valve, is de-energized without 0 thermostat input.
- The Y2OUT output is energized for increased indoor blower speed/airflow volume.
- Recording of overall compressor heating cycle runtime begins.
- The compressor anti-short cycle delay (ASCD) is active if less than 5 minutes have elapsed since interface control board power-up or since previous compressor cooling operation ended.
    - The STATUS/FAULT will display the heating mode ASCD indicator with compressor capacity step 4 indicator.



- With the compressor ASCD expired, the interface control board sends an outdoor fan speed command to the inverter.
    - The inverter brakes, starts and ramps the outdoor fan motor to the commanded speed
        - The inverter sends outdoor fan motor speed feedback information to the interface control board.
    - The STATUS/FAULT of the interface control board will display the compressor heating mode capacity step 4 indicator.



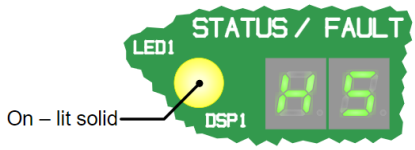
- With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
    - The inverter starts and ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
- With proper compressor motor operation confirmed.
    - The interface control board sends a compressor crankcase heater off command to the inverter.
        - If not already off from Standby operation, the inverter switches off the compressor crankcase heater.
    - Recording of compressor heating capacity step 4 runtime begins.
    - The defrost cycle is enabled – if conditions require, the interface control board will perform the defrost cycle.
- If Y1 and Y2 thermostat inputs are removed before capacity step 4 runtime reaches 60 minutes.
    - The interface control board sends a compressor off command to the inverter.
        - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
    - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
        - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board. With both the compressor and outdoor fan motor confirmed to be stopped.
    - Capacity step 4 at the end of the operating cycle is stored.
    - A “low load” indicator for the operating cycle is stored.
    - Overall compressor heating cycle runtime is stored.
    - The Y2OUT output is de-energized.
    - The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
    - The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.



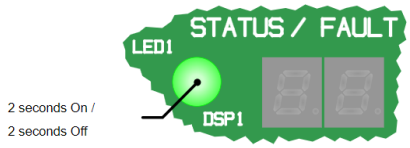
- If the capacity step 4 runtime reaches 60 minutes or more with AMBIENT less than -5° F.
    - Compressor heating capacity step 4 operation continues with Low Ambient Compressor Heating compressor motor speed increase.
        - If Y1 and Y2 thermostat inputs are then removed. The interface control board sends a compressor off command to the inverter.
    - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
        - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
    - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board.
        - With both the compressor and outdoor fan motor confirmed to be stopped.

1. Capacity step 4 at the end of the operating cycle is stored.
2. A “low load” indicator for the operating cycle is stored.
3. Overall compressor heating cycle runtime is stored.
4. The Y2OUT output is de-energized.
5. The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
6. The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.

- If capacity step 4 runtime reaches 60 minutes with AMBIENT temperature more than -5° F.
    - The interface control board sends a compressor capacity step 5 command to the inverter.
        - The inverter ramps the compressor motor to the commanded speed. The inverter sends compressor motor speed feedback information to the interface control board.
        - The inverter continues to operate the outdoor fan motor at the commanded speed.
    - With proper compressor operation confirmed.
        - Compressor heating capacity step 4 runtime data is cleared.
        - Recording of compressor heating capacity step 5 runtime begins.
        - Recording of overall Compressor heating cycle runtime continues.
        - The defrost cycle remains enabled – if conditions require, the interface control board will perform the defrost cycle.
        - The Y2OUT output remains energized for increased indoor blower speed/airflow volume.
        - The STATUS/FAULT of the interface control board will display the heating mode compressor capacity step 5 indicator.



- If Y1 and Y2 thermostat inputs are then removed.
    - The interface control board sends a compressor off command to the inverter.
        - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
    - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
        - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board. With both the compressor and outdoor fan motor confirmed to be stopped.
    - Capacity step 5 at the end of the operating cycle is stored.
    - A “high load” indicator for the operating cycle is stored.
    - Overall compressor heating cycle runtime is stored.
    - The Y2OUT output is de-energized.
    - The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
    - The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.



“Normal” Compressor Heating Cycle

A “normal” compressor heating cycle occurs when stored data from the previous compressor heating cycle is available.

“Normal” Compressor Heating Cycle operation from initiation of Y1 and/or Y2 thermostat input:

- The interface control board determines the compressor capacity step at the initiation of the “normal” compressor heating cycle based on the capacity step stored at the end of the previous operating cycle and the presence of Y1 and/or Y2 thermostat input.
  - The initiation capacity step is reduced by one step from the capacity step stored at the end of the previous operating cycle if both.
    - There is only Y1 thermostat input.
    - A “low load” indicator was stored for the previous operating cycle. Capacity step 1 is the minimum decrease possible at the initiation of the compressor operating cycle.
  - The initiation capacity step is the same as the capacity step stored at the end of the previous operating cycle if both.
    - There is only Y1 thermostat input.
    - A “high load” indicator was stored for the previous operating cycle. Exception: If capacity step 5 was stored at the end of the previous operating cycle, capacity step 4 is the maximum allowed at the initiation of the compressor operating cycle.
  - The initiation capacity step is increased by one step from the capacity step stored at the end of the previous operating cycle if both.
    - There is Y2 thermostat input within 2 seconds from when Y1 thermostat input was received or there is only Y2 thermostat input.
    - A “low load” indicator was stored for the previous operating cycle. Capacity step 4 is the maximum increase allowed at the initiation of the compressor operating cycle.
  - The initiation capacity step is increased by two steps from the capacity step stored at the end of the previous operating cycle if both.
    - There is Y2 thermostat input within 2 seconds from when Y1 thermostat input was received or there is only Y2 thermostat input.
    - A “high load” indicator was stored for the previous operating cycle. Capacity step 4 is the maximum increase allowed at the initiation of the compressor operating cycle.
- The RV output, and reversing valve, is de-energized without 0 thermostat input.
- The Y2OUT output it energized for increased indoor blower speed/airflow volume if:
  - The HOT HEAT PUMP jumper-tab is in the OFF position (or missing) and compressor heating capacity steps 3 or 4 are in operation.
  - The HOT HEAT PUMP jump-tab is in the ON position and compressor heating capacity step 4 is in operation.
- Recording of overall compressor heating cycle runtime begins.
- The compressor anti-short cycle delay (ASCD) is active if less than 5 minutes have elapsed since previous compressor operation ended.
- The STATUS/FAULT will display the heating mode ASCD indicator with compressor capacity step indicator.

- With the compressor ASCD expired, the interface control board sends an outdoor fan speed command to the inverter.
  - The inverter brakes, starts and ramps the outdoor fan motor to the commanded speed.
    - The inverter sends outdoor fan motor speed feedback information to the interface control board. OBJ
  - The STATUS/FAULT of the interface control board will display the heating mode compressor capacity step indicator.

- With proper outdoor fan motor operation confirmed, the interface control board then sends the determined initiation compressor capacity step command to the inverter.
    - The inverter starts and ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
- With proper compressor motor operation confirmed.
    - The interface control board sends a compressor crankcase heater off command to the inverter.
        - If not already off from Standby operation, the inverter switches off the compressor crankcase heater.
    - Recording of the current compressor heating capacity step runtime begins.
- Capacity step increase during the “normal” compressor heating cycle due to capacity step runtime:
    - If capacity steps 1 through 3 is in operation and the capacity step runtime reaches 15 minutes during the “normal” compressor heating cycle.
        - The interface control board sends an increased by one step compressor capacity step command to the inverter. The inverter ramps the compressor motor to the commanded speed.
    - The inverter sends compressor motor speed feedback information to the interface control board.
        - With AMBIENT temperature less than -5°F, capacity step 4 is the maximum increase allowed during the compressor heating operating cycle (Low Ambient Compressor Heating compressor motor speed increase).
    - If capacity step 4 is in operation with AMBIENT temperature -5°F or more and capacity step 4 runtime is 30 minutes or more, the interface control board sends a compressor capacity step 5 command to the inverter.
        - The inverter ramps the compressor motor to the commanded speed. The inverter sends compressor motor speed feedback information to the interface control board.
        - The inverter continues to operate the outdoor fan motor at the commanded speed.
    - With proper compressor and outdoor fan motor operation confirmed.
        - The previous compressor heating capacity step runtime data is cleared.
        - Recording of the newly increased compressor heating capacity step runtime begins.
        - Recording of overall compressor heating cycle runtime continues.
    - The Y2OUT output is energized for increased indoor blower speed/airflow volume if:
        - The HOT HEAT PUMP jumper-tab is in the OFF position (or missing) and compressor heating capacity steps 3, 4 or 5 are in operation.
        - The HOT HEAT PUMP jumper-tab is on the ON position and compressor heating capacity steps 3, 4 or 5 are in operation.
        - The STATUS/FAULT of the interface control board will display the newly increased cooling mode compressor capacity step indicator.

- If at any time during the “normal” compressor heating cycle Y2 thermostat input is removed and Y1 thermostat input remains present.
    - There is no change to the interface control board compressor capacity step command, recording of heating capacity step runtime and overall heating cycle runtime continues.
- If at any time during the “normal” compressor heating cycle both Y1 and Y2 thermostat inputs are removed.
    - The interface control board sends a compressor off command to the inverter.
        - The inverter ramps down and stops compressor motor output and sends motor speed feedback information to the interface control board.
    - With the compressor confirmed to be stopped, the interface control board sends an outdoor fan off command to the inverter.
        - The inverter ramps down and stops outdoor fan motor output and sends outdoor fan motor speed feedback information to the interface control board. With both the compressor and outdoor fan motor confirmed to be stopped.
    - The capacity step at the end of the operating cycle is stored.
    - A “low load” indicator for the operating cycle is stored if overall compressor heating cycle runtime is less than the previous cycle.
    - A “high load” indicator for the operating cycle is stored if overall compressor heating cycle runtime is less than the previous cycle.
    - Overall compressor heating cycle runtime is stored.
    - The Y2OUT output is de-energized if previously energized for compressor heating capacity steps 3, 4 or 5 operations.
    - The 5-minute compressor anti-short cycle delay (ASCD) timing begins.
    - The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.

Note
If a wiring error or other service issue exists where Y1 thermostat input is not present and Y2 thermostat cycles during compressor heating mode operation: The initiation capacity step is increased by at least one step from the capacity step stored at the end of the previous operating cycle. After a few cycles, this will result in the interface control board determining compressor heating capacity step 4 is to be used at the initiation of every “normal” compressor heating cycle until the stored data from the previous compressor heating cycle is empty (cleared).

Auxiliary/Supplemental Heating Mode

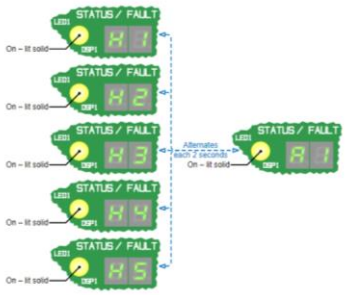
Auxiliary/Supplemental Heating Mode Definition: (Heat Pump Configuration)

The interface control board is powered by 24 volts AC from the indoor unit transformer to the C and R pins, there are 1, Y1, and/or Y2 thermostat inputs to the interface control board and no faults active.

During Auxiliary/supplemental Heating mode, compressor heating operation from Y1 and/or Y2 thermostat input is initiated or continues as detailed in the previous Compressor Heating mode section.

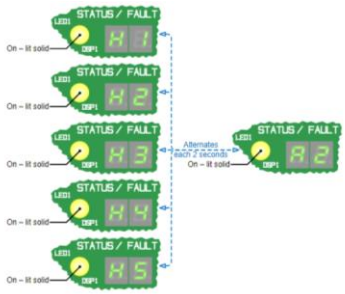
Auxiliary/supplemental Heating mode operation from initiation of W thermostat input:

- The W1OUT output is energized to operate a portion of the indoor unit auxiliary/supplemental heat.
- The 15-minute timer for the W2OUT output begins.
- The STATUS/FAULT will display the heating mode compressor operating capacity step indicator alternating each 2 seconds with the auxiliary/supplemental (W1OUT) output indicator.



If W thermostat input is sustained for 15 minutes or more:

- The W1OUT output remains energized to operate a portion of the indoor unit auxiliary/supplemental heat.
- When the 15-minute timer for the W2OUT output ends.
  - The W2OUT output is energized to operate the remainder of the indoor unit auxiliary/supplemental heat.
  - The STATUS/FAULT will display the heating mode compressor operating capacity step indicator alternating each 2 seconds with the auxiliary/supplemental (W1OUT + W2OUT) output indicator.



When W thermostat input is removed:

- The W1OUT output is de-energized.
  - The 15-minute timer for the W2OUT output is cleared.
- The W2OUT output is de-energized if previously energized.
- If Y1 and/or Y2 thermostat remain present, the STATUS/FAULT will display the heating mode compressor operating capacity step indicator.

- If both Y1 and Y2 thermostat inputs are also removed:
  - The interface control board ends compressor heating operation in the same manner as Compressor Heating mode.
  - The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.

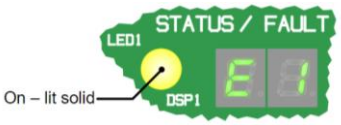
Emergency Heating Mode

The interface control board is powered by 24 volts AC from the indoor unit transformer to the C and R pins, there is only W input to the interface control board and no faults active.

Since there is no Y1 and/or Y2 thermostat input during Emergency Heating mode, compressor operation is not permitted. Unit functions other than auxiliary/supplemental heat perform as detailed in the previous Standby mode section during Emergency Heating mode.

Emergency Heating mode operation from initiation of W thermostat input:

- The W1OUT output is energized to operate a portion of the indoor unit auxiliary/supplemental heat.
- The 15-minute timer for the W2OUT output beings.
- The STATUS/FAULT will display the emergency heating mode auxiliary/supplemental (W1OUT) output indicator.



If W thermostat input is sustained for 15 minutes or more:

- The W1OUT output remains energized to operate a portion of the indoor unit auxiliary/supplemental heat.
- When the 15-minute timer for the W2OUT output ends:
  - The W1OUT output is energized to operate the remainder of the indoor unit auxiliary/supplemental heat.
  - The STATUS/FAULT will display the emergency heating mode auxiliary/supplemental (W1OUT + W2OUT) output indicator).

When W thermostat input is removed:

- The W1OUT output is de-energized.
  - The 15-minute timer for the W2OUT output is cleared.
- The W2OUT output is de-energized if previously energized.
- The interface control board enters Standby mode, and the STATUS/FAULT will display the Standby mode indicator.

Low Ambient Cooling Operation

At ambient (outdoor air) temperatures 61°F to 109.3°F the unit operates as described in the previous section for Cooling mode.

Low Ambient Cooling sequences provide stable refrigerant circuit operating pressures at lower outdoor temperatures to reduce the chance of indoor coil icing and resulting compressor damage.

Low Ambient Cooling sequences are the same whether:

- Cooling operation is newly initiated by thermostat input with ambient temperature 60°F or less.
- Ambient temperature falls to 60°F or less with Cooling operation established.

During Low Ambient Cooling operation, the STATUS/FAULT will display the cooling mode compressor capacity step 4 indicator alternating each 2 seconds with the low ambient cooling indicator.

Low Ambient Cooling operation at 60°F temperature:

- With the compressor ASCD expired, the interface control board sends reduced outdoor fan speed command to the inverter.
  - In 2-ton units the outdoor fan speed at 60°F ambient is 700 RPM.
  - In 3-ton units the outdoor fan speed at 60°F ambient is 675 RPM.
  - In 4-ton units the outdoor fan speed at 60°F ambient is 700 RPM.
  - In 5-ton units the outdoor fan speed at 60°F ambient is 750 RPM.
    - The inverter (brakes, starts and) ramps the outdoor fan motor to the commanded speed. The inverter sends outdoor fan motor speed feedback information to the interface control board.
- The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator alternating every 2 seconds with the low ambient cooling indicator.
- The Y2OUT output is energized for increased indoor blower speed/airflow volume.
- With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
  - The inverter (starts and) ramps the compressor motor to the commanded speed.
    - The inverter sends compressor motor speed feedback information to the interface control board.
  - Recording of cooling capacity step 4 runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
  - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.

Low Ambient Cooling operation at 59°F down to 35°F ambient temperatures:

- With the compressor ASCD expired; based on AMBIENT temperature, the interface control board sends a progressively reduced outdoor fan speed command to the inverter down to the following minimum values:
  - In 2-ton units the outdoor fan speed at 40°F down to 35°F AMBIENT is 330 RPM.
  - In 3-ton units the outdoor fan speed at 35°F AMBIENT is 300 RPM.
  - In 4-ton units the outdoor fan speed at 40°F down to 35°F AMBIENT is 330 RPM.
  - In 5-ton units the outdoor fan speed at 35°F AMBIENT is 370 RPM.
    - The inverter (brakes, starts and) ramps the outdoor fan motor to the commanded speed. The inverter sends outdoor fan motor speed feedback information to the interface control board.
- The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator alternating every 2 seconds with the low ambient cooling indicator.
- The Y2OUT output is energized for increased indoor blower speed/airflow volume.

- With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
    - The inverter (starts and) ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
    - Recording of cooling capacity step 4 runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
    - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.

Cooling operation at ambient temperatures 34°F or less:

- With the compressor ASCD expired; based on AMBIENT temperature, the interface control board sends an outdoor fan off command to the inverter.
    - The inverter ramps down and stops outdoor fan motor output.
        - The inverter sends outdoor fan motor speed feedback information to the interface control board.
- The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator alternating every 2 seconds with the low ambient cooling indicator.
- The Y2OUT output is energized for increased indoor blower speed/airflow volume.
- With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
    - The inverter (starts and) ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
    - Recording of cooling capacity step 4 runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
    - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.

High Ambient Cooling Operation

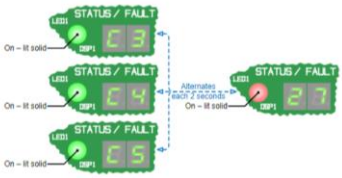
At ambient (outdoor air) temperatures 61°F to 109.3°F the unit operates as described in the previous section for Cooling mode.

High Ambient Cooling sequences limit the maximum cooling mode motor speed to protect inverter internal components from damage due to excessive temperature.

High Ambient Cooling sequences are the same whether:

- Cooling operation is newly initiated by thermostat input with ambient temperature from 109.4°F up to 124.8°F.
- Ambient temperature rises to 109.4°F up to 124.8°F with Cooling operation established.

During High Ambient Cooling operation up to 124.8°F the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling motor speed limiting indicator.



Cooling operation at 109.4°F (43°C) ambient temperature:

- The maximum compressor motor speed command the interface control board can send to the inverter is limited to:
  - 3500 RPM in 2-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.
  - 3600 RPM in 3-ton units.
    - Cooling mode compressor capacity step 4 is affected.
  - 3800 RPM in 4-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.
  - 4000 RPM in 5-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.
- Recording of the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
- Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
- When compressor motor speed is limited, the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator.
- Where required, the interface control board sends a reduced outdoor fan speed command to the inverter.
  - In 4-ton units the outdoor fan speed at 109.4°F to 113°F ambient is 925 RPM.
  - In 5-ton units the outdoor fan speed at 109.4°F to 113°F ambient is 925 RPM.

Cooling operation at 113°F (45°C) to 118.4°F (48°C) ambient temperature:

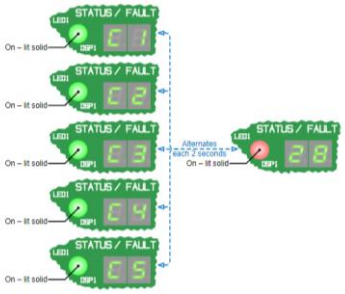
- The maximum compressor motor speed command the interface control board can send to the inverter is limited to:
  - 3100 RPM in 2-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.
  - 3200 RPM in 3-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.
  - 3360 RPM in 4-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.
  - 3600 RPM in 5-ton units.
    - Cooling mode compressor capacity steps 4 and 5 are affected.

- Recording of the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
- Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as cooling operation.
- When compressor motor speed is limited, the STATUS/FALG will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator.
- Where required, the interface control board sends a reduced outdoor fan speed command to the inverter.
    - In 3-ton units the outdoor fan speed at 113°F to 118.4°F ambient is 750 RPM.
    - In 4-ton units the outdoor fan speed at 113°F to 118.4°F ambient is 925 RPM.
    - In 5-ton units the outdoor fan speed at 113°F to 118.4°F ambient is 925 RPM.

Cooling operation at 118.4°F (48°C) to 124.8°F (51.6°C) ambient temperature:

- The maximum compressor motor speed command the interface control board can send to the inverter is limited to:
    - 2700 RPM in 2-ton units.
        - Cooling mode compressor capacity steps 3, 4 and 5 are affected.
    - 2800 RPM in 3-ton units.
        - Cooling mode compressor capacity steps 3, 4 and 5 are affected.
    - 2940 RPM in 4-ton units.
        - Cooling mode compressor capacity steps 3, 4 and 5 are affected.
    - 3200 RPM in 5-ton units.
        - Cooling mode compressor capacity steps 3, 4 and 5 are affected.
- Recording of the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
- Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as Cooling operation.
- When compressor motor speed is limited, the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator.
- Where required, the interface control board sends a reduced outdoor fan speed command to the inverter.
    - In 3-ton units the outdoor fan speed at 118.4°F to 124.4°F ambient is 750 RPM.
    - In 4-ton units the outdoor fan speed at 118.4°F to 124.4°F ambient is 925 RPM.
    - In 5-ton units the outdoor fan speed at 118.4°F to 124.4°F ambient is 925 RPM.

Motor speed reduction/shutdown occurs with High Ambient Cooling operation above 124.8°F (51.6°C) ambient temperature. Compressor motor speed reduction as low as 1800 RPM or shutdown can affect all cooling mode compressor capacity steps. During High Ambient Cooling operation at about 124.8°F the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating every 2 seconds with the high ambient cooling motor speed reduction indicator.



Additional inverter-based fault codes due to the excessive temperature of internal components are also highly likely to occur with Cooling operation above 124.8°F (51.6°C) ambient temperature.

Low Ambient Compressor Heating Operation

At ambient (outdoor air) temperatures above -5 degrees F the unit operates as described in the previous sections for Compressor Heating and Auxiliary/supplemental Heating modes.

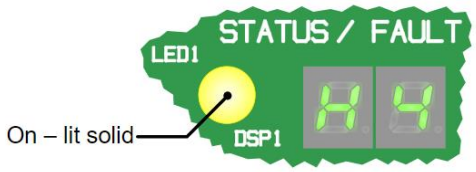
With Compressor Heating mode and Auxiliary/supplemental Heating mode operation, the Low Ambient Compressor Heating sequence increases the compressor motor speed to produce increased system heating capacity.

Low Ambient Compressor Heating sequences are the same whether:

- Compressor heating operation is newly initiated by thermostat input with ambient temperature -5 degrees F or below.
- Ambient temperature falls to -5 degrees F or below with compressor heating operation established.

Compressor Heating mode and Auxiliary/supplemental Heating mode operation at -5 degrees F or below ambient temperature:

- The interface control board sends a 6000 RPM compressor motor speed command to the inverter.
- Recording of compressor heating capacity step 4 runtime begins/continues and the data is used for the next heating cycle in the same manner as Compressor Heating operation.
- Recording of overall compressor heating cycle runtime begins/continues and the data is used for the next cooling cycle in the same manner as Compressor Heating operation.
- If not previously energized for compressor heating capacity steps 3, 4 or 5 operations, the Y2OUT output is energized for increased indoor blower speed/airflow volume.
- The STATUS/FAULT will display compressor heating capacity step 4 indicator.



Defrost Operation

The interface control board uses “adaptive” defrost programming where the defrost cycle is initiated by varying methods depending on conditions surrounding compressor heating operation and previous defrost cycle termination.

Based on interface control board compressor heating capacity step commands to the inverter and COIL temperature, all defrost initiation methods use defrost initiation accumulated runtime to establish the duration of compressor heating operation between defrost cycle.

The defrost initiation accumulated runtime timer is paused when either:

- The interface control board remains in a heating mode (0 input has not been received) and there are no compressor heating capacity step commands to the inverter.
- The COIL temperature is 32 degrees F or more with compressor heating capacity step commands to the inverter.

The defrost initiation accumulated runtime timer is cleared (zeroed) when either:

- The COIL temperature reached or is above the DEFROST TEMP selection.
- Following termination of a defrost cycle.

The defrost initiation accumulated runtime timer is cleared (zeroed) and stored defrost cycle data is emptied when either:

- Following interface control board power-up.
- The interface control board received O input.

Calibration Defrost Initiation

The purpose of calibration defrost initiation is to gather data for the next defrost cycle initiation. Calibration defrost initiation occurs when:

- As occurs normally following power-up and cooling mode operation, previous defrost cycle data stored by the interface control board is empty.
- There have been 31 minutes of defrost initiation accumulated runtime.

Time/Temperature Defrost Initiation

The purpose of time/temperature defrost initiation is to respond to atypical conditions where the previous defrost cycle may not have completely cleared the outdoor coil of frost.

Time/temperature defrost initiation occurs when:

- The previous defrost cycle was terminated by the 12-minute maximum defrost cycle timer.
- The COIL temperature has remained 35°F or less for the final 4 minutes of the previous defrost cycle.
- There have been 31 minutes of defrost initiation accumulated runtime since the previous defrost cycle and the COIL temperature is presently 35°F or less.

Demand Defrost Initiation

Demand defrost is the preferred method of defrost cycle initiation. The purpose of demand defrost initiation is to respond most efficiently to typical conditions where a defrost cycle is necessary to clear the outdoor coil of frost.

Demand defrost initiation occurs when:

- The conditions at termination of the previous were either:
  - The previous defrost cycle was terminated by the 12-minute maximum defrost cycle timer and the COIL temperature was more than 35°F for the final 4 minutes of the previous defrost cycle.
  - The previous defrost cycle was terminated by the COIL temperature reaching the DEFROST TEMP selection.
- There have been 31 minutes or more of defrost initiation accumulated runtime since the previous defrost cycle.
- The COIL temperature is less than the demand defrost "curve" calculated from previous defrost cycle data and current conditions.

Forced Defrost Initiation

The purpose of forced defrost initiation is to return oil to the compressor sump when there is extended compressor heating run time at lower refrigerant flow such as with sub-freezing outdoor temperatures. Very low outdoor humidity typically accompanies sub-freezing temperatures so there is sufficient accumulation of frost on the outdoor coil for the initiation of a demand defrost cycle.

Forced defrost initiation occurs when:

- There have been 6 hours of defrost initiation accumulated runtime since the previous defrost cycle and the COIL temperature is presently 35°F or less.

The defrost cycle sequences are the same regardless of which of the above defrost initiation methods is used.

