



**BUREAU
VERITAS**

TEST REPORT UNE217001 IN

Requisitos y ensayos para sistemas que eviten el vertido de
energía a la red de distribución

Report reference number..... : PVSP200917N006-9

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Testing laboratory name..... : Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch

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Accreditation..... :



Applicant's name..... : Shenzhen SOFARSOLAR Co., Ltd.

Address..... : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong
Community, XinAn Street, BaoAn District, Shenzhen, China

Test specification

Standard..... : UNE 217001 IN: 2015

Requirements and tests for systems intended to avoid the energy
transmission to the distribution network (RD 244:2019)

Test Report Form No..... : UNE 217001 IN VER.0

TRF Originator..... : Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch

Master TRF..... : Dated 2020-03-11

Test item description..... : Hybrid Inverter / Power sensor / Current transducer

Trademark..... :



Model / Type..... :

Solar inverter :

HYD 3000-EP, HYD 3680-EP, HYD 4000-EP,
HYD 4600-EP, HYD 5000-EP, HYD 5500-EP,
HYD 6000-EP

Power sensor:

DDSU666

ACR10R-D24TE

Current transducer:

HY94C2

AKH-0.66 K- Φ 24

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Ratings..... :	HYD 3000-EP	HYD 3680-EP	HYD 4000-EP
Full load MPP DC voltage range [V].:	160-520V	180-520V	200-520V
Input DC voltage range[V]	90-600V		
Input DC current [A]	Max. 13A/13A		
Output AC voltage [V]	L/N/PE, 230Vac, 50Hz		
Output AC current [A]	15,0	16,0	20,0
Output power [W]	3000	3680	4000
Max. output power [VA]	3300	3680	4400
Output DC voltage range [V]	42-58V		
[Battery charge]			
Input/Output DC current [A]	Max. 75A	Max. 80A	Max. 85A
[Battery charge/discharge]			
Charge and discharge power[W]	Max. 3750	Max. 4000	Max. 4250
Output AC voltage [V]	L/N/PE, 230Vac, 50Hz		
Max. Input/Output AC current [A]	13,6	16,0	18,2
[Battery charge/discharge mode]			
Max. Input/Output AC power [VA]	3000	3680	4000
[Battery charge/discharge mode]			
Ratings..... :	HYD 4600-EP	HYD 5000-EP	HYD 5500-EP
Full load MPP DC voltage range [V].:	230-520V	250-520V	250-520V
Input DC voltage range[V]	90-600V		
Input DC current [A]	Max. 13A/13A		
Output AC voltage [V]	L/N/PE, 230Vac, 50Hz		
Output AC current [A]	20,9	21,7	25,0
Output power [W]	4600	5000	5000
Max. output power [VA]	4600	5000	5500
Output DC voltage range [V]	42-58V		
[Battery charge]			
Input/Output DC current [A]	Max. 100A		
[Battery charge/discharge]			
Charge and discharge power[W]	Max. 5000		
Output AC voltage [V]	L/N/PE, 230Vac, 50Hz		
Max. Input/Output AC current [A]	20,9	22,7	22,7
[Battery charge/discharge mode]			
Max. Input/Output AC power [VA]	4600	5000	5000
[Battery charge/discharge mode]			



Ratings..... :	HYD 6000-EP
Full load MPP DC voltage range [V].:	300-520V
Input DC voltage range[V]	90-600V
Input DC current [A].....:	Max. 13A/13A
Output AC voltage [V].....:	L/N/PE, 230Vac, 50Hz
Output AC current [A]	27,3
Output power [W].....:	6000
Max. output power [VA]	6000
Output DC voltage range [V]	42-58V
[Battery charge].....:	
Input/Output DC current [A].....:	Max. 100A
[Battery charge/discharge]	
Charge and discharge power[W].....:	Max. 5000
Output AC voltage [V].....:	L/N/PE, 230Vac, 50Hz
Max. Input/Output AC current [A]	22,7
[Battery charge/discharge mode] ...:	
Max. Input/Output AC power [VA]	5000
[Battery charge/discharge mode] ...:	



Testing Location: **Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch**
Address.....: No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province, 523942, People’s Republic of China

Tested by
 (name and signature): Lukes Lin

Approved by
 (name and signature): James Huang

Manufacturer’s name: **Shenzhen SOFARSOLAR Co., Ltd.**
Manufacturer address.....: 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China
Factory’s name: **Dongguan SOFAR SOLAR Co.,Ltd.**
Factory address: 1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City, Guangdong, China.

Document History			
Date	Internal reference	Modification / Change / Status	Revision
2021-03-25	Lukes Lin	Initial report was written	0



Test item particulars	
Equipment mobility	: Permanent connection
Operating condition	: Continuous
Class of equipment	: Class I
Protection against ingress of water	: IP65 according to EN 60529
Mass of equipment [kg].....	: Approx. 21,5kg
Possible test case verdicts	
- test case does not apply to the test object.....	: N/A
- test object does meet the requirement	: P (Pass)
- test object does not meet the requirement	: F (Fail)
Testing	
Date of receipt of test item	: 2020-09-17
Date (s) of performance of tests	: 2020-09-17 to 2021-03-16

General remarks

Preface:

The test results presented in this report relate only to the object(s) tested.

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"(see Annex #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

Description of the vector system to depict test results:

The regarded system of the voltage and current vectors is the generator reference system (Figure 1):

- If the inverter feeds to the grid the active power is measured with positive sign.
- If the load consumes from grid the active power is measured with negative sign.

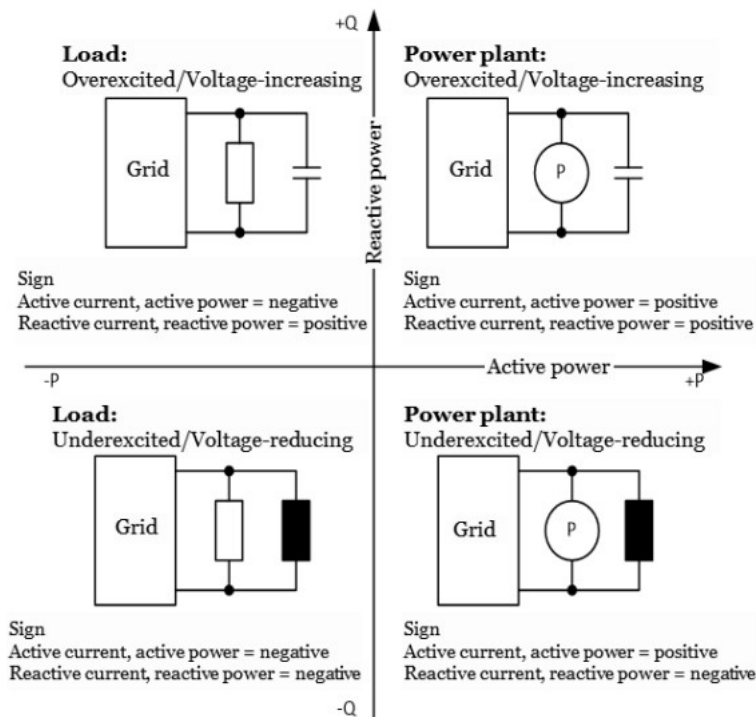


Figure 1 – Generator reference arrow system



This report consists of the following documents and/or enclosures:

No.	Contents
1)	Basic outline of the system
2)	Power analyzer and class of measurement transformers for power measurement.
3)	Control element.
4)	Type of communications used between the different elements.
5)	Type generators for which the system is valid.
6)	Power of the type generator tested and generators / analyser's assimilated.
7)	Control algorithm
8)	Electric characteristics of the generator
9)	Maximum number of generators to be connected
5	Test
5.1	Tolerance in permanent mode
5.2	Response to load disconnections
5.3	Response to power increases in the primary energy source
5.4	Action in case of loss of communications
A.1	Annex 1 - Pictures of the unit
A.2	Annex 2 -Test Equipment list

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Inverter

SOFAR
SOLAR
Hybrid Inverter

Model No: HYD 3000-EP

Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V~580V
MAX.PV Isc	2x18A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	75A
Max.Discharging Current	75A
Max.Charging&Discharging Power	3750W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	15.0A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	3000W
Backup Rated Current	13.6A
Backup Rated Apparent Power	3000VA
Ingress Protection	IP 65
Operating Temperature Range	-30.+60°C
Protective Class	Class I

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G98,AS4777,UTE C15-712-1

SOFAR
SOLAR
Hybrid Inverter

Model No: HYD 3680-EP

Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V~580V
MAX.PV Isc	2x18A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	80A
Max.Discharging Current	80A
Max.Charging&Discharging Power	4000W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	16.0A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	3680W
Backup Rated Current	16.0A
Backup Rated Apparent Power	3680VA
Ingress Protection	IP 65
Operating Temperature Range	-30.+60°C
Protective Class	Class I

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SOFAR
SOLAR
Hybrid Inverter

Model No: HYD 4000-EP

Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V~580V
MAX.PV Isc	2x18A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	85A
Max.Discharging Current	85A
Max.Charging&Discharging Power	4250W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	20.0A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	4000W
Backup Rated Current	18.2A
Backup Rated Apparent Power	4000VA
Ingress Protection	IP 65
Operating Temperature Range	-30.+60°C
Protective Class	Class I

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SOFAR
SOLAR
Hybrid Inverter

Model No: HYD 4600-EP

Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V~580V
MAX.PV Isc	2x18A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	100A
Max.Discharging Current	100A
Max.Charging&Discharging Power	5000W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	20.9A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	4600W
Backup Rated Current	20.9A
Backup Rated Apparent Power	4600VA
Ingress Protection	IP 65
Operating Temperature Range	-30.+60°C
Protective Class	Class I

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Copy of marking plate

SOFAR SOLAR
Hybrid Inverter

Model No: HYD 5000-EP

Max. DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX. PV Isc	2x18A
Battery Type	Lead-acid, Lithium-ion
Battery Voltage Range	42-58V
Max. Charging Current	100A
Max. Discharging Current	100A
Max. Charging & Discharging Power	5000W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max. Output Current	21.7A
Nominal Grid Frequency	50/60Hz
Power Factor	1 (adjustable +/- 0.8)
Nominal Output Power	5000W
Backup Rated Current	22.7A
Backup Rated Apparent Power	5000VA
Ingress Protection	IP 65
Operating Temperature Range	-30-+60°C
Protective Class	Class I

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SOFAR SOLAR
Hybrid Inverter

Model No: HYD 5500-EP

Max. DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX. PV Isc	2x18A
Battery Type	Lead-acid, Lithium-ion
Battery Voltage Range	42-58V
Max. Charging Current	100A
Max. Discharging Current	100A
Max. Charging & Discharging Power	5000W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max. Output Current	25.0A
Nominal Grid Frequency	50/60Hz
Power Factor	1 (adjustable +/- 0.8)
Nominal Output Power	5000W
Backup Rated Current	22.7A
Backup Rated Apparent Power	5000VA
Ingress Protection	IP 65
Operating Temperature Range	-30-+60°C
Protective Class	Class I

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SOFAR SOLAR
Hybrid Inverter

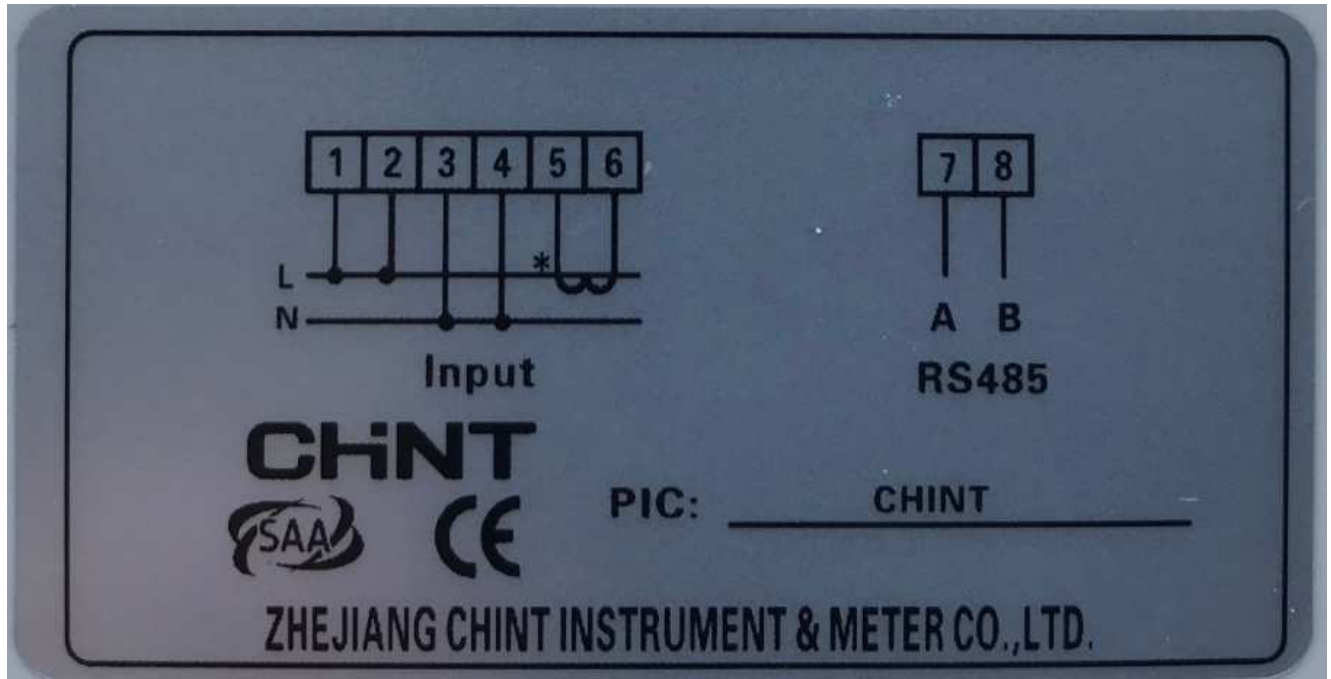
Model No: HYD 6000-EP

Max. DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX. PV Isc	2x18A
Battery Type	Lead-acid, Lithium-ion
Battery Voltage Range	42-58V
Max. Charging Current	100A
Max. Discharging Current	100A
Max. Charging & Discharging Power	5000W
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max. Output Current	27.3A
Nominal Grid Frequency	50/60Hz
Power Factor	1 (adjustable +/- 0.8)
Nominal Output Power	6000W
Backup Rated Current	22.7A
Backup Rated Apparent Power	5000VA
Ingress Protection	IP 65
Operating Temperature Range	-30-+60°C
Protective Class	Class I

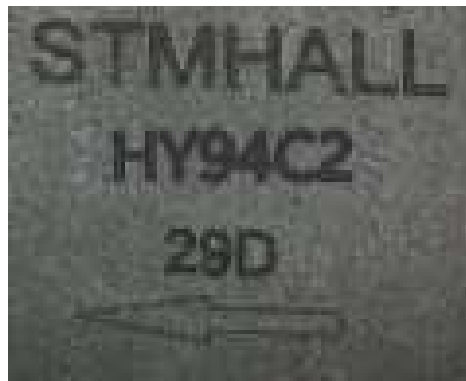
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Power Sensor



Current transducer



General product information:

General product information:

The inverter converts DC voltage, generated by photovoltaic modules, into AC voltage.

The units are single-phases hybrid-inverter.

Rate of change of frequency (RoCoF) detection was used for LOM protection.

The internal control is redundant built. It consists of Main DSP(U4) and slave DSP(U43).

The Main DSP(U4) can control the relays, measures voltage, and frequency, AC current with injected DC, insulation resistance and residual current, In addition it tests the array insulation resistance and the RCMU circuit before each start up.

The slave DSP(U43) is using for controlling the relays, measuring the voltage , frequency, inject a dc AC current, the residual current, and communicating with the master DSP(U4). And if the communicating with the master DSP, the slave DSP will disconnect the relays.

The unit provides two relays in series on Line and Neutral conductors. When single-fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the PV array and the mains. All the relays are tested before start up. Both controllers Main DSP(U4), Slave DSP(U43) can open the relays.

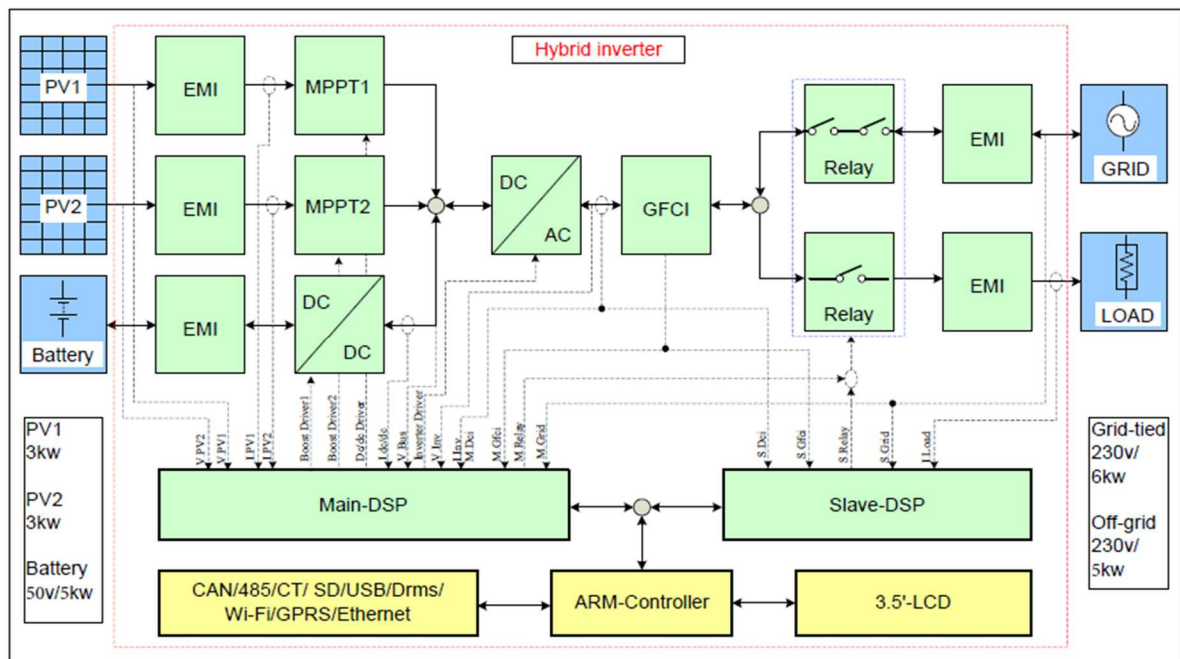


Figure 2 – Block diagram



General product information:

Description of the differences of the models within a series:

The models HYD 3000-EP, HYD 3680-EP, HYD 4000-EP, HYD 4600-EP, HYD 5000-EP, HYD 5500-EP and HYD 6000-EP are completely identical and output power derated by software, except for the following table.

	HYD 3000-EP	HYD 3680-EP	HYD 4000-EP	HYD 4600-EP	HYD 5000-EP	HYD 5500-EP	HYD 6000-EP
R332, R334, R336	(NC, 0Ω, NC)			(0Ω, NC, 0Ω)			
Bus capacitance	6pcs			8pcs			
INV inductor	1,035mH			0,75mH			
R123, R132	(499Ω, 499Ω)			(1.5kΩ, 1.5kΩ)			

Description of test object(s):

The tests were performed on solar inverter HYD 6000-EP with the Power sensor *DDSU666* and current sensor *HY94C2*.

