Zero Export Bidirectional Energy Meter for Inverter

Bidirectional Energy Meter, RS485 (MODBUS-RTU) to Inverter, for Zero Export.

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1. Scenario Preset

(1) The scenario is based on a small on-grid Solar PV system without DC energy storage.

(2) In order to realize zero export, we need energy meter with bidirectional metering function installed on Grids Side [Need to monitor the girds' overall 3-phase incoming circuit so that we can monitor the total power consumption supplied from grids to house loads and also monitor the over-generatedreflux/export energy from Solar PV to grids or power transformer.]

(3) Selected model here was just for example, all energy meter with RS485 (MODBUS-RTU) refer in section 4 has the ability to integrate inverter based on RS485 (MODBUS-RTU) to realize Zero Export control

(4) Suppose grids sides incomming circuits is with rated current of 600A AC and rated voltage of 230Vac L-N&400Vac L-N.
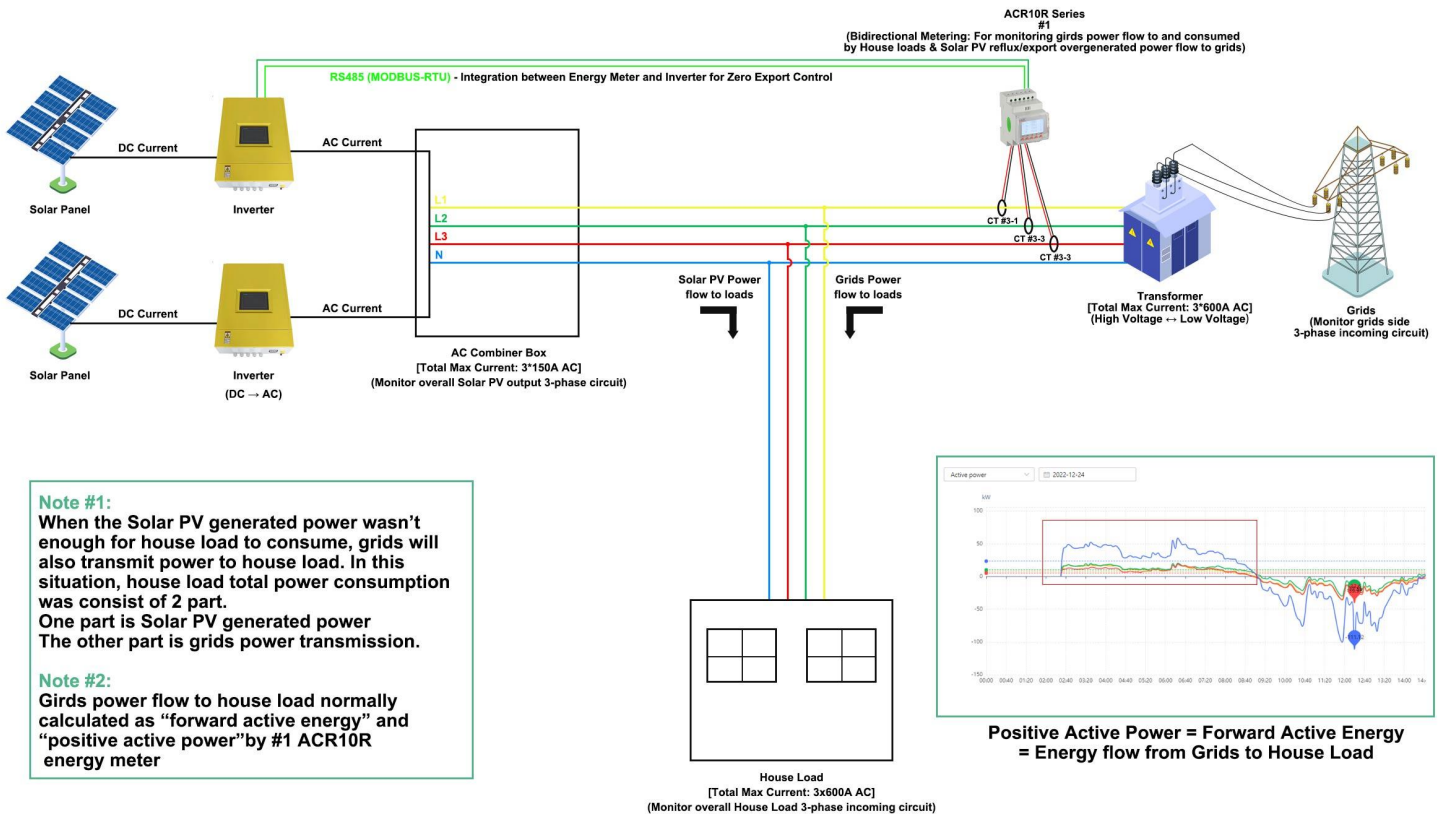
2. Devices Deployment Plan

