Zero Export Bidirectional Energy Meter for Inverter

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

Ver. Date: July,6th 2023

Acrel Co., Ltd.

No.253 Yulv Road,Jiading District,Shanghai,China

2023/06/07 Ver.

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

Author: Loki Elfin
E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

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.]

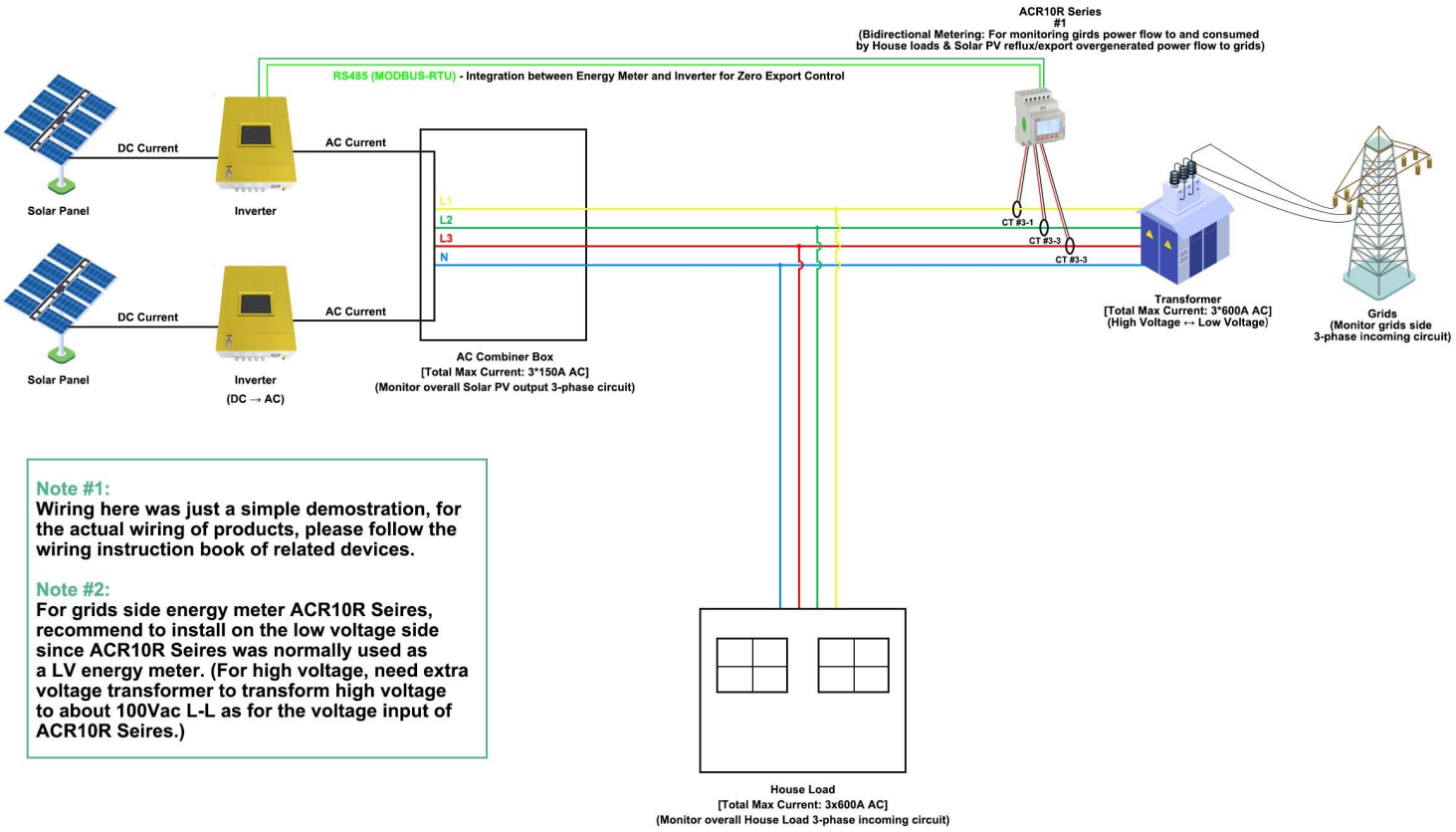
(3) Selected model here was just for example, all energy meter with RS485 (MODBUS-RTU) refer in section 4 has the ability to integrate inverter based on RS485 (MODBUS-RTU) to realize Zero Export control

(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



Note #1:
Wiring here was just a simple demostration, for the actual wiring of products, please follow the wiring instruction book of related devices.

