

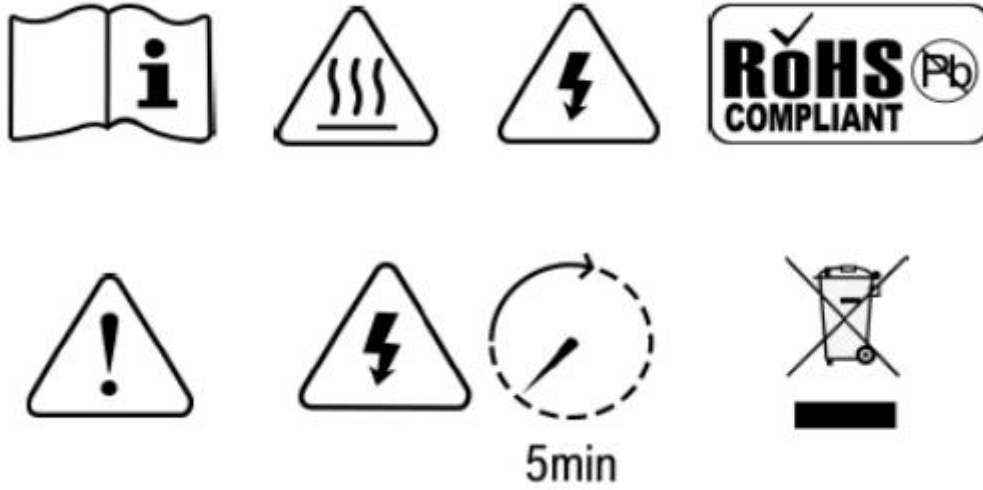
EMP31/EMP51

Master Power Unit



Version: A2.3

Date: December 2023



WARNING: HIGH VOLTAGE INSIDE

CAUTION: THE DC FUSE MUST HAVE BEEN TURNED OFF BEFORE SERVICING

MADE IN CHINA

Disclaimer

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About this Manual

This manual describes our product features and provides procedure of installations. This manual is for anyone intending to install our equipment.

General Instruction

Thanks for choosing our products and this manual were suitable for EMP Master Power Unit.

This chapter contains important safety and operation instructions. Read and keep this User Guide well for later reference.

The EMP Master Power Unit needs to be installed by professionals and please pay attention to the following points prior to installation:

- 1) Please check the input voltage or voltage of battery is same to the nominal input voltage of this unit.
- 2) Please connect positive terminal “+” of battery to “+” input of this unit.
- 3) Please connect negative terminal “-” of battery to “-” input of this unit.
- 4) Please use the shortest cable to connect and ensure the secure connection.
- 5) While connecting, please secure the connection and avoid short cut between positive terminal and negative terminal of battery, which will cause damage of battery.
- 6) This unit will have high voltage inside. Only authorized electrician can open the case.
- 7) This unit WAS NOT designed to use in any life retaining equipment.

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1. General Safety Instruction

1.1 Safety Instruction

As dangerous voltages and high temperature exist within the EMP Master Power Unit, only qualified and authorized maintenance personnel are permitted to open and repair it. Please make sure the unit is turned off before open and repair it.

This manual contains information concerning the installation and operation of EMP Master Power Unit. All relevant parts of the manual should be read prior to commencing the installation. Please follow the local stipulation meantime.

Any operation against safety requirement or against design, manufacture, safety standard, and are out of the manufacturer warranty.

1.2 General Precaution

- 1) Do not expose to dust, rain, snow or liquids of any type, it is designed for indoor use. DO NOT block off ventilation, otherwise the EMP Master Power Unit would be overheating.
- 2) To avoid fire and electric shock, make sure all cables selected with right gauge and being connected well. Smaller diameter and broken cable are not allowed to use.
- 3) Please do not put any inflammable goods near to this unit.
- 4) Never place this unit directly above batteries, gases from a battery will corrode and damage EMP Master Power Unit.
- 5) Do not place battery over EMP Master Power Unit.

1.3 Precaution regarding battery operation

- 1) Use plenty of fresh water to clean in case battery acid contacts skin, clothing, or eyes and consult with doctor as soon as possible.
- 2) The battery may generate flammable gas during charging. NEVER smoke or allow a spark or flame in vicinity of a battery.
- 3) Do not put the metal tool on the battery, spark and short circuit might lead to explosion.
- 4) REMOVE all personal metal items such as rings, bracelets, necklaces, and watches while working with batteries. Batteries can cause short-circuit current high enough to make metal melt, and could cause severe burns.

