

# KEMA TYPE TEST REPORT OF COMPLETE TYPE TESTS

**Object** Distribution Network Automation Station Terminal **1726-24**  
**Revision 2**

**Type** Remote Control Unit (RTU) **Serial No.** 24280806  
RXN-2000 9P 3L A A 3 1 7 A 24280800  
RXN-2000 9P 3L A A 3 0 7 A

Rated input voltage 24 Vdc Ethernet ports 4  
Mechanical class 1  
Device reliability class 1  
EMC immunity location H EMC emission class A

**Manufacturer** Fanox Electronic, S.L.,  
Parque tecnológico de Bizkaia, Edificio 604, 48160 Derio, Spain \*)

**Client** Fanox Electronic, S.L.,  
Parque tecnológico de Bizkaia, Edificio 604, 48160 Derio, Spain

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

**Date of tests** July 3 to November 19, 2024

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 61850-3:2013**

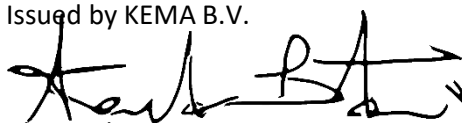
The results are shown in the record of proving tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard(s) and to justify the ratings assigned by the manufacturer as listed on page 7.

This Certificate applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.

\*) as declared by the manufacturer

This Certificate consists of 131 pages in total.

Issued by KEMA B.V.



Alessandro Bertani  
Director,  
Services & Smart Technologies

Arnhem, January 23, 2025

## **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 programmes 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 behaviour 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.

**REVISION OVERVIEW**

| Rev. No | Date of issue     | Reason for issue                                                                                                                                                                                                                                                     |
|---------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0       | November 25, 2024 | First issue                                                                                                                                                                                                                                                          |
| 1       | January 22, 2025  | <ul style="list-style-type: none"><li>• Copyright year added to foot note of front page.</li><li>• On page 81, the specified burden for A307 model, 24 Vdc, was corrected.</li><li>• On page 85, the specified burden for D11-D148 circuit, was corrected.</li></ul> |
| 2       | January 23, 2025  | <ul style="list-style-type: none"><li>• Page 21 and 22: Corrected IED#2 table to: 6x NO contacts and 2x CO contacts</li><li>• Page 86: Corrected a cell of the table to read 'Specified burden mW'</li></ul>                                                         |

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## 1 SUMMARY

By order of the client type tests according to IEC 61850-3 have been performed on the test object.

| Test / Measurement                            | Test result |
|-----------------------------------------------|-------------|
| Dimensions of structure and visual inspection | Passed      |
| Product safety                                | Passed      |
| Electromagnetic compatibility (EMC)           | Passed      |
| Burden tests                                  | Passed      |
| Climatic environmental conditions             | Passed      |
| Mechanical environmental conditions           | Passed      |
| Enclosure protection                          | Passed      |

During the testing period the following changes on the test object were made:

- change 1: the product marking

The changes on the test object have been documented in chapter 16 “Photographs of changes of the test object”.

## 2 IDENTIFICATION OF THE OBJECT TESTED

### 2.1 Ratings/characteristics of the object tested

|                                   |        |
|-----------------------------------|--------|
| Rated auxiliary voltage           | 24 Vdc |
| Output contact continuous current | < 10 W |
| Number of ethernet ports          | 4      |
| Number of optical ports           | -      |
| Maximum operating temperature     | +70 °C |
| Minimum operating temperature     | -25 °C |
| Maximum storage temperature       | +70 °C |
| Minimum storage temperature       | -25 °C |

#### Classification

|                       |                                                              |
|-----------------------|--------------------------------------------------------------|
| IP-class              | IP20 front, sides, top and bottom                            |
| Mechanical class      | 1                                                            |
| EMC emission class    | B                                                            |
| Reliability class     | 1                                                            |
| EMC immunity location | High-voltage (HV) substations Power supply (+, -, Earth)     |
| Signal connections    | Field connections RS232 or RS485                             |
|                       | Connections to HV equipment Digital inputs and Relay outputs |
|                       | Telecommunication Ethernets (RJ45) ports                     |
| Over voltage category | III                                                          |
| Pollution degree      | 2                                                            |
| Insulation type       | Basic/functional                                             |

## 2.2 Description of the object tested

|              |                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------|
| Manufacturer | Fanox Electronic, S.L.,<br>Parque tecnológico de Bizkaia, Edificio 604,<br>48160 Derio, Spain |
| Type         | Remote Control Unit (RTU)<br>RNX-2000 9P 3L A A 3 1 7 A<br>RNX-2000 9P 3L A A 3 0 7 A         |
| Object       | Unless otherwise specified, the default settings of the manufacturer were used.               |

### Test objects list

| IED | Module                        | Serial No.      | Hardware Version | CPU/Software Version                                        | Web/Dashboard Version |
|-----|-------------------------------|-----------------|------------------|-------------------------------------------------------------|-----------------------|
| 1   | RNX-2000 9P<br>3L A A 3 1 7 A | 24280806        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 2   | RNX-2000 9P<br>3L A A 3 1 7 A | 24280807        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 3   | RNX-2000 9P<br>3L A A 3 1 7 A | 24280808        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 4   | RNX-2000 9P<br>3L A A 3 1 7 A | 24280809        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 5   | RNX-2000 9P<br>3L A A 3 1 7 A | 24290000<br>(*) | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 6   | RNX-2000 9P<br>3L A A 3 1 7 A | 24290001        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |

| IED | Module                        | Serial No.      | Hardware Version | Software Version                                            | Web/Dashboard Version |
|-----|-------------------------------|-----------------|------------------|-------------------------------------------------------------|-----------------------|
| 1   | RNX-2000 9P<br>3L A A 3 0 7 A | 24280800        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 2   | RNX-2000 9P<br>3L A A 3 0 7 A | 24280801        | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |
| 3   | RNX-2000 9P<br>3L A A 3 0 7 A | 24280802<br>(*) | R1.03            | OS v0.4.22.0002 / RT 0.3.8 / IO 1.0.3 / II 1.0.3 / IV 1.0.3 | v0.4.22.0002          |

### Note

(\*) The samples were tested without transient suppressors for the dielectric tests.

### PCB modules list

| PCB modules        | Description                     | Revision | Date     |
|--------------------|---------------------------------|----------|----------|
| Bus253             | Back panel                      | 1.03     | 24-05-06 |
| CPU                | CPU and communications          | 1.03     | 24-05-07 |
| Fountain           | Power supply                    | 1.02     | 24-05-06 |
| Inputs             | Binary or Ditung input          | 1.01     | 23-04-12 |
| MeasurementS2dsPIC | Current and voltage measurement | 1.02     | 23-10-26 |
| Outputs            | Relay outputs                   | 1.01     | 23-04-13 |
| Outputs 16         | Relay outputs 16                | 1.01     | 23-04-13 |

## 2.3 List of cables

Power input (power supplies) cable

- Type unshielded
- Length 0,1/ 1/ 2 m

Ethernet cable (RJ45)

- Type shielded CAT 6
- Length 0,1/ 1/ 20 m

Analog and Digital I/O cables

- Type unshielded
- Length 0,1/ 1/ 2 m

RS-232/RS-485 cables

- Type unshielded
- Length 0,1/ 1/ 2/ 10 m

## 2.4 List of drawings

According to the client the following drawings and/or documents numbers refer to the tested object. KEMA Labs has not verified these drawings and/or documents.

| Drawing no./document no.        | Revision | Date     |
|---------------------------------|----------|----------|
| User's manual                   | 0.003    | N.A.     |
| Back panel                      | 1.03     | 24-05-06 |
| CPU and communications          | 1.03     | 24-05-07 |
| Power supply                    | 1.02     | 24-05-06 |
| Binary or Dtitag input          | 1.01     | 23-04-12 |
| Current and voltage measurement | 1.02     | 23-10-26 |
| Relay outputs                   | 1.01     | 23-04-13 |
| Relay outputs 16                | 1.01     | 23-04-13 |

## 2.5 Photographs of test object



Left side: RXN-2000 9P 3L A A 3 1 7 A (16 outputs (15 x NO contacts and 1 x NC contact))

Right side: RXN-2000 9P 3L A A 3 0 7 A (8 outputs (6 x NO contacts and 2 x CO contact))



The product overview includes product marking.

### 3 GENERAL INFORMATION

#### 3.1 The tests were witnessed by

**Name**

Jira Chareonpak-Verkerk  
Frank Nouwens

**Company**

KEMA B.V.  
Arnhem, The Netherlands

#### 3.2 Subcontracting

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

- Measurement of radiated emission in accordance with IEC 61850-3 and CISPR22.
- Radiated, radio-frequency electromagnetic field immunity test in accordance with IEC 61850-3 and IEC 61000-4-3.

The following tests were subcontracted to Sebert Trillingstechniek B.V., Bergschenhoek, the Netherlands:

- Vibration response and endurance test in accordance with IEC 60255-21-1.
- Shock response and withstand test in accordance with IEC 60255-21-2.
- Bump test in accordance with IEC 60255-21-2.
- Seismic test in accordance with IEC 60255-21-3.

#### 3.3 Purpose of the tests

Purpose of the tests was to verify whether the material complies with the specified requirements.

#### 3.4 Measurement uncertainty

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

#### 3.5 Laboratory environmental conditions

Tests have been performed in a controlled laboratory environment, where the environmental conditions are maintained within the applicable ranges.

|                      |                                          |
|----------------------|------------------------------------------|
| Ambient temperature  | 15 °C to 25 °C                           |
| Relative Humidity    | 45% to 75%                               |
| Atmospheric pressure | 86 kPa (860 mbar) to 106 kPa (1060 mbar) |

When a condition has direct influence on a test, the value of the condition will be presented explicitly.

### 3.6 Instruments used

A detailed list with instruments used is enclosed in this Certificate.

### 3.7 Standards

The product standard IEC 61850-3 (2013-12) 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.

### 3.8 Acceptance criteria

According to IEC 61850-3 subclause 7.5.

#### General

The equipment shall be considered to have passed the tests if, during, or because of, the tests, all the conditions listed below are met for the reliability class of the device.

#### Conditions to be met by class 1 and class 2 devices

- No hardware damage occurs.
- No loss or corruption of stored memory or data, including active or stored settings, occurs.
- Device resets do not occur, and manual resetting is not required.
- No changes in the states of the electrical, mechanical, or communication status outputs occur. This includes alarms, status outputs, or targets.
- No erroneous, permanent change of state of the visual, audio, or message outputs results.
- Momentary changes of these outputs during the tests are permitted.
- During the tests, SCADA analog values shall not change by more than 2% of full-scale values. After the test, accuracy shall revert to the manufacturer-claimed accuracy.

#### Additional condition to be met by class 1 devices

Established communications and operation may be disrupted or sustain errors during the period of the tests. If disrupted, the communications recover within the manufacturer's specified time period.

#### Additional condition to be met by class 2 devices

Established communications and operation shall NOT be disrupted or experience errors during the period the tests are applied.

## 4 TEST ARRANGEMENT

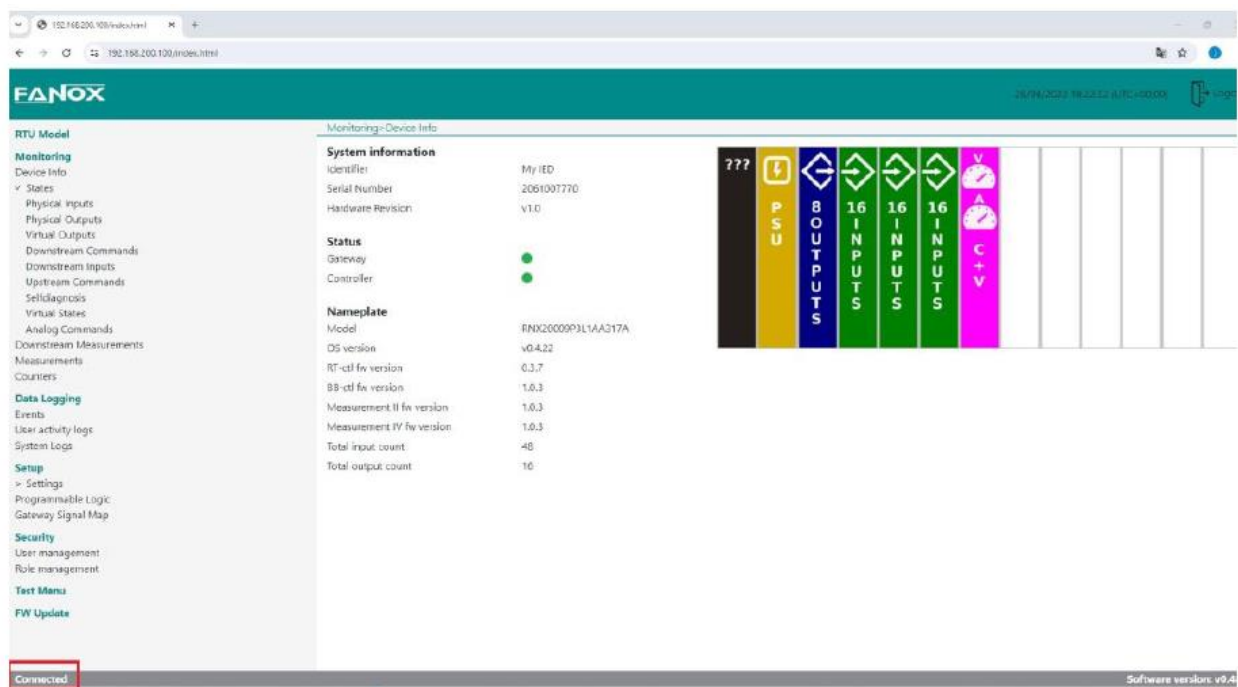
An RTU (Remote Terminal Unit) is a device designed for supervisory control and data acquisition (SCADA) over a remote site. It operates setup software to link data inputs to outputs and supports communication protocols for connecting multiple entities within a data communication transmission system.

| IP address      | Terminal  | Access to viewer website | Ping command protocol test | VINCI protocol 3.1.0.171 test |
|-----------------|-----------|--------------------------|----------------------------|-------------------------------|
| 192.168.200.100 | ETH Local | Yes                      | Yes                        | Yes                           |
| 192.168.201.100 | ETH LAN   | No                       | Yes                        | Yes                           |
| 192.168.202.100 | ETH WAN1  | No                       | Yes                        | Yes                           |
| 192.168.203.100 | ETH WAN2  | No                       | Yes                        | Yes                           |

### Ethernet port and communication testing:

The lower-left side indicates that the device is in normal communication, showing "connected" with the website.

### Navigator website

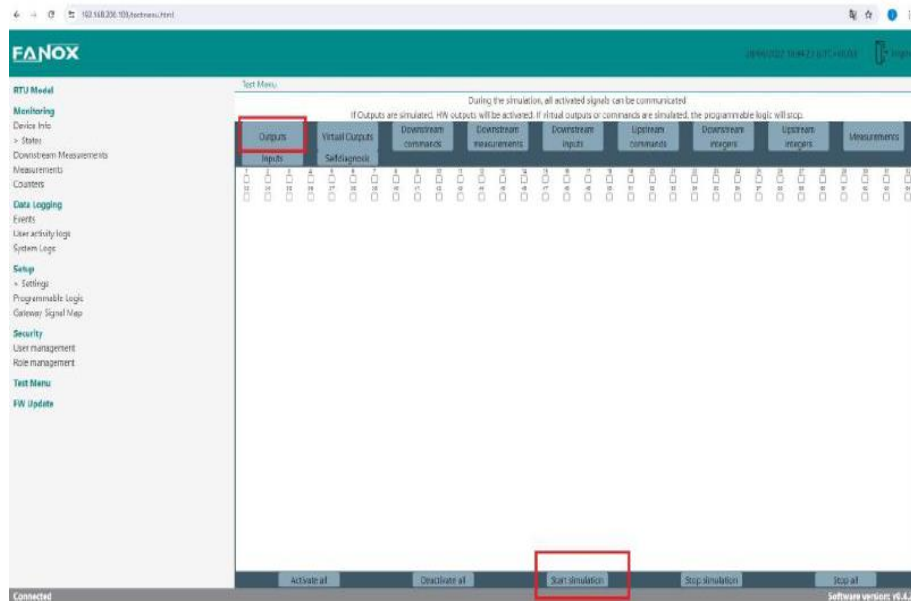


### Note

During the test, the functionality of the protocols was monitored using the VINCI software.

## Relay output testing:

Since it is not possible to program logic directly into the device, the process outputs are activated by clicking the simulation button. This enables us to verify the signal activities on the website and subsequently observe the LED activation at the output, indicating that the relay is switching to close the circuit.

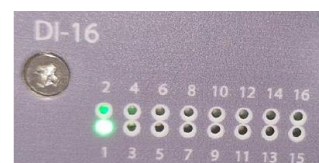
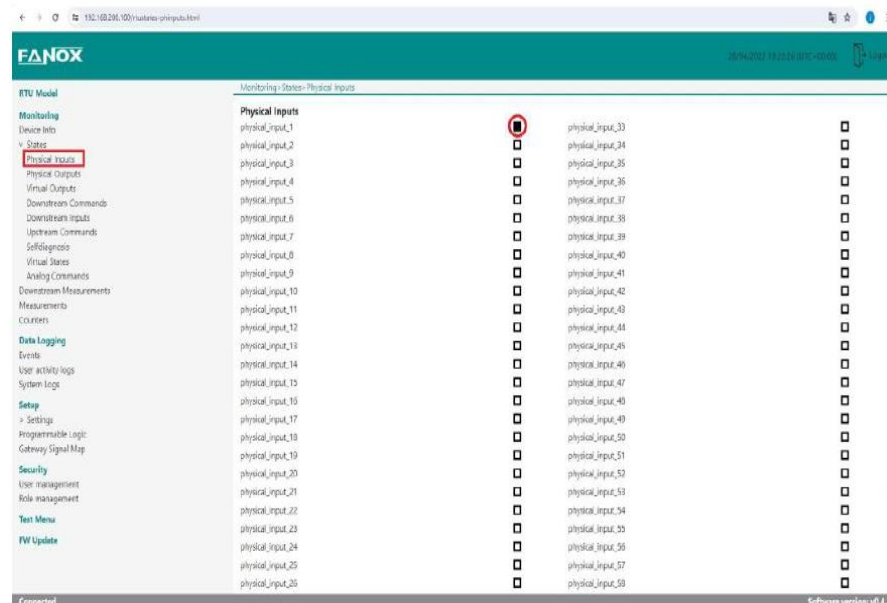


## Note

The relay output switches to close, activating LED output 1, which turns on.

## Digital inputs testing

During the tests, when a voltage of 24–48 VDC is directly applied to each terminal, the active status is indicated by the corresponding LED turning on. This status can also be monitored via the website.



## Note

The digital input activates at 24-48VDC, triggering LED output 1 to turn on.

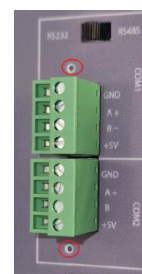
## RS232/RS485 Testing:

To confirm proper functionality, verify these messages in the source column.

VINCI: The RTU port is responding, this confirms the RTU is active.

RX: This message shows the simulator's query, ensuring data transmission.

| Time         | Source | Message | Save | Function | Start | Number | Value | RawData             |
|--------------|--------|---------|------|----------|-------|--------|-------|---------------------|
| 12:44:17:588 | VINCI  | 5       | 3    |          |       |        | 00 00 | 05 03 02 00 00 4... |
| 12:44:18:000 | RX     | 5       | 3    | 512      |       | 1      |       | 05 03 02 00 00 0... |
| 12:44:18:000 | VINCI  | 5       | 3    |          |       |        | 00 00 | 05 03 02 00 00 4... |
| 12:44:18:011 | RX     | 5       | 3    | 522      |       | 1      |       | 05 03 02 0A 00 0... |
| 12:44:18:012 | VINCI  | 5       | 3    |          |       |        | 00 00 | 05 03 02 00 00 4... |
| 12:44:18:024 | RX     | 5       | 3    | 500      |       | 1      |       | 05 03 01 F4 00 0... |
| 12:44:18:024 | VINCI  | 5       | 3    |          |       |        | 00 00 | 05 03 02 00 00 4... |
| 12:44:18:035 | RX     | 5       | 3    | 512      |       | 1      |       | 05 03 02 00 00 0... |



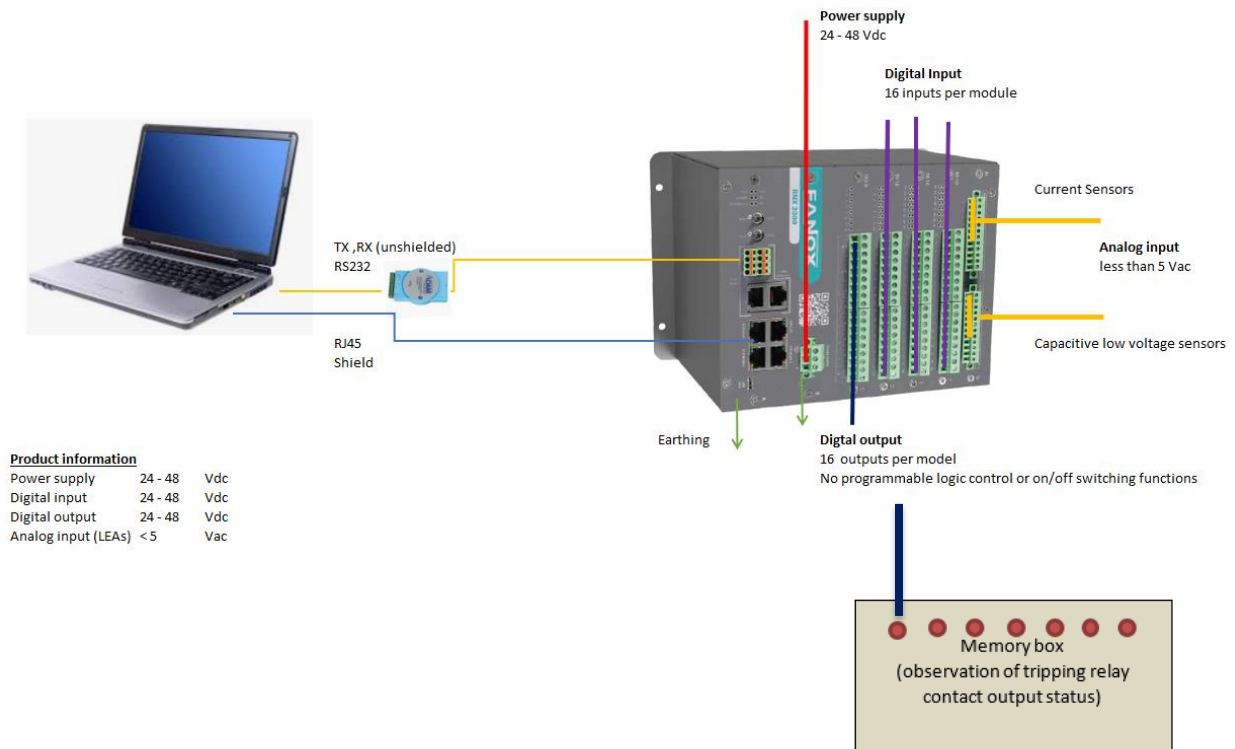
### Note

- The manufacturer informed us that the three wires that need to be tested and monitored are TXD, RXD, and GND (RS232).
- Once the connection is established, the testing procedure is the same as that used for testing the RS-485 ports.

## 4.1 Description of the types and characteristics of interface cables

| Interface               | Terminals                                 | Type       |
|-------------------------|-------------------------------------------|------------|
| Power supply input port | +, -, and PE                              | Unshielded |
| Analog inputs           | VTs and CTs                               | Unshielded |
| Input/Output            | Digital Inputs and Relay outputs          | Unshielded |
| Signal port             | RS232 and RS485                           | Unshielded |
| Ethernet Port (RJ45)    | ETH Local, ETH LAN, ETH WAN1 and ETH WAN2 | Shielded   |

## 4.2 Test diagram setup during EMC testing and monitoring



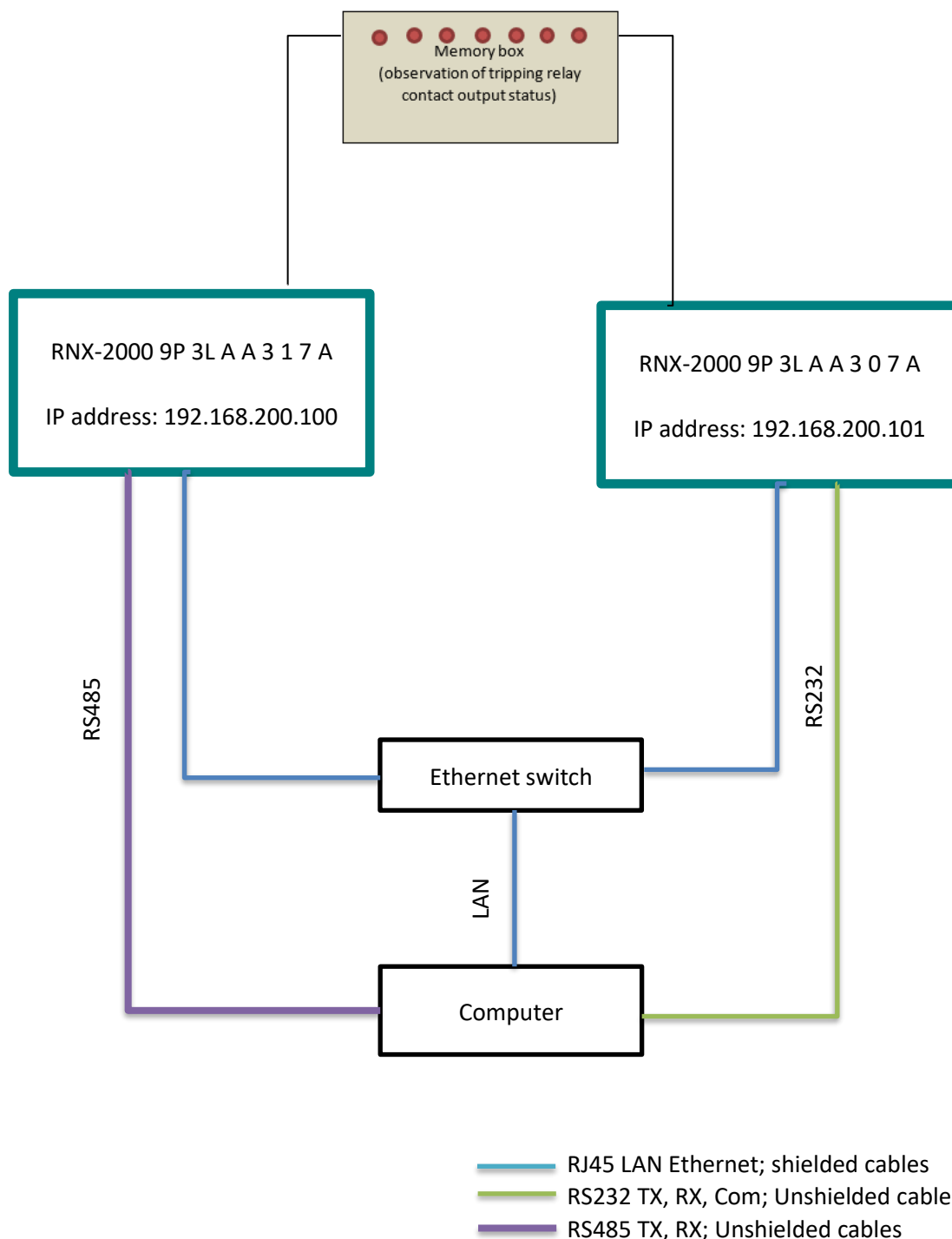
The test object (EUT) has been configured to operate as in normal use.

| Port                            | Terminal              | Energizing and Signal monitoring                                                                                                           |
|---------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Auxiliary power supply input    | +, -, and Earth       | 24 Vdc                                                                                                                                     |
| Analog inputs                   | CTs (IA, IB, IC)      | 3 Vac which corresponds with current 300A on viewer website.                                                                               |
|                                 | VTs (VA, VB, VC)      | 3Vac which corresponds with voltage 15kV on viewer website.                                                                                |
| Digital input / output ports    | DI and relay outputs  | The threshold level is 24 - 48 Vdc and No programable logic control to relay output                                                        |
| Process bus communication ports | Ethernet ports (RJ45) | Protocol test have been conducted using the ping command and Vinci software.                                                               |
| RS-485/ RS232                   | TX, RX/ TX, RX, GND   | Vinci software                                                                                                                             |
| Alarm Contact                   | NC, COM, NO           | The memory box detects changes in contact status. For a Normally Open contact, the alarm status only updates when the device is rebooted." |

### 4.3 Test diagram setup for climate and mechanical tests

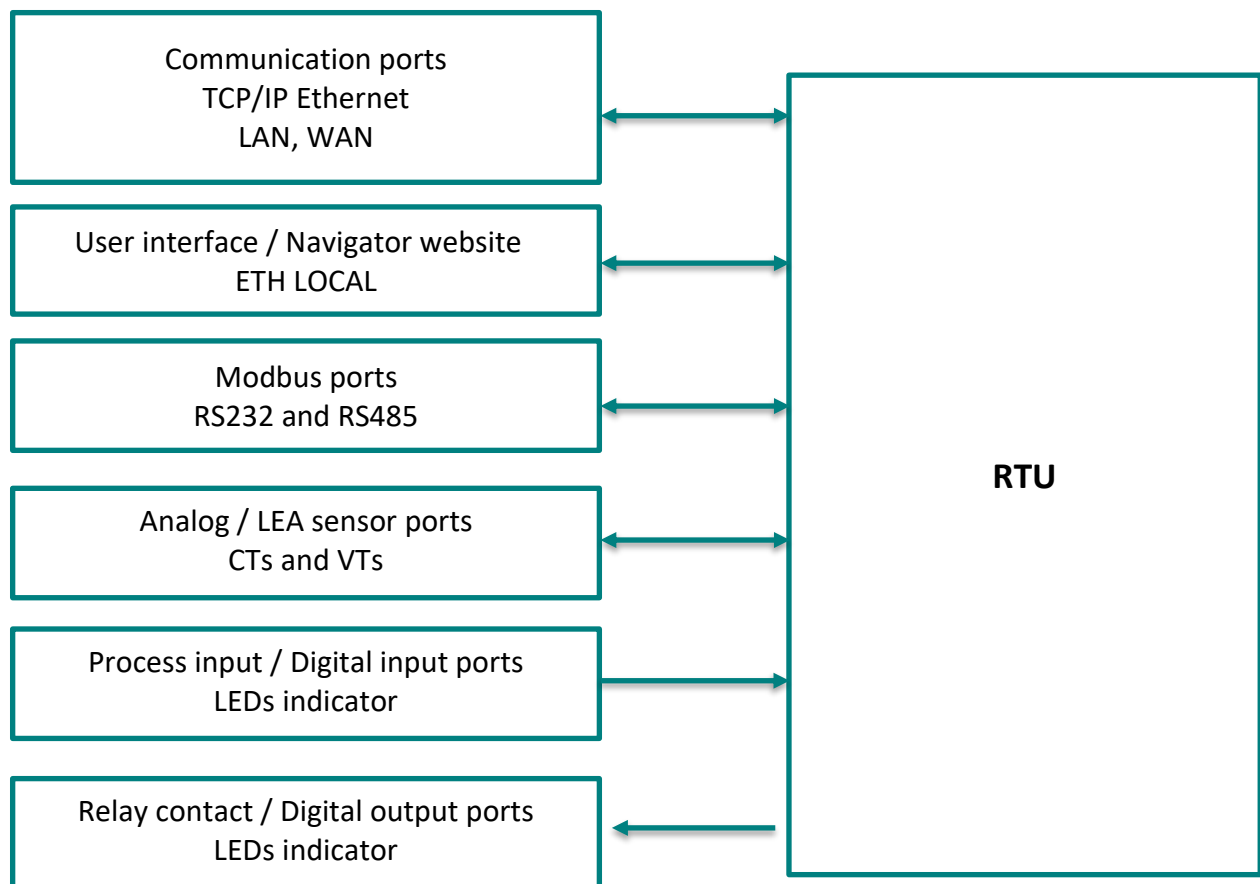
Monitor and observe the analog input values before and after testing via the Navigator website. Any communication loss during the protocol network test, as well as RS232 and RS485 signal communication, is tracked using Vinci software.

If the devices are restarted, the alarm relay will switch to a closed circuit. The memory box will detect this, and the LED will turn on with a red alarm indicator.



#### 4.4 Functional diagram

The RTU (Remote Terminal Unit) is a device used in industrial control systems to monitor and control remote equipment, typically in settings such as power generation, transmission, and distribution systems. The RTUs collect data from sensors or meters (such as voltage, current, and temperature readings) and transmit it back to a central control system. The RTU are commonly used in Medium Voltage (MV) and High Voltage (HV) substations and power networks.



#### Note

The visualization website allows monitoring of values during the test, but it does not support programming or configuring logic during the test.

## 5 RISK ASSESSMENT

Clause 7.6 in IEC 61850-1 describes that testing a product which is part of a product family shall be considered sufficient to cover the entire product family provided a documented risk assessment is carried out to determine which type tests are valid and which tests need to be repeated on the rest of the product family.

A risk assessment is performed for the following line protection IED's and modules:

| Test                                                   | IED#1                             | IED#2                             | Remarks |
|--------------------------------------------------------|-----------------------------------|-----------------------------------|---------|
|                                                        | RNX-2000 9P 3L 1 A A 3 1 7 A      | RNX-2000 9P 3L 1 A A 3 0 7 A      |         |
|                                                        | 16 outputs                        | 8 outputs                         |         |
|                                                        | 15x NO contacts and 1x NC contact | 6x NO contacts and 2x CO contacts |         |
| <b>1 Dimensions of structure and visual inspection</b> |                                   |                                   |         |
| • Markings                                             | X                                 | -                                 |         |
| • Documentation                                        | X                                 | -                                 |         |
| • Packaging                                            | X                                 | -                                 |         |
| • Dimensions                                           | X                                 | -                                 |         |
| <b>2 Product safety</b>                                |                                   |                                   |         |
| • Clearance and creepage                               | X                                 | X <sup>*1</sup>                   |         |
| • Accessible parts                                     | X                                 | X <sup>*1</sup>                   |         |
| • IP rating (IP20)                                     | X                                 | X <sup>*1</sup>                   |         |
| • Impulse voltage                                      | X                                 | X <sup>*1</sup>                   |         |
| • Dielectric voltage                                   | X                                 | X <sup>*1</sup>                   |         |
| • Insulation resistance                                | X                                 | X <sup>*1</sup>                   |         |
| • Protective bonding                                   | X                                 | -                                 |         |
| • Flammability                                         | X                                 | X <sup>*1</sup>                   |         |
| • Single fault                                         | X                                 | -                                 |         |

### Remark

\*1 On the output board only.

\*2 In parallel

### Legend

X = Test need to be repeated.

V = Valid for specific product IED

– = Not applicable for this module.

| Test                                         | IED#1                               | IED#2                               | Remarks |
|----------------------------------------------|-------------------------------------|-------------------------------------|---------|
|                                              | <b>RNX-2000 9P 3L 1 A A 3 1 7 A</b> | <b>RNX-2000 9P 3L 1 A A 3 0 7 A</b> |         |
|                                              | 16 outputs,                         | 8 outputs                           |         |
|                                              | 15x NO contacts and 1x NC contact   | 6x NO contacts and 2x CO contacts   |         |
| <b>3 EMC emission tests</b>                  |                                     |                                     |         |
| • Radiated emission                          | X*                                  | -                                   |         |
| • Conducted emission                         | X                                   | -                                   |         |
| <b>3 EMC immunity tests</b>                  |                                     |                                     |         |
| • Damped oscillatory wave (1 MHz)            | X                                   | -                                   |         |
| • Electrostatic discharge                    | X                                   | -                                   |         |
| • Radiated, radio-frequency magnetic field   | X*                                  | -                                   |         |
| • Fast transient/burst                       | X                                   | -                                   |         |
| • Surge                                      | X                                   | -                                   |         |
| • Conducted disturbance, induced by RF field | X                                   | -                                   |         |
| • Main frequency voltage                     | X                                   | -                                   |         |
| • Power frequency magnetic field             | X                                   | -                                   |         |
| • DC dips, interruptions                     | X                                   | X                                   |         |
| • Ripple                                     | X                                   | X                                   |         |
| • AC dips and interruptions                  | N.A.                                | N.A.                                |         |
| <b>4 Energizing quantities</b>               |                                     |                                     |         |
| • DC Burden & inrush current PSU             | X                                   | X                                   |         |
| • AC Burden & inrush current PSU             | N.A.                                | N.A.                                |         |
| • Burden binary input                        | X                                   | -                                   |         |
| <b>5 Climatic tests</b>                      |                                     |                                     |         |
| • Cold operation (-25 °C)                    | X                                   | X*2                                 |         |
| • Dry heat operation (+70 °C)                | X                                   | X*2                                 |         |
| • Cold storage (-25 °C)                      | X                                   | X*2                                 |         |
| • Dry heat storage (+70 °C) -> retest        | X                                   | X*2                                 |         |
| • Change of temperature (-25 °C to +70 °C)   | X                                   | X*2                                 |         |
| • Damp heat steady (+40 °C, 93%)             | X                                   | X*2                                 |         |
| • Damp heat cyclic (+25 °C, 55 °C (outdoor)) | X                                   | X*2                                 |         |
| <b>6 Mechanical tests</b>                    |                                     |                                     |         |
| • Vibration                                  | X                                   | X*2                                 |         |
| • Shock                                      | X                                   | X*2                                 |         |
| • Bump                                       | X                                   | X*2                                 |         |
| • Seismic                                    | X                                   | X*2                                 |         |

## 6 MARKING AND DOCUMENTATION

### Standard and date

Standard IEC 61850-3, subclause 6.1 and 6.2  
Test date October 16, 2024

### Characteristic test data

|               |                          |                            |
|---------------|--------------------------|----------------------------|
| Serial number | 24290000                 | RNX-2000 9P 3L A A 3 1 7 A |
| Documentation | RNX 2000 RTU user manual | Rev. 003                   |

### Requirement

- the markings on the test object shall comply with the requirements of IEC 61850-3, subclause 6.1
- the documentation of the test object shall comply with the requirements of IEC 61850-3, subclause 6.2.

