Report

TIC 7053-14

Test on a direct connected, electronic three-phase four-wire energy meter

Arnhem, 7 October 2014

Experience you can trust.

TIC 7053-14

TYPE TEST CERTIFICATE OF COMPLETE TYPE TEST

OBJECT	A direct connected, electronic three-phase four-wire energy meter
TYPE	DTS718 - active: class 1 - reactive: class 2
MANUFACTURER	Shenzhen Clou Electronics Co., Ltd., Shenzhen, China
CLIENT	Shenzhen Clou Electronics Co., Ltd., Shenzhen, China
TESTED BY	KEMA Nederland B.V., Arnhem, The Netherlands
DATE(S) OF TESTS	July till October 2014

The object, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with

IEC 62052-11, **IEC 62053-21** and **IEC 62053-23**

The results are shown in the record of Proving Tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above Standard and to justify the ratings assigned by the manufacturer as listed on page 5.

This Certificate consists of 34 pages in total.

KEMA Nederland B.V.

S.A.M. Verhoeven
Director Testing, Inspections &
Certification The Netherlands

Arnhem, 7 October 2014

Contents

Summary

The energy meter as described in chapter 2, meets the requirements of:

IEC 62052-11 (2003)	:	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Metering equipment
IEC 62053-21 (2003)	:	Electricity metering equipment (a.c.) - Static meters for active energy (classes 1 and 2)
IEC 62053-23 (2003)	:	Electricity metering equipment (a.c.) - Static meters for reactive energy (classes 2 and 3)

Requirements for outdoor use.
Based on a non-recurrent examination.

1 Introduction

The type test was carried out in the laboratory of KEMA, from July till October 2014, on behalf of Shenzhen Clou Electronics Co., Ltd., on the meter as described in chapter 2.

The energy meters were tested in respect of the following requirements:

IEC 62052-11 (2003)	:	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Metering equipment
IEC 62053-21 (2003)	:	Electricity metering equipment (a.c.) - Static meters for active energy (classes 1 and 2)
IEC 62053-23 (2003)	:	Electricity metering equipment (a.c.) - Static meters for reactive energy (classes 2 and 3)

2 Data related to the energy meters tested and marking

Manufacturer	:	Shenzhen Clou Electronics Co., Ltd.
Contact person	:	Ms. Amy Wu
Address	:	Clou building, Baoshen Road South, Science Industry Park North, Nanshan District, Shenzhen.
Postal code, Place	:	518057, Shenzhen
Country	:	China
Production site	:	Shenzhen Clou Electronics Co., Ltd.
Address	:	Clou building, Baoshen Road South, Science Industry Park North, Nanshan District, Shenzhen.
Postal code, Place	:	518057, Shenzhen
Country	:	China
Instrument	:	Electronic three-phase four-wire energy meter Direct connected
Mark - Type	:	DTS718
Register	:	LCD
Accuracy Class	:	active: class 1 reactive: class 2
Measurement range	:	220/380 – 240/415 V 5(100) A 50 or 60 Hz active : 400 imp./kWh reactive : 400 imp./varh
Use	:	Outdoor
Protection Class	:	II
Registry method	:	Bidirectional method <u>per phase</u> with always positive register: the meter always counts the energy of each phase as received energy, irrespective of the real energy direction of the phase. The nameplate must explicitly state: ”The meter is suitable for energy measurement in one direction only!” or "Uni-directional measurement meter".

Sample Identification: 201400000301, 201400000302, 201400000303, 201400000304, 201400000330, 201400000333, 201400000334 and 201400000335

The meter contains all required markings.

The basic current and the reference voltage of the meter are standardised values.

All tests are performed at reference voltage and reference frequency, unless mentioned otherwise.

The measurements are carried out with standards that are traceable to international standards.

3 Results of the type test

3.1 Tests of the mechanical properties

3.1.1 General

The meter was subjected to the mechanical tests. In order to evaluate the materials used and the construction of the meter, the meters were assessed with regard to the following points.

3.1.2 Case

The meter can be sealed in such a way that the inside of the meter is only accessible after breaking the seal.

3.1.3 Spring Hammer test

After carrying out the spring hammer test according to IEC publication 60068-2-75 with a kinetic energy of 0,2 J, it showed that the mechanical strength of the meter case of the energy meter is adequate.

3.1.4 Shock test

A shock test was performed according to IEC 60068-2-27, with a half-sine pulse, a peak acceleration of 300 m/s^2 and a pulse duration of 18 ms. Application of the shock has been performed by Sebert Trillingstechniek (S2T). After this test the meter showed no damage.

3.1.5 Vibration test

A vibration test according to IEC 60068-2-6, test procedure A, was carried out on the meters in non-operating condition, frequency range from 10 Hz to 150 Hz, with a constant movement amplitude of 0,075 mm up to 60 Hz and a constant acceleration of 9,8 m/s^2 above 60 Hz. Per axis 10 sweep cycles were carried out. Application of the vibrations has been performed by Sebert Trillingstechniek (S2T). After the test the meter showed no damage.

3.1.6 Protection against penetration of dust and water

The test was carried out according to IEC 60529, protection degree IP54 (outdoor).

The meter is dustproof as required by IEC 62052-11 (Cat. 1 according to IEC 60529).

The results of the water penetration test were satisfying.

The test was subcontracted to DEKRA certification b.v.

The meter meets the requirements.

3.1.7 Terminals and terminal block

The clearances and creepage distances in the terminal block are adequate.

The terminal block material was tested in accordance with ISO 75 at a temperature of 135 ºC and a pressure of 1,8 MPa (method A). The worst case deflection at 135 ºC was 0,05 mm (requirement ≤ 0,26 mm). The material meets the requirements.

Type: 80% PC + 20% FG
Manufacturer: Shenzhen Clou Electronics Co., Ltd.
Colour: Black.

The terminal cover can be sealed independently of the meter cover.

3.1.8 Resistance to heat and fire

The material of both the terminal block and the meter case was subjected to a glow-wire test in accordance with IEC 60695-2-11. The temperature of the glow-wire was 960 °C for the terminal block, 650 °C for the meter case and cover. The test was subcontracted to DEKRA certification b.v. The materials meet the requirements.

3.1.9 Register and output device

The meter has an LCD register and records in kWhs.
On the front of the meter optical (LED) outputs are available for Wh and varh measurements.

The energy registry method with regards to delivered- and received energy is
Bidirectional method per phase with always positive register: the meter always counts the energy of each phase as received energy, irrespective of the real energy direction of the phase. The nameplate must explicitly state:
”The meter is suitable for energy measurement in one direction only!” or
"Uni-directional measurement meter".

The meter meets the requirements.

3.2 Tests of climatic influences

3.2.1 General

In order to evaluate the materials used and the construction of the meter, the relevant meter was assessed with regard to the following points.

3.2.2 Dry heat test

The test was performed with meter no. 201400000330.

