KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

1597-21
Revision 4

Object	A direct connected, electronic three-phase four-wire and single-phase two-wire meter on phase L1, energy meter.
Type	MA309MH4LAT1 and MA309MH4LAT2 - active: class 1/B - reactive: class 2
Manufacturer	Shenzhen Kaifa Technology (Chengdu) Co., Ltd., No. 99 Tianquan Rd., Hi-Tech Development Zone, Chengdu, China
Production location	Shenzhen Kaifa Technology (Chengdu) Co., Ltd., No. 99 Tianquan Rd., Hi-Tech Development Zone, Chengdu, China
Tested by	KEMA B.V., Klingelbeekseweg 195, Arnhem, The Netherlands
Date of tests	June to November 2018, January till February 2019, April 2019, January 2021, April to May 2021 and July to November 2021

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

IEC 62052-11:2003**, IEC 62053-21**:2003**, IEC 62053-23**:2003**,**
EN 50470-1:2006 and **EN 50470-3**:2006

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

This Certificate consists of 114 pages in total.

KEMA B.V.

Bas Verhoeven
Director, High-Voltage Laboratory

Arnhem, 17 December 2021

INFORMATION SHEET

1 KEMA Type Test Certificate

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

2 KEMA Report of Performance

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

3 KEMA Test Report

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

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

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

4 Official and uncontrolled test documents

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

5 Accreditation of KEMA Labs

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

REVISION OVERVIEW

Rev. No	Date of issue	Reason for issue
0	26 November 2021	First issue
1	30 November 2021	- Adding missing pictures - Change typos
2	3 December 2021	Adding missing pictures
3	7 December 2021	Pictures are changed
4	17 December 2021	Typo corrected

TABLE OF CONTENTS

1 SUMMARY

The energy meter as described in chapter 3, meets the requirements of:

IEC 62052-11:2003	:	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Metering equipment
IEC 62053-21:2003	:	Electricity metering equipment (a.c.) - Static meters for active energy (classes 1 and 2)
IEC 62053-23:2003	:	Electricity metering equipment (a.c.) - Static meters for reactive energy (classes 2 and 3)
EN 50470-1:2006	:	Electricity metering equipment (a.c.)-part 1: General requirements, tests and test conditions - Metering equipment (class indexes A, B and C)
EN 50470-3:2006	:	Electricity metering equipment (a.c.)-part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

In addition the meter meets the following requirements

- Water penetration test IPx4 instead of IPx1. See paragraph 4.1.6
- Ambient temperature variation test -40 °C up to 70 °C. See paragraph 4.4.1
- Immunity to conducted disturbances in the frequency range 2-150 kHz (CLC/TR 50579, 2012). See paragraph 4.17.

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

2 INTRODUCTION

The type test was carried out at KEMA Labs, from June till November 2018, from January till February 2019 and April 2019, January 2021, April to May 2021 and July to November 2021, on behalf of Shenzhen Kaifa Technology Co., Ltd., on the meter as described in chapter 3.

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

IEC 62052-11:2003	:	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Metering equipment
IEC 62053-21:2003	:	Electricity metering equipment (a.c.) - Static meters for active energy (classes 1 and 2)
IEC 62053-23:2003	:	Electricity metering equipment (a.c.) - Static meters for reactive energy (classes 2 and 3)
EN 50470-1:2006	:	Electricity metering equipment (a.c.)-part 1: General requirements, tests and test conditions - Metering equipment (class indexes A, B and C)
EN 50470-3:2006	:	Electricity metering equipment (a.c.)-part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

- Water penetration test IPx4 instead of IPx1. See paragraph 4.1.6
- Ambient temperature variation test -40 °C up to 70 °C. See paragraph 4.4.1
- Immunity to conducted disturbances in the frequency range 2-150 kHz (CLC/TR 50579, 2012). See paragraph 4.17.

The kWh meters used as three-phase four-wire and single-phase two-wire use the same measuring elements for both Wh- and varh-measurement. The meter calculates both from the same voltage and current measurement (with respect to the angle between the voltage and current). In many tests verification of the Wh function is therefore sufficient to cover compliance to both Wh- and varh-standards.

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

The test plan was based on these assumptions.

All tests are performed at reference voltage and reference frequency, unless mentioned otherwise. The measurements are carried out with standards that are traceable to international standards.

2.1 Applied Standards

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

2.2 Subcontractors

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

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

The laboratory is accredited by RvA under accreditation number L022.

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

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

The laboratory is accredited by RvA under accreditation number L540.

2.3 Reference to other reports

Report 1320-21 R0 has been used as a base for this report.
The report is updated because:
Changes only applicable for type MA309MH4LAT2

- change U27 from solid state relay to mechanical relay.
- Add optional RS485 port
- Add optional button
- Add optional relay
- Updated software
- Add communication module CAT M CL102

Report 1106-21 R0 has been used as a base for report 1320-21 R0.
The report is updated because:

- Adding NB-Lot communication module (CL102 and CL102G)

Report 1179-19 V2 has been used as a base for report 1106-21 R0.
The report is updated because:

- Minor hardware changes

Report 1066-19 has been used as a base for this report.
The report is updated because:

- Minor hardware changes
- Minor software changes

2.4 Measurement uncertainty

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

3 DATA RELATED TO THE ENERGY METERS TESTED AND MARKING

Manufacturer	:	Shenzhen Kaifa Technology (Chengdu) Co., Ltd.	
Contact person	:	Ms. Sona Qin	
Address	:	No. 99 Tianquan Rd., Hi-Tech Development Zone	
	:	Chengdu	
Country	:	China	
Production site	:	Shenzhen Kaifa Technology (Chengdu) Co., Ltd.	
Address	:	No. 99 Tianquan Rd., Hi-Tech Development Zone	
	:	Chengdu	
Country	:	China	
Instrument	:	Electronic three-phase four-wire energy meter Direct connected	
Connection		Three-phase four-wire	Single-phase two-wire (phase R)
Mark - Type	:	MA309MH4LAT1 and MA309MH4LAT2	
Register	:	LCD	
Accuracy Class	:	Active: 1/B - 2000 imp./kWh, 1000 imp./kWh and 500 imp./kWh Reactive: 2 – 2000 imp./kvarh, 1000 imp./kvarh and 500 imp./kvarh	
Measurement range	:	230/400 V 0,25..5(60) A and 0,25..5(100) A 50 Hz	230 V
Temperature range	:	-40 .. 70 °C	
Use	:	Indoor, not sensitive to phase sequence	
Protection Class	:	II	
Environmental class	:	M1, M2, E1 and E2	
Registry method	:	Programmable, the meters are delivered as: Bi-directional method separate registers: received- and delivered energy of the whole connection is added in separate registers	

Note

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

Sample identification 0,25..5(60) A:

Serial number	Communication module
1KFM0200000001	LTE
1KFM0200000002	LTE
1KFM0200000003	LTE
1KFM0200000004	LTE
1KFM0200000005	LTE
1KFM0200000006	LTE
1KFM0200000007	LTE
1KFM0200000008	PLC
1KFM0200000010	PLC
1KFM0200000011	PLC
1KFM0200000012	PLC
1KFM0100000014	PLC
1KFM0100000015	PLC
1KFM02000000027	PLC
1KFM02000000028	LTE

Sample identification 0,25..5(100) A:

Serial number	Communication module
1KFM0700000001	LTE
1KFM0700000002	LTE
1KFM0300000003	PLC
1KFM0300000004	PLC
1KFM0300000005	PLC
1KFM0300000006	PLC
1KFM0300000007	LTE
1KFM0300000008	LTE
1KFM0300000018	LTE
1KFM0300000019	LTE
1KFM0799000065	LTE
1KFM0799000066	LTE
1KFM0799000067	PLC
1KFM0799000068	PLC
1KFM0799000075	NB-LoT (CL102G)
1KFM0799000076	NB-LoT (CL102G)
1KFM0799000077	NB-LoT (CL102G)
1KFM0399000062	NB-LoT (CL102)
1KFM0399000063	NB-LoT (CL102)
1KFM0399000064	NB-LoT (CL102)
1KFM0699000001	NB-LoT (CL102G)
1KFM0699000002	NB-LoT (CL102G)
1KFM0699000003	NB-LoT (CL102G)
1KFM0299000077	NB-LoT (CL102)
1KFM0299000078	NB-LoT (CL102)
1KFM0299000079	NB-LoT (CL102)
1KFM5290000005	LTE-M/NB-loT (CL102)
1KFM5290000006	LTE-M/NB-loT (CL102)
1KFM5390000022	LTE-M/NB-loT (CL102)
1KFM5290000009	G3-PLC CP115
1KFM5290000010	G3-PLC CP115
1KFM5290000011	G3-PLC CP115
1KFM5290000013	G3-PLC CP115
1KFM5290000014	LTE-M/NB-loT (CL102)

Drawings:
Drawings of the PCB: See appendix B.

The meter contains all required markings.

The tests were carried out in conformity with IEC 62052-11, IEC 62053-21, IEC 62053-23, EN 50470-1 and EN 50470-3 using a static energy standard. The measurements are carried out with standards that are traceable to international standards. The results in this report relate only to the items tested.

3.1 Current specifications

The current values in this document are all based on the reference current. The relationships between the different terms of the current are clarified in the following table.

Current 0,25 .. 5(60)			
Current specification		Current A	Percentage of the reference current I_{ref}
Starting current	I_{st}	0,02	≤ 0,4%
Minimum current	I_{min}	0,25	≤ 5%
Transitional current	I_{tr}	0,5	10%
Basic current	I_b	5	100%
Maximum current	I_{max}	60	≥ 500%

Current 0,25 .. 5(100)			
Current specification		Current A	Percentage of the reference current I_{ref}
Starting current	I_{st}	0,02	≤ 0,4%
Minimum current	I_{min}	0,25	≤ 5%
Transitional current	I_{tr}	0,5	10%
Basic current	I_b	5	100%
Maximum current	I_{max}	100	≥ 500%

3.2 Accuracy class for Wh

The definition of the accuracy class indication of the meter is slightly different for the two standards mentioned in this document. Class B is comparable, but not identical to Class 1. This document covers all the requirements needed for the type test of a kWh meter according to Class 1 (IEC 62052-11) and Class B (EN 50470-1).

4 RESULTS OF THE TYPE TEST

4.1 Tests of the mechanical properties

4.1.1 General

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

4.1.2 Case

The meter can be sealed in such a way that the inside of the meter is only accessible after breaking the seal. See photograph appendix B. These show two methods of sealing. Both meet the requirements.

4.1.3 Spring Hammer test

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

4.1.4 Shock test

This test was carried out on meter no. 1KFM02000000010.

A shock test was performed according to EN-IEC 60068-2-27, with a half-sine pulse, a peak acceleration of 300 m/s^2 and a pulse duration of 18 ms. After this test the meter showed no damage.

4.1.5 Vibration test

This test was carried out on meter no. 1KFM0200000002.

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

4.1.6 Protection against penetration of dust and water

This test was carried out on meter no. 1KFM02000000015, 1KFM5290000011 (dust) and 1KFM02000000014, 1KFM5290000009 (water)

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

The meter is dustproof as required by EN 50470-1 and IEC 62052-11 (Cat. 2 according to EN-IEC 60529).

The results of the water penetration test were satisfying.

The meter meets the requirements.

4.1.7 Terminals and terminal block

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

The terminal block material was tested in accordance with ISO 75 at a temperature of 135 ºC and a pressure of 1,8 MPa (method A). The worst case deflection at 135 ºC was 0,24 mm (requirement ≤ 0,34 mm). The material meets the requirements.

Specification of the material:
Type: 503R, polycarbonate, glass reinforced
Manufacturer: Sabic innovative plastics
Colour: Beige

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

4.1.8 Resistance to heat and fire

The material of both the terminal block and the meter case was subjected to a glow-wire test in accordance with EN-IEC 60695-2-10 and EN-IEC 60695-2-11. The temperature of the glow-wire was 960 °C for the terminal block, 650 °C for the meter case and cover. The materials meet the requirements.

4.1.9 Register and output device

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

The energy registry method with regards to delivered- and received energy is programmable, the meters are delivered as Bi-directional method separate registers: received- and delivered energy is added in separate registers.

The meter meets the requirements.

4.2 Tests of climatic influences

4.2.1 General

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

4.2.2 Dry heat test

This test was carried out on meter no. 1KFM02000000011.

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

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

The meter meets the requirements.

4.2.3 Cold test

This test was carried out on meter no. 1KFM02000000011.

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

Afterwards the meter showed no damage or loss of information.

The meter meets the requirements.

4.2.4 Damp heat cyclic test

The test was performed with meter no. 1KFM02000000011.

The test was carried out according to EN-IEC 60068-2-30 (variant 1) with an upper temperature of 40 °C for 6 cycles.

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

The meter meets the requirements.

4.2.5 Solar radiation test

This test is not applicable to indoor meters.

4.3 Accuracy measurement at different loads

These tests were carried out on meter no. 1KFM0200000001, 1KFM0200000006, 1KFM0200000007, 1KFM0700000001, 1KFM0300000003 and 1KFM0300000004 for 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

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

The measuring conditions were as specified in section 8.7.1 of EN 50470-3 and in section 8.5 of IEC 62053-21. The measurements were made with an accurate static energy standard.

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

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

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

The values for the errors registered at different currents and various values for cos φ / sin φ, at reference voltage and reference frequency (average of 3 repeatable measurements per loadpoint), can be found in appendix A. The results show that the static energy meters, under the reference conditions given in section 8.7.1. of EN 50470-3 and in section 8.5 of IEC 62053-21, meet the requirements given in the relevant publication.

4.3.1 Interpretation of test results

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

4.3.2 Test of meter constant

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

4.3.3 Starting current

The minimum load at which the energy meters tested recorded Whs at reference voltage, reference frequency and cos φ = 1 was less than 0,2% of Iref (req. ≤ 0,4% Iref) for the 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.
The minimum load at which the energy meters tested recorded varhs at reference voltage, reference frequency and sin φ = 1 was less than 0,2% of Iref (req. ≤ 0,5% Iref) for the 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

4.3.4 Test of no load condition

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

The meter meets the requirements.

4.4 Effect of change of influence quantities on accuracy

4.4.1 Influence of ambient temperature variation

The meter was placed into a climatic room with ambient temperatures as shown in the table below until thermal equilibrium was reached. The measured deviations in the errors according to IEC 62053-21 are shown in the following table.

Serial number 1KFM0200000006 as 3P4W						Wh-measurement		
I in % of I_b	cos φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..5	5..23	23..40	40..55	55..70
5	1	0,007%	0,003%	0,002%	0,006%	0,012%	0,016%	0,019%
10	0,5 ind.	0,030%	0,033%	0,035%	0,036%	0,040%	0,041%	0,041%
100	1	0,007%	0,003%	0,001%	0,007%	0,011%	0,016%	0,019%
100	0,5 ind.	0,030%	0,033%	0,035%	0,037%	0,039%	0,041%	0,040%
I_{max}	1	0,007%	0,003%	0,001%	0,006%	0,011%	0,016%	0,019%
I_{max}	0,5 ind.	0,030%	0,033%	0,035%	0,036%	0,039%	0,041%	0,039%

Serial number 1KFM0200000007 as 3P4W						Wh-measurement		
I in % of I_b	cos φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..5	5..23	23..40	40..55	55..70
5	1	0,008%	0,004%	0,001%	0,004%	0,010%	0,014%	0,017%
10	0,5 ind.	0,028%	0,031%	0,033%	0,035%	0,038%	0,038%	0,039%
100	1	0,009%	0,005%	0,000%	0,005%	0,009%	0,014%	0,018%
100	0,5 ind.	0,029%	0,031%	0,033%	0,034%	0,039%	0,037%	0,039%
I_{max}	1	0,009%	0,005%	0,000%	0,005%	0,009%	0,014%	0,017%
I_{max}	0,5 ind.	0,028%	0,031%	0,034%	0,036%	0,038%	0,037%	0,038%

Serial number 1KFM0300000004 as 3P4W						Wh-measurement		
I in % of I_b	cos φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..5	5..23	23..40	40..55	55..70
5	1	0,007%	0,008%	0,003%	0,009%	0,009%	0,005%	0,003%
10	0,5 ind.	0,007%	0,008%	0,001%	0,016%	0,012%	0,017%	0,002%
100	1	0,008%	0,007%	0,003%	0,010%	0,007%	0,005%	0,004%
100	0,5 ind.	0,009%	0,009%	0,001%	0,018%	0,011%	0,017%	0,001%
I_{max}	1	0,008%	0,007%	0,003%	0,011%	0,008%	0,004%	0,003%
I_{max}	0,5 ind.	0,015%	0,011%	0,001%	0,017%	0,015%	0,012%	0,001%

Serial number 1KFM0200000006 as 1P2W on phase L1						Wh-measurement		
I in % of I_b	cos φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..5	5..23	23..40	40..55	55..70
5	1	0,006%	0,004%	0,003%	0,005%	0,012%	0,015%	0,020%
10	0,5 ind.	0,030%	0,035%	0,037%	0,038%	0,041%	0,041%	0,041%
100	1	0,007%	0,003%	0,001%	0,008%	0,012%	0,016%	0,019%
100	0,5 ind.	0,031%	0,033%	0,037%	0,047%	0,045%	0,041%	0,042%
I_{max}	1	0,008%	0,003%	0,001%	0,006%	0,011%	0,015%	0,019%
I_{max}	0,5 ind.	0,030%	0,033%	0,036%	0,039%	0,039%	0,040%	0,041%

Serial number 1KFM02000000012 as 3P4W						varh-measurement		
I in % of I_b	sin φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..10	10..30	30..45	45..55	55..70
5	1	0,009%	0,005%	0,001%	0,005%	0,004%	0,010%	0,005%
10	0,5 ind.	0,044%	0,039%	0,024%	0,020%	0,009%	0,017%	0,004%
100	1	0,009%	0,005%	0,001%	0,004%	0,005%	0,009%	0,004%
100	0,5 ind.	0,045%	0,038%	0,024%	0,020%	0,008%	0,017%	0,005%
I_{max}	1	0,009%	0,005%	0,000%	0,004%	0,005%	0,008%	0,005%
I_{max}	0,5 ind.	0,043%	0,039%	0,024%	0,021%	0,010%	0,016%	0,005%

Serial number 1KFM0300000004 as 3P4W						varh-measurement		
I in % of I_b	sin φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..10	10..30	30..45	45..55	55..70
5	1	0,005%	0,002%	0,006%	0,012%	0,013%	0,009%	0,017%
10	0,5 ind.	0,009%	0,003%	0,004%	0,005%	0,017%	0,008%	0,013%
100	1	0,005%	0,002%	0,006%	0,012%	0,013%	0,009%	0,016%
100	0,5 ind.	0,007%	0,004%	0,003%	0,007%	0,015%	0,008%	0,013%
I_{max}	1	0,005%	0,001%	0,006%	0,012%	0,015%	0,009%	0,016%
I_{max}	0,5 ind.	0,007%	0,002%	0,003%	0,005%	0,045%	0,003%	0,015%

Serial number 1KFM02000000012 as 1P2W						varh-measurement		
I in % of I_b	sin φ	Temperature coefficient for the specified temperature range in % per K						
		-40..-25	-25..-10	-10..10	10..30	30..45	45..55	55..70
5	1	0,011%	0,007%	0,001%	0,005%	0,009%	0,014%	0,016%
10	0,5 ind.	0,049%	0,039%	0,029%	0,021%	0,013%	0,008%	0,002%
100	1	0,011%	0,007%	0,001%	0,005%	0,009%	0,013%	0,016%
100	0,5 ind.	0,047%	0,038%	0,030%	0,021%	0,013%	0,008%	0,002%
I_{max}	1	0,011%	0,007%	0,001%	0,005%	0,009%	0,014%	0,019%
I_{max}	0,5 ind.	0,045%	0,038%	0,029%	0,022%	0,013%	0,008%	0,001%

The meter meets the requirements.

The measured values of the additional percentage errors according to EN 50470-3 are shown in the following table.

Serial number: 1KFM0200000006 as 3P4W		Wh-measurement								
I in % of I_{ref}	cos φ	Phase	Additional percentage error due to temperature variation %							
			-40 ºC	-25 ºC	-10 ºC	5 ºC	30 ºC	40 ºC	55 ºC	70 ºC
5	1	RST	0,01%	-0,09%	-0,13%	-0,10%	0,08%	0,20%	0,44%	0,73%
10	1	RST	0,01%	-0,10%	-0,14%	-0,11%	0,07%	0,19%	0,43%	0,73%
10	0,5 ind	RST	-2,12%	-1,67%	-1,18%	-0,65%	0,30%	0,68%	1,29%	1,90%
10	0,8 cap	RST	0,93%	0,58%	0,31%	0,12%	-0,02%	-0,01%	0,07%	0,22%
10	1	R	0,01%	-0,08%	-0,13%	-0,10%	0,07%	0,19%	0,43%	0,72%
10	0,5 ind	R	-2,19%	-1,73%	-1,23%	-0,69%	0,28%	0,70%	1,30%	1,93%
10	1	S	0,05%	-0,06%	-0,12%	-0,10%	0,07%	0,18%	0,42%	0,70%
10	0,5 ind	S	-2,16%	-1,70%	-1,21%	-0,66%	0,27%	0,67%	1,26%	1,86%
10	1	T	-0,05%	-0,14%	-0,17%	-0,13%	0,07%	0,20%	0,44%	0,75%
10	0,5 ind	T	-2,05%	-1,62%	-1,15%	-0,64%	0,25%	0,64%	1,25%	1,87%
I_{max}	1	RST	0,02%	-0,09%	-0,13%	-0,11%	0,07%	0,19%	0,43%	0,72%
I_{max}	0,5 ind	RST	-2,12%	-1,67%	-1,17%	-0,65%	0,28%	0,67%	1,28%	1,87%
I_{max}	0,8 cap	RST	0,92%	0,57%	0,31%	0,30%	-0,01%	1,09%	0,63%	0,25%
I_{max}	1	R	0,00%	-0,11%	-0,15%	-0,12%	0,07%	0,19%	0,43%	0,73%
I_{max}	0,5 ind	R	-2,15%	-1,70%	-1,21%	-0,67%	0,27%	0,66%	1,25%	1,85%
I_{max}	1	S	0,04%	-0,08%	-0,13%	-0,11%	0,07%	0,19%	0,43%	0,72%
I_{max}	0,5 ind	S	-2,15%	-1,70%	-1,20%	-0,66%	0,26%	0,63%	1,19%	1,75%
I_{max}	1	T	-0,07%	-0,17%	-0,18%	-0,14%	0,08%	0,21%	0,47%	0,78%
I_{max}	0,5 ind	T	-2,03%	-1,61%	-1,16%	-0,65%	0,25%	0,63%	1,24%	1,86%

Serial number: 1KFM0200000007 as 3P4W		Wh-measurement								
I in % of I_{ref}	cos φ	Phase	Additional percentage error due to temperature variation %							
			-40 ºC	-25 ºC	-10 ºC	5 ºC	30 ºC	40 ºC	55 ºC	70 ºC
5	1	RST	0,11%	-0,01%	-0,07%	-0,08%	0,06%	0,17%	0,38%	0,64%
10	1	RST	0,10%	-0,02%	-0,09%	-0,09%	0,05%	0,16%	0,37%	0,63%
10	0,5 ind	RST	-2,02%	-1,60%	-1,13%	-0,63%	0,26%	0,64%	1,21%	1,79%
10	0,8 cap	RST	1,03%	0,65%	0,34%	0,13%	-0,04%	-0,04%	0,01%	0,13%
10	1	R	0,01%	-0,10%	-0,14%	-0,12%	0,07%	0,19%	0,43%	0,71%
10	0,5 ind	R	-1,89%	-1,47%	-1,04%	-0,58%	0,25%	0,60%	1,15%	1,71%
10	1	S	0,32%	0,13%	0,01%	-0,04%	0,04%	0,11%	0,27%	0,49%
10	0,5 ind	S	-1,94%	-1,54%	-1,11%	-0,61%	0,26%	0,64%	1,18%	1,76%
10	1	T	0,01%	-0,10%	-0,14%	-0,12%	0,06%	0,18%	0,42%	0,70%
10	0,5 ind	T	-2,24%	-1,77%	-1,24%	-0,68%	0,27%	0,69%	1,29%	1,89%
I_{max}	1	RST	0,13%	-0,01%	-0,09%	-0,09%	0,06%	0,16%	0,37%	0,63%
I_{max}	0,5 ind	RST	-2,04%	-1,62%	-1,15%	-0,64%	0,26%	0,64%	1,20%	1,77%
I_{max}	0,8 cap	RST	1,04%	0,66%	0,36%	0,15%	-0,02%	-0,03%	0,03%	0,16%
I_{max}	1	R	0,01%	-0,11%	-0,15%	-0,13%	0,07%	0,19%	0,42%	0,72%
I_{max}	0,5 ind	R	-1,84%	-1,47%	-1,05%	-0,60%	0,22%	0,57%	1,10%	1,63%
I_{max}	1	S	0,31%	0,12%	0,01%	-0,04%	0,05%	0,11%	0,28%	0,50%
I_{max}	0,5 ind	S	-1,97%	-1,57%	-1,13%	-0,64%	0,25%	0,61%	1,16%	1,70%
I_{max}	1	T	0,00%	-0,10%	-0,15%	-0,12%	0,07%	0,19%	0,43%	0,72%
I_{max}	0,5 ind	T	-2,23%	-1,76%	-1,24%	-0,69%	0,27%	0,66%	1,26%	1,84%

Serial number: 1KFM0300000004 as 3P4W			Wh-measurement							
I in % of I_{ref}	cos φ	Phase	Additional percentage error due to temperature variation %							
			-40 ºC	-25 ºC	-10 ºC	5 ºC	30 ºC	40 ºC	55 ºC	70 ºC
5	1	RST	0,03%	-0,08%	-0,20%	-0,16%	0,06%	0,15%	0,07%	0,11%
10	1	RST	0,01%	-0,11%	-0,22%	-0,18%	0,06%	0,13%	0,05%	0,10%
10	0,5 ind	RST	-0,09%	-0,19%	-0,31%	-0,29%	0,12%	0,21%	-0,04%	-0,07%
10	0,8 cap	RST	0,06%	-0,08%	-0,18%	-0,12%	0,03%	0,10%	0,10%	0,17%
10	1	R	0,07%	-0,06%	-0,18%	-0,15%	0,03%	0,12%	0,03%	0,07%
10	0,5 ind	R	0,32%	0,02%	-0,14%	-0,21%	0,10%	0,25%	-0,02%	-0,03%
10	1	S	-0,08%	-0,18%	-0,26%	-0,20%	0,08%	0,14%	0,09%	0,15%
10	0,5 ind	S	-0,18%	-0,31%	-0,42%	-0,38%	0,17%	0,26%	0,00%	0,00%
10	1	T	0,05%	-0,08%	-0,20%	-0,17%	0,05%	0,11%	0,02%	0,07%
10	0,5 ind	T	0,01%	-0,16%	-0,29%	-0,30%	0,15%	0,21%	-0,08%	-0,13%
I_{max}	1	RST	0,00%	-0,12%	-0,23%	-0,19%	0,06%	0,14%	0,08%	0,13%
I_{max}	0,5 ind	RST	0,08%	-0,14%	-0,31%	-0,30%	0,11%	-0,25%	-0,43%	-0,42%
I_{max}	0,8 cap	RST	0,03%	-0,11%	-0,15%	-0,11%	0,07%	0,34%	0,28%	0,37%
I_{max}	1	R	-0,01%	-0,13%	-0,25%	-0,19%	0,04%	0,10%	0,03%	0,09%
I_{max}	0,5 ind	R	0,04%	-0,05%	-0,38%	-0,25%	-0,09%	-0,35%	-0,50%	-0,50%
I_{max}	1	S	-0,15%	-0,25%	-0,32%	-0,23%	0,06%	0,14%	0,07%	0,14%
I_{max}	0,5 ind	S	-0,33%	-0,34%	-0,59%	-0,35%	-0,21%	-0,35%	-0,45%	-0,47%
I_{max}	1	T	-0,01%	-0,15%	-0,25%	-0,19%	0,06%	0,12%	0,03%	0,07%
I_{max}	0,5 ind	T	-0,14%	-0,21%	-0,48%	-0,29%	-0,27%	-0,40%	-0,51%	-0,56%

Serial number 1KFM0200000006 as 1P2W on phase L1								Wh-measurement		
I in % of I_{ref}	cos φ	ºC	Additional percentage error due to temperature variation %							
			-40	-25	-10	5	30	40	55	70
5	1		0,02%	-0,07%	-0,13%	-0,09%	0,08%	0,20%	0,43%	0,73%
10	1		0,02%	-0,08%	-0,13%	-0,11%	0,07%	0,20%	0,43%	0,73%
10	0,5 ind		-2,20%	-1,75%	-1,23%	-0,68%	0,29%	0,69%	1,31%	1,92%
10	0,8 cap		0,99%	0,62%	0,34%	0,13%	-0,02%	-0,01%	0,05%	0,21%
I_{max}	1		0,04%	-0,08%	-0,13%	-0,11%	0,07%	0,19%	0,42%	0,71%
I_{max}	0,5 ind		-2,19%	-1,74%	-1,24%	-0,70%	0,26%	0,66%	1,26%	1,88%
I_{max}	0,8 cap		0,97%	0,61%	0,33%	0,14%	-0,02%	-0,01%	0,06%	0,21%

The meter meets the requirements.

4.4.2 Effect of changes in the auxiliary supply voltage

Not applicable.

4.4.3 Voltage variation

This test was carried out on meter no. 1KFM0200000001, 1KFM0200000006, 1KFM0200000007, 1KFM0700000001, 1KFM0300000003 and 1KFM0300000004. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

The change in the error due to a 10% change of the measuring voltage over the complete voltage range of the meter was measured at various loads.
The maximum change in error was:

Balanced load:

- 0,02% registering Wh at cos φ = 1 (Requirement ≤ 0,7%)
- 0,16% registering Wh at cos φ = 0,5 ind. (Requirement ≤ 1,0%)
- 0,30% registering Wh at cos φ = 0,8 cap. (Requirement ≤ 1,0%)
- 0,06% registering varh at sin φ = 1 (Requirement ≤ 1,0%)
- 0,07% registering varh at sin φ = 0,5 ind. (Requirement ≤ 1,5%).

Single phase load:

- 0,01% registering Wh at cos φ = 1 (Requirement ≤ 1,0%)
- 0,11% registering Wh at cos φ = 0,5 ind (Requirement ≤ 1,5%).

Severe voltage variations were tested in accordance with EN 50470-3 and IEC 62053-21.

The meter meets the requirements.

4.4.4 Frequency variation

This test was carried out on meter no. 1KFM0200000001, 1KFM0200000006, 1KFM0200000007, 1KFM0700000001, 1KFM0300000003 and 1KFM0300000004. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

The change in the error due to a 2% change of the reference frequency over the complete voltage range of the meter was measured at various loads.
The maximum change in error was:

Balanced load:

- 0,03% registering Wh at cos φ = 1 (Requirement ≤ 0,5%)
- 0,32% registering Wh at cos φ = 0,5 ind. (Requirement ≤ 0,7%)
- 0,16% registering Wh at cos φ = 0,8 cap. (Requirement ≤ 0,7%)
- 0,01% registering varh at sin φ = 1 (Requirement ≤ 2,5%)
- 0,30% registering varh at sin φ = 0,5 ind. (Requirement ≤ 2,5%).

Single phase load:

- 0,03% registering Wh at cos φ = 1 (Requirement ≤ 0,7%)
- 0,31% registering Wh at cos φ = 0,5 ind (Requirement ≤ 1,0%).

The meter meets the requirements.

4.4.5 Magnetic induction of external origin 0,5 mT

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM0700000001, 1KFM0300000004 and 1KFM5290000013. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

An external magnetic field was generated using a round coil measuring 1 meter in diameter. The field was applied in all three directions in order to determine the worst-case position. The phase position of the field current (with respect to the measuring voltage) was shifted between 0° and 360°. The meter was measured in 3P4W connection and on 3P4W connection connected as 1P2W on phase L1.
The maximum change measured at reference voltage, reference current and reference frequency was 0,08%. The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 2,0%.
The maximum permissible change allowed by IEC 62053-23 is 3,0%.

The meter meets the requirements.

4.4.6 Harmonic components in the current and voltage circuits

This test was carried out on meter no. 1KFM0200000001, 1KFM0200000006, 1KFM0200000007, 1KFM0700000001, 1KFM0300000003 and 1KFM0300000004. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

Using the special amplifiers of the meter test equipment, 10% of fifth harmonic was added to the voltage and 40% of fifth harmonic was added to the current. Using a load at 0,5 I_{max}, a 4% increase of power in the fifth harmonic in relation to the nominal frequency was generated. The energy measured was compared to the energy measured by the standard equipment.
The worst case change in the error was 0,03%.
The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 0,8%.

The meter meets the requirements.

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

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM0700000001 and 1KFM0300000004. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

Using diodes, a rectified waveform was generated in the meter current circuits according to Annex C1 of EN 50470-3 and Annex A1 of IEC 62053-21. The energy measured was compared to the energy measured by the standard equipment. The test was carried out at a current of $I_{max}/\sqrt{2}$. The worst case change in the error was 0,70%. The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 3,0%.

The meter meets the requirements.

4.4.8 Odd harmonics in the a.c. current circuit

This test was carried out on meter no. 1KFM0200000001, 1KFM0200000006, 1KFM0200000007, 1KFM0700000001, 1KFM0300000003 and 1KFM0300000004. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

Using the special amplifiers of the meter test equipment, a phase-fired waveform was generated in the current circuits according to Annex C2 of EN 50470-3 and Annex A2 of IEC 62053-21. The energy measured was compared to the energy measured by an energy standard. The worst case difference was 0,27%.
The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 3,0%.

The meter meets the requirements.

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

This test was carried out on meter no. 1KFM0200000001, 1KFM0200000006, 1KFM0200000007, 1KFM0700000001, 1KFM0300000003 and 1KFM0300000004. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

Using the special amplifiers of the meter test equipment, a "2 on 2 off cycle burst" was generated in the current circuits according to Annex C3 of EN 50470-3 and Annex A3 of IEC 62053-21. The energy measured was compared to the energy measured by an energy standard. The worst case difference was 0,06%.
The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 3,0%.

The meter meets the requirements.

4.4.10 Reversed phase sequence

This test was carried out with meter no. 1KFM0200000006, 1KFM0200000007 and 1KFM0300000004.

The change in the error with reversed phase sequence was compared with the error with normal phase sequence measured at reference voltage, rated frequency and 10% of the reference current at cos φ = 1. The worst case change in error was 0,01%.
The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 1,5%.

The meter meets the requirements.

4.4.11 Voltage unbalance

This test was carried out with meter no. 1KFM0200000006, 1KFM0200000007 and 1KFM0300000004.

The influence of an interruption of one phase of the three-phase network, at reference voltage, rated frequency and reference current, on the accuracy of the meter was 0,01%.
The influence of an interruption of two phases was 0,04%.
The maximum permissible change allowed by EN 50470-3 and IEC 62053-21 is 2,0%.

The meter meets the requirements.

4.4.12 Continuous magnetic induction of external origin

This test was carried out on meter no. 1KFM0200000004 and 1KFM0200000008. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

The magnetic field was generated using an electromagnet as described in annex E of EN 50470-1 and Annex B of IEC 62053-21. The change in the error due to this magnetic field was less than 0,01% (requirement ≤ 2,0%).

The meter meets the requirements.

4.4.13 Operation of accessories

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

4.4.14 Immunity to earth fault

Not applicable.

4.5 Effect of short time over currents on the accuracy

This test was carried out on meter no. 1KFM0200000010 and 1KFM0300000003.

A current of 30 times I_{max} flowed through the current circuit of the energy meter for a period of one half-cycle (10 ms), with the voltage circuits being supplied with nominal voltage.
Both before and after the test the error was measured at reference current, reference voltage, rated frequency and cos φ = 1. The difference in the error measured before and after this test is listed below:

Serial No.	Difference in error %	Requirement %
1KFM0200000010	< 0,01	≤ 1,5
1KFM0300000003	0,03	≤ 1,5

The meter meets the requirements.

4.6 Self-heating

4.6.1 Influence of self-heating on the accuracy

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

Serial No.	Maximum change %	
	cos φ = 1	cos φ = 0,5
1KFM0200000006 as 3P4W	0,14 (req. ≤ 0,7)	0,67 (req. ≤ 1,0)
1KFM0200000007 as 3P4W	0,13 (req. ≤ 0,7)	0,72 (req. ≤ 1,0)
1KFM0700000002 as 3P4W	0,06 (req. ≤ 0,7)	0,60 (req. ≤ 1,0)
1KFM5290000013 as 3P4W	0,08 (req. ≤ 0,7)	0,56 (req. ≤ 1,0)
1KFM5290000014 as 3P4W	0,09 (req. ≤ 0,7)	0,63 (req. ≤ 1,0)

Serial No.	Maximum change %	
	cos φ = 1	cos φ = 0,5
1KFM0200000010 3P4W connected as 1P2W on phase L1	0,03 (req. ≤ 0,7)	0,59 (req. ≤ 1,0)

The meter meets the requirements.

4.6.2 Heating

This test was carried out on a 3P4W meter with no. 1KFM0200000006, 1KFM0200000007, 1KFM0700000002, 1KFM5290000013 and 1KFM5290000014.

The meter was powered with 115% of nominal voltage and maximum current for 2 hours.
The maximum temperature rise of the meters was 21 K (req. ≤ 25 K).

This test was carried out on a 3P4W meter connected as 1P2W meter on phase L1 with no. 1KFM0200000010.

The meter was powered with 115% of nominal voltage and maximum current for 2 hours.
The maximum temperature rise of the meters was 12 K (req. ≤ 25 K).

The meter meets the requirements.

4.7 Power consumption of the voltage and current circuits

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

Serial number	1KFM0200000004		1KFM0200000008	
Reference Voltage	230/400		230/400	
Voltage circuit	VA	W	VA	W
L1	2,52	0,92	9,57	1,35
L2	2,48	0,85	2,93	1,08
L3	2,47	0,85	2,93	1,08
Current circuit	VA		VA	
L1	0,04		0,03	
L2	0,04		0,03	
L3	0,04		0,03	

Serial number	1KFM0399000063		1KFM0799000077	
Reference Voltage	230/400		230/400	
Voltage circuit	VA	W	VA	W
L1	2,44	0,84	2,37	0,79
L2	2,36	0,76	2,33	0,74
L3	2,36	0,76	2,31	0,74
Current circuit	VA		VA	
L1	0,01		0,01	
L2	0,01		0,01	
L3	0,01		0,01	

Serial number	1KFM0299000078		1KFM0699000001	
Reference Voltage	230/400		230/400	
Voltage circuit	VA	W	VA	W
L1	2,12	0,67	2,64	0,93
L2	2,12	0,61	2,61	0,89
L3	2,08	0,62	2,58	0,88
Current circuit	VA		VA	
L1	0,02		0,02	
L2	0,02		0,02	
L3	0,02		0,02	

Serial number	1KFM5390000022		1KFM5290000011	
Reference Voltage	230/400		230/400	
Voltage circuit	VA	W	VA	W
L1	3,34	1,22	9,98	1,46
L2	3,30	1,18	3,32	1,21
L3	3,32	1,20	3,33	1,21
Current circuit	VA		VA	
L1	<0,01		0,02	
L2	<0,01		0,02	
L3	<0,01		0,02	

Serial number	1KFM0200000004		1KFM0200000008	
Reference voltage	230 V		230 V	
connection	3P4W connected as 1P2W meter on phase L1		3P4W connected as 1P2W meter on phase L1	
Voltage circuit	VA 8,40	W 2,25	VA 12,40	W 3,10
Current circuit	VA 0,03		VA 0,03	

The maximum permissible power consumption for the voltage circuits is 10 VA and 2 W (including the power supply) and for the current circuits 4 VA.

The maximum allowed power is 10 VA according to EN 50470-3. However, in accordance with EN-IEC 62053-61 (Power consumption and voltage requirements) subclause 4.3.1, the maximum consumption of power can be agreed upon between the user and the manufacturer.

The meter meets the requirements.

4.8 Fast transient burst test

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008,1KFM0300000007, 1KFM0699000002, 1KFM0299000077, 1KFM0399000063, 1KFM0799000077 and 1KFM5290000009.

4.8.1 Test method

The test was carried out with the current circuit carrying reference current.
The test was carried out in accordance with clause 7.4.7 of EN 50470-1 and 7.5.4 of IEC 62052-11.

