Certificate of Conformity

Number CoC-2375062-02
Project number 2375062

Issued by	:	NMi Certin B.V. Thijsseweg 11 2629 JA Delft The Netherlands
Applicant	:	S.C. "ADD-PRODUCTION" S.R.L. 36, Dragomirna str., MD-2008, Chisinau, Republic of Moldova
Submitted	:	**Static electrical energy meter**

Manufacturer	:	S.C. "ADD-PRODUCTION" S.R.L.
Type	:	AD13A (DC) and
Destined for the measurement of	:	AD13A.3 (CT) Electrical energy in a - three phase four wire system

Characteristics	:	See page 2
In accordance with	:	See page 2

The undersigned declares that the described product is tested according to the above mentioned standards and meet their requirements, based on a non-recurrent examination. The appertaining test data is presented in the type evaluation report NMi-2375062-02, NMi-2375062-03, NMi-2375062-04, NMi-2375062-06 and NMi-2375062-08, granted by NMi.

NMi Certin B.V.
3 March 2020

Certification Board

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Certificate of Conformity

Applicable standards

IEC 62052-11
"Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment"
IEC 62053-21
"Electricity metering equipment (AC) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)"
IEC 62053-23
"Electricity metering equipment (AC) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)"
IEC 62052-21
"Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 21: Tariff and load control equipment"
IEC 62054-21
"Electricity metering equipment (a.c.) - Tariff and load control - Part 21: Particular requirements for time switches";
EN 50470-1
“Electricity metering equipment (a.c.) – Part 1: general requirements, tests and test conditions – Metering equipment (class indexes A,B and C)”;
EN 50470-3
“Electricity metering equipment (a.c.) – Part 3: Particular requirements – Static meters for active energy (class indexes A, B and C)”
CLC/TR 50579
"Electricity metering equipment - Severity levels, immunity requirements and test methods for conducted disturbances in the frequency range 2 -150 kHz"
IEC 61000-4-19
"Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports".

Characteristics of the measuring instrument

The general characteristics of the measuring instrument are presented.

Model	AD13A (DC)	AD13A.3 (CT)
Accuracy class	B or A (EN 50470-3) 1 or 2 (IEC 62053-21) 2 (IEC 62053-23)	C or B (EN 50470-3) 0,5S or 1 (IEC 62053-22) 2 (IEC 62053-23)
Destined for the measurement of	Electrical energy in a - three phase four wire system	
U_{ref}	3x230/400 V	
I_b	5 or 10 A	1 or 5 A
I_{max}	80 or 100 A	6 or 10 A
f_{ref}	50 Hz	
Temperature range	-40° … +70°C	
Degree of protection	IP54	
Software version / checksum	8.1.03 / 8655B9CC	
Hardware version	758728.498 (main board) 758728.425 (antenna board)	

Evaluation report

Issued by	NMi Certin B.V.
Relevant document	Directive 2014/32/EU of the European parliament and of the council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (MID)
Manufacturer	S.C. "ADD-PRODUCTION" S.R.L. 36, Dragomirna str. MD-2008, Chisianau Republic of Moldova
Measuring instrument	An **electrical energy meter** Type : AD13A (DC) and AD13A.3 (CT)
Result	The technical design of the measuring instrument has been evaluated by carrying out examinations and tests in accordance with the relevant documents as mentioned on the following pages. As a result it has been concluded that the measuring instrument meets the essential requirements of Directive 2014/32/EU (MID). The examination has resulted in EU-type examination certificate no. T11778 revision 0. The executed evaluations, reference documents and reports used during the examination are described on the following pages.
Issue Date	3 March 2020

E. Kokshoorn
Team Leader

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1 Examinations according to the Directive

Furthermore, the activities listed in point 4 of Annex II, module B of Directive 2014/32/EU are executed with the results as stated in the table below.

Point	Activity	Performed and Passed [yes/no/N.A.]
4.1	Examine the technical documentation	Yes
4.2	Verify that specimens have been manufactured in conformity with the technical documentation	Yes
	Identify elements designed in accordance with the relevant provisions of the relevant documents	Yes
	Identify elements which have been designed without applying the relevant provisions of the relevant documents	N.A.
4.3	Carry out the appropriate examinations and tests, or have them carried out, to check whether, where the manufacturer has chosen to apply the solutions in the relevant documents, these have been applied correctly	Yes
	Applied harmonised standard / normative document	See next chapter
4.4	Carry out the appropriate examinations and tests, or have them carried out, to check whether, where the manufacturer has chosen not to apply the solutions in the relevant documents, the solutions adopted by the manufacturer meet the corresponding essential requirements of this Directive	N.A.
4.5	Agree with the applicant on the location where the examinations and tests are carried out	Yes
4.6	Examine the technical documentation and supporting evidence to assess the adequacy of the technical design of the other parts of the measuring instrument	N.A.

2 Harmonized standards, normative documents and / or recommendations

The measuring instrument is examined in accordance with the relevant document listed in this Evaluation Report, page 1.

The following harmonized standards, normative documents and / or recommendations are applied:
- EN 50470-1 “Electricity metering equipment (a.c.) – Part 1: general requirements, tests and test conditions – Metering equipment (class indexes A,B and C)”;
- EN 50470-3 “Electricity metering equipment (a.c.) – Part 3: Particular requirements – Static meters for active energy (class indexes A, B and C)”;

- IEC 62052-11 “Electricity metering equipment (AC) – General requirements, tests and test conditions – Part 11: Metering equipment”;
- IEC 62053-21 "Electricity metering equipment (AC) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)";
- IEC 62053-22 "Electricity metering equipment (AC) - Particular requirements - Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)";
- IEC 62053-23 "Electricity metering equipment (AC) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)";
- IEC 62052-21 "Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 21: Tariff and load control equipment";
- IEC 62054-11 "Electricity metering equipment (a.c.) - Tariff and load control - Part 11: Particular requirements for ripple control receivers";
- IEC 62054-21 "Electricity metering equipment (a.c.) - Tariff and load control - Part 21: Particular requirements for time switches";
- WELMEC 7.2, 2019 “Software Guide”;
- CLC/TR 50579 "Electricity metering equipment - Severity levels, immunity requirements and test methods for conducted disturbances in the frequency range 2 -150 kHz";
- IEC 61000-4-19 "Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports".

3 Reports

The conformity was established by the results of tests and examinations provided in the associated report(s):

Test	Part / Type	Report	Remarks
Complete evaluation	AD13A & AD13A.3	NMi-2375062-02 NMi-2375062-03 NMi-2375062-04 NMi-2375062-05 NMi-2375062-06 NMi-2375062-08 CoC-2375062-02	EN 50470-1 EN 50470-3 IEC 62052-11 IEC 62053-21 IEC 62053-22 IEC 62053-23 IEC 62054-11 IEC 62054-21 IEC 610000-4-19 Welmec 7.2

4 Additional Evaluations

This Evaluation Report is supplemented by the following additional evaluations:

Test	Part / Type	Document	Remarks
N.A.			

5 Revision History

Project no.	Rev.	Date	Report / Document	Description / Remarks
2375062	0	03-03-2020	NMi-2375062-02 NMi-2375062-03 NMi-2375062-04 NMi-2375062-05 NMi-2375062-06 NMi-2375062-08 CoC-2375062-02	Complete evaluation

Type evaluation report

Issued by	:	NMi Certin B.V., accredited by the national accreditation body (RvA), based on the ISO/IEC 17020, with identification number I122 and the ISO/IEC 17025, with identification number L029. RvA is signatory member of both the Multi-Lateral Agreement of the European cooperation for Accreditation (EA) and the Mutual Recognition Arrangement of the International Laboratory Accreditation Cooperation (ILAC). The evaluation results are reported under I122. The test results, including interpretations, are reported under L029.
Applicant	:	S.C."ADD-PRODUCTION" S.R.L. 36, Dragomirna str. MD-2008, Chisianau Republic of Moldova
Measuring instrument	:	**A poly phase static watthourmeter** Manufacturer : S.C."ADD-PRODUCTION" S.R.L. Type : AD13A.3
Test specifications	:	- IEC 62052-11 "Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment" - IEC 62053-22 "Electricity metering equipment (AC) - Particular requirements - Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)" - IEC 62053-23 "Electricity metering equipment (AC) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)" - EN 50470-1 "Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 1: Metering equipment (class indexes A, B - EN 50470-3 "Electricity metering equipment (a.c.) - Particular requirements - Part 3: Static meters for active energy (class indexes A, B and C)"
Testing period	:	November 2019 up to and including February 2020
Issue date	:	2 March 2020

Performed by:	Reviewed by:
M.P. Cloo	J.M.J. Boereboom
Senior Approvals Expert	Approvals Expert

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INSPECTION RvA I 122

TESTING RvA L 029

Tests	:	The meters as specified in annex 2 were tested for compliance with the standards as specified on page 1 of this type evaluation report. The performed tests are stated in annex 1. If applicable specific test conditions are stated at each test.
Results		See annex 1 of this type evaluation report. The meter fulfils the general requirements of the IEC 62052-11, and the requirements for class 0,5S S of the IEC 62053-22 as well as the requirements for class 2 of the IEC 62053-23 for all performed tests. The meter fulfils the general requirements of the EN 50470-1 [2006], and the requirements for class C of the EN 50470-3 [2006] for all performed tests. Based on the compliance with the EN 50470 documents NMi presumes conformity with the Measuring Instrument Directive (MID). The investigation has resulted in a class C EU-type examination certificate nr. T11778 revision 0.
Traceability	:	The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA.
Uncertainty	:	The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which provides a confidence level of approximately 95%. The total uncertainty of the measurements of the error of indication is 0,20% for power factor=1, and 0,25% for power factor=0,5 inductive or 0,8 capacative. The total uncertainty in the measurements of power is 0,02 W.
Annexes	:	The complete type evaluation report consists of the following annexes: annex 1 : performed tests annex 2 : characteristics of the tested meters annex 3 : checklist of general requirements annex 4 : test data
Remark	:	The test data as presented in the annex 4 of this type evaluation report is performed under RvA accreditation with reference number L029, in which conformity to ISO/IEC 17025 has been demonstrated. The data as presented in the annexes 1, 2 and 3 gives extra information.

Annex 1: Performed tests

In the following tables the performed tests are indicated with the accompanying results, as well as the page number of the appertaining annex where the results are presented.

Particular requirements of the IEC 62053-22 / IEC 62053-23 / EN 50470-3:

article IEC 62053-22 / IEC 62053-23 / EN 50470-3	tests:	passed	not applicable	not performed	annex 4 page
8.1 / 8.1	error due to variation of current (at reference conditions)	√			1
8.1 / 8.1	error due to variation of current (single phase load)	√			4
8.3 / 8.7.9	starting- and no-load condition	√			6
8.4 / 8.7.10	meter constant	√			7
8.2 / 8	variation of the error due to variation of the voltage	√			8
8.2 / 8	variation of the error due to variation of the frequency	√			10
8.2 / 8.5	reversed phase sequence	√			11
8.2 / 8.5	voltage unbalance	√			12
8.2 / 8.5	auxiliary voltage		√		-
8.2 / 8.5	operation of accessories	√			13
8.2 / -	variation of the error due to variation of the temperature	√			14
8.2 / 8.5	variation of the error due to harmonics	√			16
8.2 / 8.5	continuous magnetic induction of external origin	√			17
8.2 / 8.5	magnetic induction of external origin (0,5 mT)	√			18
7.1 / 7.1	power consumption	√			19
7.2 / 8.6	variation of the error due to short-time overcurrents	√			20
7.3 / 8.5	variation of the error due to self-heating	√			21
7.3.3 / 7.2	AC voltage test	√			23

General requirements of the IEC 62052-11 / EN 50470-1:

article IEC 62052-11 / EN 50470-1	tests:	passed	not applicable	not performed	annex 4 page
7.3.2 / 7.3	impulse voltage test	√			23
7.4 / -	earth fault	√			25
7.5.2 / 7.4.5	immunity to electrostatic discharges	√			26
7.5.3 / 7.4.6	immunity to electromagnetic RF-fields	√			27
7.5.4 / 7.4.7	fast transient bursts	√			29
7.5.5 / 7.4.8	immunity to conducted disturbances	√			30
7.5.6 / 7.4.9	surge immunity	√			31
7.5.7 / 7.4.10	damped oscillatory waves immunity	√			33
7.5.8 / 7.4.13	radio interference suppression	√			35
7.1.2 / 7.4.4	influence of supply voltage	√			38
7.2 / 7.2	influence of heating	√			39
6.3.1, 6.3.2, 6.3.3	dry heat test, cold test and damp heat, cyclic test	√			40
6.3.4	solar radiation		√		-
5.2.2.2, 5.2.2.3	shock and vibration tests	√			41
5.2.2.1	spring hammer test	√			42
5.9	protection against dust and water	√			42
5.8	test of resistance to heat and fire	√			44

Extra requirements for the EN 50470-3:

article EN 50470-3	tests:	passed	not applicable	not performed	annex 4 page
8.1	accuracy tests at reference conditions	√			44
8.2	repeatability	√			45
8.3	variation of the error due to variation of the voltage	√			46
8.3	variation of the error due to variation of the frequency	√			47
8.3	variation of the error due to variation of the temperature	√			48
8.4	maximum permissible error	√			50
8.5	earth fault	√	√		25

Other tests:

	tests:	passed	not applicable	not performed	annex 4 page
TR 50579	disturbance with harmonics in the frequency range 2-150 kHz	√*			-
WELMEC 11	one phase export, remaining phases import	√			52

Remark: The measurements are performed at a reference temperature of 23±2 °C, unless an other temperature is stated.

The radio interference suppression, 6 kV surge, 12 kV impulse voltage and damped oscillatory waves test are performed at the TÜV Rheinland EPS BV laboratory in Leek, the Netherlands.

*) see report NMi-2375062-06

Annex 2: Characteristics of the tested meters

Sample number	Model	Serial number	Year of fabrication	I_{min} [A]	I_n [A]	I_{max} [A]	U_{ref} [V]	f_{ref} [Hz]	Meter constant [imp./kWh] [imp./kvarh]
13	AD13A.3	13259632	2019	0.01	1	10	3x230/400	50	10,000
14	AD13A.3	13259633	2019	0.01	1	10	3x230/400	50	10,000
17	AD13A.3	13259638	2019	0.01	1	10	3x230/400	50	10,000
18	AD13A.3	13259641	2019	0.01	1	10	3x230/400	50	10,000
19	AD13A.3	13259642	2019	0.01	1	10	3x230/400	50	10,000
20	AD13A.3	13259644	2019	0.01	1	10	3x230/400	50	10,000

IEC accuracy class:	0.5S	
Software version:*	8.1.02	Checksum: A925C2EA
Hardware version:	Main board	758728.498
	Antenna board	758728.425

Remarks: The results as mentioned in this type evaluation report relate only to the meters which are tested.

* Based on documentation provided by the manufacturer software version 8.1.03 with checksum 8655B9CC is also approved.

The above mentioned characteristics were stated on the watthour meters under test and are required by the IEC documents.
However, according to the Annex V of the MID and the EN 50470 documents, other parameters are used to define the meter characteristics. Therefore in addition the following characteristics are used during the investigation:

- I_{tr} : $0{,}05 * I_n$
- I_{min} : $0{,}2 * I_{tr}$ ($= 0{,}01 * I_n$)
- I_{st} : $0{,}04 * I_{tr}$ ($= 0{,}001 * I_n$)

Several tests are performed to show compliance with both the IEC documents and EN 50470 documents, as indicated in Annex 1. For those tests mainly the terminology as indicated in the IEC documents is used. The above mentioned values for I_{tr}, I_{min} and I_{st} can be used for a cross reference between the two different kind of terminologies.

Photographs:

Annex 3: Checklist of general requirements

General requirements standard IEC 62052-11:

article	requirement	passed (yes/no)	not applicable
4.1 - 4.3	the meter must have a 'standard' value for voltage, current and frequency.	yes	
5.1	the meters shall be designed in such a way to avoid any danger, for electric shocks, excessive temperatures, fire and penetration of dust and water.	yes	
5.2.1	internal parts may only be accessible after breaking a seal.	yes	
	the cover may only be removed by use of a tool.	yes	
	non-permanent deformation may not influence the meter.	yes	
	meters with a reference voltage > 250V shall and whose case is wholly or partilly made of metal, shall be provided with a protected earth terminal.		n.a.
5.3	the registers must be observed clearly.	yes	
5.4	requirements for terminals	yes	
	the material of the terminal block has passed the tests given in ISO 75 for a temperature of 135°C and a pressure of 1,8 MPa (Method A).	yes*)	
5.5	the terminal cover shall be sealed independently.	yes	
5.6	see requirements for clearance / creepage distances	yes	
5.7	meters of protective class II shall be sufficient isolated (see requirements).	yes	
5.10	presentation of measured energy must be clearly by a mechanical/electronical register, containing sufficient elements for 1500 hours running at I_{max}, while the indication is in kWh	yes	
	the active tariff shall be indicated, the identification of each tariff applied shall be possible and, for automatic sequencing displays, each display shall be retained for a minimum of 5 s.	yes	
	at interruption of the tension the indication must be recovered within a period of at least 4 months,	yes	
5.11	the meter shall have a test output.	yes	
5.11.1	the maximum pulse frequency shall not exceed 2,5 kHz, the pulse transition time shall not exceed 20 µs.	yes	
5.11.2	the wavelength is between 550 nm and 1000 nm.	yes	
5.12.1	all necessary markings shall be put onto the meter.	yes	
5.12.2	the meter is marked with a connection diagram	yes	

*) The judgement is performed based on documents delivered by the applicant.

General requirements standard EN 50470-1:

article	requirement	passed (yes/no)	not applicable
4.1 - 4.3	the meter must have a 'standard' value for voltage, current and frequency.	yes	
5.1	the meters shall be designed in such a way to avoid any danger, for electric shocks, excessive temperatures, fire and penetration of dust and water.	yes	
5.2.1	internal parts may only be accessible after breaking a seal.	yes	
	the cover may only be removed by use of a tool.	yes	
	non-permanent deformation may not influence the meter.	yes	
5.3	the registers must be observed clearly.	yes	
5.4	requirements for terminals	yes	
	the material of the terminal block has passed the tests given in ISO 75 for a temperature of 135°C and a pressure of 1,8 MPa (Method A).	yes*)	
5.5	the terminal cover shall be sealed independently.	yes	
5.6	see requirements for clearance / creepage distances	yes	
5.7	meters of protective class II shall be sufficient isolated (see requirements).	yes	
5.10	presentation of measured energy must be clearly by a mechanical/electronical register, containing sufficient elements for 4000 hours running at I_{max}, while the indication is in kWh or MWh	yes	
	the active tariff shall be indicated, the identification of each tariff applied shall be possible and, for automatic sequencing displays, each display shall be retained for a minimum of 5 s.	yes	
	for testing purposes it shall be possible to increase the resolution to 0,01 times the principal unit	yes	
	at interruption of the tension the indication must be recovered within a period of at least 4 months,	yes	
5.11	the meter shall have a test output.	yes	
5.11.1	the maximum pulse frequency shall not exceed 2,5 kHz, the pulse transition time shall not exceed 20 µs.	yes	
5.11.2	the wavelength is between 550 nm and 1000 nm.	yes	
5.12.1	all necessary markings shall be put onto the meter.	yes	
5.12.2	the meter is marked with a connection diagram	yes	
5.13	for each meter type, an instruction manual shall be made available including the stated information	yes	

*) The judgement is performed based on documents delivered by the applicant.

General requirements standard EN 50470-3:

article	requirement	passed (yes/no)	not applicable
9	durability the meter shall be designed to maintain an adequate stability of its metrological characteristics over a period estimated by the manufacturer.	yes*)	
10	reliability the meter shall be designed to operate reliable.	yes**)	
11	the functions implemented in software shall be unambiguously identified and their operation adequately documented by the manufacturer	yes	
	software identification shall be easily provided.	yes	
	corruption of metrologically relevant software shall be easily detected.	yes	
	metrologically relevant parameters shall be identified and protected against accidental or intentional changes after placing the legal seals.	yes	
	evidence of any intervention shall be available for a reasonable time.	yes	
	if there are parameters, which are allowed to be set in the field, this shall be possible only under adequate protection, using the specified method; any admissible changes of such parameters shall be properly traceable.	yes	
	the security system of the meter shall be adequately documented.	yes	
	non-relevant functions in the software shall not influence the correct operation of the metrologically relevant software.	yes	

*) The judgement is performed based on documents delivered by the applicant.

Requirements WELMEC 11:

article	requirement	passed (yes/no)	not applicable
	The cumulative register is protected by means of a hardware seal.	yes	
	If no cumulative register is available, the registers from which the total quant supplied can be derived, are protected by means of a hardware seal.		n.a.
	If the effect of different phase sequences is **NOT** negligible, the meter shall bear information in respect of phase sequence to be applied.		n.a.

Annex 4: Test data

Test: Error due to variation of the current (at reference conditions)

The error of the meters is measured under reference conditions at different values of the current and power factor.

Results: Active energy measurements, balanced load:

I [%] of I_n	Error [%] Import					
	Sample nr. 15			Sample nr. 16		
	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.
1	+ 0.1			+ 0.0		
2	+ 0.1	+ 0.1	+ 0.0	+ 0.0	+ 0.1	− 0.0
5	+ 0.0	+ 0.0	+ 0.0	− 0.0	+ 0.1	− 0.0
10	+ 0.0	+ 0.0	+ 0.0	− 0.0	+ 0.1	− 0.0
20	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
50	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
100	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
0,5·Imax	+ 0.0	− 0.1	+ 0.1	− 0.0	− 0.0	+ 0.0
Imax	+ 0.0	− 0.1	+ 0.1	+ 0.0	− 0.1	+ 0.0

I [%] of I_b	Error [%] Export					
	Sample nr. 15			Sample nr. 16		
	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.
1	+ 0.0			+ 0.0		
2	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
5	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
10	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
20	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
50	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
100	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.1	− 0.0
0,5·Imax	+ 0.0	− 0.1	+ 0.1	− 0.0	− 0.0	+ 0.0
Imax	+ 0.0	− 0.2	+ 0.1	− 0.0	− 0.1	+ 0.0

Reactive energy measurements, balanced load:

I [%] of I_n	Error [%] Import					
	Sample nr. 15			Sample nr. 16		
	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.
2	– 0.1			– 0.2		
5	– 0.1	– 0.1	– 0.1	– 0.1	– 0.2	– 0.1
10	– 0.0	– 0.1	– 0.1	– 0.1	– 0.2	– 0.1
20	– 0.0	– 0.0	– 0.0	– 0.1	– 0.2	– 0.1
50	– 0.0	– 0.0	– 0.0	– 0.1	– 0.2	– 0.1
100	– 0.0	+ 0.0	– 0.1	– 0.1	– 0.1	– 0.1
150	– 0.0	+ 0.0	– 0.1	– 0.1	– 0.1	– 0.1
200	– 0.0	+ 0.0	– 0.1	– 0.1	– 0.1	– 0.1
0,2·Imax	– 0.0	+ 0.0	– 0.1	– 0.1	– 0.1	– 0.1
0,4·Imax	– 0.0	+ 0.1	– 0.1	– 0.1	– 0.1	– 0.1
0,6·Imax	– 0.0	+ 0.1	– 0.1	– 0.1	– 0.1	– 0.2
0,8·Imax	– 0.0	+ 0.1	– 0.2	– 0.1	– 0.1	– 0.2
Imax	– 0.0	+ 0.1	– 0.2	– 0.1	– 0.0	– 0.2

I [%] of I_n	Error [%] Import					
	Sample nr. 15			Sample nr. 16		
	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.
10	– 0.0	– 0.1	– 0.1	– 0.1	– 0.3	– 0.0
20	– 0.0	– 0.1	– 0.1	– 0.1	– 0.3	+ 0.0
100	– 0.0	+ 0.1	– 0.1	– 0.1	– 0.2	– 0.0
Imax	– 0.0	+ 0.3	– 0.4	– 0.1	+ 0.1	– 0.3

I [%] of I_n	Error [%] Export					
	Sample nr. 15			Sample nr. 16		
	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.
2	+ 0.1			− 0.0		
5	+ 0.0	+ 0.1	+ 0.1	− 0.1	− 0.1	+ 0.0
10	+ 0.0	+ 0.0	+ 0.0	− 0.1	− 0.1	+ 0.0
20	− 0.0	+ 0.0	+ 0.0	− 0.1	− 0.2	− 0.0
50	+ 0.0	+ 0.0	+ 0.0	− 0.1	− 0.2	− 0.0
100	+ 0.0	+ 0.0	− 0.0	− 0.1	− 0.2	− 0.1
150	+ 0.0	+ 0.0	− 0.1	− 0.1	− 0.1	− 0.1
200	− 0.0	+ 0.0	− 0.1	− 0.1	− 0.1	− 0.1
0,2·Imax	− 0.0	+ 0.0	− 0.1	− 0.1	− 0.1	− 0.1
0,4·Imax	− 0.0	+ 0.1	− 0.1	− 0.1	− 0.1	− 0.1
0,6·Imax	− 0.0	+ 0.1	− 0.2	− 0.1	− 0.1	− 0.2
0,8·Imax	− 0.0	+ 0.1	− 0.2	− 0.1	− 0.1	− 0.2
Imax	− 0.0	+ 0.1	− 0.2	− 0.1	− 0.0	− 0.2

I [%] of I_n	Error [%] Export					
	Sample nr. 15			Sample nr. 16		
	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.
10	+ 0.0	+ 0.1	+ 0.1	− 0.1	− 0.2	+ 0.1
20	+ 0.0	+ 0.1	+ 0.0	− 0.1	− 0.2	+ 0.1
100	− 0.0	+ 0.1	− 0.1	− 0.1	− 0.2	− 0.0
Imax	− 0.0	+ 0.3	− 0.4	− 0.1	+ 0.1	− 0.3

Remark: Before the measurements were started, the voltage was connected for at least one hour and a current of $0{,}1 \cdot I_n$ was running through the meters.

Active energy measurements, single phase load:

I [%] of I_n	Sample nr. 15 Error [%] Import					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
5	+ 0.1	+ 0.0	+ 0.0			
10	+ 0.0	+ 0.0	+ 0.0	– 0.1	+ 0.1	+ 0.1
20	+ 0.1	+ 0.0	+ 0.0	– 0.1	+ 0.1	+ 0.1
100	+ 0.1	+ 0.0	+ 0.0	– 0.1	+ 0.1	+ 0.1
0,5·Imax	+ 0.0	+ 0.0	+ 0.0	– 0.2	– 0.0	– 0.0
Imax	+ 0.1	+ 0.0	+ 0.0	– 0.3	– 0.1	– 0.1

I [%] of I_n	Sample nr. 16 Error [%] Import					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
5	– 0.1	+ 0.0	+ 0.1			
10	– 0.1	+ 0.0	+ 0.1	+ 0.0	+ 0.1	+ 0.2
20	– 0.1	+ 0.0	+ 0.1	– 0.0	+ 0.1	+ 0.1
100	– 0.1	+ 0.1	+ 0.1	+ 0.0	+ 0.1	+ 0.1
0,5·Imax	– 0.1	+ 0.0	+ 0.0	– 0.1	+ 0.0	+ 0.0
Imax	– 0.1	+ 0.1	+ 0.0	– 0.2	– 0.0	– 0.0

I [%] of I_n	Sample nr. 15 Error [%] Export					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
5	+ 0.1	+ 0.0	+ 0.0			
10	+ 0.0	+ 0.0	+ 0.0	+ 0.1	– 0.0	– 0.1
20	+ 0.0	+ 0.0	+ 0.0	+ 0.2	– 0.0	– 0.1
100	+ 0.1	+ 0.0	+ 0.0	+ 0.3	+ 0.0	– 0.1
0,5·Imax	+ 0.1	+ 0.0	+ 0.0	+ 0.3	+ 0.1	+ 0.0
Imax	+ 0.1	+ 0.0	+ 0.0	+ 0.3	+ 0.1	+ 0.1

I [%] of I_n	Sample nr. 16 Error [%] Export					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
5	– 0.1	+ 0.1	+ 0.0			
10	– 0.1	+ 0.0	+ 0.0	– 0.2	+ 0.0	– 0.0
20	– 0.1	+ 0.1	+ 0.1	– 0.2	+ 0.0	– 0.0
100	– 0.1	+ 0.1	+ 0.1	– 0.1	+ 0.0	– 0.0
0,5·Imax	– 0.1	+ 0.1	+ 0.0	– 0.1	+ 0.1	+ 0.0
Imax	– 0.1	+ 0.1	+ 0.0	– 0.0	+ 0.1	+ 0.1

Reactive energy measurements, single phase load:

I [%] of I_n	Sample nr. 15 Error [%] Import								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
5	+ 0.1	– 0.1	– 0.1						
10	+ 0.1	– 0.1	– 0.1	+ 0.2	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.0
20	+ 0.1	– 0.1	– 0.1	+ 0.2	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.0
100	+ 0.1	– 0.1	– 0.1	+ 0.3	– 0.1	– 0.1	– 0.0	– 0.1	– 0.0
0,5·Imax	+ 0.1	– 0.1	– 0.1	+ 0.3	– 0.0	– 0.0	– 0.1	– 0.2	– 0.1
Imax	+ 0.1	– 0.1	– 0.0	+ 0.3	+ 0.0	+ 0.1	– 0.2	– 0.2	– 0.1

I [%] of I_n	Sample nr. 16 Error [%] Import								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
5	– 0.4	– 0.0	+ 0.0						
10	– 0.4	– 0.0	+ 0.0	– 0.5	– 0.1	– 0.1	– 0.3	+ 0.0	+ 0.1
20	– 0.3	+ 0.0	+ 0.0	– 0.5	– 0.1	– 0.0	– 0.3	+ 0.0	+ 0.1
100	– 0.3	– 0.0	+ 0.1	– 0.4	– 0.0	– 0.0	– 0.3	+ 0.0	+ 0.1
0,5·Imax	– 0.4	– 0.0	+ 0.1	– 0.3	+ 0.0	+ 0.1	– 0.4	– 0.1	+ 0.0
Imax	– 0.4	– 0.0	+ 0.0	– 0.3	+ 0.1	+ 0.1	– 0.5	– 0.1	– 0.0

I [%] of I_n	Sample nr. 15 Error [%] Export								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
5	+ 0.2	– 0.0	– 0.0						
10	+ 0.2	– 0.1	– 0.0	+ 0.4	– 0.1	– 0.1	+ 0.1	+ 0.0	+ 0.1
20	+ 0.1	– 0.1	– 0.0	+ 0.3	– 0.1	– 0.1	+ 0.1	– 0.0	+ 0.1
100	+ 0.1	– 0.1	– 0.0	+ 0.3	– 0.1	– 0.1	+ 0.0	– 0.1	+ 0.0
0,5·Imax	+ 0.1	– 0.1	– 0.1	+ 0.3	– 0.0	– 0.0	– 0.1	– 0.1	– 0.1
Imax	+ 0.1	– 0.1	– 0.0	+ 0.4	+ 0.0	+ 0.0	– 0.2	– 0.2	– 0.1

I [%] of I_n	Sample nr. 16 Error [%] Export								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
5	– 0.3	– 0.0	+ 0.1						
10	– 0.4	– 0.0	+ 0.1	– 0.4	– 0.0	+ 0.0	– 0.3	+ 0.0	+ 0.2
20	– 0.3	– 0.0	+ 0.1	– 0.4	– 0.1	+ 0.0	– 0.3	+ 0.0	+ 0.2
100	– 0.3	+ 0.0	+ 0.1	– 0.4	– 0.0	+ 0.0	– 0.3	+ 0.0	+ 0.1
0,5·Imax	– 0.4	– 0.0	+ 0.0	– 0.4	+ 0.1	+ 0.1	– 0.4	– 0.1	+ 0.0
Imax	– 0.4	+ 0.0	+ 0.0	– 0.3	+ 0.1	+ 0.1	– 0.5	– 0.1	– 0.0

Remark: Before the measurements were started, the voltage was connected for at least one hour and a current of $0,1 \cdot I_n$ was running through the meters.

Test: Starting and no-load condition

The starting and no-load condition is checked at reference conditions.

Results: Active energy measurements:

Sample nr. 15	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_n Registration checked at % of I_n with export energy	0.1 % 0.1 %

Sample nr. 16	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_n Registration checked at % of I_n with export energy	0.1 % 0.1 %

The meter is functional within 5 s after the rated voltage is applied to the meter terminals: yes

Reactive energy measurements:

Sample nr. 15	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_n Registration checked at % of I_n with export energy	0.3 % 0.3 %

Sample nr. 16	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_n Registration checked at % of I_n with export energy	0.3 % 0.3 %

The meter is functional within 5 s after the rated voltage is applied to the meter terminals: yes

Test: Meter constant

The meter constant is checked with the value stated on the nameplate.

Results: The test is performed with: Sample nr. 15
Sample nr. 16

The meter constant as stated on the nameplate complies with the measured values of the test output.

Test: Variation of the error due to variation of the voltage

The variation of the error is measured due to variation of the voltage at nominal current and different values of the power factor.

Results: Active energy measurements:

Sample nr. 15		
	I_n	
percentage of U_{ref}	power factor	variation [%]
115	1	– 0.0
	0,5 ind.	+ 0.0
110	1	– 0.0
	0,5 ind.	+ 0.0
90	1	– 0.0
	0,5 ind.	+ 0.0
80	1	– 0.0
	0,5 ind.	+ 0.0
50	1	+ 0.0
	0,5 ind.	+ 0.0
<50	1	no registration
	0,5 ind.	

Sample nr. 16		
	I_n	
percentage of U_{ref}	power factor	variation [%]
115	1	+ 0.0
	0,5 ind.	+ 0.0
110	1	– 0.0
	0,5 ind.	+ 0.0
90	1	+ 0.0
	0,5 ind.	+ 0.0
80	1	+ 0.0
	0,5 ind.	+ 0.0
50	1	+ 0.0
	0,5 ind.	+ 0.0
<50	1	no registration
	0,5 ind.	

Reactive energy measurements:

Sample nr. 15 I_n		
percentage of U_{ref}	power factor	variation [%]
115	1	– 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
110	1	– 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
90	1	– 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
80	1	– 0.0
	0,5 ind.	– 0.0
	0,5 cap.	+ 0.0
60	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
<60	1	no registration
	0,5 ind.	
	0,5 cap.	

Sample nr. 16 I_n		
percentage of U_{ref}	power factor	variation [%]
115	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
110	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
90	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
80	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
60	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
<60	1	no registration
	0,5 ind.	
	0,5 cap.	

<u>Definition:</u> Variation = (Error at percentage of U_{ref}) - (Error at reference conditions)

Test: Variation of the error due to variation of the frequency

The variation of the error is measured at the stated changes of the frequency at different values of the current and the power factor.

Results: Active energy measurements:

Sample nr. 15		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_n$, cos(f)=1	+ 0.0	+ 0.0
$I=0,5I_{max}$, cos(f)=1	– 0.0	– 0.0
$I=0,5I_{max}$, cos(f)=0,5 ind.	+ 0.0	– 0.0

Sample nr. 16		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_n$, cos(f)=1	– 0.0	– 0.0
$I=0,5I_{max}$, cos(f)=1	+ 0.0	+ 0.0
$I=0,5I_{max}$, cos(f)=0,5 ind.	+ 0.0	– 0.0

Reactive energy measurements:

Sample nr. 15		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_n$, sin(f)=1	+ 0.0	– 0.0
$I=0,5I_{max}$, sin(f)=1	+ 0.0	– 0.0
$I=0,5I_{max}$, sin(f)=0,5 ind.	– 0.0	+ 0.0
$I=0,5I_{max}$, sin(f)=0,5 cap.	+ 0.0	– 0.0

Sample nr. 16		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_n$, sin(f)=1	– 0.0	+ 0.0
$I=0,5I_{max}$, sin(f)=1	+ 0.0	+ 0.0
$I=0,5I_{max}$, sin(f)=0,5 ind.	+ 0.0	+ 0.0
$I=0,5I_{max}$, sin(f)=0,5 cap.	+ 0.0	– 0.0

Definition: Variation = (Error at stated frequency) - (Error at reference conditions)

Test: Reversed phase sequence

The variation of the error is determined due to reversed phase sequence.

Results:

I [%] of I_n	Sample nr. 15					
	balanced load			single phase load		
	10	100	I_{max}	50 R	50 S	50 T
error with RST sequence [%]	+ 0.03	+ 0.03	+ 0.02	+ 0.02	+ 0.03	+ 0.01
error with RTS sequence [%]	+ 0.03	+ 0.04	+ 0.01	+ 0.00	+ 0.03	+ 0.01
variation [%]	+ 0.00	+ 0.01	– 0.01	– 0.02	+ 0.00	+ 0.00

I [%] of I_n	Sample nr. 16					
	balanced load			single phase load		
	10	100	I_{max}	50 R	50 S	50 T
error with RST sequence [%]	+ 0.01	+ 0.00	– 0.03	– 0.05	+ 0.05	+ 0.06
error with RTS sequence [%]	+ 0.00	+ 0.00	– 0.02	– 0.07	+ 0.06	+ 0.06
variation [%]	– 0.01	+ 0.00	+ 0.01	– 0.02	+ 0.01	+ 0.00

Definition: Variation = (Error with RTS sequence) - (Error with RST sequence)

Test: Voltage unbalance

The meter is tested while the voltage of one or more phases is interrupted.
The test is performed at nominal current.

Results:

Sample nr. 15						
interruption of phase	R	S	T	RS	RT	ST
error with balanced load [%]	+ 0.04					
error without phase [%]	+ 0.01	+ 0.05	+ 0.07	+ 0.00	+ 0.04	+ 0.04
variation [%]	– 0.03	+ 0.01	+ 0.03	– 0.04	+ 0.00	+ 0.00

Sample nr. 16						
interruption of phase	R	S	T	RS	RT	ST
error with balanced load [%]	+ 0.01					
error without phase [%]	+ 0.01	+ 0.05	+ 0.07	+ 0.00	+ 0.04	+ 0.04
variation [%]	+ 0.00	+ 0.04	+ 0.06	– 0.01	+ 0.03	+ 0.03

Definition: Variation = (Error without phase) - (Error with applied phase)

Test: Operation of accessories

The influence of the operation of accessories is determined at 1% of the nominal current.

Results: Active energy measurements:

Sample nr. 21 & 22	
error without operation of accessories [%]	+ 0.06
max. error with operation of accessories [%]	+ 0.07
variation [%]	+ 0.01

Reactive energy measurements:

Sample nr. 21 & 22	
error without operation of accessories [%]	– 0.15
max. error with operation of accessories [%]	– 0.14
variation [%]	+ 0.01

Definition: Variation = (Error with operation of accessories) - (Error without operation of accessories)

The following auxiliary devices have been examined:
- Optical communication
- RS485 (2x)
- RF
- G3 PLC (Sample nr. 21)
- PLC PRIME (Sample nr. 34)

Test: Variation of the error due to variation of the temperature

The variation of the error is determined due to variation of the temperature.
The error of indication is measured at a reference temperature of +23°C and at the stated temperatures.
The shift of the error due to the shift of temperature is stated in the following tables.

Results: Active energy measurements:

Sample nr. 15								
U_{ref}	Variation at temperature							Max. temperature coefficient %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
I=0,05I_n, cos(f)=1	+ 0.1	+ 0.1	+ 0.1	+ 0.0	– 0.0	– 0.1	– 0.1	0.005
I=0,1I_n, cos(f)=0,5 ind.	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	– 0.0	+ 0.0	0.003
I=I_n, cos(f)=1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.0	– 0.1	– 0.1	0.005
I=I_n, cos(f)=0,5 ind.	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	0.002
I=I_{max}, cos(f)=1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	– 0.0	– 0.1	– 0.2	0.006
I=I_{max}, cos(f)=0,5 ind.	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	– 0.0	– 0.1	0.004

Sample nr. 16								
U_{ref}	Variation at temperature							Max. temperature coefficient %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
I=0,05I_n, cos(f)=1	+ 0.1	+ 0.1	+ 0.0	+ 0.0	– 0.0	– 0.0	– 0.1	0.006
I=0,1I_n, cos(f)=0,5 ind.	+ 0.1	+ 0.1	– 0.0	– 0.0	– 0.0	+ 0.0	– 0.1	0.005
I=I_n, cos(f)=1	+ 0.1	+ 0.1	+ 0.0	+ 0.0	– 0.0	– 0.0	– 0.1	0.005
I=I_n, cos(f)=0,5 ind.	+ 0.1	+ 0.0	– 0.0	– 0.0	– 0.0	– 0.0	– 0.1	0.004
I=I_{max}, cos(f)=1	+ 0.1	+ 0.0	+ 0.0	+ 0.0	– 0.0	– 0.1	– 0.2	0.007
I=I_{max}, cos(f)=0,5 ind.	+ 0.1	+ 0.0	– 0.0	+ 0.0	– 0.0	– 0.0	– 0.1	0.005

Definition: Variation = (Error at specified temperature) - (Average error at +23°C)

Remark: Instead of the prescribed 20 K range (see par. 8.2, remark 9, of the IEC 62053-21), the above mentioned temperatures are used.

Reactive energy measurements:

Sample nr. 15								
U_{ref}	Variation at temperature							Max. temperature coëfficiënt %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
$I=0{,}05I_n$, sin(f)=1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.0	– 0.1	– 0.1	0.004
$I=0{,}1I_n$, sin(f)=0,5 ind.	+ 0.1	+ 0.1	+ 0.1	+ 0.1	– 0.0	– 0.1	– 0.2	0.008
$I=0{,}1I_n$, sin(f)=0,5 cap.	+ 0.0	– 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	0.003
$I=I_n$, sin(f)=1	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.0	– 0.1	– 0.1	0.004
$I=I_n$, sin(f)=0,5 ind.	+ 0.1	+ 0.1	+ 0.1	+ 0.1	– 0.0	– 0.1	– 0.2	0.007
$I=I_n$, sin(f)=0,5 cap.	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	0.003
$I=I_{max}$, sin(f)=1	+ 0.1	+ 0.0	+ 0.0	+ 0.1	– 0.0	– 0.1	– 0.2	0.005
$I=I_{max}$, sin(f)=0,5 ind.	+ 0.1	+ 0.1	+ 0.1	+ 0.1	– 0.1	– 0.2	– 0.3	0.007
$I=I_{max}$, sin(f)=0,5 cap.	+ 0.0	– 0.0	+ 0.0	+ 0.0	– 0.0	– 0.0	– 0.1	0.003

Sample nr. 16								
U_{ref}	Variation at temperature							Max. temperature coëfficiënt %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
$I=0{,}05I_n$, sin(f)=1	+ 0.2	+ 0.1	+ 0.0	+ 0.0	+ 0.0	– 0.0	– 0.1	0.006
$I=0{,}1I_n$, sin(f)=0,5 ind.	+ 0.2	+ 0.1	+ 0.1	+ 0.0	– 0.0	– 0.1	– 0.2	0.005
$I=0{,}1I_n$, sin(f)=0,5 cap.	+ 0.1	+ 0.1	+ 0.0	+ 0.0	+ 0.0	+ 0.0	– 0.0	0.005
$I=I_n$, sin(f)=1	+ 0.1	+ 0.1	+ 0.0	+ 0.0	– 0.0	– 0.1	– 0.1	0.005
$I=I_n$, sin(f)=0,5 ind.	+ 0.1	+ 0.1	+ 0.1	+ 0.0	– 0.0	– 0.1	– 0.2	0.005
$I=I_n$, sin(f)=0,5 cap.	+ 0.1	+ 0.1	+ 0.0	+ 0.0	+ 0.0	– 0.0	– 0.0	0.005
$I=I_{max}$, sin(f)=1	+ 0.1	+ 0.1	+ 0.0	+ 0.0	– 0.0	– 0.1	– 0.2	0.005
$I=I_{max}$, sin(f)=0,5 ind.	+ 0.2	+ 0.1	+ 0.1	+ 0.0	– 0.1	– 0.1	– 0.2	0.007
$I=I_{max}$, sin(f)=0,5 cap.	+ 0.1	+ 0.1	+ 0.0	+ 0.0	– 0.0	– 0.0	– 0.1	0.004

Definition: Variation = (Error at specified temperature) - (Average error at +23°C)

Remark: Instead of the prescribed 20 K range (see par. 8.2, remark 7, of the IEC 62053-23), the above mentioned temperatures are used.

Test: Variation of the error due to harmonics

The watthourmeter is tested with harmonics. The following tests are performed:
- harmonic components in the current and voltage circuits;
- DC and even harmonics in the a.c. current circuit (half wave rectification);
- odd harmonics in the a.c. current circuit (phase fired waveform);
- sub-harmonics in the a.c. current circuit (burst control).

Results: Active energy measurements:

harmonic components in the current and voltage circuits:

U_{ref}, $I=0{,}5I_{max}$, cos(f)=1		
U_5 = 10%, I_5 = 40%	Sample nr. 15	Sample nr. 16
error without harmonics [%]	+ 0.04	– 0.00
error with harmonics [%]	+ 0.03	– 0.03
variation [%]	– 0.01	– 0.02

odd harmonics in the a.c. current circuit (phase fired waveform):

U_{ref}, cos(f)=1	Sample nr. 15	Sample nr. 16
error with reference waveform 0,5 I_b [%]	+ 0.03	– 0.02
error with phase fired waveform I_b [%]	+ 0.03	– 0.00
variation [%]	+ 0.00	+ 0.01

sub-harmonics in the a.c. current circuit (burst control):

U_{ref}, cos(f)=1	Sample nr. 15	Sample nr. 16
error with reference waveform 0,5 I_b [%]	+ 0.04	– 0.03
error with burst control I_b [%]	+ 0.03	– 0.03
variation [%]	– 0.01	+ 0.00

Definition: Variation = (Error with harmonics) - (Error without harmonics)

Test: Continuous magnetic induction of external origin

The influence of a continuous magnetic field on the registration of the watthourmeter is investigated. The continuous magnetic induction is obtained by using the electromagnet according to annex B of the and IEC 62053-23, energized with a DC current.
A magneto-motive force of 1000 At (ampere-turns) is applied.

The test is performed with sample nr. 15.

Results: The influence due to the continuous magnetic field was negligible.

The meter was functioning correctly when applying the magnetic field.

