KEMA

2092291 -QUA/CAL 06-4019

Type test of a static transformer operated three-phase four-wire energy meter, made by Schneider Electric - PMC, type ION 8800, class 0,2S

Arnhem, 31 July 2006

Author R.H. Garssen
KEMA Quality B.V.
Calibration

By order of Schneider Electric - PMC, Canada

author : R.H. Garssen		31-7-2006	reviewed	: A.P.M. Baars
B	37 pages	3 annexes	approved	: J.H.M. Overbeek

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Contents

Summary

The transformer operated static three-phase four-wire energy meter made by Schneider Electric - PMC type ION 8800, class 0,2S, was tested according to the requirements laid down in:

- IEC 62052-11 (2003): "Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Metering equipment.
- IEC 62053-22 (2003): "Electricity metering equipment (a.c.) - Static meters for active energy (classes 0,2S and 0,5S)", (requirements for indoor use)
- IEC 62053-23 (2003): "Electricity metering equipment (a.c.) - Static meters for reactive energy (classes 2 and 3)", (requirements for indoor use)

All requirements are met.

1 Introduction

The type test was carried out in the Calibration Laboratory of KEMA, from April 2006 till July 2006, on behalf of Schneider Electric - PMC, on the static three-phase four-wire energy meter, made by Schneider Electric - PMC.

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 62053-22 (2003): "Electricity metering equipment (a.c.) - Static meters for active energy (classes 0,2S and 0,5S)", (requirements for indoor use)
- IEC 62053-23 (2003): "Electricity metering equipment (a.c.) - Static meters for reactive energy (classes 2 and 3)", (requirements for indoor use)

2 Data related to the energy meters tested and marking

Manufacturer	:	Schneider Electric - PMC
Type	:	ION 8800
Class	:	0,2S
Nominal current	:	1 or 5 A
Maximum current	:	10 A
Reference voltage	:	57 to 277 V
Reference frequency	:	50 or 60 Hz
Meter constant	:	1000 or 10000 (programmable)
Sample Identification	:	

Serial No.	**freq**
KA-060300001	60
KA-060300002	60
KA-060300004	50
KA-060300005	50
KA-060300006	50
KA-060300008	50

The meter contains all required markings.

The nominal 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 tests were carried out in conformity with IEC 62052-11 and IEC 62053-22/23 using a static energy standard.

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. 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. 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 IP51 (indoor).

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

The results of the water penetration test were satisfying.

The meter meets the requirements. The front of the meter was tested. Additional protection of the back of the meter must be provided by the system in which the meter is installed.

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 manufacturer has shown proof that the material meets the requirements.

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 60695-2-1. The temperature of the glow-wire was 960 °C for the terminal block, 650 °C for the meter case and cover. The materials meet the requirements.

3.1.9 Register and output device

The meter has an LCD register and records in kWhs and kvarhs.
On the front of the meter optical (LED) outputs (visible and infrared) are available for Wh and varh measurements.
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. KA-060300006.

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. KA-060300006.

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.

3.2.4 Damp heat cyclic test

The test was performed with meter no. KA-060300006.

The test was carried out according to IEC 60068-2-30 (variant 1) with an upper temperature of 40 °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

This test is not applicable to indoor meters.

3.3 Accuracy measurement at different loads

These tests were carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.

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 62053-22. 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/sin φ, at reference voltage and reference frequency, 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 62053-22, 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 kWh-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_n (req. $\leq$ 0,1 % I_n).

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 KA-060300004 Wh-measurement

I in % of I_n	cos φ	Temperature coefficient for the specified temperature range in % per K -10 .. 10	10 .. 30	30 .. 45 °C	Mean temperature coefficient in % per K	
5	1	0,003	0,004	0,001	0,003	(req.: ≤ 0,01)
10	0,5 ind.	0,003	0,002	0,003	0,002	(req.: ≤ 0,02)
100	1	0,004	0,005	0,001	0,003	(req.: ≤ 0,01)
100	0,5 ind.	0,003	0,002	0,003	0,003	(req.: ≤ 0,02)
I_{max}	1	0,004	0,004	0,005	0,004	(req.: ≤ 0,01)
I_{max}	0,5 ind.	0,003	0,004	0,001	0,002	(req.: ≤ 0,02)

Serial number KA-060300008 Wh-measurement

I in % of I_n	cos φ	Temperature coefficient for the specified temperature range in % per K -10 .. 10	10 .. 30	30 .. 45 °C	Mean temperature coefficient in % per K	
5	1	0,005	0,002	0,005	0,004	(req.: ≤ 0,01)
10	0,5 ind.	0,007	0,003	0,006	0,005	(req.: ≤ 0,02)
100	1	0,002	0,003	0,003	0,002	(req.: ≤ 0,01)
100	0,5 ind.	0,005	0,003	0,006	0,005	(req.: ≤ 0,02)
I_{max}	1	0,001	0,001	0,001	0,001	(req.: ≤ 0,01)
I_{max}	0,5 ind.	0,001	0,002	0,004	0,002	(req.: ≤ 0,02)

Serial number KA-060300004 varh-measurement

I in % of I_n	sin φ	Temperature coefficient for the specified temperature range in % per K -10 .. 10	10 .. 30	30 .. 45 °C	Mean temperature coefficient in % per K	
5	1	0,002	0,003	0,003	0,003	(req.: ≤ 0,10)
10	0,5 ind.	0,003	0,008	0,007	0,006	(req.: ≤ 0,15)
100	1	0,004	0,003	0,001	0,002	(req.: ≤ 0,10)
100	0,5 ind.	0,005	0,002	0,001	0,003	(req.: ≤ 0,15)
I_{max}	1	0,005	0,003	0,003	0,003	(req.: ≤ 0,10)
I_{max}	0,5 ind.	0,007	0,002	0,001	0,003	(req.: ≤ 0,15)

Serial number KA-060300008 varh-measurement

I in % of I_n	sin φ	Temperature coefficient for the specified temperature range in % per K -10 .. 10	10 .. 30	30 .. 45	ºC Mean temperature coefficient in % per K	
5	1	0,006	0,003	0,007	0,005	(req.: ≤ 0,10)
10	0,5 ind.	0,003	0,002	0,004	0,003	(req.: ≤ 0,15)
100	1	0,004	0,002	0,005	0,004	(req.: ≤ 0,10)
100	0,5 ind.	0,000	0,002	0,001	0,001	(req.: ≤ 0,15)
I_{max}	1	0,003	0,002	0,001	0,002	(req.: ≤ 0,10)
I_{max}	0,5 ind.	0,004	0,001	0,002	0,002	(req.: ≤ 0,15)

The meter meets the requirements.

