KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

Object	A direct connected, electronic single-phase two-wire, smart card and keypad pre-payment two-element energy meter	**1049-20**
Type	JN101 (keypad) and JN101-C (smart card) - active: class 1	

Manufacturer NINGBO JIANAN ELECTRONICS CO., LIMITED
No.711, Keji Road, Gutang Street, Cixi, Zhejiang, China

Production location NINGBO JIANAN ELECTRONICS CO., LIMITED
No.711, Keji Road, Gutang Street, Cixi, Zhejiang, China

Tested by KEMA B.V.,
Klingelbeekseweg 195, Arnhem, The Netherlands

Date of tests September 2019 to February 2020

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 the complete type test requirements of

IEC 62052-11:2003,
IEC 62053-21:2003 and
IEC 62055-31:2005 including **Annex A, B, C** and **D**

The results are shown in the record of proving tests. The values obtained and the general performance are considered to comply with the above standard(s) and to justify the ratings assigned by the manufacturer as listed in chapter 3.

This Certificate consists of 74 pages in total.

KEMA B.V.

Bas Verhoeven
Director, High-Voltage Laboratory

KEMA Laboratories

Arnhem, 26 February 2020

INFORMATION SHEET

1 KEMA Type Test Certificate

A KEMA Type Test Certificate contains a record of a series of (type) tests carried out in accordance with a recognized standard. The object tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by DNV GL. In addition, the object’s technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The Certificate contains the essential drawings and a description of the object tested. A KEMA Type Test Certificate signifies that the object meets all the requirements of the named subclauses of the standard. It can be identified by gold-embossed lettering on the cover and a gold seal on its front sheet.
The Certificate is applicable to the object tested only. DNV GL is responsible for the validity and the contents of the Certificate. The responsibility for conformity of any object having the same type references as the one tested rests with the manufacturer.
Detailed rules on types of certification are given in DNV GL’s Certification procedure applicable to KEMA Laboratories.

2 KEMA Report of Performance

A KEMA Report of Performance is issued when an object has successfully completed and passed a subset (but not all) of test programs in accordance with a recognized standard. In addition, the object’s technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The report is applicable to the object tested only. A KEMA Report of Performance signifies that the object meets the requirements of the named subclauses of the standard. It can be identified by silver-embossed lettering on the cover and a silver seal on its front sheet.
The sentence on the front sheet of a KEMA Report of Performance will state that the tests have been carried out in accordance with …… The object has complied with the relevant requirements.

3 KEMA Test Report

A KEMA Test Report is issued in all other cases. Reasons for issuing a KEMA Test Report could be:

- Tests were performed according to the client’s instructions.
- Tests were performed only partially according to the standard.
- No technical drawings were submitted for verification and/or no assessment of the condition of the object after the tests was performed.
- The object failed one or more of the performed tests.

The KEMA Test Report can be identified by the grey-embossed lettering on the cover and grey seal on its front sheet.
In case the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer, the following sentence will appear on the front sheet. The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on ..... If the object does not pass the tests such behavior will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests is only done on client's request.
When the tests, test procedure and/or test parameters are not in accordance with a recognized standard, the front sheet will state the tests have been carried out in accordance with client’s instructions.

4 Official and uncontrolled test documents

The official test documents of DNV GL are issued in bound form. Uncontrolled copies may be provided as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

5 Accreditation of KEMA Laboratories

The KEMA Laboratories of DNV GL are accredited in accordance with ISO/IEC 17025 by the respective national accreditation bodies. KEMA Laboratories Arnhem, the Netherlands, is accredited by RvA under nos. L020, L218, K006 and K009. KEMA Laboratories Chalfont, United States, is accredited by A2LA under no. 0553.01. KEMA Laboratories Prague, the Czech Republic, is accredited by CAI as testing laboratory no. 1035.

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1 SUMMARY

The energy meter as described in chapter 3, 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 62055-31:2005	:	Particular requirements – Static payment meters for active energy (classes 1 and 2)

The scope of the type testing is carried out including IEC 62055-31 Annex A.
The scope of the type testing is carried out including IEC 62055-31 Annex B.
The scope of the type testing is carried out including IEC 62055-31 Annex C.
The scope of the type testing is carried out including IEC 62055-31 Annex D.

In addition, the following requirements were met:

- Accuracy of the meter using the current measurement in the Neutral wire.
  See paragraph 4.3.5.

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

2 INTRODUCTION

The type test was carried out at KEMA Laboratories, from September 2019 till February 2020, on behalf of NINGBO JIANAN ELECTRONICS CO., LIMITED, on the meter as described in chapter 3.

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 62055-31:2005	:	Particular requirements – Static payment meters for active energy (classes 1 and 2)

The scope of the type testing is carried out including IEC 62055-31 Annex A.
The scope of the type testing is carried out including IEC 62055-31 Annex B.
The scope of the type testing is carried out including IEC 62055-31 Annex C.
The scope of the type testing is carried out including IEC 62055-31 Annex D.

In addition, the following tests were carried out:

- Accuracy of the meter using the current measurement in the Neutral wire.
  See paragraph 4.3.5.

The meter was tested using functionality with energy measurement in both wires (L and N), as described below:
The meter starts measurement on L after power on.
If I_L < 83% I_N, meter switches to I_N for measurement
If I_N < 83% I_L, meter switches to I_L for measurement

Accuracy on both wires is tested separately as described in 3.3.5.
In all other tests, the meter is connected such that the situation of intended use is made (i.e. the same current in both wires).

For all types being part of this type test the test plan of each type is determined based on a comparison of the different types. The expected impact on the result of each test is based on of the differences and similarities between the types. Based on that impact it is decided which types need to be tested on which test.

The test plan was based on these assumptions.

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.

2.1 Applied Standards

The product standard refers to documents, in whole or in part, these documents are normatively referenced to in this product standard and these documents are indispensable for its application. For dated references, only the edition cited applies. For undated references the latest edition of the referenced document (including any amendments) applies. KEMA Laboratories will use the latest edition of the referenced documents (including any amendments) in all cases, also in the cases reference is made to dated editions.

2.2 Subcontractors

The following tests were subcontracted to DEKRA Certification B.V., Arnhem, the Netherlands:

- Radio interference measurement fields in accordance with IEC 62052-11 and CISPR 22.

The laboratory is accredited by RvA under accreditation number L022.

The following tests were subcontracted to Sebert Trillingstechniek BV, Bergschenhoek, the Netherlands:

- shock test in accordance with IEC 60068-2-27;
- vibration test in accordance with IEC 60068-2-6.

The laboratory is accredited by RvA under accreditation number L540.

2.3 Measurement uncertainty

A table with measurement uncertainties is enclosed in this report. Unless otherwise stated, the measurement uncertainties of the results presented in this report are as indicated in that table.

3 DATA RELATED TO THE ENERGY METERS TESTED AND MARKING

Manufacturer	:	NINGBO JIANAN ELECTRONICS CO., LIMITED
Contact person	:	Mr Shen Ye
Address	:	No.711, Keji Road, Gutang Street, Cixi, Zhejiang
Country	:	China.
Production site	:	NINGBO JIANAN ELECTRONICS CO., LIMITED
Address	:	No.711, Keji Road, Gutang Street, Cixi, Zhejiang,
Country	:	China.
Instrument	:	Electronic single-phase two-wire, keypad and smart card pre-payment two-element energy meter, Direct connected
Mark - Type	:	JN101 : keypad JN101-C : smartcard
Register	:	LCD
Accuracy Class	:	Active: 1 ;1000 imp./kWh
Measurement range	:	230 V 5(60) A 50 Hz
Use	:	Indoor
Protection Class	:	II
Utilisation category	:	UC2
Internal clock	:	Crystal controlled
Token carrier interface	:	JN101: Keypad interface JN101-C: Token carrier acceptor interface
Payment type	:	Monetary units
Registry method	:	Programmable, delivered as: Bidirectional method with always positive register: the meter always counts the energy of the measuring point as received energy, irrespective of the real energy direction. At received and delivered energy the amount of energy is deducted from the remain energy.

Note
Production site information was copied from customer specification and not verified by KEMA Laboratories.

The meter contains all required markings.

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

Sample identification:

Smart card meters: 13900000001, 13900000002, 13900000003, 13900000004, 13900000005, 13900000006, 13900000007, 13900000008, 13900000009, 13900000010, 13900000011 and 13900000012.

Keypad meters: 13900000013, 13900000014, 13900000015, 13900000016, 13900000017, 13900000018, 13900000019, 13900000020, 13900000021, 13900000022, 13900000024, 13900000025 and 13900000026.

4 RESULTS OF THE TYPE TEST

4.1 Tests of the mechanical properties

4.1.1 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.

4.1.2 Case

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

4.1.3 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.

4.1.4 Shock test

This test was carried out on meter no. 13900000016.

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. After this test the meter showed no damage.

4.1.5 Vibration test

This test was carried out on meter no. 13900000014.

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. After the test the meter showed no damage.

4.1.6 Protection against penetration of dust and water

This test was carried out on meter no. 13900000012 and 13900000014 (water test) and 13900000004 and 13900000019 (dust test).

The test was carried out according to IEC 60529, protection degree IP51 (indoor).

The meter is dustproof as required by IEC 62052-11 (Cat. 2 according to IEC 60529).

The results of the water penetration test were satisfying.

Immediately after the tests and without disturbing the meter, the payment meter operates correctly and a valid token was accepted on the first attempt.

The meter meets the requirements.

4.1.7 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 0,12 mm (requirement ≤ 0,34 mm). The material meets the requirements.

Specification of the material:
Type: 3412ECR - 739
Manufacturer: Ningbo Sanying chemical
Colour: black

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

4.1.8 Resistance to heat and fire

The material of the terminal block, the meter case and insulating material of the load switch in position were subjected to a glow-wire test in accordance with IEC 60695-2-11. The temperature of the glow-wire was 960 °C for the load switch and terminal block, 650 °C for the meter case and cover.

The materials meet the requirements.

4.1.9 Register and output device

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

In normal operation important indicators can be programmed on the payment meter such as:

- Available kWh energy register
- Cumulative kWh energy register
- Current date
- Current time

The battery symbol (Li = lithium) and utilisation category are marked on the meter.

The energy registry method with regards to delivered- and received energy is Programmable, delivered as:
Bidirectional method with always positive register: the meter always counts the energy of the measuring point as received energy, irrespective of the real energy direction.
At delivered and received energy the amount of energy is also deducted from the remain energy.

The meter meets the requirements.

4.1.10 Token carrier acceptor

This test was carried out on meter no. 13900000005 and 13900000021.

The insertion force required to insert a token carrier into the token carrier acceptor did not exceed 10N. The force required to remove a token carrier from the token carrier acceptor did not exceed 10N.

The token carrier interface was tested to operate for a minimum of 10.000 operations.

After the test the token carrier acceptor worked properly.

The keypad interface was tested to operate for a minimum of 20.000 operations for each individual key, the insertion force did not exceed 10N.

After the test the keypad interface worked properly.

The token carrier acceptor meets the requirements.

4.2 Tests of climatic influences

4.2.1 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.

4.2.2 Dry heat test - Storage and transport

This test was carried out on meter no. 13900000010.

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

The status of all registers, values, and parameters associated with the meter accounting process were valid and free from corruption and there was no resulting damage or degradation to the metrological and functional characteristics of the meter.

The meter meets the requirements.

4.2.3 Cold test

This test was carried out on meter no. 13900000010.

The test was carried out according to IEC 60068-2-1, at a temperature of -25°C for a duration of 72 hours.

Afterwards the meter showed no damage or loss of information.

4.2.4 Damp heat cyclic test

This test was carried out on meter no. 13900000010.
The test was carried out according to IEC 60068-2-30 (variant 1) with an upper temperature of 40°C for 6 cycles.

After the test an insulation test was carried out. The meter showed no damage or loss of information.

The meter meets the requirements.

4.2.5 Solar radiation test

This test is not applicable to indoor meters.

4.2.6 Crystal-controlled clocks on operation reserve

This test was carried out on meter no. 13900000009.

The payment meter to be tested was supplied with power and synchronised with a reference clock. Before the test, the payment meter was powered for a suitable length of time.
The power supply to the payment meter under test was switched off for 68 hours. When the power supply was restored, the time-indication discrepancy between the reference clock and payment meter under test was 0,08 s (req. < 1,5 s/36 h).

The meter meets the requirements.

4.2.7 Crystal-controlled clocks on a.c. supplies

This test was carried out on meter no. 13900000004.

The payment meter to be tested was supplied with power and synchronised with a reference clock. Before the test, the payment meter was powered for a suitable length of time.
After a testing period of 68 hours, the time-indication discrepancy between the reference clock and the payment meter under test was 0,08 s (req. < 1,0 s/48 h).

The meter meets the requirements.

4.2.8 Accuracy of crystal-controlled clocks at temperature limits

This test was carried out on meter no 13900000018.

The payment meter is placed in a climatic chamber and its time base was measured at +23 °C. The temperature was then set at +45 °C.
After a testing period of 24 hours at thermal equilibrium, the time-indication discrepancy between the reference clock and the payment meter under test was 0,50 s (req. < 3,8 s/24 h).

The payment meter is placed in a climatic chamber and its time base was measured at +23 °C. The temperature was then set at -10 °C.
After a testing period of 25 hours at thermal equilibrium, the time-indication discrepancy between the reference clock and the payment meter under test was 0,16 s (req. < 5,45 s/24 h).

The meter meets the requirements.

4.2.9 3th Harmonic component in the voltage circuits

This test was carried out on meter no. 13900000018.

The payment meter was synchronised to a suitable reference clock. Using the special amplifiers of the meter test equipment a third harmonic content equivalent to 10% of Un is added to the supply voltage of the payment meter under test, symmetrically to each phase. The test is carried out for a period of 68 hours under reference conditions.
At the end of the test, the time-indication discrepancy between the payment meter under test and the reference clock was 0,02 s (req. < 1 s / 48 h).

The meter meets the requirements.

4.3 Accuracy measurement at different loads

These tests were carried out on meter no. 13900000010 and 13900000020.

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, at reference voltage and reference frequency (average of 3 repeatable measurements per load point), can be found in appendix 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.

4.3.1 Interpretation of test results

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

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4.3.2 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.

4.3.3 Starting current

The minimum load at which the energy meters tested recorded Whs at reference voltage, reference frequency and cos φ = 1 was less than 0,2 % of Ib (req. ≤ 0,4 % I_b).

The meter meets the requirements.

4.3.4 Test of no load condition

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

The meter meets the requirements.

4.3.5 Accuracy measurement at different loads in the Neutral wire

These tests were carried out on meter no. 13900000006.

Using the same conditions as listed under 4.3, the accuracy was tested when measuring energy in the Neutral wire. The meter functionality allows the meter to decide if this line is used for current measurement, where normally measurement in the L wire is used. Functionality is described in chapter 2.

The values for the errors registered at different currents and various values for cos φ, at reference voltage and reference frequency, can be found in appendix A.
The listed results show the wire used for current measurement for each table.

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.

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

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

The minimum load at which the energy meters tested recorded Whs at reference voltage, reference frequency and cos φ = 1 was less than 0,2% of I_b (req. < 0,4 % I_b).

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

The meter meets the requirements.

4.4 Effect of change of influence quantities on accuracy

4.4.1 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 according to IEC 62053-21 are shown in the following table.

