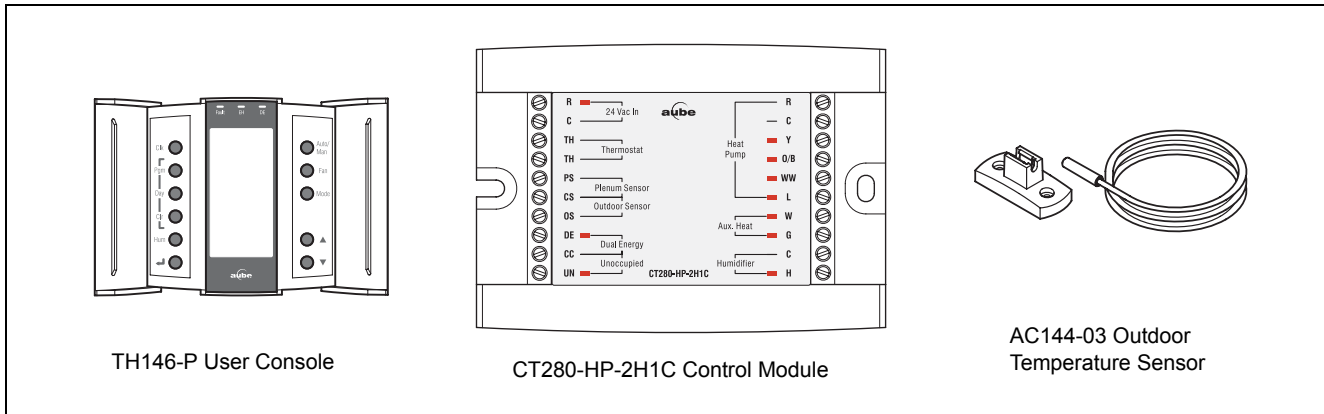


Installation Guide Programmable Heat Pump Controller



1. Introduction

1.1 Applications

The TH146-P-DE programmable controller can be used to control a heat pump system. The following devices can be connected to the controller:

- ▶ heat pump
- ▶ auxiliary heating (furnace)
- ▶ air recirculation fan
- ▶ humidifier
- ▶ dual-register meter (dual energy)
- ▶ remote control device (for the unoccupied mode)

1.2 Supplied Parts

- CT280-HP-2H1C control module
- TH146-P console with two wall anchors and mounting screws
- AC144-03 outdoor temperature sensor (3 m or 10 ft) with mounting clip (see section 2.7)

1.3 Accessories

- RC845 relay (see section 2.5)
- AC146-410 plenum temperature sensor (see section 2.8)
- CT241 telephone controller (see section 2.10)

2. Installation

2.1 Control Module (CT280-HP-2H1C)

Install the control module on the furnace's electrical panel, away from the heat source.

2.2 User Console (TH146-P)

Install the console in the area where you wish to measure the temperature and humidity. Avoid locations where there are air drafts (e.g., top of staircase or air outlet) or stagnant air (behind a door). Do not install the console on a wall hiding air ducts nor expose it to direct sunlight.

NOTE: If this controller replaces an existing thermostat, the wires that were connected to the thermostat can be used to connect the console. The maximum wire length is 30 m (100 feet).

- 1) Choose a location about 5 ft. (1.5 m) above the floor on an inside wall.
- 2) Loosen the captive screw under the console.
- 3) Detach the console from its base by pulling the bottom section.
- 4) Secure the base using the wall anchors and screws.
- 5) Connect the console to controller terminals TH and TH (no polarity).

2.3 Heat Pump

Connect the heat pump to the controller as follows:

- Controller terminals R and C to heat pump terminals R and C (see section 2.4)
- Controller terminal Y to heat pump terminal Y
- Controller terminal O/B to heat pump terminal O
- Controller terminal WW to heat pump terminal WW

- Controller terminal L to heat pump terminal L
- Controller terminal W to heat pump terminal W (see section 2.5)
- Controller terminal G to heat pump terminal G (see section 2.5)

2.4 24 V Transformer

You might need a 24 V transformer if you have an add-on installation. Connect the transformer to the controller terminals R and C (24 Vac In).

2.5 RC845 Relay

If you have an add-on installation, you might need a relay such as Aube's RC845 to connect the furnace (auxiliary heating) and its fan to the controller. Install the relay near the control module. Connect the wires of the RC845 relay as follows:

- relay terminals W, G and C to controller terminals W, G and C.
- relay terminals T and T to the appropriate furnace terminals: T and T (oil); TH and TH (gas); R and W (electric).

