

Éxupery's Power Distribution and Charging Box fabrication

Arturo Montalvo Garcia

Hamburg University

January 2010

1 INTRODUCTION

The Power Distribution/Charging Box (*Power Box*) for the Volcano Fast Response System (VFRS) is an energy support system that uses Solar Panel or Fuel cells as primary energy source; includes lightning and current overload protections, and a low battery breaker (figure 1.1).

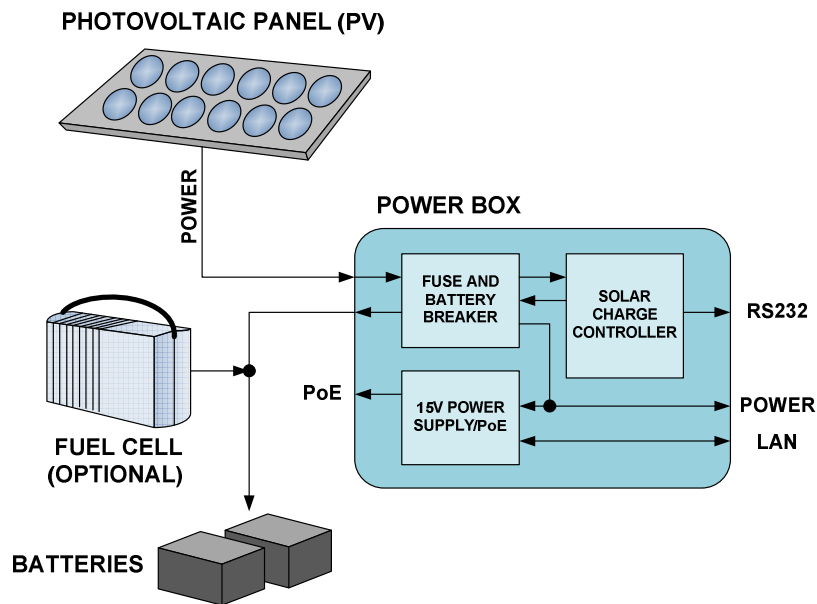


Figure 1.1 - Power Distribution/Charging Box (*Power Box*) concept.

The energy support system is based on a 45 amperes solar charge controller from TriStar (Morningstar) (Fig. 1.2.a), placed inside one hermetic box, model 1450 from PeliCase (Fig. 1.2.b). The power box can support two 80 W solar panels, and two 120 A/hr batteries, with four outlets for instruments, and two electronic circuits for energy distribution, including current and low battery protections, and other for the WLAN radio power supply.



Figure 1.2 – a) TriStar 45 solar charge controller and b) 1450 PeliCase box.

The kit includes one complete Power Box with one 85W solar panel, batteries and a complete set of cables for batteries, instrument and radio power supply; RS232 communication and grounding. The components list can be consulted in the Component List section.

2 MORNINGSTAR[®] SOLAR CHARGE CONTROLLER PREPARATION

The TriStar solar charge controller is delivered as shown at figure 2.1, due to its size, an adaptation is needed.



Figure 2.1 – TriStar solar charge controller (Morningstar[®], 2007)

Remove the main cover unscrewing the four Phillips screws (figure 2.2), after that, please remove the grounding nut and keep it for future use. To finalize, remove the low cover unscrewing from the black dissipater, and then, carefully remove the plastic fasteners from the main circuit board (keep it fasteners for future use).

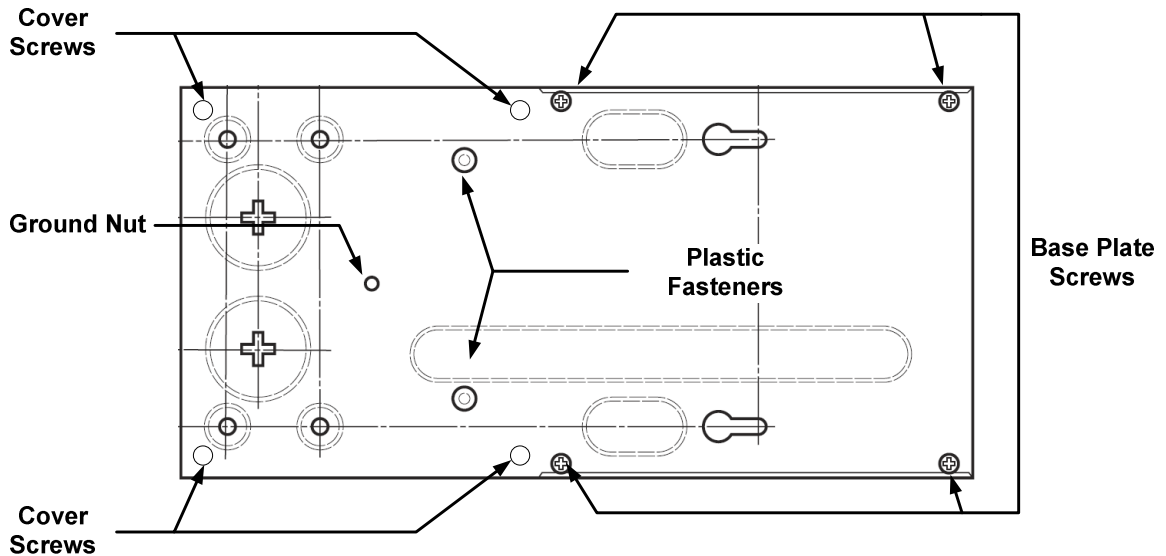


Figure 2.2 –Screws localization.

