12.0 CONDENSING UNITS EQUIPPED WITH THE COMFORT CONTROL\textsuperscript{2} SYSTEM™

The Comfort Control\textsuperscript{2} is the next generation of the Integrated Compressor Control (ICC) and is an integral part of the Comfort Control\textsuperscript{2} System™ with the following features:

12.1 Control Description (see Figure 4)

Dual 7-Segment LED
- Displays status and diagnostic codes (See Status and Diagnostic Description)
- Displays diagnostic/fault recall (See Test Mode/Fault Recall)

Red LED (Y1)
- Y1 red LED (solid on) indicates Y1 call from thermostat is present

\begin{center}
\textbf{CAUTION}
\end{center}

UNIT MAY START SUDDENLY AND WITHOUT WARNING
Solid red light indicates a thermostat call for unit operation is present at the ICC control. ICC control will attempt to start unit after short cycle timer expires or when in Active Protection mode will attempt to restart unit prior to Lockout mode.

Line Voltage Connector
- Line voltage is connected to control board at lug terminals L1 & L2
- Maximum wire size accepted is 6 AWG copper wire
  - # 4 – 6 AWG 45 in/lbs
  - # 8 AWG 40 in/lbs
  - # 10 – 14 AWG 35 in/lbs
  (Check wire terminations annually)

Compressor Control (K2)
- Sealed single pole compressor relay switch with optical feedback feature (arc detection)

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{ICC Board}
\end{figure}
**Therm ostat Connector (E2)**
- R – 24VAC from the indoor unit 24VAC transformer (40 VA minimum)
- C – 24VAC Common from the indoor unit 24VAC transformer
- 1-Data: System Communications Line 1
- 2-Data: System Communications Line 2

**Low Volt Fuse**
- If required replace with 3 A automotive ATC style blade fuse

**Low Pressure Control (LPC Input)**
- Low-pressure control is factory installed
- Low pressure control is an automatic resetting device

**High Pressure Control (HPC Input)**
- High-pressure control is factory installed
- High pressure control is an automatic resetting device

**Ambient Temperature Sensor (included with all applications)**
- Included with all applications

**TEST and SW2 Buttons**
- TEST and SW2 buttons used to enter Test and Fault Recall Mode

**Memory Card**
- The memory card stores all unit information.
- The unit information is called shared data.
- The shared data is all the information needed for proper unit operation.

---

**FIGURE 5**
**TYPICAL COMFORT CONTROL™ SYSTEM WIRING DIAGRAM**

![Wiring Diagram](image_url)
12.2 Comfort Control² Control Wiring

The four 18AWG low voltage control wires must be installed from the thermostat to the indoor unit and from indoor unit to the outdoor unit. The wire length between the thermostat and indoor unit should not be greater than 100 feet. The wire length between the indoor unit and outdoor unit should not be greater than 125 feet.

A serial communicating HVAC system consists of:
- Serial communicating heat pump or serial communicating condensing unit
- Serial communicating air handler or serial communicating furnace
- Serial communicating thermostat

**IMPORTANT:** If the installed system does not meet these requirements, the system must be wired using traditional control wiring, reference Section 12.7 Conventional 24VAC Thermostat Control Wiring.

The Comfort Control² requires four (4) control wires for unit operation:
- R – 24VAC
- C – 24VAC common
- 1 – Data wire 1
- 2 – Data wire 2

**Note:** Comfort Control² requires 18 AWG thermostat wire.

**Note:** Term dipswatches should be in "ON" position.

If the low voltage control wiring is run in conduit with the power supply, Class I insulation is required. Class II insulation is required if run separate. Low voltage wiring may be run through the insulated bushing provided in the 7/8 hole in the base panel, up to and attached to the pigtails from the bottom of the control box. Conduit can be run to the base panel if desired by removing the insulated bushing.

The serial communicating air handler or serial communicating furnace transformer is equipped with a 24 volt, 50 VA transformer for proper system operation. See the wiring diagram in Figure 5 for reference.

12.3 Comfort Control² ICC Control Operation

**Installation Verification**
- 24V AC power on R&C must be present at the ICC for it to operate
- Line voltage must be present at the ICC for the compressor and the outdoor fan to operate
- The ICC displays a “0” for standby mode. Standby mode indicates line voltage and 24VAC are present at the ICC and there is not a command for unit operation from the serial communicating thermostat.

