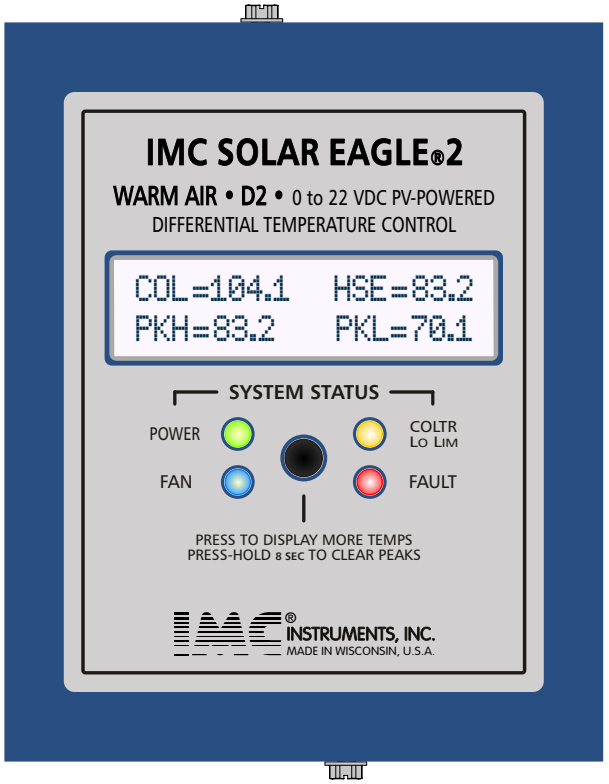
IMC SOLAR EAGLE®2 DIFFERENTIAL TEMPERATURE CONTROLLERS

MAIN FEATURES

- **PV POWERED from 0 V to 22 VDC** with ***smart*** power management at very low PV power levels, ***A must,*** for soft FAN start & ***smooth*** controller operation.
- **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

  This unique transmitter allows these devices to be located up to 500 feet away connected with a conventional CAT-5 cable.
- **Solid State relay** that can handle up to 5 A for use with brushless DC or "soft start" motors. 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
- **Two industrial 400°F rated 10K thermistors with +/- 1°F accuracy** are included.
- **Auxiliary inputs** for two optional thermistors that can be located up to 1000 feet away.



SHOWN AT 5/8 SCALE

CONTROLLERS with 1/2" conduit holes for permanent wiring "hard wired":

Product #
E2D2-0700-WA
with NON-isolated DATA PORT

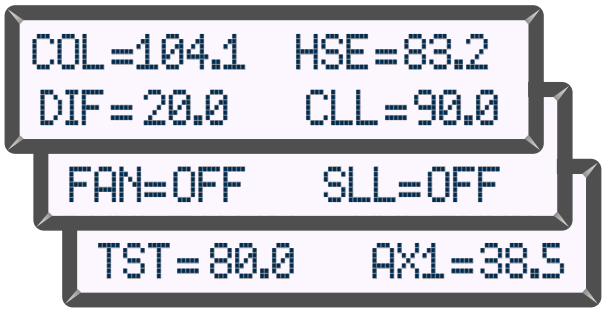
THERMOSTAT

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:

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* 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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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)

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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
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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:
0.250 Watts @ 12 VDC; **0 V min. to 22 VDC max.**
Warranty is VOID if voltage exceeds 22 VDC

Solid State Relay Ratings:
Normally Open- 5 amps DC motor @ 17vdc max
Use with **BRUSHLESS DC MOTORS ONLY!**