Grids Side - Grids' Overall 3-phase Incoming Circuit:

- 1* ACR10RH-D110RE4 3-phase Rogowski Coil Energy Meter
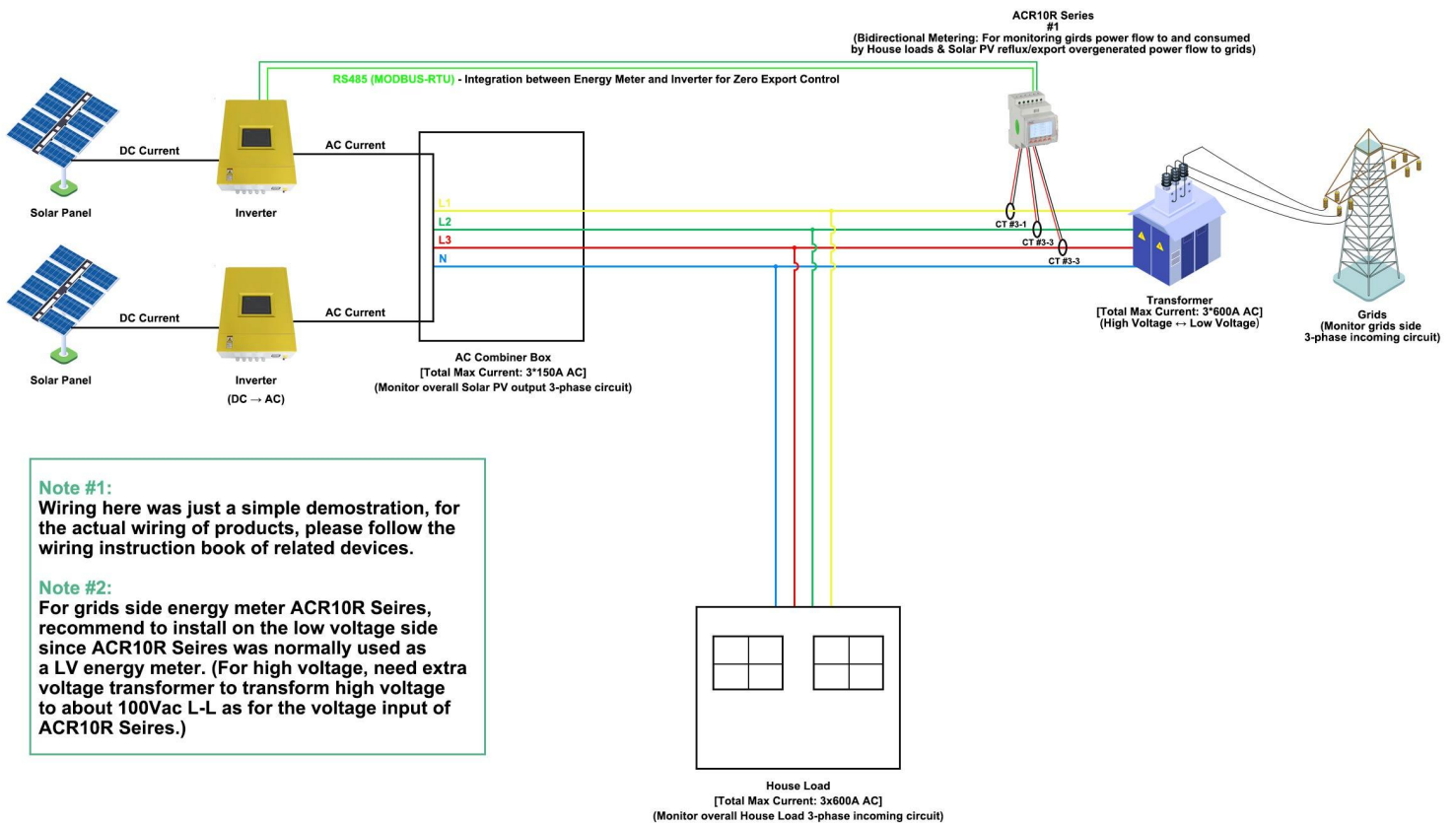
3. Calculation Logic - When the Solar PV Generated Power < House Load Consumed Power