[Diagram of zero (0) displayed, ICC in standby]

**Command for Compressor Operation (Y1 LED)**
- If a command for compressor operation is received by the ICC (first stage/second stage cooling or first stage/second stage heating), the red Y1 LED will illuminate.
- The ICC has an on/off fan delay of one (1) second for each stage of heating or cooling.
- The ICC ignores the low pressure control for the first 90 seconds of compressor operation.
- On heat pumps, the ICC ignores the LPC during the defrost cycle.
- The dual 7-segment LED displays five (5) operational status codes:
  1) **First Stage Cooling Operation** – When the ICC receives a command for first stage cooling operation, a lower case “c” is displayed on the dual 7-segment LEDs.
  
  ![Diagram of lower case “c” indicating first stage cooling operation]

  Lower case “c” indicates first stage cooling operation
  
  2) **Second Stage Cooling Operation** – When the ICC receives a command for second stage cooling operation, an upper case “C” is displayed on the dual 7-segment LEDs.
3) **First Stage Heating Operation** - When the ICC receives a command for first stage heating operation, “h” is displayed on the dual 7-segment LEDs.

4) **Second Stage Heating Operation** - When the ICC receives a command for second stage heating operation, “H” is displayed on the dual 7-segment LEDs.

5) **Defrost Operation** – When the ICC starts a defrost cycle, a lower case “d” is displayed on the dual 7-segment LEDs.

**3-minute Anti-short Cycle Timer**

- The ICC has a built in 3-minute time delay between compressor operations to protect the compressor against short cycling. The dual 7-segment LEDs will flash “c”, “C”, “h”, or “H” while the short cycle timer is active and a command for unit operation is received.

- **Flashing lower case c**
  - A command for first stage cooling has been received

- **Flashing upper case C**
  - A command for second stage cooling has been received

- **Flashing lower case h**
  - A command for first stage heating has been received

- **Flashing upper case H**
  - A command for second stage heating has been received
• The 3-minute time delay can be bypassed when a command for compressor operation is present by pressing the TEST button for 1 second and releasing. The compressor will begin operation and the dual 7-segment will stop flashing.

30 Second Minimum Run Timer
• The ICC has a built-in 30 second minimum run time. If a command for compressor operation is received by the ICC and the command is removed, the compressor will continue to operate for 30 seconds. The dual 7-segment LEDs will flash “c”, “C”, “h”, or “H” while the minimum run timer is active.

1 Second Compressor/Fan Delay
• The ICC starts/stops the outdoor fan one (1) second after the start/stop of the compressor upon a command for compressor operation to minimize current irush and/or voltage drop.

12.4 Active Compressor Protection Mode
• The ICC actively protects the compressor from harmful operation during a fault condition.
• When the ICC detects a condition that could damage the compressor, the ICC will enter active protection mode and lockout compressor operation.
• The condition causing active protection must be resolved before ICC will restart the system.
• There are five (5) active protection modes:

1) Low Pressure Control Lockout
• The ICC will display a flashing “L” followed by a flashing 21 when a low pressure control lockout occurs.
• The ICC addresses low pressure control faults differently depending on the mode of unit operation (cooling or heating mode).

Active Protection – Code L21 – Open low pressure control

Cooling Mode
• If the LPC opens three (3) times during the same command for cooling operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”.

IMPORTANT: This mode of active protection must be manually reset.

Heating Mode
• There are two scenarios that will cause active protection during a LPC trip when the unit is in the heating mode:

Active Protection with hard lockout:
If the LPC opens three (3) times within 120 minutes for the same command for heating operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”.

IMPORTANT: This mode of active protection must be manually reset.

Active Protection with soft lockout:
If the LPC opens three (3) times for the same command for heating and the outdoor ambient temperature is below 5°F, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”. Once the outdoor ambient rises above 5°F the ICC will clear active protection automatically.

IMPORTANT: This mode of active protection will automatically deactivate once the outdoor temperature rises above 5°F. Wait until the outdoor ambient temperature rises above 5°F before performing further diagnostics.
2) High Pressure Control Lockout
- If the HPC opens three (3) times during the same command for unit operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “29”.

![L 29](image)

Active Protection – Code L29 – Open high pressure control

**IMPORTANT:** This mode of active protection must be manually reset.

3) Locked Rotor
- The ICC will display a flashing “L” followed by a flashing “04” when a locked rotor condition occurs.

![L 04](image)

Active Protection – Code L4 – Locked rotor

If the ICC detects the compressor has run less than 15 seconds for four (4) consecutive starts during the same command for unit operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “04”.

**IMPORTANT:** This mode of active protection must be manually reset.

4) Compressor Protector Trip
- If ICC detects a protector trip it will display a “P”. If protector doesn’t reset within 4 hours, the ICC display will change to “5”.

