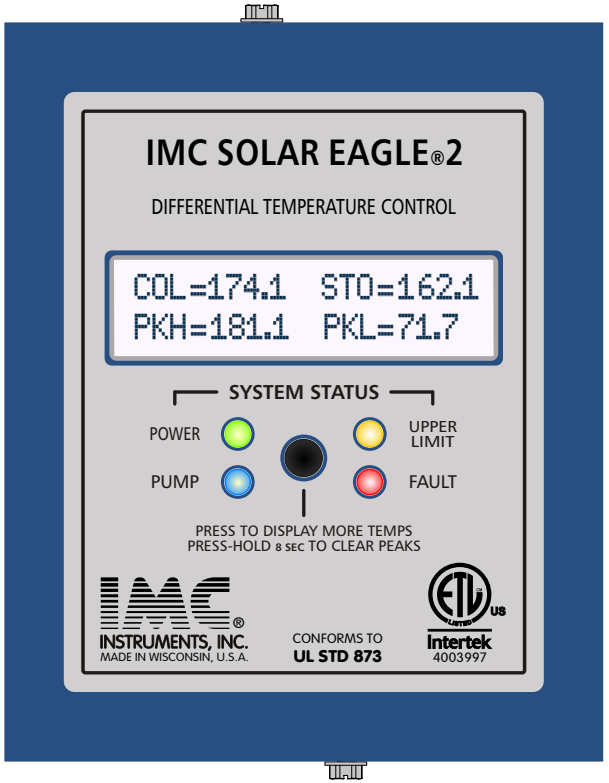
IMC SOLAR EAGLE®2 DIFFERENTIAL TEMPERATURE CONTROLLERS

MAIN FEATURES

- **Microprocessor** programed specifically for optimal performance of “DRAINBACK” 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 p.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.
Also available, model with 2 relays for non-drainback, 2-loop or closed loop systems.



SHOWN AT 5/8 SCALE

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

Product #

E2W1-2000-DB
with NON-isolated DATA PORT

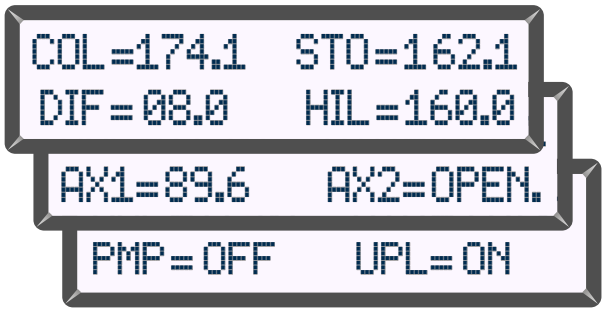
E2W1-2000-DBIP
with isolated DATA PORT

LOCAL LCD DISPLAY

The LCD display has 2 lines of 20 characters each. The first line permanently displays the COLLECTOR and the STORAGE temperatures. The bottom line can be paged (switched) by pressing the black button. These pages display all system information* including OVERRIDE messages.

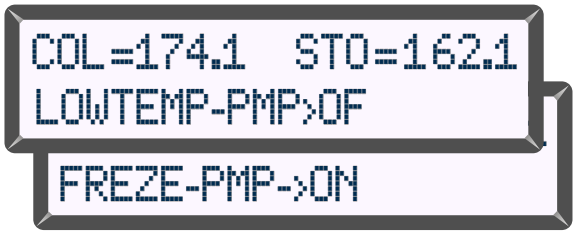
Page 1 is shown to the left.

Pages 2, 3 & 4 are shown below:



* ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT
COL= COLLECTOR; STO= STORED HOT WATER
PKH= WATER PEAK HIGH; PKL= WATER PEAK LOW
DIF= DIFFERENTIAL; HIL= HIGH LIMIT(SETTINGS)
AX1; AX2= AUXILIARY SENSORS (OPTIONAL)
PMP= STATUS; UPL= WATER UPPER LIMIT (OFF/ON)

SYSTEM OVERRIDE MESSAGES FLASH on the LOWER LCD LINE are shown below:



Web: www.solar.imcinstruments.com

INSTRUMENTS, INC.
Tel: 715- 253-2801 Fax: 715- 253-2811
468 Liberty Drive Wittenberg, WI 54499 U.S.A.