3.4.2 Effect of changes in the auxiliary supply voltage

This test was carried out with meter no. KA-060300004 and KA-060300008.
The change in the error due to a 15% change of the auxiliary supply voltage over the complete voltage range of the supply voltage was measured at a load of 0,01.I_n and cos φ =1.
The maximum change in error was less than 0,01 % (Requirement ≤ 0,05 %).
The meter meets the requirements.

3.4.3 Voltage variation

This test was carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.
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 ≤ 0,1%),
- 0,02 % registering Wh at cosφ = 0,5 ind (Requirement ≤ 0,2%),
- 0,02 % registering varh at sinφ = 1 (Requirement ≤ 1,0%),
- 0,02 % registering varh at sinφ = 0,5 ind (Requirement ≤ 1,5%).

The meter meets the requirements.

3.4.4 Frequency variation

This test was carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.
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 ≤ 0,1%),
- 0,01 % registering Wh at cosφ = 0,5 ind (Requirement ≤ 0,1%),
- 0,02 % registering varh at sinφ = 1 (Requirement ≤ 2,5%),
- 0,01 % 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. KA-060300008.
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, nominal current, reference frequency and cos φ = 1 was 0,01%. The maximum permissible change allowed by IEC 62053-22 is 0,5%.
The meter meets the requirements.

3.4.6 Harmonic components in the current and voltage circuits

This test was carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.
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_n, 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 62053-22 is 0,4%.
The meter meets the requirements.

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

This test is not applicable to transformer connected meters.

3.4.8 Odd harmonics in the a.c. current circuit

This test is applicable to class 1 and class 2 meters only.

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

This test was carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.
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 62053-22. The energy measured was compared to the energy measured by an energy standard. The worst case difference was 0,15%.
The maximum permissible change allowed by IEC 62053-22 is 0,6%.
The meter meets the requirements

3.4.10 Reversed phase sequence

This test was carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.
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 62053-22 is 0,05%.
The meter meets the requirements.

3.4.11 Voltage unbalance

This test was carried out with meter no. KA-060300001, KA-060300002, KA-060300004 and KA-060300008.
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 0,02%.
The maximum permissible change allowed by IEC 62053-22 is 0,5%.
The meter meets the requirements.

3.4.12 Continuous magnetic induction of external origin

This test was carried out with meter no. KA-060300008.
The magnetic field was generated using an electromagnet as described in annex B of IEC 62053-22. The change in the error due to this magnetic field was less than 0,01% (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

This test was carried out with meter no. KA-060300004 and KA-060300008.
The meter was subjected to the test for immunity to earth fault, as described in IEC 62052-11, paragraph 7.4 and annex C. The worst-case change in error of the meter at nominal current and cos φ = 1 caused by this fault condition was 0,02% (requirement ≤ 0,1%).
The meters meet the requirements.

3.5 Effect of short-time overcurrents on the accuracy

A current of 20 times I_{max} flowed through the current circuits of the energy meter for a period of 0,5 seconds. The voltage circuit was connected to the reference voltage with rated frequency. Both before and after the test the error was measured at nominal 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
KA-060300008	0,01	≤ 0,05 %

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 (277 V), 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	Imax (A)	maximum change in %	
		cos φ = 1	cos φ = 0,5 ind.
KA-060300004		0,03 (req. ≤ 0,1)	0,03 (req. ≤ 0,1)
KA-060300008		0,02 (req. ≤ 0,1)	0,02 (req. ≤ 0,1)

The meter meets the requirements.

3.6.2 Heating

This test was carried out with meter no. KA-060300004 and KA-060300008.
The meter was powered with 115% of nominal voltage (277 V) and maximum current for 2 hours.
The maximum temperature rise of the meters was 6 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	KA-060300008			
Reference Voltage	57 V		240 V	
Voltage circuit	VA	W	VA	W
L1	0,01	< 0,01	0,04	0,01
L2	0,01	< 0,01	0,04	0,01
L3	0,01	< 0,01	0,03	0,01

Nominal current	1 A
Current circuit	VA
L1	0,07
L2	0,07
L3	0,07

Auxiliary supply	VA
85 VAC	8,8
240 VAC	13,2
110 VDC	6,1
270 VDC	6,8

The maximum permissible power consumption for the voltage circuits is 0,5 VA (for meters with an auxiliary power supply) and for the current circuits 1 VA. The meter meets the requirements.
The maximum allowed power is 10 VA according to IEC 62053-22. However, in accordance with IEC 62053-61 (Power consumption and voltage requirements) clause 4.3.1, the maximum consumption of power can be agreed upon between the user and the manufacturer.

3.8 Fast transient burst test

The test was performed on the energy meters with serial number KA-060300005.

3.8.1 Test method

The test was carried out with the current circuit carrying nominal 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

The test was performed on the energy meters with serial number KA-060300005.

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.
The meter meets the requirements.

3.10 Immunity to electromagnetic RF fields

The test was performed on the energy meters with serial number KA-060300005.

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 nominal 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 62053-22 is 1,0%.
Without current in the current circuits the RF field did not produce a change in the register.
The meter meets the requirements.

3.11 Immunity to conducted disturbances induced by RF fields

The test was performed on the energy meters with serial number KA-060300005.

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 nominal 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 62053-22 is 1,0%. Without current in the current circuits the RF field did not produce a change in the register.
The meter meets the requirements.

3.12 Radio interference measurement

The test was performed on the energy meters with serial number KA-060300005.

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 43,2 dBµV (limit 50 dBµV), at 24,5 MHz.
In the frequency range from 30 to 1000 MHz the maximum peak value measured was 41,7 dBµV/m (limit 47 dBµV/m), at 500 MHz.

The meter meets the requirements.

3.13 Voltage dips and short interruptions

The test was performed on the energy meters with serial numbers KA-060300004 and KA-060300008.

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 test was carried out for with the maximum and minimum reference voltage of the meter.
The meter meets the requirements.

3.14 Surge immunity test

The test was performed on the energy meters with serial number KA-060300008, with improved power supply board installed.

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

The test was performed on the energy meters with serial number KA-060300005.

3.15.1 Test method

The test was carried out at nominal current in accordance with clause 7.5.7 of IEC 62052-11.

3.15.2 Test levels

The test was carried out with a test voltage of 2,5 kV common mode and 1,0 kV differential mode, in accordance with IEC 62052-11. The test was performed at a test frequency of 1 MHz (repetition rate 400Hz) and 100 kHz (repetition rate 40Hz).

3.15.3 Test results

The influence of the damped oscillatory waves was less than 1 % in all cases.
The meter meets the requirements.

3.16 Insulation

The tests were performed on the energy meter with serial number KA-060300004.

3.16.1 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 ; 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 voltage circuit 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.

Applied pulse	50 Hz voltage			
	Specification of circuits(s)	Amplitude (open voltage)	requirement	result
Between input circuits and earth (common mode)	Between voltage circuit and earth	2 kV	2 kV	pass
	Between current circuit and earth	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. The meter meets the requirements.

