Installation guide

P2S

plug&single-phase

P2S powered by
epic power

Version 3.3.en

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Epic Power Converters S.L.

Content of the Guide

1. P2S GENERAL DESCRIPTION

Plug & single-phase system, P2S, is a new electronic device that allows to fully supplying an elevator with **single-phase** mains, **with 500W of maximum power consumption from the supply system**. Furthermore, **it allows one hundred elevator trips** in case of energy supply disruption, making unnecessary the addition of a conventional UPS.

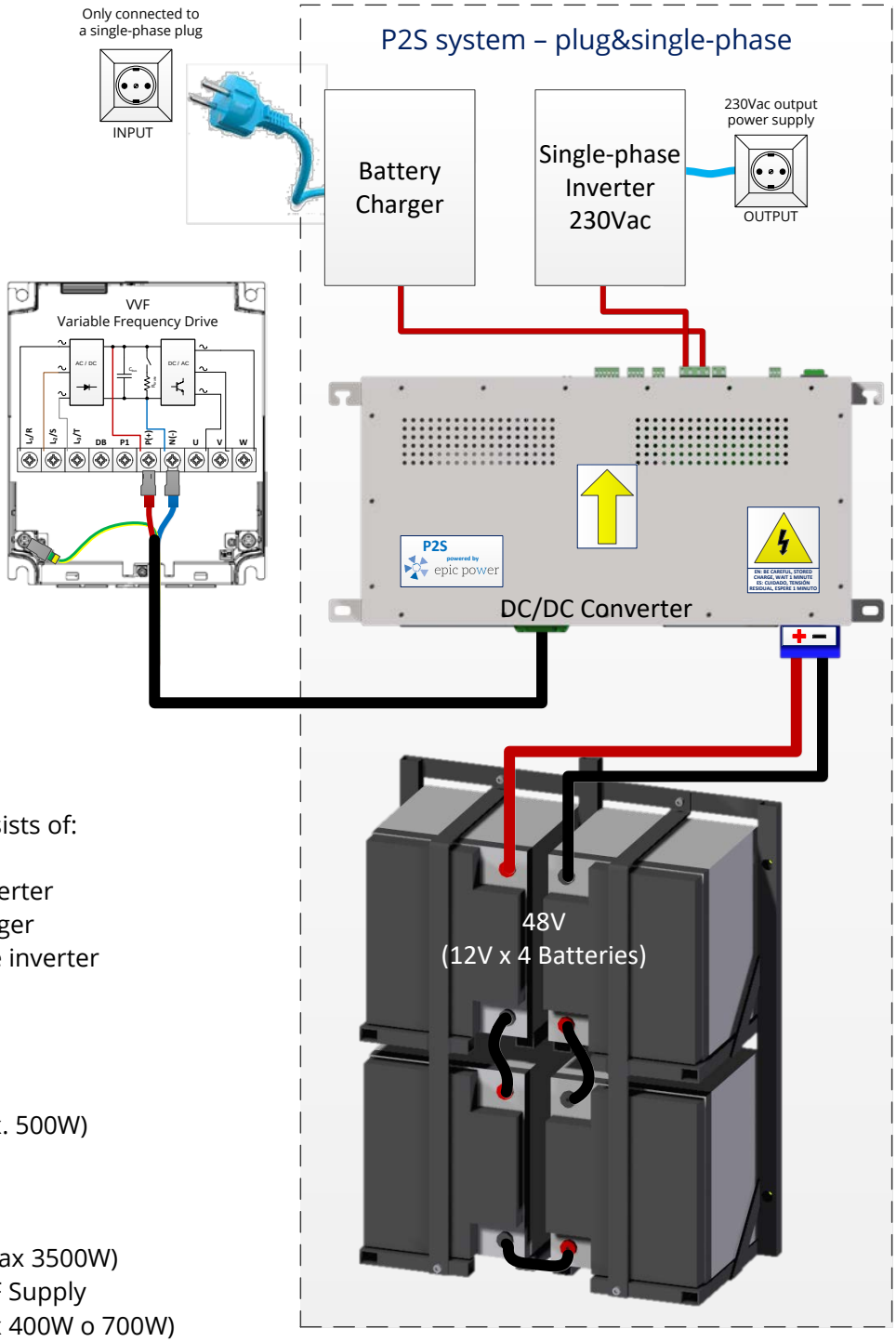
It can be used both in new constructions and in existing elevators (as long as they have a VVVF Lift Drive), with very simple maintenance.

P2S performance is based in charging a battery in two different ways. First one, a charger with very low peak power (500W) withdraws energy from the electric supply. Second one, by storing the energy the elevator engine generates, that is, when the motor is braking. . In conventional elevators, this energy is dissipated as heat in the brake resistors. However, under no circumstances does P2S replace this security device.

This results in two different monetary savings. Firstly, there is up to 55% energy savings of the traction (reusing braking energy). Secondly, the peak power contracted can be reduced significantly (which usually implies lower contract costs, although this depends on the installation country).

In order to achieve a fully self-sufficient and sustainable elevator, P2S system also allows for connecting solar panels.

2. P2S EXTERNAL DESCRIPTION



P2S system consists of:

- DC/DC Converter
- Battery charger
- Single-Phase inverter
- Batteries.

Supply Input:

- 230Vac (max. 500W)

Supply Output:

- 560V Vdc (max 3500W)
  - VVVF Supply
- 230Vac (max 400W o 700W)
  - Brakes, lighting supply

Fig. 1 P2S System

2.1. DC/DC CONVERTER

The next figure describes P2S DC/DC converter external connections.

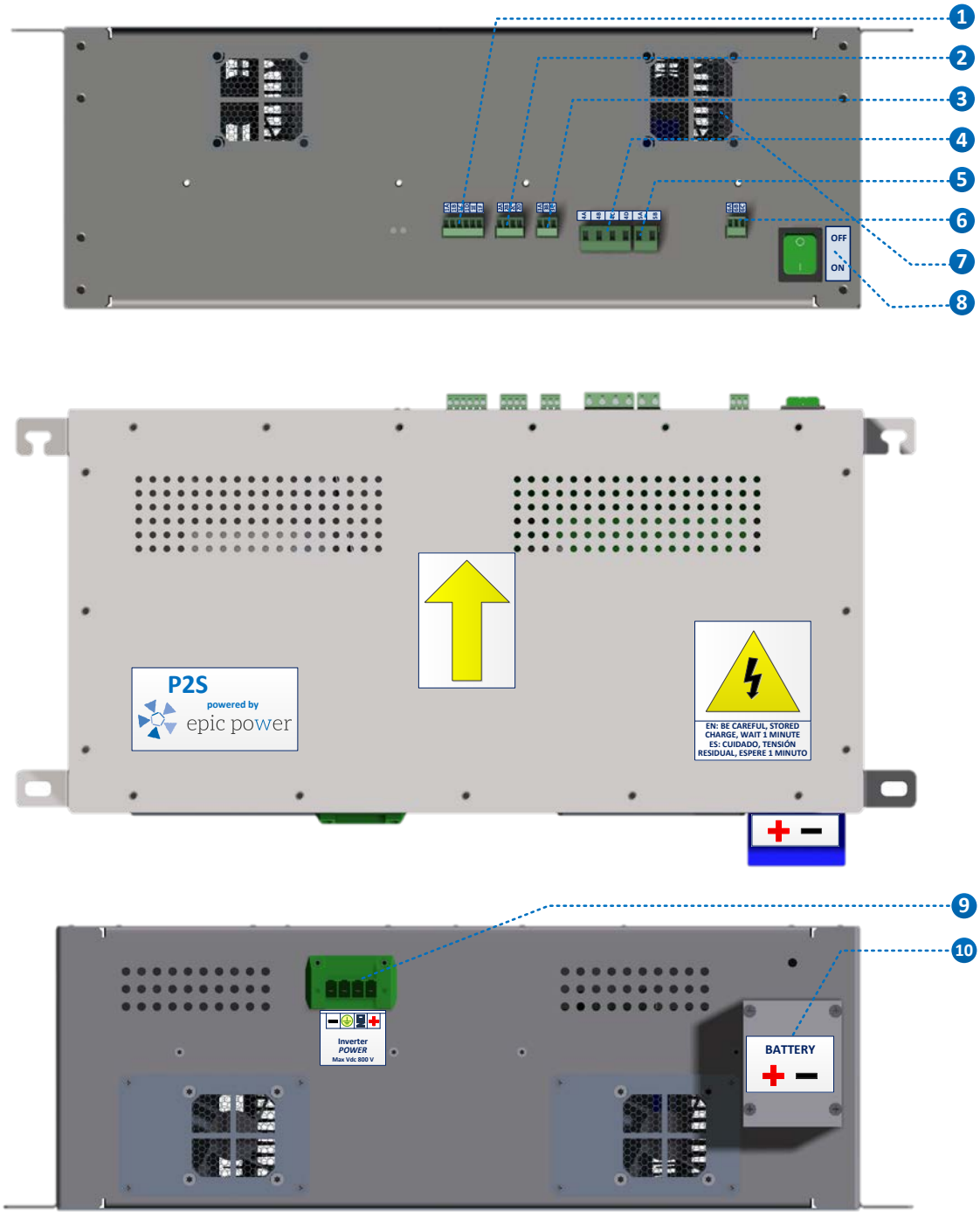
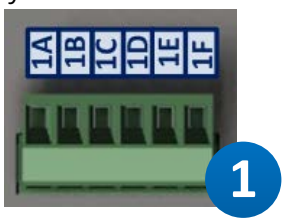


Fig. 2 DC/DC Converter connections

1) OUTPUTS to CONTROLLER:
   - 1A) GND: Common ground connection of terminals 1B, 1C, 1D, 1E y 1F.
   - 1B) STATUS OK: (Normally Open). When this terminal is short-circuited to ground it indicates that the DC/DC converter is in operation and therefore, it is supplying the DC link of the drive, so the drive is energized.
   - 1C) LOW BATTERY 1 NC (Normally Close): Open circuited indicates that the battery SOC (State-Of-Charge) is less than 30%
   - 1D) LOW BATTERY 1 NO (Normally Open): Short-circuited to ground indicates that the battery SOC is less than 30%
   - 1E) LOW BATTERY 2 NO: (Normally Open) Short-circuited to ground indicates that the battery SOC is less than 60%
   - 1F) AC CHARGER ON: (Normally Open) Short-circuited to ground it indicates to the controller that the charger is operating correctly. Con circuito cerrado a masa indica a la maniobra que el cargador de red está funcionando correctamente.



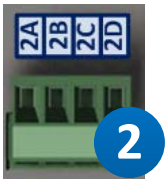
IMPORTANT NOTE: These outputs should never withstand voltages higher than 24V DC or 250V in AC. Outputs should never conduct currents higher than 5A.

MODE	CONDITION	OUTPUT STATUS 1C	OUTPUT STATUS 1D	OUTPUT STATUS 1E	VVVF STATUS
1	SOc => 60%	Close	Open	Abierto	ON
2	30% <= SOc < 60%	Close	Open	Close	ON
3	SoC < 30%	Abierto	Cerrado	Abierto	ON
4	SoC <= 15%	Abierto	Cerrado	Cerrado	OFF

Once the state-of-charge (SoC) is below 30%, the system enters mode 3. The controller should recognize and process this signal to end the travel in progress (if any) and stop the elevator until this signal does no longer appear. Once the SoC is above 30%, the system enters mode 2 and the controller may allow the elevator to move, but not before that. A travel should not be started under mode 3.

When the system enters mode 4, it would not be possible to move the elevator because the VVVF drive would be turned off (the converters is not supplying energy to drive). The system will return to mode 3 when SoC is above 17%.

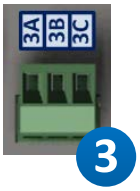
2) OUTPUTS to AUXILIARY ELEMENTS:



- 2A) and 2B) (Remote Control) RC INVERTER + and -: This output is short-circuited to disable the inverter.
    - For example, the inverter can be disabled by controller requirement (using input ENABLE INV (3C).

  If the DC/DC converter is turned off with the main switch, the inverter will also be disabled.
- 2C) and 2D) (Remote Control) RC CHARGER + and -: A short-circuit between terminals 2A and 2B disables the battery charger.
    - For example, the DC/DC converter disables the charger when the solar regulator is in operation and if there is enough solar radiation. For that particular case, the consumption from mains would be zero.

3) INPUTS from the CONTROLLER:



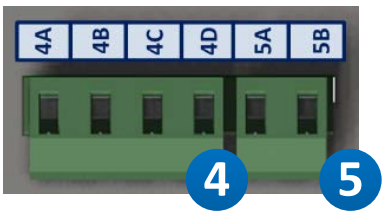
- 3A) GND: Common ground for the ENABLE inputs (3B and 3C).
- 3B) ENABLE DC/DC: DC/DC Converter enabling or disabling input. To provide energy to the DC bus, it is mandatory that the controller short-circuits terminals 3A and ·3B. The controller may use this option to turn off the drive to avoid standby consumption.

