TEST REPORT

EN 50549-2:2019

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

Report reference number.....:	**PV2210WDG0045-2**
Date of issue.....:	2022-12-05
Total number of pages.....:	220
Testing laboratory name.....:	**Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch**
Address.....:	No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province, 523942, People's Republic of China
Accrediation.....:	ilac-MRA; A2LA ACCREDITED Certificate # 2951.01
Applicant's name.....:	**AISWEI Technology Co., Ltd.**
Address.....:	Room 905B, 757 Mengzi Road, Huangpu District, 200023 Shanghai, P.R.China
Test specification	
Standard.....:	EN 50549-2:2019 for Type A and Type B
Test Report Form No.....:	EN 50549-2 VER.0
TRF Originator.....:	Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Master TRF.....:	Dated 2022-11-20
Test item description.....:	Solar Inverter
Trademark.....:	Solplanet
Model / Type.....:	ASW75K-LT, ASW80K-LT, ASW100K-LT, ASW110K-LT

Ratings..... :	**ASW75K-LT**	**ASW80K-LT**
Max. input DC voltage [V]..... :	1100	
Input DC voltage range [V] ..... :	200-1100	
Max. Input DC current [A]..... :	8*32	
Output AC voltage [V]..... :	3L/N/PE, 230V, 50Hz	
Max. Output AC current [A] ..... :	114,0	127,0
Nominal Output power [kW]..... :	75	80
Max. Output power [kVA]..... :	75	88
Ratings..... :	**ASW100K-LT**	**ASW110K-LT**
Max. input DC voltage [V]..... :	1100	
Input DC voltage range [V] ..... :	200-1100	
Max. Input DC current [A]..... :	10*32	
Output AC voltage [V]..... :	3L/N/PE, 230V, 50Hz	
Max. Output AC current [A] ..... :	158,8	174,7
Nominal Output power [kW]..... :	100	110
Max. Output power [kVA]..... :	110	121

Testing Location.....:	**AISWEI Technology (Shanghai) Co., Ltd suzhou branch**
Address .....:	Building 9, No.198 Xiangyang Road, 215011 Suzhou, PEOPLE'S REPUBLIC OF CHINA
Tested by (name and signature) .....:	Ryan He 
Approved by (name and signature) .....:	Ken Chan 
Manufacturer's name .....:	**AISWEI Technology Co., Ltd.**
Manufacturer address.....:	Room 905B, 757 Mengzi Road, Huangpu District, 200023 Shanghai, P.R.China
Factory's name .....:	**AISWEI New Energy Technology (Yangzhong) Co., Ltd**
Factory address.....:	No.588 Gangxing Road, Economic Development Zone, 212200 Yangzhong, Jiangsu Province, P.R.China

Document History			
Date	**Internal reference**	**Modification / Change / Status**	**Revision**
2022-12-05	Ryan He	Initial report was written	0
Supplementary information:			

Test items particulars	
Equipment mobility	Permanent connection
Operating condition	Continuous
Class of equipment.....	Class I
Protection against ingress of water ..	IP66 according to EN 60529
Mass of equipment [kg]	Approx. 85kg for all model
Test case verdicts	
Test case does not apply to the test object	N/A
Test item does meet the requirement	P(ass)
Test item does not meet the requirement	F(ail)
Testing	
Date of receipt of test item	2022-10-18
Date(s) of performance of test.....	2022-10-18 to 2022-12-02

General remarks:

The test results presented in this report relate only to the object(s) tested.
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Conformity statements are decided in accordance with IEC GUIDE 115:2021 Procedure 2 (accuracy method), unless otherwise normatively specified or contractually agreed.

"(see Annex #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

- "P_n" for the nominal active power:
  $P_n = V_n \times I_n \times \cos \varphi_n$ (single-Phase); $P_n = \sqrt{3} \times V_n \times I_n \times \cos \varphi_n$ (three-Phase)
- "P_m" for the momentary power
- "(c)" for over-excited
- "(i)" for under-excited

Active and reactive power:

The regarded system of the voltage and current vectors is the load view (Figure 2):

- if the inverter feeds to the grid the active power is measured with negative sign. For the sake of reading the document the measured active infeed power has a positive sign.

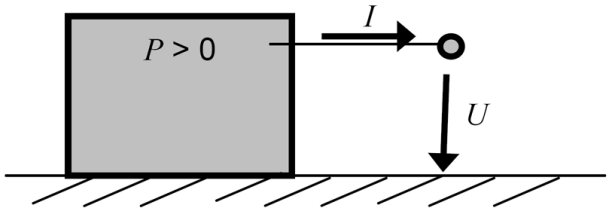

Figure 1

For the representation in quadrants, a power circle is chosen whose representation is compatible with mathematical representations of trigonometry and complex numbers (see Figure 2). Angles are counted positively counter-clockwise as in mathematics. The phase angle is defined as the angle from the current pointer to the voltage pointer. The current pointer is always in the real axis; the position of the voltage pointer corresponds to the apparent power and the phase angle.

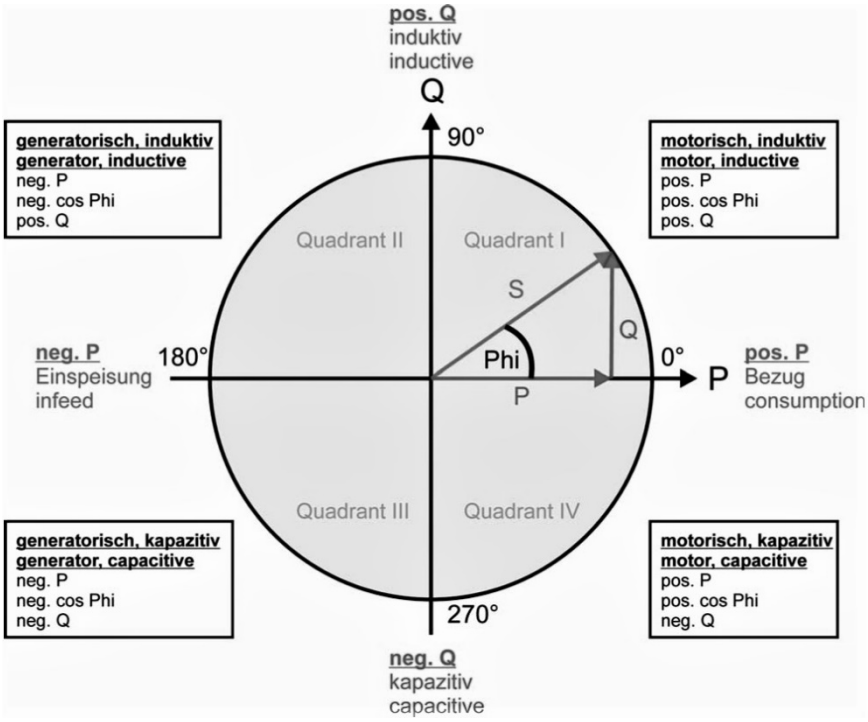

Figure 2

The different operating states can be represented in quadrants I to quadrant IV. The quadrants are named in a counter-clockwise direction.

- Quadrant I: Ohmic inductive load (coil)
- Quadrant II: One active power supplying generation plant with simultaneous reactive power consumption
- Quadrant III: A generation plant supplying active and reactive power
- Quadrant IV: Ohmic-capacitive load (capacitor)

This Test Report consists of the following documents:

1. Test Report

   4.4 Normal operating range

   4.5 Immunity to disturbances

   4.6 Active response to frequency deviation

   4.7 Power response to voltage variations and voltage changes

   4.8 EMC and power quality

   4.9 Interface protection

   4.10 Connection and starting to generate electrical power

   4.11 Ceasing and reduction of active power on set point

   4.13 Requirements regarding single fault tolerance of interface protection system and interface switch
2. Annex No. 1 – Datasheet of the relay
3. Annex No. 2 – Pictures of the unit
4. Annex No. 3 – Test equipment list

Copy of marking plate

Solplanet

Model: ASW75K-LT

Max. input voltage	d.c. 1100V
MPP voltage range	d.c. 200-1000V
Max. input current	d.c. 8x32A
Isc PV(absolute maximum)	d.c. 8x48A
Rated grid voltage	3/N/PE ~ 380/400/415V
Rated grid frequency	50/60Hz
Rated AC output active power	75kW
Rated AC output apparent power	75kVA
Max. AC output apparent power	75kVA
Max. continuous output current	a.c. 114.0A
Adjustable cos(φ)	0.8ind...0.8cap
Operating temperature range	-25...+60℃
Topology	Non-isolated
Ingress protection	IP66
Protective class	I
Overvoltage category	II(PV), III(MAINS)

AISWEI Technology Co., Ltd.
Web: www.solplanet.net
Add.: Room 9058, 757 Mengzi Road, Huangpu District, Shanghai, 200023, China

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532-10001 3-00

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Solplanet

Model: ASW80K-LT

Max. input voltage	d.c. 1100V
MPP voltage range	d.c. 200-1000V
Max. input current	d.c. 8x32A
Isc PV(absolute maximum)	d.c. 8x48A
Rated grid voltage	3/N/PE ~ 380/400/415V
Rated grid frequency	50/60Hz
Rated AC output active power	80kW
Rated AC output apparent power	80kVA
Max. AC output apparent power	88kVA *1
Max. continuous output current	a.c. 127.0A
Adjustable cos(φ)	0.8ind...0.8cap
Operating temperature range	-25...+60℃
Topology	Non-isolated
Ingress protection	IP66
Protective class	I
Overvoltage category	II(PV), III(MAINS)

*1 For AS/NZS4777.2, Smax=80kVA.

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Model: ASW100K-LT

Max. input voltage	d.c. 1100V
MPP voltage range	d.c. 200-1000V
Max. input current	d.c. 10x32A
Isc PV(absolute maximum)	d.c. 10x48A
Rated grid voltage	3/N/PE ~ 380/400/415V
Rated grid frequency	50/60Hz
Rated AC output active power	100kW
Rated AC output apparent power	100kVA
Max. AC output apparent power	110kVA *1
Max. continuous output current	a.c. 158.8A
Adjustable cos(φ)	0.8ind...0.8cap
Operating temperature range	-25...+60°C
Topology	Non-isolated
Ingress protection	IP66
Protective class	I
Overvoltage category	II(PV), III(MAINS)

*1 For AS/NZS4777.2, Smax=100kVA.

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Model: ASW110K-LT

Max. input voltage	d.c. 1100V
MPP voltage range	d.c. 200-1000V
Max. input current	d.c. 10x32A
Isc PV(absolute maximum)	d.c. 10x48A
Rated grid voltage	3/N/PE ~ 380/400/415V
Rated grid frequency	50/60Hz
Rated AC output active power	110kW
Rated AC output apparent power	110kVA
Max. AC output apparent power	121kVA *1
Max. continuous output current	a.c. 174.7A
Adjustable cos(φ)	0.8ind...0.8cap
Operating temperature range	-25...+60°C
Topology	Non-isolated
Ingress protection	IP66
Protective class	I
Overvoltage category	II(PV), III(MAINS)

*1 For AS/NZS4777.2, Smax= Smax=110kVA.

AISWEI Technology Co., Ltd.
Web: www.solplanet.net
Add.: Room 9058, 757 Mengzi Road, Huangpu District, Shanghai, 200023,China

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General product information:

The Solar Inverter converts DC voltage into AC voltage.
The Solar Inverter is three phase type and DC input supply by PV array.
The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the PV input and output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundantly by the high power switching bridge and two relays. This assures that the opening of the output circuit will also operate in case of a single error.

Description of the electrical circuit:

The internal control is redundant built. It consists of Microcontroller Main DSP (U112) and slave DSP (U109).

The Main DSP (U112) control the relays by switching signals; measures the PV voltage, PV current, Bus voltage, grid voltage, frequency, AC current with injected DC and the array insulation resistance to ground. In addition it tests the current sensors and the RCMU circuit before each start up.

The slave DSP (U109) is measures the grid voltage, grid frequency and residual current, also can switch off the relays independently, and communicate with Main DSP (U112) each other.

The current is measured by a current sensor. The AC current signal and the injected DC current signal are sent to the Main DSP (U112). The Main DSP (U112) tests and calibrates before each start up all current sensors.

The unit provides two relays in series in all output conductors. When single fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the PV array and the mains. All the relays are tested before each start up.

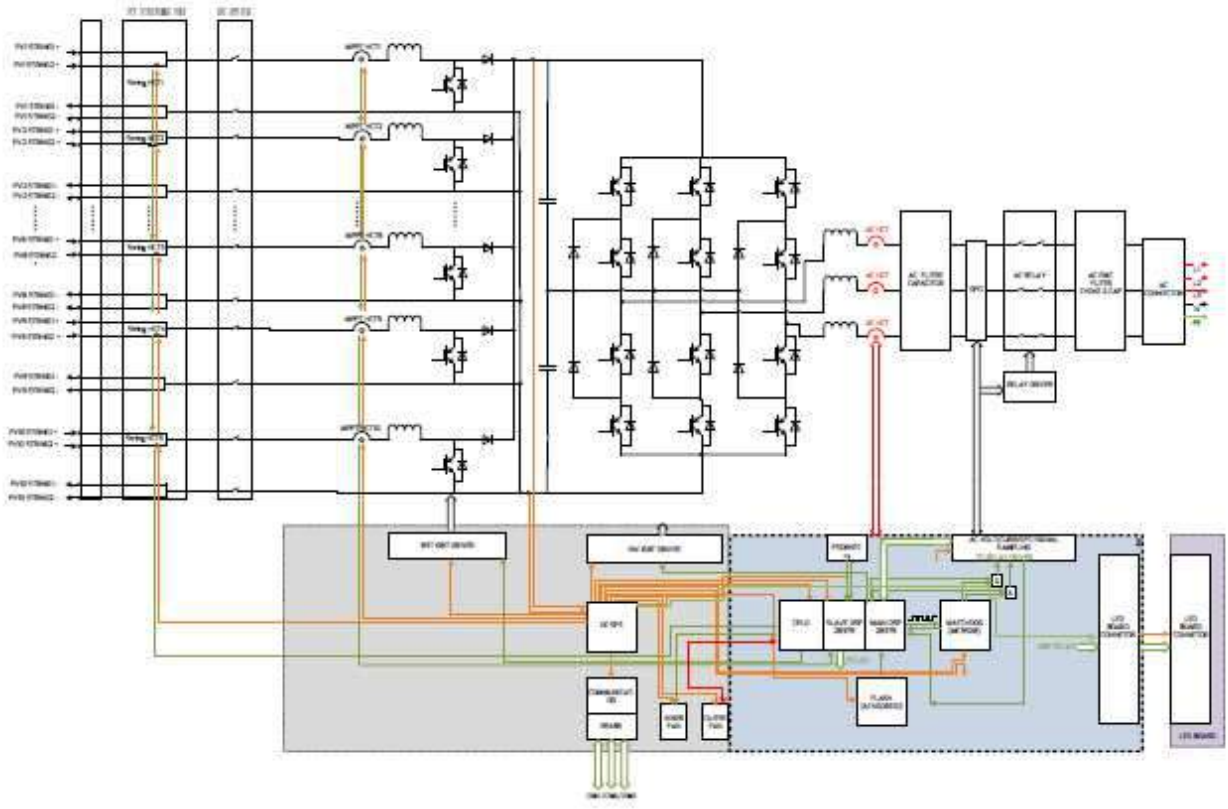


Figure 3 – Block diagram

Differences of the models:

The models ASW75K-LT, ASW80K-LT, ASW100K-LT and ASW110K-LT are almost identical in hardware and software, expected the components are desctription as below table and the output power derated by software.

Item	Type	ASW75K-LT, ASW80K-LT	ASW100K-LT, ASW110K-LT
		Quantity	Quantity
PV connector	PV-FT-C2M-HSG	8*2	10*2
	PV-FT-C2F-HSG	8*2	10*2
DC switch	GHX5-32P/4P1100-32	1	2
BOOST-IGBT	MPBQ75N120BF	8	10
BOOST-DIODE	SDS120J040H2	8	10
BOOST-Inductor	TRDK3J3383-2-30-85-L9	0	1
	TRDK3J3383-2-30-85-L10	0	1

The product was tested on:

Hardware:
PSDR: 270-102001-00
ACOUT: 270-702001-00

Main DSP Software version: V610-04001-00
Slave DSP Software version: V610-04002-00
Safety package (Flash) version: V610-12001-00

All tests were performed on ASW110K-LT. Tests of the EUT of ASW110K-LT not applicable for the models ASW75K-LT, ASW80K-LT and ASW100K-LT were performed on the concerned models and a statement is given at the relevant test.

Test Results

Default interface protection settings according EN 50549-2:2019:			
Parameter	**Max. disconnection time**	**Min. operate time**	**Trip value**
Over voltage – stage 1	3,0 s	0,1 s	230V +15% (264,5 V)
Over voltage – stage 2	0,2 s	0,1 s	230V +25% (287,5 V)
Under voltage – stage 1	5,0 s	0,1 s	230V -20% (184V)
Under voltage – stage 2	2,0 s	0,1 s	230V -50% (115V)
Over frequency – stage 1	0,5 s	0,3 s	51,5 Hz
Over frequency – stage 2	0,2 s	0,1 s	52,0 Hz
Under frequency– stage 1	0,5 s	0,3 s	47,5 Hz
Under frequency– stage 2	0,2 s	0,1 s	47,0 Hz
Reconnection settings for voltage		$0,85\ U_n \le U \le 1,10\ U_n$	
Connection settings for frequency (Normal operational start-up)		49,5 Hz ≤ f ≤ 50,1 Hz	
Reconnection settings for frequency (Automatic reconnection after tripping)		49,5 Hz ≤ f ≤ 50,2 Hz	
Reconnection time		≥ 60 s	
Active power gradient after reconnection		$10\%P_n$/min	
Permanent DC-injection		0,5% of rated inverter output current or 20mA	
Loss of mains according EN 62116		Inverter shall disconnect within 2 s.	
The stated currents and voltages are 'true r.m.s.'-values. The voltages in this table are - phase-to-neutral in 230 V single phase systems and 230/400 V systems, - phase-to-phase in a multiphase 230 V system.			
Tolerances on trip values: - Voltage: ± 1% of U_n - Frequency: ± 0,05 Hz - Disconnection time : ± 10%			

EN 50549-2:2019, clause 4: Tests		
Clause	**Test requirement (According to table C.1)**	**Result**
4.4	Normal operating range	**P**
4.5	Immunity to disturbances	**P**
4.6	Active response to frequency deviation	**P**
4.7	Power response to voltage variations and voltage changes	**P**
4.8	EMC and power quality	**P**
4.9	Interface protection	**P**
4.10	Connection and starting to generate electrical power	**P**
4.11	Ceasing and reduction of active power on set point	**P**
4.12	Remote information exchange	**N/A**
4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	**P**

EN 50549-2:2019: Normal operating range			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.4.2	Operating frequency range	EN 50438, Annex D.3.1	**P**
4.4.3	Minimal requirement for active power delivery at underfrequency	G99/1-9:2022, clause A.7.2.3	**P**
4.4.4	Continuous operating voltage range	EN 50438, Annex D.3.1	**P**

4.4.2 Operating frequency range 4.4.4 Continuous operating voltage range			P
Setting values	Over-voltage [V]:	253,0	
	Under-voltage [V]:	195,5	
	Over-frequency [Hz]:	51,5	
	Under-frequency [Hz]:	47,5	

- Test 1: U = 195,5 V; f = 47,5 Hz; P = 1,00 S_n; cosφ = 1; Period of test 30 minutes
- Test 2: U = 195,5 V; f = 48,5 Hz; P = 1,00 S_n; cosφ = 1; Period of test 30 minutes
- Test 3: U = 253,0 V; f = 51,5 Hz; P = 1,00 S_n; cosφ = 1; Period of test 30 minutes
- Test 4: U = 230,0 V; f = 50,0 Hz; Voltage Phase jumps Change +20 degrees P = 1,00 S_n; cosφ = 1
- Test 5: U = 230,0 V; f = 50,0 to 50,5 Hz;RoCoF=1Hz/s; P = 1,00 S_n; cosφ = 1; Period of test 0,5 seconds

Test result:

Test sequence	Voltage [V]	Frequency [Hz]	Output power [kW]	Cos φ
Test1	195,84	47,50	103,038	0,998
Test2	195,65	48,50	102,972	0,998
Test3	253,13	51,50	120,381	0,998
Test4	230,47	50,00	120,551	0,997
Test5	230,48	50,00 to 50,50	120,830	0,999

Note:

Test method refer clause D.3.1 of EN 50438:2013.

During the tests the interface protection was disabled.

Operation at reduced power is allowed during test 1 and test 2, equal to the maximum power that can be supplied on reaching the maximum output current limit (P ≥ 0,85 S_n).

During the sequence of test 3, automatic adjustment to reduce power in the case of over-frequency was disabled.

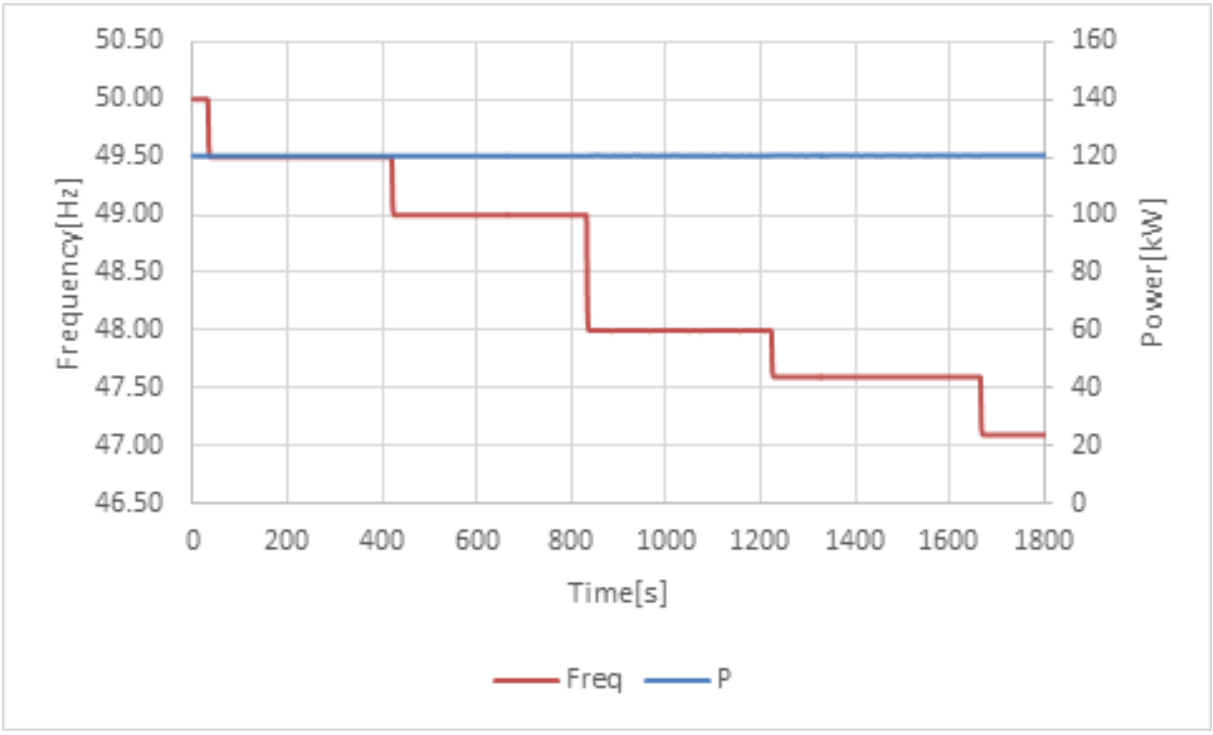
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.4.3	Minimal requirement for active power delivery at under-frequency	P

Test result:

	Switch to:					
5-min mean value (each)	a) 50,00 Hz	a) 49,50 Hz	b) 49,00 Hz	c) 48,00 Hz	d) 47,60 Hz	e) 47,10 Hz
Frequency [Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Active power [kW]:	120,45	120,47	120,49	120,52	120,51	120,52
$\Delta P/P_{Emax}$ [%] :		-0,438	-0,421	-0,397	-0,405	-0,397

Graph of frequency a) to b) to c) to d) to e):



Assessment criterion:

Test method refer clause A.7.2.3 of G99/1-9:2022.

In both cases a suitable test could be to start the test at nominal frequency with the Synchronous Power Generating Module operating at 100% of its Registered Capacity.

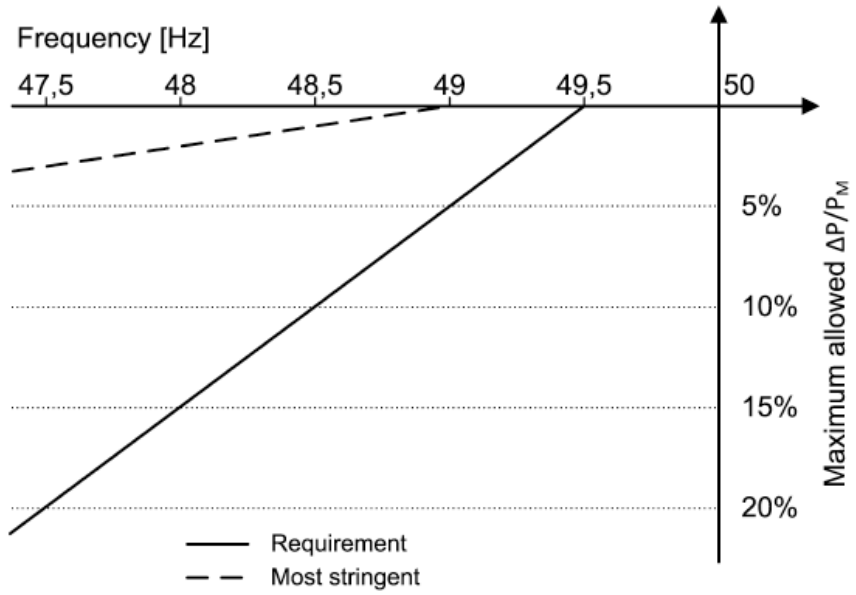
The frequency should then be set to 49,5 Hz for 5 minutes. The output should remain at 100% of registered Capacity.

The frequency should then be set to 49,0 Hz and once the output has stabilised, held at this frequency for 5 minutes. The Active Power output must not be below 99% of registered Capacity.

The frequency should then be set to 48,0 Hz and once the output has stabilised, held at this frequency for 5 minutes. The Active Power output must not be below 97% of registered Capacity.

The frequency should then be set to 47,6 Hz and once the output has stabilised, held at this frequency for 5 minutes. The Active Power output must not be below 96.2% of registered Capacity.

The frequency should then be set to 47,1 Hz and held at this frequency for 20s. The Active Power output must not be below 95,0% of registered Capacity and the Synchronous Power Generating Module must not trip in less than the 20s of the test.



Maximum allowable power reduction in case of under-frequency

Note:

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

EN 50549-2:2019: Immunity to disturbances			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.5.2	Rate of change of frequency (RoCoF) immunity	G99/1-9:2022, clause A.7.1.2.6	**P**
4.5.3	Under-voltage ride through (UVRT)	VDE V 0124-100:2020, clause 5.8.3.	**P**
4.5.4	Over-voltage ride through (OVRT)	VDE V 0124-100:2020, clause 5.8.3.	**P**
4.7.4.2	Generating plant with non-synchronous generating technology	VDE V 0124-100:2020, clause 5.8.3.	**P**

4.5.2	Rate of change of frequency (ROCOF) immunity(default setting)	P

	Start Frequency	Change	End Frequency	Confirm no trip
Positive Frequency drift	49Hz	+2Hz/sec	51Hz	No trip
Negative Frequency drift	51Hz	-2Hz/sec	49Hz	No trip

Note:

Test method refer clause A.7.1.2.6 of G99/1-9:2022.

Hold for 10 s

Manufacturers considering new designs should allow for the RoCoF where stability is required to be increased to, up to 2Hz per second, as proposed in the new European network codes, which are expected to come into force over the period 2014/2015. Under these conditions RoCoF will cease to be an effective loss of mains protection and is unlikely to be permitted in future revisions of this document.

For the step change test the SSEG should be operated with a measureable output at the start frequency and then a vector shift should be applied by extending or reducing the time of a single cycle with subsequent cycles returning to the start frequency. The start frequency should then be maintained for a period of at least 10 seconds to complete the test. The SSEG should not trip during this test.