Serial number 13900000003 in L					Wh-measurement
I in % of I_{ref}	cos φ	Temperature coefficient for the specified temperature range in % per K			
		-10 .. 10	10 .. 30	30..45	ºC
10	1	0,013%	0,013%	0,003%	(req.: ≤ 0,05)
20	0,5 ind	0,013%	0,014%	0,001%	(req.: ≤ 0,07)
100	1	0,012%	0,013%	0,001%	(req.: ≤ 0,05)
100	0,5 ind	0,012%	0,013%	0,001%	(req.: ≤ 0,07)
I_{max}	1	0,011%	0,012%	0,000%	(req.: ≤ 0,05)
I_{max}	0,5 ind	0,011%	0,012%	0,001%	(req.: ≤ 0,07)

Serial number 13900000015 in L					Wh-measurement
I in % of I_{ref}	cos φ	Temperature coefficient for the specified temperature range in % per K			
		-10 .. 10	10 .. 30	30..45	ºC
10	1	0,014%	0,014%	0,005%	(req.: ≤ 0,05)
20	0,5 ind	0,014%	0,013%	0,001%	(req.: ≤ 0,07)
100	1	0,013%	0,013%	0,001%	(req.: ≤ 0,05)
100	0,5 ind	0,014%	0,013%	0,000%	(req.: ≤ 0,07)
I_{max}	1	0,012%	0,013%	0,000%	(req.: ≤ 0,05)
I_{max}	0,5 ind	0,013%	0,012%	0,001%	(req.: ≤ 0,07)

Serial number 13900000003 in N					Wh-measurement
I in % of I_{ref}	cos φ	Temperature coefficient for the specified temperature range in % per K			
		-10 .. 10	10 .. 30	30..45	ºC
10	1	0,014%	0,016%	0,001%	(req.: ≤ 0,05)
20	0,5 ind	0,015%	0,017%	0,001%	(req.: ≤ 0,07)
100	1	0,014%	0,016%	0,000%	(req.: ≤ 0,05)
100	0,5 ind	0,014%	0,016%	0,001%	(req.: ≤ 0,07)
I_{max}	1	0,014%	0,016%	0,000%	(req.: ≤ 0,05)
I_{max}	0,5 ind	0,016%	0,010%	0,004%	(req.: ≤ 0,07)

Serial number 13900000003 in N					Wh-measurement
I in % of I_{ref}	cos φ	Temperature coefficient for the specified temperature range in % per K			
		-10 .. 10	10 .. 30	30..45	ºC
10	1	0,016%	0,017%	0,001%	(req.: ≤ 0,05)
20	0,5 ind	0,016%	0,018%	0,001%	(req.: ≤ 0,07)
100	1	0,017%	0,017%	0,000%	(req.: ≤ 0,05)
100	0,5 ind	0,017%	0,017%	0,000%	(req.: ≤ 0,07)
I_{max}	1	0,016%	0,017%	0,000%	(req.: ≤ 0,05)
I_{max}	0,5 ind	0,014%	0,022%	0,006%	(req.: ≤ 0,07)

The meter meets the requirements.

4.4.2 Effect of changes in the auxiliary supply voltage

Not applicable.

4.4.3 Voltage variation

This test was carried out on meter no. 13900000010 and 13900000020.

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:

- 0,12% registering Wh at cos φ = 1 (Requirement ≤ 0,7%)
- 0,02% registering Wh at cos φ = 0,5 ind. (Requirement ≤ 1,0%)

Severe voltage variations were tested.

The meter meets the requirements.

4.4.4 Frequency variation

This test was carried out on meter no. 13900000010 and 13900000020.

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:

- 0,10% registering Wh at cos φ = 1 (Requirement ≤ 0,5%);
- 0,08% registering Wh at cos φ = 0,5 ind. (Requirement ≤ 0,7%).

The meter meets the requirements.

4.4.5 Magnetic induction of external origin 0,5 mT

This test was carried out on meter no. 13900000005 and 13900000021.

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 and reference frequency was 0,06% (L-measurement) and 1,94% (N-measurement). The maximum permissible change allowed by IEC 62053-21 is 2,0%.

The meter meets the requirements.

4.4.6 5th Harmonic components in the current and voltage circuits

This test was carried out on meter no. 13900000010 and 13900000020.

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 0,02%.
The maximum permissible change allowed by IEC 62053-21 is 0,8%.

The meter meets the requirements.

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

This test was carried out on meter no. 13900000003 and 13900000015.

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 0,10% (L-measurement) and 1,01% (N-measurement). The maximum permissible change allowed by IEC 62053-21 is 3,0%.

The meter meets the requirements.

4.4.8 Odd harmonics in the a.c. current circuit

This test was carried out on meter no. 13900000010 and 13900000020.

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 0,17%.
The maximum permissible change allowed by IEC 62053-21 is 3,0%.

The meter meets the requirements.

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

This test was carried out on meter no. 13900000010 and 13900000020.

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 0,10%.
The maximum permissible change allowed by IEC 62053-21 is 3,0%.

The meter meets the requirements.

4.4.10 Reversed phase sequence

This test is not applicable to single-phase meters.

4.4.11 Voltage unbalance

This test is not applicable to single-phase meters.

4.4.12 Continuous magnetic induction of external origin

This test was carried out on meter no. 13900000003 and 13900000015.

The magnetic field was generated using an electromagnet as described in appendix B of IEC 62053-21. The change in the error due to this magnetic field was less than 0,02% (requirement ≤ 2,0%).

The meter meets the requirements.

4.4.13 Operation of accessories

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

4.4.14 Extended Voltage operation range

This test was carried out on meter no. 13900000005 and 13900000015.

Within specified operating range of 0,8Un to 1,15Un, the meter operates correctly.
Within this range, the operation of the power supply circuits, the display, any push buttons, the meter accounting process, any associated registers, values, parameters, the load switch, internal clock and the token carrier interface circuits operates correct.
A valid token was accepted at the first attempt and an invalid token was rejected without damage or cancellation.

The meter meets the requirements.

4.4.15 Abnormal voltage conditions

This test was carried out on meter no. 13900000003.

The payment meter shall withstand, without a safety hazard arising, the maximum withstand voltage (1,9 U_n) applied between the line voltage and neutral terminals. The maximum withstand voltage was applied for a period of 4 h together with a current of 50% of I_{max} and unity power factor.
The timekeeping facility continued to maintain timekeeping under these conditions.
The deviation of the internal clock for internal tariff control after the tests was < 1 s.

The meter meets the requirements.

4.4.16 Limit Voltage range of operation with voltage.

This test was carried out on meter no. 13900000006 and 13900000017.

Outside the extended operating range of supply voltage but within the limit range of operation (i.e. from 0,0 U_n to 0,8 U_n) the following tests, under reference conditions, in prepayment mode and mounted under normal service conditions are used, to verify the severe voltage conditions.

a) The meter was arranged to have a negative value of available credit, such as to ensure that the load switch is open. Readings of the cumulative kWh register and available credit value are then recorded. The supply voltage was then removed.
b) The supply voltage increased from zero at a steady and progressive rate of approximately 1% of U_n per second with no load current, dwelling at each of the following levels for 60 s: 20% U_n, 40% U_n, 60% U_n, 80% U_n. At 80% U_n the load switch is in the correct position.
c) After 60 s. at 80% U_n the supply voltage was decreased at a steady and progressive rate of approximately 1% of U_n per second with no load current, dwelling at each of the following levels for 60 s: 70% U_n, 50% U_n, 30% U_n, 10% U_n, before reaching zero.
d) After 10 s at zero voltage, a supply voltage of 0,8 U_n was applied to the meter and the readings of the cumulative kWh register and available credit value recorded. Sufficient token credit was loaded to ensure that the load switch was closed.

The test sequence in (b), and (c) were then repeated with the load switch closed but no load current applied.

The status of all registers, values, and parameters associated with the meter accounting process are valid and free of corruption.

The deviation of the internal clock for internal tariff control after the tests was < 1 s.

The meter meets the requirements.

4.4.17 Core functional tests within the voltage and temperature range limits

This test was carried out on meter no. 13900000003 and 13900000024.

Within temperature range specified in the standard (i.e. from -10 °C to 45 °C), the operation of the power supply circuits, the display, push buttons, the meter accounting process, the load switch, the token interface and output circuits are correct.
With the supply voltage applied to the payment meter and the payment meter outside the specified operating range but within the limit range of operation (i.e. from –25 °C to –10 °C and from +45 °C to +55 °C) the token interface and output circuits are correct.

The core functions of the meter are tested in the following conditions:

- lower temperature limit + lower voltage limit (-10 °C tested at -25 °C + 0,8 U_n)
- lower temperature limit + reference voltage (-25 °C + U_n)
- lower temperature limit + upper voltage limit (-10 °C tested at -25 °C + 1,15 U_n)
- upper temperature limit + lower voltage limit (+45 °C tested at 55 °C + 0,8 U_n)
- upper temperature limit + reference voltage (+55 °C + U_n)
- upper temperature limit + upper voltage limit (+45 °C tested at 55 °C + 1,15U_n).

At each condition the payment meter was in the prepayment mode and mounted for normal service.
The following core functions were tested:

a) The meter was prepared by applying a load until the available credits exhausted and the load switch opens automatically. Readings of the cumulative kWh register and available credit value was recorded. The supply voltage removed.
b) The meter was subjected to the desired temperature limit and the temperature was allowed to stabilise. The supplied voltage was then applied with zero load current and after one minute, the register and value readings are again recorded, and checked for correct retention. An invalid token was presented and checked for correct rejection.
c) A valid token carrying a suitable amount of credit was then presented to the meter to check token acceptance. The readings were recorded and checked for the correct advance of available credit. The load switch was closed.
d) The supply voltage was then removed for 5 min and then restored with zero load current. The readings were recorded and checked for correct retention.
e) A load of I_{max} and unity power factor then was applied so that the available credit reduces and eventually the load switch opens automatically. The readings were recorded and their changes checked for correct reconciliation.

After the above mentioned conditions the deviation of the internal clock for internal tariff control was < 1 s.
Outside the specified operating range but within the limit range of operation and when there was no supply voltage applied to the payment meter, the status of all registers, values, and parameters associated with the meter accounting process are valid and free from corruption and there were no changes to the metrological and functional characteristics of the meter when the supply voltage was subsequently restored.

The meter meets the requirements.

4.5 Effect of short time overcurrents on the accuracy

A current of 30 times Imax 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
13900000009	<0,01	≤ 1,5 %

The meter meets the requirements.

4.6 Self-heating

4.6.1 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 No.	Maximum change in % cos φ = 1	cos φ = 0,5
13900000010	0,42 (req. ≤ 0,7)	0,36 (req. ≤ 1,0)
13900000020	0,33 (req. ≤ 0,7)	0,40 (req. ≤ 1,0)

The meter meets the requirements.

4.6.2 Heating

This test was carried out on meter no. 13900000010 and 13900000020.

The meter was powered with 115% of nominal voltage and maximum current for 2 hours.
The maximum temperature rise of the meters was 16 K (req. ≤ 25 K).

The meter meets the requirements.

4.7 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.

4.7.1 According: IEC 62053-21 (measured at nominal current)

The power consumption for the current circuits was measured at nominal current.

Serial number	13900000003		13900000015	
Reference Voltage	230 V		230 V	
Reference frequency	50 Hz		50 Hz	
Voltage circuit	VA 3,98	W 1,24	VA 3,83	W 1,03
Current circuit	VA 0,03		VA 0,04	

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.

4.7.2 According: IEC 62055-31 (measured at I_{max})

The power consumption for the current circuits was measured at maximum current.

Serial number	13900000003		13900000015	
Reference Voltage	230 V		230 V	
Reference frequency	50 Hz		50 Hz	
Voltage circuit	VA 3,31	W 1,16	VA 3,17	W 0,89
Current circuit	4,53 VA		5,50 VA	

The maximum permissible power consumption for the voltage circuits is 10 VA and 3 W (including the power supply).
For the current circuits at a nominal voltage of 230 V: 11,0 VA. (0,08% U_n * 100% I_{max}).

The meter meets the requirements.

4.8 Fast transient burst test

This test was carried out on meter no. 13900000009 and 13900000022.

4.8.1 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.

4.8.2 Test levels

The test was carried out with a test voltage of 4 kV in accordance with IEC 62052-11.
This test was first performed with the load switch closed. The test was repeated with the load switch open.

4.8.3 Test results

The meter was not influenced by the fast transient burst.
The influence of the fast transient burst was less than 0,5% in all cases.
The maximum allowed variation according to IEC 62053-21 is 4,0%.

Afterwards there was no change in the operating state and the meter continues to operate correctly without any external intervention.
During and after the test the disturbances did not produce any change in time indication discrepancy.

The deviation of the internal clock for internal tariff control was < 1 s.

The meter meets the requirements.

4.9 Electrostatic discharges

This test was carried out on meter no. 13900000009 and 13900000022.

4.9.1 Test method

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

4.9.2 Test levels

A discharge voltage of 15 kV (air discharge) respectively 8 kV (contact- / indirect discharge) was applied in accordance with IEC 62052-11.
This test was first performed with the load switch closed. The test was repeated with the load switch open.

4.9.3 Test results

The tests with electrostatic discharges did not cause any disturbances of the meter functions.
Afterwards the meter continues to operate correctly without any external intervention.
During and after the test the disturbances did not produce any change in time indication discrepancy.

The deviation of the internal clock for internal tariff control was < 1 s.

The meter meets the requirements.

4.10 Immunity to electromagnetic RF fields

This test was carried out on meter no. 13900000009 and 13900000022.

4.10.1 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.

4.10.2 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.

4.10.3 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.

Afterwards the meter continues to operate correctly without any external intervention.
During and after the test the disturbances did not produce any change in time indication discrepancy.

The deviation of the internal clock for internal tariff control was < 1 s.

The meter meets the requirements.

4.11 Immunity to conducted disturbances induced by RF fields

This test was carried out on meter no. 13900000009 and 13900000022.

4.11.1 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.

4.11.2 Test levels

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

4.11.3 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.
The meter meets the requirements.

Afterwards there was no change in the operating state and the meter continues to operate correctly without any external intervention.

The deviation of the internal clock for internal tariff control was < 1 s.

The meter meets the requirements.

4.12 Radio interference measurement

This test was carried out on meter no. 13900000009, 13900000022 (conducted), 13900000011 and 13900000019 (radiated).

4.12.1 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.

4.12.2 Test results

The maximum peak value measured in the frequency range from 0,15 MHz to 30 MHz was more than 16 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 8 dB below the maximum allowed peak value in the entire frequency range.

The meter meets the requirements.

4.13 Voltage dips and short interruptions

This test was carried out on meter no. 13900000005 and 13900000021.

4.13.1 Test levels

The test levels were taken from IEC 62052-11 clause 7.1.2 and IEC 62055-31 clause 7.2.2 and annex D D5.2.

4.13.2 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 50 Hz	20 ms	20 ms	Pass

The test was carried out first with the load switch closed and it stayed in the closed position until the end of the test. The test was repeated with the switch open and it stayed open throughout the test.

After the tests, a valid credit token was presented. The token and payment meter operates correctly, including operation of the load switch.

The meter meets the requirements.

4.13.3 The results according IEC 62055-31 Annex D

This test was carried out on meter no. 13900000015.

Applied phenomena in the line voltage	Duration of the phenomenon	Requirement	Result
Variation in the line voltage V_{ref} −50%	2min.	2min.	Pass
Interruption time 100ms in the line voltage, 20 times with at least 5 seconds intervals	See annex D of IEC 62055-31		Pass
Interruption time 1s in the line voltage, 20 times with at least 5 seconds intervals	See annex D of IEC 62055-31		Pass

After the test the time indication discrepancy between the payment meter under test and reference clock was:

- After 20 interruptions, 100 msec. : 0,35 sec. (req. < 1 s).
- After 20 interruptions, 1 sec. : 0,19 sec. (req. < 1 s).
- After 2 minutes dip : 0,03 sec. (req. < 1 s).

The meter meets the requirements.

4.14 Surge immunity test

This test was carried out on meter no. 13900000009 and 13900000022.

4.14.1 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.

4.14.2 Test levels

The test on mains lines was carried out with a test voltage of 4 kV, in accordance with IEC 62052-11 clause 7.5.6.
This test was first performed with the load switch closed. The test was repeated with the load switch in the open position.

4.14.3 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.

Afterwards the meter continues to operate correctly without any external intervention.
During and after the test the disturbances did not produce any change in time indication discrepancy.

The deviation of the internal clock for internal tariff control was < 1 s.

The meter meets the requirements.

4.15 Damped oscillatory waves immunity test

This test is not applicable to direct connected meters.

4.16 Insulation

This test was carried out on meter no13900000010.

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

4.16.1 Impulse voltage test

The test was carried out in accordance with clause 7.3.2 of IEC 62052-11.

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

During the test a metal token was fitted in the token carrier acceptor, no flashovers were observed. After the tests had been carried out the meter operates correctly.

The change in accuracy due to the test was 0,04%.

The meter meets the requirement.

4.16.2 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 test a metal token was fitted in the token carrier acceptor.
No flashovers were observed. After the tests had been carried out the meter operates correctly.

The change in accuracy due to the test was 0,04%.

The meter meets the requirement.

5 TOKEN HANDLING

5.1 Interruptions to token acceptance

This test is not applicable for keypad meters.

This test was carried out on meter no. 13900000005.

A token carrier was inserted into the token carrier acceptor and normally the data transfer process will be completed before token carrier withdrawn takes place. The meter is designed such that data on the token carrier is not corrupted or lost and any data transferred to the payment meter is not actioned until the token transaction is subsequently completed.

The meter meets the requirement.

5.2 Token acceptance

This test was carried out on meter no. 13900000005 and 13900000015.

The acceptance of a valid token results in the exact amount of credit on the token carrier being transferred to the appropriate register(s) in the payment meter, and the available credit value in the meter was incremented by exactly this amount.

The meter meets the requirement.

