On-Grid PV Inverter

Installation and Operation Manual

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Contents

1.About This Manual

1.1 Scope of Validity

This manual describes the installation, commissioning, operation and maintenance of the following on-grid PV inverters produced by Afore New Energy:

Three-Phase

BNT050KTL BNT060KTL

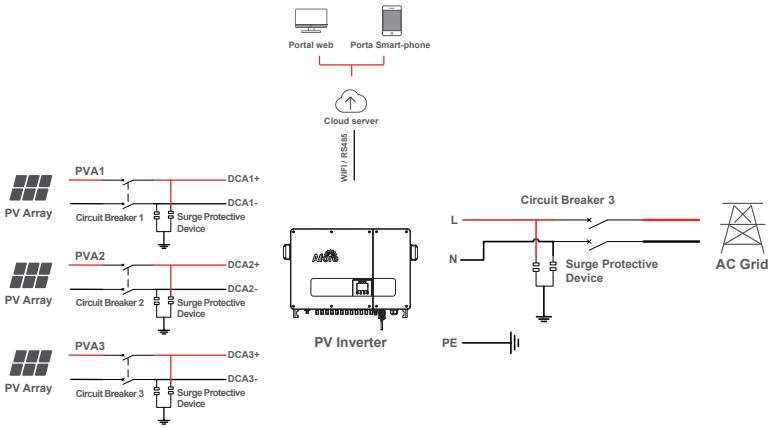
Please keep this manual all the time available in case of emergency.

1.2 Target Group

This manual is for qualified personnel. The tasks described in this manual must only be performed by qualified personnel.

1.3 System Diagram

The typical connection diagram for the entire PV system is on-grid.



Circuit Breaker and Surge Protector Recommendation:

Type	Max AC Current [A]	Rate current of AC breaker[A]
BNT050KTL	75	100
BNT060KTL	90	125

• SPD: Lightning protection system, refer to the following options:
• AC side, nominal discharge current 20KA, second grade lightning protection, protection voltage 2.5KV
• DC side, nominal discharge current 20KA, second grade lightning protection, protection voltage 2.5KV
• The wiring distance between the inverter and the distribution box should be at least 5 meters.

Note:
The Inverter can be only connected to low-voltage grid. (380/400/415Vac, 50/60Hz).

2.Safety & Symbols

2.1 Safety Precautions

1. All work on the inverter must be carried out by qualified electricians.
2. The device may only be operated with PV panels.
3. The PV panels and inverter must be connected to the ground.
4. Do not touch the inverter cover until 5 minutes after disconnecting both DC and AC power supply.
5. Do not touch the inverter enclosure when operating, keep away from materials that may be affected by high temperatures.
6. Please ensure that the used device and any relevant accessories are disposed of in accordance with applicable regulations.
7. Afore inverter should be placed upwards and handled with care in delivery. Pay attention to waterproof. Do not expose the inverter to water, rain, snow or spray.
8. Alternative uses, modifications to the inverter not recommended. The warranty can become void if the inverter was tampered with or if the installation is not in accordance with the relevant installation instructions.

2.2 Explanations of Symbols

Afore inverter strictly comply with relevant safety standards. Please read and follow all the instructions and cautions during installation, operation and maintenance.

	Danger of Electric Shock. The inverter contains fatal DC and AC power. All work on the inverter must be carried out by qualified personnel only.
	Beware of hot surface. The inverter's housing may reach uncomfortably hot 60°C (140°F)under high power operation.Do not touch the inverter enclosure when operation.
	Residual power discharge Do not open the inverter cover until 5 minutes after disconnection both DC and AC power supply
	Important notes Read all instructions carefully. Failure to follow these instructions, warnings and precautions may lead to device malfunction or damage.
	Do not dispose of this device with the normal domestic waste.
	Without Transformer. This inverter does not use transformer for the isolation function.
	CE mark. The inverter complies with the requirements of the applicable CE guidelines.
	Refer to manual before service.

3.Installation

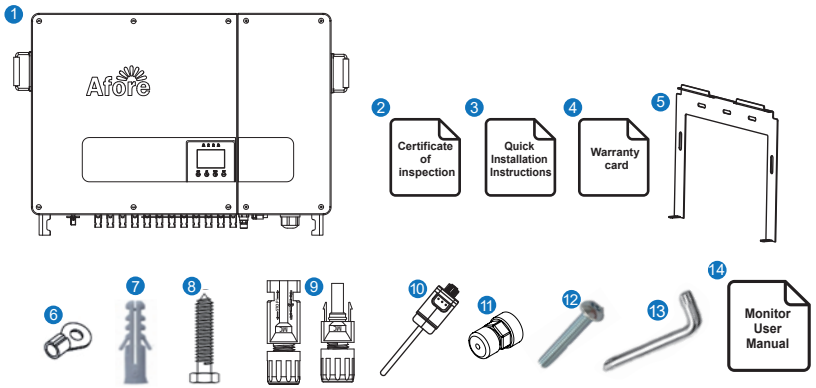
3.1 Package

Unpacking

On receiving the inverter, please check to make sure the packing and all of the components are not missing or damaged. Please contact your dealer directly for supports if there is any damage or missing components.

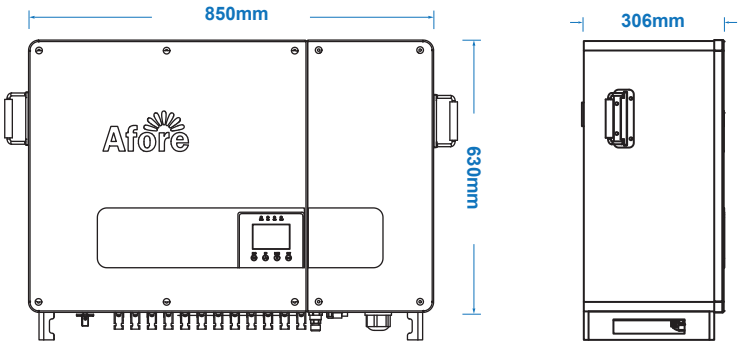
Package List

Open the package, please check the packing list shown as below.