![P](image)

Compressor Protector – Code P – Protector Trip

5) Open Start Circuit Lockout
- The ICC will display a flashing “L” followed by a flashing “06” when an open start circuit condition occurs.

![L 06](image)

Active Protection – Code L6 – Compressor open start circuit

If the ICC detects current in the run circuit without current present in the start circuit, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “06”.

**IMPORTANT:** This mode of active protection must be manually reset.

6) Open Run Circuit Lockout
- The ICC will display a flashing “L” followed by a flashing “07” when an open start circuit condition occurs.

![L 07](image)

Active Protection – Code L7 – Compressor open run circuit
If the ICC detects current in the start circuit without current present in the run circuit, the ICC will lockout the compressor to keep it from continuing to operate and flash a "L" on the dual 7-segment LEDs followed by a "07".

**IMPORTANT:** This mode of active protection must be manually reset.

**Exiting Active Compressor Protection Lockout**

There are three methods to reset the ICC after an active protection lockout:

1) Cycle the line voltage to the unit
2) Cycle 24VAC to the ICC (remove the R or C connection to the ICC)
3) Push the TEST button down with an insulated probe for one (1) second and release

*Note:* The ICC will attempt to start the unit when the TEST button is pressed and released

**Note:** The preferred method of resetting the ICC is to push the TEST button down for one (1) second.

### 12.5 Test and Fault Recall Modes

**Test Mode (Test Button on the ICC)**

- Enter TEST mode by pressing the TEST button with an insulated probe for one (1) second and release.
- The TEST mode causes the ICC to do the following
  1) Resets the ICC from any active protection lockout mode
  2) Resets the 3-minute anti-short cycle timer
  3) Energizes the unit without a command for unit operation
- If the 3-minute anti-short cycle timer or 30 second minimum run timer is active (a flashing "t", "C", "h", or "H" is displayed on the dual 7-segment LEDs) and a command for unit operation is present, TEST mode causes:
  1) A “t” to display momentarily on the dual 7-segment display
  2) The compressor will start and the outdoor fan will operate
  3) The display will change to a steady "c", "C", "h", or "H" to show the current command for unit operation.

*Note:* If a command for unit operation is present at the end of TEST mode, the unit will continue to operate.

- If no command for unit operation is present, TEST mode causes
  1) A steady ‘t” appears on the dual 7-segment LEDs
  2) The compressor will start
  3) The compressor will turn off after 5-seconds.

*Note:* Entering TEST mode without a command for unit operation will cause the compressor to run 5-seconds.

**Fault Recall Mode (TEST and SW2 Buttons)**

- Enter FAULT RECALL mode by pressing the TEST and SW2 buttons at the same time with insulated probes for one (1) second and release.
- When entering and exiting FAULT RECALL mode the top and bottom segments of the dual 7-segment LEDs will illuminate.

  Fault Recall Mode – the top and bottom segments on the right side are illuminated

- When entering FAULT RECALL mode, the ICC will automatically scroll through stored faults on the dual 7-segment LEDs.
- Each fault is displayed one time with the top right hand segment of the dual 7-segment display activated between faults.
- Each fault is displayed with the most recent fault displayed first.
- A maximum of six individual faults can be stored.
- A maximum of three consecutive identical faults are stored.
- A “0” will be displayed with no faults are stored.
- The ICC will automatically exit the FAULT RECALL mode after displaying stored faults.

Clear Fault History (TEST and SW2 Buttons)
- Clear FAULT HISTORY by pressing both TEST and SW2 button for five (5) seconds with insulated probes and release.
- The top and bottom segments of the dual 7-segment LEDs flash to indicate the history has been cleared.

Fault history is cleared with the top and bottom LED segments flash

NOTE: The memory card for the unit has specific shared data for this unit. The memory card is attached to the control box with a tether. The tether has an identification tag that can be used to identify the memory card. For the system data faults d1 through d8 reference the label on the memory card tether.
## ICC Diagnostic Codes

Descriptions of the ICC diagnostic codes are provided below:

<table>
<thead>
<tr>
<th>Dual 7-Segment LEDs Display Code</th>
<th>Diagnostic Description</th>
<th>Status/Possible Cause – Troubleshooting Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Blank LED]</td>
<td>0 – Standby</td>
<td>Normal operation</td>
</tr>
<tr>
<td>![Led C]</td>
<td>c - First Stage Cooling</td>
<td>Unit has received a command for first stage cooling</td>
</tr>
</tbody>
</table>
| ![Led C Flashing]               | c - Anti-short cycle timer (3 minutes) or Minimum run timer (30 seconds) active | • The unit has received a command for first stage cooling during an active anti-short cycle timer or minimum run timer.  
  • Wait until unit timer has expired or press the TEST button to defeat short cycle delay. |
| ![Led C Flashing]               | C - Second Stage Cooling| Normal operation                                  |
| ![Led H]                         | h - First Stage Heat Pump| Normal operation                                  |
| ![Led H Flashing]               | h – Anti-short cycle timer (3 minutes) or Minimum run timer (30 seconds) active | • The unit has received a command for first stage heat pump during an active anti-short cycle timer or minimum run timer.  
  • Wait unit timer has expired or press the TEST button to defeat short cycle delay. |
| ![Led H]                         | H – Second Stage Heat Pump| Normal operation                                  |
| ![Led H Flashing]               | H – Anti-short cycle timer (3 minutes) or Minimum run timer (30 seconds) active | • The unit has received a command for second stage heat pump during an active anti-short cycle timer or minimum run timer.  
  • Wait unit timer has expired or press the TEST button to defeat short cycle delay. |
<p>| ![Led D]                         | d – Defrost Active     | Normal operation                                  |
| ![Led T]                         | t - Test Mode          | The ICC is in TEST mode                           |</p>
<table>
<thead>
<tr>
<th>Dual 7-Segment LEDs Display Code</th>
<th>Diagnostic Description</th>
<th>Status/Possible Cause – Troubleshooting Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>P – Protector Trip&lt;br&gt;A command for compressor operation is present but no current is measured to the compressor</td>
<td>• Motor protector open</td>
</tr>
<tr>
<td>01</td>
<td>01 – Long Run Time (Compressor)&lt;br&gt;The compressor has continuously run for more than 18 hours in the cooling mode.</td>
<td>• Low refrigerant charge&lt;br&gt;• Air ducts have substantial leakage&lt;br&gt;• Dirty indoor air filter&lt;br&gt;• Dirty outdoor coil</td>
</tr>
<tr>
<td>02</td>
<td>02 – High Side Fault&lt;br&gt;Compressor limit has opened four (4) times within a call for operation</td>
<td>• Outdoor coil is dirty (cooling mode)&lt;br&gt;• Outdoor fan is not running (cooling mode)&lt;br&gt;• Dirty indoor coil or filter (heating mode)&lt;br&gt;• Indoor blower is not running (heating mode)&lt;br&gt;• Liquid line restriction&lt;br&gt;• Excessive refrigerant charge</td>
</tr>
<tr>
<td>03</td>
<td>03 – Short Cycling&lt;br&gt;The ICC detects the run time for the past four (4) compressor cycles is less than three (3) minutes each.</td>
<td>• Check thermostat wire connections (R, C, 1, &amp; 2)&lt;br&gt;• Check thermostat location in zone (too close to discharge grill)</td>
</tr>
<tr>
<td>L4</td>
<td>L4 – Locked Rotor&lt;br&gt;The ICC detects four (4) consecutive protector trips have occurred and the average run time for each trip is less than 15 seconds</td>
<td>• Bad run capacitor&lt;br&gt;• Low line voltage&lt;br&gt;• Excessive refrigerant in compressor&lt;br&gt;• Seized bearings in compressor</td>
</tr>
<tr>
<td>05</td>
<td>05 – Open circuit (Compressor will not Run)&lt;br&gt;• The ICC has had a protector trip for longer than 4 hours</td>
<td>• Check for damaged, miswired, or wrong run capacitor&lt;br&gt;• Check for broken wires, loose connectors, or miswired compressor&lt;br&gt;• Check compressor windings for continuity&lt;br&gt;• Check for open compressor internal protector</td>
</tr>
<tr>
<td>06</td>
<td>06 – Compressor Open Start Circuit&lt;br&gt;The ICC detects current in the Run circuit but not in the Start circuit of the compressor</td>
<td>• Check for damaged, miswired, or wrong run capacitor&lt;br&gt;• Check for broken wires, loose connectors, or miswired compressor&lt;br&gt;• Check compressor windings for continuity</td>
</tr>
<tr>
<td>L6</td>
<td>L6 – Compressor Open Start Circuit&lt;br&gt;The ICC detects current in the Run circuit but not in the Start circuit of the compressor&lt;br&gt;The compressor four (4) times in one compressor call</td>
<td>• Check for damaged, miswired, or wrong run capacitor&lt;br&gt;• Check for broken wires, loose connectors, or miswired compressor&lt;br&gt;• Check compressor windings for continuity</td>
</tr>
<tr>
<td>07</td>