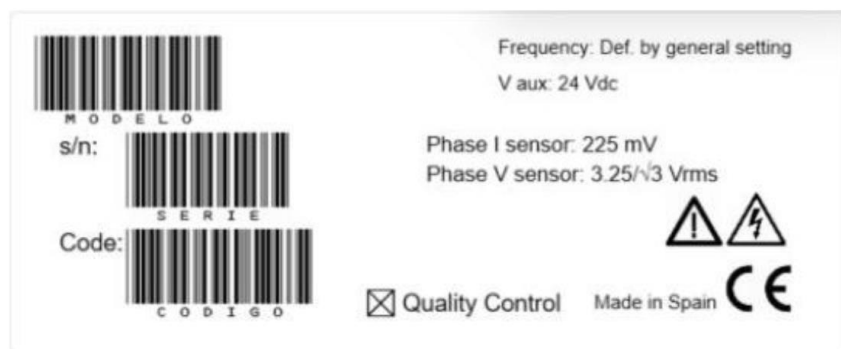
### Result

The provided documentation meets the marking and documentation requirements.

### Photograph of test labels



S/N 24280808 (old label)



Replacement with the new product label.

Photograph of documentation (User's manual)



## 7 PACKAGING

### Standard and date

Standard IEC 61850-3, subclause 6.3

Test date July 3, 2024

### Requirement

The manufacturer shall ensure that the equipment is suitably packaged to withstand, without damage, reasonable handling and environmental conditions appropriate to the method(s) of transportation to the user's delivery address.

A visual inspection should be made by the user to check that the equipment has not been damaged during transportation.

### Result

- The packaging meets the packaging requirements.
- No visual damage to the packaging and the equipment has been observed.

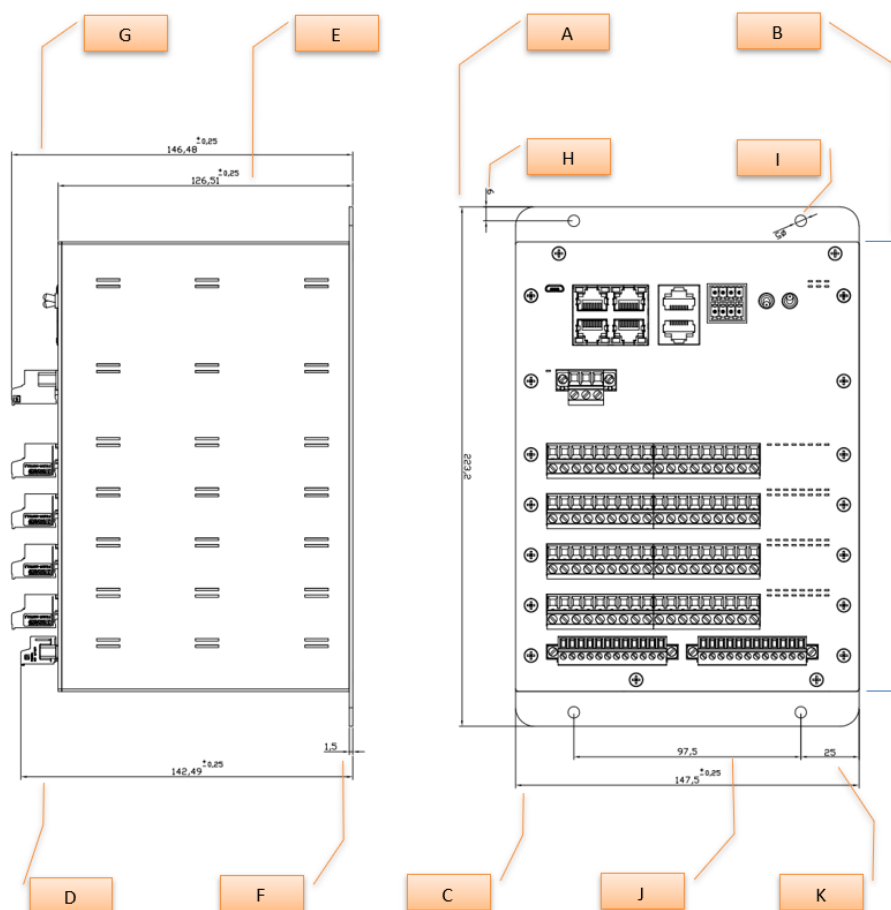
### Photograph of test object



## 8 DIMENSIONS OF STRUCTURE

### Standard and date

Standard IEC 61850-3, subclause 6.4  
 Serial number 42490001  
 Test date July 23, 2024



| Item   | Unit | Measured | Specified by the client |
|--------|------|----------|-------------------------|
| Side A | mm   | 223,26   | $223,2 \pm 0,25$        |
| Side B | mm   | 193,30   | $193,2 \pm 0,25$        |
| Side C | mm   | 147,50   | $147,5 \pm 0,25$        |
| Side D | mm   | 142,57   | $142,55 \pm 0,25$       |
| Side E | mm   | 126,80   | $127 \pm 0,25$          |
| Side F | mm   | 1,49     | $1,5 \pm 0,25$          |
| Side G | mm   | 146,48   | $146,48 \pm 0,25$       |
| Side H | mm   | 6,05     | $6 \pm 0,25$            |
| Side I | mm   | 5,00     | $5 \pm 0,25$            |
| Side K | mm   | 97,55    | $97,5 \pm 0,25$         |

### Observations

The measured dimensions were within the specified dimensions.

### Result

The object passed the test.

## **9 PRODUCT SAFETY**

### **9.1 Inspection**

#### **9.1.1 Pre-inspection**

The pre-inspection is performed to verify that the test object is in operating state. The pre-inspection is carried out previous to the test procedure.

The communication with the maintenance computer is verified. Signals are simulated to verify the functioning and operation with the specified performance specification for the following inputs and outputs:

- analogue inputs
- digital inputs
- contact outputs
- data communication ports

#### **9.1.2 Visual and functional inspection**

After each test a visual and functional inspection is carried out as described in this chapter.

The visual inspection is carried out to verify that there is no visual mechanical damage.

There shall be no:

- burning of any components
- paint blisters on any components
- discolouration on components
- deformation of modules or components
- interruptions or damage on interconnecting cables, wires and connectors

Functional inspection is carried out to verify the correct operation of the test object.

There shall be no:

- alarm indications on display and LED's
- error messages reported in the maintenance computer
- unintentional change of contact outputs
- there shall be no degradation of performance below the claimed performance according reliability class (1 or 2)

Unless otherwise stated the visual and functional inspection was carried out successfully after each test.

## 9.2 Clearances and creepage distances

### Standard and date

Standard IEC 61850-3, subclause 6.6.1  
Test date November 12, 2024

### Characteristic test data

Serial number 24290000  
24280802  
PCB Coating No  
Overvoltage category III  
Pollution degree 2

| Position | Measurement between                           | PCB-ID            | Rated insulation voltage or working voltage V | Creepage distance Required mm | Measured mm |
|----------|-----------------------------------------------|-------------------|-----------------------------------------------|-------------------------------|-------------|
| A        | Input lines + - and lines ~PE                 | Fuente r1.02      | 0 - 50                                        | 0,04                          | 1,87        |
| B        | Line PowerLED to PE                           | Fuente r1.02      | 0 - 50                                        | 0,04                          | 0,53        |
| C        | Transformer primary to PE                     | Fuente r1.02      | 100 - 150                                     | 0,36                          | 0,55        |
| D        | Transformer secondary to PE                   | Fuente r1.02      | 0 - 50                                        | 0,04                          | 0,41        |
| E        | Smallest distance between relay contact lines | OutputS 16 r.01   | 0 - 50                                        | 0,04                          | 1,48        |
| F        | Smallest distance between relay contact lines | OutputS r.01 8ch. | 0 - 50                                        | 0,04                          | 2,83        |
| G        | Smallest distance between relay contact lines | OutputS r.01 8ch. | 0 - 50                                        | 0,04                          | 0,16        |

| Position | Measurement between | PCB-ID            | Rated insulation voltage or working voltage V | Clearance Required mm | Measured mm |
|----------|---------------------|-------------------|-----------------------------------------------|-----------------------|-------------|
| H        | Closest clearance   | OutputS r.01 8ch. | 150 - 300                                     | 3,00                  | ≥4,50       |

### Requirement

The required creepage and clearance distances specified above are valid for functional, basic or supplementary insulation.

### Result

The object passed the test.

## Photograph of test point position

Drawing no.

Fuente r1.02

OutputS16 r.01

OutputS r.01 8ch.

PCB name

Power supply PCB

Digital output 8 O/P

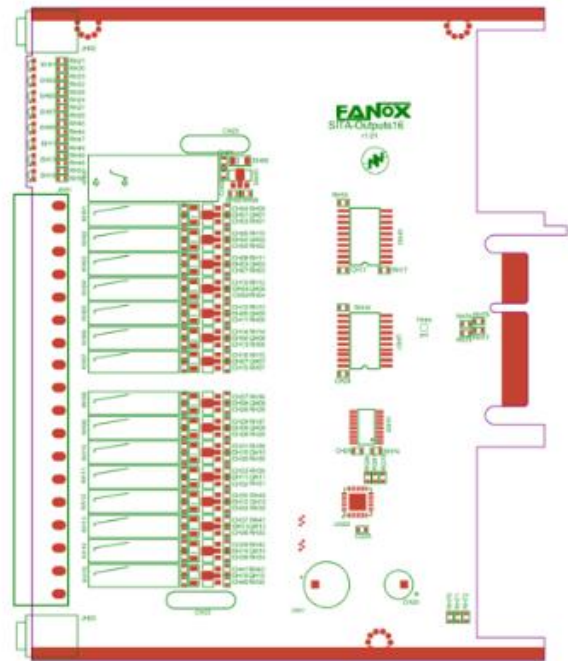
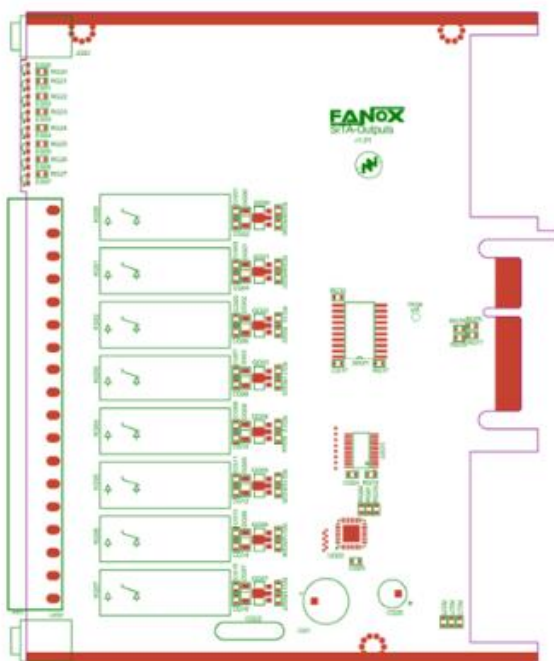
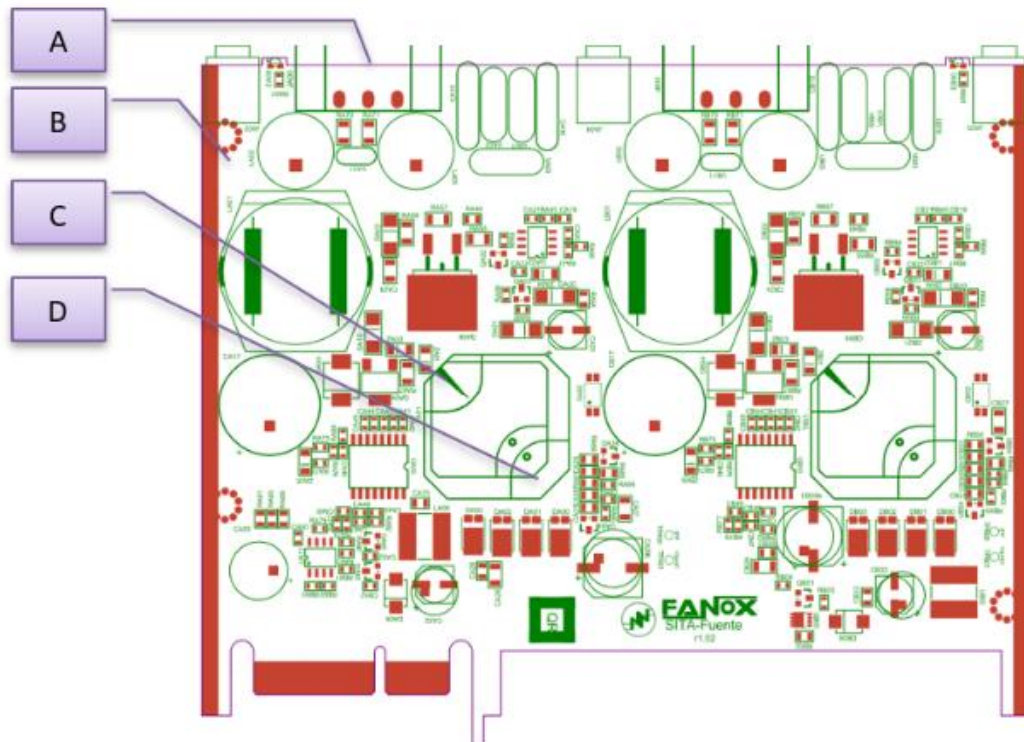
Digital output 16 O/P

PCB layout

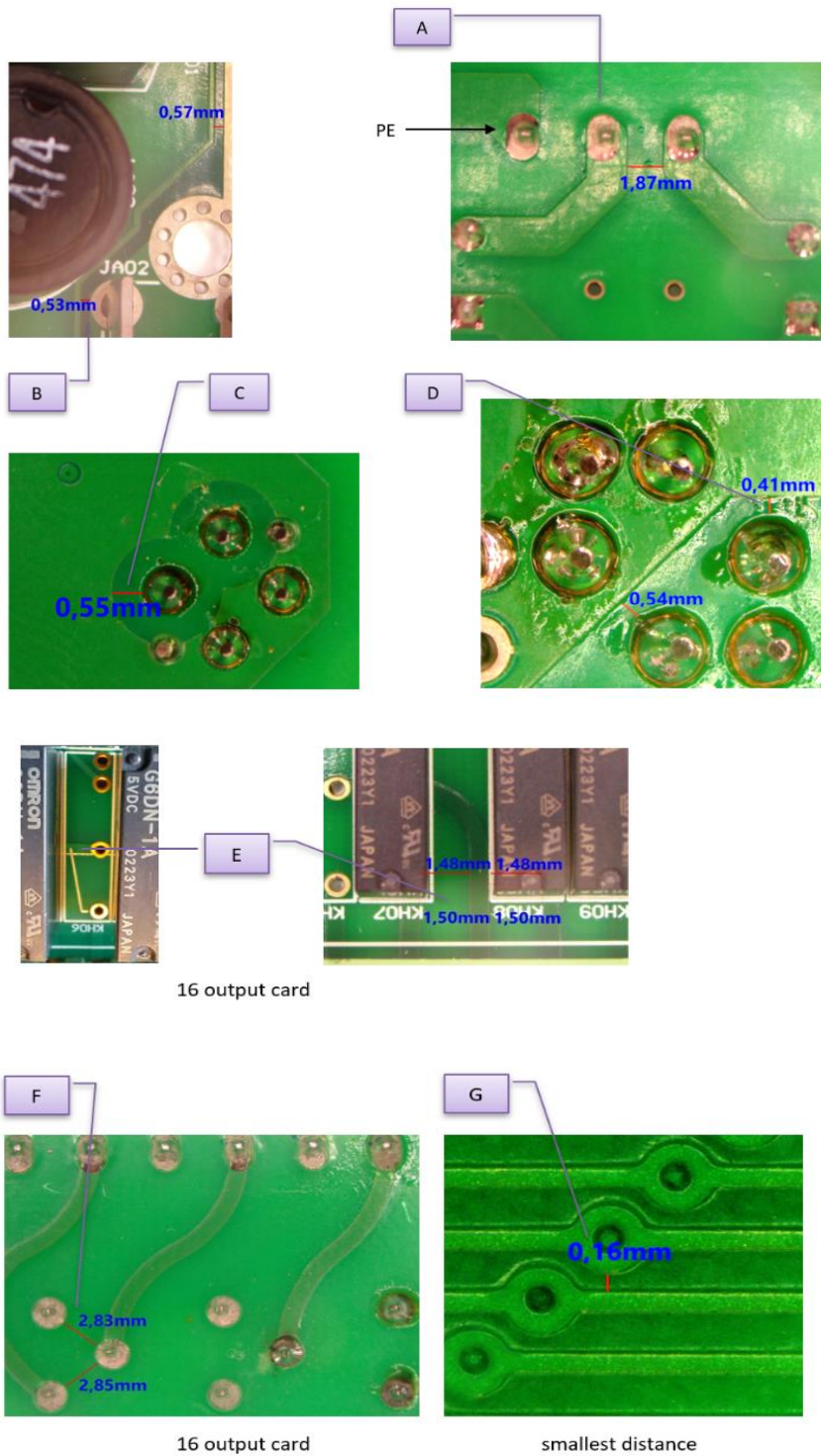
Top

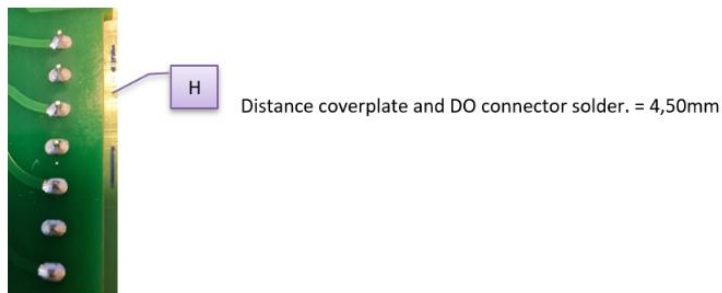
Bottom, right

Bottom, left



**Photograph of test arrangement**





### 9.3 IP rating test

#### Standard and date

Standard IEC 61850-3, subclause 6.6.2  
 Basic standard IEC 60529  
 Test date October 30, 2024

#### Characteristic test data

Serial number 24290000 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280802 RNX-2000 9P 3L 1 A A 3 0 7 A

| Terminal side<br><b>RNX-2000 9P 3L 1 A A 3 1 7 A</b>                                                                                                           | Degree of protection              |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------|
|                                                                                                                                                                | Specification by the manufacturer | Observation |
| Front                                                                                                                                                          | IP 2X                             | IP 2X       |
| Top                                                                                                                                                            | IP 2X                             | IP 2X       |
| Bottom                                                                                                                                                         | IP 2X                             | IP 2X       |
| Back <ul style="list-style-type: none"> <li>Analog inputs</li> <li>Digital inputs</li> <li>Digital outputs</li> <li>RJ45 ports</li> <li>RS485/RS232</li> </ul> | IP 2X                             | IP 2X       |
| Left                                                                                                                                                           | IP 2X                             | IP 2X       |
| Right                                                                                                                                                          | IP 2X                             | IP 2X       |

| Terminal side<br><b>RNX-2000 9P 3L 1 A A 3 0 7 A</b>                   | Degree of protection              |             |
|------------------------------------------------------------------------|-----------------------------------|-------------|
|                                                                        | Specification by the manufacturer | Observation |
| Back <ul style="list-style-type: none"> <li>Digital outputs</li> </ul> | IP 2X                             | IP 2X       |

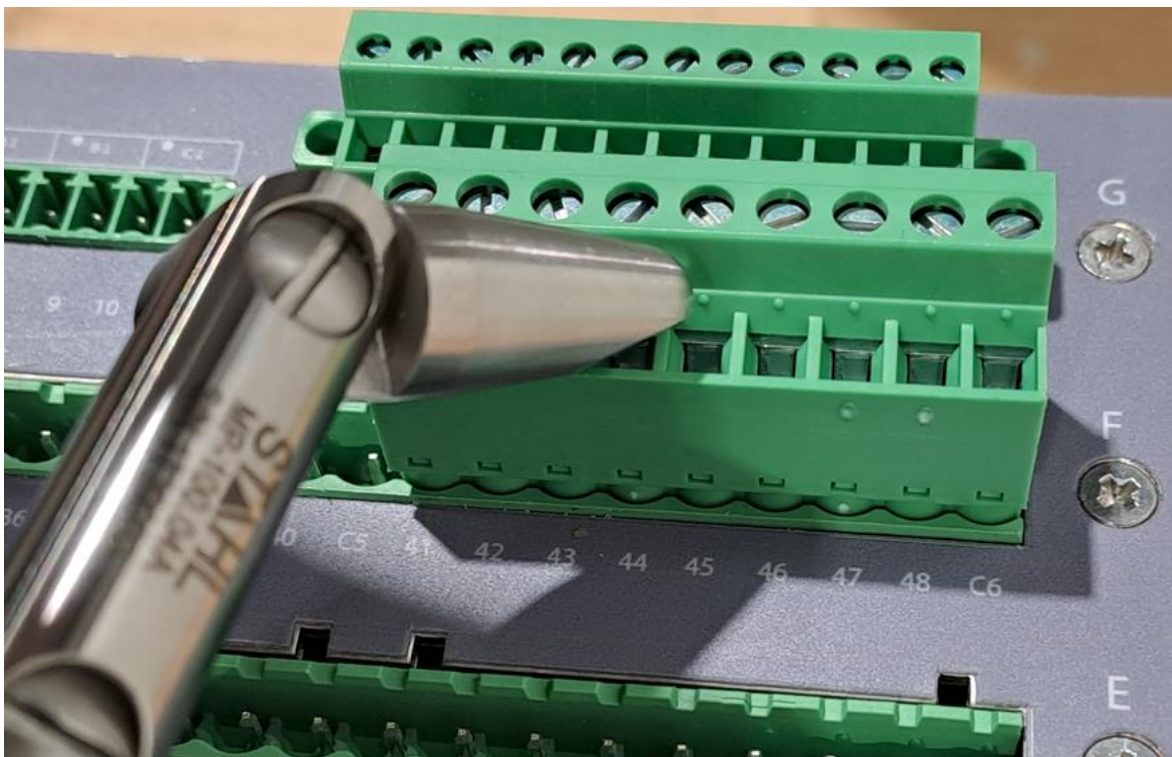
#### Requirement

- the test finger shall not touch hazardous live parts
- the test finger IP2X voltage or energy shall not exceed the safe limits for normal operational use
- no visual or functional inspection required.

#### Result

The object passed the test.

**Photograph of test arrangement**



IP-2x test on all terminal connectors and RJ45 ports

## 9.4 Impulse voltage test

### Standard and date

Standard IEC 61850-3, subclause 6.6.3

Test date October 25, 2024

### Environmental conditions

Ambient temperature 23 °C Relative humidity 50 %  
Ambient air pressure 1023 hPa

### Characteristic test data

Serial number 24280206 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280800 RNX-2000 9P 3L 1 A A 3 0 7 A

Time to rise-value 1,2  $\mu$ s ( $\pm$  30%)  
Time to half-value 50  $\mu$ s ( $\pm$  20%)  
Source impedance 500  $\Omega$  ( $\pm$  10%)  
Insulation resistance > 0,55 G $\Omega$   
Output energy 0,5 J ( $\pm$  10%)  
Pulse interval  $\geq$  1 s

| Test arrangement                                          | Voltage applied | No. of impulses | Polarity | Observations |
|-----------------------------------------------------------|-----------------|-----------------|----------|--------------|
| Voltage applied to<br><b>RNX-2000 9P 3L 1 A A 3 1 7 A</b> | kV              |                 |          |              |
| Analog inputs 1-12 and 13-24                              | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital inputs 33-40                                      | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital inputs 41-48                                      | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital inputs 17-24                                      | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital inputs 25-32                                      | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital inputs 31-16                                      | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital inputs 1-15                                       | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital outputs 1-8                                       | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Digital outputs 9-16                                      | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| Power Supply - / +                                        | 5               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| RJ45 ports                                                | 1               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |
| RS232 and RS485                                           | 1               | 5               | Positive | -            |
|                                                           |                 |                 | Negative | -            |

| Test arrangement<br>Voltage applied to<br><b>RNX-2000 9P 3L 1 A A 3 0 7 A</b> | Voltage applied<br>kV | No. of impulses | Polarity | Observations |
|-------------------------------------------------------------------------------|-----------------------|-----------------|----------|--------------|
| Digital inputs 1-3                                                            | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 4-6                                                           | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 7-8                                                           | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 9-10                                                          | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 11-12                                                         | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 13-14                                                         | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 15-16                                                         | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |
| Digital outputs 17-18                                                         | 5                     | 5               | Positive | -            |
|                                                                               |                       |                 | Negative | -            |

#### Note

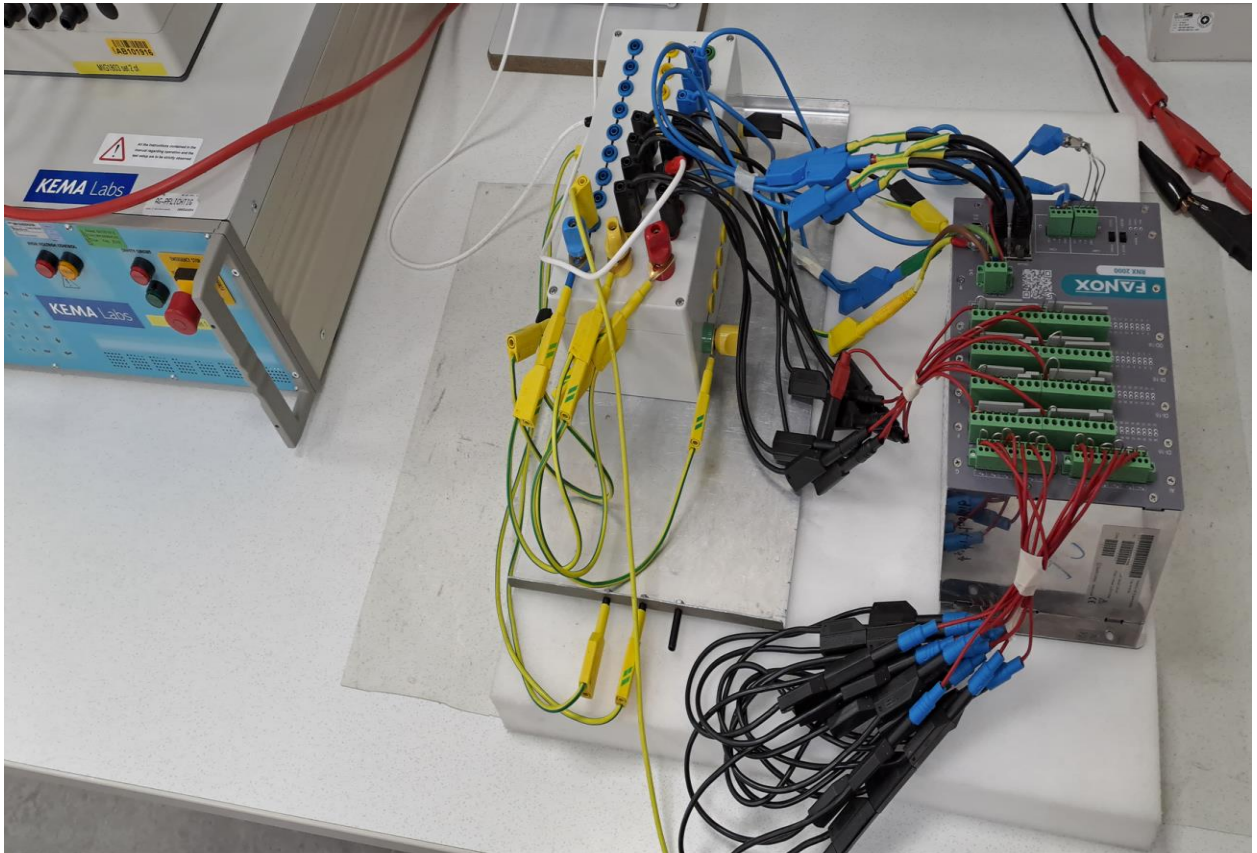
Each circuit has been tested against all other circuits and earth connected together.  
The test has been performed after completion of the climatic tests.

#### Requirement

- no disruptive discharges or flashovers shall occur
- the visual and functional inspection shall not reveal any defects or malfunctions.

#### Result

The object passed the test.

**Photograph of test arrangement**

## 9.5 Dielectric voltage test

### Standard and date

Standard IEC 61850-3, subclause 6.6.4  
Test date October 23, 2024

### Environmental conditions

Ambient temperature 22 °C Relative humidity 60 %

### Characteristic test data

Serial number 24280206 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
Frequency 50 Hz  
Rated insulation voltage 2,0 kV  
1,0 kV  
Test duration 1 min

| Test arrangement<br><b>RNX-2000 9P 3L 1 A A 3 1 7 A</b> | Insulation resistance at 500 Vdc | Voltage applied | Insulation resistance at 500 Vdc | Observations |
|---------------------------------------------------------|----------------------------------|-----------------|----------------------------------|--------------|
| Voltage applied to                                      | MΩ                               | kVac            | MΩ                               |              |
| Analog inputs 1-12 and 13-24                            | > 550                            | 2               | > 550                            | -            |
| Digital inputs 33-40                                    | > 550                            | 2               | > 550                            | -            |
| Digital inputs 41-48                                    | > 550                            | 2               | > 550                            | -            |
| Digital inputs 17-24                                    | > 550                            | 2               | > 550                            | -            |
| Digital inputs 25-32                                    | > 550                            | 2               | > 550                            | -            |
| Digital inputs 31-16                                    | > 550                            | 2               | > 550                            | -            |
| Digital inputs 1-15                                     | > 550                            | 2               | > 550                            | -            |
| Digital outputs 1-8                                     | > 550                            | 2               | > 550                            | -            |
| Digital outputs 9-16                                    | > 550                            | 2               | > 550                            | -            |
| Power Supply - / +                                      | > 550                            | 2               | > 550                            | -            |
| RJ45 ports                                              | > 550                            | 1               | > 550                            | -            |
| RS232 and RS485                                         | > 550                            | 1               | > 550                            | -            |

### Note

- Each circuit has been tested against all other circuits and earth connected together, the test has been performed after completion of the climatic tests.
- The maximum reading of the resistance differs per applied measurement equipment; the minimum resistance shall be > 100 Mohm for new equipment and not be less than 10 Mohm after the test.

| Test arrangement<br><b>RNX-2000 9P 3L 1 A A 3 0 7 A</b> | Insulation resistance at 500 Vdc before the test<br>MΩ | Voltage applied<br>kVac | Insulation resistance at 500 Vdc after the test<br>MΩ | Observations |
|---------------------------------------------------------|--------------------------------------------------------|-------------------------|-------------------------------------------------------|--------------|
| Voltage applied to                                      |                                                        |                         |                                                       |              |
| Digital inputs 1-3                                      | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 4-6                                     | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 7-8                                     | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 9-10                                    | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 11-12                                   | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 13-14                                   | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 15-16                                   | > 550                                                  | 2                       | > 550                                                 | -            |
| Digital outputs 17-18                                   | > 550                                                  | 2                       | > 550                                                 | -            |

#### Note

- Each circuit has been tested against all other circuits and earth connected together, the test has been performed after completion of the climatic tests.
- The maximum reading of the resistance differs per applied measurement equipment; the minimum resistance shall be > 100 Mohm for new equipment and not be less than 10 Mohm after the test.

#### Requirement

- no disruptive discharges or flashovers shall occur
- the visual and functional inspection shall not reveal any defects or malfunctions.

#### Result

The object passed the test.

## 9.6 Protective bonding resistance

### Standard and date

Standard IEC 61850-3, subclause 6.6.5  
Test date October 30, 2024

### Environmental conditions

Ambient temperature 23 °C Relative humidity 53 %  
Ambient air pressure 1023 hPa

### Characteristic test data

Serial number 24290000 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280802 RNX-2000 9P 3L 1 A A 3 0 7 A  
Test voltage 8 Vac  
Test current 20 A  
Test duration 60 s

| Test point | Terminal | Resistance (mΩ)              |                              |
|------------|----------|------------------------------|------------------------------|
|            |          | RNX-2000 9P 3L 1 A A 3 1 7 A | RNX-2000 9P 3L 1 A A 3 0 7 A |
| 1          | A        | 23                           | 20                           |
| 2          | B        | 22                           | 17                           |
| 3          | C        | 21                           | 14                           |
| 4          | D        | 19                           | 10                           |

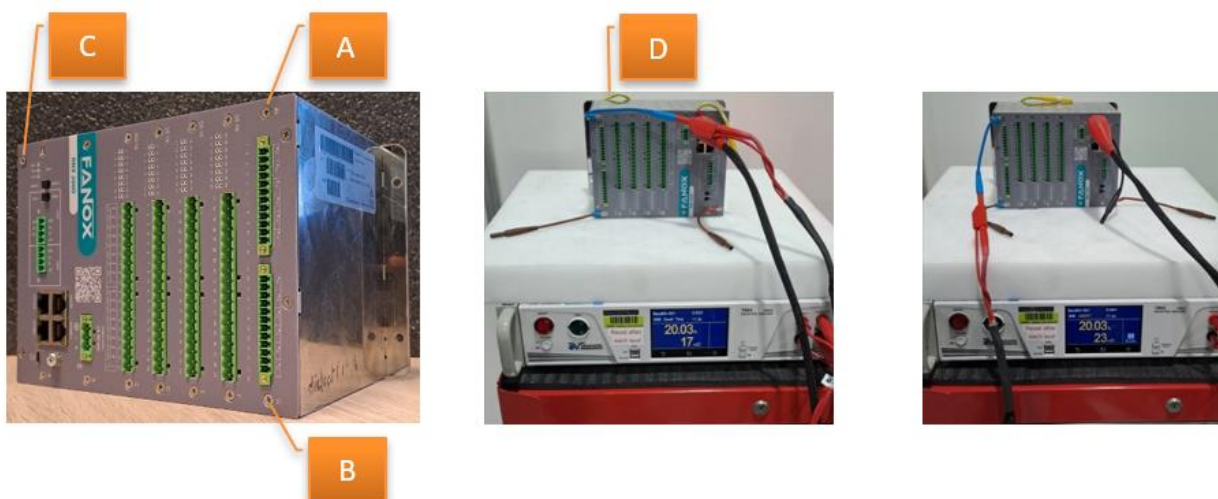
### Requirement

- the resistance between the test point and the protective conductor terminal shall not exceed 0,1 Ω
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

### Photograph of test points



## 9.7 Flammability of insulating materials, components and fire enclosures

### Standard and date

Standard IEC 61850-3, subclause 6.6.6  
Basic standard IEC 60255-27, subclause 10.6.5.2  
Test date October 30, 2024

### Characteristic test data

Serial number 24290000 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280802 RNX-2000 9P 3L 1 A A 3 0 7 A

### Assessment results

- Housing/enclosure is made of metal/plastic having a flammability rating of V1 or better
- Bottom ventilation holes are covered with a metal screen providing suitable flame barrier.
- Mechanical properties are compliant with IEC 60255-27, subclause 7.10
- The sides shall have no openings within the area that is included within the inclined line C
- Materials for components which fill an opening in a fire enclosure, and which are intended to be mounted in that opening shall be of flammability class V-1, or better or pass the flammability test of IEC 60695-11-10.

Materials which fill an opening in the fire enclosure, or which are outside the fire enclosure are listed in the table below.

| Module | Component                                          | Make / Material | Article no. / Drawing / Document                                                    | Specified flammability | Required flammability |
|--------|----------------------------------------------------|-----------------|-------------------------------------------------------------------------------------|------------------------|-----------------------|
| HMI    | reflex™ LT DIGITAL                                 | Polyester       |  | VTM-2                  | HB75                  |
| IO     | MSTB 2,5/18-G-5,08 - PCB header                    | PBT             | Productsheet 1759172 of Phoenix contact                                             | V-0                    | V-1                   |
| IO     | MSTB 2,5/18-G-5,08 - PCB header                    | PBT             | Productsheet 1776511 of Phoenix contact                                             | V-0                    | V-1                   |
| IO     | FRONT-MSTB 2,5/ 9-ST-5,08 - PCB connector          | PA              | Productsheet 1777358 of Phoenix contact                                             | V-0                    | V-1                   |
| IO     | FRONT-MSTB 2,5/ 3-STF-5,08 - PCB connector 1777811 | PA              | Productsheet 1777811 of Phoenix contact                                             | V-0                    | V-1                   |
| IO     | MC 1,5/ 4-G-3,81 -PCB header                       | PBT             | Productsheet 1803293 of Phoenix contact                                             | V-0                    | V-1                   |
| IO     | MC 1,5/12-GF-3,81 - PCB header                     | PBT             | Productsheet 1827965 of Phoenix contact                                             | V-0                    | V-1                   |

| Module | Component                                | Make / Material | Article no. / Drawing / Document        | Specified flammability | Required flammability |
|--------|------------------------------------------|-----------------|-----------------------------------------|------------------------|-----------------------|
| IO     | FRONT-MC 1,5/4-ST-3,81 - PCB connector   | PA              | Productsheet 1850686 of Phoenix contact | V-0                    | V-1                   |
| IO     | FRONT-MC 1,5/12-STF-3,81 - PCB connector | PA              | Productsheet 1850958 of Phoenix contact | V-0                    | V-1                   |
| IO     | Modular Jack connector RJ45              | PA46 + 30% GF   | Productsheet 2041376 of TE Connectivity | V-0                    | V-1                   |

**Requirements**

- the object shall comply with the flammability requirements of IEC 60255-27, subclause 7.1. to 7.12.
- no visual or functional inspection required.

**Result**

The object passed the test.

## 9.8 Single-fault condition

### Standard and date

Standard IEC 61850-3, subclause 6.6.7  
Test date November 7, 2024

### Environmental conditions

Ambient temperature 19,9 °C Relative humidity 45,3 %  
Ambient air pressure 1026 hPa

### Characteristic test data

Serial number 24290000 RNX-2000 9P 3L 1 A A 3 1 7 A  
Power supply 24 Vdc

| Circuit                    | Test                                                 | Observations |
|----------------------------|------------------------------------------------------|--------------|
| Power supply               | S.0 Normal condition                                 | -            |
| Total system short circuit | S.1 Short circuit through whole backbone *)          | -            |
| DC input voltage           | S.2 Reversal of the polarity of the DC input voltage | -            |

### Note

\*) the short circuit is placed on the last card. The maximum current goes through the backbone.