For frequency drift tests the SSEG should be operated with a measureable output at the start frequency and then the frequency changed in a ramp function at 0,95Hz per second to the end frequency. On reaching the end frequency it should be maintained for a period of at least10 seconds. The SSEG should not trip during this test.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.5.3 **4.5.4** **4.7.4.2**	**Under-voltage ride through (UVRT)** **Over-voltage ride through (OVRT)** **Generating plant with non-synchronous generating technology**	**P**

General:

If the voltage on the generator terminals falls below <0,8 U_n and if the generator terminals exceed the voltage of> 1,15 U_n (start of fault), generator must pass through voltage dips without any current being drawn into the grid Network operator (limited dynamic network support).
After the onset of a fault, the step response of reactive current $\Delta i_{B1,2}$ at the power generating unit shall be between the following value for step response time: ≤ 30ms and settling time: ≤ 60ms
(Refer BDEW TG3, Rev. 25, VDE-AR-N 4110:2018-11, and VDE V 0124-100:2020

After the voltage returned to continuous operating voltage range of -0,1 U_n to +0,1 U_n, 0,9 of pre fault power shall be resumed as fast as possible, but at the latest within 1 s.

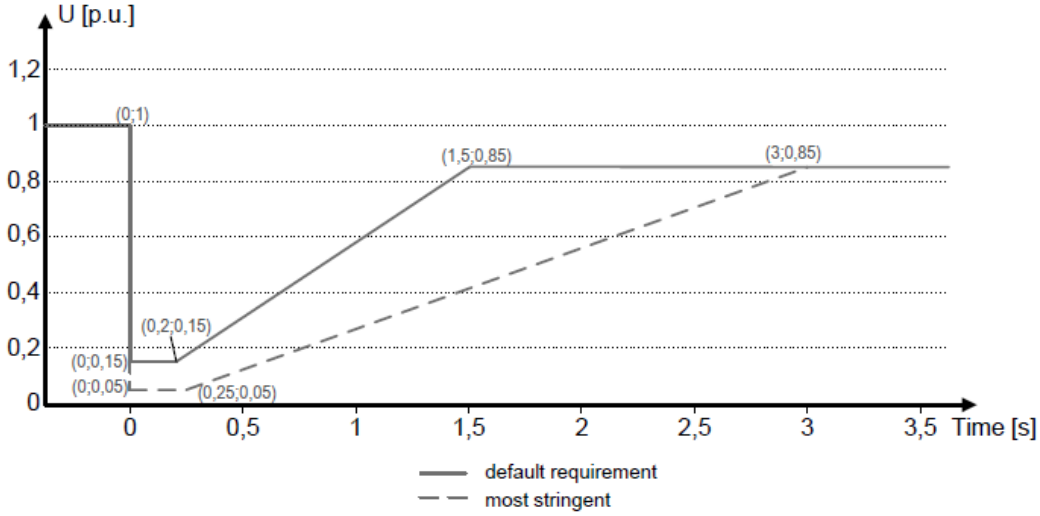


Figure 6 — Low voltage ride through capability for non-synchronous generating technology

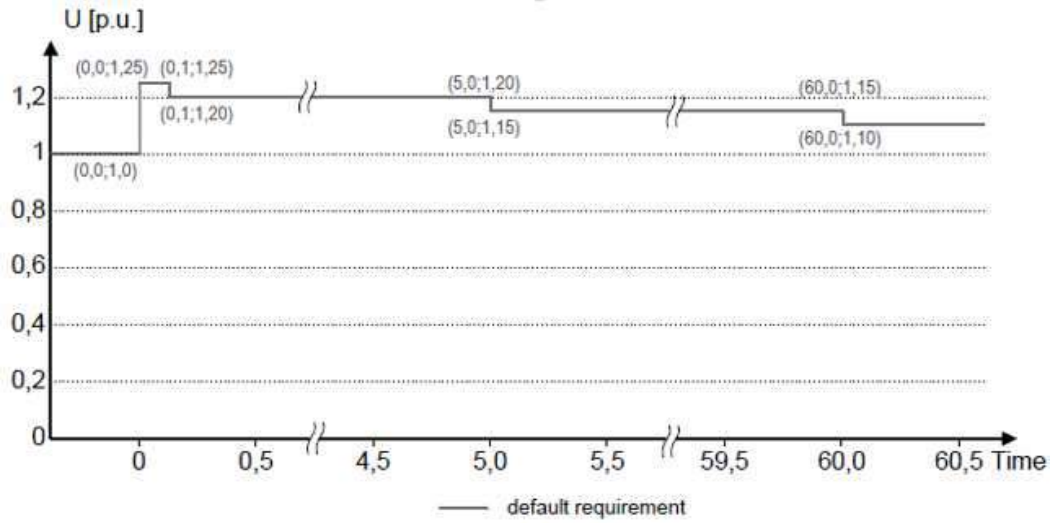


Figure 8 — Over-voltage ride through capability

Test	Drop depth requirement [p.u. U_n]	Symmetry	Fault duration [ms]	Output power level		k-factor	Test no.
				P set point (P_{rE} / p.u.)	Q set point (Q / p.u.)		
1.A.1	0,03	Symmetrical	250	1,0	0,00	2	1.A.1
1.A.2				0,2			1.A.2
1.D.1		Asymmetrical		1,0			1.D.1
1.D.2				0,2			1.D.2
1.B.1		Single phase*		1,0			1.B.1
1.B.2				0,2			1.B.2
2.A.1	0,31	Symmetrical	1300	1,0	0,00	2	2.A.1
2.A.1				1,0		2&limited mode[1)]*	2.A.1
2.A.2				0,2		2	2.A.2
2.D.1		Asymmetrical		1,0			2.D.1
2.D.1				1,0		2&limited mode[1)]*	2.D.1
2.D.2				0,2		2	2.D.2
2.B.1		Single phase*		1,0			2.B.1
2.B.2				0,2			2.B.2
3.A.1	0,82	Symmetrical	3000	1,0	0,00	2	3.A.1
3.A.2				0,2			3.A.2
3.D.1		Asymmetrical		1,0			3.D.1
3.D.2				0,2			3.D.2
3.B.1		Single phase*		1,0			3.B.1
3.B.2				0,2			3.B.2
4.A.1	0,85	Symmetrical	180000	1,0	0,00	2	4.A.1
4.A.2				0,2			4.A.2
4.D.1		Asymmetrical		1,0			4.D.1
4.D.2				0,2			4.D.2
4.B.1		Single phase*		1,0			4.B.1
4.B.2				0,2			4.B.2
OV1	1,25	Symmetrical	100	1,0	0,00	2	OV1
OV2	1,20		5000	1,0			OV2
OV3	1,15		60000	1,0			OV3

Assessment criterion:

If the voltage on the generator terminals falls below <0,8 U_n and if the generator terminals exceed the voltage of> 1,15 U_n (start of fault), PV generators must pass through voltage dips without any current being drawn into the grid Network operator (limited dynamic network support).

Unless the relevant OS in consultation with the TSO decides otherwise, the PPM shall be capable of generating an additional, fast short-circuit current, in accordance with the following static characteristics with an adjustable K-factor value in the range of 2 - 6 with a minimum step size of 0,5 over time:
(i) 90 % of the additional reactive current at the terminals of the primary generating installations in no more than 60 ms.
(ii) The target value of this current shall be reached with an accuracy of -10%/+20% within 100 ms of the voltage deviation.
For voltages below 15 % U_C, no current supply is required.
(Refer Requirements of general application resulting from Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for the connection of generating units to the network (NC RfG))
After the voltage returned to continuous operating voltage range of -15% U_n to +10% U_n, 90 % of pre fault power shall be resumed as fast as possible, but at the latest within 1 s.
Note: k-Factor=2

Note:

1)* *Limited dynamic grid support* mode:
PGU shall be able to ride through voltage dips to values of ≤ 0,5U_c so that the current fed into the network during the network fault does not exceed 20% of the rated current I_r within a maximum time period of 60 ms after the value of 0,5U_c is fallen short of and so that it does not exceed 10%I_r after100 ms.

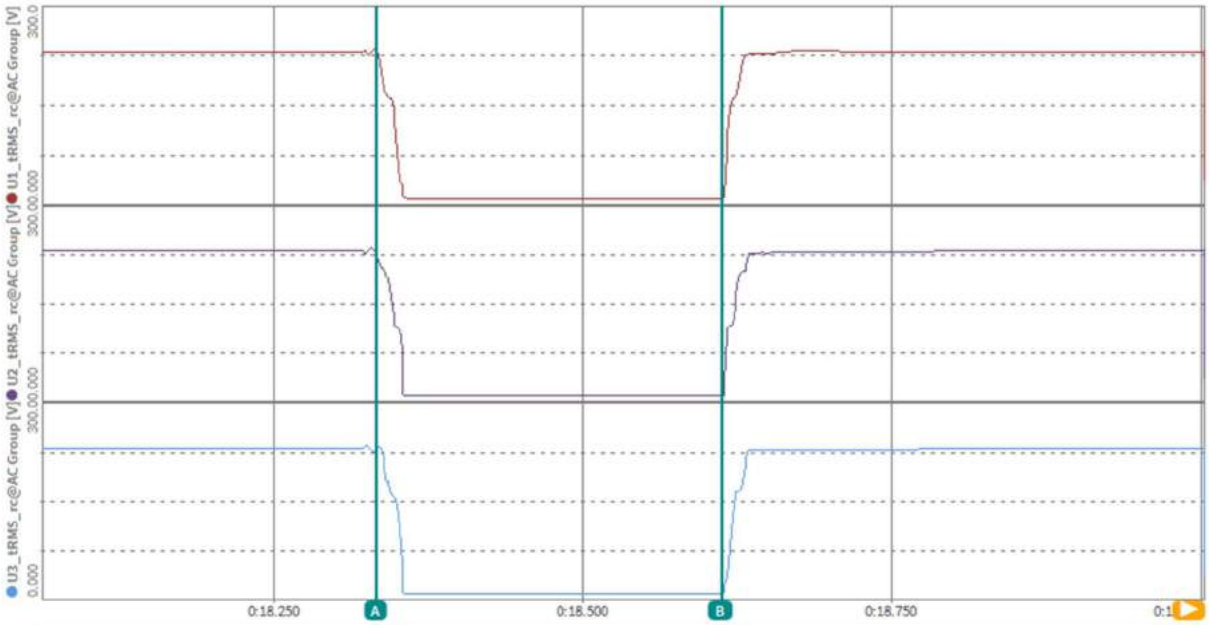
No Load				
Test result:				
List of tests	**Residual amplitude of phase-to-phase voltage [p.u. U_n]**	**Duration limit [ms]**	**Duration [ms]**	**Result**
P_{Emax} in %	No Load			
1.A.1- Symmetrical	0,03	≥ 250	278	Pass
1.D.1- Asymmetrical	0,03	≥ 250	281	Pass
1.B.1- Single phase	0,03	≥ 250	280	Pass
2.A.1- Symmetrical	0,31	≥ 1300	1323	Pass
2.D.1- Asymmetrical	0,31	≥ 1300	1328	Pass
2.B.1- Single phase	0,31	≥ 1300	1328	Pass
3.A.1- Symmetrical	0,82	≥ 3000	3021	Pass
3.D.1- Asymmetrical	0,82	≥ 3000	3022	Pass
3.B.1- Single phase	0,82	≥ 3000	3025	Pass
4.A.1- Symmetrical	0,85	≥ 180000	180169	Pass
4.D.1- Asymmetrical	0,85	≥ 180000	180059	Pass
4.B.1- Single phase	0,85	≥ 180000	180306	Pass
OV1- Symmetrical	1,25	≥ 100	100	Pass
OV2-Symmetrical	1,20	≥ 5000	5001	Pass
OV3-Symmetrical	1,15	≥ 60000	60003	Pass

Graph of FRT test one

Test Result:

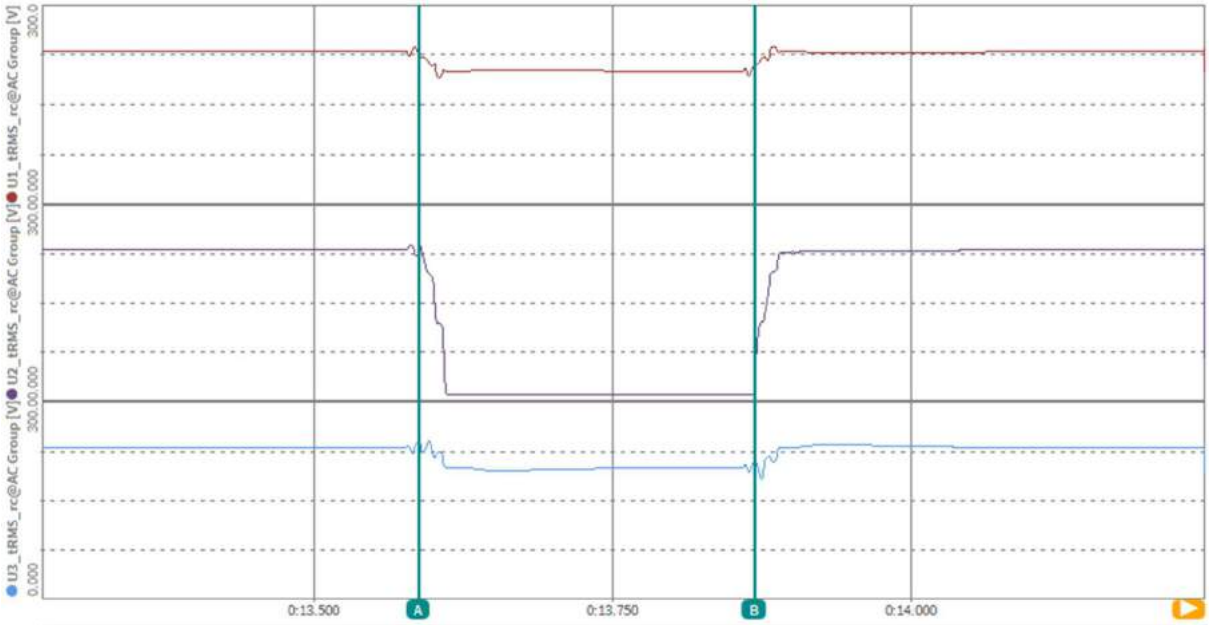
#.	Test no.	Drop depth requirement [p.u. Un]	Duration fault [ms]				Recovery after fault [ms]	Result
			Limit for fault duration [ms]	duration [ms]	Postive reaictive current(A)	Negitive reactive current(A)		
1	1.A.1	0,00	≥250	282	0,09	0,00	168	Pass
2	1.A.2	0,00	≥250	281	0,09	0,00	71	Pass
3	1.D.1	0,00	≥250	290	91,55	-85,17	181	Pass
4	1.D.2	0,00	≥250	278	91,12	-84,83	90	Pass
5	1.B.1	0,00	≥250	282	92,28	-84,17	175	Pass
6	1.B.2	0,00	≥250	279	91,81	-85,10	83	Pass
7	2.A.1	0,31	≥1300	1323	174,70	-1,11	160	Pass
8	2.A.1	0,31	≥1300	1323	1,02	0,03	159	Pass
9	2.A.2	0,31	≥1300	1318	175,19	-1,22	62	Pass
10	2.D.1	0,31	≥1300	1332	92,67	-83,96	166	Pass
11	2.D.1	0,31	≥1300	1331	2,28	1,21	159	Pass
12	2.D.2	0,31	≥1300	1330	92,21	-85,24	82	Pass
13	2.B.1	0,31	≥1300	1323	79,19	-76,11	139	Pass
14	2.B.2	0,31	≥1300	1322	80,45	-75,99	44	Pass
15	3.A.1	0,82	≥3000	3032	62,81	-1,63	67	Pass
16	3.A.2	0,82	≥3000	3025	67,67	0,22	41	Pass
17	3.D.1	0,82	≥3000	3016	32,87	-32,02	82	Pass
18	3.D.2	0,82	≥3000	3021	34,08	-31,54	42	Pass
19	3.B.1	0,82	≥3000	3030	22,57	-21,03	61	Pass
20	3.B.2	0,82	≥3000	3030	23,62	-20,84	21	Pass
21	4.A.1	0,82	≥180000	180016	53,44	-0,16	51	Pass
22	4.A.2	0,82	≥180000	180027	56,47	0,24	39	Pass
23	4.D.1	0,82	≥180000	180022	29,09	-25,89	73	Pass
24	4.D.2	0,82	≥180000	180024	30,34	-25,28	39	Pass
25	4.B.1	0,82	≥180000	180021	18,56	-17,48	48	Pass
26	4.B.2	0,82	≥180000	180019	19,81	-17,36	69	Pass
27	OV1	1,25	≥100	119	-86,11	-2,32	55	Pass
28	OV2	1,20	≥5000	5020	-69,39	-2,32	200	Pass
29	OV3	1,15	≥60000	60019	-53,06	-1,26	44	Pass

Test 1.A.1-Symmetrical fault (U/U_{nom} = 0,03); No load



	A	B	Delta
Time [s]	0:18.333588	0:18.611984	0.278396
U1_tRMS_rc@AC Group [V]	233.2933	6.611604	-226.6817
U2_tRMS_rc@AC Group [V]	228.8765	6.014686	-222.8618
U3_tRMS_rc@AC Group [V]	226.4321	6.287145	-220.1450

Test 1.D.1- Asymmetrical fault (U/U_{nom} = 0,03); No load

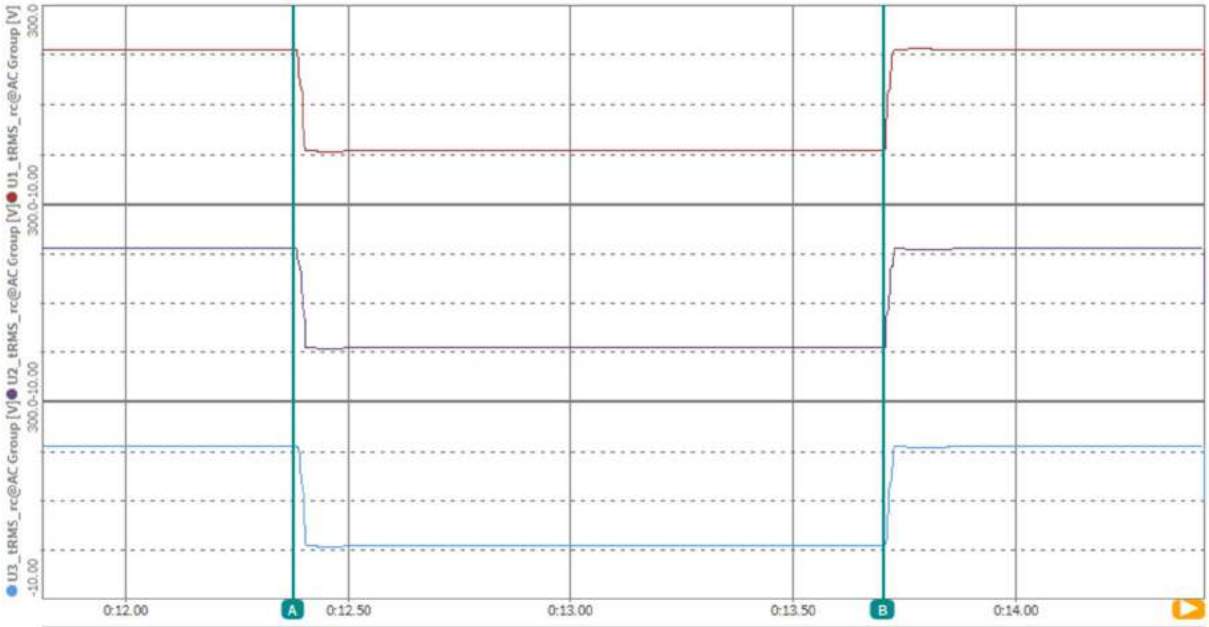


	A	B	Delta
Time [s]	0:13.588187	0:13.869284	0.281097
U1_tRMS_rc@AC Group [V]	232.6924	201.0582	-31.63423
U2_tRMS_rc@AC Group [V]	221.2868	5.920382	-215.3664
U3_tRMS_rc@AC Group [V]	234.3814	200.5547	-33.82669

Test 1.B.1- Single phase fault (U/U_{nom} = 0,03); No load

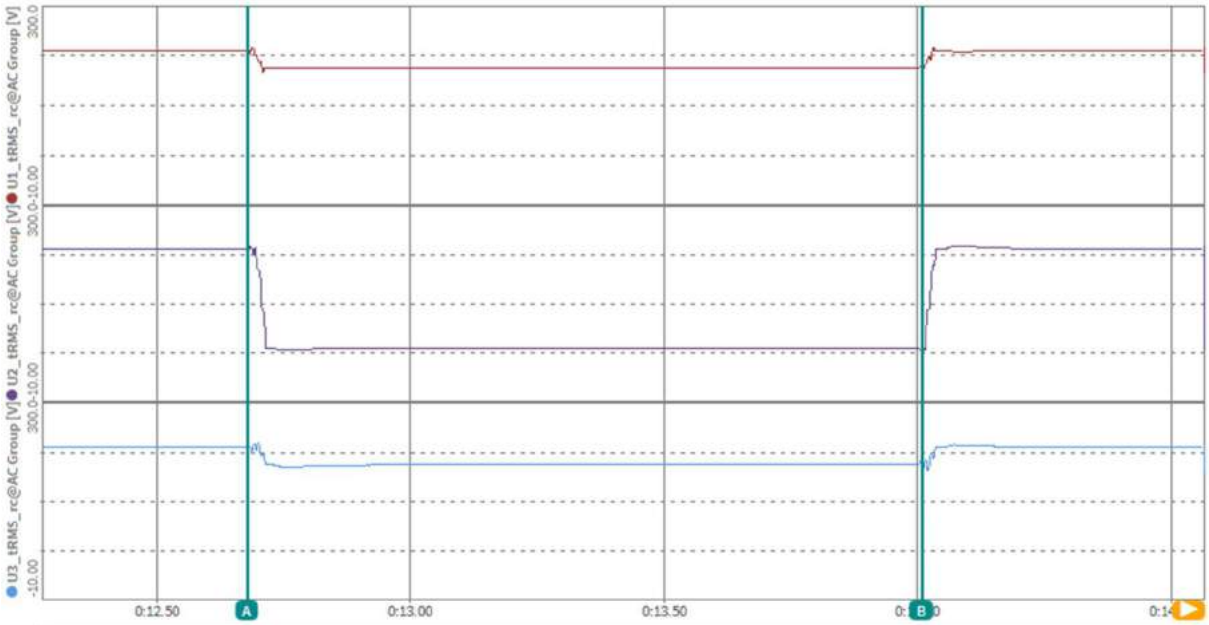
	A	B	Delta
Time [s]	0:12.542135	0:12.821863	0.279728
U1_tRMS_rc@AC Group [V]	229.3078	229.3747	0.066910
U2_tRMS_rc@AC Group [V]	229.7116	6.478228	-223.2334
U3_tRMS_rc@AC Group [V]	229.5138	229.2934	-0.220444

Test 2.A.1-Symmetrical fault (U/U_{nom} = 0,31); No load



	A	B	Delta
Time [s]	0:12.38008	0:13.70295	1.32287
U1_tRMS_rc@AC Group [V]	229.2560	71.08006	-158.1759
U2_tRMS_rc@AC Group [V]	229.8158	71.40251	-158.4133
U3_tRMS_rc@AC Group [V]	229.6058	71.24496	-158.3608

Test 2.D.1- Asymmetrical fault (U/U_{nom} = 0,31); No load

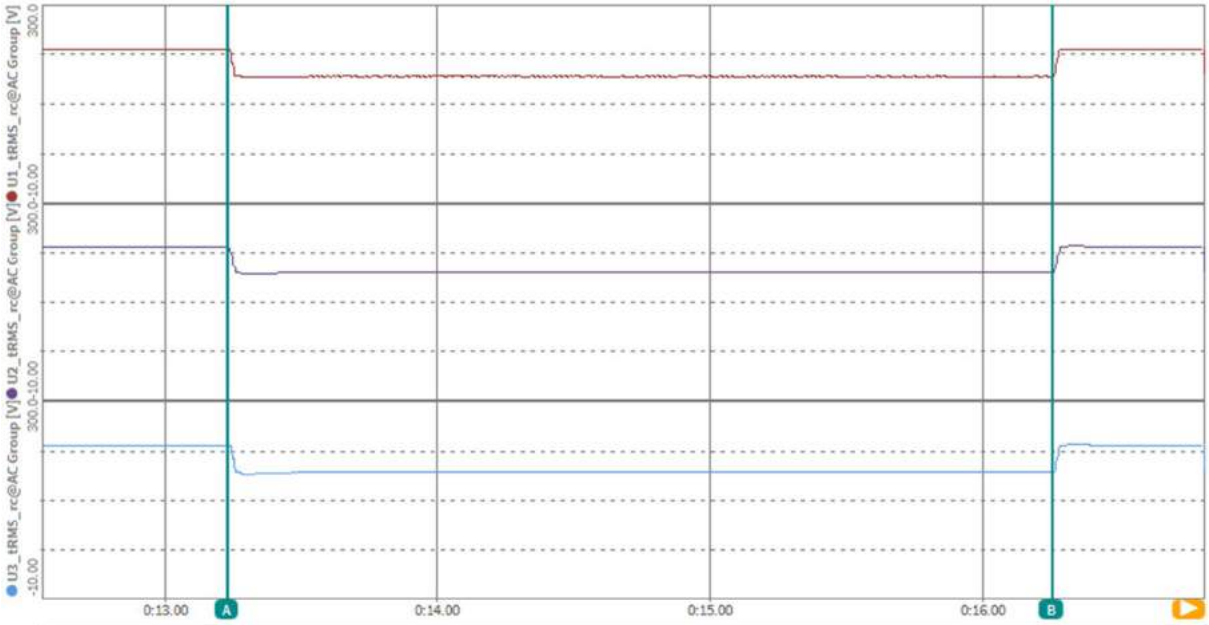


	A	B	Delta
Time [s]	0:12.68078	0:14.00901	1.32823
U1_tRMS_rc@AC Group [V]	229.3231	202.7313	-26.59186
U2_tRMS_rc@AC Group [V]	229.5351	71.03767	-158.4975
U3_tRMS_rc@AC Group [V]	229.6438	202.3705	-27.27336

Test 2.B.1- Single phase fault (U/U_{nom} = 0,31); No load

	A	B	Delta
Time [s]	0:12.74102	0:14.06888	1.32786
U1_tRMS_rc@AC Group [V]	229.1179	229.1921	0.074173
U2_tRMS_rc@AC Group [V]	229.6247	71.72462	-157.9001
U3_tRMS_rc@AC Group [V]	229.6343	229.5305	-0.103806

Test 3.A.1-Symmetrical fault (U/U_{nom} = 0,82); No load



	A	B	Delta
Time [s]	0:13.23122	0:16.25230	3.02108
U1_tRMS_rc@AC Group [V]	229.2144	187.9359	-41.27849
U2_tRMS_rc@AC Group [V]	229.8059	188.3589	-41.44699
U3_tRMS_rc@AC Group [V]	229.5495	188.3396	-41.20987

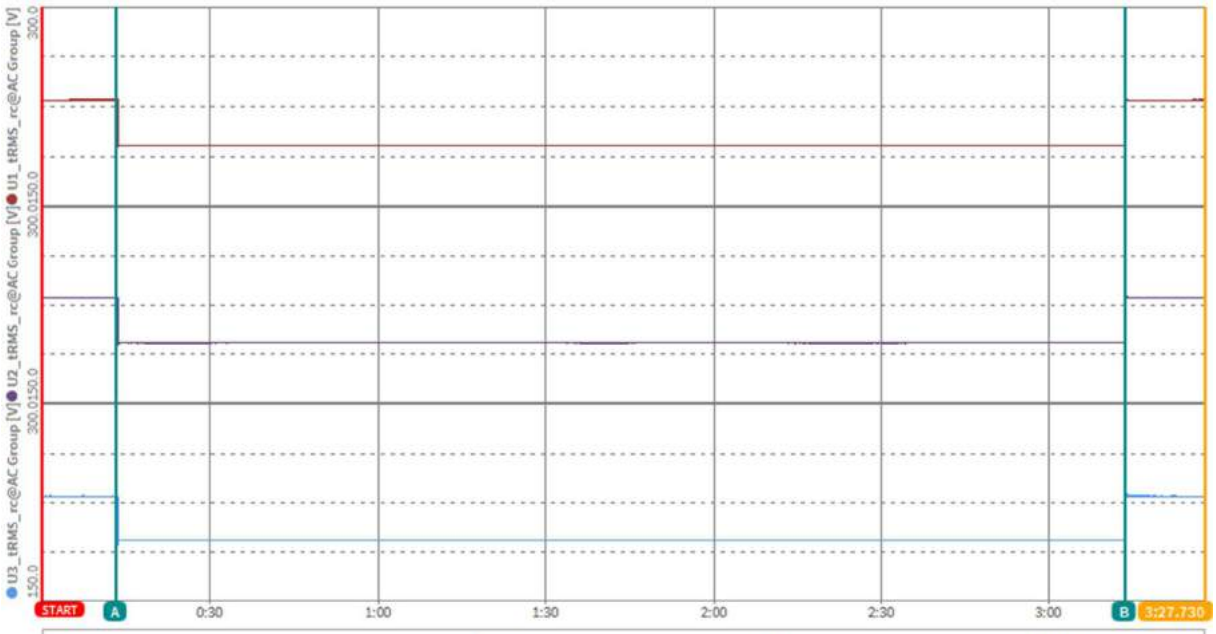
Test 3.D.1- Asymmetrical fault (U/U_{nom} = 0,82); No load