3C) ENABLE INVERTER: Input to enable or disable the complete supply of the elevator. When terminal 3C is short-circuited to 3A, both DC/DC converter and inverter are enabled, thus the elevator is being supplied (drive and all the rest). If 3C and 3A are in open circuit both DC/DC converter and AC inverter are disabled and there is NO supply being provided to any element of the elevator.

4) POWER CONNECTIONS (1)

- 4A) BATTERY TO INVERTER +: Supplies the inverter from the battery, positive terminal
- 4B) BATTERY TO INVERTER -: Supplies the inverter from the battery, negative terminal
- 4C) AC+ CHARGER: Battery charger to battery, positive terminal.
- 4D) AC- CHARGER: Battery charger to battery, negative terminal.

5) POWER CONNECTIONS (2)



- 5A) PV+ CHARGER: Solar regulator charges the batteries from the solar panels. It is only of interest if the solar regulator (MPPT) has been purchased (P2S with solar connectivity). Positive terminal.
- 5B) PV- CHARGER: Same as above, negative terminal to solar regulator.

6) CAN: CAN connectivity to controller (optional)

- 6A) GND
- 6B) CAN HIGH

- 6C) CAN LOW
  Nota: For CAN connectivity please contact epic power

7) FAN

8) “ON OFF”: Main switch of DC/DC converter.
In the OFF position, both the supply to the drive, as well as the output of the AC inverter will be disabled.

9) “Inverter POWER”: Output to the DC bus of the drive. Typically, to connectors named N(-), EARTH, NC, P(+) in the drive.

10) “BATTERY”: Connection to battery pack.

2.2. Battery Charger

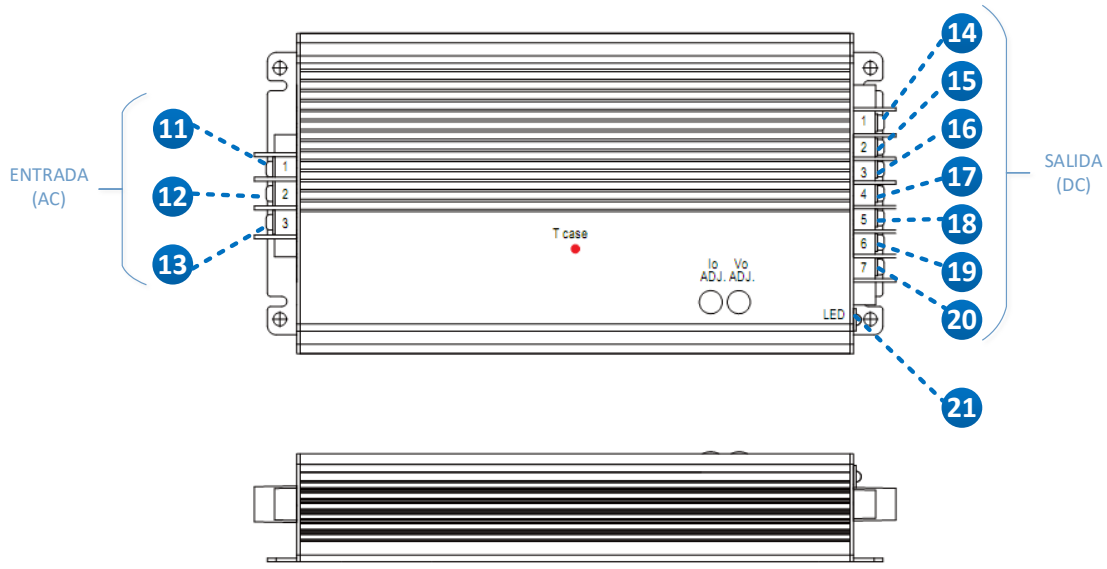


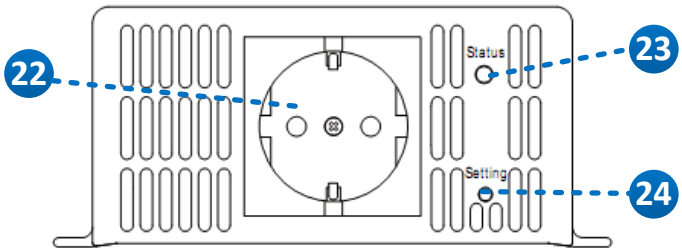
Fig. 3 Battery charger (1)

11) Ground connection–(FG)
12) AC connection (Phase) – (AC/L)
13) AC connection (Neutral) – (AC/N)
14) Conexión con el terminal RC CHARGER + del convertidor DC/DC– (RC+)
15) Conexión con el terminal RC CHARGER - del convertidor DC/DC – (RC- & GND)
16) Do not connect – ($+5V_{SB}$)
17) Battery negative terminal connection – (-V)
    i) Same electric node as (18)
18) Battery negative terminal connection – (-V)
    i) Same electric node as (17)
19) Battery positive terminal connection – (+V)
    i) Same electric node as (20)
20) Battery positive terminal connection – (+V)
    i) Same electric node as (19)
21) LED indicator

Fig. 4 Battery charger (2)

2.3. Single-phase inverter

Front view



Rear view

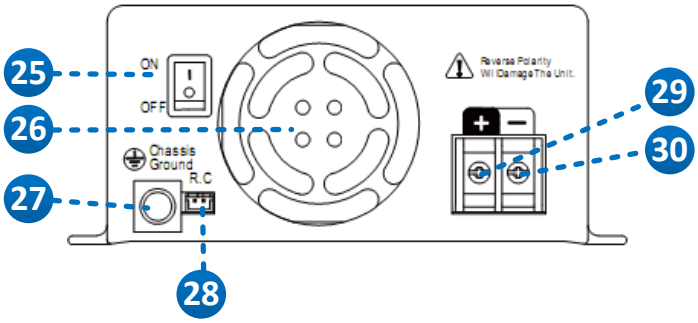


Fig. 5 Single-phase inverter (1)

22) 230Vac Output
    i) Supplies all single-phase elements of the elevator.
23) LED diode Status
    i) Green
24) Setting button
    i) Allows output voltage switching between 220Vac and 240Vac, and frequency switching between 50Hz y 60Hz.
    ii) Default output set at 230Vac and 50Hz
25) ON/OFF Switch
26) Fan
27) Ground connection.
28) RC: Connected to terminals "RC inverter +" and "RC inverter -" of the converter (terminals 2A and 2B).
29) Battery positive DC Input
30) Battery negative DC Input

Fig. 6 Single-phase inverter (2)

2.4. Batteries

Different types of batteries are needed and should be installed according to elevator features (elevator travel and rated load). Thus, two battery sizes are available: SMALL y MEDIUM. epic power will provide the necessary advice in order to select the most suited set of batteries in each deployment.

2.4.1.Small Batteries

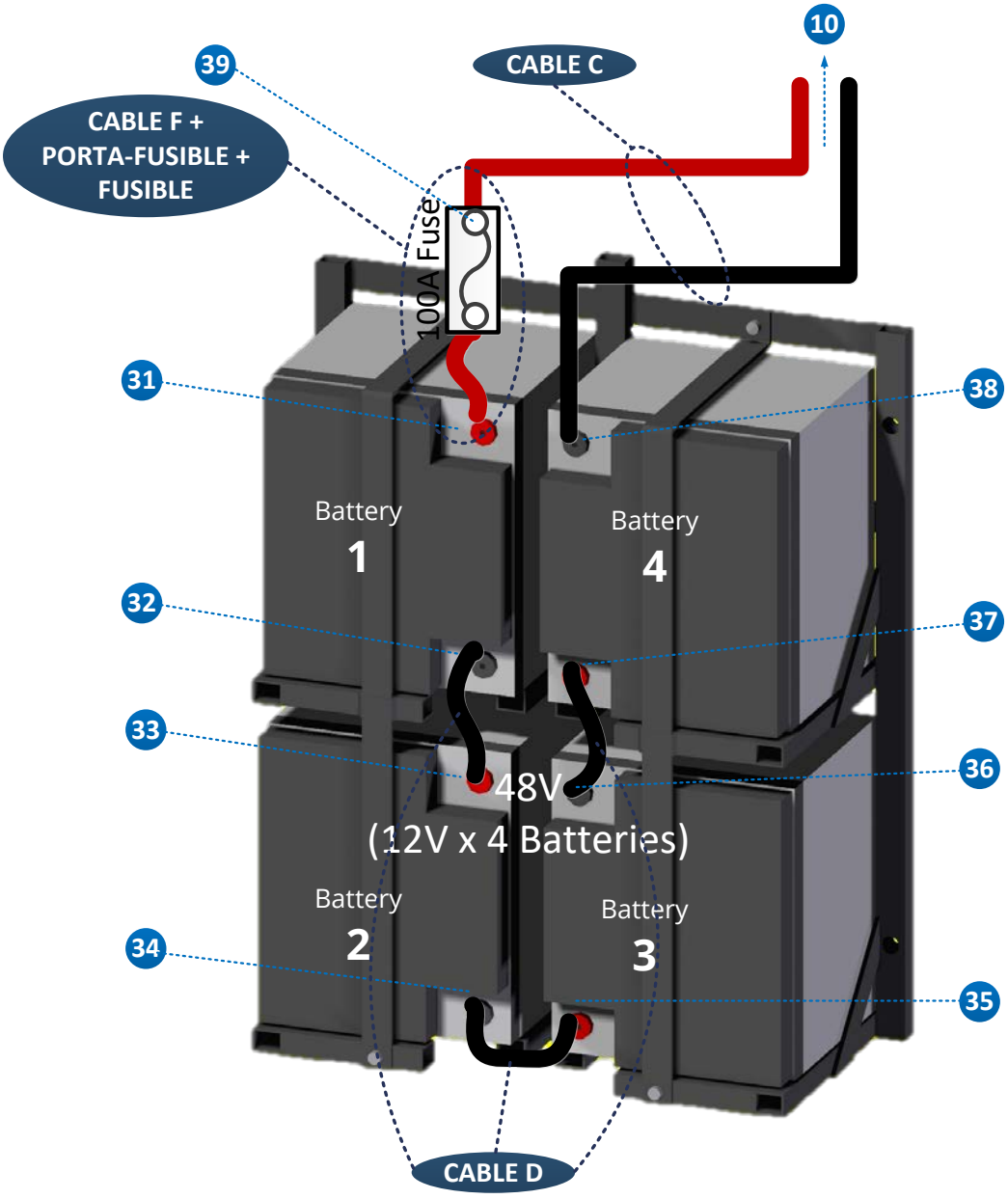


Fig. 7 Small batteries frame, port numbering and port wiring.

2.4.2. Medium Batteries

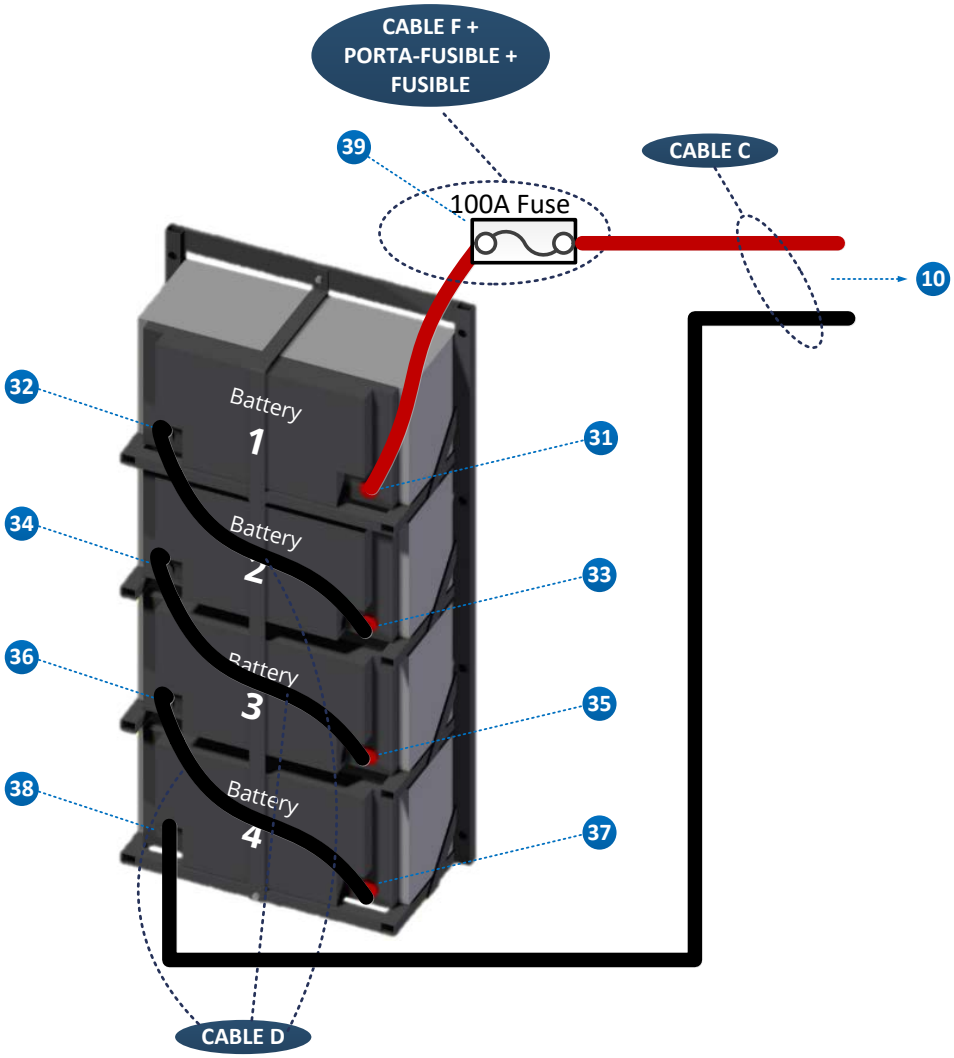


Fig. 8 Medium batteries frame, port numbering and port wiring

31) Positive terminal of battery 1
32) Negative terminal battery 1
33) Positive terminal of battery 2
34) Negative terminal battery 2
35) Positive terminal of battery 3
36) Negative terminal battery 3
37) Positive terminal of battery 4
38) Negative terminal battery 4
39) Fuse and fuse-holder

2.5. Cables provided with the system

- CABLE type A: VVVF Supply. Three 2.5mm^2 cored, three metre-long cable. Open Ports in one side, and aerial connector for 9 on the other side.
    - Connects “Inverter Power” output 9 at DC/DC converter, to VVVF Drive.