At initiation of the defrost cycle the interface control board performs the following:

- Stores the operating compressor heating capacity step at the initiation of the defrost cycle.
- Pauses recording of compressor heating capacity step runtime and overall compressor heating cycle runtime.
- Energizes the reversing valve (RV) output.
- Sends a compressor cooling capacity step 4 command to the inverter.
- If not already done for heating mode operation, the Y2OUT output is energized to increase indoor blower speed/airflow volume as required with compressor cooling capacity step 4 operation.
- Sends an outdoor fan motor off command to the inverter.
- If not already done for auxiliary/supplemental heating mode operation, the W1OUT output is energized to operate a portion of the indoor unit auxiliary/supplement heat.
  - During the defrost cycle, the W2OUT output is only energized to operate the remainder of the indoor unit auxiliary/supplemental heat if the 15-minute timer from W1OUT output initiation expires due to earlier auxiliary/supplemental heating mode operation.
- Begins the 12-minute maximum defrost cycle timer.
- The STATUS/FAULT indicates defrost cycle operation.

While continuing the items listed above, during the defrost cycle the interface control board performs the following:

- Does not utilize ("ignores") the LPS input.
  - Continues all other protective functions (high pressure switch, discharge temperature, inverter, etc.)
- Tracks the time the COIL temperature was more than 35°F.

If the heating call ends (Y1, Y2 and W inputs are removed) during the defrost cycle, the interface control board performs the following:

- Sends a compressor off command to the inverter.
- De-energizes the Y2OUT, W1OUT (and W2OUT) outputs.
- Pauses the 12-minute maximum defrost cycle timer.

The defrost cycle then resumes when the heating call returns (Y1 and/or Y2 input present) if the COIL temperature remains 35°F or less.

If a 0 input is received during the defrost cycle, the interface control board will continue the defrost cycle until it is terminated. If the cooling call (O, Y1 and/or Y2 input present) is sustained, cooling operation would then begin after the defrost cycle is terminated.

The defrost cycle is terminated when:

- The COIL temperature reaches the DEFROST TEMP selection.
- The 12-minute maximum defrost cycle timer expires.

At termination of the defrost cycle the interface control board performs the following:

- De-energizes the reversing valve (RV) output.
- Begins timers associated with defrost cycle termination.
    - 5 seconds after defrost cycle termination.
        - Sends a compressor heating capacity step 2 command to the inverter.
        - Sends an outdoor fan motor on command to the inverter.
    - 35 seconds after defrost cycle termination.
        - Sends a compressor heating capacity step 4 command to the inverter.
    - 120 seconds after defrost cycle termination.
        - Begins utilizing (no longer “ignores”) the LPS input.
    - 5 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
    - 6 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
    - 7 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
    - 8 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
        - Clear (zero) the 12-minute maximum defrost cycle timer.
        - Clears (zero) the defrost initiation accumulated runtime rimer.
        - Sends a command to the inverter for the operating compressor heating capacity step stored at the initiation of the defrost cycle. If increased indoor blower speed/airflow volume is not needed for the operating compressor heating capacity step, the Y2OUT output is de-energized.
    - If W1 input for auxiliary/supplemental heating mode operation is not present, the W1OUT output is de-energized.
    - The STATUS/FAULT will return to display of the normal operating mode.

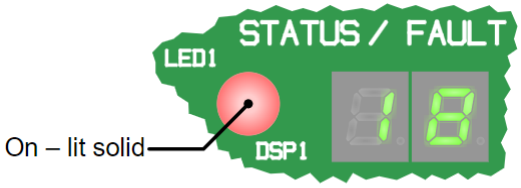
If the heating call ends (Y1, Y2 and W inputs are removed) during the COIL temperature and ambient temperature sampling period from 5 minutes, 35 seconds to 8 minutes, 35 seconds to 8 minutes, 35 seconds after defrost cycle termination; the interface control board retains the previous defrost cycle data, rather than the current incomplete data, for use in the next defrost cycle.

Abnormal Thermostat Inputs

Abnormal thermostat inputs received by the interface control board do not prevent operation otherwise requested by the other thermostat inputs. Abnormal thermostat inputs will result in STATUS/FAULT display indication of the interface control board configuration and/or field wiring error.

0 input received with the interface control board configured for air conditioning:

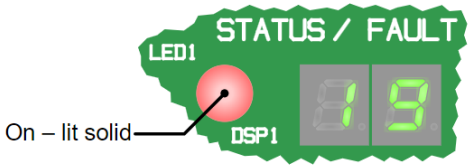
- The RV output is energized whenever there is 0 input.
  - In heat pump units this will allow cooling operation as requested by thermostat inputs.
- The STATUS/FAULT will display the indicator shown below.
  - In heat pump units this is an indication of an interface control board configuration error (the reversing valve coil was not connected/open at interface control board power-up).



W input received with the interface control board configured for air conditioning:

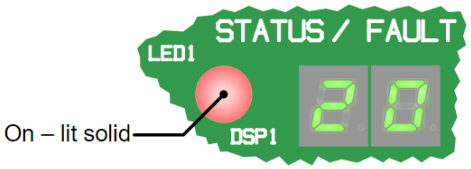
W input received with the interface control board configured for air conditioning:

- The W1OUT output is energized whenever there is W input, the W2OUT output is energized 15 minutes after the initiation of the W1OUT output.
  - In heat pump systems this will allow auxiliary/supplemental heating operation as requested by thermostat inputs.
- The STATUS/FAULT will display the indicator shown below.
  - In heat pump units this is an indication of an interface control board configuration error (the reversing valve coil was not connected/open at interface control board power-up).



O and W inputs received simultaneously with the interface control board configured for air conditioning:

- The RV output is energized whenever there is 0 input.
  - In heat pump units this will allow cooling operation as requested by thermostat inputs.
- The W1OUT output is energized whenever there is W input, the W2OUT output is energized 15 minutes after the initiation of the W1OUT output.
  - In heat pump systems this will allow auxiliary/supplemental heating operation as requested by thermostat inputs.
- The STATUS/FAULT will display the indicator shown below.
  - In heat pump units this is an indication of an interface control board configuration error (the reversing valve coil was not connected/open at interface control board power-up) and a thermostat input wiring error.



O and W inputs received simultaneously with the interface control board configured for heat pump:

- Outdoor unit operation is not permitted (soft lockout) due to conflicting cooling and heating requests from the thermostat inputs.
    - Outdoor unit operation as requested by thermostat inputs can resume once either or both O and w inputs are removed.
- The STATUS/FAULT will display the indicator shown above.
    - In heat pump units this is an indication of a thermostat input wiring error.

05

Service Features & Troubleshooting

TEST Pins

The TEST pins are a 5.0 volts DC input circuit. The left pin is DC - /common. The right pin is +5.0 volts DC. TEST pins features are initiated by a short (less than 4000Ω) between the pins or from the right pin to C/ cabinet ground that drops the input voltage.

The conditions of inputs, timing, and interface control board configuration along with the duration of the short determine the responses to the TEST pins input. The runtime data of any cooling, heating, or defrost operation initiated by TEST pins input is not stored for determination of “normal” next cycle initiation.

With these conditions:

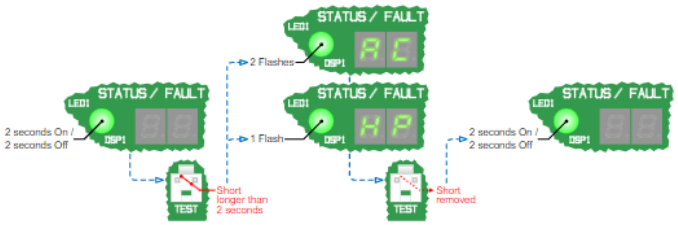
- There are no O, Y1, Y2 or W thermostat inputs present.
- The STATUS/FAULT displays the Standby operating mode, a soft lockout fault code indicator or a hard lockout fault code indicator.

The interface control board performs the following after a short of the TEST pins for longer than 2 seconds:

- The STATUS/FAULT displays the air conditioning or heat pump configuration indicator.
- Active soft lockout fault codes are cleared.
- Active soft-to-hard lockout fault code counts are cleared.
- Active hard lockout fault codes are cleared.

When the TEST pins short is removed:

- Normal operation resumes.
- The STATUS/FAULT display the Standby operating mode indicator or a soft lockout indicator if conditions for the soft lockout remain.



With these conditions:

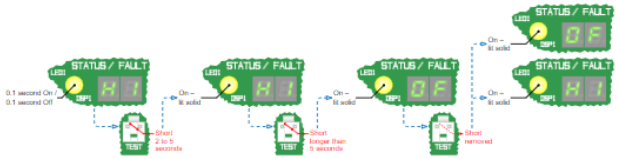
- The interface control board is configured for heat pump operation.
- There is only Y1 or Y2 thermostat input present.
- The STATUS/FAULT displays the heating mode compressor ASCD indicator.

The interface control board performs the following after a short of the TEST pins for 2 to 5 seconds.

- The compressor anti-short cycle delay (ASCD timer is set to 0 (“bypassed”).
- Active soft lockout fault codes are cleared.
- Active soft-to-hard lockout fault code counts are cleared.
- Active hard lockout fault codes are cleared.

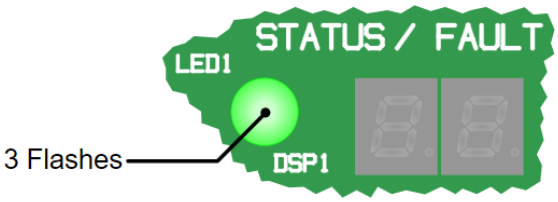
With compressor heating operation underway, either thought the compressor ASCD bypass described above or normal heating mode operation, the interface control board performs the following after a short of the TEST pins for longer than 5 seconds.

- Initiate and remain in a defrost cycle.
- When the TEST pins short is removed:
- If COIL temperature is at or above the DEFROST TEMP selection
    - Normal operation resumes.
- If COIL temperature is below the DEFROST TEMP selection
    - The defrost cycle continues until terminated by either.
        - The COIL temperature reaches the DEFROST TEMP selection.
        - The 12-minute maximum defrost cycle timer expires.
    - Normal operation then resumes.



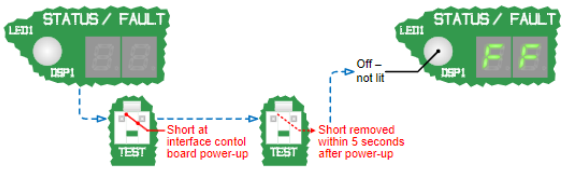
With these conditions:

- There is only Y2 thermostat input present.
- The interface control board performs the following with a short of the TEST pins for any duration:
- The stored fault code history is emptied.
- The STATUS/FAULT displays the indicator for the stored fault code history has been emptied (one sequence of three green LED1 flashes)



The Run Test mode is used to operate the outdoor unit at a specific capacity steps. The Run Test mode is entered by:

- The TEST pins are shortened before the interface control board is powered.
- The interface control board is powered.
- The TEST pins short is removed withing 5 second of power being applied to the interface control board (typically).
    - Run Test mode defrost operation begins if the TEST pins short remains for 5 seconds or more.
- The STATUS/FAULT then displays the Run Test mode indicator.
    - Or the Run Test mode indicator alternating with the compressor capacity step indicator if thermostat inputs are present – stops.



The interface control board remains in the Run Test mode for 10 minutes unless power is removed.

While the Run Test mode is active:

- The compressor anti-short cycle delay (ASCD) timer is not effective.
- If only Y1 thermostat input is present:
    - The unit operates at compressor heating capacity step 1 (heat pump configuration).
        - The STATUS/FAULT displays the Run Test mode indicator alternating with the compressor heating capacity step 1 indicator.

While the Run Test mode is active:

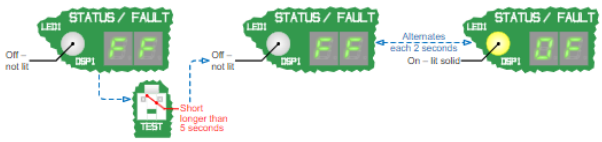
- The compressor anti-short cycle delay (ASCD) timer is not effective.
- If only Y1 thermostat input is present:
  - The unit operates at compressor heating capacity step 1 (heat pump configuration).
    - The STATUS/FAULT displays the Run Test mode indicator alternating with the compressor heating capacity step 1 indicator.

- If only Y1 and O thermostat inputs are present:
  - The unit operates at compressor cooling capacity step 1 (heat pump configuration).
    - The STATUS/FAULT displays the Run Test mode indicator alternating with the compressor cooling capacity step 1 indicator.

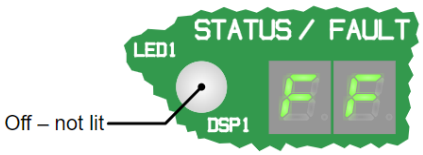
- If only Y1 and Y2 thermostat inputs are present:
  - The unit operates at compressor heating capacity step 4 (heat pump configuration).
    - The STATUS/FAULT displays the Run Test mode indicator alternating with the compressor heating capacity step 4 indicator.

- If Y1, Y2 and O thermostat inputs are present:
  - The unit operates at compressor cooling capacity step 4 (heat pump configuration).
    - The STATUS/FAULT displays the Run Test mode indicator alternating with the compressor cooling capacity step 4 indicator.

- If only Y1 and Y2 thermostat inputs are present and the TEST pins are shortened for 5 seconds or more.
  - The unit beings the Run Test mode defrost cycle (heat pump configuration).
    - The STATUS/FAULT displays the Run Test mode indicator alternating with the defrost cycle indicator.
  - The Run Test defrost cycle ends when the TEST pins short is removed; defrost termination conditions do not apply.



- Run Test mode operation of the compressor ends when Y1 input is removed.
    - The STATUS/FAULT then displays the Run Test mode indicator.



TEST Mode Jumper-Tab

Operating sequences are as described in the previous Operation section with the TEST MODE jumper-tab in the N ("normal") position or not connected.

The other TEST MODE jumper-tab positions are used to operate the outdoor unit at specific capacity steps. Typically, the TEST MDOE jumper-tab is returned to the N position once service procedures are complete. The runtime data of any cooling, heating, or defrost operation initiated by the TEST MODE jumper-tab is not stored for determination of "normal" next cycle initiation.

With the TEST MODE jumper-tab in the L ("low") position:

- The unit operates only at cooling capacity step 1 when there is O, Y1, and/or Y2 thermostat input (heat pump configuration).
- The unit operates only at compressor heating capacity step 1 when there is Y1 and/or Y2 thermostat input (heat pump configuration).
    - Auxiliary/supplemental heating and defrost operation remain as described in previous sections.

With the TEST MODE jumper-tab in the M ("medium") position:

- The unit operates only at cooling capacity step 2 when there is O, Y1 and/or Y2 thermostat input (heat pump configuration).
- The unit operates only at compressor heating capacity step 2 when there is Y1 and/or Y2 thermostat input (heat pump configuration).
    - Auxiliary/supplement heating and defrost operation remain as described in previous sections.

With the TEST MODE jumper-tab in the H ("high") position:

- The unit operates only at cooling capacity step 4 when there is O, Y1 and/or Y2 thermostat input (heat pump configuration).
- The unit operates only at compressor heating capacity step 4 when there is Y1 and/or Y2 thermostat input (heat pump configuration).
    - Auxiliary/supplemental heating, hot heat pump and defrost operation remain as described in previous sections.

Active Fault Code, Store Fault Code History & Last Error Button

The STATUS/FAULT indication updates approximately 2 seconds after changes in operational status or fault code occurrence. Display of the most recently occurring active fault code has priority over operational status display. When two or more fault codes are active, the most recently occurring active fault is displayed at the STATUS/FAULT indicator and the other active fault codes enter the stored fault code history of the interface control board.

Separate from the stored fault code history, the interface control board records event time and event count for fault codes that have time and count qualifications. This recorded event time and event count information is cleared when:

- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Details of operational status and fault codes are listed in the next section. Fault codes are in three categories based on the requirements to clear the fault code:

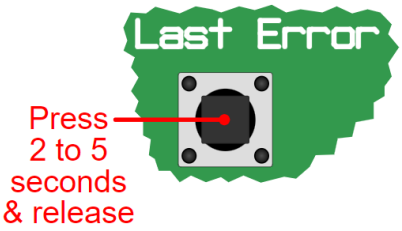
- Non-lockout fault codes are cleared when:
  - Conditions that produced the fault code return to a normal range/state.
- Soft lockout fault codes are cleared when:
  - Conditions that produced the fault code return to a normal range/state and either:
    - Y1 and Y2 thermostat input is removed.
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.
- Hard lockout fault codes are cleared when:
  - Conditions that produced the fault code return to a normal range/state and either:
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.

Once an active fault code is cleared:

- That fault code enters the stored fault code history of the interface control board.
  - Only one fault code indicator is stored in fault code history if there are multiple occurrences of the same fault code.
- The STATUS/FAULT indicator displays either:
  - The most recently occurring active fault code that has not been cleared if other fault codes are active.
  - The operational status indication if no other fault codes are active.

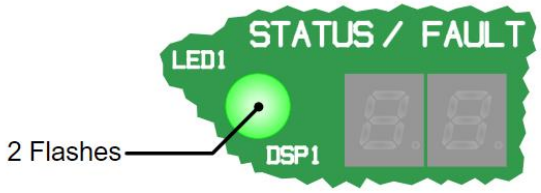
The stored fault code history of the interface control board is held in non-volatile memory and is retained for up to 30 days when the interface control board is not powered. Up to ten of the most recently occurring fault codes are stored in fault code history in order of newest to oldest. If ten faults are stored and a differing fault code occurs, the oldest fault code is “pushed out” of the fault code history. Only one fault code indicator is stored in fault code history if there are multiple occurrences of the same fault code.

The Last Error button allows review and emptying of the store fault code history.

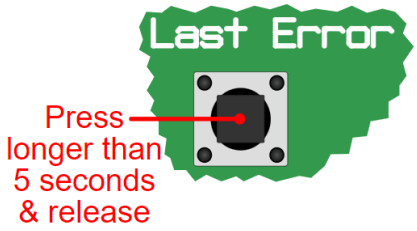


When there is no Y1, Y2 or W thermostat inputs and the Last Error button is pressed for 2 to 5 seconds and released the STATUS/FAULT indicator displays either:

- The indicator for the stored fault code history is empty (one sequence of two green LED1 flashes).
- The indicator for the most recently occurring fault code stored in fault code history is displayed for 2 seconds.
    - Then, if present, the indicator for the 2nd most recently occurring fault code stored in fault code history is displayed for 2 seconds.
        - This sequence continues until the, up to 10 total fault codes stored in fault code history are displayed.



Once the stored fault code history display is complete; or if interrupted by Y1, Y2 or W thermostat input becoming present; the STATUS/FAULT indicator then returns to operational status or active fault code display.



When there is no Y1, Y2 or W thermostat inputs and the Last Error button is pressed for longer than 5 seconds and released:

- The stored fault code history is emptied.
- The STATUS/FAULT displays the indicator for the stored fault code history has been emptied (one sequence of three green LED1 flashes).
    - The STATUS/FAULT indicator then returns to operational status or active fault code display.

STATUS/FAULT Indications

The STATUS/FAULT indication updates approximately 2 seconds after changes in operational status fault occurrence.

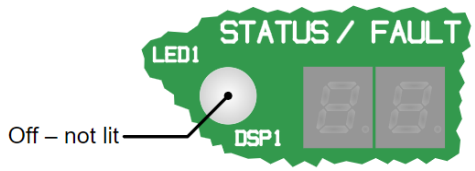
Please note that the “Technician Corrective Action” segment that accompanies the STATUS/FAULT indication listings in this section intended as a troubleshooting guide rather than a complete step-by-step repair procedure.

The “baseline” measurements in the table that follows are referenced with inverter-based fault codes in this section. These “normal” inverter output measurements are valid only with meter listed in the table; due to the nature of the “sine-like” inverter output, these readings are indicators rather than true measurements and the use of another brand or model of meter will not produce the same readings. Also, these “normal” inverter output measurements are only valid at capacity step 4; temporarily placing the TEST MODE jumper-tab in the H position best ensures the unit will operate at capacity step 4 when comparing the table to field measurements during testing.

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units									
Unit Size	Single-phase 208/230 Volts AC line voltage supply			Ohmmeter measurement of motors		Inverter output circuit measurements; capacity step 4, 70°F ambient, Fluke 3.75 meter			
	Maximum Voltage	Minimum Voltage with Circuit Loaded	Maximum Current Draw	Winding-to-winding resistance at 68°F		Leg-to-leg voltage		Current Draw of each leg	
				Compressor motor	Outdoor fan motor	Compressor motor	Outdoor fan motor	Compressor motor	Outdoor fan motor
2-ton	253 VAC	187 VAC	14 amps AC	0.88Ω	36.5Ω	C4: 143.0 VAC	148.1 VAC	C4: 4.2 amps AC	0.5 amps AC
						H4: 143.0 VAC	150.0	H4: 5.2 amps AC	0.5 amps AC
3-ton	253 VAC	187 VAC	21 amps AC	0.53Ω	11.8Ω	C4: 146.0 VAC	100.3	C4: 7.3 amps AC	1.2 amps AC
						H4: 144.0 VAC	102.1	H4: 7.5 amps AC	1.2 amps AC
4-ton	253 VAC	187 VAC	26 amps AC	0.44Ω	9.8Ω	C4: 173.3 VAC	144.5	C4: 9.0 amps AC	1.2 amps AC
						H4: 174.5 VAC	146.5	H4: 11.0 amps AC	1.3 amps AC
5-ton	253 VAC	187 VAC	32 amps AC	0.29Ω	9.8Ω	145.6 VAC	145.6	C4: 10.8 amps AC	1.2 amps AC
						146.0 VAC	146.0	H4: 14.9 amps AC	1.2 amps AC
				Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.		*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.			

Refer to the Service Data tables in the Extras section for “baseline” refrigerant circuit measurements for comparison to field measurements during testing.

LED Not Lit – No Numeric Indication



Type of Indication: Status, Alternately Fault Code

- There is less than 12.0 volts AC to the interface control board C and R pins.
    - Alternately the interface control board has catastrophic damage that will not allow STATUS/FAULT display (it is likely that there will be visible physical evidence of the damage).

Interface Control Board Response

- Outputs and communicated commands to the inverter are not possible; the outdoor unit is idle.
- If W input is present, 24 volts AC will be passed through the normally closed on board relay contact to the W1OUT output for initiation of a portion of the indoor unit heat capacity.

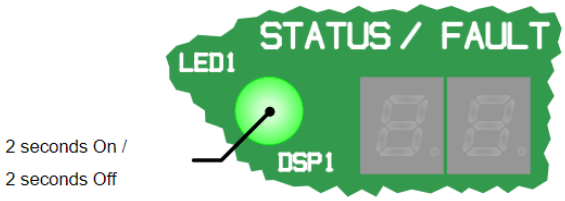
Technician Corrective Action

Verify the indoor unit is powered and has line voltage to the primary of the control transformer. Verify 24 volts AC is present at the secondary of the control transformer indicating the transformer is intact. Investigate causes for control circuit shorts or overload if there is not 24 volts at the transformer secondary. Verify 24 volts AC is present at the indoor unit C and R connections indicating the control fuse and indoor unit wiring is intact. Investigate causes for control circuit shorts or overload if the control fuse is blown. Verify 24 volts AC is present at the interface control board C and R connections indicating the wiring connecting the indoor and units is intact. Correct the causes of the open circuit if 24 volts AC is not present at the interface control board C and R pins. Investigation of causes for excessive voltage, surges, etc. and replacement of the interface control board is required if 24 volts AC is present at the interface control board C and R pins and there is no STATUS/FAULT display.

Method to Clear

24 volts AC, nominal (more than 12.0 volts AC), is applied to the interface control board C and R pins.

Green LED Flashing 2 Sec ON, 2 Sec OFF



Type of Indication: Status

- Standby
  - The interface control board is powered.
  - There are no faults active.
  - There are no Y1, Y2, or W thermostat inputs to the interface control board.

Interface Control Board Response

- Cooling cycle off time and heating cycle off time are recorded.
- If 0 input is present with heat pump configurating, the RV output for the reversing valve is energized.
- Through communicated command to the inverter, the compressor crankcase heater is cycled on 10 minutes/off 10 minutes when the compressor is off for 20 minutes or more and ambient temperature is below 55 degrees F.
- The compressor and outdoor fan motor are commanded off.

Green LED Flashing 0.1 Sec ON, 0.1 Sec OFF – C# on Digital Display

Type of Indication: Status

- Cooling anti-short cycle delay (ASCD)
  - There are no faults active.
  - There are O, Y1 and/or Y2 thermostat inputs to the interface control board (heat pump configuration)
  - There have been less than 5 minutes since the compressor last operated or interface control board power-up.

Interface Control Board Response

- The compressor and outdoor fan motor remain commanded off until the ASCD timer expires.

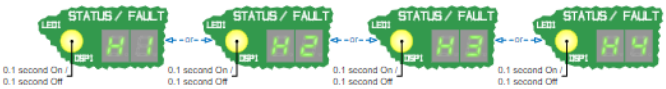
Technician Corrective Action

If needed for service procedures, the currently active ASCD timer is set to 0 (“bypassed”) after a short of the TEST pins for 2 to 5 seconds.

Method to Clear

The currently active ASCD timer expires or is “bypassed” through a short of the TEST pins.

Yellow LED Flashing 0.1 Sec ON, 0.1 Sec OFF – H# on Digital Display



Type of Indication: Status

- Compressor heating anti-short cycle delay (ASCD)
  - There are no active faults.
  - The interface control board is configured for heat pump operation.
  - There are Y1 and/or Y2 thermostat inputs to the interface control board.
  - There have been less than 5 minutes since the compressor last operated or interface control board power-up.

Interface Control Board Response

The compressor and outdoor fan motor remain commanded off until the compressor ASCD timer expires.

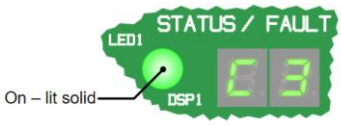
Technician Corrective Action

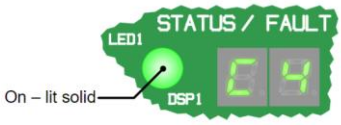
If needed for service procedures, the currently active ASCD timer is set to 0 (“bypassed”) after a short of the TEST pins for 2 to 5 seconds.

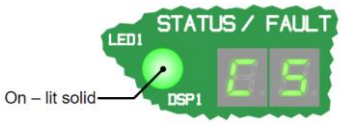
Method to Clear

The currently active ASCD timer expires or is “bypassed” through a short of the TEST pins.

Green LED Lit – C# on Digital Display







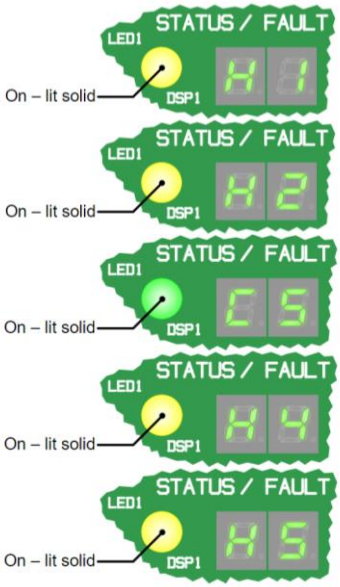
Type of Indication: Status

- Cooling operation
  - There are no faults active.
  - There are O, Y1 and/or Y2 thermostat inputs to the interface control board (heat pump configuration).
  - The compressor ASCD timer has expired.
  - Low Ambient Cooling sequences are not active.
  - High Ambient Cooling sequences are not active.