3 PELICASE[®] 1450, BOX PREPARATION

3.1 Aluminium mounting plate

The aluminium mounting plate must be fabricated according to the specifications of the figure 3.1; using 3mm thickness aluminium. The mounting plate allows fixation of components and cables needed for the power box.

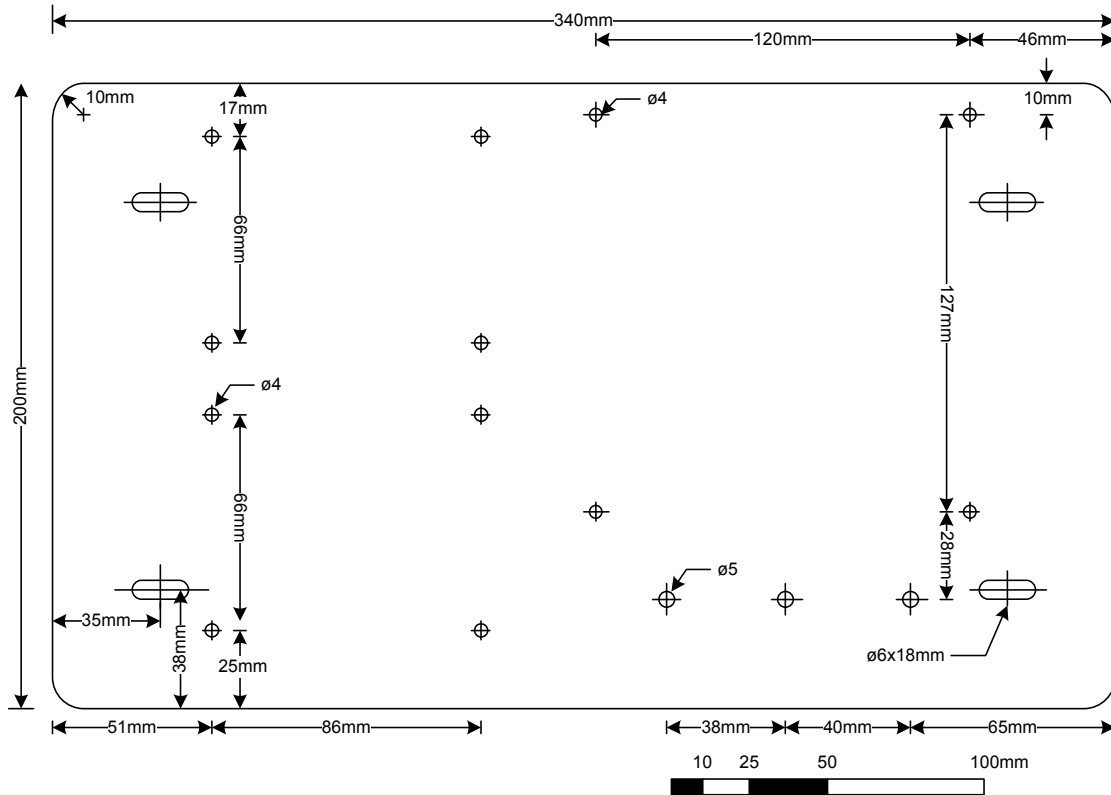


Figure 3.1 – Aluminium mounting plate, metric drawing.

With the mounting plate and the circuit boards ready, proceed to install main components:

- Fix eight M3X20mm fasteners for the two electronic boards at the position indicated in the figure 3.2;
- Insert the three plastic fasteners recovered from the solar charge controller (figure 3.2);
- Remember the position for the grounding nut recovered from the solar charge controller (figure 3.2);

d) Fix the solar charge controller and the two electronic boards as showed in the figure 3.3.

Grounding Nut

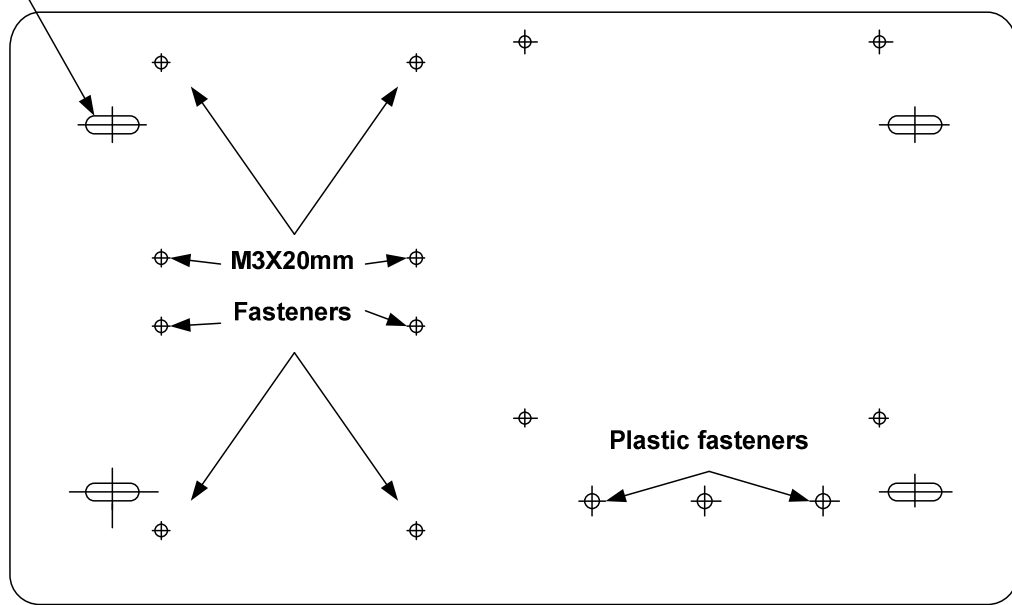


Figure 3.2 – Fasteners and grounding nut location.

