GOODWE & PYLONTECH
ENERGY STORAGE

GOODWE
your solar engine

PYLONTECH

Segen

- **About Goodwe**
- Product Review
- Goodwe Competitive Advantage
- Pylontech batteries

About GoodWe

- Focus on developing and producing solar inverters and monitoring products.
- **300** employees, over **100** R&D centre staff and **50** patents
- **5** offices worldwide: Suzhou (China), Flensburg (Germany), Melbourne (Australia), London (UK), Utrecht (Netherlands)

JXT Group is one of our main shareholders, a company with world-class design and manufacturing capability, one of the main component suppliers of Apple and Samsung mobile devices.

World Leading Supplier

GoodWe Certificates and Awards

Approved Global Safety Certificates: CGC, VDE, TUV, CE, G83, G59, SAA, EN-50438, CEC listed, Western Power listed, Danish Government listed

- 2012-2013: SNEC - “Global Gold Awards” for solar inverters twice
- 2012-2013: Polar Star - “TOP 10” solar inverter brand twice
- 2012: Photon test result “Double A”, ranking top 3rd in the world
- 2013: Photon test result “Double A”, ranking top 6th in the world
- 2013-2014: Shine Magazine’s Top 10 Solar Inverter Enterprise
- 2013: Government listed High-tech Enterprise
- 2013: Government listed Product - GoodWe ES Series Hybrid Inverter
- 2014: PVP365 – “Top 10 Chinese Solar Inverter Companies 2014”
- 2015: Appraisal of new technology and new products at provincial level
- 2015: Listed as one of the key projects of Suzhou science and technology program
- **2016:** **TÜV Rheinland “Quality China Awards” "Best Single Phase String Inverter for Home Use–for the GW5000DNS" and "Best PV Energy Storage System for Home Use–for the GW5048D-ES"**

Global Sites – GoodWe Group

Our Value Proposition

Quality Brand

Innovative Technology

Good Value for Money

GoodWe offers the “best of both worlds” with a **quality product** backed-up by **comprehensive warranties** from a **stable**, **bankable company** but taking advantage of **lower manufacturing costs** in China:
a **“Premium Chinese Brand”**

- About Goodwe
- **Product Review**
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Our GoodWe Product Range

- Our range consists of two models

- The ES model offers 2 sizes: the GW3648-ES(3kW-DT) and the GW5048-ES(4.6kW-DT)

- The EM model offers 3 sizes: the GW3048-EM(3kW-ST), GW3648-EM(3.6kW-DT) and the GW5048-EM(5kW-DT)

The GoodWe Storage Solution

With our **Hybrid ES and EM series**, any new installations become "**future-proof**" whether the end-user installs a battery from Day 1 or at a later stage.

Unlike other battery storage systems in the market, the GoodWe ES and EM inverters work on the DC side of the system offering the **most efficient and easy to install option**.

Hybrid Solar Inverter ES— 3.6kW and 4.6kW

- Innovation for solar PV
- Charge controller and inverter integrated
- Intelligent battery management function
- Capable of being grid-interactive or grid-independent
- Compatible with both lead-acid and Li-Ion batteries
- Bi-directional energy flow, highly integrated
- Without Fan, <25DB, quiet operation
- IP65 rated, can be installed both indoors and outdoors
- ON-GRID and BACK UP mode
- NRS097-2-1:2010 certified

Hybrid Solar Inverter EM— 3.0kW, 3.6kW and 5kW

- Integrated charge controller and inverter
- Intelligent battery management function
- Grid-tied or grid-independent operation
- Compatible with both lead-acid and Li-ion batteries
- Increased performance and security
- Max. power output up to 5kW
- IP65 dust-proof and water-proof rating
- Easy remote monitoring via PC's, tablets and mobiles
- Fan-less low-noise design
- Built-in BMS communication
- NRS097-2-1:2017 certified




- About Goodwe
- Product Review
- **Goodwe Competitive Advantage**
- Pylontech batteries

GoodWe Business Plan

GoodWe as a company has built its corporate reputation by achieving sustainable growth in every market it operates in.

A prudent, step-by-step approach of strategic growth and consolidation in our markets offers longevity, profitable growth and increased market share; a business model also adopted by some of the world's leading renewable companies.




- About Goodwe
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- Goodwe Competitive Advantage
- **Pylontech batteries**

PYLONTECH

Pylon Technologies, Co. Ltd, founded in October 2009, and is the pioneer for LFP (lithium iron phosphate) battery deployed in ESS (energy storage system) and EV (electrical vehicle) . Pylontech's products and solutions had been widely deployed for high end vehicles, cloud computing system power backup, telecom power backup, new energy storage systems and electric vehicles. They continue serving high end customers with stable qualities and non-stop innovation.

Pylontech batteries

- Vertical industry integration ensures more than 6000 cycles with 80% DoD
- Deliver up to 5kW with single module (2.4kWh)
- Modular design gives the end customers the power of choice of capacity
- Compatible with Goodwe ES and EM
- Simple buckle fixing minimize the installation time and cost
- Compact and fashionable design fits in your sweet home environment
- Safety Cert.TÜV CE UN38.3 TLC

Pylontech specifications

SPECIFICATION	BASICPARAMETERS	US2000B
Nominal	Nominal Voltage（V）	48
	Nominal Capacity（Ah）	50
Physical	Dimension (mm)	440*410*89
	Weight (Kg)	24
Electrical	Discharge Voltage (V)	45 ~ 54
	Charge Voltage (V)	52.5 ~ 54
	Peak Discharge Current (A)	5kW@1Min
	Peak Charge Current (A)	5kW@1Min
Others	Communication	RS232，RS485，CAN
	Charging Temperature	0℃~50℃
	Discharging Temperature	-10℃~50℃
	Shelf Temperature	-40℃~80℃
	Certification	TÜV / CE / UN38.3 / TLC
	Design life	10+ Years（25℃/77℉）
	Cycle Life	>6000（ 80% DoD）

Pylontech – inverter compatibility list

PYLONTECH

The list of compatibility between inverters and Pylontech Battery in 48V (July 7th 2017)

Inverter		Battery		Communication
Brand of Inverter	Type	US2000B	Phantom-S	Terminal
SUNGROW	SH5K	√		CAN
SOLAX	SK-SU, SK-TL, SK-BMU			CAN/RS232
VICTRON	Multi / Quattro in 48V			CAN
IMEON	IMEON 3.6 &9.12			CAN
GOODWE	GOODWE-BP, GW5048D-ES, GW5048-EM			CAN
LIBRA	Smartverter			CAN
REDBACK	SH4600			RS485
SOFAR	ME 3000SP			RS485/CAN
GMDE	SolDate 3700TL+BM024			RS485
DOWELL	iPower			RS485/CAN
NICESTESS	NESS3048S			RS232

Note: There are others compatible test with other brands under process, updating will be made when finishing.

Any questions so far?

Training outline

Lesson 1: Hybrid inverter overview & main components

Lesson 2: Six work modes (scenarios)

Lesson 3: Battery sizing

Lesson 4: Application note

Lesson 5: Live Demo

Lesson 6: System monitoring

Lesson 7: Benefits to clients

Lesson 8: Datasheet, Warranty, Certificates

Lesson 1 – Hybrid inverter overview

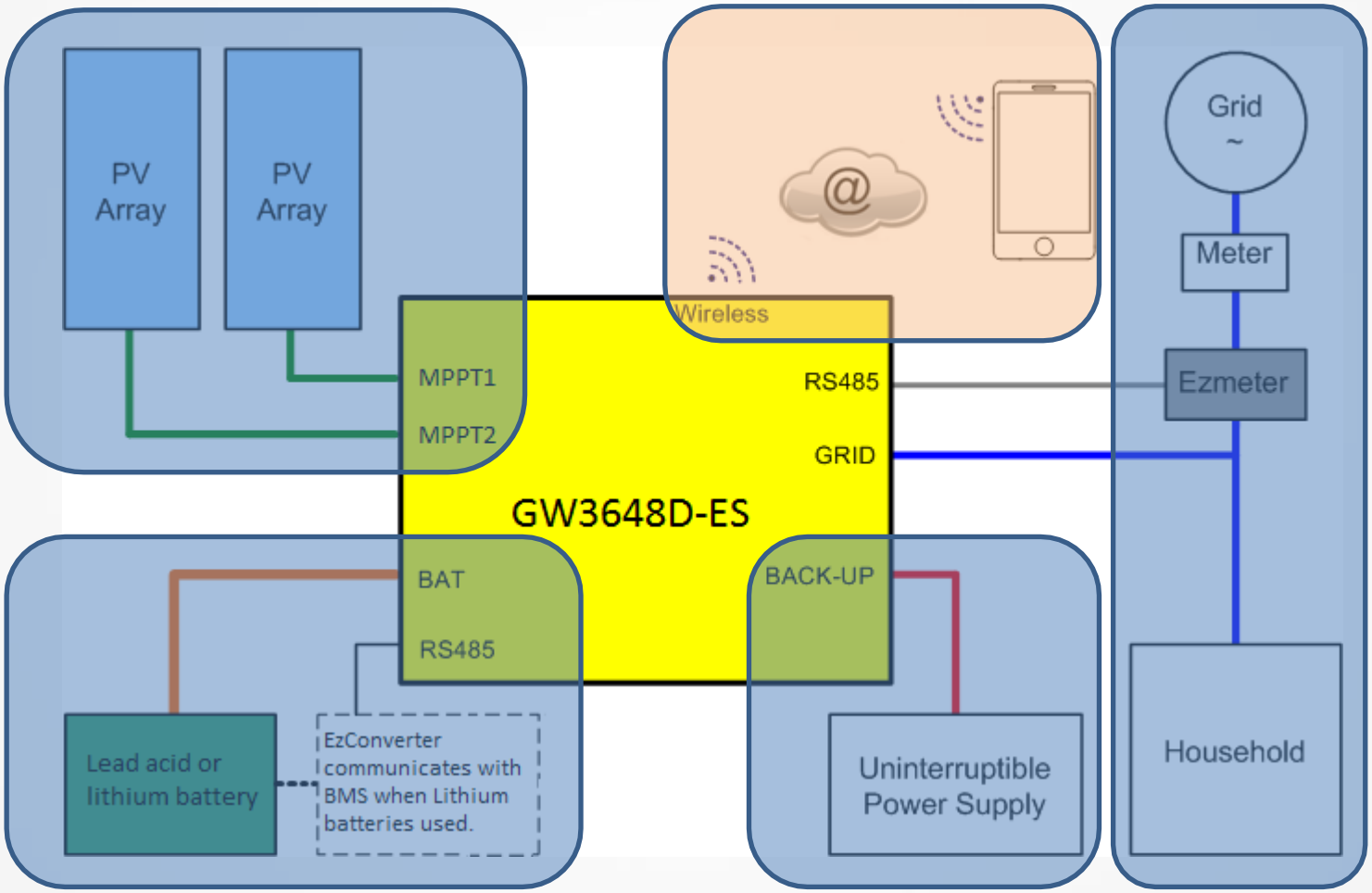
Lesson 1 – Hybrid inverter overview

Key features

- Grid-interactive or grid-independent
- Compatible with both Lead-acid and Li-Ion battery
- Charge controller and inverter integrated
- Intelligent battery management function
- Automatic back-up power supply
- Limit the power exported to the grid
- App controlled
- Data monitoring on portal and Apps

