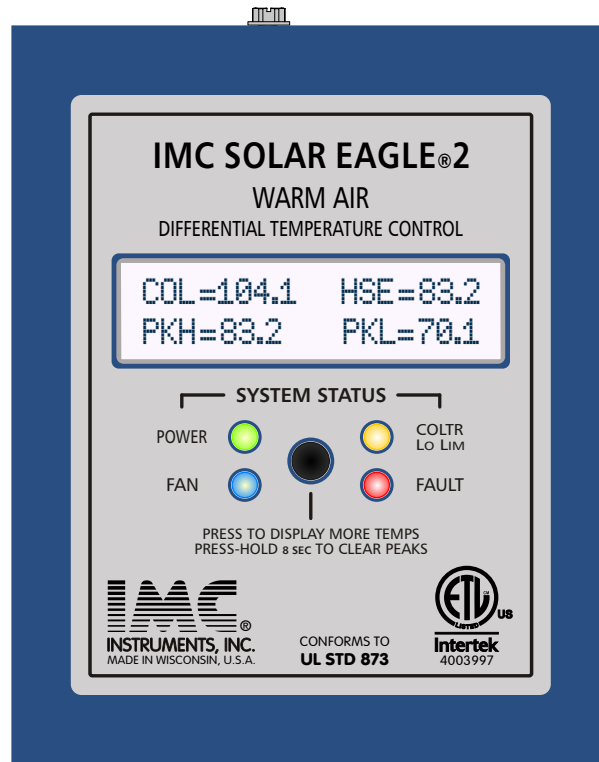


# IMC SOLAR EAGLE®2 DIFFERENTIAL TEMPERATURE CONTROLLERS

## MAIN FEATURES

- **Microprocessor** programed specifically for optimal performance of "WARM AIR" systems.
  - **Large easy-to-read 40 character** (2x20) backlit LCD display showing every parameter measured and controlled by the onboard microprocessor.
  - **With IMC's exclusive "DATA PORT"** designed for use with one of these optional devices:
    - REMOTE 4 LINE LCD DISPLAY
    - DATA ADAPTER TO PC'S RS-232
    - DATA ADAPTER TO PC'S USB
    - SD CARD RECORDER
    - BACNET INTERFACE
- This unique transmitter allows these devices to be located up to 500 feet away connected with a conventional CAT-5 cable.
- **Model "IP" has an electrically isolated DATA PORT** to maximize reliability for systems requiring permanent monitoring.
  - **Power relay** that can handle up to 20 A or 2 HP. See specifications on pg. 3 for complete ratings.
  - **Fault LED indicators** for simple diagnostics
  - **Electrostatic** discharge protected electronics
  - **Polyester coated 16 gage** rugged steel enclosure with features for efficient installation.
  - **Reliable operation** when installed where the ambient swings do not exceed -10 to 120°F
- \* Model is available with power cord and receptacle for simpler installation.



SHOWN AT 5/8 SCALE

**CONTROLLERS conform to UL STD 873 with 1/2" conduit holes for permanent wiring "hard wired":**

**Product #  
E2W1-2000-WA  
with NON-isolated DATA PORT**

**E2W1-2000-WAIP  
with isolated DATA PORT**



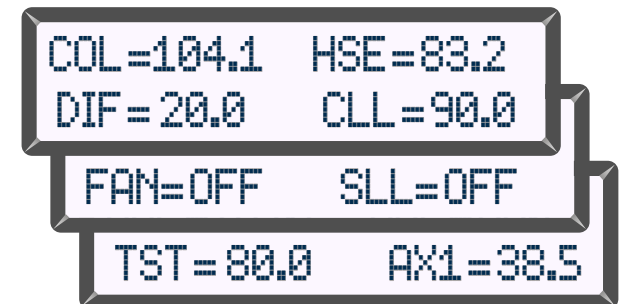
THERMOSTAT

## LOCAL LCD DISPLAY

The LCD display has 2 lines of 20 characters each. The top line permanently displays the COLLECTOR and the HOUSE temperatures. The bottom line can be paged (switched) by pressing the black button. These pages display all system information\*including relay "override switch" status.

Page 1 is shown to the left.