5.3 Rejection of duplicate tokens

This test was carried out on meter no. 13900000005 and 13900000015.

The payment system operation is based on meter-specific tokens for single use, the payment meter ensures that no customer token intended for single use may be actioned more than once, including where token acceptance has been interrupted.

If the token is presented for the second time, the token is rejected, the information on the display shows Err=37.

The meter meets the requirement.

5.4 Rejection of valid tokens when available credit is saturated

This test was carried out on meter no 13900000005 and 13900000015.

A valid token was presented to the payment meter that resulted in the amount of available credit exceeding the maximum amount possible in the meter. The token was rejected. The token was not erased or invalidated. At a later time when the conditions allowed, the token was presented again and accepted.

The meter meets the requirement.

5.5 Energy register roll-over

The execution of this test was performed by the manufacturer as agreed between the manufacturer and test lab.

The meter meets the requirement.

5.6 Token carrier interface test

This test is not applicable for keypad meters.

This test was carried out on meter no. 13900000005.

The payment meter was fitted with a metallic token carrier inserted into the token aperture such that it short circuits all contacts to the token carrier token carrier acceptor.
The meter and token carrier acceptor did not suffer electrical damage with the payment metering operating at U_n, zero current, and with the load switch closed.

The meter meets the requirement.

6 LOAD SWITCH REQUIREMENTS

6.1 Load switching capabilities

Summary of test currents for the switch:

Test clause		UC2
C.3	Electrical endurance	A
C.5	Fault current making capacity	2,5 kA
C.6	Short-circuit current carrying capacity – test 1	4,5 kA
C.6	Short-circuit current carrying capacity – test 2	2,5 kA

6.2 Electrical endurance

This test was carried out on sample No. 13900000013.

The test was carried out in accordance with clause C.3 of IEC 62055-31.

6.2.1 Required test values

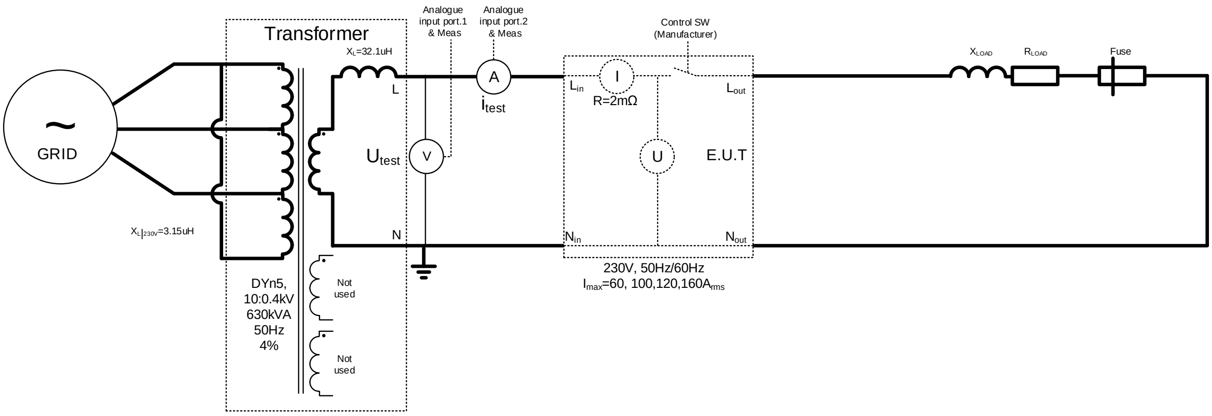
1st 5000 cycles at 10 seconds make time and 20 seconds break time.

Type of circuit : L + N
Voltage : 230 Vac
Current : 60 A
Power factor : 1,00

2nd 5000 cycles at 10 seconds make time and 20 seconds break time.

Type of circuit : L + N
Voltage : 230 Vac
Current : 60 A
Power factor : 0,50 ind.

6.2.2 Test circuit



Phase	Part of test	Power factor	Appendix D – plot no.	Contact welded	Result
L1	Shot 1	1.0	Figure 1	No	Pass
L1	Shot 5000	1.0	-	No	Pass
L1	Shot 1	0.5	Figure 2	No	Pass
L1	Shot 5000	0.5	-	No	Pass

current 59,6 A
Voltage 230,1 V
Power factor 1,0
break time t_{on} = 10 s
t_{off} = 20 s

current 60,0 A
Voltage 232,0 V
Power factor 0,50
break time t_{on} = 10 s
t_{off} = 20 s

6.2.3 Minimum switched current Test conditions

6.2.3.1 Test method

The test was carried out at reference voltage, minimum switch current and power factor 1,0.
The test was carried out in accordance with clause C7 of IEC 62055-31.

6.2.3.2 Test levels

Execute 10 operating cycles at approximately 10 s closed and 20 s open.

6.2.3.3 Test results

The test current shall successfully conduct each time the contacts are in the closed position.
The test current shall successfully break each time the contacts are in the open position.

The meter meets the requirements.

6.2.4 Power consumption

The power consumption is measured according: IEC 62055-31 (measured at I_{max}).

Reference Voltage	230 V	
Reference frequency	50 Hz	
Voltage circuit	VA 3,71	W 1,35
Current circuit	4,56 VA	

The maximum permissible power consumption for the voltage circuits is 10 VA and 3 W (including the power supply).
For the current circuits at a nominal voltage of 230 V: 11,0 VA. (0,08% U_n * 100% I_{max}).

The meter meets the requirements.

6.2.5 Impulse voltage test

The test was carried out in accordance with clause C8 of IEC 62055-31 with open switch.

Applied pulse: 1,2 / 50 µs pulse ; R_i = 500 Ω			
Specification of circuits(s)	Amplitude (open voltage)	Requirement	Result
Over the open contacts of the switch	2 kV	2 kV	Pass

During the tests no flashovers were observed. After the tests had been carried out no degradation in the measured insulation resistance was found and the meter operates correctly with no change in any of the memory registers.

The meter meets the requirement.

6.2.6 A.C. voltage test

The test was carried out in accordance with clause C8 of IEC 62055-31 with open switch.

A voltage of 1 kV at a frequency of 50 Hz was applied over the open contacts of the switch.

During the tests no flashovers were observed. After the tests had been carried out there was no change in any of the memory registers.

The meter meets the requirement.

6.3 Fault current making capacity

This test was carried out on sample No. 13900000008.

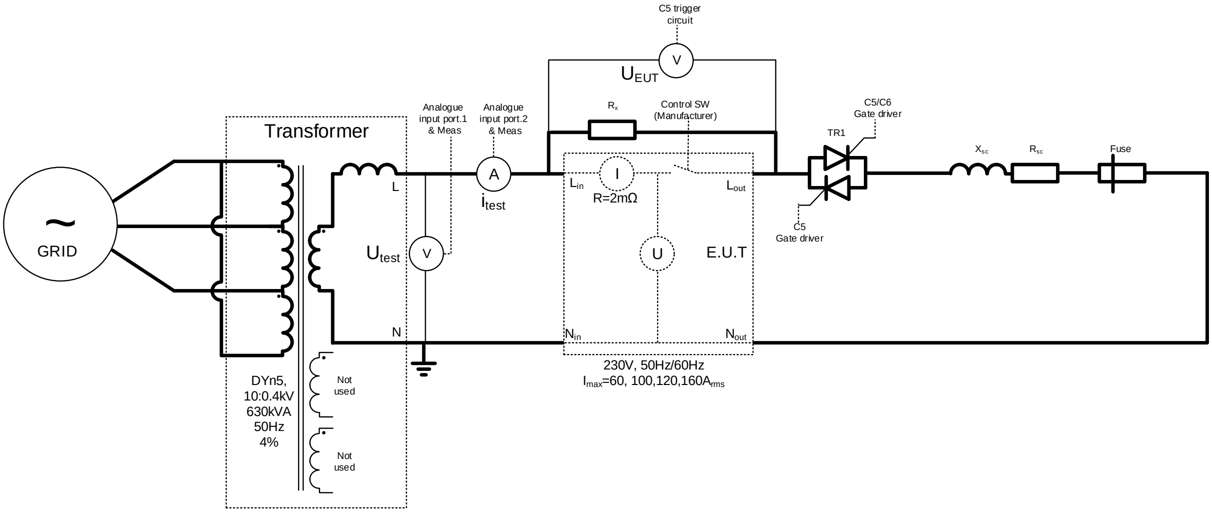
The test was carried out in accordance with clause C.5 of IEC 62055-31.

6.3.1 Required test values

3 times making on the prospective short circuit current.

Type of circuit	:	L + N
Voltage (+5% ... -5%)	:	264 Vac (115%Un)
Current (+5% ... -0%)	:	2500 A
Utilisation category	:	UC2
Power factor (+0.00 ... -0.05)	:	0,85 – 0,90

6.3.2 Test circuit



6.3.3 Pre-fusing cycles

3 cycles of pre fusing at I_c with a power factor 1,0 at an interval of 10 seconds.

The meter meets the requirements.

6.3.4 Fault current making capacity

Initial measurement

Voltage Vac	Peak current A	r.m.s. current A	Power factor
265	3660	2588	0,80

Test shots

Phase	Voltage Vac	Peak current A	r.m.s. current A	Power factor
L1	265	2800	1980	0,80
L1	265	3610	2553	0,80
L1	265	3510	2482	0,80

Phase	Part of test	Appendix D – plot no.	Contact welded	Result
	Initial	Figure 3	-	-
L1	Shot 1	Figure 4	No	Pass
L1	Shot 2	Figure 5	No	Pass
L1	Shot 3	Figure 6	No	Pass

6.3.5 Minimum switched current Test conditions:

6.3.5.1 Test method

The test was carried out at reference voltage, minimum switch current and power factor 1,0.
The test was carried out in accordance with clause C7 of IEC 62055-31.

6.3.5.2 Test levels

Execute 10 operating cycles at approximately 10 s closed and 20 s open.

6.3.5.3 Test results

The test current shall successfully conduct each time the contacts are in the closed position.
The test current shall successfully break each time the contacts are in the open position.

The meter meets the requirements.

6.3.6 Power consumption

The power consumption is measured according: IEC 62055-31 (measured at I_{max}).

Reference Voltage	230 V	
Reference frequency	50 Hz	
Voltage circuit	VA 3,83	W 1,43
Current circuit	3,13 VA	

The maximum permissible power consumption for the voltage circuits is 10 VA and 3 W (including the power supply).
For the current circuits at a nominal voltage of 230 V: 11,0 VA. (0,08% U_n * 100% I_{max}).

The meter meets the requirements.

6.3.7 Impulse voltage test

The test was carried out in accordance with clause C8 of IEC 62055-31 with open switch.

Applied pulse: 1,2 / 50 μs pulse ; R_i = 500 Ω			
Specification of circuits(s)	Amplitude (open voltage)	Requirement	Result
Over the open contacts of the switch	2 kV	2 kV	Pass

During the tests no flashovers were observed. After the tests had been carried out no degradation in the measured insulation resistance was found and the meter operates correctly with no change in any of the memory registers.

The meter meets the requirement.

6.3.8 A.C. voltage test

The test was carried out in accordance with clause C8 of IEC 62055-31 with open switch.

A voltage of 1 kV at a frequency of 50 Hz was applied over the open contacts of the switch.

During the tests no flashovers were observed. After the tests had been carried out there was no change in any of the memory registers.

The meter meets the requirement.

6.4 Short-circuit carrying capacity, test 1

This test was carried out on sample No. 13900000002.

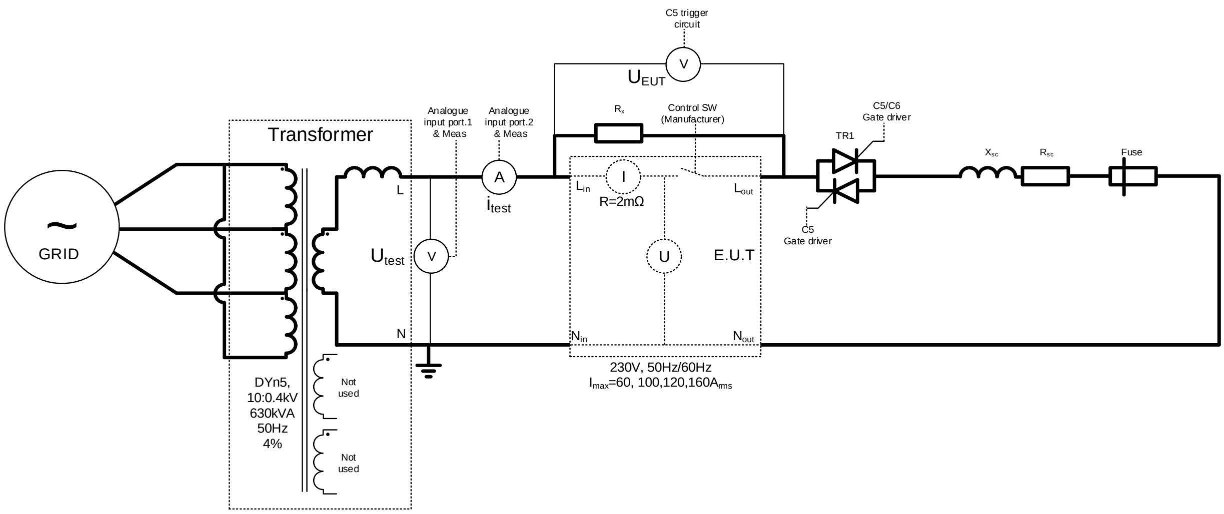
The test was carried out in accordance with clause C.6 of IEC 62055-31.

6.4.1 Required test values

3 times making on the prospective short circuit current.

Type of circuit	:	L + N
Voltage (+5% ... -5%)	:	264 Vac (115%Un)
Current (+5% ... -0%)	:	4500
Utilisation category	:	UC2
Power factor (+0.00 ... -0.05)	:	0,75 – 0,80

Test circuit



6.4.2 Pre-fusing cycles

3 cycles of pre fusing at I_c with a power factor 1,0 at an interval of 10 seconds.

The meter meets the requirement.

6.4.3 Short-circuit current carrying capacity

Initial measurement

Voltage Vac	Peak current A	r.m.s. current A	Power factor
265	6560	4639	0,80

Test shots

Phase	Voltage Vac	Peak current A	r.m.s. current A	Power factor
L1	265	6500	4596	0,80
L1	265	6510	4603	0,80
L1	265	6500	4596	0,80

Phase	Part of test	Appendix D – plot no.	Contact welded	Result
	Initial	Figure 7	-	-
L1	Shot 1	Figure 8	No	Pass
L1	Shot 2	Figure 9	No	Pass
L1	Shot 3	Figure 10	No	Pass

6.4.4 Minimum switched current Test conditions

6.4.4.1 Test method

The test was carried out at reference voltage, minimum switch current and power factor 1,0.
The test was carried out in accordance with clause C7 of IEC 62055-31.

6.4.4.2 Test levels

Execute 10 operating cycles at approximately 10 s closed and 20 s open.

6.4.4.3 Test results

The test current shall successfully conduct each time the contacts are in the closed position.
The test current shall successfully break each time the contacts are in the open position.

The meter meets the requirements.

6.4.1 Power consumption

The power consumption is measured according: IEC 62055-31 (measured at I_{max}).

Reference Voltage	230 V	
Reference frequency	50 Hz	
Voltage circuit	VA 3,88	W 1,44
Current circuit	3,59 VA	

The maximum permissible power consumption for the voltage circuits is 10 VA and 3 W (including the power supply).
For the current circuits at a nominal voltage of 230 V: 11,0 VA. (0,08% U_n * 100% I_{max}).

The meter meets the requirements.

6.4.2 Impulse voltage test

The test was carried out in accordance with clause C8 of IEC 62055-31 with open switch.

Applied pulse: 1,2 / 50 μs pulse ; R_i = 500 Ω			
Specification of circuits(s)	Amplitude (open voltage)	Requirement	Result
Over the open contacts of the switch	2 kV	2 kV	Pass

During the tests no flashovers were observed. After the tests had been carried out no degradation in the measured insulation resistance was found and the meter operates correctly with no change in any of the memory registers.

The meter meets the requirement.

6.4.3 A.C. voltage test

The test was carried out in accordance with clause C8 of IEC 62055-31 with open switch.

A voltage of 1 kV at a frequency of 50 Hz was applied over the open contacts of the switch.

During the tests no flashovers were observed. After the tests had been carried out there was no change in any of the memory registers.

The meter meets the requirement.

6.5 Short-circuit carrying capacity, test 2

Short-circuit carrying capacity, test 1 is passed. Beside this the load switch did not show signs of malfunction, sticking or welding of contacts or reluctance to latch.

Therefore, short-circuit carrying capacity, test 2 did not need to be performed.