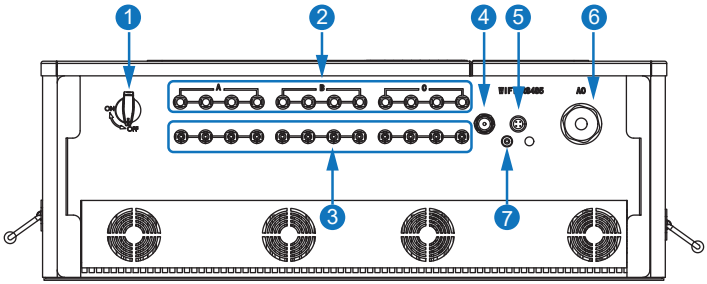
No.	Qty	Items	No.	Qty	Items
1	1	Solar Inverter	8	5	Mounting Bracket Screw
2	1	Certificate Of Inspection	9	12	DC Connector sets
3	1	Quick Installation Instructions	10	1	Monitor Module
4	1	Warranty Card	11	1	Zero-Injection Connector(Optional)
5	1	Wall Mounting Bracket	12	2	Security Screw
6	1	Grounding Terminal	13	1	Screwdriver For Security Screw
7	5	Plastic Expansion Tube	14	1	Monitor User Manual

3.2 Product Overview



Overview of the Connection Area

The following figures show the assignment of the individual connection areas on the bottom of the inverter.



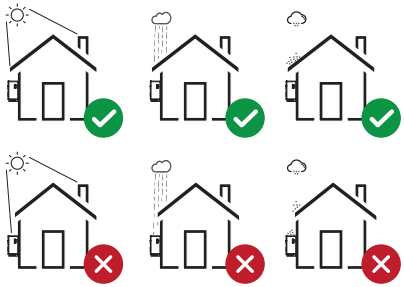
No.	Items
1	DC Switch
2	DC Connectors (+) For PV Strings
3	DC Connectors (−) For PV Strings

No.	Items
4	Zero-Injection Port (Optional)
5	Monitor Module Port
6	AC Connect
7	ModBus(Optional)

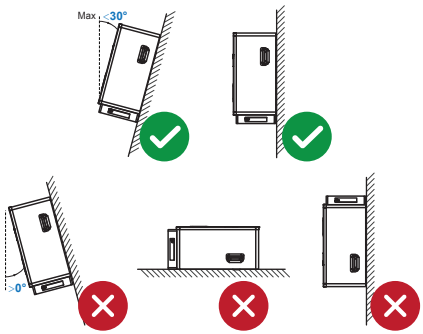
3.3 Mounting Location

The inverters are designed for indoor and outdoor installation (IP65), to increase the safety, performance and lifespan of the inverter, please select the mounting location carefully based on the following rules:

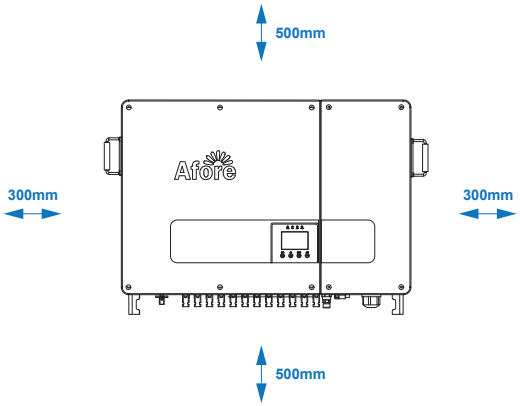
- The inverter should be installed on a solid surface, far from flammable or corrosion materials, where is suitable for inverter's weight and dimensions.
- The ambient temperature should be within -25℃ ~ 60℃ (between -13 °F and 140°F).
- The installation of inverter should be protected under shelter. Do not expose the inverter to direct sunlight, water, rain, snow, spray lightning, etc



• The inverter should be installed vertically on the wall, or lean back on plane with a limited tilted angle. Please refer to below picture.

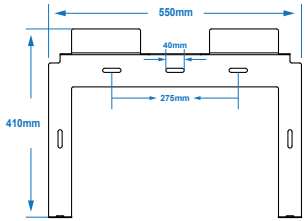


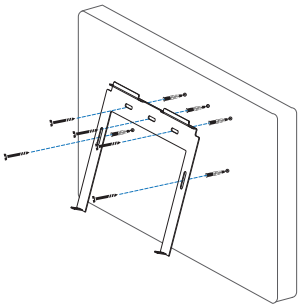
• Leave the enough space around inverter, easy for accessing to the inverter, connection points and maintenance.



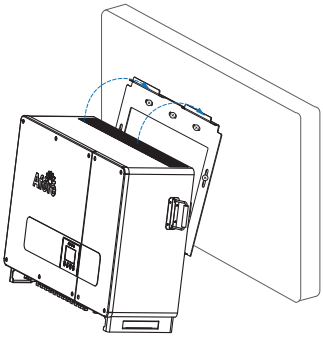
3.4 Installation On-grid PV Inverter

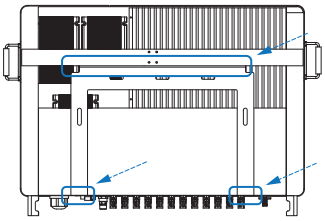
Step 1





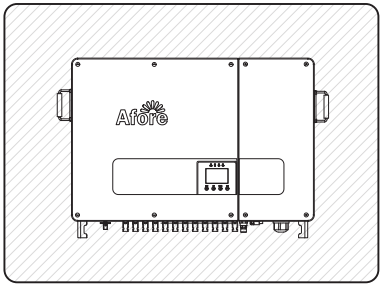
Step 2



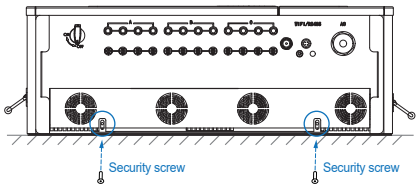


Check to ensure the inverter is correctly seated.