Pages 2, 3 & 4 are shown below:



\* ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT  
 COL= COLLECTOR; HSE= HOUSE  
 PKH= HOUSE PEAK HIGH; PKL= HOUSE PEAK LOW  
 DIF= DIFFERENTIAL; CLL= COLLECTOR LOW LIMIT  
 FAN= STATUS; SLL= SYSTEM LOW LIMIT (OFF/ON)  
 TST= THERMOSTAT; AX1= AUXILIARY SENSOR



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E2W1-2000-WA  
 Rev 11-02-11 PG- 1

## CONTROLLER OPERATION

**HI LIMIT House Thermostat Operation-** Adjustment range is 65°F to 105°F w / 3°F hysteresis. Locate thermostat in “HOUSE” space to be heated.

When the SPACE temperature rises 3°F above the THERMOSTAT’s dialed setting, the DIFFERENTIAL CONTROLLER will “**disable**” its **TEMPERATURE DIFFERENTIAL** and **LOW LIMIT** control functions and the FAN relay will turn off without delay. When the SPACE temperature decreases below the THERMOSTAT’s setting, the CONTROLLER will “**enable**” its “**DIFFERENTIAL**” and “**LOW LIMIT**” control functions as described below.

**DIFFERENTIAL Control Operation-** “ON DIF” setpoint adjustment range is 8°F to 24°F with 4°F fixed OFF.

When the temperature difference between solar COLLECTOR and SPACE sensors (“HSE” located in the THERMOSTAT) exceeds the dialed ON differential “ON DIF” setting, the FAN relay will actuate after a 30-second delay. The BLUE LED indicator will also turn ON. When the temperature difference decreases and falls 4°F (2.2°C) below the dialed “ON DIF”, the FAN relay and the BLUE LED indicator will turn off without delay.

**LOW LIMIT Control Operation-** “LO LIM” setpoint adjustment range 30°F to 110°F with 10°F hysteresis.

This feature is incorporated to prevent the system from operating the FAN when the collector temperatures are too low and could result in COLD DRAFTS in the heated space. If the Collector Sensor temperature is below the LOW limit “LO LIM” setting, the controller’s DIFFERENTIAL function will be disabled and the POWER RELAY will be kept in the OFF position. If the COLLECTOR’s temperature rises above the LOW LIMIT setting PLUS 10°F, the DIFFERENTIAL CONTROL function will be enabled and the controller will return to normal “**TEMPERATURE DIFFERENTIAL**” operation.

### **Example of Residential CONTROLLER settings:**

Space Thermostat setting = 85.0°F This will set the maximum allowable space temperature.

Space temp < 85.0°F Heating enabled

Space temp > 85.0 + 3°F Heating disabled

Controller Settings; Differential “ON DIF” = 15.0°F When the COLLECTOR rises 15.0°F warmer than HOUSE while heating is enabled, the FAN will turn ON. When this temperature difference drops to 11°F (15 - 4) then the fan will turn OFF.

Low Limit “LO LIM” = 90.0°F minimum Collector temperature for system operation  
Collector temp < 90.0°F Heating disabled  
Collector temp > 90.0+10°F Heating enabled

## **DATA-PORT**

This PORT transmits data ONLY, it is NOT bi-directional. The frequency at which the data transmissions occur is selected by the data refresh jumper labeled “2S 6M” on the circuit board (see drawing). Set jumper position to 2S for one complete line of “total system information” to be sent to the computer every 2 seconds, or set to 6M for 6 minutes. Complete instructions are supplied with accessories required to connect to a computer.

**DO NOT CONNECT THIS PORT DIRECTLY TO ANY ETHERNET DEVICE OR COMPUTER PORT!**

### ***TYPICAL RANDOM SAMPLE DATA collected from PORT- (not all controllers output the same format)***

RUNTIME	COLL -T	HOUSE -T	DIFF -T	COLim-T	TSTA-1	AUX-1	FAN	SLoLi	FAULT	THESE COMMENTS ARE NOT TRANSMITTED-
0:00	107.2	69.0	08.0	91.0	72.5	OPEN.S	ON	OFF		System circulating WARM AIR; AUX-1 N.C.
0:06	87.9	69.0	08.0	91.0	72.5	OPEN.S	OFF	OFF	LoColTem-FAN->OFF	Collector temp too low; FAN OFF
0:12	103.2	69.0	08.0	91.0	72.5	OPEN.S	OFF	OFF	FanSW!	Fan override switch ON
0:18	103.4	OPEN.S	08.0	91.0	72.5	OPEN.S	OFF	OFF	SENS!	Bad HOUSE sensor/broken wires; FAN OFF
0:24	103.2	69.0	08.0	91.0	OPEN.S	OPEN.S	OFF	OFF		Bad thermostat/broken wires; FAN OFF