Interface Control Board Response

- The off time of the previous cooling cycle is recorded.
- The compressor and outdoor fan motor are commanded on, and the inverter has communicated proper motor speed feedback information to the interface control board.
  - The C# in the STATUS/FAULT display indicates the compressor cooling capacity step command.
- The Y2OUT output is energized to increase indoor blower speed/airflow volume with compressor cooling capacity step 3, 4 and 5 operations.
- The RV output for the reversing valve is energized (heat pump configuration).
- The LPS input is not utilized (“ignored”) for the first 120 seconds following the initiation of compressor operation.
- Cooling cycle run time and compressor cooling capacity step up run time are recorded.

Yellow LED Lit – H# on Digital Display



Type of Indication: Status

- Compressor heating without auxiliary/supplemental heating operation.

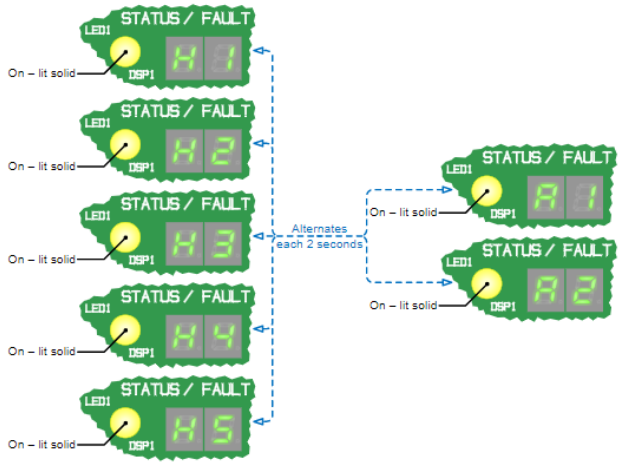
THERE ARE NO FAULTS ACTIVE.

- The interface control board is configured for heat pump operation.
- There are Y1 and/or Y2 thermostat inputs to the interface control board.
- The compressor ASCD timer has expired.
- A defrost cycle is not underway.
- Low Ambient Heating sequences are not active.

Interface Control Board Response

- The off time of the previous heating cycle is recorded.
- The compressor and outdoor fan motor are commanded on, and the inverter has communicated proper motor speed feedback information to the interface control board.
    - The H# in the STATUS/FAULT display indicates the compressor heating capacity step command.
- If the HOT HEAT PUMP jumper-tab is in the OFF position or missing, the Y2OUT output is energized to increase indoor blower speed/airflow volume with compressor heating capacity step 3, 4 and 5 operations.
- If the HOT HEAT PUMP jumper-tab is in the ON position, the Y2OUT output is energized to increase indoor blower speed/airflow volume with compressor heating capacity step 4 and 5 operations.
- The conditions for Defrost operation are effective.
- The LPS input is not utilized (“ignored”) for the first 120 seconds following the initiation of compressor operation and when ambient temperature is less than 15 degrees F.
- Heating cycle run time and compressor cooling capacity step run time are recorded.

Yellow LED Lit – H# on Digital Display, Alternating with A#



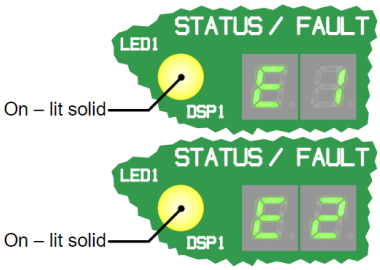
Type of Indication: Status

- Compressor heating with auxiliary/supplemental heating operation.
    - There are no faults active.
    - The interface control board is configured for heat pump operation.
    - There are W, Y and/or Y2 thermostat inputs to the interface control board.
    - The compressor ASCD timer has expired.
    - A defrost cycle is not underway.
    - Low Ambient Heating sequences are not active.

Interface Control Board Response

- The off time of the previous heating cycle is recorded.
- The compressor and outdoor fan motor are commanded on, and the inverter has communicated proper motor speed feedback information to the interface control board.
    - The H# in the STATUS/FAULT display indicates the compressor heating capacity step command.
- If the HOT HEAT PUMP jumper-tab is in the OFF position or missing, the Y2OUT output is energized to increase indoor blower speed/airflow volume with compressor heating capacity step 3, 4 and 5 operations.
- If the HOT HEAT PUMP jumper-tab is in the ON position, the Y2OUT is energized to increase indoor blower speed/airflow volume with compressor heating capacity step 4 and 5 operations.
- From the W input, 24 volts AC is passed through the normally closed on board relay contact to the W1OUT output for initiation of a portion of the indoor unit heat capacity.
    - The A1 in the STATUS/FAULT display indicates W1OUT output.
- After a continuous 15 minutes of W1OUT output, the W2OUT output is energized for the rest of the indoor unit heat capacity.
    - The A2 in the STATUS/FAULT display indicates there is both W1OUT output and W2OUT output.
- The conditions for Defrost operation are effective.
- The LPS input is not utilized (“ignored”) for the first 120 seconds following the initiation of compressor operation and when ambient temperature is less than 15 degrees F.
- Heating cycle run time and compressor cooling capacity step run time are recorded.

Yellow LED Lit – E# on Digital Display



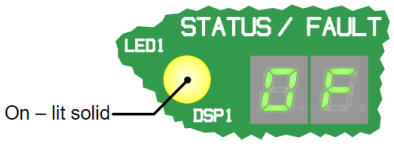
Type of Indication: Status

- Emergency heating operation
  - There are no faults active.
  - The interface control board is configured for heat pump operation.
  - There is only W thermostat input to the interface control board.

Interface Control Board Response

- Cooling cycle off time and heating cycle off time are recorded.
- Through communicated command to the inverter, the compressor crankcase heater is cycled on 10 minutes/off 10 minutes when the compressor is off for 20 minutes or more and ambient temperature is below 55 degrees F.
- The compressor and outdoor fan motor are commanded off.
- From the W input, 24 volts AC is passed through the normally closed on board relay contact to the W1OUT output for initiation of a portion of the indoor unit heat capacity.
  - The E1 in the STATUS/FAULT display indicates W1OUT output.
- After a continuous 15 minutes of W1OUT output, the W2OUT output is energized for initiation of the remainder of the indoor unit heat capacity.
  - The E2 in the STATUS/FAULT display indicates there is both W1OUT output and W2OUT output.

Yellow LED Lit – DF on Digital Display



Type of Indication: Status

- A defrost cycle is underway.
    - There is no fault active.
    - The interface control board is configured for heat pump operation.
    - If not manually initiated by a short of the TEST pins for 5 seconds or more.
        - There is Y1 and/or Y2 with/without W thermostat inputs to the interface control board.
        - The compressor ASCD timer has expired.
        - There have been at least 31 minutes of compressor heating mode accumulated runtime since the previous defrost.
        - The COIL temperature has been 35 degrees F or less.

Interface Control Board Response

At initiation of the defrost cycle the interface control board performs the following:

- Stores the operating compressor heating capacity step at the initiation of the defrost cycle.
- Energizes the reversing valve (RV) output.
- Sends a compressor cooling capacity step 4 command to the inverter.
- If not already done for heating mode operation, the Y2OUT output is energized to increase indoor blower speed/airflow volume as required with compressor cooling capacity step 4 operation.
- Sends an outdoor fan motor off command to the inverter.
- If not already done for auxiliary/supplemental heating more operation, the W1OUT output is energized to operate a portion of the indoor unit auxiliary/supplemental heat.
    - During the defrost cycle, the W2OUT output is only energized to operate the remainder of the indoor unit auxiliary/supplemental heat if the 15-minute timer from W1OUT output initiation expires due to earlier auxiliary/supplemental heating mode operation.
- Begins the 12-minute maximum defrost cycle timer.
- The STATUS/FAULT indicates defrost cycle operation.

While continuing the items listed above, during the defrost cycle the interface control board performs the following:

- Does not utilize (“ignores”) the LPS input.
    - Continues all other protective functions (high pressure switch, discharge temperature, inverter, etc.)
- Tracks the time the COIL temperature was more than 35 degrees F.

If the heating call ends (Y1, Y2 and W inputs are removed) during the defrost cycle, the interface control board performs the following:

- Sends a compressor off command to the inverter.
- De-energizes the Y2OUT, W1OUT (and W2OUT) outputs.
- Pauses the 12-minute maximum defrost cycle timer.

The defrost cycle then resumes when the heating call returns (Y1 and/or Y2 input present) if the COIL temperature remains 35 degrees F or less.

If an O input is received during the defrost cycle, the interface control board will continue the defrost cycle until it is terminated. If the cooling call (O, Y1 and/or Y2 input present) is sustained, cooling operation would then begin after the defrost cycle is terminated.

The defrost cycle is terminated when:

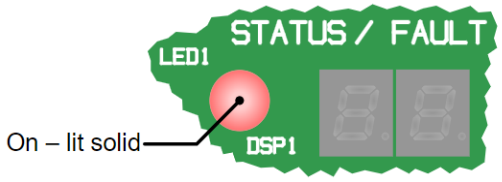
- The COIL temperature reaches the DEFROST TEMP selection.
- The 12-minute maximum defrost cycle timer expires.

At termination of the defrost cycle the interface control board performs the following:

- De-energizes the reversing valve (RV) output.
- Begins timers associated with defrost cycle termination.
    - 5 seconds after defrost cycle termination.
        - Sends a compressor heating capacity step 2 command to the inverter.
        - Sends an outdoor fan motor on command to the inverter.
    - 35 seconds after defrost cycle termination.
        - Sends a compressor heating capacity step 4 command to the inverter.
    - 120 seconds after defrost cycle termination.
        - Begins utilizing (no longer “ignores”) the LPS input.
    - 5 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
    - 6 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
    - 7 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
    - 8 minutes, 35 seconds after defrost cycle termination.
        - Samples COIL temperature and ambient temperature for averaging and use in “frost free” calculation for demand defrost initiation of the next defrost cycle.
        - Clear (zeros) the 12-minute maximum defrost cycle timer.
        - Clears (zeros) the compressor heating mode accumulated runtime timer.
        - Sends a command to the inverter for the operating compressor heating capacity step stored at the initiation of the defrost cycle. If increased indoor blower speed/airflow volume is not needed for the operating compressor heating capacity step, the Y2OUT output is de-energized.
        - If W1 input for auxiliary/supplemental heating mode operation is not present, the W1OUT output is de-energized.
        - The STATUS/FAULT will return to display of the normal operating mode.

If the heating call ends (Y1, Y2 and W inputs are removed) during the COIL temperature and ambient temperature sampling period from 5 minutes, 35 seconds to 8 minutes, 35 seconds after defrost cycle termination; the interface control board retains the previous defrost cycle data, rather than the current incomplete data, for use in the next defrost cycle.

Red LED Lit – No Digital Indication



Type of Indication: Hard Lockout Fault Code

The interface control board microprocessor has not passed its self-monitoring checks.

Interface Control Board Response

- Outputs and communicated commands to the inverter are not possible; the outdoor unit is idle.
- If W input is present, 24 volts AC will be passed through the normally closed on board relay contact to the W1OUT output for initiation of a portion of the indoor unit heat capacity.
- If possible, the fault code enters the stored fault code history.

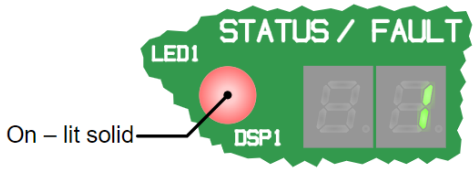
Technician Corrective Action

Investigate causes for excessive voltage, surges, brownouts, etc. that could create a false indication or damage the interface control board. Cycle power to the interface control board and verify 24 volts AC is present at the C and R connections. Monitor the STATUS/FAULT display for repeat occurrence. If the microprocessor has not passed its self-monitoring checks indication returns, replacement of the interface control board is required.

Method to Clear

Cycling of 24 volts AC power to the interface control board – if there is no damage to the interface control board.

Red LED Lit – Digital Indication



Type of Indication: Status

- The first high-pressure switch trip within a 6-hour period.
    - With Y1 and/or Y2 thermostat input to the interface control board either:
        - The HPS input to the inverter is open.
        - The compressor ASCD is active following an opening of the HPS input.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
    - The compressor and outdoor fan motor remain commanded off until both the HPS input to the inverter closes and the compressor ASCD timer expires.
- The high-pressure switch trip is recorded.
- The fault code enters the stored fault code history.

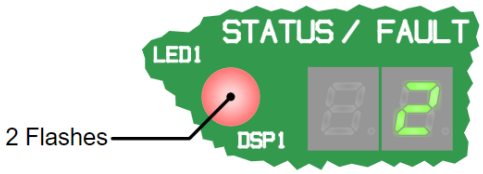
Technician Corrective Action

Verify the 12 volts DC HPS circuit is intact; the wiring harness connecting the HPS pins near the upper-left corner of the inverter to the high-pressure switch is in place. Monitor system discharge pressure and verify the high-pressure switch switching action (open 650 PSIG/reset 450 PSIG). For high pressure trips that occur in cooling mode operation; ensure there is proper outdoor coil airflow and that the coil is not fouled with dirt, etc. For high pressure trips that occur in heating mode operation; ensure there is proper indoor coil airflow, the filter is clean and that the coil is not fouled with dirt, etc. Investigate and correct refrigerant circuit causes of excessive discharge pressure, over-charging, non-condensable contamination, and flow restriction.

Method to Clear

Both the HPS input to the inverter closes and the compressor ASCD timer expires.

Red LED 2 Flashes – Digital Indication 2



Type of Indication: Soft Lockout Fault Code

There have been two high pressure switch trips within a 6-hour period of clock time. The second trip occurred during either Cooling mode operation or Compressor Heating mode operation.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
- The fault code is recorded.
- The fault code enters the stored fault code history.

Technician Corrective Action

Verify the 12 volts DC HPS circuit is intact; the wiring harness connecting the HPS pins near the upper-left corner of the inverter to the high-pressure switch is in place. Monitor system discharge pressure and verify the high-pressure switch switching action (open 65p PSIG/reset 450 PSIG). For high pressure trips that occur in cooling mode operation; ensure there is proper outdoor coil airflow and that the coil is not fouled with dirt, etc. For high pressure trips that occur in heating mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. Investigate and correct refrigerant circuit causes of excessive discharge, over-charging, non-condensable contamination, and flow restriction.

Method to Clear

- The HPS input to the inverter closes, the compressor ASCD timer expires and either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED 3 Flashes – Digital Indication 2

Type of Indication: Hard Lockout Fault code

- There have been two high pressure switch trips within a 6-hour period of clock time. The second trip occurred during either Cooling mode operation or Compressor Heating mode operation.
- There has also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
    - High pressure switch trips.
    - Low pressure switch trips.
    - High discharge line temperature.
    - Low discharge line temperature.
    - Compressor motor speed feedback has remained at 0 RPM (startup).
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup).
- The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
- The fault code is recorded.
- The fault code enters the stored fault code history.

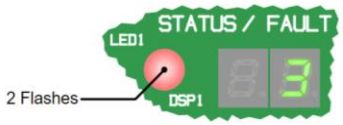
Technician Corrective Action

Verify the 12 volts DC HPS circuit is intact; the wiring harness connecting the HPS pins near the upper-left corner of the inverter to the high-pressure switch is in place. Monitor system discharge pressure and verify the high-pressure switch switching action (open 65p PSIG/reset 450 PSIG). For high pressure trips that occur in cooling mode operation; ensure there is proper outdoor coil airflow and that the coil is not fouled with dirt, etc. For high pressure trips that occur in heating mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. Investigate and correct refrigerant circuit causes of excessive discharge, over-charging, non-condensable contamination, and flow restriction.

Method to Clear

- The HPS input to the inverter closes, the compressor ASCD timer expires and either:
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.

Red LED 2 Flashes – Digital Indication 3



Type of Indication: Soft Lockout Fault Code

There have been two high pressure switch trips within a 6-hour period of clock time. The second trip occurred during defrost cycle operation.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
- The fault code is recorded.
- The fault code enters the store fault code history.

Technician Corrective Action

Verify the 12 volts DC HPS circuit is intact; the wiring harness connecting the HPS pins near the upper-left corner of the inverter to the high-pressure switch is in place. Monitor system discharge pressure and verify the high-pressure switch switching action (open 65p PSIG/reset 450 PSIG). For high pressure trips that occur in cooling mode operation; ensure there is proper outdoor coil airflow and that the coil is not fouled with dirt, etc. For high pressure trips that occur in heating mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. Investigate and correct refrigerant circuit causes of excessive discharge, over-charging, non-condensable contamination, and flow restriction.

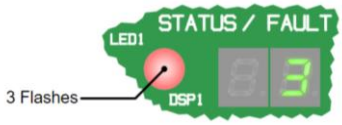
Method to Clear

The HPS input to the inverter closes, the compressor ASCD timer expires and either:

Y1 & Y2 thermostat input is removed

- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED 3 Flashes – Digital Indication 3



Type of Indication: Hard Lockout Fault Code

- There have been two high pressure switch trips within a 5-hour period of clock time. The second trip occurred during defrost cycle operation.
- There have also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
  - High pressure switch trips.
  - Low pressure switch trip.
  - High discharge line temperature.
  - Low discharge line temperature.
  - Compressor motor speed feedback has remained at 0 RPM (startup).
  - Outdoor fan motor speed feedback has remained at 0 RPM (startup).
- The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
- The fault code is recorded.
- The fault code enters the stored fault code history.

Technician Corrective Action

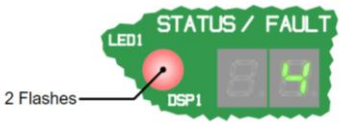
Verify the 12 volts DC HPS circuit is intact; the wiring harness connecting the HPS pins near the upper-left corner of the inverter to the high-pressure switch is in place. Monitor system discharge pressure and verify the high-pressure switch switching action (open 65p PSIG/reset 450 PSIG). For high pressure trips that occur in cooling mode operation; ensure there is proper outdoor coil airflow and that the coil is not fouled with dirt, etc. For high pressure trips that occur in heating mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. Investigate and correct refrigerant circuit causes of excessive discharge pressure, over-charging, non-condensable contamination, and flow restriction.

Method to Clear

The HPS input to the inverter closes, the compressor ASCD timer expires and either:

- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED 2 Flashes – Digital Indication 4



Type of Indication: Soft Lockout Fault Code

- There has been a low-pressure switch trip.
    - A low-pressure trip is when the LPS input circuit is open for longer than 5 seconds with Y1 and/or Y2 thermostat input to the interface control board and the following operating conditions:
        - After the first 120 seconds following the initiation of compressor operation
        - The heat pump defrost cycle is not active.
        - After the first 120 seconds following the completion of the heat pump defrost cycle.
        - When the sensed ambient temperature is 15°F or more.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
- The fault code is recorded.
- The fault code enters the stored fault code history.

Technician Corrective Action

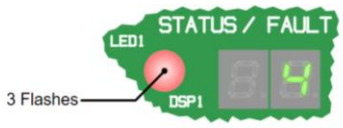
Verify the 24 volts AC LPS circuit is intact; the wiring harness connecting the LPS pins near the lower-left corner of the interface control board to the low-pressure switch is in place. Monitor system suction pressure and verify the low-pressure switch switching action (open 30 PSIG/reset 60 PSIG). For low pressure trips that occur in cooling mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. For low pressure trips that occur in heating mode operation; ensure there is proper outdoor coil airflow, and the coil is not fouled with dirt, etc. Verify COIL and AMBIENT sensors are providing accurate temperature information for proper defrost cycle initiation and termination. Investigate and correct refrigerant circuit causes of low suction pressure, under-charging, and flow restriction.

Method to Clear

The LPS input closes, the compressor ASCD timer expires and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED 3 Flashes – Digital Indication 4



Type of Indication: Hard Lockout Fault Code

- There has been a low-pressure switch trip.
    - A low-pressure trip is when the LPS input circuit is open for longer than 5 seconds with Y1 and/or Y2 thermostat input to the interface control board and the following operating conditions:
        - After the first 120 seconds following the initiation of compressor operation.
        - The heat pump defrost cycle is not active.
        - After the first 120 seconds following the completion of the heat pump defrost cycle.
        - When the sensed ambient temperature is 15°F or more.
- There has also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
    - High pressure switch trips.
    - Low pressure switch trips.
    - High discharge line temperature.
    - Low discharge line temperature.
    - Compressor motor speed feedback has remained 0 RPM (startup).
    - Outdoor fan motor speed feedback has remained at o RPM (startup).
- The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The compressor ASCD timer begins.
- The fault code is recorded.
- The fault code enters the stored fault code history.

Technician Corrective Action

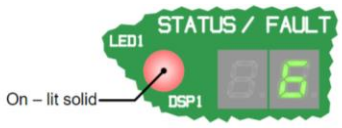
Verify the 24 volts AC LPS circuit is intact; the wiring harness connecting the LPS pins near the lower-left corner of the interface control board to the low-pressure switch is in place. Monitor system suction pressure and verify the low-pressure switch switching action (open 30 PSIG/reset 60 PSIG). For low pressure trips that occur in cooling mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. For low pressure trips that occur in heating mode operation; ensure there is proper outdoor coil airflow, and the coil is not fouled with dirt, etc. Verify COIL and AMBIENT sensors are providing accurate temperature information for proper defrost cycle initiation and termination. Investigate and correct refrigerant circuit causes of low suction pressure, under-charging, and flow restriction.

Method to Clear

The LPS input closes, the compressor ASCD timer expires and either:

- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 6



Type of Indication: Non-Lockout Fault Code

Between 19.2 +/- 0.1 volts AC to the interface control board C and R pins have been maintained for a duration of 2 seconds or longer.

Interface Control Board Response

When there is between 19.2 +/- 0.1 volts AC and 16.0 +/- 0.1 volts AC for a duration of 0.125 seconds or longer, the interface control board will not permit additional output.

- The current compressor and outdoor fan motor commands are maintained.
- The RV, Y2OUT, W1OUT and W2OUT outputs are maintained in their current state.
- The fault code enters the stored fault code history.

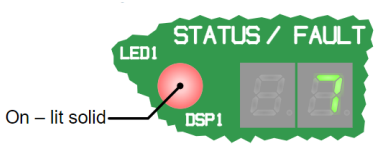
Technician Corrective Action

Verify the indoor unit is powered and has full line voltage to the primary of the control transformer. Verify 24 volts AC is present at the secondary of the control transformer and monitor the current draw of the control circuit. Investigate and correct causes for control circuit shorts or overload if the current draw exceed 1.5 Amps in systems with 40 VA control transformers. Verify 24 volts AC is present at the indoor unit C and R connections indicating the indoor unit wiring is intact. Verify 24 volts AC is present at the interface control board C and R connections indicating the wiring connecting the indoor and units is intact. Correct the cause of the poor connections, etc. if there is voltage drop from 24 volts AC at the interface control board C and R pins without excessive current draw of the control circuit.

Method to Clear

24 volts AC, nominal (more than 19.2 +/- 0/1 volts AC), is applied to the interface control board C and R pins.

Red LED Lit – Digital Indication 7



Type of Indication: Non-Lockout Fault Code

Between 16.0 +/- 0.1 volts AC and 12.0 volts AC to the interface control board C and R pins has been maintained for a duration of 2 seconds or longer.

Interface Control Board Response

- When there is between 16.0 +/- 0.1 volts AC and 12.0 volts AC for a duration of 0.125 seconds or longer, the interface control board will not permit output.
  - The compressor and outdoor fan motor are commanded off.
  - The RV, Y2OUT, W1OUT and W2OUT outputs are de-energized.
    - Output operation can resume once there is more than 19.2 +/- 0/1 volts AC to the C and R pins for a duration of 0.125 seconds or longer and the output anti-short cycle delay (ASCD) timer expires.
  - The fault code enters the stored fault code history.

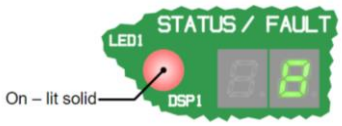
Technician Corrective Action

Verify the indoor unit is powered and has full line voltage to the primary of the control transformer. Verify 24 volts AC is present at the secondary of the control transformer and monitor the current draw of the control circuit. Investigate and correct causes for control circuit shorts or overload if the current draw exceed 1.5 Amps in systems with 40 VA control transformers. Verify 24 volts AC is present at the indoor unit C and R connections indicating the indoor unit wiring is intact. Verify 24 volts AC is present at the interface control board C and R connections indicating the wiring connecting the indoor and units is intact. Correct the cause of the poor connections, etc. if there is voltage drop from 24 volts AC at the interface control board C and R pins without excessive current draw of the control circuit.

Method to Clear

24 volts AC, nominal (more than 19.2 +/- 0.1 volts AC) is applied to the interface control board C and R.

Red LED Lit – Digital Indication 8



Type of Indication: Non-Lockout Fault Code

The interface control board has lost communication with the inverter for more than 60 seconds.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
  - If the compressor was operating, the compressor ASCD timer begins.
- The fault code enters the stored fault code history.
- Inverter response:
- Output to the compressor and outdoor fan motor ends when the inverter has lost communication with the interface control board for more than 60 seconds.

Technician Corrective Action

Verify single-phase 208/230 volts AC line voltage is supplied to the outdoor unit. Verify 208/230 volts AC is applied to the L1 (black) and L2 (yellow) wires of the inverter indicating the surface-mounted circuit breaker in the unit control box is intact and not tripped.

If the circuit breaker is tripped; review the stored fault history of the interface control board, investigate and correct causes for excessive current draw for the components of the modulating outdoor unit. Verify the inverter-to-interface control board communication wiring harness is intact and connected. Verify all the chokes are in place and the unit wiring is properly routed. With the communication wiring harness in place (closed circuit), verify C to B-voltage reads 1.30 to 2.10 volts DC (pulsing) and C to A+ voltage reads 1.46 to 2.40 volts DC (pulsing).

If the voltage readings from the closed communication circuit are not in range, disconnect the inverter-to-interface control board communication wiring harness for open circuit readings at the interface control board and inverter communication connection pins. With the interface control board powered and the communication wiring harness removed (open circuit), field measurements of C pin and B- pins voltage will read 2.50 volts DC and C pin to A+ pin voltage will read 2.75 volts DC indicating the interface control board communication circuit is intact.

With the inverter powered and the communication wiring harness removed (open circuit), field measurements of C pin to B- pin voltage will read 2.43 volts DC and C pin to A+ pin voltage will read 2.68 volts DC indicating the inverter communication circuit is intact. Inverter-to-interface control board communication wiring harness issues are indicated if closed circuit readings are not in range but open circuit readings at the interface control board pins and inverter pins are in range. Open circuit readings at the pins that are not in range indicate damage to the interface control board or inverter communication circuit requiring component replacement. Investigate causes for excessive voltage, surges, etc. if replacement of the interface control board or inverter is required due to communication circuit damage.

Method to Clear

Inverter-to-interface control board communication resumes.