2. EMP31/EMP51 INTRODUCTION

2.1 Features

- Smart battery charger 12V18A (EMP31) / 12V30A (EMP51)
 - ✧ Active PFC charging
- 16 Fused DC outputs, including water pump and lighting central control.
- Battery charging relay 12V 30A
- Battery Low Voltage Protection
- Support external remote main switch
- Control one water pump with two tank probes
- Solar charger controller (PMW), 15A

2.2 LED Display

Table 1 LED indication

NO.	LED	Color	Status	Description
1	CHG	Green	ON	Battery charged
			Flashing (flash once every second)	Battery charging
			OFF	Battery discharge
2	Dischg	Orange	ON	Battery discharging
			OFF	Battery charging
3	CHG/ Dischg	Green/Orange	Both ON	Power supply

3. KEY FEATURES AND FUNCTIONS

3.1 Multiple inputs

EMP master power unit may have multiple sources at one time. These sources include the Shore power, Solar panel and Alternator (Motor battery). There is priority among these sources, but EMP allows several sources to charge auxiliary battery at the same time. The priorities are listed below.

Table 2 Energy sources priority

AC Mains	✓	✓	✓		
Solar panel	✓	✓		✓	✓
Alternator (Motor battery)	✓		✓	✓	
Dominating Source	AC mains + Solar panel	AC mains + Solar panel	AC mains	Alternator + Solar panel	Solar panel

3.2 Battery Charger of Auxiliary Battery

The charger automatically starts when the appropriate qualified power is connected, either from grid, generator. With multiple charging stages (soft start-bulk-absorption-float-recycle), EMP is designed to fully charge battery quickly. To guarantee the optimal charging for batteries of different states, the EMP features Microprocessor-controlled charging algorithm. The Float and Recycle charging programs guarantees the battery being charged properly when battery is connected for a longer period.