The test was carried out according to IEC 60068-2-2, at a temperature of 70 °C for a duration of 72 hours.

Afterwards, the meter showed no damage or loss of information.

3.2.3 Cold test

The test was performed with meter no. 201400000330.

The test was carried out according to IEC 60068-2-1, at a temperature of -40 °C for a duration of 16 hours.

Afterwards the meter showed no damage or loss of information.

3.2.4 Damp heat cyclic test

The test was performed with meter no. 201400000330.

The test was carried out according to IEC 60068-2-30 (variant 1) with an upper temperature of 55 °C for 6 cycles.

An insulation test was carried out. The meter showed no damage or loss of information.

The meter meets the requirements.

3.2.5 Solar radiation test

The solar radiation test was carried out in accordance with IEC 62052-11 clause 6.3.4 and IEC 60068-2-5, using test method A, for 3 days with an upper temperature of 55 °C.
After the test the meter was visually inspected. The meter was tested before and after the test.

The meter meets the requirements.

3.3 Accuracy measurement at different loads

These tests were carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.

The meters were examined at an ambient temperature of (23 ± 2) °C and after the voltage circuits had been connected to reference voltage for at least 1 hour.

The measuring conditions were as specified in section 8.5 of IEC 62053-21. The measurements were made with an accurate static energy standard.

The percentage error of the meter can be expressed as follows:

$$p = \frac{PM - PA}{PA} \times 100\%$$

in which p = percentage error
PM = energy recorded by meter
PA = actual energy.

The values for the errors registered at different currents and various values for cos φ / sin φ, at reference voltage and reference frequency (average of 3 repeatable measurements per loadpoint), can be found in annex A. The results show that the static energy meters, under the reference conditions given in section 8.5 of IEC 62053-21, meet the requirements given in section 8.1 of the relevant publication.

3.3.1 Interpretation of test results

There was no need to displace the zero line to bring the errors of the energy-meters within the limits.

3.3.2 Test of meter constant

A test has been carried out to prove that the relation between the test output and the registered energy (display) is correct.

3.3.3 Starting current

The minimum load at which the energy meters tested recorded at reference voltage, reference frequency and cos φ = 1 was less than 0,1 % of I_b (req. $\leq$ 0,4 % I_b).

3.3.4 Test of no load condition

At zero current, reference frequency and a voltage of 115 % U_n, no pulse was generated by the energy meters tested.

The meter meets the requirements.

3.4 Effect of change of influence quantities on accuracy

3.4.1 Influence of ambient temperature variation

The meter was placed into a climatic room with ambient temperatures as shown in the table below until thermal equilibrium was reached. The measured deviations in the errors are shown in the following table.

Serial number 201400000302 Wh-measurement

I in % of I_{ref}	cos φ	Temperature coefficient for the specified temperature range in % per K -25..-10	-10.. 10	10..30	30..45	45..55	°C
10	1	0,006%	0,006%	0,006%	0,007%	0,007%	(req.: ≤ 0,05)
20	0,5 ind	0,006%	0,007%	0,006%	0,007%	0,008%	(req.: ≤ 0,07)
100	1	0,005%	0,007%	0,006%	0,007%	0,007%	(req.: ≤ 0,05)
100	0,5 ind	0,006%	0,007%	0,006%	0,008%	0,006%	(req.: ≤ 0,07)
I_{max}	1	0,005%	0,007%	0,007%	0,007%	0,006%	(req.: ≤ 0,05)
I_{max}	0,5 ind	0,005%	0,007%	0,007%	0,007%	0,007%	(req.: ≤ 0,07)

Serial number 201400000303 Wh-measurement

I in % of I_{ref}	cos φ	Temperature coefficient for the specified temperature range in % per K -25..-10	-10.. 10	10..30	30..45	45..55	°C
10	1	0,001%	0,001%	0,001%	0,002%	0,003%	(req.: ≤ 0,05)
20	0,5 ind	0,001%	0,001%	0,002%	0,003%	0,002%	(req.: ≤ 0,07)
100	1	0,001%	0,001%	0,002%	0,002%	0,001%	(req.: ≤ 0,05)
100	0,5 ind	0,001%	0,001%	0,002%	0,002%	0,002%	(req.: ≤ 0,07)
I_{max}	1	0,001%	0,001%	0,003%	0,002%	0,003%	(req.: ≤ 0,05)
I_{max}	0,5 ind	0,001%	0,002%	0,002%	0,002%	0,003%	(req.: ≤ 0,07)

Serial number 201400000302 varh-measurement

I in % of I_{ref}	sin φ	Temperature coefficient for the specified temperature range in % per K -25..-10	-10.. 10	10..30	30..45	45..55	°C
10	1	0,006%	0,007%	0,007%	0,008%	0,009%	(req.: ≤ 0,10)
20	0,5 ind	0,005%	0,006%	0,008%	0,007%	0,007%	(req.: ≤ 0,15)
100	1	0,005%	0,007%	0,007%	0,007%	0,007%	(req.: ≤ 0,10)
100	0,5 ind	0,005%	0,007%	0,007%	0,005%	0,007%	(req.: ≤ 0,15)
I_{max}	1	0,005%	0,007%	0,007%	0,007%	0,007%	(req.: ≤ 0,10)
I_{max}	0,5 ind	0,005%	0,007%	0,006%	0,008%	0,008%	(req.: ≤ 0,15)

Serial number 201400000303 varh-measurement

I in % of I_{ref}	sin φ	Temperature coefficient for the specified temperature range in % per K -25..-10	-10.. 10	10..30	30..45	45..55	°C
10	1	0,001%	0,002%	0,002%	0,003%	0,003%	(req.: ≤ 0,10)
20	0,5 ind	0,000%	0,001%	0,003%	0,001%	0,002%	(req.: ≤ 0,15)
100	1	0,001%	0,001%	0,002%	0,002%	0,001%	(req.: ≤ 0,10)
100	0,5 ind	0,001%	0,001%	0,002%	0,002%	0,000%	(req.: ≤ 0,15)
I_{max}	1	0,001%	0,001%	0,003%	0,002%	0,001%	(req.: ≤ 0,10)
I_{max}	0,5 ind	0,001%	0,001%	0,003%	0,003%	0,002%	(req.: ≤ 0,15)

The meter meets the requirements.

3.4.2 Effect of changes in the auxiliary supply voltage

Not applicable.

3.4.3 Voltage variation

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
The change in the error due to a 10% change of the measuring voltage over the complete voltage range of the meter was measured at various loads.
The maximum change in error was
- 0,02 % registering Wh at cosφ = 1 (Requirement ≤ 0,7%)
- 0,02 % registering Wh at cosφ = 0,5 ind. (Requirement ≤ 1,0%)
- 0,12 % registering varh at sinφ = 1 (Requirement ≤ 1,0%)
- 0,10 % registering varh at sinφ = 0,5 ind. (Requirement ≤ 1,5%).

