

TEST REPORT

EN 50549-10

October 2022

Requirements for generating plants to be connected in parallel with distribution networks - Part 10: Tests for conformity assessment of generating units

Shenzhen Yixing Information Technology Co., Ltd.

For the unit(s) **CME06-2BM250, CME06-2BM250-08**

Test report no. **LS2A25112702EGEU01**

Date **2026-04-23**

ACCREDITED
Certificate # 5200.02

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Trademark .....:	conow
Model / Type reference.....:	**CME06-2BM250**, **CME06-2BM250-08**
Technical data .....:	See section 3.1 on p.9
Dates of testing.....:	2026-02-01 - 2026-04-20

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LYNS-TCi TECHNOLOGY LYNS-TCi

Lukes Lin (Project manager)

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1 General information of test report

1.1 Important Note

General disclaimer

The test results presented in this report relate only to the object tested.

This report is for the exclusive use of LYNS's Client and is provided pursuant to the agreement between LYNS and its Client. This report shall not be reproduced, except in full, without the written approval of LYNS. Test reports without seal and signature are not valid.

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1.2 Revision history

Revision	Date	Editor	Modification / Change	Status
LS2A25112702EGEU01	2026-04-23	Pan Pan	Initial report was written	Active

2 General remarks for documentation

The test results presented in this report relate only to the object(**s**) tested.

Throughout this report a ☐ comma ',' / ☒ point '.' is used as decimal separator and a ☐ point '.' / ☒ comma ',' as thousands separator.

The following **suffixes** / **indices** are used for variables in tables and figures:

0.2	average values over 200 milliseconds
60	average values over 60 seconds
600	average values over 10 minutes
+	positive sequence component for 3-phase generating unit
-	negative sequence component for 3-phase generating unit
0	zero sequence component for 3-phase generating unit
1	fundamental component (main frequency)
Lx	index of phase x
LxLy	phase-to-phase voltages of phase x and phase y
s	apparent
p	active
q	reactive

Abbreviations

AC	:	Alternating Current
CT	:	Current Transformer
DC	:	Direct Current
DSO	:	Distribution System Operator
EES	:	Electrical Energy Storage
EUT	:	Equipment Under Test
GUT	:	Generating Unit Under Test
LV	:	Low Voltage
MP	:	Measurement Point
MPP	:	Maximum Power Point
MV	:	Medium Voltage
PGM	:	Power Generating Module
PGU	:	Power Generating Unit
POC	:	Point of Connection
PWHD	:	Partial Weighted Harmonic Distortion
THD	:	Total Harmonic Distortion
PWHD	:	Partial Weighted Harmonic Distortion

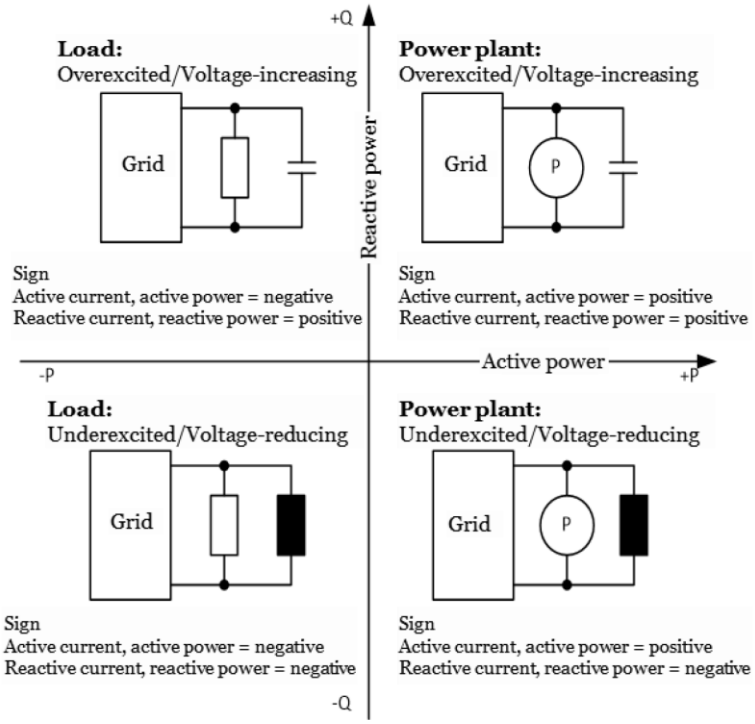
Symbols

A_r	:	Required accuracy
G_R	:	Reset value of the characteristic quantity
G_S	:	Setting value of the characteristic quantity (activation threshold)
I_n	:	Nominal current, nominal value of generating unit, either as stated by the manufacturer or which shall be calculated from nominal active power P_n and nominal voltage U_n
k_i	:	Switching current factor
P_D	:	Design active power, maximum AC active power output at an active factor of 0,9 (EN 50549-1:2019) the active factor specified by the DSO or the responsible party for a certain generating plant or generating technology
P_n	:	Nominal active power, nominal value of a generating unit's active power, which is stated by the manufacturer
P_M	:	Momentary active power, actual AC active power output at a certain instant
P_{max}	:	Maximum active power, maximum continuous active power, measured in a 10 min average, which a generating unit or the sum of all the generating units in a generating plant can produce, minus any loads associated solely with facilitating the operation of that generating plant and not fed into the network as specified in the connection agreement or as agreed between the DSO and the generating plant operator
S_{max}	:	(Definition acc. EN 50549-1) Maximum apparent power, maximum AC apparent power output, measured in a 10 min average, that the generating unit or the sum of all the generating units in a generating plant is designed to achieve under normal operating conditions
T_{Op}	:	Operate time (equals start time plus time delay setting)
T_{Res}	:	Reset time
T_{Ov}	:	Overshoot time
> / >>	:	First / second stage of protection function
Δf	:	Frequency step
Δt	:	Time step
ΔU	:	Voltage step

Direction definition of P and Q

in this test report, the regarded system of the voltage and current vectors is the active sign convention system:

- If the inverter feeds to the grid the active power is measured with positive sign.
- If the inverter injects reactive power / current with leading power factor the reactive power / current is marked “leading” or “inductive” (under-excited) or has a negative sign.
- If the inverter injects reactive power / current with lagging power factor the reactive power / current is marked “lagging” or “capacitive” (over-excited) or has a positive sign.



3 General product information

Factory's name 1	**PYS High-Tech Co.,Ltd**
Factory address 1	(1F-12F)101-1201, Block 9, Lianhua Industrial Zone, Longhua Longyuan Road,518109, Hualian Community, Longhua Street, Longhua District,Shenzhen City,Guangdong Province, P. R. China
Factory's name 2	**GUANGDONG UNIONMAN NEW ENERGY CO., LTD.**
Factory address 2	No.9 Qitai Road, Huinan Hi-Tech Industrial Park, Huizhou City, Guangdong Province, China
Factory's name 3	**Huizhou Ten Pao Chuangneng Technology Co., Ltd.**
Factory address 3	No.8, Qingli 3rd Road, Shuikou Street, Huicheng District,Huizhou City, Guangdong Province, 516005, P.R.China

3.1 Technical data of the unit(s)

Model	**CME06-2BM250**	**CME06-2BM250-08**
Hardware version (tested)	V1.0.0	
Software version (tested)	V1.01.02	
Parameter set (used for testing)	*EN50549*	
Battery		
Battery Type	LiFePO4	
Battery information	25.6 V, 100 Ah, 2560Wh	
Life Cycle (Times)	> 6000 (25°C)	
Firmware version of the BMS	V1.0.2	
Standard Charge/Discharge Current	50A/50A	
Max. Charge/Discharge Current	70A/70A	
AC INPUT/OUTPUT		
Input/Output Voltage	220V / 230V, L+N+PE, 50 Hz *	
Max. Output Power	1500W	800W
Max. Output Current	6.6A	3.5A
Max. Input Current	10.5A	
Max. Input Power	2400W	
Power Factor Adjustment Range	0.8leading – 0.8lagging	
* All tests are performed at 230V, 50Hz.		

Mass of equipment	27.7±0.5kg
IP Rating	IP65
Protective Class	I
Overvoltage Category	II (DC), III (AC)
Topology	Isolated

Datasheet of the generating units:

Note:

The units CME06-2BM250-07 is not considered in this test report.

Model	CME06-2BM250	CME06-2BM250-07	CME06-2BM250-08
Battery			
Capacity	2560Wh		
Voltage Range	21.6 V - 28.8 V		
Rated Voltage/capacity	25.6 V/100 Ah		
Rated Power(Single device)	1500W		
Charge Current	Max. 70A DC		
Discharge Current	Max. 70A DC		
Standard Charge Current	50A		
Standard Discharge Current	50A		
Standard Charge Voltage	28.8V		
Upper limit Charging Voltage	28.8V		
End-of-discharge Voltage	21.6V		
Life Cycle (Times)	> 6000 (25°C)		
Battery Type	LiFePO4		
On-grid Terminal (AC)			
On-grid Output Power	1500 W	799 W	800 W
On-grid Input Power	Max.2400 W		
AC Nominal Output Voltage	230VAC		
AC Frequency	50 Hz		
AC Nominal Input/Output Voltage	L+N+PE 220V/230V AC		
Max. Input Current	10.5 A		
Max. Output Current	6.6 A	3.5 A	3.5 A
Total Harmonic Distortion	Typ. < 3%, Max. < 5%		
Power Factor	0.8 lagging - 0.8 leading		
Off-Grid Terminal (AC)			
Rated Output Power	Single-unit: 1500 W; Parallel-unit: 2400 W		
AC Output Apparent Power	Max. 2400VA		
AC Output Current	Max. 10.5 A		
AC Nominal Output Voltage	230VAC		
AC Frequency	50 Hz		
Backup Output Peak	200%		
EPS Switching Time	≤10 ms		
Environmental and Mechanical			
Communication	Wi-Fi & Bluetooth, RS485		
Storage Temperature Range	-20°C to +55°C (recommend: 10°C to +35°C)		
Charge Temperature Range	0°C to +50°C		

Model	CME06-2BM250	CME06-2BM250-07	CME06-2BM250-08
Discharge Temperature Range	-20°C to +55°C		
Operating Humidity	≤85%RH (non-condensation)		
Storage Humidity	10% - 85%RH (non-condensation)		
Enclosure Rating	IP65		
Cooling Mode	Natural convection		
Dimensions (W × H × D)	260±2 mm x 445±2 mm x 250±2 mm		
Weight	27.7±0.5 kg		
Noise	≤ 30dB		
Maximum Altitude Rating	≤ 2000 m		
Warranty	10 years		
Self-consumption (bypass off)	11.5 W		
Pollution Degree	PD III		
Topology Type	Isolation		
Efficiency			
Max. Output Efficiency	94.8%		
Battery Charge Efficiency	94.8%		
Protection			
Protective Class	Class I		
Over Voltage Category	AC.OVC III, DC.OVC II		
Inverter Topology	Isolated		
Overvoltage Protection	Yes		
Undervoltage Protection	Yes		
Over-frequency Protection	Yes		
Underfrequency Protection	Yes		
Short Circuit Protection	Yes		
Reverse Connection Protection	Yes		
Over Temperature Protection	Yes		
Anti-Islanding Protection	Yes		
Safety certification			
IEC62109-1, IEC61000-6-1/-3, IEC61000-3-2/-3, IEC62619, EN 50549-1/-10, NEN EN50549-1+BWB R0037940 Netcode, ETSI EN300328, ETSI EN301489-1/17, OVE-directive R25:2020-3 TOR Erzeuger Type A, VDE 4105, VDE 0124, NF50549-10, UN 38.3, C10/11, CEI 0-21, IEC61000-4, IEC 62920			

NOTICE

Recommend charging method declared by the manufacturer:

- Cell: Charge the battery at constant current 50A until voltage reaches 3.65V, then charge at constant voltage 3.65V till charge current is 5A.
- Battery System: Charge the battery at constant current 50A until voltage reaches 28.8V, then charge at constant voltage 28.8V till charge current is 5A

3.2 P-Q characteristic of the generating unit(s)

(Manufacturer's Data) see *Annex 3 – Capability curve of the PGU(s)*

3.3 Description of the differences of the models within the product series

The units of the series are identical hardware platform.

The implemented control and firmware are identical in all units. There is no difference regarding AC behaviour between the PGU-types apart from the power rating deviation and current limitation of each unit.

The units in the product series:

- sharing the same control electronics,
- with the same firmware,
- with the same construction solutions including the power part,
- with the same number of phases,
- with the same power electronics, filters and transducers.

3.4 Copy of marking plate









Note:

The marking plates shown above may be only a draft. The use of certification marks on products must be approved by the respective NCBs to which these marks belong.

The marking plate is attached to the side surface or the back of the enclosure and is visible after installation.

3.5 Description of the power circuit

This balcony energy storage system consists of four main modules: micro-inverter, battery BMS, LED light panel and BCU main control unit.

The internal control system is redundantly constructed, consisting of a master microcontroller CPU 1 (IC7) and a slave CPU 2 (IC16).

Master CPU 1 (IC7) measures information load voltages and currents, such as those from the inverter, battery voltage and current, as well as bus voltage and heatsink temperature; controls relays through switching signals; exchanges system status data with slave CPU 2 (IC16); optimizes the charging and discharging power of grid systems; and manages the system's operating modes.

Slave CPU 2 (IC16) measures battery voltage and current, and heatsink temperature information; performs ground insulation resistance tests before startup; and communicates with master CPU 1 (IC7) to receive control commands.

The grid-connected section achieves dual protection for battery systems through an isolation transformer and dual relays: even if a single relay fails, the other relay will disconnect, and the synchronization of the isolation transformer maintains insulation and disconnection. When a relay abnormality is detected, the system triggers an alarm and displays an error code. In the event of a fault, the master and slave DSPs coordinate to initiate protection, and if necessary, the low-voltage side is disconnected through relays or the isolation transformer to ensure basic insulation between the battery system and the grid.

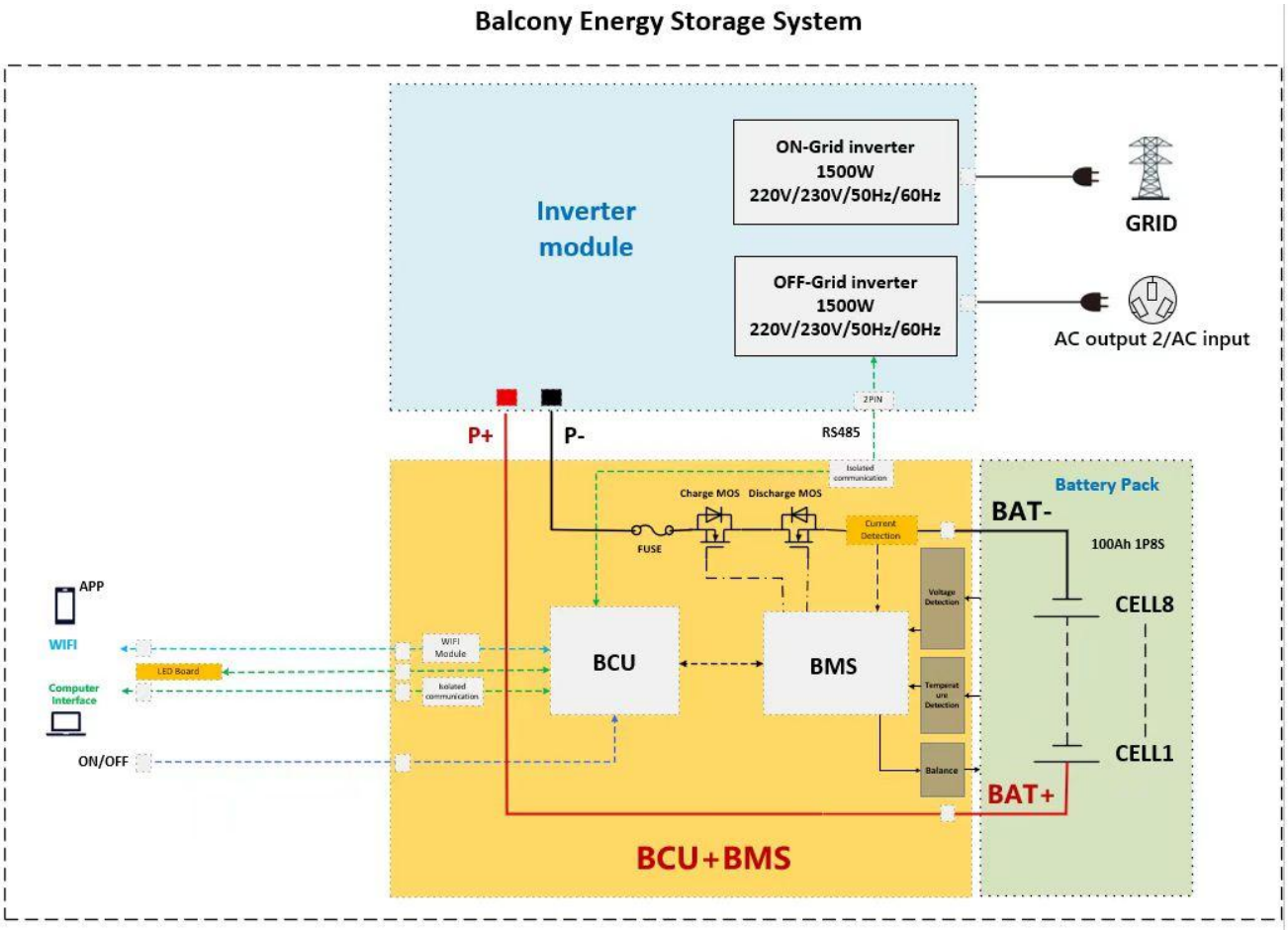


Figure 1 – Block diagram of the power circuit (Energy Storage System)

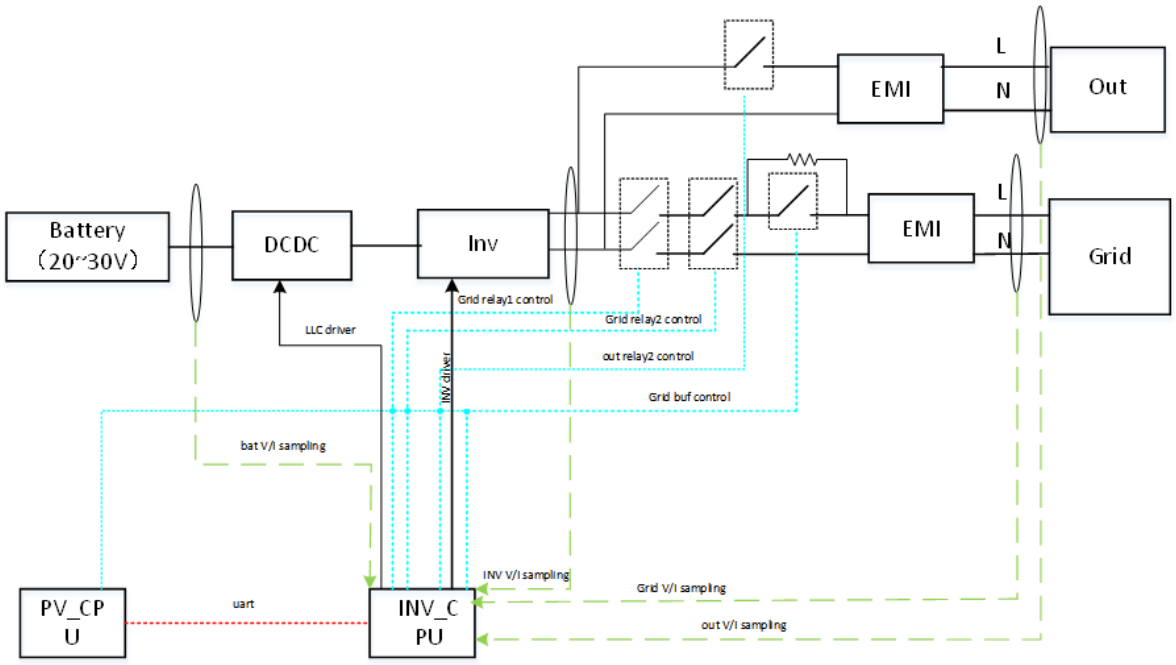


Figure 2 – Block diagram of the power circuit (Inverter module)

4 General remarks for testing

4.1 Energy Conversion Technology

Photovoltaic *	Fuel Cells	Hydro	Wind	Electricity Storage devices	Other
☐	☐	☐	☐	☒	---

Note:

* Connection scenario:

☐ Photovoltaic Power Park Module connected to the DNO's Distribution Network via an Inverter

☐ Hybrid converter:

Photovoltaic Power Park Module with DC coupled storage unit connected to the DNO's Distribution Network via an Inverter

In this case the Registered Capacity is based on the Inverter rating. The storage unit has no compliance effect, compliance based on the inverter.

4.2 PGM categories

The PGUs considered in this test report are:

☒ Type A

☐ Type B

generating module(s).

4.3 Scope of measurements

The type tests documented in this test report are intended to demonstrate that the generating unit(s) considered herein meet(s) the following technical requirements for grid connection:

☒ **EN 50549-1:2019+A1:2023**: Requirements for generating plants to be connected in parallel with distribution networks - Part 1: connection to a LV distribution network - Generating plants up to and including Type B

☐ **EN 50549-2:2019+A1:2023**: Requirements for generating plants to be connected in parallel with distribution networks - Part 2: Connection to a MV distribution network - Generating plants up to and including Type B

Date of receipt of test items ..... : 2026-02-01

Date(s) of performance of tests ..... : 2026-02-01 - 2026-04-20

Clause(s) / subclause(s) of EN 50549-1:2019 or EN 50549-2:2019	Applicable Clause(s) / subclause(s) of EN 50549-10:2022	Section in this test report	Tests completed
4.4.2 Operating frequency range	5.2.1 Frequency operating range	6.1.1	☒
4.4.3 Minimal requirement for active power delivery at underfrequency	5.2.1 Frequency operating range	6.1.1	☒
4.4.4 Continuous operating voltage range	5.2.2 Voltage operating range	6.1.2	☒
4.5.2 Rate of change of frequency (ROCOF) immunity	5.3.1 Immunity to disturbances - Rate of change of frequency (ROCOF)	6.2.1	☒

Clause(s) / subclause(s) of EN 50549-1:2019 or EN 50549-2:2019	Applicable Clause(s) / subclause(s) of EN 50549-10:2022	Section in this test report	Tests completed
4.5.3.2 Generating plant with non-synchronous generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	☒
4.5.3.3 Generating plant with synchronous generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	---	☐
4.5.4 Over-voltage ride through (OVRT)	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	☒
4.5.5 Phase jump immunity	5.3.2 Phase jump	6.2.2	☒
4.6.1 Power response to overfrequency	5.4 Active response to frequency deviation	6.3.1	☒
4.6.2 Power response to underfrequency	5.4 Active response to frequency deviation	6.3.2	☒
4.7.2.2 Voltage support by reactive power, Capabilities	5.5.1 Power capabilities assessment	6.4.1	☒
4.7.2.3 Voltage support by reactive power, Control modes	5.5.2 Voltage support by reactive power - test to determine the reactive power control modes	6.4.2	☒
4.7.2.3.2 Set point control modes	5.5.2.3 Verification procedure for Set point control	6.4.2.1	☒
4.7.2.3.3 Voltage related control modes	5.5.2.4 Verification procedure for voltage related control modes for reactive power	6.4.2.2	☒
4.7.2.3.4 Power related control mode	5.5.2.5 Verification procedure for power related control modes for reactive power	6.4.2.3	☒
4.7.3 Voltage related active power reduction	5.6 Voltage related active power reduction - P(U)	6.5	☒
only EN 50549-2:2019 4.7.4.2.1.1 Voltage support during faults and voltage steps – General	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	☐
only EN 50549-2:2019 4.7.4.2.1.2 Voltage support during faults and voltage steps - Optional Modes	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	☐
4.7.4.2.2 Zero current mode for converter connected generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	☒
4.8 EMC and power quality	5.7 EMC and power quality	6.6	☒
only EN 50549-1:2019 4.9.3 Requirements on voltage and frequency protection	5.8.3 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as internal device or 5.8.4 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as dedicated device	6.7	☒
only EN 50549-2:2019, 4.9.3. Requirements on voltage and frequency protection	5.8.5 Verification procedure for generating plants to be connected to a MV distribution network	---	☐
4.9.4 Means to detect island situation	5.8.6 Islanding detection	6.7.4	☒
4.10.2 Automatic reconnection after tripping	5.9.3 Automatic reconnection after tripping	6.8.1	☒

Clause(s) / subclause(s) of EN 50549-1:2019 or EN 50549-2:2019	Applicable Clause(s) / subclause(s) of EN 50549-10:2022	Section in this test report	Tests completed
4.10.3 Starting to generate electrical power	5.9.4 Starting to generate electrical power	6.8.2	☒
4.11.1 Ceasing active power	5.10 Active power reduction on set point	6.9	☒
4.11.2 Reduction of active power on set point	5.10 Active power reduction on set point	6.9	☒
4.12 Remote information exchange	5.11 Remote information exchange	---	☐
only EN 50549-1:2019, 4.13 single fault tolerance of interface protection system and interface switch	5.12 Requirements regarding single fault tolerance of interface protection system and interface switch	6.11	☒
---	5.13 Model definition and model validation for generating units of synchronous generating technology	6.12	☐

4.3.1 Definition of the boundary of the EUT

	Clause / subclause of EN 50549-10:2022	Description
☐	4.2.1	Test on complete generating unit
☒	4.2.2	Test on the electrical generation system *
☐	4.2.3	Test on the nacelle of a wind turbine
☐	4.2.4	Test on the primary energy converter
☐	4.2.5	Test at limited power
☐	4.2.6	Test on stopped generating unit
☐	4.2.7	Test on an independent component
☐	4.2.8	Simulated input test
☐	4.2.9	Test by changing a control parameter
☐	4.2.10	Field measurements
☐	4.2.11	Test by calculation and numerical simulation for generating units of synchronous generating technology
☐	4.2.12	Test of the real generating unit control unit in a simulated environment (“Controller-Hardware-in-the-loop” (HIL) test)
☐	4.2.13	Evaluation by inspection and test of dependent components

Note:

* Tests were performed on a EUT limited to the *electrical generation system* with an alternative energy source emulating the behaviour of that primary source:

☒ The nominal frequency of the output stage of the EUT corresponds to the nominal frequency of the distribution network.

☒ The generating units considered in this test report are designed for connection to the LV distribution network, the voltage level at the output stage of the EUT is in line with the voltage of the LV distribution network.

☐ The generating units considered in this test report are designed for connection to the MV distribution network, the voltage level at the output stage of the EUT corresponds to

☐ the voltage of the MV distribution network.

☐ the rated output voltage of the inverter, which requires a transformer in the final installation.

☒ The primary energy converter is replaced by an alternative energy source emulating the behaviour of that primary source.

☒ a DC source is used to emulate the characteristics of a PV array

☐ a bi-directional DC source is used to emulate the characteristics of the battery

(Note:
This is acceptable as the behaviour of the primary source can be emulated sufficiently accurately by the alternative energy source used. This does not impact the results of the assessed requirement.)

☒ includes all auxiliary equipment of the electrical generation system.

The boundary of the EUT as defined as descripted above (for more details see Figure 3, Figure 4).

4.3.2 Selecting the EUT to cover the entire product family

- **Definition of EUT**
  This report defines the EUT using guidelines from the following document:
  EG HCF: Harmonization of Equipment Certificate Acceptance at European Level and Product Family Grouping (V 1.0, dated 16/03/23)

  ☐ Based on the tests done on the smallest and biggest representative units of the family*

  ☒ Based on a range dependent on the tested unit's nominal active power; this can be defined as in Germany (Pgen/√10 < Pgentestate < Pgen x 2)

  CME06-2BM250-08 which provides the highest current / power was selected as the **EUT.**

- Technical justification for transferability of measurement results:
  see section 3.3 on p.12.

4.3.3 General information on EUT

All tests were performed on the EUT **CME06-2BM250-08** equipped with the following hardware/software:

- Serial No.: CBGEAC2601280027
- Hardware Version: V1.0.0
- Software Version: V1.01.02

4.3.4 Parameter set

In this report following parameter set(s) is/are considered:

☒ Single parameter set: "*EN50549*"

☐ Test for one specific setting

☒ Test for multiple settings (setting range verification)

☐ Multiple parameter sets: ---

☐ Test for one specific setting

☐ Test for multiple settings (setting range verification)

For details on the parameter set and the configurability of the associated parameters, see Annex 1

4.4 Reference values

Reference values for the p.u. or percentage calculations:

	CME06-2BM250	CME06-2BM250-08
Nominal active power [1] P_n [W]	1500	800
Nominal voltage (phase-to-neutral), U_n [V]	230	
Nominal frequency, f_n [Hz]	50	
Nominal current, I_n [2] [A]	6.6	3.5

4.5 Measurement setup

Tests documented in this test report were performed using the following test configuration:

☐ Measurements in the field on real grid

☐ Test bench tests on real grid

☒ Test bench tests on an AC grid simulator

Operating mode of the EUT during the measurement

☐ MPP-Tracking operation mode

☒ Fixed voltage control operation mode

The PGU is connected on the DC-side to a PV-simulator and on the AC-side to an AC-grid simulator. The AC-grid simulator is operated with nominal conditions of U_n = 230 (phase-to-neutral) and f_n = 50 Hz unless stated otherwise by the applied test requirement.

[1] Definition according to EN 50549-10:2022, section 3.1.3.1.

[2] Definition according to EN 50549-10:2022, section 3.1.3.2.

The measurement setups are shown in Figure 3 and Figure 4. The specific test and measurement devices are stated in section 4.6.

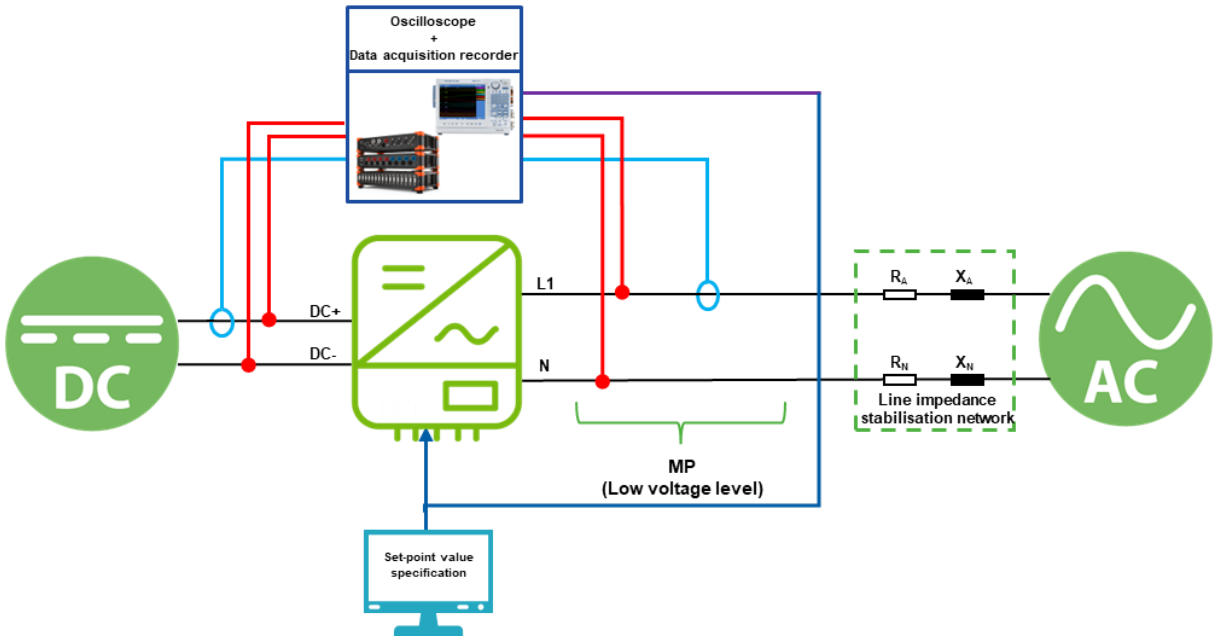


Figure 3 – Measurement setup used for tests except Loss of Mains and Short Circuit test

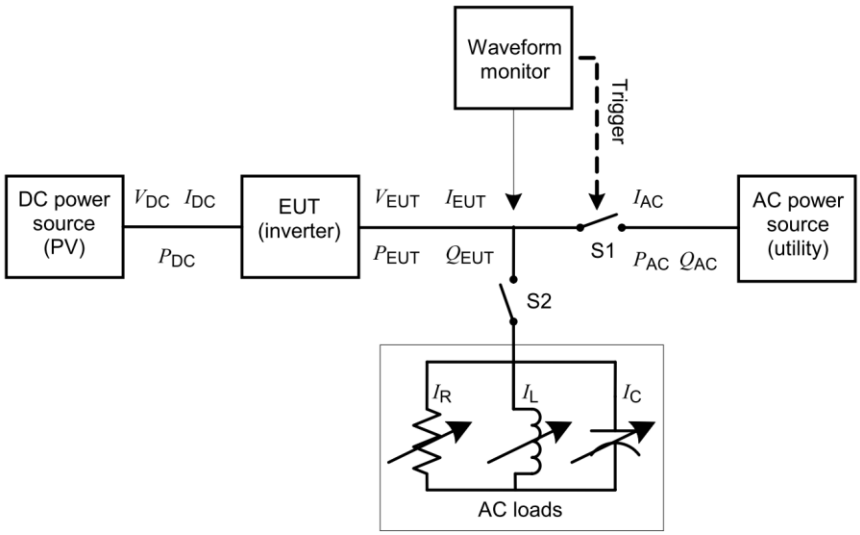


Figure 4 – Test circuit for Loss of Mains according to *IEC 62116:2014*

4.6 Measurement equipment

Equipment	Internal No.	Manufacturer	Type	Serial No.	Next Calibration
AC source	HC-ENG-030	KEWELL	KAC-45-345-33	6018888220300485	Monitored by Power Analyzer
RCD Load	HC-ENG-059	LYNS-Tci	IMAX5345-45KVA	20230415013	
RLC Load	HC-ENG-005	Qunling Energy Resources	ACLT-3803H	93H006289	
Oscilloscope	--	Tektronix	MDO3014	--	2026-08-28
Power analyser	HC-ENG-045	DEWETRON	TRION-1820-POWER	A1221033/C5220852	2027-03-18
Current sensor	HC-ENG-045-001	SIGNALTEC	CT 400	1220490451	2027-03-18
	HC-ENG-045-002	SIGNALTEC	CT 400	1220490452	2027-03-18
	HC-ENG-045-003	SIGNALTEC	CT 400	1220490453	2027-03-18
	HC-ENG-045-004	SIGNALTEC	CT 400	1220490454	2027-03-18
Humidity & Temperature recorder	HC-ENG-002	Jiangsu Jingchuang Electric Co., Ltd.	GSP-8A	CMA215000031	2027-03-18

Note:

All measurement equipment was used within the calibration period. Copy of calibration certificates are available at the laboratory for reference.

4.7 Sampling rates of measurement equipment and data acquisition

Test item	Voltages and currents signals A)	Set points and reference signals B)	Other signals (e.g. wind speed, rotational speed, battery state of charge etc.) C)	Sampling rates used for testing (for all signals A), B) & C))
5.1 Power specification of the generating unit	≥ 3 kHz	≥ 3 kHz	≥ 1 kHz	10 kHz
5.2 Normal operating range	≥ 3 kHz	≥ 3 kHz	≥ 1 kHz	10 kHz
5.3 Immunity to disturbances	≥ 10 kHz	N/A	≥ 1 kHz	10 kHz
5.4 Active response to frequency deviation	≥ 3 kHz	N/A	≥ 1 kHz	10 kHz
5.5 Power specification and response to voltage variations	≥ 3 kHz	≥ 3 kHz	≥ 1 kHz	10 kHz
5.7 EMC and power quality				
5.7.2.2 Verification procedure for harmonics, interharmonics and higher frequencies up to 9 kHz	≥ 20 kHz	N/A	≥ 1 kHz	50 kHz
5.7.2.3 Verification procedure for flicker and rapid voltage changes	≥ 3 kHz	N/A	≥ 1 kHz	10 kHz
5.7.2.4 Verification procedure for DC injection	≥ 3 kHz	N/A	≥ 1 kHz	10 kHz

Test item	Voltages and currents signals A)	Set points and reference signals B)	Other signals (e.g. wind speed, rotational speed, battery state of charge etc.) C)	Sampling rates used for testing (for all signals A), B) & C))
5.8 Interface protection	≥ 10 kHz (≥ 1 kHz for voltage protection tests)	N/A	≥ 1 kHz	10 kHz
5.9 Connection and starting	≥ 3 kHz	N/A	≥ 1 kHz	10 kHz
5.10 Active power reduction on set point	≥ 3 kHz	≥ 3 kHz	≥ 1 kHz	10 kHz
5.11 Remote information exchange	N/A	N/A	N/A	---
5.12 Requirements regarding single fault tolerance of interface protection system and interface switch	N/A	N/A	N/A	---
5.13 Model definition and model validation for generating units of synchronous generating technology	N/A	N/A	N/A	---

4.8 Measurement uncertainties

Value	Required measurement uncertainty (k = 2) (excluding the contribution of voltage and current transducers)	Maximum uncertainty (k = 2) measurement equipment used for testing (contribution of voltage and current transducers has been taken into account)
Voltage (fundamental)	≤ 0.5% of U_n	±0.06%
Current (fundamental)	≤ 0.5% of I_n	±0.14
Harmonic currents up to 9 kHz		
≥ 0,1% of I_n	≤ 30% of measured value	±0.66
< 0,1% of I_n	≤ 0.03% of I_n	±0.016%
Set point signals	≤ 0.5% of nominal value	±0.18% of nominal value
Flicker	≤ 5.8% referenced to P_{st} = 1	±1.7%
Interface protection (test signals)	voltage ≤ 0.1% of U_n frequency ≤ 0.01% of f_n	Voltage: ±0.05% of U_n frequency: ±0.006% of f_n
pole wheel angle	≤4°electrical	---

4.9 Test environment conditions

Applicable Clause(s) / subclause(s) of EN 50549-10:2022	**Test date**	Tamb during test [°C]	Humidity during test [%rH]	Air pressure [hPA]
5.2.1 Frequency operating range	2026-02-01	26	70	965
5.2.2 Voltage operating range	2026-02-03	26	70	965
5.3.1 Immunity to disturbances - Rate of change of frequency (ROCOF)	2026-02-07	26	71	966
5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	2026-02-15	26	70	965

Applicable Clause(s) / subclause(s) of EN 50549-10:2022	Test date	Tamb during test [°C]	Humidity during test [%rH]	Air pressure [hPA]
5.4 Active response to frequency deviation	2026-02-28	25	72	964
5.5.1 Power capabilities assessment	2026-03-01	26	70	965
5.5.2 Voltage support by reactive power - test to determine the reactive power control modes	2026-03-04	26	70	965
5.5.2.3 Verification procedure for Set point control	2026-03-05	25	71	965
5.5.2.5 Verification procedure for power related control modes for reactive power	2026-03-08	26	70	966
5.8.3 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as internal device or 5.8.4 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as dedicated device	2026-03-11	27	70	965
5.8.5 Verification procedure for generating plants to be connected to a MV distribution network	--	--	--	--
5.8.6 Islanding detection	2026-03-21	26	70	965
5.9.3 Automatic reconnection after tripping	2026-04-09	25	71	963
5.9.4 Starting to generate electrical power	2026-04-16	26	70	965
5.10 Active power reduction on set point	2026-04-20	27	72	966
5.11 Remote information exchange	---	---	---	---
5.12 Requirements regarding single fault tolerance of interface protection system and interface switch	---	---	---	---
5.13 Model definition and model validation for generating units of synchronous generating technology	---	---	---	---

5 Assessment overview

Possible test case verdicts:

Test item does meet the requirement.....: P (Pass)

Test item does not meet the requirement....: F (Fail)

Test case does not apply to the test object...: N/A

Test case is not rated .....: N/R

Reference to declaration documents.....: R/D

Note:

Conformity statement are decided in accordance with ILAC-G8:09/2019 *Binary Statement for Simple Acceptance Rule*, unless otherwise normatively specified. or contractually agreed.

For the ***transferability*** of test results from the EUT to other units within the product family, refer to section 4.3.2.

Clause(s) / subclause(s) of EN 50549-1:2019 or EN 50549-2:2019	Applicable Clause(s) / subclause(s) of EN 50549-10:2022	Section in this test report	Remark	Verdict
4.4.2 Operating frequency range	5.2.1 Frequency operating range	6.1.1	---	P
4.4.3 Minimal requirement for active power delivery at underfrequency	5.2.1 Frequency operating range	6.1.1	---	P
4.4.4 Continuous operating voltage range	5.2.2 Voltage operating range	6.1.2	---	P
4.5.2 Rate of change of frequency (ROCOF) immunity	5.3.1 Immunity to disturbances - Rate of change of frequency (ROCOF)	6.2.1	---	P
4.5.3.2 Generating plant with non-synchronous generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	---	P
4.5.3.3 Generating plant with synchronous generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	---	---	N/A
4.5.4 Over-voltage ride through (OVRT)	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	---	P
4.5.5 Phase jump immunity	5.3.2 Phase jump	6.2.2	---	P
4.6.1 Power response to overfrequency	5.4 Active response to frequency deviation	6.3.1	---	P
4.6.2 Power response to underfrequency	5.4 Active response to frequency deviation	6.3.2	---	P
4.7.2.2 Voltage support by reactive power, Capabilities	5.5.1 Power capabilities assessment	6.4.1	---	P
4.7.2.3 Voltage support by reactive power, Control modes	5.5.2 Voltage support by reactive power - test to determine the reactive power control modes	6.4.2	---	P
4.7.2.3.2 Set point control modes	5.5.2.3 Verification procedure for Set point control	6.4.2.1	---	P
4.7.2.3.3 Voltage related control modes	5.5.2.4 Verification procedure for voltage related control modes for reactive power	6.4.2.2	---	P
4.7.2.3.4 Power related control mode	5.5.2.5 Verification procedure for power related control modes for reactive power	6.4.2.3	---	P

Clause(s) / subclause(s) of EN 50549-1:2019 or EN 50549-2:2019	Applicable Clause(s) / subclause(s) of EN 50549-10:2022	Section in this test report	Remark	Verdict
4.7.3 Voltage related active power reduction	5.6 Voltage related active power reduction - P(U)	6.5	---	P
only EN 50549-2:2019 4.7.4.2.1.1 Voltage support during faults and voltage steps – General	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	---	N/A
only EN 50549-2:2019 4.7.4.2.1.2 Voltage support during faults and voltage steps - Optional Modes	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	---	N/A
4.7.4.2.2 Zero current mode for converter connected generating technology	5.3.3 Immunity to disturbances - Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)	6.2.3	---	P
4.8 EMC and power quality	5.7 EMC and power quality	6.6	---	P
only EN 50549-1:2019 4.9.3 Requirements on voltage and frequency protection	5.8.3 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as internal device or 5.8.4 Verification procedure for generating plants to be connected to a LV distribution network with Interface protection as dedicated device	6.7	---	P
only EN 50549-2:2019, 4.9.3. Requirements on voltage and frequency protection	5.8.5 Verification procedure for generating plants to be connected to a MV distribution network	---	---	N/A
4.9.4 Means to detect island situation	5.8.6 Islanding detection	6.7.4	---	P
4.10.2 Automatic reconnection after tripping	5.9.3 Automatic reconnection after tripping	6.8.1	---	P
4.10.3 Starting to generate electrical power	5.9.4 Starting to generate electrical power	6.8.2	---	P
4.11.1 Ceasing active power	5.10 Active power reduction on set point	6.9	---	P
4.11.2 Reduction of active power on set point	5.10 Active power reduction on set point	6.9	---	P
4.12 Remote information exchange	5.11 Remote information exchange	---	---	N/A
only EN 50549-1:2019, 4.13 single fault tolerance of interface protection system and interface switch	5.12 Requirements regarding single fault tolerance of interface protection system and interface switch	6.11	---	P
---	5.13 Model definition and model validation for generating units of synchronous generating technology	6.12	---	N/A

6 Measurement results

6.1 Normal operating range

6.1.1 Frequency operating range

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.2.1.3, EN 50549-10

Active Power level	100%P_{max}
Active factor	1.000
LFSM-O control function	disable
Voltage and frequency protection	deactivated

Acceptance criteria

- the generating unit does not trip and operates at frequencies stated in section 5.2.1.3, EN 50549-10 or
- the generating unit does not trip and operates at an exceeding frequency range as stated by the manufacturer or responsible party or a specific grid code.
- When evaluating the underfrequency condition the generating unit is allowed to decrease its power output by up to 10%P_{max} per Hertz starting from 49,5 Hz according to characteristic described in EN 50549-1:2019 and EN 50549-2:2019, 4.4.3, Figure 5 or to a more stringent power reduction characteristic defined by the manufacturer or responsible party or a specific grid code.

Manufacturer's data

(Regarding the nominal voltage/frequency of the EUT, please refer to section 4.4.)

The unit can be continuously operated within the voltage/frequency range:

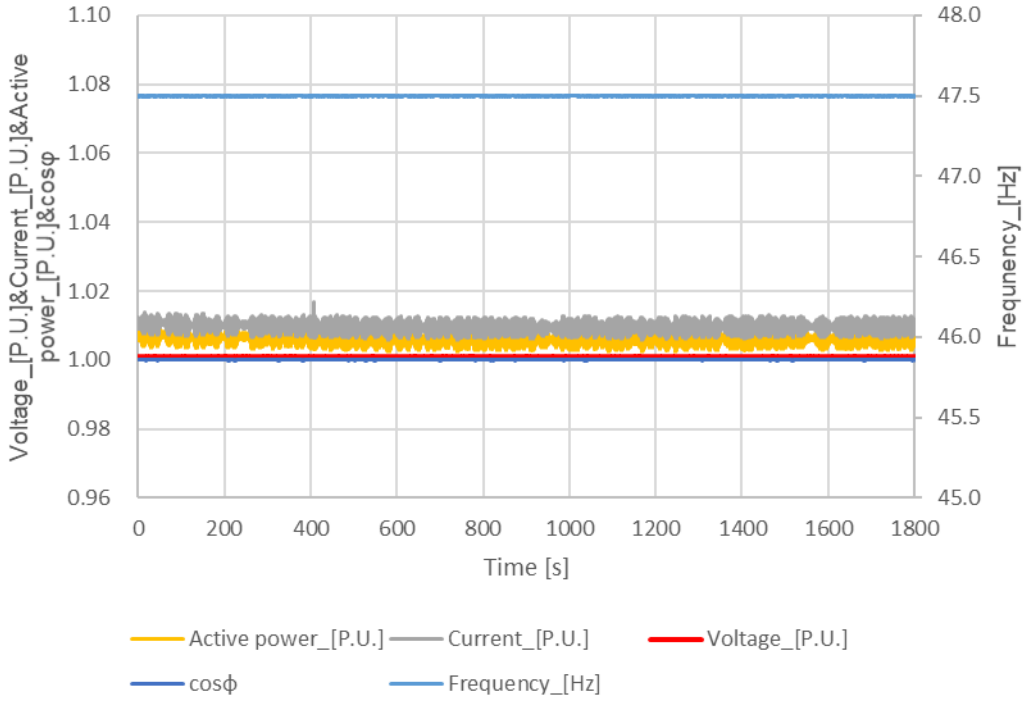
- 85%U_n ~ 110%U_n
- 47.5Hz ~ 51.5Hz (requirements according to table 1, EN 50549-1 can be met)

The operating range of voltage and frequency can also be limited using the protection functions.

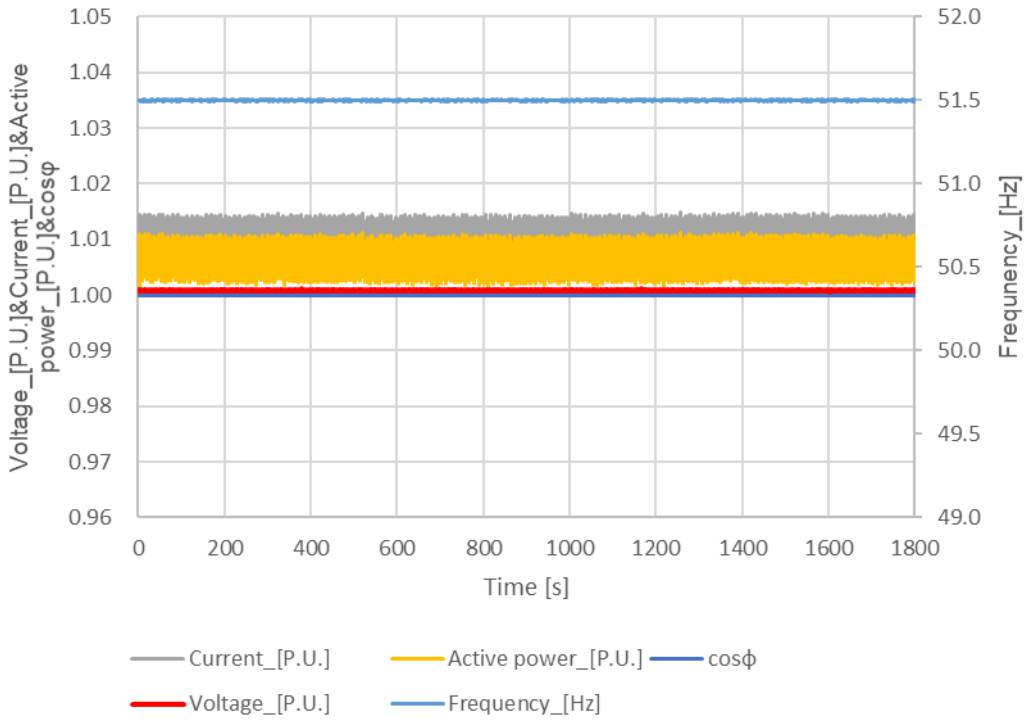
Test results

Test no.	U [%]	f [Hz]	P_{meas} [%P_{max}]	Active factor [-]	Duration of recording [min]	EUT tripped during test?	
1	100	47.50	100.6	0.999	≥ 30 min	☐ Yes	☒ No
2	100	51.50	100.6	0.999	≥ 30 min	☐ Yes	☒ No
3	100	47.00	100.8	0.999	≥ 20 s	☐ Yes	☒ No
4	100	52.00	101.2	0.999	≥ 30 min	☐ Yes	☒ No

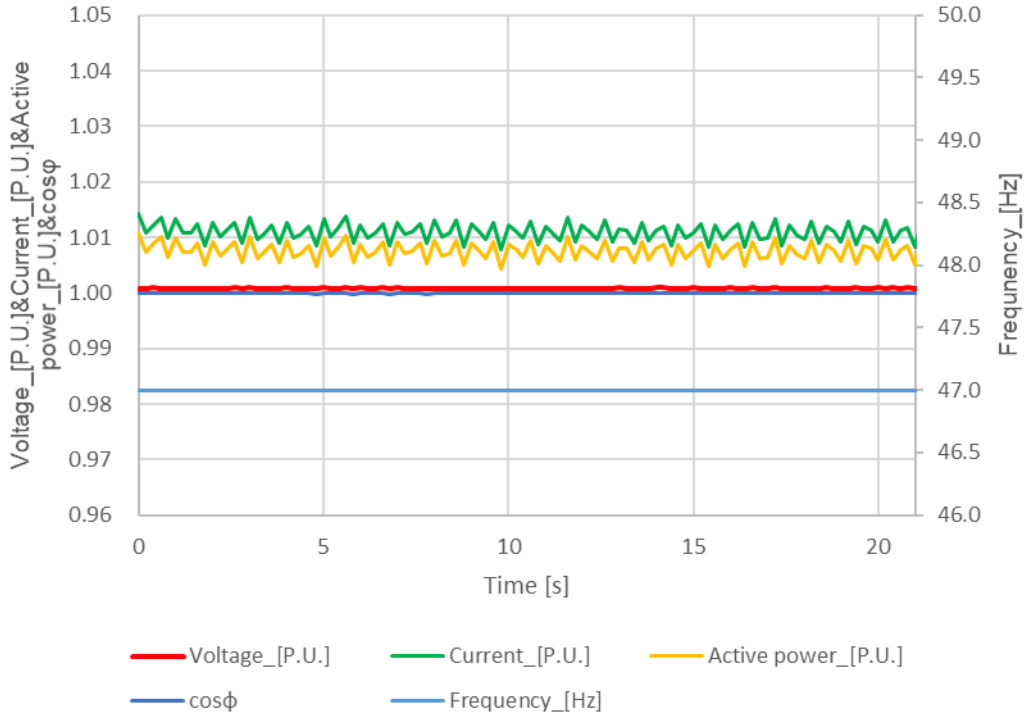
Test 1


Voltage_[P.U.]&Current_[P.U.]&Active power_[P.U.]&cosφ
Frequency_[Hz]
Time [s]
1.10
1.08
1.06
1.04
1.02
1.00
0.98
0.96
48.0
47.5
47.0
46.5
46.0
45.5
45.0
0
200
400
600
800
1000
1200
1400
1600
1800
Active power_[P.U.]
Current_[P.U.]
Voltage_[P.U.]
cosφ
Frequency_[Hz]

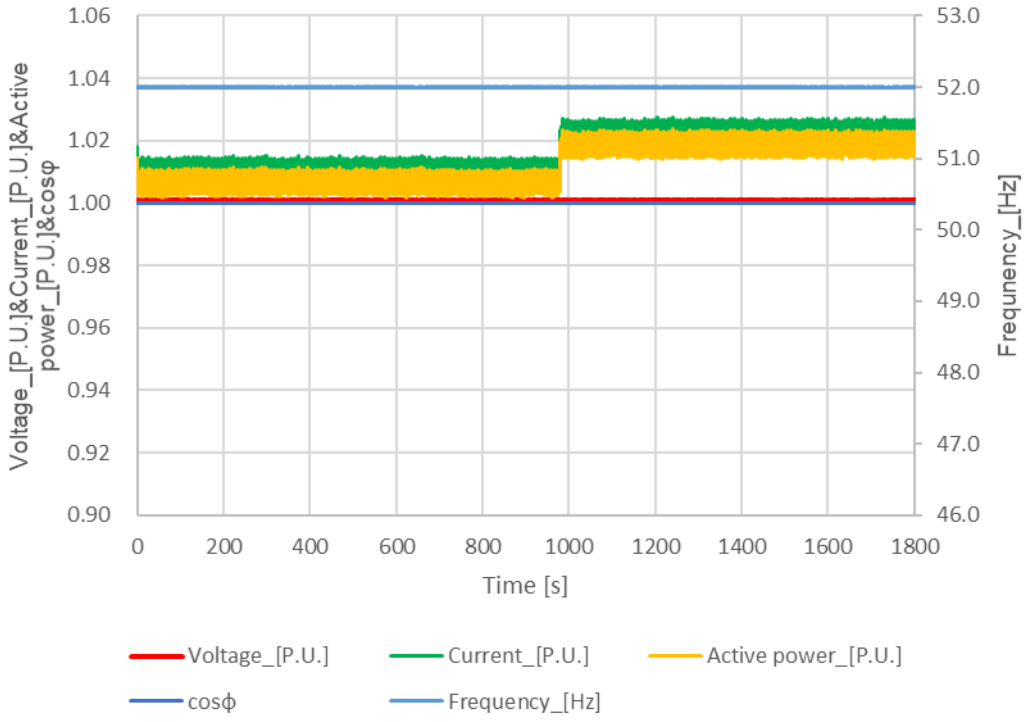
Test 2


Voltage_[P.U.]&Current_[P.U.]&Active power_[P.U.]&cosφ
Frequency_[Hz]
Time [s]
1.05
1.04
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
52.0
51.5
51.0
50.5
50.0
49.5
49.0
0
200
400
600
800
1000
1200
1400
1600
1800
Current_[P.U.]
Active power_[P.U.]
cosφ
Voltage_[P.U.]
Frequency_[Hz]

Test 3


Voltage_[P.U.]&Current_[P.U.]&Active power_[P.U.]&cosφ
Frequency_[Hz]
Time [s]
Voltage_[P.U.]
Current_[P.U.]
Active power_[P.U.]
cosϕ
Frequency_[Hz]

Test 4


Voltage_[P.U.]&Current_[P.U.]&Active power_[P.U.]&cosφ
Frequency_[Hz]
Time [s]
Voltage_[P.U.]
Current_[P.U.]
Active power_[P.U.]
cosϕ
Frequency_[Hz]

6.1.2 Voltage operating range

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.2.2.3, EN 50549-10

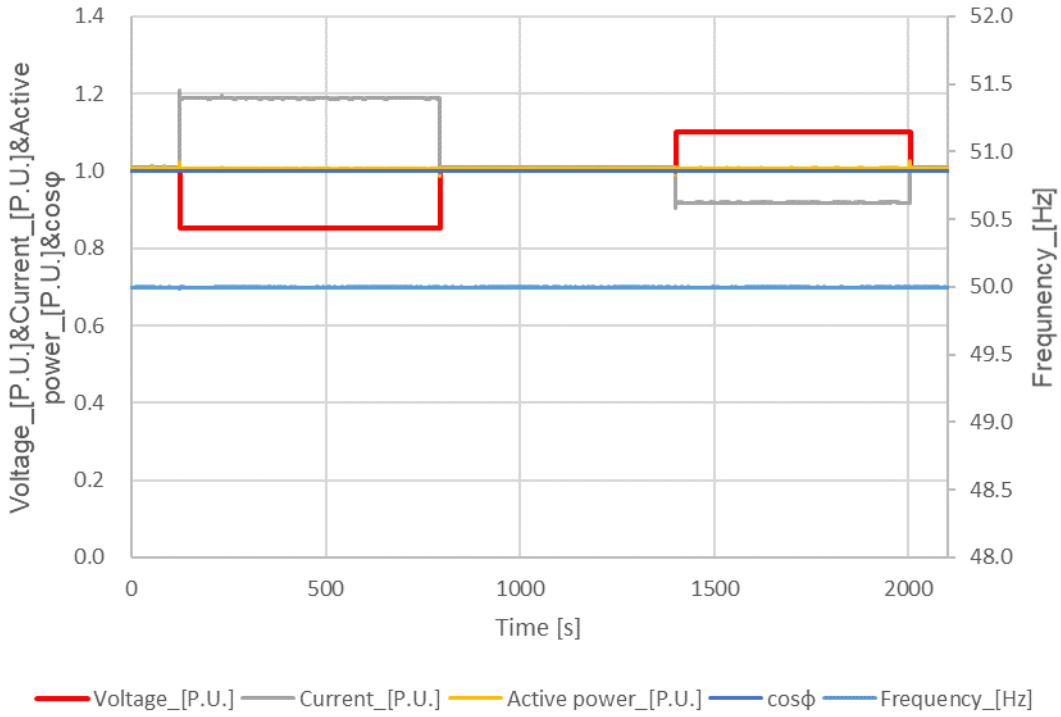
Active Power level	100%P_{max}
Active factor	1.000
LFSM-O control function	disable
Voltage and frequency protection	deactivated

Acceptance criteria
The requirement is considered passed when the generating unit is able to remain in operation and does not disconnect from the system during the test and if the documentation provided shows that the generating unit is expected to run within its operational limits (e.g. temperature on the components does not exceed insulation thermal classes).

Manufacturer's data
(Regarding the nominal voltage/frequency of the EUT, please refer to section 4.4.) The unit can be continuously operated within the voltage/frequency range: - 85%U_n ~ 110%U_n - 47.5Hz ~ 51.5Hz (requirements according to table 1, EN 50549-1 can be met) The operating range of voltage and frequency can also be limited using the protection functions.

Test results

Test seq.	U_{L-L} [%]	U_{L-N} [%]	f [Hz]	P_{meas} [%P_{max}]	Active factor [-]	Duration of recording [min]	EUT tripped during test?	
1	100.1	100.1	50.00	100.69	0.999	≥ 1 min	☐ Yes	☒ No
2	85.1	85.1	50.00	100.59	0.999	≥ 10 min	☐ Yes	☒ No
3	100.1	100.1	50.00	100.63	0.999	≥ 5 min	☐ Yes	☒ No
4	110.1	110.1	50.00	100.71	0.999	≥ 10 min	☐ Yes	☒ No
5	100.1	100.1	50.00	100.65	0.999	≥ 1 min	☐ Yes	☒ No



6.2 Immunity to disturbances

6.2.1 Rate of change of frequency (ROCOF)

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.3.1.3, EN 50549-10

Active Power level	100%P_n
Active factor	1.000
ROCOF protection	disable
Vector shift protection	not available
LFSM-O control function	disable
Voltage and frequency protection	set to values not interfering to the tests

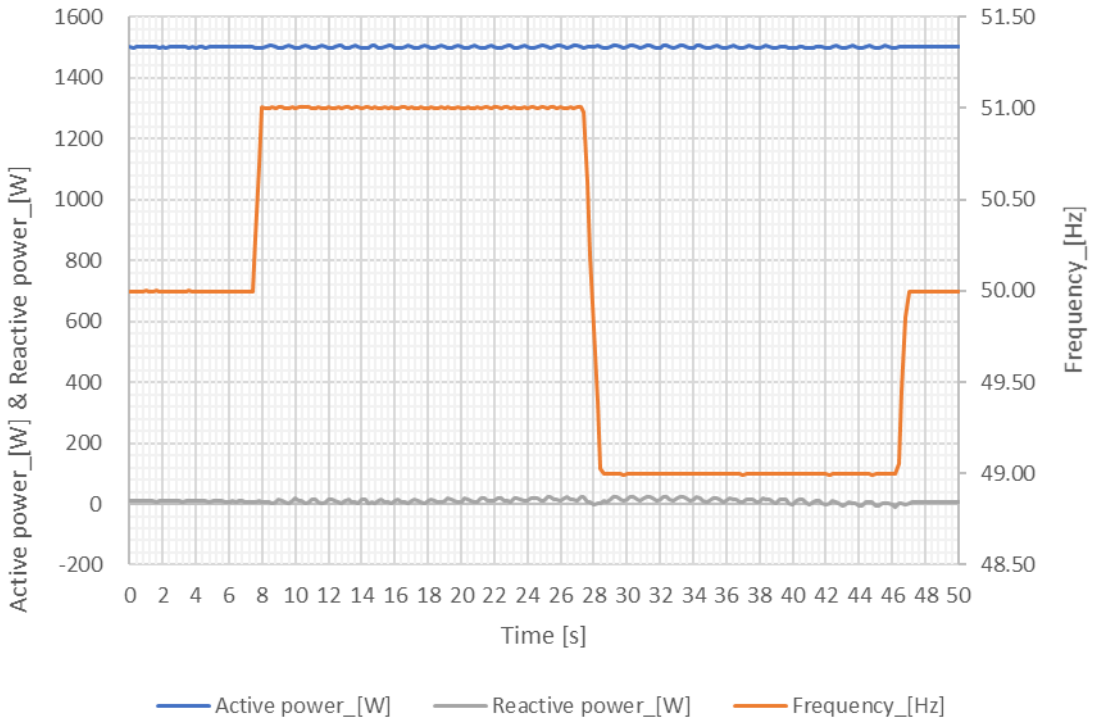
Acceptance criteria
The generating unit operates or unit component remains in operation without disconnection from the grid (no trip).

Test results

☒ ≥ 2 Hz/s ☐ specified by the responsible party: ≥ _ Hz/s

Test seq.	Step	f [Hz]	ROCOF value [Hz/s]	EUT tripped during test?
1	T0	50.0	---	☐ Yes ☒ No

	↓		2	☐ Yes	☒ No
2	T1	51.0	---	☐ Yes	☒ No
	↓		2	☐ Yes	☒ No
3	T2	51.0	---	☐ Yes	☒ No
	↓		2	☐ Yes	☒ No
4	T3	49.0	---	☐ Yes	☒ No
	↓		2	☐ Yes	☒ No
5	T4	49.0	---	☐ Yes	☒ No
	↓		2	☐ Yes	☒ No
6	T5	50.0	---	☐ Yes	☒ No



6.2.2 Phase jump

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.3.2.3, EN 50549-10

Active Power level	100%P_n
Active factor	1.000
ROCOF protection	disable
Vector shift protection	disable
LFSM-O control function	disable
Voltage and frequency protection	deactivated

Acceptance criteria

- The phase jump ride through capability 1 as declared by the manufacturer or as requested by the responsible party or a specific grid code is confirmed.
- The active power and reactive power recovery response times and settling times as declared by the manufacturer or as requested by the responsible party or a specific grid code are confirmed. (section 4.5.5 EN 50549-1: after the phase jump, 90 % of pre-fault power or available power whichever is the smallest shall be resumed as fast as possible, but at the latest within 3 s in case of synchronous generating technologies and within 1 s in case of non-synchronous generating technologies.)
- The withstand without damage capability as declared by the manufacturer or as requested by the responsible party or a specific grid code is confirmed.

Manufacturer's data

- Capability 1, phase jump ride through:
  - $\delta_1 = 90°$
- Capability 2, withstand without damage:
  - $\delta_{2.1} = 90°$, $\delta_{2.2} = 180°$

Test results

Note:

Prior to testing, the EUT shall be operated at nominal voltage, a power level greater than $0.9P_n$, with a unit power factor (cos = 1) for at least 5 min, or the time required for the internal temperature stabilization, whichever is longer. The phase jump shall then be simulated using the Grid Simulator according to the requirements of "Capability 1" and "Capability 2".

Capability 1

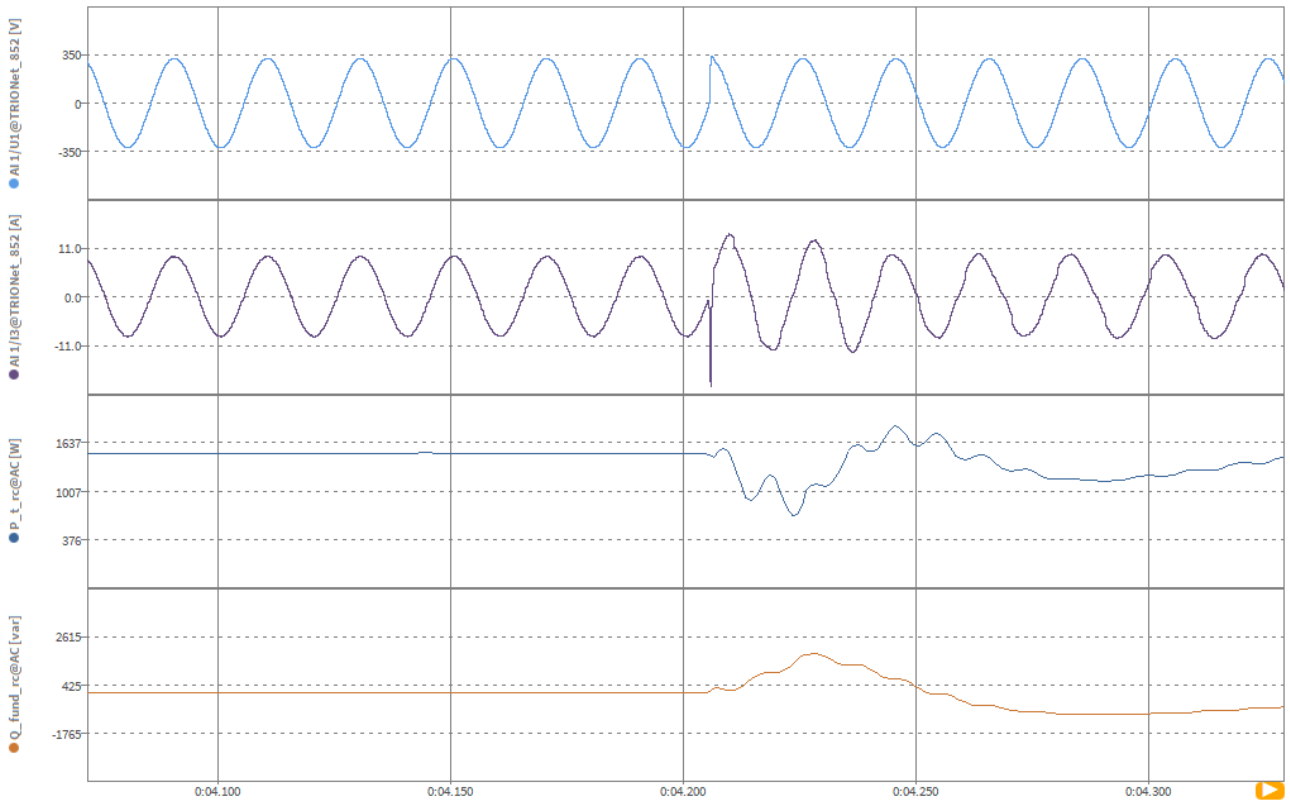
Test no.	Type of phase jump	P-Recovery response time [s]	P-Recovery settling time [s]	Q-Recovery response time [s]	Q-Recovery settling time [s]
1	$+\delta_1$ at voltage zero crossing (0°)	0.129	0.129	0.295	0.295
2	$+\delta_1$ at the top of the sinewave (+90°)	0.124	0.124	0.249	0.249
3	$-\delta_1$ at voltage zero crossing (0°)	0.209	0.209	0.271	0.271
4	$-\delta_1$ at the top of the sinewave (+90°)	0.215	0.215	0.300	0.300

Capability 2

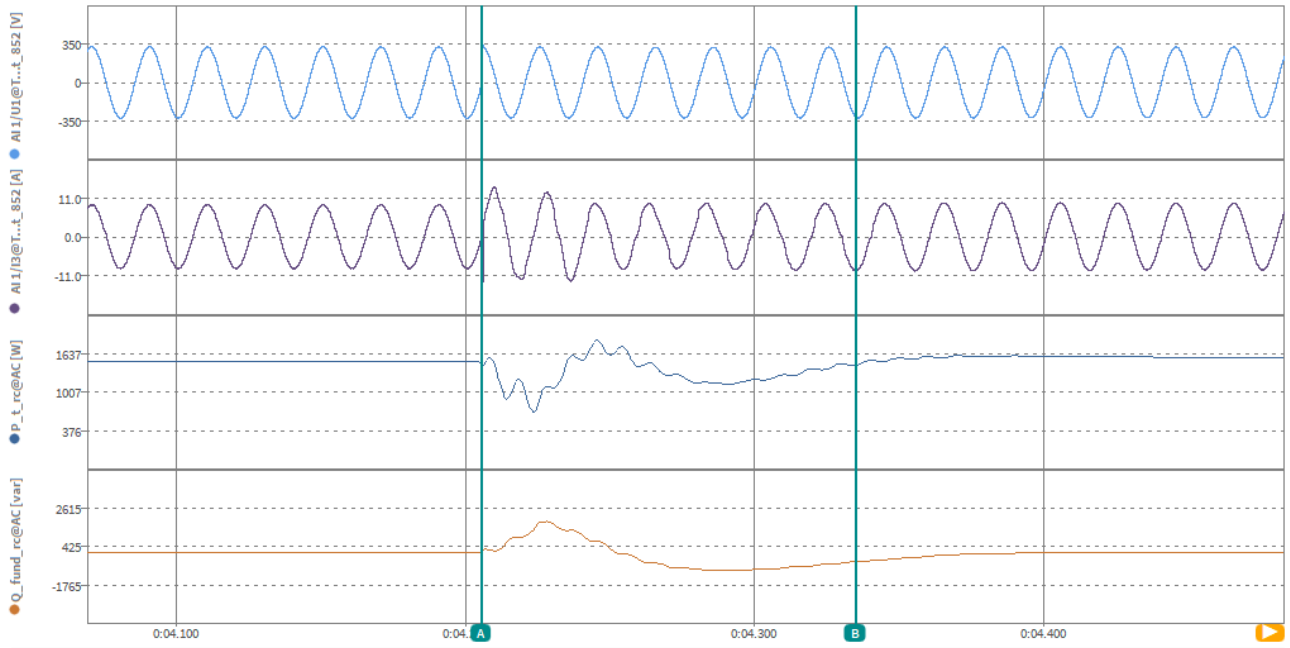
Test no.	Type of phase jump	Description of behaviours of the EUT after phase jump
5	$+\delta_{2.1}$ at voltage zero crossing (0°)	EUT no tripped after phase jump. EUT can be operated normally.
6	$+\delta_{2.1}$ at the top of the sinewave (+90°)	EUT no tripped after phase jump. EUT can be operated normally.
7	$+\delta_{2.2}$ at voltage zero crossing (0°)	EUT tripped after phase jump but caused no damage. EUT can be operated normally after the restart.
8	$+\delta_{2.2}$ at the top of the sinewave (+90°)	EUT tripped after phase jump but caused no damage. EUT can be operated normally after the restart.

Test 1

+δ_1 at voltage zero crossing (0°)

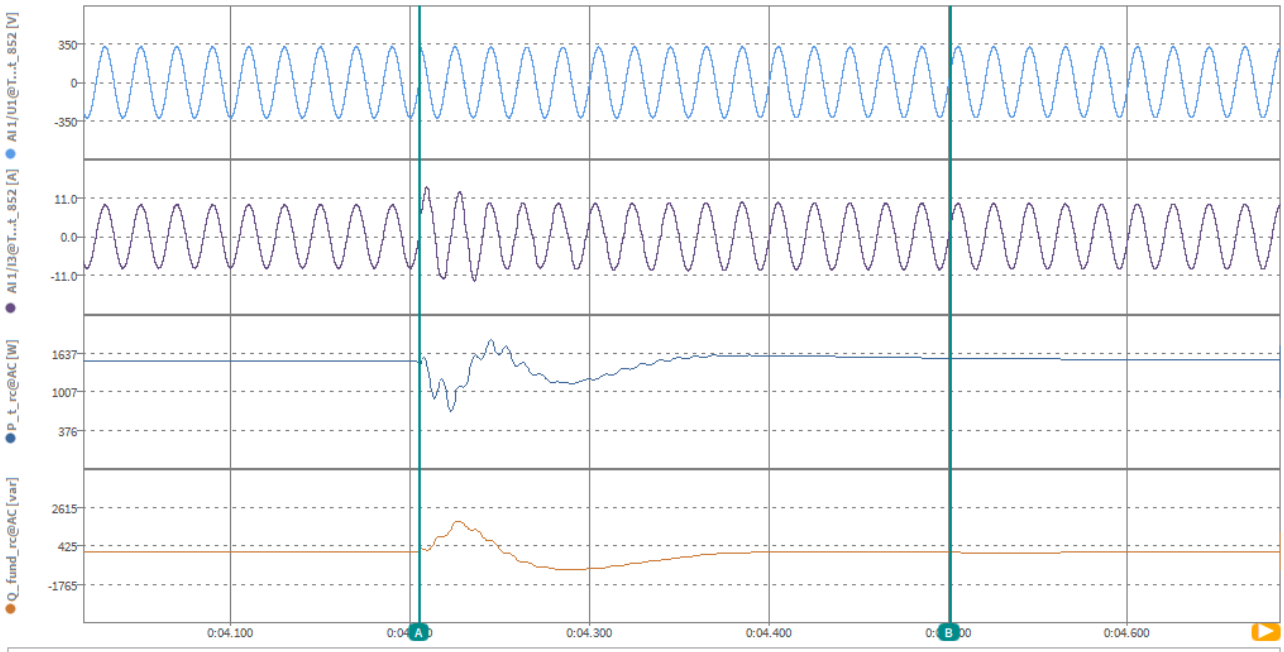


P settling time



	A	B	间隔
时间 [s]	4.2056228	4.3350202	0.1293974
AI 1/U1@TRIONet_852 [V]	-24.30606	-313.5486	-289.2425
AI 1/I3@TRIONet_852 [A]	-0.687081	-9.543735	-8.856655
P_t_rc@AC [W]	1492.368	1432.420	-59.94775
Q_fund_rc@AC [var]	5.810447	-511.9176	-517.7280

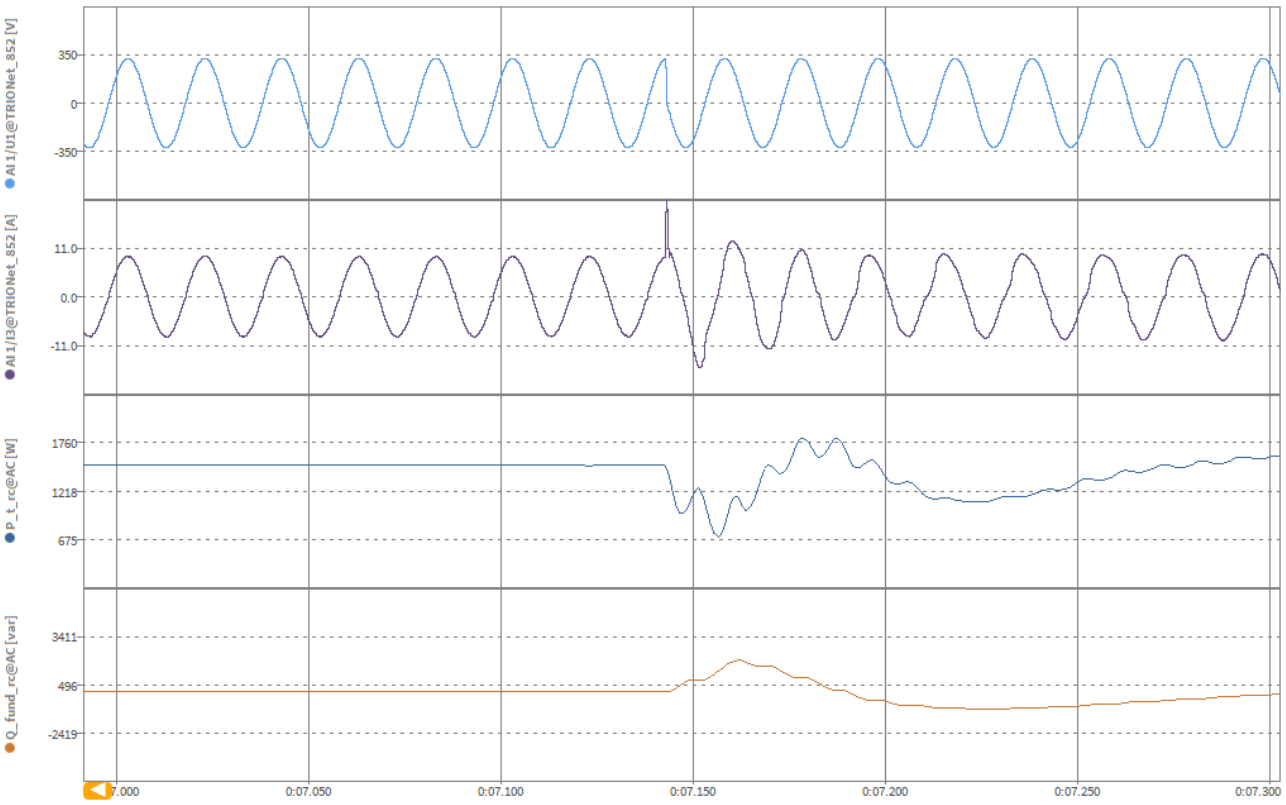
Q settling time



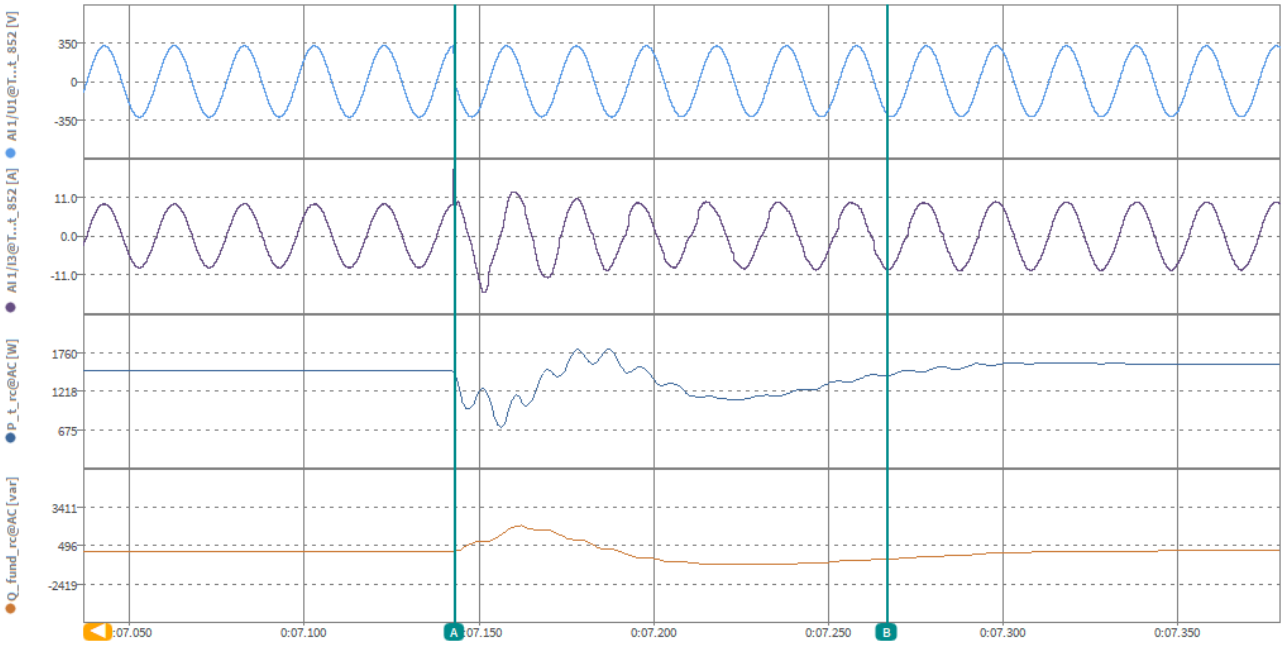
	A	B	间隔
时间 [s]	4.2056228	4.5009929	0.2953701
AI 1/U1@TRIONet_852 [V]	-24.30606	9.058476	33.36454
AI 1/I3@TRIONet_852 [A]	-0.687081	0.453752	1.140833
P_t_rc@AC [W]	1492.368	1543.458	51.09045
Q_fund_rc@AC [var]	5.810447	-6.645388	-12.45583

Test 2

+δ_1 at the top of the sinewave (+90°)

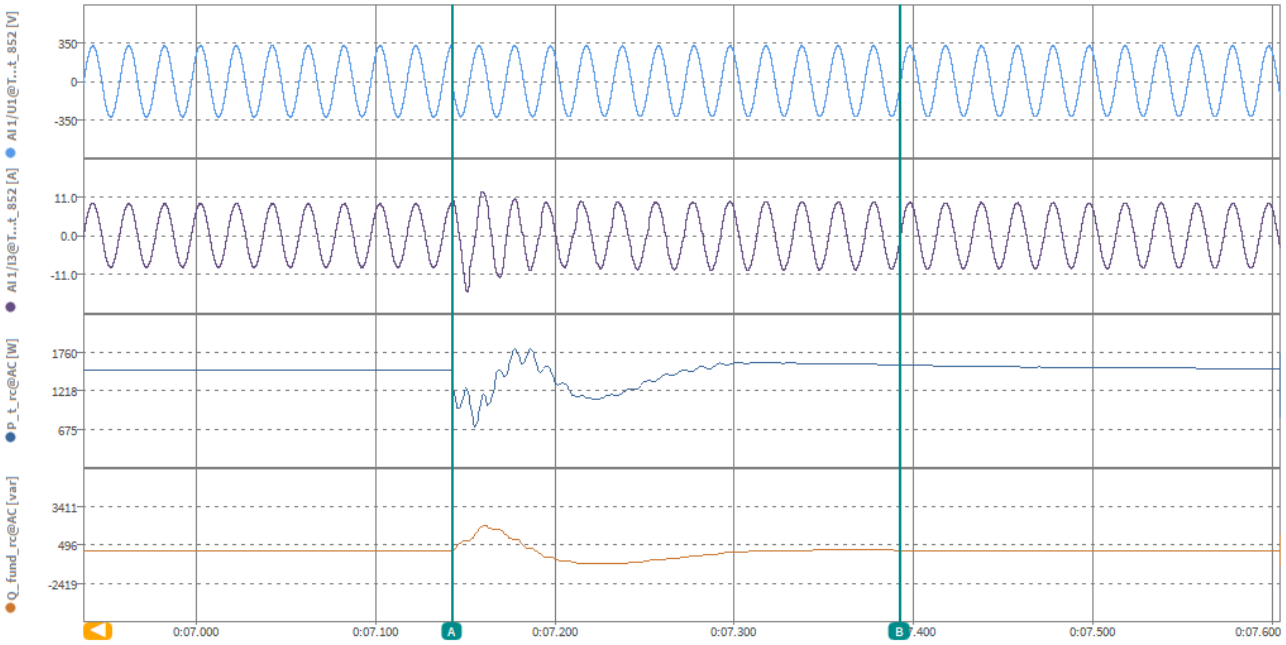


P settling time



	A	B	间隔
时间 [s]	7.1432730	7.2667839	0.1235109
AI 1/U1@TRIONet_852 [V]	145.0079	-288.3299	-433.3377
AI 1/I3@TRIONet_852 [A]	28.80292	-9.613473	-38.41639
P_t_rc@AC [W]	1498.721	1423.592	-75.12866
Q_fund_rc@AC [var]	2.194289	-584.3529	-586.5472

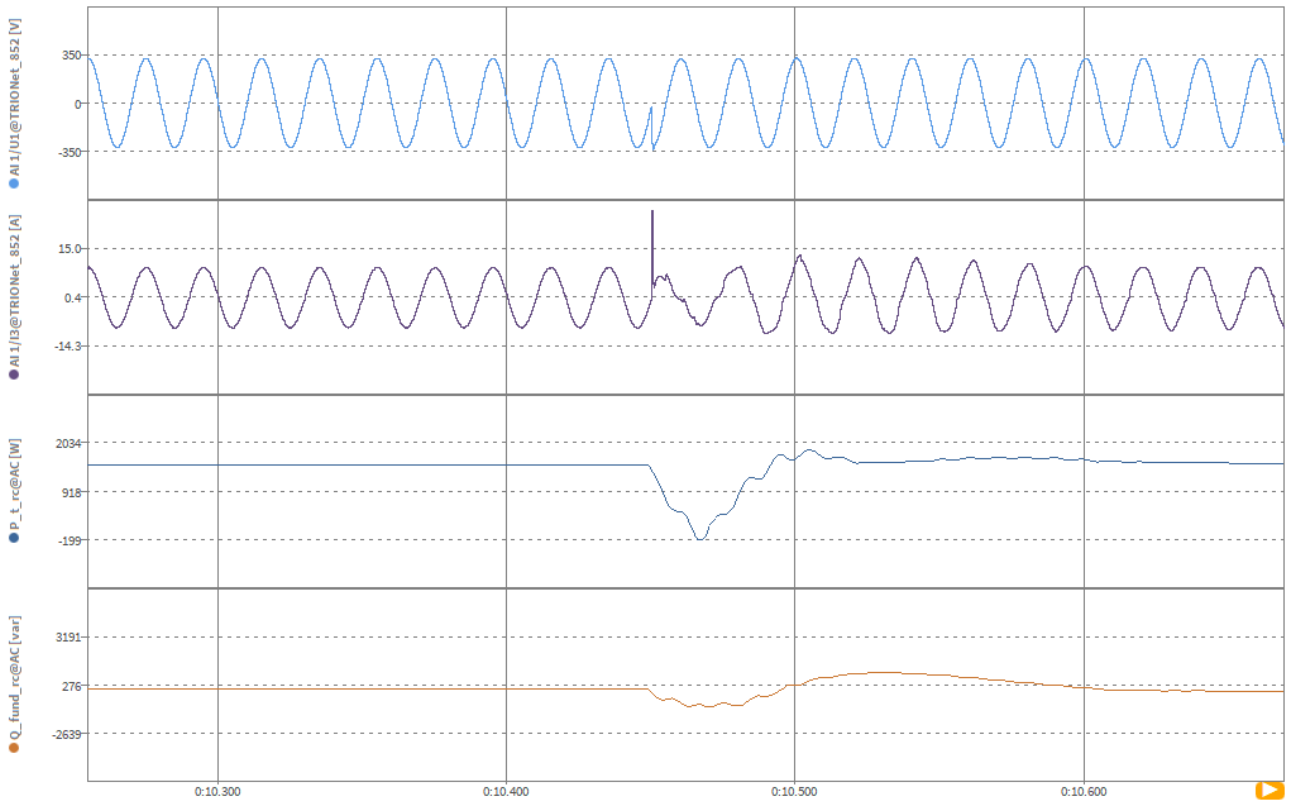
Q settling time



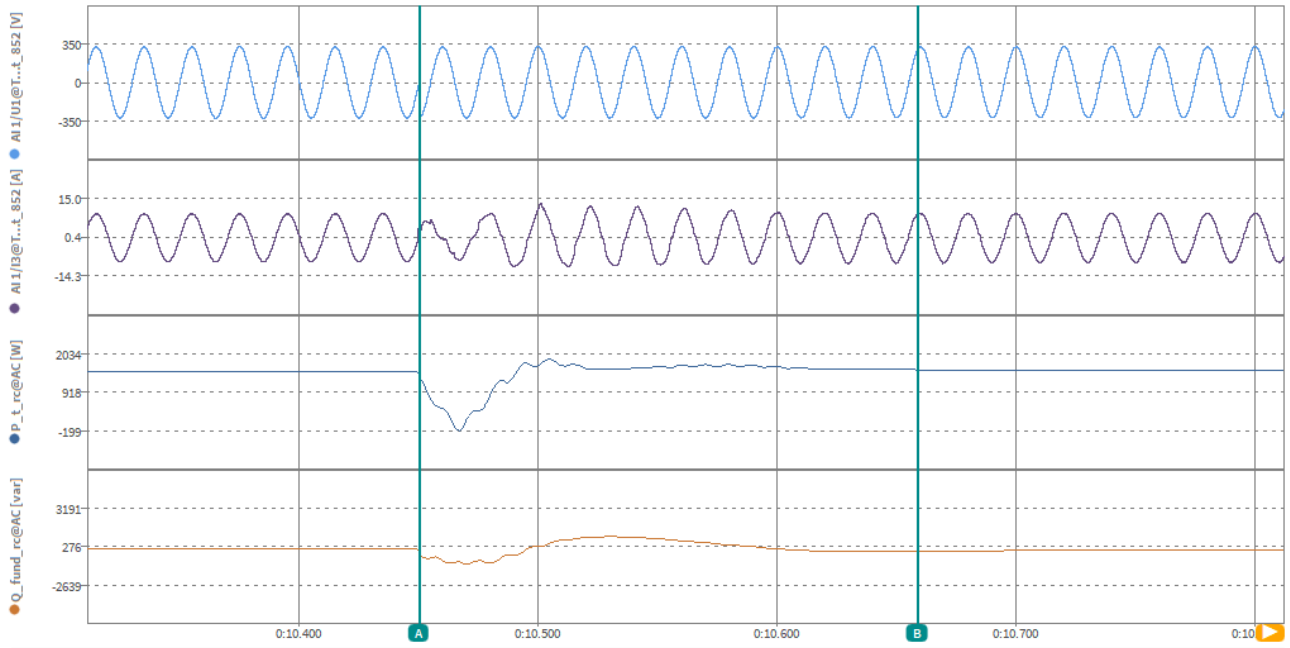
	A	B	间隔
时间 [s]	7.1432730	7.3924512	0.2491782
AI 1/U1@TRIONet_852 [V]	145.0079	-79.37980	-224.3877
AI 1/I3@TRIONet_852 [A]	28.80292	-2.215940	-31.01886
P_t_rc@AC [W]	1498.721	1567.869	69.14795
Q_fund_rc@AC [var]	2.194289	11.62700	9.432713

Test 3

-δ_1 at voltage zero crossing (0°)

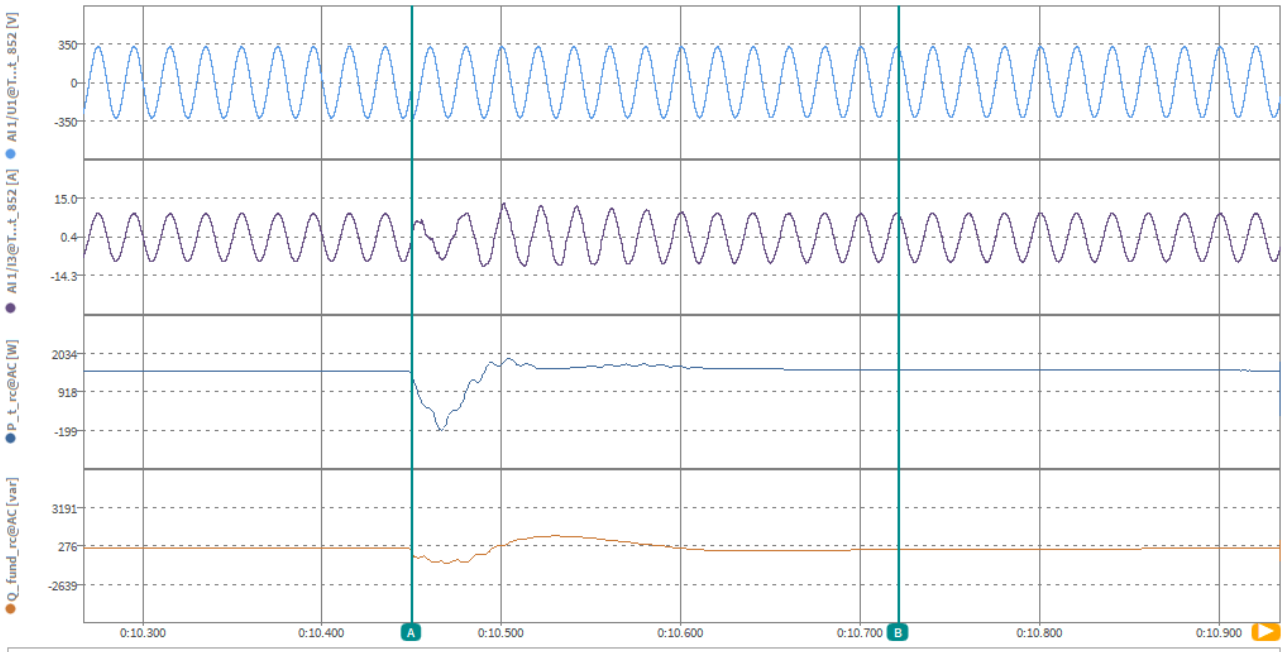


P settling time



	A	B	间隔
时间 [s]	0:10.4503950	0:10.6590219	0.2086270
AI 1/U1@TRIONet_852 [V]	-42.00316	293.6812	335.6843
AI 1/I3@TRIONet_852 [A]	3.609818	9.110135	5.500317
P_t_rc@AC [W]	1500.510	1544.348	43.83789
Q_fund_rc@AC [var]	-0.735347	-151.3626	-150.6273

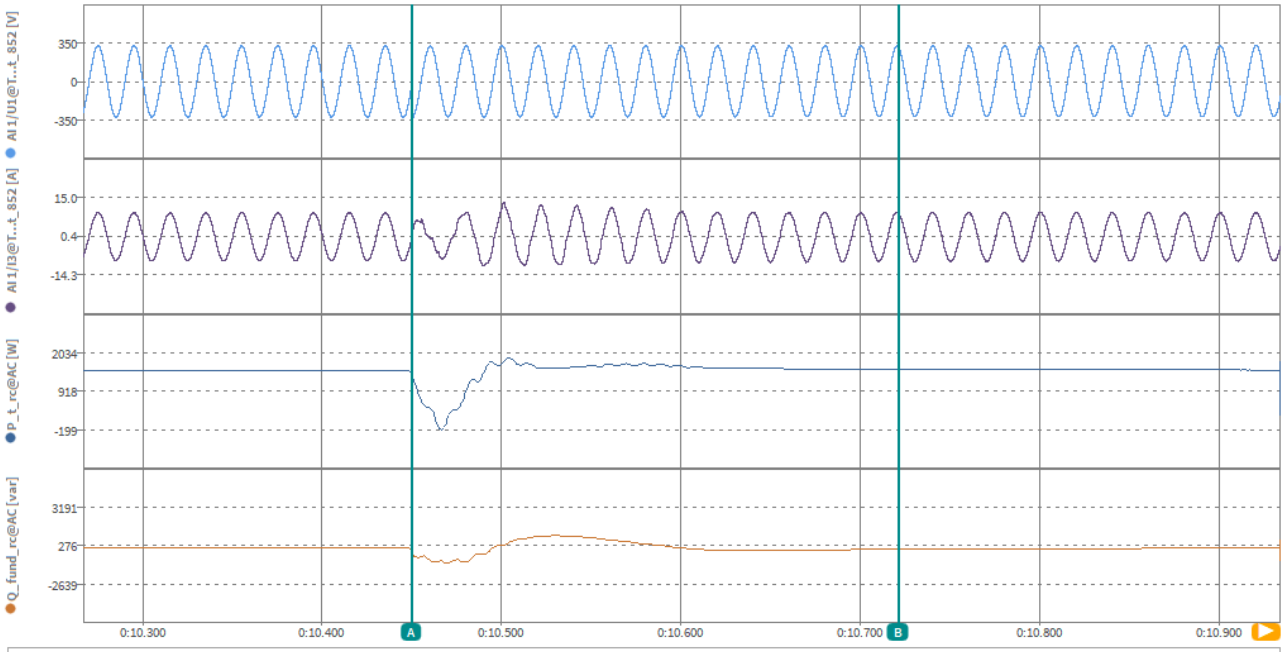
Q settling time



	A	B	间隔
时间 [s]	0:10.4503950	0:10.7213801	0.2709852
AI 1/U1@TRIONet_852 [V]	-42.00316	314.7247	356.7279
AI 1/I3@TRIONet_852 [A]	3.609818	9.156627	5.546809
P_t_rc@AC [W]	1500.510	1534.666	34.15588
Q_fund_rc@AC [var]	-0.735347	-74.05267	-73.31732

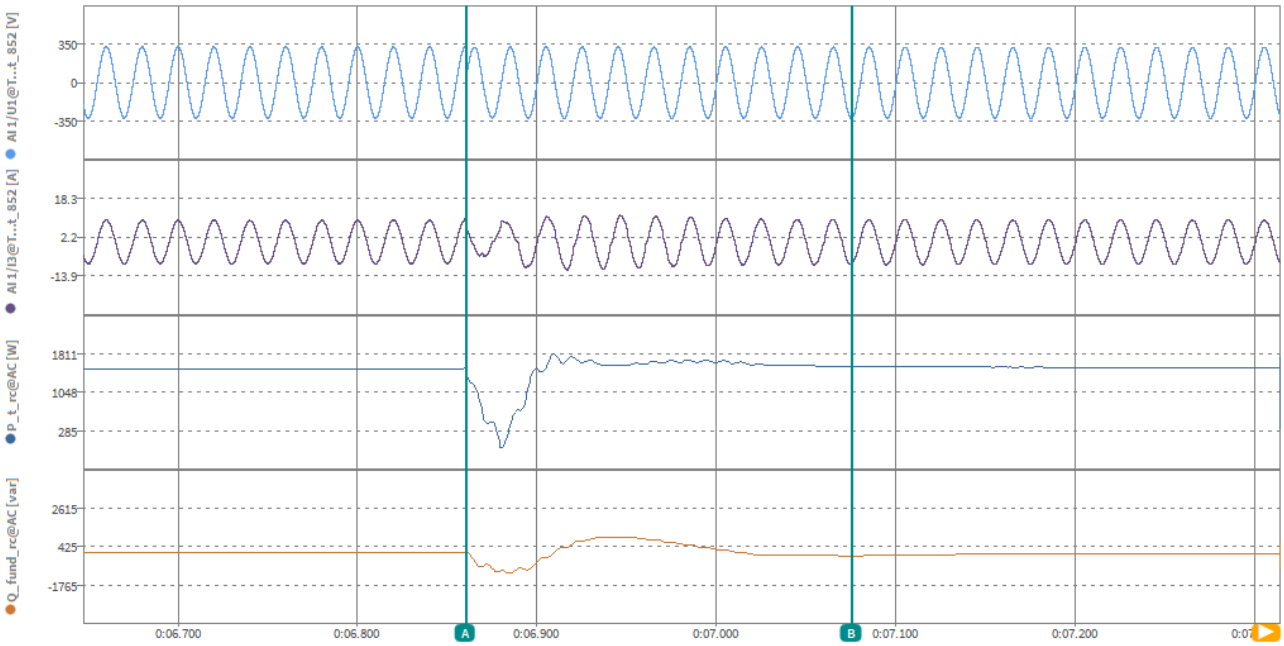
Test 4

-δ_1 at the top of the sinewave (+90°)



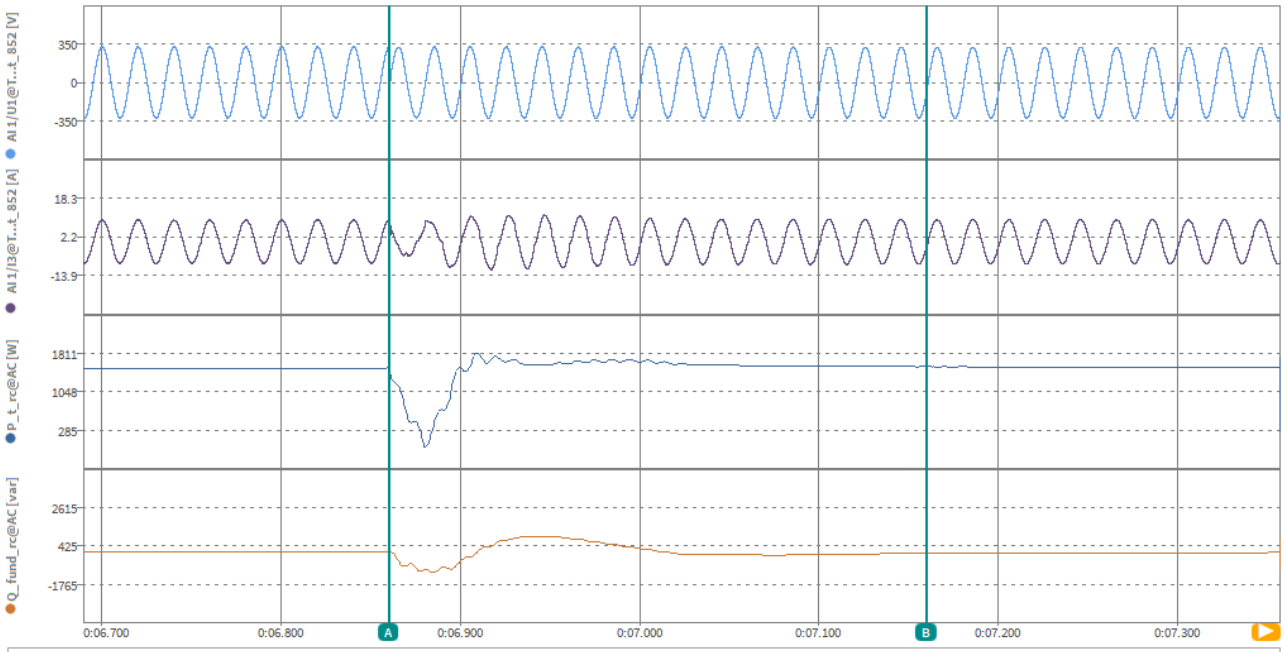
	A	B	间隔
时间 [s]	0:10.4503950	0:10.7213801	0.2709852
AI 1/U1@TRIONet_852 [V]	-42.00316	314.7247	356.7279
AI 1/I3@TRIONet_852 [A]	3.609818	9.156627	5.546809
P_t_rc@AC [W]	1500.510	1534.666	34.15588
Q_fund_rc@AC [var]	-0.735347	-74.05267	-73.31732

P settling time



	A	B	间隔
时间 [s]	6.8606291	7.0756400	0.2150109
AI 1/U1@TRIONet_852 [V]	321.0373	-326.1197	-647.1570
AI 1/I3@TRIONet_852 [A]	10.27779	-9.280879	-19.55867
P_t_rc@AC [W]	1497.619	1534.774	37.15527
Q_fund_rc@AC [var]	5.879285	-157.3407	-163.2199