Lesson 1 – Hybrid inverter overview

- **Block diagram of ES series**

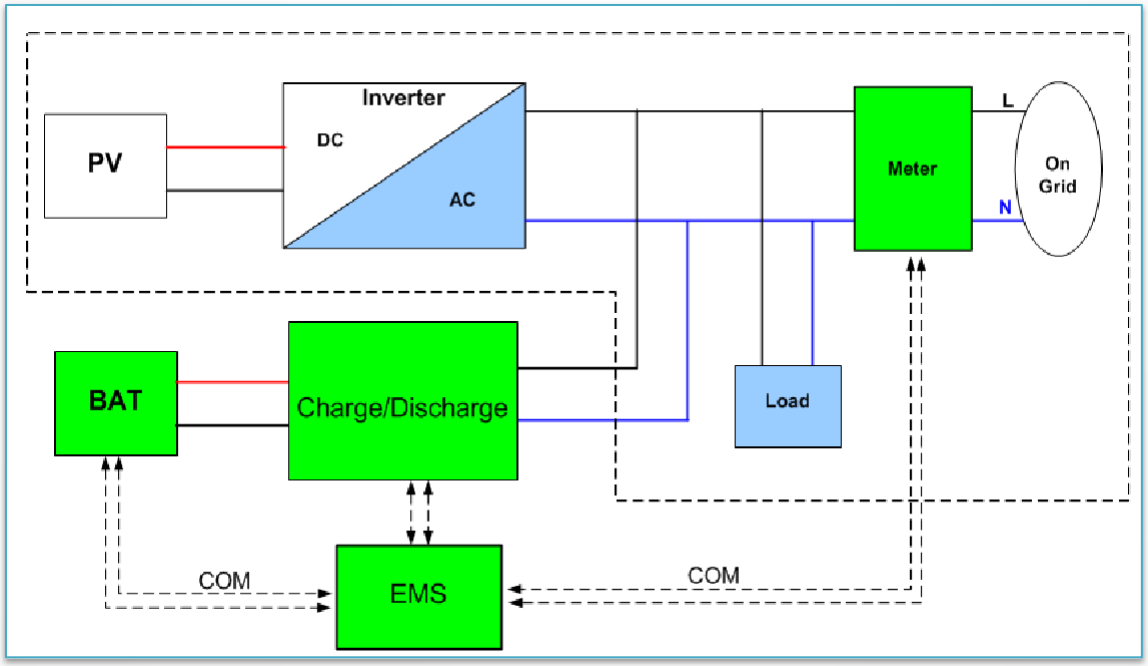


Lesson 1 – Hybrid inverter overview

❑ ES System Development Background

Traditional Energy Storage Solutions:

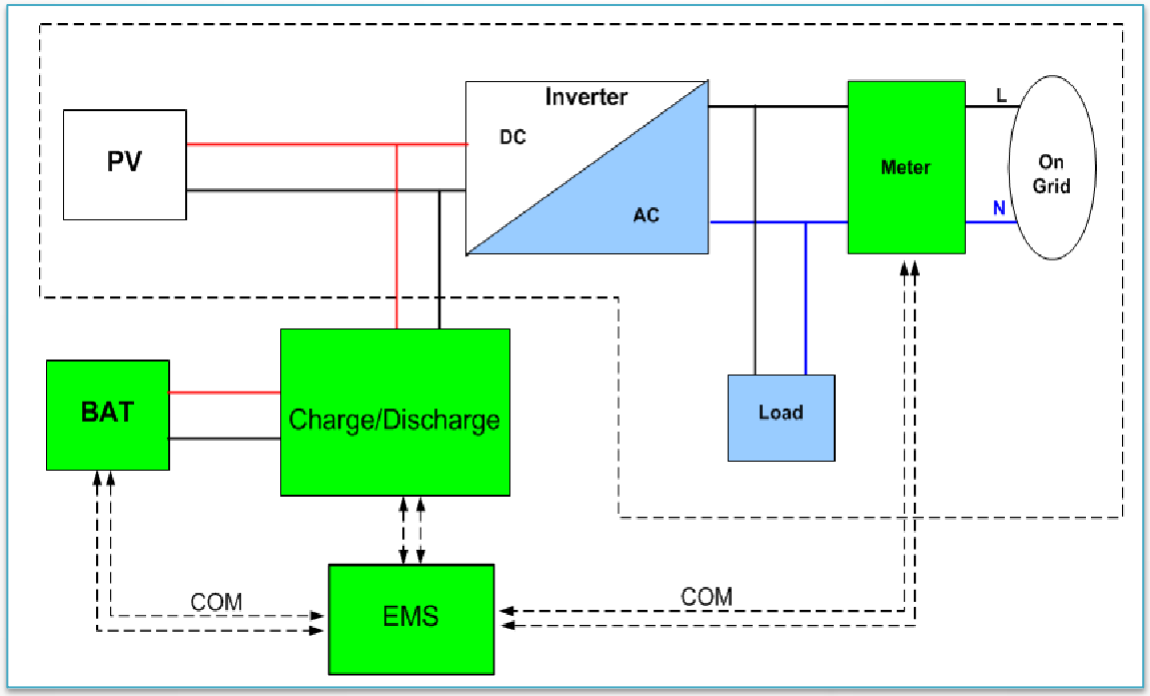
Common AC BUS system comprises the following additional equipment: BAT, EMS, Charge-Discharge Controller and Meter.



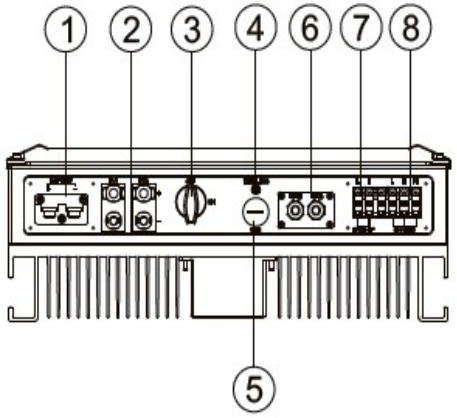
Lesson 1 – Hybrid inverter overview

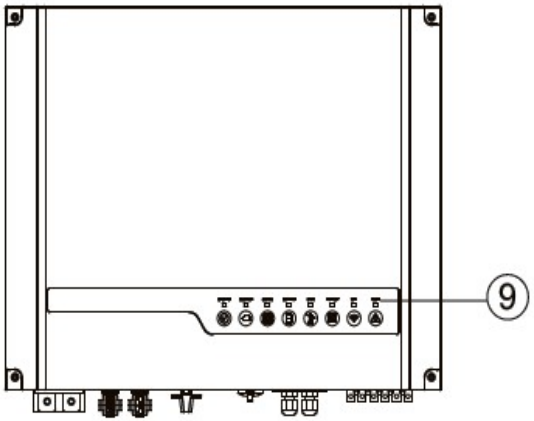
❑ ES System Development Background

The GoodWe Solution: Common DC BUS system, which is compatible with most inverters in the market, also with lower cost, higher efficiency and easy installation.
We introduce you GoodWe ES series inverter.



❑ ES function identification

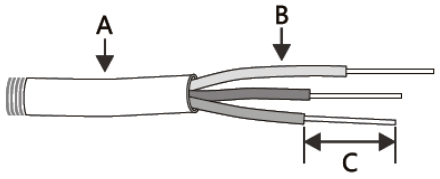




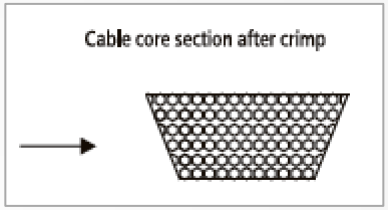
1. Battery input terminals
2. PV input terminals
3. DC Switch (Optional)
4. Wi-Fi antenna port
5. USB port
6. RS-485 port
7. Back-Up port
8. On-Grid port
9. LED lights