4.8.2 Test levels

The test was carried out with a test voltage of 4 kV, in accordance with EN 50470-1 and IEC 62052-11.

4.8.3 Test results

The meter was not influenced by the fast transient burst.
The influence of the fast transient burst was less than 0,5% in all cases.
The maximum allowed variation according to IEC 62053-21 is 4,0%.
The maximum allowed variation according to IEC 62053-23 is 4,0%.

The meter meets the requirements.

4.9 Electrostatic discharges

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM0699000002, 1KFM0299000077, 1KFM0399000063, 1KFM0799000077 and 1KFM5290000009.

4.9.1 Test method

The test was carried out in accordance with subclause 7.4.5 of EN 50470-1 and 7.5.2 of IEC 62052-11.

4.9.2 Test levels

A discharge voltage of 15 kV (air discharge) respectively 8 kV (contact- / indirect discharge) was applied in accordance with EN 50470-1 and IEC 62052-11.

4.9.3 Test results

The tests with electrostatic discharges did not cause any disturbances of the meter functions.

The meter meets the requirements.

4.10 Immunity to electromagnetic RF fields

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM0300000007, 1KFM0699000002, 1KFM0299000077, 1KFM0399000063, 1KFM0799000077 and 1KFM5290000009.

4.10.1 Test method

The test with an electromagnetic field was carried out in a GTEM cell in the frequency range from 80 MHz to 2 GHz. The test was carried out in accordance with subclause 7.4.6 of EN 50470-1 and 7.5.3 of IEC 62052-11.
The meter was tested at reference voltage.

4.10.2 Test levels

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

4.10.3 Test results

The measured variation in error of the meter due to the electromagnetic field was less than 0,5%.
The maximum allowed variation according to EN 50470-3 and IEC 62053-21 is 2,0%.
The maximum allowed variation according to IEC 62053-23 is 3,0%.
Without current in the current circuits the RF field did not produce a change in the register.

The meter meets the requirements.

4.11 Immunity to conducted disturbances induced by RF fields

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM0300000007, 1KFM0699000002, 1KFM0299000077, 1KFM0399000063, 1KFM0799000077 and 1KFM5290000009.

4.11.1 Test method

The test for immunity to conducted disturbances induced by radio frequency fields was carried out using CDNs in the frequency range from 150 kHz to 80 MHz. The test was carried out in accordance with clause 7.4.8 of EN 50470-1 and 7.5.5 of IEC 62052-11. The meter was tested at reference voltage.

4.11.2 Test levels

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

4.11.3 Test results

The measured variation in error of the meter due to the electromagnetic field was less than 0,5%.
The maximum allowed variation according to EN 50470-3 and 62053-21 is 2,0%.
The maximum allowed variation according to IEC 62053-23 is 3,0%.
Without current in the current circuits the RF field did not produce a change in the register.

The meter meets the requirements.

4.12 Radio interference measurement

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM0699000002, 1KFM0299000077, 1KFM0399000063, 1KFM0799000077 and 1KFM5290000009 (conducted emission as 3P4W meter and as 3P4W meter connected as 1P2W meter on phase L1).
1KFM0200000003, 1KFM02000000011, 1KFM0699000002, 1KFM0299000077, 1KFM0399000064, 1KFM0799000075 and 1KFM5290000005 (radiated emission as 3P4W meter and as 3P4W meter connected as 1P2W meter on phase L1).

4.12.1 Test levels

The test levels were taken from EN 50470-1 subclause 7.4.13 and IEC 62052-11 subclause 7.5.8. The test was carried out in accordance with EN 55022 and CISPR 22.

4.12.2 Test results

The maximum peak value measured in the frequency range from 0,15 MHz to 30 MHz (according to EN 55022) was measured at 318 kHz and was 5 dB below the limit connected as 3p4w meter.

In the frequency range from 30 to 1000 MHz the maximum peak value measured was more than 10 dB below the maximum allowed peak value in the entire frequency range.

4.13 Voltage dips and short interruptions

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM5290000011 and 1KFM5390000022. For 3P4W meter and for the 3P4W meter connected as 1P2W meter on phase L1.

4.13.1 Test levels

The test levels were taken from EN 50470-1 subclause 7.4.4 and IEC 62052-11 subclause 7.1.2.

4.13.2 Test results

The results of the measurements are mentioned below.

Applied phenomena in the line voltage	Duration of the phenomenon	Requirement	Result
Variation in the line voltage V_{ref} –50%	1 min.	1 min.	Pass
Interruption in the line voltage 3 times with 50 ms restoring time	See annex C of EN 50470-1 or annex B of IEC 62052-11		Pass
Interruption in the line voltage 50 Hz	20 ms	20 ms	Pass

The meter meets the requirements.

4.14 Surge immunity test

This test was carried out on meter no. 1KFM0200000004, 1KFM0200000008, 1KFM02000000027, 1KFM0300000007, 1KFM0699000002, 1KFM0299000077,1KFM0399000063, 1KFM0799000077 and 1KFM5290000006.

4.14.1 Test method

The test was carried out in accordance with subclause 7.4.9 of EN 50470-1 and subclause 7.5.6 of IEC 62052-11 using a surge generator with impedances as specified in the standard.

4.14.2 Test levels

The test levels were taken from EN 50470-1 subclause 7.4.9 and IEC 62052-11 subclause 7.5.6.

4.14.3 Test results

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

The meter meets the requirements.

4.15 Damped oscillatory waves immunity test

This test is not applicable to direct connected meters.

4.16 Insulation

This test was carried out on meter no. 1KFM0200000004, 1KFM0300000007 and 1KFM5290000013.

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

4.16.1 Impulse voltage test

The test was carried out in accordance with subclause 7.3.3 of EN 50470-1 and 7.3.2 of IEC 62052-11.

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

The change in accuracy due to the test was 0,01%. The meter meets the requirement.

4.16.2 A.C. voltage test

The test was carried out in accordance with subclause 7.3.4 of EN 50470-1 and subclause 7.3.3 of IEC 62052-11.

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

During the tests no flashovers were observed. After the tests had been carried out no degradation in the measured insulation resistance was found.
The change in accuracy due to the test was < 0,01%.

The meter meets the requirement.

4.17 Immunity to conducted disturbances 2-150 kHz

This test was carried out on meter no. 1KFM0200000004 and 1KFM0200000008.

4.17.1 Test method

Immunity to conducted disturbances in the frequency range 2-150 kHz was tested in accordance with CLC/TR 50579 dated June 2012. The test was carried out using direct injection using a generator, amplifier and decoupling impedances. The meter was tested at reference voltage and reference current.

4.17.2 Test levels

The value of the disturbing current was 2 A in the range of 2 kHz to 30 kHz and 1 A in the range of 30 kHz to 150 kHz; in accordance with table 2 of CLC/TR 50579.

4.17.3 Test results

The measured variation in error of the meter due to the disturbing current was less than 0,5%. The maximum allowed variation according to of CLC/TR 50579 is 4%.

The meter meets the requirements.

5 MAXIMUM PERMISSIBLE ERROR

In accordance with subclause 8.4 of EN 50470-3, the composite error is calculated at several temperatures and tested to the maximum permissible error. The calculated values of the composite error are shown in the following table.

Serial No.: 1KFM0200000006 as 3P4W

I in % of I_{ref}	cos φ	Phase	Composite error %							
			-40 ºC	-25 ºC	-10 ºC	5 ºC	30 ºC	40 ºC	55 ºC	70 ºC
5	1	RST	0,03%	0,09%	0,13%	0,10%	0,09%	0,20%	0,44%	0,73%
10	1	RST	0,01%	0,10%	0,14%	0,11%	0,07%	0,19%	0,43%	0,73%
10	0,5 ind	RST	2,14%	1,69%	1,21%	0,70%	0,40%	0,73%	1,32%	1,92%
10	0,8 cap	RST	0,94%	0,60%	0,34%	0,18%	0,14%	0,14%	0,16%	0,26%
10	1	R	0,04%	0,09%	0,14%	0,11%	0,08%	0,19%	0,43%	0,72%
10	0,5 ind	R	2,21%	1,76%	1,27%	0,76%	0,42%	0,77%	1,34%	1,96%
10	1	S	0,05%	0,06%	0,12%	0,10%	0,07%	0,18%	0,42%	0,70%
10	0,5 ind	S	2,18%	1,72%	1,24%	0,71%	0,38%	0,72%	1,29%	1,88%
10	1	T	0,06%	0,15%	0,17%	0,14%	0,08%	0,20%	0,44%	0,75%
10	0,5 ind	T	2,07%	1,64%	1,18%	0,70%	0,37%	0,70%	1,28%	1,89%
I_{max}	1	RST	0,06%	0,10%	0,14%	0,12%	0,09%	0,20%	0,43%	0,72%
I_{max}	0,5 ind	RST	2,15%	1,71%	1,23%	0,75%	0,47%	0,77%	1,33%	1,91%
I_{max}	0,8 cap	RST	0,95%	0,61%	0,38%	0,38%	0,23%	1,11%	0,67%	0,34%
I_{max}	1	R	0,05%	0,12%	0,16%	0,13%	0,09%	0,20%	0,43%	0,73%
I_{max}	0,5 ind	R	2,18%	1,74%	1,27%	0,77%	0,46%	0,76%	1,30%	1,89%
I_{max}	1	S	0,07%	0,10%	0,14%	0,12%	0,09%	0,20%	0,43%	0,72%
I_{max}	0,5 ind	S	2,18%	1,74%	1,26%	0,76%	0,45%	0,73%	1,25%	1,79%
I_{max}	1	T	0,09%	0,18%	0,19%	0,15%	0,10%	0,22%	0,47%	0,78%
I_{max}	0,5 ind	T	2,06%	1,65%	1,21%	0,74%	0,43%	0,72%	1,29%	1,89%

Serial No.: 1KFM0200000007 as 3P4W

I in % of I_{ref}	cos φ	Phase	Composite error %							
			-40 ºC	-25 ºC	-10 ºC	5 ºC	30 ºC	40 ºC	55 ºC	70 ºC
5	1	RST	0,11%	0,02%	0,07%	0,08%	0,06%	0,17%	0,38%	0,64%
10	1	RST	0,10%	0,02%	0,09%	0,09%	0,05%	0,16%	0,37%	0,63%
10	0,5 ind	RST	2,04%	1,62%	1,16%	0,69%	0,38%	0,70%	1,24%	1,81%
10	0,8 cap	RST	1,04%	0,66%	0,36%	0,18%	0,14%	0,14%	0,13%	0,18%
10	1	R	0,02%	0,10%	0,14%	0,12%	0,07%	0,19%	0,43%	0,71%
10	0,5 ind	R	1,92%	1,50%	1,09%	0,66%	0,40%	0,68%	1,19%	1,74%
10	1	S	0,32%	0,13%	0,03%	0,05%	0,05%	0,11%	0,27%	0,49%
10	0,5 ind	S	1,96%	1,57%	1,14%	0,67%	0,38%	0,70%	1,21%	1,78%
10	1	T	0,04%	0,11%	0,14%	0,13%	0,07%	0,18%	0,42%	0,70%
10	0,5 ind	T	2,26%	1,79%	1,27%	0,73%	0,38%	0,74%	1,32%	1,91%
I_{max}	1	RST	0,14%	0,05%	0,10%	0,10%	0,07%	0,17%	0,37%	0,63%
I_{max}	0,5 ind	RST	2,07%	1,66%	1,21%	0,74%	0,45%	0,74%	1,26%	1,81%
I_{max}	0,8 cap	RST	1,06%	0,70%	0,43%	0,27%	0,23%	0,23%	0,23%	0,28%
I_{max}	1	R	0,07%	0,13%	0,17%	0,15%	0,10%	0,20%	0,43%	0,72%
I_{max}	0,5 ind	R	1,87%	1,51%	1,10%	0,68%	0,39%	0,66%	1,15%	1,66%
I_{max}	1	S	0,31%	0,13%	0,04%	0,05%	0,06%	0,12%	0,28%	0,50%
I_{max}	0,5 ind	S	2,01%	1,62%	1,20%	0,75%	0,46%	0,72%	1,22%	1,74%
I_{max}	1	T	0,05%	0,11%	0,16%	0,13%	0,09%	0,20%	0,43%	0,72%
I_{max}	0,5 ind	T	2,26%	1,80%	1,30%	0,79%	0,47%	0,76%	1,32%	1,88%

Serial No.: 1KFM0300000004 as 3P4W

I in % of I_{ref}	cos φ	Phase	Composite error %							
			-40 ºC	-25 ºC	-10 ºC	5 ºC	30 ºC	40 ºC	55 ºC	70 ºC
5	1	RST	0,04%	0,08%	0,20%	0,16%	0,07%	0,15%	0,08%	0,11%
10	1	RST	0,03%	0,11%	0,22%	0,18%	0,07%	0,13%	0,06%	0,10%
10	0,5 ind	RST	0,40%	0,43%	0,50%	0,49%	0,41%	0,44%	0,39%	0,40%
10	0,8 cap	RST	0,16%	0,17%	0,23%	0,19%	0,15%	0,18%	0,18%	0,22%
10	1	R	0,08%	0,07%	0,18%	0,15%	0,04%	0,12%	0,04%	0,08%
10	0,5 ind	R	0,52%	0,41%	0,43%	0,46%	0,42%	0,48%	0,41%	0,41%
10	1	S	0,09%	0,18%	0,26%	0,20%	0,09%	0,14%	0,10%	0,15%
10	0,5 ind	S	0,48%	0,55%	0,61%	0,59%	0,48%	0,52%	0,45%	0,45%
10	1	T	0,05%	0,08%	0,20%	0,17%	0,05%	0,11%	0,03%	0,07%
10	0,5 ind	T	0,32%	0,36%	0,43%	0,44%	0,35%	0,38%	0,33%	0,35%
I_{max}	1	RST	0,02%	0,12%	0,23%	0,19%	0,06%	0,14%	0,08%	0,13%
I_{max}	0,5 ind	RST	0,58%	0,59%	0,65%	0,64%	0,58%	0,62%	0,71%	0,71%
I_{max}	0,8 cap	RST	0,24%	0,26%	0,28%	0,26%	0,25%	0,41%	0,37%	0,44%
I_{max}	1	R	0,03%	0,13%	0,25%	0,19%	0,05%	0,10%	0,04%	0,10%
I_{max}	0,5 ind	R	0,65%	0,65%	0,75%	0,69%	0,65%	0,73%	0,82%	0,82%
I_{max}	1	S	0,15%	0,25%	0,32%	0,23%	0,07%	0,14%	0,08%	0,14%
I_{max}	0,5 ind	S	0,71%	0,71%	0,86%	0,72%	0,66%	0,72%	0,77%	0,78%
I_{max}	1	T	0,03%	0,15%	0,25%	0,19%	0,06%	0,12%	0,04%	0,07%
I_{max}	0,5 ind	T	0,54%	0,56%	0,71%	0,59%	0,59%	0,66%	0,73%	0,76%

Serial No.: 1KFM0200000006 as 1P2W on phase L1

I in % of I_{ref}	cos φ		Composite error %							
		ºC	-40	-25	-10	5	30	40	55	70
5	1		0,08%	0,10%	0,15%	0,12%	0,11%	0,21%	0,44%	0,73%
10	1		0,03%	0,08%	0,13%	0,11%	0,07%	0,20%	0,43%	0,73%
10	0,5 ind		2,22%	1,77%	1,26%	0,73%	0,40%	0,74%	1,34%	1,94%
10	0,8 cap		1,00%	0,64%	0,37%	0,20%	0,15%	0,15%	0,16%	0,26%
I_{max}	1		0,08%	0,10%	0,14%	0,13%	0,09%	0,20%	0,42%	0,71%
I_{max}	0,5 ind		2,21%	1,77%	1,28%	0,77%	0,41%	0,73%	1,30%	1,91%
I_{max}	0,8 cap		1,00%	0,65%	0,40%	0,27%	0,23%	0,23%	0,24%	0,31%

6 DURABILITY AND RELIABILITY

In accordance with chapter 9 and 10 of EN 50470-3 durability and reliability of the meters were verified.

In order to conform to these clauses the manufacturer provided the documentation for verification to KEMA Labs and additional verification tests were carried out on request of KEMA Labs.

The meter meets the requirements.

7 SOFTWARE AND PROTECTION AGAINST CORRUPTION

In accordance with chapter 11 of EN 50470-3 software and protection against corruption of the meters were verified.

In order to conform to these clauses the manufacturer provided the documentation for verification to KEMA Labs. The description of applied methods was based on Welmec guide 7.2 and includes application of the following methods (for risk class C):
I3 – Specific software requirements (Active electrical energy meters)
P – Specific requirements for type P (built-for-Purpose measuring instruments)
T – Specific software requirements for data Transmission
S - Specific software requirements for software Separation
D - Specific Software Requirements for Download of Legally Relevant Software.

The approved final versions of the software:

MA309MH4LAT1 legally relevant software part: 10.00.07
MA309MH4LAT1 Legally related software digital signature
D62A00C2D001953F555EBE9255191EEB62C39949421B22E597CDA3225F2DDE79
A27C3E782A3262FEC50E6C2424579734451832EE936EABA8F7BE15368CD8D099

MA309MH4LAT1 non-legally relevant software part: 11.00.58
MA309MH4LAT1 Legally related software digital signature:
D45A7A13F6733F759427B8624969FEF04D231F0C3F262B1135EBEE43BEEF9563C
F0B389F232511F1B13BDAE313DF0F7350D2018D5CBD52B27BFE3DD52CF14256

For MA309MH4LAT2 the final version of the legally relevant software to be applied is
version: 100001 with CRC code: 35D6267E
The final version of the legally non relevant software to be applied is: 110101 with CRC code: 118E564B

An earlier version of this report may show a later version of the software for type MA309MH4LAT1.
In this later version an improvement was made to display the long signature and some modifications not relevant to this specific version of the meter.
This has no impact on the correct functionality of this meter.

The meter meets the requirements.

Appendix A Accuracy test results

Accuracy test results, serial number 1KFM0200000006 as 3P4W.

230/400 V						Wh
I in %	3/1	Percentage error at cos φ =				
of I_{ref}	ph	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	3ph	0,02%				
5*	3ph	-0,08%				
10	3ph	0,00%	0,04%	0,00%		
10	1ph,1	0,03%	0,16%			
10	1ph,2	0,00%	0,03%			
10	1ph,3	-0,04%	-0,03%			
20	3ph	-0,01%	0,02%	-0,02%	0,08%	-0,02%
20	1ph,1		0,09%			
20	1ph,2		0,02%			
20	1ph,3		-0,03%			
50	3ph	-0,03%	0,00%	-0,04%	0,00%	-0,04%
100	3ph	-0,03%	-0,02%	-0,04%	0,02%	-0,06%
100*	3ph	-0,03%	-0,01%	-0,05%		
100	1ph,1	-0,03%	0,01%			
100	1ph,2	-0,02%	-0,02%			
100	1ph,3	-0,05%	-0,03%			
200	3ph	-0,03%	-0,02%	-0,04%		
½I_{max}	3ph	-0,04%	-0,02%	-0,06%		
¾ I_{max}	3ph	-0,05%	0,03%	-0,10%		
I_{max}	3ph	-0,05%	0,18%	-0,16%		
I_{max}	1ph,1	-0,05%	0,22%			
I_{max}	1ph,2	-0,05%	0,24%			
I_{max}	1ph,3	-0,05%	0,15%			

* Reverse energy

Accuracy test results, serial number 1KFM0200000007 as 3P4W.

230/400V						Wh
I in % of I_{ref}	3/1 ph	Percentage error at cos φ =				
		1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	3ph	0,00%				
5*	3ph	-0,07%				
10	3ph	-0,01%	0,03%	-0,02%		
10	1ph,1	0,01%	0,12%			
10	1ph,2	-0,01%	0,00%			
10	1ph,3	-0,03%	0,00%			
20	3ph	-0,01%	0,01%	-0,02%	0,08%	-0,03%
20	1ph,1		0,06%			
20	1ph,2		0,00%			
20	1ph,3		0,00%			
50	3ph	-0,04%	-0,01%	-0,05%	0,01%	-0,07%
100	3ph	-0,04%	-0,03%	-0,05%	-0,01%	-0,07%
100*	3ph	-0,04%	-0,02%	-0,05%		
100	1ph,1	-0,06%	-0,02%			
100	1ph,2	-0,02%	-0,02%			
100	1ph,3	-0,04%	-0,02%			
200	3ph	-0,04%	-0,03%	-0,04%		
½I_{max}	3ph	-0,05%	-0,02%	-0,07%		
¾ I_{max}	3ph	-0,05%	0,03%	-0,10%		
I_{max}	3ph	-0,04%	0,17%	-0,16%		
I_{max}	1ph,1	-0,07%	0,12%			
I_{max}	1ph,2	-0,03%	0,23%			
I_{max}	1ph,3	-0,05%	0,25%			

* Reverse energy

Accuracy test results, serial number 1KFM0300000004 as 3P4W.

230/400V						Wh
Iin% ofI$_{ref}$	3/1 ph	Percentageerroratcosφ= 1	0,5ind	0,8cap	0,25ind	0,5cap
5	3ph	0,02%				
5*	3ph	-0,05%				
10	3ph	0,01%	0,33%	-0,08%		
10	1ph,1	0,02%	0,36%			
10	1ph,2	0,02%	0,39%			
10	1ph,3	0,00%	0,28%			
20	3ph	0,01%	0,31%	-0,10%	0,73%	-0,27%
20	1ph,1		0,32%			
20	1ph,2		0,38%			
20	1ph,3		0,28%			
50	3ph	0,00%	0,30%	-0,12%	0,67%	-0,30%
100	3ph	0,00%	0,28%	-0,13%	0,51%	-0,22%
100*	3ph	0,00%	0,28%	-0,13%		
100	1ph,1	-0,01%	0,27%			
100	1ph,2	0,01%	0,32%			
100	1ph,3	0,01%	0,27%			
200	3ph	0,01%	0,22%	-0,07%		
½I$_{max}$	3ph	0,01%	0,19%	-0,08%		
¾I$_{max}$	3ph	0,01%	0,29%	-0,13%		
I$_{max}$	3ph	0,01%	0,49%	-0,20%		
I$_{max}$	1ph,1	-0,01%	0,60%			
I$_{max}$	1ph,2	0,02%	0,58%			
I$_{max}$	1ph,3	0,01%	0,47%			

* Reverse energy

Accuracy test results, serial number 1KFM0200000001 as 3P4W.

230/400 V						varh
I in % of I_{ref}	3/1 ph	Percentage error at sin φ =				
		1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	3ph	-0,48%				
5*	3ph	0,36%				
10	3ph	-0,26%	-0,49%	-0,47%		
10	1ph,1	-0,28%				
10	1ph,2	-0,28%				
10	1ph,3	-0,25%				
20	3ph	-0,16%	-0,28%	-0,25%	-0,50%	-0,43%
20	1ph,1		-0,31%			
20	1ph,2		-0,32%			
20	1ph,3		-0,25%			
50	3ph	-0,14%	-0,23%			
100	3ph	-0,10%	-0,14%	-0,12%	-0,25%	-0,17%
100*	3ph	-0,03%	0,00%	0,02%		
100	1ph,1	-0,12%	-0,22%			
100	1ph,2	-0,09%	-0,16%			
100	1ph,3	-0,10%	-0,12%			
200	3ph	-0,08%	-0,10%			
½I_{max}	3ph	-0,09%	-0,15%	-0,08%	-0,30%	-0,04%
¾ I_{max}	3ph	-0,08%	-0,22%			
I_{max}	3ph	-0,08%	-0,31%	0,21%	-0,82%	0,68%
I_{max}	1ph,1	-0,12%	-0,41%			
I_{max}	1ph,2	-0,07%	-0,42%			
I_{max}	1ph,3	-0,07%	-0,27%			

* Exported energy

Accuracy test results, serial number 1KFM0700000001 as 3P4W.

230/400 V						varh
I in % of I_{ref}	3/1 ph	Percentage error at sin φ =				
		1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	3ph	-0,13%				
5*	3ph	0,19%				
10	3ph	-0,06%	-0,25%	-0,01%		
10	1ph,1	-0,03%				
10	1ph,2	-0,08%				
10	1ph,3	-0,05%				
20	3ph	-0,01%	-0,18%	0,07%	-0,41%	0,14%
20	1ph,1		-0,13%			
20	1ph,2		-0,22%			
20	1ph,3		-0,16%			
50	3ph	-0,03%	-0,21%			
100	3ph	-0,01%	-0,17%	0,07%	-0,35%	0,16%
100*	3ph	0,03%	-0,06%	0,18%		
100	1ph,1	-0,02%	-0,17%			
100	1ph,2	-0,01%	-0,18%			
100	1ph,3	0,00%	-0,12%			
200	3ph	0,00%	-0,11%			
½I_{max}	3ph	0,00%	-0,13%	0,09%	-0,41%	0,33%
¾ I_{max}	3ph	0,00%	-0,26%			
I_{max}	3ph	0,01%	-0,38%	0,23%	-0,25%	0,35%
I_{max}	1ph,1	0,00%	-0,53%			
I_{max}	1ph,2	0,00%	-0,27%			
I_{max}	1ph,3	0,01%	-0,07%			

* Exported energy

Accuracy test results, serial number 1KFM0100000006 as 3P4W connected as 1P2W on Phase L1.

230 V					Wh
I in %	Percentage error at cos φ =				
of I_n	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	0,07%				
5[1)]	-0,18%				
10	0,01%	0,05%	0,05%		
20	0,00%	0,01%	0,01%	0,08%	0,04%
50	-0,02%	-0,02%	-0,01%	-0,01%	0,00%
100	-0,03%	-0,04%	-0,02%	-0,02%	-0,01%
100[1)]	-0,04%	-0,06%	-0,04%		
200	-0,03%	-0,04%	-0,03%		
½I_{max}	-0,04%	-0,05%	-0,04%		
¾I_{max}	-0,05%	-0,05%	-0,08%		
I_{max}	-0,06%	0,07%	-0,13%		

[1)] Reverse energy

Accuracy test results, serial number 1KFM0100000007 as 3P4W connected as 1P2W on Phase L1.

230 V					Wh
I in %	Percentage error at cos φ =				
of I_n	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	0,03%				
5[1)]	-0,21%				
10	-0,01%	-0,01%	0,03%		
20	-0,03%	-0,05%	0,00%	-0,02%	0,05%
50	-0,06%	-0,08%	-0,04%	-0,09%	-0,02%
100	-0,07%	-0,10%	-0,05%	-0,11%	-0,04%
100[1)]	-0,08%	-0,11%	-0,07%		
200	-0,06%	-0,10%	-0,04%		
½I_{max}	-0,08%	-0,12%	-0,07%		
¾I_{max}	-0,08%	-0,08%	-0,09%		
I_{max}	-0,08%	-0,02%	-0,13%		

[1)] Reverse energy

Accuracy test results, serial number 1KFM0300000004 as 3P4W connected as 1P2W on Phase L1.

230 V					Wh
I in %	Percentage error at cos φ =				
of I_n	1	0,5 ind	0,8 cap	0,25 ind	0,5 cap
5	0,09%				
5[1)]	-0,06%				
10	0,05%	0,34%	-0,04%		
20	0,04%	0,31%	-0,05%	0,63%	-0,18%
50	0,01%	0,25%	-0,08%	0,52%	-0,19%
100	0,01%	0,23%	-0,07%	0,48%	-0,20%
100[1)]	0,00%	0,20%	-0,09%		
200	0,00%	0,20%	-0,07%		
½I_{max}	0,01%	0,16%	-0,07%		
¾I_{max}	0,00%	0,25%	-0,13%		
I_{max}	0,00%	0,43%	-0,22%		

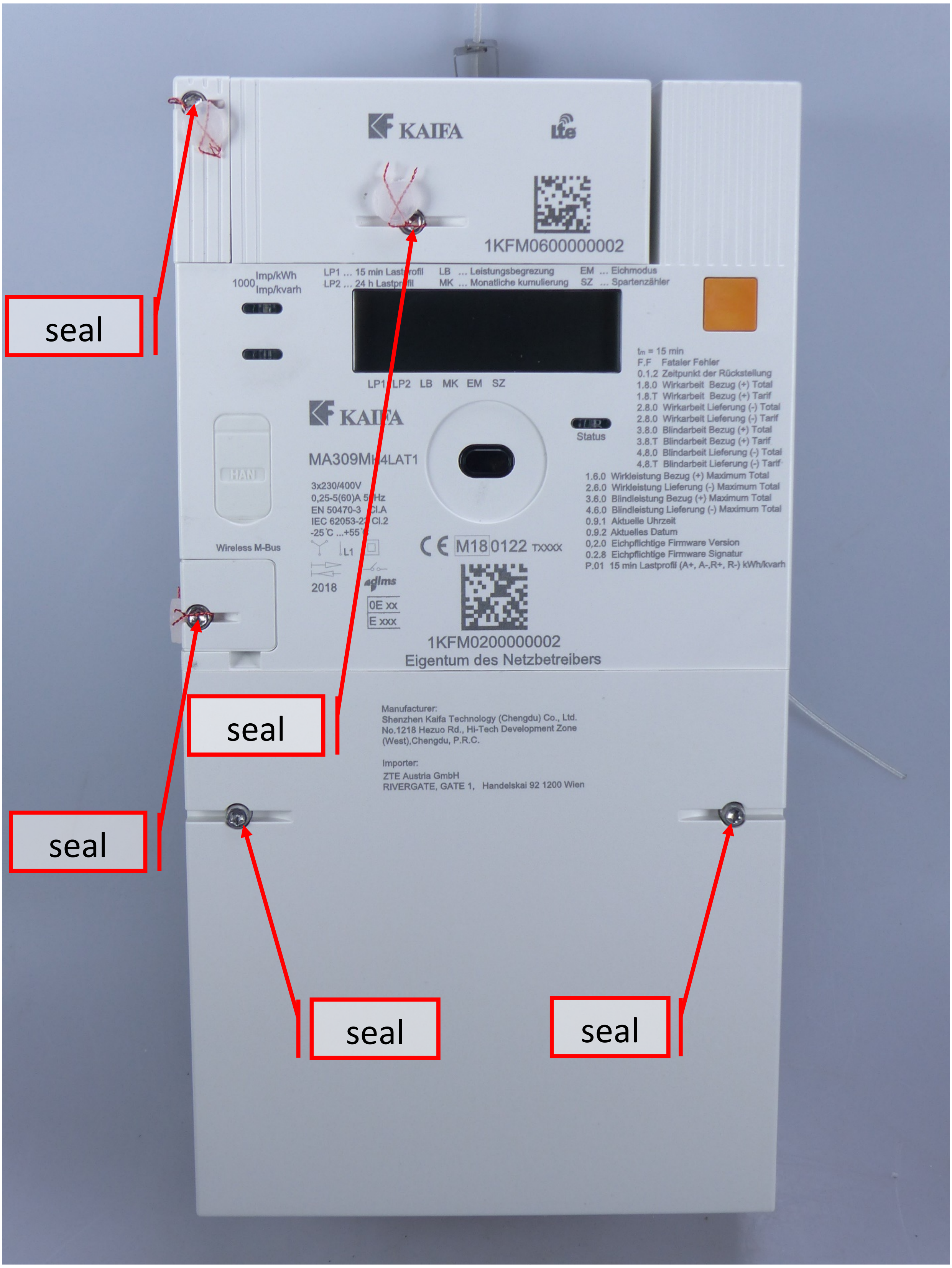
[1)] Reverse energy

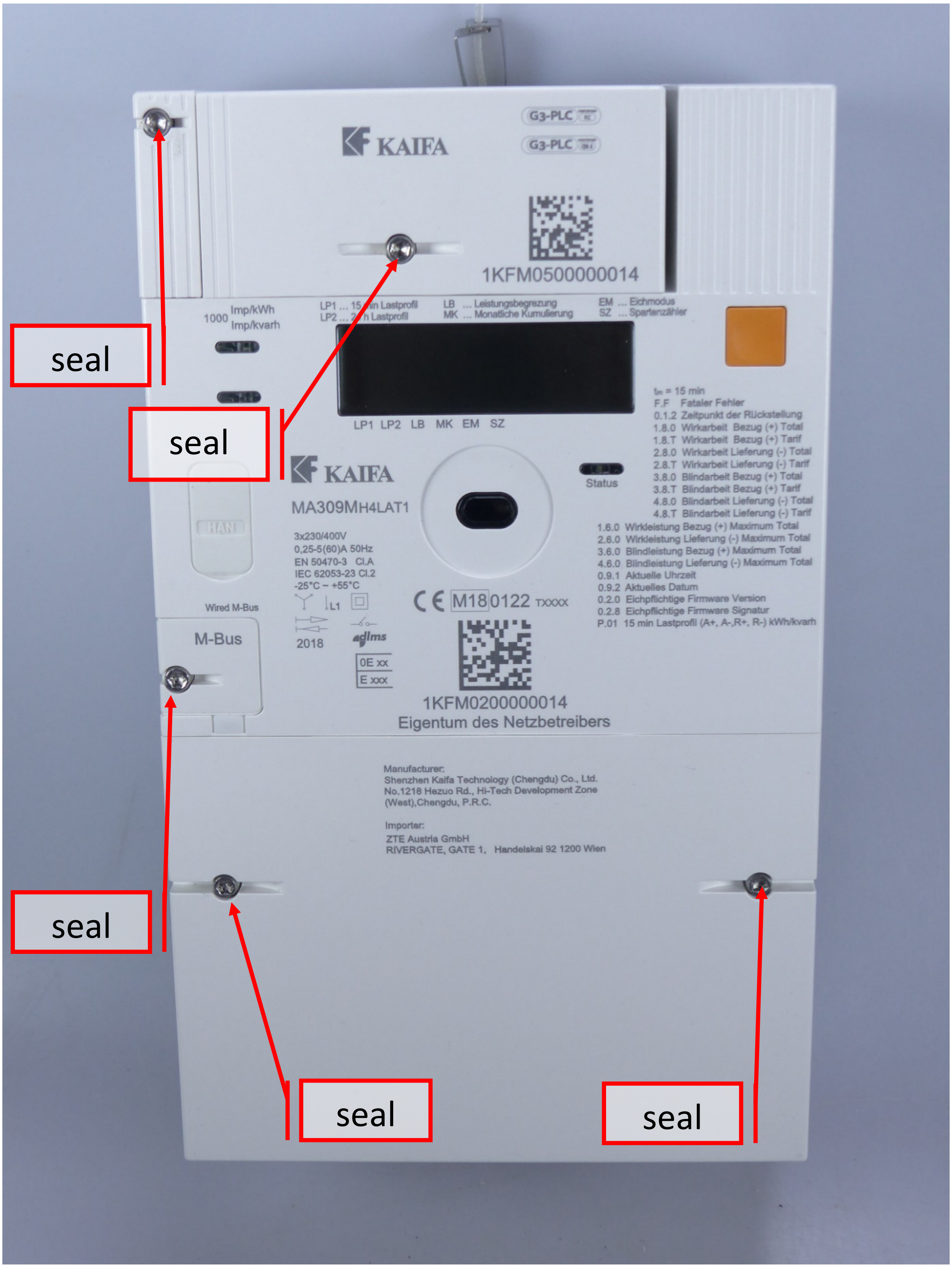
Accuracy test results, serial number 1KFM0100000001 as 3P4W connected as 1P2W on Phase L1.

