



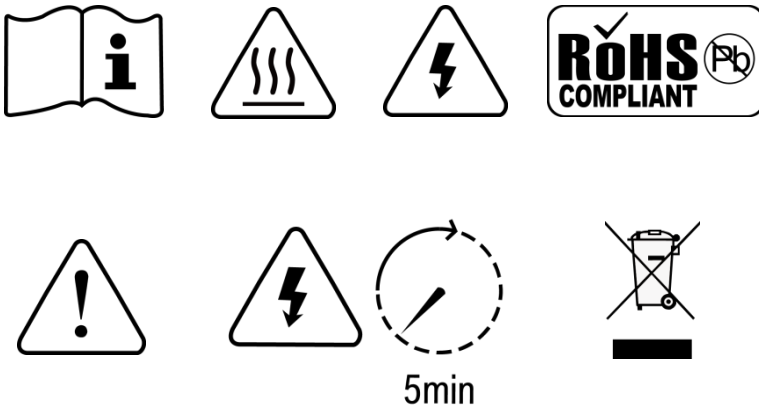
# User Manual

## Solar Intelligent Energy System (SIES)



**Version A1.0**

**Date: Mar. 2018**



WARNING: FIRE HAZARD

SUITABLE FOR MOUNTING ON CONCRETE OR OTHER  
NON-COMBUSTIBLE SURFACE ONLY

CAUTION: THE DC AND AC BREAKER MUST HAVE BEEN  
TURNED OFF BEFORE SERVICING

MADE IN CHINA

## Disclaimer

Unless specially agreed in writing, TBB Power Co., Ltd.

- Take no warranty as to the accuracy, sufficiency of suitability of any technical or other information provided in this manual or other documentation.
- Assumes no responsibility or liability for loss or damage, whether direct, indirect, consequential or incidental, which might arise out of the use of such information
- TBB offers standard warranty with its products, taking no responsibility for direct or indirect loss due to equipment failure.

## 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 Solar Intelligent Energy System (SIES). This chapter contains important safety and operation instructions. Read and keep this User Guide well for later reference.

SIES 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 inverter.
- 2) Please connect positive terminal “+” of battery to “+” input of the inverter.
- 3) Please connect negative terminal “-” of battery to “-” input of the inverter.
- 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) Inverter will have high voltage inside. Only authorized electrician can open the case.
- 7) The inverter WAS NOT designed to use in any life retaining equipment.

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# 1. General Safety Instruction

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## 1.1 Safety Instruction

As dangerous voltages and high temperature exist within the Solar Intelligent Energy System (SIES), only qualified and authorized maintenance personnel are permitted to open and repair it. Please make sure SIES system is turned off before open and repair it.

This manual contains information concerning the installation and operation of SIES system. 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

Do not expose to dust, rain, snow or liquids of any type, it is designed for indoor use. DO NOT block off ventilation, otherwise SIES system would be overheating.

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.

Please do not put any inflammable goods near to SIES system.

Never place unit directly above batteries, gases from a battery will corrode and damage energy storage system.

## 1.3 Precaution regarding battery operation

Use plenty of fresh water to clean in case battery acid contacts skin, clothing, or eyes and consult with doctor as soon as possible.

The battery may generate flammable gas during charging. Provide adequate ventilation during charging. NEVER smoke or allow a spark or flame in vicinity of a battery.

Do not put the metal tool on the battery; spark and short circuit might lead to explosion.

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.

A battery circuit breaker was built in the intelligent power distribution box.

## **1.4 Precaution regarding photovoltaic**

Photovoltaic produce electrical power when exposed to light and can cause an electric shock, energy, or fire hazard. Series fuse protection or PV box maybe required, depending on the type and configuration of the photovoltaic used in system. Series fuse, diodes and PV circuit breaker were built in our PV box.

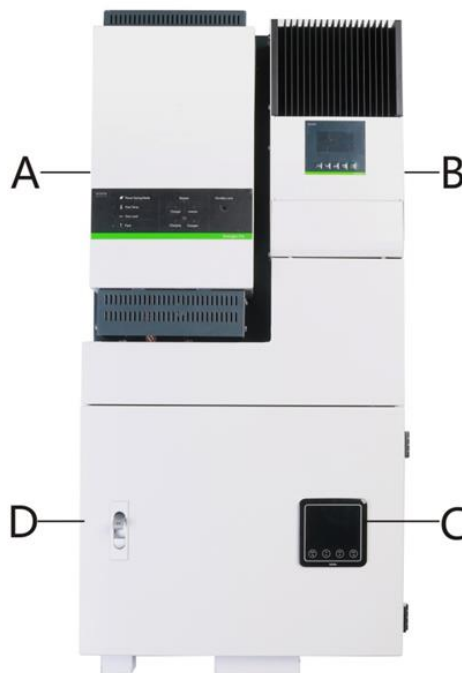
## 2. System Introduction

SIES is a self-consumption hybrid PV system developed by TBB power. Working together with various kinds of battery, SIES can take advantage of energy from sun, grid or generator, in order to realize energy independent. With built-in AGS (Automatic Generator Start) function, SIES can automatically start or stop generator.

As an independent power solution for household and small business, SIES assures you the continuous power and immunes to power shedding or blackout. It is the reliable solution for areas where have no power supply or suffer electricity shortage.

Combined of MPPT charge controller, heavy duty bi-directional inverter, energy management system, energy meters, circuit breakers and central monitor, SIES is a fully integrated system with all components well configured and programmed.

Designed with the concept of "Plug and Play", it requires no further configuration and much less connection effort. System installation is quite easy and system performance is strengthened accordingly.



*Figure 1 Overall appearance of SIES*



Table 1 Configuration of SIES system

Items	System Components
A	Energier Pro bi-directional inverter
B	Solar Mate MPPT charge controller
C	Cyber(central monitoring)
D	Smart Box

## 2.1 Work Modes of SIES

SIES has multiple work modes, which can be configured through SmartPhone APP or Web-based Monitoring Platform.

### 2.1.1 Solar Hybrid mode

This work mode is for those areas suffering from frequent power shedding. Energy from solar will be the prioritized source for powering the loads and meanwhile charging the battery. When it is sunset and grid is available, grid will be major source to power the loads and charge battery. Only if there is power blackout, will battery be discharged to power the loads.

Table 2 Solar Hybrid mode

Work Mode	Priorities of Energy Source	Description
Solar Hybrid	Solar > Grid > Battery	<ol style="list-style-type: none"> <li>1. During daytime, Solar Energy has priority to power the loads and at the same time charge battery.</li> <li>2. If Solar Energy is not sufficient and grid is available, the grid will be introduced to power the loads and charge battery.</li> <li>3. Upon power blackout, battery will be discharged to power the loads.</li> </ol>

### 2.1.2 Energy Storage mode

There are two scenarios:

#### 2.1.2.1 Scenario A: Grid is not available

This work mode is mainly working for areas without grid. Energy from solar is the prioritized source for powering the loads and meanwhile charging the battery. When it is sunset, battery will be discharged to power the loads. If battery has been deeply discharged, SIES will start the diesel generator in order to power the loads and meanwhile charge the battery.

*Table 3 Energy Storage mode: Grid is not available*

Work Mode	Priorities of Energy Source	Description
Energy Storage (A)	Solar > Battery > Generator	<ol style="list-style-type: none"> <li>1. During daytime, Solar Energy has priority to power the loads and at the same time charge battery.</li> <li>2. If Solar Energy is not sufficient, battery will be discharged to power the loads.</li> <li>3. When battery is discharged to low voltage level, generator will be automatically started to power the loads and charge the battery.</li> </ol>

### 2.1.2.2 Scenario B. Grid is available but not the preferred energy source

This work mode can also be useful for areas where have grid but the people want to be independent from grid. Energy from solar will be the prioritized source for powering the loads and meanwhile charging the battery. When it is sunset, battery will be discharged to power the loads. Only if battery is deeply discharged, grid will be introduced to power the loads. Furthermore, the system can be configured whether the power from grid will be used for charging battery or completely not.

*Table 4 Energy Storage mode: Grid is available but not the preferred energy source*

Work Mode	Priorities of Energy Source	Description
Energy Storage (B)	Solar > Battery > Grid	<ol style="list-style-type: none"> <li>1. During daytime, Solar Energy has priority to power the loads and at the same time charge battery.</li> <li>2. If Solar Energy is not sufficient, battery will be discharged to power the loads.</li> <li>3. When battery is discharged to low voltage level, grid will be introduced to power the loads and charge the battery.</li> </ol>

### 2.1.3 Power Backup mode

This work mode is aiming at those area suffering occasional power blackout. Grid is the main power source, and PV and grid will charge the battery together. Battery is to be discharged to power the loads only if there is power blackout.

*Table 5 Power Backup mode*

Work Mode	Priorities of Energy Source	Description
Power Backup	Grid > Battery	<ol style="list-style-type: none"> <li>1. Grid will be major power source for powering loads. PV and grid charge the battery together.</li> <li>2. Upon power blackout, battery will be discharged to power the loads.</li> </ol>

## 2.2 System features

### High performance inverter

Energier Pro series bi-directional inverter generates true sine-wave alternative current (AC) so that it can reliably power all kind of home appliances, such as TV, washing machine, electrical stove, microwave, water pump and air conditioner, etc. Thanks to its industrial leading efficiency, the SIES system can efficiently manage the energy flow and help you save energy.

More information about Energier Pro, please refers to the dedicated user manual of Energier Pro.

### High system efficiency

Solar Mate series MPPT charge controller of SIES has a peak efficiency up to 98%. Maximum Power Point Tracking (MPPT) technology can increase the energy generation of PV panel by more than 30%, especially when the sun irradiation is at low level, for example sunrise or cloudy day etc. Solar Mate is a multi-voltage MPPT charge controller with sophisticated battery charging algorithm for lead acid battery or lithium-ion battery.

Energier Pro series bi-directional inverter of SIES features high conversion efficiency up to 94% and extraordinary low zero-load power consumption, therefore the SIES can make full advantage of the energy harvested from the sun.

### Intelligent energy management

According to the chosen work mode, SIES will automatically monitor and manage the energy flow. Energy generated by PV system and from grid or generator will be converged and optimized to a maximum extent.

### Comprehensive monitoring

SIES offers comprehensive monitoring of whole system. Cyber central monitor displays all information including energy generation, energy consumption and battery state of charge (SoC), etc, clearly and in real time.

Besides, as a web-based remote monitoring platform, TBB Energy Management Solution (TEMS) meets more advanced requirement on monitoring and control. Abundant system data of SIES system can be remotely monitored through GPRS or WIFI connections, and the system can be remotely configured and operated.

### Quick installation design

Designed with the concept of “Plug and Play”, the SIES system can be installed quickly with minimum time, labor and footprint.

## 2.3 Energier Pro inverter charger combination

Energier Pro bi-directional inverter is a new generation inverter charger combination, which integrates a powerful battery charger, true sine wave inverter and a high speed AC transfer switch into a single enclosure. Meantime, its multiple energy management functions / accessories enables the users to configure advanced hybrid independent power systems for various applications.

For detailed information of Energier Pro, please refer to its user manual.

## 2.4 Solar Mate MPPT charger controller

Solar Mate MPPT charge controller is a solar charge controller with built-in Maximum Power Point Tracking (MPPT) technology, which can optimize the PV's output by eliminating the fluctuation due to shading or temperatures variation. It tracks the maximum power point of a PV array in order to deliver the maximum charging current to battery, so that the energy generation of PV array can be significantly increased by as much as 30% comparing with PWM technology.

For detailed information of Solar Mate, please refer to its user manual.

## 2.5 Smart Box (SMB)

Smart Box is an intelligent power distribution box, which was designed with the target not only to simplify the installation of SIES system, but also strengthen the system functions with built-in components such as MEDU (Multiple Energy Detection Unit), circuit breakers, central monitor and maintenance bypass, etc.

Smart Box contains the following components:

*Table 6 Components of Smart Box*

Category	Device
AC input	Circuit breaker, SPD, Terminals
AC output	Residual current device, Manual Bypass Circuit Breaker, Load Management Unit, Terminals
PV input	Circuit Breaker and relevant Terminals
Battery	Circuits Breaker and relevant Terminals

MEDU is the energy detection unit, which collects the status information from the following components and communicates with Cyber central monitor. Its functions are described as following table.

Table 7 Functions of MEDU

Category	Functions
AC input	• Measure voltage, current, frequency, power and KWh
AC output	• Measure voltage, current, frequency, power and KWh
Battery	• Measure SoC, charging and discharging current, voltage, temperature, charging and discharging KWh
Load management	<ul style="list-style-type: none"> <li>• Measure the power and KWh of programmable AC output L2 and L3.</li> <li>• Users or installers can program the work logic of two AC outputs L2 and L3, based on multiple conditions: length of time, power, battery SoC, interlock and consumed energy in KWh.</li> </ul>

## 2.6 Cyber central monitor

Thanks to T-Bus communication protocol, Cyber can display the work status of all system components in real time, including PV array, inverter charger combination, battery and loads.

In the middle of LCD screen of Cyber, there are two green triple arrows and one blue triple arrow which indicate the energy flows. These two energy flow bars display the system status in real time, and are explained in detail in chapter 6.



Figure 2 Cyber the central monitor of SIES

Table 8 Functions of Cyber

Category	Functions
Monitoring	Energier Pro bi-directional inverter, Solar Mate MPPT charge controller, Battery and Load
Configuration	Battery Type, Battery Capacity
Control	Battery Equalization
Communication	Built-in Bluetooth, optional GPRS or WIFI
Others	Calendar, Clock

## 2.7 Maintenance bypass

Upon failure of Energier Pro, the Maintenance Bypass, which is located in Smart Box, can be used for the purpose of system maintenance. As a result, on one side, the Energier Pro can be safely dismantled from the rest of SIES for further examining and repairing, and on another side, the loads can be continually powered by available grid or generator.

Please refer to Chapter 5.5 for more details of maintenance bypass.



This operation might damage bi-directional inverter, and can ONLY be performed by professional. The failure of inverter due to unauthorized operation is out of warranty.

## 2.8 Intelligent charging management

SIES coordinates the battery charging from two chargers (Battery charger of Energier Pro and Solar Mate MPPT charge controller) and charges battery according to multiple parameters related with battery. Energy generated from PV array will be prioritized power source and grid as supplement one, as a result the charging current won't exceed the limit.

## 2.9 AGS (Automatic Generator Start)

With the built-in AGS function, SIES can automatically start the generator once the predefined conditions are met. The conditions can be battery voltage, power of loads and length of time. A software for Windows system is provided to easily program the conditions of starting and stopping generator.

## 2.10 Load management (programmable AC output)

AC outputs L2 and L3 are for smart load control and can be programmed to control the specific loads, for example air conditioner, water heater, etc. The load control can be based on combination of conditions such as load power, battery SoC, length of time, or accumulated energy consumption of relevant load.