The meter meets the requirement.

Appendix A Accuracy test results

Accuracy test results, serial number 13900000010.

230 V	L				Wh
	Percentage error at cos φ =				
I in % of I_b	1	0,5 ind	0,8 cap	0,25 ind	0,25 cap
5	0,01%				
5 *	0,18%				
10	0,05%	0,05%	0,01%		
20	0,07%	0,10%	0,05%	0,12%	0,01%
50	0,08%	0,13%	0,06%	0,17%	0,03%
100	0,09%	0,14%	0,06%	0,18%	0,03%
100 *	0,10%	0,15%	0,08%		
200	0,09%	0,14%	0,07%		
$^1/_2$ I_{max}	0,11%	0,17%	0,12%		
$^3/_4$ I_{max}	0,16%	0,22%	0,19%		
I_{max}	0,25%	0,31%	0,30%		

* Reverse energy

Extra accuracy test results according to chapter 8: IEC 62055-31, serial number 13900000010.

230V	L Wh
I in % of I_b	Percentage error at cos φ = 1
5	-0,02%
I_{max}	0,25%

Version: 1

Accuracy test results, serial number 13900000010.

230 V	N				Wh
	Percentage error at cos φ =				
I in % of I_b	1	0,5 ind	0,8 cap	0,25 ind	0,25 cap
5	0,04%				
5 *	0,03%				
10	0,05%	0,10%	0,02%		
20	0,04%	0,10%	0,02%	0,17%	-0,01%
50	0,04%	0,08%	0,02%	0,14%	0,00%
100	0,04%	0,07%	0,02%	0,10%	0,00%
100 *	0,04%	0,07%	0,02%		
200	0,03%	0,04%	0,03%		
$^1/_2$ I_{max}	0,02%	-0,02%	0,04%		
$^3/_4$ I_{max}	0,02%	-0,05%	0,06%		
I_{max}	0,03%	-0,06%	0,06%		

* Reverse energy

Extra accuracy test results according to chapter 8: IEC 62055-31, serial number 13900000010.

230V	N Wh
I in % of I_b	Percentage error at cos φ = 1
5	0,02%
I_{max}	0,03%

Accuracy test results, serial number 13900000010.

230 V	L+N				Wh
	Percentage error at cos φ =				
I in % of I_b	1	0,5 ind	0,8 cap	0,25 ind	0,25 cap
5	0,14%				
5 *	0,06%				
10	0,11%	0,50%	-0,02%		
20	0,11%	0,49%	-0,04%	0,99%	-0,25%
50	0,10%	0,49%	-0,04%	0,97%	-0,25%
100	0,11%	0,47%	-0,05%	0,94%	-0,26%
100 *	0,10%	0,48%	-0,05%		
200	0,11%	0,49%	-0,04%		
$^1/_2$ I_{max}	0,12%	0,51%	0,00%		
$^3/_4$ I_{max}	0,04%	0,56%	0,06%		
I_{max}	0,26%	0,64%	0,16%		

* Reverse energy

Extra accuracy test results according to chapter 8: IEC 62055-31, serial number 13900000010.

230V	L+N Wh
I in % of I_b	Percentage error at cos φ = 1
5	0,14%
I_{max}	0,26%

Version: 1

Accuracy test results, serial number 13900000020.

230 V	L				Wh
	Percentage error at cos φ =				
I in % of I_b	1	0,5 ind	0,8 cap	0,25 ind	0,25 cap
5	-0,18%				
5 *	-0,13%				
10	-0,17%	-0,14%	-0,18%		
20	-0,15%	-0,12%	-0,16%	-0,08%	-0,19%
50	-0,15%	-0,12%	-0,16%	-0,07%	-0,17%
100	-0,14%	-0,11%	-0,16%	-0,06%	-0,18%
100 *	-0,14%	-0,11%	-0,15%		
200	-0,14%	-0,10%	-0,15%		
$^1/_2$ I_{max}	-0,12%	-0,08%	-0,11%		
$^3/_4$ I_{max}	-0,07%	-0,02%	-0,04%		
I_{max}	0,01%	0,06%	0,06%		

* Reverse energy

Accuracy test results, serial number 13900000020.

230 V	N				Wh
	Percentage error at cos φ =				
I in % of I_b	1	0,5 ind	0,8 cap	0,25 ind	0,25 cap
5	-0,01%				
5 *	-0,01%				
10	-0,01%	0,04%	-0,03%		
20	0,00%	0,03%	-0,02%	0,10%	-0,05%
50	0,04%	0,05%	-0,01%	0,11%	-0,04%
100	0,00%	0,03%	-0,01%	0,07%	-0,03%
100 *	0,00%	0,04%	-0,01%		
200	0,00%	0,00%	0,00%		
$^1/_2$ I_{max}	-0,01%	-0,06%	0,01%		
$^3/_4$ I_{max}	-0,01%	-0,09%	0,02%		
I_{max}	0,00%	-0,10%	0,03%		

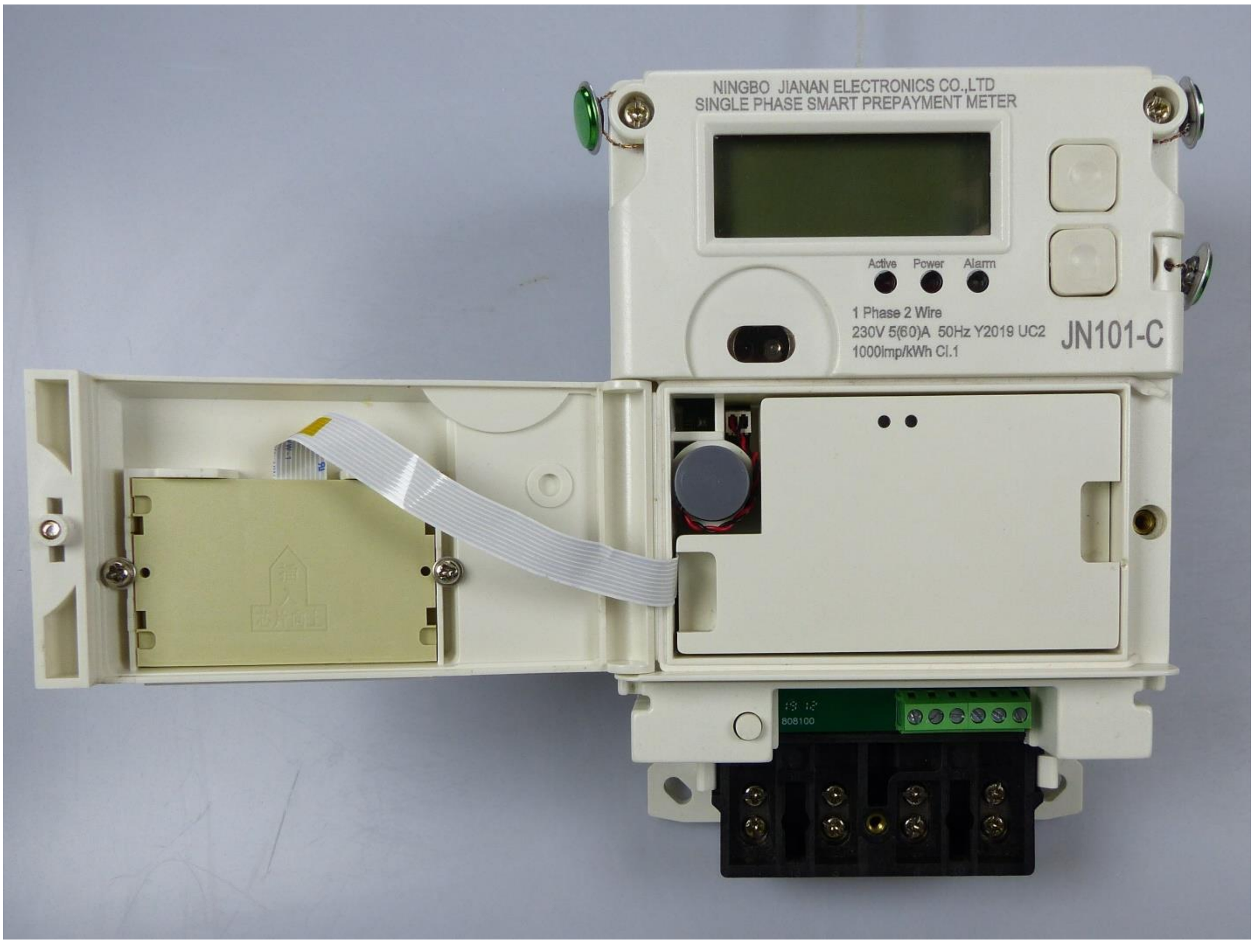
* Reverse energy

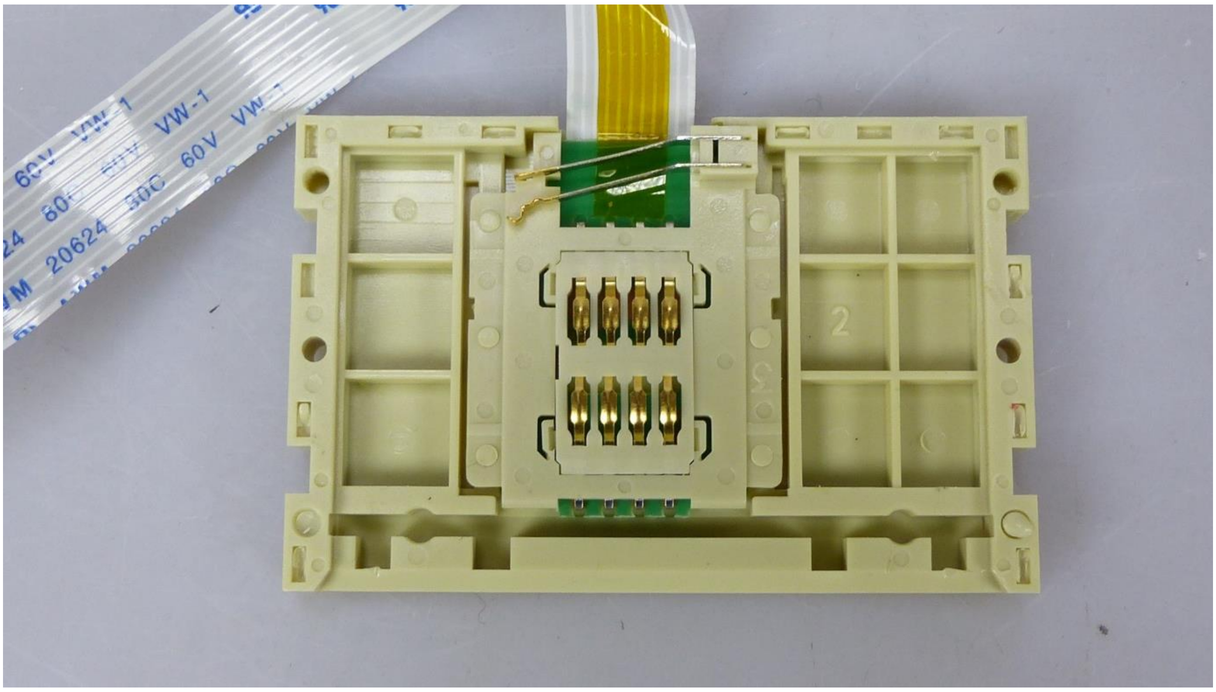
Accuracy test results, serial number 13900000020.

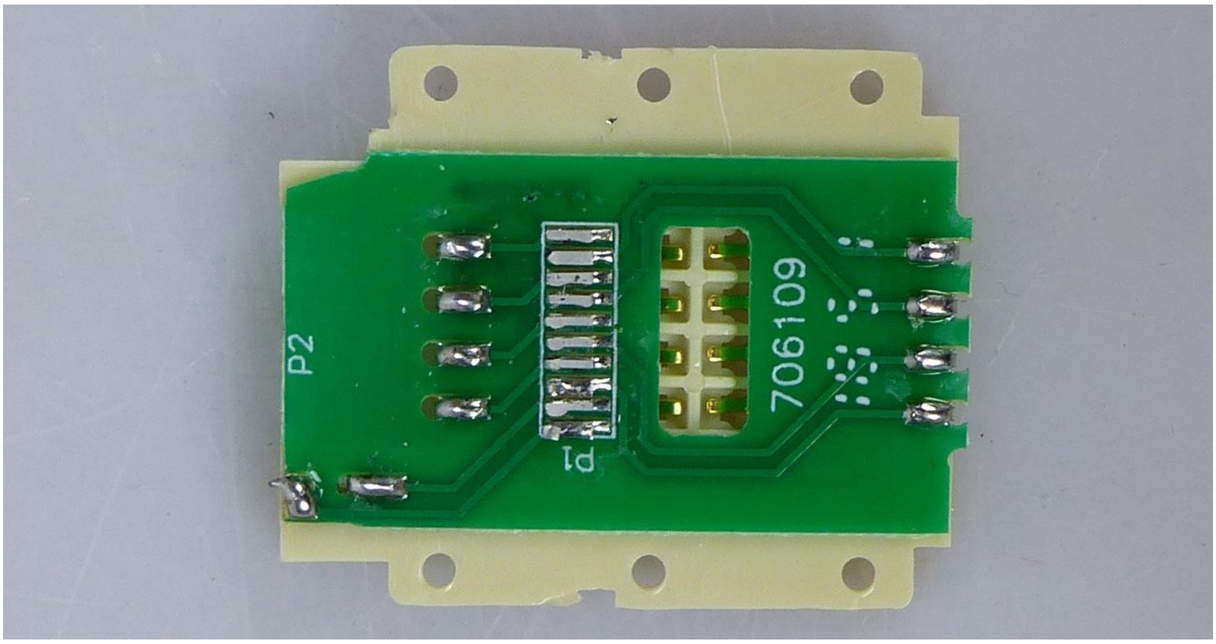
230 V	L+N				Wh
	Percentage error at cos φ =				
I in % of I_b	1	0,5 ind	0,8 cap	0,25 ind	0,25 cap
5	-0,12%				
5 *	-0,18%				
10	-0,13%	0,37%	-0,34%		
20	-0,14%	0,36%	-0,34%	0,99%	-0,61%
50	-0,14%	0,35%	-0,35%	0,99%	-0,61%
100	-0,14%	0,33%	-0,34%	0,96%	-0,62%
100 *	-0,14%	0,34%	-0,36%		
200	-0,13%	0,36%	-0,34%		
$^1/_2$ I_{max}	-0,12%	0,38%	-0,30%		
$^3/_4$ I_{max}	-0,07%	0,42%	-0,23%		
I_{max}	0,01%	0,51%	-0,12%		

* Reverse energy

Appendix B Photographs of the meter

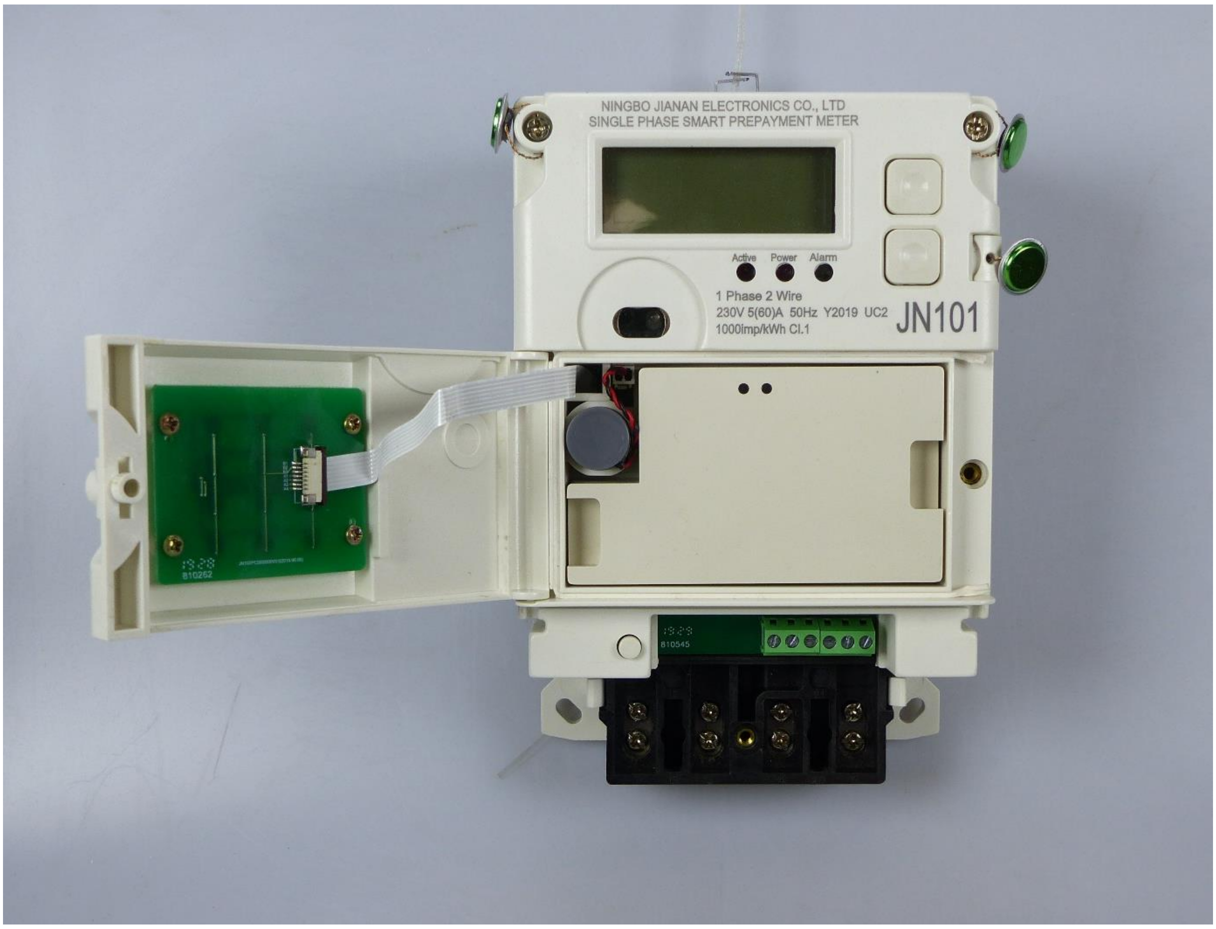

NINGBO JIANAN ELECTRONICS CO.,LTD
SINGLE PHASE SMART PREPAYMENT METER
Active
Power
Alarm
1 Phase 2 Wire
230V 5(60)A 50Hz Y2019 UC2
1000imp/kWh Cl.1
JN101-C