Step 2



Make sure to lock it with the security screws.



3.5 Electrical Connection

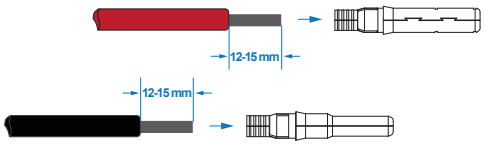
3.5.1 PV Connection

The inverter is equipped with 3 MPPT channels, and each channel contains 4 PV string inputs. For best results, make sure that each MPPT channel is connected to a PV string separately. Otherwise, the inverter will automatically activate voltage or current protection.

· The open-circuit voltage and short-circuit current of PV string must not exceed inverter's range
· The isolation resistance between PV string and ground must exceed 10 kΩ
· The polarity from PV strings are correct
· Use the DC plugs in the accessory
· The lightning protector should be equipped between PV strings and inverter
· Disconnect all of the PV (DC) switch during wiring

Warning:
The fatal high voltage may on the DC side, please comply with electric safety when connecting.
Please make sure the correct polarity of the cable connected with inverter, otherwise inverter could be damaged.

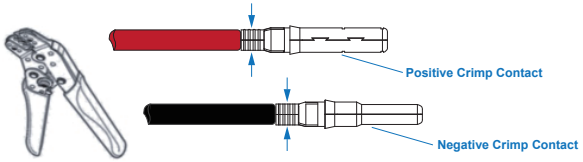
Step 1



Note: PV cable suggestion

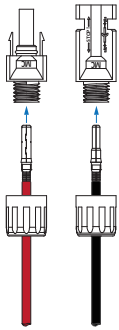
Cross-section
4 mm²

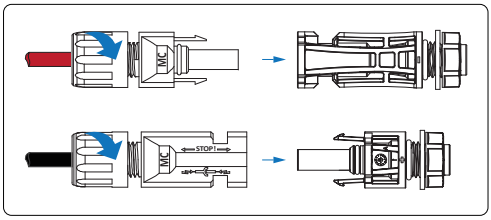
Step 2



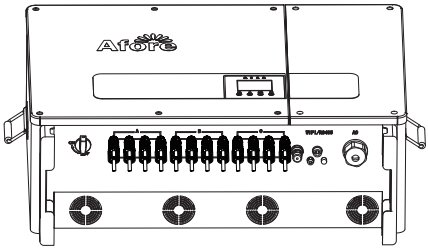
Note: Please use PV connector crimper to pinch the point of the arrow

Step 3





Note:
You'll hear click sound when the connector assembly is correct



Note:
It is strongly recommended to connect by 12 strings of panels for models of 12 sets of DC connectors.

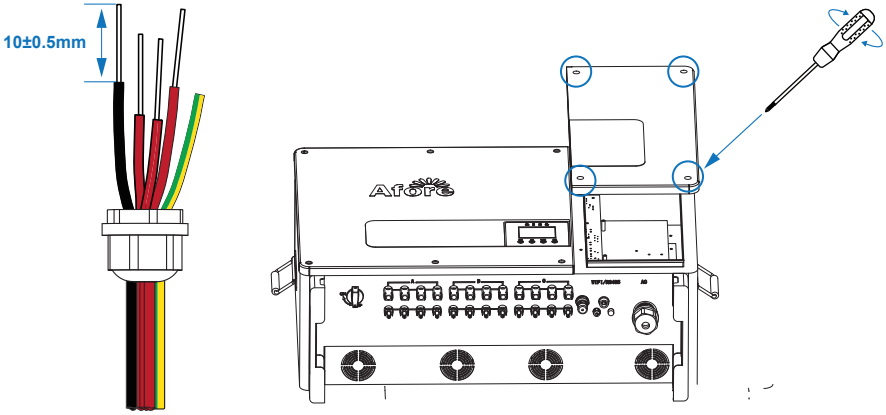
3.5.2 Grid Connection

The three-phase on-grid PV inverters work with grid (380/400/415/440 Vac, 50/60 Hz).
The external AC switch should be installed between inverter and grid to isolate from grid. Please make sure below requirements are followed before connecting AC cable to the inverter.

- The AC (grid) voltage must not exceed inverter's range
- The phase-line from AC distribution box are correctly connected
- Use the AC plugs in the accessory
- The surge protector should be equipped between grid and inverter
- Disconnect the AC (grid) switch during wiring

Warning:
The fatal high voltage may on the AC side, please comply with electric safety when connecting.
Please make sure the right line of AC grid connected with inverter, otherwise inverter could be damaged.

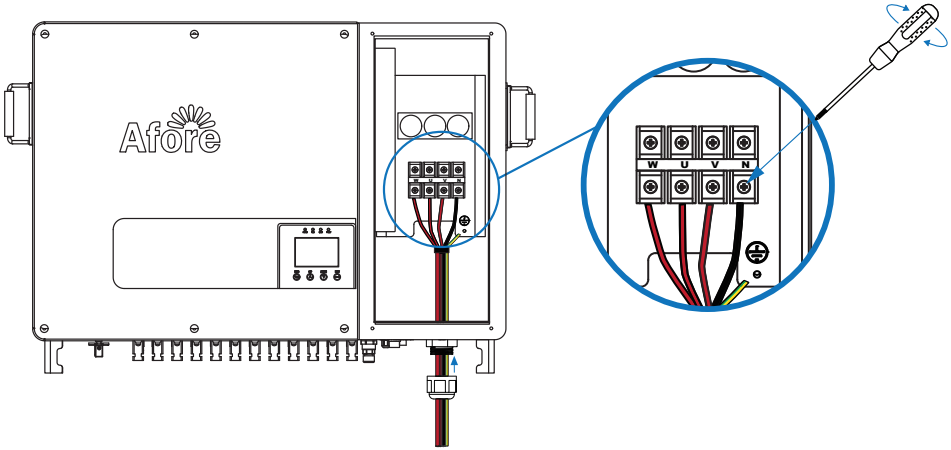
Step 1



Sectional Area > 16mm²

Remove the waterproof cap at the AC wiring under the inverter, pass the cable through the cap, and open the inverter cover.