NOTE: Refer to the relay's installation instructions for more details.

2.6 Humidifier

Connect the humidifier to controller terminals C and H (no polarity).

2.7 Outdoor Sensor (AC144-03)

The outdoor sensor is required for the following:

- balance points
- automatic humidity control
- outdoor temperature display
- defrost point

When installing the sensor, observe the following guidelines:

- Avoid locations where the sensor can be covered with snow or exposed to direct sunlight.
- Avoid air outlets and concealed chimneys or stove pipes.

Install the sensor using its mounting clip and connect it to controller terminals OS and CS (no polarity).

NOTE: The maximum wire length is 30 m (100 feet).

2.8 Plenum Sensor (AC146-410)

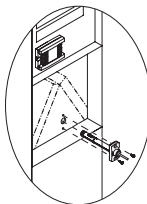
The plenum sensor measures the temperature inside the plenum. This data is required for high pressure protection during the defrost cycle (see section 4.3).

NOTE: The plenum sensor is generally needed for add-on installations only. It is not needed if the heat pump is not connected to the controller terminal WW.

Install the sensor on the side of the plenum and position it such that its aperture faces the air flow.

Connect the sensor to controller terminals PS and CS (no polarity). For more information, refer to the instructions provided with the sensor.

NOTE: The maximum wire length is 30 m (100 feet).



2.9 Dual-energy Input

The dual-energy input can be connected to the dual-register meter equipped with a normally open (NO) dry contact. Connect the terminals DE and CC of the controller to the terminals (yellow and red wires) of the dual-register meter.

When the contact is open, the heat pump and auxiliary heating operate as usual. The contact closes when the outdoor temperature drops below the set threshold. When the contact is closed, the heat pump is disabled and only the auxiliary heat can be used.

2.10 Unoccupied Mode Input

To use the unoccupied mode, the controller requires a remote control device such as Aube's telephone controller CT241 equipped with a dry-contact output (normally open). The unoccupied mode is activated when the contact closes. (See section 6.4.)

2.11 Wiring Table

24 Vac In	R C	Power; 24 Vac
Thermostat	TH TH	Console connection
Plenum Sensor	PS CS	Plenum temperature sensor connection
Outdoor Sensor	OS CS	Outdoor temperature sensor connection
Dual Energy	DE CC	Dual energy connection (requires a normally open contact)
Unoccupied	UN CC	Unoccupied mode connection (requires a normally open contact)
Heat Pump	R C	Power; 24 Vac / 3 A
	Y	Output; 24 Vac / 1 A (compressor)
	O/B	Output; 24 Vac / 1 A (reversing valve; energized on cool)
	WW	Input; 24 Vac / 2 mA (defrost)
	L	Input; 24 Vac / 2 mA (fault)
Aux. Heat	W G	Output; 24 Vac / 1 A (auxiliary heat and fan)
Humidifier	C H	Output; 24 Vac / 1 A

3. Configuration

3.1 Switch Configuration

To access the 2 configuration switches, loosen the captive screw under the console and separate the console from its base by pulling the bottom section.

3.1.1 Keypad Lock (SW1)

I: The keypad is locked. Settings cannot be changed.

O: The keypad is unlocked.

3.1.2 Access Mode (SW2)

INST: Installer mode. Gives access to all configuration parameters.

NOTE: In this mode, the short-cycle protection is disabled and the interstage delay is reduced to 1 minute.

USER: User mode. Gives access to configuration parameters 1 to 4 only.

3.2 Software Configuration

- 1 Place the controller in Installer mode (INST) using the SW2 selector switch on the back of the console.
- 2 Press the **Mode** button for 3 seconds to access the configuration menu (see page 4). The first menu item (parameter) is displayed.
- 3 To view another menu item, briefly press the **Mode** button. The following table shows the order in which the parameters appear as well as a description of each parameter.
- 4 To modify a parameter, press either ▲▼ button.
- 5 To exit the configuration menu, press ←.
- 6 Return the controller to User mode (USER) using the SW2 selector switch.

4. Principles of Operation

4.1 Automatic Heating/Cooling Changeover

With automatic changeover, there's no need to adjust the controller at every change of season or weather condition. The controller switches automatically between heating mode and cooling mode to maintain the desired temperature.

