Zero Injection Smart Meter

Installation and Operation Manual

www.aforenergy.com

Afore
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Contents

1. About This Manual

Afore smart meter is an intelligent control device, which is designed for grid-connected inverters. Its main function is to measure the generation and consumption, transmit the data to the inverter through RS485 communication, to ensure that the generated power of the inverter is less or equal to the user's load. Achieve the purpose of no power feed into the grid.

This manual describes the installation, operation and maintenance of the following Afore Smart Meter.

**For Single-phase System Application**

SAPM-10kW

For Three-phase System Application

TAPM-50kW, TAPM-130kW

2. Parameter

Type	SAPM-10KW	TAPM-50KW	TAPM-130KW
Power（kW）	10	50	130
Max Power (kW)	18	55	150
Accuracy (%)	1	1	1
Rating voltage (V)	230	230/400	230/400
Voltage Range (V)	184-253	320-440	320-440
Rating Current (A)	50	72.5	200(MAX 5000)
Max Current (A)	80	80	220(MAX 5000)
Connection For Measurement (Hz)	Direct Connect	Direct Connect	Via CT(current transducers)
Frequency Range (Hz)	45-65	45-65	
Grid Type	L+N	3P+N	
Communication	RS485	RS485	
Dimmension (W,L,H , mm)	36 x 98 x 65	72 x 100 x 65	
IP	IP20		
Installation	35mm Rail		

a. Single-phase Smart Meter
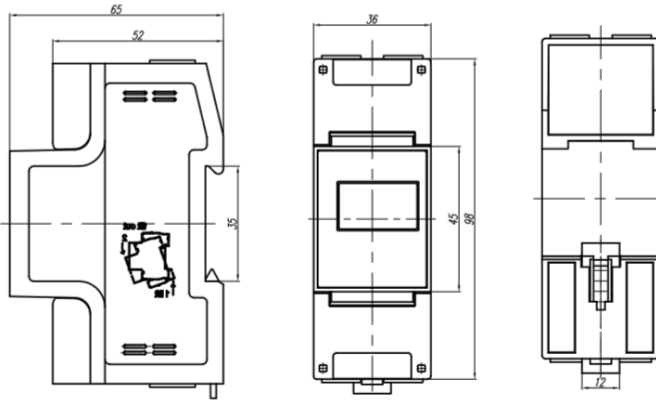
b. Three-phase Smart Meter
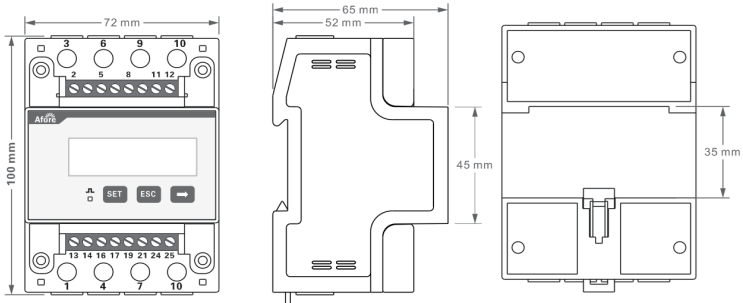
3. Zero-injection Connection

Note:
1. CAT5/CAT6 cable should be used between smart meter and inverter
Maximum length of cable less than 300m
2. Meter connection on the inverter
The meter needs to be connected to the inverter's Zero-injection
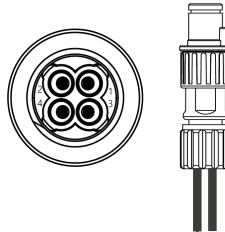port (RJ45 terminal).

RJ45 Pin order for single-phase inverter

568B Standard

1. White green   5. White blue
2. Green   6. Orange
3. White orange   7. White brown
4. Blue   8. Brown

Zero-Injection Connector wiring for three-phase 3-25kW inverter

PIN	Asignment
1/2	RS485 B
3/4	RS485 A

RJ45 Pin order for three-phase 30-60kW inverter

568B Standard

1. White orange   5. White blue
2. Orange   6. Green
3. White blue   7. White brown
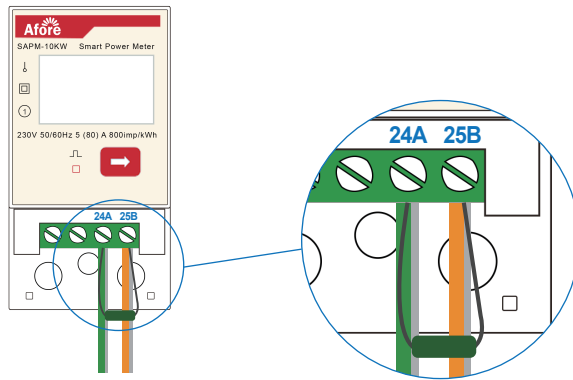4. Blue   8. Brown

Note:

1. For single-phase inverter, please follow below pin order
   RS485A (Pin 7) to single-phase meter (Pin 24)
   RS485B (Pin 8) to single-phase meter (Pin 25)

2. For three-phase 3-25kW inverter, please follow below pin order
   RS485A (Pin 3 / 4) to three-phase meter (Pin 24)
   RS485B (Pin 1 / 2) to three-phase meter (Pin 25)

3. For three-phase 30-60kW inverter, please follow below pin order
   RS485A (Pin 1) to three-phase meter (Pin 24)
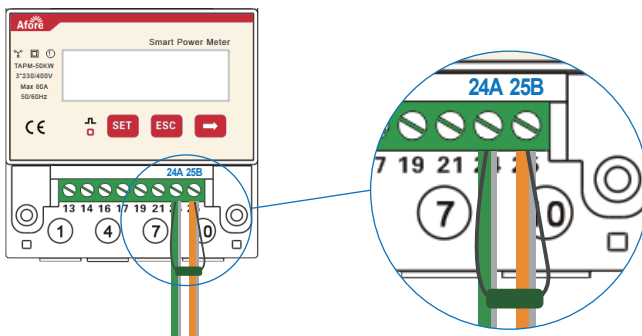   RS485B (Pin 2) to three-phase meter (Pin 25)

