



# INSTRUMENTS, INC.

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## SERVICE AND INSTALLATION INSTRUCTIONS

### MAIN FEATURES

- **Microprocessor** accuracy and dependability with ambient operation from -10 to 120°F
- **Large easy-to-read 40 character** (20x2) backlit LCD display showing every parameter measured and controlled by the microprocessor.
- **PC DATA PORT** with built-in transmitter allows optional adapter and up to 500 ft. cable to interface with computers for ease in startup and remote diagnostics. Or, for adding an **Optional large 80 character** (4x20) backlit LCD display. Remote-mount up to 150 ft. distances with a CAT-5 cable.
- **Long-term diagnostics** and data logging is possible using communications software that is included in Windows' OS.

**Fault LED indicators** for quick servicing and diagnostics

- **Fast and easy** installation with "screwless" sensor terminals and easy access for all other wiring
- **Electrostatic** discharge protected
- **One HP or 20 AMP** high reliability relay
- **Polyester coated 16 gage** rugged steel enclosure
- **Model available** with receptacle & power cord or with 1/2" conduit holes for higher current permanent wiring
- **Two industrial 400°F (204°C) rated 10 K thermistors** with +/- 1°F accuracy are included.
- **Two auxiliary thermistor inputs** for optional sensors that can be located up to 1000' away.
- **Selectable overrides** for **low temperature shut down** or **freeze protection** modes for safe operation.

### LCD DISPLAY

The LCD display has 2 lines of 20 characters each. The first line permanently displays the COLLECTOR and the STORAGE temperatures. The second line can be paged by pressing the button located just below the LCD display. The following 4 pages display all system information including OVERRIDE messages.

PG 1



PG 2



PG 3



Pg 4



IMC LCD MASTER DIGITAL DISPLAY PANEL for REMOTE indication

### EAGLE 2 SUN CONTROL DIFFERENTIAL TEMPERATURE CONTROLLER



P# SOLR-2EPC-10

SYSTEM OVERRIDE MESSAGES **FLASH** on the LOWER LCD LINE as follows:

LOWTEMP-PMP>OF

FREZE-PMP->ON

**INSTRUMENTATION WITH QUALITY ENGINEERING**

## DATA PORT

Requires an IMC Data Port ADAPTER that will allow interface to a standard computer's serial RS232 port. The ADAPTER can also accept a serial to USB converter to connect directly to portable computers that only have USB ports. If wireless operation is desired for short distances, BLUE TOOTH transceiver can also be connected. The rate at which the data is sent from the EAGLE solar controller is determined by a jumper in the controller as show in the CONTROLLER diagram on page 4. If the jumper is placed on position labeled "2S", one complete line of "total system information" will be sent to the computer every 2 seconds which is necessary when performing diagnostics or a system startup. If the same jumper is placed on position labeled "6M", then data will be sent every 6 minutes. This will allow a more suitable data-send rate for long-term DATA LOGGING, specially when storing the data in a "CAPTURE" file setup in the computer's communications program such as "Terminal" or "Hyper Terminal".

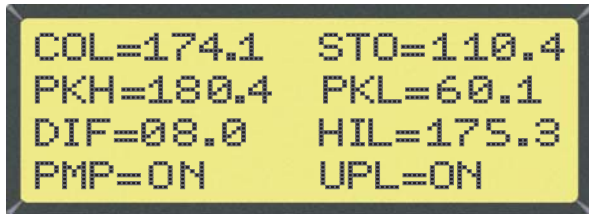
### SAMPLE DATA PORT PRINT

| RUNTIME | COLL-T | STOR-T | DIFF-T | HILI-T | AUX-1 | AUX-2 | PUMP | UPLim | FAULT         |  |
|---------|--------|--------|--------|--------|-------|-------|------|-------|---------------|--|
| 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            |

An **IMC LCD MASTER DIGITAL DISPLAY PANEL** can also be connected to the DATA PORT. It has an RJ-45 jack and is supplied with a 3 foot long cable that can be substituted with a standard CAT5 cable up to 150 feet long. These ethernet cables are available at most retail stores. The display panel also has a PEAK RESET button located on the side to reset previous STORAGE temperature peaks.