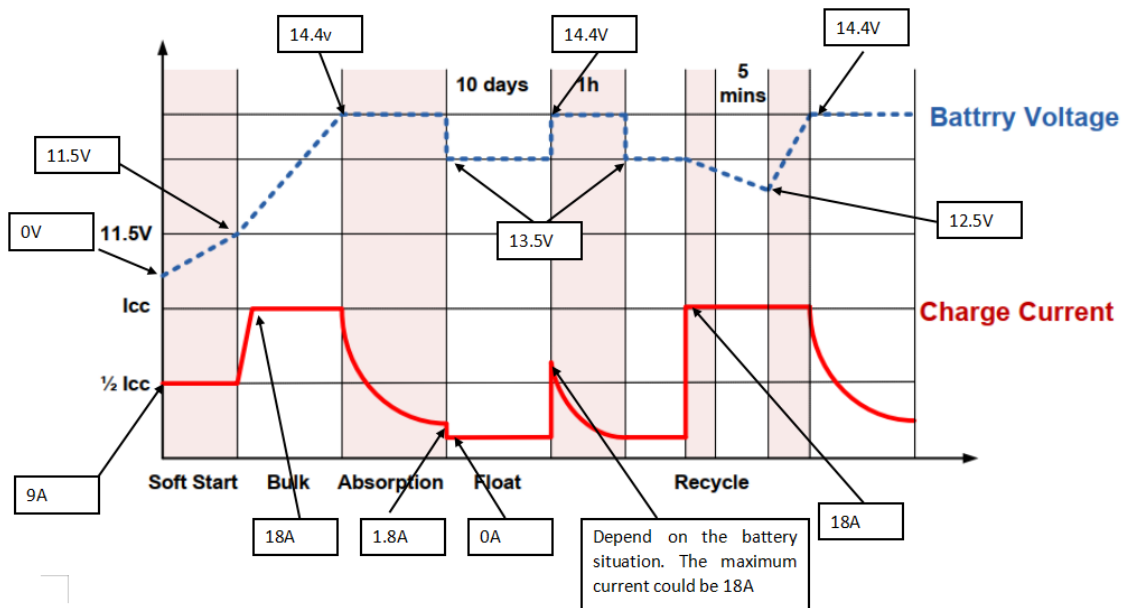


Figure 1 Charging algorithm for lead-acid battery of EMP31

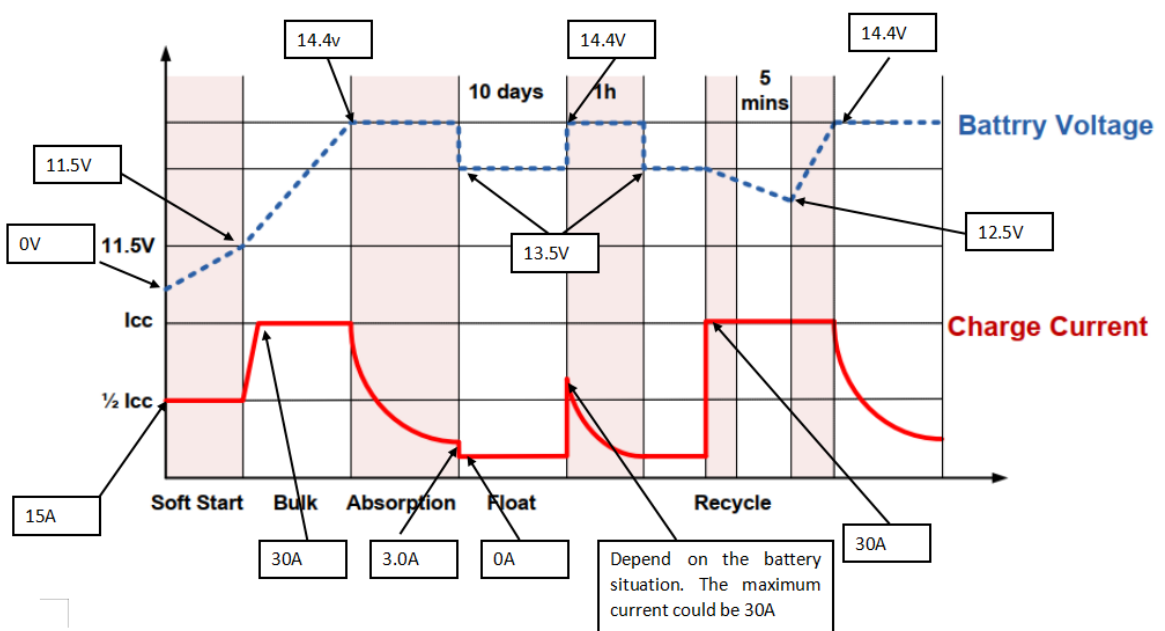


Figure 2 Charging algorithm for lead-acid battery of EMP51

3.3 Lithium battery charging

The EMP can be configured to charge Lithium battery.

3.4 Power Supply Mode

If no battery is attached to EMP unit, it will work as a power supply automatically with a 12.8VDC output.

3.5 PWM Solar charger controller

EMP has a built-in PWM charger for the auxiliary battery.

- ✧ Max open circuit voltage is 30VDC
- ✧ Max supply current is 15A

3.6 Voltage Charging Relay (VCR)

EMP Master Power Unit has a built-in voltage charging relay (VCR), which can get power from alternator to supply the system and charge auxiliary whilst the engine is running.

Here is the working logic of VCR

Table 3 VCR working logic

		D+ Enabled	D+ Disabled
LFP battery	Disengage	VCR will be disengaged immediately if no D+ is sensed or detected	VCR will be disengaged when alternator/motor battery's voltage is less than 13.5V and charging current is less than 2A for 60S
	Engage	VCR will be engaged when:1) D+ is sensed or detected; 2) Alternator or motor battery's voltage is greater than 14.0V for 10S	VCR will be engaged when alternator or motor battery's voltage is greater than 14.0V for 10S
AGM/GEL battery	Disengage	VCR will be disengaged immediately if no D+ is sensed or detected	VCR will be disengaged when alternator or motor battery's voltage is less than 12.8V for 60S
	Engage	VCR will be engaged when:1) D+ is sensed or detected; 2) Alternator or motor battery's voltage is greater than 12.0V for 10S	VCR will be engaged when alternator or motor battery's voltage is greater than 13.4V for 10S

Remarks:

- a. **D+ enabled means the EMP box has sensed or detected D+ once, afterwards EMP31 box would deem it as D+ enabled**
- b. **D+ disabled means the EMP box has never sensed or detected D+, so EMP box would deem it as D+ disabled**

3.7 Battery Low Voltage Protection (BLVP)

EMP31 master power unit has a built-in low voltage protection relay. The protection is decided by battery type lithium battery or lead acid battery. Below please find the protection and resume value:

Table 4 Low voltage protection and resume

Protection	Threshold value
Low voltage protection	AGM/GEL/WET: 10.8+/-0.3Vdc
	LFP: 11.2+/-0.3Vdc
Low voltage protection resume	AGM/GEL/WET: 11.8+/-0.3Vdc
	LFP: 12.2+/-0.3Vdc