Note:

The distance between the inverter and smart meter is suggested sless than 100M. For the distance more than 100M, it needs to parallel a 120Ω resistor between 24A and 25B of the smart meter.
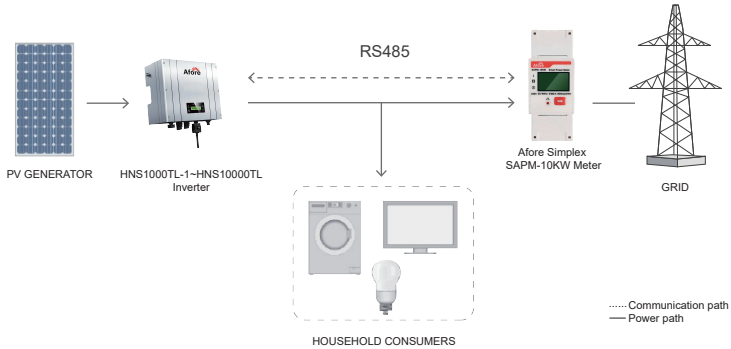
Single-phase Smart Meter

Three-phase Smart Meter

4. Connect the Smart Meter to Single-phase System

4.1 System Diagram

PV GENERATOR   HNS1000TL-1~HNS10000TL Inverter

RS485

Afore Simplex SAPM-10KW Meter

GRID

HOUSEHOLD CONSUMERS

······ Communication path
—— Power path

Note:

When the load exceeds 10kW, a CT needs to be added, see the figure below:

LOAD

RS485A
RS485B

3 7 8 4

Afore

DDSU666 DIN-RAIL METER

— ⊓ ⊙ ♦ ⊠
230V ⁱ100mA 800imp/kWh

CT

5 6

|* (White)

| (Blue)

L   N

LINE

4.2 Inverter Setting

Step 1

Step 2

Afore New Energy	**1s Delay** →	Normal Power=xx W

UP/DOWN
Choose Function Enable

Function Enable	← **ENT**	Setting
safety		Inverter Info

UP/DOWN
Choose Setting   **ENT**

UP/DOWN
Choose password: 5432

PassWord	**ENT** →	Upstream: ON
xxxx		

UP/DOWN Choose ON
press ENT to confirm

UP/DOWN
Choose password: 5432

PassWord	← **ESC**	Zero Injection
xxxx		safety

UP/DOWN
Choose Zero Injection   **ESC**

Press ENT
Choose MeterFun

MeterFun: OFF	→	MeterFun: ON
PtoGrid: xxW		PtoGrid: xxW

UP/DOWN Choose ON
press ENT to confirm
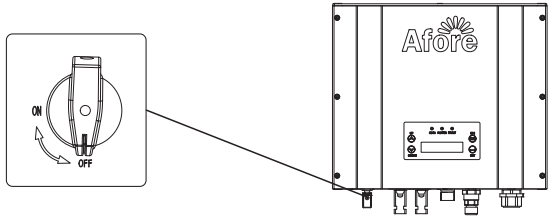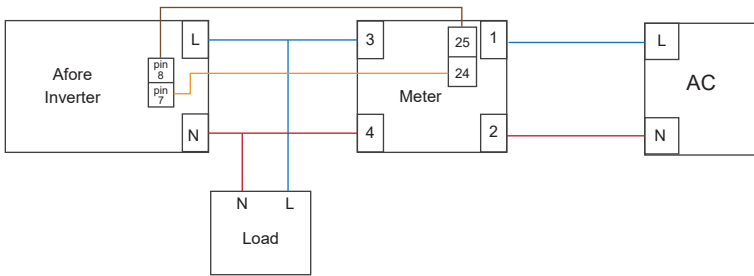
Step 3

Note:
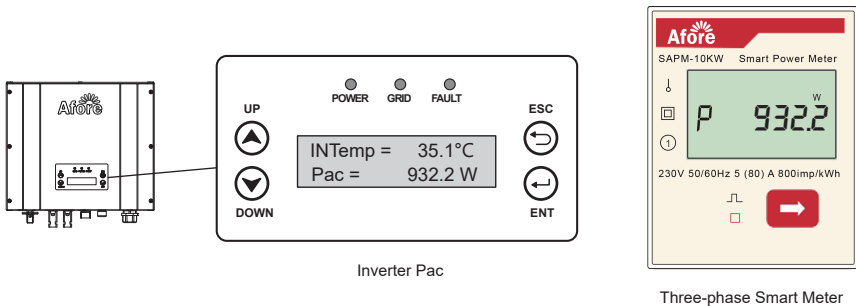After activate "Zero Injection" function, please restart the inverter.

4.3 Single-phase System Wiring Diagram

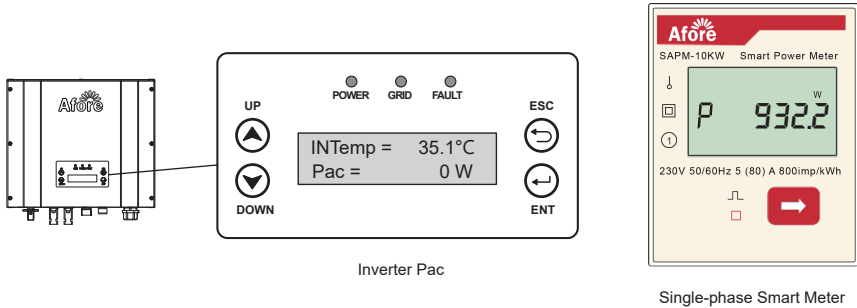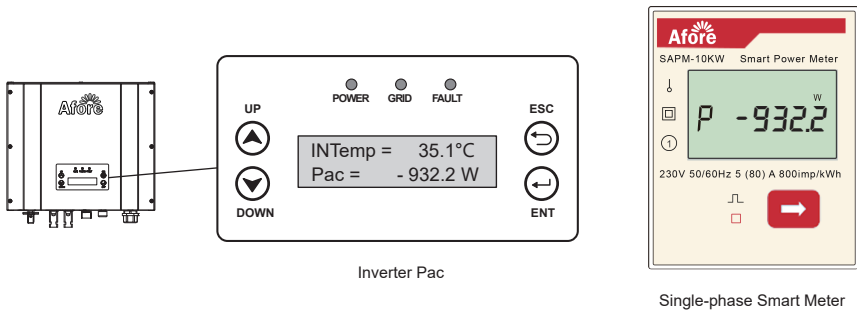# 5. Single-phase Inverter Zero-Injection FAQ

a. After complete wiring between smart meter and inverter. The power P display on the smart meter will synchronize with inverter Pac display.