Test: Variation of the error due to a magnetic induction of external origin (0,5 mT)

The influence of an external magnetic field on the registration of the meter is investigated, with a field strength of 0,5 mT.
An external magnetic field is made with the help of a round coil with a diameter of 1 meter. The meter is placed into the middle of the coil.
The measurements are performed with a variable phase shift between the current that caused the magnetic field and the measuring circuit voltage of the meter.
The phase shift is adjusted between 0° and 360°. For each measurement the coil and the meter are placed in several positions.

Results: Active energy measurements:

Sample nr. 14 $U=U_{ref}$, $I=I_b$ and cos(f)=1	
Variation [%]	< 0.05

Reactive energy measurements:

Sample nr. 14 $U=U_{ref}$, $I=I_b$ and sin(f)=1	
Variation [%]	< 0.05

Definition: Variation = (Error with an external magnetic field) - (Error at reference conditions)

Remark: The uncertainty in the generated magnetic field is 1%.

Test: Power consumption

The power consumption of the voltage circuits and the current circuits is measured at reference conditions and at the stated current.

Results: Active energy measurements:

	Sample nr. 15	Sample nr. 16
maximum power consumption of the voltage circuits	8.7 VA and 0.7 W	8.7 VA and 0.7 W
maximum power consumption of the current circuits with nominal current	0.00 VA	0.00 VA

Reactive energy measurements:

	Sample nr. 15	Sample nr. 16
maximum power consumption of the voltage circuits	8.7 VA and 0.7 W	8.7 VA and 0.7 W
maximum power consumption of the current circuits with nominal current	0.00 VA	0.00 VA

Test: Variation of the error due to short time overcurrents

The meter is tested by applying an impulse current to the current circuit of the meter. During the test the voltage circuits were energized with the reference voltage. Before and after the test the error of indication is measured at reference conditions.

The impulse current had the following characteristics:
- 20 times the maximum current, during 0,5 s

The tests are performed with sample nr. 18.

Results: The difference in the error of indication at reference conditions before and after the test was not greater than the uncertainty of the measurements.

Test: Variation of the error due to self-heating

The influence of self-heating of the watthourmeter is determined by difference occurring in the error at measuring directly after switching-in of the maximum current with respect to a second measurement at least one hour after switching-in of the current and after thermal stability is reached.

During the test cables are used with an area of 7 square mm.

Results: Active energy measurements:

time [min]	Sample nr. 15		Sample nr. 16	
	cos(f)=1	cos(f)=0,5 ind.	cos(f)=1	cos(f)=0,5 ind.
0	+ 0.03	+ 0.03	– 0.03	– 0.04
5	+ 0.05	– 0.11	– 0.04	– 0.13
10	+ 0.04	– 0.11	– 0.04	– 0.12
15	+ 0.02	– 0.11	– 0.04	– 0.14
30	+ 0.03	– 0.10	– 0.04	– 0.12
45	+ 0.04	– 0.10	– 0.05	– 0.12
60	+ 0.05	– 0.11	– 0.05	– 0.13
90	+ 0.03	– 0.10	– 0.05	– 0.12
120	+ 0.03	– 0.10	– 0.05	– 0.13
Variation [%]	+ 0.00	– 0.13	– 0.02	– 0.09

Definition: Variation = (Error after thermal stability) - (Error at the start)

Remark: Before the measurements were started, the voltage was connected for at least 2 hours.

Reactive energy measurements:

time [min]	Sample nr. 15			Sample nr. 16		
	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.
0	– 0.02	+ 0.12	– 0.15	– 0.11	– 0.02	– 0.21
5	+ 0.00	+ 0.14	– 0.16	– 0.11	– 0.02	– 0.20
10	– 0.02	+ 0.13	– 0.16	– 0.11	– 0.03	– 0.19
15	– 0.01	+ 0.14	– 0.16	– 0.11	– 0.01	– 0.21
30	+ 0.00	+ 0.13	– 0.16	– 0.11	– 0.02	– 0.20
45	– 0.01	+ 0.13	– 0.17	– 0.11	+ 0.00	– 0.20
60	– 0.01	+ 0.14	– 0.17	– 0.12	– 0.02	– 0.20
90	– 0.01	+ 0.14	– 0.16	– 0.12	– 0.03	– 0.19
120	+ 0.00	+ 0.13	– 0.15	– 0.10	– 0.01	– 0.20
Variation [%]	+ 0.02	+ 0.01	+ 0.00	+ 0.01	+ 0.01	+ 0.01

Definition: Variation = (Error after thermal stability) - (Error at the start)

Remark: Before the measurements were started, the voltage was connected for at least 2 hours.

Test: Impulse voltage test and AC voltage test

The insulation properties of the watthourmeter are tested by performing an impulse voltage test and an AC voltage test. Before the tests and after the test the error of the meter is measured at reference conditions.

a) Impulse voltage test
The meter is tested according to:
- 6 kV in accordance with the IEC 62052-11
- 12 kV in accordance with the Swedish requirements as described in the document SP 1618

The test is performed with each circuit. The impulse voltage is applied ten times with one polarity and then repeated with the other polarity.
The minimum time between the impulses was 3 s.

b) AC voltage test
The AC voltage test is performed with a r.m.s. test voltage of:
- 4 kV, between all current and voltage circuits as well as auxiliairy circuits above 40V, connected together, and, on the other hand earth;
- 2 kV, between circuits not intended to be connected together in service.

The tests are performed with sample nr. 16 and 20 (12 kV).

Results:

a) Impulse voltage test
During the test no flashover, disruptive discharge or puncture occurred.

b) AC voltage test
During the test no flashover, disruptive discharge or puncture occurred.

The difference in the error of indication at reference conditions before and after the test was not greater than the uncertainty of the measurements.
No mechanical damage occurred to the meter.

Remark: During the test with 6 kV according to IEC 62052-11 the following auxilliary circuits are investigated:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Photograph of the impulse voltage test:

Test: Immunity to earth fault

During a test under simulated earth fault condition in one of the three lines, all voltages are increased to 1,1 times the nominal voltage during 4 hours.
The neutral terminal is connected to phase R, as indicated in Annex C of the IEC 62052-11. In this way the two voltage terminals of the meters under test which are not affected by the earth fault are connected to 1,9 times the nominal phase voltages.

During the test the current was 50% of In, power factor 1, with symmetrical load.

Before and after the test the error of indication is measured at nominal current.

Results: The test is performed with sample nr. 15.

The change of the error of indication at nominal current due to the earth fault test was negligible.

Damage after the test : no
Correct operation after the test : yes

Test: Immunity to electrostatic discharges

The meter is tested with electrostatic discharges.

The test is performed with the following characteristics:
- air discharge;
- test voltage : 15 kV
- number of discharges : 10

meter in operating condition:
- voltage and auxiliary circuits are energized with reference voltage;
- without any current in the current circuits and the current terminals are open circuit.

The test is performed with sample nr. 14.

Results: During the tests the following was observed:

Change in register during the test	:	0.00	kWh / kvarh
Pulse produced by the test output	:	0	impulses
Change of information after the test	:	no	

Test: Immunity to electromagnetic RF-fields

The watthourmeter is tested with electromagnetic RF fields according to IEC 61000-4-3 with the characteristics:

frequency [MHz]	:	80 - 2000
modulation	:	80% AM, 1 kHz sine wave

The following tests are performed:

with active energy:

a) without any current in the current circuits and the current terminals are open circuit, with a field strength of 30 V/m;
b) with nominal current and power factor = 1, with a field strength of 10 V/m.

with reactive energy:

c) without any current in the current circuits and the current terminals are open circuit, with field strength of 30 V/m;
d) with nominal current and power factor = 1, with field strength of 10 V/m.

The tests are performed with reference voltage, with sample nr. 14.

<u>Results:</u>

During the tests the following was observed:

a)	change of the register due to the RF-field:		0.00 kWh
	produced signals of the test output:		0 impulses
b)	the maximum measured influence due to the RF-field was:	<	0.38 %
c)	change of the register due to the RF-field:		0.00 kvarh
	produced signals of the test output:		0 impulses
d)	the maximum measured influence due to the RF-field was:	<	0.32 %

The uncertainty of the measurements was 0,4%.

Remark: During the test the following auxilliary circuits were connected:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Photograph of the immunity to RF fields test:

Test: Fast transient bursts

The meter is tested with fast transient bursts. During the tests the voltage and auxiliary circuits were energized with reference voltage.
At least 60 seconds of positive bursts and 60 seconds of negative bursts were applied during each test to the circuits.

The following test is performed:

- with nominal current:	peak value current/voltage circuit	:	4 kV
	peak value auxiliary circuit	:	2 kV

Besides the stated peak value, the fast transient bursts had the following characteristics:

rise time	:	5	ns
peak width	:	50	ns
peak distance	:	200	µs
burst duration	:	15	ms
burst distance	:	300	ms

The test is performed with sample nr. 14.

Results: During the test the influence was negligible.

Remark: During the test the following auxilliary circuits were connected:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Test: Immunity to conducted disturbances, induced by radio-frequency fields

The meter is tested with conducted disturbances according to IEC 61000-4-6, with the characteristics:

frequency	:	0.15 - 80 MHz
voltage level	:	10 V
modulation	:	80% AM, 1 kHz sine wave

The following tests are performed:
- with nominal current and power factor = 1, with active energy
- with nominal current and power factor = 1, with reactive energy

The tests are performed with reference voltage, with sample nr. 14.

Results: During the tests the following was observed:

- the maximum measured influence due to the RF-field was negligible.

The uncertainty of the measurements was 0,4%.

Remark: During the test the following auxilliary circuits were connected:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Test: Surge immunity test

The meter is tested with surges, with the following characteristics:

- cable length	:	1 m
- test mode	:	differential
- phase angle	:	at 60° and 240° relative to zero crossing
- test voltage main circuits	:	4 kV and 6 kV
- test voltage aux. circuits	:	1 kV
- number of tests	:	5 positive and 5 negative
- reptition rate	:	1 / min

meter in operating condition:
- voltage and auxiliary circuits are energized with reference voltage;
- without any current in the current circuits and the current terminals are open circuit.

The test is performed with sample nr. 14 and 20 (6 kV).

Results: During the tests the following was observed:

Change in register during the test	:	0.00	kWh / kvarh
Pulse produced by the test output	:	0	impulses

Change of information after the test : no

Photograph of the surge test:

Test: Damped oscillatory waves immunity test

The test is carried out according to IEC 61000-4-12, under the following conditions:

- test voltage common mode [kV]	:	2.5
- test voltage diff. mode [kV]	:	1
- 100 kHz, repetition rate [Hz]	:	40
- 1 MHz, repetition rate [Hz]	:	400
- test duration [s]	:	60 (15 cycles with 2s on, 2s off)

meter in operating condition:
- voltage and auxiliary circuits are energized with reference voltage;
- with nominal current

The test is performed with sample nr. 20.

<u>Results:</u>

Error before the test [%]	:	+ 0.30
Error during the test [%]	:	+ 0.30
Difference [%]	:	+ 0.00
During the test the meter is perturbed	:	no
The variation of the error is within the limits of the relevant standard	:	yes

Photograph of the damped oscillatory waves immunity test:

Test: Radio interference suppression

The emission of the meter is tested according to CISPR 22, for class B equipment.

The following tests are performed:

a) the radiated emission is measured at an AR in the following frequency range: 30 - 1000 MHz;
b) the emission on the AC mains is measured in the following frequency range: 0,15 - 30 MHz.

The tests are performed with sample nr. 20.

At each test the emission is measured under the following conditions of the watthourmeter:

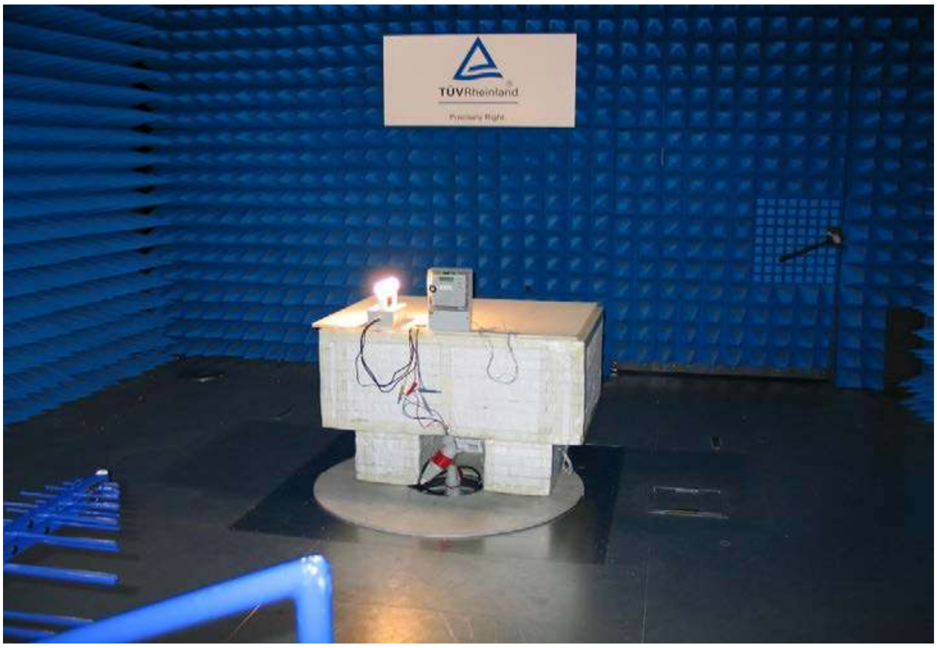
- with reference voltage;
- current is 10% of the nominal current.

Results: During the tests the following was observed:

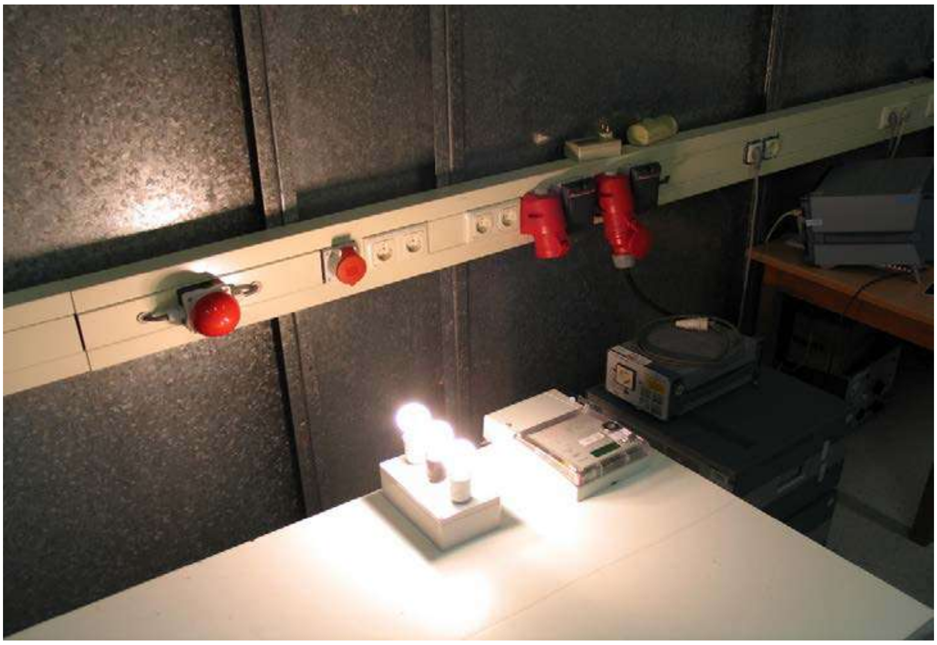
a) the maximum measured radiated emission was 25.8 dB(μV)/m at 59.09 MHz.
b) the maximum measured emission on the AC mains was 35.7 dB(μV) at 0.44 MHz.

Remark: The cables have been manipulated in such a way that maximum disturbance levels have been recorded.

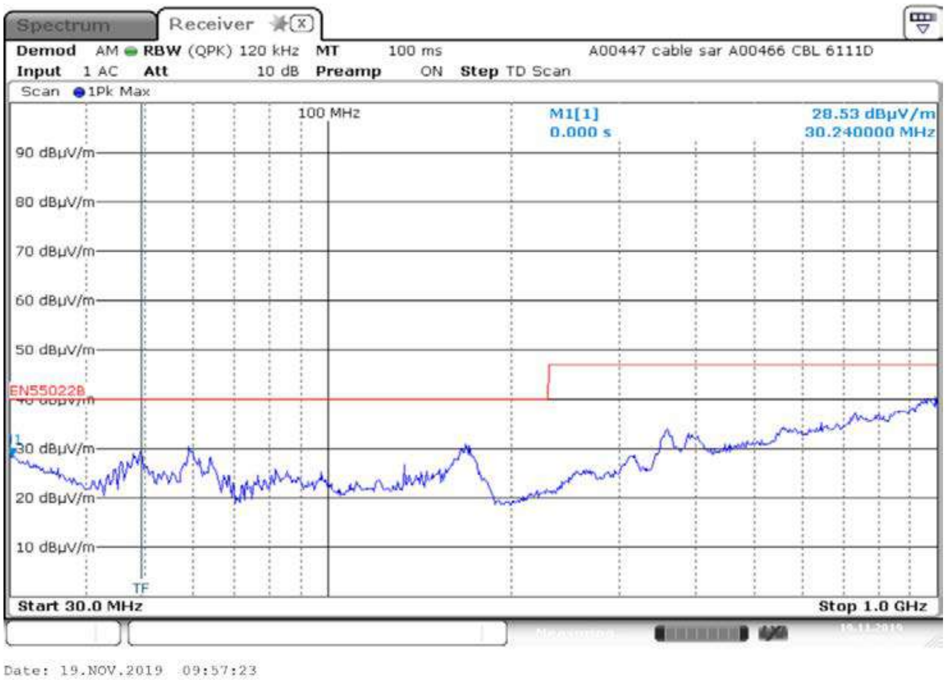
Photograph of the radiated emission test:



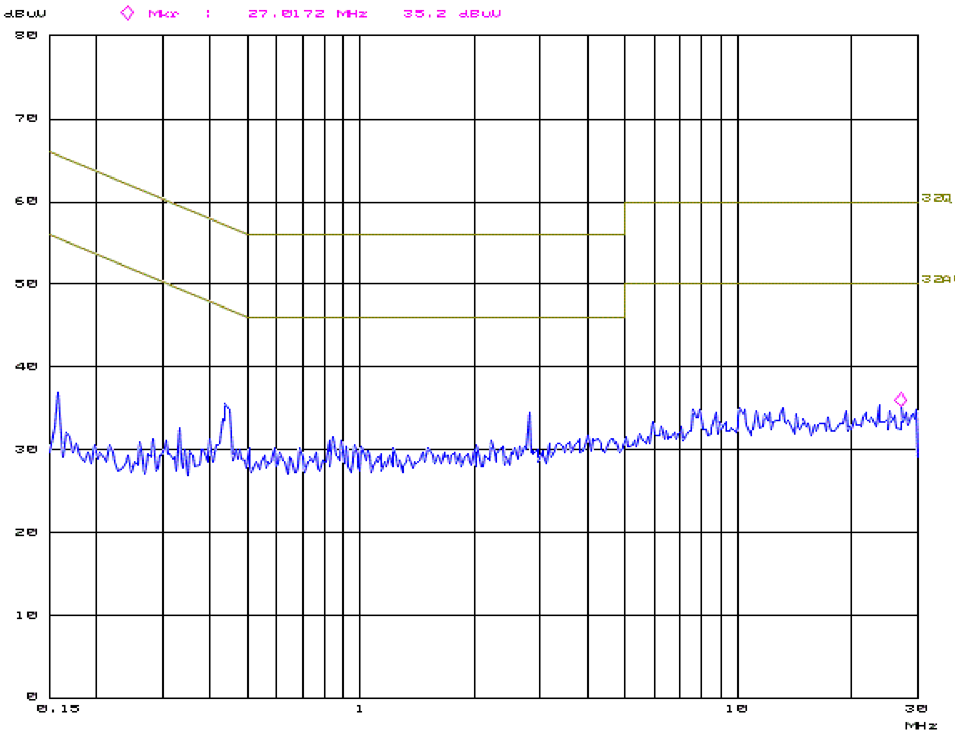
Photograph of the conducted emission test:



Plot of the radated emission test:



Plot of the conducted emission test:



Test: Test of influence of supply voltage

The meter is tested with interruptions of the voltage. The following interruptions were applied, while voltage and auxiliary circuits were energized with reference voltage and without any current in the current circuits:

a) voltage interruptions of DU=100%
- interruption time: 1s
- number of interruptions: 3
- restoring time between interruptions: 50 ms

b) voltage interruptions of DU=100%
- interruption time: 20 ms
- number of interruptions: 1

c) voltage dips of DU=50%
- dip time: 1 min.
- number of dips: 1

The tests are performed with sample nr. 15.

Results: During the tests a, b and c the content of the register is not changed, for both active and reactive energy.

Test: Influence of heating

With each current circuit of the meter carrying the maximum current and with each voltage circuit carrying 1,15 times the reference voltage, the temperature rise of the external surface is measured at an ambient temperature of 23 ± 2°C.

Duration of the test: 2 hours
During the test cables are used with an area of 7 square mm.

Results:

Sample nr. 16 1,15 U_{ref}, I_{max}, power factor = 1		
Position of the sensor at the terminal block	back side near terminals, at I-in	back side near terminals, at I-out
temperature at the start [°C]	+ 24.2	+ 24.2
temperature after 2 hours [°C]	+ 26.0	+ 25.8
variation [°C]	+ 1.8	+ 1.6

Damage after the test : no
Compliance with the dielectric strength tests : yes

Remark: Instead of using the prescribed ambient temperature of 40°C (according to section 7.2 of the IEC standard 62052-11), the test is performed at an ambient temperature of 23 ± 2°C, in order to avoid that the temperature control of the used climatic chamber would affect the measurement results.

Test: Climatic influences

The watthourmeter is exposed to the following climatic tests:

- dry heat test (70 °C for 72 hours)
- cold test (-25 °C for 72 hours)
- damp heat, cyclic test (upper temperature 40 °C, 6 cycles)

After the test the following dielectric tests are performed:

- an impulse voltage test (peak level 4,8 kV)
- an AC voltage test (test voltage 4 kV)

The dry heat and cold test are performed with sample nr. 18.
The damp heat, cyclic test is performed with sample nr. 18.

<u>Results:</u>

Compliance with dielectric tests	:	yes
Damage after the test or visible corrosion	:	no
Change of information after the test	:	no

Test: Shock test

The meter is exposed to a shock test according to IEC 60068-2-27, under the following conditions:

- meter in non-operating condition
- half-sine pulse
- peak acceleration (m/s^2) : 300
- duration of the pulse (ms) : 18

The test is performed with sample nr. 18.

Result:

Damage after the test	:	no
Change of information after the test	:	no
Correct operation after the test	:	yes

Test: Vibration test

The meter is exposed to vibrations according to IEC 60068-2-6, under the following conditions:

- meter in non-operating condition;
- frequency range [Hz] : 10 - 150
- transition frequency [Hz] : 60
- f<60 Hz, constant amplitude [mm] : 0,075
- f>60 Hz, constant acceleration [m/s^2] : 9,8
- number of sweep cycles per axis : 10

The test is performed with sample nr. 18.

Result:

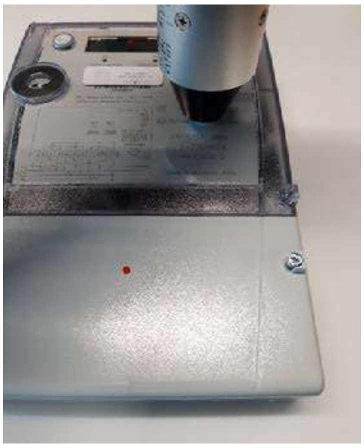
Damage after the test	:	no
Change of information after the test	:	no
Correct operation after the test	:	yes

Test: Spring hammer test

The mechanical strength of the meter case is tested with a spring hammer (IEC 60068-2-75), with a kinetic energy of 0.2 J.

The test is performed with sample nr. 18.

Result: The meter case was not damaged; no affection of the meter functions took place. After the test it was not possible to touch live parts.



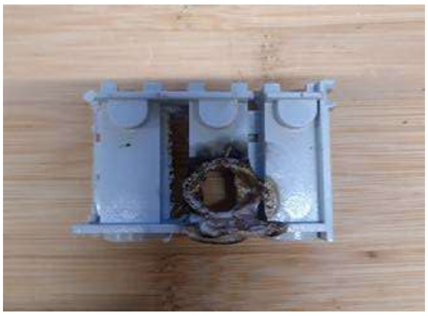
Test: Resistance to heat and fire

The test is carried out according to IEC 60695-2-11, with the following temperatures:

- terminal block : 960 °C
- terminal cover and meter case : 650 °C
- duration : 30 s

The test is performed with a sample of the material.

Result: At 650 °C there was no flame. At 960 °C there was a flame but it extinguished < 3 sec.



Test: Protection against penetration of dust and water

The protection against penetration of dust and water is tested according to IEC 60529, conform IP54.

The test is performed with sample nr. 14 (dust) & 16 (water).

Result: Ingress of dust and water of any quantity to impair the operation of the meter has not been detected. The insulation strength test in accordance with par. 5.4.6 has been carried out and no performance degradation of the insulation properties was detected.

Test: Accuracy tests at reference conditions

The error of the meters is measured under reference conditions at different values of the current and power factor, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Error [%]	
		Sample nr. 15	Sample nr. 16
Imin	1	0.1	0.0
Itr	1	0.0	0.0
	0,5 ind.	0.1	0.1
	0,8 cap.	0.0	0.0
Itr phase R	1	0.0	-0.1
	0,5 ind.	-0.1	0.0
Itr phase S	1	0.0	0.0
	0,5 ind.	0.1	0.1
Itr phase T	1	0.0	0.1
	0,5 ind.	0.1	0.2
20 Itr	1	0.0	0.0
	0,5 ind.	0.0	0.1
	0,8 cap.	0.1	0.0
20 Itr phase R	1	0.1	-0.1
	0,5 ind.	-0.1	0.0
20 Itr phase S	1	0.0	0.1
	0,5 ind.	0.1	0.1
20 Itr phase T	1	0.0	0.1
	0,5 ind.	0.1	0.1
Imax	1	0.0	0.0
	0,5 ind.	-0.1	-0.1
	0,8 cap.	0.1	0.0
Imax phase R	1	0.0	-0.1
	0,5 ind.	-0.2	-0.2
Imax phase S	1	0.0	0.1
	0,5 ind.	-0.1	0.0
Imax phase T	1	0.0	0.0
	0,5 ind.	-0.1	0.0

Remark: Before the measurements were started, the voltage was connected for at least one hour and a current of I_{tr} was running through the meters.

Test: Repeatability

The accuracy measurements at reference conditions are performed 3 times in order to determine the repeatability, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Measure time [s]	Sample nr. 15				
			Error 1 [%]	Error 2 [%]	Error 3 [%]	Average error [%]	Repeatability [%]
Imin	1	240	+ 0.07	+ 0.08	+ 0.07	+ 0.07	+ 0.01
Itr	1	180	+ 0.03	+ 0.03	+ 0.04	+ 0.03	+ 0.01
	0,5 ind.		+ 0.06	+ 0.05	+ 0.04	+ 0.05	+ 0.02
	0,8 cap.		+ 0.03	+ 0.03	+ 0.03	+ 0.03	+ 0.00
Itr phase R	1	180	+ 0.05	+ 0.03	+ 0.05	+ 0.04	+ 0.02
	0,5 ind.		– 0.06	– 0.06	– 0.06	– 0.06	+ 0.00
Itr phase S	1		+ 0.03	+ 0.02	+ 0.01	+ 0.02	+ 0.02
	0,5 ind.		+ 0.07	+ 0.05	+ 0.07	+ 0.06	+ 0.02
Itr phase T	1		+ 0.01	+ 0.02	+ 0.02	+ 0.02	+ 0.01
	0,5 ind.		+ 0.14	+ 0.15	+ 0.15	+ 0.15	+ 0.01
20 Itr	1	60	+ 0.05	+ 0.04	+ 0.05	+ 0.05	+ 0.01
	0,5 ind.		+ 0.01	+ 0.02	+ 0.04	+ 0.02	+ 0.03
	0,8 cap.		+ 0.05	+ 0.05	+ 0.05	+ 0.05	+ 0.00
20 Itr phase R	1	60	+ 0.08	+ 0.07	+ 0.05	+ 0.07	+ 0.03
	0,5 ind.		– 0.07	– 0.07	– 0.06	– 0.07	+ 0.01
20 Itr phase S	1		+ 0.03	+ 0.03	+ 0.03	+ 0.03	+ 0.00
	0,5 ind.		+ 0.05	+ 0.06	+ 0.05	+ 0.05	+ 0.01
20 Itr phase T	1		+ 0.01	+ 0.01	+ 0.00	+ 0.01	+ 0.01
	0,5 ind.		+ 0.06	+ 0.06	+ 0.06	+ 0.06	+ 0.00
Imax	1	30	+ 0.01	+ 0.01	+ 0.01	+ 0.01	+ 0.00
	0,5 ind.		– 0.12	– 0.13	– 0.12	– 0.12	+ 0.01
	0,8 cap.		+ 0.07	+ 0.08	+ 0.07	+ 0.07	+ 0.01
Imax phase R	1	30	+ 0.01	+ 0.02	+ 0.02	+ 0.02	+ 0.01
	0,5 ind.		– 0.23	– 0.23	– 0.23	– 0.23	+ 0.00
Imax phase S	1		+ 0.02	+ 0.02	+ 0.03	+ 0.02	+ 0.01
	0,5 ind.		– 0.07	– 0.07	– 0.07	– 0.07	+ 0.00
Imax phase T	1		+ 0.00	+ 0.00	+ 0.00	+ 0.00	+ 0.00
	0,5 ind.		– 0.07	– 0.06	– 0.07	– 0.07	+ 0.01

Current	Power factor	Measure time [s]	Sample nr. 16				
			Error 1 [%]	Error 2 [%]	Error 3 [%]	Average error [%]	Repeatability [%]
Imin	1	240	+ 0.02	+ 0.02	+ 0.02	+ 0.02	+ 0.00
Itr	1	180	+ 0.00	+ 0.00	+ 0.00	+ 0.00	+ 0.00
	0,5 ind.		+ 0.07	+ 0.08	+ 0.09	+ 0.08	+ 0.02
	0,8 cap.		– 0.02	– 0.02	– 0.02	– 0.02	+ 0.00
Itr phase R	1	180	– 0.10	– 0.07	– 0.10	– 0.09	+ 0.03
	0,5 ind.		+ 0.01	+ 0.01	+ 0.00	+ 0.01	+ 0.01
Itr phase S	1		+ 0.04	+ 0.03	+ 0.04	+ 0.04	+ 0.01
	0,5 ind.		+ 0.07	+ 0.08	+ 0.08	+ 0.08	+ 0.01
Itr phase T	1		+ 0.06	+ 0.06	+ 0.06	+ 0.06	+ 0.00
	0,5 ind.		+ 0.18	+ 0.16	+ 0.19	+ 0.18	+ 0.03
20 Itr	1	60	+ 0.01	+ 0.01	+ 0.01	+ 0.01	+ 0.00
	0,5 ind.		+ 0.05	+ 0.06	+ 0.07	+ 0.06	+ 0.02
	0,8 cap.		– 0.01	+ 0.00	– 0.01	– 0.01	+ 0.01
20 Itr phase R	1	60	– 0.06	– 0.08	– 0.09	– 0.08	+ 0.03
	0,5 ind.		+ 0.00	+ 0.03	+ 0.00	+ 0.01	+ 0.03
20 Itr phase S	1		+ 0.05	+ 0.05	+ 0.05	+ 0.05	+ 0.00
	0,5 ind.		+ 0.08	+ 0.08	+ 0.08	+ 0.08	+ 0.00
20 Itr phase T	1		+ 0.06	+ 0.06	+ 0.06	+ 0.06	+ 0.00
	0,5 ind.		+ 0.13	+ 0.13	+ 0.12	+ 0.13	+ 0.01
Imax	1	30	+ 0.00	+ 0.00	+ 0.00	+ 0.00	+ 0.00
	0,5 ind.		– 0.09	– 0.09	– 0.09	– 0.09	+ 0.00
	0,8 cap.		+ 0.04	+ 0.03	+ 0.03	+ 0.03	+ 0.01
Imax phase R	1	30	– 0.12	– 0.12	– 0.11	– 0.12	+ 0.01
	0,5 ind.		– 0.22	– 0.23	– 0.21	– 0.22	+ 0.02
Imax phase S	1		+ 0.05	+ 0.05	+ 0.05	+ 0.05	+ 0.00
	0,5 ind.		– 0.03	– 0.03	– 0.03	– 0.03	+ 0.00
Imax phase T	1		+ 0.04	+ 0.05	+ 0.04	+ 0.04	+ 0.01
	0,5 ind.		– 0.03	– 0.03	– 0.03	– 0.03	+ 0.00

Test: Variation of the error due to variation of the voltage

The variation of the error is measured due to variation of the voltage at different currents and at different values of the power factor, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Sample nr. 15	
		Shift 1,1 U_{ref} [%]	Shift 0,9 U_{ref} [%]
Imin	1	– 0.0	– 0.0
Itr	1 0,5 ind. 0,8 cap.	– 0.0 – 0.0 – 0.0	+ 0.0 – 0.0 – 0.0
Itr phase R	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Itr phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Itr phase T	1 0,5 ind.	– 0.0 – 0.0	+ 0.0 – 0.0
20 Itr	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
20 Itr phase R	1 0,5 ind.	– 0.0 + 0.1	– 0.0 + 0.0
20 Itr phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
20 Itr phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Imax	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 – 0.0	+ 0.0 – 0.0 + 0.0
Imax phase R	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Imax phase S	1 0,5 ind.	– 0.0 + 0.0	+ 0.0 – 0.0
Imax phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0

Current	Power factor	Sample nr. 16	
		Shift 1,1 U_{ref} [%]	Shift 0,9 U_{ref} [%]
Imin	1	+ 0.0	+ 0.0
Itr	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
Itr phase R	1 0,5 ind.	+ 0.0 + 0.1	+ 0.0 – 0.0
Itr phase S	1 0,5 ind.	– 0.0 – 0.0	– 0.0 – 0.0
Itr phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
20 Itr	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
20 Itr phase R	1 0,5 ind.	+ 0.0 + 0.1	+ 0.0 + 0.1
20 Itr phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
20 Itr phase T	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 – 0.0
Imax	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
Imax phase R	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 – 0.0
Imax phase S	1 0,5 ind.	– 0.0 + 0.0	+ 0.0 + 0.0
Imax phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0

Test: Variation of the error due to variation of the frequency

The variation of the error is measured at the stated changes of the frequency at different values of the current and the power factor, while using the test points as indicated in table 13 of the EN 50470-3 document.

<u>Results:</u>

Current	Power factor	Sample nr. 15	
		Shift 51 Hz [%]	Shift 49 Hz [%]
Imin	1	+ 0.0	+ 0.0
Itr	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
	0,8 cap.	+ 0.0	+ 0.0
Itr phase R	1	+ 0.0	+ 0.0
	0,5 ind.	+ 0.0	+ 0.1
Itr phase S	1	+ 0.0	+ 0.0
	0,5 ind.	+ 0.0	+ 0.0
Itr phase T	1	+ 0.0	– 0.0
	0,5 ind.	– 0.0	+ 0.0
20 Itr	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
	0,8 cap.	+ 0.0	+ 0.0
20 Itr phase R	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
20 Itr phase S	1	– 0.0	– 0.0
	0,5 ind.	– 0.0	+ 0.0
20 Itr phase T	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
Imax	1	+ 0.0	+ 0.0
	0,5 ind.	+ 0.0	+ 0.0
	0,8 cap.	+ 0.0	+ 0.0
Imax phase R	1	+ 0.0	– 0.0
	0,5 ind.	– 0.0	+ 0.0
Imax phase S	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
Imax phase T	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0

Current	Power factor	Sample nr. 16	
		Shift 51 Hz [%]	Shift 49 Hz [%]
Imin	1	– 0.0	– 0.0
Itr	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
	0,8 cap.	+ 0.0	– 0.0
Itr phase R	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
Itr phase S	1	– 0.0	+ 0.0
	0,5 ind.	– 0.0	– 0.0
Itr phase T	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
20 Itr	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	– 0.0
	0,8 cap.	+ 0.0	+ 0.0
20 Itr phase R	1	+ 0.0	+ 0.0
	0,5 ind.	+ 0.0	+ 0.0
20 Itr phase S	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
20 Itr phase T	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
Imax	1	+ 0.0	+ 0.0
	0,5 ind.	– 0.0	+ 0.0
	0,8 cap.	– 0.0	– 0.0
Imax phase R	1	– 0.0	– 0.0
	0,5 ind.	– 0.0	+ 0.0
Imax phase S	1	– 0.0	– 0.0
	0,5 ind.	+ 0.0	+ 0.0
Imax phase T	1	+ 0.0	+ 0.0
	0,5 ind.	+ 0.0	– 0.0

Test: Variation of the error due to variation of the temperature

The variation of the error is measured due to variation of the temperature at different currents and at different values of the power factor, as indicated in table 13 of the EN 50470-3 document.
At each temperature the shift is calculated in comparison with the measurement at 23°C.

Results:

Current	Power factor	Sample nr. 15						
		Shift -40°C [%]	Shift -25°C [%]	Shift -10°C [%]	Shift +5°C [%]	Shift +40°C [%]	Shift +55°C [%]	Shift +70°C [%]
Imin	1	0.1	0.1	0.1	0.0	0.0	-0.1	-0.1
Itr	1	0.1	0.1	0.1	0.0	0.0	-0.1	-0.1
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2
Itr phase R	1	0.3	0.3	0.2	0.2	0.1	-0.2	-0.1
	0,5 ind.	0.2	0.2	0.2	0.1	0.1	-0.1	0.0
Itr phase S	1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
Itr phase T	1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	-0.1	-0.1	-0.1	0.0	0.0	0.1	0.1
20 Itr	1	0.1	0.1	0.1	0.1	0.0	-0.1	-0.1
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2
20 Itr phase R	1	0.3	0.2	0.2	0.2	0.0	-0.2	-0.2
	0,5 ind.	0.2	0.2	0.2	0.1	0.1	-0.1	0.0
20 Itr phase S	1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
20 Itr phase T	1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.1
Imax	1	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2
Imax phase R	1	0.3	0.3	0.3	0.2	0.0	-0.2	-0.3
	0,5 ind.	0.2	0.2	0.2	0.2	0.1	-0.1	-0.1
Imax phase S	1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Imax phase T	1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Current	Power factor	Sample nr. 16						
		Shift -40°C [%]	Shift -25°C [%]	Shift -10°C [%]	Shift +5°C [%]	Shift +40°C [%]	Shift +55°C [%]	Shift +70°C [%]
Imin	1	0.1	0.0	0.0	0.0	0.0	-0.1	-0.1
Itr	1	0.1	0.1	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	0.1	0.1	0.0	0.0	0.0	0.0	-0.1
	0,8 cap.	0.1	0.1	0.0	0.0	0.0	0.0	-0.2
Itr phase R	1	1.1	0.7	0.4	0.2	-0.3	-0.4	-0.9
	0,5 ind.	1.1	0.7	0.3	0.2	-0.3	-0.4	-0.8
Itr phase S	1	-0.3	-0.2	-0.1	-0.1	0.1	0.1	0.1
	0,5 ind.	-0.3	-0.2	-0.2	-0.1	0.1	0.2	0.2
Itr phase T	1	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.4
	0,5 ind.	-0.4	-0.4	-0.3	-0.1	0.1	0.3	0.4
20 Itr	1	0.1	0.1	0.0	0.0	0.0	0.0	-0.1
	0,5 ind.	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
	0,8 cap.	0.1	0.1	0.0	0.0	0.0	-0.1	-0.2
20 Itr phase R	1	1.1	0.8	0.4	0.2	-0.3	-0.5	-0.9
	0,5 ind.	1.0	0.7	0.4	0.2	-0.3	-0.4	-0.8
20 Itr phase S	1	-0.3	-0.2	-0.1	-0.1	0.1	0.1	0.1
	0,5 ind.	-0.3	-0.2	-0.2	-0.1	0.1	0.2	0.2
20 Itr phase T	1	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.4
	0,5 ind.	-0.4	-0.3	-0.3	-0.1	0.1	0.2	0.4
Imax	1	0.1	0.0	0.0	0.0	0.0	-0.1	-0.2
	0,5 ind.	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
	0,8 cap.	0.1	0.1	0.0	0.0	-0.1	-0.1	-0.2
Imax phase R	1	1.1	0.7	0.4	0.2	-0.4	-0.6	-1.0
	0,5 ind.	1.0	0.6	0.4	0.2	-0.4	-0.5	-0.9
Imax phase S	1	-0.3	-0.2	-0.2	-0.1	0.1	0.1	0.1
	0,5 ind.	-0.3	-0.3	-0.2	-0.1	0.1	0.1	0.2
Imax phase T	1	-0.5	-0.4	-0.3	-0.1	0.1	0.2	0.3
	0,5 ind.	-0.5	-0.4	-0.3	-0.2	0.1	0.2	0.4

Test: Maximum permissible error

For each measuring point the composite error is calculated by using the following formula:

$$e_c = \sqrt{e^2(I,\cos\varphi) + \delta e^2(T,I,\cos\varphi) + \delta e^2(U,I,\cos\varphi) + \delta e^2(f,I,\cos\varphi)}$$

with:

- $e\,(I, \cos\varphi)$	=	the intrinsic error of the meter at a certain load;
- $\delta e\,(T, I, \cos\varphi)$	=	the additional percentage error due to the variation of the temperature at the same load;
- $\delta e(U, I, \cos\varphi)$	=	the additional percentage error due to the variation of the voltage at the same load;
- $\delta e(f, I, \cos\varphi)$	=	the additional percentage error due to the variation of the frequency at the same load.

<u>Results:</u>

Current	Power factor	Sample nr. 15							
		Error -40°C [%]	Error -25°C [%]	Error -10°C [%]	Error +5°C [%]	Error +23°C [%]	Error +40°C [%]	Error +55°C [%]	Error +70°C [%]
Imin	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Itr	1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2
Itr phase R	1	0.3	0.3	0.2	0.2	0.1	0.1	0.2	0.2
	0,5 ind.	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1
Itr phase S	1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Itr phase T	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
20 Itr	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0,8 cap.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
20 Itr phase R	1	0.3	0.2	0.2	0.2	0.1	0.1	0.2	0.2
	0,5 ind.	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
20 Itr phase S	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20 Itr phase T	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Imax	1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,8 cap.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Imax phase R	1	0.3	0.3	0.3	0.2	0.0	0.0	0.2	0.3
	0,5 ind.	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
Imax phase S	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Imax phase T	1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Current	Power factor	Sample nr. 16							
		Error -40°C [%]	Error -25°C [%]	Error -10°C [%]	Error +5°C [%]	Error +23°C [%]	Error +40°C [%]	Error +55°C [%]	Error +70°C [%]
Imin	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Itr	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,8 cap.	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2
Itr phase R	1	1.1	0.7	0.4	0.2	0.1	0.3	0.4	0.9
	0,5 ind.	1.1	0.7	0.3	0.2	0.1	0.3	0.4	0.8
Itr phase S	1	0.3	0.2	0.1	0.1	0.0	0.1	0.1	0.1
	0,5 ind.	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2
Itr phase T	1	0.5	0.4	0.3	0.1	0.1	0.2	0.3	0.4
	0,5 ind.	0.5	0.4	0.3	0.2	0.2	0.2	0.3	0.4
20 Itr	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,8 cap.	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2
20 Itr phase R	1	1.1	0.8	0.4	0.2	0.1	0.3	0.5	0.9
	0,5 ind.	1.0	0.7	0.4	0.2	0.1	0.3	0.4	0.8
20 Itr phase S	1	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1
	0,5 ind.	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2
20 Itr phase T	1	0.5	0.4	0.3	0.1	0.1	0.2	0.3	0.4
	0,5 ind.	0.5	0.4	0.3	0.2	0.1	0.2	0.3	0.4
Imax	1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,8 cap.	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.2
Imax phase R	1	1.1	0.7	0.4	0.3	0.1	0.4	0.6	1.0
	0,5 ind.	1.0	0.7	0.4	0.3	0.2	0.4	0.6	1.0
Imax phase S	1	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	0,5 ind.	0.3	0.3	0.2	0.1	0.0	0.1	0.1	0.2
Imax phase T	1	0.5	0.4	0.3	0.2	0.0	0.1	0.2	0.3
	0,5 ind.	0.5	0.4	0.3	0.2	0.0	0.1	0.2	0.4

Test: One phase export, remaining phases import

The meter is examined with:
- one phase loaded with export energy;
- remaining phases loaded with import energy.

In the table below it is indicated in which phase export energy is flowing.

I [%] of I_n	Error [%] Sample nr. 15								
	cos(f)=1			cos(f)=0,5 ind.			cos(f)=0,8 cap.		
	export phase			export phase			export phase		
	R	S	T	R	S	T	R	S	T
5	– 0.1	+ 0.1	+ 0.1						
10	– 0.1	+ 0.1	+ 0.1	+ 0.2	+ 0.1	– 0.1	– 0.2	+ 0.1	+ 0.2
100	– 0.0	+ 0.1	+ 0.1	+ 0.2	– 0.0	– 0.1	– 0.2	+ 0.2	+ 0.2
Imax	– 0.0	+ 0.1	+ 0.1	+ 0.0	– 0.2	– 0.2	– 0.1	+ 0.2	+ 0.2

I [%] of I_n	Error [%] Sample nr. 16								
	cos(f)=1			cos(f)=0,5 ind.			cos(f)=0,8 cap.		
	export phase			export phase			export phase		
	R	S	T	R	S	T	R	S	T
5	+ 0.2	– 0.1	– 0.1						
10	+ 0.2	– 0.1	– 0.1	+ 0.3	+ 0.0	– 0.1	+ 0.2	– 0.1	– 0.1
100	+ 0.2	– 0.1	– 0.0	+ 0.2	+ 0.1	– 0.1	+ 0.2	– 0.1	– 0.1
Imax	+ 0.2	– 0.2	– 0.1	+ 0.2	– 0.2	– 0.2	+ 0.3	– 0.1	– 0.1

The meter is examined with:
- one phase loaded with 20% In export energy;
- remaining phases loaded with In import energy.