### Requirements

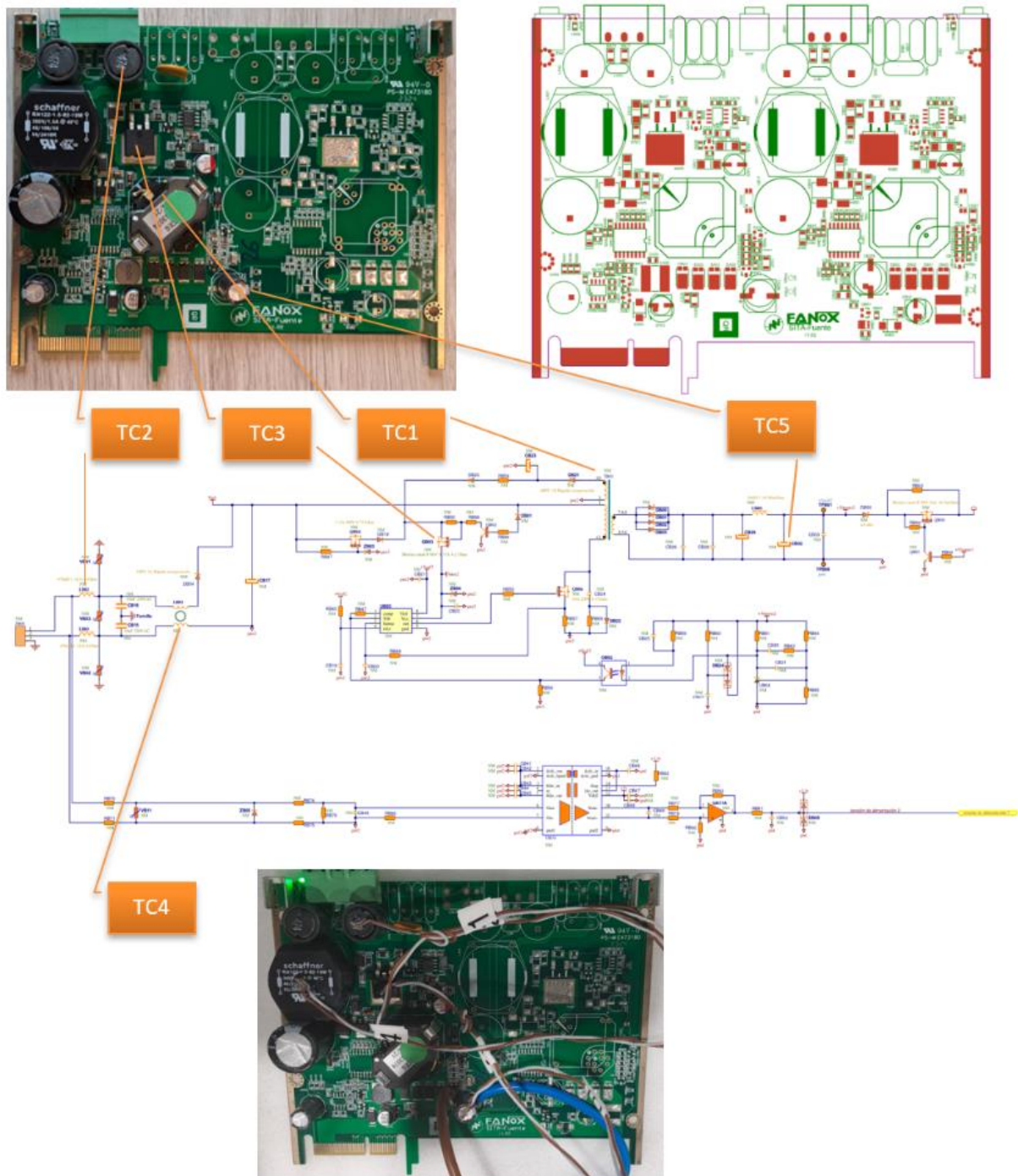
- the test shall not result in the spread of fire or result in an electric shock hazard.
- the test object does not have to be functional after the test.
- no visual or functional inspection required.

### Result

The object passed the test in Class B. Please refer to the next page for the maximum operating temperature.

## Photograph of test points

| Test points and test Condition | TC1<br>T1<br>°C | TC2<br>V4<br>°C | TC3<br>V2<br>°C | TC4<br>V24<br>°C | TC5<br>Top<br>°C | TC6 | Input<br>A | Input<br>W | Output<br>A | Output<br>V | Output<br>W |
|--------------------------------|-----------------|-----------------|-----------------|------------------|------------------|-----|------------|------------|-------------|-------------|-------------|
| S.0                            | 51              | 45              | 52              | 43               | 47               | 42  | 0,45       | 10,8       | 0,82        | 5,10        | 4,18        |
| S.1                            | 125             | 96              | 115             | 86               | 76               | 82  | 1,36       | 32,64      | 5,60        | 4,40        | 24,64       |
| S.2                            | 19              | 19              | 19              | 19               | 19               | 19  | 0          | 0          | 0           | 0           | 0           |



## **10 ELECTROMAGNETIC COMPATIBILITY**

### **10.1 Inspection**

#### **10.1.1 Pre-inspection**

The pre-inspection is performed to verify that the test object is in operational state. The pre-inspection is carried out prior to the test procedure.

The communication with the maintenance computer is verified. Signals are simulated to verify the functioning and operation with the specified performance specification for the following inputs and outputs:

- analogue inputs
- digital inputs
- contact outputs
- data communication.

#### **10.1.2 Visual and functional inspection**

After each test a visual and functional inspection is carried out as described in this chapter.

The visual inspection is carried out to verify that there is no visual mechanical damage.  
There shall be no burning of any components.

Functional inspection is carried out to verify the correct operation of the test object.

The measurements of analogue input data shall not exceed twice the class index for the measurement.

There shall be no:

- alarm indications on display and LED's
- error messages reported in the maintenance computer
- unintentional change of contact outputs
- there shall be no degradation of performance below the claimed performance according reliability class (1 or 2).

Unless otherwise stated the visual and functional inspection was carried out successfully after each test.

## 10.2 Radiated emission

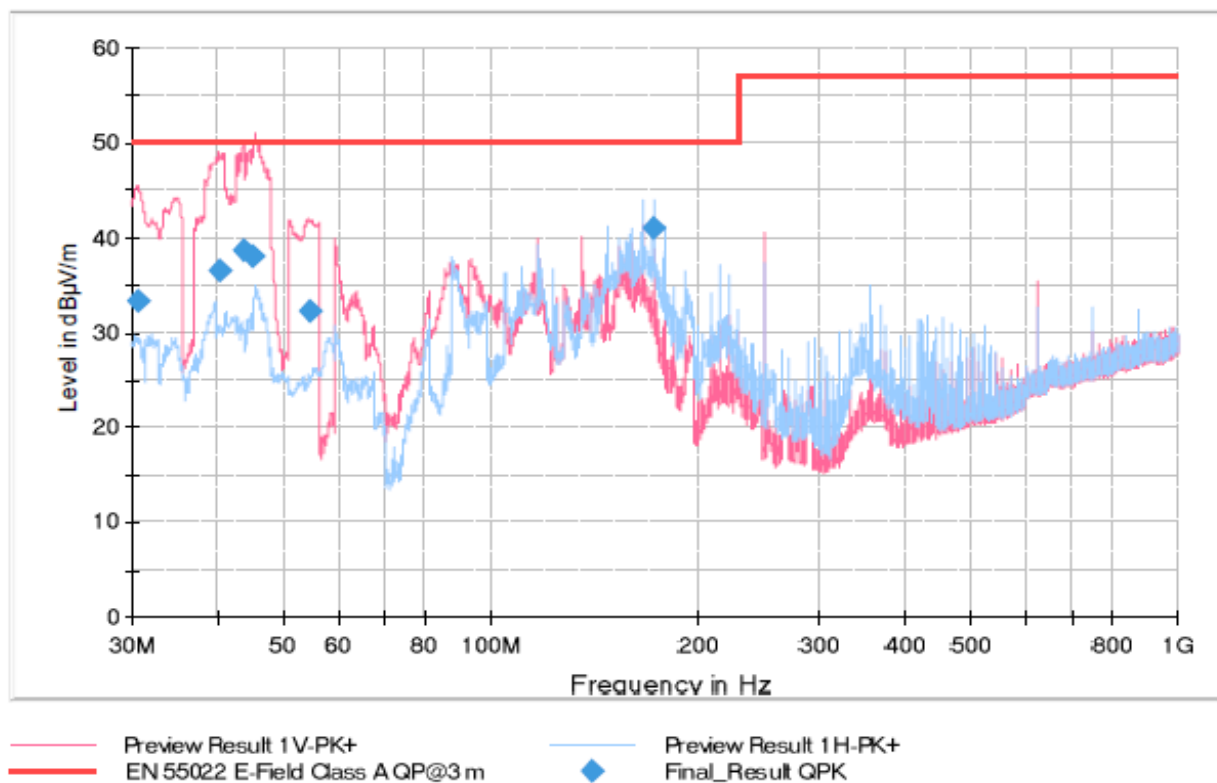
### Standard and date

Standard IEC 61850-3, subclause 6.7.4  
Basic standard CISPR 22  
Test date September 30, 2024

### Characteristic test data

Serial number 24280807 RNX-2000 9P 3L 1 A A 3 1 7 A  
Power supply 24 Vdc

**Power supply voltage of 24 Vdc with horizontal and vertical antenna polarization, in the frequency range 30MHz – 1GHz (red = vertical, blue = horizontal)**

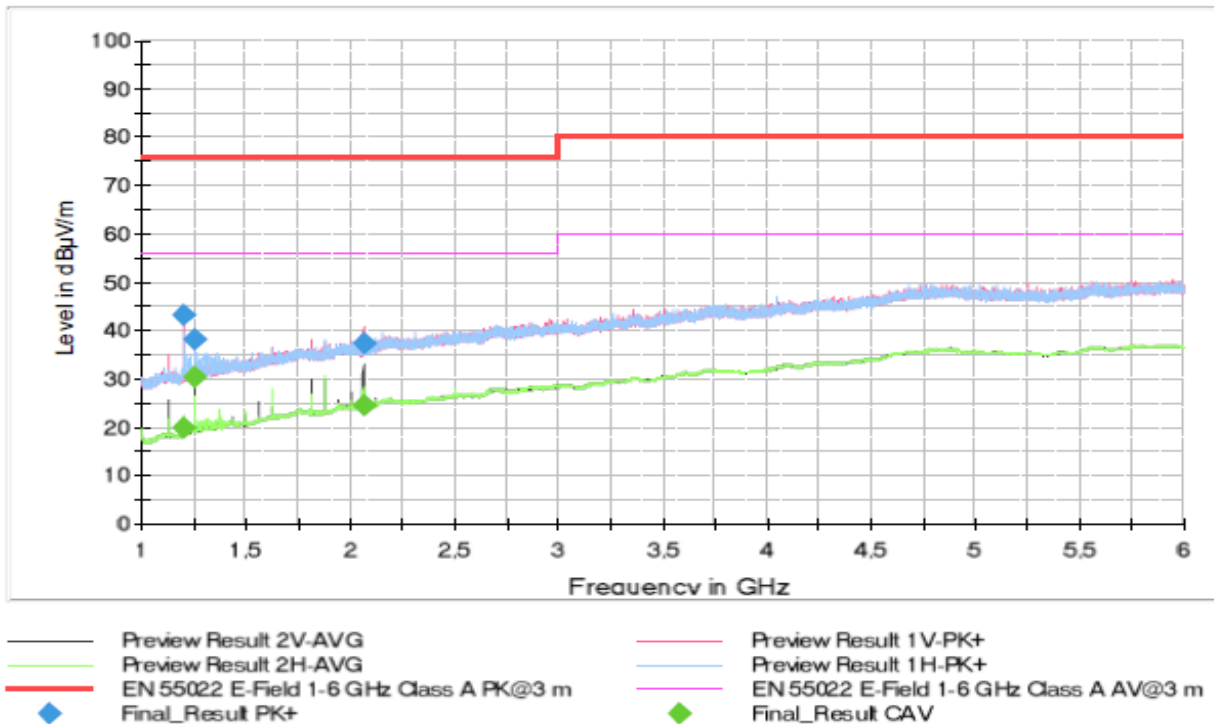


### Final result (30 – 1000 MHz)

| Frequency | QuasiPeak | Limit           | Margin | Meas.      | Bandwidth | Height | Pol | Azimuth |
|-----------|-----------|-----------------|--------|------------|-----------|--------|-----|---------|
| MHz       | dBμV/m    | at 3m<br>dBμV/m | dB     | Time<br>ms | kHz       | cm     |     | deg     |
| 30,6      | 33,36     | 50              | 16,64  | 3000       | 120       | 117    | V   | 0       |
| 40,17     | 36,42     | 50              | 13,58  | 3000       | 120       | 100    | V   | 154     |
| 43,65     | 38,57     | 50              | 11,43  | 3000       | 120       | 116    | V   | 1       |
| 45,18     | 37,93     | 50              | 12,07  | 3000       | 120       | 140    | V   | 257     |
| 54,39     | 32,34     | 50              | 17,66  | 3000       | 120       | 188    | V   | 271     |
| 172,29    | 41,05     | 50              | 8,95   | 3000       | 120       | 204    | H   | -35     |

**The final scan measurement with worst-case selection.**

- The power supply voltage of 24 VDC is assumed to have passed, as we have conducted tests under two conditions (24Vdc and 48Vdc) within the frequency range of 30 MHz to 1 GHz.
- Power supply voltage of 48 Vdc with horizontal and vertical antenna polarization, in the frequency range 1 – 6 GHz (red = vertical, blue = horizontal) as shown in below.



**Final result (1000 – 6000 MHz)**

| Frequency | MaxPeak | Average | Limit at 3 m | Margin | Meas. Time | Bandwidth | Height | Pol | Azimuth |
|-----------|---------|---------|--------------|--------|------------|-----------|--------|-----|---------|
| MHz       | dBμV/m  | dBμV/m  | dBμV/m       | dB     | ms         | kHz       | cm     |     | deg     |
| 1200      | -       | 20      | 56           | 36     | 2000       | 1000      | 138    | V   | -6      |
| 1200      | 43,35   | -       | 76           | 32,65  | 2000       | 1000      | 138    | V   | -6      |
| 1250      | -       | 30,43   | 56           | 25,57  | 2000       | 1000      | 142    | V   | 128     |
| 1250      | 38,27   | -       | 76           | 37,73  | 2000       | 1000      | 142    | V   | 128     |
| 2036      | -       | 24,64   | 56           | 31,36  | 2000       | 1000      | 400    | V   | 0       |
| 2063      | 37,47   | -       | 76           | 38,53  | 2000       | 1000      | 400    | V   | 0       |

**Observation**

No significant emission was measured while employing both horizontal and vertical antenna polarization.

**Requirement**

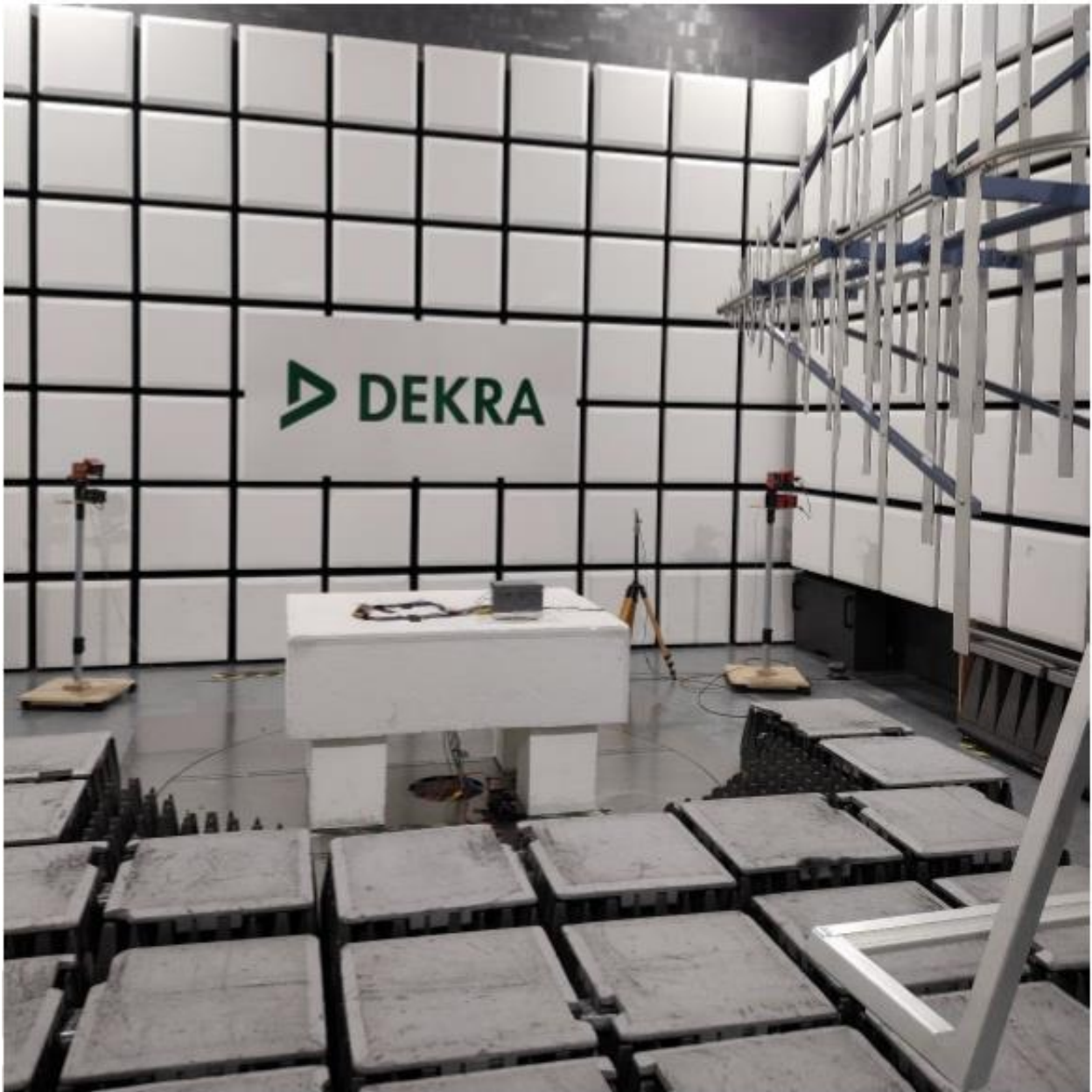
The radiated emission shall not exceed the limits specified in the standard CISPR 22 for class A equipment.

**Result**

The object passed the test.

**Photograph of test arrangement**

Radiated electromagnetic disturbances (30 – 1000 MHz)



Radiated electromagnetic disturbances (above 1 GHz)

### 10.3 Conducted emission

#### Standard and date

|                |                              |
|----------------|------------------------------|
| Standard       | IEC 61850-3, subclause 6.7.4 |
| Basic standard | CISPR 22                     |
| Test date      | October 10 to 11, 2024       |

#### Characteristic test data

|               |                                       |
|---------------|---------------------------------------|
| Serial number | 24280807 RNX-2000 9P 3L 1 A A 3 1 7 A |
| Power supply  | 24 Vdc                                |

Power supply → the limits are;

0,15 to 0,5 MHz; 79 dBuV QP

0,15 to 0,5 MHz; 66 dBuV AV

0,5 to 30 MHz; 73 dBuV QP

0,5 to 30 MHz; 60 dBuV AV

Telecommunication → the limits are;

0,15 to 0,5 MHz; 97 – 87 dBuV QP

0,15 to 0,5 MHz; 84 – 74 dBuV AV

0,5 to 30 MHz; 87 dBuV QP

0,5 to 30 MHz; 74 dBuV AV

#### Requirement

The conducted emission shall not exceed the limits for class A equipment, specified in the standard CISPR 22.

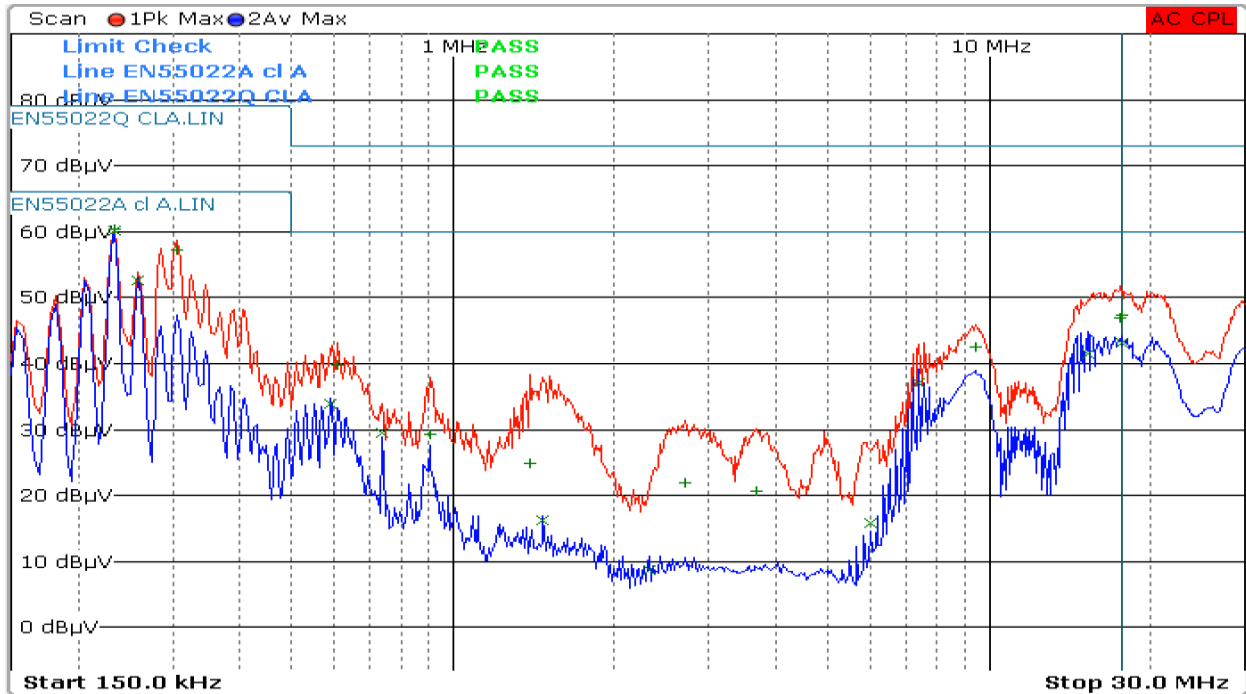
#### Observations

No degradation of performance observed during and after the test.

#### Result

The object passed the test. Please refer to test conditions 10.3.1 to 10.3.7 for details.

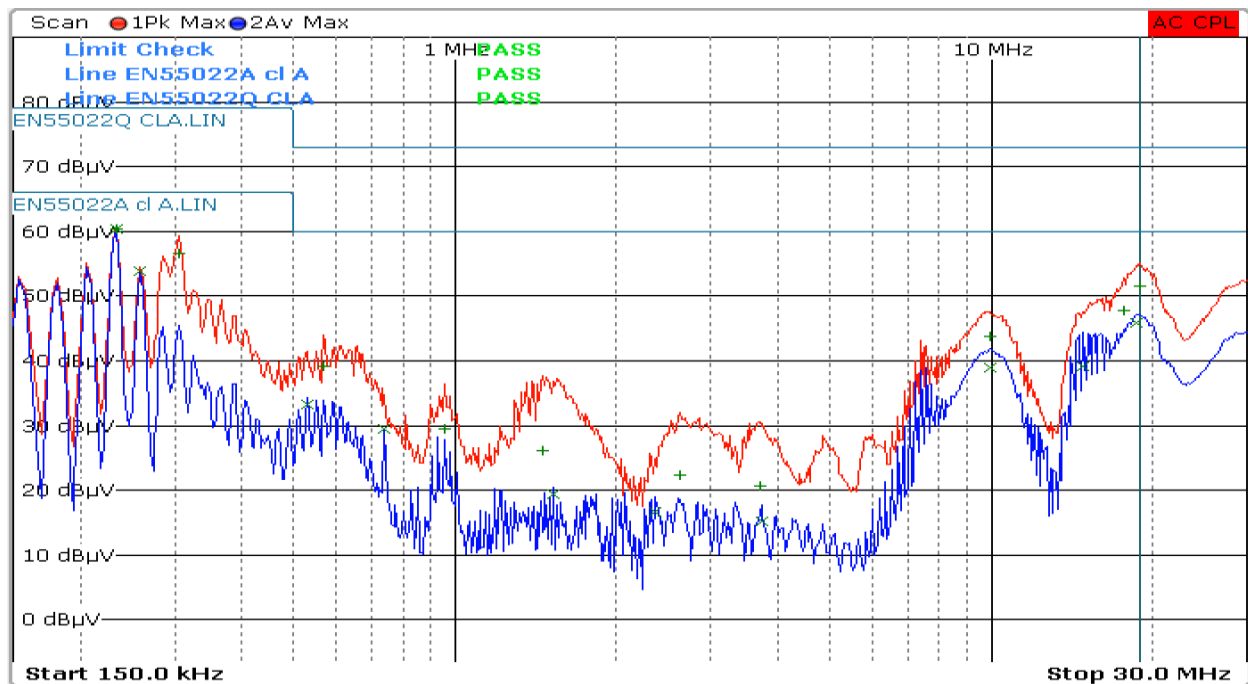
### 10.3.1 Power supply voltage is set 24 Vdc



#### Final result

| Frequency        | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|------------------|---------------|-------|-------------------|-------------------|
| 234,00000000 kHz | 60,28         | N     | Quasi Peak        | -18,72            |
| 234,00000000 kHz | 60,24         | N     | Average           | -5,76             |
| 258,00000000 kHz | 52,53         | L1    | Average           | -13,47            |
| 306,00000000 kHz | 57,24         | L1    | Quasi Peak        | -21,76            |
| 590,00000000 kHz | 33,89         | L1    | Average           | -26,11            |
| 610,00000000 kHz | 39,83         | L1    | Quasi Peak        | -33,17            |
| 738,00000000 kHz | 29,54         | L1    | Average           | -30,46            |
| 910,00000000 kHz | 29,36         | L1    | Quasi Peak        | -43,64            |
| 1,394000000 MHz  | 24,80         | L1    | Quasi Peak        | -48,20            |
| 1,474000000 MHz  | 16,25         | L1    | Average           | -43,75            |
| 2,330000000 MHz  | 8,77          | L1    | Average           | -51,23            |
| 2,714000000 MHz  | 21,89         | L1    | Quasi Peak        | -51,11            |
| 3,690000000 MHz  | 20,72         | L1    | Quasi Peak        | -52,28            |
| 6,014000000 MHz  | 15,77         | N     | Average           | -44,23            |
| 7,390000000 MHz  | 36,98         | N     | Average           | -23,02            |
| 9,454000000 MHz  | 42,56         | N     | Quasi Peak        | -30,44            |
| 15,294000000 MHz | 41,43         | N     | Average           | -18,57            |
| 17,594000000 MHz | 46,86         | N     | Quasi Peak        | -26,14            |
| 17,698000000 MHz | 43,24         | N     | Average           | -16,76            |
| 17,702000000 MHz | 47,25         | N     | Quasi Peak        | -25,75            |

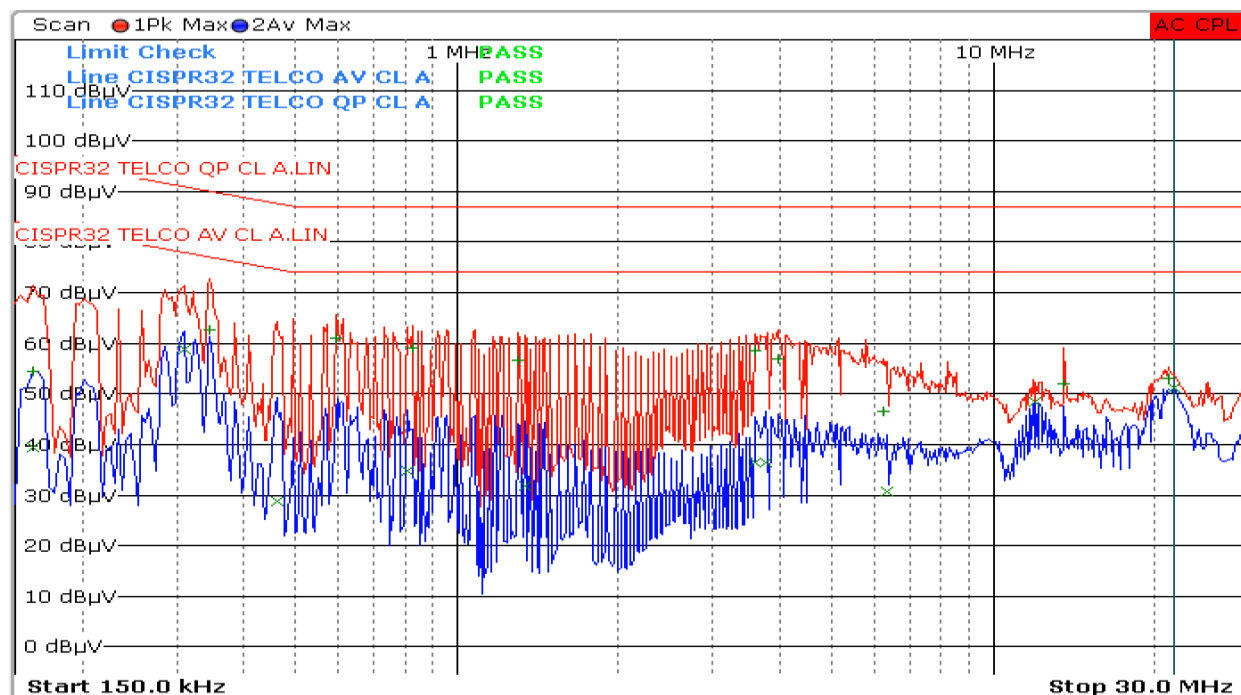
### 10.3.2 Power supply voltage is set 48 Vdc (This is an additional test)



#### Final result

| Frequency        | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|------------------|---------------|-------|-------------------|-------------------|
| 234,00000000 kHz | 60,40         | N     | Quasi Peak        | -18,60            |
| 234,00000000 kHz | 60,42         | N     | Average           | -5,58             |
| 258,00000000 kHz | 53,82         | L1    | Average           | -12,18            |
| 306,00000000 kHz | 56,51         | L1    | Quasi Peak        | -22,49            |
| 530,00000000 kHz | 33,20         | L1    | Average           | -26,80            |
| 570,00000000 kHz | 39,24         | L1    | Quasi Peak        | -33,76            |
| 738,00000000 kHz | 29,52         | L1    | Average           | -30,48            |
| 954,00000000 kHz | 29,53         | L1    | Quasi Peak        | -43,47            |
| 1,458000000 MHz  | 26,12         | L1    | Quasi Peak        | -46,88            |
| 1,526000000 MHz  | 19,37         | L1    | Average           | -40,63            |
| 2,354000000 MHz  | 16,60         | L1    | Average           | -43,40            |
| 2,638000000 MHz  | 22,33         | L1    | Quasi Peak        | -50,67            |
| 3,698000000 MHz  | 20,61         | L1    | Quasi Peak        | -52,39            |
| 3,726000000 MHz  | 15,26         | L1    | Average           | -44,74            |
| 9,966000000 MHz  | 43,80         | N     | Quasi Peak        | -29,20            |
| 9,970000000 MHz  | 38,89         | N     | Average           | -21,11            |
| 14,778000000 MHz | 39,09         | N     | Average           | -20,91            |
| 17,622000000 MHz | 47,73         | L1    | Quasi Peak        | -25,27            |
| 18,730000000 MHz | 45,81         | N     | Average           | -14,19            |
| 18,906000000 MHz | 51,58         | N     | Quasi Peak        | -21,42            |

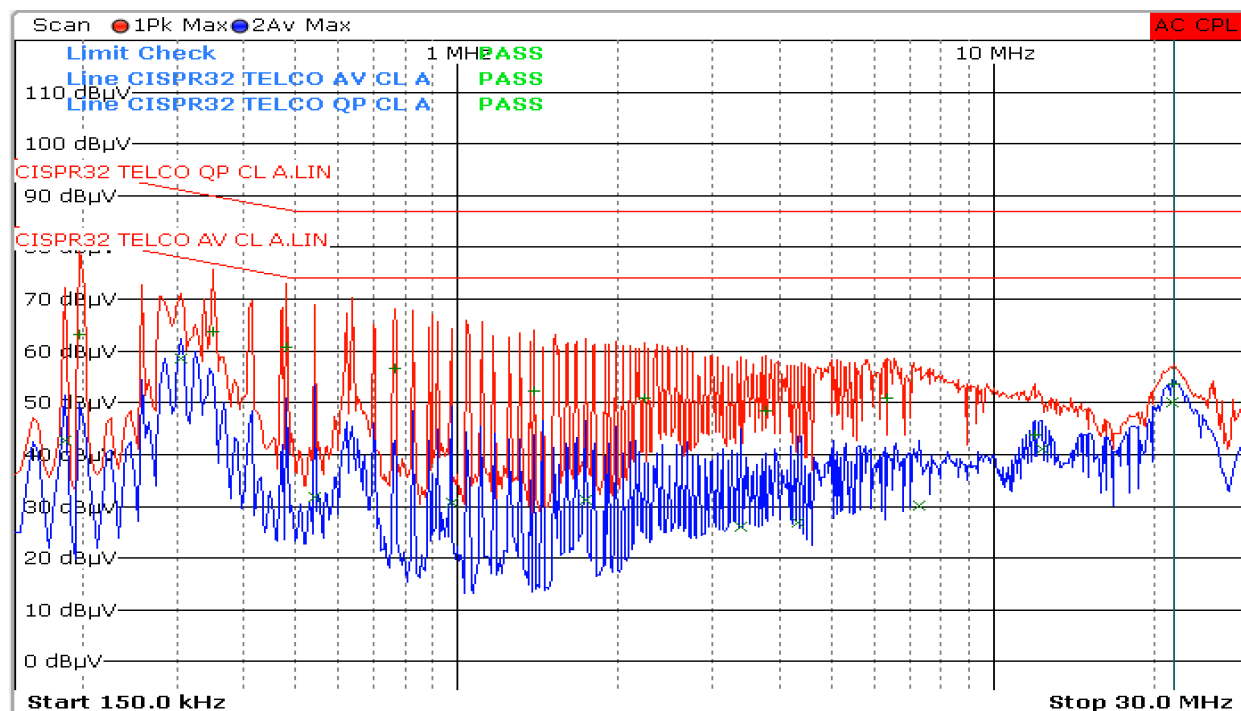
### 10.3.3 Telecommunication port RS485, COM 1



#### Final result

| Frequency        | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|------------------|---------------|-------|-------------------|-------------------|
| 162,00000000 kHz | 60,40         |       | Quasi Peak        | -18,60            |
| 162,00000000 kHz | 60,42         |       | Average           | -5,58             |
| 310,00000000 kHz | 53,82         |       | Average           | -12,18            |
| 346,00000000 kHz | 56,51         |       | Quasi Peak        | -22,49            |
| 462,00000000 kHz | 33,20         |       | Average           | -26,80            |
| 594,00000000 kHz | 39,24         |       | Quasi Peak        | -33,76            |
| 806,00000000 kHz | 29,52         |       | Average           | -30,48            |
| 826,00000000 kHz | 29,53         |       | Quasi Peak        | -43,47            |
| 1,302000000 MHz  | 26,12         |       | Quasi Peak        | -46,88            |
| 1,338000000 MHz  | 19,37         |       | Average           | -40,63            |
| 3,598000000 MHz  | 16,60         |       | Average           | -43,40            |
| 3,602000000 MHz  | 22,33         |       | Quasi Peak        | -50,67            |
| 3,754000000 MHz  | 20,61         |       | Quasi Peak        | -52,39            |
| 3,966000000 MHz  | 15,26         |       | Average           | -44,74            |
| 6,242000000 MHz  | 43,80         |       | Quasi Peak        | -29,20            |
| 6,338000000 MHz  | 38,89         |       | Average           | -21,11            |
| 12,014000000 MHz | 39,09         |       | Average           | -20,91            |
| 13,558000000 MHz | 47,73         |       | Quasi Peak        | -25,27            |
| 21,278000000 MHz | 45,81         |       | Average           | -14,19            |
| 21,794000000 MHz | 51,58         |       | Quasi Peak        | -21,42            |

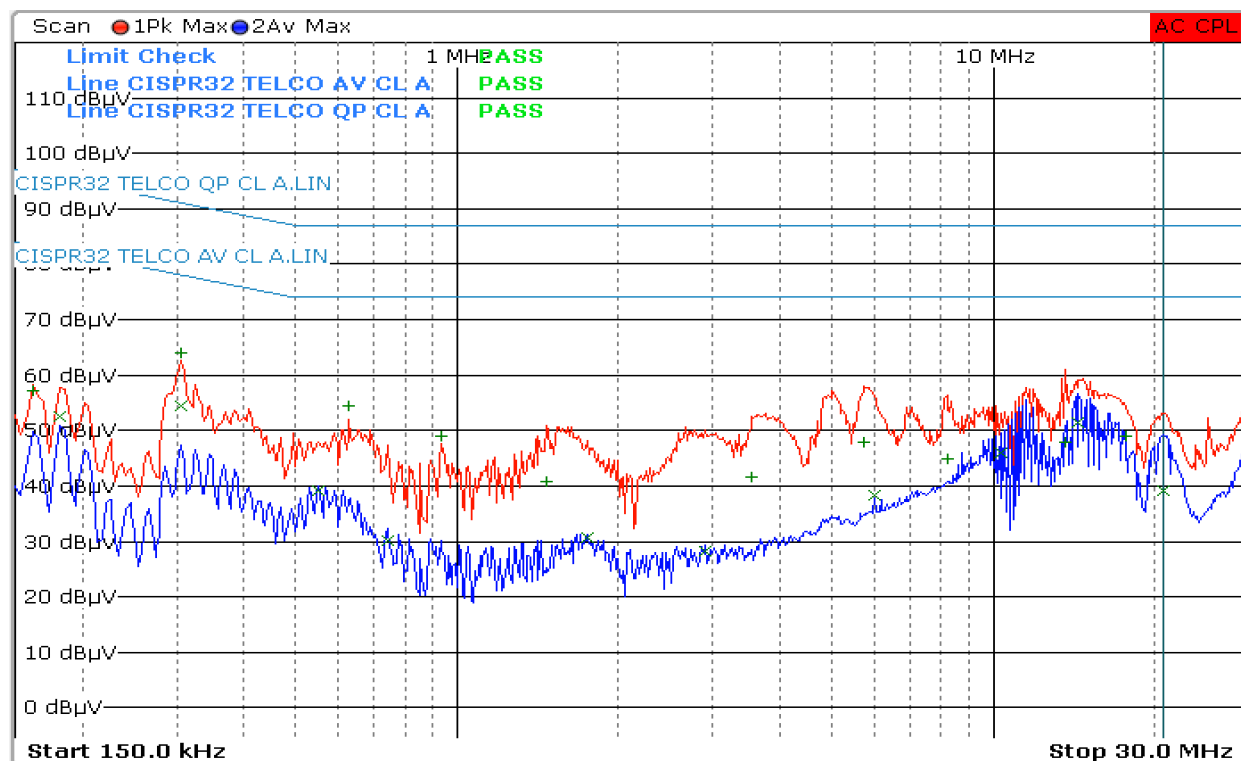
### 10.3.4 Telecommunication port RS485, COM 2