(1) When the solar PV generated power wasn't enough for house loads to consume. Grids will also distribute power to house load for consuming. So, in this situation, the house load total power consumption was consisted of 2 parts, solar PV generated power and grids distribution power.
(2) Girds power flow to house load for consuming was normally calculated as "forward active energy, EPI" and "postive active power, +kw" by #1 ACR10R energy meter.

Note #1:
When the Solar PV generated power wasn't enough for house load to consume, grids will also transmit power to house load. In this situation, house load total power consumption was consist of 2 part.
One part is Solar PV generated power
The other part is grids power transmission.

Note #2:
Girds power flow to house load normally calculated as "forward active energy" and "positive active power"by #1 ACR10R energy meter

Positive Active Power = Forward Active Energy
= Energy flow from Grids to House Load

Calculation logic (When Solar PV not Enough)

Diagram of "Forward Active Energy, EPI"

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**Solar PV Zero Export
Model Selection Plan
(Energy Meter Selection)**

Author: Aaron Shi
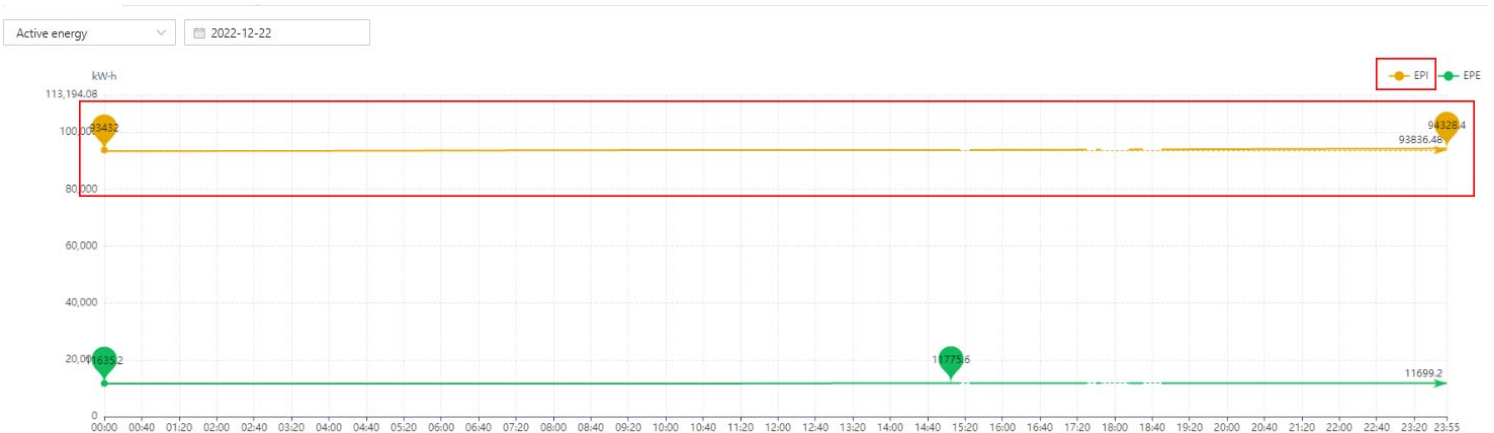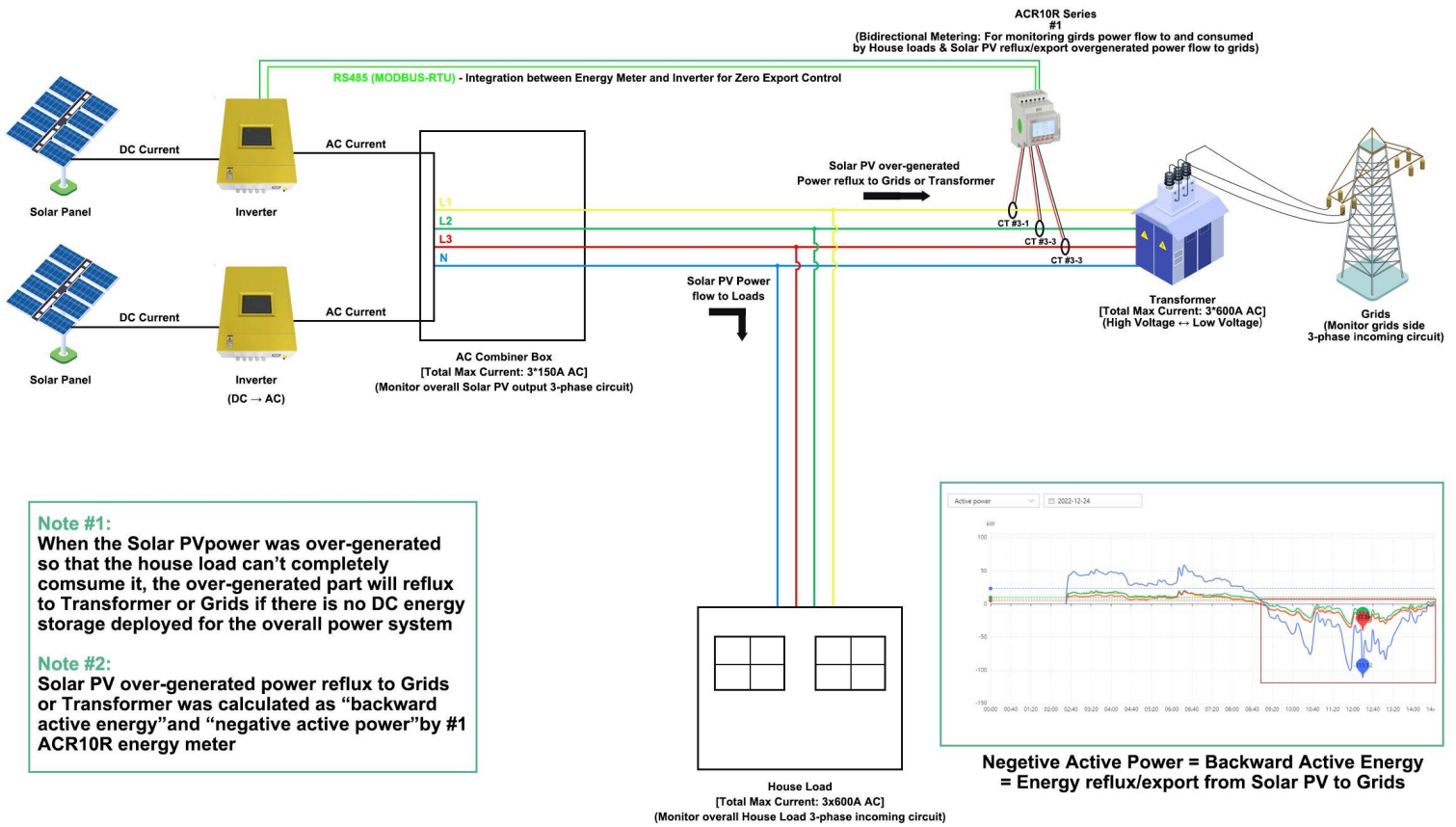E-mail: aaron@acrel.cn

3. Calculation Logic - When the Solar PV Generated Power > House Load Consumed Power

(1) When the solar PV generated power was larger than house loads power consumtpion. The part of over-generated solar PV power will reflux/export to power transformer or grids. In this situation, solar PV power generation will be distributed to 2 part, to house loads and to power transformer or girds.(2) Solar PV over-generated power which reflux/export to power transformer or girds was normally calculated as "backward active energy, EPE" and "negative active power, -kw" by #1 ACR10R energy meter.