In the table below it is indicated in which phase export energy is flowing.

Sample nr. 15 Error [%]					
cos(f)=1			cos(f)=0,5 ind.		
export phase			export phase		
R	S	T	R	S	T
+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.0	+ 0.0

Sample nr. 16 Error [%]					
cos(f)=1			cos(f)=0,5 ind.		
export phase			export phase		
R	S	T	R	S	T
+ 0.1	– 0.0	– 0.0	+ 0.1	+ 0.0	+ 0.0

The correct operation of the energy register(s) has been verified.

Type evaluation report

Issued by	:	NMi Certin B.V. Thijsseweg 11 2629 JA Delft The Netherlands
Applicant	:	S.C."ADD-PRODUCTION" S.R.L. 36, Dragomirna str. MD-2008, Chisianau Republic of Moldova
Measuring instrument	:	**A poly phase static watthourmeter** Manufacturer : S.C."ADD-PRODUCTION" S.R.L. Type : AD13A.3
Test specifications	:	- IEC 62052-11 ed. 2 (CD2) "Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment" - IEC 62053-22 ed. 2 (CD2) "Electricity metering equipment (AC) - Particular requirements - Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)" - IEC 61000-4-19 - "Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports"
Testing period	:	January 2020
Issue date	:	2 March 2020

Performed by:

J.M.J. Boereboom
Approvals Expert

Reviewed by:

M.P. Cloo
Senior Approvals Expert

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Tests : The meters as specified in annex 2 were tested for compliance with the standards as specified on page 1 of this type evaluation report. The performed tests are stated in annex 1. If applicable specific test conditions are stated at each test.

Results See annex 1 of this type evaluation report The meter fulfils the general requirements of the IEC 62052-11, and the requirements for class 0,5 S of the IEC 62053-22 for all performed tests.

Uncertainty : The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which provides a confidence level of approximately 95%.
The total uncertainty of the measurements of the error of indication is 0,10% for power factor=1, and 0,14% for power factor=0,5 inductive or power factor=0,8 capacitive.
The total uncertainty in the measurements of power is 0,02 W.

Annexes : The complete type evaluation report consists of the following annexes:

annex 1 : performed tests
annex 2 : characteristics of the tested meters
annex 3 : test data

Annex 1: Performed tests

In the following tables the performed tests are indicated with the accompanying results, as well as the page number of the appertaining annex where the results are presented.

	AC voltage test	#PEΦ!				-
article IEC 62052-11	tests:	passed	failed	not applicable	not performed	annex 3 page
9.3.8 / Annex G	**IEC 61000-4-19 - Differential mode current disturbances**					
	- test waves profile: "CW Pulse with pause"	√				1
	- test waves profile: "rectangular modulated - 3 Hz"	√				2
	- test waves profile: "rectangular modulated - 101 Hz"	√				3
	- test waves profile: "rectangular modulated - 301 Hz"	√				4
	- test waves profile: "rectangular modulated - 601 Hz"	√				5

Performance criteria description:

criteria A

A temporary degradation or loss of primary functions is not acceptable:

1) energy registration: at any time during the test the additional energy measurement error due to an influence quantity shall not exceed the limits specified in the relevant accuracy class standards,
2) indicating display: the indication of the content of energy registers shall remain unambiguously readable, even though degradation of display quality (colour, brightness, contrast, sharpness, geometry, etc.) during the test is acceptable,
3) supply and load control switches: unexpected operation of the switch during the test shall not occur;

A temporary degradation or loss of other meter functions is acceptable;

The measurements are performed at a reference temperature of 23±2 °C, unless an other temperature is stated.

Annex 2: Characteristics of the tested watthour meters

Sample number	Model	Serial number	Year of fabrication	I_b [A]	I_{max} [A]	U_{ref} [V]	f_{ref} [Hz]	Meter constant [imp./kWh]
15	AD13A.3	13259636	2019	1	10	230	50	10,000

Accuracy class:	0,5S	IEC 62053-22		
	C	EN 50470-3		
Software version:*	8.1.02		Checksum	A925C2EA
Hardware version:	Main board		758728.498	
	Antenna board		758728.425	

Remarks: The results as mentioned in this type evaluation report relate only to the meters which are tested.

EN 50470 documents, as indicated in Annex 1. For those tests mainly the terminology

* Based on documentation provided by the manufacturer software version 8.1.03 with checksum 8655B9CC is also approved.

Photograph:


AD13A.3
PRODUCTION
ADDAX
10000 imp/kWh
10000 imp/kvarh
PN: 2375062
ADD AD13A.3 (CT)
Sample 15
13259636
36, Dragomirna str., MD-2008
Chisinau, Republic of Moldova
RS-485-2 X2
R1 R2
X1 RS-485-1
ANTENNA
-ACTIVE
-REACTIVE
0.01-1(10) A 50Hz
3 x 230/400 V
-40 °C to 70 °C
Made in Moldova 2019

Annex 3: Test data

Test: Differential mode current disturbances - CW Pulses with pause

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:

- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

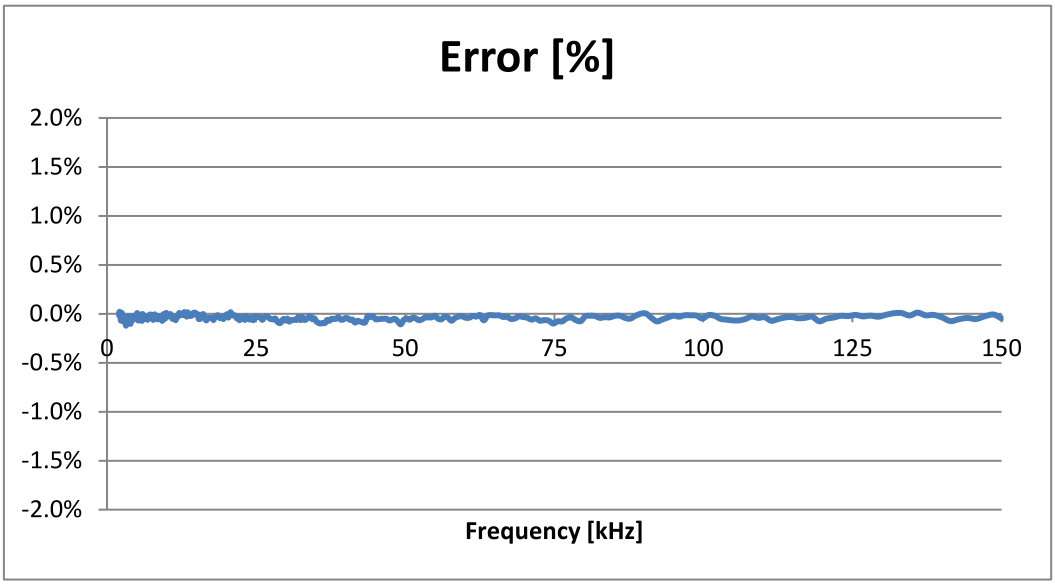
The disturbances are applied with the following characteristics:

- test wave profile: CW pulses with pause
- test level: Level 3, as specified below
  - 2-30 kHz: 3% Imax
  - 30-150 kHz: 1,5% Imax
- frequency step: 1%
- dwell time: 3 s minimally

The tests are performed with sample no. 15.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,12%.



Test: Differential mode current disturbances - rectangularly modulated - 3 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

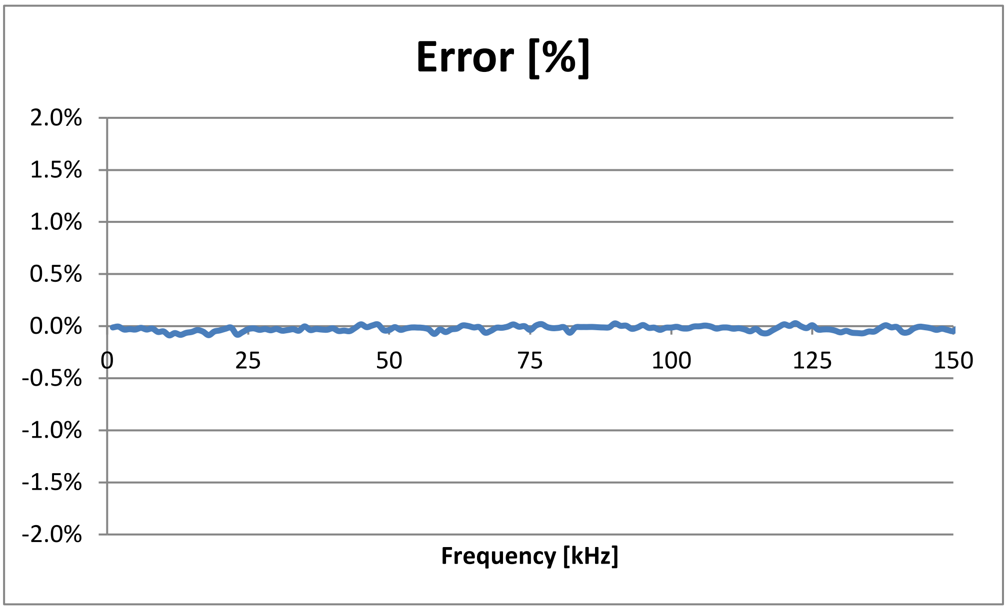
The disturbances are applied with the following characteristics:

- test wave profile:	rectangular modulated, 3 Hz	
- test level:	Level 3, as specified below:	
	2-30 kHz:	3% Imax
	30-150 kHz:	1,5% Imax
- frequency step:	1%	
- dwell time:	3 s minimally	

The tests are performed with sample no. 15.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,09%.



Test: Differential mode current disturbances - rectangularly modulated - 101 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor one = 1.

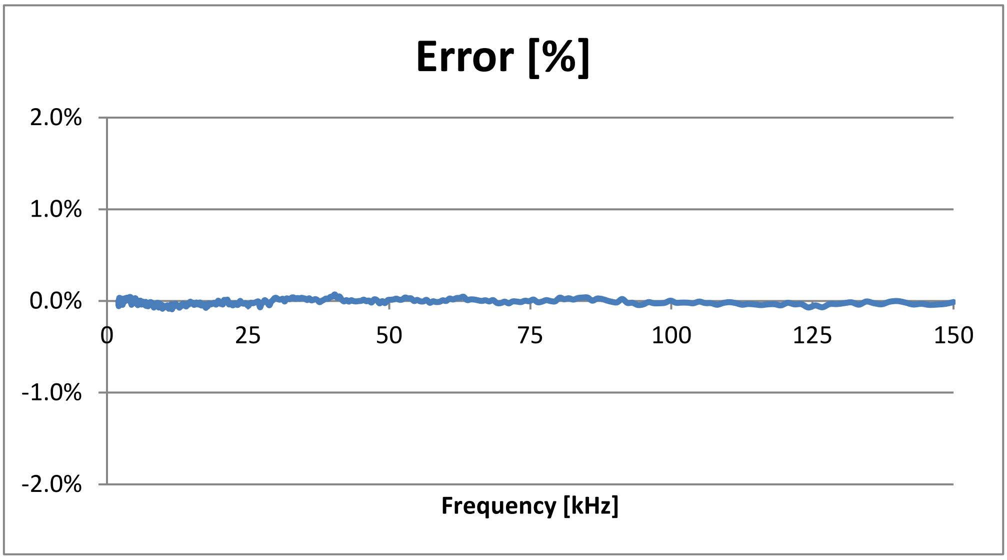
The disturbances are applied with the following characteristics:

- test wave profile:	rectangular modulated, 101 Hz	
- test level:	Level 3, as specified below:	
	2-30 kHz:	3% Imax
	30-150 kHz:	1,5% Imax
- frequency step:	1%	
- dwell time:	3 s minimally	

The tests are performed with sample no. 15.

<u>Results:</u> No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,09%.



Test: Differential mode current disturbances - rectangularly modulated - 301 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

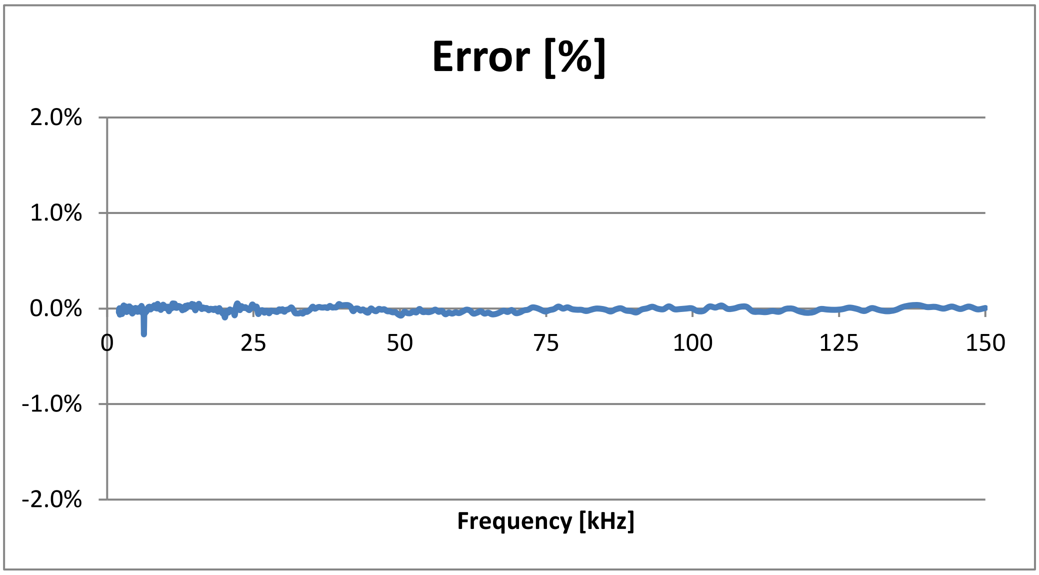
The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

The disturbances are applied with the following characteristics:
- test wave profile: rectangular modulated, 301 Hz
- test level: Level 3, as specified below:
  - 2-30 kHz: 3% Imax
  - 30-150 kHz: 1,5% Imax
- frequency step: 1%
- dwell time: 3 s minimally

The tests are performed with sample no. 15.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,27%.



Test: Differential mode current disturbances - rectangularly modulated - 601 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

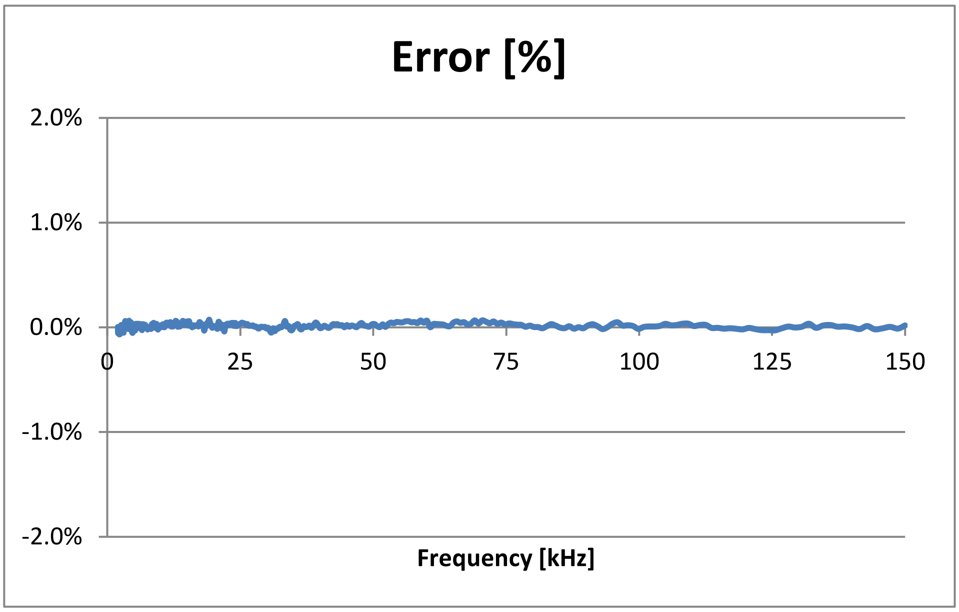
The disturbances are applied with the following characteristics:

- test wave profile:	rectangular modulated, 601 Hz	
- test level:	Level 3, as specified below:	
	2-30 kHz:	3% Imax
	30-150 kHz:	1,5% Imax
- frequency step:	1%	
- dwell time:	3 s minimally	

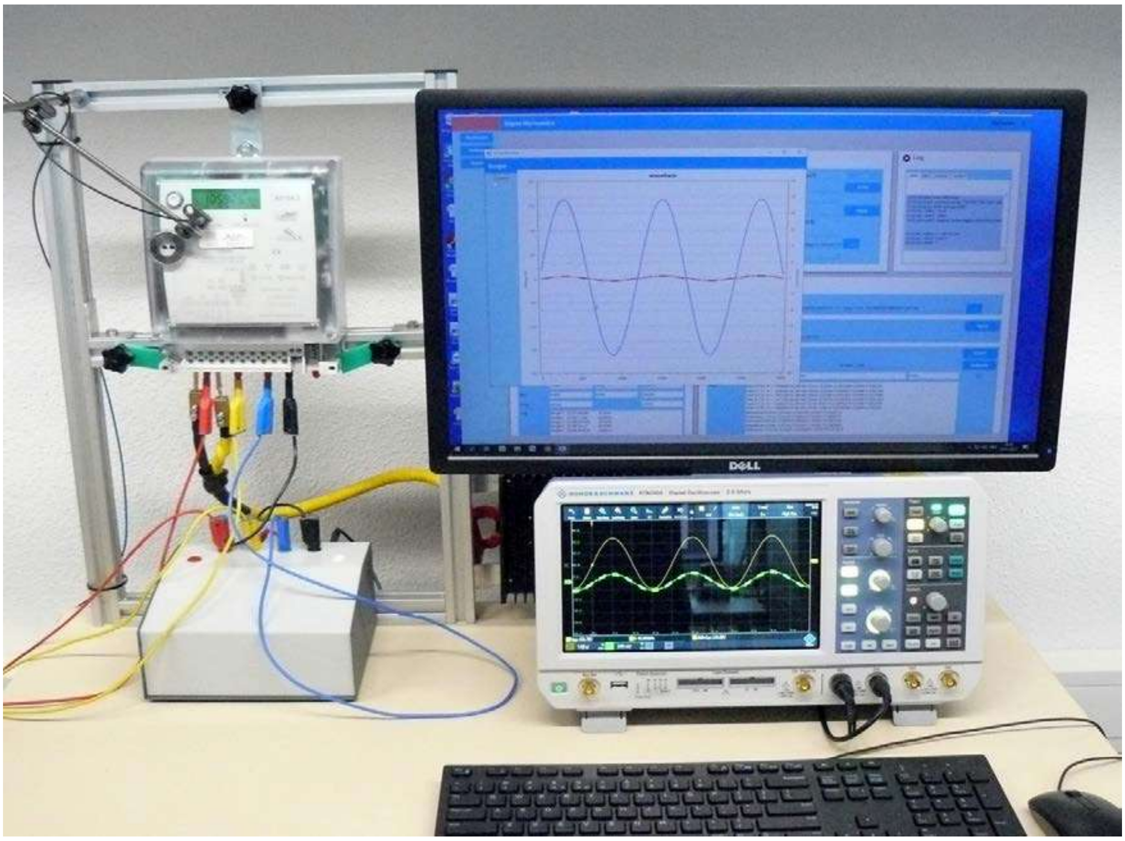
The tests are performed with sample no. 15.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,07%.



Photograph: Test setup



Type evaluation report

Issued by	:	NMi Certin B.V., accredited by the national accreditation body (RvA), based on the ISO/IEC 17020, with identification number I122 and the ISO/IEC 17025, with identification number L029. RvA is signatory member of both the Multi-Lateral Agreement of the European cooperation for Accreditation (EA) and the Mutual Recognition Arrangement of the International Laboratory Accreditation Cooperation (ILAC). The evaluation results are reported under I122. The test results, including interpretations, are reported under L029.
Applicant	:	S.C."ADD-PRODUCTION" S.R.L. 36, Dragomirna str. MD-2008, Chisianau Republic of Moldova
Measuring instrument	:	**A poly phase static watthourmeter** Manufacturer : S.C."ADD-PRODUCTION" S.R.L. Type : AD13A
Test specifications	:	- IEC 62052-11 "Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment" - IEC 62053-21 "Electricity metering equipment (AC) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)" - IEC 62053-23 "Electricity metering equipment (AC) - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)" - EN 50470-1 "Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 1: Metering equipment (class indexes A, B - EN 50470-3 "Electricity metering equipment (a.c.) - Particular requirements - Part 3: Static meters for active energy (class indexes A, B and C)"
Testing period	:	November 2019 up to and including February 2020
Issue date	:	2 March 2020

Performed by:	Reviewed by:
M.P. Cloo	J.M.J. Boereboom
Senior Approvals Expert	Approvals Expert

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Tests	:	The meters as specified in annex 2 were tested for compliance with the standards as specified on page 1 of this type evaluation report. The performed tests are stated in annex 1. If applicable specific test conditions are stated at each test.
Results		See annex 1 of this type evaluation report. The meter fulfils the general requirements of the IEC 62052-11, and the requirements for class 1 of the IEC 62053-21 as well as the requirements for class 2 of the IEC 62053-23 for all performed tests. The meter fulfils the general requirements of the EN 50470-1 [2006], and the requirements for class B of the EN 50470-3 [2006] for all performed tests. Based on the compliance with the EN 50470 documents NMi presumes conformity with the Measuring Instrument Directive (MID). The investigation has resulted in a class B EU-type examination certificate nr. T11778 revision 0.
Traceability	:	The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA.
Uncertainty	:	The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which provides a confidence level of approximately 95%. The total uncertainty of the measurements of the error of indication is 0,15% for power factor=1, and 0,20% for power factor=0,5 inductive or power factor=0,8 capacitive. The total uncertainty in the measurements of power is 0,02 W.
Annexes	:	The complete type evaluation report consists of the following annexes: annex 1 : performed tests annex 2 : characteristics of the tested meters annex 3 : checklist of general requirements annex 4 : test data
Remark	:	The test data as presented in the annex 4 of this type evaluation report is performed under RvA accreditation with reference number L029, in which conformity to ISO/IEC 17025 has been demonstrated. The data as presented in the annexes 1, 2 and 3 gives extra information.

Annex 1: Performed tests

In the following tables the performed tests are indicated with the accompanying results, as well as the page number of the appertaining annex where the results are presented.

Particular requirements of the IEC 62053-21 / IEC 62053-23 / EN 50470-3:

article IEC 62053-21/ IEC 62053-23 / EN 50470-3	tests:	passed	not applicable	not performed	annex 4 page
8.1 / 8.1	error due to variation of current (at reference conditions)	√			1
8.1 / 8.1	error due to variation of current (single phase load)	√			4
8.3 / 8.7.9	starting- and no-load condition	√			6
8.4 / 8.7.10	meter constant	√			7
8.2 / 8	variation of the error due to variation of the voltage	√			8
8.2 / 8	variation of the error due to variation of the frequency	√			10
8.2 / 8.5	reversed phase sequence	√			11
8.2 / 8.5	voltage unbalance	√			12
8.2 / 8.5	auxiliary voltage		√		-
8.2 / 8.5	operation of accessories	√			13
8.2 / -	variation of the error due to variation of the temperature	√			14
8.2 / 8.5	variation of the error due to harmonics	√			16
8.2 / 8.5	continuous magnetic induction of external origin	√			18
8.2 / 8.5	magnetic induction of external origin (0,5 mT)	√			19
7.1 / 7.1	power consumption	√			20
7.2 / 8.6	variation of the error due to short-time overcurrents	√			21
7.3 / 8.5	variation of the error due to self-heating	√			22
7.3.3 / 7.2	AC voltage test	√			24

General requirements of the IEC 62052-11 / EN 50470-1:

article IEC 62052-11 / EN 50470-1	tests:	passed	not applicable	not performed	annex 4 page
7.3.2 / 7.3	impulse voltage test	√			24
7.4 / -	earth fault		√		-
7.5.2 / 7.4.5	immunity to electrostatic discharges	√			26
7.5.3 / 7.4.6	immunity to electromagnetic RF-fields	√			27
7.5.4 / 7.4.7	fast transient bursts	√			29
7.5.5 / 7.4.8	immunity to conducted disturbances	√			30
7.5.6 / 7.4.9	surge immunity	√			31
7.5.7 / 7.4.10	damped oscillatory waves immunity		√		-
7.5.8 / 7.4.13	radio interference suppression	√			32
7.1.2 / 7.4.4	influence of supply voltage	√			35
7.2 / 7.2	influence of heating	√			36
6.3.1, 6.3.2, 6.3.3	dry heat test, cold test and damp heat, cyclic test	√			37
6.3.4	solar radiation		√		-
5.2.2.2, 5.2.2.3	shock and vibration tests	√			38
5.2.2.1	spring hammer test	√			39
5.9	protection against dust and water	√			39
5.8	test of resistance to heat and fire	√			41

Extra requirements for the EN 50470-3:

article EN 50470-3	tests:	passed	not applicable	not performed	annex 4 page
8.1	accuracy tests at reference conditions	√			41
8.2	repeatability	√			42
8.3	variation of the error due to variation of the voltage	√			43
8.3	variation of the error due to variation of the frequency	√			44
8.3	variation of the error due to variation of the temperature	√			45
8.4	maximum permissible error	√			47
8.5	earth fault		√		-

Other tests:

	tests:	passed	not applicable	not performed	annex 4 page
TR 50579	disturbance with harmonics in the frequency range 2-150 kHz	√*			-
WELMEC 11	one phase export, remaining phases import	√			49

Remark: The measurements are performed at a reference temperature of 23±2 °C, unless an other temperature is stated.

The radio interference suppression, 6 kV surge and 12 kV impulse voltage test are performed at the TÜV Rheinland EPS BV laboratory in Leek, the Netherlands.

*) see test report NMi-2375062-08.

Annex 2: Characteristics of the tested meters

Sample number	Model	Serial number	Year of fabrication	I_{min} [A]	I_b [A]	I_{max} [A]	U_{ref} [V]	f_{ref} [Hz]	Meter constant [imp./kWh] [imp./kvarh]
1	AD13A	13259600	2019	0.25	5	100	230	50	1,000
2	AD13A	13259601	2019	0.25	5	100	230	50	1,000
3	AD13A	13259602	2019	0.25	5	100	230	50	1,000
4	AD13A	13259603	2019	0.25	5	100	230	50	1,000
5	AD13A	13259604	2019	0.25	5	100	230	50	1,000
6	AD13A	13259605	2019	0.25	5	100	230	50	1,000
7	AD13A	13259606	2019	0.25	5	100	230	50	1,000
8	AD13A	13259607	2019	0.25	5	100	230	50	1,000
9	AD13A	13259609	2019	0.25	5	100	230	50	1,000
10	AD13A	13259610	2019	0.25	5	100	230	50	1,000
11	AD13A	13259613	2019	0.25	5	100	230	50	1,000
12	AD13A	13259614	2019	0.25	5	100	230	50	1,000
13	AD13A	00007387	2020	0.25	5	100	230	50	1,000
14	AD13A	13259612	2019	0.25	5	100	230	50	1,000
15	AD13A	13259611	2019	0.25	5	100	230	50	1,000

IEC accuracy class:	1		
Software version:*	8.1.02	Checksum:	A925C2EA
Hardware version:	Main board	758728.498	
	Antenna board	758728.425	

<u>Remarks:</u> The results as mentioned in this type evaluation report relate only to the meters which are tested.

* Based on documentation provided by the manufacturer software version 8.1.03 with checksum 8655B9CC is also approved.

The above mentioned characteristics were stated on the watthour meters under test and are required by the IEC documents.
However, according to the Annex V of the MID and the EN 50470 documents, other parameters are used to define the meter characteristics. Therefore in addition the following characteristics are used during the investigation:

- I_{tr} : $0,1 * I_b$
- I_{min} : $0,5 * I_{tr}$ ($= 0,05 * I_b$)
- I_{st} : $0,04 * I_{tr}$ ($= 0,004 * I_b$)

Several tests are performed to show compliance with both the IEC documents and EN 50470 documents, as indicated in Annex 1. For those tests mainly the terminology as indicated in the IEC documents is used. The above mentioned values for I_{tr}, I_{min} and I_{st} can be used for a cross reference between the two different kind of terminologies.

Photographs:

Annex 3: Checklist of general requirements

General requirements standard IEC 62052-11:

article	requirement	passed (yes/no)	not applicable
4.1 - 4.3	the meter must have a 'standard' value for voltage, current and frequency.	yes	
5.1	the meters shall be designed in such a way to avoid any danger, for electric shocks, excessive temperatures, fire and penetration of dust and water.	yes	
5.2.1	internal parts may only be accessible after breaking a seal.	yes	
	the cover may only be removed by use of a tool.	yes	
	non-permanent deformation may not influence the meter.	yes	
	meters with a reference voltage > 250V shall and whose case is wholly or partilly made of metal, shall be provided with a protected earth terminal.		n.a.
5.3	the registers must be observed clearly.	yes	
5.4	requirements for terminals	yes	
	the material of the terminal block has passed the tests given in ISO 75 for a temperature of 135°C and a pressure of 1,8 MPa (Method A).	yes*)	
5.5	the terminal cover shall be sealed independently.	yes	
5.6	see requirements for clearance / creepage distances	yes	
5.7	meters of protective class II shall be sufficient isolated (see requirements).	yes	
5.10	presentation of measured energy must be clearly by a mechanical/electronical register, containing sufficient elements for 1500 hours running at I_{max}, while the indication is in kWh	yes	
	the active tariff shall be indicated, the identification of each tariff applied shall be possible and, for automatic sequencing displays, each display shall be retained for a minimum of 5 s.	yes	
	at interruption of the tension the indication must be recovered within a period of at least 4 months,	yes	
5.11	the meter shall have a test output.	yes	
5.11.1	the maximum pulse frequency shall not exceed 2,5 kHz, the pulse transition time shall not exceed 20 µs.	yes	
5.11.2	the wavelength is between 550 nm and 1000 nm.	yes	
5.12.1	all necessary markings shall be put onto the meter.	yes	
5.12.2	the meter is marked with a connection diagram	yes	

*) The judgement is performed based on documents delivered by the applicant.

General requirements standard EN 50470-1:

article	requirement	passed (yes/no)	not applicable
4.1 - 4.3	the meter must have a 'standard' value for voltage, current and frequency.	yes	
5.1	the meters shall be designed in such a way to avoid any danger, for electric shocks, excessive temperatures, fire and penetration of dust and water.	yes	
5.2.1	internal parts may only be accessible after breaking a seal.	yes	
	the cover may only be removed by use of a tool.	yes	
	non-permanent deformation may not influence the meter.	yes	
5.3	the registers must be observed clearly.	yes	
5.4	requirements for terminals	yes	
	the material of the terminal block has passed the tests given in ISO 75 for a temperature of 135°C and a pressure of 1,8 MPa (Method A).	yes*)	
5.5	the terminal cover shall be sealed independently.	yes	
5.6	see requirements for clearance / creepage distances	yes	
5.7	meters of protective class II shall be sufficient isolated (see requirements).	yes	
5.10	presentation of measured energy must be clearly by a mechanical/electronical register, containing sufficient elements for 4000 hours running at I_{max}, while the indication is in kWh or MWh	yes	
	the active tariff shall be indicated, the identification of each tariff applied shall be possible and, for automatic sequencing displays, each display shall be retained for a minimum of 5 s.	yes	
	for testing purposes it shall be possible to increase the resolution to 0,01 times the principal unit	yes	
	at interruption of the tension the indication must be recovered within a period of at least 4 months,	yes	
5.11	the meter shall have a test output.	yes	
5.11.1	the maximum pulse frequency shall not exceed 2,5 kHz, the pulse transition time shall not exceed 20 μs.	yes	
5.11.2	the wavelength is between 550 nm and 1000 nm.	yes	
5.12.1	all necessary markings shall be put onto the meter.	yes	
5.12.2	the meter is marked with a connection diagram	yes	
5.13	for each meter type, an instruction manual shall be made available including the stated information	yes	

*) The judgement is performed based on documents delivered by the applicant.

General requirements standard EN 50470-3:

article	requirement	passed (yes/no)	not applicable
9	durability the meter shall be designed to maintain an adequate stability of its metrological characteristics over a period estimated by the manufacturer.	yes*)	
10	reliability the meter shall be designed to operate reliable.	yes*)	
11	the functions implemented in software shall be unambiguously identified and their operation adequately documented by the manufacturer	yes	
	software identification shall be easily provided.	yes	
	corruption of metrologically relevant software shall be easily detected.	yes	
	metrologically relevant parameters shall be identified and protected against accidental or intentional changes after placing the legal seals.	yes	
	evidence of any intervention shall be available for a reasonable time.	yes	
	if there are parameters, which are allowed to be set in the field, this shall be possible only under adequate protection, using the specified method; any admissible changes of such parameters shall be properly traceable.	yes	
	the security system of the meter shall be adequately documented.	yes	
	non-relevant functions in the software shall not influence the correct operation of the metrologically relevant software.	yes	

*) The judgement is performed based on documents delivered by the applicant.

Requirements WELMEC 11:

article	requirement	passed (yes/no)	not applicable
	The cumulative register is protected by means of a hardware seal.	yes	
	If no cumulative register is available, the registers from which the total quant supplied can be derived, are protected by means of a hardware seal.	yes	
	If the effect of different phase sequences is **NOT** negligible, the meter shall bear information in respect of phase sequence to be applied.		n.a.

Annex 4: Test data

Test: Error due to variation of the current (at reference conditions)

The error of the meters is measured under reference conditions at different values of the current and power factor.

Results: Active energy measurements, balanced load:

I [%] of I_b	Error [%] Import					
	Sample nr. 4			Sample nr. 8		
	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.
5	+ 0.0			+ 0.1		
10	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.2	+ 0.1
20	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
50	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
100	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1
150	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1
200	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1
0,2·Imax	+ 0.1	− 0.0	+ 0.1	+ 0.1	− 0.0	+ 0.1
0,4·Imax	+ 0.1	− 0.1	+ 0.1	+ 0.1	− 0.1	+ 0.2
0,6·Imax	+ 0.1	− 0.2	+ 0.2	+ 0.1	− 0.1	+ 0.2
0,8·Imax	+ 0.1	− 0.2	+ 0.2	+ 0.1	− 0.2	+ 0.2
Imax	+ 0.1	− 0.2	+ 0.2	+ 0.1	− 0.2	+ 0.2

I [%] of I_b	Error [%] Export					
	Sample nr. 4			Sample nr. 8		
	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.	cos(f)=1	cos(f)=0,5 ind.	cos(f)=0,8 cap.
5	+ 0.1			+ 0.1		
10	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.2	+ 0.1
20	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
50	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
100	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1
150	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1
200	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1
0,2·Imax	+ 0.1	− 0.0	+ 0.1	+ 0.1	+ 0.0	+ 0.2
0,4·Imax	+ 0.1	− 0.1	+ 0.2	+ 0.1	− 0.1	+ 0.2
0,6·Imax	+ 0.1	− 0.1	+ 0.2	+ 0.1	− 0.1	+ 0.2
0,8·Imax	+ 0.1	− 0.1	+ 0.2	+ 0.1	− 0.1	+ 0.2
Imax	+ 0.1	− 0.1	+ 0.2	+ 0.1	− 0.1	+ 0.2

Reactive energy measurements, balanced load:

I [%] of I_b	Error [%] Import					
	Sample nr. 4			Sample nr. 8		
	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.
5	− 0.1			− 0.2		
10	− 0.0	− 0.1	− 0.1	− 0.1	− 0.2	− 0.1
20	+ 0.0	− 0.0	− 0.0	− 0.0	− 0.1	− 0.0
50	+ 0.0	+ 0.0	− 0.0	+ 0.0	+ 0.0	+ 0.0
100	+ 0.0	+ 0.0	− 0.0	+ 0.0	+ 0.0	+ 0.0
150	+ 0.0	+ 0.1	− 0.0	+ 0.0	+ 0.1	+ 0.0
200	+ 0.0	+ 0.1	− 0.1	+ 0.0	+ 0.1	− 0.0
0,2·Imax	− 0.0	+ 0.1	− 0.1	+ 0.0	+ 0.1	− 0.1
0,4·Imax	+ 0.0	+ 0.2	− 0.2	+ 0.0	+ 0.2	− 0.2
0,6·Imax	− 0.0	+ 0.2	− 0.2	+ 0.0	+ 0.2	− 0.2
0,8·Imax	+ 0.0	+ 0.3	− 0.2	+ 0.0	+ 0.3	− 0.2
Imax	+ 0.0	+ 0.3	− 0.2	+ 0.1	+ 0.3	− 0.2

I [%] of I_b	Error [%] Import					
	Sample nr. 4			Sample nr. 8		
	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.
20	+ 0.0	− 0.1	− 0.1	+ 0.0	− 0.2	− 0.1
100	+ 0.0	+ 0.1	− 0.1	+ 0.0	+ 0.1	− 0.1
Imax	+ 0.0	+ 0.6	− 0.5	+ 0.0	+ 0.6	− 0.5

I [%] of I_b	Error [%] Export					
	Sample nr. 4			Sample nr. 8		
	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.
5	+ 0.2			+ 0.3		
10	+ 0.1	+ 0.2	+ 0.2	+ 0.2	+ 0.2	+ 0.3
20	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.2	+ 0.2
50	+ 0.1	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.1
100	+ 0.0	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.0
150	+ 0.0	+ 0.1	+ 0.0	+ 0.1	+ 0.1	+ 0.0
200	+ 0.1	+ 0.1	− 0.0	+ 0.1	+ 0.1	+ 0.0
0,2·Imax	+ 0.0	+ 0.1	− 0.1	+ 0.0	+ 0.1	− 0.1
0,4·Imax	+ 0.0	+ 0.2	− 0.1	+ 0.1	+ 0.2	− 0.1
0,6·Imax	+ 0.0	+ 0.2	− 0.2	+ 0.0	+ 0.2	− 0.2
0,8·Imax	+ 0.0	+ 0.3	− 0.2	+ 0.1	+ 0.3	− 0.2
Imax	+ 0.0	+ 0.3	− 0.2	+ 0.1	+ 0.3	− 0.2

I [%] of I_b	Error [%] Export					
	Sample nr. 4			Sample nr. 8		
	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.	sin(f)=1	sin(f)=0,25 ind.	sin(f)=0,25 cap.
20	+ 0.1	+ 0.2	+ 0.2	+ 0.1	+ 0.3	+ 0.3
100	+ 0.0	+ 0.1	− 0.0	+ 0.1	+ 0.2	+ 0.0
Imax	+ 0.0	+ 0.6	− 0.5	+ 0.1	+ 0.6	− 0.5

Remark: Before the measurements were started, the voltage was connected for at least one hour and a current of $0,1 \cdot I_b$ was running through the meters.

Active energy measurements, single phase load:

I [%] of I_b	Sample nr. 4 Error [%] Import					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
10	+ 0.1	+ 0.1	+ 0.1			
20	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
100	+ 0.1	+ 0.1	+ 0.1	+ 0.0	+ 0.0	+ 0.0
0,5·Imax	+ 0.1	+ 0.1	+ 0.1	− 0.1	− 0.1	+ 0.0
Imax	+ 0.0	+ 0.1	+ 0.1	− 0.3	− 0.2	− 0.1

I [%] of I_b	Sample nr. 8 Error [%] Import					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
10	+ 0.1	+ 0.2	+ 0.2			
20	+ 0.1	+ 0.2	+ 0.2	+ 0.1	+ 0.1	+ 0.2
100	+ 0.1	+ 0.1	+ 0.2	+ 0.0	+ 0.1	+ 0.1
0,5·Imax	+ 0.1	+ 0.1	+ 0.1	− 0.1	− 0.0	+ 0.1
Imax	− 0.0	+ 0.1	+ 0.2	− 0.3	− 0.1	− 0.1

I [%] of I_b	Sample nr. 4 Error [%] Export					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
10	+ 0.1	+ 0.1	+ 0.1			
20	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
100	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1
0,5·Imax	+ 0.0	+ 0.1	+ 0.1	+ 0.3	+ 0.2	+ 0.1
Imax	+ 0.0	+ 0.1	+ 0.1	+ 0.3	+ 0.4	+ 0.3

I [%] of I_b	Sample nr. 8 Error [%] Export					
	cos(f)=1			cos(f)=0,5 ind.		
	R	S	T	R	S	T
10	+ 0.1	+ 0.1	+ 0.2			
20	+ 0.1	+ 0.1	+ 0.1	+ 0.0	+ 0.1	+ 0.1
100	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.2	+ 0.2
0,5·Imax	+ 0.0	+ 0.1	+ 0.1	+ 0.2	+ 0.3	+ 0.2
Imax	+ 0.1	+ 0.2	+ 0.2	+ 0.3	+ 0.4	+ 0.4

Reactive energy measurements, single phase load:

I [%] of I_b	Sample nr. 4 Error [%] Import								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
10	+ 0.0	+ 0.0	+ 0.0						
20	+ 0.0	+ 0.0	+ 0.0	+ 0.0	+ 0.0	− 0.0	− 0.1	− 0.0	− 0.0
100	+ 0.0	+ 0.0	+ 0.0	+ 0.1	+ 0.1	+ 0.0	− 0.0	− 0.0	− 0.0
0,5·Imax	+ 0.0	+ 0.0	− 0.0	+ 0.0	+ 0.2	− 0.1	− 0.1	− 0.2	+ 0.1
Imax	− 0.0	+ 0.0	+ 0.0	+ 0.2	+ 0.3	+ 0.2	− 0.3	− 0.2	− 0.1

I [%] of I_b	Sample nr. 8 Error [%] Import								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
10	− 0.1	+ 0.1	+ 0.1						
20	+ 0.0	+ 0.0	+ 0.1	− 0.0	+ 0.0	+ 0.0	− 0.1	+ 0.0	+ 0.1
100	+ 0.0	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1	− 0.0	+ 0.0	+ 0.1
0,5·Imax	+ 0.0	+ 0.0	+ 0.1	+ 0.0	+ 0.2	+ 0.1	− 0.1	− 0.2	+ 0.1
Imax	− 0.1	+ 0.1	+ 0.1	+ 0.2	+ 0.3	+ 0.3	− 0.2	− 0.2	− 0.1

I [%] of I_b	Sample nr. 4 Error [%] Export								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
10	+ 0.1	+ 0.1	+ 0.1						
20	+ 0.0	+ 0.0	+ 0.0	+ 0.1	+ 0.1	+ 0.0	− 0.0	+ 0.0	+ 0.0
100	+ 0.0	+ 0.0	+ 0.0	+ 0.1	+ 0.1	+ 0.0	− 0.1	− 0.0	+ 0.0
0,5·Imax	− 0.0	− 0.0	− 0.0	− 0.0	+ 0.2	− 0.1	− 0.1	− 0.2	+ 0.1
Imax	− 0.1	+ 0.0	+ 0.0	+ 0.1	+ 0.3	+ 0.2	− 0.3	− 0.2	− 0.1

I [%] of I_b	Sample nr. 8 Error [%] Export								
	sin(f)=1			sin(f)=0,5 ind.			sin(f)=0,5 cap.		
	R	S	T	R	S	T	R	S	T
10	+ 0.1	+ 0.1	+ 0.1						
20	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.0	+ 0.1	+ 0.1
100	+ 0.0	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	− 0.0	+ 0.0	+ 0.1
0,5·Imax	+ 0.0	+ 0.0	+ 0.1	+ 0.0	+ 0.2	+ 0.1	+ 0.0	− 0.2	+ 0.1
Imax	− 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.3	+ 0.3	− 0.3	− 0.2	− 0.1

Remark: Before the measurements were started, the voltage was connected for at least one hour and a current of $0{,}1 \cdot I_b$ was running through the meters.

Test: Starting and no-load condition

The starting and no-load condition is checked at reference conditions.

Results: Active energy measurements:

Sample nr. 4	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_b	0.4 %
Registration checked at % of I_b with export energy	0.4 %

Sample nr. 8	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_b	0.4 %
Registration checked at % of I_b with export energy	0.4 %

The meter is functional within 5 s after the rated voltage is applied to the meter terminals: yes

Reactive energy measurements:

Sample nr. 4	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_b	0.5 %
Registration checked at % of I_b with export energy	0.5 %

Sample nr. 8	
No-load condition with no current and a voltage of 115% of the reference voltage	√
Registration checked at % of I_b	0.5 %
Registration checked at % of I_b with export energy	0.5 %

The meter is functional within 5 s after the rated voltage is applied to the meter terminals: yes

Test: Meter constant

The meter constant is checked with the value stated on the nameplate.

Results: The test is performed with: Sample nr. 4
Sample nr. 8

The meter constant as stated on the nameplate complies with the measured values of the test output.

Test: Variation of the error due to variation of the voltage

The variation of the error is measured due to variation of the voltage at nominal current and different values of the power factor.

Results: Active energy measurements:

Sample nr. 4		
	I_b	
percentage of U_{ref}	power factor	variation [%]
115	1	– 0.0
	0,5 ind.	– 0.0
110	1	– 0.0
	0,5 ind.	+ 0.0
90	1	– 0.0
	0,5 ind.	– 0.0
80	1	– 0.0
	0,5 ind.	+ 0.0
50	1	+ 0.0
	0,5 ind.	+ 0.0
<50	1	no registration
	0,5 ind.	

Sample nr. 8		
	I_b	
percentage of U_{ref}	power factor	variation [%]
115	1	+ 0.0
	0,5 ind.	+ 0.0
110	1	+ 0.0
	0,5 ind.	+ 0.0
90	1	+ 0.0
	0,5 ind.	+ 0.0
80	1	+ 0.0
	0,5 ind.	+ 0.0
50	1	+ 0.0
	0,5 ind.	+ 0.0
<50	1	no registration
	0,5 ind.	

Reactive energy measurements:

Sample nr. 4 I_b		
percentage of U_{ref}	power factor	variation [%]
115	1	– 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
110	1	+ 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
90	1	+ 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
80	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
50	1	+ 0.0
	0,5 ind.	– 0.0
	0,5 cap.	– 0.0
<50	1	no registration
	0,5 ind.	
	0,5 cap.	