#### Final result

| Frequency        | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|------------------|---------------|-------|-------------------|-------------------|
| 186,00000000 kHz | 42,72         |       | Average           | -39,49            |
| 198,00000000 kHz | 63,11         |       | Quasi Peak        | -31,58            |
| 306,00000000 kHz | 58,54         |       | Average           | -19,54            |
| 350,00000000 kHz | 63,81         |       | Quasi Peak        | -26,15            |
| 482,00000000 kHz | 60,85         |       | Quasi Peak        | -26,45            |
| 542,00000000 kHz | 31,67         |       | Average           | -42,33            |
| 766,00000000 kHz | 56,51         |       | Quasi Peak        | -30,49            |
| 978,00000000 kHz | 30,73         |       | Average           | -43,27            |
| 1,390000000 MHz  | 52,36         |       | Quasi Peak        | -34,64            |
| 1,738000000 MHz  | 31,34         |       | Average           | -42,66            |
| 2,242000000 MHz  | 50,82         |       | Quasi Peak        | -36,18            |
| 3,390000000 MHz  | 26,03         |       | Average           | -47,97            |
| 3,758000000 MHz  | 48,37         |       | Quasi Peak        | -38,63            |
| 4,326000000 MHz  | 26,98         |       | Average           | -47,02            |
| 6,338000000 MHz  | 50,85         |       | Quasi Peak        | -36,15            |
| 7,258000000 MHz  | 30,07         |       | Average           | -43,93            |
| 11,946000000 MHz | 43,91         |       | Quasi Peak        | -43,09            |
| 12,350000000 MHz | 41,04         |       | Average           | -32,96            |
| 21,278000000 MHz | 45,81         |       | Average           | -14,19            |
| 21,794000000 MHz | 51,58         |       | Quasi Peak        | -21,42            |

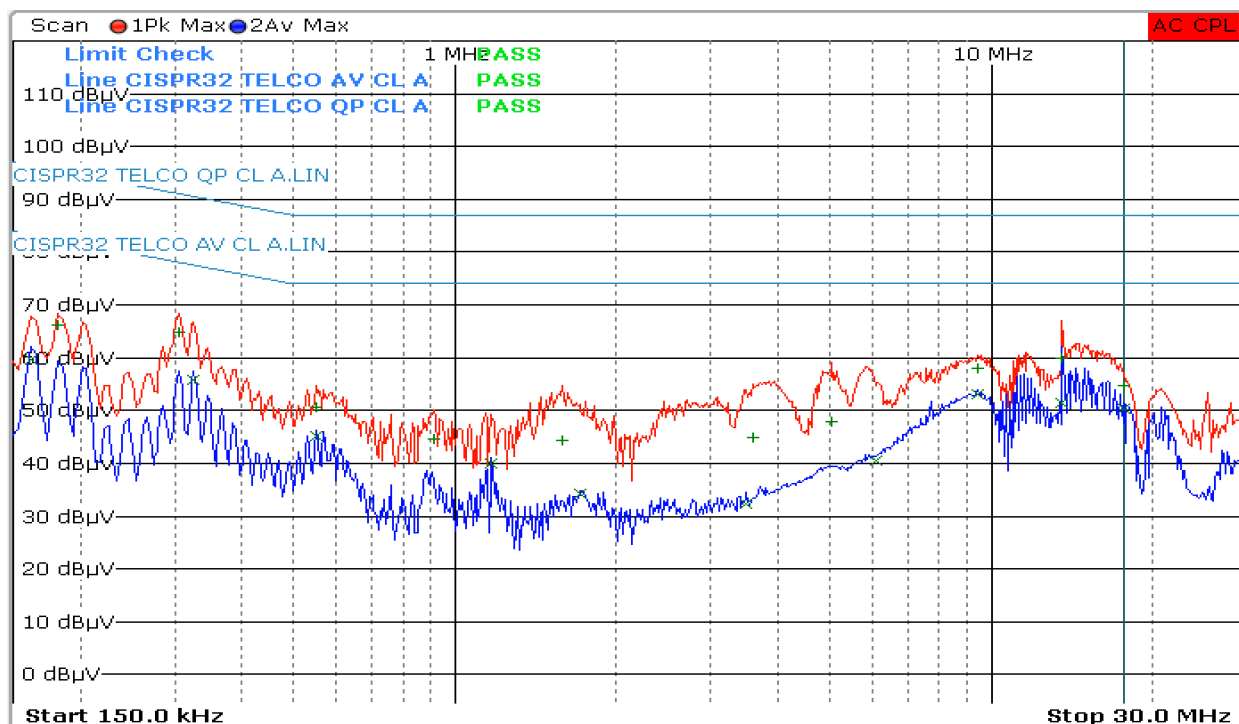
### 10.3.5 Telecommunication port RJ45, LAN



#### Final result

| Frequency         | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|-------------------|---------------|-------|-------------------|-------------------|
| 162,000000000 kHz | 57,19         |       | Quasi Peak        | -39,17            |
| 182,000000000 kHz | 52,41         |       | Average           | -29,98            |
| 306,000000000 kHz | 63,97         |       | Quasi Peak        | -27,11            |
| 306,000000000 kHz | 54,54         |       | Average           | -23,54            |
| 550,000000000 kHz | 39,22         |       | Average           | -34,78            |
| 630,000000000 kHz | 54,55         |       | Quasi Peak        | -32,45            |
| 742,000000000 kHz | 30,09         |       | Average           | -43,91            |
| 938,000000000 kHz | 48,93         |       | Quasi Peak        | -38,07            |
| 1,466000000 MHz   | 40,82         |       | Quasi Peak        | -46,18            |
| 1,750000000 MHz   | 30,77         |       | Average           | -43,23            |
| 2,902000000 MHz   | 28,28         |       | Average           | -45,72            |
| 3,554000000 MHz   | 41,58         |       | Quasi Peak        | -45,42            |
| 5,746000000 MHz   | 47,95         |       | Quasi Peak        | -39,05            |
| 6,014000000 MHz   | 38,39         |       | Average           | -35,61            |
| 8,206000000 MHz   | 45,00         |       | Quasi Peak        | -42,00            |
| 10,310000000 MHz  | 46,05         |       | Average           | -27,95            |
| 13,626000000 MHz  | 47,85         |       | Quasi Peak        | -39,15            |
| 14,434000000 MHz  | 51,32         |       | Average           | -22,68            |
| 17,698000000 MHz  | 49,06         |       | Quasi Peak        | -37,94            |
| 20,790000000 MHz  | 39,21         |       | Average           | -34,79            |

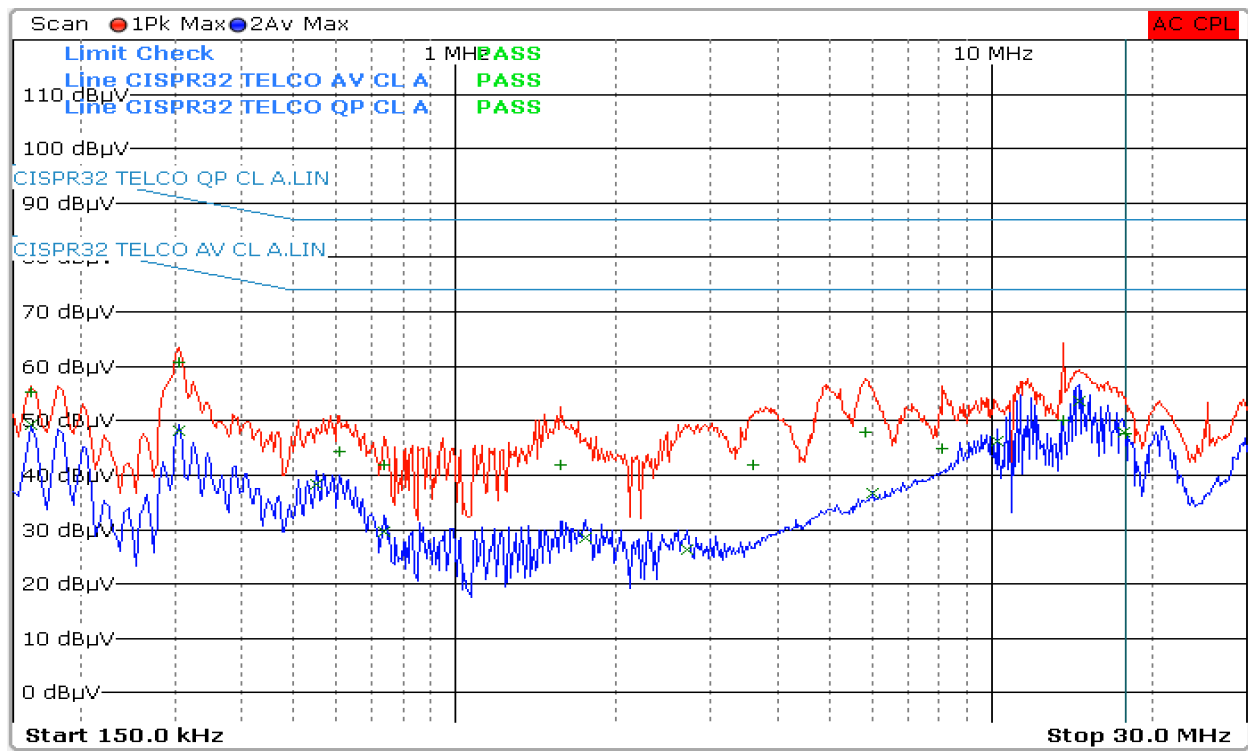
### 10.3.6 Telecommunication port RJ45, LOCAL



#### Final result

| Frequency         | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|-------------------|---------------|-------|-------------------|-------------------|
| 162,000000000 kHz | 59,73         |       | Average           | -23,63            |
| 182,000000000 kHz | 66,18         |       | Quasi Peak        | -29,21            |
| 306,000000000 kHz | 64,88         |       | Quasi Peak        | -26,20            |
| 326,000000000 kHz | 55,94         |       | Average           | -21,61            |
| 550,000000000 kHz | 50,58         |       | Quasi Peak        | -36,42            |
| 550,000000000 kHz | 45,21         |       | Average           | -28,79            |
| 914,000000000 kHz | 44,61         |       | Quasi Peak        | -42,39            |
| 1,170000000 MHz   | 40,11         |       | Average           | -33,89            |
| 1,586000000 MHz   | 44,38         |       | Quasi Peak        | -42,62            |
| 1,718000000 MHz   | 34,21         |       | Average           | -39,79            |
| 3,494000000 MHz   | 32,34         |       | Average           | -41,66            |
| 3,590000000 MHz   | 44,93         |       | Quasi Peak        | -42,07            |
| 5,054000000 MHz   | 47,80         |       | Quasi Peak        | -39,20            |
| 6,102000000 MHz   | 40,61         |       | Average           | -33,39            |
| 9,450000000 MHz   | 58,11         |       | Quasi Peak        | -28,89            |
| 9,450000000 MHz   | 53,19         |       | Average           | -20,81            |
| 13,558000000 MHz  | 60,04         |       | Quasi Peak        | -26,96            |
| 13,558000000 MHz  | 51,41         |       | Average           | -22,59            |
| 17,698000000 MHz  | 54,84         |       | Quasi Peak        | -32,16            |
| 17,698000000 MHz  | 50,26         |       | Average           | -23,74            |

### 10.3.7 Telecommunication port RJ45, WAN1

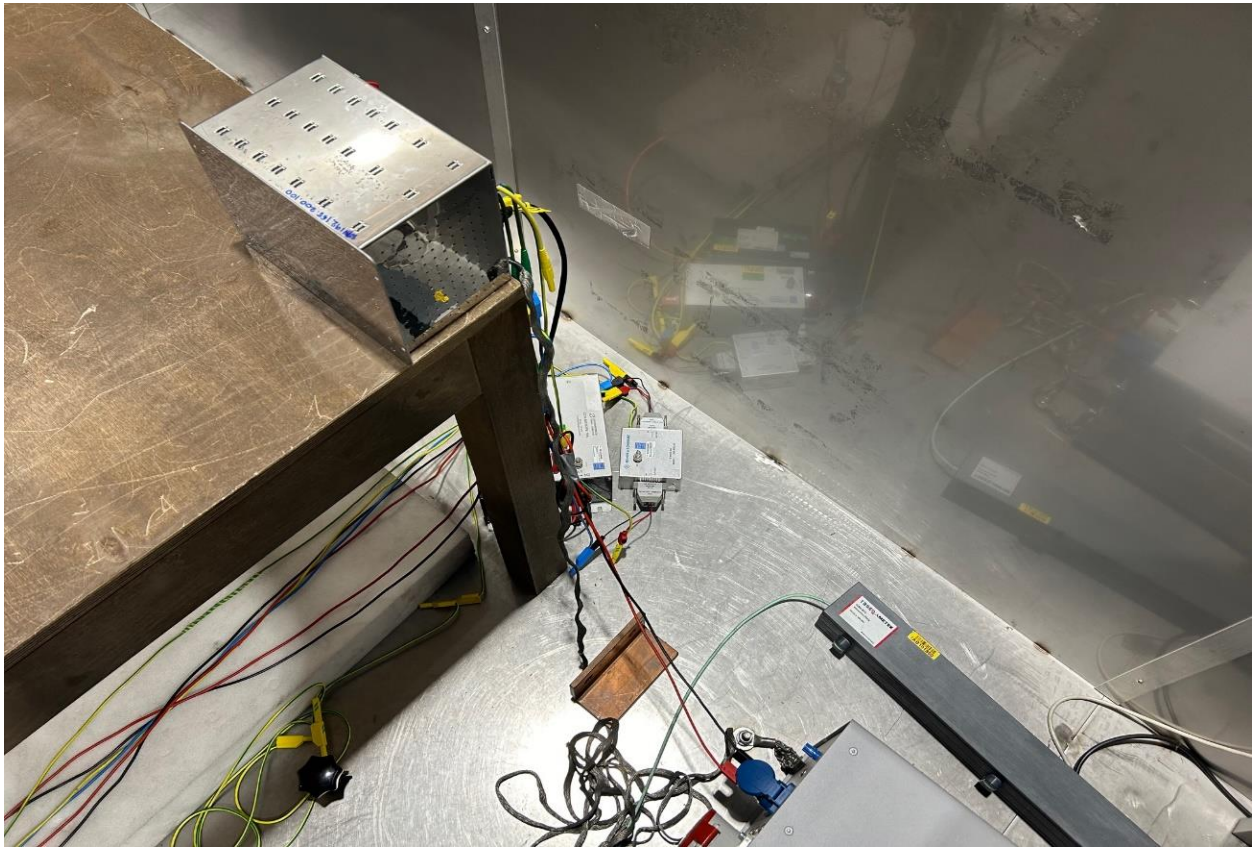


#### Final result

| Frequency        | Level<br>dBμV | Phase | Detector<br>AV/QP | Delta Limit<br>dB |
|------------------|---------------|-------|-------------------|-------------------|
| 162,00000000 kHz | 55,29         |       | Quasi Peak        | -41,07            |
| 162,00000000 kHz | 49,15         |       | Average           | -34,21            |
| 306,00000000 kHz | 60,73         |       | Quasi Peak        | -30,35            |
| 306,00000000 kHz | 48,05         |       | Average           | -30,03            |
| 550,00000000 kHz | 38,25         |       | Average           | -35,75            |
| 610,00000000 kHz | 44,43         |       | Quasi Peak        | -42,57            |
| 738,00000000 kHz | 41,99         |       | Quasi Peak        | -45,01            |
| 738,00000000 kHz | 29,51         |       | Average           | -44,49            |
| 1,574000000 MHz  | 41,82         |       | Quasi Peak        | -45,18            |
| 1,750000000 MHz  | 28,43         |       | Average           | -45,57            |
| 2,706000000 MHz  | 26,30         |       | Average           | -47,70            |
| 3,586000000 MHz  | 42,02         |       | Quasi Peak        | -44,98            |
| 5,826000000 MHz  | 47,81         |       | Quasi Peak        | -39,19            |
| 6,010000000 MHz  | 36,67         |       | Average           | -37,33            |
| 8,130000000 MHz  | 44,95         |       | Quasi Peak        | -42,05            |
| 10,302000000 MHz | 46,21         |       | Average           | -27,79            |
| 13,614000000 MHz | 49,98         |       | Quasi Peak        | -37,02            |
| 14,590000000 MHz | 53,61         |       | Average           | -20,39            |
| 17,682000000 MHz | 47,77         |       | Average           | -26,23            |
| 17,778000000 MHz | 47,73         |       | Quasi Peak        | -39,27            |

**Photographs of test arrangement**

Conducted emission test setup



Zoomed-in view of the conducted emission test setup

## 10.4 Electrostatic discharge

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-2  
 Test date October 24, 2024

### Environmental conditions

Ambient temperature 23,1 °C Relative humidity 54 %  
 Ambient air pressure 1023,8 hPa

### Characteristic test data

Serial number 0030114  
 Power supply 24 Vdc

| Discharge type   | Test level<br>kV | Test points                    | Polarity | Observations |
|------------------|------------------|--------------------------------|----------|--------------|
| Contact          | 6                | the areas marked with red dots | + and -  | -            |
| Indirect contact | 6                | VCP right of object            | + and -  | -            |
|                  |                  | HCP under object               | + and -  | -            |

### Observations

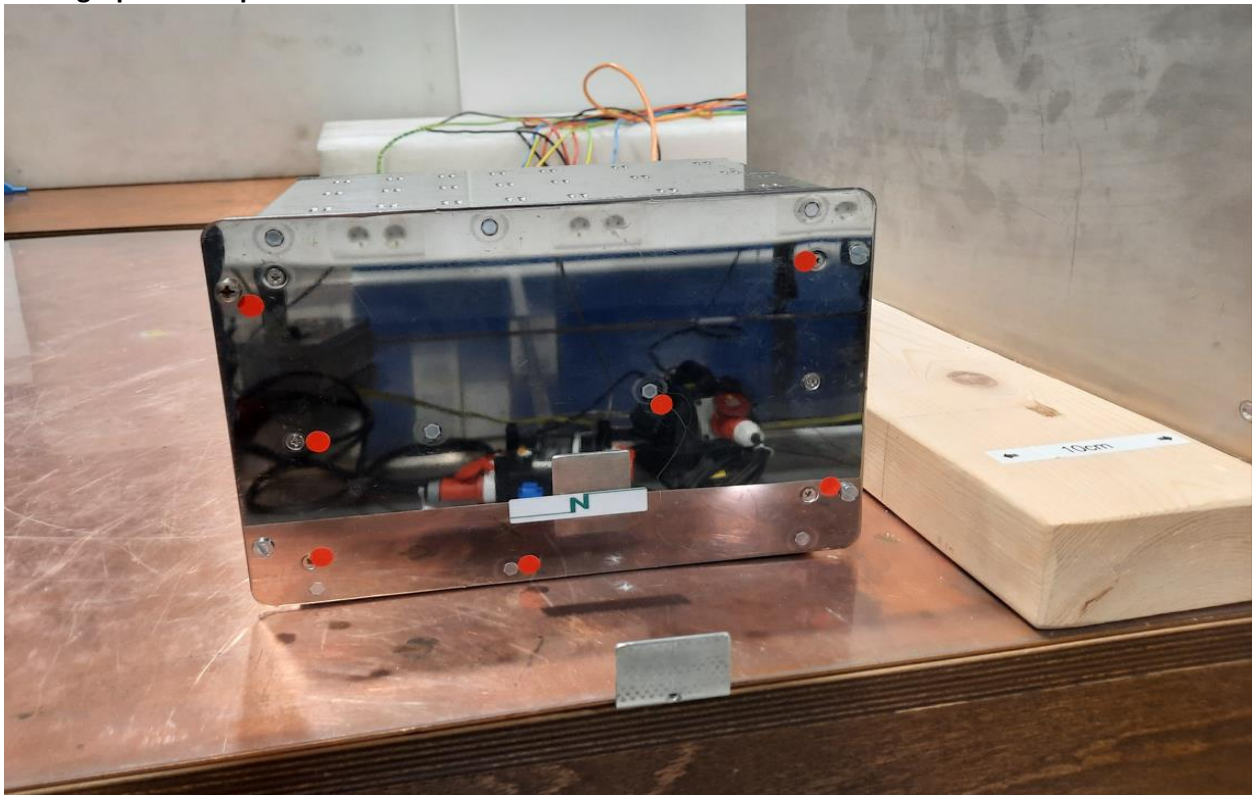
No degradation of performance observed during and after the test

### Requirements

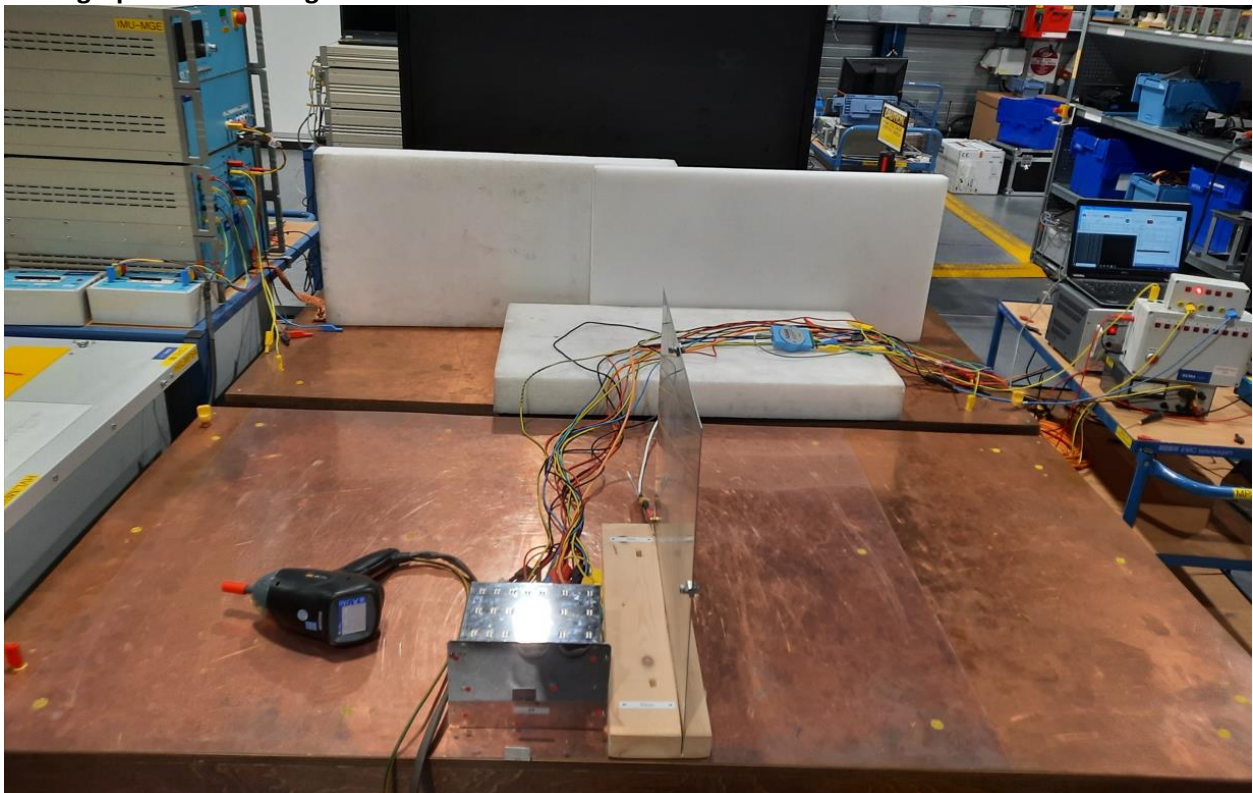
- the object shall comply with reliability class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

**Photograph of test points**

Refer to the test points highlighted within the red marks.

**Photograph of test arrangement**

Electrostatic Discharge (ESD) Test Setup.

### 10.4.1 Radiated interference

#### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-3  
 Test date September 30, 2024

#### Characteristic test data

Serial number 24280807  
 Amplitude modulated 80 % AM (1 kHz)  
 Dwell time 2 s  
 Power supply / test condition 24 and 48 Vdc  
 Frequency range 80 - 3000 MHz MHz step (size 1 %)  
 Dwell time 2 s  
 Spot frequency 80, 160, 380, 450, 900, 1851, 2150 MHz  
 Dwell time 20 s  
 Power supply 24 and 48 Vdc

#### Frequency sweep

| Direction<br><b>24 Vdc</b>                                           | Test level<br>V/m | Sweep rate | Frequency sweep<br>MHz | Observations |
|----------------------------------------------------------------------|-------------------|------------|------------------------|--------------|
| Front side of test object<br>(horizontal & vertical polarization)    | 10                | ≤ 1%       | 80 – 3000              | -            |
| Left side of EUT test object<br>(horizontal & vertical polarization) | 10                | ≤ 1%       | 80 – 3000              | -            |
| Right side of test object<br>(horizontal & vertical polarization)    | 10                | ≤ 1%       | 80 – 3000              | -            |

| Direction<br><b>48 Vdc is an additional test</b>                     | Test level<br>V/m | Sweep rate | Frequency sweep<br>MHz | Observations |
|----------------------------------------------------------------------|-------------------|------------|------------------------|--------------|
| Front side of test object<br>(horizontal & vertical polarization)    | 10                | ≤ 1%       | 80 – 3000              | -            |
| Left side of EUT test object<br>(horizontal & vertical polarization) | 10                | ≤ 1%       | 80 – 3000              | -            |
| Right side of test object<br>(horizontal & vertical polarization)    | 10                | ≤ 1%       | 80 – 3000              | -            |

#### Observations

No degradation of performance observed during and after the test.

#### Requirements

- the object shall comply with reliability class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

#### Result

The object passed the test.

**Photographs of test arrangement**

Radiated interference test setup, back side



Radiated interference test setup, front side

## 10.5 Electrical fast transient

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-4  
 Test date October 16 to 21, 2024

### Characteristic test data

Serial number 24290001  
 Polarity positive and negative  
 Test duration 1 minute

| Circuit                       | Terminals      | Coupling | Test voltage<br>kV | Repetition<br>frequency<br>kHz | Observations |
|-------------------------------|----------------|----------|--------------------|--------------------------------|--------------|
| Power supply<br>port (24 Vdc) | + , -          | CM (CDN) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Ethernet                      | LOCAL          | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Ethernet                      | WAN1           | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Ethernet                      | LAN1           | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Binary input<br>port          | DI1            | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Binary input<br>port          | DI21           | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Binary input<br>port          | DI48           | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Alarm/Relay<br>output port    | DO1            | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Alarm/Relay<br>output port    | DO5            | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Alarm/Relay<br>output port    | DO11           | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| RS-232                        | COM2<br>TX, RX | CM (CCC) | ±2                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |
| Earth port                    | PE             | CM (CCC) | ±4                 | 5                              | -            |
|                               |                |          |                    | 100                            | -            |

### Note

Fast transients at 100 kHz are optional and not required by IEC 61850-3.

CM = Common Mode

CDN = Coupling-Decoupling Network

CCC = Capacitive Coupling Clamp

### Observations

No degradation of performance observed during and after the test.

**Requirements**

- the object shall comply with reliability class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

**Result**

The object passed the test.

**Photograph of test arrangement**

## 10.6 Slow damped oscillatory wave

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
Basic standard IEC 61000-4-18  
Test date September 9 to 11, 2024

### Characteristic test data

Serial number 24290001  
Voltage oscillation frequency 100 kHz / 1 MHz  
Voltage rise time 75 ns  
Repetition frequency 40 / 400 s  
Output impedance 200  $\Omega$   
Polarity of the first half-period Positive and negative

| Circuit/Port        | Terminals           | Coupling         | Test voltage<br>kV | Observations |
|---------------------|---------------------|------------------|--------------------|--------------|
| Power supply port 1 | + , -               | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Binary input        | DI1                 | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Ethernet port       | LOCAL               | CM <sup>1)</sup> | 2,5                | -            |
| Ethernet port       | WAN                 | CM <sup>1)</sup> | 2,5                | -            |
| Ethernet port       | LAN                 | CM <sup>1)</sup> | 2,5                | -            |
| RS-232              | COM1<br>TX, RX, com | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Binary input        | DI 21               | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Binary input        | DI 48               | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Output contact      | Relay 1             | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Output contact      | Relay 5             | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |
| Output contact      | Relay 9             | CM               | 2,5                | -            |
|                     |                     | DM               | 1,0                | -            |

### Note

<sup>1)</sup> injected on the shield  
(Slow damped oscillatory wave 100 kHz is optional and not required by IEC 61850-3:100 kHz)

### Observations

No degradation of performance observed during and after the test.

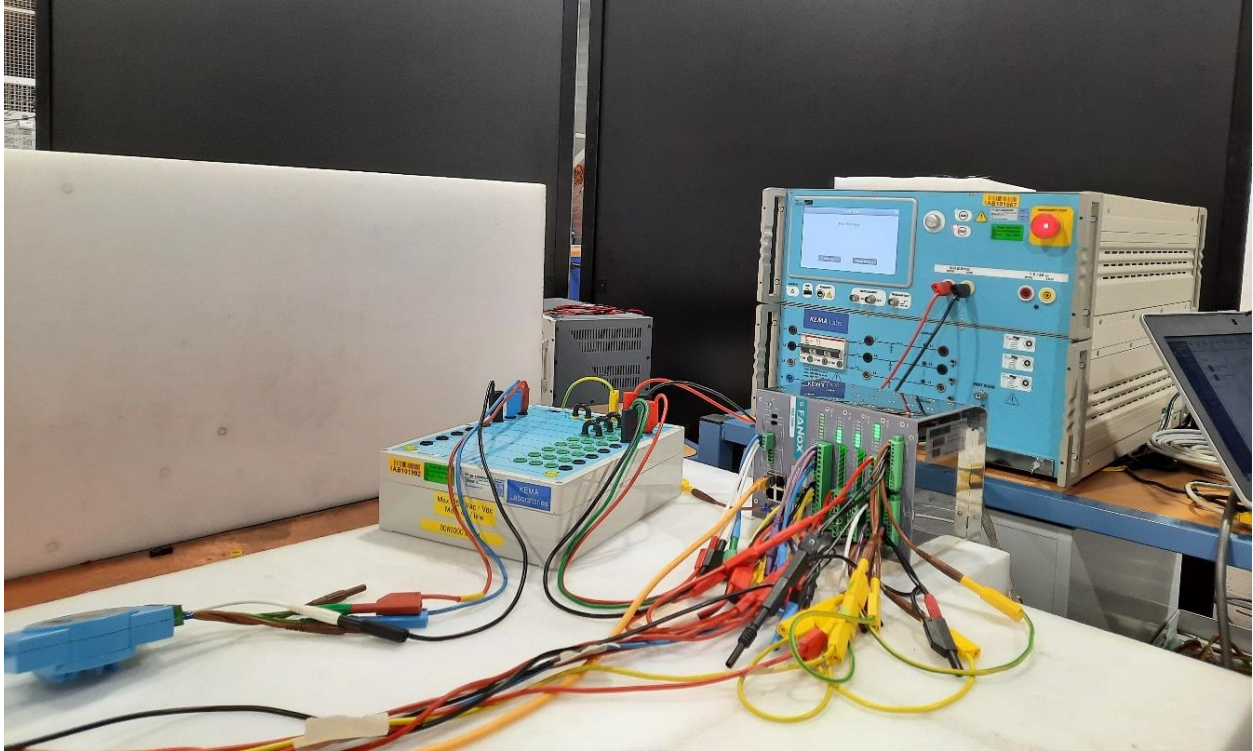
### Requirements

- the object shall comply with reliability class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

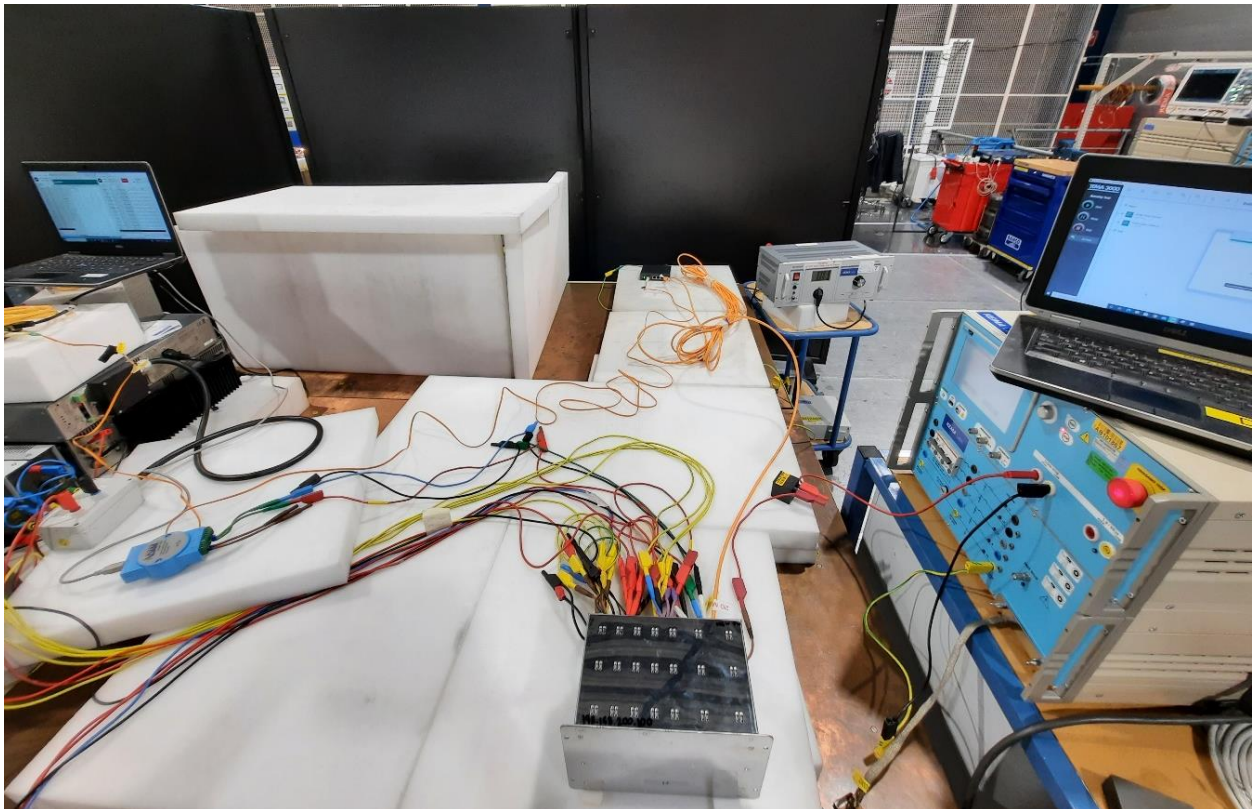
### Result

The object passed the test.

**Photographs of test arrangement**



The slow damped oscillatory wave test performed on the RS232 port.



The slow damped oscillatory wave test performed on the Ethernet port.