Remarks:

- a. There will be 60 seconds as time delay before above protection or resume

3.8 DC Distribution

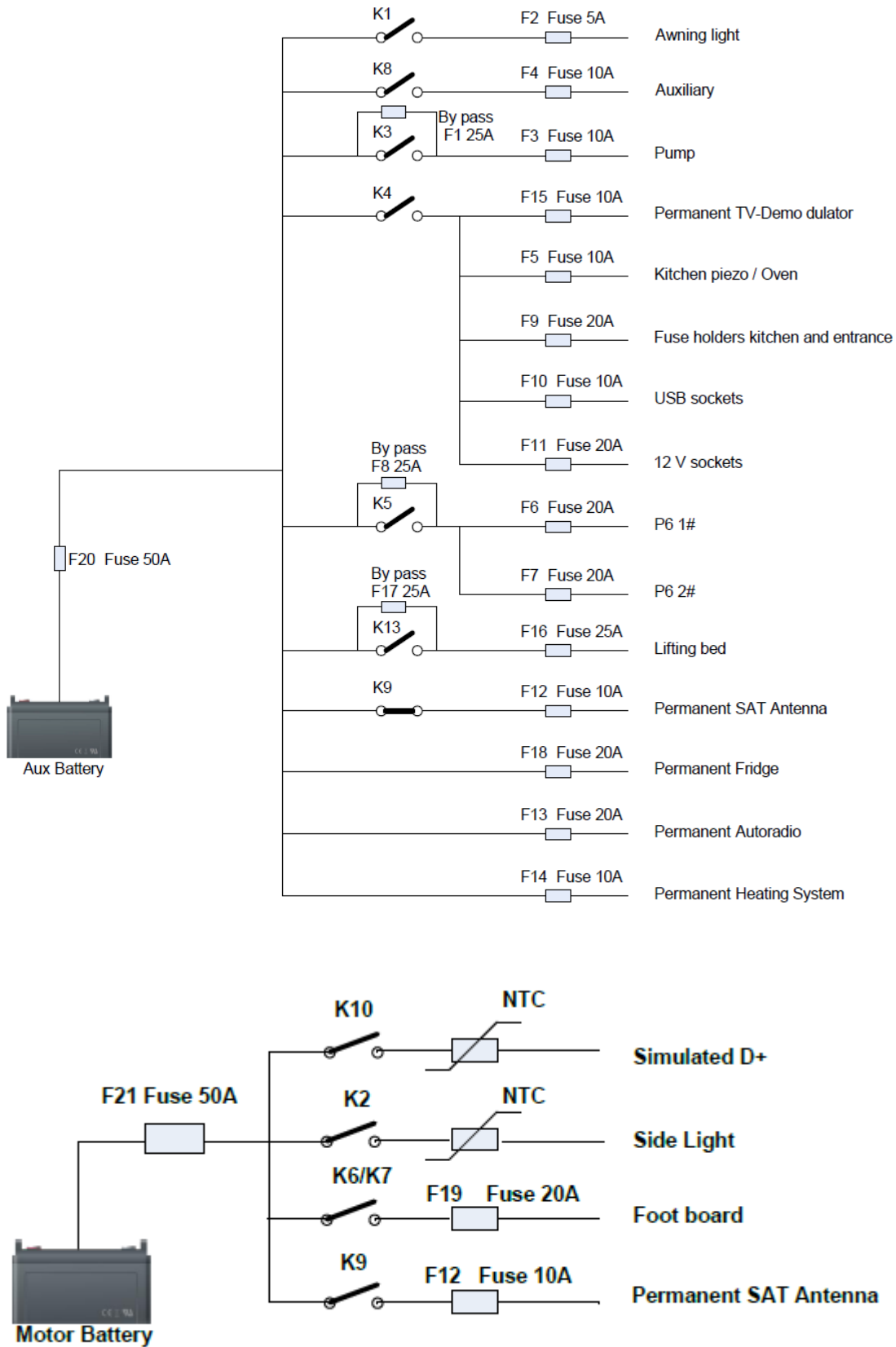


Figure 2 DC distribution schematic diagram of auxiliary and motor battery

4. STRUCTURE AND INSTALLATION

4.1 EMP Master Power Unit

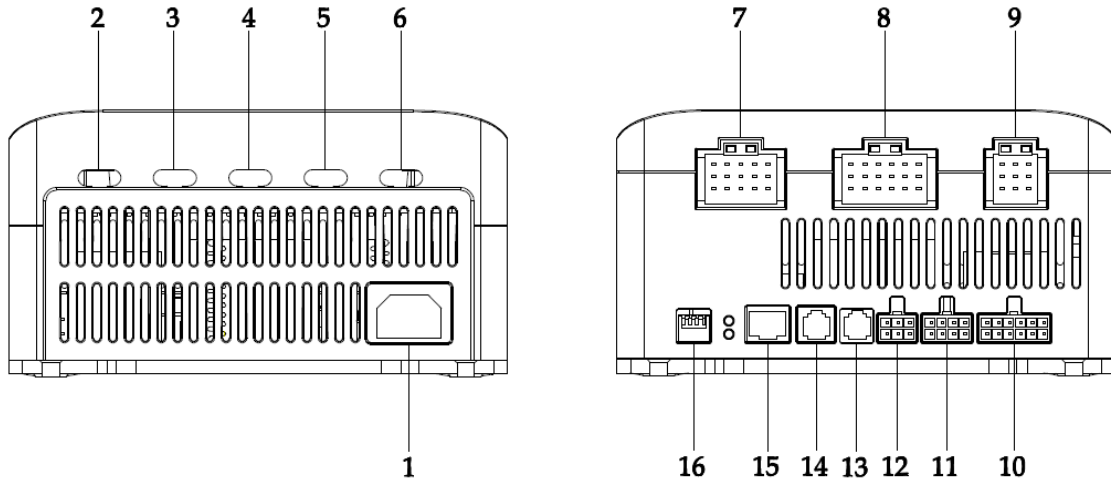


Figure 3 Connectors at front and back

Table 5 Connectors and terminals

No.	DEFINITION	LABEL	DESCRIPTION
1	/	AC Input	AC input port
2	/	PV	Connect to PV Panel
3	/	Fridge	Connect to fridge
4	/	Lifting Bed	Connect to lifting bed
5	/	Motor BAT	Connect to Motor BAT
6	/	AUX BAT	Connect to AUX BAT
7	Loads	[1]1	POS : Awning lamp
		[1]2	GND : Awning lamp
		[1]3	POS : Info D+ Fridge
		[1]4	POS : Side lights
		[1]5	GND : Side lights
		[1]6	POS : Info D+ SAT antenna
		[1]7	POS : Pump + WC
		[1]8	GND : Pump + WC
		[1]9	POS : Info D+ Preheating pump
		[1]10	POS : Autoradio Signal
		[1]11	GND :
		[1]12	GND :
		[1]13	POS : Oven + Piezo
		[1]14	GND : Oven +Piezo
		[1]15	GND : Buzzer Footstep

8	Loads	[2]1	POS : P6 lighting right side
		[2]2	GND : P6 lighting right side