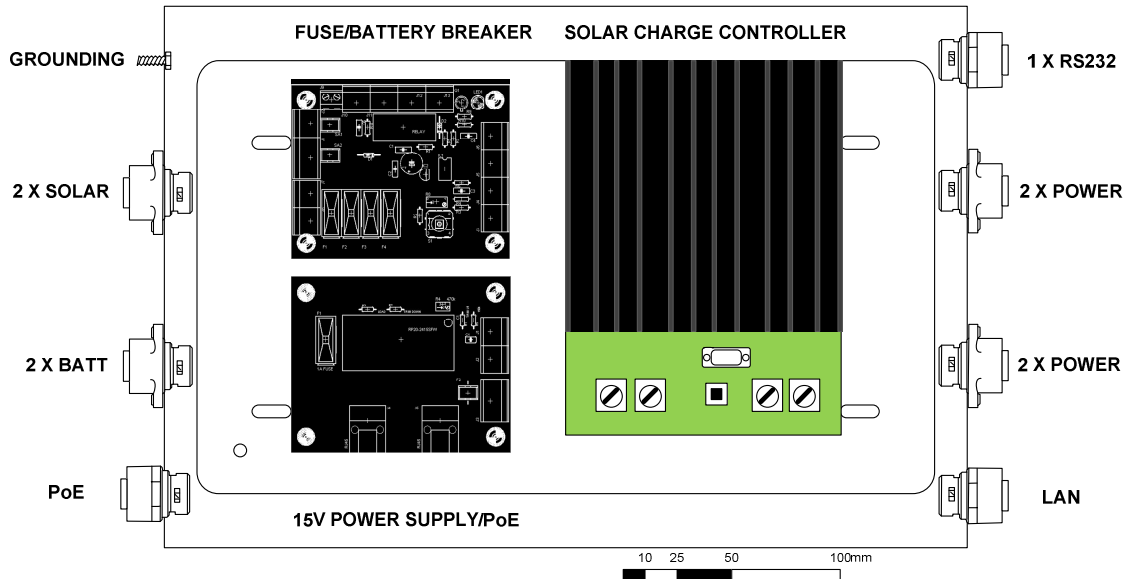


Figure 3.3 – Components distribution at the mounting plate and PeliCase box.

3.2 Pelicase® 1450 drills preparation, bottom side

- 1) At bottom side (figure 3.4), drill four 6mm holes inside each box feet;
- 2) Insert four M6X20 mm screws and use them to fix four fasteners M6X18 mm inside the box;
- 3) Cover the interior of each box feet with thermal glue or maritime silicone;
- 4) Do not fix the mounting plate yet.

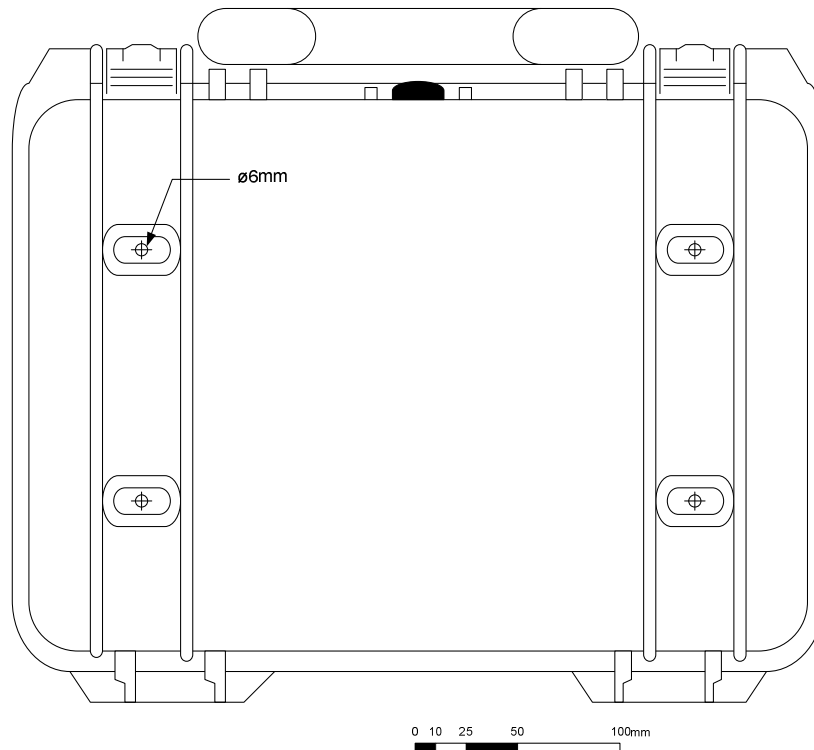


Figure 3.4 – Pelicase® 1450, bottom view.

3.3 Pelicase® 1450 drill preparation, right and left side

At right and left sides of the box, drill it holes according with the holes mask (figure 3.5). Clean plastic residuals using a sharp knife or a hand drill with sand paper roll head. On the left side of the box there is a connector marked with the name PoE, for this connector, reduce the box thickness, to allow a better fixation.