<td>07 – Compressor Open Run Circuit&lt;br&gt;The ICC detects current in the Start circuit but not in the Run circuit of the compressor</td>
<td>• Check for damaged, miswired, or wrong run capacitor&lt;br&gt;• Check for broken wires, loose connectors, or miswired compressor&lt;br&gt;• Check compressor windings for continuity</td>
</tr>
<tr>
<td>L7</td>
<td>L7 – Compressor Open Run Circuit&lt;br&gt;The ICC detects current in the Start circuit but not in the Run circuit of the compressor&lt;br&gt;The compressor four (4) times in one compressor call</td>
<td>• Check for damaged, miswired, or wrong run capacitor&lt;br&gt;• Check for broken wires, loose connectors, or miswired compressor&lt;br&gt;• Check compressor windings for continuity</td>
</tr>
<tr>
<td>09</td>
<td>09 – Low Secondary Volts&lt;br&gt;The secondary voltage at R and C is below 18VAC</td>
<td>• Control transformer overloaded&lt;br&gt;• Low line voltage</td>
</tr>
<tr>
<td>Dual 7-Segment LEDs Display Code</td>
<td>Diagnostic Description</td>
<td>Status/Possible Cause – Troubleshooting Information</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------</td>
<td>---------------------------------------------------</td>
</tr>
</tbody>
</table>
| 21                              | 21 – Low Pressure Control Open  
The ICC detects the LPC is open. Note: The low pressure control is ignored for the first 90 seconds of compressor operation | • Unit has low refrigerant charge  
• Indoor coil is frozen (cooling mode)  
• Dirty indoor coil or filter (cooling mode)  
• Indoor blower is not running (cooling mode)  
• Outdoor coil is frozen (heating mode)  
• Expansion valve is not operating correctly |
| L21 – **Active Protection** Low Pressure Control Trip | LPC has opened 3 times in the same cooling operation, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 21 |
| 27                              | 27 – Low Line Voltage or No Line Voltage Fault | • Check incoming line voltage to the disconnect and unit  
• Check wiring connections |
| 28                              | 28 – High Line Voltage Fault | • Check line voltage |
| 29                              | 29 – High Pressure Control Open  
The ICC detects the HPC is open | • Outdoor coil is dirty (cooling mode)  
• Outdoor fan is not running (cooling mode)  
• Dirty indoor coil or filter (heating mode)  
• Indoor blower is not running (heating mode)  
• Liquid line restriction  
• Excessive refrigerant charge |
| L29 – **Active Protection** High Pressure Control Trip | LPC has opened 3 times in the same cooling operation, the ICC has locked out the compressor to protect it. ICC alternately flashes L and 29 |
| 30                              | 30 – Fuse Open  
The ICC detects the on-board fuse is open | • The 3-amp fuse on the ICC is open.  
• Low voltage wiring at R and C is damaged or miswired. |
| 80                              | 80 – Low Air Flow  
The ICC detects that the indoor unit is not providing the minimum airflow requirements. | • Misapplied/wrong indoor air mover – replace with properly sized unit. |
| 83                              | 83 – Condenser Coil Temperature Fault  
The sensor detects an abnormally low or high coil temperature | • Replace the sensor  
• Check sensor is installed correctly on control |
| 84                              | 84 – Outdoor Ambient Temperature Fault  
The sensor detects an abnormally low or high outdoor ambient temperature | • Check unit placement – If the outdoor unit is in a high temperature area, wait until the ambient temperature drops and check sensor reading.  
• Replace the sensor.  
• Check sensor is installed correctly on control |
| 93                              | 93 – Internal Control Fault  
The control is not functioning properly. | • Check control for proper system operation.  
• Replace control |
<table>
<thead>
<tr>
<th>Dual 7-Segment LEDs Display Code</th>
<th>Diagnostic Description</th>
<th>Status/Possible Cause – Troubleshooting Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>d1</td>
<td>d1 – No Shared Data</td>
<td>• Replace memory card with correct system information.</td>
</tr>
<tr>
<td>d3</td>
<td>d3 – Airflow CFM Mismatch</td>
<td>• Misapplied/wrong indoor air mover – replace with properly sized air handler/furnace.</td>
</tr>
<tr>
<td></td>
<td>The indoor air mover (air handler/furnace) cannot supply the required airflow for proper system operation</td>
<td></td>
</tr>
<tr>
<td>d4</td>
<td>d4 – (Device) Memory Card Invalid for Device</td>
<td>• Check memory card to ensure it matches device</td>
</tr>
<tr>
<td></td>
<td>The data in the memory card inserted into the control board does not match the data in the control.</td>
<td>• Check if memory card is present</td>
</tr>
<tr>
<td>d8</td>
<td>d8 – Old Shared Data</td>
<td>• If system will not operate, order new memory card to update system information.</td>
</tr>
<tr>
<td></td>
<td>System data is obsolete</td>
<td></td>
</tr>
</tbody>
</table>