Annex A. Accuracy test results

Accuracy test results, serial number KA-060300004.

57 V	50 Hz	1(10) A				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
1	3ph	0,06%				
1 *	3ph	0,08%				
2	3ph	0,00%	0,02%	0,00%		
5	3ph	0,02%				
5	1ph,1	0,02%				
5	1ph,2	0,06%				
5	1ph,3	-0,04%				
10	3ph	0,00%	0,01%	0,00%	0,02%	0,00%
10	1ph,1		0,03%			
10	1ph,2		0,04%			
10	1ph,3		-0,03%			
20	3ph	0,00%	0,00%	0,00%	0,01%	-0,01%
50	3ph	-0,01%	0,00%	-0,01%	0,03%	-0,02%
100	3ph	0,00%	0,01%	0,00%	0,02%	-0,00%
100 *	3ph	0,00%	0,01%	0,00%		
100	1ph,1	0,00%	0,03%			
100	1ph,2	0,05%	0,06%			
100	1ph,3	-0,05%	-0,04%			
½I_{max}		-0,01%	0,01%	-0,01%	0,03%	-0,03%
I_{max}	3ph	-0,01%	0,01%	-0,01%	0,04%	-0,03%
I_{max}	1ph,1	0,00%	0,03%			
I_{max}	1ph,2	0,03%	0,04%			
I_{max}	1ph,3	-0,06%	-0,02%			

* Reverse energy

Accuracy test results, serial number KA-060300008.

57 V	50 Hz	1(10) A				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
1	3ph	0,06%				
1 *	3ph	0,05%				
2	3ph	-0,01%	0,01%	-0,02%		
5	3ph	0,01%				
5	1ph,1	0,02%				
5	1ph,2	0,02%				
5	1ph,3	0,00%				
10	3ph	0,00%	0,02%	0,00%	0,03%	0,00%
10	1ph,1		0,03%			
10	1ph,2		0,02%			
10	1ph,3		0,00%			
20	3ph	0,00%	0,01%	0,00%	0,02%	0,00%
50	3ph	0,00%	0,01%	0,00%	0,04%	0,00%
100	3ph	0,00%	0,00%	0,00%	0,01%	-0,01%
100 *	3ph	0,00%	0,00%	0,00%		
100	1ph,1	0,01%	0,03%			
100	1ph,2	0,00%	0,00%			
100	1ph,3	-0,01%	0,00%			
½I_{max}		0,00%	0,01%	0,00%	0,04%	-0,01%
I_{max}	3ph	0,00%	0,01%	-0,00%	0,03%	-0,02%
I_{max}	1ph,1	0,00%	0,03%			
I_{max}	1ph,2	0,02%	0,03%			
I_{max}	1ph,3	-0,03%	-0,01%			

* Reverse energy

Accuracy test results, serial number KA-060300004.

277 V	50 Hz	1(10) A				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
1	3ph	0,07%				
1 *	3ph	0,09%				
2	3ph	0,02%	0,04%	0,01%		
5	3ph	0,03%				
5	1ph,1	0,04%				
5	1ph,2	0,03%				
5	1ph,3	0,01%				
10	3ph	0,02%	0,02%	0,02%	0,03%	0,01%
10	1ph,1		0,03%			
10	1ph,2		0,02%			
10	1ph,3		0,01%			
20	3ph	0,00%	0,02%	0,00%	0,03%	0,01%
50	3ph	0,01%	0,02%	0,00%	0,06%	0,00%
100	3ph	0,02%	0,03%	0,02%	0,04%	0,01%
100 *	3ph	0,02%	0,03%	0,02%		
100	1ph,1	0,02%	0,03%			
100	1ph,2	0,04%	0,04%			
100	1ph,3	0,00%	0,01%			
½I_{max}		0,01%	0,03%	0,00%	0,06%	-0,01%
I_{max}	3ph	0,01%	0,03%	0,00%	0,07%	0,00%
I_{max}	1ph,1	0,02%	0,03%			
I_{max}	1ph,2	0,01%	0,04%			
I_{max}	1ph,3	0,00%	0,03%			

* Reverse energy

Accuracy test results, serial number KA-060300008.

277 V	50 Hz	1(10) A				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
1	3ph	0,03%				
1 *	3ph	0,02%				
2	3ph	-0,01%	0,02%	-0,02%		
5	3ph	0,00%				
5	1ph,1	0,01%				
5	1ph,2	-0,01%				
5	1ph,3	0,00%				
10	3ph	0,00%	0,02%	0,00%	0,05%	0,00%
10	1ph,1		0,02%			
10	1ph,2		0,01%			
10	1ph,3		0,04%			
20	3ph	0,00%	0,02%	0,00%	0,05%	-0,01%
50	3ph	0,00%	0,03%	-0,01%	0,07%	-0,02%
100	3ph	0,00%	0,01%	-0,00%	0,03%	-0,02%
100 *	3ph	0,00%	0,01%	-0,01%		
100	1ph,1	0,01%	0,02%			
100	1ph,2	-0,02%	-0,01%			
100	1ph,3	0,00%	0,03%			
½I_{max}		0,00%	0,03%	0,00%	0,07%	-0,01%
I_{max}	3ph	0,00%	0,02%	-0,01%	0,06%	-0,02%
I_{max}	1ph,1	0,01%	0,02%			
I_{max}	1ph,2	0,00%	0,03%			
I_{max}	1ph,3	-0,01%	0,03%			

* Reverse energy

Accuracy test results, serial number KA-060300002.

57 V	60 Hz	1(10) A				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
1	3ph	-0,07%				
1 *	3ph	-0,07%				
2	3ph	-0,07%	-0,04%	-0,07%		
5	3ph	-0,04%				
5	1ph,1	-0,04%				
5	1ph,2	-0,02%				
5	1ph,3	-0,04%				
10	3ph	-0,03%	-0,03%	-0,03%	-0,02%	-0,03%
10	1ph,1		-0,07%			
10	1ph,2		0,00%			
10	1ph,3		-0,01%			
20	3ph	-0,03%	-0,03%	-0,03%	-0,02%	-0,04%
50	3ph	-0,03%	-0,02%	-0,04%	-0,01%	-0,04%
100	3ph	-0,03%	-0,03%	-0,03%	-0,03%	-0,03%
100 *	3ph	-0,03%	-0,03%	-0,04%		
100	1ph,1	-0,04%	-0,06%			
100	1ph,2	-0,04%	-0,02%			
100	1ph,3	-0,02%	-0,01%			
½I_{max}		-0,02%	-0,01%	-0,01%	0,00%	-0,04%
I_{max}	3ph	-0,03%	-0,02%	-0,05%	-0,02%	-0,05%
I_{max}	1ph,1	-0,04%	-0,06%			
I_{max}	1ph,2	-0,02%	-0,01%			
I_{max}	1ph,3	-0,03%	-0,01%			

* Reverse energy

Accuracy test results, serial number KA-060300001.