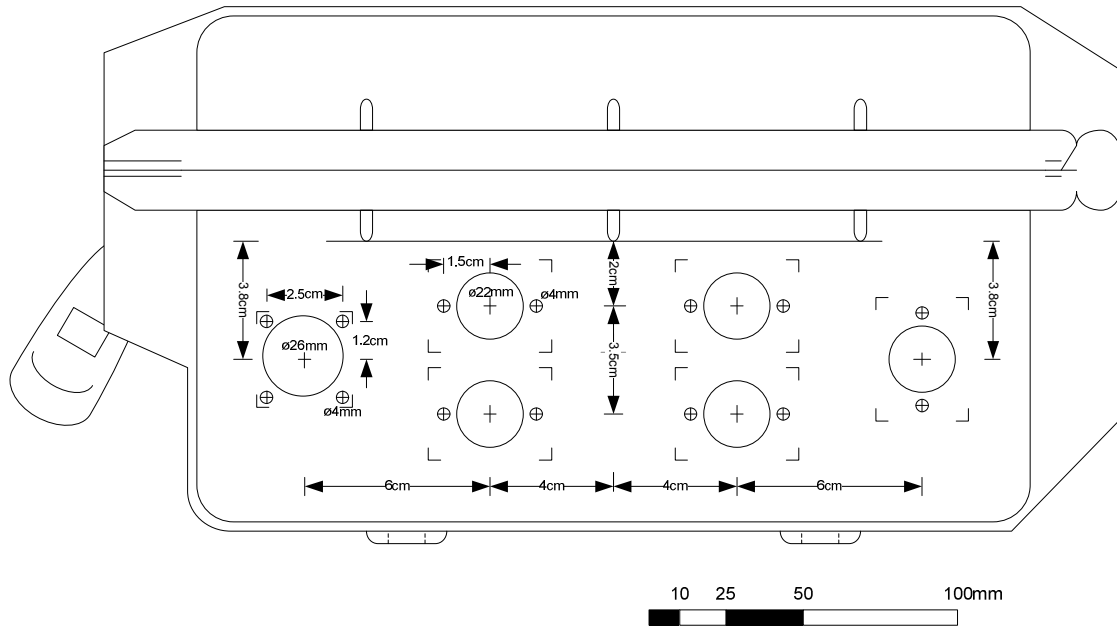


Figure 3.5– Pelicase[®] 1450, right and left side holes mask.

Once this operation finished, and with the box cleaned, put and fix the mounting plate using 6X20mm screws, remember the position of the grounding nut that must be fixed to the plate.

4 CABLES, CONNECTORS AND WIRING

4.1 Power Box Connectors

4.1.1 Solar Panel Connector (2 per box)

Four poles power connector Hirschmann code CA 3 GS (figure 4.1.a) and two cables of 4mm² section, one red and one black, with 15cm length (confirm with the power box), and connect according figure 4.1.b.

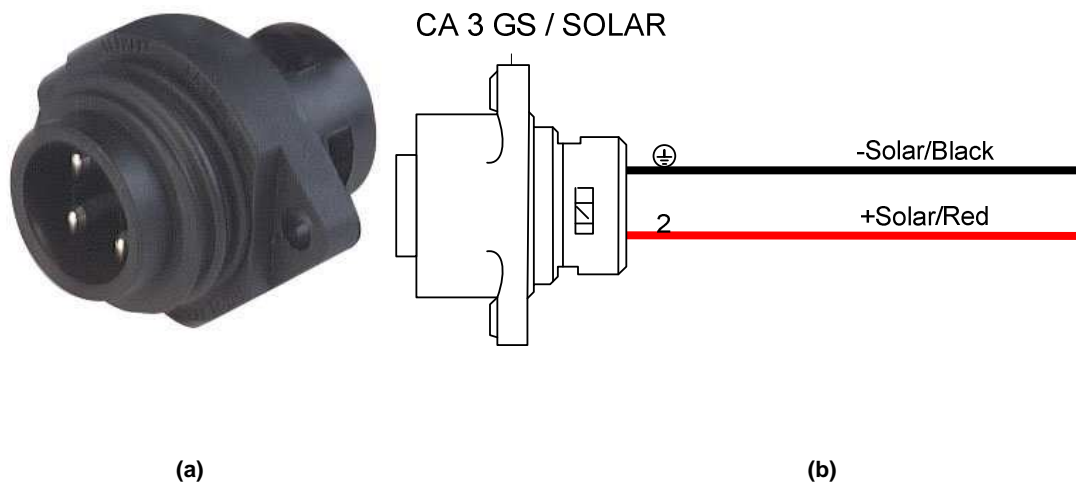
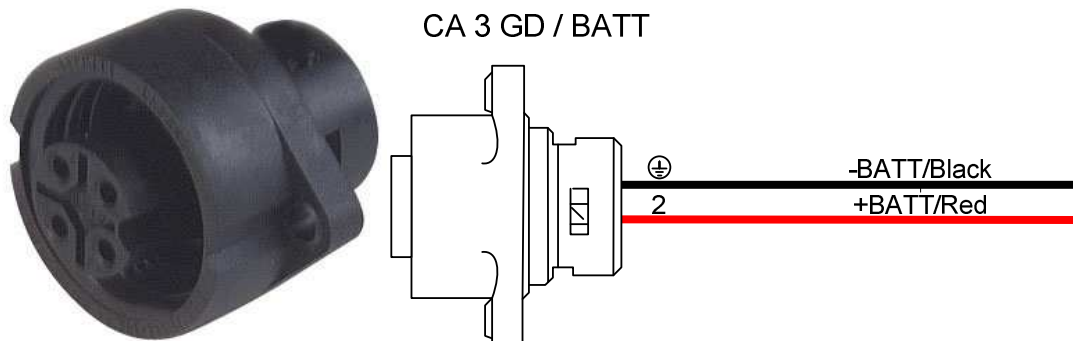


Figure 4.1– a) Hirschmann CA 3 GS connector and b) electric connection.