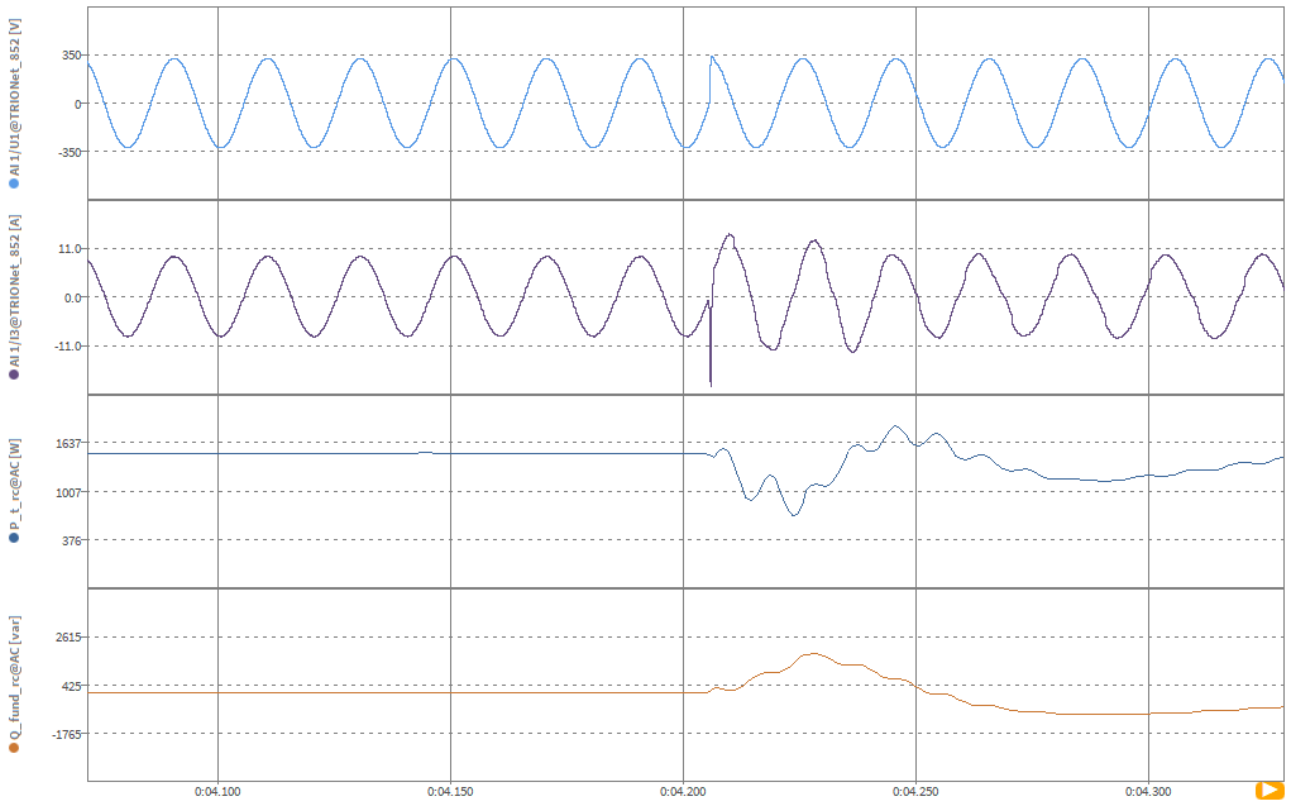
Q settling time

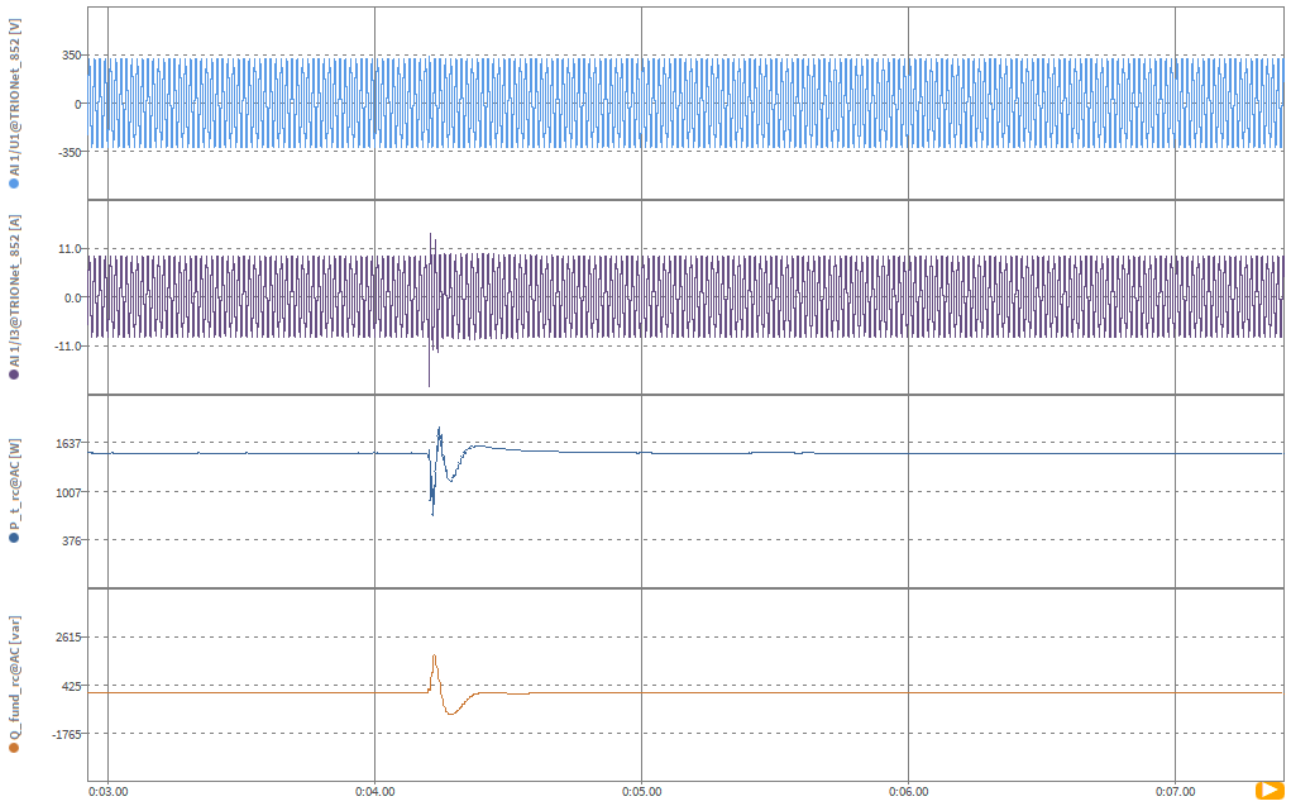


	A	B	间隔
时间 [s]	6.8606291	7.1601536	0.2995245
AI 1/U1@TRIONet_852 [V]	321.0373	-71.43093	-392.4682
AI 1/I3@TRIONet_852 [A]	10.27779	-1.362997	-11.64079
P_t_rc@AC [W]	1497.619	1528.768	31.14880
Q_fund_rc@AC [var]	5.879285	-59.39363	-65.27292

Test 5

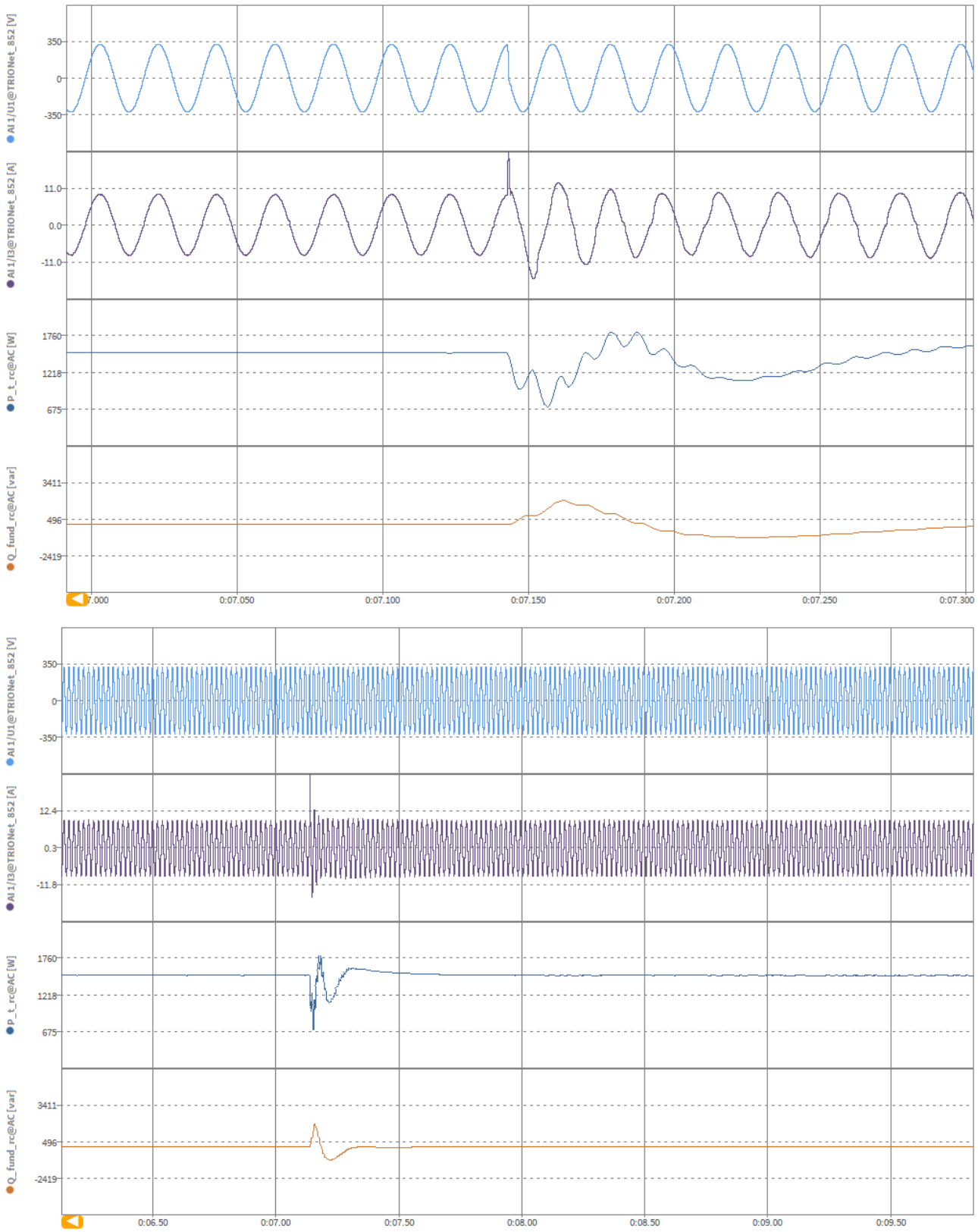
$+\delta_{2.1}$ at voltage zero crossing (0°)





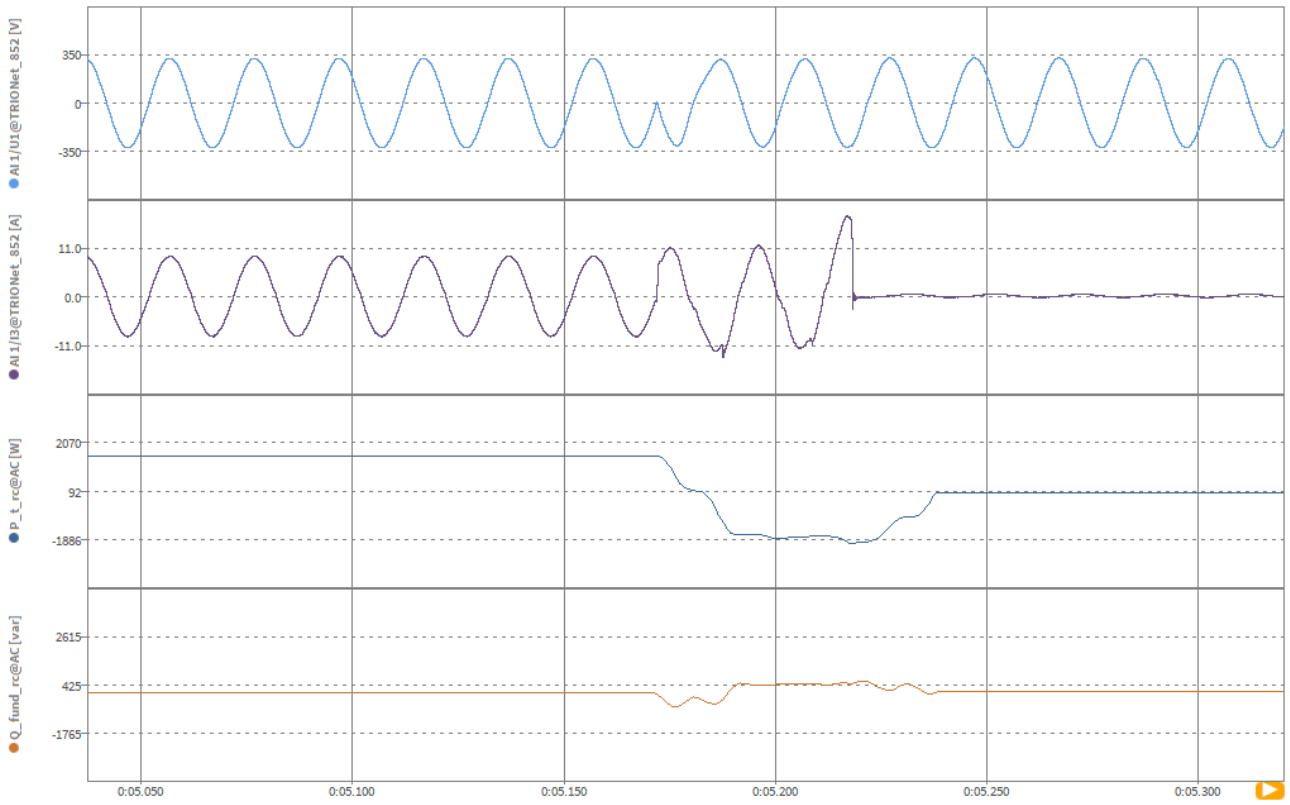
Test 6

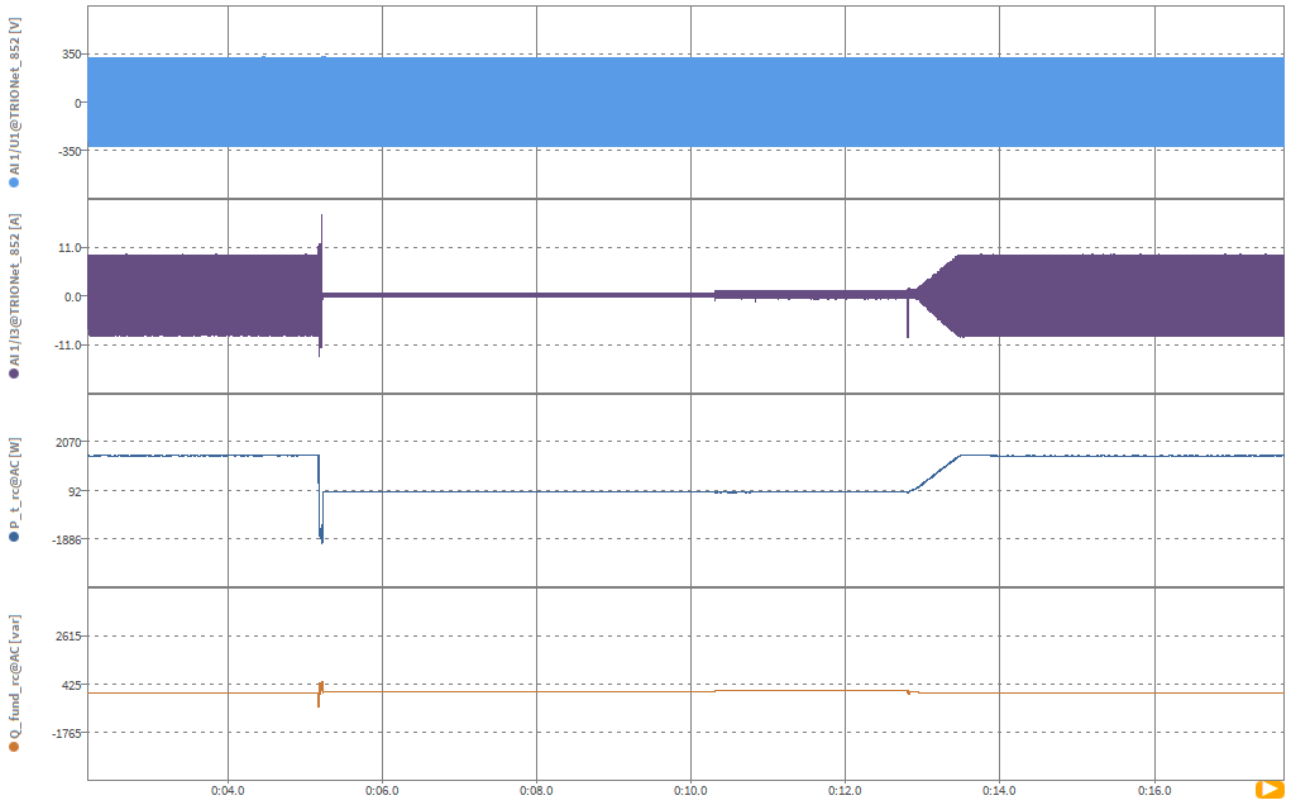
+$\delta_{2.1}$ at the top of the sinewave (+90°)



Test 7

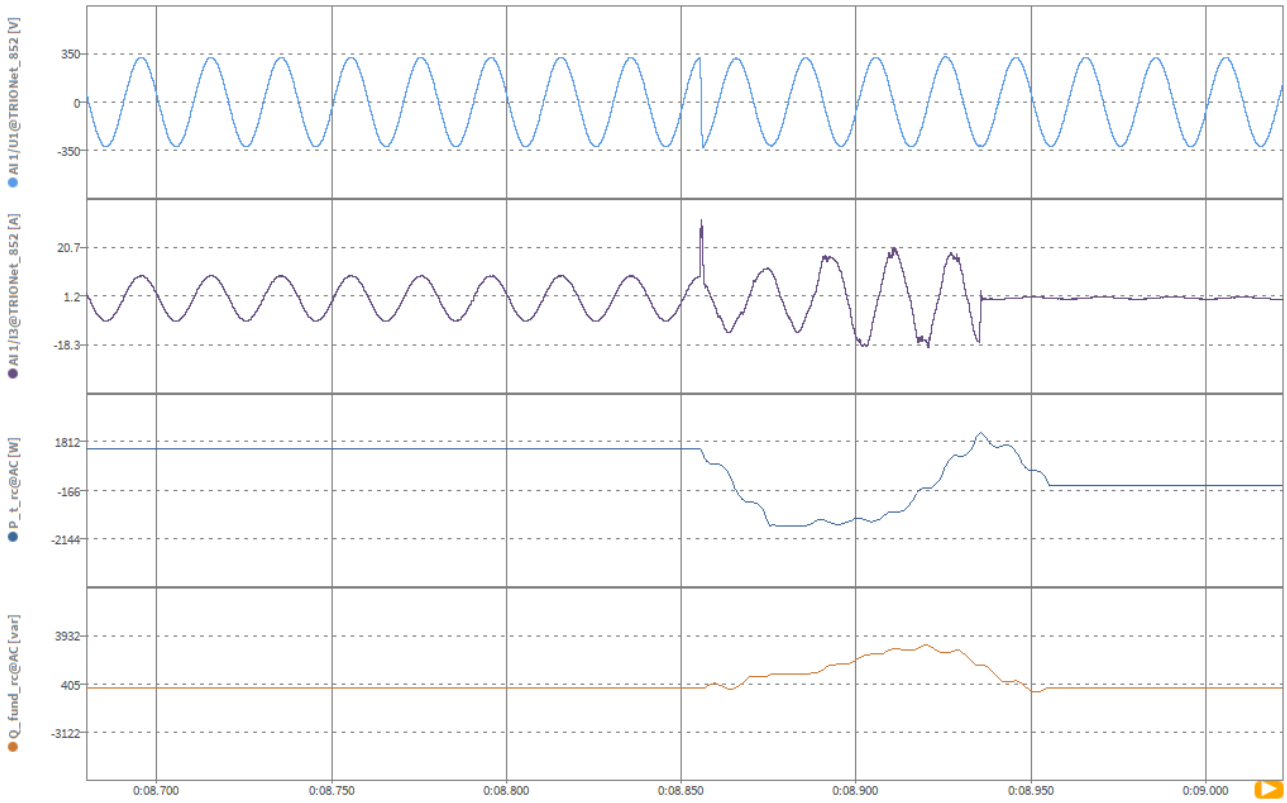
$+\delta_{2.2}$ at voltage zero crossing (0°)

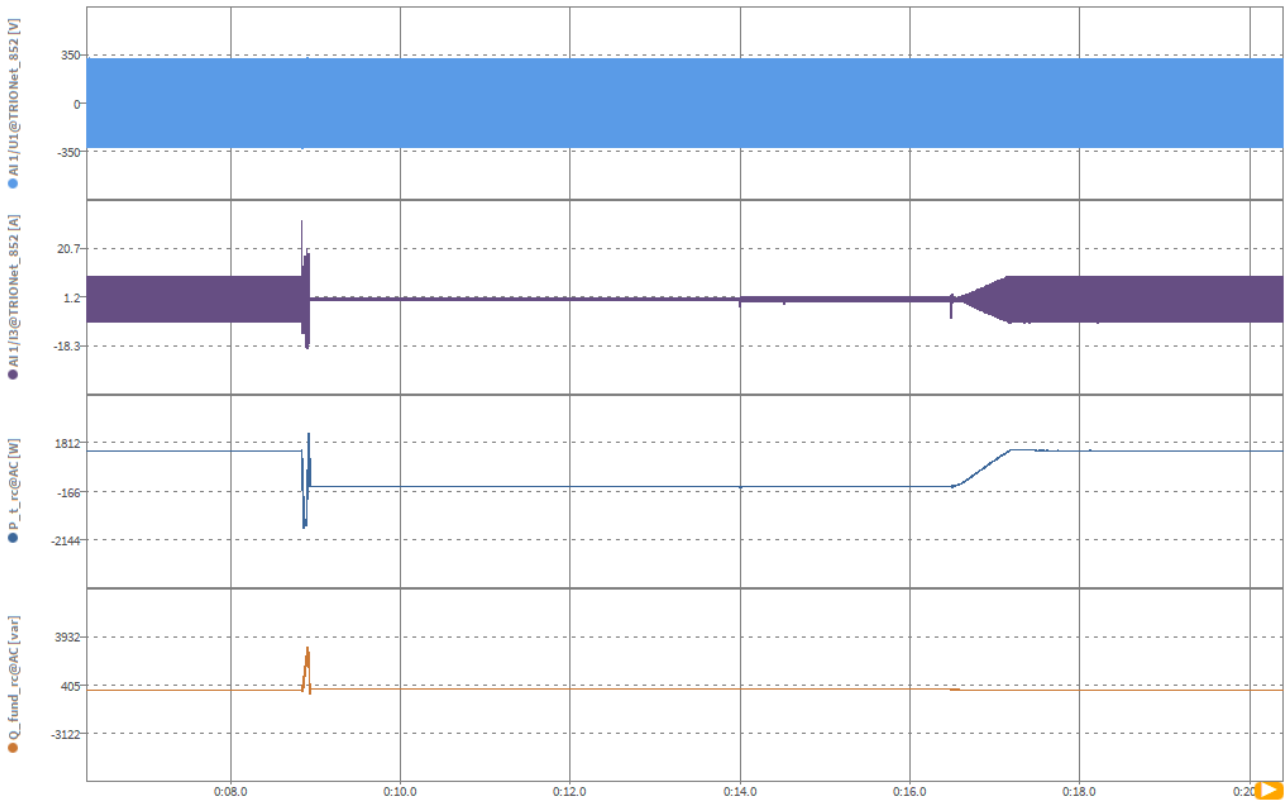




Test 8

$+\delta_{2.2}$ at the top of the sinewave (+90°)





6.2.3 Fault ride through, over-voltage (OVRT) and under-voltage (UVRT)

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22 Note: The line impedances depicted in *Figure 3* primarily represent the impedance of the connection cable. (As the FRT mode tested in this report is "zero current mode", the generating unit has a negligible impact on the voltage magnitude during grid fault. Therefore, this test setup is adequate for the test requirements.) Nominal apparent power of the test setup S_n [VA]: 1500 Grid impedance R_A [mΩ]: 0.675 Grid reactance X_A [mΩ]: 2.312 X/R: 3.43
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.3.3.3, EN 50549-10

Operating mode of the EUT	☐ MPP-Tracking operation mode ☒ Fixed voltage control operation mode
Active Power level	See table *Test cases* below
Reactive Power setpoint	See table *Test cases* below
Voltage protection	deactivated
Active islanding detection	disable

Voltage support mode provide by the PGU(s)	☒ No voltage support during faults (*zero current mode only*) ☐ Voltage support during faults ☐ Zero current mode (*in addition to voltage support mode*) ☐ Active power priority ☐ Reactive current limitation

Voltage ride through capability according to:

☒ EN 50549-1: ☒ most stringent ☐ default requirement

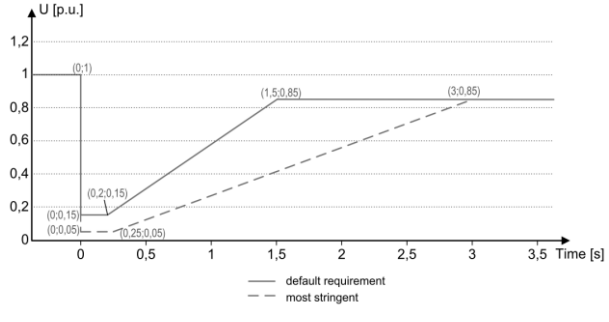


Figure 6 — Under-voltage ride through capability for non-synchronous generating technology

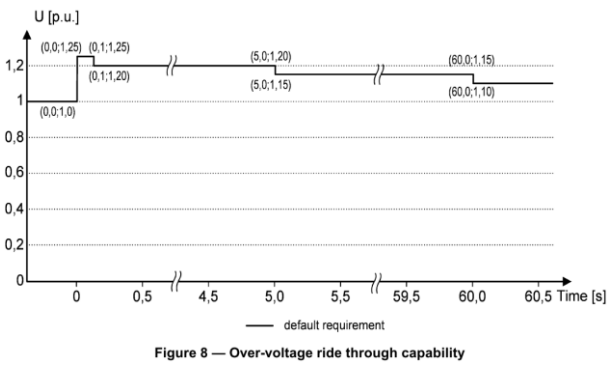


Figure 8 — Over-voltage ride through capability

U_{min} = 0.05; U_{UVRC} = 0.95, U_{max} = 1.25, U_{OVRC} = 0.25

☐ EN 50549-2 ☐ most stringent ☐ default requirement

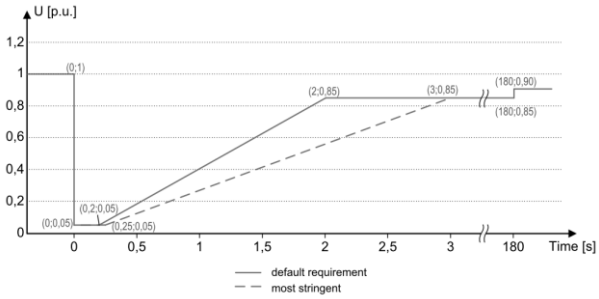


Figure 6 — Under-voltage ride through capability for non-synchronous generating technology

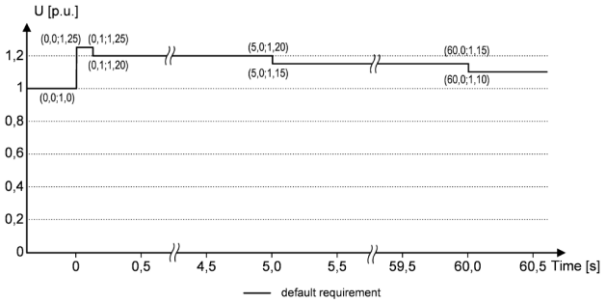


Figure 8 — Over-voltage ride through capability

U_{min} = 0.05; U_{UVRC} = 0.95, U_{max} = 1.25, U_{OVRC} = 0.25

Acceptance criteria

- The conducted tests verify the specified capability curve of the manufacturer.
- No trip occurred.
- Conducted tests represent the specified capability in duration and depth of voltage dips.
- The specified capability curve of the manufacturer does not show any “may disconnect” areas above (test case UVRT) or below (test case OVRT) the voltage time characteristic as specified by the DSO or applied grid code.
- The active power recovery time after fault is equal or less the time specified by the DSO or applied grid code.

☒ Assessment criteria of zero current mode for non-synchronous generating technology

- All criteria of section 5.3.3.6, EN 50549-10 apply (see above)
- The conducted tests verify the activation threshold with an accuracy of 5 % of nominal voltage.
- The EUT reduced its current as fast as technically feasible below 10 % of rated current. A response time below 30 ms and a settling time below 60 ms is considered sufficient. In case of longer response and/or settling times, justification shall be provided. Delays resulting from the calculation of the phasor and the symmetrical components, typically 20 ms, shall be considered in the evaluation of the controlled short circuit current.
- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Note: Parameters cannot be modified.

☐ Assessment criteria of controlled short circuit current contribution for non-synchronous generating technology

- The tests and the selection of voltage levels and fault duration have been conducted according to section 5.3.3.3, EN 50549-10. All requirements of section 5.3.3.6, EN 50549-10 (see above) apply.
- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).
- The conducted tests verify the activation beyond the insensitivity range with an accuracy of 5 % of nominal voltage.
- The conducted tests verify the provision of controlled short circuit current with:
  - Accuracy for positive and negative sequence current as required of the applicable grid code, or according to Figure 17 of EN 50549-2:2019.
  - Dynamic of response and settling time as required of the applicable grid code. In case of EN 50549-2:2019: 30 ms response time, 60 ms settling time for both fault inception and fault clearance. Delays resulting from the calculation of the phasor and the symmetrical components, typically 20 ms, shall be considered in the evaluation of the controlled short circuit current.

Test	Voltage dip U/Un (p.u.)	VRT fault type	Fault duration (t2-t1) (ms)	P/Pn (p.u.)	Q/Pn (p.u.)	Test No.	
						Test1	Test2
1	0.05	VD1	≥ 250	0.98 to 1.02	0 to ± 0.1	1.1	1.1
				0.1 to 0.5		1.2	1.2
		VD6		0.98 to 1.02		1.3	1.3
				0.1 to 0.5		1.4	1.4
2	0.24	VD2	≥ 910	0.98 to 1.02	0 to ± 0.1	2.1	2.1
				0.1 to 0.5		2.2	2.2
		VD7		0.98 to 1.02		2.3	2.3
				0.1 to 0.5		2.4	2.4
3	0.52	VD3	≥ 1870	0.98 to 1.02	0 to ± 0.1	3.1	3.1
				0.1 to 0.5		3.2	3.2
		VD8		0.98 to 1.02		3.3	3.3
				0.1 to 0.5		3.4	3.4
4	0.76	VD4	≥ 2690	0.98 to 1.02	0 to ± 0.1	4.1	4.1
				0.1 to 0.5		4.2	4.2
		VD9		0.98 to 1.02		4.3	4.3
				0.1 to 0.5		4.4	4.4
5	0.90	VD5	≥ 6000	0.98 to 1.02	0 to ± 0.1	5.1	5.1
				0.1 to 0.5		5.2	5.2
		VD10		0.98 to 1.02		5.3	5.3
				0.1 to 0.5		5.4	5.4
6	1.15	VS2.2	≥ 60000	0.98 to 1.02	0 to ± 0.1	6.1	6.1
				0.1 to 0.5		6.2	6.2
		VS4.2		0.98 to 1.02		6.3	6.3
				0.1 to 0.5		6.4	6.4
7	1.20	VS2.1	≥ 5000	0.98 to 1.02	0 to ± 0.1	7.1	7.1
				0.1 to 0.5		7.2	7.2
		VS4.1		0.98 to 1.02		7.3	7.3
				0.1 to 0.5		7.4	7.4
8	1.25	VS1	≥ 100	0.98 to 1.02	0 to ± 0.1	8.1	8.1
				0.1 to 0.5		8.2	8.2
		VS3		0.98 to 1.02		8.3	8.3
				0.1 to 0.5		8.4	8.4

FRT fault type A and D	Test equipment (AC grid simulator)	Test sample
Connection terminal	U	L1
	V	L2
	W	L3 (L for single phase)

	U/U_n (MV side)	Phase-earth voltages (LV side)			Phase angles		
		$U_1 / U_{1,n}$	$U_2 / U_{2,n}$	$U_3 / U_{3,n}$	φ_{U1}	φ_{U2}	φ_{U3}
VD6	0.05 ± 0.05	0.05 ± 0.05	0.87 ± 0.05	0.87 ± 0.05	0°	268°	92°
	0.15 ± 0.05	0.15 ± 0.05	0.87 ± 0.05	0.87 ± 0.05	0°	265°	95°
VD7	0.25 ± 0.05	0.25 ± 0.05	0.88 ± 0.05	0.88 ± 0.05	0°	262°	98°
	0.30 ± 0.05	0.25 ± 0.05	0.88 ± 0.05	0.88 ± 0.05	0°	260°	100°
VD8	0.50 ± 0.05	0.50 ± 0.05	0.90 ± 0.05	0.90 ± 0.05	0°	254°	106°
	0.55 ± 0.05	0.55 ± 0.05	0.91 ± 0.05	0.91 ± 0.05	0°	252°	108°
VD9	0.75 ± 0.05	0.75 ± 0.05	0.94 ± 0.05	0.94 ± 0.05	0°	247°	113°
	0.80 ± 0.05	0.80 ± 0.05	0.95 ± 0.05	0.95 ± 0.05	0°	245°	115°
VD10	0.90 ± 0.05	0.90 ± 0.05	0.98 ± 0.05	0.98 ± 0.05	0°	243°	117°
VS3	1.25 ± 0.05	1.25 ± 0.05	1.07 ± 0.05	1.07 ± 0.05	0°	234°	126°
VS4.1	1.20 ± 0.05	1.20 ± 0.05	1.05 ± 0.05	1.05 ± 0.05	0°	235°	125°
VS4.2	1.15 ± 0.05	1.15 ± 0.05	1.04 ± 0.05	1.04 ± 0.05	0°	236°	124°
normal conditions	1	1	1	1	0°	240°	120°

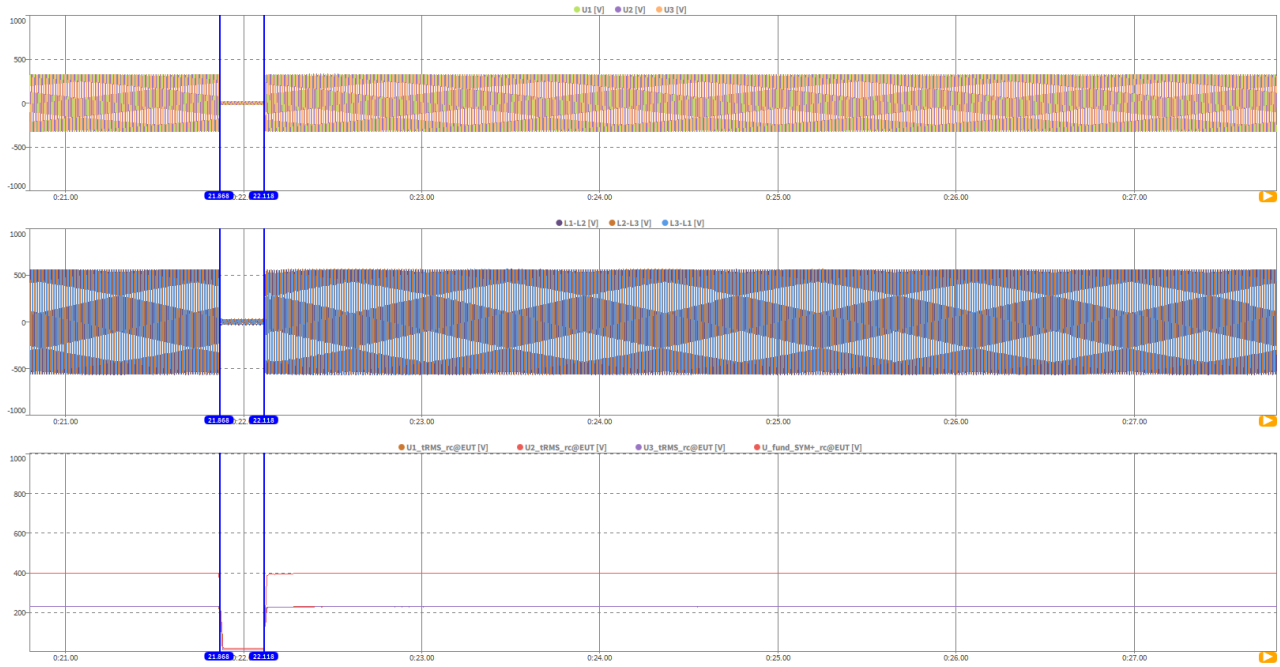
Note:
The test method refers to EN 50549-1:2019

☒ Additional specifications for test of inverters with specified DC input voltage range:

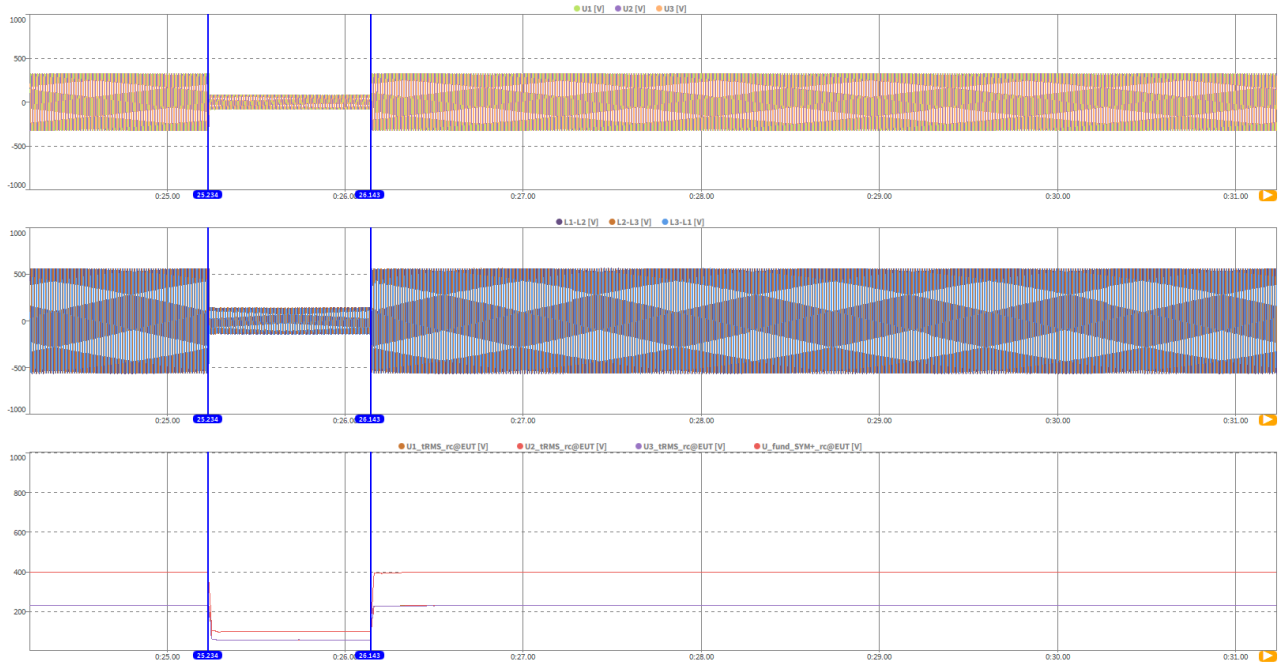
DC voltage input of PGU: 25.6 V

Test results

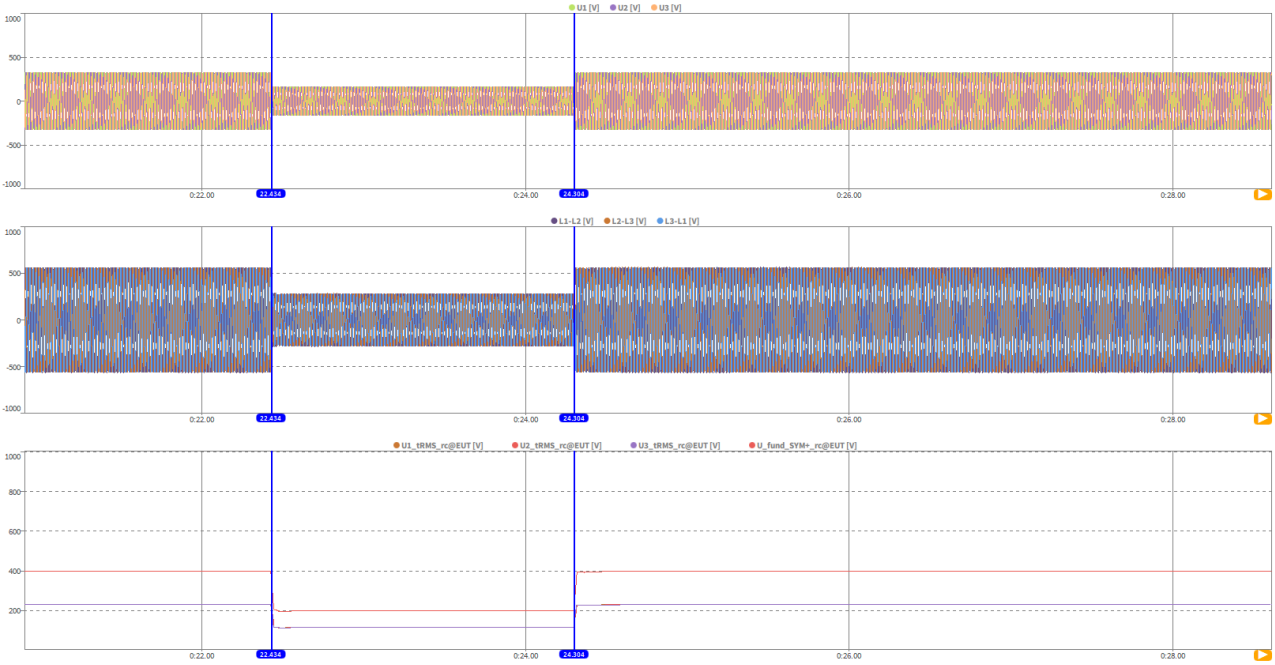
No load VD1



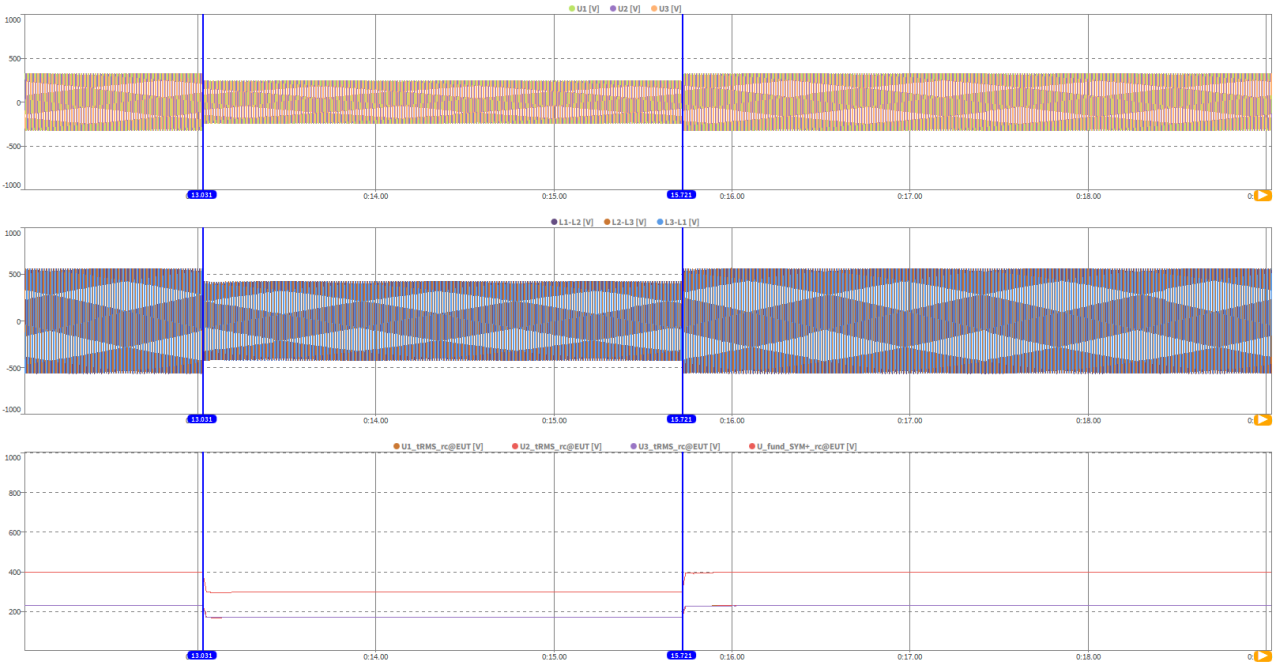
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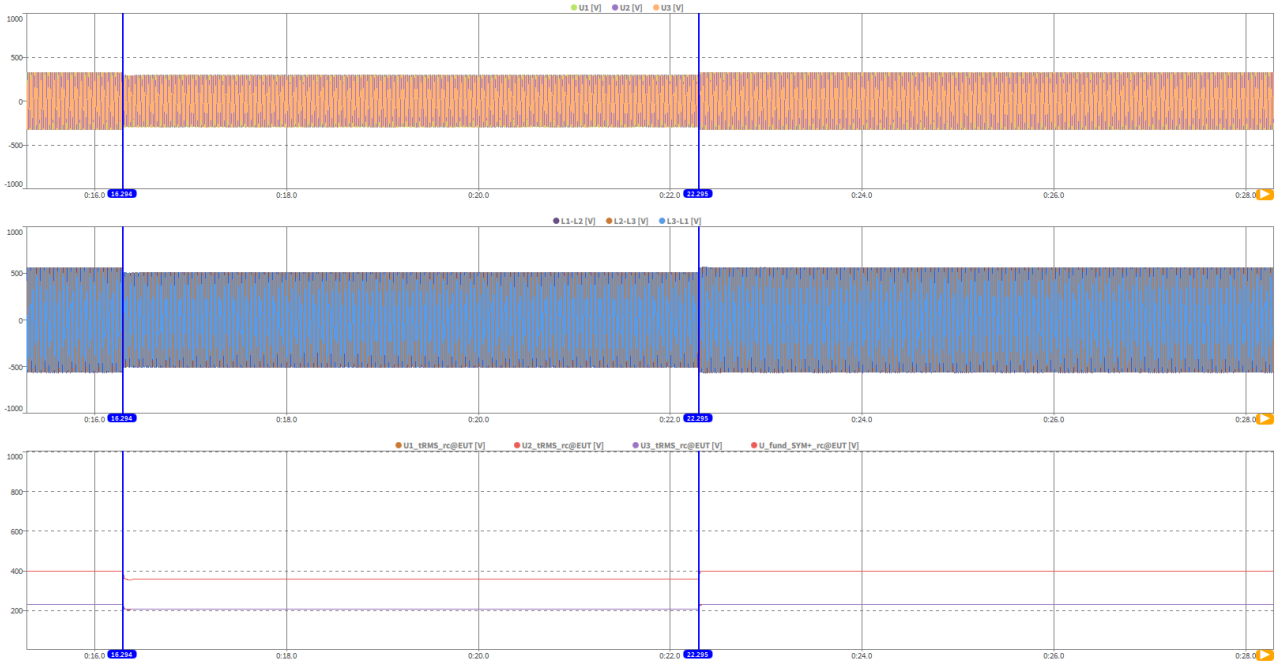
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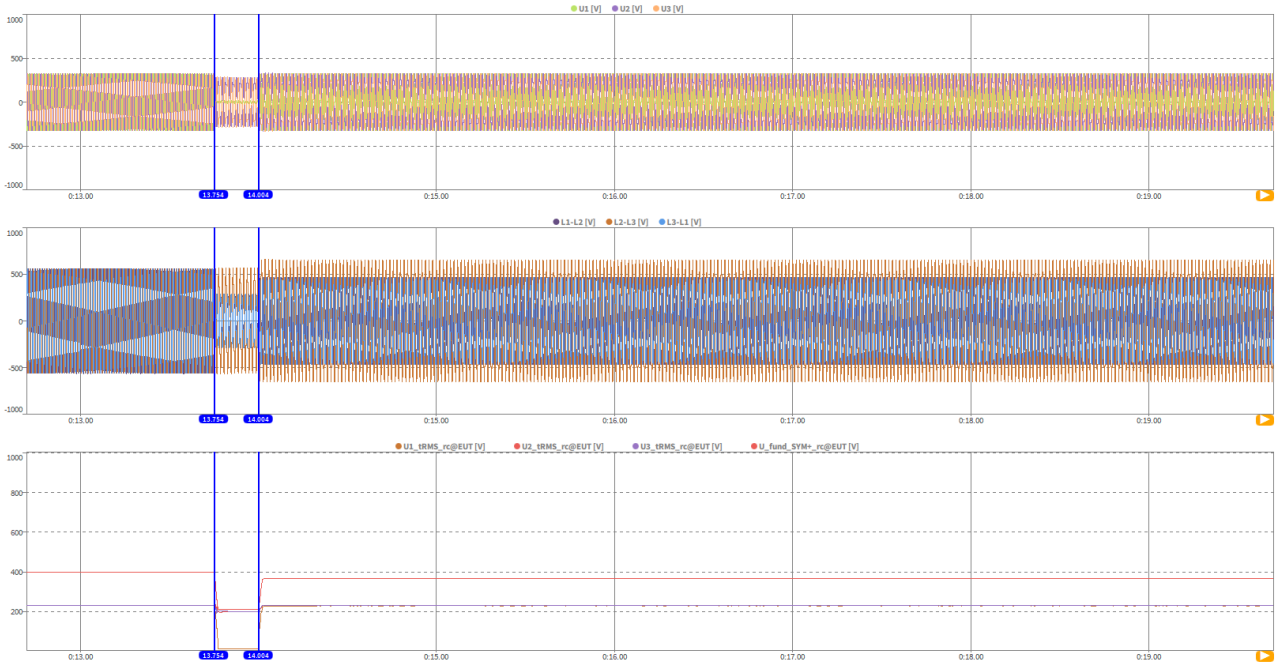
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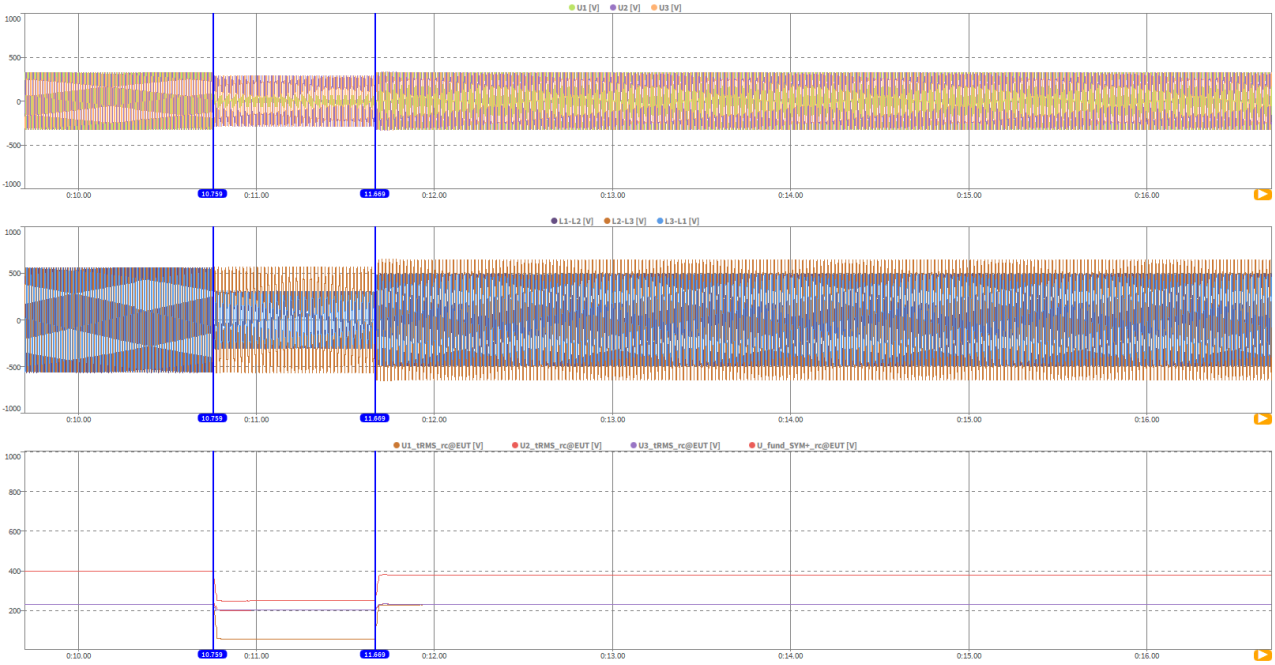
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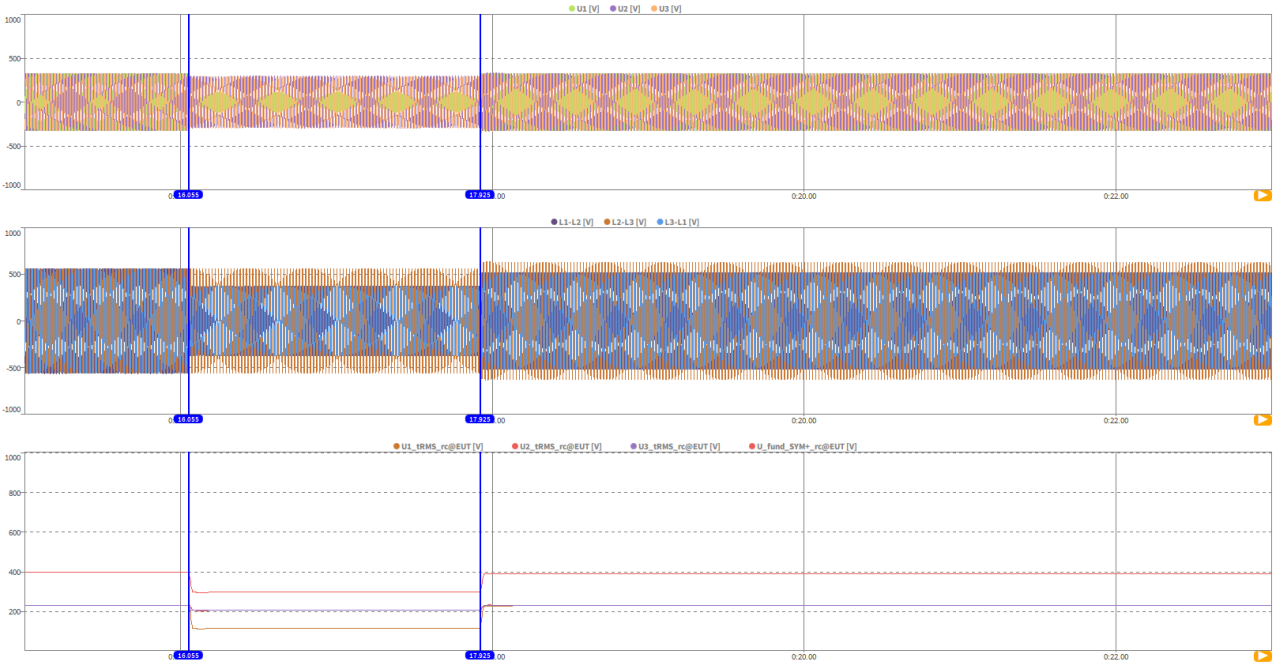
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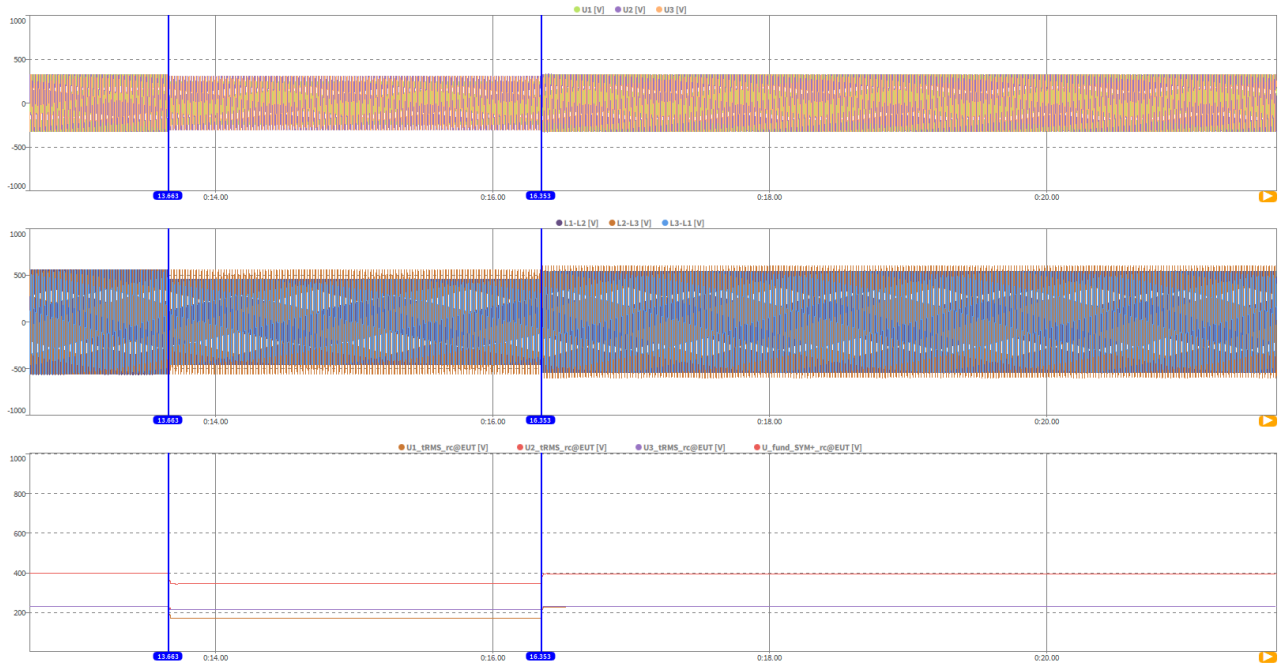
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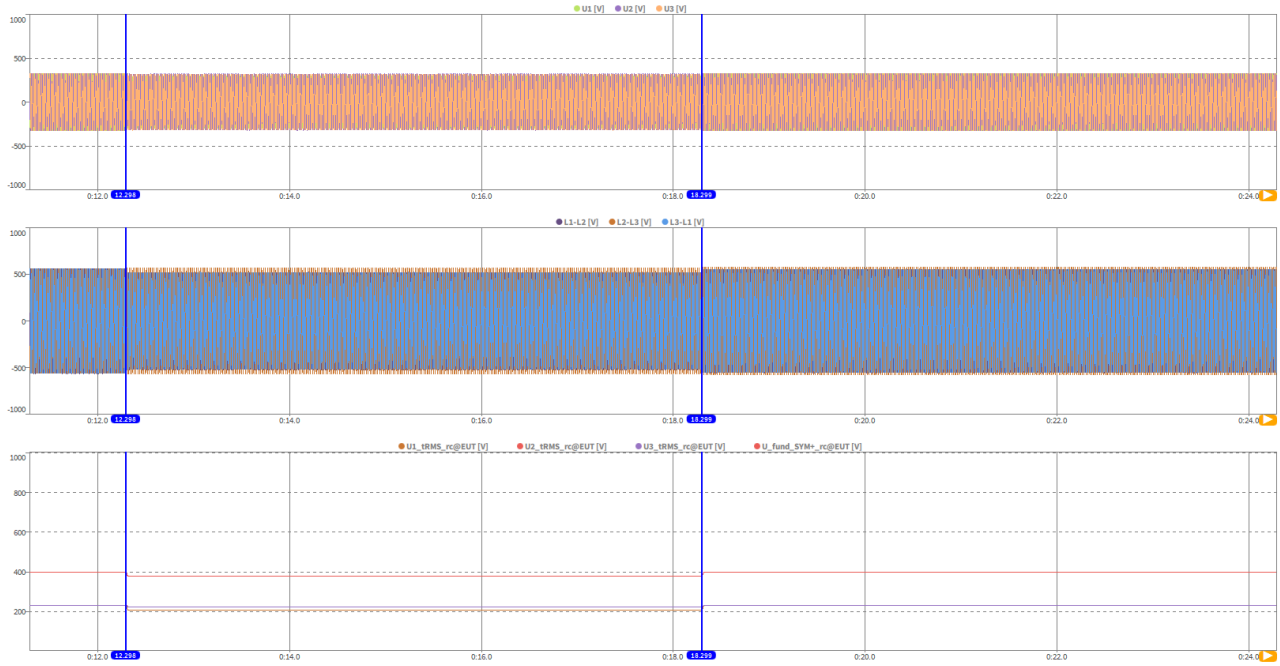
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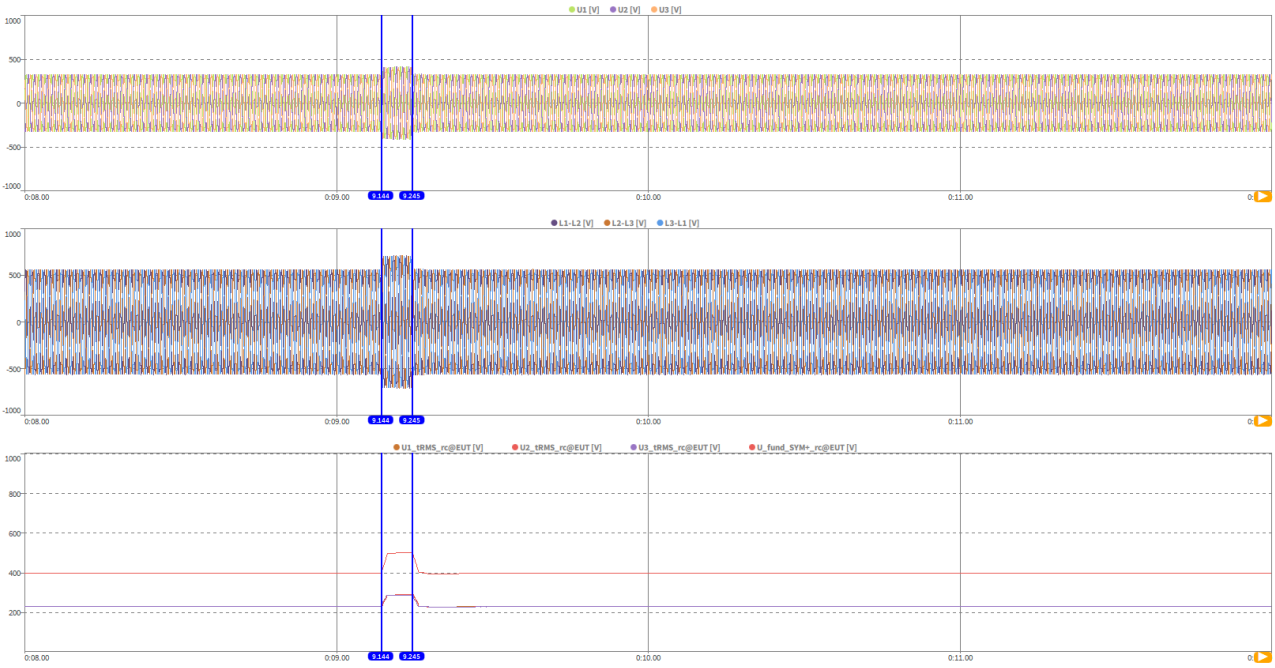
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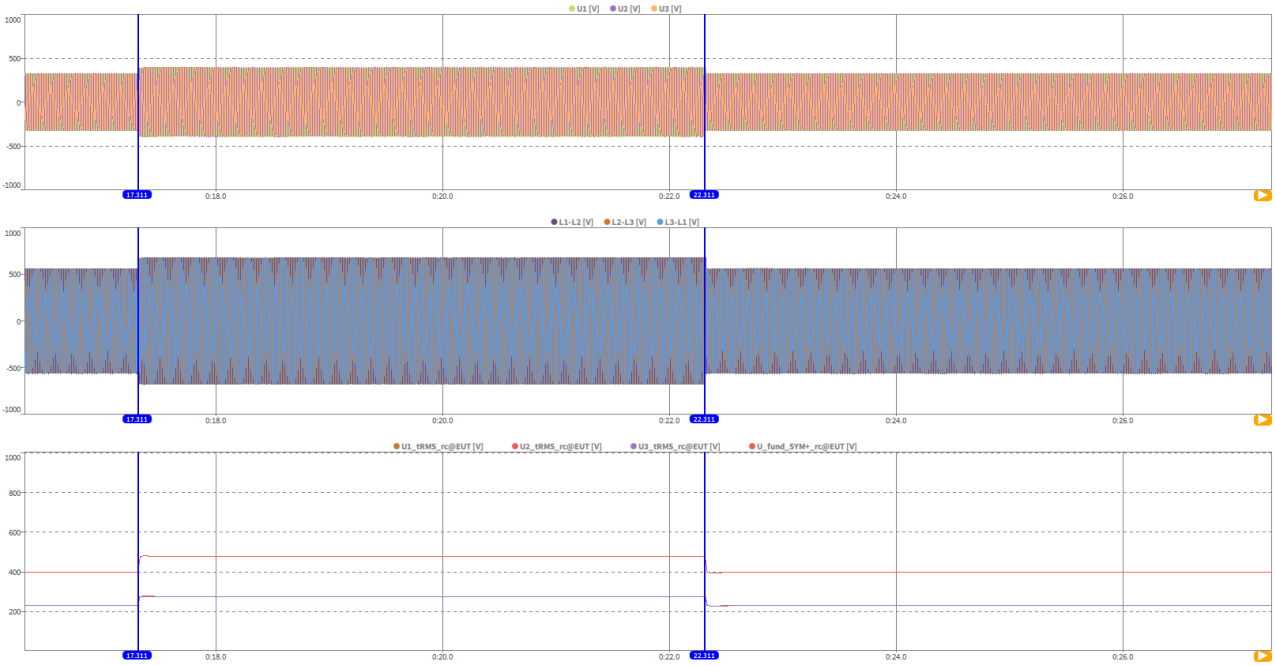
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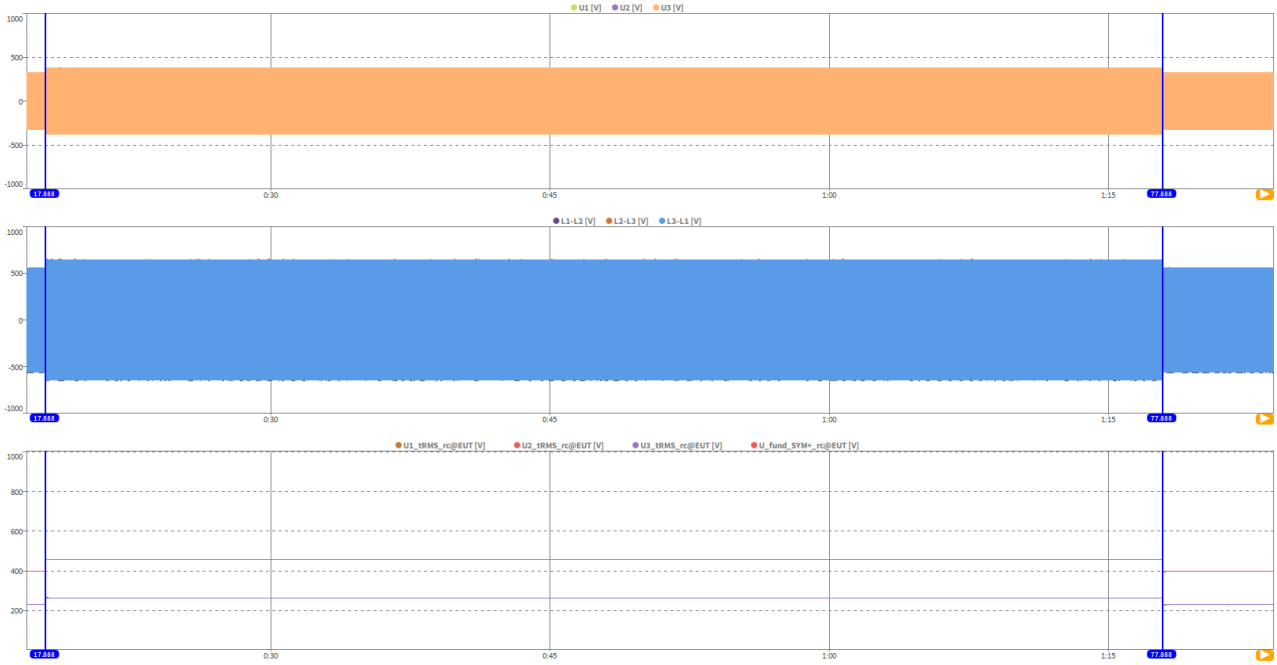
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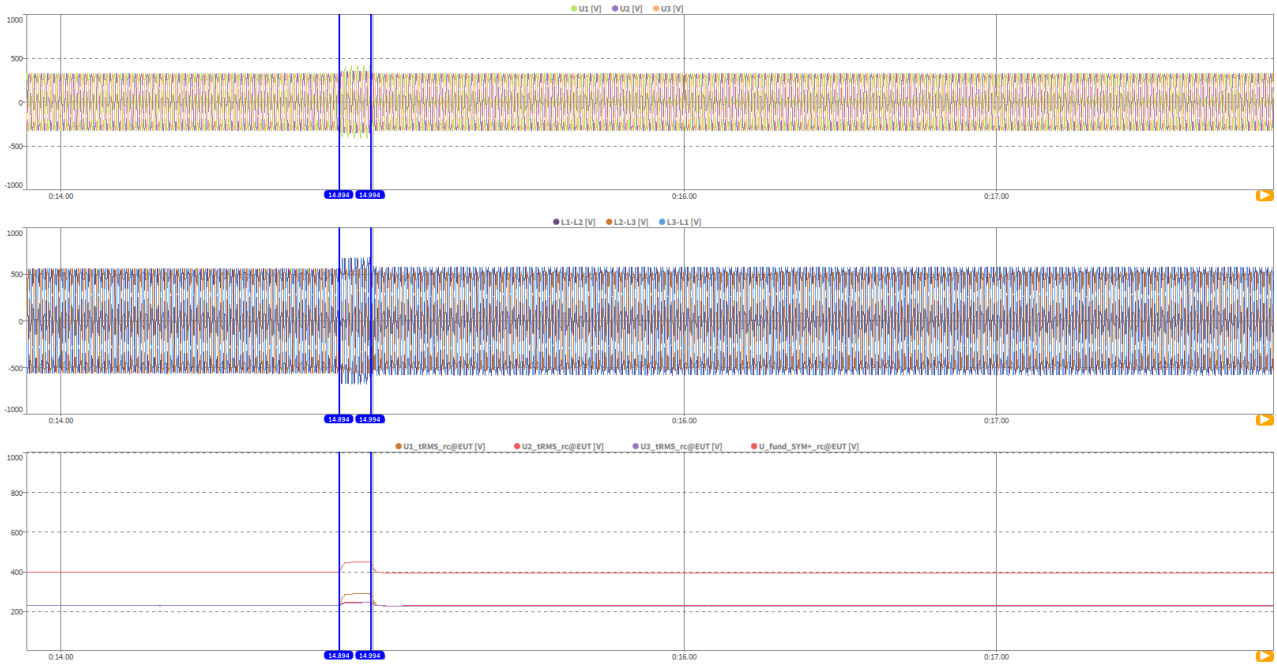
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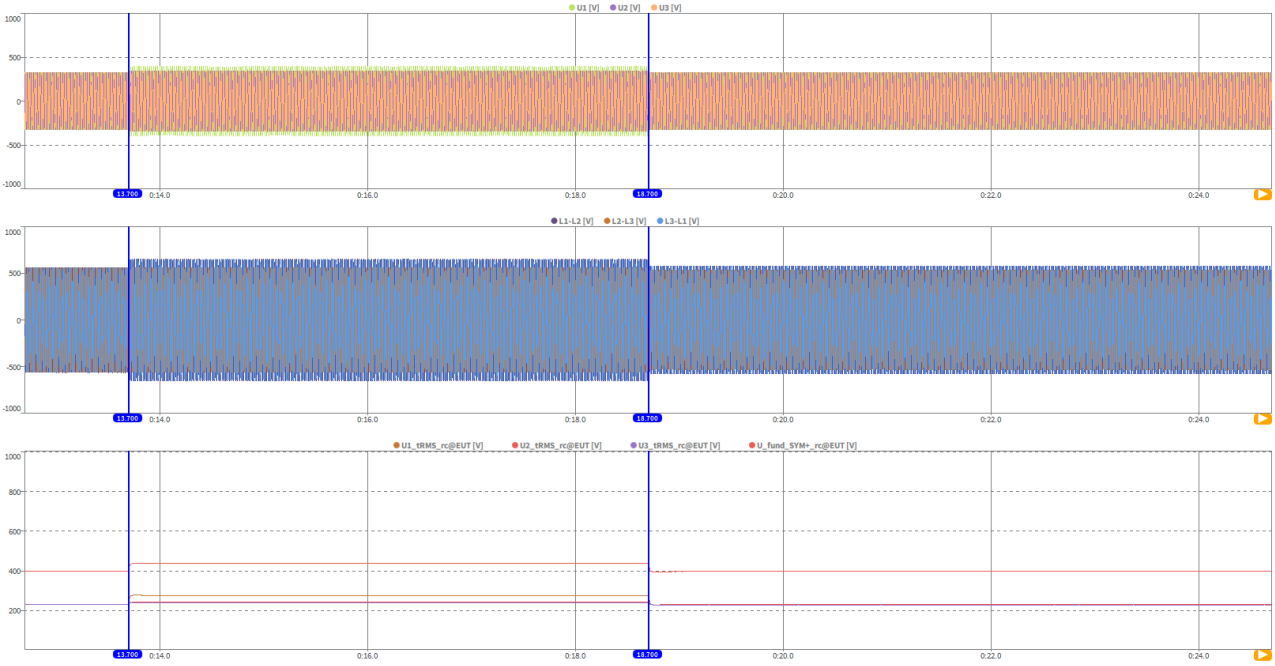
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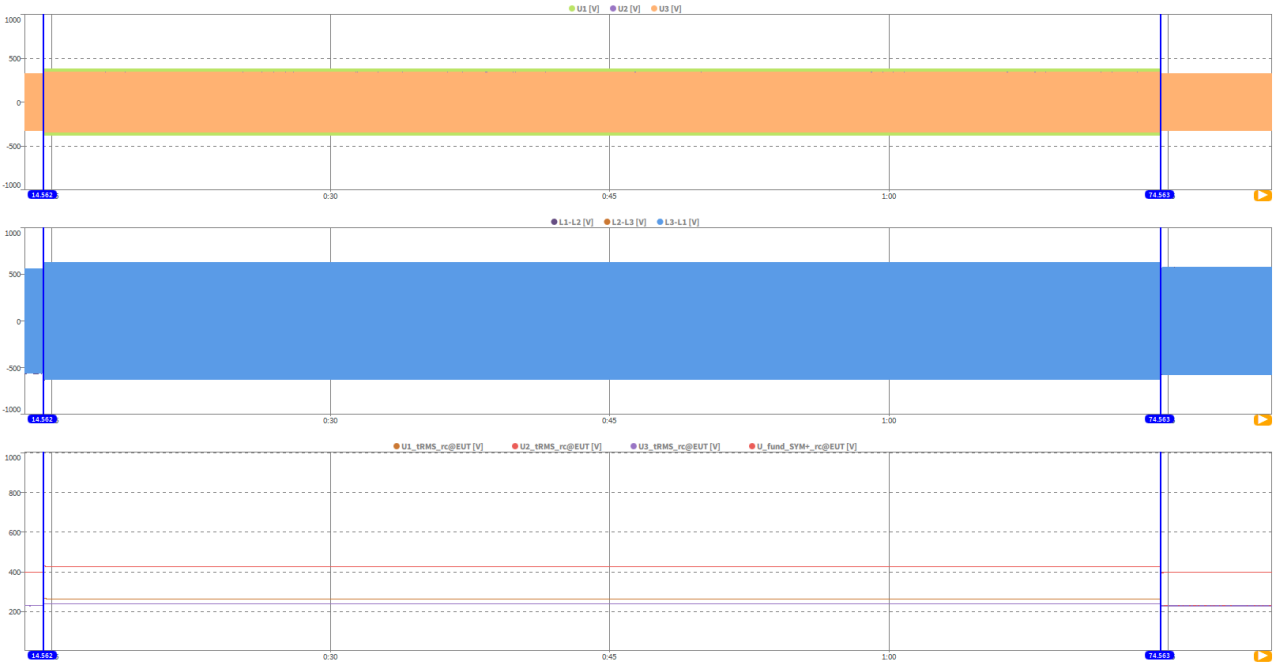
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No load VS4.1

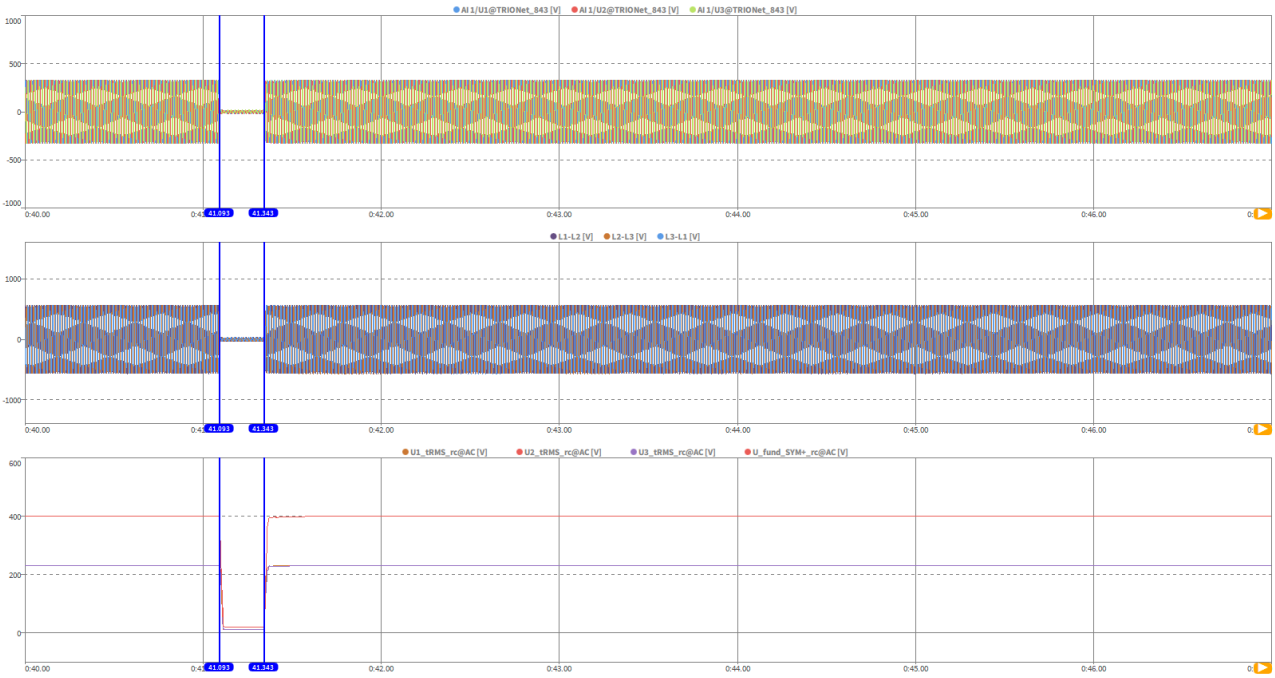


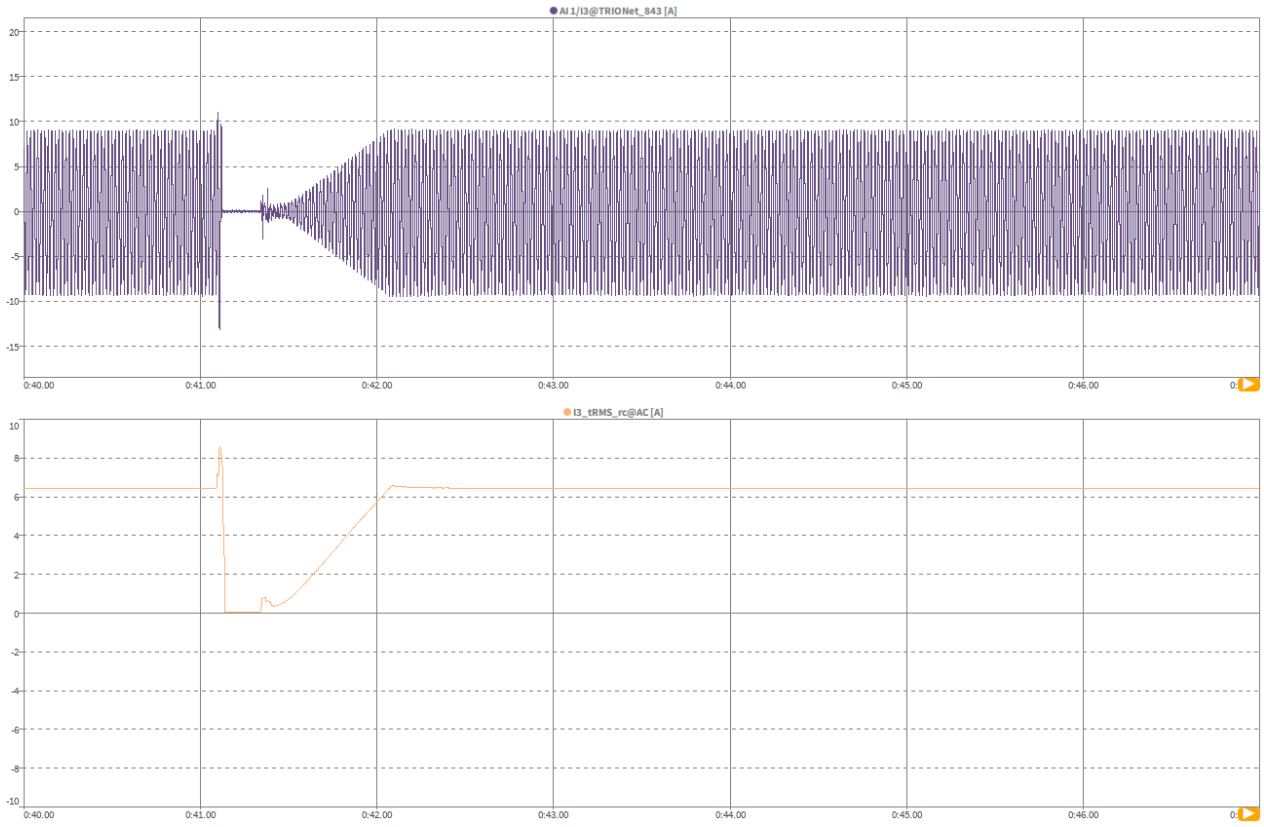
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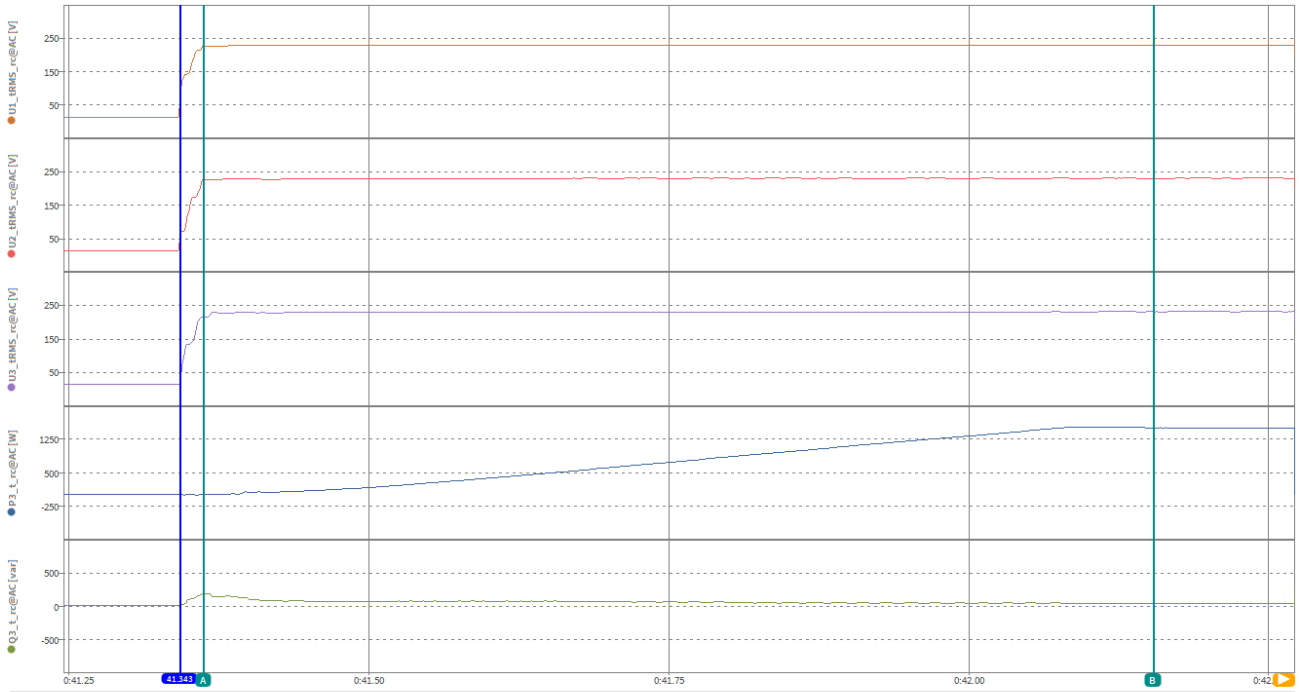


1.1

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	1.1		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:14:43		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.05		
	5	Drop duration setpoint	Total	--	[ms]	250		
	6	Fault occurrence (t1)	Total	--	[ms]	41093		
	7	Fault clearance (t2)	Total	--	[ms]	41343		
	8	Fault duration determined from no-load test	Total	--	[ms]	250		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.052	0.052	0.050
	10		Positive sequence		[p.u.]	0.050	0.050	0.050
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.986
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.989
	14		Positive sequence			--	--	0.989
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.002
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.052	0.052	0.050
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.007
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.007
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.000
	22		Positive sequence			--	--	0.000
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.989
	25		Positive sequence			--	--	0.989
	26	Response time active power	Positive sequence	--	[s]	--	--	0.791
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.002
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

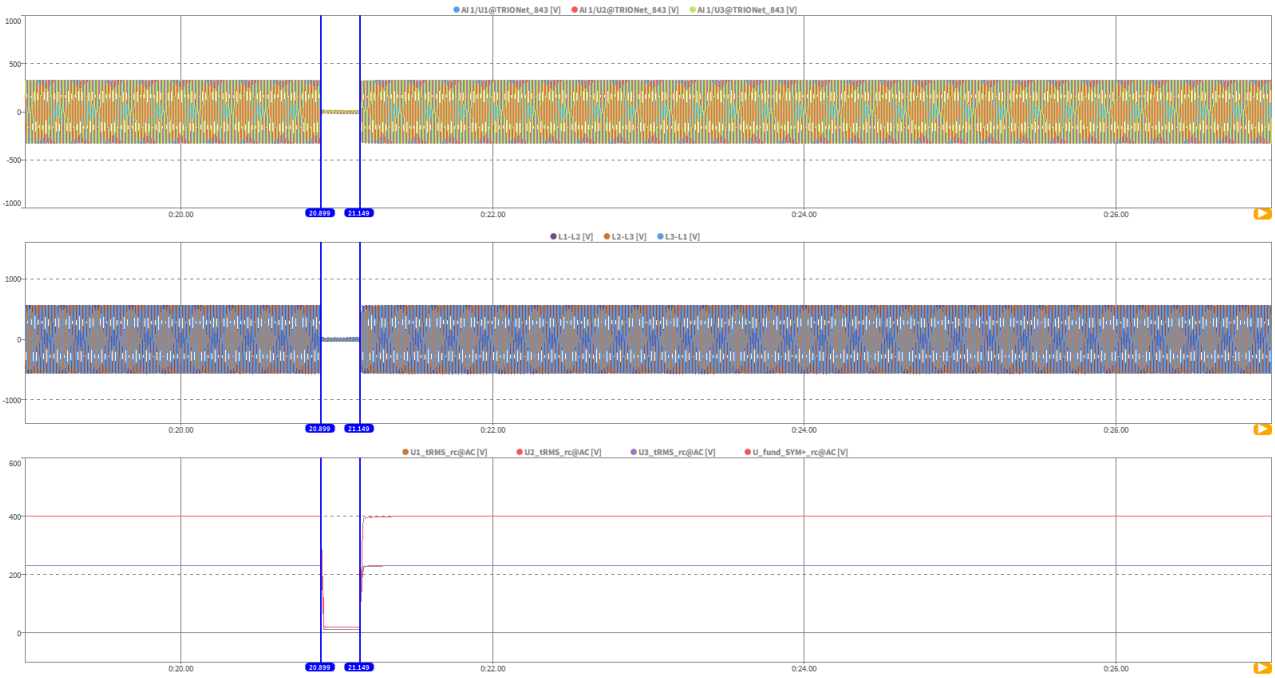

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

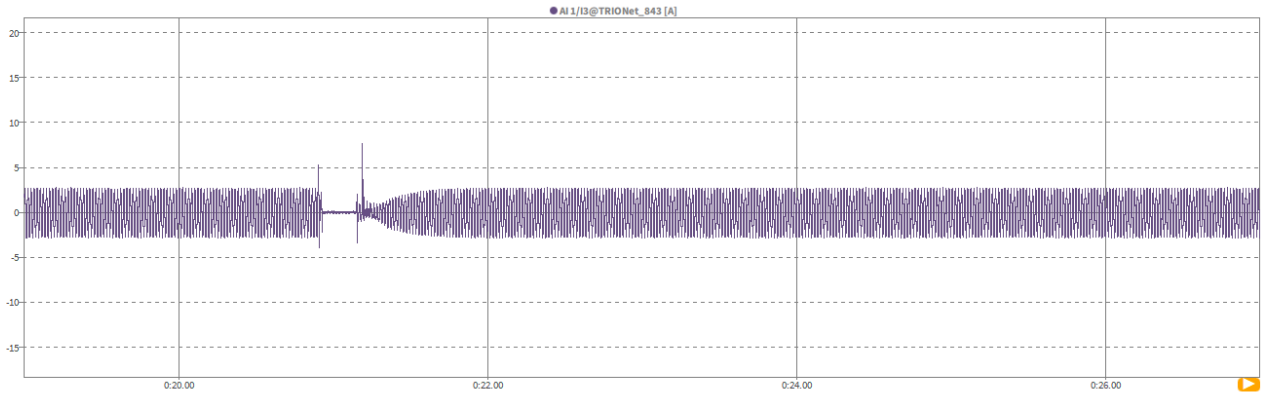


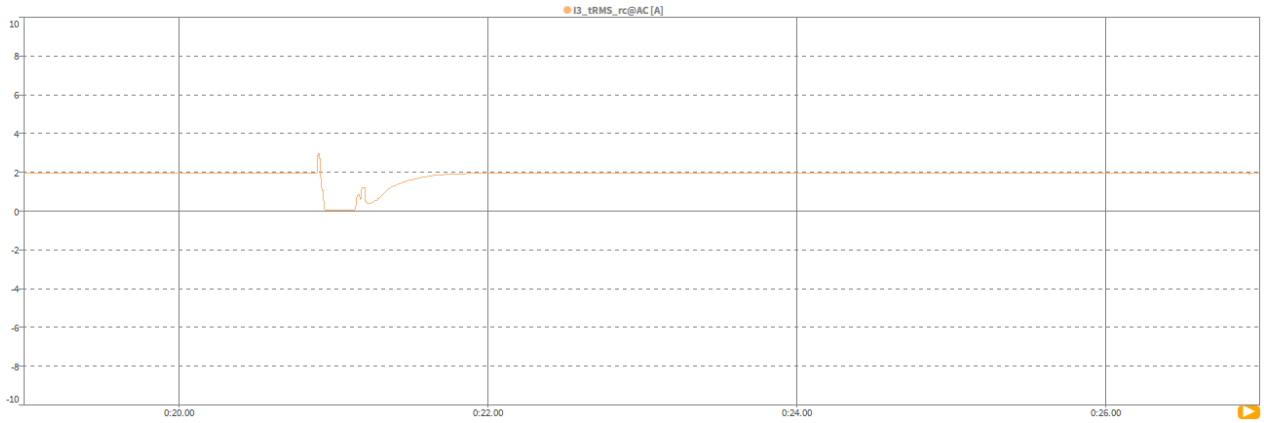
	A	B	间隔
时间 [s]	0:41.362952	0:42.153956	0.791004
U1_tRMS_rc@AC [V]	220.2525	230.1716	9.919128
U2_tRMS_rc@AC [V]	220.1384	230.8411	10.70270
U3_tRMS_rc@AC [V]	213.5962	230.8951	17.29887
P3_t_rc@AC [W]	-1.430189	1501.573	1503.003
Q3_t_rc@AC [var]	173.5419	31.60406	-141.9378

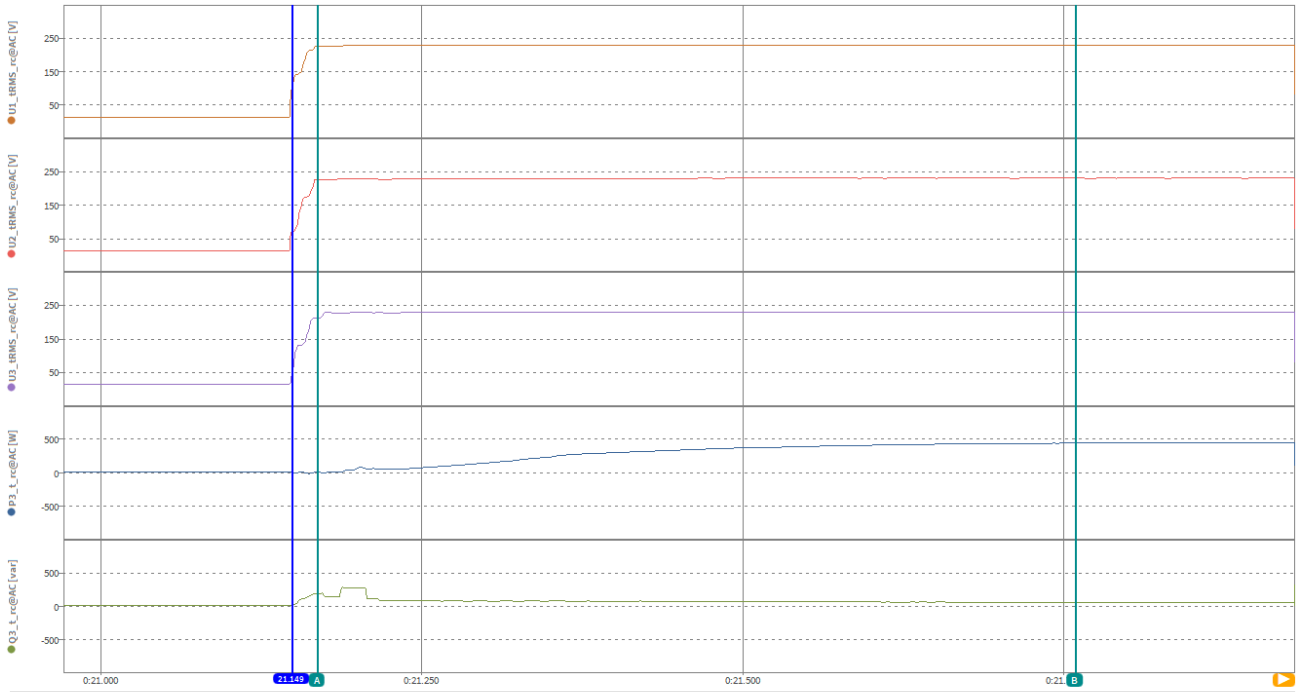
1.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	1.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	15:50:51		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.05		
	5	Drop duration setpoint	Total	--	[ms]	250		
	6	Fault occurrence (t1)	Total	--	[ms]	20899		
	7	Fault clearance (t2)	Total	--	[ms]	21149		
	8	Fault duration determined from no-load test	Total	--	[ms]	250		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.055	0.053	0.050
	10		Positive sequence		[p.u.]	0.050	0.050	0.050
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.008
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.055	0.053	0.050
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.012
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.012
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.000
	22		Positive sequence			--	--	0.000
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.590
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:20.00
20.899
21.149
0:22.00
0:24.00
0:26.00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:20.00
20.899
21.149
0:22.00
0:24.00
0:26.00
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:20.00
20.899
21.149
0:22.00
0:24.00
0:26.00


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:20.00
0:22.00
0:24.00
0:26.00

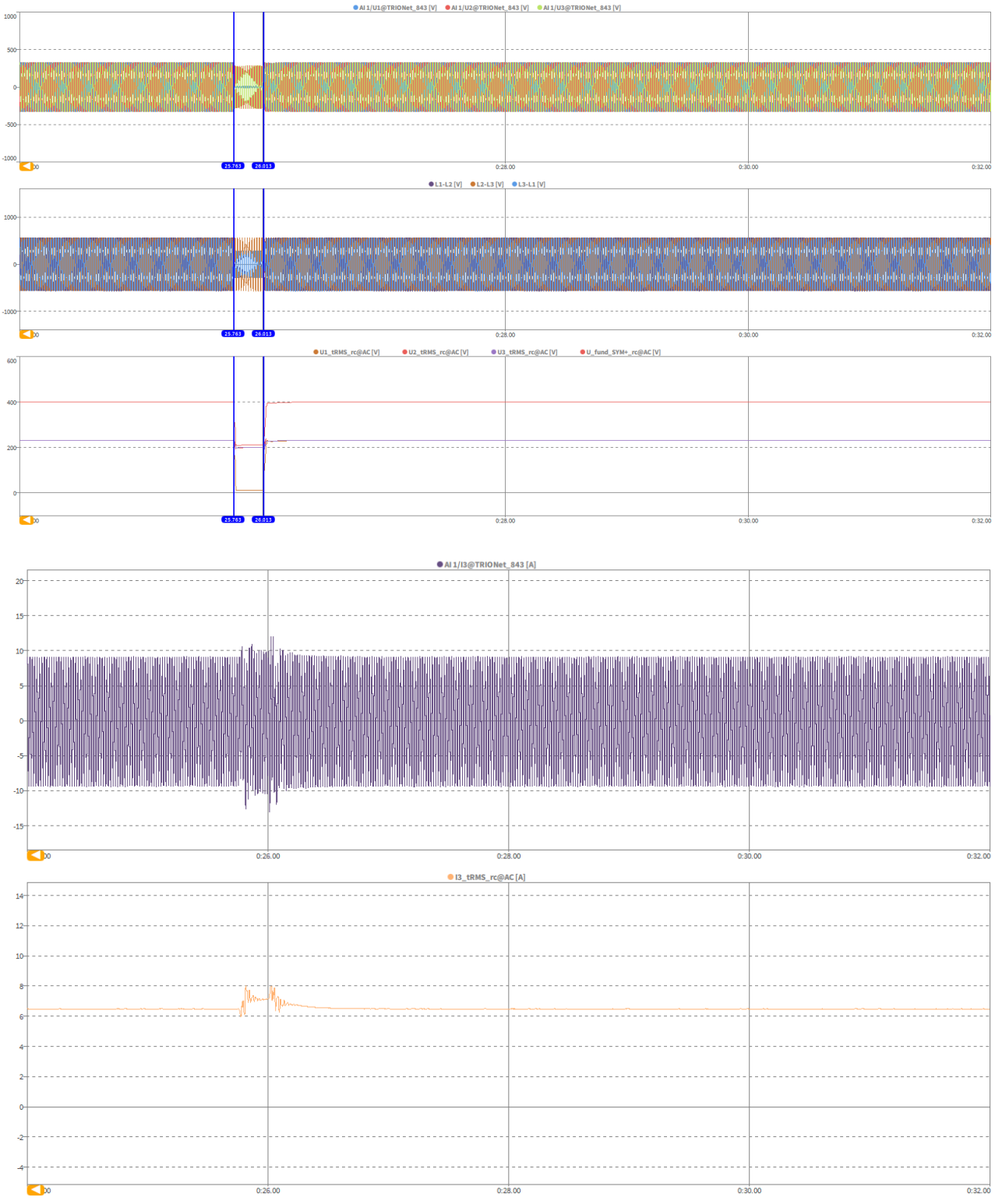

I3_tRMS_rc@AC [A]
10
8
6
4
2
0
-2
-4
-6
-8
-10
0:20.00
0:22.00
0:24.00
0:26.00

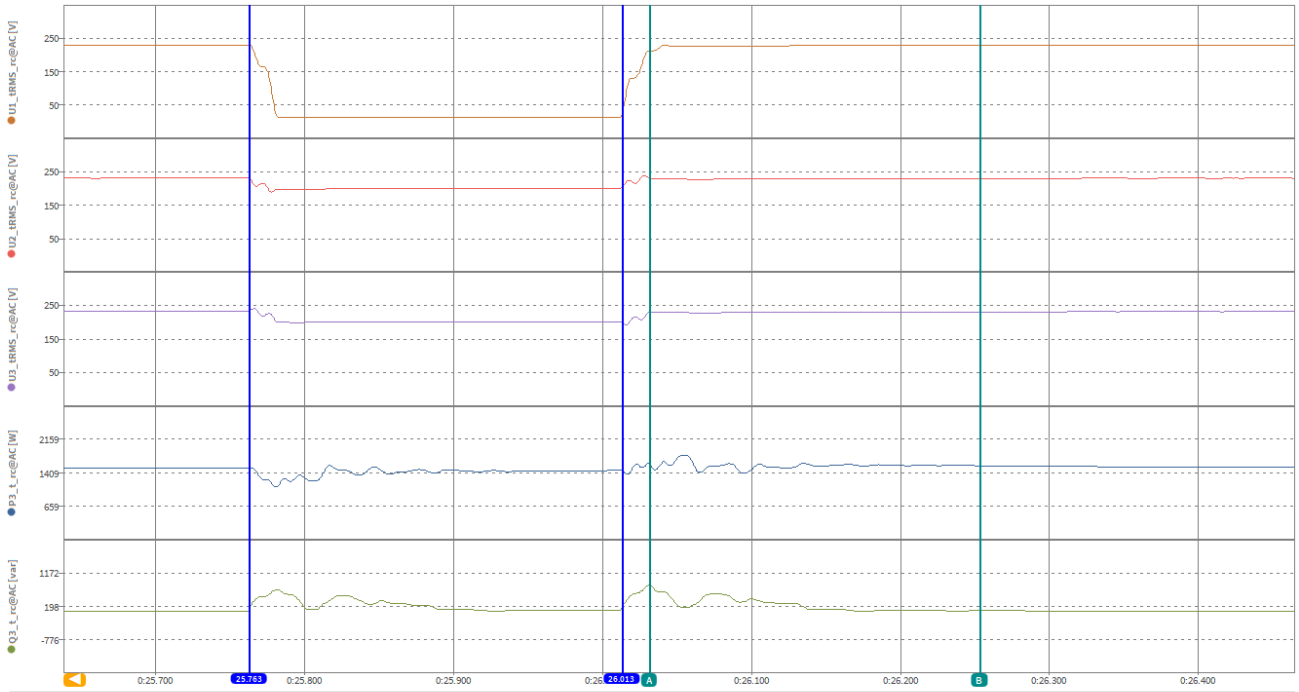


	A	B	间隔
时间 [s]	0:21.169074	0:21.758712	0.589638
U1_tRMS_rc@AC [V]	224.6140	230.2487	5.634674
U2_tRMS_rc@AC [V]	225.6357	230.9070	5.271362
U3_tRMS_rc@AC [V]	211.5519	230.8283	19.27643
P3_t_rc@AC [W]	-0.403902	435.6541	436.0580
Q3_t_rc@AC [var]	182.3979	47.80557	-134.5923

1.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	1.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:39:46		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.05	0.87	0.87
	5	Drop duration setpoint	Total	--	[ms]	250		
	6	Fault occurrence (t1)	Total	--	[ms]	25763		
	7	Fault clearance (t2)	Total	--	[ms]	26013		
	8	Fault duration determined from no-load test	Total	--	[ms]	250		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.050	0.870	0.875
	10		Positive sequence		[p.u.]	0.530	0.530	0.530
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.997
	14		Positive sequence			--	--	0.997
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.003
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.050	0.870	0.875
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	1.030
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	1.097
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.956
	22		Positive sequence			--	--	0.956
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.997
	25		Positive sequence			--	--	0.997
	26	Response time active power	Positive sequence	--	[s]	--	--	0.222
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.003
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

