Application Note: 3044

Thermostat Interface Sequence of Operations

Introduction

The Mitsubishi Electric US, Inc. Thermostat Interface (P/N PAC-US444CN-1) allows for a 3rd party 24VAC thermostat to control a Mitsubishi Electric HVAC system while still allowing the ability to use the benefits of inverter driven technology.

We have tested the Thermostat interface with Nest®, Lyric®, ecoBee®, and INNCOM® thermostats.

The algorithm used within the thermostat interface has been patented by Mitsubishi Electric US, Inc.. under US patent US20160252266A1.

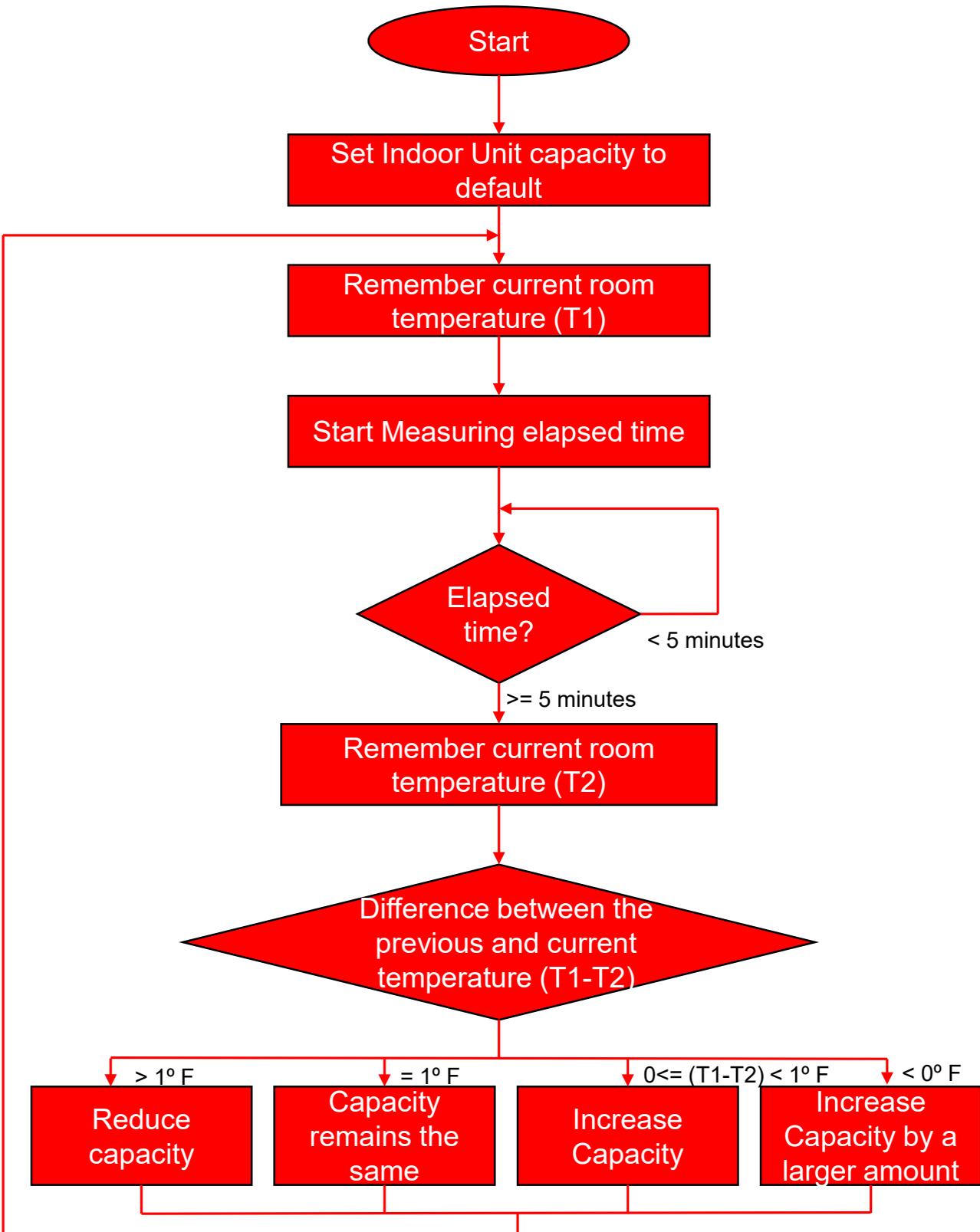## Thermostat Interface Dip Switch 2-6 Settings

The Thermostat Interface has 2 Dip Switch Banks that allow for additional settings to be configured during initial operation. It is important that Dip Switch 2-6 be set to ON. This will allow the system to benefit from the Mitsubishi Electric inverter driven technology and gives the indoor unit the ability to vary its capacity as needed.