4.1.2 Battery connector (2 per box)

Four poles power connector from Hirschmann code CA 3 GD (figure 4.2.a) and two cables of 4mm² section, one red and one black, with 20cm length (confirm with the power box), and connect according figure 4.2.b.



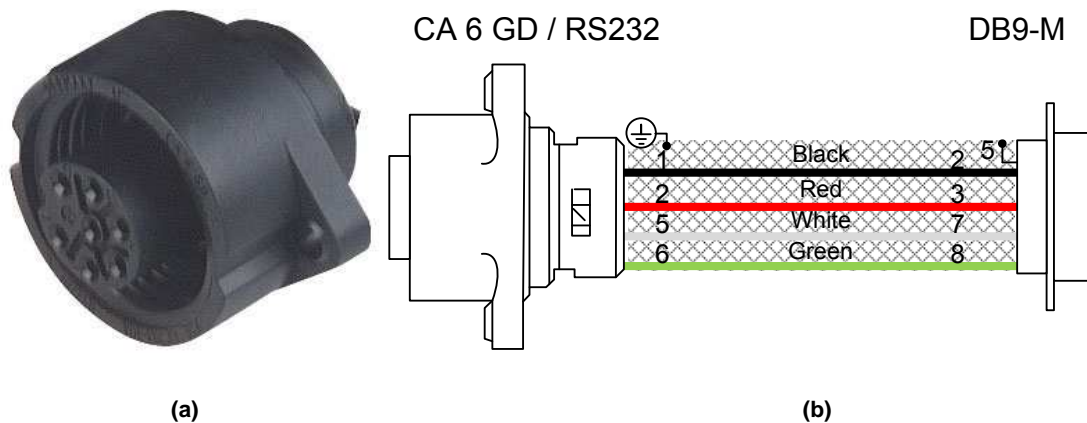
(a)

(b)

Figure 4.2– a) Hirschmann CA 3 GD connector and b) electric connection.

4.1.3 Solar Charge Controller communication connector (1 per box)

Seven poles connector from Hirschmann, code CA 6 GD (figure 4.3.a), and 4 ways audio cable, Conrad code 600807, with 35cm length audio cable (confirm with the power box), and connect according figure 4.3.b, using the shield as ground signal.



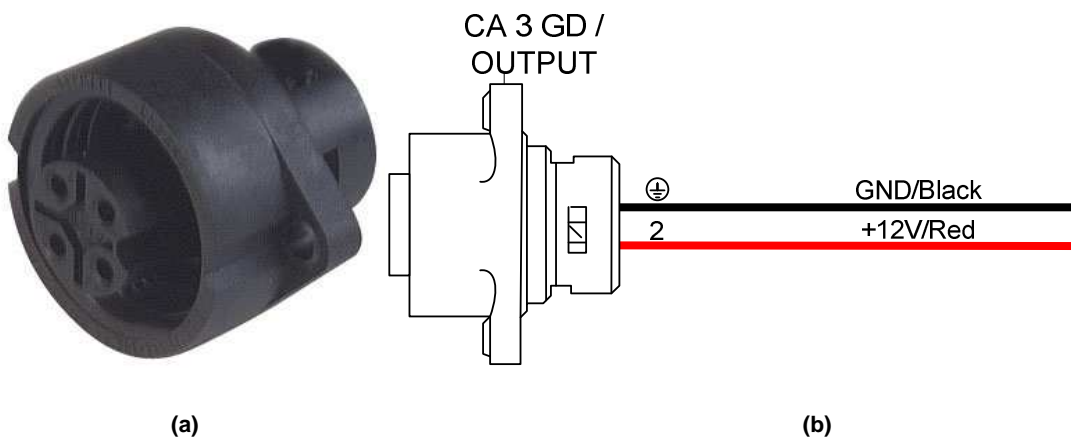
(a)

(b)

Figure 4.3– a) Hirschmann CA 6 GD connector and b) electric connection.

4.1.4 Power output for instruments connectors (4 per box)

Four poles power connector from Hirschmann, code CA 3 GD (figure 4.4.a), and two cables of 1.5mm² section, one red and one black; two with 40cm length, one with 50cm length and one with 35cm length (confirm with the power box), and connect according figure 4.4.b.



(a)

(b)

Figure 4.4– a) Hirschmann CA 3 GD connector and b) electric connection.

4.1.5 Power Over Ethernet (PoE) and LAN cable/connectors

The PoE connector from COMPONA, model LTWRJ45-IU21RX (figure 4.5), includes 15cm cable ready to install and connect to PoE board.