*Table 9 Load Management*

Category	Condition	Action	Resume
Power	Load power $\geq$ set value	Switch off	Press FUNC switch in Cyber
Battery SoC	SoC $\leq$ set value	Switch off	Resume output when battery SoC is 10% higher than the set value
Length of Time	Exceeds the set value	Switch off	
KWh	Consumed maximum KWh per setting	Switch off	Automatically resume in a new day cycle

## 2.11 Software configuration

SIES is fully programmable through web-based platform, for the following functions or parameters:

- System work modes
- AC input parameters
- Inverter parameters
- Battery parameters
- Battery charging parameters
- Automatic Generator Start (AGS)
- Load management

## 2.12 Naming rules of SIES

### 2.12.1 Models of SIES

The following naming rules are applied on models of SIES:

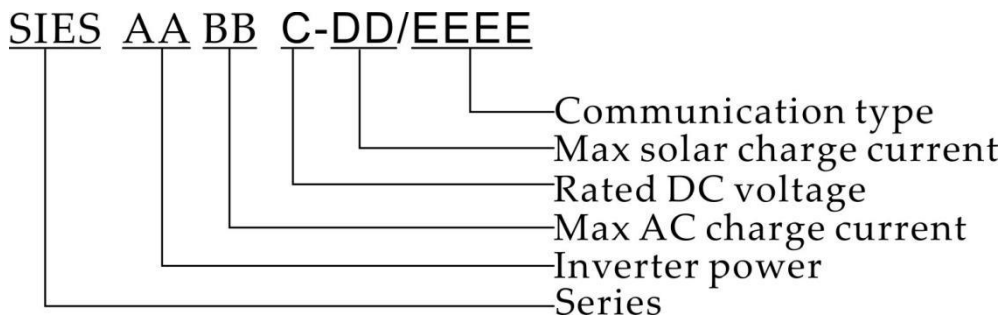


Figure 3 Naming rules of SIES

Table 10 Naming rules of SIES

Field	Figures	Explanation	
SIES	SIES	Series Name	
AA	20	Inverter Power	2000VA
	30		3000VA
	40		4000VA
	50		5000VA
	60		6000VA
	80		8000VA
BB	15	Max. AC charge current	15A
	20		20A
	30		30A
	40		40A
	45		45A
	50		50A
	60		60A
	90		90A
C	L	Rated DC voltage	12V
	M		24V
	S		48V
DD	60	Max solar charge current	60A
	60x2		2pcs 60A
EEEE	N.A.	Communication Type	Bluetooth
	GPRS		GPRS and Bluetooth
	WIFI		Wi-Fi and Bluetooth

## 2.12.2 Models of Smart Box

The following naming rules are applied on models of Smart Box

Table 11 Naming rules of Smart Box

Field	Figures	Explanation	
SMB	SMB	Series name	
AA	30	Max inverter Power	3000VA
	40		4000VA
	80		8000VA
B	L	Rated DC voltage	12V
	M		24V
	S		48V



<b>CC</b>	60	Max solar charge current	60A
	60x2		2pcs 60A
<b>DDDD</b>	N.A.	Communication Type	Bluetooth
	GPRS		GPRS and Bluetooth
	WIFI		Wi-Fi and Bluetooth

### 2.13 System scheme of SIES

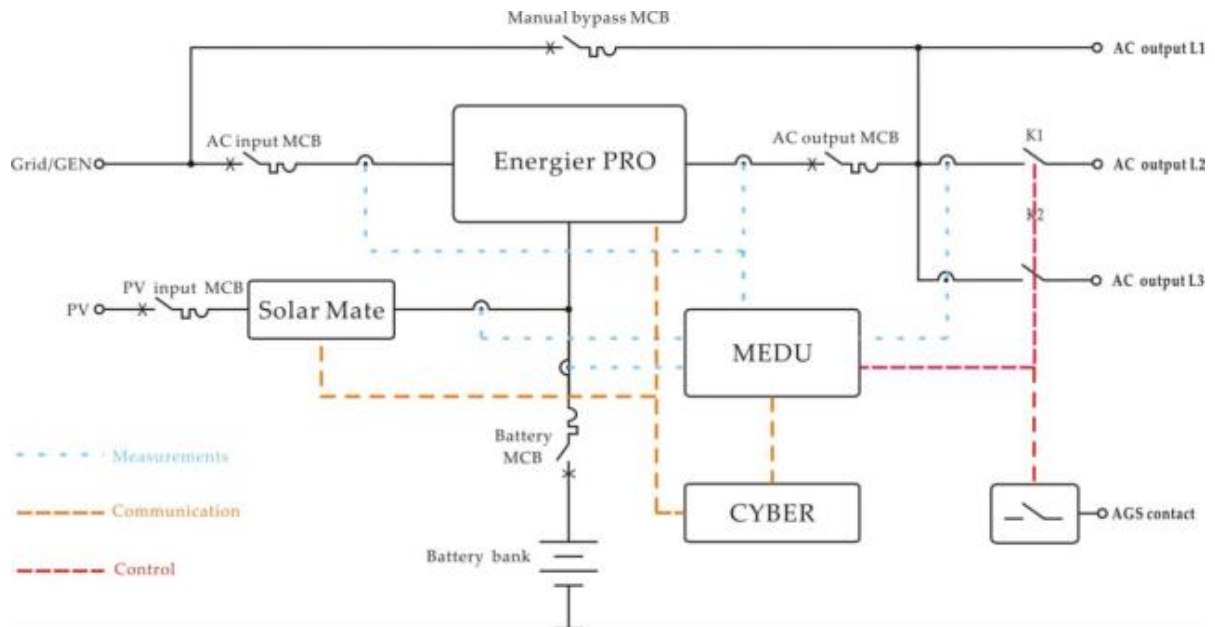


Figure 4 System scheme of SIES

### 3. Structure

#### 3.1 SIES 2-4 KVA models

Table 12 SIES 2-4 KVA models

System Components	Product Models
Energier Pro Bi-directional Inverter	<ul style="list-style-type: none"> <li>• 12V models: CF2060L; CF3090L;</li> <li>• 24V models: CF2030M; CF3045M</li> <li>• 48V models: CF2015S; CF3020S; CF4030S</li> </ul>
Solar Mate MPPT Charge Controller	<ul style="list-style-type: none"> <li>• 12V / 24V / 48V model: SP60-150</li> </ul>

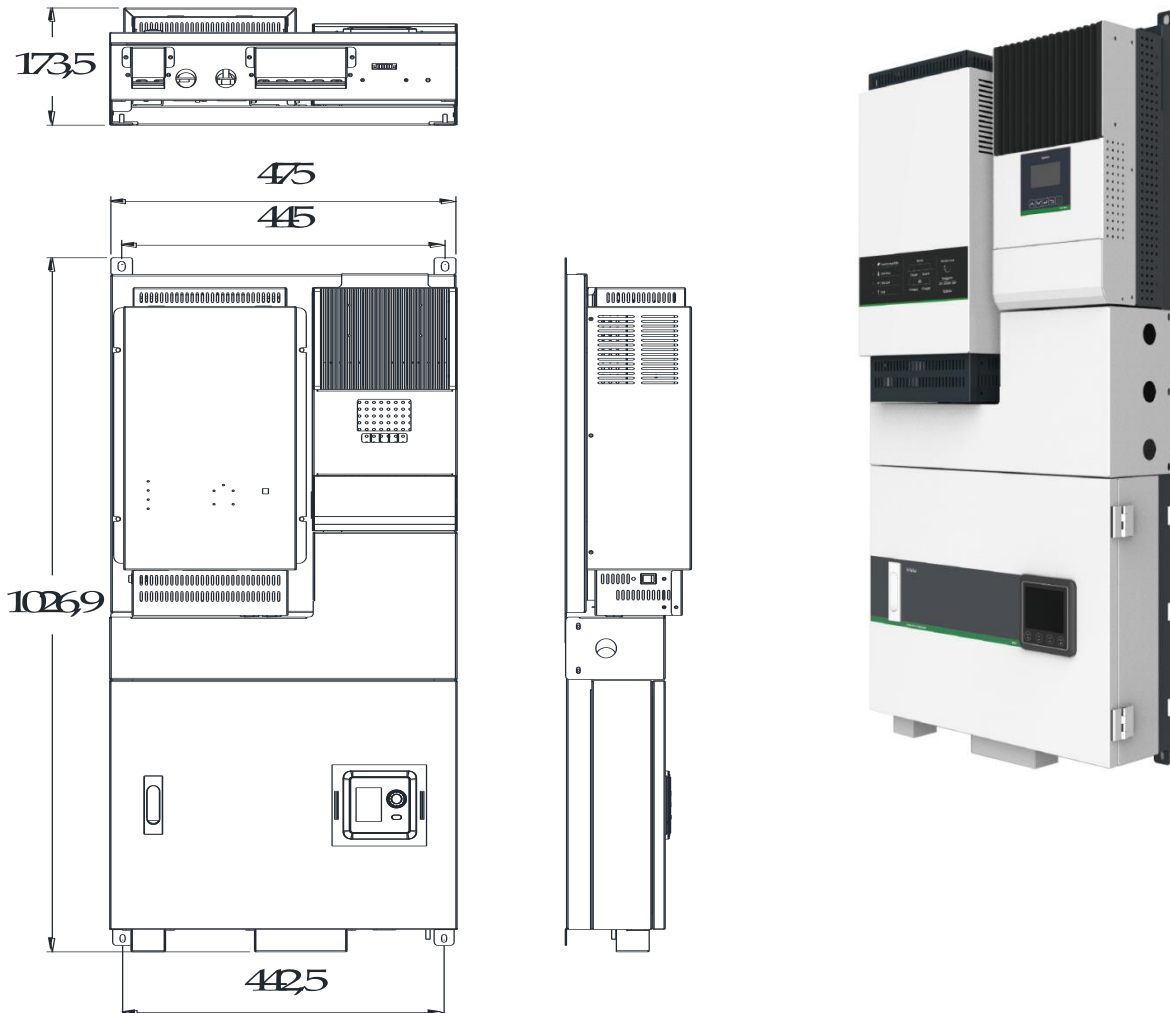


Figure 5 Dimension of SIES 2-4 KVA models

### 3.2 SIES 5-8KVA models with one Solar Mate MPPT

Table 13 SIES 5-8KVA models with one Solar Mate MPPT

System Components	Product Models
Energier Pro Bi-directional Inverter	<ul style="list-style-type: none"> <li>• 24V models: CF5090M</li> <li>• 48V models: CF6050S, CF8060S</li> </ul>
Solar Mate MPPT Charge Controller	<ul style="list-style-type: none"> <li>• 12V / 24V / 48V model: SP60-150</li> </ul>

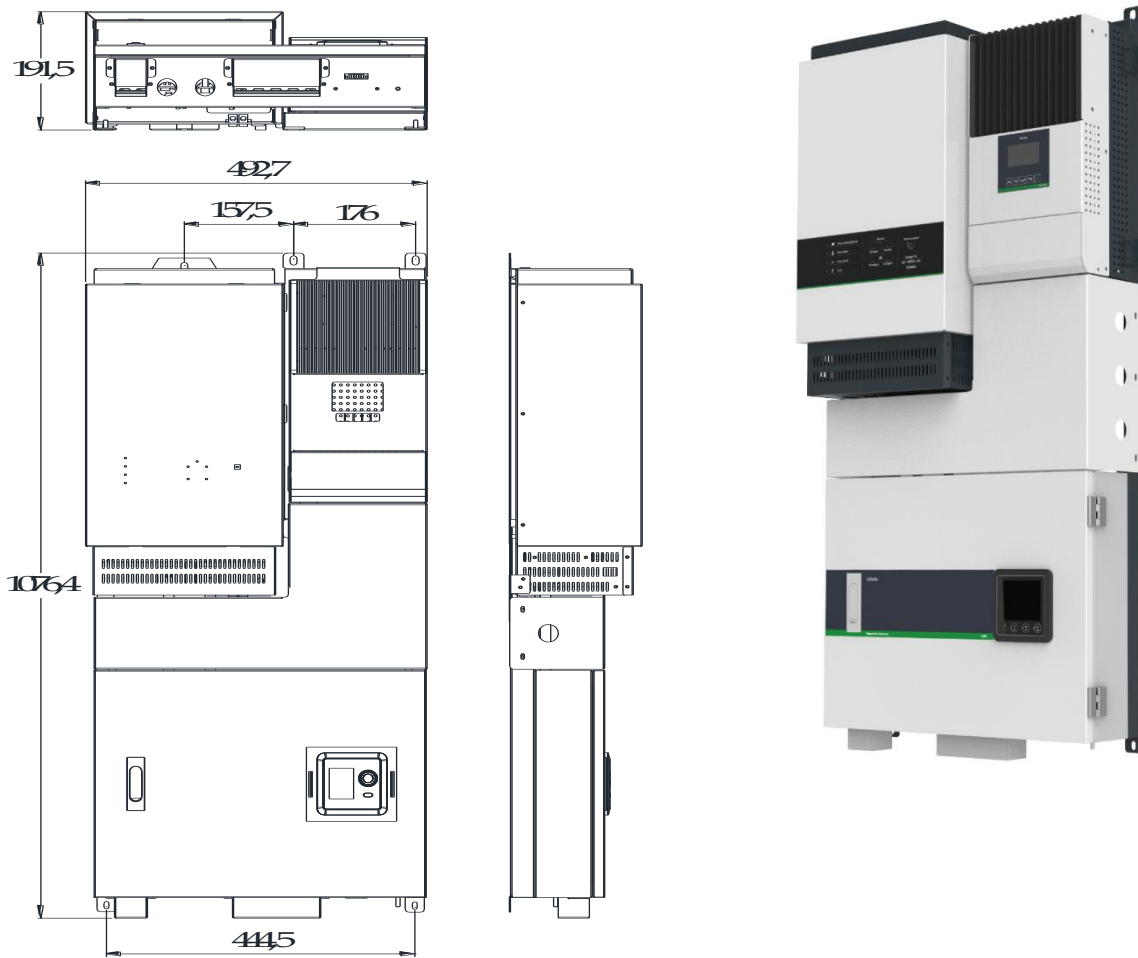


Figure 6 Dimension of SIES 5-8KVA models with one Solar Mate MPPT

### 3.3 SIES 5-8KVA with two Solar Mate MPPT

Table 14 SIES 5-8KVA with two Solar Mate MPPT

System Components	Product Models
Energier Pro Bi-directional Inverter	<ul style="list-style-type: none"> <li>48V models: CF6050S, CF8060S</li> </ul>
Solar Mate MPPT Charge Controller	<ul style="list-style-type: none"> <li>12V / 24V / 48V model: SP60-150 x 2</li> </ul>