Hardware version:

The products was tested on following HW revisions:

Solar inverter: V001

Power sensor:

DDSU666	:	ZTY8.067.1931
ACR10R-D24TE	:	ASJ10-LCD-V10(02)

Current transducer:

HY94C2	:	D.03
AKH-0.66 K- Φ 24	:	T1.00

Software (FW) version:

The products were tested on:

Solar inverter: V02000

Power sensor:

DDSU666	:	V5.09
ACR10R-D24TE	:	T1.00

Current transducer: N/A

1) Basic outline of the system

Informative

Application Scenarios

Single machine photovoltaic power generation system: Solar inverter + smart power sensor + current sensor

The smart power sensor is used to realize power restriction for household energy management. It adopts RS485 communication, which can realize the electrical quantity measurement, energy metering function and in respond to the upper host for the real-time data query.

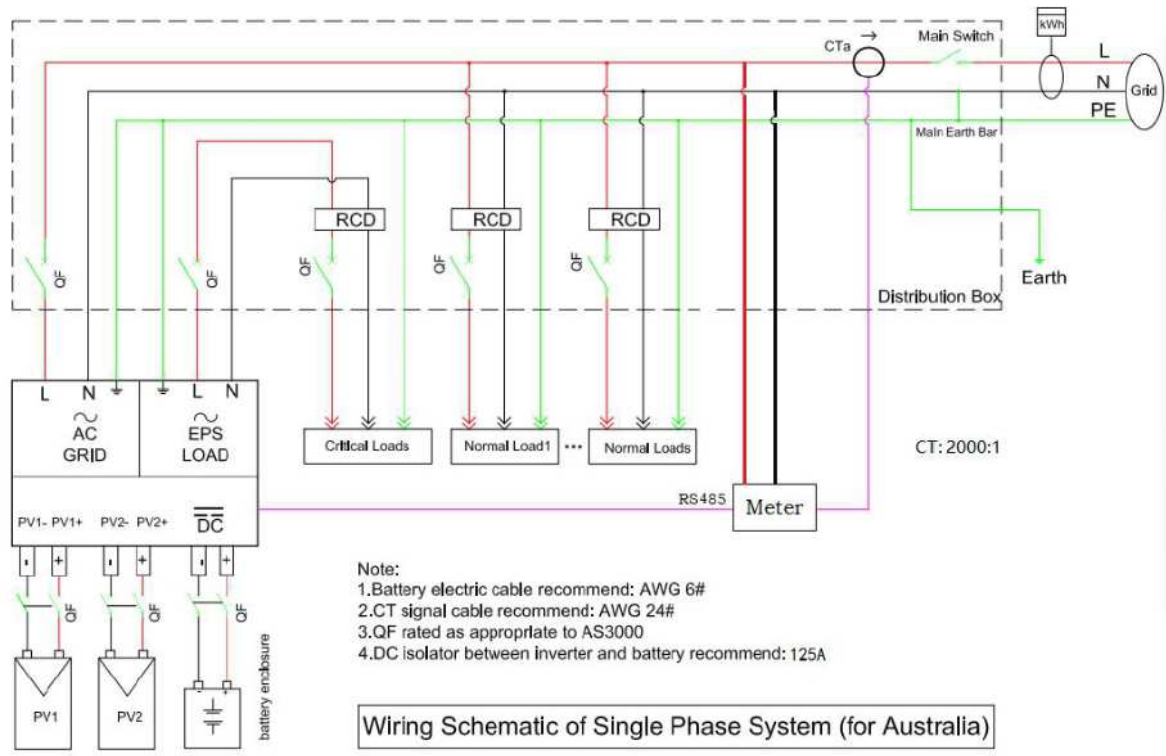


Figure 3 – Scheme of Single machine photovoltaic power generation system

2) Power analyzer and class of measurement transformers for power measurement.		Informative
Power Sensor		
Model:		DDSU666
Environmental Specifications		
Regulated working temperature range		: -25°C to +55°C
Electrical parameter		
Specified operating voltage range		: 0,9-1,1Un
Nominal voltage		: 230Vac
Current range		: 200A
Data detection		: Voltage/Current/Active Power/Reactive Power/Frequency
Energy calculation		: Active/Reactive Power energy
Precision	Active Power	: Class 0,5
	Reactive Power	: Class 2
Comm.	With Inverter	: RS485(1222bps, 2400bps, 4800bps, 9600bps)
Note:		

EMC Specifications	
EMC performance of the meter conforms to the following relevant technical standard:	
EN 61326-1:2013	
IEC 61010-1:2010	
Current transducer	
Model	: HY94C2
Primary rated current	: 200 A
Secondary rated current	: 100 mA
Accuracy class @ $R_L \leq 20\Omega$ (IEC 60044-1:2003)	: 0,5
R.m.s.voltage for AC isolation test @50Hz, 1min	: 2kV
Voltage transformer ratio	: 2000:1
Insulation resistance @500V DC	: 100M Ω
Ambient storage temperature	: -45°C ..+90°C
Ambient operating temperature	: -40°C ..+85°C
Environmental relative humidity	: $\leq 90\%RH$
Highest voltage for equipment	: 0,72kV
Length of secondary wires	: $1\pm 3\%m$
Working frequency	: 50...400Hz
Primary aperture	: 24*24mm
Overload rating	: 120%
Altitude	: $\leq 1000m$
Working environment	No serious pollution No strong vibration

Power Sensor(spare material)		
Model:		ACR10R-D24TE
Environmental Specifications		
Regulated working temperature range		: -10°C to +55°C
Electrical parameter		
Specified operating voltage range		: 1.2Un(continuous); 2.0Un(lastest for 1s)
Nominal voltage		: 220Vac
Current range		: 200A
Data detection		: Voltage/Current/Active Power/Reactive Power/Frequency
Energy calculation		: Active/Reactive Power energy
Precision	Active Power	: Class 0,5
	Reactive Power	: Class 1
Comm.	With Inverter	: RS485, Modbus-TRU
Note:		
Current transducer: AKH-0.66 K- Φ 24		

3) Control element.

Informative

A typical installation consists of a solar inverter (HYD 6000-EP), a smart power meter of type *DDSU666* using the *HY94C2* for current measurement.

The smart power meter measures and monitors the power exchange between the client installation and the grid. The energy generation and consumption balance at the interconnection point can be achieved via regulating the power output of the solar inverter by the smart power meter.

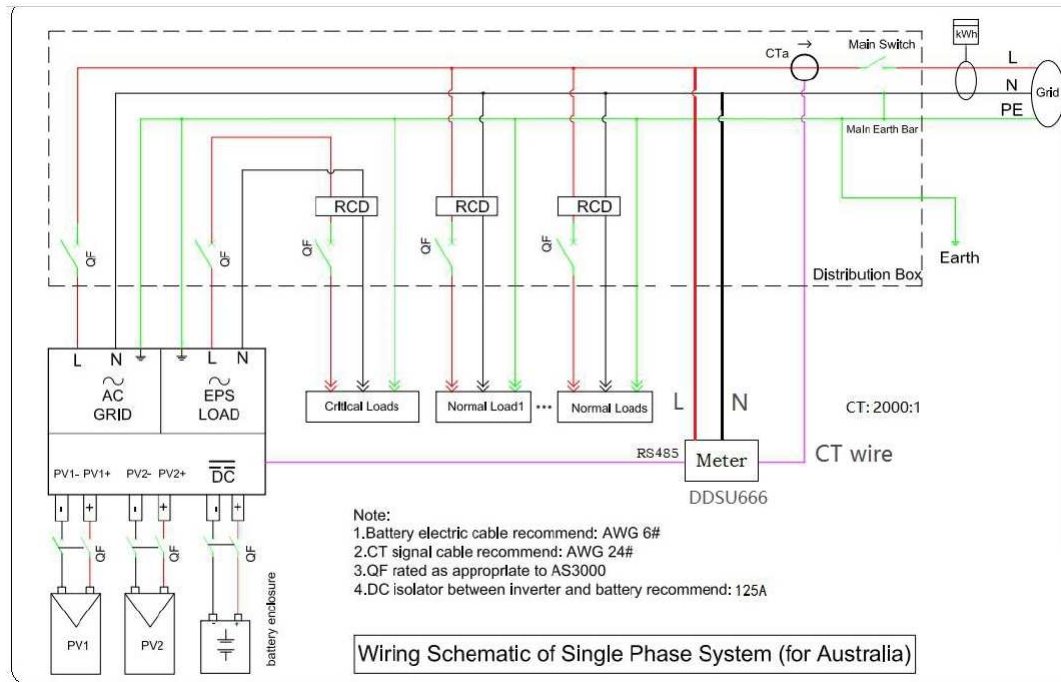


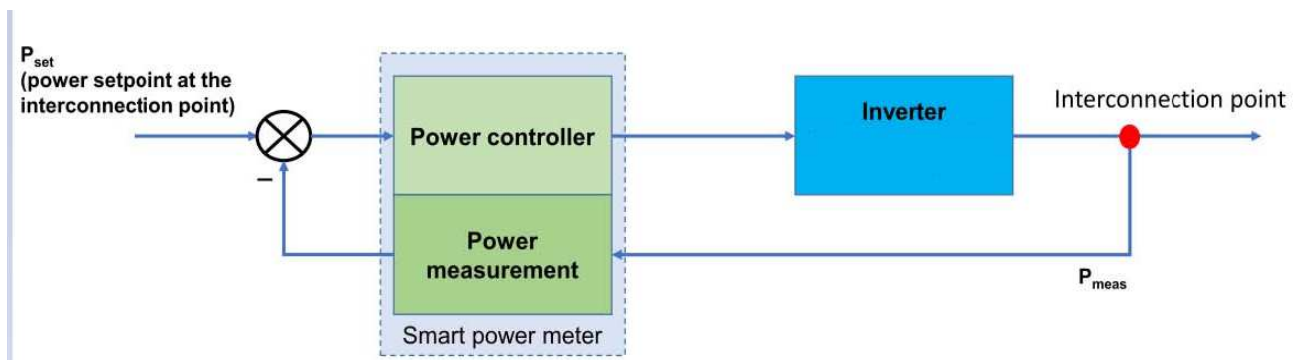
Figure 3 – Scheme of typical installation

4) Type of communications used between the different elements.		Informative
Inverter ↔ power sensor		
Inverter:	HYD 6000-EP	
Power sensor:	DDSU666	
Supported Communication Interface:	RS485	
Communication protocol:	Modbus	
Response time:	≤ 0,1 s	
Power sensor and current transducer		
Power sensor:	DDSU666	
Current sensor:	HY94C2	
<p>The Current transducer HY94C2 is a passive electrical device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal is an analog current. The generated signal will further analyzed in the DDSU666 with which the HY94C2 is connected.</p>		
5) Type generators for which the system is valid.		Informative
Following Generators are Valid for the System:		
<p>Inverter: HYD 3000-EP, HYD 3680-EP, HYD 4000-EP, HYD 4600-EP, HYD 5000-EP, HYD 5500-EP, HYD 6000-EP</p>		
Comment:		
The test have been Performed on the HYD 6000-EP.		
6) Power of the type generator tested and generators / analyser's assimilated.		Informative
<p>Note: The power rating of the generators can be found on page 2. The technical data of the power sensor and current transducer can be found on page 14.</p>		

7) Control algorithm

Informative

The control algorithm of the system is described as follows:



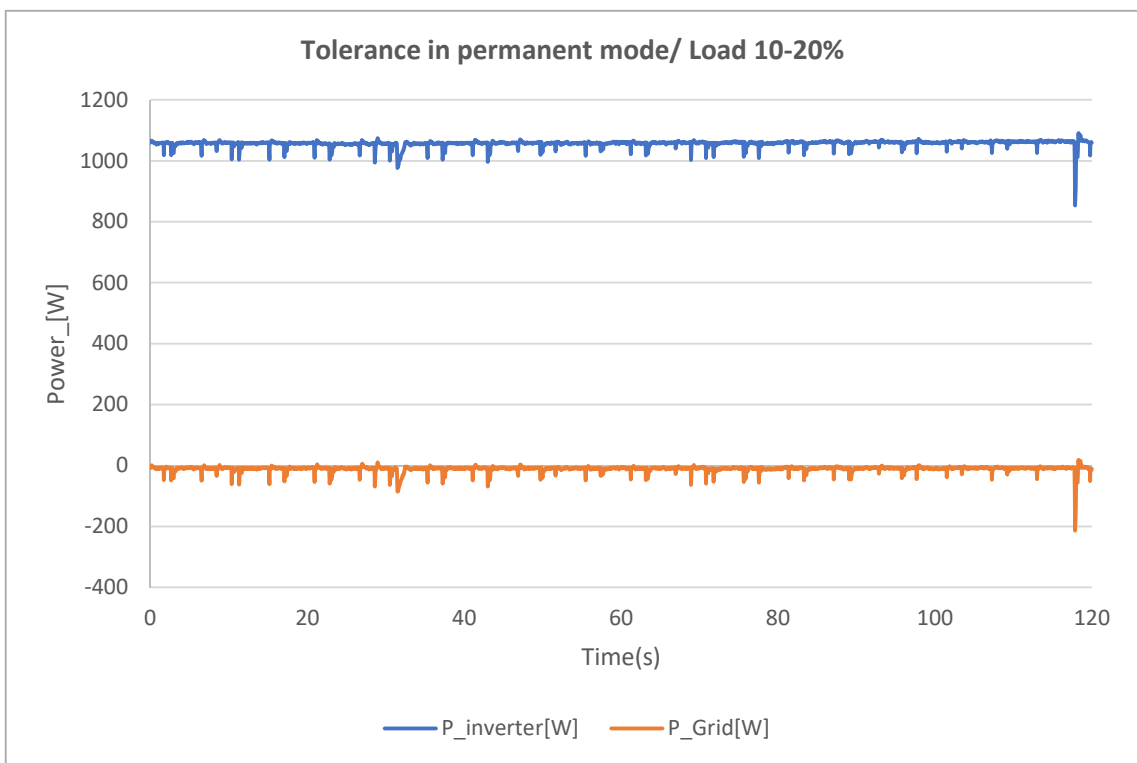
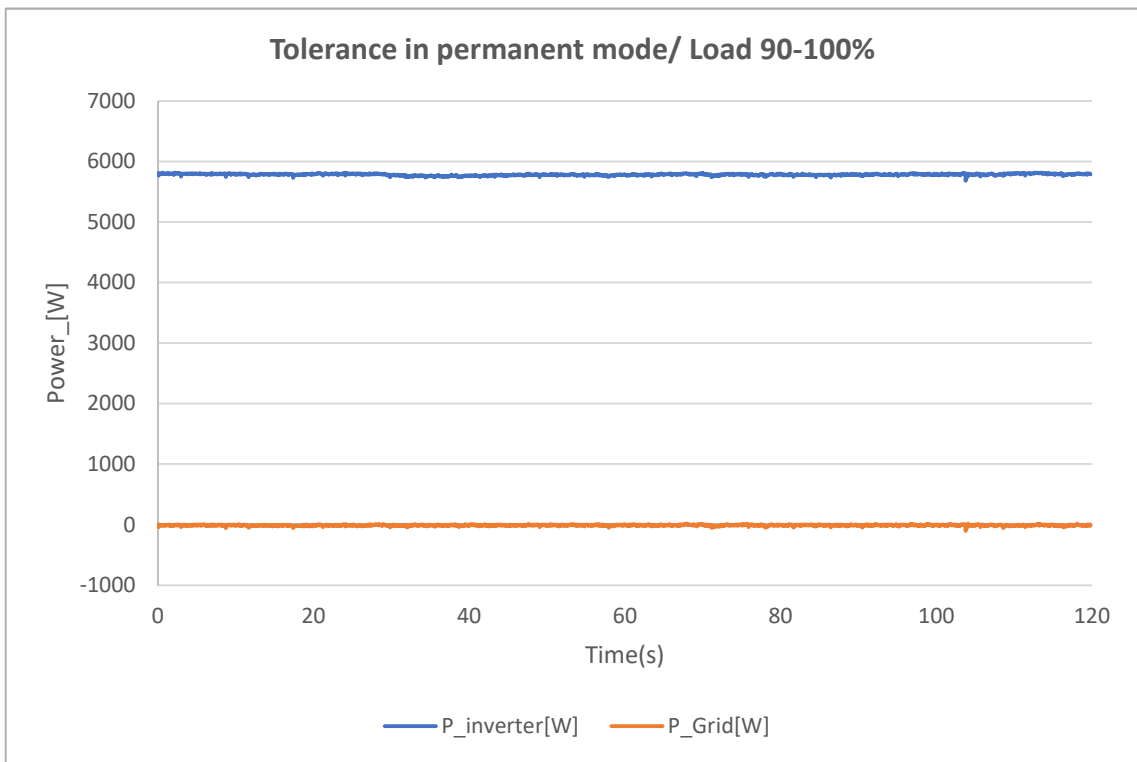
The smart power meter provides following operation modes:

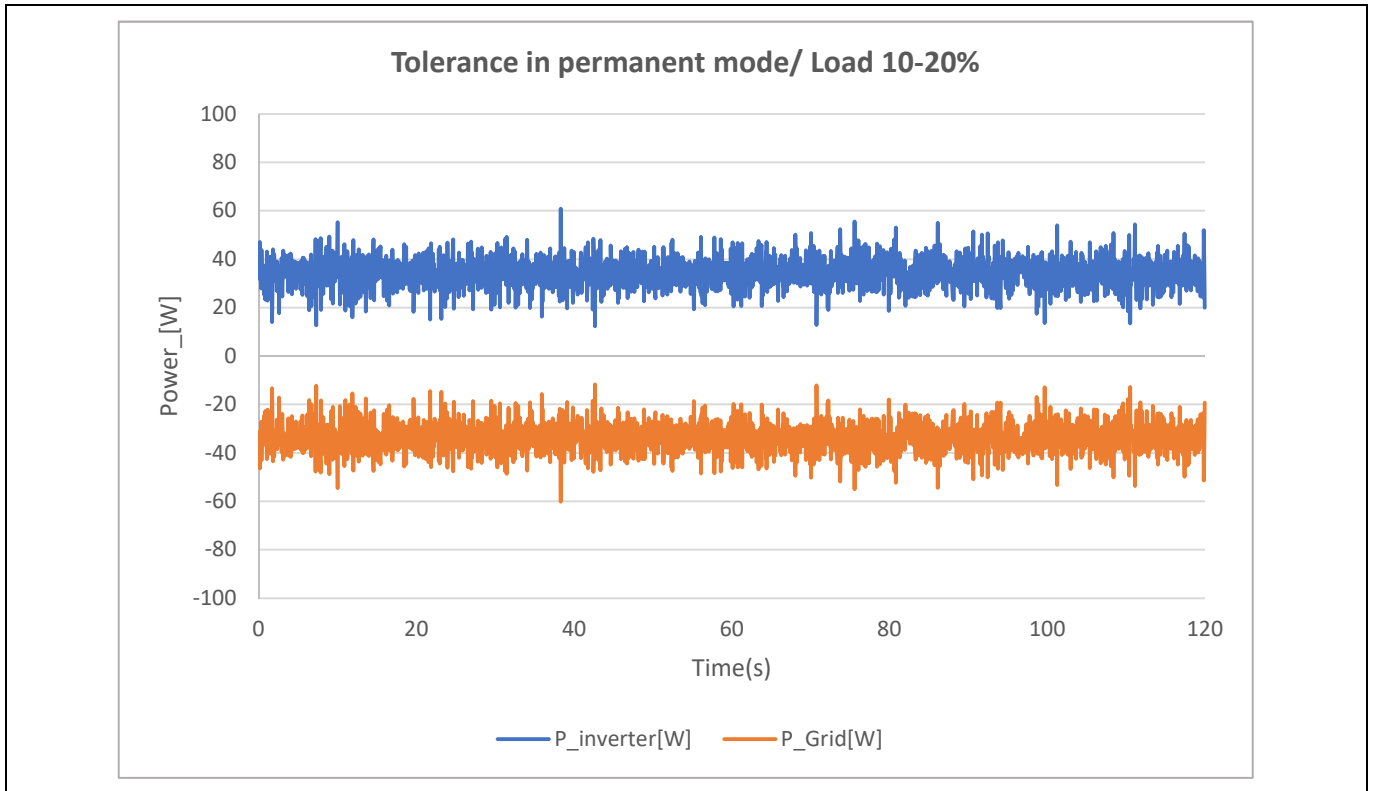
- Unlimited operation
No power supply limitation. The inverter products power depending on available primary energy.
- Limited power operation
Output power of the inverter is controlled:
power injection to the grid \leq defined power set point at the interconnection point
- Zero power injection
Output power of the inverter is controlled. Energy generation and consumption balance at the interconnection point can be achieved. No power injection into grid.