Sample nr. 8 I_b		
percentage of U_{ref}	power factor	variation [%]
115	1	+ 0.0
	0,5 ind.	– 0.0
	0,5 cap.	+ 0.0
110	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
90	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
80	1	– 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	+ 0.0
50	1	+ 0.0
	0,5 ind.	+ 0.0
	0,5 cap.	– 0.0
<50	1	no registration
	0,5 ind.	
	0,5 cap.	

Definition: Variation = (Error at percentage of U_{ref}) - (Error at reference conditions)

Test: Variation of the error due to variation of the frequency

The variation of the error is measured at the stated changes of the frequency at different values of the current and the power factor.

Results: Active energy measurements:

Sample nr. 4		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_b$, cos(f)=1	+ 0.0	+ 0.0
$I=0,5I_{max}$, cos(f)=1	– 0.0	+ 0.0
$I=0,5I_{max}$, cos(f)=0,5 ind.	+ 0.0	– 0.0

Sample nr. 8		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_b$, cos(f)=1	– 0.0	– 0.0
$I=0,5I_{max}$, cos(f)=1	– 0.0	– 0.0
$I=0,5I_{max}$, cos(f)=0,5 ind.	+ 0.0	+ 0.0

Reactive energy measurements:

Sample nr. 4		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_b$, sin(f)=1	+ 0.0	+ 0.0
$I=0,5I_{max}$, sin(f)=1	– 0.0	– 0.0
$I=0,5I_{max}$, sin(f)=0,5 ind.	– 0.0	+ 0.0
$I=0,5I_{max}$, sin(f)=0,5 cap.	+ 0.0	– 0.0

Sample nr. 8		
U_{ref}	Variation at frequency	
	49 Hz	51 Hz
$I=0,1I_b$, sin(f)=1	– 0.0	– 0.0
$I=0,5I_{max}$, sin(f)=1	+ 0.0	– 0.0
$I=0,5I_{max}$, sin(f)=0,5 ind.	+ 0.0	– 0.0
$I=0,5I_{max}$, sin(f)=0,5 cap.	+ 0.0	+ 0.0

Definition: Variation = (Error at stated frequency) - (Error at reference conditions)

Test: Reversed phase sequence

The variation of the error is determined due to reversed phase sequence.

Results:

I [%] of I_b	Sample nr. 4					
	balanced load			single phase load		
	10	100	I_{max}	50 R	50 S	50 T
error with RST sequence [%]	+ 0.08	+ 0.07	+ 0.04	+ 0.08	+ 0.10	+ 0.07
error with RTS sequence [%]	+ 0.09	+ 0.07	+ 0.05	+ 0.08	+ 0.12	+ 0.08
variation [%]	+ 0.01	+ 0.00	+ 0.01	+ 0.00	+ 0.02	+ 0.01

I [%] of I_b	Sample nr. 8					
	balanced load			single phase load		
	10	100	I_{max}	50 R	50 S	50 T
error with RST sequence [%]	+ 0.14	+ 0.12	+ 0.11	+ 0.10	+ 0.13	+ 0.14
error with RTS sequence [%]	+ 0.12	+ 0.12	+ 0.10	+ 0.09	+ 0.14	+ 0.15
variation [%]	– 0.02	+ 0.00	– 0.01	– 0.01	+ 0.01	+ 0.01

Definition: Variation = (Error with RTS sequence) - (Error with RST sequence)

Test: Voltage unbalance

The meter is tested while the voltage of one or more phases is interrupted.
The test is performed at basic current.

Results:

	Sample nr. 4					
interruption of phase	R	S	T	RS	RT	ST
error with balanced load [%]	+ 0.07					
error without phase [%]	+ 0.08	+ 0.06	+ 0.06	+ 0.07	+ 0.08	+ 0.08
variation [%]	+ 0.01	– 0.01	– 0.01	+ 0.00	+ 0.01	+ 0.01

	Sample nr. 8					
interruption of phase	R	S	T	RS	RT	ST
error with balanced load [%]	+ 0.12					
error without phase [%]	+ 0.13	+ 0.14	+ 0.13	+ 0.14	+ 0.12	+ 0.14
variation [%]	+ 0.01	+ 0.02	+ 0.01	+ 0.02	– 0.00	+ 0.02

Definition: Variation = (Error without phase) - (Error with applied phase)

Test: Operation of accessories

The influence of the operation of accessories is determined at 5% of the basic current.

Results: Active energy measurements:

Sample nr. 14 & 15	
error without operation of accessories [%]	+ 0.15
max. error with operation of accessories [%]	+ 0.16
variation [%]	+ 0.01

Reactive energy measurements:

Sample nr. 14 & 15	
error without operation of accessories [%]	– 0.14
max. error with operation of accessories [%]	– 0.16
variation [%]	– 0.02

Definition: Variation = (Error with operation of accessories) - (Error without operation of accessories)

The following auxiliary devices have been examined:
- Optical communication
- RS485 (2x)
- RF
- G3 PLC (Sample nr. 15)
- PLC PRIME (Sample nr. 14)

Test: Variation of the error due to variation of the temperature

The variation of the error is determined due to variation of the temperature.
The error of indication is measured at a reference temperature of +23°C and at the stated temperatures.
The shift of the error due to the shift of temperature is stated in the following tables.

Results: Active energy measurements:

Sample nr. 4								
U_{ref}	Variation at temperature							Max. temperature coefficient %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
I=0,1I_b, cos(f)=1	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.2	0.004
I=0,1I_b, cos(f)=0,5 ind.	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.007
I=I_b, cos(f)=1	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.1	0.005
I=I_b, cos(f)=0,5 ind.	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.008
I=I_{max}, cos(f)=1	– 0.2	– 0.2	– 0.1	– 0.0	+ 0.0	+ 0.1	+ 0.1	0.006
I=I_{max}, cos(f)=0,5 ind.	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.1	0.006

Sample nr. 8								
U_{ref}	Variation at temperature							Max. temperature coefficient %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
I=0,1I_b, cos(f)=1	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.007
I=0,1I_b, cos(f)=0,5 ind.	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.3	0.007
I=I_b, cos(f)=1	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.006
I=I_b, cos(f)=0,5 ind.	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.3	0.007
I=I_{max}, cos(f)=1	– 0.3	– 0.2	– 0.2	– 0.1	+ 0.1	+ 0.1	+ 0.2	0.006
I=I_{max}, cos(f)=0,5 ind.	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.006

Definition: Variation = (Error at specified temperature) - (Average error at +23°C)

Remark: Instead of the prescribed 20 K range (see par. 8.2, remark 9, of the IEC 62053-21), the above mentioned temperatures are used.

Reactive energy measurements:

Sample nr. 4								
U_{ref}	Variation at temperature							Max. temperature coëfficiënt %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
$I=0,1I_b$, sin(f)=1	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.1	0.004
$I=0,2I_b$, sin(f)=0,5 ind.	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.0	+ 0.1	+ 0.0	0.007
$I=0,2I_b$, sin(f)=0,5 cap.	– 0.2	– 0.2	– 0.1	– 0.0	+ 0.1	+ 0.1	+ 0.2	0.007
$I=I_b$, sin(f)=1	– 0.2	– 0.2	– 0.1	– 0.0	+ 0.1	+ 0.1	+ 0.1	0.005
$I=I_b$, sin(f)=0,5 ind.	– 0.2	– 0.2	– 0.1	– 0.0	+ 0.0	+ 0.1	+ 0.1	0.005
$I=I_b$, sin(f)=0,5 cap.	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.2	0.005
$I=I_{max}$, sin(f)=1	– 0.2	– 0.2	– 0.1	– 0.0	+ 0.0	+ 0.1	+ 0.1	0.004
$I=I_{max}$, sin(f)=0,5 ind.	– 0.2	– 0.1	– 0.1	– 0.0	+ 0.0	+ 0.0	+ 0.0	0.004
$I=I_{max}$, sin(f)=0,5 cap.	– 0.2	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.2	0.005

Sample nr. 8								
U_{ref}	Variation at temperature							Max. temperature coëfficiënt %/K
	-40°C	-25°C	-10°C	5°C	40°C	55°C	70°C	
$I=0,1I_b$, sin(f)=1	– 0.3	– 0.2	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.005
$I=0,2I_b$, sin(f)=0,5 ind.	– 0.3	– 0.2	– 0.1	– 0.1	+ 0.1	+ 0.1	+ 0.1	0.006
$I=0,2I_b$, sin(f)=0,5 cap.	– 0.3	– 0.2	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.007
$I=I_b$, sin(f)=1	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.006
$I=I_b$, sin(f)=0,5 ind.	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.1	+ 0.2	0.006
$I=I_b$, sin(f)=0,5 cap.	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.3	0.007
$I=I_{max}$, sin(f)=1	– 0.3	– 0.2	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.005
$I=I_{max}$, sin(f)=0,5 ind.	– 0.3	– 0.2	– 0.2	– 0.1	+ 0.0	+ 0.1	+ 0.1	0.005
$I=I_{max}$, sin(f)=0,5 cap.	– 0.3	– 0.3	– 0.2	– 0.1	+ 0.1	+ 0.2	+ 0.2	0.006

<u>Definition:</u> Variation = (Error at specified temperature) - (Average error at +23°C)

<u>Remark:</u> Instead of the prescribed 20 K range (see par. 8.2, remark 7, of the IEC 62053-23), the above mentioned temperatures are used.

Test: Variation of the error due to harmonics

The watthourmeter is tested with harmonics. The following tests are performed:
- harmonic components in the current and voltage circuits;
- DC and even harmonics in the a.c. current circuit (half wave rectification);
- odd harmonics in the a.c. current circuit (phase fired waveform);
- sub-harmonics in the a.c. current circuit (burst control).

Results: Active energy measurements:

harmonic components in the current and voltage circuits:

U_{ref}, $I=0,5I_{max}$, cos(f)=1		
U_5 = 10%, I_5 = 40%	Sample nr. 4	Sample nr. 8
error without harmonics [%]	+ 0.04	+ 0.12
error with harmonics [%]	+ 0.04	+ 0.12
variation [%]	+ 0.00	– 0.00

DC and even harmonics in the a.c. current circuit (half wave rectification):

U_{ref}, cos(f)=1	Sample nr. 4	Sample nr. 8
error with reference waveform at $I_{max}/2\sqrt{2}$ [%]	+ 0.02	+ 0.11
corrected error with half wave rectification at $I_{max}/\sqrt{2}$ [%]	– 0.70	+ 0.44
variation [%]	– 0.72	+ 0.33

odd harmonics in the a.c. current circuit (phase fired waveform):

U_{ref}, cos(f)=1	Sample nr. 4	Sample nr. 8
error with reference waveform 0,5 I_b [%]	+ 0.06	+ 0.14
error with phase fired waveform I_b [%]	+ 0.06	+ 0.14
variation [%]	+ 0.00	+ 0.00

sub-harmonics in the a.c. current circuit (burst control):

U_{ref}, cos(f)=1	Sample nr. 4	Sample nr. 8
error with reference waveform 0,5 I_b [%]	+ 0.07	+ 0.12
error with burst control I_b [%]	+ 0.09	+ 0.13
variation [%]	+ 0.01	+ 0.00

Definition: Variation = (Error with harmonics) - (Error without harmonics)

Reactive energy measurements:

DC and even harmonics in the a.c. current circuit (half wave rectification):

U_{ref}, sin(f)=1	Sample nr. 4	Sample nr. 8
error with reference waveform at I_{max} / 2√2 [%]	– 0.09	+ 0.05
corrected error with half wave rectification at I_{max} / √2 [%]	– 0.86	+ 0.48
variation [%]	– 0.77	+ 0.43

Definition: Variation = (Error with harmonics) - (Error without harmonics)

Test: Continuous magnetic induction of external origin

The influence of a continuous magnetic field on the registration of the watthourmeter is investigated. The continuous magnetic induction is obtained by using the electromagnet according to annex B of the IEC 62053-21 and IEC 62053-23, energized with a DC current.
A magneto-motive force of 1000 At (ampere-turns) is applied.

The test is performed with sample nr. 4.

Results: The influence due to the continuous magnetic field was negligible.

The meter was functioning correctly when applying the magnetic field, with both active and reactive energy.

Test: Variation of the error due to a magnetic induction of external origin (0,5 mT)

The influence of an external magnetic field on the registration of the meter is investigated, with a field strength of 0,5 mT.
An external magnetic field is made with the help of a round coil with a diameter of 1 meter. The meter is placed into the middle of the coil.
The measurements are performed with a variable phase shift between the current that caused the magnetic field and the measuring circuit voltage of the meter.
The phase shift is adjusted between 0° and 360°. For each measurement the coil and the meter are placed in several positions.

Results: Active energy measurements:

Sample nr. 14 $U=U_{ref}$, $I=I_b$ and cos(f)=1	
Variation [%]	< 0.10

Reactive energy measurements:

Sample nr. 14 $U=U_{ref}$, $I=I_b$ and sin(f)=1	
Variation [%]	< 0.10

Definition: Variation = (Error with an external magnetic field) - (Error at reference conditions)

Remark: The uncertainty in the generated magnetic field is 1%.

Test: Power consumption

The power consumption of the voltage circuits and the current circuits is measured at reference conditions and at the stated current.

Results: Active energy measurements:

	Sample nr. 4	Sample nr. 8
maximum power consumption of the voltage circuits	9.5 VA and 0.7 W	9.3 VA and 0.7 W
maximum power consumption of the current circuits with basic current	0.01 VA	0.02 VA

Reactive energy measurements:

	Sample nr. 4	Sample nr. 8
maximum power consumption of the voltage circuits	9.5 VA and 0.7 W	9.3 VA and 0.7 W
maximum power consumption of the current circuits with basic current	0.01 VA	0.02 VA

Test: Variation of the error due to short time overcurrents

The meter is tested by applying an impulse current to the current circuit of the meter. During the test the voltage circuits were energized with the reference voltage. Before and after the test the error of indication is measured at reference conditions.

The impulse current had the following characteristics:
- 30 times the maximum current, for one half-cycle at rated frequency

The tests are performed with sample nr. 2.

Results: The difference in the error of indication at reference conditions before and after the test was not greater than the uncertainty of the measurements.

The test is performed with both active and reactive energy.

Test: Variation of the error due to self-heating

The influence of self-heating of the watthourmeter is determined by difference occurring in the error at measuring directly after switching-in of the maximum current with respect to a second measurement at least one hour after switching-in of the current and after thermal stability is reached.

During the test cables are used with an area of 35 square mm.

Results: Active energy measurements:

time [min]	Sample nr. 4		Sample nr. 8	
	cos(f)=1	cos(f)=0,5 ind.	cos(f)=1	cos(f)=0,5 ind.
0	+ 0.06	– 0.17	+ 0.09	– 0.18
5	+ 0.09	– 0.19	+ 0.11	– 0.17
10	+ 0.11	– 0.17	+ 0.14	– 0.13
15	+ 0.10	– 0.13	+ 0.18	– 0.09
30	+ 0.15	– 0.09	+ 0.21	– 0.02
45	+ 0.15	– 0.07	+ 0.25	+ 0.01
60	+ 0.17	– 0.05	+ 0.26	+ 0.03
90	+ 0.17	– 0.03	+ 0.26	+ 0.06
120	+ 0.16	– 0.02	+ 0.26	+ 0.07
Variation [%]	+ 0.10	+ 0.15	+ 0.17	+ 0.25

Definition: Variation = (Error after thermal stability) - (Error at the start)

Remark: Before the measurements were started, the voltage was connected for at least 2 hours.

Reactive energy measurements:

time [min]	Sample nr. 4			Sample nr. 8		
	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.	sin(f)=1	sin(f)=0,5 ind.	sin(f)=0,5 cap.
0	+ 0.02	+ 0.25	– 0.22	+ 0.04	+ 0.27	– 0.17
5	+ 0.03	+ 0.27	– 0.23	+ 0.08	+ 0.31	– 0.21
10	+ 0.03	+ 0.30	– 0.21	+ 0.10	+ 0.34	– 0.15
15	+ 0.04	+ 0.30	– 0.18	+ 0.12	+ 0.35	– 0.13
30	+ 0.08	+ 0.32	– 0.14	+ 0.17	+ 0.39	– 0.06
45	+ 0.10	+ 0.33	– 0.11	+ 0.20	+ 0.40	+ 0.00
60	+ 0.10	+ 0.31	– 0.09	+ 0.22	+ 0.41	+ 0.00
90	+ 0.12	+ 0.30	– 0.07	+ 0.21	+ 0.40	+ 0.01
120	+ 0.11	+ 0.29	– 0.07	+ 0.21	+ 0.41	+ 0.02
Variation [%]	+ 0.09	+ 0.04	+ 0.15	+ 0.17	+ 0.14	+ 0.19

Definition: Variation = (Error after thermal stability) - (Error at the start)

Remark: Before the measurements were started, the voltage was connected for at least 2 hours.

Test: Impulse voltage test and AC voltage test

The insulation properties of the watthourmeter are tested by performing an impulse voltage test and an AC voltage test. Before the tests and after the test the error of the meter is measured at reference conditions.

a) Impulse voltage test
The meter is tested according to:
- 6 kV in accordance with the IEC 62052-11
- 12 kV in accordance with the Swedish requirements as described in the document SP 1618

The test is performed with each circuit. The impulse voltage is applied ten times with one polarity and then repeated with the other polarity.
The minimum time between the impulses was 3 s.

b) AC voltage test
The AC voltage test is performed with a r.m.s. test voltage of:
- 4 kV, between all current and voltage circuits as well as auxiliairy circuits above 40V, connected together, and, on the other hand earth;
- 2 kV, between circuits not intended to be connected together in service.

The tests are performed with sample nr. 8 and 6 (12 kV).

Results:

a) Impulse voltage test
During the test no flashover, disruptive discharge or puncture occurred.

b) AC voltage test
During the test no flashover, disruptive discharge or puncture occurred.

The difference in the error of indication at reference conditions before and after the test was not greater than the uncertainty of the measurements.
No mechanical damage occurred to the meter.

Remark: During the test with 6 kV according to IEC 62052-11 the following auxilliary circuits are investigated:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Photograph of the impulse voltage test:

Test: Immunity to electrostatic discharges

The meter is tested with electrostatic discharges.

The test is performed with the following characteristics:

- air discharge;
- test voltage : 15 kV
- number of discharges : 10

meter in operating condition:

- voltage and auxiliary circuits are energized with reference voltage;
- without any current in the current circuits and the current terminals are open circuit.

The test is performed with sample nr. 10.

Results: During the tests the following was observed:

Change in register during the test	:	0.00	kWh / kvarh
Pulse produced by the test output	:	0	impulses
Change of information after the test	:	no	

Test: Immunity to electromagnetic RF-fields

The watthourmeter is tested with electromagnetic RF fields according to IEC 61000-4-3 with the characteristics:

frequency [MHz]	:	80 - 2000
modulation	:	80% AM, 1 kHz sine wave

The following tests are performed:

with active energy:
a) without any current in the current circuits and the current terminals are open circuit, with a field strength of 30 V/m;
b) with basic current and power factor = 1, with a field strength of 10 V/m.

with reactive energy:
c) without any current in the current circuits and the current terminals are open circuit, with field strength of 30 V/m;
d) with basic current and power factor = 1, with field strength of 10 V/m.

The tests are performed with reference voltage, with sample nr. 10.

Results: During the tests the following was observed:

a)	change of the register due to the RF-field:		0.00 kWh
	produced signals of the test output:		0 impulses
b)	the maximum measured influence due to the RF-field was negligible.		
c)	change of the register due to the RF-field:		0.00 kvarh
	produced signals of the test output:		0 impulses
d)	the maximum measured influence due to the RF-field was:	<	0.29 %

The uncertainty of the measurements was 0,4%.

Remark: During the test the following auxilliary circuits were connected:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Photograph of the immunity to RF fields test:

Test: Fast transient bursts

The meter is tested with fast transient bursts. During the tests the voltage and auxiliary circuits were energized with reference voltage.
At least 60 seconds of positive bursts and 60 seconds of negative bursts were applied during each test to the circuits.

The following test is performed:

-	with basic current:	peak value current/voltage circuit	:	4 kV
		peak value auxiliary circuit	:	2 kV

Besides the stated peak value, the fast transient bursts had the following characteristics:

rise time	:	5	ns
peak width	:	50	ns
peak distance	:	200	µs
burst duration	:	15	ms
burst distance	:	300	ms

The test is performed with sample nr. 10.

Results: During the test the influence was negligible.

Remark: During the test the following auxilliary circuits were connected:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Test: Immunity to conducted disturbances, induced by radio-frequency fields

The meter is tested with conducted disturbances according to IEC 61000-4-6, with the characteristics:

frequency	:	0.15 - 80 MHz
voltage level	:	10 V
modulation	:	80% AM, 1 kHz sine wave

The following tests are performed:
- with basic current and power factor = 1, with active energy
- with basic current and power factor = 1, with reactive energy

The tests are performed with reference voltage, with sample nr. 10.

<u>Results:</u> During the tests the following was observed:

- the maximum measured influence due to the RF-field was negligible.

The uncertainty of the measurements was 0,4%.

Remark: During the test the following auxilliary circuits were connected:
- Output relays (R1, R2), RS-485 (X1, X2), Antenna

Test: Surge immunity test

The meter is tested with surges, with the following characteristics:

- cable length	:	1 m
- test mode	:	differential
- phase angle	:	at 60° and 240° relative to zero crossing
- test voltage main circuits	:	4 kV & 6 kV
- test voltage aux. circuits	:	1 kV
- number of tests	:	5 positive and 5 negative
- reptition rate	:	1 / min

meter in operating condition:

- voltage and auxiliary circuits are energized with reference voltage;
- without any current in the current circuits and the current terminals are open circuit.

The test is performed with sample nr. 10 (4 kV) and 6 (6 kV).

Results: During the tests the following was observed:

Change in register during the test	:	0.00	kWh / kvarh
Pulse produced by the test output	:	0	impulses

Change of information after the test : no

Test: Radio interference suppression

The emission of the meter is tested according to CISPR 22, for class B equipment.

The following tests are performed:
a) the radiated emission is measured at an AR in the following frequency range: 30 - 1000 MHz;
b) the emission on the AC mains is measured in the following frequency range: 0,15 - 30 MHz.

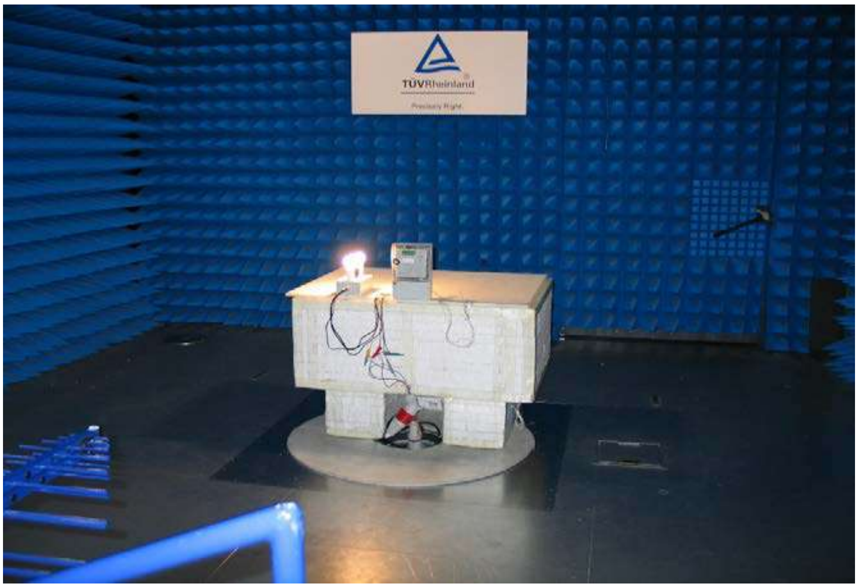
The tests are performed with sample nr. 6.

At each test the emission is measured under the following conditions of the watthourmeter:
- with reference voltage;
- current is 10% of the basic current.

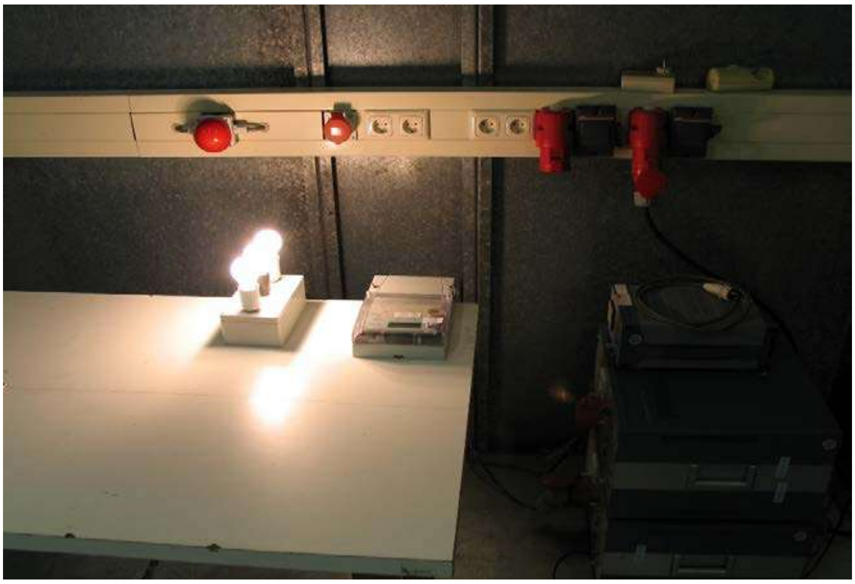
<u>Results:</u> During the tests the following was observed:
a) the maximum measured radiated emission was 24.2 dB(μV)/m at 48.63 MHz.
b) the maximum measured emission on the AC mains was 38.5 dB(μV) at 0.44 MHz.

<u>Remark:</u> The cables have been manipulated in such a way that maximum disturbance levels have been recorded.

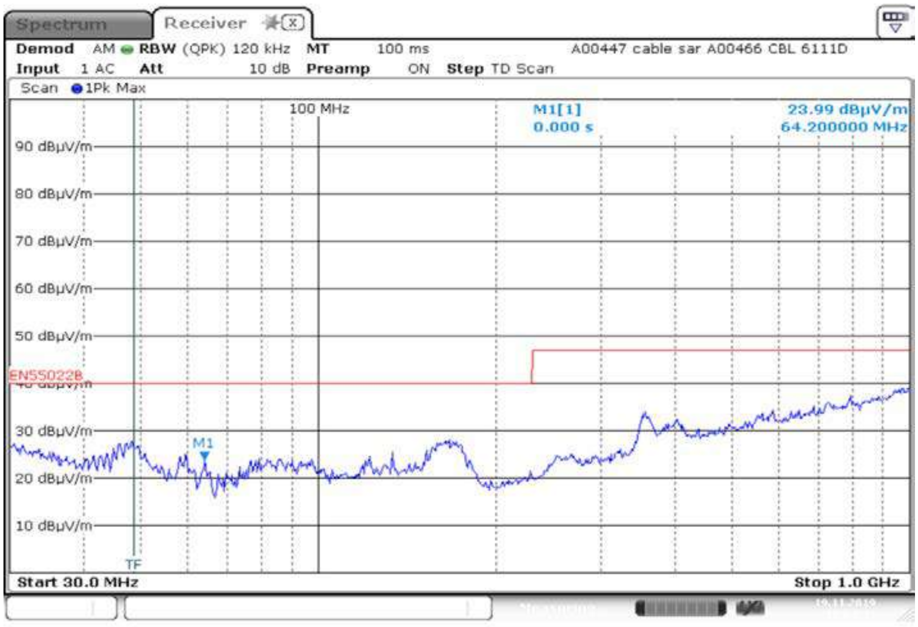
Photograph of the radiated emission test:



Photograph of the conducted emission test:



Plot of the radiated emission test:



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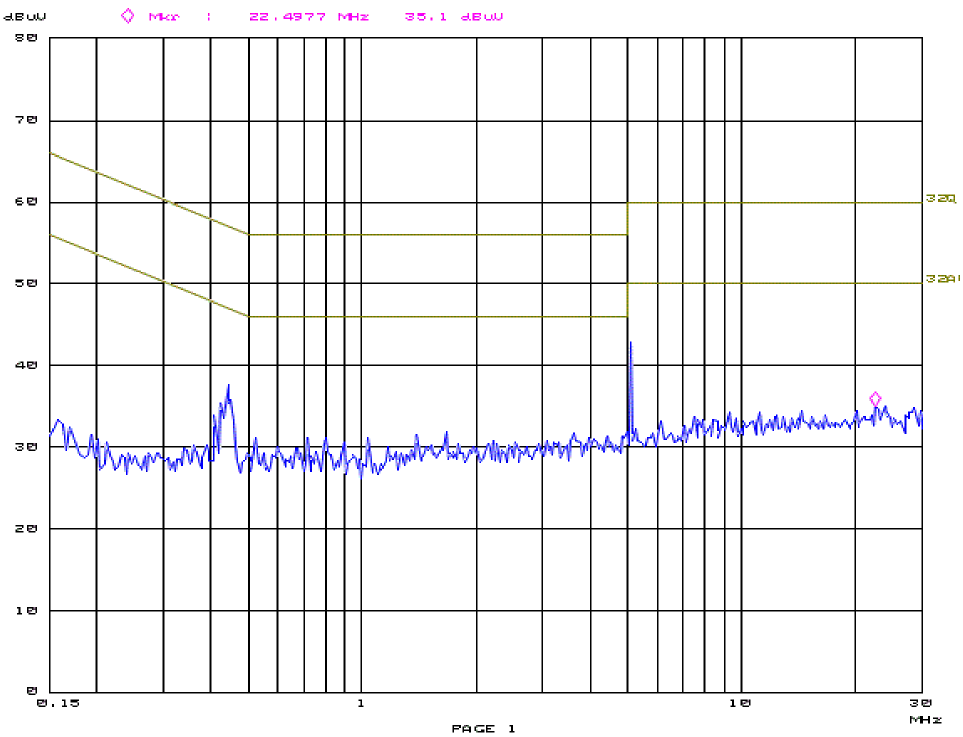
Plot of the conducted emission test:



Test: Test of influence of supply voltage

The meter is tested with interruptions of the voltage. The following interruptions were applied, while voltage and auxiliary circuits were energized with reference voltage and without any current in the current circuits:

a) voltage interruptions of DU=100%
  - interruption time: 1s
  - number of interruptions: 3
  - restoring time between interruptions: 50 ms

b) voltage interruptions of DU=100%
  - interruption time: 20 ms
  - number of interruptions: 1

c) voltage dips of DU=50%
  - dip time: 1 min.
  - number of dips: 1

The tests are performed with sample nr. 4.

Results: During the tests a, b and c the content of the register is not changed, for both active and reactive energy.

Test: Influence of heating

With each current circuit of the meter carrying the maximum current and with each voltage circuit carrying 1,15 times the reference voltage, the temperature rise of the external surface is measured at an ambient temperature of 23 ± 2°C.

Duration of the test: 2 hours
During the test cables are used with an area of 35 square mm.

Results:

Sample nr. 8 1,15 U_{ref}, I_{max}, power factor = 1		
Position of the sensor at the terminal block	back side near terminals, at I-in	back side near terminals, at I-out
temperature at the start [°C]	+ 23.6	+ 23.7
temperature after 2 hours [°C]	+ 55.2	+ 56.3
variation [°C]	+ 31.6	+ 32.6

Damage after the test : no
Compliance with the dielectric strength tests : yes

Remark: Instead of using the prescribed ambient temperature of 40°C (according to section 7.2 of the IEC standard 62052-11), the test is performed at an ambient temperature of 23 ± 2°C, in order to avoid that the temperature control of the used climatic chamber would affect the measurement results.

Based on the decisions made on the IEC TC13 WG11 meeting in Budapest, November 2007, an extra shift of 10 degrees K is allowed for meters with internal breakers.
In total, for meters with internal breakers a maximum shift of 35 degrees K is allowed.

Test: Climatic influences

The watthourmeter is exposed to the following climatic tests:

- dry heat test (70 °C for 72 hours)
- cold test (-25 °C for 72 hours)
- damp heat, cyclic test (upper temperature 40 °C, 6 cycles)

After the test the following dielectric tests are performed:

- an impulse voltage test (peak level 4,8 kV)
- an AC voltage test (test voltage 4 kV)

The dry heat and cold test are performed with sample nr. 2.
The damp heat, cyclic test is performed with sample nr. 2.

Results:

Compliance with dielectric tests	:	yes
Damage after the test or visible corrosion	:	no
Change of information after the test	:	no

Test: Shock test

The meter is exposed to a shock test according to IEC 60068-2-27, under the following conditions:

- meter in non-operating condition
- half-sine pulse
- peak acceleration (m/s^2) : 300
- duration of the pulse (ms) : 18

The test is performed with sample nr. 2.

Result:

Damage after the test	:	no
Change of information after the test	:	no
Correct operation after the test	:	yes

Test: Vibration test

The meter is exposed to vibrations according to IEC 60068-2-6, under the following conditions:

- meter in non-operating condition;
- frequency range [Hz] : 10 - 150
- transition frequency [Hz] : 60
- f<60 Hz, constant amplitude [mm] : 0,075
- f>60 Hz, constant acceleration [m/s^2] : 9,8
- number of sweep cycles per axis : 10

The test is performed with sample nr. 2.

Result:

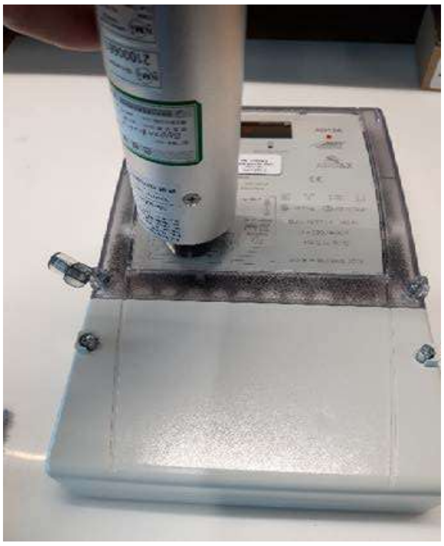
Damage after the test	:	no
Change of information after the test	:	no
Correct operation after the test	:	yes

Test: Spring hammer test

The mechanical strength of the meter case is tested with a spring hammer (IEC 60068-2-75), with a kinetic energy of 0.2 J.

The test is performed with sample nr. 6.

Result: The meter case was not damaged; no affection of the meter functions took place. After the test it was not possible to touch live parts.



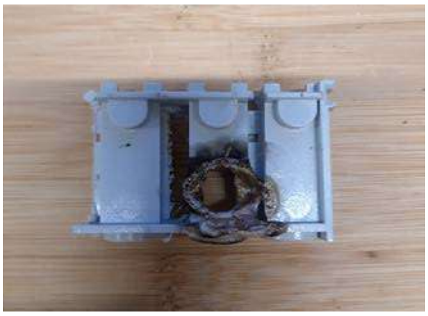
Test: Resistance to heat and fire

The test is carried out according to IEC 60695-2-11, with the following temperatures:

- terminal block : 960 °C
- terminal cover and meter case : 650 °C
- duration : 30 s

The test is performed with a sample of the material.

Result: At 650 °C there was no flame. At 960 °C there was a flame but it extinguished < 3 sec.



Test: Protection against penetration of dust and water

The protection against penetration of dust and water is tested according to IEC 60529, conform IP54.

The test is performed with sample nr. 2 (dust) & 13 (water).

<u>Result:</u> Ingress of dust and water of any quantity to impair the operation of the meter has not been detected. The insulation strength test in accordance with par. 5.4.6 has been carried out and no performance degradation of the insulation properties was detected.

Test: Accuracy tests at reference conditions

The error of the meters is measured under reference conditions at different values of the current and power factor, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Error [%]	
		Sample nr. 4	Sample nr. 8
Imin	1	0.1	0.1
Itr	1	0.1	0.1
	0,5 ind.	0.1	0.2
	0,8 cap.	0.1	0.1
Itr phase R	1	0.1	0.1
	0,5 ind.	0.1	0.2
Itr phase S	1	0.1	0.1
	0,5 ind.	0.1	0.1
Itr phase T	1	0.1	0.1
	0,5 ind.	0.1	0.2
10 Itr	1	0.1	0.1
	0,5 ind.	0.0	0.1
	0,8 cap.	0.1	0.1
10 Itr phase R	1	0.1	0.1
	0,5 ind.	0.0	0.0
10 Itr phase S	1	0.1	0.1
	0,5 ind.	0.0	0.1
10 Itr phase T	1	0.1	0.1
	0,5 ind.	0.0	0.1
Imax	1	0.1	0.1
	0,5 ind.	-0.2	-0.2
	0,8 cap.	0.2	0.2
Imax phase R	1	0.0	0.0
	0,5 ind.	-0.3	-0.2
Imax phase S	1	0.1	0.2
	0,5 ind.	-0.1	-0.1
Imax phase T	1	0.2	0.2
	0,5 ind.	-0.1	-0.1

Remark: Before the measurements were started, the voltage was connected for at least one hour and a current of I_{tr} was running through the meters.

Test: Repeatability

The accuracy measurements at reference conditions are performed 3 times in order to determine the repeatability, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Measure time [s]	Sample nr. 4				
			Error 1 [%]	Error 2 [%]	Error 3 [%]	Average error [%]	Repeatability [%]
Imin	1	240	+ 0.07	+ 0.07	+ 0.08	+ 0.07	+ 0.01
Itr	1	180	+ 0.09	+ 0.09	+ 0.09	+ 0.09	+ 0.00
	0,5 ind.		+ 0.08	+ 0.09	+ 0.08	+ 0.08	+ 0.01
	0,8 cap.		+ 0.07	+ 0.08	+ 0.07	+ 0.07	+ 0.01
Itr phase R	1	180	+ 0.12	+ 0.09	+ 0.09	+ 0.10	+ 0.03
	0,5 ind.		+ 0.09	+ 0.08	+ 0.07	+ 0.08	+ 0.02
Itr phase S	1		+ 0.08	+ 0.08	+ 0.08	+ 0.08	+ 0.00
	0,5 ind.		+ 0.07	+ 0.07	+ 0.07	+ 0.07	+ 0.00
Itr phase T	1		+ 0.07	+ 0.07	+ 0.08	+ 0.07	+ 0.01
	0,5 ind.		+ 0.09	+ 0.08	+ 0.09	+ 0.09	+ 0.01
10 Itr	1	60	+ 0.08	+ 0.08	+ 0.07	+ 0.08	+ 0.01
	0,5 ind.		+ 0.04	+ 0.04	+ 0.04	+ 0.04	+ 0.00
	0,8 cap.		+ 0.09	+ 0.08	+ 0.09	+ 0.09	+ 0.01
10 Itr phase R	1	60	+ 0.07	+ 0.07	+ 0.07	+ 0.07	+ 0.00
	0,5 ind.		+ 0.03	+ 0.03	+ 0.03	+ 0.03	+ 0.00
10 Itr phase S	1		+ 0.06	+ 0.07	+ 0.07	+ 0.07	+ 0.01
	0,5 ind.		+ 0.03	+ 0.02	+ 0.03	+ 0.03	+ 0.01
10 Itr phase T	1		+ 0.05	+ 0.05	+ 0.06	+ 0.05	+ 0.01
	0,5 ind.		+ 0.04	+ 0.05	+ 0.05	+ 0.05	+ 0.01
Imax	1	30	+ 0.07	+ 0.06	+ 0.06	+ 0.06	+ 0.01
	0,5 ind.		− 0.18	− 0.18	− 0.18	− 0.18	+ 0.00
	0,8 cap.		+ 0.18	+ 0.18	+ 0.18	+ 0.18	+ 0.00
Imax phase R	1	30	+ 0.00	+ 0.01	+ 0.00	+ 0.00	+ 0.01
	0,5 ind.		− 0.27	− 0.26	− 0.26	− 0.26	+ 0.01
Imax phase S	1		+ 0.15	+ 0.15	+ 0.14	+ 0.15	+ 0.01
	0,5 ind.		− 0.12	− 0.12	− 0.11	− 0.12	+ 0.01
Imax phase T	1		+ 0.16	+ 0.15	+ 0.15	+ 0.15	+ 0.01
	0,5 ind.		− 0.07	− 0.07	− 0.07	− 0.07	+ 0.00

Current	Power factor	Measure time [s]	Sample nr. 8				
			Error 1 [%]	Error 2 [%]	Error 3 [%]	Average error [%]	Repeatability [%]
Imin	1	240	+ 0.14	+ 0.13	+ 0.14	+ 0.14	+ 0.01
Itr	1	180	+ 0.13	+ 0.11	+ 0.12	+ 0.12	+ 0.02
	0,5 ind.		+ 0.17	+ 0.18	+ 0.17	+ 0.17	+ 0.01
	0,8 cap.		+ 0.10	+ 0.09	+ 0.10	+ 0.10	+ 0.01
Itr phase R	1	180	+ 0.11	+ 0.15	+ 0.13	+ 0.13	+ 0.04
	0,5 ind.		+ 0.15	+ 0.16	+ 0.16	+ 0.16	+ 0.01
Itr phase S	1		+ 0.11	+ 0.10	+ 0.11	+ 0.11	+ 0.01
	0,5 ind.		+ 0.13	+ 0.13	+ 0.13	+ 0.13	+ 0.00
Itr phase T	1		+ 0.14	+ 0.14	+ 0.14	+ 0.14	+ 0.00
	0,5 ind.		+ 0.19	+ 0.20	+ 0.20	+ 0.20	+ 0.01
10 Itr	1	60	+ 0.09	+ 0.10	+ 0.10	+ 0.10	+ 0.01
	0,5 ind.		+ 0.07	+ 0.07	+ 0.07	+ 0.07	+ 0.00
	0,8 cap.		+ 0.09	+ 0.10	+ 0.10	+ 0.10	+ 0.01
10 Itr phase R	1	60	+ 0.09	+ 0.10	+ 0.07	+ 0.09	+ 0.03
	0,5 ind.		+ 0.04	+ 0.03	+ 0.04	+ 0.04	+ 0.01
10 Itr phase S	1		+ 0.10	+ 0.10	+ 0.10	+ 0.10	+ 0.00
	0,5 ind.		+ 0.07	+ 0.06	+ 0.06	+ 0.06	+ 0.01
10 Itr phase T	1		+ 0.13	+ 0.12	+ 0.13	+ 0.13	+ 0.01
	0,5 ind.		+ 0.13	+ 0.13	+ 0.13	+ 0.13	+ 0.00
Imax	1	30	+ 0.08	+ 0.07	+ 0.07	+ 0.07	+ 0.01
	0,5 ind.		− 0.17	− 0.17	− 0.17	− 0.17	+ 0.00
	0,8 cap.		+ 0.20	+ 0.22	+ 0.20	+ 0.21	+ 0.02
Imax phase R	1	30	+ 0.00	+ 0.02	+ 0.01	+ 0.01	+ 0.02
	0,5 ind.		− 0.23	− 0.21	− 0.22	− 0.22	+ 0.02
Imax phase S	1		+ 0.19	+ 0.19	+ 0.19	+ 0.19	+ 0.00
	0,5 ind.		− 0.09	− 0.09	− 0.08	− 0.09	+ 0.01
Imax phase T	1		+ 0.18	+ 0.17	+ 0.17	+ 0.17	+ 0.01
	0,5 ind.		− 0.11	− 0.10	− 0.10	− 0.10	+ 0.01

Test: Variation of the error due to variation of the voltage

The variation of the error is measured due to variation of the voltage at different currents and at different values of the power factor, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Sample nr. 4	
		Shift 1,1 U_{ref} [%]	Shift 0,9 U_{ref} [%]
Imin	1	– 0.0	– 0.0
Itr	1 0,5 ind. 0,8 cap.	– 0.0 – 0.0 – 0.0	– 0.0 + 0.0 – 0.0
Itr phase R	1 0,5 ind.	+ 0.1 + 0.0	+ 0.0 – 0.0
Itr phase S	1 0,5 ind.	– 0.0 + 0.0	+ 0.0 + 0.0
Itr phase T	1 0,5 ind.	– 0.0 + 0.0	– 0.0 + 0.0
10 Itr	1 0,5 ind. 0,8 cap.	+ 0.0 – 0.0 – 0.0	+ 0.0 – 0.0 + 0.0
10 Itr phase R	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
10 Itr phase S	1 0,5 ind.	– 0.0 – 0.0	+ 0.0 – 0.0
10 Itr phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Imax	1 0,5 ind. 0,8 cap.	– 0.0 + 0.0 – 0.0	+ 0.0 + 0.0 + 0.0
Imax phase R	1 0,5 ind.	– 0.0 + 0.0	– 0.0 + 0.0
Imax phase S	1 0,5 ind.	+ 0.0 + 0.0	– 0.0 + 0.0
Imax phase T	1 0,5 ind.	+ 0.0 + 0.0	– 0.0 + 0.0

Current	Power factor	Sample nr. 8	
		Shift 1,1 U_{ref} [%]	Shift 0,9 U_{ref} [%]
Imin	1	– 0.0	– 0.0
Itr	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 – 0.0	+ 0.0 + 0.0 – 0.0
Itr phase R	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 – 0.0
Itr phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Itr phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 – 0.0
10 Itr	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
10 Itr phase R	1 0,5 ind.	– 0.1 – 0.0	– 0.0 + 0.0
10 Itr phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
10 Itr phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Imax	1 0,5 ind. 0,8 cap.	– 0.0 + 0.0 – 0.0	+ 0.0 + 0.0 + 0.0
Imax phase R	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 – 0.0
Imax phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Imax phase T	1 0,5 ind.	– 0.0 + 0.0	– 0.0 + 0.0

Test: Variation of the error due to variation of the frequency

The variation of the error is measured at the stated changes of the frequency at different values of the current and the power factor, while using the test points as indicated in table 13 of the EN 50470-3 document.