277 V	60 Hz	1(10) A				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
1	3ph	0,02%				
1 *	3ph	0,04%				
2	3ph	-0,01%	0,01%	-0,02%		
5	3ph	-0,01%				
5	1ph,1	-0,01%				
5	1ph,2	-0,04%				
5	1ph,3	0,00%				
10	3ph	-0,01%	0,00%	-0,01%	0,01%	-0,02%
10	1ph,1		0,00%			
10	1ph,2		0,00%			
10	1ph,3		0,01%			
20	3ph	0,00%	0,00%	-0,00%	0,02%	-0,01%
50	3ph	0,00%	0,01%	-0,00%	0,04%	-0,01%
100	3ph	-0,01%	0,00%	-0,02%	0,00%	-0,02%
100 *	3ph	-0,01%	0,00%	-0,02%		
100	1ph,1	-0,02%	-0,02%			
100	1ph,2	-0,01%	0,00%			
100	1ph,3	-0,01%	0,00%			
½I_{max}		0,00%	0,01%	0,00%	0,03%	-0,02%
I_{max}	3ph	0,00%	0,00%	-0,02%	0,03%	-0,02%
I_{max}	1ph,1	0,00%	0,00%			
I_{max}	1ph,2	-0,01%	0,01%			
I_{max}	1ph,3	0,00%	0,01%			

* Reverse energy

Accuracy test results, serial number KA-060300004.

230 V	50 Hz	5(10) A				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
1	3ph	0,04%				
1 *	3ph	0,04%				
2	3ph	0,03%	0,04%	0,02%		
5	3ph	0,02%				
5	1ph,1	0,04%				
5	1ph,2	0,03%				
5	1ph,3	0,00%				
10	3ph	0,01%	0,03%	0,00%	0,05%	0,00%
10	1ph,1		0,04%			
10	1ph,2		0,04%			
10	1ph,3		0,01%			
20	3ph	0,03%	0,04%	0,00%	0,05%	0,01%
50	3ph	0,01%	0,03%	0,00%	0,04%	0,00%
100	3ph	0,01%	0,03%	0,01%	0,06%	0,00%
100 *	3ph	0,01%	0,03%	0,00%		
100	1ph,1	0,02%	0,04%			
100	1ph,2	0,02%	0,04%			
100	1ph,3	0,00%	0,02%			
½I_{max}		0,01%	0,03%	0,00%	0,06%	0,00%
I_{max}	3ph	0,01%	0,04%	0,00%	0,07%	0,00%
I_{max}	1ph,1	0,02%	0,05%			
I_{max}	1ph,2	0,01%	0,04%			
I_{max}	1ph,3	0,00%	0,03%			

* Reverse energy

Accuracy test results, serial number KA-060300008.

230 V	50 Hz	5(10) A				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
1	3ph	0,01%				
1 *	3ph	0,01%				
2	3ph	0,01%	0,03%	0,00%		
5	3ph	0,01%				
5	1ph,1	0,02%				
5	1ph,2	0,01%				
5	1ph,3	0,00%				
10	3ph	0,01%	0,03%	0,00%	0,07%	-0,01%
10	1ph,1		0,04%			
10	1ph,2		0,03%			
10	1ph,3		0,04%			
20	3ph	0,00%	0,02%	-0,01%	0,04%	-0,01%
50	3ph	0,00%	0,02%	0,00%	0,05%	-0,00%
100	3ph	0,01%	0,03%	0,00%	0,07%	-0,01%
100 *	3ph	0,01%	0,03%	-0,00%		
100	1ph,1	0,02%	0,03%			
100	1ph,2	0,01%	0,03%			
100	1ph,3	0,00%	0,04%			
½I_{max}		0,01%	0,03%	-0,00%	0,07%	-0,01%
I_{max}	3ph	0,00%	0,03%	-0,00%	0,06%	-0,01%
I_{max}	1ph,1	0,01%	0,03%			
I_{max}	1ph,2	0,01%	0,03%			
I_{max}	1ph,3	0,00%	0,03%			

* Reverse energy

Accuracy test results, serial number KA-060300004.

57 V	50 Hz	1(10) A				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
2	3ph	0,00%				
2 *	3ph	-0,02%				
5	3ph	0,00%	0,00%	0,02%		
5	1ph,1	0,01%				
5	1ph,2	0,04%				
5	1ph,3	-0,04%				
10	3ph	-0,00%	-0,01%	0,00%	-0,02%	0,01%
10	1ph,1		0,00%			
10	1ph,2		0,03%			
10	1ph,3		-0,08%			
20	3ph	-0,01%	-0,02%			
50	3ph	-0,02%	-0,04%			
100	3ph	-0,00%	-0,02%	0,00%	-0,04%	0,01%
100 *	3ph	-0,01%	-0,03%	0,00%		
100	1ph,1	-0,01%	-0,04%			
100	1ph,2	0,03%	0,03%			
100	1ph,3	-0,06%	-0,08%			
½I_{max}		-0,02%	-0,05%			
I_{max}	3ph	-0,02%	-0,05%	0,00%	-0,08%	0,03%
I_{max}	1ph,1	-0,01%	-0,04%			
I_{max}	1ph,2	0,01%	0,00%			
I_{max}	1ph,3	-0,07%	-0,11%			

* Reverse energy

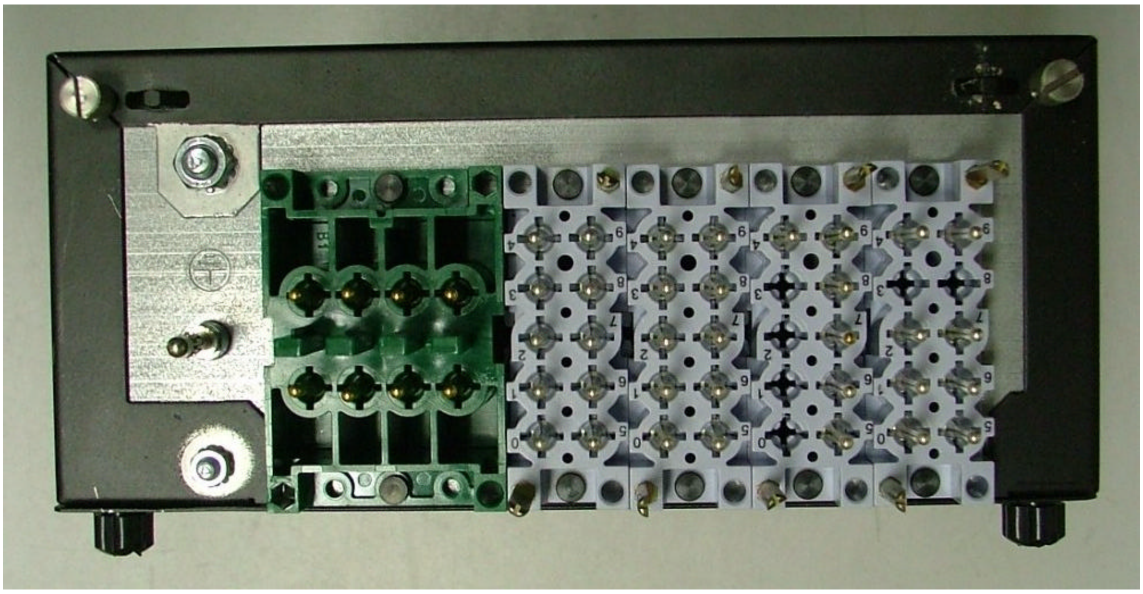
Accuracy test results, serial number KA-060300008.