Manual Mode

When the controller is in manual mode, the heating/cooling mode changeover occurs as follows:

- The controller switches to cooling mode when the indoor temperature is higher than the setpoint by more than 1.5°C (2.5°F) for 15 minutes.
- The controller switches the heating mode when the indoor temperature is lower than the setpoint by more than 1.5°C (2.5°F) for 15 minutes.

Automatic Mode

When the controller is in automatic mode, it follows the programmed schedule. Two temperature settings (heating setpoint and cooling setpoint) are programmed for each period of the schedule. The heating/cooling mode changeover occurs as follows:

- When the controller is in heating mode, the indoor temperature is maintained at the heating setpoint. However, if the temperature rises and remains above the cooling setpoint for 15 minutes, the controller will switch to cooling mode.
- When the controller is in cooling mode, the indoor temperature is maintained at the cooling setpoint. However, if the temperature drops and remains below the heating setpoint for 15 minutes, the controller will switch to heating mode.

4.2 Balance Points

Balance points are used to disable the heat pump operation or auxiliary heating below or above a certain temperature.

- When the outdoor temperature is below the balance point low (bP L), the heat pump is disabled and only auxiliary heating can be used (see page 4, item 5).

- When the outdoor temperature is above the balance point high (bP H), the auxiliary heat is disabled (see page 4, item 6) and only the heat pump can be used.

NOTE: Balance points will not work if the AC144-03 outdoor temperature sensor is not connected to the controller.

4.3 Heating During Defrost

The auxiliary heat is activated during defrost except under the following conditions:

- When the outdoor temperature is above the defrost point (see page 4, item 7). **NOTE:** This condition will not apply if the AC144-03 outdoor temperature sensor is not connected to the controller.
- When the plenum temperature is above 40°C (104°F). The auxiliary heat is re-activated when the plenum temperature drops below 32°C (90°F). **NOTE:** This condition will not apply if the AC146-410 plenum sensor is not connected to the controller.

NOTE: The auxiliary heat's short-cycle protection is disabled during defrost.

4.4 Types of Heat Pump Installations

The controller can be configured for either of the following types of heat pump installations (see page 4, item 8).

- **Add-on Installation:** This type of installation is performed when adding a heat pump to an existing furnace. When the heat pump is installed, the furnace becomes the auxiliary heat source. In this type of installation, the indoor coils are usually installed downstream of the auxiliary heat source. When the controller is configured for an add-on installation, the heat pump is disabled during auxiliary heating to prevent overpressure.
- **New Installation:** In this type of installation, as there is not already a furnace, the auxiliary heat source is installed at the same time as the heat pump. In this type of installation, the indoor coils are located upstream of the auxiliary heat. When the controller is configured for a new installation, the heat pump and the auxiliary heat can operate simultaneously.

4.5 "Smart Fan"

When "smart fan" is enabled (see page 4, item 10), the fan operates as follows:

- During the unoccupied mode (i.e., when you are away from home), the fan operates only when heating or cooling is activated.
- The fan operates continuously the rest of the time.

NOTE: "Smart fan" is useful only when the fan is set to On (see section 5.3).