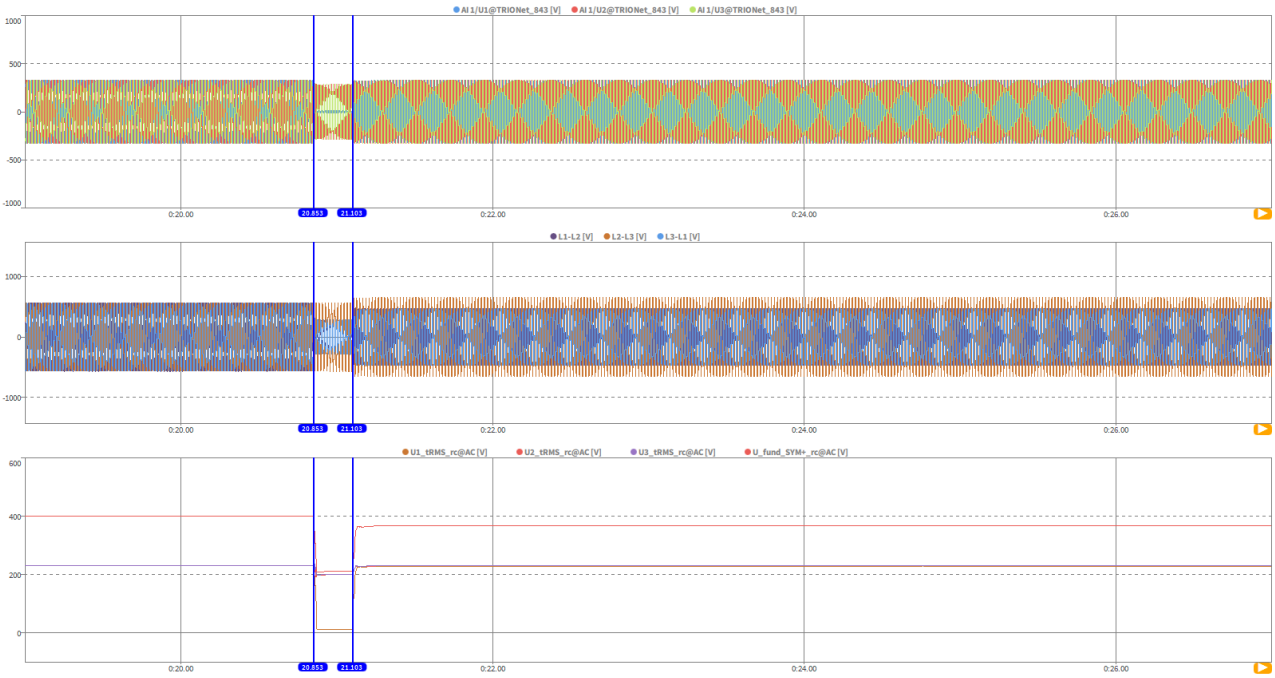

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]
0:26.00
0:28.00
0:30.00
0:32.00



	A	B	间隔
时间 [s]	0:26.031749	0:26.253403	0.221654
U1_tRMS_rc@AC [V]	211.1315	229.8608	18.72937
U2_tRMS_rc@AC [V]	232.3517	230.7297	-1.621933
U3_tRMS_rc@AC [V]	225.7387	230.7594	5.020676
P3_t_rc@AC [W]	1602.980	1549.485	-53.49548
Q3_t_rc@AC [var]	806.9822	42.84292	-764.1393

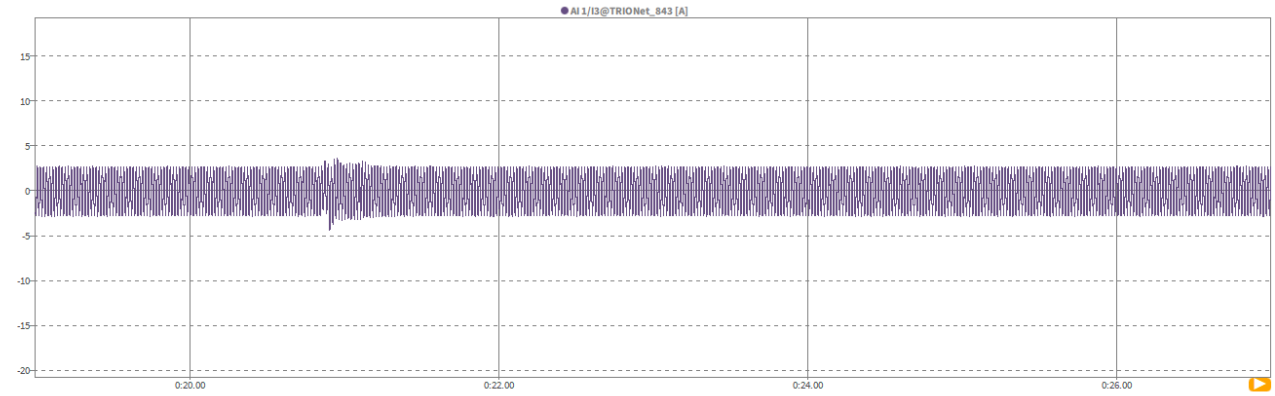
1.4

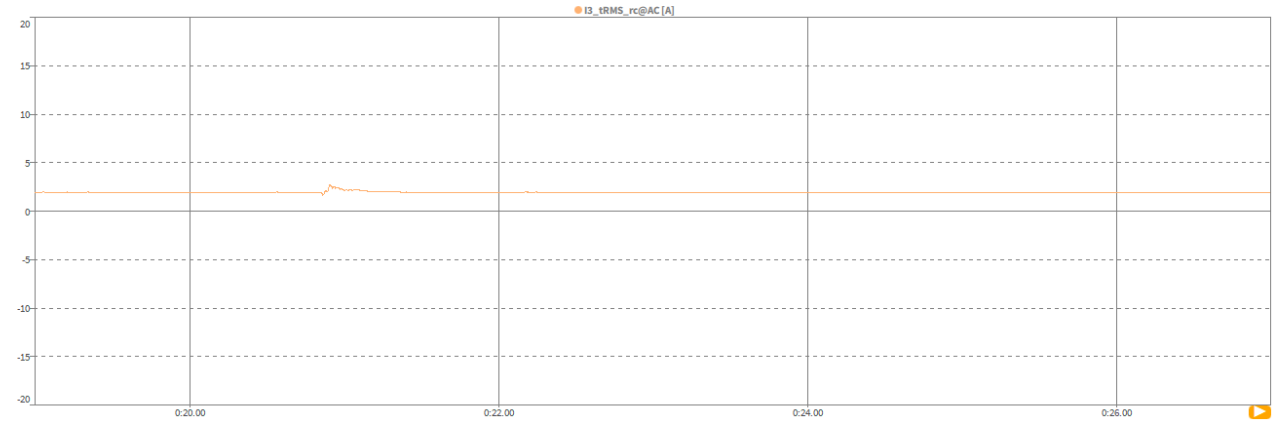
	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	1.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	15:44:00		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.05	0.87	0.87
	5	Drop duration setpoint	Total	--	[ms]	250		
	6	Fault occurrence (t1)	Total	--	[ms]	20853		
	7	Fault clearance (t2)	Total	--	[ms]	21103		
	8	Fault duration determined from no-load test	Total	--	[ms]	250		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.050	0.870	0.875
	10		Positive sequence		[p.u.]	0.530	0.530	0.530
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.050	0.870	0.875
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.329
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.365
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.295
	22		Positive sequence			--	--	0.295
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	0.997	1.001	1.006
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.115
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

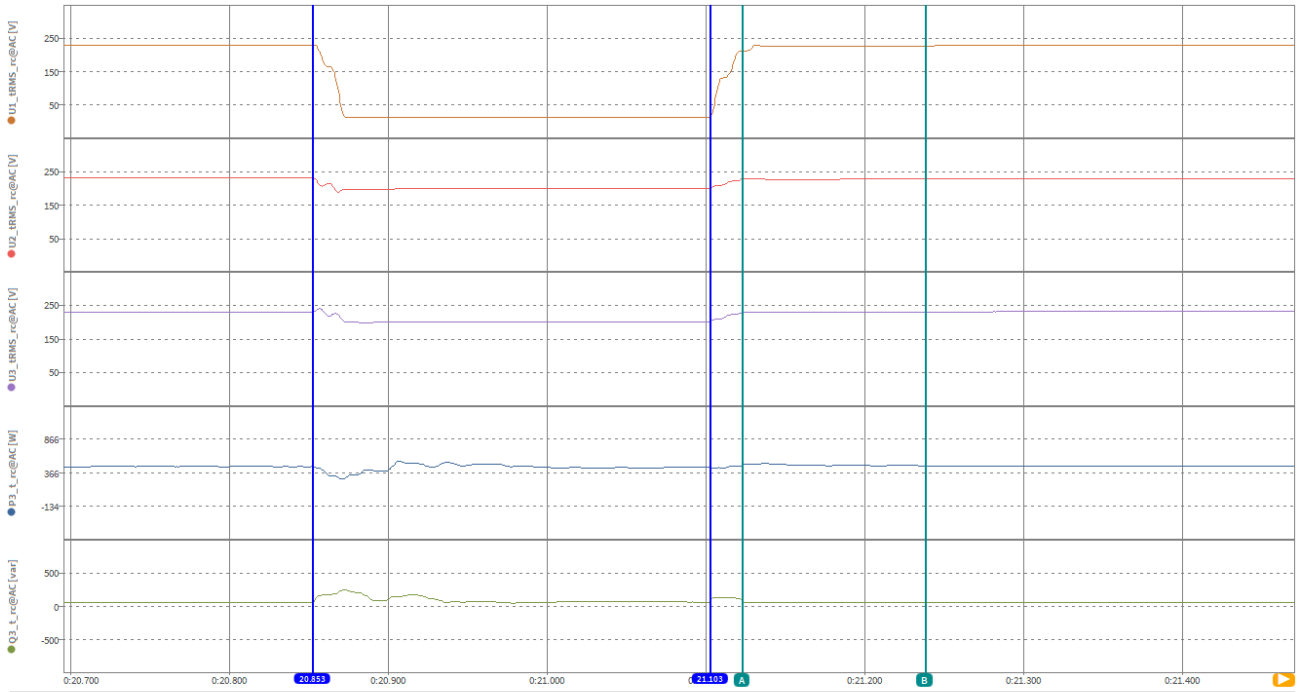

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:20.00
20.853
21.103
0:22.00
0:24.00
0:26.00

L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:20.00
20.853
21.103
0:22.00
0:24.00
0:26.00

U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:20.00
20.853
21.103
0:22.00
0:24.00
0:26.00


AI 1/I3@TRIONet_843 [A]
15
10
5
0
-5
-10
-15
-20
0:20.00
0:22.00
0:24.00
0:26.00

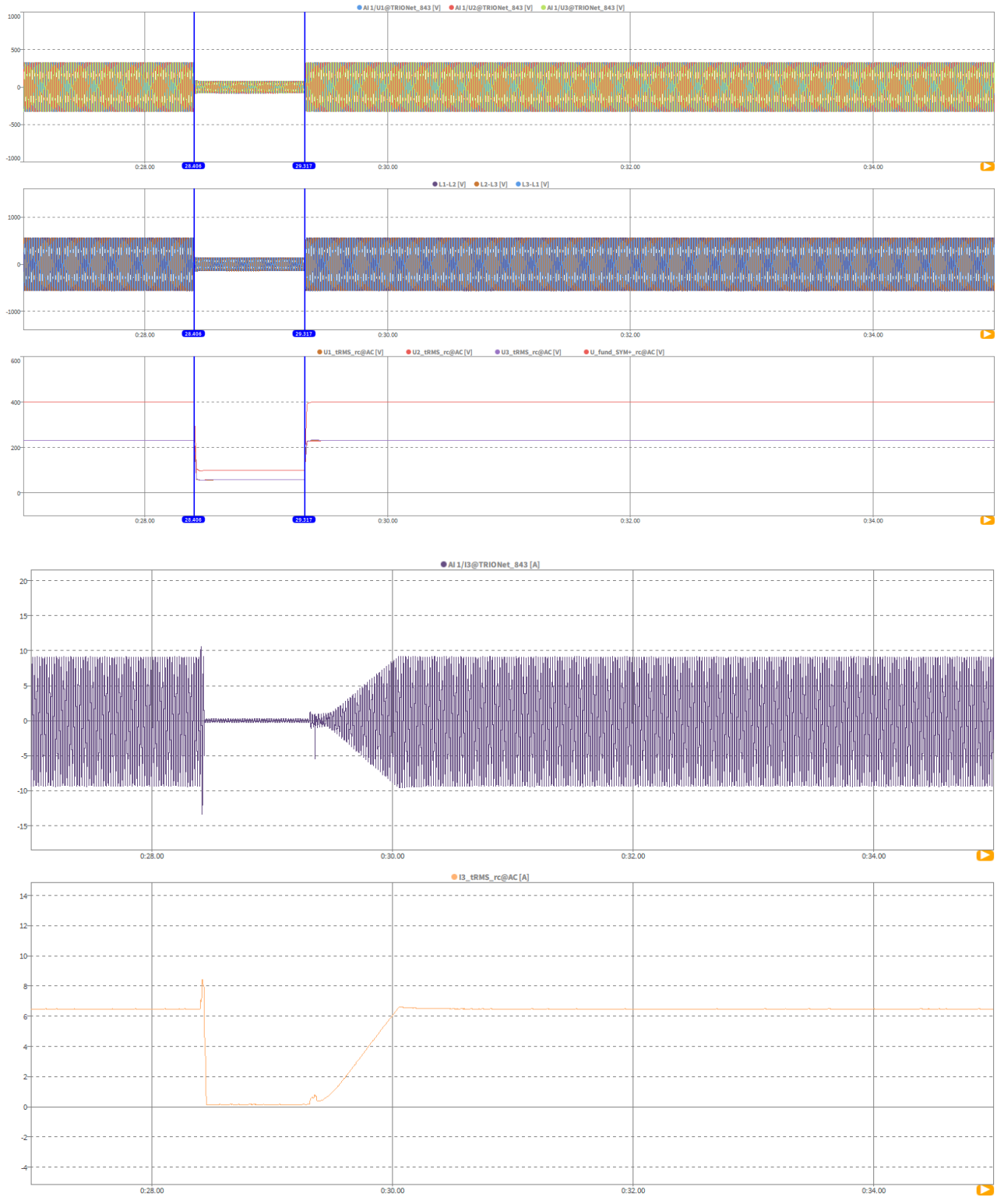

I3_tRMS_rc@AC [A]
20
15
10
5
0
-5
-10
-15
-20
0:20.00
0:22.00
0:24.00
0:26.00

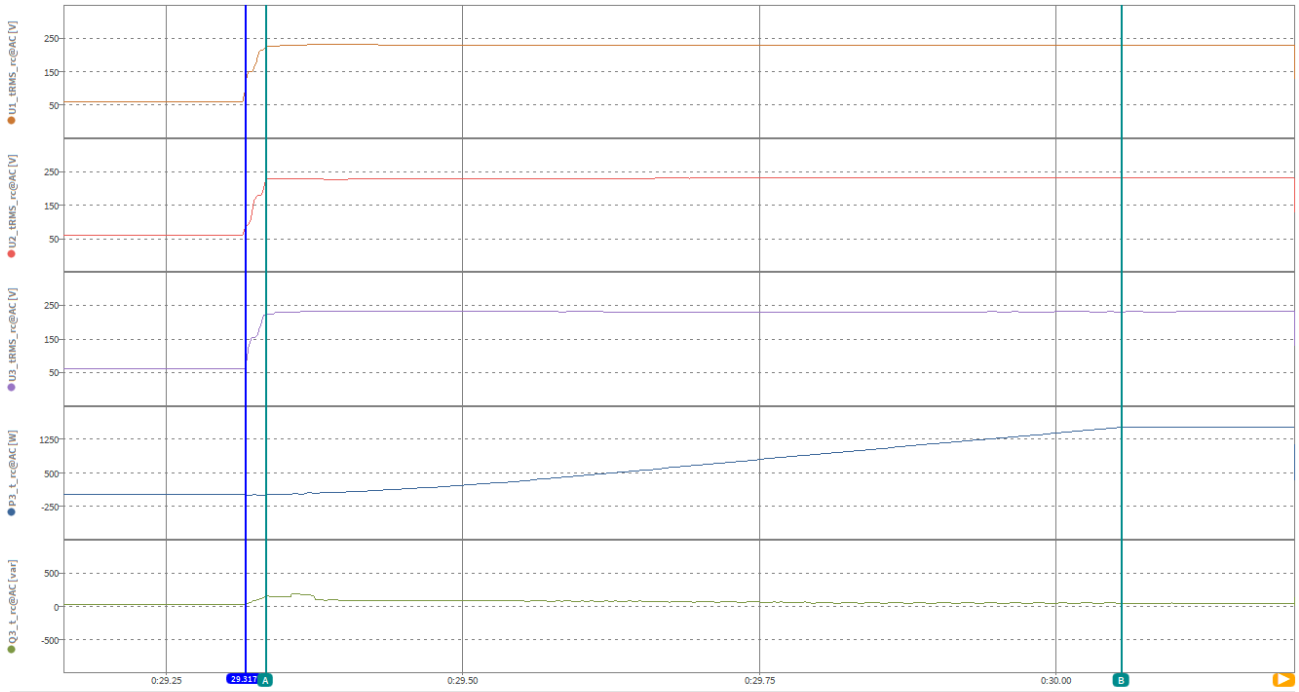


	A	B	间隔
时间 [s]	0:21.122998	0:21.238021	0.115023
U1_tRMS_rc@AC [V]	212.3163	227.7542	15.43790
U2_tRMS_rc@AC [V]	226.8842	229.2230	2.338867
U3_tRMS_rc@AC [V]	227.8833	230.3921	2.508789
P3_t_rc@AC [W]	456.9836	459.6106	2.627045
Q3_t_rc@AC [var]	102.1208	41.15734	-60.96342

2.1

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	2.1		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:44:34		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.25		
	5	Drop duration setpoint	Total	--	[ms]	910		
	6	Fault occurrence (t1)	Total	--	[ms]	28406		
	7	Fault clearance (t2)	Total	--	[ms]	29317		
	8	Fault duration determined from no-load test	Total	--	[ms]	911		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.249	0.251	0.251
	10		Positive sequence		[p.u.]	0.250	0.250	0.250
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.993
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.997
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.019
	16		Positive sequence			--	--	0.002
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.249	0.251	0.251
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.023
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.023
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.000
	22		Positive sequence			--	--	0.000
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.997
	25		Positive sequence			--	--	0.997
	26	Response time active power	Positive sequence	--	[s]	--	--	0.720
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.002
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

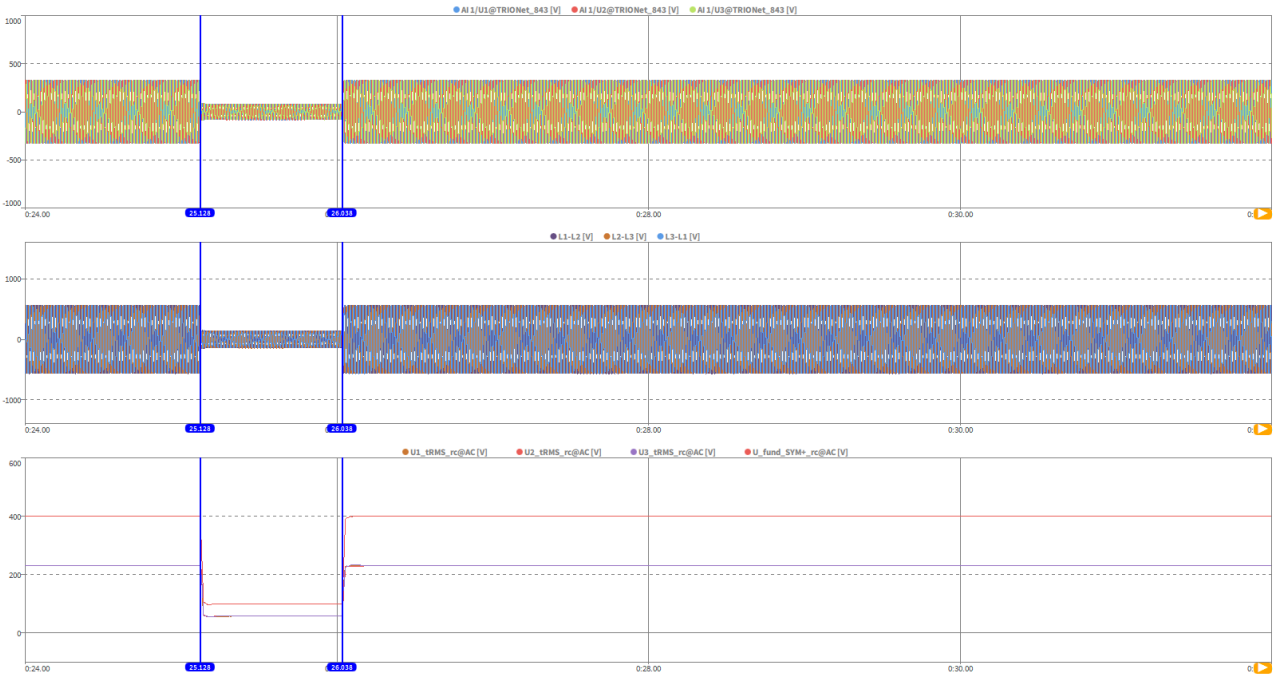

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]
0:28.00
0:30.00
0:32.00
0:34.00

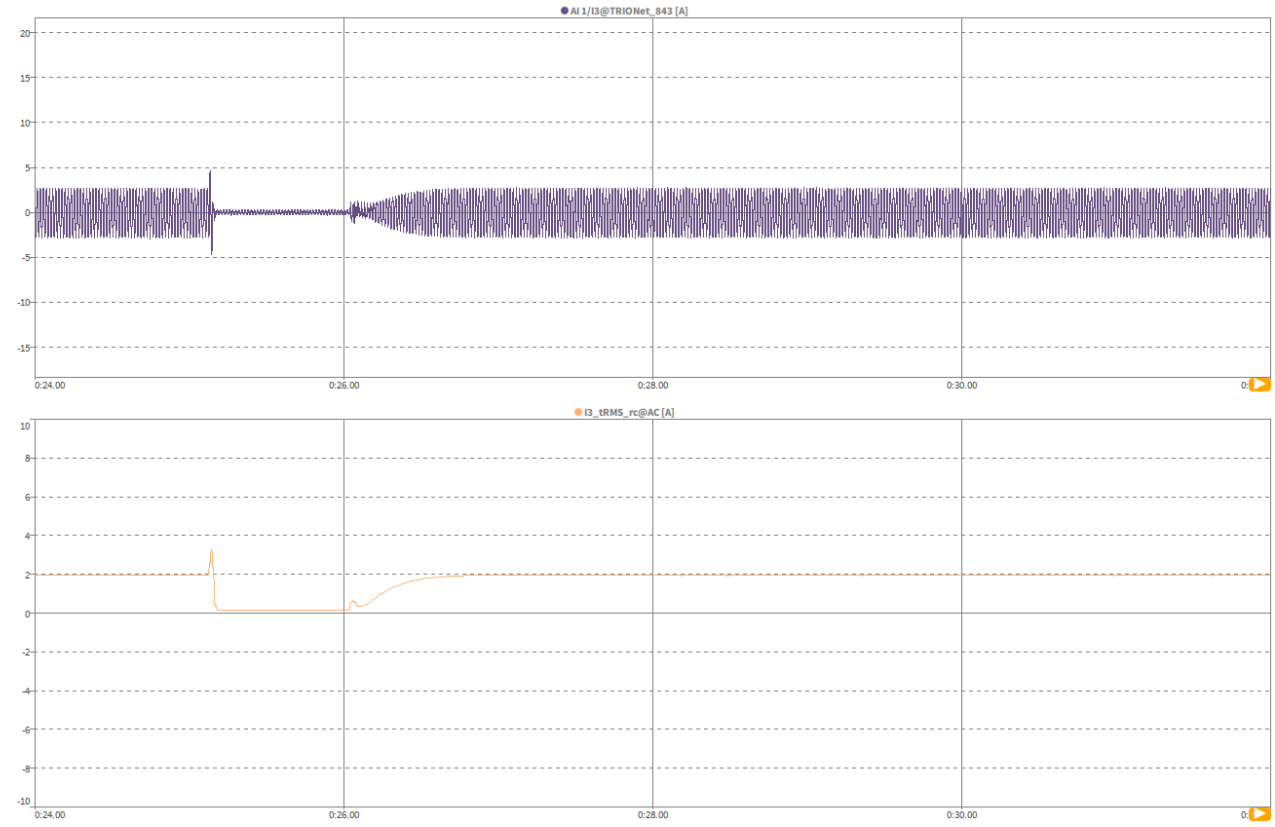


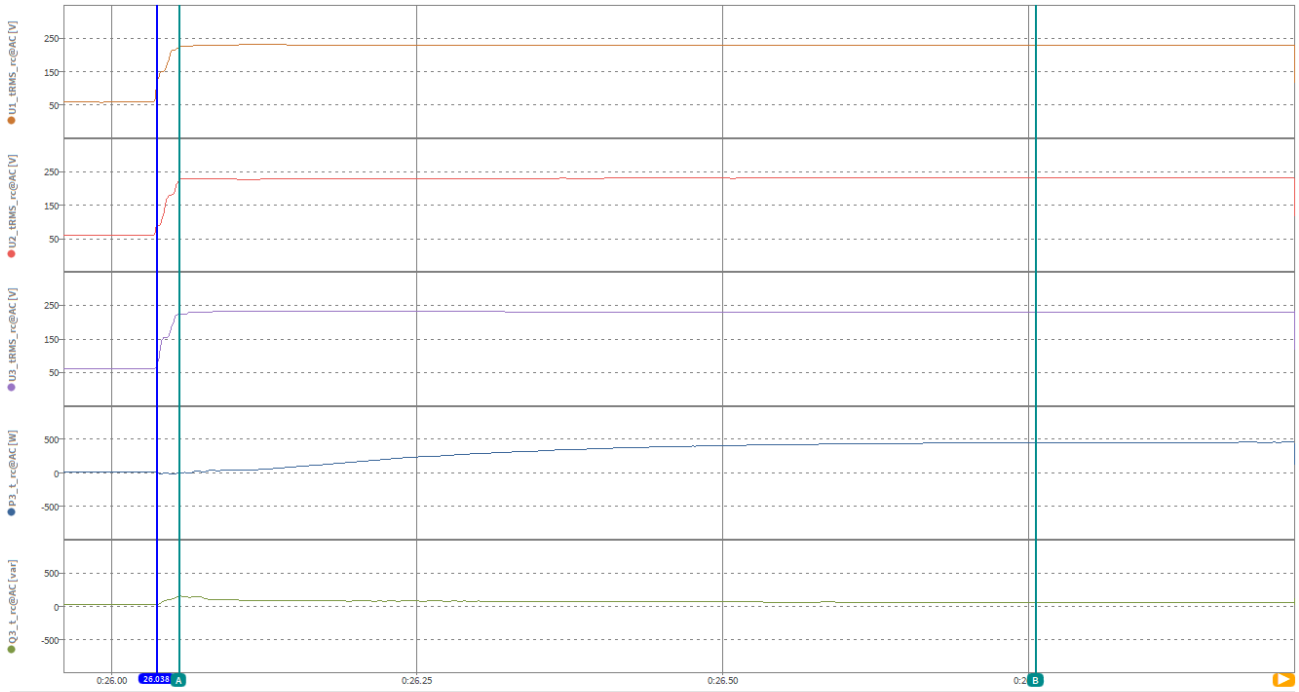
	A	B	间隔
时间 [s]	0:29.33463	0:30.05509	0.72047
U1_tRMS_rc@AC [V]	216.4079	230.2121	13.80418
U2_tRMS_rc@AC [V]	206.5186	230.9159	24.39731
U3_tRMS_rc@AC [V]	219.7213	230.8699	11.14853
P3_t_rc@AC [W]	-19.52425	1511.051	1530.575
Q3_t_rc@AC [var]	129.4810	30.40865	-99.07233

2.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	2.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	15:56:25		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.25		
	5	Drop duration setpoint	Total	--	[ms]	910		
	6	Fault occurrence (t1)	Total	--	[ms]	25128		
	7	Fault clearance (t2)	Total	--	[ms]	26038		
	8	Fault duration determined from no-load test	Total	--	[ms]	910		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.249	0.251	0.251
	10		Positive sequence		[p.u.]	0.250	0.250	0.250
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.249	0.251	0.251
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.046
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.024
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.000
	22		Positive sequence			--	--	0.000
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.701
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.006
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

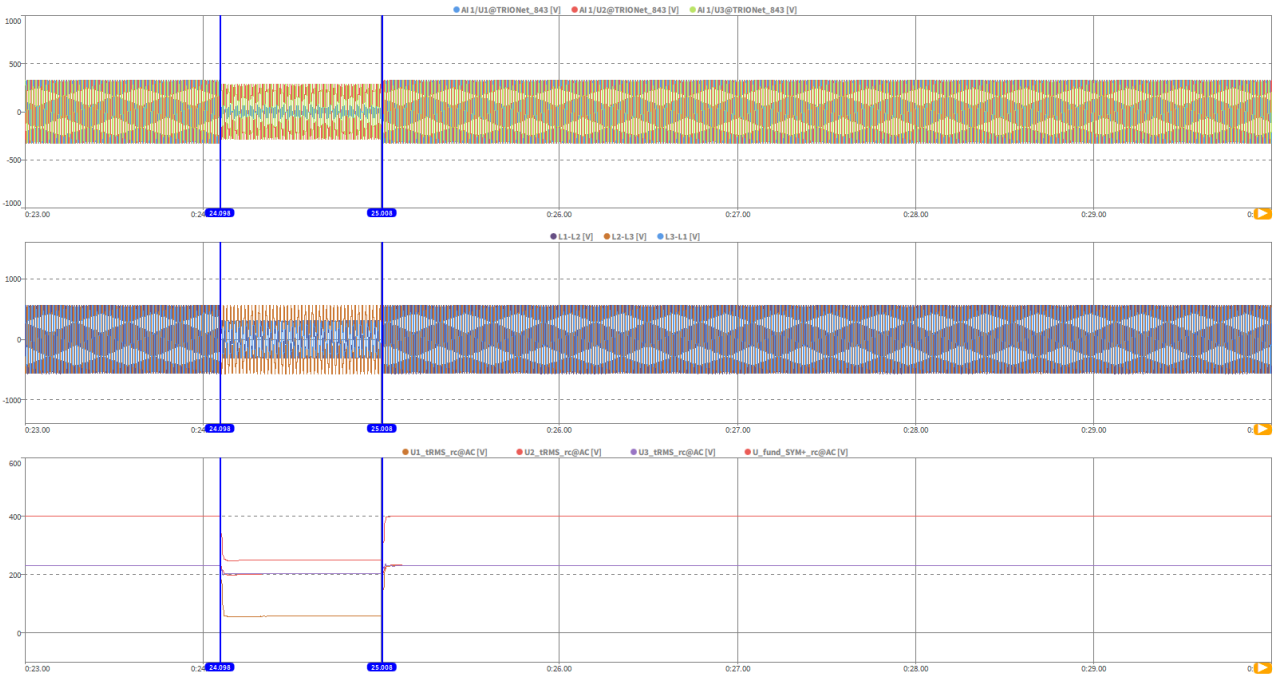

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

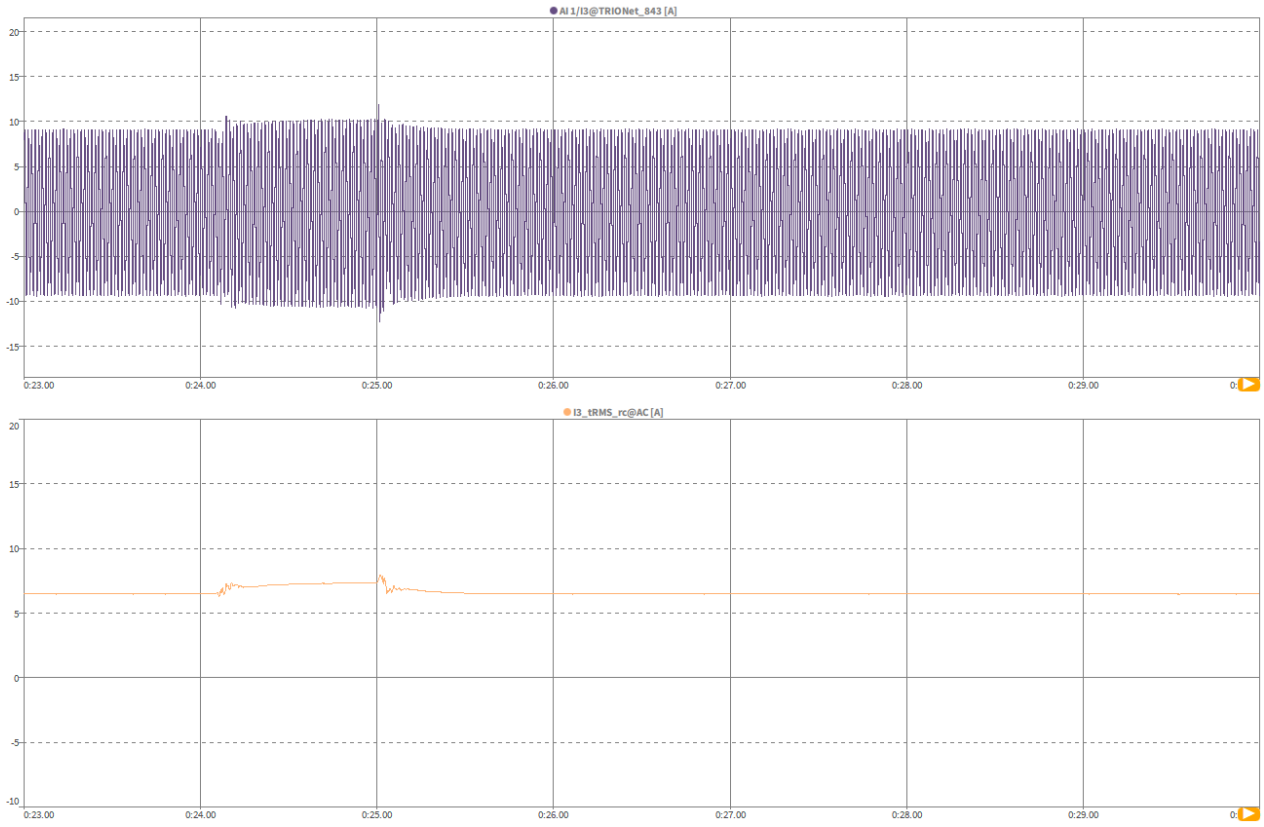


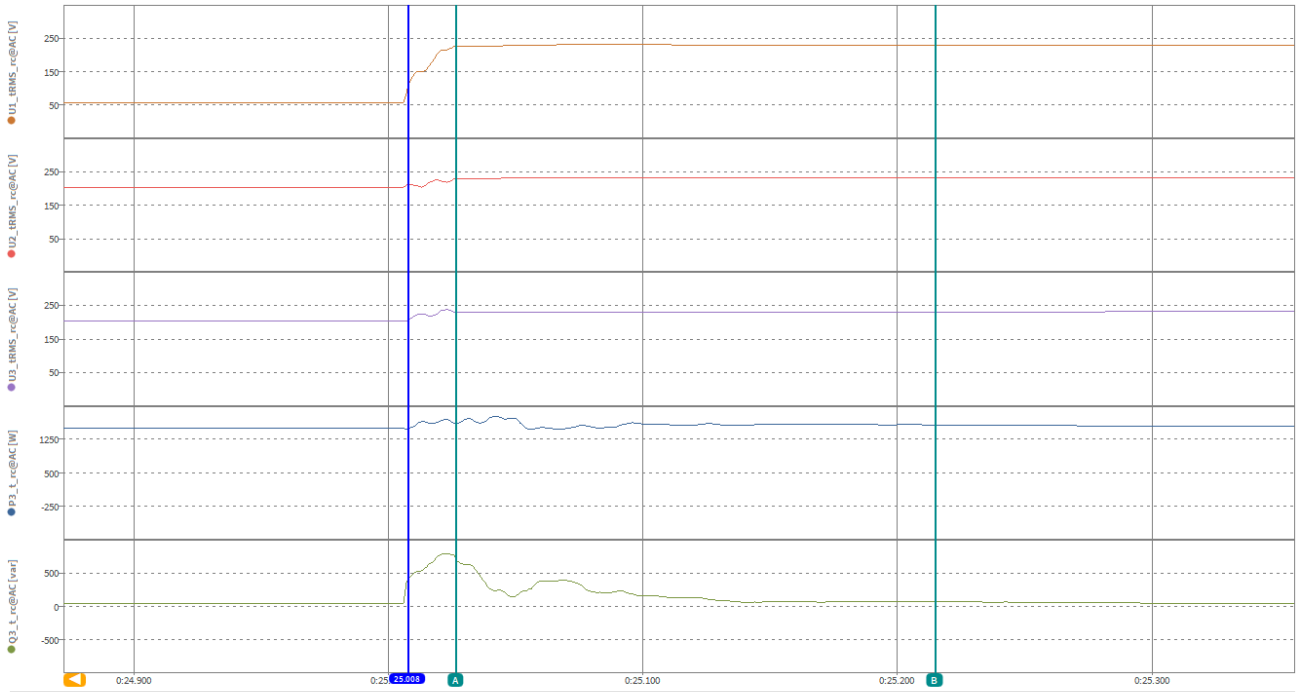
时间 [s]	A	B	间隔
U1_tRMS_rc@AC [V]	217.4698	230.2280	12.75815
U2_tRMS_rc@AC [V]	210.6135	230.9707	20.35715
U3_tRMS_rc@AC [V]	221.3822	230.8061	9.423950
P3_t_rc@AC [W]	-18.08206	440.3549	458.4370
Q3_t_rc@AC [var]	131.7094	44.83021	-86.87923

2.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	2.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:47:27		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.25	0.88	0.88
	5	Drop duration setpoint	Total	--	[ms]	910		
	6	Fault occurrence (t1)	Total	--	[ms]	24098		
	7	Fault clearance (t2)	Total	--	[ms]	25008		
	8	Fault duration determined from no-load test	Total	--	[ms]	910		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.249	0.880	0.885
	10		Positive sequence		[p.u.]	0.628	0.628	0.628
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.993
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.997
	14		Positive sequence			--	--	0.997
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.003
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.249	0.880	0.885
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	1.109
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	1.123
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.981
	22		Positive sequence			--	--	0.981
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.997
	25		Positive sequence			--	--	0.997
	26	Response time active power	Positive sequence	--	[s]	--	--	0.188
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.003
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

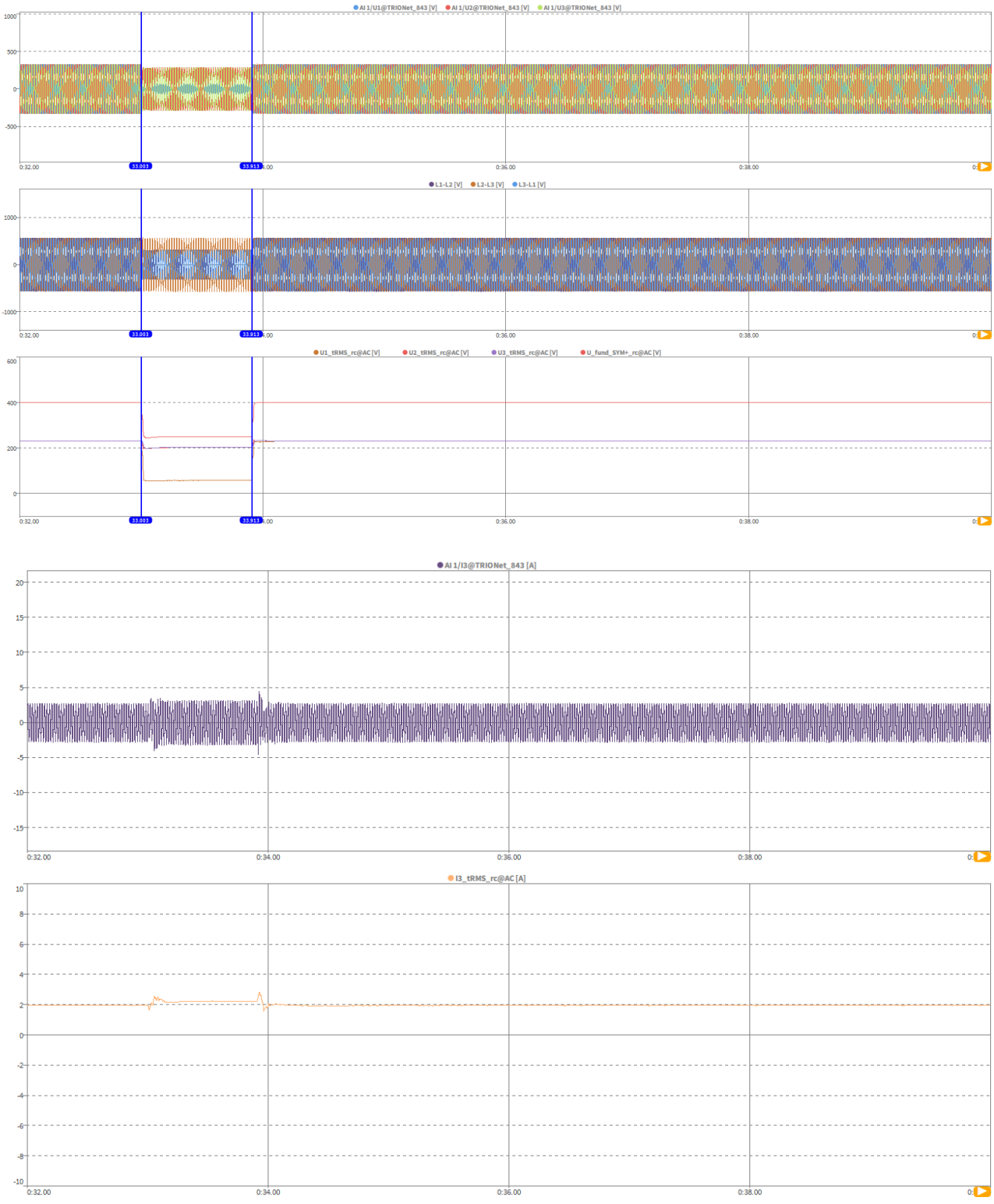

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

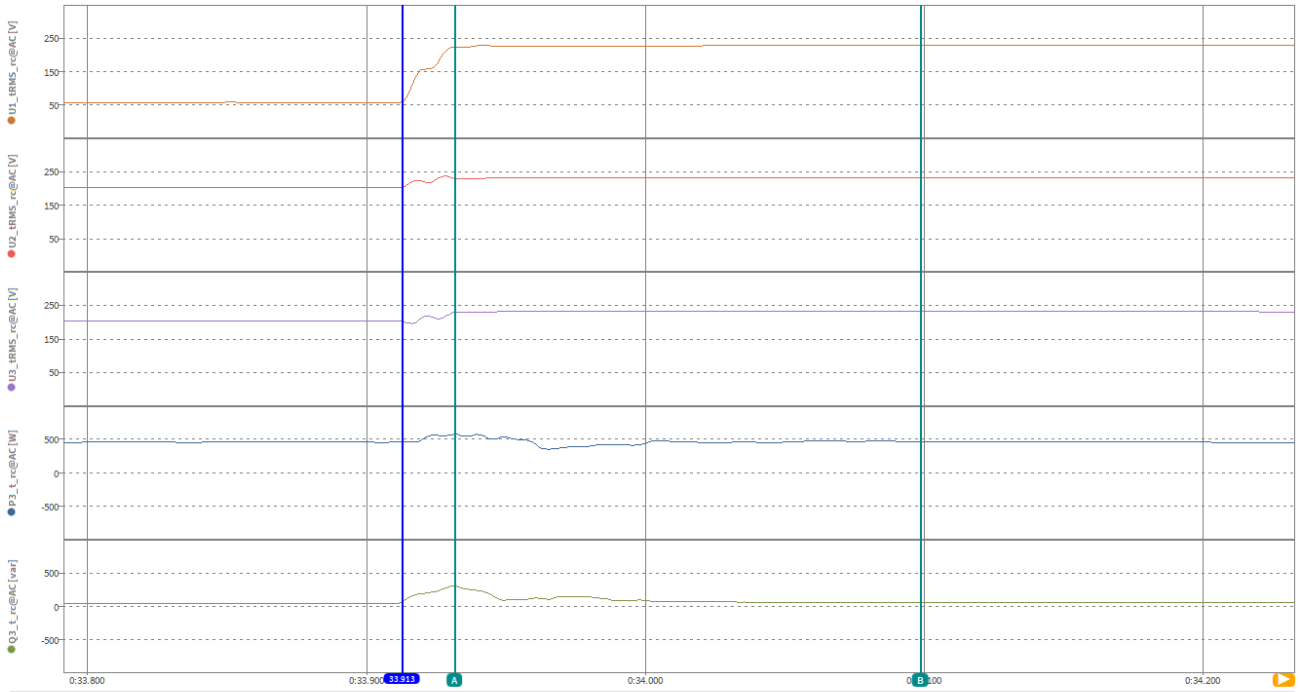


	A	B	间隔
时间 [s]	0:25.026730	0:25.214854	0.188124
U1_tRMS_rc@AC [V]	226.3885	230.3733	3.984833
U2_tRMS_rc@AC [V]	230.0370	231.2041	1.167114
U3_tRMS_rc@AC [V]	230.6726	230.7242	0.051514
P3_t_rc@AC [W]	1596.044	1564.341	-31.70239
Q3_t_rc@AC [var]	770.4644	56.42292	-714.0414

2.4

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	2.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	16:14:20		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.25	0.88	0.88
	5	Drop duration setpoint	Total	--	[ms]	910		
	6	Fault occurrence (t1)	Total	--	[ms]	33003		
	7	Fault clearance (t2)	Total	--	[ms]	33913		
	8	Fault duration determined from no-load test	Total	--	[ms]	910		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.249	0.880	0.884
	10		Positive sequence		[p.u.]	0.628	0.628	0.628
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	1.963
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.249	0.880	0.884
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.359
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.370
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.299
	22		Positive sequence			--	--	0.299
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.167
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

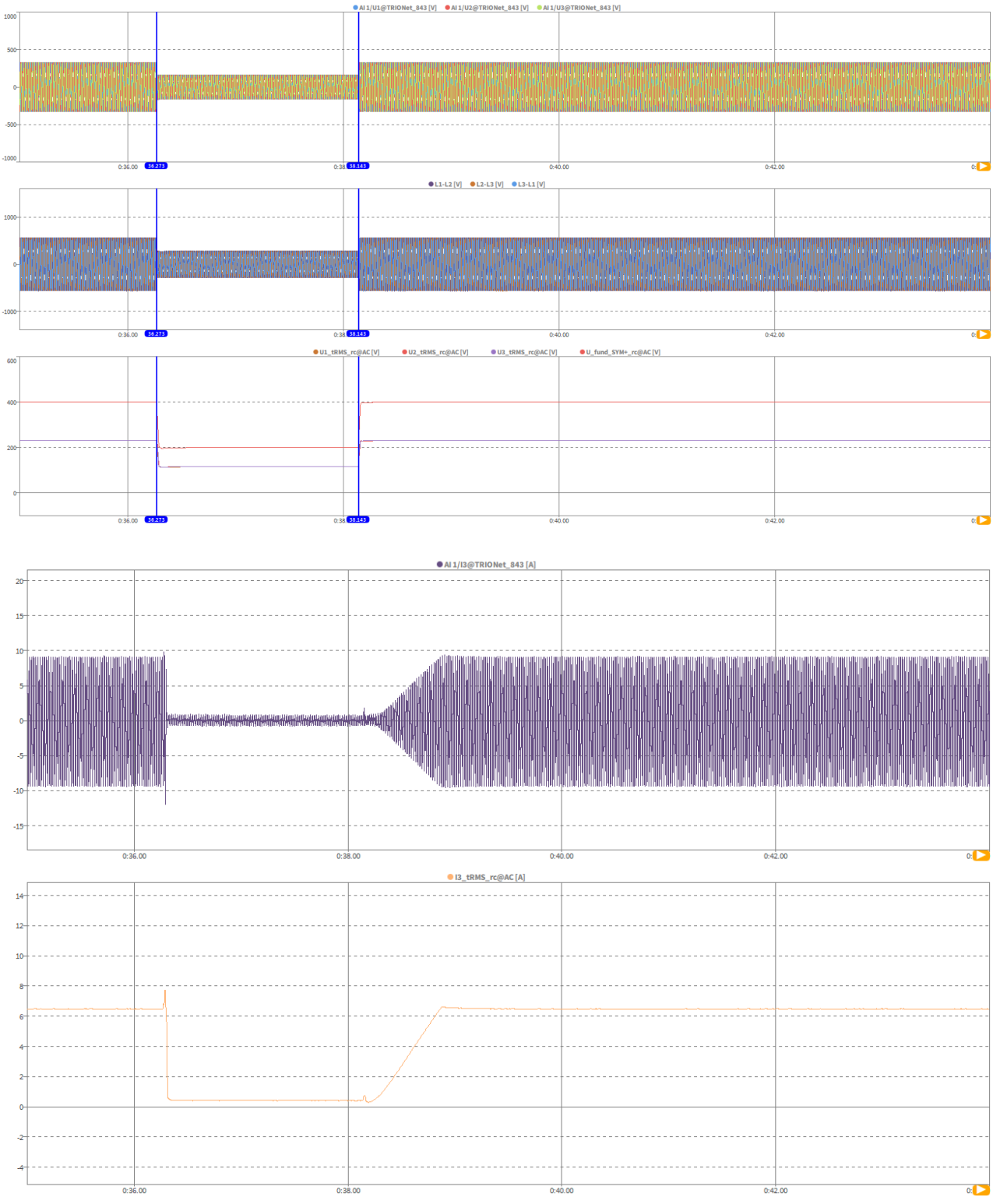

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

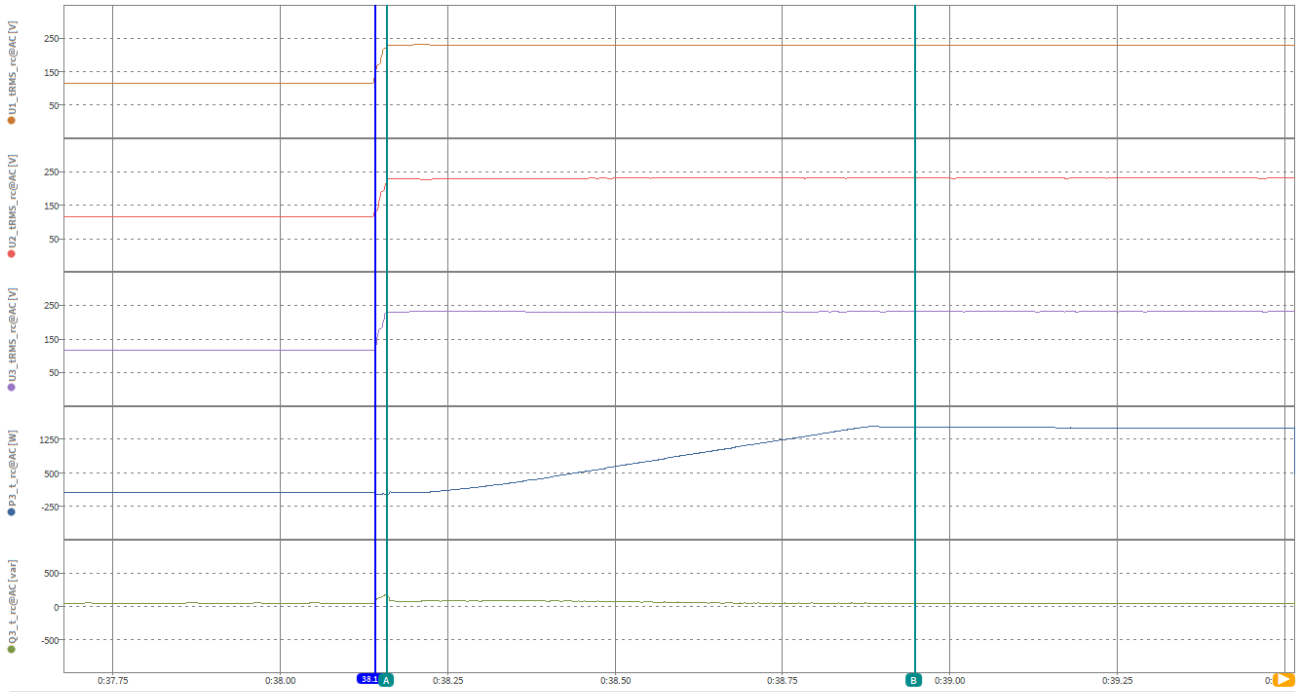


	A	B	间隔
时间 [s]	0:33.931926	0:34.098884	0.166959
U1_tRMS_rc@AC [V]	224.4478	229.4528	5.005005
U2_tRMS_rc@AC [V]	230.6177	231.3996	0.781982
U3_tRMS_rc@AC [V]	229.6696	231.3547	1.685150
P3_t_rc@AC [W]	571.5006	462.0038	-109.4968
Q3_t_rc@AC [var]	296.6674	40.80524	-255.8622

3.1

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	3.1		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:52:55		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.50		
	5	Drop duration setpoint	Total	--	[ms]	1870		
	6	Fault occurrence (t1)	Total	--	[ms]	36273		
	7	Fault clearance (t2)	Total	--	[ms]	38143		
	8	Fault duration determined from no-load test	Total	--	[ms]	1870		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.499	0.502	0.501
	10		Positive sequence		[p.u.]	0.500	0.500	0.500
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.001
	17	Cosφ	Total	t1-10s to t1	--	--	--	1.000
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.499	0.502	0.501
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.089
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.067
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.020
	22		Positive sequence			--	--	0.021
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.787
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.001
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

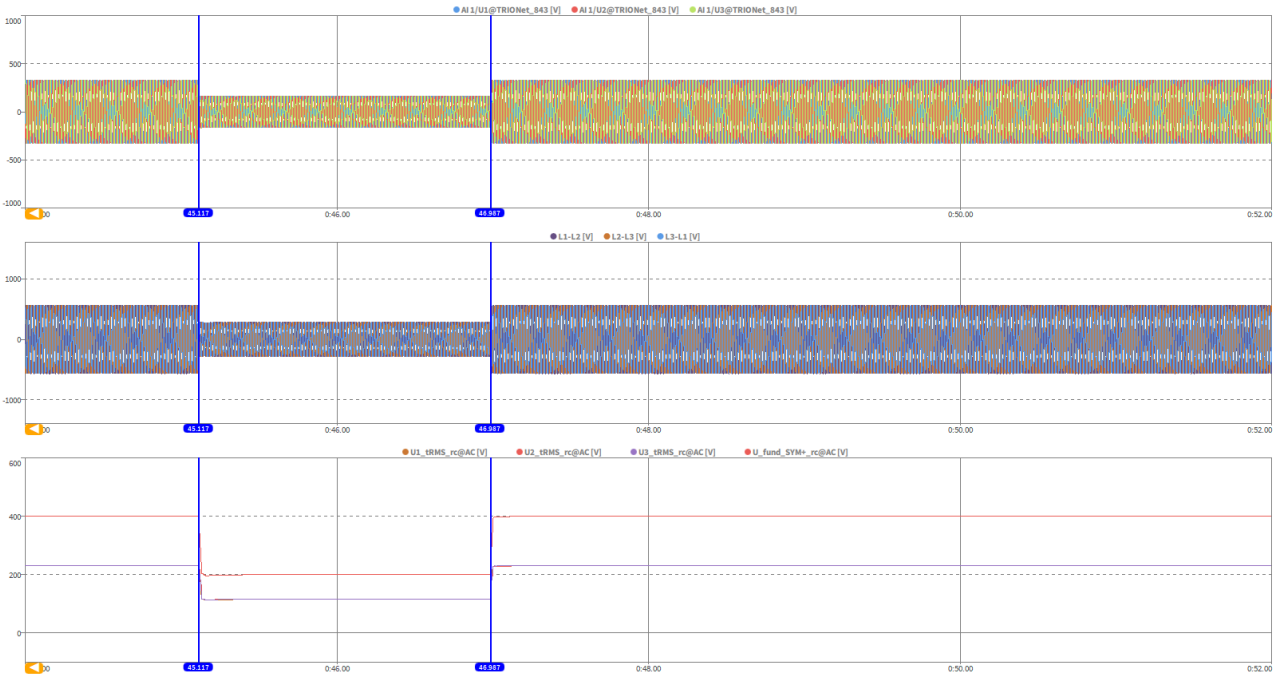

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]
0:36.00
0:38.00
0:40.00
0:42.00

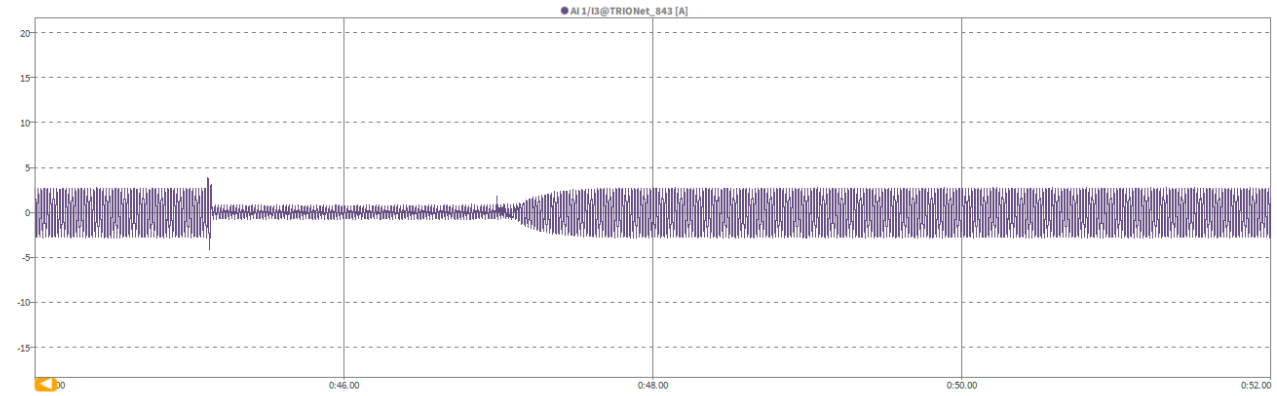


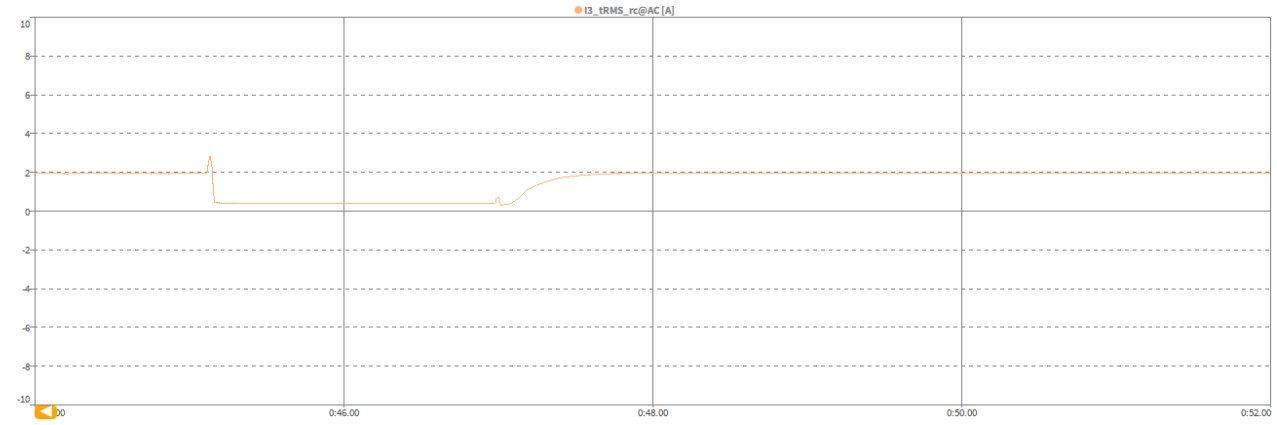
	A	B	间隔
时间 [s]	0:38.16005	0:38.94706	0.78701
U1_tRMS_rc@AC [V]	219.6242	230.1660	10.54175
U2_tRMS_rc@AC [V]	205.0216	230.8834	25.86177
U3_tRMS_rc@AC [V]	222.6315	230.9129	8.281464
P3_t_rc@AC [W]	1.188088	1518.547	1517.359
Q3_t_rc@AC [var]	159.2366	31.79605	-127.4406

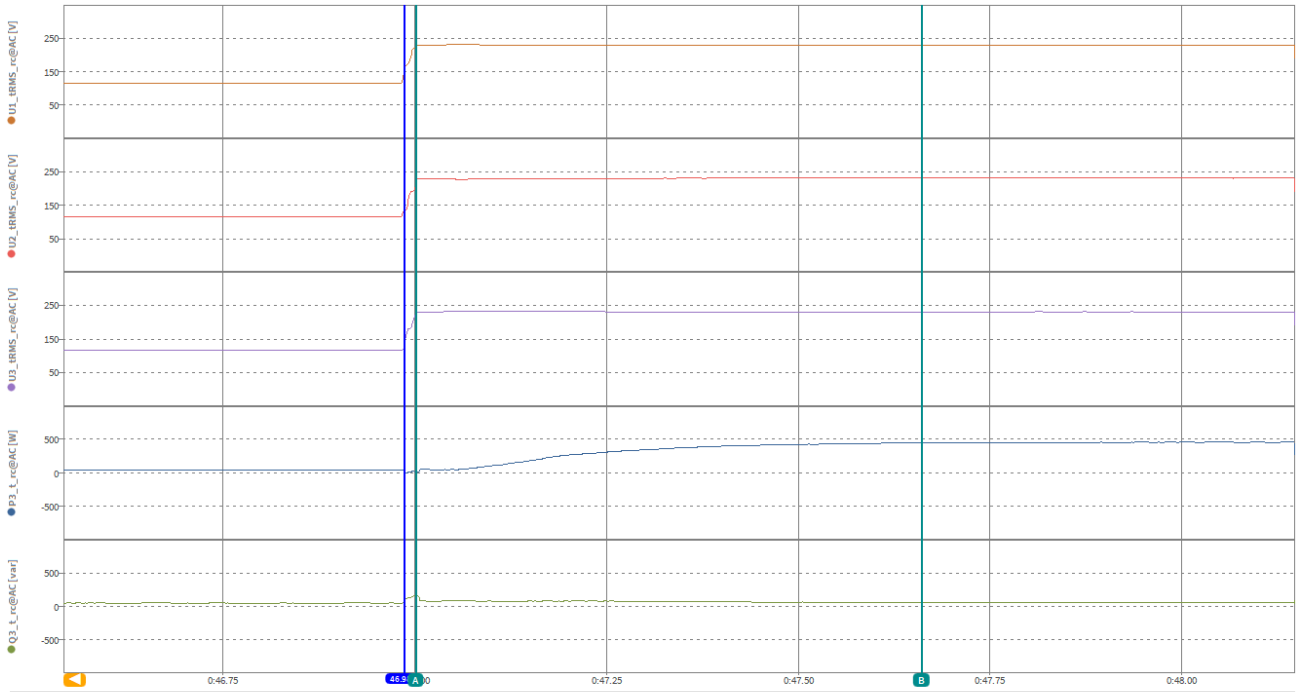
3.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	3.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	16:21:18		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.50		
	5	Drop duration setpoint	Total	--	[ms]	1870		
	6	Fault occurrence (t1)	Total	--	[ms]	45117		
	7	Fault clearance (t2)	Total	--	[ms]	46987		
	8	Fault duration determined from no-load test	Total	--	[ms]	1870		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.499	0.502	0.501
	10		Positive sequence		[p.u.]	0.500	0.500	0.500
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.499	0.502	0.501
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.069
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.065
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.021
	22		Positive sequence			--	--	0.021
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.659
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
45.117
46.987
0:46.00
0:48.00
0:50.00
0:52.00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:46.00
0:48.00
0:50.00
0:52.00

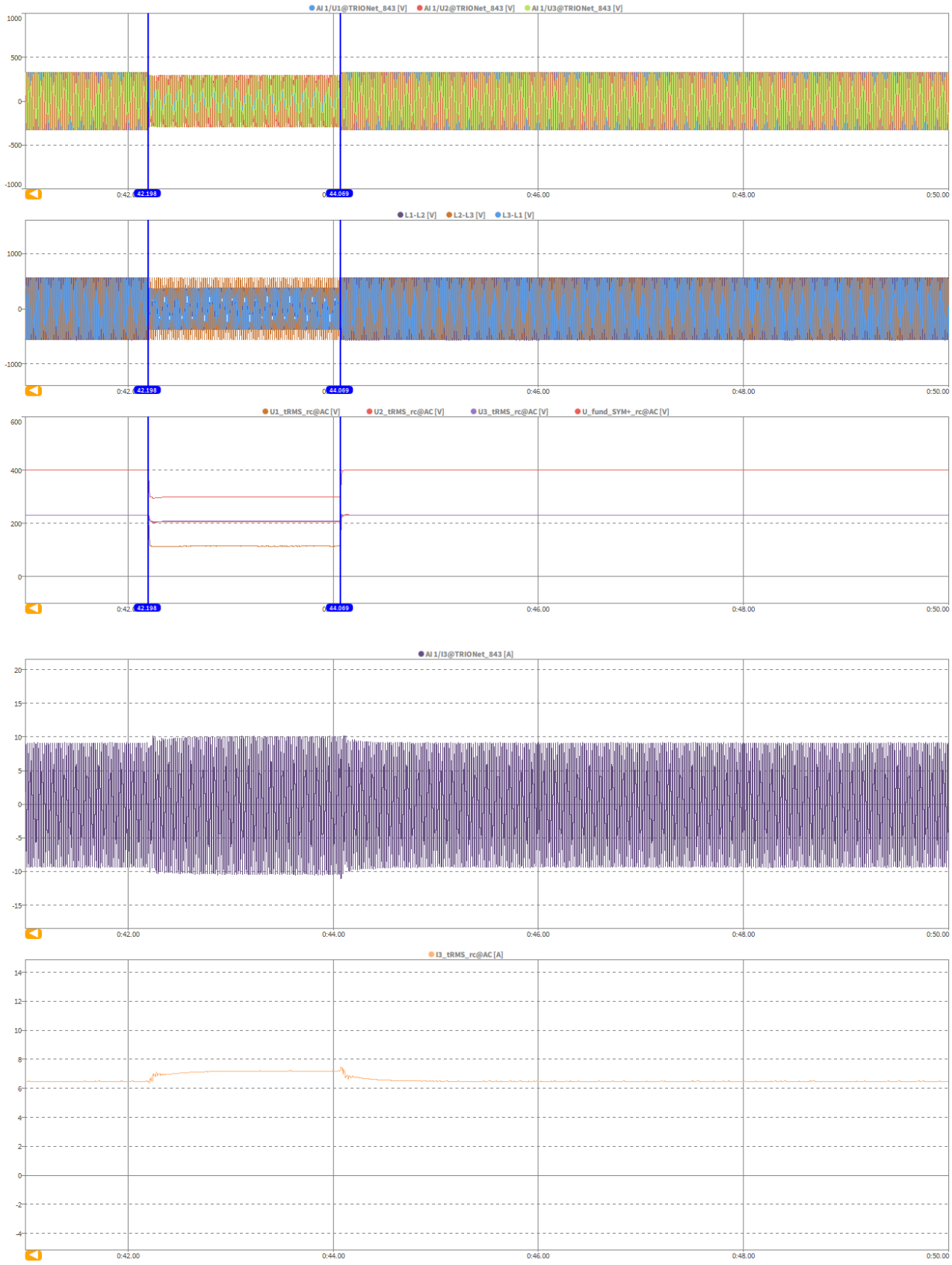

I3_tRMS_rc@AC [A]
10
8
6
4
2
0
-2
-4
-6
-8
-10
0:46.00
0:48.00
0:50.00
0:52.00

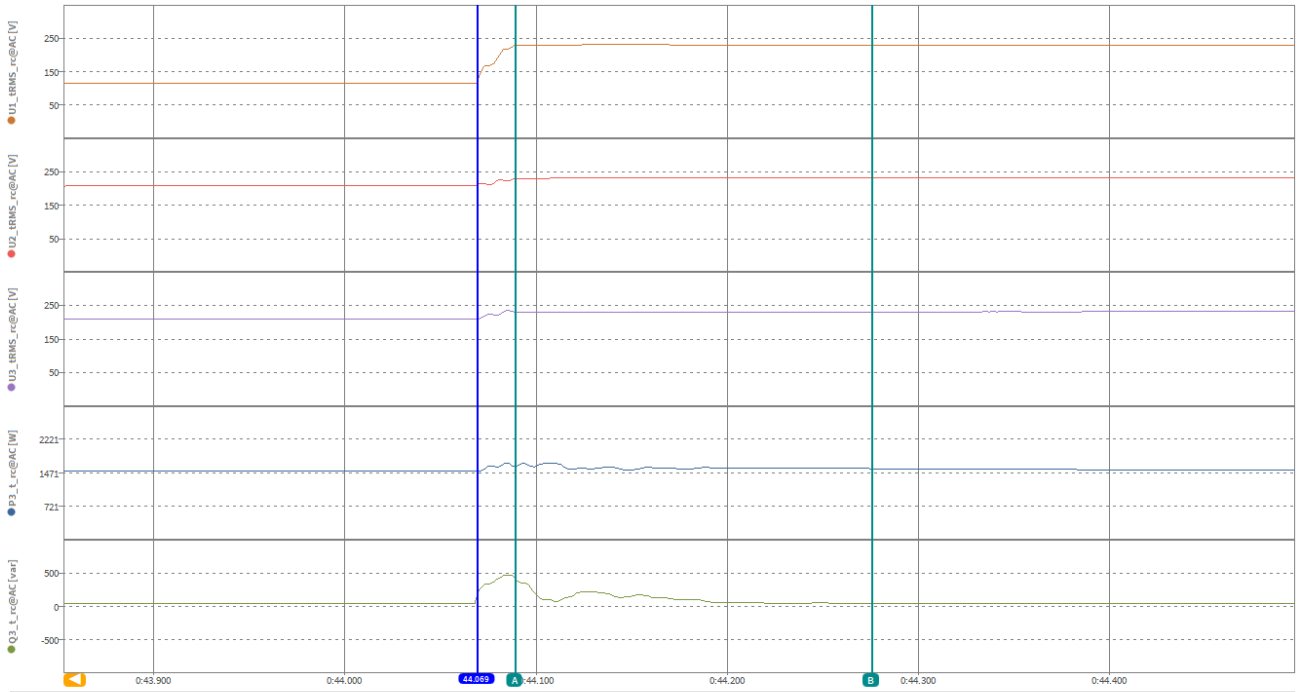


	A	B	间隔
时间 [s]	0:47.00255	0:47.66142	0.65887
U1_tRMS_rc@AC [V]	219.3655	230.2290	10.86354
U2_tRMS_rc@AC [V]	201.5977	230.9135	29.31572
U3_tRMS_rc@AC [V]	220.3500	230.7809	10.43091
P3_t_rc@AC [W]	6.567738	439.1481	432.5804
Q3_t_rc@AC [var]	153.8341	45.39782	-108.4363

3.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	3.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:56:09		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.50	0.90	0.90
	5	Drop duration setpoint	Total	--	[ms]	1870		
	6	Fault occurrence (t1)	Total	--	[ms]	42198		
	7	Fault clearance (t2)	Total	--	[ms]	44069		
	8	Fault duration determined from no-load test	Total	--	[ms]	1871		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.499	0.901	0.905
	10		Positive sequence		[p.u.]	0.750	0.750	0.750
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.997
	14		Positive sequence			--	--	0.997
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.003
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.499	0.901	0.905
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	1.058
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	1.082
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.991
	22		Positive sequence			--	--	0.991
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.186
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.003
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

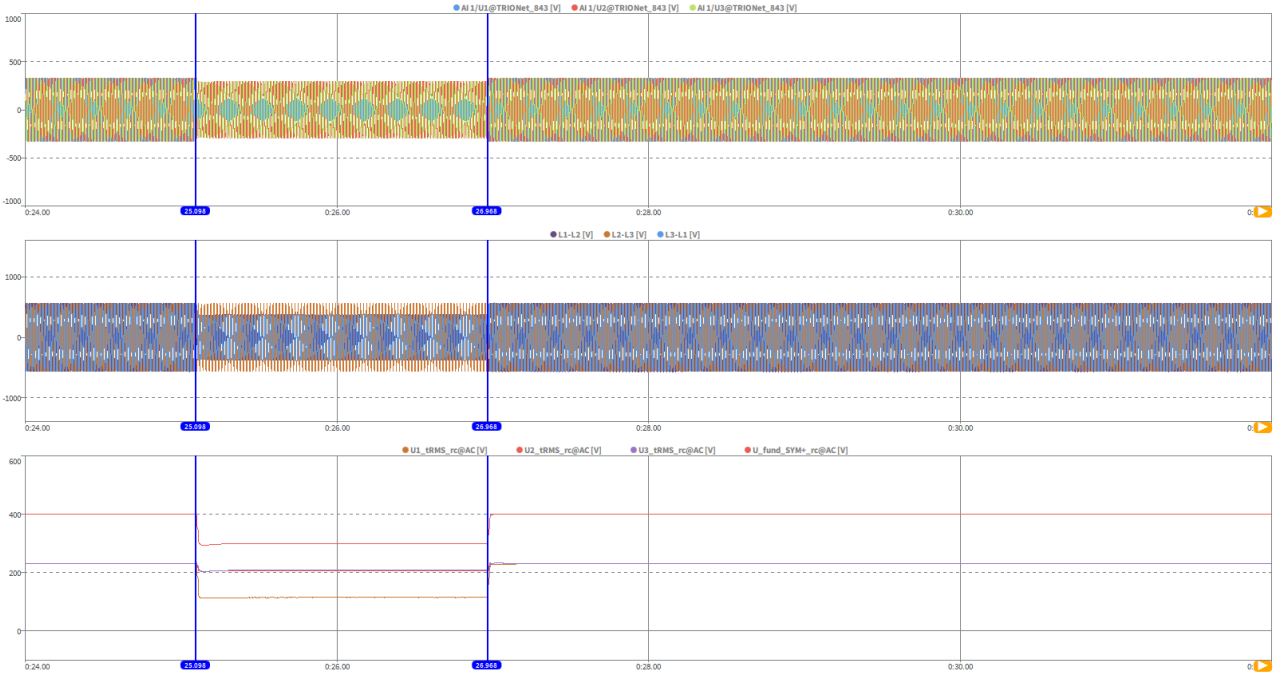

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:42.198
0:44.069
0:46.00
0:48.00
0:50.00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:42.198
0:44.069
0:46.00
0:48.00
0:50.00
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:42.198
0:44.069
0:46.00
0:48.00
0:50.00
AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:42.00
0:44.00
0:46.00
0:48.00
0:50.00
I3_tRMS_rc@AC [A]
14
12
10
8
6
4
2
0
-2
-4
0:42.00
0:44.00
0:46.00
0:48.00
0:50.00

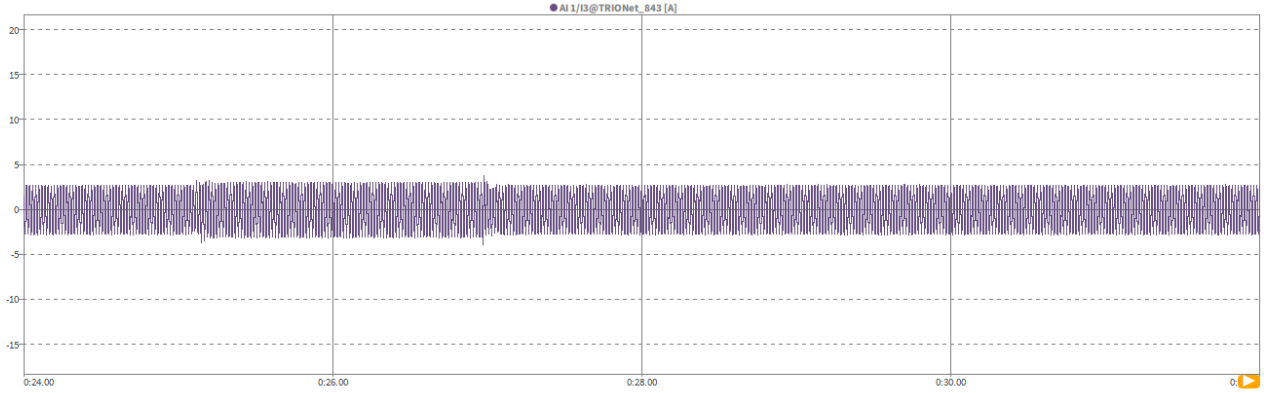


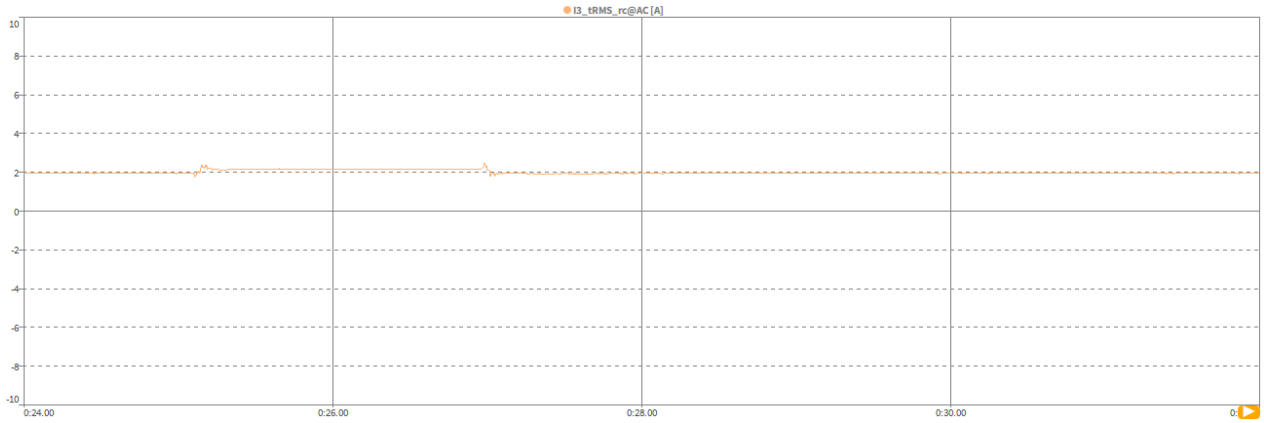
	A	B	间隔
时间 [s]	0:44.08906	0:44.27546	0.18639
U1_tRMS_rc@AC [V]	223.0673	230.3294	7.262070
U2_tRMS_rc@AC [V]	227.1950	231.2150	4.019958
U3_tRMS_rc@AC [V]	231.4881	230.7980	-0.690063
P3_t_rc@AC [W]	1613.327	1548.484	-64.84351
Q3_t_rc@AC [var]	452.0759	34.95417	-417.1217

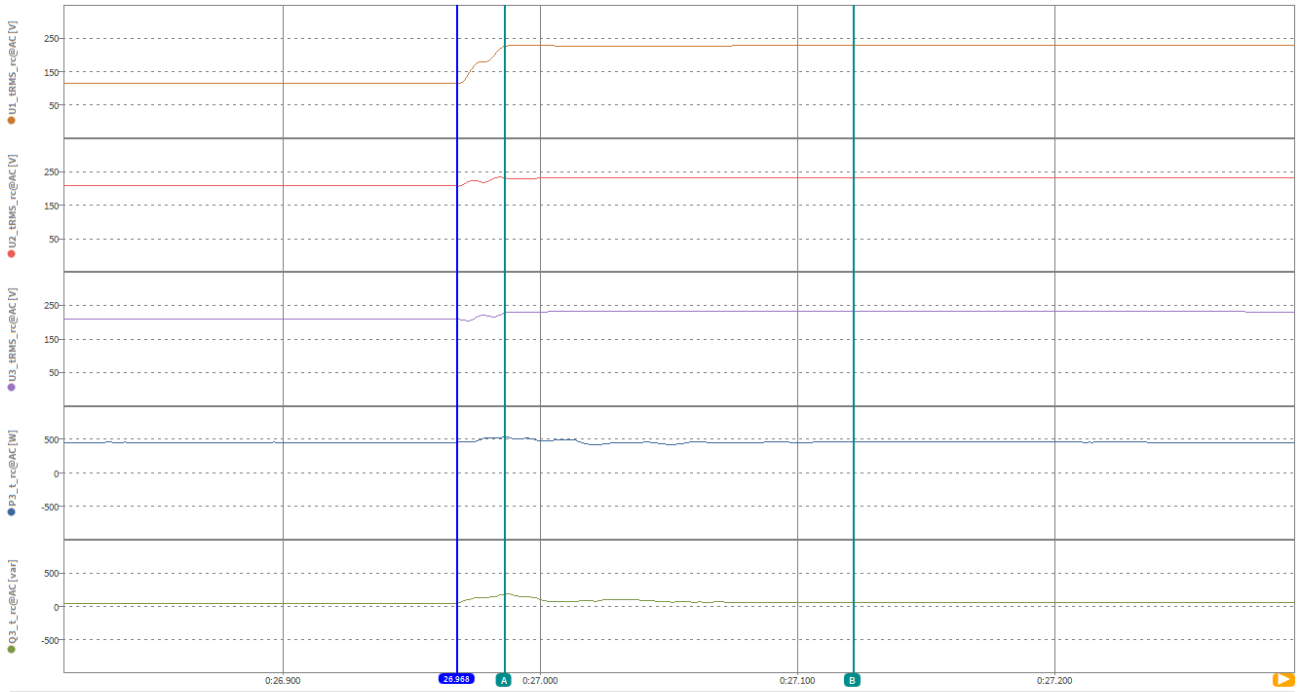
3.4

General information	0	Test no.	--	--	--	3.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	16:30:06		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.50	0.90	0.90
	5	Drop duration setpoint	Total	--	[ms]	1870		
	6	Fault occurrence (t1)	Total	--	[ms]	25098		
	7	Fault clearance (t2)	Total	--	[ms]	26968		
	8	Fault duration determined from no-load test	Total	--	[ms]	1870		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.498	0.902	0.904
	10		Positive sequence		[p.u.]	0.750	0.750	0.750
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.498	0.902	0.904
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.338
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.356
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.298
	22		Positive sequence			--	--	0.298
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.136
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:24.00
25.098
0:26.00
28.968
0:28.00
0:30.00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:24.00
25.098
0:26.00
28.968
0:28.00
0:30.00
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:24.00
25.098
0:26.00
28.968
0:28.00
0:30.00


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:24.00
0:26.00
0:28.00
0:30.00

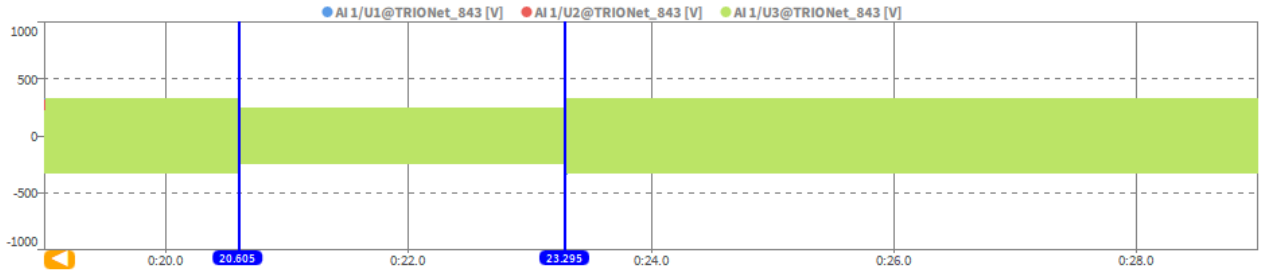

I3_tRMS_rc@AC [A]
10
8
6
4
2
0
-2
-4
-6
-8
-10
0:24.00
0:26.00
0:28.00
0:30.00

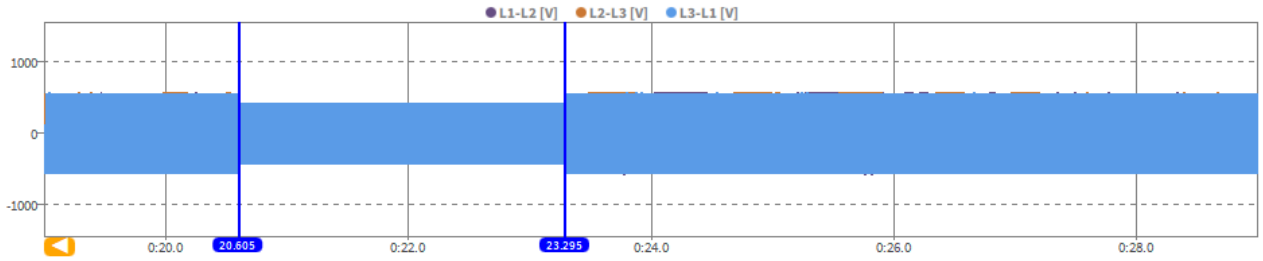


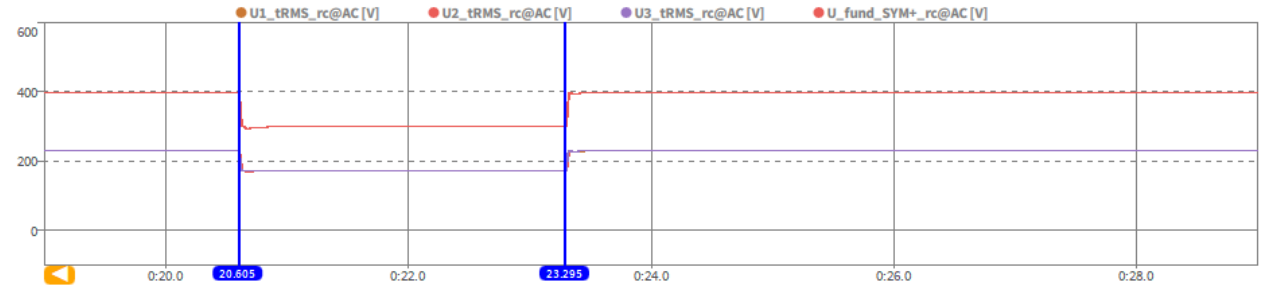
	A	B	间隔
时间 [s]	0:26.9860	0:27.1216	0.1356
U1_tRMS_rc@AC [V]	223.7481	228.9407	5.192551
U2_tRMS_rc@AC [V]	233.1902	231.6047	-1.585526
U3_tRMS_rc@AC [V]	224.9599	231.4280	6.468109
P3_t_rc@AC [W]	524.2485	457.3639	-66.88455
Q3_t_rc@AC [var]	164.2749	40.69179	-123.5832

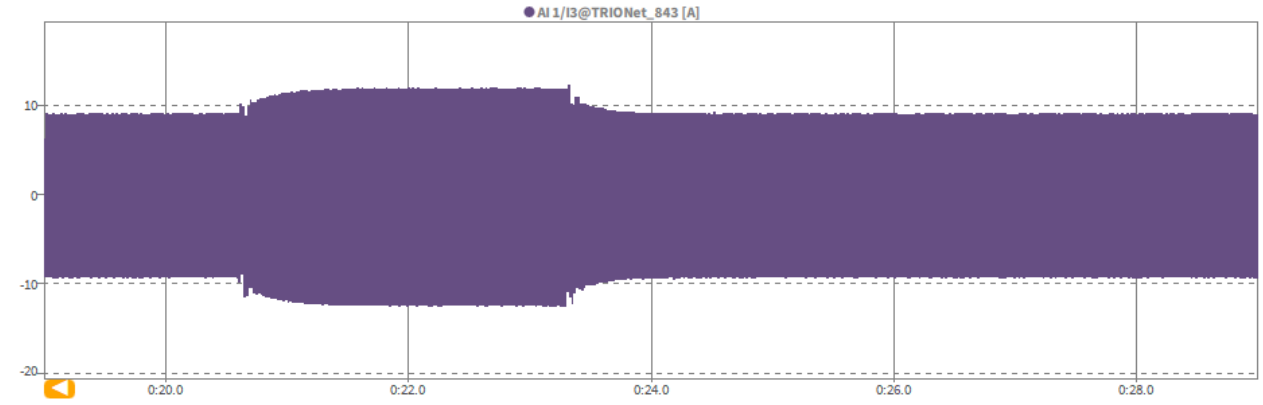
4.1

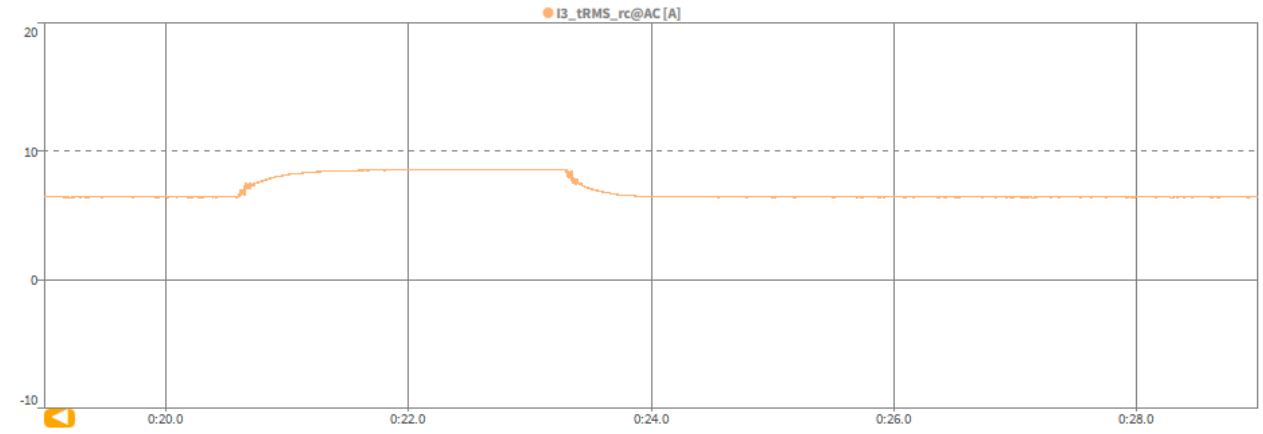
	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	4.1		
	1	Date	--	--	[dd.mm.yyyy]	07.04.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:27:32		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.75		
	5	Drop duration setpoint	Total	--	[ms]	2690		
	6	Fault occurrence (t1)	Total	--	[ms]	20605		
	7	Fault clearance (t2)	Total	--	[ms]	23295		
	8	Fault duration determined from no-load test	Total	--	[ms]	2690		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.749	0.752	0.752
	10		Positive sequence		[p.u.]	0.750	0.750	0.750
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.000	1.003	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.985
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.988
	14		Positive sequence			--	--	0.988
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.005
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.749	0.752	0.752
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	1.146
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	1.141
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.971
	22		Positive sequence			--	--	0.971
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.000	1.003	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.988
	25		Positive sequence			--	--	0.988
	26	Response time active power	Positive sequence	--	[s]	--	--	0.321
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.006
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

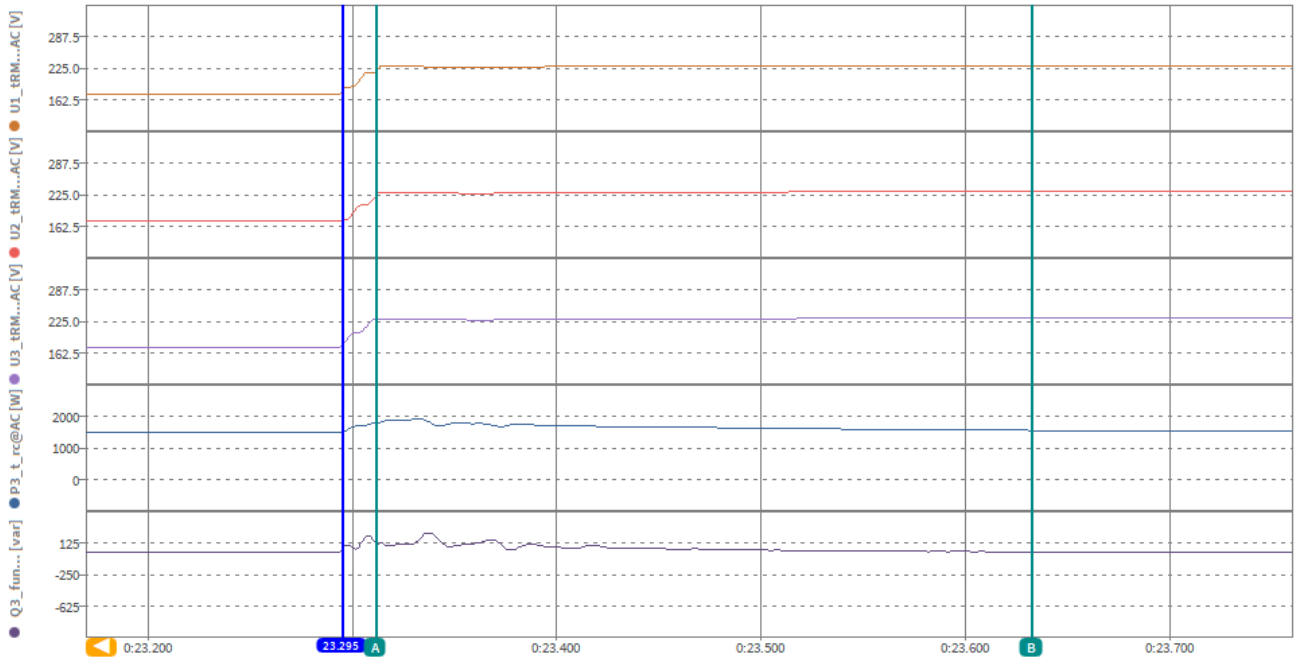

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:20.0
20.605
0:22.0
23.295
0:24.0
0:26.0
0:28.0


L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:20.0
20.605
0:22.0
23.295
0:24.0
0:26.0
0:28.0


U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:20.0
20.605
0:22.0
23.295
0:24.0
0:26.0
0:28.0


AI 1/I3@TRIONet_843 [A]
10
0
-10
-20
0:20.0
0:22.0
0:24.0
0:26.0
0:28.0

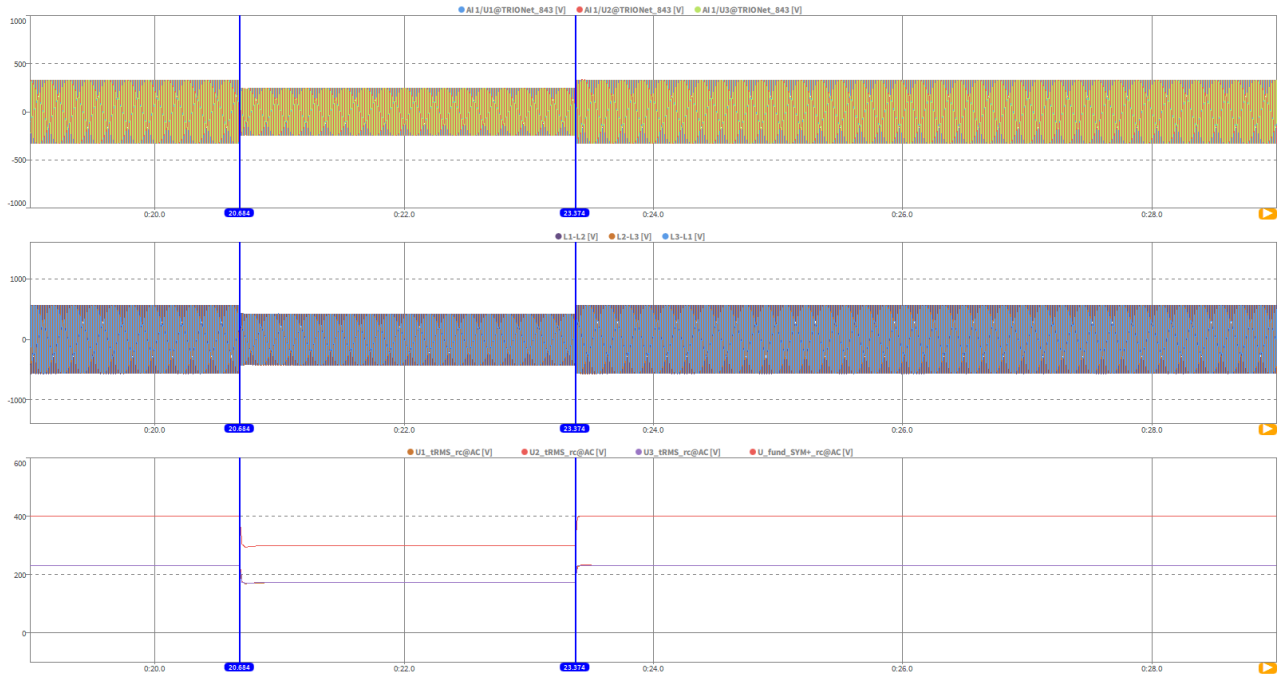

I3_tRMS_rc@AC [A]
20
10
0
-10
0:20.0
0:22.0
0:24.0
0:26.0
0:28.0

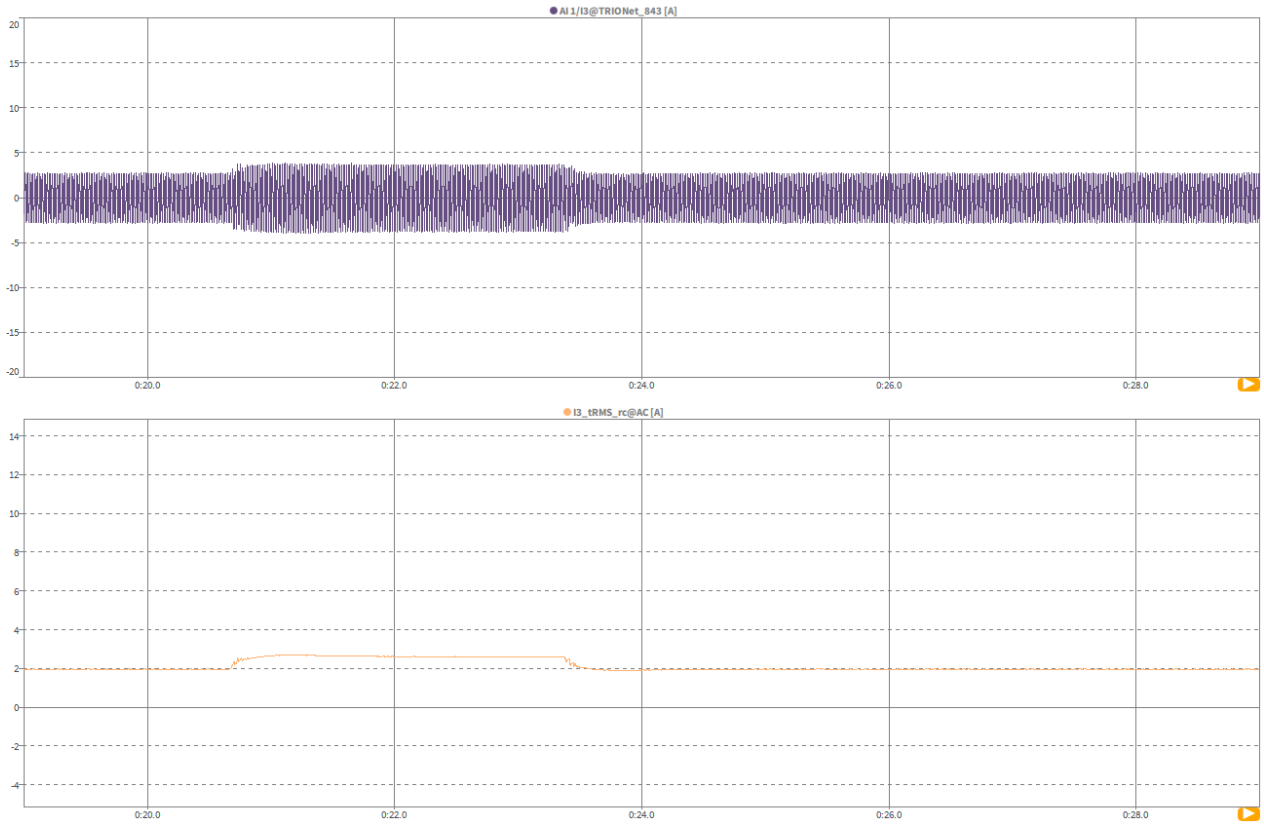


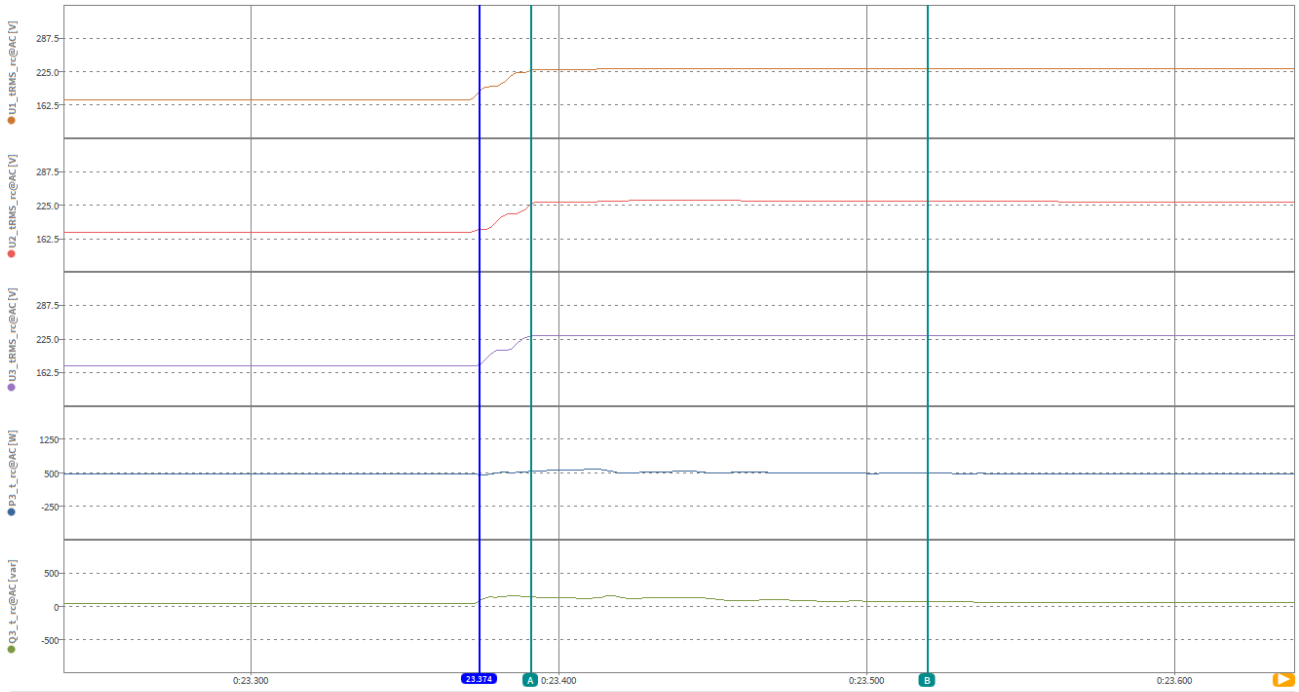
	A	B	Delta
Time [s]	0:23.311644	0:23.632347	0.320702
U1_tRMS_rc@AC [V]	215.8132	229.9360	14.12279
U2_tRMS_rc@AC [V]	213.9457	230.6979	16.75220
U3_tRMS_rc@AC [V]	226.9384	230.6012	3.662796
P3_t_rc@AC [W]	1792.208	1558.406	-233.8016
Q3_fund_rc@AC [var]	161.5754	19.12647	-142.4490

4.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	4.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:11:55		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.75		
	5	Drop duration setpoint	Total	--	[ms]	2690		
	6	Fault occurrence (t1)	Total	--	[ms]	20684		
	7	Fault clearance (t2)	Total	--	[ms]	23374		
	8	Fault duration determined from no-load test	Total	--	[ms]	2690		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.750	0.753	0.752
	10		Positive sequence		[p.u.]	0.751	0.751	0.751
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.299
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.300
	14		Positive sequence			--	--	0.300
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.031
	16		Positive sequence			--	--	0.010
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.750	0.753	0.752
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.336
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.383
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.302
	22		Positive sequence			--	--	0.302
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.300
	25		Positive sequence			--	--	0.300
	26	Response time active power	Positive sequence	--	[s]	--	--	0.129
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.031
	28		Positive sequence			--	--	0.010
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