8) Electric characteristics of the generator	Informative
Note: The electric characteristics of the generators can be found on page 2.	
9) Maximum number of generators to be connected	Informative
Note: N/A	

5. Test							P
5.1. Tolerance in permanent mode							P
a) (Scheme of Single machine photovoltaic power generation system, see Figure 3)							
Connection scheme:	Phase 1	Phase 2	Phase 3	Test 1	Test 2	Test 3	Result
Single Phase	$P_{inv}\%$	$P_{inv}\%$	$P_{inv}\%$	P_{Grid} [kW]	P_{Grid} [kW]	P_{Grid} [kW]	
	90-100	90-100	90-100	-0,013	-0,010	-0,012	P
	10-20	10-20	10-20	-0,011	-0,011	-0,011	P
	0	0	0	-0,034	-0,034	-0,033	P
Test procedure:							
<p>The test must be repeated with the different type generators that are going to be approved for the system, each of which can be tested separately.</p> <p>To verify this condition, the following test is carried out, following the scheme shown in the figures 3:</p> <ol style="list-style-type: none"> 1. Connect the generator to a power source capable of supplying a power equal to or greater than the power of the generator to be tested. 2. Connect the generator to the network to be tested. 3. Set the load value according to the values indicated in table 1. 4. Wait a time of at least two seconds before beginning the measurement. <p>Measure the power exchanged at the test point, with an accuracy of at least 0,2%, making averages of 50ms.</p>							
Assessment criterion:							
<p>At all times, the power measured at the point of consumption must be greater than the power generated. The margin of difference between consumption and generation must exceed the tolerance value of the measurement system, calculated as the sum of the tolerance of the power analyzer and the class of the measurement transformers included in the system.</p>							
Note:							
<p>In case of unbalanced load the inverter will not inject any power.</p>							





5.2. Response to load disconnections						P
a) (Scheme of Single machine photovoltaic power generation system, see Figure 3)						
TEST	Initial load	Final load	Test 1	Test 2	Test 3	Result
	P _{inv} %	P _{inv} %	Response time in sec.	Response time in sec.	Response time in sec.	
1	90-100%	60-70%	1,05	0,80	1,20	P
2	90-100%	30-40%	1,60	0,90	1,80	P
3	90-100%	0%	1,45	1,55	1,60	P
4	60-70%	30-40%	1,65	1,65	1,80	P
5	60-70%	0%	1,45	1,35	1,35	P
6	30-40%	0%	1,45	1,35	1,35	P

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of which can be tested separately.

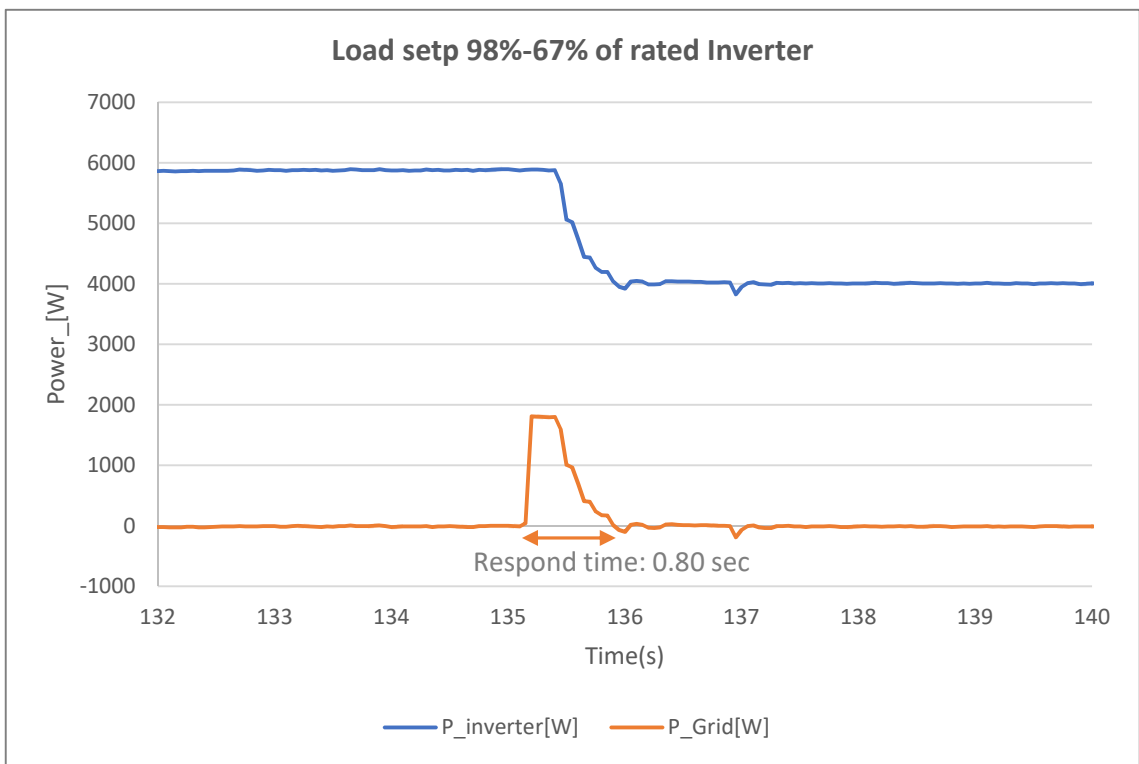
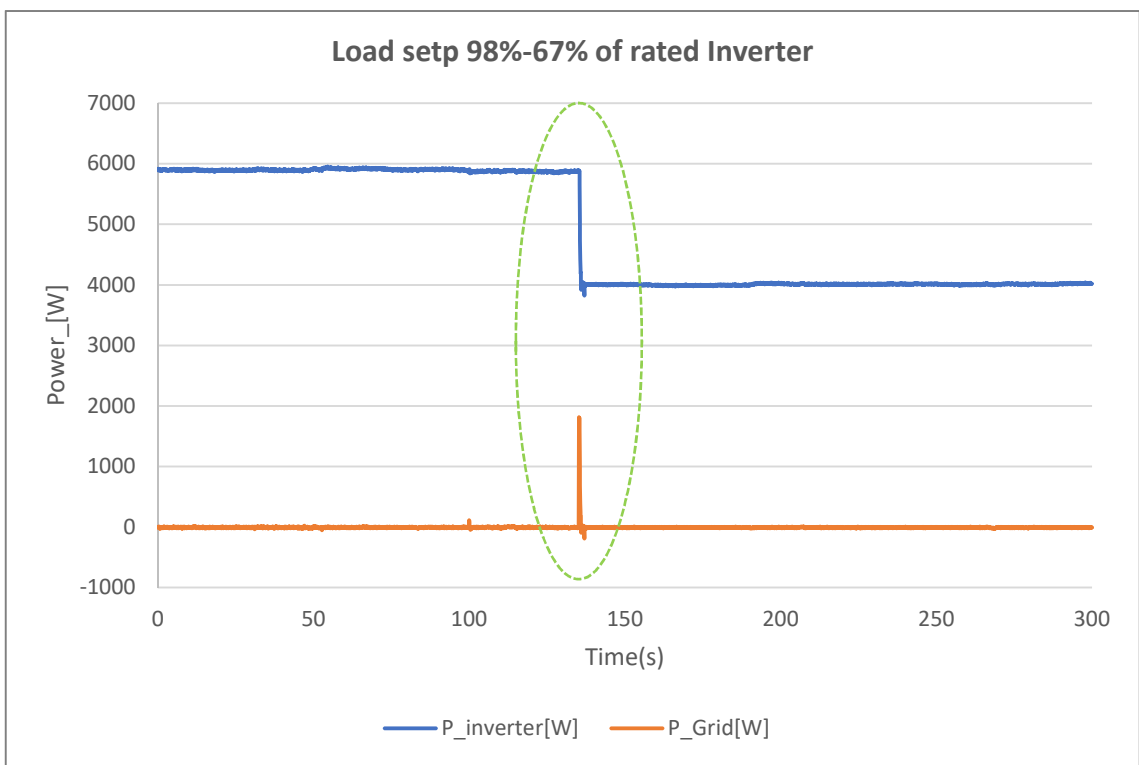
To verify this condition, the following test is carried out, following the scheme that corresponds to the system to be tested, shown in figures 1 to 3:

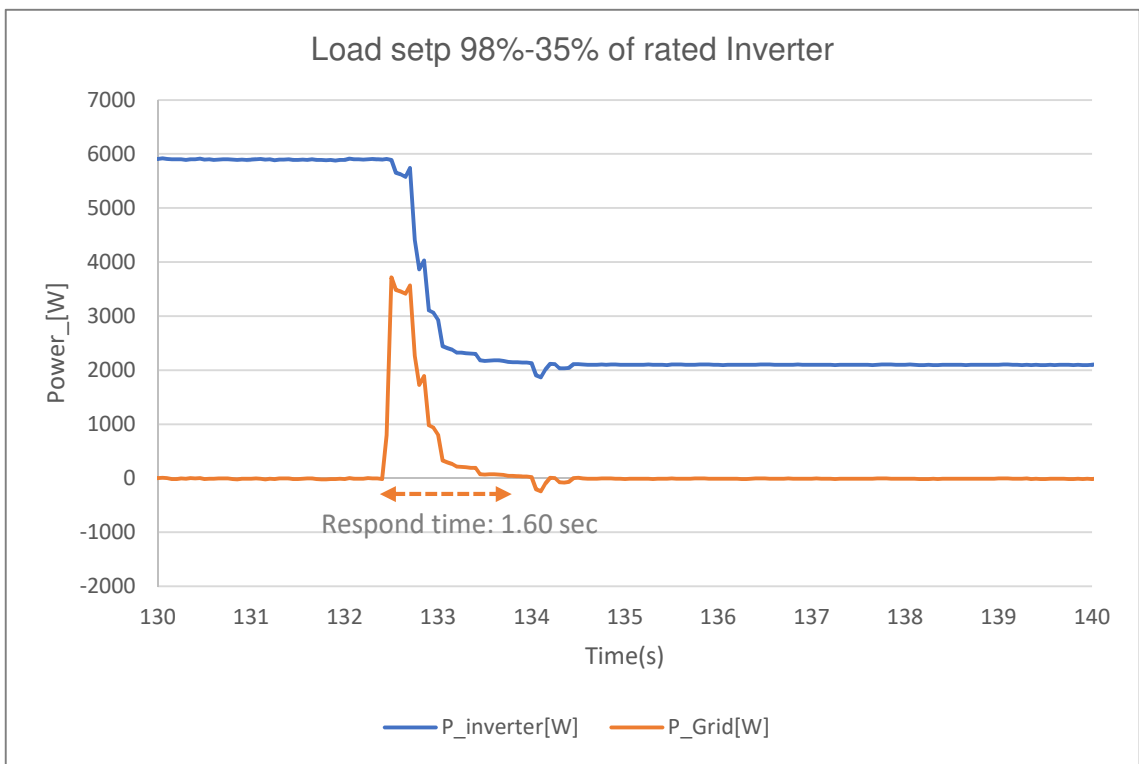
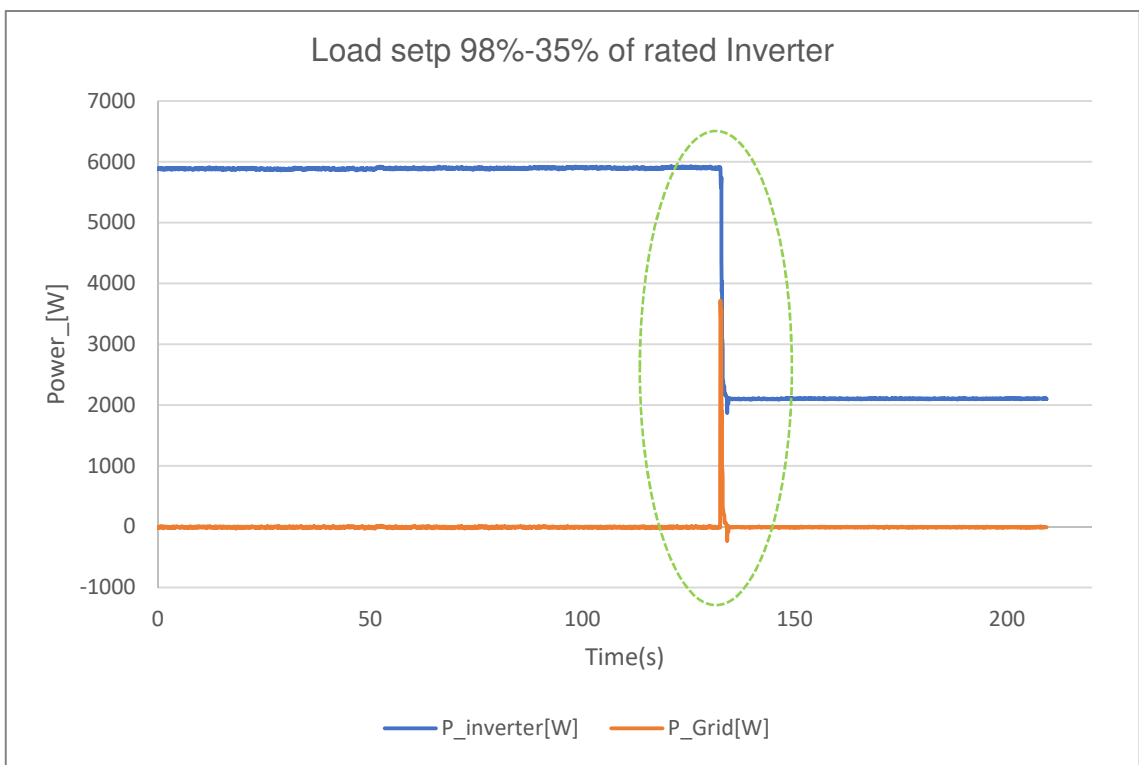
1. Connect the generator to a power source capable of supplying a power equal to or greater than the power of the generator to be tested.
2. Connect the generator to the network to be tested.
3. Carry out the load disconnections proposed in table 2.
4. Measure the power exchanged with the network, with an accuracy of at least 0,2%, making averages of 50ms in a time window of 2 min comprising at least one minute before and after the load disconnection.

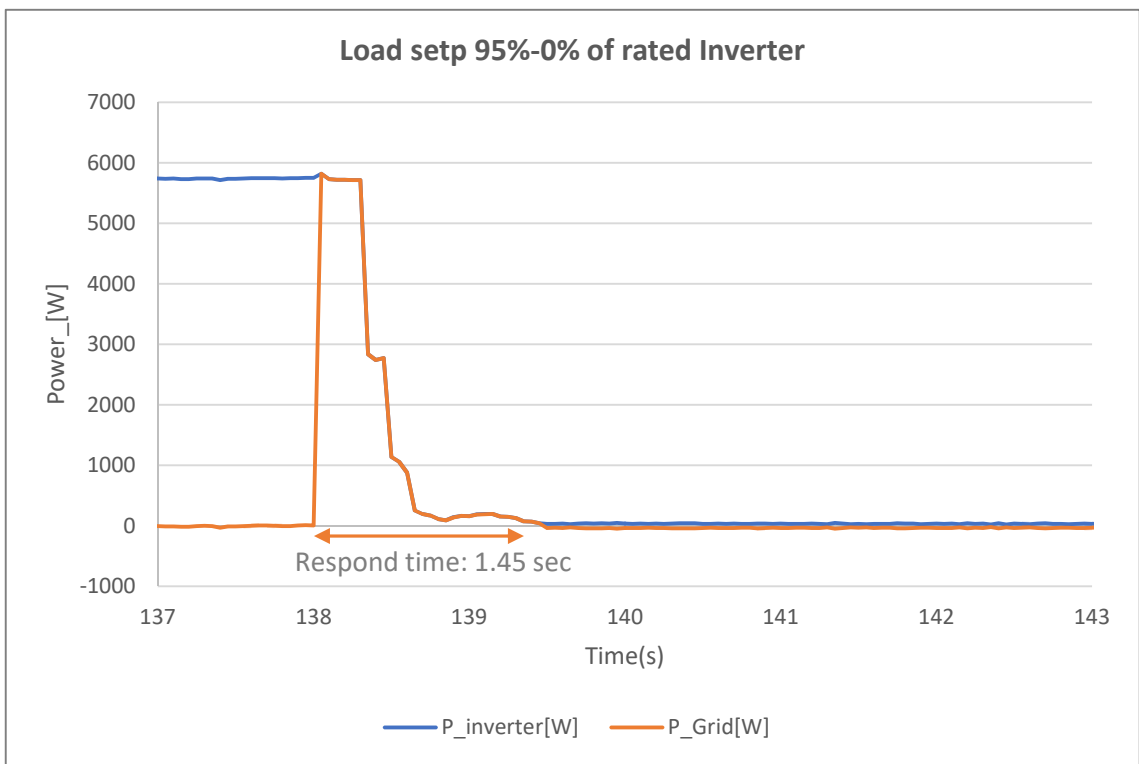
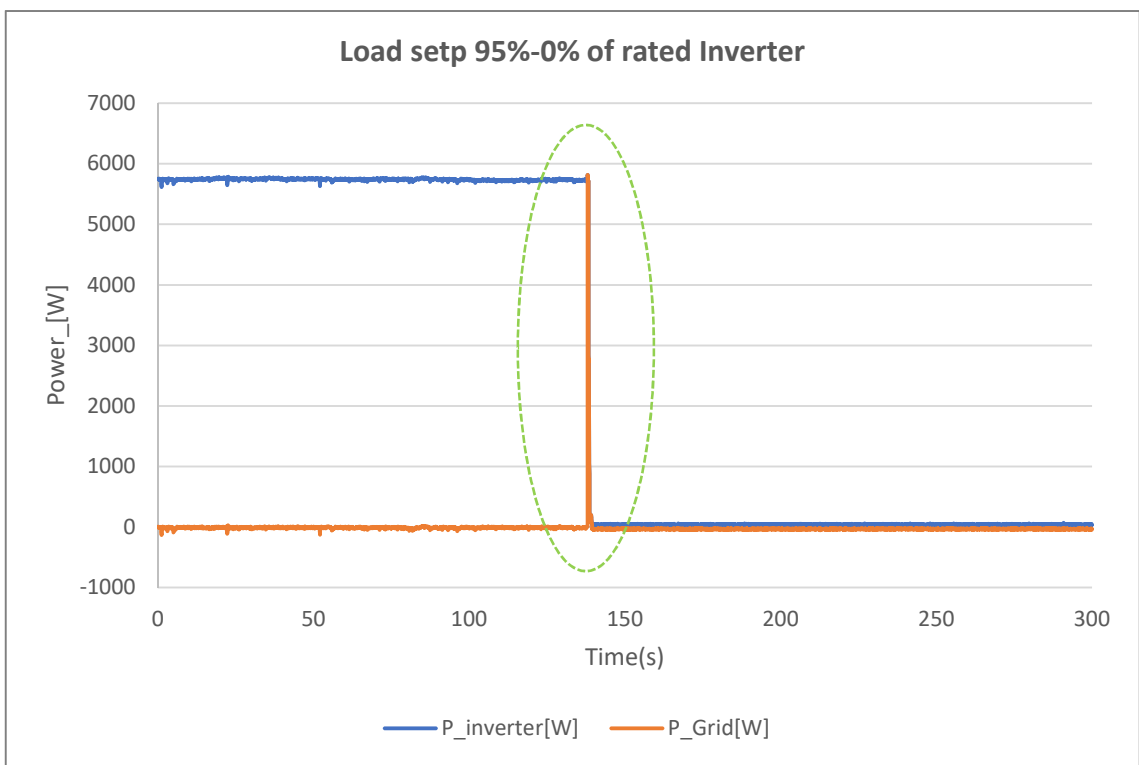
Assessment criterion:

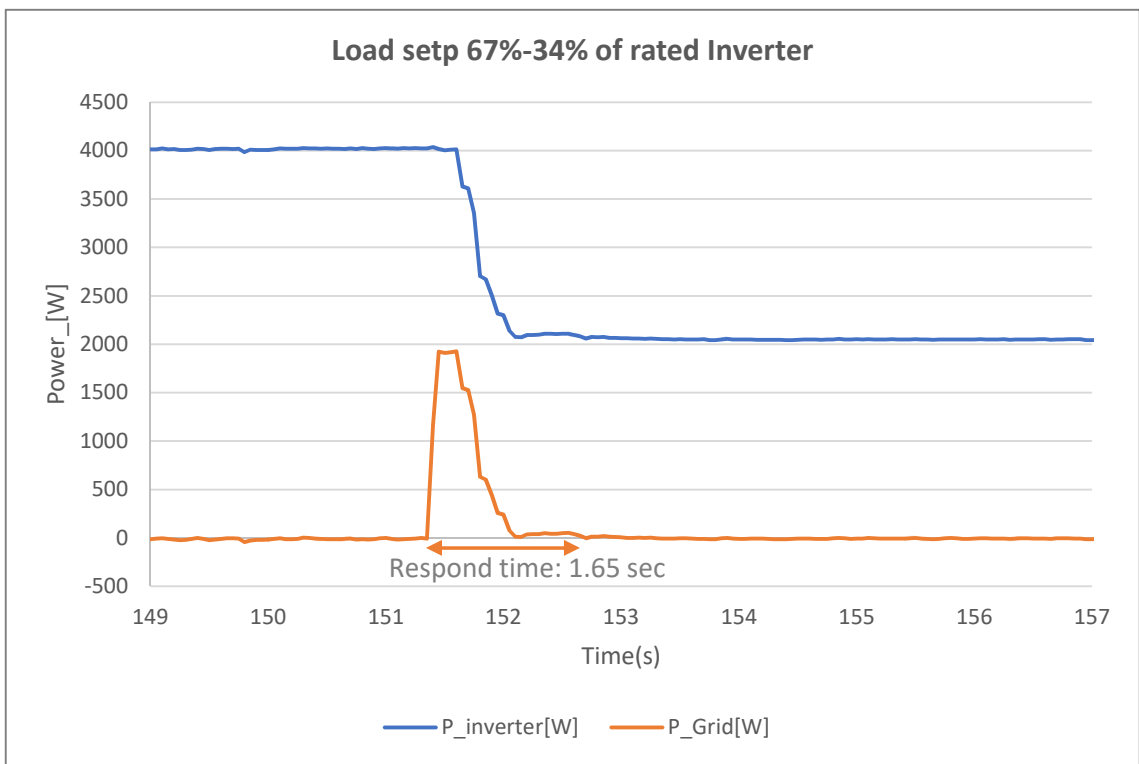
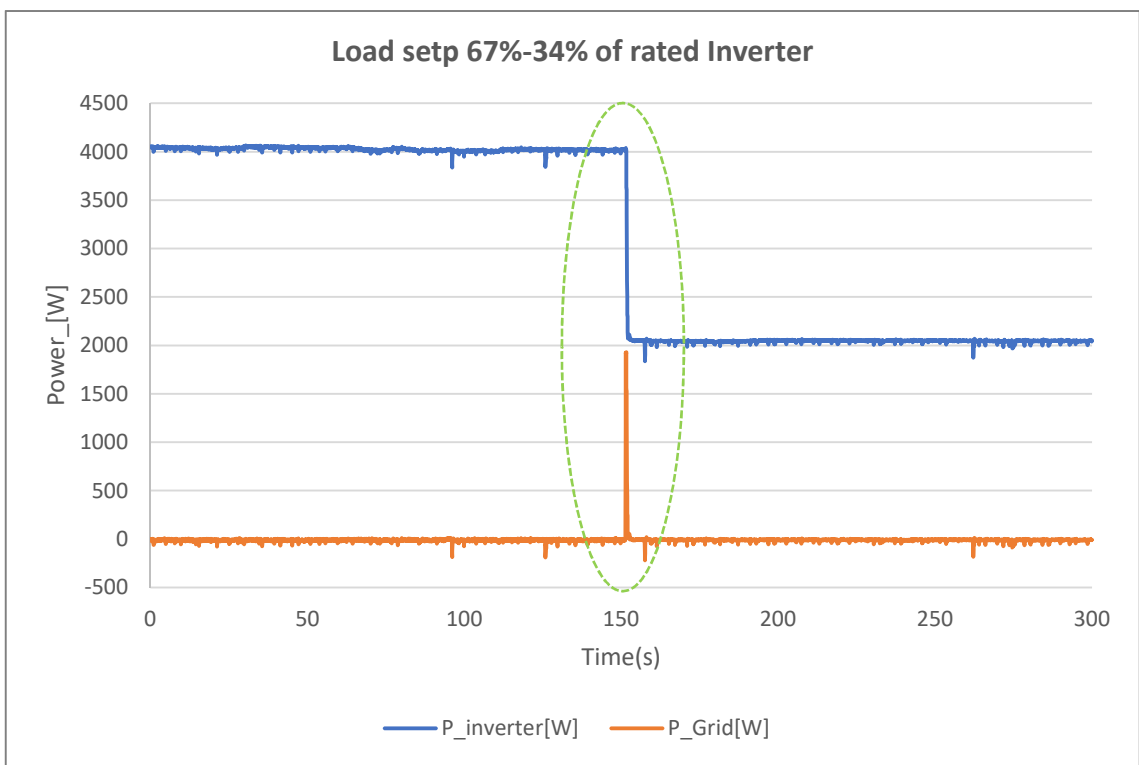
At all times, the power measured at the point of consumption must be greater than the power generated. The margin of difference between consumption and generation must exceed the tolerance value of the measurement system, calculated as the sum of the tolerance of the power analyzer and the class of the measurement transformers included in the system.

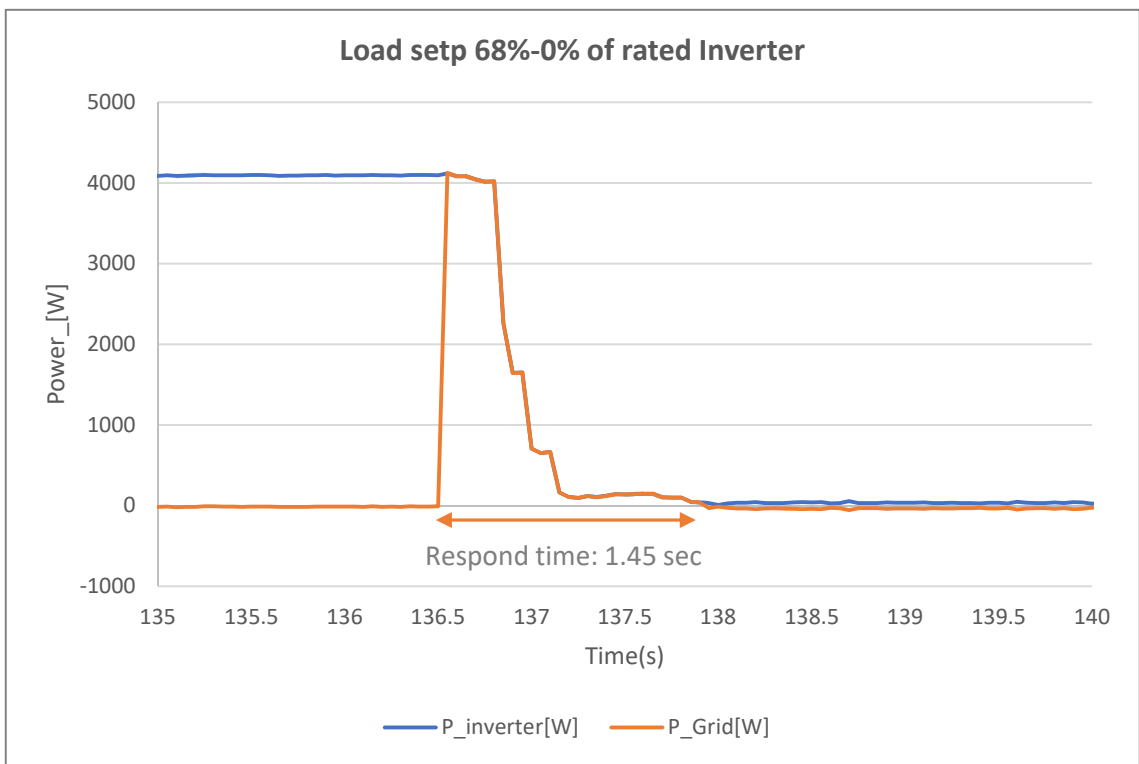
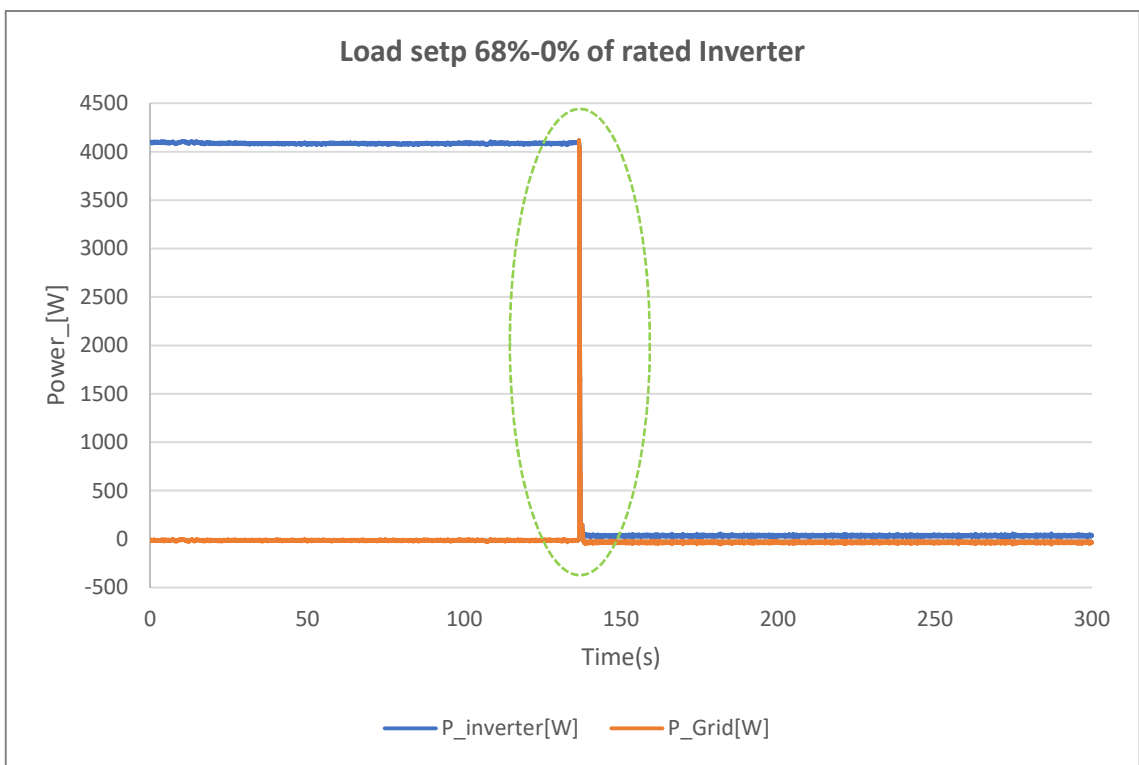
The breach of the previous requirement must be corrected in a time inferior to 2 s.

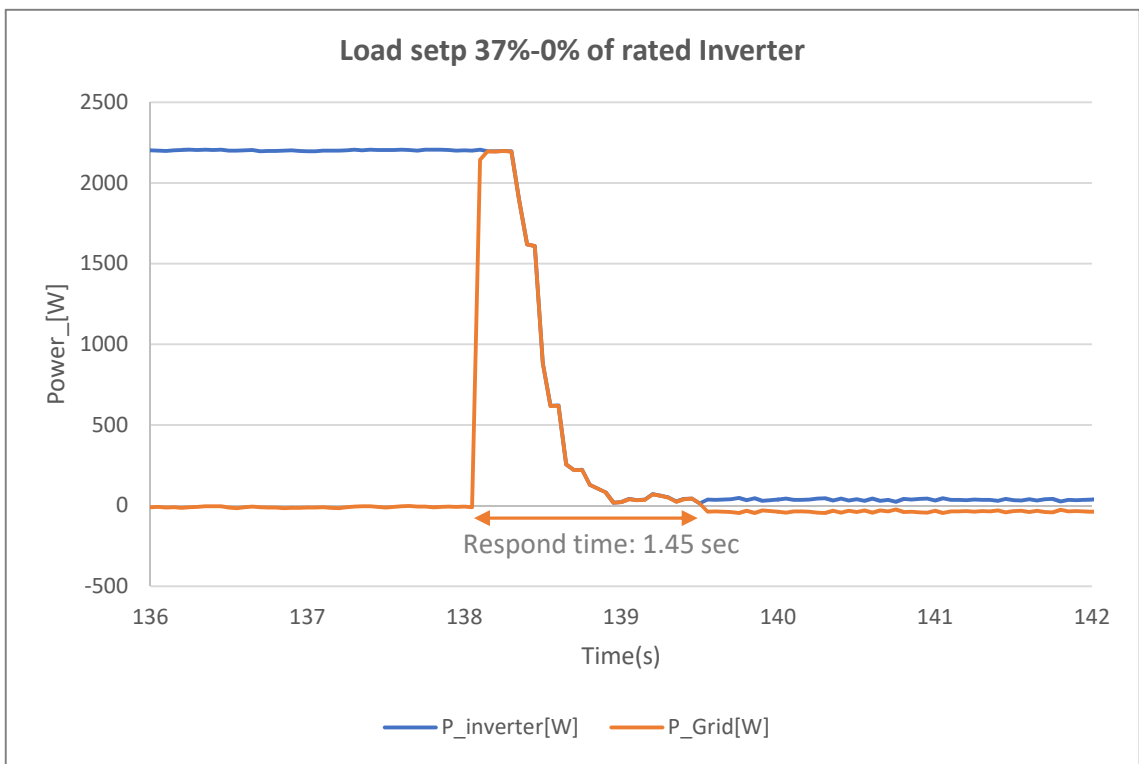
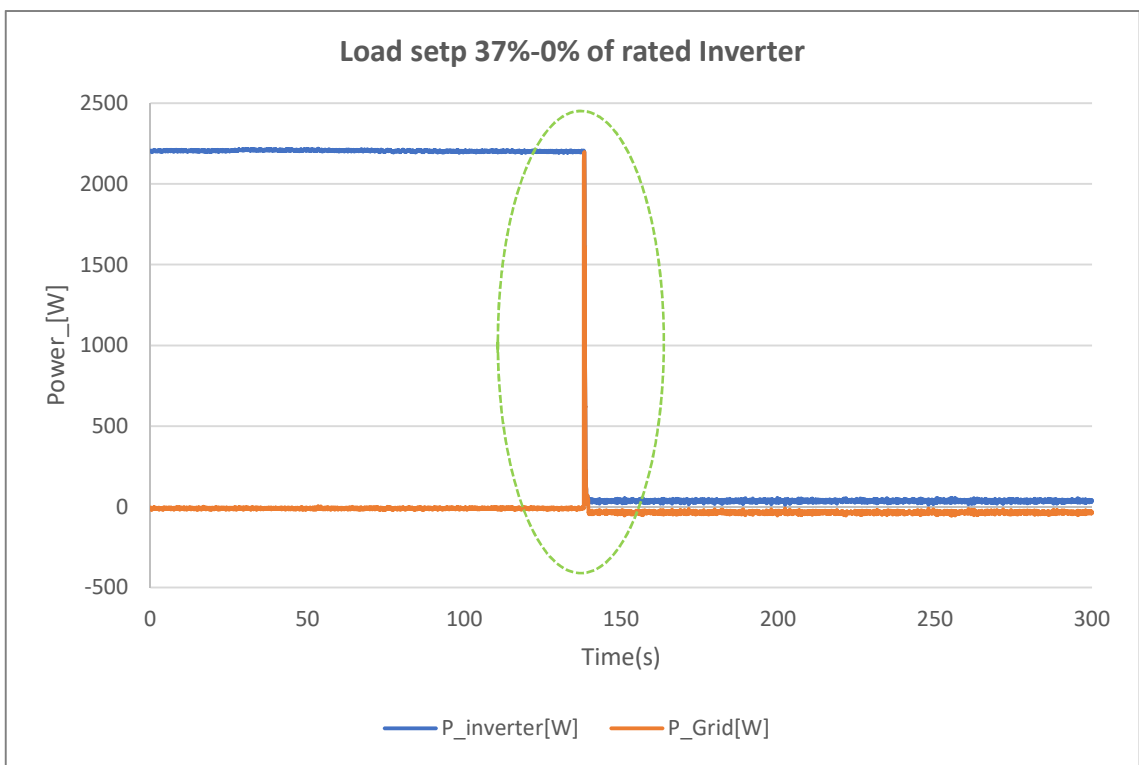












5.3. Response to power increases in the primary energy source						P
a) (Scheme of Single machine photovoltaic power generation system, see Figure 3)						
Step	AC load	Power DC source	Test 1	Test 2	Test 3	Result
	$P_{inv}\%$	$P_{inv}\%$	Response time in sec.	Response time in sec.	Response time in sec.	
1	60-70%	40-50%	0,30 s	0,45 s	0,25 s	P
2	60-70%	90-100%				

Test procedure:

The power limitation system must guarantee that when there is an increase in power in the primary energy source, for example an increase in irradiance in a photovoltaic installation, leading to a situation in which there is more available energy than consumption, the generator resets its production coming back to the permanent regime in less than 2 s.

The test must be repeated with the different type generators that are going to be approved for the system, each of which can be tested separately.

