Using the Heater Output on the ERT-A2 unit

The ERT-A2 can be powered by an internal LiFePO4 battery, which is normally charged from a solar panel. This battery cannot be charged when the ambient temperature is below 0°Celsius. The ERT-A2 unit disables its battery charge circuit in this case.

The power from the solar panel (or other external supply) can be used to warm up the ERT-A2 unit until it reaches a temperature suitable for charging the battery. The HTR (Heater) output switches to GND when the charger is disabled due to low temperature. By connecting a resistive heater between SOL (Solar) and HTR terminals, the heater will be powered from the solar panel while charging is disabled due to low temperature.

Recommended Heater options

Heater and solar panel requirements will vary depending on local conditions. This table provides some guidelines. (Solar Panel should be 12V nominal)

Winter Sun Conditions / Expected Min. Temp	Generally Clear Skies And Day length > 7h	Often Overcast Or Day length < 7h	Mains Supply 24V
0 to -10 ℃	25W Solar Heater 100W Solar Panel	25W Solar Heater 200W Solar Panel	1A 24V Heater (24W) 1.5A Minimum Supply
-10 to -40 ℃	50W Solar Heater	50W Solar Heater	2A 24V Heater (48W)
Below -30 ℃: Add Insulation	200W Solar panel	300W Solar Panel	2.5A Minimum Supply

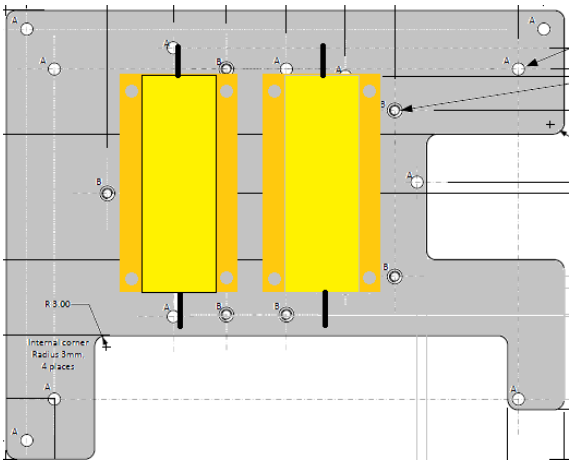
Solar Panel Selection

When selecting a solar panel, it is important to understand that the heating should be able to happen even when there is not full sun available. In high latitudes, and in regions with wet and overcast winters, it is important that the unit warms up as early as possible to allow charging to begin. The guidelines above select the solar panel so that the heater is operating at full power when the panel is at 25% capacity (good sun regions) and when the panel is at 12-16% capacity (poor sun regions). You should select a panel so that its power output matches the heater power as soon as practical at the start of the day.

Heater Construction

The following is a recommendation on heater construction using easily available chassis mount resistors bolted to the housing internal front panel. All examples use one or two 12 Ohm 100W resistors. For example: https://au.rs-online.com/web/p/chassis-mount-resistors/1663851

The resistors should be mounted on the mounting bracket inside the front cover. ELPRO part number W-MODBKTERTA2.



25W Solar Heater

Use One 100W 12 Ohm resistor and mount to the mounting plate. Solder wires to each end and connect to the SOL and HTR terminals.

50W Solar Heater

Use Two (2) 100W 12 Ohm resistors and mount to the front panel plate. Solder wires to connect the resistors in parallel, and then wire to each end and connect to the SOL and HTR terminals. Note this part can become hot during heating phase and appropriate warnings labels should be used.

1A 24V Heater

Use Two (2) 100W 12 Ohm resistors and mount to the front panel plate. Solder wires to connect the resistors in series, and then wire to the remaining terminals and connect to the SOL and HTR terminals.

2A 24V Heater

Use One 100W 12 Ohm resistor and mount to the front panel plate. Solder wires to each end and connect to the SOL and HTR terminals. Note this part can become hot during heating phase and appropriate warnings labels should be used.

DIY Heater Design

If you prefer to design your own heater unit, the process is straightforward. You can estimate how your system will perform with some basic calculations. You should over-design your heater's power capacity to cover unusual situations. Note that solar panel output voltage will be increased with low temperature (0.35% per ℃ typical) so a panel which outputs 22V at 25℃ will output around 27V at -40℃.

To size your system, you can use the numbers below as a guide.

Case Thermal Resistance (R_θ) : 0.8 ℃/W

Use this to calculate the power required to increase the case internal temperature by the desired amount. For example, a 25W heater will eventually result in a temperature rise of:

$25\text{W} \times 0.8℃/\text{W} = 20℃$

Mounting Bracket to case internal temperature ($\theta_{bkt\text{-}internal}$): 2.2 ℃/W

Use this to calculate the temperature the bracket and resistor combination will reach during heating for the purpose of user safety. The heater will turn off when the internal temperature reaches 5℃, so for a 50W heater the maximum bracket temperature will be:

$50\text{W} \times 2.2℃/\text{W} + 5℃ = 115℃.$

Case Thermal Mass (C_{th}): 1.2 ℃/Wh

Use this to calculate how quickly the unit will initially heat up when the heater is active. For a 25W heater, the initial rate of temperature rise will be:

$25\text{W} \times 1.2℃/\text{Wh} = 30℃/\text{hour}$

Amendment Register:

Issue No.	Date	Details of Amendment
1.0	14/07/23	Draft Issue