	A	B	Delta
Time [s]	0:11.77372	0:14.79596	3.02224
U1_tRMS_rc@AC Group [V]	229.1278	220.0166	-9.111191
U2_tRMS_rc@AC Group [V]	229.5298	188.2332	-41.29652
U3_tRMS_rc@AC Group [V]	229.6822	220.5210	-9.161209

Test 3.B.1- Single phase fault (U/U_{nom} = 0,82); No load

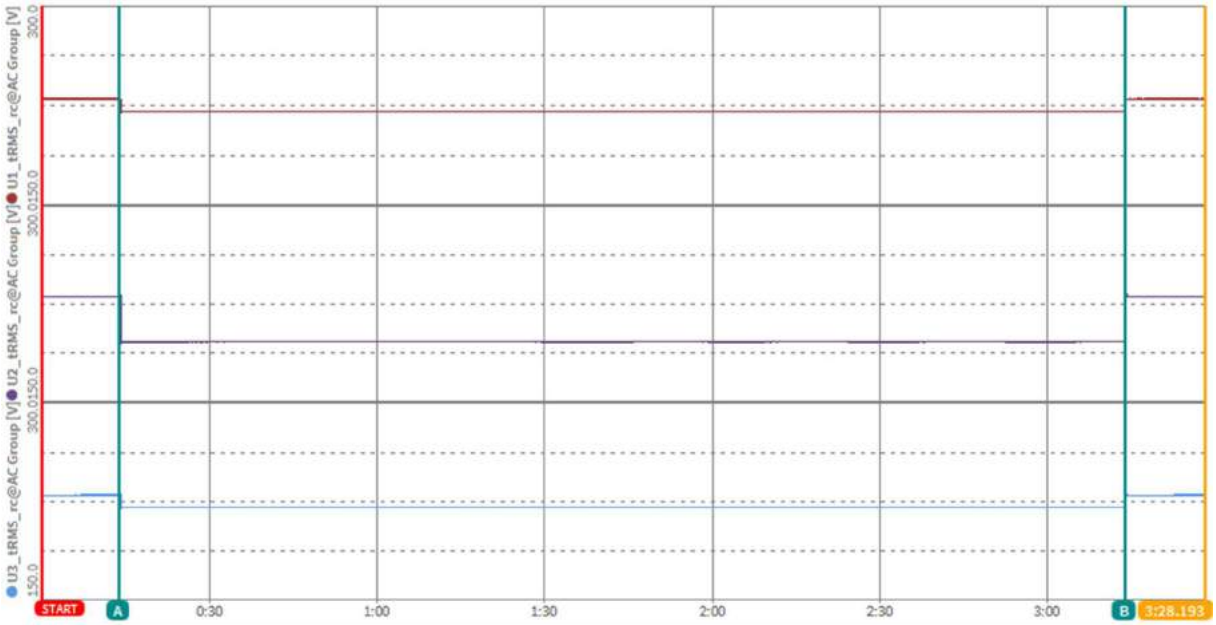
	A	B	Delta
Time [s]	0:13.13246	0:16.15789	3.02543
U1_tRMS_rc@AC Group [V]	229.1741	229.2446	0.070496
U2_tRMS_rc@AC Group [V]	229.6367	188.5324	-41.10428
U3_tRMS_rc@AC Group [V]	229.7560	229.5588	-0.197250

Test 4.A.1-Symmetrical fault (U/U_{nom} = 0,85); No load



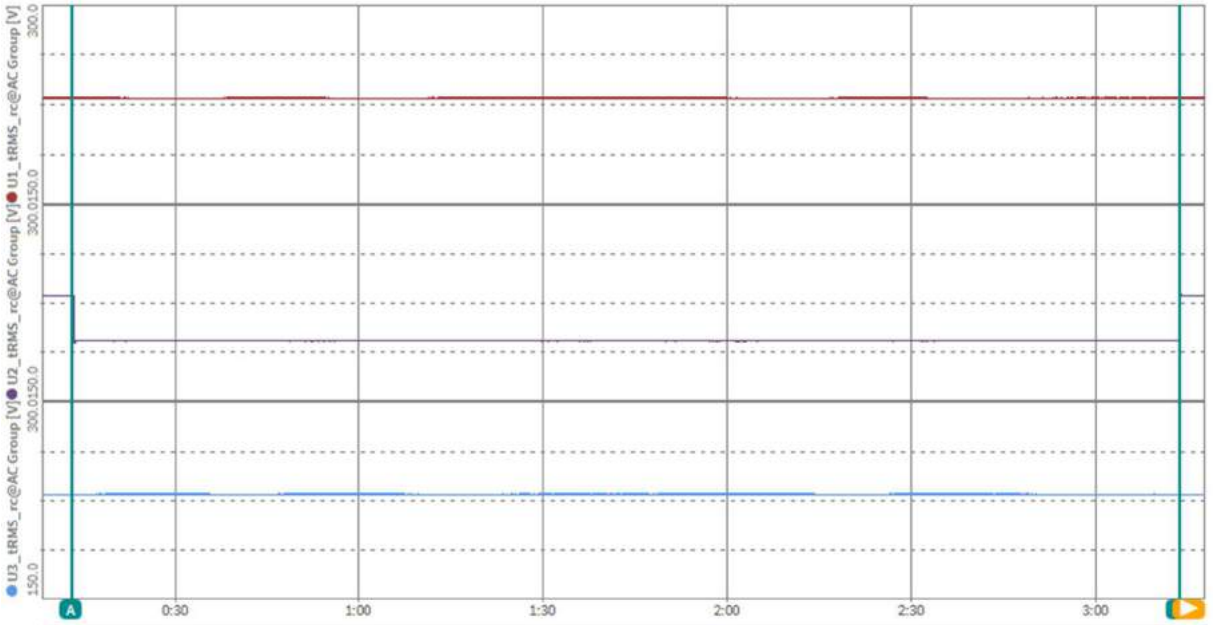
	A	B	Delta
Time [s]	0:13.270	3:13.439	3:00.169
U1_tRMS_rc@AC Group [V]	229.3705	194.7482	-34.62231
U2_tRMS_rc@AC Group [V]	229.5434	195.3108	-34.23256
U3_tRMS_rc@AC Group [V]	229.5484	195.2509	-34.29741

Test 4.D.1- Asymmetrical fault (U/U_{nom} = 0,85); No load



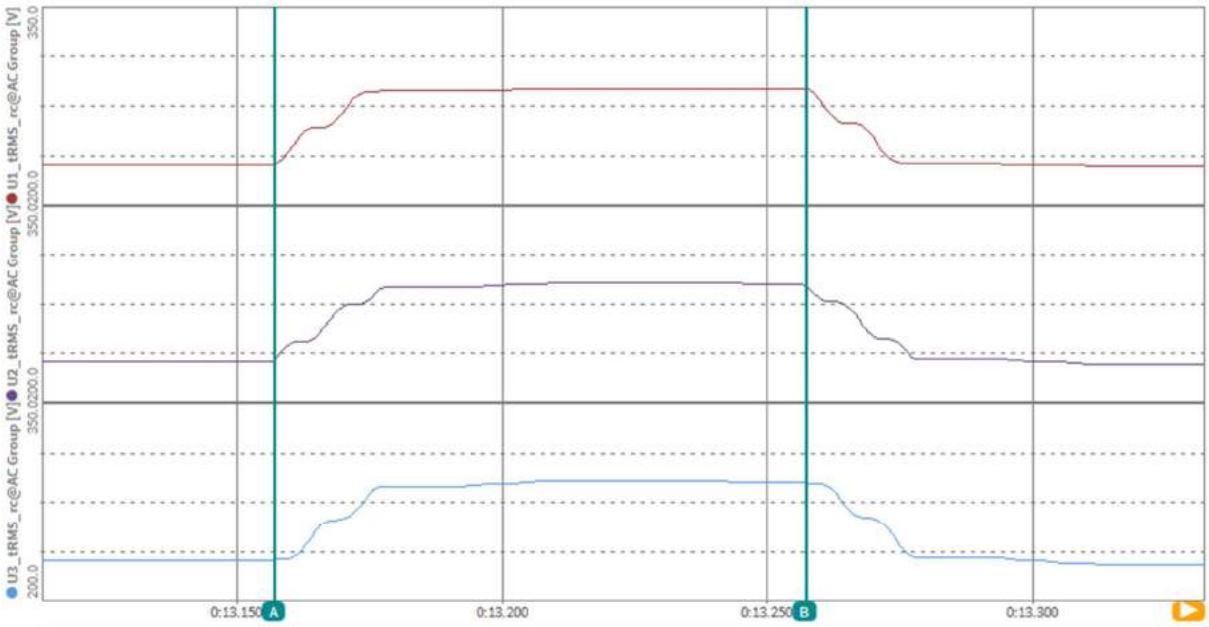
	A	B	Delta
Time [s]	0:13.811	3:13.871	3:00.059
U1_tRMS_rc@AC Group [V]	229.3402	220.1082	-9.232025
U2_tRMS_rc@AC Group [V]	229.4373	195.2345	-34.20271
U3_tRMS_rc@AC Group [V]	229.7007	220.3588	-9.341904

Test 4.B.1- Single phase fault (U/U_{nom} = 0,85); No load



	A	B	Delta
Time [s]	0:13.300	3:13.606	3:00.306
U1_tRMS_rc@AC Group [V]	229.3953	229.3322	-0.063110
U2_tRMS_rc@AC Group [V]	229.7153	195.3027	-34.41260
U3_tRMS_rc@AC Group [V]	229.7260	229.5557	-0.170303

Test OV1-Symmetrical fault (U/U_{nom} = 1,25); No load

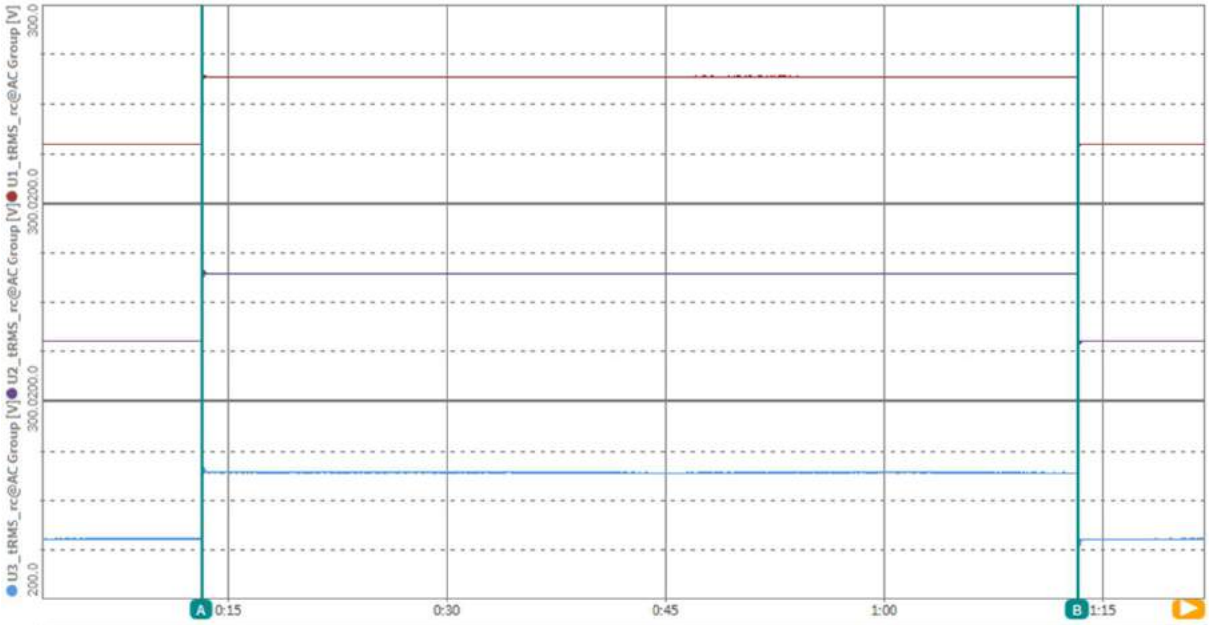


	A	B	Delta
Time [s]	0:13.157185	0:13.257198	0.100013
U1_tRMS_rc@AC Group [V]	229.3288	287.5114	58.18262
U2_tRMS_rc@AC Group [V]	229.7167	288.8061	59.08937
U3_tRMS_rc@AC Group [V]	229.4911	289.7094	60.21826

Test OV2-Symmetrical fault (U/U_{nom} = 1,20); No load

	A	B	Delta
Time [s]	0:13.38298	0:18.38402	5.00104
U1_tRMS_rc@AC Group [V]	229.1301	275.0826	45.95250
U2_tRMS_rc@AC Group [V]	229.6536	275.5694	45.91579
U3_tRMS_rc@AC Group [V]	229.8251	275.5255	45.70041

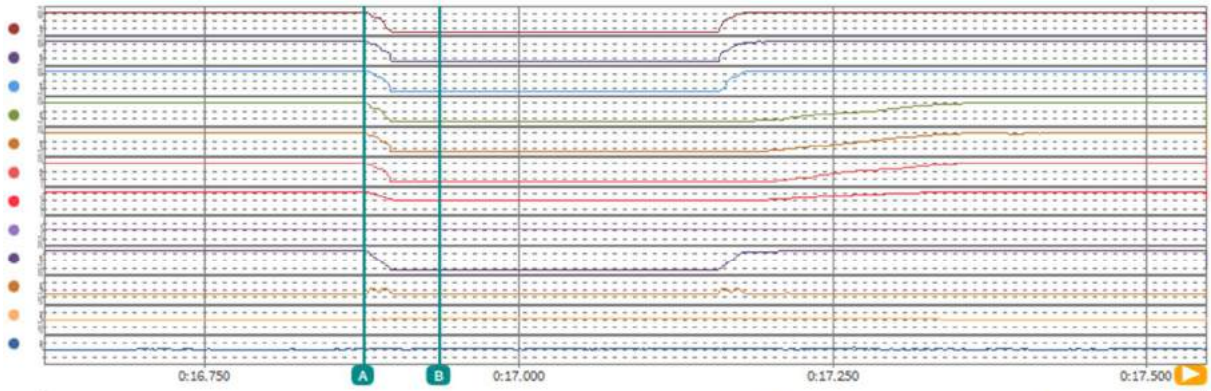
Test OV3-Symmetrical fault (U/U_{nom} = 1,15); No load



	A	B	Delta
Time [s]	0:13.2804	1:13.2835	1:00.0032
U1_tRMS_rc@AC Group [V]	229.1954	263.6967	34.50133
U2_tRMS_rc@AC Group [V]	229.4899	264.1842	34.69423
U3_tRMS_rc@AC Group [V]	229.8264	263.9324	34.10606

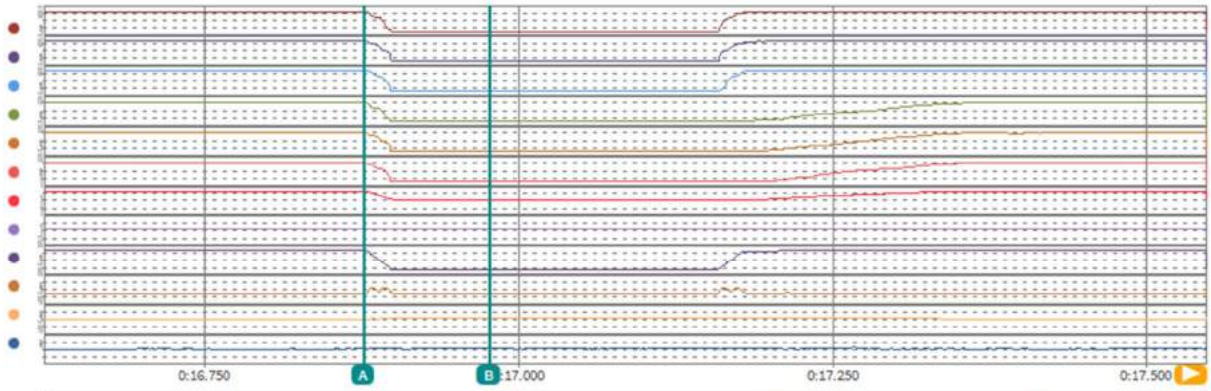
Test 1.A.1-Symmetrical fault (U/U_{nom} = 0,03); P = 100% ±5% P_n

0~60ms



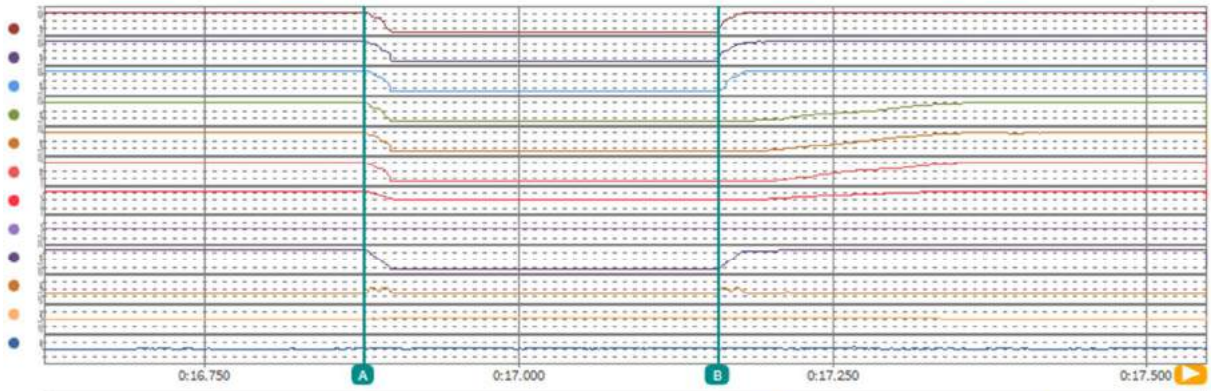
	A	B	Delta
Time [s]	0:16.876956	0:16.937193	0.060237
U1_tRMS_rc@AC Group [V]	229.2641	6.072367	-223.1917
U2_tRMS_rc@AC Group [V]	230.5468	6.092198	-224.4546
U3_tRMS_rc@AC Group [V]	231.0207	5.965218	-225.0555
I1_tRMS_rc@AC Group [A]	176.3407	0.130710	-176.2100
I2_tRMS_rc@AC Group [A]	175.6332	0.133975	-175.4992
I3_tRMS_rc@AC Group [A]	175.3728	0.178636	-175.1942
P_t_rc@AC Group [W]	121417.4	-4.571e-3	-121417.4
Q_t_rc@AC Group [var]	2067.464	2.675518	-2064.789
U_fund_SYM+_rc@AC Group [V]	398.8333	10.35794	-388.4753
U_fund_SYM-_rc@AC Group [V]	0.440502	0.119615	-0.320888
I_fund_Q_SYM+_rc@AC Group	-0.589352	0.091461	0.680813
I_fund_Q_SYM-_rc@AC Group [A]	0.108509	1.718e-3	-0.106791

0~100ms



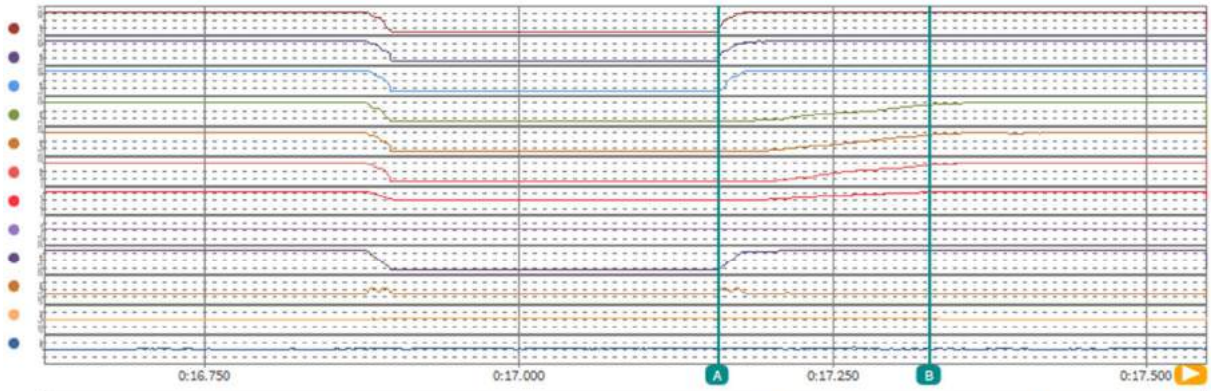
	A	B	Delta
Time [s]	0:16.876956	0:16.976972	0.100016
U1_tRMS_rc@AC Group [V]	229.2641	6.119106	-223.1450
U2_tRMS_rc@AC Group [V]	230.5468	6.126631	-224.4202
U3_tRMS_rc@AC Group [V]	231.0207	6.007740	-225.0130
I1_tRMS_rc@AC Group [A]	176.3407	0.150416	-176.1903
I2_tRMS_rc@AC Group [A]	175.6332	0.134020	-175.4991
I3_tRMS_rc@AC Group [A]	175.3728	0.180291	-175.1925
P_t_rc@AC Group [W]	121417.4	-9.383e-3	-121417.4
Q_t_rc@AC Group [var]	2067.464	2.824620	-2064.639
U_fund_SYM+_rc@AC Group [V]	398.8333	10.33883	-388.4944
U_fund_SYM-_rc@AC Group [V]	0.440502	0.095336	-0.345166
I_fund_Q_SYM+_rc@AC Group	-0.589352	0.091868	0.681221
I_fund_Q_SYM-_rc@AC Group [A]	0.108509	1.360e-3	-0.107149

Duration time



	A	B	Delta
Time [s]	0:16.876956	0:17.158820	0.281864
U1_tRMS_rc@AC Group [V]	229.2641	6.594413	-222.6697
U2_tRMS_rc@AC Group [V]	230.5468	6.030441	-224.5163
U3_tRMS_rc@AC Group [V]	231.0207	6.248352	-224.7724
I1_tRMS_rc@AC Group [A]	176.3407	0.137672	-176.2030
I2_tRMS_rc@AC Group [A]	175.6332	0.137237	-175.4959
I3_tRMS_rc@AC Group [A]	175.3728	0.169465	-175.2034
P_t_rc@AC Group [W]	121417.4	-0.053997	-121417.5
Q_t_rc@AC Group [var]	2067.464	2.793819	-2064.670
U_fund_SYM+_rc@AC Group [V]	398.8333	10.26076	-388.5725
U_fund_SYM-_rc@AC Group [V]	0.440502	0.114898	-0.325604
I_fund_Q_SYM+_rc@AC Group	-0.589352	0.092057	0.681409
I_fund_Q_SYM-_rc@AC Group [A]	0.108509	1.906e-3	-0.106603

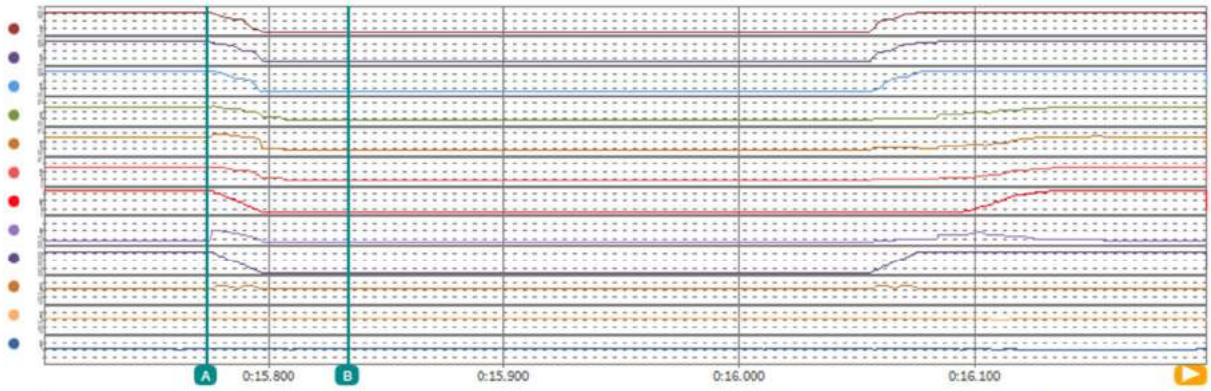
Recovery time



	A	B	Delta
Time [s]	0:17.158820	0:17.327029	0.168209
U1_tRMS_rc@AC Group [V]	6.594413	231.7642	225.1698
U2_tRMS_rc@AC Group [V]	6.030441	232.6754	226.6449
U3_tRMS_rc@AC Group [V]	6.248352	232.5749	226.3265
I1_tRMS_rc@AC Group [A]	0.137672	160.2028	160.0652
I2_tRMS_rc@AC Group [A]	0.137237	155.7912	155.6540
I3_tRMS_rc@AC Group [A]	0.169465	157.5709	157.4014
P_t_rc@AC Group [W]	-0.053997	109930.6	109930.6
Q_t_rc@AC Group [var]	2.793819	4559.061	4556.267
U_fund_SYM+_rc@AC Group [V]	10.26076	402.3933	392.1325
U_fund_SYM-_rc@AC Group [V]	0.114898	0.278298	0.163400
I_fund_Q_SYM+_rc@AC Group	0.092057	0.459010	0.366953
I_fund_Q_SYM-_rc@AC Group [A]	1.906e-3	2.047600	2.045694

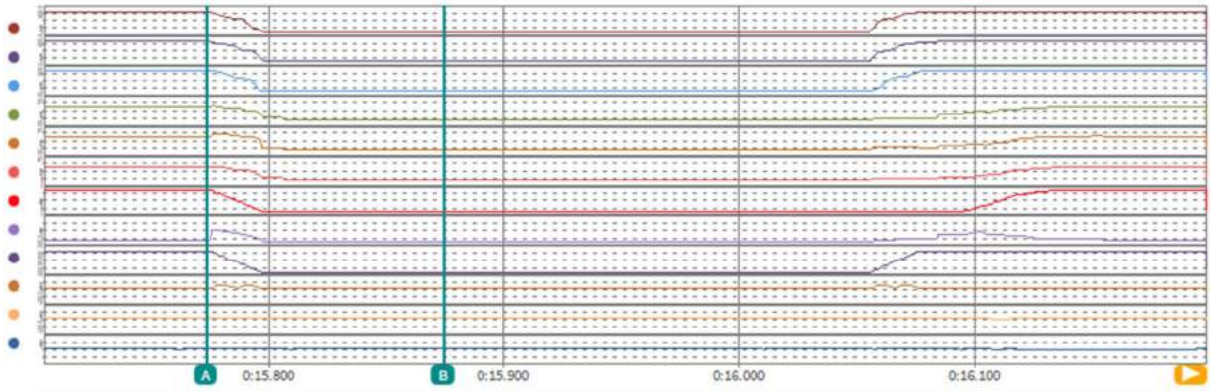
Test 1.A.2-Symmetrical fault (U/U_{nom} = 0,03); P = 20% ±5% P_n

0~60ms



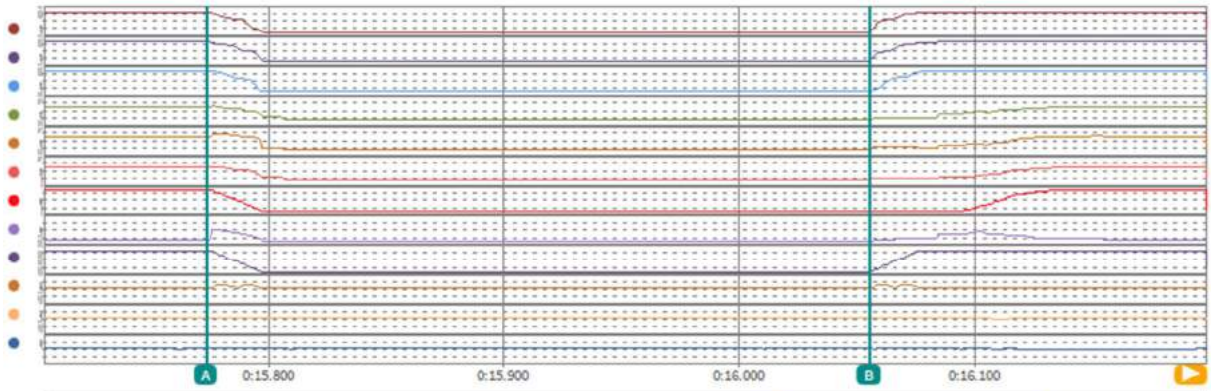
	A	B	Delta
Time [s]	0:15.7740019	0:15.8340034	0.0600015
U1_tRMS_rc@AC Group [V]	229.3711	6.145784	-223.2254
U2_tRMS_rc@AC Group [V]	229.9573	6.033699	-223.9236
U3_tRMS_rc@AC Group [V]	229.9369	6.035419	-223.9015
I1_tRMS_rc@AC Group [A]	35.97564	0.133275	-35.84237
I2_tRMS_rc@AC Group [A]	36.00850	0.137602	-35.87089
I3_tRMS_rc@AC Group [A]	35.49951	0.167555	-35.33195
P_t_rc@AC Group [W]	24667.16	-0.026122	-24667.18
Q_t_rc@AC Group [var]	1168.901	2.660470	-1166.240
U_fund_SYM+_rc@AC Group [V]	397.9414	10.33995	-387.6015
U_fund_SYM-_rc@AC Group [V]	0.291913	0.136751	-0.155162
I_fund_Q_SYM+_rc@AC Group	1.104383	0.091281	-1.013102
I_fund_Q_SYM-_rc@AC Group [A]	0.287752	6.630e-4	-0.287089

