WHITE-RODGERS

16E09-201
Universal Electronic Temperature Control
**INSTALLATION AND
OPERATION INSTRUCTIONS**

FAILURE TO READ AND FOLLOW ALL INSTRUCTIONS CAREFULLY BEFORE INSTALLING OR OPERATING THIS CONTROL COULD CAUSE PERSONAL INJURY AND/OR PROPERTY DAMAGE.

DESCRIPTION

The 16E09-201 is a single stage electronic temperature control, with a Nema 1 rated enclosure, and can be used for most applications within the temperature control range of -40° to 220°F, (-40° to 104°C). The control has an SPDT (Single Pole Double Throw) output load relay.

The control has user options to control differential, anti-short cycle delay, set back, offset, alarms and more. It includes an NTC (Negative Temperature Coefficient) thermistor temperature sensor, and can be used with certain other NTC or PTC (Positive Temperature Coefficient) thermistors that meet the specified resistance vs. temperature specifications. See the tables on page 7.

The control can fit many applications, which range from refrigeration to heating due to the wide temperature range of the control stated above. Typical applications include walk-in freezers, beverage coolers, supermarket display cases for flowers, produce, meats, convenience store refrigerated cases, food warmers, boiler control, and certain industrial applications.

PRECAUTIONS

⚠ WARNING

- **Failure to read and follow all instructions carefully before installing or operating this control could cause personal injury and/or property damage.**

- **To prevent electrical shock, personal injury and/or equipment damage, disconnect electric power to system at main fuse or circuit breaker box prior to installation or service.**

- **To prevent scald injury, do not use this control to heat water for bathing, washing, hot tub or similar applications.**

- **Where failure of this control may result in personal injury and/or property damage, additional alarms or limit controls must be installed.**

- **This control is a temperature control and is not to be used as a temperature limit control.**

CONTENTS

16E09-201 Optional Accessories / Service Items:

Immerson Well F89-0286
Replacement 7.5' NTC Remote Sensor F136-0114
Well Heat Transfer Compound F145-0163

EMERSON

emerson.com/white-rodgers

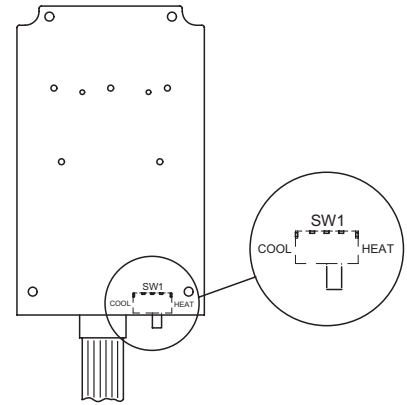**PART NO. 37-7809001**

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INSTALLATION

⚠ **To prevent electrical shock and/or equipment damage, disconnect electric power to system at main fuse or circuit breaker box prior to installation or service.**

⚠ **Where failure of this control may result in personal injury and/or property damage, additional alarms or limit controls must be installed.**

⚠ **This control is a temperature control and is not to be used as a temperature limit control.**

The control has a user selection for changing the setpoint to be either the Cut In or the Cut Out setting. The user must be careful to understand how this effects the "range" in which the control will operate when the differential value is entered. If entered values are incorrect, the control could operate outside the user's intended settings due to set-up error. See section titled "Operation".

Fig. 1 Control Front View and Description

TEMPERATURE UNITS INDICATOR (°F or °C)

ACTUAL TEMPERTURE AT TEMPERATURE SENSOR

SETPOINT TEMPERATURE

HEATING MODE INDICATOR (💧)

BINARY INPUT INDICATOR LIT WHEN UNIT IS IN "SETBACK" MODE REFER TO PAGE 6

COOLING MODE INDICATOR (❄)

STATUS INDICATOR LED LIT WHEN CONTROLLED LOAD IS ENERGIZED (ON). (SEE NOTE)