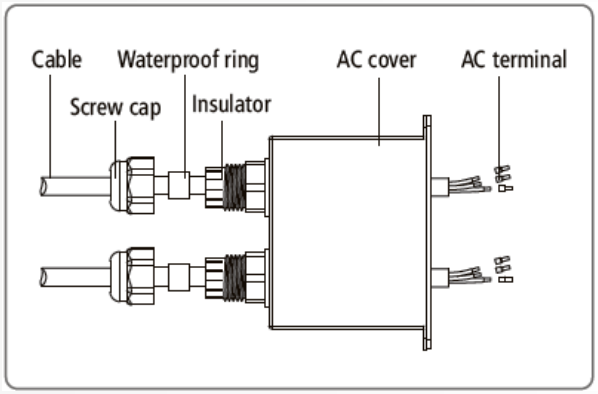
Lesson 1 – Hybrid inverter overview

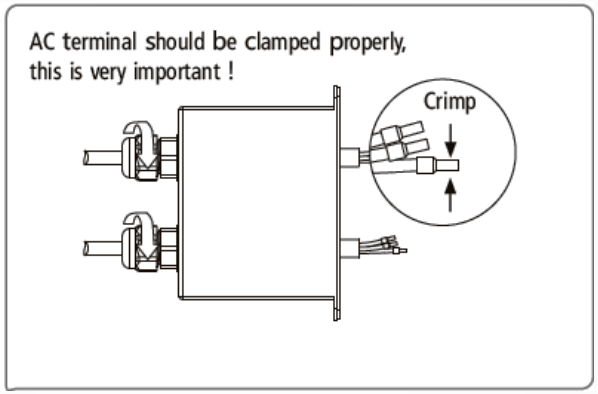
❑ AC Terminal connection

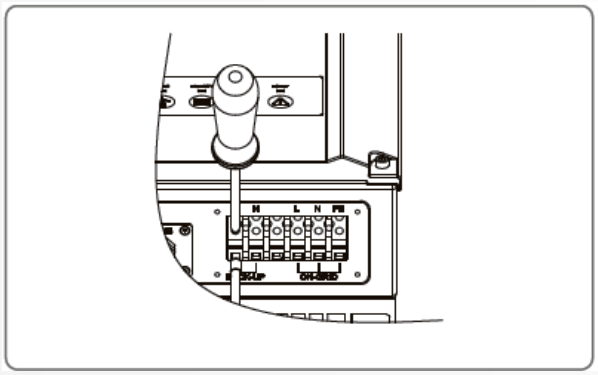


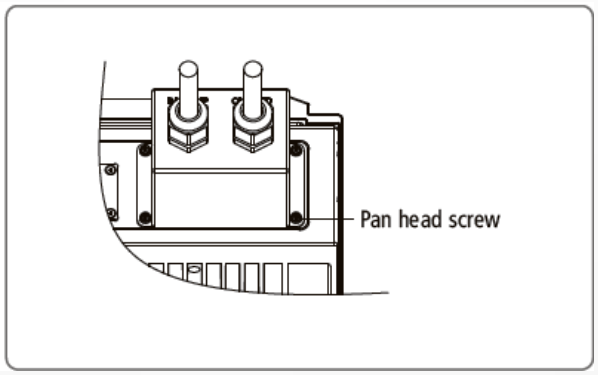
Grade	Description	Value
A	O.D.	11~12mm
B	Conductor Material Sectional Area	6mm²
C	Bare Wire Length	10mm around





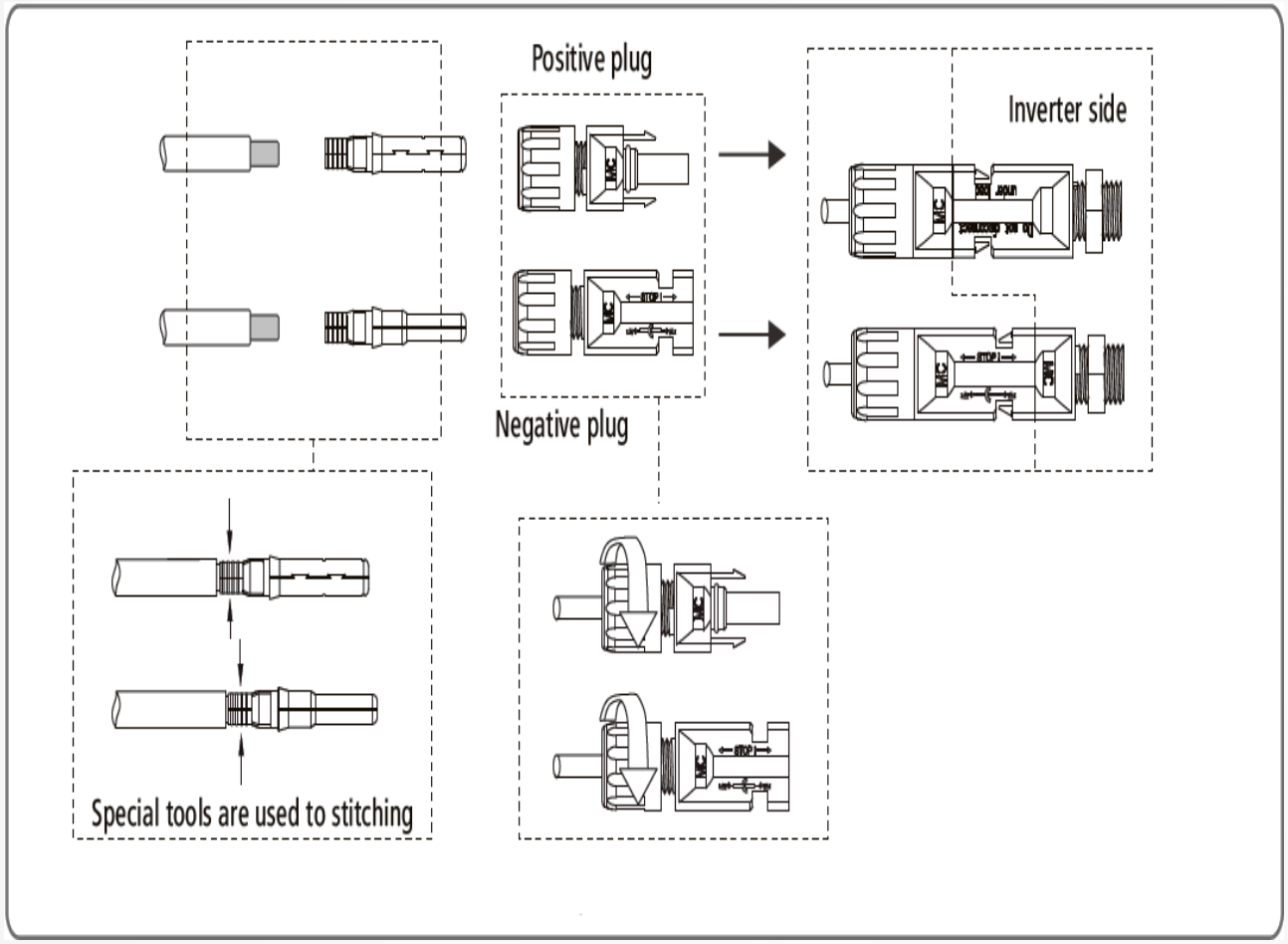






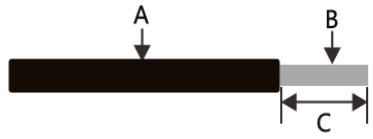
Lesson 1 – Hybrid inverter overview

❑ PV Terminals Connection

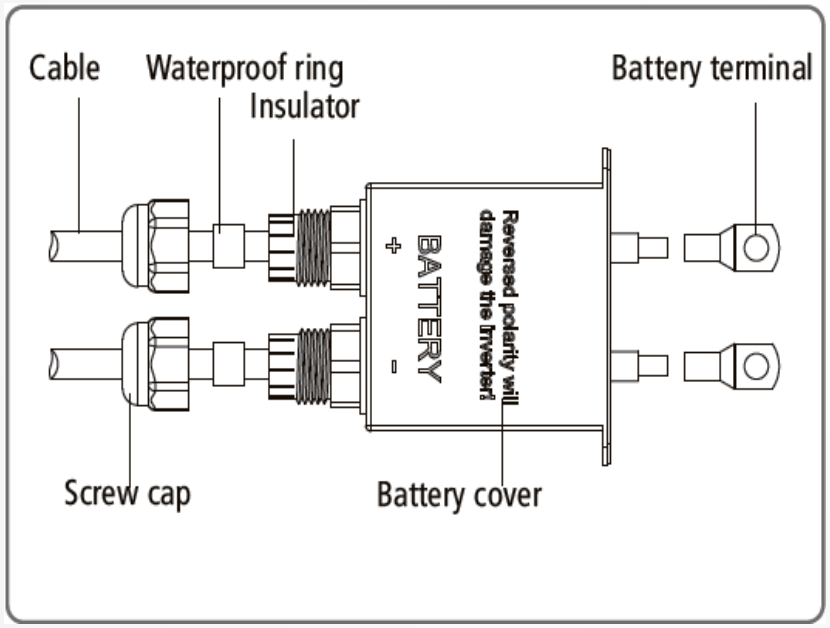


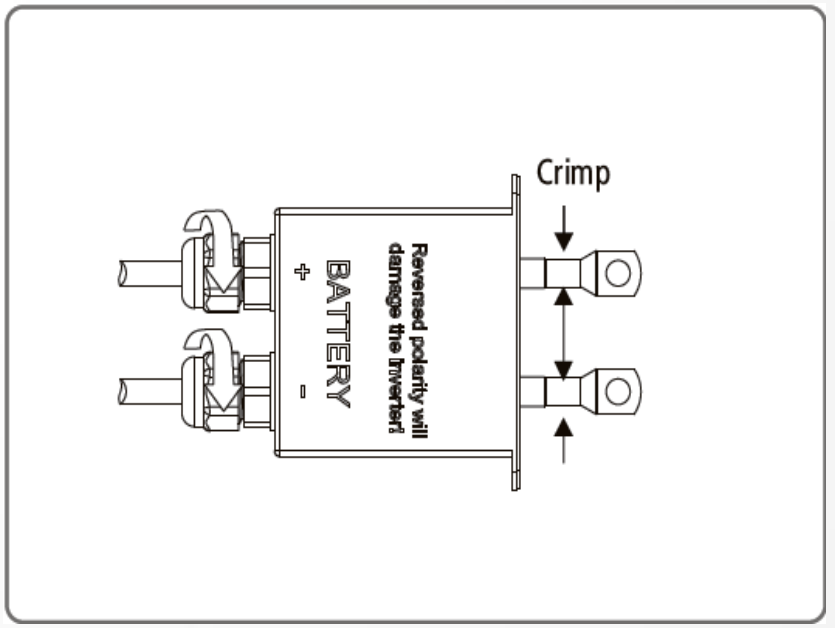
Lesson 1 – Hybrid inverter overview

❑ Battery Terminals Connection



Grade	Description	Value
A	O.D.	10~12mm
B	Conductor Material Sectional Area	20~25mm²
C	Bare Wire Length	10mm around