Results:

Current	Power factor	Sample nr. 4	
		Shift 51 Hz [%]	Shift 49 Hz [%]
Imin	1	+ 0.0	– 0.0
Itr	1 0,5 ind. 0,8 cap.	+ 0.0 – 0.0 – 0.0	+ 0.0 + 0.0 – 0.0
Itr phase R	1 0,5 ind.	+ 0.0 + 0.0	– 0.0 + 0.0
Itr phase S	1 0,5 ind.	– 0.0 – 0.0	+ 0.0 + 0.0
Itr phase T	1 0,5 ind.	– 0.0 – 0.0	– 0.0 + 0.0
10 Itr	1 0,5 ind. 0,8 cap.	– 0.0 – 0.0 + 0.0	– 0.0 + 0.0 – 0.0
10 Itr phase R	1 0,5 ind.	– 0.0 – 0.0	– 0.0 + 0.0
10 Itr phase S	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 + 0.0
10 Itr phase T	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 + 0.0
Imax	1 0,5 ind. 0,8 cap.	+ 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
Imax phase R	1 0,5 ind.	+ 0.0 – 0.0	– 0.0 – 0.0
Imax phase S	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0
Imax phase T	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 + 0.0

Current	Power factor	Sample nr. 8	
		Shift 51 Hz [%]	Shift 49 Hz [%]
Imin	1	– 0.0	– 0.0
Itr	1 0,5 ind. 0,8 cap.	+ 0.0 – 0.0 – 0.0	– 0.0 + 0.0 – 0.0
Itr phase R	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 – 0.0
Itr phase S	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 – 0.0
Itr phase T	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 + 0.0
10 Itr	1 0,5 ind. 0,8 cap.	+ 0.0 – 0.0 + 0.0	+ 0.0 + 0.0 – 0.0
10 Itr phase R	1 0,5 ind.	+ 0.0 + 0.0	– 0.0 + 0.0
10 Itr phase S	1 0,5 ind.	+ 0.0 – 0.0	– 0.0 + 0.0
10 Itr phase T	1 0,5 ind.	+ 0.0 – 0.0	+ 0.0 + 0.0
Imax	1 0,5 ind. 0,8 cap.	– 0.0 + 0.0 + 0.0	+ 0.0 + 0.0 + 0.0
Imax phase R	1 0,5 ind.	– 0.0 – 0.0	– 0.0 – 0.0
Imax phase S	1 0,5 ind.	– 0.0 – 0.0	– 0.0 + 0.0
Imax phase T	1 0,5 ind.	+ 0.0 + 0.0	+ 0.0 + 0.0

Test: Variation of the error due to variation of the temperature

The variation of the error is measured due to variation of the temperature at different currents and at different values of the power factor, as indicated in table 13 of the EN 50470-3 document.
At each temperature the shift is calculated in comparison with the measurement at 23°C.

Results:

Current	Power factor	Sample nr. 4						
		Shift -40°C [%]	Shift -25°C [%]	Shift -10°C [%]	Shift +5°C [%]	Shift +40°C [%]	Shift +55°C [%]	Shift +70°C [%]
Imin	1	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.2
Itr	1	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.2
	0,5 ind.	-0.2	-0.2	-0.1	-0.1	0.1	0.2	0.2
	0,8 cap.	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.1
Itr phase R	1	0.5	0.3	0.1	0.1	-0.1	-0.2	-0.3
	0,5 ind.	0.5	0.3	0.2	0.0	-0.1	-0.1	-0.2
Itr phase S	1	-0.6	-0.5	-0.3	-0.2	0.1	0.3	0.4
	0,5 ind.	-0.6	-0.4	-0.3	-0.2	0.1	0.3	0.5
Itr phase T	1	-0.5	-0.4	-0.2	-0.1	0.2	0.3	0.4
	0,5 ind.	-0.4	-0.3	-0.2	-0.1	0.2	0.3	0.5
10 Itr	1	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.1
	0,5 ind.	-0.2	-0.2	-0.1	-0.1	0.1	0.2	0.2
	0,8 cap.	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.1
10 Itr phase R	1	0.5	0.3	0.2	0.1	-0.1	-0.2	-0.3
	0,5 ind.	0.5	0.3	0.2	0.0	-0.1	-0.1	-0.2
10 Itr phase S	1	-0.6	-0.5	-0.3	-0.2	0.1	0.3	0.4
	0,5 ind.	-0.6	-0.4	-0.3	-0.2	0.1	0.3	0.4
10 Itr phase T	1	-0.5	-0.4	-0.2	-0.1	0.2	0.3	0.4
	0,5 ind.	-0.5	-0.3	-0.2	-0.1	0.1	0.3	0.5
Imax	1	-0.2	-0.2	-0.1	0.0	0.0	0.1	0.1
	0,5 ind.	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.1
	0,8 cap.	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.0
Imax phase R	1	0.5	0.3	0.3	0.1	-0.2	-0.3	-0.6
	0,5 ind.	0.5	0.3	0.2	0.1	-0.1	-0.2	-0.5
Imax phase S	1	-0.6	-0.5	-0.3	-0.2	0.1	0.3	0.4
	0,5 ind.	-0.6	-0.5	-0.4	-0.2	0.2	0.3	0.5
Imax phase T	1	-0.5	-0.4	-0.2	-0.1	0.1	0.3	0.4
	0,5 ind.	-0.5	-0.4	-0.3	-0.2	0.1	0.3	0.4

Current	Power factor	Sample nr. 8						
		Shift -40°C [%]	Shift -25°C [%]	Shift -10°C [%]	Shift +5°C [%]	Shift +40°C [%]	Shift +55°C [%]	Shift +70°C [%]
Imin	1	-0.3	-0.2	-0.2	-0.1	0.1	0.2	0.3
Itr	1	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.2
	0,5 ind.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.3
	0,8 cap.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.2
Itr phase R	1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
	0,5 ind.	-0.1	0.0	-0.1	0.0	0.0	0.1	0.1
Itr phase S	1	-0.6	-0.5	-0.3	-0.2	0.2	0.3	0.5
	0,5 ind.	-0.6	-0.5	-0.3	-0.2	0.2	0.3	0.4
Itr phase T	1	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.2
	0,5 ind.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.3
10 Itr	1	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.2
	0,5 ind.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.3
	0,8 cap.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.2
10 Itr phase R	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.1	0.1
10 Itr phase S	1	-0.6	-0.5	-0.3	-0.2	0.2	0.3	0.4
	0,5 ind.	-0.6	-0.5	-0.3	-0.2	0.2	0.3	0.4
10 Itr phase T	1	-0.4	-0.3	-0.2	-0.1	0.1	0.2	0.2
	0,5 ind.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.3
Imax	1	-0.3	-0.2	-0.2	-0.1	0.1	0.1	0.2
	0,5 ind.	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.2
	0,8 cap.	-0.3	-0.2	-0.2	-0.1	0.1	0.1	0.1
Imax phase R	1	0.0	0.1	0.0	0.0	0.0	-0.1	-0.2
	0,5 ind.	0.0	0.1	0.0	0.0	0.0	-0.1	-0.2
Imax phase S	1	-0.6	-0.5	-0.3	-0.2	0.2	0.3	0.4
	0,5 ind.	-0.7	-0.5	-0.4	-0.2	0.2	0.3	0.5
Imax phase T	1	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.3
	0,5 ind.	-0.4	-0.3	-0.2	-0.1	0.1	0.2	0.3

Test: Maximum permissible error

For each measuring point the composite error is calculated by using the following formula:

$$e_c = \sqrt{e^2(I, \cos\varphi) + \delta e^2(T, I, \cos\varphi) + \delta e^2(U, I, \cos\varphi) + \delta e^2(f, I, \cos\varphi)}$$

with:

- $e(I, \cos\varphi)$ = the intrinsic error of the meter at a certain load;
- $\delta e(T, I, \cos\varphi)$ = the additional percentage error due to the variation of the temperature at the same load;
- $\delta e(U, I, \cos\varphi)$ = the additional percentage error due to the variation of the voltage at the same load;
- $\delta e(f, I, \cos\varphi)$ = the additional percentage error due to the variation of the frequency at the same load.

Results:

Current	Power factor	Sample nr. 4							
		Error -40°C [%]	Error -25°C [%]	Error -10°C [%]	Error +5°C [%]	Error +23°C [%]	Error +40°C [%]	Error +55°C [%]	Error +70°C [%]
Imin	1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Itr	1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
	0,5 ind.	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.3
	0,8 cap.	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Itr phase R	1	0.5	0.3	0.2	0.1	0.1	0.2	0.2	0.3
	0,5 ind.	0.5	0.3	0.2	0.1	0.1	0.1	0.1	0.2
Itr phase S	1	0.6	0.5	0.3	0.2	0.1	0.2	0.3	0.4
	0,5 ind.	0.6	0.4	0.3	0.2	0.1	0.1	0.3	0.5
Itr phase T	1	0.5	0.4	0.3	0.1	0.1	0.2	0.3	0.4
	0,5 ind.	0.4	0.4	0.3	0.2	0.1	0.2	0.3	0.5
10 Itr	1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2
	0,5 ind.	0.2	0.2	0.1	0.1	0.0	0.1	0.2	0.2
	0,8 cap.	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10 Itr phase R	1	0.5	0.3	0.2	0.1	0.1	0.2	0.2	0.4
	0,5 ind.	0.5	0.3	0.2	0.0	0.0	0.1	0.1	0.2
10 Itr phase S	1	0.6	0.5	0.3	0.2	0.1	0.2	0.3	0.4
	0,5 ind.	0.6	0.4	0.3	0.2	0.0	0.1	0.3	0.4
10 Itr phase T	1	0.5	0.4	0.2	0.1	0.1	0.2	0.3	0.4
	0,5 ind.	0.5	0.3	0.3	0.1	0.1	0.2	0.3	0.5
Imax	1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
	0,5 ind.	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
	0,8 cap.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Imax phase R	1	0.5	0.3	0.3	0.1	0.0	0.2	0.3	0.6
	0,5 ind.	0.6	0.4	0.4	0.3	0.3	0.3	0.3	0.5
Imax phase S	1	0.6	0.5	0.3	0.2	0.1	0.2	0.3	0.4
	0,5 ind.	0.6	0.5	0.4	0.2	0.1	0.2	0.4	0.5
Imax phase T	1	0.5	0.4	0.3	0.2	0.2	0.2	0.3	0.4
	0,5 ind.	0.5	0.4	0.3	0.2	0.1	0.2	0.3	0.4

Current	Power factor	Sample nr. 8							
		Error -40°C [%]	Error -25°C [%]	Error -10°C [%]	Error +5°C [%]	Error +23°C [%]	Error +40°C [%]	Error +55°C [%]	Error +70°C [%]
Imin	1	0.4	0.3	0.2	0.2	0.1	0.2	0.2	0.3
Itr	1	0.3	0.3	0.2	0.2	0.1	0.2	0.2	0.3
	0,5 ind.	0.4	0.3	0.3	0.2	0.2	0.2	0.3	0.4
	0,8 cap.	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2
Itr phase R	1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,5 ind.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Itr phase S	1	0.6	0.5	0.3	0.2	0.1	0.2	0.3	0.5
	0,5 ind.	0.6	0.5	0.3	0.2	0.1	0.2	0.4	0.5
Itr phase T	1	0.4	0.3	0.2	0.2	0.1	0.2	0.2	0.3
	0,5 ind.	0.4	0.3	0.3	0.2	0.2	0.2	0.3	0.3
10 Itr	1	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2
	0,5 ind.	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.3
	0,8 cap.	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2
10 Itr phase R	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10 Itr phase S	1	0.6	0.5	0.3	0.2	0.1	0.2	0.3	0.4
	0,5 ind.	0.6	0.5	0.3	0.2	0.1	0.2	0.3	0.4
10 Itr phase T	1	0.4	0.3	0.2	0.2	0.1	0.2	0.2	0.3
	0,5 ind.	0.4	0.3	0.2	0.2	0.1	0.2	0.2	0.3
Imax	1	0.3	0.2	0.2	0.1	0.1	0.1	0.2	0.2
	0,5 ind.	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.3
	0,8 cap.	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Imax phase R	1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2
	0,5 ind.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Imax phase S	1	0.7	0.5	0.4	0.3	0.2	0.2	0.4	0.5
	0,5 ind.	0.7	0.5	0.4	0.2	0.1	0.2	0.3	0.5
Imax phase T	1	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.3
	0,5 ind.	0.4	0.3	0.2	0.2	0.1	0.2	0.2	0.3

Test: One phase export, remaining phases import

The meter is examined with:
- one phase loaded with export energy;
- remaining phases loaded with import energy.

In the table below it is indicated in which phase export energy is flowing.

I [%] of I_b	Error [%] Sample nr. 4								
	cos(f)=1			cos(f)=0,5 ind.			cos(f)=0,8 cap.		
	export phase			export phase			export phase		
	R	S	T	R	S	T	R	S	T
5	+ 0.0	+ 0.0	+ 0.1						
10	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.0	+ 0.0	+ 0.0	+ 0.1
100	+ 0.0	+ 0.1	+ 0.1	+ 0.0	+ 0.0	− 0.0	+ 0.1	+ 0.1	+ 0.1
Imax	+ 0.1	− 0.1	+ 0.0	− 0.1	− 0.3	− 0.3	+ 0.3	+ 0.0	+ 0.1

I [%] of I_b	Error [%] Sample nr. 8								
	cos(f)=1			cos(f)=0,5 ind.			cos(f)=0,8 cap.		
	export phase			export phase			export phase		
	R	S	T	R	S	T	R	S	T
5	+ 0.2	+ 0.1	+ 0.1						
10	+ 0.2	+ 0.1	+ 0.1	+ 0.3	+ 0.2	+ 0.1	+ 0.1	+ 0.1	+ 0.1
100	+ 0.2	+ 0.1	+ 0.1	+ 0.2	+ 0.1	− 0.1	+ 0.2	+ 0.1	+ 0.1
Imax	+ 0.3	− 0.1	+ 0.0	− 0.0	− 0.2	− 0.3	+ 0.4	+ 0.0	+ 0.1

The meter is examined with:
- one phase loaded with 20% Ib export energy;
- remaining phases loaded with Ib import energy.

In the table below it is indicated in which phase export energy is flowing.

Sample nr. 4 Error [%]					
cos(f)=1			cos(f)=0,5 ind.		
export phase			export phase		
R	S	T	R	S	T
+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1

Sample nr. 8 Error [%]					
cos(f)=1			cos(f)=0,5 ind.		
export phase			export phase		
R	S	T	R	S	T
+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.1

The correct operation of the energy register(s) has been verified.

Type evaluation report

Issued by	:	NMi Certin B.V. Thijsseweg 11 2629 JA Delft The Netherlands
Applicant	:	S.C."ADD-PRODUCTION" S.R.L. 36, Dragomirna str. MD-2008, Chisianau Republic of Moldova
Measuring instrument	:	**A poly phase static watthourmeter** Manufacturer : S.C."ADD-PRODUCTION" S.R.L. Type : AD13A (Direct connected)
Test specifications	:	- IEC 62052-11 ed. 2 (CD2) "Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment" - IEC 62053-21 ed. 2 (CD2) "Electricity metering equipment (AC) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)" - IEC 61000-4-19 - "Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports"
Testing period	:	January 2020
Issue date	:	2 March 2020

Performed by: Reviewed by:

J.M.J. Boereboom
Approvals Expert

M.P. Cloo
Senior Approvals Expert

NMi Certin B.V.
Thijsseweg 11
2629 JA Delft
The Netherlands
T +31 88 636 2332
certin@nmi.nl
www.nmi.nl

Tests	:	The meters as specified in annex 2 were tested for compliance with the standards as specified on page 1 of this type evaluation report. The performed tests are stated in annex 1. If applicable specific test conditions are stated at each test.
Results		See annex 1 of this type evaluation report The meter fulfils the general requirements of the IEC 62052-11, and the requirements for class 1 of the IEC 62053-21 for all performed tests.
Uncertainty	:	The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which provides a confidence level of approximately 95%. The total uncertainty of the measurements of the error of indication is 0,15% for power factor=1, and 0,20% for power factor=0,5 inductive or power factor=0,8 capacitive. The total uncertainty in the measurements of power is 0,02 W.
Annexes	:	The complete type evaluation report consists of the following annexes:

annex 1 : performed tests
annex 2 : characteristics of the tested meters
annex 3 : test data

Annex 1: Performed tests

In the following tables the performed tests are indicated with the accompanying results, as well as the page number of the appertaining annex where the results are presented.

article IEC 62052-11	tests:	passed	failed	not applicable	not performed	annex 3 page
9.3.8 / Annex G	**IEC 61000-4-19 - Differential mode current disturbances**					
	- test waves profile: “CW Pulse with pause"	√				1
	- test waves profile: “rectangular modulated - 3 Hz"	√				2
	- test waves profile: “rectangular modulated - 101 Hz"	√				3
	- test waves profile: “rectangular modulated - 301 Hz"	√				4
	- test waves profile: “rectangular modulated - 601 Hz"	√				5

Performance criteria description:

criteria A

A temporary degradation or loss of primary functions is not acceptable:

1) energy registration: at any time during the test the additional energy measurement error due to an influence quantity shall not exceed the limits specified in the relevant accuracy class standards,
2) indicating display: the indication of the content of energy registers shall remain unambiguously readable, even though degradation of display quality (colour, brightness, contrast, sharpness, geometry, etc.) during the test is acceptable,
3) supply and load control switches: unexpected operation of the switch during the test shall not occur;

A temporary degradation or loss of other meter functions is acceptable;

The measurements are performed at a reference temperature of 23±2 °C, unless an other temperature is stated.

Annex 2: Characteristics of the tested watthour meters

Sample number	Model	Serial number	Year of fabrication	I_b [A]	I_{max} [A]	U_{ref} [V]	f_{ref} [Hz]	Meter constant [imp./kWh]
1	AD13A	13259600	2019	5	100	3x230/400	50	1,000

Accuracy class: 1 IEC 62053-21
B EN 50470-3

Software version:* 8.1.02 Checksum A925C2EA
Hardware version: Main board 758728.498
Antenna board 758728.425

Remarks: The results as mentioned in this type evaluation report relate only to the meters which are tested.

* Based on documentation provided by the manufacturer software version 8.1.03 with checksum 8655B9CC is also approved.

Photograph:


AD13A
1000 imp/kWh
1000 imp/kvarh
PRODUCTION
PN: 2375062
ADD AD13A (DC)
Sample 1
13259600
ADDAX
36, Dragomirna str., MD-2008
Chisinau, Republic of Moldova
RS-485-2
R1
R2
RS-485-1
ANTENNA
1 3 4 6 7 9 10 12
-ACTIVE
-REACTIVE
0.25-5(100) A 50Hz
3 x 230/400 V
-40 °C to 70 °C
Made in Moldova 2019

Annex 3: Test data

Test: Differential mode current disturbances - CW Pulses with pause

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

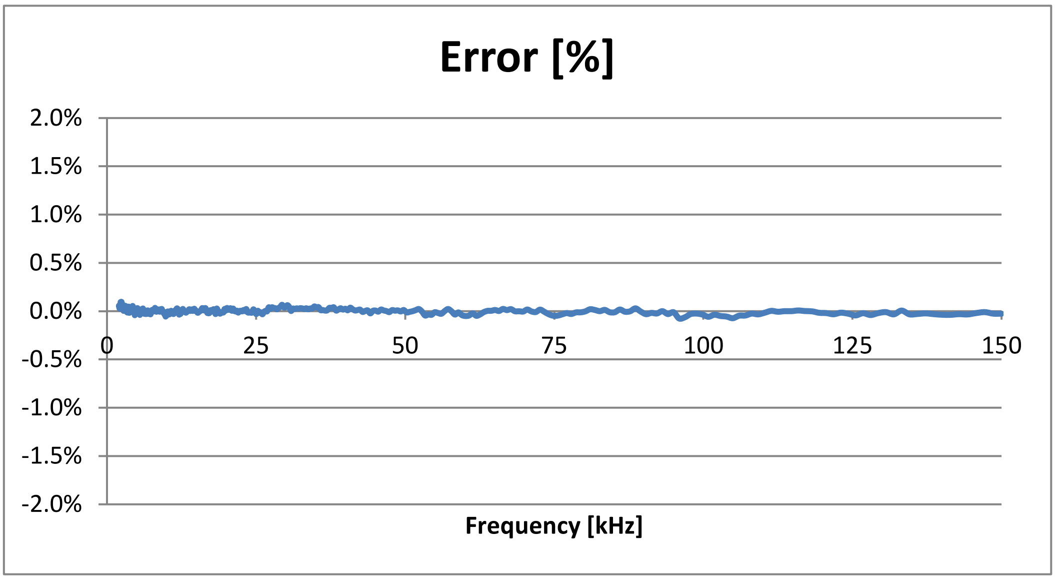
The disturbances are applied with the following characteristics:

- test wave profile:	CW pulses with pause		
- test level:	Level 3, as specified below		
	2-30 kHz:	3 A	
	30-150 kHz:	1,5 A	
- frequency step:	1%		
- dwell time:	3 s minimally		

The tests are performed with sample no. 1.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,1%.



Test: Differential mode current disturbances - rectangularly modulated - 3 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

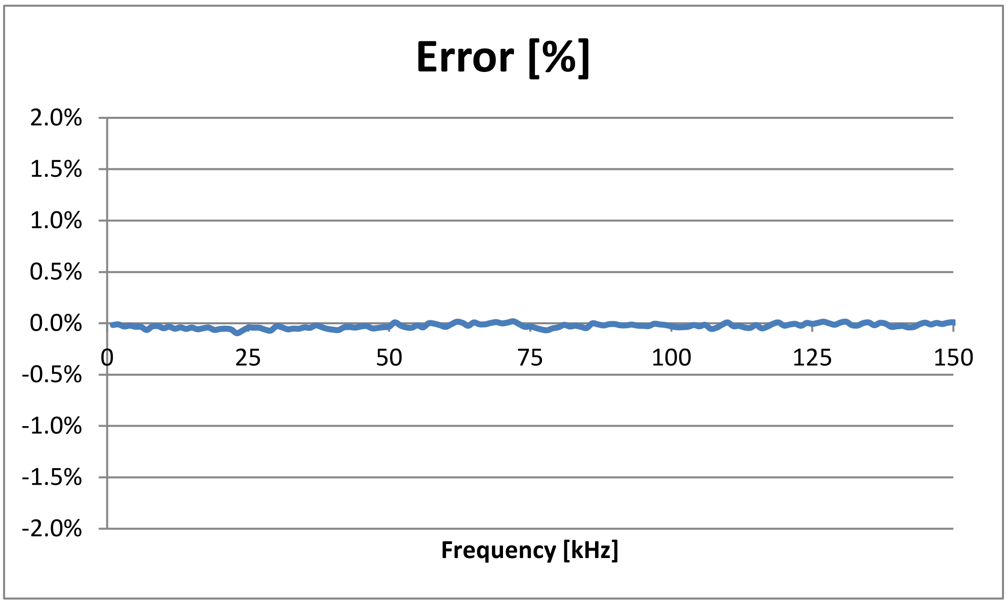
The disturbances are applied with the following characteristics:

- test wave profile:	rectangular modulated, 3 Hz	
- test level:	Level 3, as specified below:	
	2-30 kHz:	3 A
	30-150 kHz:	1,5 A
- frequency step:	1%	
- dwell time:	3 s minimally	

The tests are performed with sample no. 1.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,1%.



Test: Differential mode current disturbances - rectangularly modulated - 101 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

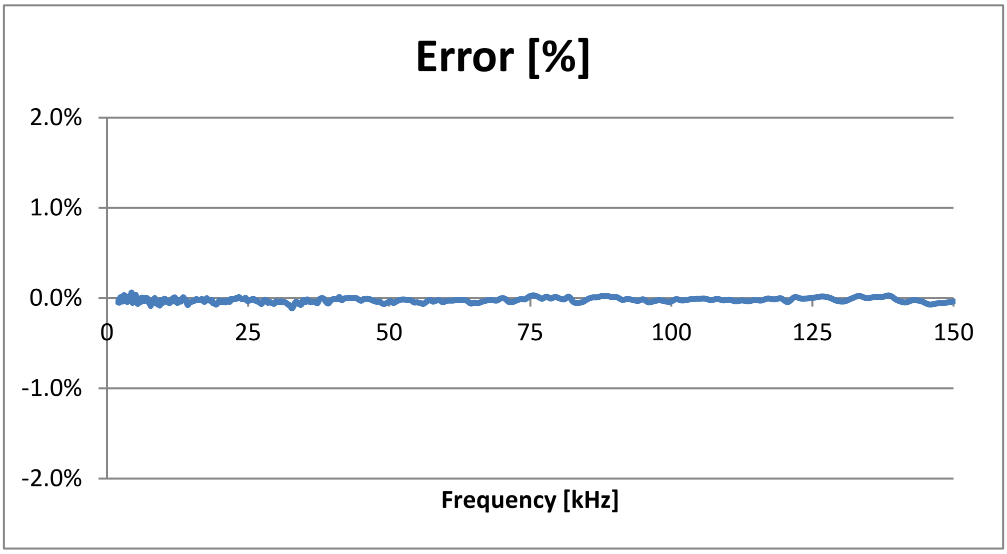
The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor one = 1.

The disturbances are applied with the following characteristics:
- test wave profile: rectangular modulated, 101 Hz
- test level: Level 3, as specified below:
  - 2-30 kHz: 3 A
  - 30-150 kHz: 1,5 A
- frequency step: 1%
- dwell time: 3 s minimally

The tests are performed with sample no. 1.

<u>Results:</u> No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,11%.



Test: Differential mode current disturbances - rectangularly modulated - 301 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

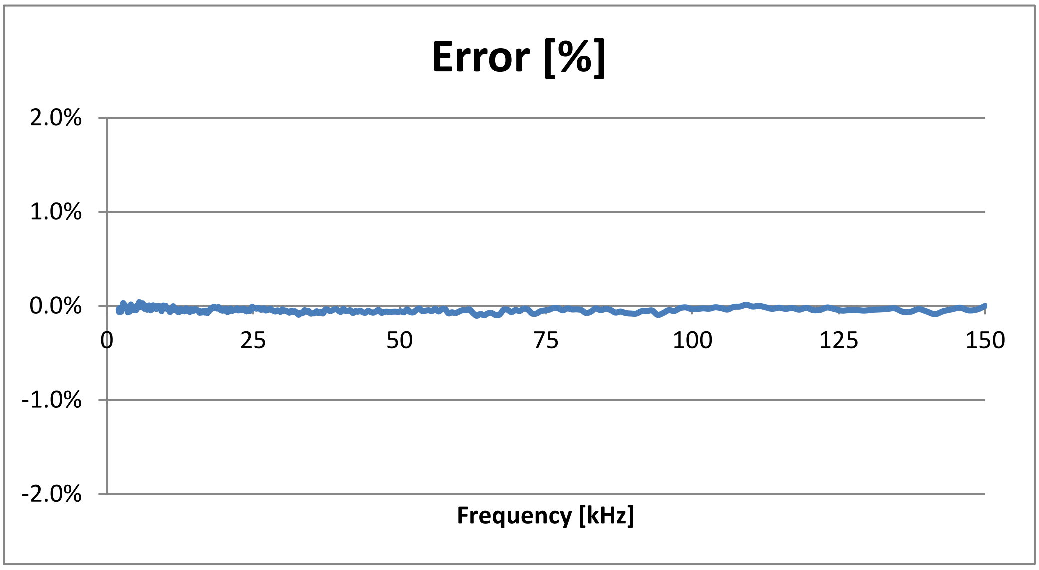
The disturbances are applied with the following characteristics:

- test wave profile:	rectangular modulated, 301 Hz	
- test level:	Level 3, as specified below:	
	2-30 kHz:	3 A
	30-150 kHz:	1,5 A
- frequency step:	1%	
- dwell time:	3 s minimally	

The tests are performed with sample no. 1.

<u>Results:</u> No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,1%.



Test: Differential mode current disturbances - rectangularly modulated - 601 Hz

The meter is tested with differential mode current disturbances in the frequency range 2 kHz to 150 kHz, according to IEC 61000-4-19.

The measurements are performed under the following conditions:
- Voltage and auxiliary power circuits energized with nominal voltage;
- with basic current;
- power factor = 1.

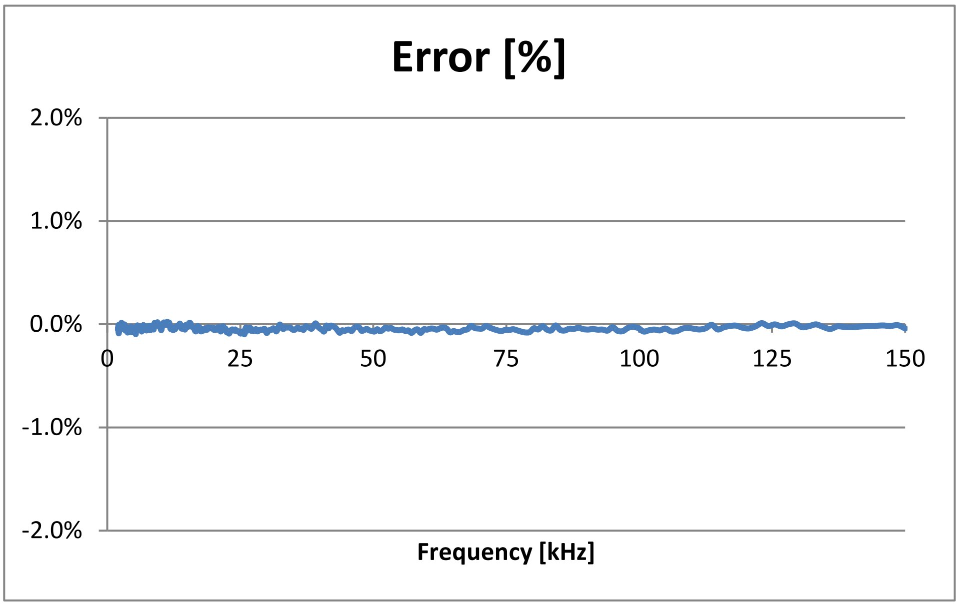
The disturbances are applied with the following characteristics:

- test wave profile:	rectangular modulated, 601 Hz	
- test level:	Level 3, as specified below:	
	2-30 kHz:	3 A
	30-150 kHz:	1,5 A
- frequency step:	1%	
- dwell time:	3 s minimally	

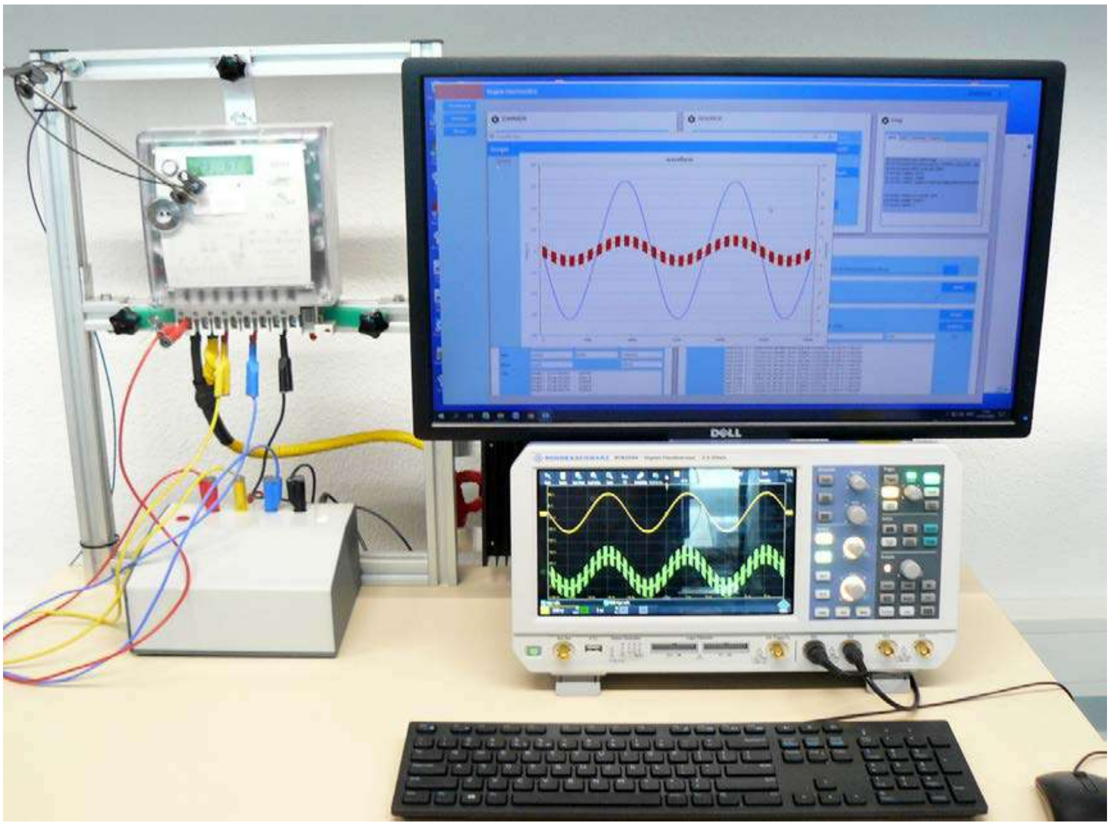
The tests are performed with sample no. 1.

Results: No degradation of the primary functions was observed.

During the tests the maximum observed deviation was: ±0,1%.



Photograph: Test setup



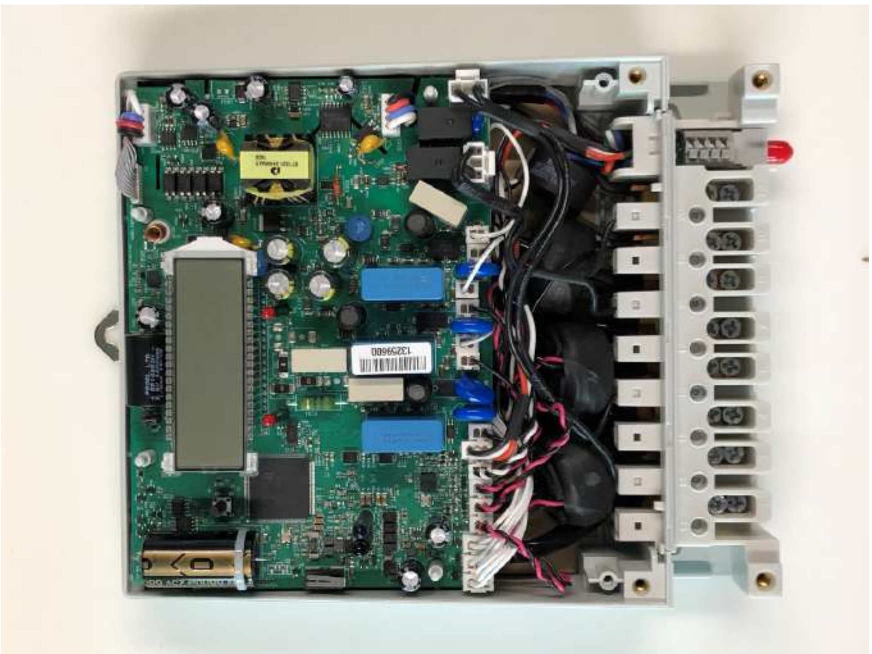
Documentation folder

Number **T11778-1**
Project number 2375062

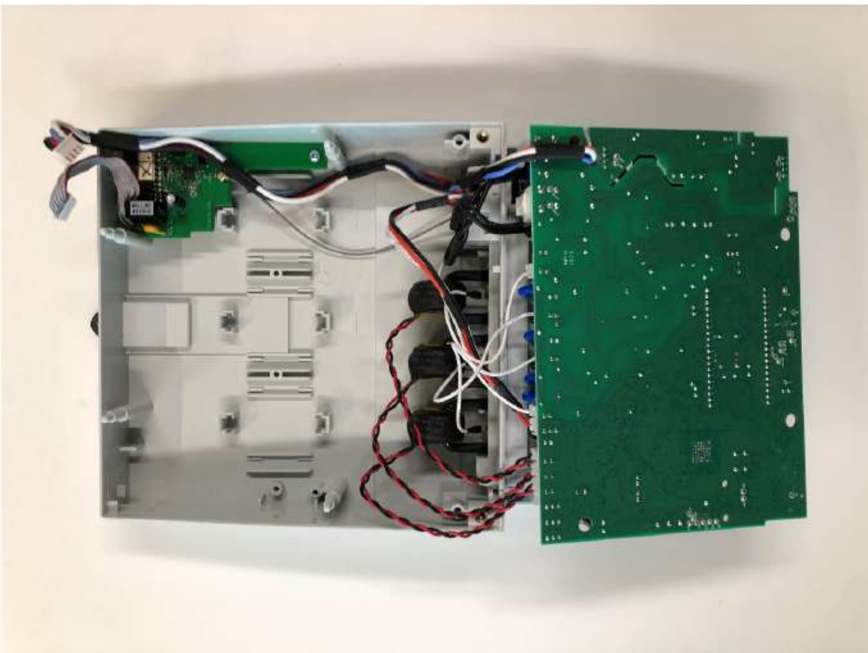
Number	Pages	Description	Remark
11778/0-01	7	Photographs	Example
11778/0-02	3	Type designation	-
11778/0-03	2	Markings	Example
11778/0-04	1	Current sensor DC	-
11778/0-05	2	Current sensor CT	-
11778/0-06	8	Supply Control Switch	- DC only
11778/0-07	5	Display / error messages	-
11778/0-08	1	Terminal block DC	-
11778/0-09	1	Terminal block CT	-
11778/0-10	1	Sealing	Example
		Main printed circuit board	
11778/0-11	1	- Assembly	-
11778/0-12	4	- Parts list DC	-
11778/0-13	4	- Parts list CT	-
		Antenna printed circuit board	
11778/0-14	1	- Assembly	-
11778/0-15	1	- Parts list	-

Housing

Terminal block

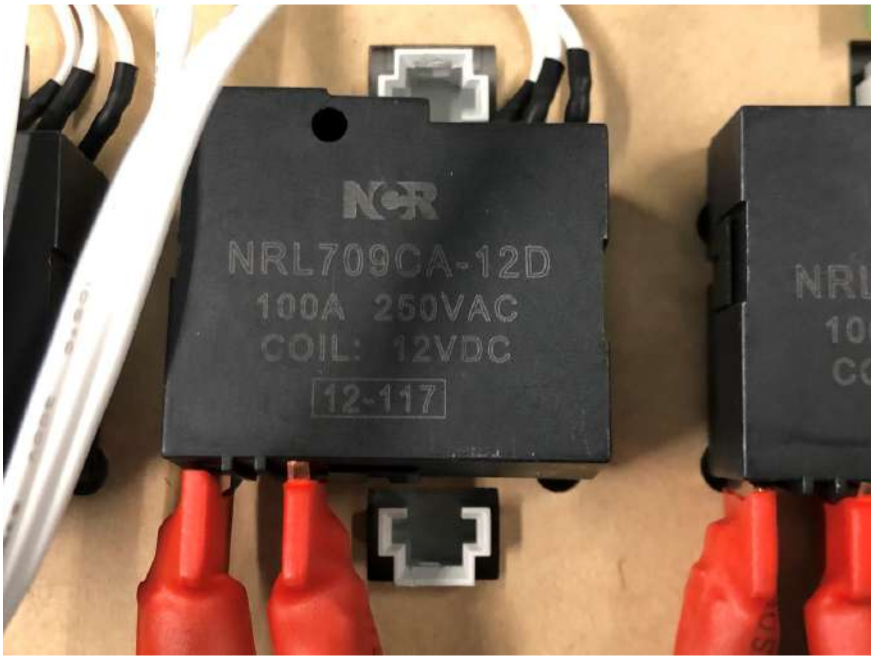


Inside

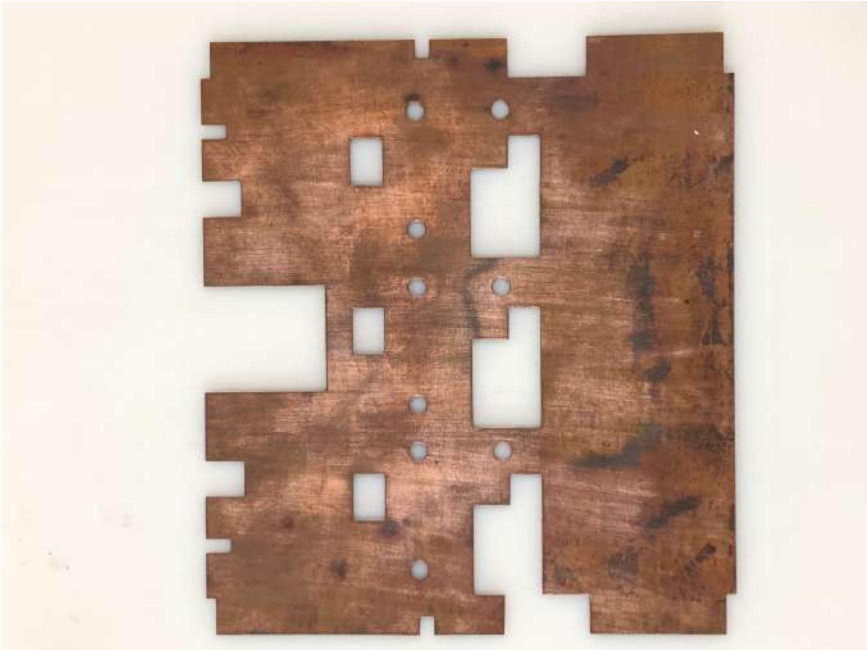


Inside

Current sensor



Supply Control Switch

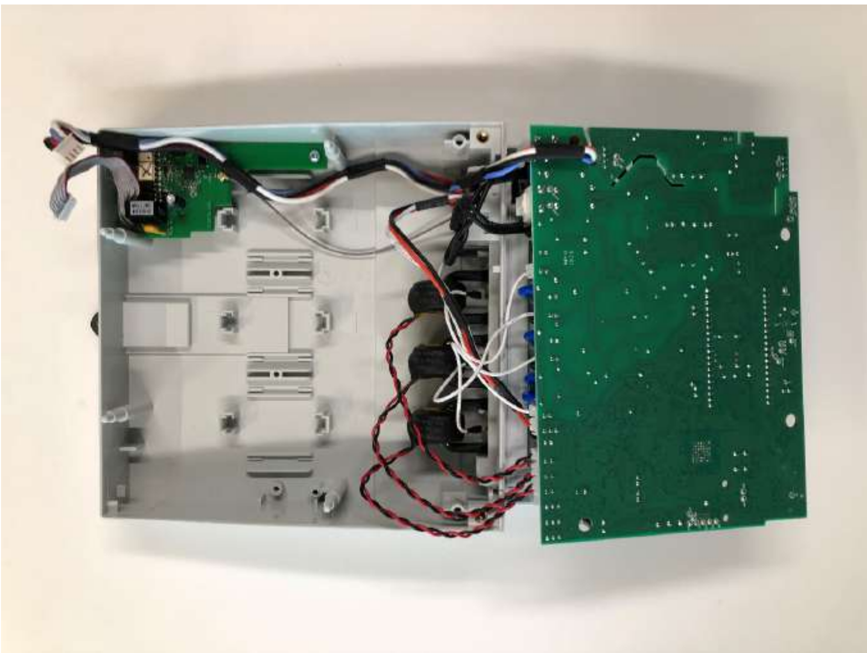


Copper shield

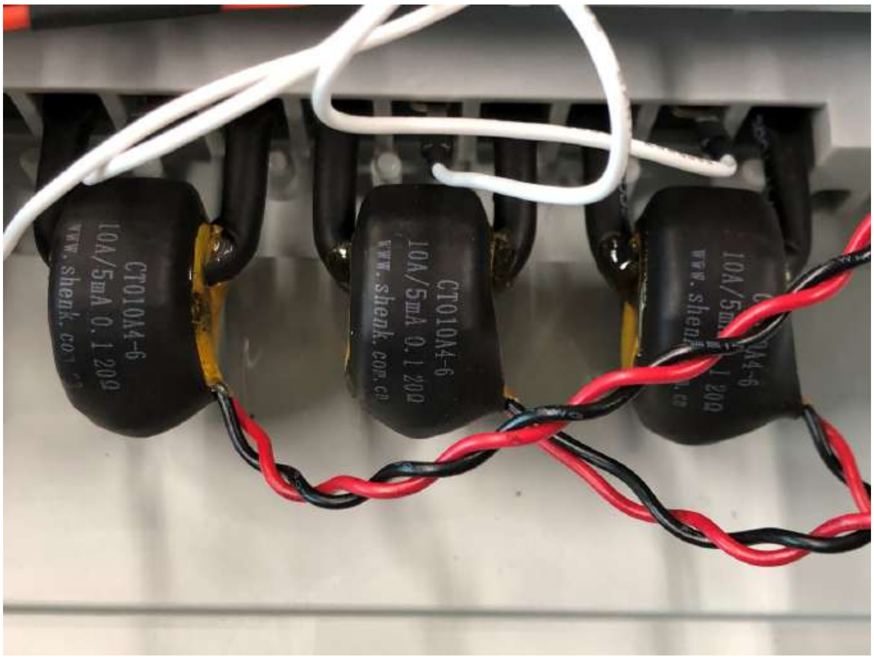
Housing

Terminal block

Inside



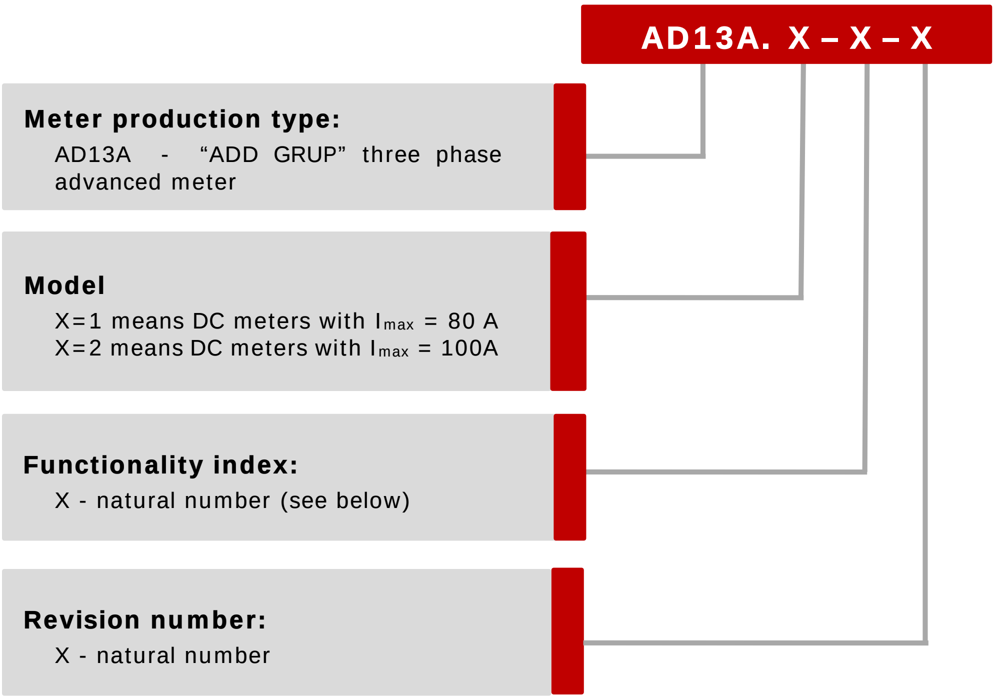
Inside



Current sensor

2.1 Meter Designation and Modifications

Meter family AD13A.X-X-X defines the set of meters with different functionality. The following system is used to indicate the types of meters within the family:



Thus the designation AD13A is used to identify a series of three phase meters. The designation AD13.X-X-X is used for identification of specific meter type within the family, for example, AD13A.1-1-1.