### 12.7 Conventional 24VAC Thermostat Control Wiring

The (-)PRL series of heat pumps allow the installer to use conventional 24VAC control wiring and a conventional thermostat for proper unit operation.

**IMPORTANT:** The preferred method of unit installation and operation is by the Comfort Control® System™, which allows access to the fault history of the system. This diagnostic information is not available when the (-)PRL unit is using a conventional thermostat. Reference section 12.2 Comfort Control® System™ Control Wiring.

Thermostat control wiring requires a minimum of six (6) wires for proper unit operation:

- R – 24VAC
- C – 24VAC common
- Y1 – First stage operation
- Y2 – Second stage operation
- B – Heat pump operation
- D – Defrost

Optional wiring:

- L – ICC fault information

### L Terminal Output

- Flash 1 – Compressor running extremely long run cycle or low pressure
- Flash 2 – High pressure control trip
- Flash 3 – Unit short cycling
- Flash 4 – Locked rotor
- Flash 5 – Compressor will not run, open circuit
- Flash 6 – Open start circuit
- Flash 7 – Open run circuit
- Flash 8 – Control mis-operation
- Flash 9 – Low control voltage

When the L terminal from the outdoor unit is connected to a conventional thermostat that is L terminal compatible, the thermostat display will flash the above codes.

If the low voltage control wiring is run in conduit with the power supply, Class I insulation is required. Class II insulation is required if run separate. Low voltage wiring may be run through the insulated bushing provided in the 7/8 hole in the base panel, up to and attached to the pigtails from the bottom of the control box. Conduit can be run to the base panel if desired by removing the insulated bushing.
A thermostat and a 24-volt, 40VA minimum transformer are required for the control circuit of the condensing unit. The furnace or the air handler transformer may be used if sufficient. See the wiring diagram for reference. Use Table 7 to size the 24-volt control wirings.

### Table 7

<table>
<thead>
<tr>
<th>Length of Run - Feet (1)</th>
<th>SOLID COPPER WIRE - AWG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>16 14 12 10 10 10</td>
</tr>
<tr>
<td>100</td>
<td>16 14 12 12 10 10</td>
</tr>
<tr>
<td>150</td>
<td>18 16 14 12 12 10</td>
</tr>
<tr>
<td>200</td>
<td>18 16 14 12 12 10</td>
</tr>
<tr>
<td>250</td>
<td>18 16 14 12 12 10</td>
</tr>
<tr>
<td>300</td>
<td>18 16 14 12 12 10</td>
</tr>
</tbody>
</table>

(1) Wire length equals twice the run distance.

**NOTE:** Do not use control wiring smaller than No. 18 AWG between thermostat and outdoor unit.

**Wire Color Code**

- BK – BLACK
- G – GREEN
- PR – PURPLE
- Y – YELLOW
- BR – BROWN
- GY – GRAY
- R – RED
- BL – BLUE
- O – ORANGE
- W – WHITE

#### 12.8 Typical Non-Communicating Thermostat Wiring Diagrams

The following figures show the typical wiring diagrams with (-)HPL air handler and (-)PRL heat pump. Cooling and heat pump airflows may need to be adjusted for homeowner comfort once the system is operational.

**Figure 6**

Typical 2-stage Thermostat: Heat Pump with Electric Heat

**Figure 7**

Typical Two-stage Thermostat: (-)PRL Heat Pump with Electric Heat Using a Humidistat for Dehumidification*

**Figure 8**

Typical Two-stage Thermostat: (-)PRL Heat Pump with Electric Heat Using a Two-stage Thermostat with Dehumidification*

**Figure 9**

(-)PRL Heat Pump with Electric Heat Using a Two-stage Thermostat with Dehumidification and a Malfunction Light

---

**TABLE 7**

<table>
<thead>
<tr>
<th>Field Wire Size for 24 Volt Thermostat Circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOLID COPPER WIRE - AWG.</strong></td>
</tr>
<tr>
<td>3.0</td>
</tr>
<tr>
<td>2.5</td>
</tr>
<tr>
<td>2.0</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>150</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>250</td>
</tr>
<tr>
<td>300</td>
</tr>
</tbody>
</table>

(1) Wire length equals twice the run distance.