		[2]3	POS : Buzzer Footstep
		[2]4	POS : P6 lighting left side
		[2]5	POS : P6 lighting left side
		[2]6	GND: In/Out Footstep (COM)
		[2]7	NOT USED
		[2]8	NOT USED
		[2]9	Out Footstep (Normally Open)
		[2]10	POS + Fuse holders
		[2]11	GND – Fuse holders
		[2]12	In Footstep (Normally Open)
		[2]13	POS + 12V socket
		[2]14	GND – 12V socket
		[2]15	M1 - Footstep
		[2]16	POS + USB socket
		[2]17	GND – USB socket
		[2]18	M2 Footstep
9	Loads	[3]1	POS : Permanent Autoradio
		[3]2	GND : SAT antenna
		[3]3	POS : SAT antenna
		[3]4	POS : Combi + TRUMA/ALDE control
		[3]5	GND : Combi + TRUMA/ALDE control
		[3]6	GND : Elec Fridge
		[3]7	POS : TV
		[3]8	GND : TV
		[3]9	POS : Elec. Fridge
10	Signal terminal	[7]1	D+ (active high +BAT
		[7]2	Switch ON/OFF (Main)
		[7]3	D+ (active down GND)
		[7]4	DRY1_COM
		[7]5	Sidelights (active high +BAT)
		[7]6	+APC (active high +BAT)
		[7]7	Sidelights (active down GND)
		[7]8	+APC (active down GND)
		[7]9	Switch ON/OFF (NO)
		[7]10	Footboard End of stroke (COM)
		[7]11	Footboard End of stroke (NO)
		[7]12	DRY1_NO
11	Water tank	[6]1	
		[6]2	
		[6]3	
		[6]4	
		[6]5	