Inverter Pac

Three-phase Smart Meter

b. If the Zero-injection function is not activated or communication cable is not well connected, the power displayed on the inverter is Pac=0W.

INTemp =   35.1°C
Pac =   0 W

Inverter Pac

Afore
SAPM-10KW   Smart Power Meter
P   932.2 W
230V 50/60Hz 5 (80) A 800imp/kWh

Single-phase Smart Meter

c. If the smart meter's pin order is incorrect wiring, the Smart Meter and the inverter Pac will display negative values.

INTemp =   35.1°C
Pac =   - 932.2 W

Inverter Pac

Afore
SAPM-10KW   Smart Power Meter
P -932.2 W
230V 50/60Hz 5 (80) A 800imp/kWh

Single-phase Smart Meter
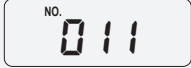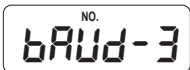
Note:
The button on the smart meter cannot be kept pressing for a long time, it can only be pressed intermittently, otherwise the meter will be locked.

Note:
Due to the fluctuation on the grid side, the data transition delay will occur between smart meter and inverter. And the values displayed on the smart meter and inverter will be different.

6. Explanation of Smart Meter Display Content

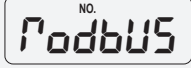| Page	Content	Description
Page1	U 230.0 V	AC Voltage
Page2	I 5.000 A	AC Current
Page3	P 1.100 kW	AC Power
Page4	Ft 1.000	Power Factor
Page5	F 50.00	AC Frequency
Page6	EImp. 0001.20 kWh	Total Power Consumption
Page7	EExp. 0001.00 kWh	Total Power Feed into Grid
Page8	NO. ModbUS	Modbus Communication
Page9	NO. 8n1	8 Communication data position
Page10	NO. 011	Communication Address
Page11	NO. bAUd-3	Baud Rate

⚠️ **Note:**
Don't press the button for long time, or you may change the default setting.

7. Connect the Smart Meter to Three-phase System

7.1 System Diagram

a. Three-phase System with TAPM-50KW Smart Meter

RS485

PV GENERATOR

BNT003KTL~BNT0025KTL
Inverter

Afore Three-phase
TAPM-50KW Meter

GRID

HOUSEHOLD CONSUMERS

······ Communication path
—— Power path
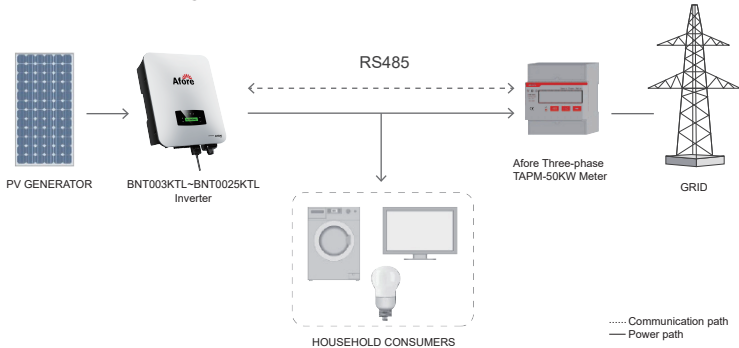
⚠️ **Note:**
The 50kW smart meter does not support adding a CT

b. Three-phase System with TAPM-130KW Smart Meter

Afore Three-phase
TAPM-130KW Meter

RS485

PV GENERATOR

BNT030KTL~BNT0060KTL

GRID

HOUSEHOLD CONSUMERS

······ Communication path
—— Power path
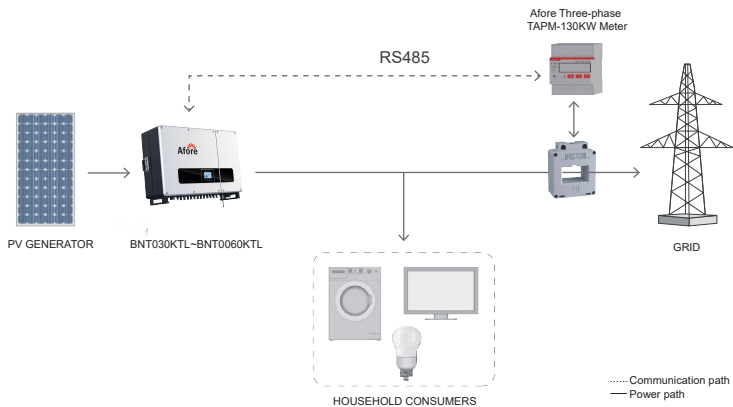
⚠️ **Note:**
There are two faces P1&P2 on CT, P1 directs to Grid,
P2 directs to inverter and load.