Severe voltage variations were tested.

The meter meets the requirements.

3.4.4 Frequency variation

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
The change in the error due to a 2% change of the reference frequency over the complete voltage range of the meter was measured at various loads.
The maximum change in error was
- 0,01 % registering Wh at cosφ = 1 (Requirement ≤ 0,5%)
- 0,02 % registering Wh at cosφ = 0,5 ind. (Requirement ≤ 0,7%)
- 0,05 % registering varh at sinφ = 1 (Requirement ≤ 2,5%)
- 0,04 % registering varh at sinφ = 0,5 ind. (Requirement ≤ 2,5%).

The meter meets the requirements.

3.4.5 Magnetic induction of external origin 0,5 mT

This test was carried out with meter no. 201400000301 and 201400000334.
An external magnetic field was generated using a round coil measuring 1 meter in diameter. The field was applied in all three directions in order to determine the worst-case position. The phase position of the field current (with respect to the measuring voltage) was shifted between 0° and 360°.
The maximum change measured at reference voltage, basic current, reference frequency and cos $\varphi = 1$ was 0,03%. The maximum permissible change allowed by IEC 62053-21 is 2,0%.
The meter meets the requirements.

3.4.6 Harmonic components in the current and voltage circuits

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
Using the special amplifiers of the meter test equipment, 10% of fifth harmonic was added to the voltage and 40% of fifth harmonic was added to the current. Using a load at 0,5 I_{max}, a 4% increase of power in the fifth harmonic in relation to the nominal frequency was generated. The energy measured was compared to the energy measured by the standard equipment.
The worst case change in the error was 0,06%.
The maximum permissible change allowed by IEC 62053-21 is 0,8%.
The meter meets the requirements.

3.4.7 DC and even harmonics in the a.c. current circuit

This test was carried out with meter no. 201400000330 and 201400000334.
Using diodes, a rectified waveform was generated in the meter current circuits according to Annex A1 of IEC 62053-21. The energy measured was compared to the energy measured by the standard equipment. The test was carried out at a current of $I_{max}/\sqrt{2}$. The worst case change in the error was 0,64%. The maximum permissible change allowed by IEC 62053-21 is 3,0%.
The meter meets the requirements.

3.4.8 Odd harmonics in the a.c. current circuit

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
Using the special amplifiers of the meter test equipment, a phase-fired waveform was generated in the current circuits according to Annex A2 of IEC 62053-21. The energy measured was compared to the energy measured by an energy standard. The worst case difference was 0,02%.
The maximum permissible change allowed by IEC 62053-21 is 3,0%.
The meter meets the requirements.

3.4.9 Sub-harmonics in the a.c. current circuit

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
Using the special amplifiers of the meter test equipment, a "2 on 2 off cycle burst" was generated in the current circuits according to Annex A3 of IEC 62053-21. The energy measured was compared to the energy measured by an energy standard. The worst case difference was 0,04%.
The maximum permissible change allowed by IEC 62053-21 is 3,0%.
The meter meets the requirements.

3.4.10 **Reversed phase sequence**

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
The change in the error with reversed phase sequence was compared with the error with normal phase sequence measured at reference voltage, rated frequency and 10% of the nominal current at cosφ = 1.
The worst case change in error was 0,01%.
The maximum permissible change allowed by IEC 62053-21 is 1,5%.
The meter meets the requirements.

3.4.11 **Voltage unbalance**

This test was carried out with meter no. 201400000302, 201400000303, 201400000330 and 201400000335.
The influence of an interruption of one phase of the three-phase network, at reference voltage, rated frequency and nominal current, on the accuracy of the meter was 0,01%.
The influence of an interruption of two phases was 0,05%.
The maximum permissible change allowed by IEC 62053-21 is 2,0%.
The meter meets the requirements.

3.4.12 **Continuous magnetic induction of external origin**

This test was carried out with meter no. 201400000330 and 201400000334.
The magnetic field was generated using an electromagnet as described in annex B of IEC 62053-21. The change in the error due to this magnetic field was less than 0,02% (requirement ≤ 2,0%).

3.4.13 **Operation of accessories**

Operation of accessories did not influence the registration of the meter.

3.4.14 **Immunity to earth fault**

Not applicable.

3.5 Effect of short-time overcurrents on the accuracy

This test was carried out with meter no. 201400000335.
A current of 3000 A (30 x I_{max}) flowed through the current circuit of the energy meter for a period of one half-cycle (10 ms), with the voltage circuits being supplied with nominal voltage.
Both before and after the test the error was measured at basic current, reference voltage, rated frequency and cos φ = 1. The difference in the error measured before and after this test is listed below:

Serial No.	Difference in error in %	Requirement
201400000335	0,01	≤ 1,5 %

The meter meets the requirements.

3.6 Self-heating

3.6.1 Influence of self-heating on the accuracy

The changes in the error as a result of self-heating with I_{max}, measured at reference voltage, reference frequency, cos φ = 1 and also at cos φ = 0,5 inductive, are shown in the table below. The changes were measured for at least 60 minutes after connecting the current.

Serial	maximum change in %	
No.	cos φ = 1	cos φ = 0,5 ind.
201400000330	0,07 (req. ≤ 0,7)	0,05 (req. ≤ 1,0)
201400000335	0,08 (req. ≤ 0,7)	0,07 (req. ≤ 1,0)

The meter meets the requirements.

3.6.2 Heating

This test was carried out with meter no. 201400000330 and 201400000335.
The meter was powered with 115% of nominal voltage and maximum current for 2 hours.
The maximum temperature rise of the meters was 13 K (req. ≤ 25 K).
The meter meets the requirements.

3.7 Power consumption of the voltage and current circuits

The meters were tested for power consumption at a nominal voltage. The maximum values are shown in the table below. The power consumption for the current circuits was measured at nominal current.

Serial number	2014 00000330		2014 00000334		2014 00000301		2014 00000304	
Frequency	50 Hz		50 Hz		60 Hz		60 Hz	
Reference Voltage	220/380 V		220/380 V		240/415 V		240/415 V	
Voltage circuit	VA	W	VA	W	VA	W	VA	W
L1	0,48	0,39	0,39	0,32	0,51	0,33	0,52	0,35
L2	0,50	0,39	0,40	0,33	0,51	0,35	0,48	0,34
L3	0,48	0,39	0,40	0,34	0,53	0,35	0,53	0,35
Current circuit	VA		VA		VA		VA	
L1	0,01		0,01		0,01		0,01	
L2	0,01		0,01		0,01		0,01	
L3	0,01		0,01		0,02		0,01	

The maximum permissible power consumption for the voltage circuits is 10 VA and 2 W (including the power supply) and for the current circuits 2,5 VA. The meter meets the requirements.

3.8 Fast transient burst test

This test was carried out with meter no. 201400000335.