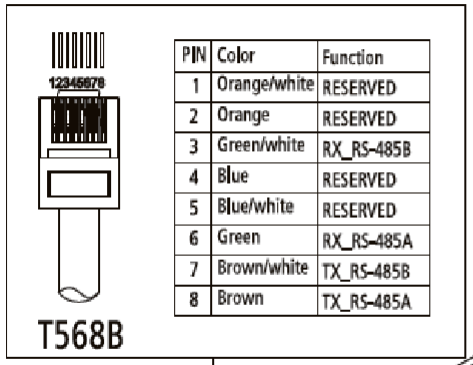
Lesson 1 – Hybrid inverter overview

❑ EzMeter

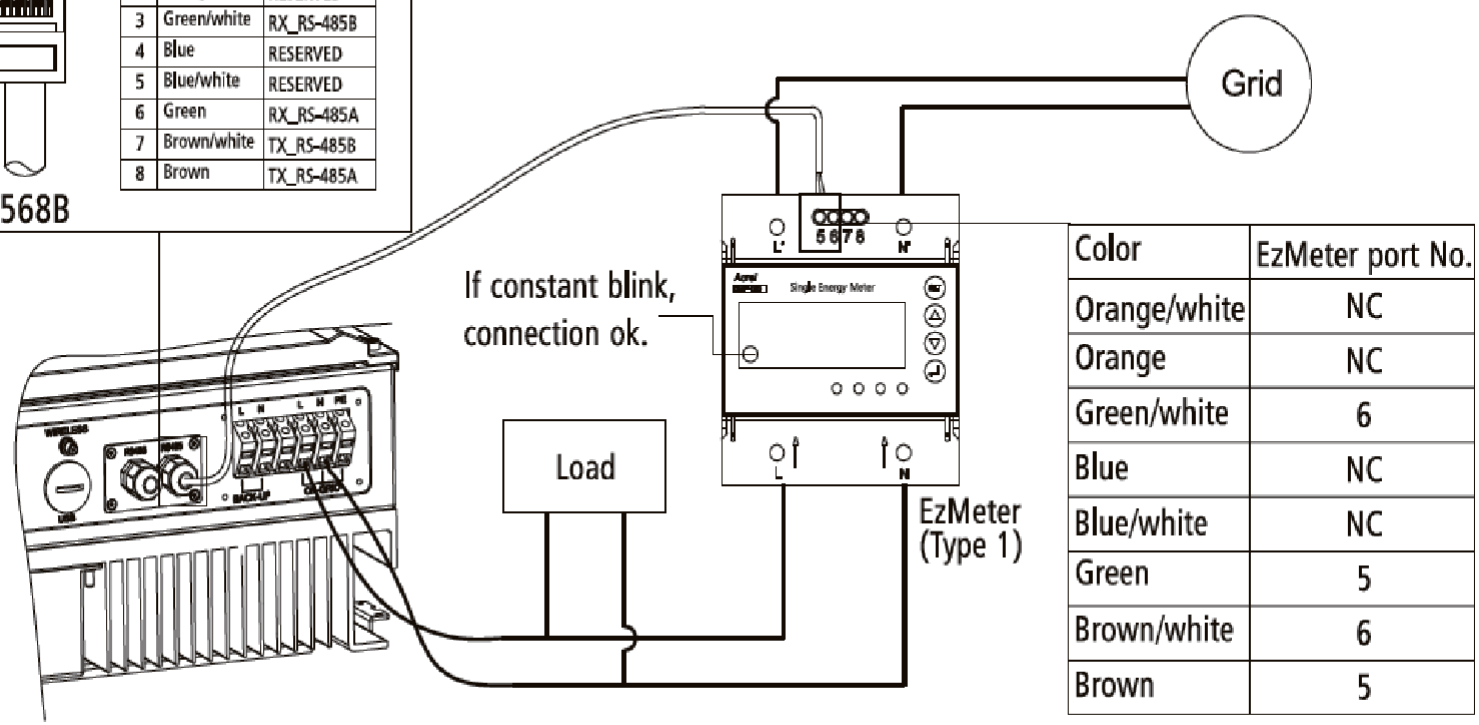
- Standard accessory with the inverter.
- Controls energy exported to the grid and the work modes of the Energy Storage system.
- Communicates with the ES inverter via a RS485 cable.
- Meter reading NOT used, treat this device as a Black Box.
- LED on the bottom left blinks to indicate the system is running.

Lesson 1 – Hybrid inverter overview

❑ EzMeter connection



PIN	Color	Function
1	Orange/white	RESERVED
2	Orange	RESERVED
3	Green/white	RX_RS-485B
4	Blue	RESERVED
5	Blue/white	RESERVED
6	Green	RX_RS-485A
7	Brown/white	TX_RS-485B
8	Brown	TX_RS-485A



Color	EzMeter port No.
Orange/white	NC
Orange	NC
Green/white	6
Blue	NC
Blue/white	NC
Green	5
Brown/white	6
Brown	5

Lesson 1 – Hybrid inverter overview

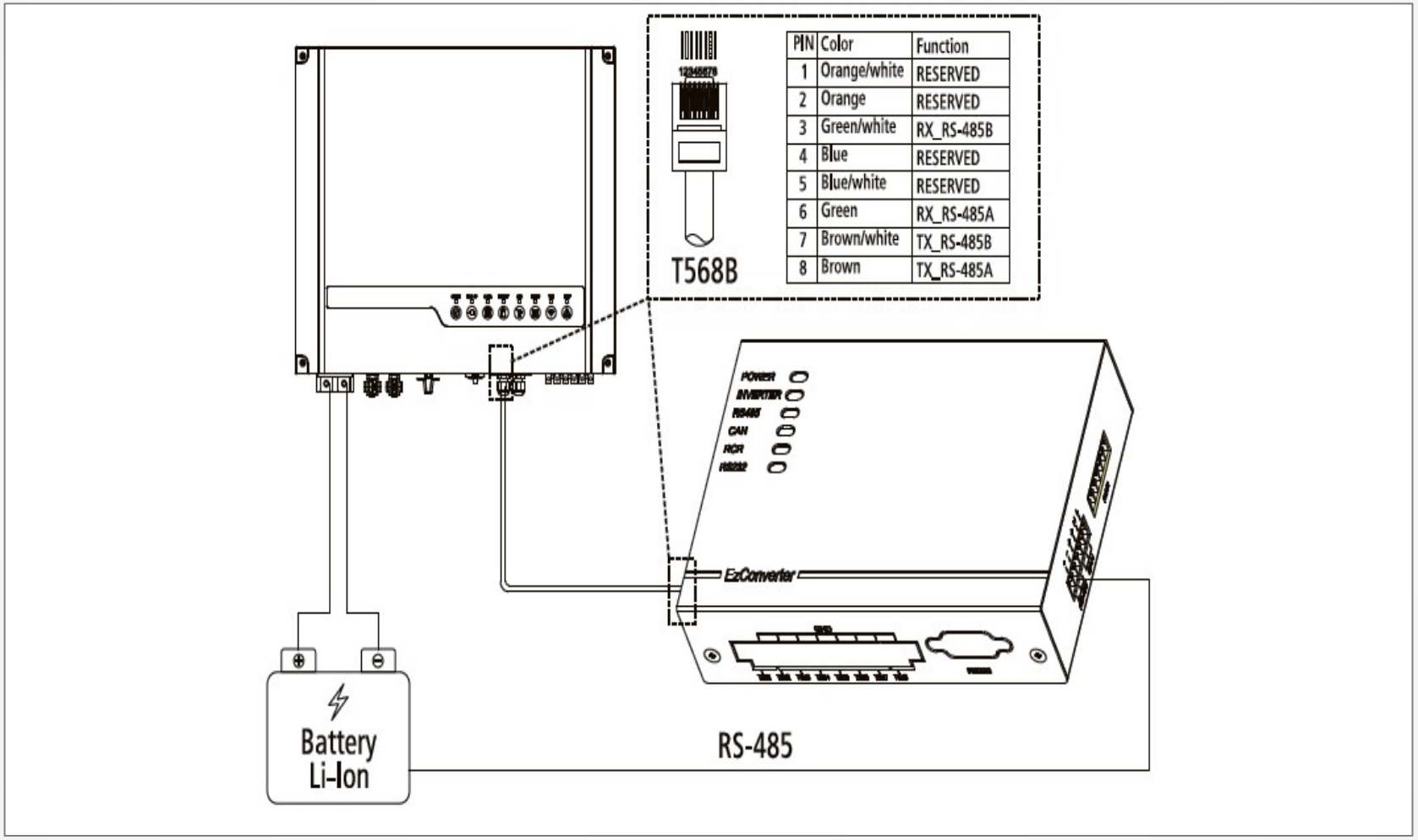
❑ EzConverter

- ➢ If a lithium battery is connected to the ES system, the EzConverter should be configured.
- ➢ Inverter and EzConverter communicate via RS485.
- ➢ 3 types of battery protocol supported.
  - ❑ RS485
  - ❑ CAN
  - ❑ RS232
- ➢ Choose corresponding dial-up circuit of lithium battery, please refer to table below to dial-up protocol comparison.

Switch State					Function
Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	
OFF	OFF	OFF	OFF	OFF	Reserved
OFF	ON	ON	ON	ON	BMS communication protocol for Alpha lithium battery