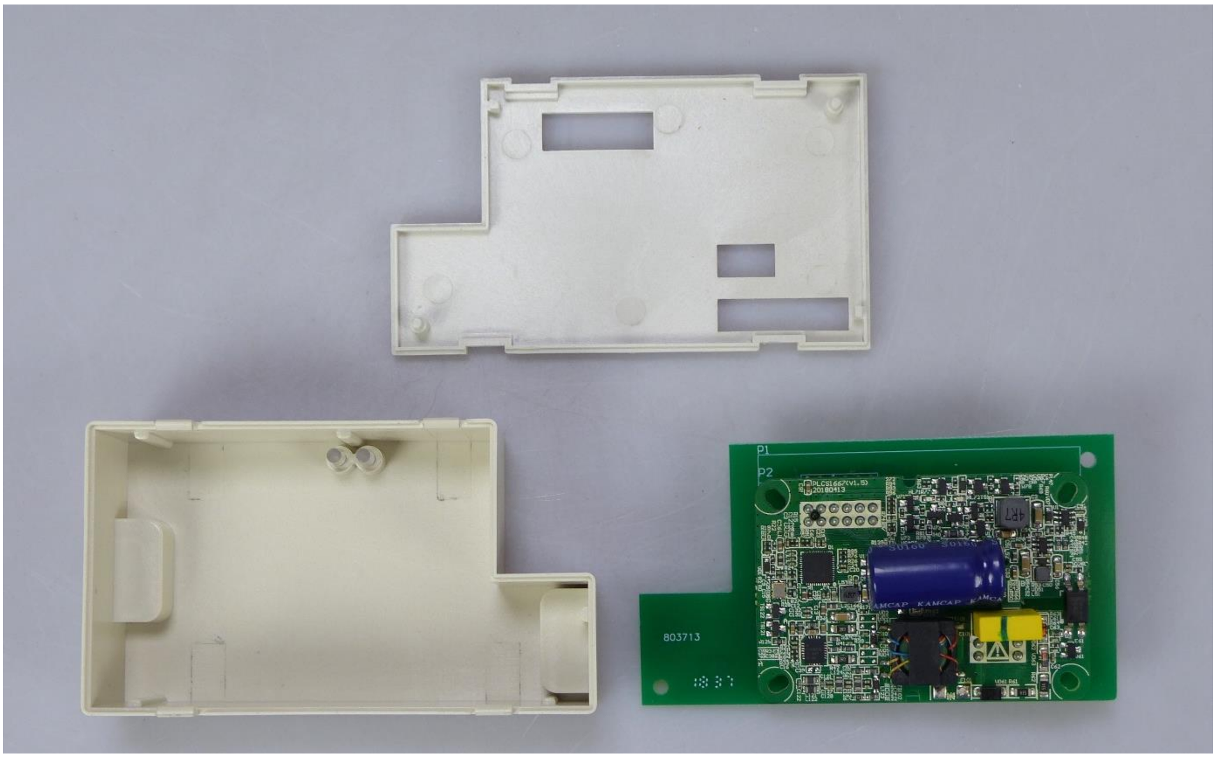




Version: 1


NINGBO JIANAN ELECTRONICS CO., LTD
SINGLE PHASE SMART PREPAYMENT METER
Active
Power
Alarm
1 Phase 2 Wire
230V 5(60)A 50Hz Y2019 UC2
1000imp/kWh Cl.1
JN101
IEC62052-11
IEC62053-21
IEC62055-31
Over-current
breaking capacity:
0.09kA
Made in P.R.C.
013900000025
1 2 3
4 5 6
7 8 9
0
810545
1 3 4 6
L
N
L
N


NINGBO JIANAN ELECTRONICS CO., LTD
SINGLE PHASE SMART PREPAYMENT METER
Active Power Alarm
1 Phase 2 Wire
230V 5(60)A 50Hz Y2019 UC2
1000Imp/kWh Cl.1
JN101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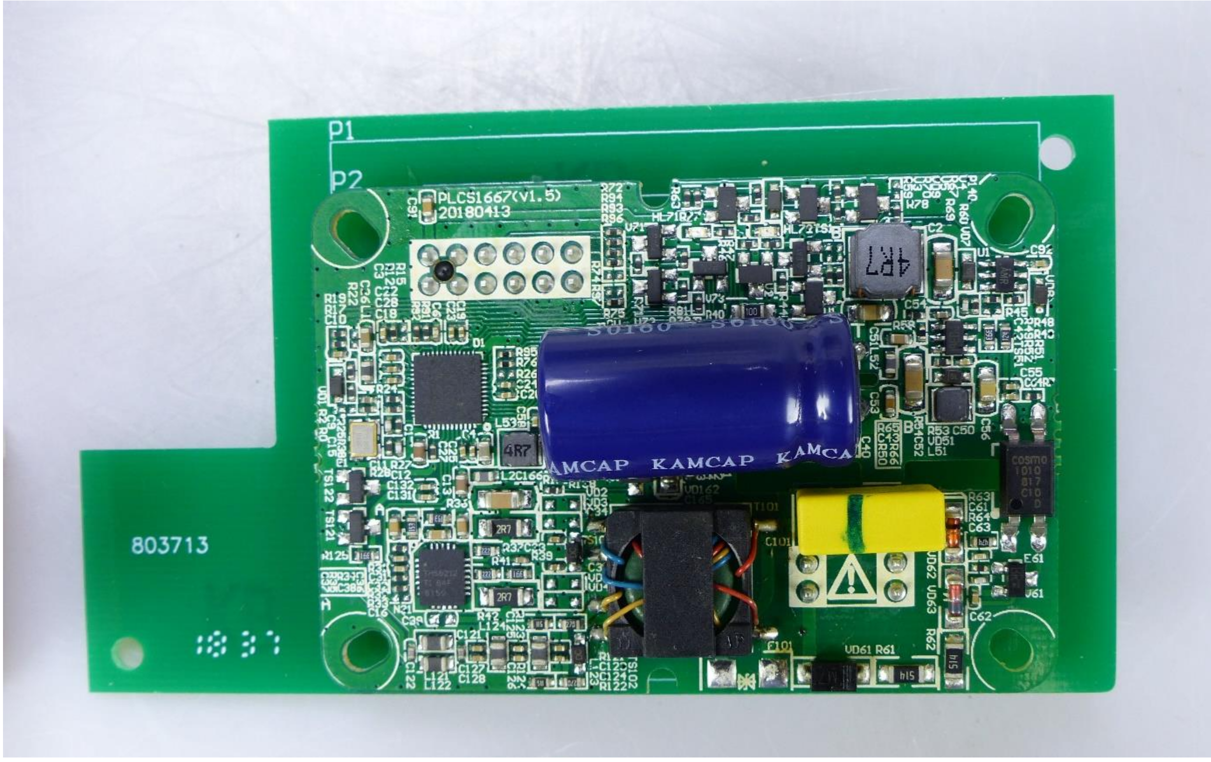
P1
P2
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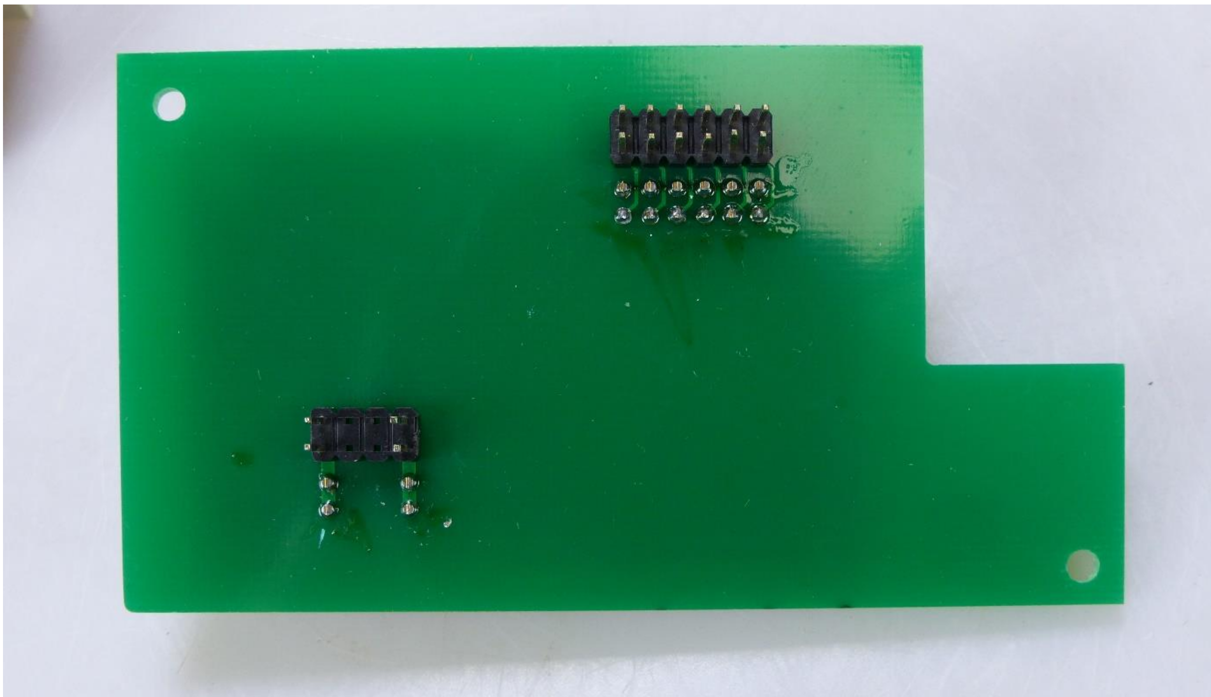
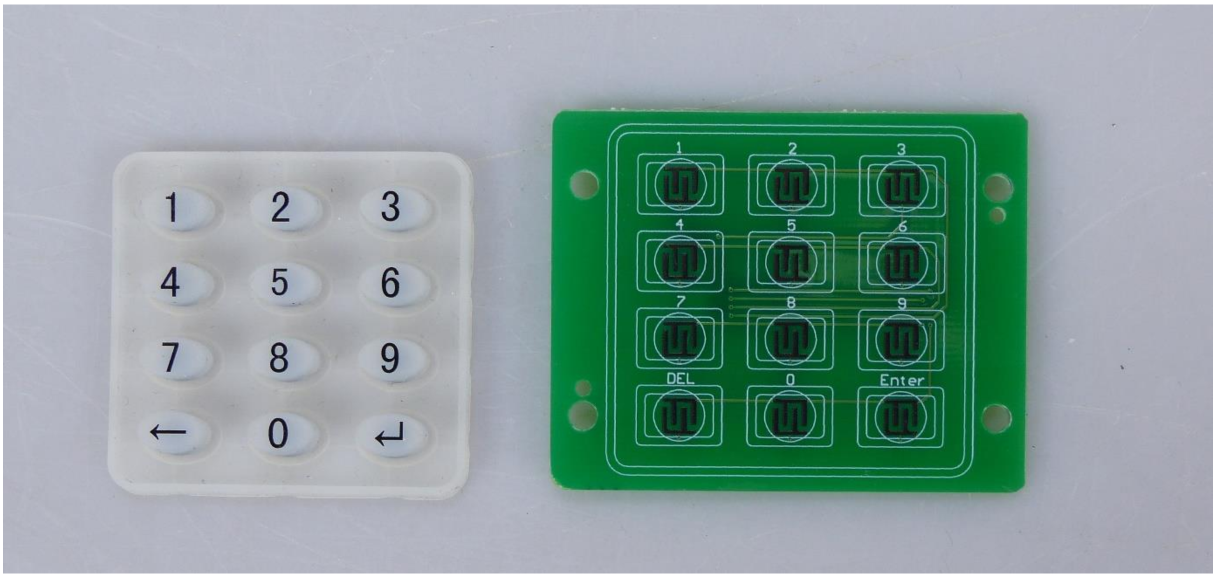
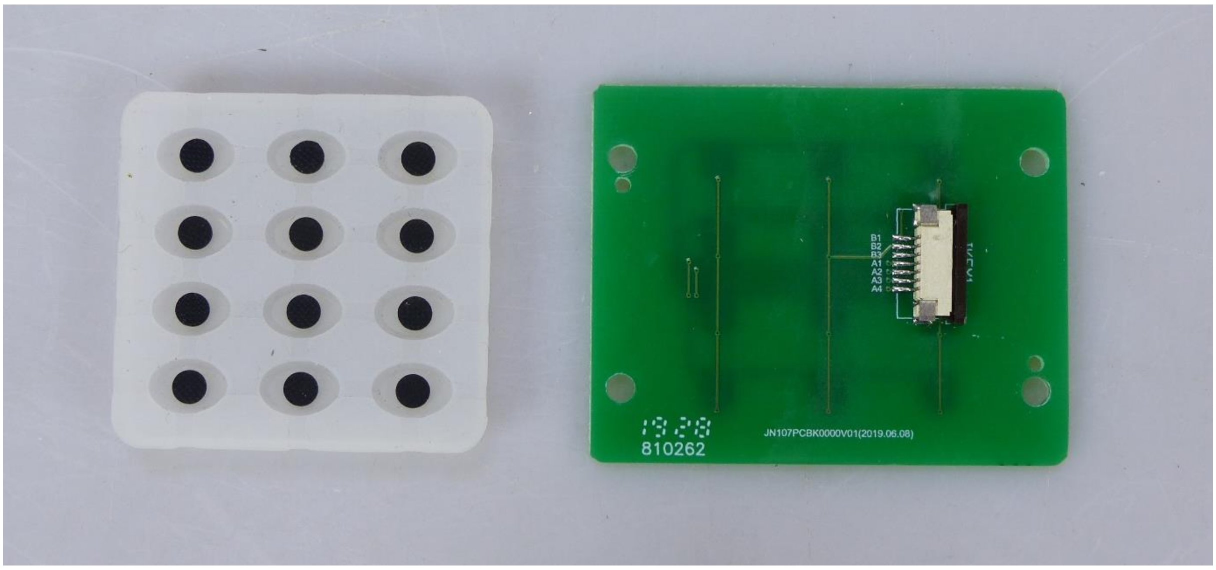
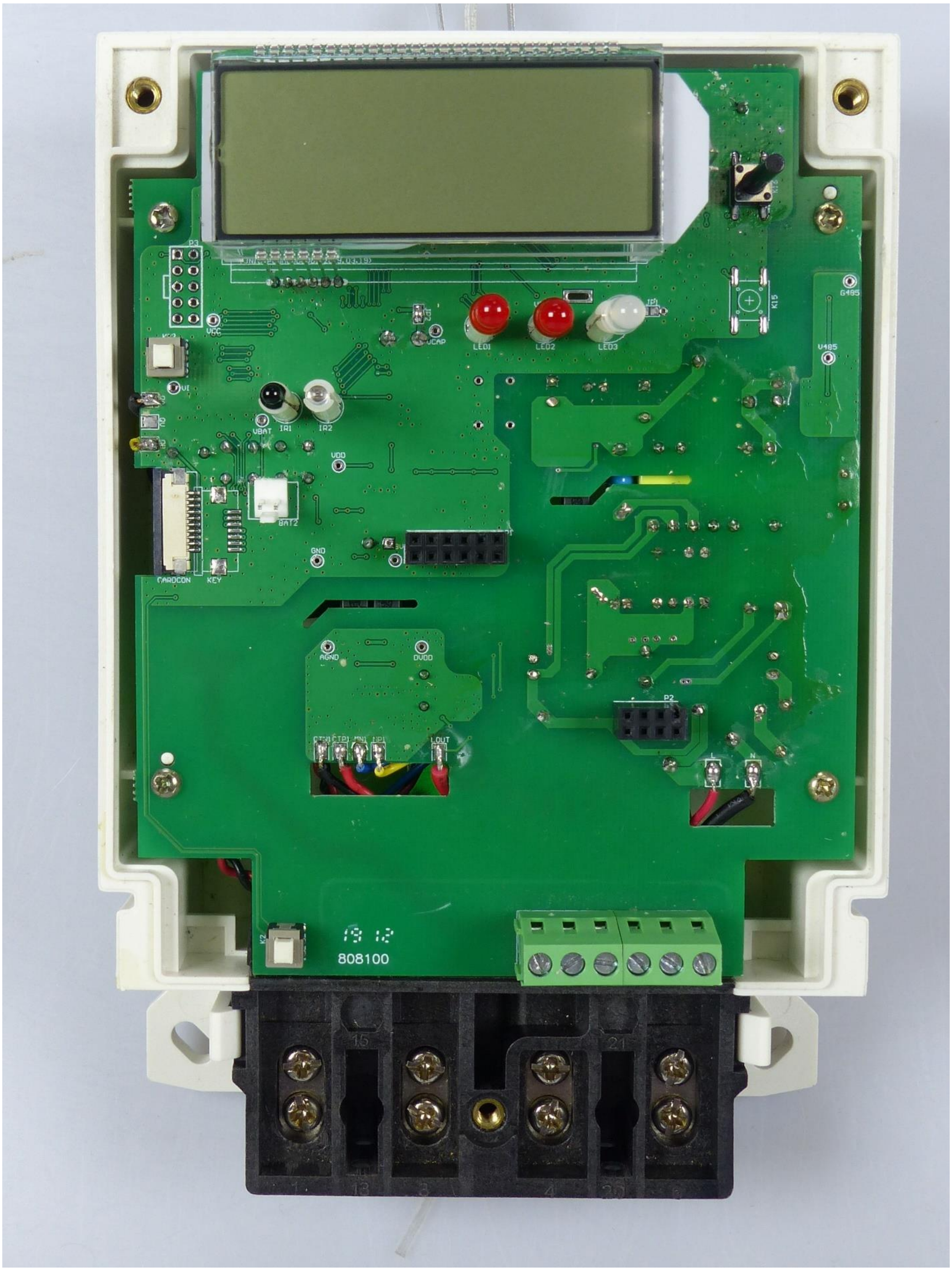
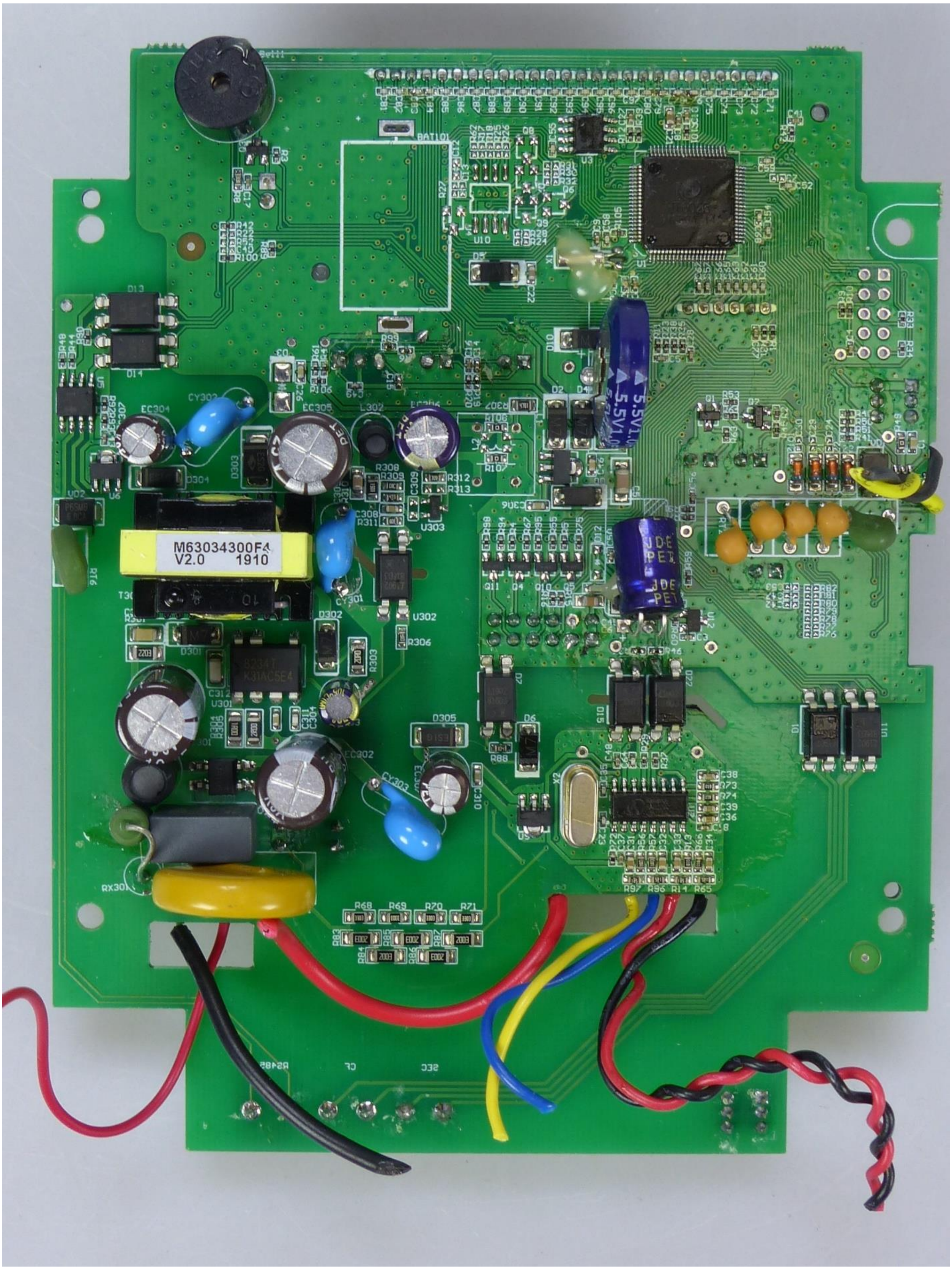
20180413
803713
KAMCAP KAMCAP
4R7
cosmo