Fig. 8 Cable type A

- CABLE type B: Connection between batteries and AC inverter. Twisted four-wire cable of 2.5mm2 and 1m long. Aerial terminal on one side and U connectors on the other side.
    - Two of the wires connect the terminals “Battery to inverter +” 4 and “Battery to inverter -” 4 from the DC/DC converter to terminals 28 and 29 of the AC inverter.
    - The other two wires connect the terminals “AC+ charger” 4 and “AC- charger” 4 of the DC/DC converter to the terminals 19 and 18 of the battery charger.

Fig. 9 Cable type B

- CABLE type C: Connects batteries to DC/DC converter. Two 16mm^2 cored, 2 metres long twisted wire. Closed ports in both sides.
    - Connects DC/DC converter terminal 10 to terminal 30 and 37 at the batteries array.

Fig. 10 Cable type C

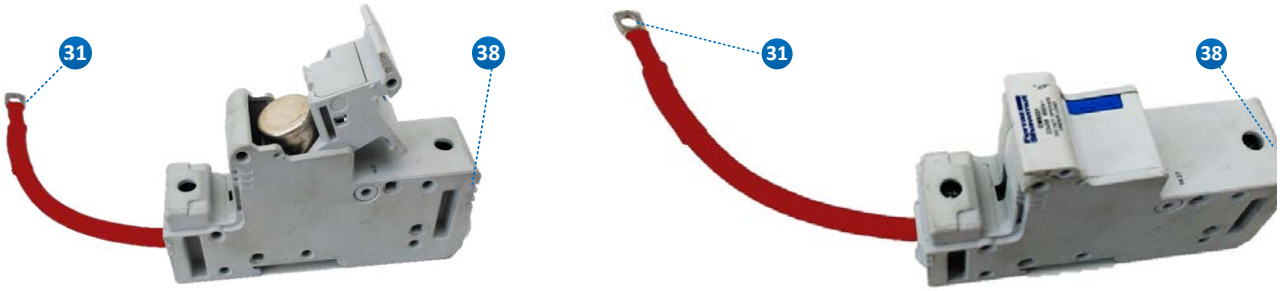
- CABLE type D: (3 units). Connects a couple of batteries. 16mm^2 and 15 cm long cable. Closed port in both sides.
    - First wire connects negative terminal at battery 1 (32) to positive terminal at battery 2 (33).
    - Second one connects negative terminal at battery 3 (36) to positive terminal at battery 4 (37).
    - Third one connects negative terminal at battery 2 (34) to positive terminal at battery 3 (35).

Fig. 11 Cable type D

- CABLE type E (optional): Twisted pair, two wires. 2.5mm^2 core an 65 cm long. Connects the solar regulator (MPPT) with the Dc/Dc converter.
    - Connection of terminals 5 and 5 of the DC, DC converter to the solar regulator.

Fig. 12 Cable type E (opcional)

- Cable type F + FUSE HOLDER + FUSE: 16mm^2 wire connected to a fuse holder. On one side, closed terminal (31). On the other side, fuse holder connection (39).
    - Connects positive terminal of battery 1 (31) to positive terminal at red core in CABLE C(39)
        - It inserts a fuse between the batteries and the DC/DC converter.



a) Fuse holder open b) Fuse holder closed

Fig. 13 Cable type F + fuse holder + fuse

- CABLE type G: Four wire cable terminated in an aerial connector on one side and male PCB connector on the other (two wires) and U terminals in the other two wires. It is 1m long.
    - o Connects terminals RC INVERTER + (2A), RC INVERTER - (2B) of the DC/DC Converter to the connector 28 of the single-phase inverter and RC CHARGER + (2C) y RC CHARGER - (2D) of the DC/DC Converter to terminals 14 and 15 of the battery charger.

Fig. 14 Cable type G

2.6. Optional accessories

2.6.1.Solar charger or MPPT

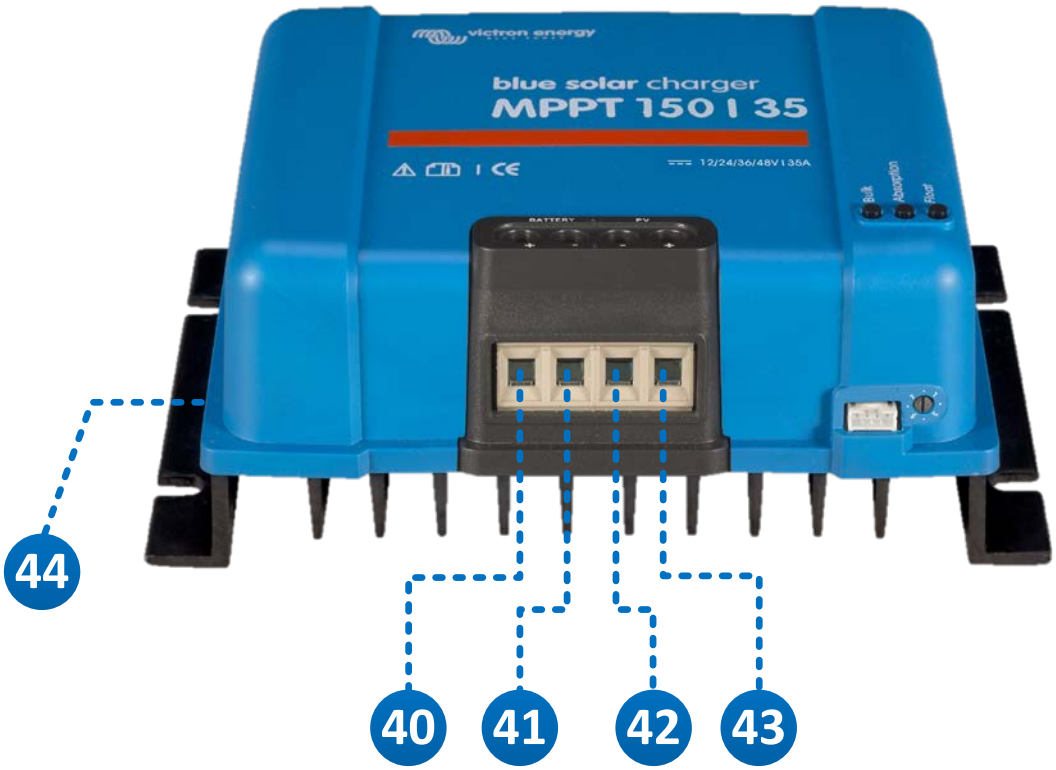
Fig. 15 Solar charger (MPPT)

To charge the batteries with solar energy, a solar charger or solar panel regulator is included as an option. This MPPT or solar charger enables the connection to solar panels. The solar charger has the following technical features.

Description	Value
Reference	MPPT 150/35
Maximum current to battery	35A
Maximum charge current	16.25 A
Máximum open-circuit FV	150V
Maximum efficiency	98%
Operating temperature	-30 ÷60ºC (40º for nominal power)
Weight	1.25 Kg

IMPORTANT NOTE: FV voltage must exceed in 5V the voltage of the battery (Vbat) for the controller to be started. Once in operation, the minimum FV should be Vbat + 1V.

This device is connected to the DC/DC converter and to the solar panels. Taking into consideration the specifications of the batteries, the maximum solar power that can be installed is 800W. It is very important to revise the solar panel features to make sure they are compatible with this solar charger. As an example, for solar panels of short-circtui current of 8.1A and 36V in maximum power, two panels have to be connected in series to match the regulator requirements.

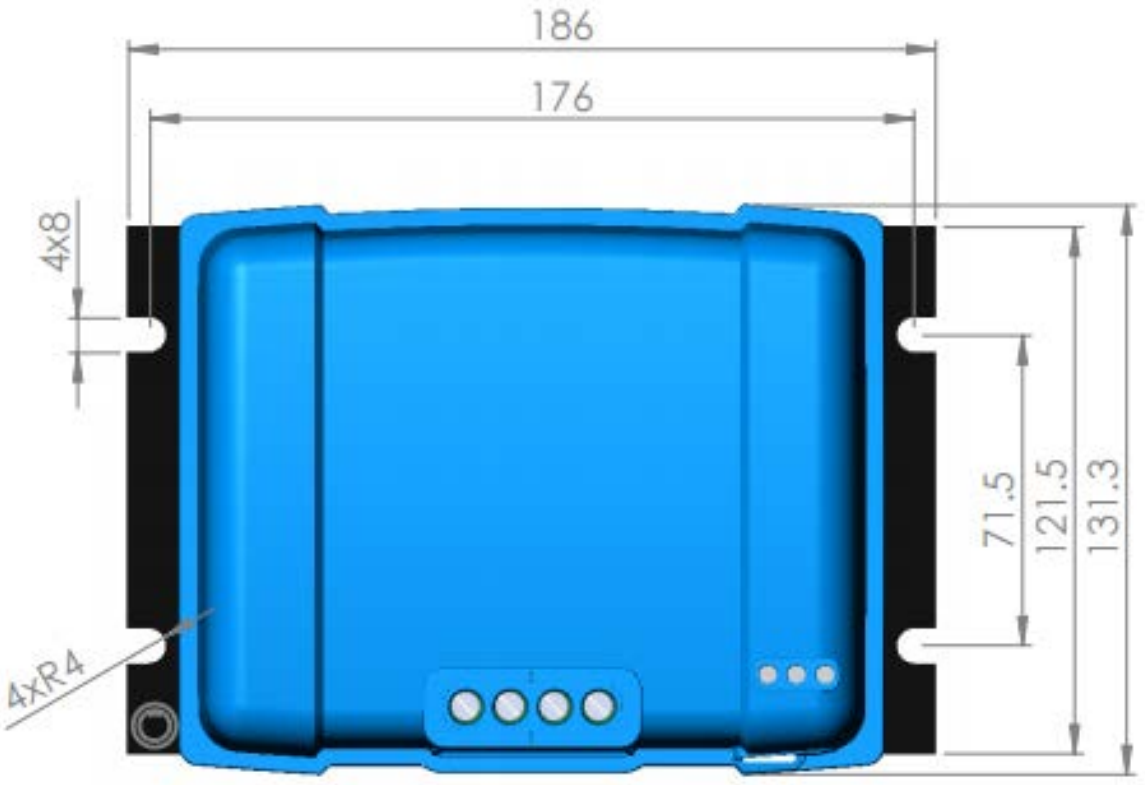


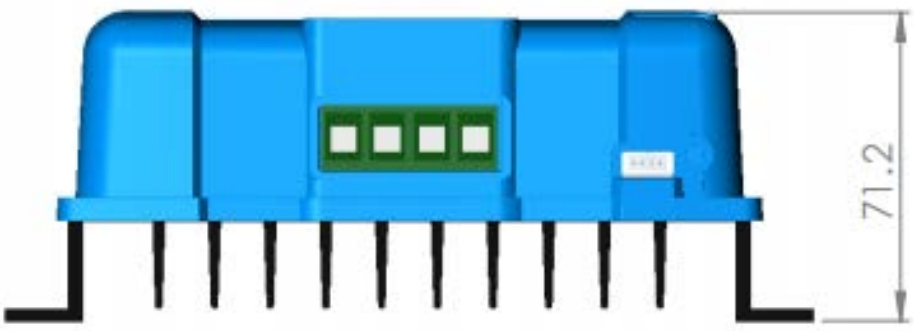
40) "BATTERY +": Connected to terminal 5A of the DC/DC converter with the red wire of cable type E.