Target Method Sequence of Operation - Cooling

When the thermostat interface has dip switch SW 2-6 set to ON and the thermostat interface has Y1 energized, the indoor unit will turn on and be set to COOL mode. During this time, the indoor unit will adjust the set point to -2 degrees Fahrenheit from the space temperature. A set point difference of -2 degrees Fahrenheit from the space temperature will be maintained for five minutes.

After five minutes of a continuous call for cooling by input Y1 being energized with 24VAC, the thermostat interface will check the rate of change of the space temperature. If the thermostat interface measures that the rate of change is different than 1°F per 5 minutes, it will adjust the indoor unit capacity accordingly as well as comparing the first recorded space temperature with the current temperature:

- If the temperature difference is zero, no change will be made to the set point.

- If the temperature difference has increased, then the set point difference will be increased by 1°F.

- If the temperature difference has decreased, then the set point difference will be decreased by 1°F.

- If the thermostat determines with its own logic that the space temperature is not meeting the set point, the thermostat will call for a second stage of cooling. The Thermostat Interface will receive that command via Y2. The indoor unit will operate at full capacity until the thermostat de-energizes Y1 and Y2.

- If Y1 is not energized and no other inputs (excluding TR, R) to the thermostat interface are being powered, the indoor unit will turn off.

- If the indoor unit is not meeting the 1°F per 5 minute cooling requirement, the indoor unit will reach full capacity in approximately 25 to 35 minutes.

Figure 2: Flowchart for Cooling
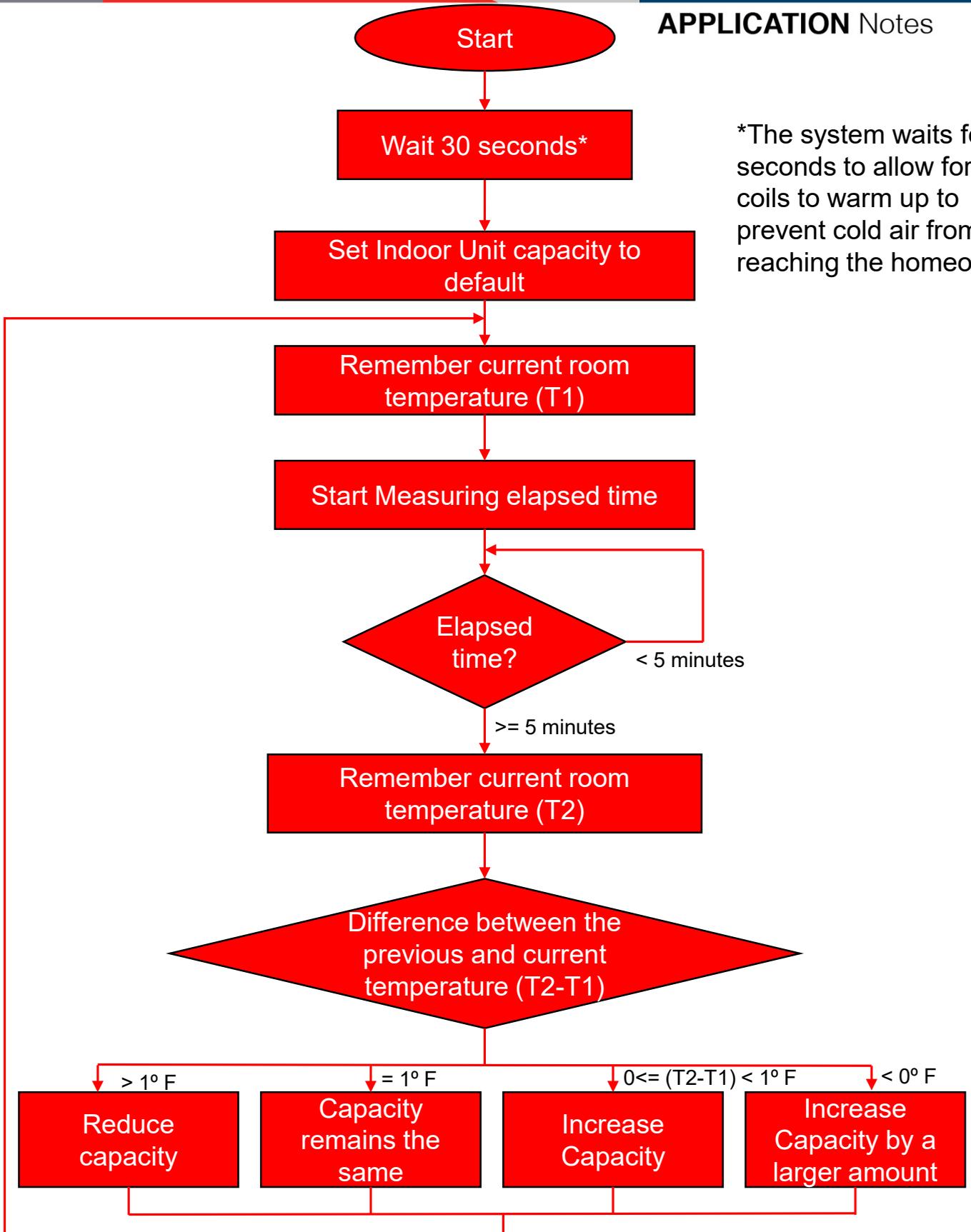
Target Method Sequence of Operation - Heating