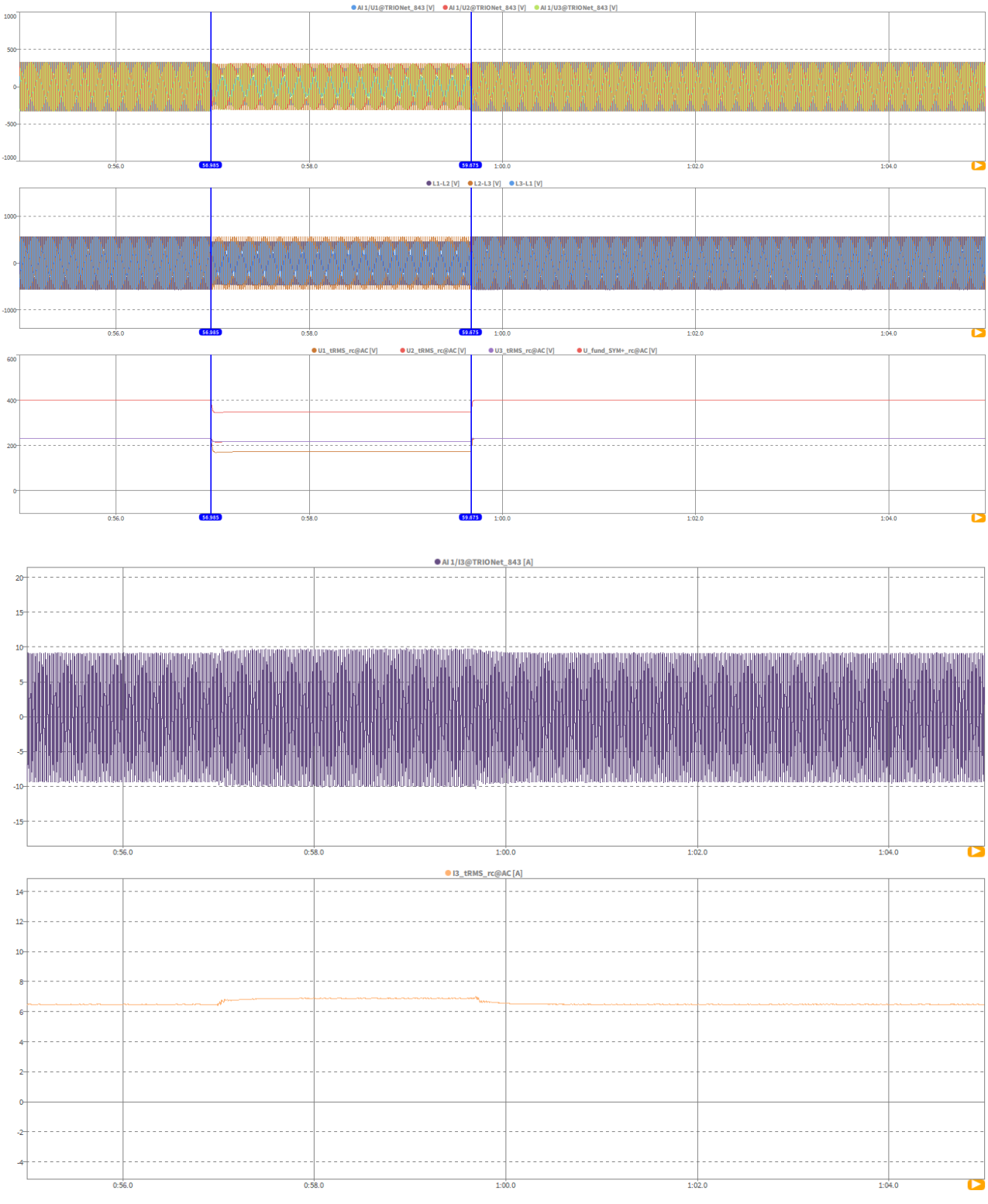

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

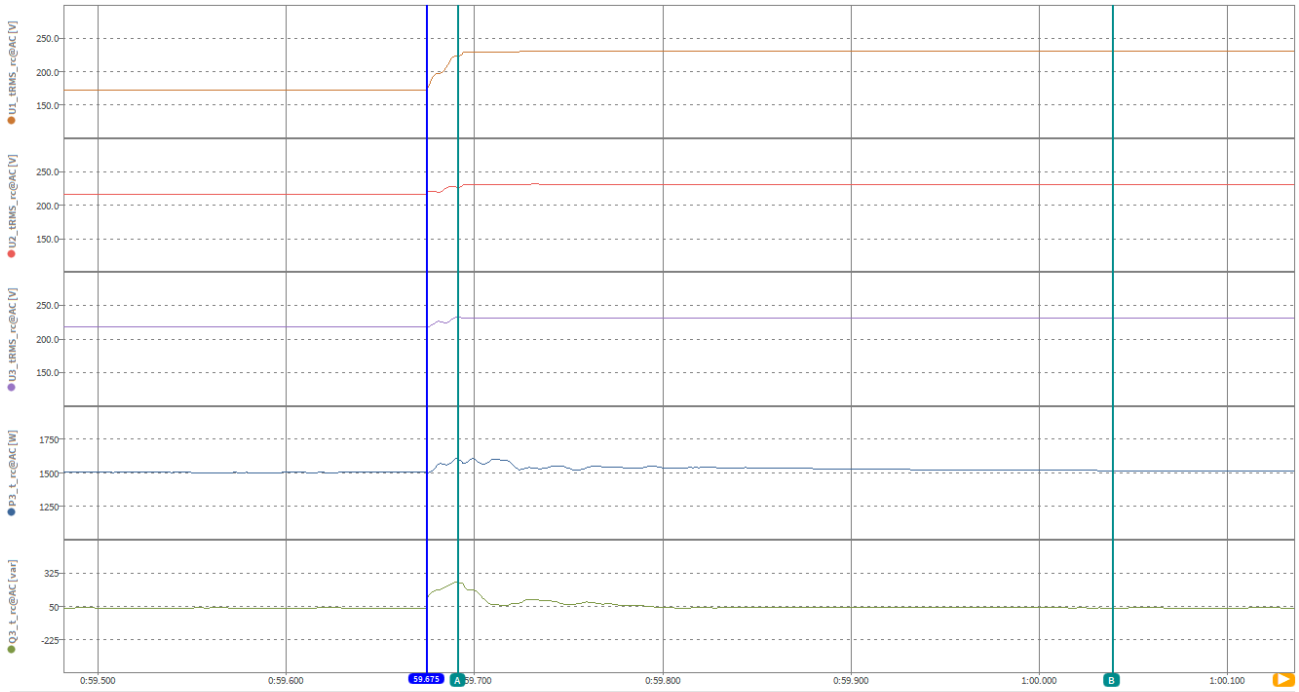


	A	B	间隔
时间 [s]	0:23.3911	0:23.5198	0.1287
U1_tRMS_rc@AC [V]	224.7804	230.4381	5.657639
U2_tRMS_rc@AC [V]	222.8112	231.9763	9.165070
U3_tRMS_rc@AC [V]	229.2818	231.0619	1.780182
P3_t_rc@AC [W]	514.4996	470.7920	-43.70767
Q3_t_rc@AC [var]	125.0505	54.56340	-70.48706

4.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	4.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:01:17		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.75	0.94	0.94
	5	Drop duration setpoint	Total	--	[ms]	2690		
	6	Fault occurrence (t1)	Total	--	[ms]	56985		
	7	Fault clearance (t2)	Total	--	[ms]	59675		
	8	Fault duration determined from no-load test	Total	--	[ms]	2690		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.749	0.943	0.945
	10		Positive sequence		[p.u.]	0.873	0.873	0.873
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.002
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.749	0.943	0.945
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	1.028
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	1.045
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.995
	22		Positive sequence			--	--	0.995
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.347
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.003
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

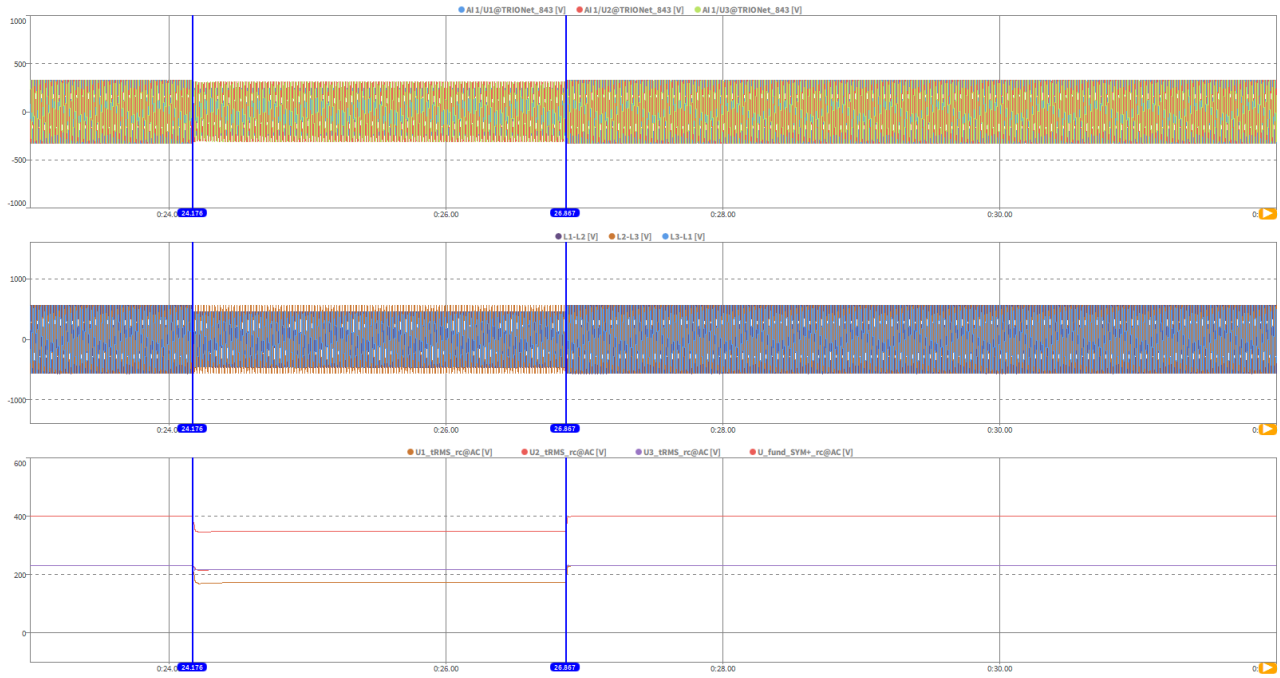

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]
0:56.0
0:58.0
1:00.0
1:02.0
1:04.0

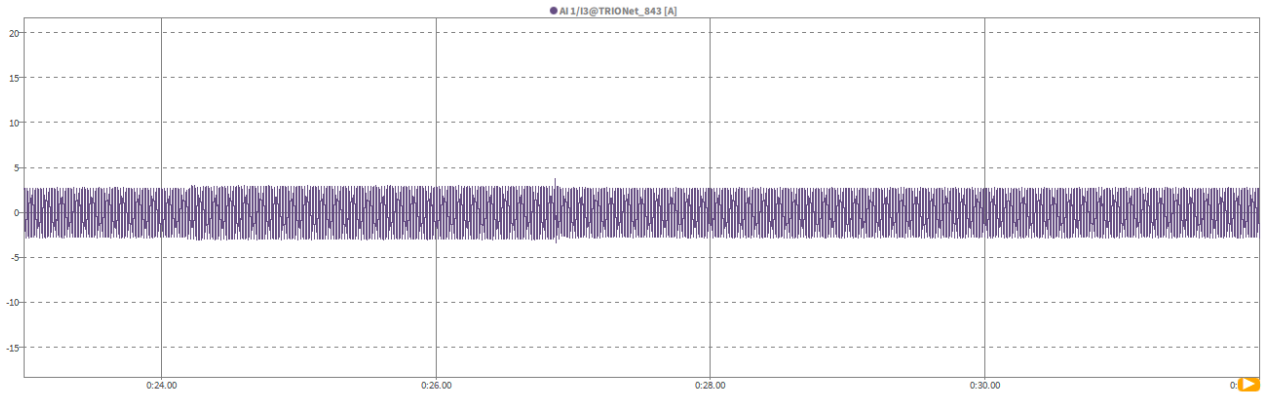


	A	B	间隔
时间 [s]	0:59.69157	1:00.03889	0.34732
U1_tRMS_rc@AC [V]	223.8116	230.1546	6.342987
U2_tRMS_rc@AC [V]	226.6294	230.9599	4.330566
U3_tRMS_rc@AC [V]	232.1019	230.9147	-1.187164
P3_t_rc@AC [W]	1599.973	1509.908	-90.06555
Q3_t_rc@AC [var]	241.7324	29.44504	-212.2874

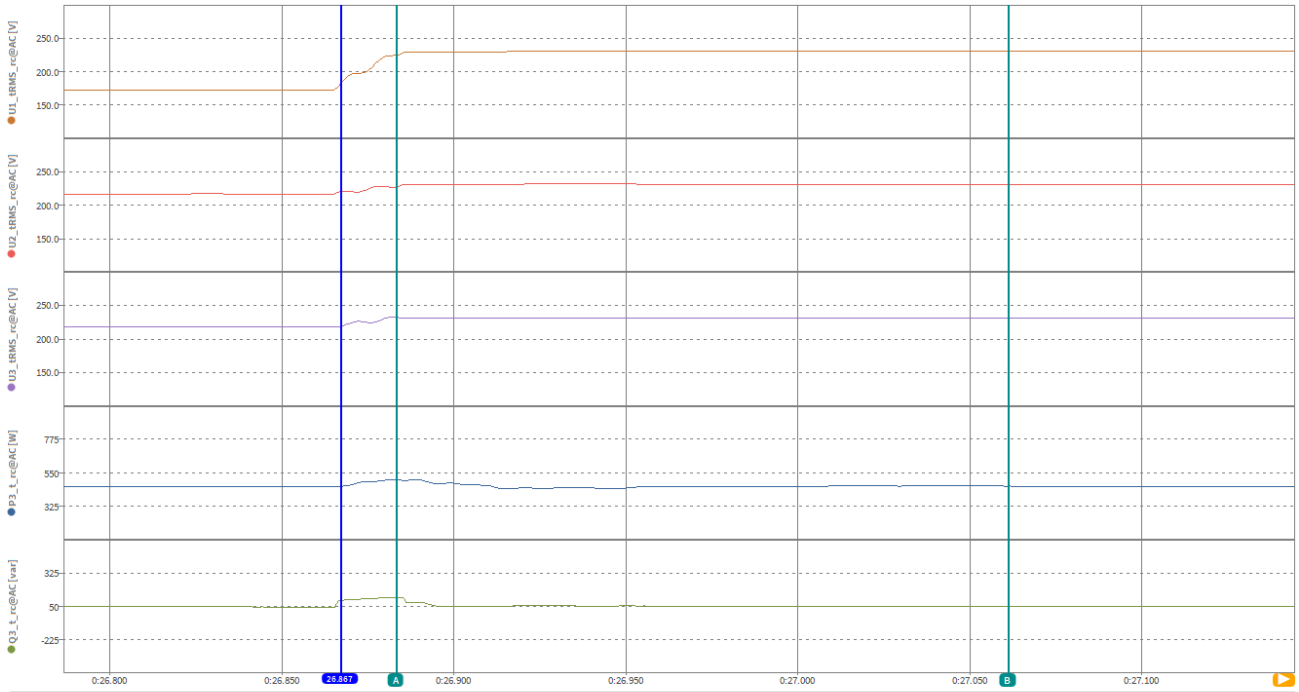
4.4

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	4.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:14:22		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.75	0.94	0.94
	5	Drop duration setpoint	Total	--	[ms]	2690		
	6	Fault occurrence (t1)	Total	--	[ms]	24176		
	7	Fault clearance (t2)	Total	--	[ms]	26867		
	8	Fault duration determined from no-load test	Total	--	[ms]	2691		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.749	0.943	0.944
	10		Positive sequence		[p.u.]	0.874	0.874	0.874
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.299
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.300
	14		Positive sequence			--	--	0.300
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.750	0.939	0.943
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.327
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.331
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.300
	22		Positive sequence			--	--	0.300
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.300
	25		Positive sequence			--	--	0.300
	26	Response time active power	Positive sequence	--	[s]	--	--	0.178
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:24.176
0:26.00
26.867
0:28.00
0:30.00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
24.176
0:26.00
26.867
0:28.00
0:30.00
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
24.176
0:26.00
26.867
0:28.00
0:30.00


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:24.00
0:26.00
0:28.00
0:30.00

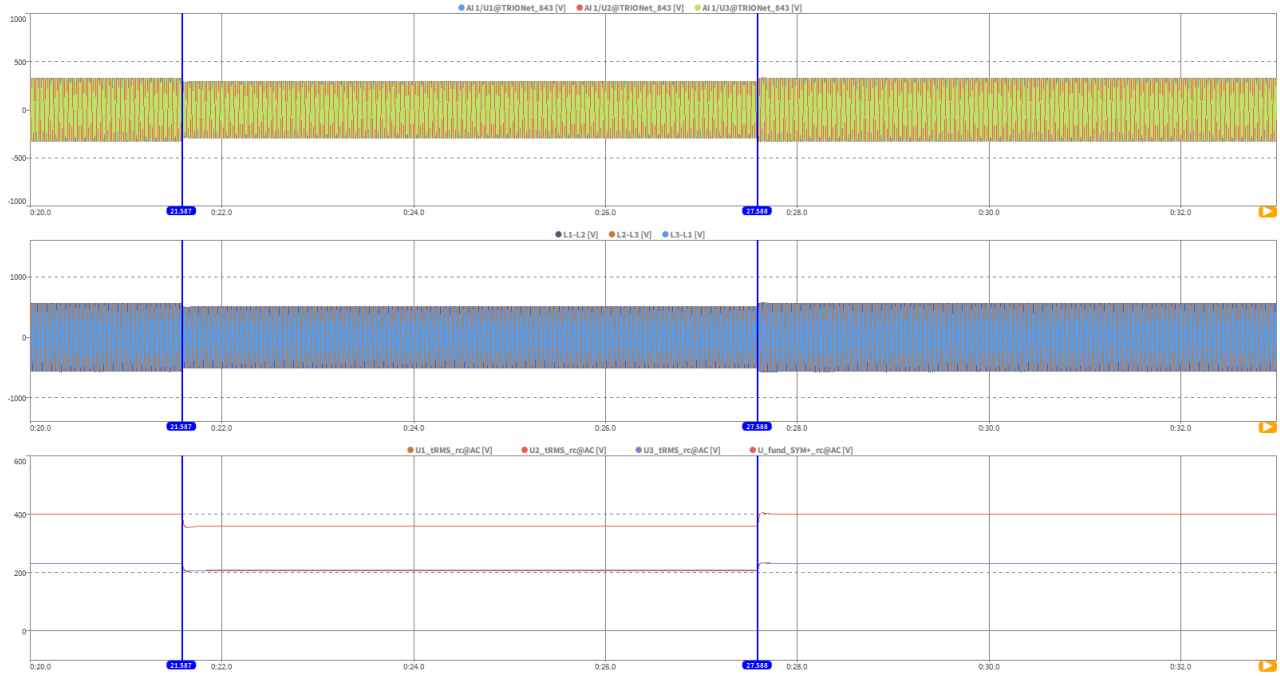

I3_tRMS_rc@AC [A]
14
12
10
8
6
4
2
0
-2
-4
0:24.00
0:26.00
0:28.00
0:30.00

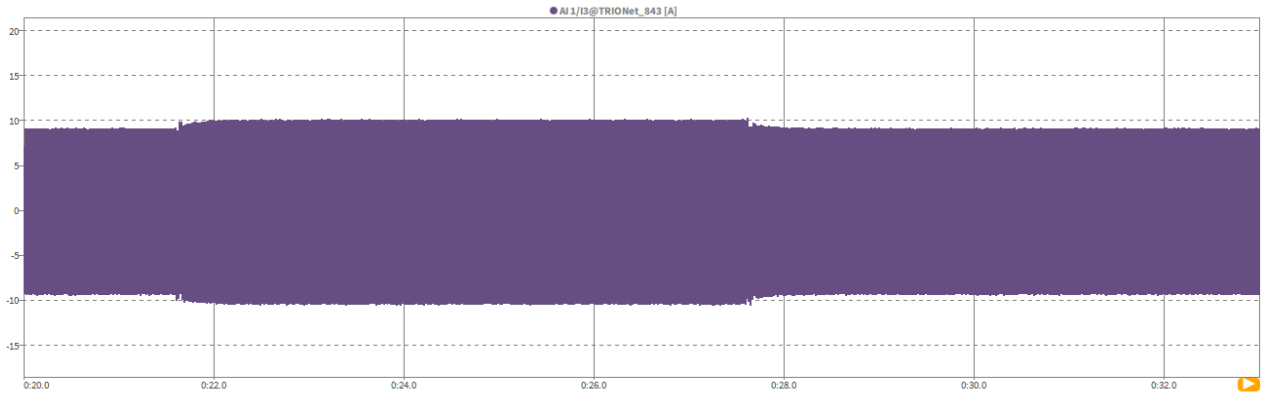


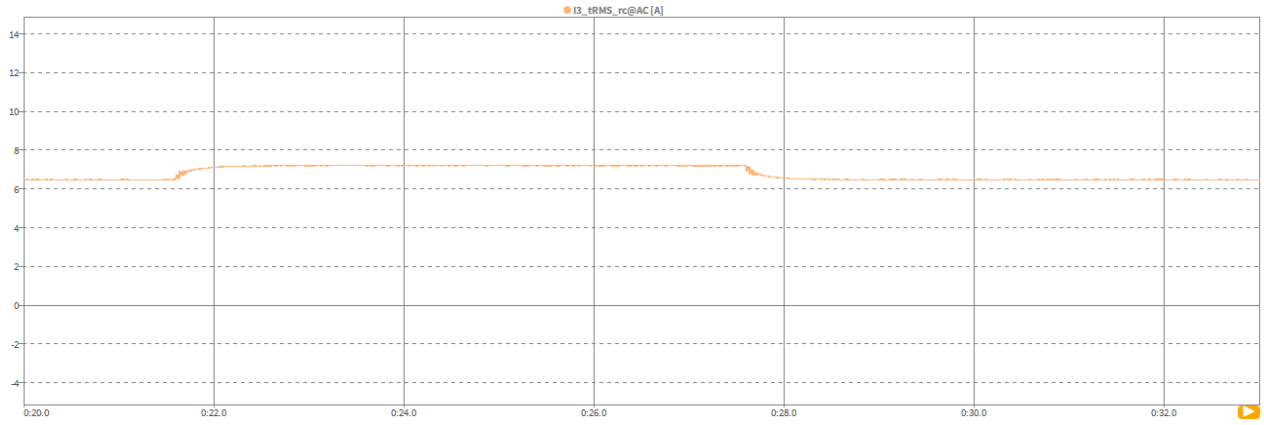
	A	B	间隔
时间 [s]	0:26.88333	0:27.06112	0.17779
U1_tRMS_rc@AC [V]	224.0857	230.3532	6.267548
U2_tRMS_rc@AC [V]	226.3557	231.1268	4.771088
U3_tRMS_rc@AC [V]	232.4481	230.7387	-1.709366
P3_t_rc@AC [W]	499.1612	453.9705	-45.19073
Q3_t_rc@AC [var]	117.1463	40.74951	-76.39675

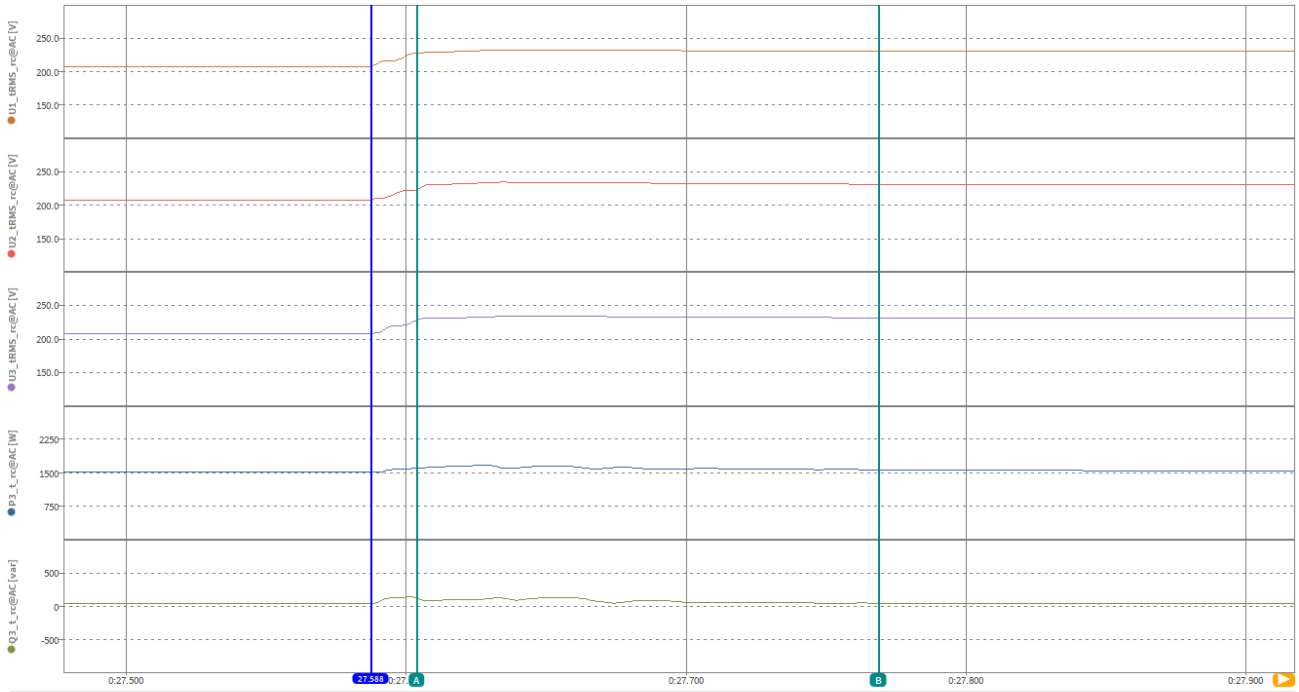
5.1

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	5.1		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:04:15		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.90		
	5	Drop duration setpoint	Total	--	[ms]	6000		
	6	Fault occurrence (t1)	Total	--	[ms]	21587		
	7	Fault clearance (t2)	Total	--	[ms]	27588		
	8	Fault duration determined from no-load test	Total	--	[ms]	6001		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.900	0.903	0.903
	10		Positive sequence		[p.u.]	0.901	0.901	0.901
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.001
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.900	0.903	0.903
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	1.061
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	1.063
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.995
	22		Positive sequence			--	--	0.995
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.165
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.001
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]


AI 1/I3@TRIONet_843 [A]

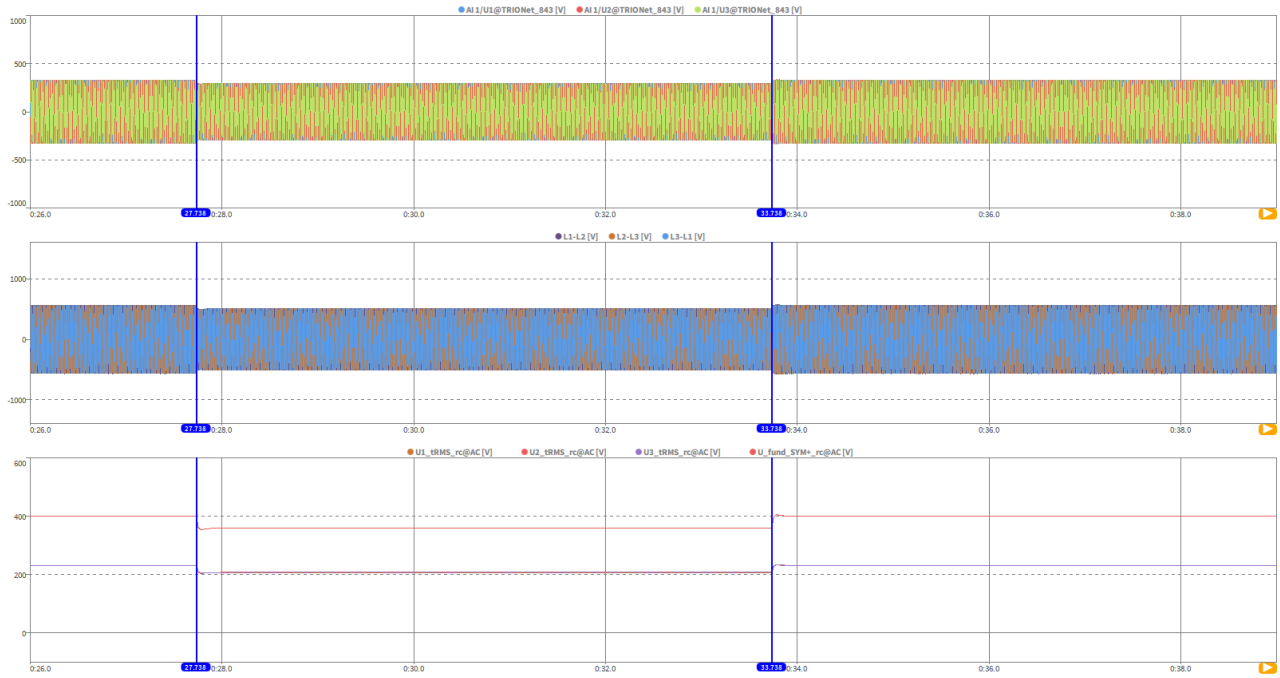

I3_tRMS_rc@AC [A]

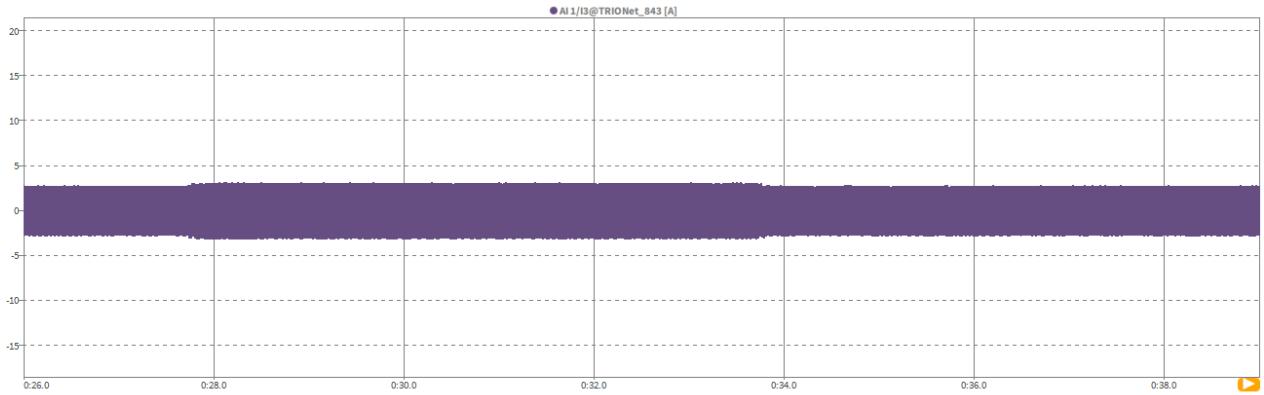


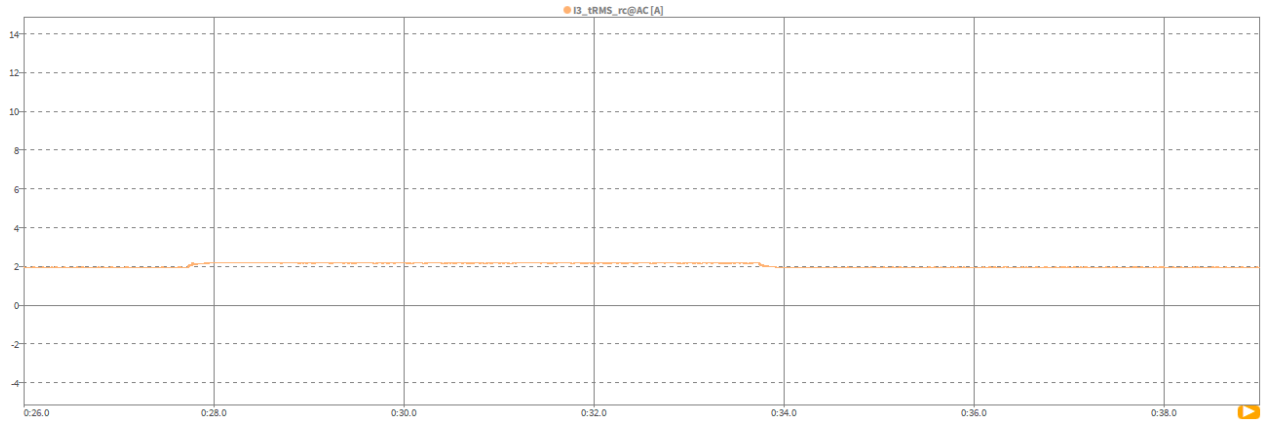
	A	B	间隔
时间 [s]	0:27.60409	0:27.76888	0.16479
U1_tRMS_rc@AC [V]	227.2694	230.7221	3.452728
U2_tRMS_rc@AC [V]	222.5780	231.4766	8.898636
U3_tRMS_rc@AC [V]	226.9123	231.4429	4.530594
P3_t_rc@AC [W]	1585.704	1550.664	-35.04053
Q3_t_rc@AC [var]	111.4750	35.65183	-75.82316

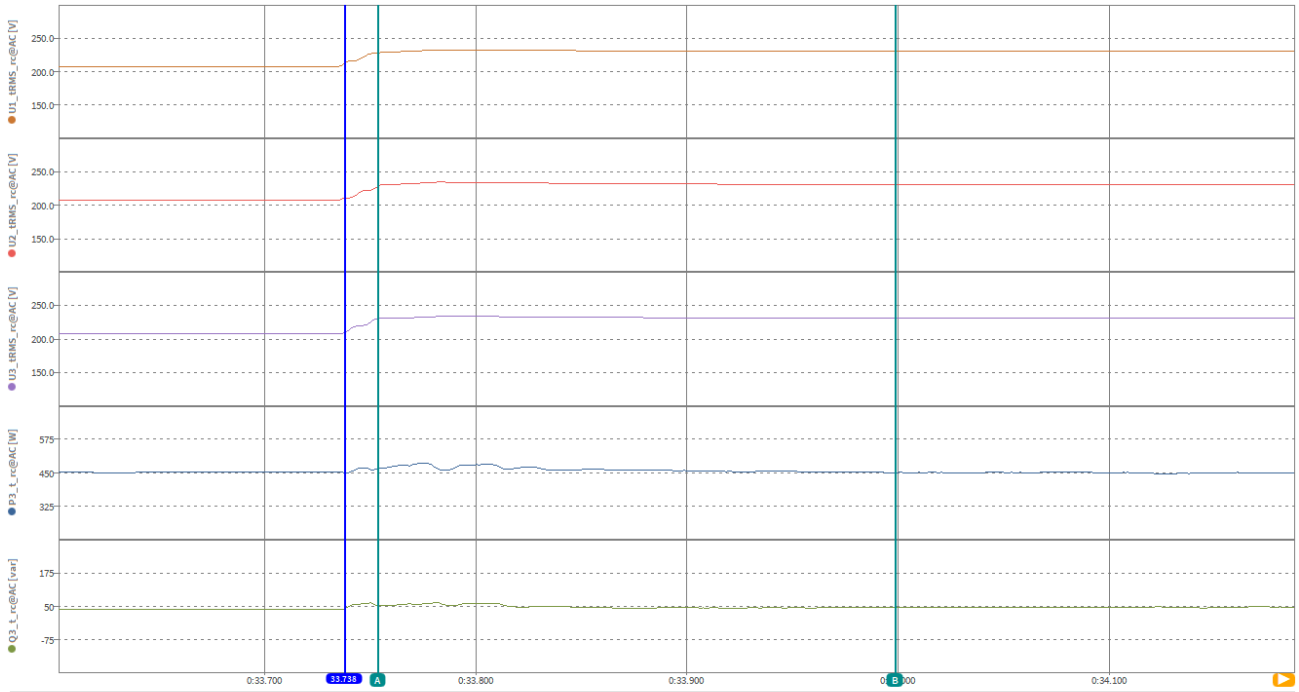
5.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	5.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:16:38		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.90		
	5	Drop duration setpoint	Total	--	[ms]	6000		
	6	Fault occurrence (t1)	Total	--	[ms]	27738		
	7	Fault clearance (t2)	Total	--	[ms]	33738		
	8	Fault duration determined from no-load test	Total	--	[ms]	6000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.900	0.903	0.903
	10		Positive sequence		[p.u.]	0.902	0.902	0.902
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.299
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.300
	14		Positive sequence			--	--	0.300
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.030
	16		Positive sequence			--	--	0.008
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.900	0.903	0.903
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.333
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.330
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.300
	22		Positive sequence			--	--	0.300
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.300
	25		Positive sequence			--	--	0.300
	26	Response time active power	Positive sequence	--	[s]	--	--	0.245
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.030
	28		Positive sequence			--	--	0.009
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]


AI 1/I3@TRIONet_843 [A]

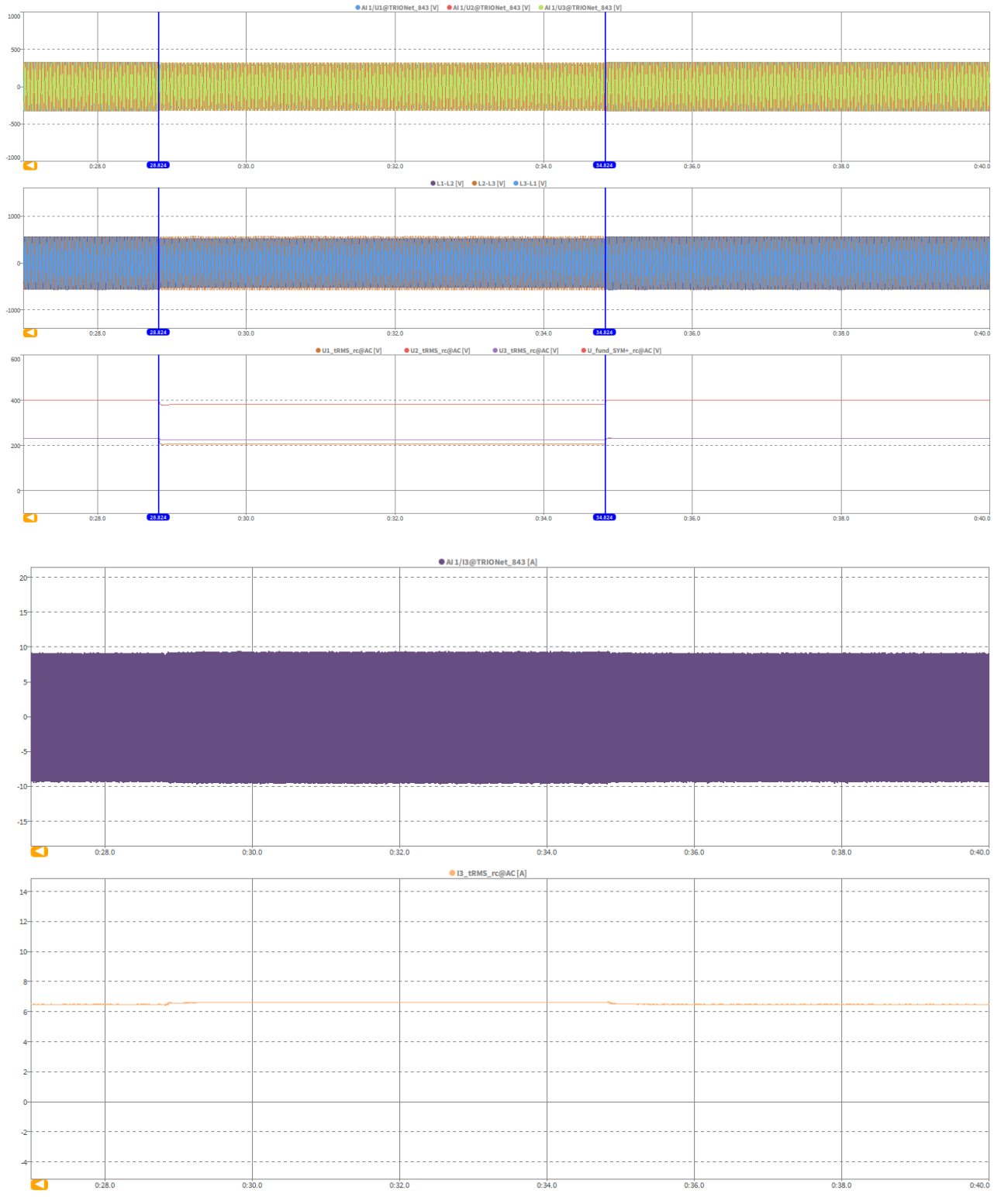

I3_tRMS_rc@AC [A]

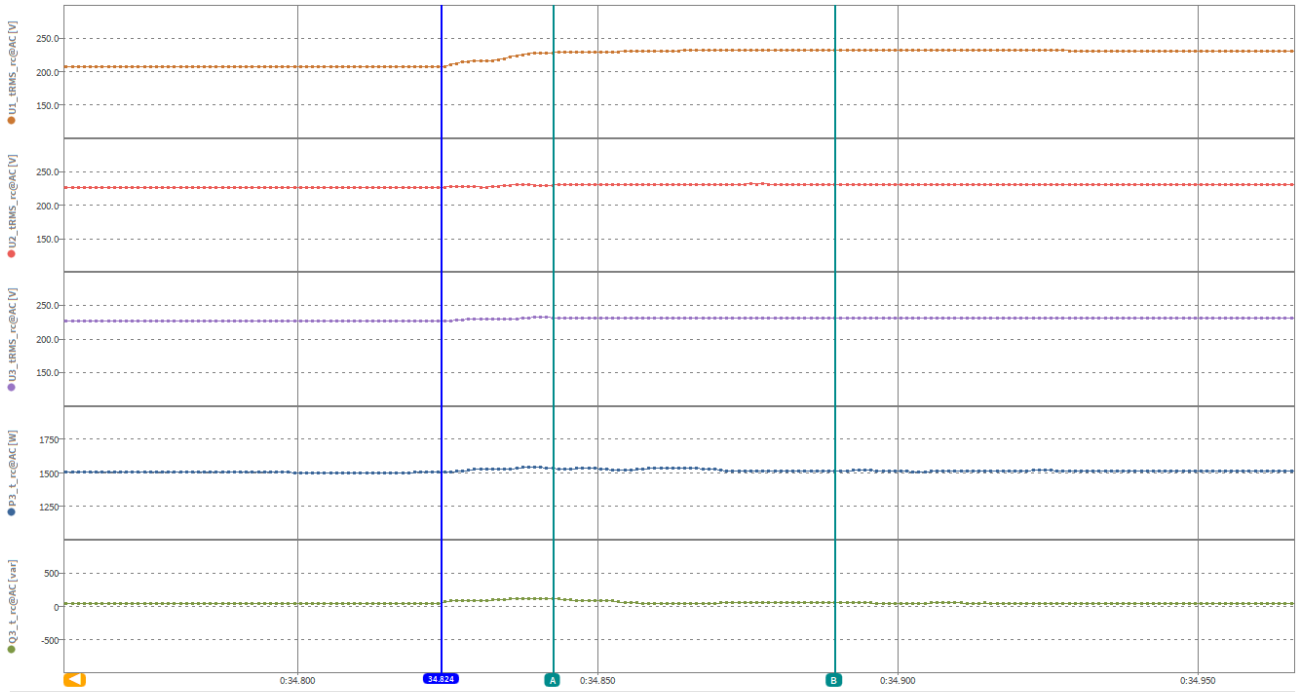


	A	B	间隔
时间 [s]	0:33.75414	0:33.99886	0.24472
U1_tRMS_rc@AC [V]	227.4129	230.3491	2.936142
U2_tRMS_rc@AC [V]	224.6046	231.0993	6.494781
U3_tRMS_rc@AC [V]	228.9594	230.9179	1.958542
P3_t_rc@AC [W]	459.6790	448.1010	-11.57797
Q3_t_rc@AC [var]	52.11831	42.28850	-9.829807

5.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	5.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:08:39		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.90	0.98	0.98
	5	Drop duration setpoint	Total	--	[ms]	6000		
	6	Fault occurrence (t1)	Total	--	[ms]	28824		
	7	Fault clearance (t2)	Total	--	[ms]	34824		
	8	Fault duration determined from no-load test	Total	--	[ms]	6000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.900	0.984	0.985
	10		Positive sequence		[p.u.]	0.954	0.954	0.954
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.002
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.900	0.984	0.985
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.994
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.988
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.998
	22		Positive sequence			--	--	0.998
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.047
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.002
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

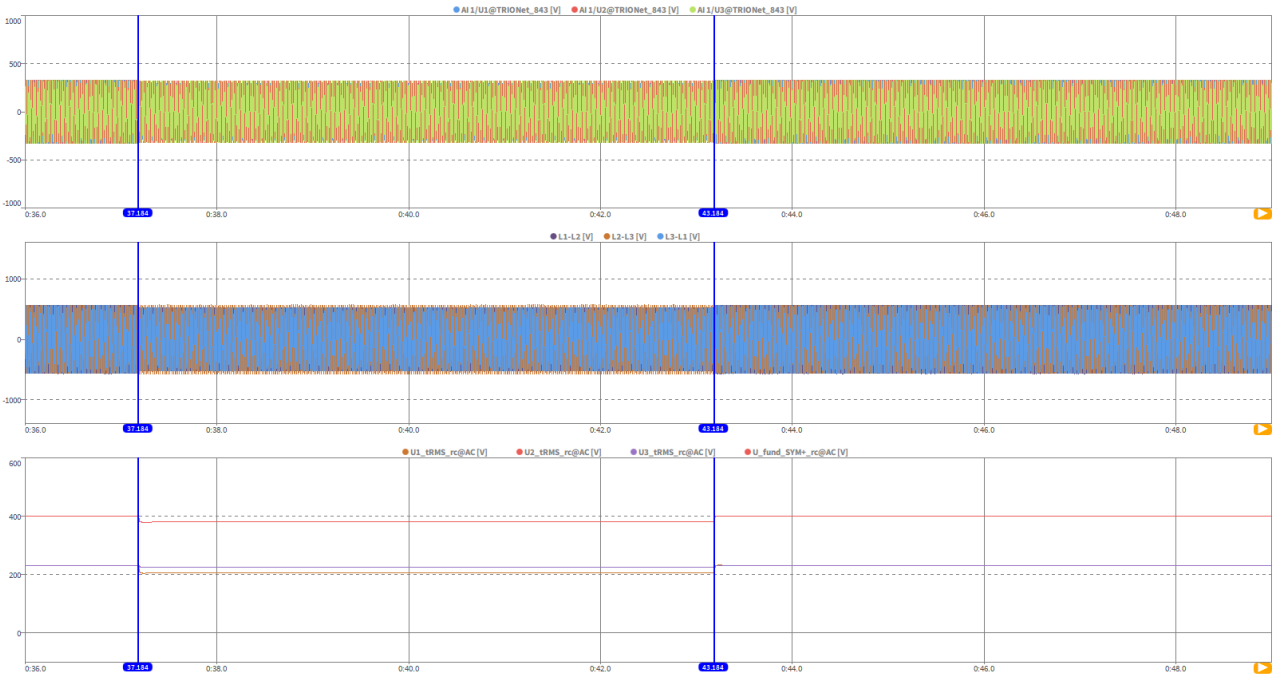

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

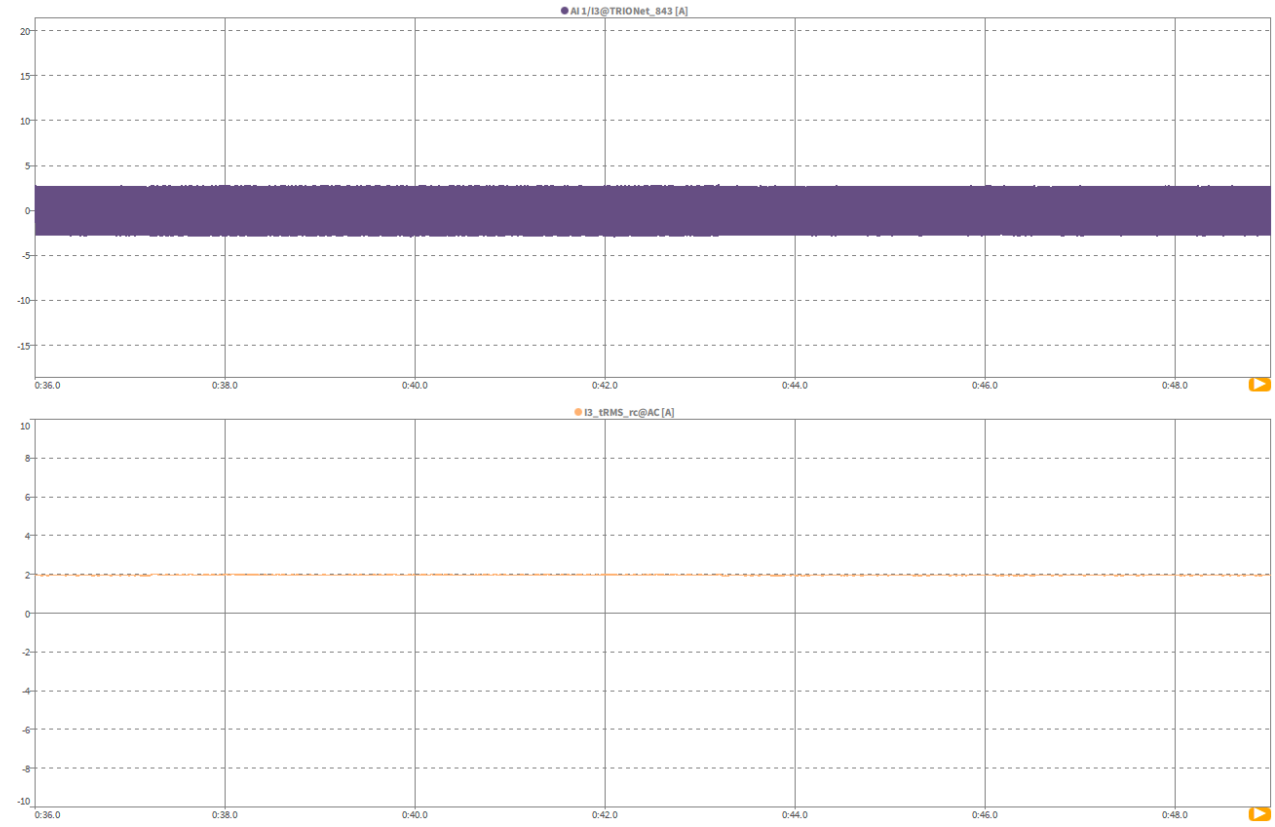


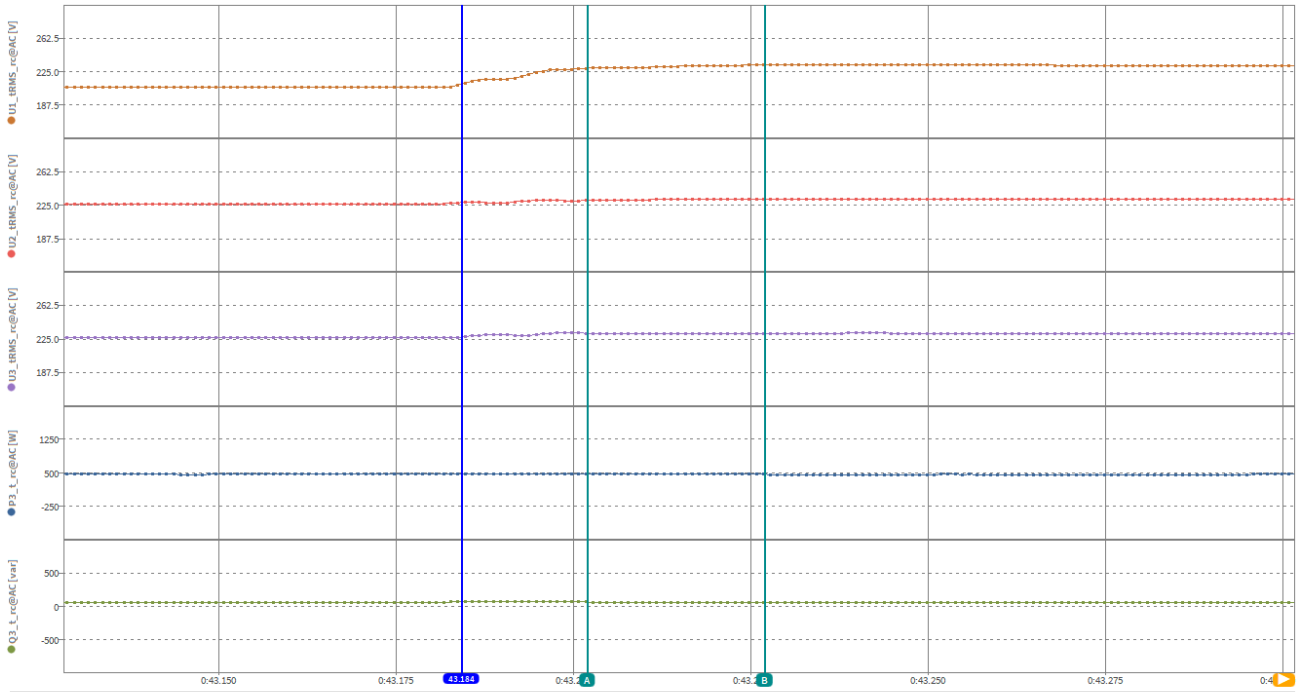
	A	B	间隔
时间 [s]	0:34.842536	0:34.889467	0.046931
U1_tRMS_rc@AC [V]	227.3950	232.7549	5.359924
U2_tRMS_rc@AC [V]	229.4863	231.5730	2.086777
U3_tRMS_rc@AC [V]	231.7405	231.2323	-0.508179
P3_t_rc@AC [W]	1531.738	1507.655	-24.08337
Q3_t_rc@AC [var]	102.0491	43.98962	-58.05946

5.4

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	5.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:20:10		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	0.90	0.98	0.98
	5	Drop duration setpoint	Total	--	[ms]	6000		
	6	Fault occurrence (t1)	Total	--	[ms]	37184		
	7	Fault clearance (t2)	Total	--	[ms]	43184		
	8	Fault duration determined from no-load test	Total	--	[ms]	6000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	0.900	0.984	0.984
	10		Positive sequence		[p.u.]	0.955	0.955	0.955
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.030
	16		Positive sequence			--	--	0.009
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	0.900	0.984	0.984
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.307
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.308
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.297
	22		Positive sequence			--	--	0.297
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.025
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

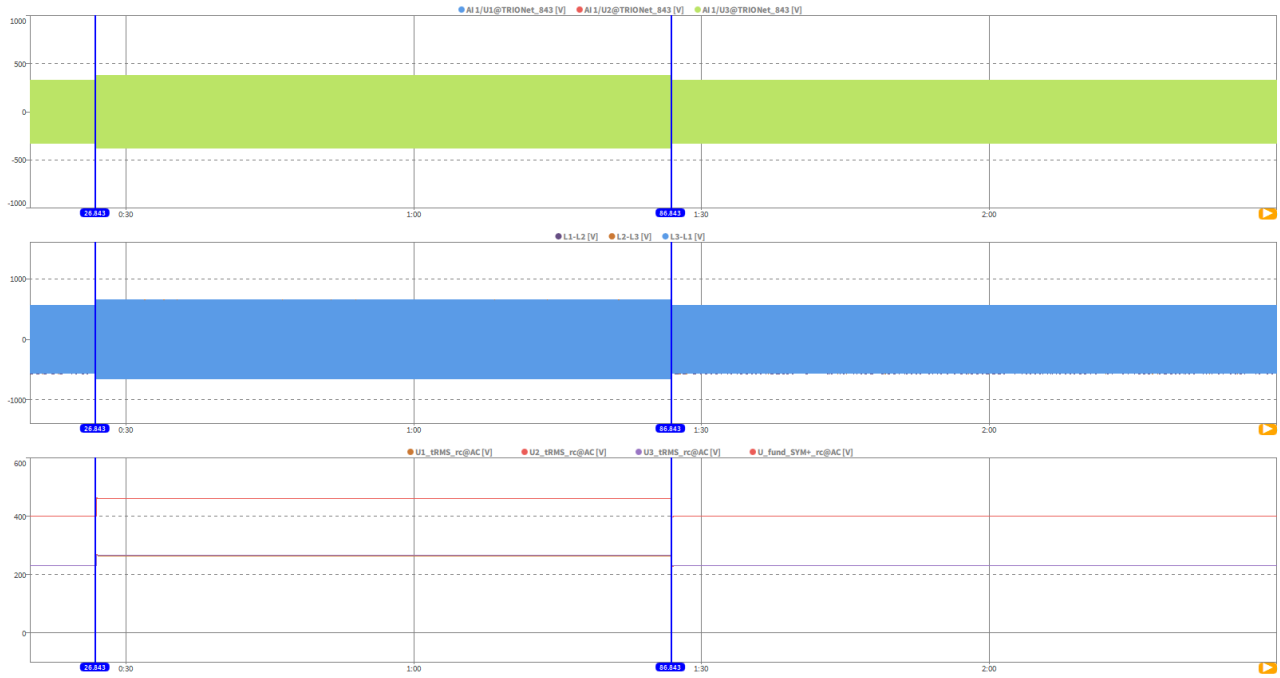

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

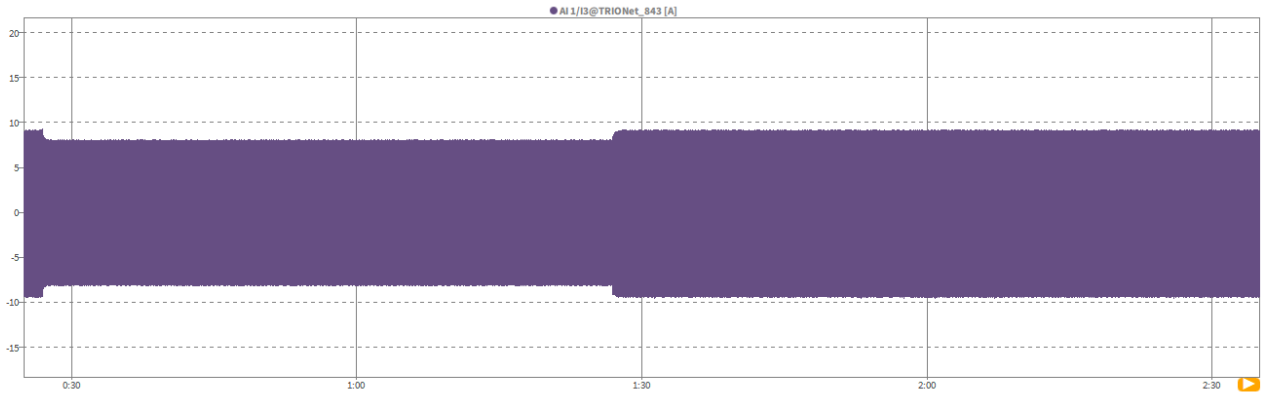


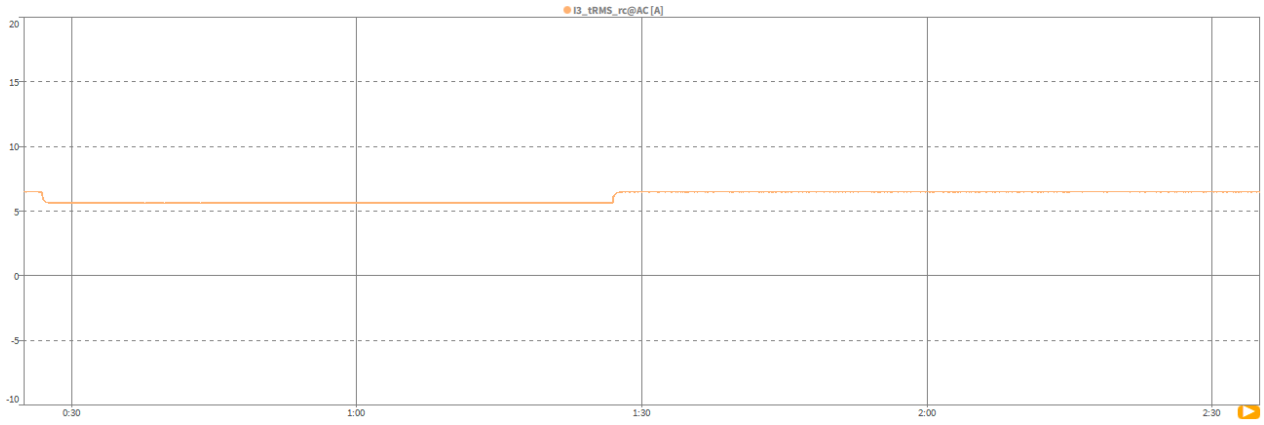
	A	B	间隔
时间 [s]	0:43.2021	0:43.2270	0.0250
U1_tRMS_rc@AC [V]	228.6477	232.8598	4.212097
U2_tRMS_rc@AC [V]	230.4858	231.6139	1.128052
U3_tRMS_rc@AC [V]	230.8695	230.9839	0.114334
P3_t_rc@AC [W]	459.5134	445.9094	-13.60400
Q3_t_rc@AC [var]	61.08656	40.83209	-20.25447

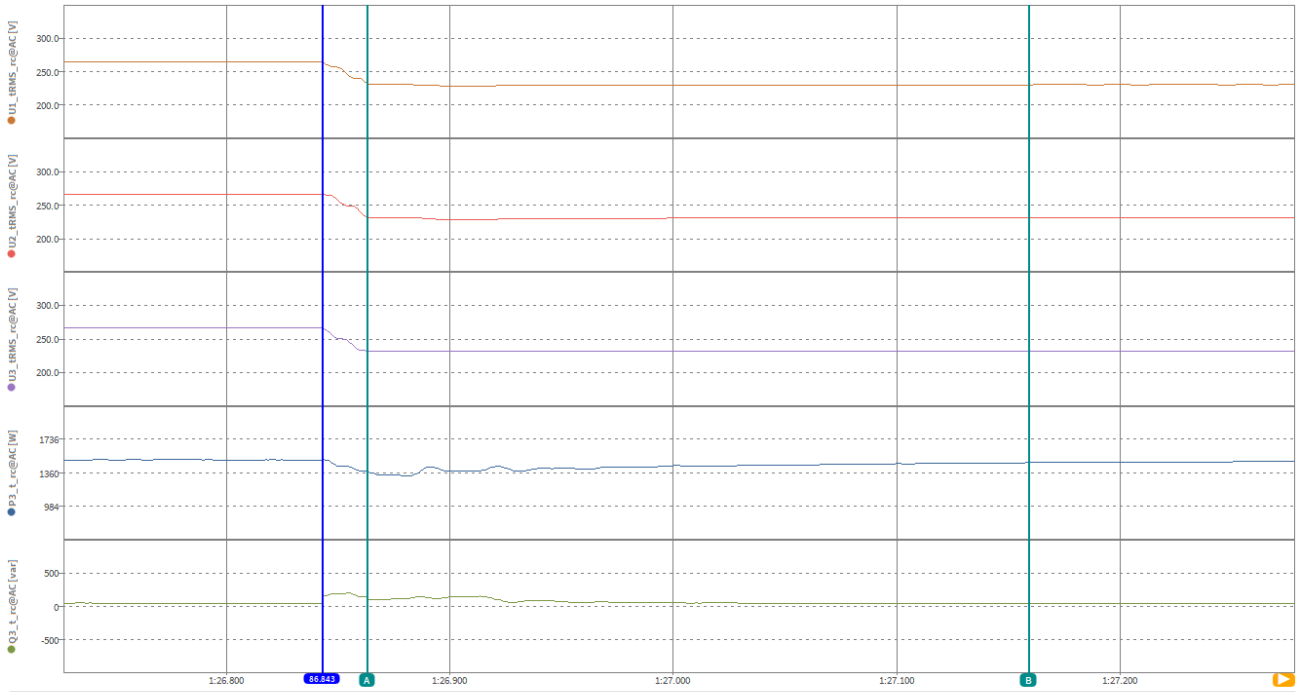
6.1

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	6.1		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	17:14:54		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.15		
	5	Drop duration setpoint	Total	--	[ms]	60000		
	6	Fault occurrence (t1)	Total	--	[ms]	26843		
	7	Fault clearance (t2)	Total	--	[ms]	86843		
	8	Fault duration determined from no-load test	Total	--	[ms]	60000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.152	1.155	1.155
	10		Positive sequence		[p.u.]	1.152	1.152	1.152
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.005
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.152	1.155	1.155
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.918
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.908
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.999
	22		Positive sequence			--	--	0.999
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.296
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.005
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:30
1:00
1:30
2:00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:30
1:00
1:30
2:00
2:30

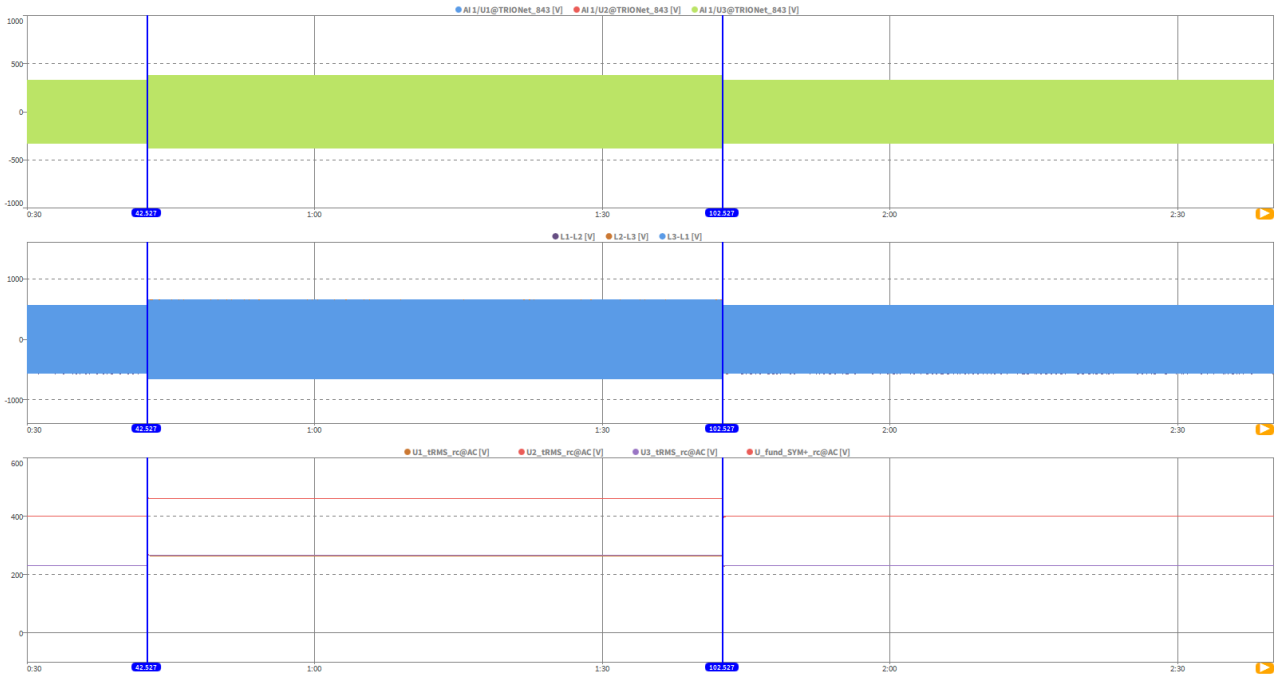

I3_tRMS_rc@AC [A]
20
15
10
5
0
-5
-10
0:30
1:00
1:30
2:00
2:30

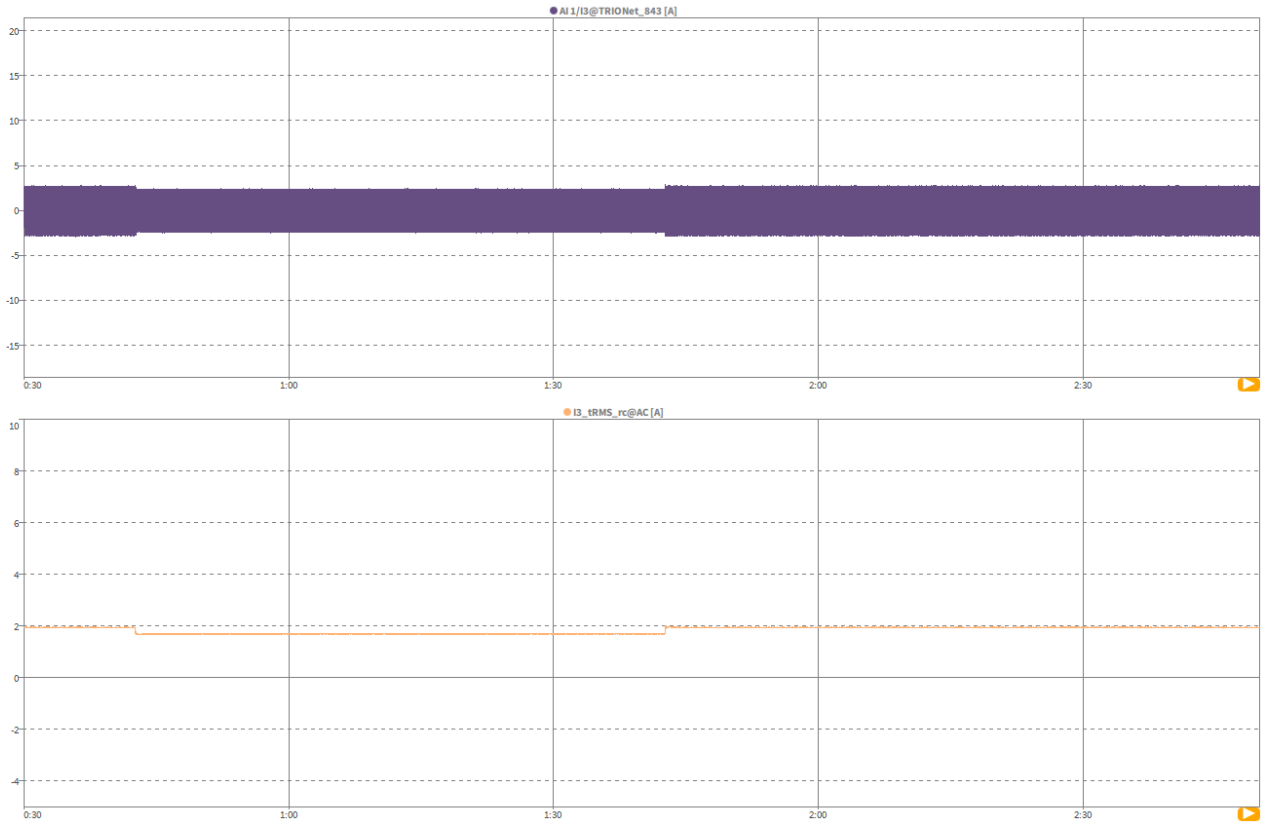


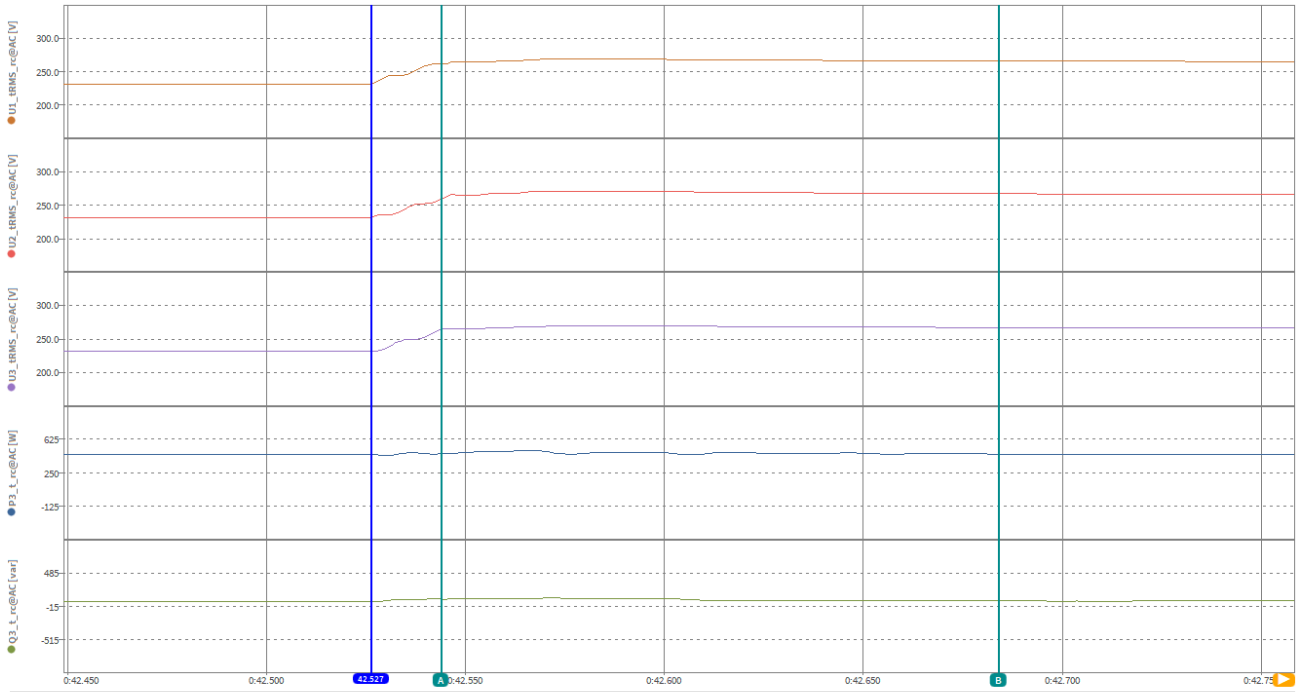
	A	B	间隔
时间 [s]	1:26.86343	1:27.15918	0.29575
U1_tRMS_rc@AC [V]	232.4276	230.1445	-2.283081
U2_tRMS_rc@AC [V]	231.9811	230.8336	-1.147568
U3_tRMS_rc@AC [V]	231.3967	230.9469	-0.449829
P3_t_rc@AC [W]	1369.766	1465.277	95.51062
Q3_t_rc@AC [var]	127.2673	28.95802	-98.30924

6.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	6.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:24:44		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.15		
	5	Drop duration setpoint	Total	--	[ms]	60000		
	6	Fault occurrence (t1)	Total	--	[ms]	42527		
	7	Fault clearance (t2)	Total	--	[ms]	102527		
	8	Fault duration determined from no-load test	Total	--	[ms]	60000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.152	1.155	1.154
	10		Positive sequence		[p.u.]	1.153	1.153	1.153
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.152	1.155	1.154
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.262
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.258
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.298
	22		Positive sequence			--	--	0.298
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.140
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.030
	28		Positive sequence			--	--	0.008
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

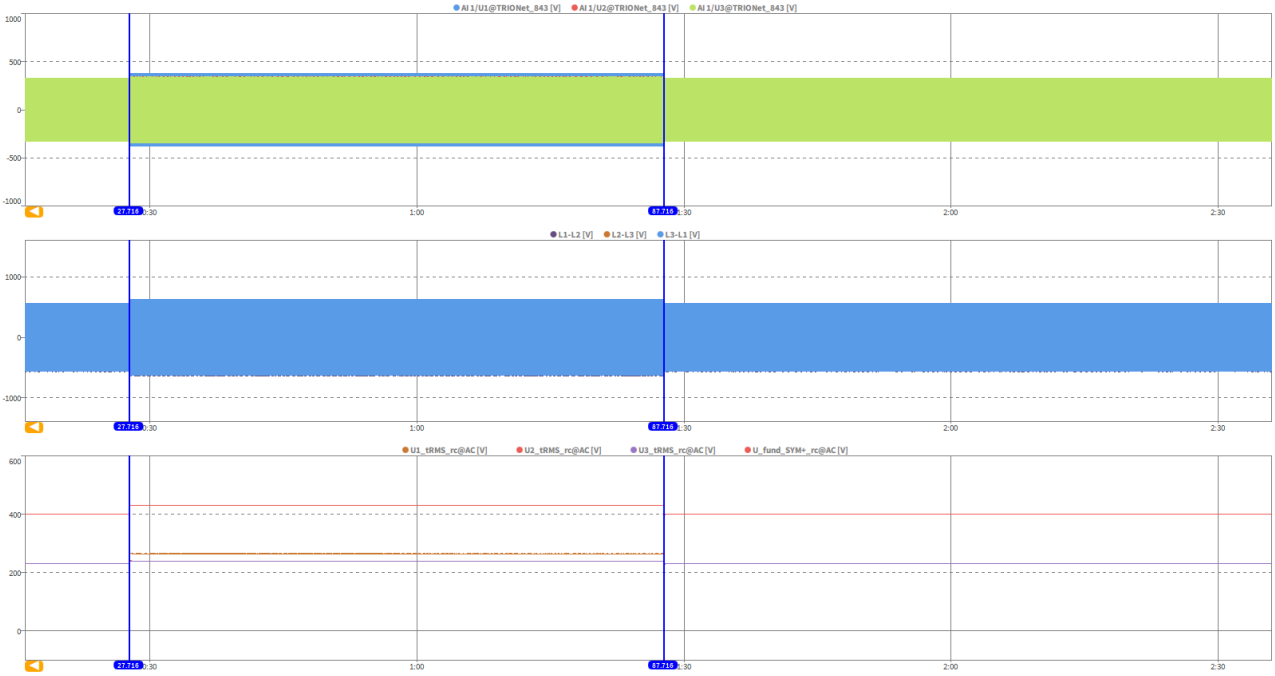

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]



	A	B	间隔
时间 [s]	0:42.54404	0:42.68406	0.14002
U1_tRMS_rc@AC [V]	261.0641	266.0154	4.951294
U2_tRMS_rc@AC [V]	256.6749	267.0863	10.41138
U3_tRMS_rc@AC [V]	263.0105	266.5963	3.585754
P3_t_rc@AC [W]	456.6270	451.1638	-5.463257
Q3_t_rc@AC [var]	81.40766	55.56632	-25.84134

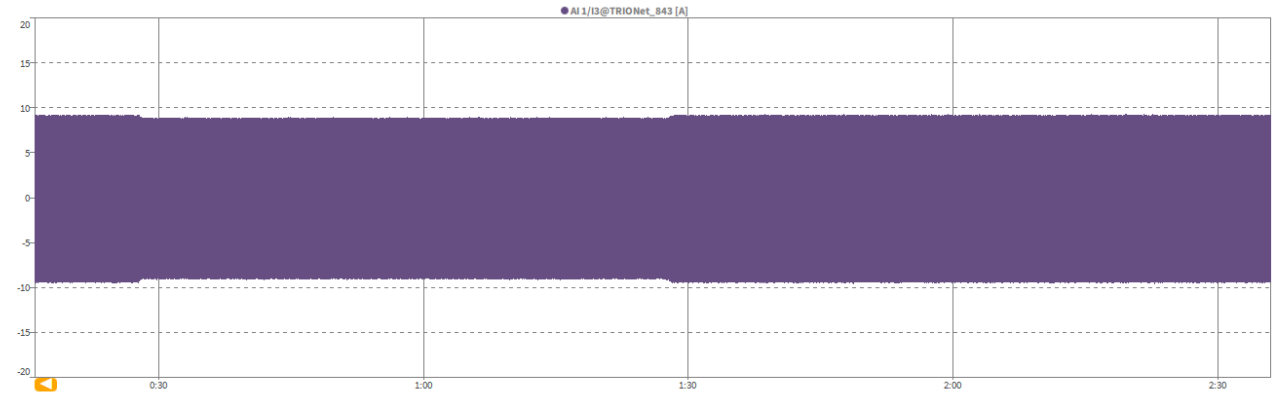
6.3

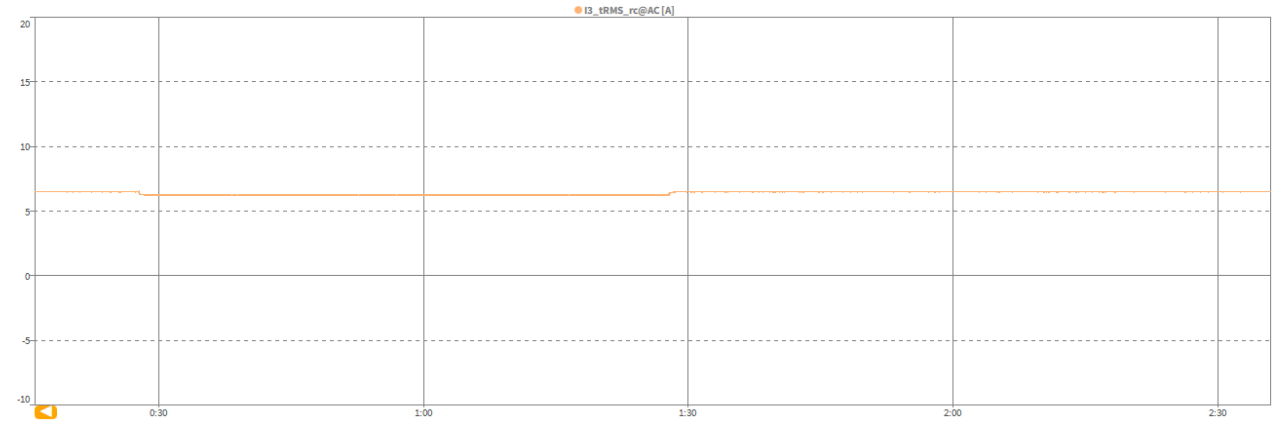
	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	6.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	17:19:58		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.15	1.04	1.04
	5	Drop duration setpoint	Total	--	[ms]	60000		
	6	Fault occurrence (t1)	Total	--	[ms]	27716		
	7	Fault clearance (t2)	Total	--	[ms]	87716		
	8	Fault duration determined from no-load test	Total	--	[ms]	60000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.152	1.045	1.044
	10		Positive sequence		[p.u.]	1.077	1.077	1.077
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.002	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.005
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.152	1.045	1.044
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.982
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.973
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.999
	22		Positive sequence			--	--	0.999
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.063
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.002
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

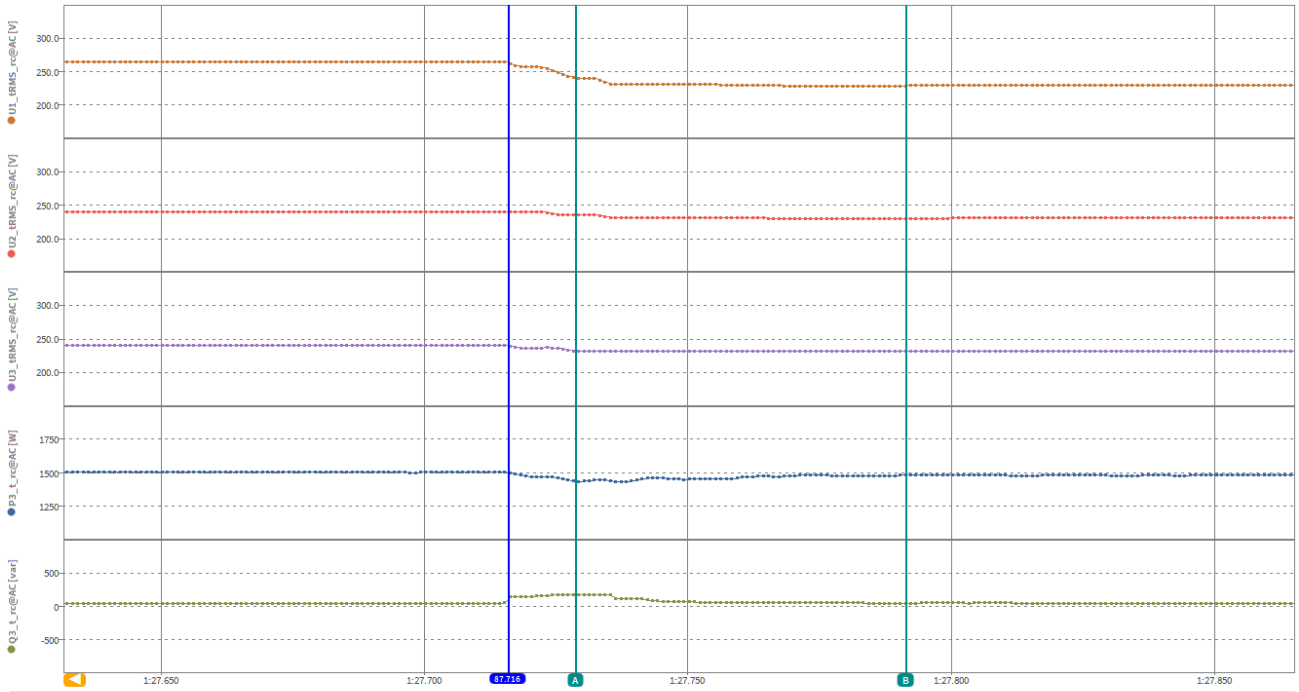

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
27.716
87.716
0:30
1:00
1:30
2:00
2:30

L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
27.716
87.716
0:30
1:00
1:30
2:00
2:30

U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
27.716
87.716
0:30
1:00
1:30
2:00
2:30


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
-20
0:30
1:00
1:30
2:00
2:30

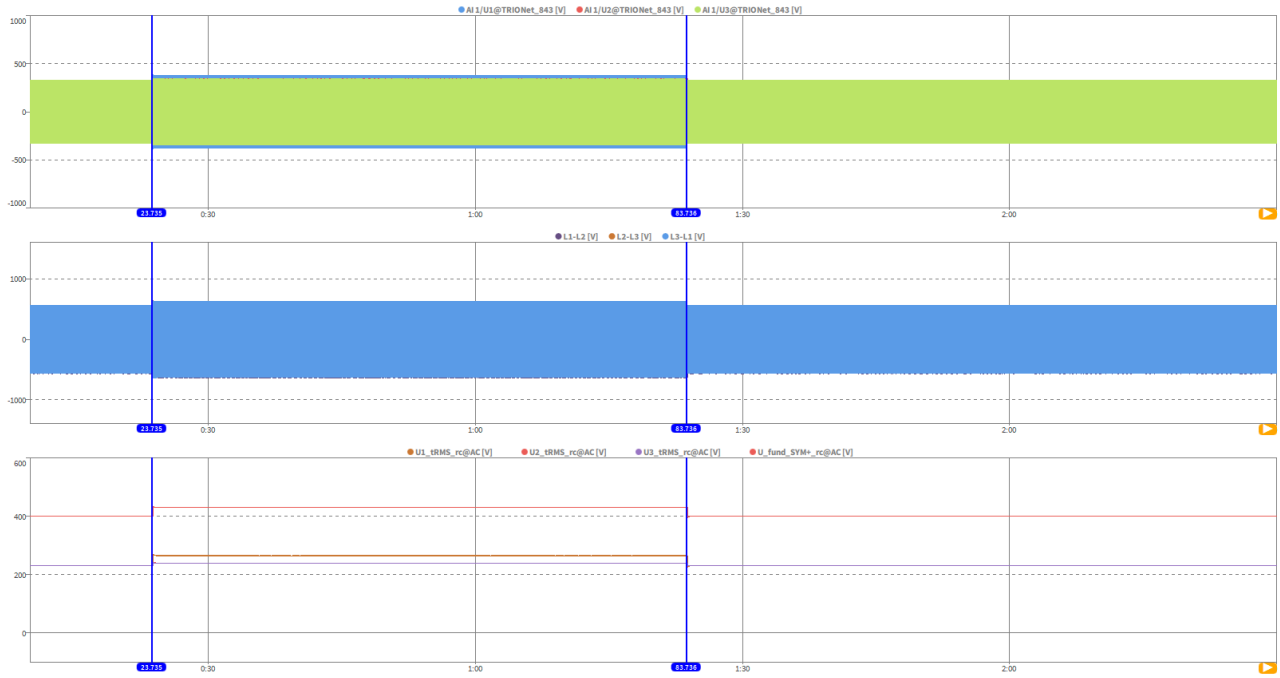

I3_tRMS_rc@AC [A]
20
15
10
5
0
-5
-10
0:30
1:00
1:30
2:00
2:30

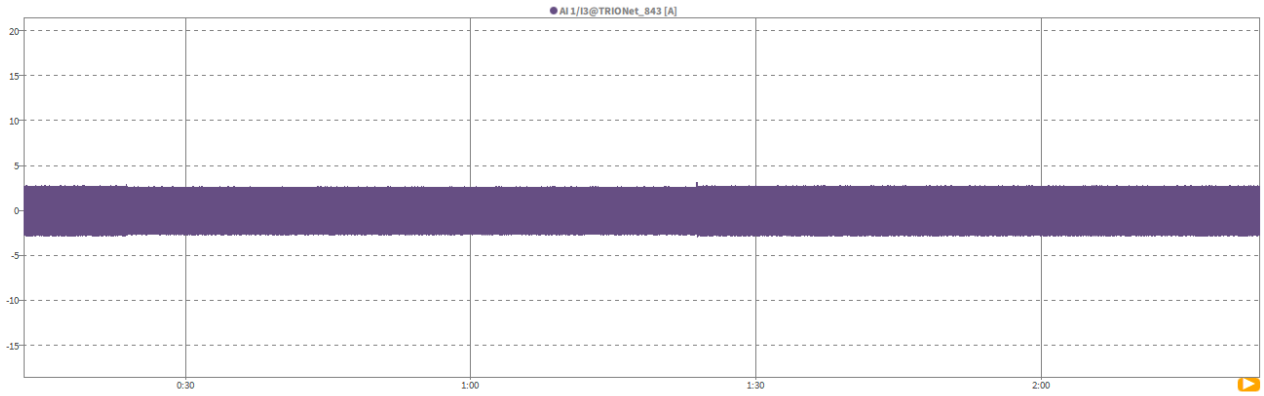


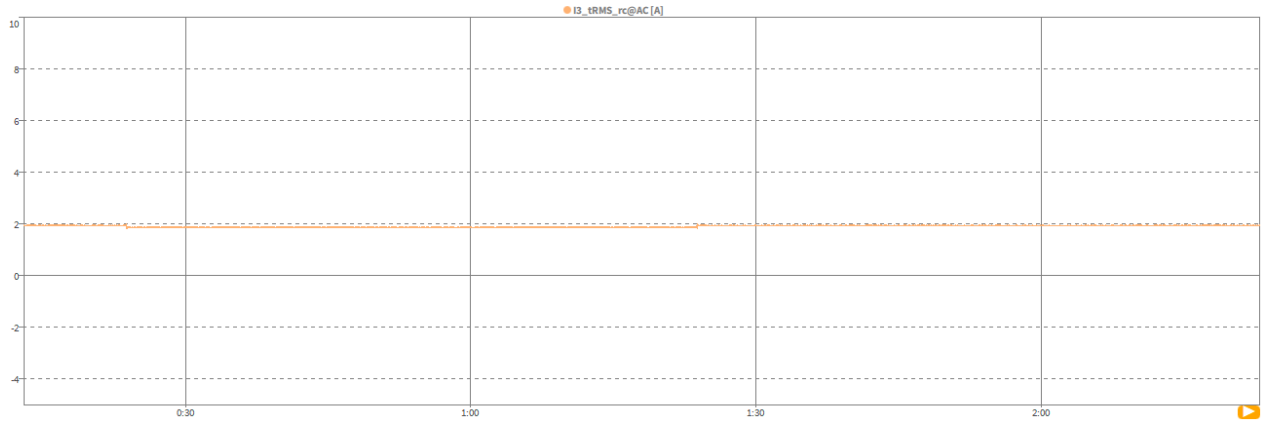
	A	B	间隔
时间 [s]	1:27.7289	1:27.7915	0.0626
U1_tRMS_rc@AC [V]	240.7505	228.6706	-12.07990
U2_tRMS_rc@AC [V]	235.0862	230.0591	-5.027130
U3_tRMS_rc@AC [V]	231.3941	231.0944	-0.299744
P3_t_rc@AC [W]	1433.360	1474.963	41.60278
Q3_t_rc@AC [var]	162.6743	32.99251	-129.6818

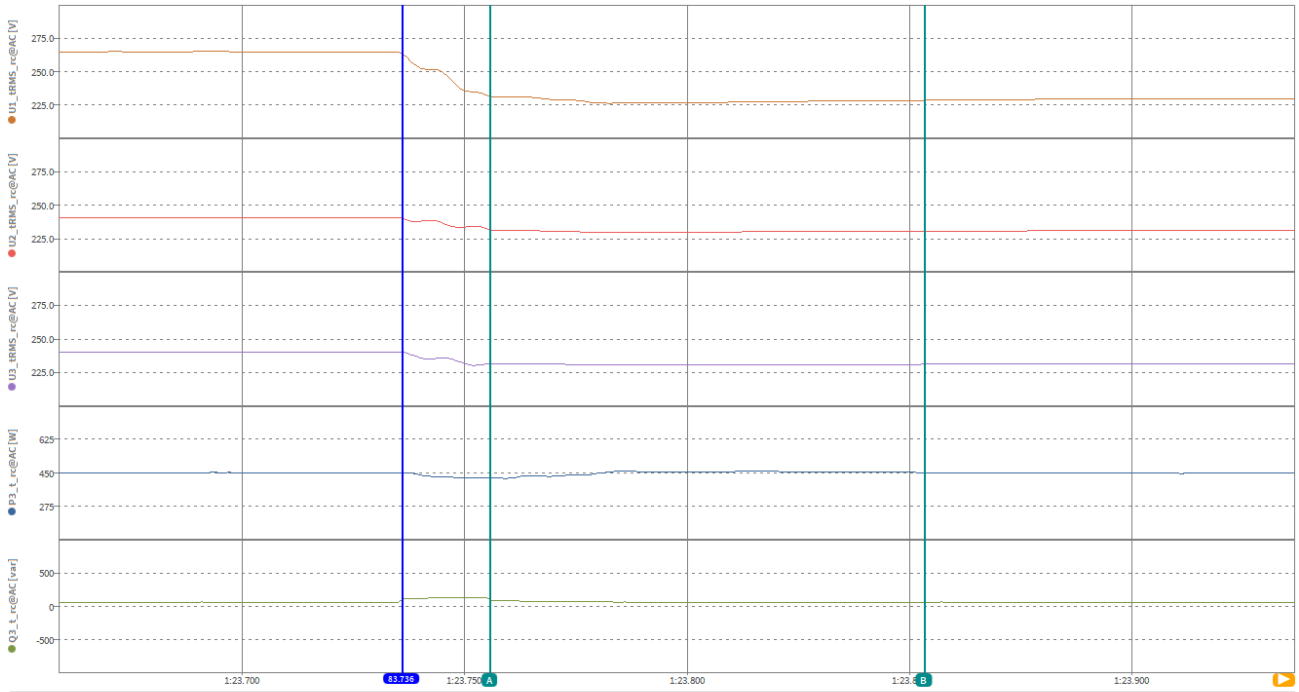
6.4

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	6.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:28:14		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.15	1.04	1.04
	5	Drop duration setpoint	Total	--	[ms]	60000		
	6	Fault occurrence (t1)	Total	--	[ms]	23735		
	7	Fault clearance (t2)	Total	--	[ms]	83736		
	8	Fault duration determined from no-load test	Total	--	[ms]	60001		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.152	1.045	1.043
	10		Positive sequence		[p.u.]	1.078	1.078	1.078
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.030
	16		Positive sequence			--	--	0.009
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.152	1.045	1.043
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.282
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.285
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.298
	22		Positive sequence			--	--	0.298
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.098
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.030
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
23.735
0:30
1:00
83.736
1:30
2:00
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
23.735
0:30
1:00
83.736
1:30
2:00
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
23.735
0:30
1:00
83.736
1:30
2:00


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:30
1:00
1:30
2:00

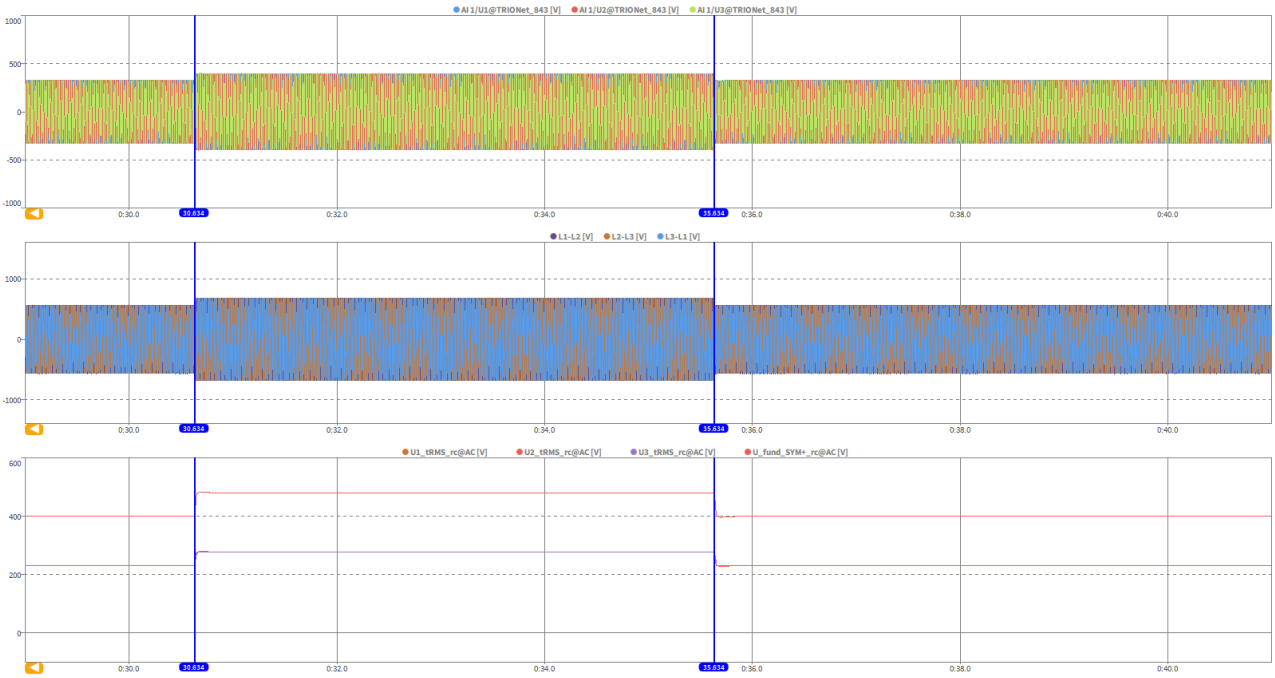

I3_tRMS_rc@AC [A]
10
8
6
4
2
0
-2
-4
0:30
1:00
1:30
2:00

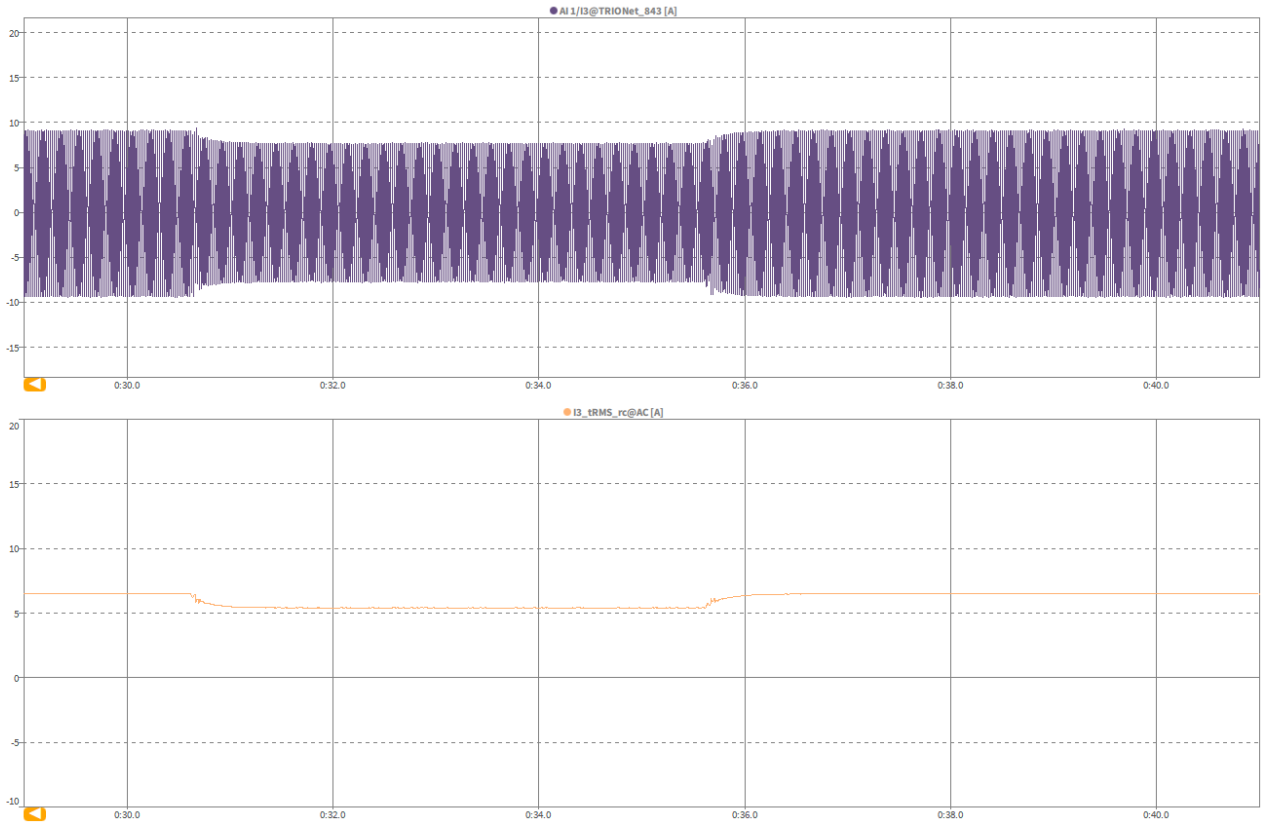


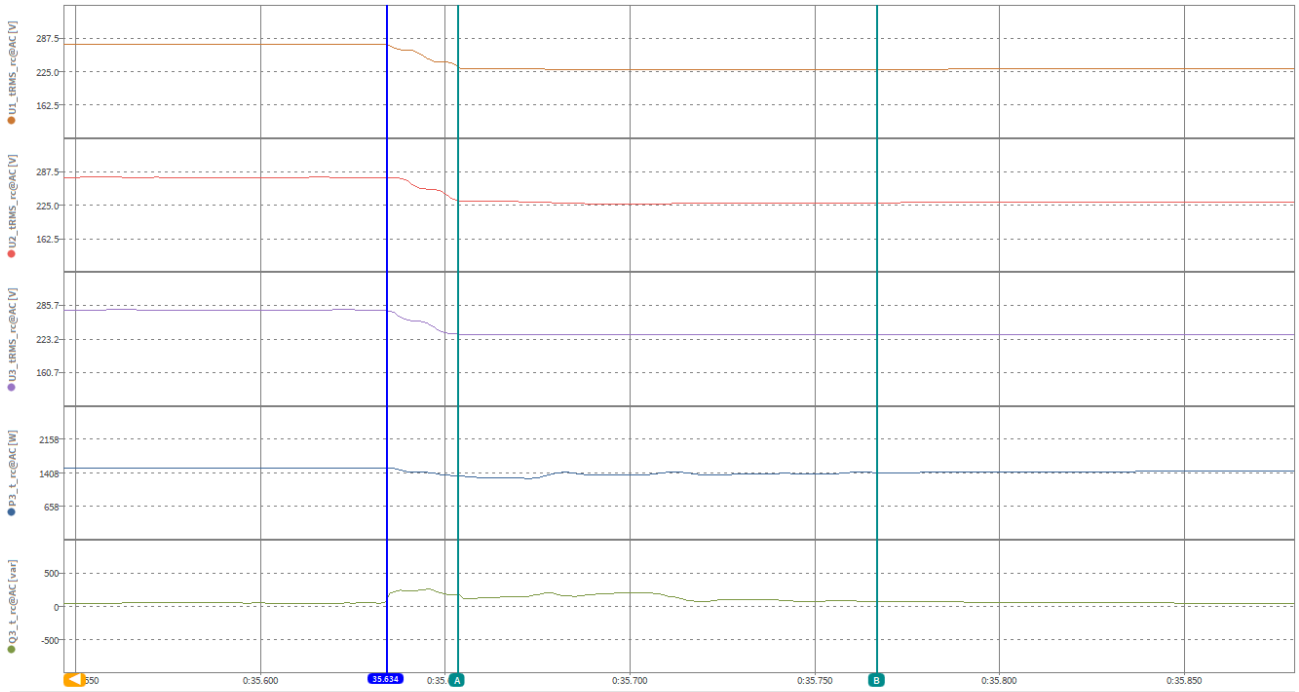
	A	B	间隔
时间 [s]	1:23.755794	1:23.853385	0.097592
U1_tRMS_rc@AC [V]	231.6163	228.3075	-3.308823
U2_tRMS_rc@AC [V]	231.6899	230.2640	-1.425949
U3_tRMS_rc@AC [V]	230.8119	230.5029	-0.309036
P3_t_rc@AC [W]	419.2496	446.5406	27.29102
Q3_t_rc@AC [var]	117.3846	49.29305	-68.09155