3.8.1 Test method

The test was carried out with the current circuit carrying basic current.
The test was carried out in accordance with clause 7.5.4 of IEC 62052-11.

3.8.2 Test levels

The test was carried out with a test voltage of 4 kV, in accordance with IEC 62052-11.

3.8.3 Test results

The meter was not influenced by the fast transient burst.
The meter meets the requirements.

3.9 Electrostatic discharges

This test was carried out with meter no. 201400000335.

3.9.1 Test method

The test was carried out in accordance with clause 7.5.2 of IEC 62052-11.

3.9.2 Test levels

A discharge voltage of 15 kV (air discharge) respectively 8 kV (contact- / indirect discharge) was applied in accordance with IEC 62052-11.

3.9.3 Test results

The tests with electrostatic discharges did not cause any disturbances of the meter functions. Air discharge did occur on the battery.
The meter meets the requirements.

3.10 Immunity to electromagnetic RF fields

This test was carried out with meter no. 201400000333.

3.10.1 Test method

The test with an electromagnetic field was carried out in a GTEM cell in the frequency range from 80 MHz to 2 GHz. The test was carried out in accordance with clause 7.5.3 of IEC 62052-11.
The meter was tested at reference voltage.

3.10.2 Test levels

At a field strength of 10 V/m the meter was tested at basic current.
At a field strength of 30 V/m the meter was tested without current.

3.10.3 Test results

The measured variation in error of the meter due to the electromagnetic field was less than 0,5%. The maximum allowed variation according to IEC 62053-21 is 2,0%.
Without current in the current circuits the RF field did not produce a change in the register. The test was subcontracted to DEKRA certification b.v.
The meter meets the requirements.

3.11 Immunity to conducted disturbances induced by RF fields

This test was carried out with meter no. 201400000335.

3.11.1 Test method

The test for immunity to conducted disturbances induced by radio frequency fields was carried out using CDNs in the frequency range from 150 kHz to 80 MHz. The test was carried out in accordance with clause 7.5.5 of IEC 62052-11. The meter was tested at reference voltage.

3.11.2 Test levels

At a field strength of 10 V_{emf} the meter was tested at basic current and without current.

3.11.3 Test results

The measured variation in error of the meter due to the electromagnetic field was less than 0,5%. The maximum allowed variation according to IEC 62053-21 is 2,0%. Without current in the current circuits the RF field did not produce a change in the register.

3.12 Radio interference measurement

This test was carried out with meter no. 201400000333.

3.12.1 Test levels

The test levels were taken from IEC 62052-11 clause 7.5.8. The test was carried out in accordance with CISPR 22.

3.12.2 Test results

The maximum peak value measured in the frequency range from 0,15 MHz to 30 MHz (according to CISPR 22) was far (more than 20 dB) below the maximum allowed peak value in the entire frequency range.
In the frequency range from 30 to 1000 MHz the maximum peak value measured was more than 10 dB below the maximum allowed peak value in the entire frequency range. The test was subcontracted to DEKRA certification b.v.

The meter meets the requirements.

3.13 Voltage dips and short interruptions

This test was carried out with meter no. 201400000301, 201400000302, 201400000330 and 201400000334.

3.13.1 Test levels

The test levels were taken from IEC 62052-11 clause 7.1.2.

3.13.2 Test results

The results of the measurements are mentioned below.

Applied phenomena in the line voltage	Duration of the phenomenon	Requirement	Result
Variation in the line voltage V_{ref} –50 %	1 min.	1 min.	Pass
Interruption in the line voltage 3 times with 50 ms restoring time	See annex B of IEC 62052-11		Pass
Interruption in the line voltage	20 ms	20 ms	Pass

The meter meets the requirements.

3.14 Surge immunity test

This test was carried out with meter no. 201400000335.

3.14.1 Test method

The test was carried out in accordance with clause 7.5.6 of IEC 62052-11 using a surge generator with impedances as specified in the standard.

3.14.2 Test levels

The test levels were taken from IEC 62052-11 clause 7.5.6.

3.14.3 Test results

The meter was not influenced by the surges. The surges did not produce a change in the register.
The meter did not show any damage after the tests.
The meter meets the requirements.

3.15 Damped oscillatory waves immunity test

This test is not applicable to direct connected meters.

3.16 Insulation

This test was carried out with meter no. 201400000303 and 201400000330.

The auxiliary circuits operating at a reference voltage equal to or below 40 V were connected to earth.

3.16.1 Impulse voltage test

The test was carried out in accordance with clause 7.3.2 of IEC 62052-11. The test was subcontracted to DEKRA certification b.v.

Applied pulse	1,2 / 50 μs pulse ; Ri = 500 Ω			
	Specification of circuits(s)	Amplitude (open voltage)	Requirement	Result
Between input leads (differential mode)	Between leads voltage circuit	6 kV	6kV	Pass
Between input circuits and earth (common mode)	Between system and earth	6 kV	6kV	Pass

The meter meets the requirements

3.16.2 A.C. voltage test

The test was carried out in accordance with clause 7.3.3 of IEC 62052-11.

A voltage of 4 kV (Protective class II) at a frequency of 50 Hz was applied between system and earth.

During the tests no flashovers were observed. After the tests had been carried out no degradation in the measured insulation resistance was found. The meter meets the requirements.

Annex A. Accuracy test results

Accuracy test results, serial number 201400000330.

220/380 V	50 Hz					Wh
	3/1	Percentage error at cos φ =				
I in % of I_n	ph	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	3ph	0,00%				
5*	3ph	-0,04%				
10	3ph	-0,01%	0,04%	-0,01%		
10	1ph,1	0,01%				
10	1ph,2	0,08%				
10	1ph,3	0,02%				
20	3ph	-0,01%	0,02%	-0,03%	0,06%	-0,05%
20	1ph,1		0,07%			
20	1ph,2		0,09%			
20	1ph,3		0,06%			
50	3ph	-0,03%	-0,01%	-0,04%	0,01%	-0,04%
100	3ph	-0,03%	-0,02%	-0,02%	-0,02%	-0,03%
100*	3ph	-0,02%	-0,01%			
100	1ph,1	-0,04%	-0,02%			
100	1ph,2	0,00%	0,00%			
100	1ph,3	-0,03%	-0,01%			
½I_{max}	3ph	-0,11%	-0,26%	-0,07%		
I_{max}	3ph	-0,18%	-0,42%	-0,15%		
I_{max}	1ph,1	-0,21%	-0,47%			
I_{max}	1ph,2	-0,14%	-0,36%			
I_{max}	1ph,3	-0,19%	-0,40%			

* Reverse energy

Accuracy test results, serial number 201400000335.