0~100ms



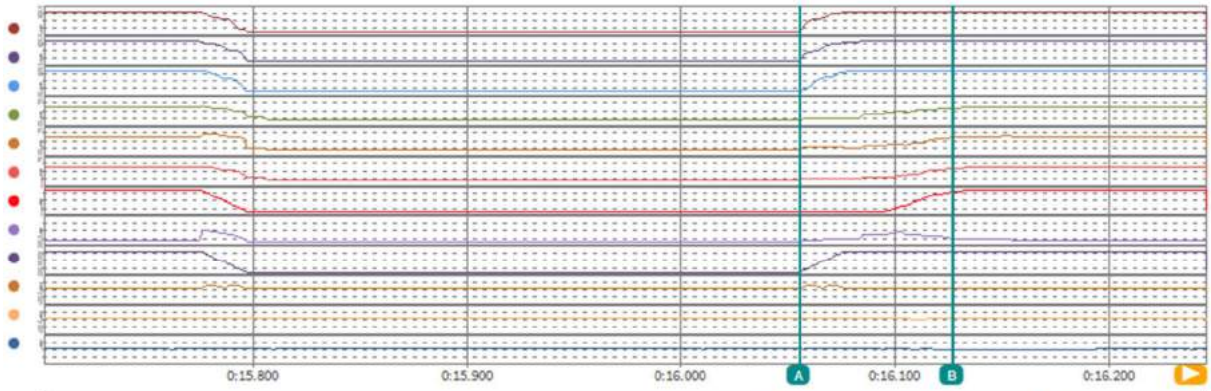
	A	B	Delta
Time [s]	0:15.7740019	0:15.8746105	0.1006087
U1_tRMS_rc@AC Group [V]	229.3711	6.225848	-223.1453
U2_tRMS_rc@AC Group [V]	229.9573	6.042203	-223.9151
U3_tRMS_rc@AC Group [V]	229.9369	6.132253	-223.8047
I1_tRMS_rc@AC Group [A]	35.97564	0.136046	-35.83960
I2_tRMS_rc@AC Group [A]	36.00850	0.130075	-35.87842
I3_tRMS_rc@AC Group [A]	35.49951	0.189289	-35.31022
P_t_rc@AC Group [W]	24667.16	-0.015382	-24667.17
Q_t_rc@AC Group [var]	1168.901	2.793666	-1166.107
U_fund_SYM+_rc@AC Group [V]	397.9414	10.36014	-387.5813
U_fund_SYM-_rc@AC Group [V]	0.291913	0.159522	-0.132391
I_fund_Q_SYM+_rc@AC Group	1.104383	0.091179	-1.013203
I_fund_Q_SYM-_rc@AC Group [A]	0.287752	8.465e-4	-0.286905

Duration time



	A	B	Delta
Time [s]	0:15.7740019	0:16.0552213	0.2812194
U1_tRMS_rc@AC Group [V]	229.3711	6.571301	-222.7998
U2_tRMS_rc@AC Group [V]	229.9573	6.106597	-223.8507
U3_tRMS_rc@AC Group [V]	229.9369	6.454063	-223.4828
I1_tRMS_rc@AC Group [A]	35.97564	0.129486	-35.84616
I2_tRMS_rc@AC Group [A]	36.00850	0.131838	-35.87666
I3_tRMS_rc@AC Group [A]	35.49951	0.142030	-35.35748
P_t_rc@AC Group [W]	24667.16	-0.049039	-24667.21
Q_t_rc@AC Group [var]	1168.901	2.572173	-1166.329
U_fund_SYM+_rc@AC Group [V]	397.9414	10.28329	-387.6581
U_fund_SYM-_rc@AC Group [V]	0.291913	0.047044	-0.244870
I_fund_Q_SYM+_rc@AC Group	1.104383	0.091740	-1.012642
I_fund_Q_SYM-_rc@AC Group [A]	0.287752	-2.718e-4	-0.288023

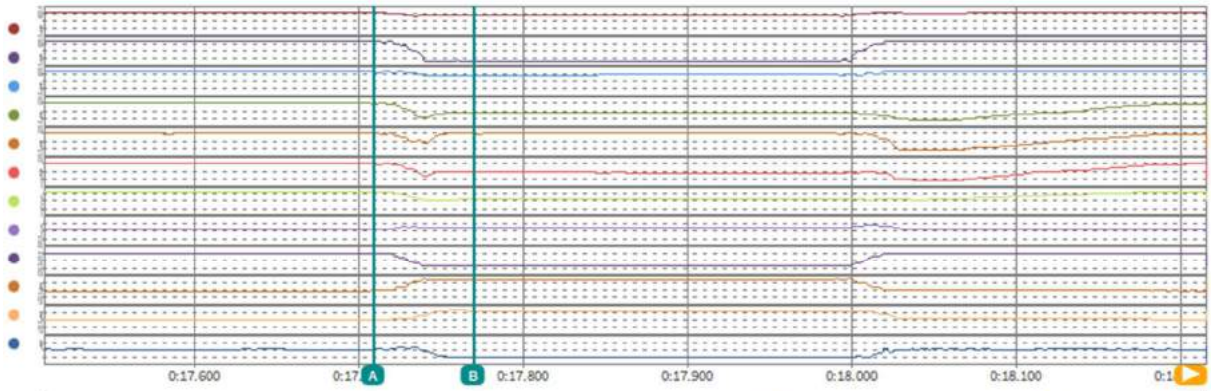
Recovery time



	A	B	Delta
Time [s]	0:16.0552213	0:16.1267141	0.0714929
U1_tRMS_rc@AC Group [V]	6.571301	234.5117	227.9404
U2_tRMS_rc@AC Group [V]	6.106597	231.9021	225.7955
U3_tRMS_rc@AC Group [V]	6.454063	231.5744	225.1203
I1_tRMS_rc@AC Group [A]	0.129486	31.69463	31.56515
I2_tRMS_rc@AC Group [A]	0.131838	34.70821	34.57638
I3_tRMS_rc@AC Group [A]	0.142030	32.47131	32.32928
P_t_rc@AC Group [W]	-0.049039	22672.79	22672.84
Q_t_rc@AC Group [var]	2.572173	3872.891	3870.319
U_fund_SYM+_rc@AC Group [V]	10.28329	402.9589	392.6756
U_fund_SYM-_rc@AC Group [V]	0.047044	1.809798	1.762754
I_fund_Q_SYM+_rc@AC Group	0.091740	2.150323	2.058583
I_fund_Q_SYM-_rc@AC Group [A]	-2.718e-4	-1.544110	-1.543838

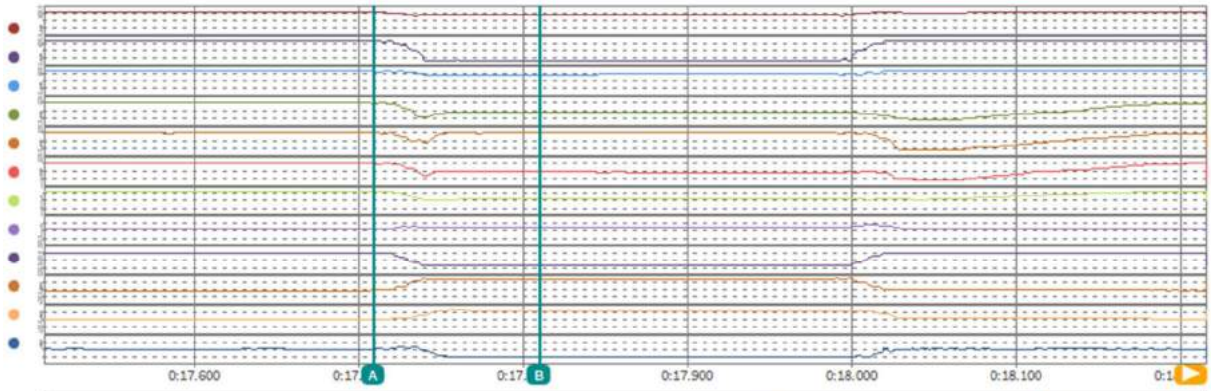
Test 1.D.1- Asymmetrical fault (U/U_{nom} = 0,03); P = 100% ±5% P_n

0~60ms



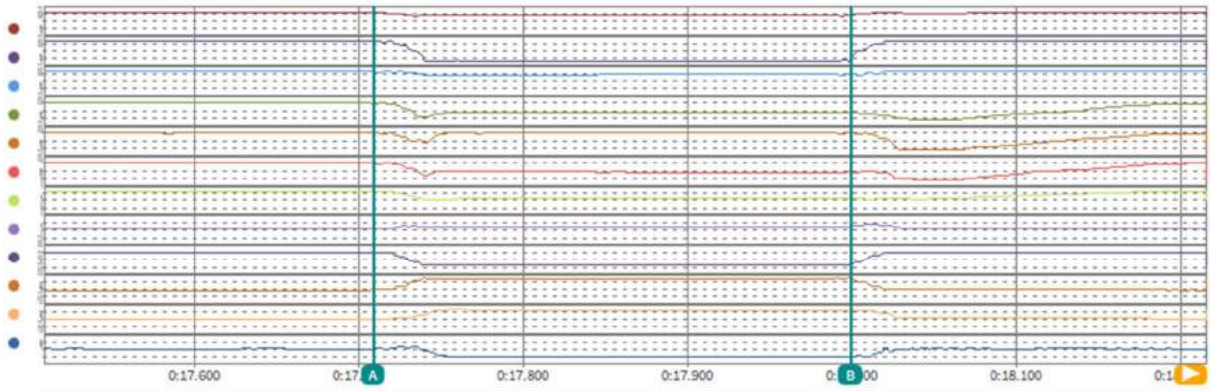
	A	B	Delta
Time [s]	0:17.709455	0:17.770212	0.060757
U1_tRMS_rc@AC Group [V]	229.6690	202.1956	-27.47345
U2_tRMS_rc@AC Group [V]	230.5319	14.07130	-216.4606
U3_tRMS_rc@AC Group [V]	231.2208	188.6638	-42.55704
I1_tRMS_rc@AC Group [A]	176.2811	82.59665	-93.68440
I2_tRMS_rc@AC Group [A]	174.9391	175.5058	0.566727
I3_tRMS_rc@AC Group [A]	175.4658	94.14617	-81.31962
P_t_rc@AC Group [W]	121369.5	663.3550	-120706.2
Q_t_rc@AC Group [var]	2039.975	36926.29	34886.31
U_fund_SYM+_rc@AC Group [V]	399.1750	205.2229	-193.9521
U_fund_SYM-_rc@AC Group [V]	0.368407	185.9230	185.5546
I_fund_Q_SYM+_rc@AC Group	-0.620622	91.96856	92.58918
I_fund_Q_SYM-_rc@AC Group [A]	-0.476838	-82.81250	-82.33566

0~100ms



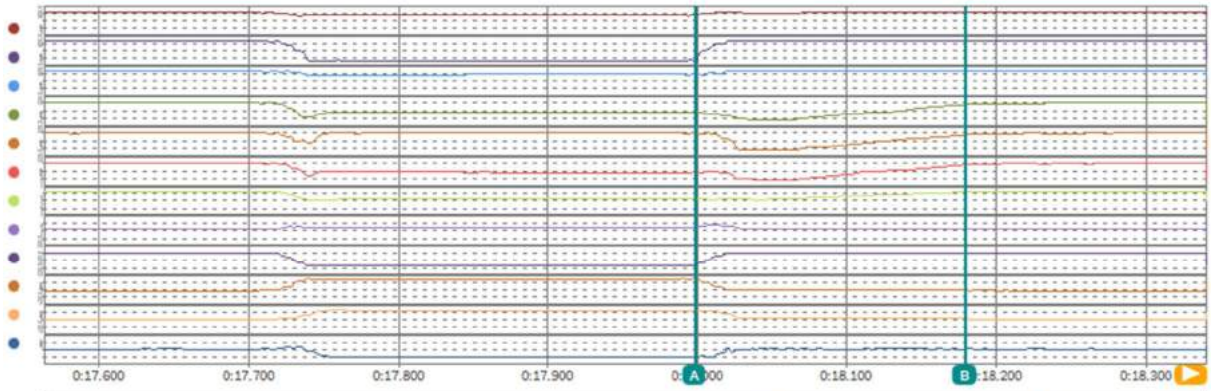
	A	B	Delta
Time [s]	0:17.709455	0:17.810138	0.100683
U1_tRMS_rc@AC Group [V]	229.6690	202.2282	-27.44087
U2_tRMS_rc@AC Group [V]	230.5319	14.11031	-216.4216
U3_tRMS_rc@AC Group [V]	231.2208	191.3021	-39.91872
I1_tRMS_rc@AC Group [A]	176.2811	83.03929	-93.24176
I2_tRMS_rc@AC Group [A]	174.9391	177.0639	2.124741
I3_tRMS_rc@AC Group [A]	175.4658	94.71957	-80.74622
P_t_rc@AC Group [W]	121369.5	342.5995	-121026.9
Q_t_rc@AC Group [var]	2039.975	37409.79	35369.82
U_fund_SYM+_rc@AC Group [V]	399.1750	206.9266	-192.2484
U_fund_SYM-_rc@AC Group [V]	0.368407	186.7091	186.3407
I_fund_Q_SYM+_rc@AC Group	-0.620622	91.54842	92.16904
I_fund_Q_SYM-_rc@AC Group [A]	-0.476838	-85.17455	-84.69771

Duration time



	A	B	Delta
Time [s]	0:17.709455	0:17.999353	0.289898
U1_tRMS_rc@AC Group [V]	229.6690	206.0478	-23.62120
U2_tRMS_rc@AC Group [V]	230.5319	14.31723	-216.2147
U3_tRMS_rc@AC Group [V]	231.2208	204.5795	-26.64136
I1_tRMS_rc@AC Group [A]	176.2811	88.17294	-88.10811
I2_tRMS_rc@AC Group [A]	174.9391	182.4731	7.534012
I3_tRMS_rc@AC Group [A]	175.4658	94.64542	-80.82037
P_t_rc@AC Group [W]	121369.5	605.0940	-120764.5
Q_t_rc@AC Group [var]	2039.975	40138.30	38098.33
U_fund_SYM+_rc@AC Group [V]	399.1750	213.1054	-186.0695
U_fund_SYM-_rc@AC Group [V]	0.368407	193.5903	193.2219
I_fund_Q_SYM+_rc@AC Group	-0.620622	92.21959	92.84021
I_fund_Q_SYM-_rc@AC Group [A]	-0.476838	-88.28568	-87.80884

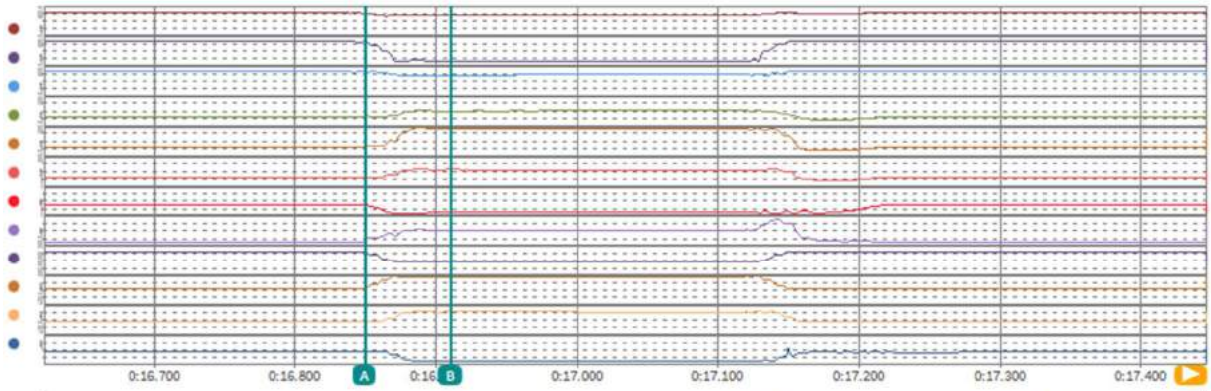
Recovery time



	A	B	Delta
Time [s]	0:17.998485	0:18.179167	0.180682
U1_tRMS_rc@AC Group [V]	201.7330	230.3920	28.65901
U2_tRMS_rc@AC Group [V]	14.65742	232.7454	218.0880
U3_tRMS_rc@AC Group [V]	200.0444	234.5383	34.49397
I1_tRMS_rc@AC Group [A]	86.29925	160.3476	74.04836
I2_tRMS_rc@AC Group [A]	179.0278	157.5313	-21.49654
I3_tRMS_rc@AC Group [A]	93.08826	161.3417	68.25343
P_t_rc@AC Group [W]	591.4274	111311.2	110719.7
Q_t_rc@AC Group [var]	38650.75	5527.250	-33123.50
U_fund_SYM+_rc@AC Group [V]	208.9027	402.7831	193.8804
U_fund_SYM-_rc@AC Group [V]	188.8539	1.743822	-187.1101
I_fund_Q_SYM+_rc@AC Group	90.53413	0.326603	-90.20752
I_fund_Q_SYM-_rc@AC Group [A]	-86.56137	-2.254002	84.30737

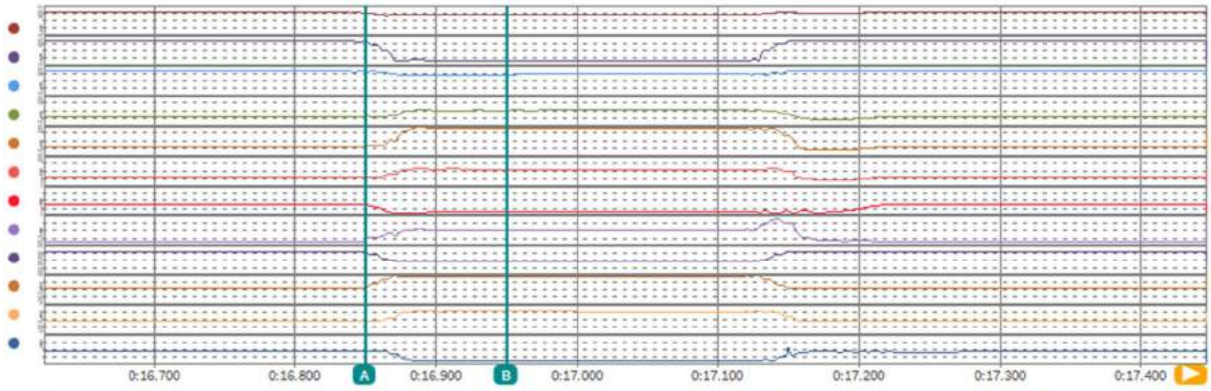
Test 1.D.2- Asymmetrical fault (U/U_{nom} = 0,03); P = 20% ±5% P_n

0~60ms



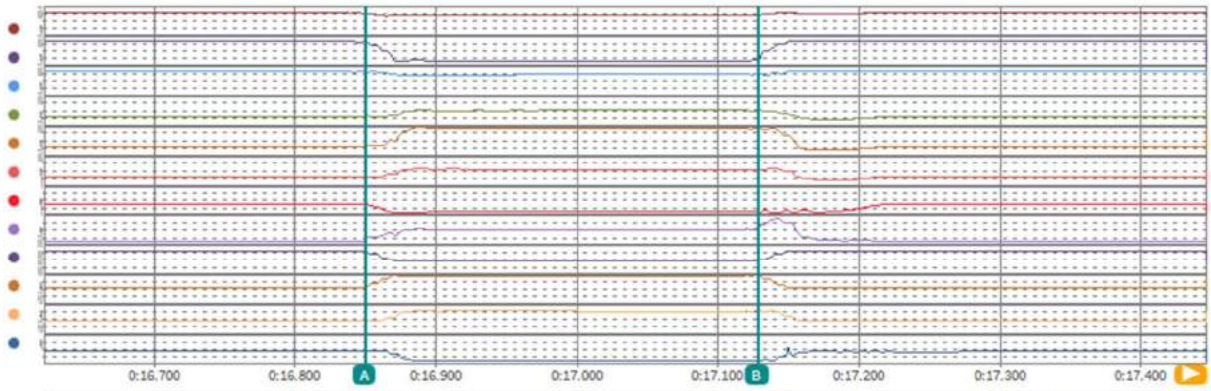
	A	B	Delta
Time [s]	0:16.8500095	0:16.9107226	0.0607131
U1_tRMS_rc@AC Group [V]	221.3199	203.5955	-17.72437
U2_tRMS_rc@AC Group [V]	230.5934	14.11540	-216.4780
U3_tRMS_rc@AC Group [V]	236.9067	189.2043	-47.70238
I1_tRMS_rc@AC Group [A]	34.86538	82.32285	47.45748
I2_tRMS_rc@AC Group [A]	35.77095	176.9850	141.2141
I3_tRMS_rc@AC Group [A]	36.46529	95.62049	59.15520
P_t_rc@AC Group [W]	24568.73	276.2502	-24292.48
Q_t_rc@AC Group [var]	1313.396	37349.57	36036.17
U_fund_SYM+_rc@AC Group [V]	393.1715	206.5090	-186.6625
U_fund_SYM-_rc@AC Group [V]	16.02645	186.5403	170.5139
I_fund_Q_SYM+_rc@AC Group	1.074650	91.60252	90.52787
I_fund_Q_SYM-_rc@AC Group [A]	0.012630	-85.23528	-85.24791

0~100ms



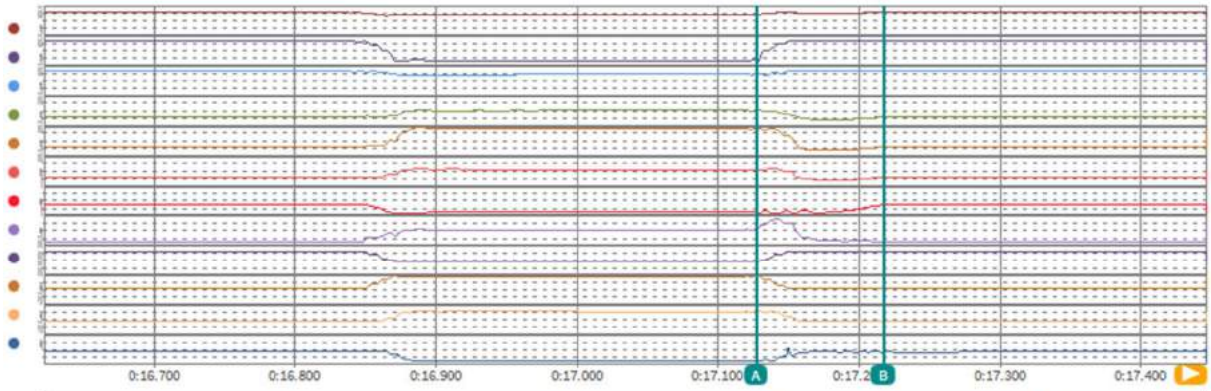
	A	B	Delta
Time [s]	0:16.8500095	0:16.9501937	0.1001841
U1_tRMS_rc@AC Group [V]	221.3199	202.2776	-19.04222
U2_tRMS_rc@AC Group [V]	230.5934	14.25393	-216.3394
U3_tRMS_rc@AC Group [V]	236.9067	193.3933	-43.51340
I1_tRMS_rc@AC Group [A]	34.86538	83.76761	48.90223
I2_tRMS_rc@AC Group [A]	35.77095	176.3474	140.5765
I3_tRMS_rc@AC Group [A]	36.46529	93.19646	56.73117
P_t_rc@AC Group [W]	24568.73	630.0618	-23938.67
Q_t_rc@AC Group [var]	1313.396	37476.23	36162.84
U_fund_SYM+_rc@AC Group [V]	393.1715	207.8960	-185.2755
U_fund_SYM-_rc@AC Group [V]	16.02645	187.8173	171.7909
I_fund_Q_SYM+_rc@AC Group	1.074650	91.12070	90.04605
I_fund_Q_SYM-_rc@AC Group [A]	0.012630	-84.83118	-84.84381

Duration time



	A	B	Delta
Time [s]	0:16.8500095	0:17.1281704	0.2781609
U1_tRMS_rc@AC Group [V]	221.3199	199.2583	-22.06152
U2_tRMS_rc@AC Group [V]	230.5934	14.94873	-215.6446
U3_tRMS_rc@AC Group [V]	236.9067	197.7683	-39.13840
I1_tRMS_rc@AC Group [A]	34.86538	85.49045	50.62507
I2_tRMS_rc@AC Group [A]	35.77095	177.1113	141.3404
I3_tRMS_rc@AC Group [A]	36.46529	91.97939	55.51410
P_t_rc@AC Group [W]	24568.73	656.1775	-23912.56
Q_t_rc@AC Group [var]	1313.396	37867.20	36553.80
U_fund_SYM+_rc@AC Group [V]	393.1715	206.7166	-186.4549
U_fund_SYM-_rc@AC Group [V]	16.02645	186.3611	170.3346
I_fund_Q_SYM+_rc@AC Group	1.074650	89.42294	88.34829
I_fund_Q_SYM-_rc@AC Group [A]	0.012630	-85.70107	-85.71370

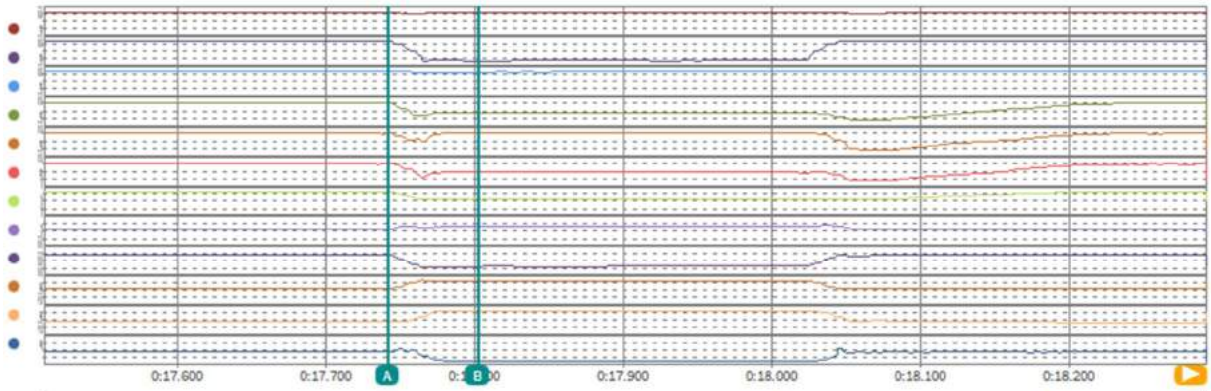
Recovery time



	A	B	Delta
Time [s]	0:17.1273075	0:17.2173825	0.0900750
U1_tRMS_rc@AC Group [V]	199.2583	228.2098	28.95148
U2_tRMS_rc@AC Group [V]	14.94873	231.0615	216.1128
U3_tRMS_rc@AC Group [V]	197.7683	238.9405	41.17218
I1_tRMS_rc@AC Group [A]	85.49045	34.16554	-51.32491
I2_tRMS_rc@AC Group [A]	177.1113	30.49860	-146.6127
I3_tRMS_rc@AC Group [A]	91.97939	32.28563	-59.69376
P_t_rc@AC Group [W]	656.1775	22278.95	21622.77
Q_t_rc@AC Group [var]	37867.20	3539.205	-34327.99
U_fund_SYM+_rc@AC Group [V]	206.7166	403.0950	196.3784
U_fund_SYM-_rc@AC Group [V]	186.3611	5.017005	-181.3441
I_fund_Q_SYM+_rc@AC Group	89.42294	0.706782	-88.71616
I_fund_Q_SYM-_rc@AC Group [A]	-85.70107	-1.918631	83.78243