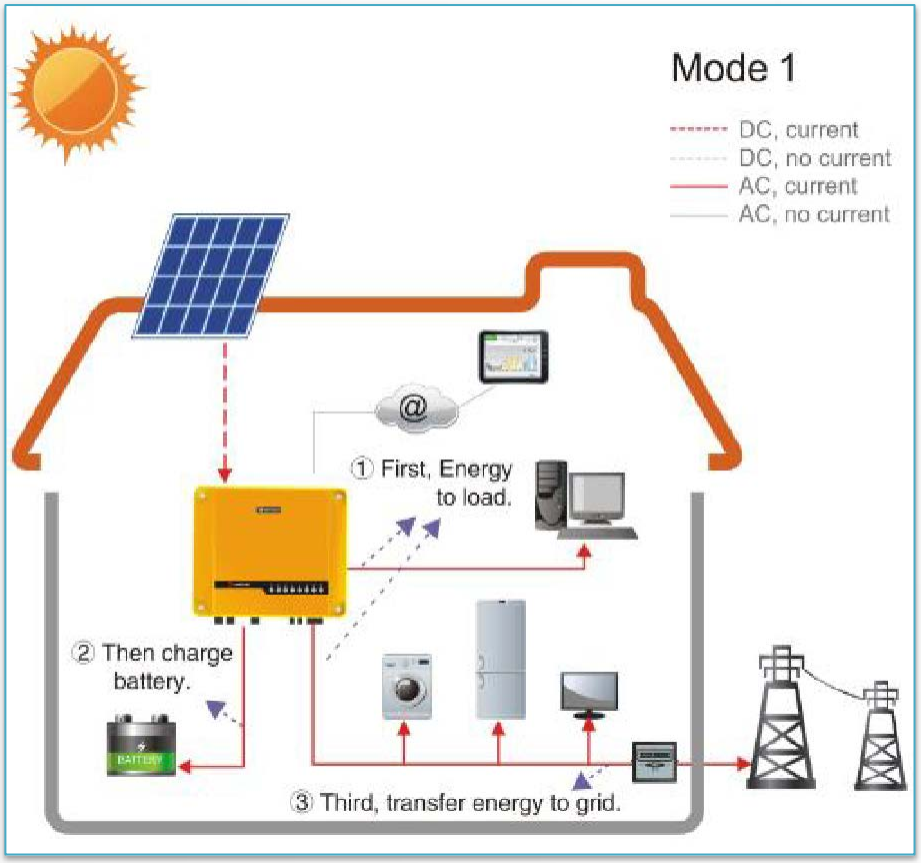
Lesson 1 – Hybrid inverter overview

❑ EzConverter connection with Lithium battery RS485



Lesson 2 – Six work modes

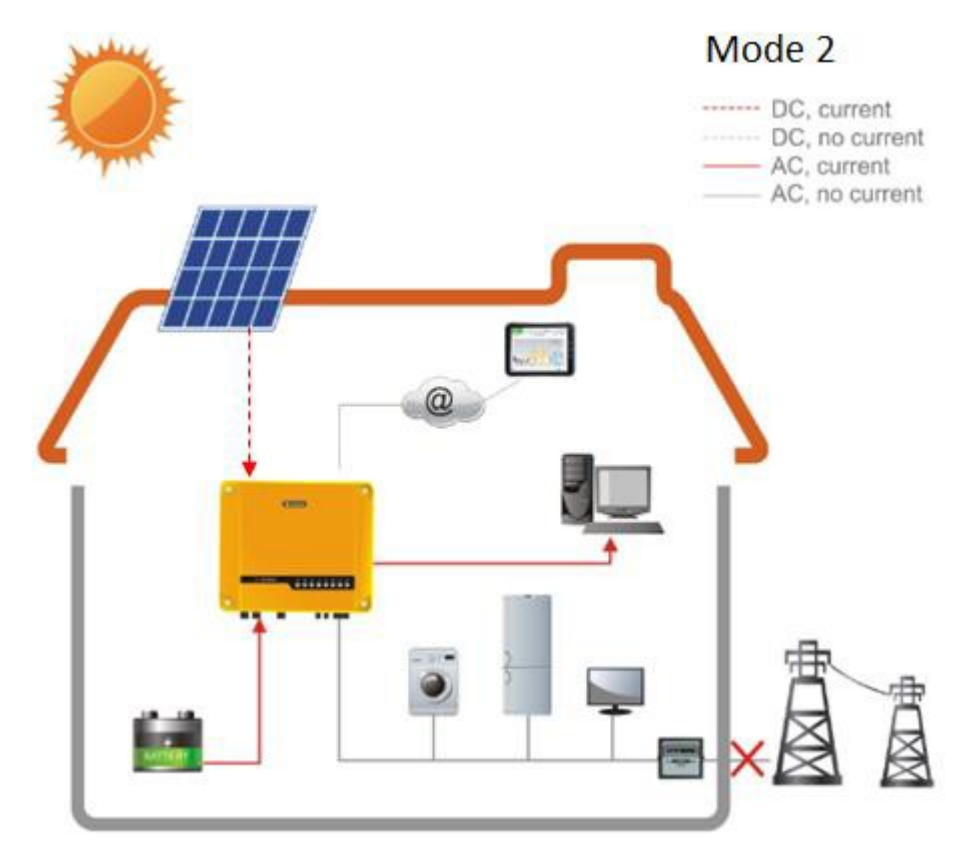
Lesson 2 - Six Work Modes



Mode 1
Condition: PV ON; Peak Generation

Energy produced by the PV system is for self-consumption optimization. Solar energy will firstly support the load, secondly it will charge the battery and finally export to the grid or draw from the grid, if the load demands more energy.

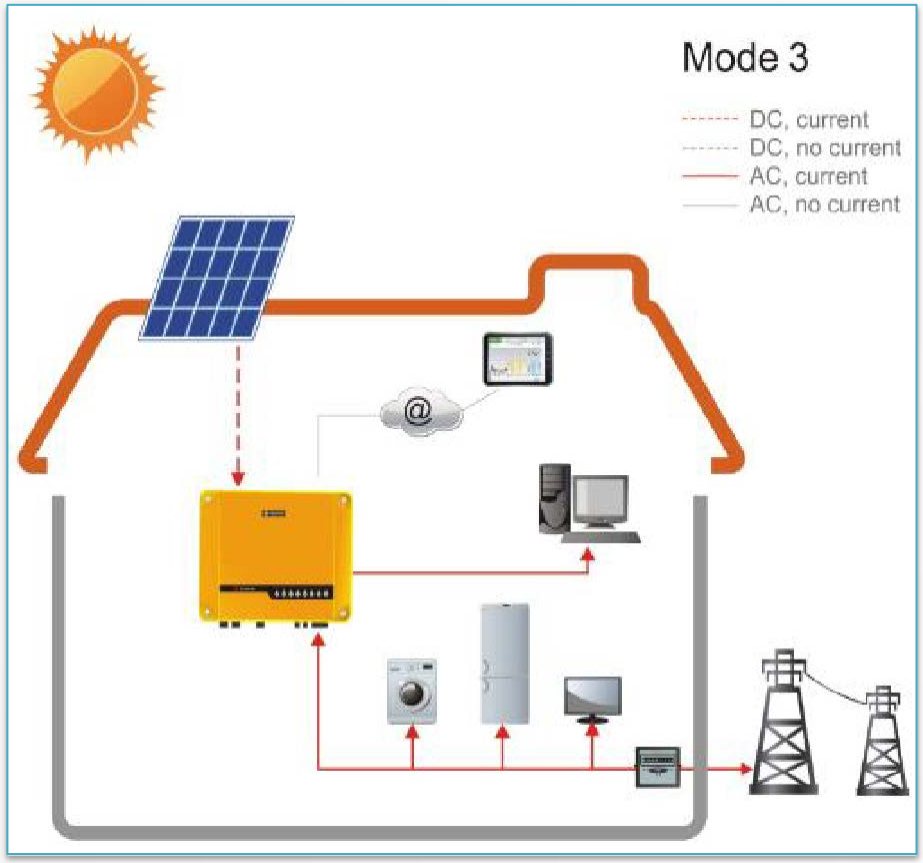
Six Work Mode



Mode 2
Condition: Day time, grid fails

The system **automatically** switches to back-up mode. Solar energy will first support the load connected to the back-up side. If more energy is generated, it will be used to charge the battery.

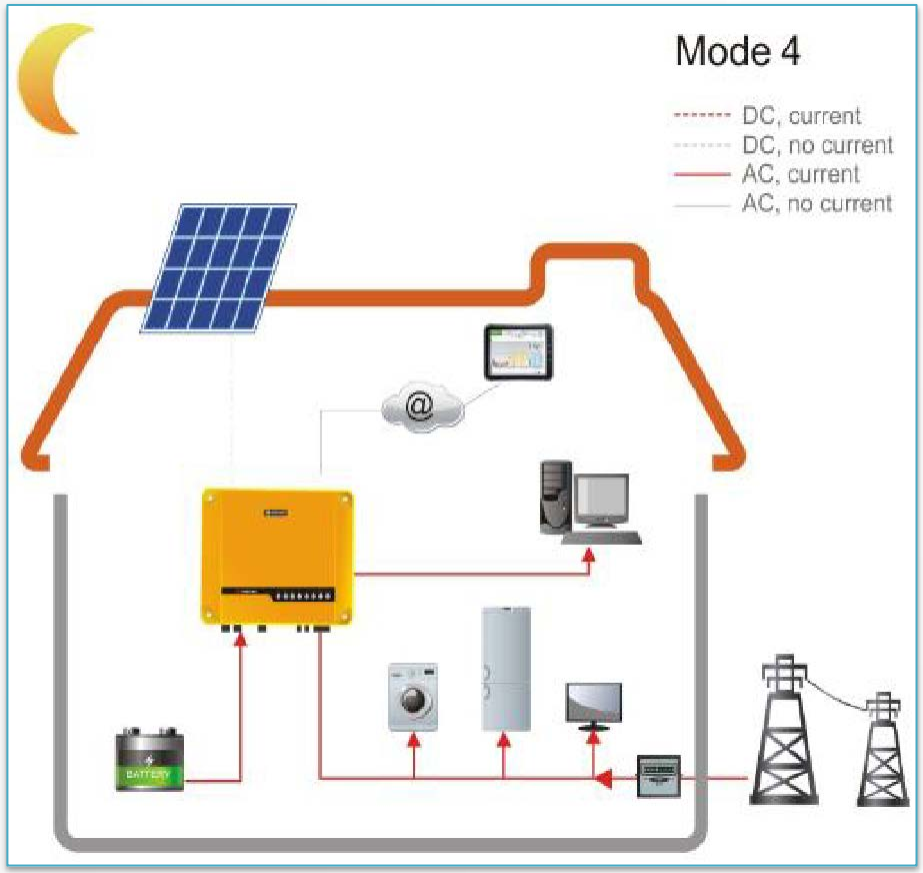
Lesson 2 - Six Work Modes



Mode 3
Condition: System without Battery

Solar energy will first support the load, excess power will be exported to the grid. If generation level is too low, power will be imported from the grid.

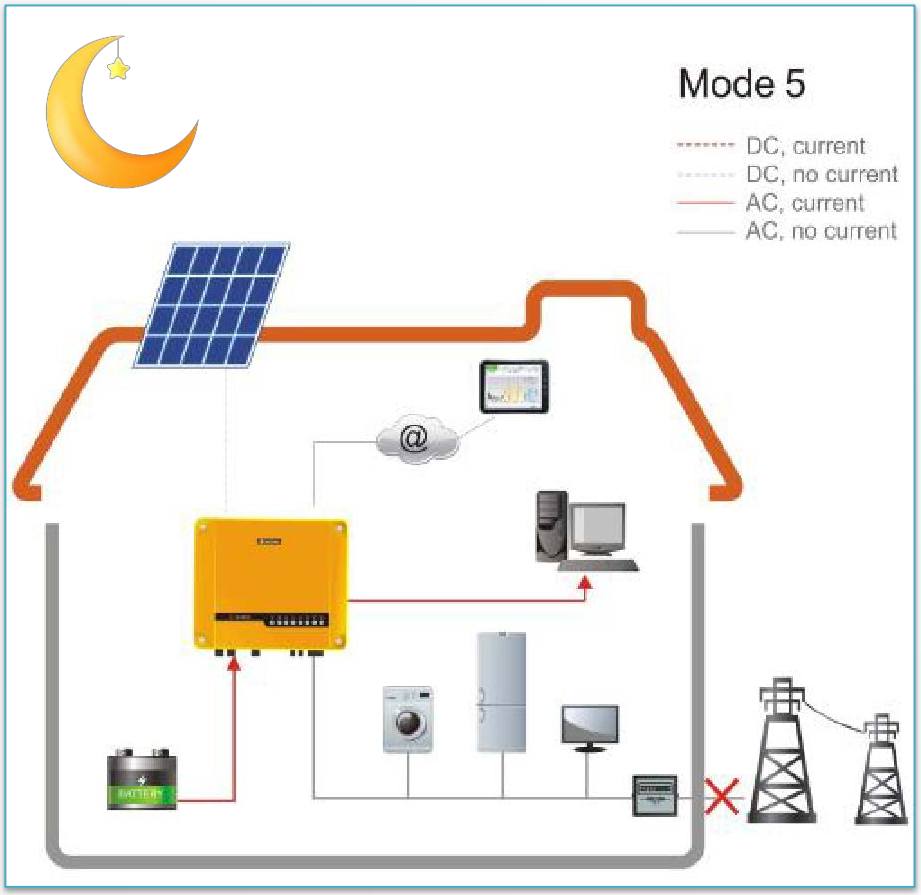
Lesson 2 - Six Work Modes



Mode 4
Condition: Night-time

ES inverter will discharge the battery to support the load. If battery stored energy is not enough, the rest of the power will be supplied from the grid.