## 10.7 Surge

### Standard and date

|                |                                               |
|----------------|-----------------------------------------------|
| Standard       | IEC 61850-3, subclause 6.7.3                  |
| Basic standard | IEC 61000-4-5                                 |
| Test date      | September 21 to 25 and October 14 to 18, 2024 |

### Characteristic test data

|                              |                   |
|------------------------------|-------------------|
| Serial number                | 24290001          |
| Source impedance             | 2 $\Omega$        |
| Front time (voltage)         | 1,2 $\mu\text{s}$ |
| Time to half value (voltage) | 50 $\mu\text{s}$  |
| Front time (current)         | 8 $\mu\text{s}$   |
| Time to half value (current) | 20 $\mu\text{s}$  |
| Auxiliary power supply port  |                   |
| Coupling capacitor           | 18 $\mu\text{F}$  |
| Coupling resistor            | 0 $\Omega$        |
| Coupling resistor            | 10 $\Omega$       |
| Coupling capacitor           | 9 $\mu\text{F}$   |
| Input and output ports       |                   |
| Coupling resistor            | 40 $\Omega$       |
| Coupling capacitor           | 0,5 $\mu\text{F}$ |

| Circuit                       | Terminals           | Coupling | Test voltage<br>kV | Observations |
|-------------------------------|---------------------|----------|--------------------|--------------|
| Power supply port<br>(24 Vdc) | + , -               | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| Ethernet port                 | LOCAL               | LL       | -                  | -            |
|                               |                     | LE       | $\pm 4^{1)}$       | -            |
| Ethernet port                 | WAN1                | LL       | -                  | -            |
|                               |                     | LE       | $\pm 4^{1)}$       | -            |
| Ethernet port                 | LAN1                | LL       | -                  | -            |
|                               |                     | LE       | $\pm 4^{1)}$       | -            |
| Binary input port             | DI1                 | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| Binary input port             | DI21                | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| Binary input port             | DI48                | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| Alarm/Relay output<br>port    | DO1                 | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| Alarm/Relay output<br>port    | DO5                 | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| Alarm/Relay output<br>port    | DO11                | LL       | $\pm 2$            | -            |
|                               |                     | LE       | $\pm 4$            | -            |
| RS-232                        | COM2<br>TX, RX, COM | LL       | $\pm 1$            | -            |
|                               |                     | LE       | $\pm 2$            | -            |

### Note

<sup>1)</sup> direct injection on the shield

### Observations

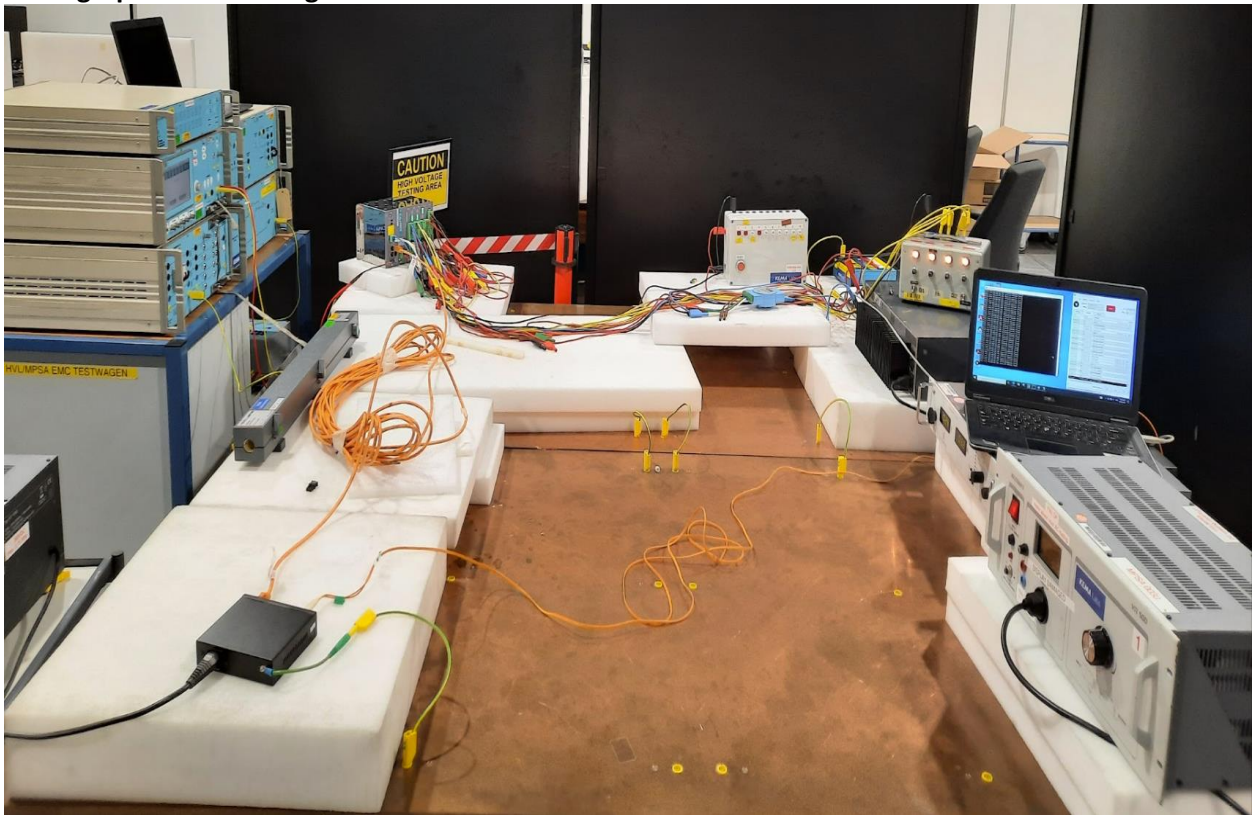
No degradation of performance observed during and after the test.

### Requirements

- the object shall comply with acceptance criteria class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

**Photograph of test arrangement**

The surge test performed on the Ethernet port.

## 10.8 Conducted disturbance induced by radio-frequency fields

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-6  
 Test date August 5 to 9, 2024

### Characteristic test data

Serial number 24290001  
 Source impedance 150  $\Omega$   
 Amplitude modulated 80 % AM (1 kHz)  
 Sweep rate 1 %  
 1,5 x 10<sup>-3</sup> decade/s  
 Dwell time (frequency sweep) 1 s  
 Test duration spot frequencies 10 s

### Frequency sweep

| Circuit                       | Terminals      | Test level<br>V | CDN | Sweep<br>rate | Frequency<br>sweep<br>MHz | Observations |
|-------------------------------|----------------|-----------------|-----|---------------|---------------------------|--------------|
| Power supply port<br>(24 Vdc) | + , -          | 10              | M2  | ≤ 1 %         | 0,15 - 80                 | -            |
| Ethernet port                 | LAN            | 10              | S8  | ≤ 1 %         | 0,15 - 80                 | -            |
| Ethernet port                 | Local          | 10              | S8  | ≤ 1 %         | 0,15 - 80                 | -            |
| RS-232                        | COM2<br>TX, RX | 10              | AF3 | ≤ 1 %         | 0,15 - 80                 | -            |
| Binary input port             | DI34 - 27      | 10              | AF8 | ≤ 1 %         | 0,15 - 80                 | -            |
| Binary input port             | DI9 - 16       | 10              | AF8 | ≤ 1 %         | 0,15 - 80                 | -            |
| Alarm/Relay output port       | DO9            | 10              | AF2 | ≤ 1 %         | 0,15 - 80                 | -            |
| Alarm/Relay output port       | DO1            | 10              | AF2 | ≤ 1 %         | 0,15 - 80                 | -            |
| Alarm/Relay output port       | DO7            | 10              | AF2 | ≤ 1 %         | 0,15 - 80                 | -            |
| Earth port                    | PE             | 10              | M1  | ≤ 1 %         | 0,15 - 80                 | -            |

### Observations

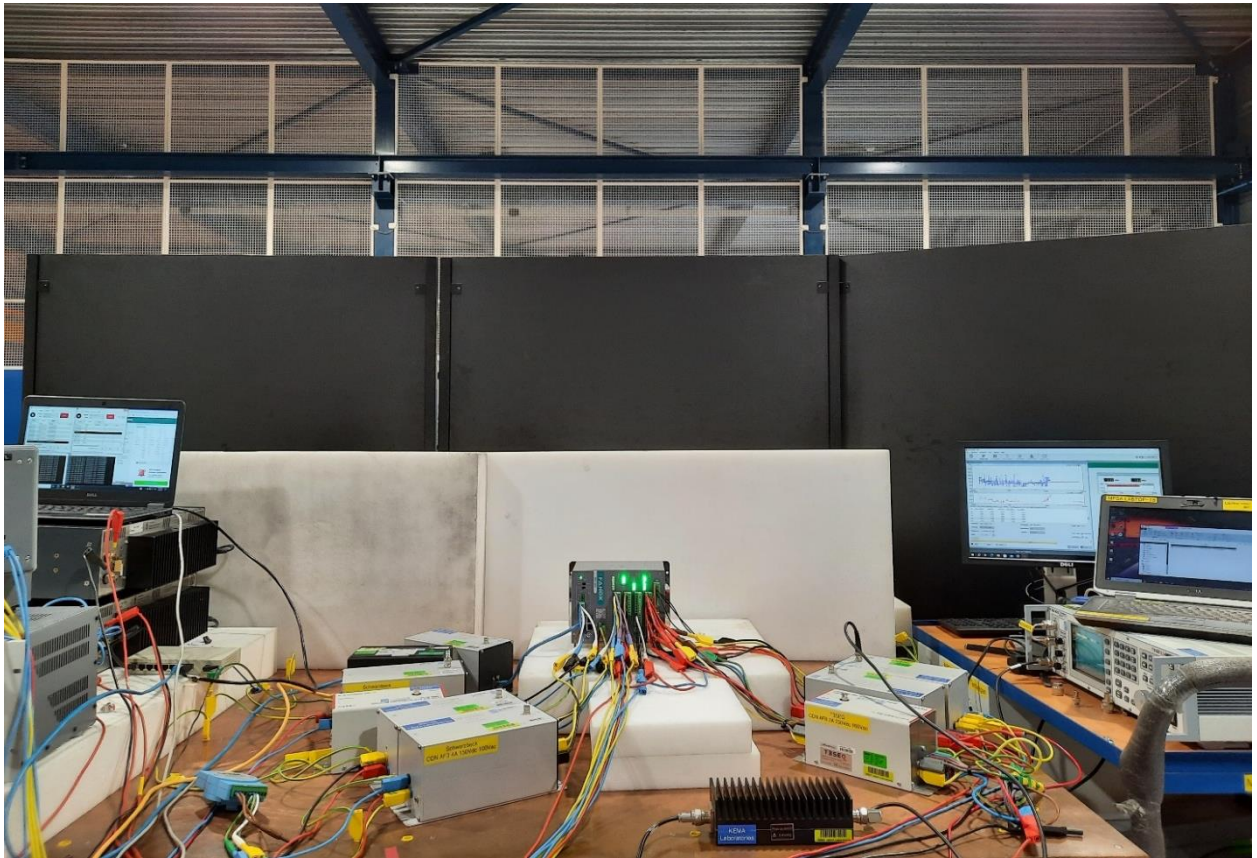
No degradation of performance observed during and after the test.

### Requirement

- The object shall comply with reliability class 2 of chapter 7.5 of the standard.

### Result

The object passed the test.

**Photograph of test arrangement**

## 10.9 Power frequency magnetic field

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-8  
 Test date August 18 to 19, 2024

### Characteristic test data

Serial number 24290001  
 Power supply 24 Vdc  
 Frequency 50 Hz

| Direction                   | Test level<br>A/m | Duration<br>s   | Observations |
|-----------------------------|-------------------|-----------------|--------------|
| Horizontal longitudinal (x) | 100               | 60 (continuous) | -            |
|                             | 1000              | 1 s             | -            |
| Horizontal transversal (y)  | 100               | 60 (continuous) | -            |
|                             | 1000              | 1 s             | -            |
| Vertical (z)                | 100               | 60 (continuous) | -            |
|                             | 1000              | 1 s             | -            |

### Observations

No degradation of performance observed during and after the test.

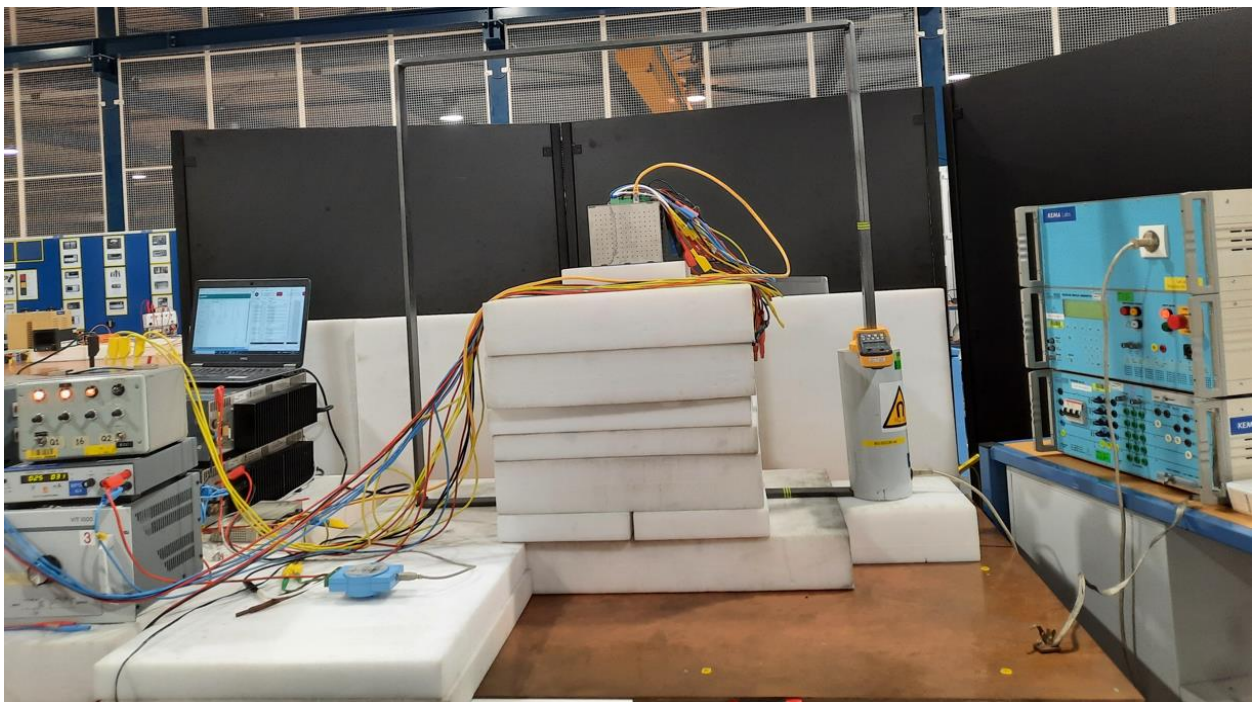
### Requirements

- the object shall comply with reliability class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

**Photographs of test arrangement**





## 10.10 Mains frequency voltage immunity

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-16  
 Test date October 21, 2024

### Characteristic test data

Serial number 24290001  
 Frequency 50 and 60 Hz  
 Power supply 24 Vdc

#### DC power ports

| Circuit             | Terminals | Test duration<br>s | Test voltage<br>V | Coupling resistor<br>$\Omega$ | Coupling capacitor<br>$\mu\text{F}$ | Observations |
|---------------------|-----------|--------------------|-------------------|-------------------------------|-------------------------------------|--------------|
| DC input power port | +, -      | 60                 | 30                | 200                           | -                                   | -            |
|                     |           | 1                  | 300               | 200                           | -                                   | -            |

#### DC Binary input ports

| Circuit             | Terminals | Test duration<br>s | Test voltage<br>V | Coupling resistor<br>$\Omega$ | Coupling capacitor<br>$\mu\text{F}$ | Observations |
|---------------------|-----------|--------------------|-------------------|-------------------------------|-------------------------------------|--------------|
| Binary input Slot 3 | 1, GND    | 60                 | 30                | 200                           | 1,0                                 | -            |
|                     |           | 1                  | 300               | 200                           | 1,0                                 | -            |

### Observations

No degradation of performance observed during and after the test.

### Requirements

- the object shall comply with acceptance criteria class 2 of chapter 7.5 of the standard.
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

**Photograph of test arrangement**

## 10.11 Voltage dips and voltage interruptions on DC power supply voltage

### Standard and date

Standard IEC 61850-3, subclause 6.7.3  
 Basic standard IEC 61000-4-11, IEC 61000-4-29  
 Test date October 22, 2024

### Characteristic test data

Serial number 24290001 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280801 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Time 0,1 s  
 Power supply 1 24 and 48 Vdc

### Voltage dips (The 48Vdc is an additional test)

| A317 model |       | Dip duration | Dip | Residual voltage | Observations |
|------------|-------|--------------|-----|------------------|--------------|
| PWR 1      | PWR 2 |              |     |                  |              |
| Vdc        | Vdc   | ms           | %   | Vdc              |              |
| 24         | N.A.  | 100          | 60  | 9,6              | 2            |
| 24         | N.A.  | 100          | 30  | 16,8             | 2            |
| 48         | N.A.  | 100          | 60  | 19,2             | 1            |
| 48         | N.A.  | 100          | 30  | 33,6             | 1            |

| A307 model |       | Dip duration | Dip | Residual voltage | Observations |
|------------|-------|--------------|-----|------------------|--------------|
| PWR 1      | PWR 2 |              |     |                  |              |
| Vdc        | Vdc   | ms           | %   | Vdc              |              |
| 24         | N.A.  | 100          | 60  | 9,6              | 2            |
| 24         | N.A.  | 100          | 30  | 16,8             | 2            |
| 48         | N.A.  | 100          | 60  | 19,2             | 1            |
| 48         | N.A.  | 100          | 30  | 33,6             | 1            |

### Observations

1. No degradation of performance observed during and after the test.
2. Performance degradation was observed during the test. The communication was disrupted, and the alarm relays changed status but self-recovered after the test was completed.

### Requirements

- the object shall comply with the required reliability class 1 of chapter 7.5.
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

### Remark

The 48 Vdc is an additional test.

**Voltage interruptions**

| <b>A317 model</b>      |       | Dip duration | Interruption | Residual voltage | Observations |
|------------------------|-------|--------------|--------------|------------------|--------------|
| PWR 1                  | PWR 2 |              |              |                  |              |
| Vdc                    | Vdc   |              | ms           | Vdc              |              |
| 24<br>(low impedance)  | N.A.  | 50           | 100          | 0                | 2            |
| 24<br>(high impedance) | N.A.  | 50           | 100          | 0                | 2            |
| 48<br>(low impedance)  | N.A.  | 50           | 100          | 0                | 1            |
| 48<br>(high impedance) | N.A.  | 50           | 100          | 0                | 1            |

| <b>A317 model</b>      |       | Dip duration | Interruption | Residual voltage | Observations |
|------------------------|-------|--------------|--------------|------------------|--------------|
| PWR 1                  | PWR 2 |              |              |                  |              |
| Vdc                    | Vdc   |              | ms           | Vdc              |              |
| 24<br>(low impedance)  | N.A.  | 50           | 100          | 0                | 2            |
| 24<br>(high impedance) | N.A.  | 50           | 100          | 0                | 2            |
| 48<br>(low impedance)  | N.A.  | 50           | 100          | 0                | 1            |
| 48<br>(high impedance) | N.A.  | 50           | 100          | 0                | 1            |

**Observations**

1. No degradation of performance observed during and after the test.
2. Performance degradation was observed during the test. The communication was disrupted, and the alarm relays changed status but self-recovered after the test was completed.

**Requirements**

- the object shall comply with the required reliability class 1 of chapter 7.5.
- the visual and functional inspection shall not reveal any defects or malfunctions.

**Result**

The object passed the test.

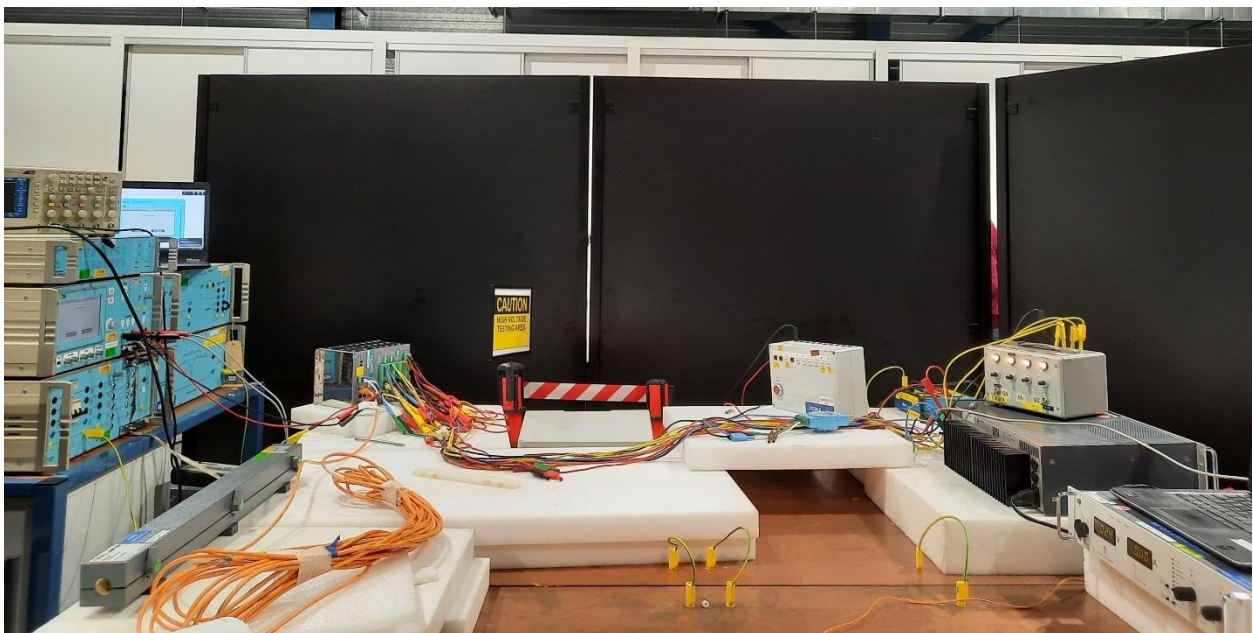
**Remark**

The 48 Vdc is an additional test.

### Photograph of test arrangement



Communication loss and relay status changes occurred during the application of 24 VDC input, with self-recovery after the test was completed. The device passed Class 1.



The device operated normally during the application of 48 VDC power and passed Class 2.

## 10.12 Voltage ripple on DC power supply voltage

### Standard and date

Standard IEC 61850-3, subclause 6.15  
 Basic standard IEC 61000-4-17  
 Test date October 24, 2024

### Characteristic test data

Serial number 24280807 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280801 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Auxiliary power supply input voltage 24 and 48 Vdc  
 Rated power frequency 50 Hz

| Power supply voltage<br>Vdc | Test frequency<br>Hz | Ripple<br>V/% | See oscillogram on<br>next pages | Observations |
|-----------------------------|----------------------|---------------|----------------------------------|--------------|
| 24                          | 100                  | 2,4/10        | 1 and 3                          | -            |
| 48                          | 100                  | 4,8/10        | 2 and 4                          | -            |

### Observations

No degradation of performance observed during and after the test.

### Requirements

- the object shall comply with the required reliability class 2 of chapter 7.5.
- the visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

### Remark

The 48 Vdc is an additional test.

## Oscillograms, Serial number: 24280807 (A317 model)

Oscillogram 1; 24 Vdc at 100 Hz



2,499 Vp-p

Oscillogram 2; 48 Vdc at 100 Hz



4,851 Vp-p

## Oscillograms, Serial number: 24280801 (A307 model)

Oscillogram 3; 24 Vdc at 100 Hz



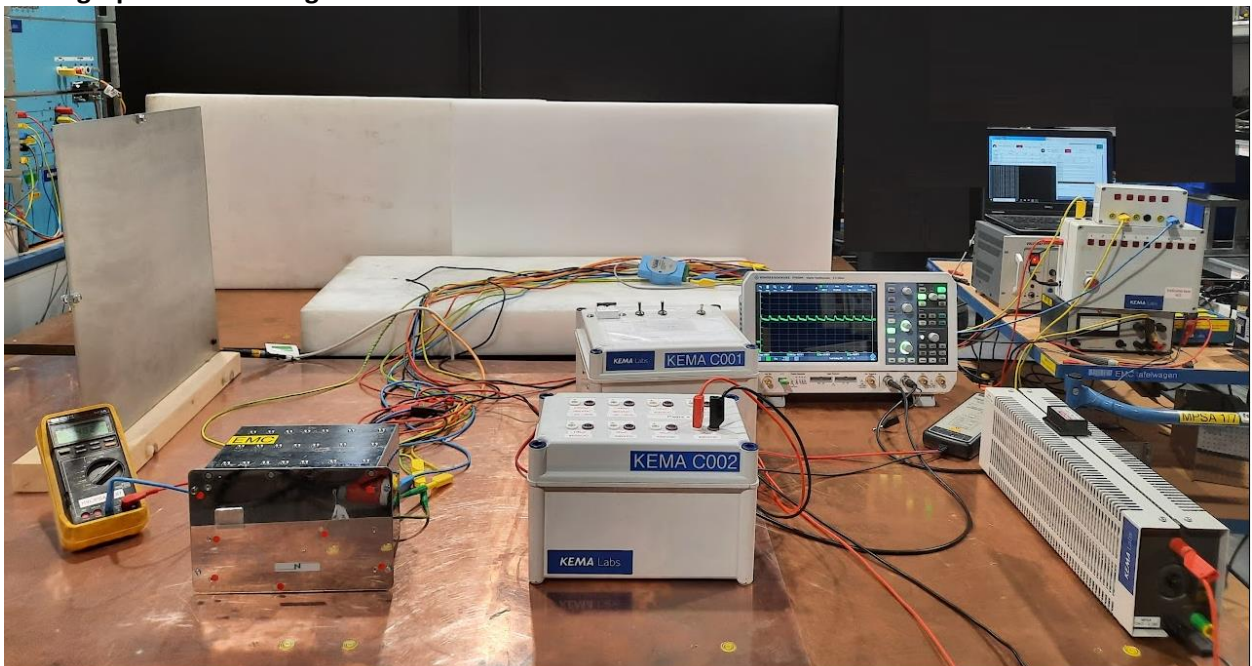
2,401Vp-p

Oscillogram 4; 48 Vdc at 100 Hz



4,802 Vp-p

## Photograph of test arrangement



## 11 ENERGIZING QUANTITIES

### 11.1 Burden for DC power supply

#### Standard and date

Standard IEC 61850-3, subclause 6.8.2

Test date September 4 to 5, 2024

#### Characteristic test data

Serial number 24290001 RNX-2000 9P 3L 1 A A 3 1 7 A

24280803 RNX-2000 9P 3L 1 A A 3 0 7 A

Number of measurements 5 (issue maximum value)

| Power input voltage<br>(A317 model)<br>Vdc | Measured<br>Current<br>A | Specified<br>burden<br>W | Calculated<br>burden<br>W | Observations |
|--------------------------------------------|--------------------------|--------------------------|---------------------------|--------------|
| 24                                         | 0,34                     | < 10                     | 8,16                      | -            |
| 48                                         | 0,16                     | < 10                     | 7,68                      | -            |

| Power input voltage<br>(A307 model)<br>Vdc | Measured<br>Current<br>A | Specified<br>burden<br>mW | Calculated<br>burden<br>W | Observations |
|--------------------------------------------|--------------------------|---------------------------|---------------------------|--------------|
| 24                                         | 0,35                     | < 10                      | 8,40                      | -            |
| 48                                         | 0,17                     | < 10                      | 8,16                      | -            |

#### Observations

No degradation of performance observed during and after the test.

#### Result

The object passed the test.

#### Remark

The 48 Vdc is an additional test.

## 11.2 Inrush current

### Standard and date

Standard IEC 61850-3, subclause 6.8.1.2 and 6.8.2.2  
 Test date September 4 to 5, 2024

### Characteristic test data

Serial number 24290001 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280803 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Number of measurements 5 (issue maximum value)

| Power input voltage<br>Vdc (A307 model) | Measured Peak current<br>A | Power up duration | Observations |
|-----------------------------------------|----------------------------|-------------------|--------------|
| 24                                      | 3,1                        | 2 mS              | -            |
| 48                                      | 13,6                       | 400 $\mu$ s       | -            |

| Power input voltage<br>Vdc (A317 model) | Measured Peak current<br>A | Power up duration | Observations |
|-----------------------------------------|----------------------------|-------------------|--------------|
| 24                                      | 3,5                        | 2 mS              | -            |
| 48                                      | 13,8                       | 400 $\mu$ s       | -            |

### Observations

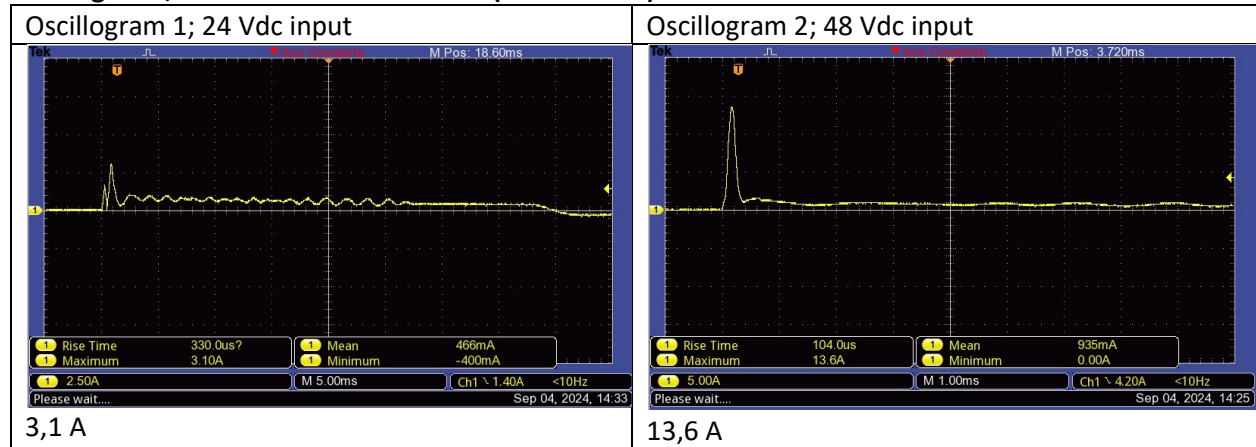
No degradation of performance observed during and after the test.

### Result

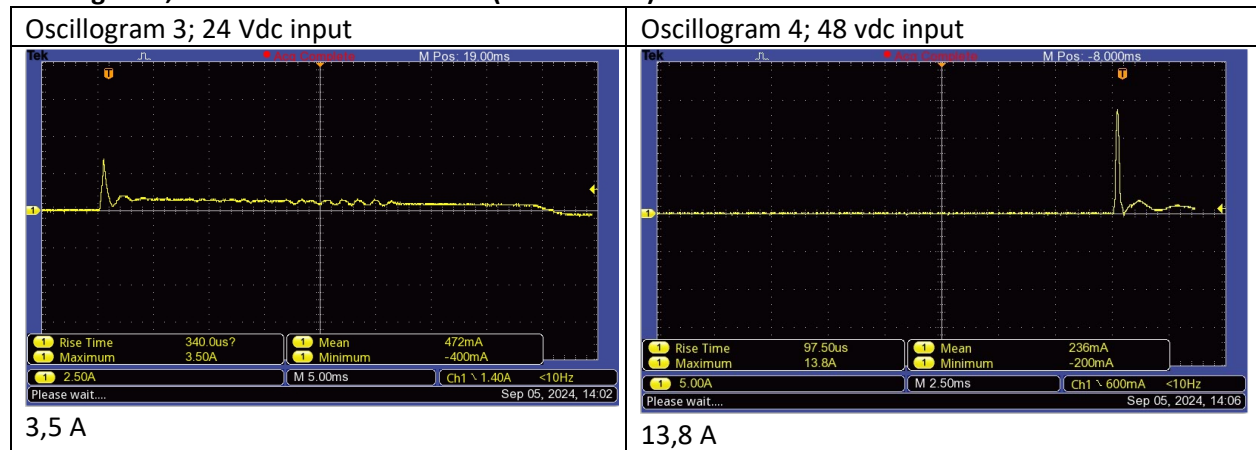
The object passed the test.

**Remark:** The 48Vdc is an additional test.

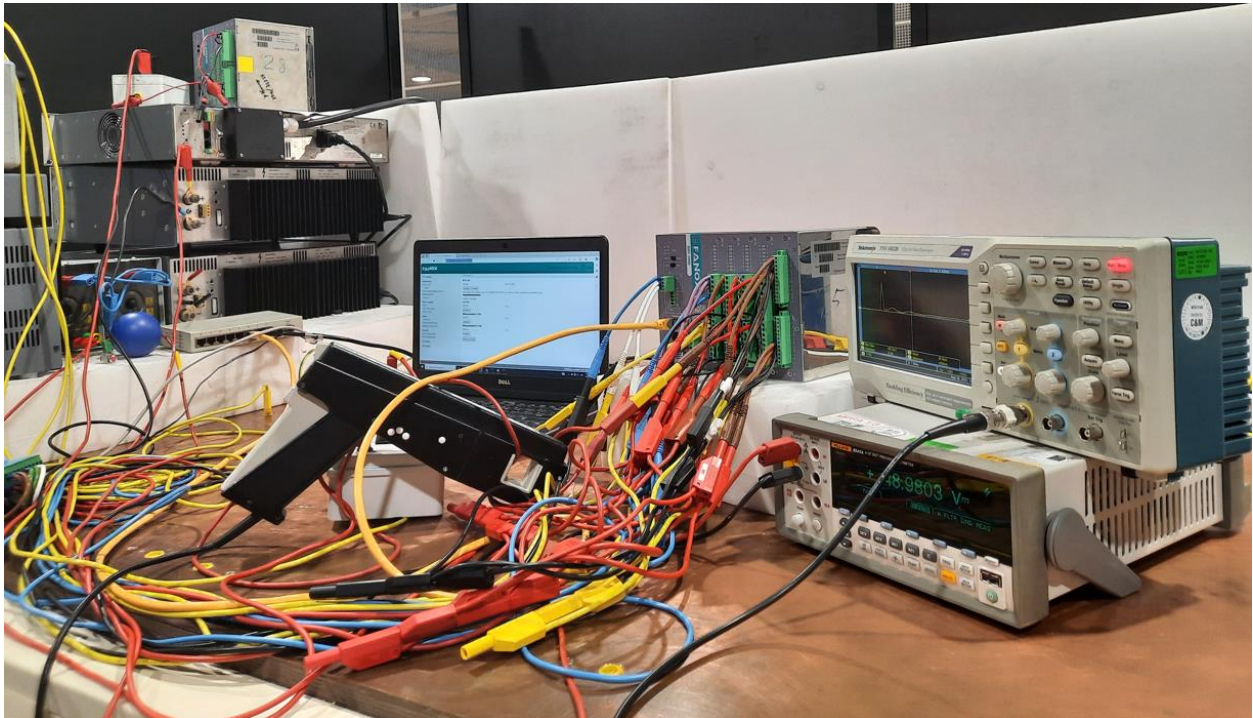
**Oscillograms, Serial number: 24290001 (A307 model)**



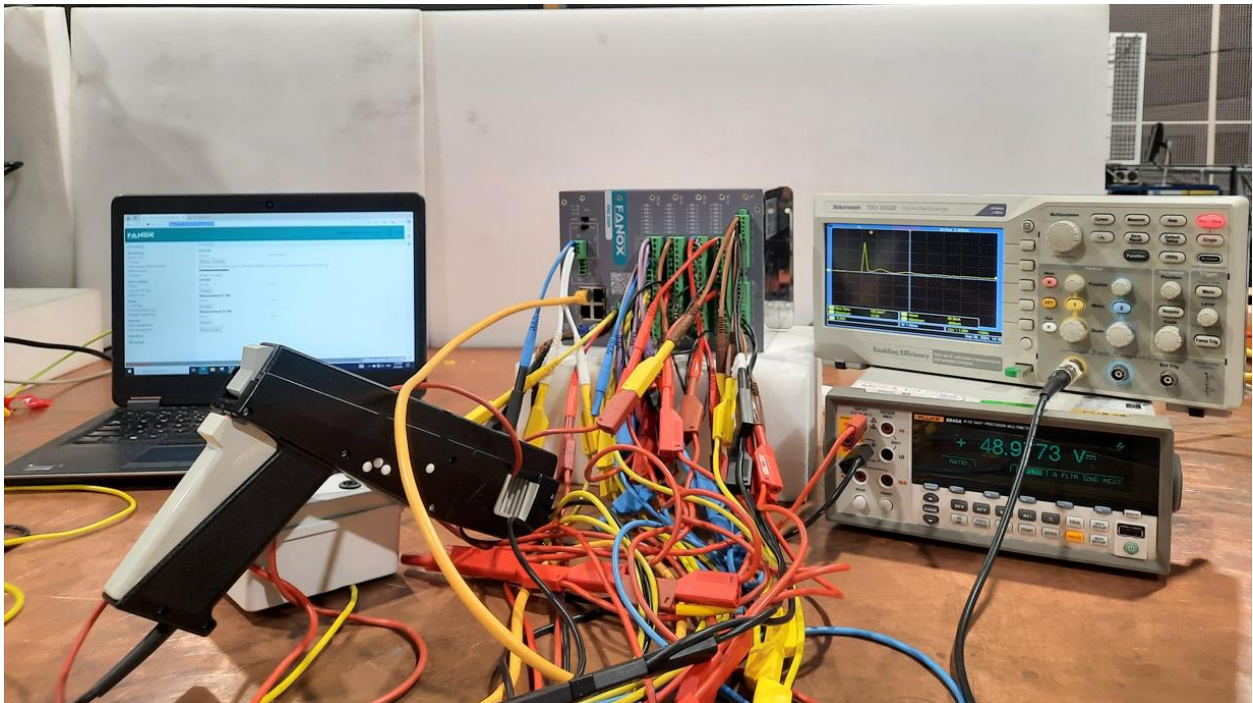
**Oscillograms, Serial number: 24280803 (A317 model)**



### Photograph of test arrangement



Test application voltage input 24 Vdc



Test application voltage input 48 Vdc

11.3 Burden for binary input

Standard and date

Standard IEC 61850-3, subclause 6.8.3  
Test date September 4 to 5, 2024

Characteristic test data

Serial number 24280803  
Number of measurements 5 (issue maximum value)

| Binary inputs |                           |                           | Burden              |                      | Remarks |
|---------------|---------------------------|---------------------------|---------------------|----------------------|---------|
| Circuit       | Applied Input voltage Vdc | Measured Input current mA | Specified burden mW | Calculated burden mW |         |
| DI1 - DI48    | 24                        | 57,23                     | < 4800              | 1373,52              | -       |
| DI1 - DI48    | 48                        | 69,65                     | < 4800              | 3343,20              | -       |
| DI1 - DI8     | 24                        | 9,81                      | < 800               | 235,44               | -       |
| DI1 - DI8     | 48                        | 11,71                     | < 800               | 562,08               | -       |
| DI1           | 24                        | 1,32                      | < 100               | 31,68                | -       |
| DI1           | 48                        | 1,5                       | < 100               | 72,00                | -       |

Observations

No degradation of performance observed during and after the test.

Result

The object passed the test.

## **12 CLIMATIC ENVIRONMENT**

### **12.1 Inspection**

#### **12.1.1 Pre-inspection**

The pre-inspection is performed to verify that the test object is in operational state. The pre-inspection is carried out prior to the test procedure.

The communication with the maintenance computer is verified. Signals are simulated to verify the functioning and operation with the specified performance specification for the following inputs and outputs:

- analogue inputs
- digital inputs
- contact outputs
- data communication

#### **12.1.2 Visual and functional inspection**

After each test a visual and functional inspection is carried out as described in this chapter.

The visual inspection is carried out to verify that there is no visual mechanical damage.