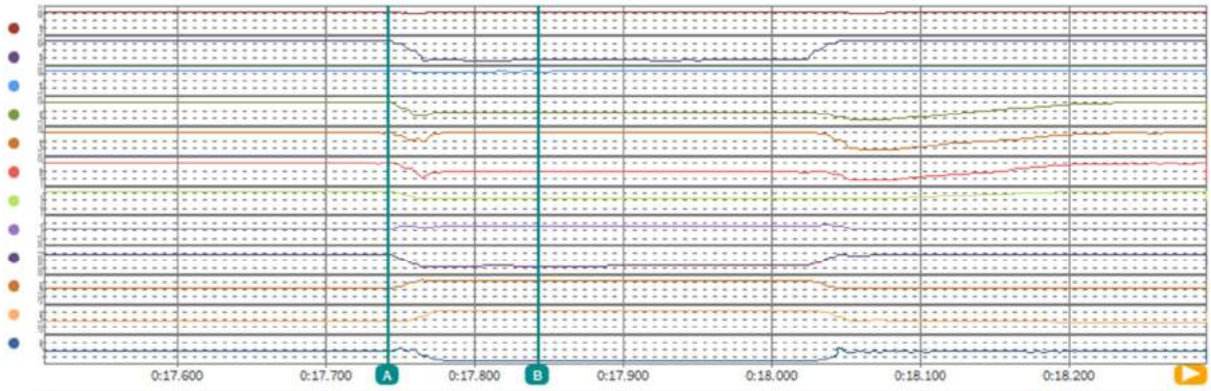
Test 1.B.1- Single phase fault (U/U_{nom} = 0,03); P = 100% ±5% P_n

0~60ms



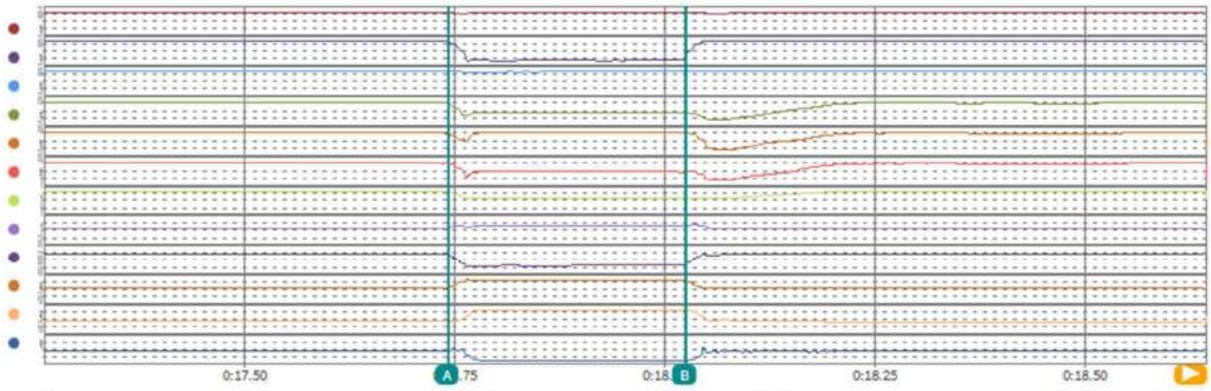
	A	B	Delta
Time [s]	0:17.742031	0:17.802438	0.060407
U1_tRMS_rc@AC Group [V]	229.3085	230.9317	1.623199
U2_tRMS_rc@AC Group [V]	230.2861	14.37192	-215.9142
U3_tRMS_rc@AC Group [V]	231.8414	225.4226	-6.418823
I1_tRMS_rc@AC Group [A]	175.9476	85.82578	-90.12183
I2_tRMS_rc@AC Group [A]	174.7433	177.1156	2.372299
I3_tRMS_rc@AC Group [A]	175.9416	93.47276	-82.46888
P_t_rc@AC Group [W]	121361.6	2550.121	-118811.5
Q_t_rc@AC Group [var]	1980.891	43361.33	41380.44
U_fund_SYM+_rc@AC Group [V]	399.1705	270.4998	-128.6707
U_fund_SYM-_rc@AC Group [V]	1.182745	122.4741	121.2914
I_fund_Q_SYM+_rc@AC Group	-0.672569	93.32604	93.99861
I_fund_Q_SYM-_rc@AC Group [A]	-0.733801	-83.52877	-82.79497

0~100ms



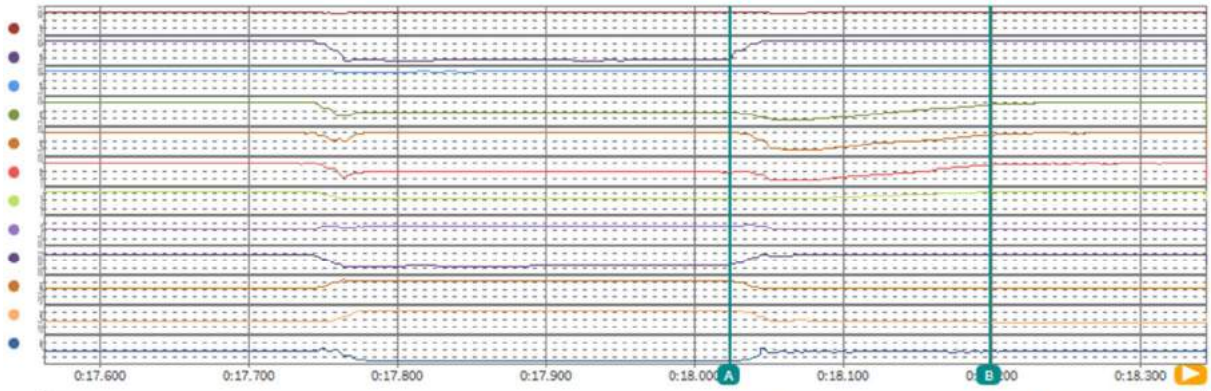
	A	B	Delta
Time [s]	0:17.742031	0:17.842741	0.100710
U1_tRMS_rc@AC Group [V]	229.3085	229.8108	0.502258
U2_tRMS_rc@AC Group [V]	230.2861	14.49823	-215.7879
U3_tRMS_rc@AC Group [V]	231.8414	226.5543	-5.287064
I1_tRMS_rc@AC Group [A]	175.9476	84.69035	-91.25726
I2_tRMS_rc@AC Group [A]	174.7433	176.6254	1.882141
I3_tRMS_rc@AC Group [A]	175.9416	93.55076	-82.39088
P_t_rc@AC Group [W]	121361.6	1974.741	-119386.9
Q_t_rc@AC Group [var]	1980.891	43172.70	41191.81
U_fund_SYM+_rc@AC Group [V]	399.1705	270.5608	-128.6097
U_fund_SYM-_rc@AC Group [V]	1.182745	122.2223	121.0396
I_fund_Q_SYM+_rc@AC Group	-0.672569	92.27991	92.95248
I_fund_Q_SYM-_rc@AC Group [A]	-0.733801	-84.16698	-83.43318

Duration time



Time [s]	A 0:17.742031	B 0:18.024229	Delta 0.282198
U1_tRMS_rc@AC Group [V]	229.3085	229.3056	-2.960e-3
U2_tRMS_rc@AC Group [V]	230.2861	14.76505	-215.5211
U3_tRMS_rc@AC Group [V]	231.8414	229.4105	-2.430862
I1_tRMS_rc@AC Group [A]	175.9476	85.96272	-89.98489
I2_tRMS_rc@AC Group [A]	174.7433	177.0466	2.303391
I3_tRMS_rc@AC Group [A]	175.9416	92.61409	-83.32755
P_t_rc@AC Group [W]	121361.6	2023.284	-119338.3
Q_t_rc@AC Group [var]	1980.891	43525.48	41544.59
U_fund_SYM+_rc@AC Group [V]	399.1705	272.0331	-127.1375
U_fund_SYM-_rc@AC Group [V]	1.182745	122.7899	121.6072
I_fund_Q_SYM+_rc@AC Group	-0.672569	92.10346	92.77603
I_fund_Q_SYM-_rc@AC Group [A]	-0.733801	-84.72020	-83.98640

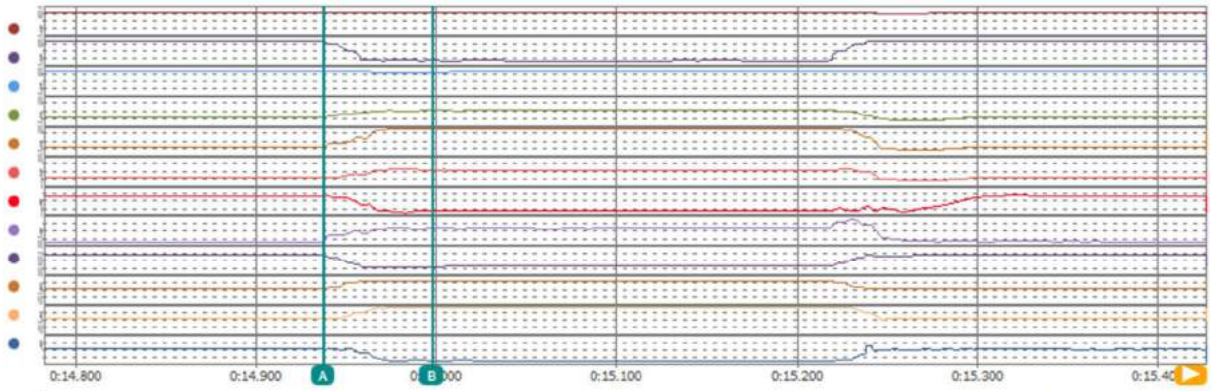
Recovery time



Time [s]	A 0:18.023342	B 0:18.197989	Delta 0.174647
U1_tRMS_rc@AC Group [V]	229.3073	230.4632	1.155914
U2_tRMS_rc@AC Group [V]	14.77916	234.1300	219.3509
U3_tRMS_rc@AC Group [V]	229.3774	233.3605	3.983109
I1_tRMS_rc@AC Group [A]	85.96397	156.0580	70.09402
I2_tRMS_rc@AC Group [A]	177.0638	158.5302	-18.53363
I3_tRMS_rc@AC Group [A]	92.62608	157.6169	64.99079
P_t_rc@AC Group [W]	2016.127	109775.8	107759.7
Q_t_rc@AC Group [var]	43528.68	4397.685	-39130.99
U_fund_SYM+_rc@AC Group [V]	272.0431	402.9485	130.9054
U_fund_SYM-_rc@AC Group [V]	122.7863	1.514841	-121.2714
I_fund_Q_SYM+_rc@AC Group	92.11558	-2.682652	-94.79823
I_fund_Q_SYM-_rc@AC Group [A]	-84.74140	-0.243237	84.49816

Test 1.B.2- Single phase fault (U/U_{nom} = 0,03); P = 20% ±5% P_n

0~60ms

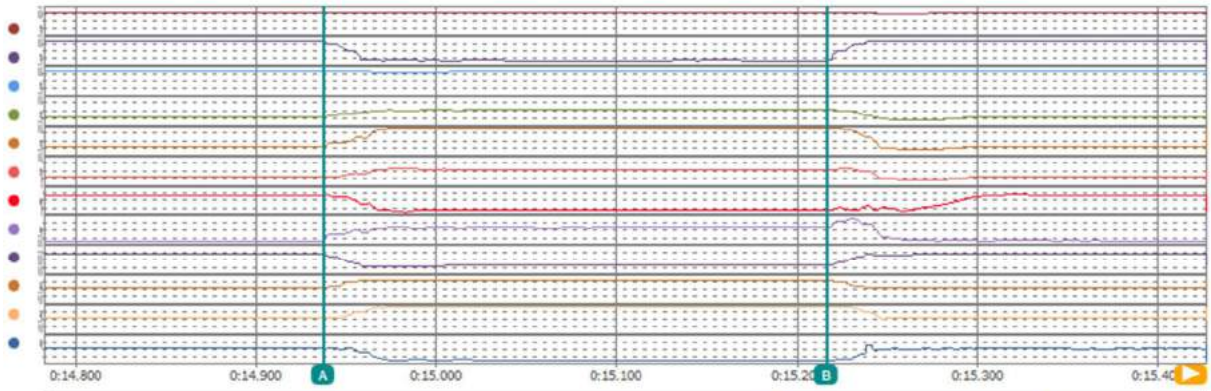


	A	B	Delta
Time [s]	0:14.937826	0:14.997960	0.060134
U1_tRMS_rc@AC Group [V]	229.3013	230.8451	1.543762
U2_tRMS_rc@AC Group [V]	229.7340	14.52029	-215.2137
U3_tRMS_rc@AC Group [V]	230.0430	225.6005	-4.442459
I1_tRMS_rc@AC Group [A]	35.77621	86.73653	50.96032
I2_tRMS_rc@AC Group [A]	35.77497	178.4149	142.6400
I3_tRMS_rc@AC Group [A]	35.51287	93.71654	58.20367
P_t_rc@AC Group [W]	24547.85	2395.698	-22152.15
Q_t_rc@AC Group [var]	1468.708	43690.20	42221.49
U_fund_SYM+_rc@AC Group [V]	397.8332	270.5941	-127.2390
U_fund_SYM-_rc@AC Group [V]	0.281033	122.1967	121.9156
I_fund_Q_SYM+_rc@AC Group	1.282168	92.74069	91.45852
I_fund_Q_SYM-_rc@AC Group [A]	0.160876	-85.43050	-85.59138

0~100ms

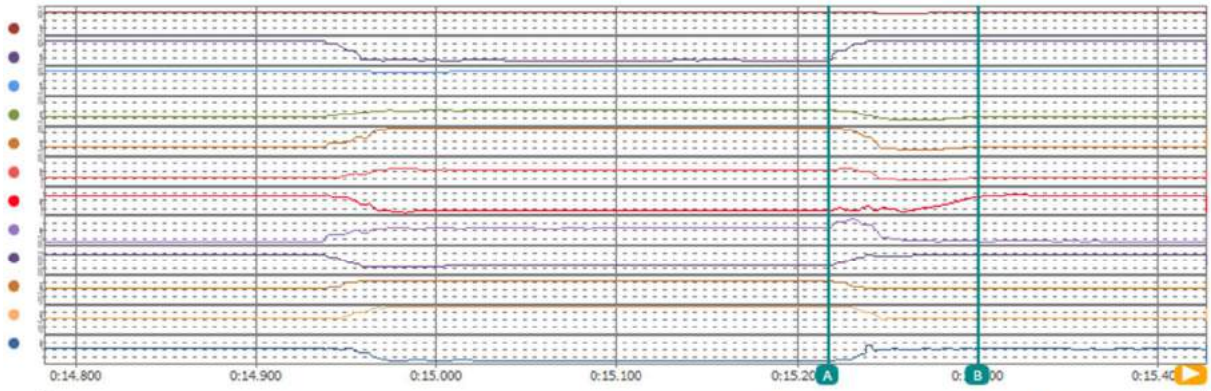
	A	B	Delta
Time [s]	0:14.937826	0:15.038314	0.100488
U1_tRMS_rc@AC Group [V]	229.3013	231.0331	1.731766
U2_tRMS_rc@AC Group [V]	229.7340	14.55346	-215.1805
U3_tRMS_rc@AC Group [V]	230.0430	227.7672	-2.275772
I1_tRMS_rc@AC Group [A]	35.77621	84.90664	49.13042
I2_tRMS_rc@AC Group [A]	35.77497	176.6817	140.9067
I3_tRMS_rc@AC Group [A]	35.51287	93.30985	57.79698
P_t_rc@AC Group [W]	24547.85	2041.069	-22506.78
Q_t_rc@AC Group [var]	1468.708	43392.52	41923.81
U_fund_SYM+_rc@AC Group [V]	397.8332	271.9955	-125.8377
U_fund_SYM-_rc@AC Group [V]	0.281033	122.8027	122.5217
I_fund_Q_SYM+_rc@AC Group	1.282168	91.95358	90.67141
I_fund_Q_SYM-_rc@AC Group [A]	0.160876	-84.53778	-84.69866

Duration time



	A	B	Delta
Time [s]	0:14.937826	0:15.216343	0.278517
U1_tRMS_rc@AC Group [V]	229.3013	229.4885	0.187149
U2_tRMS_rc@AC Group [V]	229.7340	14.47271	-215.2613
U3_tRMS_rc@AC Group [V]	230.0430	229.3598	-0.683167
I1_tRMS_rc@AC Group [A]	35.77621	85.79762	50.02141
I2_tRMS_rc@AC Group [A]	35.77497	177.0514	141.2765
I3_tRMS_rc@AC Group [A]	35.51287	92.68906	57.17619
P_t_rc@AC Group [W]	24547.85	1900.837	-22647.01
Q_t_rc@AC Group [var]	1468.708	43469.58	42000.87
U_fund_SYM+_rc@AC Group [V]	397.8332	271.9142	-125.9190
U_fund_SYM-_rc@AC Group [V]	0.281033	122.9683	122.6872
I_fund_Q_SYM+_rc@AC Group	1.282168	91.80151	90.51935
I_fund_Q_SYM-_rc@AC Group [A]	0.160876	-85.09810	-85.25897

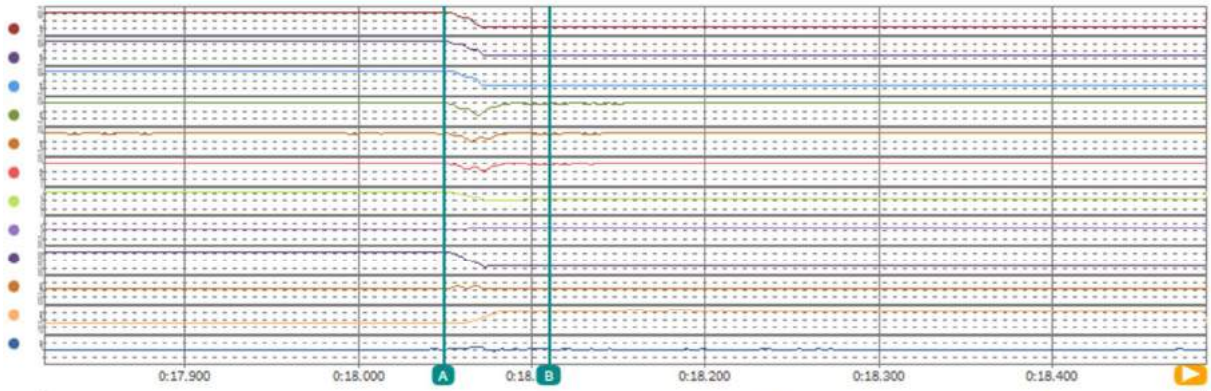
Recovery time



	A	B	Delta
Time [s]	0:15.217135	0:15.300215	0.083080
U1_tRMS_rc@AC Group [V]	229.4794	229.2161	-0.263336
U2_tRMS_rc@AC Group [V]	14.47298	236.7457	222.2727
U3_tRMS_rc@AC Group [V]	229.3977	233.7728	4.375076
I1_tRMS_rc@AC Group [A]	85.78939	33.19558	-52.59381
I2_tRMS_rc@AC Group [A]	177.0278	33.10192	-143.9259
I3_tRMS_rc@AC Group [A]	92.67461	32.16431	-60.51029
P_t_rc@AC Group [W]	1900.687	22462.77	20562.08
Q_t_rc@AC Group [var]	43466.82	4775.762	-38691.06
U_fund_SYM+_rc@AC Group [V]	271.9210	403.9760	132.0551
U_fund_SYM-_rc@AC Group [V]	122.9540	3.733091	-119.2209
I_fund_Q_SYM+_rc@AC Group	91.78604	1.550358	-90.23568
I_fund_Q_SYM-_rc@AC Group [A]	-85.07685	0.431859	85.50871

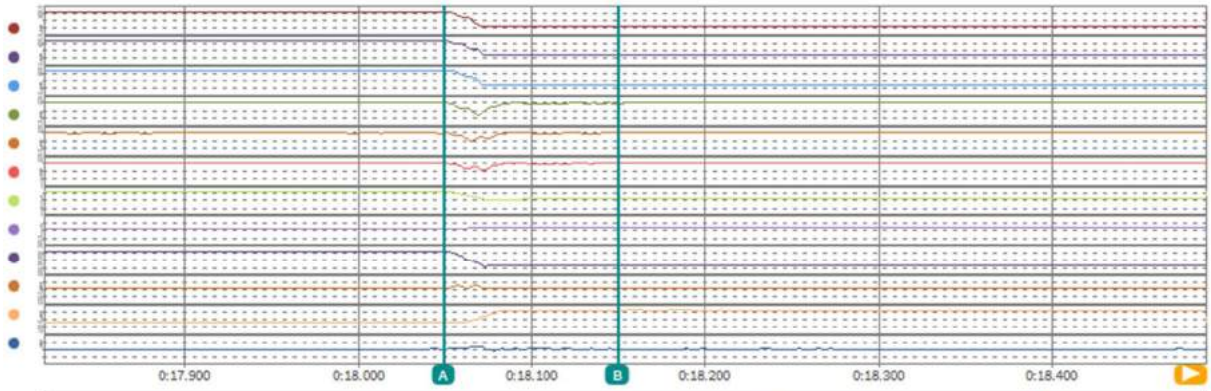
Test 2.A.1-Symmetrical fault (U/U_{nom} = 0,31); P = 100% ±5% P_n

0~60ms



	A	B	Delta
Time [s]	0:18.04990	0:18.11043	0.06053
U1_tRMS_rc@AC Group [V]	229.7013	75.98714	-153.7142
U2_tRMS_rc@AC Group [V]	229.9484	75.22242	-154.7260
U3_tRMS_rc@AC Group [V]	231.5751	76.03875	-155.5364
I1_tRMS_rc@AC Group [A]	175.5764	172.9511	-2.625290
I2_tRMS_rc@AC Group [A]	174.6114	170.3129	-4.298477
I3_tRMS_rc@AC Group [A]	175.6357	170.0095	-5.626251
P_t_rc@AC Group [W]	121139.5	2012.170	-119127.4
Q_t_rc@AC Group [var]	1911.734	38828.61	36916.88
U_fund_SYM+_rc@AC Group [V]	399.0585	131.0788	-267.9797
U_fund_SYM-_rc@AC Group [V]	1.300538	0.746347	-0.554190
I_fund_Q_SYM+_rc@AC Group	-0.539342	170.1647	170.7040
I_fund_Q_SYM-_rc@AC Group [A]	-0.390509	1.288114	1.678623

0~100ms

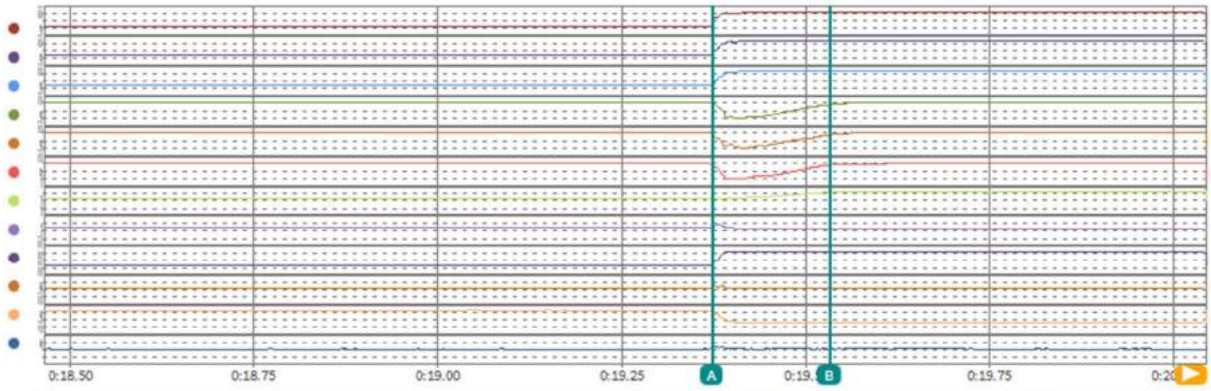


	A	B	Delta
Time [s]	0:18.04990	0:18.14992	0.10003
U1_tRMS_rc@AC Group [V]	229.7013	75.29443	-154.4069
U2_tRMS_rc@AC Group [V]	229.9484	75.09859	-154.8498
U3_tRMS_rc@AC Group [V]	231.5751	75.58960	-155.9855
I1_tRMS_rc@AC Group [A]	175.5764	174.1833	-1.393097
I2_tRMS_rc@AC Group [A]	174.6114	175.2734	0.662048
I3_tRMS_rc@AC Group [A]	175.6357	176.8161	1.180389
P_t_rc@AC Group [W]	121139.5	3435.773	-117703.8
Q_t_rc@AC Group [var]	1911.734	39494.12	37582.38
U_fund_SYM+_rc@AC Group [V]	399.0585	130.3550	-268.7035
U_fund_SYM-_rc@AC Group [V]	1.300538	1.063249	-0.237289
I_fund_Q_SYM+_rc@AC Group	-0.539342	174.7048	175.2442
I_fund_Q_SYM-_rc@AC Group [A]	-0.390509	-1.105105	-0.714596

Duration time

	A	B	Delta
Time [s]	0:18.04990	0:19.37321	1.32332
U1_tRMS_rc@AC Group [V]	229.7013	72.18260	-157.5187
U2_tRMS_rc@AC Group [V]	229.9484	71.12499	-158.8234
U3_tRMS_rc@AC Group [V]	231.5751	71.92211	-159.6530
I1_tRMS_rc@AC Group [A]	175.5764	176.3718	0.795441
I2_tRMS_rc@AC Group [A]	174.6114	176.7634	2.152023
I3_tRMS_rc@AC Group [A]	175.6357	177.0325	1.396820
P_t_rc@AC Group [W]	121139.5	2988.083	-118151.4
Q_t_rc@AC Group [var]	1911.734	37918.27	36006.54
U_fund_SYM+_rc@AC Group [V]	399.0585	124.1460	-274.9125
U_fund_SYM-_rc@AC Group [V]	1.300538	1.075184	-0.225354
I_fund_Q_SYM+_rc@AC Group	-0.539342	176.1553	176.6946
I_fund_Q_SYM-_rc@AC Group [A]	-0.390509	-0.426178	-0.035669

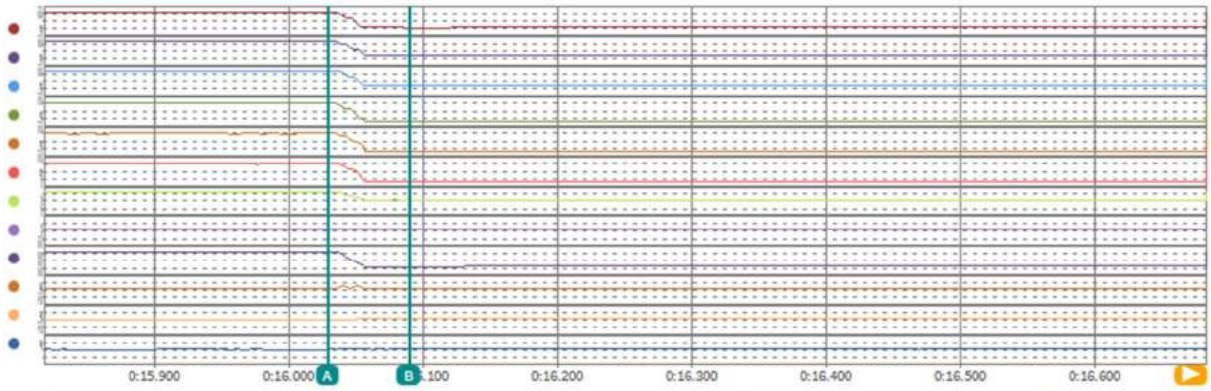
Recovery time



	A	B	Delta
Time [s]	0:19.37352	0:19.53313	0.15961
U1_tRMS_rc@AC Group [V]	72.13654	230.4935	158.3569
U2_tRMS_rc@AC Group [V]	71.07898	232.4037	161.3248
U3_tRMS_rc@AC Group [V]	72.02663	232.2716	160.2450
I1_tRMS_rc@AC Group [A]	176.5568	159.7318	-16.82503
I2_tRMS_rc@AC Group [A]	176.8964	158.1665	-18.72989
I3_tRMS_rc@AC Group [A]	176.7819	160.0285	-16.75339
P_t_rc@AC Group [W]	2988.493	110560.4	107571.9
Q_t_rc@AC Group [var]	37925.25	6403.064	-31522.19
U_fund_SYM+_rc@AC Group [V]	124.1546	401.3399	277.1853
U_fund_SYM-_rc@AC Group [V]	0.861242	0.912996	0.051754
I_fund_Q_SYM+_rc@AC Group	176.1797	-7.457989	-183.6377
I_fund_Q_SYM-_rc@AC Group [A]	-0.131931	-0.694176	-0.562245