4.6 Interstage Delay

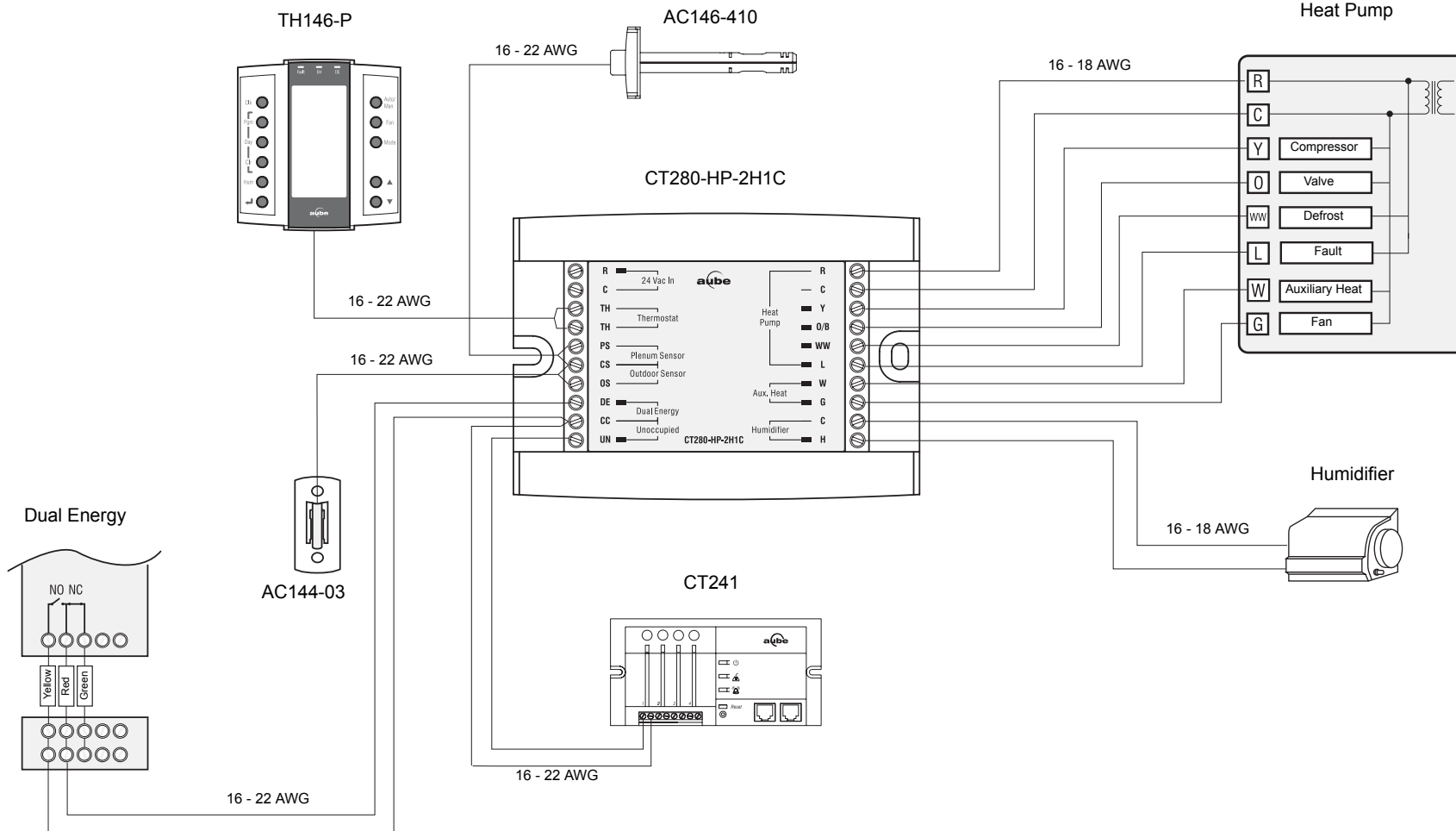
The interstage delay is the time that the temperature has to return to an acceptable value when it deviates too much from the setpoint. After this delay, auxiliary heating is activated. Auxiliary heating will be deactivated once the temperature returns to an acceptable value (see page 4, item 11).