220/380 V	50 Hz					Wh
	3/1	Percentage error at cos φ =				
I in % of I_n	ph	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	3ph	0,00%				
5*	3ph	-0,05%				
10	3ph	0,00%	0,02%	0,00%		
10	1ph,1	0,00%				
10	1ph,2	0,06%				
10	1ph,3	0,03%				
20	3ph	0,00%	0,00%	-0,01%	0,02%	-0,01%
20	1ph,1		0,02%			
20	1ph,2		0,01%			
20	1ph,3		0,10%			
50	3ph	-0,02%	-0,02%	-0,01%	-0,02%	0,00%
100	3ph	-0,01%	-0,04%	-0,01%	-0,07%	0,00%
100*	3ph	-0,02%	-0,05%			
100	1ph,1	-0,03%	-0,04%			
100	1ph,2	0,00%	-0,06%			
100	1ph,3	-0,02%	0,00%			
½I_{max}	3ph	-0,05%	-0,18%	0,00%		
I_{max}	3ph	-0,07%	-0,21%	0,00%		
I_{max}	1ph,1	-0,07%	-0,16%			
I_{max}	1ph,2	-0,04%	-0,20%			
I_{max}	1ph,3	-0,09%	-0,24%			

* Reverse energy

Accuracy test results, serial number 201400000302.

240/415 V	60 Hz					Wh
	3/1	Percentage error at cos φ =				
I in % of I_n	ph	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	3ph	-0,01%				
5*	3ph	-0,03%				
10	3ph	-0,01%	0,01%	-0,02%		
10	1ph,1	0,01%				
10	1ph,2	0,03%				
10	1ph,3	0,04%				
20	3ph	-0,01%	0,01%	-0,02%	0,04%	-0,03%
20	1ph,1		0,02%			
20	1ph,2		0,04%			
20	1ph,3		0,08%			
50	3ph	-0,02%	0,00%	-0,03%	0,00%	-0,03%
100	3ph	-0,02%	-0,02%	-0,02%	-0,02%	-0,02%
100*	3ph	-0,01%	0,00%			
100	1ph,1	-0,02%	-0,02%			
100	1ph,2	-0,01%	-0,01%			
100	1ph,3	-0,03%	0,00%			
½I_{max}	3ph	-0,10%	-0,25%	-0,07%		
I_{max}	3ph	-0,17%	-0,39%	-0,14%		
I_{max}	1ph,1	-0,18%	-0,44%			
I_{max}	1ph,2	-0,15%	-0,36%			
I_{max}	1ph,3	-0,19%	-0,37%			

* Reverse energy

Accuracy test results, serial number 201400000303.

240/415 V	60 Hz					Wh
	3/1	Percentage error at cos φ =				
I in % of I_n	ph	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	3ph	0,01%				
5*	3ph	-0,03%				
10	3ph	0,00%	0,03%	0,00%		
10	1ph,1	0,03%				
10	1ph,2	0,07%				
10	1ph,3	0,02%				
20	3ph	0,00%	0,01%	-0,02%	0,03%	-0,03%
20	1ph,1		0,06%			
20	1ph,2		0,07%			
20	1ph,3		0,01%			
50	3ph	-0,03%	-0,01%	-0,01%	0,01%	0,00%
100	3ph	0,00%	-0,01%	0,00%	0,00%	0,00%
100*	3ph	-0,01%	-0,02%			
100	1ph,1	0,00%	0,00%			
100	1ph,2	0,01%	0,01%			
100	1ph,3	-0,01%	-0,01%			
½I_{max}	3ph	-0,04%	-0,16%	0,00%		
I_{max}	3ph	-0,06%	-0,17%	0,01%		
I_{max}	1ph,1	-0,04%	-0,15%			
I_{max}	1ph,2	-0,06%	-0,14%			
I_{max}	1ph,3	-0,09%	-0,22%			

* Reverse energy

Accuracy test results, serial number 201400000330.

240/415 V	50 Hz					varh
	3/1	Percentage error at sin φ =				
I in % of I_n	ph	1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	3ph	-0,86%				
5*	3ph	0,84%				
10	3ph	-0,43%	-0,89%	-0,82%		
10	1ph,1	0,49%				
10	1ph,2	-0,13%				
10	1ph,3	0,50%				
20	3ph	-0,21%	-0,46%	-0,38%	-0,92%	-0,79%
20	1ph,1		0,45%			
20	1ph,2		-0,13%			
20	1ph,3		0,46%			
50	3ph	-0,08%	-0,17%			
100	3ph	-0,03%	-0,06%	-0,07%	-0,14%	-0,15%
100*	3ph	0,03%	0,08%	0,08%		
100	1ph,1	0,03%	0,08%			
100	1ph,2	0,01%	0,03%			
100	1ph,3	0,03%	0,08%			
½I_{max}	3ph	-0,04%	0,03%			
I_{max}	3ph	-0,06%	0,03%	-0,22%	0,10%	-0,39%
I_{max}	1ph,1	-0,08%	0,01%			
I_{max}	1ph,2	-0,05%	0,03%			
I_{max}	1ph,3	-0,10%	-0,03%			

* Exported energy

Accuracy test results, serial number 201400000335.

240/415 V	50 Hz					varh
	3/1	Percentage error at sin φ =				
I in % of I_n	ph	1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	3ph	-0,83%				
5*	3ph	0,83%				
10	3ph	-0,42%	-0,83%	-0,82%		
10	1ph,1	0,47%				
10	1ph,2	-0,11%				
10	1ph,3	0,46%				
20	3ph	-0,19%	-0,42%	-0,40%	-0,82%	-0,81%
20	1ph,1		0,46%			
20	1ph,2		-0,04%			
20	1ph,3		0,43%			
50	3ph	-0,08%	-0,13%			
100	3ph	-0,03%	-0,03%	-0,09%	-0,07%	-0,21%
100*	3ph	0,03%	0,10%	0,05%		
100	1ph,1	0,04%	0,09%			
100	1ph,2	0,01%	0,09%			
100	1ph,3	0,03%	0,08%			
½I_{max}	3ph	-0,03%	0,08%			
I_{max}	3ph	-0,04%	0,10%	-0,19%	0,24%	-0,37%
I_{max}	1ph,1	-0,04%	0,07%			
I_{max}	1ph,2	-0,03%	0,14%			
I_{max}	1ph,3	-0,07%	0,09%			

* Exported energy

Accuracy test results, serial number 201400000302.