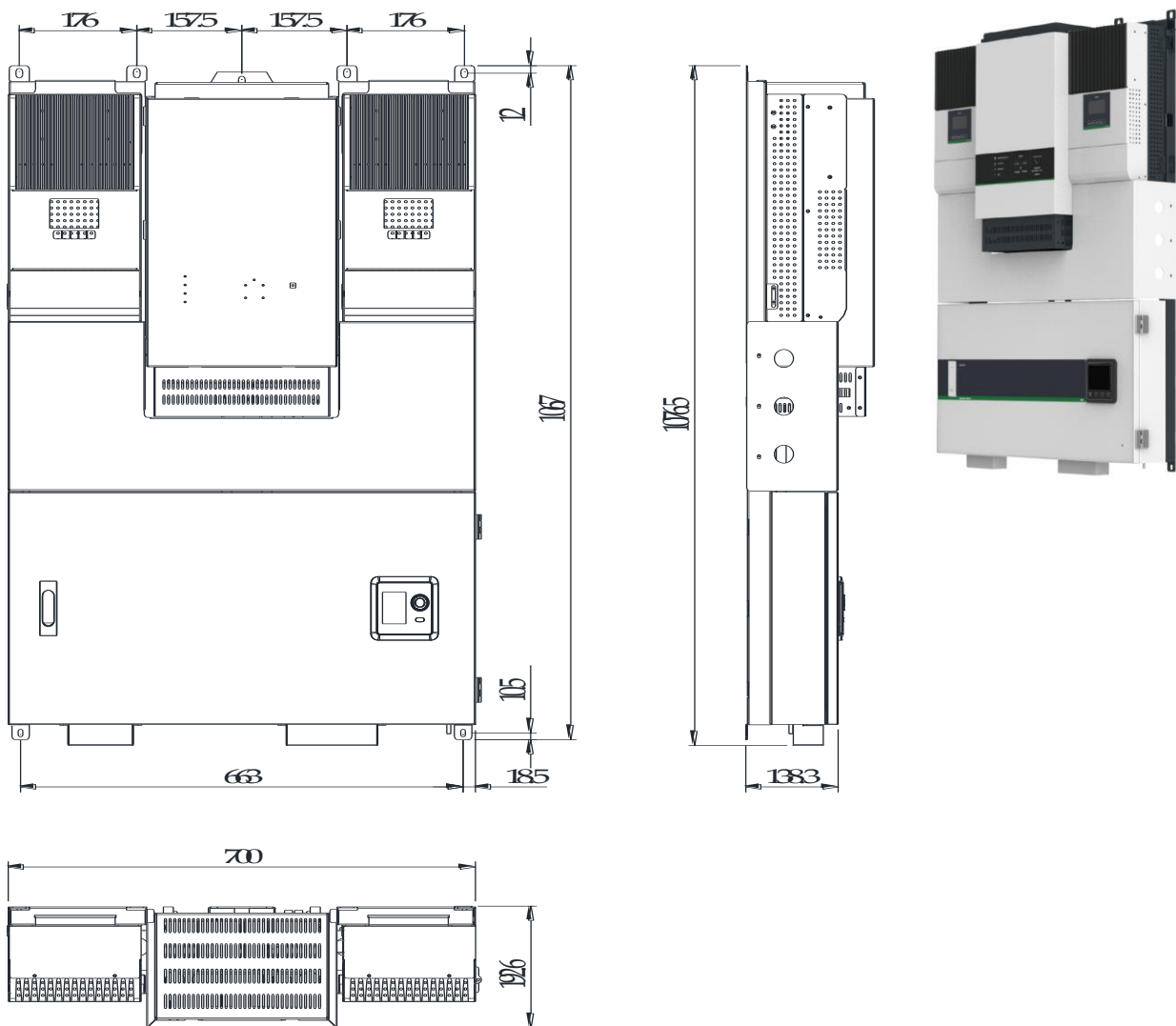


Figure 7 Dimension of SIES 5-8KVA with two Solar Mate MPPT

### 3.4 Front panel of Enerjier Pro

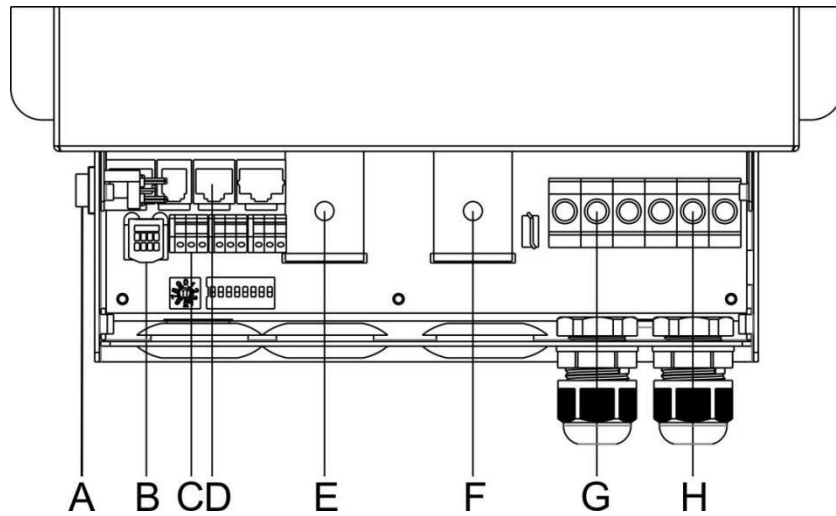


Figure 8 Front Panel of Models: CF2060L; CF3090L, CF2030M, CF3045M, CF2015S, CF3020S, CF4030S

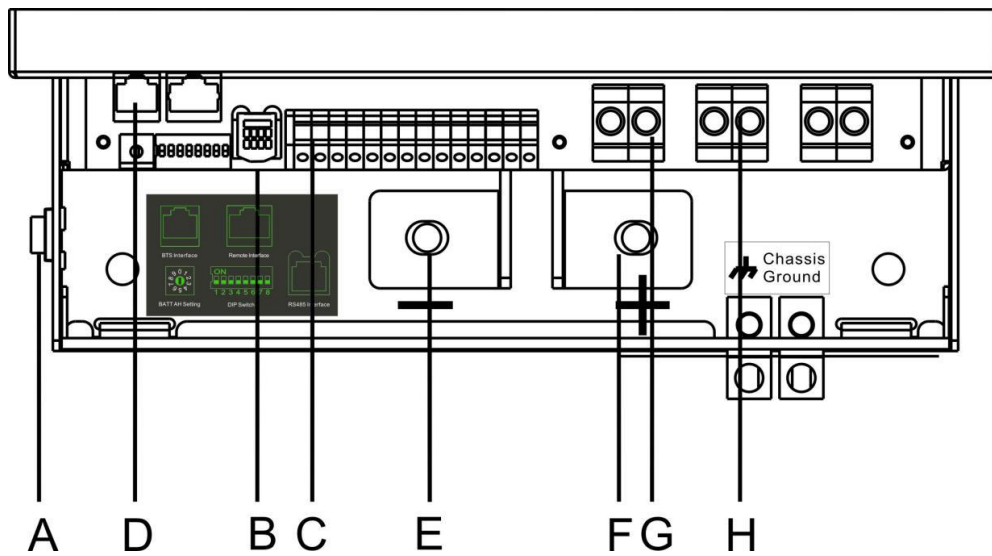


Figure 9 Front Panel of Models: CF5090M, CF5040S, CF6050S, CF8060S

Table 15 Parts of Enerjier Pro

Alphabet	Elements	Alphabet	Elements
A	Main switch	E	Battery negative(-) terminal
B	RS485 Interface	F	Battery positive (+) terminal
C	Voltage Sensor terminals	G	AC Output terminals
D	BTS Interface	H	AC Input terminals

### 3.5 Front panel of Solar Mate MPPT

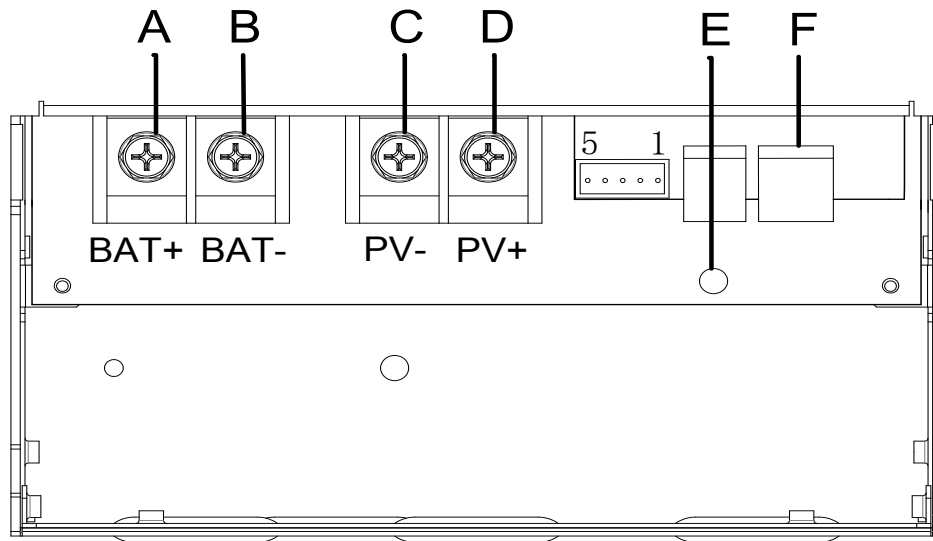


Figure 10 Front panel of Solar Mate MPPT

Table 16 Parts of Solar Mate MPPT

Alphabet	Elements	Alphabet	Elements
A	Battery+ terminal	D	PV IN + terminal
B	Battery- terminal	E	PE terminal
C	PV IN - terminal	F	COM Interface (RS485 communication)

### 3.6 Smart Box (SMB)

#### 3.6.1 Smart Box with one Solar Mate MPPT

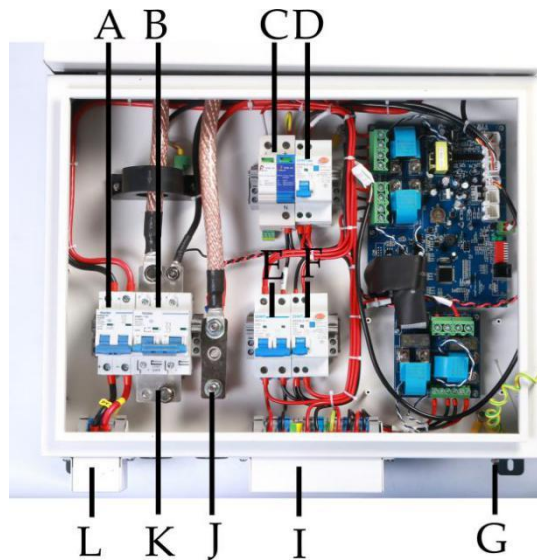


Figure 11 SMB-30L60, SMB-30M60, SMB-40S60, SMB-50M60, SMB-80S60

#### 3.6.2 Smart Box with two Solar Mate MPPT

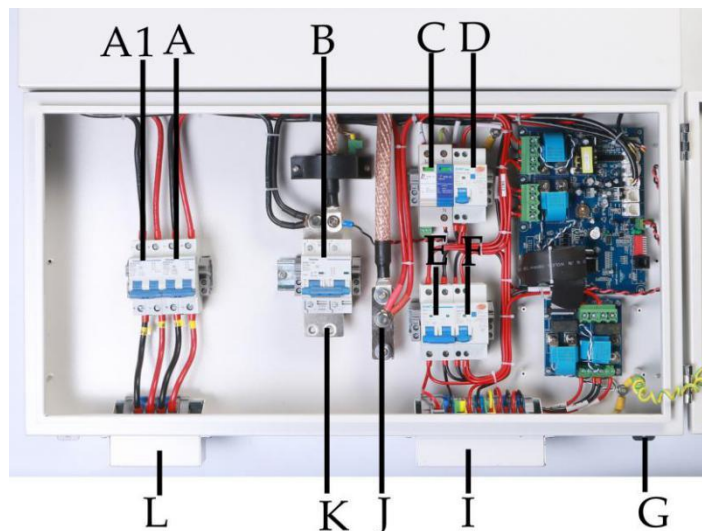


Figure 12 SMB-80S60x2

Table 17 Parts of Smart Box

<b>Alphabet</b>	<b>Elements</b>	<b>Alphabet</b>	<b>Elements</b>
A	PV input circuit breaker	G	PE terminal
A1	PV input circuit breaker (only for SMB-80S60x2)	H	AGS terminal
B	Battery input circuit breaker	I	AC input and output terminal (covered by metal plate )
C	AC input SPD <sup>1)</sup>	J	Battery positive (+) terminal
D	Manual bypass circuit breaker (RCD <sup>2)</sup> )	K	Battery negative (-) terminal
E	AC input circuit breaker (RCD)	L	PV input terminal (covered by metal plate )
F	Output circuit breaker		

【Note】 1)SPD: Surge Protection Device; 2) RCD: Residual Current Device



## 4. Installation and Connection

Preparation steps:

- Read the Installation Guide carefully
- Prepare all the tools and materials required during installation.
- Review the Safety Instructions in section 1.1.
- Be aware of all local safety and electrical code which must be met

**Failure to follow these instructions will result in death or serious injury.**



1. All wiring should be done by qualified personnel to ensure the compliance with all local applicable installation codes and regulations.
2. Disconnect all AC and DC power sources.
3. Disable and secure all AC and DC disconnect devices and automatic generator starting devices.



For the user operation safety, cut off the power before installation. Photovoltaic produce electrical power when exposed to light and can cause an electric shock, energy, or fire hazard.



Please make sure Smart Box, Energier Pro bi-directional inverter and Solar Mate MPPT charge controller have been switched off before connection. Otherwise, there might be a danger of high voltage.

### 4.1 Material list

#### 4.1.1 Standard components provided by TBB Power

The SIES system includes the following basic components:

- Energier Pro bi-directional inverter
- Solar Mate MPPT charger controller
- Smart Box
- Plastic bags containing all screw
- Battery Temperature Sensor (BTS)
- Voltage Sensor (VS)
- User's manual

### 4.1.2 Optional components provided by TBB Power

- Photovoltaic panel
- PV Box
- Battery Bank
- Battery Cable
- PV special cables

### 4.1.3 Installation Tools

- Screw Driver
- Phillips Screw Driver
- Drill or Impact Drill
- Wrench
- Wire Stripper
- Level indicator

## 4.2 Installation Location

Please install the system at a place where is dry, clean, cool with good ventilation.

- Operating temperature: -10°C ~ 50°C
- Storage temperature: -40°C ~ 70°C
- Relative humidity: 0% ~ 95%, non-condensing
- Cooling: Forced air

## 4.3 Wires Selection

Please find the recommend wire sizes as following table. In case of DC cable is longer than 1m, the cross section of cable should be increased in order to reduce the voltage drop and energy losses.

*Table 18 Wires Selection of SIES*

Inverter power	AC wiring		DC wiring						PV wiring	
	230VAC		12VDC		24VDC		48VDC		<150Vdc	
3000VA	4mm <sup>2</sup>	11 AWG	70mm <sup>2</sup>	0 AWG	50mm <sup>2</sup>	0 AWG	/	/	16mm <sup>2</sup>	5AWG
4000VA	6mm <sup>2</sup>	9 AWG	/		/	/	35mm <sup>2</sup>	2AWG	16mm <sup>2</sup>	5AWG
5000VA	10mm <sup>2</sup>	7AWG	/		70mm <sup>2</sup>	000 AWG	/	/	16mm <sup>2</sup>	5AWG
8000VA	16mm <sup>2</sup>	5AWG	/		/	/	70mm <sup>2</sup>	000 AWG	16mm <sup>2</sup>	5AWG

## 4.4 Installation of SIES components

The detailed installation steps, please refer to ANNEX I

- Ensure that the SIES system has the correct DC voltage compatible with the existing battery bank.
- Install the SIES system as close to the batteries as possible in order to reduce the voltage drop and energy losses in cables and ensure better performance of system.



Do not connect the AC output of SIES to existing household electrical appliance when they are connected to any available AC power sources either 230Vac main grid or generator.



Even though there is an over-current protection device for PV input and DC input in the Smart Box, we still suggest to install the over-current protection device as close to the PV input and battery terminal as possible. Or else, there is a risk of short-circuit which would cause fire.

For the specification of over-current protection device, please refer to the user manual of Energier Pro bi-directional inverter and Solar Mate MPPT charge controller.

## 4.5 Connection of internal cables

As soon as all system components of SIES have been installed in the rack, the internal cables should be connected in the next step. All connection terminals of internal cables had been pre-assembled in Smart Box. The installer should only connect the relevant cables to the terminals of Energier Pro or Solar Mate.