41) "BATTERY -": Connected to terminal 5B of the DC/DC converter with the black wire of cable type E.

42) "PV -": Connection to solar panels. .
43) "PV +": Connection to solar panels
44) Connection to GND

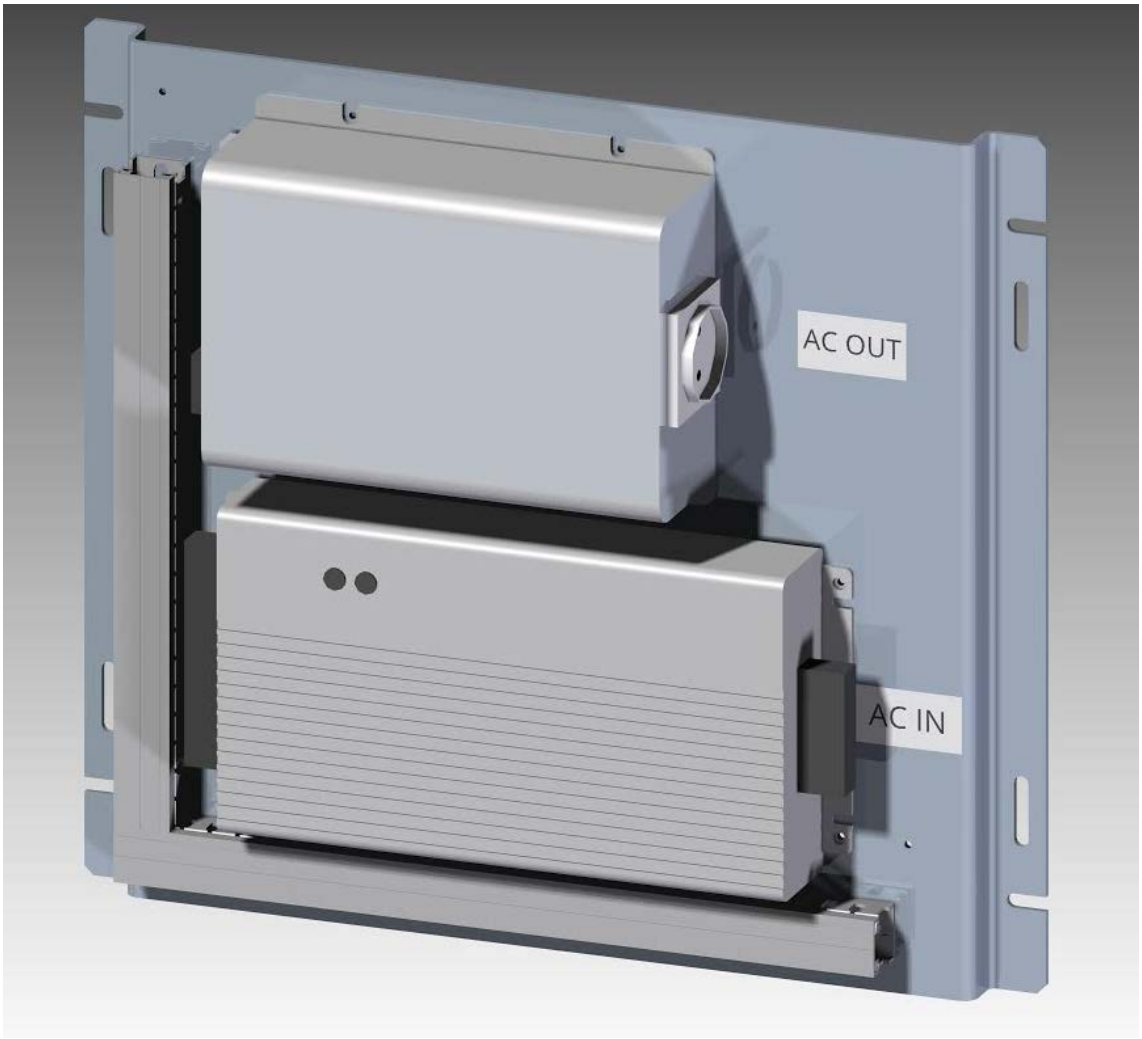
Solar charger dimensions





2.6.2.Holder tray

A metallic plate can be purchased for greater ease when installing and wiring the multiple components. The battery charger and the inverter are already installed and pre-wired.



You can skip some installation steps of chapter 3 if you have acquired this item..

If, in addition to this accessory, the solar charger has been acquired, the solar charger will be fixed in the holder tray

3. P2S INSTALLATION PROCEDURE

3.1. Prerequisites to be met before the installation

P2S provides two different supply systems:

- VVVF supply:

Installation should meet the following requisites in order to be able to accommodate a P2S system:

- o It must have a VVVF 380～400V.
- o Power terminals at VVVF (+ and -) must be accessible, and connected to the DC bus. These connectors are common in most commercial VVVF drives (for instance, Frenic-Lift from Fuji or Control Techniques). They are usually placed at the power connector and may have different designations, such as P(+) or N(-). They are normally accessible because they are used to connect external DC rescue voltage or other regenerative systems. Consult your lift guide to verify the location of the connections.

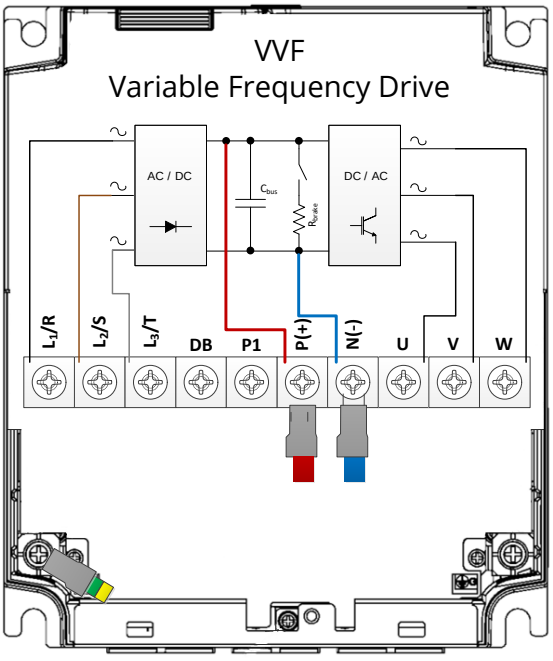


Fig. 16 Needed VVVF connection

- o Correct and doubtless identification of these terminals is essential. P2S system and/or VVVF may be otherwise damaged.

- 230Vac Supply
    - P2S 230Vac inverter provides a single-phase supply.
    - Identify each one of the elements which need to be connected to this supply, so they will keep on working in case of mains energy supply disruption.

3.2. Installation

If you have previously acquired the holding tray as an extra accessory, you may skip the steps marked with two asterisks (**).

These are the steps to install:

a) In order to prevent P2S system from water splashes or dust, choose a vertical surface to hang the components. Likewise, a close-to-the-VVVF Drive surface should be chosen, with the purpose of minimizing cable length.

i. P2S DC/DC converter should always be attached to a vertical surface, with the indication arrow pointing upwards. Make room in front of the ventilation grille (at least, 250mm). Otherwise, cooling system may not operate properly and the converter may become damaged.

If the tray has been acquired, it should be placed as it is shown in the picture.

ii. ** Single-phase inverter should be placed in a horizontal position; thereafter its cooling system remains horizontal too.

1. Do not place the single-phase inverter far from the DC/DC converter. Provided wire may not be long enough. The switch of this inverter 25 should be OFF.

iii. ** Battery Charger may be placed in any position.

1. Do not place battery charger far from the DC/DC converter. Provided wire may not be long enough.

iv. Batteries and battery frame must be placed

and attached as shown in the picture.

1. Do not place batteries more than 3 metres away from the DC/DC converter. Provided wires may not be long enough.

b. Once each component has been placed on the wall, go on wiring them. P2S components should be wired first, before connecting the elevator:

i. Battery wiring (follow suggested order). Each terminal screw must have its own tightening torque (2.5Nm).

1. Connect battery 1 to battery 2 with a D type cable (see Fig. 17)
2. Connect battery 3 to battery 4 with a D type cable (see Fig. 17)
3. Connect battery 2 to battery 3 with a D type cable (see Fig. 17)
4. Connect battery 1 positive terminal to closed terminal at cable F (31).
5. Before making the next connection, open the fuse holder (see Fig. 13b).
6. Connect C cable red core to DC/DC converter 10 terminal and to fuse holder 39 terminal.
   . It is VERY IMPORTANT to observe polarity at DC/DC converter 10 connector (see Fig. 2).
7. Connect C cable black core to DC/DC converter 10 connector and to battery 4 negative terminal (38).
   . It is VERY IMPORTANT to observe polarity at DC/DC converter 10 connector (see Fig. 2).
8. While doing these steps, **KEEP THE FUSE HOLDER OPENED** (see Fig. 13b)

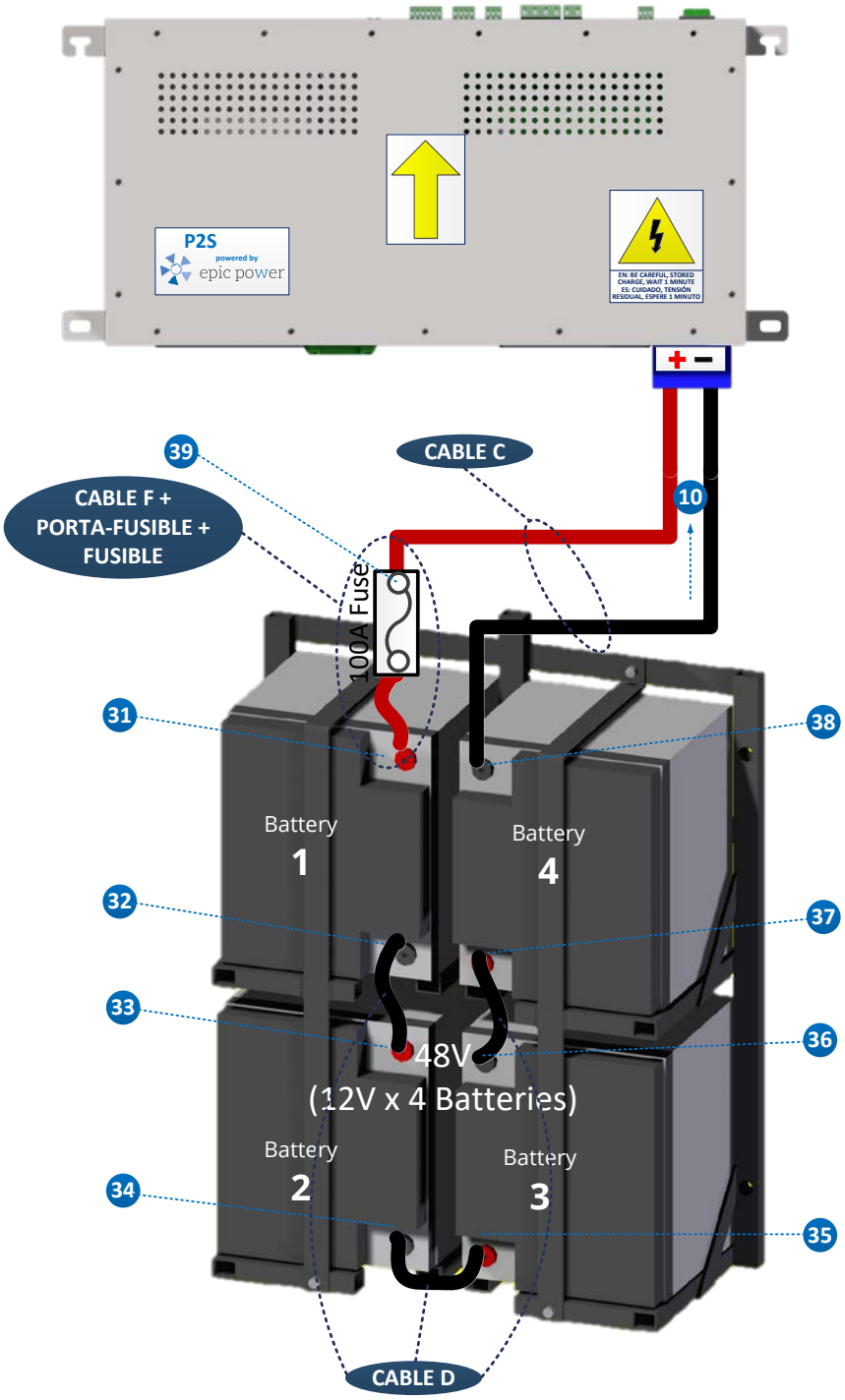


Fig. 17 Small batteries and DC/DC converter wiring

NOTE: This is how the installation should look like using small batteries. The wiring shall be the same, even using other kind of batteries.

ii. Connecting the AC inverter

1. Using cable type B, connect “BATTERY TO INVERTER +" 4A and “BATTERY TO INVERTER -" 4B form the DC/DC converter to 29 (brown) and 30 (blue) of the AC inverter.
2. Using cable type G, connect the terminals “RC INVERTER +" 2A and “RC INVERTER -" 2B of the DC/DC converter to terminal 28 of the AC inverter.
3. Connect terminal 27 of the AC inverter to installation ground. In case you have purchased the holding tray, make sure this connection is made.

iii. Connecting the battery charger

1. Using a CABLE type B connect outputs “AC CHARGER +" 4C and “AC CHARGER -" 4D of the DC/DC converter with the terminals 20 (brown) and 17 (blue) of the battery charger.
2. Using the CABLE type G connect “RC CHARGER +" 2C and “RC CHARGER -" 2D of the DC/DC converter with terminals 14 (red) and 15 (black) of the battery charger.
3. Connect terminal 11 of the battery charger to installation ground. If you have purchased the tray, make sure this connection is made.

c. Next step is to **disconnect electric mains, ensuring there is not voltage left in the nodes about to be handled**.
d. Wait a reasonable time according to your VVVF drive handbook. Get access to P (+) and N (-) drive terminals. See Fig. 18.