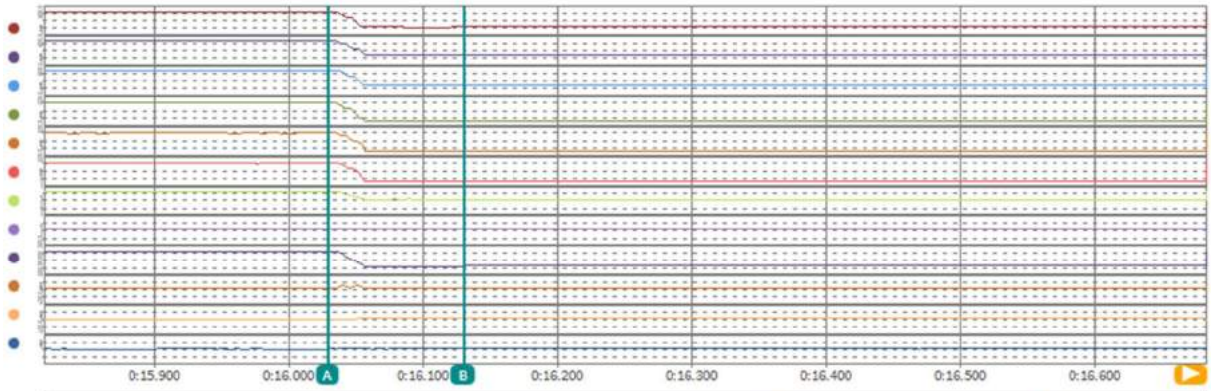
Test 2.A.1-Symmetrical fault (U/U_{nom} = 0,31); P = 100% ±5% P_n (limited mode)

0~60ms



	A	B	Delta
Time [s]	0:16.029930	0:16.090060	0.060130
U1_tRMS_rc@AC Group [V]	229.4247	62.83174	-166.5930
U2_tRMS_rc@AC Group [V]	230.6240	69.04198	-161.5820
U3_tRMS_rc@AC Group [V]	231.3062	69.07900	-162.2272
I1_tRMS_rc@AC Group [A]	175.4827	0.990901	-174.4918
I2_tRMS_rc@AC Group [A]	174.8407	1.054297	-173.7864
I3_tRMS_rc@AC Group [A]	175.0459	1.044489	-174.0014
P_t_rc@AC Group [W]	121057.1	0.271505	-121056.8
Q_t_rc@AC Group [var]	1880.727	207.2029	-1673.524
U_fund_SYM+_rc@AC Group [V]	399.1372	115.9658	-283.1714
U_fund_SYM-_rc@AC Group [V]	0.896522	3.781252	2.884730
I_fund_Q_SYM+_rc@AC Group	-0.481668	1.022686	1.504354
I_fund_Q_SYM-_rc@AC Group [A]	-0.360915	0.031991	0.392906

0~100ms

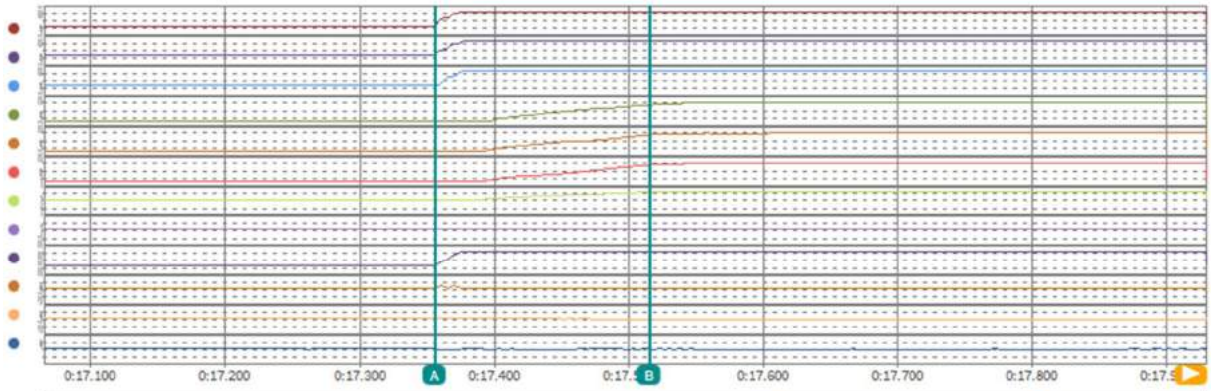


	A	B	Delta
Time [s]	0:16.029930	0:16.130410	0.100480
U1_tRMS_rc@AC Group [V]	229.4247	63.87352	-165.5512
U2_tRMS_rc@AC Group [V]	230.6240	70.32882	-160.2951
U3_tRMS_rc@AC Group [V]	231.3062	70.60539	-160.7009
I1_tRMS_rc@AC Group [A]	175.4827	1.016091	-174.4666
I2_tRMS_rc@AC Group [A]	174.8407	1.074400	-173.7663
I3_tRMS_rc@AC Group [A]	175.0459	1.076149	-173.9697
P_t_rc@AC Group [W]	121057.1	-0.773716	-121057.9
Q_t_rc@AC Group [var]	1880.727	216.4431	-1664.284
U_fund_SYM+_rc@AC Group [V]	399.1372	118.2335	-280.9037
U_fund_SYM-_rc@AC Group [V]	0.896522	3.675080	2.778557
I_fund_Q_SYM+_rc@AC Group	-0.481668	1.050216	1.531884
I_fund_Q_SYM-_rc@AC Group [A]	-0.360915	0.031713	0.392628

Duration time

Time [s]	A 0:16.029930	B 0:17.352936	Delta 1.323007
U1_tRMS_rc@AC Group [V]	229.4247	71.10130	-158.3234
U2_tRMS_rc@AC Group [V]	230.6240	71.51233	-159.1116
U3_tRMS_rc@AC Group [V]	231.3062	71.39199	-159.9143
I1_tRMS_rc@AC Group [A]	175.4827	1.099749	-174.3829
I2_tRMS_rc@AC Group [A]	174.8407	1.106017	-173.7347
I3_tRMS_rc@AC Group [A]	175.0459	1.099943	-173.9459
P_t_rc@AC Group [W]	121057.1	-0.253865	-121057.4
Q_t_rc@AC Group [var]	1880.727	235.8144	-1644.913
U_fund_SYM+_rc@AC Group [V]	399.1372	123.5471	-275.5901
U_fund_SYM-_rc@AC Group [V]	0.896522	0.114802	-0.781721
I_fund_Q_SYM+_rc@AC Group	-0.481668	1.097416	1.579084
I_fund_Q_SYM-_rc@AC Group [A]	-0.360915	2.602e-3	0.363517

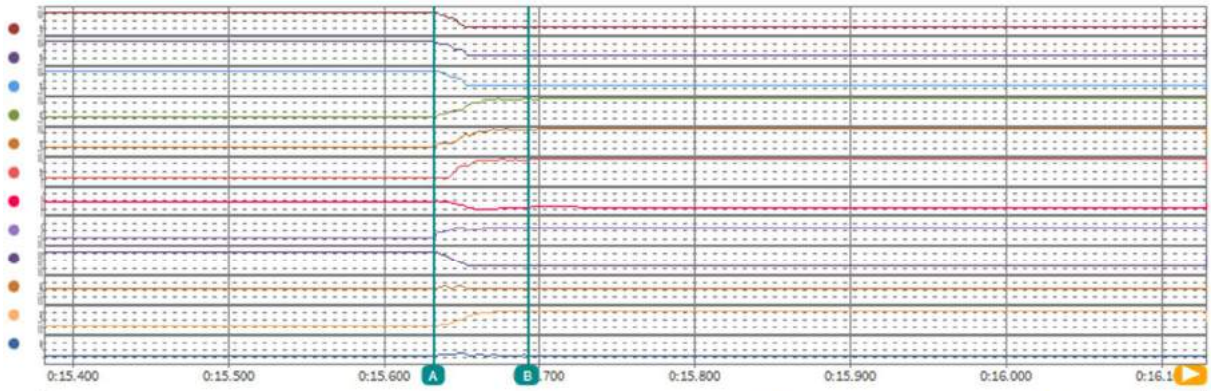
Recovery time



Time [s]	A 0:17.356518	B 0:17.515794	Delta 0.159276
U1_tRMS_rc@AC Group [V]	71.11667	232.2708	161.1542
U2_tRMS_rc@AC Group [V]	71.53905	232.7201	161.1810
U3_tRMS_rc@AC Group [V]	71.43060	232.8337	161.4031
I1_tRMS_rc@AC Group [A]	1.100621	159.5458	158.4452
I2_tRMS_rc@AC Group [A]	1.105350	156.6809	155.5755
I3_tRMS_rc@AC Group [A]	1.099874	159.3553	158.2555
P_t_rc@AC Group [W]	-0.255064	110493.6	110493.8
Q_t_rc@AC Group [var]	235.9126	5368.424	5132.511
U_fund_SYM+_rc@AC Group [V]	123.5945	402.8716	279.2771
U_fund_SYM-_rc@AC Group [V]	0.125327	0.244250	0.118923
I_fund_Q_SYM+_rc@AC Group	1.097728	-4.745386	-5.843114
I_fund_Q_SYM-_rc@AC Group [A]	1.248e-3	1.502941	1.501693

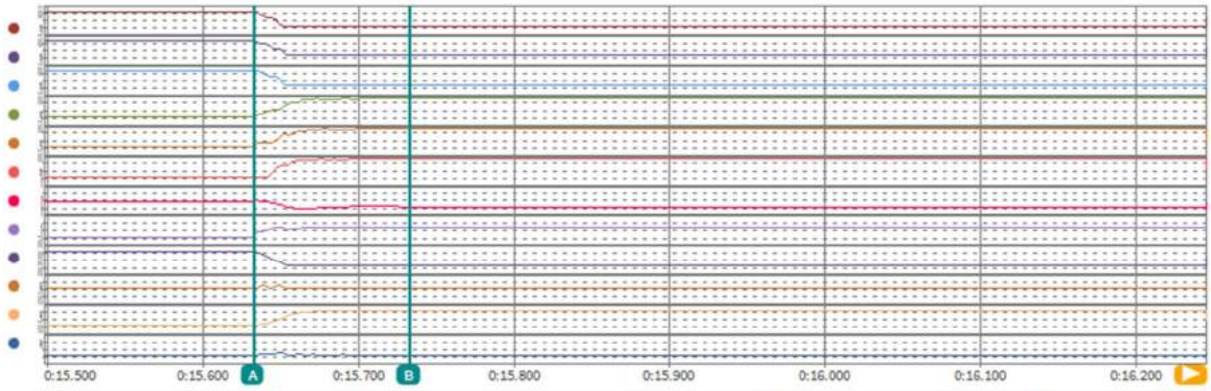
Test 2.A.2-Symmetrical fault (U/U_{nom} = 0,31); P = 20% ±5% P_n

0~60ms



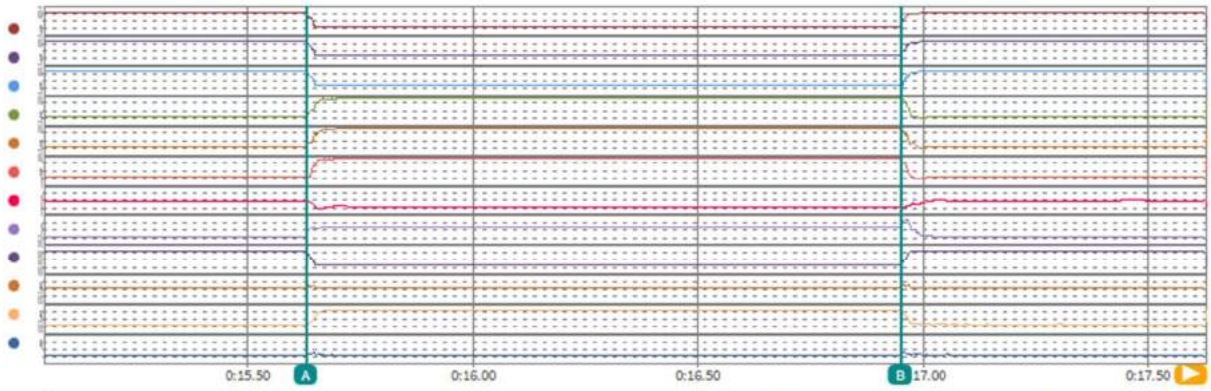
	A	B	Delta
Time [s]	0:15.632701	0:15.692968	0.060267
U1_tRMS_rc@AC Group [V]	229.2911	75.76051	-153.5306
U2_tRMS_rc@AC Group [V]	229.8505	75.08948	-154.7610
U3_tRMS_rc@AC Group [V]	229.9787	76.16355	-153.8152
I1_tRMS_rc@AC Group [A]	35.98096	174.2887	138.3077
I2_tRMS_rc@AC Group [A]	35.60242	169.9572	134.3548
I3_tRMS_rc@AC Group [A]	35.23078	170.5009	135.2701
P_t_rc@AC Group [W]	24499.75	2931.304	-21568.45
Q_t_rc@AC Group [var]	1327.244	38841.70	37514.45
U_fund_SYM+_rc@AC Group [V]	397.8560	130.9564	-266.8996
U_fund_SYM-_rc@AC Group [V]	0.408465	0.437040	0.028575
I_fund_Q_SYM+_rc@AC Group	1.222042	170.6566	169.4345
I_fund_Q_SYM-_rc@AC Group [A]	0.308783	0.800485	0.491703

0~100ms



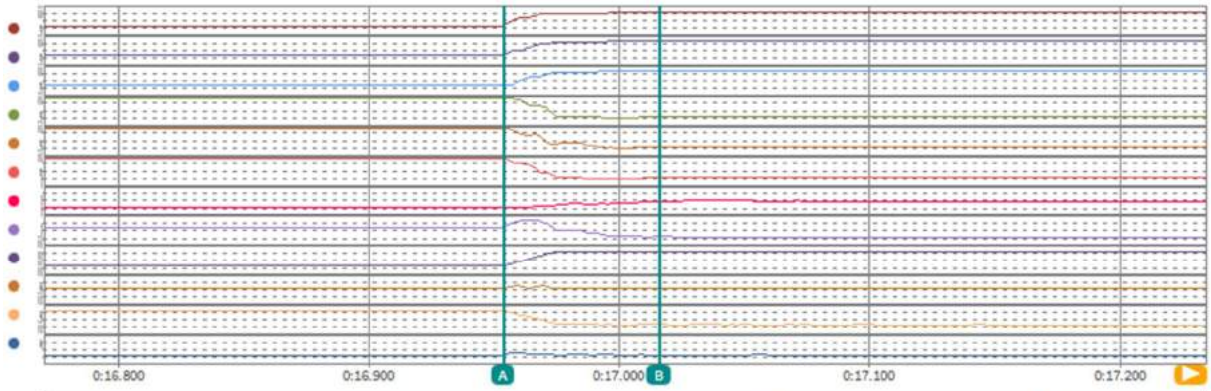
	A	B	Delta
Time [s]	0:15.632701	0:15.733080	0.100379
U1_tRMS_rc@AC Group [V]	229.2911	75.38373	-153.9074
U2_tRMS_rc@AC Group [V]	229.8505	75.11324	-154.7372
U3_tRMS_rc@AC Group [V]	229.9787	75.55314	-154.4256
I1_tRMS_rc@AC Group [A]	35.98096	175.4844	139.5034
I2_tRMS_rc@AC Group [A]	35.60242	174.9865	139.3841
I3_tRMS_rc@AC Group [A]	35.23078	177.0170	141.7862
P_t_rc@AC Group [W]	24499.75	3304.650	-21195.10
Q_t_rc@AC Group [var]	1327.244	39609.04	38281.80
U_fund_SYM+_rc@AC Group [V]	397.8560	130.3933	-267.4627
U_fund_SYM-_rc@AC Group [V]	0.408465	1.087497	0.679033
I_fund_Q_SYM+_rc@AC Group	1.222042	175.1917	173.9697
I_fund_Q_SYM-_rc@AC Group [A]	0.308783	-1.223090	-1.531872

Duration time



Time [s]	A 0:15.632701	B 0:16.950910	Delta 1.318209
U1_tRMS_rc@AC Group [V]	229.2911	71.88464	-157.4065
U2_tRMS_rc@AC Group [V]	229.8505	71.33929	-158.5112
U3_tRMS_rc@AC Group [V]	229.9787	71.69155	-158.2872
I1_tRMS_rc@AC Group [A]	35.98096	176.4763	140.4953
I2_tRMS_rc@AC Group [A]	35.60242	176.1047	140.5023
I3_tRMS_rc@AC Group [A]	35.23078	177.2372	142.0064
P_t_rc@AC Group [W]	24499.75	3034.218	-21465.54
Q_t_rc@AC Group [var]	1327.244	37834.05	36506.81
U_fund_SYM+_rc@AC Group [V]	397.8560	123.9620	-273.8940
U_fund_SYM-_rc@AC Group [V]	0.408465	1.272958	0.864494
I_fund_Q_SYM+_rc@AC Group	1.222042	176.0210	174.7990
I_fund_Q_SYM-_rc@AC Group [A]	0.308783	-0.720232	-1.029014

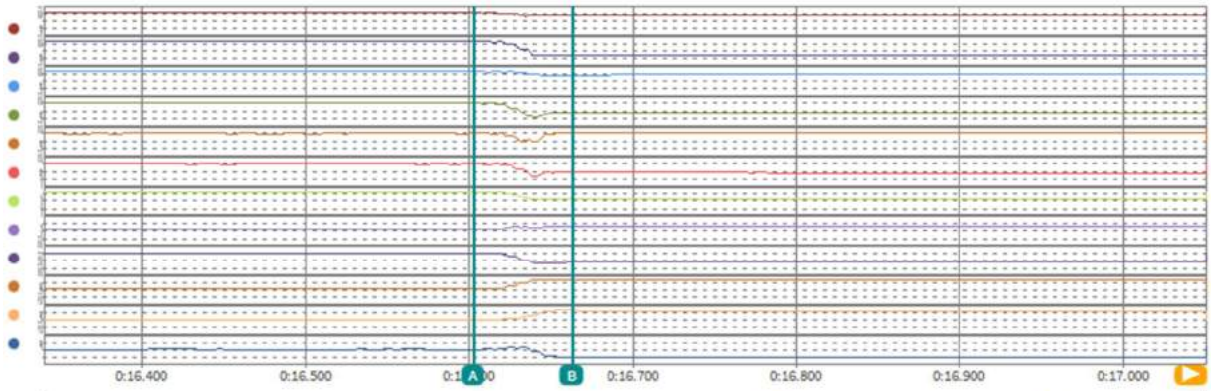
Recovery time



Time [s]	A 0:16.9541054	B 0:17.0162279	Delta 0.0621225
U1_tRMS_rc@AC Group [V]	72.11592	229.8372	157.7213
U2_tRMS_rc@AC Group [V]	71.05953	231.5830	160.5234
U3_tRMS_rc@AC Group [V]	71.81787	231.7338	159.9159
I1_tRMS_rc@AC Group [A]	176.1205	32.72158	-143.3989
I2_tRMS_rc@AC Group [A]	176.8593	33.70839	-143.1510
I3_tRMS_rc@AC Group [A]	176.9455	33.08039	-143.8651
P_t_rc@AC Group [W]	3055.649	22640.85	19585.20
Q_t_rc@AC Group [var]	37853.36	4007.421	-33845.93
U_fund_SYM+_rc@AC Group [V]	124.0135	400.1803	276.1668
U_fund_SYM-_rc@AC Group [V]	1.110624	0.960064	-0.150560
I_fund_Q_SYM+_rc@AC Group	176.0491	1.772699	-174.2764
I_fund_Q_SYM-_rc@AC Group [A]	-0.483196	0.186995	0.670192

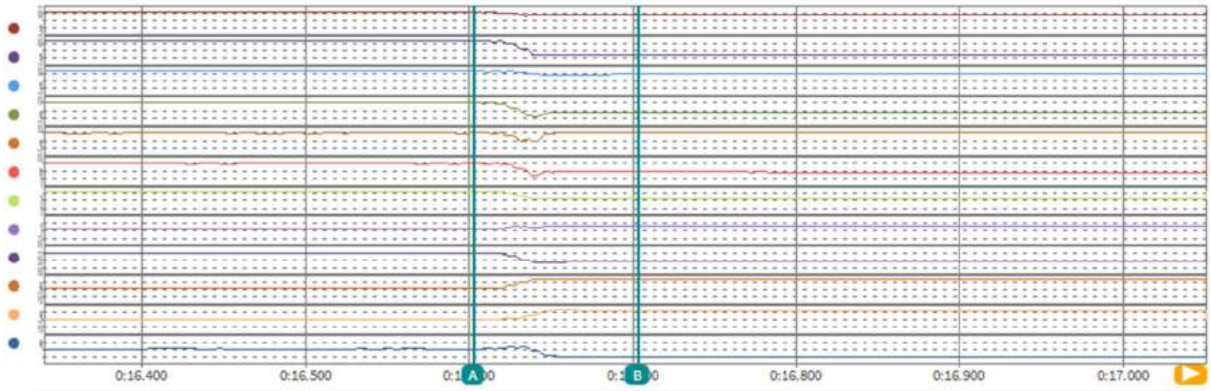
Test 2.D.1- Asymmetrical fault (U/U_{nom} = 0,31); P = 100% ±5% P_n

0~60ms



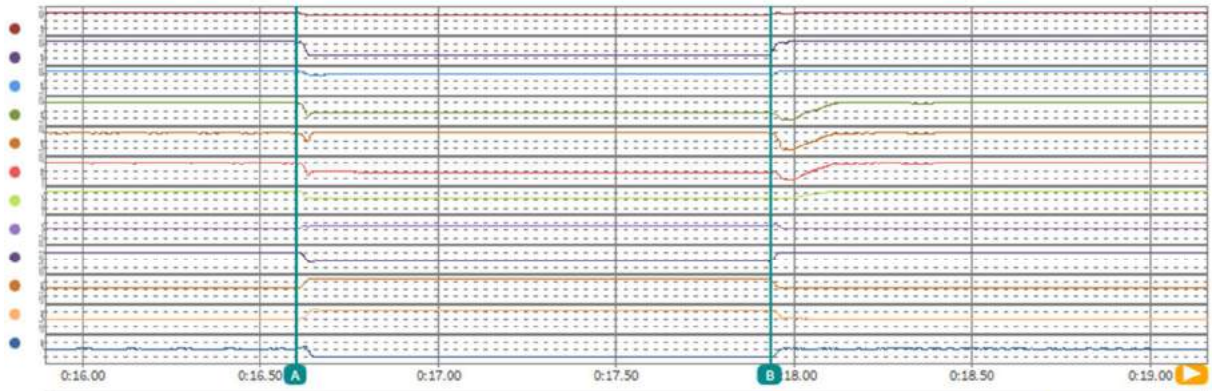
	A	B	Delta
Time [s]	0:16.602977	0:16.663194	0.060217
U1_tRMS_rc@AC Group [V]	229.4594	201.8265	-27.63283
U2_tRMS_rc@AC Group [V]	230.5495	74.13786	-156.4117
U3_tRMS_rc@AC Group [V]	231.4695	193.5547	-37.91475
I1_tRMS_rc@AC Group [A]	175.7246	86.74499	-88.97961
I2_tRMS_rc@AC Group [A]	174.8013	186.7928	11.99152
I3_tRMS_rc@AC Group [A]	174.7851	101.9003	-72.88475
P_t_rc@AC Group [W]	121065.7	1054.168	-120011.5
Q_t_rc@AC Group [var]	1823.894	51068.27	49244.38
U_fund_SYM+_rc@AC Group [V]	399.2090	258.0488	-141.1602
U_fund_SYM-_rc@AC Group [V]	0.557078	130.7203	130.1632
I_fund_Q_SYM+_rc@AC Group	-0.709503	99.26591	99.97541
I_fund_Q_SYM-_rc@AC Group [A]	-0.303622	-86.70469	-86.40107

0~100ms



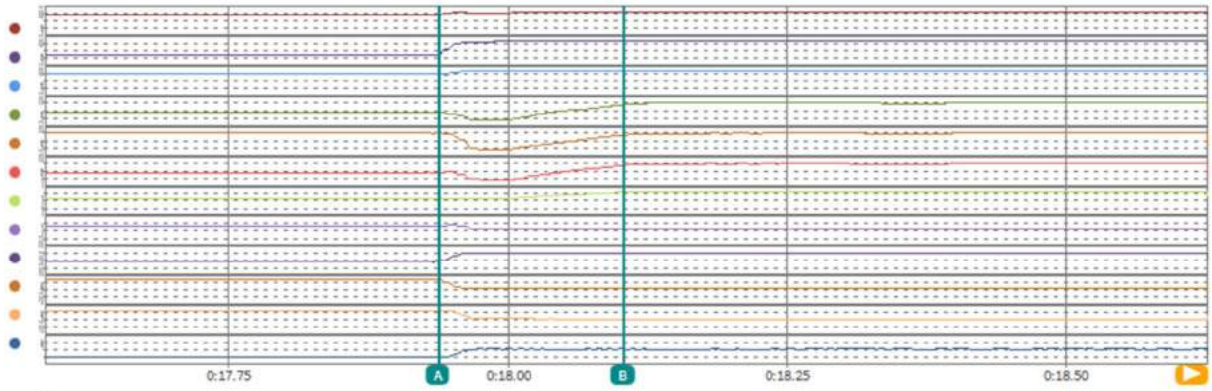
	A	B	Delta
Time [s]	0:16.602977	0:16.703353	0.100376
U1_tRMS_rc@AC Group [V]	229.4594	204.1675	-25.29187
U2_tRMS_rc@AC Group [V]	230.5495	76.31017	-154.2393
U3_tRMS_rc@AC Group [V]	231.4695	194.5309	-36.93852
I1_tRMS_rc@AC Group [A]	175.7246	84.07054	-91.65405
I2_tRMS_rc@AC Group [A]	174.8013	177.0400	2.238693
I3_tRMS_rc@AC Group [A]	174.7851	93.92461	-80.86048
P_t_rc@AC Group [W]	121065.7	2074.799	-118990.9
Q_t_rc@AC Group [var]	1823.894	48901.67	47077.78
U_fund_SYM+_rc@AC Group [V]	399.2090	261.1977	-138.0114
U_fund_SYM-_rc@AC Group [V]	0.557078	130.7904	130.2333
I_fund_Q_SYM+_rc@AC Group	-0.709503	92.67366	93.38316
I_fund_Q_SYM-_rc@AC Group [A]	-0.303622	-83.96185	-83.65822

Duration time



	A	B	Delta
Time [s]	0:16.602977	0:17.934802	1.331825
U1_tRMS_rc@AC Group [V]	229.4594	196.1705	-33.28882
U2_tRMS_rc@AC Group [V]	230.5495	73.53682	-157.0127
U3_tRMS_rc@AC Group [V]	231.4695	198.1343	-33.33513
I1_tRMS_rc@AC Group [A]	175.7246	84.13355	-91.59104
I2_tRMS_rc@AC Group [A]	174.8013	172.1790	-2.622253
I3_tRMS_rc@AC Group [A]	174.7851	88.60938	-86.17572
P_t_rc@AC Group [W]	121065.7	1596.881	-119468.8
Q_t_rc@AC Group [var]	1823.894	46695.29	44871.39
U_fund_SYM+_rc@AC Group [V]	399.2090	256.7517	-142.4573
U_fund_SYM-_rc@AC Group [V]	0.557078	128.2437	127.6867
I_fund_Q_SYM+_rc@AC Group	-0.709503	88.34989	89.05939
I_fund_Q_SYM-_rc@AC Group [A]	-0.303622	-82.50404	-82.20042

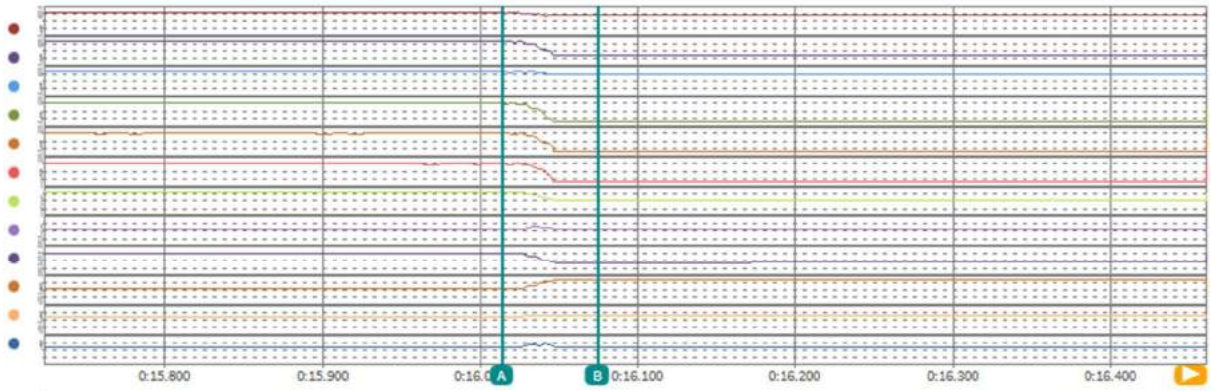
Recovery time



	A	B	Delta
Time [s]	0:17.9378679	0:18.1037424	0.1658745
U1_tRMS_rc@AC Group [V]	203.4031	230.2856	26.88251
U2_tRMS_rc@AC Group [V]	72.49251	232.7107	160.2182
U3_tRMS_rc@AC Group [V]	199.6940	234.8754	35.18146
I1_tRMS_rc@AC Group [A]	85.67570	157.8376	72.16186
I2_tRMS_rc@AC Group [A]	177.6919	158.3014	-19.39050
I3_tRMS_rc@AC Group [A]	92.53771	156.3801	63.84243
P_t_rc@AC Group [W]	2533.148	109734.0	107200.9
Q_t_rc@AC Group [var]	48721.45	6322.040	-42399.41
U_fund_SYM+_rc@AC Group [V]	260.0444	402.9007	142.8562
U_fund_SYM-_rc@AC Group [V]	134.4093	1.491016	-132.9183
I_fund_Q_SYM+_rc@AC Group	90.77177	-6.377651	-97.14943
I_fund_Q_SYM-_rc@AC Group [A]	-85.79736	0.946078	86.74343