## **IMPORTANT NOTICE-**

If a malfunction of an E2 series controller could cause personal injury or damage to equipment or property, other limit or safety controls, or alarm or supervisory systems, intended to warn and or protect against such occurrences must be incorporated into and maintained as part of the control system. This redundant built-in safety is required.

# SPECIFICATIONS

## Controller Power Input:

2.5 Watts Minimum @ 120VAC ±10% 50/60HZ

## Power Relay Contact Ratings:

### Common (CM)-

30VDC MAX. or 240VAC MAX.

### Normally Open (NO)-

20A Resistive @ 120VAC & 240VAC

1 HP @ 120VAC; 2 HP @ 240VAC

20A @ 30VDC; TV-5

### Normally Closed (NC)-

15A Resistive @ 120VAC & 240VAC

1/4 HP @ 120VAC; 1/2 HP @ 240VAC

15A @ 30VDC

## Relay Action:

30sec delay ON; no delay OFF

## ON Differential:

Adjustable 8 to 24 °F; Fixed 4°F hysteresis

## Low Limit:

Adjustable 30 to 110 °F; Fixed 10°F reset

## Accuracy: +/- 1 °F

## Sensors:

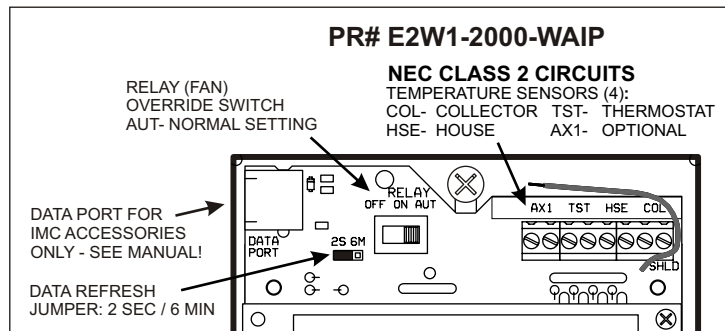
10K @ 77°F (25°C) Rated to 400°F

## Environmental:

-10 to 120°F @ 0 to 95 %RH

## Dimensions & Weight:

5.00"W x 6.12"H x 2.50"D; Appx. 2.0 lbs



**SENSORS** are Industrial grade 10K IMC thermistors rated for 400°F with +/-1°F accuracy. When sensors are installed properly, the additional error is ONE degree max. for these cable lengths:  
1000 ft. of 18 ga.; 700 ft. of 20 ga.; 500 ft. of 22 ga.