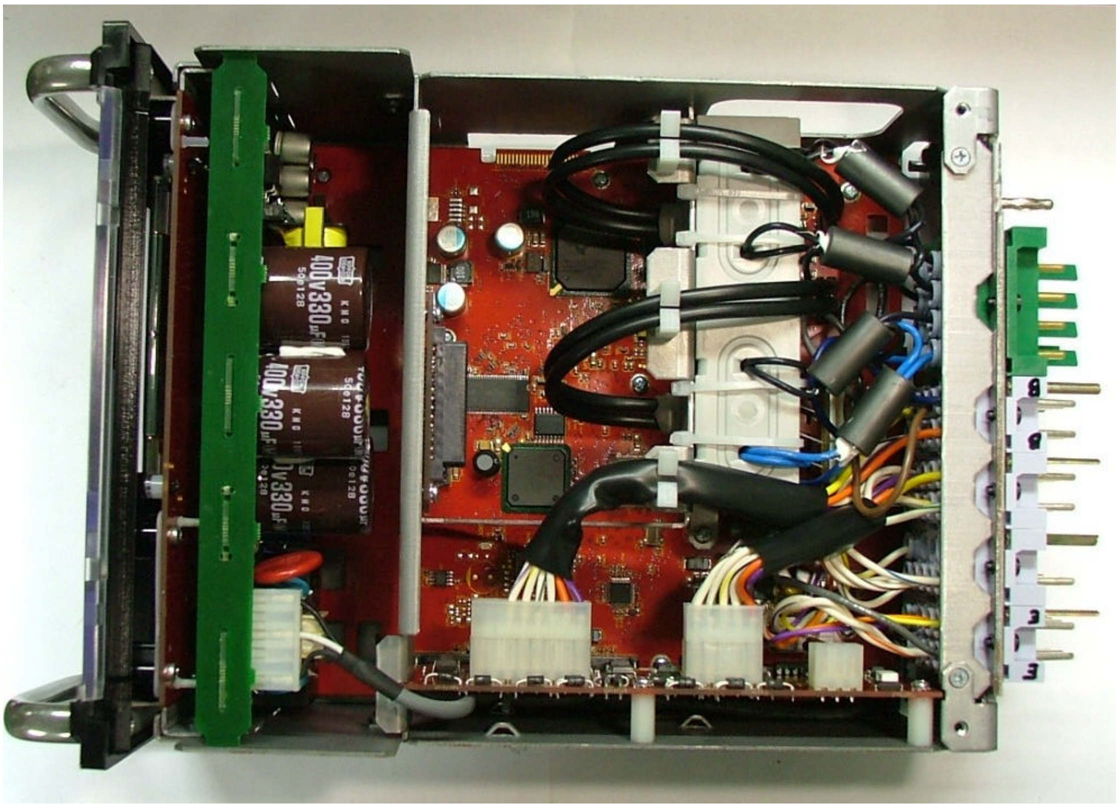
57 V	50 Hz	1(10) A				varh
	3/1	Percentage error at sin φ =				
I in % of I_n	ph	1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
2	3ph	-0,02%				
2 *	3ph	-0,02%				
5	3ph	0,00%	-0,01%	0,00%		
5	1ph,1	0,01%				
5	1ph,2	0,00%				
5	1ph,3	-0,03%				
10	3ph	-0,01%	-0,02%	0,00%	-0,03%	0,01%
10	1ph,1		-0,01%			
10	1ph,2		0,00%			
10	1ph,3		-0,06%			
20	3ph	-0,01%	-0,02%			
50	3ph	-0,02%	-0,04%			
100	3ph	-0,02%	-0,03%	-0,01%	-0,04%	-0,00%
100 *	3ph	-0,02%	-0,03%	-0,01%		
100	1ph,1	-0,00%	-0,02%			
100	1ph,2	-0,02%	-0,03%			
100	1ph,3	-0,04%	-0,05%			
½I_{max}		-0,01%	-0,03%			
I_{max}	3ph	-0,02%	-0,04%	-0,00%	-0,06%	0,00%
I_{max}	1ph,1	-0,01%	-0,03%			
I_{max}	1ph,2	0,00%	-0,01%			
I_{max}	1ph,3	-0,05%	-0,08%			