There shall be no:

- burning of any components
- paint blisters on any components
- discolouration on components
- deformation of modules or components
- interruptions or damage on interconnecting cables, wires and connectors

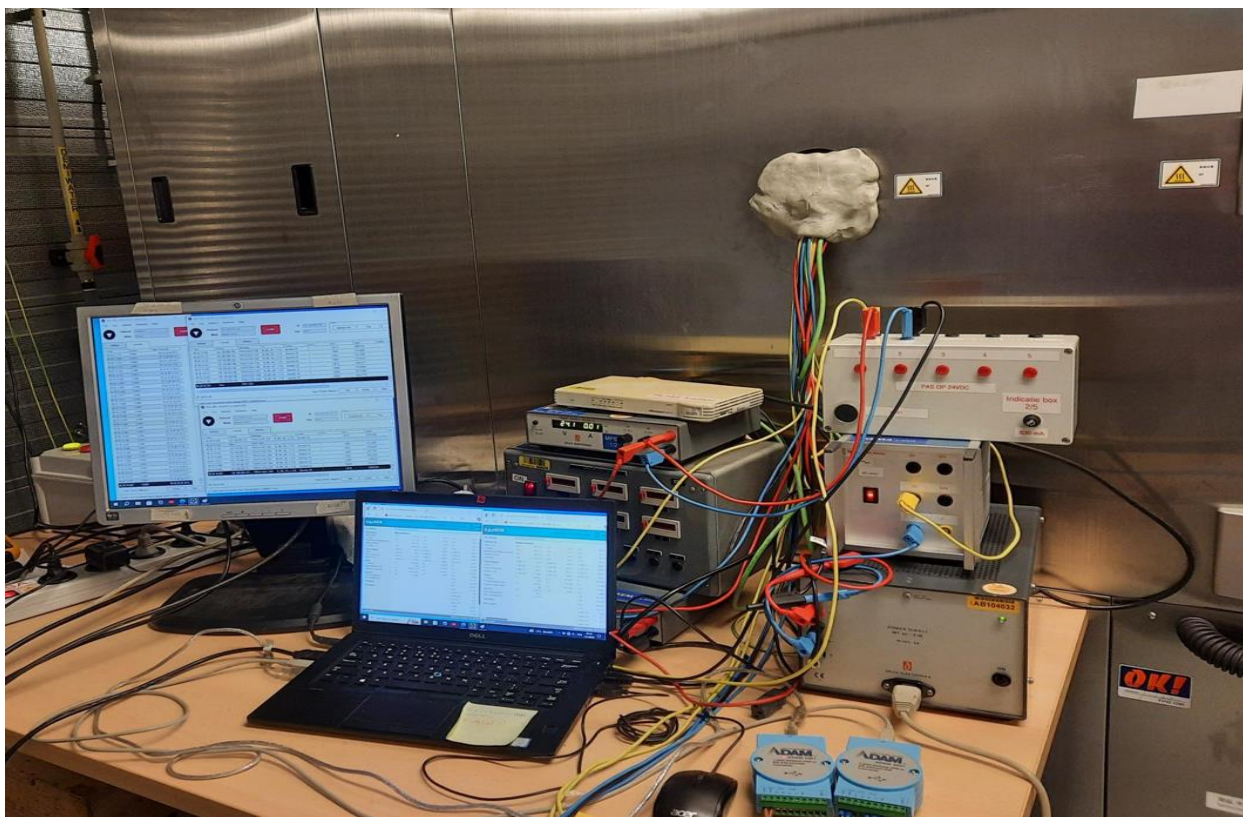
Functional inspection is carried out to verify the correct operation of the test object.

There shall be no:

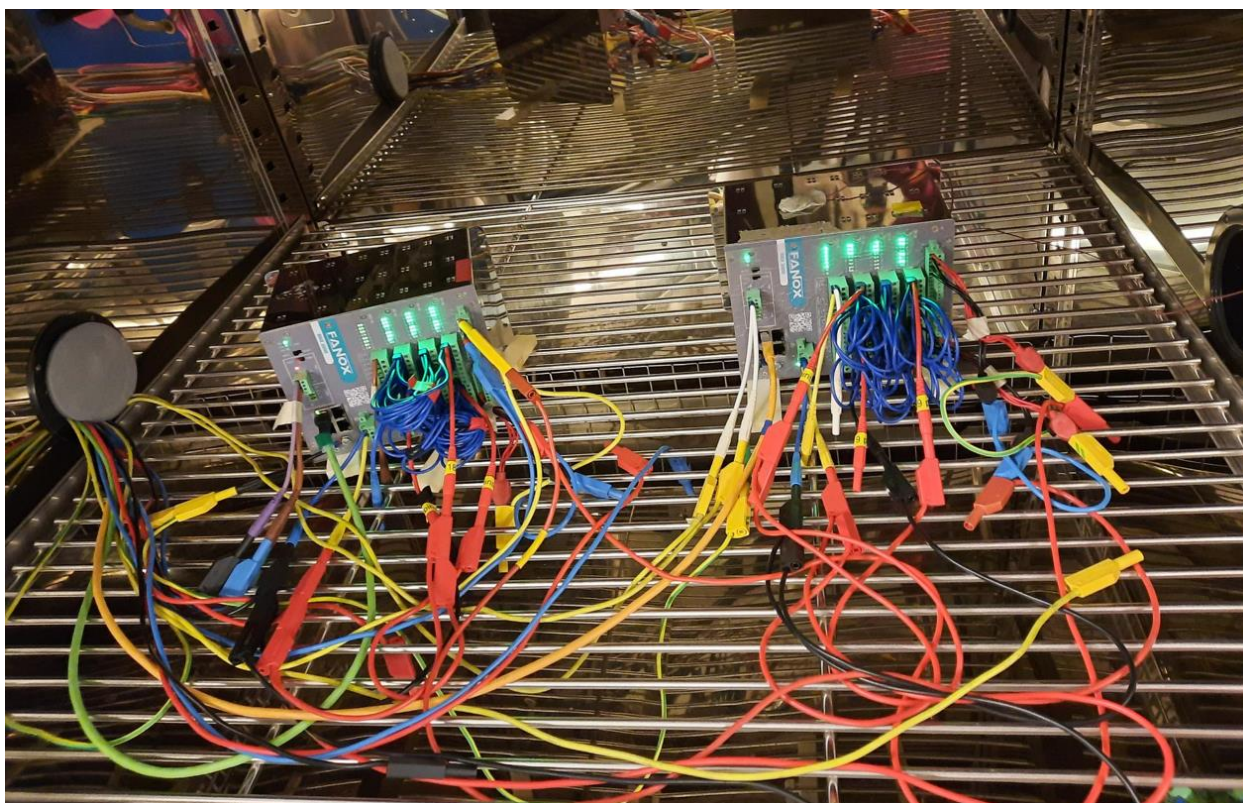
- alarm indications on display and LED's
- error messages reported in the maintenance computer
- unintentional change of contact outputs
- there shall be no degradation of performance below the claimed performance according reliability class (1 or 2)

Unless otherwise stated the visual and functional inspection was carried out successfully after each test.

## 12.2 Photograph of test arrangement

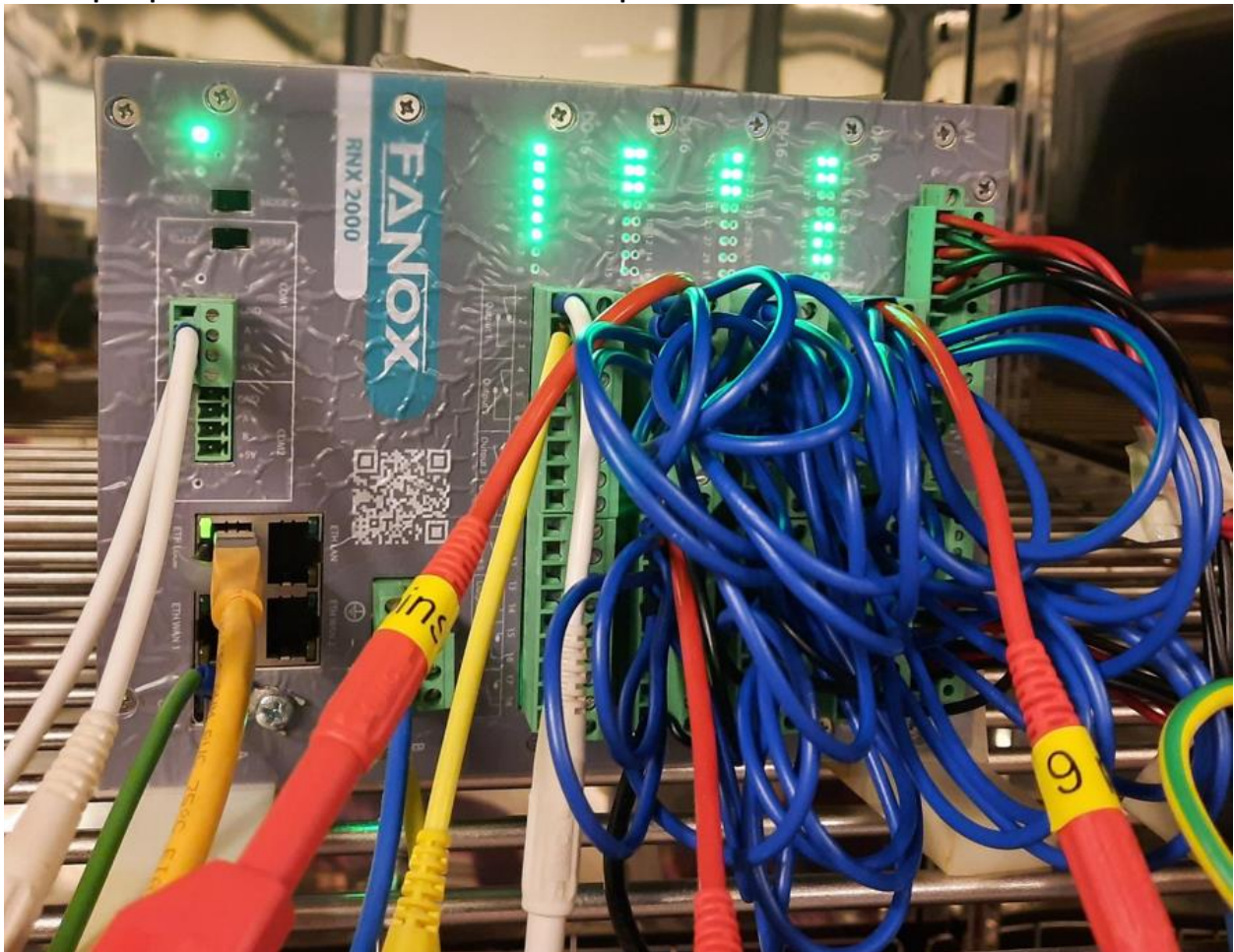


Outside view; Both devices are in normal operating condition after completing the climate test program.

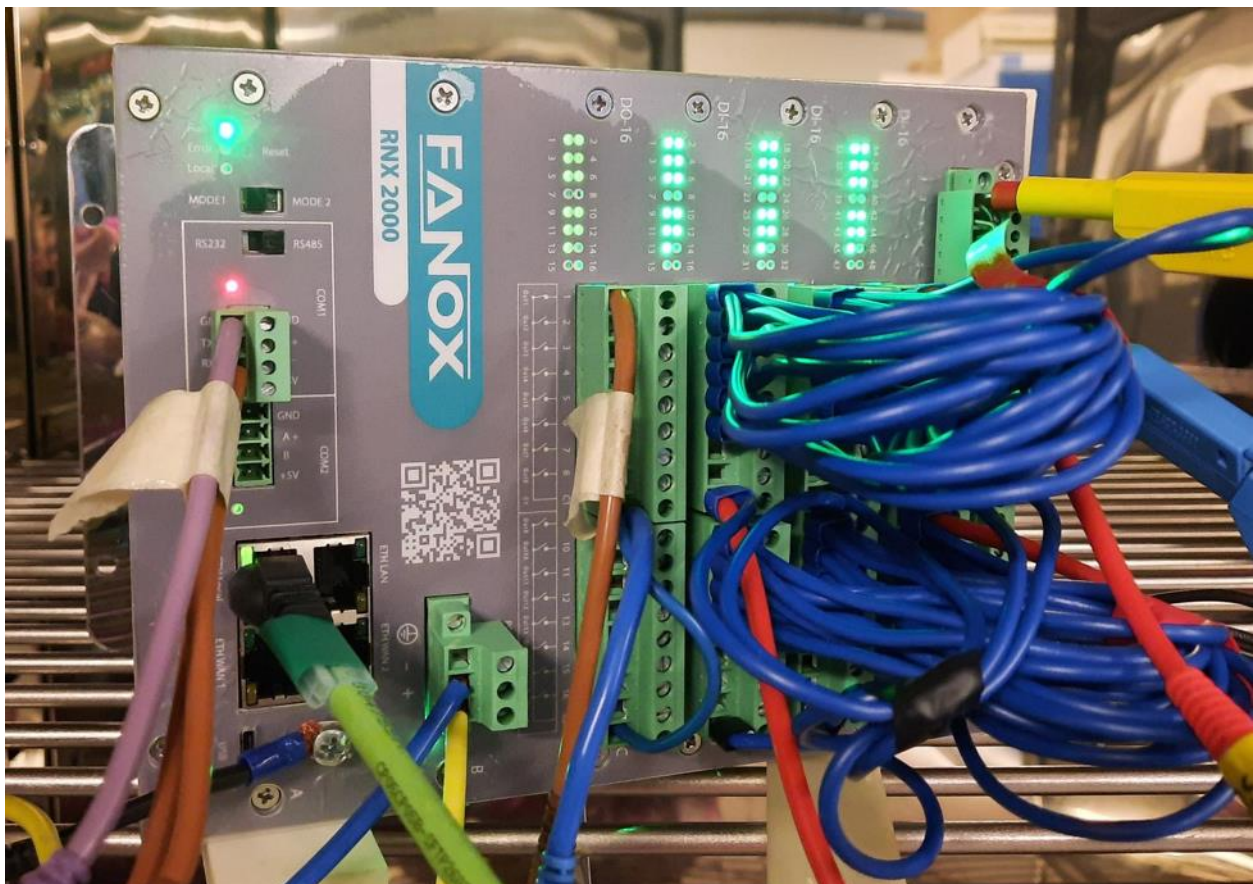


Inside view; The visual inspection inside the chamber during and after the operation.

Close-up inspection conducted after the test is completed.



A307 model, SN 24280809



A317 model, SN 242800

We observed that the plastic melted slightly due to the high temperature, but it did not affect the device's behavior during or after the test. This indicates that both devices are functioning normally.

## 12.3 Climatic environmental tests

### 12.3.1 Dry-heat test - operational

#### Standard and date

Standard IEC 61850-3, subclause 6.9.3.1

Basic standard IEC 60068-2-2

Test date November 7 - 11, 2024

#### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280800 RNX-2000 9P 3L 1 A A 3 0 7 A

Type of test Bd

Operating conditions energized

Power supply 24 Vdc

Relative humidity < 50 %

Maximum rate of change 1 °C/min over a period of 5 min

| Test procedure                         | Duration of exposure<br>h | Operating temperature<br>°C | Observation |
|----------------------------------------|---------------------------|-----------------------------|-------------|
| Powering up after                      | 1                         | + 70                        | -           |
| Correct function at rated load/current | 96                        |                             | -           |

#### Observations

No visual damage or functional errors were observed during or after the test.

#### Requirement

- A dielectric voltage test shall be performed
- Measurement of insulation resistance should be performed before and after climatic tests  
And before and after dielectric tests
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5

#### Result

The object passed the test.

### 12.3.2 Cold test - operational

#### Standard and date

Standard IEC 61850-3, subclause 6.9.3.2  
 Basic standard IEC 60068-2-1  
 Test date September 9 to 16, 2024

#### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Type of test Ad  
 Operating conditions energized  
 Power supply 24 Vdc  
 Relative humidity < 50 %  
 Maximum rate of change 1 °C/min over a period of 5 min

| Test procedure                            | Duration of exposure<br>h | Operating temperature<br>°C | Observation |
|-------------------------------------------|---------------------------|-----------------------------|-------------|
| Powering up after                         | 1                         | - 25                        | -           |
| Correct function at<br>rated load/current | 96                        |                             | -           |

#### Observations

No visual damage or functional errors were observed during or after the test.

#### Requirement

- A dielectric voltage test shall be performed.
- Measurement of insulation resistance should be performed before and after climatic tests and before and after dielectric tests.
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5

#### Result

The object passed the test.

12.3.3 Dry-heat test at maximum storage temperature

**Standard and date**

Standard IEC 61850-3, subclause 6.9.3.3  
Basic standard IEC 60068-2-2  
Test date November 14 to 18, 2024

**Characteristic test data**

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
Type of test Bb  
Operating conditions non-energized  
Power supply 0 V  
Relative humidity < 50 %  
Maximum rate of change 1 °C/min over a period of 5 min

| Test procedure | Duration of exposure<br>h | Operating temperature<br>°C | Observation |
|----------------|---------------------------|-----------------------------|-------------|
| Storage        | 96                        | + 70                        | -           |

**Observations**

No visual damage was observed, and both devices were operating normally after completing the test.

**Requirement**

- A dielectric voltage test shall be performed.
- Measurement of insulation resistance should be performed before and after climatic tests and before and after dielectric tests.
- The visual and functional inspection shall not reveal any defects or malfunctions.

**Result**

The object passed the test.

### 12.3.4 Cold test at minimum storage temperature

#### Standard and date

Standard IEC 61850-3, subclause 6.9.3.4  
Basic standard IEC 60068-2-1  
Test date September 3 to 9, 2024

#### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
Type of test Ab  
Operating conditions non-energized  
Power supply 0 V  
Relative humidity < 50 %  
Maximum rate of change 1 °C/min over a period of 5 min

| Test procedure | Duration of exposure<br>h | Operating temperature<br>°C | Observations |
|----------------|---------------------------|-----------------------------|--------------|
| Storage        | 96                        | - 25                        | -            |

#### Observations

No visual damage was observed, and both devices were operating normally after completing the test.

#### Requirement

- A dielectric voltage test shall be performed.
- Measurement of insulation resistance should be performed before and after climatic tests and before and after dielectric tests.
- The visual and functional inspection shall not reveal any defects or malfunctions.

#### Result

The object passed the test.

### 12.3.5 Change of temperature test

#### Standard and date

Standard IEC 61850-3, subclause 6.9.3.5  
 Basic standard IEC 60068-2-14  
 Test date November 12 to 14, 2024

#### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Type of test Nb  
 Operating conditions energized  
 Power supply 24 Vdc  
 Relative humidity <50 %  
 Maximum rate of change 1 °C/min  
 Exposure time  $t_1$  3 h  
 Duration of exposure 5 cycles

| Test procedure   | Exposure time<br>h | Duration of exposure | Operating temperature<br>°C | Observations |
|------------------|--------------------|----------------------|-----------------------------|--------------|
| Pre-conditioning | 1                  | -                    | +22                         | -            |
| Correct function | 3                  | 5                    | Min. - 25                   | -            |
|                  |                    |                      | Max. + 75                   | -            |

#### Observations

No visual damage or functional errors were observed during or after the test.

#### Requirement

- A dielectric voltage test shall be performed.
- Measurement of insulation resistance should be performed before and after climatic tests and before and after dielectric tests.
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5

#### Result

The object passed the test.

### 12.3.6 Damp-heat steady-state test

**Standard and date**

Standard IEC 61850-3, subclause 6.9.3.6  
 Basic standard IEC 60068-2-78  
 Test date July 26 to August 6, 2024

**Characteristic test data**

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Type of test Cab  
 Operating conditions energized  
 Power supply 24 Vdc  
 Relative humidity 93 %

| Test procedure    | Duration of exposure | Operating temperature °C | Humidity % | Observations |
|-------------------|----------------------|--------------------------|------------|--------------|
| Powering up after | 1 h                  | + 25                     | 50         | -            |
| Correct function  | 10 days              | + 40                     | 93         | -            |

**Observations**

No visual damage or functional errors were observed during or after the test.

**Requirement**

- A dielectric voltage test shall be performed.
- Measurement of insulation resistance should be performed before and after climatic tests and before and after dielectric tests.
- A protective bonding resistance test shall be performed.
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5

**Result**

The object passed the test.

### 12.3.7 Damp heat cyclic (12 h + 12 h) test

#### Standard and date

Standard IEC 61850-3, subclause 6.9.3.7  
 Basic standard IEC 60068-2-30  
 Test date August 28 to September 3, 2024

#### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Type of test Db  
 Operating conditions energized  
 Power supply 24 Vdc

| Test procedure   | Duration of exposure<br>h | Operating temperature<br>°C | Humidity<br>% | Observations |
|------------------|---------------------------|-----------------------------|---------------|--------------|
| Pre-conditioning | 1                         | +25                         | 60            | -            |
| Correct function | 12                        | +55                         | 93            | -            |
| Correct function | 12                        | +25                         | 97            | -            |

#### Observations

No visual damage or functional errors were observed during or after the test.

#### Requirement

- A dielectric voltage test shall be performed
- Measurement of insulation resistance should be performed before and after climatic tests and before and after dielectric tests
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5

#### Result

The object passed the test.

## 12.4 Measurement of insulation resistance

### Standard and date

Standard IEC 61850-3, subclause 6.9.2.2  
Test date November 19, 2024

### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
Test voltage 500 Vdc

| A317 model, circuit's | Before climatic tests<br>Observation | After climatic tests<br>Observation | After dielectric tests<br>Observation |
|-----------------------|--------------------------------------|-------------------------------------|---------------------------------------|
| Power supply          | -                                    | -                                   | -                                     |
| Digital Inputs        | -                                    | -                                   | -                                     |
| 16 Digital output     | -                                    | -                                   | -                                     |
| Ethernet RJ45         | -                                    | -                                   | -                                     |
| Serial RS232, RS485   | -                                    | -                                   | -                                     |
| CT, VT analog input   | -                                    | -                                   | -                                     |

| A307 model, circuit's | Before climatic tests<br>Observation | After climatic tests<br>Observation | After dielectric tests<br>Observation |
|-----------------------|--------------------------------------|-------------------------------------|---------------------------------------|
| 8 Digital output      | -                                    | -                                   | -                                     |

### Requirement

- The insulation resistance shall not be less than 10 MΩ
- No visual or functional inspection required.

### Result

The object passed the test.

## 12.5 Dielectric voltage test

### Standard and date

Standard IEC 61850-3, subclause 6.6.4  
 Test date November 19, 2024

### Characteristic test data

Serial number 24280809 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280800 RNX-2000 9P 3L 1 A A 3 0 7 A  
 Duration of test 1 min

| A317 model, circuit's | Before climatic tests<br>Observation | After climatic tests<br>Observation |
|-----------------------|--------------------------------------|-------------------------------------|
| Power supply          | -                                    | -                                   |
| Digital Inputs        | -                                    | -                                   |
| 16 Digital output     | -                                    | -                                   |
| Ethernet RJ45         | -                                    | -                                   |
| Serial RS232, RS485   | -                                    | -                                   |
| CT, VT analog input   | -                                    | -                                   |

| A307 model, circuit's | Before climatic tests<br>Observation | After climatic tests<br>Observation |
|-----------------------|--------------------------------------|-------------------------------------|
| 8 Digital output      | -                                    | -                                   |

### Requirement

The visual and functional inspection shall not reveal any defects or malfunctions.

### Result

The object passed the test.

## **13 MECHANICAL ENVIRONMENTAL CONDITION TESTS**

### **13.1 Inspection**

#### **13.1.1 Pre-inspection**

The pre-inspection is performed to verify that the test object is in operational state. The pre-inspection is carried out prior to the test procedure.

The communication with the maintenance computer is verified. Signals are simulated to verify the functioning and operation with the specified performance specification for the following inputs and outputs:

- analogue inputs
- digital inputs
- contact outputs
- data communication

#### **13.1.2 Visual and functional inspection**

After each test a visual and functional inspection is carried out as described in this chapter.

The visual inspection is carried out to verify that there is no visual mechanical damage.

There shall be no:

- burning of any components
- paint blisters on any components
- discolouration on components
- deformation of modules or components
- interruptions or damage on interconnecting cables, wires and connectors

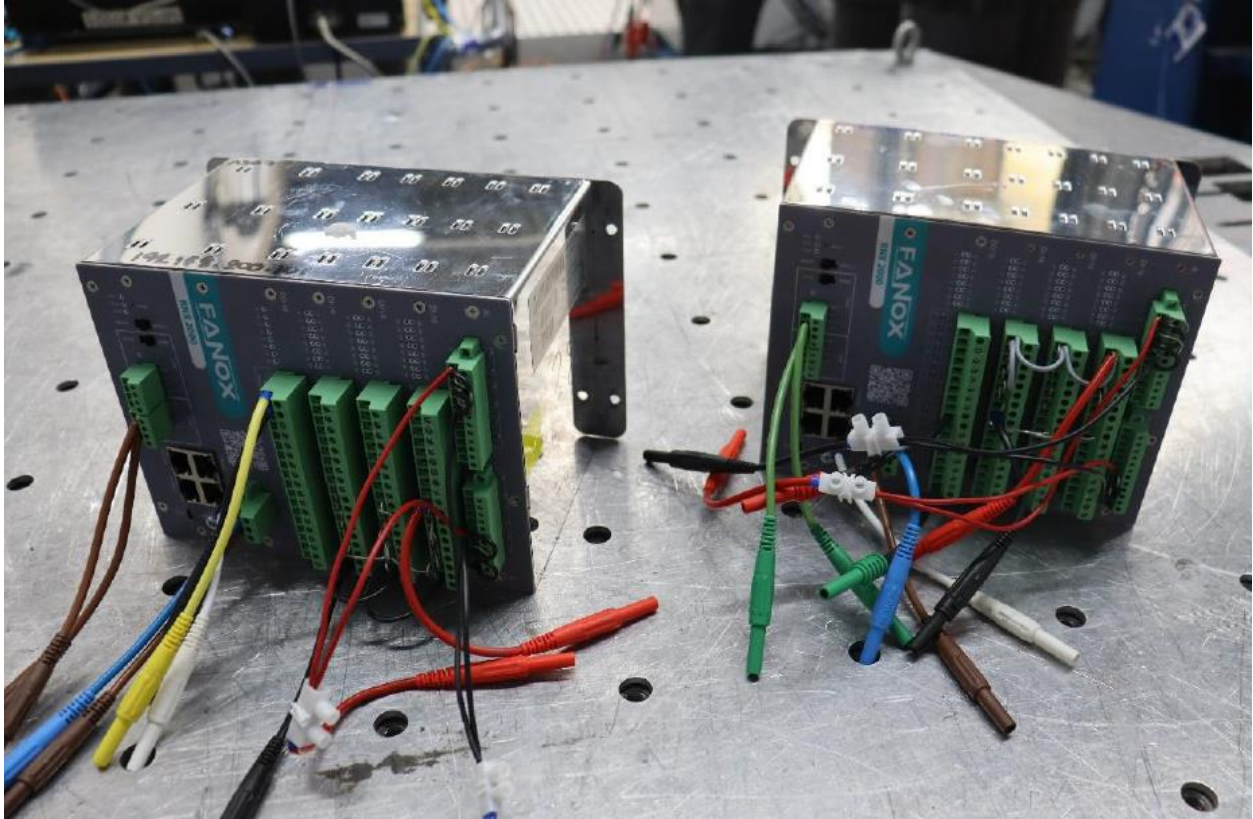
Functional inspection is carried out to verify the correct operation of the test object.

There shall be no:

- alarm indications on display and LED's
- error messages reported in the maintenance computer
- unintentional change of contact outputs
- there shall be no degradation of performance below the claimed performance according reliability class (1 or 2)

Unless otherwise stated the visual and functional inspection was carried out successfully after each test.

## 13.2 Photographs of test arrangement (before)



Serial nr. 24280801 (A307 model, Left side) and Serial nr. 24280806 (A317 model, Right side)  
Figure 1: Test item

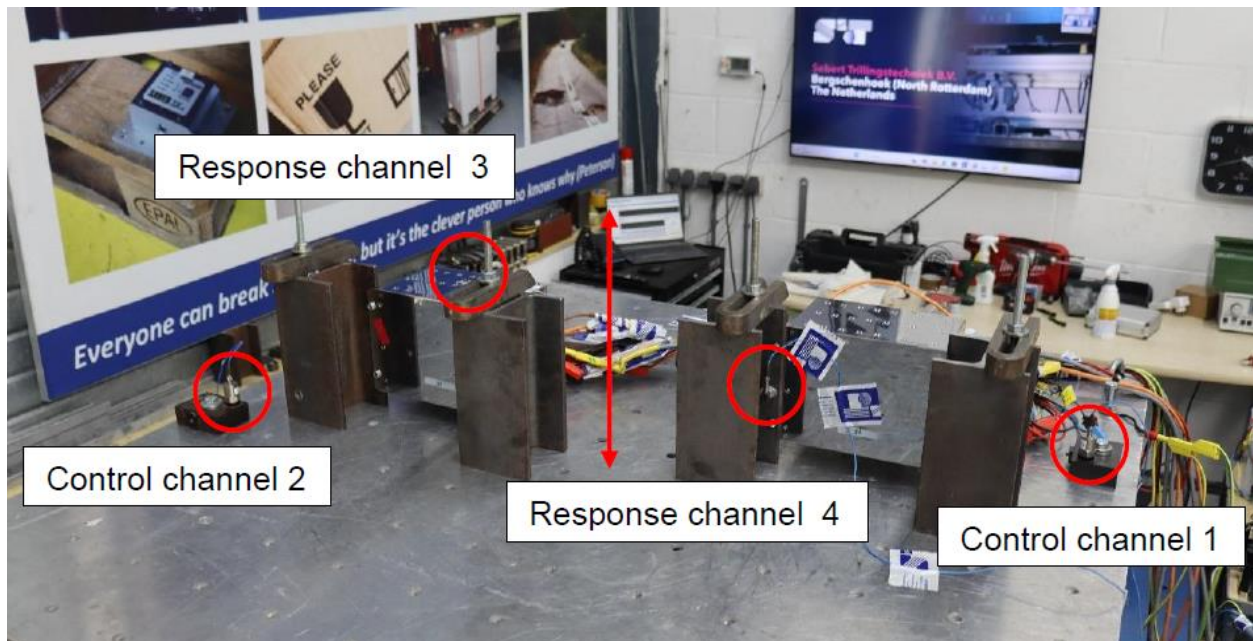


Figure 2: Test direction vertical (Z) and accelerometer location

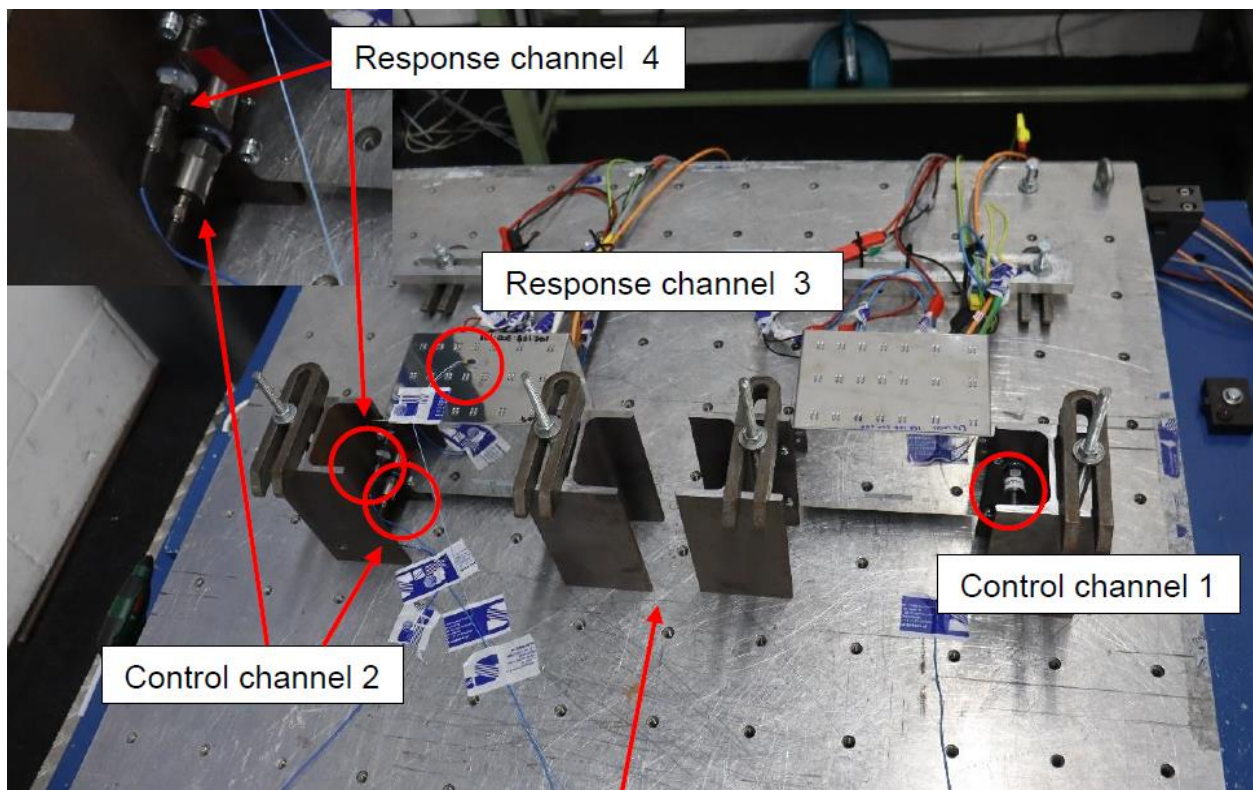


Figure 3: Test direction horizontal transversal (X) and accelerometer location

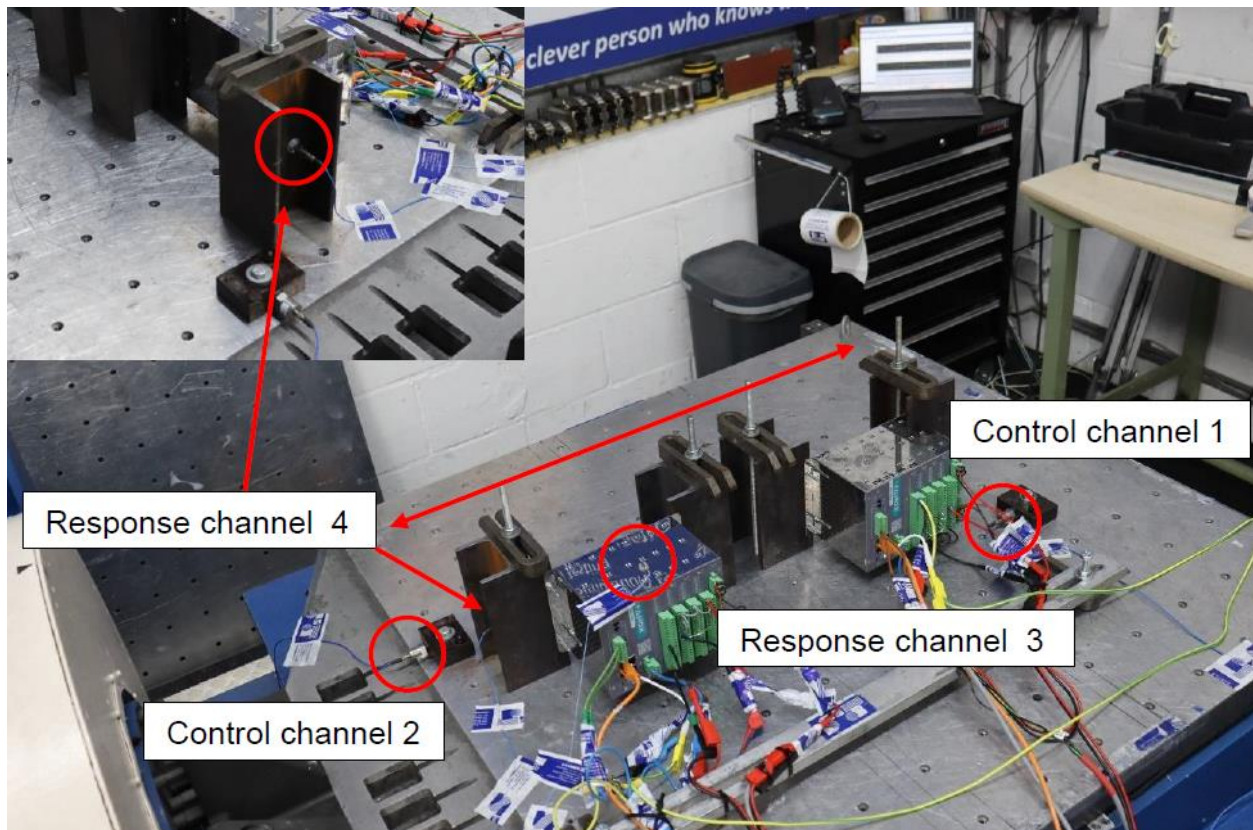
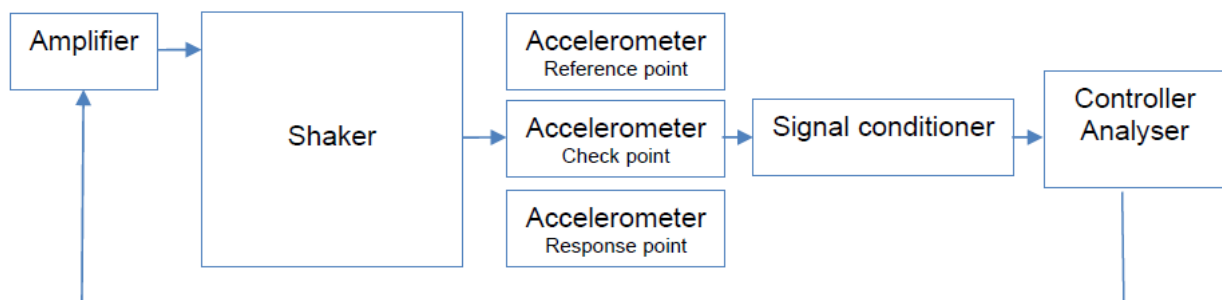


Figure 4: Test direction horizontal longitudinal (Y) and accelerometer location

#### Sketch of the test configuration



#### Measurement uncertainty and tolerances

All the measurements were carried out with a signal tolerance, including instrumentation errors, lower than 5% according to the standards. The combined standard uncertainty and the expanded uncertainty ( $k=2$ )  $U$  is lower than 10% according to: Measurement Uncertainty Calculator form version 23.8. For lower vibration frequency ( $>1 <10$  Hz), large size and high mass the signal tolerance is lower than 10%. Temperature and relative humidity are not operational factors.