CONTROLLER OPERATION

TEMPERATURE DIFFERENCE CONTROL-

When the temperature difference between the sensor on the solar collector and the sensor in the storage tank exceeds the dialed temperature setting on “ON DIF”, the PUMP relay will actuate after a 30 second delay. The BLUE LED “RLY” indicator will also turn ON. When the storage tank temperature falls 4 degrees below the dialed setting on “ON DIF”, the PUMP relay and the BLUE LED indicator will turn off without delay. See “High Limit Control” below.

HIGH LIMIT CONTROL-

When the temperature in the storage tank exceeds the dialed setting on “HI LIM”, the PUMP relay will turn OFF without delay regardless of the temperature difference that exists between the STORAGE tank and the solar COLLECTOR. The BLUE LED indicator will turn OFF and the AMBER LED “ULT” indicator will turn ON. When the storage tank temperature falls 4 degrees below the dialed setting on “HI LIM”, the controller will resume normal operation. The PUMP relay will always have a 30 second delay before switching ON and the BLUE LED will always show its STATUS.

POWER & FAULT INDICATORS “LEDs”-

The GREEN LED “PWR” indicator is ON when the microprocessor is POWERED and the SOLAR controller is operating. The RED LED “FLT” indicator will be FLASHING when there is a FAULT condition. Faults occur when either storage or collector sensor is OPEN or missing, or if any sensor has resistance OUT of RANGE, or when the pump RELAY SWITCH is NOT set to “AUT” (automatic) position. It is also possible that an internal circuit malfunction initiates the FAULT condition.

EXTENDED “PUMP relay ON” OPERATION-

This feature is available to extend the PUMP ON operation by **five minutes** prior to turning the pump relay OFF. This will allow hydronic system components to achieve thermal equilibrium and eliminate short cycling at the beginning of the solar cycle or when low levels of solar insolation exist. To enable this feature, a jumper must be placed onto the pins marked “DEL” on the circuit board.