Note #1:
When the Solar PVpower was over-generated so that the house load can't completely comsume it, the over-generated part will reflux to Transformer or Grids if there is no DC energy storage deployed for the overall power system

Note #2:
Solar PV over-generated power reflux to Grids or Transformer was calculated as "backward active energy"and "negative active power"by #1 ACR10R energy meter

Negetive Active Power = Backward Active Energy = Energy reflux/export from Solar PV to Grids
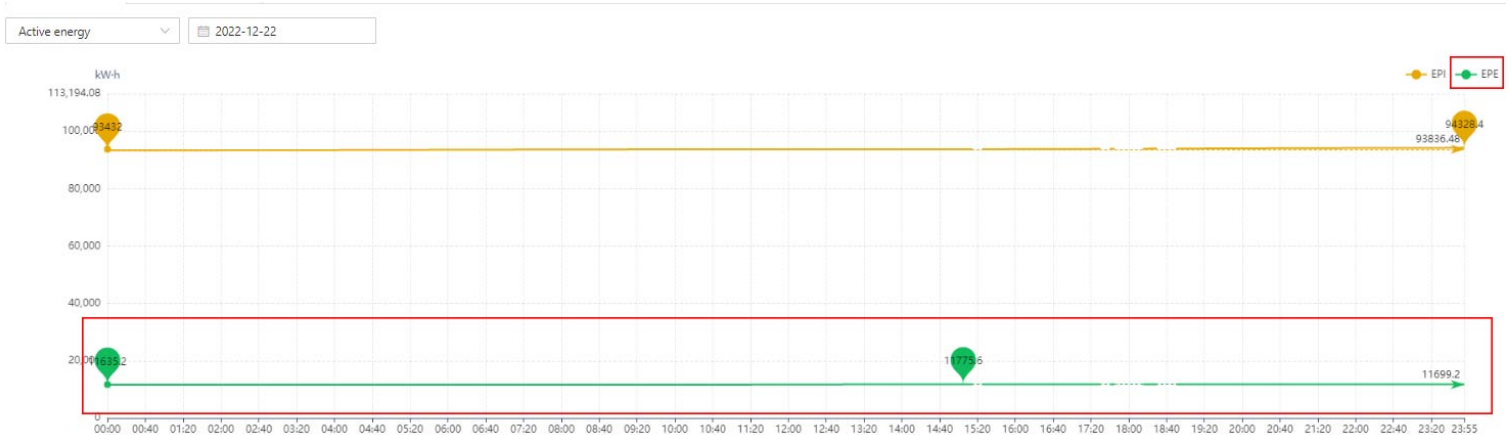
Calculation Logic (Solar PV Over-generated)

Diagram of "Backward Active Energy, EPE"

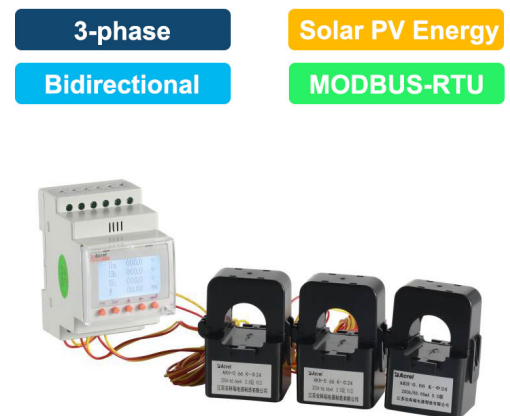## 4. Energy Meter Model Selection (For Solar PV Zero Export Solution)

Model 1: ACR10R-D16TE 1-phase Energy Meter

- Metering: Bidirctional AC Metering 1-phase

- Rated Voltage: 220~264Vac L-N (45~65Hz)

- Rated Current: 120A AC [via paired CT]