7.1

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	7.1		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	17:27:55		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.20		
	5	Drop duration setpoint	Total	--	[ms]	5000		
	6	Fault occurrence (t1)	Total	--	[ms]	30634		
	7	Fault clearance (t2)	Total	--	[ms]	35634		
	8	Fault duration determined from no-load test	Total	--	[ms]	5000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.202	1.206	1.206
	10		Positive sequence		[p.u.]	1.203	1.203	1.203
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.004
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.202	1.206	1.206
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.894
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.886
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	1.003
	22		Positive sequence			--	--	1.003
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.114
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]

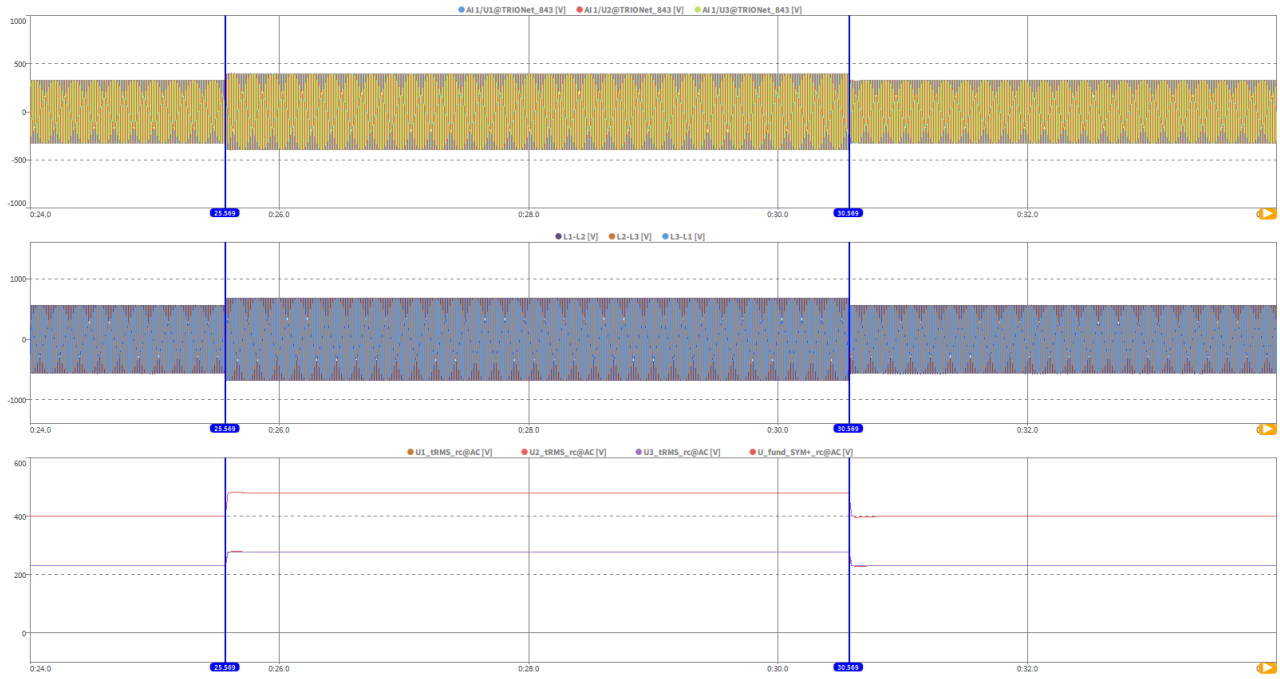

AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

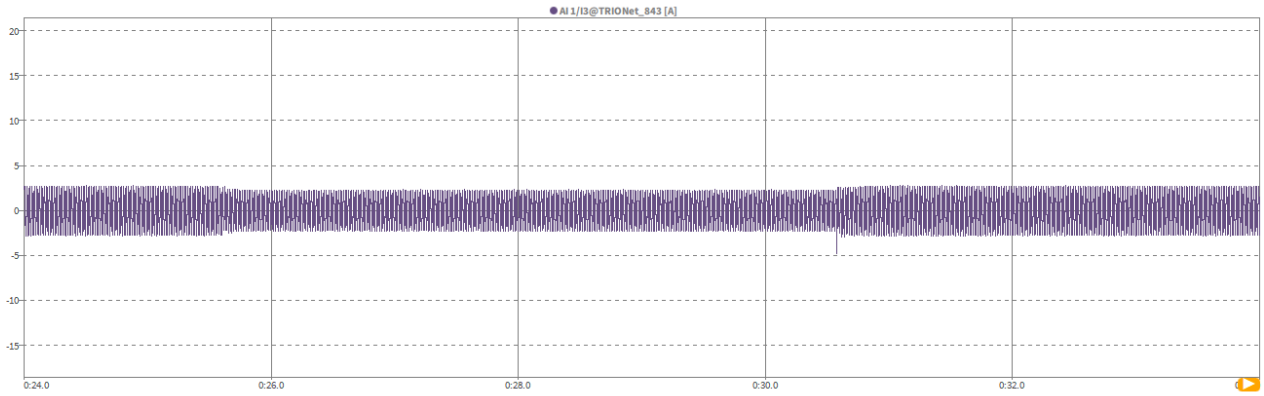


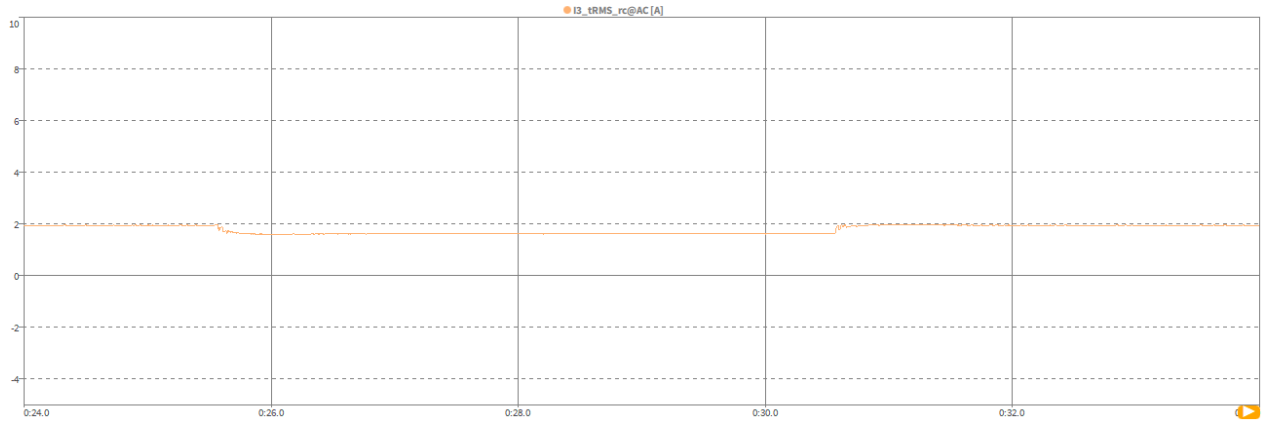
	A	B	间隔
时间 [s]	0:35.65338	0:35.76690	0.11353
U1_tRMS_rc@AC [V]	235.1949	229.3091	-5.885788
U2_tRMS_rc@AC [V]	233.3861	229.4154	-3.970718
U3_tRMS_rc@AC [V]	231.7628	230.5641	-1.198669
P3_t_rc@AC [W]	1329.404	1396.630	67.22595
Q3_t_rc@AC [var]	160.8622	55.78246	-105.0797

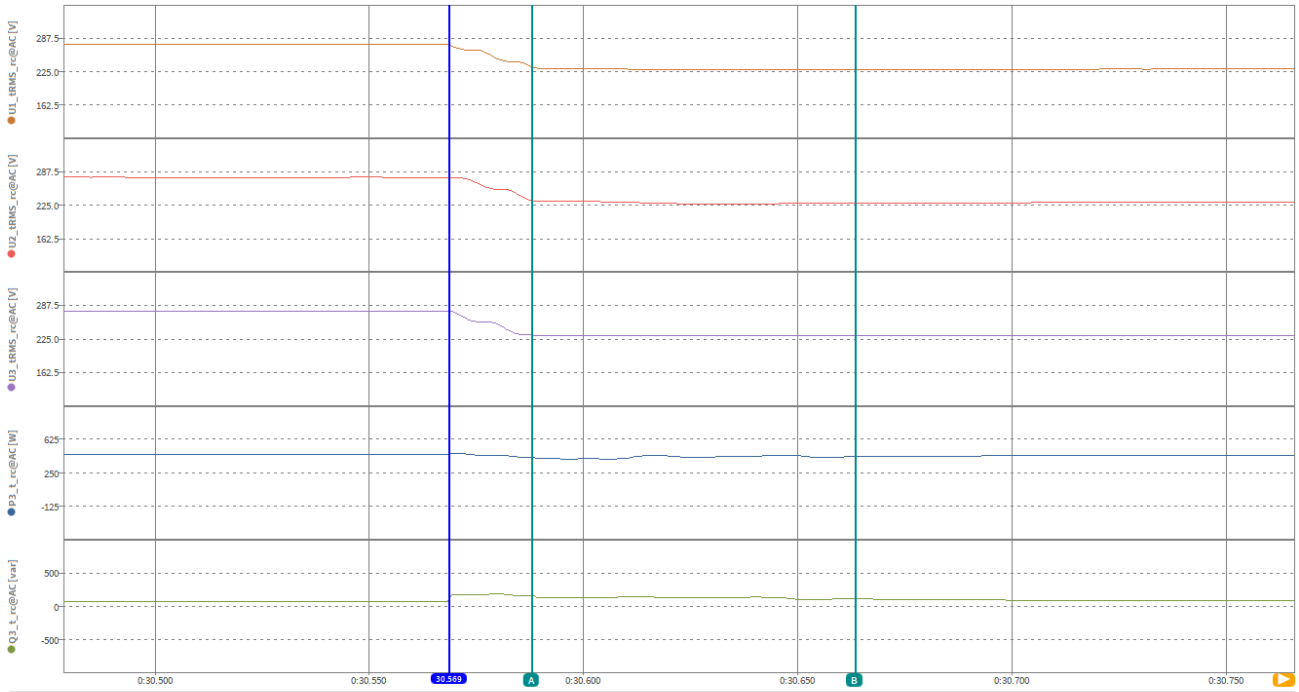
7.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	7.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:35:10		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.20		
	5	Drop duration setpoint	Total	--	[ms]	5000		
	6	Fault occurrence (t1)	Total	--	[ms]	25569		
	7	Fault clearance (t2)	Total	--	[ms]	30569		
	8	Fault duration determined from no-load test	Total	--	[ms]	5000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.202	1.206	1.205
	10		Positive sequence		[p.u.]	1.204	1.204	1.204
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.030
	16		Positive sequence			--	--	0.008
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.202	1.206	1.205
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.257
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.251
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.297
	22		Positive sequence			--	--	0.297
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.075
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.030
	28		Positive sequence			--	--	0.008
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:24.0
25.569
0:26.0
0:28.0
0:30.0
30.569
0:32.0
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:24.0
25.569
0:26.0
0:28.0
0:30.0
30.569
0:32.0
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:24.0
25.569
0:26.0
0:28.0
0:30.0
30.569
0:32.0


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:24.0
0:26.0
0:28.0
0:30.0
0:32.0

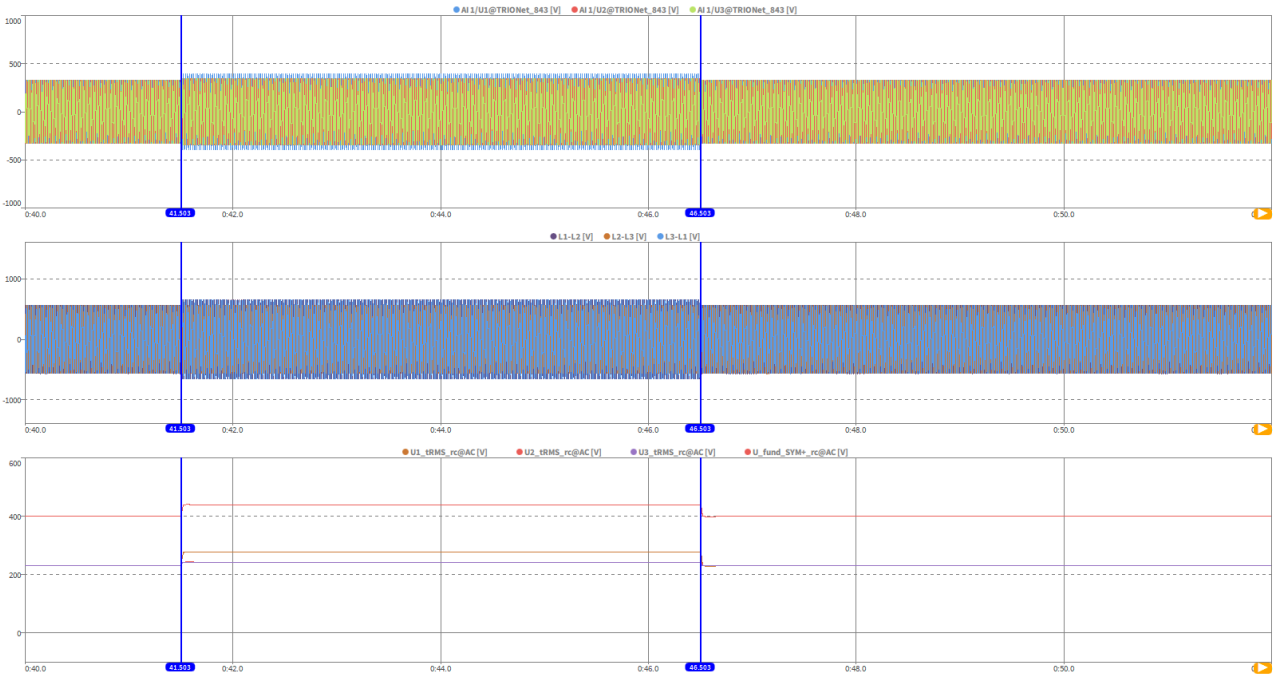

I3_tRMS_rc@AC [A]
10
8
6
4
2
0
-2
-4
0:24.0
0:26.0
0:28.0
0:30.0
0:32.0

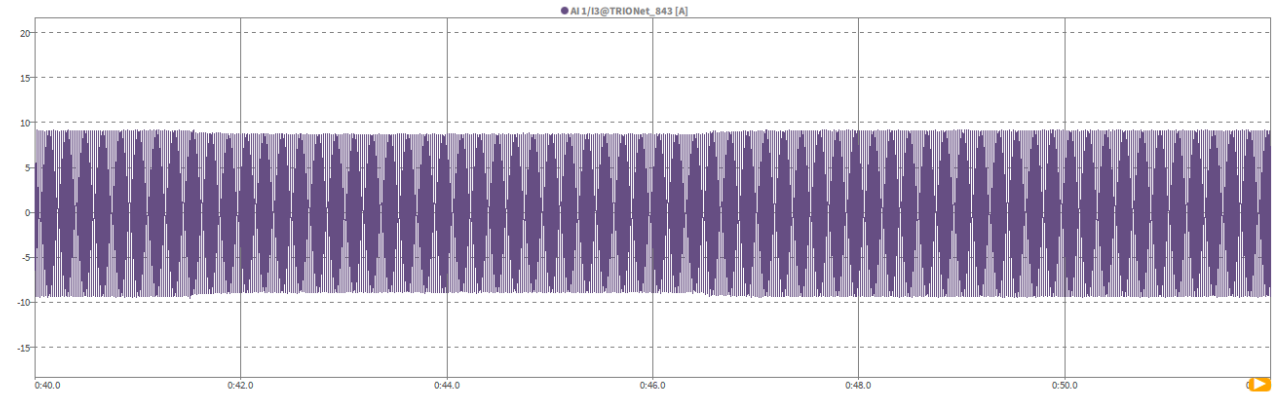


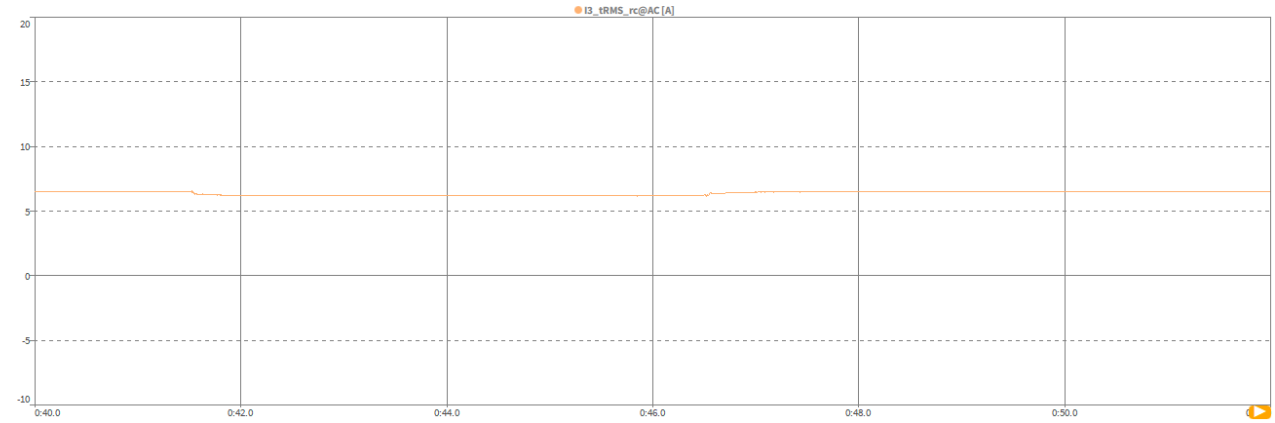
	A	B	间隔
时间 [s]	0:30.5879551	0:30.6633283	0.0753732
U1_tRMS_rc@AC [V]	236.3775	228.6517	-7.725769
U2_tRMS_rc@AC [V]	234.0237	228.3402	-5.683472
U3_tRMS_rc@AC [V]	231.9227	230.2638	-1.658829
P3_t_rc@AC [W]	418.5080	422.9744	4.466370
Q3_t_rc@AC [var]	153.4861	100.3253	-53.16077

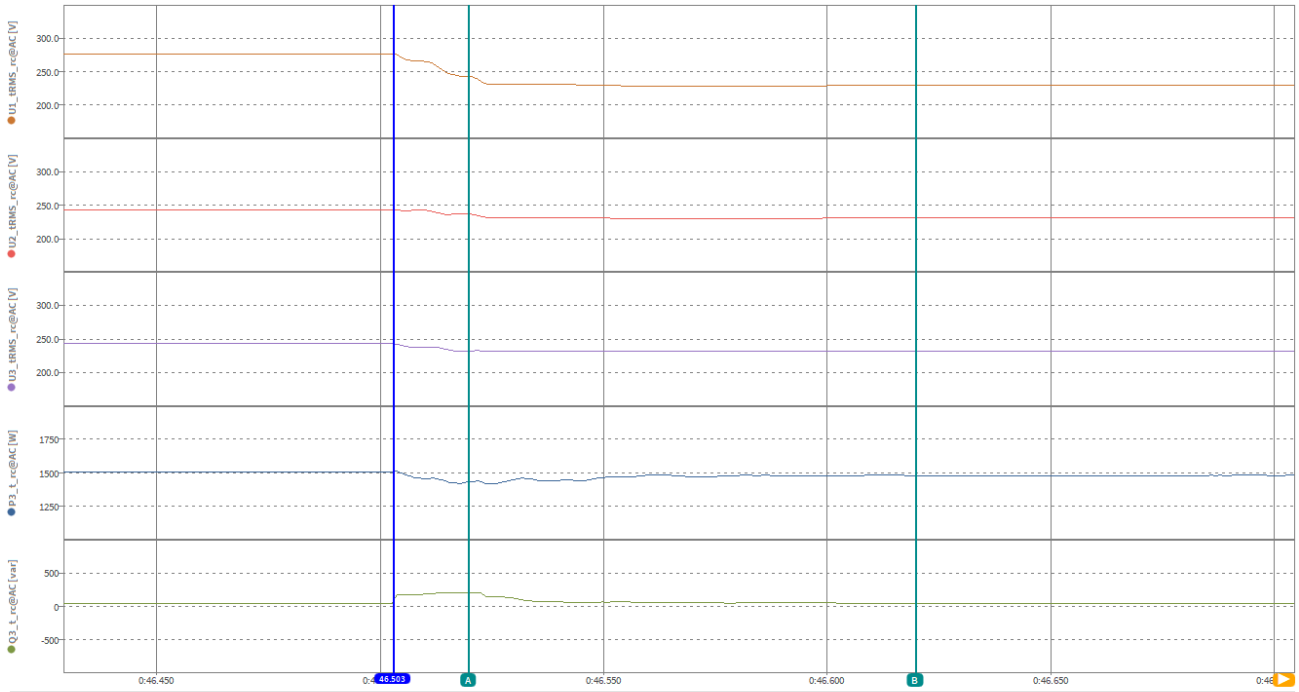
7.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	7.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	17:35:25		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.20	1.05	1.05
	5	Drop duration setpoint	Total	--	[ms]	5000		
	6	Fault occurrence (t1)	Total	--	[ms]	41503		
	7	Fault clearance (t2)	Total	--	[ms]	46503		
	8	Fault duration determined from no-load test	Total	--	[ms]	5000		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.203	1.055	1.054
	10		Positive sequence		[p.u.]	1.099	1.099	1.099
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.995
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.003
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.203	1.055	1.054
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.978
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.965
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	1.000
	22		Positive sequence			--	--	1.000
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.100
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.003
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:40.0
41.503
0:42.0
0:44.0
0:46.0
46.503
0:48.0
0:50.0
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0


AI 1/I3@TRIONet_843 [A]
20
15
10
5
0
-5
-10
-15
0:40.0
0:42.0
0:44.0
0:46.0
0:48.0
0:50.0

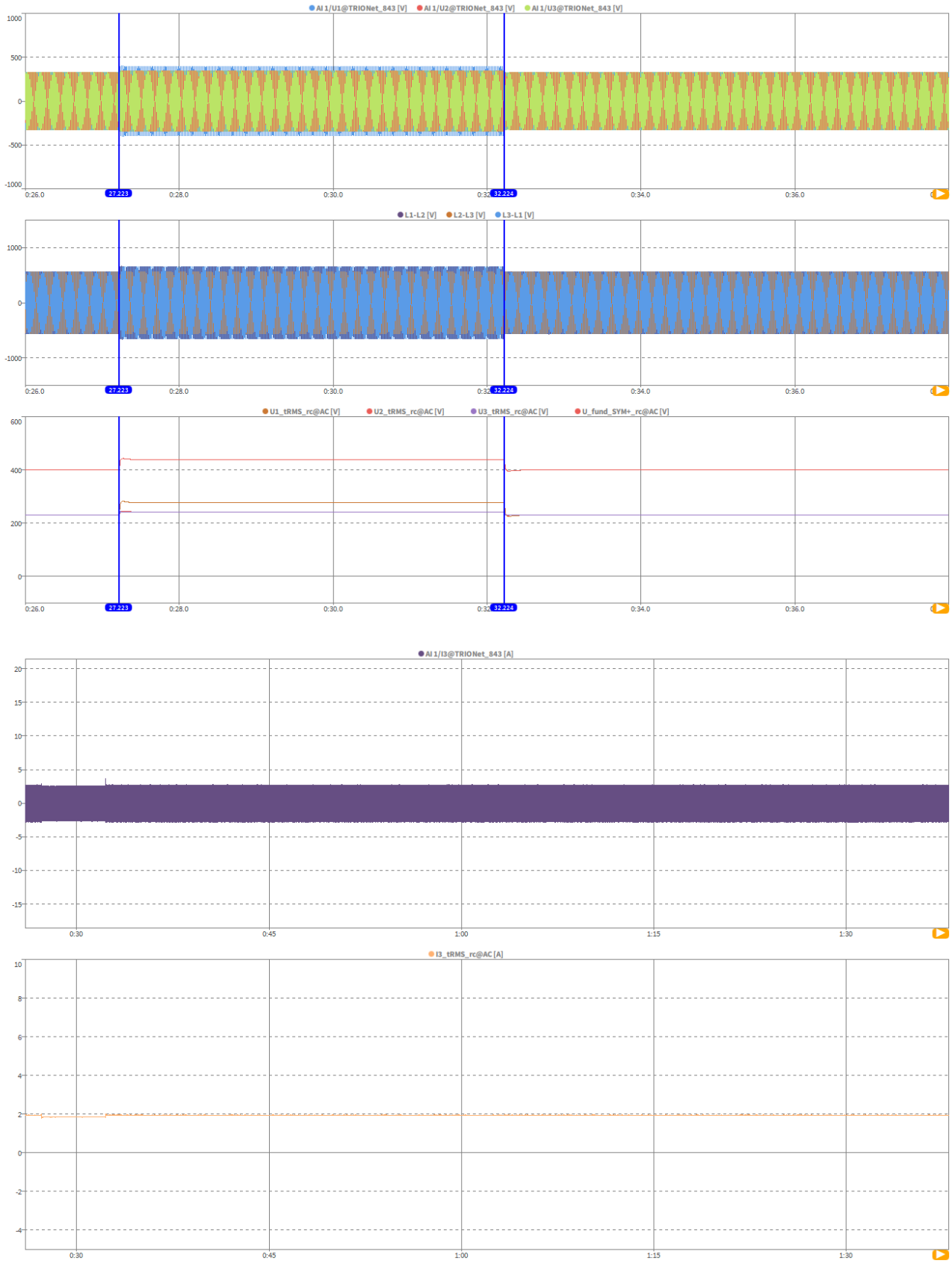

I3_tRMS_rc@AC [A]
20
15
10
5
0
-5
-10
0:40.0
0:42.0
0:44.0
0:46.0
0:48.0
0:50.0

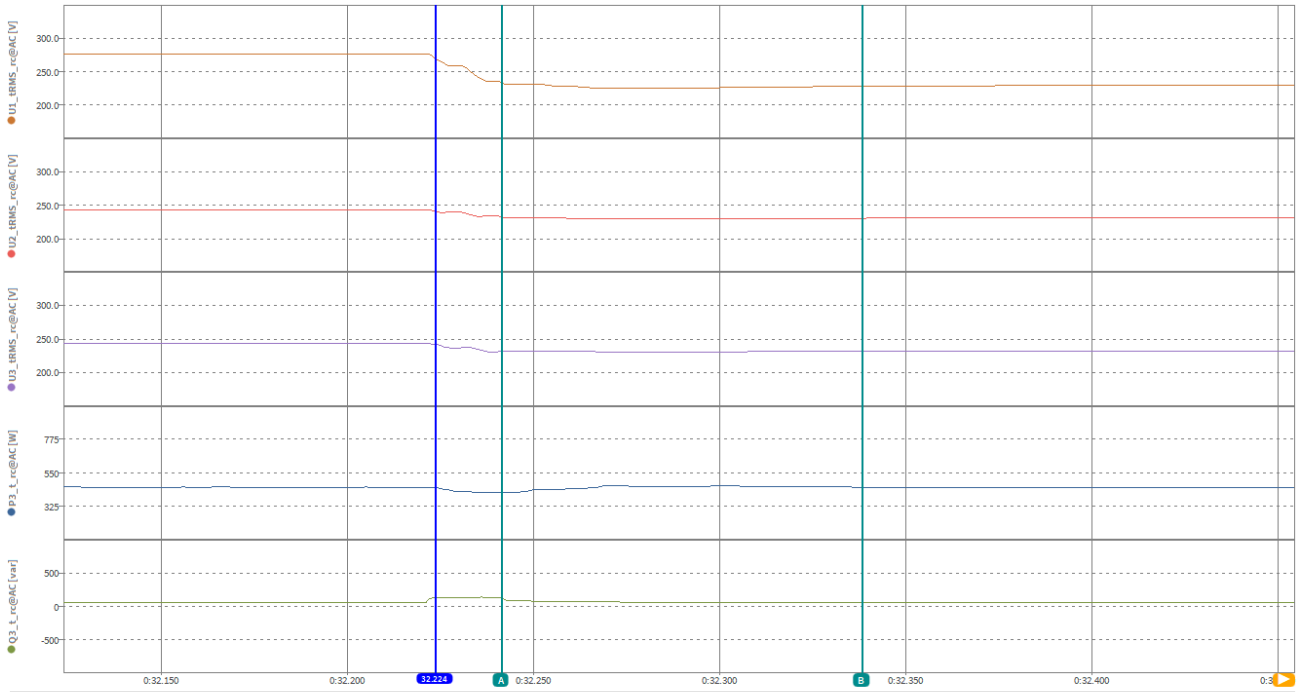


	A	B	间隔
时间 [s]	0:46.519902	0:46.619803	0.099901
U1_tRMS_rc@AC [V]	242.7495	229.0692	-13.68030
U2_tRMS_rc@AC [V]	236.9200	230.3562	-6.563797
U3_tRMS_rc@AC [V]	230.3505	231.0844	0.733948
P3_t_rc@AC [W]	1417.316	1472.446	55.13086
Q3_t_rc@AC [var]	192.0889	35.41057	-156.6783

7.4

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	7.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:41:11		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.20	1.05	1.05
	5	Drop duration setpoint	Total	--	[ms]	5000		
	6	Fault occurrence (t1)	Total	--	[ms]	27223		
	7	Fault clearance (t2)	Total	--	[ms]	32224		
	8	Fault duration determined from no-load test	Total	--	[ms]	5001		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.203	1.055	1.053
	10		Positive sequence		[p.u.]	1.101	1.101	1.101
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.203	1.055	1.053
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.275
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.278
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.298
	22		Positive sequence			--	--	0.298
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.097
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

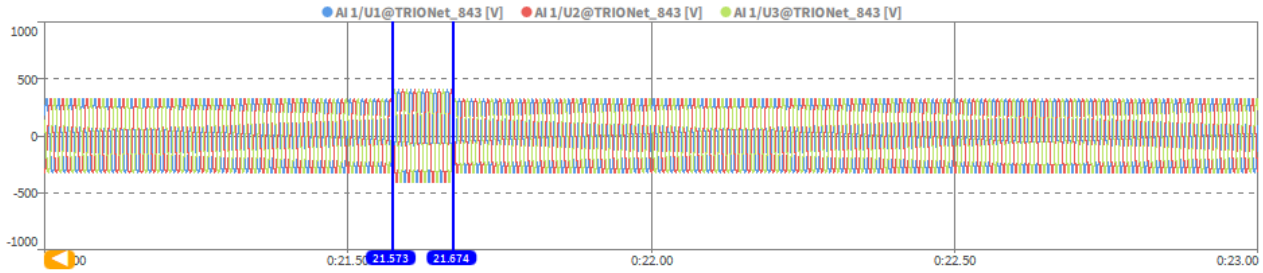

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

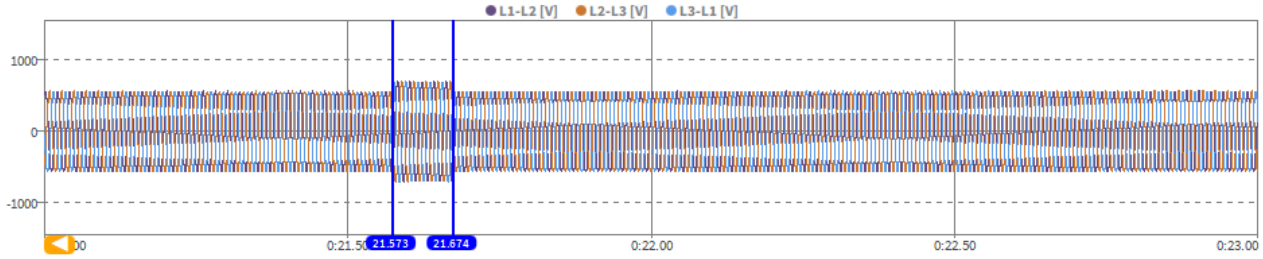


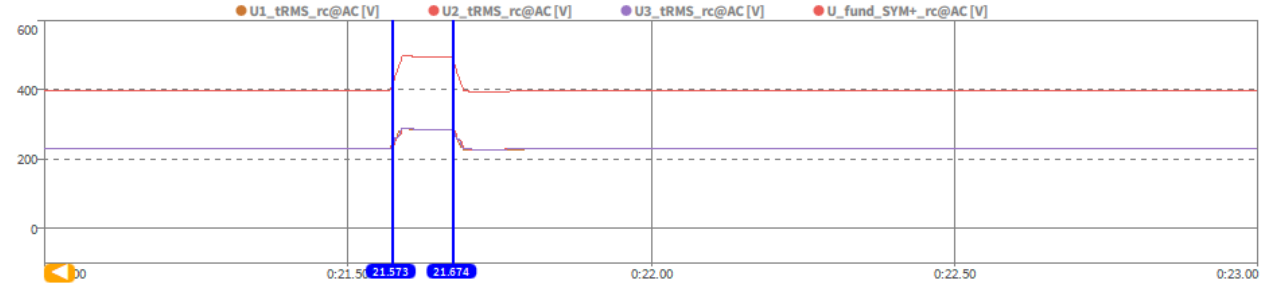
	A	B	间隔
时间 [s]	0:32.24148	0:32.33835	0.09687
U1_tRMS_rc@AC [V]	233.2783	227.6782	-5.600082
U2_tRMS_rc@AC [V]	232.6339	230.1220	-2.511856
U3_tRMS_rc@AC [V]	230.6881	230.3778	-0.310349
P3_t_rc@AC [W]	410.9255	446.3318	35.40631
Q3_t_rc@AC [var]	124.8018	46.75928	-78.04254

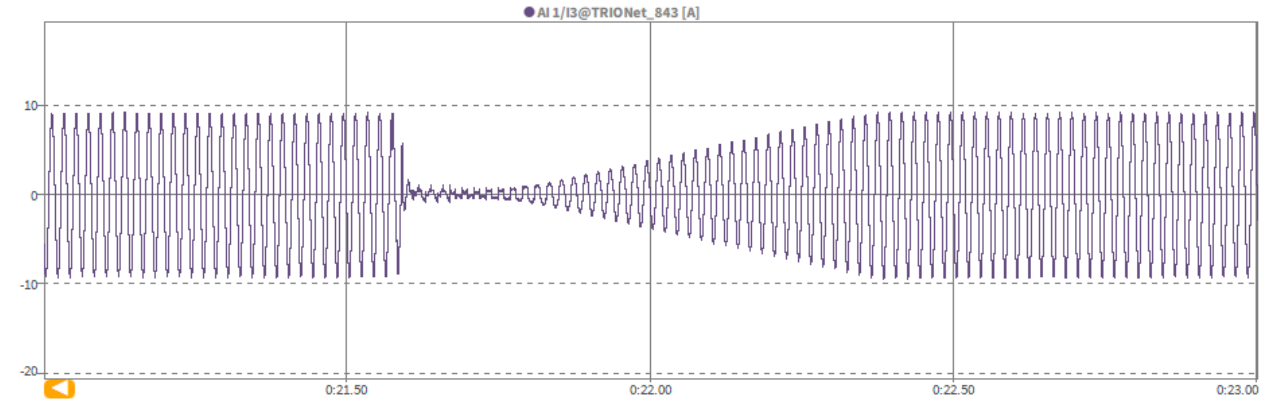
8.1

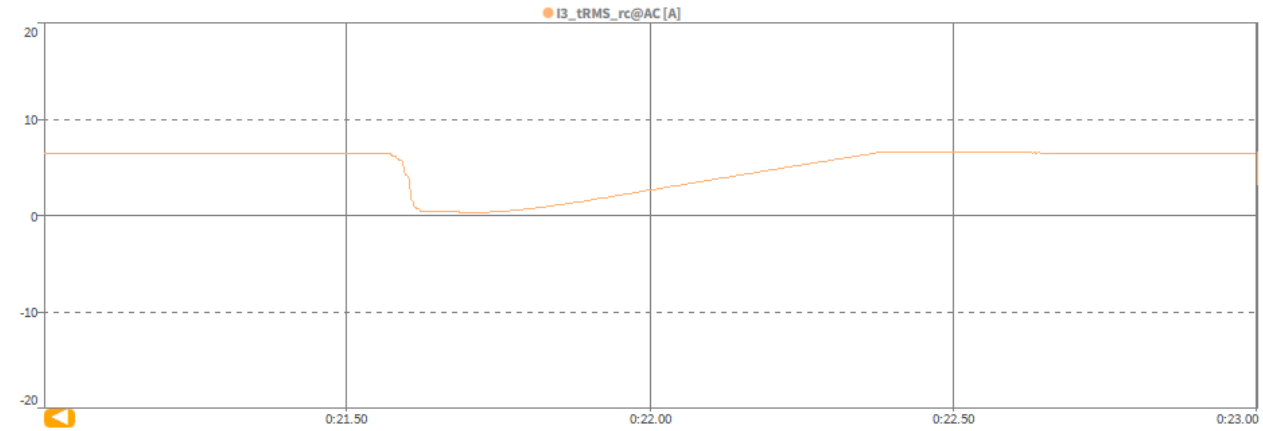
	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	8.1		
	1	Date	--	--	[dd.mm.yyyy]	07.04.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	19:42:58		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.25		
	5	Drop duration setpoint	Total	--	[ms]	100		
	6	Fault occurrence (t1)	Total	--	[ms]	21573		
	7	Fault clearance (t2)	Total	--	[ms]	21674		
	8	Fault duration determined from no-load test	Total	--	[ms]	101		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.216	1.231	1.242
	10		Positive sequence		[p.u.]	1.220	1.220	1.220
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.000	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.992
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.996
	14		Positive sequence			--	--	0.996
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.022
	16		Positive sequence			--	--	0.005
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.216	1.231	1.242
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.084
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.065
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.015
	22		Positive sequence			--	--	0.016
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.996
	25		Positive sequence			--	--	0.996
	26	Response time active power	Positive sequence	--	[s]	--	--	0.748
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.022
	28		Positive sequence			--	--	0.005
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

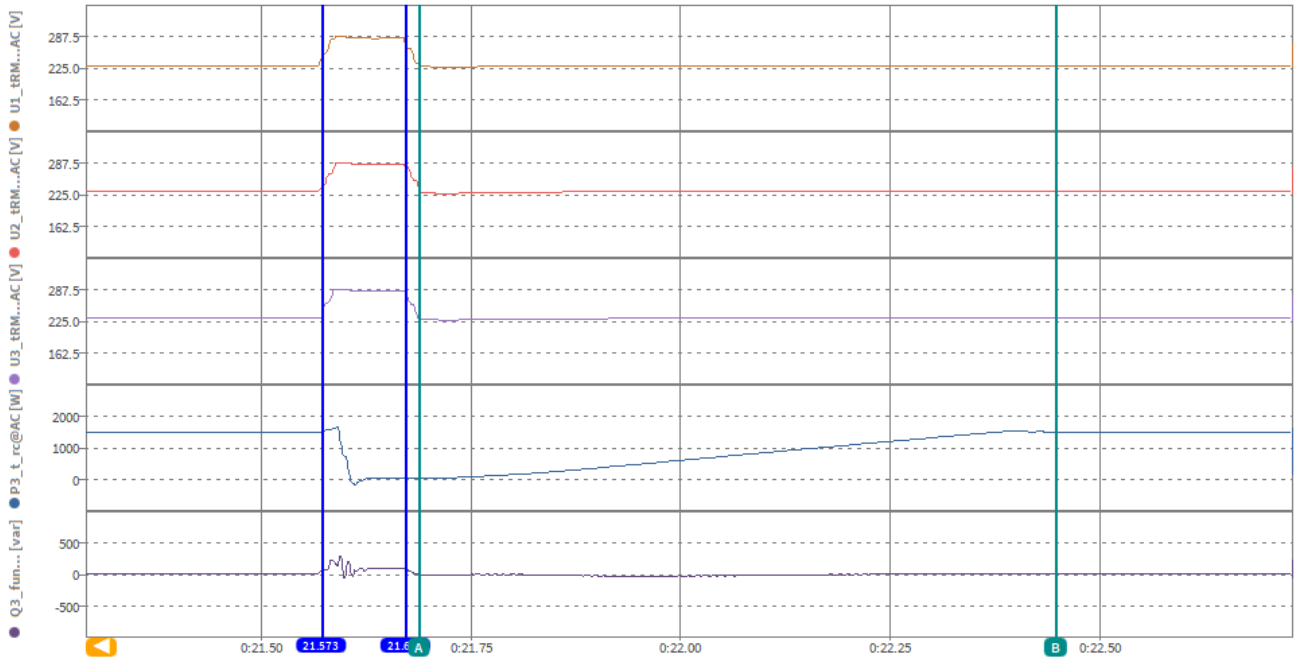

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
1000
500
0
-500
-1000
0:21.573
21.674
0:22.00
0:22.50
0:23.00


L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
1000
0
-1000
0:21.573
21.674
0:22.00
0:22.50
0:23.00


U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
600
400
200
0
0:21.573
21.674
0:22.00
0:22.50
0:23.00


AI 1/I3@TRIONet_843 [A]
10
0
-10
-20
0:21.50
0:22.00
0:22.50
0:23.00

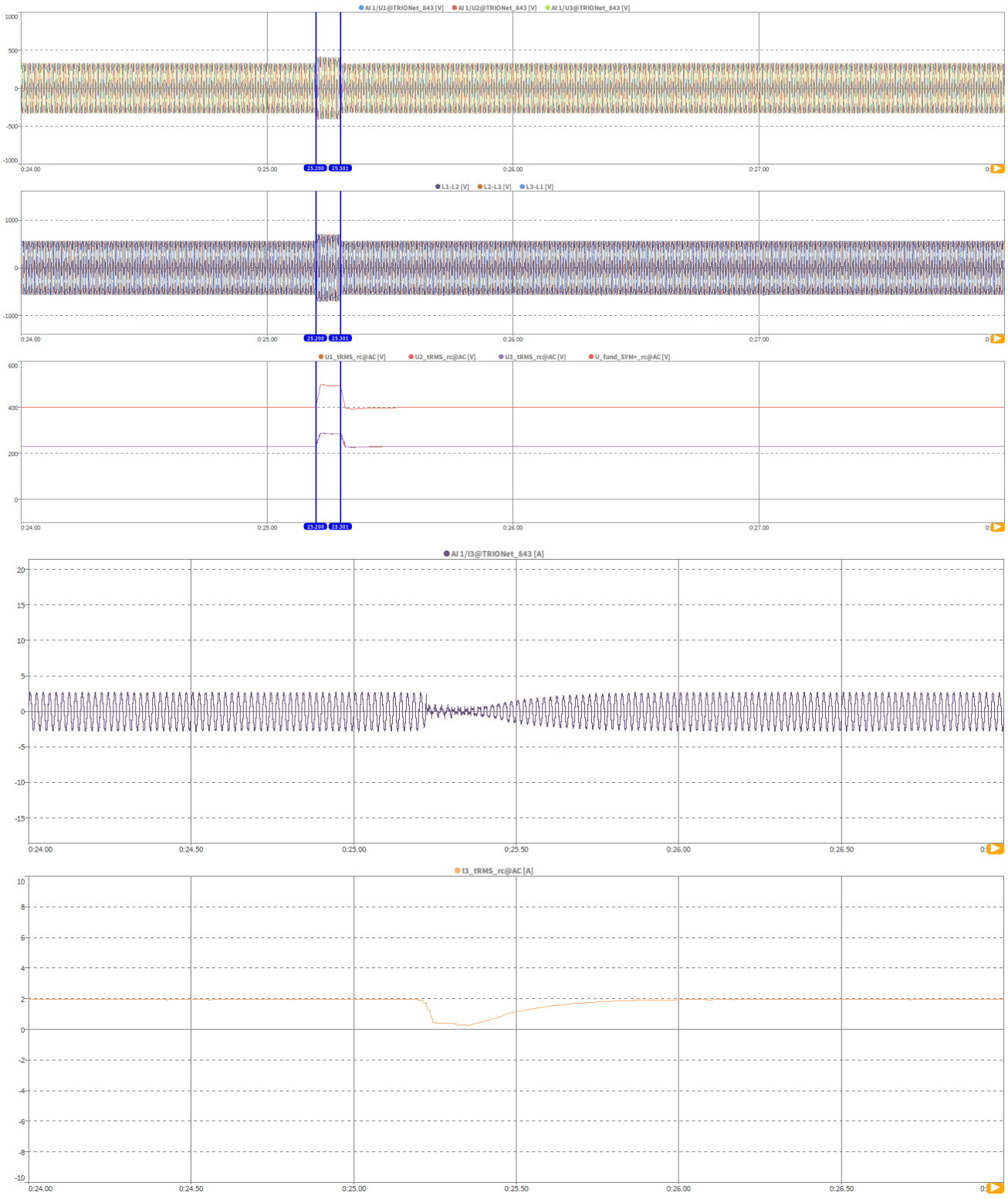

I3_tRMS_rc@AC [A]
20
10
0
-10
-20
0:21.50
0:22.00
0:22.50
0:23.00

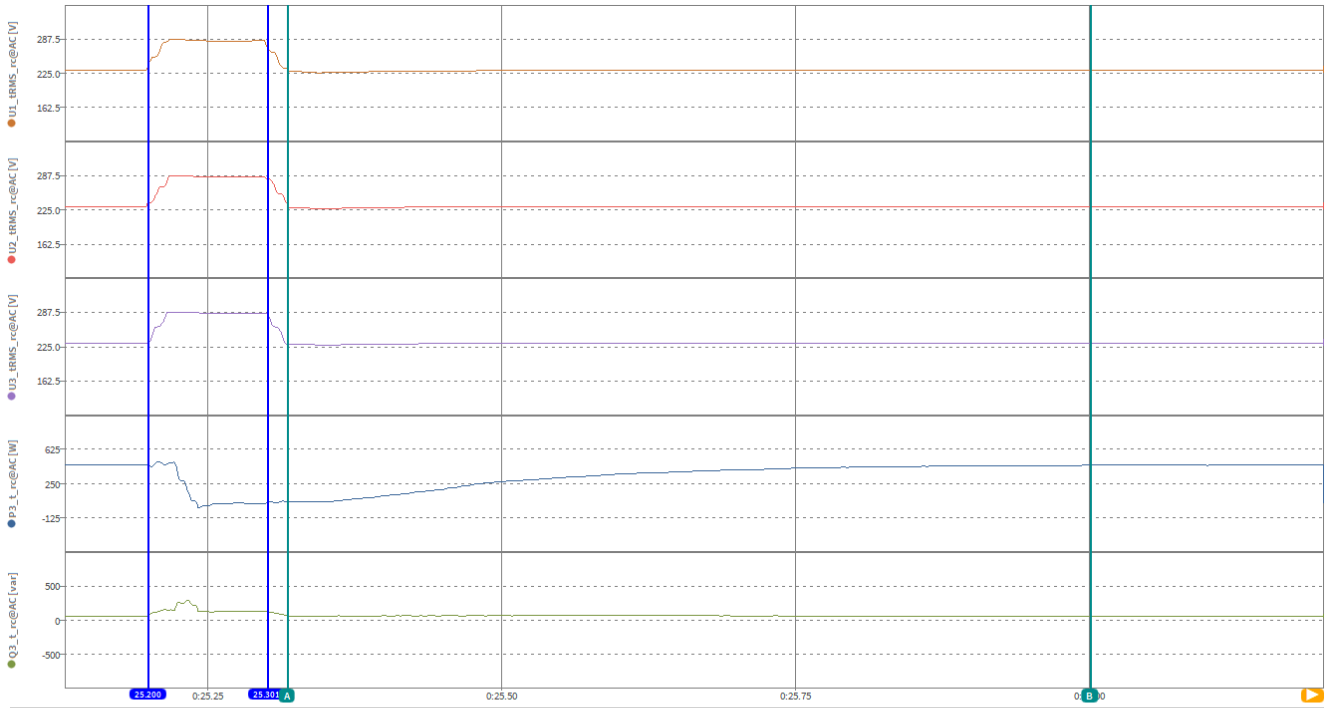


	A	B	Delta
Time [s]	0:21.6897039	0:22.4481474	0.7584434
U1_tRMS_rc@AC [V]	233.6256	230.1909	-3.434647
U2_tRMS_rc@AC [V]	240.1176	230.8707	-9.246948
U3_tRMS_rc@AC [V]	230.0701	230.8337	0.763550
P3_t_rc@AC [W]	41.05881	1514.307	1473.248
Q3_fund_rc@AC [var]	5.327226	13.62328	8.296055

8.2

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	8.2		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:44:07		
	3	Type of fault (number of affected phases)	--	--	--	Symmetrical three-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.25		
	5	Drop duration setpoint	Total	--	[ms]	100		
	6	Fault occurrence (t1)	Total	--	[ms]	25200		
	7	Fault clearance (t2)	Total	--	[ms]	25301		
	8	Fault duration determined from no-load test	Total	--	[ms]	101		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.231	1.239	1.243
	10		Positive sequence		[p.u.]	1.237	1.237	1.237
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.003
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.297
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.030
	16		Positive sequence			--	--	0.009
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.231	1.239	1.243
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.067
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.062
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.015
	22		Positive sequence			--	--	0.015
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.003
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.298
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.683
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.030
	28		Positive sequence			--	--	0.009
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

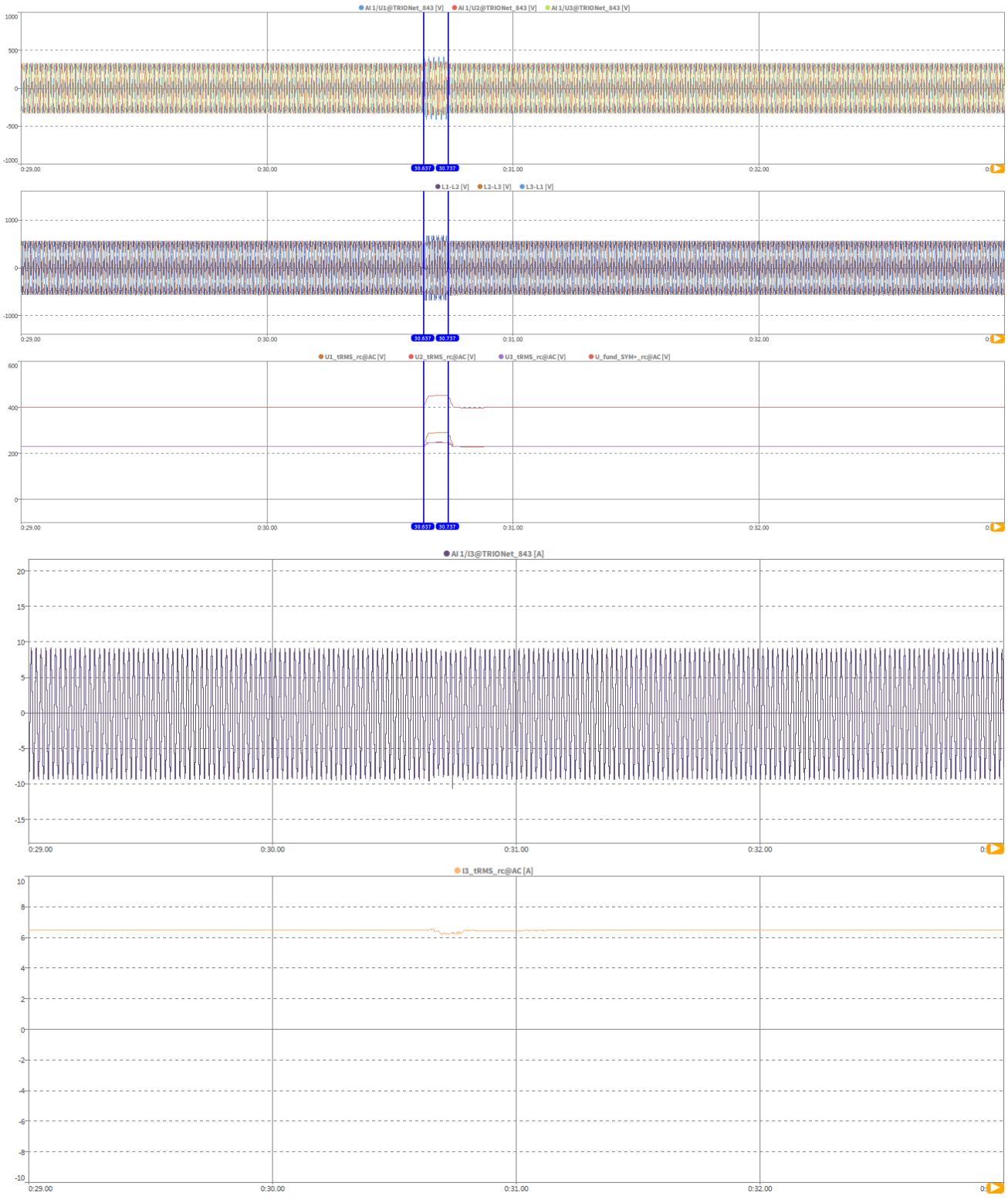

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]

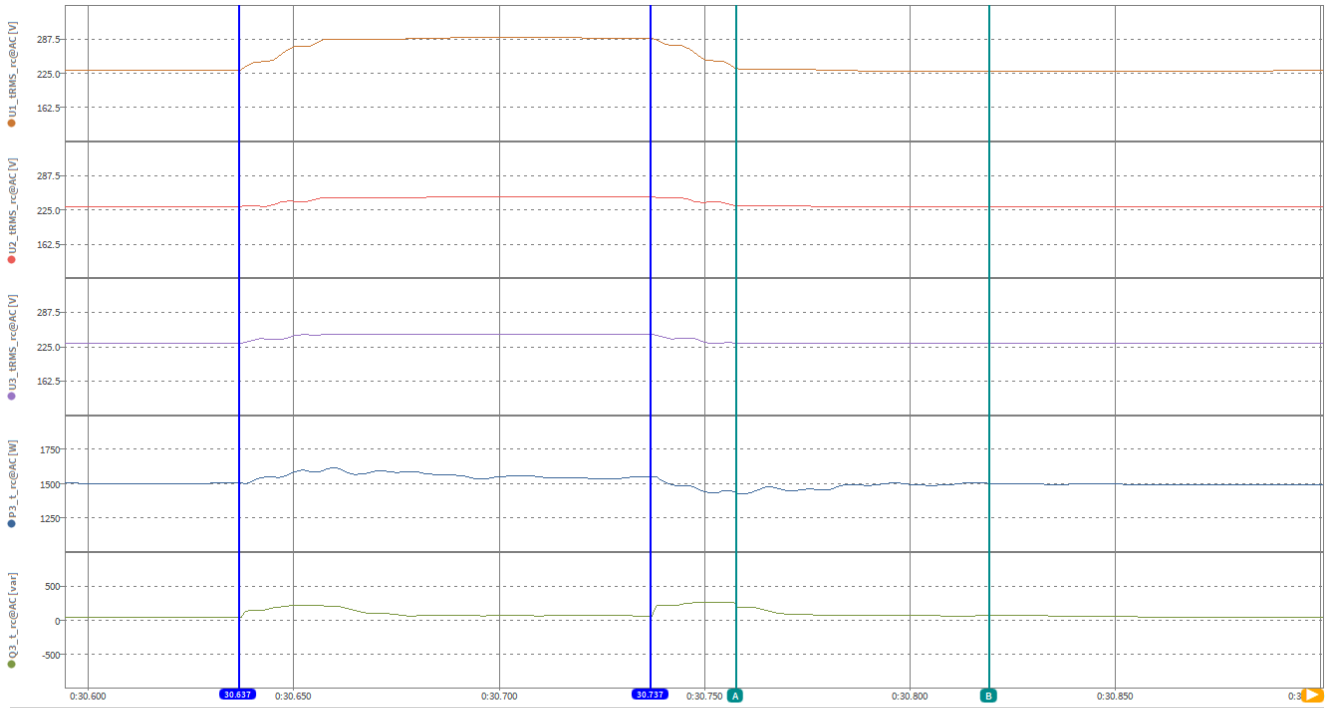


	A	B	间隔
时间 [s]	0:25.318269	0:26.000959	0.682691
U1_tRMS_rc@AC [V]	233.6343	230.2841	-3.350235
U2_tRMS_rc@AC [V]	242.0626	230.9554	-11.10725
U3_tRMS_rc@AC [V]	231.0930	230.8606	-0.232422
P3_t_rc@AC [W]	44.77793	444.4891	399.7112
Q3_t_rc@AC [var]	64.45689	48.97549	-15.48140

8.3

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	8.3		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	17:48:04		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.25	1.07	1.07
	5	Drop duration setpoint	Total	--	[ms]	100		
	6	Fault occurrence (t1)	Total	--	[ms]	30637		
	7	Fault clearance (t2)	Total	--	[ms]	30737		
	8	Fault duration determined from no-load test	Total	--	[ms]	100		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.260	1.079	1.074
	10		Positive sequence		[p.u.]	1.132	1.132	1.132
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.994
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.998
	14		Positive sequence			--	--	0.998
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.020
	16		Positive sequence			--	--	0.003
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.260	1.079	1.074
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.968
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.955
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	1.031
	22		Positive sequence			--	--	1.031
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.998
	25		Positive sequence			--	--	0.998
	26	Response time active power	Positive sequence	--	[s]	--	--	0.062
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.020
	28		Positive sequence			--	--	0.003
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes

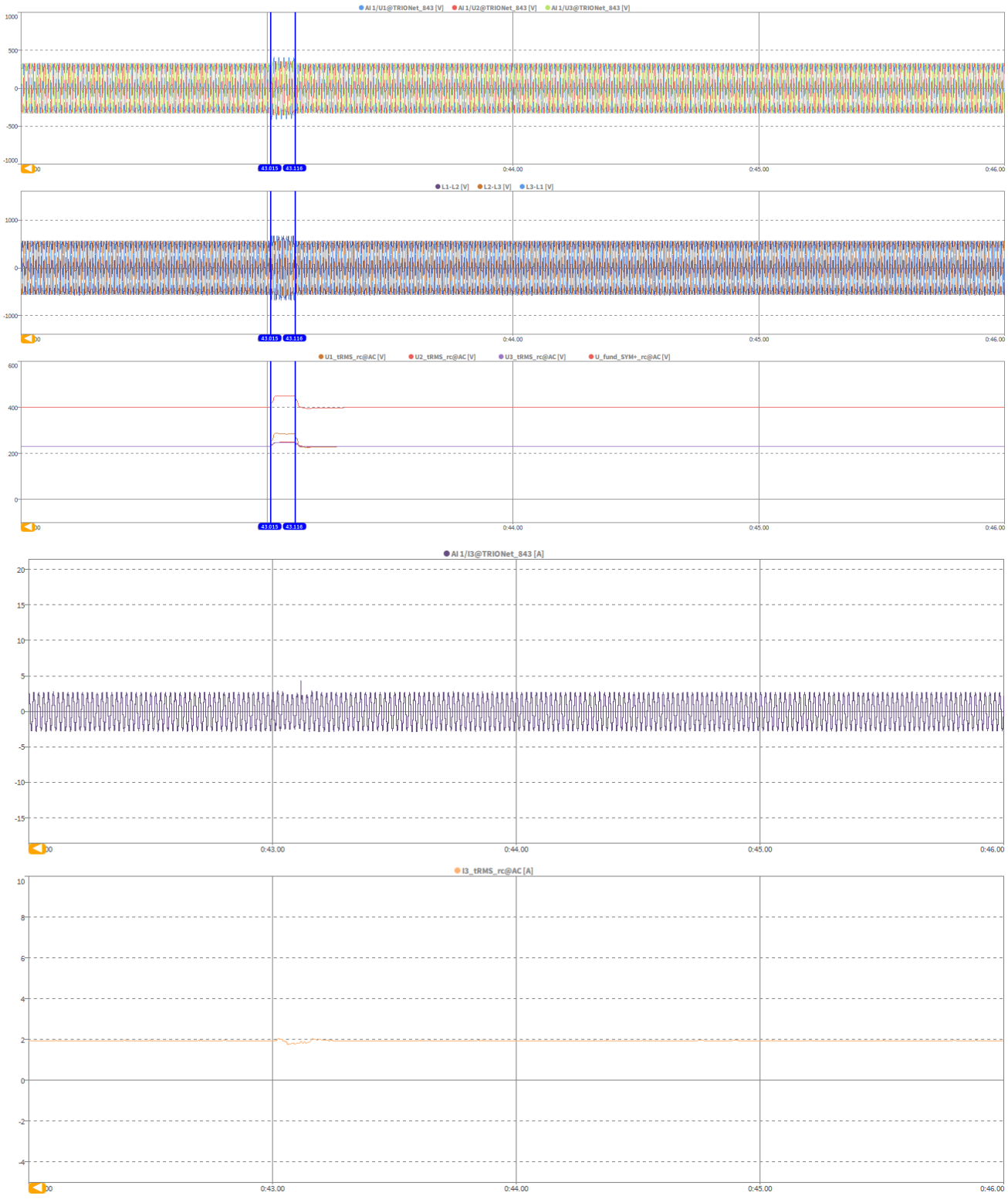

AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]
0:29.00
0:30.00
0:31.00
0:32.00

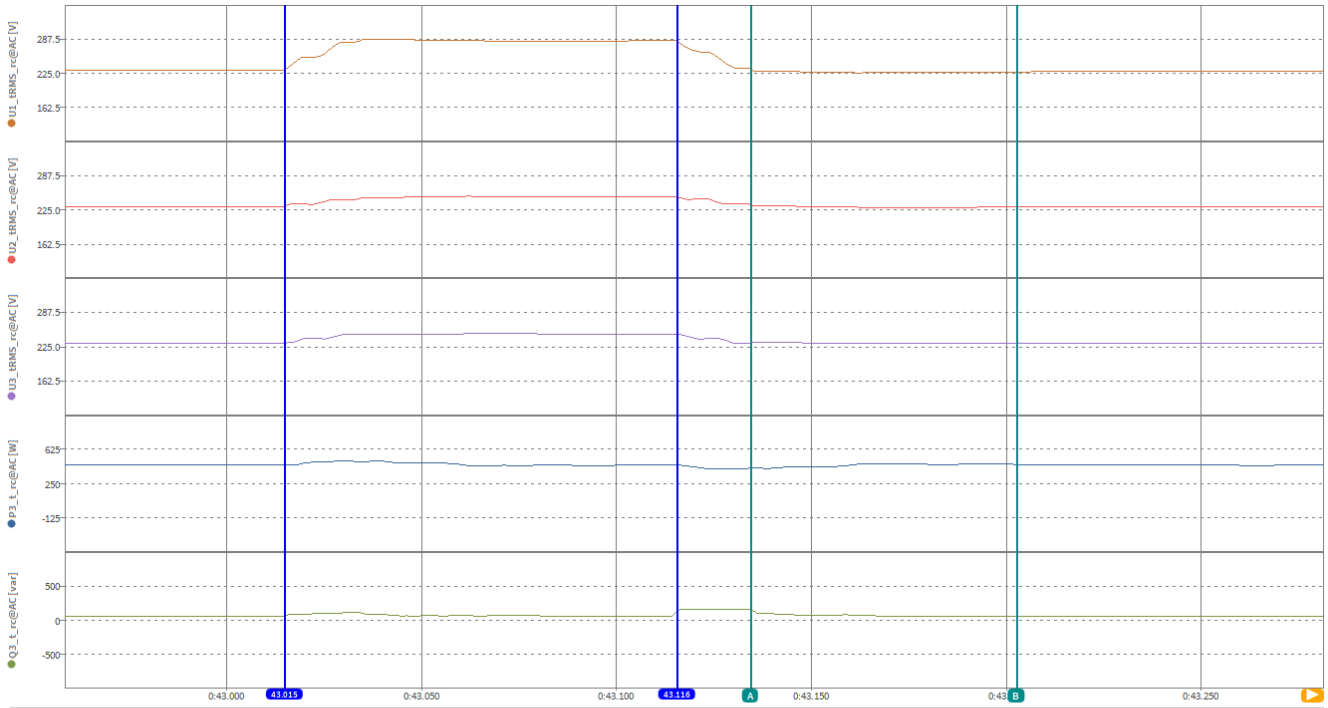


	A	B	间隔
时间 [s]	0:30.757623	0:30.819307	0.061685
U1_tRMS_rc@AC [V]	233.7670	228.3760	-5.390945
U2_tRMS_rc@AC [V]	232.1641	230.1308	-2.033325
U3_tRMS_rc@AC [V]	230.9454	231.1475	0.202072
P3_t_rc@AC [W]	1433.367	1497.129	63.76196
Q3_t_rc@AC [var]	250.4708	55.34157	-195.1293

8.4

	No.	Parameter	Phase reference	Reference time	Value [unit]	Measurement results		
						Phase 1	Phase 2	Phase 3
General information	0	Test no.	--	--	--	8.4		
	1	Date	--	--	[dd.mm.yyyy]	23.03.2026		
	2	Time (start of test)	--	--	[hh:mm:ss.f]	20:47:44		
	3	Type of fault (number of affected phases)	--	--	--	Asymmetric two-phase fault		
	4	Drop depth setpoint	Phase	--	[p.u.]	1.25	1.07	1.07
	5	Drop duration setpoint	Total	--	[ms]	100		
	6	Fault occurrence (t1)	Total	--	[ms]	43015		
	7	Fault clearance (t2)	Total	--	[ms]	43116		
	8	Fault duration determined from no-load test	Total	--	[ms]	101		
	9	Voltage drop / increase determined from no-load test	Total	t1+100ms to t2 and t1-10s to t1	[p.u.]	1.240	1.081	1.076
	10		Positive sequence		[p.u.]	1.128	1.128	1.128
Before voltage dip < t1	11	Voltage	Phase to Neutral	t1-10s to t1	[p.u.]	1.001	1.004	1.004
	12	Current	Positive sequence	t1-500ms to t1-100ms	[p.u.]	--	--	0.297
	13	Active power	Total	t1-10s to t1	[p.u.]	--	--	0.298
	14		Positive sequence			--	--	0.298
	15	Reactive power	Total	t1-10s to t1	[p.u.]	--	--	0.029
	16		Positive sequence			--	--	0.007
	17	Cosφ	Total	t1-10s to t1	--	--	--	0.999
During voltage dip t1 to t2	18	Voltage	Phase to Neutral	t1+100ms to t2-20ms	[p.u.]	1.240	1.081	1.076
	19	Phase current	Phase to Neutral	t1+50ms	[p.u.]	--	--	0.270
	20	Phase current	Phase to Neutral	t1+80ms	[p.u.]	--	--	0.271
	21	Active power	Total	t1+100ms to t2-20ms	[p.u.]	--	--	0.297
	22		Positive sequence			--	--	0.298
After valtage dip > t2	23	Voltage	Phase to Neutral	t2+3s to t2+10s	[p.u.]	1.001	1.004	1.004
	24	Active power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.297
	25		Positive sequence			--	--	0.298
	26	Response time active power	Positive sequence	--	[s]	--	--	0.068
	27	Reactive power	Total	t2+3s to t2+10s	[p.u.]	--	--	0.029
	28		Positive sequence			--	--	0.007
	29	Reactive power rising time	Positive sequence	--	[s]	--	--	--
	30	PGU has not disconnected from the grid within 60 s after the end of the fault: yes / no	--	t2 to t2+60s	[Yes / No]	--	--	Yes


AI 1/U1@TRIONet_843 [V]
AI 1/U2@TRIONet_843 [V]
AI 1/U3@TRIONet_843 [V]
L1-L2 [V]
L2-L3 [V]
L3-L1 [V]
U1_tRMS_rc@AC [V]
U2_tRMS_rc@AC [V]
U3_tRMS_rc@AC [V]
U_fund_SYM+_rc@AC [V]
AI 1/I3@TRIONet_843 [A]
I3_tRMS_rc@AC [A]
0:43.00
0:44.00
0:45.00
0:46.00



	A	B	间隔
时间 [s]	0:43.13449	0:43.20268	0.06819
U1_tRMS_rc@AC [V]	233.6633	227.6339	-6.029343
U2_tRMS_rc@AC [V]	236.2109	229.7410	-6.469864
U3_tRMS_rc@AC [V]	230.7288	230.1824	-0.546417
P3_t_rc@AC [W]	408.4295	453.4318	45.00232
Q3_t_rc@AC [var]	149.1579	43.06122	-106.0967

6.3 Active response to frequency deviation

6.3.1 Power response to over-frequencies

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	Test setup n.1 according to section 5.4.2.1, EN 50549-10. See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.4.3, EN 50549-10

Operating mode of the EUT	☐ MPP-Tracking operation mode ☒ Fixed voltage control operation mode
Active Power level	See table *Test cases* below
Active factor	1.000
ROCOF protection	disable
Voltage protection	set to values not interfering to the tests
Other LFSM-O-relevant parameter settings	See table *Test cases* below and *Annex 1 – Parameter list*

Acceptance criteria

- for each frequency point, the deviation between the expected and the measured value of active power falls within the required tolerance, e.g. ±10%P_n, evaluated with a 1 min average value;
- the dead time of the EUT is less than required value, e.g. 2 s, in test scenarios with a configured intentional delay of zero;
- the dead time of the EUT is less than required value, e.g. 2 s, and the accuracy of the configured intentional delay shall be ± 250 ms in test scenarios with a configured intentional delay other than zero;
- the intentional delay acts only for the activation of the function;
- the step response time is less than required value, e.g. 30 s;
- for the procedure for setting (a) or the setting for a specific grid code with power level at start of the test in partial load, the ramp of active power after deactivation of the active power frequency response does not exceed the required value, e.g. 10%P_n/min;
- in case of active power response to over-frequency with configured deactivation threshold, if the ramp of active power after deactivation of the active power frequency response does not exceed the required value, e.g. 10%P_n/min;
- an EES in charging mode during over frequency does not reduce charging power within required tolerance, e.g. 10% and if declared by the manufacturer, an EES in charging mode does increase the charging power according to the configured droop (see par. 4.6.1 of EN 50549-1:2019 and EN 50549-2:2019).
- randomized disconnection documentation complies to the requirement of EN 50549-1:2019 or EN 50549-2:2019, if this option is used;
- the settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test cases

Technology of the PGUs:

☐ T1: Synchronous generating technology: $P_{ref} = P_{max}$

☒ T2: Systems with energy storage: $P_{ref} = P_{max}$

☐ T3: Other non-synchronous generating technology: $P_{ref} = P_M$

Note:

T2: mainly refers to AC-coupled Energy Storage Systems (EES).

- For DC-coupled storage integrated into the DC side of a generating unit, if they are not capable of charging from AC, they shall be considered according to **T3**. In this case, the units, upon reaching zero power, shall remain at zero power and shall not switch into charging mode.
- For DC-coupled storage integrated into the DC side of a generating unit, if they are capable of charging from AC, they shall be considered according to **T2**.

LFSM-O control strategy

☒ Figure 9, EN 50549-1 or EN 50549-2: suffix „-F9“

☒ Figure 10, EN 50549-1 or EN 50549-2: suffix „-F10“

Note:

The two LFSM-O control modes can be switched via parameters Ena[1,2] (see also *Annex 1 – Parameter list*)

	Setting (a)	Setting (b)	Setting (c)
frequency threshold f_{th} [Hz]	50.2	50.5	50.2
droop [%]	5	2	12
power level at start of test [%P_n]	100 / 50 / -50	60	40
Intentional delay [s]	0	0	2
Configured deactivation threshold and time f_{stop} [Hz] / t_{stop} [s]	N/A	50.5 / 1	50.05 / 600

T3-F9-Test 1: Setting (a), power level at start of test: 100%P_n
T3-F9-Test 2: Setting (a), power level at start of test: 50%P_n
T3-F10-Test 3: Setting (b), power level at start of test: 60%P_n
T3-F10-Test 4: Setting (c), power level at start of test: 40%P_n
T2-F9-Test 1: Setting (a), power level at start of test: 100%P_{max}
T2-F9-Test 2: Setting (a), power level at start of test: 50%P_{max}
T2-F9-Test 3: Setting (a), power level at start of test: -50%P_{max}
T2-F10-Test 4: Setting (b), power level at start of test: 60%P_{max}
T2-F10-Test 5: Setting (c), power level at start of test: 40%P_{max}

Test results

Note:

The frequency points/sequence acc. Table 7 and Figure 11, EN 50549-10 were modified to the frequency steps specified in the result tables below.

T3-F9-Test 1

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	---	---	---	---
2	50.10	---	---	---	---	---
3	50.80	---	76.0%	---	---	

4	51.40	---	52.0%	---	---	≤ 10
5	52.00	---	28.0%	---	---	
6	51.40	---	52.0%	---	---	
7	50.80	---	76.0%	---	---	
8	50.10	---	---	---	---	---
9	50.00	---	---	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	---	---	---	---	< 2	< 1	---
3 → 4	---	---	---	---	< 2		
4 → 5	---	---	---	---			
5 → 6	---	---	---	---			
6 → 7	---	---	---	---			
7 → 8	---	---	---	---			
8 → 9	---	---	---	---	---	---	---

Note:

* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T3-F9-Test 2

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	---	---	---	---
2	50.10	---	---	---	---	---
3	50.80	---	38.0%	---	---	≤ 10
4	51.40	---	26.0%	---	---	
5	52.00	---	14.0%	---	---	
6	51.40	---	26.0%	---	---	
7	50.80	---	38.0%	---	---	
8	50.10	---	---	---	---	---
9	50.00	---	---	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	---	---	---	---	< 2	< 1	---
3 → 4	---	---	---	---	< 2		
4 → 5	---	---	---	---			
5 → 6	---	---	---	---			

6 → 7	---	---	---	---			
7 → 8	---	---	---	---			
8 → 9	---	---	---	---	---	---	---

Note:
* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;
The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T3-F10-Test 3

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	---	---	---	---
2	50.25	---	---	---	---	---
3	51.00	---	30.0%	---	---	≤ 10
4	51.50	---	0.0%	---	---	
5	52.00	---	0.0%	---	---	
6	51.50	---	0.0%	---	---	
7	51.00	---	0.0%	---	---	
8	50.25	---	---	---	---	---
9	50.00	---	---	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Deactivation time [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
						T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---	---
2 → 3	---	---	---	---	---	< 2	< 1	---
3 → 4	---	---	---	---	---	< 2		
4 → 5	---	---	---	---	---	---	---	
5 → 6	---	---	---	---	---			
6 → 7	---	---	---	---	---			
7 → 8	---	---	---	---	---			≤ 10
8 → 9	---	---	---	---	---	---	---	---

Note:
* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;
The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T3-F10-Test 4

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	---	---	---	---
2	50.10	---	---	---	---	---

3	50.80	---	36.0%	---	---	≤ 10
4	51.40	---	32.0%	---	---	
5	52.00	---	28.0%	---	---	
6	51.40	---	28.0%	---	---	
7	50.80	---	28.0%	---	---	
8	50.10	---	---	---	---	---
9	50.00	---	---	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Deactivation time [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
						T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---	---
2 → 3	---	---	---	---	---	1.75 ~ 2	< 1	
3 → 4	---	---	---	---	---	< 2		
4 → 5	---	---	---	---	---			
5 → 6	---	---	---	---	---	---	---	
6 → 7	---	---	---	---	---			
7 → 8	---	---	---	---	---			
8 → 9	---	---	---	---	---			≤ 10

Note:

* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T2-F9-Test 1

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_{max} [%]	Measured value P/P_{max} [%]	Deviation $\Delta P/P_{max}$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_{max}\rvert$ [%]
1	50.00	50.00	---	100.12%	---	---
2	50.10	50.10	---	100.08%	---	---
3	50.80	50.80	76.0%	76.06%	0.06%	≤ 10
4	51.40	51.40	52.0%	52.51%	0.51%	
5	52.00	52.00	28.0%	27.76%	0.24%	
6	51.40	51.40	52.0%	51.08%	0.92%	
7	50.80	50.80	76.0%	75.79%	0.21%	
8	50.10	50.10	---	100.08%	---	---
9	50.00	50.00	---	100.07%	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_{max}/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_{max}/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	0.2	0.2	0.2	---	< 2	< 1	---
3 → 4	0.2	0.2	0.2	---	< 2		
4 → 5	0.2	0.2	0.2	---			

5 → 6	0.2	0.2	0.2	---			
6 → 7	0.2	0.2	0.2	---			
7 → 8	0.2	0.2	0.2	---			
8 → 9	---	---	---	---	---	---	---

Note:

* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T2-F9-Test 2

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_{max} [%]	Measured value P/P_{max} [%]	Deviation $\Delta P/P_{max}$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_{max}\rvert$ [%]
1	50.00	50.00	---	50.25%	---	---
2	50.10	50.10	---	50.18%	---	---
3	50.80	50.80	26.0%	26.59%	0.59%	≤ 10
4	51.40	51.40	2.0%	2.69%	0.69%	
5	52.00	52.00	-22.0%	-22.32%	0.32%	
6	51.40	51.40	2.0%	1.06%	0.94%	
7	50.80	50.80	26.0%	26.06%	0.06%	
8	50.10	50.10	---	50.17%	---	---
9	50.00	50.00	---	50.18%	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_{max}/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_{max}/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	0.2	0.2	0.2	---	< 2	< 1	---
3 → 4	0.2	0.2	0.2	---	< 2		
4 → 5	0.2	0.2	0.2	---			
5 → 6	0.2	0.2	0.2	---			
6 → 7	0.2	0.2	0.2	---			
7 → 8	0.2	0.2	0.2	---			
8 → 9	---	---	---	---	---	---	---

Note:

* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T2-F9-Test 3

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_{max} [%]	Measured value P/P_{max} [%]	Deviation $\Delta P/P_{max}$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_{max}\rvert$ [%]
1	50.00	50.00	---	-50.35%	---	---
2	50.10	50.10	---	-50.35%	---	---
3	50.80	50.80	-74.0%	-74.19%	0.19%	

4	51.40	51.40	-98.0%	-97.83%	0.17%	≤ 10
5	52.00	52.00	-100.0%	-100.55%	0.55%	
6	51.40	51.40	-98.0%	-99.33%	1.33%	
7	50.80	50.80	-74.0%	-74.53%	0.53%	
8	50.10	50.10	---	-50.34%	---	---
9	50.00	50.00	---	-50.33%	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_{max}/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_{max}/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	0.2	0.2	0.2	---	< 2	< 1	---
3 → 4	0.2	0.2	0.2	---	< 2		
4 → 5	0.2	0.2	0.2	---			
5 → 6	0.2	0.2	0.2	---			
6 → 7	0.2	0.2	0.2	---			
7 → 8	0.2	0.2	0.2	---			
8 → 9	---	---	---	---	---	---	---

Note:

* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T2-F10-Test 4

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_{max} [%]	Measured value P/P_{max} [%]	Deviation $\Delta P/P_{max}$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_{max}\rvert$ [%]
1	50.00	50.00	---	60.49%	---	---
2	50.25	50.25	---	60.50%	---	---
3	51.00	51.00	10.0%	11.27%	1.27%	≤ 10
4	51.50	51.50	-40.0%	-39.41%	0.59%	
5	52.00	52.00	-90.0%	-89.81%	0.19%	
6	51.50	51.50	-90.0%	-89.86%	0.14%	
7	51.00	51.00	-90.0%	-89.85%	0.15%	
8	50.25	50.25	---	60.50%	---	---
9	50.00	50.00	---	60.50%	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Deactivation time [s]	Ramp of active power after deactivation LFSM-O [P_{max}/min]	Limit		
						T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_{max}/min]
1 → 2	---	---	---	---	---	---	---	---
2 → 3	0.2	0.4	0.4	---	---	< 2	< 1	---
3 → 4	0.2	0.2	0.2	---	---	< 2		
4 → 5	0.2	0.2	0.2	---	---			

5 → 6	---	---	---	---	---	---	---	
6 → 7	---	---	---	---	---	---	---	
7 → 8	---	---	---	---	6.06%			≤ 10
8 → 9	---	---	---	---	---	---	---	---

Note:

* The Dead time for frequency step 1 → 2 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

T2-F10-Test 5

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_{max} [%]	Measured value P/P_{max} [%]	Deviation $\Delta P/P_{max}$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_{max}\rvert$ [%]
1	50.00	50.00	--	39.82%	--	---
2	50.10	50.10	--	39.81%	--	---
3	50.80	50.80	30.0%	30.09%	0.09%	≤ 10
4	51.40	51.40	20.0%	20.08%	0.08%	
5	52.00	52.00	10.0%	10.16%	0.16%	
6	51.40	51.40	10.0%	10.11%	0.11%	
7	50.80	50.80	10.0%	10.11%	0.11%	
8	50.10	50.10	--	10.11%	--	---
9	50.00	50.00	--	39.72%	--	---

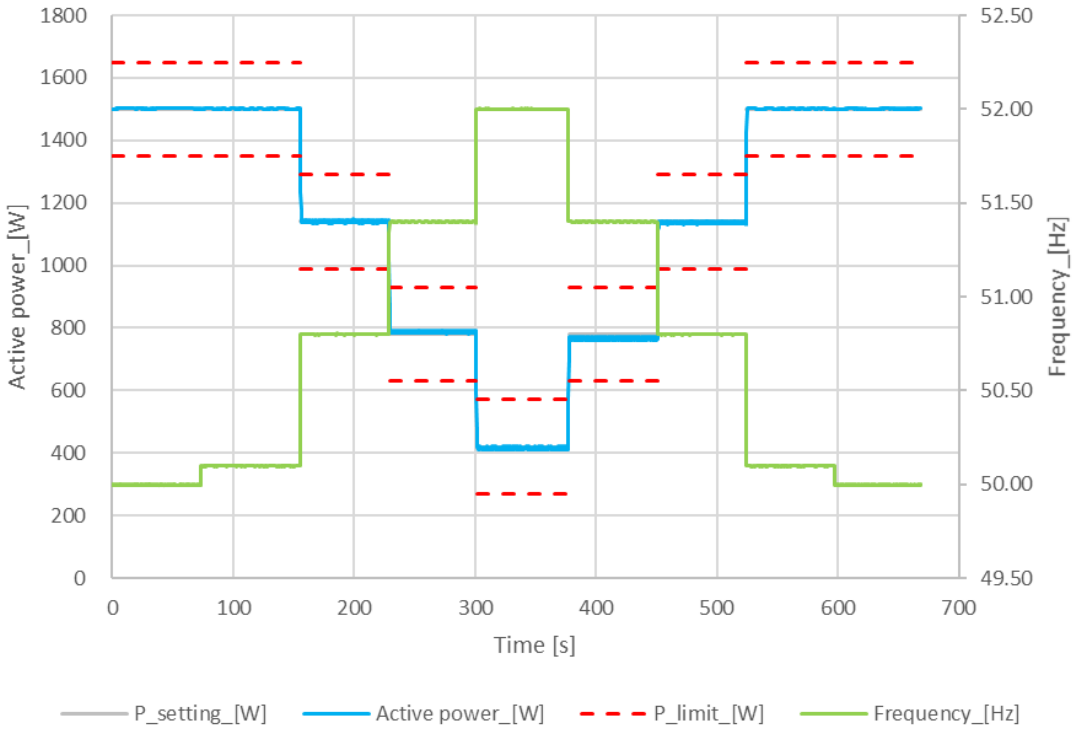
Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Deactivation time [s]	Ramp of active power after deactivation LFSM-O [P_{max}/min]	Limit		
						T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_{max}/min]
1 → 2	---	---	---	---	---	---	---	---
2 → 3	1.8	0.2	0.2	---	---	1.75 ~ 2	< 1	
3 → 4	0.2	0.2	0.2	---	---	< 2		
4 → 5	0.2	0.2	0.2	---	---			
5 → 6	---	---	---	---	---	---	---	
6 → 7	---	---	---	---	---			
7 → 8	---	---	---	---	---			
8 → 9	---	---	---	636	5.95%			≤ 10

Note:

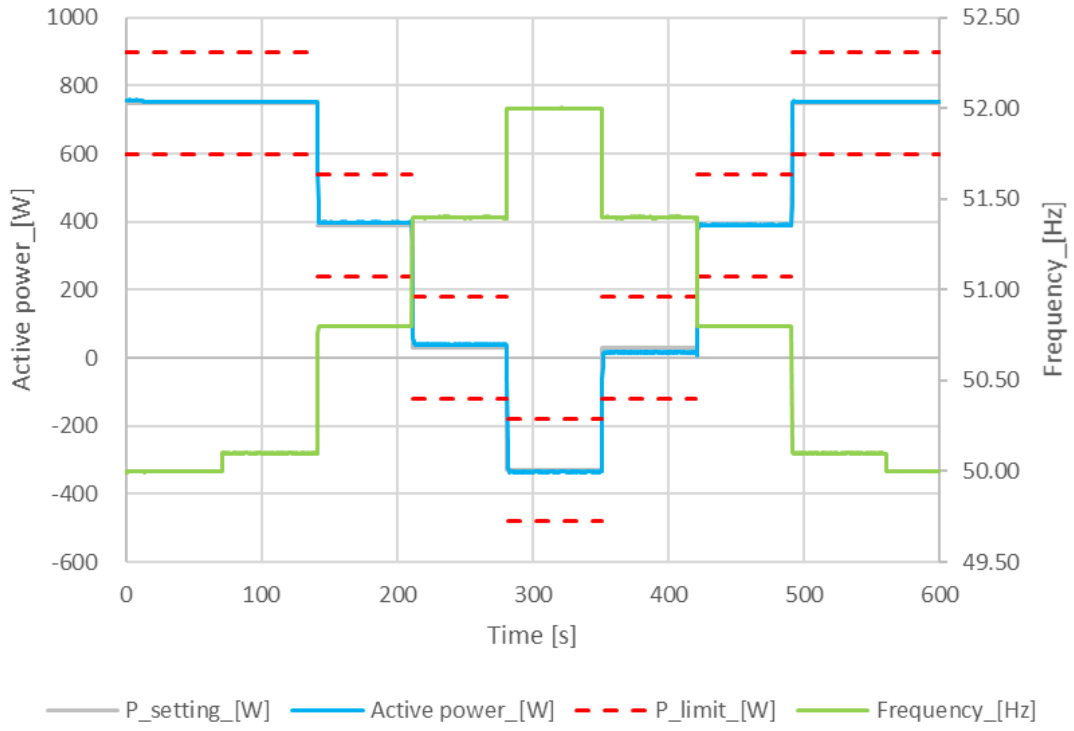
* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

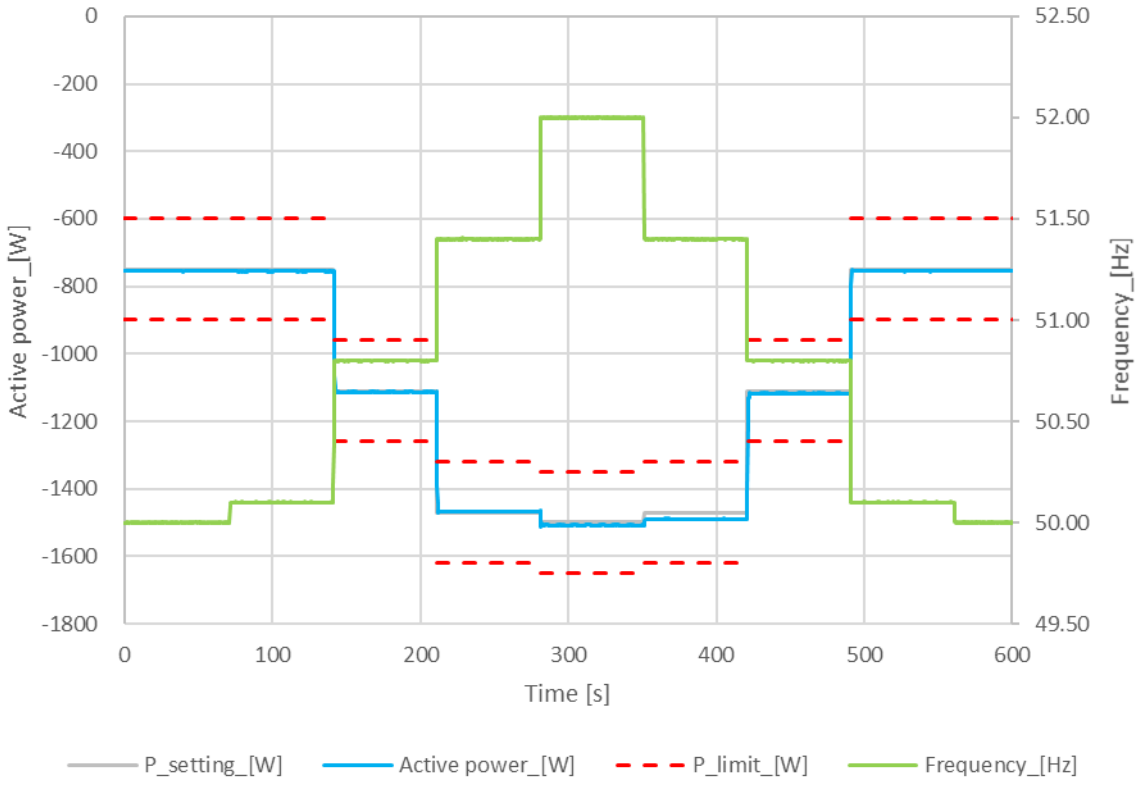
T2-F9-Test 1



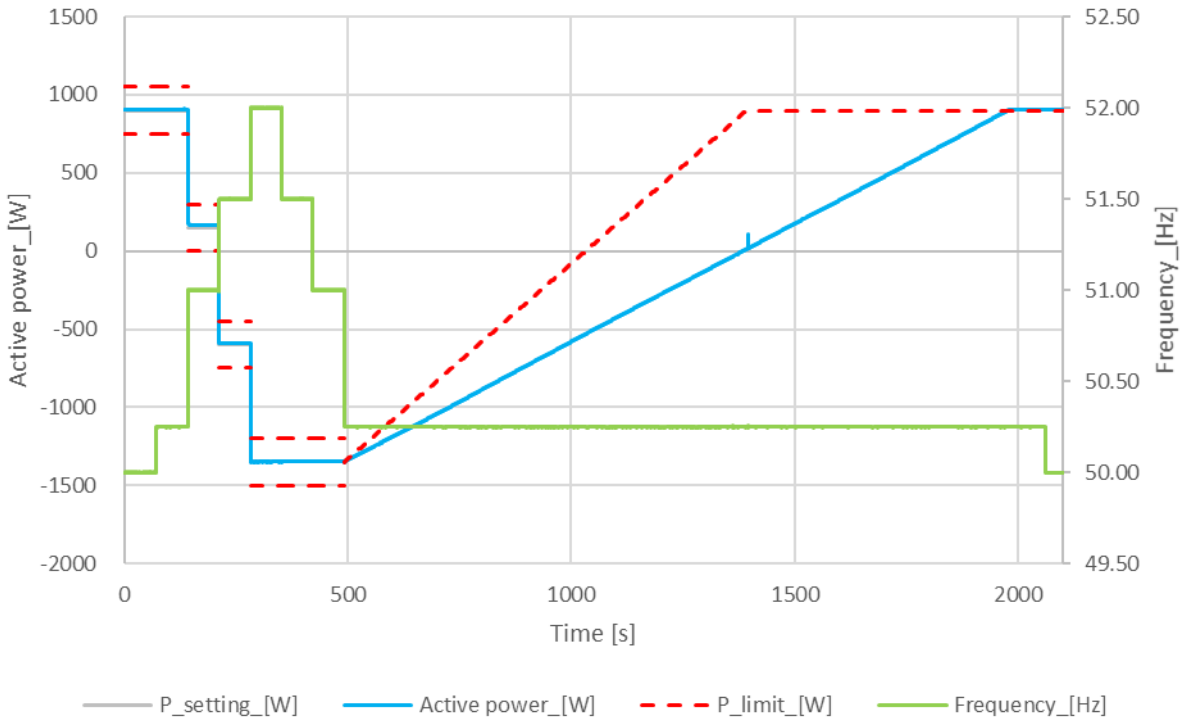
T2-F9-Test 2



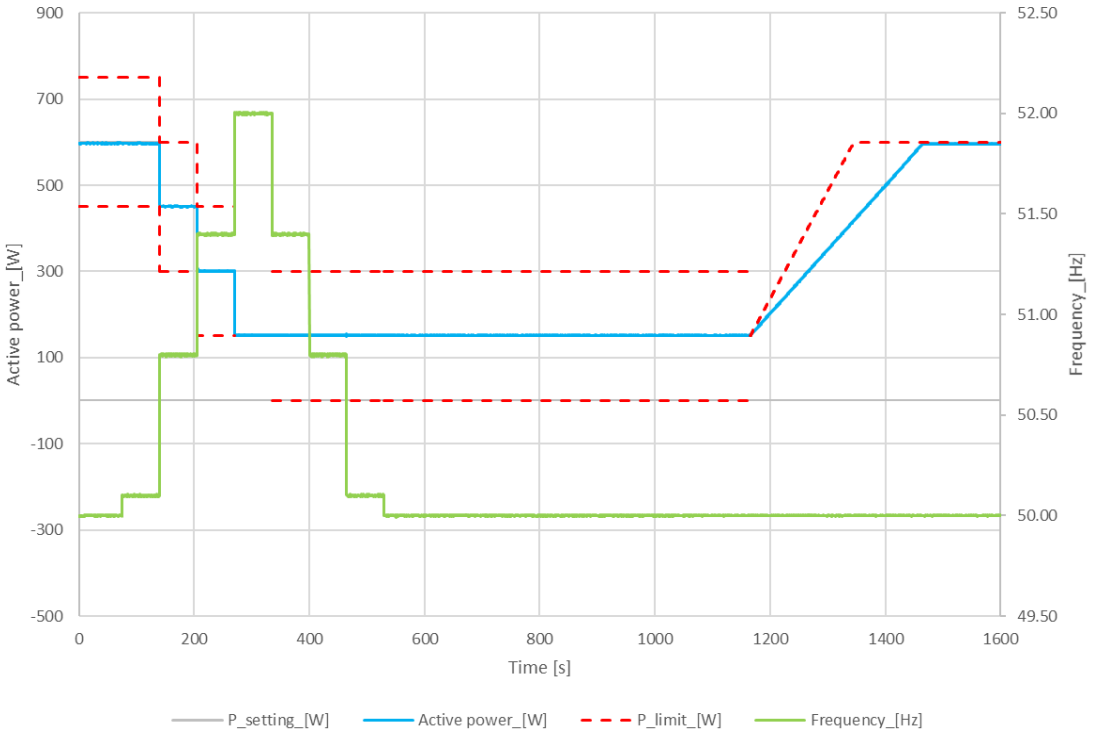
T2-F9-Test 3



T2-F10-Test 4



T2-F10-Test 5


900
700
500
300
100
-100
-300
-500
Active power_[W]
52.50
52.00
51.50
51.00
50.50
50.00
49.50
Frequency_[Hz]
0
200
400
600
800
1000
1200
1400
1600
Time [s]
P_setting_[W]
Active power_[W]
P_limit_[W]
Frequency_[Hz]

6.3.2 Power response to under-frequency

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	Test setup n.1 according to section 5.4.2.1, EN 50549-10. See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.4.3, EN 50549-10

Operating mode of the EUT	☐ MPP-Tracking operation mode ☒ Fixed voltage control operation mode
Active Power level	See table *Test cases* below
Active factor	1.000
ROCOF protection	disable
Voltage protection	set to values not interfering to the tests
Other LFSM-U-relevant parameter settings	See table *Test cases* below and *Annex 1 – Parameter list*

Acceptance criteria

- for each frequency point, the deviation between the expected and the measured value of active power falls within the required tolerance, e.g. ±10%P_n, evaluated with a 1 min average value;
- the dead time of the EUT is less than required value, e.g. 2 s, in test scenarios with a configured intentional delay of zero;
- the dead time of the EUT is less than required value, e.g. 2 s, and the accuracy of the configured intentional delay shall be ± 250 ms in test scenarios with a configured intentional delay other than zero;
- the intentional delay acts only for the activation of the function;
- the step response time is less than required value, e.g. 30 s;
- for the procedure for setting (a) or the setting for a specific grid code with power level at start of the test in partial load, the ramp of active power after deactivation of the active power frequency response does not exceed the required value, e.g. 10%P_n/min;
- in case of active power response to over-frequency with configured deactivation threshold, if the ramp of active power after deactivation of the active power frequency response does not exceed the required value, e.g. 10%P_n/min;
- an EES in charging mode during over frequency does not reduce charging power within required tolerance, e.g. 10% and if declared by the manufacturer, an EES in charging mode does increase the charging power according to the configured droop (see par. 4.6.1 of EN 50549-1:2019 and EN 50549-2:2019).
- randomized disconnection documentation complies to the requirement of EN 50549-1:2019 or EN 50549-2:2019, if this option is used;
- the settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test cases

Technology of the PGUs:

☐ Synchronous generating technology: $P_{ref} = P_{max}$

☒ Systems with energy storage: $P_{ref} = P_{max}$

☒ Other non-synchronous generating technology: $P_{ref} = P_{max}$

Note:

For DC-coupled storage integrated into the DC side of a generating unit, if they are capable of charging from AC, they shall be considered according to *Systems with energy storage*.

	Setting (a)	Setting (b)	Setting (c)
frequency threshold f_{th} [Hz]	49.8	49.5	49.8
droop [%]	5	2	12
power level at start of test [%P_n]	-50 / 0	0	50
Intentional delay [s]	0	0	2
Configured deactivation threshold	---	---	---

Test 1: Setting (a), power level at start of test: 0%P_n

Test 2: Setting (b), power level at start of test: 0%P_n

Test 3: Setting (c), power level at start of test: 50%P_n

Test 4: Setting (a), power level at start of test: -50%P_{max}

Test 5: Setting (b), power level at start of test: 0%P_{max}

Test 6: Setting (c), power level at start of test: 50%P_{max}

Test results

Note:

The frequency points/sequence acc. Table 10 were modified to the frequency steps specified in the result tables below.

Test 1 (Other non-synchronous generating technology) - Setting (a)-0%P_n

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	---	---	---	---
2	49.90	---	---	---	---	---
3	49.00	---	32.0	---	---	≤ 10
4	48.00	---	72.0	---	---	
5	47.50	---	92.0	---	---	
6	48.00	---	72.0	---	---	
7	49.00	---	32.0	---	---	
8	49.90	---	---	---	---	---
9	50.00	---	---	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	---	---	---	---	< 2	< 30	---

3 → 4	---	---	---	---	< 2		---
4 → 5	---	---	---	---			
5 → 6	---	---	---	---			
6 → 7	---	---	---	---			
7 → 8	---	---	---	---			
8 → 9	---	---	---	---	---	---	---

Note:
* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;
The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

Test 2 (Other non-synchronous generating technology) - Setting (b)-0%P_n

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	0.00	---	---	---
2	49.80	---	0.00	---	---	---
3	49.20	---	30.00	---	---	≤ 10
4	48.80	---	70.00	---	---	
5	47.50	---	100.00	---	---	
6	48.80	---	70.00	---	---	
7	49.20	---	30.00	---	---	
8	49.80	---	0.00	---	---	---
9	50.00	---	0.00	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	---	---	---	---	< 2	< 30	---
3 → 4	---	---	---	---	< 2		
4 → 5	---	---	---	---			
5 → 6	---	---	---	---			
6 → 7	---	---	---	---			
7 → 8	---	---	---	---			
8 → 9	---	---	---	---	---	---	---

Note:
* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;
The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

Test 3 (Other non-synchronous generating technology) - Setting (c)-50%P_n

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	---	50.00	---	---	---

2	49.80	---	50.00	---	---	---
3	49.20	---	60.00	---	---	≤ 10
4	48.00	---	80.00	---	---	
5	47.50	---	88.00	---	---	
6	48.00	---	80.00	---	---	
7	49.20	---	60.00	---	---	
8	49.80	---	50.00	---	---	---
9	50.00	---	50.00	---	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	---	---	---	---	< 2	< 30	---
3 → 4	---	---	---	---	< 2		
4 → 5	---	---	---	---			
5 → 6	---	---	---	---			
6 → 7	---	---	---	---			
7 → 8	---	---	---	---			
8 → 9	---	---	---	---	---	---	---

Note:

* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

Test 4 (Systems with energy storage) - Setting (a)-(-50%)P_{max}

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	50.00	-50.00	-50.33	---	---
2	49.90	49.90	-50.00	-50.32	---	---
3	49.00	49.00	-18.00	-18.67	0.67	≤ 10
4	48.00	48.00	22.00	21.29	0.71	
5	47.50	47.50	42.00	41.62	0.38	
6	48.00	48.00	22.00	22.48	0.48	
7	49.00	49.00	-18.00	-17.45	0.55	
8	49.90	49.90	-50.00	-50.29	---	---
9	50.00	50.00	-50.00	-50.30	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	0.2	0.2	0.2	---	< 2	< 30	---
3 → 4	0.2	0.2	0.2	---			

4 → 5	0.2	0.2	0.2	---	< 2		
5 → 6	0.2	0.2	0.2	---			
6 → 7	0.2	0.2	0.2	---			
7 → 8	0.2	0.2	0.2	---			
8 → 9	---	---	---	---	---	---	---

Note:
* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;
The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

Test 5 (Systems with energy storage) - Setting (b)-0%P_{max}

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	50.00	0.00	0.07	---	---
2	49.80	49.80	0.00	0.08	---	---
3	49.20	49.20	30.00	28.49	1.51	≤ 10
4	48.80	48.80	70.00	70.05	0.05	
5	47.50	47.50	100.00	100.74	0.74	
6	48.80	48.80	70.00	71.34	1.34	
7	49.20	49.20	30.00	30.78	0.78	
8	49.80	49.80	0.00	0.14	---	---
9	50.00	50.00	0.00	0.08	---	---

Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	0.2	0.2	0.2	---	< 2	< 30	---
3 → 4	0.2	0.2	0.2	---	< 2		
4 → 5	0.2	0.2	0.2	---			
5 → 6	0.2	0.2	0.2	---			
6 → 7	0.2	0.2	0.2	---			
7 → 8	0.2	0.2	0.2	---			
8 → 9	---	---	---	---	---	---	---

Note:
* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;
The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

Test 6 (Systems with energy storage) - Setting (c)-50%P_{max}

Frequency step	Simulated frequency [Hz]	Measured frequency [Hz]	P-Setpoint P_{set}/P_n [%]	Measured value P/P_n [%]	Deviation $\Delta P/P_n$ [%] (Measured value - Set point)	Limit $\lvert\Delta P/P_n\rvert$ [%]
1	50.00	50.00	50.00	50.11	---	---
2	49.80	49.80	50.00	50.11	---	---

3	49.20	49.20	60.00	59.94	0.06	≤ 10
4	48.00	48.00	80.00	80.14	0.14	
5	47.50	47.50	88.00	88.38	0.38	
6	48.00	48.00	80.00	80.43	0.43	
7	49.20	49.20	60.00	60.38	0.38	
8	49.80	49.80	50.00	50.12	---	---
9	50.00	50.00	50.00	50.09	---	---

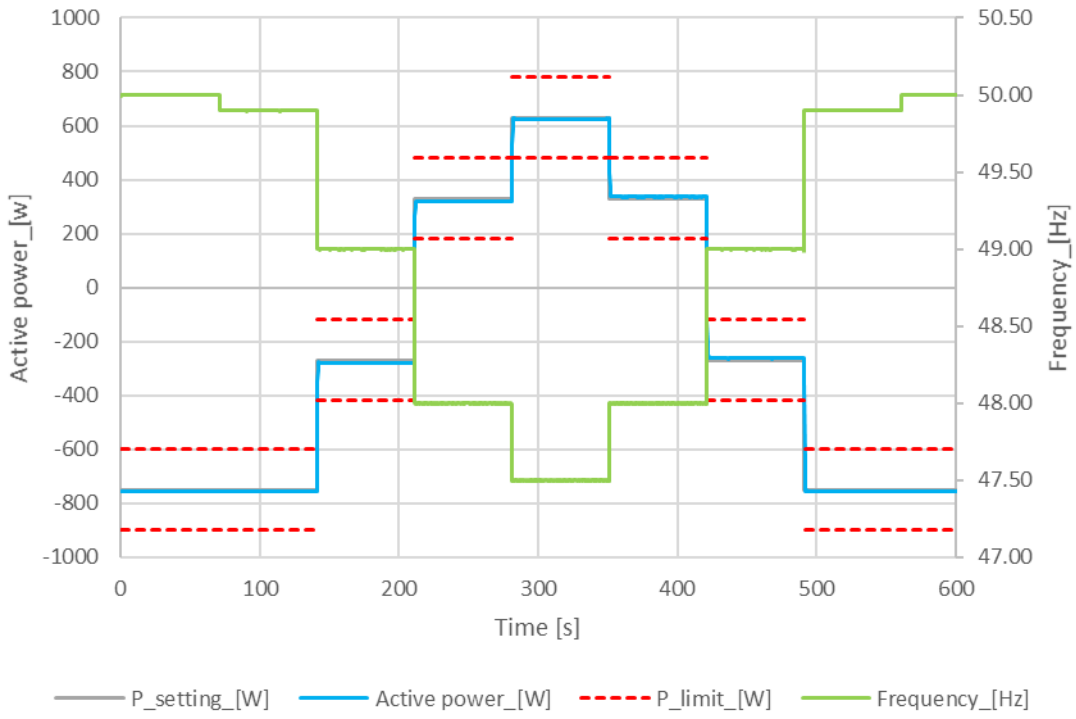
Frequency step	T_d [s] *	T_{sr} [s]	T_s [s]	Ramp of active power after deactivation LFSM-O [P_n/min]	Limit		
					T_d [s]	T_{sr} [s]	Ramp of active power after deactivation LFSM-O [%P_n/min]
1 → 2	---	---	---	---	---	---	---
2 → 3	0.2	0.2	0.2	---	< 2	< 30	---
3 → 4	0.2	0.2	0.2	---	< 2		
4 → 5	0.2	0.2	0.2	---			
5 → 6	0.2	0.2	0.2	---			
6 → 7	0.2	0.2	0.2	---			
7 → 8	0.2	0.2	0.2	---			
8 → 9	---	---	---	---	---	---	---

Note:

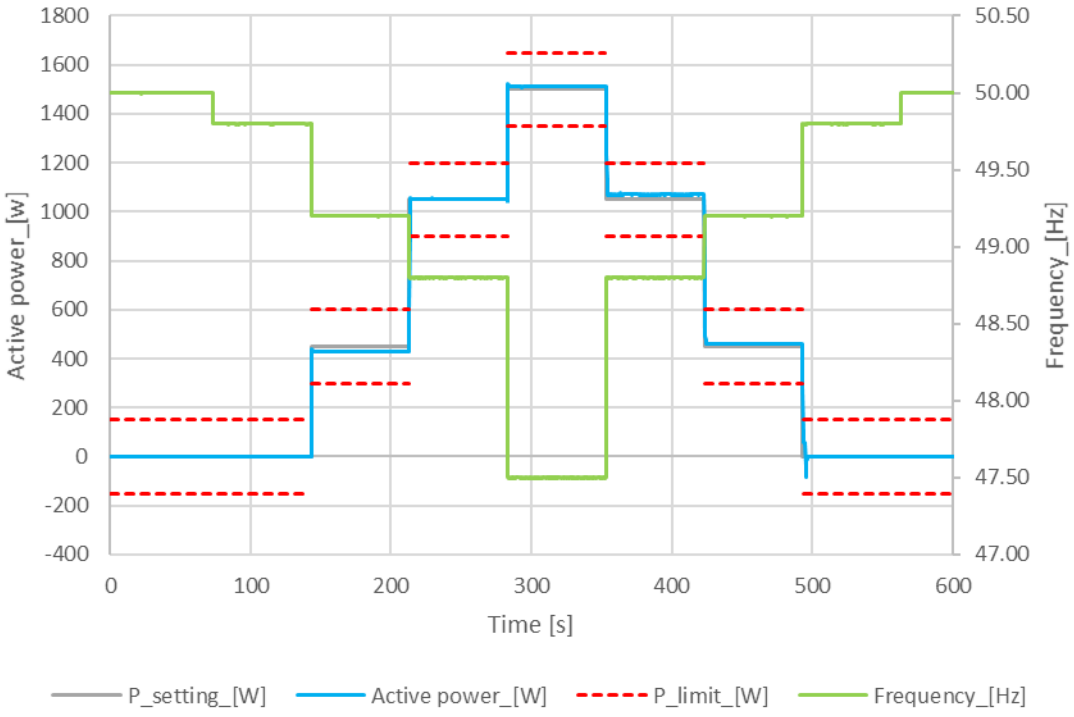
* The Dead time for frequency step 2 → 3 refers to the **intentional delay** for the activation of the function;

The Dead time for other frequency steps refers to the intrinsic dead time of the LFSM control algorithm for response to frequency changes.