7.2 Three-phase 3-25kW Inverter Setting

Step 1

Step 2

Afore New Energy	→

PPv: xxxW
PGrid: xxxW

UP/DOWN
Choose Run Param
→ **ENT**

Run   Param
Prot   Param

UP/DOWN
Choose password: 5432

*   *   *   *

← **ENT**

UP/DOWN
Choose Meter Param
↓ **ENT**

Meter Param
P Mode

→ **ENT**

UP/DOWN
Choose Meter

Meter
No Meter

↓ **ENT**

UP/DOWN Choose Afoer3
press ENT to confirm

Afore3
UKOB
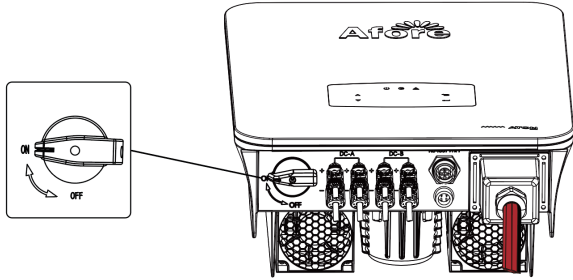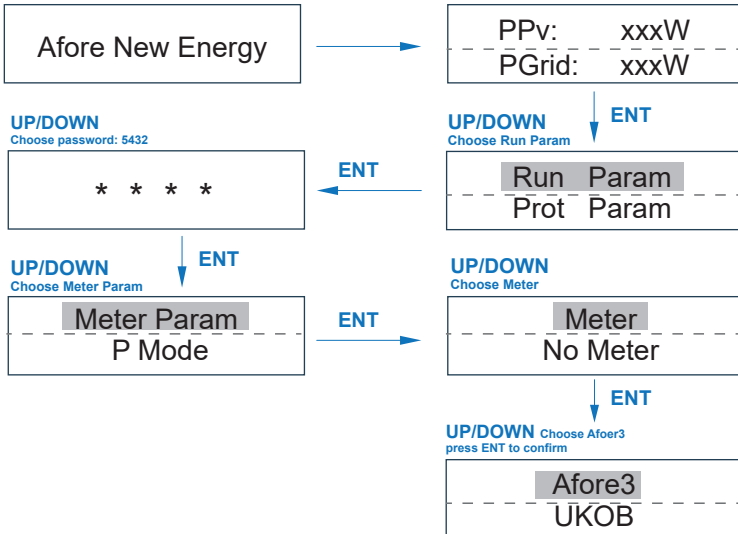
Step 3

⚠️ **Note :**
After activate "Meter" function, please restart the inverter.

7.3 Three-phase 30-60kW Inverter Setting

Step 1

Step 2

Afore
ww.aforenergy.com

→ 1s Delay →

System Checking...
>>>>>>>>

→ 1s Delay →

P(%)
110
50
0
5 8 11 14 17 20 23

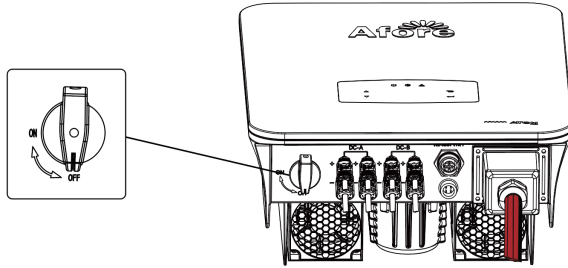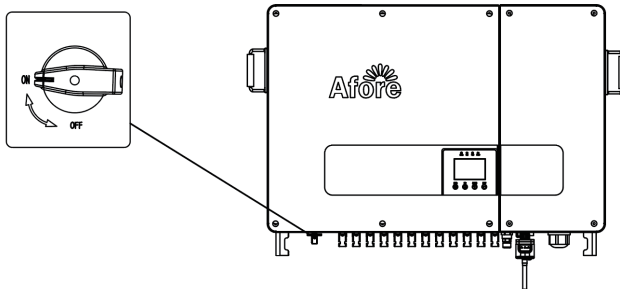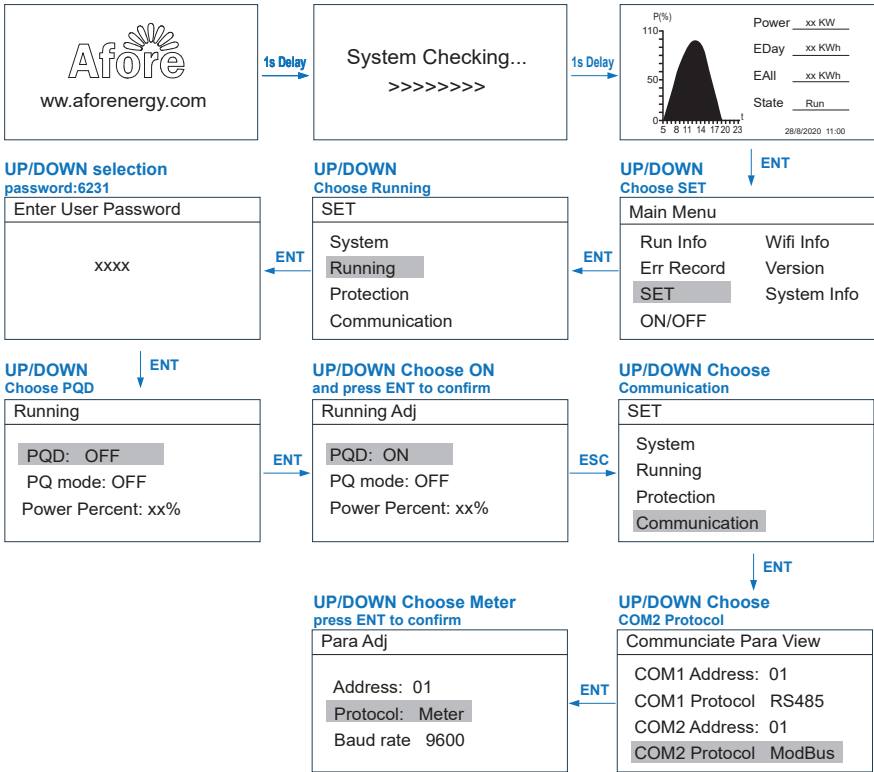| Power | xx KW |
EDay	xx KWh
EAll	xx KWh
State	Run