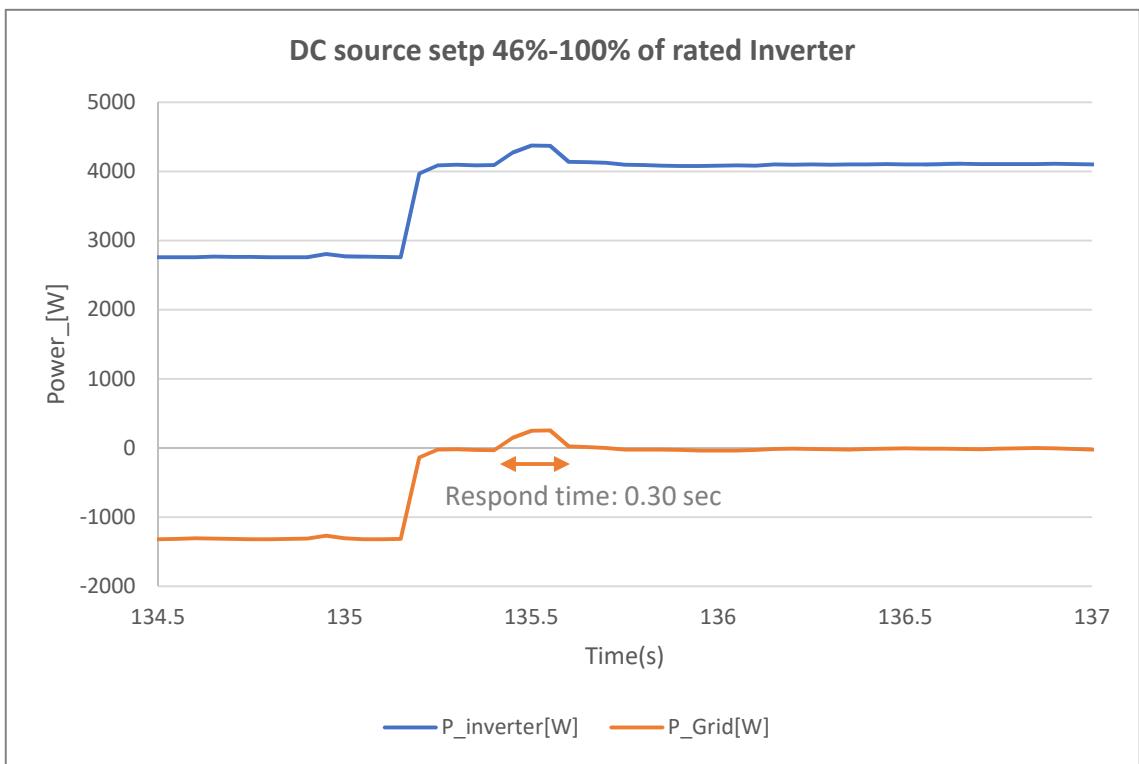
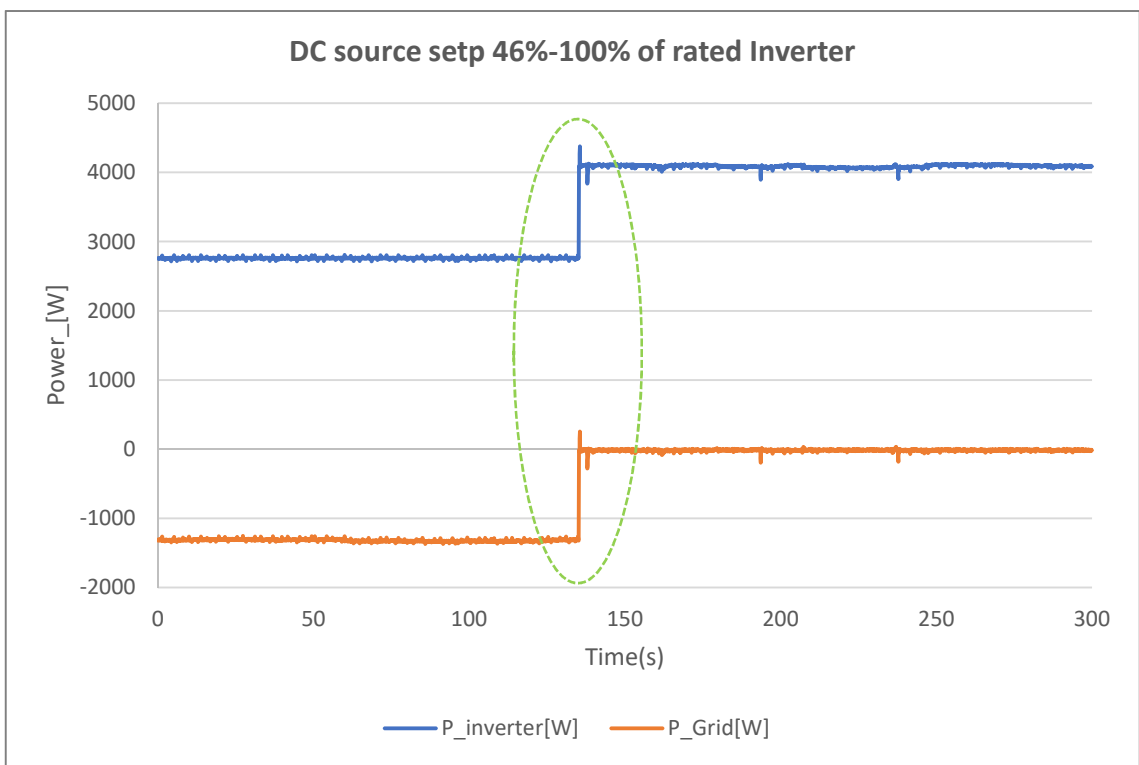
To verify this condition, the following test is carried out, following the scheme shown in figures 1 to 3:

1. Connect the generator to a power source that supplies between 40% and 50% of the power of the generator to be tested.
2. Connect the generator to the network to be tested.
3. Connect a load that consumes between 60% and 70% of the power of the generator to be tested.
4. Increase by a step the power available in the power source above 90% of the nominal power of the generator to be tested.
5. Measure the power exchanged with the network, with an accuracy of at least 0.2%, making averages of 50 ms in a time window of 2 min comprising at least one minute before and after the increase of the generator power.

Repeat each of the tests three times.

Assessment criterion:

At all times, the power measured at the point of consumption must be greater than the power generated. The margin of difference between consumption and generation must exceed the tolerance value of the measurement system, calculated as the sum of the tolerance of the power analyzer and the class of the measurement transformers included in the system.



5.4. Action in case of loss of communications							P
a) (Scheme of Single machine photovoltaic power generation system, see Figure 3)							
Step	AC load	Power DC source	Communication between energy meter and generator	Test 1	Test 2	Test 3	Result
	P _{inv} %	P _{inv} %		Response time in sec.	Response time in sec.	Response time in sec.	
1	60-70%	90-100%	Yes	1,100 s	1,180 s	0,640 s	P
2	60-70%	90-100%	No				

Note:

The generator must stop generating in case of loss of communication between the different elements of the system in less than 2 s time integrated in the same device.

To verify this condition, the following test is carried out, following the scheme shown in figures 1 to 3:

1 Connect the generator to a power source capable of supplying a power equal to or greater than the power of the generator to be tested.

2 Connect the generator to the indoor network to be tested.

3 Set a load of 60% and 70% of the rated power of the generator.

4 Cut off the communication between the control element and the power analyser.

5 Measure the elapsed time between the cut-off of the communication and the generator shutdown or total power limitation of the generator (0%).

6 Measure the power generated by the generator, with an accuracy of at least 0.2%, making means of 50 ms.

The test must be repeated 3 times.

The test is considered valid if the generator is disconnected or totally limits its generated power in less than 2 s. Repeat the test by cutting the communication between the control element and the generator.

Assessment criterion:

At all times, the power measured at the point of consumption must be greater than the power generated. The margin of difference between consumption and generation must exceed the tolerance value of the measurement system, calculated as the sum of the tolerance of the power analyzer and the class of the measurement transformers included in the system.

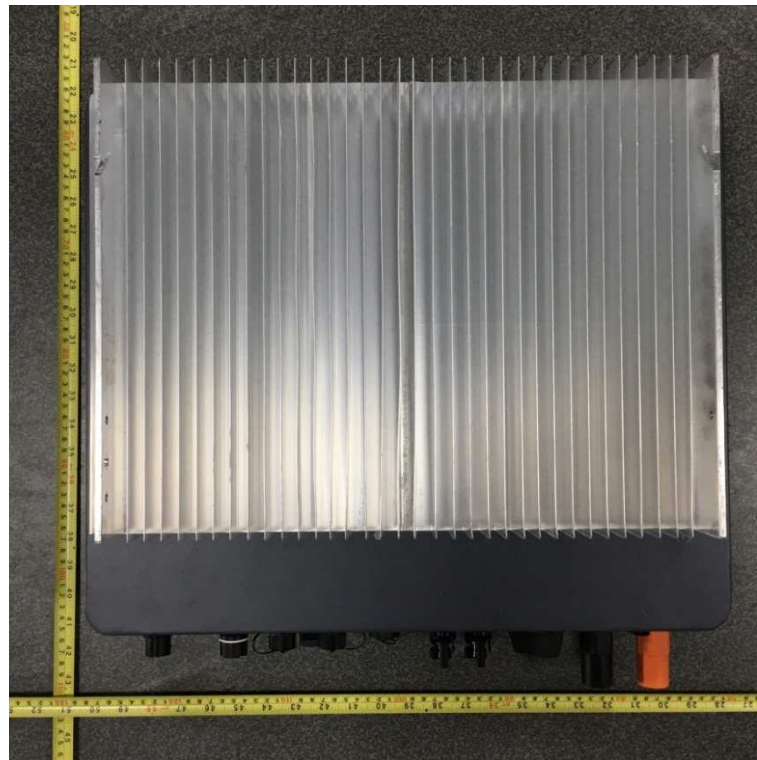
Annex No. 1

Pictures of the unit

Enclosure front view



Enclosure rear view



Enclosure bottom view



Enclosure side view



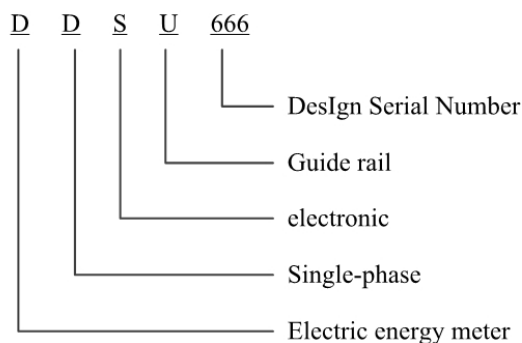
Power sensor



DDSU666 Datasheet:

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1.3 Model composition and significance



1.4 Environmental conditions

Rated temperature: -25°C ~ +55°C;

Limit temperature : -40°C ~ +70°C;

Relative humidity(average annual):≤75 %;

Atmosphere: 86kPa ~ 106kPa.

2. The overall principle block-diagram

The follow figure 1 is the overall principle block-diagram of the instrument.

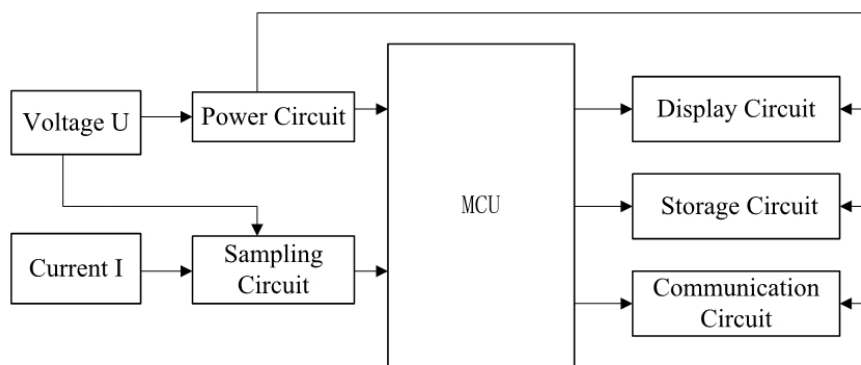


Figure 1 the overall principle block-diagram

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3. The major specifications and parameter

3.1 types and specifications

model numbers	accuracy grade	frequency	Reference voltage	current rating	constant	type
DDSU666	Active power I	50Hz/60Hz	230 V	5(60)A	800imp/kWh	direct access meter
DDSU666	Active power I	50Hz/60Hz	230 V	*/100mA	800imp/kWh	Mutual inductance access

*Note: in order to prevail in kind

3.2 Percentage error

The percentage error of single-phase electric meter shall not exceed the following limit value.

Current value		power factor	Percent error limit of Each level meter	
direct access meter	Connected with electronic transformers		1	2
$0.05 I_b \leq I < 0.1 I_b$	$0.02 I_n \leq I < 0.05 I_n$	1	±1.5	±2.5
$0.1 I_b \leq I \leq I_{max}$	$0.05 I_n \leq I \leq I_{max}$	1	±1.0	±2.0
$0.1 I_b \leq I < 0.2 I_b$	$0.05 I_n \leq I < 0.1 I_n$	0.5L	±1.5	±2.5
		0.8C	±1.5	--
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.5L	±1.0	±2.0
		0.8C	±1.0	--
The user's special requirements		0.25L	±3.5	--
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.5C	±2.5	--

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3.3 Start

Under the condition of reference voltage and table 4, the electric meter can start and continuously measure the electric energy.

instrument	grade of electric meter		power factor
	1 grade	2 grade	
direct access meter	0.004I _b	0.005I _b	1
Connected with electronic transformers	0.002I _n	0.003I _n	

3.4 Creeping

The meter should have good anti creeping logic, when the voltage loop is applied with 1.15 times reference voltage and current circuit is open, the meter will not produce more than 1 pulse.

3.5 Electrical parameters

Specified operating voltage range	0.9U _n ~ 1.1U _n
Extended operating voltage range	0.7U _n ~ 1.2U _n
Limiting operating voltage range	0 U _n ~ 1.9U _n
Voltage line power consumption	≤2W/10VA
Current line power consumption	≤2.5VA

3.6 Other technical parameters

Range of measurement	0 ~ 999999.99 kWh (Only show 6 bits, decimal shift automatically)
Display mode	LCD
Communication protocol	DL/T 645-2007 (default) Modbus-RTU

3.7 Key parts and components

Metering chip: HT5019

Pressure sensitive resistance: 14K681

crystal oscillator: 32.768KHz

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Power transformer: ZTY6.170.234

Printed circuit board: ZTY8.067.1930, ZTY8.067.1931, ZTY8.067.1932, ZTY8.067.1933.

4. Main functions

4.1 Metering function(Not as the basis for billing, for reference)

It measures the positive and negative electric energy, and the negative electric energy is added up as the positive

After power off, the stored data would not be lost.

4.1 Display function

When working in normal condition (load condition), the positive pulse indicator light should be flashing. If there is no flicker or light for a long time, please check the wiring.








Meaning of liquid crystal identification

Notations	Meaning
V	A unit of voltage, Meaning that LCD shows the voltage data
A	A unit of current, Meaning that LCD shows the current data
W	A unit of power, Meaning that LCD shows the power data
var	A unit of Reactive power, Meaning that LCD shows the Reactive power data
Hz	A unit of frequency, Meaning that LCD shows the frequency data
kWh	A unit of Active electric energy, Meaning that LCD shows the Active electric energy data
kvarh	A unit of Reactive power, Meaning that LCD shows the Reactive power data




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The measurement data pages display per 5 seconds, and the pages as follows. (if the instrument panel is not the same, depend on the actual model).

Display instructions

PageS	Content	instruction
Page1		Meaning that the meter is showing the voltage, the unit is 'V', The picture left shows : U=220.0V.
Page2		Meaning that the meter is showing the current, the unit is 'A', The picture left shows : I=5.000V.
Page3		Meaning that the meter is showing the active power, the unit is 'W', The picture left shows : P=0.0 W.
Page4		Meaning that the meter is showing the active energy, the unit is 'A', The picture left shows : Imp=0000.50kWh.
Page5		Meaning that the meter is showing the 645 communication protocol

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Page6		Meaning that the current 645 address is 100000000011
Page7		
Page8		Meaning that the baud rate is 2400

4.2 Communication function

The instrument adopts RS485 communication mode, the baud rate can be set to 1200, 2400bps, 4800bps, 9600bps.

The communication line can be connected up to 32 meters at the same time, and the address of each meter can be set. Communication connections should use Copper mesh shielded twisted pair and the diameter would not be less than 0.5mm². Wire the communication line distance from the power cable or other strong electric field, the maximum transmission distance is 1200m, the typical network connection is shown in the follow figure, and the user can object other suitable connection in accordance with specific conditions.

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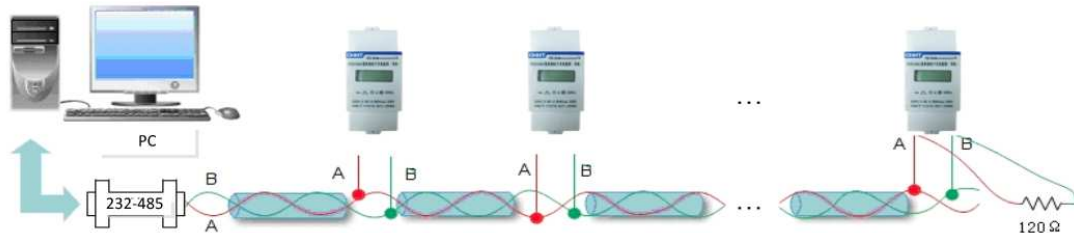


Figure 2 the typical network connection

When the instrument is set DL/T 645-2007 transmission mode, the instrument must measure up to the relevant stipulate in DL/T 645-2007. Pay attention to read data: electric energy data support power total; variable data support the voltage and current, instantaneous active and reactive power and power factor; support address settings, and the detail protocols are in DL/T 645-2007.

When DL/T 645-2007 protocol is changed to the ModBus-RTU protocol, the data frame is as follows:

FE FE FE FE 68 xx xx xx xx xx xx 68 14 0E 33 33 35 3D 35 33 33 33 33 33 33 33 33 33 CS 16

Parameter address	Parameter code	Instruction of the parameters	Type of data	Length of data Word	Read&write attributes
0000H	UCode	Programming password codE	16-bit with symbols	1	R/W
0001H	REV.	Reserved, actual read is the version number	16-bit with symbols	1	R
0002H	ClrE	Electric energy zero clearing CLr.E(1:zero clearing)	16-bit with symbols	1	R/W
0003H	RESERVED	RESERVED	16-bit with symbols	1	

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0004H	RESERVED	RESERVED	16-bit with symbols	1	
0005H	ChangeProtocol	Protocol changing-over	16-bit with symbols	1	R/W
0006H	Addr	Communication address Addr	16-bit with symbols	1	R/W
0007H	RESERVED	RESERVED	16-bit with symbols	1	
0008H	RESERVED	RESERVED	16-bit with symbols	1	
0009H	RESERVED	RESERVED	16-bit with symbols	1	
000AH	RESERVED	RESERVED	16-bit with symbols	1	
000BH	Meter type	Meter type	16-bit with symbols	1	R
000CH	BAud	Communication baud rate bAud	16-bit with symbols	1	R/W
000DH	RESERVED	RESERVED	16-bit with symbols	1	
000EH	RESERVED	RESERVED	16-bit with symbols	1	
000FH	RESERVED	RESERVED	16-bit with symbols	1	
0010H	RESERVED	RESERVED	16-bit with symbols	1	
Electric quantity of the secondary side					
2000H	U	Voltage	single precision floating decimal	2	R
2002H	I	Current	single precision floating decimal	2	R
2004H	P	Conjunction active power , the unit is KW	single precision floating decimal	2	R
2006H	Q	Conjunction reactive power , the unit is Kvar	single precision floating decimal	2	R
2008H	RESERVED	RESERVED	single precision floating decimal	2	R
200AH	PF	Conjunction power factor	single precision floating decimal	2	R

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200CH	RESERVED	RESERVED	single precision floating decimal	2	R
200EH	Freq	Frequency	single precision floating decimal	2	R
2010H	RESERVED	RESERVED	single precision floating decimal	2	R
Electrical data of the secondary side					
4000H	Ep	Active in electricity	single precision floating decimal	2	R
400AH	-Ep	Reverse in electricity	single precision floating decimal	2	R

Note: XX XX XX XX XX is the table communication address; CS is the check code

When the instrument is set to the ModBus-RTU transmission mode, the ModBus-RTU communication protocol uses a master-slave mode to communicate in a communication line. First, the signal of the host computer is addressed to a single address terminal device (slave), and then the response signal from the terminal device is transmitted to the host in the opposite direction, i.e., half duplex mode of operation. The agreement is only allowed in the host (PC, PLC) and the communication between the terminal equipment between the terminal equipment and does not allow the independent data exchange, so that the terminal equipment does not occupy the communication line in their initialization, but only to query the machine response signal.