Red LED Lit – Digital Indication 9

Type of Indication: Soft Lockout Fault Code

The AMBIENT sensor input circuit has shorted (pin-to-pin reads 0.48 volts DC or less/the circuit has less than 1000Ω resistance).

Interface Control Board

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

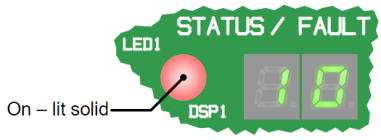
Inspect the AMBIENT sensor wiring for shorting or grounding, repair as needed. Inspect the sensor case for cracks that allow water entry to intermittent shorts. Replace the sensor.

Method to Clear

The AMBIENT sensor input circuit reads more than 0.48 volts DC/has 1000Ω or more resistance and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pings are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 10



Type of Indication: Soft Lockout Fault Code

The AMBIENT sensor input circuit has opened (pin-to-pin reads 5.10 volts DC or more/the circuit has more than 350,000Ω resistance).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

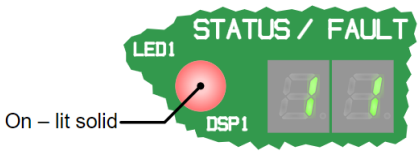
Inspect the AMBIENT sensor wiring and connection to the interface control board for breaks in the circuit, repair as needed. Replace the sensor.

Method to Clear

The AMBIENT sensor input circuit reads less than 5.10 volts DC/has 350,000Ω or less resistance and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 11



Type of Indication: Soft Lockout Fault Code

The interface control board is configured for heat pump operation and the COIL sensor input circuit has shorted (pin-to-pin reads 0.48 volts DC or less/the circuit has less than 1000Ω resistance).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

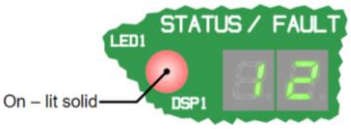
Technician Corrective Action

Inspect the COIL sensor wiring for shorting or grounding, repair as needed. Inspect the sensor case for cracks that allow water entry for intermittent shorts. Replace the sensor.

Method to Clear

- The COIL sensor input circuit reads more than 0.48 volts DC/has 1000Ω or more resistance and either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 12



Type of Indication: Soft Lockout Fault Code

The interface control board is configured for heat pump operation and the COIL sensor input circuit has opened (pin-to-pin reads 5.10 volts DC or more/the circuit has more than 350,000Ω resistance).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

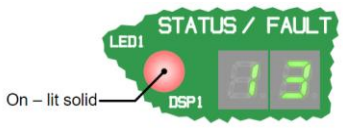
Inspect the COIL sensor wiring and connection to the interface control board for breaks in the circuit, repair as needed. Replace the sensor.

Method to Clear

For heat pump units:

- The COIL sensor input circuit reads less than 5.10 volts DC/has 350,000Ω or less resistance and either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 13



Type of Indication: Soft Lockout Fault Code

The DIS sensor input circuit has shorted (pin-to-pin reads 0.05 volts DC or less/the circuit has less than 90Ω resistance).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

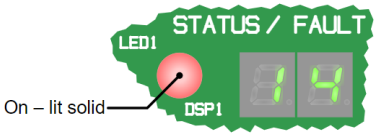
Inspect the DIS sensor wiring for shorting or grounding, repair as needed. Inspect the sensor case for cracks that allow water entry for intermittent shorts. Replace the sensor.

Method to Clear

The DIS sensor input circuit reads more than 0.05 volts DC/has 90Ω or more resistance and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 14



Type of Indication: Soft Lockout Fault Code

The DIS sensor input circuit has opened (pin-to-pin reads 5.10 volts DC or less/the circuit has less than 350,000Ω resistance).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

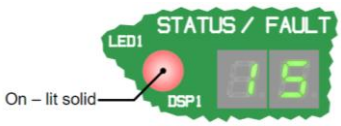
Inspect the DIS sensor wiring and connection to the interface control board for breaks in the circuit, repair as needed. Replace the sensor.

Method to Clear

The DIS sensor input circuit reads less than 5.10 volts DC/has 350,000Ω or less resistance and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 15



Type of Indication: Soft Lockout Fault Code/Hard Lockout Fault Code

- The DIS sensor temperature has been more than 248°F (input circuit pin-to-pin reads 0.19 volts DC or less/the circuit has less than 390Ω resistance) continuously for 30 seconds with compressor operation underway.
- Becomes a hard lockout fault code with the following:
  - There has also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
    - High pressure switch trips
    - Low pressure switch trip
    - High discharge line temperature
    - Low discharge line temperature
    - Compressor motor speed feedback has remained at 0 RPM (startup)
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup)
  - The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

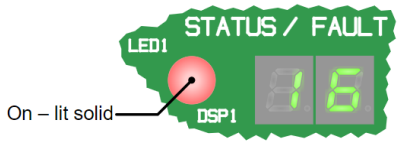
Technician Corrective Action

Ensure the DIS sensor is accurate; measure discharge line temperature and compare pin-to-pin voltage/resistance per sensor temperature to the sensor temp/VDC/resistance table in Section 3. Investigate and correct refrigerant circuit causes of excessive suction superheat; under-charging, non-condensable contamination, flow restriction, heat pump reversing valve not shifting completely, etc.

Method to Clear

- For a lockout fault code; the DIS sensor temperature is less than 248°F (input circuit pin-to-pin reads more than 0.19 volts DC/the circuit has 391Ω or more resistance) and either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code, the DIS sensor temperature is less than 248°F (input circuit pin-to-pin reads more than 0.19 volts DC/the circuit has 391Ω or more resistance) and either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 16



Type of Indication: Soft Lockout Fault Code/Hard Lockout Fault Code

- The DIS sensor temperature has been less than 70°F (input circuit pin-to-pin reads 2.85 volts DC or more/the circuit has more than 11,883Ω resistance) continuously for 60 minutes with compressor operation underway after either:
  - The first 8 minutes of compressor operation.
  - The first 15 minutes following defrost termination.
- Becomes a hard lockout fault code with the following:
  - There has also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
    - High pressure switch trips
    - Low pressure switch trip
    - High discharge line temperature
    - Low discharge line temperature
    - Compressor motor speed feedback has remained at 0 RPM (startup)
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup)
  - The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

Verify the DIS sensor is mounted within approximately 6 inches of the compressor piping stub in contact with the discharge line. Ensure the DIS sensor is accurate; measure discharge line temperature and compare pin-to-pin voltage/resistance per sensor temperature to the sensor temp/VDC/resistance table in Section 3. Investigate and correct refrigerant circuit causes of extremely low suction superheat such as over-charging.

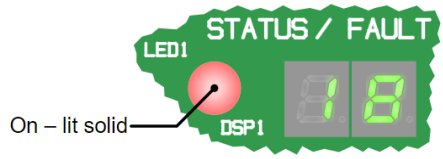
For low discharge line temperature faults that occur in cooling mode operation; ensure there is proper indoor coil airflow, the filter is clean, and the coil is not fouled with dirt, etc. For low discharge line temperature faults that occur in heating mode operation; ensure there is proper outdoor coil airflow, and the coil is not fouled with dirt, etc.

Verify COIL and AMBIENT sensors provide accurate temperature information for proper defrost cycle initiation and termination.

Method to Clear

- For a soft lockout fault code, the DIS sensor temperature is 70°F or more (input circuit pin-to-pin reads 2.85 volts DC or more/the circuit has 11,883Ω or less resistance) and either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code, the DIS sensor temperature is 70°F or more (input circuit pin-to-pin reads 2.85 volts DC or more/the circuit has 11,883Ω or less resistance) and either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 18



Type of Indication: Non-Lockout Fault Code

O input has been received with the interface control board configured for air conditioning.

Interface Control Board Response

- The RV output is energized whenever there is “O” input.
  - In heat pump units this will allow cooling operation as requested by thermostat inputs.
- The fault code enters the stored fault code history.

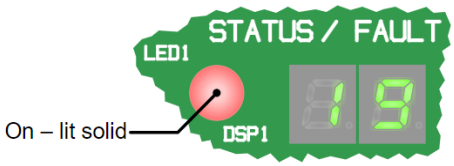
Technician Corrective Action

For heat pump units, ensure the reversing valve coil is not electrically open and is connected to the interface control board RVG and RV pins, cycle power to the interface control board, review the stored fault code history and clear as needed.

Method to Clear

For heat pump units, there is connection (closed circuit/3500Ω or less) to the RVG and RV pins at interface control board power-up.

Red LED Lit – Digital Indication 19



Type of Indication: Non-Lockout Fault Code

W input has been received with the interface control board configured for air conditioning.

Interface Control Board Response

- The W1OUT output is energized whenever there is W input, the W2OUT output is energized 15 minutes after the initiation of the W1OUT output.
  - In air conditioning systems this has no effect on operation since there is no connection of W1OUT and W2OUT for control of the auxiliary/supplemental heat.
  - In heat pump systems this will allow auxiliary/supplemental heating operation as requested by thermostat inputs.
- The fault code enters the stored fault code history.

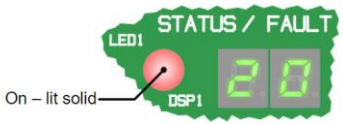
Technician Corrective Action

For heat pump units, ensure the reversing valve coil is not electrically open and is connected to the interface control board RVG and RV pins, cycle power to the interface control board, review the stored fault code history and clear as needed.

Method to Clear

For heat pump units: there is connection (closed circuit/3500Ω or less) to the RVG and RV pins at interface control board power-up.

Red LED Lit – Digital Indication 20



Type of Indication: Non-Lockout Fault Code

0 and W inputs received simultaneously with the interface control board configured for air conditioning.

Interface Control Board

- The RV output is energized whenever there is “O” input.
  - In heat pump units this will allow cooling operation as requested by thermostat inputs.
- The W1OUT output is energized whenever there is W input, the W2OUT output is energized 15 minutes after the initiation of the W1OUT output.
  - In heat pump systems this will allow auxiliary/supplemental heating operation as requested by thermostat inputs.
- The fault code enters the stored fault code history.

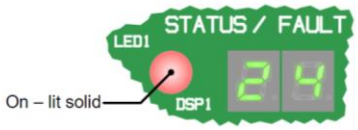
Technician Corrective Action

For heat pump units, correct the thermostat input wiring error that is causing simultaneous O and W inputs to the interface control board. Ensure the reversing valve coil is not electrically open and is connected to the interface control board RVG and RV pins, cycle power to the interface control board, review the stored fault code history and clear as needed.

Method to Clear

For heat pump units: the O and W inputs are removed and there is connection (closed circuit/3500Ω or less) to the RVG and RV pins at interface control board power-up.

Red LED Lit – Digital Indication 24



Type of Indication: Soft Lockout Fault Code

O and W inputs received simultaneously with the interface control board configured for heat pump.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
  - Outdoor unit operation as requested by thermostat inputs can resume once either or both O and W inputs are removed.
- The fault code enters the stored fault code history.

Technician Corrective Action

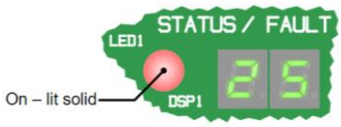
For heat pump units, correct the thermostat input wiring error that is causing simultaneous O and W inputs to the interface control board.

Method to Clear

For heat pump units: The O and/or W input is removed and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 25



Type of Indication: Non-Lockout Fault Code/Soft Lockout Fault Code/Hard Lockout Fault Code

Compressor motor speed feedback from the inverter has remained at 0 RPM following initiation of a compressor capacity step command (startup) from the interface control board.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- After 1 minute, the interface control board will re-initiate the compressor capacity step command.
- Becomes a soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 12-hour period of clock time from these causes.
    - Compressor motor speed feedback has remained at 0 RPM (startup)
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup)
- Becomes a hard lockout fault code with the following:
  - There has also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes.
    - High pressure switch trips
    - Low pressure switch trips
    - High discharge line temperature
    - Low discharge line temperature
    - Compressor motor speed feedback has remained at 0 RPM (startup)
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup)
  - The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other inverter-based fault codes related to compressor operation. Verify single-phase 208/230 volts AC line voltage is supplied to the outdoor unit. Verify 208/230 volts Ac is applied to the L1 (black) and L2 (yellow) wires of the inverter indicating the surface-mounted circuit breaker in the unit control box is intact and there are not poor connections in the line voltage supplied to the inverter. Further checks require disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts DC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V, and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit.) Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Compressor Motor
	Winding-to-winging resistance of 68 degrees F
2-ton	.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, V and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70 degrees F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	Current draw of each leg
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70 degrees F ambient, expect variation in field measurements due to changes in motor loading.	

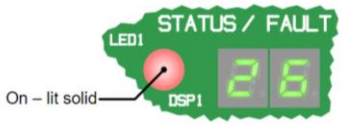
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor.

Method to Clear

- For a non-lockout fault, following re-initiation of a compressor capacity step command (startup), the compressor motor speed feedback from the inverter is within 30 RPM of the speed requested by the interface control board command and modified by applicable inverter protective functions.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 26



Type of Indication: Non-Lockout Fault Code/Soft Lockout Fault Code/Hard Lockout Fault Code

Outdoor fan motor speed feedback from the inverter has remained at 0 RPM following initiation of a compressor capacity step command (startup) from the interface control board.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- After 1 minute, the interface control board will re-initiate the compressor capacity step command.
- Becomes a soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
    - Compressor motor speed feedback has remained at 0 RPM (startup)
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup)
- Becomes a hard lockout fault code with the following:
  - There has also been a total of four soft lockout fault codes, in any combination, within a 12-hour period of clock time from these causes:
    - High pressure switch trips
    - Low pressure switch trips
    - High discharge line temperature
    - Low discharge line temperature
    - Compressor motor speed feedback has remained at 0 RPM (startup)
    - Outdoor fan motor speed feedback has remained at 0 RPM (startup)
  - The previous soft lockout fault codes within the 12-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other inverter-based fault codes related to outdoor fan operation. Verify single-phase 208/230 volts AC line voltage is supplied to the outdoor unit. Verify 208/230 volts AC is applied to the L1 (black) and L2 (yellow) wires of the inverter indicating the surface-mounted circuit breaker in the unit control box is intact and there are not poor connections in the line voltage supplied to the inverter. Further checks require disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit.) Once it is confirmed there is no line voltage or inverter output voltage present; verify the outdoor fan motor turns freely. Verify there are not poor connections in the wiring from the inverter to outdoor fan motor. Disconnecting the wiring harness from the inverter fan output pins R, S and T; normal winding-to-winding ohm readings through the connecting wiring to the outdoor fan motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68 degrees F
2-ton	36.5Ω
3-ton	11.8Ω
4-ton	9.8Ω
5-ton	9.8Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed, reconnect the wiring harness to the inverter fan output pins R, S and T and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On restart, monitor the AC voltage and current draw for each leg of the outdoor fan motor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70 degrees F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	148.1 VAC	0.5 amps AC
	150.0 VAC	0.5 amps AC
3-ton	100.3 VAC	1.2 amps AC
	102.1 VAC	1.2 amps AC
4-ton	144.5 VAC	1.2 amps AC
	146.5 VAC	1.3 amps AC
5-ton	145.6 VAC	1.2 amps AC
	146.0 VAC	1.2 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70 degrees F ambient, expect variation in field measurements due to changes in motor loading.	

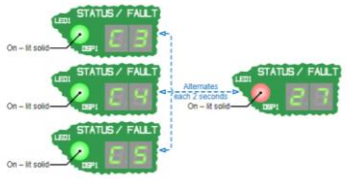
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three outdoor fan motor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining outdoor fan motor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three outdoor fan motor output legs at restart indicates mechanical damage to the outdoor fan motor.

Method to Clear

- For a non-lockout fault code, following re-initiation of a compressor capacity step command (startup), the outdoor motor speed feedback from the inverter is within 30 RPM of the speed requested by the interface control board command and modified by applicable inverter protective functions.
- For a soft lockout fault code:
    - Y1 and Y2 thermostat input is removed.
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.

Green LED Lit – Digital Indication C# Alternating with Red LED Lit – Digital Indication 27



Type of Indication: Status

Compressor and outdoor fan motor speed are limited due to High Ambient Cooling Operation at ambient (outdoor air) temperatures from 109.4°F up to 124.8°F.

Interface Control Board Response

- With cooling operation at 109.4 to 113 degrees F ambient temperature.
  - The maximum compressor motor speed command the interface control board can send to the inverter is limited to:
    - 3500 RPM in 2-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
    - 3600 RPM in 3-ton units. Cooling mode compressor capacity step 5 is affected.
    - 3800 RPM in 4-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
    - 4000 RPM in 5-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
  - Recording the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
  - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
  - When compressor motor speed is limited, the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator (status 27).
  - Where required, the interface control board sends a reduced outdoor fan speed command to the inverter.
    - In 4-ton units the outdoor fan speed at 109.4 degrees F to 113 degrees F ambient is 925 RPM
    - In 5-ton units the outdoor fan speed at 109.4 degrees F to 113 degrees F ambient is 925 RPM
- With cooling operation at 113°F to 118.4°F ambient temperature:
  - The maximum compressor motor speed command the interface control board can send to the inverter is limited to:
    - 3100 RPM in 2-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
    - 3200 RPM in 3-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
    - 3360 RPM in 4-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
    - 3600 RPM in 5-ton units. Cooling mode compressor capacity steps 4 and 5 are affected.
  - Recording the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
  - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
  - When compressor motor speed is limited, the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator (status 27).
  - Where required, the interface control board sends a reduced outdoor fan speed command to the inverter.
    - In 3-ton units the outdoor fan speed at 113°F to 118.4°F ambient is 750 RPM
    - In 4-ton units the outdoor fan speed at 113°F to 118.4°F ambient is 925 RPM
    - In 5-ton units the outdoor fan speed at 113°F to 118.4°F ambient is 925 RPM
- With cooling operation at 118.4°F to 124.8°F ambient temperature:
  - The maximum compressor motor speed command the interface control board can send to the inverter is limited to:
    - 2700 RPM in 2-ton units. Cooling mode compressor capacity steps 3, 4 and 5 are affected.
    - 2800 RPM in 3-ton units. Cooling mode compressor capacity steps 3, 4 and 5 are affected.

        - 2940 RPM in 4-ton units. Cooling mode compressor capacity steps 3, 4 and 5 are affected.
        - 3200 RPM in 5-ton units. Cooling mode compressor capacity steps 3, 4 and 5 are affected.
    - Recording the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
    - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
    - When compressor motor speed is limited, the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator (status 27).
    - Where required, the interface control board sends a reduced outdoor fan speed command to the inverter.
        - In 3-ton units the outdoor fan speed at 118.4°F to 124.8°F ambient is 750 RPM
        - In 4-ton units the outdoor fan speed at 118.4°F to 124.8°F ambient is 925 RPM
        - In 5-ton units the outdoor fan speed at 118.4°F to 124.8°F ambient is 925 RPM

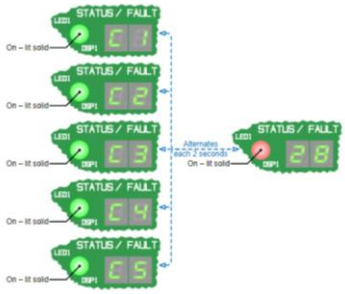
Technician Corrective Action

If ambient temperature is not from 109.4°F up to 124.8°F, verify the AMBIENT sensor is providing accurate temperature information and is not influenced by recirculated outdoor coil airflow. Inspect the AMBIENT sensor wiring for shorting or grounding, repair as needed. Inspect the sensor case for cracks that allow water entry for intermittent shorts. Replace the sensor as needed.

Method to Clear

Cooling operation ends or ambient (outdoor air) temperature is no longer in the range from 109.4 degrees F up to 124.8°F.

Green LED Lit – Digital Indication C# Alternating with Red LED Lit – Digital Indication 28



Type of Indication: Status

Compressor and outdoor fan motor speed are reduced due to High Ambient Cooling Operation at ambient (outdoor air) temperatures 124.8° F.

Interface Control Board Response

- Compressor motor speed reduction as low as 1800 RPM or shutdown can affect all cooling mode compressor capacity steps.
- Recording the requested cooling capacity step runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
- Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
- When compressor motor speed is reduced, the STATUS/FAULT will display the cooling mode compressor capacity step indicator alternating each 2 seconds with the high ambient cooling indicator (status 28).
- Additional inverter-based fault codes due to the excessive temperature of internal components is also very likely to occur with Cooling operation above 124.8 degrees F (51.6 degrees C) ambient temperature.

Technician Corrective Action

If ambient temperature is not 124.8°F or more, verify the AMBIENT sensor is providing accurate temperature information and is not influenced by recirculated outdoor coil airflow. Inspect the AMBIENT sensor wiring for shorting or grounding, repair as needed. Inspect the sensor case for cracks that allow water entry for intermittent shorts. Replace the sensor as needed.

Methods to Clear

Cooling operation ends or ambient (outdoor air) temperature falls below 124.8°F.

Green LED Lit – Digital Indication C4 Alternating with Red LED Lit – Digital Indication 29

Type of Indication: Status

Cooling capacity step 4 operation is “locked in” and outdoor fan motor speed is reduced due to low Ambient Cooling Operation at ambient (outdoor air) temperatures 60°F or less.

Interface Control Board Response

- With Low Ambient Cooling operation at 60°F ambient temperature.
- With the compressor ASCD expired, the interface control board sends reduced outdoor fan speed command to the inverter.
    - In 2-ton units the outdoor fan speed at 60°F ambient is 700 RPM
    - In 3-ton units the outdoor fan speed at 60°F ambient is 675 RPM
    - In 4-ton units the outdoor fan speed at 60°F ambient is 700 RPM
    - In 5-ton units the outdoor fan speed at 60°F ambient is 750 RPM
        - The inverter (brakes, starts and) ramps the outdoor fan motor to the commanded speed. The inverter sends outdoor fan motor speed feedback information to the interface control board.
- The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator alternating each 2 seconds with the low ambient cooling indicator (status 28).
- The Y2OUT output is energized for increased indoor blower speed/airflow volume.
- With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
    - The inverter (starts and) ramps the compressor motor to the commanded speed.
        - The inverter sends compressor motor speed feedback information to the interface control board.
    - Recording cooling capacity step 4 runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
    - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
- With Low Ambient Cooling operation at 59°F down to 35°F ambient temperatures:
    - With the compressor ASCD expired; based on AMBIENT temperature, the interface control board sends a progressively reduced outdoor fan speed command to the inverter down to the following minimum values.
        - In 2-ton units the outdoor fan speed at 40°F down to 35°F AMBIENT is 330 RPM
        - In 3-ton units the outdoor fan speed at 35°F ambient is 300 RPM
        - In 4-ton units the outdoor fan speed at 40°F down to 35°F AMBIENT is 330 RPM
        - In 5-ton units the outdoor fan speed at 35°F ambient is 370 RPM
            - The inverter (brakes, starts and) ramps the outdoor fan motor to the commanded speed.
    - The inverter sends outdoor fan motor speed feedback information to the interface control board.
    - The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator alternating each 2 seconds with the low ambient cooling indicator (status 28).
    - The Y2OUT output is energized for increased indoor blower speed/airflow volume.
    - With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
        - The inverter (starts and) ramps the compressor motor to the commanded speed. The inverter sends compressor motor speed feedback information to the interface control board.
    - Recording cooling capacity step 4 runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.

    - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
- With Low Ambient Cooling operation at ambient temperatures 34°F or less:
    - With the compressor ASCD expired; based on AMBIENT temperature, the interface control board sends an outdoor fan off command to the inverter.
        - The inverter ramps down and stops outdoor fan motor output. The inverter sends outdoor fan motor speed feedback information to the interface control board.
    - The STATUS/FAULT of the interface control board will display the cooling mode compressor capacity step 4 indicator alternating each 2 seconds with the low ambient cooling indicator (status 28).
    - The Y2OUT output is energized for increased indoor blower speed/airflow volume.
    - With proper outdoor fan motor operation confirmed, the interface control board sends a compressor capacity step 4 command to the inverter.
        - The inverter (starts and) ramps the compressor motor to the commanded speed. The inverter sends compressor motor speed feedback information to the interface control board.
    - Recording cooling capacity step 4 runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.
    - Recording of overall cooling cycle runtime begins/continues and the data is used for the next cooling cycle like Cooling operation.

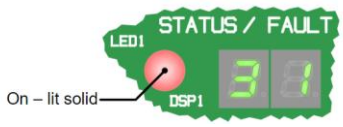
Technician Corrective Action

If ambient temperature is not 60°F or less; verify the AMBIENT sensor is providing accurate temperature information. Inspect the AMBIENT sensor wiring for poor connection or grounding, repair as needed. Inspect the sensor case for cracks that allow water entry for intermittent inaccuracy. Replace the sensor as needed.

Method to Clear

Cooling operation ends or ambient (outdoor air) temperature rises to 61°F or more.

Red LED Lit – Digital Indication 31



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

- Any one of the following inverter-based fault codes related to the compressor motor output has occurred:
  - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34)
  - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
  - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
  - There has been excessive temperature at the inverter internal controller (fault code 37).
  - There has been excessive voltage detected at the inverter internal controller (fault code 38).
  - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
  - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
  - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
  - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
  - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
  - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
  - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
  - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
  - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
  - The inverter has detected an error at the internal rectification circuit (fault code 53).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if all:
  - The conditions causing the other inverter-based fault code related to compressor operation return to a normal range.
  - The nature of the other inverter-based fault code related to compressor operation permits.
  - The compressor ASDC has expired.

Technician Corrective Action

Review the stored fault code history for other inverter-based fault codes related to compressor operation. Correct the conditions causing the other inverter-based fault codes related to compressor operation.

Method to Clear

- For a non-lockout fault code, the conditions causing the other inverter-based fault code related to compressor operation return to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 32

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

Any one of the following inverter-based fault codes related to the outdoor fan motor output has occurred:

- There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
- The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
- The inverter has detected phase loss for the outdoor fan motor outdoor circuit (fault code 49).
- There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
- There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if all:
  - The conditions causing the other inverter-based fault code related to the outdoor fan motor output return to a normal range.
  - The nature of the other inverter-based fault code related to the outdoor fan motor output permits.
  - The compressor ASCD has expired.

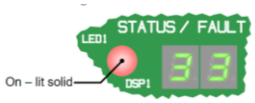
Technician Corrective Action

Review the stored fault code history for other inverter-based fault codes related to the outdoor fan motor output. Correct the conditions causing the other inverter-based fault codes related to the outdoor fan motor output.

Method to Clear

- For a non-lockout fault code, the conditions causing the other inverter-based fault code related to compressor operation return to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 33



Type of Indication: Non-Lockout Fault Code

The inverter has lost communication with the interface control board for more than 60 seconds.

Interface Control Board Response

- If possible, the compressor and outdoor fan motor are commanded off.
    - If the compressor was operating, the compressor ASCD timer begins.
- If possible, the fault code enters the stored fault code history.
- Inverter response:
- Output to the compressor and outdoor fan motor ends when the inverter has lost communication with the interface control board for more than 60 seconds.