**NOTE:** Do not use control wiring smaller than No. 18 AWG between thermostat and outdoor unit.

**Wire Color Code**

- BK – BLACK
- G – GREEN
- PR – PURPLE
- Y – YELLOW
- BR – BROWN
- GY – GRAY
- R – RED
- BL – BLUE
- O – ORANGE
- W – WHITE

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12.9 ICC Control Operation with Conventional Thermostat Wiring

Installation Verification
- 24V AC power on R&C must be present at the ICC for it to operate
- Line voltage must be present at the ICC for the compressor and the outdoor fan to operate
- The ICC displays a “0” for standby mode. Standby mode indicates line voltage and 24VAC are present at the ICC and there is not a call for unit operation from the thermostat.

Zero (0) displayed
The unit is in standby

Call for Compressor Operation (Y1 LED)
- If a call for compressor operation is received by the ICC (first stage/second stage cooling or first stage/second stage heating), the red Y1 LED will illuminate.
- The ICC has an on/off fan delay of one (1) second for each stage of heating or cooling.
- The ICC ignores the lower pressure control for the first 90 seconds of compressor operation.
- On heat pumps, the ICC ignores the LPC during the defrost cycle.
- The dual 7-segment LED displays five (5) operational status codes:

1) First Stage Cooling Operation – When the ICC receives a call for first stage cooling operation, a lower case “c” is displayed on the dual 7-segment LEDs.

Lower case “c” indicates first stage cooling operation

2) Second Stage Cooling Operation – When the ICC receives a call for second stage cooling operation, an upper case “C” is displayed on the dual 7-segment LEDs.

Upper case “C” indicates second stage cooling operation

3) First Stage Heating Operation - When the ICC receives a call for first stage heating operation, “h” is displayed on the dual 7-segment LEDs.

“h” indicates first stage heating operation

4) First Stage Heating Operation - When the ICC receives a call for first stage heating operation, “h” is displayed on the dual 7-segment LEDs.
4) **Second Stage Heating Operation** - When the ICC receives a call for second stage heating operation, “H” is displayed on the dual 7-segment LEDs.

```
H
```

“H” indicates second stage heating operation

5) **Defrost Operation** – When the ICC starts a defrost cycle, a lower case “d” is displayed on the dual 7-segment LEDs.

```
d
```

Lower case “d” indicates defrost operation (in heating mode)

**3-minute Anti-short Cycle Timer**

- The ICC has a built in 3-minute time delay between compressor operations to protect the compressor against short cycling. The dual 7-segment LEDs will flash “c”, “C”, “h”, or “H” while the short cycle timer is active and a call for unit operation is received.

```
c
```

Flashing lower case c  
A call for first stage cooling has been received

```
C
```

Flashing upper case C  
A call for second stage cooling has been received

```
h
```

Flashing lower case h  
A call for first stage heating has been received

```
H
```

Flashing upper case h  
A call for second stage heating has been received

- The 3-minute time delay can be bypassed when a call for compressor operation is present by pressing the TEST button for 1 second and releasing. The compressor will begin operation and the dual 7-segment will stop flashing.

**30 Second Minimum Run Timer**

- The ICC has a built in 30 second minimum unit run time. If a call for compressor operation is received by the ICC and the call is removed, the compressor will continue to operate for 30 seconds. The dual 7-segment LEDs will flash “c”, “C”, “h”, or “H” while the minimum run timer is active.

**1 Second Compressor/Fan Delay**

- The ICC starts/stops the outdoor fan one (1) second after the start/stop of the compressor upon a call for compressor operation to minimize current inrush and/or voltage drop.
12.10 Active Compressor Protection Mode

- The ICC actively protects the compressor from harmful operation during a fault condition.
- When the ICC detects a condition that could damage the compressor, the ICC will enter active protection mode and lockout compressor operation
- The condition causing active protection must be resolved then the ICC can be reset to restart the system.
- There are five (5) active protection modes:

1) Low Pressure Control Lockout

- The ICC will display a flashing “L” followed by a flashing 21 when a low pressure control lockout occurs.
- The ICC addresses low pressure control faults differently depending on the mode of unit operation (cooling or heating mode).

Active Protection – Code L21 – Open low pressure control

Cooling Mode

- If the LPC opens three (3) times during the same call for cooling operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”.

IMPORTANT: This mode of active protection must be manually reset.

Heating Mode

- There are two scenarios that will cause active protection during a LPC trip when the unit is in the heating mode:

Active Protection with hard lockout:

If the LPC opens three (3) times within 120 minutes for the same call for heating operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”.

IMPORTANT: This mode of active protection must be manually reset.

Active Protection with soft lockout:

If the LPC opens three (3) times for the same call for heating and the outdoor ambient temperature is below 5F, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “21”. Once the outdoor ambient rises above 5F the ICC will clear active protection automatically.