The Information on the **LCD MASTER DISPLAY PANEL** is displayed as follows:

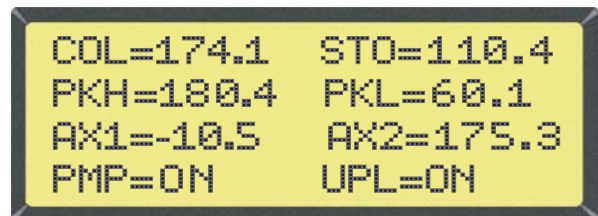
### **PG 1**



COLLECTOR TEMPERATURE  
 STORAGE TEMPERATURE  
 DIFFERENTIAL CONTROL SETTING  
 HI LIMIT CONTROL SETTING  
 PUMP STATUS  
 UPPER LIMIT STATUS  
 PEAK HI= MAXIMUM TEMPERATURE  
 PEAK LO= MINIMUM TEMPERATURE  
 AUXILIARY SENSORS 1 AND 2

This Master LCD has a second page which will display the auxiliary sensor temperatures on PG 2. To display, press and release the PAGE/RESET button on the side of the display housing. The Auxiliary sensors will be displayed within 2 seconds. To RESET the STORED PEAK temperatures of the storage tank, press and hold for 6 seconds the PAGE/RESET button. The current temperatures will appear after the button is released. The Master LCD display is updated every 2 seconds.

### **PG 2**



## 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 difference setting (ON DIF), the PUMP relay will actuate after a 30 second delay. The BLUE LED indicator will also turn ON. When the temperature difference decreases and falls below 4°F (2.2°C), the PUMP relay and the BLUE LED indicator will turn off without delay.

**HIGH LIMIT CONTROL-** When the temperature in the storage tank exceeds the HI-LIMIT dialed setting, the PUMP relay will be turned OFF without delay regardless of the status of the temperature difference that exists between the STORAGE tank and the solar COLLECTOR. The BLUE LED indicator will also turn OFF. When the storage tank temperature falls 4 degrees below the setting in the HI-LIMIT, the controller will then 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 condition.

## **CONTROLLER OPERATION-continued**

**LOW TEMPERATURE SHUT-DOWN OVERRIDE-** This feature is available to prevent the system from operating at low outdoor temperatures. If this feature is enabled normal operation will stop when the COLLECTOR temperature falls below 50°F. The PUMP relay will then be turned OFF. Normal control operation will not resume until the COLLECTOR temperature returns to 70°F or above. To enable this feature, a jumper must be placed onto the jumper pins marked "LO" on the circuit board. Only ONE of these two override features can be enabled.

**FREEZE PROTECTION OVERRIDE-** This feature is available to prevent a non-drain back "water only" 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 37°F. The PUMP relay will then be turned ON until the COLLECTOR temperature reaches 52°F. Normal control operation will resume above this temperature. To enable this feature, a jumper must be placed onto the jumper pins marked "FZ" on the circuit board. Only ONE of these two override features can be enabled.

**STATUS INDICATION LEDS-** There are four status indication LEDS. The GREEN LED indicates that the microprocessor is POWERED and the SOLAR controller is running. The BLUE LED indicates PUMP operation. When ON, the PUMP is operating and solar energy is being stored in the STORAGE tank. The AMBER LED indicates if the UPPER LIMIT temperature in the storage has been exceeded. The RED LED indicates when there is a fault condition. The conditions that can cause the fault LED to turn ON are as follows: OPEN or SHORTED or OUT of RANGE temperature SENSORS, pump RELAY SWITCH NOT set to "AUT" (automatic) position and internal component malfunctions. The RED LED will always be FLASHING when the FAULT indication is ON

**SENSOR "SCREWLESS" TERMINALS-** The "screwless" block is BLUE/ORANGE and has 9 terminals. The terminals accept solid or stranded wire from 18ga. to 22ga. For efficient and reliable wire installation, strip 3/8" (slightly shorter than block width) 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 pinched or deformed so that it can fit into the terminal hole easily. If the wire is stranded, make sure the strands are tightly twisted. Guide the wire tip carefully into the terminal hole while depressing the ORANGE button directly over the hole. Pushing with your finger works, if adjacent wires are kept from sliding out. It is easiest to insert one wire at a time using a flat blade screwdriver to depress the appropriate button but do not slip off and damage any circuit components. If the wire is stranded, pay careful attention that all the strands are in the terminal hole properly.

**SENSORS-** Industrial 400°F (204°C) rated 10K IMC thermistors have +/- 1°F accuracy. When installed, they will not exceed ONE degree of additional error for cable distances up to 1000 feet of 18ga., 700 feet of 20ga. or 500 feet of 22ga.

**POWER AND RELAY TERMINALS-** The power terminals are for 120 vac operation (230 vac operation is optional). They accept gages from 12ga. to 18ga. The power RELAY is rated for 20 Amps and is designed to connect directly to PUMPS or FANS not exceeding a total of 1 hp. A 30 amp relay option is available.

## **INSTALLATION**

**MOUNTING-** The Eagle line of SOLAR controllers are designed to be mounted indoors, protected from the weather. Use two #10 screws in the enclosure "keyholes" for mounting.

**POWER WIRING-** Hard wired models are designed for 120 vac operation. All wiring is to be done in accordance with local codes. Models supplied with line cords and receptacles are to be connected directly to power outlets with out the use of extension cords.