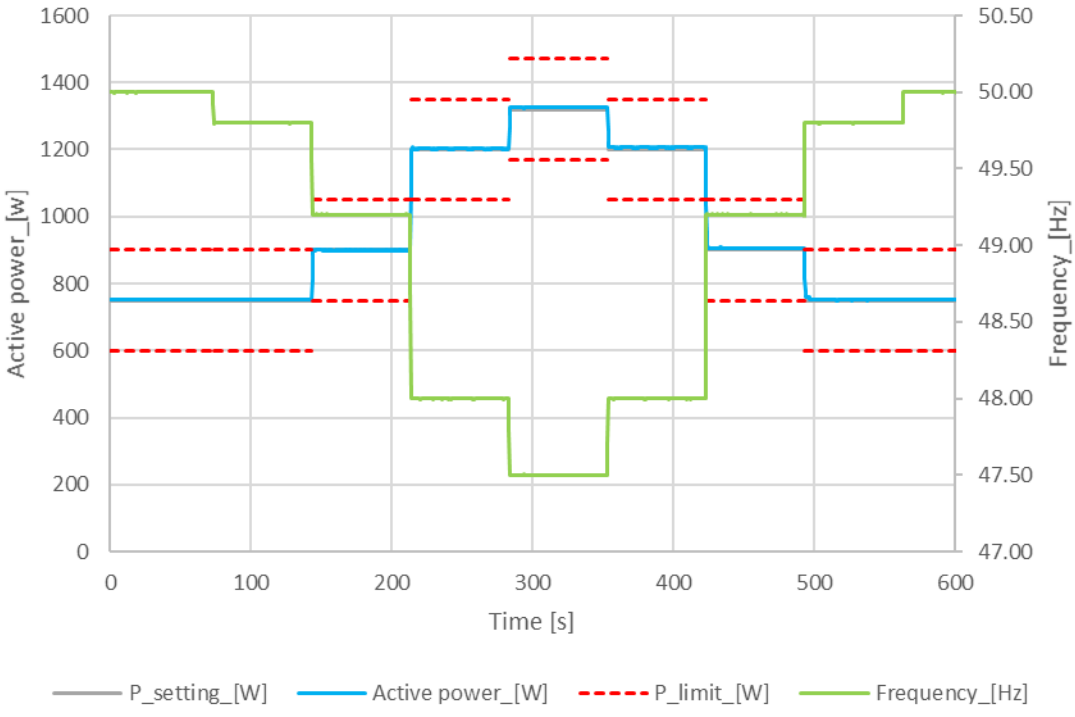
Test 4



Test 5


1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
Active power_[w]
50.50
50.00
49.50
49.00
48.50
48.00
47.50
47.00
Frequency_[Hz]
0
100
200
300
400
500
600
Time [s]
P_setting_[W]
Active power_[W]
P_limit_[W]
Frequency_[Hz]

Test 6


1600
1400
1200
1000
800
600
400
200
0
Active power_[w]
50.50
50.00
49.50
49.00
48.50
48.00
47.50
47.00
Frequency_[Hz]
0
100
200
300
400
500
600
Time [s]
P_setting_[W]
Active power_[W]
P_limit_[W]
Frequency_[Hz]

6.4 Power specification and response to voltage variations

6.4.1 Power capabilities assessment - voltage support by reactive power

6.4.1.1 Determine the power capability at nominal voltage

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.5.1.3 & 5.5.1.6, EN 50549-10

Acceptance criteria
The generating unit is able to meet the reactive power value of the capability curve in overexcited and underexcited condition as declared by the manufacturer. In particular the values are reached and maintained for the specified time.

Manufacturer's data

Th PGU(s) are designed for the P-Q capability acc.:

☐ EN 50549-1:

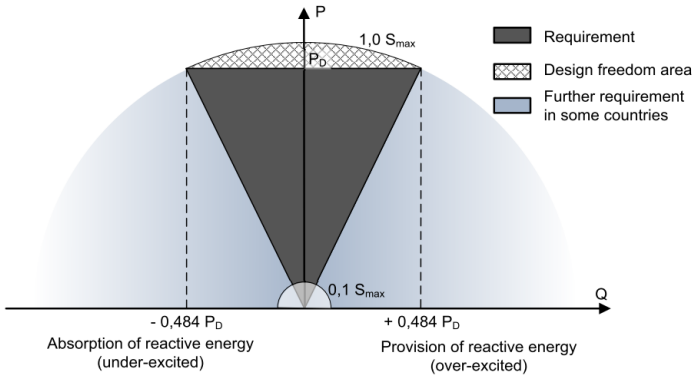


Figure 12 — Reactive power capability at nominal voltage

☐ EN 50549-2 ☐ Stringent Requirement ☐ default requirement

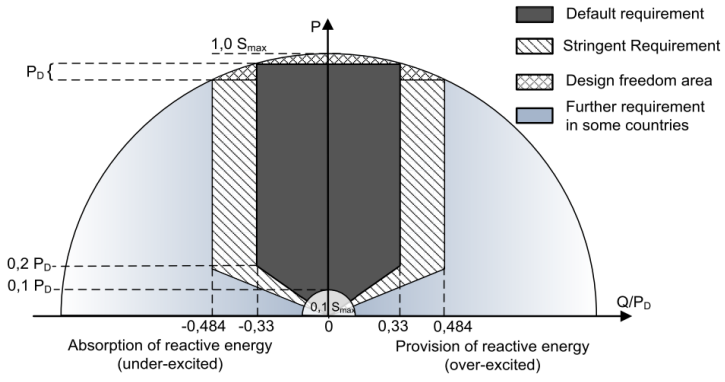


Figure 12 — Reactive power capability at nominal voltage

☒ According to manufactuer' data

See *Annex 3 – Capability curve of the PGU(s)*.

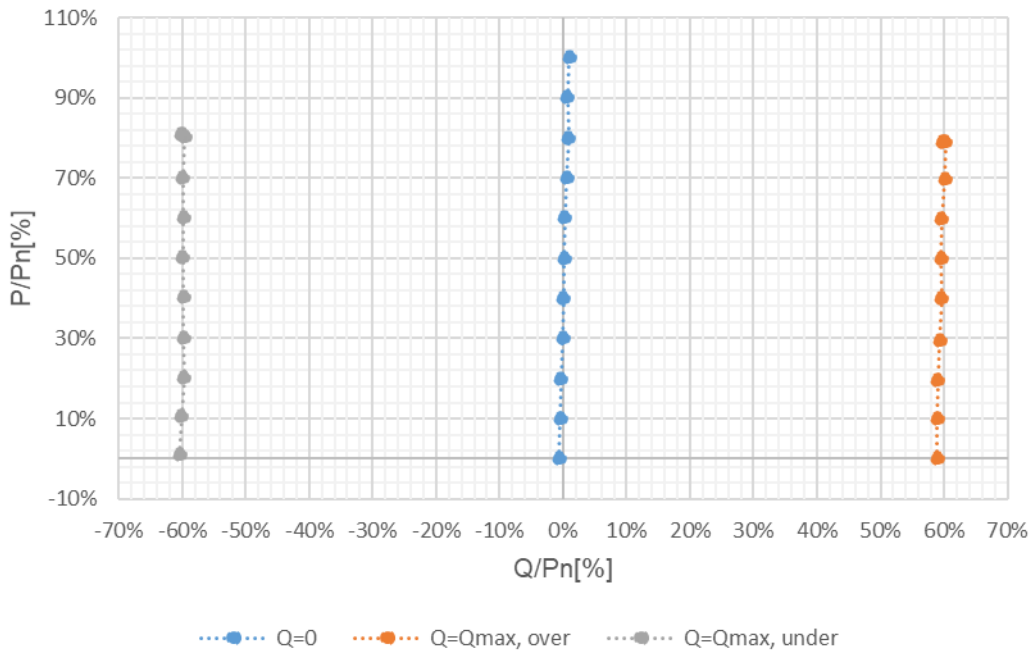
Test results

Active power level P/P_n [%]	Q = 0								
	P_{60}		Q_{60}		S_{60}		$\cos\varphi_{60}$ [-]	U_{60}[V]	
	[W]	[p.u. based P_n]	[Var]	[p.u. based P_n]	[VA]	[p.u. based P_n]		[V]	[p.u. based U_n]
0	0	0.00	-9	-0.01	9	0.01	0.036	230.52	1.00
10	151	0.10	-7	0.00	151	0.10	0.999	229.98	1.00
20	300	0.20	-5	0.00	300	0.20	1.000	229.97	1.00
30	451	0.30	-1	0.00	451	0.30	1.000	229.95	1.00
40	601	0.40	2	0.00	601	0.40	1.000	229.93	1.00
50	751	0.50	2	0.00	751	0.50	1.000	229.92	1.00
60	902	0.60	4	0.00	902	0.60	1.000	229.90	1.00
70	1052	0.70	9	0.01	1052	0.70	1.000	229.88	1.00
80	1202	0.80	13	0.01	1202	0.80	1.000	229.87	1.00
90	1352	0.90	11	0.01	1352	0.90	1.000	229.85	1.00
100	1503	1.00	15	0.01	1503	1.00	1.000	229.83	1.00

Active power level P/P_n [%]	Underexcited								
	P_{60}		Q_{60}		S_{60}		$\cos\varphi_{60}$ [-]	U_{60}[V]	
	[W]	[p.u. based P_n]	[Var]	[p.u. based P_n]	[VA]	[p.u. based P_n]		[V]	[p.u. based U_n]
0	14	0.01	-906	-0.60	906	0.60	-0.016	230.02	1.00
10	160	0.11	-901	-0.60	915	0.61	-0.175	230.04	1.00
20	305	0.20	-896	-0.60	946	0.63	-0.322	230.08	1.00
30	454	0.30	-896	-0.60	1005	0.67	-0.452	230.10	1.00
40	604	0.40	-896	-0.60	1081	0.72	-0.559	230.11	1.00
50	754	0.50	-899	-0.60	1174	0.78	-0.643	230.11	1.00
60	903	0.60	-896	-0.60	1273	0.85	-0.710	230.12	1.00
70	1054	0.70	-899	-0.60	1385	0.92	-0.761	230.13	1.00
80	1204	0.80	-893	-0.60	1499	1.00	-0.803	230.14	1.00
90	1214	0.81	-899	-0.60	1511	1.01	-0.804	230.14	1.00
100	1214	0.81	-903	-0.60	1513	1.01	-0.802	230.14	1.00

Active power level P/P_n [%]	Overexcited								
	P_{60}		Q_{60}		S_{60}		$\cos\varphi_{60}$ [-]	U_{60}[V]	
	[W]	[p.u. based P_n]	[Var]	[p.u. based P_n]	[VA]	[p.u. based P_n]		[V]	[p.u. based U_n]
0	1	0.00	883	0.59	883	0.59	0.001	230.01	1.00
10	148	0.10	883	0.59	896	0.60	0.166	230.05	1.00
20	295	0.20	886	0.59	934	0.62	0.316	230.11	1.00
30	445	0.30	890	0.59	995	0.66	0.447	230.12	1.00
40	600	0.40	894	0.60	1076	0.72	0.557	230.11	1.00
50	750	0.50	894	0.60	1167	0.78	0.643	230.12	1.00
60	899	0.60	894	0.60	1268	0.85	0.709	230.13	1.00
70	1048	0.70	902	0.60	1383	0.92	0.758	230.13	1.00
80	1185	0.79	903	0.60	1490	0.99	0.795	230.14	1.00
90	1184	0.79	898	0.60	1486	0.99	0.797	230.14	1.00
100	1184	0.79	901	0.60	1488	0.99	0.796	230.14	1.00

$P_{max,\ 600}$ = max ($P_{max,\ 600,\ underexcited}$, $P_{max,\ 600,\ Q=0}$, $P_{max,\ 600,\ overexcited}$) [W]	1512
$P_{max,\ 60}$ = max ($P_{max,\ 60,\ underexcited}$, $P_{max,\ 60,\ Q=0}$, $P_{max,\ 60,\ overexcited}$) [W]	1504
$P_{max,\ 0.2}$ = max ($P_{max,\ 0.2,\ underexcited}$, $P_{max,\ 0.2,\ Q=0}$, $P_{max,\ 0.2,\ overexcited}$) [W]	1501
$S_{max,\ 600}$ = max ($S_{max,\ 600,\ underexcited}$, $S_{max,\ 600,\ Q=0}$, $S_{max,\ 600,\ overexcited}$) [VA]	1518
$S_{max,\ 60}$ = max ($S_{max,\ 60,\ underexcited}$, $S_{max,\ 60,\ Q=0}$, $S_{max,\ 60,\ overexcited}$) [VA]	1515
$S_{max,\ 0.2}$ = max ($S_{max,\ 0.2,\ underexcited}$, $S_{max,\ 0.2,\ Q=0}$, $S_{max,\ 0.2,\ overexcited}$) [VA]	1511
$Q_{max,\ over,\ 600}$ = max ($Q_{max,\ 600,\ overexcited}$) [var]	910
$Q_{max,\ over,\ 60}$ = max ($Q_{max,\ 60,\ overexcited}$) [var]	901
$Q_{max,\ over,\ 0.2}$ = max ($Q_{max,\ 0.2,\ overexcited}$) [var]	897
$Q_{max,\ under,\ 600}$ = max ($Q_{max,\ 600,\ underexcited}$) [var]	-912
$Q_{max,\ under,\ 60}$ = max ($Q_{max,\ 60,\ underexcited}$) [var]	-906
$Q_{max,\ under,\ 0.2}$ = max ($Q_{max,\ 0.2,\ underexcited}$) [var]	-899



6.4.1.2 Determine the power capability considering voltage range

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9

Acceptance criteria
The U-Q diagram provides all the information to evaluate the performance of the generating unit considering active power, reactive power and associated voltage level. The U-Q diagram shall be equal or exceed U-Q requirements.

Manufacturer's data
See *Annex 3 – Capability curve of the PGU(s)*.

Test results									
Voltage level U/U_n [%]	$Q = Q_{max, under}$								
	P_{60}		Q_{60}		S_{60}		$\cos\varphi_{60}$ [-]	$U_{+, 60}$[V]	
	[W]	[p.u. based P_n]	[Var]	[p.u. based P_n]	[VA]	[p.u. based P_n]		[V]	[p.u. based U_n]
85	1223	0.82	-900	-0.60	1518	1.01	0.805	195.7	0.85
90	1222	0.81	-901	-0.60	1518	1.01	0.805	207.1	0.90
95	1221	0.81	-901	-0.60	1518	1.01	0.805	218.6	0.95
100	1222	0.81	-904	-0.60	1520	1.01	0.804	230.1	1.00
105	1222	0.81	-907	-0.60	1521	1.01	0.803	241.6	1.05
110	1222	0.81	-909	-0.61	1523	1.02	0.802	253.1	1.10
	$Q = Q_{max, over}$								
85	1200	0.80	901	0.60	1501	1.00	0.800	195.7	0.85
90	1199	0.80	901	0.60	1500	1.00	0.800	207.2	0.90
95	1200	0.80	900	0.60	1500	1.00	0.800	218.7	0.95
100	1200	0.80	897	0.60	1498	1.00	0.801	230.1	1.00
105	1200	0.80	894	0.60	1496	1.00	0.802	241.6	1.05
110	1200	0.80	889	0.59	1493	1.00	0.804	253.1	1.10

6.4.2 Determine the reactive power control modes

6.4.2.1 Q-Set point control

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9

The interface used to provide reactive power set points	Using specialized software tool *at_**mbpoll**_*tool through the RS485 interface.
Reactive power set points	Parameter: Var (see *Annex 1 – Parameter list*)

Acceptance criteria
Reactive power set point control accuracy (static reactive power value) is better than 2 % Smax. In case of cos φ set points, the reactive power accuracy applies for the reactive power set value derived from the cos φ set point and the active power during the measurement.

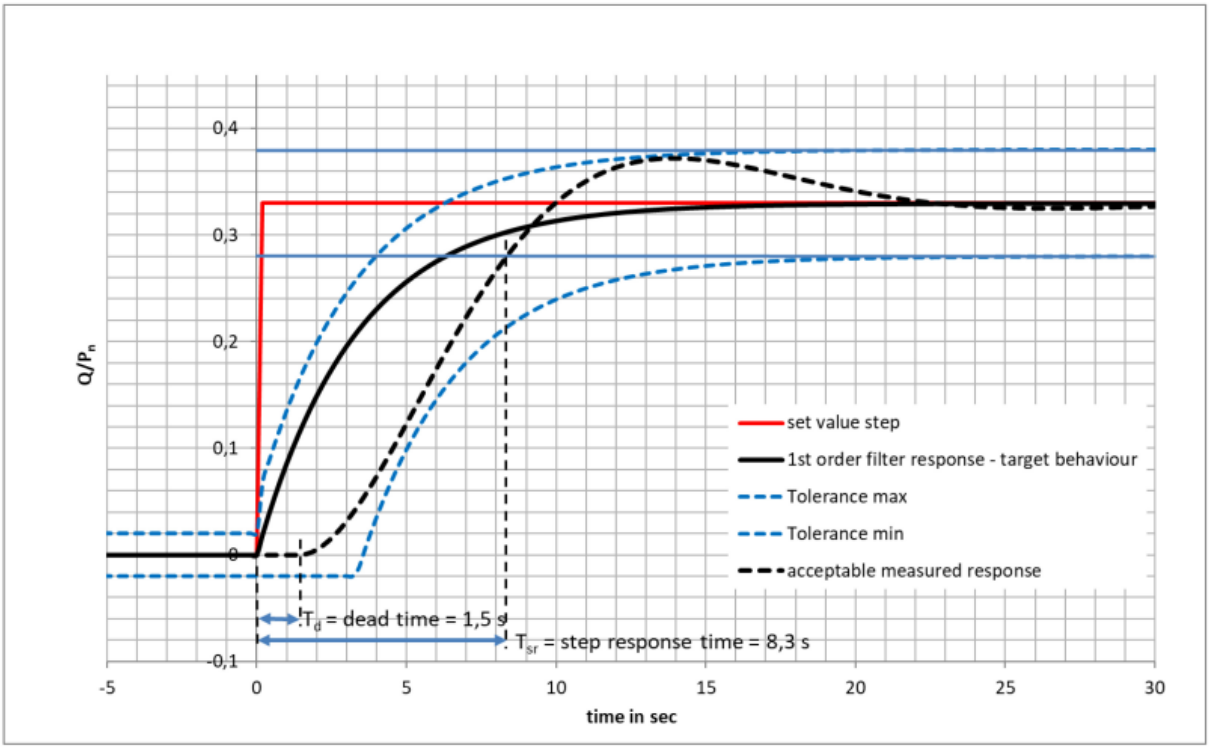
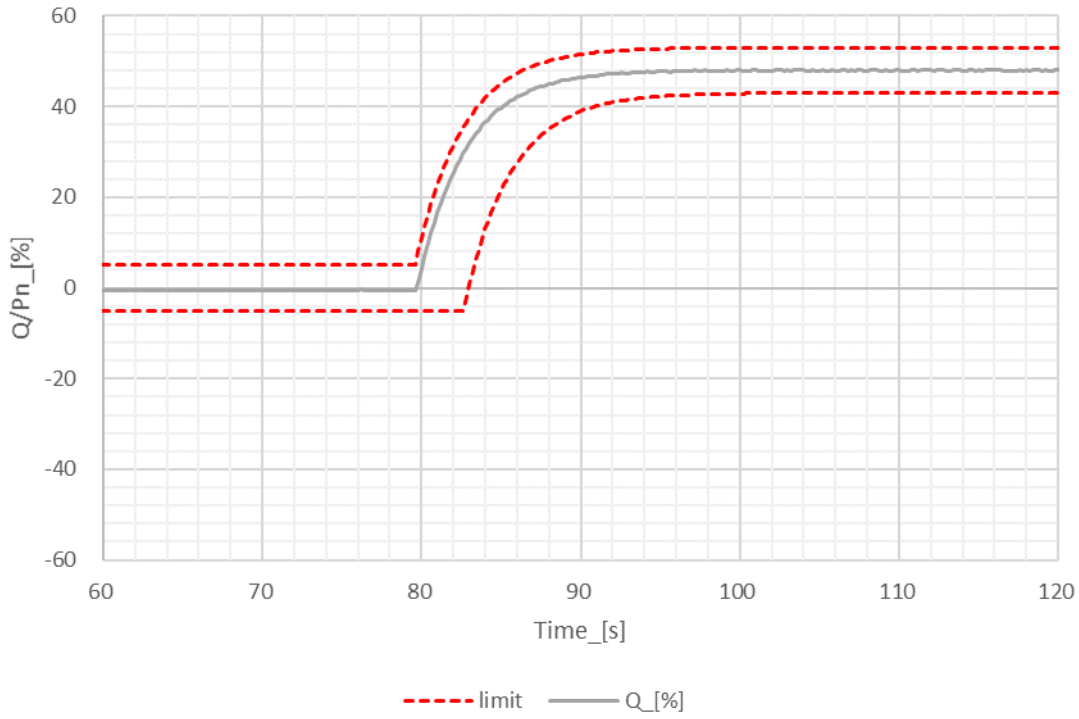


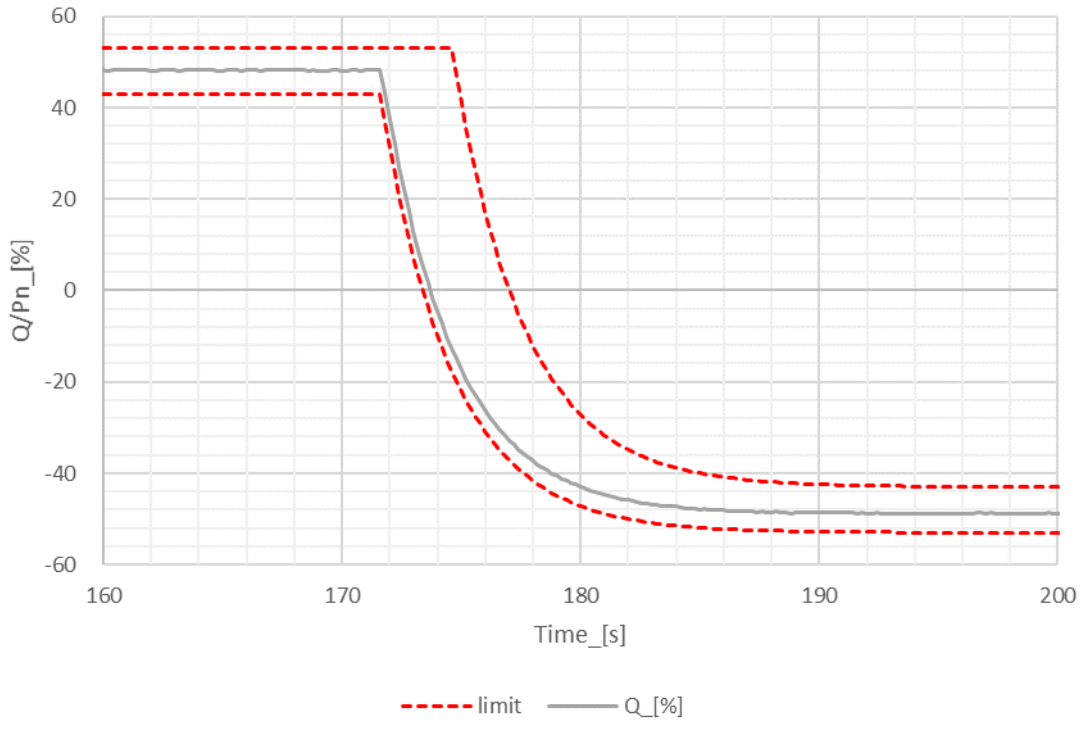
Figure 32 — Example graphical representation of step response behaviour for a step from Q = 0 to Q = 0,33 % P_n with a time constant configured to a value equal to 3,33 s (settling time $3 \times \tau = 10s$).

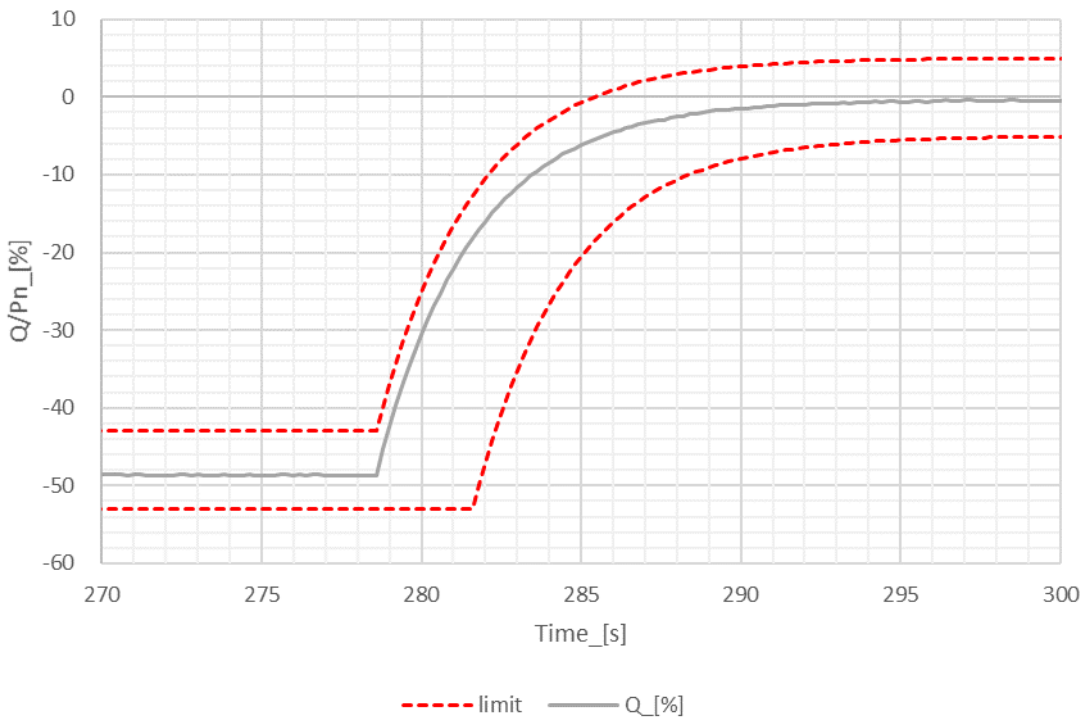
Manufacturer's data
See *Annex 3 – Capability curve of the PGU(s)*.

Reactive power step Q/Pn (pu)	Voltage	Set point value		Measured value (1-min average)		Deviation (Measured value - Set point)	
	[V]	[Var]	[p.u. based P_n]	[Var]	[p.u. based P_n]	[Var]	[p.u. based P_n]
Q = 0	230.1	0	0.000	-7	-0.004	-7	-0.004
Q = 0.5$Q_{max,over}$	230.0	450	0.300	449	0.299	-1	-0.001
Q = 0.5$Q_{max,under}$	230.0	-450	-0.300	-463	-0.309	-13	-0.009

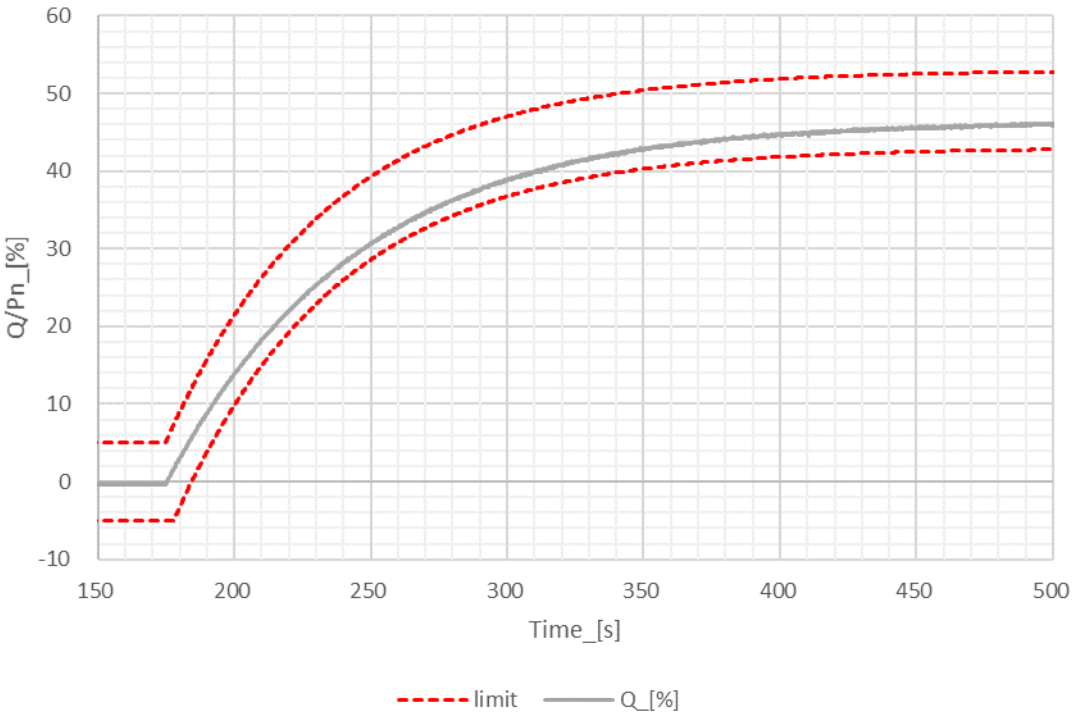
Tau=3s			
Reactive power set point step p.u.	Generating unit response time setting [s]	Measured response behaviour [s]	
		dead time	response time / settling time
Q = 0 ➔ Q = Qmax over	9	0.2	7.0
Q = Qmax over ➔ Q = Qmax under	9	0.2	8.4
Q = Qmax under ➔ Q = 0	9	0.2	7.2

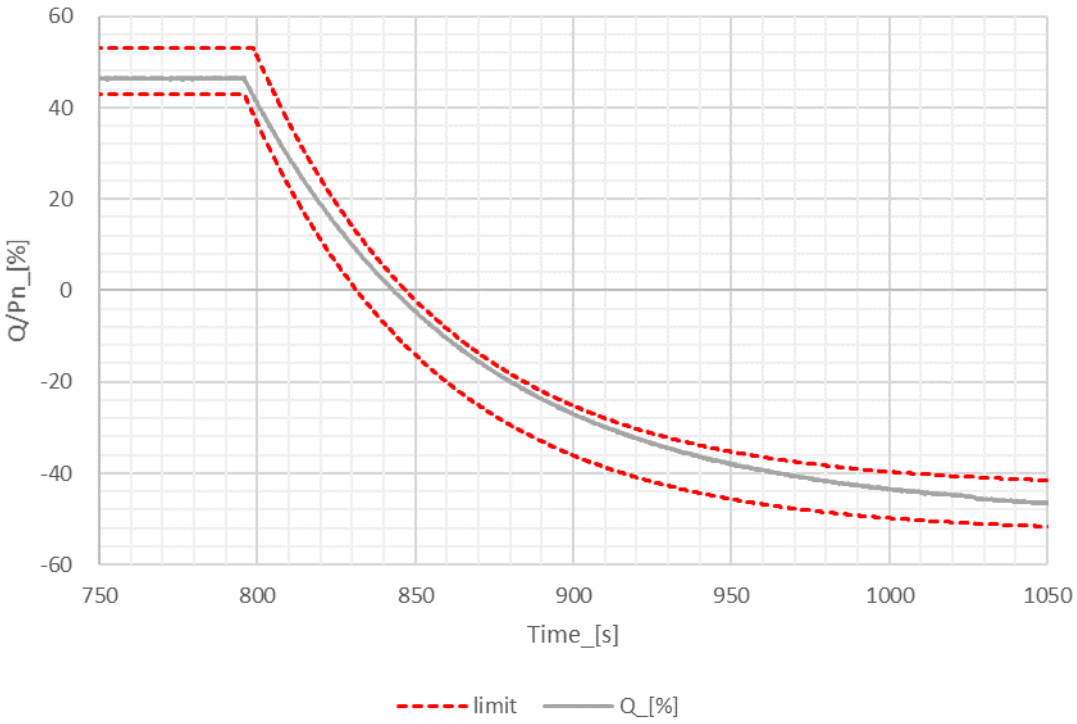


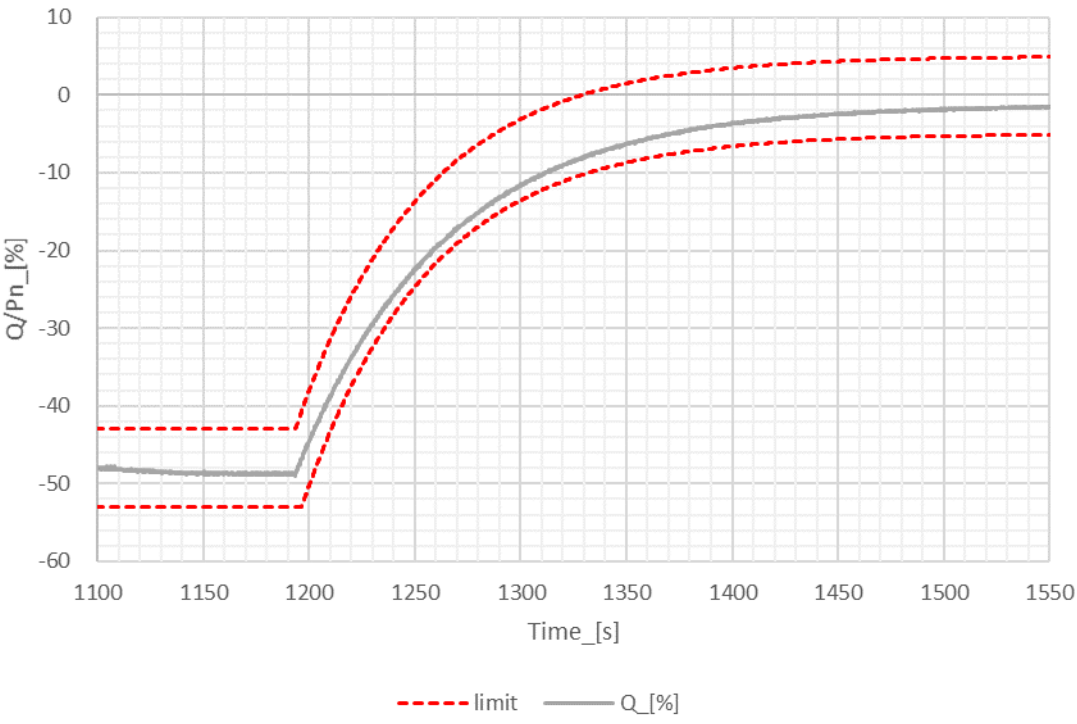

60
40
20
0
-20
-40
-60
Q/Pn_[%]
160
170
180
190
200
Time_[s]
limit
Q_[%]


10
0
-10
-20
-30
-40
-50
-60
Q/Pn_[%]
270
275
280
285
290
295
300
Time_[s]
limit
Q_[%]

Tau=60s			
Reactive power set point step p.u.	Generating unit response time setting [s]	Measured response behaviour [s]	
		dead time	response time / settling time
Q = 0 ➔ Q = Qmax over	180	0.2	179.2
Q = Qmax over ➔ Q = Qmax under	180	0.2	199.2
Q = Qmax under ➔ Q = 0	180	0.2	178.6







6.4.2.2 Voltage related control mode for reactive power Q(U)

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9

Acceptance criteria
-The test of the accuracy of the Q(U) control under quasi-stationary conditions shall be considered passed if: The measured 30-s averages of the reactive power (positive sequence components) during steady-state conditions are within a tolerance band of + 2 % Smax and + 1 % Un of the set Q(U) characteristic including correct behaviour related to Lock-in/Lock-out and min cos φ. - The test of the dynamic behaviour of the Q(U) control shall be considered passed if: 1. the time response of the reactive power during the measurement is within the tolerance band resulting from the behaviour of an equivalent first order filter element and the configured time constant tau. Accepted tolerances are ± 5 % Pn for the reactive power values and 3 s for the time delay deviating from an ideal first order filter response. The tolerance bands can be calculated according to Table 14 (see also Figure 32). 2. No discontinuities in the characteristic curve are detected and no oscillations of the reactive power after the end of the transient period of 5 τ as configured and no disconnection of the EUT occur. 3. Correct functioning of lock-in and lock-out thresholds if activated: Q(U) is disabled for power levels below the lock-out setting and enabled again if the active power is above lock-in threshold. 4. Correct functioning of minimum active factor if activated: The reactive power value is reduced for small active power to maintain the configured minimum active factor. The accuracy requirement for the active factor set point applies. 5. The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data
See *Annex 3 – Capability curve of the PGU(s)*.

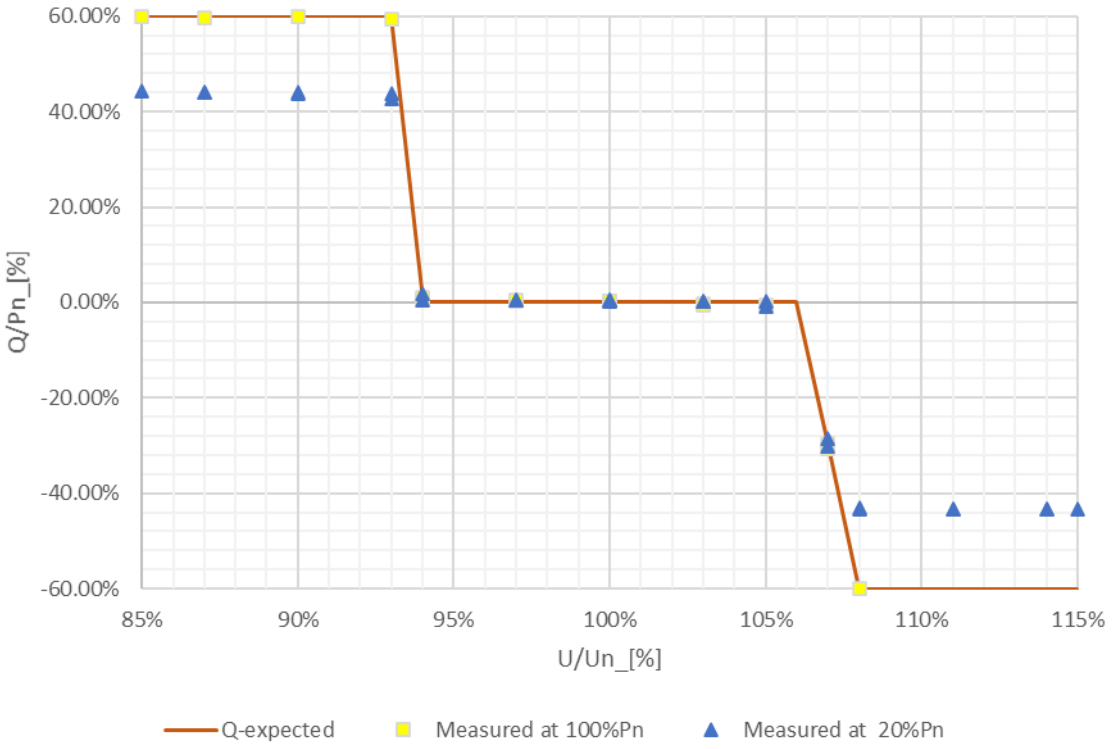
TABLE: Test procedure for steady-state behaviour

Test procedure for accuracy-**Setting (a)**

Q(U) curve settings:	Set points	X1	X2	X3	X4
	U/Un	93%	94%	106%	108%
	Q/Qmax	100%	0	0	-100%

Test Conditions		Measurements			Target value	Δ	Δ Limits	
U/Un	P/Pn	Q/Pn	U/Un	Cosφ	Q/Pn	ΔQ/ Smax*	ΔQ/ Smax	Cosφ
100%	100%	0.29%	100.1%	0.999	0.00%	0.29%	≤ ±2 Smax%	≥0.4
103%	100%	-0.22%	103.1%	0.999	0.00%	0.22%		
105%	100%	-0.61%	105.1%	0.999	0.00%	0.61%		
107%	100%	-29.67%	107.1%	0.955	-30.00%	0.33%		
108%	100%	-60.15%	108.1%	0.802	-60.00%	0.15%		
111%	100%	-60.14%	111.1%	0.802	-60.00%	0.14%		
114%	100%	-60.50%	114.0%	0.800	-60.00%	0.50%		
115%	100%	-60.69%	115.0%	0.799	-60.00%	0.69%		
114%	100%	-60.76%	114.1%	0.799	-60.00%	0.76%		
111%	100%	-60.10%	111.0%	0.802	-60.00%	0.10%		
108%	100%	-59.97%	108.0%	0.802	-60.00%	0.03%		
107%	100%	-30.67%	107.1%	0.952	-30.00%	0.67%		
105%	100%	-0.72%	105.1%	0.999	0.00%	0.72%		
103%	100%	-0.60%	103.1%	0.999	0.00%	0.60%		
100%	100%	0.20%	100.1%	0.999	0.00%	0.20%		

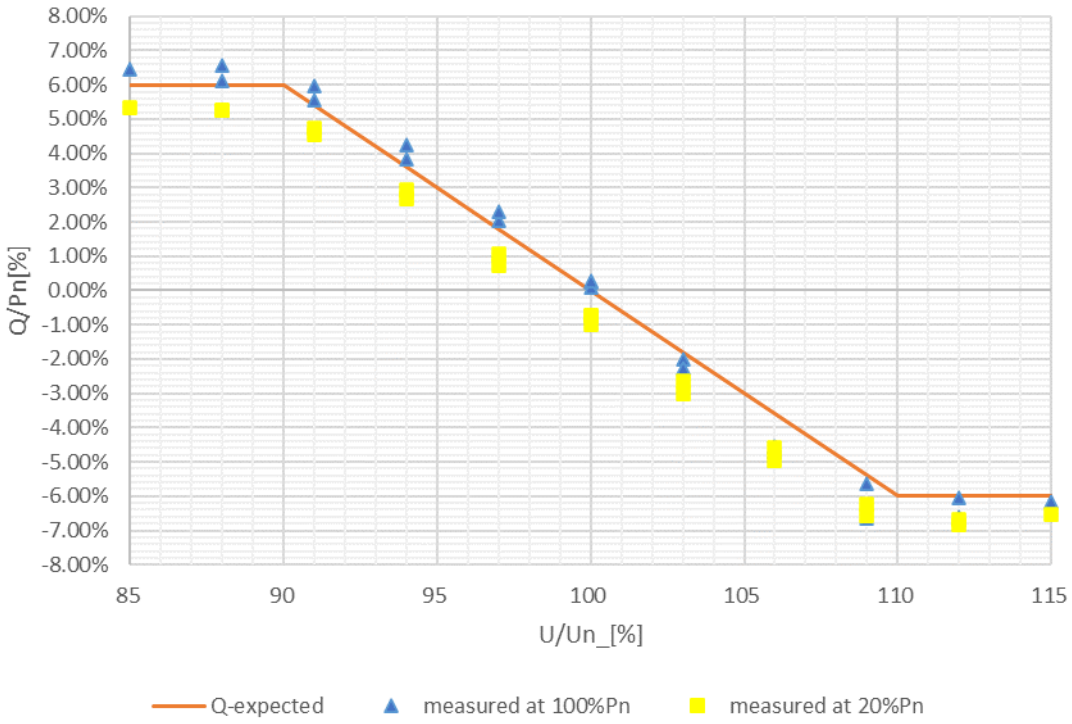
97%	100%	0.30%	97.1%	0.999	0.00%	0.30%		
94%	100%	0.46%	94.1%	0.999	0.00%	0.46%		
93%	100%	59.35%	93.0%	0.800	60.00%	0.65%		
90%	100%	60.11%	90.1%	0.795	60.00%	0.11%		
87%	100%	60.14%	87.1%	0.795	60.00%	0.14%		
85%	100%	59.98%	85.1%	0.796	60.00%	0.02%		
87%	100%	59.68%	87.1%	0.797	60.00%	0.32%		
90%	100%	59.84%	90.1%	0.796	60.00%	0.16%		
93%	100%	60.02%	93.0%	0.795	60.00%	0.02%		
94%	100%	1.02%	94.1%	0.999	0.00%	1.02%		
97%	100%	0.42%	97.1%	0.999	0.00%	0.42%		
100%	100%	0.21%	100.1%	0.999	0.00%	0.21%		
100%	20%	0.37%	100.0%	0.999	0.00%	0.37%		
103%	20%	0.33%	103.0%	0.999	0.00%	0.33%		
105%	20%	0.25%	105.2%	0.999	0.00%	0.25%		
107%	20%	-28.59%	107.0%	0.580	-30.00%	1.41%		
108%	20%	-43.02%	107.8%	0.431	-60.00%	16.98%		
111%	20%	-43.28%	110.9%	0.429	-60.00%	16.72%		
114%	20%	-43.30%	113.9%	0.429	-60.00%	16.70%		
115%	20%	-43.30%	115.2%	0.429	-60.00%	16.70%		
114%	20%	-43.24%	113.9%	0.429	-60.00%	16.76%		
111%	20%	-43.31%	110.9%	0.429	-60.00%	16.69%		
108%	20%	-43.32%	107.8%	0.430	-60.00%	16.68%		
107%	20%	-30.05%	107.0%	0.563	-30.00%	0.05%		
105%	20%	-0.93%	105.2%	0.999	0.00%	0.93%		
103%	20%	0.24%	103.0%	0.999	0.00%	0.24%		
100%	20%	0.39%	100.0%	0.999	0.00%	0.39%		
97%	20%	0.47%	97.0%	0.999	0.00%	0.47%		
94%	20%	0.59%	93.9%	0.999	0.00%	0.59%		
93%	20%	42.84%	93.0%	0.412	60.00%	17.16%		
90%	20%	44.01%	90.0%	0.402	60.00%	15.99%		
87%	20%	44.17%	87.0%	0.401	60.00%	15.83%		
85%	20%	44.26%	85.2%	0.400	60.00%	15.74%		
87%	20%	44.12%	87.0%	0.401	60.00%	15.88%		
90%	20%	43.85%	90.0%	0.403	60.00%	16.15%		
93%	20%	43.75%	93.0%	0.404	60.00%	16.25%		
94%	20%	1.96%	93.9%	0.999	0.00%	1.96%		
97%	20%	0.62%	97.0%	0.999	0.00%	0.62%		
100%	20%	0.62%	100.0%	0.999	0.00%	0.62%		



Note(s):
Time constant: as fast as possible but not slower as 3 s.
Min cos φ: 0.4,
P lock-in: deactivated; P lock-out: deactivated.
*：The accuracy exceeding 2% Smax is due to prioritizing the requirement of Min cos φ: 0.4.

Test procedure for accuracy-**Setting (b)**						
Q(U) curve settings:	Set points	X1		X2		X3
	U/Un	90%		100%		110%
	Q/Qmax	10%		0%		-10%
Test Conditions		Measurements		Target value	Δ	Δ Limits
U/Un	P/Pn	Q/Pn	U/Un	Q/Pn*	ΔQ/ Smax	ΔQ/ Smax
100%	100%	0.26%	100.0%	0.00%	0.26%	≤ ±2 Smax%
103%	100%	-2.01%	103.0%	-1.80%	0.21%	
106%	100%	-4.56%	106.1%	-3.60%	0.96%	
109%	100%	-6.63%	109.1%	-5.40%	1.23%	
112%	100%	-6.60%	112.2%	-6.00%	0.60%	
115%	100%	-6.15%	115.2%	-6.00%	0.15%	
112%	100%	-6.05%	112.2%	-6.00%	0.05%	
109%	100%	-5.65%	109.1%	-5.40%	0.25%	
106%	100%	-4.71%	106.1%	-3.60%	1.11%	
103%	100%	-2.26%	103.0%	-1.80%	0.46%	
100%	100%	0.09%	100.0%	0.00%	0.09%	
97%	100%	2.05%	97.0%	1.80%	0.25%	

94%	100%	3.84%	94.0%	3.60%	0.24%	
91%	100%	5.54%	91.3%	5.40%	0.14%	
88%	100%	6.11%	88.3%	6.00%	0.11%	
85%	100%	6.45%	85.2%	6.00%	0.45%	
88%	100%	6.57%	88.3%	6.00%	0.57%	
91%	100%	5.98%	91.3%	5.40%	0.58%	
94%	100%	4.26%	94.0%	3.60%	0.66%	
97%	100%	2.29%	97.0%	1.80%	0.49%	
100%	100%	0.30%	100.0%	0.00%	0.30%	
100%	20%	-0.73%	100.0%	0.00%	0.73%	
103%	20%	-2.63%	103.0%	-1.80%	0.83%	
106%	20%	-4.58%	106.1%	-3.60%	0.98%	
109%	20%	-6.57%	109.1%	-5.40%	1.17%	
112%	20%	-6.82%	112.2%	-6.00%	0.82%	
115%	20%	-6.53%	115.2%	-6.00%	0.53%	
112%	20%	-6.67%	112.2%	-6.00%	0.67%	
109%	20%	-6.22%	109.1%	-5.40%	0.82%	
106%	20%	-4.95%	106.1%	-3.60%	1.35%	
103%	20%	-3.00%	103.0%	-1.80%	1.20%	
100%	20%	-0.98%	100.0%	0.00%	0.98%	
97%	20%	0.73%	97.0%	1.80%	1.07%	
94%	20%	2.69%	93.9%	3.60%	0.91%	
91%	20%	4.53%	90.9%	5.40%	0.87%	
88%	20%	5.24%	87.9%	6.00%	0.76%	
85%	20%	5.33%	85.2%	6.00%	0.67%	
88%	20%	5.25%	87.9%	6.00%	0.75%	
91%	20%	4.75%	90.9%	5.40%	0.65%	
94%	20%	2.94%	93.9%	3.60%	0.66%	
97%	20%	1.05%	97.0%	1.80%	0.75%	
100%	20%	-0.75%	100.0%	0.00%	0.75%	



Note(s):
Time constant: as slow as possible but not slower as 20 s.
P lock-in: 20%Pn; P lock-out: 5%Pn.

Test procedure for dynamic-Setting (a)

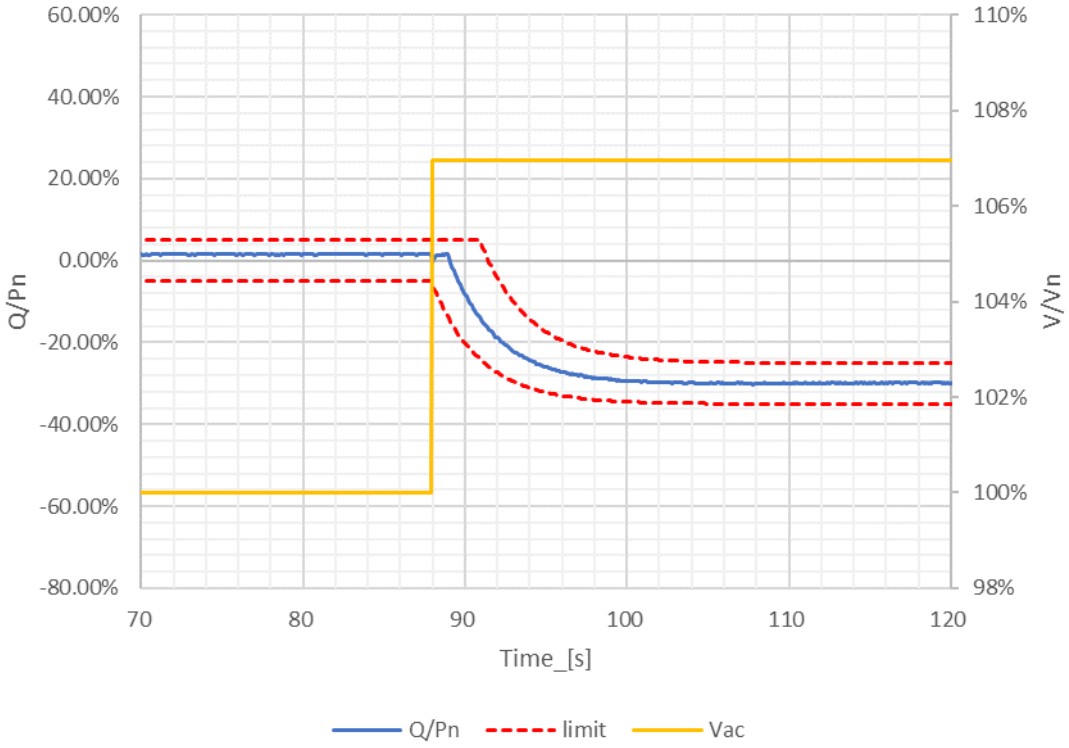
Q(U) curve settings:	Set points	X1	X2	X3	X4
	U/Un	93%	94%	106%	108%
	Q/Qmax	100%	0%	0%	100%
	Tau	3s			

Step No	Test Conditions		Measurements			Deviation	Target value	T_d	T_r/T_s*	Δ Limits
	U/Un	P/Pn	Q/Pn	P/Pn	U/Un	ΔQ/Pn	Q/Pn*			ΔQ/Pn
1	100%	100%	1.45%	99.68%	100.00%	1.45%	0.0%	--	--	≤ ±5%
2	107%	100%	-29.94%	95.75%	106.96%	0.06%	-30.0%	1.0	6.2	
3	109%	100%	-60.10%	81.33%	109.13%	0.10%	-60.0%	0.9	6.4	
4	109%	18%	-60.50%	18.95%	109.13%	0.50%	-60.0%	--	--	
5	109%	3%	-0.34%	3.01%	108.92%	0.34%	0.0%	1.1	8.8	
6	109%	22%	-60.34%	22.97%	109.13%	0.34%	-60.0%	1.3	8.4	
7	109%	100%	-60.25%	81.33%	109.13%	0.25%	-60.0%	--	--	
8	100%	100%	1.82%	100.00%	100.00%	1.82%	0.0%	1.1	7.6	
9	92%	100%	61.06%	79.33%	91.74%	1.06%	60.0%	0.2	7.3	
10	92%	18%	59.42%	17.14%	91.74%	0.58%	60.0%	--	--	
11	92%	3%	-0.06%	3.00%	91.78%	0.06%	0.0%	1.0	8.7	

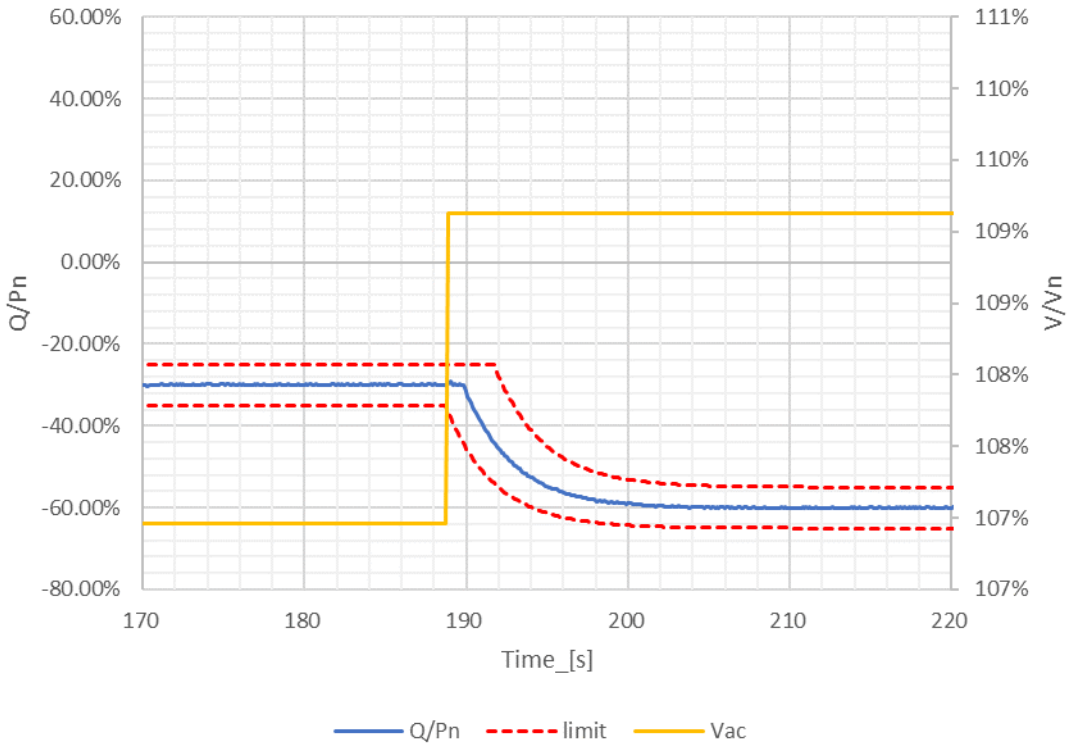
12	92%	22%	59.38%	21.17%	91.74%	0.62%	60.0%	1.2	8.2	
13	92%	100%	60.37%	79.33%	91.74%	0.37%	60.0%	--	--	
14	93%	100%	60.74%	79.33%	93.04%	0.74%	60.0%	--	--	
15	100%	100%	2.26%	100.00%	100.00%	2.26%	0.0%	1.1	10.2	

Note(s):
P lock-in: 20%Pn; P lock-out: 5%Pn.
*Step response time and settling time are identical.

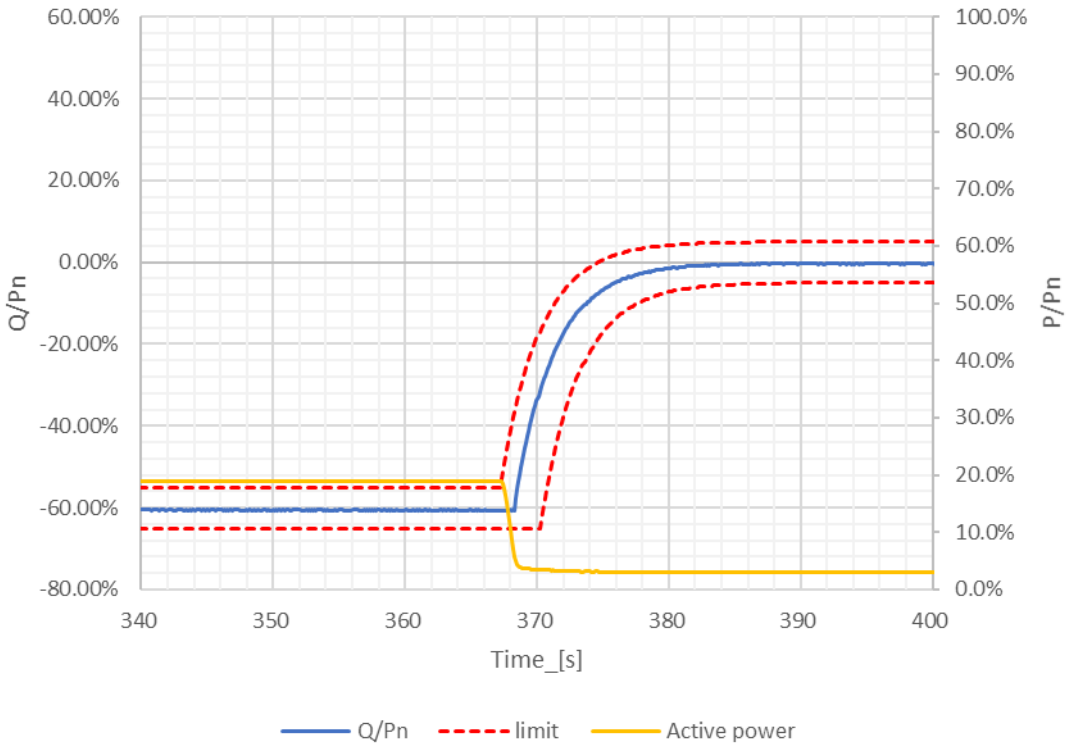
Step 2: 100%Un to 107%Un



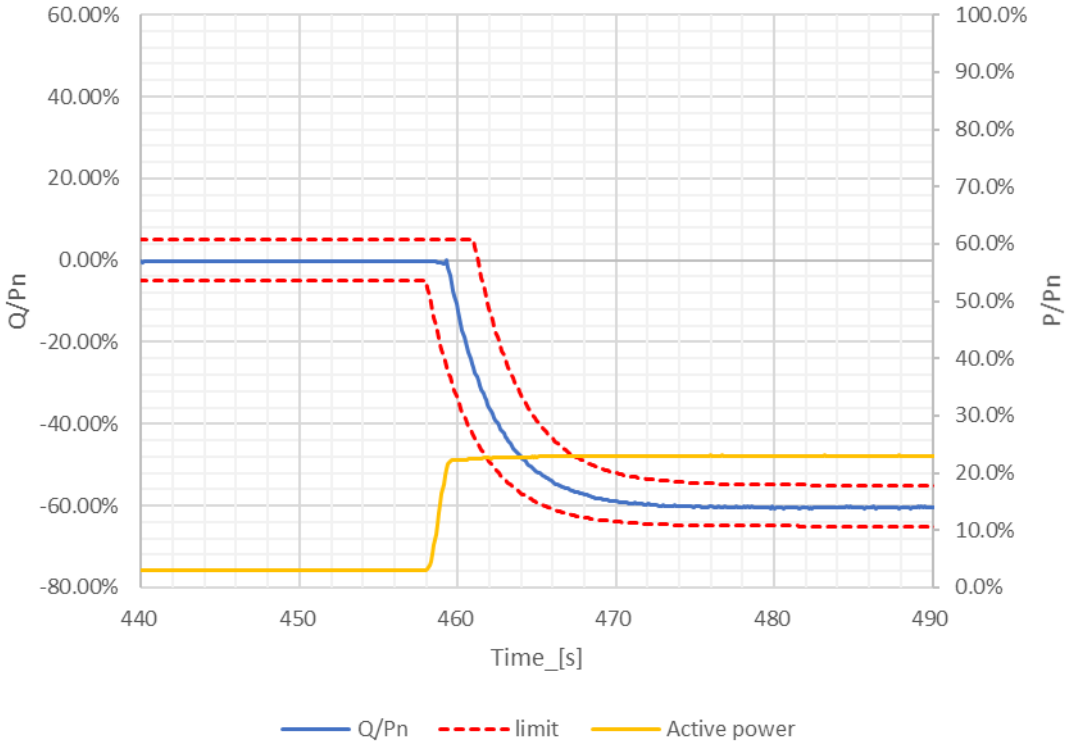
Step 3: 107%Un to 109%Un



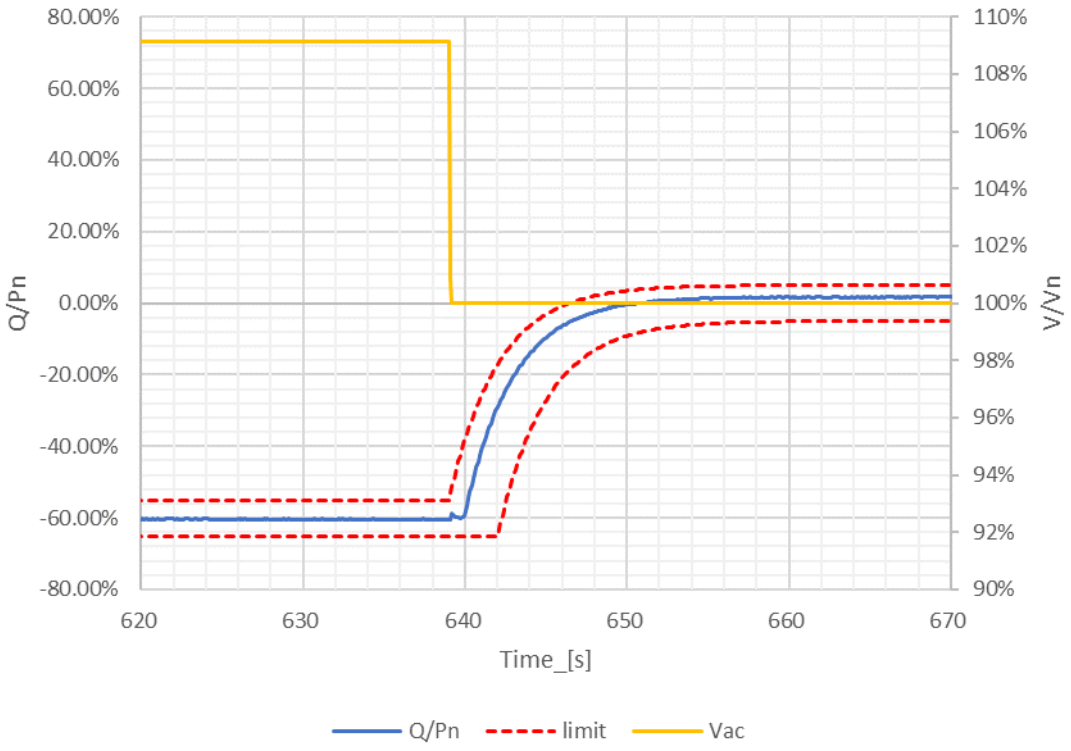
Step 5: 18%Pn to 3%Pn



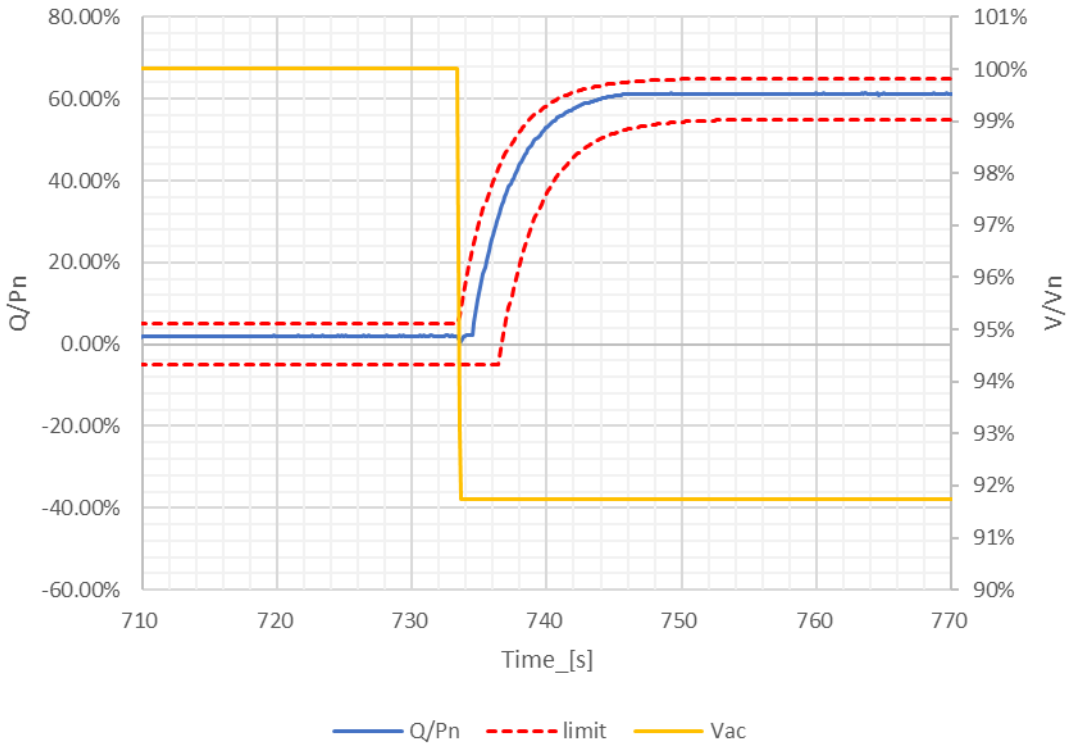
Step 6: 3%Pn to22%Pn



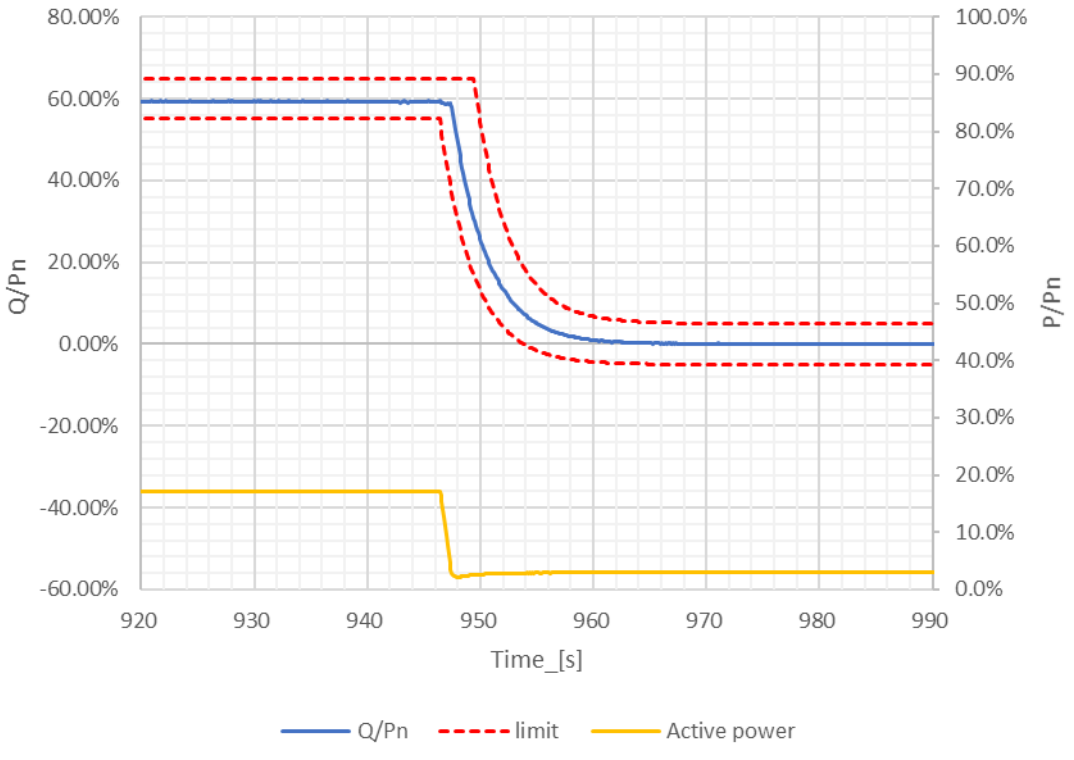
Step 8: 109%Un to 100%Un



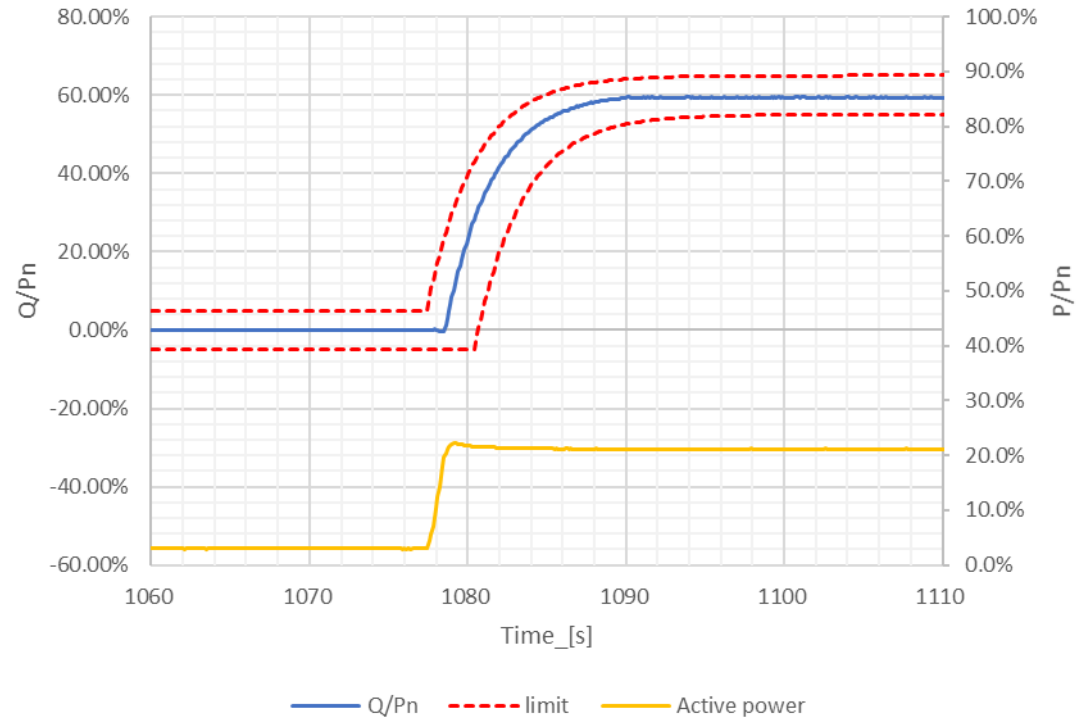
Step 9: 100%Un to 92%Un



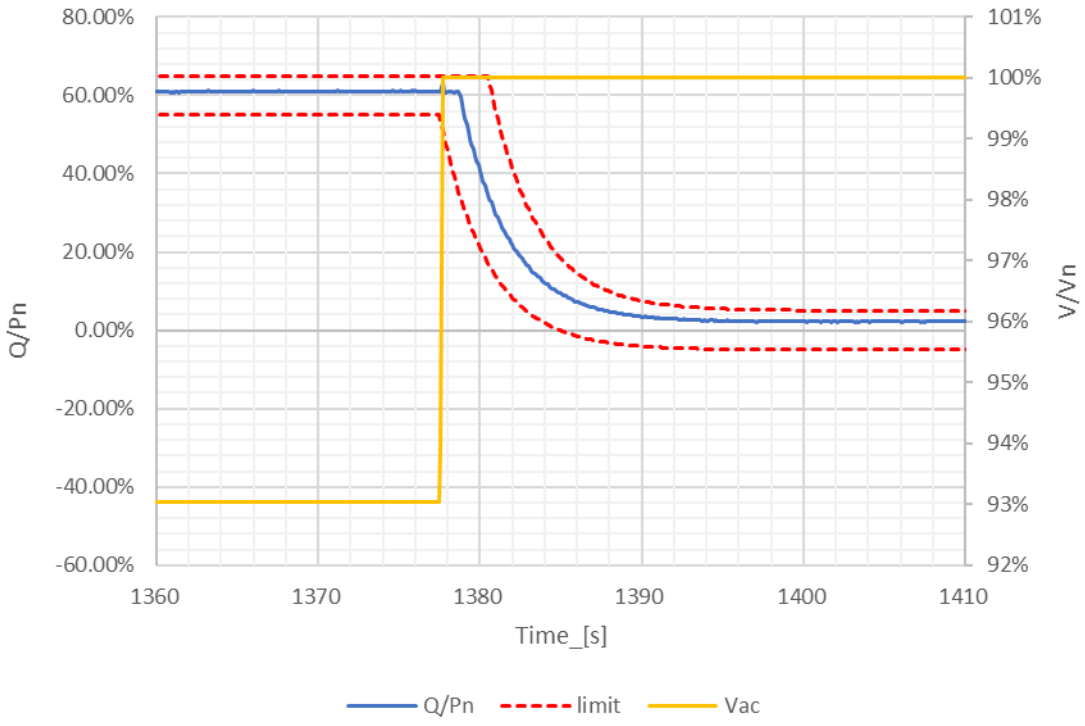
Step 11: 18%Pnto 3%Pn



Step 12: 3%Pnto 22%Pn



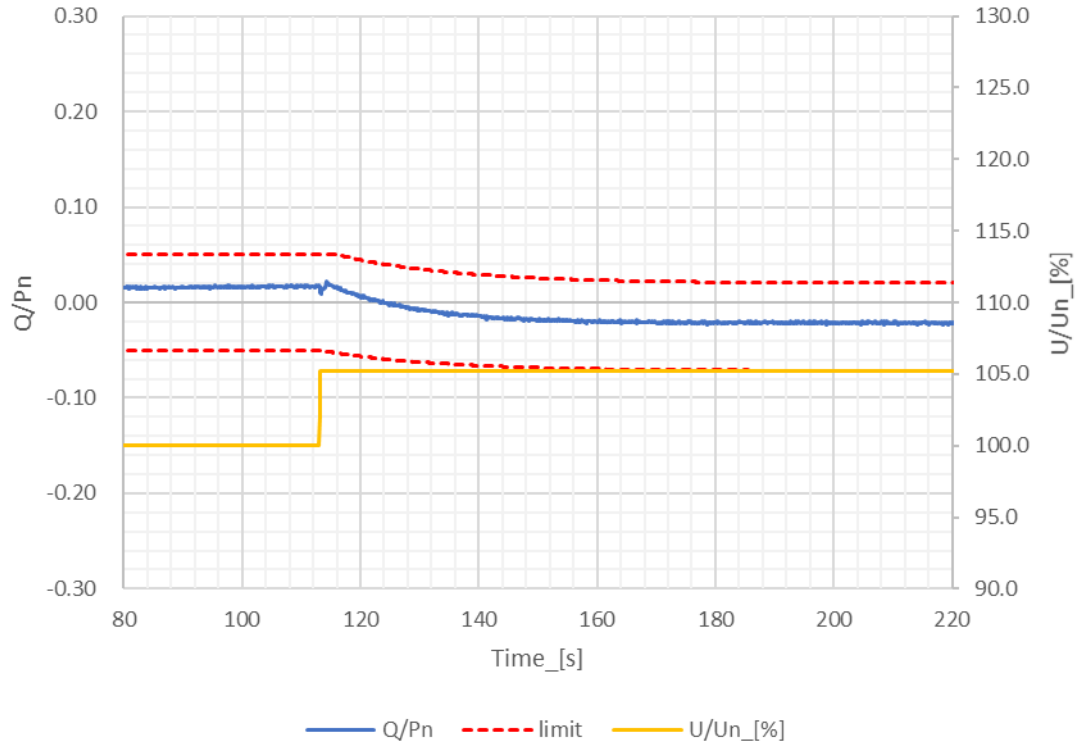
Step 15: 93%Un to 100%Un



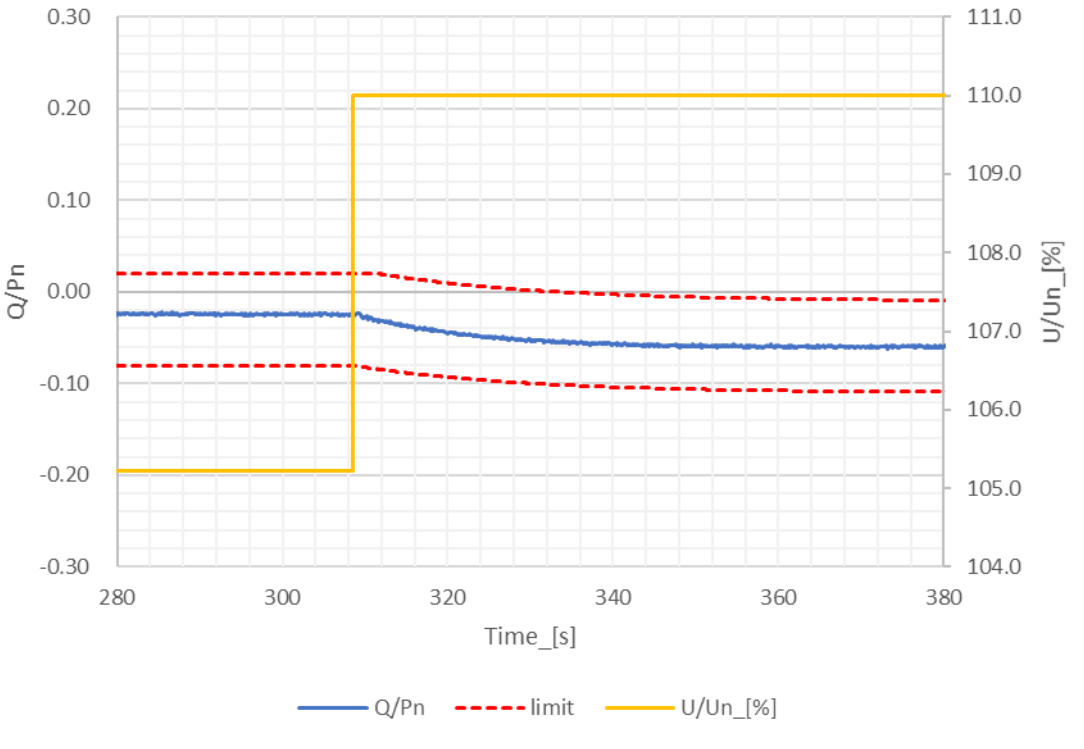
Test procedure for dynamic-Setting (b)									
Q(U) curve settings:	Set points	X1		X2		X3			
	U/Un	90%		100%		110%			
	Q/Qmax	10%		0%		-10%			
	Tau	20s							
Test Conditions		Measurements			Deviation	Target value	T_d	T_r/T_s*	Δ Limits
U/Un	P/Pn	Q/Pn	P/Pn	U/Un	ΔQ/Pn	Q/Pn			ΔQ/Pn
100%	100%	1.49%	99.56%	100.00%	1.49%	0.00%	--	--	≤ ±5%
105%	100%	-2.24%	100.00%	105.22%	0.76%	-3.00%	0.2	0.2	
110%	100%	-5.77%	100.00%	110.00%	0.23%	-6.00%	0.2	0.2	
110%	18%	-6.00%	18.08%	110.00%	0.00%	-6.00%	--	--	
110%	3%	-0.70%	2.99%	110.00%	0.70%	0.00%	0.2	1.2	
110%	22%	-6.19%	22.11%	110.00%	0.19%	-6.00%	0.2	0.2	
110%	100%	-6.08%	100.00%	110.00%	0.08%	-6.00%	--	--	
100%	100%	1.87%	100.00%	100.00%	1.87%	0.00%	0.2	0.2	
90%	100%	7.22%	99.99%	90.00%	1.22%	6.00%	0.2	0.2	
90%	18%	6.32%	17.88%	90.00%	0.32%	6.00%	--	--	
90%	3%	0.66%	2.94%	90.00%	0.66%	0.00%	0.2	7.6	
90%	22%	6.96%	21.92%	90.00%	0.96%	6.00%	0.2	0.2	
90%	100%	7.67%	100.00%	90.00%	1.67%	6.00%	--	--	
100%	100%	2.08%	100.00%	100.00%	2.08%	0.00%	0.2	8.9	

Note(s):
P lock-in: 20%Pn; P lock-out: 5%Pn.
*Step response time and settling time are identical.

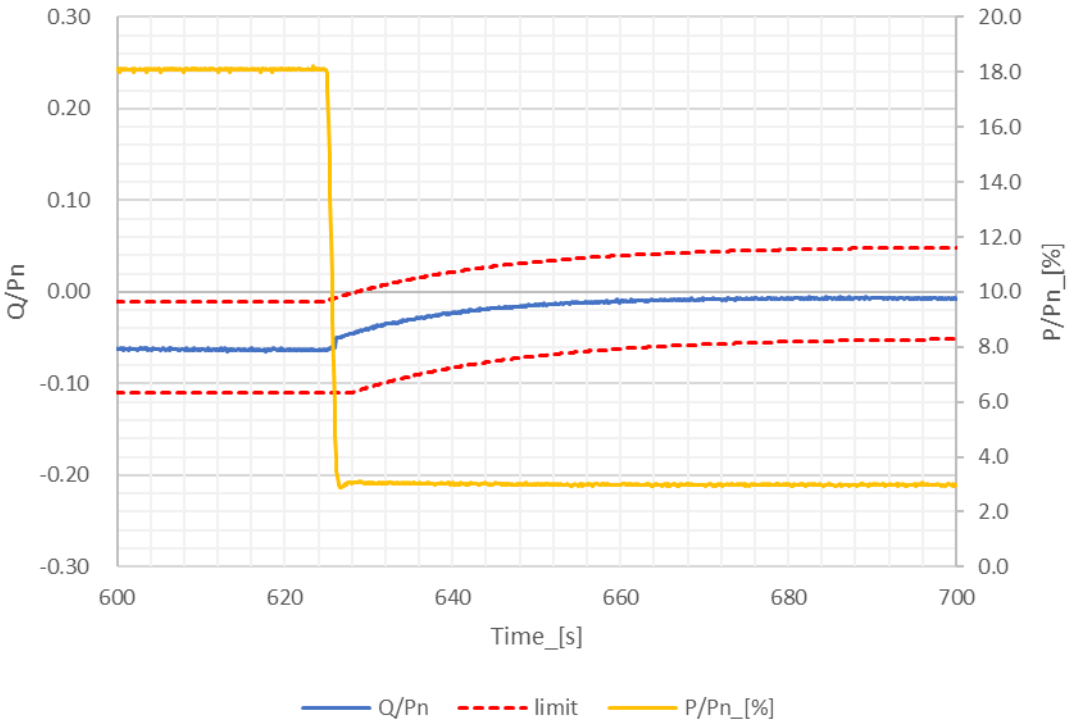
Step 2: 100%Un to 105%Un



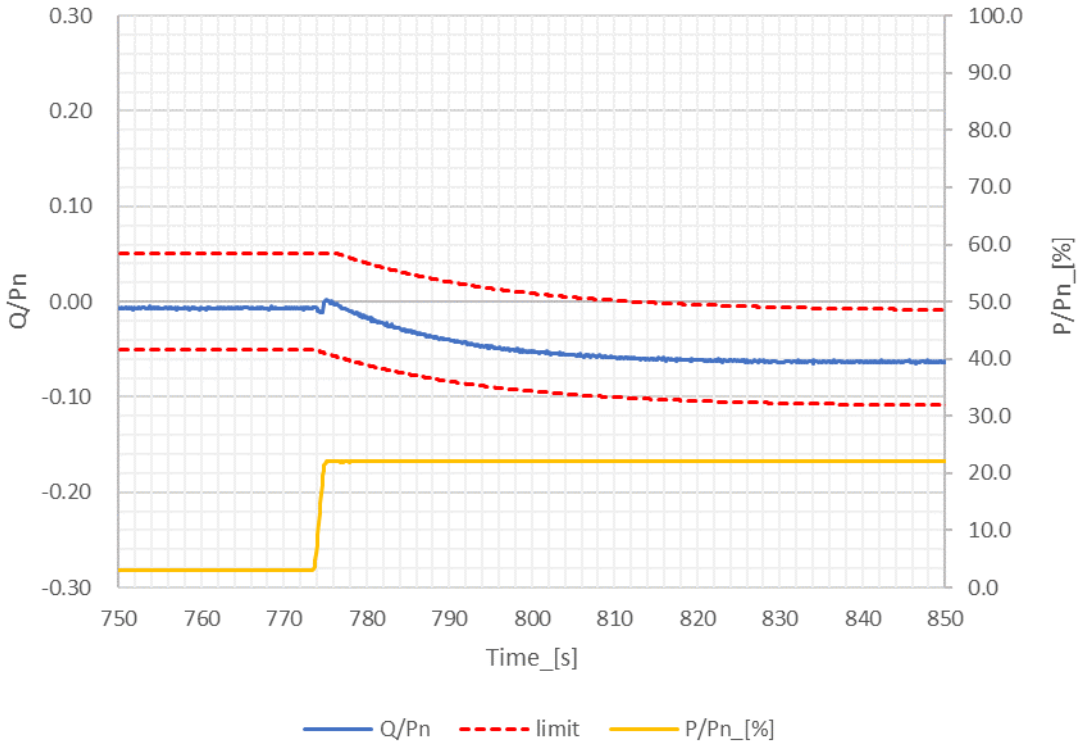
Step 3: 105%Un to 110%Un



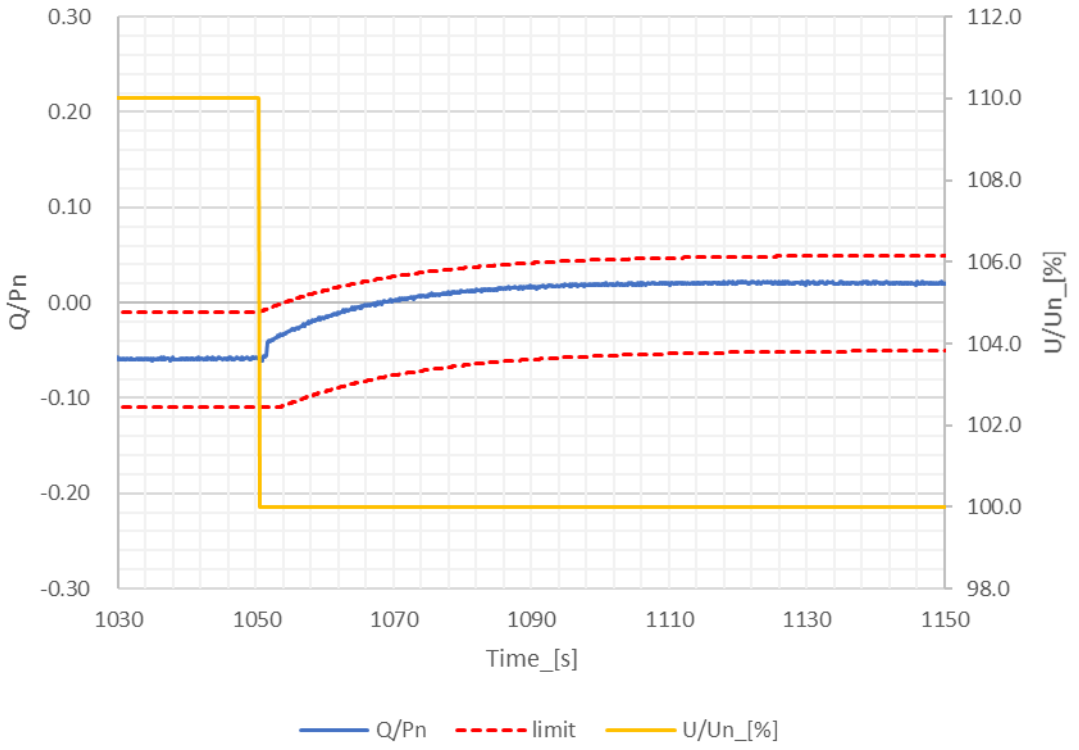
Step 5: 18%Pn to 3%Pn



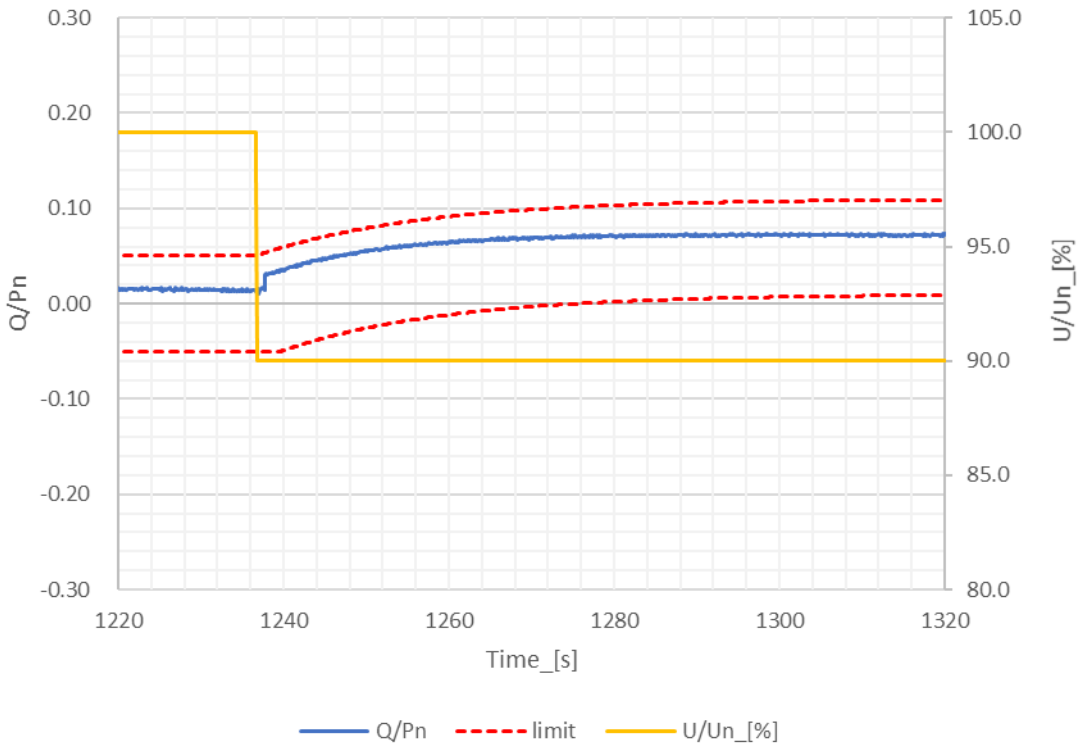
Step 6: 3%Pn to 22%Pn



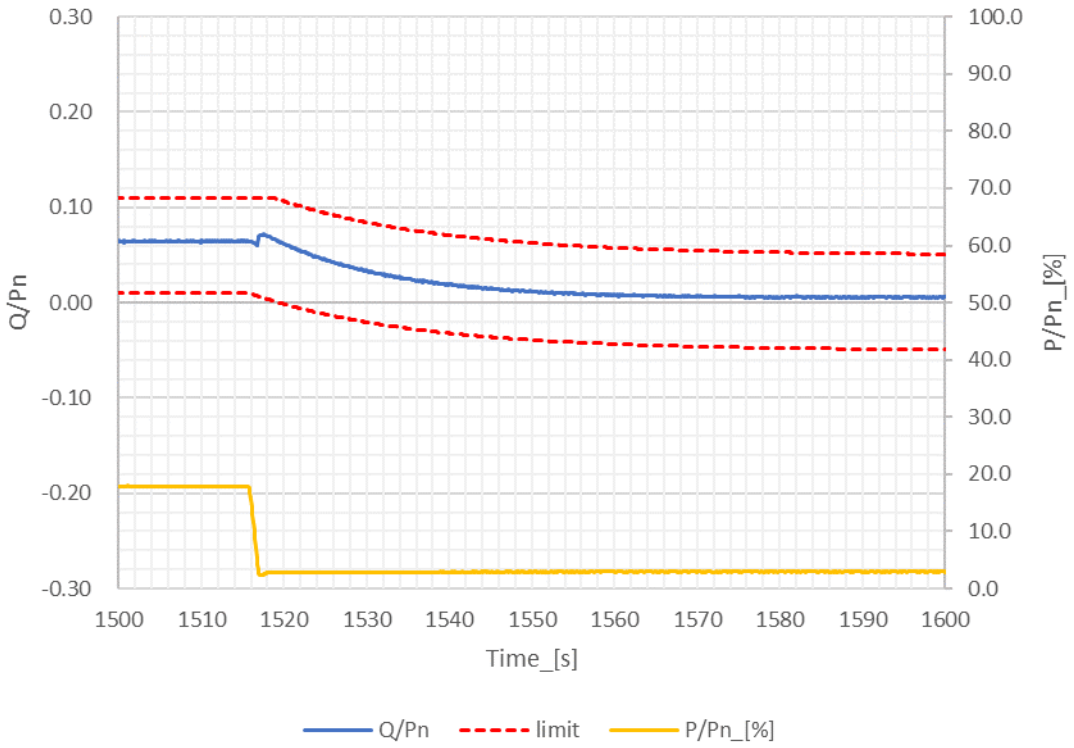
Step 8: 110%Un to 100%Un



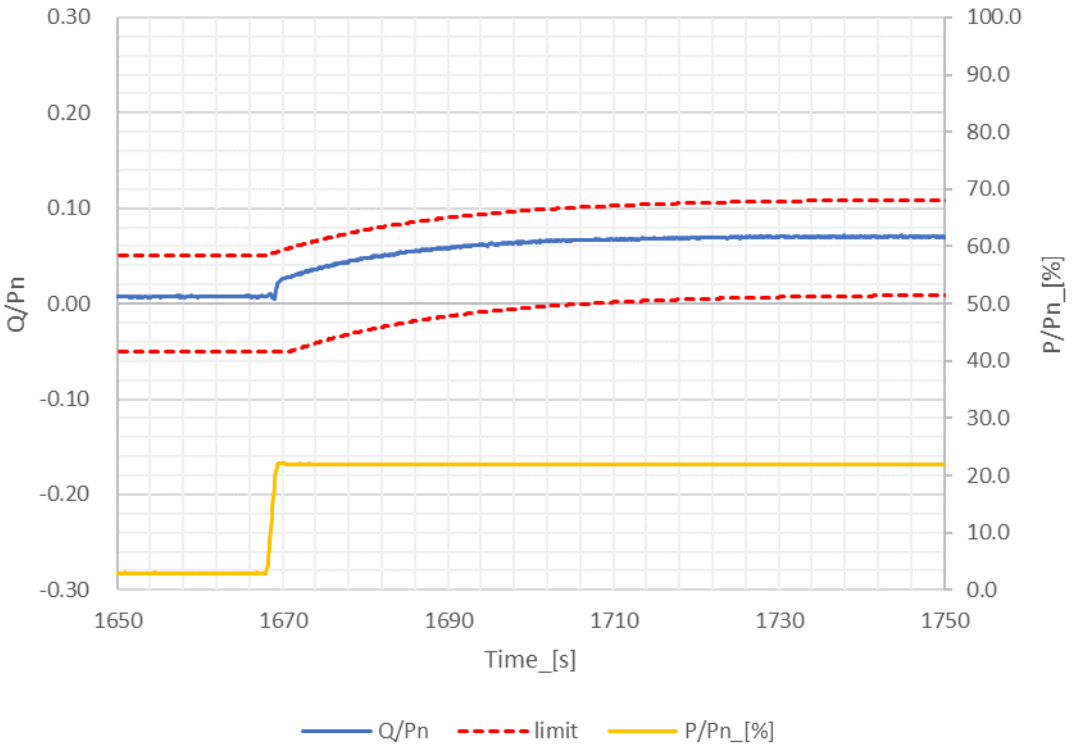
Step 9: 100%Un to 90%Un



Step 11: 18%Pn to 3%Pn



Step 12: 3%Pn to 22%Pn




Step 14: 90%Un to 100%Un
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
Q/Pn
110.0
100.0
90.0
80.0
70.0
60.0
50.0
U/Un_[%]
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
Time_[s]
Q/Pn
limit
U/Un_[%]

6.4.2.3 Power related control mode for reactive power

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9

Acceptance criteria
-The measured 30-s averages of the reactive power during steady-state conditions are within a tolerance band of ± 2 % Smax around the reactive power set point resulting from the measured active power and the given cos φ (P) or Q (P) characteristic.

Manufacturer's data
See *Annex 3 – Capability curve of the PGU(s)*.