The instrument provides the ModBus-RTU communication protocol (see Appendix A), the communication can read or modify the parameter information, see the following table.

Table 3 Communication parameter information

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Change Protocol: Protocol switch mode word, when the data is 2, the protocol is Modbus-RTU protocol, when the data is 1, the protocol is DL/T 645-2007 protocol;

CLr.E: electric energy cleared, when write 1 will clear the total electric energy;

BAud: 0:1200bps; 1:2400bps; 2:4800bps; 3:9600bps.

4.3 Output function

The electric energy pulse output interface of the meter is a passive photoelectric isolated output, and the output pulse waveform is 80 + 16ms square wave.

Meter pulse indication uses long life led display.

5. Externa and installation dimension

Externa dimension: 36mmx89mmx74mm; Installation dimension: 35mm.

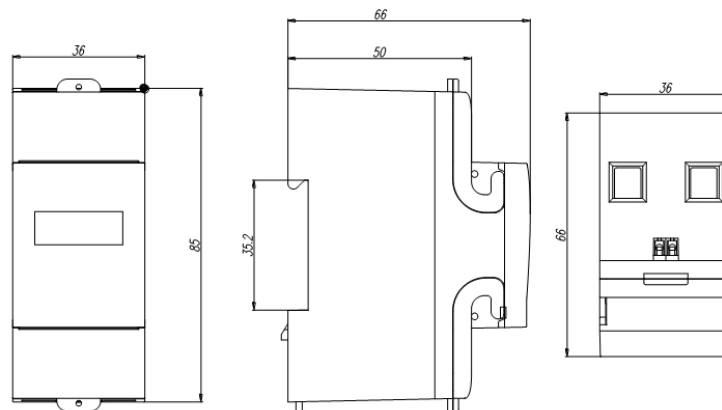


Figure 3 Outline and installation dimension

6. Installation and instructions for use

6.1 Check

- 1) Before installation, please check whether the model and specifications of the products on the box are in line with the material, if not, please contact the supplier;
- 2) Check the packing case of the product is damaged, if damaged, please contact the supplier.

6.2 Install

Stuck the instrument on the guide rail directly, and install the instrument and the rail in the distribution box finally.

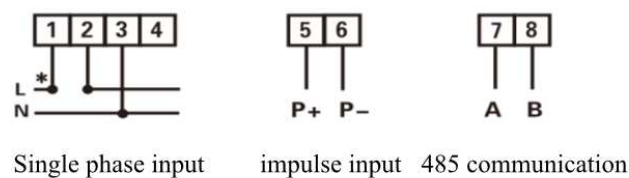
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- 1) when installed, stuck the end of the card slot in the guide rail.
- 2) when uninstalled, use a screwdriver to press the card to remove the instrument

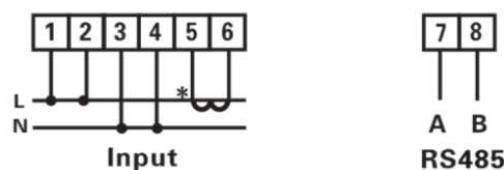
6.3 Connection

6.3.1 Terminal description

Prior to power up, check the wiring is correct, wiring diagram is as follow:



Direct access to the instrument



Mutual inductance access to the instrument

Figure 4 wiring diagram

7. Diagnosis, analysis and troubleshooting of common faults

7.1 Display fault

- (1) Check up: Dose the actual wiring accord with wiring requirements, actually the positon of 'N'.
- (2) Measure: If the connection is no problem, check up the external line related using a multi-meter to make sure the wiring terminal and diverter is conducting.

Note: when checking up the current and voltage lines, we must ensure that the signal current and voltage is in the open state, to ensure personal safety.

7.2 Communication failure

- (1) Check up: Check up the communication settings are the same as the PC, such as address, baud

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rate, and parity.

If the above methods can't remove failures, please contact the Zhejiang CHINT Instrument Co., Ltd..

8. Package, transportation and storage

The package of the meter should use the material which can meet environmental requirements. The storage environment temperature is $-40^{\circ}\text{C} \sim 70^{\circ}\text{C}$, relative humidity should be no more than 75%.

The package should meet the standards in GB/T 13384-2008, Conventional storage and transportation environment should meet the standards in GB/T 25480-2010.

A complete set of packaging products, including follows:

- 1) A meter
- 2) A user manual
- 3) A packet of desiccant
- 4) Certificate

9. Maintenance and repair

If users find any quality problem within 18 months from the date of dispatch, our company is responsible for repairing or replacing for free, on the condition that users operate according to the manual's provision with correct operation and the factory's seal is complete.

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Appendix A MODBUS-RTU Communication protocol

A.1 Communication format

Transmission of information is adopted asynchronous mode and byte as the unit. The communication data transmitted between the host and slave computer is the format of 11-digit bits, including 1 start bit(0), 8 data bits and 2 stop bits(1).

Format of information frame:

Table A.1

Start	Address code	Function code	Data field	CRC check code	End
Pause time for more than 3.5 characters	1 byte	1 byte	N bytes	2 bytes	Pause time for more than 3.5 characters

A.2 Communication information transmitting procedure

When communication command is transmitted from the host computer to the slave device ,the slave device which matches the address code sent by the host computer receives communication command. If CRC checks without any fault, then corresponding operation is carried out, after that the implement result (data) is returned to the host computer. The returned information contains address code, function code, implement date and CRC check code. No information will be returned upon erroneous CRC verification code.

A.2.1 Address code

Address code is the first byte of each communication frame, the range is 1 ~ 247. Each slave must have an exclusive address code in the bus, only the slave device which matches the address code sent by the host computer can respond returned information. When the slave device returns back information, returned data all begins with respective address code. The address code sent from the host computer indicates the slave address, and the returned address code of the slave computer indicates the slave address. The corresponding address code indicates the source of the information.

A.2.2 Function code

It's the second byte of each communication frame. It's sent by the host and tells the slave

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computer what actions should be carried out. The slave will respond, it indicates the slave have responded the host and carry out relative operations .The returned function code of the slave is the same as the function code sent by the host.

The meter supports the following two function codes:

Table A.2

Function code	Definition	Operation
03H	Read register	Read the data of one or several registers
10H	Write multi-port register	Write n 16-digit binary data into n continuous registers

A.2.3 Data field

The data field is different with different function codes. These data can be numerical values, reference addresses and so on. For different slave devices, both the address and data information are different, and the communication information table should be provided.

The host utilizes communicate command (function code 03H and 10H) to read and modify the data registers of the slave freely. But the data length which is read or write at one time should not be out of the effective range of the data register's address.

A.3 Function code

A.3.1 Function code 03H: Read register

For example: The host intends to read slave address 01H, 2 register data whose start register address is 0CH, then the host will send:

Table A.3

Host to send		Sent data
Address code		01H
Function code		03H
Start register address	High byte	00H
	Low byte	0CH
The number of registers	High byte	00H

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CRC check code	Low byte	02H
	Low byte	04H
	High byte	08H

If the data of the slave register 0CH, 0DH is 0000H, 1388H, the slave will return:

表 A.4

Slave to return		Returned information
Address code		01H
Function code		03H
The number of bytes		04H
Data of register 0CH	High byte	00H
	Low byte	00H
Data of register 0DH	High byte	13H
	Low byte	88H
CRC check code	Low byte	F7H
	High byte	65H

A.3.2 Function code 10H: Write multi-port register

For example: The host intends to keep the data 0002H、1388H、000AH into 01H slave address, 3 registers whose start register address is 00H, the host will send:

表 A.5

Host to send		Sent information
Address code		01H
Function code		10H
Start register address	high byte	00H
	low byte	00H
The number of	high byte	00H

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registers	low byte	03H
Number of written bytes		06H
Data of 00H to be written	high byte	00H
	low byte	02H
Data of 01H to be written	high byte	13H
	low byte	88H
Data of 02H to be written	high byte	00H
	low byte	0AH
CRC check code	low byte	9BH
	high byte	E9H

The slave will return:

Slave to return		Returned information
Address code		01H
Function code		10H
Start register address	high byte	00H
	low byte	00H
The number of registers	high byte	00H
	low byte	03H
CRC check code	low byte	80H
	high byte	08H

A.4 16-digit CRC check code

The host and slave can be judged by the check code to see if the received information is correct or not. The interruption by electronic noises or other factors may cause errors during information transmission. The check code can check the communication information of the host or slave is correct or not.

16-digit CRC check code is calculated by the host, it's located at the end of the transmit information frame. The slave recalculates the CRC of the received information and compares if the

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calculated CRC goes in line with the received CRC, if not, there is error. Only 8 data bits are used during CRC calculation, both the start bits and the stop bits are not involved in the calculation.

The calculation method of CRC check code is as follows:

- 1) Pre-arrange one 16-digit register as a hexadecimal FFFF (i.e. fully 1), the register is called CRC register;
- 2) Make the first 8-digit binary data (the first byte of the communication information frame) with the lower 8 digits of the 16-digit CRC register by XOR calculation, the result is placed in CRC register;
- 3) Shift the content of CRC register rightward by one digit (towards the lower digit) and fill in the highest digit with 0, check the shift-out digit after rightward shifting;
- 4) If the shift-out digit is 0: repeat step 3) (shift rightward one digit again);
If the shift-out digit is 1: make CRC register with multinomial A001 (1010 0000 0000 0001) by XOR calculation
- 5) Repeat step 3) and 4) until shift rightward for 8 times, then all the 8 digits are processed;
- 6) Repeat step 2) and 5), process the next byte of the communication information frame;
- 7) After calculating all the bytes of the communication information frame (exclude CRC check code) according to the above steps, the content of the CRC register to be get is: 16-digit CRC check code.

A.5 Error handling

When the meter detects other errors except the error of CRC check code, the information will be returned to the host, the highest digit of the function code is 1, i.e. the function code returned to the host from the slave is adding 128 base on the function code sent from the host. The error returned from the slave is as follows:

表 A.7

Address code	Function code (the highest digit is 1)	Error code	low byte of CRC check code	high byte of CRC check code
1 byte	1 byte	1 byte	1 byte	1 byte

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Error code is as follows:

表 A.8

01H	Illegal function code	the meter does not support the received function code
02H	Illegal register address	The received register address exceeds the register address range of the meter
03H	Illegal data value	The received data exceeds the data range of the corresponding address

Current sensor



HY94C2 Datasheet:

SPECIFICATION	STMHALL	BEIJING STM MEASUREMENT & CONTROL TECHNOLOGY CO.,LTD	
Model Name		Model Type	
Split-core Current Transformer		HY94C2	
		Version	D.03



Features

For the measurement or control of AC current in power cables and equipment
Electrical insulation between primary side and secondary side
Split-core structure, easy to be mounted without primary conductor dismounting
Secondary side lead output

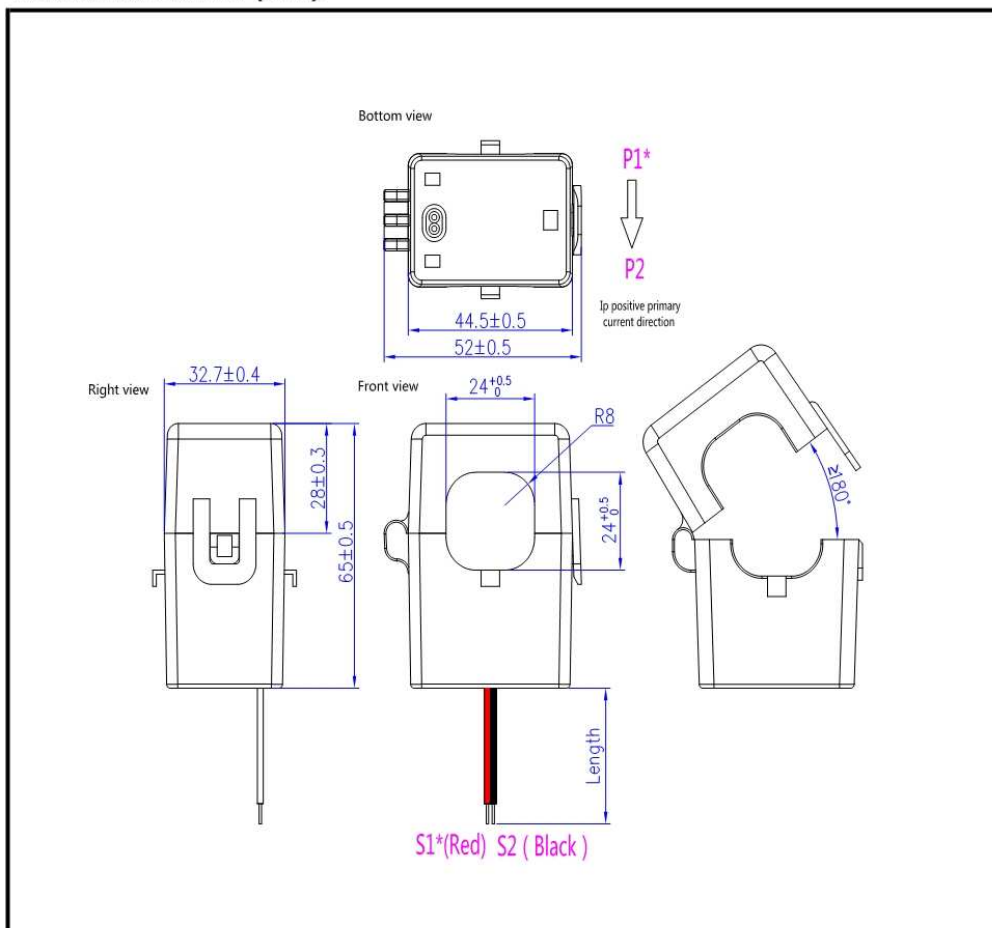
Performance data

I_{PN}	Primary nominal rms current	200	A
I_{SN}	Secondary nominal rms current	100	mA
X	Accuracy class @ $R_L \leq 20\Omega$ (IEC 60044-1:2003)	0.5	
V_d	R.m.s.voltage for AC isolation test @50Hz,1min	2	kV
K_n	Voltage transformer ratio	2000: 1	
R_i	Insulation resistance @500V DC	100	M Ω
T_s	Ambient storage temperature	-45...+90	$^{\circ}\text{C}$
T_A	Ambient operating temperature	-40...+85	$^{\circ}\text{C}$
RH	Environmental relative humidity	≤ 90	%RH
U_m	Highest voltage for equipment	0.72	kV
Length	Length of secondary wires	$1 \pm 3\%$	m
	Working frequency	50...400	Hz
	Primary aperture	24*24	mm
	Overload rating	120%	
	Altitude	≤ 1000	m
	Working environment	No serious pollution No strong vibration	
	Insulated plastic case material	UL 94-V0	

Model type explanation

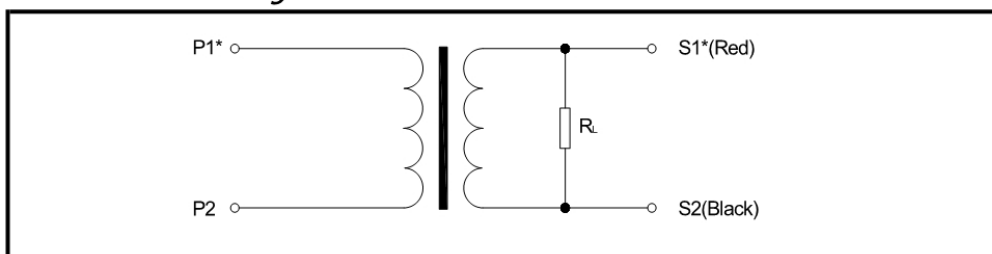
HY	Marking of STM transformer product series
94	Product series
C	Current transducer
2	#2 product

Mechanical outline (mm)



Note: I_s is positive when I_p flows in the direction of the arrow.

Electric schematic diagram



STMHALL	Company	BEIJING STM MEASUREMENT & CONTROL TECHNOLOGY CO.,LTD
	Website	www.bjstmck.com

www.bjstmck.com

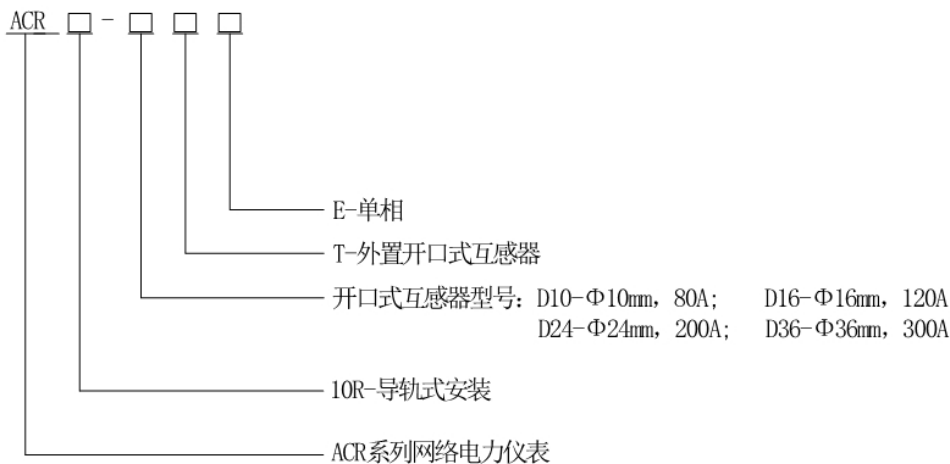
2

Power sensor & Current sensor



ACR10R-D24TE Datasheet:

2. 产品规格 Product Specifications



E-单相	E-Single-phase
T-外置开口式互感器	T-External open current transformer
开口式互感器型号	Open current transformer model:
10R-导轨式安装	10R-Rail-type installation
ACR 系列网络电力仪表	ACR series grid electrical instruments

3. 产品功能 Product Function

型 号 Model		ACR10R-DxxTE
功 能 特 性 Function		
测 量 参 数 Measurement Parameters	单相电流 Single-phase current	■
	单相电压 Single-phase voltage	■
	单相 (有功功率、 无功功率、功率因素) Single-phase (active power, reactive power, power factor)	■
	单相 (有功电能、无功电能) Three-phase (active energy, reactive energy)	■

注: 1、“■”为标配功能, 以上仪表标配 1 路 RS485 通讯;

Note:1. “■” refers to standard function, the standard configuration for above instruments is 1 channel RS485 communication.