Identifier "Model" with the value equal to 1 determines the DC meter family with I_{max} = 80 A.

Identifier "Model" with the value equal to 2 determines the DC meter family with I_{max} = 100 A.

Identifier "Functionality Index" is the natural number that unambiguously identifies meter functionality (set of hardware components). Each of hardware components supports one of optional meter functionalities. In "ADD" meter the following hardware components can be supported:

- PLC and RF modems (optional);
- Extra relays (one or two, each of 5 A);
- Basic relay 80/100 A;
- Iref = 5 A;
- Iref = 10 A.

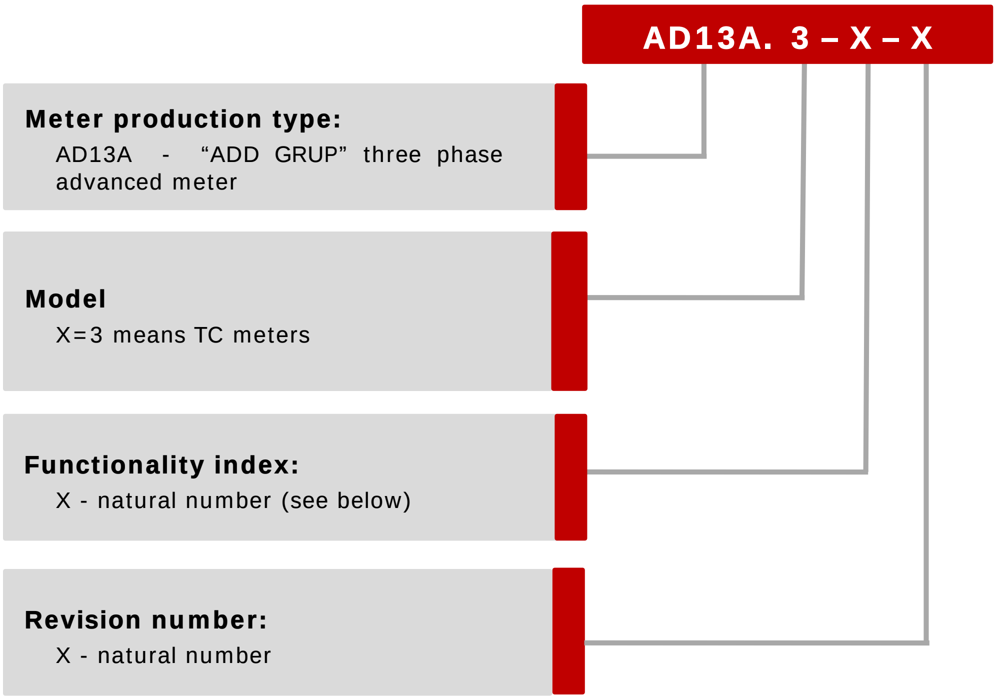
Each set of hardware components is assigned to a particular functional index – natural number. Number assignment performed if necessary, for example, when entering a specific order from the customer.

All the meters within the family are based on the same, universal Printed Circuit Board. Support of one function is related to the existence or not of relevant electronic components.

Identifier “Revision number” characterizes the possible changes of the meter hardware in the future. Changing the “Revision number” requires certification in Accredited Metrology Laboratory. For current certification “Revision number” is equal to 1.

2.1 Meter Designation and Modifications

Meter family AD13A.X-X-X defines the set of meters with different functionality. The following system is used to indicate the types of meters within the family:



Thus the designation AD13A is used to identify a series of three phase meters. The designation AD13.3-X-X is used for identification of specific meter type within the family, for example, AD13A.3-1-1.

Identifier “Model” with the value equal to 3 determines the TC meter family with I_{max} = 6/10 A.

Identifier “Functionality Index” is the natural number that unambiguously identifies meter functionality (set of hardware components). Each of hardware components supports one of optional meter functionalities. In “ADD” meter the following hardware components can be supported:

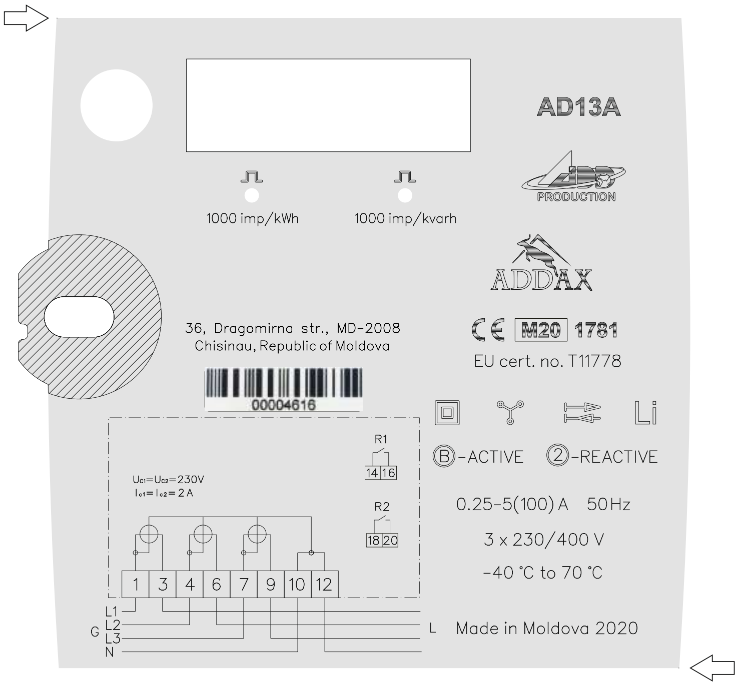
- PLC and RF modems (optional);
- RS-485-1 (optional);
- RS-485-2 (optional);
- RF interface (optional);
- Extra relays (one or two, each of 5 A);

Each set of hardware components is assigned to a particular functional index – natural number. Number assignment performed if necessary, for example, when entering a specific order from the customer.

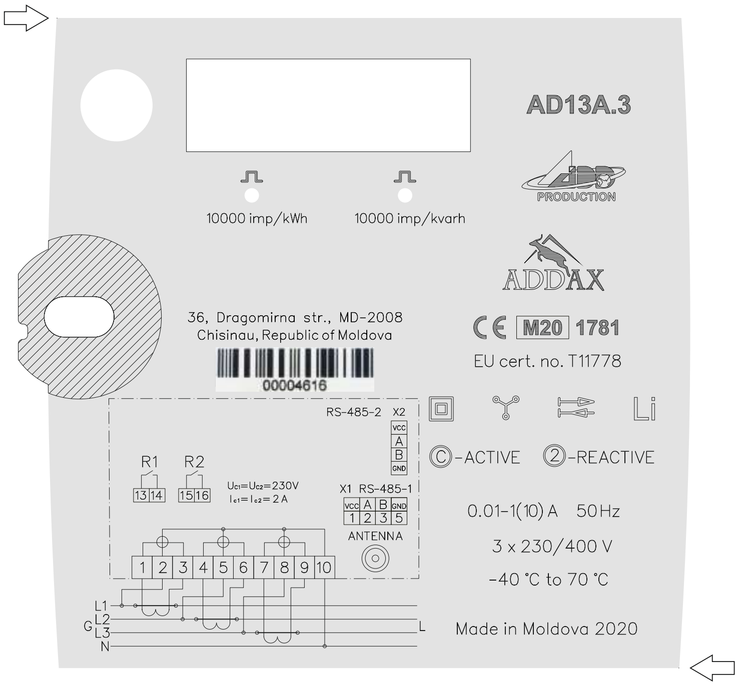
All the meters within the family are based on the same, universal Printed Circuit Board. Support of one function is related to the existence or not of relevant electronic components.

Identifier “Revision number” characterizes the possible changes of the meter hardware in the future. Changing the “Revision number” requires certification in Accredited Metrology Laboratory. For current certification “Revision number” is equal to 1.

AD13A(AD13A.2-18-1)LR_20(Ndr_ NMi Certin B.V)-02



AD13A.3(AD13A.3-18-1)LR_20(Ndr_ NMi Certin B.V)-02

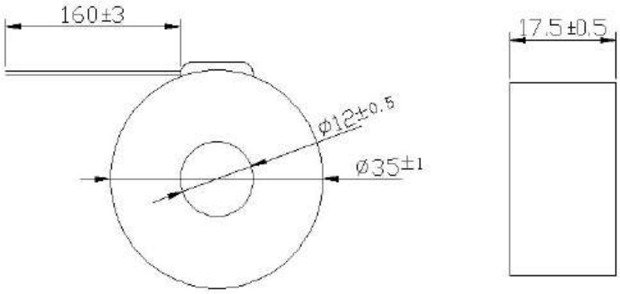


Doc no	11778/0-03
Page	2 of 2

ZHEJIANG NCR ELECTRIC CO.,LTD

NRC100A DCT 1:2500 0.1Class 12.5Ω

Apperance



Datasheet	Rated primary current (A）	Secondary Output Current （mA）	Rated Load Rb (Ω)	Max Current (A)	Accurancy	Remark
			12.5	100	0.1	

Error Limit	Accuracy	Current Error±（%）		Phase Error±（′）					
		At Below current		At below current					
		0.01In	≥0.05In	0.05In	0.2In	1In	2In	3In	Imax
	0.1	0.002	0.001	6.8	6.3	5.8	4	4	4
	Remark：Measuring temperature：10℃~30℃								

Environment	Temp：-40℃~+85℃；Relative humidity：≤95%

Primary winding and secondary winding resistance between internal pressure not less than 4 KV,

Sine half-wave introduction of watt-hour meter measurement error is less than 2.5%

Remark :

DCTs withstand 8 kV pulse voltage (5 positive pulses 1.2/50 uS and 5 negative pulses 1.2/50 uS) between prim and sec winding

Application

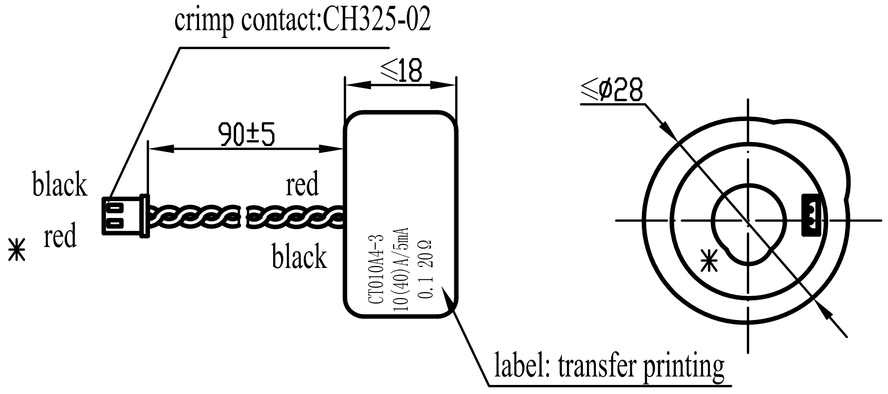
The Current Transformer (CT) CT010A4-3 10(40)A/5mA 1:2000 0.1 20Ω can be used as a current sensing device in a utility electric meter. The design and production of this type of CT is as per the national standard of GB 1208-2006 (equivalent to IEC 185:1987) or IEC 60044; inspection and testing of the CT is as per the national standard of JJG 313-1994.

Performance Characteristics

Characteristics	Values
Operating frequency	50 ~ 400 Hz
Operating temperature	-40℃ ~ 85℃
Relative humidity	≤95%
Rated primary current I_p	10 A
Maximum primary operating current I_{max}	40A
Rated secondary current I_s	5mA
Transformation ratio N	1:2000
User supplied burden resistor R_b	20Ω
Accurate operating current range	5% I_p ~ I_{max}
Accuracy class[i]	0.1
Insulation Volts under power frequency (between case to the secondary winding)	withstand 4000 Volts lasting for 1 minute without damage
Insulation resistance	>500MΩ/500Vdc

[i] Definition of the "accuracy class" is as per the national standard GB 1208-2006, with error limits satisfying the values listed below:

Accuracy Class	Ratio Error (±%) with the percentage (%) of I_p				Phase Displacement (±') with the percentage (%) of I_p			
	5	20	100	I_{max}	5	20	100	I_{max}
0.1	0.1	0.1	0.1	0.1	15'	13'	8'	5'



Note:
1. * represent terminal in phase.
2. core: nanocrystalline, core size: 14/19/8.

借(通)用件登记
描图
描校
旧底图总号
底图总号
签字
日期

标记	处数	分区	更改文件号	签名	年月日
设计			标准化		2019-4-16
审核					
工艺			批准		

CT010A4-3 10(40)A/5mA 1:2000 0.1 20Ω

阶段标记 | 重量 | 比例 1: 1

共 张 第 张

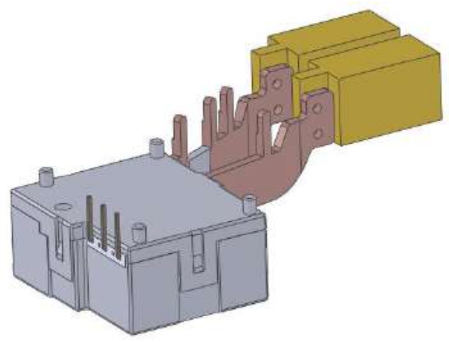
Shenke Electronics Co., Ltd of Hebei

Current Transformer (ADD)

NCR
Industrial & Electrical Components

磁保持继电器
Magnetic Latching Relay

Model
NRL709CA-100A



- **Features**
- 体积小，100A触点切换能力；
  Small Size,100A Contact Switch
- 线圈功耗小、温升极底；
  Low consumption, Low temperature rise
- 触点接触电阻小，电接触稳定性能好；
  Small Contact Resistance, stable electric contact
- 抗冲击、抗振动能力强；
  Strong Resistance shock & vibration
- Outline Dimension：(38.0x33.0x17.0)mm;
- According to IEC62055-31:UC2,UC3

触点参数 CONTACT DATA

触点形式 contact form	1A/1B
触点材料 contact material	Silver Alloy
接触电阻 contact resistance	Max.:0.5 mΩ
触点负载 contact Rating(Res.load)	100A 250VAC
最大转换功率 Max. Switching Power	25000VA
最大转换电压 Max. Switching Voltage	440VAC
机械寿命 Mechanical life	1×10^6
电气寿命 Electrical life	1×10^4

性能CHARACTERISTICS

绝缘电阻 Insulation Resistance		1000MΩ (500 VDC)
介质耐压 Dielectric strength	触点与线圈间 Between Coil & Contacts	4000VAC 1 min.
	断开触点间 Between Open Contacts	2000VAC 1 min
闭合时间 Operate Time		15msec. Max.
断开时间 Release Time		15msec. Max.
湿度 Humidity		98%RH ,40℃
温度范围 Ambient temperature		-40～+85℃
引出端方式 Terination		PCB
重量 Unit weight		约95g
封装形式 Constrution		防尘罩 Dust protected

线圈 COIL

线圈功耗 coil power	单线圈：1.5W 双线圈：3.0W single coil:1.5W double coil:3.0W

线圈参数 COIL DATA

额定电压VDC Nominal Voltage	动作电压VDC Pick-upVvoltage	脉冲宽度ms Pulse Duration	线圈电阻Ω Coil Resistance
单线圈 Single Coil			
9	6.75	50	54±10%
12	9	50	96±10%
24	18	50	384±10%
48	36	50	1536±10%
双线圈 Double Coil			
9	6.75	50	2x27±10%
12	9	50	2x48±10%
24	18	50	2x192±10%
48	36	50	2x768±10%

Remark:We can make special design according to customer's requirement

典型应用 TYPICAL APPLICATION

1)主要用于IC卡预付费电表，集中抄表系统；

Prepayment Energy Meters/Water Meters/Gas Meters

2) 也用于家电和自动控制装置

Electrial Telecommunication, Auto Controling

ORDERING INFORMATION

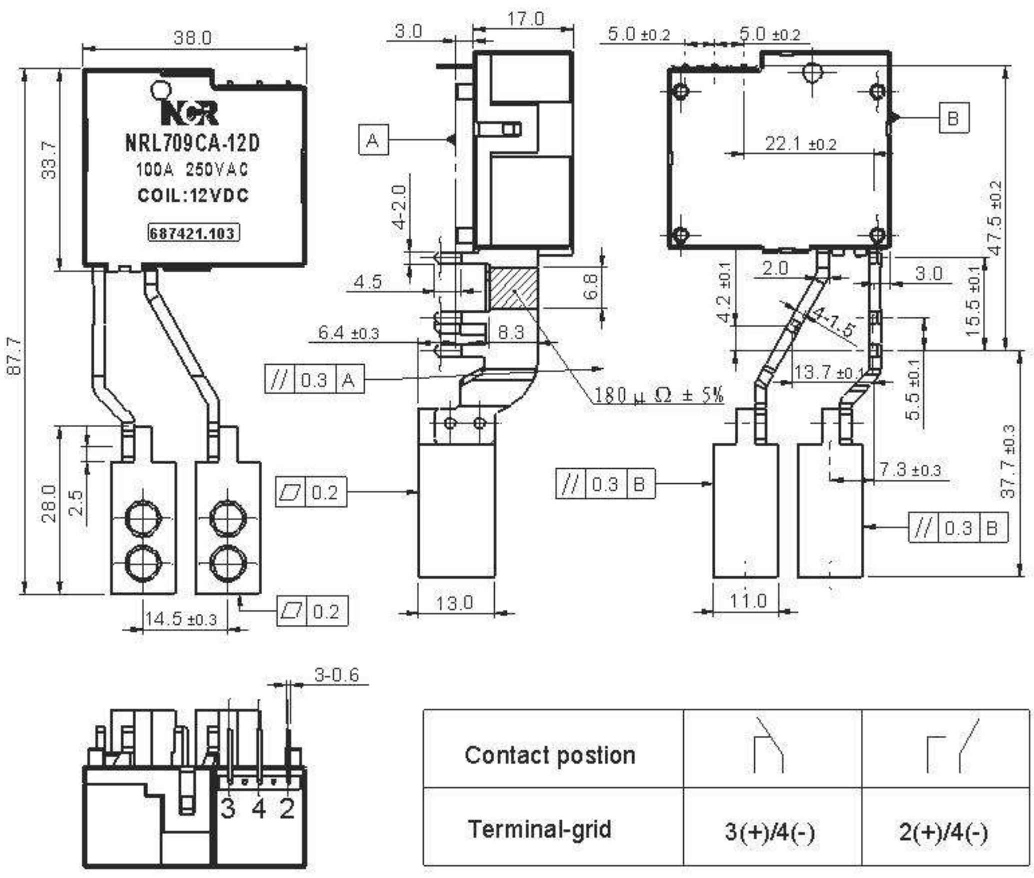
NRL　　709CA-100A -　　12 -　　S

①　　②　　③　　④

① 公司代号	Company Code
② 产品型号	Product Type
③ 线圈电压	Coil Voltage
④ D表示双线圈，S表示单线圈	D= Double Coil; S= Single Coil
⑤ Contact Resistance :NIL=0.6 mOhm H=0.5 mOhm	

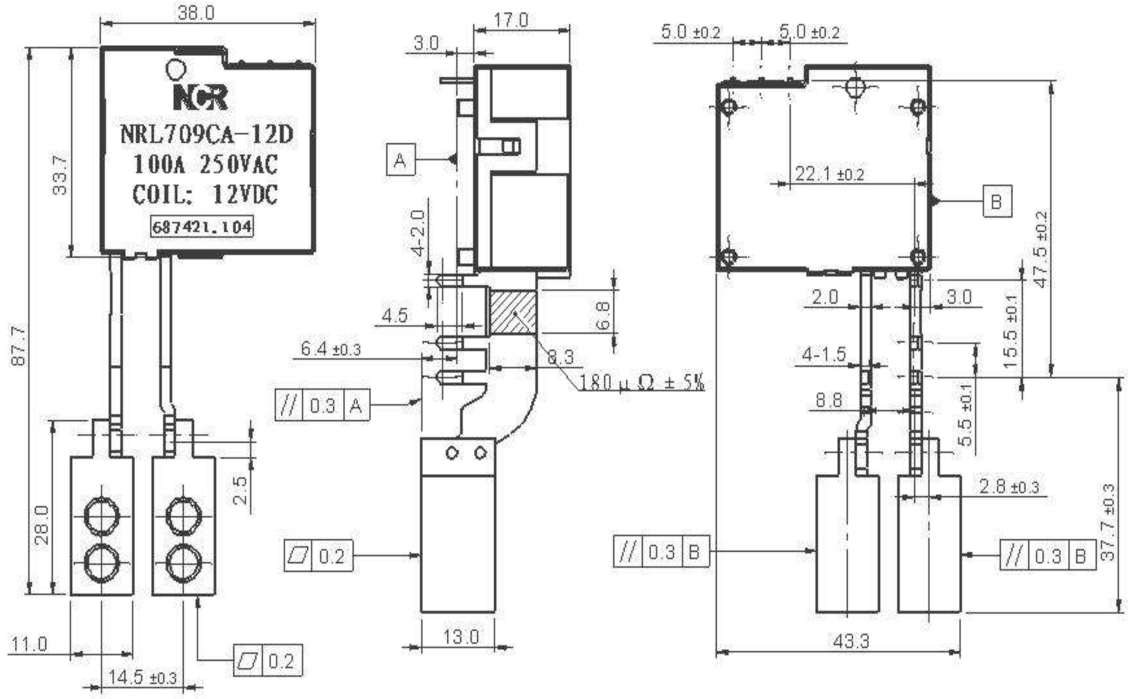
Outline Dimension (尺寸图) Unit: mm

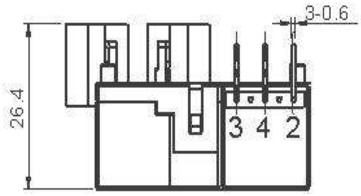
double coil



Contact postion		
Terminal-grid	3(+)/4(-)	2(+)/4(-)

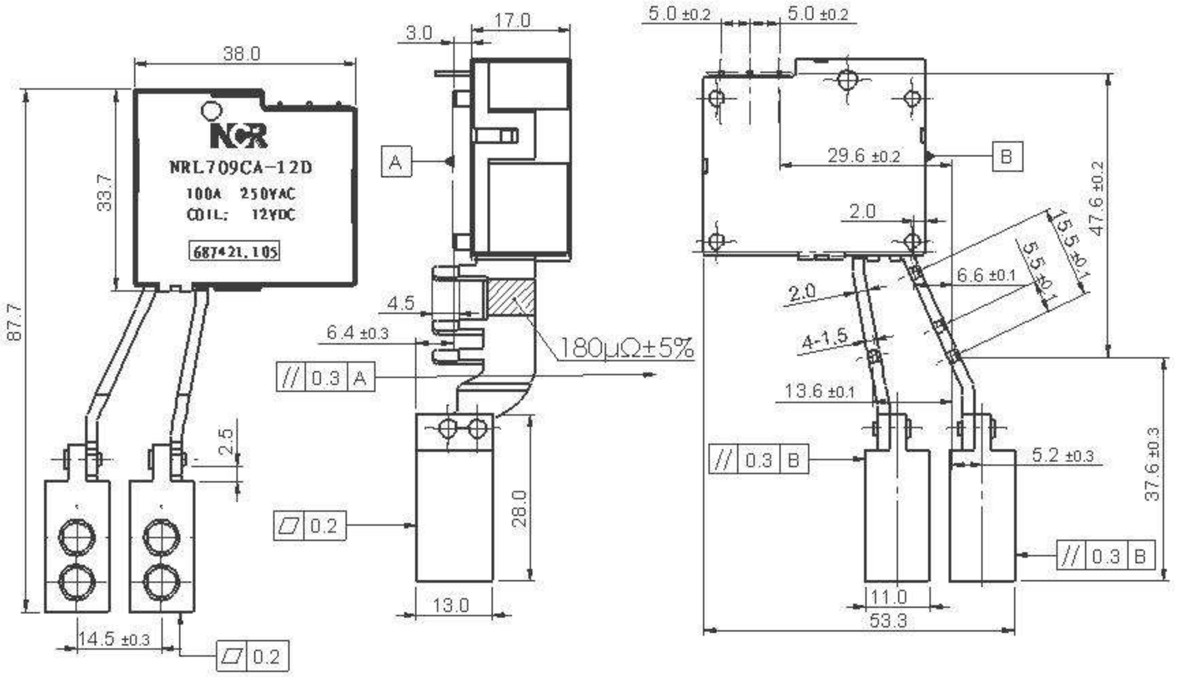
NCR
NRL709CA-A-100A

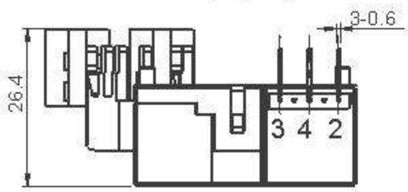




Contact postion		
Terminal-grid	3(+)/4(-)	2(+)/4(-)

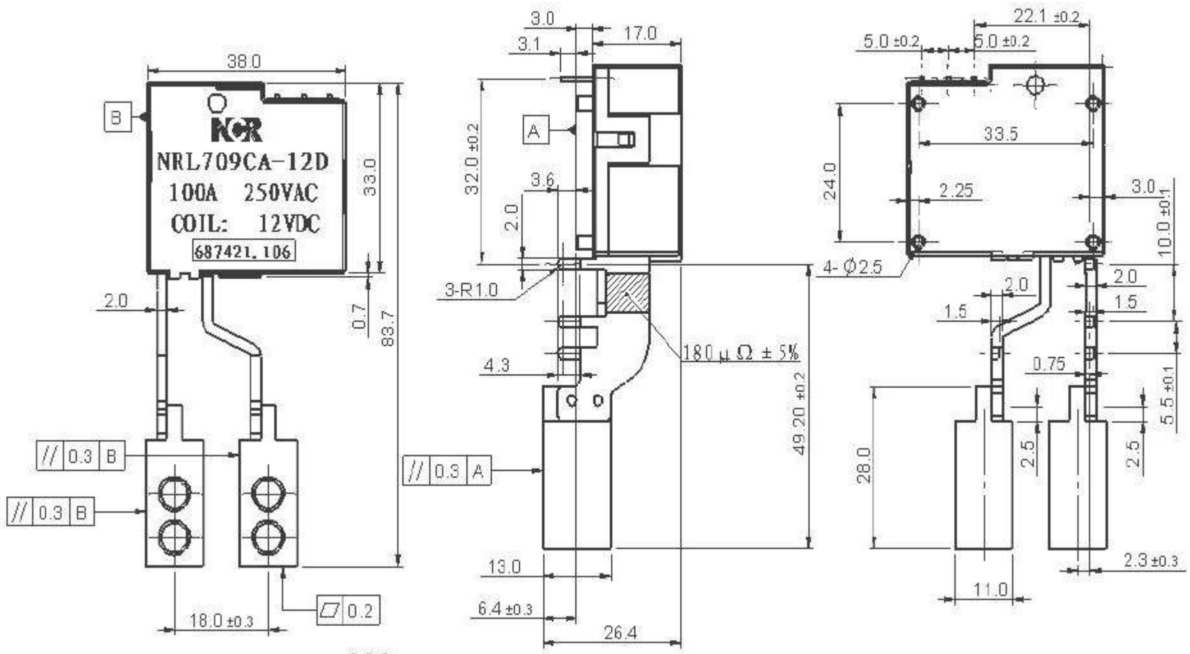
NCR
NRL709CA-B-100A

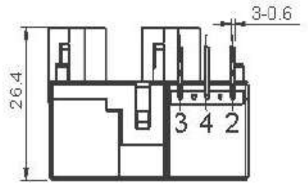




Contact postion		
Terminal-grid	3(+)4(-)	2(+)/4(-)

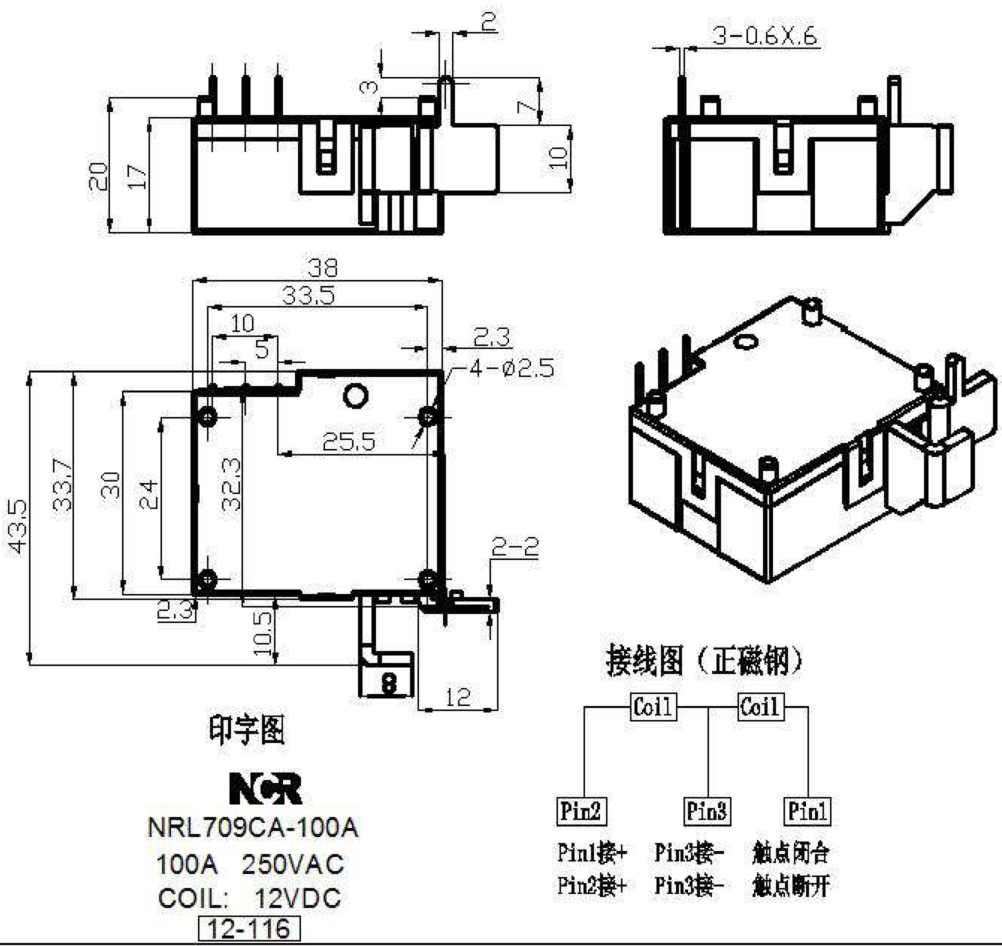
NCR
NRL709CA-C-100A



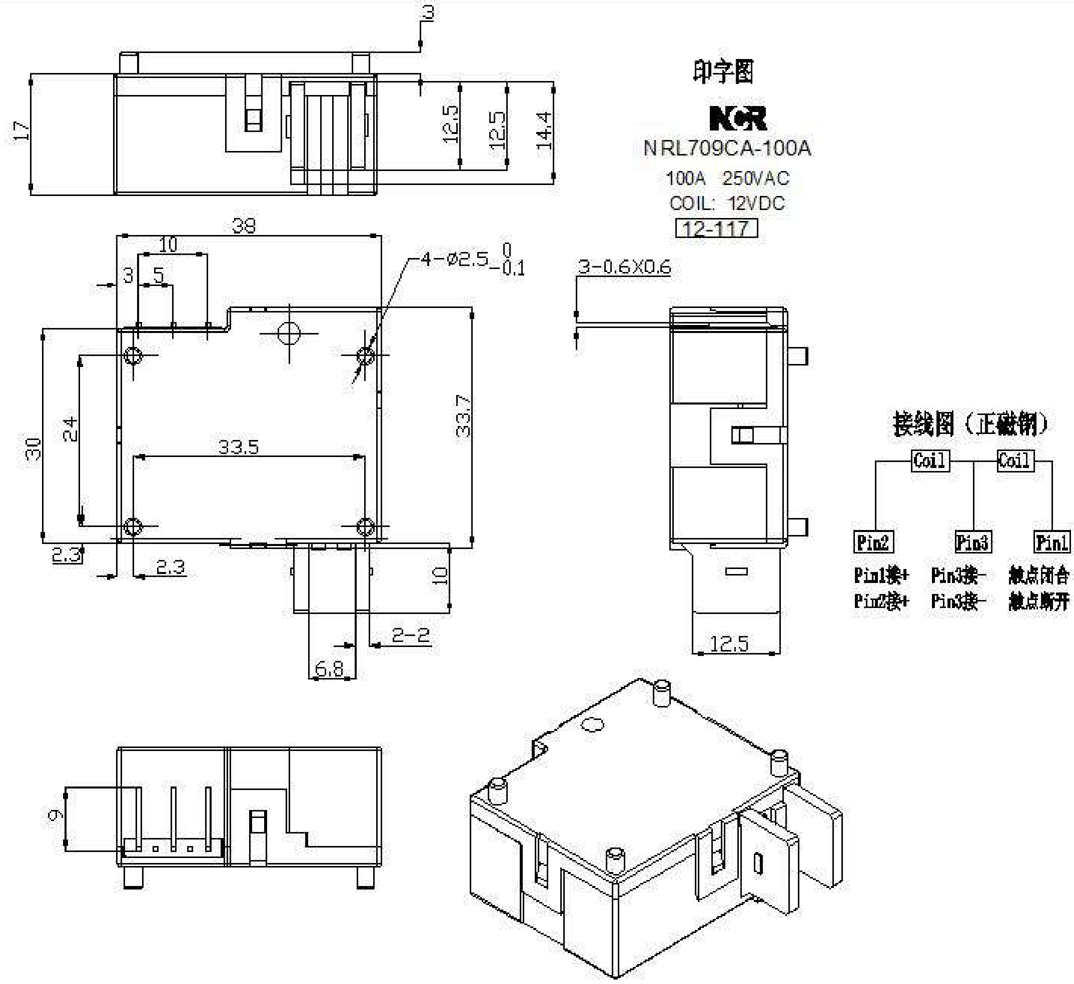


Contact postion		
Terminal-grid	3(+)/4(-)	2(+)/4(-)

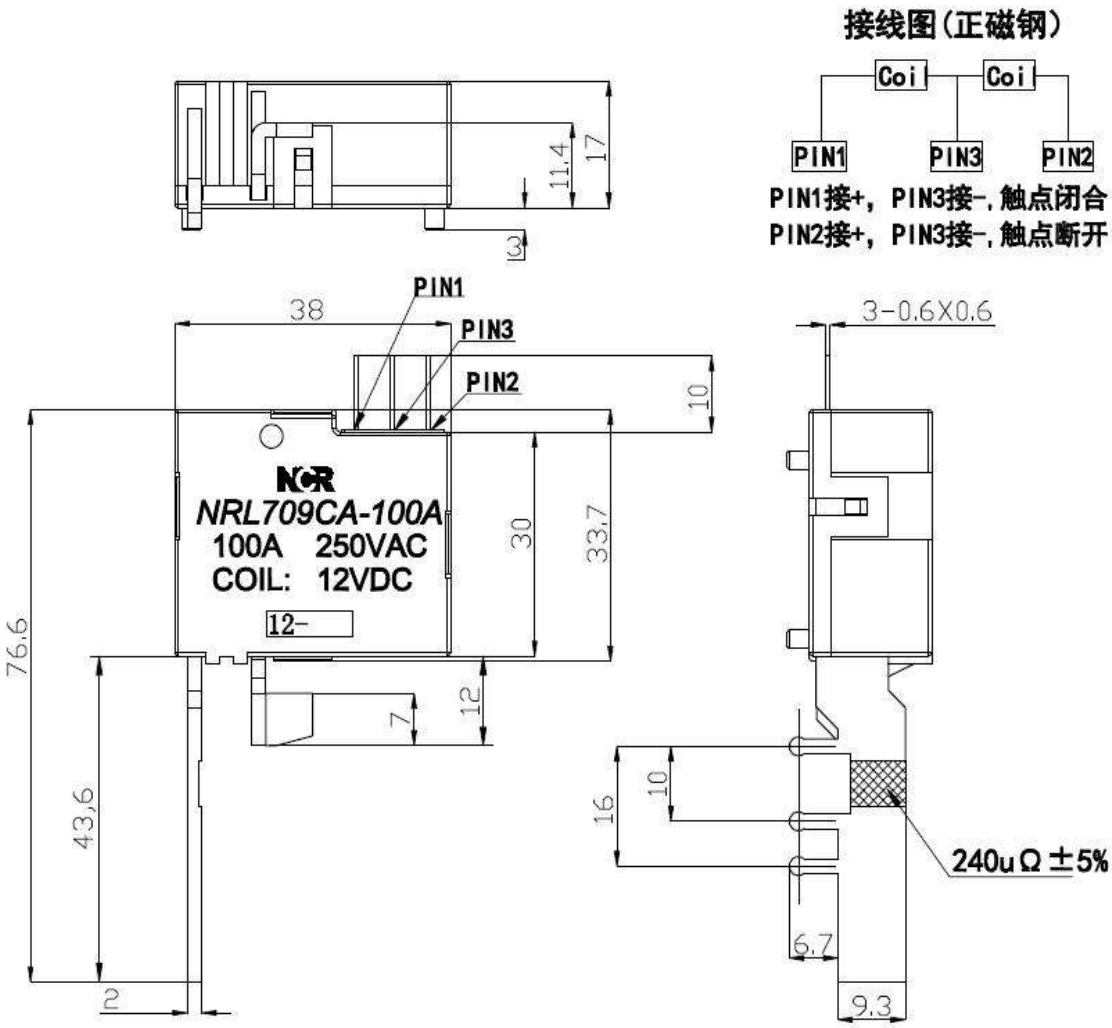
NRL709CA-D-100A



NCR
NRL709CA-E-100A



NRL709CA-F-100A



NCR
NRL709CA-G-100A

www.nicerelay.com

5. DISPLAY

The meter supports integrated LCD to cyclically display detailed information on electrical energy consumption. The cycle time is configured. The meter is equipped with a backlit which facilitates the data visualization. The data type, its formats and output sequence are specified in the meter configuration and can be set both locally via the optical port and remotely from the HES. Data identification is presented in the form of symbols and OBIS codes according to IEC 62056-61. Set of display symbols indicate the meter state and may vary for different meter types and versions. The periodicity of symbols blinking is once per second (1 Hz). The meter display viewing direction is six o'clock.

The meter features three working modes of the display:

- **Normal** - The Normal mode is a default display mode and is generally used to display the client-specific data (e.g., billing).
- **Alternate** - The Alternate mode is functionally identical to the Normal mode. The meter itself still operates under normal measurement, but the display sequence can be programmed to show a different set of displayable items from those in the Normal mode. This mode is activated by a short press of the push button. A special symbol is displayed on the meter display when this mode is activated. The displayed symbol depends on the meter version.

  Upon completion of the Alternate mode timeout period (configurable), the meter automatically returns to the Normal mode.
- **Test** – The meter display test mode is intended for the meter testing in a special working mode. It can be accessed from either the Normal or Alternate mode by removing the meter cover and pressing the test button, or by using special software.

  In this mode the meter stores the billing related parameters (active/reactive energy, active power) in a separate location. This mode does not influence the billing related parameters stored during the Normal working mode.

  A special symbol is displayed on the meter display when this mode is activated. The displayed symbol depends on the meter version. The following fixed list of parameters (by default) is displayed for this mode: active power, active energy, reactive energy, etc.

  Upon completion of the Test mode timeout period (configurable), the meter automatically returns to the Normal mode.

The list of parameters to be displayed is configured separately for all modes. The maximum number of parameters in each list is limited to 20.

The meter can display the meter parameters according to preset configuration:

- Date (day – months – year) and time (24-hour format);
- active energy consumption (in kWh, including total energy by a separate tariff and sum by all tariffs);
- active power (in kW, total by all phases, and for separate phase);
- reactive capacitive and inductive power (in kvar);
- reactive capacitive and inductive energy (in kvarh);
- instantaneous voltage (in V);
- instantaneous current (A);
- cos φ (power factor);
- meter state;
- actual tariff;
- supply network state;

- basic relay state and reason of disconnection.

The list of parameters to be displayed in case of a power outage can be negotiated.
The information on the display is divided into 3 lines: Top and bottom lines are parameter indicators, OBIS codes, and flags. OBIS codes allow identification of each measured value. Middle line represents metering data (8 digits of 9.2 mm height, up to 3 decimals, the number of decimals is configured) and measuring units (**kWh**, **kvarh, VA**) as well as messages to a consumer*.

Text message is any text of up to 8 symbols, statically displayed, or a scrolling line of up to 32 symbols, both comprising case-insensitive letters and numbers. Detailed description of text messages form is presented in the Reference 2.

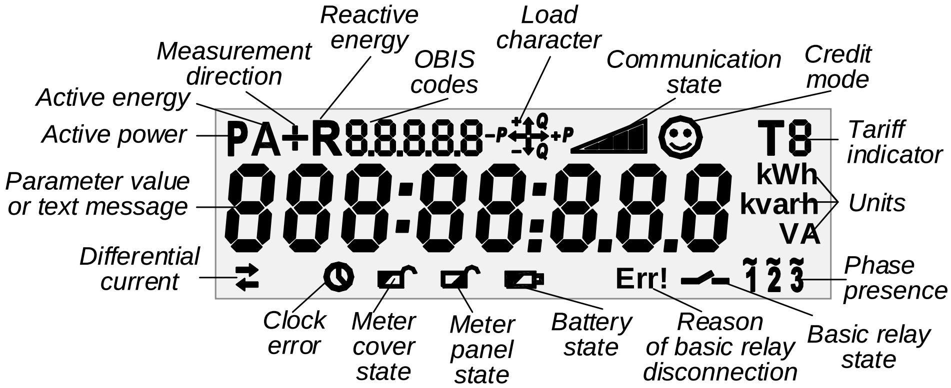
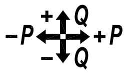


Fig.5.1. Common symbol and OBIS codes display test mode view.
All segments are active

Table 5.1. Common symbol and OBIS codes display indications

Indication	Description
8.8.8.8.8	OBIS (Object Identification System) codes according to IEC 62056-61.
	Load characteristic, which is used to illustrate energy flow (import/export) and specify metering quadrant.
	Indicator of communication interface state represents the signal level of last data package received via PLC or RF1 channel. This symbol indicates communication state according to the Table 5.2. Signal level grading is similar for PLC and RF
	Meter operates in credit mode.
T8	Tariff indicator.
1 2 3	Phase presence. Absence of symbol indicates phase voltage absence. Phases blink simultaneously* in case of wrong connection (i.e. wrong sequence of phases or a phase absence).

* *Displayed information depends on the meter version.*

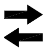
Indication	Description
	Differential current presence.
	Time synchronization error.
	Meter cover is opened.
	Terminal block cover is opened.
	Battery is discharged (in case the battery is used as backup power supply, optionally) When battery voltage decreases to 3V from the nominal one of 3.6V, low battery symbol is displayed. When battery is charged enough, symbol is not displayed.
	Basic relay is switched off remotely.
	Basic relay is switched off by the reason, e.g. on exceeding of demand or differential current thresholds, by button.

Table 5.2. Indication of communication interface state

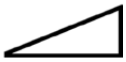
Communication indicator		PL or RF modem
Blinking full triangle		Modem not configured
Blinking empty triangle		Other error
Empty triangle		Not registered with Data Concentrator
Triangle with one mark		Registered – signal level “low”
Triangle with two marks		Registered – signal level “fair”
Triangle with three marks		Registered – signal level “good”
Triangle with four marks		Registered – signal level “high”

Table 5.3. Combination of top line of symbols and readings (examples)

P 16.7.0 0.151 kW Active power (abs(QI+QIV)-(abs(QII+QIII))	P + 15.7.0 0.060 kW Active power (abs(QI+QIV)+(abs(QII+QIII))
17.0.1 1.000 kW Active power demand limit	A 15.8.0 300.000 kWh Total Active energy
A+ 1.8.0 300.001 kWh Active energy import	A+ 1.8.0 300.001 kWh Active energy import, rate 1
A− 2.8.0 187.035 kWh Active energy export	A− 2.8.1 001.946 kWh Active energy export, rate 1
P +R 3.7.0 0.010 kvar Reactive power import	P −R 4.7.0 8.888 kvar Reactive power export
+R 3.8.0 080.500 kvarh Reactive energy import	+R 3.8.1 000.707 kvarh Reactive energy import, rate 1
−R 4.8.0 036.000 kvarh Reactive energy export	−R 4.8.1 000.111 kvarh Reactive energy export, rate 1
C.1.0 87654321 Device ID	0.9.1 09:32:17 Local Time

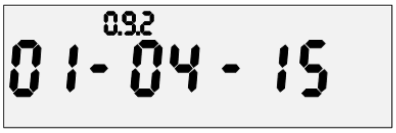
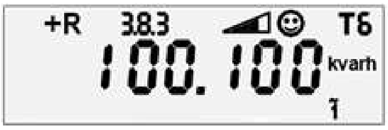
 Local Date	

Table 5.4. Combination of top and bottom lines of symbols and readings (examples)

	
Readings for the import of total active energy (for all tariffs), OBIS code 1.8.0; no load is applied; meter modem is registered in HES, “high” signal level is established; meter operates in credit mode; current tariff – 1; all three phases are present; basic relay is connected, if any; no flags are set (no alarms are detected).	Readings for the import of reactive energy at tariff 3, OBIS code 3.8.3; no load is applied; meter modem is registered in HES, “good” signal level is established; meter operates in credit mode; current tariff – 6; supplying voltage is present in the “1” phase; no flags are set (no alarms are detected).