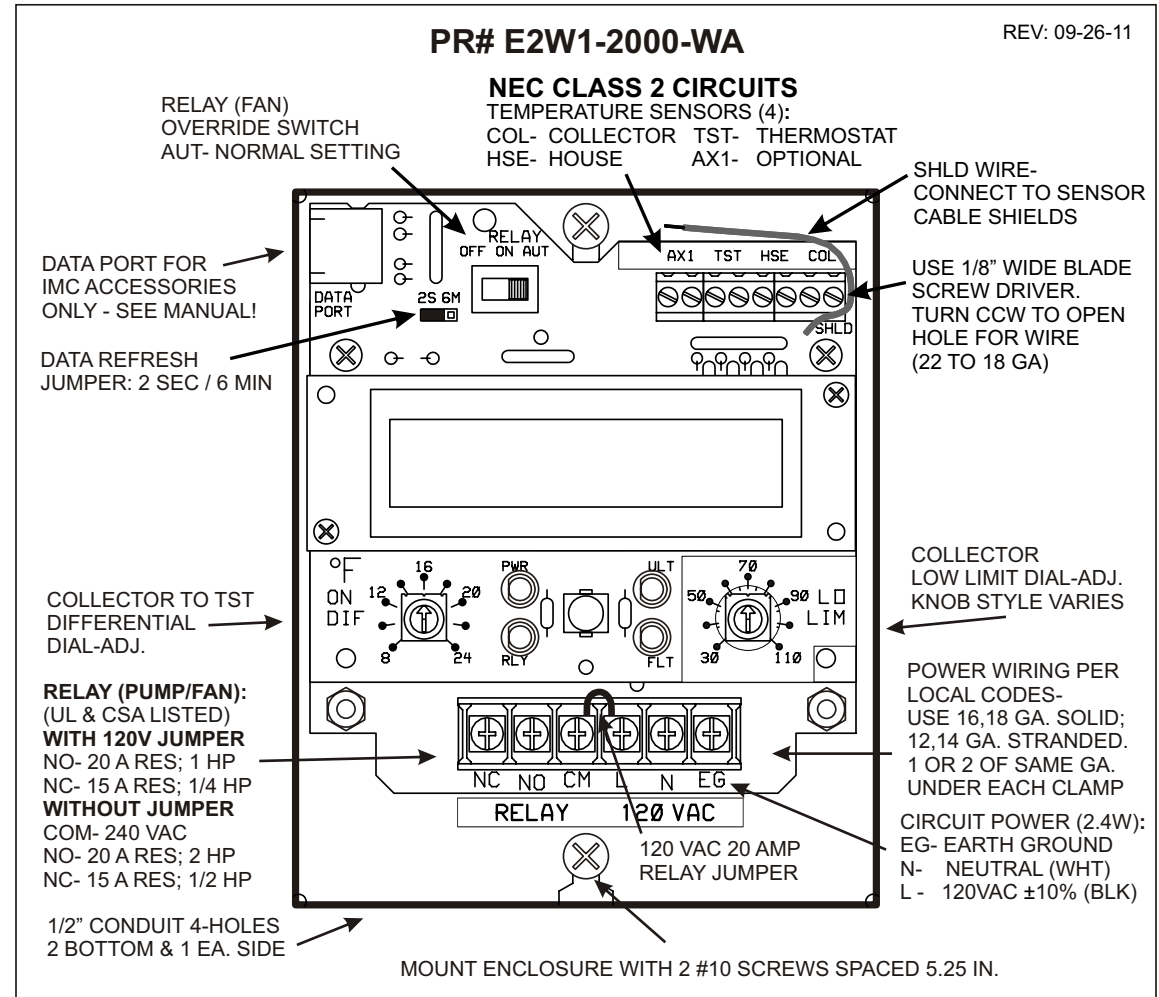


One "BOLT-ON" sensor and one THERMOSTAT (with the "HOUSE" sensor) are included with each controller. Contact factory for availability of other probe types and sizes.

"BOLT-ON" sensor

## NOTICE:

The **DATA PORT's "RJ-45"** is **NOT** an ethernet or network connection!



5/8TH SCALE INTERNAL DRAWING WITH METAL COVER AND H-V WIRING ACCESS COVER REMOVED

## **CONTROLLER INSTALLATION**

**MOUNTING-** The Eagle line of SOLAR controllers are designed to be mounted indoors, protected from rain and condensing or dripping moisture. Overhead sensor wires may provide a path for dripping liquids, so form a “drip loop” before wire enters the enclosure opening. Use two #10 screws in the enclosure “keyholes” for mounting on a vertical wall with the two conduit holes facing down to the floor. After wiring and adjustments are done, replace the metal cover and tighten screws firmly.

**SENSOR INSTALLATION AND WIRING-** Sensor installation should be done in a manner as to permit proper sensor contact of the areas to be measured. Cover and/or insulate the sensors to prevent them from being affected by the surrounding ambient temperatures. Sensor wiring installed outdoors must be rated for OUTDOOR use. All connections exposed to the weather must be made with waterproof “outdoor rated” connectors. Today’s strong radio interference “RI” environment requires that all sensor wiring be shielded. Listed below are a few suggested cable/wire part numbers. Any other cable/wire selected must also meet local codes. Wiring exposed to outdoor weather must be rated for outdoor use by its manufacturer.