### 13.3 Vibration response test

#### Standard and date

|                |                               |
|----------------|-------------------------------|
| Standard       | IEC 61850-3, subclause 6.10.1 |
| Basic standard | IEC 60255-21-1                |
| Test date      | November 24 to 26, 2024       |

#### Characteristic test data

|                                     |                                                                                |
|-------------------------------------|--------------------------------------------------------------------------------|
| Serial number                       | 24280806 RNX-2000 9P 3L 1 A A 3 1 7 A<br>24280801 RNX-2000 9P 3L 1 A A 3 0 7 A |
| Test object                         | energized                                                                      |
| Auxiliary power supply input        | 24 Vdc                                                                         |
| Frequency range                     | 10 to 150 Hz                                                                   |
| Displacement                        | 0,075 mm                                                                       |
| Acceleration                        | 1,0 g                                                                          |
| Number of sweep cycles in each axis | 1                                                                              |
| Number of axis (X, Y, Z)            | 3                                                                              |

#### Vibration response test in vertical direction (z)

##### Observations

- During and after the test, the test object was functional.
- No visual damage or functional errors have been found on the test object.

#### Vibration response test in horizontal transversal direction (y)

##### Observations

- During and after the test, the test object was functional.
- No visual damage or functional errors have been found on the test object.

#### Vibration response test in horizontal longitudinal direction (x)

##### Observations

- During and after the test, the test object was functional.
- No visual damage or functional errors have been found on the test object.

#### Requirement

- The object shall be subjected to the class 2 vibration response test parameters (Table 1) of IEC 60255-21-1
- the visual and functional inspection shall not reveal any defects or malfunctions.
- the object shall comply with the required reliability class 2 of chapter 7.5

#### Result

The object passed the test.

Test profile A: Typical sine vibration response plot

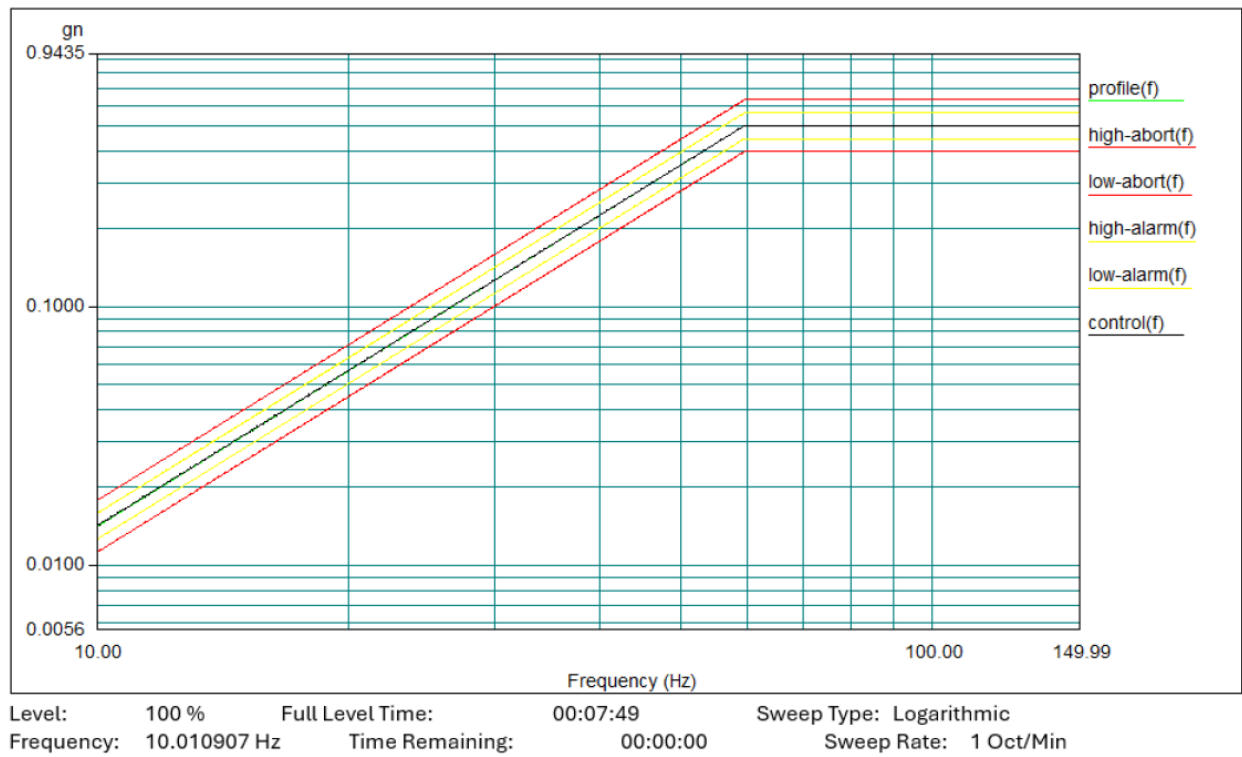


Table A: Vibration response test result

| Direction                   | Test time [min] | Result |
|-----------------------------|-----------------|--------|
| Vertical (Z)                | 8               | Passed |
| Horizontal transversal (X)  | 8               | Passed |
| Horizontal longitudinal (Y) | 8               | Passed |

**13.4 Vibration endurance test**

**Standard and date**

Standard IEC 61850-3, subclause 6.10.1  
Basic standard IEC 60255-21-1  
Test date November 24 to 26, 2024

**Characteristic test data**

Serial number 24280806 RNX-2000 9P 3L 1 A A 3 1 7 A  
24280801 RNX-2000 9P 3L 1 A A 3 0 7 A  
Test object non-energized  
Frequency range 10 to 150 Hz  
Acceleration 2 g  
Number of sweep cycles in each axis 20  
Number of axis (X, Y, Z) 3

**Vibration endurance test in vertical direction (z)**

**Observation**

No visual damage and no functional errors have been found on the test object.

**Vibration endurance test in horizontal transversal direction (y)**

**Observation**

No visual damage and no functional errors have been found on the test object.

**Vibration endurance test in horizontal longitudinal direction (x)**

**Observation**

No visual damage and no functional errors have been found on the test object.

**Requirement**

- The object shall be subjected to the class 2 of the vibration endurance test parameters (Table 2) of IEC 60255-21-1.
- The visual and functional inspection shall not reveal any defects or malfunctions.

**Result**

The object passed the test.

Test profile B: Typical sine vibration endurance plot

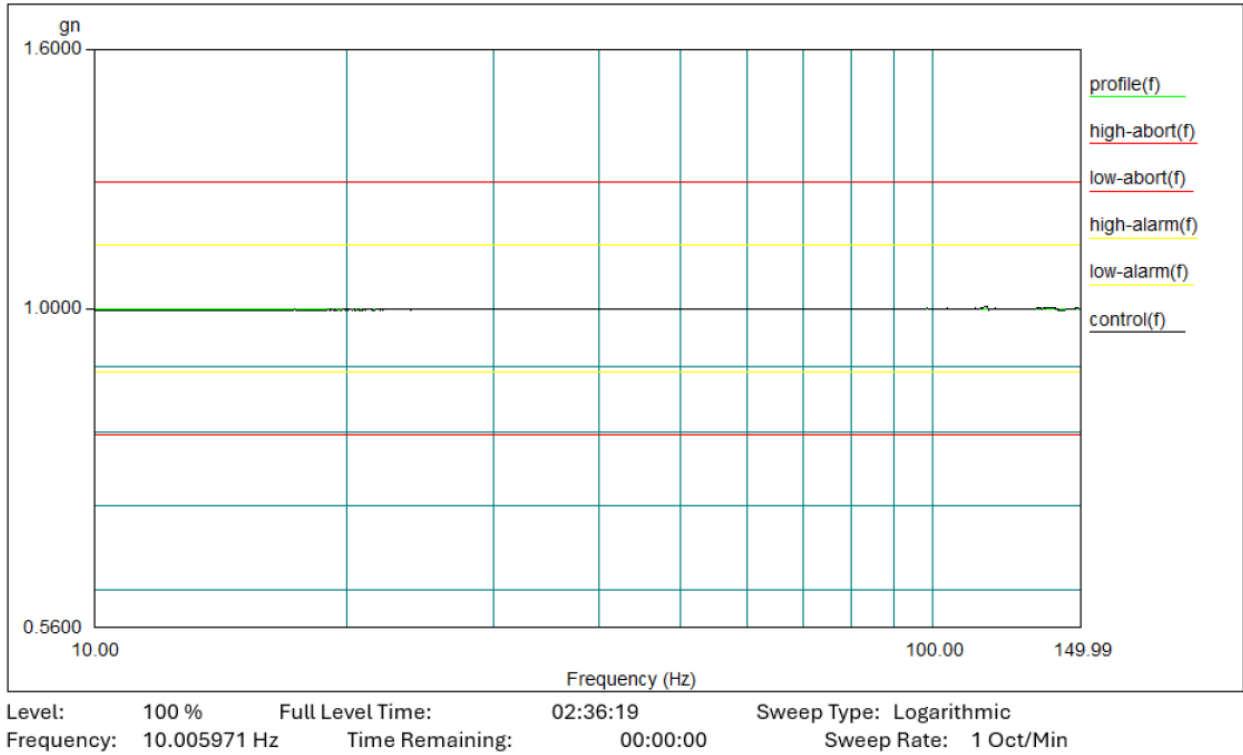


Table B: Vibration endurance test result

| Direction                   | Test time [min] | Result |
|-----------------------------|-----------------|--------|
| Vertical (Z)                | 156             | Passed |
| Horizontal transversal (X)  | 156             | Passed |
| Horizontal longitudinal (Y) | 156             | Passed |

## 13.5 Shock response test

### Standard and date

|                |                               |
|----------------|-------------------------------|
| Standard       | IEC 61850-3, subclause 6.10.2 |
| Basic standard | IEC 60255-21-2                |
| Test date      | November 24 to 26, 2024       |

### Characteristic test data

|                               |                                  |
|-------------------------------|----------------------------------|
| Serial number                 | 001414 RedFox-5728-F24G-T4G-LVLV |
| Test object                   | energized                        |
| Power supply                  | 24 Vdc                           |
| Acceleration                  | 10 g                             |
| Duration of pulses            | 11 ms                            |
| Number of pulses in each axis | 6                                |
| Number of axis (X, Y, Z)      | 3                                |

### Shock response test in vertical direction (Z)

#### Observations

- During and after the test, the test object was functional.
- No visual damage and no functional errors have been found on the test object.

### Shock response test in horizontal transversal direction (y)

#### Observations

- During and after the test, the test object was functional.
- No visual damage and functional errors have been found on the test object.

### Shock response test in horizontal longitudinal direction (x)

#### Observations

- During and after the test, the test object was functional.
- No visual damage or functional errors have been found on the test object.

### Requirement

- The object shall be subjected to the class 2 of the shock response test parameters (Table I) of IEC 60255-21-2
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5

### Result

The object passed the test.

Test profile C: Typical shock response plot

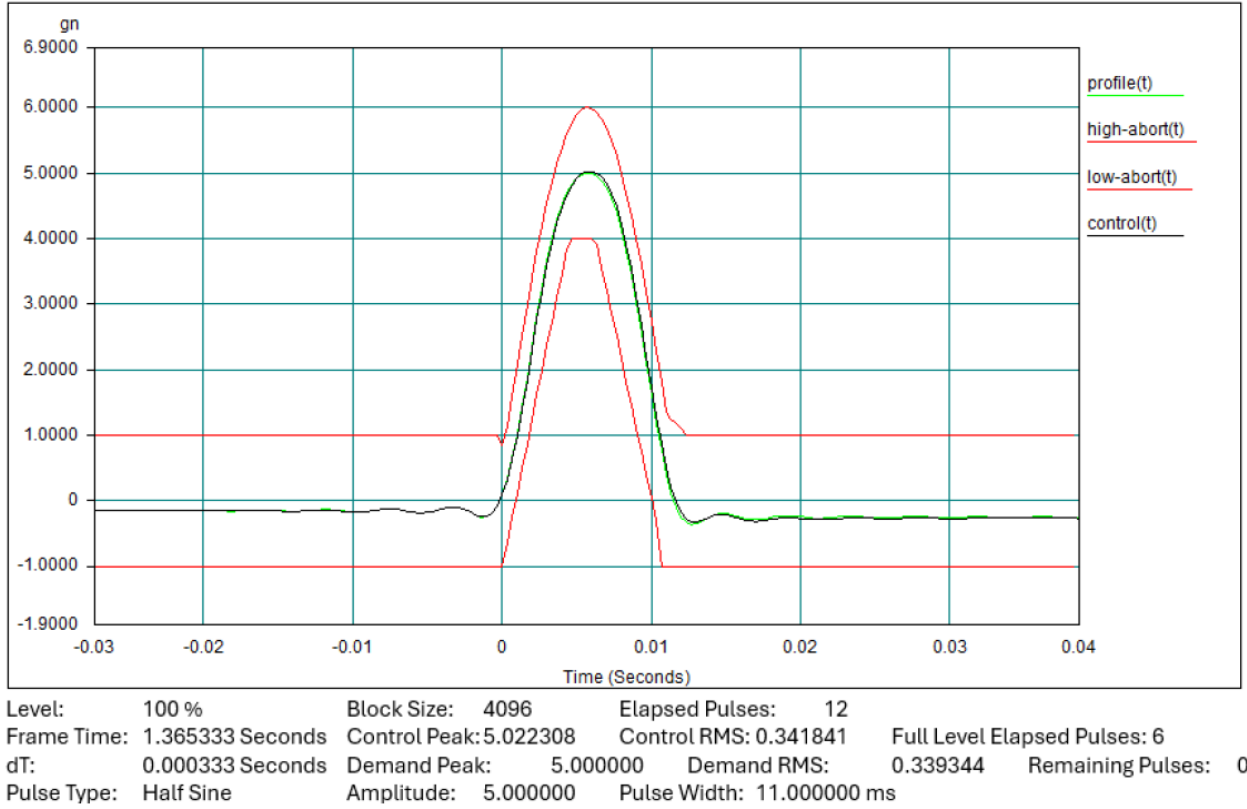


Table C: Half-sine shock response test

| Direction                    | Number of shocks | Result |
|------------------------------|------------------|--------|
| Vertical (Z-)                | 3                | Passed |
| Vertical (Z+)                | 3                | Passed |
| Horizontal transversal (X+)  | 3                | Passed |
| Horizontal transversal (X-)  | 3                | Passed |
| Horizontal longitudinal (Y-) | 3                | Passed |
| Horizontal longitudinal (Y+) | 3                | Passed |

13.6 Shock withstand test

Standard and date

|                |                               |
|----------------|-------------------------------|
| Standard       | IEC 61850-3, subclause 6.10.2 |
| Basic standard | IEC 60255-21-2                |
| Test date      | November 24 to 26, 2024       |

Characteristic test data

|                               |                                       |
|-------------------------------|---------------------------------------|
| Serial number                 | 24280806 RNX-2000 9P 3L 1 A A 3 1 7 A |
|                               | 24280801 RNX-2000 9P 3L 1 A A 3 0 7 A |
| Test object                   | non-energized                         |
| Acceleration                  | 30 g                                  |
| Duration of pulses            | 11 ms                                 |
| Number of pulses in each axis | 6                                     |
| Number of axis (X, Y, Z)      | 3                                     |

Shock withstand test in vertical direction (Z)

Observation

No visual damage and no functional errors have been found on the test object.

Shock withstand test in horizontal transversal direction (y)

Observation

No visual damage and no functional errors have been found on the test object.

Shock withstand test in horizontal longitudinal direction (x)

Observation

No visual damage and no functional errors have been found on the test object.

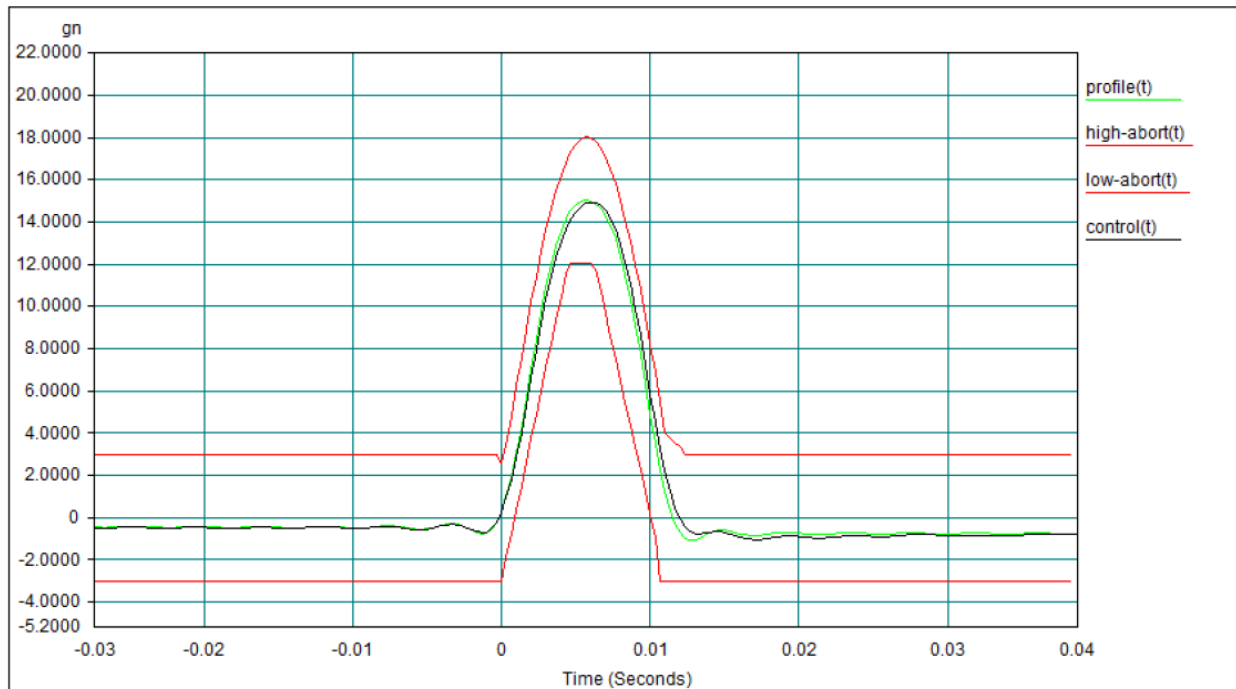
Requirement

- The object shall be subjected to the class 1 of the shock withstand test parameters (Table II) of IEC 60255-21-2
- The visual and functional inspection shall not reveal any defects or malfunctions.

Result

The object passed the test.

Test profile D: Typical shock withstand plot



Level: 100 % Block Size: 4096 Elapsed Pulses: 13  
 Frame Time: 1.365333 Seconds Control Peak: 14.914152 Control RMS: 1.023510 Full Level Elapsed Pulses: 6  
 dT: 0.000333 Seconds Demand Peak: 14.999999 Demand RMS: 1.018032 Remaining Pulses: 0  
 Pulse Type: Half Sine Amplitude: 14.999999 Pulse Width: 11.000000 ms

Table D: Half-sine shock withstands test results

| Direction                    | Number of shocks | Result |
|------------------------------|------------------|--------|
| Vertical (Z-)                | 3                | Passed |
| Vertical (Z+)                | 3                | Passed |
| Horizontal transversal (X+)  | 3                | Passed |
| Horizontal transversal (X-)  | 3                | Passed |
| Horizontal longitudinal (Y-) | 3                | Passed |
| Horizontal longitudinal (Y+) | 3                | Passed |

13.7 Bump test

Standard and date

|                |                               |
|----------------|-------------------------------|
| Standard       | IEC 61850-3, subclause 6.10.2 |
| Basic standard | IEC 60255-21-2                |
| Test date      | November 24 to 26, 2024       |

Characteristic test data

|                               |                                       |
|-------------------------------|---------------------------------------|
| Serial number                 | 24280806 RNX-2000 9P 3L 1 A A 3 1 7 A |
|                               | 24280801 RNX-2000 9P 3L 1 A A 3 0 7 A |
| Test object                   | non-energized                         |
| Acceleration                  | 20 g                                  |
| Duration of pulses            | 16 ms                                 |
| Number of pulses in each axis | 2000                                  |
| Number of axis (X, Y, Z)      | 3                                     |

Bump test in vertical direction (Z)

Observation:

No visual damage or functional errors have been found on the test object.

Bump test in horizontal transversal direction (y)

Observation:

No visual damage or functional errors have been found on the test object.

Bump test in horizontal longitudinal direction (x)

Observation:

No visual damage or functional errors have been found on the test object.

Requirement

- The object shall be subjected to the class 1 of the bump test parameters (Table III) of IEC 60255-21-2
- The visual and functional inspection shall not reveal any defects or malfunctions.

Result

The object passed the test.

Test profile E: Typical bump plot

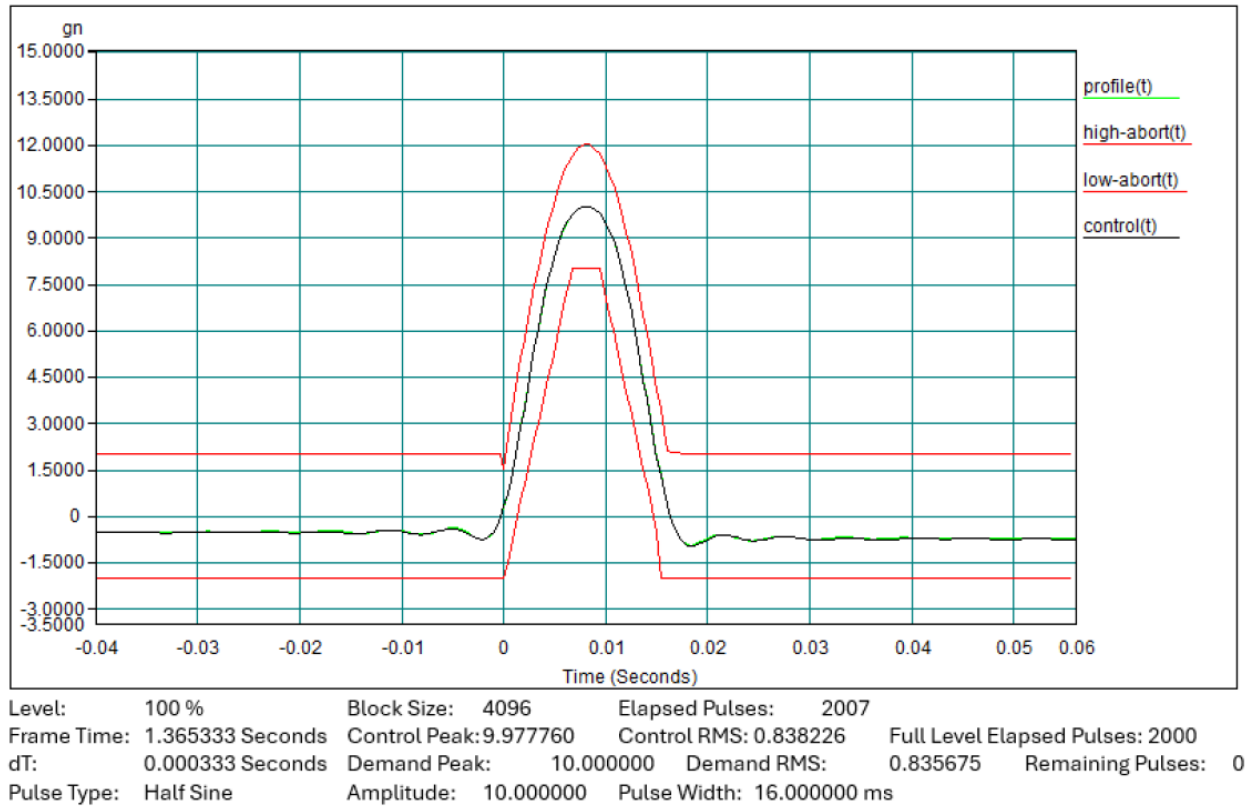


Table D: Half-sine bump withstand test

| Direction                    | Number of shocks | Result |
|------------------------------|------------------|--------|
| Vertical (Z-)                | 1000             | Passed |
| Vertical (Z+)                | 1000             | Passed |
| Horizontal transversal (X+)  | 1000             | Passed |
| Horizontal transversal (X-)  | 1000             | Passed |
| Horizontal longitudinal (Y-) | 1000             | Passed |
| Horizontal longitudinal (Y+) | 1000             | Passed |

## 13.8 Single axis sine sweeps seismic test

### Standard and date

|                |                               |
|----------------|-------------------------------|
| Standard       | IEC 61850-3, subclause 6.10.3 |
| Basic standard | IEC 60255-21-2                |
| Test date      | November 24 to 26, 2024       |

### Characteristic test data

|                                     |                                                                                |
|-------------------------------------|--------------------------------------------------------------------------------|
| Serial number                       | 24280806 RNX-2000 9P 3L 1 A A 3 1 7 A<br>24280801 RNX-2000 9P 3L 1 A A 3 0 7 A |
| Test object                         | energized                                                                      |
| Power supply input                  | 24 Vdc                                                                         |
| Frequency range                     | 1 to 35 Hz                                                                     |
| Cross-over frequency                | 8 to 9 Hz                                                                      |
| Displacement horizontal axis (x)    | 7,5 mm                                                                         |
| Displacement vertical axis (y)      | 3,5 mm                                                                         |
| Acceleration horizontal axis (x)    | 2,0 g                                                                          |
| Acceleration vertical axis (y)      | 1,0 g                                                                          |
| Number of sweep cycles in each axis | 1                                                                              |
| Number of axis (X, Y, Z)            | 3                                                                              |

### Single axis sine sweep seismic test in vertical direction (Z)

#### Observation:

No visual damage or functional errors have been found on the test object.

### Single axis sine sweep seismic test in horizontal transversal direction (Y)

#### Observation:

No visual damage or functional errors have been found on the test object.

### Single axis sine sweep seismic test in horizontal longitudinal direction (X)

#### Observation:

No visual damage or functional errors have been found on the test object.

### Requirement

- The object shall be subjected to the class 2 of the seismic vibration test parameters (Table I) of IEC 60255-21-3.
- The visual and functional inspection shall not reveal any defects or malfunctions.
- The object shall comply with the required reliability class 2 of chapter 7.5.

### Result

The object passed the test.

Test profile F: Typical sine vibration seismic (vertical) plot

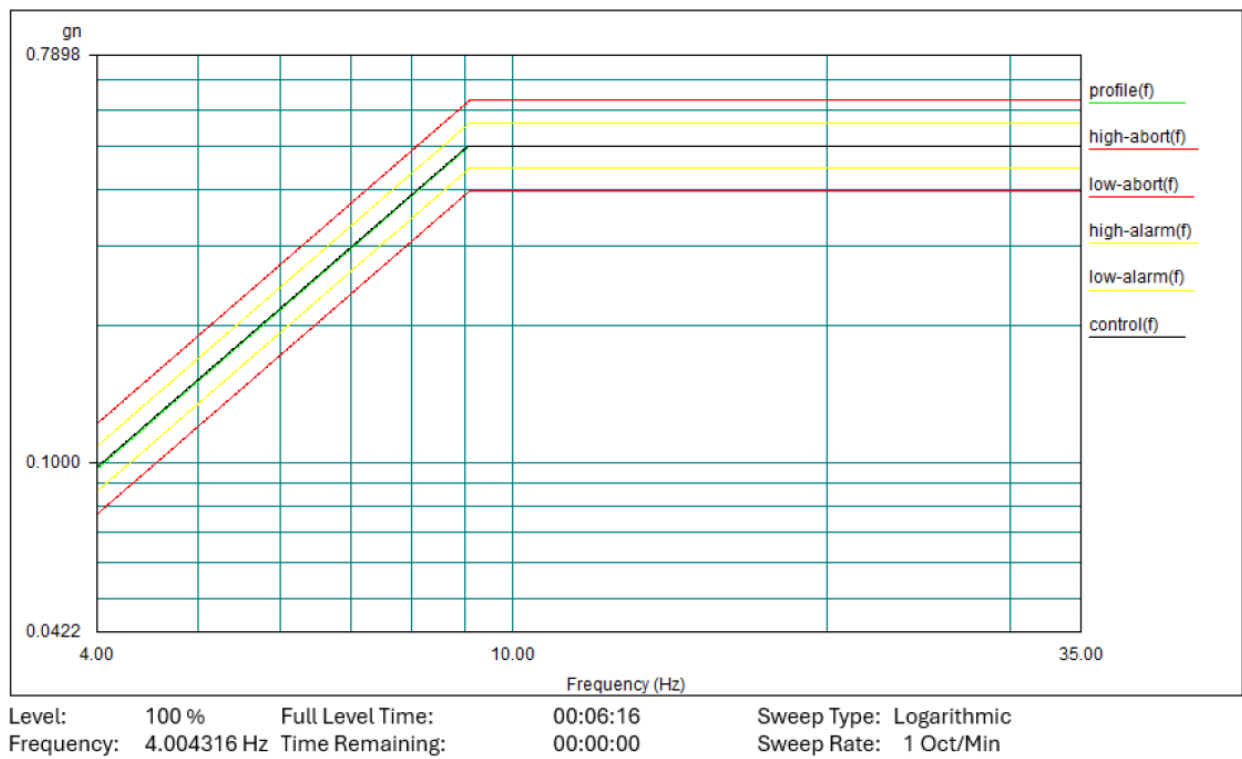


Table F Vibration response test result

| Direction                   | Test time [min] | Result |
|-----------------------------|-----------------|--------|
| Vertical (Z)                | 6               | Passed |
| Horizontal transversal (X)  | 6               | Passed |
| Horizontal longitudinal (Y) | 6               | Passed |

### 13.9 Photographs of test arrangement (after)

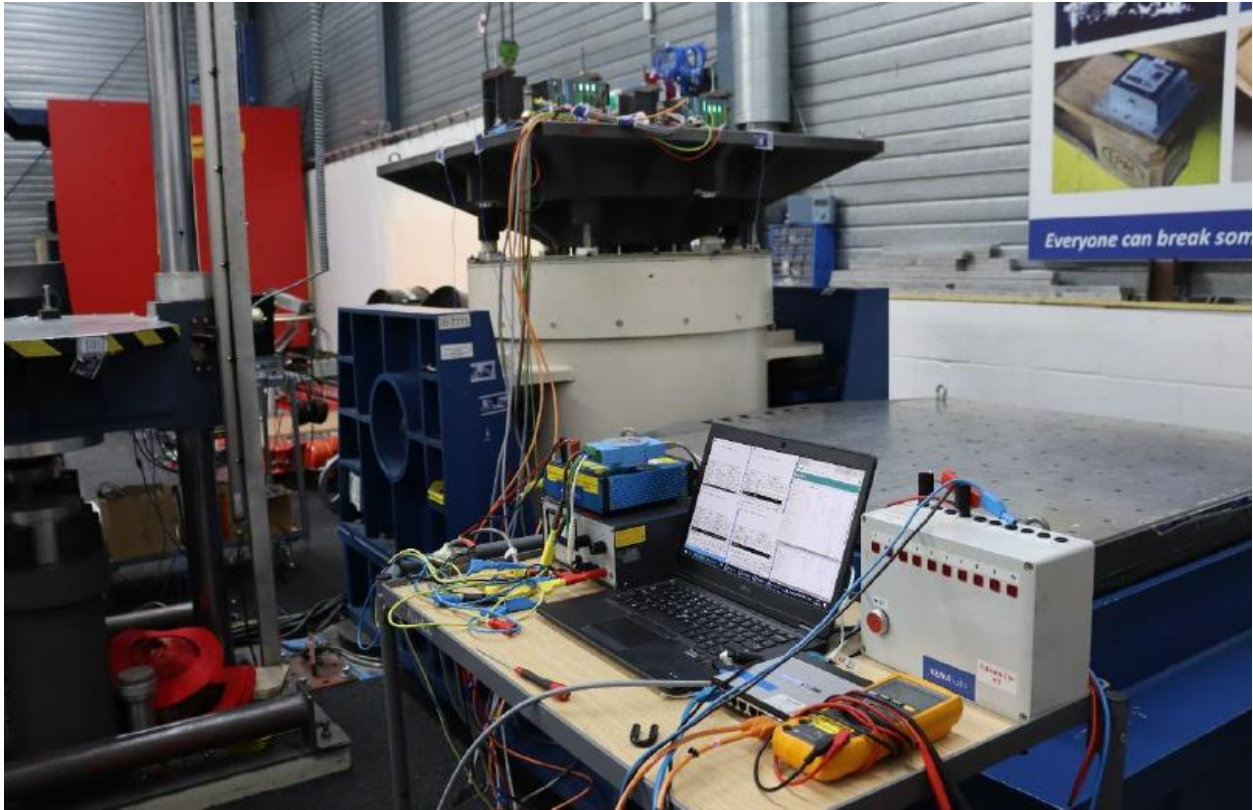


Figure 5: Functional testing after the test

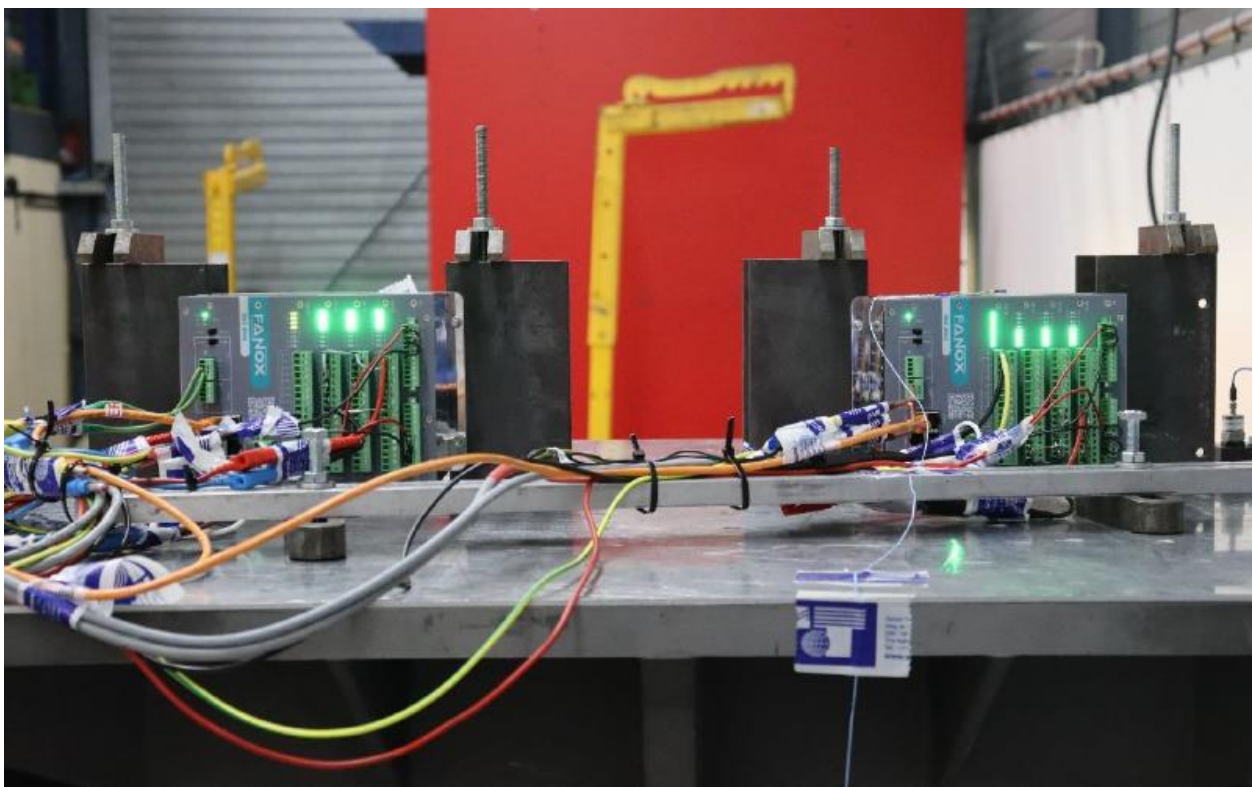


Figure 5: Functional testing and visual inspection were conducted after the test

## 14 ENCLOSURE PROTECTION

### Standard and date

Standard IEC 61850, subclause 6.11  
 Basic standard IEC 60529  
 Test date October 30, 2024

### Characteristic test data

Serial number 24290000 RNX-2000 9P 3L 1 A A 3 1 7 A  
 24280802 RNX-2000 9P 3L 1 A A 3 0 7 A

| Terminal side<br><b>RNX-2000 9P 3L 1 A A 3 1 7 A</b>                                                                                                           | Degree of protection<br>Specification by the manufacturer | Observation |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------|
| Front                                                                                                                                                          | IP 2X                                                     | IP 2X       |
| Top                                                                                                                                                            | IP 2X                                                     | IP 2X       |
| Bottom                                                                                                                                                         | IP 2X                                                     | IP 2X       |
| Back <ul style="list-style-type: none"> <li>Analog inputs</li> <li>Digital inputs</li> <li>Digital outputs</li> <li>RJ45 ports</li> <li>RS485/RS232</li> </ul> | IP 2X                                                     | IP 2X       |
| Left                                                                                                                                                           | IP 2X                                                     | IP 2X       |
| Right                                                                                                                                                          | IP 2X                                                     | IP 2X       |

| Terminal side<br><b>RNX-2000 9P 3L 1 A A 3 0 7 A</b>                   | Degree of protection<br>Specification by the manufacturer | Observation |
|------------------------------------------------------------------------|-----------------------------------------------------------|-------------|
| Back <ul style="list-style-type: none"> <li>Digital outputs</li> </ul> | IP 2X                                                     | IP 2X       |

### Requirement

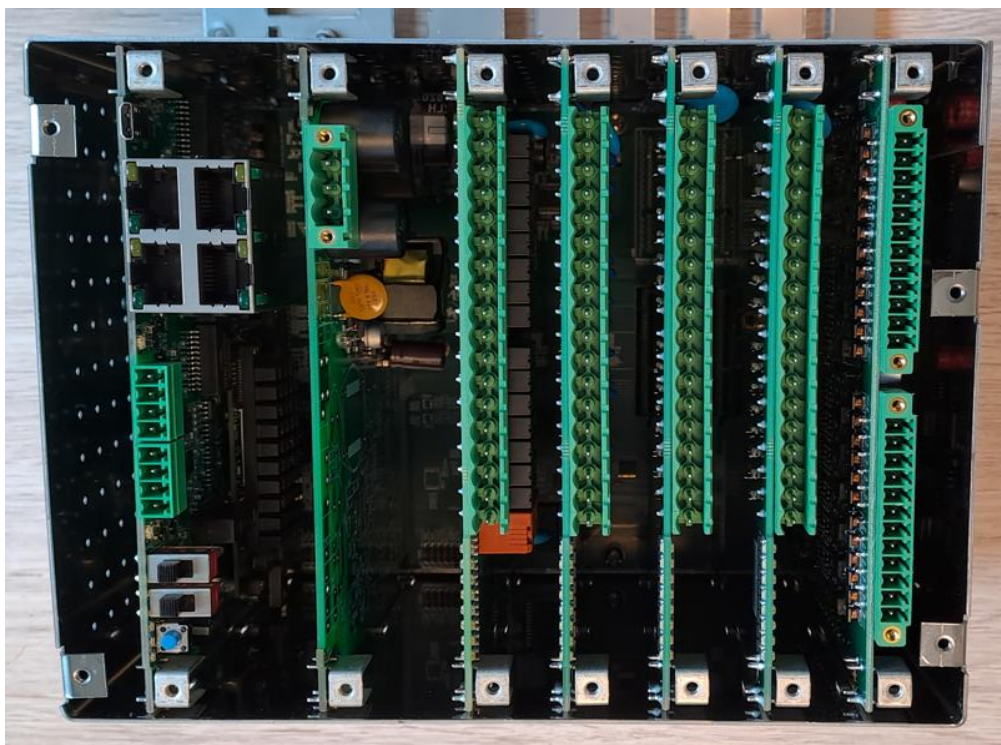
- the test finger shall not touch hazardous live parts
- the test finger IP2X voltage or energy shall not exceed the safe limits for normal operational use
- no visual or functional inspection required.