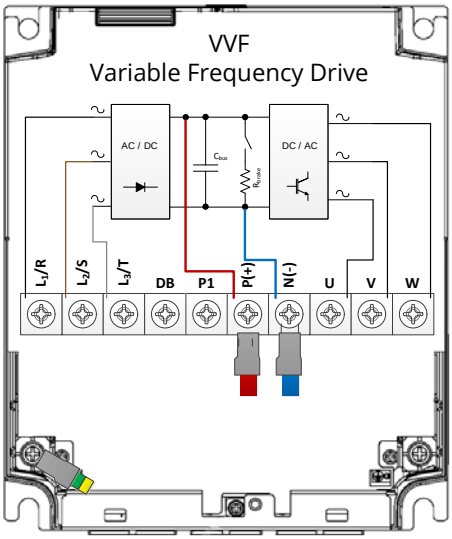


Fig. 18 VVVF connection through cable A terminals.

e. Check that residual voltage between P(+) and N(-) is within safe levels (lower than 50V) with the aid of a multimeter. Go on if it is safe. If not, wait.

f. Connect "Inverter POWER" terminal at DC/DC converter 9 to the VVVF drive through cable A. The female connector is located at the DC/DC converter bottom side. Cable A provides male connector. See Fig. 19

   i. **CAUTION**: From now on, the VVVF is going to be supplied through this connection. Make sure there is no other connection at the usual VVVF supply input, L_1/R, L_2/S, L_3/T

   ii. **CAUTION:** DC/DC converter "ON OFF" switch 8 must be in "OFF" position, and "ENABLE INVERTER" must be disabled (not short-circuited 3C and 3A). See Fig. 20.

   iii. **CAUTION**: DC/DC converter maximum nominal power is 3500W.Therefore, VVVF Drive must never draw power above this level. More information in section 3.4 "Maximum consumed power adjustment. CAUTION" will be given.

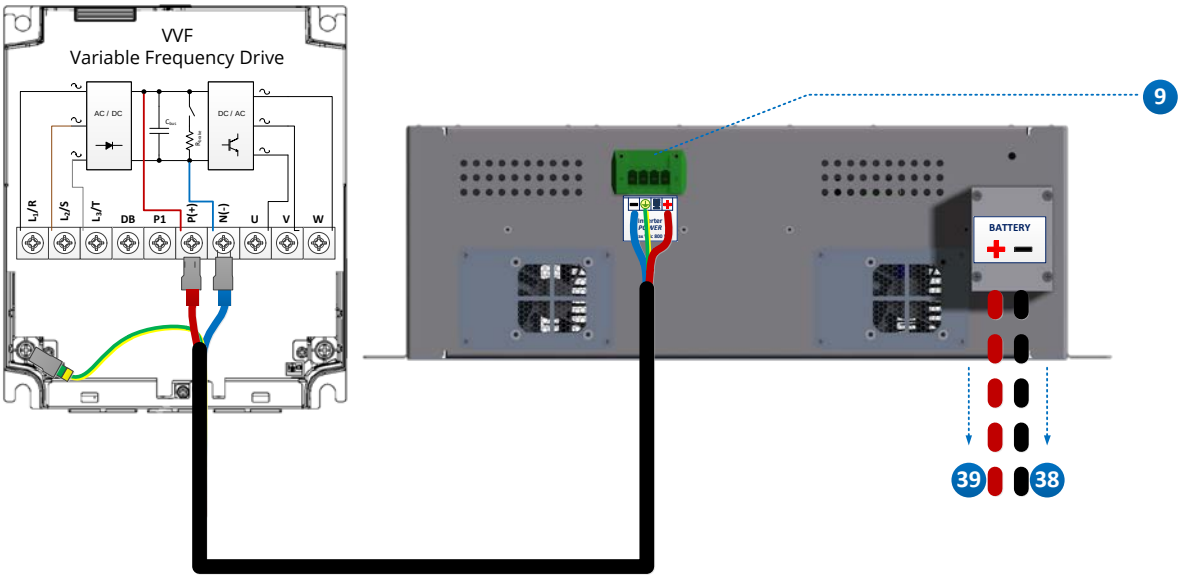


Fig. 19 DC/DC converter to VVVF Drive connection

Fig. 20 VVVF Drive supply output and Inverter V230ac output external enabling
(Short-circuited - ON / Open-circuited – OFF)

At this point, ***P2S*** system is already installed and ready for the first start up.

WARNING

IT IS ESSENTIAL to earth the conductor (minimum 1.5 mm^2 section).

If the connection stops, the system will keep on working, but will be isolated from the earth connection. It may become more dangerous for operators, and the system may result damaged.

WARNING

Supply must be shut down, and VVVF Drive must be disconnected from three-phase mains before making any connection. Otherwise, risk of electrocution exists for the operator. The drive and the P2S system may also become damaged.

WARNING

Connect firstly the positive wire (red) while CONNECTING the battery array.

Disconnect firstly the negative wire (black) while DISCONNECTING the battery array.

WARNING

Remember: battery array will remain charged after a system disconnection. DO NOT **SHORT-CIRCUIT THE BATTERY ARRAY TERMINALS UNDER ANY CIRCUMSTANCES.**

WARNING

Holding wires mechanical stress should not be supported by the terminals. Fixing flanges may be recommended.

WARNING

The system has been designed for weather conditinos type B, and pollution level 2. Check the manufacturer in any other case (epic power).

WARNING

Connection wire must have bullet style connectors, to prevent from loose threads (as the connection wire we provide, cable A).

3.3. P2S System Start Up

3.3.1.Before connecting

Once "Installation" chapter has been completed; you can proceed with the start-up steps. If you followed each one of the installation steps, everything should be found as follows. In any other case, fix it.

- Elevator is disconnected from electric mains.
- Each element is well adjusted to the wall.
- DC/DC converter, battery charger, single-phase inverter and batteries are wired.
- Each earth connection (DC/DC converter, battery charger and single-phase inverter) is properly wired. We recommend verifying it with a multimeter.
- Fuse holder is open (see Fig. 13b)
- DC/DC converter "ON OFF" switch (8) in OFF position.
- DC/DC converter "ENABLE INVERTER" terminals 3C 3A must not be shorted. See Fig. 20.
- Single-phase inverter ON/OFF switch (25) in OFF position.

3.3.2.Connection

a) Close fuse holder (see Fig. 13a)

b) Wire batteries charger terminals 11, 12 y 13 to single-phase mains. This will be the only source of energy consumption, as it is the only electric grid connection (make sure the supply is shut down before connecting).

   i) 11- Earth connection – (FG)
   ii) 12- AC (Phase) connection – (AC/L)
   iii) 13- AC (Neutral) connection – (AC/N)

c) VVVF Drive supply source has a double security layer: DC/DC converter "ON OFF" switch (8) and "ENABLE" terminal 1. See Fig. 20

   i) **CAUTION:** Elevator controller should, in any case, control external enabling "ENABLE INVERTER" 3C 3A, thereby drive supply is automatically disabled without the need for switching on DC/DC converters "ON OFF" switch (8).
      - "ENABLE INVERTER" and "ENABLE DC/DC" 3C 3B 3A terminal must be shorted, (see Fig. 20) for its correct functioning.
   ii) Turn ON DC/DC converter "ON OFF" switch (8).
      - VVVF Drive will turn on after a few seconds.

d) Turn ON single-phase inverter "ON/OFF" switch (25).

i) The inverter will provide 230Vac. If you made all necessary connections, the elevator will begin to work properly.

e) The lift is ready to operate.

3.4. Maximum consumed power adjustment. CAUTION

As mentioned above, DC/DC converter is able to supply up to 3500W to the VVVF Drive. Therefore, drive maximum consumed power cannot go beyond this value. Some parameters should be adjusted according to elevator features.

The two parameters that may make the elevator demand more power are, roughly speaking, cabin speed and load. Thus, as maximum allowed load is stablished by the elevator, we can only adjust cabin speed to change consumed power. It is strongly recommended to act as follows, depending on the drive type:

a) If the drive has power limitation.

i) In this case, power provided to the engine by the drive should be limited to 3200W.The drive should be able to select the cabin speed according to each situation.

ii) Example:

- If cabin speed is stablished at 1m/s, and this speed would consume more than 3500W (going down and empty cabin), the drive would adjust speed to the needed value automatically, ensuring a power consumption lower than the limit at 3200W.
- In loaded trips, consumption is lower, thus the elevator will travel at stablished speed (1m/s), always demanding less than 3200W.

NOTE: 3200W is an illustrative value. In any case, a security range lower than 3500W allowed for.

b) If the drive does not have power limitation, but it is possible to monitor power consumption on the screen.

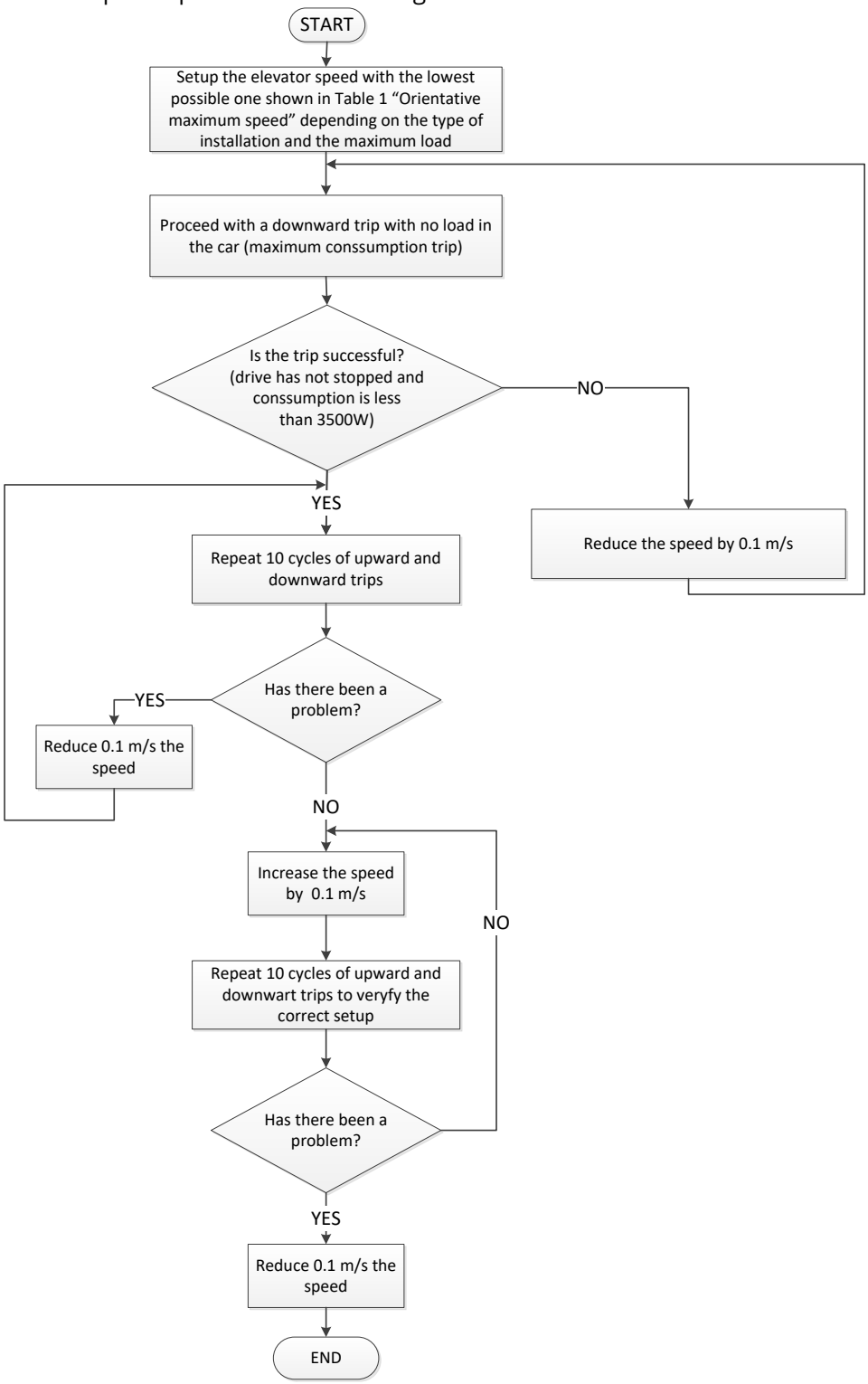
i) First of all, we should set the drive to show power consumption on the screen.

ii) According to lift type, (see "Table 1 ") we should start by setting the lower speed value shown in the table, and commanding an empty cabin downward trip. Now we should check on the screen, that maximum consumed power does not increase above the limit at 3500W.