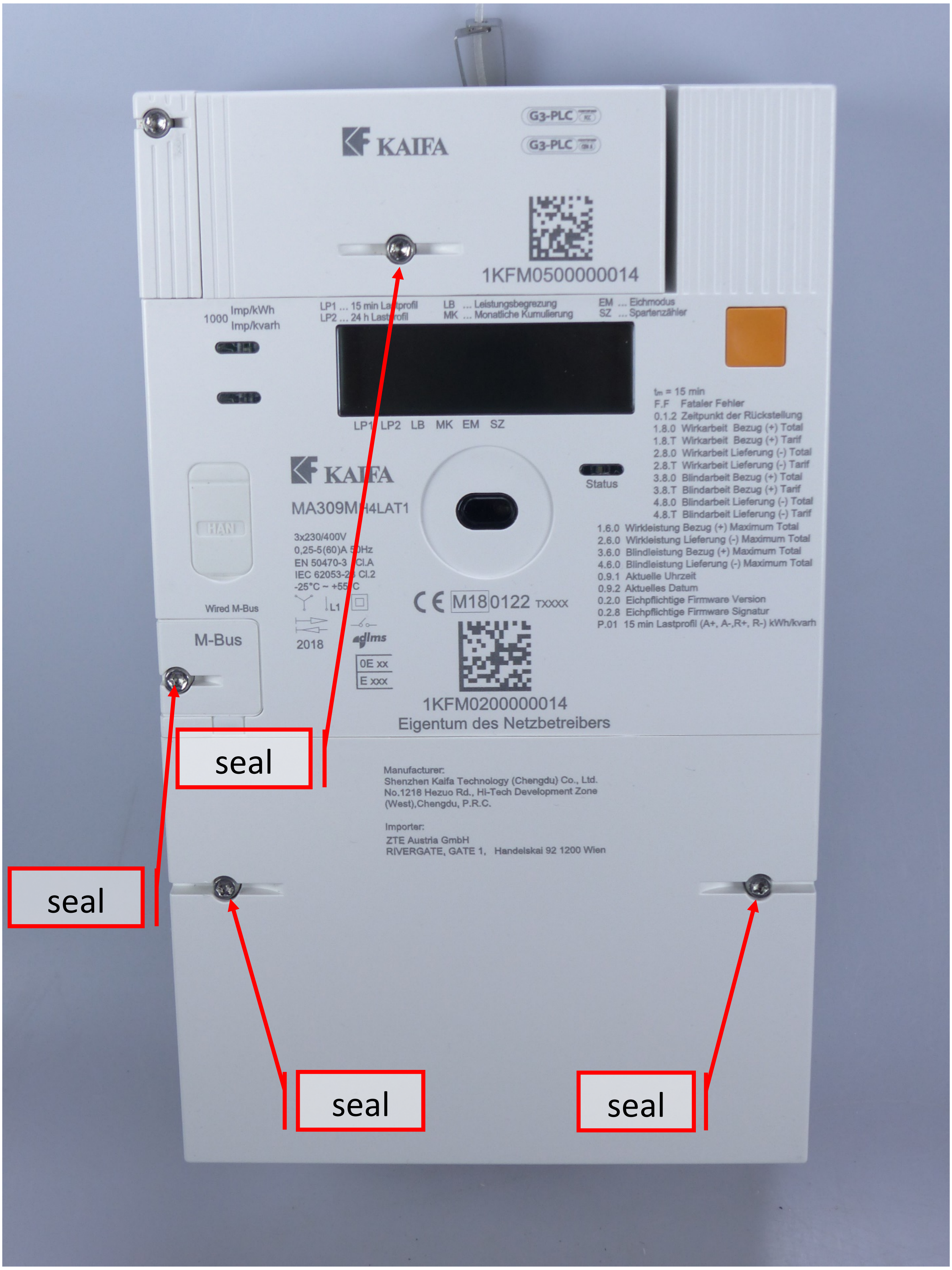
230 V					varh
I in %	Percentage error at sin φ =				
of I_n	1	0,5 ind	0,5 cap	0,25 ind	0,25 cap
5	-0,39%				
5[1)]	0,32%				
10	-0,22%	-0,40%	-0,39%		
20	-0,12%	-0,20%	-0,21%	-0,38%	-0,39%
50	-0,10%	-0,16%			
100	-0,08%	-0,12%	-0,11%	-0,16%	-0,16%
100[1)]	-0,04%	-0,02%	0,00%		
200	-0,08%	-0,08%			
½I_{max}	-0,09%	-0,10%	-0,09%	-0,17%	-0,05%
¾I_{max}	-0,09%	-0,18%			
I_{max}	-0,09%	-0,25%	0,07%	-0,58%	0,39%

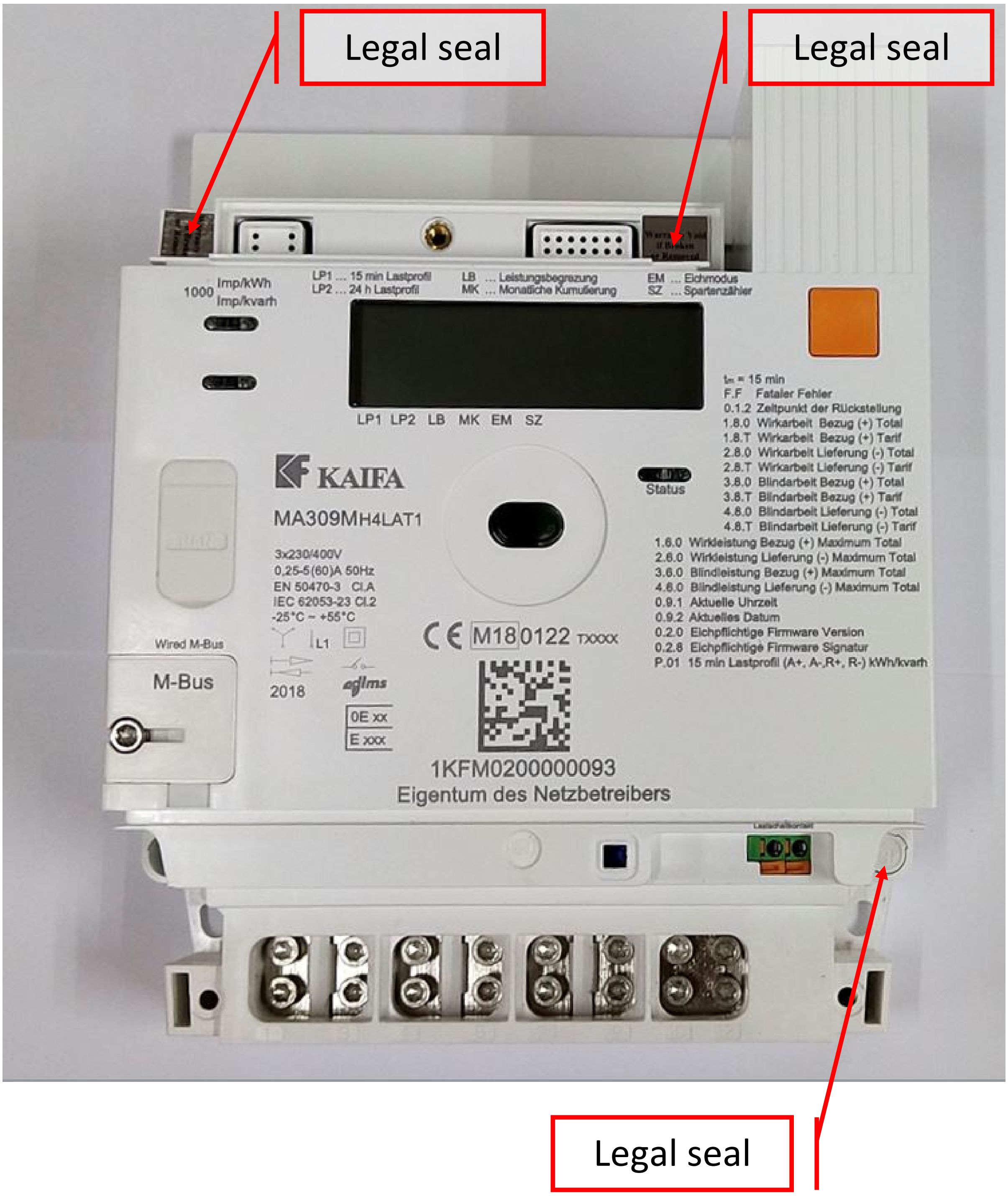
[1)] Exported energy

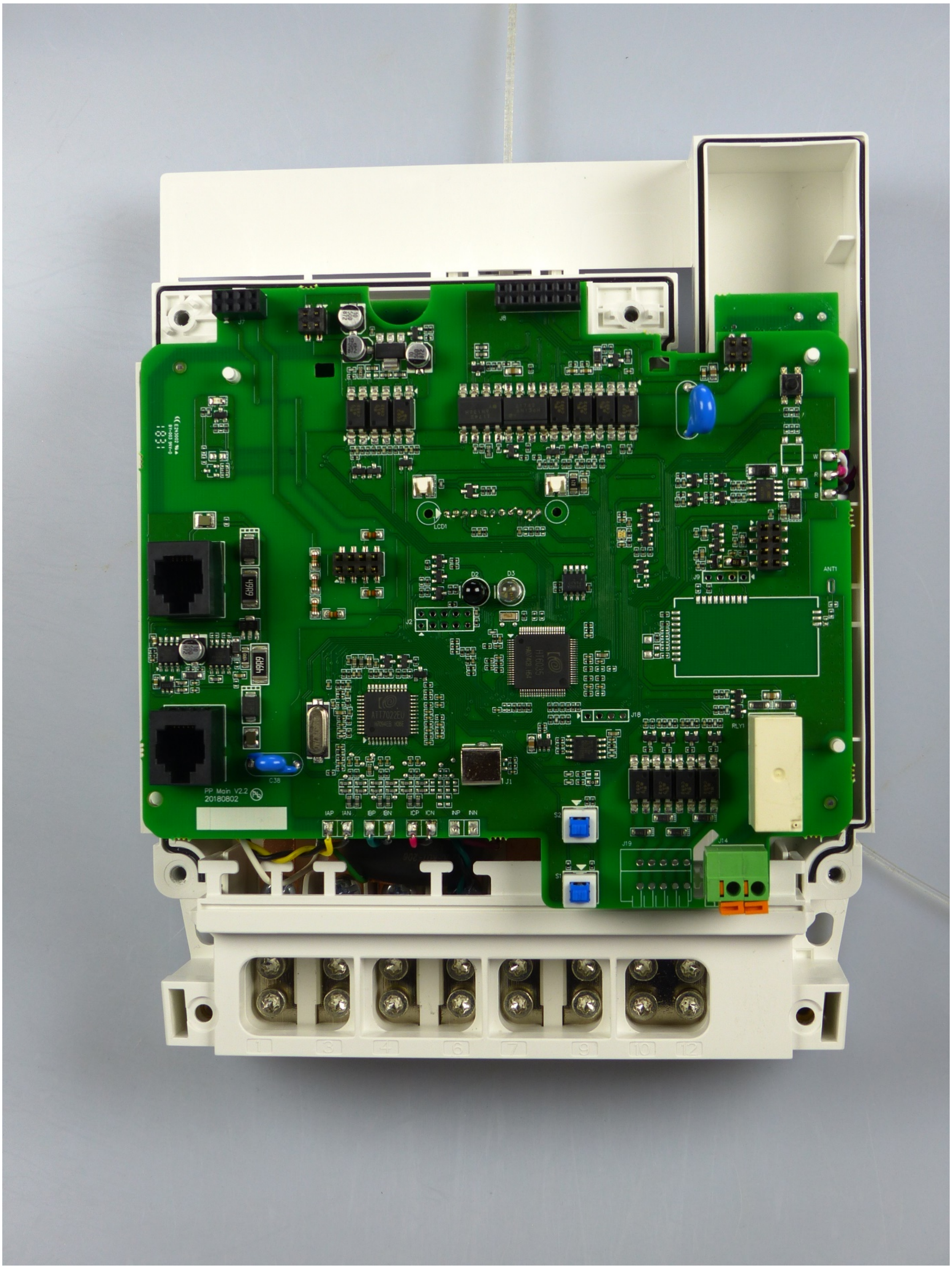
Appendix B Photographs and PCB drawings of the meter, MA309MH4LAT1

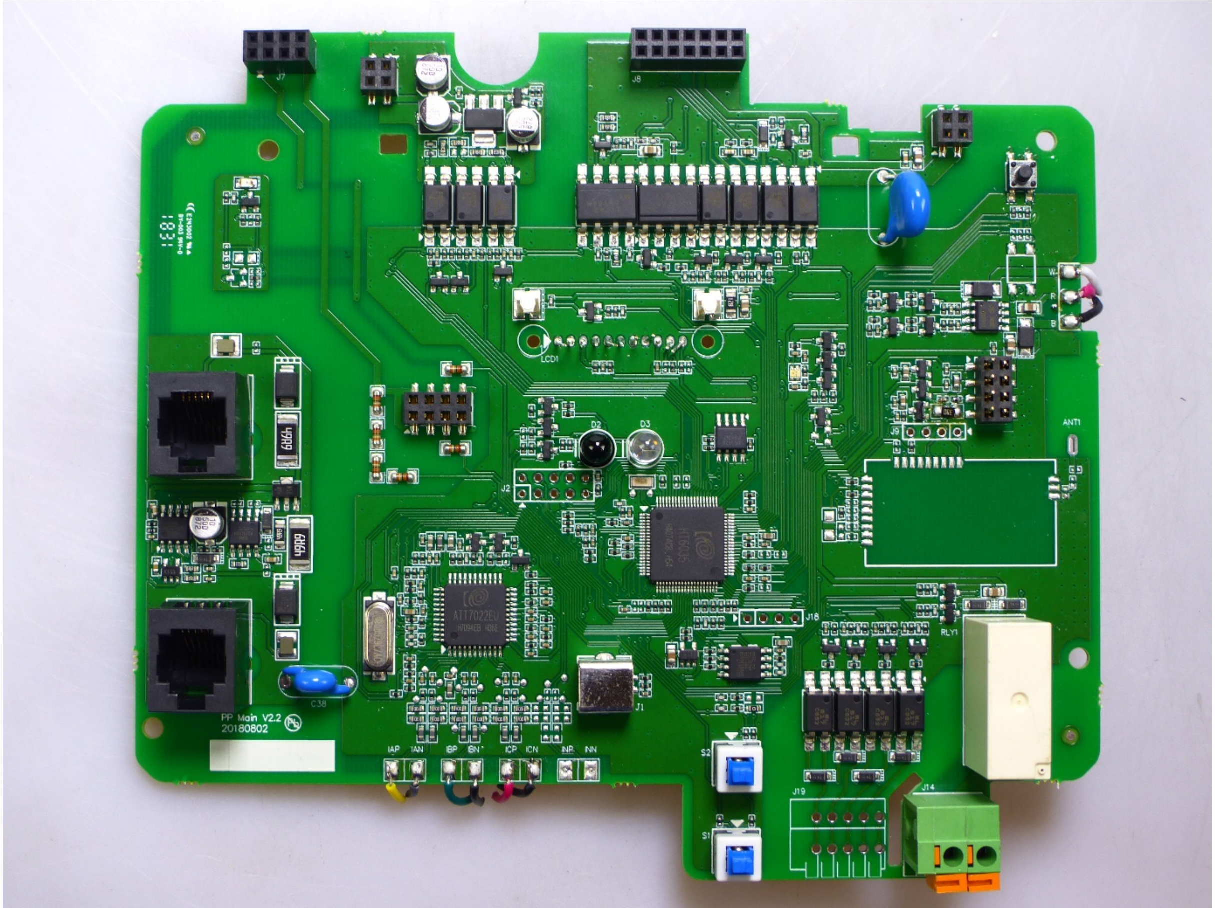


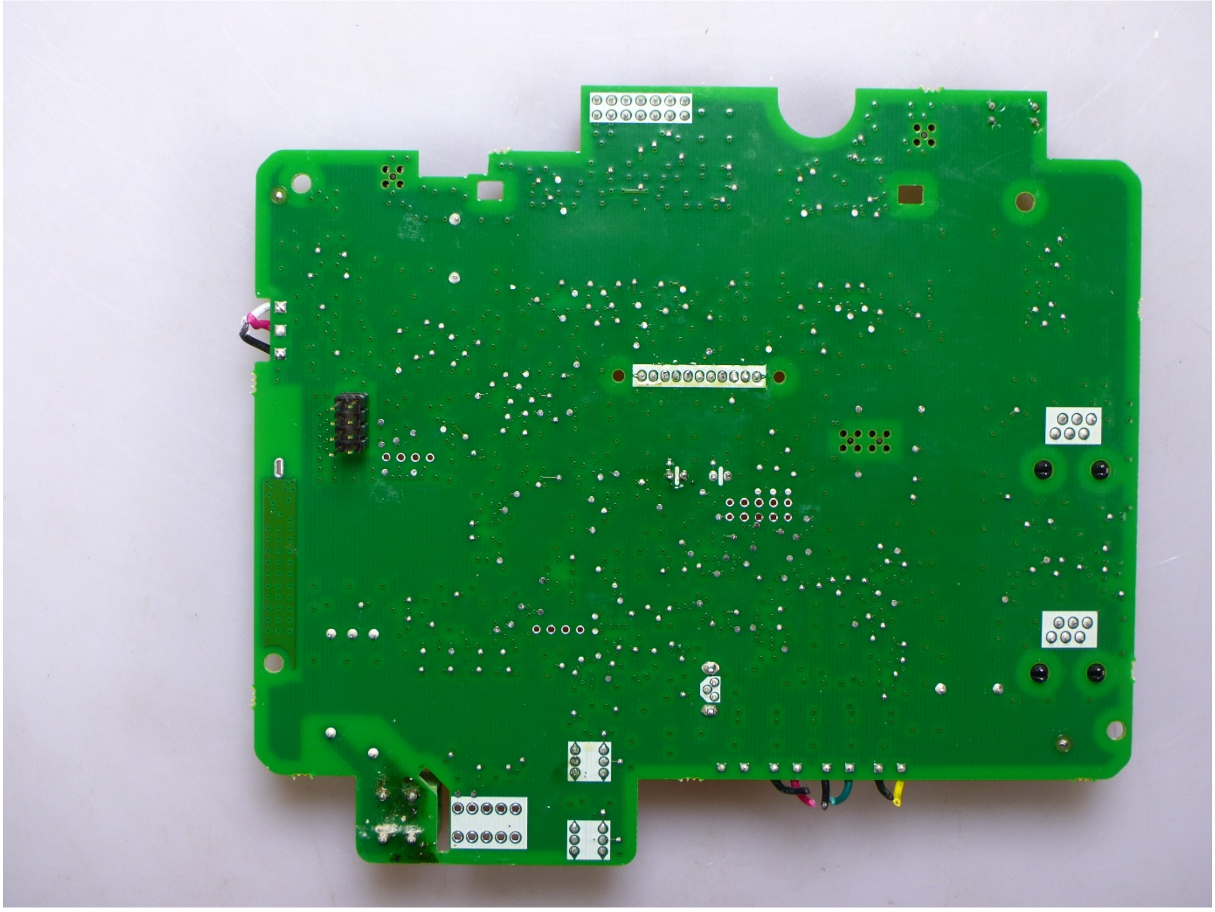

seal
seal
seal
seal
seal
KAIFA
G3-PLC
G3-PLC
1KFM0500000014
1000 Imp/kWh
Imp/kvarh
LP1 LP2 LB MK EM SZ
KAIFA
MA309MH4LAT1
3x230/400V
0,25-5(60)A 50Hz
EN 50470-3 Cl.A
IEC 62053-23 Cl.2
-25°C ~ +55°C
2018
M18 0122
Status
HAN
Wired M-Bus
M-Bus
1KFM0200000014
Eigentum des Netzbetreibers
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No.1218 Hezuo Rd., Hi-Tech Development Zone
(West),Chengdu, P.R.C.
Importer:
ZTE Austria GmbH
RIVERGATE, GATE 1, Handelskai 92 1200 Wien

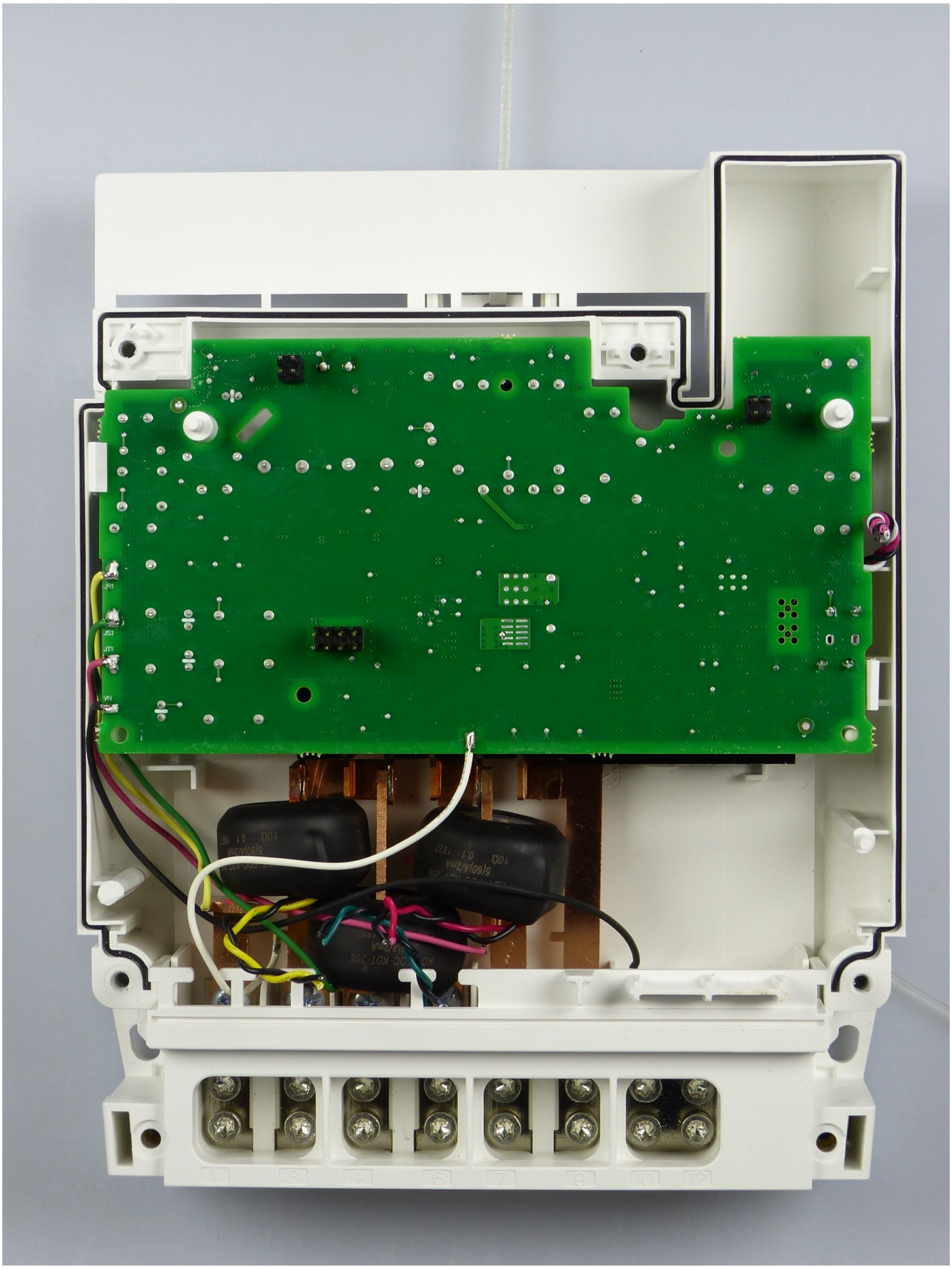

G3-PLC
G3-PLC
KAIFA
1KFM0500000014
1000 Imp/kWh
Imp/kvarh
LP1 ... 15 min Lastprofil
LP2 ... 24 h Lastprofil
LB ... Leistungsbegrenzung
MK ... Monatliche Kumulierung
EM ... Eichmodus
SZ ... Spartenzähler
LP1 LP2 LB MK EM SZ
KAIFA
MA309MH4LAT1
3x230/400V
0,25-5(60)A 50Hz
EN 50470-3 Cl.A
IEC 62053-23 Cl.2
-25°C ~ +55°C
HAN
Wired M-Bus
M-Bus
2018
dlms
0E xx
E xxx
Status
M180122 TXXXX
1KFM0200000014
Eigentum des Netzbetreibers
F.F Fataler Fehler
0.1.2 Zeitpunkt der Rückstellung
1.8.0 Wirkarbeit Bezug (+) Total
1.8.T Wirkarbeit Bezug (+) Tarif
2.8.0 Wirkarbeit Lieferung (-) Total
2.8.T Wirkarbeit Lieferung (-) Tarif
3.8.0 Blindarbeit Bezug (+) Total
3.8.T Blindarbeit Bezug (+) Tarif
4.8.0 Blindarbeit Lieferung (-) Total
4.8.T Blindarbeit Lieferung (-) Tarif
1.6.0 Wirkleistung Bezug (+) Maximum Total
2.6.0 Wirkleistung Lieferung (-) Maximum Total
3.6.0 Blindleistung Bezug (+) Maximum Total
4.6.0 Blindleistung Lieferung (-) Maximum Total
0.9.1 Aktuelle Uhrzeit
0.9.2 Aktuelles Datum
0.2.0 Eichpflichtige Firmware Version
0.2.8 Eichpflichtige Firmware Signatur
P.01 15 min Lastprofil (A+, A-,R+, R-) kWh/kvarh
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No.1218 Hezuo Rd., Hi-Tech Development Zone
(West),Chengdu, P.R.C.
Importer:
ZTE Austria GmbH
RIVERGATE, GATE 1, Handelskai 92 1200 Wien
seal
seal
seal
seal

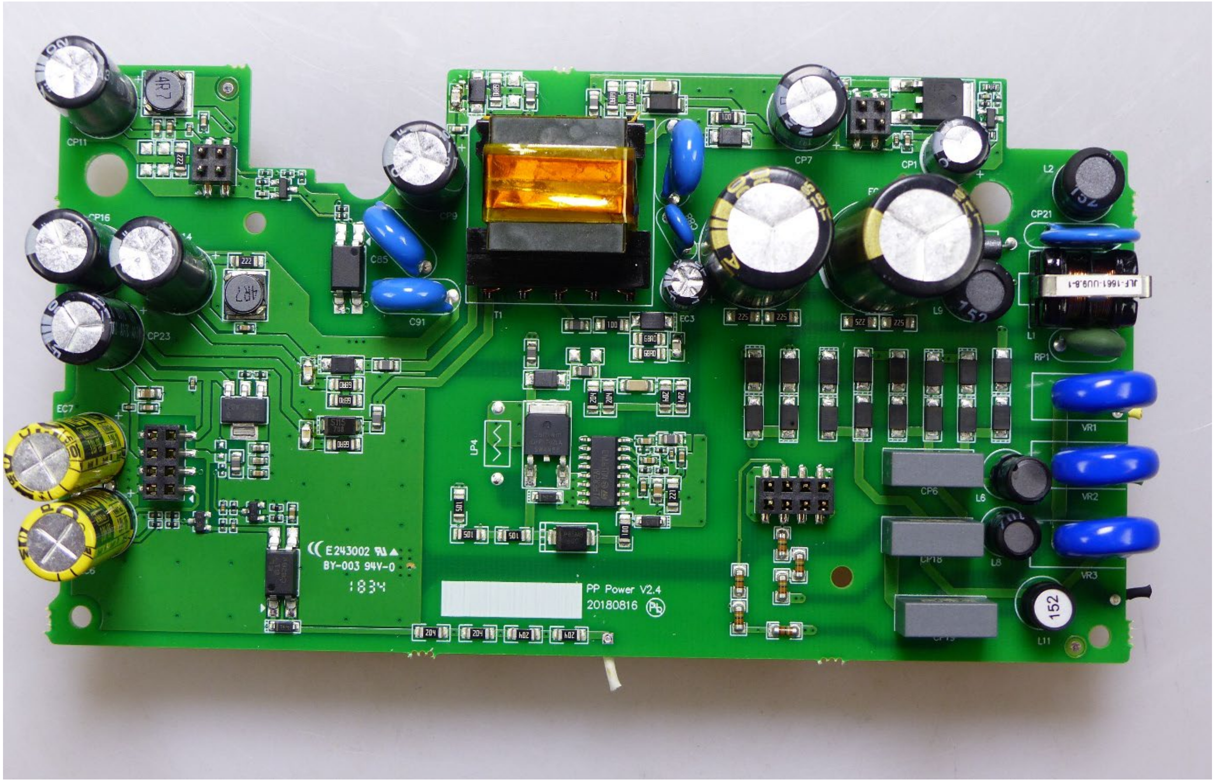

Legal seal
Legal seal
1000 Imp/kWh
Imp/kvarh
LP1 ... 15 min Lastprofil
LP2 ... 24 h Lastprofil
LB ... Leistungsbegrenzung
MK ... Monatliche Kumulierung
EM ... Eichmodus
SZ ... Spartenzähler
LP1 LP2 LB MK EM SZ
KAIFA
MA309MH4LAT1
3x230/400V
0,25-5(60)A 50Hz
EN 50470-3 Cl.A
IEC 62053-23 Cl.2
-25°C ~ +55°C
Status
M180122 TXXXX
Wired M-Bus
M-Bus
2018
0E xx
E xxx
1KFM0200000093
Eigentum des Netzbetreibers
Legal seal