		[6]6	
		[6]7	
		[6]8	
12	Water tank	[5]1	RSE_CLOCK1
		[5]2	RSE_DATA1
		[5]3	VCC_12V
		[5]4	GND2
		[5]5	
		[5]6	
13	Signal control (RJ11)	[4]1	IO_FROM_VCU
		[4]2	IO_TO_VCU
		[4]3	
		[4]4	
14	CI Bus port	[9]1	VCC_12V
		[9]2	
		[9]3	LIN
		[9]4	
		[9]5	GND2
		[9]6	
15	Communication port	[8]1	VCC_12V
		[8]2	GND2
		[8]3	
		[8]4	CANH
		[8]5	CANL
		[8]6	
		[8]7	VCC_12V
		[8]8	GND2
16	DIP Switch	1 VCR	Set the battery type, VCR and Mode
		2 Mode	
		3 Bat type	
		4 Bat type	

4.2 Installation

For good ventilation, ensure empty space of at least 5 cm on each side of the EMP unit.

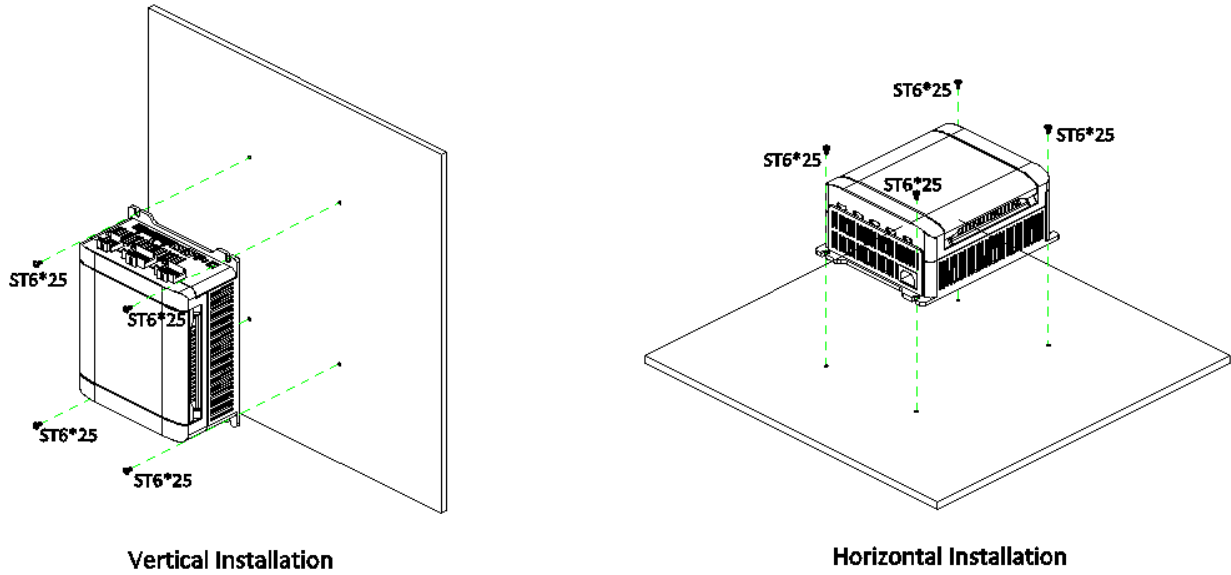


Figure 4 Installation

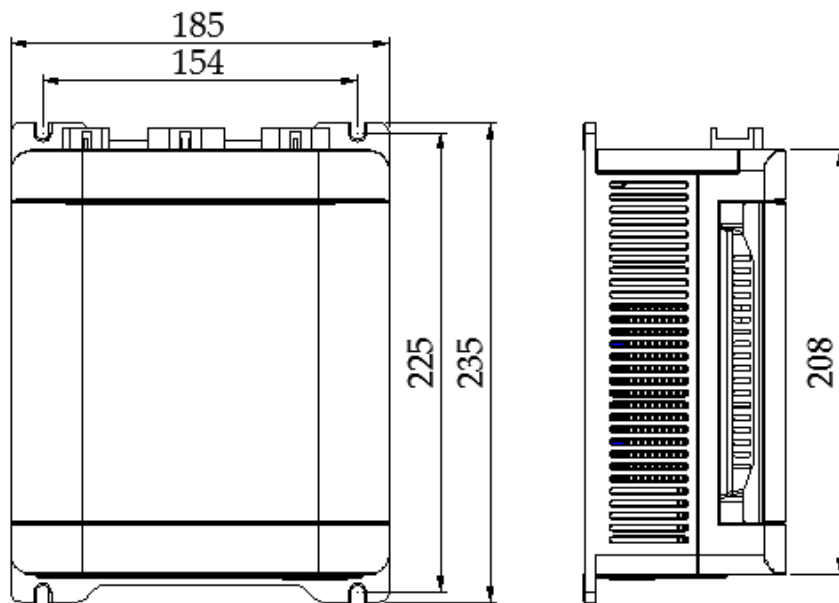


Figure 5 Dimensions of EMP

4.3 Fuse specification

Here is a list for the fuses installed on EMP. Please also take reference of Figure 2.

Table 6 Fuse specification list

Fuse No.	DC loads	Specification
F2	Awning light	5A
F3	Pump	10A
F4	Auxiliary	10A
F5	Kitchen piezo/oven	10A
F6	P6 1#	20A
F7	P6 2#	20A
F9	Fuse holders	20A
F10	USB sockets	10A
F11	12V sockets	20A
F12	Permanent SAT Antenna	10A
F13	Permanent Autoradio	20A
F14	Permanent Heating System	10A
F15	Permanent TV-Demodulator	10A
F16	Lifting Bed	25A
F18	Permanent Fridge	20A
F19	Footboard	20A
F20	AUX BAT	50A
F21	Motor BAT	50A
F1	By-pass Pump	25A
F8	By-pass Lighting	25A
F17	By-pass Lifting	25A

5. OPERATION

5.1 Configuration on EMP

You can set the battery type, VCR mode and working mode by the dip switch of EMP



Dip switch #2 (working mode) always needs to be OFF. For dip switches #1, 3 and 4, settings made from a connected tablet have priority.

5.1.1 Dip switch setting

There are dip switches for you to set VCR mode, Working mode and Battery type.

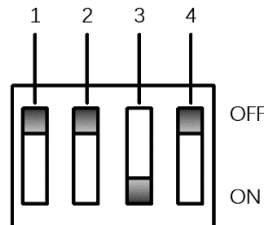