Please refer to the following internal wiring diagram:

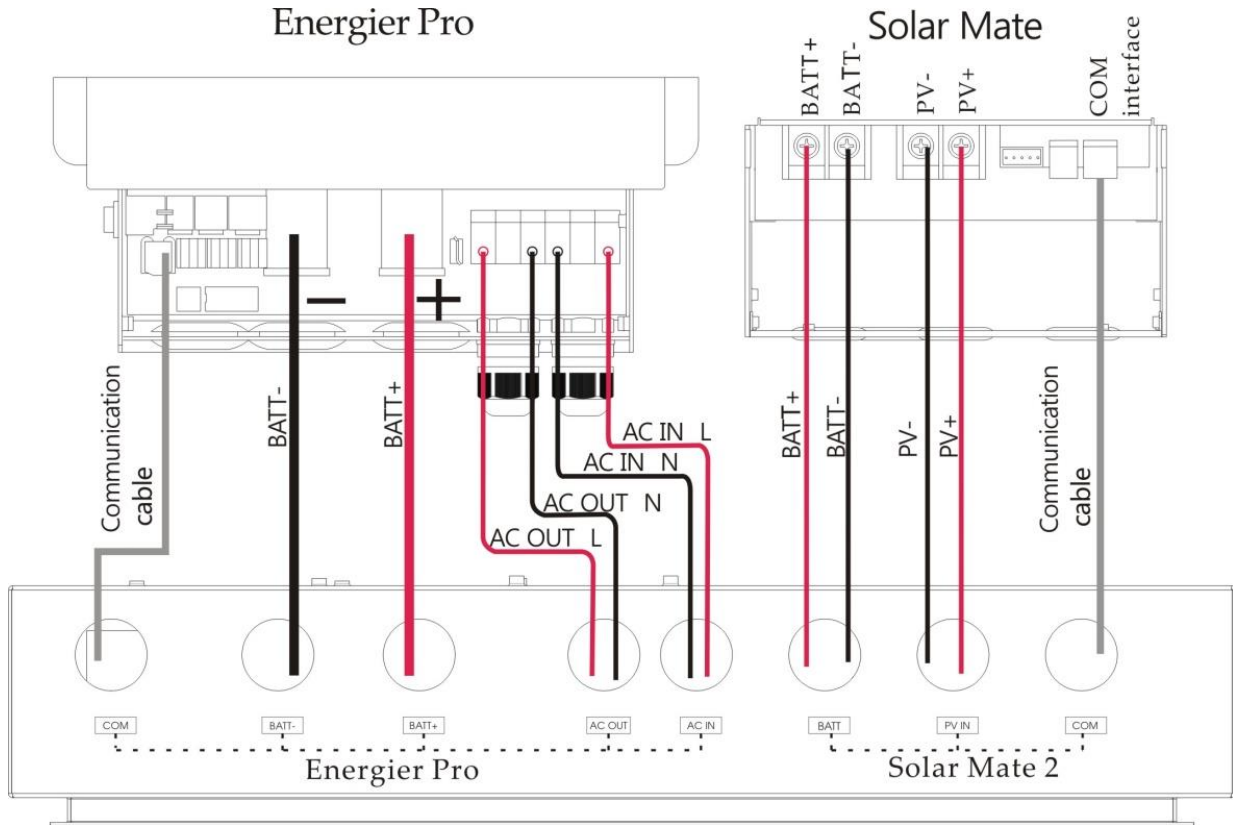


Figure 13 Internal wiring diagram of SMB-30L60, SMB-30M60 and SMB-40S60

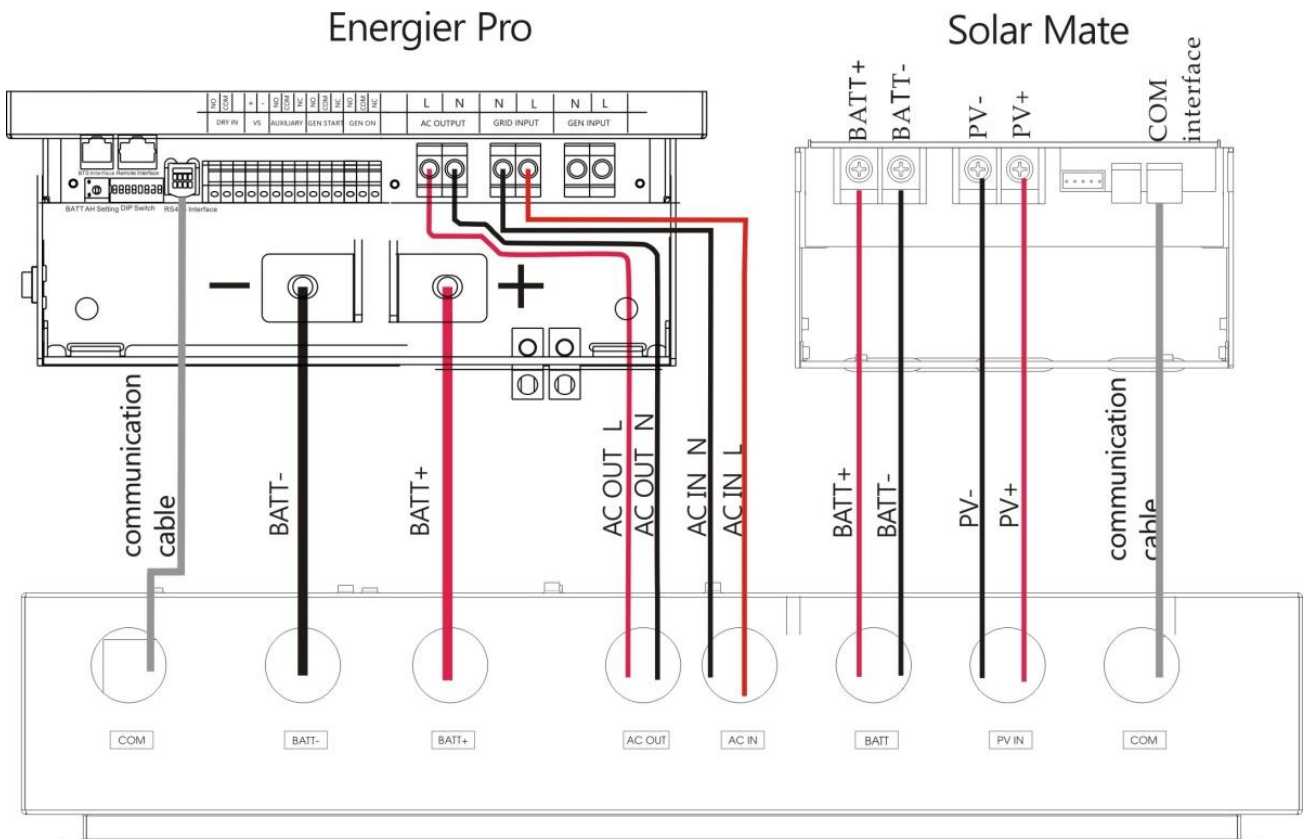


Figure 14 Internal wiring diagram of SMB-50M60 and SMB-80S60

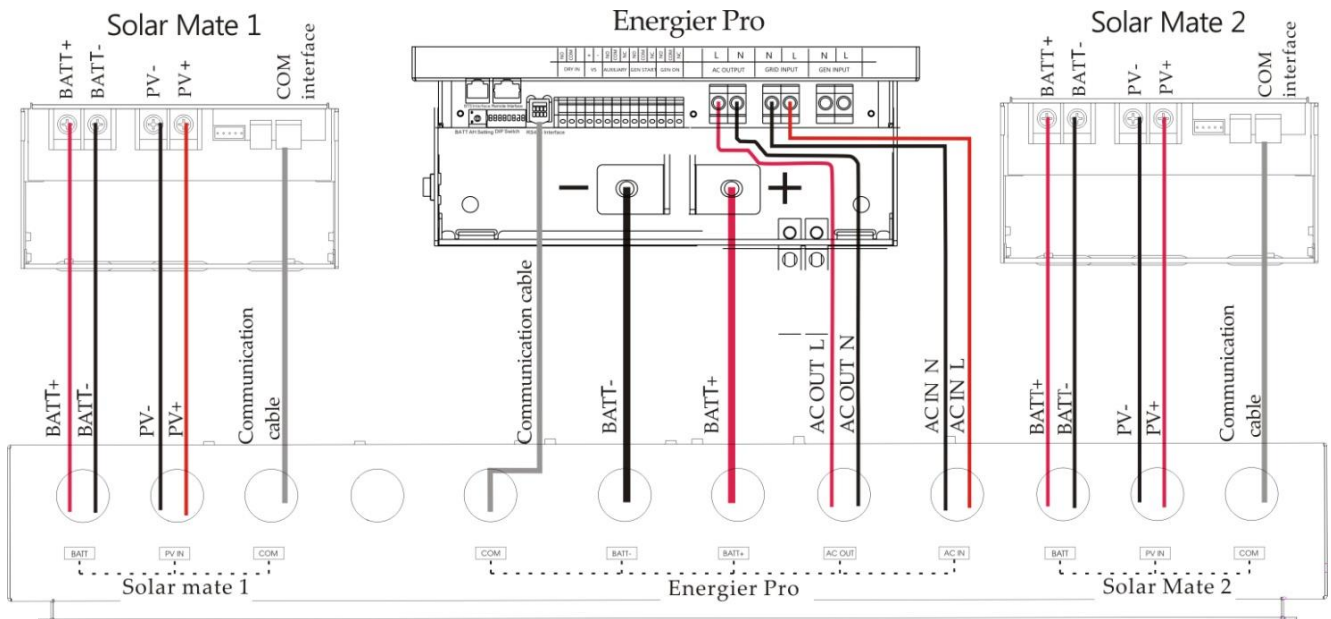


Figure 15 Internal wiring diagram of SMB-80S60x2 ( 2 x Solar Mate)

### 4.5.1 Connect cables from Smart Box to Energier Pro

The cables between Smart Box and Energier Pro are AC input cables, AC output cables, Battery/DC cables and Communication Cables.

#### 4.5.1.1 Battery cable

- Carefully check if the polarity marked on the cables and terminals are the same. That is, “BATT+” cable to “+” plus terminal, and “BATT-” cable to “-” minus terminal.
- Pull the battery cables through the holes in the front panel of Energier Pro.
- The battery cables connected to “+”/plus and “-”/minus terminals must be tightly screwed.

#### 4.5.1.2 AC input and output cables

Carefully check if the polarity marked on the cables and terminals are the same. Refer to below sheet to assure the “Label of Cable” is consistent with “Terminal of Energier Pro”:

Table 19 AC Input and Output Cables

Label of cable	Terminal on Energier Pro
AC IN L	L of AC input (line)
AC IN N	N of AC input (neutral )

AC OUT L	L of AC output (line)
AC OUT N	N of AC output (neutral )

- Pull the cables of AC input and AC output through the holes in front panel of Energier Pro,
- The cables of AC inputs and AC outputs should be connected to right terminals respectively, and must be tightly screwed.

#### **4.5.1.3 Communication cable**

- There is a communication cable between the COM interface of Smart Box (left inside) and the RS485 port of Energier Pro. Pull this communication cable through the hole at the left-top side of the Smart Box to implement connection.
- Carefully check the connections and make sure it is well connected.

### **4.5.2 Connect cable from Smart Box to Solar Mate MPPT**

The connection cables between Smart Box and Solar Mate MPPT are: battery cables, PV cables and communication cables.

#### **4.5.2.1 Battery cables**

- Carefully check if the polarity marked on the battery cables and terminals of Solar Mate are the same. The battery cables marked with “BATT+” should be connected to “BATT+” terminal of Solar Mate, and the cable marked with “BATT-” should be connected to “BATT-” terminal in Solar Mate.
- Pull the battery cables through the holes in the front panel of Solar Mate,
- The battery cables connected to “BATT+” and ”BATT-“ terminals of Solar Mate must be tightly screwed.

#### **4.5.2.2 PV cables**

- Carefully check if the polarity marked on the PV cables and terminals of Solar Mate are the same. The cable marked with “PV+” should be connected to “PV+” terminal of Solar Mate, the cable marked with “PV-” should be connected to “PV-” terminal of Solar Mate.
- Pull the battery cables through the holes in the front panel of Solar Mate.
- The battery cables connected to “PV+” and ”PV-“ terminals of Solar Mate must be tightly screwed.

#### **4.5.2.3 Communication cable**

- There is a communication cable between the COM interface of Smart Box (right inside) and the RS485 port of Solar Mate MPPT. Pull this communication cable through the hole at the right-top side of the Smart Box to implement connection.
- Carefully check the connections and make sure it is well connected.

## 4.6 Installation of Battery

### 4.6.1 General Advice

- Never place other equipment directly above the batteries — gas from battery will corrode and damage the inverter/charger.
- Battery must be installed in a well-ventilated area.
- Battery must be installed evenly with proper clearance between batteries.
- Battery cables must have clear marks of Plus (+) and Minus (-).
- Assure the connection cables to battery terminal are tightly screwed.

### 4.6.2 Connect the batteries

Several smaller batteries can be connected together to configure a battery bank of required size. There are three ways to connect batteries: parallel, series or series-parallel.

To configure a larger battery bank, thick and heavy cables should be used to connect individual batteries. The actual size of the cables depend on the maximum current which will flow through the cables.



The size of battery cables should not be smaller than the size of inverter cables — for example, if the cables between battery and Energier Pro is 16 mm<sup>2</sup>, the interconnect cables among batteries is recommended 16 mm<sup>2</sup>, too.



The batteries which will be connected in parallel should be made by the same manufacturer, and of same type and amp-hour rating.

#### 4.6.2.1 Series Connection

When batteries are connected with the positive terminal of one battery to the negative terminal of the next battery, they are connected in series. In a series configuration, the battery bank has the same amp-hour rating as a single battery, but the overall voltage is equal to the sum of all individual batteries.

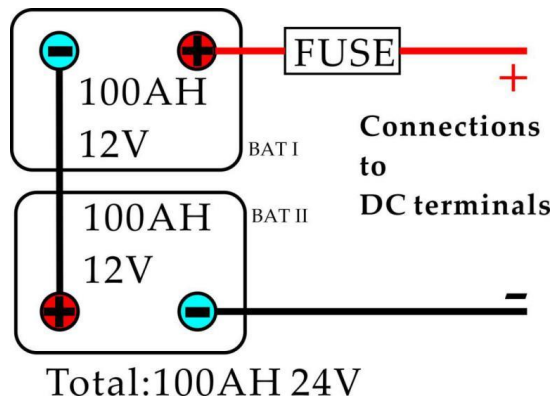


Figure 16 Series Connection

#### 4.6.2.2 Parallel Connection

When all positive terminals of a group of batteries are connected in together, and respectively, separately, all negative terminals of this group of batteries are connected in together, we call that they are connected in parallel. In a parallel configuration, the battery bank has the same voltage as a single battery, but its amp-hour rating is equal to the sum of all individual batteries.

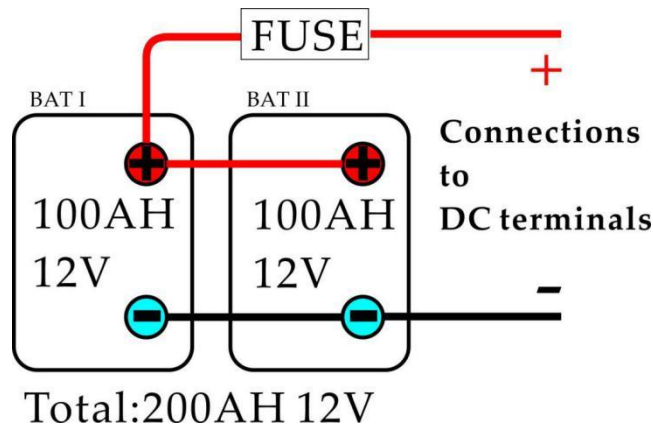


Figure 17 Parallel Connection



The length of connection cables between batteries should be same, in order to assure the resistance is equal in each battery.