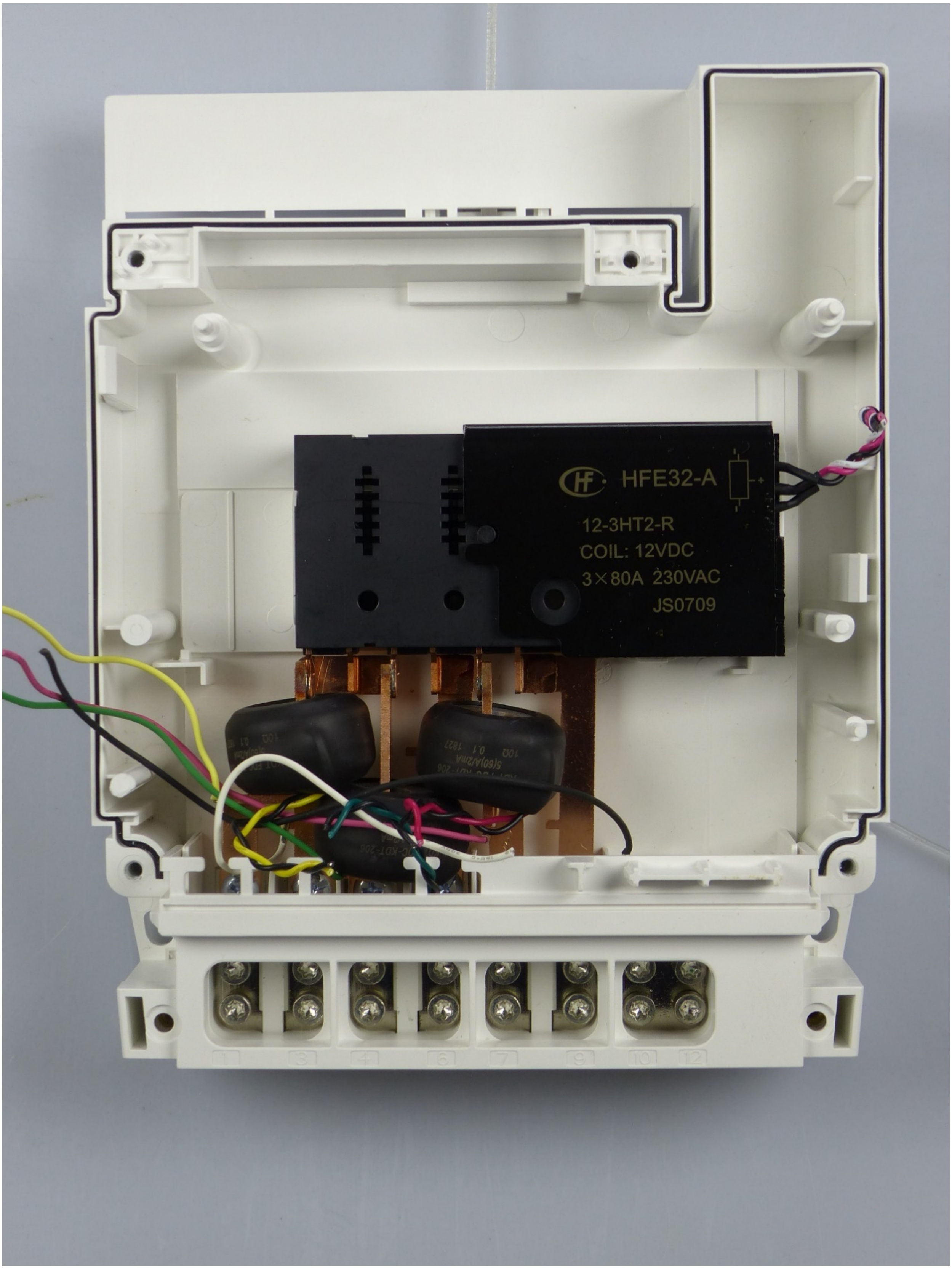

PP Main V2.2
20180802



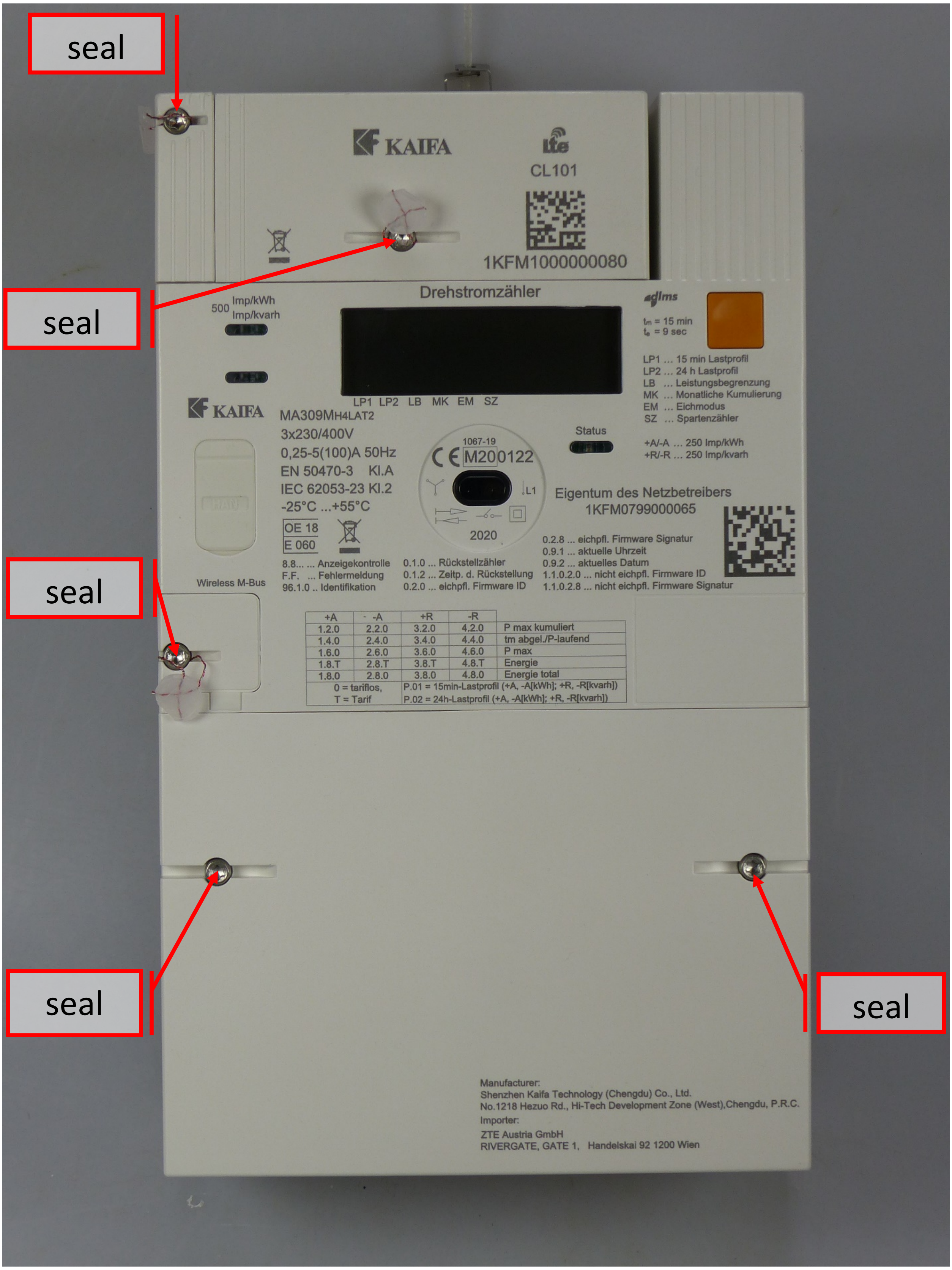


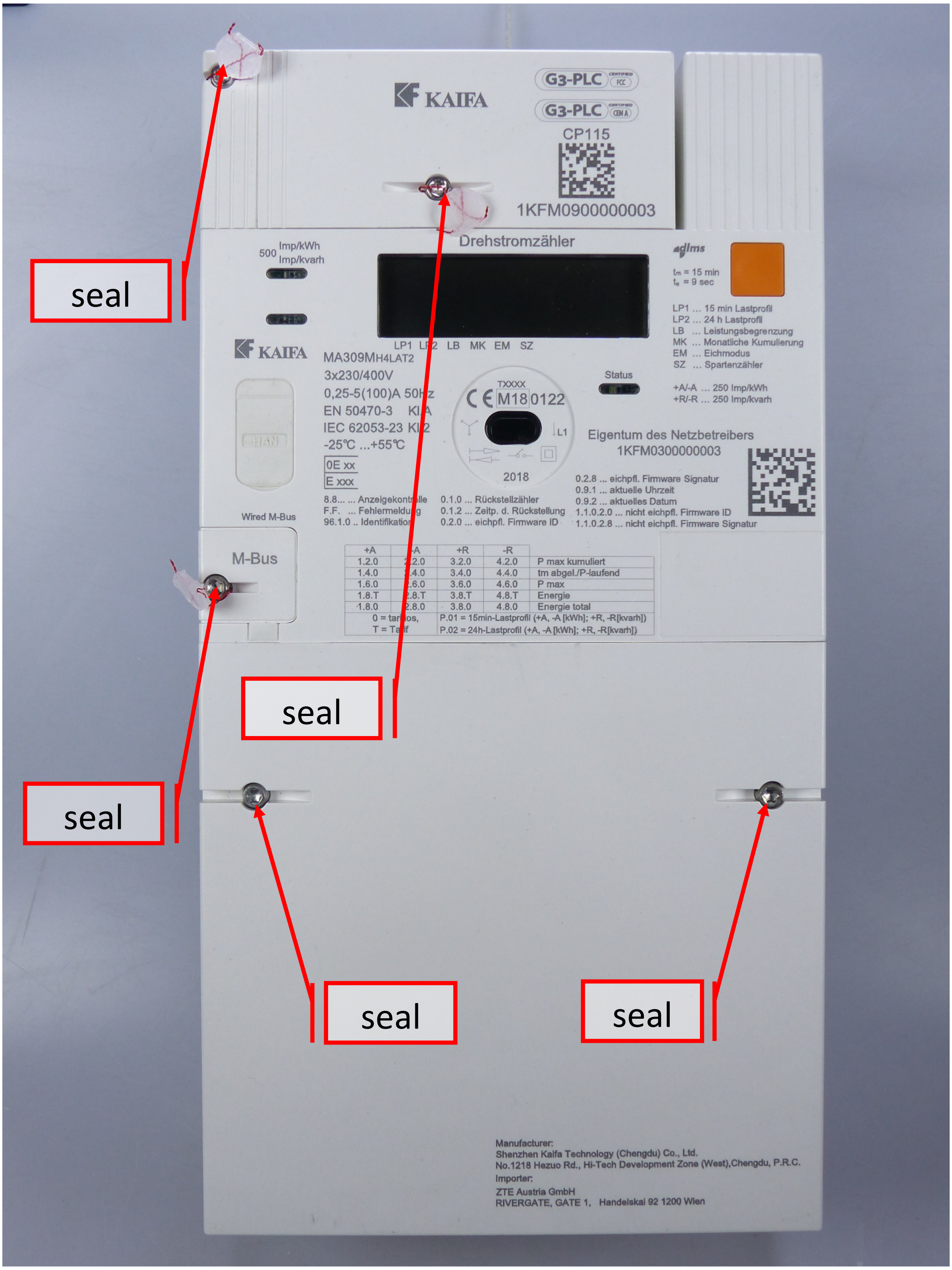


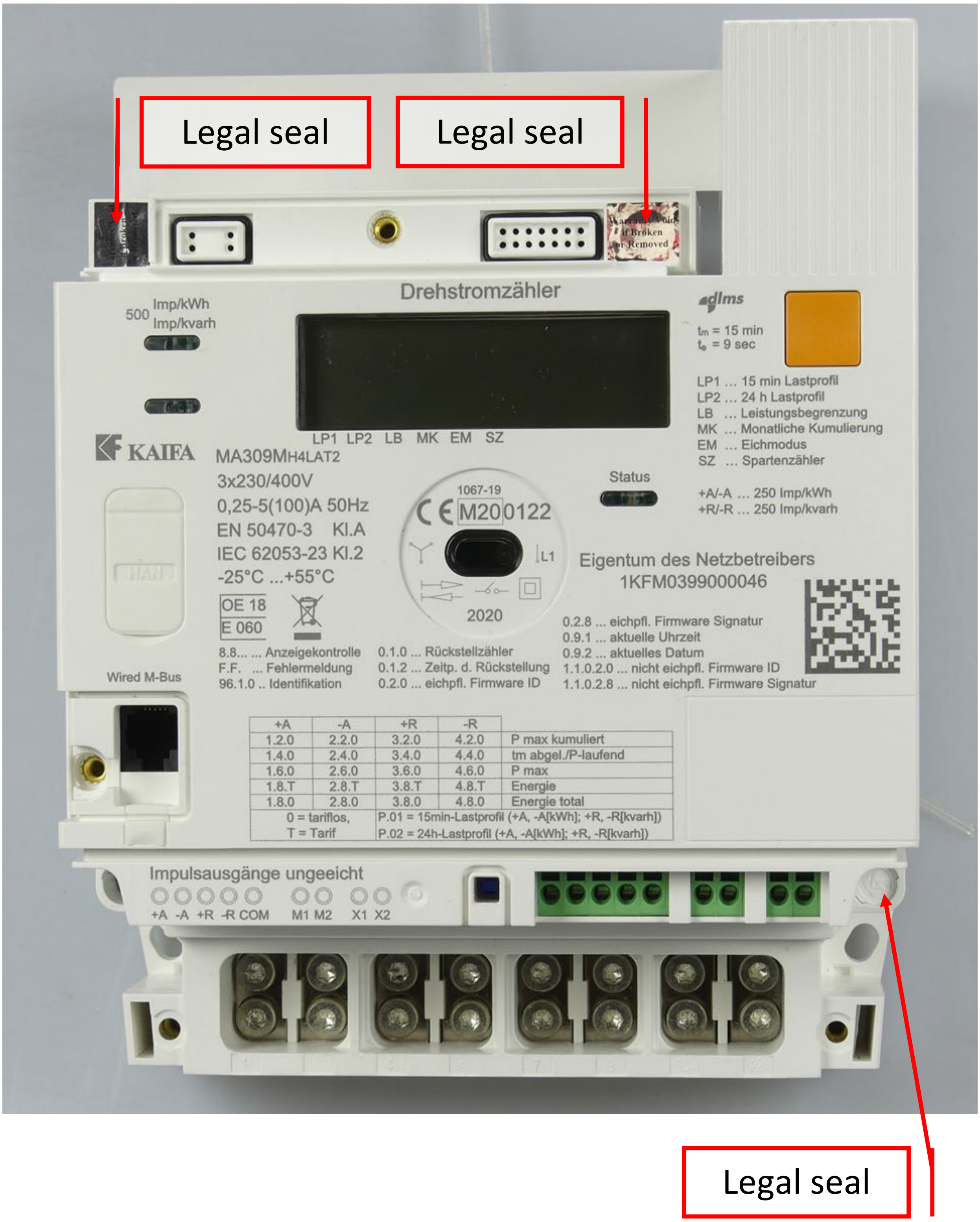

PP Power V2.4
20180816
E243002
BY-003 94V-0
1834

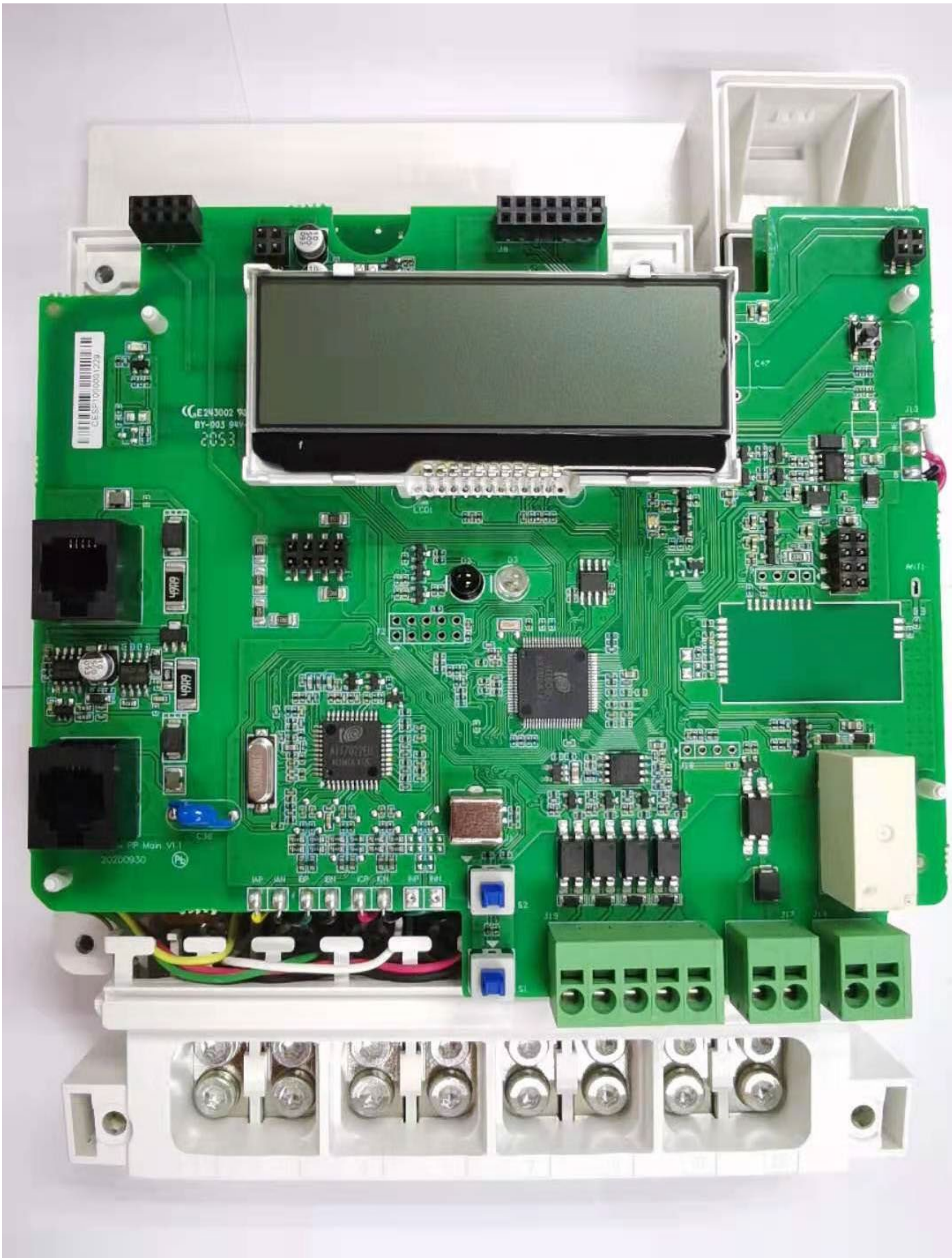

HFE32-A
12-3HT2-R
COIL: 12VDC
3×80A 230VAC
JS0709

Appendix C Photographs and PCB drawings of the meter, MA309MH4LAT2



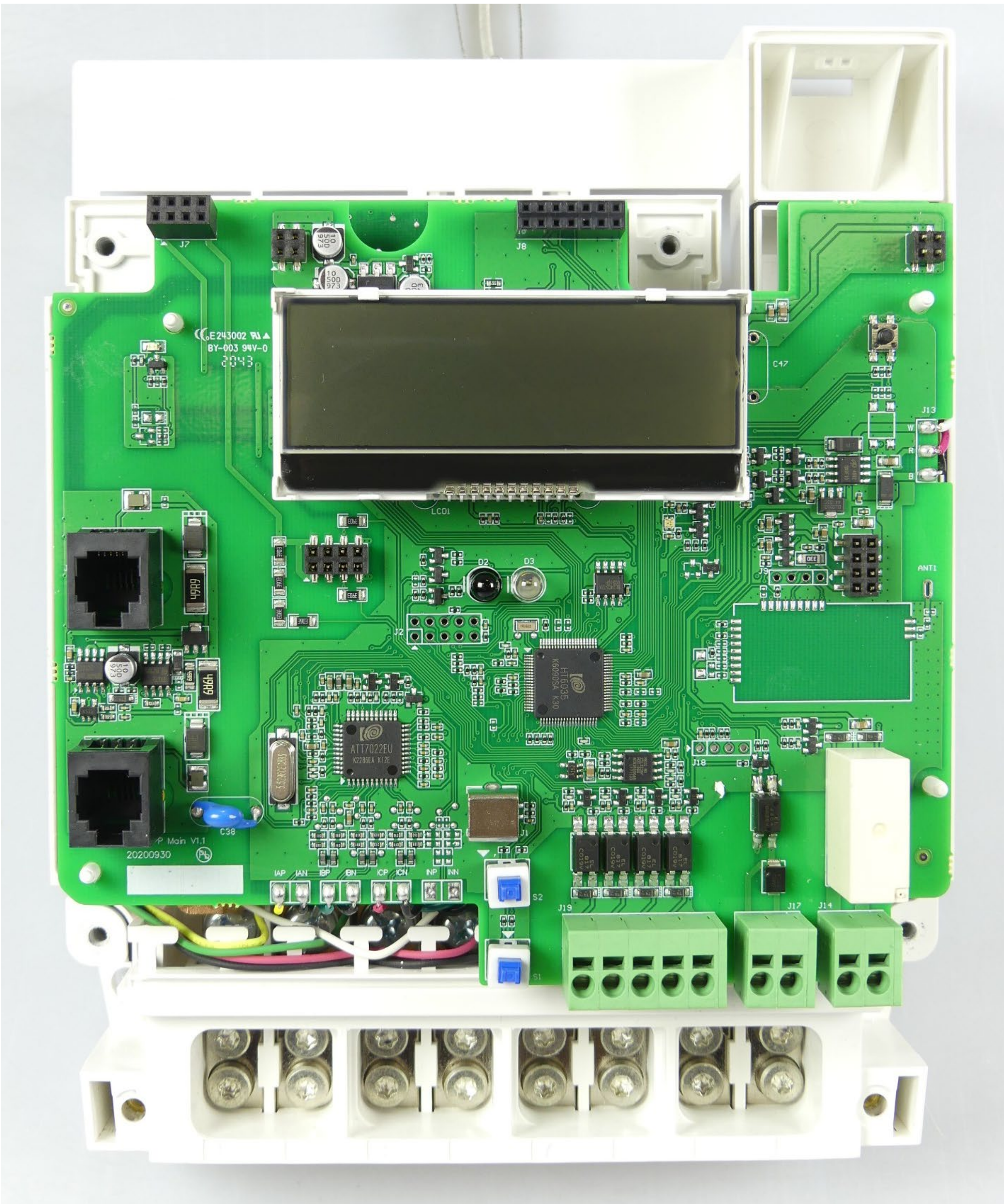

seal
seal
seal
seal
seal
KAIFA
G3-PLC
G3-PLC
CP115
1KFM0900000003
Drehstromzähler
500 Imp/kWh Imp/kvarh
MA309MH4LAT2
3x230/400V
Status
Eigentum des Netzbetreibers
1KFM0300000003
M-Bus
Wired M-Bus
2018
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No.1218 Hezuo Rd., Hi-Tech Development Zone (West),Chengdu, P.R.C.
Importer:
ZTE Austria GmbH
RIVERGATE, GATE 1, Handelskai 92 1200 Wien


Legal seal
Legal seal
Legal seal
Drehstromzähler
500 Imp/kWh
Imp/kvarh
dlms
tm = 15 min
te = 9 sec
LP1 ... 15 min Lastprofil
LP2 ... 24 h Lastprofil
LB ... Leistungsbegrenzung
MK ... Monatliche Kumulierung
EM ... Eichmodus
SZ ... Spartenzähler
LP1 LP2 LB MK EM SZ
KAIFA
MA309MH4LAT2
3x230/400V
0,25-5(100)A 50Hz
EN 50470-3 Kl.A
IEC 62053-23 Kl.2
-25°C ...+55°C
OE 18
E 060
1067-19
CE M20 0122
2020
Status
+A/-A ... 250 Imp/kWh
+R/-R ... 250 Imp/kvarh
Eigentum des Netzbetreibers
1KFM0399000046
HAN
Wired M-Bus
8.8... ... Anzeigekontrolle
F.F. ... Fehlermeldung
96.1.0 .. Identifikation
0.1.0 ... Rückstellzähler
0.1.2 ... Zeitp. d. Rückstellung
0.2.0 ... eichpfl. Firmware ID
0.2.8 ... eichpfl. Firmware Signatur
0.9.1 ... aktuelle Uhrzeit
0.9.2 ... aktuelles Datum
1.1.0.2.0 ... nicht eichpfl. Firmware ID
1.1.0.2.8 ... nicht eichpfl. Firmware Signatur
+A -A +R -R
1.2.0 2.2.0 3.2.0 4.2.0 P max kumuliert
1.4.0 2.4.0 3.4.0 4.4.0 tm abgel./P-laufend
1.6.0 2.6.0 3.6.0 4.6.0 P max
1.8.T 2.8.T 3.8.T 4.8.T Energie
1.8.0 2.8.0 3.8.0 4.8.0 Energie total
0 = tariflos,
T = Tarif
P.01 = 15min-Lastprofil (+A, -A[kWh]; +R, -R[kvarh])
P.02 = 24h-Lastprofil (+A, -A[kWh]; +R, -R[kvarh])
Impulsausgänge ungeeicht
+A -A +R -R COM M1 M2 X1 X2

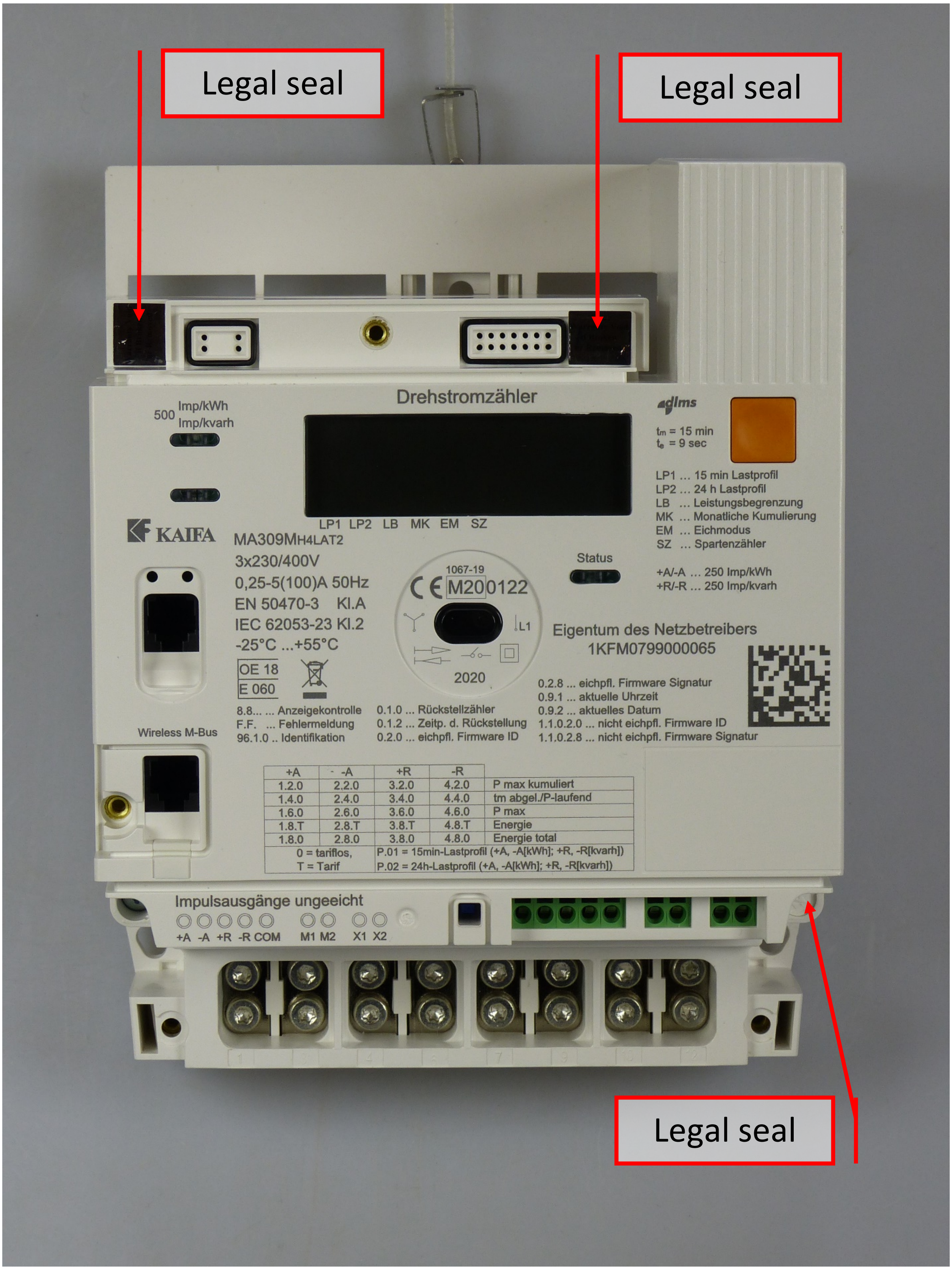


MA309MH4LAT2 upper PCB option 1

MA309MH4LAT2 upper PCB option 2

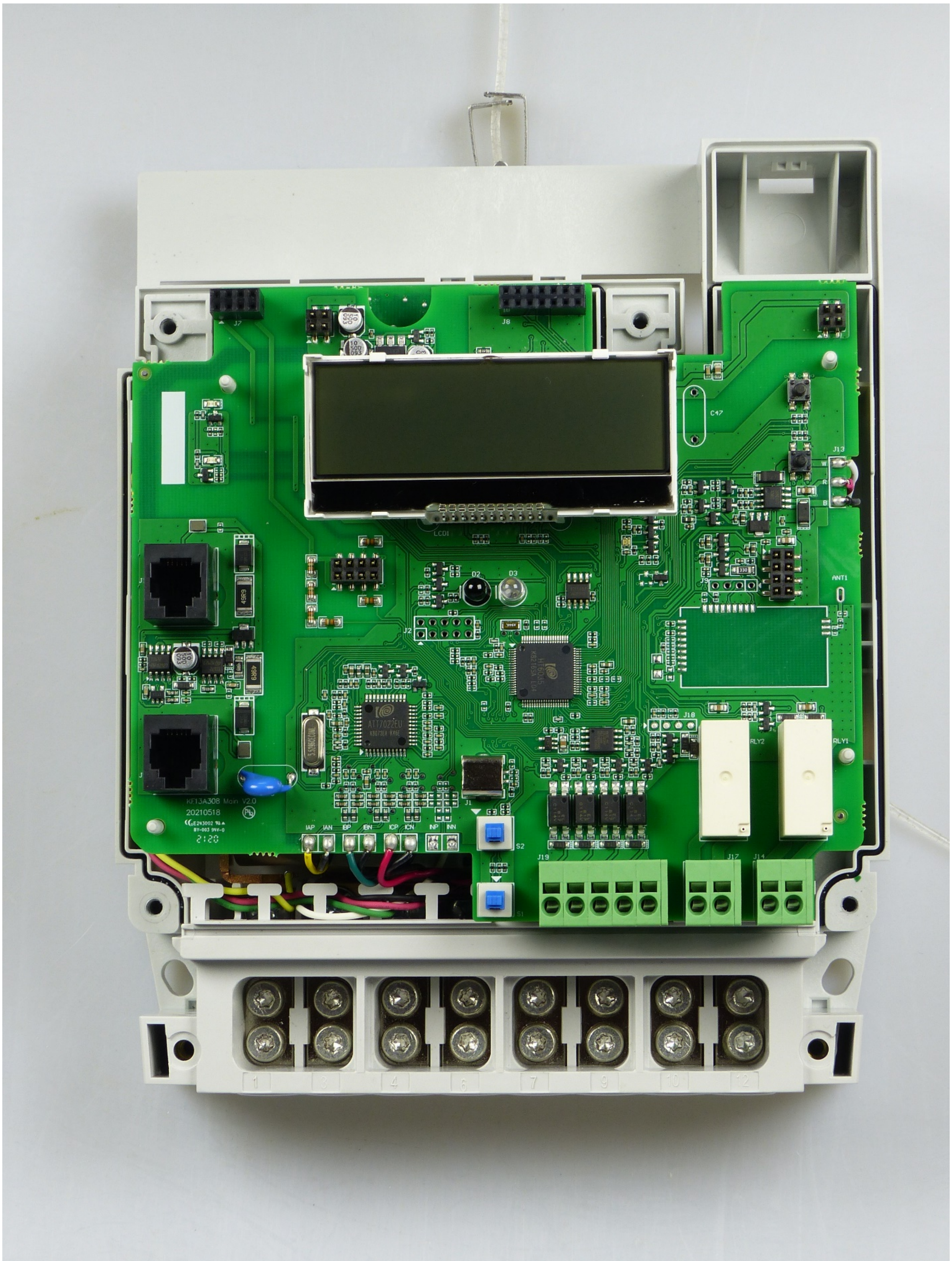


MA309MH4LAT2 upper PCB option 3

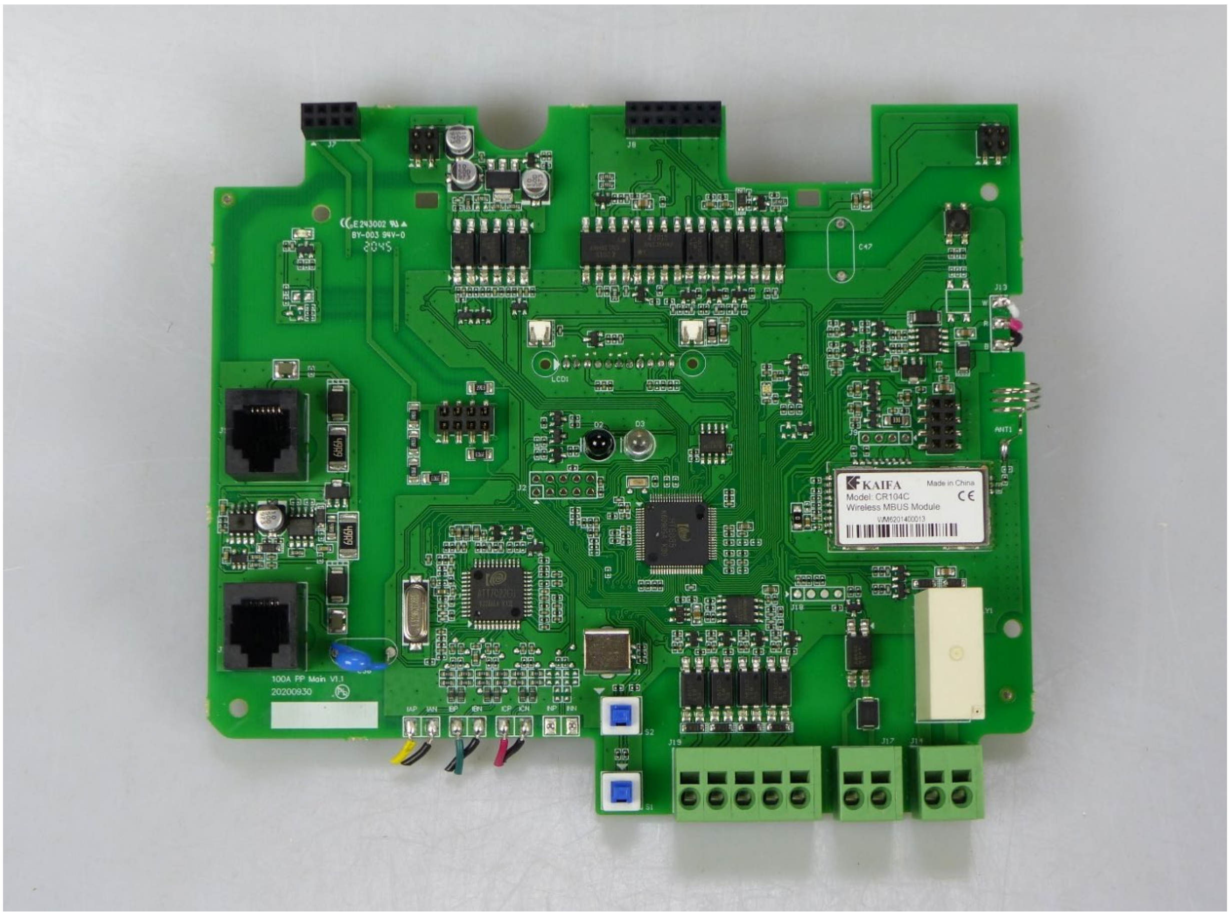

Legal seal
Legal seal
Legal seal
Drehstromzähler
500 Imp/kWh
Imp/kvarh
KAIFA
MA309MH4LAT2
3x230/400V
0,25-5(100)A 50Hz
EN 50470-3 Kl.A
IEC 62053-23 Kl.2
-25°C ...+55°C
OE 18
E 060
LP1 LP2 LB MK EM SZ
1067-19
CE M200122
2020
Status
tm = 15 min
te = 9 sec
LP1 ... 15 min Lastprofil
LP2 ... 24 h Lastprofil
LB ... Leistungsbegrenzung
MK ... Monatliche Kumulierung
EM ... Eichmodus
SZ ... Spartenzähler
+A/-A ... 250 Imp/kWh
+R/-R ... 250 Imp/kvarh
Eigentum des Netzbetreibers
1KFM0799000065
8.8... ... Anzeigekontrolle
F.F. ... Fehlermeldung
96.1.0 .. Identifikation
0.1.0 ... Rückstellzähler
0.1.2 ... Zeitp. d. Rückstellung
0.2.0 ... eichpfl. Firmware ID
0.2.8 ... eichpfl. Firmware Signatur
0.9.1 ... aktuelle Uhrzeit
0.9.2 ... aktuelles Datum
1.1.0.2.0 ... nicht eichpfl. Firmware ID
1.1.0.2.8 ... nicht eichpfl. Firmware Signatur
Wireless M-Bus
Impulsausgänge ungeeicht
+A -A +R -R COM M1 M2 X1 X2

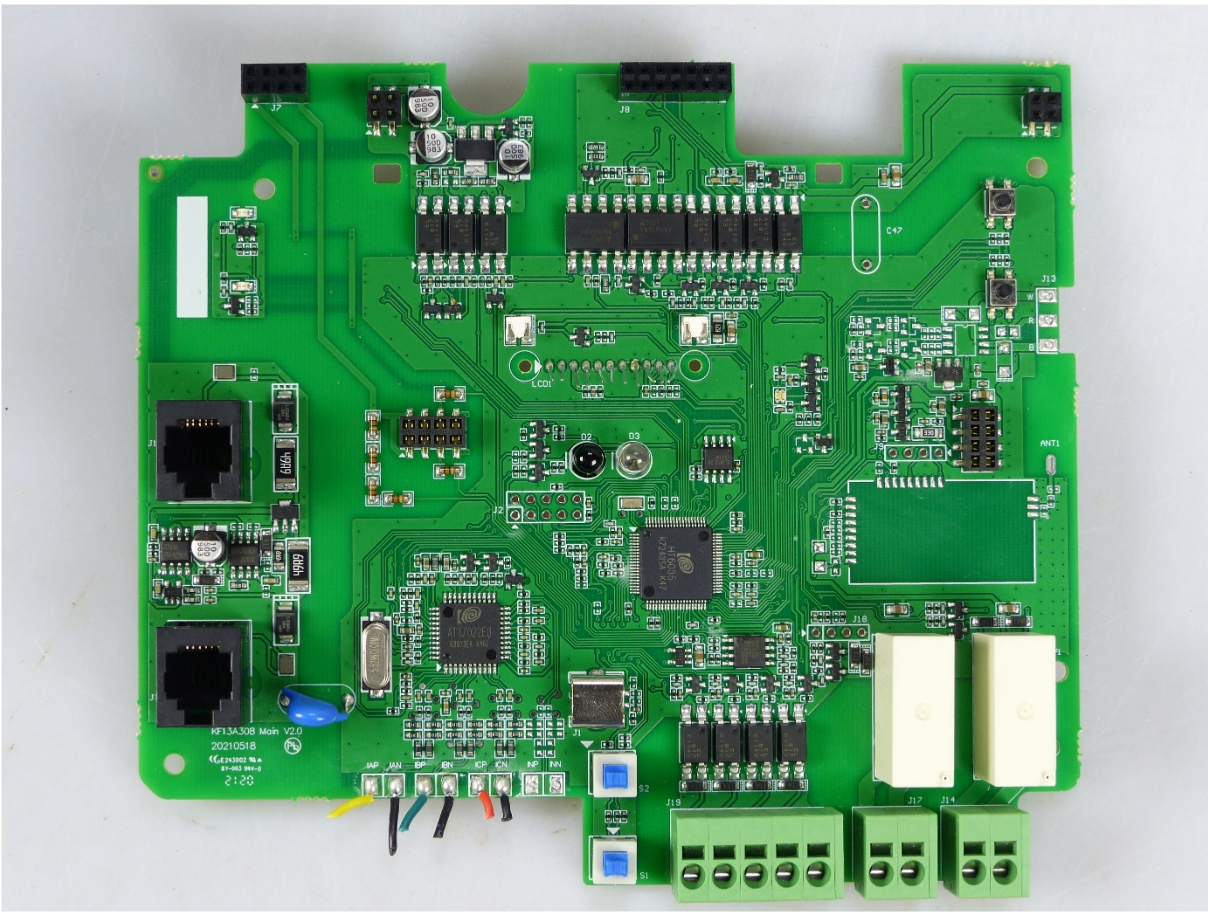
MA309MH4LAT2 upper PCB option 4

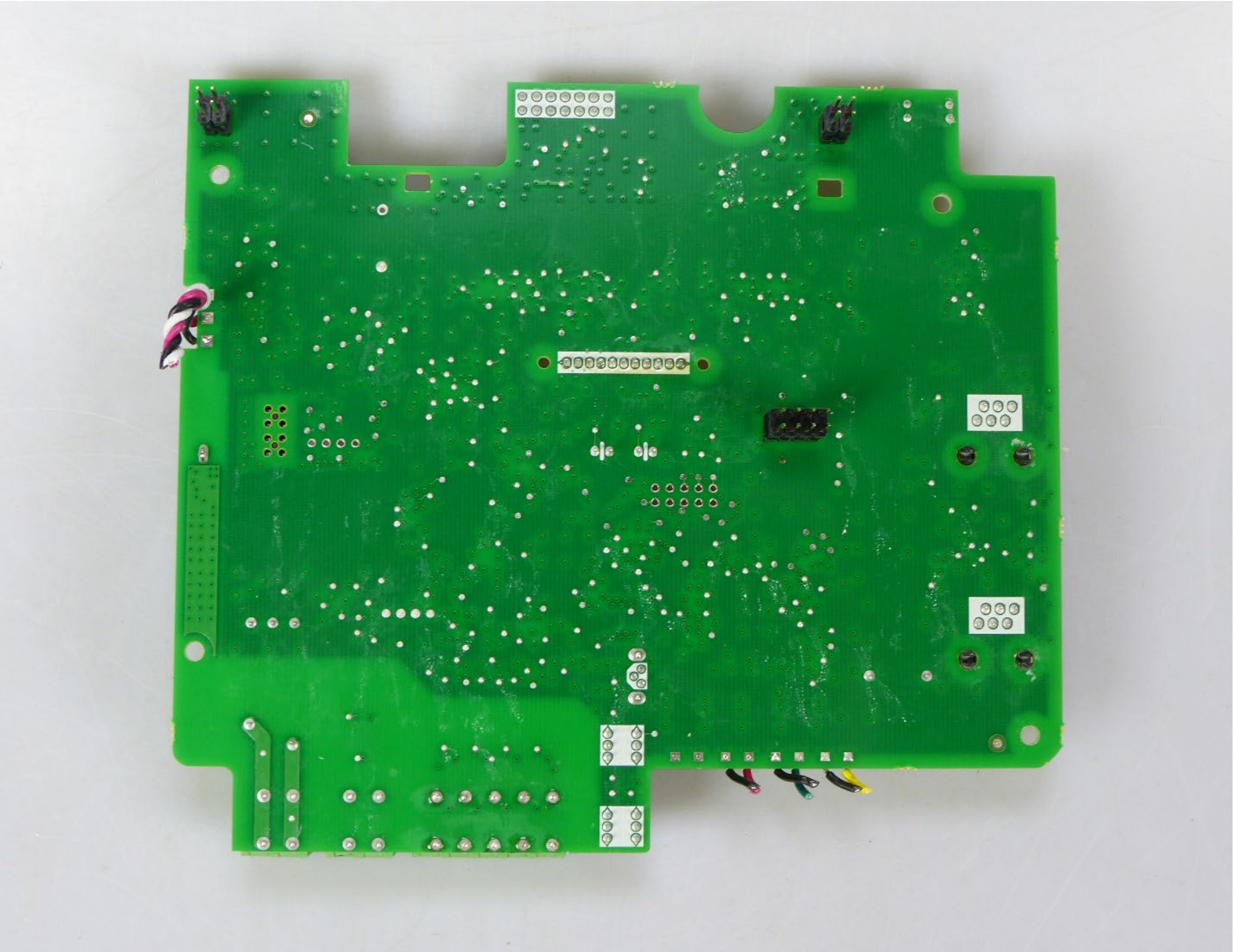
MA309MH4LAT2 upper PCB option 5

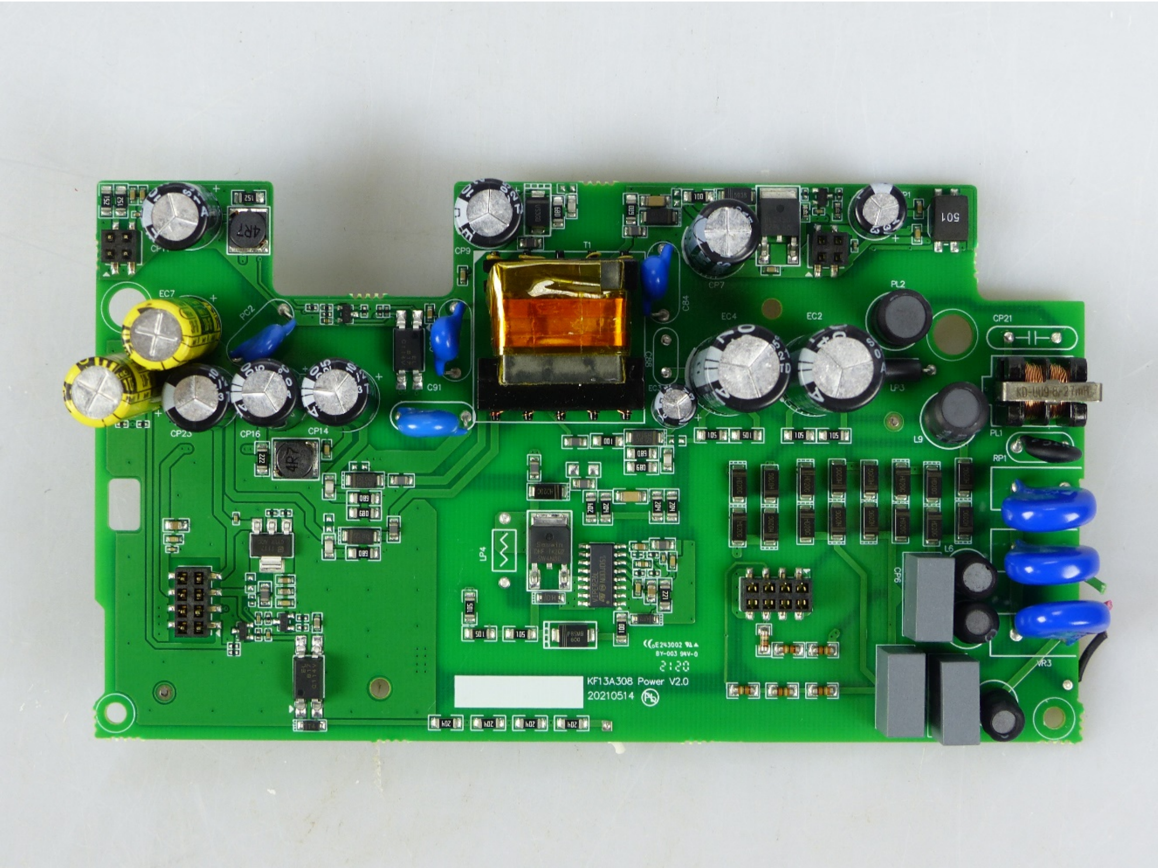


MA309MH4LAT2 upper PCB option 6

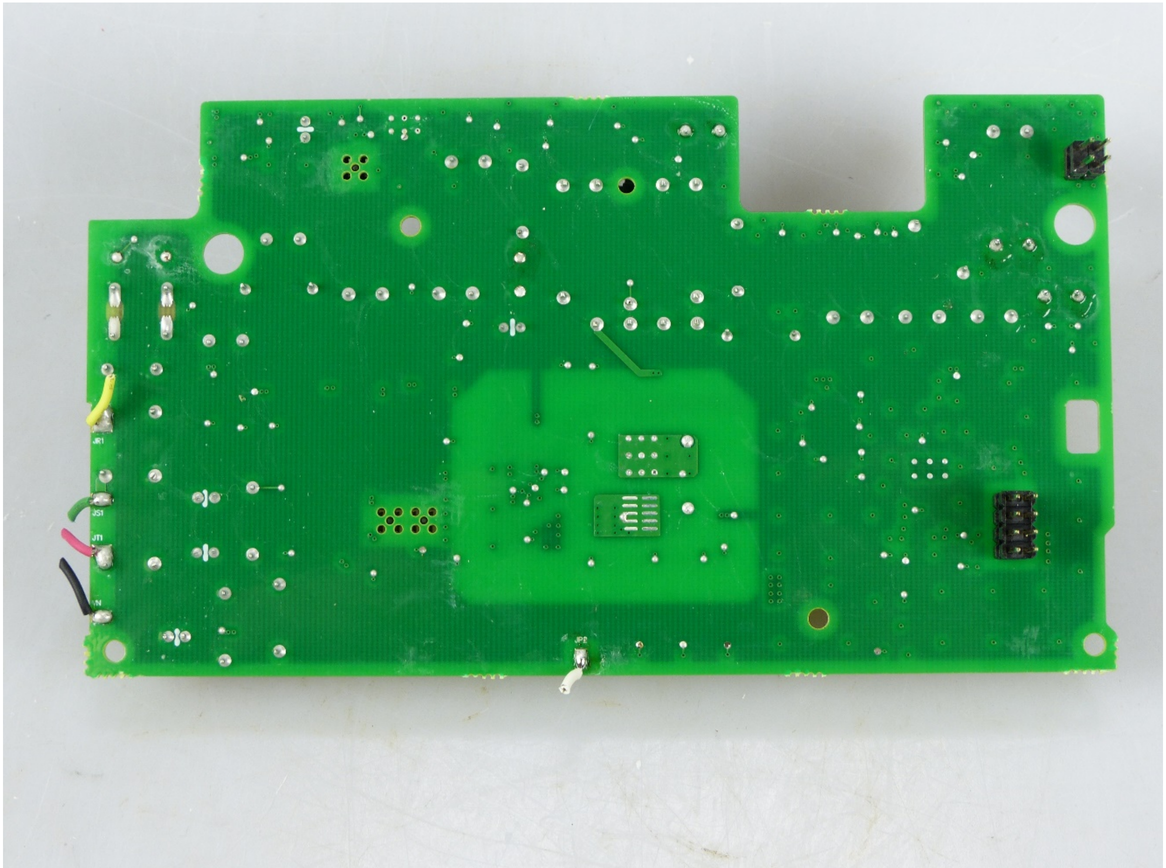

KAIFA
Made in China
Model: CR104C
Wireless MBUS Module
100A PP Main V1.1
20200930


KF13A308 Main V2.0
20210518

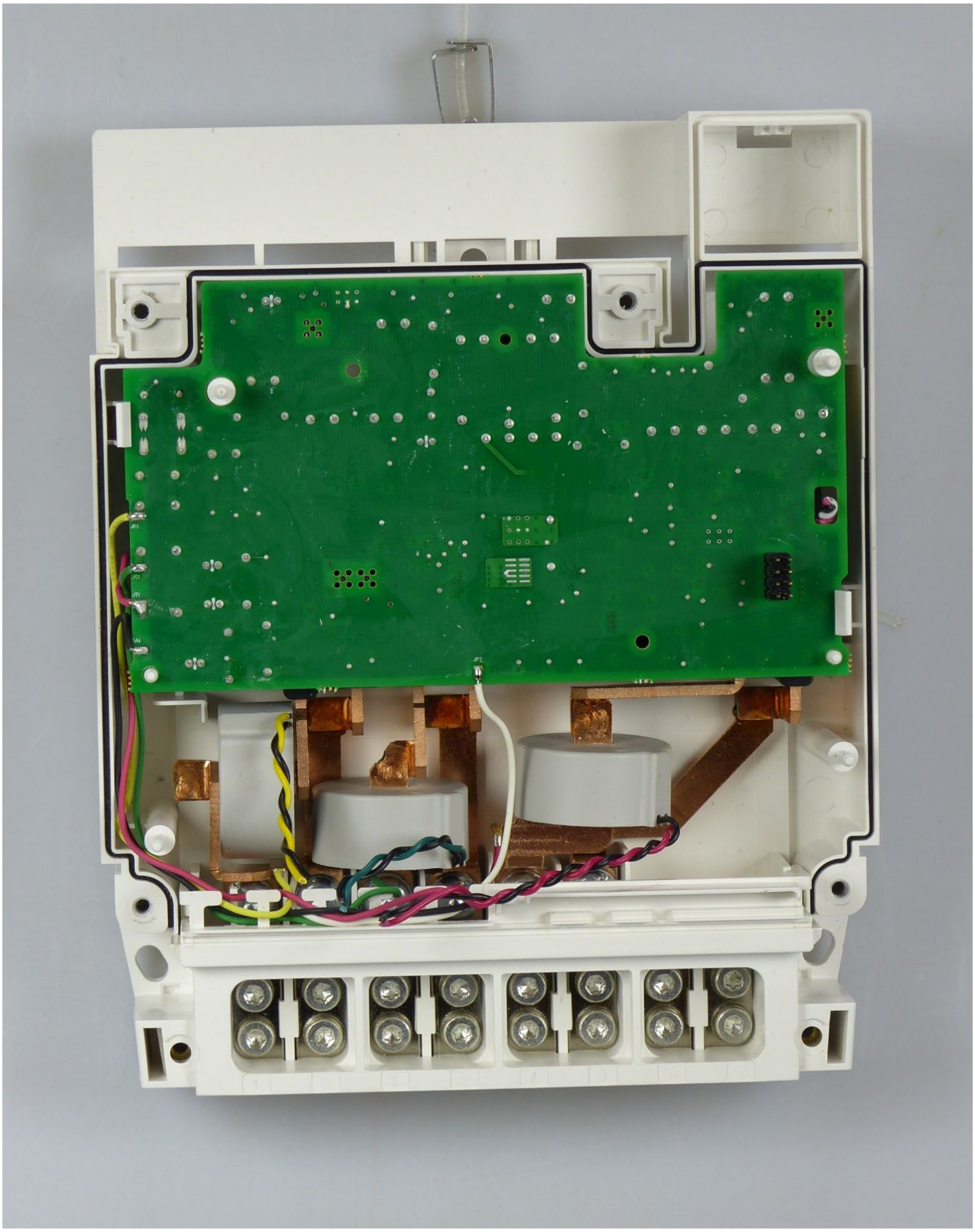




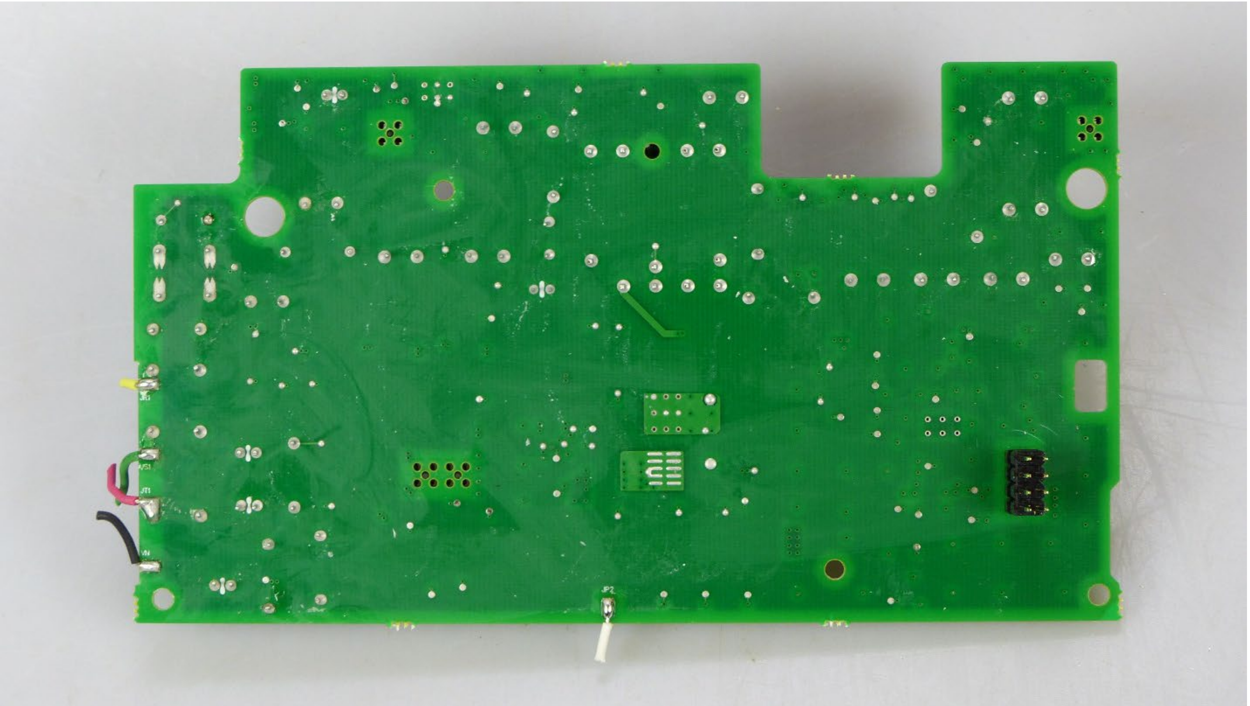
with breaker, without RS485 with LTE-M/NB-IoT (CL102) module: Power board