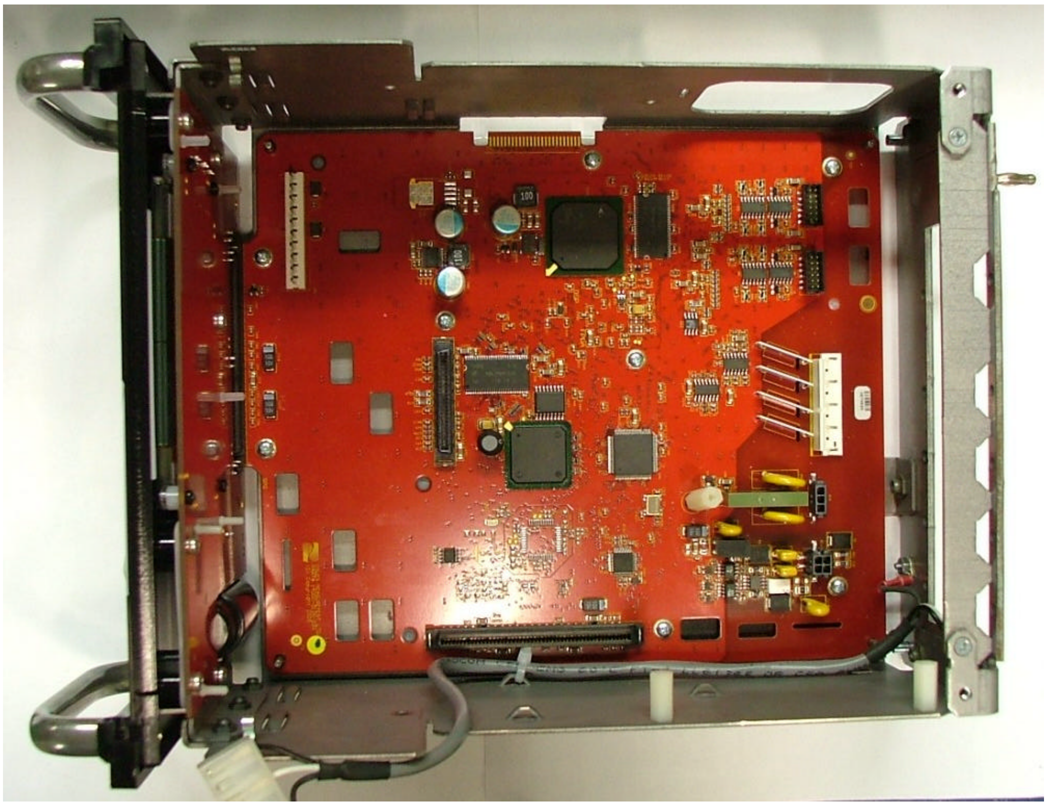
* Reverse energy

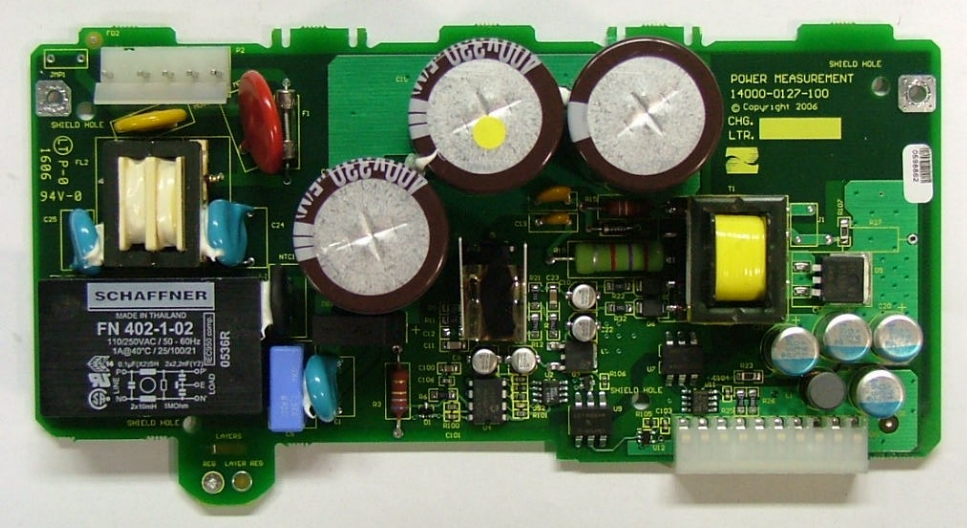
Annex B. Photographs of the meter

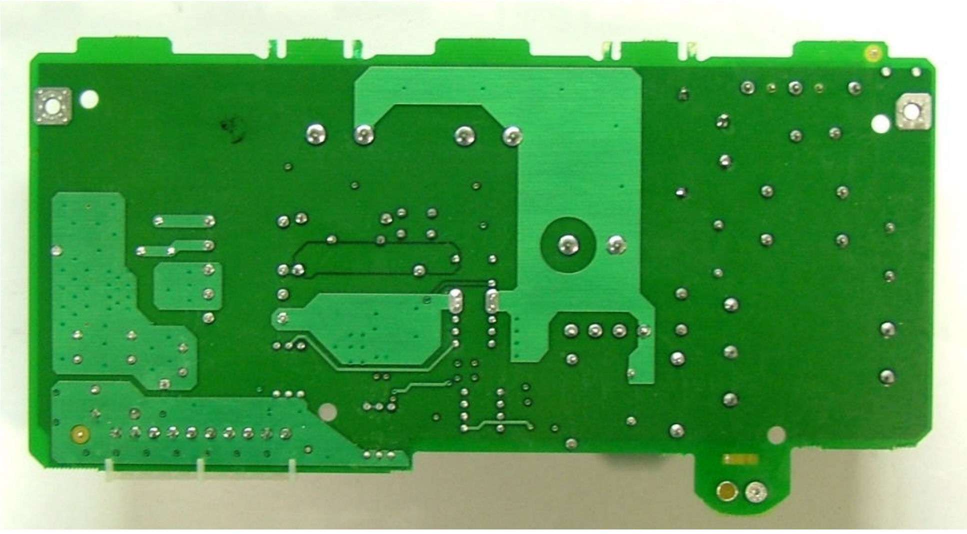

Schneider
Electric

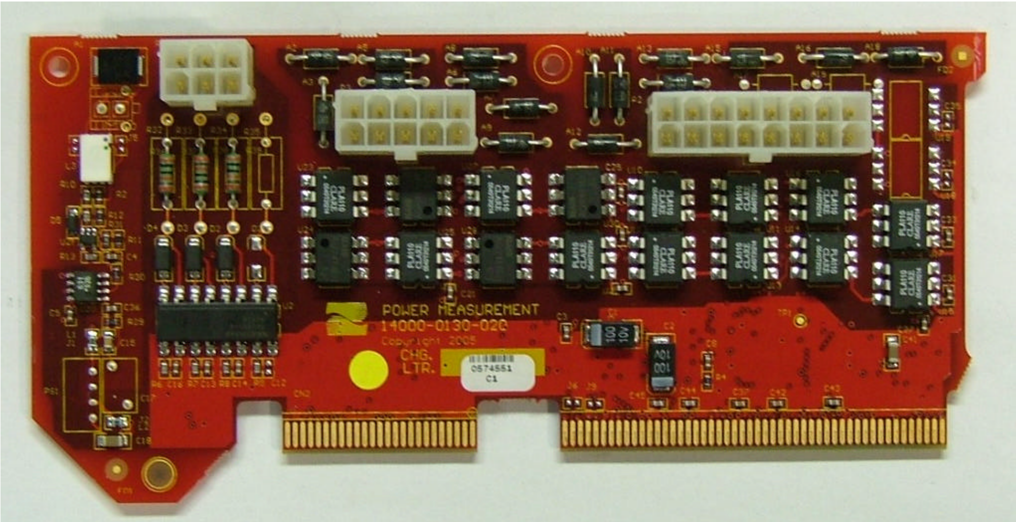



400v330
400v330