28/8/2020 11:00

↓ ENT

UP/DOWN selection
password:6231

Enter User Password

xxxx

← ENT ←

UP/DOWN
Choose Running

SET
System
Running
Protection
Communication

← ENT ←

UP/DOWN
Choose SET

Main Menu
Run Info   Wifi Info
Err Record   Version
SET   System Info
ON/OFF

↓ ENT

UP/DOWN
Choose PQD

Running

PQD: OFF
PQ mode: OFF
Power Percent: xx%

→ ENT →

UP/DOWN Choose ON
and press ENT to confirm

Running Adj

PQD: ON
PQ mode: OFF
Power Percent: xx%

→ ESC →

UP/DOWN Choose
Communication

SET
System
Running
Protection
Communication

↓ ENT

UP/DOWN Choose Meter
press ENT to confirm

Para Adj

Address: 01
Protocol: Meter
Baud rate   9600

← ENT ←

UP/DOWN Choose
COM2 Protocol

Communciate Para View

COM1 Address: 01
COM1 Protocol   RS485
COM2 Address: 01
COM2 Protocol   ModBus
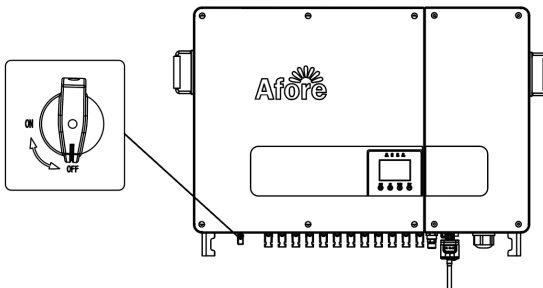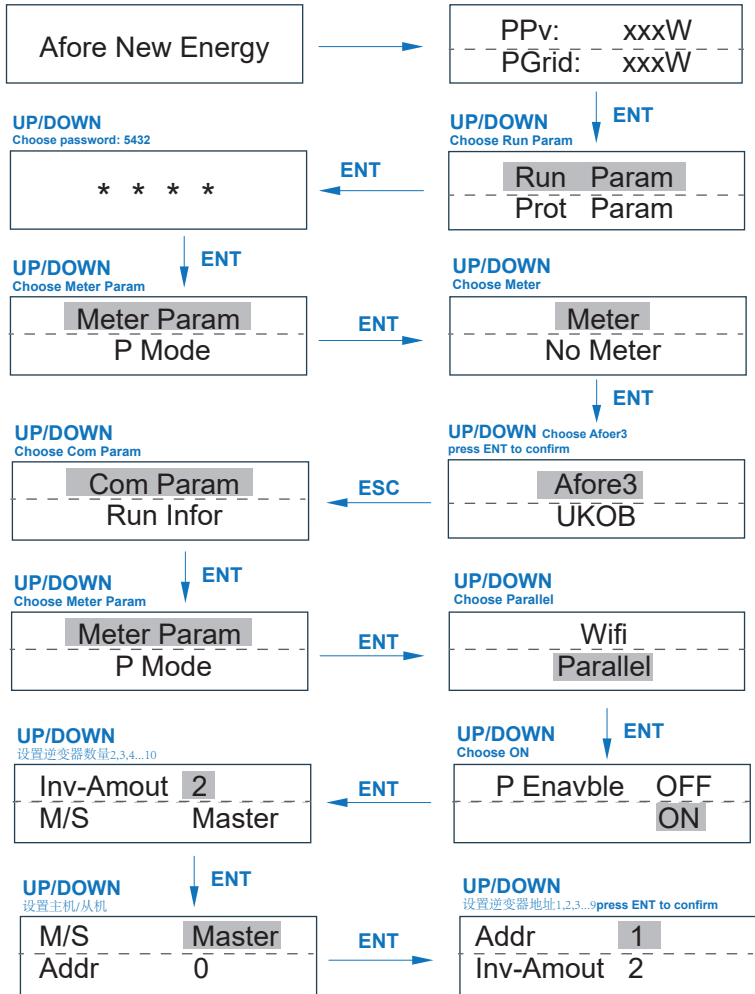
Step 3

⚠️ **Note:**
After activate "PQD" function, please restart the inverter.

7.4 Multiple Inverter System Connection Setting
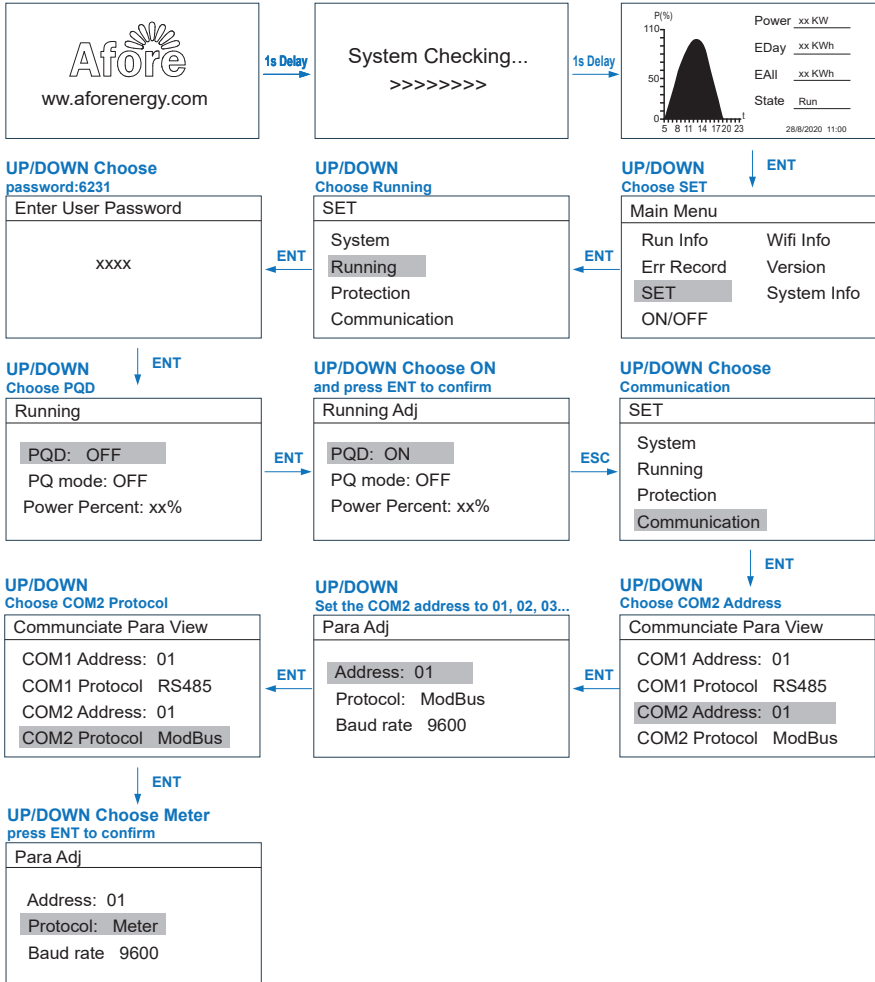
a. For Three-phase 3-25kW Setting