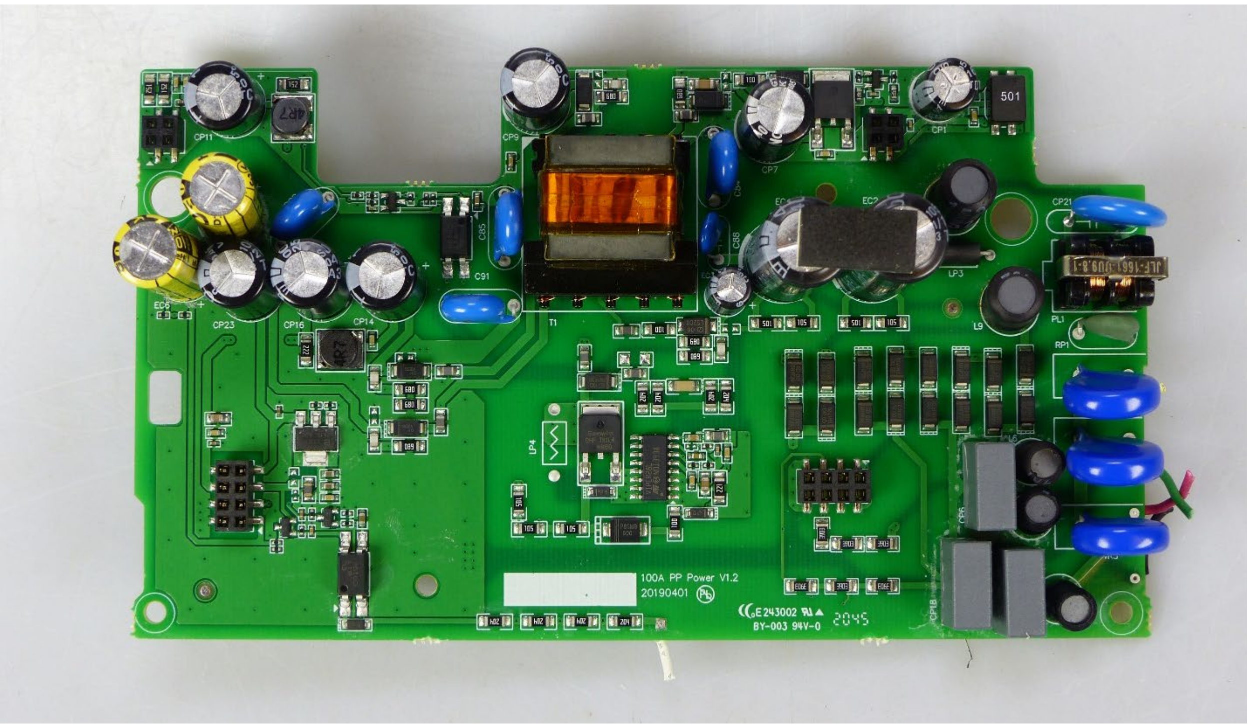
with breaker, without RS485 with LTE-M/NB-IoT (CL102) module: Power board



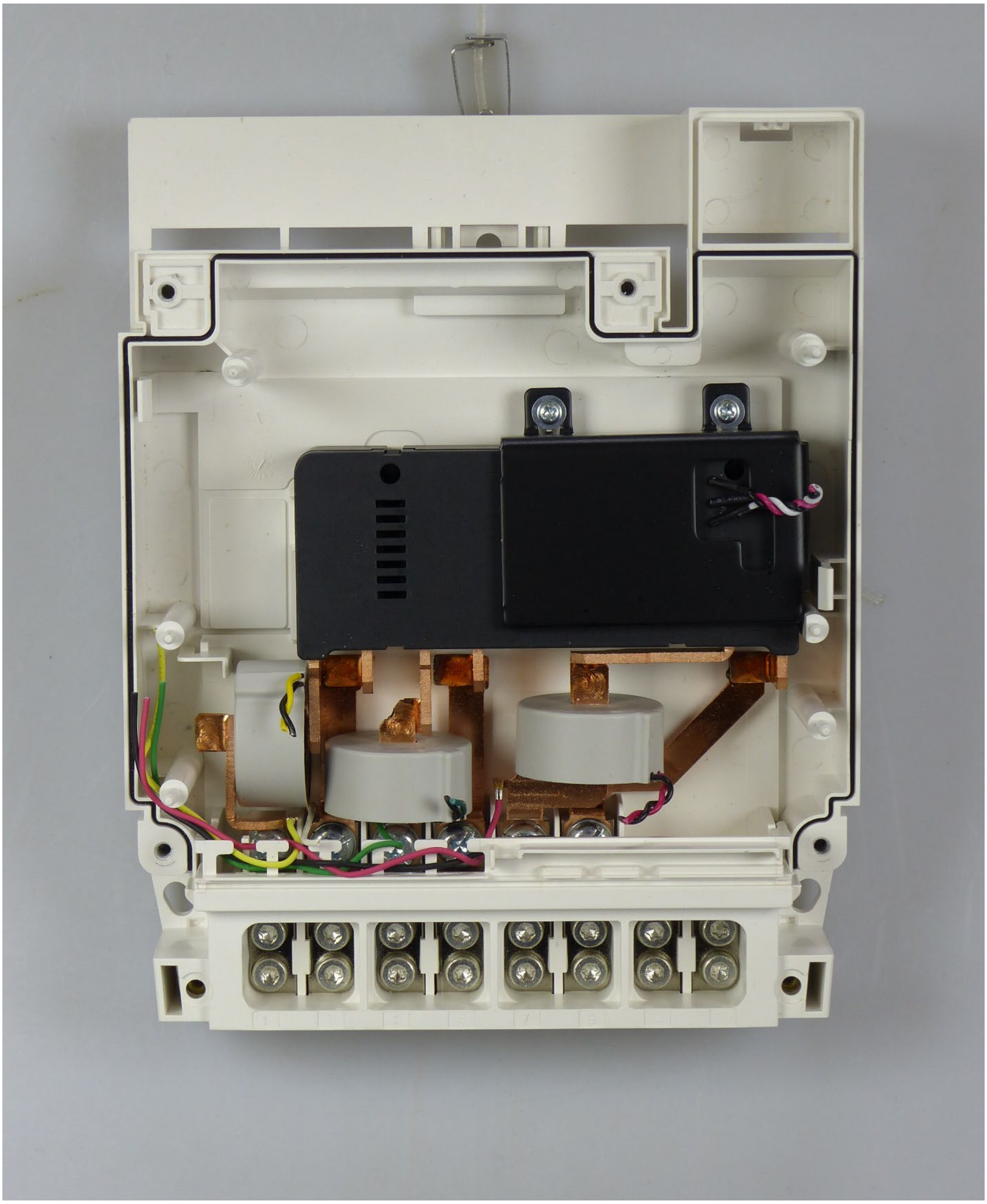
MA309MH4LAT2 with switch



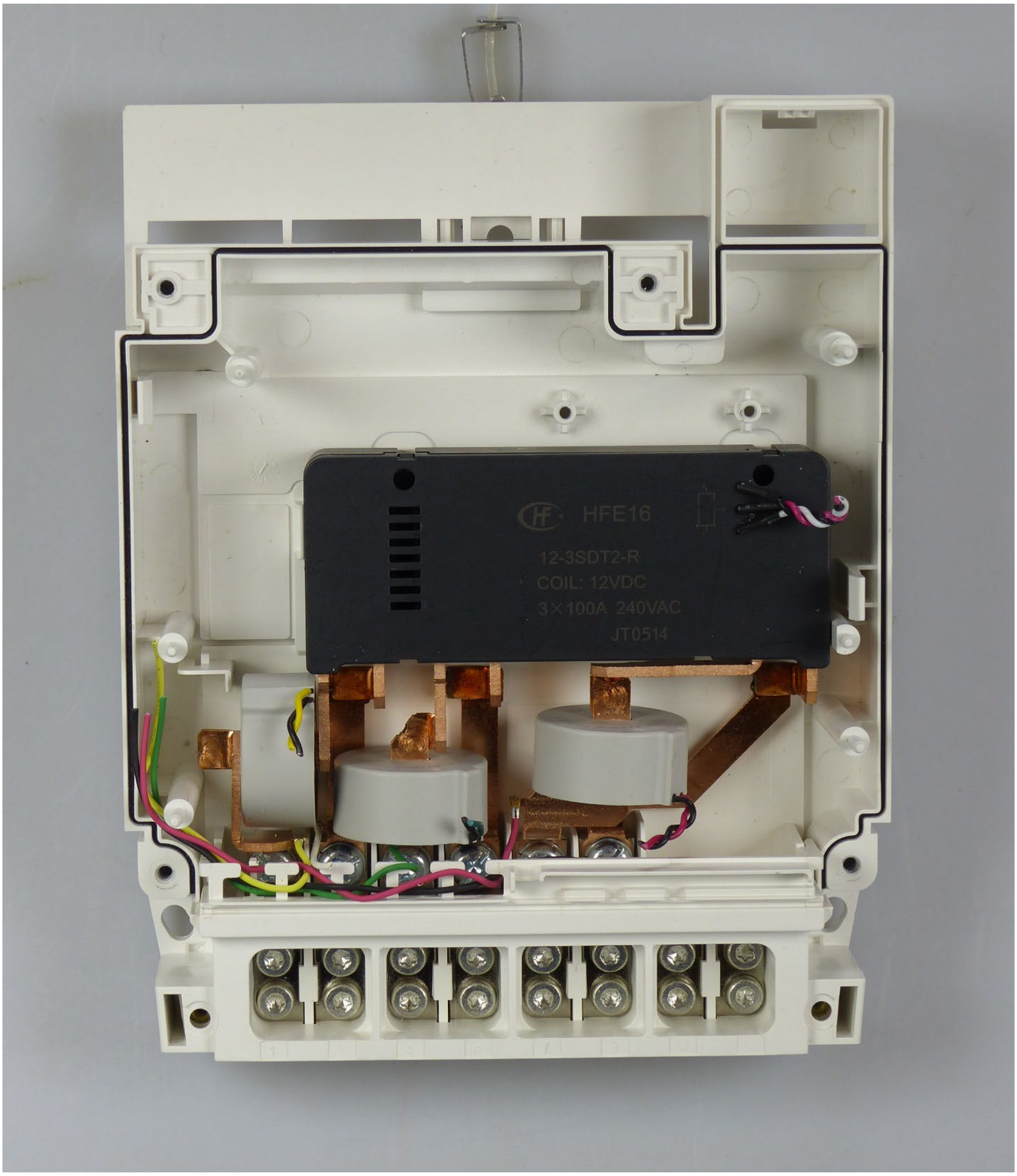
MA309MH4LAT2 with switch



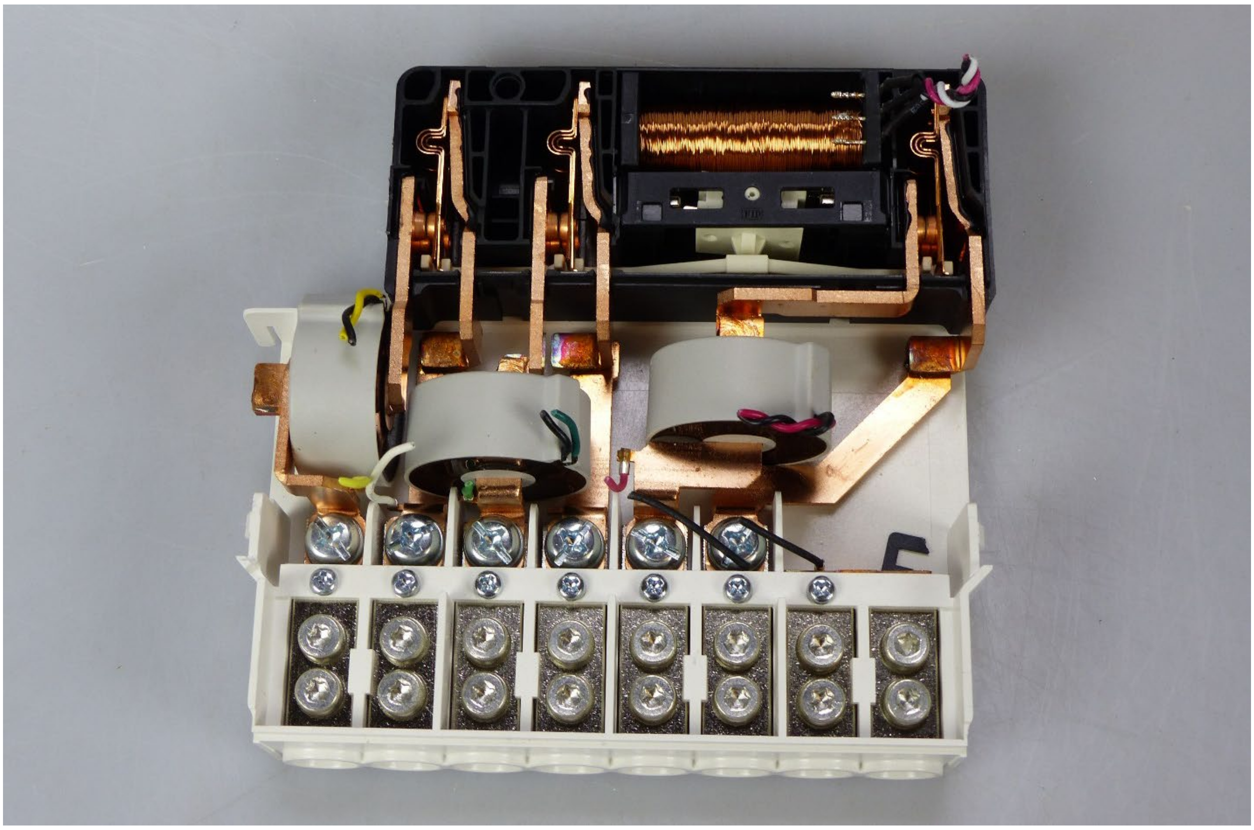
MA309MH4LAT2 with switch

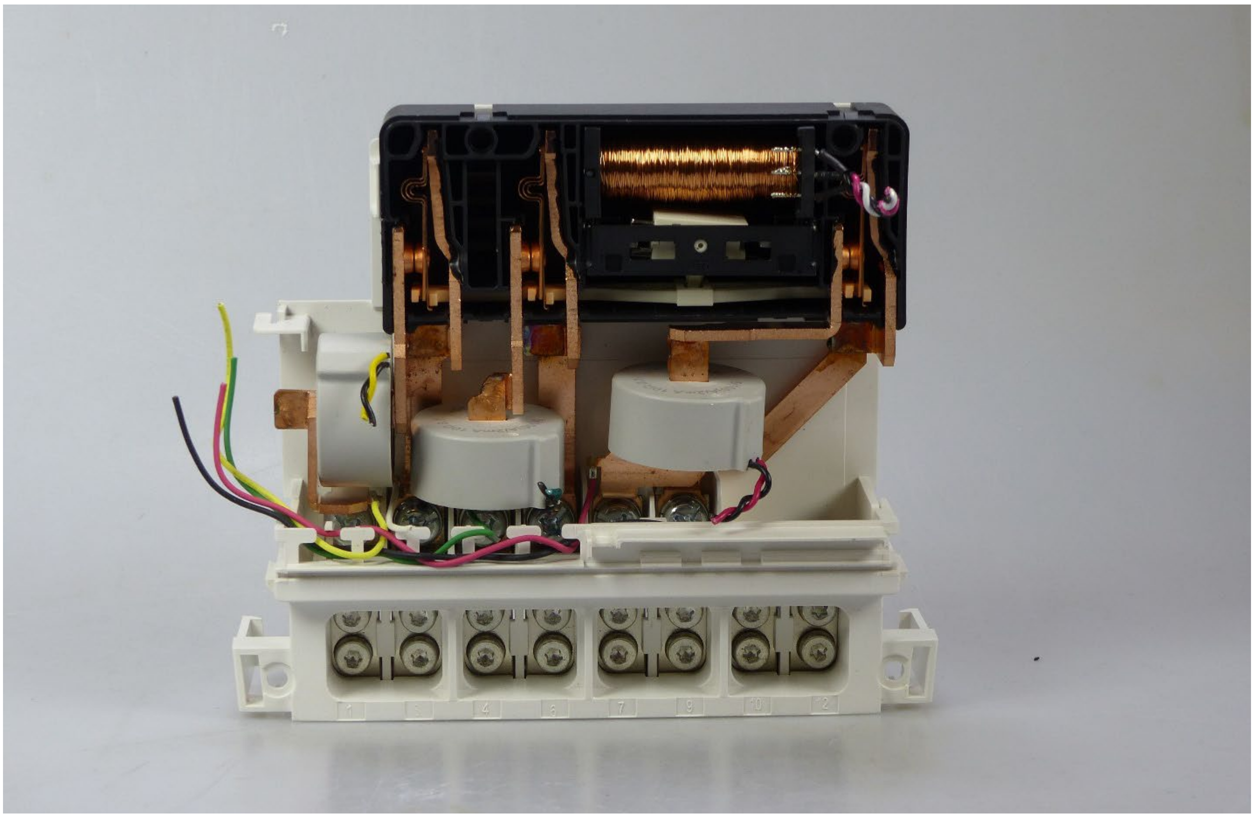


MA309MH4LAT2 with switch



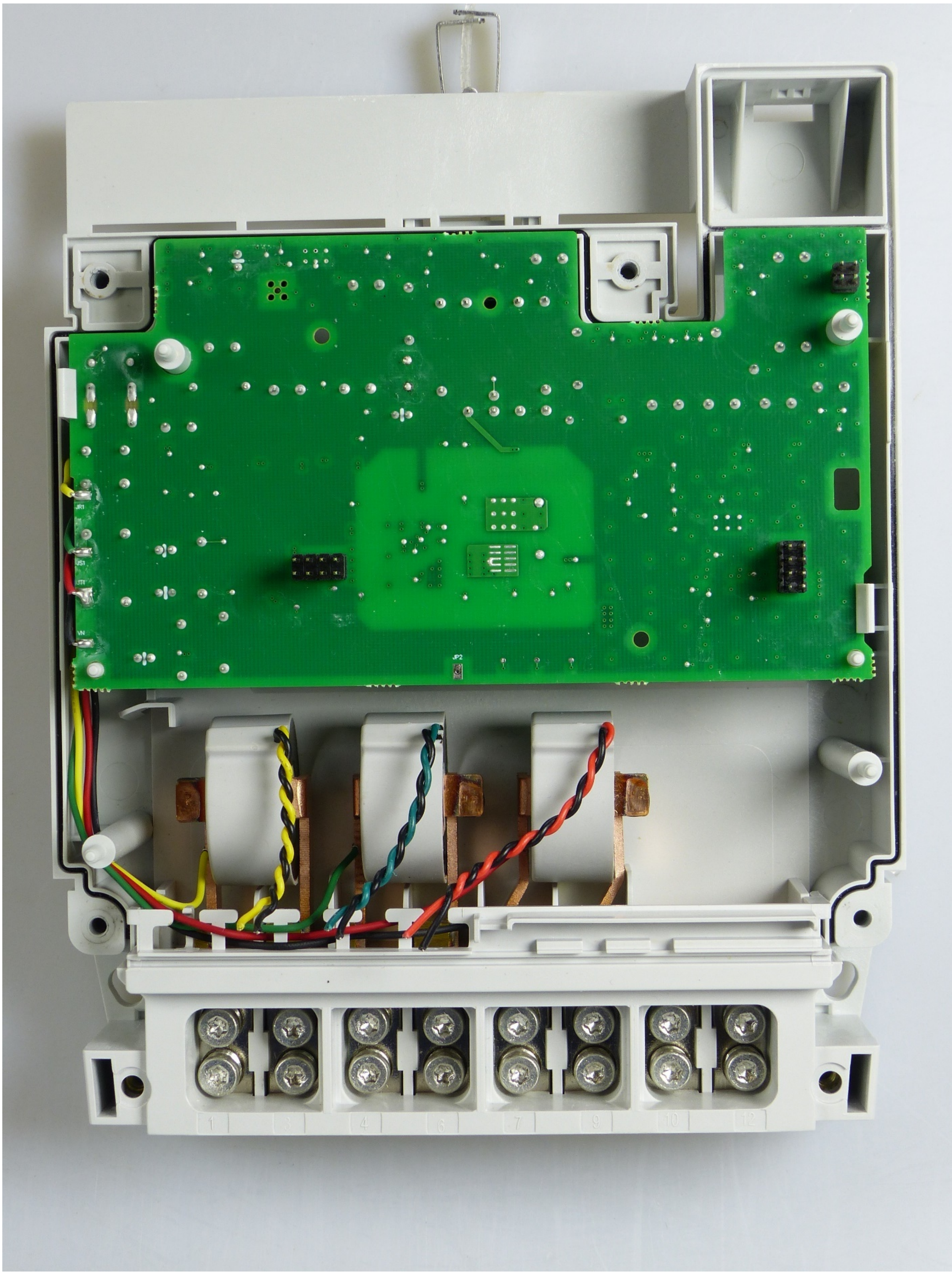
MA309MH4LAT2 with switch



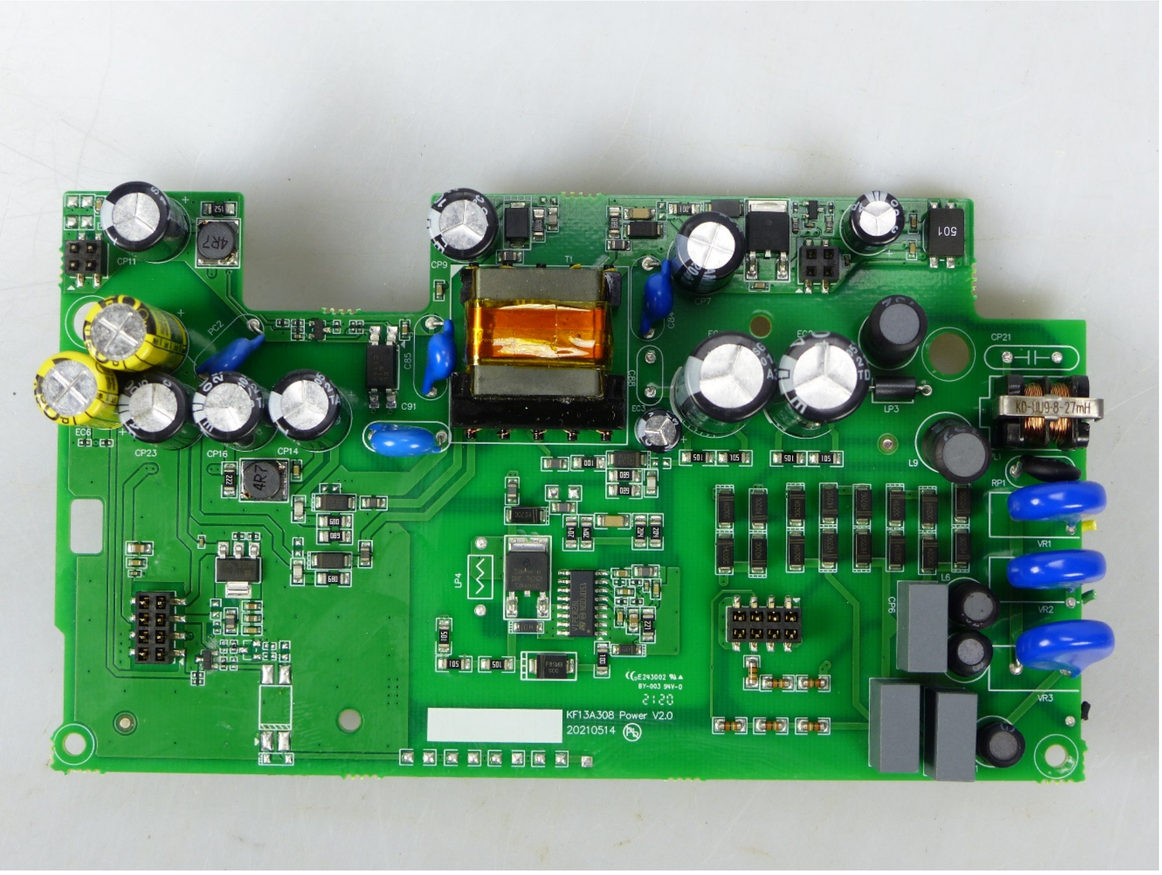



KAIFA
G3-PLC
CP115
1KFM5190000006
Drehstromzähler
2000 Imp/kWh
2000 Imp/kvarh
MA309MH4LAT2
3x230/400V
0,25-5(100)A 50Hz
EN 50470-3 Kl.B
IEC 62053-23 Kl.2
-40°C ...+70°C
Sunrise upc
kapsch
M210122
2021
Status
CH M21 CH01
CH-CH003-20032
1KFM5290000014
HAN
Wired M-Bus
M-Bus
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No. 99 Tianquan Rd., Hi-Tech Development Zone, Chengdu, P.R.C.
Importer:
Kapsch BusinessCom AG
Fürstenlandstrasse 41
9000 St. Gallen
Schweiz

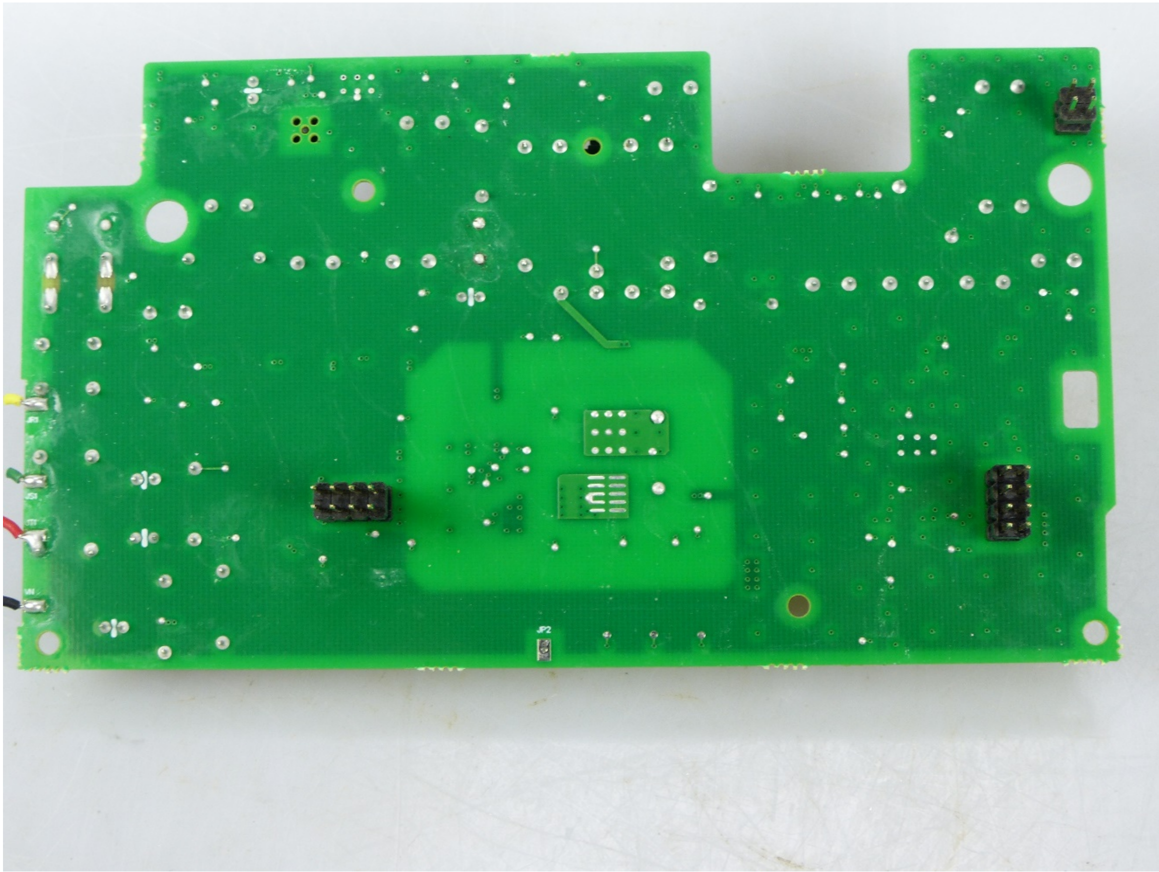
without breaker, with LTE-M/NB-IoT (CL102) module