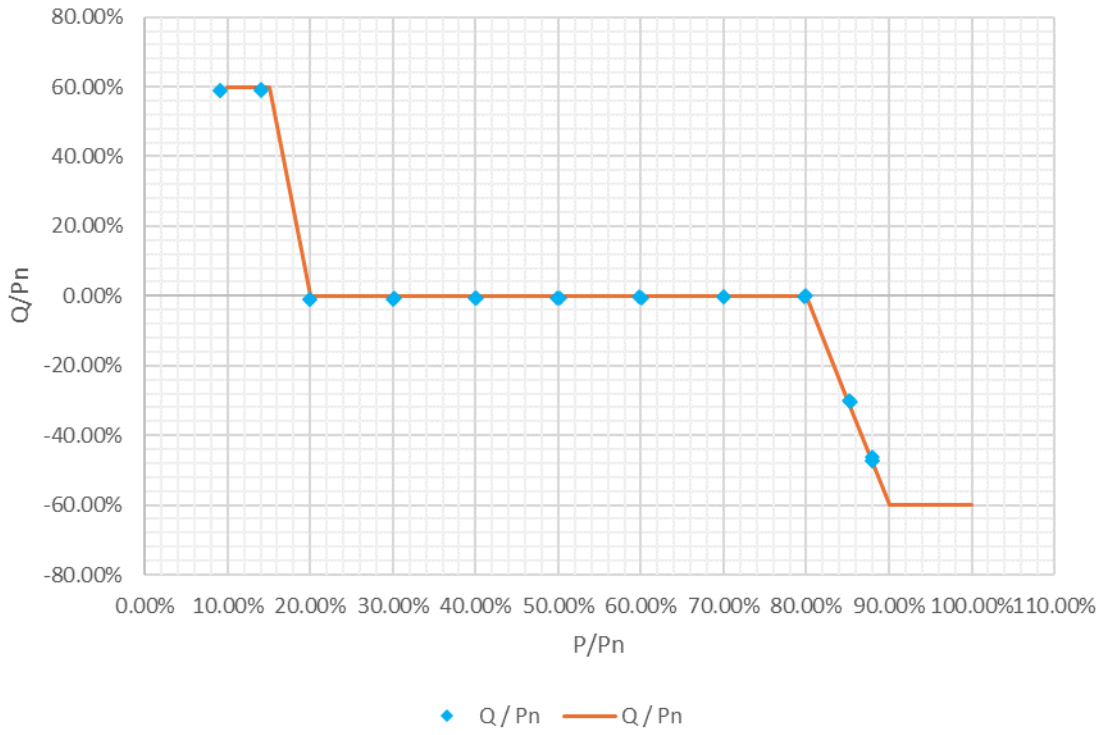
Test procedure for quasi-stationary behaviour - **Setting (a)**

Q (P) curve settings:	Set points	1	2	3	4
	P/Pn	15%	20%	80%	90%
	Q	100%Q max over	0	0	100%Q max under

Test Conditions		Measurements			Target value	Δ	Δ Limits
P / Pn	U / Un	P / Pn	Q / Pn	cosφ	Q / Pn	Δ Q / Smax*	Δ Q / Smax
10%	100%	9.07%	58.93%	0.152	60.00%	1.07%	±2%
15%	100%	14.04%	59.12%	0.231	60.00%	0.88%	
20%	100%	20.00%	-0.83%	0.999	0.00%	0.83%	
30%	100%	29.95%	-0.89%	1.000	0.00%	0.89%	
40%	100%	39.89%	-0.79%	1.000	0.00%	0.79%	
50%	100%	49.82%	-0.52%	1.000	0.00%	0.52%	
60%	100%	59.78%	-0.22%	1.000	0.00%	0.22%	
70%	100%	69.99%	-0.22%	1.000	0.00%	0.22%	
80%	100%	79.77%	-0.28%	1.000	0.00%	0.28%	
85%	100%	85.18%	-29.86%	0.944	-30.00%	0.14%	
90%	100%	88.00%	-47.12%	0.881	-60.00%	12.88%	
100%	100%	88.00%	-47.27%	0.880	-60.00%	12.73%	
90%	100%	88.06%	-46.33%	0.884	-60.00%	13.67%	
85%	100%	85.38%	-30.24%	0.943	-30.00%	0.24%	
80%	100%	79.99%	0.01%	1.000	0.00%	0.01%	
70%	100%	70.01%	-0.13%	1.000	0.00%	0.13%	
60%	100%	60.16%	-0.45%	1.000	0.00%	0.45%	
50%	100%	50.13%	-0.55%	1.000	0.00%	0.55%	
40%	100%	40.13%	-0.59%	1.000	0.00%	0.59%	

30%	100%	30.14%	-0.68%	1.000	0.00%	0.68%	
20%	100%	20.01%	-0.85%	0.999	0.00%	0.85%	
15%	100%	14.02%	58.80%	0.232	60.00%	1.20%	
10%	100%	9.05%	58.88%	0.152	60.00%	1.12%	

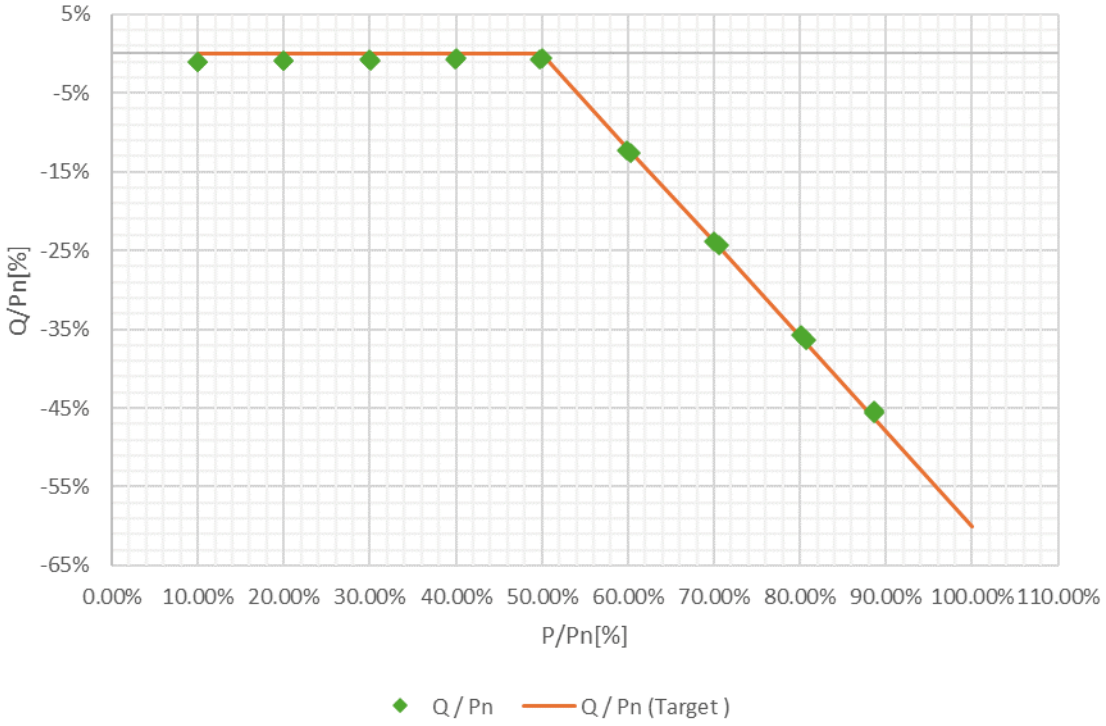
Note:
*The accuracy exceeding 2% of Smax is due to the output apparent power reaching its maximum value.



Test procedure for quasi-stationary behaviour - **Setting (c)**							
Q (P) curve settings:	Set points	1	2	3	4		
	P/Pn	20%	40%	50%	100%		
	Q	0	0	0	-Qmax		
Test Conditions		Measurements			Target value	Δ	Δ Limits
P / Pn	U / Un	P / Pn	Q / Pn	cosφ	Q / Pn	Δ Q / Smax*	Δ Q / Smax
10%	100%	10.00%	-1.13%	0.994	0.00%	1.13%	±2%
20%	100%	19.93%	-0.98%	0.999	0.00%	0.98%	
30%	100%	29.89%	-0.79%	1.000	0.00%	0.79%	
40%	100%	39.86%	-0.73%	1.000	0.00%	0.73%	
50%	100%	49.78%	-0.67%	1.000	0.00%	0.67%	
60%	100%	59.90%	-12.25%	0.980	-12.00%	0.25%	
70%	100%	70.00%	-23.90%	0.946	-24.00%	0.10%	
80%	100%	80.16%	-35.81%	0.913	-36.00%	0.19%	
90%	100%	88.67%	-45.37%	0.890	-48.00%	2.63%	
100%	100%	88.67%	-45.48%	0.890	-60.00%	14.52%	
90%	100%	88.67%	-45.67%	0.889	-48.00%	2.33%	

80%	100%	80.67%	-36.31%	0.912	-36.00%	0.31%
70%	100%	70.66%	-24.38%	0.945	-24.00%	0.38%
60%	100%	60.25%	-12.63%	0.979	-12.00%	0.63%
50%	100%	50.06%	-0.56%	1.000	0.00%	0.56%
40%	100%	40.07%	-0.64%	1.000	0.00%	0.64%
30%	100%	30.05%	-0.84%	1.000	0.00%	0.84%
20%	100%	19.93%	-0.90%	0.999	0.00%	0.90%
10%	100%	9.98%	-1.05%	0.995	0.00%	1.05%

Note:
*The accuracy exceeding 2% of Smax is due to the output apparent power reaching its maximum value.

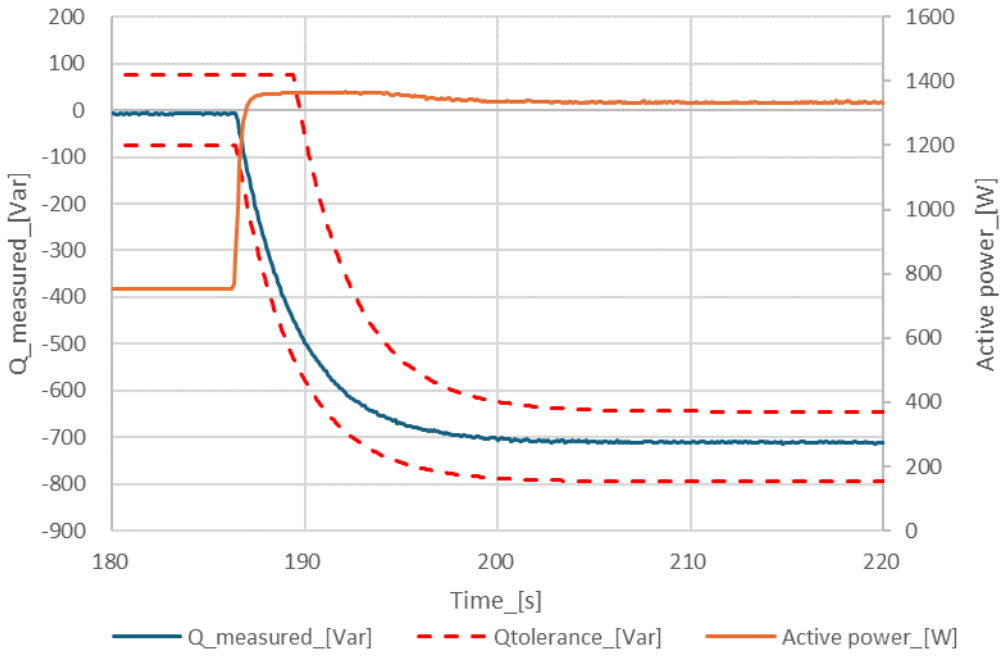


Test procedure for dynamic behaviour:

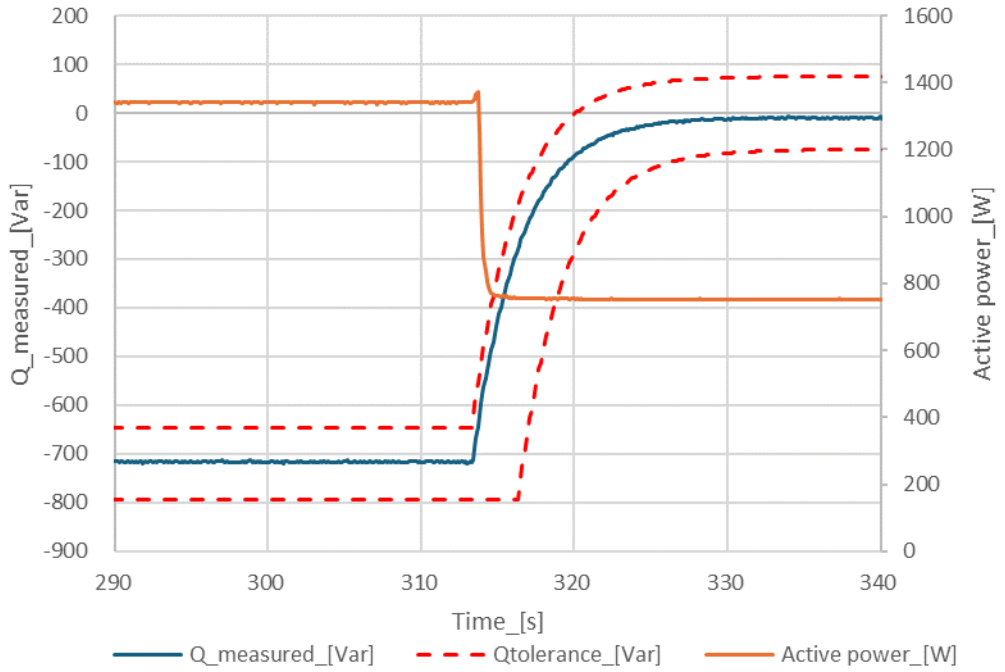
Setting (a)-Time constant: as fast as possible but not slower as 3s-3s

Test Conditions	Measurements					
	Tsr [s]	Ts [s]	Td [s]	Reactive power/Pn [%]	Active power/Pn [%]	Grid voltage/Un [%]
20%Pn	--	--	--	-1.04%	20.04%	100.03%
20%Pn -> 50%Pn	--	--	--	-0.45%	50.01%	100.05%
50%Pn -> 90%Pn	7.2	7.2	0.2	-47.56%	89.12%	100.06%
90%Pn -> 50%Pn	7.3	7.3	0.2	-0.57%	50.17%	100.05%
50%Pn -> 20%Pn	--	--	--	-1.01%	20.11%	100.03%

Step 3: 50%Pn to 90%Pn

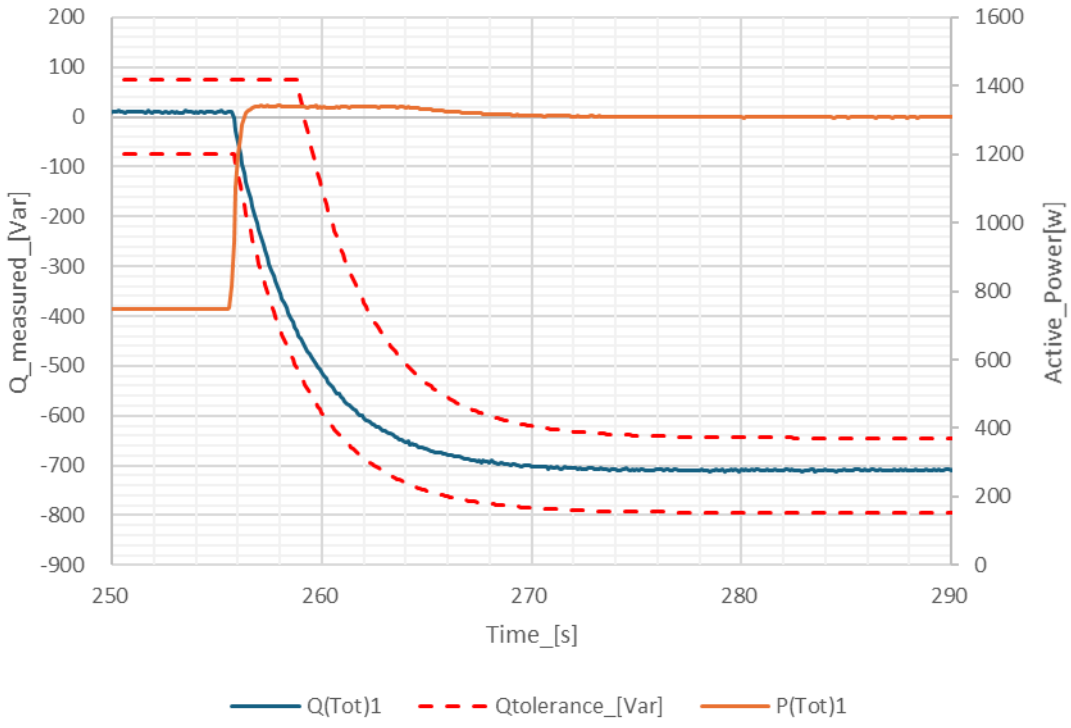


Step 4: 90%Pn to 50%Pn

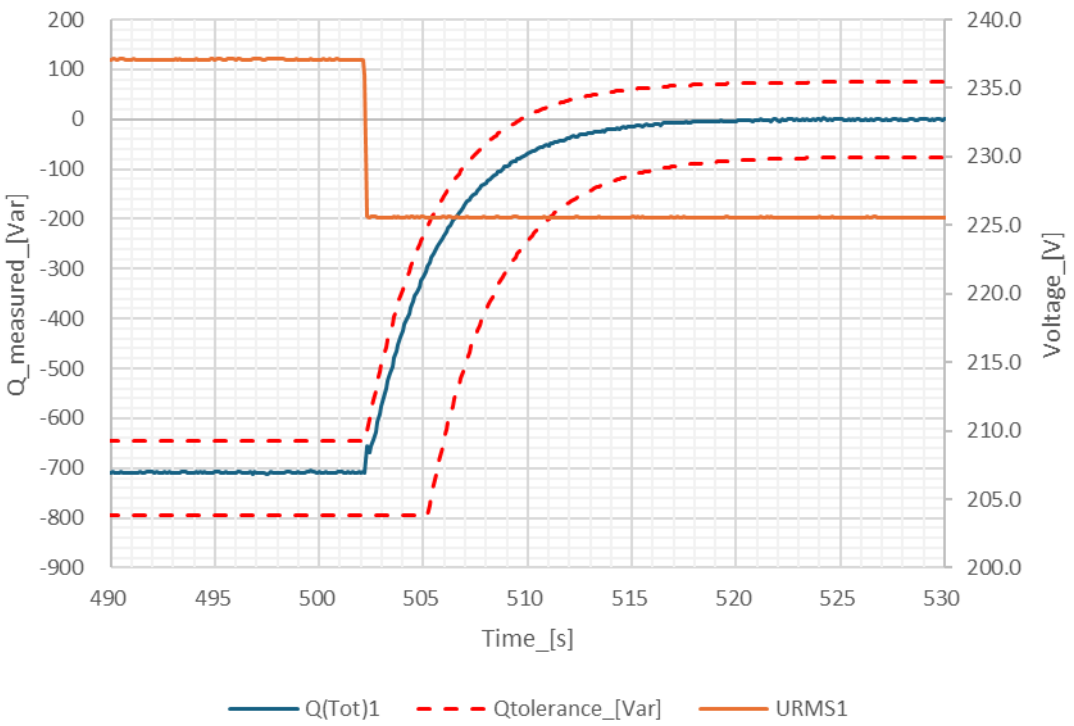


Setting (c)--Time constant: 3.33s							
Test Conditions		Measurements					
P	U/Un	Tsr [s]	Ts [s]	Td [s]	Reactive power [var]	Active power [W]	Grid voltage [V]
20%Pn	107%	--	--	--	17	300	246.2
20%Pn -> 50%Pn	107%	--	--	--	10	748	246.2
50%Pn -> 90%Pn	107%	7.9	7.9	0.2	-714	1320	246.3
90%	103%	--	--	--	-699	1324	237.1
90%	98%	7.7	7.7	0.2	-3	1354	225.6
90%	107%	7.9	7.9	0.2	-711	1321	246.3
90%	100%	--	--	--	-679	1333	230.2
90%Pn -> 50%Pn	100%	7.2	7.2	0.2	8	752	230.1
50%Pn -> 20%Pn	100%	--	--	--	13	301	230.1

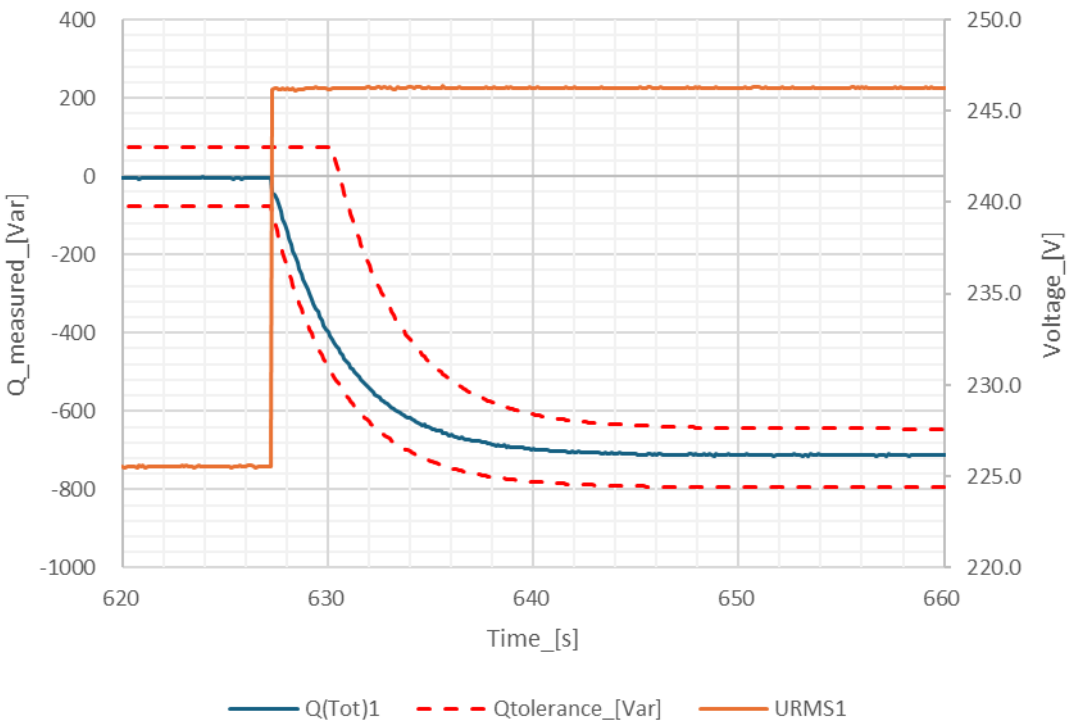
50%Pn to 90%Pn

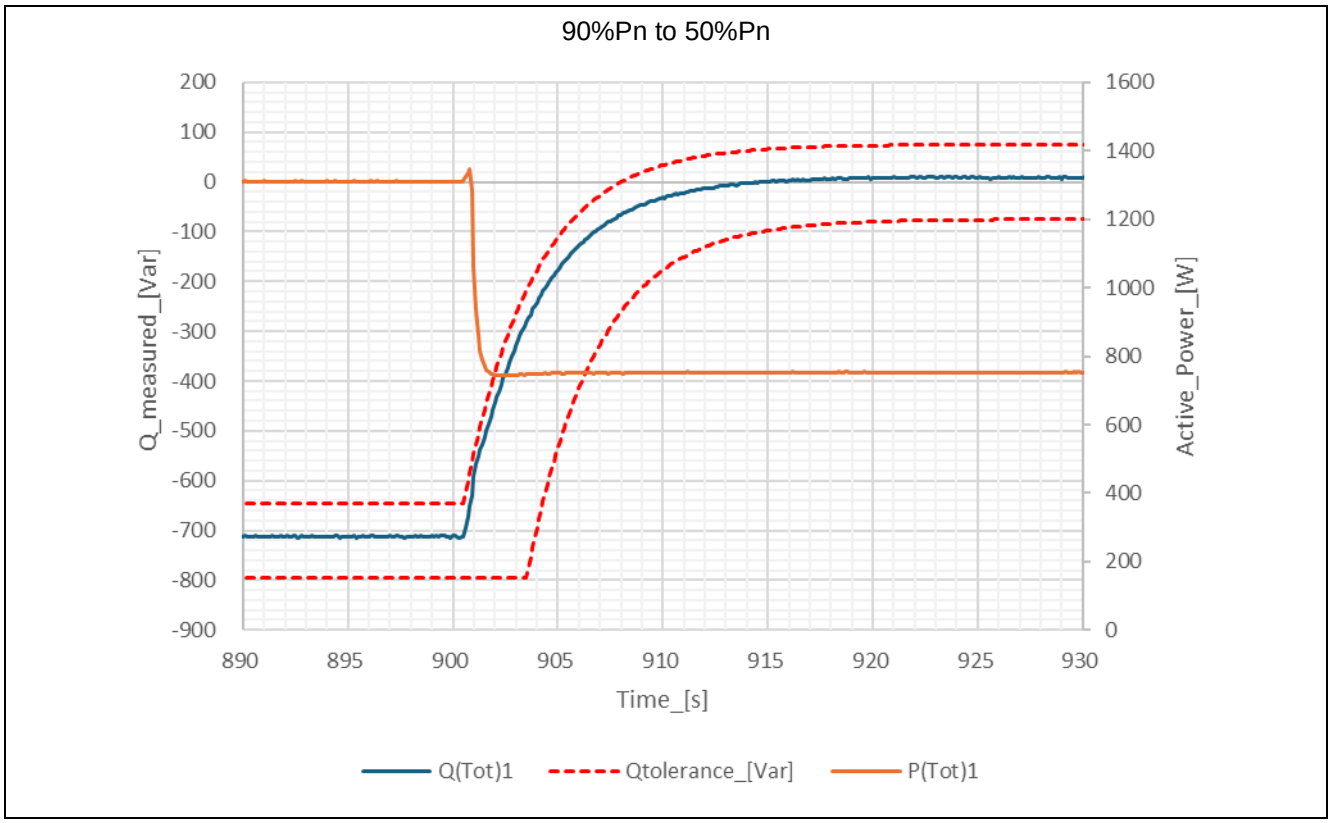


103%Un to 98%Un



98%Un to 107%Un





6.5 Voltage related active power reduction - P(U)

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.6.3 & 5.6.4, EN 50549-10

Active Power level	100%P_n
Active factor	1.000
Voltage protection	deactivated
Relevant parameter setting	Default setting used for testing, see *Annex 1 – Parameter list*
Corresponding characteristic curve applied	Show figure

Acceptance criteria

- The measured 30-s averages of the active power (positive sequence components) during steady-state conditions are within a tolerance band of ±2%S_{max} and ±1%U_n of the set P(U) characteristic.
- the time response of the active power during the measurement represents the applied configuration within the tolerance band resulting from the behaviour of an equivalent first order filter element and the configured time constant tau. Accepted tolerances are
  ○ −5%P_n for the active power values and 3 s for the time in case of a power decrease.
  ○ +5%P_n for the active power values and 3 s for the time in case of a power increase.
- No discontinuities in the characteristic curve are detected and no oscillations of the active power after the end of the transient period of 5τ as configured and no disconnection of the EUT occur.

- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test results

Note:

* In the case of a single-phase unit, the RMS values of the active power are recorded in the following table instead of the positive sequence components of the active power (P_+).

**The accuracy exceeding 2% of Smax is due to the output apparent power reaching its maximum value.

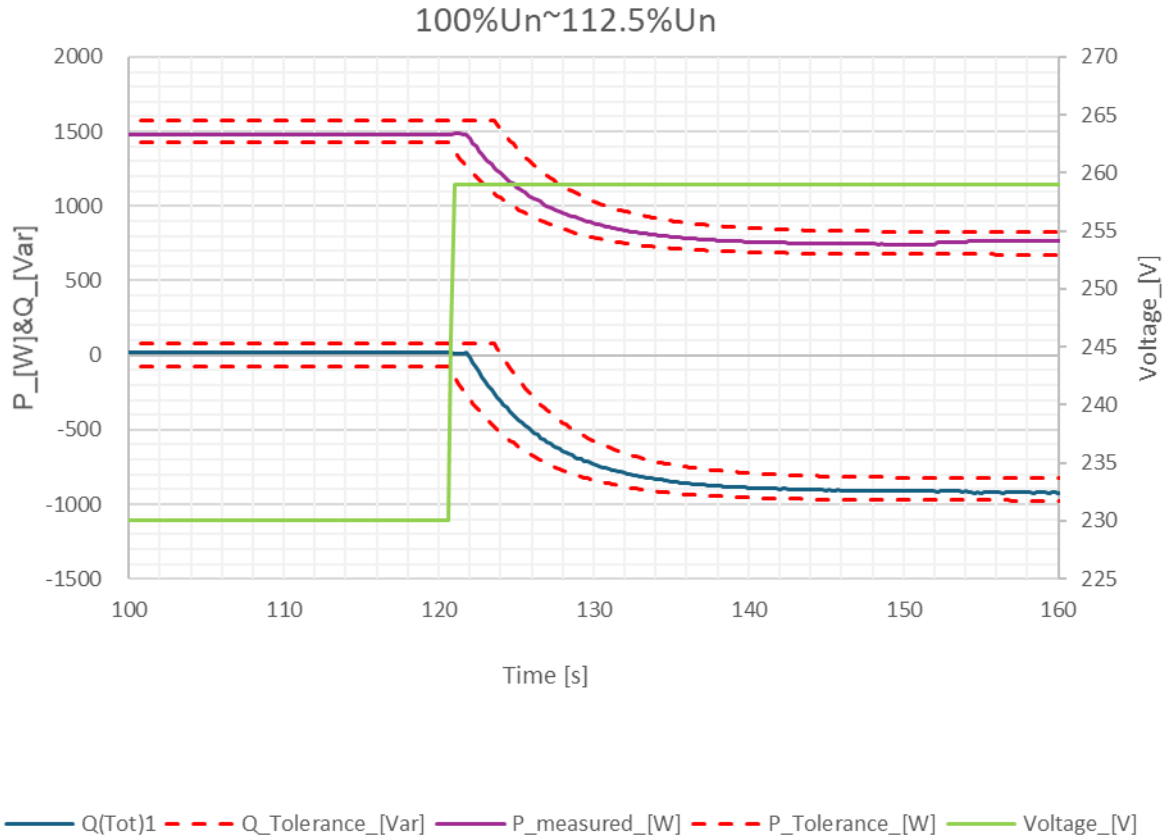
Test 1 - Steady-state behaviour

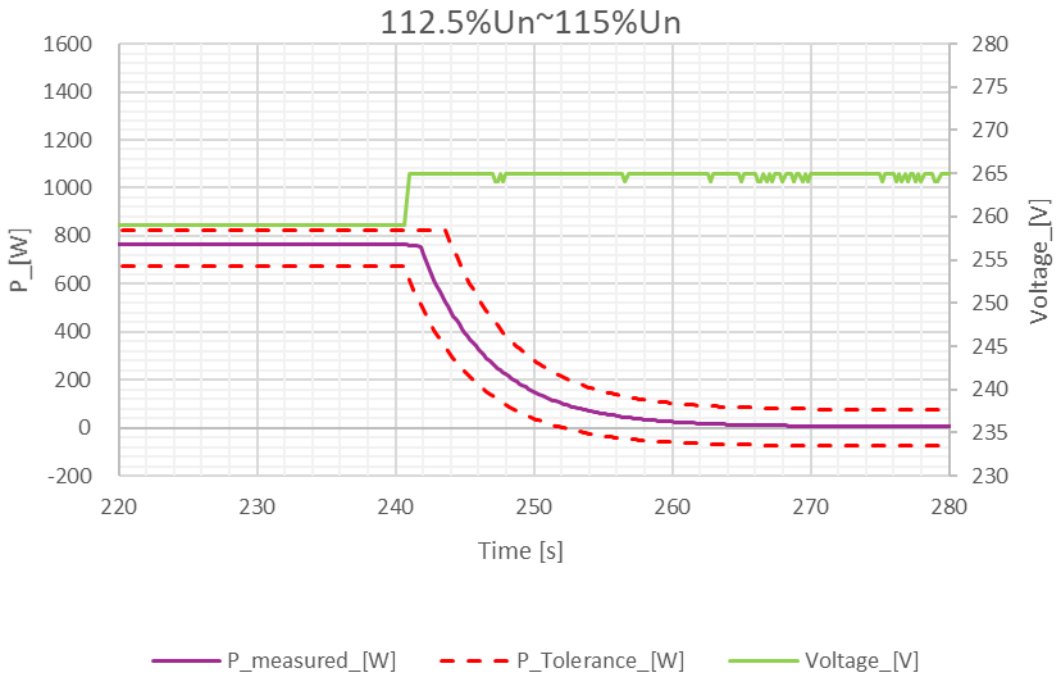
Voltage step U/U_n [%]	Measured value U/U_n [%]	Deviation (Measured value - Set point) U/U_n [%]	Measured value P_+/P_n [%] *	Set point value P_+/P_n [%] *	Deviation (Measured value - Set point)	
					P_+/P_n [%] *	P_+/S_{max} [%] *
100	100.00%	0.00%	99.73%	100.0%	-0.27%	-0.27%
103	103.04%	0.04%	100.05%	100.0%	0.05%	0.05%
106	106.09%	0.09%	100.04%	100.0%	0.04%	0.04%
109**	109.13%	0.13%	81.35%	100.0%	-18.65%	-18.65%
112	112.17%	0.17%	59.41%	60.0%	-0.59%	-0.59%
115	115.10%	0.10%	0.91%	0.0%	0.91%	0.91%
112	112.17%	0.17%	59.42%	60.0%	-0.58%	-0.58%
109**	109.13%	0.13%	80.67%	100.0%	-19.33%	-19.33%
106	106.09%	0.09%	100.02%	100.0%	0.02%	0.02%
103	103.04%	0.04%	100.01%	100.0%	0.01%	0.01%
100	100.00%	0.00%	100.00%	100.0%	0.00%	0.00%

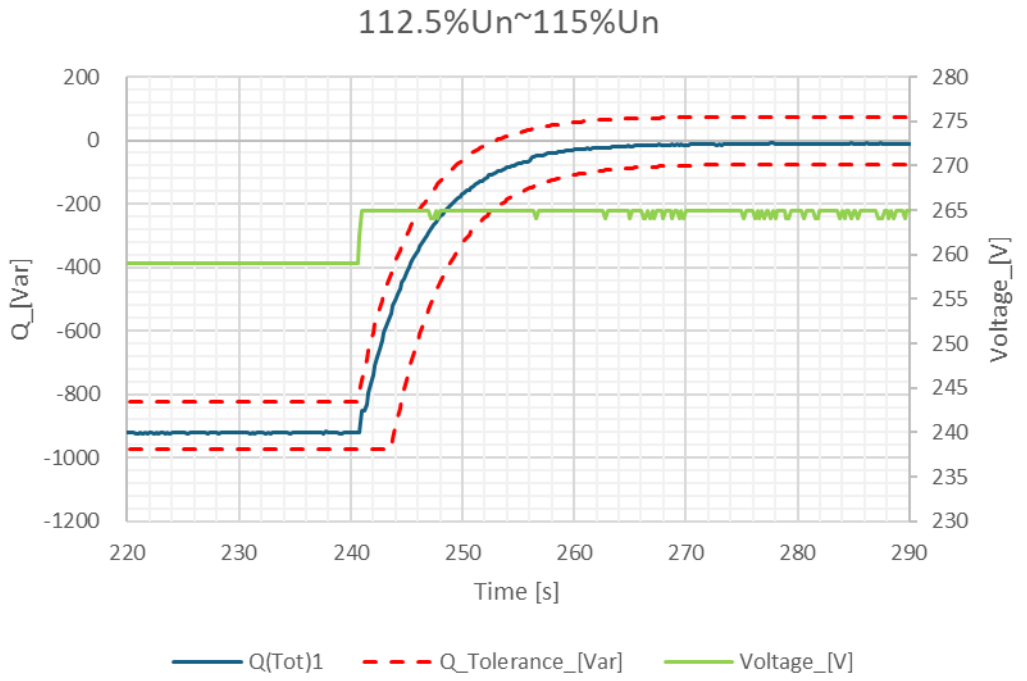
Test 2 - Dynamic behaviour

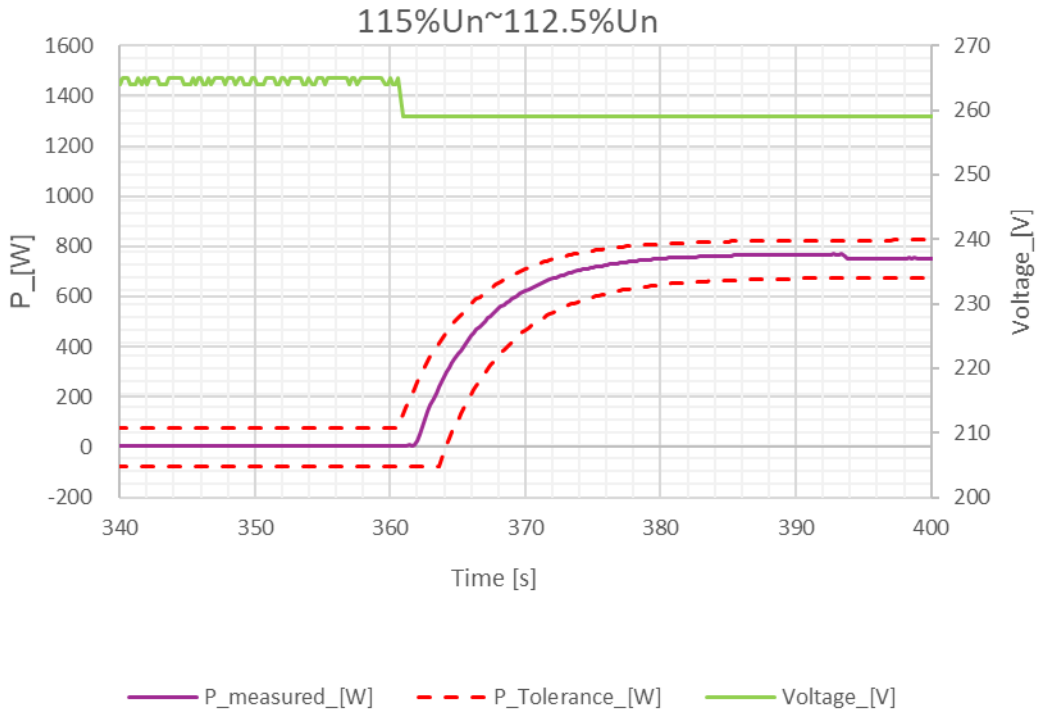
Voltage step U/U_n [%]	Measured value P_+/P_n [%] *	Set point value P_+/P_n [%] *	Dead time [s]	Response time [s]	Settling time [s]
100	98.67%	100.0%	--	--	--
112.5	50.88%	50.0%	0.2	12.2	12.2
115	0.42%	0.0%	0.2	13.2	13.2
112.5	50.46%	50.0%	0.2	11.6	11.6
100	99.33%	100.0%	0.2	13.2	13.2

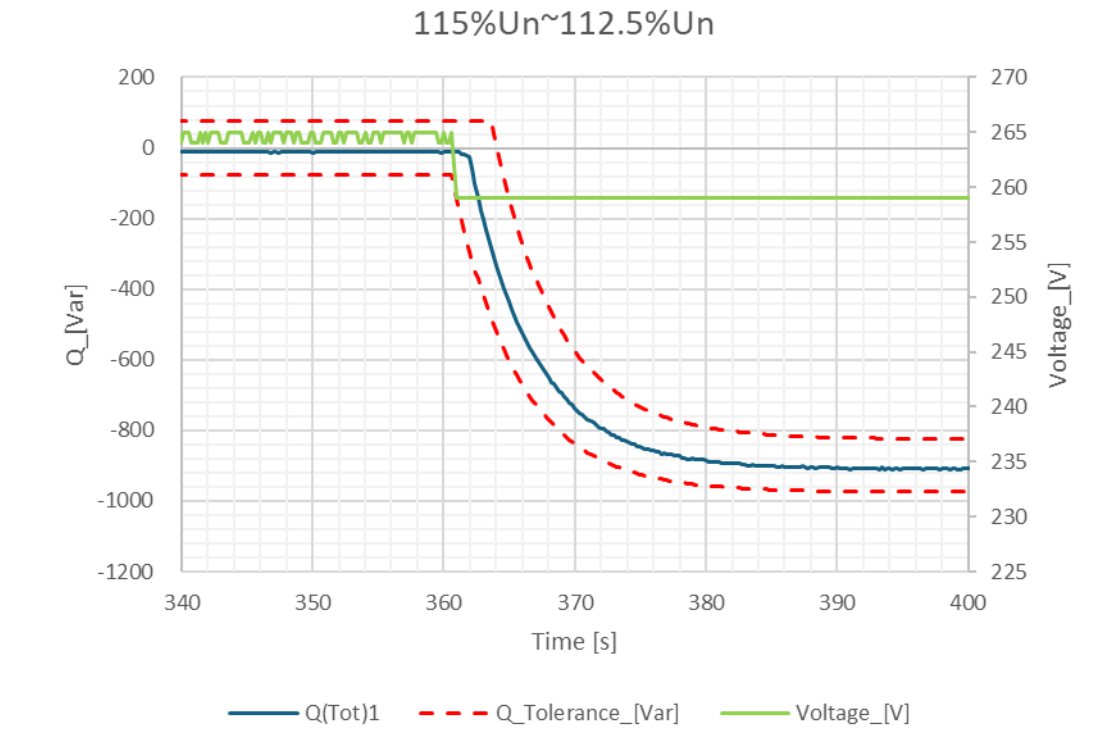
Test 2 - Dynamic behaviour

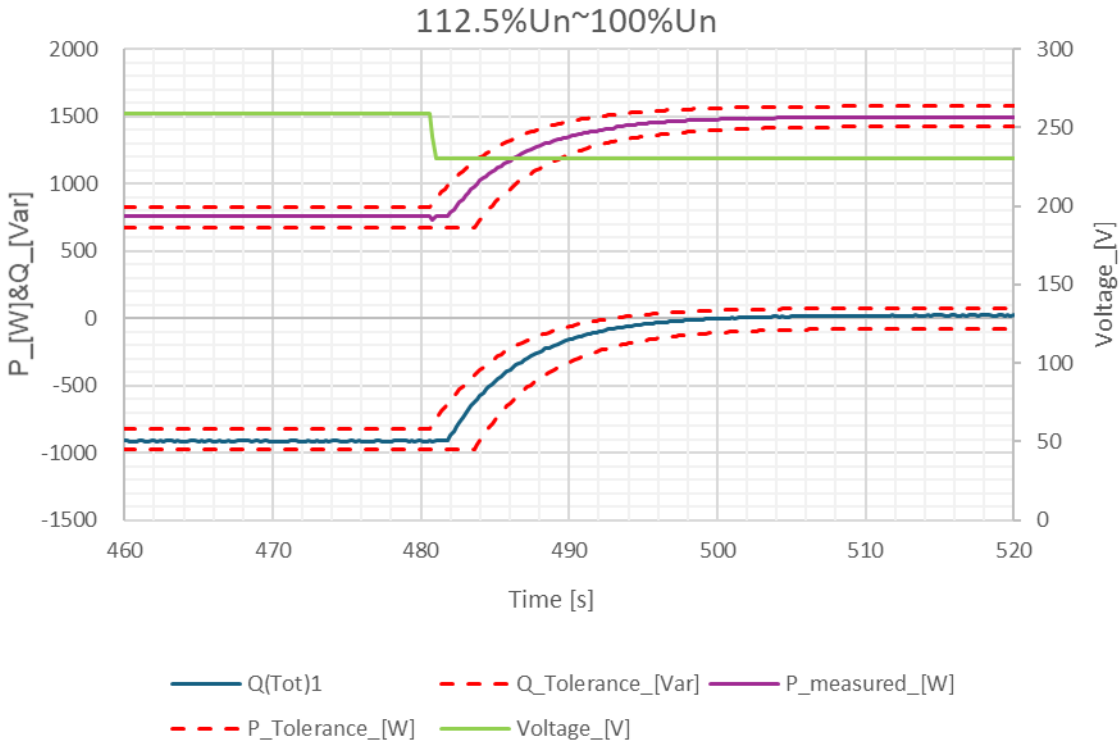





112.5%Un~115%Un
Q_[Var]
Voltage_[V]
Time [s]
Q(Tot)1
Q_Tolerance_[Var]
Voltage_[V]


115%Un~112.5%Un
P_[W]
Voltage_[V]
Time [s]
P_measured_[W]
P_Tolerance_[W]
Voltage_[V]


115%Un~112.5%Un
200
0
-200
-400
-600
-800
-1000
-1200
Q_[Var]
270
265
260
255
250
245
240
235
230
225
Voltage_[V]
340
350
360
370
380
390
400
Time [s]
Q(Tot)1
Q_Tolerance_[Var]
Voltage_[V]


112.5%Un~100%Un
2000
1500
1000
500
0
-500
-1000
-1500
P_[W]&Q_[Var]
300
250
200
150
100
50
0
Voltage_[V]
460
470
480
490
500
510
520
Time [s]
Q(Tot)1
Q_Tolerance_[Var]
P_measured_[W]
P_Tolerance_[W]
Voltage_[V]

6.6 EMC and power quality

6.6.1 EMC

The generating units comply with the requirements on electromagnetic compatibility	EMC test report, see *Annex 2 – EMC report*.
The interface protection systems, including integrated systems, comply to EN 60255-26	N/A

6.6.2 Power Quality

6.6.2.1 Harmonics

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Standards applied
☒ generating units with rated current ≤ 16A: EN 61000-3-2
☐ generating units with rated current > 16A and ≤ 75A: EN 61000-3-12
☐ generating units with rated current > 75A: EN 61000-4-7

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22 Note: The line impedances depicted in *Figure 3* primarily represent the impedance of the connection cable. Grid impedance R_A [mΩ]: 0.675 Grid reactance X_A [mΩ]: 2.312
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.7.2.2, EN 50549-10

Test results

EN 61000-3-2

Classification:	Class A						
Voltage [V]	230.0						
Frequency [Hz]	50.00						
Active factor	0.999						
Test at	45-55%P_n			100%P_n			
Active Power [W]	754			1498			
Phase	L1	L2	L3	L1	L2	L3	
Harmonic order	Measured Value [A]			Measured Value [A]			Limit [A]
1	3.268	--	--	6.490	--	--	--
2	0.035	--	--	0.066	--	--	1.080
3	0.039	--	--	0.031	--	--	2.300
4	0.008	--	--	0.015	--	--	0.430
5	0.051	--	--	0.029	--	--	1.140
6	0.012	--	--	0.010	--	--	0.300

7	0.071	--	--	0.026	--	--	0.770
8	0.010	--	--	0.009	--	--	0.263
9	0.050	--	--	0.025	--	--	0.400
10	0.009	--	--	0.007	--	--	0.184
11	0.036	--	--	0.020	--	--	0.330
12	0.005	--	--	0.006	--	--	0.153
13	0.030	--	--	0.016	--	--	0.210
14	0.004	--	--	0.006	--	--	0.131
15	0.031	--	--	0.020	--	--	0.150
16	0.005	--	--	0.005	--	--	0.115
17	0.021	--	--	0.016	--	--	0.132
18	0.006	--	--	0.006	--	--	0.102
19	0.019	--	--	0.015	--	--	0.188
20	0.003	--	--	0.002	--	--	0.092
21	0.019	--	--	0.019	--	--	0.107
22	0.003	--	--	0.005	--	--	0.084
23	0.015	--	--	0.013	--	--	0.098
24	0.002	--	--	0.003	--	--	0.077
25	0.014	--	--	0.013	--	--	0.090
26	0.003	--	--	0.003	--	--	0.071
27	0.013	--	--	0.011	--	--	0.080
28	0.003	--	--	0.003	--	--	0.066
29	0.009	--	--	0.009	--	--	0.078
30	0.003	--	--	0.003	--	--	0.061
31	0.008	--	--	0.009	--	--	0.073
32	0.002	--	--	0.002	--	--	0.057
33	0.007	--	--	0.008	--	--	0.068
34	0.002	--	--	0.002	--	--	0.054
35	0.006	--	--	0.007	--	--	0.064
36	0.002	--	--	0.002	--	--	0.051
37	0.005	--	--	0.006	--	--	0.061
38	0.002	--	--	0.002	--	--	0.048
39	0.006	--	--	0.006	--	--	0.058
40	0.002	--	--	0.002	--	--	0.046

Test results

EN 61000-4-7

Voltage [V]	230.0
Frequency [Hz]	50.00
Active factor	0.999

Current Harmonics

L1

Integer harmonic currents

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	P_{max}	Max
Order	I_h [%I_n]												
2	0.199	0.322	0.491	0.506	0.491	0.537	0.567	0.675	0.767	0.874	1.012	--	1.012
3	1.779	2.223	1.963	1.349	0.859	0.598	0.445	0.399	0.414	0.460	0.475	--	2.223
4	0.169	0.383	0.092	0.077	0.123	0.123	0.107	0.123	0.153	0.184	0.230	--	0.383
5	1.227	1.058	1.119	1.119	0.935	0.782	0.659	0.567	0.491	0.475	0.445	--	1.227
6	0.199	0.184	0.230	0.184	0.184	0.184	0.184	0.184	0.169	0.169	0.153	--	0.230
7	1.457	1.533	1.073	1.242	1.257	1.089	0.828	0.629	0.460	0.399	0.399	--	1.533
8	0.138	0.153	0.138	0.153	0.138	0.153	0.169	0.169	0.169	0.153	0.138	--	0.169
9	1.227	1.135	0.997	0.721	0.813	0.767	0.613	0.537	0.475	0.445	0.383	--	1.227
10	0.123	0.138	0.138	0.138	0.138	0.138	0.123	0.123	0.123	0.107	0.107	--	0.138
11	0.951	0.813	0.751	0.583	0.491	0.552	0.552	0.552	0.475	0.429	0.307	--	0.951
12	0.107	0.092	0.092	0.077	0.092	0.077	0.061	0.046	0.061	0.077	0.092	--	0.107
13	0.644	0.567	0.506	0.552	0.399	0.460	0.521	0.491	0.383	0.307	0.245	--	0.644
14	0.077	0.077	0.046	0.061	0.061	0.061	0.092	0.107	0.123	0.123	0.092	--	0.123
15	0.537	0.521	0.552	0.552	0.506	0.475	0.521	0.460	0.368	0.353	0.307	--	0.552
16	0.031	0.031	0.046	0.046	0.061	0.077	0.092	0.077	0.061	0.046	0.077	--	0.092
17	0.414	0.429	0.414	0.383	0.414	0.322	0.322	0.322	0.337	0.322	0.245	--	0.429
18	0.046	0.046	0.061	0.077	0.092	0.092	0.077	0.061	0.077	0.092	0.092	--	0.092
19	0.399	0.414	0.383	0.368	0.383	0.291	0.291	0.353	0.337	0.276	0.230	--	0.414
20	0.031	0.031	0.031	0.046	0.046	0.046	0.031	0.031	0.046	0.046	0.031	--	0.046
21	0.337	0.337	0.322	0.322	0.291	0.291	0.276	0.307	0.307	0.307	0.291	--	0.337
22	0.061	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.061	0.061	0.077	--	0.077
23	0.276	0.261	0.245	0.245	0.215	0.230	0.215	0.230	0.245	0.230	0.199	--	0.276
24	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.046	--	0.046
25	0.230	0.215	0.199	0.199	0.199	0.215	0.184	0.199	0.215	0.199	0.199	--	0.230
26	0.046	0.031	0.031	0.031	0.031	0.046	0.046	0.046	0.046	0.046	0.046	--	0.046
27	0.199	0.184	0.184	0.184	0.184	0.199	0.169	0.169	0.184	0.199	0.169	--	0.199
28	0.031	0.031	0.031	0.031	0.046	0.046	0.031	0.031	0.046	0.046	0.046	--	0.046
29	0.138	0.138	0.138	0.153	0.138	0.138	0.123	0.123	0.138	0.138	0.138	--	0.153
30	0.031	0.031	0.031	0.046	0.046	0.046	0.031	0.046	0.046	0.046	0.046	--	0.046
31	0.138	0.138	0.153	0.138	0.138	0.123	0.138	0.123	0.123	0.138	0.138	--	0.153
32	0.031	0.031	0.046	0.046	0.031	0.031	0.046	0.046	0.031	0.046	0.031	--	0.046
33	0.123	0.138	0.138	0.123	0.107	0.107	0.123	0.107	0.107	0.123	0.123	--	0.138
34	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	--	0.031
35	0.092	0.107	0.092	0.092	0.092	0.092	0.107	0.092	0.107	0.107	0.107	--	0.107
36	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	--	0.031
37	0.092	0.092	0.092	0.092	0.092	0.077	0.077	0.077	0.077	0.092	0.092	--	0.092
38	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	--	0.031
39	0.107	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092	--	0.107
40	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	--	0.031
41	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.061	0.077	0.077	--	0.077

42	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	--	0.031
43	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	--	0.077
44	0.031	0.031	0.031	0.046	0.031	0.031	0.031	0.031	0.046	0.031	0.031	--	0.046
45	0.061	0.061	0.061	0.077	0.061	0.061	0.061	0.061	0.061	0.061	0.061	--	0.077
46	0.031	0.031	0.046	0.046	0.031	0.046	0.031	0.031	0.046	0.046	0.046	--	0.046
47	0.077	0.077	0.077	0.077	0.061	0.061	0.061	0.061	0.077	0.077	0.077	--	0.077
48	0.046	0.031	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	--	0.046
49	0.077	0.077	0.061	0.061	0.077	0.061	0.061	0.061	0.061	0.061	0.061	--	0.077
50	0.046	0.046	0.031	0.031	0.046	0.046	0.046	0.046	0.046	0.031	0.046	--	0.046
THD_I [%I_n]	3.282	3.466	3.064	2.657	2.340	2.094	1.855	1.736	1.619	1.611	1.596	--	3.466

Interharmonic currents

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	P_{max}	Max
f [Hz]	I_h [%I_n]												
75	0.080	0.089	0.098	0.110	0.116	0.112	0.121	0.122	0.123	0.131	0.131	--	0.131
125	0.079	0.084	0.090	0.095	0.099	0.095	0.099	0.100	0.101	0.103	0.103	--	0.103
175	0.082	0.091	0.099	0.106	0.112	0.110	0.113	0.115	0.115	0.116	0.116	--	0.116
225	0.077	0.082	0.086	0.090	0.094	0.093	0.093	0.096	0.097	0.097	0.097	--	0.097
275	0.081	0.088	0.094	0.099	0.102	0.100	0.102	0.105	0.105	0.107	0.105	--	0.107
325	0.079	0.085	0.092	0.096	0.098	0.098	0.102	0.102	0.103	0.104	0.105	--	0.105
375	0.078	0.084	0.093	0.095	0.097	0.097	0.099	0.100	0.102	0.103	0.103	--	0.103
425	0.078	0.083	0.090	0.094	0.096	0.097	0.100	0.099	0.103	0.104	0.104	--	0.104
475	0.078	0.083	0.090	0.093	0.094	0.097	0.098	0.099	0.101	0.104	0.103	--	0.104
525	0.078	0.083	0.088	0.092	0.094	0.096	0.098	0.099	0.102	0.105	0.103	--	0.105
575	0.079	0.083	0.088	0.091	0.092	0.097	0.098	0.100	0.102	0.104	0.103	--	0.104
625	0.078	0.082	0.088	0.091	0.092	0.096	0.098	0.099	0.101	0.104	0.104	--	0.104
675	0.078	0.082	0.086	0.090	0.091	0.095	0.098	0.099	0.102	0.105	0.105	--	0.105
725	0.077	0.082	0.087	0.089	0.091	0.094	0.097	0.099	0.101	0.106	0.105	--	0.106
775	0.078	0.083	0.088	0.088	0.091	0.094	0.096	0.098	0.101	0.104	0.106	--	0.106
825	0.079	0.081	0.087	0.087	0.091	0.094	0.095	0.099	0.101	0.105	0.106	--	0.106
875	0.079	0.082	0.088	0.088	0.091	0.094	0.096	0.099	0.103	0.107	0.108	--	0.108
925	0.078	0.082	0.086	0.087	0.090	0.093	0.096	0.098	0.102	0.106	0.107	--	0.107
975	0.077	0.081	0.084	0.085	0.088	0.091	0.094	0.096	0.102	0.104	0.106	--	0.106
1025	0.103	0.106	0.107	0.108	0.112	0.113	0.115	0.117	0.120	0.122	0.127	--	0.127
1075	0.078	0.082	0.083	0.085	0.088	0.091	0.093	0.097	0.101	0.104	0.105	--	0.105
1125	0.076	0.079	0.081	0.083	0.085	0.089	0.091	0.094	0.098	0.102	0.105	--	0.105
1175	0.077	0.080	0.081	0.083	0.085	0.089	0.090	0.094	0.098	0.101	0.105	--	0.105
1225	0.077	0.079	0.080	0.082	0.085	0.088	0.090	0.093	0.099	0.101	0.104	--	0.104
1275	0.077	0.078	0.080	0.081	0.083	0.087	0.087	0.091	0.097	0.099	0.103	--	0.103
1325	0.080	0.081	0.082	0.082	0.086	0.088	0.091	0.093	0.099	0.100	0.104	--	0.104
1375	0.077	0.080	0.081	0.082	0.084	0.086	0.088	0.092	0.099	0.100	0.104	--	0.104
1425	0.076	0.079	0.078	0.079	0.082	0.084	0.085	0.089	0.094	0.095	0.099	--	0.099
1475	0.086	0.089	0.086	0.092	0.089	0.094	0.092	0.101	0.106	0.109	0.113	--	0.113
1525	0.090	0.087	0.091	0.087	0.093	0.093	0.101	0.099	0.103	0.109	0.115	--	0.115
1575	0.076	0.077	0.077	0.077	0.079	0.081	0.082	0.086	0.090	0.094	0.097	--	0.097
1625	0.074	0.077	0.076	0.076	0.078	0.081	0.083	0.085	0.088	0.092	0.097	--	0.097
1675	0.075	0.075	0.075	0.076	0.078	0.079	0.081	0.083	0.086	0.091	0.094	--	0.094
1725	0.075	0.076	0.076	0.076	0.077	0.079	0.082	0.083	0.084	0.088	0.092	--	0.092
1775	0.075	0.075	0.076	0.076	0.077	0.078	0.081	0.083	0.085	0.090	0.095	--	0.095
1825	0.074	0.075	0.074	0.075	0.077	0.078	0.079	0.081	0.084	0.087	0.092	--	0.092
1875	0.071	0.072	0.073	0.073	0.073	0.075	0.077	0.078	0.082	0.084	0.087	--	0.087

1925	0.071	0.071	0.074	0.075	0.073	0.075	0.076	0.078	0.083	0.084	0.088	--	0.088
1975	0.071	0.071	0.074	0.078	0.072	0.074	0.074	0.079	0.086	0.084	0.087	--	0.087

Higher Frequency components of harmonics

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	P_{max}	Max
f [kHz]	I_h [%I_n]												
2.1	0.198	0.198	0.232	0.246	0.198	0.206	0.198	0.225	0.240	0.227	0.231	--	0.246
2.3	0.274	0.240	0.289	0.315	0.277	0.295	0.268	0.271	0.308	0.303	0.294	--	0.315
2.5	0.289	0.292	0.250	0.229	0.292	0.277	0.291	0.280	0.257	0.270	0.285	--	0.292
2.7	0.183	0.203	0.169	0.149	0.175	0.170	0.189	0.186	0.159	0.181	0.199	--	0.203
2.9	0.120	0.119	0.114	0.115	0.119	0.115	0.121	0.120	0.119	0.126	0.133	--	0.133
3.1	0.083	0.084	0.084	0.083	0.084	0.084	0.085	0.086	0.088	0.090	0.094	--	0.094
3.3	0.062	0.062	0.062	0.062	0.061	0.062	0.062	0.062	0.063	0.065	0.065	--	0.065
3.5	0.036	0.036	0.036	0.036	0.036	0.037	0.036	0.037	0.038	0.039	0.039	--	0.039
3.7	0.023	0.023	0.023	0.023	0.023	0.023	0.024	0.024	0.024	0.024	0.025	--	0.025
3.9	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.016	0.016	0.016	0.016	--	0.016
4.1	0.014	0.014	0.014	0.014	0.014	0.014	0.015	0.015	0.016	0.016	0.017	--	0.017
4.3	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	--	0.009
4.5	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	--	0.006
4.7	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	--	0.005
4.9	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	--	0.005
5.1	0.001	0.020	0.002	0.001	0.001	0.002	0.002	0.004	0.002	0.002	0.001	--	0.020
5.3	0.008	0.019	0.004	0.007	0.007	0.013	0.011	0.006	0.009	0.007	0.010	--	0.019
5.5	0.008	0.018	0.004	0.007	0.006	0.012	0.011	0.006	0.009	0.008	0.010	--	0.018
5.7	0.008	0.018	0.004	0.007	0.006	0.013	0.011	0.006	0.009	0.008	0.010	--	0.018
5.9	0.008	0.018	0.005	0.007	0.006	0.012	0.011	0.006	0.009	0.008	0.010	--	0.018
6.1	0.008	0.018	0.004	0.007	0.007	0.012	0.011	0.006	0.009	0.008	0.010	--	0.018
6.3	0.008	0.017	0.004	0.007	0.006	0.011	0.011	0.006	0.008	0.007	0.009	--	0.017
6.5	0.008	0.017	0.005	0.007	0.007	0.012	0.010	0.006	0.008	0.007	0.009	--	0.017
6.7	0.008	0.016	0.005	0.007	0.006	0.012	0.010	0.006	0.009	0.008	0.009	--	0.016
6.9	0.008	0.016	0.005	0.007	0.007	0.011	0.010	0.006	0.008	0.008	0.010	--	0.016
7.1	0.008	0.016	0.005	0.007	0.007	0.011	0.010	0.006	0.009	0.008	0.009	--	0.016
7.3	0.008	0.016	0.005	0.007	0.006	0.011	0.010	0.005	0.008	0.008	0.009	--	0.016
7.5	0.008	0.017	0.006	0.007	0.006	0.011	0.010	0.005	0.008	0.008	0.009	--	0.017
7.7	0.008	0.015	0.004	0.006	0.006	0.011	0.010	0.005	0.008	0.007	0.009	--	0.015
7.9	0.007	0.015	0.003	0.006	0.006	0.010	0.009	0.005	0.007	0.006	0.008	--	0.015
8.1	0.007	0.015	0.003	0.006	0.005	0.010	0.009	0.004	0.008	0.006	0.008	--	0.015
8.3	0.007	0.015	0.003	0.006	0.005	0.010	0.009	0.004	0.007	0.006	0.008	--	0.015
8.5	0.007	0.015	0.003	0.006	0.005	0.010	0.009	0.004	0.007	0.006	0.008	--	0.015
8.7	0.007	0.015	0.003	0.006	0.005	0.010	0.009	0.004	0.007	0.006	0.008	--	0.015
8.9	0.007	0.015	0.003	0.006	0.005	0.010	0.009	0.004	0.007	0.006	0.008	--	0.015

Voltage Harmonics

Integer harmonic voltages

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	Max.	**Limit**
Order	V_h [%V_n]												
2	0.068	0.071	0.072	0.072	0.071	0.064	0.052	0.041	0.034	0.031	0.032	0.072	--
3	0.312	0.314	0.310	0.308	0.304	0.295	0.281	0.265	0.250	0.240	0.233	0.314	--
4	0.024	0.025	0.023	0.021	0.019	0.013	0.007	0.004	0.006	0.008	0.012	0.025	--
5	0.029	0.036	0.040	0.051	0.061	0.068	0.072	0.073	0.073	0.071	0.068	0.073	--
6	0.010	0.010	0.010	0.011	0.012	0.013	0.014	0.014	0.013	0.012	0.010	0.014	--

7	0.069	0.076	0.076	0.081	0.082	0.077	0.068	0.054	0.040	0.028	0.016	0.082	--
8	0.008	0.008	0.009	0.010	0.012	0.013	0.014	0.012	0.010	0.008	0.007	0.014	--
9	0.059	0.056	0.050	0.045	0.038	0.026	0.013	0.010	0.020	0.027	0.031	0.059	--
10	0.018	0.018	0.017	0.016	0.015	0.013	0.010	0.007	0.005	0.004	0.003	0.018	--
11	0.027	0.020	0.011	0.009	0.014	0.023	0.034	0.038	0.036	0.032	0.025	0.038	--
12	0.012	0.012	0.012	0.010	0.010	0.010	0.010	0.009	0.009	0.008	0.007	0.012	--
13	0.009	0.011	0.017	0.022	0.024	0.028	0.030	0.023	0.012	0.004	0.006	0.030	--
14	0.009	0.008	0.008	0.008	0.009	0.010	0.011	0.011	0.011	0.009	0.006	0.011	--
15	0.015	0.021	0.027	0.029	0.029	0.029	0.025	0.013	0.004	0.012	0.016	0.029	--
16	0.006	0.007	0.009	0.010	0.012	0.014	0.012	0.008	0.004	0.005	0.010	0.014	--
17	0.025	0.025	0.023	0.021	0.017	0.009	0.005	0.013	0.017	0.014	0.006	0.025	--
18	0.008	0.008	0.008	0.009	0.009	0.008	0.005	0.004	0.005	0.006	0.005	0.009	--
19	0.025	0.023	0.018	0.015	0.012	0.008	0.014	0.017	0.012	0.008	0.011	0.025	--
20	0.004	0.004	0.004	0.005	0.006	0.008	0.007	0.005	0.003	0.003	0.004	0.008	--
21	0.025	0.022	0.018	0.016	0.015	0.017	0.020	0.017	0.016	0.019	0.017	0.025	--
22	0.007	0.005	0.004	0.004	0.004	0.005	0.004	0.005	0.005	0.004	0.003	0.007	--
23	0.010	0.009	0.008	0.010	0.011	0.011	0.009	0.011	0.011	0.008	0.010	0.011	--
24	0.006	0.006	0.008	0.008	0.008	0.006	0.004	0.004	0.005	0.005	0.005	0.008	--
25	0.007	0.007	0.008	0.010	0.011	0.011	0.008	0.008	0.006	0.008	0.008	0.011	--
26	0.004	0.004	0.005	0.005	0.005	0.005	0.004	0.003	0.004	0.004	0.003	0.005	--
27	0.013	0.014	0.015	0.015	0.016	0.016	0.015	0.015	0.017	0.016	0.013	0.017	--
28	0.005	0.005	0.006	0.006	0.006	0.004	0.004	0.004	0.004	0.004	0.003	0.006	--
29	0.013	0.014	0.014	0.013	0.012	0.011	0.012	0.012	0.011	0.013	0.013	0.014	--
30	0.006	0.006	0.006	0.007	0.006	0.005	0.005	0.005	0.004	0.004	0.005	0.007	--
31	0.015	0.015	0.013	0.013	0.012	0.013	0.013	0.011	0.012	0.012	0.011	0.015	--
32	0.006	0.007	0.007	0.006	0.005	0.004	0.006	0.005	0.004	0.006	0.004	0.007	--
33	0.014	0.013	0.010	0.010	0.011	0.011	0.011	0.010	0.011	0.010	0.012	0.014	--
34	0.006	0.006	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.003	0.005	0.006	--
35	0.013	0.013	0.014	0.015	0.014	0.013	0.014	0.012	0.012	0.012	0.012	0.015	--
36	0.007	0.006	0.005	0.005	0.005	0.006	0.005	0.005	0.004	0.005	0.005	0.007	--
37	0.009	0.009	0.010	0.010	0.008	0.009	0.011	0.009	0.009	0.008	0.009	0.011	--
38	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	--
39	0.005	0.006	0.006	0.006	0.006	0.007	0.006	0.007	0.006	0.007	0.006	0.007	--
40	0.004	0.004	0.004	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	--
41	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.010	0.009	0.008	0.007	0.010	--
42	0.003	0.005	0.006	0.006	0.005	0.004	0.005	0.004	0.004	0.004	0.004	0.006	--
43	0.008	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.005	0.006	0.008	--
44	0.003	0.005	0.005	0.004	0.003	0.004	0.004	0.003	0.003	0.004	0.004	0.005	--
45	0.012	0.012	0.012	0.012	0.012	0.011	0.011	0.012	0.012	0.012	0.012	0.012	--
46	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	--
47	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	--
48	0.004	0.003	0.003	0.003	0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.004	--
49	0.003	0.003	0.004	0.004	0.003	0.003	0.004	0.003	0.003	0.004	0.004	0.004	--
50	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	--
THD_U [$\%U_n$]	0.342	0.346	0.342	0.342	0.339	0.328	0.312	0.292	0.274	0.262	0.254	0.346	--

L2

Integer harmonic currents

P [$\%P_n$]	0 - 5	10	20	30	40	50	60	70	80	90	100	P_{max}	Max
Order	I_h [$\%I_n$]												
2	--	--	--	--	--	--	--	--	--	--	--	--	--

3	--	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	--	--	--	--	--
22	--	--	--	--	--	--	--	--	--	--	--	--	--
23	--	--	--	--	--	--	--	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--	--	--	--	--	--
25	--	--	--	--	--	--	--	--	--	--	--	--	--
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Interharmonic currents

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Higher Frequency components of harmonics

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f [kHz]	I_h [%I_n]												
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Voltage Harmonics

Integer harmonic voltages

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L3

Integer harmonic currents

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Interharmonic currents

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	P_{max}	Max
f [Hz]	I_h [%I_n]												
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Higher Frequency components of harmonics

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	P_{max}	Max
f [kHz]	I_h [%I_n]												
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6.3	--	--	--	--	--	--	--	--	--	--	--	--	--
6.5	--	--	--	--	--	--	--	--	--	--	--	--	--
6.7	--	--	--	--	--	--	--	--	--	--	--	--	--
6.9	--	--	--	--	--	--	--	--	--	--	--	--	--
7.1	--	--	--	--	--	--	--	--	--	--	--	--	--
7.3	--	--	--	--	--	--	--	--	--	--	--	--	--
7.5	--	--	--	--	--	--	--	--	--	--	--	--	--
7.7	--	--	--	--	--	--	--	--	--	--	--	--	--
7.9	--	--	--	--	--	--	--	--	--	--	--	--	--
8.1	--	--	--	--	--	--	--	--	--	--	--	--	--
8.3	--	--	--	--	--	--	--	--	--	--	--	--	--
8.5	--	--	--	--	--	--	--	--	--	--	--	--	--
8.7	--	--	--	--	--	--	--	--	--	--	--	--	--
8.9	--	--	--	--	--	--	--	--	--	--	--	--	--

Voltage Harmonics

Integer harmonic voltages

P [%P_n]	0 - 5	10	20	30	40	50	60	70	80	90	100	Max.	**Limit**
Order	V_h [%V_n]												
2	--	--	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	--	--	--	--	--
22	--	--	--	--	--	--	--	--	--	--	--	--	--
23	--	--	--	--	--	--	--	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--	--	--	--	--	--
25	--	--	--	--	--	--	--	--	--	--	--	--	--
26	--	--	--	--	--	--	--	--	--	--	--	--	--
27	--	--	--	--	--	--	--	--	--	--	--	--	--
28	--	--	--	--	--	--	--	--	--	--	--	--	--
29	--	--	--	--	--	--	--	--	--	--	--	--	--
30	--	--	--	--	--	--	--	--	--	--	--	--	--
31	--	--	--	--	--	--	--	--	--	--	--	--	--
32	--	--	--	--	--	--	--	--	--	--	--	--	--
33	--	--	--	--	--	--	--	--	--	--	--	--	--

34	--	--	--	--	--	--	--	--	--	--	--	--	--
35	--	--	--	--	--	--	--	--	--	--	--	--	--
36	--	--	--	--	--	--	--	--	--	--	--	--	--
37	--	--	--	--	--	--	--	--	--	--	--	--	--
38	--	--	--	--	--	--	--	--	--	--	--	--	--
39	--	--	--	--	--	--	--	--	--	--	--	--	--
40	--	--	--	--	--	--	--	--	--	--	--	--	--
41	--	--	--	--	--	--	--	--	--	--	--	--	--
42	--	--	--	--	--	--	--	--	--	--	--	--	--
43	--	--	--	--	--	--	--	--	--	--	--	--	--
44	--	--	--	--	--	--	--	--	--	--	--	--	--
45	--	--	--	--	--	--	--	--	--	--	--	--	--
46	--	--	--	--	--	--	--	--	--	--	--	--	--
47	--	--	--	--	--	--	--	--	--	--	--	--	--
48	--	--	--	--	--	--	--	--	--	--	--	--	--
49	--	--	--	--	--	--	--	--	--	--	--	--	--
50	--	--	--	--	--	--	--	--	--	--	--	--	--
THD_U [%U_n]	--	--	--	--	--	--	--	--	--	--	--	--	--

6.6.2.2 Flicker and rapid voltage changes

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Standards applied
☒ generating units with rated current ≤ 16A: EN 61000-3-3
☐ generating units with rated current > 16A and ≤ 75A: EN 61000-3-11
☐ generating units with rated current > 75A

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.7.2.3, EN 50549-10

Test results

EN 61000-3-3

		Starting			Stopping			Running	
	Phase no.	d_{max} [%]	d_c [%]	d(t) [ms]	d_{max} [%]	d_c [%]	d(t) [ms]	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	L1	1.802	1.478	0.000	1.859	1.059	0.000	0.078	0.072
	L2	--	--	--	--	--	--	--	--
	L3	--	--	--	--	--	--	--	--
	Overall worst case	--	--	--	--	--	--	--	--
Normalised to standard impedance	L1	1.802	1.478	0.000	1.859	1.059	0.000	0.078	0.072
	L2	--	--	--	--	--	--	--	--
	L3	--	--	--	--	--	--	--	--

	Overall worst case	--	--	--	--	--	--	--	--
Normalised to required maximum impedance	L1	3.877	3.180	0.000	4.000	2.279	0.000	0.131	0.120
	L2	--	--	--	--	--	--	--	--
	L3	--	--	--	--	--	--	--	--
	Overall worst case	--	--	--	--	--	--	--	--
Limits		4	3.3	500 (3.3%)	4	3.3	500 (3.3%)	1.0	0.65

Test Impedance	R:	0.40 Ω	X:	0.25 Ω
Standard Impedance	R:	☐ 0.24 * ☒ 0.4 ^ Ω	X:	☐ 0.15 * ☒ 0.25 ^ Ω
Maximum Impedance	R:	0.86 Ω	X:	0.54 Ω

*	☐ three-phase **Power Generating Module**s	☐	split single phase **Power Generating Module**s
^	☒ single phase **Power Generating Module**	☐	**Power Generating Module**s using two phases on a three-phase system

Test results

Tests acc. IEC 61000-4-30, IEC 61400-21 and IEC 61000-4-15

Background flicker:	Stable AC source (see *4.6 Measurement equipment*) used for testing. Background flicker can be ignored.
Instruments:	Power quality analyzer used for testing met IEC 61000-4-30 Class A (see *4.6 Measurement equipment*)
Testing method:	According to IEC 61400-21
Evaluation method:	Using flickermeter in accordance with IEC 61000-4-15
Results:	The stated results in the following results table are maximum values over all 3 phases and all datasets. Measurement results of all 3 phases are available at the laboratory for reference.

Flicker measurements

Test conditions:	
Reactive power setpoint:	Q = 0
Ratio $S_{k,fic}/S_n$ in the fictitious grid used for analysis:	20

Grid impedance angle, ψ_k	30°	50°	70°	85°
Power level [%P_{max}]	Flicker coefficient, c(ψ_k, P)			
0 - 5	--	--	--	--
10	--	--	--	--
20	--	--	--	--
30	--	--	--	--
40	--	--	--	--
50	--	--	--	--
60	--	--	--	--
70	--	--	--	--

80	--	--	--	--
90	--	--	--	--
100	--	--	--	--
Max. Flicker coefficient, $c(\psi_k, P)$	--	--	--	--
Max. Short-term flicker, P_{st}	--	--	--	--

RVC measurements				
Test conditions:				
Reactive power setpoint:	Q = 0			
Ratio $S_{k,fic}/S_n$ in the fictitious grid used for analysis:	20			
Case of switching operation	Switch-on at $P_{available} < 10\%P_{max}$			
Max. no of switching operations, N_{10}	20			
Max. number of switching operations, N_{120}	240			
Grid impedance angle, ψ_k	30°	50°	70°	85°
Flicker step factor, $k_f(\psi_k)$	--	--	--	--
Voltage change factor, $k_u(\psi_k)$	--	--	--	--
Maximum inrush current factor k_{imax}	--			
Case of switching operation	Switch-on at $P_{available} = 100\%P_{max}$			
Max. no of switching operations, N_{10}	1			
Max. number of switching operations, N_{120}	12			
Grid impedance angle, ψ_k	30°	50°	70°	85°
Flicker step factor, $k_f(\psi_k)$	--	--	--	--
Voltage change factor, $k_u(\psi_k)$	--	--	--	--
Maximum inrush current factor k_{imax}	--			
Case of switching operation	Switching from $10\%P_{max}$ to $100\%P_{max}$			
Max. no of switching operations, N_{10}	---			
Max. number of switching operations, N_{120}	---			
Grid impedance angle, ψ_k	30°	50°	70°	85°
Flicker step factor, $k_f(\psi_k)$	--	--	--	--
Voltage change factor, $k_u(\psi_k)$	--	--	--	--
Maximum inrush current factor k_{imax}	--			
Case of switching operation	Service shutdown at $P_{available} = 100\%P_{max}$			
Max. no of switching operations, N_{10}	1			
Max. number of switching operations, N_{120}	12			
Grid impedance angle, ψ_k	30°	50°	70°	85°
Flicker step factor, $k_f(\psi_k)$	--	--	--	--
Voltage change factor, $k_u(\psi_k)$	--	--	--	--
Maximum inrush current factor k_{imax}	--			

6.6.2.3 DC injection

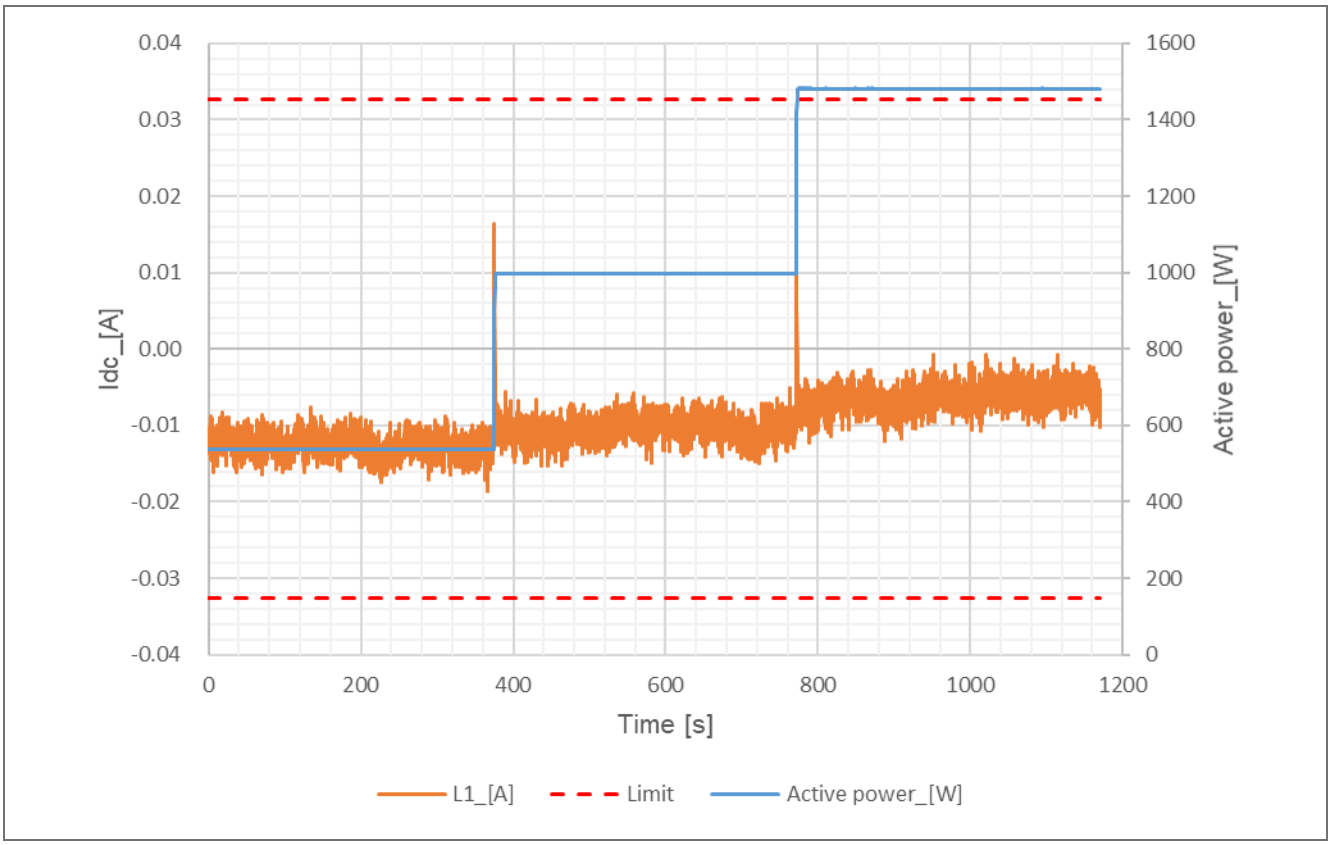
Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.7.2.4, EN 50549-10
Voltage [V]	230.0
Frequency [Hz]	50.00
THD of the mains voltage: < 2.5 %?	The test equipment used met the requirements.
Network simulators used, DC component of the voltage < 0.1 %?	The test equipment used met the requirements.

Operating mode of the EUT	☐ MPP-Tracking operation mode: input voltage equal to the nominal value declared by the manufacturer ☒ Fixed voltage control operation mode: input voltage equal to the nominal value declared by the manufacturer

Acceptance criteria
DC current for all 5 min average values calculated is lower than 0.5% of nominal current or 20 mA whatever is the higher value

Test results									
Test power level	30 ~ 40%P_{max}			60 ~ 70%P_{max}			>95%P_{max}		
P [W]	537			997			1481		
Phase	L1	L2	L3	L1	L2	L3	L1	L2	L3
Max. DC current [mA]	18	--	--	15	--	--	12	--	--
Max. DC current [%I_n]	0.283	--	--	0.236	--	--	0.190	--	--
Avg. DC current [mA]	13	--	--	10	--	--	6	--	--
Avg. DC current [%I_n]	0.193	--	--	0.159	--	--	0.097	--	--
Limit [%]	max{0.5%I_n, 33mA}								



6.7 Interface protection

Verification methodology & Test setup	See section 4.3.1 & 4.5.
Manufacturer data	
Type of interface protection	☒ Interface protection as internal device (Section 5.8.3, EN 50549-10) ☐ Interface protection as dedicated device (Section 5.8.4, EN 50549-10)
	☒ Single-phase interface protection ☐ Three-phase interface protection
Test terminal	☒ Test terminal available, tests were carried out on the test terminal without disconnecting wires ☐ Test terminal NOT available
Voltage evaluation principle	☒ phase-to-neutral (star) ☐ phase-to-phase (delta)
Disconnection device	**Relay- Model (main): HF140FF-G**, opening time (T_{open}): max. 15 ms
	Relay- Model (alternative): **CHI05-V-212H1A2H**
Start time of protection relay [ms] Time delay setting ($T_{setting}$) of protection relay includes	20 ☒ Start time (T_{start}) of the protection relay ☐ Opening time (T_{open}) of the disconnection device Note:

	The shown disconnection times (T_{disc}) in this test report include the operate time (T_{OP}) of the protection relay and opening time (T_{open}) of the disconnection device.
Reset time	<50ms
Reset ratio	Voltage: <2%U_n Frequency: <0.2Hz

6.7.1 Voltage and frequency protections

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.8.3, EN 50549-10

Relevant parameter setting	Default setting used for testing, see *Annex 1 – Parameter list*

Acceptance criteria

- For tests with ramp signal (Ramp), if for all tests the tolerance between the setting value and value of the characteristic quantity that causes the operation of the relay is less than the required accuracy for the voltage and for the frequency. (EN 50549-1:2019 requires a voltage measurement accuracy of 1%U_n and a frequency accuracy of 0.05 Hz.)
- For tests with jump signal (Jump), if for all tests the operate time is equal to or below the configured time delay setting plus the start time as stated in the product documentation. If due to the test setup the disconnection time is evaluated instead of the operate time the test is passed if for all tests the disconnection time is equal to or below the configured time delay setting plus the start time plus the circuit breaker opening time as stated in the product documentation. If the configured time delay setting includes the start time or the opening time, the condition has to be modified accordingly.
- For criteria 1) and 2) it is ensured that no voltage other than the voltage to be tested exceeds one of the setting values
- For tests with non-operation signal (NOP) the relay does not operate.
- If the interface protection operates the interface switch opens.

Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test results

Note:

Test procedure acc. Section 5.8.3.2, EN 50549-10.

For the parameter setting range, please refer to *Annex 1 – Parameter list*.

1) Overvoltage protection stage 1 (>) - Accuracy of the setting values (Ramp tests)

Test cases	Setting [%Un]	Tripping values [%Un]							Limit
		(U > 1) $U_{all-phases}$	(U > 2) U_{L1-N}	(U > 3) U_{L2-N}	(U > 4) U_{L3-N}	(U > 5) U_{L1-L2}	(U > 6) U_{L2-L3}	(U > 7) U_{L3-L1}	

Min. of setting range	100.0	--	100.1	--	--	--	--	--	$\lvert U_{meas} - U_{set} \rvert \leq 1\%U_n$
30% of setting range	106.0	--	105.7	--	--	--	--	--	
60% of setting range	112.0	--	112.1	--	--	--	--	--	
Max. of setting range	120.0	--	119.9	--	--	--	--	--	
Maximum deviation from setting value [$\%U_n$]					0.3				

Note:

For **time delay setting** during tests, the following applied:

- "Min. of setting range" of threshold: max. of setting range of time delay, time delay was limited to 100 s for testing
- "30% of setting range" of threshold: 60% of setting range of time delay, time delay was limited to 60 s for testing
- "60% of setting range" of threshold: 30% of setting range of time delay, time delay was limited to 30 s for testing
- "Max. of setting range" of threshold: min. of setting range of time delay, time delay was limited to 0.1 s for testing

2) Overvoltage protection stage 1 (>) - Time measurements (Jump tests)

Test cases	Setting [s]	Tripping times [s]							Limit [s]
		(U > 8) $U_{all\text{-}phases}$	(U > 9) $U_{L1\text{-}N}$	(U > 10) $U_{L2\text{-}N}$	(U > 11) $U_{L3\text{-}N}$	(U > 12) $U_{L1\text{-}L2}$	(U > 13) $U_{L2\text{-}L3}$	(U > 14) $U_{L3\text{-}L1}$	
Min. of setting range	0.1	--	0.117	--	--	--	--	--	0.1-0.2
30% of setting range	30.0	--	30.080	--	--	--	--	--	30.0-30.1
60% of setting range	60.0	--	60.000	--	--	--	--	--	60.0-60.1
Max. of setting range	100.0	--	100.000	--	--	--	--	--	100.0-100.1
Maximum deviation from operate time / time delay setting [s]					0.080				

Note:

For **tripping threshold setting** during tests, the following applied:

- "Min. of setting range" of tripping time: max. of setting range of tripping threshold
- "30% of setting range" of tripping time: 60% of setting range of tripping threshold
- "60% of setting range" of tripping time: 30% of setting range of tripping threshold
- "Max. of setting range" of tripping time: min. of setting range of tripping threshold

* The start (pick-up) signal is NOT accessible.

The shown Tripping / disconnection times (T_{disc}) in this test report include the operate time (T_{OP}) of the protection relay and opening time (T_{open}) of the disconnection device:

$T_{disc} = T_{OP} + T_{open}$

The determined deviation calculated from the measured value and the (setting value + max. opening time of the disconnection device (30ms)).

3) Overvoltage protection stage 1 (>) - Reset time (NOP tests)

Test cases	Setting (G_S) [$\%U_n$]	(U > 15) $U_{L1\text{-}N}$	(U > 15) $U_{L2\text{-}N}$	(U > 15) $U_{L3\text{-}N}$	Relay operated / interface switch opened?
50% of setting range	110	Test sequence see below	--	--	☐ yes ☒ no

Note:

Test sequence modified acc. Figure 42, EN 50549-10:

Step 0: $G_{Start} = G_S - 2.5\%U_n$, $\Delta t_1 = T_S + 200$ ms

↓

Step 1: $G_{End} = G_S + 2.5\%U_n$, $\Delta t_2 = T_{OP} - 60$ ms

↓

Step 2: Signal value = $G_S - 2\%U_n$, $\Delta t_1 = T_S + 200$ ms

4) Overvoltage protection stage 2 (≫) - Accuracy of the setting values (Pulsed ramp tests)

Test cases	Setting [%U_n]	Tripping values [%Un]							Limit
		(U ≫ 1) $U_{all-phases}$	(U ≫ 2) U_{L1-N}	(U ≫ 3) U_{L2-N}	(U ≫ 4) U_{L3-N}	(U ≫ 5) U_{L1-L2}	(U ≫ 6) U_{L2-L3}	(U ≫ 7) U_{L3-L1}	
Min. of setting range	100.0	--	100.1	--	--	--	--	--	$\lvert U_{meas} - U_{set} \rvert \leq 1\%U_n$
30% of setting range	109.0	--	109.1	--	--	--	--	--	
60% of setting range	118.0	--	118.1	--	--	--	--	--	
Max. of setting range	130.0	--	129.1	--	--	--	--	--	
Maximum deviation from setting value [%U_n]		0.9							

Note:

For **time delay setting** during tests, the following applied:

- "Min. of setting range" of threshold: max. of setting range of time delay, time delay was limited to 5.0 s for testing
- "30% of setting range" of threshold: 60% of setting range of time delay, time delay was limited to 3.0 s for testing
- "60% of setting range" of threshold: 30% of setting range of time delay, time delay was limited to 1.5 s for testing
- "Max. of setting range" of threshold: min. of setting range of time delay, time delay was limited to 0.1 s for testing

5) Overvoltage protection stage 2 (≫) - Time measurements (Jump tests)

Test cases	Setting [s]	Tripping times [s]							Limit [s]
		(U ≫ 8) $U_{all-phases}$	(U ≫ 9) U_{L1-N}	(U ≫ 10) U_{L2-N}	(U ≫ 11) U_{L3-N}	(U ≫ 12) U_{L1-L2}	(U ≫ 13) U_{L2-L3}	(U ≫ 14) U_{L3-L1}	
Min. of setting range	0.1	--	0.107	--	--	--	--	--	0.1-0.2
30% of setting range	1.5	--	1.516	--	--	--	--	--	1.5-1.6
60% of setting range	3.0	--	3.035	--	--	--	--	--	3.0-3.1
Max. of setting range	5.0	--	5.040	--	--	--	--	--	5.0-5.1
Maximum deviation from time delay setting [s]		0.040							

Note:

For **tripping threshold setting** during tests, the following applied:

- "Min. of setting range" of tripping time: max. of setting range of tripping threshold
- "30% of setting range" of tripping time: 60% of setting range of tripping threshold
- "60% of setting range" of tripping time: 30% of setting range of tripping threshold
- "Max. of setting range" of tripping time: min. of setting range of tripping threshold

* The start (pick-up) signal is NOT accessible.

The shown Tripping / disconnection times (T_{disc}) in this test report include the operate time (T_{OP}) of the protection relay and opening time (T_{open}) of the disconnection device:

$T_{disc} = T_{OP} + T_{open}$

The determined deviation calculated from the measured value and the (setting value + max. opening time of the disconnection device (30ms)).

6) Overvoltage protection stage 2 (≫) - Reset time (NOP tests)

Test cases	Setting (G_S) [%U_n]	(U ≫ 15) U_{L1-N}	(U ≫ 15) U_{L2-N}	(U ≫ 15) U_{L3-N}	Relay operated / interface switch opened?
67% of setting range	120	Test sequence see below	--	--	☐ yes ☒ no

Note:

Test sequence modified acc. Figure 42, EN 50549-10:

Step 0: $G_{Start} = G_S - 2.5\%U_n$, $\Delta t_1 = T_S + 200$ ms

↓

Step 1: $G_{End} = G_S + 2.5\%U_n$, $\Delta t_2 = T_{OP} - 60$ ms

↓

Step 2: Signal value = $G_S - 2\%U_n$, $\Delta t_1 = T_S + 200$ ms

7) Undervoltage protection stage 1 (<) - Accuracy of the setting values (Ramp tests)

Test cases	Setting [%U_n]	Tripping values [%Un]							Limit
		(U < 1) $U_{all-phases}$	(U < 2) U_{L1-N}	(U < 3) U_{L2-N}	(U < 4) U_{L3-N}	(U < 5) U_{L1-L2}	(U < 6) U_{L2-L3}	(U < 7) U_{L3-L1}	
Min. of setting range	20	--	20.0	--	--	--	--	--	$\lvert U_{meas} - U_{set} \rvert \le 1\%U_n$
30% of setting range	44	--	43.9	--	--	--	--	--	
60% of setting range	68	--	68.1	--	--	--	--	--	
Max. of setting range	100	--	100.0	--	--	--	--	--	
Maximum deviation from setting value [%U_n]		0.1							

Note:

For **time delay setting** during tests, the following applied:

- "Min. of setting range" of threshold: min. of setting range of time delay, time delay was limited to 0.1 s for testing
- "30% of setting range" of threshold: 30% of setting range of time delay, time delay was limited to 30 s for testing
- "60% of setting range" of threshold: 60% of setting range of time delay, time delay was limited to 60 s for testing
- "Max. of setting range" of threshold: max. of setting range of time delay, time delay was limited to 100 s for testing

8) Undervoltage protection stage 1 (<) - Time measurements (Jump tests)

Test cases	Setting [s]	Tripping times [s]							Limit [s]
		(U < 8) $U_{all-phases}$	(U < 9) U_{L1-N}	(U < 10) U_{L2-N}	(U < 11) U_{L3-N}	(U < 12) U_{L1-L2}	(U < 13) U_{L2-L3}	(U < 14) U_{L3-L1}	
Min. of setting range	0.1	--	0.108	--	--	--	--	--	0.1-0.2
30% of setting range	30.0	--	30.036	--	--	--	--	--	30.0-30.1
60% of setting range	60.0	--	60.010	--	--	--	--	--	60.0-60.1

Max. of setting range	100.0	--	100.000	--	--	--	--	--	100.0-100.1
Maximum deviation from operate time / time delay setting [s]	0.036								

Note:

For **tripping threshold setting** during tests, the following applied:

- "Min. of setting range" of tripping time: min. of setting range of tripping threshold
- "30% of setting range" of tripping time: 30% of setting range of tripping threshold
- "60% of setting range" of tripping time: 60% of setting range of tripping threshold
- "Max. of setting range" of tripping time: max. of setting range of tripping threshold

9) Undervoltage protection stage 1 (<) - Reset time (NOP tests)

Test cases	Setting (G_S) [%U_n]	(U < 15) U_{L1-N}	(U < 15) U_{L2-N}	(U < 15) U_{L3-N}	Relay operated / interface switch opened?
88% of setting range	90	Test sequence see below	--	--	☐ yes ☒ no

Note:

Test sequence modified acc. Figure 42, EN 50549-10:

Step 0: $G_{Start} = G_S + 2.5\%U_n$, $\Delta t_1 = T_S + 200$ ms

↓

Step 1: $G_{End} = G_S - 2.5\%U_n$, $\Delta t_2 = T_{OP} - 60$ ms

↓

Step 2: Signal value = $G_S + 2\%U_n$, $\Delta t_1 = T_S + 200$ ms

10) Undervoltage protection stage 2 (≪) - Accuracy of the setting values (Pulsed ramp tests)

Test cases	Setting [%U_n]	Tripping values [%Un]							Limit
		(U ≪ 1) $U_{all-phases}$	(U ≪ 2) U_{L1-N}	(U ≪ 3) U_{L2-N}	(U ≪ 4) U_{L3-N}	(U ≪ 5) U_{L1-L2}	(U ≪ 6) U_{L2-L3}	(U ≪ 7) U_{L3-L1}	
Min. of setting range	20	--	20.0	--	--	--	--	--	$\lvert U_{meas} - U_{set} \rvert \leq 1\%U_n$
30% of setting range	44	--	44.6	--	--	--	--	--	
60% of setting range	68	--	69.0	--	--	--	--	--	
Max. of setting range	100	--	100.1	--	--	--	--	--	
Maximum deviation from setting value [%U_n]	0.6								

Note:

For **time delay setting** during tests, the following applied:

- "Min. of setting range" of threshold: min. of setting range of time delay, time delay was limited to 0.1 s for testing
- "30% of setting range" of threshold: 30% of setting range of time delay, time delay was limited to 1.5 s for testing
- "60% of setting range" of threshold: 60% of setting range of time delay, time delay was limited to 3.0 s for testing
- "Max. of setting range" of threshold: max. of setting range of time delay, time delay was limited to 5.0 s for testing

11) Undervoltage protection stage 2 (≪) - Time measurements (Jump tests)

Test cases	Setting [s]	Tripping times [s]							Limit [s]
		(U ≪ 8) $U_{all-phases}$	(U ≪ 9) U_{L1-N}	(U ≪ 10) U_{L2-N}	(U ≪ 11) U_{L3-N}	(U ≪ 12) U_{L1-L2}	(U ≪ 13) U_{L2-L3}	(U ≪ 14) U_{L3-L1}	

Min. of setting range	0.1	--	0.103	--	--	--	--	--	0.1-0.2
30% of setting range	1.5	--	1.526	--	--	--	--	--	1.5-1.6
60% of setting range	3.0	--	3.032	--	--	--	--	--	3.0-3.1
Max. of setting range	5.0	--	5.003	--	--	--	--	--	5.0-5.1
Maximum deviation from operate time / time delay setting [s]					0.032				

Note:

For **tripping threshold setting** during tests, the following applied:

- "Min. of setting range" of tripping time: min. of setting range of tripping threshold
- "30% of setting range" of tripping time: 30% of setting range of tripping threshold
- "60% of setting range" of tripping time: 60% of setting range of tripping threshold
- "Max. of setting range" of tripping time: max. of setting range of tripping threshold

* The start (pick-up) signal is NOT accessible.

The shown Tripping / disconnection times (T_{disc}) in this test report include the operate time (T_{OP}) of the protection relay and opening time (T_{open}) of the disconnection device:

$T_{disc} = T_{OP} + T_{open}$

The determined deviation calculated from the measured value and the (setting value + max. opening time of the disconnection device (30ms)).

12) Undervoltage protection stage 2 (≪) - Reset time (NOP tests)

Test cases	Setting (G_S) [%U_n]	(U ≪ 15) U_{L1-N}	(U ≪ 15) U_{L2-N}	(U ≪ 15) U_{L3-N}	Relay operated / interface switch opened?
75% of setting range	80	Test sequence see below	--	--	☐ yes ☒ no

Note:

Test sequence modified acc. Figure 42, EN 50549-10:

Step 0: $G_{Start} = G_S + 2.5\%U_n$, $\Delta t_1 = T_S + 200$ ms

↓

Step 1: $G_{End} = G_S - 2.5\%U_n$, $\Delta t_2 = T_{OP} - 60$ ms

↓

Step 2: Signal value = $G_S + 2\%U_n$, $\Delta t_1 = T_S + 200$ ms

13) Overfrequency protection stage 1 (>) and 2 (≫)- Accuracy of the setting values (Ramp tests) and time measurements (Jump tests)

Test cases	Setting [Hz]	Tripping values [Hz] (f > 1)	Limit	Setting [Hz]	Tripping values [Hz] (f ≫ 1)	Limit
Min. of setting range	50.0	50.00	$\lvert f_{meas} - f_{set} \rvert \le 0.05$ Hz	50.0	50.00	$\lvert f_{meas} - f_{set} \rvert \le 0.05$ Hz
30% of setting range	50.5	50.50		50.5	50.50	
60% of setting range	51.5	51.50		51.5	51.50	
Max. of setting range	52.0	52.00		52.0	52.00	
Maximum deviation from setting value [Hz]				0.00		

Test cases	Setting [s]	Tripping times [s]	Limit [s]	Setting [s]	Tripping times [s]	Limit [s]

		(f > 2)			(f ≫ 2)	
Min. of setting range	0.1	0.149	0.1-0.2	0.1	0.169	0.1-0.2
30% of setting range	30.0	30.057	30.0-30.1	1.5	1.591	1.5-1.6
60% of setting range	60.0	60.010	60.0-60.1	3.0	3.013	3.0-3.1
Max. of setting range	100.0	100.060	100.0-100.1	5.0	5.007	5.0-5.1
Maximum deviation from operate time / time delay setting [s]				0.060		

14) Overfrequency protection stage 1 (>) and 2 (≫) - Reset time (NOP tests)

Test cases	Setting (G_S) [Hz]	(f > 3)	(f ≫ 3)	Relay operated / interface switch opened?
25% of setting range	50.5	Test sequence see below		☐ yes ☒ no
75% of setting range	51.5			☐ yes ☒ no

Note:
Test sequence modified acc. Figure 42, EN 50549-10:

Step 0: $G_{Start} = G_S - 0.3$ Hz, $\Delta t_1 = T_S + 200$ ms

↓

Step 1: $G_{End} = G_S + 0.3$ Hz, $\Delta t_2 = T_{OP} - 60$ ms

↓

Step 2: Signal value = $G_S - 0.2$ Hz, $\Delta t_1 = T_S + 200$ ms

15) Underfrequency protection stage 1 (<) and 2 (≪) - Accuracy of the setting values (Ramp tests) and time measurements (Jump tests)

Test cases	Setting [Hz]	Tripping values [Hz] (f < 1)	Limit	Setting [Hz]	Tripping values [Hz] (f ≪ 1)	Limit
Min. of setting range	47.0	47.00	$\lvert f_{meas} - f_{set} \rvert \le 0.05$ Hz	47.0	47.00	$\lvert f_{meas} - f_{set} \rvert \le 0.05$ Hz
33% of setting range	48.0	48.00		48.0	48.00	
67% of setting range	49.0	49.00		49.0	49.00	
Max. of setting range	50.0	50.00		50.0	50.00	
Maximum deviation from setting value [Hz]				0.00		

Test cases	Setting [s]	Tripping times [s] (f < 2)	Limit [s]	Setting [s]	Tripping times [s] (f ≪ 2)	Limit [s]
Min. of setting range	0.1	0.175	0.1-0.2	0.1	0.157	0.1-0.2
30% of setting range	30.0	30.050	30.0-30.1	1.5	1.556	1.5-1.6
60% of setting range	60.0	60.000	60.0-60.1	3.0	3.058	3.0-3.1
Max. of setting range	100.0	100.050	100.0-100.1	5.0	5.057	5.0-5.1

Maximum deviation from operate time / time delay setting [s]	0.075

16) Underfrequency protection stage 1 (<) and 2 (≪) - Reset time (NOP tests)

Test cases	Setting (G_S) [Hz]	(f < 3)	(f ≪ 3)	Relay operated / interface switch opened?
50% of setting range	48.5	Test sequence see below		☐ yes ☒ no
83% of setting range	49.5			☐ yes ☒ no

Note:

Test sequence modified acc. Figure 42, EN 50549-10:

Step 0: $G_{Start} = G_S + 0.3$ Hz, $\Delta t_1 = T_S + 200$ ms

↓

Step 1: $G_{End} = G_S - 0.3$ Hz, $\Delta t_2 = T_{OP} - 60$ ms

↓

Step 2: Signal value = $G_S + 0.2$ Hz, $\Delta t_1 = T_S + 200$ ms

17) Immunity to voltage harmonics

Test cases	Setting [%U_n]	Tripping values [%Un] (U < 1) $U_{all\text{-}phases}$	Limit	Setting [Hz]	Tripping values [Hz] (f < 1)	Limit
Min. of setting range	20	19.9	$\lvert U_{meas} - U_{set}\rvert \le 1\%U_n$	47.00	46.99	$\lvert f_{meas} - f_{set}\rvert \le 0.05$ Hz
30% of setting range	44	43.9		47.90	47.90	
60% of setting range	68	67.9		48.80	48.80	
Max. of setting range	100	99.9		50.00	50.00	
Maximum deviation from setting value [%U_n or Hz]		0.1			0.01	

Test cases	Delay time [s]	Tripping time [s] (U < 1) $U_{all\text{-}phases}$	Limit	Delay time [s]	Tripping time [s] (f < 1)	Limit
Min. of setting range	0.1	0.116	0.1-0.2	0.1	0.134	0.1-0.2
30% of setting range	30.0	30.020	30.0-30.1	30.0	30.010	30.0-30.1
60% of setting range	60.0	60.060	60.0-60.1	60.0	60.080	60.0-60.1
Max. of setting range	100.0	100.050	100.0-100.1	100.0	100.060	100.0-100.1
Maximum deviation from operate time / time delay setting [s]		0.060			0.080	

Note:

For test U<1: under the voltage conditions as described in EN 61000-4-13:2002, Table 8 class 3 (see Annex C.2, EN 50549-10).

For test f<1: under the voltage conditions as described in EN IEC 60255-181:2019, Table 26 (see Annex C.1, EN 50549-10).

For **time delay setting** during tests, the following applied:

- “Min of setting range” of threshold: min. of setting range of time delay
- “30% of setting range” of threshold: 30% of setting range of time delay
- “60% of setting range” of threshold: 60% of setting range of time delay
- “Max of setting range” of threshold: max. of setting range of time delay

6.7.2 Overvoltage 10 min mean protection

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.8.3, EN 50549-10

Overvoltage threshold 10 min mean protection	1.10 U_n
Time delay setting	0 ms
Another relevant parameter setting	Default setting used for testing, see *Annex 1 – Parameter list*

Acceptance criteria

- For tests U10M 1 and U10M 3 if the operation occurs between T1 and T2 after the jump, see Figure 43, where

$$T1 = \frac{\left(G_S - A_r\right) - U_{Start}}{U_{End} - U_{Start}} \times 600\,;$$

$$T2 = \frac{\left(G_S + A_r\right) - U_{Start}}{U_{End} - U_{Start}} \times 600\,;$$

- For tests U10M 2 if no operation occurred within and after 600 s, see Figure 43.
- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test results

Note:

Test procedure acc. Section 5.8.3.3.2, EN 50549-10.

For the parameter setting range, please refer to *Annex 1 – Parameter list*.