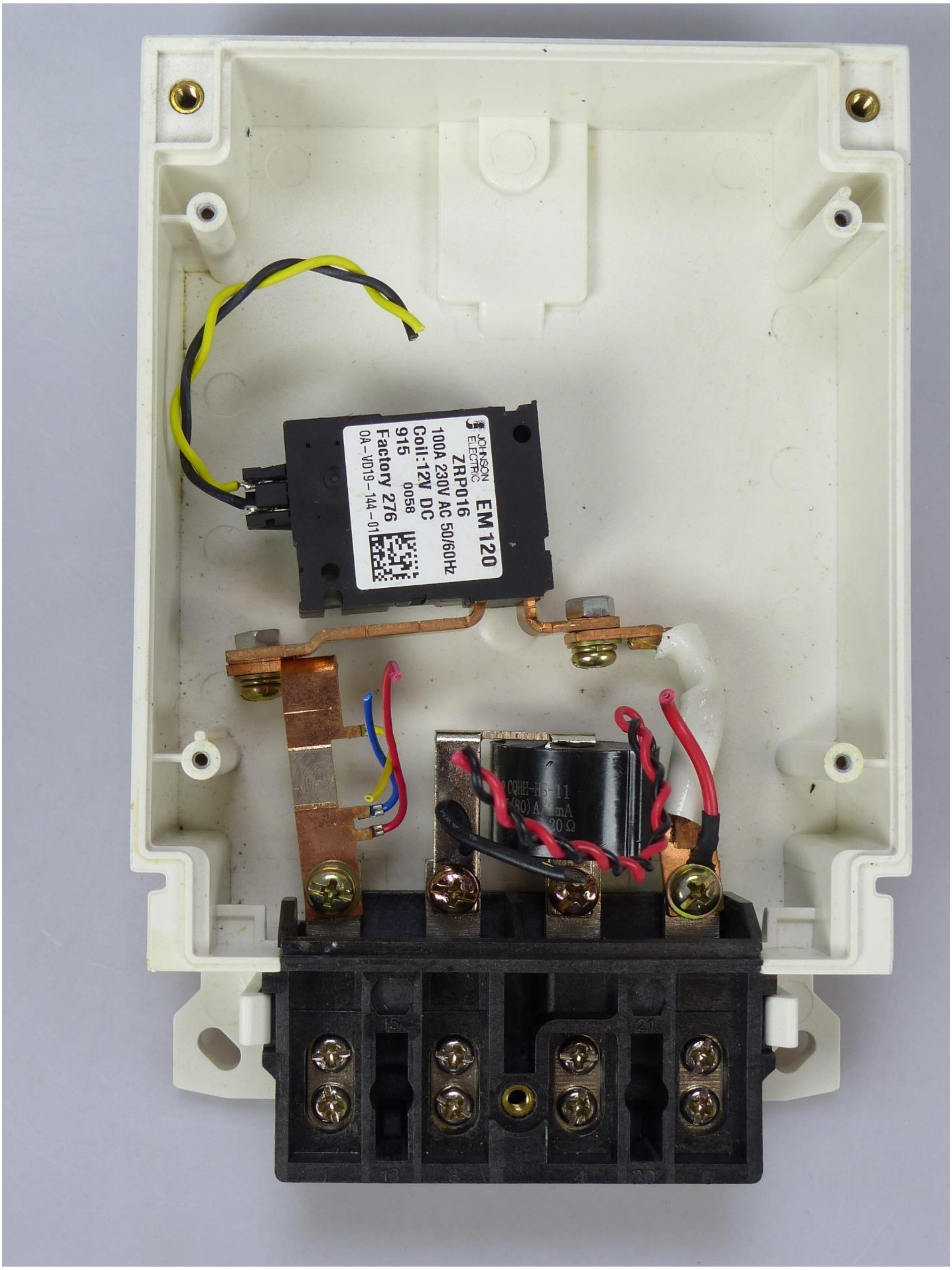


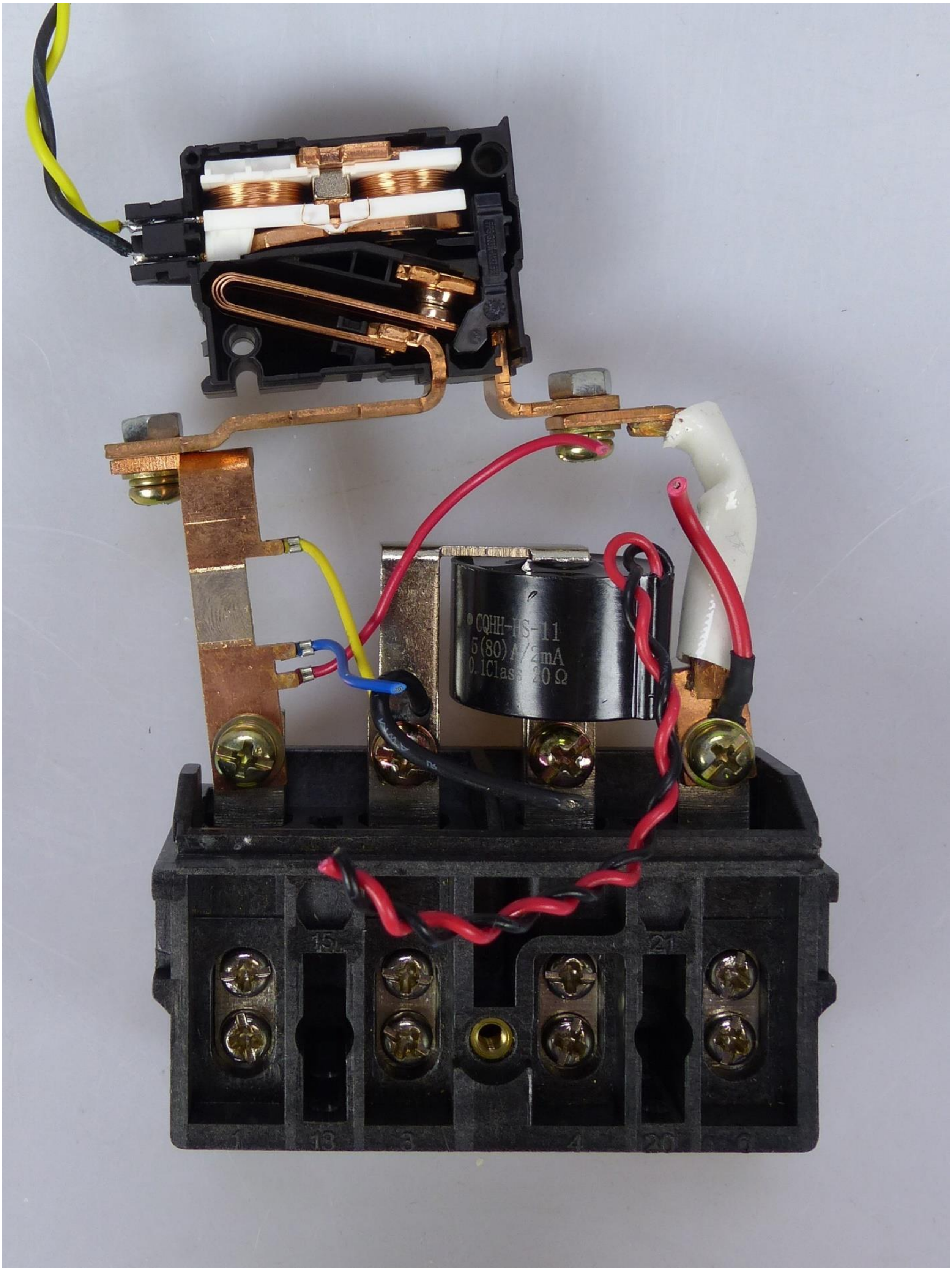

1
2
3
4
5
6
7
8
9
DEL
0
Enter

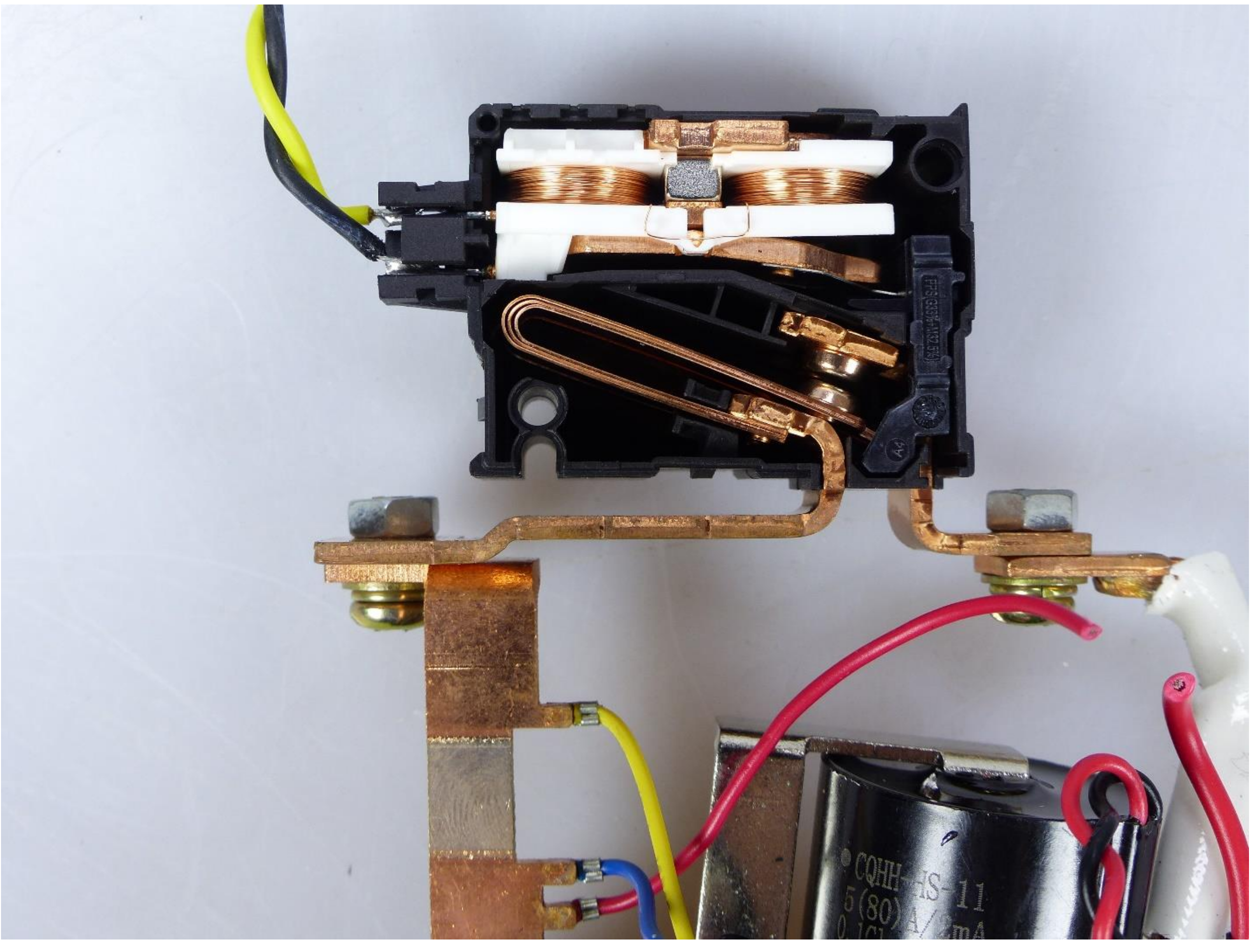

B1
B2
B3
A1
A2
A3
A4
810262
JN107PCBK0000V01(2019.06.08)