Configuration Menu

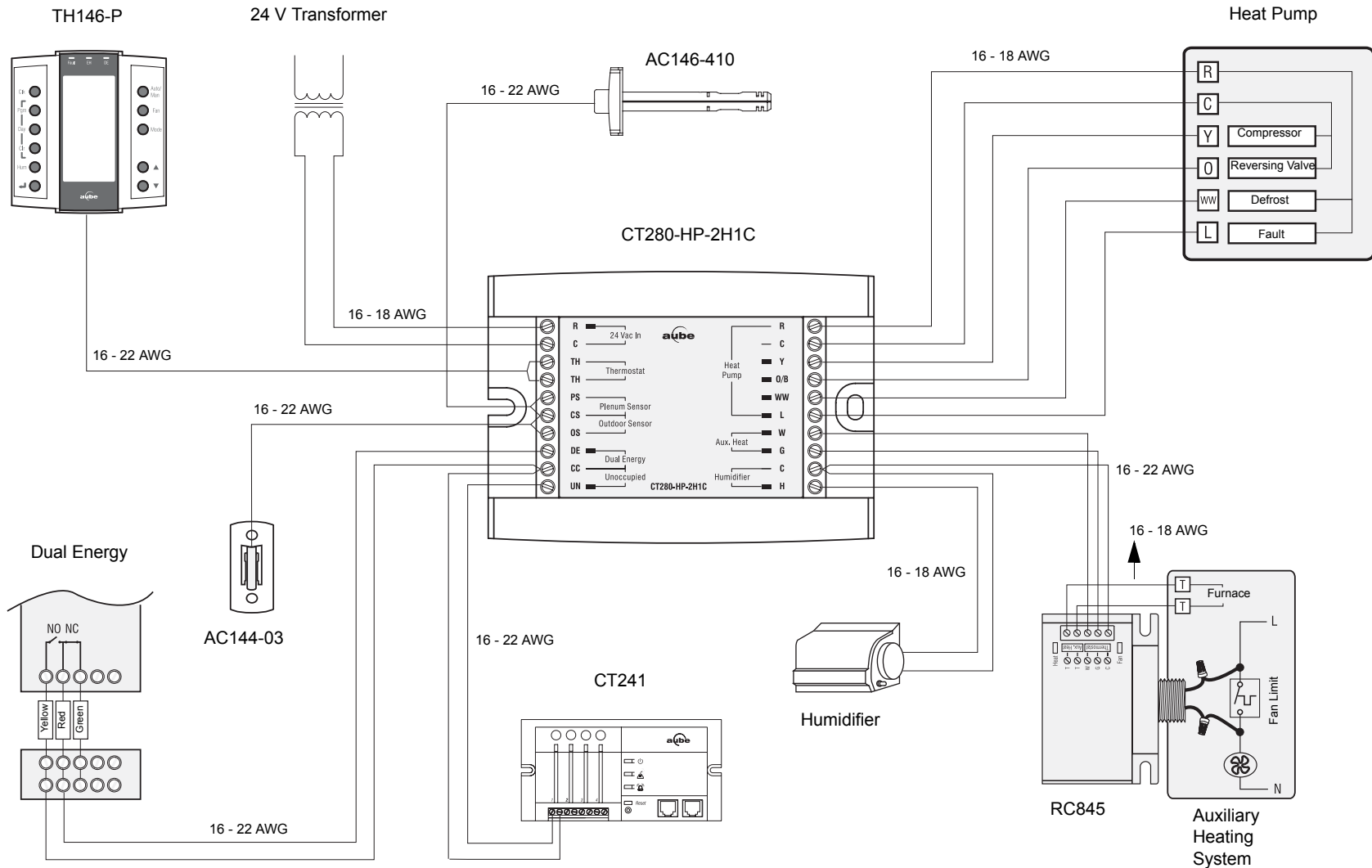
Item	Parameters	Display	Options	Default	Description
1	Time format	Hr	12 Hr / 24 Hr	24 Hr	Select the time display format.
2	Early Start	ES	On / OF	OF	On: Heating or cooling starts in advance (as determined by the controller) so that the desired temperature is attained at the set times. OF (Off): Heating or cooling starts at the set times. NOTE: Early Start applies for periods 1 and 3 (P1 and P3) only. When this feature is enabled, heating or cooling will start in advance of the set time for P1 and P3 but will start at the set time (not earlier) for P2 and P4.
3	Automatic daylight savings adjustment	dLS	OF / 1 / 2	OF	OF (Off): The normal time is used all year long. 1 : The controller switches to daylight savings time on the first Sunday of April and to normal time on the last Sunday of October. 2 : The controller switches to daylight savings time on the second Sunday of March and to normal time on the first Sunday of November.
4	Temperature scale	dISP	°C / °F	°C	Select the temperature display format.
5	Balance point low	bP L	-30°C to 10°C (-22°F to 50°F)	-10°C (14°F)	Set the bP L value (see section 4.2).
6	Balance point high	bP H	-5°C to 30°C (23°F to 86°F)	5°C (41°F)	Set the bP H value (see section 4.2).
7	Defrost point	dEFr	-10°C to 15°C (14°F to 59°F)	10°C (50°F)	During defrost, auxiliary heating is activated when the outside temperature is below the defrost point (see section 4.3).
8	Installation type	INST	Ad / nr	Ad	Set according to the type of heat pump installation (see section 4.4). Ad (add-on): Use this setting when the indoor coils are located downstream of the auxiliary heat source. This is generally the case for add-on installations. nr (normal): Select this setting when the indoor coils are located upstream of the auxiliary heat source. This is generally the case for new installations.
9	Cycles per hour	CPH	2 to 6	4	Allows you to select the number of cycles per hour. It is recommended to use the default setting except in exceptional cases.
10	"Smart fan"	SFAF	On / OF	OF	On: "Smart fan" is On (see section 4.5). OF: "Smart fan" is Off.
11	Interstage delay	2nd T	5 to 90 min.	10 min.	Set the interstage delay (see section 4.6).
12	Humidifier operating mode	HUM	HE / Fn	HE	HE (heat): The humidifier can operate only when heating is activated. Fn (fan): The humidifier can operate as long as the fan is running, whether heating is activated or not. NOTE: The humidifier is disabled when cooling is activated.