**SENSOR INSTALLATION AND WIRING-** Sensor installation should be in a manner as to permit proper sensor contact of the areas to be measured. Shield 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.

It is recommended in today's Radio interference "RICH" environment that all sensor wiring be shielded. Listed below are a few suggested wire part numbers. Wire selected must also meet local codes and be rated for indoor/outdoor use by its manufacturer.

- |    |   |                           |
|----|---|---------------------------|
| 1) | "PLTC" Belden # 9322 (22ga) or 9320 (20ga)    | Best specifications       |
| 2) | "Control" Belden # 8761 (22ga) or 8762 (20ga) | Better specifications     |
| 3) | "Audio" Belden # 9451-10 Black (22ga)         | Acceptable specifications |

The SHIELD must be brought to the shield grounding terminal located to the right of the COL sensor screw-less terminals as shown in the controller layout diagram. For ease of shield installation, insert one short wire in the shield terminal labeled "SHLD" and connect all the shields together with a "wire-nut" or other reliable means. Ungrounded shields may result in damage to the Solar controller circuits. The shield requires grounding at the controller side ONLY. DO NOT attempt to ground the collector panel with the sensor shield.

### INSTALLATION-continued

**COLLECTOR GROUNDING-** The Solar collector panel array “must be GROUNDED” directly to an earth ground line. This is necessary to prevent damage from nearby lightning strikes which induce very DAMAGING high voltages in all nearby ungrounded metallic surfaces. Please consult local, state and federal codes for proper grounding.

**DATA LOGGING TO A COMPUTER-** All the EAGLE Solar controllers can be connected to the serial port of a PC or Laptop computers. An IMC DATAPORT/RS232 adapter is required. The maximum recommended adapter cable length is 500 feet. All Windows operating systems have a communications programs such as “Terminal” or “Hyper Terminal” which are used to receive and/or CAPTURE data from the PC serial ports. This feature is “EXTREMELY” valuable in starting up newly installed SOLAR systems. Long term Data logging is now possible which can be very useful in service and diagnostics of intermittent malfunctions. Complete “system status” including Temperature is presented in a line by line format including timer information. In applications where the computer’s interface is going to be permanent it is recommended that an IMC “ISOLATED” DATA PORT adapter be used in order to protect the connecting computer from electrical surges.

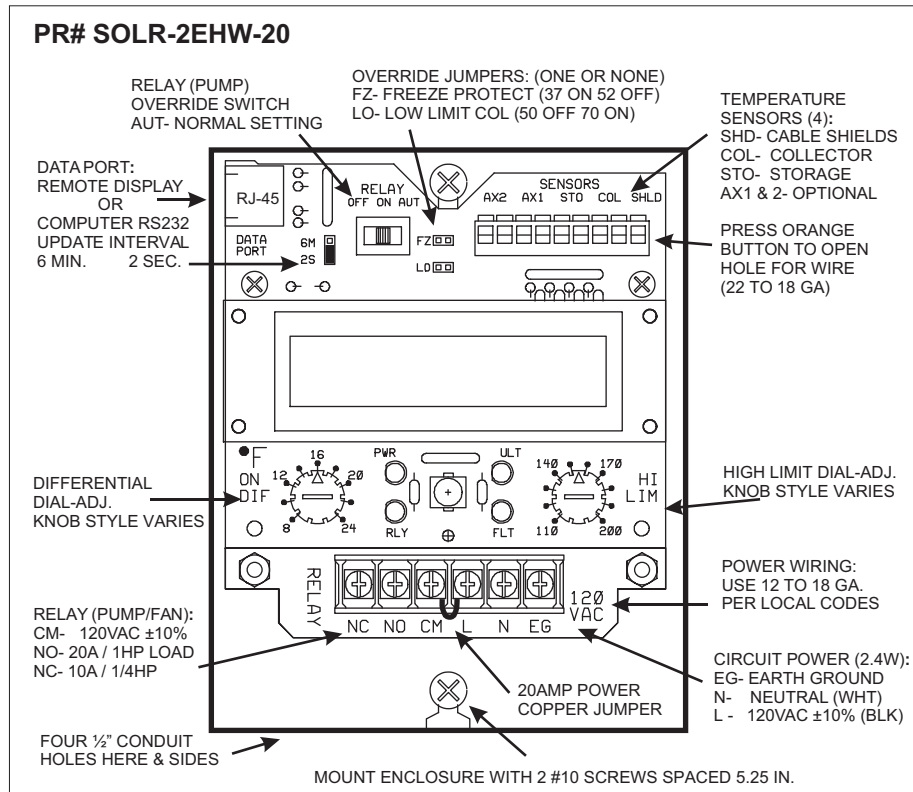
Please visit our website for new or more detailed operating instruction at “[www.imcinstruments.com](http://www.imcinstruments.com)”.