Figure 6 Dip switch - Example of LFP battery

Table 7 Dip switch definition

DIP SWITCH	1	2	3	4
	VCR mode / Booster	Working mode	Battery type	

5.1.1.1 Dip switch for VCR mode and Working mode

Table 8 Dip switch for VCR mode and Working mode selection

VCR mode	OFF	Built-in VCR is enabled (Default setting)
	ON	Built-in VCR is disabled
Working mode	OFF	Charger (Default setting)
	ON	Power supply

a) VCR mode

There are two VCR modes for optional:

- Built-in VCR is enabled: When this mode is selected, the integrated VCR is activated; please see more details how VCR works in Table 3
- Built-in VCR is disabled: When this mode is selected, the integrated VCR is deactivated and the relay will remain as disengaged; an external booster could be added when built-in VCR is disabled

b) Working mode

There are two working modes for optional:

- Charger: When this mode is selected, the EMP will operate as a charger to charge the auxiliary battery as long as the grid 230V or qualified PV is introduced
- Power supply: when this mode is selected, the EMP will provide a stable output 12.8Vdc 18A to power the connected DC loads

5.1.1.2 Dip switch for battery type

Table 9 Dip switch for battery type setting

Switch #3	Switch #4	Battery type
OFF	OFF	AGM
OFF	ON	GEL
ON	OFF	LFP
ON	ON	WET

5.1.1.3 External Main Switch (Optional)

EMP offers a possibility to connect with an external main switch, which allows user to turn on/off the EMP remotely.



Figure 7 Main switch

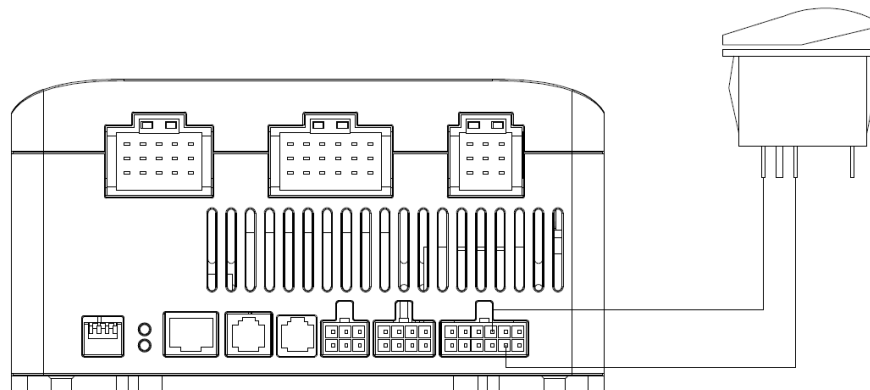


Figure 8 Wiring diagram of main switch

5.2 Daily Maintenance

- Check and insure the nominal battery voltage is 12Vdc.
- When replacing the existing battery with a new one, please have the new battery fully charged by Grid for the first time use