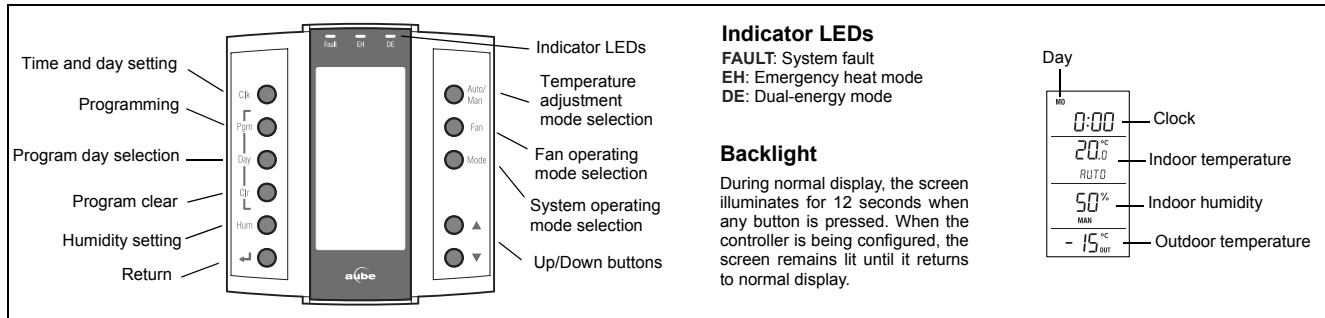
NOTE: Only items 1 to 4 are available when the controller is placed in user mode (SW2 switch).

Connection Diagram — New Installation



Connection Diagram — Add-on Installation





5. General Setting

5.1 Clock and Day Setting

- 1 Press **Clk**. The hour display flashes.
- 2 Set the hour using **▲▼**.
- 3 Press **Clk**. The minute display flashes.
- 4 Set the minutes using **▲▼**.
- 5 Press **Clk**. The day display flashes.
- 6 Set the day using **▲▼**.
- 7 Press **↵** to return to the normal display.

5.2 Date Setting

- 1 Press **Clk** for 3 seconds to display the year.
- 2 Set the year using **▲▼**.
- 3 Press **Clk** to display the month.
- 4 Set the month using **▲▼**.
- 5 Press **Clk** to display the date.
- 6 Set the date using **▲▼**.
- 7 Press **↵** to return to the normal display.

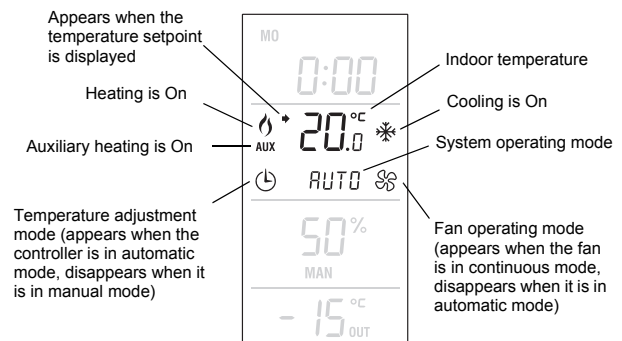
5.3 Fan Operating Mode

Press the **Fan** button to select the fan operating mode.

- In automatic mode, the fan runs only when heating or cooling is activated.
- In continuous mode, the fan runs continuously and the symbol is displayed. **NOTE:** If the "smart fan" feature is enabled, the fan will run only when heating or cooling will be activated during unoccupied mode.

6. Temperature Setting

6.1 Display



The controller normally displays the measured indoor temperature. To view the setpoint, press one of the **▲▼** buttons. The setpoint will be displayed along with the symbol for the next 5 seconds.

6.2 System Operating Mode

Press **Mode** to place the system in one of the following modes:

- HEAT** The system is in heating mode.
- COOL** The system is in cooling mode.
- AUTO** The system is in automatic changeover. (The system switches between heating mode and cooling mode to maintain the desired temperature.)
- OFF** Both heating or cooling are off.
- EH/HT** The system is in emergency heat mode. Only auxiliary heating is used when there is a call for heat.