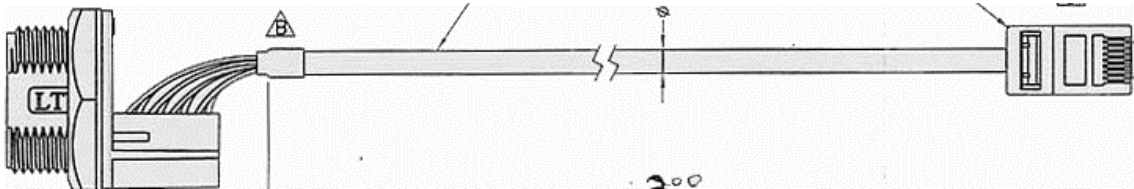


Figure 4.5– LTWRJ45-IU21RX connector.

The LAN connector for instruments must be assembly with two different cables. Both connectors are Amphenol RJF 544 series (figure 4.6), with direct and crossover Ethernet cables, that allows connections between the instrument and the PoE board inside Power Box.



Figure 4.6– Amphenol RJF 544 series connectors.

The Ethernet cable for internal connection is one 35cm UTP cable with direct connection (table I) and the instrument cable is one 1.5m UTP cable with crossover connection and one Amphenol cable connector (table II).

Table 1 – TIA/EIA-568-B, T568A Wiring, direct connection.


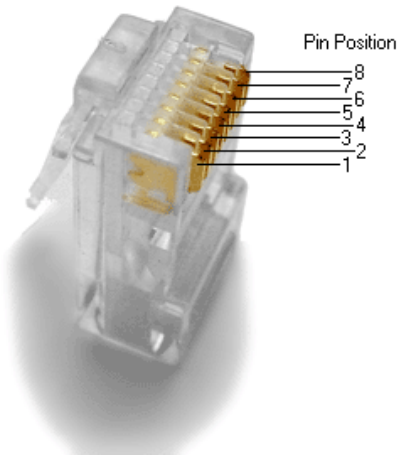






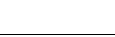


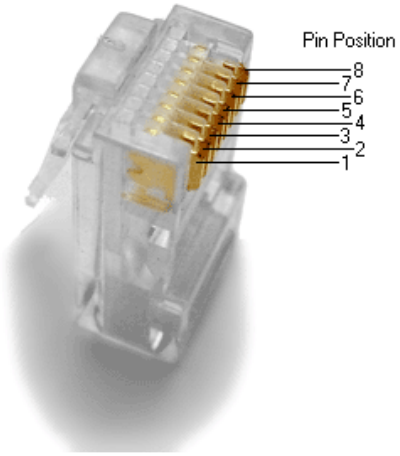














PIN	Connection	Pins on plug face (jack is reversed)
1	 white/green	
2	 green	
3	 white/orange	
4	 blue	
5	 white/blue	
6	 orange	
7	 white/brown	
8	 brown	

Table II – 10base-T/100 base Crossover cable

PIN	Connection1	Connection 2	Pins on plug face (jack is reversed)
1	 white/green stripe	 white/orange stripe	
2	 green solid	 orange solid	
3	 white/orange stripe	 white/green stripe	
4	 blue solid	 blue solid	
5	 white/blue stripe	 white/blue stripe	
6	 orange solid	 green solid	
7	 white/brown stripe	 white/brown stripe	
8	 brown solid	 brown solid	

4.2 Battery cables and instrument cables

Four poles power connector, Hirschmann code CA 3 LS (figure 4.7), and 2m of 2X4 MM cable (Conrad code 600628 – 62). For battery cable, use two 6mm diameter metal ring terminals; and for instruments, use properly connector according its specifications.

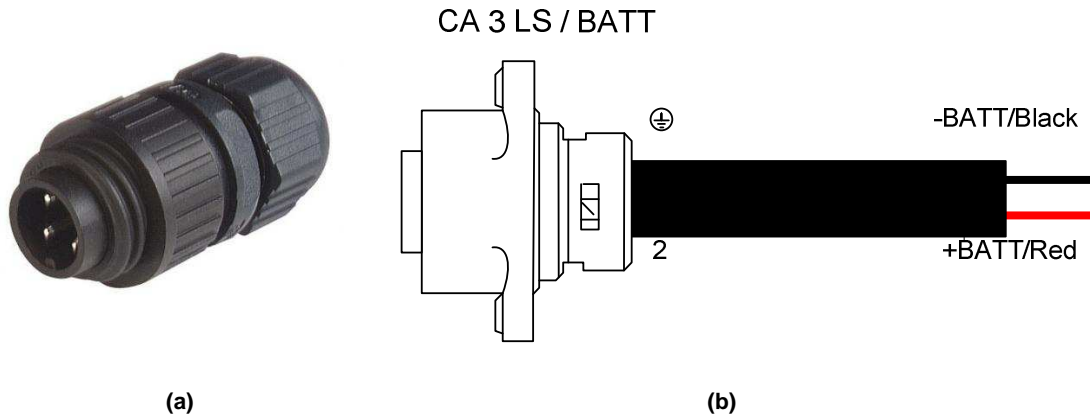


Figure 4.7– a) Hirschmann CA 3 LS connector and b) electric connection

4.3 Serial to WLAN radio cable

One seven poles power connector from Hirschmann code CA 6 LS (figure 4.8.a), one EN3C9M26 connector; and 7.5m of audio cable (Conrad code 600807 - 62). Connections are presented in figure 4.8.b