Technician Corrective Action

Verify the inverter-to-interface control board communication wiring harness is intact and connected. Verify all the chokes are in place and the unit wiring is properly routed. With the communication wiring harness in place (closed circuit), verify C to B- voltage reads 1.30 to 2.10 volts DC (pulsing) and C to A+ voltage reads 1.46 to 2.40 volts DC (pulsing). If the voltage readings from the closed communication circuit are not in range, disconnect the inverter-to-interface control board communication wiring harness for open circuit readings at the interface control board and inverter communication connection pins.

With the interface control board powered and the communication wiring harness removed (open circuit), field measurements of C pin to B- pin voltage will read 2.50 volts DC and C pin to A+ pin voltage will read 2.75 volts DC indicating the interface control board communication circuit is intact. With the inverter powered and the communication wiring harness removed (open circuit), field measurements of C pin to B- pin voltage will read 2.43 volts DC and C pin to A+ pin voltage will read 2.68 volts DC indicating the inverter communication circuit is intact.

Inverter-to-interface control board communication wiring harness issues are indicated if closed circuit readings are not in range but open circuit readings at the interface control board pins and inverter pins are in range. Open circuit readings at the pins that are not in range indicate damage to the interface control board or inverter communication circuit requiring component replacement. Investigate causes for excessive voltage, surges, etc. if replacement of the interface control board or inverter is required due to communication circuit damage.

Method to Clear

Inverter-to-interface control board communication resumes.

Red LED Lit – Digital Indication 34

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been excessive voltage detected at the internal DC bus for inverter compressor motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).

- Once an inverter-based soft lockout fault code occurs.
  - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
    - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
    - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
  - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
  - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other inverter-based fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC. Contact the power utility for correction if the power supplied to the outdoor unit exceeds 253 colts AC. With less than 253 volts AC supplied to the inverter and the compressor operating at capacity step 4 (use of the TEST pins or the TEST MODE jumper-tab features recommended), verify the AC voltage at the compressor output circuit, terminals U, V and W, is reasonably close to the listing in the table below indicating the inverter is not damaged.

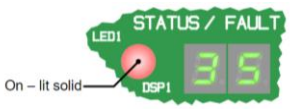
“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

Method to Clear

- For a non-lockout fault code, the voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 35



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).

        - Once an inverter-based soft lockout fault code occurs.
            - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
                - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
                - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other inverter-based fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC. Contact the power utility for correction if the power supplied to the outdoor unit exceeds 253 colts AC. With less than 253 volts AC supplied to the inverter and the compressor operating at capacity step 4 (use of the TEST pins or the TEST MODE jumper-tab features recommended), verify the AC voltage at the compressor output circuit, terminals U, V and W, is reasonably close to the listing in the table below indicating the inverter is not damaged.

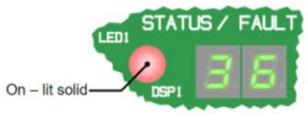
“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

Method to Clear

- For a non-lockout fault code, the voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
- For a soft lockout fault code either:
    - Y1 and Y2 thermostat input is removed.
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 36



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been excessive current draw at the internal DC bus for inverter compressor motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).

- Once an inverter-based soft lockout fault code occurs.
  - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
    - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
    - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
  - There have also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
  - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are not airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing excessive compressor current draw. Verify the fins of the heat sink on the back of the inverter are clear of debris and extend into the outdoor fan air stream to dissipate heat from inverter operation. Verify there has not been cooling mode operation at high ambient temperature. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out-tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring form the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

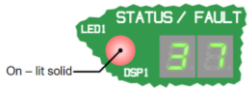
Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

With all other checks complete:
Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor.

Method to Clear

- For a non-lockout fault code, the voltage detected at the internal DC bus for inverter compressor motor output is 0 amps DC with the compressor commanded off.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 37



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been excessive temperature at the inverter internal controller.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).

- Once an inverter-based soft lockout fault code occurs.
  - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
    - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
    - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
  - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
  - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing excessive compressor current draw. Verify the fins of the heat sink on the back of the inverter are clear of debris and extend into the outdoor fan air stream to dissipate heat from inverter operation. Verify there has not been cooling mode operation at high ambient temperature. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out-tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

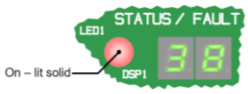
Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

With all other checks complete:
Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 38



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been excessive temperature at the inverter internal controller.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).

        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC. Contact the power utility for correction if the power supplied to the outdoor unit exceeds 253 volts AC. With less than 253 volts AC supplied to the inverter and the compressor operating at capacity step 4 (use of the TEST pins of the TEST MODE jumper-tab features recommended), verify the AC voltage at the compressor output circuit, terminals U, V and W, is reasonably close to the listing in the table below indicating the inverter is not damaged.

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	Current draw of each leg
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
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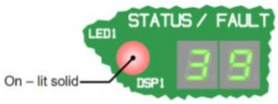
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
    - Y1 and Y2 thermostat input is removed.
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 39



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been insufficient voltage detected at the inverter internal controller.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
    - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
    - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
    - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
        - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
        - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
        - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
        - There has been excessive temperature at the inverter internal controller (fault code 37).
        - There has been excessive voltage detected at the inverter internal controller (fault code 38).
        - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
        - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
        - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
        - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
        - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
        - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
        - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
        - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
        - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
        - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.

        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC. Contact the power utility for correction if the power supplied to the outdoor unit exceeds 253 volts AC. With less than 253 volts AC supplied to the inverter and the compressor operating at capacity step 4 (use of the TEST pins of the TEST MODE jumper-tab features recommended), verify the AC voltage at the compressor output circuit, terminals U, V and W, is reasonably close to the listing in the table below indicating the inverter is not damaged.

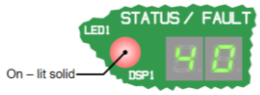
“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
    - Y1 and Y2 thermostat input is removed.
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
    - Power to the interface control board is cycled.
    - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 40



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

The compressor motor speed feedback was not within /- 30 RPM of the commanded speed.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).

- Once an inverter-based soft lockout fault code occurs.
  - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
    - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
    - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
  - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
  - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing excessive compressor loading. Verify there are no airflow or refrigerant circuit issues such as dirty filters, failed coils, refrigerant under-charging, etc. causing insufficient compressor loading. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks required disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	Current draw of each leg
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

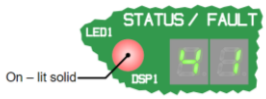
With all other checks complete:

- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor.
- Extremely light current draw on compressor restart indicates mechanical damage to the compressor such as a broken crankshaft.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 41



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

Compressor motor phase loss was detected by compressor motor speed feedback.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).

- Once an inverter-based soft lockout fault code occurs.
  - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
    - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
    - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
  - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
  - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there is no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing excessive compressor loading. Verify there are no airflow or refrigerant circuit issues such as dirty filters, failed coils, refrigerant under-charging, etc. causing insufficient compressor loading. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks required disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 42

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.

    - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
    - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
        - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
        - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
        - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
        - There has been excessive temperature at the inverter internal controller (fault code 37).
        - There has been excessive voltage detected at the inverter internal controller (fault code 38).
        - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
        - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
        - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
        - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
        - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
        - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
        - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
        - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
        - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
        - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there is no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing excessive compressor loading. Verify there are no airflow or refrigerant circuit issues such as dirty filters, failed coils, refrigerant under-charging, etc. causing insufficient compressor loading. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks required disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	Current draw of each leg
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 43

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).

        - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
        - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
        - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
        - There has been excessive temperature at the inverter internal controller (fault code 37).
        - There has been excessive voltage detected at the inverter internal controller (fault code 38).
        - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
        - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
        - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
        - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
        - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
        - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
        - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
        - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
        - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
        - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there is no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing excessive compressor loading. Verify there is no airflow or refrigerant circuit issues such as dirty filters, failed coils, refrigerant under-charging, etc. causing insufficient compressor loading. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks required disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	Current draw of each leg
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

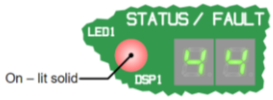
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor such as dragging bearings.
- Extremely light current draw on compressor restart indicates mechanical damage to the compressor such as a broken crankshaft.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.

Red LED Lit – Digital Indication 44



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Code/Inverter-Based Hard Lockout Fault Code

There has been a frequency error at the internal DC bus for inverter compressor motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:

- There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).
- Once an inverter-based soft lockout fault code occurs.
    - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
        - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
        - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.

- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit and that all chokes are in place. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

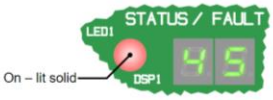
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor such as dragging bearings.
- Extremely light current draw on compressor restart indicates mechanical damage to the compressor such as a broken crankshaft.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.

Red LED Lit – Digital Indication 45



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).

        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit and that all chokes are in place. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

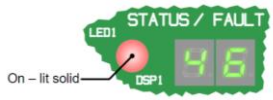
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor such as dragging bearings.
- Extremely light current draw on compressor restart indicates mechanical damage to the compressor such as a broken crankshaft.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.

Red LED Lit – Digital Indication 46



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

The inverter compressor (“3-phase”) output has been unbalanced.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has bene excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).
  - Once an inverter-based soft lockout fault code occurs.

        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There have also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit and that all chokes are in place. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

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Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
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2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

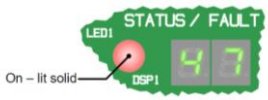
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 47



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been abnormal voltage waveform detected at the inverter outdoor fan motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.

- The compressor ASCD has expired.

- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).
  - Once an inverter-based soft lockout fault code occurs.
    - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
      - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
      - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
  - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
  - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit and that all chokes are in place. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC

	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.

With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor such as dragging bearings.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 48

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

The inverter has detected a locked rotor for the outdoor fan motor.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).

        - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
        - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
        - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
        - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
        - The inverter compressor ("3-phase") output has been unbalanced (fault code 46).
        - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
        - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a "clear faults" command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send "clear faults" commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit and that all chokes are in place. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

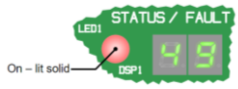
With all other checks complete:

- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw and lowered/in-range voltage on all three compressor output legs at restart indicates mechanical damage to the compressor such as dragging bearings.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 49



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

The inverter has detected phase loss for the outdoor fan motor output circuit.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).
  - Once an inverter-based soft lockout fault code occurs.

        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit and that all chokes are in place. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

“Baseline” Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

With all other checks complete:

- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 50

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:

- There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).
- Once an inverter-based soft lockout fault code occurs.
    - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
        - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
        - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.

- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other inverter-based fault codes related to outdoor fan operation and voltage. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Contract the power utility/consult an electrician for correct if the power supplied to the outdoor unit is not within the nameplate rating. With proper AC voltage supplied to the inverter and the outdoor fan motor operating in a mode other than low ambient cooling, verify the AC voltage at the inverter fan output pins R, S and T, is reasonably close to the listing in the table below indicating the inverter is not damaged.

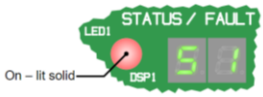
"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 51



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been excessive current draw and the internal DC bus for inverter outdoor fan motor output.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:

- There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
    - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
    - The inverter has detected an error at the internal rectification circuit (fault code 53).
- Once an inverter-based soft lockout fault code occurs.
    - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
        - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
        - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.

- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to outdoor fan operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC

	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.

With all other checks complete:
Excessive current draw on outdoor fan motor restart indicates mechanical damage to the outdoor fan motor such as dragging bearings.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 52

Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

There has been low voltage detected at the inverter compressor motor output switching transistor.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).

        - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
        - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
        - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
        - The inverter compressor ("3-phase") output has been unbalanced (fault code 46).
        - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
        - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a "clear faults" command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send "clear faults" commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, refrigerant under-charging, etc. causing rapid changes in compressor loading. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the sing-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

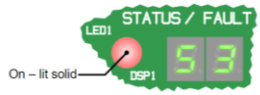
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw on outdoor fan motor restart indicates mechanical damage to the outdoor fan motor such as dragging bearings.
- Extremely light current draw on compressor restart indicates mechanical damage to the compressor such as broken crankshaft.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 53



Type of Indication: Non-Lockout Fault Code/Inverter-Based Soft Lockout Fault Code/Inverter-Based Hard Lockout Fault Code

The inverter has detected an error at the internal rectification circuit.

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.
- The interface control board will re-initiate the compressor capacity step command if both:
  - The voltage detected at the internal DC bus for inverter compressor motor output returns to a normal range.
  - The compressor ASCD has expired.
- Becomes and inverter-based soft lockout fault code with the following:
  - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 34).
    - There has been insufficient voltage detected at the internal DC bus for inverter compressor motor output (fault code 35).
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36).
    - There has been excessive temperature at the inverter internal controller (fault code 37).
    - There has been excessive voltage detected at the inverter internal controller (fault code 38).
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39).
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40).
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41).
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42).
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43).
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44).
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45).
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46).

        - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47).
        - The inverter has detected a locked rotor for the outdoor fan motor (fault code 48).
        - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49).
        - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50).
        - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51).
        - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52).
        - The inverter has detected an error at the internal rectification circuit (fault code 53).
    - Once an inverter-based soft lockout fault code occurs.
        - After 4 minutes, 50 seconds the interface control board sends a “clear faults” command to the inverter.
            - If there are no inverter-based fault codes that remain active, the interface control board will re-initiate the compressor capacity step command at the expiration of the compressor ASCD.
            - If inverter-based fault codes remain active, the compressor and outdoor fan motor remain commanded off and the interface control board continues to send “clear faults” commands to the inverter in 4 minute, 50 second intervals.
- Becomes an inverter-based hard lockout fault code with the following:
    - There has also been a total of four inverter-based soft lockout fault codes, in any combination, with a 2-hour period of clock time (fault code 55 will also enter the fault code history).
    - The previous inverter-based soft lockout fault codes within the 2-hour period were cleared by removing Y1 and Y2 thermostat input.

Technician Corrective Action

If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit is not sourced from a local generator. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load. Further checks require disconnection and lock-out/tag-out of the 208/230 volts AC line voltage supplied to the outdoor unit.

Warning
Potentially lethal voltage may be present after the modulating outdoor unit inverter is disconnected from AC line voltage. Before handling or servicing the inverter: ▪ Allow at least two minutes to pass after the inverter is disconnected from AC line voltage. ▪ Ensure the green and both the red LEDs on the inverter are not lit. ▪ Verify there is 0 volts AC present at the inverter line voltage input wires L1 (black) and L2 (yellow). ▪ Verify there is 0 volts DC present at the inverter compressor output terminals U, V and W. ▪ Verify there is 0 volts DC present at the inverter fan output pins R, S and T.

(An incidental non-lockout fault code for the interface control board losing communication with the inverter for more than 60 seconds will occur with line voltage disconnected from the outdoor unit). Once it is confirmed there is no line voltage or inverter output voltage present; verify there are not poor connections in the wiring from the inverter to compressor terminals. Disconnect the wiring from the inverter compressor output terminals U, V and W; normal winding-to-winding ohm readings through the connecting wiring to the compressor motor are as follows:

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Ohmmeter Measurement of Outdoor Fan Motor
	Winding-to-winding resistance of 68°F
2-ton	0.88Ω
3-ton	0.53Ω
4-ton	0.44Ω
5-ton	0.29Ω *Expect variation in field measurements due to changes in winding temperature and accuracy of test instruments.

With normal winding-to-winding ohm readings confirmed; reconnect the wiring to the inverter compressor output terminals U, T and W, temporarily set the TEST MODE jumper-tab to the H position and then reconnect the 208/230 volts AC line voltage supplied to the outdoor unit. On compressor restart, monitor the AC voltage and current draw for each leg of the compressor output circuit.

"Baseline" Electrical Troubleshooting Measurements of Modulating Heat Pump Outdoor Units

Unit Size	Compressor or motor inverter output circuit measurements: capacity step 4, 70°F ambient, Fluke 375 meter*	
	Leg-to-leg voltage	**Current draw of each leg**
2-ton	C4: 143.0 VAC	C4: 4.2 amps AC
	H4: 143.0 VAC	H4: 5.2 amps AC
3-ton	C4: 146.0 VAC	C4: 7.3 amps AC
	H4: 144.0 VAC	H4: 7.5 amps AC
4-ton	C4: 173.3 VAC	C4: 9.0 amps AC
	H4: 174.5 VAC	H4: 11.0 amps AC
5-ton	C4: 173.5 VAC	C4: 10.8 amps AC
	H4: 174.3 VAC	H4: 14.9 amps AC
	*The above readings are only valid for capacity step 4 operation measured by the Fluke 375 meter; other meters will not produce the same readings. The above readings were taken at 70°F ambient, expect variation in field measurements due to changes in motor loading.	

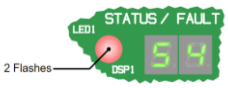
With all other checks complete:

- Low/zero current draw and low/zero voltage on two or all three compressor output legs at restart indicate damage to the inverter.
- Excessive current draw and lowered/in-range voltage on two legs with low/zero current draw and low/zero voltage on the remaining compressor output leg at restart indicates damage to the inverter.
- Excessive current draw on outdoor fan motor restart indicates mechanical damage to the outdoor fan motor such as dragging bearings.
- Extremely light current draw on compressor restart indicates mechanical damage to the compressor such as broken crankshaft.

Method to Clear

- For a non-lockout fault code, the temperature at the inverter internal controller returns to a normal range.
- For a soft lockout fault code either:
  - Y1 and Y2 thermostat input is removed.
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.
- For a hard lockout fault code either:
  - Power to the interface control board is cycled.
  - The TEST pins are shorted for longer than 2 seconds.

Red LED Lit – Digital Indication 54



Type of Indication: Inverter-Based Soft Lockout Fault Code

- There has been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes.
    - There has also been a total of three non-lockout fault codes, in any combination, within a 30-minute period of clock time from these causes (fault code 54 will also enter the fault code history).
    - There has been excessive voltage detected at the internal DC bus for inverter compressor motor output (fault code 35)
    - There has been excessive current draw at the internal DC bus for inverter compressor motor output (fault code 36)
    - There has been excessive temperature at the inverter internal controller (fault code 37)
    - There has been excessive voltage detected at the inverter internal controller (fault code 38)
    - There has been insufficient voltage detected at the inverter internal controller (fault code 39)
    - The compressor motor speed feedback was not within +/- 30 RPM of the commanded speed (fault code 40)
    - Compressor motor phase loss was detected by compressor motor speed feedback (fault code 41)
    - Compressor motor phase loss was detected by current draw at the internal DC bus for inverter compressor output (fault code 42)
    - There has been abnormal voltage waveform detected at the inverter compressor motor output switching transistor (fault code 43)
    - There has been a frequency error at the internal DC bus for inverter compressor motor output (fault code 44)
    - There has been an error in the starting frequency at the internal DC bus for inverter compressor motor output (fault code 45)
    - The inverter compressor (“3-phase”) output has been unbalanced (fault code 46)
    - There has been abnormal voltage waveform detected at the inverter outdoor fan motor output switching transistor (fault code 47)
    - The inverter has detected locked rotor for the outdoor fan motor (fault code 48)
    - The inverter has detected phase loss for the outdoor fan motor output circuit (fault code 49)
    - There has been excessive or insufficient voltage detected at the internal DC bus for inverter outdoor fan motor output (fault code 50)
    - There has been excessive current draw at the internal DC bus for inverter outdoor fan motor output (fault code 51)
    - There has been low voltage detected at the inverter compressor motor output switching transistor (fault code 52)
    - The inverter has detected an error at the internal rectification circuit (fault code 53)

Interface Control Board Response

- The compressor and outdoor fan motor are commanded off.
- The fault code enters the stored fault code history.

Technician Corrective Action

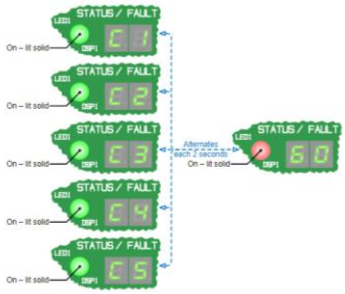
Review the stored fault code history for other inverter-based fault codes. Correct the conditions causing the other inverter-based fault codes.

Method to Clear

The conditions causing the other inverter-based fault codes(s) return to a normal range and either:

- Y1 and Y2 thermostat input is removed.
- Power to the interface control board is cycled.
- The TEST pins are shorted for longer than 2 seconds.

Green LED Lit – C# on Digital Display, Alternating with Red LED Lit – 60 on Digital Display



Type of Indication: Status

Inverter output is limited due to high temperature at the inverter internal control. The maximum compressor motor speed limit is in a range from less than the current capacity step command down to 1800 RPM.

Interface Control Board Response

- The maximum speed of the compressor (and outdoor fan) motor is limited.
- The fault code enters the stored fault code history.

Technician Corrective Action

It is normal for this status fault code to occur with cooling mode operation at high ambient temperatures.

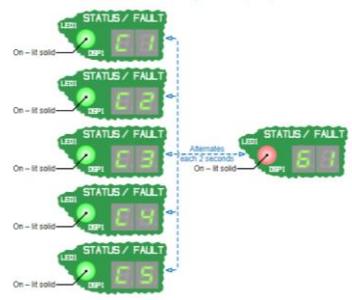
If there has not been cooling mode operation at high ambient temperatures. If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are not outdoor coil airflow issues such as dirt fouling, recirculation, etc. causing elevated outdoor coil temperatures. Verify the fins of the heat sink on the back of the inverter are clear of debris and extend into the outdoor fan air stream to dissipate heat from inverter operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load.

Method to Clear

Either:

- The temperature at the inverter internal control returns to a normal range.
- The compressor motor speed of the current capacity step command is less than maximum compressor motor speed limit due to high temperature at the inverter internal controller.

Green LED Lit – C# on Digital Display, Alternating with Red LED Lit – 61 on Digital Display



Type of Indication: Status
Inverter output is limited due to high temperature at the inverter internal controller. The maximum compressor motor speed limit is in a range from less than the current capacity step command down to 1800 RPM.

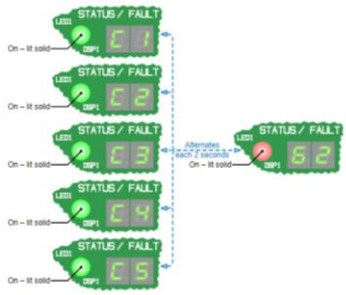
Interface Control Board Response
- The maximum speed of the compressor (and outdoor fan) motor is limited.
- The fault code enters the stored fault code history.

Technician Corrective Action
It is normal for this status fault code to occur with cooling mode operation at high ambient temperatures.

If there has not been cooling mode operation at high ambient temperatures. If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not fall below 187 volts AC with the circuit under load.

Method to Clear
Either:
- The voltage at the internal DC bus for inverter compressor motor output returns to a normal range.
- The compressor motor speed of the current capacity step command is less than maximum compressor motor speed limit due to low voltage at the internal DC bus for inverter compressor motor output.

Green LED Lit – C# on Digital Display, Alternating with Red LED Lit – 62 on Digital Display



Type of Indication: Status
Inverter output is limited due to the high temperature at the inverter internal controller. The maximum compressor motor speed limit is in range from less than the current capacity step command down to 1800 RPM.

Interface Control Board Response
- The maximum speed of the compressor (and outdoor fan) motor is limited.
- The fault code enters the stored fault code history.

Technician Corrective Action
It is normal for this status fault code to occur with cooling mode operation at high ambient temperatures.

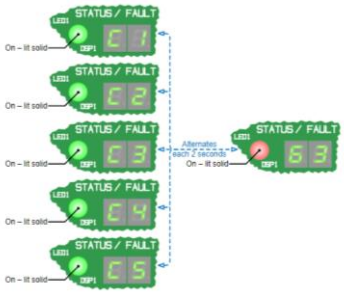
If there has not been cooling mode operation at high ambient temperatures. If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing high compressor current draw. Verify the fins of the heat sink on the back of the inverter are clear of debris and extend into the outdoor fan air stream to dissipate heat from inverter operation. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load.

Method to Clear

Either:

- The current draw at the internal DC bus for inverter compressor motor output returns to a normal range.
- The compressor motor speed of the current capacity step command is less than maximum compressor motor speed limit due to low voltage at the internal DC for inverter compressor motor output.

Green LED Lit – C# on Digital Display, Alternating with Red LED Lit – 63 on Digital Display



Type of Indication: Status

Inverter output is limited due to the high temperature at the inverter internal controller. The maximum compressor motor speed limit is in range from less than the current capacity step command down to 1800 RPM.

Interface Control Board Response

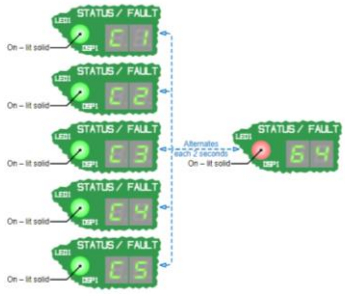
- The speed of the compressor (and outdoor fan) motor is reduced.
- The fault code enters the stored fault code history.

Technician Corrective Action

It is normal for this status fault code to occur with cooling mode operation at high ambient temperatures.

If there has not been cooling mode operation at high ambient temperatures. If the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not fall below 187 volts AC with the circuit under load.

Green LED Lit – C# on Digital Display, Alternating with Red LED Lit – 64 on Digital Display



Type of Indication: Status

Inverter output is limited due to the high temperature at the inverter internal controller. The maximum compressor motor speed limit is in a range from less than the current capacity step command down to 1800 RPM.

Interface Control Board Response

- The speed of the compressor motor is reduced.
- The fault code enters the stored fault code history.

Technician Corrective Action

It is normal for this status fault code to occur with cooling mode operation at high ambient temperatures. If there has not been cooling mode operation at high ambient temperatures: if the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are no airflow or refrigerant circuit issues such as dirty filters, fouled coils, refrigerant over-charging, etc. causing high compressor current draw.

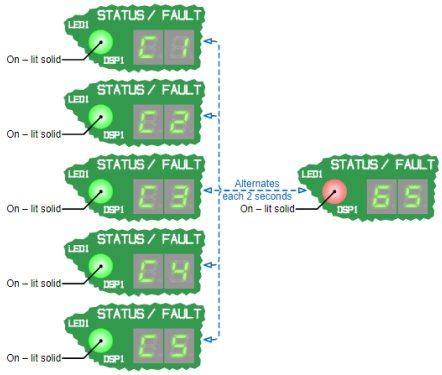
Verify the fins of the heat sink on the back of the inverter are clear of debris and extend into the outdoor fan air stream to dissipate heat from inverter operation. Verify there has not been compressor heating mode operation at warm ambient temperatures. Verify the single-phase 208/230 volts AC line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load.

Method to Clear

Either:

- The voltage at the internal DC bus for inverter compressor motor output returns to a normal range.
- The compressor motor speed of the current capacity step command is less than compressor motor speed reduction due to high current draw at the internal DC bus for inverter compressor motor output.

Green LED Lit – C# on Digital Display, Alternating with Red LED Lit – 65 on Digital Display



Type of Indication: Status

- Inverter output is limited due to the high temperature at the inverter internal controller.
    - The maximum compressor motor speed limit is in a range from less than the current capacity step command down to 1800 RUPM.