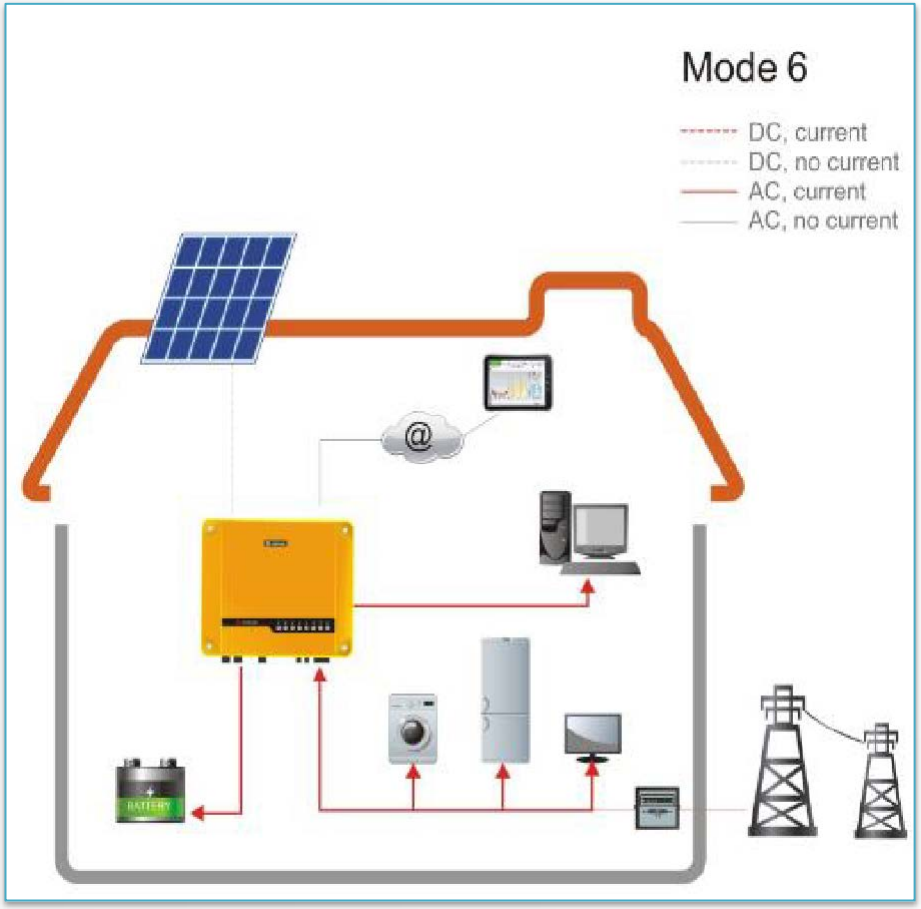
Lesson 2 - Six Work Modes



Mode 5
Condition: Night time, grid fails

Once the grid fails, the system automatically switches to back-up mode. ES inverter will discharge the battery to support the load.

Lesson 2 - Six Work Modes



Mode 6
Condition: Use as UPS

If the customer wants to use the system as UPS, the inverter can also be set to charge the battery by the grid.

Lesson 3 – Battery sizing

Lesson 3 – Battery sizing

- Pylon battery

Specification	Basic Parameters	US 2000A	US 2000B
Nominal	Nominal Voltage (V)	48	
	Nominal Capacity (Ah)	50	
Physical	Dimension (mm)	436*370*132	441*450*95
	Weight (Kg)	30	
Electrical	Discharge Voltage (V)	45 ~ 54	
	Charge Voltage (V)	52.5 ~ 54	
	Maximum Discharge Current (A)	50 (1C)	100 (2C)
	Maximum Charge Current (A)	50 (1C)	100 (2C)
Others	Communication Port	RS232, CAN	RS232 , RS485 , CAN
	Working Life	15 Years (25℃/77℉)	
	Cycle Life	>6,000 (Temp. 25℃, DoD 95%) EOL 60% >8,000 (Temp. 25℃, DoD 80%) EOL 60%	
	Working Temperature	0℃~50℃	
	Safety Certifications	TÜV、CE、UN38.3、TLC	

Lesson 3 – Battery sizing

- Simple Battery Sizing Calculation

Battery Capacity (Ah) = Load demand at night (Ah)[1] / Maximum Depth of Discharge (%)[2]

(1)Load demand at night = Total power consumed at night / 48V[3]

(2)The maximum depth of discharge is the percentage of the batteries capacity that can be discharged without causing harm to the life of the battery. The DOD varies from brand and model.

(3) 48V is the battery voltage required by the Hybrid inverter.

Lesson 3 – Battery sizing

❑ Simple Battery Sizing Example

Equipment	Power rating (W)	Quantity	Duration(hours)	KWhrs
Light bulbs	20	10	6	1.2
Fridge/freezer	120	1	8	0.96
TV	50	2	4	0.4
Phone	20	2	2	0.08
Heating	100	1	5	0.5
Kettle	2000	1	0.16	0.32
				3.46

If the power used at night is 3.5kWh, and the depth of discharge is 80%, the battery capacity (Ah) will be …

Load demand at night = 3500/48 = 73Ah

Battery capacity = 73/80% = 91.25Ah

This means 2 x 50Ah batteries will provide the required power.

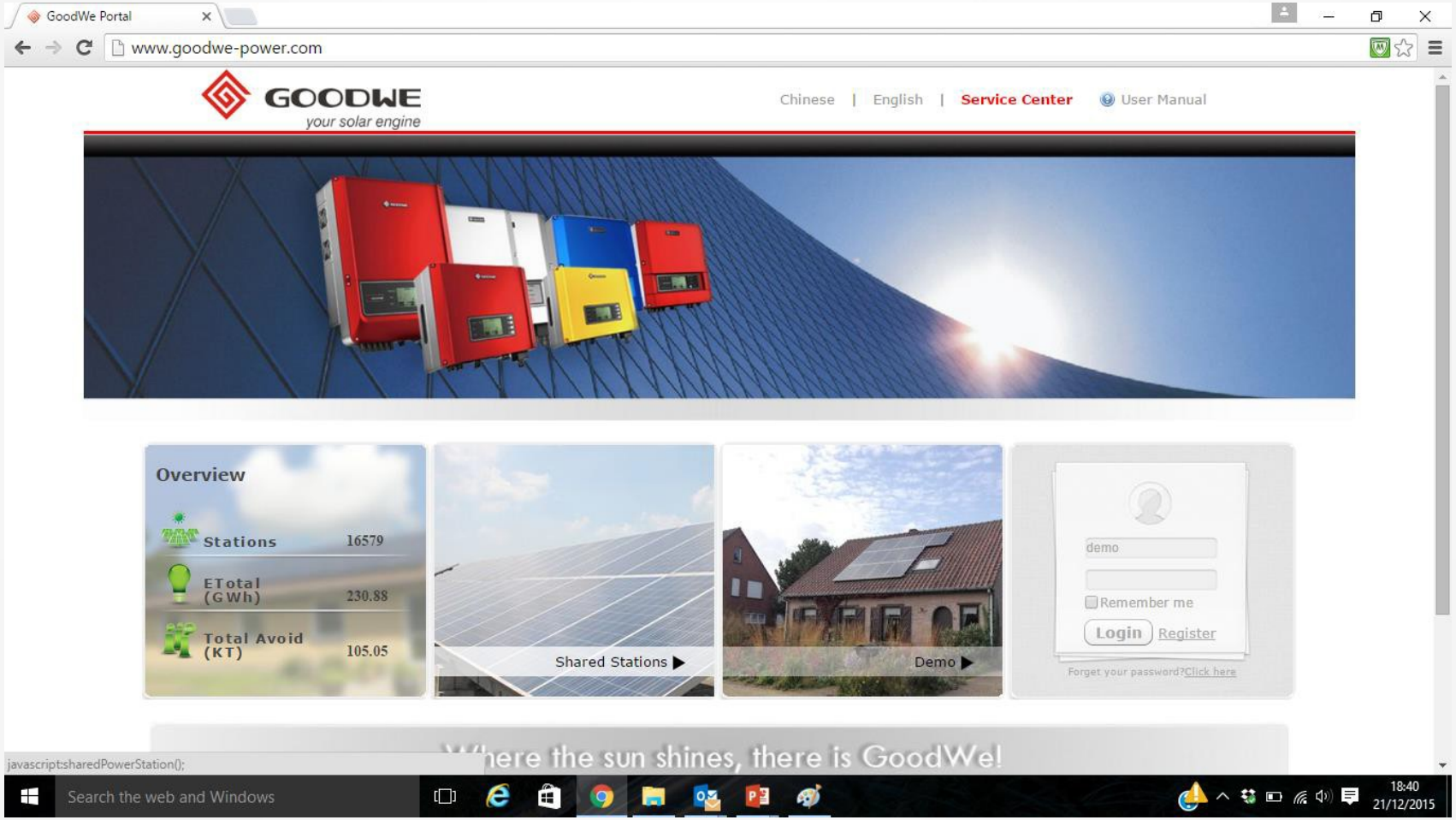
Lesson 4 – Application note

Lesson 5 – Live Demo

Lesson 6 – System monitoring

Lesson 5 – System monitoring

- Portal – registration and monitoring



Lesson 5 – System monitoring

❑ Registration

The Ezlogger is ready to transport data to the GoodWe server. Follow steps below to register an account and create a station on the GoodWe portal.