Step 2



N=Neutral line
W, V, U=Live line

Unscrew the row of screws, insert the wire harness into the W, U, V, N caps one by one, and tighten the screws

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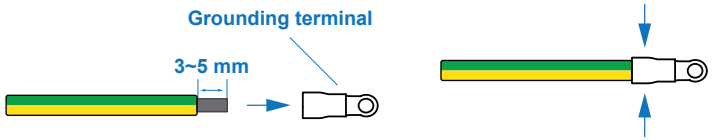
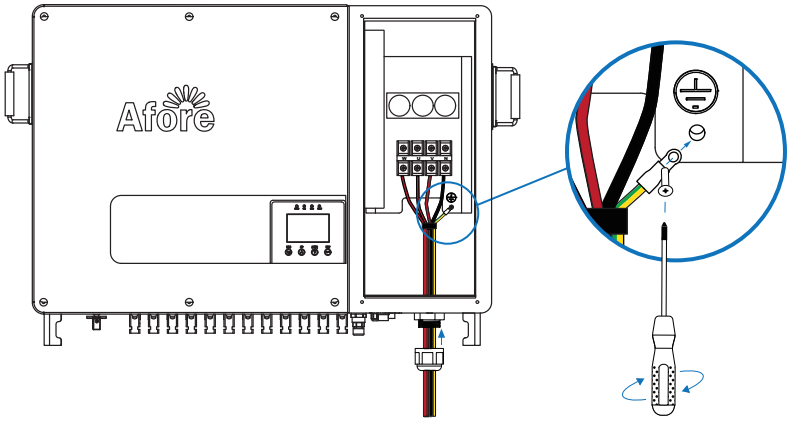
The user must connect a protective earth (PE) terminal to prevent electric shock. And make sure this PE terminal is properly grounded.

Step 3



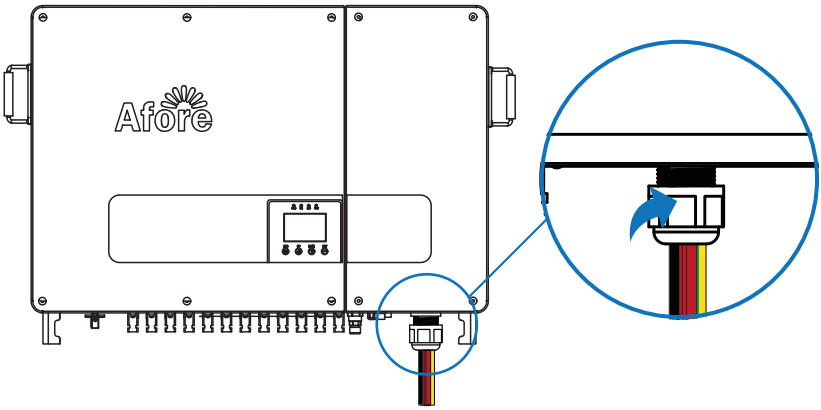
Note: copper cable or aluminum cable more than 6mm²

Step 4



Grounding terminal is connected to the inverter at left or right side

Step5



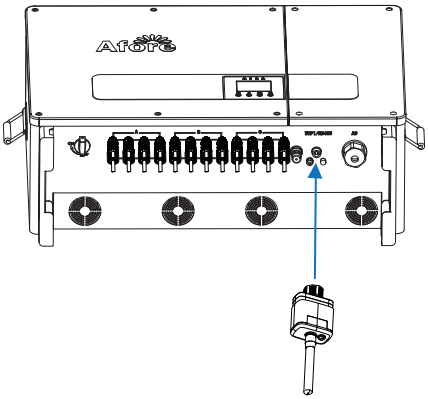
3.5.3 Communication Connection

The monitoring module could transmit the data to the cloud server, and display the data on the PC, tablet and smart-phone.

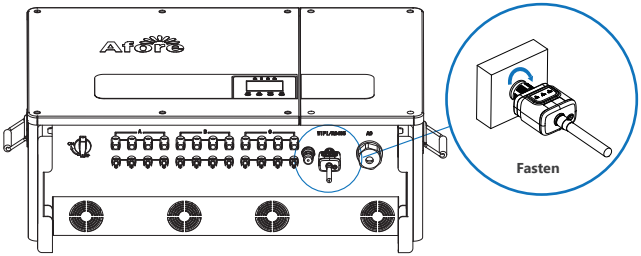
Install the Wi-Fi / Ethernet / GPRS / RS485 Communication

WIFI / Ethernet / GPRS / RS485 communication is applicable to the inverter. Please refer to "Communication Configuration Instruction" for detailed instruction.

Step 1



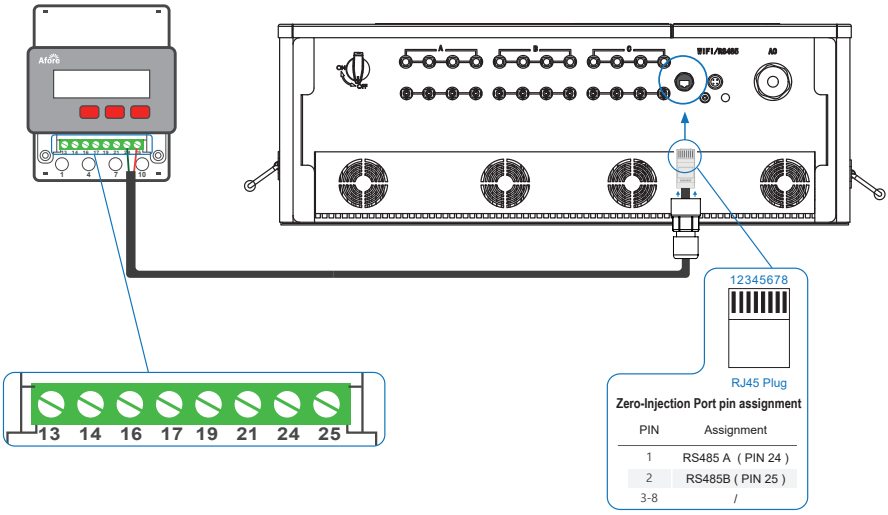
Step 2



Install the ZeroInjection Smart Meter(optional)

The Smart Meter is used for monitoring the power consumption of home electricity, the inverter will active export power limit function based on the monitoring data. Please refer to "Zero injection Smart Meter Instruction" for detailed instruction.