### SPECIFICATIONS

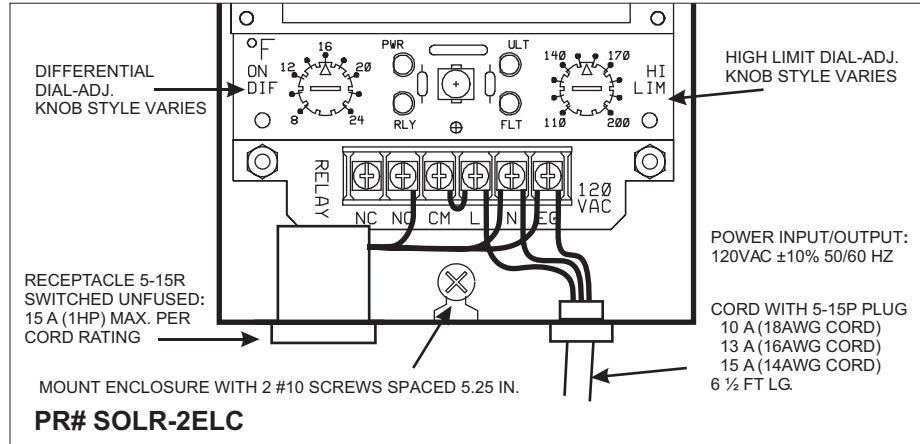
**Input Power:** 2 Watts @ 120\* VAC  
**Output Relay:**  
 NO contact- 20\*\* Amp, or 1 HP  
                   @ 120 VAC with  
                   30 sec ON delay  
 NC contact- 10 Amp or 1/3 HP  
 \* 230 VAC power is optional  
 \*\* 30 Amp relay is optional

**Differential:** 8/4 to 24/4 °F  
**High Limit:** 110 to 200 °F  
**Accuracy:** +/- 1 °F  
**Environmental:** -10 to 120 °F  
                       0 to 95% RH  
**Sensors:** 10K @ (25 °C) 77 °F  
**Dimensions:** 5.00”W x 6.12”H x 2.50”D

Product #  
 SOLR-2EHW-20  
 With Conduit Holes  
 for Hard Wiring



Product #  
**SOLR-2ELC-10, -15**  
 With Line Cord &  
 Receptacle



**CONTROLLERS:**

With line cord & receptacle -

With conduit holes for permanent wiring -

**RATING**

- 10 Amp
- 15 Amp
- 20 Amp
- 30 Amp

**PRODUCT #**

- SOLR-2ELC-10
- SOLR-2ELC-15
- SOLR-2EHW-20
- SOLR-2EHW-30

**ACCESSORIES:**

THERMISTOR TEMPERATURE SENSORS:

Bolt-on style - SOLR-TS02



Screw-in 1/2-NPT plug style - SOLR-TS03



Immersion style with 1/4-NPT fitting - 4" long - SOLR-TS04  
 - 8" long - SOLR-TS05

Longer probe and/or 1/2-NPT fitting are available on special request

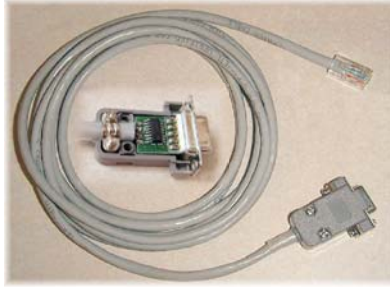


**PC Data Port Adapter RS-232 (non isolated) - SOLR-DA10**

Includes electronic circuits inside the DB-9 connector housing and a 7 foot cable terminated with an RJ-45 plug.

Connects directly to the EAGLE controller DATA PORT and permits serial PC communication at 2400 BAUD rate\*\*

EAGLE "web" models with a 2500 volt isolated PORT are recommended for long-term or permanent installations.

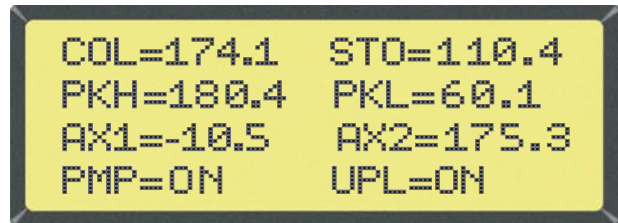


**LCD MASTER DIGITAL DISPLAY PANEL for temperature and status - SOLR-RD80**

80 characters (4x20) 1/4" character height. Includes a 3' foot cable with an RJ-45 connector that connects directly to the EAGLE controller\*\*.



**ACTUAL SIZE DISPLAY**



**\*\*IMPORTANT NOTICE**

Do not attempt to connect any ETHERNET and/or other foreign devices to the RJ-45 PORT of all IMC CONTROLLERS and accessories. This will result in damage to the connected equipment. Only devices specifically designed by IMC Instruments should be connect to these ports.