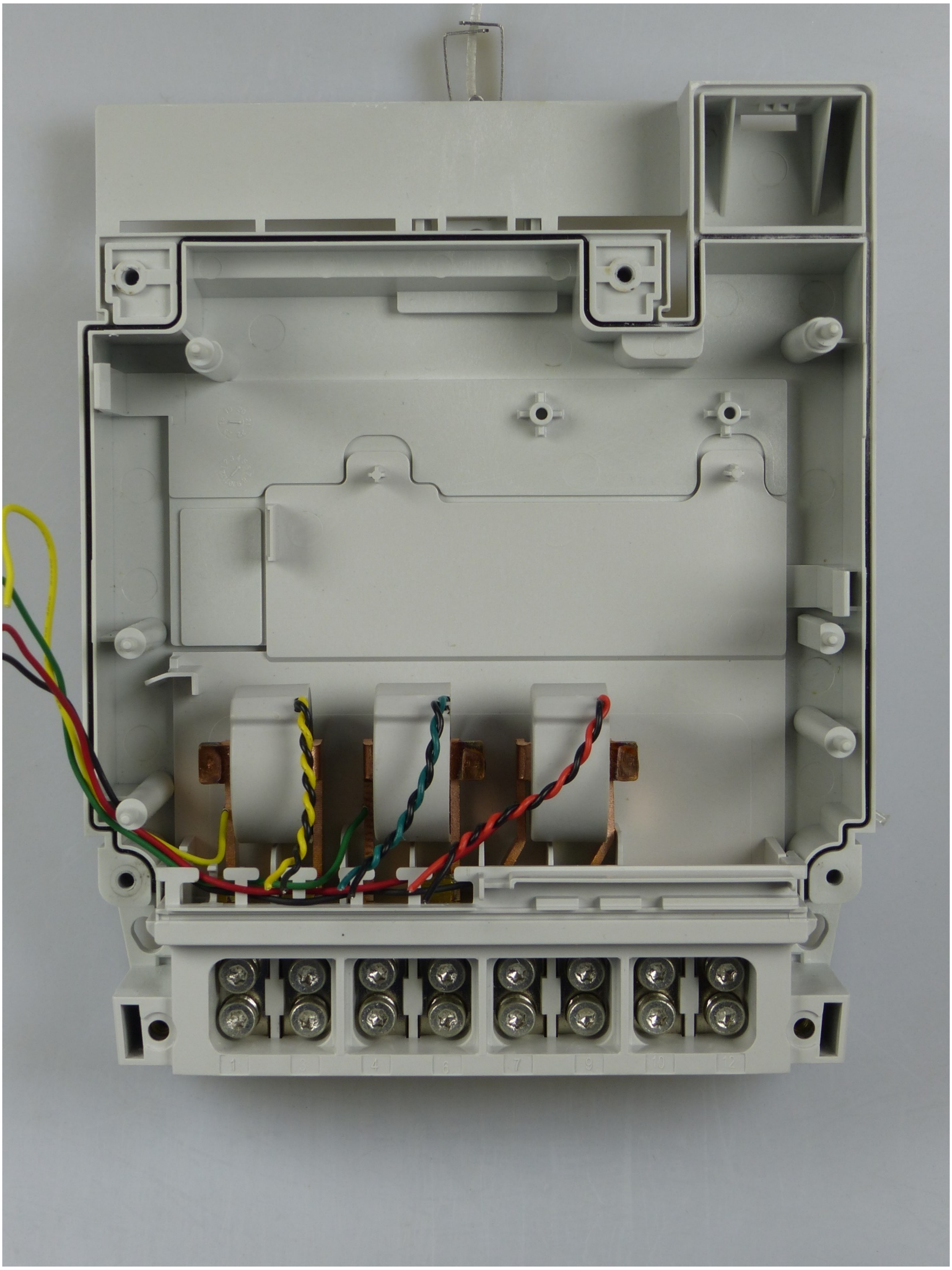
MA309MH4LAT2 without breaker



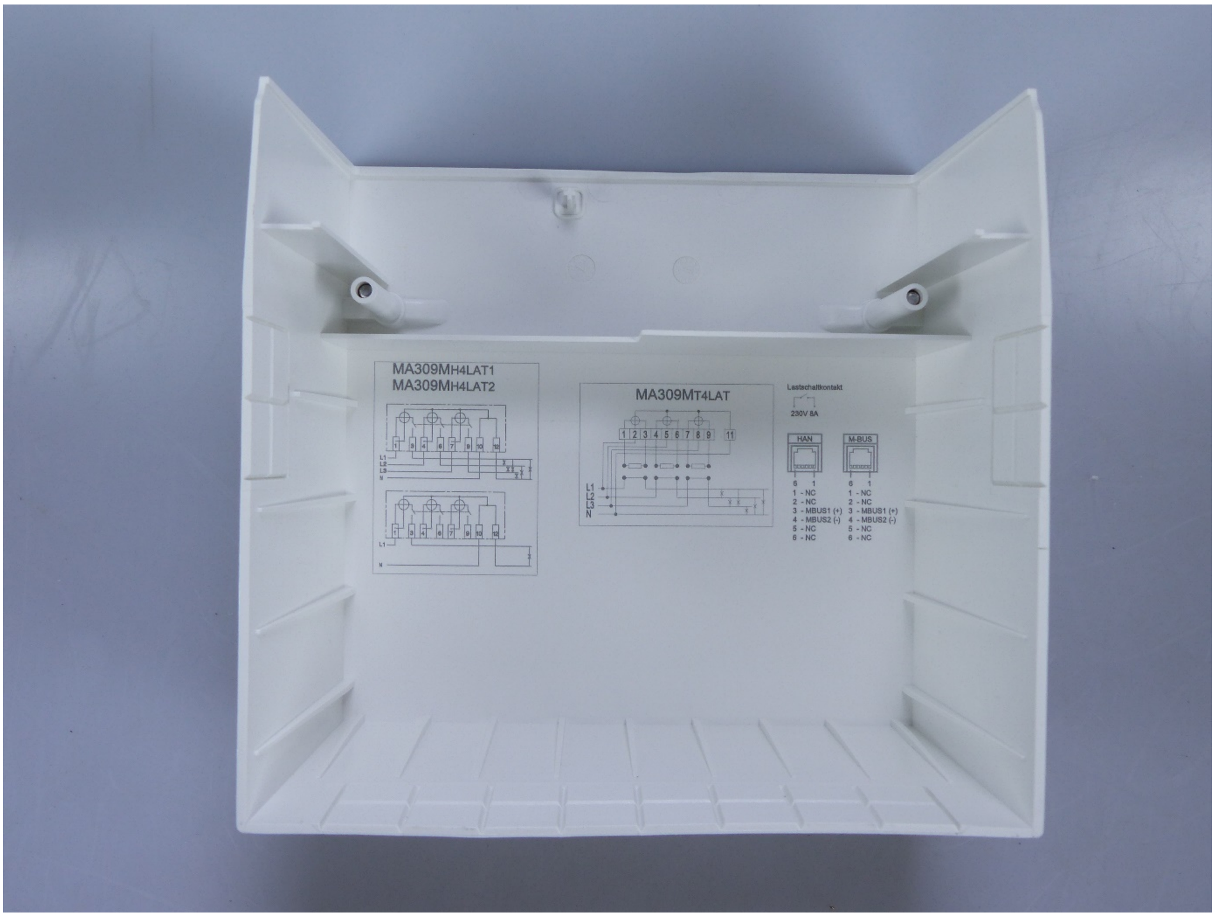
MA309MH4LAT2 without breaker

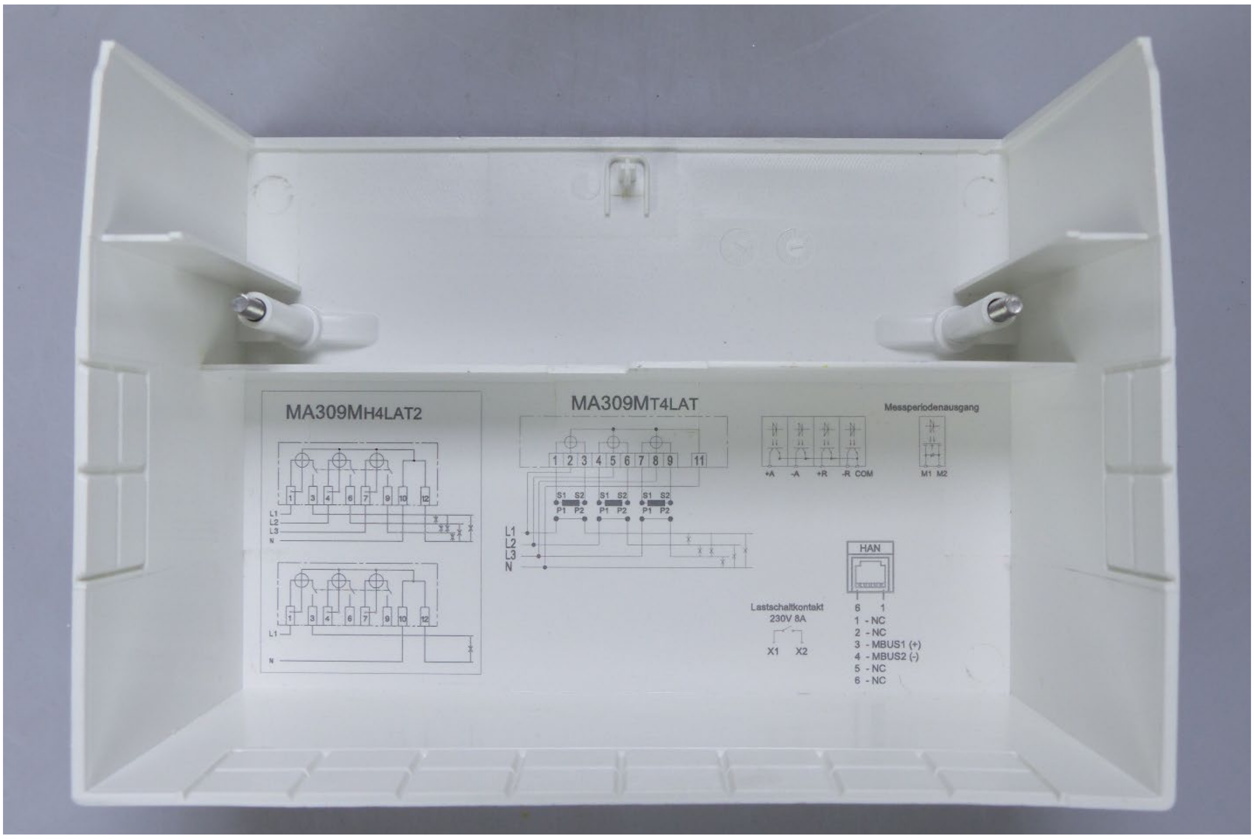


MA309MH4LAT2 without breaker

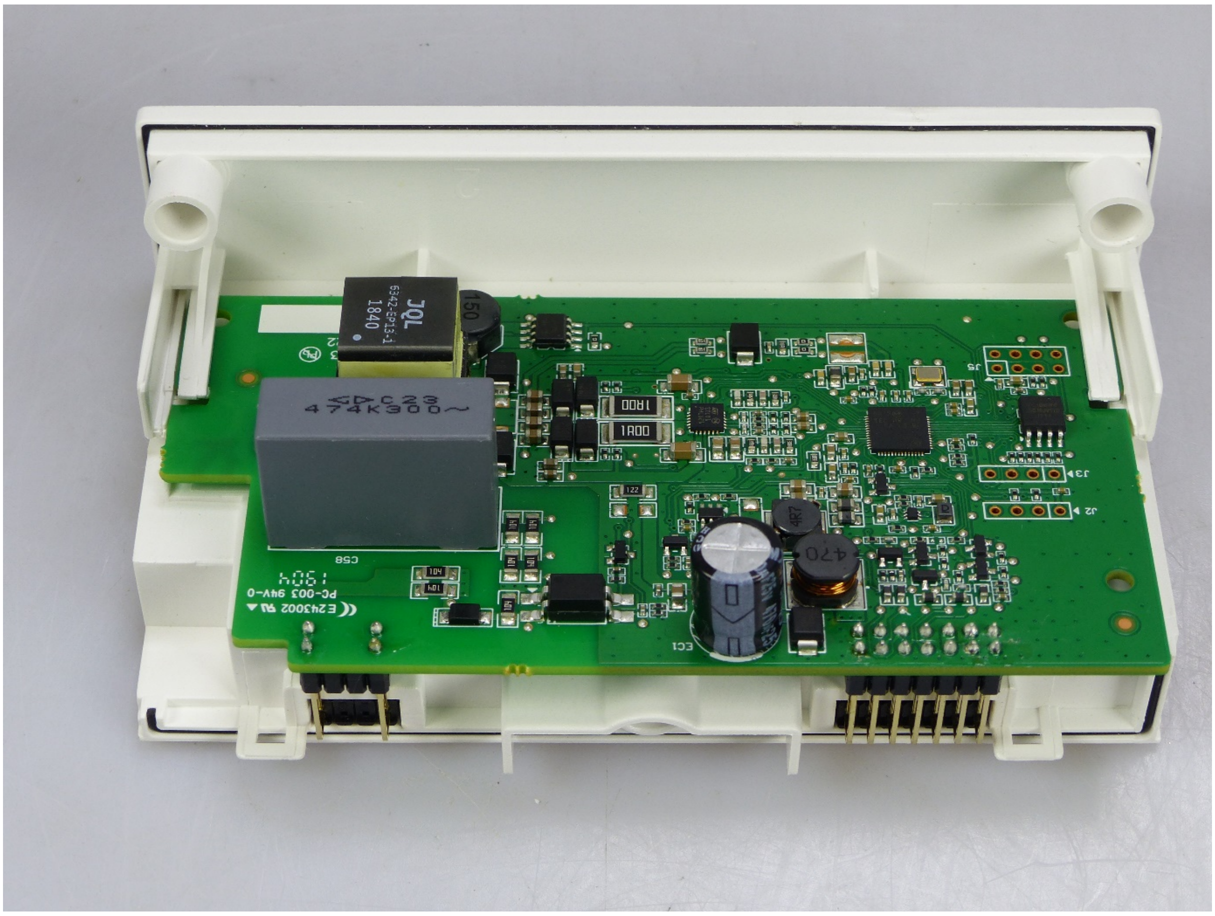


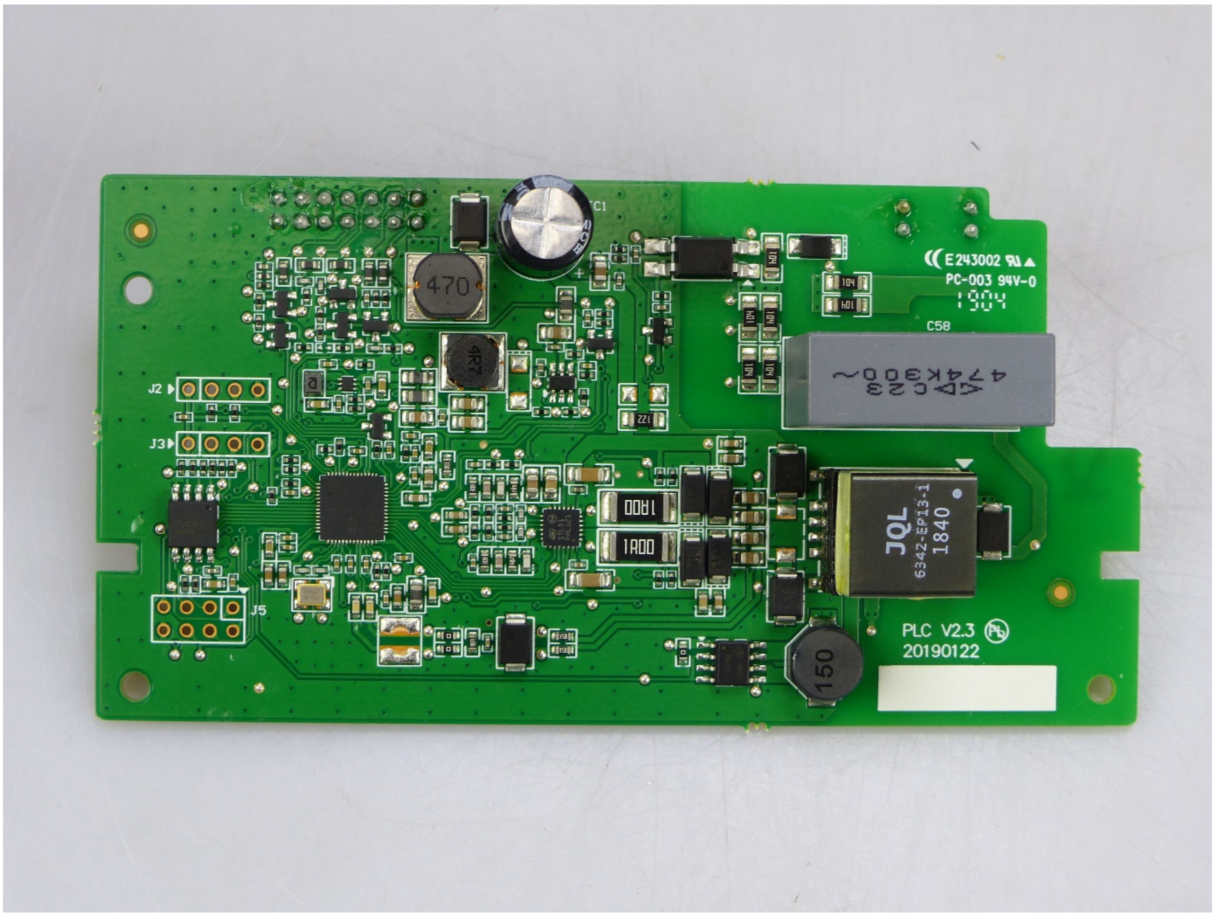
MA309MH4LAT2 without breaker

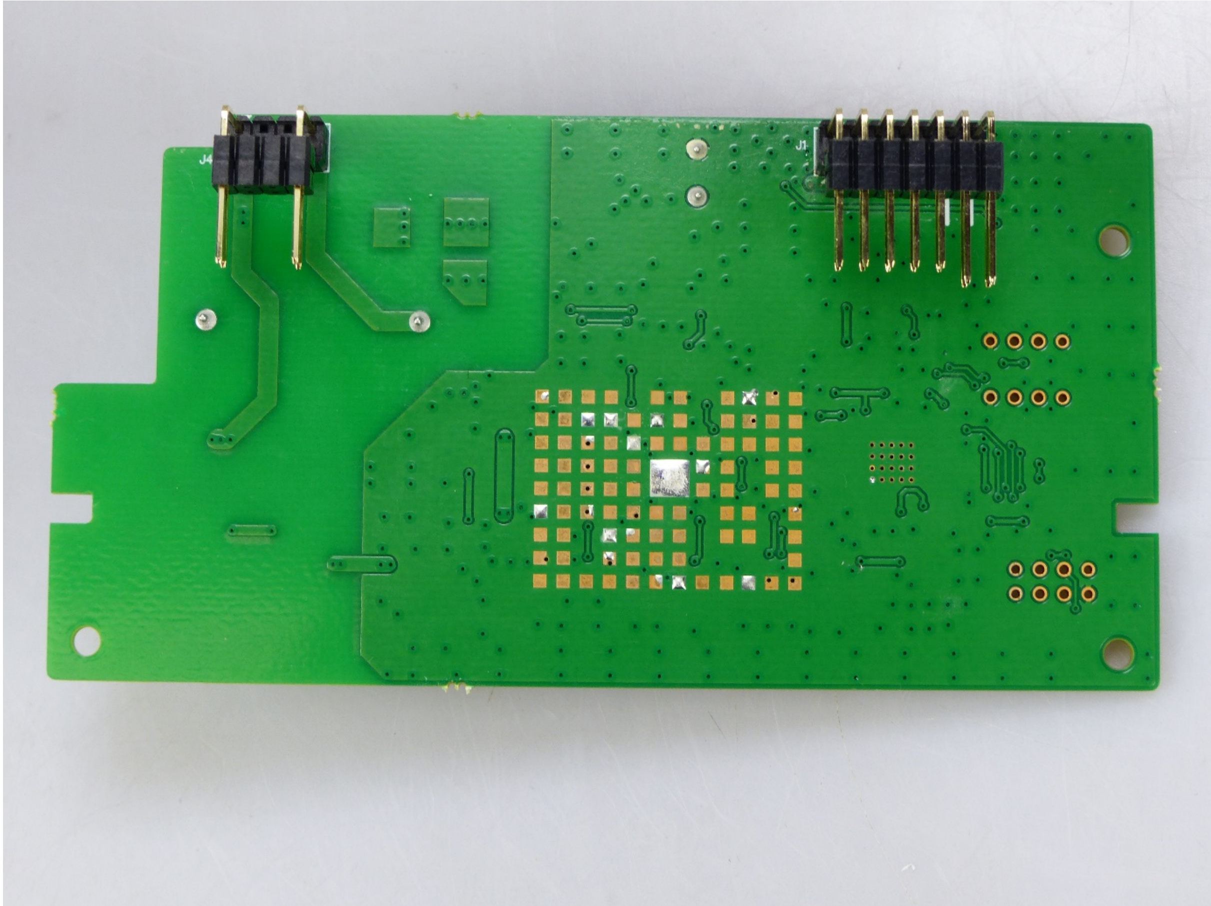

MA309MH4LAT1
MA309MH4LAT2
MA309MT4LAT
Lastschaltkontakt
230V 8A
HAN
M-BUS
L1
L2
L3
N
1 - NC
2 - NC
3 - MBUS1 (+)
4 - MBUS2 (-)
5 - NC
6 - NC


MA309MH4LAT2
MA309MT4LAT
Messperiodenausgang
HAN
Lastschaltkontakt
230V 8A
X1 X2
1 - NC
2 - NC
3 - MBUS1 (+)
4 - MBUS2 (-)
5 - NC
6 - NC

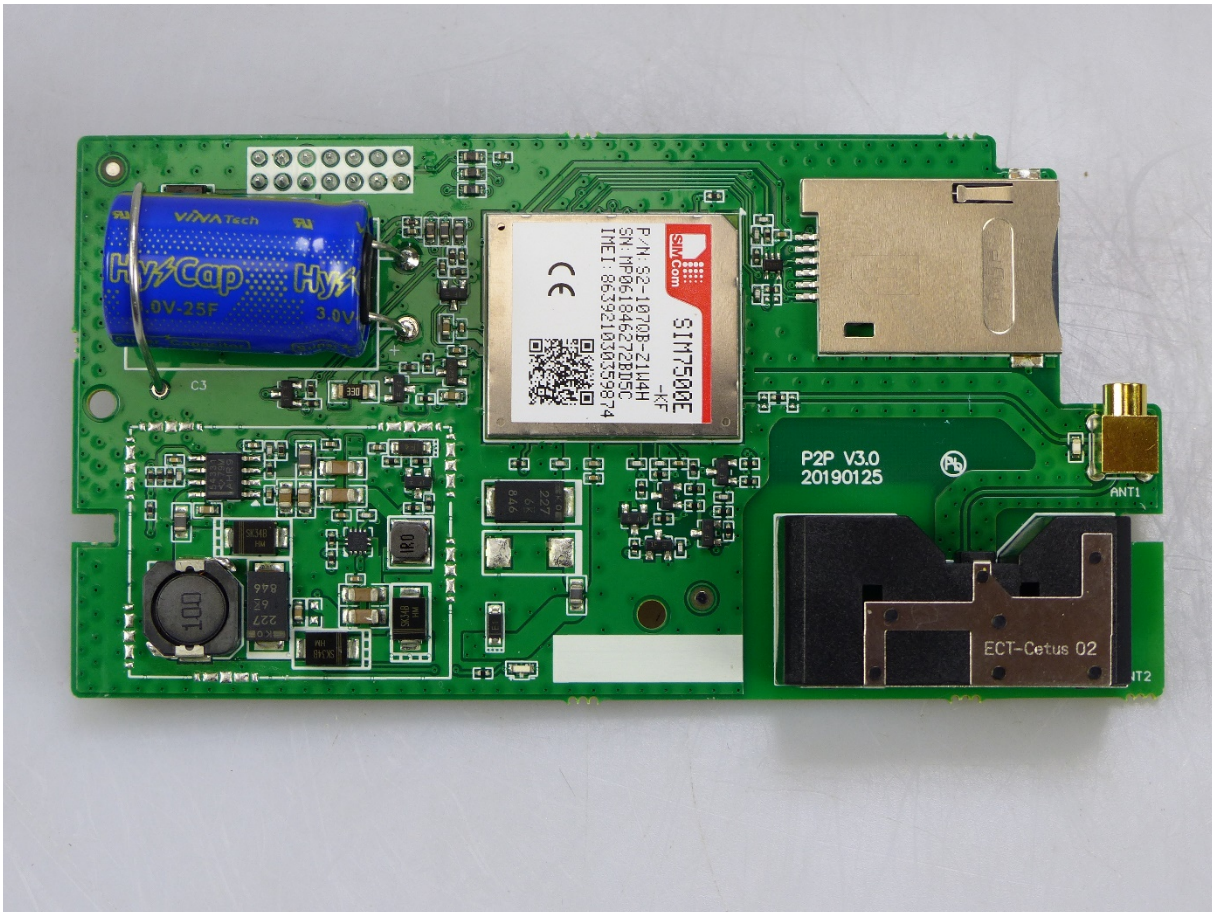

KAIFA
G3-PLC
G3-PLC
CP115
1KFM0900000017

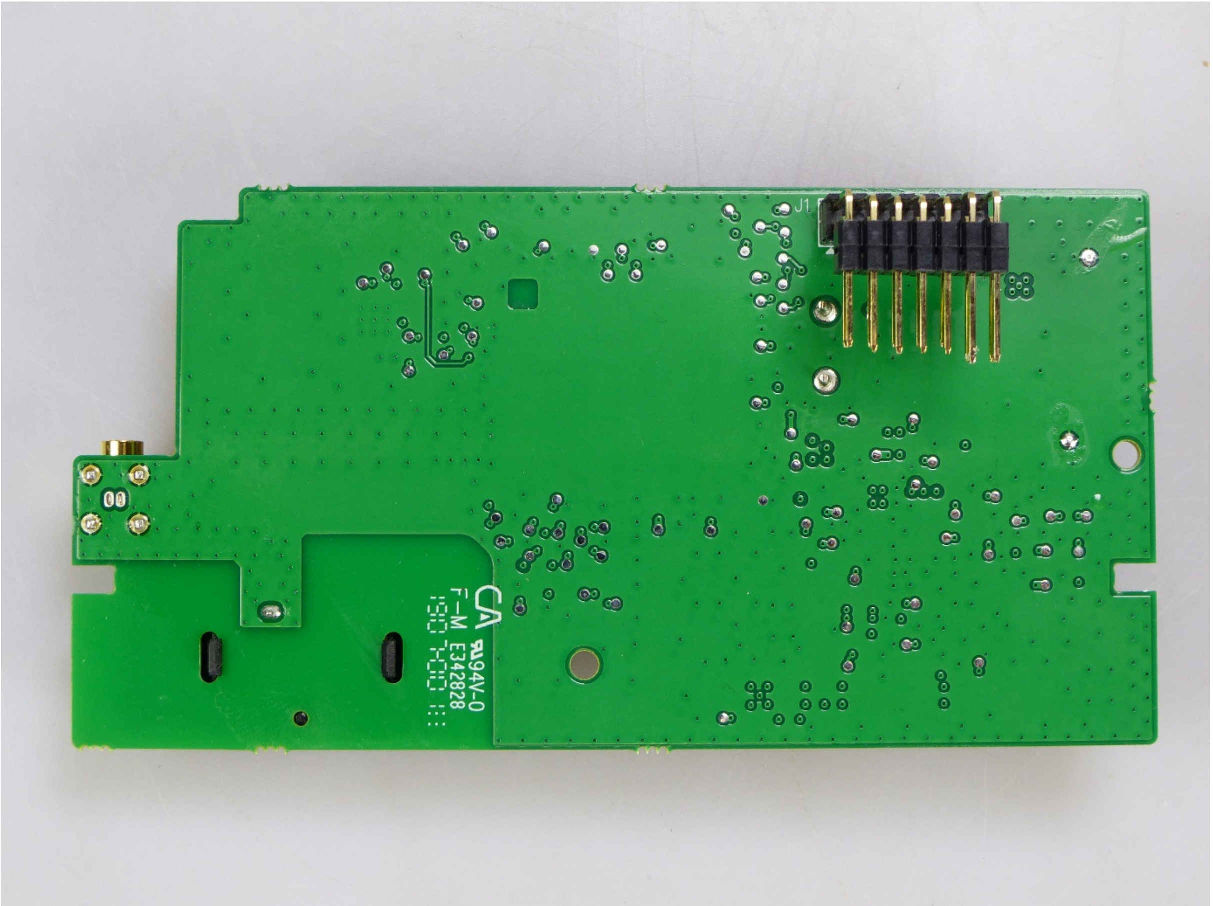

JQL
1840
C23
474K300~
1R00
4R7
470

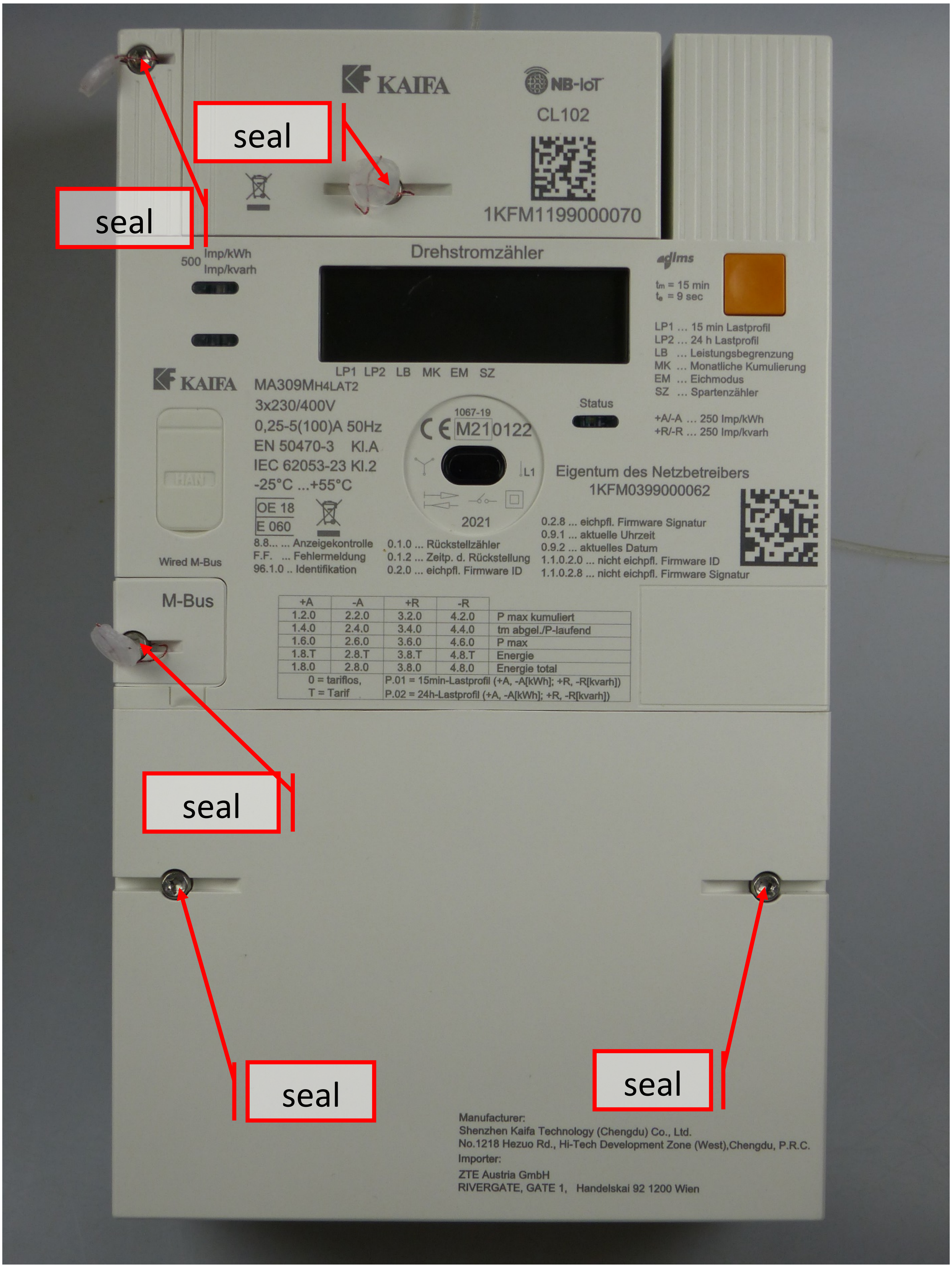

E243002
PC-003 94V-0
1904
C58
474K300~
C23
470
4R7
1R00
JQL
6342-EP13-1
1840
150
J2
J3
J5
PLC V2.3
20190122


J4
J1

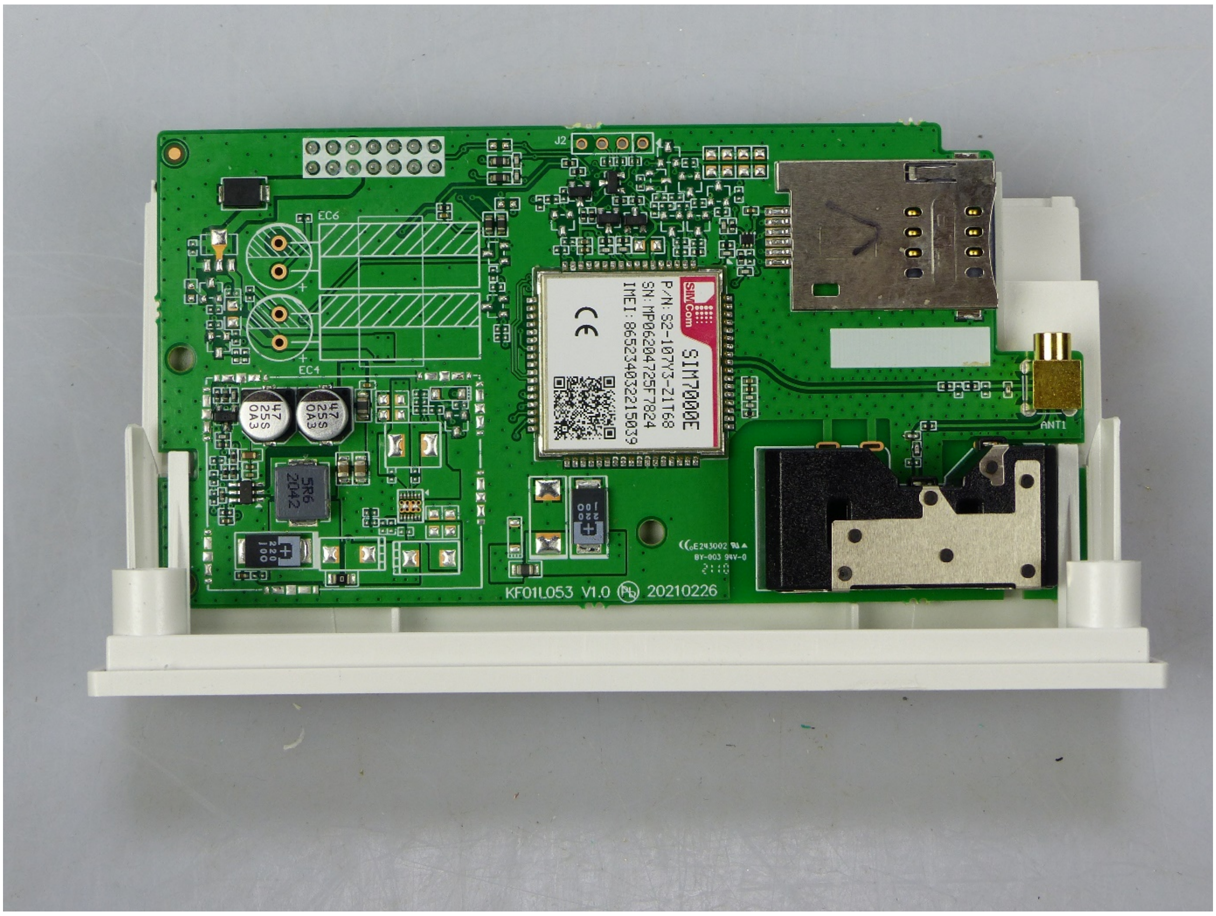

KAIFA
CL101
1KFM1000000019

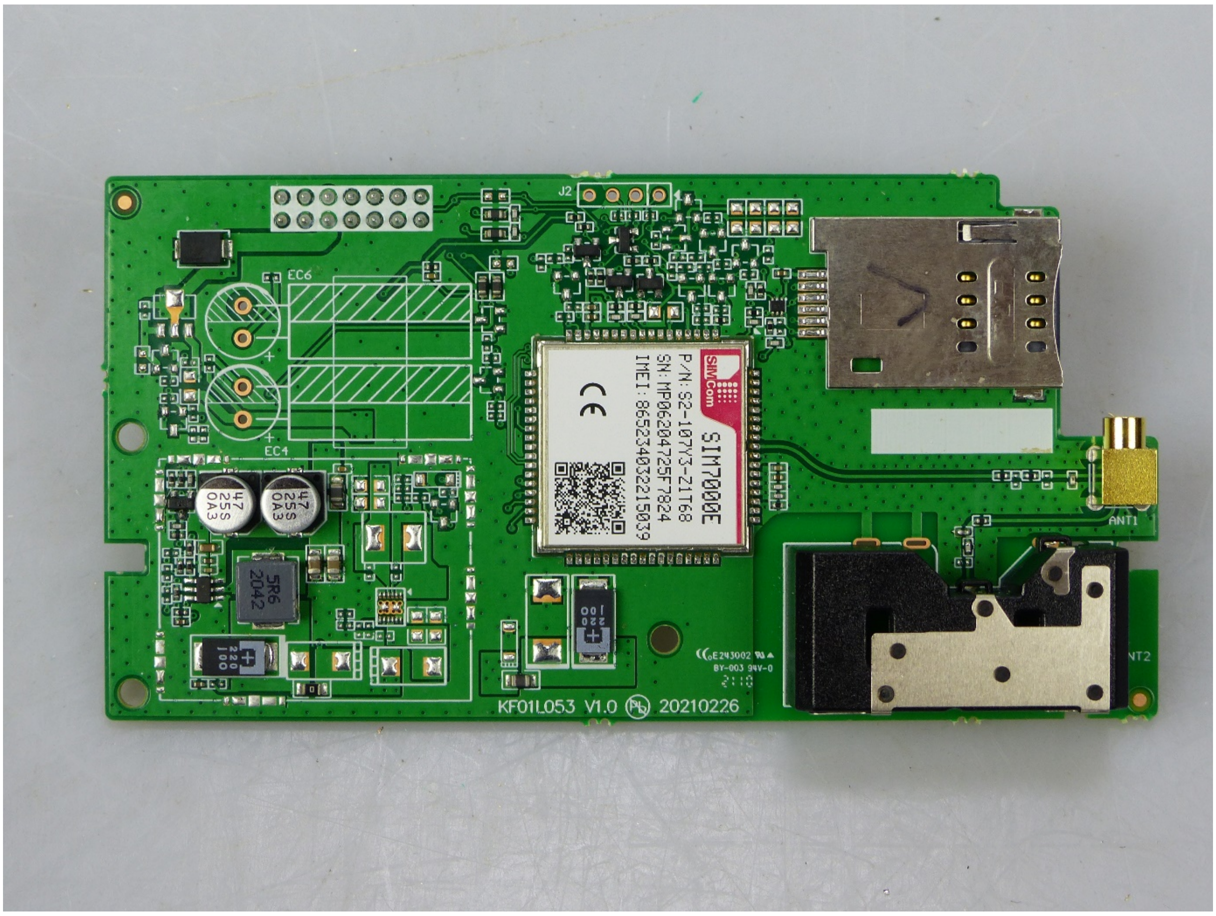

SIM7500E
P2P V3.0
20190125
ECT-Cetus 02
ANT1

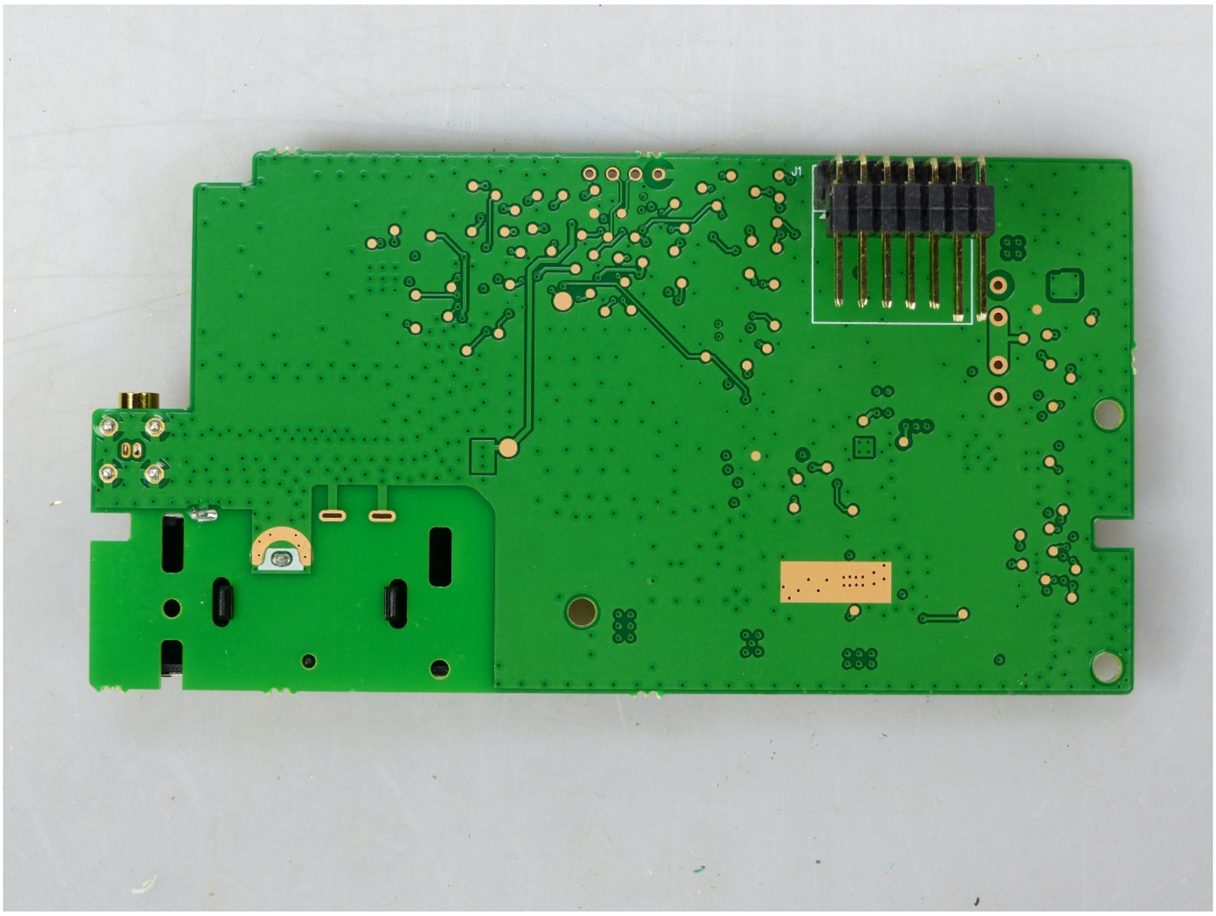

J1
94V-0
F-M
E342828

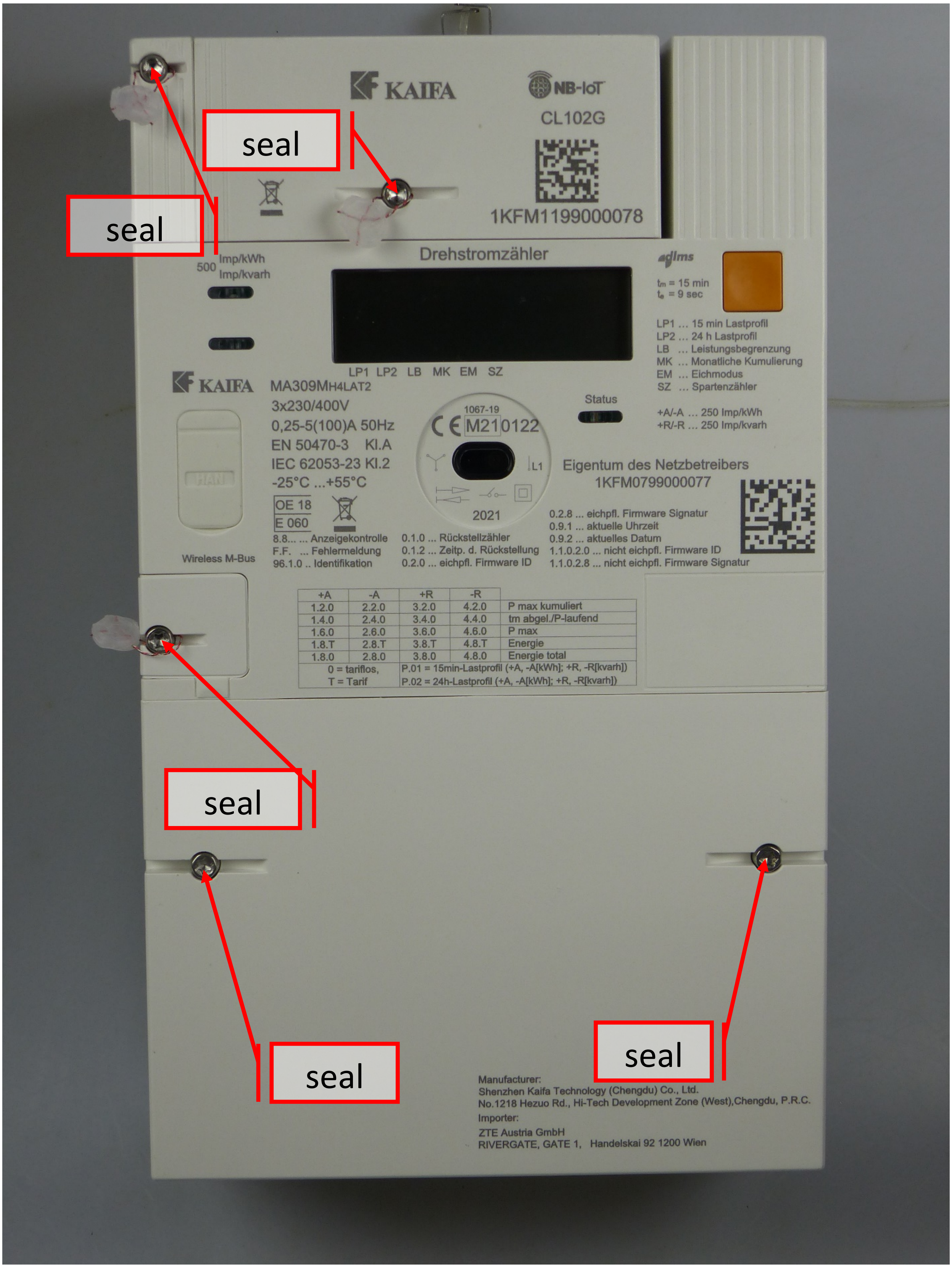

seal
seal
seal
seal
seal
KAIFA
NB-IoT
CL102
1KFM1199000070
Drehstromzähler
500 Imp/kWh
Imp/kvarh
LP1 LP2 LB MK EM SZ
KAIFA
MA309MH4LAT2
3x230/400V
0,25-5(100)A 50Hz
EN 50470-3 Kl.A
IEC 62053-23 Kl.2
-25°C ...+55°C
OE 18
E 060
1067-19
M210122
2021
L1
Status
tm = 15 min
te = 9 sec
LP1 ... 15 min Lastprofil
LP2 ... 24 h Lastprofil
LB ... Leistungsbegrenzung
MK ... Monatliche Kumulierung
EM ... Eichmodus
SZ ... Spartenzähler
+A/-A ... 250 Imp/kWh
+R/-R ... 250 Imp/kvarh
Eigentum des Netzbetreibers
1KFM0399000062
HAN
Wired M-Bus
8.8... ... Anzeigekontrolle
F.F. ... Fehlermeldung
96.1.0 .. Identifikation
0.1.0 ... Rückstellzähler
0.1.2 ... Zeitp. d. Rückstellung
0.2.0 ... eichpfl. Firmware ID
0.2.8 ... eichpfl. Firmware Signatur
0.9.1 ... aktuelle Uhrzeit
0.9.2 ... aktuelles Datum
1.1.0.2.0 ... nicht eichpfl. Firmware ID
1.1.0.2.8 ... nicht eichpfl. Firmware Signatur
M-Bus
+A -A +R -R
1.2.0 2.2.0 3.2.0 4.2.0 P max kumuliert
1.4.0 2.4.0 3.4.0 4.4.0 tm abgel./P-laufend
1.6.0 2.6.0 3.6.0 4.6.0 P max
1.8.T 2.8.T 3.8.T 4.8.T Energie
1.8.0 2.8.0 3.8.0 4.8.0 Energie total
0 = tariflos,
T = Tarif
P.01 = 15min-Lastprofil (+A, -A[kWh]; +R, -R[kvarh])
P.02 = 24h-Lastprofil (+A, -A[kWh]; +R, -R[kvarh])
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No.1218 Hezuo Rd., Hi-Tech Development Zone (West),Chengdu, P.R.C.
Importer:
ZTE Austria GmbH
RIVERGATE, GATE 1, Handelskai 92 1200 Wien