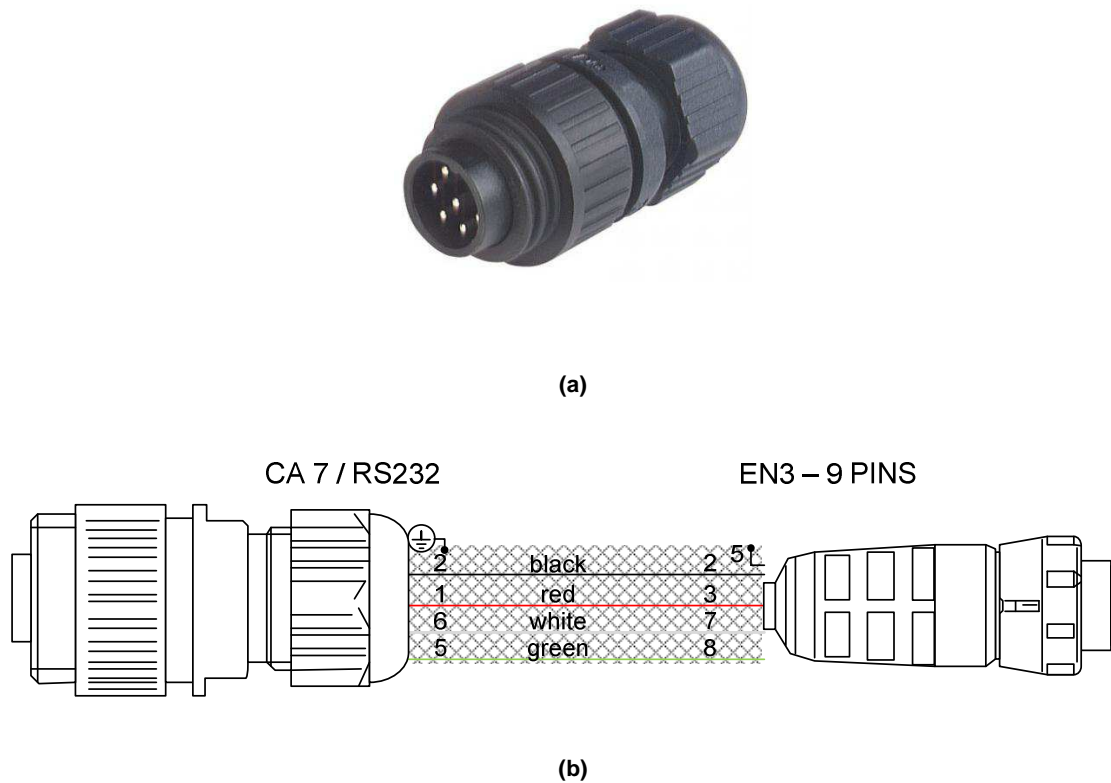


Figure 4.8– a) Hirschmann CA 6 LS connector and b) electric connection

5 POWER BOX WIRING

With all connectors mounted at Power Box, final wiring is required. Figure 5.1 shows the wiring distribution; use this figure as guide to follow wiring instructions.

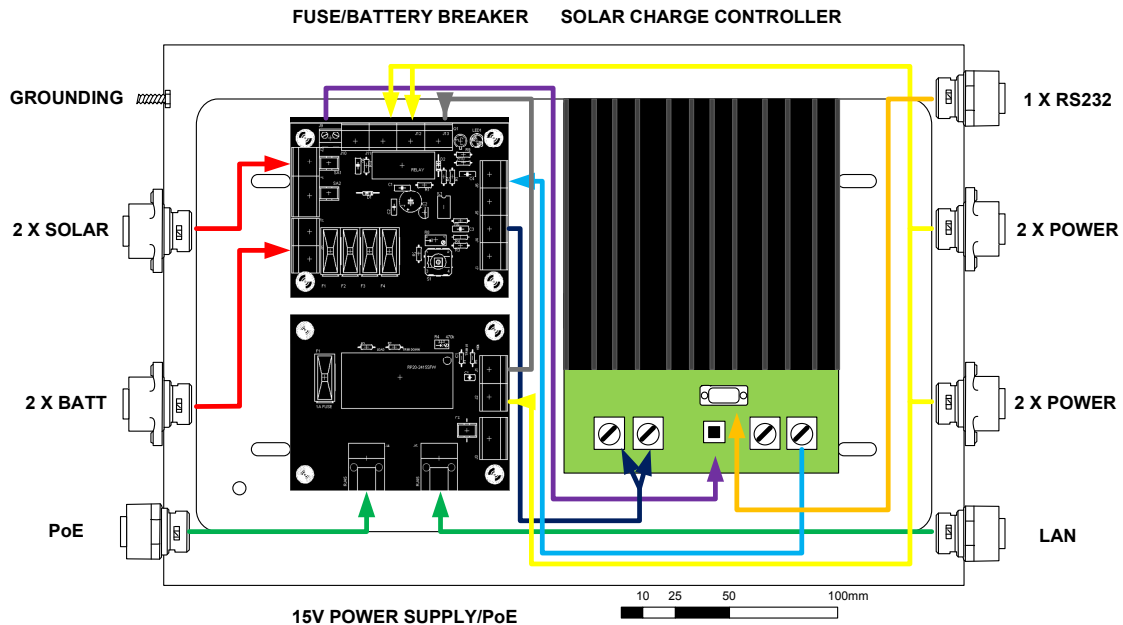


Figure 5.1– Wiring distribution.