When the thermostat interface has dip switch SW 2-6 set to ON and the thermostat interface has W1 energized, the indoor unit will turn on and be set to HEAT mode. During this time, the indoor unit will adjust the set point to 2 degrees Fahrenheit from the space temperature. A set point difference of 2 degrees Fahrenheit from the space temperature will be maintained for five minutes.

After five minutes of a continuous call for heating by input W1 being energized with 24VAC, the thermostat interface will check the rate of change of the space temperature. If the thermostat interface measures that the rate of change is different than 1°F per 5 minutes, it will adjust the indoor unit capacity accordingly as well as comparing the first recorded space temperature with the current temperature:

- If the temperature difference is zero, no change will be made to the set point.

- If the temperature difference has increased, then the set point difference will be increased by 1°F.

- If the temperature difference has decreased, then the set point difference will be decreased by 1°F.

- If the thermostat determines with its own logic that the space temperature is not meeting the set point, the thermostat will call for a second stage of heating. The Thermostat Interface will receive that command via W2. The indoor unit will operate at full capacity until the thermostat de-energizes W1 and W2.

- If W1 is not energized and no other inputs (excluding TR, R) to the thermostat interface are being powered, the indoor unit will turn off.

- If the indoor unit is not meeting the 1°F per 5 minute heating requirement, the indoor unit will reach full capacity in approximately 25 to 35 minutes.

Start

Wait 30 seconds*

*The system waits for 30 seconds to allow for the coils to warm up to prevent cold air from reaching the homeowner

Set Indoor Unit capacity to default

Remember current room temperature (T1)

Start Measuring elapsed time

Elapsed time?

< 5 minutes

>= 5 minutes

Remember current room temperature (T2)

Difference between the previous and current temperature (T2-T1)

> 1º F

Reduce capacity

= 1º F

Capacity remains the same

0<= (T2-T1) < 1º F

Increase Capacity

< 0º F

Increase Capacity by a larger amount

Figure 3: Flowchart for Heating

Appendix: Additional Thermostat Interface Information

Table 1: Thermostat Interface Terminal Information

Label	Connector	Purpose
TC	Common (In)	To Transformer
C	Common (Out)	To Thermostat
TR	24VAC (In)	To Transformer
R	24VAC (Out)	To Thermostat
G3	Fan High	High Fan Speed
G2	Fan Medium	Medium Fan Speed
G1	Fan Low	Low Fan Speed
Y2	Y2	Stage 2 Cooling
Y1	Y1	Stage 1 Cooling
W2	W2	Stage 2 Heating
W1	W1	Stage 1 Heating
G	G	Fan

Wiring the Thermostat Interface with a thermostat setup for heat pump configuration (O/B)

In some instances a thermostat can only be setup in heat pump configuration (using O/B connection) to use auxiliary heat or duel fuel. With the addition of a relay a thermostat setup in heat pump configuration (O/B) can be wired to a Mitsubishi Electric Thermostat Interface.

To operate the indoor unit via Thermostat Interface (PAC-US444CN-1) using a 24VAC thermostat in the heat pump configuration (using O/B with Y1 & Y2 output) requires a double pole- double throw relay as shown in Figure 4. This allows the 24VAC thermostat to use its auxiliary and duel fuel strategies with Mitsubishi Electric equipment. In some cases, an addition a single pole-double throw relay may be needed to power any auxiliary heat. Please refer the 24VAC thermostat documentation.

The Thermostat Interface requires wires to be terminated into TC, C, TR, R, Y2, Y1, W2, W1, and G.