6.3 Temperature Adjustment

6.3.1 Manual Adjustment

Use this adjustment mode to set the temperature manually. To place the controller in this mode, press **Auto/Man** so that ☹ disappears from the screen and set the temperature using the ▲▼ buttons.

NOTE: If the controller is in automatic heat/cool changeover, the setpoint is automatically lowered or raised by 1°C (2°F) when the controller switches to heating mode or to cooling mode respectively. For example, if you place the setpoint at 24°C (75°F) while in heating mode, the setpoint will become 25°C (77°F) in cooling mode and will return to 24°C (75°F) when the controller switches back to heating mode.

6.3.2 Automatic Adjustment

Use this adjustment mode if you want the controller to automatically adjust the temperature according to the programmed schedule. To place the controller in this mode, press **Auto/Man** so that ☹ appears on the screen.

Pre-programmed Schedule

The following schedule has been programmed at the factory. Two temperature settings are programmed for each period of the schedule: one is used in heating mode and the other in cooling mode.

NOTE: When programming the heating setpoint, it cannot be higher than 1°C (2°F) below the cooling setpoint. For example, if the cooling setpoint is 25°C (77°F), the highest you can place the heating setpoint is 24°C (75°F). Conversely, when programming the cooling setpoint, it cannot be lower than 1°C (2°F) above than the heating setpoint.

Pre-programmed Schedule			MO	TU	WE	TH	FR	SA	SU	
P1	Heating	21°C (70°F)	6:00 a.m.							
	Cooling	25.5°C (78°F)								
P2	Heating	16.5°C (62°F)	8:00 a.m.							--
	Cooling	29.5°C (85°F)								
P3	Heating	21°C (70°F)	6:00 p.m.							--
	Cooling	25.5°C (78°F)								
P4	Heating	16.5°C (62°F)	10:00 p.m.							
	Cooling	28°C (82°F)								

Modifying the Schedule

You can program up to 4 periods per day. For each period, you can set the start time, the heating mode setpoint and the cooling mode setpoint. The program can be different for each day of the week.

- Press **Pgm** to enter the programming mode. The settings for Monday, Period 1 (P1) appear.

- To select a day to program, press **Day** until the day is displayed. Press **Day** for 3 seconds to select all 7 days.

NOTE: If you select all 7 days, the settings of the displayed period will be copied to all 7 days. For example, if period 1 is displayed and you then select all 7 days, they will all now have the same settings for period 1. If you display period 2 while all 7 days are selected, they will all now have the same settings for period 2.

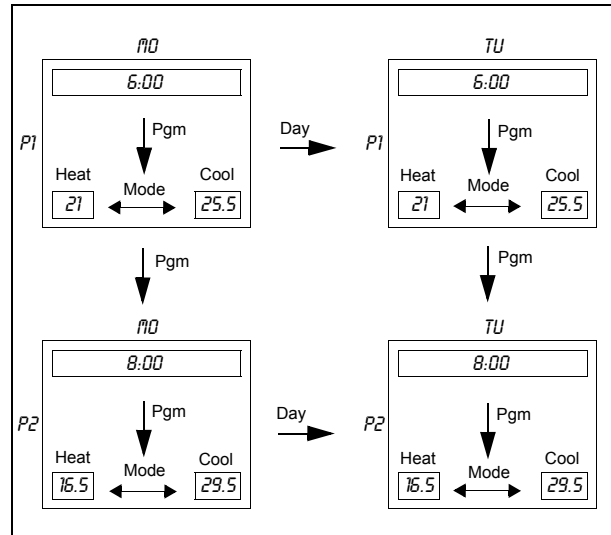
- To set the start time of a period, first press **Pgm** until the period number (P1 to P4) is displayed and the time display flashes. Then press the ▲▼ buttons. The time changes in increments of 15 minutes.

NOTE: During programming, to skip a period press **Clr** while the period is selected. For example, in the pre-programmed schedule, periods 2 and 3 have been skipped for Saturday and Sunday.

- To set the temperature for a period, first press **Pgm** until the period number (P1 to P4) is displayed and the temperature display flashes. Then press **Mode** to select the heating mode setpoint display or the cooling mode setpoint. Finally press the ▲▼ buttons.

- Press ← to exit.

The following diagram shows how to navigate the programming menu.



Temporary Bypass

When you modify the temperature setpoint while the controller is in automatic mode, the new temperature is used for the next 2 hours. The ☹ icon flashes during the bypass. After the bypass, the temperature set for the current period is used.