M63034300F4
V2.0 1910


JOHNSON ELECTRIC
EM 120
ZRP016
100A 230V AC 50/60Hz
Coil:12V DC
915 0058
Factory 276
OA-VD19-144-01


CQHH-HS-11
5(80)A/2mA
0.1Class 20 Ω


CQHH-HS-11

Appendix C Cross-reference table and checklist for static meters

Chapter	Test	IEC 62052-11 clause	IEC 62053-21 clause	Applied standards	
4.3	Accuracy measurement at different loads		8.1		Pass
4.3.4	Test of no load condition		8.3		Pass
4.3.3	Starting current		8.3		Pass
4.3.2	Meter constant		8.4		Pass
4.3.1	Interpretation of test results		8.6		Pass
4.4.3	Voltage variation		8.2		Pass
4.4.2	Auxiliary voltage variation		8.2		N.A.
4.4.4	Frequency variation		8.2		Pass
4.4.10	Reversed phase sequence		8.2		N.A.
4.4.11	Voltage unbalance		8.2		N.A.
4.4.6	Harmonic components		8.2		Pass
4.4.7	D.C. and even harmonics		8.2		Pass
4.4.8	Odd harmonics in the a.c. current circuit		8.2		Pass
4.4.9	Sub-harmonics in the a.c. current circuit		8.2		Pass
4.4.12	Continuous magnetic induction of external origin		8.2		Pass
4.4.5	Magnetic induction of external origin 0,5 mT		8.2	EN-IEC 61000-4-8	Pass
4.4.1	Influence of ambient temperature variation		8.2		Pass
4.4.13	Operation of accessories		8.2		Pass
4.9	Electrostatic discharges	7.5.2		EN-IEC 61000-4-2	Pass
4.10	Immunity to electromagnetic RF fields	7.5.3		EN-IEC 61000-4-3	Pass
4.11	Immunity to RF conducted disturbances	7.5.5		EN-IEC 61000-4-6	Pass
4.8	Fast transient burst test	7.5.4		EN-IEC 61000-4-4	Pass
4.14	Surge immunity test	7.5.6		EN-IEC 61000-4-5	Pass
4.13	Voltage dips and short interruptions	7.1.2		EN-IEC 61000-4-11	Pass
4.15	Damped oscillatory waves immunity test	7.5.7		EN-IEC 61000-4-12	N.A.
4.12	Radio interference suppression	7.5.8		CISPR 22, EN 55022	Pass
4.1	General- and mechanical requirements	5			Pass
4.1.3	Spring hammer test	5.2.2.1		EN-IEC 60068-2-75	Pass
4.1.6	Protection against penetration of dust and water	5.9		EN-IEC 60529	Pass
4.1.4	Shock test	5.2.2.2		EN-IEC 60068-2-27	Pass
4.1.5	Vibration test	5.2.2.3		EN-IEC 60068-2-6	Pass
4.1.7	Terminal block material test	5.4		ISO 75-2	Pass

Chapter	Test	IEC 62052-11 clause	IEC 62053-21 clause	Applied standards	
3	Marking of the meter	5.12		IEC 60387, IEC 60417-2, EN 62053-52	Pass
4.2.2	Dry heat test	6.3.1		EN-IEC 60068-2-2	Pass
4.2.3	Cold test	6.3.2		EN-IEC 60068-2-1	Pass
4.2.4	Damp heat cyclic test	6.3.3		EN-IEC 60068-2-30	Pass
4.2.5	Solar radiation test	6.3.4		EN-IEC 60068-2-5	N.A.
4.16.1	Impulse voltage test	7.3.2		IEC 60060-1	Pass
4.16.2	A.C. voltage test	7.3.3			Pass
4.6.1	Influence of self heating		7.3		Pass
4.6.2	Heating	7.2			Pass
4.7	Power consumption		7.1		Pass
4.5	Influence of short-time overcurrents		7.2		Pass

Chapter	Test	IEC 62055-31 clause	Applied standards	
4.1.6	Protection against penetration of dust and water	5.10	EN-IEC 60529	Pass
4.1.8	Resistance to heat and fire	5.9	EN-IEC 60695-2-11	Pass
4.1.9	Display, Register and output device	5.11 and 5.13		Pass
4.1.10	Token carrier acceptor	5.14.2		Pass
4.1.10	Keypad interface	5.14.3		Pass
4.2.2	Dry heat test - Storage and transport	6.4.2		Pass
4.2.6	Crystal-controlled clocks on a.c. supplies	Annex D 4.3.1		Pass
4.2.7	Crystal-controlled clocks on operation reserve	Annex D 4.3.2		Pass
4.2.8	Accuracy of crystal-controlled clocks at temperature limits	Annex D 4.3.3		Pass
4.2.9	3th Harmonic component in the voltage circuit	Annex D 5.3		Pass
4.3	Accuracy measurement at different loads	8		Pass
4.4.3.2	Limit Voltage range of operation	Annex A 1.4		Pass
4.4.3.3	Abnormal voltage conditions	7.2.3		Pass
4.4.15	Core functional tests within the voltage and temperature range limits	Annex A 1.3		Pass
4.4.15	Operation within the limit range of operation with temperature	Annex A 1.5		Pass
4.5	Influence of short-time overcurrents	7.4		Pass
4.7	Power consumption	7.3		Pass
4.8	Fast transient burst test	7.8.4 and annex D 5.1	EN-IEC 61000-4-4	Pass
4.9	Electrostatic discharges	7.8.2 and annex D 5.1	EN-IEC 61000-4-2	Pass
4.10	Immunity to electromagnetic RF fields	7.8.3 and annex D 5.1	EN-IEC 61000-4-3	Pass
4.11	Immunity to RF conducted disturbances	7.8.5 and annex D 5.1	EN-IEC 61000-4-6	Pass
4.13	Voltage dips and short interruptions	7.2.2 and annex D 5.2	EN-IEC 61000-4-11	Pass
4.14	Surge immunity test	7.8.6 and annex D 5.1	EN-IEC 61000-4-5	Pass
6	Performance requirements UC1	7.9.3		N/A
6	Performance requirements UC2	7.9.4		Pass
5.1	Interruptions to token acceptance	Annex A 1.6.1		Pass
5.2	Token acceptance	Annex A 1.2.1		Pass
5.3	Rejection of duplicate tokens	Annex A 1.6.2		Pass
5.4	Rejection of valid tokens when available credit is saturated	Annex A 1.6.3		Pass
5.5	Energy register roll-over	Annex A 1.6.4		Pass
5.6	Token carrier interface test	7.11		Pass

Appendix D Plots

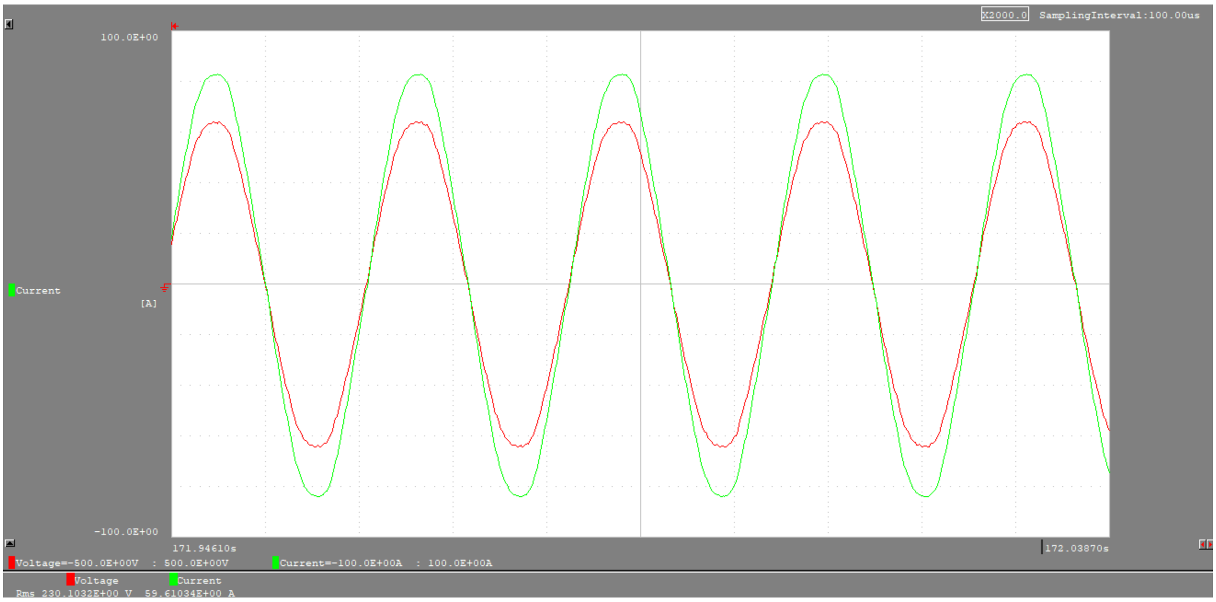


Figure 1: plot of first cycle from C3, to indicate electrical quantities at PF=1

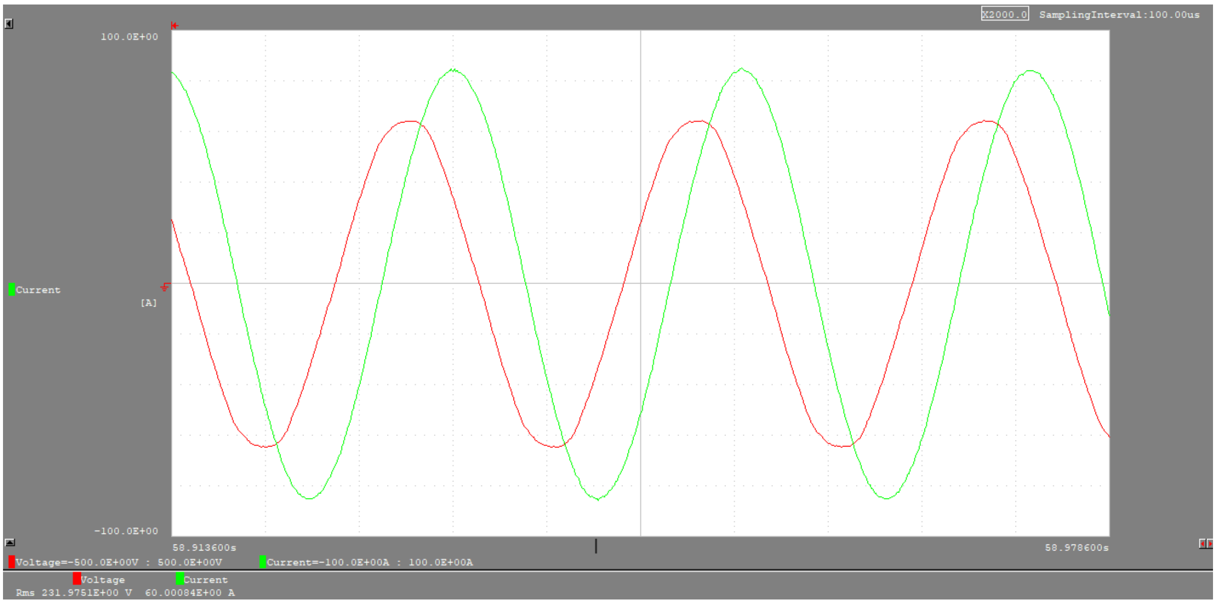


Figure 2: plot of first cycle from C3, to indicate electrical quantities at PF=0,5i

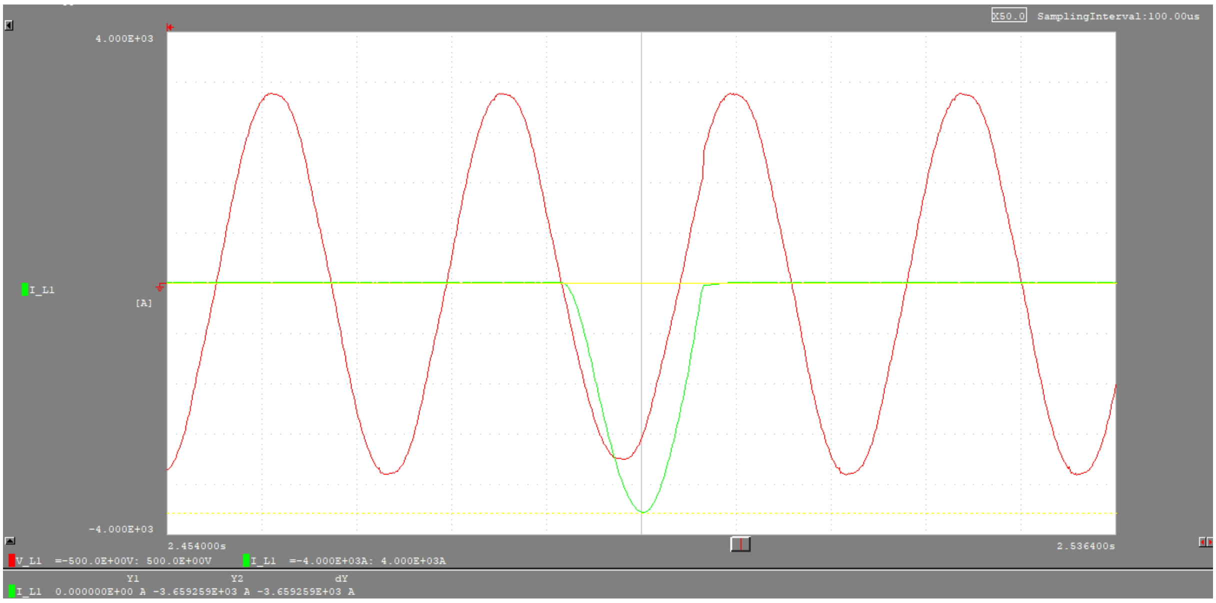


Figure 3: plot of measured initial test shot for C5, fault current making capacity