- If consumed power is clearly lower than the limit at 3500W, you can slightly increase cabin speed and repeat the trip, making sure it consumes less than 3500W again. A good value to stablish the limit is 3200W in such way that guarantees consumption lower than 3500W under any circumstances (high temperatures or intense traffic).
- If consumed power is higher than 3500W, drive will stop working ("undervoltage error", chapter 3.4.2), and we will have to decrease speed.

c) If the drive does not have power limitation and is not possible to monitor power consumption on the screen.

Follow the steps as specified in the next figure:



3.4.1.Maximum cabin speed guide values

Following table shows maximum speed guide values, assuming maximum load, so that power consumption does not exceed 3500W.

Maximum elevator load [kg]	Installation type	Maximum speed [m/s]
300	Hanger	1*
300	Rucksack	1*
450	Hanger	Between 0.7 y 1**
450	Rucksack	Between 0.5 y 1**
600	Hanger	Between 0.5 y 0.85**
600	Rucksack	Between 0.5 y 0.80**
800	Hanger	Between 0.5 y 0.75**
800	Rucksack	Between 0.5 y 0.70**

Table 1 Maximum speed guide values

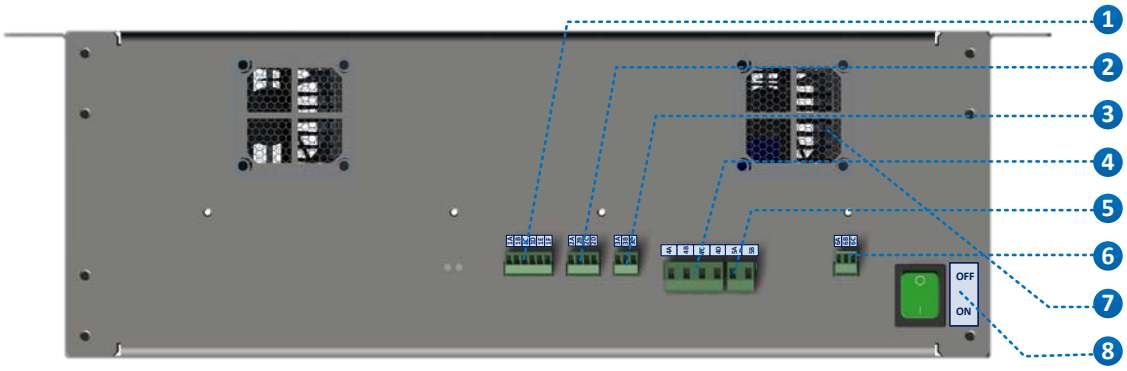
* 300kg elevators can usually move at maximum load and 1m/s, consuming less than 3500W.
** These values for speed are illustrative, and are based in experience at different installations. Needed speed in each case may vary outside described range.

3.4.2.What if maximum power consumption isn't well fitted?

In case demanded power is higher than 3500W, DC/DC converter will not be able to provide it. In that case, drive DC bus voltage will decrease, resulting in an "under voltage error" w and drive will stop working.

3.5. Other connections

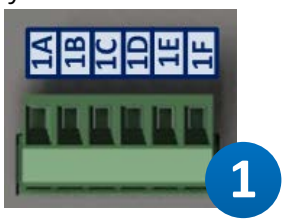
P2S converter has different connections on its upper side, so the lift controller or any other external element can take control over it.



All these connectors were already explained in section 2.1. They are repeated here for clarity.

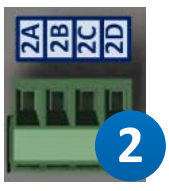
OUTPUTS to CONTROLLER:

- 1A) GND: Common ground connection of terminals 1B, 1C, 1D, 1E y 1F.
- 1B) STATUS OK: (Normally Open). When this terminal is short-circuited to ground it indicates that the DC/DC converter is in operation and therefore, it is supplying the DC link of the drive, so the drive is energized.
- 1C) LOW BATTERY 1 NC (Normally Close): Open circuited indicates that the battery SOC (State-Of-Charge) is less than 30%
- 1D) LOW BATTERY 1 NO (Normally Open): Short-circuited to ground indicates that the battery SOC is less than 60%
- 1E) LOW BATTERY 2 NO: (Normally Open) Short-circuited to ground indicates that the battery SOC is less than 60%
- 1F) AC CHARGER ON: (Normally Open) Short-circuited to ground it indicates to the controller that the charger is operating correctly. Con circuito cerrado a masa indica a la maniobra que el cargador de red está funcionando correctamente.



IMPORTANT NOTE: These outputs should never withstand voltages higher than 24V DC or 250V in AC. Outputs should never conduct currents higher than 5A.

OUTPUTS to AUXILIARY ELEMENTS:



- 2A) and 2B) RC INVERTER + and -: This output is short-circuited to disable the inverter.
    - For example, the inverter can be disabled by controller requirement (using input ENABLE INV (3C).

  If the DC/DC converter is turned off with the main switch, the inverter will also be disabled.
- 2C) and 2D) (Remote Control) RC CHARGER + and -: A short-circuit between terminals 2A and 2B disables the battery charger.

- For example, the DC/DC converter disables the charger when the solar regulator is in operation and if there is enough solar radiation. For that particular case, the consumption from mains would be zero.

INPUTS from the CONTROLLER:

- 3A) GND: Common ground for the ENABLE inputs (3B and 3C).
- 3B) ENABLE DC/DC: DC/DC Converter enabling or disabling input. To provide energy to the DC bus, it is mandatory that the controller short-circuits terminals 3A and ·3B. The controller may use this option to turn off the drive to avoid standby consumption.

3C) ENABLE INVERTER: Input to enable or disable the complete supply of the elevator. When terminal 3C is short-circuited to 3A, both DC/DC converter and inverter are enabled, thus the elevator is being supplied (drive and all the rest). If 3C and 3A are in open circuit both DC/DC converter and AC inverter are disabled and there is NO supply being provided to any element of the elevator.

NOTE ABOUT "ENABLE" CONNECTION:

The controller should be in charge of enable contacts "ENABLE DC/DC" 3B and "ENABLE INVERTER" 3C with "GND" 3A this has two very important reasons:

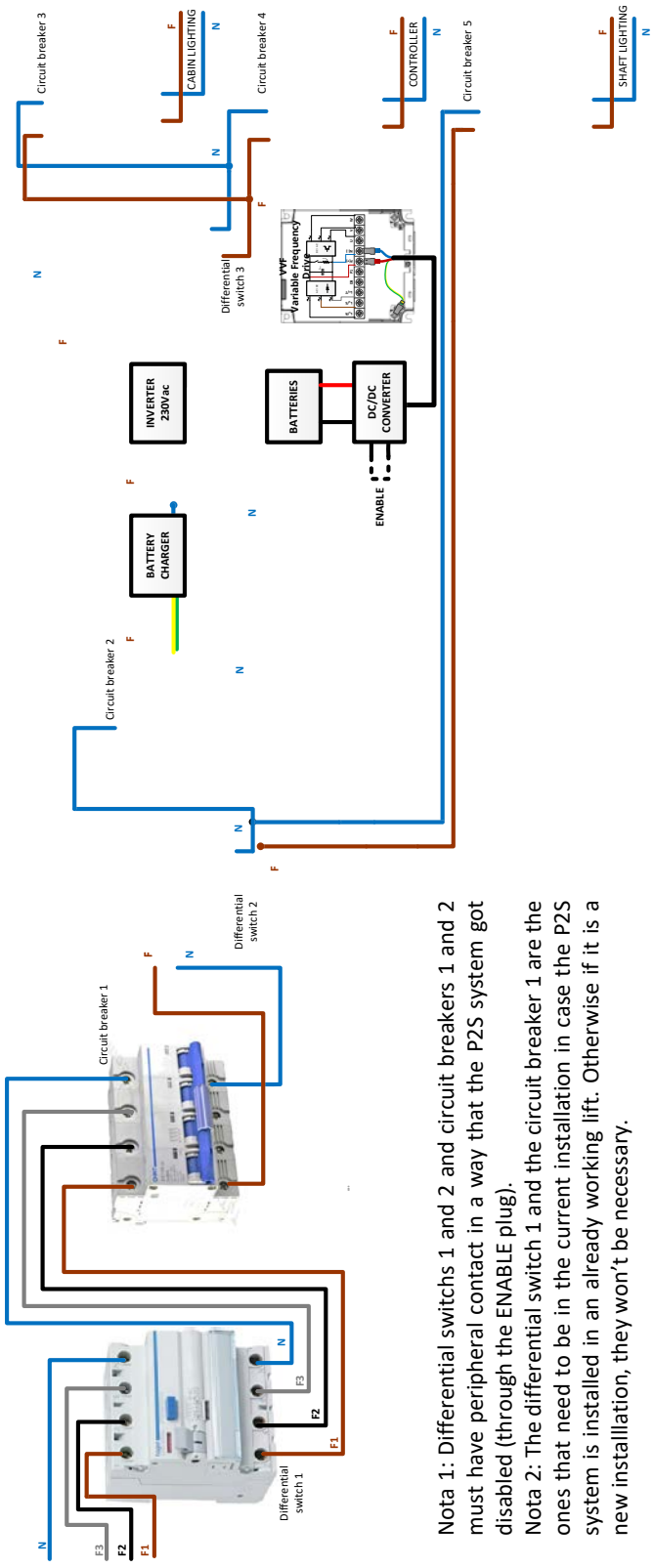
- In case the elevator is being intentionally turned off, the contact controlling "ENABLE INVERTER" should be open, and thus turn off the drive supply and the AC inverter. If this procedure is not followed, it exists danger for the maintenance personnel, due to the fact that there is a high voltage in the drive. There is danger of electroshock. .
    - IN ALL CASES WHEN THE CONTROL HAS NO SUPPLY, THE "ENABLE INVERTER" 3C MUSCT BE OPEN.
- The second reason: The control may decide to turn off the driver for a period of time, with the purpose of saving in the standby consumption. This leads to a drastic reduction of up to 50W permanently, even more, depending on the drive.
    - Using the "ENABLE DC/DC" 3B and "GND" 3A contacts of the DC/DC converter, the drive (and only the drive) can be disconnected. The use of this connector is for the sole purpose of saving drive energy.
        - Closed contact, the drive is energized.
        - Open contact, the drive is not energized (drive is turned off)
    - Please recall than to turn off the elevator completely, the terminals "ENABLE INVERTER" 3C (and "GND" 3A) need to be used.

- When the control closes again the contact to energize the drive, the DC/DC converter will turn on the drive in less than 1 second with a controlled current ramp. In less than 1 second, the drive will be ready to traction the motor.

WARNING

In case of deliberated electric supply disruption, the "ENABLE" connection must be opened, disabling drive supply. In any other case, drive will keep being supplied, and maintenance staff may receive an electrical shock.

3.6. Electrical connections diagram (suggested)



Nota 1: Differential switchs 1 and 2 and circuit breakers 1 and 2 must have peripheral contact in a way that the P2S system got disabled (through the ENABLE plug).
Nota 2: The differential switch 1 and the circuit breaker 1 are the ones that need to be in the current installation in case the P2S system is installed in an already working lift. Otherwise if it is a new installlation, they won't be necessary.

4. MAINTENANCE

4.1. Elevator maintenance

A correct P2S shutdown, as well as ensuring there is no supply, is necessary whenever the ***ELEVATOR AND/OR THE DRIVE ARE TO BE MANIPULATED***. Keep in mind that P2S system is designed, among other things, to keep on supplying the lift in case of blackout, so you should recognize diagram 3.6 and act accordingly.

a. Turn down P2S system by switching OFF single-phase inverter switch (25) and disconnect DC/DC converter with either switch 8 or disabling "ENABLE INVERTER" 3C by opening the contact (connected to the controller or else).
    i. This way, P2S system will neither be supplying the controller nor VVVF drive.
b. Drive should turn down automatically after the previous step.
c. Wait until DC bus voltage lowers down to safe level, as long as is necessary (check your drive handbook).
d. Extract DC/DC converter 9 connector.
e. Perform necessary actions with the drive.
f. Before turning on the drive, connect back connector 9.
g. Let 30 seconds elapse, then turn on P2S by switching on single-phase inverter switch (25).
h. The elevator will be operational again, supplied from P2S system.