400v330




POWER MEASUREMENT
14000-0127-100
© Copyright 2006
CHG.
LTR.
SCHAFFNER
FN 402-1-02

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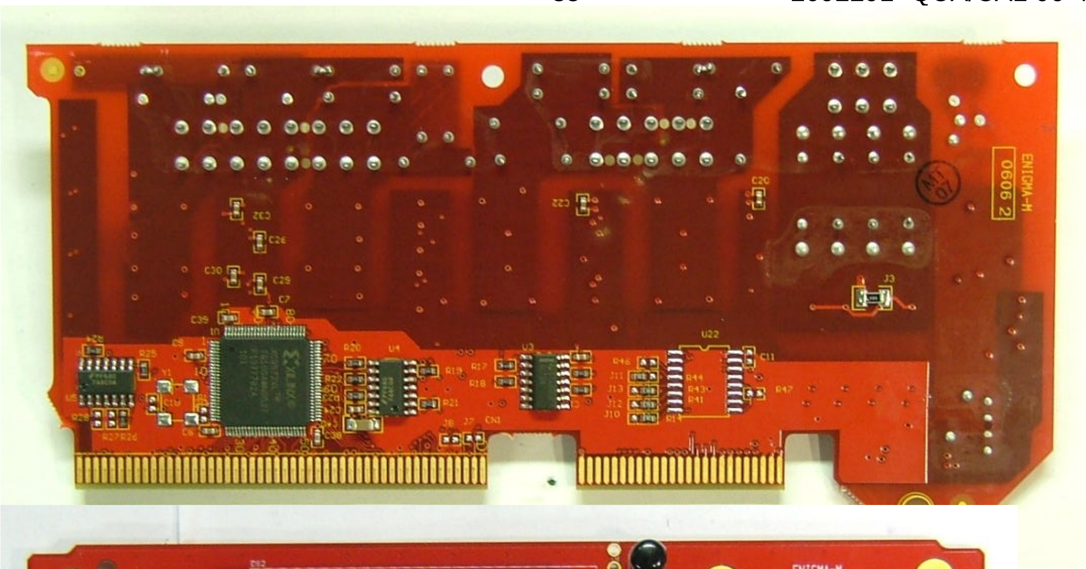
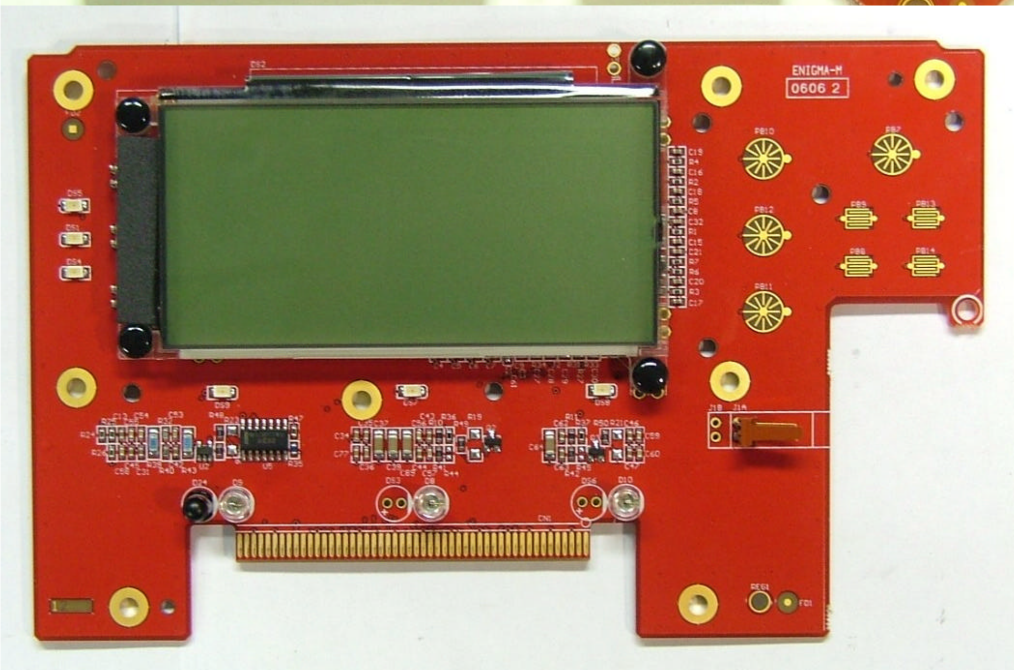
14000-0130-020
CHG.
LTR.