- Communicaiton: RS485 Interface, MODBUS-RTU Protocol

- Certificate&Standard: CE

- Currently Integrated with: Ginlong, Fusite, Alpha ESS, etc

1-phase | **Solar PV Energy**
Bidirectional | **MODBUS-RTU**
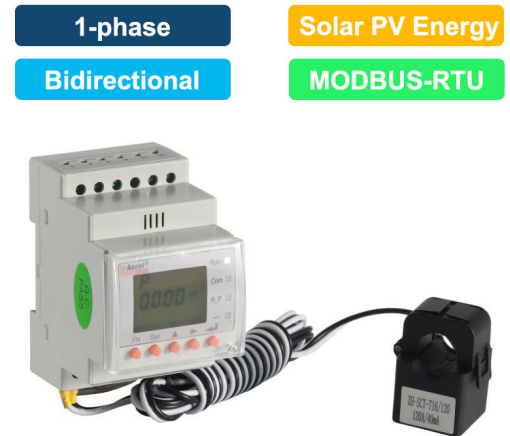
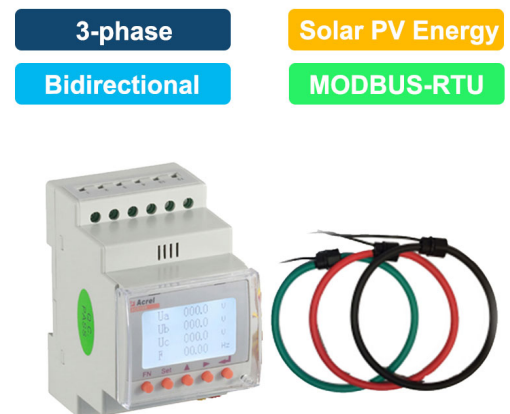### Model 2: ACR10R-D24TE4 3-phase Energy Meter

- Metering: Bidirctional AC Metering 3-phase

- Rated Voltage: 3x220~264Vac L-N & 3x380~456Vac L-L (45~65Hz)

- Rated Current: 200A AC [via paired CTs]

- Communicaiton: RS485 Interface, MODBUS-RTU Protocol

- Currently Integrated with: Ginlong, Fusite, Alpha ESS, etc.- Certificate&Standard: CE

3-phase | **Solar PV Energy**
Bidirectional | **MODBUS-RTU**

Model 3: ACR10R-D110RE4 3-phase Energy Meter

- Metering: Bidirctional AC Metering 3-phase

- Rated Voltage: 3x220~264Vac L-N & 3x380~456Vac L-L (45~65Hz)

- Rated Current: 1000A AC (via paired 3 pcs Rogowski CTs)

- Accuracy: Class 1.0 for active energy monitoring

- Communicaiton: RS485 Interface, MODBUS-RTU Protocol

- Certificate&Standard: CE

3-phase | **Solar PV Energy**
Bidirectional | **MODBUS-RTU**

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**Solar PV Zero Export
Model Selection Plan
(Energy Meter Selection)**

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4. Energy Meter Model Selection (For Solar PV Zero Export Solution)

Model 1: AGF-AE-D/200 1-phase 3-wire Energy Meter

- Metering: Bidirctional AC Metering 1-phase

- Rated Voltage: 120Vac L-N; 208/240Vac L-N

- Rated Current: 100A AC

- Communicaiton: RS485 Interface, MODBUS-RTU Protocol

- Currently Integrated with: Ginlong, SUNGROW, Growatt

etc.

1-phase 3-wire · **Solar PV Energy**
Bidirectional · **MODBUS-RTU**

Model 2: ADL3000-E 3-phase Energy Meter

- Metering: Bidirctional AC Metering 3-phase

- Rated Voltage: 3x220~264Vac L-N & 3x380~456Vac L-L

(45~65Hz)

- Rated Current: 3x1(6)A AC (via CTs)

- Communicaiton: RS485 Interface, MODBUS-RTU Protocol

- Currently Integrated with: Ginlong, SUNGROW, etc.

- Certificate&Standard: CE; UL

3-phase · **Multi-function**
Direct or via CTs · **MODBUS-RTU**

Model 3: PZ96L-E4/KC 3-phase Energy Meter

- Metering: Bidirctional AC Metering 3-phase

- Rated Voltage: 3x220~264Vac L-N & 3x380~456Vac L-L

(45~65Hz)

- Rated Current: 3x1(6)A AC (via CTs)

- Communicaiton: RS485 Interface, MODBUS-RTU Protocol

- Currently Integrated with: Huawei, etc.

- Certificate&Standard: CE

3-phase · **Multi-function**
AC Metering · **MODBUS-RTU**