Relay Action:
30sec delay ON; no delay OFF

Differential:
Adjustable 8 to 24°F; fixed 4°F reset

High Limit:
Adjustable from 110 to 200°F

Accuracy: +/- 1 °F

Sensors:
10K @ 77°F (25°C) Rated to 400°F

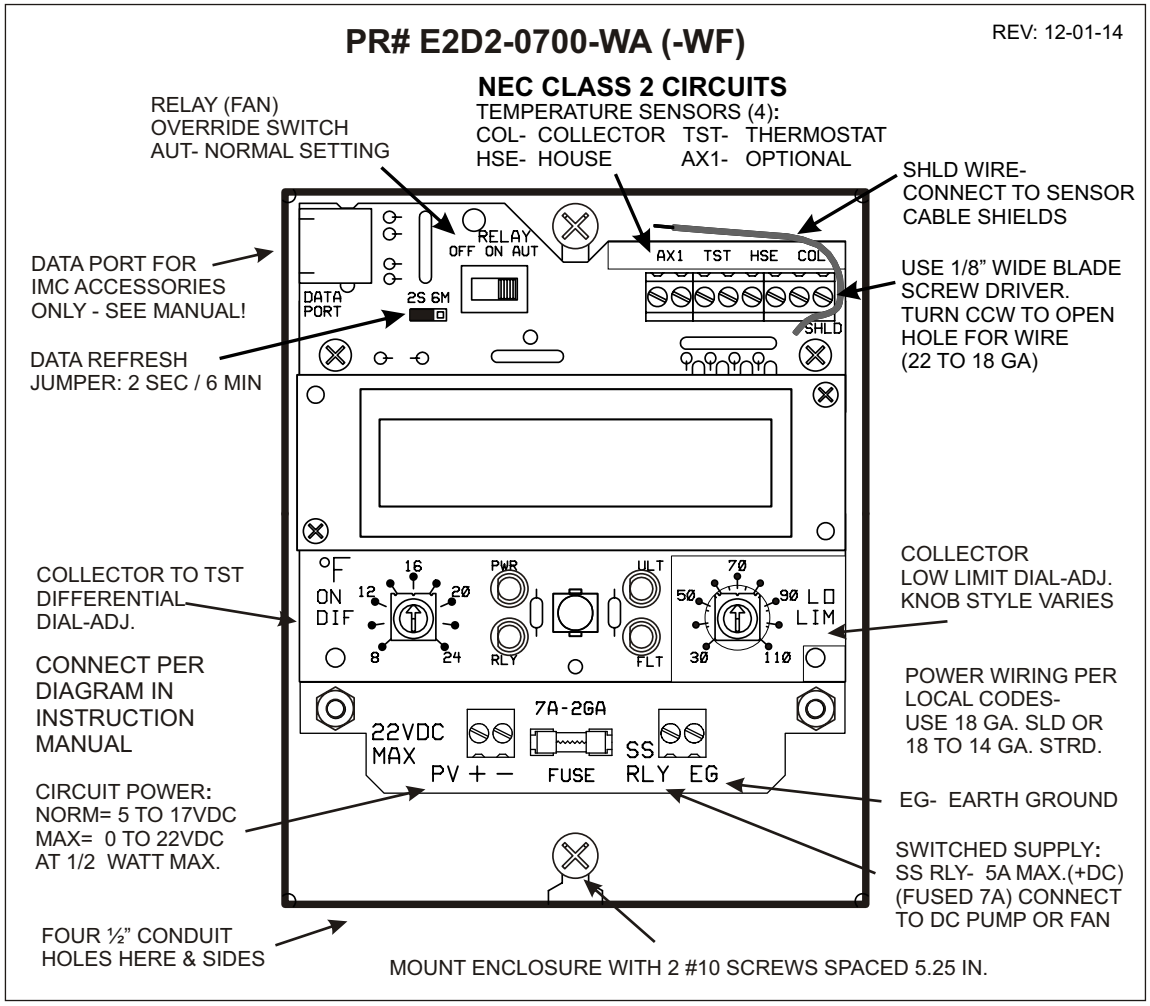
Environmental:
-10 to 120°F @ 0 to 95 %RH

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 installed properly, they will not exceed ONE degree of additional error for cable distances up to 1000 ft. of 18 ga., 700 ft. of 20 ga. or 500 ft. of 22 ga. Two “BOLT-ON” sensors are included with each controller (except -WA & -SP). See “Accessories” section for available probe types and sizes.

“BOLT-ON” sensors

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-	Better specifications-	Best specifications-
"Audio" Belden # 9451-10 Black (22ga)	"PLTC" Belden # 9322 (22ga) or 9320 (20ga)	"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".

POWER AND RELAY TERMINALS- Access this compartment by removing the shielding cover located below the LED lamps. This model operates from 4.75 Vdc to 22 Vdc@ 250 milliwatt. Operation below 4.75 Vdc is prevented by the smart POWER MANAGER including initial FAN startup until there is sufficient PV power for proper FAN operation. Operation above 22 Vdc could damage the controller and will void the warranty. The SOLID STATE relay is rated for 5 amps continuous load and has a NORMALLY OPEN (N.O.) CONTACT with the LOW SIDE connected to the NEG PV. The FAN is connected between the PV PLUS and the open RELAY terminal. (See suggested wiring diagram on last page)
Terminals require an 1/8" (3mm) wide blade screwdriver. Turn CCW to open the terminal hole. Then insert the wire end (3/8") and tighten CW. These terminal connections are designed for 18 ga solid copper or 18 to 14 ga stranded copper. All wiring must be done in accordance with local codes. If three or more wires require a common connection, it should be done in accordance with accepted methods 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 compartment.