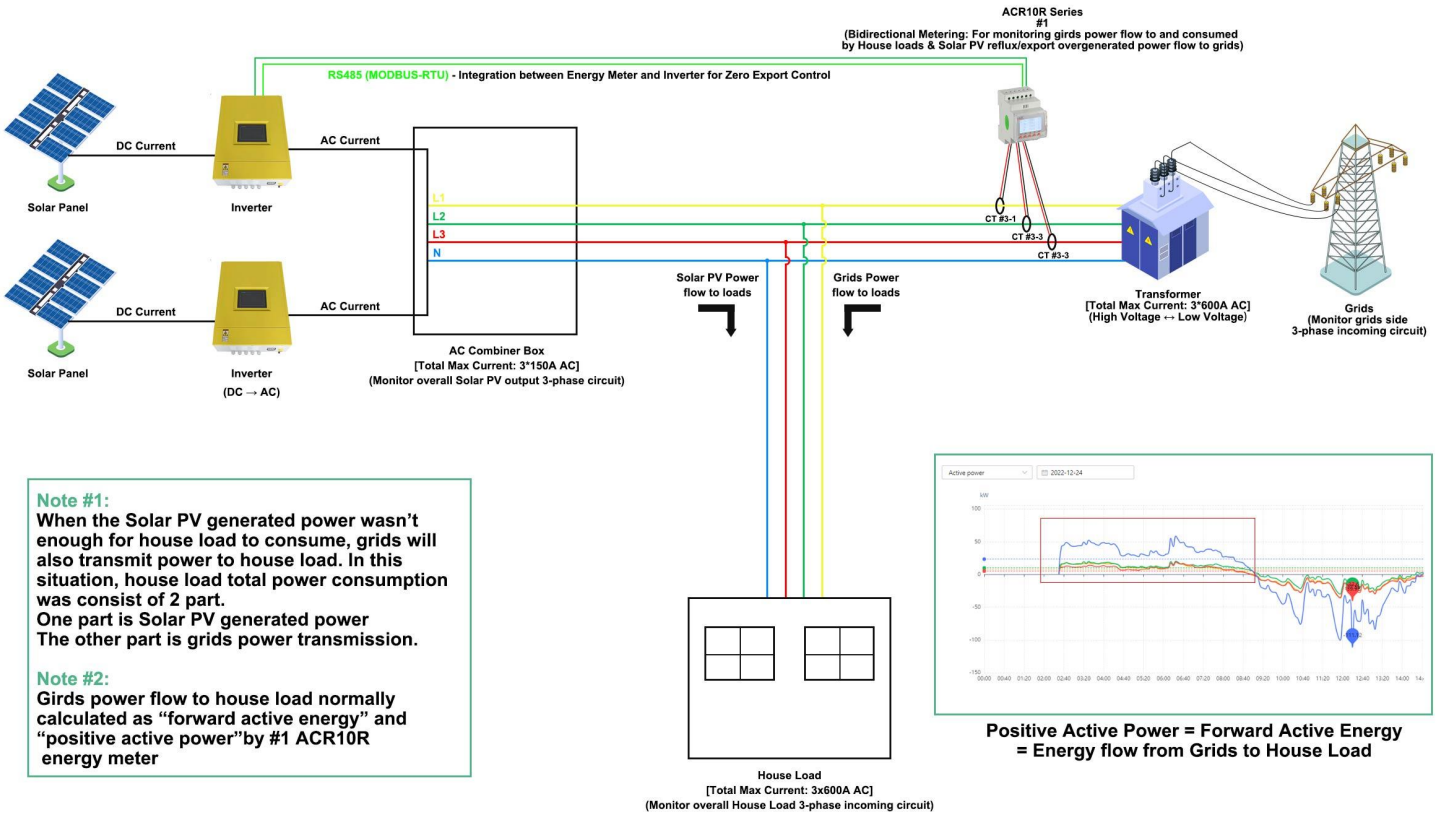
Note #2:
For grids side energy meter ACR10R Seires, recommend to install on the low voltage side since ACR10R Seires was normally used as a LV energy meter. (For high voltage, need extra voltage transformer to transform high voltage to about 100Vac L-L as for the voltage input of ACR10R Seires.)