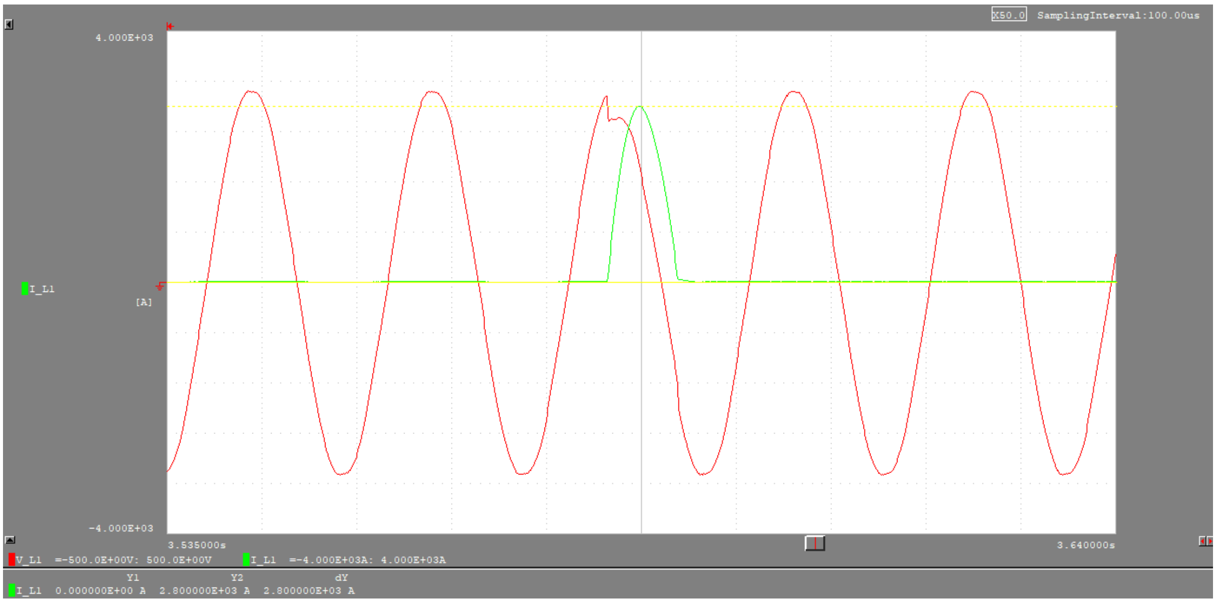


Figure 4: plot of measured test shot 1, for C5, fault current making capacity

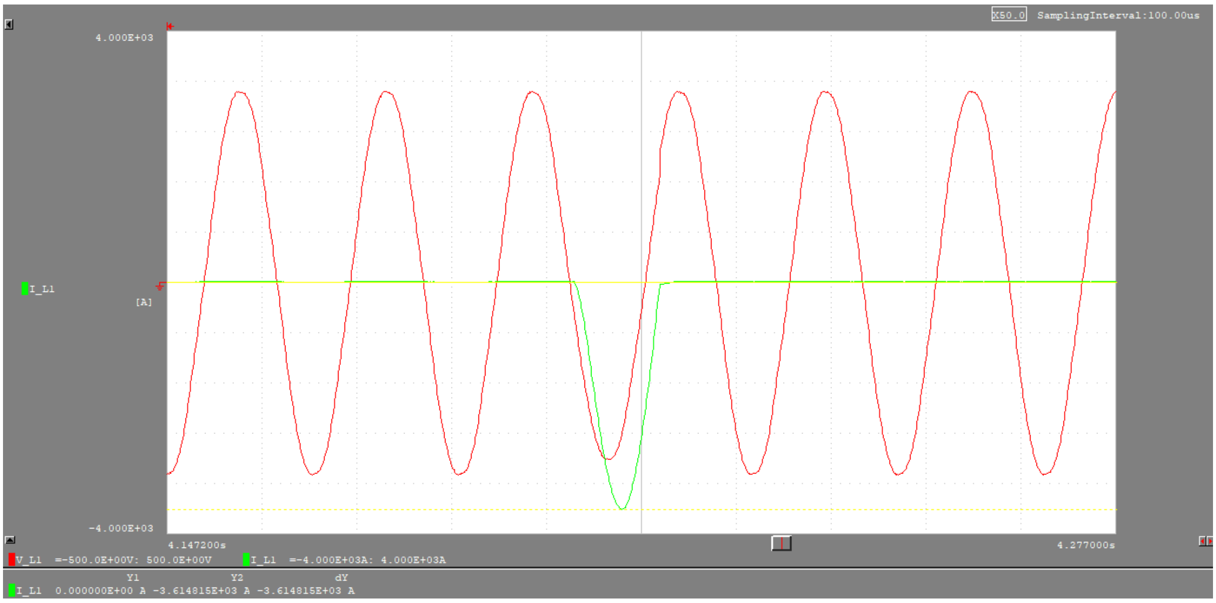


Figure 5: plot of measured test shot 2, for C5, fault current making capacity

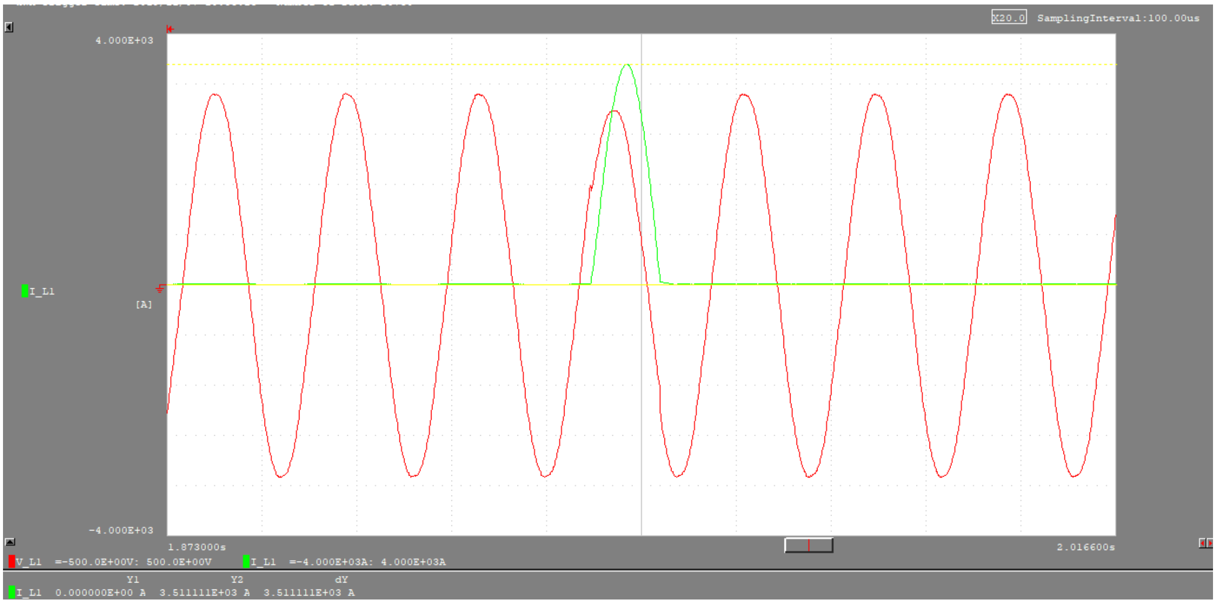


Figure 6: plot of measured test shot 3, for C5, fault current making capacity

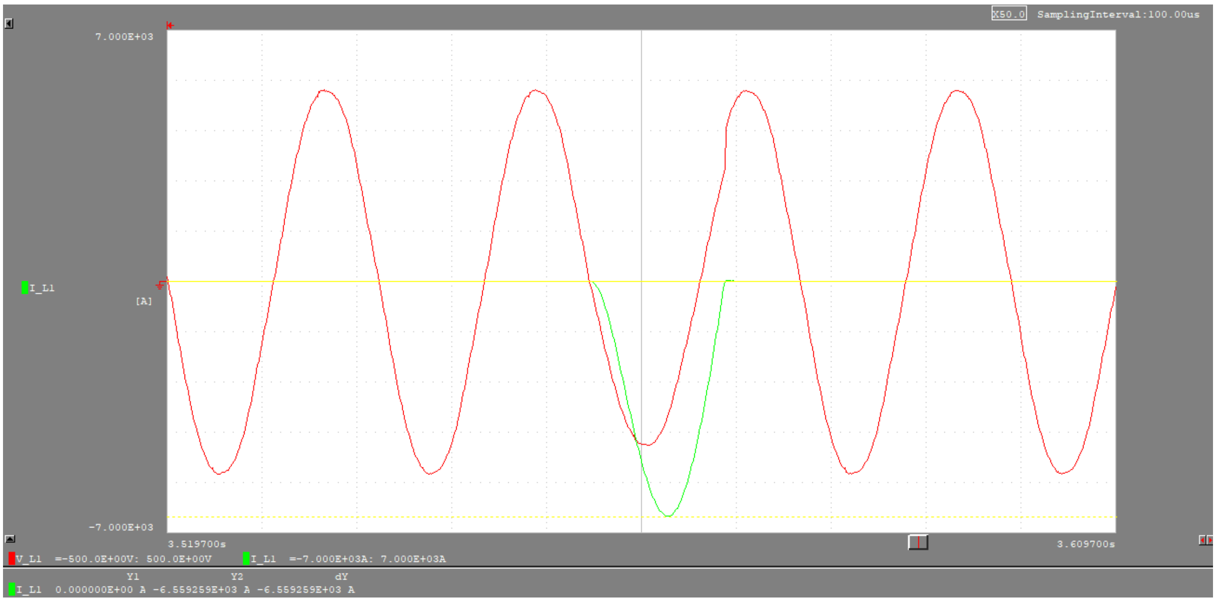


Figure 7 plot of measured initial test shot for C6 test 1, short-circuit current carrying capacity

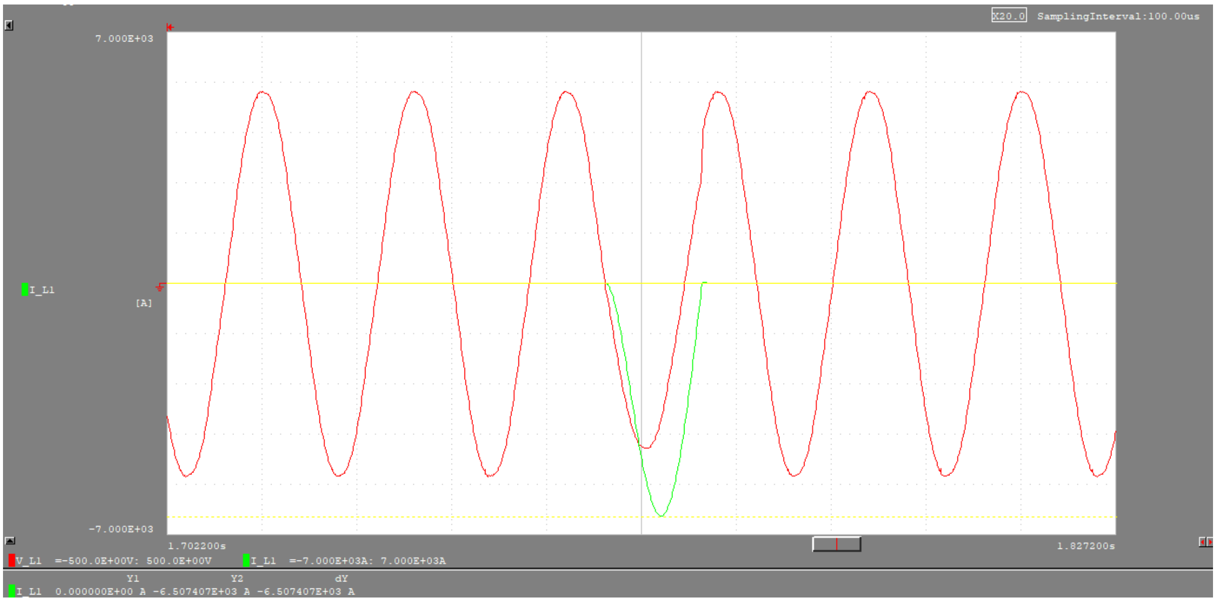


Figure 8: plot of measured test shot 1, for C6 test 1, short-circuit current carrying capacity

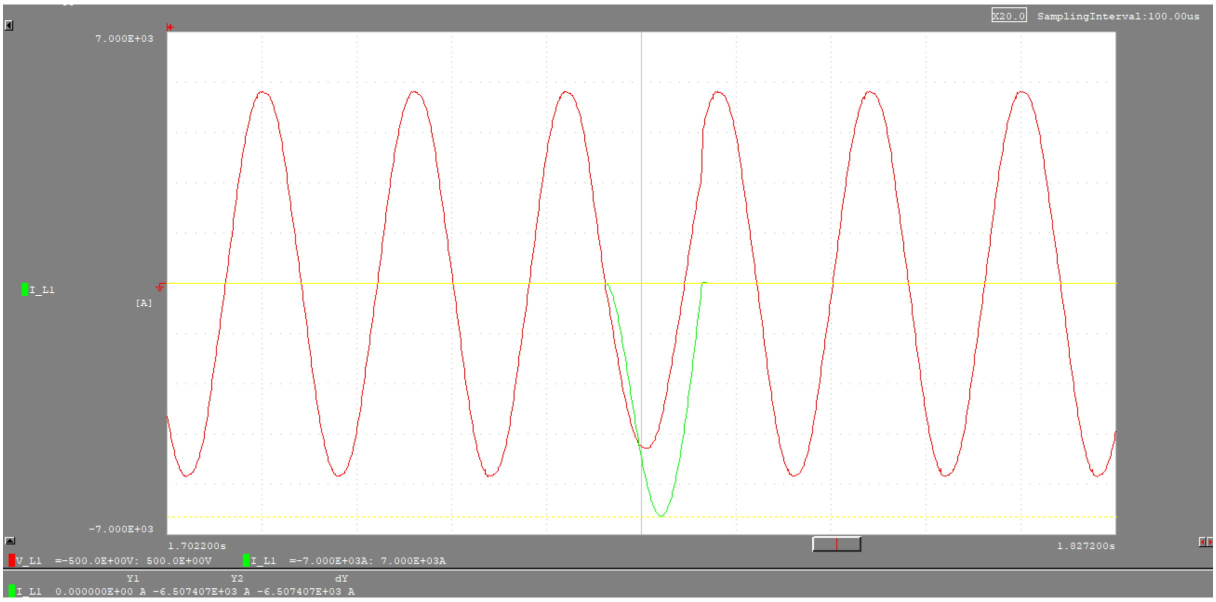


Figure 9: plot of measured test shot 2, for C6 test 1, short-circuit current carrying capacity

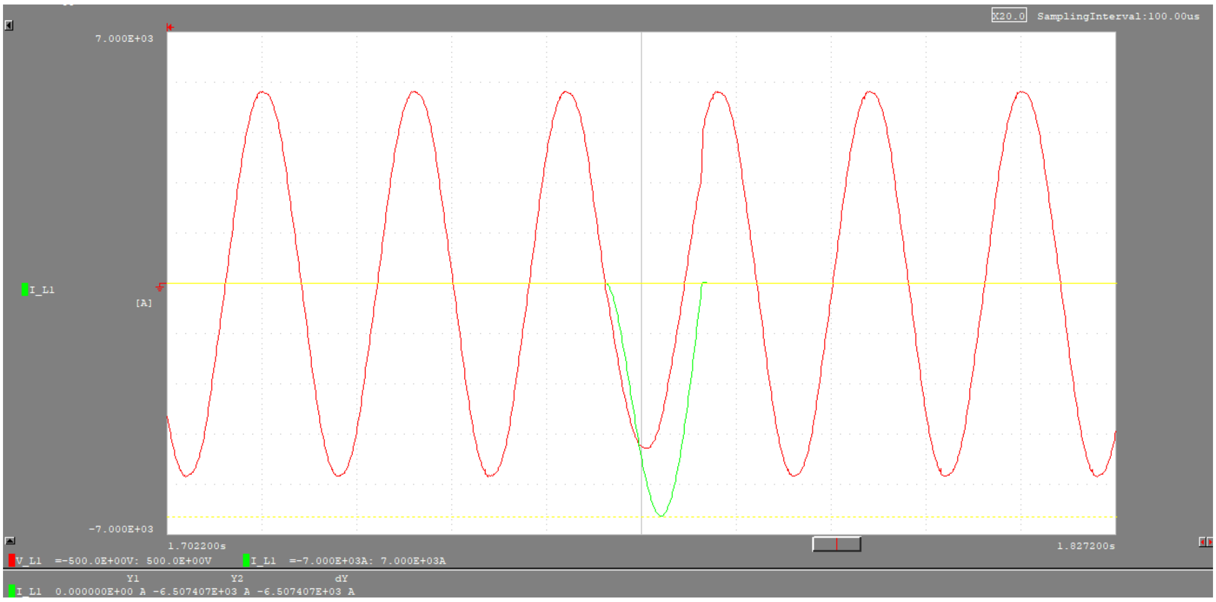


Figure 10: plot of measured test shot 3, for C6 test 1, short-circuit current carrying capacity

Version: 1

Appendix E Measurement uncertainty

The measurement uncertainties in the results presented are as specified below unless otherwise indicated.

EMC Emission

Measurement	Measurement uncertainty	
	U_{lab}	U_{CISPR}
Conducted emission (CISPR 32)		
Mains port	2,84 dB	3,4 dB
TP communication ports	4,62 dB	5,0 dB