Afore New Energy

→

| PPv: xxxW |
| PGrid: xxxW |

UP/DOWN
Choose Run Param   ENT ↓

| Run   Param |
| Prot   Param |

← ENT

UP/DOWN
Choose password: 5432

| *   *   *   * |

↓ ENT

UP/DOWN
Choose Meter Param

| Meter Param |
| P Mode |

→ ENT

UP/DOWN
Choose Meter

| Meter |
| No Meter |

↓ ENT

UP/DOWN
Choose Com Param

| Com Param |
| Run Infor |

← ESC

UP/DOWN **Choose Afoer3**
press ENT to confirm

| Afore3 |
| UKOB |

↓ ENT

UP/DOWN
Choose Meter Param

| Meter Param |
| P Mode |

→ ENT

UP/DOWN
Choose Parallel

| Wifi |
| Parallel |

↓ ENT

UP/DOWN
设置逆变器数量2,3,4...10

| Inv-Amout   2 |
| M/S   Master |

← ENT

UP/DOWN
Choose ON   ENT ↓

| P Enavble   OFF |
| ON |

↓ ENT

UP/DOWN
设置主机/从机

| M/S   Master |
| Addr   0 |

→ ENT

UP/DOWN
设置逆变器地址1,2,3...9**press ENT to confirm**

| Addr   1 |
| Inv-Amout   2 |

⚠️ **Note:**
For the multiple-inverter system, set the Master inverter Addr address as 1, set the Salve inverter Addr address as 2, 3, 4… separately.

b. For Three-phase 30-60kW Setting

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1s Delay →

System Checking...
>>>>>>>

1s Delay →

P(%)		Power	xx KW
110		EDay	xx KWh
50		EAll	xx KWh
0	5 8 11 14 17 20 23	State	Run
			28/8/2020 11:00

ENT ↓

UP/DOWN Choose
password:6231

Enter User Password

xxxx

← **ENT**

UP/DOWN
Choose Running

SET
System
Running
Protection
Communication

← **ENT**

UP/DOWN
Choose SET

Main Menu
Run Info   Wifi Info
Err Record   Version
SET   System Info
ON/OFF

ENT ↓

UP/DOWN
Choose PQD

Running

PQD: OFF
PQ mode: OFF
Power Percent: xx%

→ **ENT**

UP/DOWN Choose ON
and press ENT to confirm

Running Adj

PQD: ON
PQ mode: OFF
Power Percent: xx%

→ **ESC**

UP/DOWN Choose
Communication

SET
System
Running
Protection
Communication

ENT ↓

UP/DOWN
Choose COM2 Protocol

Communciate Para View
COM1 Address: 01
COM1 Protocol RS485
COM2 Address: 01
COM2 Protocol ModBus

← **ENT**

UP/DOWN
Set the COM2 address to 01, 02, 03...

Para Adj

Address: 01
Protocol: ModBus
Baud rate   9600

← **ENT**

UP/DOWN
Choose COM2 Address

Communciate Para View
COM1 Address: 01
COM1 Protocol RS485
COM2 Address: 01
COM2 Protocol   ModBus

ENT ↓

UP/DOWN Choose Meter
press ENT to confirm

Para Adj

Address: 01
Protocol: Meter
Baud rate   9600

⚠️ **Note:**

1. For the multiple-inverter system, set the Master inverter COM 2 address as 1, set the Salve inverter COM 2 address as 2, 3, 4… separately.

2. The total power of the inverters should not exceed 50kW (TAPM-50kW) / 130kW (TAPM-130kW).

7.5 Wiring Diagram

a. Three-phase Smart Meter (TAPM-50kW) Wiring Diagram
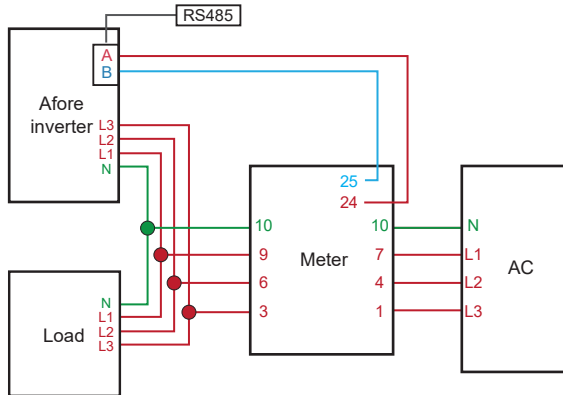
b. Three-phase Smart Meter (TAPM-130kW) Wiring Diagram
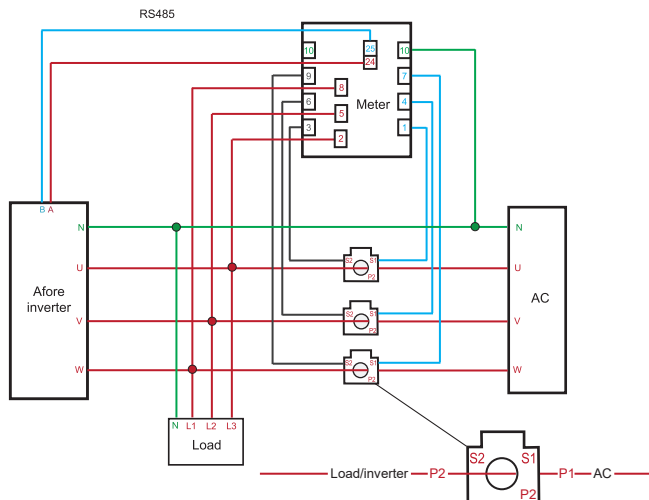
There are two faces P1&P2 on CT, P2 directs to inverter and load, P1 directs to AC.