For example, the lengths of the positive and negative connection cables from BAT I to BAT II must be the same. And the negative cable should be pulled out from the negative terminal of BAT II, and the positive cable should be pulled out from the BAT I (Figure 17).



### 4.6.2.3 Series-Parallel Connection

As the name implies, both the series and parallel connections are used in order to configure a bigger battery bank. As a result, both the overall voltage and amp-hour rating are increased comparing to individual battery. This way of connection is common in all kinds of battery-inverter system.

The batteries with lower voltage are firstly connected in series to obtain a string of batteries with the expected higher voltage, and then multiple strings are connected in parallel to increase the total capacity (amp-hour) of battery bank.



The lengths of connection cables among individual batteries should be same, in order to assure the resistance is equal in each battery.

For example: The lengths the connection cables between BAT I to BAT II, BAT III to BAT IV should be the same. And, the negative cable should be pulled out from the negative terminal of BAT II, the positive cable should be pulled out from the positive terminal of BAT III (Figure 18).

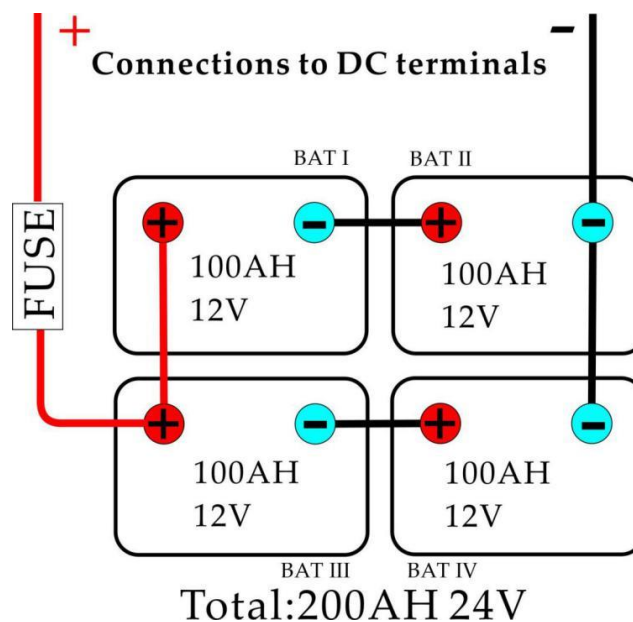


Figure 18 Series-Parallel Connection

## 4.7 Connection of external cables

The external connection terminal was located at bottom of Smart Box with marking.

Table 20 External Connection Terminals of Smart Box



Please double confirm the polarity of battery and PV input. Reverse polarity could cause permanent damage on equipment and it is out of warranty.



Please double check the polarity of AC input and output. Wrong polarity will damage the equipment and it is out of warranty.



Please double check the battery voltage matching the model you are going to install. The wrong battery voltage could damage the system and it is out of warranty.

Alphabet	Explanation	Alphabet	Explanation
A	PV input terminal block	D	AC terminal block
B	Battery negative (-) terminal	E	AGS terminal block
C	Battery positive (+) terminal		

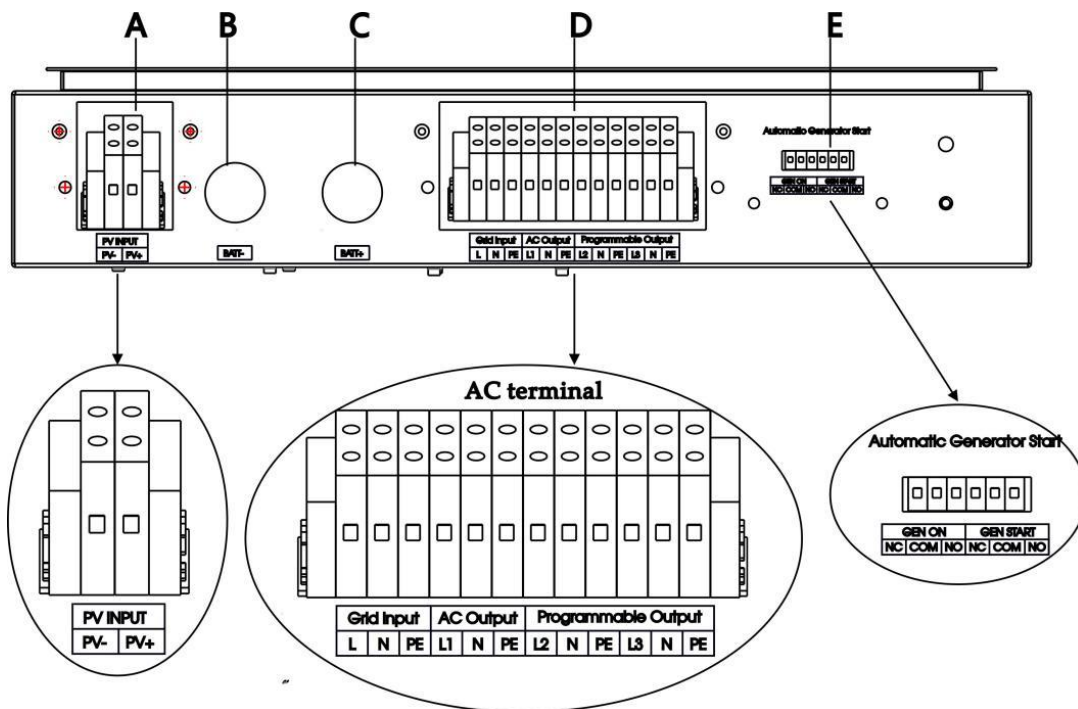


Figure 19 Terminal Block of SMB-30L60, SMB-30M60, SMB-40S60

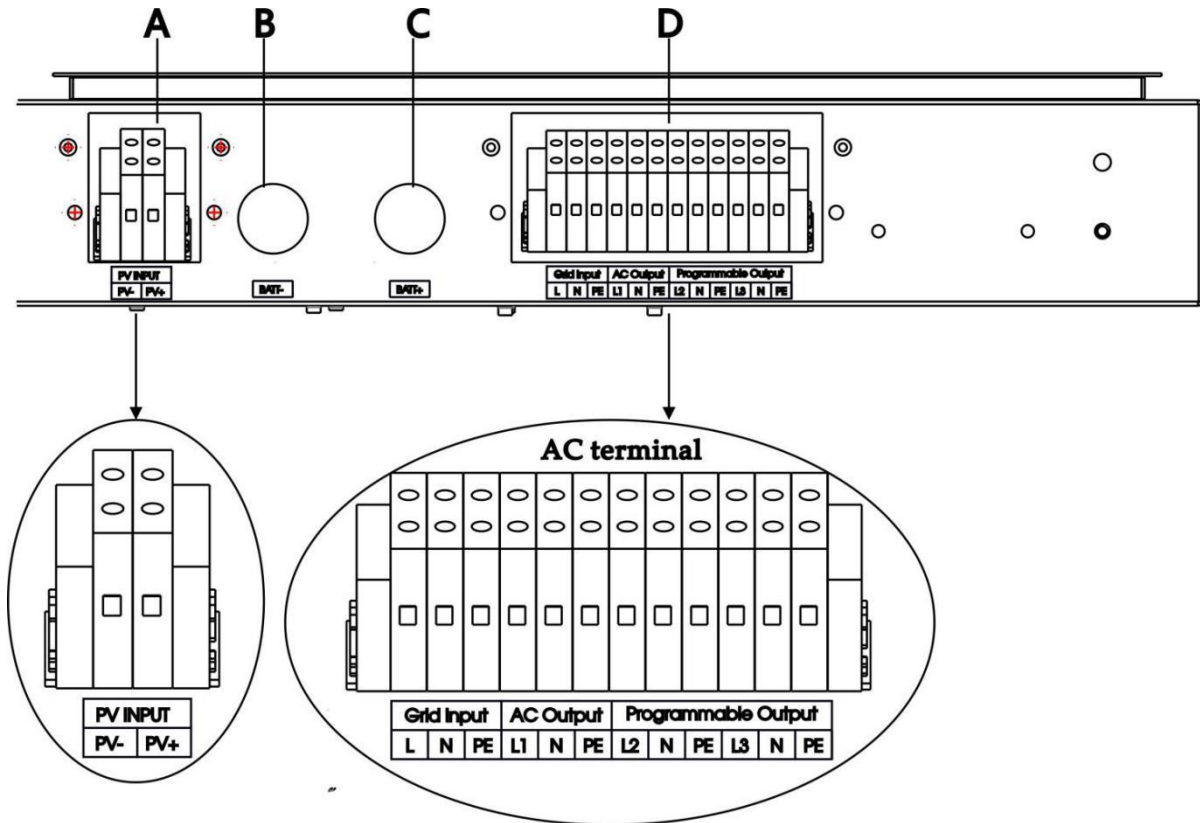


Figure 20 Terminal Block of SMB-50M60, SMB-80S60

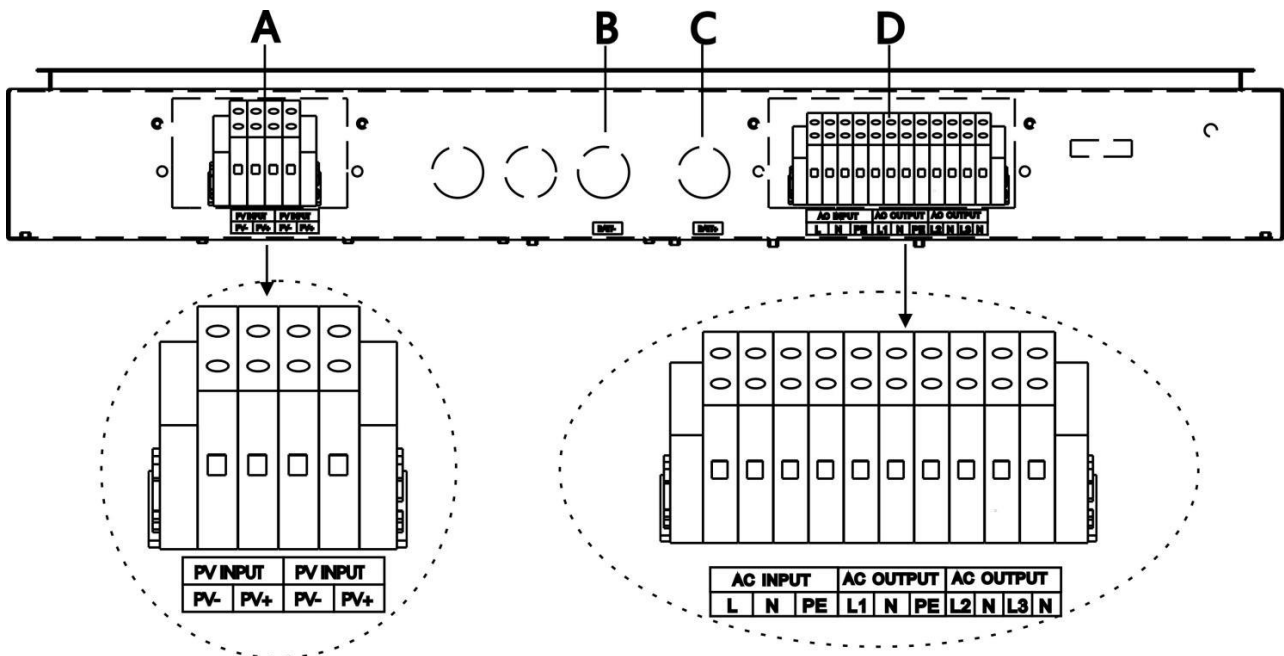


Figure 21 Terminal Block of SMB-80S60x2

Note: There are two Solar Mate MPPT in the SMB-80S60x2, therefore it has two independent PV inputs.

### 4.7.1 Connect the battery cable

- Choose the right cable size (refer to 4.3) and follow polarity guide marked on the terminal block.
- Open the door of Smart Box, Pull through the battery cables through the holes at front panel, clamping the cable on terminal.
- Secure the battery cable on BATT+ and BATT- terminals respectively making sure it is tightly screwed.

### 4.7.2 Connect PV input

Each Solar Mate must be connected to its own PV array. Please find following maximum size of PV array which can be supported according to various battery voltage.

*Table 21 Recommended PV size*

	Battery Voltage	SP60-150
Recommended PV size	12Vdc	960W
	24Vdc	1920W
	48Vdc	3840W



The Voc (open circuit voltage) of PV array must never exceed 150Voc. The Isc (short-circuit current) of PV array must not exceed the nominal current of Solar Mate at any time.



The Voc or Vmpp (Maximum Power Point Voltage) of solar panel was rated at 25°C with normal weather condition. Along with temperature reduced, the Voc / Vmpp of solar array will increase. Please consult with PV manufacturer for Voc / Vmpp of the lowest possible environment temperature and making sure it is below 150Vdc.

- PV array with Isc up to 55A is recommended for Solar Mate SP60-150 to tolerate the sudden increase of Isc caused by irradiance enhancement under certain condition.
- Please ensure the size of PV array matches the capacity of Solar Mate MPPT charge controller. Following Table 23 and Table 23 are the recommended models and sizes of PV array.

Table 22 Recommended model and size of PV array (Part 1 of 2)

Battery Voltage	PV module, maximum and recommended quantity in series configuration					
	36cells Voc<23V		48cells Voc<31V		54cells Voc<34V	
	Max.	Recommended	Max.	Recommended	Max.	Recommended
12V	4	2	2	1	2	1
24V	6	3	4	2	4	2
48V	6	5	4	3	4	3

Table 23 Recommended model and size of PV array (Part 2 of 2)

Battery Voltage	PV module, maximum and recommended quantity in series configuration						
	60cells Voc<38V		72cells Voc<46V		96cells Voc<62V		Thin-Film Module Voc>80V
	Max.	Recommended	Max.	Recommended	Max.	Recommended	
12V	2	1	2	1	1	1	1
24V	3	2	3	2	2	1	1
48V	3	3	3	2	2	2	1



Please double confirm the polarity of PV connection. Solar Mate will show fault alarm of reverse polarity connection.

- Choose the proper cable size (refer to Section 4.3) and follow polarity guide marked on the terminal block.
- To protect the PV module, PV combiner box is recommended.
- Secure the PV cables on terminals respectively to make sure they are tightly screwed.

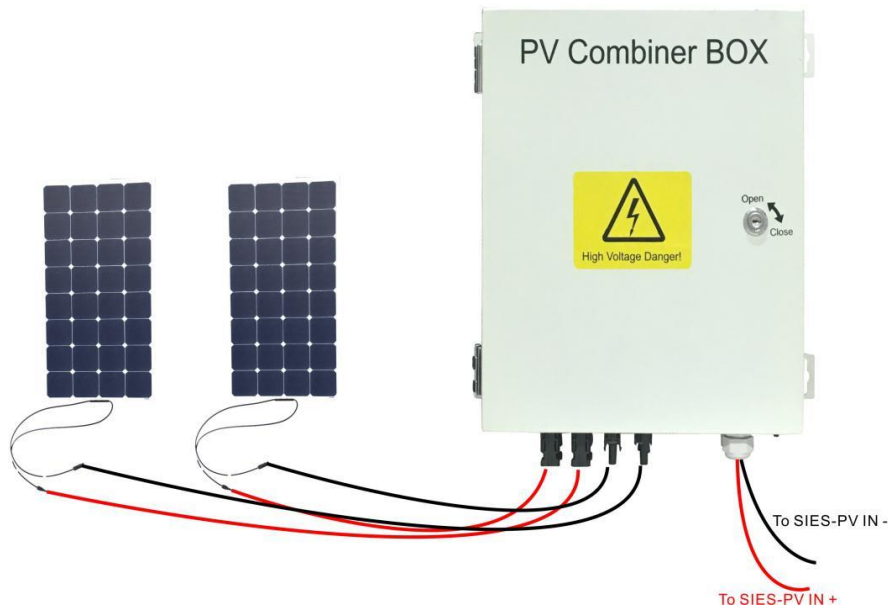


Figure 22 Connection of PV Input

- For the installation of SMB-80S60x2 system, each Solar Mate MPPT charge controller is connected to a separate PV array.