Interface Control Board Response

- The speed of the compressor (and outdoor fan) motor is reduced.
- The fault code enters the stored fault code history.

Technician Corrective Action

It is normal for this status fault code to occur with cooling mode operation at high ambient temperatures.

If there has not been cooling mode operation at high ambient temperatures: if the inverter has been replaced, confirm the correct replacement part inverter was used for the unit. Review the stored fault code history for other fault codes related to compressor operation. Verify there are not outdoor coil airflow issues such as dirt fouling, recirculation, etc. causing elevated outdoor coil temperatures. Verify the funs of the heat sink on the back of the inverter are clear of debris and extend into the outdoor fan air stream to dissipate heat from inverter operation. Verify the single-phase 208/230 volts C line voltage supplied to the outdoor unit does not exceed 253 volts AC and does not fall below 187 volts AC with the circuit under load.

Method to Clear

Either:

- The temperature at the inverter internal controller returns to a normal range.
- The compressor motor speed of the current capacity step command is less than compressor motor speed reduction due to high temperature at the inverter internal controller.

06

Extras

Refrigerant Circuit Measurement Tables

FOR USE WITH MODELS WITH TXV:

YHM24B21S

CH16B2421SA

TH16B2421SA

IMPORTANT

The main control must be moved to "H", which will lock it into 100% capacity for charge and operation evaluation before the below numbers will apply.

This data is only applicable when the main control is put on "H". If the main control jumper is not moved to "H" the data will not be applicable. After system evaluation remember to return the jumper to its normal orientation position.

YHM24B21S SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB (°F) AT 80°F DRY BULB			
	57	62	67	72
	PRESSURE (PSIG) & SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	186(3)	202(7)	205(7)	207(7)
60	204(3)	220(7)	222(7)	225(7)
65	223(4)	238(7)	241(7)	244(7)
70	243(4)	256(7)	260(7)	263(7)
75	264(5)	276(7)	279(7)	283(7)
80	286(5)	296(7)	300(7)	304(6)
85	308(5)	317(7)	321(7)	325(6)
90	331(6)	339(7)	343(7)	347(6)
95	355(6)	362(7)	365(6)	370(6)
100	380(6)	385(7)	388(6)	393(6)
105	405(6)	410(7)	412(6)	417(6)
110	432(6)	434(6)	437(6)	441(5)
115	459(6)	460(6)	462(6)	466(5)
120	487(6)	487(6)	489(6)	492(5)
125	515(5)	514(5)	515(5)	518(5)

Charging chart is for use in High Stage (full capacity) mode only.
Charging chart is for use in Cooling mode only.
Subcooling Chart is for use with TXV indoor expansion device only.

YHM24B21S W/ NOMINAL COIL

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
75/62	550	LIQUID PRESSURE (PSIG)	200	235	273	315	359	406	457	510
		LIQUID TEMPERATURE (°F)	62	72	83	93	102	111	121	130
		LIQUID SUBCOOLING (°F)	8	8	7	7	7	7	6	6
		SUCTION PRESSURE (PSIG)	109	111	113	116	120	125	131	137
		SUCTION TEMPERATURE (°F)	47	48	50	52	56	59	64	69
		SUCTION SUPERHEAT (°F)	11	11	12	13	15	16	19	21
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.5	9	9.3	9.4	9.2
		COMPRESSOR CURRENT (A)	5.6	6.7	7.7	8.5	9	9.3	9.4	9.2
		INDOOR COIL TEMP DROP (°F)	28	27	27	26	25	24	22	20
	750	LIQUID PRESSURE (PSIG)	202	237	275	317	361	408	459	512
		LIQUID TEMPERATURE (°F)	62	72	83	93	102	111	121	130
		LIQUID SUBCOOLING (°F)	8	8	7	7	7	7	6	6
		SUCTION PRESSURE (PSIG)	115	117	119	122	126	131	137	143
		SUCTION TEMPERATURE (°F)	50	50	52	55	58	61	67	71
		SUCTION SUPERHEAT (°F)	11	11	12	13	15	16	19	21
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.5	9	9.3	9.4	9.2
		COMPRESSOR CURRENT (A)	5.6	6.7	7.7	8.5	9.0	9.3	9.4	9.2
		INDOOR COIL TEMP DROP (°F)	25	24	24	23	22	21	19	17
	950	LIQUID PRESSURE (PSIG)	204	239	277	319	363	410	461	514
		LIQUID TEMPERATURE (°F)	63	73	84	93	103	112	122	130
		LIQUID SUBCOOLING (°F)	8	8	7	7	7	7	6	6
		SUCTION PRESSURE (PSIG)	121	123	125	128	132	137	143	149
		SUCTION TEMPERATURE (°F)	52	53	55	57	61	64	69	74
		SUCTION SUPERHEAT (°F)	11	11	12	13	15	16	19	21
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.5	9	9.3	9.4	9.2
		COMPRESSOR CURRENT (A)	5.6	6.7	7.7	8.5	9.0	9.3	9.4	9.2
		INDOOR COIL TEMP DROP (°F)	22	21	21	20	19	18	16	14

YHM24B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/57	550	LIQUID PRESSURE (PSIG)	196	231	270	311	356	405	456	511
		LIQUID TEMPERATURE (°F)	61	71	81	91	100	111	120	130
		LIQUID SUBCOOLING (°F)	8	8	8	8	8	7	7	6
		SUCTION PRESSURE (PSIG)	97	98	101	105	111	119	128	139
		SUCTION TEMPERATURE (°F)	40	43	46	50	54	59	64	69
		SUCTION SUPERHEAT (°F)	10	12	14	16	17	19	20	20
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.4	8.9	9.3	9.4	9.3
		COMPRESSOR CURRENT (A)	5.6	6.8	7.7	8.4	8.9	9.2	9.4	9.3
		INDOOR COIL TEMP DROP (°F)	35	35	34	33	31	29	26	23
	750	LIQUID PRESSURE (PSIG)	199	234	273	314	359	408	459	514
		LIQUID TEMPERATURE (°F)	62	73	83	92	102	112	121	131
		LIQUID SUBCOOLING (°F)	7	7	7	7	7	6	6	5
		SUCTION PRESSURE (PSIG)	107	108	111	115	121	129	138	149
		SUCTION TEMPERATURE (°F)	44	46	50	54	57	63	67	72
		SUCTION SUPERHEAT (°F)	9	11	13	15	16	18	19	19
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.4	8.9	9.3	9.4	9.3
		COMPRESSOR CURRENT (A)	5.6	6.8	7.7	8.4	8.9	9.2	9.4	9.3
		INDOOR COIL TEMP DROP (°F)	31	31	30	29	27	25	22	19
	950	LIQUID PRESSURE (PSIG)	202	237	276	317	362	411	462	517
		LIQUID TEMPERATURE (°F)	64	74	85	94	103	114	123	133
		LIQUID SUBCOOLING (°F)	6	6	6	6	6	5	5	4
		SUCTION PRESSURE (PSIG)	117	118	121	125	131	139	148	159
		SUCTION TEMPERATURE (°F)	48	51	54	58	61	67	71	75
		SUCTION SUPERHEAT (°F)	9	11	13	15	16	18	19	19
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.4	8.9	9.3	9.4	9.3
		COMPRESSOR CURRENT (A)	5.6	6.8	7.7	8.4	8.9	9.2	9.4	9.3
		INDOOR COIL TEMP DROP (°F)	27	27	26	25	23	21	18	15
80/62	550	LIQUID PRESSURE (PSIG)	200	236	274	315	360	408	458	512
		LIQUID TEMPERATURE (°F)	62	72	82	92	101	110	120	130
		LIQUID SUBCOOLING (°F)	8	8	8	8	8	8	7	6
		SUCTION PRESSURE (PSIG)	109	109	111	114	119	125	132	141
		SUCTION TEMPERATURE (°F)	45	46	49	51	54	59	64	69
		SUCTION SUPERHEAT (°F)	9	10	12	13	14	16	18	20
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.5	9	9.3	9.4	9.3
		COMPRESSOR CURRENT (A)	5.6	6.7	7.7	8.5	9	9.3	9.4	9.3
		INDOOR COIL TEMP DROP (°F)	32	32	31	30	29	27	25	23
	750	LIQUID PRESSURE (PSIG)	202	238	276	317	362	410	460	514
		LIQUID TEMPERATURE (°F)	63	74	84	93	102	112	121	131
		LIQUID SUBCOOLING (°F)	7	7	7	7	7	7	6	5
		SUCTION PRESSURE (PSIG)	116	116	118	121	126	132	139	148
		SUCTION TEMPERATURE (°F)	48	49	52	54	57	62	67	72
		SUCTION SUPERHEAT (°F)	9	10	12	13	14	16	18	20
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.5	9	9.3	9.4	9.3
		COMPRESSOR CURRENT (A)	5.6	6.7	7.7	8.5	9	9.3	9.4	9.3
		INDOOR COIL TEMP DROP (°F)	29	29	28	27	26	24	22	20
	950	LIQUID PRESSURE (PSIG)	204	240	278	319	364	412	462	516
		LIQUID TEMPERATURE (°F)	65	75	85	94	104	113	123	133
		LIQUID SUBCOOLING (°F)	6	6	6	6	6	6	5	4
		SUCTION PRESSURE (PSIG)	123	123	125	128	133	139	146	155
		SUCTION TEMPERATURE (°F)	51	52	55	57	60	65	69	75
		SUCTION SUPERHEAT (°F)	9	10	12	13	14	16	18	20
		OUTDOOR UNIT CURRENT (A)	5.6	6.8	7.7	8.5	9	9.3	9.4	9.3
		COMPRESSOR CURRENT (A)	5.6	6.7	7.7	8.5	9	9.3	9.4	9.3
		INDOOR COIL TEMP DROP (°F)	26	26	25	24	23	21	19	17

YHM24B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/67	550	LIQUID PRESSURE (PSIG)	203	239	277	319	363	410	460	513
		LIQUID TEMPERATURE (°F)	64	74	84	93	104	113	121	131
		LIQUID SUBCOOLING (°F)	7	7	7	7	6	6	6	5
		SUCTION PRESSURE (PSIG)	119	121	123	126	131	137	144	152
		SUCTION TEMPERATURE (°F)	51	53	54	56	59	64	68	73
		SUCTION SUPERHEAT (°F)	11	12	12	13	14	16	17	19
		OUTDOOR UNIT CURRENT (A)	5.4	6.7	7.7	8.5	9.1	9.4	9.5	9.3
		COMPRESSOR CURRENT (A)	5.4	6.7	7.7	8.5	9	9.4	9.5	9.3
		INDOOR COIL TEMP DROP (°F)	28	27	27	26	25	24	22	21
	750	LIQUID PRESSURE (PSIG)	205	241	279	321	365	412	462	515
		LIQUID TEMPERATURE (°F)	64	75	84	94	104	113	122	131
		LIQUID SUBCOOLING (°F)	7	7	7	7	6	6	6	5
		SUCTION PRESSURE (PSIG)	124	126	128	131	136	142	149	157
		SUCTION TEMPERATURE (°F)	54	55	56	58	61	66	70	74
		SUCTION SUPERHEAT (°F)	11	12	12	13	14	16	17	19
		OUTDOOR UNIT CURRENT (A)	5.4	6.7	7.7	8.5	9.1	9.4	9.5	9.3
		COMPRESSOR CURRENT (A)	5.4	6.7	7.7	8.5	9	9.4	9.5	9.3
		INDOOR COIL TEMP DROP (°F)	25	24	24	23	22	21	19	18
	950	LIQUID PRESSURE (PSIG)	207	243	281	323	367	414	464	517
		LIQUID TEMPERATURE (°F)	65	75	85	94	104	113	122	132
		LIQUID SUBCOOLING (°F)	7	7	7	7	6	6	6	5
		SUCTION PRESSURE (PSIG)	129	131	133	136	141	147	154	162
		SUCTION TEMPERATURE (°F)	57	58	59	61	64	69	72	77
		SUCTION SUPERHEAT (°F)	12	13	13	14	15	17	18	20
		OUTDOOR UNIT CURRENT (A)	5.4	6.7	7.7	8.5	9.1	9.4	9.5	9.3
		COMPRESSOR CURRENT (A)	5.4	6.7	7.7	8.5	9	9.4	9.5	9.3
		INDOOR COIL TEMP DROP (°F)	22	21	21	20	19	18	16	15
80/72	550	LIQUID PRESSURE (PSIG)	205	242	281	323	368	415	464	516
		LIQUID TEMPERATURE (°F)	64	75	85	95	105	114	123	132
		LIQUID SUBCOOLING (°F)	7	7	7	6	6	6	5	5
		SUCTION PRESSURE (PSIG)	129	131	135	139	143	149	156	164
		SUCTION TEMPERATURE (°F)	59	58	60	62	63	67	70	75
		SUCTION SUPERHEAT (°F)	14	13	13	13	13	14	15	17
		OUTDOOR UNIT CURRENT (A)	5.3	6.6	7.7	8.5	9.1	9.4	9.6	9.4
		COMPRESSOR CURRENT (A)	5.3	6.6	7.7	8.5	9.1	9.4	9.6	9.4
		INDOOR COIL TEMP DROP (°F)	23	22	22	21	20	19	18	16
	750	LIQUID PRESSURE (PSIG)	207	244	283	325	370	417	466	518
		LIQUID TEMPERATURE (°F)	65	75	85	96	105	114	123	132
		LIQUID SUBCOOLING (°F)	7	7	7	6	6	6	5	5
		SUCTION PRESSURE (PSIG)	135	137	141	145	149	155	162	170
		SUCTION TEMPERATURE (°F)	61	61	62	64	66	69	72	77
		SUCTION SUPERHEAT (°F)	14	13	13	13	13	14	15	17
		OUTDOOR UNIT CURRENT (A)	5.3	6.6	7.7	8.5	9.1	9.4	9.6	9.4
		COMPRESSOR CURRENT (A)	5.3	6.6	7.7	8.5	9.1	9.4	9.6	9.4
		INDOOR COIL TEMP DROP (°F)	20	19	19	18	17	16	15	13
	950	LIQUID PRESSURE (PSIG)	209	246	285	327	372	419	468	520
		LIQUID TEMPERATURE (°F)	66	76	86	96	105	114	124	132
		LIQUID SUBCOOLING (°F)	7	7	7	6	6	6	5	5
		SUCTION PRESSURE (PSIG)	141	143	147	151	155	161	168	176
		SUCTION TEMPERATURE (°F)	64	64	66	67	69	72	75	80
		SUCTION SUPERHEAT (°F)	15	14	14	14	14	15	16	18
		OUTDOOR UNIT CURRENT (A)	5.3	6.6	7.7	8.5	9.1	9.4	9.6	9.4
		COMPRESSOR CURRENT (A)	5.3	6.6	7.7	8.5	9.1	9.4	9.6	9.4
		INDOOR COIL TEMP DROP (°F)	17	16	16	15	14	13	12	10

YHM24B21S W/ NOMINAL COIL

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
60	550	SUCTION PRESS (PSIG)	129	103	91	39	20	33
		SUCTION TEMP (F)	145	33	27	-8	-28	-13
		SUCTION SUPERHEAT (F)	14	14	13	22	24	12
		LIQUID SUBCOOLING (F)	17	22	24	26	28	28
		LIQUID PRESS (PSIG)	385	352	335	250	217	236
		LIQUID TEMP(F)	97	85	80	58	47	53
		ID AIR DB TEMP. RISE	44	38	35	18	11	15
		TOTAL / COMPR. AMPS	10 / 10	9 / 9	9 / 9	7 / 7	6 / 6	7 / 7
	750	SUCTION PRESS (PSIG)	127	102	89	37	24	41
		SUCTION TEMP (F)	44	33	26	13	2	-7
		SUCTION SUPERHEAT (F)	15	14	13	23	20	11
		LIQUID SUBCOOLING (F)	15	19	21	23	25	27
		LIQUID PRESS (PSIG)	345	318	302	234	212	234
		LIQUID TEMP(F)	90	80	75	56	48	53
		ID AIR DB TEMP. RISE	36	31	28	14	9	14
		TOTAL / COMPR. AMPS	9 / 9	9 / 9	8 / 8	7 / 7	6 / 6	7 / 7
	950	SUCTION PRESS (PSIG)	125	102	87	36	27	49
		SUCTION TEMP (F)	43	32	25	-11	-20	0
		SUCTION SUPERHEAT (F)	16	14	13	23	15	11
		LIQUID SUBCOOLING (F)	13	16	18	20	23	26
		LIQUID PRESS (PSIG)	304	284	270	217	207	233
		LIQUID TEMP(F)	84	76	71	55	49	53
		ID AIR DB TEMP. RISE	28	24	21	10	8	13
		TOTAL / COMPR. AMPS	8 / 8	8 / 8	8 / 8	6 / 6	6 / 6	7 / 7
70	550	SUCTION PRESS (PSIG)	130	103	89	42	28	42
		SUCTION TEMP (F)	45	33	26	14	-19	-6
		SUCTION SUPERHEAT (F)	14	14	13	19	21	12
		LIQUID SUBCOOLING (F)	19	24	24	28	31	31
		LIQUID PRESS (PSIG)	427	394	368	292	266	291
		LIQUID TEMP(F)	103	92	86	66	57	62
		ID AIR DB TEMP. RISE	43	37	33	18	13	18
		TOTAL / COMPR. AMPS	11 / 11	10 / 10	9 / 9	8 / 8	7 / 7	8 / 8
	750	SUCTION PRESS (PSIG)	128	103	88	48	27	46
		SUCTION TEMP (F)	44	33	25	-1	-20	-3
		SUCTION SUPERHEAT (F)	15	14	13	18	20	11
		LIQUID SUBCOOLING (F)	17	21	21	25	29	30
		LIQUID PRESS (PSIG)	386	359	336	282	254	280
		LIQUID TEMP(F)	97	87	82	67	55	61
		ID AIR DB TEMP. RISE	35	30	26	16	10	15
		TOTAL / COMPR. AMPS	10 / 10	9 / 9	9 / 9	8 / 8	7 / 7	8 / 7
	950	SUCTION PRESS (PSIG)	127	102	86	54	26	49
		SUCTION TEMP (F)	44	33	24	2	-21	1
		SUCTION SUPERHEAT (F)	15	14	13	18	19	11
		LIQUID SUBCOOLING (F)	14	18	18	21	27	28
		LIQUID PRESS (PSIG)	345	325	305	273	242	270
		LIQUID TEMP(F)	91	83	78	67	54	61
		ID AIR DB TEMP. RISE	27	23	20	13	8	13
		TOTAL / COMPR. AMPS	9 / 9	8 / 10	8 / 8	8 / 8	7 / 7	7 / 7

YHM24B21S W/ NOMINAL COIL (Continued)

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
80	550	SUCTION PRESS (PSIG)	130	104	87	46	36	51
		SUCTION TEMP (F)	45	34	25	-2	-11	2
		SUCTION SUPERHEAT (F)	14	14	13	17	18	12
		LIQUID SUBCOOLING (F)	20	25	24	30	33	35
		LIQUID PRESS (PSIG)	470	437	401	334	316	346
		LIQUID TEMP(F)	109	98	93	73	66	71
		ID AIR DB TEMP. RISE	41	35	30	18	15	20
		TOTAL / COMPR. AMPS	12 / 12	11 / 11	10 / 10	8 / 8	8 / 8	8 / 8
	750	SUCTION PRESS (PSIG)	129	104	86	59	30	50
		SUCTION TEMP (F)	145	33	24	7	-17	1
		SUCTION SUPERHEAT (F)	14	14	13	14	20	12
		LIQUID SUBCOOLING (F)	18	23	21	26	32	32
		LIQUID PRESS (PSIG)	428	401	370	331	296	326
		LIQUID TEMP(F)	104	94	90	77	63	70
		ID AIR DB TEMP. RISE	33	29	24	17	11	16
		TOTAL / COMPR. AMPS	11 / 11	10 / 10	9 / 9	8 / 8	7 / 7	8 / 8
	950	SUCTION PRESS (PSIG)	128	103	85	71	24	50
		SUCTION TEMP (F)	44	33	24	16	-23	1
		SUCTION SUPERHEAT (F)	15	14	12	12	22	12
		LIQUID SUBCOOLING (F)	16	21	19	22	31	29
		LIQUID PRESS (PSIG)	386	365	339	328	277	306
		LIQUID TEMP(F)	98	89	86	80	60	68
		ID AIR DB TEMP. RISE	26	22	18	16	7	12
		TOTAL / COMPR. AMPS	10 / 10	10 / 10	9 / 9	9 / 9	7 / 7	8 / 8

FOR USE WITH MODELS WITH TXV:

YHM36B21S

CH16B3621SA

TH16B3621SA

IMPORTANT

The main control must be moved to "H", which will lock it into 100% capacity for charge and operation evaluation before the below numbers will apply.

This data is only applicable when the main control is put on "H". If the main control jumper is not moved to "H" the data will not be applicable. After system evaluation remember to return the jumper to its normal orientation position.

YHM36B21S SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB (°F) AT 80°F DRY BULB			
	57	62	67	72
	PRESSURE (PSIG) & SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	218(4)	225(9)	233(11)	238(11)
60	231(4)	240(9)	248(10)	254(11)
65	246(3)	256(9)	265(10)	271(11)
70	262(3)	273(8)	282(10)	288(11)
75	279(2)	291(8)	300(10)	306(11)
80	297(2)	309(8)	319(9)	325(11)
85	317(2)	329(7)	339(9)	345(10)
90	338(2)	349(7)	359(9)	365(10)
95	360(1)	370(6)	381(8)	386(10)
100	383(1)	392(6)	403(8)	408(10)
105	408(1)	415(5)	425(8)	431(10)
110	434(1)	438(5)	449(8)	454(9)
115	462(1)	463(5)	473(7)	478(9)
120	490(1)	488(4)	499(7)	502(9)
125	520(1)	514(4)	525(7)	528(8)

Charging chart is for use in High Stage (full capacity) mode only.
Charging chart is for use in Cooling mode only.
Subcooling Chart is for use with TXV indoor expansion device only.

YHM36B21S W/ NOMINAL COIL

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
75/62	1000	LIQUID PRESSURE (PSIG)	225	258	294	332	372	414	458	505
		LIQUID TEMPERATURE (°F)	68	77	86	95	105	114	124	134
		LIQUID SUBCOOLING (°F)	9	9	9	8	6	5	3	1
		SUCTION PRESSURE (PSIG)	116	115	116	119	125	133	143	156
		SUCTION TEMPERATURE (°F)	42	42	42	43	45	48	51	55
		SUCTION SUPERHEAT (°F)	3	3	3	3	2	2	1	1
		OUTDOOR UNIT CURRENT (A)	7.5	10.1	11.9	13	13.4	13	11.9	10.1
		COMPRESSOR CURRENT (A)	7.5	10.1	11.9	13	13.4	13	11.9	10.1
		INDOOR COIL TEMP DROP (°F)	24	24	24	23	22	20	18	15
	1200	LIQUID PRESSURE (PSIG)	227	260	296	334	374	416	460	507
		LIQUID TEMPERATURE (°F)	68	77	85	95	105	114	123	133
		LIQUID SUBCOOLING (°F)	10	10	10	9	7	6	4	2
		SUCTION PRESSURE (PSIG)	119	118	119	122	128	136	146	159
		SUCTION TEMPERATURE (°F)	43	43	43	45	46	49	52	56
		SUCTION SUPERHEAT (°F)	3	3	3	3	2	2	1	1
		OUTDOOR UNIT CURRENT (A)	7.6	10.2	12	13.1	13.5	13.1	12	10.2
		COMPRESSOR CURRENT (A)	7.6	10.2	12	13.1	13.5	13.1	12.0	10.2
		INDOOR COIL TEMP DROP (°F)	22	22	22	21	20	18	16	13
	1400	LIQUID PRESSURE (PSIG)	229	262	298	336	376	418	462	509
		LIQUID TEMPERATURE (°F)	74	83	92	101	111	120	128	135
		LIQUID SUBCOOLING (°F)	4	4	4	3	1	0	0	0
		SUCTION PRESSURE (PSIG)	122	121	122	125	131	139	149	162
		SUCTION TEMPERATURE (°F)	45	44	45	46	47	51	54	57
		SUCTION SUPERHEAT (°F)	3	3	3	3	2	2	1	1
		OUTDOOR UNIT CURRENT (A)	7.7	10.3	12.1	13.2	13.6	13.2	12.1	10.3
		COMPRESSOR CURRENT (A)	7.7	10.3	12.1	13.2	13.6	13.2	12.1	10.3
		INDOOR COIL TEMP DROP (°F)	20	20	20	19	18	16	14	11