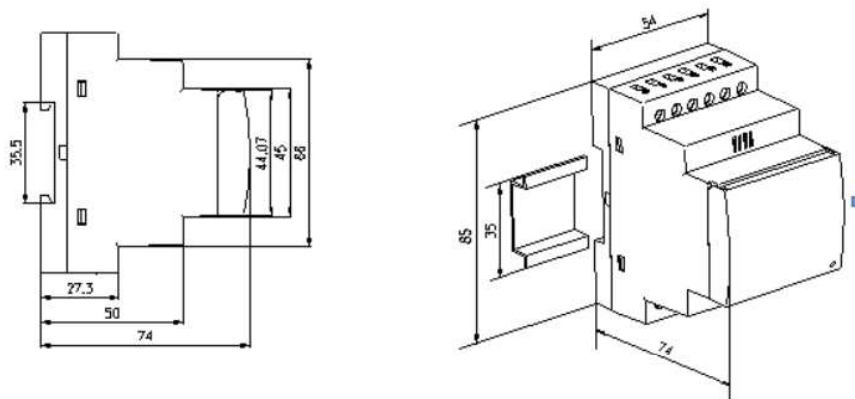
4. 技术参数 Technical Parameters

技术参数 Technical parameters		指标 Indicators
输入 Input	网络 Grid	单相 Single-phase,
	频率 Frequency	45~65Hz
	电压 Voltage	额定值: AC 100V、400V Rated voltage: AC 100V, 400V
		过负荷: 1.2 倍额定值 (连续); 2 倍额定值持续 1 秒 Overload: 1.2 times the rated voltage(continuous); 2 times the rated voltage lasting for 1 second
		功耗: 小于 0.2VA Power consumption: less then 0.2VA
	电流 Current	额定值: 10A, 20A, 40A, 80A, 120A, 200A 等 (具体见产品规格) Rated current: 10A, 20A, 40A, 80A, 120A, 200A etc. (for details see product specifications)
过负荷: 1.2 倍额定值 (连续); 10 倍额定值持续 1 秒 Overload: 1.2 times the rated current(continuous);10 times the rated current lasting for 1 second		
功耗: 小于 0.2VA Power consumption: less then 0.2VA		
输出 Output	通讯 Communication	RS485 接口、Modbus-RTU RS485 interface, Modbus-RTU
	显示 Display	LCD
测量精度 Measurement precision		电压: 0.2 级, 电流、功率、有功电能: 0.5 级, 频率 0.01Hz、无功电能: 1 级 Voltage: 0.2 level, current, power Active energy: 0.5 level,0.01Hz frequency, Reactive energy: 1 level
电源 Power supply		AC85~265V 或 DC100~350V; 功耗≤10VA AC85~265V or DC100~350V; power consumption ≤10VA
安全性 Safety	工频耐压 Power frequency withstand voltage	电源// //电流输入//电压输入和通讯之间 AC2kV 1min; 电源、电流输入、电压输入两两之间 AC2kV 1min; AC2kV 1 min between power supply // current input//voltage input and communication AC2kV 1 min between each pair of combinations among power supply, urrent input and voltage input.

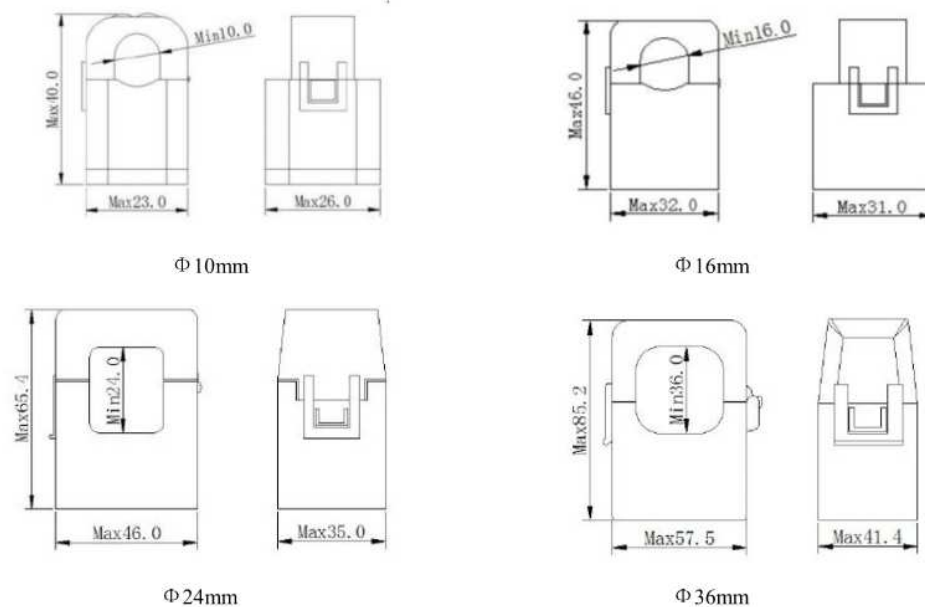
	绝缘电阻 Insulating resistor	输入、输出端对机壳>100MΩ Input, output terminal to housing >100MΩ
环境 Environment	工作温度: -10℃~+55℃; 储存温度: -20℃~+70℃ Working temperature: -10℃~+55℃; storage temperature: -20℃~+70℃ 相对湿度: 5%~95% 不结露; 海拔高度: ≤2500m Relative humidity: 5%~95%, non-condensing; altitude: ≤2500m	

5. 安装 Installation

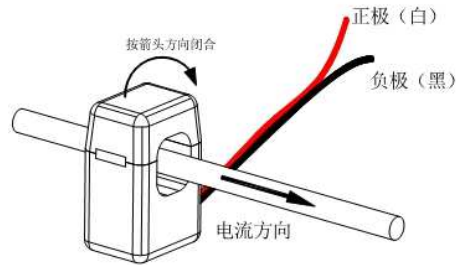
5.1 外形及安装尺寸 (单位: mm) Overall and Installation Dimensions (Unit mm)



5.2 开口式互感器尺寸 (单位: mm) Open Current Transformer's Dimension (Unit mm)



5.3 安装方法 Installation Method



开合式互感器安装方式

Installation Method of the Open Current Transformer Close

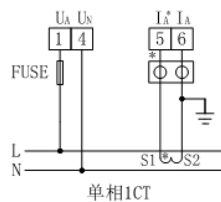
按箭头方向闭合	Close according to the arrow direction
正极 (白)	Positive (White)
负极 (黑)	Negative (Black)
电流方向	Current direction

5.4 接线方法 Connection Mode

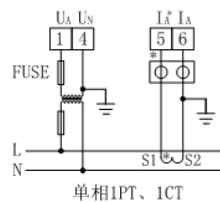
(注: 如与仪表壳体上接线图不一致, 以仪表壳体上接线图为准)

(Note: The connection diagram on the instrument housing shall prevail in case of any discrepancies with it)

根据不同的设计要求, 推荐在电源、电压输入端子增加保险丝以满足相关电气规范的安全性要求



Single-phase ICT



Single-phase IPT, ICT



RS485 communication



注: 接线图中保险丝推荐使用 0.5A 或者 3A;

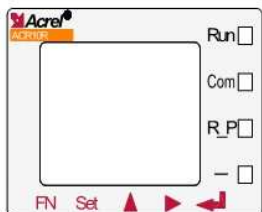
It is recommended to use 0.5A or 3A for the fuse in the connection diagram;

RS485 通讯端口接线可以选用 RJ45 母头或者普通接线端子, 二者选其一。

RS485 communication terminal connection can use either RJ45 female or normal connector.

6. 编程与使用 Programming and Use

6.1 面板说明 Panel Description



	熄灭	常亮	闪烁
Run (绿色)	仪表未运行	/	仪表正常运行
Com (红色)	仪表未通讯	/	处于通讯状态
R-P (红色)	功率为正	功率为负	/
- (红色)	/	负值指示灯	/



	Off	On	Flashing
Run (Green)	The instrument is not running	/	The instrument is running normally
Com (Red)	The instrument is not communicating	/	The instrument is in communication status.
R-P (Red)	Positive power	Negative power	/
- (Red)	/	Negative value indicator lamp	/

6.2 按键功能说明 Button Function Description

仪表五个按键从左到右依次为 FN 键、SET 键、▶ 键、回车键。

The five buttons of the instrument are FN button, SET button, , , Enter button from left to right.

FN 键 FN button	该按键功能暂未开放 The button function is not yet available.
SET 键 SET button	测量模式下，按该键进入编程模式，仪表提示输入密码 PASS，输入正确密码后，可对仪表进行编程设置；编程模式下，用于返回上一级菜单 In the measurement mode, press this button to enter the programming mode. The instrument will indicate entering password. When the correct password is entered, you can set the programming for the instrument; in the programming mode, use it to return to the previous menu

视在功率	Apparent power
功率因素	Power factor
吸收有功电能	Absorb active energy
感性无功电能	Inductive reactive energy
开关量状态	Switch status
开关量输入	Switch input
开关量输出	Switch output
释放有功电能	Release active energy
容性无功电能	Capacitive reactive energy
按  键	Press  button

6.4 编程菜单 Programming Menu

6.4.1 仪表通用编程菜单 General Programming Menu

第一级菜单 1 st level menu	第二级菜单 2 nd level menu	第三级菜单 3 rd level menu	说明 Description
SYS	dISP		开机显示画面选择, 为零自动翻页 Selection for start-up picture without auto page turning
	Code	0-9999	密码设置 (初始密码 0001) Password setting (initial password 0001)
	Clr.E		电能清零, 清除成功显示 OK OK is displayed when energy cleared off
	Err		异常次数统计 Abnormal data statistics
In	Line	1P2L, 3P3L, 3P4L	接线方式 (单相、三相三线、三相四线) Connection mode (single-phase, three-phase three-wire, three-phase four-wire)
	InU	100、400	输入电压范围 Input voltage range
	InI	10, 20, 40, 80, 120, 200, 300 等 (详见产品规格) 10, 20, 40, 80, 120, 200, 300etc. (For details, please see product	输入电流范围 (用户不可操作) Input current scope (not for user operation)

		specifications)	
	InPt	0-9999	电压倍数 Voltage multiplier
	InCt	0-9999	电流倍数 Current multiplier
bus	Addr	1-247	通讯地址 Communication address
	BAUD	4800、9600、19200、38400	通讯波特率 Communication baul rate
	mode	None/2bit/odd/even	通信模式 Communication mode (无校验、2位停止位、奇校验、偶校验) (no parity, 2 stop bit, odd parity, even parity)
IO	do	do1	开关量输出设置 Switch output setting (详见 6.4.2) (see 6.4.2)
		do2	
	di	di1	开关量输入设置 Switch input setting
		di2	

6.4.2 带开关量输出增加的菜单 Additional Menu with Switch Output

仪表开关量输出采用继电器输出，有两种控制方式：1、报警方式（“SEL”选择不为零）；2、总线控制方式（“SEL”选择为“0. do”，此时“dLy”设置为0为电平输出方式，设置非零时，do动作后延时设置的时间自动断开）

The switch output of the instrument adopts relay output with two control mode: 1. alarm mode (“SEL” is not zero); 2. bus control mode (“SEL” is selected as “0. do” and level output for zero “dLy”. When “dLy” is not zero, it is automatically cut off after do action in the set delay time.)

“SEL”中设置DO输出类型，“0. do”表示为通信控制（此时如果dLy设置为0输出为电平方式，否则为脉冲方式，如果dLy设置为2，吸合后2秒自动断开），其他为报警控制（见下表）

Set Do output type in the “SEL”. “0. do” usually refers to communication control (if “dLy” is set to 0, the output is level or pulse. If dLy is set to 2, the circuit will be off after closing for two seconds) Others are alarm control (see list below).

“dLy”为报警延时（报警用时推荐不设置为0防止干扰误动，输出类型为DO时作脉冲或电平输出控制）

“dLy” refers to alarm delay (which is not recommended to set as 0 to prevent disturbance or mistake. Pulse or level output control for Do output type)

“bAnd”为不动作带设置

“bAnd” refers to setting of the non-action band

“AL.Hi” 为高报警数值设置（不用设置最大 9999）

“AL.Hi” refers to the setting of high alarm number (no need to set the max. 9999)

“AL.Lo” 为低报警数值设置（不用设置最小-9999）

“AL.Lo” refers to the setting of low alarm number (no need to set the min. -9999)

（以上 3 个设置与电量的显示值对应，显示中含小数点。例：输入 220V 100A/5A，三相四线，则 100%P 总为 $220 \times 100 \times 3 = 66\text{kW}$ 。如 100%功率时高报警，90%返回，“AL.Hi”取 66.00，“bAnd”取 6.00；100%电压时高报警，95%返回，“AL.Hi”可取 220.0，“bAnd”取 11.0；100%电流时高报警，95%返回，“AL.Hi”可取 100.0，“bAnd”取 5.0）

(The above three settings correspond to the energy display which contains decimal point. Eg. input 220V 100A/5A, three-phase four-wire, the calculation of 100% P total is $220 \times 100 \times 3 = 66\text{kW}$. If high alarm for 100% power, return for 90% power, the “AL.Hi” can be set to 66.00, the “bAnd” to 6.00. If high alarm for 100% voltage, return for 95% voltage, the “AL.Hi” can be set to 220.0, the “bAnd” to 11.0. If high alarm for 100% current, return for 95% current, the “AL.Hi” can be set to 100.0, the “bAnd” to 5.0)

“In.=0” 为信号为 0 时是否允许低报警，Lo.on 使能，Lo.of 禁止

“In.=0” refers to whether low alarm is allowed if the signal is 0. Lo. on enable it and Lo. of disable it.

01	02	03	04	05	06	07	08
UA	UB	UC	三相相电压最值 Max/min value of three-phase phase voltage	UAB	UBC	UCA	三相线电压最值 Max/min value of three-phase linevoltage
09	10	11	12	13	14	15	16
IA	IB	IC	三相电流最值 Max/min value of three-phase current	PA	PB	PC	P 总 P total
17	18	19	20	21	22	23	24
QA	QB	QC	Q 总 Q total	SA	SB	SC	S 总 S total
25	26	27	28	29	30		31
PFA	PFB	PFC	PF	F	电压不平衡 Unbalanced voltage		电流不平衡 Unbalanced current

三相 Three-phase

01	02	03	04	05	06	07
U	I	P	Q	S	PF	F

单相 Single-phase

注：1. 三相 XX 最值表示：高报警时为三相中最大值，低报警时为三相中最小值。

Note: 1. Max/min value of three-phase ...refers to:maximum value for three-phase high alarm, minimum value for three-phase low alarm.

2. 第 2 路 DO 可设置“32.FL”组合报警功能, 设置后二级菜单变为“SEL”(功能选择)、“dLy”(延时)、“H-U”(过线电压)、“L-U”(欠线电压)、“H-F”(过频率)、“L-F”(欠频率)、“H-P”(过功率)、“L-P”(欠功率)、“H-I”(过电流)、“L-PF”(欠功率因数)、“H-b.U”(过电压不平衡, 设置为-1 断相, 判定条件至少一相 $>0.5U_e$, 至少一相 $<0.1U_e$)、“H-b.I”(过电流不平衡, 设置为-1 断相, 判定条件至少一相 $>0.2I_e$, 至少一相 $<0.01I_e$)

The second channel DO can set a “32.FL” combined alarm function. After setting, the 2nd level menu will become “SEL” (Function Selection), “dLy” (Delay), “H-U” (Overvoltage), “L-U” (Undervoltage), “H-F” (Overfrequency), “L-F” (Underfrequency), “H-P” (Overpower), “L-P” (Underpower), “H-I” (Overcurrent), “L-PF” (Underpower Factor), “H-b.U” (Unbalanced Overvoltage. Missing phase for -1 setting. The judgement conditions are at least one phase $>0.2I_e$, one phase $<0.01I_e$)

3. 不平衡计算 Unbalance calculation

(偏移平均值最大的值与平均值的差值)/平均值*100%, 如果分母的平均值小于额定值, 分母为额定值。

(Difference between the max. mean deviation and the mean value)/mean value*100%. If the mean value in the denomintor is less than the rated value, the denomintor will be the rated value.

电压额定值 U_e : 3 相 4 线 U_e 为相电压, 菜单中设置的 400V 的仪表为 220V*PT, 100V 的仪表为 57V*PT。

Rated voltage value U_e : three-phase four-wire U_e is phase voltage. The 400V instrument set in the menu is 220V*PT, and 100V instrument is 57V*PT.

电流额定值 I_e : 5A 的仪表为 5A*CT, 1A 的仪表为 1A*CT。

Rated current value I_e : 5A*CT for 5A instrument, 1A*CT for 1A instrument.

不平衡度下设置的参数为百分比格式, 如设置为 20 表示 20%。

The parameter setting for the unblance is in the percentage form, such as 20 refers to 20%.

6.5 编程示例 Programming Examples

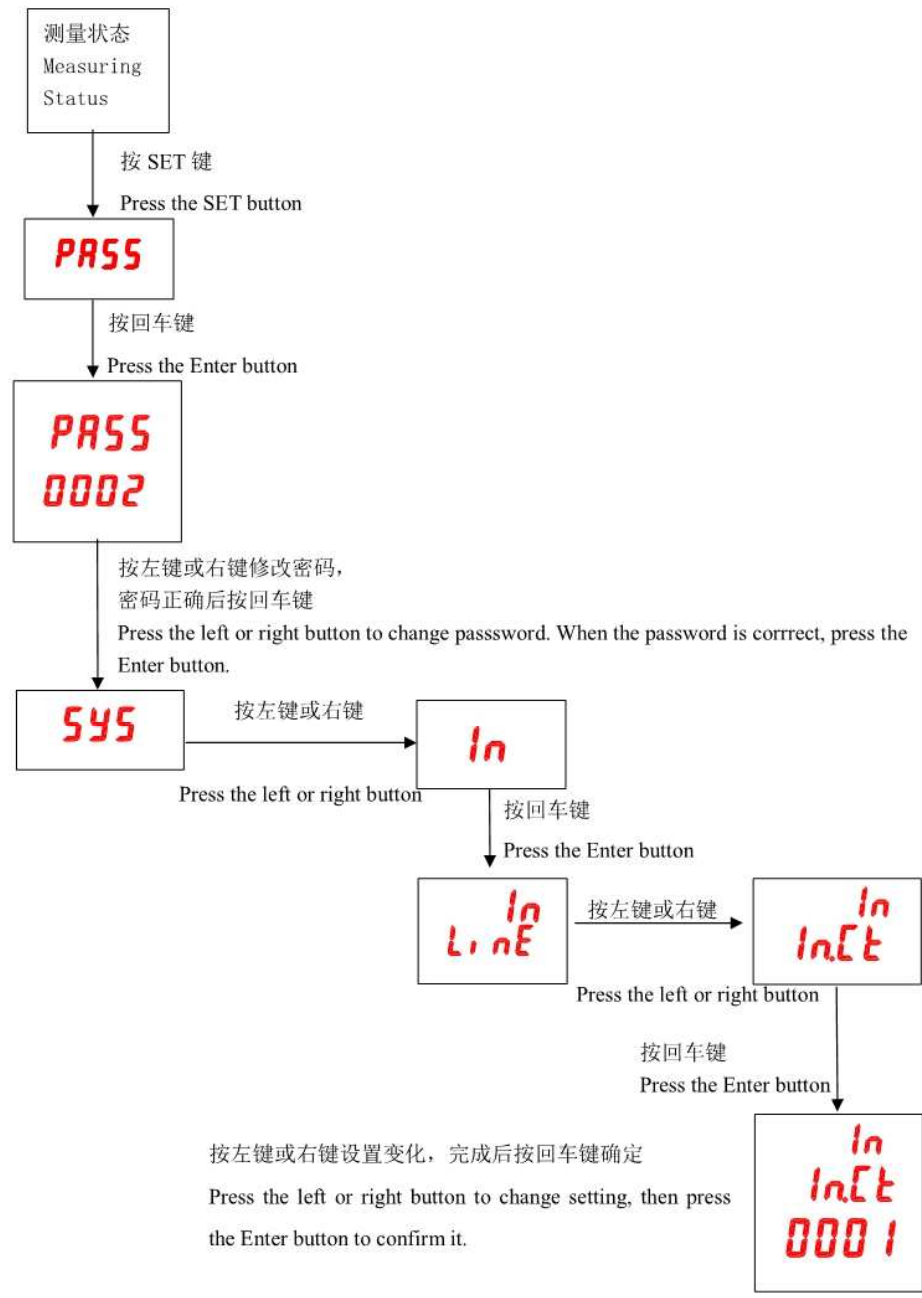
编程示例以流程图的形式介绍改变编程菜单中的某些选项, 如电流倍数、变送设置等。

This section introduces some option change in the programming menu in the form of work flow chart, such as the current multiplier, transformer setting.