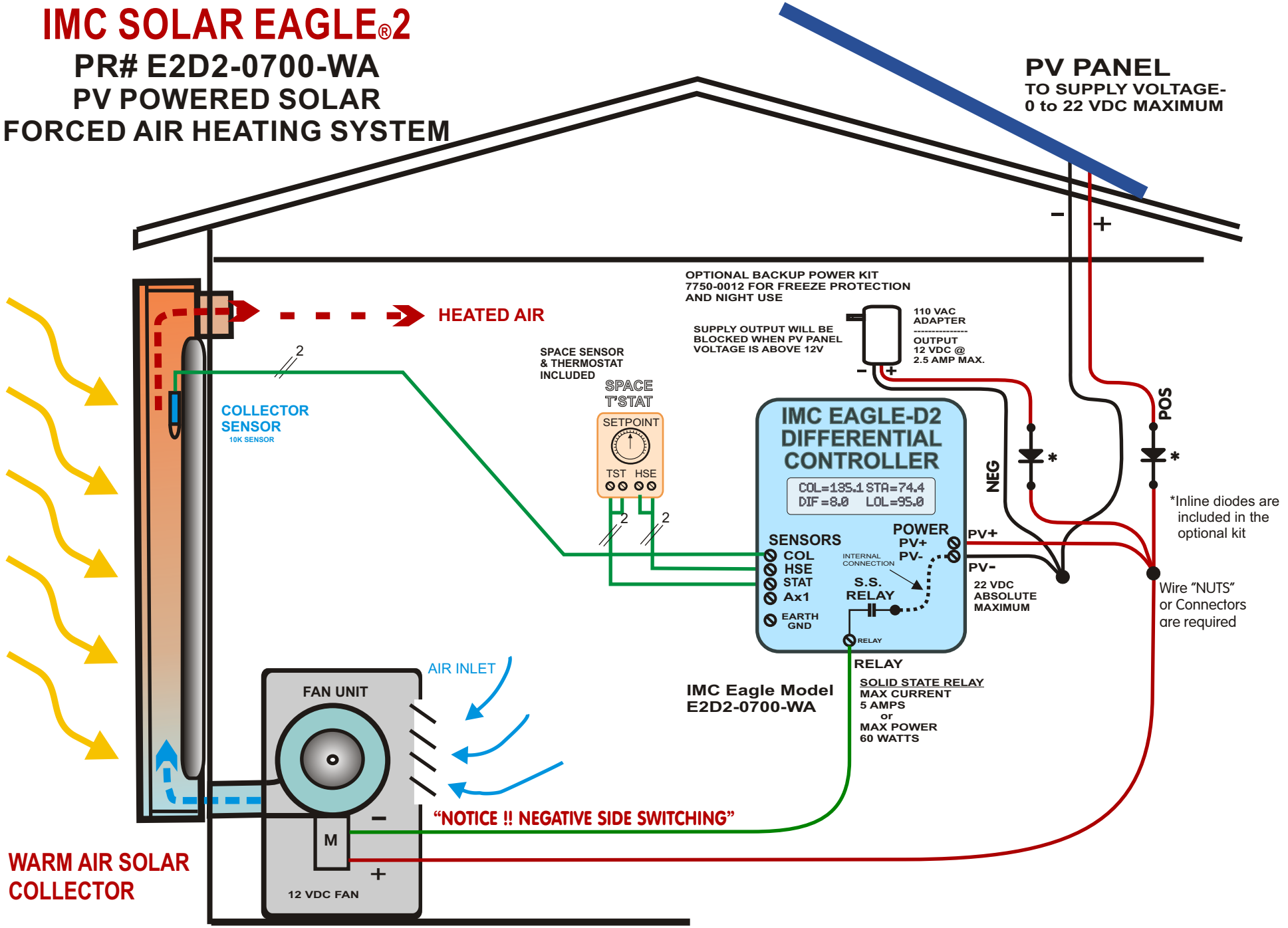
Line or power wires should NOT be bundled with or placed in the same conduit with sensor or data cables.

COLLECTOR GROUNDING- The Solar collector panel array must be GROUNDED directly to an earth ground rod. This is necessary to prevent damage from nearby lightening 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".**

IMC SOLAR EAGLE®2

PR# E2D2-0700-WA

PV POWERED SOLAR FORCED AIR HEATING SYSTEM



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