ENIGMA-M
0606 2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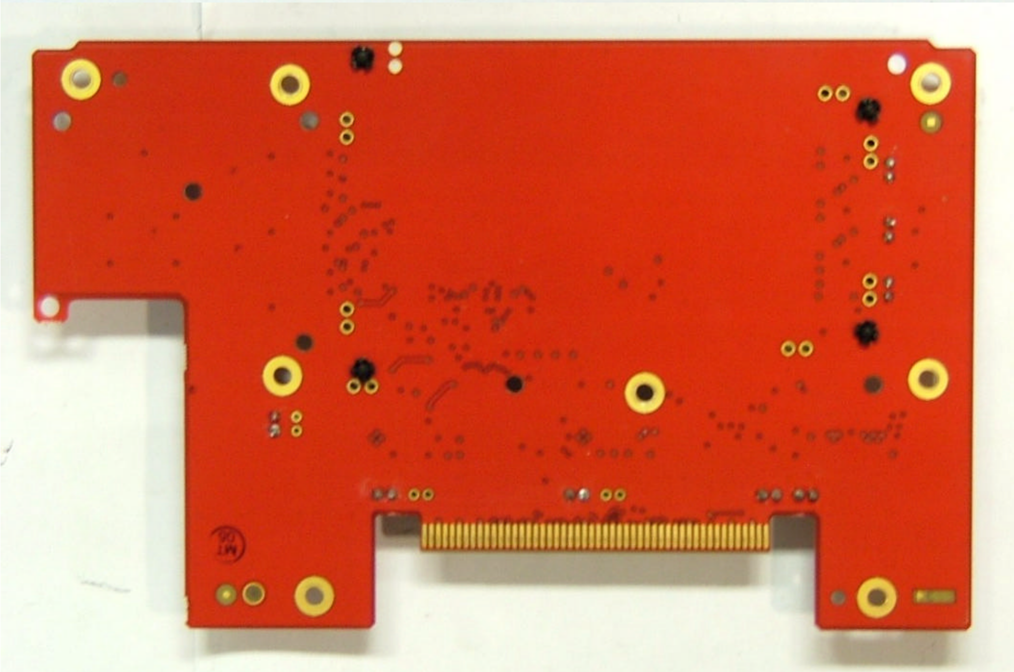
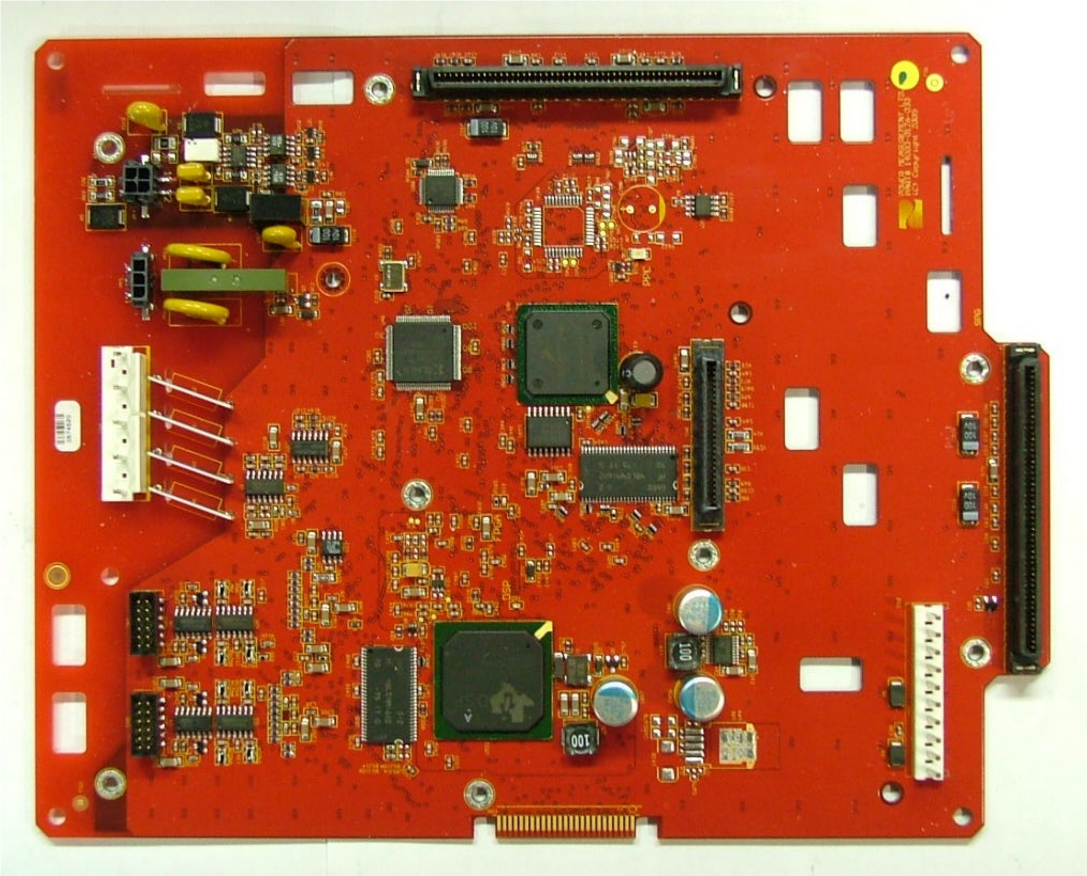
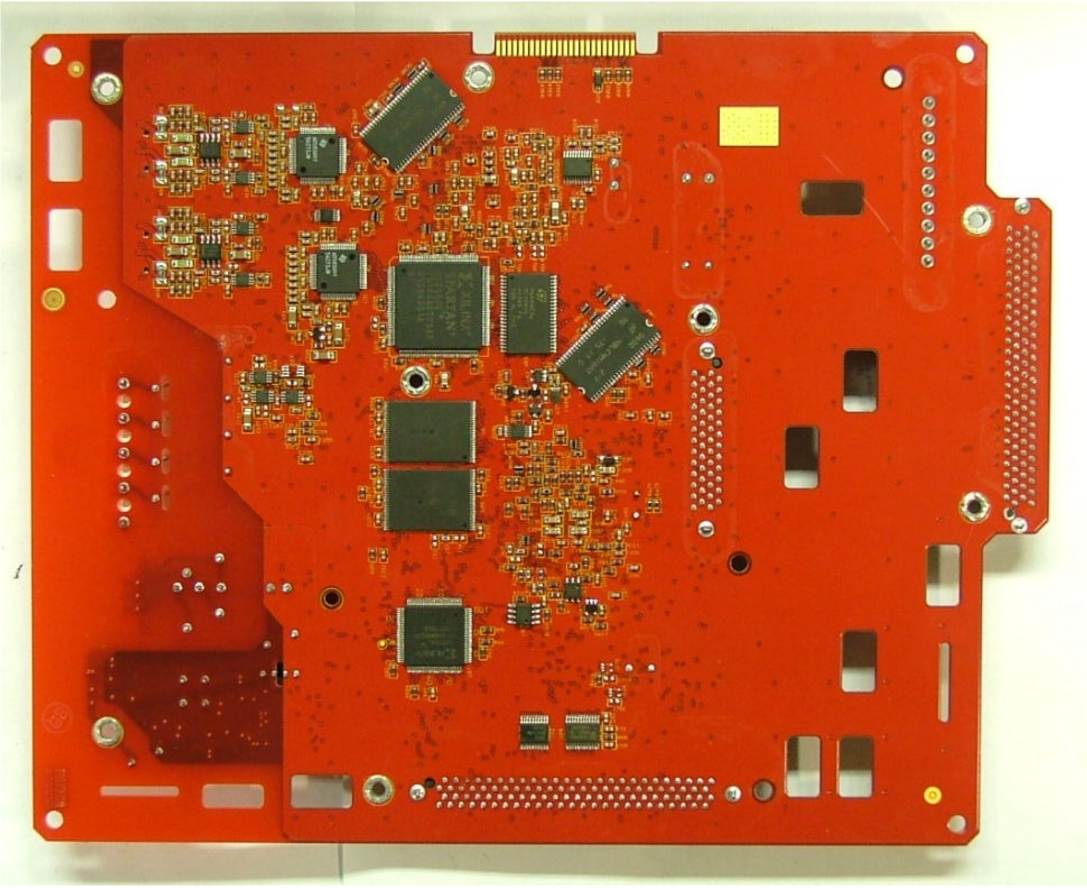
0606 2







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

Chapter	Test	IEC 62052 part 11	IEC 62053 part 21/22/23	
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	Pass
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	N.A.
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	N.A.
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	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		Pass
3.9	Electrostatic discharges	7.5.2		Pass
3.10	Immunity to electromagnetic RF fields	7.5.3		Pass
3.11	Immunity to RF conducted disturbances	7.5.5		Pass
3.8	Fast transient burst test	7.5.4		Pass
3.14	Surge immunity test	7.5.6		Pass
3.13	Voltage dips and short interruptions	7.1.2		Pass
3.15	Damped oscillatory waves immunity test	7.5.7		Pass
3.12	Radio interference suppression	7.5.8		Pass
3.1	General- and mechanical requirements	5		Pass
3.1.3	Spring hammer test	5.2.2.1		Pass
3.1.8	Resistance to heat and fire	5.8		Pass
3.1.6	Protection against penetration of dust and water	5.9		Pass
3.1.4	Shock test	5.2.2.2		Pass
3.1.5	Vibration test	5.2.2.3		Pass
3.1.7	Terminal block material test	5.4		Pass
2	Marking of the meter	5.12		Pass
3.2.2	Dry heat test	6.3.1		Pass
3.2.3	Cold test	6.3.2		Pass
3.2.4	Damp heat cyclic test	6.3.3		Pass
3.2.5	Solar radiation test	6.3.4		N.A.
3.16.1	Impulse voltage test	7.3.2		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