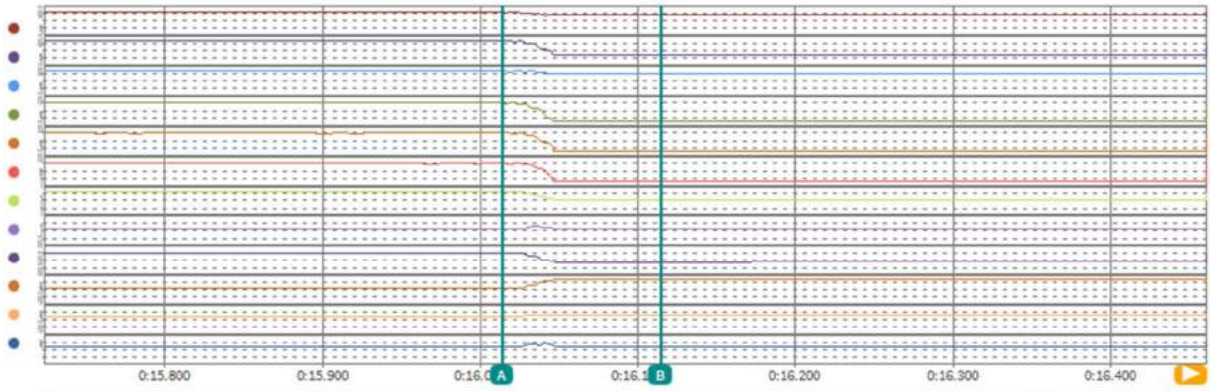
Test 2.D.1- Asymmetrical fault (U/U_{nom} = 0,31); P = 100% ±5% P_n (limited mode)

0~60ms



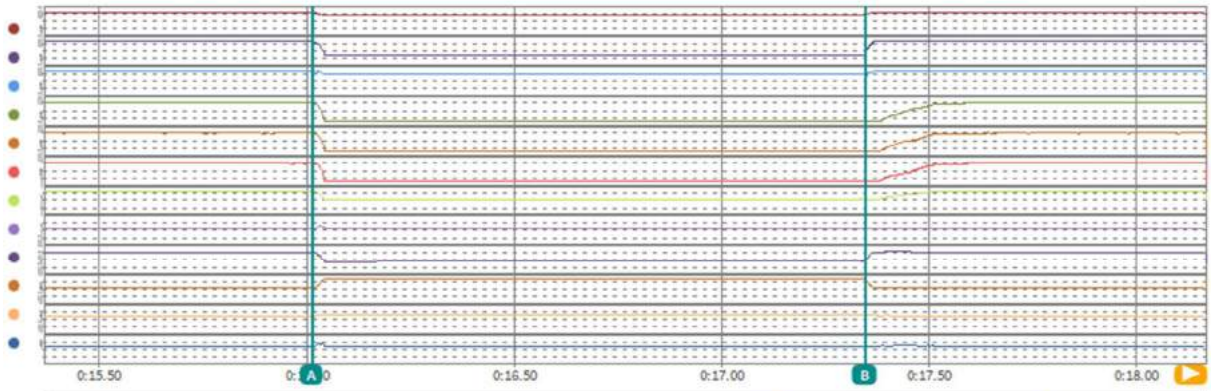
	A	B	Delta
Time [s]	0:16.014361	0:16.074904	0.060543
U1_tRMS_rc@AC Group [V]	229.5305	199.4017	-30.12880
U2_tRMS_rc@AC Group [V]	230.4968	67.31165	-163.1851
U3_tRMS_rc@AC Group [V]	231.3487	195.5190	-35.82973
I1_tRMS_rc@AC Group [A]	175.6055	3.050959	-172.5545
I2_tRMS_rc@AC Group [A]	174.8214	1.048140	-173.7732
I3_tRMS_rc@AC Group [A]	175.1576	3.017937	-172.1397
P_t_rc@AC Group [W]	121110.3	-2.544715	-121112.9
Q_t_rc@AC Group [var]	1888.589	1268.980	-619.6093
U_fund_SYM+_rc@AC Group [V]	399.1499	252.9439	-146.2059
U_fund_SYM-_rc@AC Group [V]	0.406176	136.1294	135.7232
I_fund_Q_SYM+_rc@AC Group	-0.562300	2.244272	2.806571
I_fund_Q_SYM-_rc@AC Group [A]	-0.248938	1.204951	1.453890

0~100ms



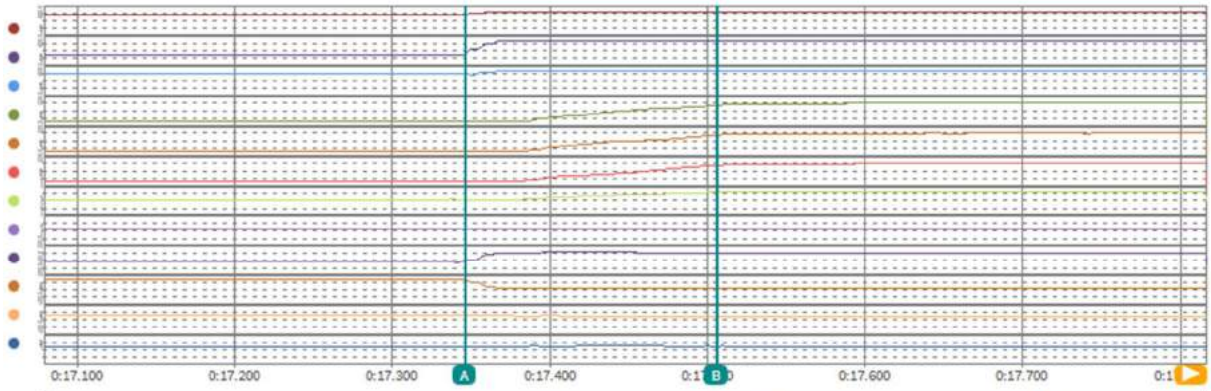
	A	B	Delta
Time [s]	0:16.014361	0:16.114766	0.100405
U1_tRMS_rc@AC Group [V]	229.5305	201.5764	-27.95406
U2_tRMS_rc@AC Group [V]	230.4968	70.03707	-160.4597
U3_tRMS_rc@AC Group [V]	231.3487	197.3389	-34.00981
I1_tRMS_rc@AC Group [A]	175.6055	3.088617	-172.5169
I2_tRMS_rc@AC Group [A]	174.8214	1.081470	-173.7399
I3_tRMS_rc@AC Group [A]	175.1576	3.048311	-172.1093
P_t_rc@AC Group [W]	121110.3	-1.709088	-121112.1
Q_t_rc@AC Group [var]	1888.589	1299.885	-588.7045
U_fund_SYM+_rc@AC Group [V]	399.1499	256.7504	-142.3995
U_fund_SYM-_rc@AC Group [V]	0.406176	136.2202	135.8140
I_fund_Q_SYM+_rc@AC Group	-0.562300	2.279334	2.841634
I_fund_Q_SYM-_rc@AC Group [A]	-0.248938	1.206735	1.455673

Duration time



	A	B	Delta
Time [s]	0:16.014361	0:17.345784	1.331424
U1_tRMS_rc@AC Group [V]	229.5305	204.3795	-25.15099
U2_tRMS_rc@AC Group [V]	230.4968	71.14709	-159.3497
U3_tRMS_rc@AC Group [V]	231.3487	200.8398	-30.50893
I1_tRMS_rc@AC Group [A]	175.6055	3.077600	-172.5279
I2_tRMS_rc@AC Group [A]	174.8214	1.095597	-173.7258
I3_tRMS_rc@AC Group [A]	175.1576	3.133088	-172.0245
P_t_rc@AC Group [W]	121110.3	-63.82880	-121174.2
Q_t_rc@AC Group [var]	1888.589	1334.670	-553.9189
U_fund_SYM+_rc@AC Group [V]	399.1499	259.3847	-139.7652
U_fund_SYM-_rc@AC Group [V]	0.406176	137.9422	137.5361
I_fund_Q_SYM+_rc@AC Group	-0.562300	2.296855	2.859155
I_fund_Q_SYM-_rc@AC Group [A]	-0.248938	1.209203	1.458141

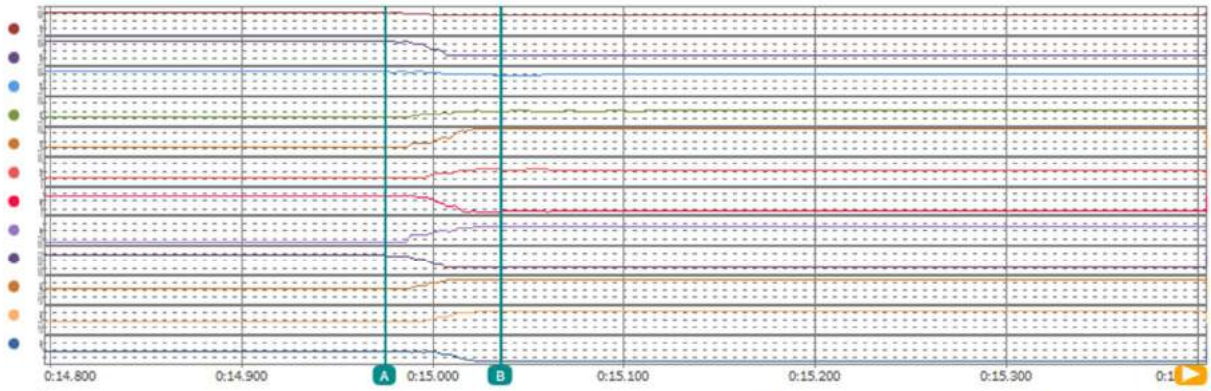
Recovery time



	A	B	Delta
Time [s]	0:17.3465812	0:17.5060297	0.1594485
U1_tRMS_rc@AC Group [V]	207.0148	231.3497	24.33490
U2_tRMS_rc@AC Group [V]	69.93728	234.9991	165.0619
U3_tRMS_rc@AC Group [V]	204.3791	234.6832	30.30411
I1_tRMS_rc@AC Group [A]	3.035613	157.0930	154.0574
I2_tRMS_rc@AC Group [A]	1.113030	155.0936	153.9806
I3_tRMS_rc@AC Group [A]	3.079980	158.0723	154.9924
P_t_rc@AC Group [W]	-49.46046	109688.2	109737.7
Q_t_rc@AC Group [var]	1334.827	6610.170	5275.343
U_fund_SYM+_rc@AC Group [V]	261.5357	404.7297	143.1940
U_fund_SYM-_rc@AC Group [V]	141.9984	1.713711	-140.2847
I_fund_Q_SYM+_rc@AC Group	2.277435	-7.223243	-9.500678
I_fund_Q_SYM-_rc@AC Group [A]	1.175266	-1.474982	-2.650248

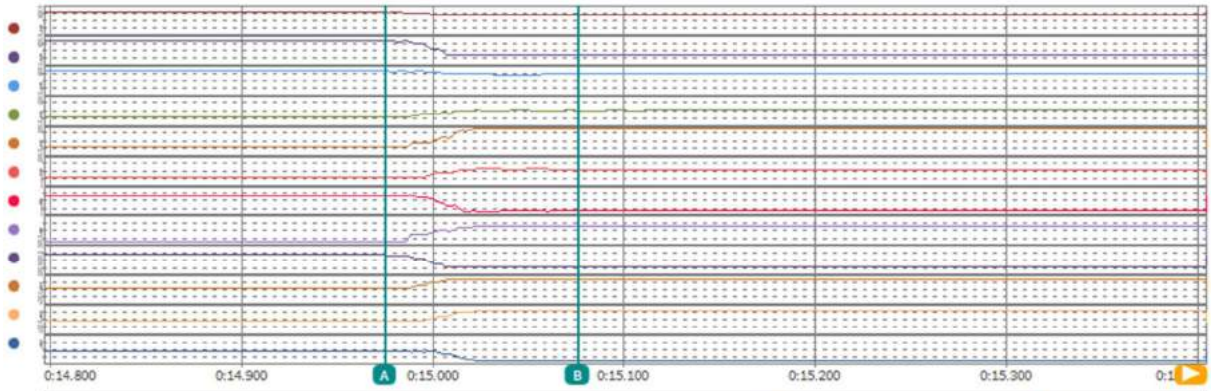
Test 2.D.2- Asymmetrical fault (U/U_{nom} = 0,31); P = 20% ±5% P_n

0~60ms



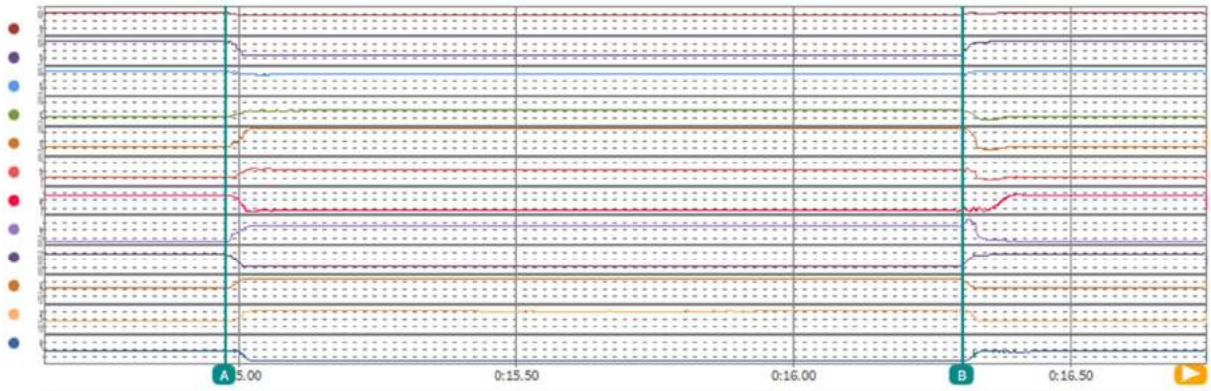
	A	B	Delta
Time [s]	0:14.975554	0:15.035843	0.060289
U1_tRMS_rc@AC Group [V]	229.3956	204.0309	-25.36470
U2_tRMS_rc@AC Group [V]	229.7416	75.64704	-154.0945
U3_tRMS_rc@AC Group [V]	229.9167	193.1288	-36.78798
I1_tRMS_rc@AC Group [A]	35.66675	82.08083	46.41407
I2_tRMS_rc@AC Group [A]	35.77932	176.9426	141.1633
I3_tRMS_rc@AC Group [A]	35.38572	96.29047	60.90475
P_t_rc@AC Group [W]	24484.81	1020.150	-23464.66
Q_t_rc@AC Group [var]	1608.051	48717.98	47109.93
U_fund_SYM+_rc@AC Group [V]	397.8175	259.9380	-137.8795
U_fund_SYM-_rc@AC Group [V]	0.146378	130.5676	130.4212
I_fund_Q_SYM+_rc@AC Group	1.265434	92.34322	91.07778
I_fund_Q_SYM-_rc@AC Group [A]	0.169604	-83.99954	-84.16915

0~100ms



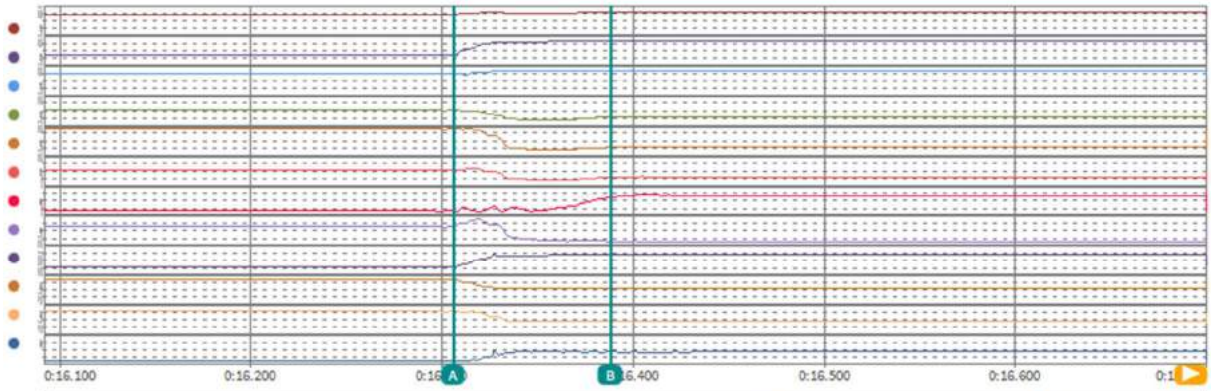
	A	B	Delta
Time [s]	0:14.975554	0:15.076159	0.100605
U1_tRMS_rc@AC Group [V]	229.3956	204.5890	-24.80656
U2_tRMS_rc@AC Group [V]	229.7416	75.97414	-153.7674
U3_tRMS_rc@AC Group [V]	229.9167	195.9276	-33.98918
I1_tRMS_rc@AC Group [A]	35.66675	84.02097	48.35421
I2_tRMS_rc@AC Group [A]	35.77932	177.8671	142.0877
I3_tRMS_rc@AC Group [A]	35.38572	94.67530	59.28958
P_t_rc@AC Group [W]	24484.81	1682.521	-22802.29
Q_t_rc@AC Group [var]	1608.051	49223.82	47615.77
U_fund_SYM+_rc@AC Group [V]	397.8175	261.9509	-135.8666
U_fund_SYM-_rc@AC Group [V]	0.146378	131.8024	131.6560
I_fund_Q_SYM+_rc@AC Group	1.265434	92.21319	90.94775
I_fund_Q_SYM-_rc@AC Group [A]	0.169604	-85.24091	-85.41051

Duration time



	A	B	Delta
Time [s]	0:14.975554	0:16.305506	1.329952
U1_tRMS_rc@AC Group [V]	229.3956	202.3112	-27.08437
U2_tRMS_rc@AC Group [V]	229.7416	72.65711	-157.0844
U3_tRMS_rc@AC Group [V]	229.9167	198.0516	-31.86511
I1_tRMS_rc@AC Group [A]	35.66675	85.22944	49.56269
I2_tRMS_rc@AC Group [A]	35.77932	176.2887	140.5094
I3_tRMS_rc@AC Group [A]	35.38572	91.54823	56.16251
P_t_rc@AC Group [W]	24484.81	2577.605	-21907.21
Q_t_rc@AC Group [var]	1608.051	48113.78	46505.73
U_fund_SYM+_rc@AC Group [V]	397.8175	258.8957	-138.9218
U_fund_SYM-_rc@AC Group [V]	0.146378	132.7471	132.6008
I_fund_Q_SYM+_rc@AC Group	1.265434	89.95380	88.68837
I_fund_Q_SYM-_rc@AC Group [A]	0.169604	-85.26109	-85.43070

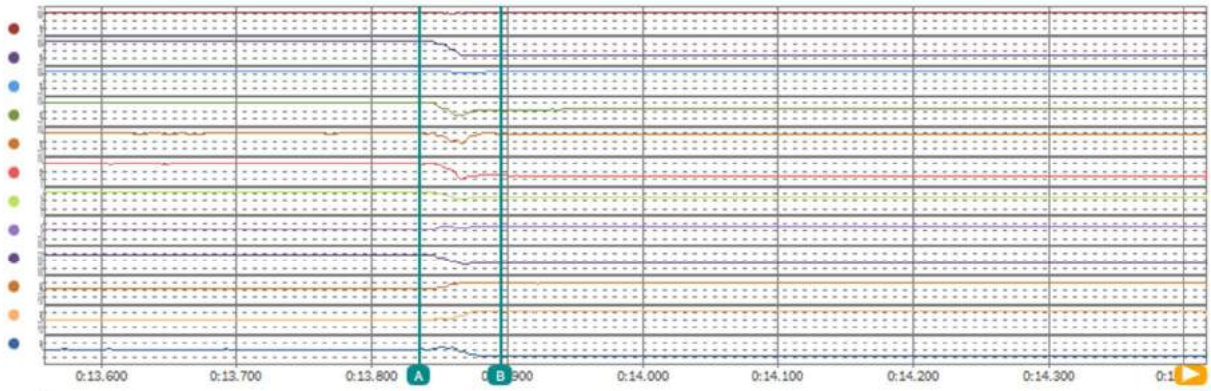
Recovery time



	A	B	Delta
Time [s]	0:16.3063432	0:16.3884680	0.0821247
U1_tRMS_rc@AC Group [V]	205.6037	227.9926	22.38885
U2_tRMS_rc@AC Group [V]	71.51229	231.0928	159.5805
U3_tRMS_rc@AC Group [V]	201.4145	237.9904	36.57591
I1_tRMS_rc@AC Group [A]	86.31834	31.89833	-54.42001
I2_tRMS_rc@AC Group [A]	178.8449	30.29526	-148.5496
I3_tRMS_rc@AC Group [A]	92.96197	33.58905	-59.37292
P_t_rc@AC Group [W]	2524.082	21886.19	19362.11
Q_t_rc@AC Group [var]	49196.16	4103.046	-45093.11
U_fund_SYM+_rc@AC Group [V]	261.3221	402.4443	141.1223
U_fund_SYM-_rc@AC Group [V]	137.2312	4.865995	-132.3652
I_fund_Q_SYM+_rc@AC Group	91.07748	1.407853	-89.66962
I_fund_Q_SYM-_rc@AC Group [A]	-86.69698	-1.239113	85.45787

Test 2.B.1- Single phase fault (U/U_{nom} = 0,31); P = 100% ±5% P_n

0~60ms



	A	B	Delta
Time [s]	0:13.835304	0:13.895483	0.060179
U1_tRMS_rc@AC Group [V]	229.6823	230.8811	1.198853
U2_tRMS_rc@AC Group [V]	230.4399	76.12370	-154.3162
U3_tRMS_rc@AC Group [V]	231.2807	227.4800	-3.800735
I1_tRMS_rc@AC Group [A]	175.1861	107.9678	-67.21829
I2_tRMS_rc@AC Group [A]	175.0091	171.6916	-3.317505
I3_tRMS_rc@AC Group [A]	174.9541	72.05487	-102.8992
P_t_rc@AC Group [W]	121020.6	22595.18	-98425.46
Q_t_rc@AC Group [var]	1482.025	49472.96	47990.94
U_fund_SYM+_rc@AC Group [V]	399.1674	308.4117	-90.75574
U_fund_SYM-_rc@AC Group [V]	0.382362	85.48174	85.09937
I_fund_Q_SYM+_rc@AC Group	-0.612230	86.48421	87.09645
I_fund_Q_SYM-_rc@AC Group [A]	-0.014079	-74.13397	-74.11989

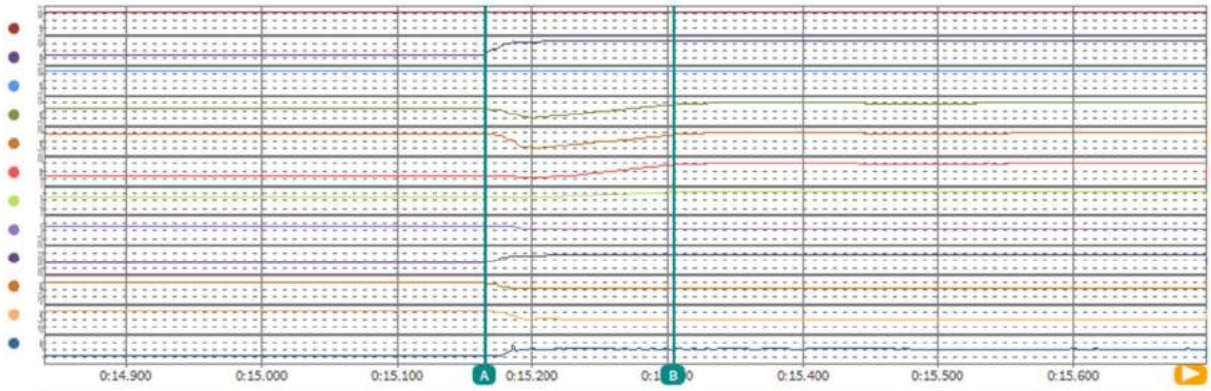
0~100ms

	A	B	Delta
Time [s]	0:13.835304	0:13.935554	0.100251
U1_tRMS_rc@AC Group [V]	229.6823	230.8251	1.142883
U2_tRMS_rc@AC Group [V]	230.4399	77.84008	-152.5998
U3_tRMS_rc@AC Group [V]	231.2807	228.5836	-2.697144
I1_tRMS_rc@AC Group [A]	175.1861	120.0308	-55.15529
I2_tRMS_rc@AC Group [A]	175.0091	170.4952	-4.513916
I3_tRMS_rc@AC Group [A]	174.9541	57.19088	-117.7632
P_t_rc@AC Group [W]	121020.6	29503.72	-91516.93
Q_t_rc@AC Group [var]	1482.025	45287.68	43805.66
U_fund_SYM+_rc@AC Group [V]	399.1674	310.0250	-89.14240
U_fund_SYM-_rc@AC Group [V]	0.382362	84.52473	84.14237
I_fund_Q_SYM+_rc@AC Group	-0.612230	79.18611	79.79834
I_fund_Q_SYM-_rc@AC Group [A]	-0.014079	-76.11071	-76.09663

Duration time

	A	B	Delta
Time [s]	0:13.835304	0:15.158105	1.322802
U1_tRMS_rc@AC Group [V]	229.6823	229.5392	-0.143082
U2_tRMS_rc@AC Group [V]	230.4399	72.00043	-158.4395
U3_tRMS_rc@AC Group [V]	231.2807	230.0909	-1.189819
I1_tRMS_rc@AC Group [A]	175.1861	123.7536	-51.43248
I2_tRMS_rc@AC Group [A]	175.0091	172.2307	-2.778397
I3_tRMS_rc@AC Group [A]	174.9541	53.83956	-121.1145
P_t_rc@AC Group [W]	121020.6	28080.22	-92940.42
Q_t_rc@AC Group [var]	1482.025	45179.72	43697.69
U_fund_SYM+_rc@AC Group [V]	399.1674	306.7347	-92.43274
U_fund_SYM-_rc@AC Group [V]	0.382362	87.97222	87.58986
I_fund_Q_SYM+_rc@AC Group	-0.612230	82.73985	83.35208
I_fund_Q_SYM-_rc@AC Group [A]	-0.014079	-78.21805	-78.20397

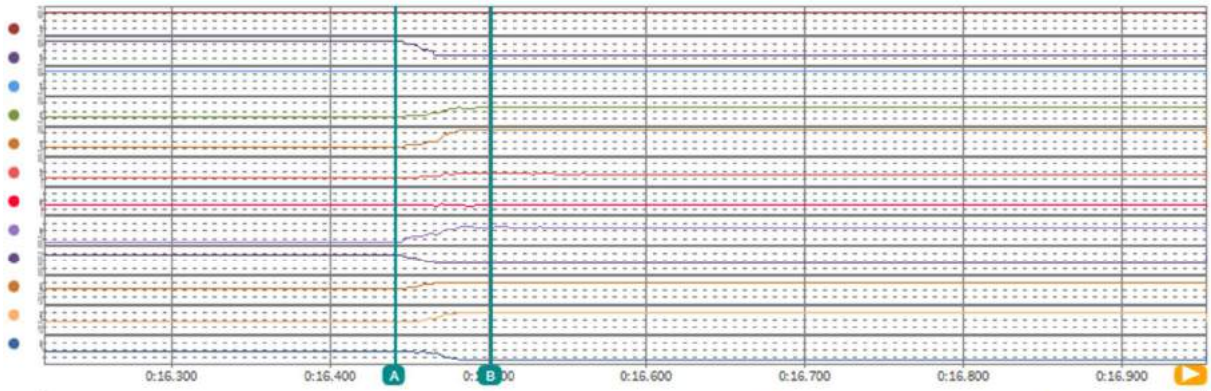
Recovery time



	A	B	Delta
Time [s]	0:15.165558	0:15.304753	0.139195
U1_tRMS_rc@AC Group [V]	229.6431	229.6996	0.056519
U2_tRMS_rc@AC Group [V]	71.97946	232.3226	160.3431
U3_tRMS_rc@AC Group [V]	230.1782	232.8565	2.678268
I1_tRMS_rc@AC Group [A]	123.1753	160.2404	37.06509
I2_tRMS_rc@AC Group [A]	172.2362	157.1547	-15.08157
I3_tRMS_rc@AC Group [A]	54.29229	160.0343	105.7420
P_t_rc@AC Group [W]	27775.58	110378.3	82602.73
Q_t_rc@AC Group [var]	45350.95	6721.246	-38629.70
U_fund_SYM+_rc@AC Group [V]	306.8581	401.1772	94.31903
U_fund_SYM-_rc@AC Group [V]	88.13847	1.444153	-86.69432
I_fund_Q_SYM+_rc@AC Group	82.88290	-7.532660	-90.41556
I_fund_Q_SYM-_rc@AC Group [A]	-78.23291	-1.609540	76.62337