### Result

The object passed the test.

## 15 PHOTOGRAPHS OF PRINTBOARDS

### Photograph of product overview

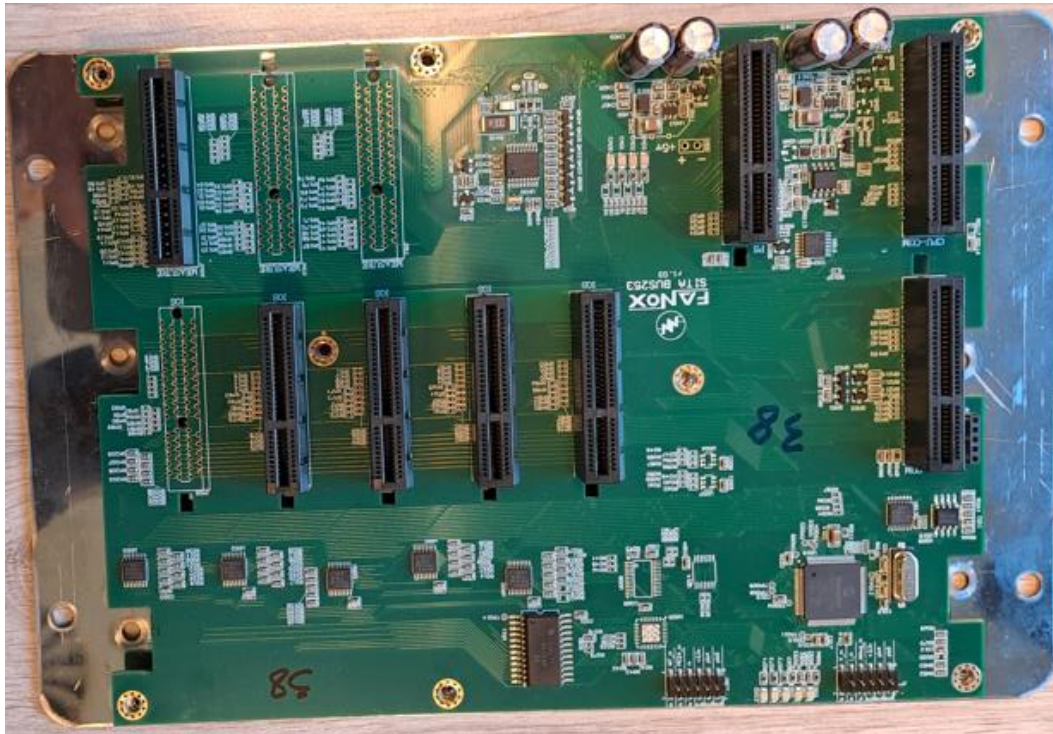


Before removing all PCB cards.

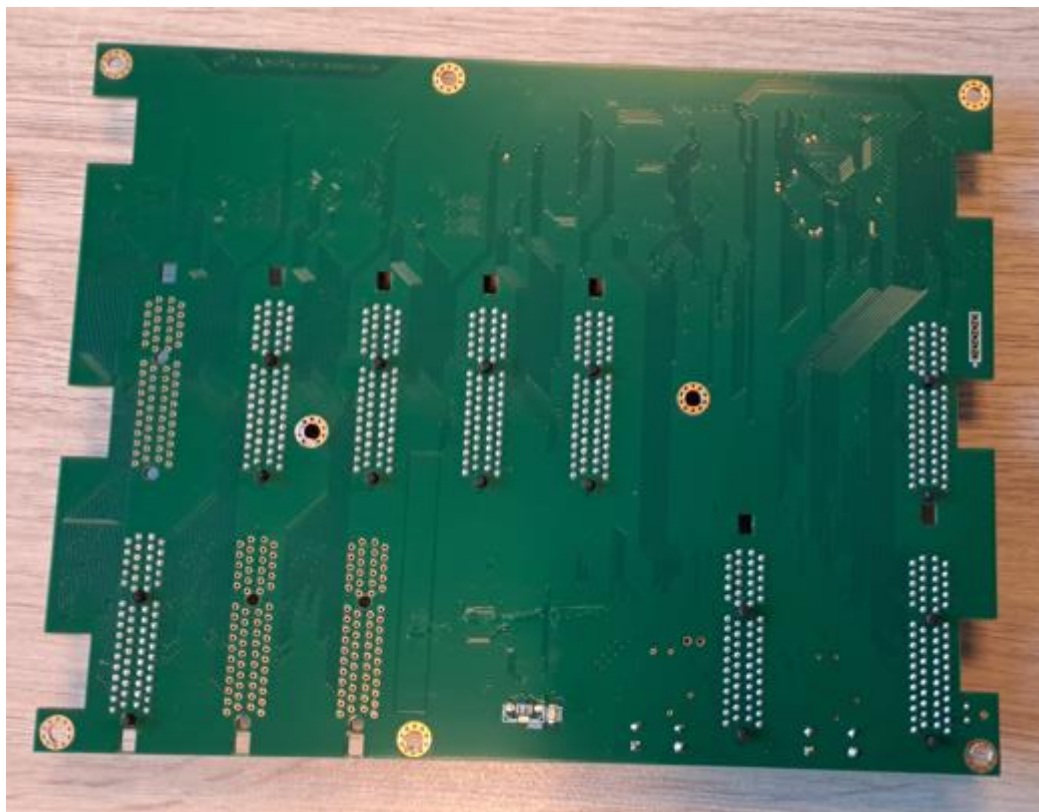


After removing all PCB cards, the backplane PCB was revealed.

Photograph of back plane



Top view



Bottom view

# Photograph of digital inputs

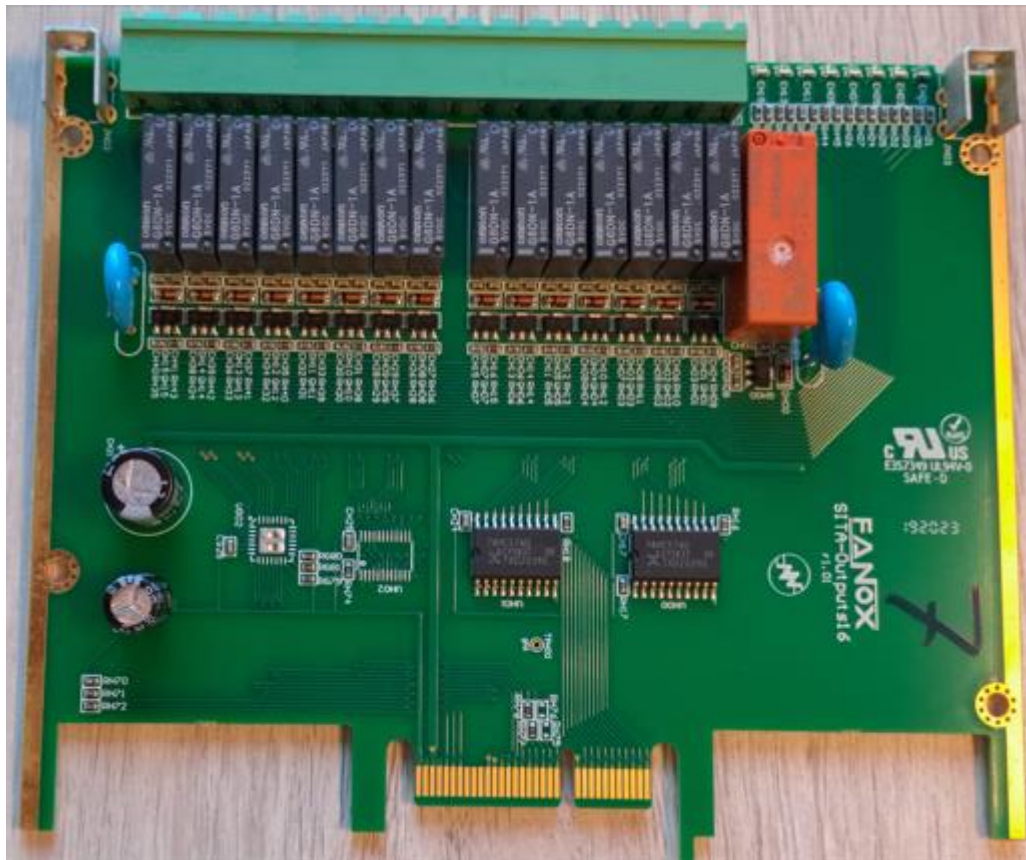


Top view

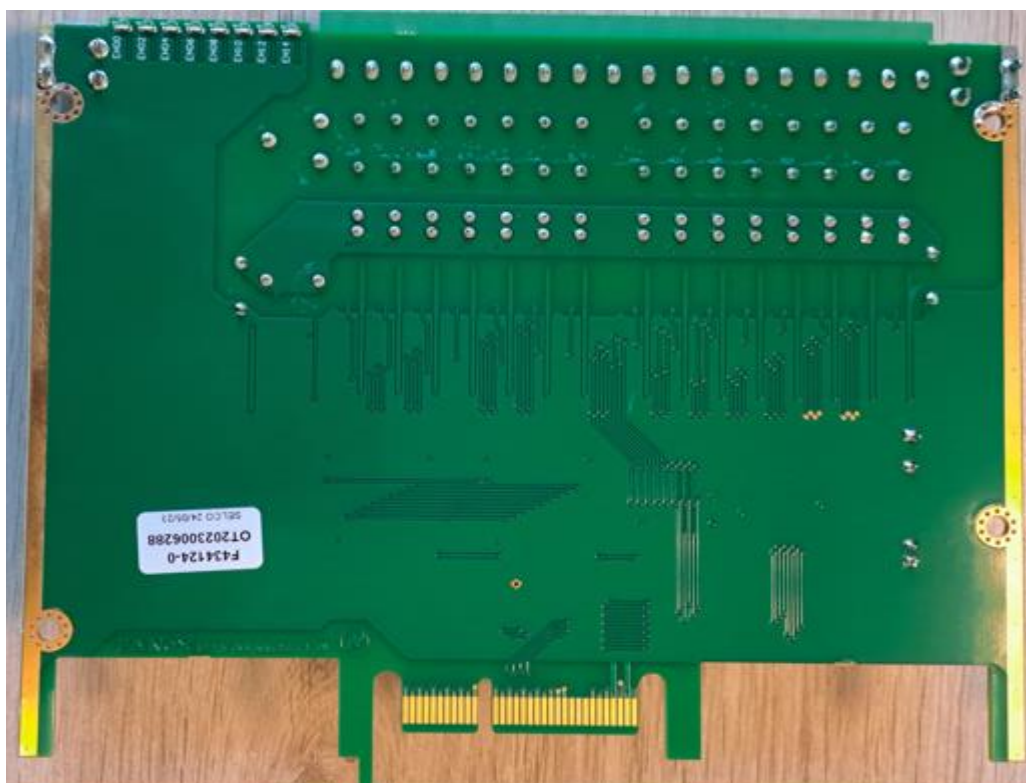


Bottom view

Photograph of 16 digital outputs



Top view

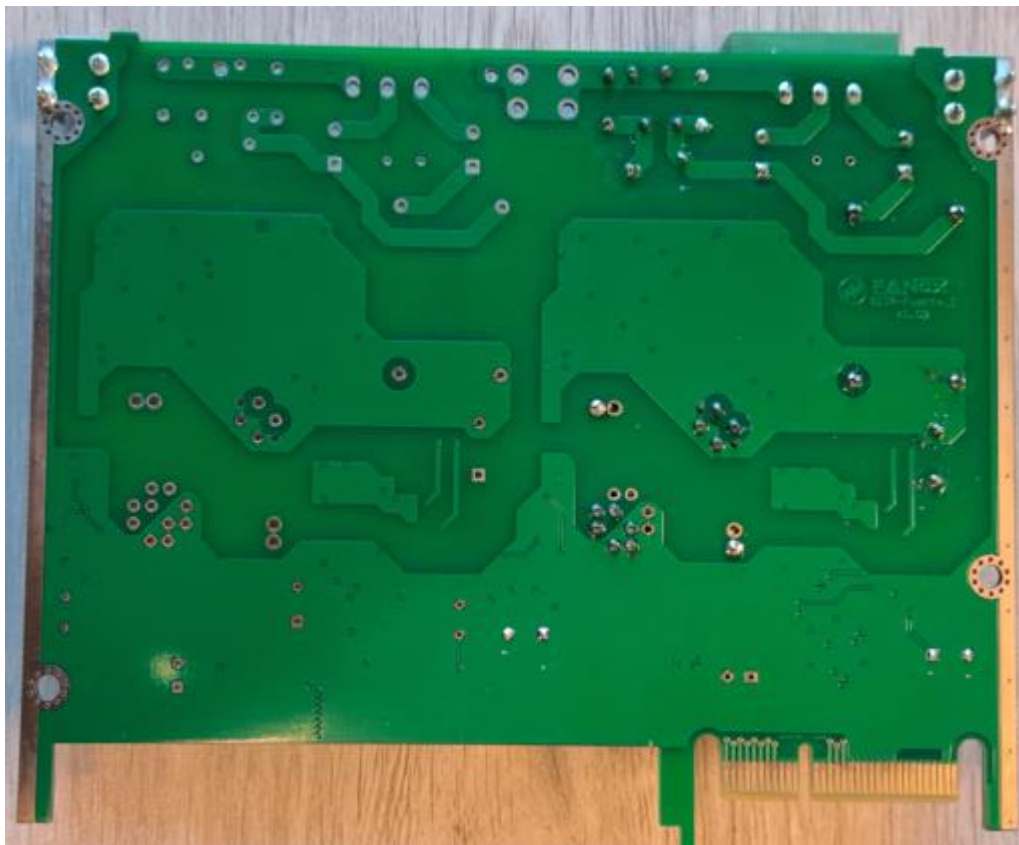


Bottom view

**Photograph of power supply**



Top view

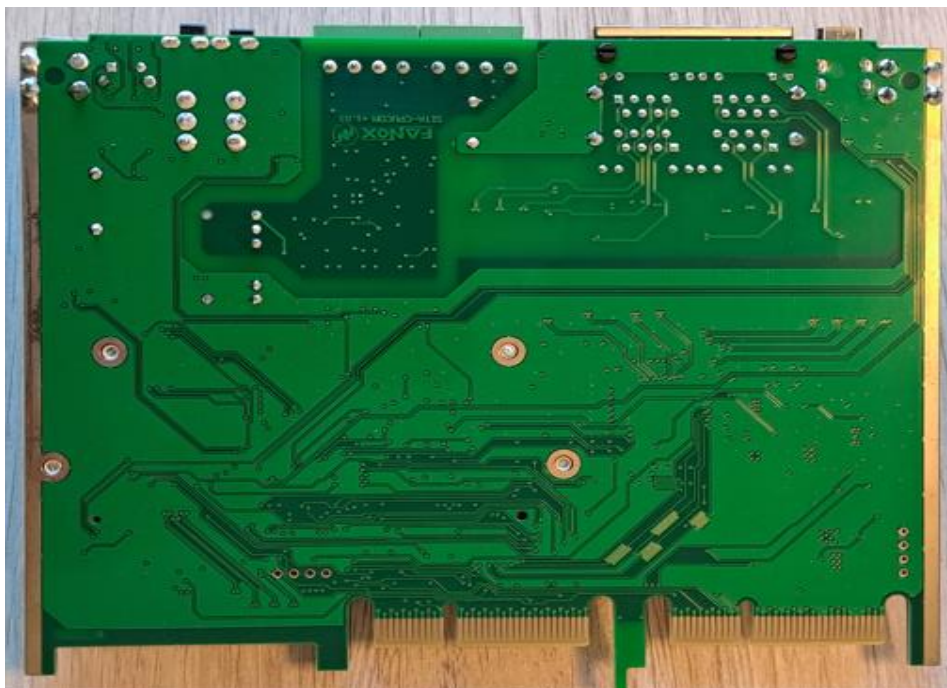


Bottom view

Photograph of CPU and communication

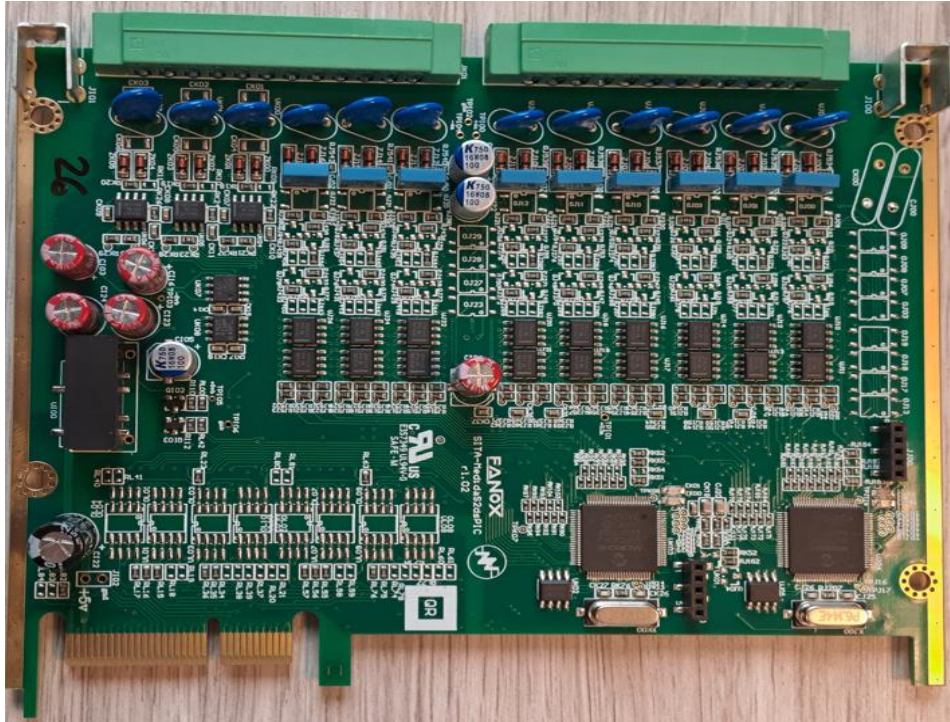


Top view

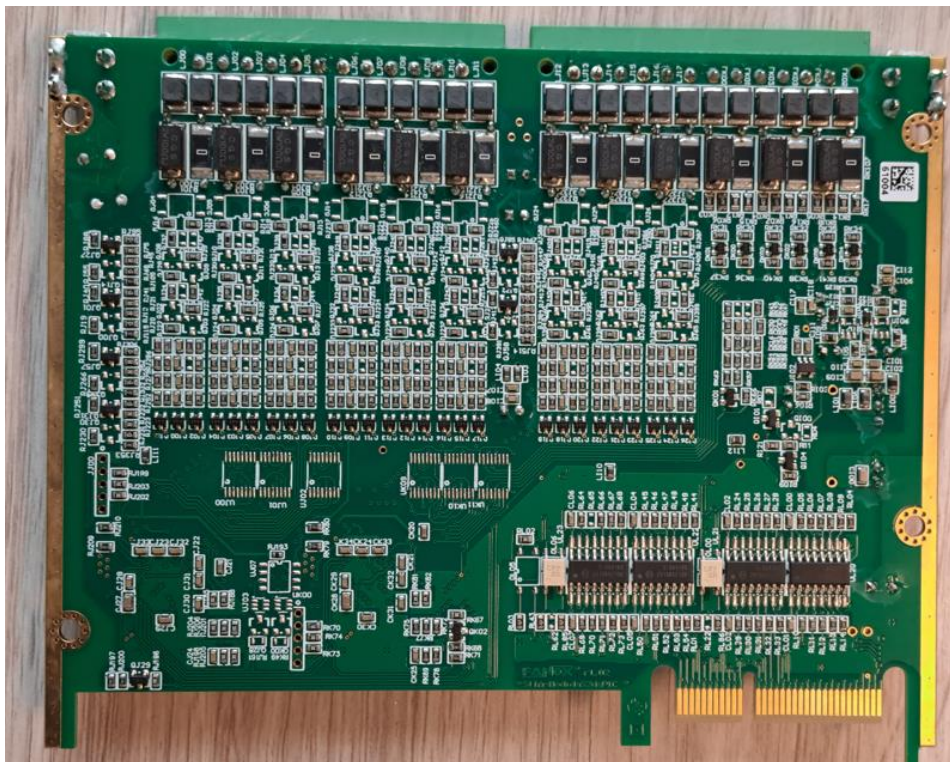


Bottom view

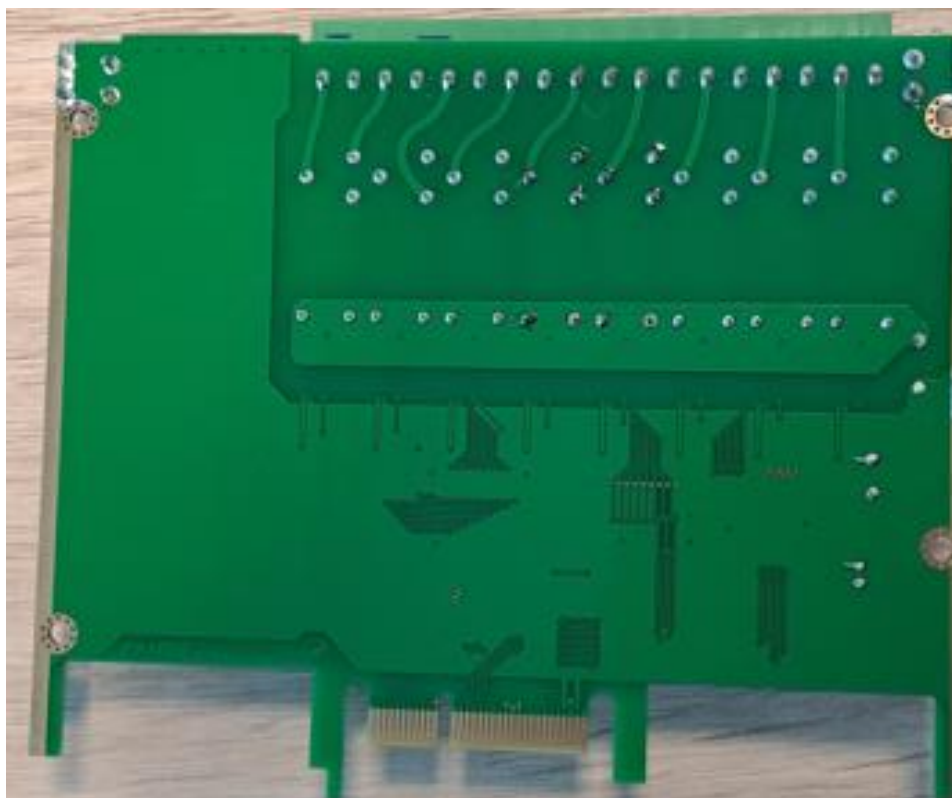
**Photograph of Analog input (CTs and VTs)**



Top view



Bottom view

**Photograph of 8 digital outputs****Top view**

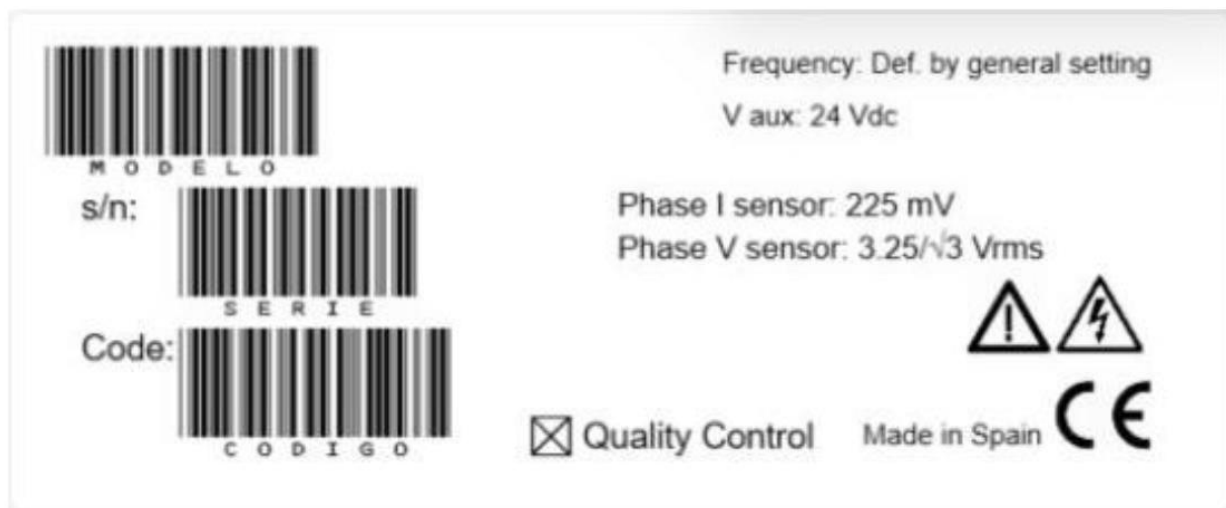
Bottom view

## 16 PHOTOGRAPHS OF CHANGES TO THE TEST OBJECT

### 16.1 The marking on the test object's label has been updated.

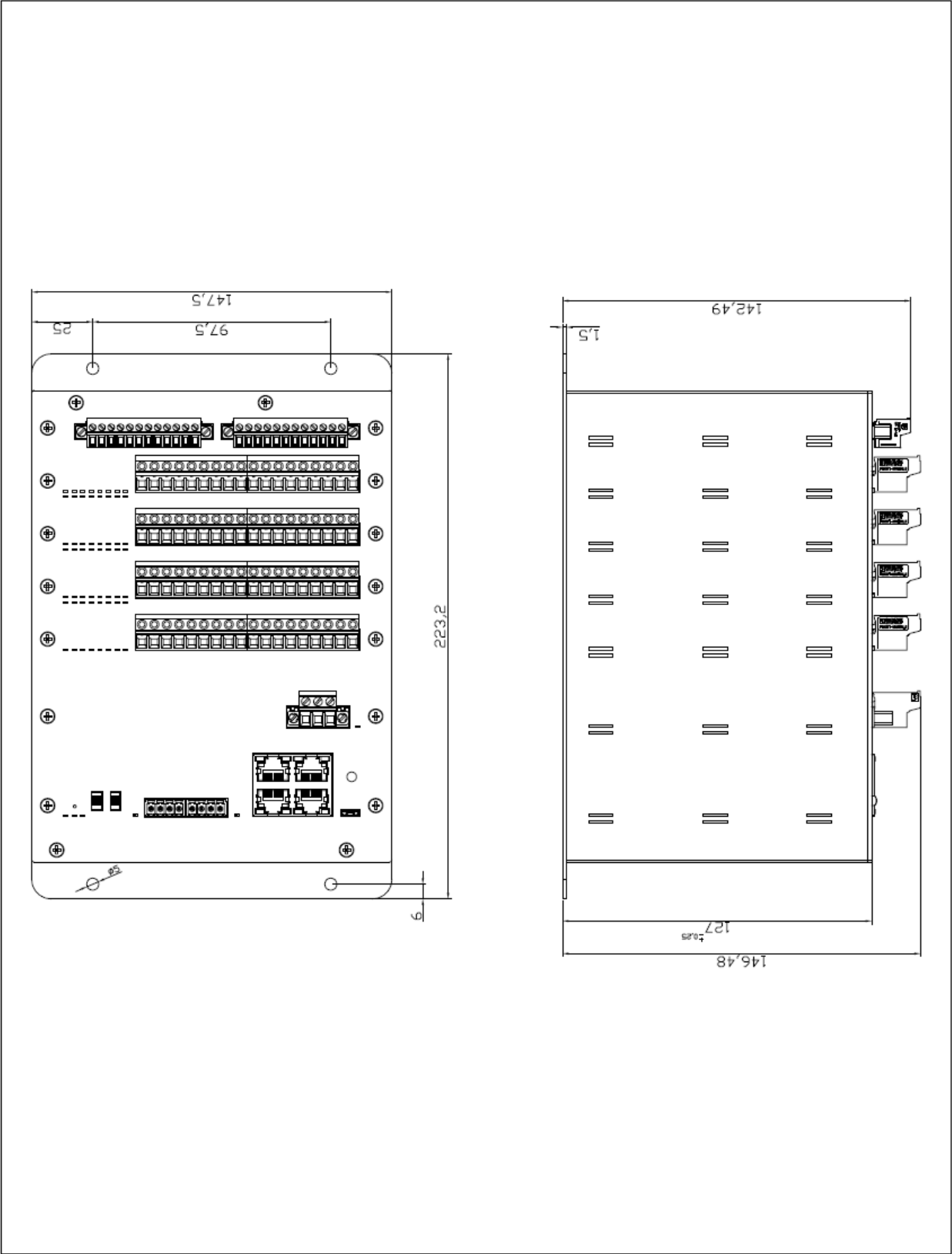


Old product label



New product label

**17 DRAWING**



## **18 MEASUREMENT UNCERTAINTY**

The used climate rooms and EMC test and measurement equipment are calibrated on an annual base. All the parameters are within the tolerances required by the basic (test/measurement) standards, taking into account the measurement uncertainty reported in the calibration certificates.

## 19 LIST OF INSTRUMENTS USED

### 19.1 EMC equipment

| EMC test equipment                         |                    |                                 |               |
|--------------------------------------------|--------------------|---------------------------------|---------------|
| Description                                | Manufacturer       | Type                            | ORS number    |
| Fast transient burst tester                | EM Test            | EFT500                          | 105169        |
| Capacitive coupling clamp                  |                    |                                 | 106168        |
| <b>Electrostatic discharge tester</b>      | <b>EM Test</b>     | <b>NX30</b>                     | <b>152004</b> |
| Air discharge                              | EM Test            | Air                             | 152012        |
| Contact discharge                          | EM Test            | Contact                         | 152011        |
| Bleeding resistors ESD                     | EM Test            | Weerstandskabel ESD             | 152013        |
| Bleeding resistors ESD                     | EM Test            | Weerstandskabel ESD             | 122014        |
| <b>Insulation tester</b>                   | <b>EMC partner</b> | <b>MIG0603OS2</b>               | <b>105333</b> |
| Oscillatory wave test system including     | EMC partner        | MIG0603OMI                      | 150022        |
| CDN                                        | EMC partner        | CDN2000-06-25                   | 150023        |
| CDN-KIT1000                                | EMC partner        | CN-U / DN-HF<br>DN-LF1 / DN-LF2 | 89.02         |
| H-field antenna                            | EMC partner        | MF1000-3                        | 151495        |
| <b>Continuous wave simulator including</b> | <b>EM Test</b>     | <b>CWS500N1.1</b>               | <b>151165</b> |
| 50 ohm attenuator                          | EM Test            | ATT 6/75                        | 151158        |
| CDN M1                                     | EM Test            | CDN M1                          | 151180        |
| CDN M2/M3                                  | EM Test            | CDN M2/M3                       | 151164        |
| CDN M2/M3                                  | EM Test            | CDN M2/M3                       | 151179        |
| CDN S8 RJ45                                | EM Test            | CDN S8 RJ45                     | 151181        |
| CDN AF2                                    | EM Test            | CDN AF2                         | 151162        |
| Injection clamp                            | EM Test            | EM101                           | 151159        |
| HF absorbing clamp                         | EM Test            | FTC101                          | 151168        |
| HF absorbing clamp                         | EM Test            | FTC101                          | 151156        |
| HF absorbing clamp                         | EM Test            | FTC101                          | 151157        |
| <b>Immunity tester, including</b>          | <b>EMC partner</b> | <b>IMU4000 F-S-D-V-C-1500</b>   | <b>151487</b> |
| HF absorbing clamp                         | EM Test            | FTC101                          | 151168        |
| HF ATTENUATION CLAMP                       | TESEQ              | KEMA 801A                       | 152042        |
| CDN                                        | EMC-Partner        | EXT-TRA3000 C-SHORT-1506        | 151486        |
| CDN                                        | EMC-Partner        | PS3-0204                        |               |
| CDN                                        | EMC-Partner        | CN16-1514                       | 151489        |
| CDN                                        | EMC-Partner        | CN16T-1507                      | 151491        |
| CDN                                        | EMC-Partner        | CN16-22-7C-1503                 | 151490        |
| CDN                                        | EMC-Partner        | CN16-22-7D-1503                 | 151492        |
| Capacitive coupling clamp                  | EMC-Partner        | CN-EFT1000-1568                 | 151497        |
| CDN                                        | EMC-Partner        | CN-BALUN-1505                   | 151493        |
| Insulation tester                          | FLUKE              | 1503                            | 150150        |
| Insulation Combitester                     | FLUKE              | 1653B                           | 150738        |
| Dielectric 50Hz AC Voltage test            | SQS Electronic     | HA3300D                         | 105156        |
| Dielectric 50Hz AC Voltage test            | SQS Electronic     | HA4000D                         | 125345        |
| <b>Multi EMC generator</b>                 | <b>EMC-Partner</b> | <b>IMU3000 F6SRTDVC</b>         | <b>152084</b> |
| CDN                                        | EMC-Partner        | CDN3000A-08-32 690V             | 152089        |
| Power supply                               | EMC-Partner        | PS3 Pwr1                        | 152087        |
| Power supply                               | EMC-Partner        | PS3 Pwr2                        | 152088        |

| <b>EMC test equipment</b> |                     |                          |                   |
|---------------------------|---------------------|--------------------------|-------------------|
| <b>Description</b>        | <b>Manufacturer</b> | <b>Type</b>              | <b>ORS number</b> |
| IEC 61000-4-16 extension  | EMC-Partner         | EXT-TRA3000 C-SHORT      | 152086            |
| IEC 61000-4-29 extension  | EMC-Partner         | EXT-TRA3000 D-29D        | 152084            |
| IEC 61000-4-5 CDN         | EMC-Partner         | CDN-UTP8 ED3             | 152077            |
| IEC 61000-4-5 CDN         | EMC-Partner         | ADAPTER BOX RJ45         | 152079            |
| ADAPTER BOX               | EMC-Partner         | ADAPTER BOX 90VG 1 to 16 | 152078            |
| IEC 61000-4-16 CDN        | EMC-Partner         | CN16                     | 152208            |
| <b>DOW generator</b>      | <b>EMC-Partner</b>  | <b>DOW3000 S-F-I</b>     | <b>152090</b>     |
| Generator                 | EMC-Partner         | MIG1803                  | 152367            |
| CDN                       | EMC-Partner         | NW-IEC61036C218-1502     | 152368            |
| CDN                       | EMC-Partner         | NW-NMI-M6C3C4-1502       | 152369            |
| test pistols              | EMC-Partner         | CN-MIG18 AMP             | 152094            |
| EUT safety connection box | EMC-Partner         | CN-MIG24                 | 152095            |
| IEC 61000-4-5 CDN kit     | EMC-Partner         | 1000ED3                  | 152146            |
| Amplifier 80-1000 MHz     | ETS Lindgren        | 8000-034RF               | 151972            |
| Amplifier 1000-6000 MHz   | ETS Lindgren        | 8100-045RF               | 151971            |

| <b>Conducted RF-emission test equipment</b> |                     |             |                   |
|---------------------------------------------|---------------------|-------------|-------------------|
| <b>Description</b>                          | <b>Manufacturer</b> | <b>Type</b> | <b>ORS number</b> |
| Measurement receiver                        | Rohde & Schwarz     | ESR         | 151944            |
| LISN (AMN)                                  | Rohde & Schwarz     | ENV432      | 151954            |
| LISN (AAN) S8 RJ45                          | Lüthi               | S8 RJ45     | 151181            |
| LISN (AAN) T8                               | Rohde & Schwarz     | ENY41       | 151948            |
| Connection cable                            | -                   | LMR240      | 152211            |

## 19.2 IP-test equipment

| <b>Environmental instrumentation</b> |                     |                   |                   |
|--------------------------------------|---------------------|-------------------|-------------------|
| <b>Description</b>                   | <b>Manufacturer</b> | <b>Type</b>       | <b>ORS number</b> |
| Test finger 2.5mm                    | PL Contactvingers   | Test vinger 2,5mm | 150692            |

## 19.3 Measurement equipment

| <b>Measurement equipment</b> |                     |             |                   |
|------------------------------|---------------------|-------------|-------------------|
| <b>Description</b>           | <b>Manufacturer</b> | <b>Type</b> | <b>ORS number</b> |
| Oscilloscope                 | Rohde & Schwarz     | RTB2002     | 152140            |
| Oscilloscope                 | Rohde & Schwarz     | RTM3002     | 152229            |

|                     |           |              |                  |
|---------------------|-----------|--------------|------------------|
| Current probe       | Tektronix | TCP A300&303 | 151982<br>151983 |
| Oscilloscope        | Tektronix | TBS 1052B    | 151943           |
| Oscilloscope        | Tektronix | TBS 1064     | 152001           |
| Differentiaal probe | Testec    | TT-SI 9010A  | 151822           |
| Differentiaal probe | Testec    | TT-SI 9010   | 152277           |
| Multimeter          | Fluke     | 8840A        | 069145           |
| Analogue multimeter | avometer  | MK.6         | 067424           |
| Multimeter          | Fluke     | 8846A        | 152266           |
| Multimeter          | Fluke     | 8846A        | 152265           |
| Multimeter          | Keysight  | 34465A       | 152269           |
| Multimeter          | Keysight  | 34465A       | 152268           |
| Clamp meter         |           |              | 77395            |