Minimum recommended specifications-  
“Audio” Belden # 9451-10 Black (22ga)

Better specifications-  
“PLTC” Belden # 9322 (22ga) or 9320 (20ga)

Best specifications-  
“PLTC” Belden # 9322 (22ga) or 9320 (20ga)

The cable’s shielding wires must be connected to the green wire that is identified as “SHLD” on the cover’s backside label or the controller’s drawing on page 3. Connect all the shielding wires together with the “wire-nut” (supplied) or other reliable means. Ungrounded shields may result in damage to the Solar controller circuits. The shielding wires requires grounding at the controller side ONLY. DO NOT attempt to ground the collector panel with this wiring.

**SENSOR SCREW TERMINALS-** There are 8 or 10 screws on a GREEN block labeled “TEMPERATURE SENSORS”- see drawing on page 3. These terminals accept solid or stranded wire 18 to 22 ga. These are low voltage NEC class 2 circuit connections. For efficient and reliable wire connections, strip 3/16” to 3/8” of insulation from an undamaged wire end. Use a strip tool that will not nick the conductors. If wire is solid, make sure that the tip is NOT deformed so that it will fit into the terminal hole easily. If the wire is stranded, make sure the strands are tightly twisted. Using a 1/8” (3mm) wide blade screwdriver, turn CCW to open the terminal hole fully. Then guide the wire into the terminal hole and hold while tightening (turn CW) the screw to clamp the wire. **WARNING-** If a 5/32” (4mm) wide screwdriver blade is used, the plastic ridge that retains the screws will be scraped off allowing them to fall out. DO NOT reverse the screw turning directions and place the wire outside the metal “cage” creating an unreliable connection. DO NOT slip off the screw and damage any circuit components. Inspect that ALL the strands are clamped in the terminal’s “cage”.

**HIGH VOLTAGE (H-V) WIRING-** Wiring within the H-V compartment must be performed by an electrician or a trained technician. Make certain that power is OFF or disconnected when the H-V access cover is removed. POWER relay terminals are rated for 20amps max at 240vac max. The “120VAC 20A RELAY JUMPER” on the “CM” terminal MUST be removed for relay operation other than 120VAC. See SPECIFICATION section for complete relay contact ratings. All connections must be made with copper wires properly inserted and tightened. All wiring used within this H-V compartment must have insulation rated for the highest voltage used on any connection, typically that would be 300 volt. E2 controllers are manufactured with one of two types of terminal blocks. The black “US” barrier type with a clamping washer & safety cover or the green “EU” type with recessed screws & square wire holes. Wire gauge used must be in accordance with local codes.

Instructions for connections to the “US” type terminals (black)- Strip 1/2” of insulation off. DO NOT nick wire or strands. Use one wire 18 or 16 solid or 18 to 12 AWG stranded. Or use two same size wires in one terminal so the washer clamps them with equal pressure. Tighten terminal screw with a #2 Phillips or a 1/4” wide x .035 thick blade tipped screwdriver to a max. torque of 10 in-lbs. After inspecting, remember to snap on the safety cover.