IMPORTANT: This mode of active protection will automatically deactivate once the outdoor temperature rises above 5F. Wait until the outdoor ambient temperature rises above 5F before performing further diagnostics.

2) High Pressure Control Lockout

- If the HPC opens three (3) times during the same call for unit operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “29”.

---

Active Protection – Code L21 – Open low pressure control
L29
Active Protection – Code L29 – Open high pressure control

IMPORTANT: This mode of active protection must be manually reset.

3) Locked Rotor
• The ICC will display a flashing “L” followed by a flashing “04” when a locked rotor condition occurs.

L4
Active Protection – Code L4 – Locked rotor

If the ICC detects the compressor has run less than 15 seconds for four (4) consecutive starts during the same call for unit operation, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “04”.

IMPORTANT: This mode of active protection must be manually reset.

4) Open Start Circuit Lockout
• The ICC will display a flashing “L” followed by a flashing “06” when an open start circuit condition occurs.

L6
Active Protection – Code L6 – Compressor open start circuit

If the ICC detects current in the run circuit without current present in the start circuit, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “06”.

IMPORTANT: This mode of active protection must be manually reset.

5) Open Run Circuit Lockout
• The ICC will display a flashing “L” followed by a flashing “07” when an open start circuit condition occurs.

L7
Active Protection – Code L7 – Compressor open run circuit

If the ICC detects current in the start circuit without current present in the run circuit, the ICC will lockout the compressor to keep it from continuing to operate and flash a “L” on the dual 7-segment LEDs followed by a “07”.

IMPORTANT: This mode of active protection must be manually reset.
**IMPORTANT:** This mode of active protection must be manually reset.

**Exiting Active Compressor Protection Lockout**

Three are three methods to reset the ICC after an active protection lockout:

1) Cycle the line voltage to the unit
2) Cycle 24VAC to the ICC (remove the R or C connection to the ICC)
3) Push the TEST button down for one (1) second and release

Note: The ICC will attempt to start the unit when the TEST button is pressed and released

Note: The preferred method of resetting the ICC is to push the TEST button down for one (1) second.

**12.11 Test and Fault Recall Modes**

**Test Mode (Test Button on the ICC)**

- Enter TEST mode by pressing the TEST button with an insulated probe for one (1) second and release.
- The TEST mode causes the ICC to do the following
  1) Resets the ICC from any active protection lockout mode
  2) Resets the 3-minute anti-short cycle timer
  3) Energizes the unit without a call for unit operation
- If the 3-minute anti-short cycle timer or 30 second minimum run timer is active (a flashing “c”, “C”, “h”, or “H” is displayed on the dual 7-segment LEDs) and a call for unit operation is present, TEST mode causes:
  1) A “t” to display momentarily on the dual 7-segment display
  2) The compressor will start
  3) The display will change to a steady “c”, “C”, “h”, or “H” to show the current call for unit operation.

Note: If a call for unit operation is present at the end of TEST mode will cause the unit to continue to operate.

- If no call for unit operation is present, TEST mode causes
  1) A steady “t” appears on the dual 7-segment LEDs
  2) The compressor will start
  3) The compressor will turn off after 5-seconds.

  Note: Entering TEST mode without a call for unit operation will cause the compressor to run 5-seconds.

**Fault Recall Mode (TEST and SW2 Buttons)**

- Enter FAULT RECALL mode by pressing the TEST and SW2 buttons at the same time with insulated probes for one (1) second and release.
- When entering and exiting FAULT RECALL mode the top and bottom segments of the dual 7-segment LEDs will illuminate.

  Fault Recall Mode – the top and bottom segments on the right hand are illuminated

- When entering FAULT RECALL mode, the ICC will automatically scroll through stored faults on the dual 7-segment LEDs.
• Each fault is displayed one time with the top right hand segment of the dual 7-segment display activated between faults.
• Each fault is displayed with the most recent fault displayed first.
• A maximum of six individual faults can be stored.
• A maximum of three consecutive identical faults are stored.
• A “0” will be displayed with no faults are stored.
• The ICC will automatically exit the FAULT RECALL mode after displaying stored faults.

**IMPORTANT:** The ICC stores the previous six history faults. The complete stored fault history cannot be displayed using a conventional thermostat.

**Clear Fault History (TEST and SW2 Buttons)**

• Clear FAULT HISTORY by pressing both TEST and SW2 button for five (5) seconds with insulated probes and release.
• The top and bottom segments of the dual 7-segment LEDs flash to indicate the history has been cleared.

Fault history is cleared with the top and bottom LED segments flash.