220/380 V	60 Hz					varh
	3/1	Percentage error at sin φ =				
I in % of I_n	ph	1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	3ph	-1,00%				
5*	3ph	0,89%				
10	3ph	-0,52%	-1,01%	-0,98%		
10	1ph,1	0,50%				
10	1ph,2	0,45%				
10	1ph,3	-0,18%				
20	3ph	-0,28%	-0,54%	-0,50%	-1,05%	-0,94%
20	1ph,1		0,48%			
20	1ph,2		0,44%			
20	1ph,3		-0,21%			
50	3ph	-0,15%	-0,23%			
100	3ph	-0,09%	-0,14%	-0,13%	-0,24%	-0,22%
100*	3ph	-0,01%	0,01%	0,04%		
100	1ph,1	0,00%	0,05%			
100	1ph,2	0,01%	0,11%			
100	1ph,3	-0,08%	-0,11%			
½I_{max}	3ph	-0,11%	-0,02%			
I_{max}	3ph	-0,13%	-0,04%	-0,27%	0,03%	-0,47%
I_{max}	1ph,1	-0,14%	-0,02%			
I_{max}	1ph,2	-0,13%	-0,04%			
I_{max}	1ph,3	-0,18%	-0,12%			

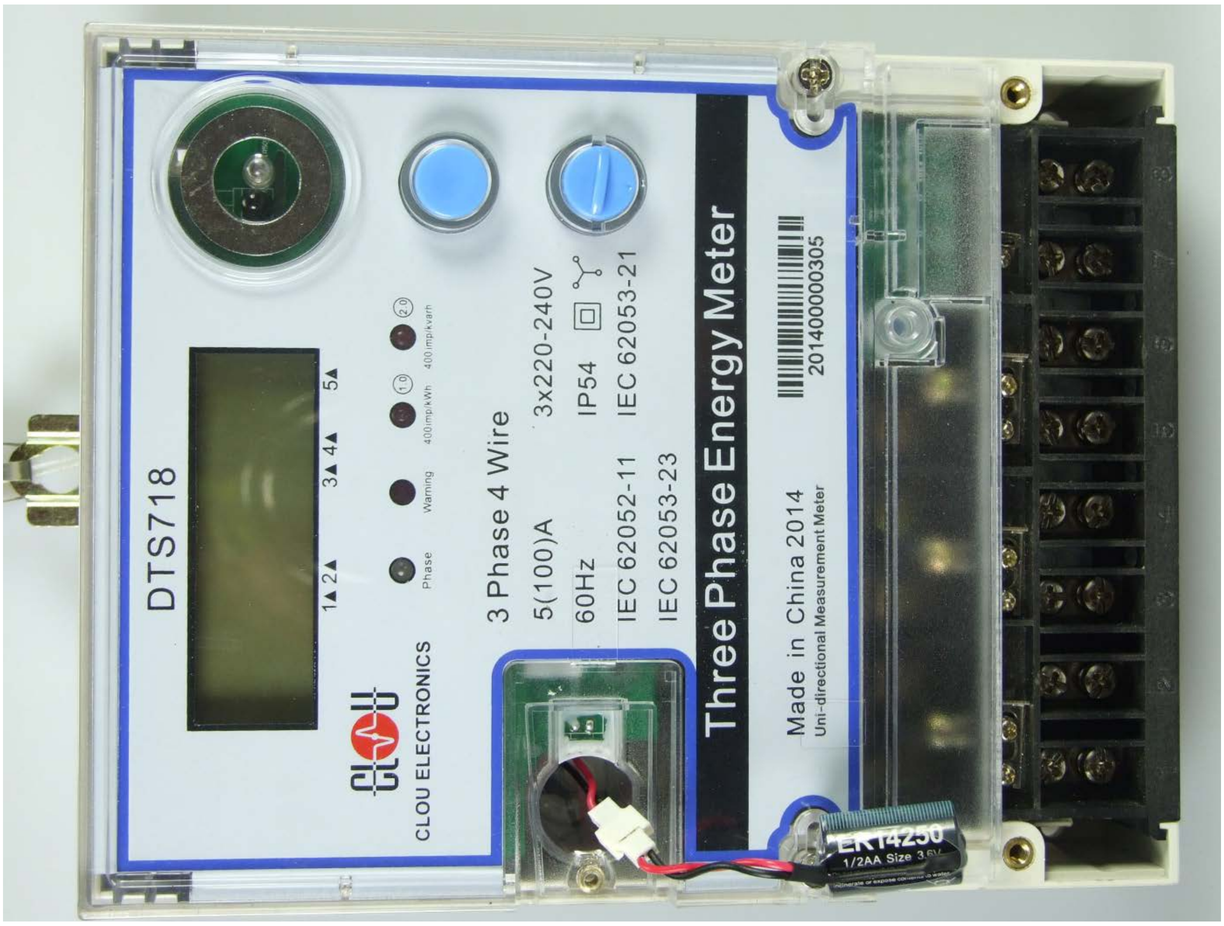
* Exported energy

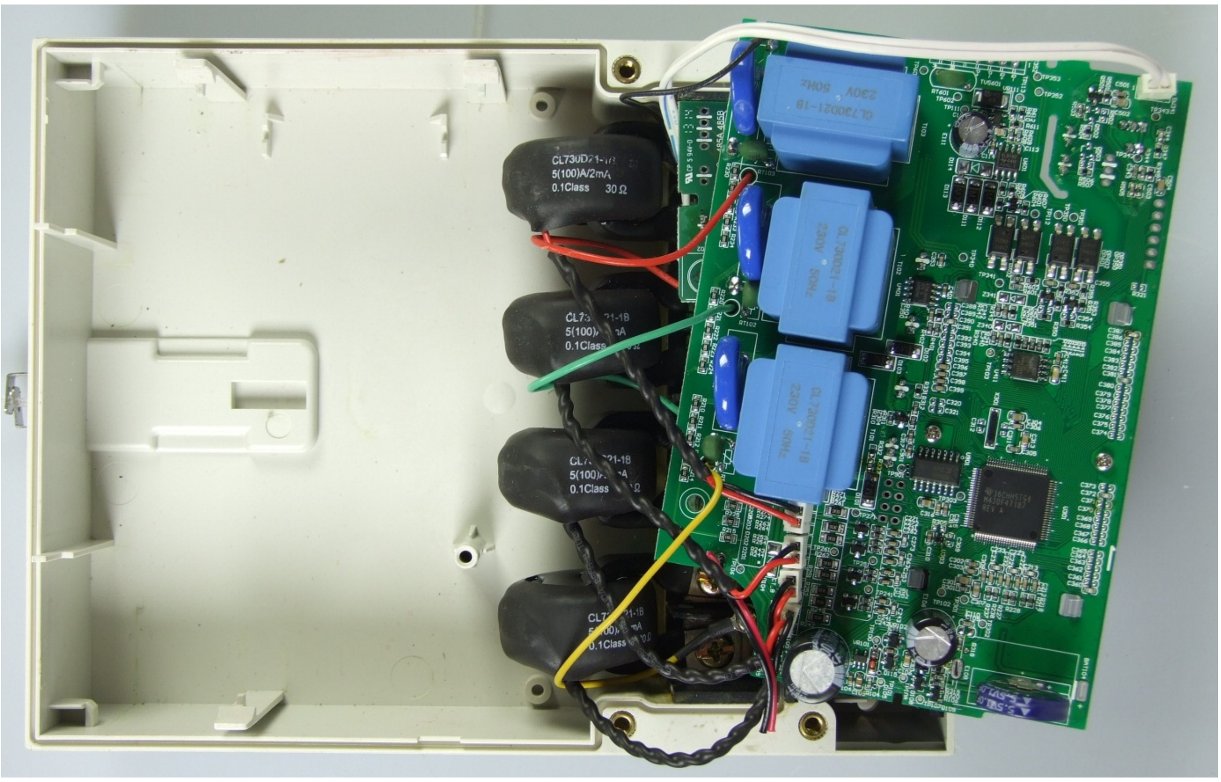
Accuracy test results, serial number 201400000302.