MENU BUTTON PRESS TO ENTER MENU MODE REFER TO PAGES 4 & 5

TEMPERATURE "UP" BUTTON

TEMPERATURE "DOWN" BUTTON

Circuit Board Inside Cover
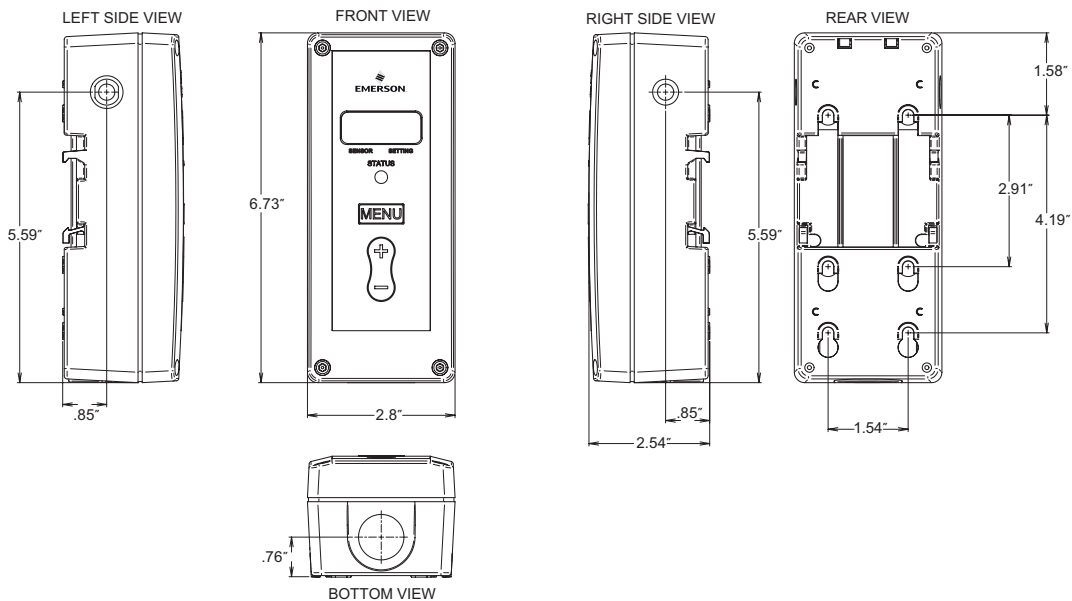

Switch SW1 must be set for system mode as shown:

	SW1
Refrigeration	Cool
Heating	Heat

NOTE:
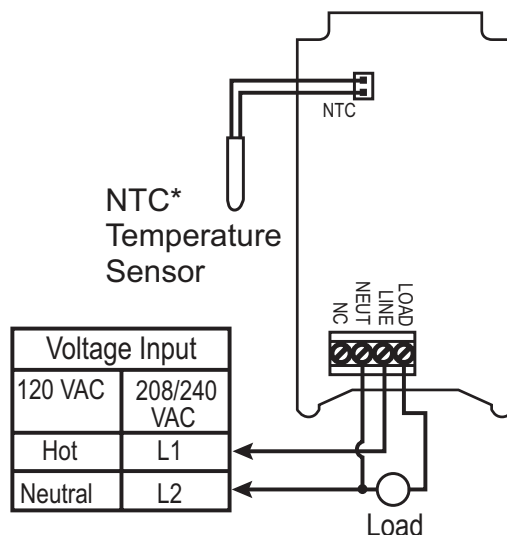**Green Status Indicator LED and display backlight operation**
It may be observed from time to time that the green status indicator LED and display back-light will briefly turn off during a call for heating or cooling. During this time, the control is performing a self-check lasting up to 15 seconds. This is normal operation of the control and the load power will be maintained

Fig. 2 Control Dimensions and Mounting Information

LEFT SIDE VIEW   FRONT VIEW   RIGHT SIDE VIEW   REAR VIEW

5.59″   6.73″   5.59″   1.58″   2.91″   4.19″

.85″   2.8″   .85″   2.54″   1.54″

.76″

BOTTOM VIEW

2

Wiring Instruction Notes

Fig. 3 Line Voltage Application
(Non-Power Stealing)

NTC* Temperature Sensor

Voltage Input	
120 VAC	208/240 VAC
Hot	L1
Neutral	L2

Load

* NTC – Negative Temperature Coefficient

USER MENU OPERATION SETTINGS:

The control has user Menu settings that will determine how the control operates. The unit is shipped with factory default settings. The user must change any of the settings as required for the application. To reset all settings to factory defaults, press and hold all 3 buttons simultaneously (MENU, ⊞, and ⊟ buttons) for approximately 5 seconds.

To view Menu items, press and hold MENU for 5 seconds. The unit will display the first Menu item on the left side of the display. The right side of the display indicates the Menu item settings. To change the setting, momentarily press the ⊞ or ⊟ key.