6.4 Unoccupied Mode

The controller can be placed in unoccupied mode via a remote control device such as Aube's CT241 telephone controller (see section 2.10). In this mode, the setpoint is set back by 4.5°C (8°F); it is lowered in heating mode or raised in cooling mode. The message **UNOC** appears during the unoccupied mode.

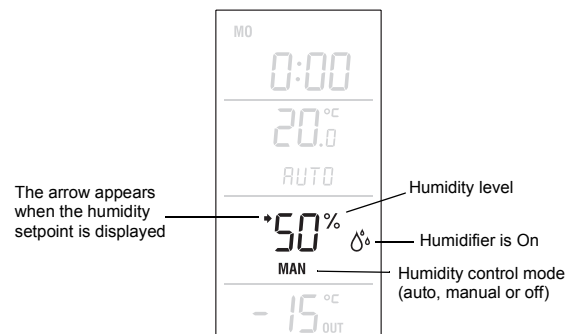
NOTE: Automatic changeover is disabled during the unoccupied mode.

Temporary Bypass

In unoccupied mode, only the ▲▼ buttons work. When you adjust the temperature during this mode, the new temperature will be used for the next 2 hours, after which the controller will return to the previous setpoint. The message **UNOC** flashes during the bypass.

7. Humidity Setting

7.1 Display



7.2 Humidity Adjustment

Manual Adjustment

In manual adjustment, the humidity level is set by the user (5% to 60%).

- 1 Press the **Hum** button until **MAN** appears on the screen.
- 2 Press one of the **▲▼** buttons to adjust the humidity level.
- 3 Press the **↵** button to return to normal display.

Automatic Adjustment

In automatic adjustment, the humidity level is set by the controller based on the outdoor temperature to prevent ice formation or condensation on the windows while providing enough humidity for your comfort. However, the user can apply an offset (-9% to 9%). For example, the user can enter a negative offset if there is still ice formation or condensation on the windows.

- 1 Press the **Hum** button until **AUTO** appears on the screen. The current humidity level set by the controller is also displayed.
- 2 Press one of the **▲▼** buttons to place or modify the offset.
- 3 Press the **↵** button to save and exit the programming.

Off

To turn off the humidity control:

- 1 Press the **Hum** button until **OFF** appears on the screen.
- 2 Press the **↵** button to save and exit the programming.

8. Technical Specifications

CT280-HP-2H1C Control Module

Power supply: 24 VAC

Current consumption: 150 mA

Maximum load per output: 1 A @ 24 VAC

Short cycle protection: 2 minutes

Control cycles: 2 to 6 per hour

Operating temperature: 0°C to 50°C (32°F to 122°F)

Storage temperature: -20°C to 50°C (-4°F to 122°F)

Humidity conditions: 0% to 95%, non-condensing

Dimensions: 76 mm x 109 mm x 25 mm (3 in. x 4.3 in. x 1 in.)

TH146-P Console

Temperature setpoint range

Heating mode: 5°C to 30°C (40°F to 86°F)

Cooling mode: 15°C to 40°C (59°F to 104°F)

Humidity setpoint range: 5% to 60%

Indoor temperature display range: 0°C to 70°C (32°F to 158°F)

Outdoor temp. display range: -50°C to 70°C (-58°F to 158°F)

Temperature display resolution: 0.5°C (1°F)

Program protection: non-volatile memory

Operating temperature: 0°C to 50°C (32°F to 122°F)

Storage temperature: -20°C to 50°C (-4°F to 122°F)

Humidity conditions: 0% to 95%, non-condensing

Dimensions: 79 mm x 79 mm x 24 mm (3.1 in. x 3.1 in. x 1 in.)

9. Warranty

Aube warrants this product, excluding battery, to be free from defects in the workmanship or materials, under normal use and ser-

vice, for a period of three (3) years from the date of purchase by the consumer. If at any time during the warranty period the product is determined to be defective or malfunctions, Aube shall repair or replace it (at Aube's option).

If the product is defective,

- (i) return it, with a bill of sale or other dated proof of purchase, to the place from which you purchased it, or
- (ii) contact Aube. Aube will make the determination whether the product should be returned, or whether a replacement product can be sent to you.

This warranty does not cover removal or reinstallation costs. This warranty shall not apply if it is shown by Aube that the defect or malfunction was caused by damage which occurred while the product was in the possession of a consumer.

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10. Support

If you have any questions about the product installation or operation, or concerning the warranty, contact us at the address shown below.



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