Example:

See the next page for an example of the Thermostat Interface wired to a Honeywell TH8320R thermostat with 2 stages of heat and a separate emergency heat source.
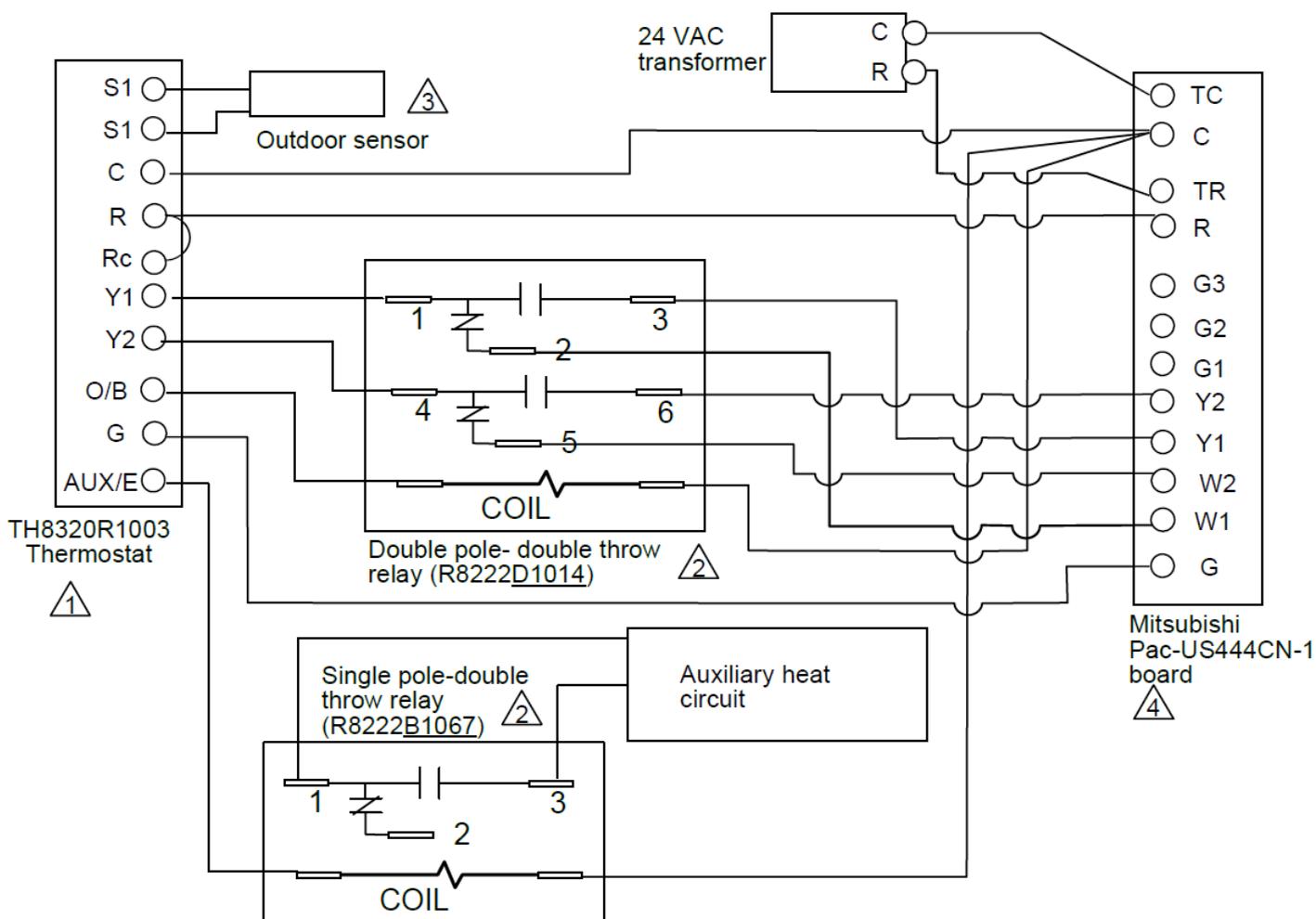
NOTES

 Configuration settings for thermostat:

- Heat pump
- Dual fuel
- Cool changeover (reversing) valve
- Thermostat controls dual fuel
- Set balance point to desired setting
- Either wireless or wired outdoor sensor. Installer preference.

 Relays:

- If the auxiliary heater used is a line voltage heater, make sure to wire the heater and line voltage power in series with the 1 and 3 relay switch contacts. The installer must verify that it is up to code in their city to control a baseboard heater with a single-pole circuit (some codes require a 4 wire circuit with a positive off).
- The switch contacts on the R8222 relay can be used for 24 volt, 120 volt, or 240 volts. At 120 or 240 volts, they are rated for 20.8 amps.

 Outdoor sensor: (Wired or wireless. installer preference).

- Wireless outdoor sensor (C7089R1013)
- Wired outdoor sensor (C7089U1006) Wires to S terminals.

 Verify the Mitsubishi Pac-US444CN-1 board is compatible with your Mitsubishi mini-split heat pump. Connect the Pac-US444CN-1 board to the Mitsubishi unit and set the dipswitches on the Mitsubishi unit according to the Pac-US444CN-1 instructions.