A momentary press of the MENU key advances the display to the next Menu item, and continues, till the last menu item is displayed. Pressing the key one more time with the last menu item, (aL) displayed returns the control to the operating mode.

Each press of MENU results in forward movement to the next Menu item. If you need to change an item "passed", you must repeatedly press MENU, return to the operating mode, then press and hold MENU for 5 seconds to re-enter the Menu mode. Then repeatedly, momentarily press MENU until the desired Menu item is again displayed.

To store any changes made to any Menu items, the Menu must be exited by pressing MENU when the last item is displayed. If no buttons are pressed for ten minutes while in the menu, the control will return to operating mode and any changes that were made will be lost.

The following table shows the menu items, default settings and optional settings.

NOTE: The Heat/ Cool switch (SW1) MUST be in the proper position BEFORE setting options.

Menu Item	Description	Factory Default	Options Press ⊞ or ⊟ to select	Comments
CF	Temperature Scale	F	C or F	Selects temperature display in Fahrenheit or Celsius
dFF	Differential	5	1 to 30	Selects the range between Cut In and Cut Out.
SP	Set Point Mode Cool Heat	CI CO	CO or CI CI or CO	Selects how the set point temperature will operate the load terminal. CI indicates the setpoint temperature will be the Cut In temperature. CO indicates the temperature will be the Cut Out temperature. See Operation section.
SOF	Sensor Operation Failure Cool Heat	1 0	0 or 1 None	Cooling - Selects the operation of the Control Load relay in the event of a sensor failure in Cool mode. 1 (default) will cause the load contacts of the relay to close and remain closed if the sensor either opens or shorts. 0 causes the load contacts of the relay to open and remain open. Heating has no optional selection. Sensor failure in Heating will result in the relay contacts opening.

USER MENU

Menu Item	Description	Factory Default	Options Press ⊞ or ⊟ to select	Comments
dL	Display Light	Off	On or Off	Selects the LCD display light Off or On. With this selected Off, the display light will illuminate any time a keypad button is pressed to provide better viewing in low lighting conditions, and go off after 10 seconds. If On is selected, the display light will be On continuously.
ASd	Anti Short-Cycle Delay	Cool 1 Heat 0	0 to 12	Selects the minimum time (in minutes) that the load contacts will remain open after a cycle before closing again. This will prevent the compressor or other load from being damaged by cycling too soon. A blinking Snowflake or Flame icon indicates that the control has a demand to energize the load, but is waiting for the delay time to elapse. A setting of 0 indicates no time and the feature is disabled. SW1 must be set to the proper position before checking this setting.
LP	Lock Front Panel Keypad	Off	On or Off	When selected Off, the keypad can be used as normal. When selected On, prevents unauthorized access to the control settings by locking out all keys. To unlock the control when it is locked, press and hold the Menu key for 5 seconds.
OFS	Ambient Temperature Offset	0	-4, -3, -2, -1, 0, 1, 2, 3, 4	This control is calibrated at the factory, but the "sensed" temperature may read different because of mounting/installation, or other factors. This item allows the displayed temperature to be shifted the number of degrees set to compensate for this difference
bIn	Binary Input	Off	On or Off	The default setting of Off will have no affect on the operation of the thermostat. When set to On, it allows an external binary input (switch or relay) to start a temperature set back. See Set Back (Sb).
Sb	Set Back	0	0 to 50	Selects the number of degrees the thermostat will change the setpoint temperature when the external binary input signal is received. 0 will cause no temperature change to occur. See Binary Input (bin).
AL	Alarm	0	0 to 99	Selects the time delay (in minutes) before a Temperature Out of Range alarm output is sent. A setting of 0 disables the alarm relay.

OPERATION

⚠ **This control is a temperature control and is not to be used as a temperature limit control.**

⚠ **To prevent scald injury, do not use this control to heat water for bathing, washing, hot tub or similar applications.**

The factory default setpoint for this control is 45°F (7°C) for Cool and 120°F (49°C) for Heat. Setpoint temperature can be adjusted using the ⊞ or ⊟ keys. A power loss does not lose the settings. All menu item selections and setpoint setting are stored in a permanent memory.

The user determines the temperature operating range. To determine the temperature range, the user must select the Set Point (SP) as the Cut Out or Cut In temperature, Differential (dFF) and enter a set point temperature. Cut out is when the load is turned off and cut in is when the load is turned on.