Please make sure each Solar Mate charge controller is connected with its own PV array. The mixing connection would cause damage which is out of warranty.

#### 4.7.3 Connect AC input cable

- Choose the proper cable size (refer to 4.3), connect the AC input cable on AC input terminal block of SMB.
- Connectors are marked as “L”-line, “N”-neutral and “PE”-earth. Making sure it is tightly screwed.



Please double check the AC input and AC output. Wrong connection will damage the equipment and it is out of warranty.

#### 4.7.4 Connect AC output cable

- Choose the right cable size (refer to Section 4.3), connect the AC output cable to AC output terminal block of Smart Box.
- Connectors are marked as “L” (Line), “N” (Neutral) and “PE” (Earth). Making sure they are tightly screwed.



Please do not connect the “N” of AC output to the “N” of AC input on SIES. Otherwise, the AC output RCD will trip and SIES will not work properly.

- The neutral output of Energier Pro bi-directional inverter is automatically connected to earth if no external source is available. Once external AC source is exist, the ground relay will be on” OPEN” status.

#### **4.7.5 Connect the cables of programmable AC outputs**

SIES system is designed with two programmable AC outputs for smart load control. Please refer to Section 2.10 for details. To set up and use the programmable AC outputs, please refer to Section 6.4

- Choose the proper cable size (refer to Section 4.3), connect the power cables of appliances to the programmable AC outputs in terminal block of Smart Box.
- Connectors are marked as “L” (Line), “N” (Neutral) and “PE” (Earth). Making sure they are tightly screwed. .

#### **4.7.6 Connect battery voltage sensor**

Normally there is voltage drop in the connection between Energier Pro and battery bank, which leads to reduction of charging efficiency. The Battery Voltage Sensor (VS) is therefore recommended to eliminate this voltage drop and improve the charging efficiency. To connect a battery voltage sensor, please follow the below steps:

- Pull the VS cables (positive and minus) through hole in the front cover of Energier Pro and connect it to the interface of Energier Pro which marked “Voltage Sensor”. Please refer to following Figure 23.
- The minus (-) of voltage sensor should be connected to the minus (-) of service battery, and the positive (+) of voltage sensor should be connected to the positive (+) of service battery. Wrong connection will damage the Energier Pro bi-directional inverter and is out of warranty.
- Please connect the minus (-) and positive (+) cables of Voltage Sensor to the terminals of battery respectively (Figure 23).

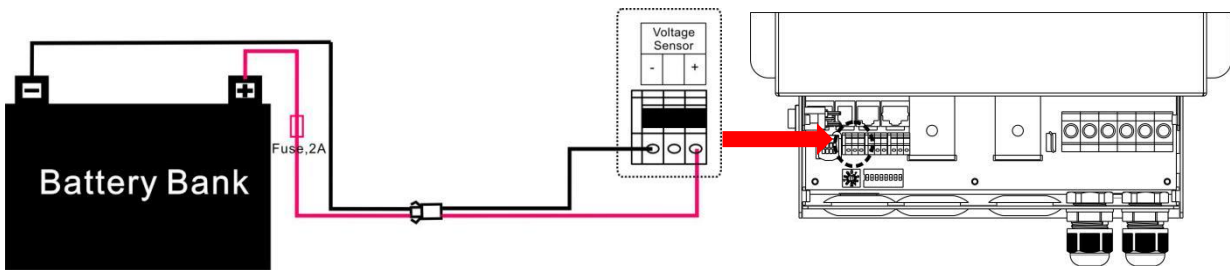


Figure 23 Interface of Voltage Sensor in Energlie Pro

#### 4.7.7 Connect battery temperature sensor

In order to improve the charging efficiency, the Battery Temperature Sensor (BTS) is necessary for every installation for the purpose of compensating charging according to battery temperature. Follow the below steps to install BTS:

- Open the door of Smart Box,
- Pull the BTS cable through the hole in the front panel and connect it to socket CN10 which is located in the PCBA inside of Smart Box.
- Please glue the temperature sensor, which was plugged into BTS socket, on the SIDE of battery and secure the attachment.

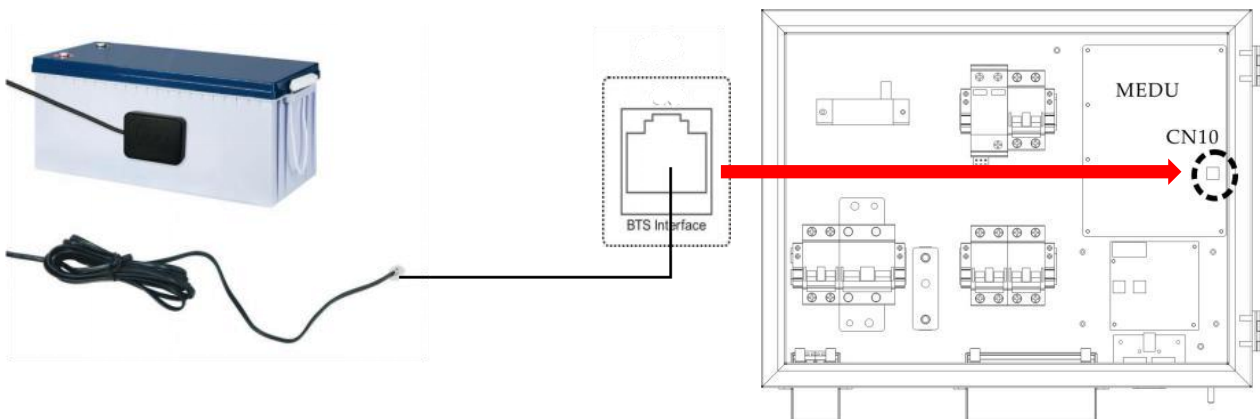


Figure 24 Connection of Battery Temperature Sensor (BTS)



The length of provided BTS cable is as around 300 cm. Do not pull cable too hard in order to avoid loose contact.

#### 4.7.8 Connect AGS (Automatic Generator Start device)

Depending on different models of SIES, the terminal block of Automatic Generator Start device (AGS) terminal block might be located at different places, either inside of Smart Box, or inside of Energlie Pro.



Table 24 Location of AGS

Model of Smart Box	Location of AGS terminal block
SMB-30L60, SMB-30M60, SMB-40S60	Terminal panel of Smart Box
SMB-50M60, SMB-80S60, SMB-80S60x2	Central panel of Energier Pro

The maximum current which AGS's built-in dry contact allows:

- **230Vac:** 2A
- **12Vdc / 24Vdc / 36Vdc:** 2A

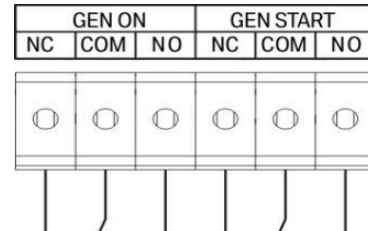


Figure 25 Automatic Generator Start (AGS)

Please refer to the user manual of generator, connect “GEN ON” or” GEN STARTNC, COM, NO” to the remote terminal of generator, for the purpose of controlling the “Start” and “Stop” of generator.

Please refer to the Chapter 7 for the introduction of how to setup the conditions of “Start” and “Stop” of generator.

Basically, there are two ways of automatically starting generator:

- **Two wires:** needs only one relay to control the “Start” and “Stop” of generator. Please refer to following Figure 26.

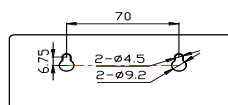


Figure 26 Two wires: Automatic Generator Start

- **Three wires:** needs two relays to control the generator. Relay 1 controls the “ON” and “OFF” of generator. Relay 2 control the “Start” and “Stop” of generator. Please refer to following Figure 27.

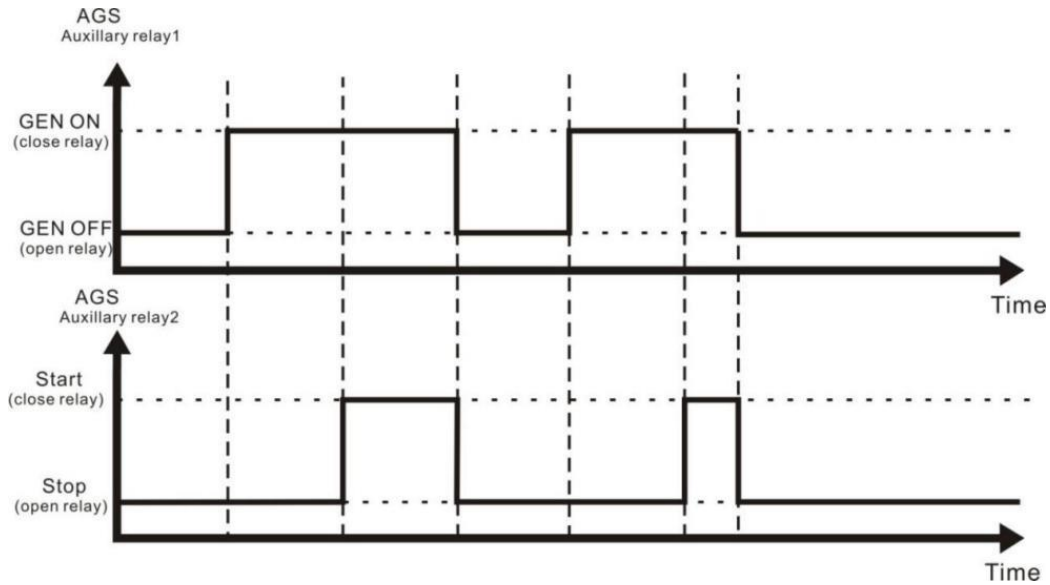


Figure 27 Three wires: Automatic Generator Start

## 4.8 Install GPRS Antenna

- Built-in Bluetooth is a standard feature of all SIES models.
- WIFI or GPRS connection is optional. For the SIES models who need GPRS function, an GPRS antenna should be installed.

As illustrated in Figure 28, put the GPRS antenna out of the outlet hole of Smart Box and front door, then stick it to the surface of Smart Box using its own magnet.

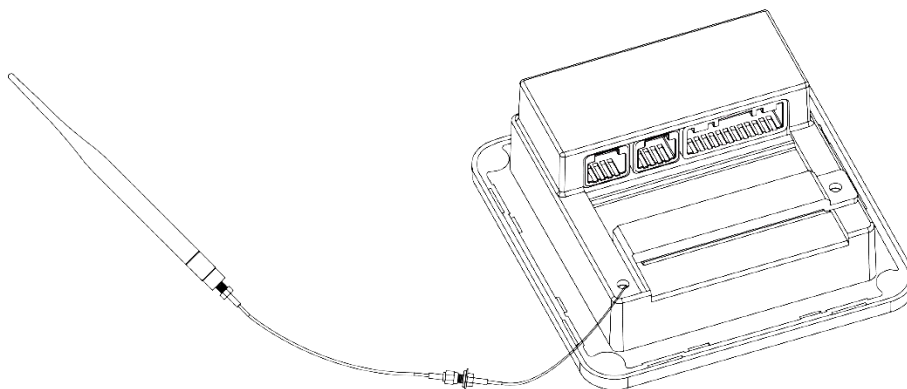


Figure 28 Installation of an GPRS antenna

## 4.9 Install the SIM Card

The SIES system with GPRS function has to be equipped with a SIM card, which enables the SIES system to communicate with web-based remote monitoring & control platform.

### 4.9.1 GPRS SIM card

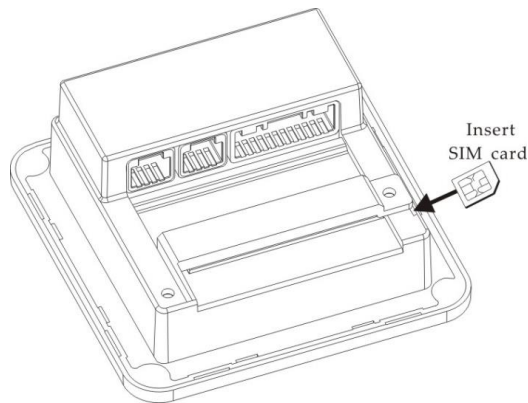
Please refer to below table to find the specification of SIM card which is compatible with SIES system:

*Table 25 Specification of SIM card*

Mobile Communication System	Frequency Band	Type of SIM card
GSM / GPRS	850 / 900 / 1800 / 1900 MHz	Micro SIM

### 4.9.2 Installation of GPRS SIM card

Open the front door of Smart Box, at the right-bottom corner of Cyber central monitor, there is a slot of SIM card. Insert the SIM card following the indication of proper direction (Figure 29).



*Figure 29 Installation of GPRS SIM card*

## 5. Operation and Configuration

### 5.1 Double Checking

- Make sure the DC input voltage of this system is the same as the nominal voltage of battery. NEVER try to connect DC input of different voltage to SIES system.
- Make sure the PV input voltage of the system is in the recommended range of Solar Mate MPPT charge controller.
- Check the polarity of DC terminals on battery, otherwise the system cannot be switched on.
- Make sure the AC inputs and AC outputs are correct to avoid short circuit.


### 5.2 Switch on the system



Before switching on Energier Pro bi-directional inverter, ensure that the locker device in Maintenance Bypass switch was secured and Maintenance Bypass switch is on “OFF” position.

It is strongly recommended to switch on the system following the below sequence:

**Battery→Energier Pro Inverter→AC input→Solar Mate MPPT charge controller→PV input**

- 1) Turn on the input circuit breaker of battery.
- 2) Switch on the main switch of Energier Pro to “ON”, all LED will be light on for self-examining. Afterwards the AC is available at AC output of Energier Pro. The LED of “Inverter” will be light on.
- 3) Next switch on the circuit breaker of AC input, Energier Pro bi-directional inverter will work under bypass mode to power the loads, and meanwhile start the battery charger (the charger is active or not depends on the setting status of AC charger). Both the LED of “Bypass” and “Charger” in the front panel of Energier Pro should be light on.
- 4) Press the  “Power On/Off” button in the front panel of Solar Mate will switch on the MPPT charger controller. In case there are two units of Solar Mate, please switch on the first unit of Solar Mate and then wait for at least for 10 seconds before switching on the second unit of Solar Mate.
- 5) Turn on the power switch of PV input. After one minute, Solar Mate MPPT will start to charge the connected battery and its LCD screen will display system status.
- 6) As soon as Cyber starts to display system status, please setup the battery parameters.

## 5.3 Configurations

Before the formal operation of SIES system, various system settings have to be completed as soon as the system was switched on. These settings include clock, calendar, battery type, battery capacity, etc. Please refer to Section 6.3 for details.

## 5.4 Battery Calibration

If battery is put into use for the first time or has been changed, the battery capacity needs to be calibrated within the system. The calibration will run automatically upon first installation and during the daily operation on regular basis.