Note :

1. The CT (30Φ 300/5A) should be used with the smart meter. For other types of CT, please confirm with dealer before use.

2. Pay attention to the indication install direction of the CT, otherwise the inverter will not work properly.

7.6 CT

Load capacity	CT secondary current	Current ratio	Accuracy	Passing heart turns
50/60KW	5A	200/5	0.5	1
100KW	5A	300/5	0.5	1
200KW	5A	400/5	0.5	1
300KW	5A	500/5	0.5	1
500KW	5A	1000/5	0.5	1
600KW	5A	1200/5	0.5	1
800KW	5A	1500/5	0.5	1
1MW	5A	2000/5	0.5	1
1.5WM	5A	3000/5	0.5	1
2MW	5A	4000/5	0.5	1

7.7 Current Ratio Setting

Buttons description: "SET" means "OK" or "Cursor shift" (when entering numbers), "ESC" means "Exit", "→" means "Add", when the number is added to the maximum value, The numbers will start from 0 again. The default user password is 701.
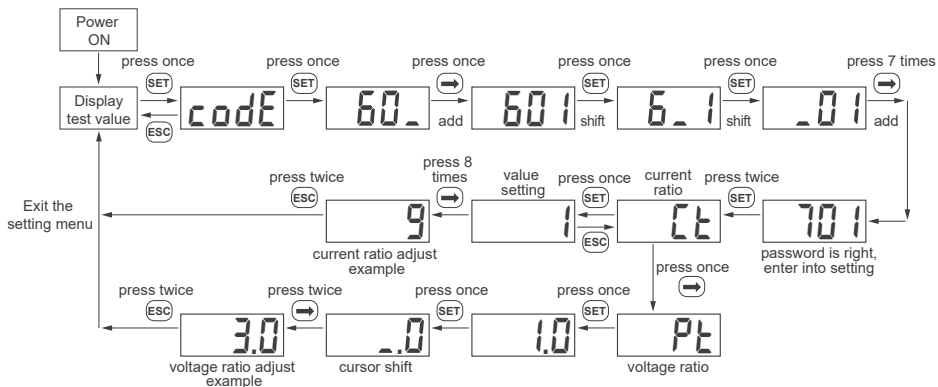
8. Three-phase Inverter Zero-Injection FAQ

8.1 Three-phase 3-25kW Zero-Injection FAQ

a. If the inverter operation normally and the smart meter wiring correctly, the phase active power value P_t display on the smart meter will be synchronize with inverter power (PGrid) value display.

PGrid: 4692W
EtoGDay: 8471W

Inverter Grid Power

Smart Power Meter

Pt 4.692 kW

Three-phase Smart Meter
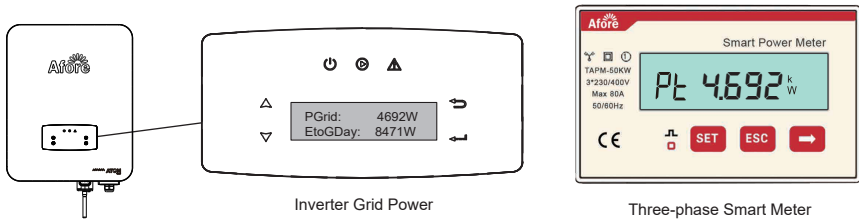
b. If the inverter running parameter (Running Param) is not selected as "Afore3" or faulty occurs to the communication line, it means the inverter and the smart meter are not in communication, the active power P_t on the smart meter is displayed normally, while the power of the inverter (PGrid) is displayed as 0W.

PGrid: 0W
EtoGDay: 8471W

Inverter Grid Power

Smart Power Meter

Pt 4.692 kW

Three-phase Smart Meter
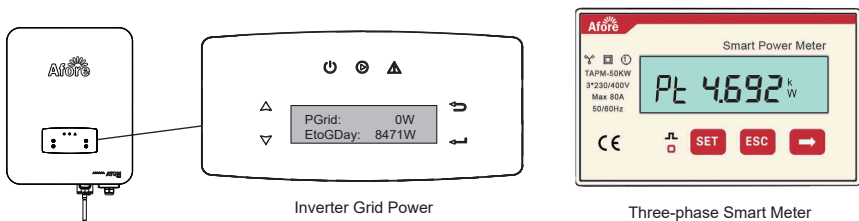
c. If ports 1/4/7/10 are incorrectly connected to the output ports of inverter, or the CT install direction is incorrect, the power on the smart meter P_t and the inverter (PGrid) will display negative values.

Inverter Grid Power

Three-phase Smart Meter
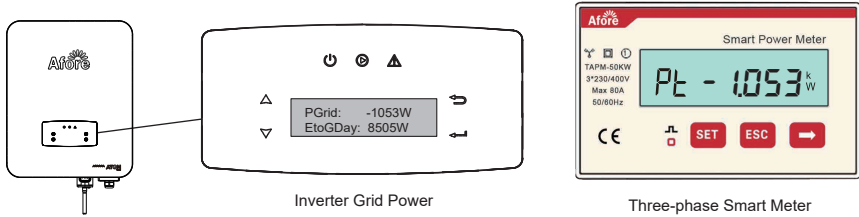
d. If wiring order of the three phases on the smart meter is incorrect, the current values of the three phases displayed on the smart meter will be different, the two phases that are incorrectly wiring will be smaller than the third phase.

• Current value of the two phases incorrectly wiring:
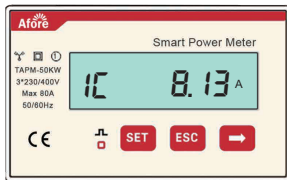
• Current value of the third phase:
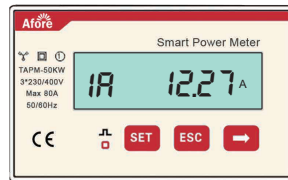
Note:

Due to the fluctuation on the grid side, the data transition delay will occur between smart meter and inverter. And the values displayed on the smart meter and inverter will be different.