Author: Loki Elfin
E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

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.



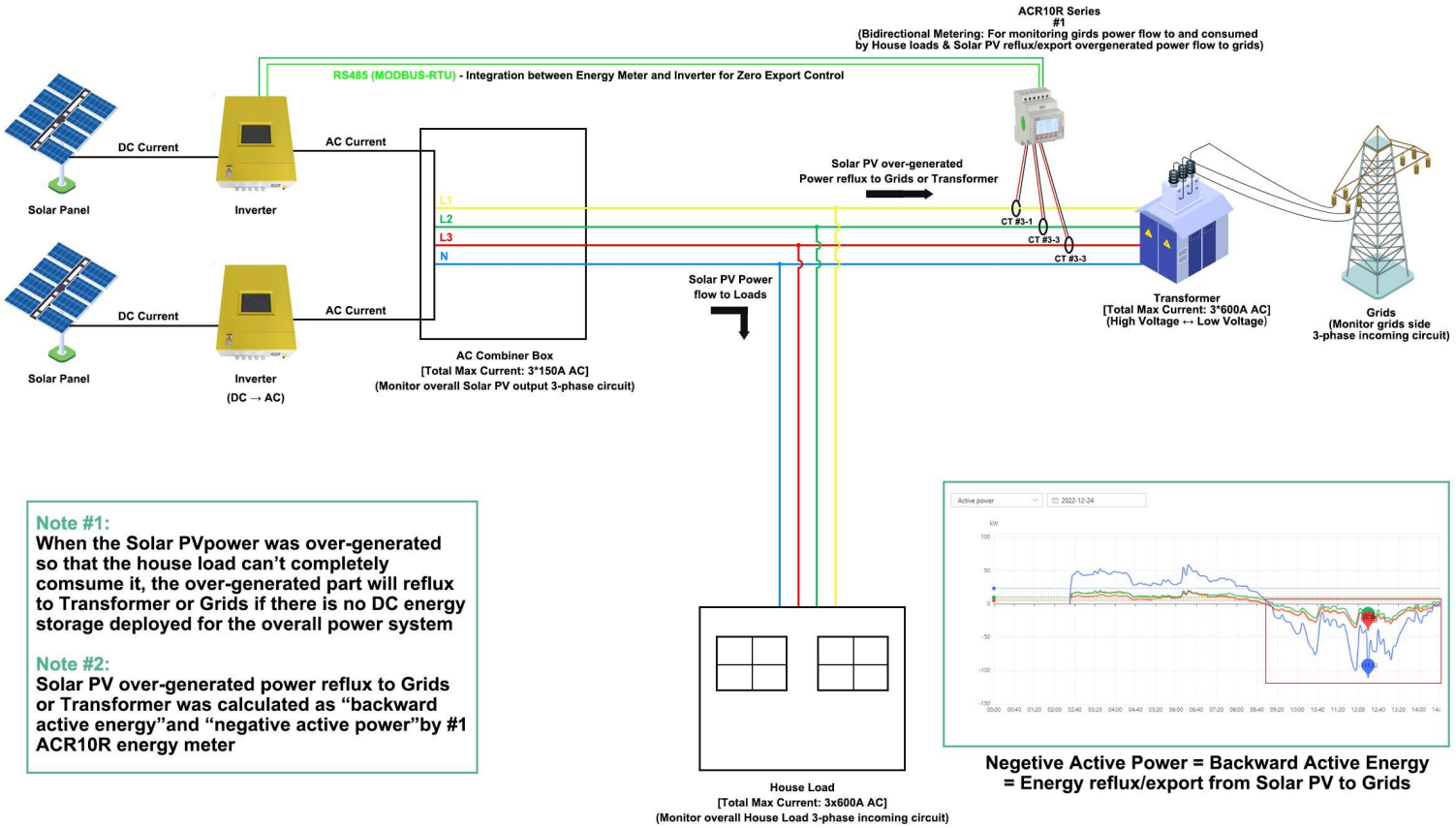
Calculation logic (When Solar PV not Enough)

Diagram of "Forward Active Energy, EPI"

Author: Loki Elfin
E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

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.