- When there is system error code 08301, it means the battery bank has to be calibrated.
- When the error code 08301 disappeared, it means the battery bank has been calibrated successfully.



Upon first installation, SIES system will not be able to switch to “Inverter” mode, until the first calibration is done either by grid or PV charging.

## 5.5 Maintenance Bypass

If Energier Pro or Solar Mate needs maintenance service, the Maintenance Bypass switch in Smart Box has to be closed up. In this way, Energier pro or Solar Mate is separated from the rest of SIES system. During the maintenance period, the loads can be powered by grid or generator.



**It is CRITICAL to follow these instructions upon using Maintenance Bypass:**

Please firstly switch off Energier Pro before other operation.



Please switch off AC output before close the switch of Maintenance Bypass. Otherwise, a wrong operation will damage Energier Pro and is out of warranty.



Before switch on Energier Pro, always make sure the Maintenance Bypass switch is on OFF position.

### 5.5.1 Enable Maintenance Bypass function

- Switch the main switch of Energier Pro to “OFF” position.
- Switch OFF the MCB / breaker of AC Output
- Switch OFF the MCB/breaker of AC Input
- Switch OFF the MCB/breaker of DC Input
- Remove the locker device in Maintenance Bypass switch
- Switch ON the Maintenance Bypass switch

After the above steps are done, Energier Pro or Solar Mate can be dismantled from the rack of SIES system for the purpose of maintenance. The household loads can be powered continually by grid or generator.

### 5.5.2 Disable Maintenance bypass function

After you perform the maintenance for Energier Pro or Solar Mate, please mount Energier Pro or Solar Mate back to the rack of SIES system. Refer to Section 4.8 to reconnect all related cables. Afterwards, follow the below steps to switch on the SIES system.

- Switch OFF the Maintenance Bypass and install the lock device back.
- Switch ON the MCB/breaker of AC Input
- Switch ON the MCB/breaker of DC input
- Switch ON Energier Pro Inverter Charger or Solar Mate MPPT charge controller
- Switch ON the AC output

## 5.6 Switch off the system

Please follow the following steps to shut off the systems

- Switch OFF the connected electrical appliances
- Switch OFF the circuit breaker of AC output to disconnect SIES.
- Switch OFF the main switch of Energier Pro bi-directional inverter.
- Switch OFF the circuit breaker of AC input.
- Switch OFF Solar Mate charge controller
- Switch OFF the circuit breakers of PV input, Solar Mate charge controller stops to charge the battery.
- Switch OFF the circuit breaker of battery, SIES system will be power off, and all equipment are to be turned off.

## 5.7 Periodic Maintenance

- Regularly inspect the Smart Box to check the status of SPD of PV combiner box. If the window of SPD became red, it needs to be changed immediately.
- It is highly recommended to inspect the RCD monthly and check whether it still works properly or not.
- If the battery had not been used for a long time, it should be charged regularly.
- Clean the dust regularly in order to prevent the dust from blocking the ventilation hole.
- Inspect the wirings regularly and check whether they were secured tightly and check if there is any broken.

## 6. Central Monitoring and Control

Cyber is the central monitor and control center of SIES system. The real time data and working status of relevant system components will be showed in the LCD screen.

### 6.1 Functions of Cyber



Figure 30 Front side of Cyber

Table 26 Functions of Cyber's display areas and buttons

Parts	Function	Description
A	Display area	Display of measurement results and system status
B	Exit / Silent	Button of Exit or Return / Silent
C	Up / EQ	Button of Upward / Enable Equalization
D	Down / FUNC	Button of Downward / Load Reconnect
E	Enter / Light	Button of Enter or Confirm / Backlight Adjustment <sup>1)</sup>

Note: 1) **Brightness adjustment:** The brightness of Cyber's LCD screen can be adjusted. Press and hold the "LIGHT" button, the brightness will be changed accordingly. Release the button when the brightness is acceptable for you.



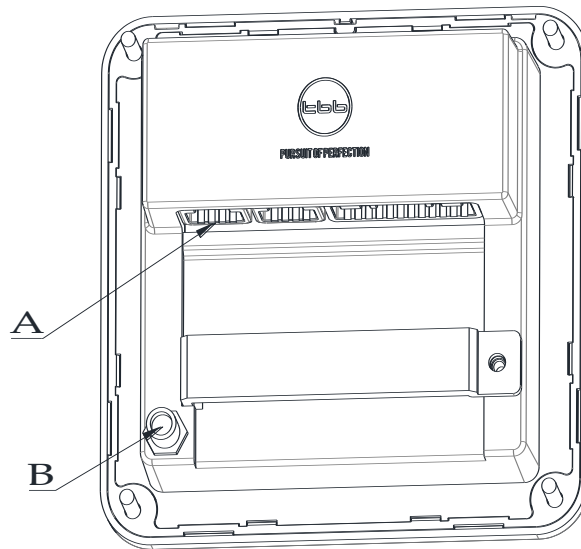


Figure 31 Back side of Cyber

Table 27 Interfaces of Cyber

Parts	Description
A	COM , internal RS485 communication interface (in White)
B	Antenna connection hole ( only available for WIFI or GPRS system)

## 6.2 Information displayed in Cyber

The Cyber displays five categories of information, which are explained in Figure 32 and Table 27:

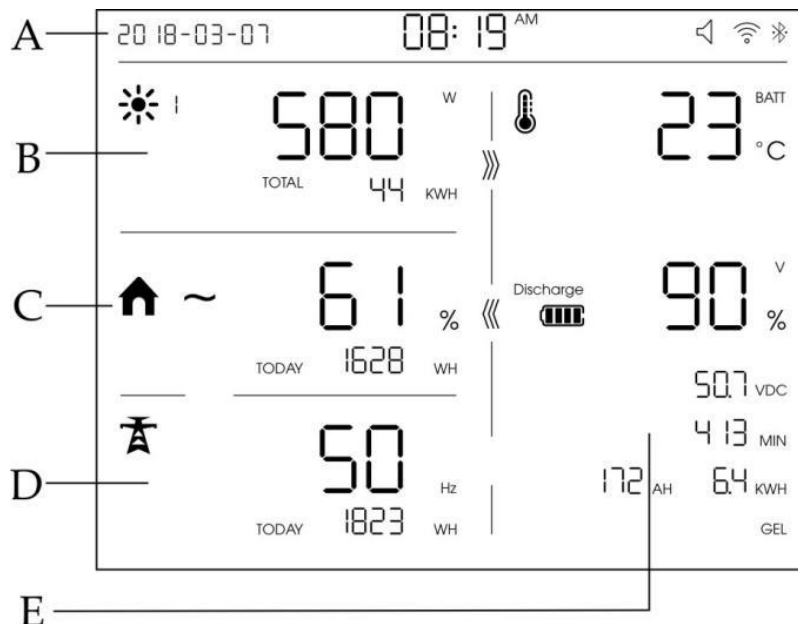


Figure 32 Information to be displayed in Cyber

Note: “>>>” indicates the direction of either AC or DC energy flows

Table 28 Five categories of information to be displayed in Cyber

Category	Description
A	System Status
B	Measurements of Solar Energy
C	Measurements of Energy Consumption
D	Measurements of AC sources: Grid or Generator
E	Measurements of Battery Status

### 6.2.1 System Status

The information area of System Status is at top of the LCD screen of Cyber.

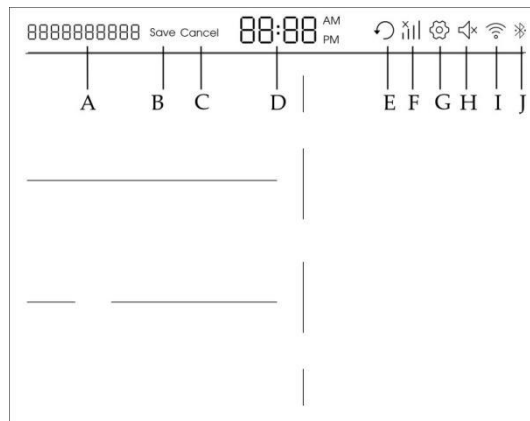


Figure 33 Information area of System Status

Table 29 Information area of System Status in Cyber

Alphabet	Description
A	Normal display status: Date / YYYY-MM-DD
	Setting status: Display some relevant setting code
B	Save the setting in setting mode
C	Cancel the setting in setting mode
D	System time: AM - morning, PM - afternoon
E	In the process of online firmware update
F	GPRS Signal
G	System in “Setting” mode
H	System in “Silent” mode
I	WIFI
J	Bluetooth

## 6.2.2 Solar Energy

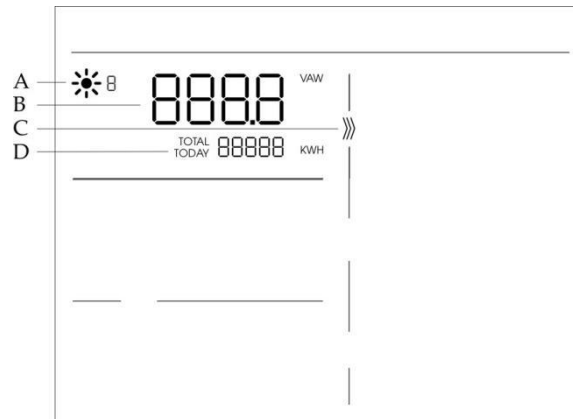


Figure 34 Information area of Solar Energy

Table 30 Information area of Solar Energy

Alphabet	Items	Description
A	PV status	When PV array is generating energy, the icon is light on. Otherwise, it will be dark. The digital number on the right means the quantity of PV inputs, in case there is more than one PV array.
B	Charging Power	Displays the charging power and charging current in turn
C	Energy flow bar	Indicates the Energy Flow from PV array to battery bank
D	Solar Energy	Displays the daily PV harvest in KWh and total solar energy generated since installation in KWh

## 6.2.3 Energy Consumption

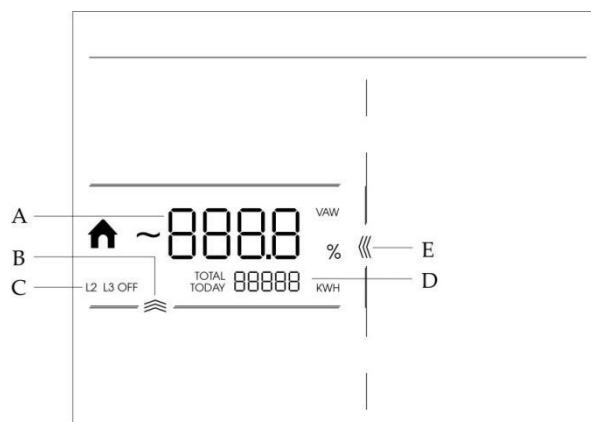


Figure 35 Information area of Energy Consumption

Table 31 Information area of Energy Consumption

Alphabet	Items	Description
A	Load condition	Displays the output voltage of Energier Pro, output power in KW, output in KVA, and percentage of Inverter load in turn.
B	Energy flow bar	Indicates the Energy Flow from Grid or Generator for powering the load
C	Programmable AC outputs	Shows the status of two programmable AC output, ON or OFF
D	Energy Consumption	Displays the daily energy consumption in KWh and total energy consumption since installation in KWh
E	Energy flow bar	Indicates that the battery is being discharged to power the loads

## 6.2.4 AC Sources

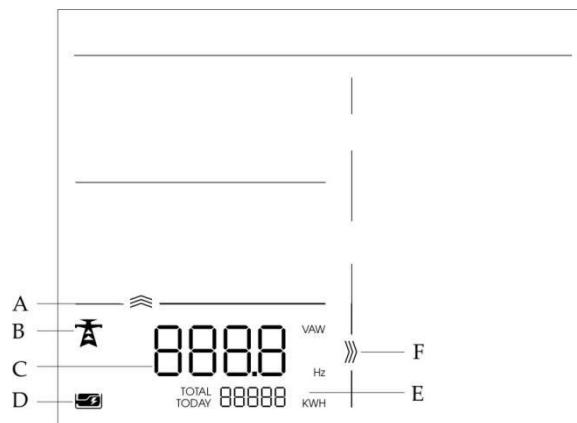


Figure 36 Information area of AC sources

Table 32 Information area of AC sources

Alphabet	Items	Description
A	Energy flow bar	Indicates that either Grid or Generator is powering the loads
B	Grid	The icon is light on when grid is available
C	AC source status	Displays the voltage and frequency of AC inputs in turn
D	Generator	The icon is light on when generator is available. TAI (Twin AC Inputs device) should be exist.
E	Energy Consumption	Displays the daily energy consumption of AC sources in KWh and total energy consumption of AC sources since installation in KWh
F	Energy flow bar	Indicates that either grid or generator is charging the battery

## 6.2.5 Battery Status

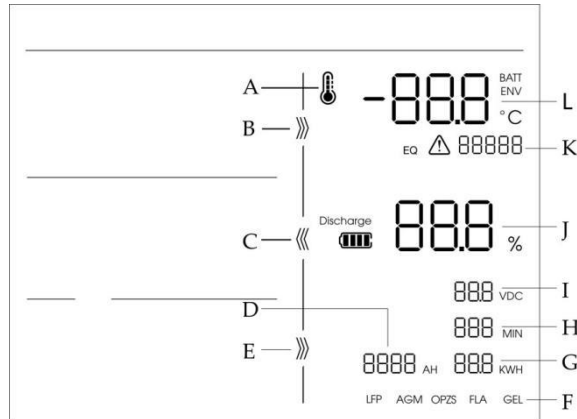


Figure 37 Information area of Battery Status

Table 33 Information area of Battery Status

Alphabet	Items	Description
A	Temperature Icon	Icon of temperature
B	Energy Flow bar	Indicates that PV array is charging battery
C	Energy Flow bar	Indicates that battery is being discharged to power the loads
D	Battery AH	Battery capacity
E	Energy Flow bar	Indicates that AC source is charging battery, either Grid or Generator.
F	Battery type	Battery type
G	Battery energy	Remaining energy within the battery in Ah
H	Time to go	How many minutes will the battery continually power the current loads
I	Battery voltage	Voltage level of battery
J	Battery SoC	Battery state of charge in %
K	Fault code and EQ	Fault code and status of Equalization Charging in case of trigger on
L	Temperature	Displays the ambient temperature and battery temperature in turn

## 6.3 System Configuration

The following parameters of SIES system can be set through three ways: 1) Cyber; 2) SmartPhone App, 3) Web-based remote monitoring platform named TBB Energy Management Solution (TEMS)

- 1) System settings: Data, Time
- 2) AC input settings: AC Source, AC input range, AEA function
- 3) Battery and AC charger settings: Disable AC Charger, Battery type, battery capacity

- 4) Inverter settings: Rated voltage, PS mode

## 6.4 System Control

### 6.4.1 Silent mode

When a typical system failure happens, its fault code will be displayed in the information area of Battery Status in Cyber. Cyber will keep beeping to remind checking and solving the fault.

To stop the beeping of system failure, Cyber can be set to enter “Silent” mode, following the below operation:

- Slightly press the “SILENT” button, when “SILENT ON” is blinking at the top left corner of Cyber, press the “Enter” button, then Cyber will enter into the “Silent” mode.

### 6.4.2 Load Management

When the programmable AC output L2 or L3 was switched off as a result of that the preset conditions had been triggered on, Cyber will show L2 OFF or L3 OFF in the information area of Energy Consumption.

If L2 or L3 was switched off due to overload protection, you need to switch on the AC output after the overload warning had disappeared. Follow the below instruction to manually switch on L2 or L3 again by Cyber.