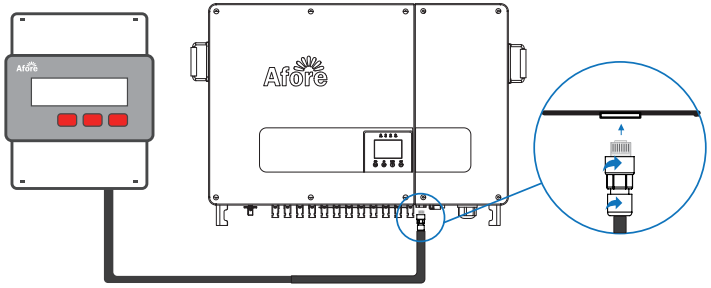
Step 1

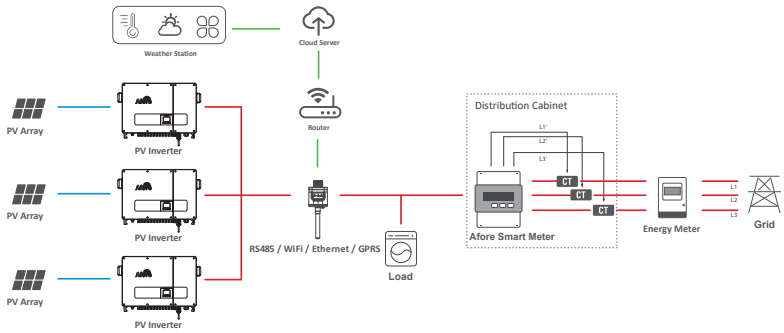


Zero-Injection Port pin assignment

PIN	Assignment
1	RS485 A (PIN 24)
2	RS485B (PIN 25)
3-8	/

Step 2

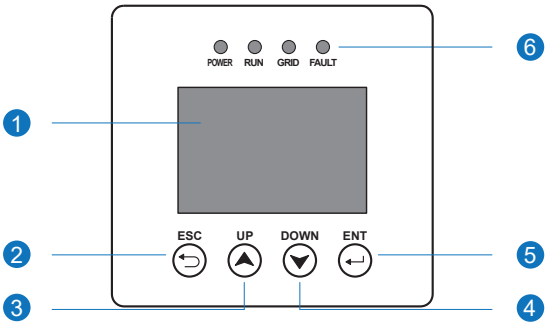




Note:
The Inverter could be connected in parallel with Smart Meter, make sure the total load power not exceed Smart Mater's limitation.

4.Operation

4.1 Control Panel



No.	Items	No.	Items
1	LCD Display	6	**POWER** LED Indicator
2	**ESC** Touch Button		**RUN** LED Indicator
3	**UP** Touch Button		**GRID** LED Indicator
4	**DOWN** Touch Button		**FAULT** LED Indicator
5	**ENT** Touch Button		

4.2 Menu Structure

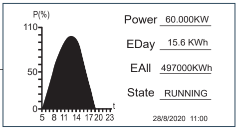
First Level Menu

Main Menu
- Run Info (selected) — Wifi Info
- Err Record — Version
- SET — System Info
- ON/OFF

Second Level Menu (Run Info)

DC Input

	U(V)	I(A)	P(W)
PV1	xx	xx	xx
PV2	xx	xx	xx



ISO Test

Pa	xxW
Pb	xxW
Pc	xxW
ISONGB	xx

Run Info

Case_Temp	xx°C
Modletemp	xx°C
ScreenTemp	xx°C

Run Info

Bus+	xx V
Bus-	xx V
RunTime	xx Hr
SumTime	xx Hr

AC Output

	Ua	Ub	Uc
Vac(V)	xx	xx	xx
	Ia	Ib	Ic
Iac(A)	xx	xx	xx
Factor(Hz)	xx		

Main Menu
- Run Info — Wifi Info
- Err Record (selected) — Version
- SET — System Info
- ON/OFF

→ **Err Record**: No Error

Main Menu
- Run Info — Wifi Info
- Err Record — Version
- SET (selected) — System Info
- ON/OFF