Test cases	Test on	Test sequency	Disconnection time [s]	Limit	Relay operated / interface switch opened?
U10M 1	L1-N	(see below)	505	Between 450 s and 550 s after voltage jump	☒ yes ☐ no
	L2-N		--		☐ yes ☐ no
	L3-N		--		☐ yes ☐ no
U10M 2	L1-N	(see below)	--	no operation of relay occurred within and after 600 s after voltage jump	☐ yes ☒ no
	L2-N		--		☐ yes ☐ no
	L3-N		--		☐ yes ☐ no
U10M 3	L1-N	(see below)	299	Between 225 s and 375 s after voltage jump	☒ yes ☐ no
	L2-N		--		☐ yes ☐ no

	L3-N		--		☐ yes ☐ no
Maximum deviation from setting value [%U_n] (from tests U10M 1 & U10M 3)			0.1		
Maximum deviation from configured operate time [s] (from tests U10M 1 & U10M 3)			5		

Note:

Test sequence modified acc. Section 5.8.3.3.1 & Figure 43, EN 50549-10:

U10M 1: U_n (600 s) → 1.12·U_n ((≥600.2 s, test can be stopped after operation of the protection)

U10M 2: U_n (600 s) → 1.08·U_n (≥600.2 s)

U10M 3: 1.06·U_n (600 s) → 1.14·U_n ((≥600.2 s, test can be stopped after operation of the protection)

* The start (pick-up) signal is NOT accessible.

The shown Tripping / disconnection times (T_{disc}) in this test report include the operate time (T_{OP}) of the protection relay and opening time (T_{open}) of the disconnection device:

$T_{disc} = T_{OP} + T_{open}$

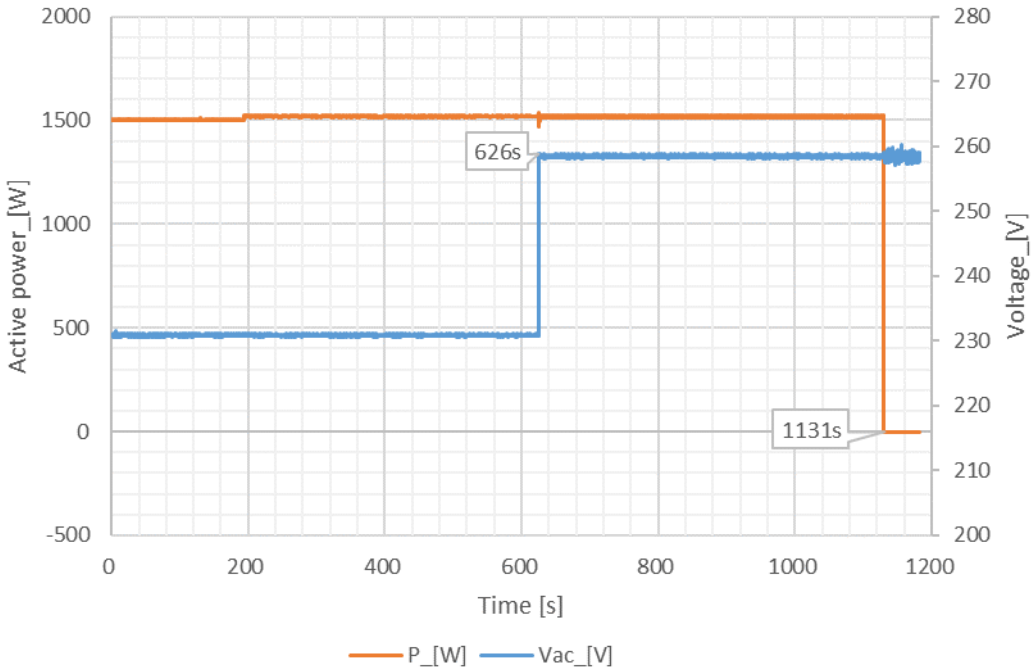
The “maximum deviation from setting value” is simplified to the deviation from the measured value and the setting value, calculated using the simplified formula:

$$\left(\frac{T_{disc,meas}}{600} * 12 + 100 - 110\right)\%$$

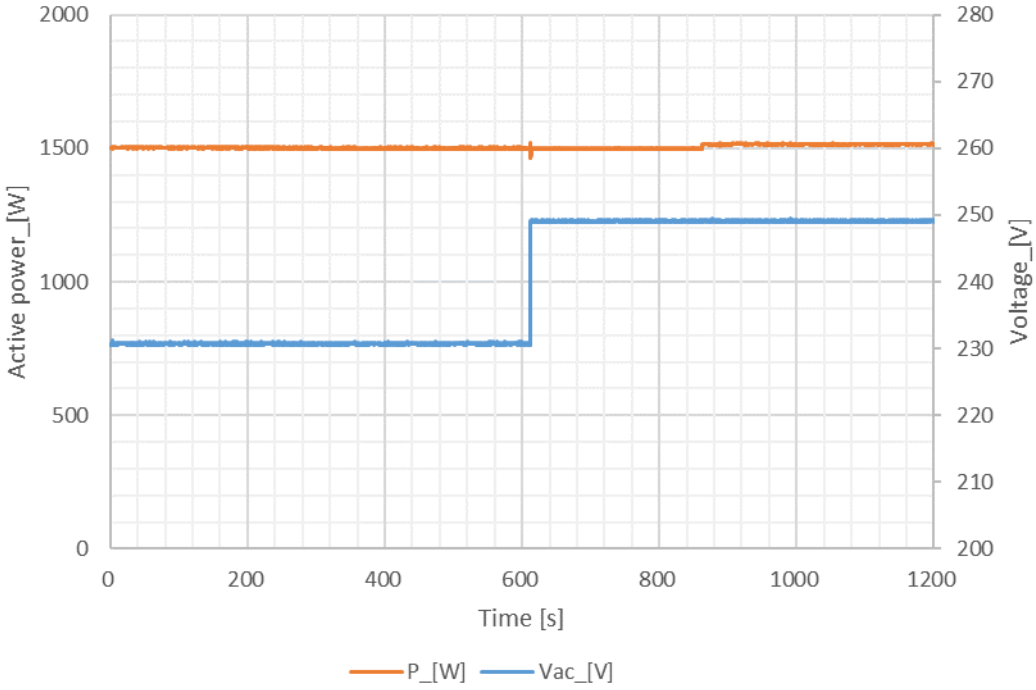
The “deviation from configured operate time or time delay setting" is simplified to:

the deviation from the measured disconnection time and the ideal disconnection time (U10M 1: 500 s, U10M 3: 300 s).

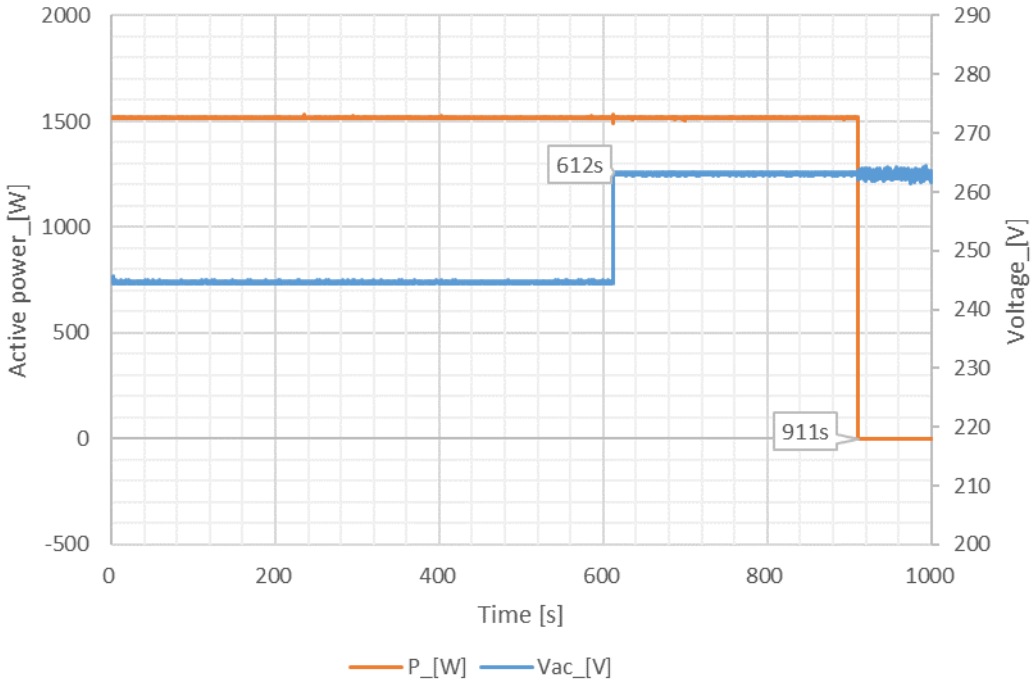
U10M 1



U10M 2


2000
1500
1000
500
0
Active power_[W]
280
270
260
250
240
230
220
210
200
Voltage_[V]
0
200
400
600
800
1000
1200
Time [s]
P_[W]
Vac_[V]

U10M 3


2000
1500
1000
500
0
-500
Active power_[W]
290
280
270
260
250
240
230
220
210
200
Voltage_[V]
612s
911s
0
200
400
600
800
1000
Time [s]
P_[W]
Vac_[V]

6.7.3 ROCOF protection

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.8.3.4.3, EN 50549-10

Frequency protection	deactivated / set to values not interfering to the tests
ROCOF protection setting	2 Hz /s
Time delay setting	500ms
Another relevant parameter setting	Default setting used for testing, see *Annex 1 – Parameter list*

Acceptance criteria

- For test item RVAL POS 2 and RVAL NEG 2, the protection function operates, and operate time is equal to or below the configured time delay setting plus the start time as stated in the product documentation. If due to the test setup the disconnection time is evaluated instead of the operate time the test is passed if for all tests the disconnection time is equal to or below the configured time delay setting plus the start time plus the circuit breaker opening time as stated in the product documentation. If the configured time delay setting includes the start time or the opening time, the condition has to be modified accordingly.
- For test item RVAL POS 1, RVAV NEG 1, NOP POS and NOP NEG, the protection function does not operate.
- If the interface protection operates the interface switch opens.
- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test results

accuracy of the setting values and operate time measurements

Test cases	Test sequency	Disconnection time [s]	Limit	Relay operated / interface switch opened?
RVAL POS 1	(see below)	--	protection function does not operate	☐ yes ☒ no
RVAL POS 2	(see below)	0.970	--	☒ yes ☐ no
RVAL NEG 1	(see below)	--	protection function does not operate	☐ yes ☒ no
RVAL NEG 2	(see below)	0.980	--	☒ yes ☐ no
Maximum deviation from configured operate time or time delay setting [s] (from tests RVAL POS 2 & RVAL NEG 2)		0.480		

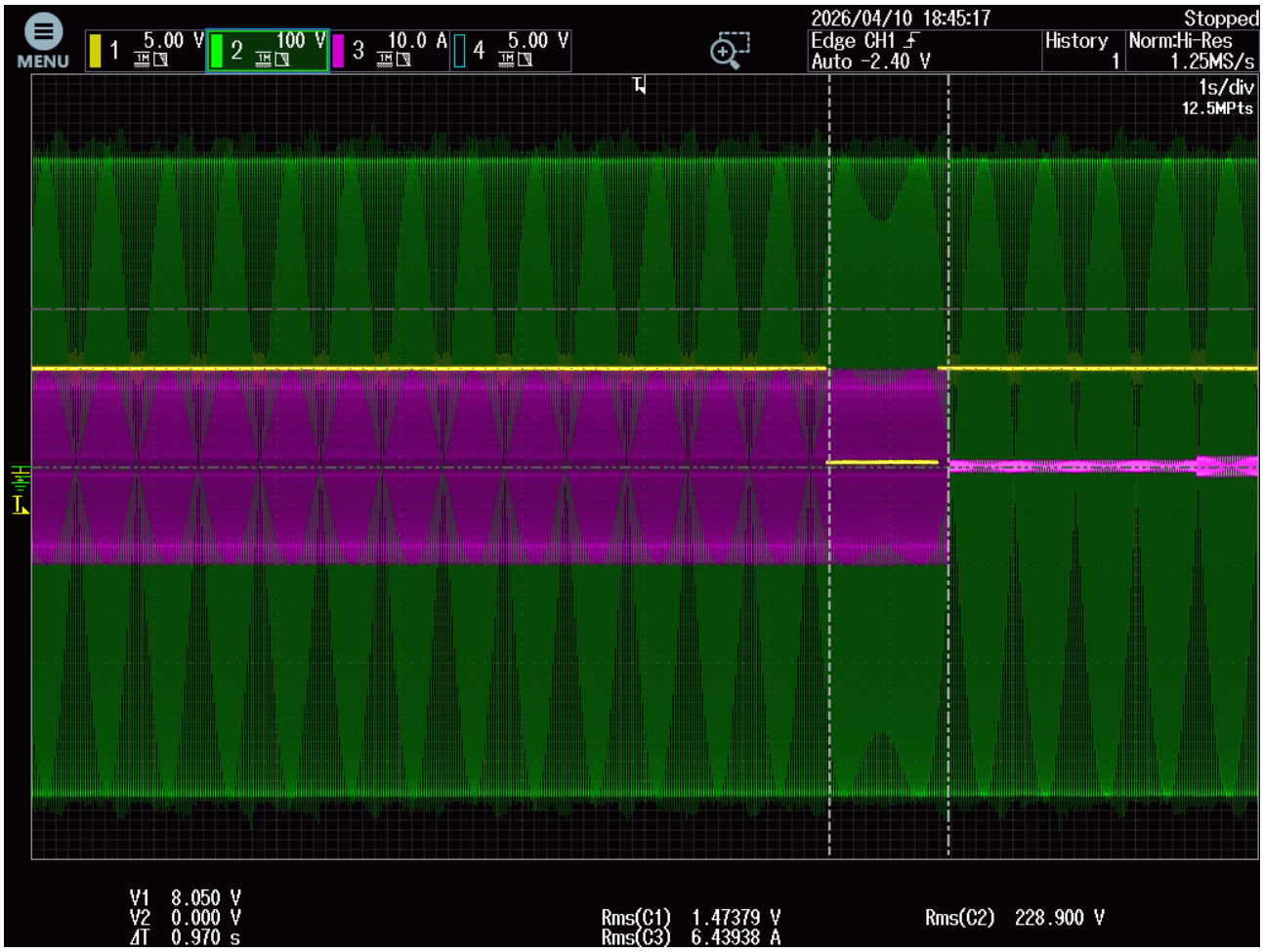
Note:

For testing, A_r defined as 0.1 Hz/s (or manufacturer definition).

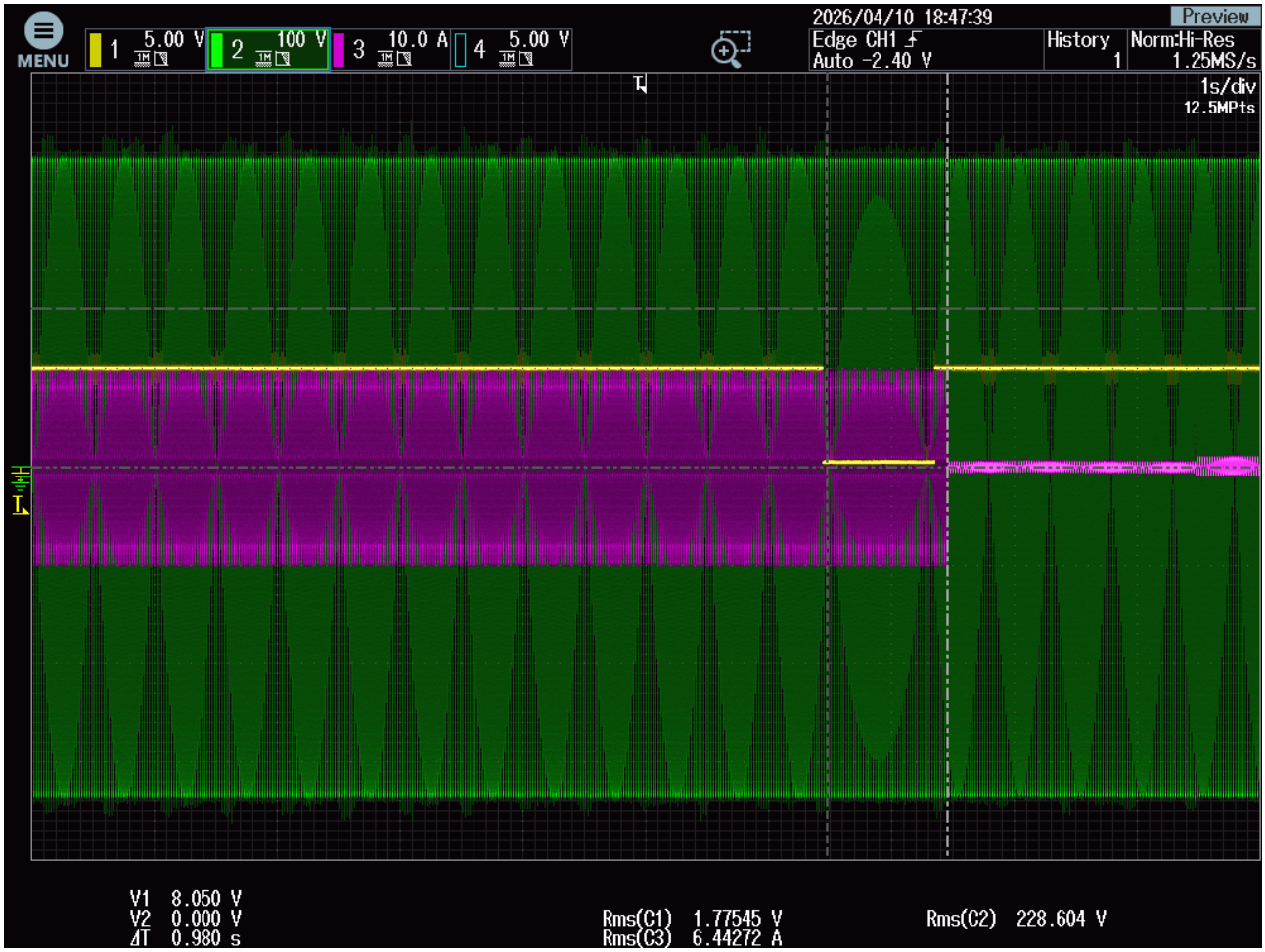
Test sequence modified acc. Section 5.8.3.4.1 & Figure 44, EN 50549-10:

RVAL POS 1:	49 Hz (1 s)	$\xrightarrow{\text{Rocof=1.8 Hz/s}}$	51 Hz (or ROCOF maintain 1 s)
RVAL POS 2:	49 Hz (1 s)	$\xrightarrow{\text{Rocof=2.2 Hz/s}}$	51 Hz (or until the protection operates)
RVAL NEG 1:	51 Hz (1 s)	$\xrightarrow{\text{Rocof=1.8 Hz/s}}$	49 Hz (or ROCOF maintain 1 s)
RVAL NEG 2:	51 Hz (1 s)	$\xrightarrow{\text{Rocof=2.2 Hz/s}}$	49 Hz (or until the protection operates)

RVAL POS 2



RVAL NEG 2


MENU
1 5.00 V
2 100 V
3 10.0 A
4 5.00 V
2026/04/10 18:47:39
Edge CH1
Auto -2.40 V
History
1
Preview
Norm:Hi-Res
1.25MS/s
1s/div
12.5MPts
V1 8.050 V
V2 0.000 V
ΔT 0.980 s
Rms(C1) 1.77545 V
Rms(C3) 6.44272 A
Rms(C2) 228.604 V

6.7.4 Islanding detection

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 4*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9

Manufacturer's data

The PGU(s) provide(s) the following Islanding Detection Technique(s):

☐ Passive anti islanding detection ONLY

☒ Active anti islanding detection: Active Frequency Drift

Test results

Note:
Only passive anti islanding detection provided. See section 6.7.1 ~ 6.7.3.
Test procedure acc. section 6.1, IEC 62116: 2014

Condition	EUT output power, P_{EUT}	EUT input voltage		EUT trip settings	Pass/fail criteria
A	100% of EUT rating	> 75% of rated input voltage range:	25.6 V	Default setting used for testing, see *Annex 1 – Parameter list*	run-on time < 2s
B	66% of EUT rating	50% of rated input voltage range, ±10%:	25.6 V		
C	33% of EUT rating	< 20% of rated input voltage range:	25.6 V		

Note: This test was conducted at the PGU's rated DC input voltage of 25.6 V.

No.	P_{EUT} [a] (% of EUT rating)	Reactive load (% of Q_L in 6.1d)1))	P_{AC} [b] (% of nominal)	Q_{AC} [c] (% of nominal)	Run on time (ms)	P_{EUT} (W)	Actual Q_f	V_{DC}	Remarks [d]
1	100	100	0	0	908	1500	1.001	25.6	Test A at BL
2	66	66	0	0	910	990	1.000	25.6	Test B at BL
3	33	33	0	0	704	495	1.000	25.6	Test C at BL
4	100	100	-5	-5	163	1500	1.027	25.6	Test A at IB
5	100	100	-5	0	778	1500	1.053	25.6	Test A at IB
6	100	100	-5	+5	776	1500	1.079	25.6	Test A at IB
7	100	100	0	-5	159	1500	0.975	25.6	Test A at IB
8	100	100	0	+5	763	1500	1.025	25.6	Test A at IB
9	100	100	+5	-5	147	1500	0.929	25.6	Test A at IB
10	100	100	+5	0	714	1500	0.953	25.6	Test A at IB
11	100	100	+5	+5	606	1500	0.977	25.6	Test A at IB
12	66	66	0	-5	189	990	0.975	25.6	Test B at IB
13	66	66	0	-4	707	990	0.980	25.6	Test B at IB
14	66	66	0	-3	804	990	0.985	25.6	Test B at IB
15	66	66	0	-2	513	990	0.990	25.6	Test B at IB
16	66	66	0	-1	912	990	0.995	25.6	Test B at IB
17	66	66	0	+1	687	990	1.005	25.6	Test B at IB

18	66	66	0	+2	774	990	1.010	25.6	Test B at IB
19	66	66	0	+3	837	990	1.015	25.6	Test B at IB
20	66	66	0	+4	649	990	1.020	25.6	Test B at IB
21	66	66	0	+5	557	990	1.025	25.6	Test B at IB
22	33	33	0	-5	162	495	0.975	25.6	Test B at IB
23	33	33	0	-4	651	495	0.980	25.6	Test B at IB
24	33	33	0	-3	605	495	0.985	25.6	Test B at IB
25	33	33	0	-2	970	495	0.990	25.6	Test B at IB
26	33	33	0	-1	867	495	0.995	25.6	Test B at IB
27	33	33	0	+1	743	495	1.005	25.6	Test B at IB
28	33	33	0	+2	699	495	1.010	25.6	Test B at IB
29	33	33	0	+3	643	495	1.015	25.6	Test B at IB
30	33	33	0	+4	779	495	1.020	25.6	Test B at IB
31	33	33	0	+5	736	495	1.025	25.6	Test B at IB

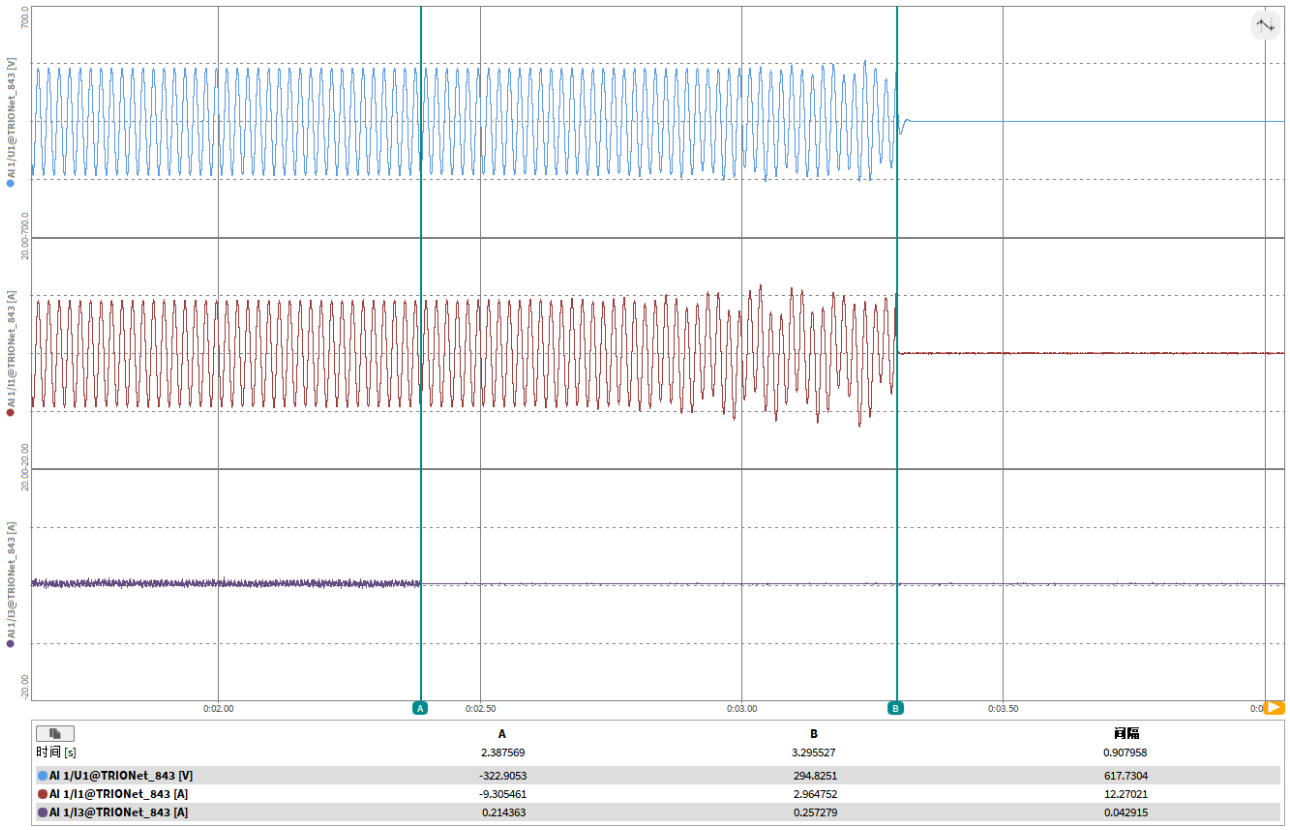
[a] P_{EUT}: EUT output power.

[b] P_{AC}: Active power flow at S1 in Figure 1, IEC / EN 62116. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

[c] Q_{AC}: Reactive power flow at S1 in Figure 1, IEC/ EN 62116. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

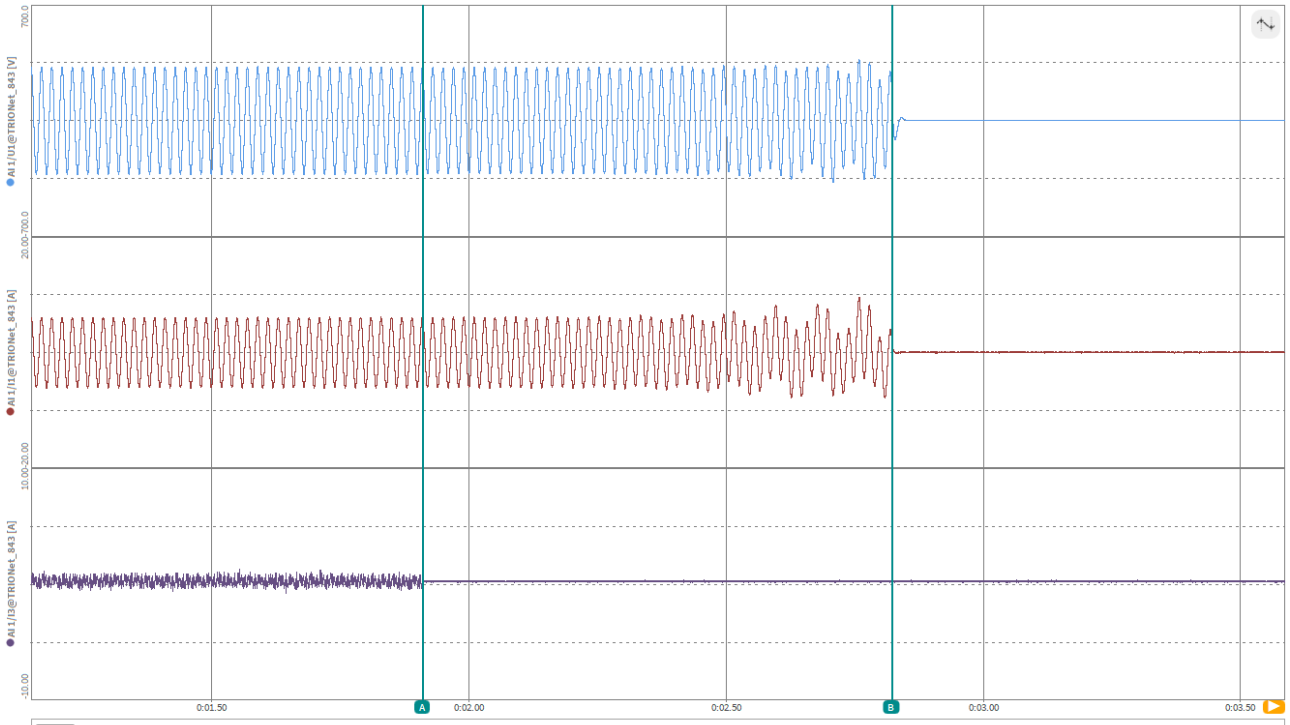
[d] BL: balance condition, IB: imbalance condition.

Disconnection at PAC 0% and QAC 0% reactive load No. 1 (100% of EUT rating)



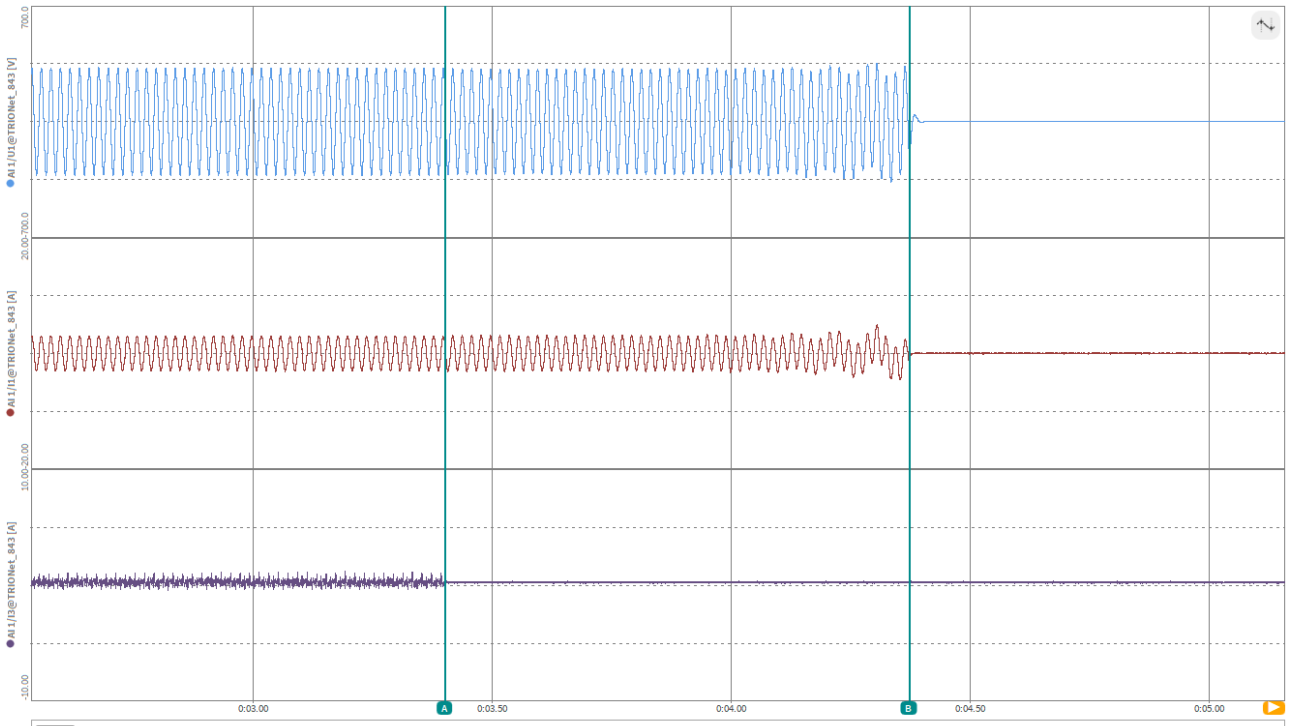
时间 [s]	A 2.387569	B 3.295527	间隔 0.907958
AI 1/U1@TRIONet_843 [V]	-322.9053	294.8251	617.7304
AI 1/I1@TRIONet_843 [A]	-9.305461	2.964752	12.27021
AI 1/I3@TRIONet_843 [A]	0.214363	0.257279	0.042915

Disconnection at PAC 0% and QAC -1% reactive load No. 16 (66% of EUT rating)



	A	B	间隔
时间 [s]	1.910737	2.822415	0.911678
AI 1/U1@TRIONet_843 [V]	325.2568	188.3171	-136.9398
AI 1/I1@TRIONet_843 [A]	6.006378	2.115386	-3.890991
AI 1/I3@TRIONet_843 [A]	0.130321	0.244762	0.114441

Disconnection at PAC 0% and QAC -2% reactive load No. 25 (33% of EUT rating)



	A	B	间隔
时间 [s]	3.401805	4.372160	0.970355
AI 1/U1@TRIONet_843 [V]	97.37301	-217.7935	-315.1665
AI 1/I1@TRIONet_843 [A]	1.013892	-1.523478	-2.537370
AI 1/I3@TRIONet_843 [A]	0.235821	0.235821	0.000000

6.8 Connection and starting

6.8.1 Automatic reconnection after tripping

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.9.3.1, EN 50549-10

Active factor	1.000
Relevant parameter setting	Default setting used for testing, see *Annex 1 – Parameter list*

Acceptance criteria

- the generating unit does not start reconnection process when it is out of voltage band or frequency band;
- he generating unit does not connect before the end of observation time after the interface protection trip provided voltage or frequency are constantly within the permitted band during observation time;
- the active power ramp-up rate, evaluated for each minute, stays below 11%/min

or

- for non-adjustable or partly adjustable generating units, the connection happens at 1 min to 10 min (randomized value) or later. The randomization can be done via the manufacturer's portfolio and has to be documented.
- Products that do have different setups implemented to fulfil different requirements for specific settings can be additionally evaluated:
- It is evaluated that the relevant setup has the correct values programmed.
- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

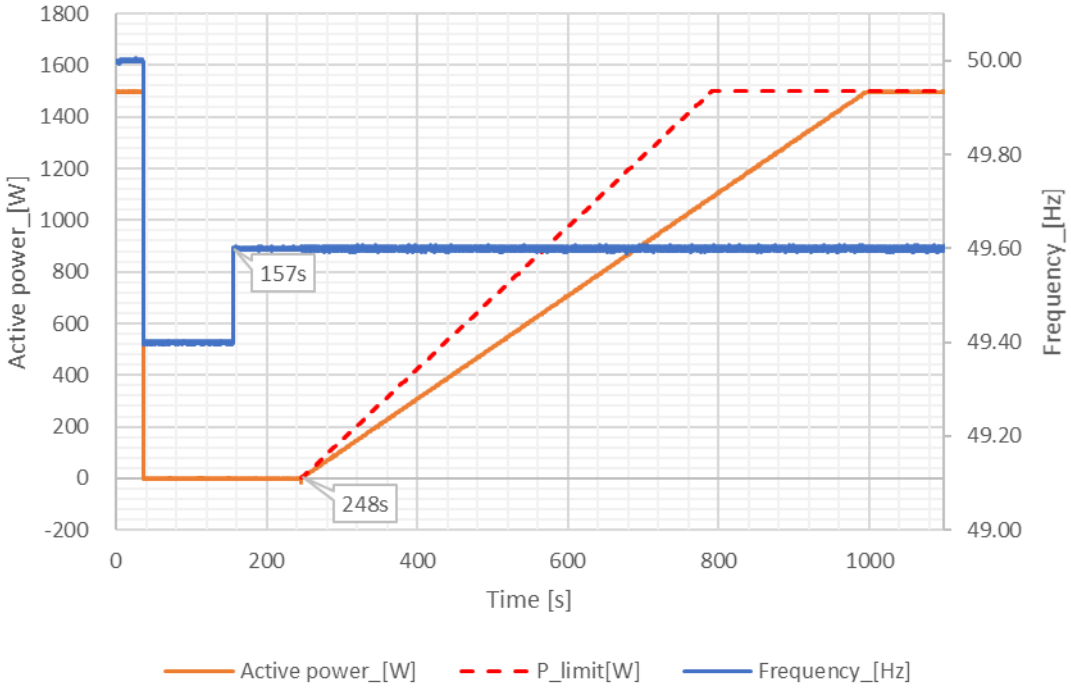
Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

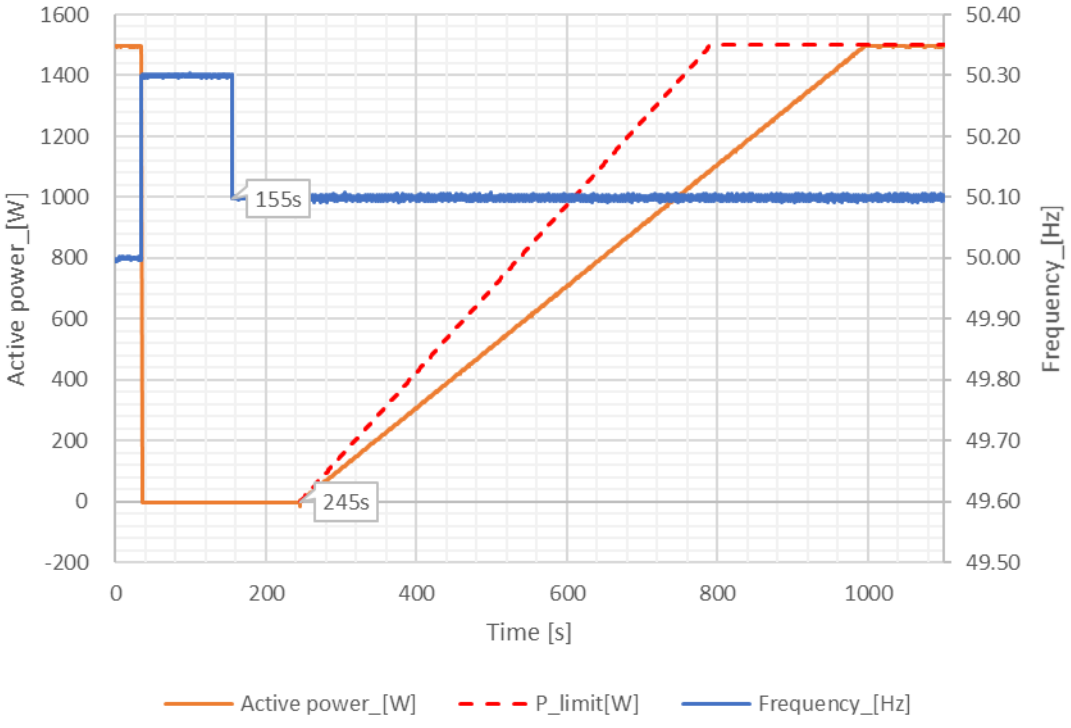
Test results

Test case	Outside reconnection range		Within reconnection range		Observation time [s]	Active power increase gradient
	Value [Hz / %U_n]	Reconnection yes / no	Value [Hz / %U_n]	Reconnection yes / no	≥ 60s	[%/min]
Underfrequency	49.45	no	49.55	yes	91	< 11
Overfrequency	50.10	no	50.00	yes	90	
Undervoltage	84.0	no	86.0	yes	92	
Overvoltage	111.0	no	109.0	yes	83	

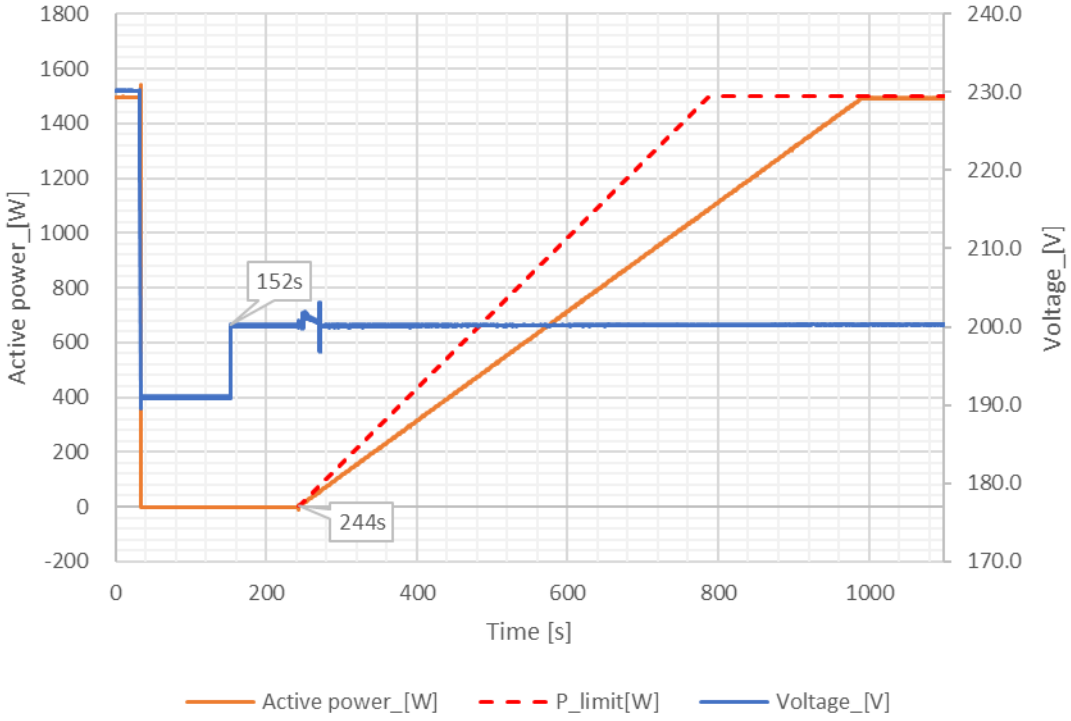
Underfrequency



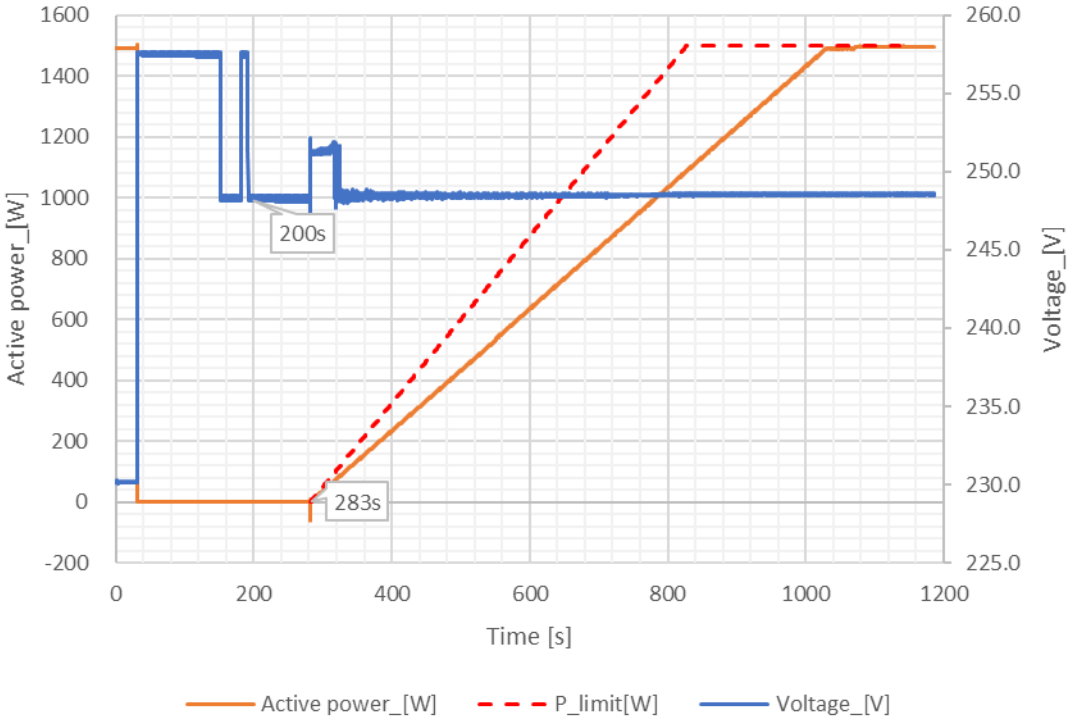
Overfrequency



Undervoltage



Overvoltage



6.8.2 Starting to generate electrical power

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.9.4.1, EN 50549-10

Active factor	1.000
Relevant parameter setting	Default setting used for testing, see *Annex 1 – Parameter list*

Acceptance criteria

- the generating unit does not start reconnection process when it is out of voltage band or frequency band;
- the generating unit does not connect before the end of observation time;
- it is evaluated that the relevant setup has the correct values programmed;
- the settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Additionally for Automatic reconnection after tripping if:

- the active power ramp-up rate is evaluated for each minute and stays below 11 %P_n/min;

or

- for non-adjustable or partly adjustable generating units, the connection happens at 1 min to 10 min (randomized value) or later. The randomization can be done via the manufacturer's portfolio and has to be documented.

Products that do have different setups implemented to fulfil different requirements for specific settings can be additionally evaluated:

- It is evaluated that the relevant setup has the correct values programmed.
- The settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

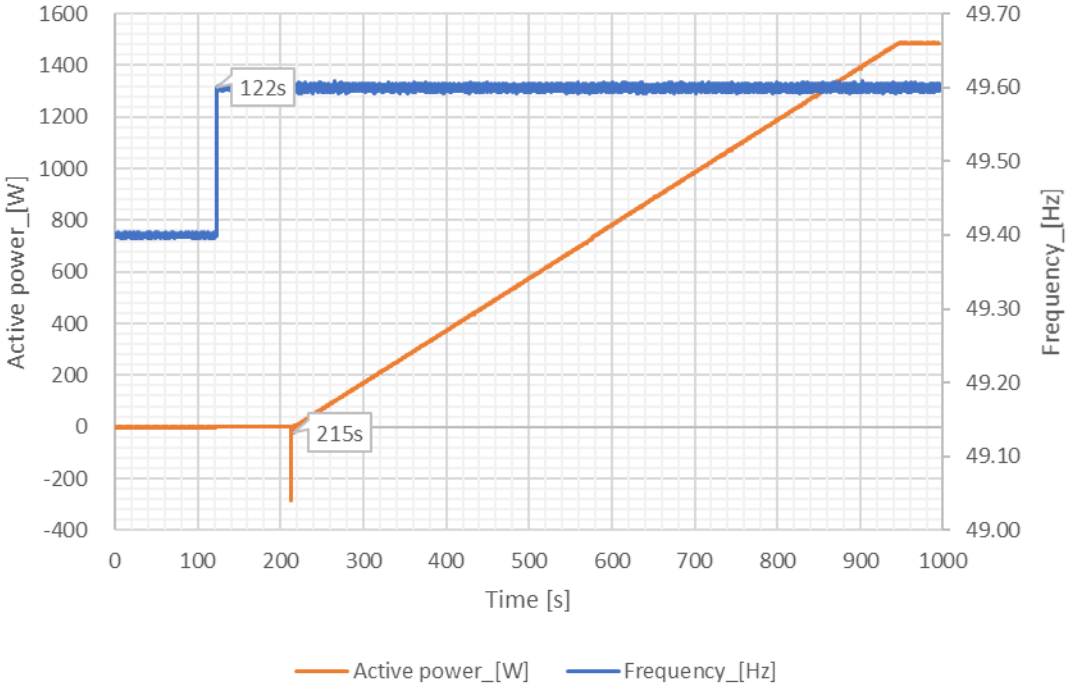
Manufacturer's data

The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

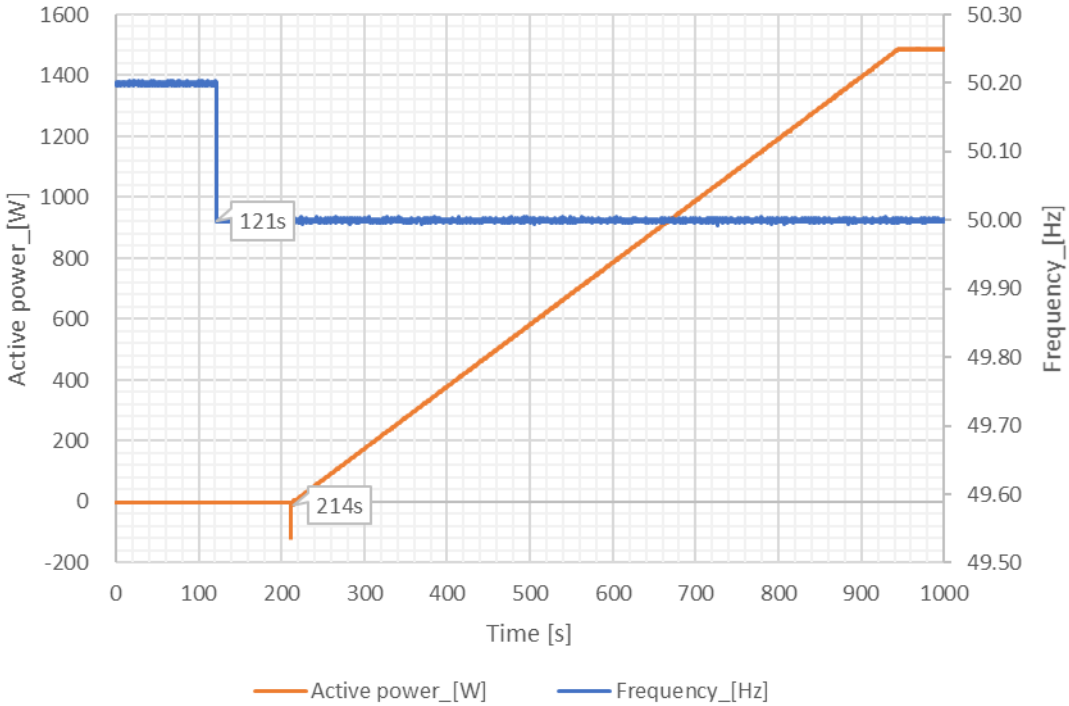
Test results

Test case	Outside reconnection range		Within reconnection range		Observation time [s]	Active power increase gradient
	Value [Hz / %U_n]	Connection yes / no	Value [Hz / %U_n]	Connection yes / no	≥ 60s	[%/min]
Underfrequency	49.45	no	49.55	yes	93	disabled
Overfrequency	50.10	no	50.00	yes	93	
Undervoltage	84.0	no	86.0	yes	96	
Overvoltage	111.0	no	109.0	yes	72	

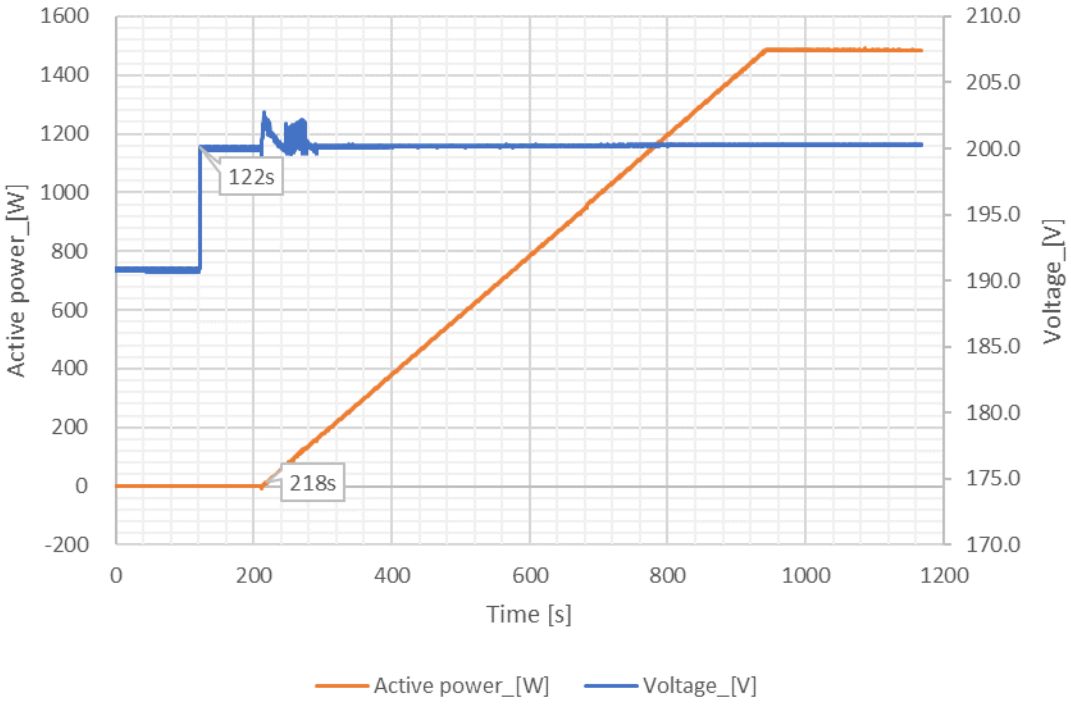
Underfrequency



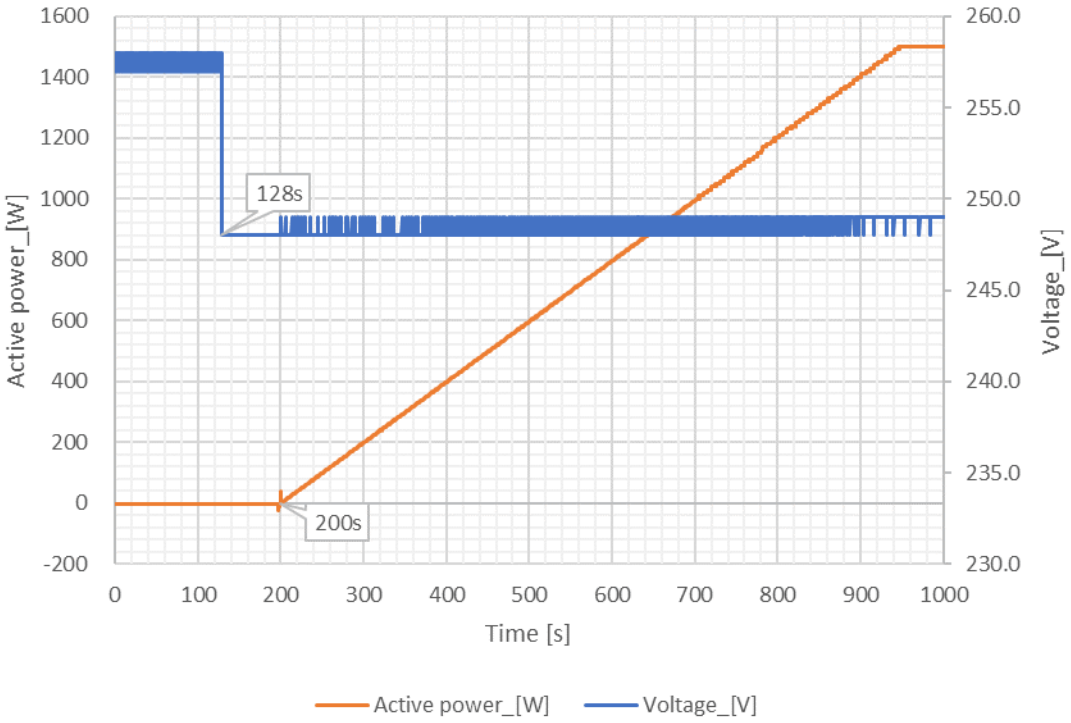
Overfrequency



Undervoltage



Overvoltage



6.8.3 Synchronisation

Verdict	☐ P	☐ F	☒ N/A	☐ N/R	☐ R/D

Note:
PGU(s) considered in this test report are inverter-based generators. See section 6.6.2.2.

6.9 Active power reduction on set point

6.9.1 Verification of the accuracy

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.10.3, EN 50549-10

Active Power level	See table *Test results* below
Active factor	1.000

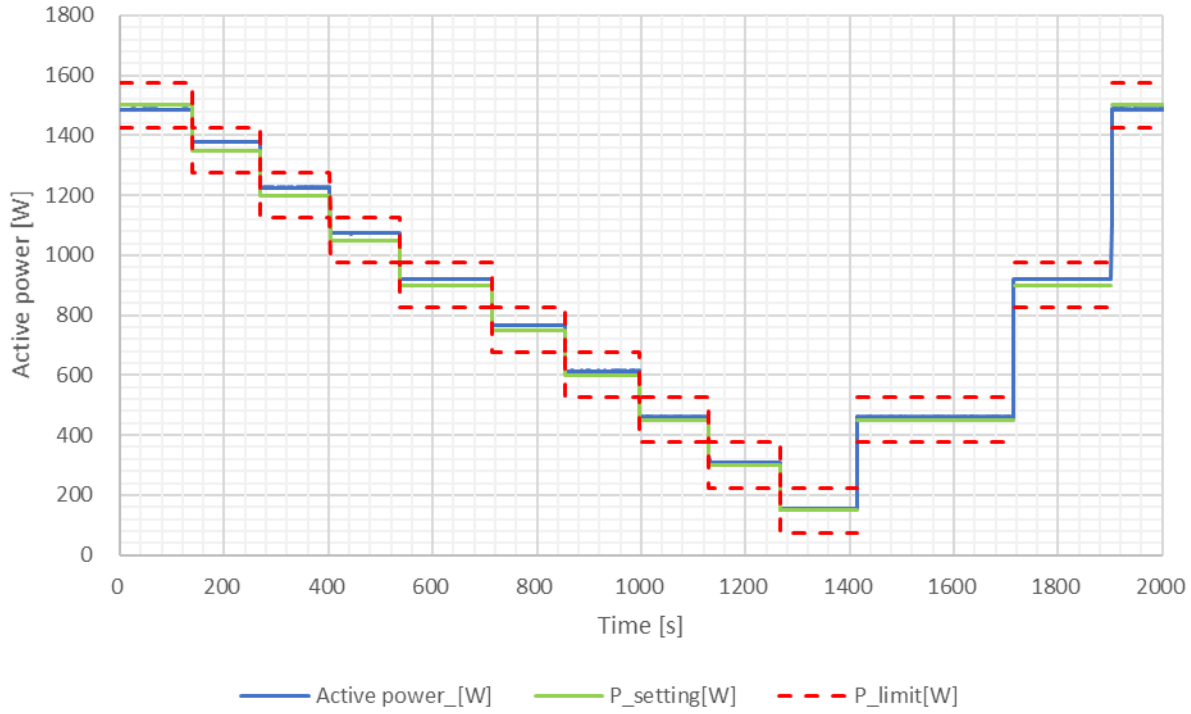
The interface used to provide active power set points	Using specialized software tool *at_**mbpoll**_*tool through the RS485 interface.
Active power set points	Parameter: Pow (see *Annex 1 – Parameter list*)

Acceptance criteria
- for power set point reduction all average values recorded are within the tolerance range ± 5 %P_n around the power reduction set point. - for power set point increase all average values recorded are below the tolerance maximum +5 %P_n above the power reduction set point.

Test results

Active power step [p.u. of P_n]	Requested set point value		Actual value		Accuracy Actual value - Set point	
	W	P/P_n [p.u.]	W	P/P_n [p.u.]	W	P/P_n [p.u.]
1.0	1500	1.00	1486	0.99	-14	-0.01
0.9	1350	0.90	1379	0.92	29	0.02
0.8	1200	0.80	1226	0.82	26	0.02
0.7	1050	0.70	1073	0.72	23	0.02
0.6	900	0.60	920	0.61	20	0.01
0.5	750	0.50	767	0.51	17	0.01
0.4	600	0.40	614	0.41	14	0.01
0.3	450	0.30	461	0.31	11	0.01
0.2	300	0.20	307	0.20	7	0.00
0.1	150	0.10	154	0.10	4	0.00
0.3	450	0.30	460	0.31	10	0.01
0.6	900	0.60	920	0.61	20	0.01
1.0	1500	1.00	1487	0.99	-13	-0.01

Graph of active power on set point:



6.9.2 Verification of dynamic behaviour

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9
Verification procedure	acc. Section 5.10.3, EN 50549-10

Active Power level	See table *Test results* below
Active factor	1.000

The interface used to provide active power set points	Using specialized software tool *at_**mbpoll**_*tool through the RS485 interface.
Active power set points	Parameter: Pow (see *Annex 1 – Parameter list*)
Further relevant parameter setting	0.50·P_n/s, see also *Annex 1 – Parameter list*

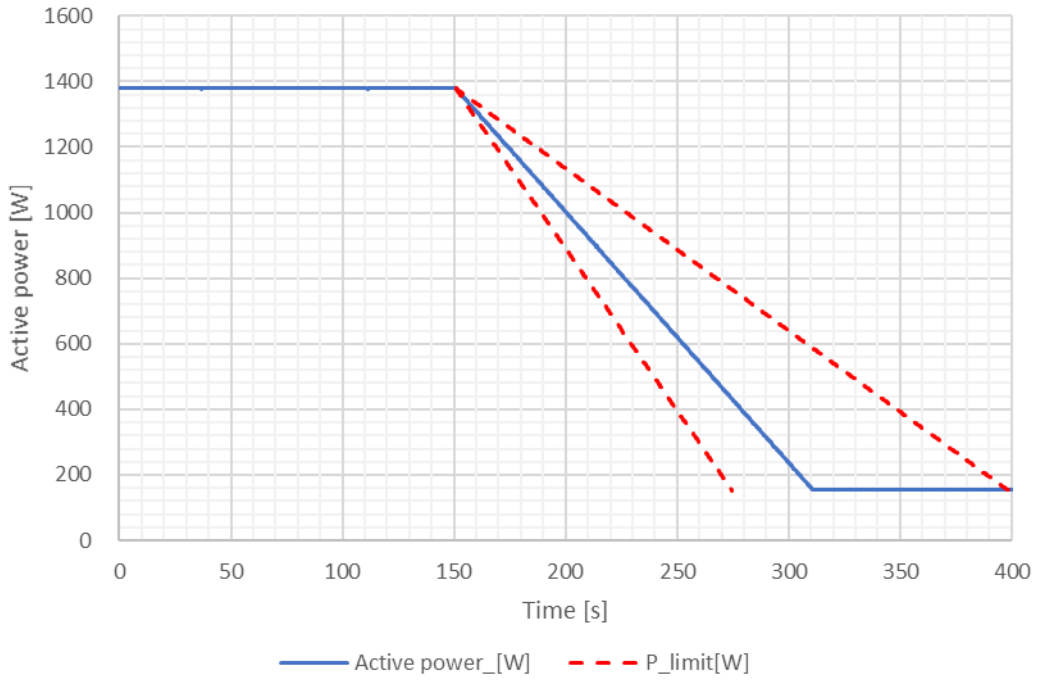
Acceptance criteria
- the settling time measured during the test has the value stated in EN 50549-1:2019 or EN 50549-2:2019 or settling time values as defined by the relevant party or as defined by the manufacturer; and - the slope equals or exceeds that corresponding to a (0.33·P_n/s) slope and does not exceed that corresponding to a (0.66·P_n/s) slope as defined by the relevant party or a slope as defined by the manufacturer; - the settings of the function, as well as the enabling and disabling of the function, are field adjustable and means are provided to protect these from unpermitted interference (e.g. password or seal).

Manufacturer's data
The settings of the function, as well as the enabling and disabling of the function, are field adjustable and are protected from unauthorized interference through special software.

Test results

Active power step [p.u. of P_n]	Requested set point value		Actual value		Accuracy Actual value - Set point		Settling time [s]	Calculated slope [P_n/s]
	W	P/P_n [p.u.]	W	P/P_n [p.u.]	W	P/P_n [p.u.]		
0.9	1350	0.9	1379	0.919	29	0.019		
↓							160.6	0.51%
0.1	150	0.1	154	0.103	4	0.003		

Graph of the gradient 90% to 10% Pn:



6.9.3 Ceasing active power

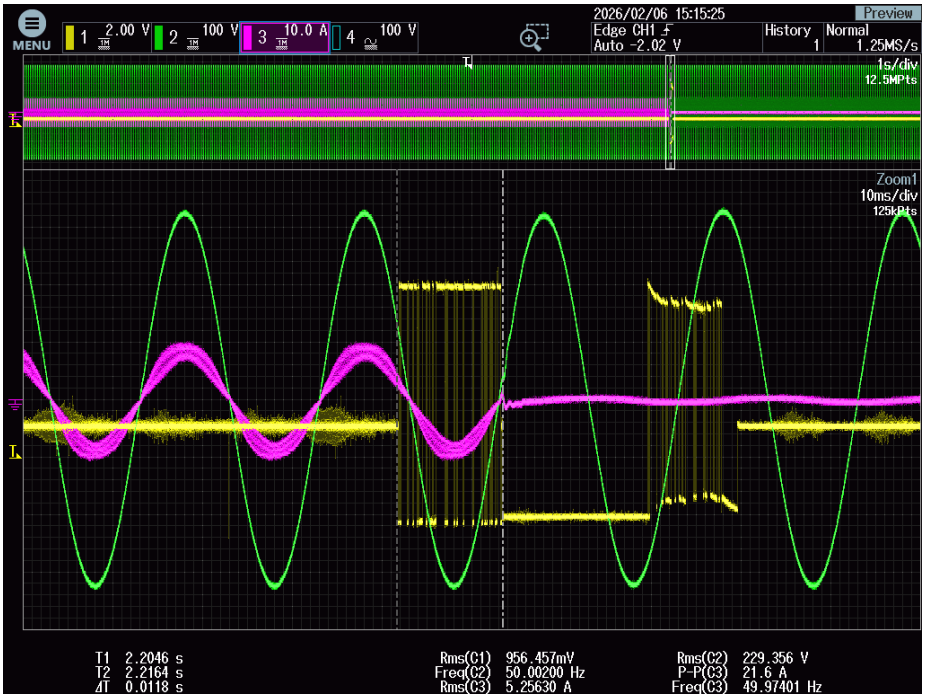
Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Test conditions	
Test setup	See *Figure 3*, *Measurement setup*, p.22
Other test environment conditions	See section 4.7 & 4.9

Acceptance criteria
Generating plants with a maximum capacity of 0.8 kW or more shall be equipped with a logic interface (input port) in order to cease active power output within five seconds following an instruction being received at the input port.

Test results		
Test Conditions	Measurements [s]	Δ Limit
Command signal from connection to disconnection	0.012	≤ 5s

Graph of Command signal from connection to disconnection:



Note:

The units in the series are equipped with a logic interface (input port) to terminate the active power output.

The test result shows that the tested device can cease the active power output within 0.012 s after receiving a command at the logical interface.

6.10 Remote information exchange

Verdict	☐ P	☐ F	☒ N/A	☐ N/R	☐ R/D

Note:

Requirements for communication protocols must be considered and assessed at the project level.

6.11 Requirements regarding single fault tolerance of interface protection system and interface switch

Verdict	☒ P	☐ F	☐ N/A	☐ N/R	☐ R/D

Component No.	Fault	Test condition		Test time	Fuse No.	Test condition		Test time
		AC	DC			AC	DC	
Relay fault RY3 pin3 to pin5	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3029 “Relay Sticking” No damage, no hazard, no fire
Relay fault RY3 pin6 to pin4	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow. Error message: 3029 “Relay Sticking” No damage, no hazard, no fire
Relay fault RY4 pin3 to pin5	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow. Error message: 3029 “Relay Sticking” No damage, no hazard, no fire
Relay fault RY4 pin6 to pin4	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow. Error message: 3029 “Relay Sticking” No damage, no hazard, no fire
Relay fault RY2 pin3 to pin4	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow. Error message: 3029 “Relay Sticking” No damage, no hazard, no fire
Grid votage sampling R257	Short	230V 6A	27V 46A	10	--	230V 0.05A	27V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3017 “Grid Overvoltage” No damage, no hazard, no fire
Grid votage sampling R258	Open	230V 6A	27V 46A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid.

								LED colour changes from blue to yellow. Error message: 3021 “Grid Undervoltage” No damage, no hazard, no fire
Grid votage sampling R268	Short	230V 6.89	26V 62A	10	--	230V 0.05	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow. Error message: 3017 “Grid Overvoltage”, 3019 “Grid Overvoltage” No damage, no hazard, no fire
Grid votage sampling R268	Open	230V 6.89	26V 62A	10	--	230V 0.05	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3022 Grid Undervoltage No damage, no hazard, no fire
Vinv voltage sampling R246	Short	230V 6.89	26V 62A	10	--	230V 0.05	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3001 “Inverter Output Overvoltage” No damage, no hazard, no fire
Vinv voltage sampling R246	Open	230V 6.89	26V 62A	10	--	230V 0.05	26V 0.05A	The unit has stopped working LED colour changes from blue to yellow Error message: 3002 “Inverter Output Undervoltage” No hazard. No damage.no fire
Vinv voltage sampling R252	Short	230V 6.89	26V 62A	10	--	230V 0.05	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3001 “Inverter Output Overvoltage” No damage, no hazard, no fire
Vinv voltage sampling R252	Open	230V 6.89	26V 62A	10	--	230V 0.05	26V 0.05A	The unit has stopped working LED colour changes from blue to yellow

								Error message: 3002 “Inverter Output Undervoltage” No hazard. No damage.no fire
BUS voltage sampling R229 R226 R233 R234	Short	230V 6.89	26V 62A	10	--	230V 0A	26V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3006 “Inverter Output Overcurrent” No hazard. No damage.no fire
BUS voltage sampling R229	Open	230V 6.89	26V 62A	10	--	230V 0A	26V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3001 “Inverter Output Overvoltage” No damage, no hazard, no fire
BUS voltage sampling R238 R239 R240 R241	Short	230V 6.89	26V 62A	10	--	230V 0A	26V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3006 “Inverter Output Overcurrent” No hazard. No damage.no fire
BUS voltage sampling R239	Open	230V 6.89	26V 62A	10	--	230V 0A	26V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3036 “Busbar Overvoltage”, 3037 “Busbar Overvoltage” No hazard. No damage.no fire
DCI defected IC11 pin12 to pin13	Short	230V 6.89	26V 62A	10	--	230V 0A	26V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3031 “Grid Overload” No hazard. No damage.no fire
DCI detection failuer IC11pin12 to pin15	Short	230V 6.89	26V 62A	10	--	230V 0A	26V 0A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3031 “Grid Overload”

								No hazard. No damage.no fire
PV ISO defected R367 R363 R369 R371	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
PV ISO defected R364 R368 R370 R372	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
PV ISO defected R381 R378 R384 R384	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
PV ISO defected R383 R380 R385 R387	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
PV ISO defected R393	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
PV ISO defected R139	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
PV ISO defected IC14 Apin2 to pin1	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire

PV ISO defected IC14 Apin3 to pin1	short before start-up	230V 0.05A	26V 0.05A	10	--	230V 0.05A	26V 0.05 A	The inverter did not star-up. LED colour changes from blue to yellow Error message: 3033 Insulation Fault Detected No hazard. No damage.no fire
Grid voltage sampling R62	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3002 Inverter Output Undervoltage No hazard. No damage.no fire
Grid voltage sampling IC2 pin2 to pin1	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3037 “Busbar Overvoltage” No hazard. No damage.no fire
Grid voltage sampling IC2 pin3 to pin1	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3037 “Busbar Overvoltage” No hazard. No damage. no fire
Vinv voltage sampling R60	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 0116 “Short Circuit Protection” Q1 Q5 Q8 Q10 damage. No hazard. no fire
Vinv voltage sampling IC3 pin2 to pin1	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow Error message: 3002 “Inverter Output Undervoltage” No hazard. No damage.no fire
Vinv voltage sampling IC3 pin3 to pin1	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter immediately disconnection from grid. LED colour changes from blue to yellow

								Error message: 3002 “Inverter Output Undervoltage” No hazard. No damage.no fire
Communication between Master DSP IC16Pin87and Slave DSP IC7Pin47	Open	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter disconnection from grid. LED colour changes from blue to yellow Error message: 2003 “Inverter Communication Error” No hazard. No damage.no fire
Communication between Master DSP IC16 Pin86 and Slave DSP IC7 Pin48	Open	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter disconnection from grid. LED colour changes from blue to yellow Error message: 2003 “Inverter Communication Error” No hazard. No damage.no fire
DSP IC16 pin 10 to pin11 (+3.3VD to GND)	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter disconnection from grid. LED colour changes from blue to yellow Error message: 2003 “Inverter Communication Error” No hazard. No damage.no fire
DSP IC16 pin12 to pin13 (XL2)	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter disconnection from grid. LED colour changes from blue to yellow Error message: 2003 “Inverter Communication Error” No hazard. No damage.no fire
DSP IC7 pin 22 to pin19 (+3.3VD to GND)	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter disconnection from grid. LED colour changes from blue to yellow Error message: 2003 “Inverter Communication Error” No hazard. No damage.no fire
DSP IC7 pin12 to pin13 (XL1)	Short	230V 6.3A	27V 48.5A	10	--	230V 0.05A	26V 0.05A	The inverter disconnection from grid. LED colour changes from blue to yellow

								Error message: 2003 “Inverter Communication Error” No hazard. No damage.no fire

Note:

The errors in the control circuit simulate that the safety is even ensured during a single fault.

Assessment criterion:

The NS protection must send a shutdown command to the coupling switch.

If the error is detected, the device is switched off within 10 s after error detection.

If the auxiliary voltage fails with the central NS protection or if the control fails with the integrated NS protection, the switch-off command must be given immediately.

6.12 Model definition and model validation for generating units of synchronous generating technology

Verdict	☐ P	☐ F	☒ N/A	☐ N/R	☐ R/D

Note:

PGU(s) considered in this test report utilizing non-synchronous generating technology. Model validation is not covered within the scope of this report.

Annex 1 – Parameter list

Name of parameter set		"EN50549"					
Clause(s) / subclause(s) of EN 50549-1:2019+A1:2023	**Parameter**	**Remarks / additional information**	**configurable value range**	**Step size**	**unit**	**default value**	
4.4.2 Operating frequency range	Internal parameter not configurable	Requirement acc. EN 50549-1, table 1 can be met	---	---	---	---	
4.4.3 Minimal requirement for active power delivery at under frequency	Internal parameter not configurable	---	not configurable	---	---	---	
4.4.4 Continuous operating voltage range	Upper limit	---	not configurable	---	$\%U_n$	110	
	Lower limit	---	not configurable	---	$\%U_n$	85	
4.5.2 Rate of change of frequency (ROCOF) immunity	Internal parameter not configurable	ROCOF withstand capability ≥ 2Hz/s	not configurable	---	Hz/s	2	
4.5.3.2 Under-voltage ride through (UVRT)	Maximum power resumption time	---	Not configurable	---	s	0.75	
	Enable under voltage ride through	---	Enable | Disable	---	---	Disable	
	Voltage-Time-Diagram	Voltage-Time-Diagram definition	Requirement acc. EN 50549-1, figure 6 (default requirement) can be met			Time	U
	V1		0.0 – 100.0	0.1	$\%U_n$		15.0
	T1		0.00 – 60.00	0.01	s	0.00	
	V2		0.0 – 100.0	0.1	$\%U_n$		72.0
	T2		0.00 – 60.00	0.01	s	0.15	
	V3		0.0 – 100.0	0.1	$\%U_n$		80.0
	T3		0.00 – 60.00	0.01	s	1.50	
4.5.4 Over-voltage ride through (OVRT)	Enable over voltage ride through	---	Enable | Disable	---	---	Disable	
	Voltage-Time-Diagram	Voltage-Time-Diagram definition	Requirement acc. EN 50549-1, figure 8 can be met			Time	U
	V1		0.0 – 130.0	0.1	$\%U_n$		125.0
	T1		0.00 – 60.00	0.01	s	0.10	
	V2		0.0 – 130.0	0.1	$\%U_n$		120.0
	T2		0.00 – 60.00	0.01	s	5.00	
	V3		0.0 – 130.0	0.1	$\%U_n$		115.0
	T3		0.00 – 60.00	0.01	s	60.00	
4.6.1 Power response to overfrequency (LFSM-O)	Activation frequency	Threshold frequency f1	50.00 – 65.00	0.01	Hz	50.20	
	Power gradient	Droop	2.0 – 12.0	0.1	%	5.0	
	Overfrequency reference power section	Power reference	P_M | P_{max}	---	---	P_{max}	
	Delay time	Intentional delay	0.0 – 60.0	0.1	s	0.0	
	Deactivation	---	50.00 – 50.20	0.01	Hz	deactivated	

Name of parameter set		"EN50549"				
Clause(s) / subclause(s) of EN 50549-1:2019+A1:2023	**Parameter**	**Remarks / additional information**	**configurable value range**	**Step size**	**unit**	**default value**
	threshold fstop					
	Deactivation time tstop	---	0.0 - 600.0	0.1	s	0.0
4.6.2 Power response to under frequency (LFSM-U)	Activation frequency	Threshold frequency f1	45.00 – 50.00	0.01	Hz	49.80
	Power gradient	Droop	2.0 – 12.0	0.1	%	5.0
	Underfrequency reference power section	Power reference	P_M | P_{max}	---	---	P_{max}
	Delay time	Intentional delay	0.0 – 60.0	0.1	s	0.0
4.7.2.2 voltage support by reactive power - Capabilities	Reactive power range overexcited	---	0.0 – 100.0	0.1	$\%S_n$	60.0
	Reactive power range underexcited	---	-100.0 – 0.0	0.1	$\%S_n$	-60.0
	Active factor range underexcited	---	0.80 - 1.00	0.01	---	0.80
	Active factor range overexcited	---	0.80 - 1.00	0.01	---	0.80
4.7.2.3 Control modes	Enabled control mode	---	Q setpoint Q(U) Q(P) cosφ setpoint cosφ(P)	---	---	Q setpoint
4.7.2.3.2 Set point control modes (Q setpoint and excitation)	Reactive power setting value	---	-60.0 – 60.0	0.1	$\%S_n$	0.0
	Delay time	---	0.0 – 60.0	0.1	s	0.0
	Tau value	PT1-filtering time constant	0.0 – 60.0	0.1	s	3.0
4.7.2.3.2 Set point control modes (cosφ setpoint and excitation)	cosφ setting value	---	0.80 - 1.00 - 0.80	0.01	---	0.80
	Delay time	---	0.0 – 60.0	0.1	s	0.0
	Tau value	PT1-filtering time constant	0.0 – 60.0	0.1	s	3.3
4.7.2.3.3 Voltage related control modes - Q(U)	Voltage node 1	---	0 – 200	1	%Un	93
	Voltage node 2	---	0 – 200	1	%Un	94
	Voltage node 3	---	0 – 200	1	%Un	106
	Voltage node 4	---	0 – 200	1	%Un	108
	Reactive Power responding node 1	---	-100 – 100	1	$\%Q_{max}$	100
	Reactive Power responding node 2	---	-100 – 100	1	$\%Q_{max}$	0
	Reactive Power responding node 3	---	-100 – 100	1	$\%Q_{max}$	0
	Reactive Power responding node 4	---	-100 – 100	1	$\%Q_{max}$	-100
	Delay time	---	0.0 – 60.0	0.1	s	0.0
	Tau value	PT1-filtering time constant	0.0 – 60.0	0.1	s	3.0
	Min cos φ	---	0.0-1.0	0.1	---	0.4
	Lock-in power	---	0.0 – 20.0	0.1	%Pn	20.0
	Lock-out power	---	0.0 – 20.0	0.1	%Pn	5.0
	PF Node 1	---	0.00 – 1.00	0.01	---	1.00

Name of parameter set		"EN50549"				
Clause(s) / subclause(s) of EN 50549-1:2019+A1:2023	**Parameter**	**Remarks / additional information**	**configurable value range**	**Step size**	**unit**	**default value**
4.7.2.3.4 Power related control mode - cosφ(P)	PF Node 2	---	0.00 – 1.00	0.01	---	1.00
	PF Node 3	---	-1.00 – 1.00	0.01	---	-0.95
	Power node 1	---	0.0 – 100.0	0.1	$\%S_n$	0.0
	Power node 2	---	0.0 - 100.0	0.1	$\%S_n$	50.0
	Power node 3	---	0.0 – 100.0	0.1	$\%S_n$	100.0
	Tau Value	PT1-filtering time constant	0.0 – 60.0	0.1	s	3.0
4.7.4.2.2 Zero current mode for converter connected generating technology	Threshold value of under voltage	---	20.0 – 100.0	0.1	%Un	50.0
	Threshold value of over voltage	---	100.0 – 120.0	0.1	%Un	120.0
4.9.3 Requirements on voltage and frequency protection	Undervoltage Protection value Level_1(V)	Undervoltage threshold stage 1	0.0 – 300.0	0.1	V	184.0
	Undervoltage Disconnection Time Level_1(V)	Undervoltage operate time stage 1	0 - 60000	1	ms	3000
	Undervoltage Protection value Level_2(V)	Undervoltage threshold stage 2	0.0 – 300.0	0.1	V	103.5
	Undervoltage Disconnection Time Level_2(V)	Undervoltage operate time stage 2	0 - 60000	1	ms	500
	Overvoltage Protection value Level_1(V)	Overvoltage threshold stage 1	0.0 – 300.0	0.1	V	253.0
	Overvoltage Disconnection Time Level_1(V)	Overvoltage operate time stage 1	0 - 60000	1	ms	100
	Overvoltage Protection value Level_2(V)	Overvoltage threshold stage 2	0.0 – 300.0	0.1	V	287.5
	Overvoltage Disconnection Time Level_2(V)	Overvoltage operate time stage 2	0 - 60000	1	ms	120
	10min overvoltage Protection Value	Overvoltage threshold 10min mean protection	0.0 – 300.0	0.1	V	253.0
	10-min mean Disconnection Time	Overvoltage operate time 10 min mean protection	---	---	---	10 min (update every 3s)
	Underfrequency Protection value Level_1	Underfrequency threshold stage 1	45.0 – 65.0	0.1	Hz	47.5Hz
	Underfrequency Disconnection Time Level_1	Underfrequency operate time stage 1	0 - 60000	1	ms	80
	Overfrequency Protection value Level_2	Underfrequency threshold stage 2	45.0 – 65.0	0.1	Hz	---
	Overfrequency Disconnection Time Level_2	Underfrequency operate time stage 2	0 - 60000	1	ms	---
	Overfrequency Protection value Level_1	Overfrequency threshold stage 1	45.0 – 65.0	0.1	Hz	51.5

Name of parameter set		"EN50549"				
Clause(s) / subclause(s) of EN 50549-1:2019+A1:2023	**Parameter**	**Remarks / additional information**	**configurable value range**	**Step size**	**unit**	**default value**
	Overfrequency Disconnection Time Level_1	Overfrequency operate time stage 1	0 - 60000	1	ms	80
	Level-2 overfrequency frequency value	Overfrequency threshold stage 2	45.0 – 65.0	0.1	Hz	---
	Level-2 overfrequency trip delay time	Overfrequency operate time stage 2	0 - 60000	1	ms	---
4.9.4.1 ROCOF tripping	Frequency rate of change protection value	---	1.0-10.0	0.1	Hz/s	2.0
	Frequency rate of change protection time	---	0-65535	1	ms	200
4.10.2 Automatic reconnection after tripping	Start up time follewing grid error	---	0 - 900	1	s	60
	Power gradient follewing grid error (%/min)	---	0.0 – 100.0	0.1	%/min	8.0
	Max. grid reconnection voltage	---	0.0 – 300.0	0.1	V	253.0
	Min. grid reconnection voltage	---	0.0 – 300.0	0.1	V	195.5
	Max. grid reconnection frequency	---	45.0 – 65.0	0.1	Hz	50.2
	Min. grid reconnection frequency	---	45.0 – 65.0	0.1	Hz	49.5
4.10.3 Starting to generate electrical power	Start up time	---	0.0 – 900.0	0.1	s	60.0
	Power gradient	---	0.0 – 100.0	0.1	%/min	10.0
	Max. grid start voltage	---	0.0 – 300.0	0.1	V	253.0
	Min. grid start voltage	---	0.0 – 300.0	0.1	V	195.5
	Max. grid start frequency	---	45.0 – 65.0	0.1	Hz	50.1
	Min. grid start frequency	---	45.0 – 65.0	0.1	Hz	49.5
4.11.1 Ceasing active power	---	---	---	---	---	RS485
4.11.2 Reduction of active power on set point	Temporary Active Power Setting	---	0 – 1500	1	W	100
	Active Power Slope Setting	---	0 – 10000	1	%/min	9000
4.12 Remote information exchange	---	---	---	---	---	---

Annex 2 – EMC report

Test Report No.: RM2601WDG0171

TEST REPORT

Applicant	Shenzhen Yixing Information Technology Co., Ltd.
Address	Room 203, Wanwei Building, No. 5, Gongye 5th Road, Yanshan Community, Zhaoshang Street, Nanshan District, Shenzhen City

Manufacturer or Supplier	Shenzhen Yixing Information Technology Co., Ltd.	
Address	Room 203, Wanwei Building, No. 5, Gongye 5th Road, Yanshan Community, Zhaoshang Street, Nanshan District, Shenzhen City	
Product	Energy Storage System	
Brand Name	conow	
Model	CME06-2BM250	
Additional Models & Model Difference	CME06-2BM250-07, etc.; See section 2.1	
Date of tests	Jan. 08, 2026 ~ Mar.16, 2026	

The submitted sample of the above equipment has been tested according to the requirements of the following standards:

☒ **EN IEC 61000-6-1:2019**	☒ **EN 301 489-1 V2.2.3 (2019-11)**
☒ **EN IEC 61000-6-3:2021**	☒ **EN 301 489-17 V3.3.1 (2024-09)**
☒ **EN 62920:2017+A1:2021**	☒ **EN IEC 61000-3-2:2019+A1:2021+A2:2024**
	☒ **EN 61000-3-3:2013+A1:2019+A2:2021**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Loren Luo Project Engineer / EMC Department	Approved by Madison Luo Assistant Manager / EMC Department
Loren	Date: Apr. 23, 2026

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

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Test Report No.: RM2601WDG0171

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RM2601WDG0171	Original release	Apr. 23, 2026

Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

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1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

EMISSION				
Standard	**Test Type**	**Result**	**Remarks**	**Test Location**
EN IEC 61000-6-3: 2021 EN 55032: 2015+ A1:2020, CLASS B	Conducted test at Grid Port (150KHz-30MHz)	PASS	Meets the requirements. Diagram(s) No. <3.1.7 >	B
	Conducted test at EPS Port (150KHz-30MHz)	PASS	Meets the requirements. Diagram(s) No. <3.1.8 >	B
	Radiated test (30MHz~1GHz)	PASS	Meets the requirements. Diagram(s) No. <3.2.7 >	B
	Radiated test (Above 1GHz)	PASS	Meets the requirements. Diagram(s) No. <3.2.8 >	B
EN IEC 61000-3-2: 2019+A1:2021+A2: 2024	Harmonic current emissions	PASS	Meets the requirements.	A
EN 61000-3-3: 2013 + A2:2021	Voltage fluctuations & flicker	PASS	Meets the requirements.	A

Test Location:
A: No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province. 523942. People's Republic of China.
B: No. 122, Houjie Avenue West Houjie Town, Dongguan City Guangdong Province, 523960, People's Republic of China.

Test Report No.: RM2601WDG0171

IMMUNITY (EN IEC 61000-6-1:2019)				
Standard	**Test Type**	**Result**	**Remarks**	**Test Location**
IEC 61000-4-2: 2008 ED. 2.0	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 8kV Air discharge, 4kV Contact discharge, Performance Criterion A	B
IEC 61000-4-3: 2020 ED. 4.0	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-1000 MHz, 3V/m, 80% AM (1kHz), 1400-6000 MHz, 3V/m, 80% AM (1kHz) Performance Criterion A	A
IEC 61000-4-4: 2012 ED. 3.0	Electrical fast transient / burst immunity test.	PASS	Electrical Fast Transient/Burst - EFT AC Power line: 1kV, DC Power line 0.5kV, Performance Criterion A	B
IEC 61000-4-5: 2017 ED. 3.1	Surge immunity test	PASS	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power Line: line to line 1 kV, line to earth 2kV, DC Power Line: line to line 0.5kV line to earth 1kV, Performance Criterion A	B
IEC 61000-4-6: 2023 ED. 5.0	Immunity to conducted disturbances, induced by radio-frequency fields	PASS	Conducted Radio Frequency Disturbances Test – CS: 0.15-80 MHz, 3Vrms, 80% AM, 1kHz, Performance Criterion A	B
IEC 61000-4-8: 2009 ED. 2.0	Power frequency magnetic field immunity test.	PASS	Power Frequency Magnetic Field Test,50 Hz, 3A/m, Performance Criterion A	B
IEC 61000-4-11: 2020 ED. 3.0	Voltage dips, short interruptions and voltage variations immunity tests	PASS	Meets the requirements of Voltage Dips: i) 0% residual for 0.5 cycle Performance Criterion A ii) 0% residual for 1 cycle, Performance Criterion A iii) 70% residual for 25 cycle, Performance Criterion A Interruptions 0% residual for 250 cycle, Performance Criterion B	B

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Test Report No.: RM2601WDG0171

IMMUNITY (EN 62920:2017+A1:2021)				
Standard	**Test Type**	**Result**	**Remarks**	**Test Location**
IEC 61000-4-2: 2008 ED. 2.0	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 8kV Air discharge, 4kV Contact discharge, Performance Criterion A	B
IEC 61000-4-3: 2020 ED. 4.0	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-1000 MHz, 3V/m, 80% AM (1kHz), 1400-6000 MHz, 3V/m, 80% AM (1kHz) Performance Criterion A	A
IEC 61000-4-4: 2012 ED. 3.0	Electrical fast transient / burst immunity test.	PASS	Electrical Fast Transient/Burst - EFT AC Power line: 1kV, DC Power line 0.5kV, Performance Criterion A	B
IEC 61000-4-5: 2017 ED. 3.1	Surge immunity test	PASS	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power Line: line to line 1 kV, line to earth 2kV, DC Power Line: line to line 0.5kV line to earth 1kV, Performance Criterion A	B
IEC 61000-4-6: 2023 ED. 5.0	Immunity to conducted disturbances, induced by radio-frequency fields	PASS	Conducted Radio Frequency Disturbances Test – CS: 0.15-80 MHz, 3Vrms, 80% AM, 1kHz, Performance Criterion A	B
IEC 61000-4-11: 2020 ED. 3.0	Voltage dips, short interruptions and voltage variations immunity tests	PASS	Meets the requirements of Voltage Dips: i) 0% residual for 0.5 cycle, Performance Criterion A ii) 0% residual for 1 cycle, Performance Criterion A iii) 70% residual for 25 cycle, Performance Criterion A Interruptions 0% residual for 250 cycle, Performance Criterion B	B

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CEI 0-21				
STANDARD	**TEST TYPE**	**RESULT**	**REMARKS**	**Test Location**
IEC 61000-4-2: 2008 ED. 2.0	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 6kV Air discharge, 8kV Contact discharge Performance Criterion A	B
IEC 61000-4-3: 2020 ED. 4.0	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-2700 MHz, 10V/m, 80% AM (1kHz), Performance Criterion A	A
IEC 61000-4-4: 2012 ED. 3.0	Electrical fast transient / burst immunity test.	PASS	Electrical Fast Transient/Burst - EFT AC Power line: 2kV, DC Power line 1kV, Performance Criterion A	B
IEC 61000-4-5: 2017 ED. 3.1	Surge immunity test	PASS	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power Line: line to line 1 kV, line to earth 2kV, DC Power Line: line to line 1kV Performance Criterion A	B
IEC 61000-4-6: 2013 ED. 4.0	Immunity to conducted disturbances, induced by radio-frequency fields	PASS	Conducted Radio Frequency Disturbances Test – CS: 0.15-80 MHz, 10Vrms, 80% AM, 1kHz, Performance Criterion A	B
IEC 61000-4-8: 2009 ED. 2.0	Power frequency magnetic field immunity test.	PASS	Power Frequency Magnetic Field Test, 50 Hz, 30A/m, Performance Criterion A	B
IEC 61000-4-16: 2015 ED. 2.0	Conducted, common mode disturbances immunity tests	PASS	Conducted, common mode disturbances tests Short duration disturbance: 15 Hz to 150 kHz, Common 300V/rms; Difference mode 100V/rms Performance Criterion A	B

IEC 61000-4-18: 2019 ED. 2.0	Oscillation train immunity tests at 1MHz	PASS	Oscillatory Waves Immunity Test: Oscillation Frequency: 1MHz AC Power Line: line to line 1 kV, line to earth 2.5kV, DC Power Line: line to line 1kV line to earth 2.5kV Performance Criterion A	B
IEC 61000-4-29: 2000 ED. 1.0	DC auxiliary voltage interruption	N/A	DC Voltage Dips and Interruptions Test, i) 0% reduction - Performance Criterion A	B

N/A: The product does not have DC input function, so it is not applicable to the item test.

Test Report No.: RM2601WDG0171

IMMUNITY (EN 301 489-1 V2.2.3 (2019-11), EN 301 489-17 V3.3.1 (2024-09))				Test Location
Standard	Test Type	Result	Remark	
EN 61000-4-2:2009	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 8kV Air discharge, 4kV Contact discharge, Performance Criterion A	B
EN IEC 61000-4-3: 2020	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-6000 MHz, 3V/m, 80% AM (1kHz) Performance Criterion A	A
EN 61000-4-4:2012	Electrical fast transient / burst immunity test.	PASS	Electrical Fast Transient/Burst - EFT, AC power line: 1 kV, DC Power line: 0.5kV Signal line: 0.5kV Performance Criterion A	B
EN 61000-4-5:2014 + A1:2017	Surge immunity test	PASS	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power line: line to line 1 kV, line to ground 2 kV Performance Criterion A	B
EN IEC 61000-4-6: 2023	Immunity to conducted disturbances, induced by radio-frequency fields	PASS	Conducted Radio Frequency Disturbances Test – CS: 0.15 ~ 80 MHz, 3 Vrms, 80% AM, 1 kHz, Performance Criterion A	B
EN IEC 61000-4-11: 2020	Voltage dips, short interruptions and voltage variations immunity tests	PASS	Meets the requirements of Voltage Dips: 0% residual – Performance Criterion A 0% residual – Performance Criterion A 70% residual – Performance Criterion A Voltage Interruptions: 0% residual – Performance Criterion B	B

Test Location:
A: No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province. 523942. People's Republic of China.
B: No. 122, Houjie Avenue West Houjie Town, Dongguan City Guangdong Province, 523960, People's Republic of China.

2 GENERAL INFORMATION

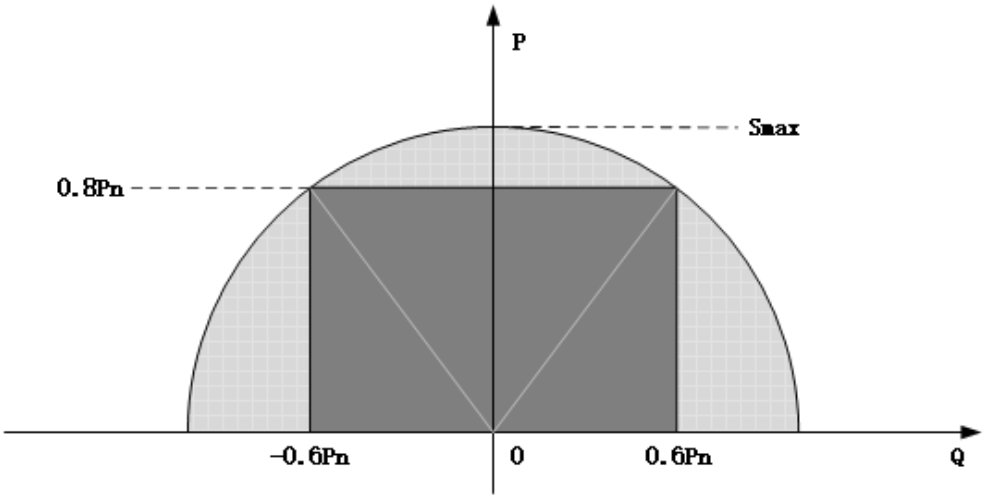
2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Energy Storage System
MODEL NO.	CME06-2BM250
ADDITIONAL MODELS	CME06-2BM250-07, CME06-2BM250-08
POWER SUPPLY	Grid Output: AC 230V/50Hz,1500W Max. AC Input: AC 230V/50Hz,2400W Max. Off-Grid: AC 230V/50Hz,2400W Max. Battery: DC 25.6V
THE HIGHEST OPERATING FREQUENCY	2.4G For WIFI&BT Function
DATA CABLE SUPPLIED	AC LINE: Unshielded, Detachable, 3.0m;

NOTE:

1. For the test results, the EUT had been tested with all conditions. But only the worst case was showed in test report.
2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
3. Please refer to the EUT photo document (Reference No.: 2601WDG0171) for detailed product photo.
4. Additional models (see about table) are identical with the test model CME06-2BM250 except the model name and rated power for trading purpose.
5. LAN port and PAR port for debugging or updating software.
6. Grid port and Backup port cannot be used simultaneously, only one of them can be used at the same time.

Annex 3 – Capability curve of the PGU(s)

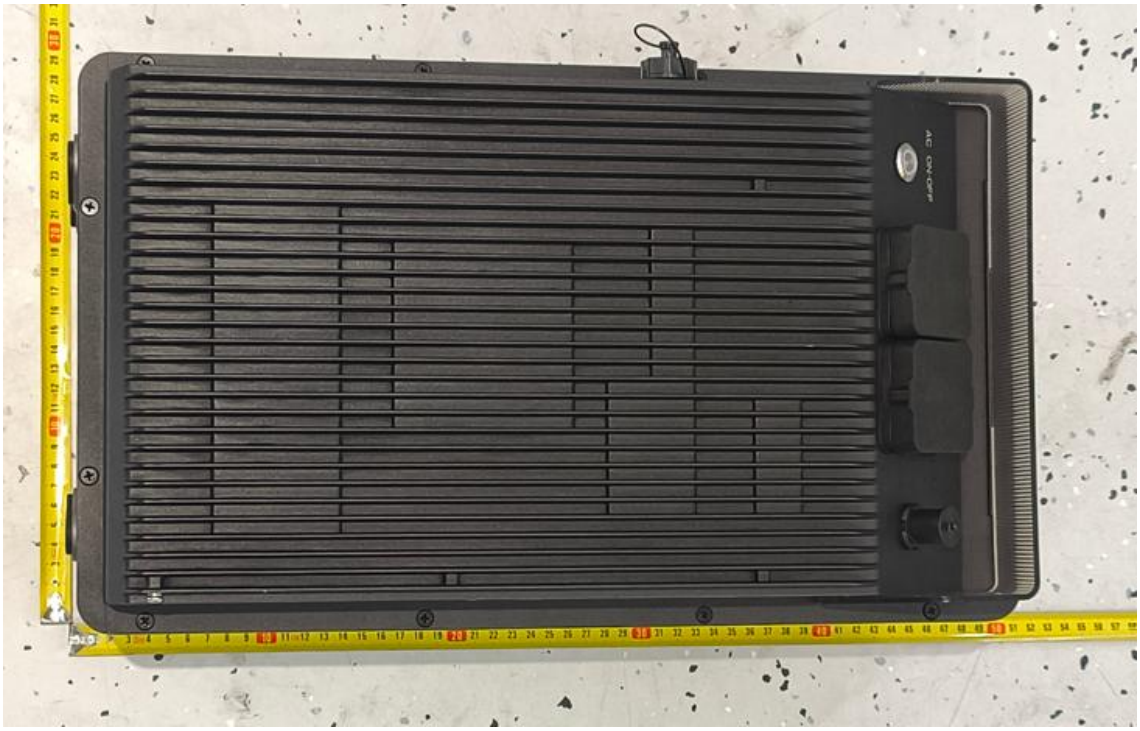


Annex 4 - Photo of the unit

Enclosure front view



Enclosure rear view



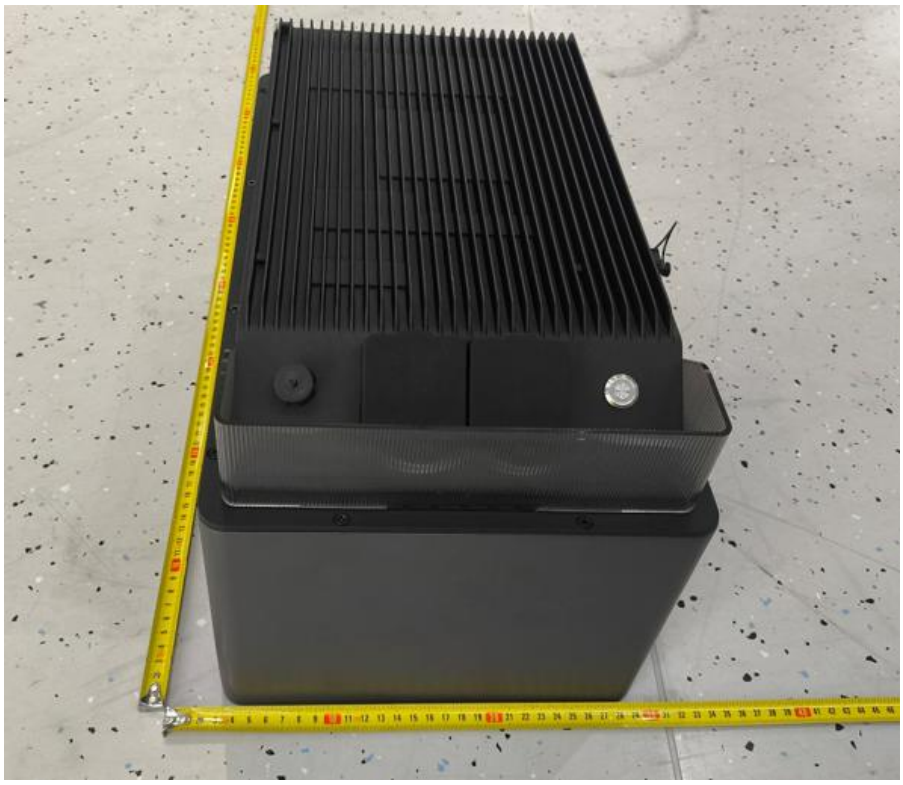
Enclosure left view



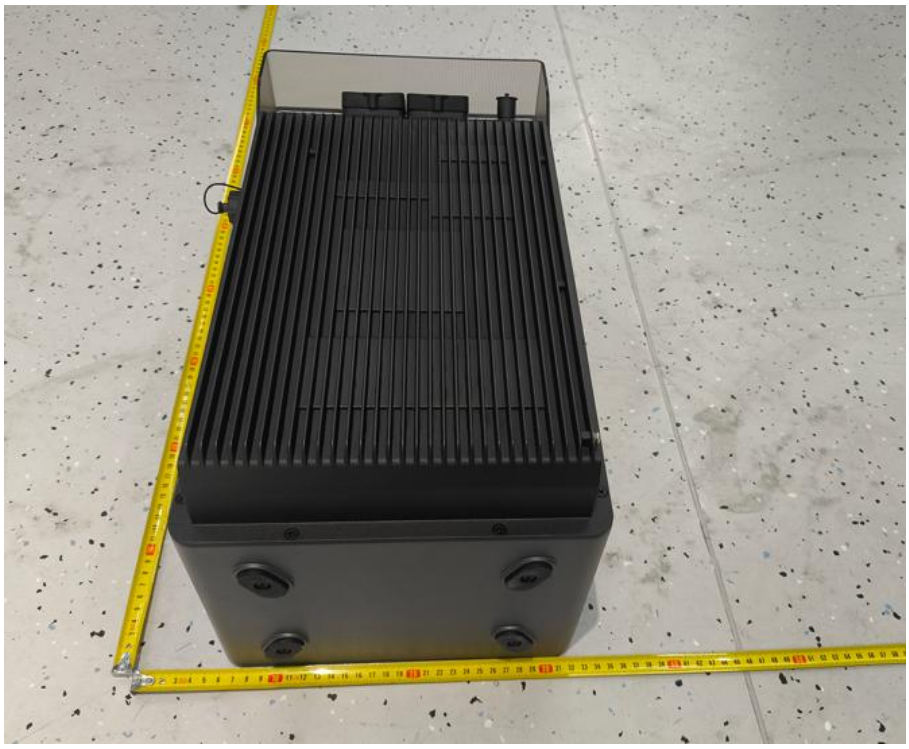
Enclosure right view



Enclosure top view



Enclosure bottom view



Enclosure internal view



»»»» **End of Test Report** ««««