Error Codes are displayed to identify a number of errors of the Error Object. This object contains itself both common errors (warnings) and critical errors and can be requested locally or remotely to view the errors and alarm events. Additionally, digits from 1 to 8 are displayed on the meter LCD together with the F.F.0 error code (corresponds to the Error Object OBIS code 0.0.97.97.0.255) to identify specified errors. The error codes are displayed in the ascending order from left to right. For each error separate position is fixed. Several error codes may be displayed at the same time. Error codes are displayed together with respective symbols or symbols for other events. By default, error codes are displayed automatically on the LCD among scrolling screens, if proper errors are detected.

Table 5.5. Combination of error codes and top and bottom lines of symbols (examples)

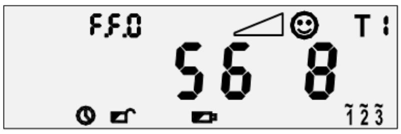
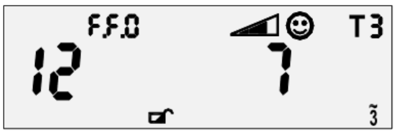
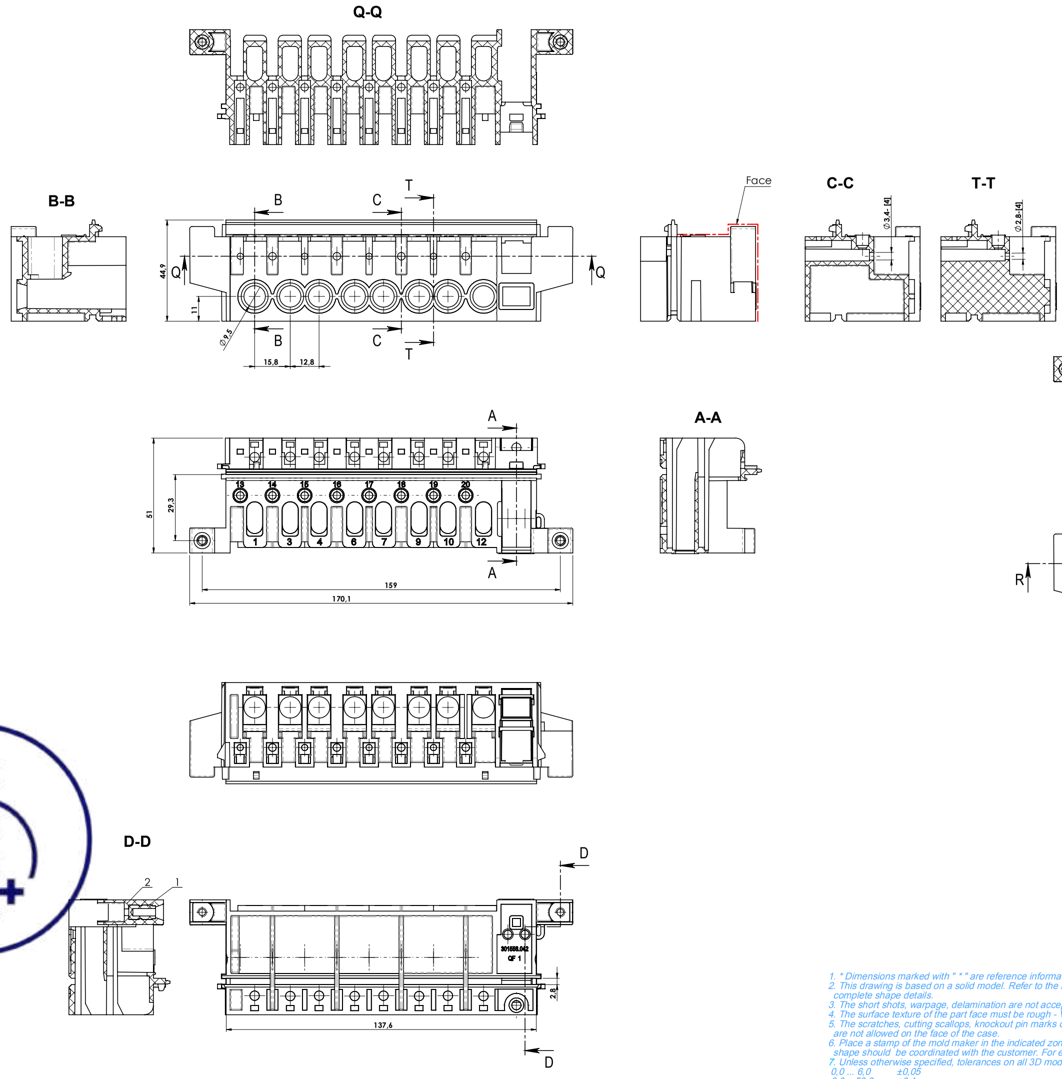
	
Time synchronization error; low battery voltage; meter cover is removed; meter is not registered by the data concentrator; current tariff – 1; all three-phases are present.	No phase “1” and “2”; terminal block cover is removed; meter modem is registered in HES, “good” signal level is established; meter operates in credit mode; current tariff – 3.

Fig.1

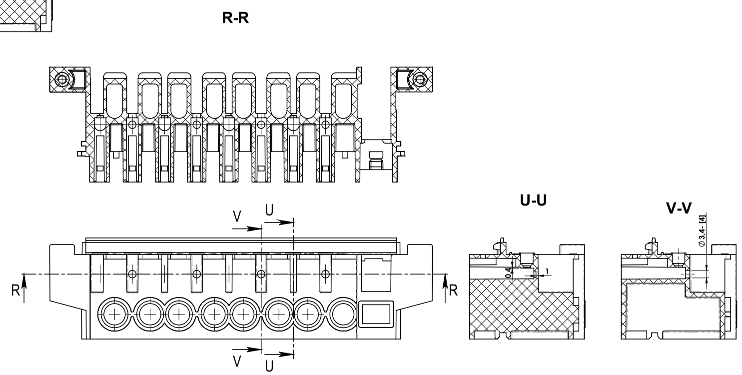
ADDM.301556.042



Name	Fig.
ADDM.301556.042	1
-01	2

Fig.2

ADDM.301556.042-01



1.*Размеры для справок.
2. Чертеж выполнен по 3D модели детали. Форму детали, литейные уклоны и размеры, неуказанные в чертеже, см. в 3D CAD файле соответствующей детали.
3. Недоливы, коробление изделия и расслоение материала не допускаются.
4. Фактура лицевой поверхности - VDI 3400.12 (Ra 0.4).
5. На лицевой поверхности не допускаются царапины, следы толкателей, инородные включения, следы механической обработки.
6. Нанести клеймо изготовителя формы литейным способом в указанном месте. Тип клейма согласовать с заказчиком. Например: QF1 (для пресс-формы1), QF2 (для пресс-формы2).
7.Неуказанные предельные отклонения размеров 3D модели:
0,0 ... 6,0 ±0,05
6,0 ...50,0 ±0,1
50,0 ...180,0 ±0,15
180,0 ...500,0 ±0,3
угловых - ±10'.

1. * Dimensions marked with " * " are reference information only.
2. This drawing is based on a solid model. Refer to the respective 3D CAD file for dimensions and drafts not shown and complete shape details.
3. The short shots, warpage, delamination are not acceptable.
4. The surface texture of the part face must be rough - VDI 3400.12 (Ra 0,4).
5. The scratches, cutting scallops, knockout pin marks or other machining marks, foreign particulates and inclusions are not allowed on the face of the case.
6. Place a stamp of the mold maker in the indicated zone. The stamp shape should be coordinated with the customer. For example : QF1 (for set1), QF2 (for set2).
7. Unless otherwise specified, tolerances on all 3D model features are to be:
0,0 ... 6,0 ±0,05
6,0 ...50,0 ±0,1
50,0 ...180,0 ±0,15
180,0 ...500,0 ±0,3
angular tolerance - ±10'.

Part list

Item	Part#	Descriptions	Qty	Notes
		Parts		
1		Molded-in Blind Threaded insert, IBB-M4-10	2	www.pemnet.com
		Materials		
2		Makrolon 9425, color RAL7035	0.14	kg

ADDM.301556.042AD mod.

Terminal block

Rev	Sheet	Dokument	Sign	Date
Author		Aseeva		
Checked		Banarescu		
Engineer				
Manager				
Eng.Appr.				
Mfg.Appr.		Deev		

Lit	Mass	Scale
		1:1
Sheet	Sheet 1	

Primary use | Reference number | Sign. and date | Inv. N dupl. | Instead. inv. N | Sign. and date | Inv. N orig.

Doc no	11778/0-08
Page	1 of 1

ADDM.301556.041 AD

Name	Fig.
ADDM.301556.041	1
-01	2

Fig.1

ADDM.301556.041

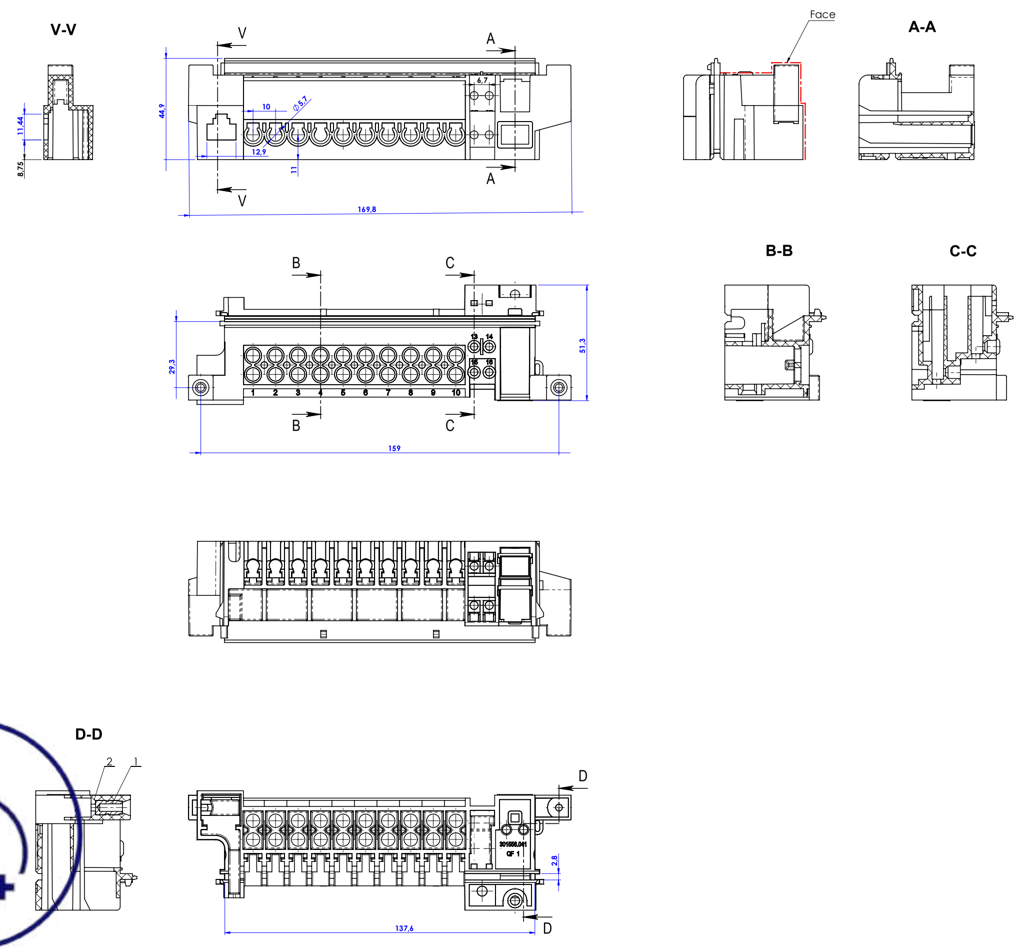
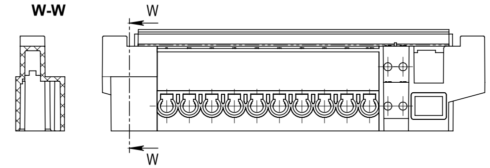


Fig.2

ADDM.301556.041-01



1.*Размеры для справок.
2. Чертеж выполнен по 3D модели детали. Форму детали, литейные уклоны и размеры, неуказанные в чертеже, см. в 3D CAD файле соответствующей детали.
3. Недоливы, коробление изделия и расслоение материала не допускаются.
4. Фактура лицевой поверхности - VDI 3400.12 (Ra 0.4).
5. На лицевой поверхности не допускаются царапины, следы толкателей, инородные включения, следы механической обработки.
6. Нанести клеймо изготовителя формы литейным способом в указанном месте. Тип клейма согласовать с заказчиком. Например: QF1 (для пресс-формы1), QF2 (для пресс-формы2).
7.Неуказанные предельные отклонения размеров 3D модели:
0,0 ... 6,0 ±0,05
6,0 ...50,0 ±0,1
50,0 ...180,0 ±0,15
180,0 ...500,0 ±0,3
угловых - ±10'.

1. * Dimensions marked with " * " are reference information only.
2. This drawing is based on a solid model. Refer to the respective 3D CAD file for dimensions and drafts not shown and complete shape details.
3. The short shots, warpage, delamination are not acceptable.
4. The surface texture of the part face must be rough - VDI 3400.12 (Ra 0,4).
5. The scratches, cutting scallops, knockout pin marks or other machining marks, foreign particulates and inclusions are not allowed on the face of the case.
6. Place a stamp of the mold maker in the indicated zone. The stamp shape should be coordinated with the customer. For example : QF1 (for set1), QF2 (for set2).
7. Unless otherwise specified, tolerances on all 3D model features are to be:
0,0 ... 6,0 ±0,05
6,0 ...50,0 ±0,1
50,0 ...180,0 ±0,15
180,0 ...500,0 ±0,3
angular tolerance - ±10'.

Part list

Item	Part#	Descriptions	Qty	Notes
		Parts		
1		Molded-in Blind Threaded insert, IBB-M4-10	2	www.pemnet.com
		Materials		
2		Makrolon 9425, color RAL7035	0.14	kg

Rev	Sheef	Dokument	Sign	Date
Author		Aseeva		
Checked		Banarescu		
Engineer				
Manager				
Eng.Appr.				
Mfg.Appr.		Deev		

ADDM.301556.041 AD_2 mod.2

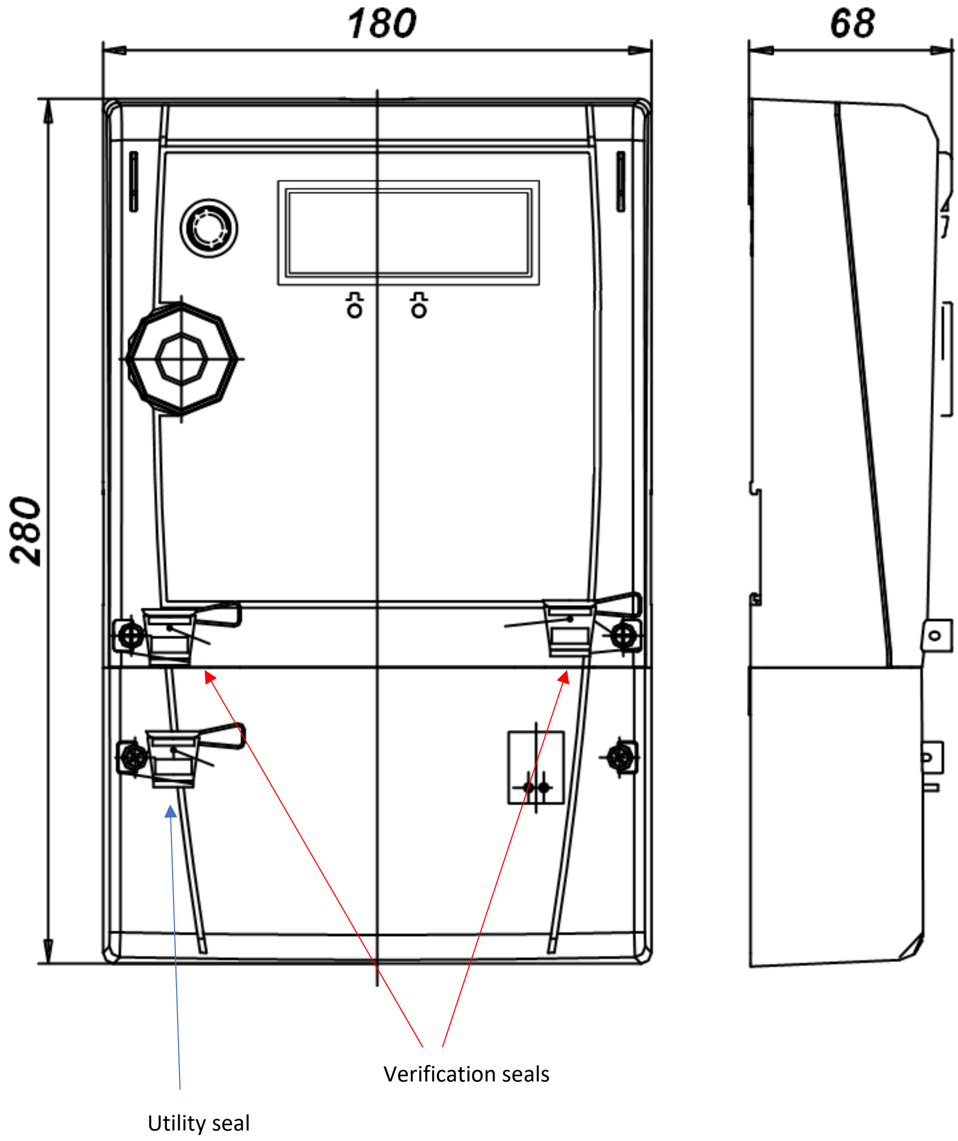
Terminal block

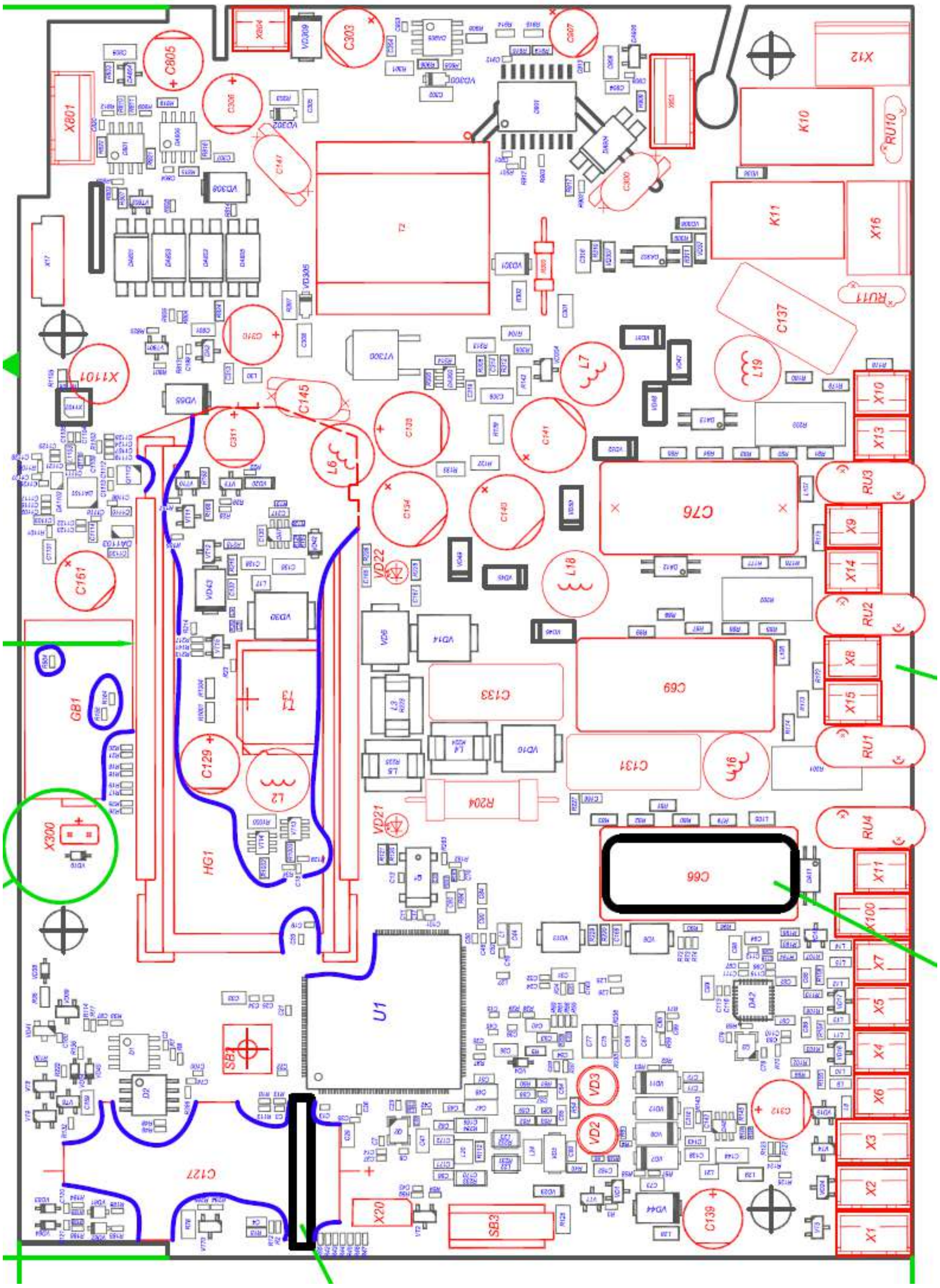
Lit | Mass | Scale 1:1

Sheet | Sheet 1

Primary use | Reference number | Sign. and date | Inv. N dupl. | Instead. inv. N | Sign. and date | Inv. N orig.

Doc no	11778/0-09
Page	1 of 1


180
68
280
Verification seals
Utility seal



Doc no	11778/0-11
Page	1 of 1

Bill of Components

Date	04-07-19	
Article (subject)	AD13AP_498_01-16_00	ADDM.411163.498-16
Number of the product	9649816	
Quantity	1	
Requested by (Name, signature)	____________	Nichita.Birliga
Approved by (Name, signature)	____________	(согласовано)

Cod	PACK	Description	Value	Voltage	Current	Pow	Tolerance	Part Reference	Manufacturer	RoHS	Quantity
1000006	SMD	DUAL DIODE SCHOTTKY 30V 0.2A SOT-23 T&R 3000	BAT54C-215	30V	0.2A	0.25W		VD39	Nexperia	yes	1
1000021	SMD	DIODE SCHOTTKY 1A 30V SMA	STPS1L30A	30V	1A			VD7 VD8 VD11 VD12	STM	yes	4
1000044	SMD	DIODE ZENER 3,9V 2% 0.35W SOT23	BZX84B3V9-7-F	3.9V				VD41	DIODES Inc	yes	1
1000086	SMD	Transil Bidirect 10V 1500W SMCJ	SMCJ8.5CA-TR	10V				VD30	STM	yes	1
1000091	SMD	Diode Rectifier 1600V 1A	GL41Y	1600V	1A			VD45 VD46 VD47 VD48 VD49 VD50 VD51 VD52	VISHAY	yes	8
1000126	SMD	TVS DIODE 13VWM 27.2VC SMA	SMAJ13CA-TR	13V	85A(8/20us)	400W		VD5	STM	yes	1
1000153	SMD	Diode Schottky Surface SOD123FL	MBR2H200SFT1G	200V	2A			VD300 VD302 VD305	ON	yes	3
1002166	SMD	DIODE GEN PURP 250V 200MA SOT23	BAS21LT1G	250V	0.2A			VD304	ON	yes	1
1002174	SMD	DIODE SCHOTTKY SOD323 T&R 3000	BAT54WS-E3-08	30V	200 mA			VD4 VD19 VD38 VD40 VD54 VD61 VD62 VD63 VD64	Vishay	yes	9
1002180	SMD	DIODE SW DBL 75V 215MA HS SOT23 T&R 3000	BAV70-215	75V	0.215A			VD24	Nexperia	yes	1
1002220	SMD	DUAL DIODE ULTRAFAST 70V 0.2A SOT-23 T&R 3000	BAV99LT1G	70V	0.2A			VD15 VD16 VD17 VD18	ON	yes	4
1002250	SMD	DIODE SW DBL 75V 215MA HS SOT23	BAW56	75V	0.215A			VD1	Nexperia		1
1003776	SMD	DIODE ZENER 7.5V 0.4W SOD80 T&R 2500	BZV55-C7V5-115	7.5V				VD20	Nexperia	yes	1
1003781	SMD	DIODE ZENER 11V 5% 0.4W SOD80 T&R 2500	BZV55-C11-115	11V				VD306	Nexperia	yes	1
1003806	SMD	DIODE ZENER 27V 0.4W SOD80	BZV55C27V	27V				VD307	PHILIPS	yes	1
1008001	SMD	DIODE Ultra Fast 200V 1A DO-213AA	EGL1D	200V	1A			VD23	DIOTEC	yes	1
1014410	SMD	DIODE SWITCH 75V 0.3A SOD80 T&R 2500	PMLL4148L	75V				VD36 VD37	Nexperia	yes	2
1014901	SMD	DIODE SCHOTTKY 40V 0.5A SOD-123 T&R 3000	MBR0540T1G	40V	0.5A			VD42	ON	yes	1
1021270	SMD	Transil 3,3V 600W SMB T&R 2500	SMLVT3V3	3.3V				VD43	STM	yes	1
1021501	SMD	Transil 6.8V 600W SMB T&R 2500	SM6T6V8A	6.8V				VD44	STM	yes	1
1021505	SMD	Transil 15V 600W SMB T&R 2500	SM6T15A	15V				VD65 VD308 VD309	STM	yes	3
1021507	SMD	Transil Bidirect 10V 600W SMB	SM6T10CA	10V				VD9 VD13	STM	yes	2
1024010	SMD	DIODE ULTRA FAST 1A 1000V SMA T&R 1800	US1M-E3/61T	1000V	1A			VD301	VISHAY	yes	1
2000035	SMD	MOSFET N-CH 60V 300MA SOT-23 T&R 3000	2N7002 T/R					VT70	NXP	yes	1
2000036	SMD	N-channel Trench MOSFET 60V 270mA SOT-23	NX7002BK	60V	0,27A	0,4W		VT2 VT6	NXP	yes	2
2000043	SMD	MOSFET P-CH, 20V, 52mOhm, -4.2A SOT23-6L	DMG2305UX-13	20	4.2			VT8 VT9 VT15	DIODES	yes	3
2000046	SMD	MOSFET N-CH 1000V 1.6A DPAK	FQD2N100TM	1000V	1.6A			VT300	Fairchild	yes	1
2000057	SMD	MOSFET N-CH SOT23 T&R 3000	AO3406	30V	3.6A			VT4 VT5	ALPHA&OMEGA	yes	2
2000065	SMD	MOSFET N-CH 30V 6A SOT23-6	STT6N3LLH6	30V	6A			VT13 VT14	ST	yes	2
2000700	SMD	TRANS NPN GP 45V 500mA SOT-23 T&R 3000	BC817-40LT1G	45V	0,5A	0,225W		VT1 VT3 VT10 VT11 VT12 VT801 VT802	ON	yes	7
3000103	SMD	IC Serial Flash Memory with SPI 32Mbit SOIC-8W T&R	W25Q32JVSSIM	2.7-3.6V				D2	Winbond	yes	1
3000156	SMD	IC FRAM Serial Memory 16K I2C SOIC-8 T&R	MB85RC16PNF-G-JNERE1	2.7-3.6V	100uA/1uA			D1	Fujitsu	yes	1
3000248	SMD	Photocoupler Ultra Small SSOP	EL3H7BTA-VG					DA302	EVERLIGHT	yes	1
3000284	SMD	Smart Meter System on Chip TQFP176	STCOMET10					U1	STM	yes	1
3000352	SMD	Polyphase Multifunction Energy Metering IC	STPM34TR					DA2	ST		1
3000411	SMD	IC REG BUCK ADJ 2A SYNC SOT-23-6	TPS562200DDC					DA7 DA8	TI	yes	2
3000414	SMD	IC PWR MGR EFUSE 18V 8SOIC	TPS25921ADR	18V	1.7A			DA806 DA905	TI	yes	2
3000485	SMD	Analog-Bipolar Hall Effect Sensor	DRV5055A4DBZR	3.3-5.0V				DA3	TI	yes	1
3000502	SMD	Low-Dropout Regulator 5 V, 100 mA,	TLV76050DBZR	5.0	0.1A		0.5%	DA804 DA906	TI	yes	2
3000518	SMD	RS485 Transceiver with IEC-ESD ptotection	THVD1500DR	5V			Temp -40 +125 C	D801	TI	yes	1
3000530	SMD	Ultra-low power, high performance, sub-1GHz transceiver	S2-LPQTR	1.8-3.6V				DA1101	STM	yes	1
3000532	SMD	Photocoupler Ultra Small SSOP	TLP290(BL-TP.SE					DA11 DA12 DA13	Toshiba	yes	3
3000533	SMD	Balun to Spirit2 868 MHz and 927 MHz	BALF-SPI2-01D3					DA1102	ST	yes	1
3000569	SMD	IC Flyback Controller With Optocoupler Feedback SOT23-6	UCC28742DR					DA300	TI	yes	1
3000581	SMD	5kVrms Isolated RS485 Transceiver with Robust EMC	ISO1410BDWR	5V			Temp -40 +125 C	D901	TI	yes	1
3000603	SMD	1.8V 250mA Ultra low noise Low Iq LDO	LP5907MFX-1.8/NOPB	1.8V	0.25A			DA1103	TI	yes	1
3005161	SMD	Optocoupler SMD4 T&R 1000	FOD817BSD(H11A817BS)					DA801 DA802 DA803 DA805 DA904	FAIRCHILD	yes	5
4000015	SMD	RES 0402	62			0.063W	5%	R37 R70 R71 R129 R214		yes	5
4000016	SMD	RES 0402	220			0.063W	5%	R2 R113 R141		yes	3

4000020	SMD	RES 0402	1M			0.063W	5%	R68 R168		yes	2
4000040	SMD	RES 0402	620			0.063W	5%	R12 R803 R804 R806 R903 R904 R912		yes	7
4000043	SMD	RES 0402	100K			0,063W	1%	R3 R4 R13 R114 R134 R144 R181		yes	7
4000083	SMD	RES 0603	4.3K			0.1W	1%	R314		yes	1
4000088	SMD	RES MMU0102-50 1% BL 13R	13	150V		0,2W	1%	R810 R811 R914 R915	VISHAY	yes	4
4000141	SMD	RES 2512	0			1W	5%	R223 R224 R225		yes	3
4000160	SMD	RES 0402	33K			0,063W	1%	R131 R197 R198		yes	3
4000164	SMD	RES 0402	21K			0,063W	1%	R69		yes	1
4000167	SMD	RES 0603	240			0.1W	1%	R226 R227 R228 R230		yes	4
4000174	SMD	RES 0402	470K			0,063W	1%	R77 R130 R136 R187 R188		yes	5
4000184	SMD	RES MMU0102-50 1% BL 470	470	150		0.2W	1%	R84 R90 R96	VISHAY	yes	3
4000197	SMD	RES 0402	120			0.063W	1%	R38 R39 R282 R283		yes	4
4000200	SMD	RES MMA0204-50 SMD	330K	200V		0.25W	1%	R172 R173 R174 R175 R176 R177 R178 R179 R180	VISHAY	yes	9
4000217	SMD	RES MMU0102-50 2% BL 4.7R	4.7			0.2W	2%	R100 R104 R108 R194	VISHAY	yes	4
4000219	SMD	RES 0402	2K			0,063W	1%	R287 R288		yes	2
4000245	SMD	RES WIRE SMW-3W	22			3W	5%	R201 R202 R203		yes	3
4000302	SMD	RES 1206 -55C...+155C	1			0.25	5%	R313		yes	1
4000303	SMD	RES 1206 -55C...+155C	100			0.25	1%	R301 R303 R307		yes	3
4000304	SMD	RES 1206 -55C...+155C	51.1			0.25	1%	R302		yes	1
4000702	SMD	RES 0603	0			0.1W	5%	R1003 R1105		yes	2
4000704	SMD	RES 0402	0			0,063W		R1101 R1104		yes	2
4001213	SMD	RES 0603	10			0.1W	5%	R163 R166		yes	2
4001218	SMD	RES 0402	10			0,063W	5%	R1103		yes	1
4001804	SMD	RES 0603	20			0.1W	5%	R306		yes	1
4002901	SMD	RES 1206	56			0.25W	5%	R78		yes	1
4003282	SMD	RES 1206	82			0.25W	5%	R704		yes	1
4003401	SMD	RES 0603	91			0.1W	1%	R40 R54		yes	2
4003493	SMD	RES 0603	100			0.1W	5%	R15 R35 R311		yes	3
4004123	SMD	RES 1206	200			0.25W	1%	R125		yes	1
4004132	SMD	RES MMU0102-50 SMD	200			0.2W	1%	R99 R102 R103 R106 R107 R110 R193 R196	VISHAY	yes	8
4004827	SMD	RES 0603	390			0.1W	1%	R112		yes	1
4005029	SMD	RES 0603	470			0.1W	5%	R309		yes	1
4005032	SMD	RES 0603	470			0.1W	1%	R308		yes	1
4005821	SMD	RES 0402	1K			0,063W	1%	R34 R124 R126 R284 R805 R808 R813 R820 R902		yes	9
4006431	SMD	RES 0603	2K			0.1W	5%	R51 R53 R120 R121 R215 R216		yes	6
4006515	SMD	RES 0402	2.2K			0.063W	1%	R182		yes	1
4007344	SMD	RES 0402	4.7K			0.063W	1%	R6 R7 R8 R22 R48 R49 R286 R814		yes	8
4007356	SMD	RES 0603	4.7K			0.1W	1%	R906		yes	1
4007746	SMD	RES 0603	6.8K			0.1W	5%	R50 R52 R807		yes	3
4007926	SMD	RES 0603	8.2K			0.1W	1%	R145		yes	1
4008122	SMD	RES 0402	10K			0,063W	1%	R9 R10 R23 R24 R28 R29 R30 R33 R42 R43 R44 R45 R46 R47 R72 R73 R74 R132 R135 R157 R158 R164 R165 R184 R186 R222 R801 R901		yes	28
4008141	SMD	RES 0603	10K			0.1W	1%	R1001 R1002		yes	2
4008795	SMD	RES 0603	20K			0.1W	1%	R312 R815 R824 R909 R917		yes	5
4009109	SMD	RES 0402	27K			0,063W	1%	R16 R17 R18 R19 R20 R21 R25 R26 R183 R185		yes	10
4009308	SMD	RES 0603	33K			0.1W	1%	R310		yes	1
4009711	SMD	RES 0402	47K			0,063W	1%	R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R123 R127 R143 R213 R217 R285		yes	17
4010025	SMD	RES 0603	62K			0.1W	1%	R819 R908		yes	2
4010511	SMD	RES MMA0204-50	100K			0.25W	1%	R83 R89 R95	VISHAY	yes	3
4010513	SMD	RES 0603	100K			0.1W	1%	R1004		yes	1
4010582	SMD	RES 0805	110K			0.125W	1%	R305		yes	1
4010663	SMD	RES MMA0204-50	120K			0.25W	1%	R82 R88 R94	VISHAY	yes	3
4011148	SMD	RES MMA0204-50 SMD	200K			0.25W	1%	R79 R80 R81 R85 R86 R87 R91 R92 R93	VISHAY	yes	9
4012803	SMD	RES 1206	1M			0.25W	1%	R139 R142		yes	2
4012822	SMD	RES 1206	1.1M			0.25W	1%	R133 R137		yes	2
5000126	SMD	CAP CER X5R 0805	10uF	25V			10%	C904	Murata	yes	1
5000134	SMD	CAP CERAMIC X7R 0402 470pF 50V	470pF	50V			±10%	C1108		yes	1

5000173	SMD	CAP CERAMIC X7R 1206	10uF	25V			10%	C47 C49 C67 C68 C75 C77 C803 C908		yes	8
5000192	SMD	CAP CERAMIC NP0 0402	1.2pF	50V			±0.1pF	C1127 C1128		yes	2
5000205	SMD	CAP CER X7R 0603	1uF	10V			±10%	C1103 C1110 C1114 C1130		yes	4
5000210	SMD	CAP CERAMIC X7R 0402	0.1uF	50V			±10%	C906 C913 C1102 C1104 C1107 C1109 C1116 C1118 C1120 C1122 C1124	Murata	yes	11
5000227	SMD	CAP CER NP0 0603	8200pF	50V			±5%	C171 C172		yes	2
5000230	SMD	CAP CERAMIC NP0 1206	0.068uF	50V			±5%	C169 C170		yes	2
5000233	SMD	CAP CERAMIC NP0 0603	1800pF	50V			±5%	C60		yes	1
5000249	SMD	CAP CERAMIC NP0 0402	100pF	50V			5%	C1105 C1111 C1115 C1117 C1119 C1121 C1123 C1125 C1126		yes	9
5000262	SMD	CAP CERAMIC X5R 1206	10uF	50 V			±20%	C136 C144		yes	2
5000281	SMD	CAP CERAMIC X7R 1206	2.2uF	50V			10%	C309		yes	1
5002104	SMD	CAP CERAMIC NP0 0603	4.7pF	50V			5%	C58 C59		yes	2
5002302	SMD	CAP CERAMIC NP0 0402	5.6pF	50V			±0,1 pF	C10 C12			2
5002903	SMD	CAP CERAMIC NP0 0402	12pF	50V			5%	C1112 C1113			2
5003304	SMD	CAP CERAMIC NP0 0402	18pF	50V			5%	C7 C8 C78 C79			4
5003504	SMD	CAP CERAMIC NP0 0603	22pF	50V			5%	C314		yes	1
5003703	SMD	CAP CERAMIC NP0 0402	27pF	50V			5%	C57 C61		yes	2
5004302	SMD	CAP CERAMIC NP0 0402	47pF	50V			5%	C28			1
5004903	SMD	CAP CERAMIC NP0 0402	82pF	50V			5%	C200 C201			2
5005206	SMD	CAP CERAMIC NP0 0402	150pF	50V			5%	C99 C110 C111 C114 C115 C116			6
5005912	SMD	CAP CERAMIC NP0 0603	330pF	50V				C319		yes	1
5006104	SMD	CAP CERAMIC X7R 1206	470pF	500V				C302 C305 C308		yes	3
5006611	SMD	CAP CERAMIC X7R 0402	1000pF	50V			10%	C804 C903		yes	2
5006810	SMD	CAP CERAMIC C0G(NP0) 0603	1500pF	50V			5%	C317 C318			2
5007004	SMD	CAP CERAMIC X7R 1206	2200pF	500VDC			±10%	C301		yes	1
5007911	SMD	CAP CERAMIC X7R 0603	4700pF	50V			±10%	C4			1
5008004	SMD	CAP CERAMIC X7R 0603	5600pF	50V				C165 C166 C167		yes	3
5008312	SMD	CAP CERAMIC X7R 0603	0.01uF	50V			10%	C56 C62 C85 C168		yes	4
5008709	SMD	CAP CERAMIC X7R 0603	0.022uF	50V				C80 C81 C82		yes	3
5008911	SMD	CAP CERAMIC X7R 0402	0.033uF	10V			10%	C3 C5 C9			3
5009100	SMD	CAP CERAMIC X7R 1206	0.047uF	50V				C316		yes	1
5009108	SMD	CAP CERAMIC X7R 0603	0.047uF	50V			10%	C84 C86 C88 C90		yes	4
5009518	SMD	CAP CERAMIC X7R 0402	0.1uF	16V			10%	C2 C6 C11 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C30 C32 C34 C35 C37 C38 C39 C42 C43 C45 C46 C50 C52 C70 C74 C83 C87 C95 C96 C97 C100 C101 C112 C113 C120 C121 C160 C163 C199 C820 C901 C912		yes	50
5009522	SMD	CAP CERAMIC X7R 0603	0.1uF	50V			10%	C48 C51 C53 C54 C64 C65 C71 C72 C130 C132 C142 C143 C304 C307 C313		yes	15
5010717	SMD	CAP CERAMIC X7R 0805	1uF	50V				C73 C94 C98 C159 C162 C801		yes	6
5011511	SMD	CAP CERAMIC 25V X5R 0805	4.7uF	25V			10%	C93		yes	1
5012116	SMD	CAP CERAMIC X7R 0805	10uF	10V			20%	C29 C31 C33 C36 C40 C41 C44 C1101		yes	8
5012517	SMD	CAP CERAMIC X5R 0805 ECJ2F1A226M	22uF	10 V			±20%	C128 C138	Panasonic	yes	2
6000123	SMD	QUARTZ SMD 32,768 T&R	SJK-6LC-32.768-12.5-20-40-C			-40 … +85	20 ppm	Q1	SJK	yes	1
6000285	SMD	Crystal SJK series7U 24.000 MHz 18 pF 30 ppm	SJK-7U-24.000-18-30-50-C-30			-40 … +85	30 ppm	Q2	SJK	yes	1
6000359	SMD	Crystal ABM8 series 52.000 MHz 8 pF 10 ppm	ABM8-52.000MHZ-8-R40-DIG-T			-40 C	10 ppm	Q1112	Abracon Corp.	yes	1
6000467	SMD	Crystal SJK series7U 16.000 MHz 18 pF 30 ppm	SJK-7U-16.000-18-30-50-C-30			-40 … +85	30 ppm	Q3	SJK	yes	1
7000011	SMD	FERRITE CHIP 600 OHM 1500mA 1206 T&R	BLM31PG601SN1L					L28 L29	MURATA	yes	2
7000013	SMD	FERRITE CHIP 50 OHM 3000mA 1206 T&R	BLM31PG500SN1L					L105 L106 L107	MURATA	yes	3
7000074	SMD	FERRITE CHIP 600 OHM 200mA 0603	BLM18AG601SN1D		0.2A		25%	L8 L9 L10 L11 L12 L13 L14 L15	MURATA	yes	8
7000145	SMD	Ferrite chip 330 Ohm 500 mA 0603	BLM18AG331SN1D		0,5A		25%	L1	MURATA	yes	1
7000201	SMD	Fixed Wirewound Shielded 1210 Inductor	470uH		30mA		10%	L20	TDK	yes	1
7000209	SMD	Fixed Wirewound Shielded 1210 Inductor	1000uH		20mA		10%	L24	TDK	yes	1
7000210	SMD	Fixed Wirewound Shielded 1210 Inductor	22uH		120mA		10%	L22 L23	TDK	yes	2
7000214	SMD	Metal Core Wire-wound 1008 Chip Power Inductors	3.3uH		1.7A		20%	L30	TAIYO YUDEN	yes	1
7000216	SMD	FERRITE CHIP 600 Ohm 300mA 0402	BLM15AG601SN1		300mA		25%	L25 L26 L27	MURATA	yes	3

7000224	SMD	Metal Core Wire-wound 1008 Chip Power Inductors	4.7uH		1.3A		20%	L17 L21	TAIYO YUDEN	yes	2
7000257	SMD	Inductor 0603 LQW18AN39NJ00	39nH		400mA		5%	L1103	MURATA	yes	1
8000664	SMD	SH1mm SMT Top Entry 10pin -40..+105C	W9110-10PATWXSR			-40..+105 C		X17	HSUAN MAO	yes	1
1014079	TH	IR PHOTODIODE	SFH203FA					VD2	OSRAM		1
1014080	TH	LED RED 3mm	BL-BUE1V1					VD21 VD22	BRIGHT LED	yes	2
1014099	TH	LED IR 5mm	TSAL 6100					VD3	VISHAY	yes	1
4000311	TH	RES AXIAL	51K			1W	5%	R300		yes	1
4001201	TH	RES WIRE KNP-2W	10			2W	5%	R204		yes	1
5000101	TH	CAP ELECTROLYTIC Low Impendance TM 6.3x12 RM2.5	100uF	25V			20%	C907	Fujicon	yes	1
5000149	TH	CAP FILM KNB1550 X1 7.5X13.5X18 RM 15	0.1uF	310VAC			20%	C131 C133 C137	ISKRA	yes	3
5000153	TH	CAP FILM X1 330VAC 10.5X26.5X18.5 RM 22.5 B32913A3474M	0.47uF	330VAC			20%	C66 C69 C76	EPCOS	yes	3
5000160	TH	CAP ELECTROLYTIC Low Impendance RM3.5 8x16	470uF	25V			20%	C306 C310 C311 C312 C805	Fujicon	yes	5
5000200	TH	CAP DISK CERAMIC RM10 Y1	470pF	500V			20%	C145 C147 C300		yes	3
5012103	TH	CAP Electrolytic 10x19 RM=5 Low ESR	10uF	400V			20%	C134 C135 C140 C141	GEMCON		4
5013707	TH	CAP ELECTROLYTIC Low Impendance TM 8x12 RM3.5	220uF	25V			20%	C129 C139 C161 C303	Fujicon	yes	4
5015601	TH	CAP ELECTROLYTIC AXIAL 37x18 RM45	6800uF	25V				C127		yes	1
6000030	TH	VARISTOR DISK 7mm 250V RMS	SIOV-S07K250	250V RMS				RU10 RU11	EPCOS	yes	2
6000154	TH	LCD on glass with back light h=20.2mm 40 pin	FP-1525PA-BL					HG1	PROEL ltd.	yes	1
6000309	TH	Miniature micro switch, 125VAC 1A / DC5V 30mA	DM1-01P-40-3	125VAC	1A	-40 ... +70		SB3	DICGU ELECTRONIX	yes	1
6000319	TH	RELAY 250VAC 5A 12V(coil)	HF32FA/012-HSL1	12V	5A			K10 K11		yes	2
6000378	TH	Primary lithium battery 1/2AA 1200 mAh -55..+85 C	ER14250N-3PT	3.6V	50mA			GB1	Proel	yes	1
6000424	TH	VARISTOR DISK 250V RMS E2K1	S14K250E2K1	250V RMS	6 kA	115 J	6 kA	RU1 RU2 RU3 RU4	TDK	yes	4
6000434	TH	ANTENNA 868 MHz spring with straight end	SW868-TH13A					X1101	NiceRF	yes	1
6000446	TH	Tact Switch: 6x6 TYPE 60-2000 Vertical H=13.5mm	60-2S3G	12V	50mA	-40 ... +85		SB2	Pran Electronics Pvt. Ltd.	yes	1
7000221	TH	Unshielded Wirewound Inductor Radial RLB9012	2.2mH		0.36A		10%	L16 L18 L19	Bourns	yes	3
7000251	TH	Inductor 09P/F-681K	680uH				10%	L6 L7	Fastron	yes	2
7000264	TH	Unshielded Wirewound Inductor Max Radial RLB0914	15uH		2.4A		10%	L2	Bourns	yes	1
8000112	TH	2.54 mm Pin Header Single Row 02P Straihgt	C2100-02ASGAS0R					X300	HSUAN MAO	yes	1
8000114	TH	1.27mm x 1.27mm 2x5	C1280-10BSGAS0R 1.27x1.27					X20	HSUAN MAO	yes	1
8000230	TH	2x1_7.50mm pitch single row male header vertical	CI7602P1V00					X12 X16	CviLux	yes	2
8000350	TH	2x1_2.50mm pitch single row header	CW325S-02G					X4 X5 X6 X7 X8 X9 X10 X11 X13 X14 X15	CHS	yes	11
8000351	TH	3x1_2.50mm pitch single row header	CW325S-03G					X1 X2 X3 X100	CHS		4
8000352	TH	4x1_2.50mm pitch single row header	CW325S-04G					X801 X803	CHS		2
9160264	TH	TRANSFORMER PLC FCC/CEN A 0.67+0.67 : 1	ADDM.671331.340					T3	ADD	yes	1
9160296	TH	Transformer Flyback PQ20/16	ADDM.671331.344	3x12V	3x0.4A	15W		T2	ADD	yes	1
8000023		2.54 mm Mini Jumper	C2700-02AAGB00					X302	HSUAN MAO		1
9510003		Cable Tie	TK 12/3					MH5	Ergom		1
9520030		LED 3mm Spacer support Black	LEDS-21					MH3 MH4	KANG YANG		2
9520093		LED SPACER SUPPORT (18,5mm) Black	LED-18,5					MH1 MH2	KANG YANG		2
9520115		SPACER SUPPORT	U-7V0					MH1000	KANG YANG		1
9249801	PCB	Printed Board AD13AP_498_01	ADDM.758728.498_01					PCB1	ADD		1