→ **SET**
- System (selected)
- Running
- Protection
- Communication

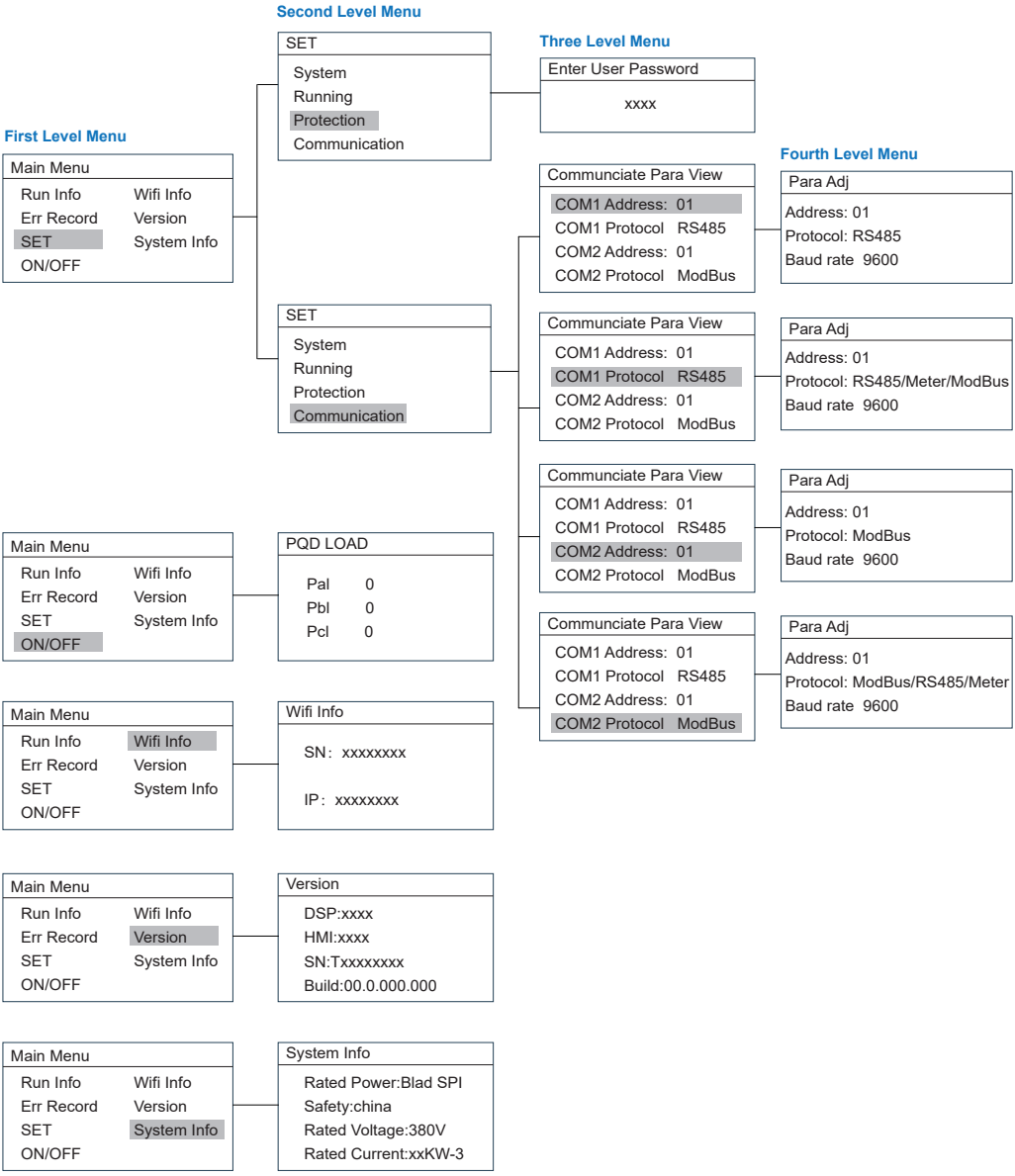
→ **SET**
- System
- Running (selected)
- Protection
- Communication

→ **Enter User Password**: xxxx

Three Level Menu / Fourth Level Menu

System (Language / Date&Time / Country / EnergyK / Etotal Reset / Clear ErrRecord / Clear RunRecord / Factory Reset)

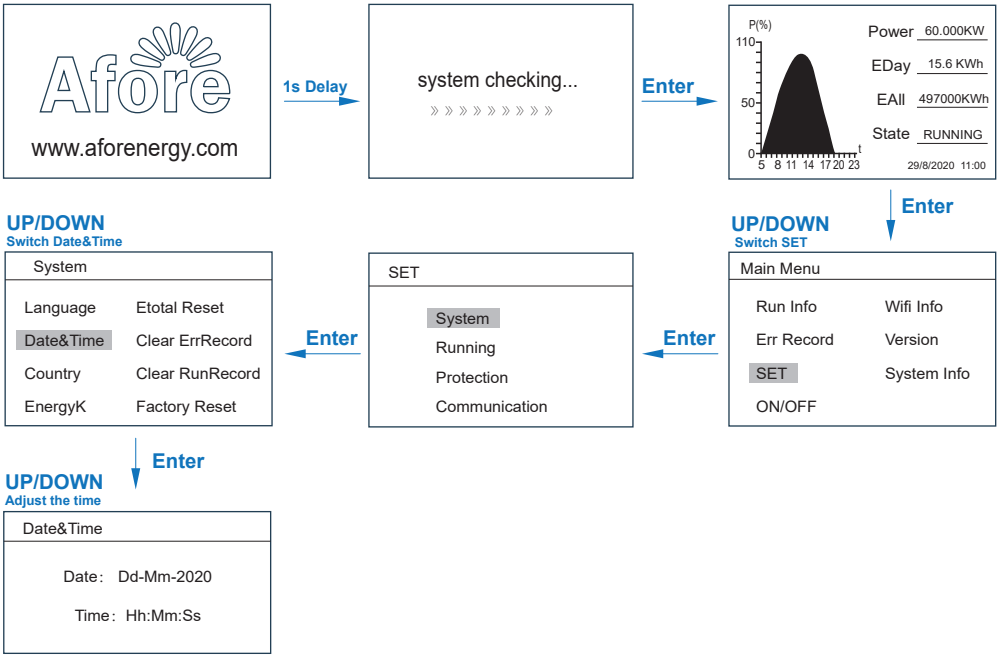
Three Level Menu (selected item)	Fourth Level Menu
Language	**Language**: 中文, English, Polish
Date&Time	**Date&Time**: Date: Dd-Mm-2020; Time: Hh:Mm:Ss
Country	**Enter User Password**: xxxx
EnergyK	**EnrgyK**: EnrgyK xxx%
Etotal Reset	**Etotal Reset**: Etotal: xxx KWh
Clear ErrRecord	**Clear ErrRecord**: xxxx
Clear RunRecord	**Enter User Password**: xxxx
Factory Reset	**Enter User Password**: xxxx