KAIFA
NB-IoT
CL102
1KFM1199000062

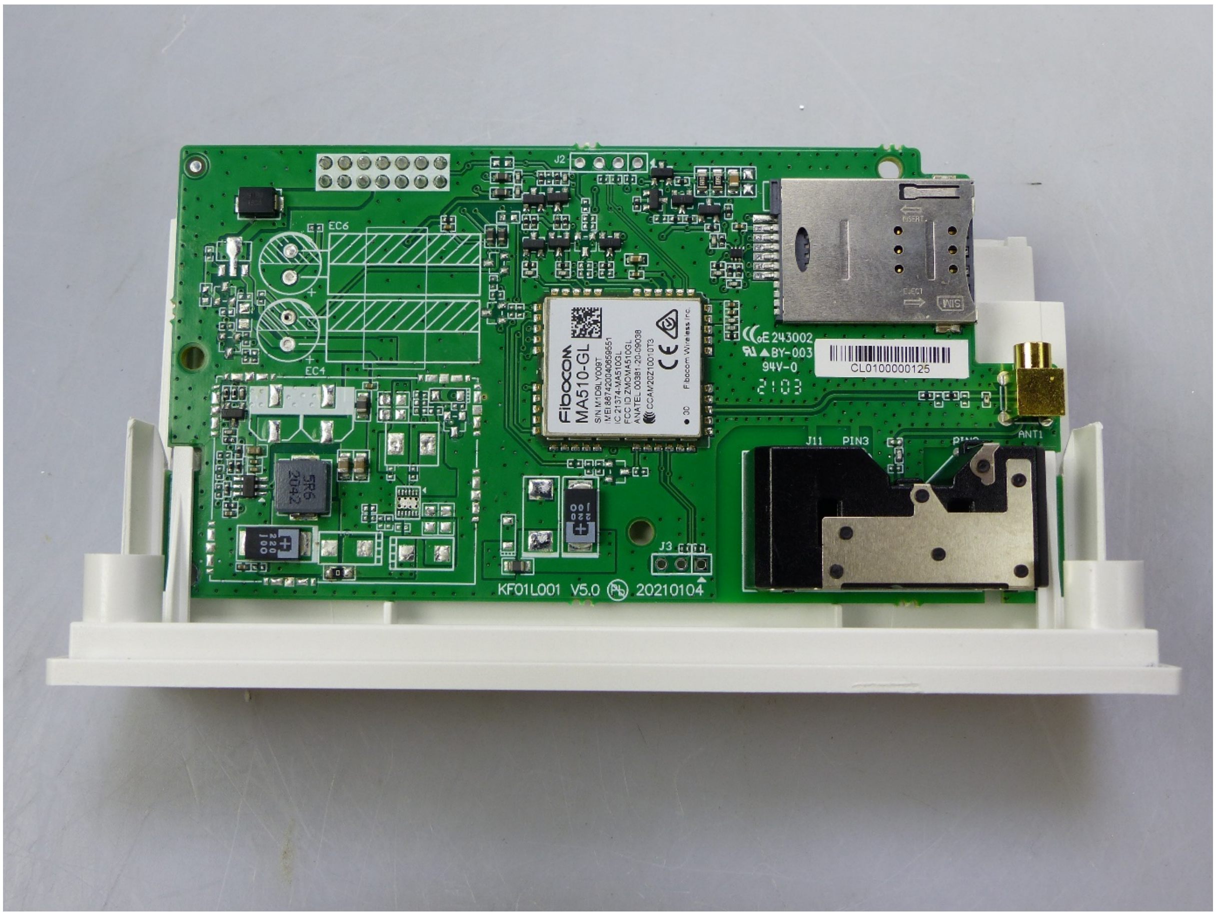

J2
EC6
EC4
ANT1
KF01L053 V1.0 20210226

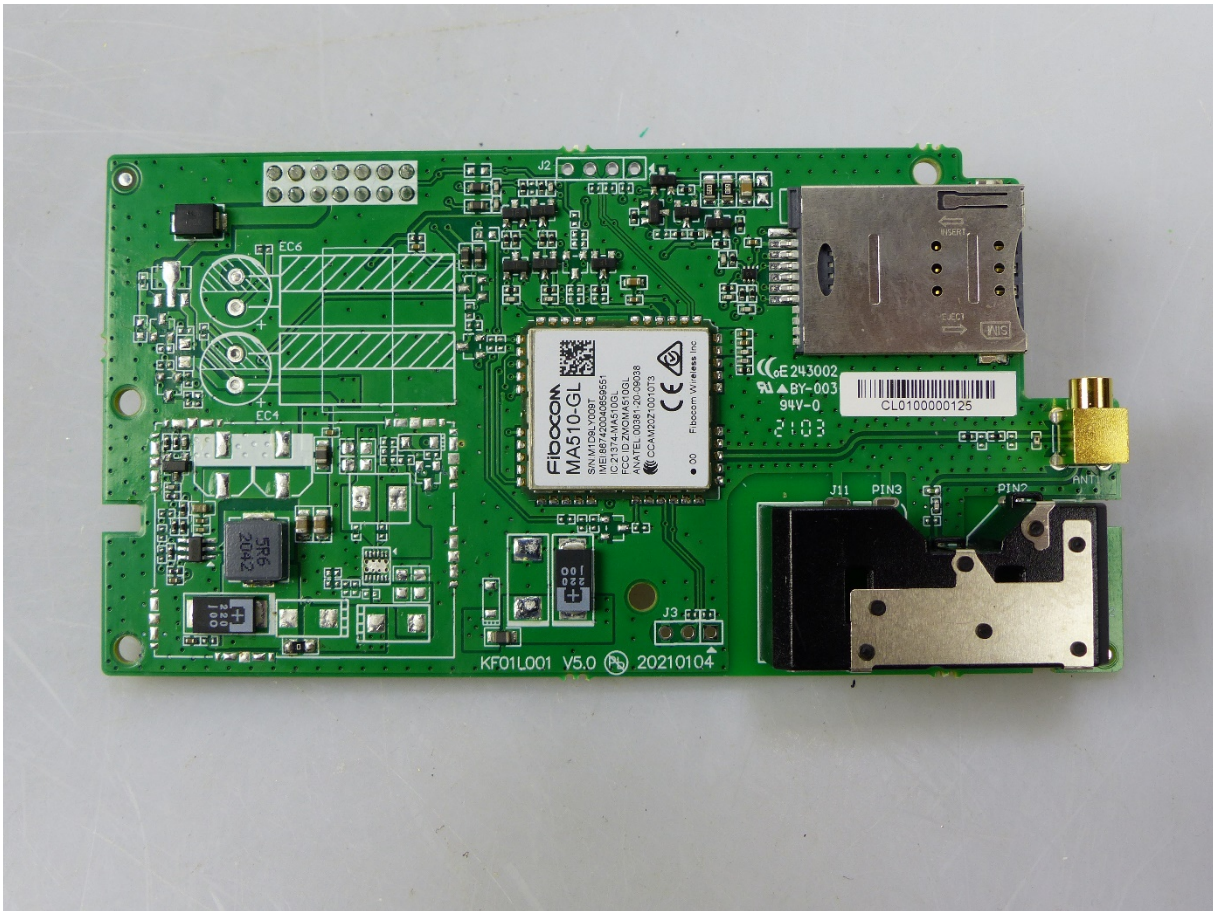

J2
EC6
EC4
ANT1
KF01L053 V1.0 20210226

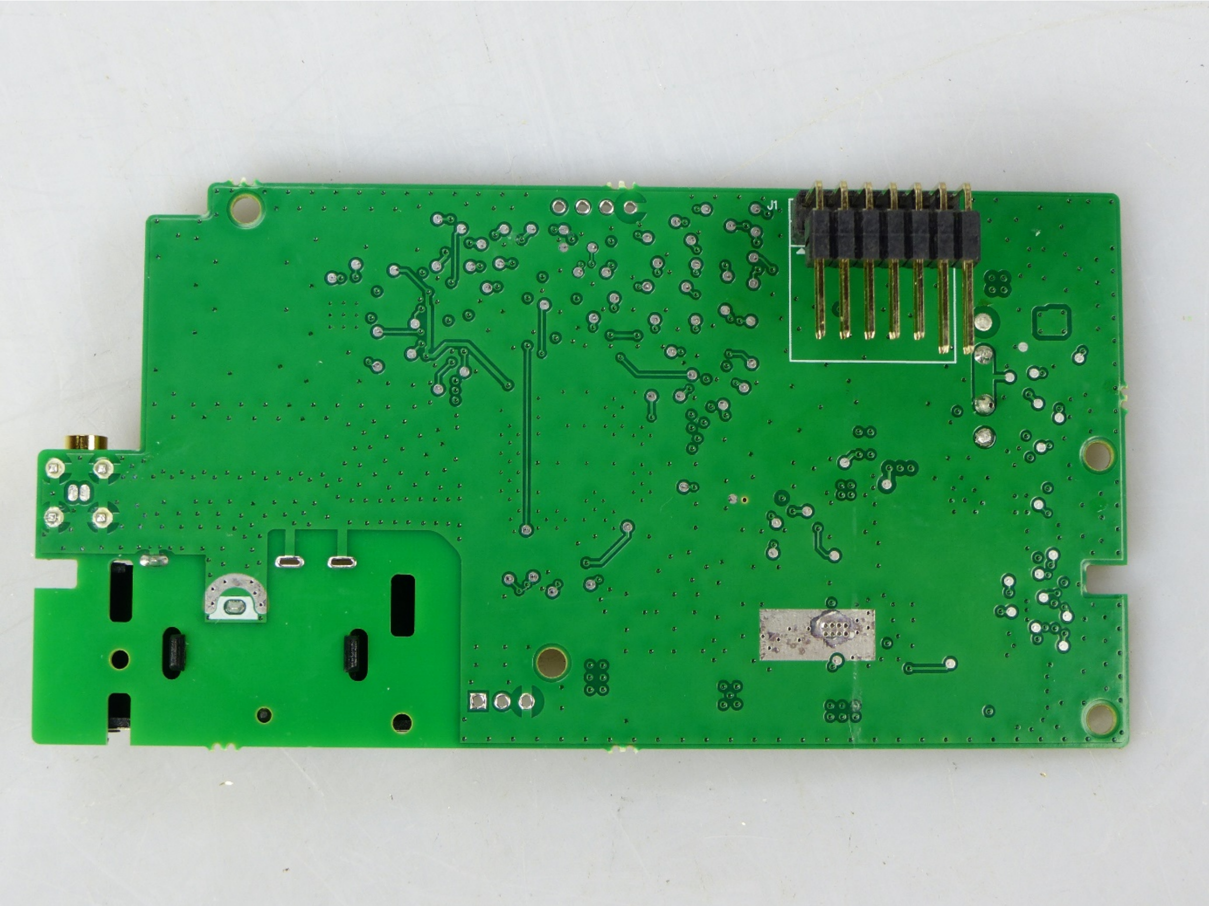

J1


seal
seal
KAIFA
NB-IoT
CL102G
1KFM1199000078
500 Imp/kWh
Imp/kvarh
Drehstromzähler
dlms
t_m = 15 min
t_e = 9 sec
LP1 ... 15 min Lastprofil
LP2 ... 24 h Lastprofil
LB ... Leistungsbegrenzung
MK ... Monatliche Kumulierung
EM ... Eichmodus
SZ ... Spartenzähler
LP1 LP2 LB MK EM SZ
KAIFA
MA309MH4LAT2
3x230/400V
0,25-5(100)A 50Hz
EN 50470-3 Kl.A
IEC 62053-23 Kl.2
-25°C ...+55°C
OE 18
E 060
1067-19
CE M210122
2021
Status
+A/-A ... 250 Imp/kWh
+R/-R ... 250 Imp/kvarh
Eigentum des Netzbetreibers
1KFM0799000077
HAN
Wireless M-Bus
8.8... ... Anzeigekontrolle
F.F. ... Fehlermeldung
96.1.0 .. Identifikation
0.1.0 ... Rückstellzähler
0.1.2 ... Zeitp. d. Rückstellung
0.2.0 ... eichpfl. Firmware ID
0.2.8 ... eichpfl. Firmware Signatur
0.9.1 ... aktuelle Uhrzeit
0.9.2 ... aktuelles Datum
1.1.0.2.0 ... nicht eichpfl. Firmware ID
1.1.0.2.8 ... nicht eichpfl. Firmware Signatur
+A -A +R -R
1.2.0 2.2.0 3.2.0 4.2.0 P max kumuliert
1.4.0 2.4.0 3.4.0 4.4.0 tm abgel./P-laufend
1.6.0 2.6.0 3.6.0 4.6.0 P max
1.8.T 2.8.T 3.8.T 4.8.T Energie
1.8.0 2.8.0 3.8.0 4.8.0 Energie total
0 = tariflos,
T = Tarif
P.01 = 15min-Lastprofil (+A, -A[kWh]; +R, -R[kvarh])
P.02 = 24h-Lastprofil (+A, -A[kWh]; +R, -R[kvarh])
seal
seal
seal
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No.1218 Hezuo Rd., Hi-Tech Development Zone (West),Chengdu, P.R.C.
Importer:
ZTE Austria GmbH
RIVERGATE, GATE 1, Handelskai 92 1200 Wien


KAIFA
NB-IoT
CL102G
1KFM1199000069


Fibocom
MA510-GL
CL0100000125
94V-0
J11
PIN3
ANT1
J2
J3
EC6
EC4
KF01L001 V5.0 20210104

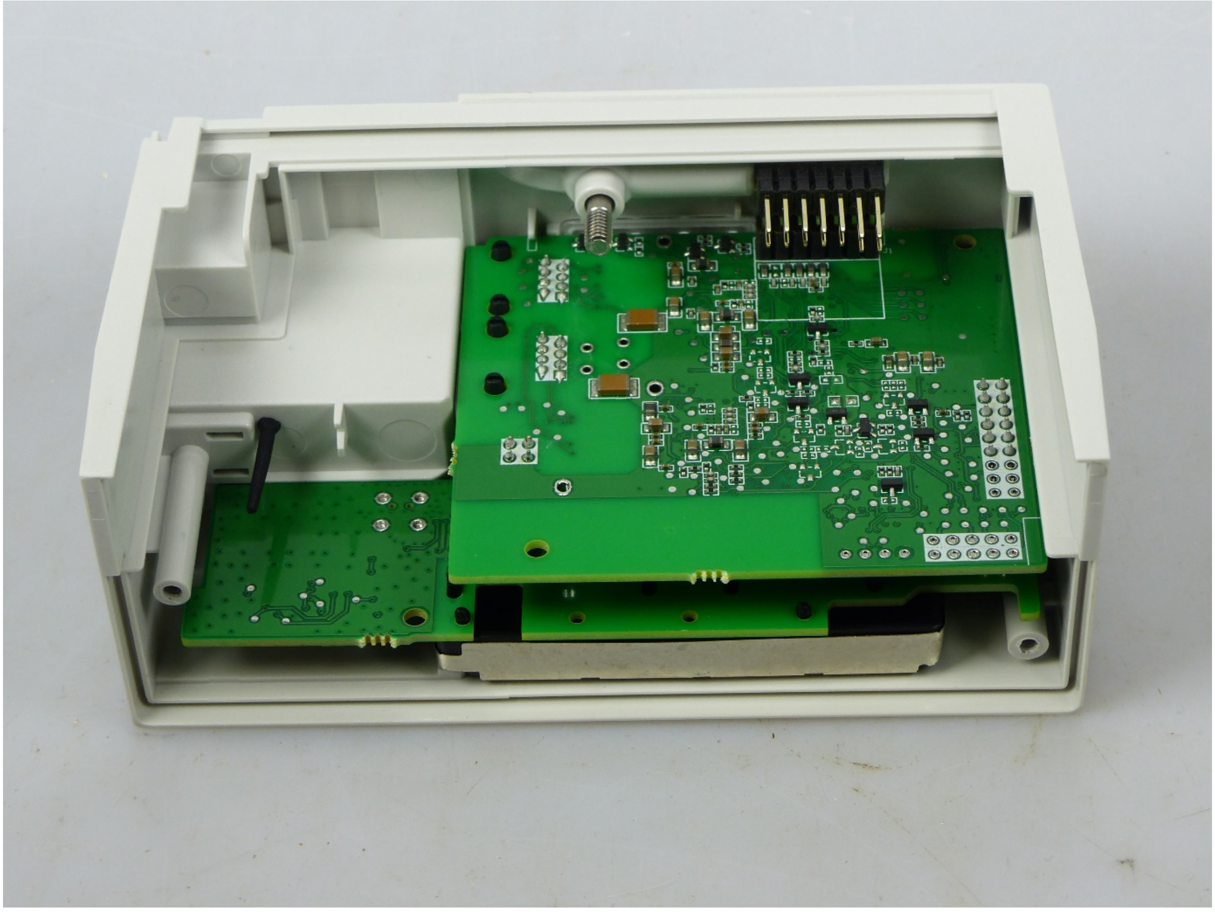

Fibocom
MA510-GL
CL0100000125
94V-0
J11
PIN3
PIN2
ANT1
J2
J3
EC6
EC4
KF01L001 V5.0 20210104

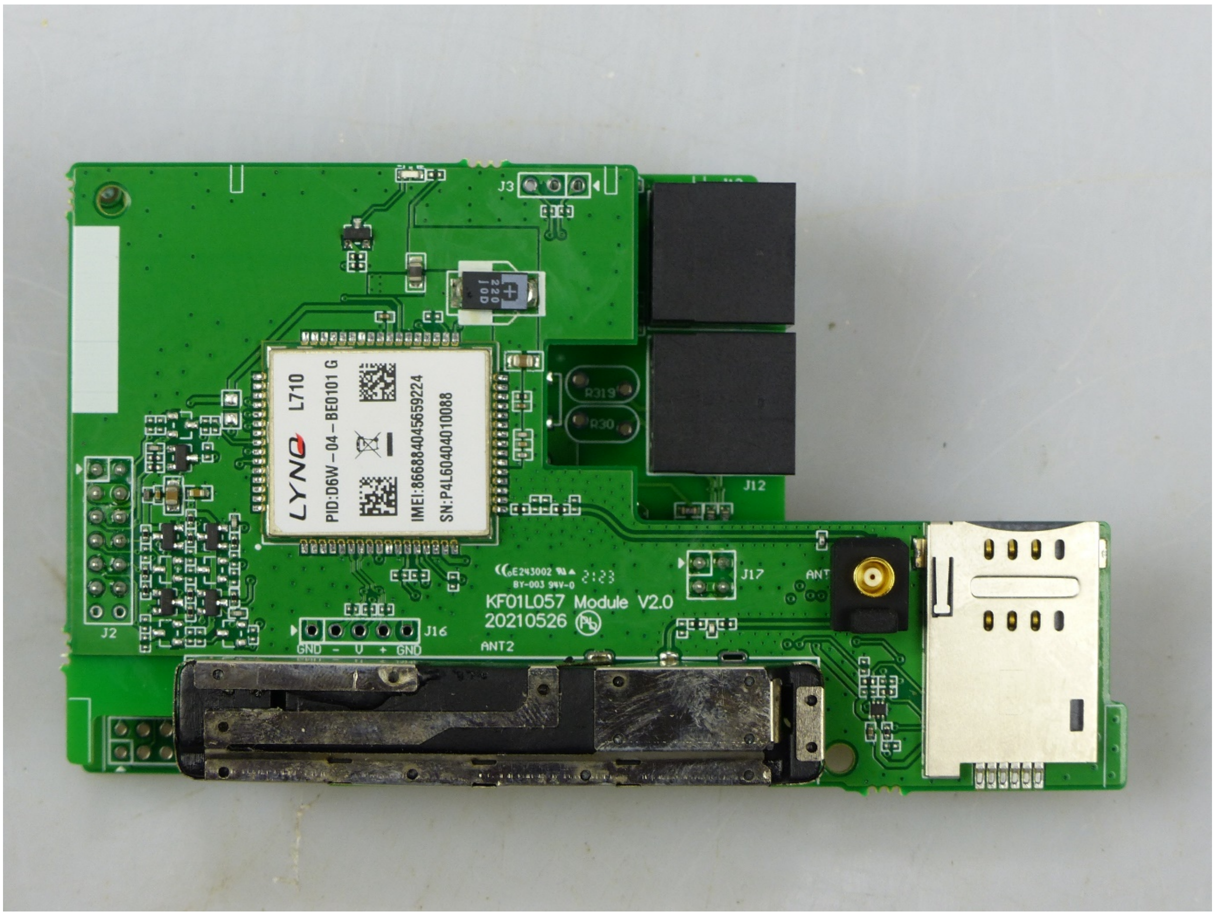

J1

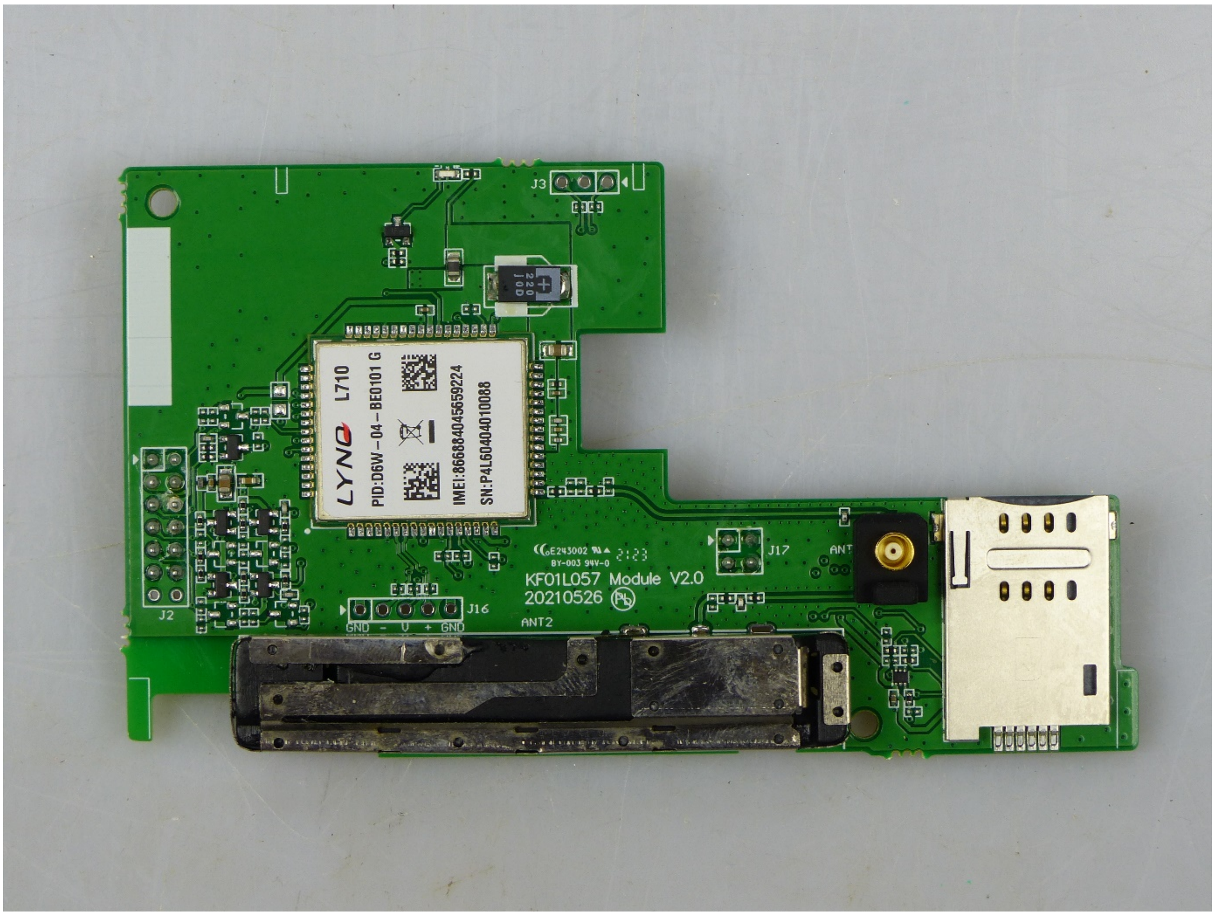

KAIFA
LTE-M/NB-IoT
CL102
ETH1
ETH2
NW
PWR
1KFM5090000037
Drehstromzähler
2000 Imp/kWh
2000 Imp/kvarh
KAIFA
F T M P R1 R2
MA309MH4LAT2
3x230/400V
0,25-5(100)A 50Hz
EN 50470-3 Kl.B
IEC 62053-23 Kl.2
-40°C ...+70°C
Sunrise upc
kapsch >>>
challenging limits
1067-19
CE M21 0122
L1
2021
Status
CH M21 CH01
CH-CH003-20032
F ... Gesichtsbedeckung offen
T ... Klemmenabdeckung offen
M ... Magnetfeld erkannt
P ... Phasenumkehr umkehren
R1...Relais1-Status
R2...Relais2-Status
1KFM5290000014
+A/-A ... 2000 Imp/kWh
+R/-R ... 2000 Imp/kvarh
DLMS
HAN
Wired M-Bus
M-Bus
8.8... ... Anzeigekontrolle
F.F. ... Fehlermeldung
96.1.0 .. Identifikation
0.1.0 ... Rückstellzähler
0.2.0 ... eichpfl. Firmware ID
0.1.2 ... Zeitp. d. Rückstellung
0.2.8 ... eichpfl. Firmware Signatur
0.9.1 ... aktuelle Uhrzeit
0.9.2 ... aktuelles Datum
1.1.0.2.0 ... nicht eichpfl. Firmware ID
1.1.0.2.8 ... nicht eichpfl. Firmware Signatur
+A -A +R -R
1.2.0 2.2.0 3.2.0 4.2.0 P max kumuliert
1.4.0 2.4.0 3.4.0 4.4.0 tm abgel./P-laufend
1.6.0 2.6.0 3.6.0 4.6.0 P max
1.8.T 2.8.T 3.8.T 4.8.T Energie
1.8.0 2.8.0 3.8.0 4.8.0 Energie total
0 = tariflos, T = Tarif
Manufacturer:
Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
No. 99 Tianquan Rd., Hi-Tech Development Zone, Chengdu, P.R.C.
Importer:
Kapsch BusinessCom AG
Fürstenlandstrasse 41
9000 St. Gallen
Schweiz

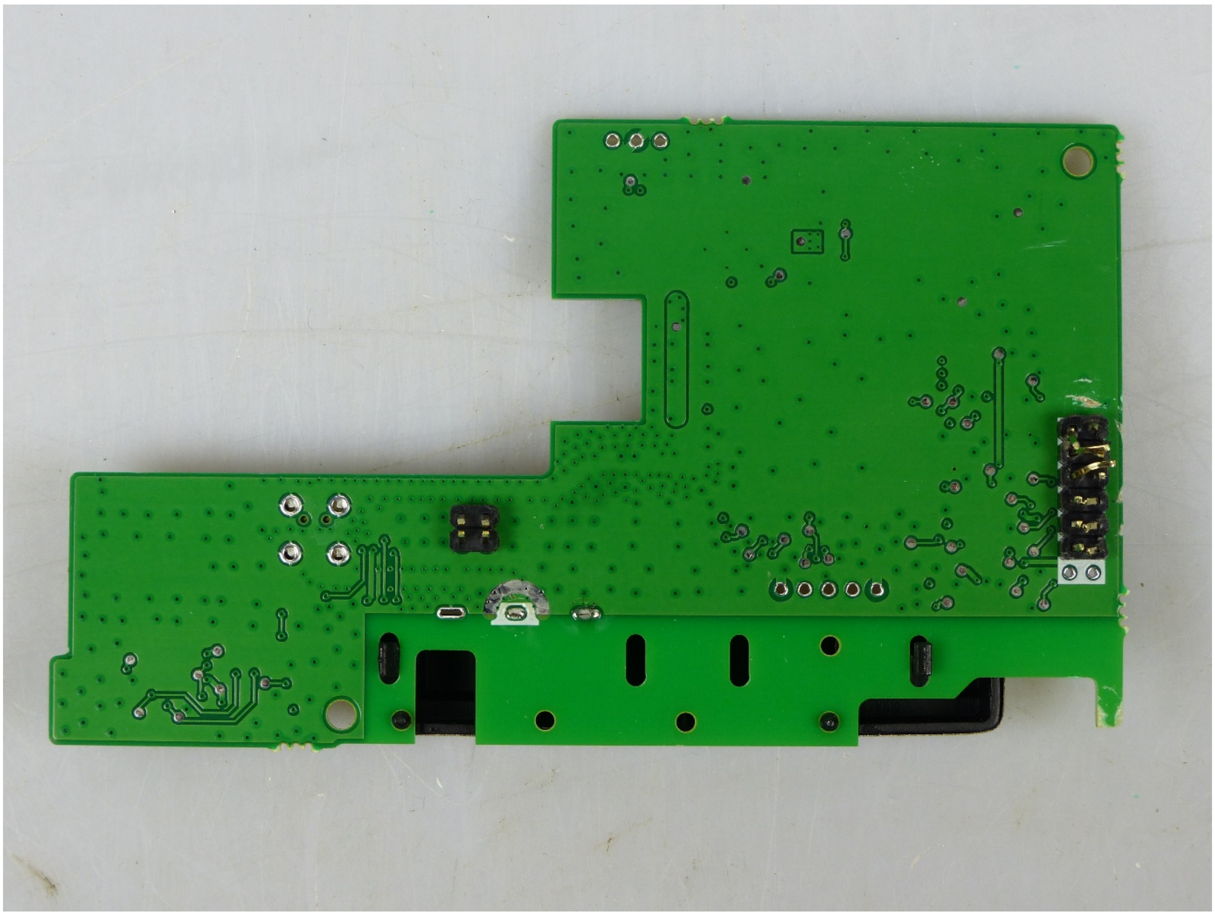

KAIFA
LTE-M/NB-IoT
CL102
ETH1
ETH2
NW
PWR
1KFM5090000037

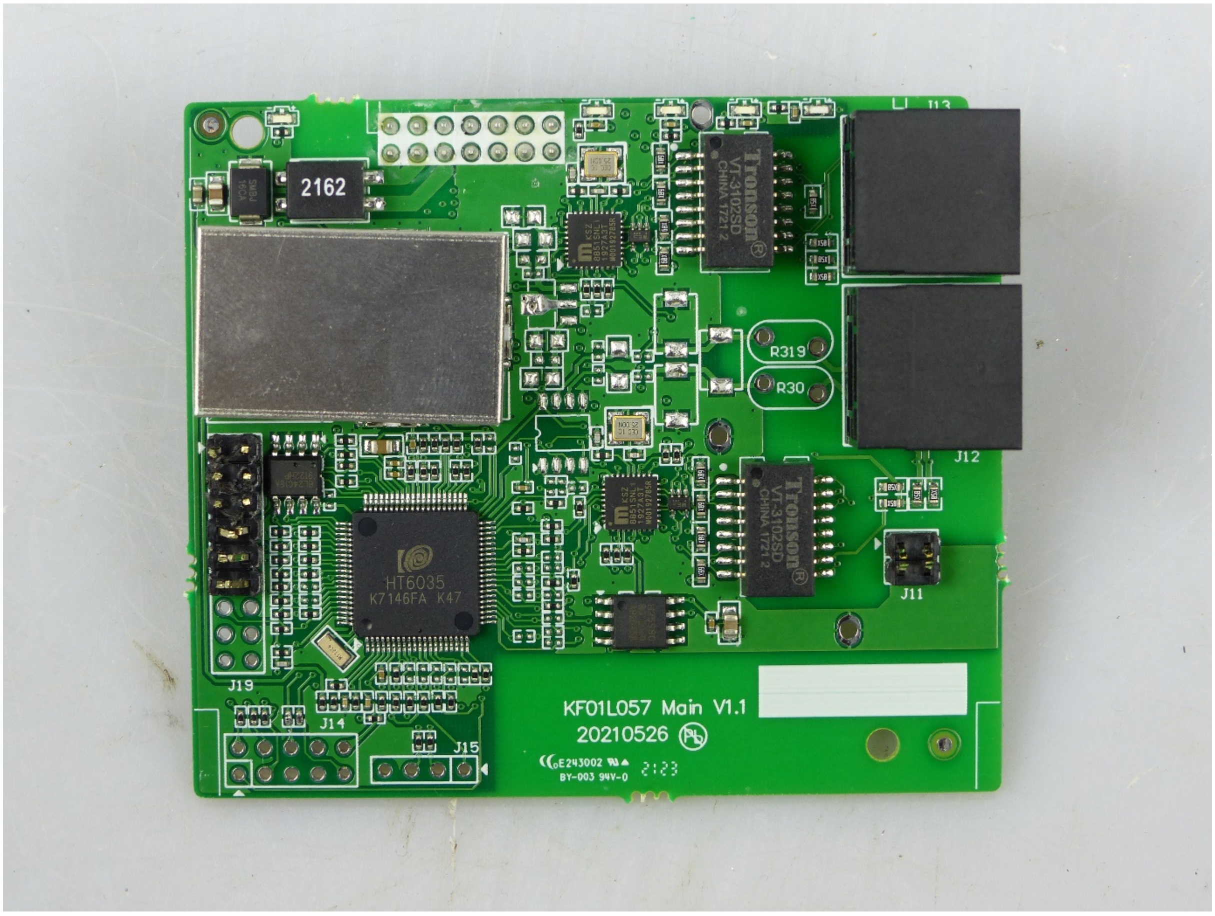

KAIFA
LTE-M/NB-IoT
CL102
ETH1
ETH2
NW
PWR
1KFM5090000037

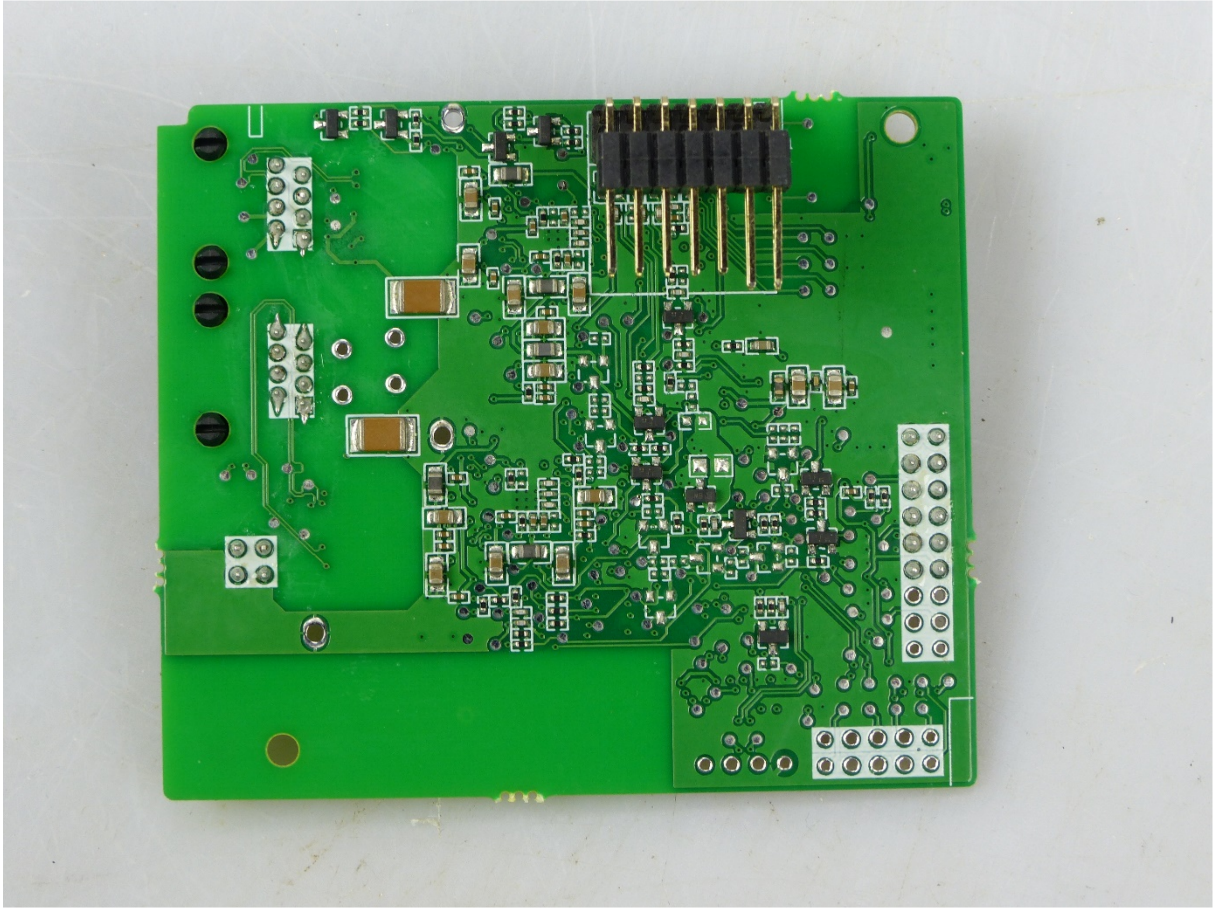


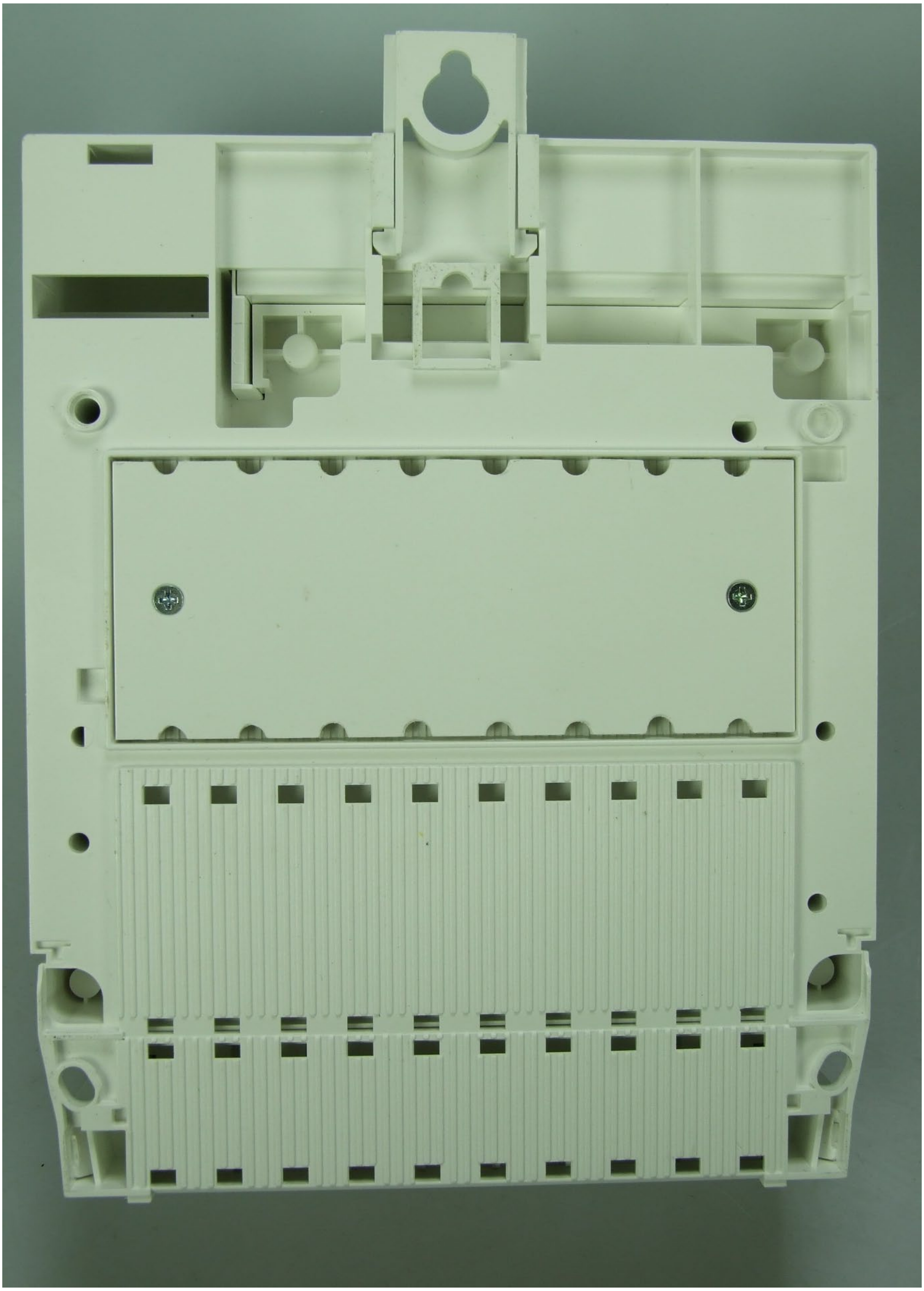

J3
LYNQ L710
PID:D6W-04-BE0101 G
IMEI:866884045659224
SN:P4L604040010088
R319
R30
J12
J2
E243002
BY-003 94V-0
KF01L057 Module V2.0
20210526
J17
ANT
J16
GND - V + GND
ANT2