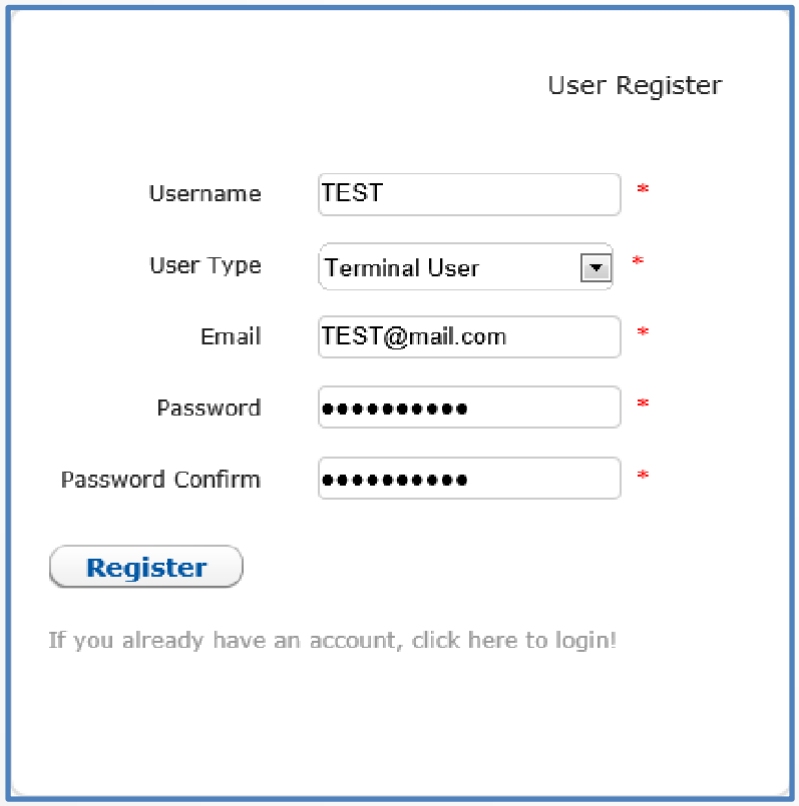
1. Browse website: http://www.goodwe-power.com/

2. Click 'Register'.

Lesson 5 – System monitoring

- Registration

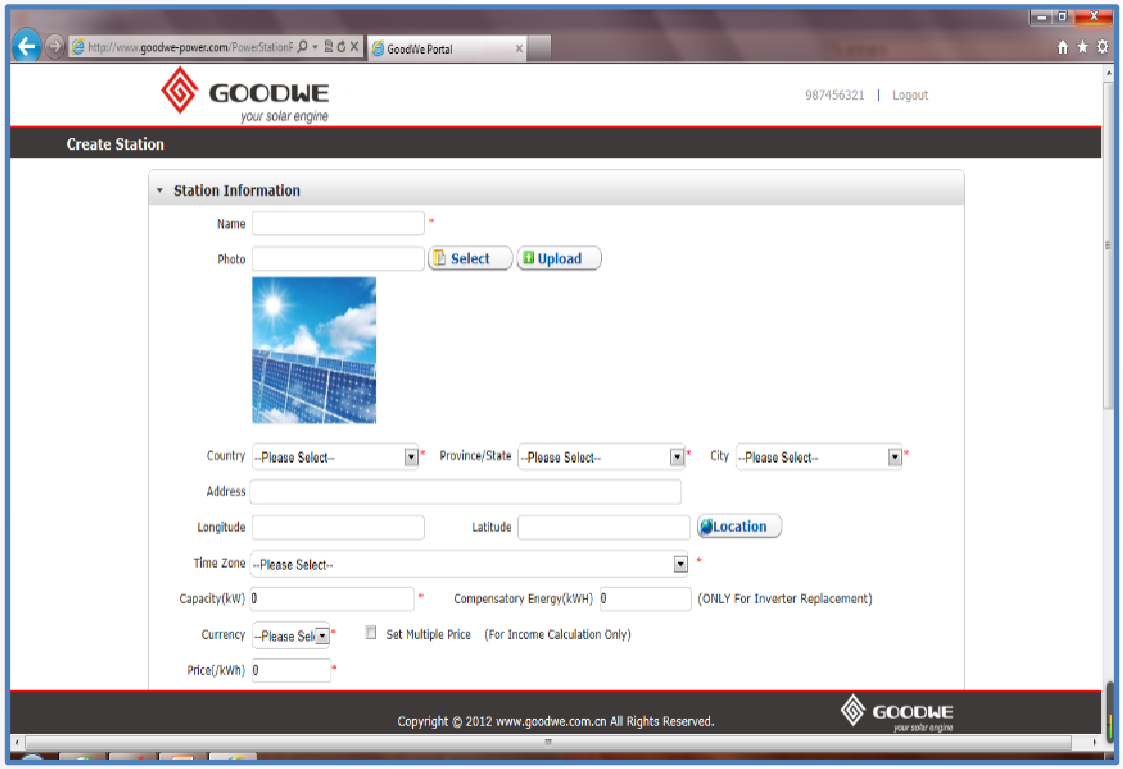
3. Click ‘User Type’, choose ‘Terminal User’ and fill all required fields.



Lesson 5 – System monitoring

- Registration

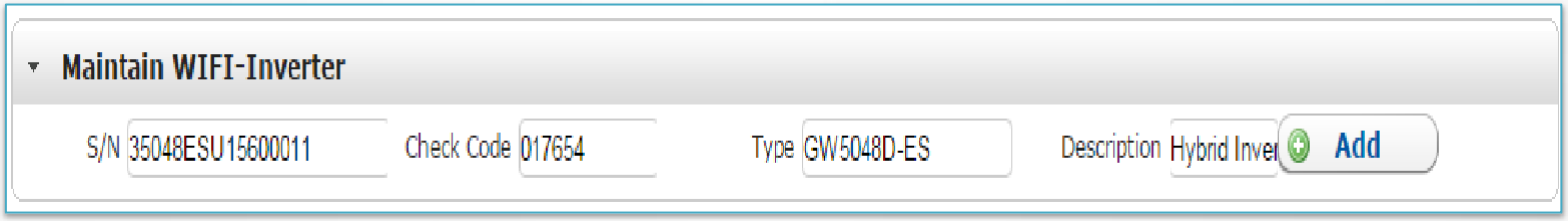
4. Click ‘Register’ and station setup page will come out.



Lesson 5 – System monitoring

- Registration

5. Fulfill the ‘Station Information’, then go to ‘Maintain Ezlogger’. Input the ‘S/N’, ‘Check Code’, ‘Type’ and ‘Description’. And click ‘Add’.