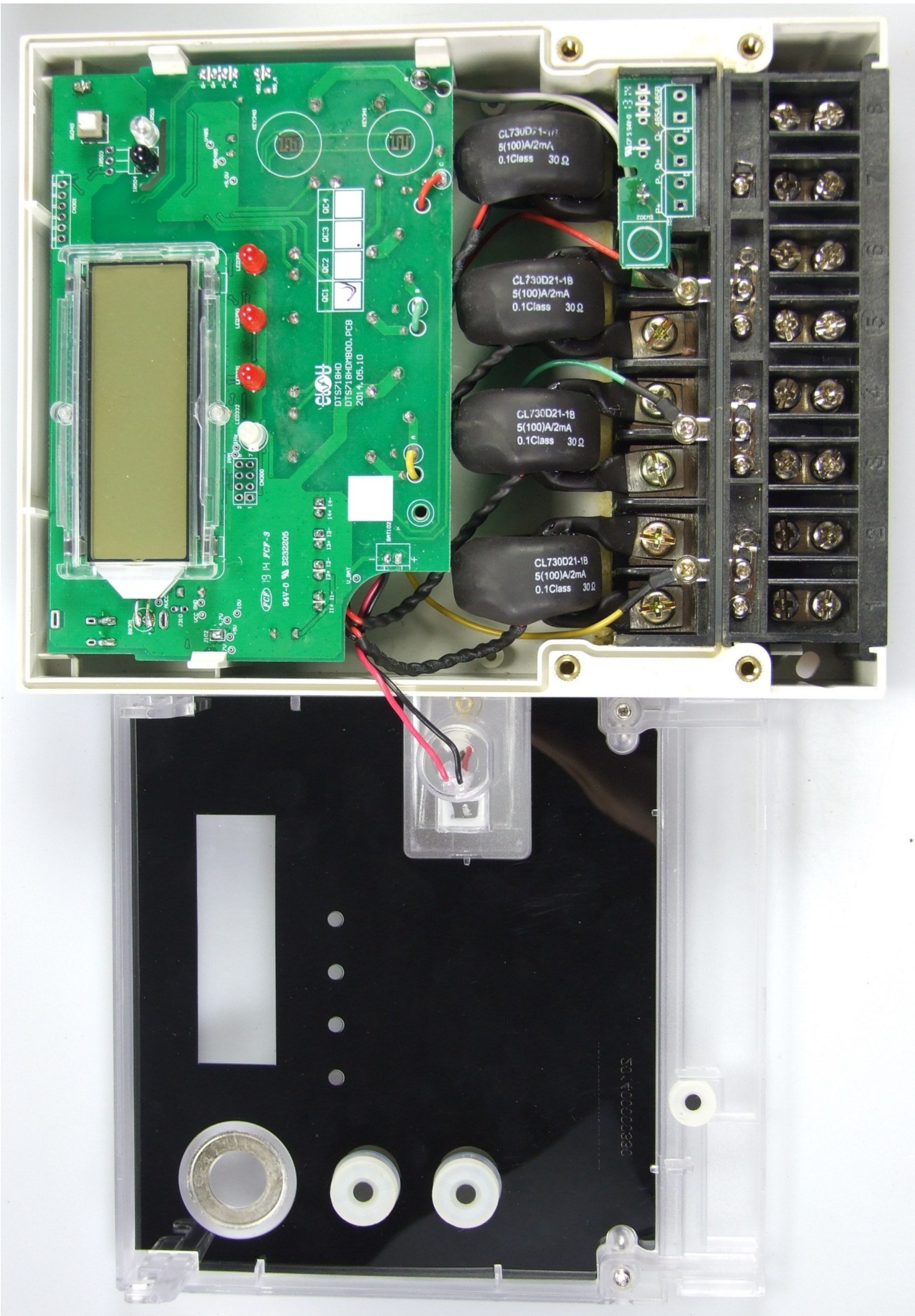
220/380 V	60 Hz					varh
	3/1	Percentage error at sin φ =				
I in % of I_n	ph	1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	3ph	-0,99%				
5*	3ph	0,91%				
10	3ph	-0,51%	-1,00%	-0,97%		
10	1ph,1	0,52%				
10	1ph,2	-0,18%				
10	1ph,3	0,49%				
20	3ph	-0,27%	-0,52%	-0,52%	-1,03%	-0,98%
20	1ph,1		0,49%			
20	1ph,2		-0,22%			
20	1ph,3		0,47%			
50	3ph	-0,16%	-0,22%			
100	3ph	-0,10%	-0,13%	-0,14%	-0,20%	-0,25%
100*	3ph	-0,02%	0,04%	0,01%		
100	1ph,1	0,00%	0,05%			
100	1ph,2	-0,05%	-0,02%			
100	1ph,3	-0,01%	0,05%			
½I_{max}	3ph	-0,10%	0,00%			
I_{max}	3ph	-0,11%	0,04%	-0,22%	0,19%	-0,37%
I_{max}	1ph,1	-0,07%	0,06%			
I_{max}	1ph,2	-0,08%	0,04%			
I_{max}	1ph,3	-0,13%	0,02%			

* Exported energy

Annex B. Photographs of the meter


DTS718
CLOU ELECTRONICS
3 Phase 4 Wire
5(100)A
3x220-240V
60Hz
IP54
IEC 62052-11
IEC 62053-21
IEC 62053-23
Three Phase Energy Meter
Made in China 2014
Uni-directional Measurement Meter
20140000305
ER14250
1/2AA Size 3.6V