5.1 Wiring Instructions

- 1) Use a 2X1mm² section cable, connect the battery output at fuse/battery breaker circuit to the sensor input at solar charge controller (violet colour line);
- 2) Use two 2mm² cables (red and black), to create a power bridge between the fuse/battery breaker board and the PoE board (gray colour line);
- 3) Connect the two battery and the two solar panel connectors into the fuse/battery breaker board (red colour line);
- 4) Connect the PoE and the LAN connectors into the PoE board (green colour line);
- 5) Connect input and output terminals from the solar charge controller to the fuse/battery breaker board (light and dark blue colour lines);

- 6) Connect the RS232 connector to the solar charge controller serial port (orange colour line);
- 7) Connect all four power connectors, three into the fuse/battery breaker board and one into the PoE board (yellow colour line).

6 COMPONENT LIST

Q.	Description	Code	Provider
1	1450 YELLOW PELI-CASE	1450 Y	MCCF
1	Mounting platte	NO CODE	UH
1	Morningstar solar charger model ST-45	24000029	Wagner
1	Connector LTW panel	IN-PL-4UXASXX	COMPONA
1	Square flange receptacle RJ45 - RJF21B	448-1683	RS
1	Panel Gasket	537-2085	RS
1	Dust cover RJF C 2B	448-1728	RS
1	RJF Steckerkappe	4481706	RS
1	RJF STECKER IP67	4481677	RS
6	GERÄTEDOSE 4 POLIG 380 V 16 A	739332-62	CONRAD
2	GERÄTESTECKER 4 POLIG 380 V 16 A	739324-LN	CONRAD
1	GERÄTEDOSE 7 POLIG 250 V 10 A	739383-LN	CONRAD
7	KAPPE FÜR 739332/739383	739154-LN	CONRAD
2	KAPPE FÜR 739324/739413	739162-LN	CONRAD
0.15	VERDRAHTUNGSLEITUNG H07V-K 1X16,00GN-GE	600074 - 62	CONRAD
16	100ER LINSENKOPFSCHRAUBE DIN 7985 M3 x 6	815322 - 62	CONRAD
22	100ER LINSENKOPFSCHRAUBE DIN 7985 M 3x16	815381 - 62	CONRAD
22	100ER SECHSKANT-MUTTER VERZINKT M 3	815624 - 62	CONRAD
22	100ER BEILAGSCHEIBE DIN 125 ZN A 3,2	814628 - 62	CONRAD
8	10ER ABSTANDSBOLZEN M3 20X20	521663 - 62	CONRAD
4	25ER TR FASTENERS — STUD, CONNECT, BZP, M6X18	1419436	FARNELL
8	50ER LINSENKOPFSCHRAUBE DIN 7985 M6 X 10	827149 - 62	CONRAD
1	100ER LINSENZYLINDERSCHR DIN 7985 M6X30	839651 - 62	CONRAD
2	50ER SECHSKANTMUTTER M 6	815390 - 62	CONRAD
6	100ER BEILAGSCHEIBE DIN 125 ZN A 6,4	814717 - 62	CONRAD
10	KABELBINDER 2,5X100 NATUR T18R 100 ST	546380 - 62	CONRAD
7.5	(metres) NIEDERVOLTLEITUNG 2X4 MM (FIL.100051)	600628 - 62	CONRAD
2	KABELDOSE 4 POLIG 380 V 16 A	739316-62	CONRAD
4	(metres) NIEDERVOLTLEITUNG 2X4 MM (FIL.100051)	600628 - 62	CONRAD
2	KABELSTECKER 4 POLIG 380 V 16 A	739308-62	CONRAD
2	BATTERIEKLEMME 25 A +	736570 - 62	CONRAD
2	BATTERIEKLEMME 25 A -	736589 - 62	CONRAD
3	(metres) NIEDERVOLTLEITUNG 2X4 MM (FIL.100051)	600628 - 62	CONRAD
2	KABELSTECKER 4 POLIG 380 V 16 A	739308-62	CONRAD
2	KABELSCHUH (RINGÖSEN) GELB Ø 6.5	737126 - 62	CONRAD
3.5	Usar cable que resta en el lab	600074 - 62	CONRAD
0.5	(m) GESCHIRMTES AUDIO- & MSR KABEL	600807 - 62	CONRAD
1	SUB D-STIFTLEISTE 9 POLIG	742066 - 62	CONRAD
1	FLIP TOP HAUBE FÜR D-SUB 9-POLIG	715968 - 62	CONRAD
2	RJ45 WESTERN STECKER RUNDK. GESCH. 5St.	922642 - 62	CONRAD
2	RJ45 WESTERN STECKER RUNDK. GESCH. 5St.	922642 - 62	CONRAD
0.5	(m) LITZE LIY-Z 2X1,0 SW/RT (FIL.100158)	607002 - 62	CONRAD
2.5	ADERLEITUNG UL(MTW)-CSA-HAR-ADER RD 100M	601537 - 62	CONRAD
1.8	ADERLEITUNG UL(MTW)-CSA-HAR-ADER BK 100M	601564 - 62	CONRAD
1.7	ADERLEITUNG UL(MTW)-CSA-HAR-ADER RD 100M	601573 - 62	CONRAD
1.7	ADERLEITUNG UL(MTW)-CSA-HAR-ADER BK 100M	601508 - 62	CONRAD
1	PV-Solarmodul BP 380J; 80Wp	21000147	Wagner
1	batteries		

2	KABELDOSE 4 POLIG 380 V 16 A	739316-62	CONRAD
2	GERÄTESTECKER 4 POLIG 380 V 16 A	739324-LN	CONRAD