8.2 Three-phase 30-60kW Zero-Injection FAQ

a. If the inverter operation normally and the smart meter wiring correctly. The total active power value P_t display on the smart meter will synchronize with inverter Total Pac (Pa+Pb+Pc) value display.
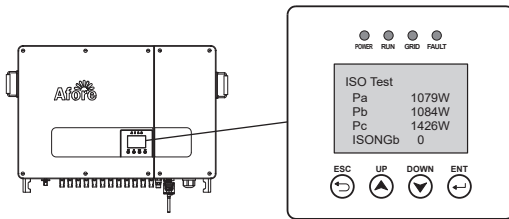
Inverter Pac (Pa+Pb+Pc)
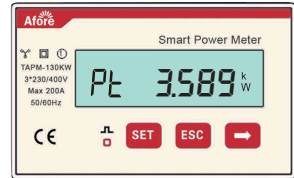
Three-phase Smart Meter

b. If the smart meter's pin wiring order is incorrect , the Smart Meter and the inverter Pac will be wrong display.
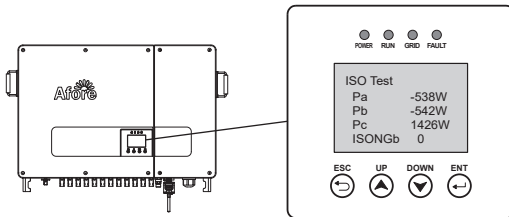
Inverter Pac (Pa+Pb+Pc)
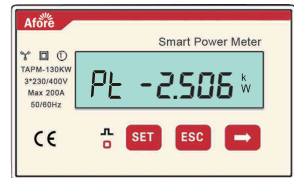
Three-phase Smart Meter

c.If the CT install direction is incorrect, the power on the smart meter and the inverter will display negative values.

d. If the CT wiring order is incorrect with smart meter, the power on the smart meter and the inverter will display negative values.

ISO Test	
Pa	-1079W
Pb	-1084W
Pc	-1426W
ISONGb	0

Inverter Pac (Pa+Pb+Pc)

Pt - 3.589 kW

Three-phase Smart Meter
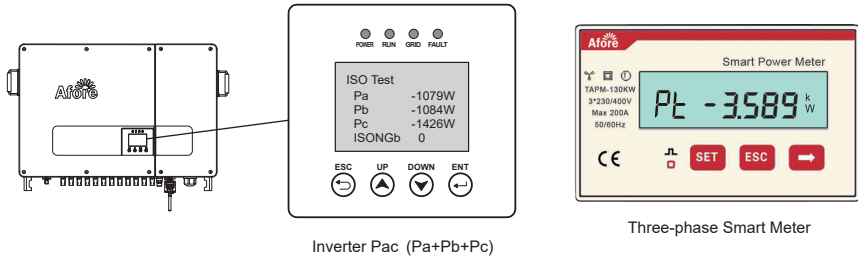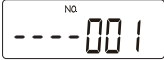
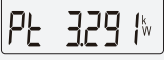e. If the PQD function is not activated, COM 2 not setting or communication cable is not well connected, the power displayed on the inverter is Pac=0W.
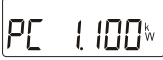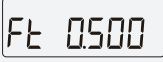

ISO Test	
Pa	0W
Pb	0W
Pc	0W
ISONGb	0

Inverter Pac (Pa+Pb+Pc)

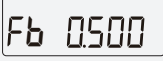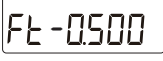Pt 3.589 kW

Three-phase Smart Meter
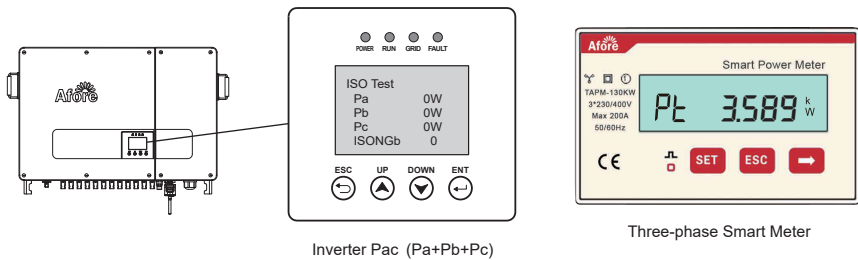
Note:
Do not connect the CT with port 10 of the meter, otherwise will lead short-circuit.

9. Explanation of Smart Meter Display Content

NUM	Display interface	Note
1	Σ 1000000 kWh	Total Active energy
2	Imp. 1000000 kWh	Positive active energy
3	Exp. 023456.7 kWh varh	Reverse active energy
4	NO. H000000	Communication Protocol
5	NO. L000001	
6	NO. n1-9600	Baud Rate
7	NO. ----001	Communication address
8	UA 230.0 v	Phase A Voltage
9	Ub 220.1 v	Phase B Voltage
10	UC 220.2 v	Phase C Voltage
11	1A 5.000 A	Phase A Current
12	1b 5.001 A	Phase B Current
13	1C 5.002 A	Phase C Current
14	Pt 3.291 kW	Total power

NUM	Display interface	Note
15	PA 1.090 kW	Phase A Power
16	Pb 1.101 kW	Phase B Power
17	PC 1.100 kW	Phase C Power
18	Ft 0.500	Power Factor
19	FA 1.000	Phase A Power Factor
20	Fb 0.500	Phase B Power Factor
21	Ft -0.500	Phase C Power Factor

10. Trouble Shooting

Fault	Reason	Solution
No display	· Wiring error · Supply voltage error	· Please check the wiring · Please check the power supply voltage
Communication failure	· Communication line connection error · Communication cable failure · Zero Injection function not activate	· Please reconnect the communication cable · Please replace the communication cable · Activate the zero injection function of the inverter and restart the inverter
Meter shows negative value	· Current transformer is not placed in the right direction · The smart meter is incorrect wiring	· Please check the direction of the CT · Please reconnect the meter
The great discrepancy between the measured value and the actual value	· Wiring error · Voltage and current phase shifts are not the same	· Please check the wiring · Please check the meter wiring