- For example, if L2 was switched OFF, firstly press “FUNC” button till the L2 OFF is disappeared from Cyber, then press “ENTER” Button, the icon of L2 will be switched ON again.

If L2 or L3 was switched off because of other reasons, L2 and L3 can be switched on automatically.

### 6.4.3 Battery Equalization

Over a period of time, the cells in a flooded or OPZS battery can develop uneven chemical states. This will result in a weak cell which further reduces the overall capacity of battery. To improve the lifespan and performance of these non-sealed batteries, Energier Pro bi-directional inverter provides a manual equalization program (EQ) which can be put into operation as recommended by battery manufacturer.

By pressing “EQ” button of Cyber, you can choose Equalization program for flooded or OPZS battery. As a result, Energer Pro’s battery charger will, after a normal charging cycle (bulk-absorption), raise the voltage to equalization level and stay at this voltage level for 30 minutes.

*Table 34 Equalization Voltage of various battery types*

Battery type	12Vdc model	24Vdc model	48Vdc model
	EQ Voltage	EQ Voltage	EQ Voltage
<i>Flooded</i>	16.2	32.4	64.8
OPzS	16.2	32.4	64.8

As a protection mechanism, if a wrong battery type is chosen, SIES won’t execute equalization charging program.



It is strongly recommended to read this section carefully before you set the Equalization charging (desulphation charging) and DO NOT leave battery unattended while performing Equalization.



Always check if the battery manufacturer supports Equalization charging. Only start when it is allowed.

Through the “EQ” button, you can run the Equalization program manually. Once you start EQ program, SIES will perform Equalization charging.

- After you have chosen this program, the charger of Energer Pro will start an ordinary charging cycle, and then it will raise the battery voltage to EQ level. The icon of “EQ” in the information area of Battery Status of Cyber will be light on.
- The Equalization charging lasts for 30 minutes. After that it will start floating charging.
- Check electrolyte level and refill battery with distilled water if necessary.
- If you want to come to normal charging:
  - Firstly switch off Energer Pro bi-directional inverter
  - Secondly switch on Energer Pro once again, then it starts a normal charging.



During equalization, the battery generates potentially flammable gases. Follow all the battery safety precautions listed in this guide. Ventilate the area around the battery thoroughly and ensure that there are no sources of flame or sparks in the vicinity.



Turn off or disconnect all loads on the battery during equalization. The voltage applied to the battery during equalization may be above the safe levels for some loads.



Equalization charging was effected after bulk and absorption, if the battery was flat, it will take long time to do the EQ, therefore suggest start the equalization charging when battery SoC is above 90%.



EQ charging should be done when grid is stable, if the grid is cut in the course of equalization, the EQ will be failed, it will need to reset the EQ again.

### Important tips on Battery Equalization

**Frequency:** Maximum once a month, for heavily used battery, you may wish to equalize your battery. For battery with light service only need to be equalized every 2-3 months.

**Important:** Equalization can damage your batteries if it is not performed properly. Always check battery fluid before and after equalization. Fill batteries only with distilled water.

Always check the equalization switch is set back to OFF after each time's equalization.

Battery manufactures' recommendations on equalization vary. Always follow the battery manufacturer's instructions so batteries are properly equalized. As a guide, a heavily used battery may require equalization once a month while a battery in light duty service, only needs equalizing once every 2 to 4 months.

**Battery type:** ONLY perform equalization to Flooded or OPZS batteries. Do not equalize Gel, AGM, Lithium-ion (LFP), Lead Carbon batteries.



## 6.5 Wireless Communication



To ensure good Bluetooth communication, Cyber should be located within the transmission distance of signal. If there is barrier such as wall between Cyber and Bluetooth device (eg. Smart Phone), the transmission distance will be shorter.



For Cyber model with WIFI or GPRS, its antenna shouldn't be shielded by metallic cover, and the antenna cable should be stretched out as much as possible. A twisted cable affects communication quality. The signal transmission distance is showed as following table.

Following table shows the best communication distance of various wireless communication

*Table 35 Communication Distances of Wireless Connections*

Wireless Technology	Antenna Type	Extension Cable	Best Communication Range
Bluetooth	Built-in	no	< 5m
WIFI	External	30cm	< 20m
GPRS	External	1.5m	---

### 6.5.1 Bluetooth Connection

Turn on the Bluetooth of Smart Phone, run TBB APP and choose the series number of TBB Power's products. .

### 6.5.2 GPRS Connection

Insert the SIM card into the SIM card slot of Cyber. When SIES system is switched on, Cyber will enable GPRS communication automatically.

### 6.5.3 WIFI Connection

To set up WIFI connection, you need to make the following preparation:

- Cyber of SIES: is switched ON
- An Android o Apple Smart Phone
- Has download and installed the SIES App to Smart Phone
- WIFI router: is connected to internet

Follow the below procedure to set up WIFI connection:

- 1) Connect Cyber to Smart Phone via Bluetooth

WARNING: Once Cyber and Smart Phone are successfully connected, you can choose whether to register or not register. If don't register the connected Cyber, anyone else can connect to Cyber with the default user name and password.

- 2) Connect Smart Phone to WIFI router
- 3) Run SIES App in Smart Phone,
- 4) Enter "System Setting" section of SIES App:
  - a. choose the WIFI SSID from the available WIFI List
  - b. input the password, click "ok" to confirm.

Cyber will set up WIFI connection successfully

## 6.6 Firmware update

The firmware update of SIES system can be realized via Bluetooth or web-based TEMS. The system components whose firmware can be updated are Cyber, Energier Pro, Solar Mate and MEDU. Please refer to the firmware update SOP (Standard Operating Procedure) for more details.

## 7. Specifications

### 7.1 SIES system configuration

*Table 36 System Configuration of SIES (Part 1 of 3)*

Model Component	<b>SIES 2060L-60</b>	<b>SIES 3090L-60</b>	<b>SIES 2030M-60</b>	<b>SIES 3045M-60</b>	<b>SIES 5090M-60</b>
Energier Pro	CF2060L	CF3090L	CF2030M	CF3045M	CF5090M
Solar Mate	SP60-150	SP60-150	SP60-150	SP60-150	SP60-150
Smart Box	SMB-30L60	SMB-30L60	SMB-30M60	SMB-30M60	SMB-30M60

*Table 37 System Configuration of SIES (Part 2 of 3)*

Model Component	<b>SIES 2015S-60</b>	<b>SIES 3020S-60</b>	<b>SIES 4030S-60</b>	<b>SIES 5040S-60</b>	<b>SIES 6050S-60</b>	<b>SIES 8060S-60</b>
Energier Pro	CF2015S	CF3020S	CF4030S	CF5040S	CF6050S	CF8060S
Solar Mate	SP60-150	SP60-150	SP60-150	SP60-150	SP60-150	SP60-150
Smart Box	SMB-40S60	SMB-40S60	SMB-40S60	SMB-80S60	SMB-80S60	SMB-80S60

*Table 38 System Configuration of SIES (Part 3 of 3)*

Model Component	<b>SIES 5040S-60X2</b>	<b>SIES 6050S-60X2</b>	<b>SIES 8060S-60X2</b>
Energier Pro	CF5040S	CF6050S	CF8060S
Solar Mate	SP60-150 X2	SP60-150 X2	SP60-150 X2
Smart Box	SMB-80S60X2	SMB-80S60X2	SMB-80S60X2

## 7.2 Specifications of Smart Box

Table 39 Specifications of Smart Box

Model	SMB-30L60	SMB-30M60	SMB-40S60	SMB-50M60	SMB-80S60	SMB-80S60X2
<b>System</b>						
Rated DC voltage	12Vdc	24Vdc	48Vdc	24Vdc	48Vdc	48Vdc
Central Monitor	Cyber					
System Logic(Settable)	Solar Hybrid/Solar Energy Storage/Solar backup					
Communication	WIFI, Blue tooth and GPRS module built in,					
<b>Measuring Unit</b>						
AC Input	Voltage, Frequency, Current, Power, Energy					
AC Output	Voltage, Frequency, Current, Power, Energy					
Battery	Voltage, Charging Current, Discharging Current, Power, Time To Go, State Of Charge.					
Solar	PV Voltage, current, PV harvest KWH					
<b>AC input</b>						
Pre-installed MCB	2-pole 25A	2-pole 25A	2-pole 32A	2-pole 40A	2-pole 63A	2-pole 63A
Pre-installed SPD	Uc:385Vac, In:20KA(8/20us), Imax:40KA(8/20us)					
Twin AC Input	Optional					
AGS	Standard, Support 2 Wire and 3 Wire generator, Max. 8A/30Vdc, 1.5mm <sup>2</sup> , PA66/V0, M3 screws					
Terminal	57A/600V 6mm <sup>2</sup> PA66/V0 M4 screw					
Includes	Cables between SMB and Energier Pro					
<b>AC output</b>						
Pre-installed RCD(residual current device)	1P+N 16A/30mA/4.5KA	1P+N 16A/30mA/4.5KA	1P+N 25A/30mA/4.5KA	1P+N 32A/30mA/4.5KA	1P+N 40A/30mA/4.5KA	1P+N 40A/30mA/4.5KA
Pre-installed Maintenance Bypass RCD (residual current device)	1P+N 16A/30mA/4.5KA	1P+N 16A/30mA/4.5KA	1P+N 25A/30mA/4.5KA	1P+N 32A/30mA/4.5KA	1P+N 40A/30mA/4.5KA	1P+N 40A/30mA/4.5KA
Programmable Output	2-ways 16Amps(max.), Base on Time , SOC or Power Limit					
Terminal	57A/600V 6mm <sup>2</sup> PA66/V0 M4 screw					
Includes	Cables between SMB and Energier Pro					
<b>DC input</b>						
Pre-installed Battery MCB	375A/60Vdc (3 pole 125A)	200A/60Vdc (2 pole 100A)	126A/60Vdc (2 pole 63A)	300A/60Vdc (3 pole 100A)	250A/60Vdc (2 pole 125A)	250A/60Vdc (2 pole 125A)

Terminal	Copper bus bar with 2XM8 screws					
Includes	cables between SMB and Energier Pro					
<b>Solar Input</b>						
Pre-installed PV MCB	63A/250Vdc	63A/500Vdc	63A/500Vdc	63A/500Vdc	63A/500Vdc	63A/500Vdc*2
Terminal	100A/800V 16mm <sup>2</sup> PA66/V0 M4 screw					
Includes	Cables between SMB and MPPT charge controller					
<b>Mechanical Data</b>						
Enclosure	Steel with powder paint					
Protect	IP20					
Dimension (mm) (Max.)	987*482*174			1050*500*190		1050*700*190
Weight(kg)	15	15	15	16	16	20
<b>Standard</b>						
Safety	EN62109-1,EN62109-2					
EMC	EN61000-3-2,EN6100-3-3,EN61000-6-1,EN61000-6-3					
<b>Compatible products</b>						
Energier Pro	CF2060L CF3090L	CF2030M CF3045M	CF2015S CF3020S CF4030S	CF5090M	CF6050S CF8060S	CF6050S CF8060S
MPPT Charge Controller	SP60-150	SP60-150	SP60-150	SP60-150	SP60-150	SP60-150 x 2
Max PV size	0.9KW	1.8KW	3.6KW	3.6KW	3.6KW	7.2KW

## 8. Trouble Shooting

### 8.1 Fault Codes indicated in Cyber

Table 40 Fault Codes indicated in Cyber

Module	Introductions	Code
SP#n <sup>1)</sup>	Site fault	n1001
	PV voltage high	n1002
	Heat sink temperature high	n1003
	Battery temperature low	n1004
	Battery temperature high	n1005
	Loss communication	n1006
	Internal temperature high	n1007
	Battery voltage low	n1008
	Battery voltage high	n1009
	Over load	n1010
	Output short	n1011
	Transformer over temperature	n1012
	Fan lock	n1013
MEDU	Loss communication	03001
COMBI#n <sup>2)</sup>	Battery voltage low	n0001
	Battery voltage high	n0002
	Over load	n0003
	Output short	n0004
	Heat sink over temperature	n0005
	Transformer over temperature	n0006
	Internal over temperature	n0007
	Fan lock	n0008
	Loss communication	n0009
Cyber	Battery SOC not calibrated	08301
	New firmware exist	08302
	Battery SOC is calibrating for the first time	08304

Note:

- 1) **Combi#n**: indicates that the fault is from Energier Pro
- 2) **SP#n**: indicates that the fault is from Solar Mate

## 8.2 Common Failure Analysis

### 1) System is switched on, but Cyber still powers off.

<b>Failure Cause</b>	Energier Pro or Solar Mate has not been switched on
<b>Solution</b>	Switch on Energier Pro or Solar Mate

### 2) The system does not work with the preset system logic

<b>Failure Cause</b>	Battery SoC has not been calibrated
<b>Solution</b>	Implement a complete process of battery calibration

### 3) The RCD (Residual Current Device) trips continuously

<b>Failure Cause</b>	The AC output may have residue current leakage
<b>Solution</b>	<ol style="list-style-type: none"> <li>Make sure there is no overload or short circuit in the AC output;</li> <li>Make sure the terminal of neutral (N) or line (L) in the AC output was not connected to GND</li> <li>Check if the neutral (N) of AC output is connected to AC input of SIES? If yes, need to isolate the neutral and connect it to AC input and AC output respectively. The neutral should NOT be in common.</li> </ol>

### 4) There are error codes 11006, 21006 in the front panel of Solar Mate

<b>Failure Cause</b>	The IP address of Solar Mate was duplicated.
<b>Solution</b>	<ol style="list-style-type: none"> <li>Make sure the communication cable of Solar Mate is well connected</li> <li>Reset the IP address: Press Esc, Status &gt; Settings &gt; Normal Settings &gt; RS485 settings &gt; Rs485 address and set the IP address for both of them as 0x31 and 0x32.</li> </ol>

### 5) GPRS connection to web is failed. The signal icon in Cyber shows “X”

<b>Failure Cause</b>	<ol style="list-style-type: none"> <li>SIM card has no credit</li> <li>The SIM card is not supported</li> <li>The antenna is not well connected</li> </ol>
<b>Solution</b>	<ol style="list-style-type: none"> <li>Keep sufficient credit in the SIM card</li> <li>Choose the another telecom operator which will be used in the Cyber</li> <li>Connect the antenna and make sure the cable is stretched out, not twined</li> </ol>

## 9. Annex I: English Alphabets displayed by Cyber

Table 41 English Alphabets displayed by Cyber

Code	Alphabet	Code	Alphabet	Code	Alphabet	Code	Alphabet
A	A	H	H	O	O	U	U
b	B	I	I	P	P	V	V
C	C	J	J	Q	Q	Y	Y
d	D	K	K	R	R		
E	E	L	L	S	S		
F	F	M	M	T	T		
g	G	N	N				



## 10. Annex II: Setting codes and functions

Long press the "LIGHT" button of Cyber, it will enter into setting mode. At the top-left corner of Cyber's screen, the relevant setting codes will be displayed. .

Table 42 Setting codes and functions

Code	Function	Instruction
CLOC	Set time	It can set time and date
bAtt	Set the battery	
TYPE	Battery type	It can set 6 battery types
CAPA	Battery Capacity	
FACTORY	Factory reset	
Cancel	Cancel	Cancel the factory reset
Save	Save	Proceed the factory reset
uEr	Firmware version No.	Will show the firmware version for different system components
bAtt rAtt		
12u	12V	12V DC voltage
24u	24V	24V DC voltage
48u	48V	48V DC voltage

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