First Level Menu
Second Level Menu
Three Level Menu
Fourth Level Menu
Main Menu
Run Info
Err Record
SET
ON/OFF
Wifi Info
Version
System Info
SET
System
Running
Protection
Communication
Enter User Password
xxxx
Communciate Para View
COM1 Address: 01
COM1 Protocol RS485
COM2 Address: 01
COM2 Protocol ModBus
Para Adj
Address: 01
Protocol: RS485
Baud rate 9600
Communciate Para View
COM1 Address: 01
COM1 Protocol RS485
COM2 Address: 01
COM2 Protocol ModBus
Para Adj
Address: 01
Protocol: RS485/Meter/ModBus
Baud rate 9600
Communciate Para View
COM1 Address: 01
COM1 Protocol RS485
COM2 Address: 01
COM2 Protocol ModBus
Para Adj
Address: 01
Protocol: ModBus
Baud rate 9600
Communciate Para View
COM1 Address: 01
COM1 Protocol RS485
COM2 Address: 01
COM2 Protocol ModBus
Para Adj
Address: 01
Protocol: ModBus/RS485/Meter
Baud rate 9600
PQD LOAD
Pal 0
Pbl 0
Pcl 0
Wifi Info
SN: xxxxxxxx
IP: xxxxxxxx
Version
DSP:xxxx
HMI:xxxx
SN:Txxxxxxxx
Build:00.0.000.000
System Info
Rated Power:Blad SPI
Safety:china
Rated Voltage:380V
Rated Current:xxKW-3

Explanation of LCD Display Content

Nouns	Explanation
Run Info	Check the grid connection status of the inverter
Error Record	Check the error list of inverter including date and time
SET	Set the protection parameter of inverter
ON/OFF	Development function, unavailable
Wifi Info	View WIFI SN and IP address
Version	Check the software version of the control board and display board
System Info	View the inverter information:Voltage,current,power and so no

4.3 Startup Setting



5.Commissioning

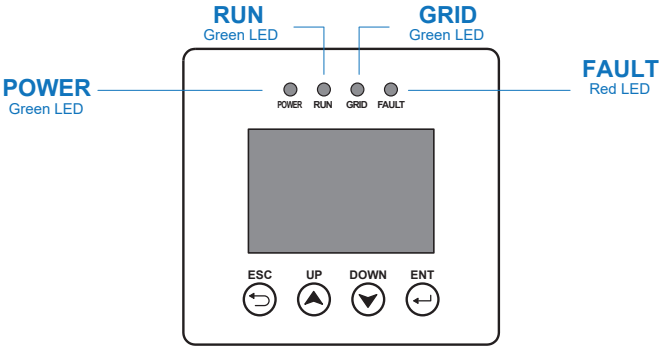
Before starting up commissioning at site, please make sure below procedures and requirements are fully meet.

· Mounting location is meet the requirements.
· All of the electrical wiring is firmly connected, including PV wiring, Grid wiring and Earth wiring.
· The inverter setting has been finished accordingly to local standards or regulations.

Commissioning Procedures

· Turn on the AC switch between inverter output and the public grid;
· Turn on the DC switch on the inverter;
· Turn on the PV switch of the system.

LED Indication



Sign	Power	Color	Explanation
POWER	On	Green	Power On
	Off		No Power
RUN	On	Green	Inverter is feeding power
	Off		Inverter is not feeding power at the moment
GRID	On	Green	Normal grid connection
	Off		Non grid
FAULT	On	Red	Fault occurred
	Off		No fault

6.Shut Down & Restart the Inverter

6.1 Shut Down Procedures

· Turn off the DC switch on the inverter;
· Turn off the PV switch of the system;
· Turn off the AC switch between inverter output and the public grid.

Note:
The inverter will be operable after minimum 5 minutes.

6.2 Restart the inverter

Follow the procedures below when the inverter needs to be restarted.
· Follow the Shut Down Procedures of Article 6 to shut down inverter;
· Follow the Commissioning Procedures of Article 5 to turn on the inverter.

7.Maintenance&Trouble Shooting

7.1 Maintenance

The inverter needs maintenance periodically, the following details should be noticed.
PV connection: check the PV connection twice a year
AC connection: check the AC connection twice a year
Earth connection: check the Earth connection twice a year
Heat sink: clean the heat sink once a year with dry towel

7.2 Fault Code and Trouble Shooting

The LCD and LED will report the fault when the error occurs, please follow thetrouble shooting list to solve the problem.