FREEZE PROTECTION OVERRIDE “FZ”-

This feature is available to prevent a “non-drain back” water system from freezing when the outdoor temperature drops too low. If this feature is enabled normal operation will stop when the COLLECTOR temperature falls below 40°F. The PUMP relay will then be turned ON until the COLLECTOR temperature reaches 55°F. Normal control operation will resume above this temperature. To enable this feature, a jumper must be placed onto the pins marked “FZ” on the circuit board. Only 1 override can be 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   STOR-T   DIFF-T   HILI-T   AUX-1    AUX-2   PUMP  UPLim   FAULT              THESE COMMENTS ARE NOT TRANSMITTED
0:00      125.9    73.7     08.0     110.0    212.2    205.4    ON     OFF                      System collecting solar HEAT
0:06       25.9    73.7     08.0     110.0    212.2    205.4    OFF    OFF    LO-TMP->OFF       System in LO TEMP shut down PUMP->OFF
0:12       25.9    73.7     08.0     110.0    212.8    205.4    ON     OFF    PmpSW!            Pump switch ON
0:18    OPEN.S     73.9     08.0     110.0    212.8    205.4    OFF    OFF    SENS!, PmpSW!     Open sensor, pump switch OFF
0:24     -16.0     74.7     08.0     110.0     25.9    184.6    ON     OFF    FREZE-PMP->ON     System in Freeze protect mode PUMP->ON
0:30    SHRT.S     74.9     08.0     110.0     25.9    154.6    OFF    OFF                      Shorted sensor->System OFF
0:36      125.9   173.7     08.0     173.0    112.2     95.4    OFF    ON                       Storage reached UPPER LIMIT
```

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

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

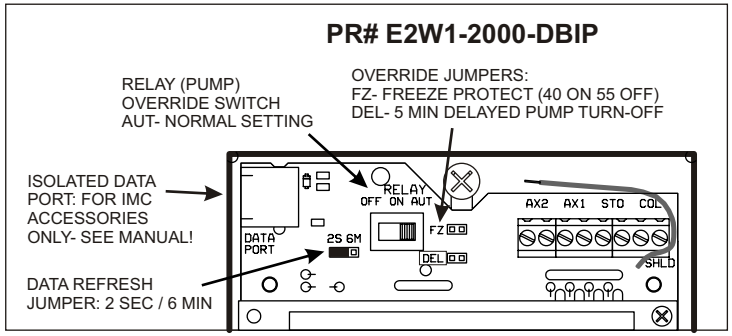
High Limit:
Adjustable from 110 to 200°F

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. 2.5 lbs

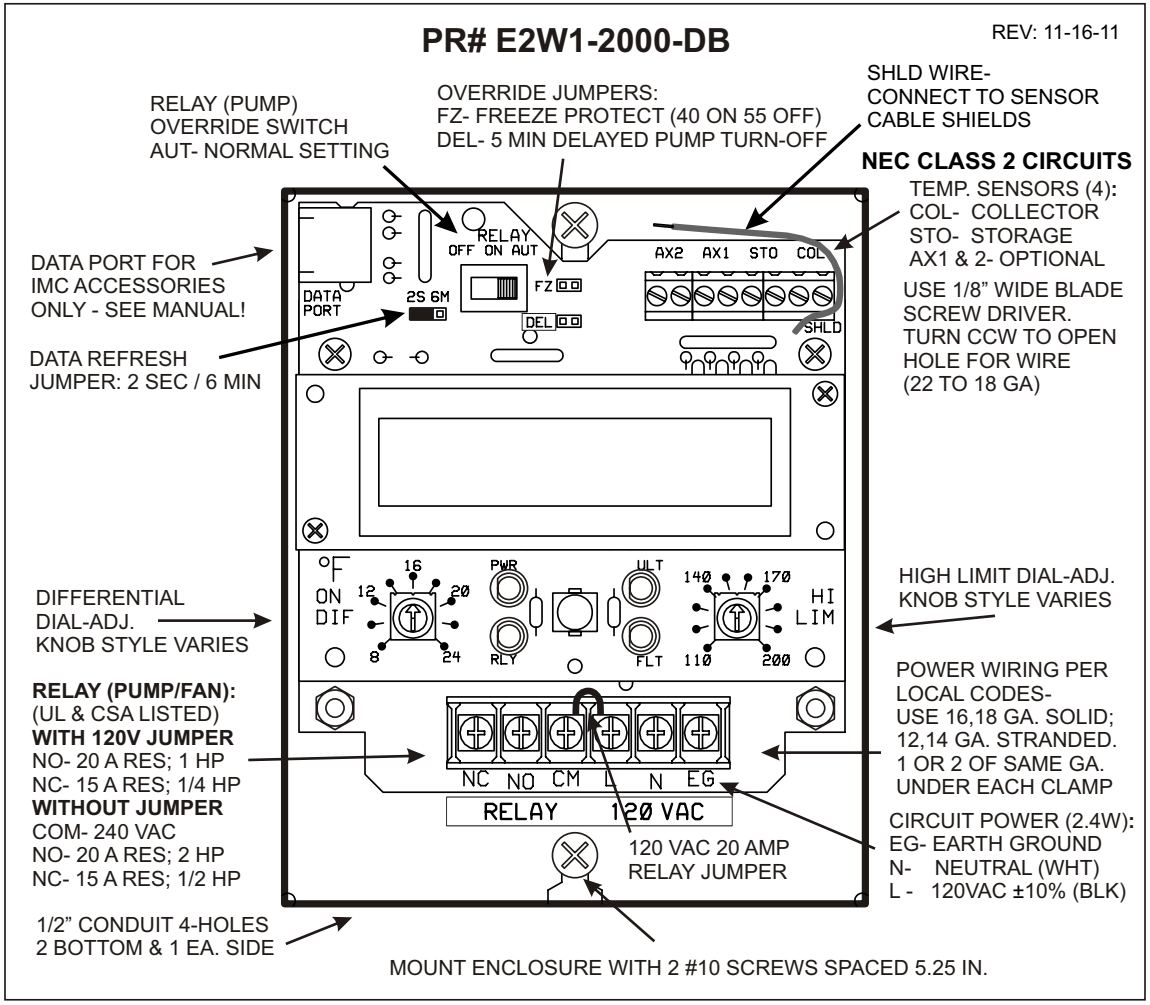


SENSORS are Industrial grade 10K IMC thermistors rated for 400°F with +/-1°F accuracy. When installed properly, they will not exceed ONE degree of additional error for cable distances up to 1000 ft. of 18 ga., 700 ft. of 20 ga. or 500 ft. of 22 ga. Two "BOLT-ON" sensors are included with each controller (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”.

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 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”.**