4.2. P2S maintenance

P2S system does not require specific maintenance actions. Checking vent holes are not clogged should be enough.

The only elements that will need periodic replacement are batteries. They are designed to have an expected lifetime of 4 years approximately.

Batteries disconnection process should follow the reverse order than the connection process. In case batteries replacement is needed, proceed as follows:

BATTERIES DISCONNECTION:

a. Open fuse-holder.
b. Disconnect cable C black soul from battery 4 negative terminal (38).
c. Disconnect cable F from battery 1 positive terminal (31).
d. Disconnect battery 2 from battery 3 (seeFig. 7)
e. Disconnect battery 3 from battery 4 (see Fig. 7)
f. Disconnect battery 1 from battery 2 (see Fig. 7)
g. You will be able to pull out old batteries and replace them by new ones.
h. To install the new batteries, follow chapter 3.2 “Installation” steps.

5. PRECAUTIONS

 WARNING	**DO NOT MANIPULATE THE DRIVE** WITHOUT BEING SURE **P2S SYSTEM IS SHUTDOWN AND CONNECTOR (9) REMOVED (for extra security)**. If there is no power consumption, P2S is able to hold drive DC voltage at deadly levels for days.
 WARNING	Operating security is guaranteed while using provided material. In case of cable replacement, use equivalent ones.
 WARNING	In case of connection wire replacement, bullet style connectors should be used, to prevent from loose threads (as the connection wire we provide).
 WARNING	P2S system **DOES NOT** replace brake resistor, which shall never be replaced or eliminated
 WARNING	P2S system is NOT parallel connected to brake resistor.

 WARNING	It is essential to strictly follow installation and/or maintenance steps order. In any other case, overvoltage or overcurrent may happen, increasing shock risk or generating drive damage.
 WARNING	Deadly high voltages (up to 800Vdc) are reached at drive connection. Ensure a right procedure with connections.
 WARNING	In case of malfunction, or doubt, contact epic power. NEVER HANDLE ANY OF P2S COMPONENTS. It is an extremely complex power electronic system, and should only be handled by highly qualified staff. Any unskilled handling may damage the system, or trigger a serious accident.

6. TECHNICAL DATA, DIMENSIONS AND WEIGHTS

6.1. P2S technical characteristics (system as a whole)

Feature	Value
Drive DC operating voltage (Vdc)	500÷800 V
Maximum drive exchanged current	6 A
Maximum supplied to drive power	3600 W
Maximum mains consumed power	500 W
Maximum operating temperature	40 °C

6.2. DC/DC converter technical characteristics

Feature	Value
Drive DC operating voltage (Vdc)	500÷800 V
Maximum drive exchanged current	6 A
Maximum power	3,6 kW
Maximum unidirectional performance	98 %
Storage temperature	-10÷70 °C
Weight	12 kg
IP protection class	IP2X

6.3. Battery charger technical characteristics

Feature	Value
Reference	HEP-600C-48
Input voltage	90÷305VAC
Output voltage	46.1÷60.5V
Maximum output current	10.5 A
Maximum power	600 W
Storage temperature	-40 ÷85°C
Weight	3.9 kg

6.4. Single-phase inverter technical characteristics

Feature	Value
Reference	TS-400-248B
Input Voltage	42÷60 VDC
Output voltage	200÷240VAC
Output frequency	50 (60) Hz
Rated power	400 W
Storage temperature	-30 ÷70ºC
Weight	1,84 Kg

6.5. Battery array technical characteristics

6.5.1.Small:

Feature	Value
Number of batteries	4
Batteries voltage	4 x 12V
Storage temperature	-20÷60 ºC
Operating temperature	-15÷50 ºC (load) -20÷60 ºC (unload)
Batteries life expectancy (assuming 200 maximum loaded 20 metres long trips a day)	4 years
Weight (4 batteries + battery frame)	60 kg

6.5.2.Medium:

Feature	Value
Number of batteries	4
Batteries voltage	4 x 12V
Storage temperature	-20÷50 ºC

Operating temperature	-15÷50 °C (load) -15÷50 °C (unload)
Batteries life expectancy	4 years
Weight (4 batteries + battery frame)	100 kg

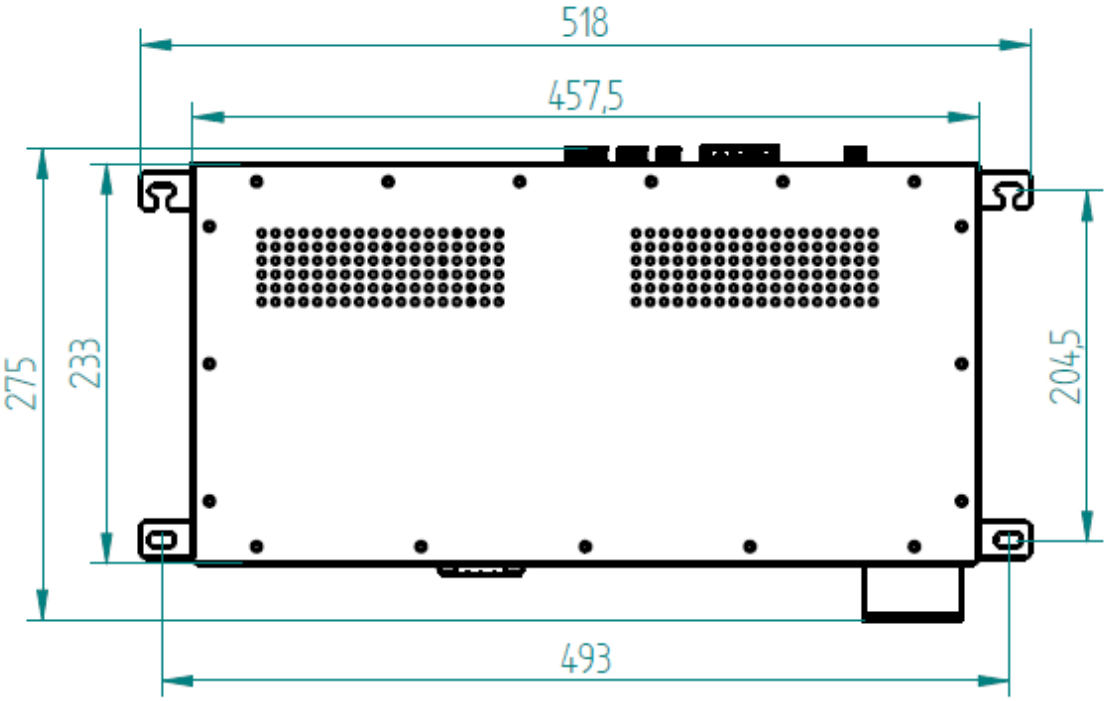
6.5.3.Large:

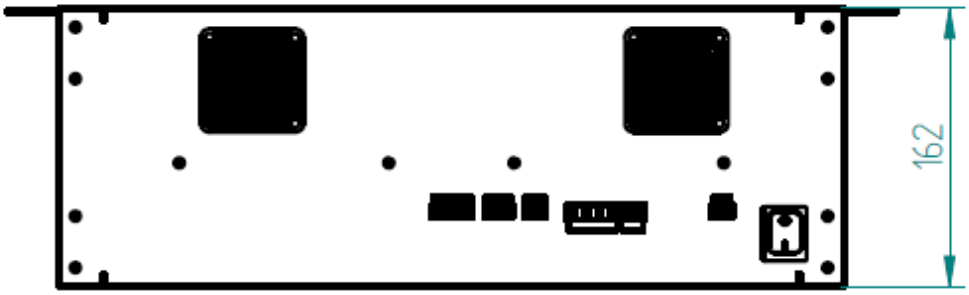
Feature	Value
Number of batteries	4
Batteries voltage	4 x 12V
Storage temperature	-20÷60 °C
Operating temperature	-15÷50 °C (load) -20÷60 °C (unload)
Batteries life expectancy	4 years
Weight (4 batteries + battery frame)	160 kg

IMPORTANT NOTE ABOUT BATTERIES:

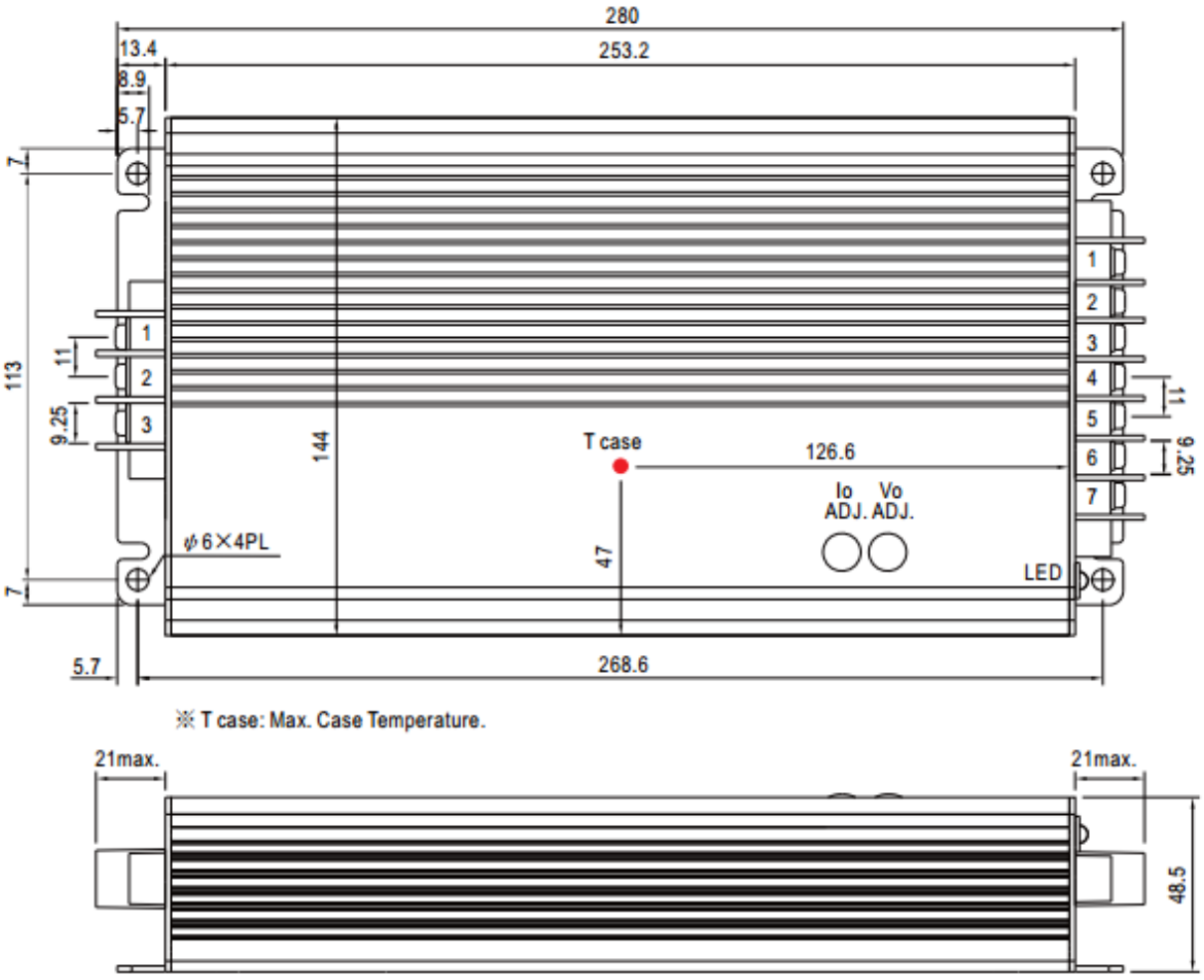
Special lead batteries are use in this specific application. Do not use any other reference than the ones provided by **epic power**. Using another kind of batteries may damage the system or cause batteries to deteriorate faster.