YHM36B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/57	1000	LIQUID PRESSURE (PSIG)	214	242	275	313	356	404	458	516
		LIQUID TEMPERATURE (°F)	72	81	90	99	108	118	127	137
		LIQUID SUBCOOLING (°F)	2	1	0	0	0	0	0	0
		SUCTION PRESSURE (PSIG)	108	108	110	115	121	130	141	155
		SUCTION TEMPERATURE (°F)	36	36	37	40	42	46	50	56
		SUCTION SUPERHEAT (°F)	1	1	1	1	1	1	1	1
		OUTDOOR UNIT CURRENT (A)	7.4	9.5	11.2	12.4	13.2	13.4	13.3	12.6
		COMPRESSOR CURRENT (A)	7.4	9.5	11.2	12.4	13.2	13.4	13.3	12.6
		INDOOR COIL TEMP DROP (°F)	31	31	31	30	28	26	23	19
	1200	LIQUID PRESSURE (PSIG)	218	246	279	317	360	408	462	520
		LIQUID TEMPERATURE (°F)	71	80	89	98	108	117	127	136
		LIQUID SUBCOOLING (°F)	4	3	2	2	1	1	1	1
		SUCTION PRESSURE (PSIG)	113	113	115	120	126	135	146	160
		SUCTION TEMPERATURE (°F)	39	39	40	42	44	48	52	58
		SUCTION SUPERHEAT (°F)	1	1	1	1	1	1	1	1
		OUTDOOR UNIT CURRENT (A)	7.5	9.6	11.3	12.5	13.3	13.5	13.4	12.7
		COMPRESSOR CURRENT (A)	7.5	9.6	11.3	12.5	13.3	13.5	13.4	12.7
		INDOOR COIL TEMP DROP (°F)	28	28	28	27	25	23	20	16
	1400	LIQUID PRESSURE (PSIG)	222	250	283	321	364	412	466	524
		LIQUID TEMPERATURE (°F)	74	83	92	101	110	119	128	138
		LIQUID SUBCOOLING (°F)	2	1	1	1	1	1	1	1
		SUCTION PRESSURE (PSIG)	118	118	120	125	131	140	151	165
		SUCTION TEMPERATURE (°F)	41	41	42	44	46	50	54	59
		SUCTION SUPERHEAT (°F)	1	1	1	1	1	1	1	1
		OUTDOOR UNIT CURRENT (A)	7.6	9.7	11.4	12.6	13.4	13.6	13.5	12.8
		COMPRESSOR CURRENT (A)	7.6	9.7	11.4	12.6	13.4	13.6	13.5	12.8
		INDOOR COIL TEMP DROP (°F)	25	25	25	24	22	20	17	13
80/62	1000	LIQUID PRESSURE (PSIG)	222	253	288	326	367	412	460	511
		LIQUID TEMPERATURE (°F)	68	77	86	96	105	115	123	133
		LIQUID SUBCOOLING (°F)	8	8	7	6	5	4	4	3
		SUCTION PRESSURE (PSIG)	116	114	115	118	125	135	148	164
		SUCTION TEMPERATURE (°F)	41	40	41	41	44	48	53	59
		SUCTION SUPERHEAT (°F)	2	2	2	1	1	1	1	1
		OUTDOOR UNIT CURRENT (A)	7.5	10	11.8	12.9	13.3	13	11.9	10.2
		COMPRESSOR CURRENT (A)	7.5	10	11.8	12.9	13.3	13	11.9	10.2
		INDOOR COIL TEMP DROP (°F)	27	28	29	28	26	24	21	16
	1200	LIQUID PRESSURE (PSIG)	225	256	291	329	370	415	463	514
		LIQUID TEMPERATURE (°F)	68	76	86	96	105	115	123	132
		LIQUID SUBCOOLING (°F)	9	9	8	7	6	5	5	4
		SUCTION PRESSURE (PSIG)	119	117	118	121	128	138	151	167
		SUCTION TEMPERATURE (°F)	42	41	42	42	45	49	54	60
		SUCTION SUPERHEAT (°F)	2	2	2	1	1	1	1	1
		OUTDOOR UNIT CURRENT (A)	7.6	10.1	11.9	13	13.4	13.1	12	10.3
		COMPRESSOR CURRENT (A)	7.6	10.1	11.9	13	13.4	13.1	12	10.3
		INDOOR COIL TEMP DROP (°F)	25	26	27	26	24	22	19	14
	1400	LIQUID PRESSURE (PSIG)	228	259	294	332	373	418	466	517
		LIQUID TEMPERATURE (°F)	76	84	94	103	112	120	128	137
		LIQUID SUBCOOLING (°F)	2	2	1	0	0	0	0	0
		SUCTION PRESSURE (PSIG)	122	120	121	124	131	141	154	170
		SUCTION TEMPERATURE (°F)	44	43	43	44	46	50	55	61
		SUCTION SUPERHEAT (°F)	2	2	2	1	1	1	1	1
		OUTDOOR UNIT CURRENT (A)	7.7	10.2	12	13.1	13.5	13.2	12.1	10.4
		COMPRESSOR CURRENT (A)	7.7	10.2	12	13.1	13.5	13.2	12.1	10.4
		INDOOR COIL TEMP DROP (°F)	23	24	25	24	22	20	17	12

YHM36B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/67	1000	LIQUID PRESSURE (PSIG)	232	264	299	338	380	424	472	524
		LIQUID TEMPERATURE (°F)	68	78	86	96	105	113	122	131
		LIQUID SUBCOOLING (°F)	11	10	10	9	8	8	7	7
		SUCTION PRESSURE (PSIG)	127	126	127	130	134	141	150	161
		SUCTION TEMPERATURE (°F)	47	47	48	49	51	53	57	60
		SUCTION SUPERHEAT (°F)	3	4	4	4	4	4	4	3
		OUTDOOR UNIT CURRENT (A)	7.7	10.3	12.1	13.3	13.7	13.4	12.3	10.5
		COMPRESSOR CURRENT (A)	7.7	10.3	12.1	13.3	13.7	13.4	12.3	10.5
		INDOOR COIL TEMP DROP (°F)	23	23	23	23	22	20	19	16
	1200	LIQUID PRESSURE (PSIG)	233	265	300	339	381	425	473	525
		LIQUID TEMPERATURE (°F)	68	78	86	96	105	113	123	131
		LIQUID SUBCOOLING (°F)	11	10	10	9	8	8	7	7
		SUCTION PRESSURE (PSIG)	130	129	130	133	137	144	153	164
		SUCTION TEMPERATURE (°F)	49	50	50	51	53	56	59	62
		SUCTION SUPERHEAT (°F)	4	5	5	5	5	5	5	4
		OUTDOOR UNIT CURRENT (A)	7.7	10.3	12.1	13.3	13.7	13.4	12.3	10.5
		COMPRESSOR CURRENT (A)	7.7	10.3	12.1	13.3	13.7	13.4	12.3	10.5
		INDOOR COIL TEMP DROP (°F)	21	21	21	21	20	18	17	14
	1400	LIQUID PRESSURE (PSIG)	234	266	301	340	382	426	474	526
		LIQUID TEMPERATURE (°F)	78	87	95	105	113	122	130	138
		LIQUID SUBCOOLING (°F)	2	1	1	1	1	1	1	1
		SUCTION PRESSURE (PSIG)	133	132	133	136	140	147	156	167
		SUCTION TEMPERATURE (°F)	51	52	52	53	55	58	61	64
		SUCTION SUPERHEAT (°F)	5	6	6	6	6	6	6	5
		OUTDOOR UNIT CURRENT (A)	7.7	10.3	12.1	13.3	13.7	13.4	12.3	10.5
		COMPRESSOR CURRENT (A)	7.7	10.3	12.1	13.3	13.7	13.4	12.3	10.5
		INDOOR COIL TEMP DROP (°F)	19	19	19	19	18	16	15	12
80/72	1000	LIQUID PRESSURE (PSIG)	237	270	305	344	385	430	477	527
		LIQUID TEMPERATURE (°F)	69	78	86	96	104	112	121	130
		LIQUID SUBCOOLING (°F)	11	11	11	10	10	10	9	8
		SUCTION PRESSURE (PSIG)	139	138	139	142	147	155	165	177
		SUCTION TEMPERATURE (°F)	57	55	56	57	59	61	64	68
		SUCTION SUPERHEAT (°F)	8	7	7	7	7	6	6	6
		OUTDOOR UNIT CURRENT (A)	7.6	10.3	12.3	13.5	13.9	13.5	12.4	10.5
		COMPRESSOR CURRENT (A)	7.6	10.3	12.3	13.5	13.9	13.5	12.4	10.5
		INDOOR COIL TEMP DROP (°F)	18	18	18	18	17	15	14	12
	1200	LIQUID PRESSURE (PSIG)	238	271	306	345	386	431	478	528
		LIQUID TEMPERATURE (°F)	70	78	87	96	104	112	121	130
		LIQUID SUBCOOLING (°F)	11	11	11	10	10	10	9	8
		SUCTION PRESSURE (PSIG)	143	142	143	146	151	159	169	181
		SUCTION TEMPERATURE (°F)	58	57	57	58	60	62	66	70
		SUCTION SUPERHEAT (°F)	8	7	7	7	7	6	6	6
		OUTDOOR UNIT CURRENT (A)	7.6	10.3	12.3	13.5	13.9	13.5	12.4	10.5
		COMPRESSOR CURRENT (A)	7.6	10.3	12.3	13.5	13.9	13.5	12.4	10.5
		INDOOR COIL TEMP DROP (°F)	16	16	16	16	15	13	12	10
	1400	LIQUID PRESSURE (PSIG)	239	272	307	346	387	432	479	529
		LIQUID TEMPERATURE (°F)	75	84	92	101	109	118	127	136
		LIQUID SUBCOOLING (°F)	6	6	6	5	5	5	4	3
		SUCTION PRESSURE (PSIG)	147	146	147	150	155	163	173	185
		SUCTION TEMPERATURE (°F)	60	58	59	60	62	64	67	71
		SUCTION SUPERHEAT (°F)	8	7	7	7	7	6	6	6
		OUTDOOR UNIT CURRENT (A)	7.6	10.3	12.3	13.5	13.9	13.5	12.4	10.5
		COMPRESSOR CURRENT (A)	7.6	10.3	12.3	13.5	13.9	13.5	12.4	10.5
		INDOOR COIL TEMP DROP (°F)	14	14	14	14	13	11	10	8

YHM36B21S W/ NOMINAL COIL

YHM36B21S W/ NOMINAL COIL

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
60	1000	SUCTION PRESS (PSIG)	112	101	91	76	60	39
		SUCTION TEMP (F)	181	145	141	136	128	100
		SUCTION SUPERHEAT (F)	14	11	11	12	12	11
		LIQUID SUBCOOLING (F)	21	21	22	24	27	25
		LIQUID PRESS (PSIG)	433	332	319	301	276	241
		LIQUID TEMP(F)	102	82	79	72	64	56
		ID AIR DB TEMP. RISE	48	31	29	25	21	15
		TOTAL / COMPR. AMPS	22 / 22	12 / 12	11 / 11	11 / 11	10 / 10	9 / 9
	1200	SUCTION PRESS (PSIG)	111	101	90	76	59	43
		SUCTION TEMP (F)	174	139	136	132	125	105
		SUCTION SUPERHEAT (F)	14	11	11	11	12	11
		LIQUID SUBCOOLING (F)	20	20	21	23	26	25
		LIQUID PRESS (PSIG)	401	313	302	286	265	239
		LIQUID TEMP(F)	97	79	76	69	62	56
		ID AIR DB TEMP. RISE	42	27	25	22	18	14
		TOTAL / COMPR. AMPS	21 / 21	11 / 11	11 / 11	10 / 10	10 / 10	9 / 9
	1400	SUCTION PRESS (PSIG)	111	100	89	75	59	48
		SUCTION TEMP (F)	166	134	131	127	122	109
		SUCTION SUPERHEAT (F)	13	10	11	11	11	11
		LIQUID SUBCOOLING (F)	19	19	20	22	25	25
		LIQUID PRESS (PSIG)	368	295	284	271	253	237
		LIQUID TEMP(F)	92	76	73	67	60	56
		ID AIR DB TEMP. RISE	36	23	21	19	15	13
		TOTAL / COMPR. AMPS	20 / 20	11 / 11	10 / 10	10 / 10	9 / 9	9 / 9
70	1000	SUCTION PRESS (PSIG)	114	103	92	77	60	44
		SUCTION TEMP (F)	189	156	152	147	140	118
		SUCTION SUPERHEAT (F)	15	12	13	13	13	13
		LIQUID SUBCOOLING (F)	21	21	23	25	28	28
		LIQUID PRESS (PSIG)	473	377	363	343	317	288
		LIQUID TEMP(F)	109	91	87	80	72	65
		ID AIR DB TEMP. RISE	46	30	28	24	20	15
		TOTAL / COMPR. AMPS	23 / 23	13 / 13	12 / 12	12 / 12	11 / 11	10 / 10
	1200	SUCTION PRESS (PSIG)	113	102	91	77	60	47
		SUCTION TEMP (F)	182	151	148	143	136	120
		SUCTION SUPERHEAT (F)	15	12	12	13	13	12
		LIQUID SUBCOOLING (F)	20	21	22	24	27	27
		LIQUID PRESS (PSIG)	443	357	345	327	304	283
		LIQUID TEMP(F)	104	88	84	78	70	65
		ID AIR DB TEMP. RISE	40	26	24	21	17	14
		TOTAL / COMPR. AMPS	22 / 22	12 / 12	12 / 12	11 / 11	10 / 10	10 / 10
	1400	SUCTION PRESS (PSIG)	112	101	91	76	60	49
		SUCTION TEMP (F)	176	146	143	139	133	122
		SUCTION SUPERHEAT (F)	14	11	12	12	13	12
		LIQUID SUBCOOLING (F)	19	20	21	23	26	27
		LIQUID PRESS (PSIG)	413	337	326	311	292	278
		LIQUID TEMP(F)	100	84	82	75	69	64
		ID AIR DB TEMP. RISE	35	22	21	18	15	12
		TOTAL / COMPR. AMPS	21 / 21	11 / 13	11 / 11	11 / 11	10 / 10	10 / 10

YHM36B21S W/ NOMINAL COIL (Continued)

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
80	1000	SUCTION PRESS (PSIG)	116	104	93	78	60	49
		SUCTION TEMP (F)	196	167	164	159	151	136
		SUCTION SUPERHEAT (F)	16	13	14	14	14	14
		LIQUID SUBCOOLING (F)	21	21	23	25	28	30
		LIQUID PRESS (PSIG)	513	422	407	385	357	336
		LIQUID TEMP(F)	115	100	95	89	80	74
		ID AIR DB TEMP. RISE	43	30	27	24	19	16
		TOTAL / COMPR. AMPS	23 / 23	14 / 14	13 / 13	12 / 12	11 / 11	11 / 11
	1200	SUCTION PRESS (PSIG)	115	103	93	77	60	50
		SUCTION TEMP (F)	191	162	159	154	147	136
		SUCTION SUPERHEAT (F)	15	13	13	14	14	13
		LIQUID SUBCOOLING (F)	20	21	22	24	27	29
		LIQUID PRESS (PSIG)	485	401	387	368	344	327
		LIQUID TEMP(F)	112	96	93	87	79	73
		ID AIR DB TEMP. RISE	38	26	24	21	17	14
		TOTAL / COMPR. AMPS	23 / 23	13 / 13	13 / 13	12 / 12	11 / 11	11 / 11
	1400	SUCTION PRESS (PSIG)	113	102	92	77	60	51
		SUCTION TEMP (F)	186	157	154	150	144	135
		SUCTION SUPERHEAT (F)	15	12	13	13	14	13
		LIQUID SUBCOOLING (F)	19	20	21	23	26	28
		LIQUID PRESS (PSIG)	457	379	368	351	331	319
		LIQUID TEMP(F)	108	93	90	84	77	72
		ID AIR DB TEMP. RISE	34	22	20	17	14	12
		TOTAL / COMPR. AMPS	22 / 22	13 / 13	12 / 12	12 / 12	10 / 10	10 / 10

FOR USE WITH MODELS WITH TXV:

YHM48B21S

CH16B4821SA

TH16B4821SA

IMPORTANT

The main control must be moved to "H", which will lock it into 100% capacity for charge and operation evaluation before the below numbers will apply.

This data is only applicable when the main control is put on "H". If the main control jumper is not moved to "H" the data will not be applicable. After system evaluation remember to return the jumper to its normal orientation position.

YHM48B21S SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB (°F) AT 80°F DRY BULB			
	57	62	67	72
	PRESSURE (PSIG) & SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	204(11)	207(11)	211(12)	214(12)
60	223(12)	226(12)	231(12)	233(12)
65	243(12)	246(12)	251(12)	253(12)
70	264(12)	267(12)	272(12)	274(12)
75	285(12)	288(12)	293(12)	295(12)
80	308(13)	310(12)	315(12)	317(12)
85	330(13)	333(12)	337(12)	339(12)
90	354(13)	356(12)	360(12)	362(12)
95	378(12)	380(12)	384(12)	386(12)
100	402(12)	404(12)	408(12)	410(11)
105	428(12)	429(12)	433(11)	434(11)
110	454(12)	455(11)	458(11)	460(11)
115	481(11)	481(11)	484(11)	485(10)
120	508(11)	508(11)	510(10)	512(10)
125	536(10)	536(10)	538(10)	539(10)

Charging chart is for use in High Stage (full capacity) mode only.
Charging chart is for use in Cooling mode only.
Subcooling Chart is for use with TXV indoor expansion device only.

YHM48B21S W/ NOMINAL COIL

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
75/62	1200	LIQUID PRESSURE (PSIG)	207	246	287	331	378	427	478	532
		LIQUID TEMPERATURE (°F)	61	71	80	90	101	110	119	129
		LIQUID SUBCOOLING (°F)	11	12	13	13	12	12	11	10
		SUCTION PRESSURE (PSIG)	106	107	108	112	117	123	131	141
		SUCTION TEMPERATURE (°F)	42	44	45	48	51	56	61	68
		SUCTION SUPERHEAT (°F)	8	9	10	11	12	14	16	19
		OUTDOOR UNIT CURRENT (A)	12.0	14.4	16.2	17.4	18	17.9	17.3	16
		COMPRESSOR CURRENT (A)	12.0	14.4	16.2	17.4	18	17.9	17.3	16
		INDOOR COIL TEMP DROP (°F)	26	26	26	25	24	23	21	19
	1400	LIQUID PRESSURE (PSIG)	208	247	288	332	379	428	479	533
		LIQUID TEMPERATURE (°F)	61	71	80	90	101	110	120	129
		LIQUID SUBCOOLING (°F)	11	12	13	13	12	12	11	10
		SUCTION PRESSURE (PSIG)	109	110	111	115	120	126	134	144
		SUCTION TEMPERATURE (°F)	44	45	47	50	53	57	63	70
		SUCTION SUPERHEAT (°F)	8	9	10	11	12	14	16	19
		OUTDOOR UNIT CURRENT (A)	12.0	14.4	16.2	17.4	18	17.9	17.3	16
		COMPRESSOR CURRENT (A)	12.0	14.4	16.2	17.4	18.0	17.9	17.3	16.0
		INDOOR COIL TEMP DROP (°F)	24	24	24	23	22	21	19	17
	1600	LIQUID PRESSURE (PSIG)	209	248	289	333	380	429	480	534
		LIQUID TEMPERATURE (°F)	62	71	81	90	101	110	120	129
		LIQUID SUBCOOLING (°F)	11	12	13	13	12	12	11	10
		SUCTION PRESSURE (PSIG)	112	113	114	118	123	129	137	147
		SUCTION TEMPERATURE (°F)	45	47	48	51	54	59	64	71
		SUCTION SUPERHEAT (°F)	8	9	10	11	12	14	16	19
		OUTDOOR UNIT CURRENT (A)	12.0	14.4	16.2	17.4	18	17.9	17.3	16
		COMPRESSOR CURRENT (A)	12.0	14.4	16.2	17.4	18.0	17.9	17.3	16.0
		INDOOR COIL TEMP DROP (°F)	22	22	22	21	20	19	17	15

YHM48B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/57	1200	LIQUID PRESSURE (PSIG)	205	244	286	330	378	428	481	537
		LIQUID TEMPERATURE (°F)	60	70	81	90	101	110	120	130
		LIQUID SUBCOOLING (°F)	11	12	12	13	12	12	11	10
		SUCTION PRESSURE (PSIG)	102	100	101	104	110	119	130	144
		SUCTION TEMPERATURE (°F)	41	41	43	46	50	56	62	69
		SUCTION SUPERHEAT (°F)	8	9	11	13	14	16	17	18
		OUTDOOR UNIT CURRENT (A)	12.1	14.4	16.2	17.4	18	18	17.4	16.3
		COMPRESSOR CURRENT (A)	12.1	14.4	16.2	17.4	18	18	17.4	16.3
		INDOOR COIL TEMP DROP (°F)	31	32	32	31	30	28	24	20
	1400	LIQUID PRESSURE (PSIG)	205	244	286	330	378	428	481	537
		LIQUID TEMPERATURE (°F)	60	70	81	90	101	110	120	130
		LIQUID SUBCOOLING (°F)	11	12	12	13	12	12	11	10
		SUCTION PRESSURE (PSIG)	106	104	105	108	114	123	134	148
		SUCTION TEMPERATURE (°F)	43	43	46	49	53	59	65	71
		SUCTION SUPERHEAT (°F)	9	10	12	14	15	17	18	19
		OUTDOOR UNIT CURRENT (A)	12.1	14.4	16.2	17.4	18	18	17.4	16.3
		COMPRESSOR CURRENT (A)	12.1	14.4	16.2	17.4	18	18	17.4	16.3
		INDOOR COIL TEMP DROP (°F)	29	30	30	29	28	26	22	18
	1600	LIQUID PRESSURE (PSIG)	205	244	286	330	378	428	481	537
		LIQUID TEMPERATURE (°F)	60	70	81	90	101	110	120	130
		LIQUID SUBCOOLING (°F)	11	12	12	13	12	12	11	10
		SUCTION PRESSURE (PSIG)	110	108	109	112	118	127	138	152
		SUCTION TEMPERATURE (°F)	46	46	49	52	56	62	67	74
		SUCTION SUPERHEAT (°F)	10	11	13	15	16	18	19	20
		OUTDOOR UNIT CURRENT (A)	12.1	14.4	16.2	17.4	18	18	17.4	16.3
		COMPRESSOR CURRENT (A)	12.1	14.4	16.2	17.4	18	18	17.4	16.3
		INDOOR COIL TEMP DROP (°F)	27	28	28	27	26	24	20	16
80/62	1200	LIQUID PRESSURE (PSIG)	207	246	288	333	380	429	481	536
		LIQUID TEMPERATURE (°F)	61	71	81	91	101	110	120	130
		LIQUID SUBCOOLING (°F)	11	12	12	12	12	12	11	10
		SUCTION PRESSURE (PSIG)	105	105	107	111	116	124	133	144
		SUCTION TEMPERATURE (°F)	43	43	44	48	51	57	62	70
		SUCTION SUPERHEAT (°F)	9	9	9	11	12	14	16	19
		OUTDOOR UNIT CURRENT (A)	12.1	14.5	16.4	17.6	18.2	18.2	17.6	16.4
		COMPRESSOR CURRENT (A)	12.1	14.5	16.3	17.6	18.2	18.2	17.6	16.4
		INDOOR COIL TEMP DROP (°F)	31	31	30	29	28	26	24	21
	1400	LIQUID PRESSURE (PSIG)	207	246	288	333	380	429	481	536
		LIQUID TEMPERATURE (°F)	61	71	81	91	101	110	120	130
		LIQUID SUBCOOLING (°F)	11	12	12	12	12	12	11	10
		SUCTION PRESSURE (PSIG)	109	109	111	115	120	128	137	148
		SUCTION TEMPERATURE (°F)	45	45	46	50	53	58	64	71
		SUCTION SUPERHEAT (°F)	9	9	9	11	12	14	16	19
		OUTDOOR UNIT CURRENT (A)	12.1	14.5	16.4	17.6	18.2	18.2	17.6	16.4
		COMPRESSOR CURRENT (A)	12.1	14.5	16.3	17.6	18.2	18.2	17.6	16.4
		INDOOR COIL TEMP DROP (°F)	29	29	28	27	26	24	22	19
	1600	LIQUID PRESSURE (PSIG)	207	246	288	333	380	429	481	536
		LIQUID TEMPERATURE (°F)	61	71	81	91	101	110	120	130
		LIQUID SUBCOOLING (°F)	11	12	12	12	12	12	11	10
		SUCTION PRESSURE (PSIG)	113	113	115	119	124	132	141	152
		SUCTION TEMPERATURE (°F)	48	48	49	52	56	61	66	74
		SUCTION SUPERHEAT (°F)	10	10	10	12	13	15	17	20
		OUTDOOR UNIT CURRENT (A)	12.1	14.5	16.4	17.6	18.2	18.2	17.6	16.4
		COMPRESSOR CURRENT (A)	12.1	14.5	16.3	17.6	18.2	18.2	17.6	16.4
		INDOOR COIL TEMP DROP (°F)	27	27	26	25	24	22	20	17

YHM48B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/67	1200	LIQUID PRESSURE (PSIG)	210	250	292	336	383	432	483	537
		LIQUID TEMPERATURE (°F)	61	72	82	92	102	112	120	130
		LIQUID SUBCOOLING (°F)	12	12	12	12	12	11	11	10
		SUCTION PRESSURE (PSIG)	116	117	119	123	128	135	143	153
		SUCTION TEMPERATURE (°F)	49	49	50	52	55	60	64	71
		SUCTION SUPERHEAT (°F)	10	10	10	10	11	13	14	17
		OUTDOOR UNIT CURRENT (A)	12.1	14.6	16.5	17.7	18.3	18.3	17.5	16.2
		COMPRESSOR CURRENT (A)	12.1	14.6	16.5	17.7	18.3	18.2	17.5	16.2
		INDOOR COIL TEMP DROP (°F)	26	26	25	25	24	22	21	19
	1400	LIQUID PRESSURE (PSIG)	211	251	293	337	384	433	484	538
		LIQUID TEMPERATURE (°F)	61	72	83	92	102	112	120	130
		LIQUID SUBCOOLING (°F)	12	12	12	12	12	11	11	10
		SUCTION PRESSURE (PSIG)	119	120	122	126	131	138	146	156
		SUCTION TEMPERATURE (°F)	50	51	52	53	56	61	65	72
		SUCTION SUPERHEAT (°F)	10	10	10	10	11	13	14	17
		OUTDOOR UNIT CURRENT (A)	12.1	14.6	16.5	17.7	18.3	18.3	17.5	16.2
		COMPRESSOR CURRENT (A)	12.1	14.6	16.5	17.7	18.3	18.2	17.5	16.2
		INDOOR COIL TEMP DROP (°F)	24	24	23	23	22	20	19	17
	1600	LIQUID PRESSURE (PSIG)	212	252	294	338	385	434	485	539
		LIQUID TEMPERATURE (°F)	61	72	83	93	102	112	121	130
		LIQUID SUBCOOLING (°F)	12	12	12	12	12	11	11	10
		SUCTION PRESSURE (PSIG)	122	123	125	129	134	141	149	159
		SUCTION TEMPERATURE (°F)	52	52	53	55	58	62	67	73
		SUCTION SUPERHEAT (°F)	10	10	10	10	11	13	14	17
		OUTDOOR UNIT CURRENT (A)	12.1	14.6	16.5	17.7	18.3	18.3	17.5	16.2
		COMPRESSOR CURRENT (A)	12.1	14.6	16.5	17.7	18.3	18.2	17.5	16.2
		INDOOR COIL TEMP DROP (°F)	22	22	21	21	20	18	17	15
80/72	1200	LIQUID PRESSURE (PSIG)	213	252	294	338	385	433	484	538
		LIQUID TEMPERATURE (°F)	62	72	83	93	102	112	121	130
		LIQUID SUBCOOLING (°F)	12	12	12	12	12	11	10	10
		SUCTION PRESSURE (PSIG)	122	125	128	133	139	147	155	165
		SUCTION TEMPERATURE (°F)	59	56	55	55	58	62	67	73
		SUCTION SUPERHEAT (°F)	17	13	11	9	9	10	12	15
		OUTDOOR UNIT CURRENT (A)	12.1	14.7	16.6	17.9	18.5	18.4	17.7	16.3
		COMPRESSOR CURRENT (A)	12.1	14.7	16.6	17.9	18.5	18.4	17.7	16.2
		INDOOR COIL TEMP DROP (°F)	20	20	20	19	18	17	16	14
	1400	LIQUID PRESSURE (PSIG)	214	253	295	339	386	434	485	539
		LIQUID TEMPERATURE (°F)	62	73	83	93	102	112	122	130
		LIQUID SUBCOOLING (°F)	12	12	12	12	12	11	10	10
		SUCTION PRESSURE (PSIG)	125	128	131	136	142	150	158	168
		SUCTION TEMPERATURE (°F)	60	57	56	56	59	63	68	74
		SUCTION SUPERHEAT (°F)	17	13	11	9	9	10	12	15
		OUTDOOR UNIT CURRENT (A)	12.1	14.7	16.6	17.9	18.5	18.4	17.7	16.3
		COMPRESSOR CURRENT (A)	12.1	14.7	16.6	17.9	18.5	18.4	17.7	16.2
		INDOOR COIL TEMP DROP (°F)	19	19	19	18	17	16	15	13
	1600	LIQUID PRESSURE (PSIG)	215	254	296	340	387	435	486	540
		LIQUID TEMPERATURE (°F)	62	73	83	93	102	112	122	130
		LIQUID SUBCOOLING (°F)	12	12	12	12	12	11	10	10
		SUCTION PRESSURE (PSIG)	128	131	134	139	145	153	161	171
		SUCTION TEMPERATURE (°F)	62	59	59	59	61	65	70	76
		SUCTION SUPERHEAT (°F)	18	14	12	10	10	11	13	16
		OUTDOOR UNIT CURRENT (A)	12.1	14.7	16.6	17.9	18.5	18.4	17.7	16.3
		COMPRESSOR CURRENT (A)	12.1	14.7	16.6	17.9	18.5	18.4	17.7	16.2
		INDOOR COIL TEMP DROP (°F)	18	18	18	17	16	15	14	12