注: 在设置或选择完成后, 需按回车键进行确认, 确认完成后连续点按 SET 键直到出现 SAVE/YES 页面, 此时必须按回车键确认, 否则设置无效。

Note: When the setting or selection is done, the Enter button must be pressed to confirm it. After the confirmation is complete, continuously press the SET button until the SAVE/YES page appears. At this time, the Enter button must be pressed at this time or the setting will not be valid.

6.5.1 如何修改电流倍数(CT 变比) How to Change Current Multiplier (CT Transformation Ratio)



7. 通讯接线 Communication Connection

该仪表提供异步半双工 RS485 通讯接口，采用 MODBUS-RTU 协议，各种数据信息均可在通讯线路上传送。理论上在一条线路上可以同时连接多达 128 个仪表，每个仪表均可设定其通讯地址 (Addr)，通讯速率 (baud) 也可通过设置选择。

The instrument provides asynchronous half-duplex RS485 communication interface which adopts MODBUS-RTU protocol so all kinds of data can be transmitted on the communication line. Theoretically, one communication line can be connected with up to 128 instruments, each of which can set a communication address (Addr) and communication rate (baud) via setting.

通讯连接建议使用三芯屏蔽线分别接 A、B、COM2，屏蔽层接大地，COM2 禁止接大地，布线时应使通讯线远离强电电缆或其他强电场环境。

For the communication connection, we recommend to use the three-core shielding wire. The core wires are connected to A, B, COM2 respectively and the shielding layer is connected to the ground. COM2 is forbidden to have ground connection. When laying the wires, the communication line shall be kept away from the strong current cable or other strong electric field.

建议最末端仪表的 A、B 之间加匹配电阻，阻值范围为 120 Ω ~ 10k Ω。

It is recommended to add a matching resistor between A and B of the end instruments. The resistance range is 120 Ω ~ 10k Ω.

具体接线实例见 7.6 所示。

See 7.6 for specific connection case.

7.1 传输方式 Transmitting Method

信息传输为异步方式，并以字节为单位，在主机和从机之间传递的通讯信息是 10 位字格式，包含 1 个起始位、8 个数据位（最小的有效位先发送）、无奇偶校验位、1 个停止位，如设置为奇偶校验位或 2 位停止位，则为 11 位字格式。

The information transmission is asynchronous and in bytes. The communication message transmitted from the master to the slave is in 10-bit format including 1 start bit, 8 data bit (LSB first delivered), no parity bit, one stop bit. If parity bit or 2 stop bit is set, the format is 11-bit.

7.2 信息帧格式 Information Frame Format

地址码 Address code	功能码 Function code	数据区 Data zone	CRC 校验码 CRC check code
1 字节 1 byte	1 字节 1 byte	n 字节 n byte(s)	2 字节 2 bytes

地址码：地址码在帧的开始部分，由一个字节（8 位二进制码）组成，十进制为 0~255，在 PZ 仪表中只使用 1~247，其它地址保留。这些位标明了用户指定的终端设备的地址，该设备将接收来自与之相连的主机数据。每个终端设备的地址必须是唯一的，仅仅被寻址到的终端会响应包含了该地址的查询。当终端发送回一个响应，响应中的从机地址数据便告诉了主机哪台终端正与之进行通信。

Address code: the address code is in the beginning of the frame, which is composed of a byte (8 bit binary code) representing 0~255 in decimal system. The PZ instrument only uses 1~247 and keeps other addresses. The bits indicate the address of the terminal device designated by the user. The device

will receive the data from the linked master. The address of every terminal device must be unique. Only the end addressed will correspond to the query containing its address. When the terminal sends back a response, the responding slave address will tell the master which terminal is communicating with it.

功能码: 功能码告诉了被寻址到的终端执行何种功能。下表列出了该系列仪表用到的功能码, 以及它们的意义和功能。

Function code: the function code tells the addressed terminal to carry out which functions. The table below lists up the function codes used by this instrument as well as their meanings and functions.

功能 Function	定义 Definition	操作 Operation
03H/04H	读数据寄存器 Data reading register	获得一个或多个寄存器的当前二进制值 Obtaining the current binary value of one or more registers.
10H	预置多寄存器 Preset multi-register	设定二进制值到一系列多寄存器中 Set the binary value into a series of multi-register

数据区: 数据区包含了终端执行特定功能所需要的数据或者终端响应查询时采集到的数据。这些数据的内容可能是数值、参考地址或者设置值。例如: 功能码告诉终端读取一个寄存器, 数据区则需要指明从哪个寄存器开始及读取多少个数据, 内嵌的地址和数据依照类型和从机之间的不同内容而有所不同。

Data zone: the data zone contains the data needed for carrying out certain functions or collected when the terminal responds to the query. The content of the data may be number, reference address or set value. For example: if the function code tells the terminal to read a register, the data zone needs to specify which register to start with and how much data to be read. The embedded address and data will vary with types and different content of the slaves.

CRC 校验码: 错误校验 (CRC) 域占用两个字节, 包含了一个 16 位的二进制值。CRC 值由传输设备计算出来, 然后附加到数据帧上, 接收设备在接收数据时重新计算 CRC 值, 然后与接收到的 CRC 域中的值进行比较, 如果这两个值不相等, 就发生了错误。

CRC check code: CRC field occupies two bytes including one 16-bit binary value. The CRC value is calculated by the transmitting device then added to the data frame. The receiving device will recalculate the CRC value upon receiving the data then compare it with the received value in the CRC field. If the two values are not identical, there is an error.

生成一个 CRC 的流程为: The procedure to generate a CRC

a、预置一个 16 位寄存器为 0FFFFH (全 1), 称之为 CRC 寄存器。

Preset a 16-bit register as 0FFFFH (full 1), which is called CRC register.

b、把数据帧中的第一个字节的 8 位与 CRC 寄存器中的低字节进行异或运算, 结果存回 CRC 寄存器。

Make XOR calculation with 8 bit of the first byte in the data frame and the lower byte in the CRC register and store the result into the CRC register.

c、将 CRC 寄存器向右移一位, 最高位填以 0, 最低位移出并检测。

Shift the CRC register right a bit and fill the MSB with 0 and take out the LSB for checking.

d、如果最低位为 0, 重复第三步(下一次移位); 如果最低位为 1, 将 CRC 寄存器与一个预设的固定值(0A001H)

进行异或运算。

If the LSB is 0, repeat step 3 (one more shift); if the LSB is 1, make XOR calculation with CRC register and preset fixed value (0A001H).

e、重复第三步和第四步直到 8 次移位。这样处理完了一个完整的八位。

Repeat step three and step four until the 8th shift. The entire 8 bit processing is complete in this way.

f、重复第 2 步到第 5 步来处理下一个八位，直到所有的字节处理结束。

Repeat step two to five to process the next 8 bits until all bytes are processed.

g、最终 CRC 寄存器的值就是 CRC 的值。

Finally, the CRC register value becomes the CRC value.

此外还有一种利用预设的表格计算 CRC 的方法，它的主要特点是计算速度快，但是表格需要较大的存储空间，该方法此处不再赘述，请参阅相关资料

Besides, there is also a way to calculate CRC using the preset table. It is characterized by rapid calculation speed. However, the table needs relatively large storage room. We will not introduce it here, please refer to relevant materials.

7.3 功能码简介 Function Code Introduction

7.3.1 功能码 03H 或 04H：读寄存器 Function Code 03H or 04H: Reading Register

此功能允许用户获得设备采集与记录的数据及系统参数。主机一次请求的数据个数没有限制，但不能超出定义的范围。

The function allows the user to obtain the data collected and recorded by the device and system parameters. The data number requested by the master computer for one time has no limitation but cannot exceed the defined address range.

下面的例子是从 01 号从机读 3 个采集到的基本数据（数据帧中每个地址占用 2 个字节）UAB、UBC、UCA，其中 UAB 的地址为 0028H，UBC 的地址为 0029H，UCA 的地址为 002AH。

The following examples are 3 basic data read from 01 slave computer (every address in the data frame takes up 2 bytes):UAB, UBC, UCA. Among them, UAB' s address is 0028H, UBC' s address is 0029H and UCA' s address is 002AH.

主机发送 Sent by master		发送信息 Sent message	从机返回 Feedback by slave		返回信息 Feedback message
地址码 Address code		01H	地址码 Address code		01H
功能码 Function code		03H	功能码 Function code		03H
起始地址 Start address	高字节 UB	00H	字节数 Bytes		06H
	低字节 LB	28H			
寄存器数量 Number of registers	高字节 UB	00H	寄存器数据 Register data	高字节 UB	不定值 Undefined
	低字节 LB	03H		低字节 LB	不定值 Undefined
CRC 校验码	低字节 LB	85H	寄存器数据 Register data	高字节 UB	不定值 Undefined
				低字节 LB	不定值 Undefined

CRC check code					Undefined
	高字节 UB	C3H	寄存器数据 Register data	高字节 UB	不定值 Undefined
				低字节 LB	不定值 Undefined
CRC 校验码 Register data				低字节 LB	不定值 Undefined
				高字节 UB	不定值 Undefined

7.3.2 功能码 10H: 写寄存器 Function Code 10H: Writing Register

功能码 10H 允许用户改变多个寄存器的内容，该仪表中系统参数、开关量输出状态等可用此功能号写入。主机一次最多可以写入 16 个 (32 字节) 数据。

The function code 10H allows the user to change the contents of multiple registers. The function code can be used to write the system parameters and switch output status. The master computer can write a maximum of 16 pieces of data (32 bytes) at once.

下面的例子是预置地址为 01 的仪表输出开关量 Do1。开关量输入/输出状态指示寄存器地址为 0022H，第 9-12 位对应 DI1-DI4，第 13-14 位分别对应 D01-D02。

The following example shows that when the preset address is 01, the switch output is Do1. The switch input/output status indication register's address is 0022H. The 9-12 bit corresponds to DI1-DI4, the 13-14 bit corresponds to D01-D02 respectively.

主机发送 Sent by master		发送信息 Sent message	从机返回 Feedback by slave		返回信息 Feedback message
地址码 Address code		01H	地址码 Address code		01H
功能码 Function code		10H	功能码 Function code		10H
起始地址 Start address	高字节 UB	00H	起始地址 Start address	高字节 UB	00H
	低字节 LB	22H		低字节 LB	22H
寄存器数量 Register number	高字节 UB	00H	寄存器数量 Register number	高字节 UB	00H
	低字节 LB	01H		低字节 LB	01H
字节数 Byte number		02H	CRC 校验码		低字节 LB
0022H 待写入数据 0022H data to be written	高字节 UB	10H	CRC check code	高字节 UB	C3H
	低字节 LB	00H			
CRC 校验码 CRC check code	低字节 LB	ADH			
	高字节 UB	12H			

7.4 通讯应用细节 Communication Application Details

仪表在设计时对通讯地址表进行了统一规划，用户根据下面的介绍可以方便地实现遥测、遥信、遥控等功能。

The instrument design has a uniform planning for the communication address list. The user can easily realize the functions of remote measurement, remote signalling and remote control according to the following introduction.

7.4.1 开关量输入输出 Switch Input and Output

仪表开关量输入是采用干接点开关信号输入方式，仪表内部配备 +5V 的工作电源，无须外部供电。当外部接

点闭合或断开时，仪表本地显示开关状态，同时可以通过仪表的通讯口实现远程传输功能，即“遥信”功能。

The switch input of the instrument adopts dry contact switch signal input method. The instrument is equipped with +5V operating power inside so it does not need external power supply. When the external contact is close or open, the instrument will show the switch status locally. At the same time, the communication port of the instrument can realize the long distance transmission function, i.e., the “remote signalling” function.

仪表开关量输出为继电器输出，可通过上位机远程控制（遥控有两种方式：1、电平触发；2、脉冲触发），实现“遥控”功能，也可以根据客户要求实现相应的报警功能（如过流、欠压）。

When the switch output is the relay output, the instrument can not only be remotely controlled by the upper computer (two ways of remote control: 1. level triggering 2. Pulse triggering) to realize “remote control” function but also realize corresponding alarm function upon customer’s request (such as overcurrent, undervoltage).

仪表与开关量输入输出相关的通讯地址为 0022H，其与开关量输入输出的对应关系如下：

The communication address related to the switch input/output is 0022H with relations to the switch I/O as below:

0022H	16	15	14	13	12	11	10	9	8~1
			D02	D01	DI4	DI3	DI2	DI1	保留 Reserved

7.5 通讯地址表(MODBUS-RTU 协议) Communication Address List (MODBUS-RTU Protocol)

(1Float=2Word, 1Word=8Byte)

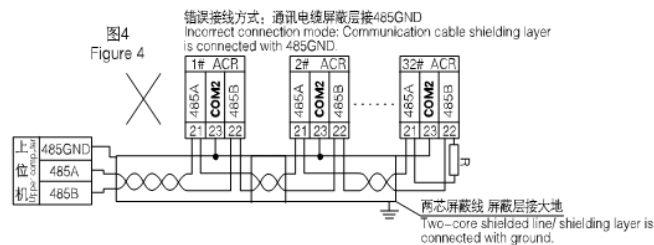
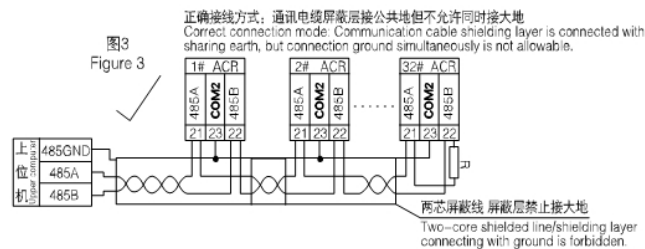
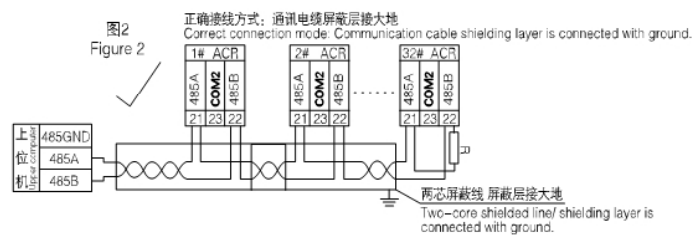
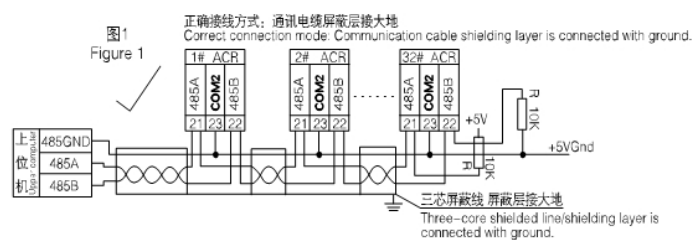
地址 Address	参数 Parameters	读写属性 R/W attribute	数值范围 Number range	数据类型 Data type	备注 Remarks
0000H	保护密码 Protective password	R/W	0001-9999	word	
0001H 高字节 0001H UB	通讯地址 Communication address	R/W	0001-0247	word	
0001H 低字节 0001H LB	通讯波特率 Baud rate	R/W	0-3: 38400、19200、9600、4800bps		
0002H	保留 Reserved	R	厂家参数，禁止用户写命令 Factory parameters. Users are not allowed to write an order.	word	
0003H	PT 变比 PT transformation ratio	R/W	1-9999	word	
0004H	CT 变比 CT transformation ratio	R/W	1-9999	word	

0005H~0021H	保留 Reserved	R	厂家参数, 禁止用户写命令 Factory parameters. Users are not allowed to write an order.	word	
0022H	开关量输入输出状态 Switch I/O status	R/W	见 7.3.2	word	
0061H	U	R	0-65535	word	保留 1 位小数 1 bit decimal is reserved
0062H~0063H	保留 Reserved	R		word	
0064H	I	R	0-65535	word	保留 2 位小数 2 bit decimal is reserved
0065H~0066H	保留 Reserved	R		word	
0067H	P	R	-32760~+32760	word	保留 3 位小数, 单位为 KW 3 bit decimal is reserved, KW
0068H~006AH	保留 Reserved	R		word	
006BH	Q	R	-32760~+32760	word	保留 3 位小数, 单位为 KVar 3 bit decimal is reserved, KVar
006CH~006EH	保留 Reserved	R		word	
006FH	S	R	0-65535	word	保留 3 位小数, 单位为 KVA 3 bit decimal is reserved, KVA
0070H~0072H	保留 Reserved	R		word	
0073H	PF	R	0-100	word	保留 2 位小数 2 bit decimal is reserved
0074H~0076H	保留 Reserved	R		word	
0077H	F	R	4500-6500		保留 2 位小数 2 bit decimal is reserved
0078H~007AH	保留 Reserved				
以下为电能地址表 Energy adress list below					
0047H~0048H	吸收有功电能 Absorbing active energy	R	0-9999999999	Float	一次侧电能 Primary energy
0049H~004AH	释放有功电能 Releasing active	R	0-9999999999	Float	一次侧电能 Primary

	energy				energy
004BH~004CH	感性无功电能 Reactive energy	R	0-99999999999	Float	一次侧电能 Primary energy
004DH~004EH	容性无功电能 Capacitive reactive energy	R	0-99999999999	Float	一次侧电能 Primary energy

7.6 通讯接线实例 Communication Connection Cases

关于通讯的接线实例如下图所示: The communication connection cases are shown as below:



Annex No. 2

Test Equipment list

Date(s) of performance of tests: 2020-09-17 to 2021-03-16

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Power Analyser	A4080002DG	YOKOGAWA	WT3000	91M210852	Jun. 16, 2021
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyser
AC Source	A7040020DG	Chroma	61512	61512000438	
DC Simulation Power Supply	A7040015DG	Chroma	62150H-1000S	62150EF00488	
DC Simulation Power Supply	A7040016DG	Chroma	62150H-1000S	62150EF00490	
DC Simulation Power Supply	A7040017DG	Chroma	620028	620028EF00120	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Eight Channel Digital Phosphor Oscilloscope	A4089017DG	YOKOGAWA	DL850	91N726247	Sep. 17, 2020
Oscilloscope probe	A4089008DG	Tektronix	TPP1000	C008230	Sep. 17, 2020
Oscilloscope probe	A4089010DG	Tektronix	TPP1000	C008228	Sep. 17, 2020
Oscilloscope probe	A4089011DG	Tektronix	TPP1000	C008229	Sep. 17, 2020
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Sep. 11, 2020
Current transducer	A1060008DG	YOKOGAWA	CT200	1130700017	Sep. 11, 2020
Current transducer	A1060012DG	YOKOGAWA	CT200	1130700018	Sep. 11, 2020