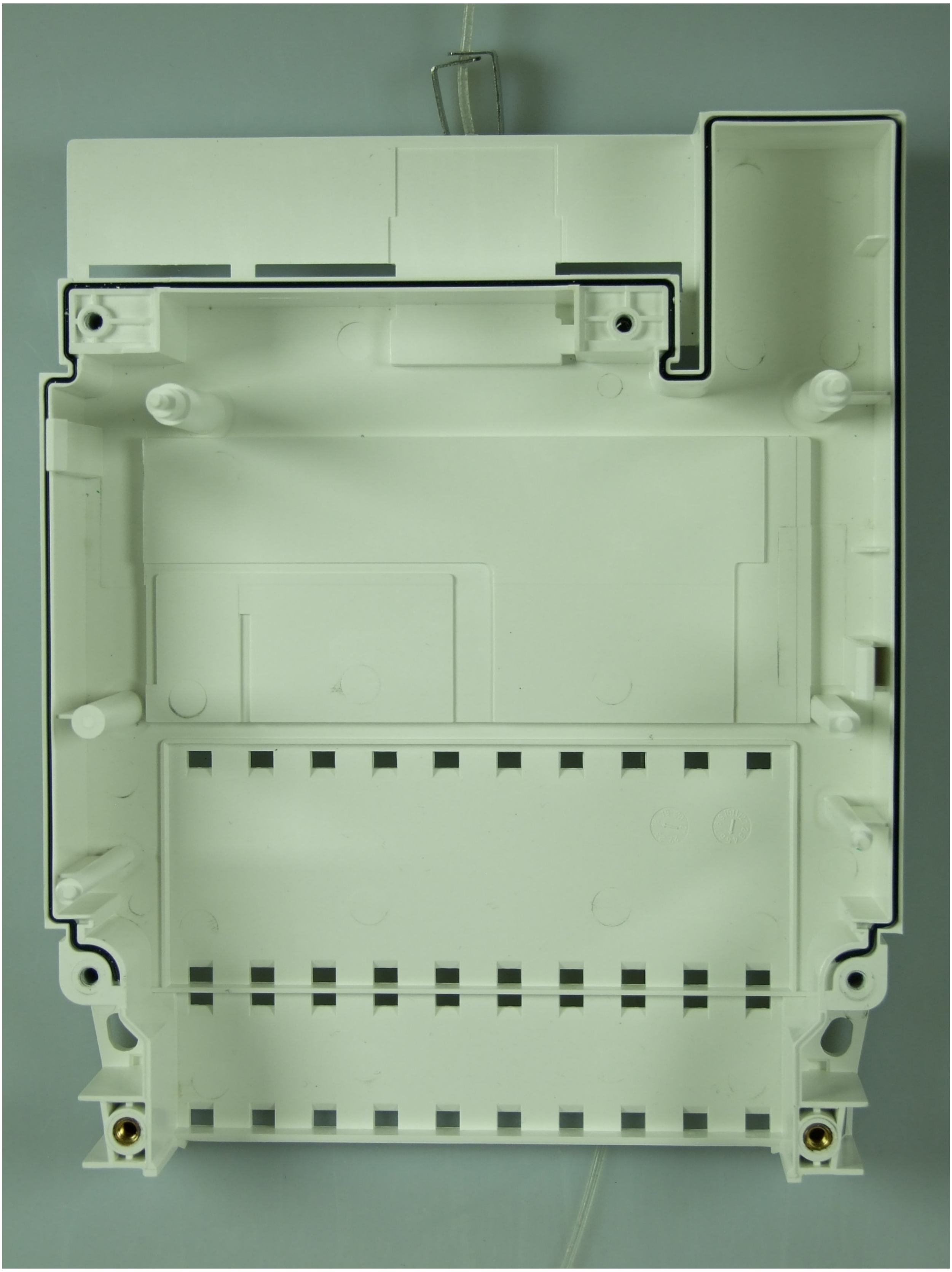

J3
L710
KF01L057 Module V2.0
20210526
J16
J17
J2
ANT
ANT2



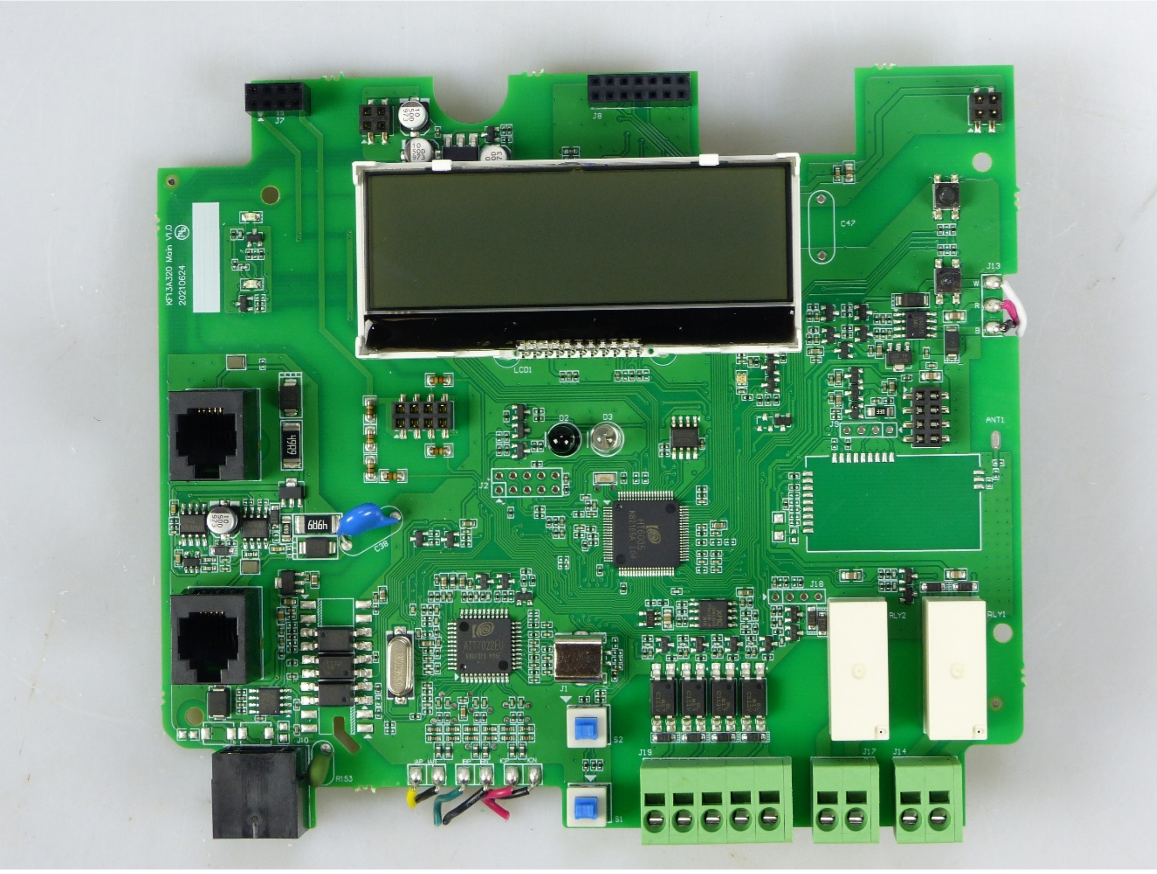

2162
HT6035
K7146FA K47
R319
R30
J12
J11
J13
J19
J14
J15
KF01L057 Main V1.1
20210526



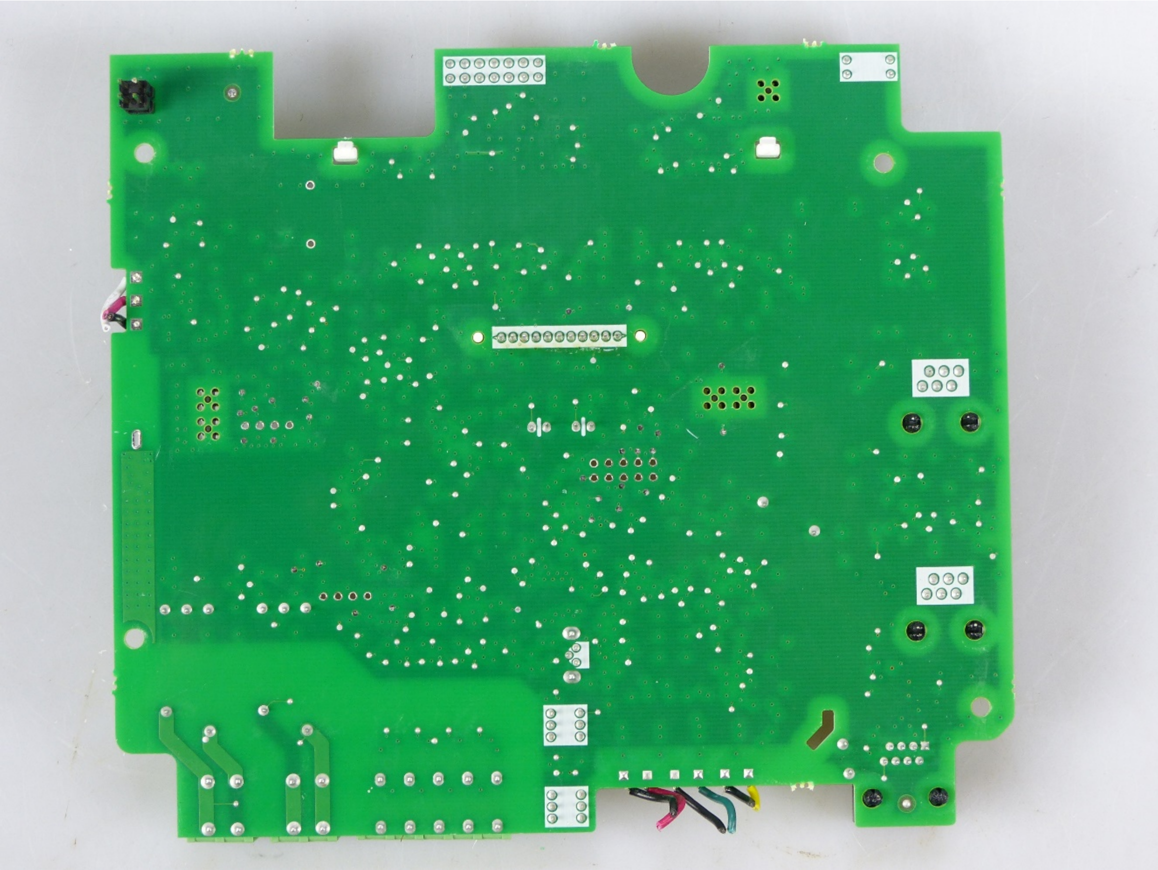




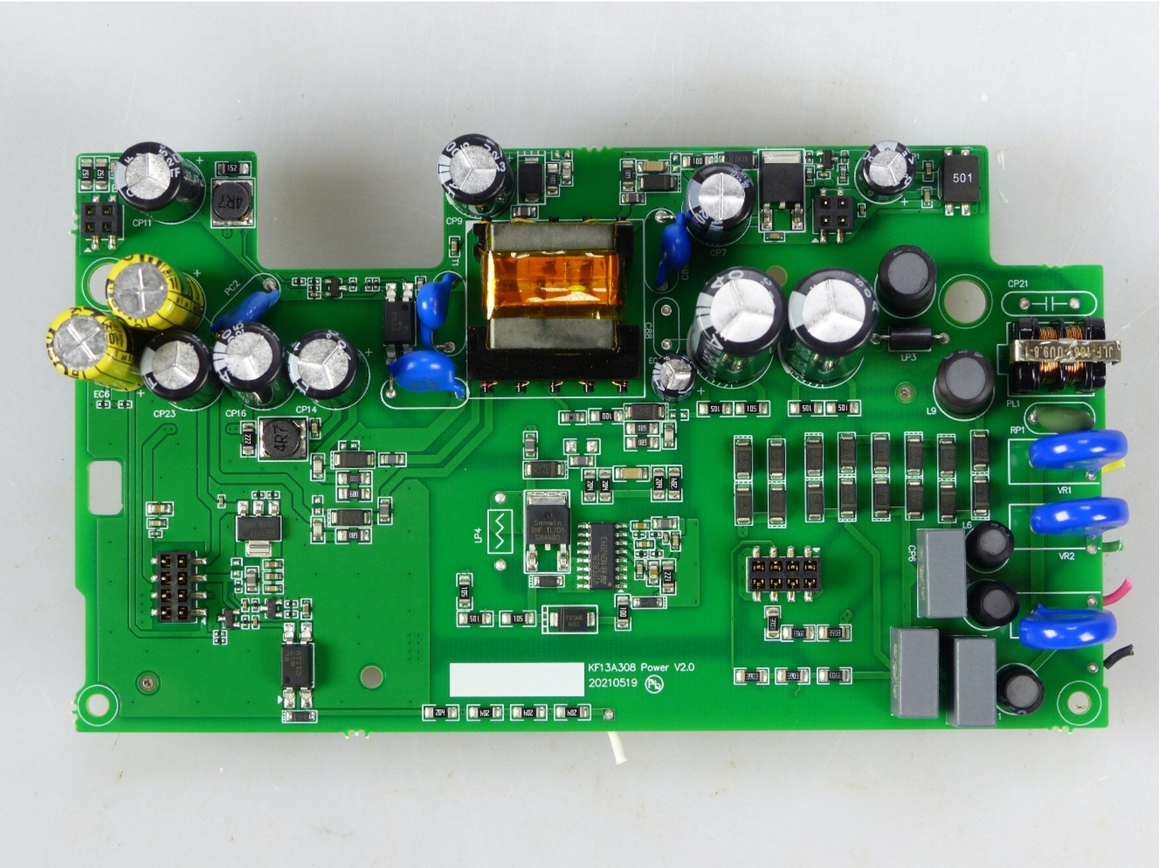
with breaker, with CP115 module(PLC) and with RS485



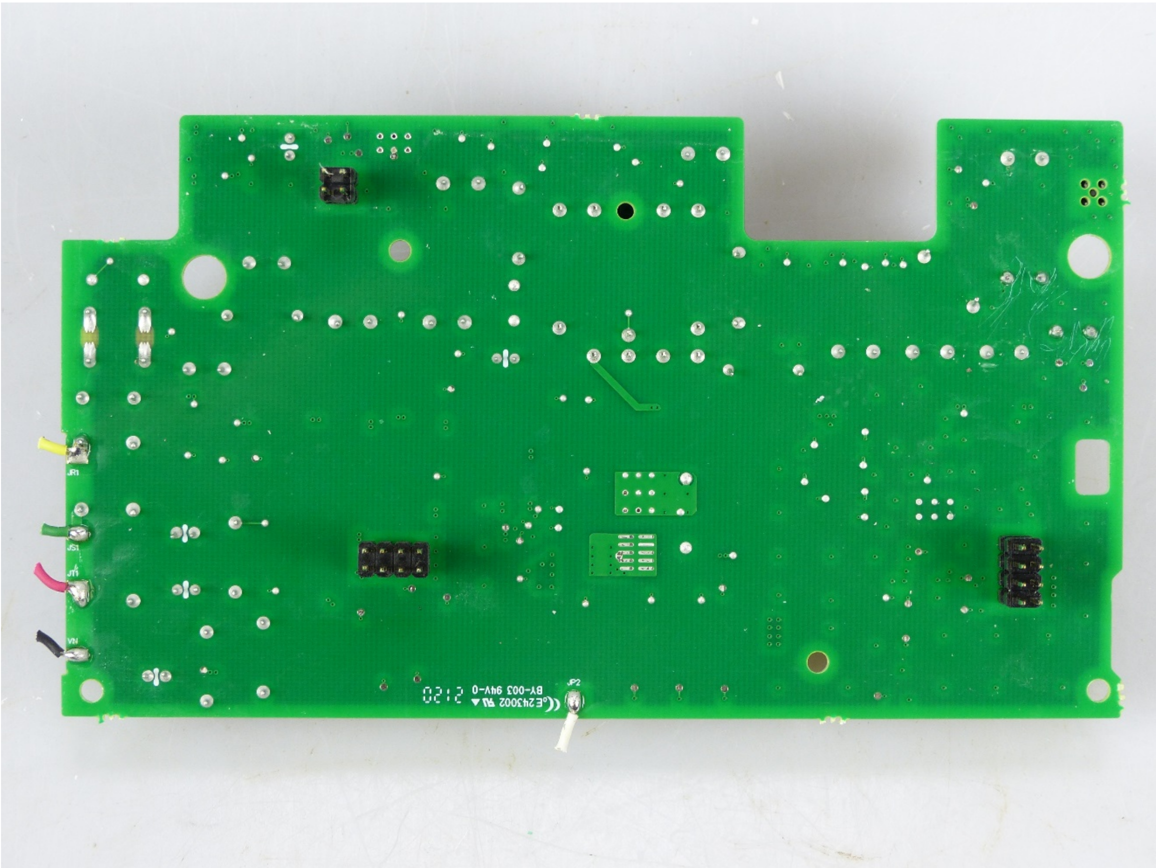
with breaker, with CP115 module(PLC) and with RS485



with breaker, with CP115 module(PLC) and with RS485



with breaker, with CP115 module(PLC) and with RS485



with breaker, with CP115 module(PLC) and with RS485

Appendix D Cross-reference table and checklist for static meters

Chapter	Test	IEC 62052-11 clause	IEC 62053-21 clause	EN 50470-1 clause	EN 50470-3 clause	Applied standards	
3	Marking of the meter	5.12		5.12		IEC 60387, IEC 60417-2, EN 62053-52	Pass
4.1	General- and mechanical requirements	5		5.1	5		Pass
4.1.3	Spring hammer test	5.2.2.1		5.2.2.1.		EN-IEC 60068-2-75	Pass
4.1.4	Shock test	5.2.2.2		5.2.2.2		EN-IEC 60068-2-27	Pass
4.1.5	Vibration test	5.2.2.3		5.2.2.3		EN-IEC 60068-2-6	Pass
4.1.6	Protection against penetration of dust and water	5.9		5.9		EN-IEC 60529	Pass
4.1.7	Terminal block material test	5.4		5.4		ISO 75-2	Pass
4.1.8	Resistance to heat and fire	5.8		5.8		EN-IEC 60695-2-11	Pass
4.2.2	Dry heat test	6.3.1		6.3.2.		EN-IEC 60068-2-2	Pass
4.2.3	Cold test	6.3.2		6.3.3.		EN-IEC 60068-2-1	Pass
4.2.4	Damp heat cyclic test	6.3.3		6.3.4.		EN-IEC 60068-2-30	Pass
4.2.5	Solar radiation test	6.3.4		6.3.5.		EN-IEC 60068-2-5	N.A.
4.3	Accuracy measurement at different loads		8.1		8.1		Pass
4.3.1	Interpretation of test results		8.6		8.7.3.		Pass
4.3.2	Meter constant		8.4		8.7.10		Pass
4.3.3	Starting current		8.3		8.7.9.4.		Pass
4.3.4	Test of no load condition		8.3		8.7.9.3.		Pass
4.4.1	Influence of ambient temperature variation		8.2		8.7.5.2.		Pass
4.4.2	Auxiliary voltage variation		8.2				N.A.
4.4.3	Voltage variation		8.2		8.7.5.3.		Pass
4.4.4	Frequency variation		8.2		8.7.5.4		Pass
4.4.5	Magnetic induction of external origin 0,5 mT		8.2		8.7.7.11	EN-IEC 61000-4-8	Pass
4.4.6	Harmonic components		8.2		8.7.7.7.		Pass
4.4.7	D.C. and even harmonics		8.2		8.7.7.8.		Pass
4.4.8	Odd harmonics in the a.c. current circuit		8.2		8.7.7.9		Pass
4.4.9	Sub-harmonics in the a.c. current circuit		8.2		8.7.7.9.		Pass
4.4.10	Reversed phase sequence		8.2		8.7.7.3.		Pass
4.4.11	Voltage unbalance		8.2		8.7.7.4.		Pass
4.4.12	Continuous magnetic induction of external origin		8.2	7.4.11	8.7.7.10		Pass
4.4.13	Operation of accessories		8.2		8.7.7.13		Pass
4.4.14	Immunity to earth fault	7.4			8.7.7.6.		N.A.
4.5	Influence of short-time overcurrents		7.2		8.7.8		Pass

Chapter	Test	IEC 62052-11 clause	IEC 62053-21 clause	EN 50470-1 clause	EN 50470-3 clause	Applied standards	
4.6.1	Influence of self heating		7.3		8.7.7.5.		Pass
4.6.2	Heating	7.2		7.2.			Pass
4.7	Power consumption		7.1		7.1		Pass
4.8	Fast transient burst test	7.5.4		7.4.7	8.7.7.14	EN-IEC 61000-4-4	Pass
4.9	Electrostatic discharges	7.5.2		7.4.5.		EN-IEC 61000-4-2	Pass
4.10	Immunity to electromagnetic RF fields	7.5.3		7.4.6.	8.7.7.12	EN-IEC 61000-4-3	Pass
4.11	Immunity to RF conducted disturbances	7.5.5		7.4.8.	8.7.7.15	EN-IEC 61000-4-6	Pass
4.12	Radio interference suppression	7.5.8		7.4.13		CISPR 22, EN 55022	Pass
4.13	Voltage dips and short interruptions	7.1.2		7.4.4.		EN-IEC 61000-4-11	Pass
4.14	Surge immunity test	7.5.6		7.4.9.		EN-IEC 61000-4-5	Pass
4.15	Damped oscillatory waves immunity test	7.5.7		7.4.10	8.7.7.16	EN-IEC 61000-4-12	N.A.
4.16.1	Impulse voltage test	7.3.2		7.3.3.		IEC 60060-1	Pass
4.16.2	A.C. voltage test	7.3.3			7.2.		Pass
5	Maximum Permissible Error				8.7.6		Pass
6	Durability				9		Pass
6	Reliability				10		Pass
7	Software and protection against corruption				11		Pass

Appendix E Checklist for Measuring Instrument Directive MID 2014/32/EU

Annex I, Essential Requirements

1	Allowable Errors	§	
1.1	Under rated operating conditions and in the absence of a disturbance, the error of measurement shall not exceed the maximum permissible error (MPE) value as laid down in the appropriate instrument-specific requirements. Unless stated otherwise in the instrument-specific annexes, MPE is expressed as a bilateral value of the deviation from the true measurement value.		Pass
1.2	Under rated operating conditions and in the presence of a disturbance, the performance requirement shall be as laid down in the appropriate instrument-specific requirements. Where the instrument is intended to be used in a specified permanent continuous electromagnetic field the permitted performance during the radiated electromagnetic field-amplitude modulated test shall be within MPE.		Pass
1.3	The manufacturer shall specify the climatic, mechanical and electromagnetic environments in which the instrument is intended to be used, power supply and other influence quantities likely to affect its accuracy, taking account of the requirements laid down in the appropriate instrument-specific annexes.	See chapter 3	Pass
1.3.1	Climatic environments The manufacturer shall specify the upper temperature limit and the lower temperature limit from any of the values in Table 1 unless otherwise specified in the Annexes III to XII, and indicate whether the instrument is designed for condensing or non-condensing humidity as well as the intended location for the instrument, i.e. open or closed.	See chapter 3. Condensing	Pass
1.3.2	(a) Mechanical environments are classified into classes M1 to M3. (b) The following influence quantities shall be considered in relation with mechanical environments: • vibration; • mechanical shock.	See chapter 3 and 4.1	Pass
1.3.3	(a) Electromagnetic environments are classified into classes E1, E2 or E3, unless otherwise laid down in the appropriate instrument-specific annexes.	See chapter 3	Pass
1.3.3	(b) The following influence quantities shall be considered in relation with electromagnetic environments: • voltage interruptions; • short voltage reductions; • voltage transients on supply lines and/or signal lines; • electrostatic discharges;EN 29.3.2014 Official Journal of the European Union L 96/171 • radio frequency electromagnetic fields; • conducted radio frequency electromagnetic fields on supply lines and/or signal lines; • surges on supply lines and/or signal lines.	See chapter 4	Pass

1.3.4	Other influence quantities to be considered, where appropriate, are: • voltage variation; • mains frequency variation; • power frequency magnetic fields; • any other quantity likely to influence in a significant way the accuracy of the instrument.	See chapter 4	Pass
1.4.1	Basic rules for testing and the determination of errors Essential requirements specified in points 1.1 and 1.2 shall be verified for each relevant influence quantity. Unless otherwise specified in the appropriate instrument-specific annex, these essential requirements apply when each influence quantity is applied and its effect evaluated separately, all other influence quantities being kept relatively constant at their reference value. Metrological tests shall be carried out during or after the application of the influence quantity, whichever condition corresponds to the normal operational status of the instrument when that influence quantity is likely to occur.	See chapter 4	Pass
1.4.2	Ambient humidity (a) According to the climatic operating environment in which the instrument is intended to be used either the damp heat-steady state (non-condensing) or damp heat cyclic (condensing) test may be appropriate. (b) The damp heat cyclic test is appropriate where condensation is important or when penetration of vapour will be accelerated by the effect of breathing. In conditions where non-condensing humidity is a factor the damp- heat steady state is appropriate.	See § 4.2	Pass
2	Reproducibility The application of the same measurand in a different location or by a different user, all other conditions being the same, shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.		Pass
3	Repeatability The application of the same measurand under the same conditions of measurement shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.		Pass
4	Discrimination and Sensitivity A measuring instrument shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.		Pass
5	Durability A measuring instrument shall be designed to maintain an adequate stability of its metrological characteristics over a period of time estimated by the manufacturer, provided that it is properly installed, maintained and used according to the manufacturer's instruction when in the environmental conditions for which it is intended.	See chapter 6	Pass
6	Reliability A measuring instrument shall be designed to reduce as far as possible the effect of a defect that would lead to an inaccurate measurement	See chapter 6	Pass

	result, unless the presence of such a defect is obvious.		
7	Suitability		Pass
7.1	A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.	See chapter 7	Pass
7.2	A measuring instrument shall be suitable for its intended use taking account of the practical working conditions and shall not require unreasonable demands of the user in order to obtain a correct measurement result.		Pass
7.3	The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.	See Appendix A	Pass
7.4	Where a measuring instrument is designed for the measurement of values of the measurand that are constant over time, the measuring instrument shall be insensitive to small fluctuations of the value of the measurand, or shall take appropriate action.		N.A.
7.5	A measuring instrument shall be robust and its materials of construction shall be suitable for the conditions in which it is intended to be used.		Pass
7.6	A measuring instrument shall be designed so as to allow the control of the measuring tasks after the instrument has been placed on the market and put into use. If necessary, special equipment or software for this control shall be part of the instrument. The test procedure shall be described in the operation manual. When a measuring instrument has associated software which provides other functions besides the measuring function, the software that is critical for the metrological characteristics shall be identifiable and shall not be inadmissibly influenced by the associated software.		Pass
8	Protection against corruption	See chapter 7	Pass
8.1	The metrological characteristics of a measuring instrument shall not be influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the measuring instrument.		Pass
8.2	A hardware component that is critical for metrological characteristics shall be designed so that it can be secured. Security measures foreseen shall provide for evidence of an intervention.		Pass
8.3	Software that is critical for metrological characteristics shall be identified as such and shall be secured. Software identification shall be easily provided by the measuring instrument. Evidence of an intervention shall be available for a reasonable period of time.		Pass
8.4	Measurement data, software that is critical for measurement characteristics and metrologically important parameters stored or transmitted shall be adequately protected against accidental or intentional corruption.		Pass
8.5	For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.		Pass

9	Information to be borne by and to accompany the instrument		
9.1	A measuring instrument shall bear the following inscriptions: (a) manufacturer's name, registered trade name or registered trade mark; (b) information in respect of its accuracy; and, where applicable: (c) information in respect of the conditions of use; (d) measuring capacity; (e) measuring range; (f) identity marking; (g) number of the EU-type examination certificate or the EU design examination certificate; (h) information whether or not additional devices providing metrological results comply with the provisions of this Directive on legal metrological control.		Pass
9.2	An instrument of dimensions too small or of too sensitive a composition to allow it to bear the relevant information shall have its packaging, if any, and the accompanying documents required by the provisions of this Directive suitably marked.		N.A.
9.3	The instrument shall be accompanied by information on its operation, unless the simplicity of the measuring instrument makes this unnecessary. Information shall be easily understandable and shall include where relevant: (a) rated operating conditions; (b) mechanical and electromagnetic environment classes; (c) the upper and lower temperature limit, whether condensation is possible or not, open or closed location; (d) instructions for installation, maintenance, repairs, permissible adjustments; (e) instructions for correct operation and any special conditions of use; (f) conditions for compatibility with interfaces, sub-assemblies or measuring instruments.		Pass
9.4	Groups of identical measuring instruments used in the same location or used for utility measurements do not necessarily require individual instruction manuals.		N.T.
9.5	Unless specified otherwise in an instrument-specific annex, the scale interval for a measured value shall be in the form 1 × 10 n , 2 × 10 n , or 5 × 10 n , where n is any integer or zero. The unit of measurement or its symbol shall be shown close to the numerical value.		Pass
9.6	A material measure shall be marked with a nominal value or a scale, accompanied by the unit of measurement used.		Pass
9.7	The units of measurement used and their symbols shall be in accordance with the provisions of Union legislation on units of measurement and their symbols.		Pass
9.8	All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non- transferable.		Pass
10	Indication of result		Pass
10.1	Indication of the result shall be by means of a display or hard copy.		Pass

10.2	The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the presented result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.		Pass
10.3	In the case of hard copy the print or record shall also be easily legible and non-erasable.		N.A.
10.4	A measuring instrument for direct sales trading transactions shall be designed to present the measurement result to both parties in the transaction when installed as intended. When critical in case of direct sales, any ticket provided to the consumer by an ancillary device not complying with the appropriate requirements of this Directive shall bear appropriate restrictive information.		N.A.
10.5	Whether or not a measuring instrument intended for utility measurement purposes can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the consumer. The reading of this display is the measurement result that serves as the basis for the price to pay.		Pass
11	Further processing of data to conclude the trading transaction		Pass
11.1	A measuring instrument other than a utility measuring instrument shall record by a durable means the measurement result accompanied by information to identify the particular transaction, when: (a) the measurement is non-repeatable; and (b) the measuring instrument is normally intended for use in the absence of one of the trading parties.		Pass
11.2	Additionally, a durable proof of the measurement result and the information to identify the transaction shall be available on request at the time the measurement is concluded.		Pass
12	Conformity evaluation		
	A measuring instrument shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of this Directive.		Pass

Annex II, Module B: EU-Type Examination

1	'EU-type examination' is the part of a conformity assessment procedure in which a notified body examines the technical design of an instrument and verifies and attests that the technical design of the instrument meets the requirements of this Directive that apply to it.	Type exam. Cert.	Pass
2	EU-type examination may be carried out in either of the following manners: (a) examination of a specimen, representative of the production envisaged, of the complete measuring instrument (production type), (b) assessment of the adequacy of the technical design of the instrument through examination of the technical documentation and supporting evidence referred to in point 3, plus examination of specimens, representative of the production envisaged, of one or more critical parts of the instrument (combination of production type and design type); (c) assessment of the adequacy of the technical design of the instrument through examination of the technical documentation and supporting evidence referred to in point 3, without examination of a specimen (design type). The notified body decides on the appropriate manner and the specimens required.	Option (a)	Pass
3	The manufacturer shall lodge an application for EU-type examination with a single notified body of his choice. The application shall include: (a) the name and address of the manufacturer and, if the application is lodged by the authorized representative, his name and address as well; (b) a written declaration that the same application has not been lodged with any other notified body; (c) the technical documentation as described in Article 18. The technical documentation shall make it possible to assess the instrument's conformity with the applicable requirements of this Directive and shall include an adequate analysis and assessment of the risk(s). The technical documentation shall specify the applicable requirements and cover, as far as relevant for the assessment, the design, manufacture and operation of the instrument. The application shall in addition contain, wherever applicable: (d) the specimens, representative of the production envisaged. The notified body may request further specimens if needed for carrying out the test programme; (e) the supporting evidence for the adequacy of the technical design solution. This supporting evidence shall mention any documents that have been used, in particular where the relevant harmonized standards, and/or normative documents have not been applied in full. The supporting evidence shall include, where necessary, the results of tests carried out in accordance with other relevant technical specifications by the appropriate laboratory of the manufacturer, or by another testing laboratory on his behalf and under his responsibility.		Pass
4	The notified body shall: For the instrument:		

4.1	examine the technical documentation and supporting evidence to assess the adequacy of the technical design of the instrument;		Pass
	The notified body shall: For the specimen(s):		
4.2	verify that the specimen(s) have been manufactured in conformity with the technical documentation and identify the elements which have been designed in accordance with the applicable provisions of the relevant harmonised standards and/or normative documents, as well as the elements which have been designed in accordance with other relevant technical specifications;		Pass
4.3	carry out appropriate examinations and tests, or have them carried out, to check whether, where the manufacturer has chosen to apply the solutions in the relevant harmonized standards and normative documents, these have been applied correctly;		Pass
4.4	carry out appropriate examinations and tests, or have them carried out, to check whether, where the solutions in the relevant harmonized standards, and/or normative documents have not been applied, the solutions adopted by the manufacturer applying other relevant technical specifications meet the corresponding essential requirements of this Directive;		Pass
4.5	agree with the manufacturer on the location where the examinations and tests will be carried out.		Pass
	For the other parts of the measuring instrument:		
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.		Pass
5	The notified body shall draw up an evaluation report that records the activities undertaken in accordance with point 4 and their outcomes. Without prejudice to its obligations vis-à-vis, the notifying authorities, the notified body shall release the content of that report, in full or in part, only with the agreement of the manufacturer.	This document	Pass
6	Where the type meets the requirements of this Directive, the notified body shall issue an EU-type examination certificate to the manufacturer. That certificate shall contain the name and address of the manufacturer, the conclusions of the examination, the conditions (if any) for its validity and the necessary data for identification of the approved type. The EU-type examination certificate may have one or more annexes attached. The EU-type examination certificate and its annexes shall contain all relevant information to allow the conformity of manufactured measuring instruments with the examined type to be evaluated and to allow for in-service control. In particular, to allow the conformity of manufactured instruments to be evaluated with the examined type regarding the reproducibility of their metrological performances, when they are properly adjusted using appropriate means, content shall include: • the metrological characteristics of the type of instrument; • measures required for ensuring the integrity of the instruments (sealing, identification of software, etc.); • information on other elements necessary for the identification of the instruments and to check their visual external		Pass

	conformity to type; • if appropriate, any specific information necessary to verify the characteristics of manufactured instruments; • in the case of a sub-assembly, all necessary information to ensure the compatibility with other sub-assemblies or measuring instruments. The EU-type examination certificate shall have a validity of 10 years from the date of its issue, and may be renewed for subsequent periods of 10 years each. Where the type does not satisfy the applicable requirements of this Directive, the notified body shall refuse to issue an EU-type examination certificate and shall inform the applicant accordingly, giving detailed reasons for its refusal.		
7	The notified body shall keep itself apprised of any changes in the generally acknowledged state of the art which indicate that the approved type may no longer comply with the applicable requirements of this Directive, and shall determine whether such changes require further investigation. If so, the notified body shall inform the manufacturer accordingly.	KEMA Labs procedures	Pass
8	The manufacturer shall inform the notified body that holds the technical documentation relating to the EU-type examination certificate of all modifications to the approved type that may affect the conformity of the instrument with the essential requirements of this Directive or the conditions for validity of that certificate Such modifications shall require additional approval in the form of an addition to the original EU-type examination certificate.	Responsibility of manufacturer	
9	Each notified body shall inform its notifying authority concerning the EU-type examination certificates and/or any additions thereto which it has issued or withdrawn, and shall, periodically or upon request, make available to its notifying authority the list of such certificates and/or any additions thereto refused, suspended or otherwise restricted. The Commission, the Member States and the other notified bodies may, on request, obtain a copy of the EU-type examination certificates and/or additions thereto. On request, the Commission and the Member States may obtain a copy of the technical documentation and the results of the examinations carried out by the notified body. The notified body shall keep a copy of the EU-type examination certificate, its annexes and additions, as well as the technical file including the documentation submitted by the manufacturer until the expiry of the validity of that certificate.	KEMA Labs procedures	Pass
10	The manufacturer shall keep a copy of the EU-type examination certificate, its annexes and additions together with the technical documentation at the disposal of the national authorities for 10 years after the instrument has been placed on the market.		Pass

Annex V, Active Electrical Energy Meters (MI-003)

1	Accuracy The manufacturer shall specify the class index of the meter. The class indices are defined as: Class A, B and C.	See chapter 3	Pass
2	Rated operating conditions	See	Pass

	The manufacturer shall specify the rated operating conditions of the meter; in particular: The values of f_n, U_n, I_n, I_{st}, I_{min}, I_{tr} and I_{max} that apply to the meter. For the current values specified, the meter shall satisfy the conditions given in Table 1 (see MID)	chapter 3	
	The voltage, frequency and power factor ranges within which the meter shall satisfy the MPE requirements are specified in Table 2. These ranges shall recognize the typical characteristics of electricity supplied by public distribution systems. The voltage and frequency ranges shall be at least: $0,9 \cdot U n \leq U \leq 1,1 \cdot U n$ $0,98 \cdot f n \leq f \leq 1,02 \cdot f n$ power factor range at least from cosφ = 0,5 inductive to cosφ = 0,8 capacitive.		Pass
3	MPEs The effects of the various measurands and influence quantities (a, b, c,…) are evaluated separately, all other measurands and influence quantities being kept relatively constant at their reference values. The error of measurement, that shall not exceed the MPE stated in Table 2, is calculated as: Error of measurement = $\sqrt{(a^2+b^2+c^2 \ldots)}$ When the meter is operating under varying-load current, the percentage errors shall not exceed the limits given in Table 2. When a meter operates in different temperature ranges the relevant MPE values shall apply. The meter shall not exploit the MPEs or systematically favour any party.	See chapter 5	Pass
4	Permissible effect of disturbances		
4.1	General As electrical energy meters are directly connected to the mains supply and as mains current is also one of the measurands, a special electromagnetic environment is used for electricity meters. EN L 96/210 Official Journal of the European Union 29.3.2014 The meter shall comply with the electromagnetic environment E2 and the additional requirements in points 4.2 and 4.3. The electromagnetic environment and permissible effects reflect the situation that there are disturbances of long duration which shall not affect the accuracy beyond the critical change values and transient disturbances, which may cause a temporary degradation or loss of function or performance but from which the meter shall recover and shall not affect the accuracy beyond the critical change values. When there is a foreseeable high risk due to lightning or where overhead supply networks are predominant, the metrological characteristics of the meter shall be protected.	See chapter 4	Pass
4.2	Effect of disturbances of long duration Reversed phase sequence Voltage unbalance (only applicable to polyphase meters) Harmonic contents in the current circuits	See chapter 4	Pass

	DC and harmonics in the current circuit Fast transient bursts Magnetic fields; HF (radiated RF) electromagnetic field; Conducted disturbances introduced by radio-frequency fields; and Oscillatory waves immunity		
4.3	Permissible effect of transient electromagnetic phenomena		
4.3.1	The effect of an electromagnetic disturbance on an electrical energy meter shall be such that during and immediately after a disturbance: • any output intended for testing the accuracy of the meter does not produce pulses or signals corresponding to an energy of more than the critical change value, • and in reasonable time after the disturbance the meter shall: • recover to operate within the MPE limits, and • have all measurement functions safeguarded, and • allow recovery of all measurement data present prior to the disturbance, and • not indicate a change in the registered energy of more than the critical change value. The critical change value in kWh is $m \cdot U_n \cdot I_{max} \cdot 10^{-6}$ (m being the number of measuring elements of the meter, U_n in Volts and I_{max} in Amps).	See chapter 4	Pass
4.3.2	For overcurrent the critical change value is 1,5 %.	See § 4.5	Pass
5	Suitability		
5.1	Below the rated operating voltage the positive error of the meter shall not exceed 10 %.		Pass
5.2	The display of the total energy shall have a sufficient number of digits to ensure that when the meter is operated for 4 000 hours at full load ($I = I_{max}$, $U = U_n$ and PF = 1) the indication does not return to its initial value and shall not be able to be reset during use.		Pass
5.3	In the event of loss of electricity in the circuit, the amounts of electrical energy measured shall remain available for reading during a period of at least 4 months.		Pass
5.4	Running with no load When the voltage is applied with no current flowing in the current circuit (current circuit shall be open circuit), the meter shall not register energy at any voltage between $0{,}8 \cdot U_n$ and $1{,}1\ U_n$.	See § 4.3.4	Pass
5.5	Starting The meter shall start and continue to register at U_n, PF = 1 (polyphase meter with balanced loads) and a current which is equal to I_{st} .	See § 4.3.3	Pass
6	Units The electrical energy measured shall be displayed in kilowatt-hours or in megawatt-hours.	See § 4.1.9	Pass

Appendix F Measurement uncertainty

Accuracy measurement and influence tests

Measurement	Measurement uncertainty
Accuracy including influence tests: Ambient temperature Continuous magnetic induction of external origin (d.c.) Magnetic induction of external origin (a.c.) Oblique suspension	0,02% divided by the power factor Stability 0,005% or better
Accuracy verification during EMC tests	0,5%
Power consumption	2,0%

EMC Emission

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

EMC immunity

Test	Measurement uncertainty
Radiated RF immunity (IEC 61000-4-20)	2,16 dB
Conducted RF immunity (IEC 61000-4-6)	2,28 dB