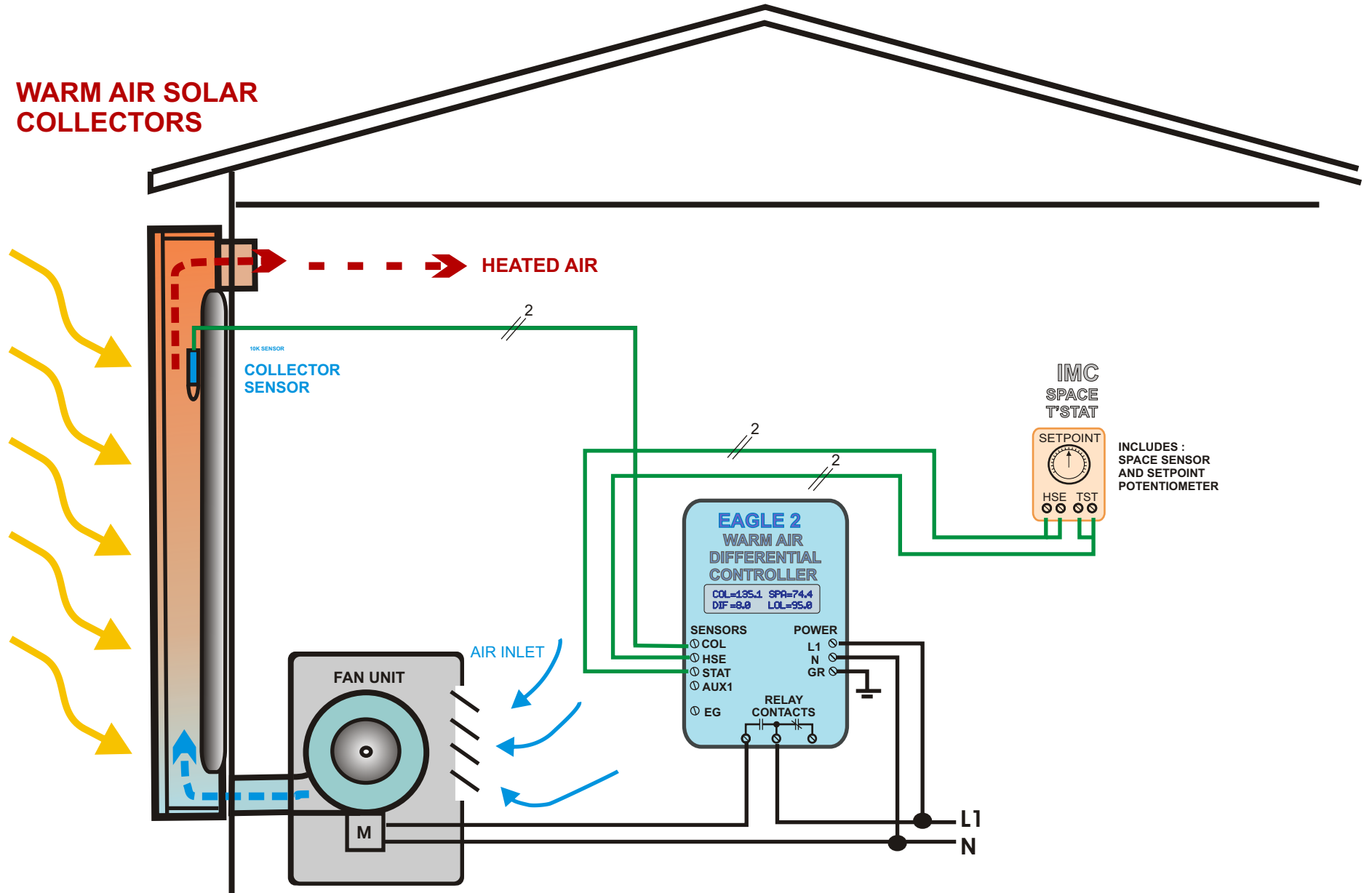
Instructions for connections to the “EU” type terminals (green)-Strip 3/8” of insulation off. DO NOT nick wire or strands. Use one wire 18 or 16 solid or 18 to 10 AWG stranded. Or use two 14 or 12 AWG wires in one terminal. When using solid wire, they must fit side-by-side so they clamp with equal pressure. Tighten terminal screw with a 3/16” wide x .025 thick blade tipped screwdriver to a max. torque of 5 in-lbs.

If three or more wires require a common connection, it should be done in accordance with accepted methods by an electrician and may require additional space in a separate junction box. Avoid using solid wire thicker than 16 AWG, because the circuit board can be damaged when forcing the wires into the H-V compartment. Line or power wires should NOT be bundled with or placed in the same conduit with sensor or data cables.

**COLLECTOR GROUNDING-** The Solar collector panel array must be GROUNDED directly to an earth ground rod. This is necessary to prevent damage from nearby lightning strikes which induce very DAMAGING high voltages in any ungrounded metal surface. Please consult local, state and federal codes for proper grounding. Please visit our website for news or recently released product information: “[www.solar.imcinstruments.com](http://www.solar.imcinstruments.com)”.

# FORCED AIR SOLAR HEATING SYSTEM

WARM AIR SOLAR COLLECTORS



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