Bill of Components

Date	04-07-19	
Article (subject)	AD13AP_498_01-17_00	ADDM.411163.498-17
Number of the product	9649817	
Quantity	1	
Requested by (Name, signature)	____________	Nichita.Birliga
Approved by (Name, signature)	____________	(согласовано)

Cod	PACK	Description	Value	Voltage	Current	Pow	Tolerance	Part Reference	Manufacturer	RoHS	Quantity
1000006	SMD	DUAL DIODE SCHOTTKY 30V 0.2A SOT-23 T&R 3000	BAT54C-215	30V	0.2A	0.25W		VD39	Nexperia	yes	1
1000021	SMD	DIODE SCHOTTKY 1A 30V SMA	STPS1L30A	30V	1A			VD7 VD8 VD11 VD12	STM	yes	4
1000044	SMD	DIODE ZENER 3,9V 2% 0.35W SOT23	BZX84B3V9-7-F	3.9V				VD41	DIODES Inc	yes	1
1000086	SMD	Transil Bidirect 10V 1500W SMCJ	SMCJ8.5CA-TR	10V				VD30	STM	yes	1
1000091	SMD	Diode Rectifier 1600V 1A	GL41Y	1600V	1A			VD45 VD46 VD47 VD48 VD49 VD50 VD51 VD52	VISHAY	yes	8
1000126	SMD	TVS DIODE 13VWM 27.2VC SMA	SMAJ13CA-TR	13V	85A(8/20us)	400W		VD5	STM	yes	1
1000153	SMD	Diode Schottky Surface SOD123FL	MBR2H200SFT1G	200V	2A			VD300 VD302 VD305	ON	yes	3
1002166	SMD	DIODE GEN PURP 250V 200MA SOT23	BAS21LT1G	250V	0.2A			VD304	ON	yes	1
1002174	SMD	DIODE SCHOTTKY SOD323 T&R 3000	BAT54WS-E3-08	30V	200 mA			VD4 VD19 VD38 VD40 VD54 VD61 VD62 VD63 VD64	Vishay	yes	9
1002220	SMD	DUAL DIODE ULTRAFAST 70V 0.2A SOT-23 T&R 3000	BAV99LT1G	70V	0.2A			VD15 VD16 VD17	ON	yes	3
1002250	SMD	DIODE SW DBL 75V 215MA HS SOT23	BAW56	75V	0.215A			VD1	Nexperia		1
1003776	SMD	DIODE ZENER 7.5V 0.4W SOD80 T&R 2500	BZV55-C7V5-115	7.5V				VD20	Nexperia	yes	1
1003781	SMD	DIODE ZENER 11V 5% 0.4W SOD80 T&R 2500	BZV55-C11-115	11V				VD306	Nexperia	yes	1
1003806	SMD	DIODE ZENER 27V 0.4W SOD80	BZV55C27V	27V				VD307	PHILIPS	yes	1
1014410	SMD	DIODE SWITCH 75V 0.3A SOD80 T&R 2500	PMLL4148L	75V				VD36 VD37	Nexperia	yes	2
1014901	SMD	DIODE SCHOTTKY 40V 0.5A SOD-123 T&R 3000	MBR0540T1G	40V	0.5A			VD42	ON	yes	1
1021270	SMD	Transil 3,3V 600W SMB T&R 2500	SMLVT3V3	3.3V				VD43	STM	yes	1
1021501	SMD	Transil 6.8V 600W SMB T&R 2500	SM6T6V8A	6.8V				VD44	STM	yes	1
1021505	SMD	Transil 15V 600W SMB T&R 2500	SM6T15A	15V				VD65 VD308 VD309	STM	yes	3
1021507	SMD	Transil Bidirect 10V 600W SMB	SM6T10CA	10V				VD9 VD13	STM	yes	2
1024010	SMD	DIODE ULTRA FAST 1A 1000V SMA T&R 1800	US1M-E3/61T	1000V	1A			VD301	VISHAY	yes	1
2000035	SMD	MOSFET N-CH 60V 300MA SOT-23 T&R 3000	2N7002 T/R					VT70	NXP	yes	1
2000036	SMD	N-channel Trench MOSFET 60V 270mA SOT-23	NX7002BK	60V	0,27A	0,4W		VT2 VT6	NXP	yes	2
2000043	SMD	MOSFET P-CH, 20V, 52mOhm, -4.2A SOT23-6L	DMG2305UX-13	20	4.2			VT8 VT9 VT15	DIODES	yes	3
2000046	SMD	MOSFET N-CH 1000V 1.6A DPAK	FQD2N100TM	1000V	1.6A			VT300	Fairchild	yes	1
2000065	SMD	MOSFET N-CH 30V 6A SOT23-6	STT6N3LLH6	30V	6A			VT13 VT14	ST	yes	2
2000700	SMD	TRANS NPN GP 45V 500mA SOT-23 T&R 3000	BC817-40LT1G	45V	0,5A	0,225W		VT1 VT3 VT10 VT11 VT12 VT801 VT802	ON	yes	7
3000103	SMD	IC Serial Flash Memory with SPI 32Mbit SOIC-8W T&R	W25Q32JVSSIM	2.7-3.6V				D2	Winbond	yes	1
3000156	SMD	IC FRAM Serial Memory 16K I2C SOIC-8 T&R	MB85RC16PNF-G-JNERE1	2.7-3.6V	100uA/1uA			D1	Fujitsu	yes	1
3000248	SMD	Photocoupler Ultra Small SSOP	EL3H7BTA-VG					DA302	EVERLIGHT	yes	1
3000284	SMD	Smart Meter System on Chip TQFP176	STCOMET10					U1	STM	yes	1
3000352	SMD	Polyphase Multifunction Energy Metering IC	STPM34TR					DA2	ST		1
3000411	SMD	IC REG BUCK ADJ 2A SYNC SOT-23-6	TPS562200DDC					DA7 DA8	TI	yes	2
3000414	SMD	IC PWR MGR EFUSE 18V 8SOIC	TPS25921ADR	18V	1.7A			DA806 DA905	TI	yes	2
3000485	SMD	Analog-Bipolar Hall Effect Sensor	DRV5055A4DBZR	3.3-5.0V				DA3	TI	yes	1
3000502	SMD	Low-Dropout Regulator 5 V, 100 mA,	TLV76050DBZR	5.0	0.1A		0.5%	DA804 DA906	TI	yes	2
3000518	SMD	RS485 Transceiver with IEC-ESD ptotection	THVD1500DR	5V			Temp -40 +125 C	D801	TI	yes	1
3000530	SMD	Ultra-low power, high performance, sub-1GHz transceiver	S2-LPQTR	1.8-3.6V				DA1101	STM	yes	1
3000533	SMD	Balun to Spirit2 868 MHz and 927 MHz	BALF-SPI2-01D3					DA1102	ST	yes	1
3000569	SMD	IC Flyback Controller With Optocoupler Feedback SOT23-6	UCC28742DR					DA300	TI	yes	1
3000581	SMD	5kVrms Isolated RS485 Transceiver with Robust EMC	ISO1410BDWR	5V			Temp -40 +125 C	D901	TI	yes	1
3000603	SMD	1.8V 250mA Ultra low noise Low Iq LDO	LP5907MFX-1.8/NOPB	1.8V	0.25A			DA1103	TI	yes	1
3005161	SMD	Optocoupler SMD4 T&R 1000	FOD817BSD(H11A817BS)					DA801 DA802 DA803 DA805 DA904	FAIRCHILD	yes	5
4000015	SMD	RES 0402	62			0.063W	5%	R37 R70 R71 R129 R214		yes	5
4000016	SMD	RES 0402	220			0.063W	5%	R2 R113 R141		yes	3
4000020	SMD	RES 0402	1M			0.063W	5%	R68 R168		yes	2
4000040	SMD	RES 0402	620			0.063W	5%	R12 R803 R804 R806 R903 R904 R912		yes	7
4000043	SMD	RES 0402	100K			0,063W	1%	R3 R4 R13 R114 R134 R144		yes	6
4000083	SMD	RES 0603	4.3K			0.1W	1%	R314		yes	1

4000088	SMD	RES MMU0102-50 1% BL 13R	13	150V		0,2W	1%	R810 R811 R914 R915	VISHAY	yes	4
4000141	SMD	RES 2512	0			1W	5%	R223 R224 R225		yes	3
4000160	SMD	RES 0402	33K			0,063W	1%	R131 R197 R198		yes	3
4000164	SMD	RES 0402	21K			0,063W	1%	R69		yes	1
4000167	SMD	RES 0603	240			0.1W	1%	R226 R227 R228 R230		yes	4
4000174	SMD	RES 0402	470K			0,063W	1%	R77 R130 R136 R187 R188		yes	5
4000184	SMD	RES MMU0102-50 1% BL 470	470	150		0.2W	1%	R84 R90 R96	VISHAY	yes	3
4000197	SMD	RES 0402	120			0.063W	1%	R38 R39 R282 R283		yes	4
4000219	SMD	RES 0402	2K			0,063W	1%	R287 R288		yes	2
4000245	SMD	RES WIRE SMW-3W	22			3W	5%	R201 R202 R203		yes	3
4000279	SMD	RES MMU0102-50 1% BL 34R	34	150		0.2W	1%	R100 R104 R108	VISHAY	yes	3
4000302	SMD	RES 1206 -55C...+155C	1			0.25	5%	R313		yes	1
4000303	SMD	RES 1206 -55C...+155C	100			0.25	1%	R301 R303 R307		yes	3
4000304	SMD	RES 1206 -55C...+155C	51.1			0.25	1%	R302		yes	1
4000702	SMD	RES 0603	0			0.1W	5%	R1003 R1105		yes	2
4000704	SMD	RES 0402	0			0,063W		R1101 R1104		yes	2
4001213	SMD	RES 0603	10			0.1W	5%	R163 R166		yes	2
4001218	SMD	RES 0402	10			0,063W	5%	R1103		yes	1
4001804	SMD	RES 0603	20			0.1W	5%	R306		yes	1
4002901	SMD	RES 1206	56			0.25W	5%	R78		yes	1
4003282	SMD	RES 1206	82			0.25W	5%	R704		yes	1
4003401	SMD	RES 0603	91			0.1W	1%	R40 R54		yes	2
4003493	SMD	RES 0603	100			0.1W	5%	R15 R35 R311		yes	3
4004132	SMD	RES MMU0102-50 SMD	200			0.2W	1%	R99 R102 R103 R106 R107 R110	VISHAY	yes	6
4004827	SMD	RES 0603	390			0.1W	1%	R112		yes	1
4005029	SMD	RES 0603	470			0.1W	5%	R309		yes	1
4005032	SMD	RES 0603	470			0.1W	1%	R308		yes	1
4005821	SMD	RES 0402	1K			0,063W	1%	R34 R284 R805 R808 R813 R820 R902		yes	7
4006431	SMD	RES 0603	2K			0.1W	5%	R51 R53 R120 R121 R215 R216		yes	6
4007344	SMD	RES 0402	4.7K			0.063W	1%	R6 R7 R8 R22 R48 R49 R286 R814		yes	8
4007356	SMD	RES 0603	4.7K			0.1W	1%	R906		yes	1
4007746	SMD	RES 0603	6.8K			0.1W	5%	R50 R52 R807		yes	3
4007926	SMD	RES 0603	8.2K			0.1W	1%	R145		yes	1
4008122	SMD	RES 0402	10K			0,063W	1%	R9 R10 R23 R24 R28 R29 R30 R33 R42 R43 R44 R45 R46 R47 R72 R73 R74 R132 R135 R157 R158 R164 R165 R184 R186 R222 R801 R901		yes	28
4008141	SMD	RES 0603	10K			0.1W	1%	R1001 R1002		yes	2
4008795	SMD	RES 0603	20K			0.1W	1%	R312 R815 R824 R909 R917		yes	5
4009109	SMD	RES 0402	27K			0,063W	1%	R16 R17 R18 R19 R20 R21 R25 R26 R183 R185		yes	10
4009308	SMD	RES 0603	33K			0.1W	1%	R310		yes	1
4009711	SMD	RES 0402	47K			0,063W	1%	R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R143 R213 R217 R285		yes	15
4010025	SMD	RES 0603	62K			0.1W	1%	R819 R908		yes	2
4010511	SMD	RES MMA0204-50	100K			0.25W	1%	R83 R89 R95	VISHAY	yes	3
4010513	SMD	RES 0603	100K			0.1W	1%	R1004		yes	1
4010582	SMD	RES 0805	110K			0.125W	1%	R305		yes	1
4010663	SMD	RES MMA0204-50	120K			0.25W	1%	R82 R88 R94	VISHAY	yes	3
4011148	SMD	RES MMA0204-50 SMD	200K			0.25W	1%	R79 R80 R81 R85 R86 R87 R91 R92 R93	VISHAY	yes	9
4012803	SMD	RES 1206	1M			0.25W	1%	R139 R142		yes	2
4012822	SMD	RES 1206	1.1M			0.25W	1%	R133 R137		yes	2
5000126	SMD	CAP CER X5R 0805	10uF	25V			10%	C904	Murata	yes	1
5000134	SMD	CAP CERAMIC X7R 0402 470pF 50V	470pF	50V			±10%	C1108		yes	1
5000173	SMD	CAP CERAMIC X7R 1206	10uF	25V			10%	C47 C49 C67 C68 C75 C77 C803 C908		yes	8
5000192	SMD	CAP CERAMIC NP0 0402	1.2pF	50V			±0.1pF	C1127 C1128		yes	2
5000205	SMD	CAP CER X7R 0603	1uF	10V			±10%	C1103 C1110 C1114 C1130		yes	4
5000210	SMD	CAP CERAMIC X7R 0402	0.1uF	50V			±10%	C906 C913 C1102 C1104 C1107 C1109 C1116 C1118 C1120 C1122 C1124	Murata	yes	11
5000227	SMD	CAP CER NP0 0603	8200pF	50V			±5%	C171 C172		yes	2
5000230	SMD	CAP CERAMIC NP0 1206	0.068uF	50V			±5%	C169 C170		yes	2
5000233	SMD	CAP CERAMIC NP0 0603	1800pF	50V			±5%	C60		yes	1

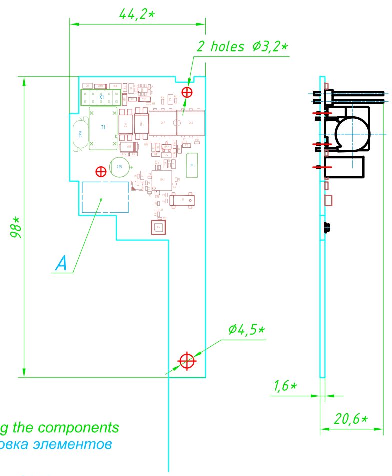
5000249	SMD	CAP CERAMIC NP0 0402	100pF	50V			5%	C1105 C1111 C1115 C1117 C1119 C1121 C1123 C1125 C1126		yes	9
5000262	SMD	CAP CERAMIC X5R 1206	10uF	50 V			±20%	C136 C144		yes	2
5000281	SMD	CAP CERAMIC X7R 1206	2.2uF	50V			10%	C309		yes	1
5002104	SMD	CAP CERAMIC NP0 0603	4.7pF	50V			5%	C58 C59		yes	2
5002302	SMD	CAP CERAMIC NP0 0402	5.6pF	50V			±0,1 pF	C10 C12			2
5002903	SMD	CAP CERAMIC NP0 0402	12pF	50V			5%	C1112 C1113			2
5003304	SMD	CAP CERAMIC NP0 0402	18pF	50V			5%	C7 C8 C78 C79			4
5003504	SMD	CAP CERAMIC NP0 0603	22pF	50V			5%	C314		yes	1
5003703	SMD	CAP CERAMIC NP0 0402	27pF	50V			5%	C57 C61		yes	2
5004302	SMD	CAP CERAMIC NP0 0402	47pF	50V			5%	C28			1
5004903	SMD	CAP CERAMIC NP0 0402	82pF	50V			5%	C200 C201			2
5005206	SMD	CAP CERAMIC NP0 0402	150pF	50V			5%	C99 C110 C111 C114 C115 C116			6
5005912	SMD	CAP CERAMIC NP0 0603	330pF	50V				C319		yes	1
5006104	SMD	CAP CERAMIC X7R 1206	470pF	500V				C302 C305 C308		yes	3
5006611	SMD	CAP CERAMIC X7R 0402	1000pF	50V			10%	C804 C903		yes	2
5006810	SMD	CAP CERAMIC C0G(NP0) 0603	1500pF	50V			5%	C317 C318			2
5007004	SMD	CAP CERAMIC X7R 1206	2200pF	500VDC			±10%	C301		yes	1
5007911	SMD	CAP CERAMIC X7R 0603	4700pF	50V			±10%	C4			1
5008004	SMD	CAP CERAMIC X7R 0603	5600pF	50V				C165 C166 C167		yes	3
5008312	SMD	CAP CERAMIC X7R 0603	0.01uF	50V			10%	C56 C62 C85 C168		yes	4
5008709	SMD	CAP CERAMIC X7R 0603	0.022uF	50V				C80 C81 C82		yes	3
5008911	SMD	CAP CERAMIC X7R 0402	0.033uF	10V			10%	C3 C5 C9			3
5009100	SMD	CAP CERAMIC X7R 1206	0.047uF	50V				C316		yes	1
5009108	SMD	CAP CERAMIC X7R 0603	0.047uF	50V			10%	C84 C86 C88		yes	3
5009518	SMD	CAP CERAMIC X7R 0402	0.1uF	16V			10%	C2 C6 C11 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C30 C32 C34 C35 C37 C38 C39 C42 C43 C45 C46 C50 C52 C74 C83 C87 C95 C96 C97 C100 C101 C112 C113 C120 C121 C160 C163 C199 C820 C901 C912		yes	49
5009522	SMD	CAP CERAMIC X7R 0603	0.1uF	50V			10%	C48 C51 C53 C54 C64 C65 C71 C72 C130 C132 C142 C143 C304 C307 C313		yes	15
5010717	SMD	CAP CERAMIC X7R 0805	1uF	50V				C73 C94 C98 C159 C162 C801		yes	6
5011511	SMD	CAP CERAMIC 25V X5R 0805	4.7uF	25V			10%	C93		yes	1
5012116	SMD	CAP CERAMIC X7R 0805	10uF	10V			20%	C29 C31 C33 C36 C40 C41 C44 C1101		yes	8
5012517	SMD	CAP CERAMIC X5R 0805 ECJ2F1A226M	22uF	10 V			±20%	C128 C138	Panasonic	yes	2
6000123	SMD	QUARTZ SMD 32,768 T&R	SJK-6LC-32.768-12.5-20-40-C			-40 … +85	20 ppm	Q1	SJK	yes	1
6000285	SMD	Crystal SJK series7U 24.000 MHz 18 pF 30 ppm	SJK-7U-24.000-18-30-50-C-30			-40 … +85	30 ppm	Q2	SJK	yes	1
6000359	SMD	Crystal ABM8 series 52.000 MHz 8 pF 10 ppm	ABM8-52.000MHZ-8-R40-DIG-T			-40 C	10 ppm	Q1112	Abracon Corp.	yes	1
6000467	SMD	Crystal SJK series7U 16.000 MHz 18 pF 30 ppm	SJK-7U-16.000-18-30-50-C-30			-40 … +85	30 ppm	Q3	SJK	yes	1
7000011	SMD	FERRITE CHIP 600 OHM 1500mA 1206 T&R	BLM31PG601SN1L					L28 L29	MURATA	yes	2
7000013	SMD	FERRITE CHIP 50 OHM 3000mA 1206 T&R	BLM31PG500SN1L					L105 L106 L107	MURATA	yes	3
7000074	SMD	FERRITE CHIP 600 OHM 200mA 0603	BLM18AG601SN1D		0.2A		25%	L8 L9 L10 L11 L12 L13	MURATA	yes	6
7000145	SMD	Ferrite chip 330 Ohm 500 mA 0603	BLM18AG331SN1D		0,5A		25%	L1	MURATA	yes	1
7000201	SMD	Fixed Wirewound Shielded 1210 Inductor	470uH		30mA		10%	L20	TDK	yes	1
7000209	SMD	Fixed Wirewound Shielded 1210 Inductor	1000uH		20mA		10%	L24	TDK	yes	1
7000210	SMD	Fixed Wirewound Shielded 1210 Inductor	22uH		120mA		10%	L22 L23	TDK	yes	2
7000214	SMD	Metal Core Wire-wound 1008 Chip Power Inductors	3.3uH		1.7A		20%	L30	TAIYO YUDEN	yes	1
7000216	SMD	FERRITE CHIP 600 Ohm 300mA 0402	BLM15AG601SN1		300mA		25%	L25 L26 L27	MURATA	yes	3
7000224	SMD	Metal Core Wire-wound 1008 Chip Power Inductors	4.7uH		1.3A		20%	L17 L21	TAIYO YUDEN	yes	2
7000257	SMD	Inductor 0603 LQW18AN39NJ00	39nH		400mA		5%	L1103	MURATA	yes	1
8000664	SMD	SH1mm SMT Top Entry 10pin -40..+105C	W9110-10PATWXSR			-40..+105 C		X17	HSUAN MAO	yes	1
1014079	TH	IR PHOTODIODE	SFH203FA					VD2	OSRAM		1
1014080	TH	LED RED 3mm	BL-BUE1V1					VD21 VD22	BRIGHT LED	yes	2
1014099	TH	LED IR 5mm	TSAL 6100					VD3	VISHAY	yes	1
4000311	TH	RES AXIAL	51K			1W	5%	R300		yes	1
4001201	TH	RES WIRE KNP-2W	10			2W	5%	R204		yes	1
5000101	TH	CAP ELECTROLYTIC Low Impendance TM 6.3x12 RM2.5	100uF	25V			20%	C907	Fujicon	yes	1

5000149	TH	CAP FILM KNB1550 X1 7.5X13.5X18 RM 15	0.1uF	310VAC			20%	C131 C133 C137	ISKRA	yes	3
5000153	TH	CAP FILM X1 330VAC 10.5X26.5X18.5 RM 22.5 B32913A3474M	0.47uF	330VAC			20%	C66 C69 C76	EPCOS	yes	3
5000160	TH	CAP ELECTROLYTIC Low Impendance RM3.5 8x16	470uF	25V			20%	C306 C310 C311 C312 C805	Fujicon	yes	5
5000200	TH	CAP DISK CERAMIC RM10 Y1	470pF	500V			20%	C145 C147 C300		yes	3
5012103	TH	CAP Electrolytic 10x19 RM=5 Low ESR	10uF	400V			20%	C134 C135 C140 C141	GEMCON		4
5013707	TH	CAP ELECTROLYTIC Low Impendance TM 8x12 RM3.5	220uF	25V			20%	C129 C139 C161 C303	Fujicon	yes	4
6000030	TH	VARISTOR DISK 7mm 250V RMS	SIOV-S07K250	250V RMS				RU10 RU11	EPCOS	yes	2
6000154	TH	LCD on glass with back light h=20.2mm 40 pin	FP-1525PA-BL					HG1	PROEL ltd.	yes	1
6000309	TH	Miniature micro switch, 125VAC 1A / DC5V 30mA	DM1-01P-40-3	125VAC	1A	-40 … +70		SB3	DICGU ELECTRONIX	yes	1
6000319	TH	RELAY 250VAC 5A 12V(coil)	HF32FA/012-HSL1	12V	5A			K10 K11		yes	2
6000378	TH	Primary lithium battery 1/2AA 1200 mAh -55..+85 C	ER14250N-3PT	3.6V	50mA			GB1	Proel	yes	1
6000424	TH	VARISTOR DISK 250V RMS E2K1	S14K250E2K1	250V RMS	6 kA	115 J	6 kA	RU1 RU2 RU3 RU4	TDK	yes	4
6000434	TH	ANTENNA 868 MHz spring with straight end	SW868-TH13A					X1101	NiceRF	yes	1
6000446	TH	Tact Switch: 6x6 TYPE 60-2000 Vertical H=13.5mm	60-2S3G	12V	50mA	-40 ... +85		SB2	Pran Electronics Pvt. Ltd.	yes	1
7000221	TH	Unshielded Wirewound Inductor Radial RLB9012	2.2mH		0.36A		10%	L16 L18 L19	Bourns	yes	3
7000251	TH	Inductor 09P/F-681K	680uH				10%	L6 L7	Fastron	yes	2
7000264	TH	Unshielded Wirewound Inductor Max Radial RLB0914	15uH		2.4A		10%	L2	Bourns	yes	1
8000112	TH	2.54 mm Pin Header Single Row 02P Straihgt	C2100-02ASGAS0R					X300	HSUAN MAO	yes	1
8000114	TH	1.27mm x 1.27mm 2x5	C1280-10BSGAS0R 1.27x1.27					X20	HSUAN MAO	yes	1
8000230	TH	2x1_7.50mm pitch single row male header vertical	CI7602P1V00					X12 X16	CviLux	yes	2
8000350	TH	2x1_2.50mm pitch single row header	CW325S-02G					X4 X5 X6 X11 X13 X14 X15	CHS	yes	7
8000351	TH	3x1_2.50mm pitch single row header	CW325S-03G					X100	CHS		1
8000352	TH	4x1_2.50mm pitch single row header	CW325S-04G					X801 X803	CHS		2
9160264	TH	TRANSFORMER PLC FCC/CEN A 0.67+0.67 : 1	ADDM.671331.340					T3	ADD	yes	1
9160296	TH	Transformer Flyback PQ20/16	ADDM.671331.344	3x12V	3x0.4A	15W		T2	ADD	yes	1
8000023		2.54 mm Mini Jumper	C2700-02AAGB00					X302	HSUAN MAO		1
9520030		LED 3mm Spacer support Black	LEDS-21					MH3 MH4	KANG YANG		2
9520093		LED SPACER SUPPORT (18,5mm) Black	LED-18,5					MH1 MH2	KANG YANG		2
9520115		SPACER SUPPORT	U-7V0					MH1000	KANG YANG		1
9249801	PCB	Printed Board AD13AP_498_01	ADDM.758728.498_01					PCB1	ADD		1

ADDM.411163.425 AD

First Reference

Reference No RF_HEDNOP_425



Mounting the components
Установка элементов

C910

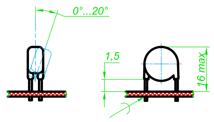


Table1

Component	ADDM.411163.425	ADDM.411163.425-01	ADDM.411163.425-02
C3	+		
C4	+	-	-
C21	-	-	-
C22	-	-	-
X1	+	-	
X3	+	-	+

1. Dimensions marked with " * " are reference information only.
2. Solder with Wave Soldering Alloy Sn99Cu1 and solder paste SAC305 (SAC405).
3. Mount the components lying on the PCB.
4. Components positional designations and pin numbers are shown just for convenience.
5. Quality department stamp is to be placed within zone A.
6. See the assembly versions difference in Table 1.
7. Mark the PCB (within zone A) with "425"... "425-02" according to PCB assembly version (see the table).
See technical requirements for marking in IPC-A-610D (i.10.3.3 or i.10.3.5,applicable class - 1).
8. See other technical requirements in IPC-A-610D (applicable class for the assembly - 3)

1. * Размеры для справок.
2. Паять припоем для пайки волной Sn99Cu1 и паяльной пастой SAC305 (SAC405).
3. Элементы паять на плату.
4. Позиционные обозначения элементов и номера контактов показаны условно.
5. Штамп ОТК разместить в зоне А.
6. См. отличия исполнений в Таблице 1.
7. Маркировать плату "425"..."425-02" в зоне А в соответствии с вариантом исполнения (см. таблицу исполнений). Технические требования к маркировке по IPC-A-610D (п. 10.3.3 или п. 10.3.5, класс 1).
8. Остальные технические требования по IPC-A-610D (класс 3)

Pcb ID: ADDM.758728.425_03

Rev	Sheet	Document No.	Sign	Date
Author		Volceanov		
Checked		Banarescu		
Engineer				
Manager				
Eng. Appr		Galocichin		
Mfg. Appr		Deev		

ADDM.411163.425 AD mod.4

RF_HEDNOP_425

Assembly drawing

Lit	Mass	Scale
		1:1

Sheet | Sheets 1

ADD

Sign and date | Dupl Stock No | Repl Stock No | Sign and date | Stock Number

Copied By | Format A3

Doc no	11778/0-14
Page	1 of 1

Bill of Components

Date 31-07-19

Article (subject) RF_HEDNOP_425_03-00_00 ADDM.411163.425

Number of the product 9642500

Quantity 1

Requested by (Name, signature) ____________ Nichita.Birliga

Approved by (Name, signature) ____________ (согласовано)

Cod	PACK	Description	Value	Voltage	Current	Pow	Tolerance	Part Reference	Manufacturer	RoHS	Quantity
1000021	SMD	DIODE SCHOTTKY 1A 30V SMA	STPS1L30A	30V	1A			VD2	STM	yes	1
1003768	SMD	DIODE ZENER 4,7V 2% 0.4W SOD80	BZV55-B4V7	4.7V				VD3	Nexperia	yes	1
1003771	SMD	ZENER 5.6V 5% SOD80 T&R 2500	BZV55-C5V6-115	5.6V				VD60	Nexperia	yes	1
1014410	SMD	DIODE SWITCH 75V 0.3A SOD80 T&R 2500	PMLL4148L	75V				VD1	Nexperia	yes	1
3000001	SMD	Optocoupler, 1MHz, SMD	H11L1SM					DA5 DA7	FAIRCHILD	yes	2
3000004	SMD	IC VREF SHUNT ADJ SOT23-3	TL431AIDBZ	2.495...36V	0.7...100mA		1%	DA3	TI	yes	1
3000445	SMD	Ultra-low power Wireless MCU with Cortex M3 128k QFN33	CC1310F128RHBR					DA2	TI	yes	1
3000447	SMD	Balun for CC13xx 868 MHz and 915 MHz JT	0850BM14E0016T					DA8	Johanson Technology	yes	1
3000494	SMD	Step-up DC/DC converter	TLV61046A	1.8V..5.5 V In, 4.5V..28 V Out	0.68A..1.25 A Switch			DA1	TI	yes	1
3005161	SMD	Optocoupler SMD4 T&R 1000	FOD817BSD(H11A817BS)					DA4 DA6	FAIRCHILD	yes	2
4000040	SMD	RES 0402	620			0.063W	5%	R12 R13 R16		yes	3
4000043	SMD	RES 0402	100K			0,063W	1%	R17		yes	1
4000173	SMD	RES 0603	30K			0.1W	1%	R10		yes	1
4000220	SMD	RES 0603	6.8K			0.1W	1%	R15		yes	1
4000704	SMD	RES 0402	0			0,063W		R18		yes	1
4003495	SMD	RES 0603	100			0.1W	1%	R5 R6		yes	2
4005024	SMD	RES 1206	470			0.25W	1%	R68		yes	1
4005821	SMD	RES 0402	1K			0,063W	1%	R3 R14		yes	2
4005839	SMD	RES 0603	1K			0.1W	1%	R7 R8		yes	2
4007356	SMD	RES 0603	4.7K			0.1W	1%	R1		yes	1
4008122	SMD	RES 0402	10K			0,063W	1%	R2 R11		yes	2
4008141	SMD	RES 0603	10K			0.1W	1%	R4 R9		yes	2
5000036	SMD	CAP CERAMIC COG (NP0) 0402-A-101-J-X-J	100pF	16V			5%	C23		yes	1
5000086	SMD	CAP CERAMIC X5R 0603	10uF	6.3V			20%	C17 C19		yes	2
5000121	SMD	CAP CERAMIC X5R 0402 1uF 6,3V	1uF	6,3V			±10%	C18	Murata	yes	1
5000210	SMD	CAP CERAMIC X7R 0402	0.1uF	50V			±10%	C6 C7 C8 C9 C10 C11 C12	Murata	yes	7
5000249	SMD	CAP CERAMIC NP0 0402	100pF	50V			5%	C21 C22		yes	2
5002903	SMD	CAP CERAMIC NP0 0402	12pF	50V			5%	C1 C2 C3 C4			4
5005005	SMD	CAP CERAMIC NP0 0603	100pF	50V			5%	C24		yes	1
5009518	SMD	CAP CERAMIC X7R 0402	0.1uF	16V			10%	C5		yes	1
5009522	SMD	CAP CERAMIC X7R 0603	0.1uF	50V			10%	C13		yes	1
5010717	SMD	CAP CERAMIC X7R 0805	1uF	50V				C14 C15 C16 C20		yes	4
6000123	SMD	QUARTZ SMD 32,768 T&R	SJK-6LC-32.768-12.5-20-40-C			-40 ... +85	20 ppm	Q1	SJK	yes	1
6000451	SMD	Crystal TSX-3225 series 24.000 MHz 9pF 15 ppm	TSX-3225 24.0000MF15X-AC3			-40 ... +85	15 ppm	Q2	EPSON	Yes	1
7000160	SMD	Ferrite bead, 1.5kOhm@100Mhz 500 mA 500mOhm DCR 0603	BLM18HE152SN1		500mA		25%	L1	MURATA	yes	1
8000406	SMD	I-PEX MHF Receptacle	20279-001E-01					X4	Wellshow Technology	yes	1
5000099	TH	CAP ELECTROLYTIC Low Impendance TM 6.3x12 RM2.5	47uF	50V			20%	C25	Fujicon	yes	1
5000200	TH	CAP DISK CERAMIC RM10 Y1	470pF	500V			20%	C910		yes	1
8000114	TH	1.27mm x 1.27mm 2x5	C1280-10BSGAS0R 1.27x1.27					X3	HSUAN MAO	yes	1
8000600	TH	2x5 2,54mm Dual Row/Dual Insulator 6/2.5/16.5/25 mm	C2200-10FSG 6/2.5/16.5/25					X1	HSUAN MAO	yes	1
9160265	TH	Transformer RS485 TPS61046 DC-DC, 1.33:1, 4kV Isolation	ADDM.671331.341					T1	ADD	yes	1
9242503	PCB	Printed Board RF_HEDNOP_425_03	ADDM.758728.425_03					PCB1	ADD		1

EU-type examination certificate

Issued by	NMi Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity modules mentioned in article 17 of Directive 2014/32/EU, after having established that the Measuring instrument meets the applicable requirements of Directive 2014/32/EU, to:		
Manufacturer	S.C. "ADD-PRODUCTION" S.R.L. 36, Dragomirna str. MD-2008, Chisianau Republic of Moldova		
Measuring instrument	A static **Active Electrical Energy Meter**		
	Type	:	AD13A (DC) and AD13A.3 (CT)
	Manufacturer's mark or name	:	S.C. "ADD-PRODUCTION" S.R.L.
	Reference voltage	:	3 x 230/400 V
	Reference current	:	5 or 10 A (DC) 1 or 5 A (CT)
	Destined for the measurement of	:	electrical energy, in a - three-phase four-wire network
	Accuracy class	:	B or A (DC) C or B (CT)
	Environment classes	:	M1 / E2
	Temperature range	:	-40 °C / +70 °C
	Further properties are described in the annexes: – Description T11778 revision 0; – Documentation folder T11778-1.		
Valid until	3 March 2030		

Issuing Authority **NMi Certin B.V., Notified Body number 0122**
3 March 2020

Certification Board

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Description

1 General information about the instrument

All properties of the static active electrical energy meter, whether mentioned or not, shall not be in conflict with the legislation.

1.1 Essential parts

Description	Document	Remarks
measuring sensor	11778/0-04 (DC) 11778/0-05 (CT)	
main pcb DC	11778/0-11, 11778/0-12	All parts of the printed circuit boards are essential, except the components which are related to parts as described in paragraph 1.4 or 1.6.
main pcb CT	11778/0-11, 11778/0-13	

1.2 Essential characteristics

1.2.1 See EU-type examination certificate T11778 revision 0 and the characteristics mentioned below.

1.2.2 Approved meter types : AD13A.X-X-X (DC) and AD13A.3-X-X (CT).
An explanation of all type designations is presented in document no.11778/0-02.

1.2.3 Frequency : 50 Hz

1.2.4 Meter constant : 1.000 imp./kWh (DC), 10.000 imp./kWh (CT)

1.2.5 Number of registers : max. 2 total registers (A+,A-), each with max. 6 rates

1.2.6 Error messages : see document no. 11778/0-07

1.2.7 Registration method : The following regstration methods are allowed:

- measurement of import energy only (A+, with reverse stop);
- measurement of import and export energy by means of vector summation (sum of all phases is registered / Ferraris mode);
- measurement of import and export energy by means of summation by sign (sum of import energy per phase and sum of export energy per phase);
- measurement of energy as the sum of import and export (absolute import energy + absolute export energy

The registration method is set at production.

1.2.8 Phase sequence : the meter is not sensitive to the direction of the applied phase sequence.

1.2.9 Export energy : the meter is capable of measuring energy in 2 directions.
The meter can also be used with 2 phases loaded with import energy and 1 phase loaded with export energy.

1.2.10 Software specification (refer to WELMEC 7.2):
- Software type P;
- Risk Class C;
- Extension L and S, while extensions D and T are not applicable.

Software version	Identification number (checksum)	Remarks
8.1.03	8655B9CC	Software version and checksum can be shown on the display by pressing the button

1.3 Essential shapes

1.3.1 The nameplate is bearing at least, good legible, the information as mentioned in the regulations on energy meters. An example of the markings is shown in document no. 11778/0-03.

1.3.2 Sealing: see chapter 2.

1.3.3 The registration observation is executed by means of an LED.

1.4 Conditional parts

1.4.1 Terminal block
The connections for the current cables on the terminal block have a diameter of at least 7 mm (DC) or 5 mm (CT). The cables are connected with the terminal block via 2 screws. See documents no. 11778/0-01, 11778/0-08 (DC) and 11778/0-09 (CT).

1.4.2 Housing
The meter has got a dustproof housing, which has sufficient tensile strength. The cover is made of synthetic material. An example of the housing is presented in document no. 111778/0-01.

1.4.3 Terminal cover
The terminal cover is made of synthetic material.

1.4.4 Register
The quantity of measured energy is presented by means of a display with at least 6 elements. The way of presentation is described in document no. 11778/0-07.
For test purposes an indication with a least significant element of at least 0,01 kWh, can be arranged via optical communication.

1.4.5 Tariff control
When the meter is provided with more than one register, a tariff control is available by means of an internal clock.

1.4.6 Communication interfaces
The meter can be provided with the following communication interfaces:
- optical communication
- PLC communication (PRIME or G3-PLC)
- RF communication
- RS485 (CT only)

Description	Document no.	Remarks
antenna PCB	11778/0-14, 11778/0-15	RF communication

Via the communication interfaces no legally relevant data can be altered.

1.4.7 Breaker (DC only)
The DC meter is equipped with a Supply Control Switch. See documentation 11778/0-06.

1.4.8 Heat sink (DC only)
The DC meter is provided with a copper heat sink. See documentation 11778/0-01.

1.5 Conditional characteristics

1.5.1 Maximum current DC meter:
smaller than or equal to 100 A, and at least 5 times higher than the reference current.

Maximum current CT meter:
smaller than or equal to 10 A, and at least 1,2 times higher than the reference current

Terminal block:

Maximum current	Document no.	Remarks
100 A	11778/0-08	DC meter
10 A	11778/0-09	CT meter

1.5.2 Minimum current: 0,25 A (DC meter)
0,01 A (CT meter)

1.6 Non-essential parts

1.6.1 Output relays

2 Seals

Both screws of the meter cover are sealed.
An example of the sealing is presented in document no.11778/0-10.

3 Conditions for conformity assessment according to module D or F

The influence factors for temperature, frequency and voltage, which are necessary to perform the conformity assessment according to module D or F, are presented in Annex 1, belonging to this EU-type examination certificate.
Based on the WELMEC 11.1, section 2.5.6, the sum of the square values is presented.

Influence factors for temperature, frequency and voltage

During the type approval examination the influence factors for temperature, frequency and voltage are determined per load point. The values depicted in the table below present the root sum square values per load point, determined via the following formula:

$$\delta e(T,U,f)=\sqrt{\delta e^2(T,I,\cos\varphi)+\delta e^2(U,I,\cos\varphi)+\delta e^2(f,I,\cos\varphi)}$$

with:

- δe(T, I, cos φ) = the additional percentage error due to the variation of the temperature at a certain load;
- δe(U, I, cos φ) = the additional percentage error due to the variation of the voltage at the same load;
- δe(f, I, cos φ) = the additional percentage error due to the variation of the frequency at the same load.

AD13A (DC):

Current	Power factor	-40°C [%]	-25°C [%]	-10°C [%]	+5°C [%]	+23°C [%]	+40°C [%]	+55°C [%]	+70°C [%]
Imin	1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2
Itr	1	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.2
	0,5 ind.	0.2	0.2	0.1	0.1	0.0	0.1	0.2	0.2
	0,8 cap.	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.1
Itr phase R	1	0.5	0.3	0.2	0.1	0.1	0.1	0.2	0.3
	0,5 ind.	0.5	0.3	0.2	0.0	0.0	0.1	0.1	0.2
Itr phase S	1	0.6	0.5	0.3	0.2	0.0	0.1	0.3	0.4
	0,5 ind.	0.6	0.4	0.3	0.2	0.0	0.1	0.3	0.5
Itr phase T	1	0.5	0.4	0.2	0.1	0.0	0.2	0.3	0.4
	0,5 ind.	0.4	0.3	0.2	0.1	0.0	0.2	0.3	0.5
10 Itr	1	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.1
	0,5 ind.	0.2	0.2	0.1	0.1	0.0	0.1	0.2	0.2
	0,8 cap.	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.1
10 Itr phase R	1	0.5	0.3	0.2	0.1	0.0	0.1	0.2	0.3
	0,5 ind.	0.5	0.3	0.2	0.0	0.0	0.1	0.1	0.2
10 Itr phase S	1	0.6	0.5	0.3	0.2	0.0	0.1	0.3	0.4
	0,5 ind.	0.6	0.4	0.3	0.2	0.0	0.1	0.3	0.4
10 Itr phase T	1	0.5	0.4	0.2	0.1	0.0	0.2	0.3	0.4
	0,5 ind.	0.5	0.3	0.2	0.1	0.0	0.1	0.3	0.5
Imax	1	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.1
	0,5 ind.	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.1
	0,8 cap.	0.2	0.2	0.1	0.1	0.0	0.0	0.1	0.0
Imax phase R	1	0.5	0.3	0.3	0.1	0.0	0.2	0.3	0.6
	0,5 ind.	0.5	0.3	0.2	0.1	0.0	0.1	0.2	0.5
Imax phase S	1	0.6	0.5	0.3	0.2	0.0	0.1	0.3	0.4
	0,5 ind.	0.6	0.5	0.4	0.2	0.0	0.2	0.3	0.5
Imax phase T	1	0.5	0.4	0.2	0.1	0.0	0.1	0.3	0.4
	0,5 ind.	0.5	0.4	0.3	0.2	0.0	0.1	0.3	0.4

Annex 1

AD13A.3 (CT):

Current	Power factor	-40°C [%]	-25°C [%]	-10°C [%]	+5°C [%]	+23°C [%]	+40°C [%]	+55°C [%]	+70°C [%]
Imin	1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1
Itr	1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2
Itr phase R	1	0.3	0.3	0.2	0.2	0.1	0.1	0.2	0.1
	0,5 ind.	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1
Itr phase S	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Itr phase T	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1
20 Itr	1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2
20 Itr phase R	1	0.3	0.2	0.2	0.2	0.0	0.0	0.2	0.2
	0,5 ind.	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
20 Itr phase S	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
20 Itr phase T	1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1
Imax	1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2
	0,5 ind.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	0,8 cap.	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2
Imax phase R	1	0.3	0.3	0.3	0.2	0.0	0.0	0.2	0.3
	0,5 ind.	0.2	0.2	0.2	0.2	0.0	0.1	0.1	0.1
Imax phase S	1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
	0,5 ind.	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Imax phase T	1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1
	0,5 ind.	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1