Trouble-Shooting List

Error Display	Error Message	Possible Fault	Correctie Measure
EepromErr	Storage device fault	low start up power under low light conditons, inverter self-check procedure cannot be complete	The inverter will restart automatically when the start up power is enough
GFCI.Err	Ground Fault Circuit Interrupter fault	1.ground leakage current high 2.PV(+) or PV(-) earthed	1. check the AC output wring and restart the inverter 2. check PV array wiring
GridF.OutLim	Grid Frequency fault	1. grid fluctuate 2. grid frequency out of setting range	1. grid back to the normal, the inverter will restart automatically 2. check inverter frequency setting range correct 3. check the AC output wiring well connected
GridV.OutLim	Grid voltage fault	1. grid fluctuate 2. grid voltage unbalance between phase to phase	1. grid back to the normal, the inverter will restart automatically 2. check each phase's voltage via inverter LCD
IntFaultB	Internal fault B	Bus voltage out of range	1. check PV input voltage (not bigger than 900Vdc per channel) 2. check the AC output wiring well connected
IntFaultD	Internal fault D	Software over current fault	1. check PV array confirguration is correct 2. fluctuate on grid, wait for the grid back to the normal, the inverter will restart automatically
IntFaultE	Internal fault E	Over current fault	grid back to the normal, the inverter will restart automatically
IntFaultG	Internal fault G	DCI high	1.check each PV array's confirguration is correct 2..check the voltage difference between BUS+ and BUS- is too high
IntFaultK	Internal fault K	Bus voltage fault	1.check the AC output wring well connect.Use stranded copper cable 2.check PV array confirguration is correct 3.check the voltage difference between BUS+ and BUS- is too high
IntFaultM	Internal fault M	Bus voltage fault	1.check the AC output wring well connect.Use stranded copper cable 2.check PV array confirguration is correct 3.check the voltage difference between BUS+ and BUS- is too high
IntFaultN	Internal fault N	Hardware fault	check the AC out put wring well connect. Use stranded copper cable
IntProtectA	Internal protection A	Bias current protection	1. turn off AC, then DC circuit breaker, restart the inverter 2. replace the control board
IntProtectB	Internal protection B	Relay fault	turn off AC, then DC circuit breaker, restart the inverter
IntProtectC	Internal protection C	Inverter current protection	turn off AC, then DC circuit breaker, restart the inverter, check the each phases' AC voltage is correct through LCD
IntProtectD	Internal protection D	Boost current protection	turn off AC, then DC circuit breaker, restart the inverter
IntProtectG	Internal protection G	Bus voltage protection	1.check the AC output wring well connect.Use stranded copper cable 2.check PV array confirguration is correct 3.check the voltage difference between BUS+ and BUS- is too high
IntProtectI	Internal protection I	Bus voltage protection	1.check the AC output wring well connect.Use stranded copper cable 2.check PV array confirguration is correct 3.check the voltage difference between BUS+ and BUS- is too high
IntProtectK	Internal protection K	Bus over voltage protection	check the AC output wring well connect.Use stranded copper cable
IntProtectN	Internal protection N	Inverter over current protection	fluctuate on grid, wait for the grid back to the normal, the inverter will restart automatically
IntProtectP	Internal protection P	Frequency fault protection	frequency abnormal of grid, wait for the grid back to the normal, the inverter will restart automatically
IntProtectQ	Internal protection Q	DCI protection	1.1.check PV array confirguration is correct 2.check the voltage difference between BUS+ and BUS- is too high
IntProtectR	Internal protection R	DCI circuit protection	1.turn off AC, then DC circuit breaker, restart the inverter 2. replace the control board
IntProtectT	Internal protection T	PV over current protection	turn off AC, then DC circuit breaker, restart the inverter
IsolationErr	Insulation resistance fault	Insulation resistance low	check the resistance between PV(+) and ground, PV(-) and ground bigger than 2MΩ.
PVVoltOver	PV voltage high	PV over voltage	check PV array confirguration is correct
SPICommErr	SPI fault	SPI communication fault	check the RS485 cable is well connect
TempOver	Over temperature	Over temperature	1. turn off the inverter still the temperature down to the normal. Or install the inverter at a well ventilated site. 2. check the heat sink and the fans is working
TempSensorErr	Temperature sensor fault	Temperature sensor fault	1. turn off AC, then DC circuit breaker, restart the inverter 2. replace the temperature sensor

8.Specifications

PV Input Data	BNT050KTL	BNT060KTL
Max. DC Power (W)	75000	84000
Max. DC Voltage (V)	1000	1000
MPPT Voltage Range (V)	200-950	200-950
MPPT Full Power Voltage Range (V)	500-950	500-950
Rated Input Voltage (V)	620	620
Start-up Voltage (V)	200	200
Max. Input Current (A)	36 x3	40 x 3
Max. Short Current (A)	45x3	50 x 3
No. of MPP Tracker / No. of PV String	3 /12	3 /12
Input Connector Type	MC4	MC4
AC Output Data	**BNT050KTL**	**BNT060KTL**
Max. Output Power (W)	55000	66000
Nominal Output Power (W)	50000	60000
Max. Output Current (A)	75	90
Nominal Output Voltage (V)	3P+N+PE /3P+PE 230/400	
Grid Voltage Range	260-519 (according to local standard)	
Nominal Output Frequency (Hz)	50/60	
Grid Frequency Range	45-55/55-65(according to local standard)	
Output Power Factor	1 default (adjustable from 0.8 leading to 0.8 lagging)	
Output Current THD	<3%	
Efficiency	**BNT050KTL**	**BNT060KTL**
Max. Efficiency	98.80%	99.00%
Euro Efficiency	98.45%	98.50%
Protection	**BNT050KTL**	**BNT060KTL**
PV Reverse Polarity Protection	YES	YES
PV Insulation Resistance Detection	YES	YES
AC Short Circuit Protection	YES	YES
AC Over Current Protection	YES	YES
AC Over Voltage Protection	YES	YES
Anti-Islanding Protection	YES	YES
Residual Current Detection	YES	YES
Over Temperature Protection	YES	YES
Integrated DC switch	YES	YES
Surge Protection	Integrated (Type II)	
General Data	**BNT050KTL**	**BNT060KTL**
Dimensions (W x H x D, mm)	630 x 850 x 306	
Weight (kg)	77	
Protection Degree	IP65	
Enclosure Material	Aluminum	
Ambient Temperature Range (°C)	-25~+60	
Humidity Range	0-100%	
Topology	Transformerless	
Communication Interface	RS485 / WiFi / Wire Ethernet / GPRS (optional)	
Cooling Concept	Intelligent Fan Cooling	
Noise Emission (db)	55	
Night Power Consumption (W)	<1	
Max. Operation Altitude (m)	4000	
Certifications and Standards	**BNT050KTL**	**BNT060KTL**
EMC Standard	EN/IEC 61000-6-2,EN/IEC 61000-6-3, EN61000-3-2,EN61000-3-3,EN61000-3-11,EN61000-3-12	
Safety Standard	EN/IEC 62109-1/-2 ,UL1547,IEC 60068-2	
Grid-connection	EN50549-1,EN50438 ,RD 1699,UNE 217001,RD 413 ,IEC61727,IEC62116,IEC61683,VDE4105, UL1741 VDE0126 AS4777.2 NB/T 32004-2013	