NOTE: The Heat/ Cool switch (SW1) MUST be in the proper position BEFORE setting options.
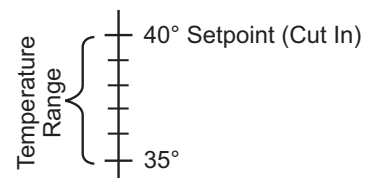
COOL/REFRIGERATION

To use as a Cooling control, SW1 must be set to Cool. The snowflake (❄) icon will display.

If control is in Cool mode, and Set Point is selected as the Cut In:

Temperature Operating Range = Setpoint Temperature − (minus) Differential

Example:

SW1 = Cool
Set Point (SP) = Cut In
Differential = 5
Setpoint temperature = 40°

Temperature Range
— 40° Setpoint (Cut In)
— 35°

If control is in Cool mode, and Set Point is selected as the Cut Out:

Temperature Operating Range = **Setpoint Temperature** **+ (plus)** **Differential**

Example:

SW1 = Cool
Set Point (SP) = Cut Out
Differential = 5
Setpoint temperature = 40°

```
                    ┬ 45°
Temperature Range   ┤
                    ┤
                    ┤
                    ┴ 40° Setpoint (Cut Out)
```
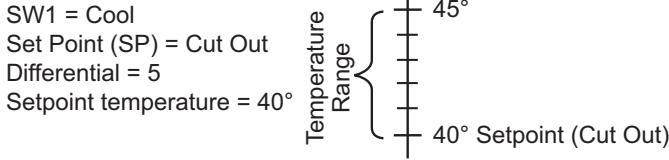
HEAT

To use as a Heating control, SW1 must be set to Heat. The flame (🔥) icon will display.

If control is in Heat mode, and Set Point is selected as the Cut Out:

Temperature Operating Range = **Setpoint Temperature** **– (minus)** **Differential**

Example:

SW1 = Heat
Set Point (SP) = Cut Out
Differential = 5
Setpoint temperature = 100°

```
                    ┬ 100° Setpoint (Cut Out)
Temperature Range   ┤
                    ┤
                    ┤
                    ┴ 95°
```

If control is in Heat mode, and Set Point is selected as the Cut In:

Temperature Operating Range = **Setpoint Temperature** **+ (plus)** **Differential**

Example:

SW1 = Heat
Set Point (SP) = Cut In
Differential = 5
Setpoint temperature = 100°

```
                    ┬ 105°
Temperature Range   ┤
                    ┤
                    ┤
                    ┴ 100° Setpoint (Cut In)
```
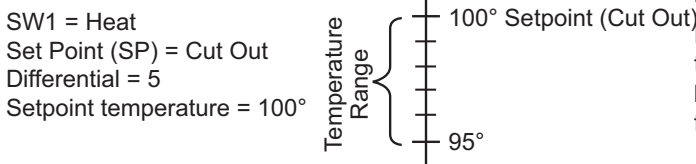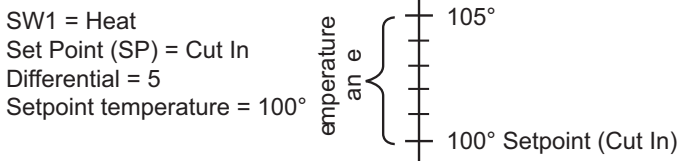
Lock Panel (LP)

The keypad can be locked to prevent unwanted tampering with the control settings. In the User Menu, change the menu item LP selection to On. When the menu is exited and settings are stored, the ✛ or ▬, and MENU keys will be disabled from normal use.

To unlock the keypad, press and hold MENU for 5 seconds. The display will change to show LP On. Momentarily press ✛ or ▬ to change to Off and then momentarily press MENU. The control will return to normal operation and the keypad will be unlocked.

## Binary Input (bIn) and Set Back (Sb)

Binary Input is an option to allow the setpoint temperature to set back to conserve energy or for other reasons as determined by the user. Set Back determines the number of degrees the setpoint temperature will be changed.

An external switch or N.O. relay can be connected to the BIN and GND terminals of the control. With bIn set to On, when the switch is closed, the control will change the setpoint temperature by the number of degrees set in Sb. In Heat mode, setpoint temperature will change lower or cooler. In Cool mode, setpoint temperature will change higher or warmer.

During the time that the switch is closed, bIn will appear in the lower left corner of the display. If an alarm is connected be sure that the alarm delay time is set long enough to allow for the temperature change to avoid a "false" alarm.