Calculation Logic (Solar PV Over-generated)

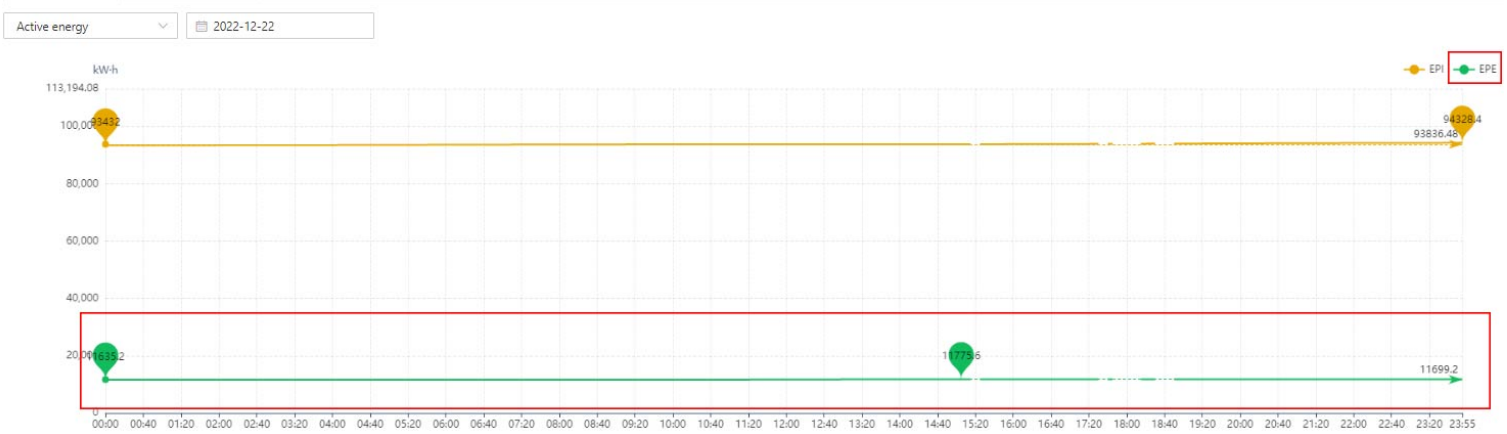


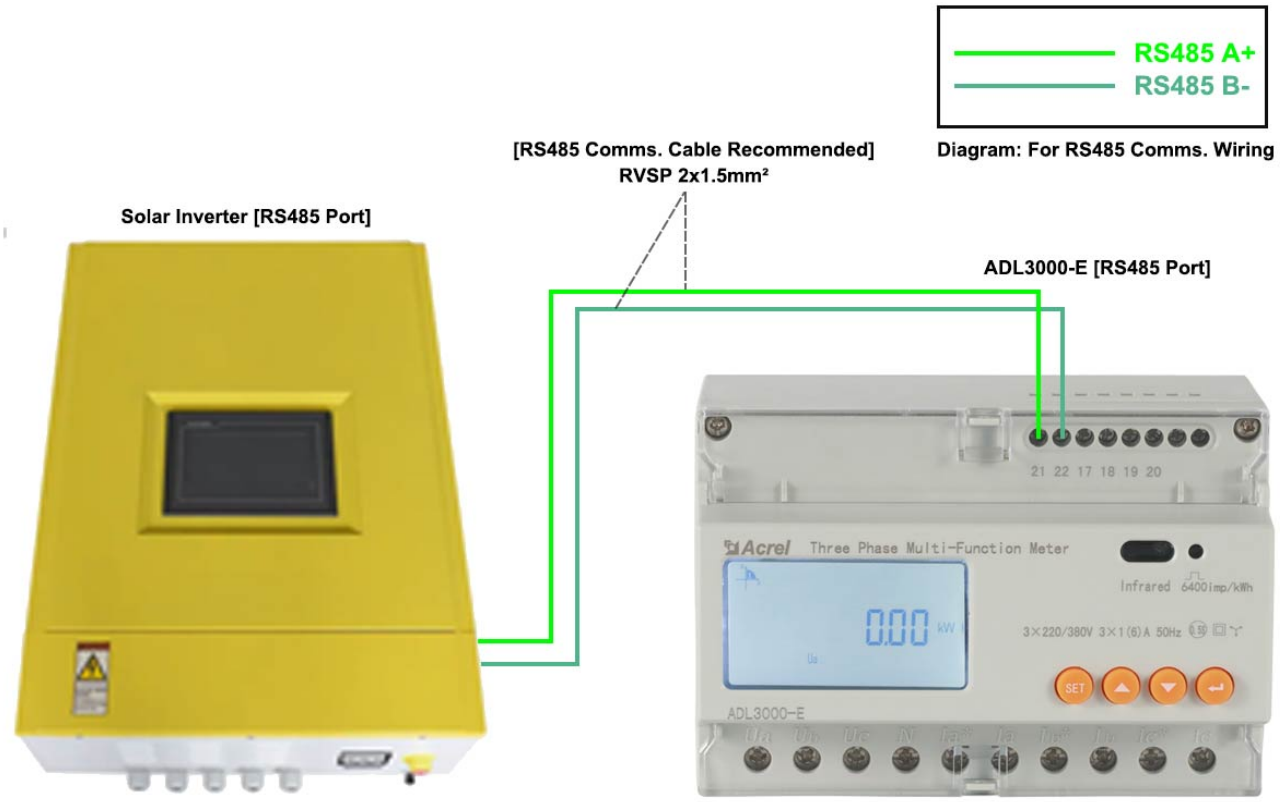
Diagram of "Backward Active Energy, EPE"

Author: Loki Elfin
E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

4. Communication Structure&Logic - To Solar Inverter [Take ADL3000-E for example]

(1) ADL3000-E energy meter also has a RS485 port [MODBUS-RTU protocol] which could be connected to Solar PV Inverter so that inverter could get the reading from ADL3000-E based on MODBUS-RTU protocol.

(2) Once the inverter get a reading of "backward active power [minus value]", the invert could automatically lower its power generation rates so that the over all Solar PV generated power won't be more than house load consumption. Thus Solar PV side won't have export to grids side and eventually realize zero export.



Note:

1. Solar PV inverter get reading of bidirectional active power of grids side from ADL3000-E based on RS485 [MODBUS-RTU]
2. Once inverter get the reading of backward active power [export], inverter will lower its power generation rates so that no more Solar PV over-generated power flow to grids side. [no more export power]
3. All the generation power control logic was decided by inverter, energy meter ADL3000-E only provide the reading of bidirectional active power. So the integration between ADL3000-E and inverter based on RS485 interface [MODBUS-RTU] protocol for get the reading of bidirectional active power must be done and inverter side must have this type of control logic. [When inverter get the reading of backward active power, it will lower its power generate rate]

Author: Loki Elfin
E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

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

1-phase | Solar PV Energy | Bidirectional | MODBUS-RTU

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.
- More Introduction: https://www.acrel-electric.fr/product/acr10r_dxxt_bidirectional_single_phase_reflux_monitoring_energy_meter

3-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
- More Introduction: https://www.acrel-electric.fr/product/acr10r_dxxtex_bidirectional_three_phase_reflux_monitoring_energy_meter

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

Author: Loki Elfin
E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

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

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

1-phase 3-wire | Solar PV Energy
Bidirectional | MODBUS-RTU

- 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.
- More Introduction: https://www.acrel-electric.fr/product/agf_ae_d_bidirectional_reflux_monitoring_meter_1_phase_3_wire_with_ul_certificate

Model 2: ADL3000-E 3-phase Energy Meter

3-phase | Multi-function
Direct or via CTs | MODBUS-RTU

- 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
- More Introduction: https://www.acrel-electric.fr/product/adl3000_e_three_phase_multi_function_din_rail_energy_meter

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

3-phase | Multi-function
AC Metering | MODBUS-RTU

- 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
- More Introduction:https://www.acrel-electric.fr/product/three_phase_ac_multi_function_energy_meter_amc96l_e4_kc