YHM48B21S W/ NOMINAL COIL

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
60	1200	SUCTION PRESS (PSIG)	107	86	75	59	47	39
		SUCTION TEMP(F)	35	24	18	8	-1	-8
		SUCTION SUPERHEAT(F)	20	19	17	17	18	18
		LIQUID SUBCOOLING(F)	22	25	27	28	31	32
		LIQUID PRESS (PSIG)	392	360	342	313	292	278
		LIQUID TEMP(F)	94	84	79	71	64	59
		ID AIR DB TEMP. RISE	45	39	35	30	25	22
		TOTAL / COMPR. AMPS	23 / 23	20 / 20	19 / 19	18 / 18	17 / 17	15 / 15
	1400	SUCTION PRESS (PSIG)	106	85	75	60	46	39
		SUCTION TEMP(F)	34	24	18	8	-2	-8
		SUCTION SUPERHEAT(F)	20	19	18	18	18	18
		LIQUID SUBCOOLING(F)	21	24	25	27	30	31
		LIQUID PRESS (PSIG)	366	338	323	299	281	269
		LIQUID TEMP(F)	89	80	76	69	62	57
		ID AIR DB TEMP. RISE	40	34	31	27	22	20
		TOTAL / COMPR. AMPS	22 / 22	20 / 20	19 / 19	17 / 17	16 / 16	15 / 15
	1600	SUCTION PRESS (PSIG)	104	84	74	61	46	39
		SUCTION TEMP(F)	34	23	18	9	-2	-8
		SUCTION SUPERHEAT(F)	21	19	18	18	19	17
		LIQUID SUBCOOLING(F)	20	23	24	26	29	31
		LIQUID PRESS (PSIG)	341	317	305	286	270	259
		LIQUID TEMP(F)	85	77	73	67	60	55
		ID AIR DB TEMP. RISE	38	30	27	23	19	17
		TOTAL / COMPR. AMPS	20 / 20	19 / 19	18 / 18	17 / 17	16 / 16	15 / 15
70	1200	SUCTION PRESS (PSIG)	110	87	76	62	46	37
		SUCTION TEMP(F)	36	25	18	10	-2	-10
		SUCTION SUPERHEAT(F)	19	18	17	17	18	19
		LIQUID SUBCOOLING(F)	22	26	28	30	32	33
		LIQUID PRESS (PSIG)	432	407	387	363	333	315
		LIQUID TEMP(F)	101	92	86	79	71	66
		ID AIR DB TEMP. RISE	43	38	35	27	24	21
		TOTAL / COMPR. AMPS	24 / 24	22 / 22	21 / 21	19 / 19	18 / 18	16 / 16
	1400	SUCTION PRESS (PSIG)	108	86	76	62	47	38
		SUCTION TEMP(F)	35	25	18	10	-1	-9
		SUCTION SUPERHEAT(F)	20	18	18	17	18	18
		LIQUID SUBCOOLING(F)	21	25	27	29	31	32
		LIQUID PRESS (PSIG)	409	384	369	347	323	307
		LIQUID TEMP(F)	97	89	84	77	70	65
		ID AIR DB TEMP. RISE	39	34	31	27	22	19
		TOTAL / COMPR. AMPS	23 / 23	21 / 21	20 / 20	19 / 19	17 / 17	16 / 16
	1600	SUCTION PRESS (PSIG)	106	86	76	63	47	40
		SUCTION TEMP(F)	35	24	18	10	-1	-7
		SUCTION SUPERHEAT(F)	21	19	18	18	19	17
		LIQUID SUBCOOLING(F)	20	24	26	28	30	31
		LIQUID PRESS (PSIG)	386	361	350	331	312	299
		LIQUID TEMP(F)	93	85	81	75	69	64
		ID AIR DB TEMP. RISE	36	30	27	23	19	17
		TOTAL / COMPR. AMPS	23 / 23	19 / 22	20 / 20	18 / 18	17 / 17	16 / 16

Continued on next page

YHM48B21S W/ NOMINAL COIL (Continued)

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
80	1200	SUCTION PRESS (PSIG)	112	89	76	65	45	35
		SUCTION TEMP(F)	37	26	19	11	-3	-12
		SUCTION SUPERHEAT(F)	18	18	17	17	18	19
		LIQUID SUBCOOLING(F)	21	27	28	31	33	34
		LIQUID PRESS (PSIG)	472	453	433	412	374	351
		LIQUID TEMP(F)	108	100	94	88	79	74
		ID AIR DB TEMP. RISE	40	37	34	23	23	19
		TOTAL / COMPR. AMPS	25 / 25	24 / 24	23 / 23	21 / 21	19 / 19	17 / 17
	1400	SUCTION PRESS (PSIG)	110	88	77	64	47	38
		SUCTION TEMP(F)	36	25	19	11	-1	-9
		SUCTION SUPERHEAT(F)	19	18	17	17	18	18
		LIQUID SUBCOOLING(F)	21	25	28	30	32	32
		LIQUID PRESS (PSIG)	452	430	414	394	365	345
		LIQUID TEMP(F)	105	97	92	85	78	74
		ID AIR DB TEMP. RISE	37	33	30	26	21	18
		TOTAL / COMPR. AMPS	25 / 25	23 / 23	22 / 22	20 / 20	18 / 18	17 / 17
	1600	SUCTION PRESS (PSIG)	108	87	77	64	49	41
		SUCTION TEMP(F)	36	25	19	11	0	-7
		SUCTION SUPERHEAT(F)	20	18	18	17	18	17
		LIQUID SUBCOOLING(F)	21	24	27	29	31	31
		LIQUID PRESS (PSIG)	432	406	395	376	355	339
		LIQUID TEMP(F)	101	94	89	83	77	74
		ID AIR DB TEMP. RISE	33	29	26	23	19	16
		TOTAL / COMPR. AMPS	25 / 25	22 / 22	21 / 21	20 / 20	18 / 18	17 / 17

FOR USE WITH MODELS WITH TXV:

YHM60B21S

CH16B6021SA

TH16B6021SA

IMPORTANT

The main control must be moved to "H", which will lock it into 100% capacity for charge and operation evaluation before the below numbers will apply.

This data is only applicable when the main control is put on "H". If the main control jumper is not moved to "H" the data will not be applicable. After system evaluation remember to return the jumper to its normal orientation position.

YHM60B21S SUBCOOLING CHARGING CHART				
OUTDOOR AMBIENT DB (°F)	INDOOR WET BULB (°F) AT 80°F DRY BULB			
	57	62	67	72
	PRESSURE (PSIG) & SUBCOOLING (°F) AT LIQUID BASE VALVE			
55	206(9)	209(9)	211(8)	212(8)
60	225(9)	228(9)	230(9)	232(8)
65	244(9)	247(9)	249(9)	252(8)
70	264(9)	267(10)	269(9)	272(9)
75	285(10)	287(10)	289(9)	294(9)
80	306(10)	308(10)	311(9)	315(9)
85	328(10)	330(10)	332(10)	338(9)
90	351(9)	352(10)	354(10)	360(9)
95	374(9)	374(10)	377(9)	384(9)
100	398(9)	398(10)	401(9)	408(9)
105	423(9)	422(9)	424(9)	432(9)
110	448(8)	446(9)	449(9)	457(9)
115	475(8)	471(9)	474(9)	482(8)
120	502(7)	497(8)	499(8)	509(8)
125	529(7)	523(7)	526(8)	535(8)

Charging chart is for use in High Stage (full capacity) mode only.
Charging chart is for use in Cooling mode only.
Subcooling Chart is for use with TXV indoor expansion device only.

YHM60B21S W/ NOMINAL COIL

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
75/62	1600	LIQUID PRESSURE (PSIG)	208	245	285	328	373	422	472	526
		LIQUID TEMPERATURE (°F)	63	74	83	92	102	111	120	130
		LIQUID SUBCOOLING (°F)	9	9	10	10	10	10	9	8
		SUCTION PRESSURE (PSIG)	114	115	116	119	123	129	135	143
		SUCTION TEMPERATURE (°F)	47	49	49	51	53	56	58	61
		SUCTION SUPERHEAT (°F)	9	10	10	11	11	11	11	11
		OUTDOOR UNIT CURRENT (A)	13.3	15.7	17.6	18.9	19.7	20	19.7	18.9
		COMPRESSOR CURRENT (A)	13.2	15.7	17.6	18.9	19.7	20	19.7	18.8
		INDOOR COIL TEMP DROP (°F)	25	24	24	23	22	21	19	18
	1800	LIQUID PRESSURE (PSIG)	209	246	286	329	374	423	473	527
		LIQUID TEMPERATURE (°F)	64	74	83	93	102	111	121	130
		LIQUID SUBCOOLING (°F)	9	9	10	10	10	10	9	8
		SUCTION PRESSURE (PSIG)	116	117	118	121	125	131	137	145
		SUCTION TEMPERATURE (°F)	48	49	50	52	54	56	59	62
		SUCTION SUPERHEAT (°F)	9	10	10	11	11	11	11	11
		OUTDOOR UNIT CURRENT (A)	13.3	15.7	17.6	18.9	19.7	20	19.7	18.9
		COMPRESSOR CURRENT (A)	13.2	15.7	17.6	18.9	19.7	20.0	19.7	18.8
		INDOOR COIL TEMP DROP (°F)	24	23	23	22	21	20	18	17
	2000	LIQUID PRESSURE (PSIG)	210	247	287	330	375	424	474	528
		LIQUID TEMPERATURE (°F)	64	74	83	93	102	111	121	130
		LIQUID SUBCOOLING (°F)	9	9	10	10	10	10	9	8
		SUCTION PRESSURE (PSIG)	118	119	120	123	127	133	139	147
		SUCTION TEMPERATURE (°F)	49	50	51	53	55	57	60	63
		SUCTION SUPERHEAT (°F)	9	10	10	11	11	11	11	11
		OUTDOOR UNIT CURRENT (A)	13.3	15.7	17.6	18.9	19.7	20	19.7	18.9
		COMPRESSOR CURRENT (A)	13.2	15.7	17.6	18.9	19.7	20.0	19.7	18.8
		INDOOR COIL TEMP DROP (°F)	23	22	22	21	20	19	17	16

YHM60B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/57	1600	LIQUID PRESSURE (PSIG)	212	277	337	391	440	484	521	554
		LIQUID TEMPERATURE (°F)	65	83	96	107	117	124	130	136
		LIQUID SUBCOOLING (°F)	8	8	8	8	7	7	7	6
		SUCTION PRESSURE (PSIG)	106	116	125	134	143	150	158	165
		SUCTION TEMPERATURE (°F)	42	50	56	62	67	71	74	76
		SUCTION SUPERHEAT (°F)	8	11	13	15	17	18	18	18
		OUTDOOR UNIT CURRENT (A)	12.8	13.8	14.5	15.1	15.4	15.5	15.4	15
		COMPRESSOR CURRENT (A)	12.7	13.7	14.5	15.1	15.4	15.5	15.4	15
		INDOOR COIL TEMP DROP (°F)	31	29	26	23	21	19	18	16
	1800	LIQUID PRESSURE (PSIG)	194	259	319	373	422	466	503	536
		LIQUID TEMPERATURE (°F)	59	77	91	103	113	120	126	133
		LIQUID SUBCOOLING (°F)	9	9	9	9	8	8	8	7
		SUCTION PRESSURE (PSIG)	104	114	123	132	141	148	156	163
		SUCTION TEMPERATURE (°F)	41	49	55	61	66	70	73	76
		SUCTION SUPERHEAT (°F)	8	11	13	15	17	18	18	18
		OUTDOOR UNIT CURRENT (A)	13.4	14.4	15.1	15.7	16	16.1	16	15.6
		COMPRESSOR CURRENT (A)	13.3	14.3	15.1	15.7	16	16.1	16	15.6
		INDOOR COIL TEMP DROP (°F)	31	29	26	23	21	19	18	16
	2000	LIQUID PRESSURE (PSIG)	176	241	301	355	404	448	485	518
		LIQUID TEMPERATURE (°F)	53	73	87	99	110	117	124	130
		LIQUID SUBCOOLING (°F)	9	9	9	9	8	8	8	7
		SUCTION PRESSURE (PSIG)	102	112	121	130	139	146	154	161
		SUCTION TEMPERATURE (°F)	41	48	54	60	66	69	72	75
		SUCTION SUPERHEAT (°F)	8	11	13	15	17	18	18	18
		OUTDOOR UNIT CURRENT (A)	14.0	15	15.7	16.3	16.6	16.7	16.6	16.2
		COMPRESSOR CURRENT (A)	13.9	14.9	15.7	16.3	16.6	16.7	16.6	16.2
		INDOOR COIL TEMP DROP (°F)	31	29	26	23	21	19	18	16
80/62	1600	LIQUID PRESSURE (PSIG)	208	246	286	329	373	421	470	522
		LIQUID TEMPERATURE (°F)	63	74	83	93	102	112	120	130
		LIQUID SUBCOOLING (°F)	9	9	10	10	10	9	9	7
		SUCTION PRESSURE (PSIG)	115	114	116	119	124	131	139	149
		SUCTION TEMPERATURE (°F)	48	48	49	51	54	56	59	63
		SUCTION SUPERHEAT (°F)	9	10	10	11	11	11	10	10
		OUTDOOR UNIT CURRENT (A)	13.2	15.8	17.7	19	19.7	19.7	19.1	17.8
		COMPRESSOR CURRENT (A)	13.2	15.7	17.7	19	19.6	19.7	19	17.8
		INDOOR COIL TEMP DROP (°F)	28	28	28	27	26	24	22	20
	1800	LIQUID PRESSURE (PSIG)	209	247	287	330	374	422	471	523
		LIQUID TEMPERATURE (°F)	64	74	83	93	102	112	120	131
		LIQUID SUBCOOLING (°F)	9	9	10	10	10	9	9	7
		SUCTION PRESSURE (PSIG)	118	117	119	122	127	134	142	152
		SUCTION TEMPERATURE (°F)	49	49	50	53	55	58	60	64
		SUCTION SUPERHEAT (°F)	9	10	10	11	11	11	10	10
		OUTDOOR UNIT CURRENT (A)	13.2	15.8	17.7	19	19.7	19.7	19.1	17.8
		COMPRESSOR CURRENT (A)	13.2	15.7	17.7	19	19.6	19.7	19	17.8
		INDOOR COIL TEMP DROP (°F)	27	27	27	26	25	23	21	19
	2000	LIQUID PRESSURE (PSIG)	210	248	288	331	375	423	472	524
		LIQUID TEMPERATURE (°F)	64	74	83	93	102	112	120	131
		LIQUID SUBCOOLING (°F)	9	9	10	10	10	9	9	7
		SUCTION PRESSURE (PSIG)	121	120	122	125	130	137	145	155
		SUCTION TEMPERATURE (°F)	50	51	52	54	56	59	61	65
		SUCTION SUPERHEAT (°F)	9	10	10	11	11	11	10	10
		OUTDOOR UNIT CURRENT (A)	13.2	15.8	17.7	19	19.7	19.7	19.1	17.8
		COMPRESSOR CURRENT (A)	13.2	15.7	17.7	19	19.6	19.7	19	17.8
		INDOOR COIL TEMP DROP (°F)	26	26	26	25	24	22	20	18

YHM60B21S W/ NOMINAL COIL (Continued)

ID DB / ID WB (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	COOLING SERVICE DATA							
			55	65	75	85	95	105	115	125
80/67	1600	LIQUID PRESSURE (PSIG)	211	249	289	332	377	424	474	526
		LIQUID TEMPERATURE (°F)	65	75	85	93	103	112	121	130
		LIQUID SUBCOOLING (°F)	8	9	9	10	9	9	9	8
		SUCTION PRESSURE (PSIG)	125	125	127	130	134	140	147	156
		SUCTION TEMPERATURE (°F)	53	53	54	56	58	60	63	66
		SUCTION SUPERHEAT (°F)	10	10	10	11	11	11	11	11
		OUTDOOR UNIT CURRENT (A)	13.2	16	18	19.3	20	19.9	19.1	17.6
		COMPRESSOR CURRENT (A)	13.2	15.9	18	19.3	19.9	19.8	19.1	17.6
		INDOOR COIL TEMP DROP (°F)	24	24	24	23	22	21	20	18
	1800	LIQUID PRESSURE (PSIG)	211	249	289	332	377	424	474	526
		LIQUID TEMPERATURE (°F)	65	75	85	93	103	112	121	130
		LIQUID SUBCOOLING (°F)	8	9	9	10	9	9	9	8
		SUCTION PRESSURE (PSIG)	128	128	130	133	137	143	150	159
		SUCTION TEMPERATURE (°F)	54	54	55	57	59	61	64	67
		SUCTION SUPERHEAT (°F)	10	10	10	11	11	11	11	11
		OUTDOOR UNIT CURRENT (A)	13.2	16	18	19.3	20	19.9	19.1	17.6
		COMPRESSOR CURRENT (A)	13.2	15.9	18	19.3	19.9	19.8	19.1	17.6
		INDOOR COIL TEMP DROP (°F)	23	23	23	22	21	20	19	17
	2000	LIQUID PRESSURE (PSIG)	211	249	289	332	377	424	474	526
		LIQUID TEMPERATURE (°F)	65	75	85	93	103	112	121	130
		LIQUID SUBCOOLING (°F)	8	9	9	10	9	9	9	8
		SUCTION PRESSURE (PSIG)	131	131	133	136	140	146	153	162
		SUCTION TEMPERATURE (°F)	55	55	56	58	60	62	65	68
		SUCTION SUPERHEAT (°F)	10	10	10	11	11	11	11	11
		OUTDOOR UNIT CURRENT (A)	13.2	16	18	19.3	20	19.9	19.1	17.6
		COMPRESSOR CURRENT (A)	13.2	15.9	18	19.3	19.9	19.8	19.1	17.6
		INDOOR COIL TEMP DROP (°F)	22	22	22	21	20	19	18	16
80/72	1600	LIQUID PRESSURE (PSIG)	212	251	292	335	380	427	476	526
		LIQUID TEMPERATURE (°F)	65	76	85	95	104	114	122	131
		LIQUID SUBCOOLING (°F)	8	8	9	9	9	8	8	7
		SUCTION PRESSURE (PSIG)	131	134	138	142	148	154	161	169
		SUCTION TEMPERATURE (°F)	57	58	59	60	62	64	68	71
		SUCTION SUPERHEAT (°F)	12	11	11	10	10	10	11	11
		OUTDOOR UNIT CURRENT (A)	13.2	16.1	18.2	19.6	20.3	20.2	19.3	17.7
		COMPRESSOR CURRENT (A)	13.2	16.1	18.2	19.6	20.2	20.1	19.3	17.7
		INDOOR COIL TEMP DROP (°F)	22	21	20	19	18	16	15	13
	1800	LIQUID PRESSURE (PSIG)	213	252	293	336	381	428	477	527
		LIQUID TEMPERATURE (°F)	66	76	86	95	104	114	122	131
		LIQUID SUBCOOLING (°F)	8	8	9	9	9	8	8	7
		SUCTION PRESSURE (PSIG)	133	136	140	144	150	156	163	171
		SUCTION TEMPERATURE (°F)	58	58	60	61	63	65	69	71
		SUCTION SUPERHEAT (°F)	12	11	11	10	10	10	11	11
		OUTDOOR UNIT CURRENT (A)	13.2	16.1	18.2	19.6	20.3	20.2	19.3	17.7
		COMPRESSOR CURRENT (A)	13.2	16.1	18.2	19.6	20.2	20.1	19.3	17.7
		INDOOR COIL TEMP DROP (°F)	21	20	19	18	17	15	14	12
	2000	LIQUID PRESSURE (PSIG)	214	253	294	337	382	429	478	528
		LIQUID TEMPERATURE (°F)	66	77	86	95	104	114	122	131
		LIQUID SUBCOOLING (°F)	8	8	9	9	9	8	8	7
		SUCTION PRESSURE (PSIG)	135	138	142	146	152	158	165	173
		SUCTION TEMPERATURE (°F)	59	59	61	61	64	66	69	72
		SUCTION SUPERHEAT (°F)	12	11	11	10	10	10	11	11
		OUTDOOR UNIT CURRENT (A)	13.2	16.1	18.2	19.6	20.3	20.2	19.3	17.7
		COMPRESSOR CURRENT (A)	13.2	16.1	18.2	19.6	20.2	20.1	19.3	17.7
		INDOOR COIL TEMP DROP (°F)	20	19	18	17	16	14	13	11

YHM60B21S W/ NOMINAL COIL

YHM60B21S W/ NOMINAL COIL

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
60	1600	SUCTION PRESS (PSIG)	117	93	81	68	51	41
		SUCTION TEMP(F)	39	28	21	14	2	-6
		SUCTION SUPERHEAT(F)	11	11	12	12	15	15
		LIQUID SUBCOOLING(F)	21	22	23	25	25	24
		LIQUID PRESS (PSIG)	345	320	301	289	264	247
		LIQUID TEMP(F)	85	72	74	68	63	60
		ID AIR DB TEMP. RISE	38	33	29	25	20	17
		TOTAL / COMPR. AMPS	19 / 19	17 / 18	17 / 17	16 / 16	15 / 15	14 / 14
	1800	SUCTION PRESS (PSIG)	116	93	79	68	51	41
		SUCTION TEMP(F)	39	28	20	13	2	-6
		SUCTION SUPERHEAT(F)	11	11	12	12	15	15
		LIQUID SUBCOOLING(F)	21	22	21	23	24	23
		LIQUID PRESS (PSIG)	329	306	286	276	256	241
		LIQUID TEMP(F)	82	72	72	67	62	59
		ID AIR DB TEMP. RISE	35	30	26	23	18	15
		TOTAL / COMPR. AMPS	19 / 19	17 / 17	16 / 16	16 / 16	14 / 14	14 / 14
	2000	SUCTION PRESS (PSIG)	115	92	77	67	51	40
		SUCTION TEMP(F)	39	28	19	13	2	-7
		SUCTION SUPERHEAT(F)	11	11	11	12	14	15
		LIQUID SUBCOOLING(F)	20	22	19	21	22	21
		LIQUID PRESS (PSIG)	313	292	270	264	249	235
		LIQUID TEMP(F)	79	72	71	66	61	58
		ID AIR DB TEMP. RISE	31	26	23	20	16	14
		TOTAL / COMPR. AMPS	18 / 18	17 / 17	16 / 16	15 / 15	14 / 14	13 / 13
70	1600	SUCTION PRESS (PSIG)	118	94	83	69	52	43
		SUCTION TEMP(F)	40	28	23	14	2	-4
		SUCTION SUPERHEAT(F)	12	12	13	14	15	15
		LIQUID SUBCOOLING(F)	21	21	24	25	25	24
		LIQUID PRESS (PSIG)	390	362	349	330	304	290
		LIQUID TEMP(F)	93	84	82	77	72	69
		ID AIR DB TEMP. RISE	37	31	29	25	20	17
		TOTAL / COMPR. AMPS	21 / 21	19 / 19	19 / 19	17 / 17	16 / 16	15 / 15
	1800	SUCTION PRESS (PSIG)	117	94	82	69	51	43
		SUCTION TEMP(F)	40	28	22	14	2	-5
		SUCTION SUPERHEAT(F)	12	12	13	13	15	15
		LIQUID SUBCOOLING(F)	21	22	23	24	24	23
		LIQUID PRESS (PSIG)	374	349	334	318	295	282
		LIQUID TEMP(F)	91	83	81	76	71	68
		ID AIR DB TEMP. RISE	34	29	26	23	18	15
		TOTAL / COMPR. AMPS	21 / 20	19 / 19	18 / 18	17 / 17	16 / 16	15 / 15
	2000	SUCTION PRESS (PSIG)	116	94	81	68	51	43
		SUCTION TEMP(F)	39	28	21	14	2	-5
		SUCTION SUPERHEAT(F)	12	12	12	13	15	15
		LIQUID SUBCOOLING(F)	20	22	21	22	23	22
		LIQUID PRESS (PSIG)	357	336	319	307	287	275
		LIQUID TEMP(F)	88	81	79	75	70	68
		ID AIR DB TEMP. RISE	30	26	23	20	16	14
		TOTAL / COMPR. AMPS	20 / 20	17 / 20	18 / 18	17 / 17	15 / 15	14 / 14

Continued on next page

YHM60B21S W/ NOMINAL COIL (Continued)

ID Temp (°F)	ID AIRFLOW (SCFM)	OUTDOOR TEMPERATURE DB (°F)	HEATING SERVICE DATA					
			60	47	40	30	17	10
80	1600	SUCTION PRESS (PSIG)	119	95	85	70	53	45
		SUCTION TEMP(F)	40	29	24	15	3	-3
		SUCTION SUPERHEAT(F)	13	13	14	15	14	14
		LIQUID SUBCOOLING(F)	21	21	25	25	25	25
		LIQUID PRESS (PSIG)	435	404	396	371	344	332
		LIQUID TEMP(F)	102	97	91	87	81	79
		ID AIR DB TEMP. RISE	36	29	28	24	19	17
		TOTAL / COMPR. AMPS	23 / 23	21 / 21	20 / 20	19 / 19	17 / 17	16 / 16
	1800	SUCTION PRESS (PSIG)	118	95	84	70	52	45
		SUCTION TEMP(F)	40	29	23	15	2	-3
		SUCTION SUPERHEAT(F)	13	13	14	15	15	14
		LIQUID SUBCOOLING(F)	30	25	24	20	13	19
		LIQUID PRESS (PSIG)	418	392	382	360	334	324
		LIQUID TEMP(F)	100	94	89	85	80	78
		ID AIR DB TEMP. RISE	33	27	25	22	17	15
		TOTAL / COMPR. AMPS	22 / 22	20 / 20	20 / 20	18 / 18	17 / 17	16 / 16
	2000	SUCTION PRESS (PSIG)	118	95	84	69	51	45
		SUCTION TEMP(F)	40	29	23	15	2	-3
		SUCTION SUPERHEAT(F)	13	13	13	14	15	14
		LIQUID SUBCOOLING(F)	20	22	23	23	23	22
		LIQUID PRESS (PSIG)	401	380	368	350	325	315
		LIQUID TEMP(F)	97	91	87	84	79	77
		ID AIR DB TEMP. RISE	29	25	23	19	15	14
		TOTAL / COMPR. AMPS	22 / 22	20 / 20	19 / 19	18 / 18	16 / 16	16 / 16

Flash Codes