Multiple Sensors

The 16E09 is normally operated with one sensor. If an average temperature of an area is required, 4 sensors may be used and wired in the method shown below. If 4 sensors are used, they must all be of the same model.
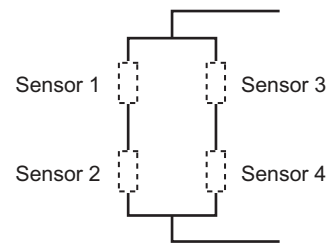
NOTE: When using multiple sensors, 4 sensors must be used. The control will not operate with 2 or 3 sensors.

SPECIFICATIONS

Load Output Relay:

	Ratings (Maximum):		
	120VAC	**208VAC**	**240VAC**
Full Load Amps NC & Load	16 A	9.2 A	8 A
Locked Rotor Amps NC & Load	96 A	55.2 A	48 A
Non-Inductive Amps NC & Load	16 A	16 A	16 A
Horsepower NC & Load	1 hp	1 hp	1 hp

Pilot Duty NC & Load   125 VA, 240 VAC
- Minimum Load Rating: 1 Amp @ 120 VAC
- Note: the above minimum current/voltage is specified to assure proper operation.

NOTE: For use on single phase circuits only.

Alarm Relay Ratings (Maximum):
N.O. contact: 1 Amp, 5 to 24 V, AC or DC

Operating Ambient Ratings (Control Enclosure):
Operating Temperature: -29°F to 140°F (-34° to 60°C)

Storage Shipping Ambient Ratings:
Storage Temperature: -40°F to 185°F (-40° to 85°C)
Operating Humidity: 0 to 95% Relative Humidity, Non-Condensing
Maximum Dew Point: 85°F (29°C)

Temperature Set-Point Range:
Set-Point Range: -40° to 220°F (-40° to 104°C)
Differential Range: 1 to 30 (Degrees F or Degrees C)

Case:
NEMA 1 Enclosure, Flammability Rating: UL94VO

Temperature Probes:

NTC
The control is shipped with an NTC (Negative Temperature Coefficient) sensor, with a cable length of 7½ feet. Cable length can be extended up to 400 feet by appropriately splicing and adding additional cable (22 AWG or larger diameter) as needed – polarity is not important. When extending cable length, verify temperature accuracy and use the menu Ambient Temperature Offset (OFS) settings to compensate accordingly if required.

NTC TEMPERATURE VERSUS RESISTANCE TABLES

Temperature (°F)	(°C)	Resistance (KΩ)	Temperature (°F)	(°C)	Resistance (KΩ)	Temperature (°F)	(°C)	Resistance (KΩ)
-40	-40	328.29	50	10	19.82	140	60	2.49
-31	-35	236.83	59	15	15.67	149	65	2.09
-22	-30	172.90	68	20	12.48	158	70	1.76
-13	-25	127.65	77	25	10.00	167	75	1.48
-4	-20	95.23	86	30	8.07	176	80	1.26
5	-15	71.74	95	35	6.55	185	85	1.07
14	-10	54.56	104	40	5.34	194	90	0.92
23	-5	41.85	113	45	4.38	203	95	0.79
32	0	32.37	122	50	3.61	212	100	0.68
41	5	25.23	131	55	2.99	221	105	0.59

TROUBLESHOOTING

LCD display, display back-light and green status indicator LED turn off in Power Stealing mode:
This "off" condition is normal for the control in power stealing mode when wired with a defrost timer or other device that interrupts electrical power to the control.

No control settings will be lost during this time, however, the installer must ensure that applications requiring power stealing are suitable for the control to be off during these periods.

Please note: if the built-in alarm feature of the control is to be used on systems that may interrupt power to the control, the control must be wired with a neutral wire and set in non-power stealing mode. This will keep the control continuously powered unless there is an actual power interruption or loss. In this case, the control will be able to signal an alarm for system power loss.

Display indicates "CaL" on power up.
Control was not calibrated. Return control for replacement.

Unit does not turn on, (LCD does not display anything):
- Check that wiring is correct.
- Make sure power is turned on.
- Check that wiring is under terminal blocks correctly.
- Make sure both switches inside control are set to proper position.

Temperature differential is wider than set:
- Temperature change of customer's unit is fast, and the Anti Short Cycle delay setting may be overriding the "call" to activate the heat or cool. Solution – lower Anti Short Cycle delay.

NOTES

TECHNICAL SUPPORT: 1-888-725-9797

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