6. Trouble shooting

6.1 LED display on EMP

Table 10 Error LED indicator of EMP

NO.	LED	Color	Status	Description
1	CHG / DISCHG	Green / Orange	Flash once per cycle	Auxiliary battery voltage low
2			Flash twice per cycle	Auxiliary battery voltage high
3			Flash 3 times per cycle	EMP over temperature
4			Flash 4 times per cycle	Bulk charge timeout

7. Specification

Table 11 Specification of EMP31/EMP51

Model			EMP31	EMP51
Electrical				
Grid	Nominal input voltage		180~265VAC, 50/60Hz	180~265VAC, 50/60Hz
	Power factor		≥0.95	≥0.95
	Input current (Full load)		1.8A	3.0 A
Batteries	Motor battery voltage		12.8~14.8Vdc	12.8~14.8Vdc
	Auxiliary battery voltage		0~16Vdc	0~16Vdc
PV	Charger controller		PWM	PWM
	Input voltage		15~30Vdc	15~30Vdc
VCR	Current		12VDC, 30A (Continuous)	12VDC, 30A (Continuous)
	Engagement voltage		13.4Vdc	13.4Vdc
	Time delay of engagement		10sec	10sec
	Disengagement voltage		12.8Vdc	12.8Vdc
	Time delay of disengagement		60sec	60sec
	Over voltage protection		14.8Vdc	14.8Vdc
Charger mode	Charging profile		TBB premium II charging algorithm	TBB premium II charging algorithm
	Battery type		AGM/GEL/LFP/WET	AGM/GEL/LFP/WET
	Start charging voltage		0Vdc	0Vdc
	Charging current	Grid	18A±1A	30A±1A
		PV	15A±1A	15A±1A
	Absorption charging voltage		(14.4/14.1/14.4/14.7)±0.3Vdc	(14.4/14.1/14.4/14.7)±0.3Vdc
Float charging voltage		(13.5/13.5/13.5/13.7)±0.3Vdc	(13.5/13.5/13.5/13.7)±0.3Vdc	
Power supply mode	Nominal output voltage		12.8±0.3Vdc	12.8±0.3Vdc
	Output current		18A±1A (max)	30A±1A (max)
Efficiency			MAX88%	MAX88%
Working temperature			-25°C~40°C working with rated power 40°C-60°C working with derated power	-25°C~40°C working with rated power 40°C-60°C working with derated power
Cooling			By nature	Forced Fan

Others				
Battery Disconnect (LVD)	Disconnect voltage	AGM/GEL/WET	10.8±0.3 Vdc	10.8±0.3 Vdc
		LFP	11.2±0.3 Vdc	11.2±0.3 Vdc
	Delay off time	60s		60s
	Reconnect voltage	AGM/GEL/WET	11.8±0.3 Vdc	11.8±0.3 Vdc
LFP		12.2±0.3 Vdc	12.2±0.3 Vdc	
Fuse	Quantity	16+2		16+2
	Specification	50A*2; 25A*1; 20A*7; 10A*7; 5A*1		50A*2; 25A*1; 20A*7; 10A*7; 5A*1
Protection	Short circuit of Power supply mode	Connected with a battery: Fuse blown up		Connected with a battery: Fuse blown up
		Connected without a battery: Shut down the output and resume automatically		Connected without a battery: Shut down the output and resume automatically
	Battery polarity reverse	Fuse blown up		Fuse blown up
	Charger over-temperature	Shut down charger output		Shut down charger output
Structure				
Housing	Plastic		Plastic	
Dimension	235mm*185mm*98.5mm		235mm*185mm*98.5mm	
Weight	2.5kg		2.6kg	
Output terminal	THB terminal		THB terminal	
AC input socket	IEC		IEC	
IP rating	IP20		IP20	
Installation	In horizontal/in vertical		In horizontal/in vertical	
Certification				
E-mark	ECE R10			

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