6.6. DC/DC converter dimensions

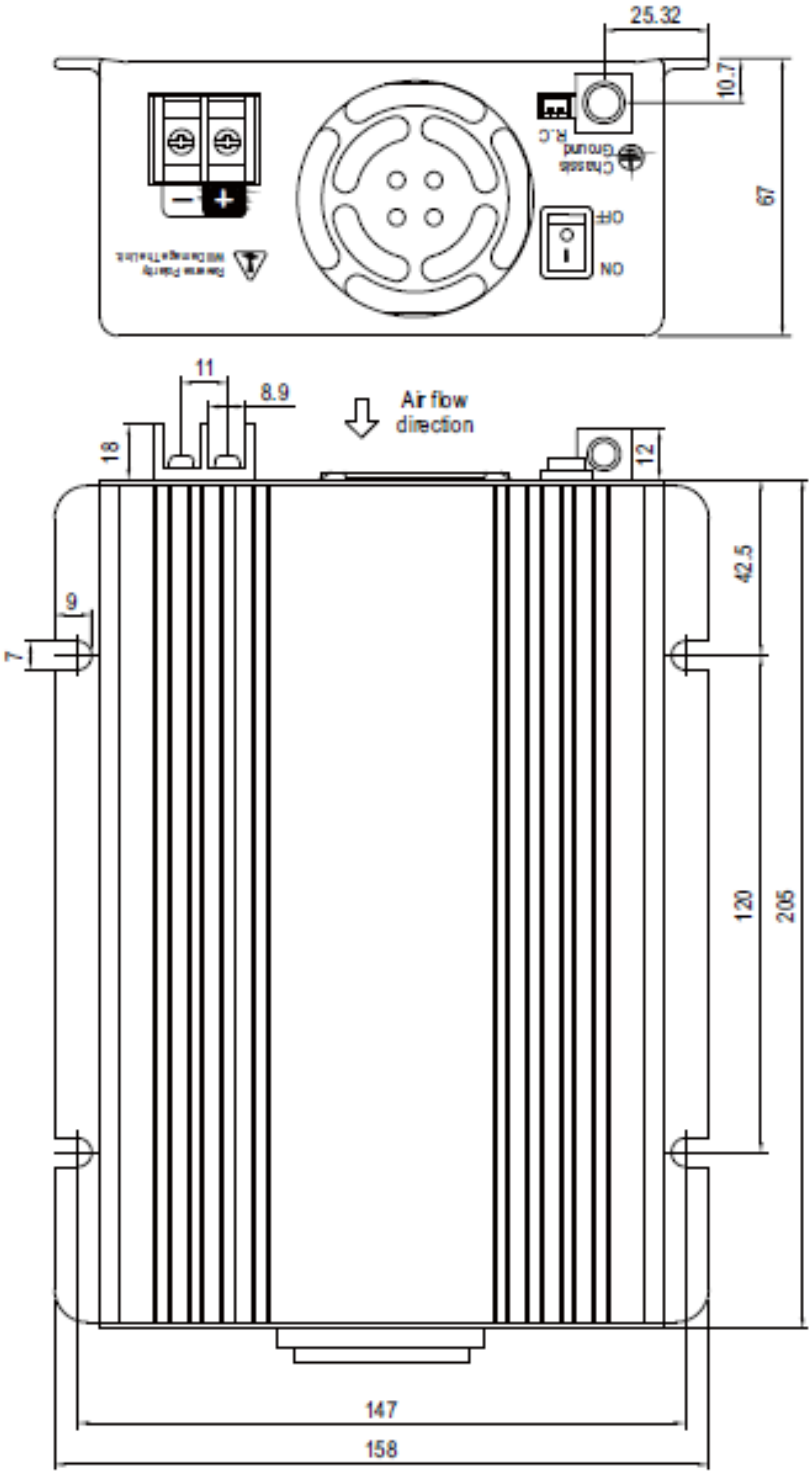




6.7. Battery charger dimensions

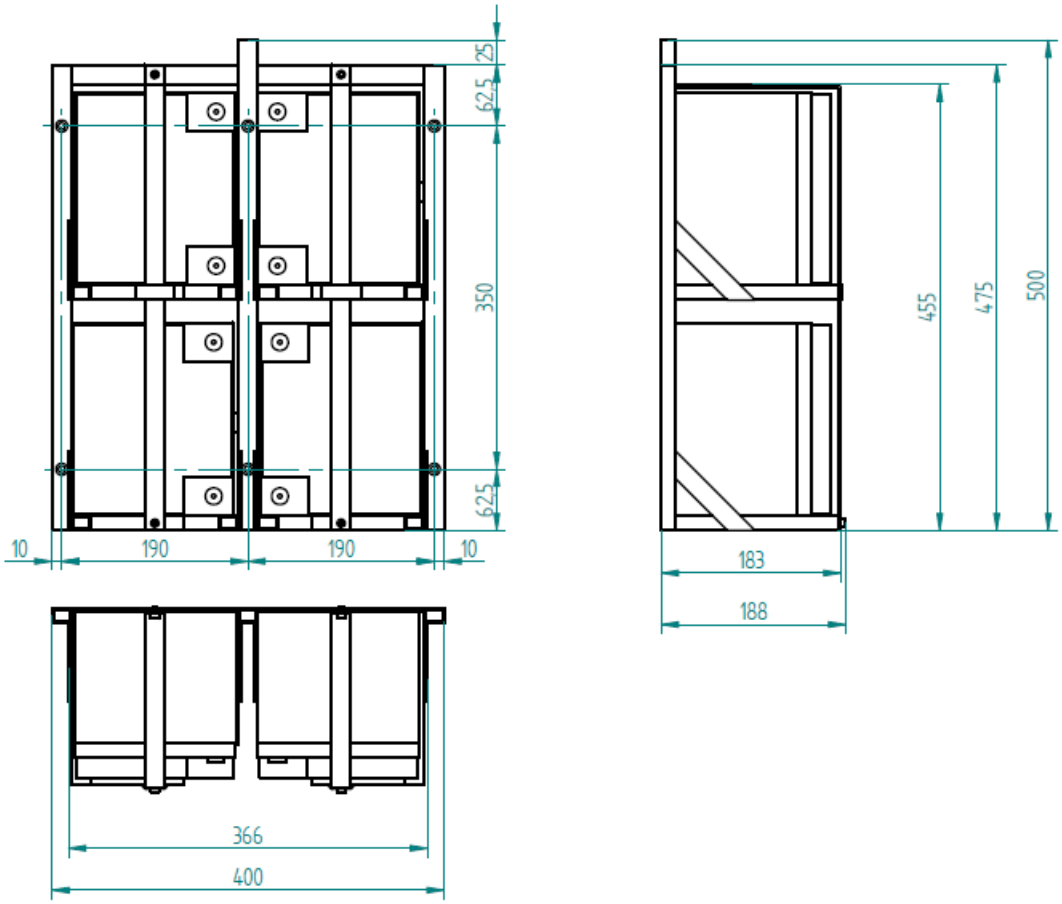


6.8. Single-phase inverter dimensions

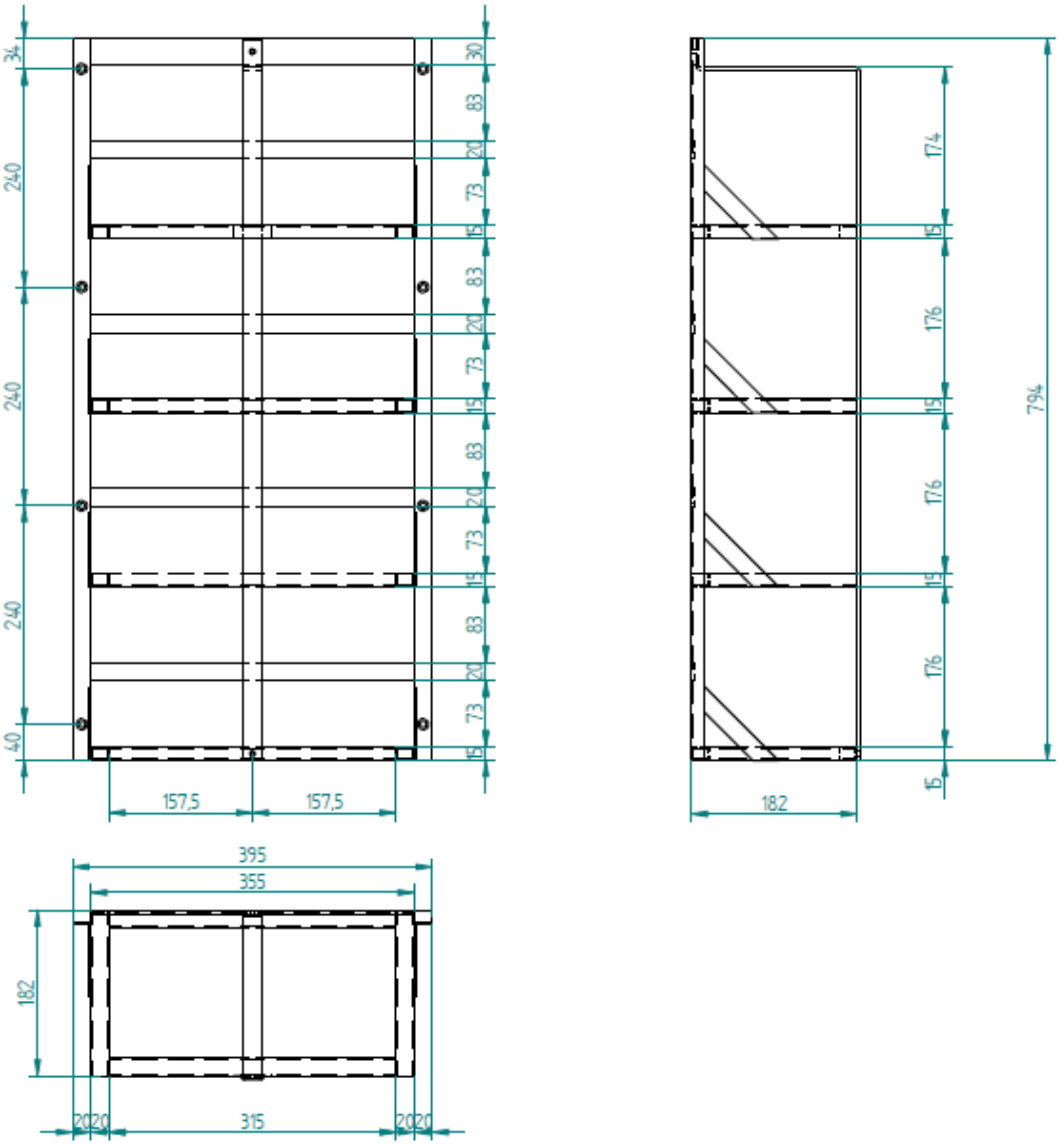


6.9. Batteries array dimensions

6.9.1.Small batteries

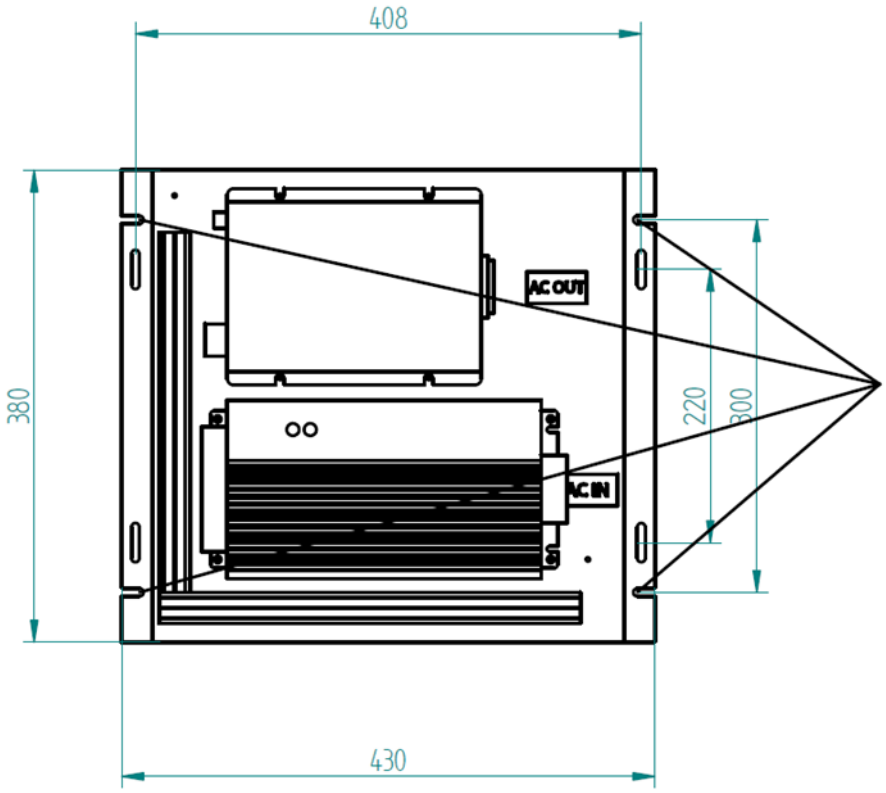


6.9.2.Medium batteries



6.10. Holder tray dimensions

The dimensions of the holder tray are 520x400x70mm



7. REGULATIONS

P2S system has been designed and manufactured according to following regulations:

- **Low Voltage Regulations (LVD)**: **2006/95/CE Directive** from European parliament and the 12 December 2006 council, which stablishes low voltage regulations for electronic systems.
    - UNE-EN 50178:1998

- **Electromagnetic Compatibility Regulations (EMG): European directive 2004/108/CE**, which regulates equipment electromagnetic compatibility and seeks the proper functioning of internal market, demanding suitable EMC levels.
    - UNE-EN 12015:2005
    - UNE-EN 12016:2014