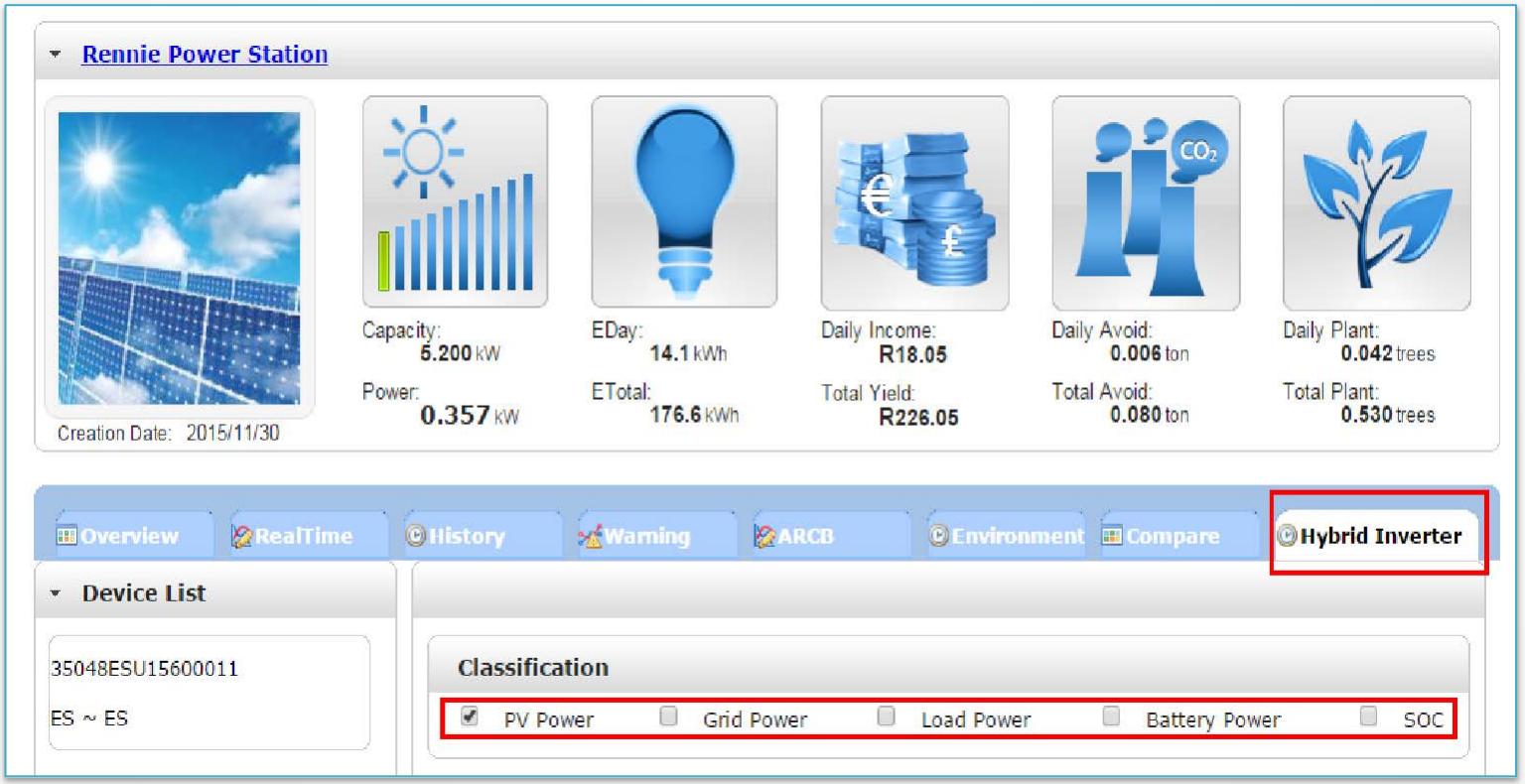


6. Type in the rest of the information and press button “Create Station”.

Lesson 5 – System monitoring

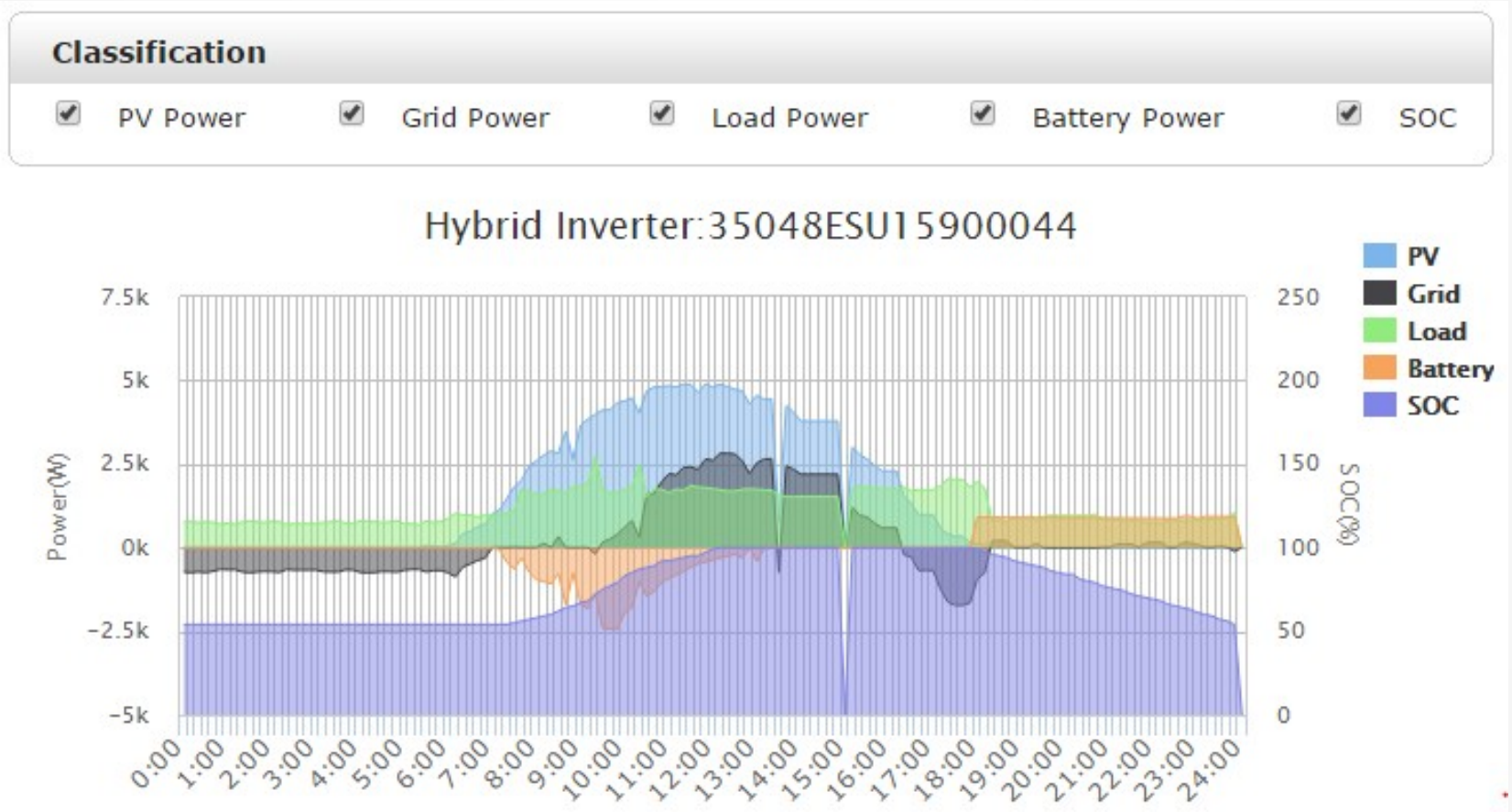
- Registration

7. Login the portal, and choose the station just built. As this is a hybrid system, choose the hybrid inverter page, and then you can view the whole system working state at anytime anywhere.



Lesson 5 – System monitoring

- ES system station overview



Lesson 5 – System monitoring

- App monitoring - EzViewer

Lesson 7 – Benefits to clients

Lesson 6 – Benefits to clients

❑ Comparison of ES and Grid-tied Inverter

Type	4kW Grid Tied Inverter	GW3648D-ES Inverter
PV Modules	250*16 =4kW	250*16 =4kW
Inverter Quantity	1	1
Battery Model	No	48v/200Ah
Daytime Power Consumption	20% self-consumption 80% sale to grid	80~100% self-consumption
Nighttime Work Mode	Buy power from grid	Discharge from battery
Grid-Off Work Mode	Shuts down	Still Operating
Power Loss	High	almost zero

Lesson 6 – Benefits to clients

1. New install
2. Customers system is out of warranty and the inverter has failed they have seen the benefits of the system so they will understand the benefits storage.
3. Switch to back-up supply in the event of a grid failure.
4. Controls the flow of energy intelligently:

   (a) During daytime, solar generation can be provided to the load, charge the battery or export to the grid.

   (b) At night, the inverter can discharge energy from the battery to support the load. When the battery power is not quite enough to support the load, power is purchased from the grid to support all loads.

Lesson 8 – Technical data, Certificates, Warranty

Lesson 7 - Technical Data

Name	Description	GW5048D-ES	GW3648D-ES
Solar	Max. DC Power (W)	5400	4200
	Max. DC Voltage (V)	580	
	MPPT Voltage Range (V)	125-550	
	Active Voltage (V)	125	
	Max. DC Current (A)	15/15	
	No. of DC Connectors	2	
	No. of MPPTs	2 (Can Parallel)	
	DC Connector	SUNCLIX /MC4 /H4 (Optional)	
Battery	Battery Type	Lead-acid or Li-Ion	
	Nominal Voltage (V)	40-60	40-60
	Max. Discharge Power (W)	4600	3600
	Max. Charge Power (W)	2300, Programmable	

Lesson 7 - Technical Data

Name	Description	GW5048D-ES	GW3648D-ES
Battery	Battery Capacity (Ah)	≥100Ah (Depending Requirement)	
	Charging Curve	3-Stage Adaptive with Maintenance	
	Charge Voltage (V)	57 (Optional)	
	Battery Temperature Compensation	Included (Li-Ion)	
	Battery Voltage Sense	Integrated	Integrated
	Current Shunt	Integrated	Integrated
AC Output Data	Nominal AC Power (W)	4600	3600
	Max. AC Power (W)	4600	3600
	Peak Power (Back-Up)(W)	1.5*Pnom, 10sec	
	Max. AC Current	20	16
	Nominal AC Output	50/60Hz; 230Vac	
	AC Output Range	45-55Hz/55-65Hz; 182-270Vac	

Lesson 7 - Technical Data

Name	Description	GW5048D-ES	GW3648D-ES
AC Output Data	THDi	<1.5%	
	Power Factor	0.9 Leading-0.9Laagging	
	Grid Connection	Single Phase	
Efficiency	Max. Efficiency	97.6%	97.6%
	Euro Efficiency	>97%	>97%
	MPPT Adaption Efficiency	>99.9%	
Protection	Residual Current Monitoring Unit	Integrated	
	Anti-Islanding Protection	Integrated	
	DC Switch (PV)	Integrated	
	AC Over Current Protection	Integrated	
	Insulation Monitoring	Integrated	

Lesson 7 - Technical Data

Name	Description	GW5048D-ES	GW3648D-ES
Certificates & Standards	Grid Regulation	VDE4105, VDE 0126-1-1+A1, G83/2, G59/3, AS4777.2/.3, IEC62109-2	
	Safety	IEC62109-1&-2, AS3100, IEC62040-1	
	EMC	EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4, EN61000-3-11, EN61000-3-12	
General Data	Dimensions (W*H*D)	516*440*184mm	
	Weight (Kg)	30	28
	Mounting	Wall Bracket	
	Ambient Temperature Range	-25~60℃ (>45℃ Derating)	
	Relative Humidity	0-95%	
	Max. Operating Altitude	4000m (>3000m Derating)	
	Protection Degree	IP65	

Lesson 7 - Technical Data

Name	Description	GW5048D-ES	GW3648D-ES
General Data	Topology	Transformerless	
	Standby Losses (W)	<8	
	Cooling	Natural Convection	
	Noise Emission (dB)	<25	
	Display	LED Light & APP	
	Communication	USB2.0; WiFi	
	Standard Warranty (years)	5	

Lesson 7 - Certificates

Series	Model	VDE0126-1-1 VDE-AR-N 4105 (Europe)	EN62109-1&2 (Europe)	SAA (Australia)	G83/2 (UK)	G59/3 (UK)	NRS097-2-1 (S.Africa)
ES	GW3648D-ES	◆	◆	◆	◆		◆
	GW3648S-ES	◆	◆	◆	◆		◆
	GW4248D-ES	◆	◆	◆		◆	◆
	GW5048D-ES	◆	◆	◆		◆	◆
	◆ Approved		◆ Processing			◆ Planning	

STANDARD WARRANTY

GOODWE NS SS DS DT ES series inverters come standard with a **manufacturer's warranty of 66 months (5.5 years)** from the date of production from JIANGSU GOODWE POWER SUPPLY TECHNOLOGY Co., Ltd (hereinafter referred to as GOODWE).

The accessory products include Antenna, EzConverter, EzMeter and EzLogger come standard with a manufacturer's warranty of 30 months (2.5 years) from the date of manufacturing from GOODWE.

For inverters (GOODWE NS SS DS DT ES series), and the accessory products, the warranty can be extended within 24months (2 years) from the date of manufacturing. Please obtain the warranty extension price list form GOODWE Sales for further information.

SERVICE AFTER WARRANTY EXPIRATION

For products which are out of warranty, GOODWE charges an on-site service fee, parts, labour cost and logistic fee to end-user which can be any/all of:

- On-site attendance fee: Cost of travel and time for the technician in attending on-site.
- Parts: Cost of replacement parts (including any shipping/admin fee that may apply).
- Labour: Labour time fee charged for the technician, who is repairing, maintaining, installing (hardware or software) and debugging the faulty product.
- Logistic fee: Cost of delivery and other derived expense when defective products are sent from user to GOODWE or/and repaired products are sent from GOODWE to user.

Thank you!

GOODWE
your solar engine

WHERE THE SUN SHINES ,THERE IS GOODWE.