CL730D21-1B
5(100)A/2mA
0.1Class 30 Ω


CL730D21-1B
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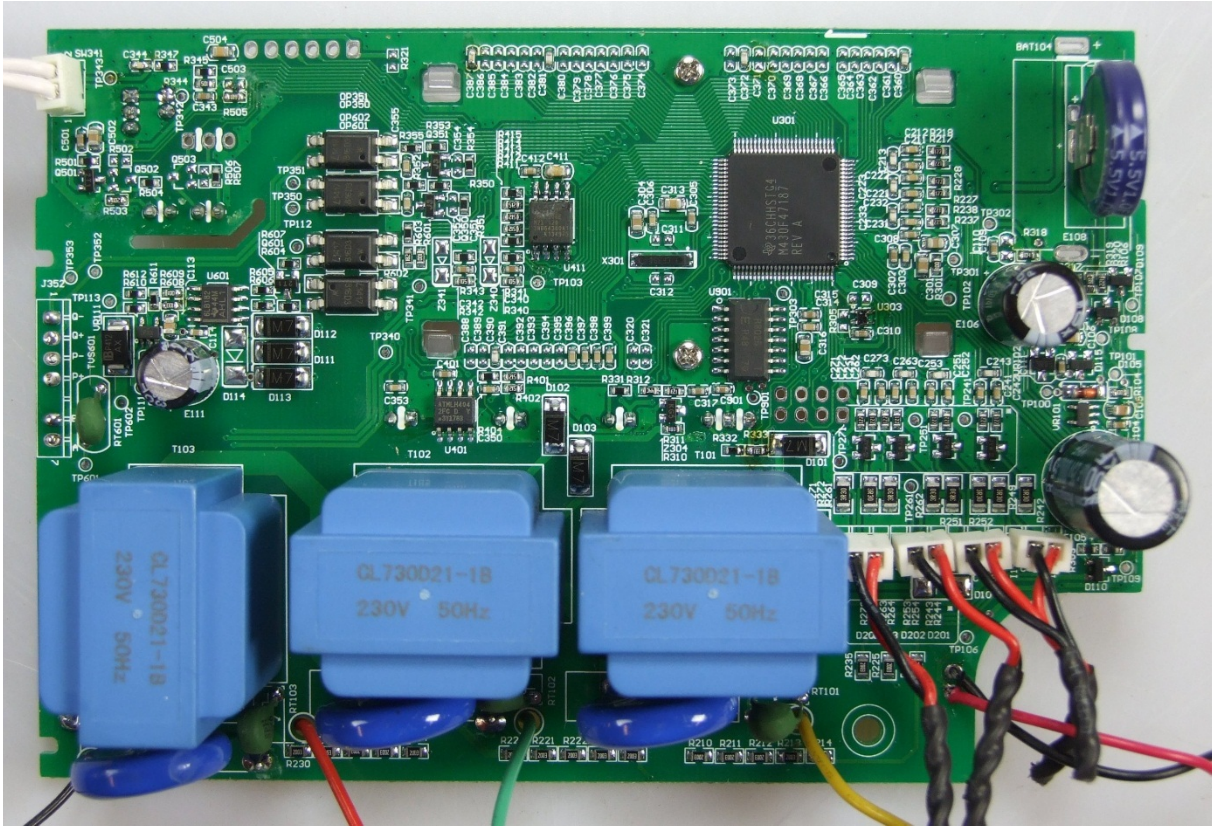
0.1Class 30Ω
DTS718HD
DTS718HDMB00.PCB
2014.05.10
94V-0
E232205


GL730D21-1B
230V 50Hz
GL730D21-1B
230V 50Hz
GL730D21-1B
230V 50Hz


DTS718
CLOU ELECTRONICS
3 Phase 4 Wire
5(100)A
3x220-240V
50 Hz
IP54
IEC 62052-11
IEC 62053-21
IEC 62053-23
Three Phase Energy Meter
Made in China 2014
201400000329
WARNING
Must CUT OFF POWER
Before Replacing the Battery
LOAD

Annex C. Cross-reference table and checklist for static meters

Chapter	Test	IEC 62052 part 11	IEC 62053 part 21/23	Applied standards	
3.3	Accuracy measurement at different loads		8.1		Pass
3.3.4	Test of no load condition		8.3		Pass
3.3.3	Starting current		8.3		Pass
3.3.2	Meter constant		8.4		Pass
3.3.1	Interpretation of test results		8.6		Pass
3.4.3	Voltage variation		8.2		Pass
3.4.2	Auxiliary voltage variation		8.2		N.A.
3.4.4	Frequency variation		8.2		Pass
3.4.10	Reversed phase sequence		8.2		Pass
3.4.11	Voltage unbalance		8.2		Pass
3.4.6	Harmonic components		8.2		Pass
3.4.7	D.C. and even harmonics		8.2		Pass
3.4.8	Odd harmonics in the a.c. current circuit		8.2		Pass
3.4.9	Sub-harmonics in the a.c. current circuit		8.2		Pass
3.4.12	Continuous magnetic induction of external origin		8.2		Pass
3.4.5	Magnetic induction of external origin 0,5 mT		8.2	EN-IEC 61000-4-8	Pass
3.4.1	Influence of ambient temperature variation		8.2		Pass
3.4.13	Operation of accessories		8.2		Pass
3.4.14	Immunity to earth fault	7.4			N.A.
3.9	Electrostatic discharges	7.5.2		EN-IEC 61000-4-2	Pass
3.10	Immunity to electromagnetic RF fields	7.5.3		EN-IEC 61000-4-3	Pass
3.11	Immunity to RF conducted disturbances	7.5.5		EN-IEC 61000-4-6	Pass
3.8	Fast transient burst test	7.5.4		EN-IEC 61000-4-4	Pass
3.14	Surge immunity test	7.5.6		EN-IEC 61000-4-5	Pass
3.13	Voltage dips and short interruptions	7.1.2		EN-IEC 61000-4-11	Pass
3.15	Damped oscillatory waves immunity test	7.5.7		EN-IEC 61000-4-12	N.A.
3.12	Radio interference suppression	7.5.8		CISPR 22, EN 55022	Pass
3.1	General- and mechanical requirements	5			Pass
3.1.3	Spring hammer test	5.2.2.1		EN-IEC 60068-2-75	Pass
3.1.8	Resistance to heat and fire	5.8		EN-IEC 60695-2-11	Pass
3.1.6	Protection against penetration of dust and water	5.9		EN-IEC 60529	Pass

3.1.4	Shock test	5.2.2.2	EN-IEC 60068-2-27	Pass
3.1.5	Vibration test	5.2.2.3	EN-IEC 60068-2-6	Pass
3.1.7	Terminal block material test	5.4	ISO 75-2	Pass
2	Marking of the meter	5.12	IEC 60387, IEC 60417-2, EN 62053-52	Pass
3.2.2	Dry heat test	6.3.1	EN-IEC 60068-2-2	Pass
3.2.3	Cold test	6.3.2	EN-IEC 60068-2-1	Pass
3.2.4	Damp heat cyclic test	6.3.3	EN-IEC 60068-2-30	Pass
3.2.5	Solar radiation test	6.3.4	EN-IEC 60068-2-5	Pass
3.16.1	Impulse voltage test	7.3.2	IEC 60060-1	Pass
3.16.2	A.C. voltage test	7.3.3		Pass
3.6.1	Influence of self heating	7.3		Pass
3.6.2	Heating	7.2		Pass
3.7	Power consumption	7.1		Pass
3.5	Influence of short-time overcurrents	7.2		Pass