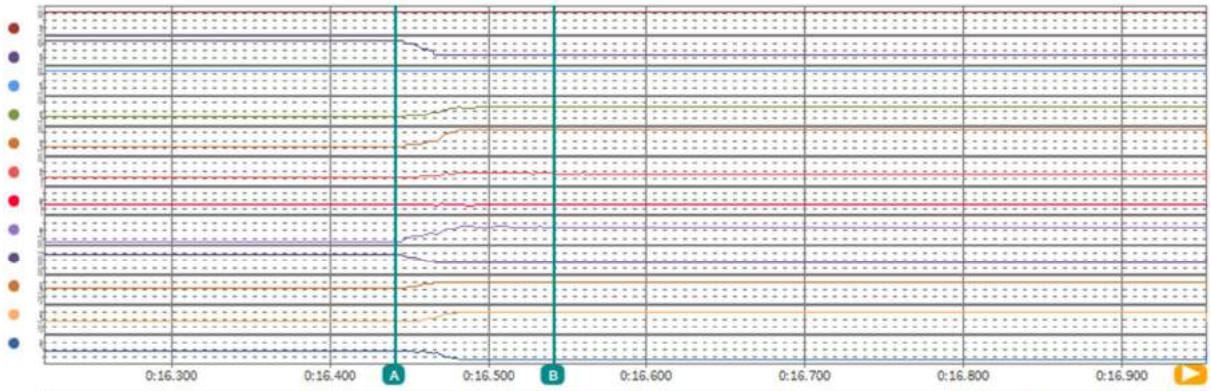
Test 2.B.2- Single phase fault (U/U_{nom} = 0,31); P = 20% ±5% P_n

0~60ms



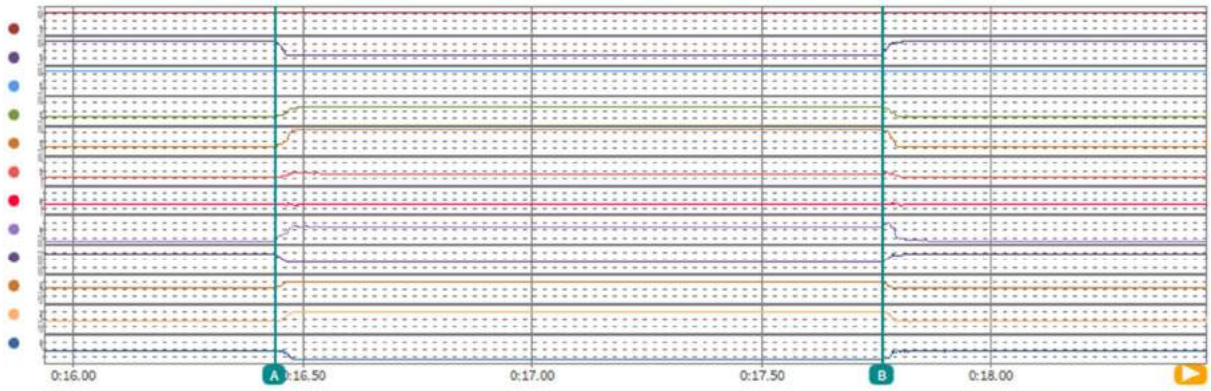
	A	B	Delta
Time [s]	0:16.441153	0:16.501807	0.060654
U1_tRMS_rc@AC Group [V]	229.3883	231.4092	2.020859
U2_tRMS_rc@AC Group [V]	229.6993	77.17419	-152.5251
U3_tRMS_rc@AC Group [V]	230.0378	227.5055	-2.532303
I1_tRMS_rc@AC Group [A]	35.80619	109.6503	73.84406
I2_tRMS_rc@AC Group [A]	35.67065	166.1261	130.4554
I3_tRMS_rc@AC Group [A]	35.09221	63.30196	28.20975
P_t_rc@AC Group [W]	24442.86	24082.65	-360.2090
Q_t_rc@AC Group [var]	1340.367	46758.88	45418.51
U_fund_SYM+_rc@AC Group [V]	397.8605	309.3147	-88.54581
U_fund_SYM-_rc@AC Group [V]	0.161749	84.93800	84.77625
I_fund_Q_SYM+_rc@AC Group	1.141641	80.01028	78.86864
I_fund_Q_SYM-_rc@AC Group [A]	0.329121	-74.18185	-74.51097

0~100ms



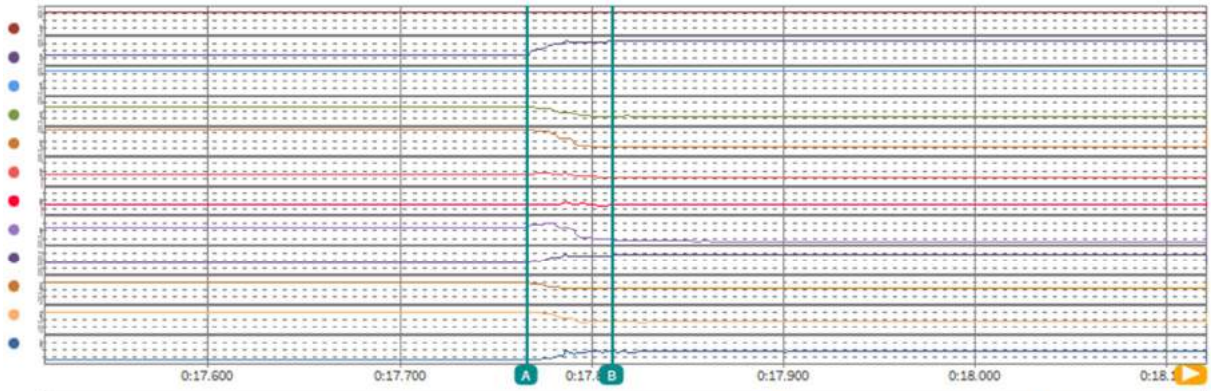
	A	B	Delta
Time [s]	0:16.441153	0:16.541442	0.100289
U1_tRMS_rc@AC Group [V]	229.3883	230.8445	1.456192
U2_tRMS_rc@AC Group [V]	229.6993	76.94754	-152.7517
U3_tRMS_rc@AC Group [V]	230.0378	228.4660	-1.571762
I1_tRMS_rc@AC Group [A]	35.80619	107.9342	72.12799
I2_tRMS_rc@AC Group [A]	35.67065	167.2323	131.5616
I3_tRMS_rc@AC Group [A]	35.09221	63.89154	28.79933
P_t_rc@AC Group [W]	24442.86	22726.67	-1716.189
Q_t_rc@AC Group [var]	1340.367	47194.13	45853.76
U_fund_SYM+_rc@AC Group [V]	397.8605	309.4170	-88.44351
U_fund_SYM-_rc@AC Group [V]	0.161749	85.23662	85.07487
I_fund_Q_SYM+_rc@AC Group	1.141641	80.45426	79.31262
I_fund_Q_SYM-_rc@AC Group [A]	0.329121	-75.98670	-76.31582

Duration time



	A	B	Delta
Time [s]	0:16.441153	0:17.762823	1.321669
U1_tRMS_rc@AC Group [V]	229.3883	229.5620	0.173706
U2_tRMS_rc@AC Group [V]	229.6993	72.26766	-157.4316
U3_tRMS_rc@AC Group [V]	230.0378	230.0204	-0.017395
I1_tRMS_rc@AC Group [A]	35.80619	115.0396	79.23344
I2_tRMS_rc@AC Group [A]	35.67065	169.3152	133.6445
I3_tRMS_rc@AC Group [A]	35.09221	57.63573	22.54352
P_t_rc@AC Group [W]	24442.86	23192.73	-1250.123
Q_t_rc@AC Group [var]	1340.367	46431.98	45091.61
U_fund_SYM+_rc@AC Group [V]	397.8605	306.9069	-90.95358
U_fund_SYM-_rc@AC Group [V]	0.161749	87.93922	87.77747
I_fund_Q_SYM+_rc@AC Group	1.141641	82.85945	81.71781
I_fund_Q_SYM-_rc@AC Group [A]	0.329121	-78.36201	-78.69114

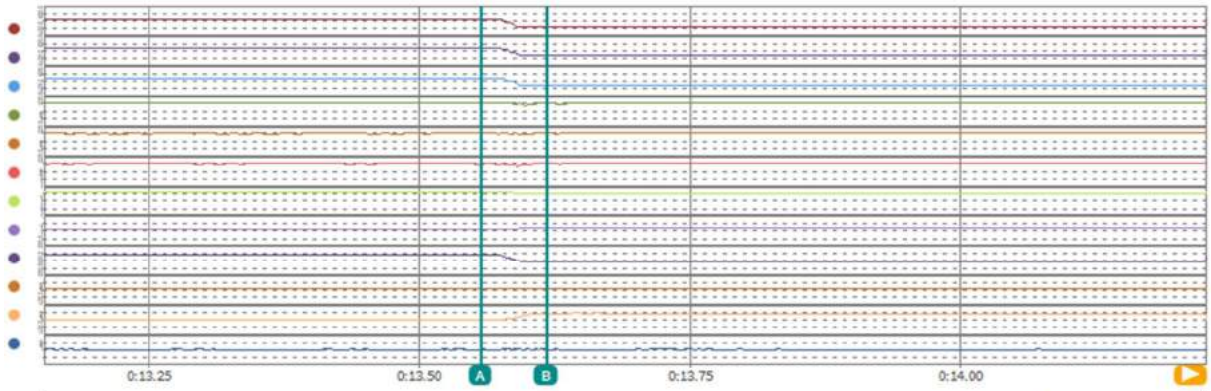
Recovery time



	A	B	Delta
Time [s]	0:17.7666161	0:17.8109772	0.0443611
U1_tRMS_rc@AC Group [V]	229.5925	227.2198	-2.372604
U2_tRMS_rc@AC Group [V]	72.24751	228.0705	155.8230
U3_tRMS_rc@AC Group [V]	230.0129	232.7099	2.697067
I1_tRMS_rc@AC Group [A]	115.1819	36.20231	-78.97957
I2_tRMS_rc@AC Group [A]	169.3349	36.10146	-133.2334
I3_tRMS_rc@AC Group [A]	57.55557	34.46619	-23.08938
P_t_rc@AC Group [W]	23257.20	22669.02	-588.1816
Q_t_rc@AC Group [var]	46416.83	9240.945	-37175.89
U_fund_SYM+_rc@AC Group [V]	306.8914	397.1822	90.29077
U_fund_SYM-_rc@AC Group [V]	87.93934	2.665363	-85.27398
I_fund_Q_SYM+_rc@AC Group	82.88400	3.086905	-79.79710
I_fund_Q_SYM-_rc@AC Group [A]	-78.32042	0.138088	78.45851

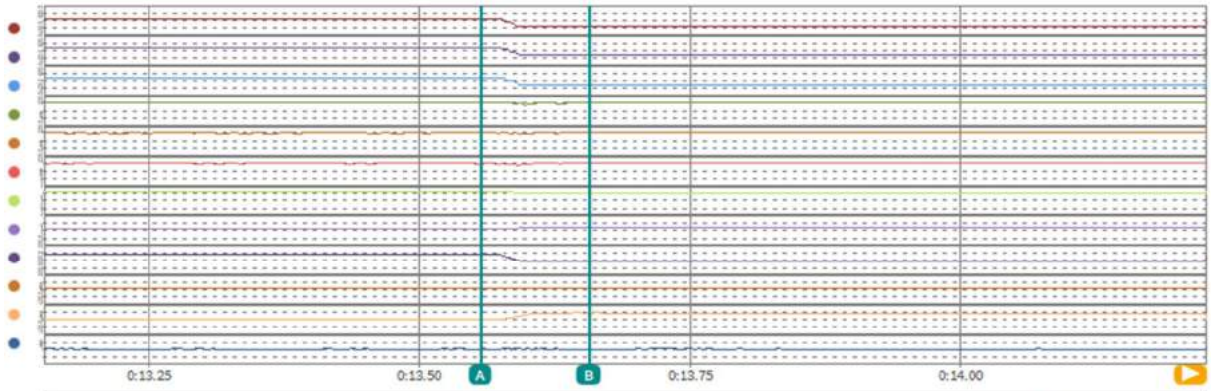
Test 3.A.1-Symmetrical fault (U/U_{nom} = 0,82); P = 100% ±5% P_n

0~60ms



	A	B	Delta
Time [s]	0:13.55731	0:13.61778	0.06046
U1_tRMS_rc@AC Group [V]	229.7001	190.1639	-39.53624
U2_tRMS_rc@AC Group [V]	230.6605	190.1146	-40.54584
U3_tRMS_rc@AC Group [V]	231.2924	190.5844	-40.70808
I1_tRMS_rc@AC Group [A]	175.2830	180.5524	5.269394
I2_tRMS_rc@AC Group [A]	174.8258	180.6863	5.860580
I3_tRMS_rc@AC Group [A]	174.6319	181.2682	6.636261
P_t_rc@AC Group [W]	120969.7	97051.95	-23917.77
Q_t_rc@AC Group [var]	1495.352	35183.46	33688.11
U_fund_SYM+_rc@AC Group [V]	399.3122	329.5518	-69.76035
U_fund_SYM-_rc@AC Group [V]	0.487714	0.607517	0.119803
I_fund_Q_SYM+_rc@AC Group	-0.761399	60.74758	61.50898
I_fund_Q_SYM-_rc@AC Group [A]	-0.085876	0.169778	0.255654

0~100ms

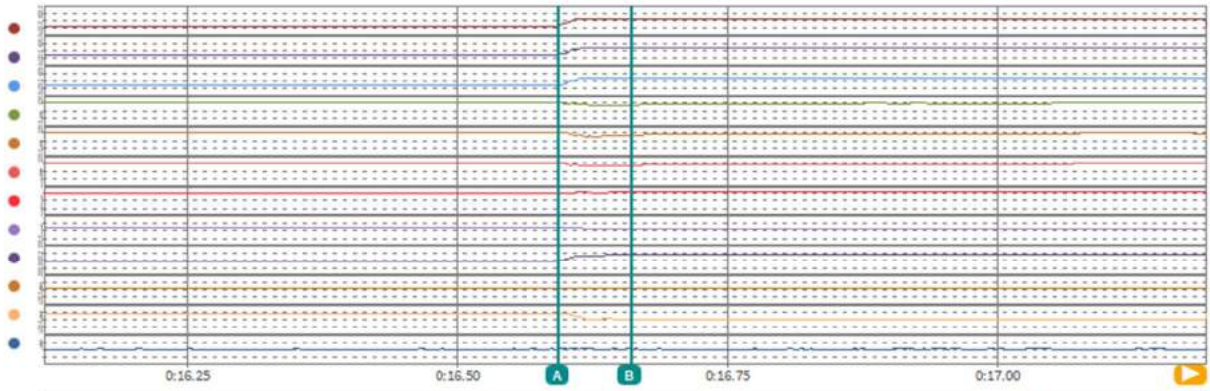


	A	B	Delta
Time [s]	0:13.55731	0:13.65739	0.10007
U1_tRMS_rc@AC Group [V]	229.7001	188.7566	-40.94356
U2_tRMS_rc@AC Group [V]	230.6605	188.1626	-42.49788
U3_tRMS_rc@AC Group [V]	231.2924	188.0468	-43.24561
I1_tRMS_rc@AC Group [A]	175.2830	176.4720	1.189026
I2_tRMS_rc@AC Group [A]	174.8258	179.2548	4.429062
I3_tRMS_rc@AC Group [A]	174.6319	179.0152	4.383286
P_t_rc@AC Group [W]	120969.7	94220.70	-26749.02
Q_t_rc@AC Group [var]	1495.352	35545.21	34049.86
U_fund_SYM+_rc@AC Group [V]	399.3122	326.1603	-73.15192
U_fund_SYM-_rc@AC Group [V]	0.487714	0.965120	0.477406
I_fund_Q_SYM+_rc@AC Group	-0.761399	62.81124	63.57264
I_fund_Q_SYM-_rc@AC Group [A]	-0.085876	-1.631968	-1.546092

Duration time

	A	B	Delta
Time [s]	0:13.55731	0:16.58932	3.03201
U1_tRMS_rc@AC Group [V]	229.7001	188.6431	-41.05701
U2_tRMS_rc@AC Group [V]	230.6605	189.0815	-41.57899
U3_tRMS_rc@AC Group [V]	231.2924	189.9963	-41.29617
I1_tRMS_rc@AC Group [A]	175.2830	178.9445	3.661545
I2_tRMS_rc@AC Group [A]	174.8258	179.0300	4.204193
I3_tRMS_rc@AC Group [A]	174.6319	178.9672	4.335266
P_t_rc@AC Group [W]	120969.7	95328.98	-25640.73
Q_t_rc@AC Group [var]	1495.352	35173.55	33678.20
U_fund_SYM+_rc@AC Group [V]	399.3122	327.7530	-71.55920
U_fund_SYM-_rc@AC Group [V]	0.487714	0.196778	-0.290937
I_fund_Q_SYM+_rc@AC Group	-0.761399	61.90719	62.66859
I_fund_Q_SYM-_rc@AC Group [A]	-0.085876	0.037913	0.123789

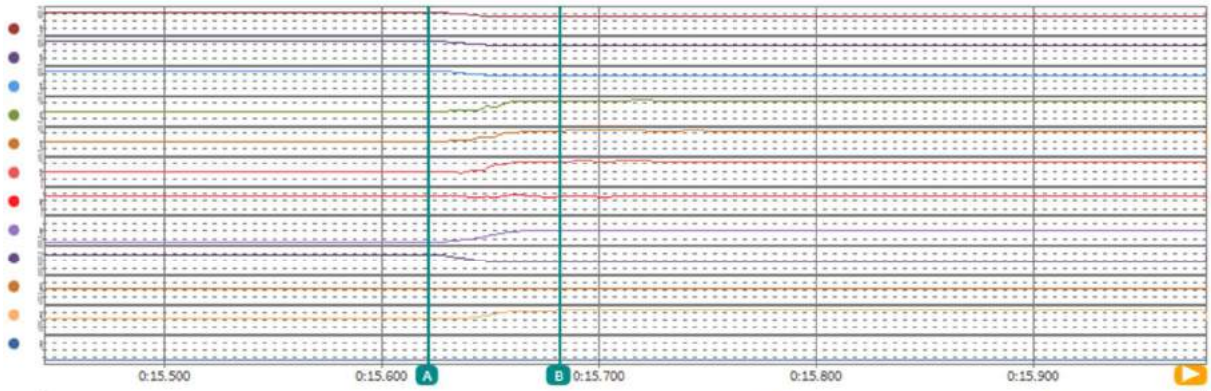
Recovery time



	A	B	Delta
Time [s]	0:16.593747	0:16.660557	0.066810
U1_tRMS_rc@AC Group [V]	188.6770	229.1527	40.47565
U2_tRMS_rc@AC Group [V]	189.0943	230.8683	41.77409
U3_tRMS_rc@AC Group [V]	190.0850	232.5531	42.46811
I1_tRMS_rc@AC Group [A]	179.1246	158.0220	-21.10266
I2_tRMS_rc@AC Group [A]	179.0206	157.6964	-21.32411
I3_tRMS_rc@AC Group [A]	179.2085	157.0120	-22.19650
P_t_rc@AC Group [W]	95446.30	109107.0	13660.70
Q_t_rc@AC Group [var]	35151.09	2331.065	-32820.02
U_fund_SYM+_rc@AC Group [V]	327.8315	399.8445	72.01297
U_fund_SYM-_rc@AC Group [V]	0.223365	1.202527	0.979163
I_fund_Q_SYM+_rc@AC Group	61.85117	-0.748042	-62.59921
I_fund_Q_SYM-_rc@AC Group [A]	-0.181385	0.196018	0.377403

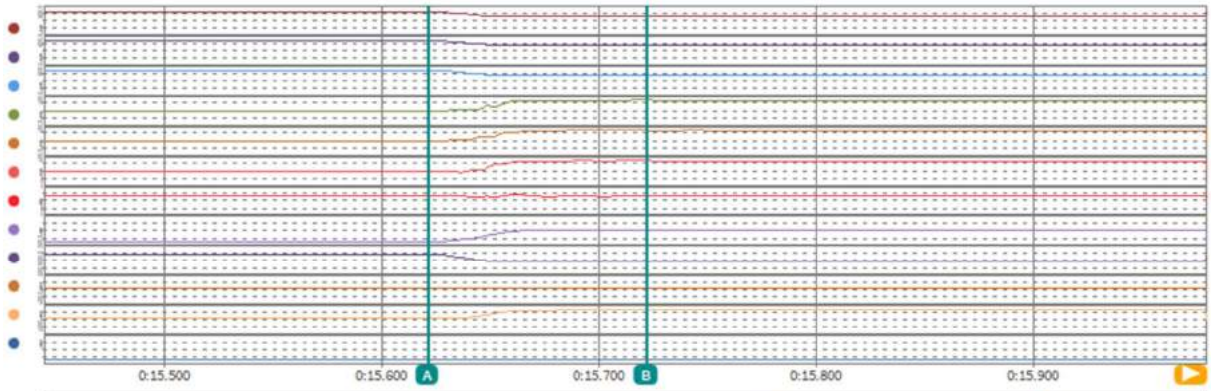
Test 3.A.2-Symmetrical fault (U/U_{nom} = 0,82); P = 20% ±5% P_n

0~60ms



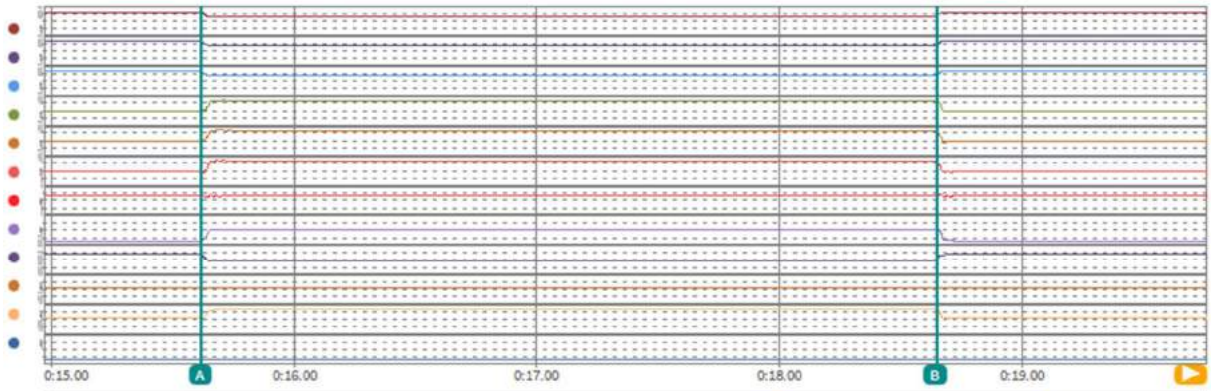
	A	B	Delta
Time [s]	0:15.62116	0:15.68169	0.06053
U1_tRMS_rc@AC Group [V]	229.3040	188.4776	-40.82643
U2_tRMS_rc@AC Group [V]	229.9130	187.3846	-42.52838
U3_tRMS_rc@AC Group [V]	229.9529	186.7432	-43.20973
I1_tRMS_rc@AC Group [A]	36.05154	74.59406	38.54251
I2_tRMS_rc@AC Group [A]	35.71905	76.25919	40.54014
I3_tRMS_rc@AC Group [A]	35.60844	78.16215	42.55370
P_t_rc@AC Group [W]	24632.78	23451.79	-1180.982
Q_t_rc@AC Group [var]	1304.643	35976.62	34671.97
U_fund_SYM+_rc@AC Group [V]	397.8872	324.7898	-73.09747
U_fund_SYM-_rc@AC Group [V]	0.228872	1.584916	1.356045
I_fund_Q_SYM+_rc@AC Group	1.221698	63.48433	62.26263
I_fund_Q_SYM-_rc@AC Group [A]	0.191964	-1.560783	-1.752747

0~100ms



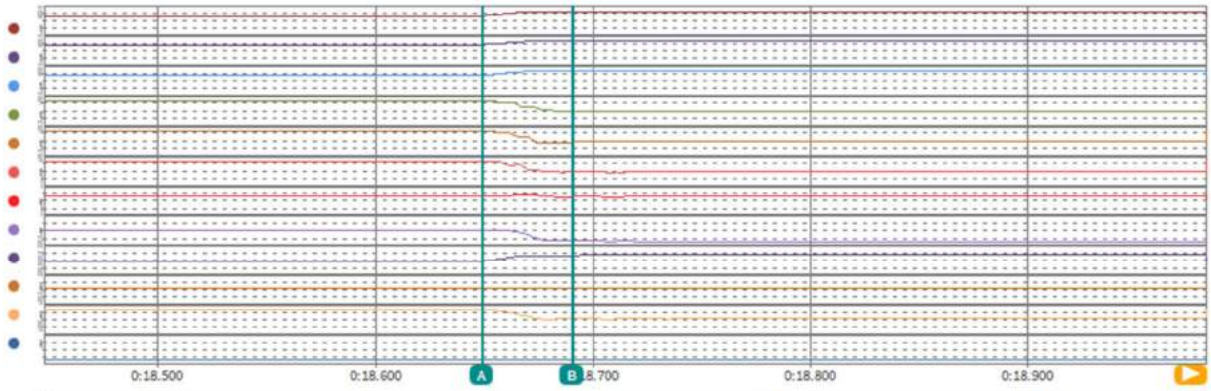
	A	B	Delta
Time [s]	0:15.62116	0:15.72176	0.10061
U1_tRMS_rc@AC Group [V]	229.3040	188.0677	-41.23634
U2_tRMS_rc@AC Group [V]	229.9130	187.2672	-42.64581
U3_tRMS_rc@AC Group [V]	229.9529	186.9795	-42.97339
I1_tRMS_rc@AC Group [A]	36.05154	80.50598	44.45444
I2_tRMS_rc@AC Group [A]	35.71905	80.15963	44.44058
I3_tRMS_rc@AC Group [A]	35.60844	80.17487	44.56643
P_t_rc@AC Group [W]	24632.78	24208.47	-424.3027
Q_t_rc@AC Group [var]	1304.643	38102.90	36798.26
U_fund_SYM+_rc@AC Group [V]	397.8872	324.6258	-73.26141
U_fund_SYM-_rc@AC Group [V]	0.228872	1.096636	0.867764
I_fund_Q_SYM+_rc@AC Group	1.221698	67.66740	66.44571
I_fund_Q_SYM-_rc@AC Group [A]	0.191964	0.221246	0.029283

Duration time



	A	B	Delta
Time [s]	0:15.62116	0:18.64607	3.02491
U1_tRMS_rc@AC Group [V]	229.3040	188.4650	-40.83899
U2_tRMS_rc@AC Group [V]	229.9130	188.5182	-41.39479
U3_tRMS_rc@AC Group [V]	229.9529	188.9115	-41.04144
I1_tRMS_rc@AC Group [A]	36.05154	77.78798	41.73644
I2_tRMS_rc@AC Group [A]	35.71905	77.78818	42.06913
I3_tRMS_rc@AC Group [A]	35.60844	77.63997	42.03152
P_t_rc@AC Group [W]	24632.78	23863.03	-769.7441
Q_t_rc@AC Group [var]	1304.643	36957.29	35652.65
U_fund_SYM+_rc@AC Group [V]	397.8872	326.6990	-71.18820
U_fund_SYM-_rc@AC Group [V]	0.228872	0.202283	-0.026589
I_fund_Q_SYM+_rc@AC Group	1.221698	65.26684	64.04514
I_fund_Q_SYM-_rc@AC Group [A]	0.191964	0.147073	-0.044890

Recovery time



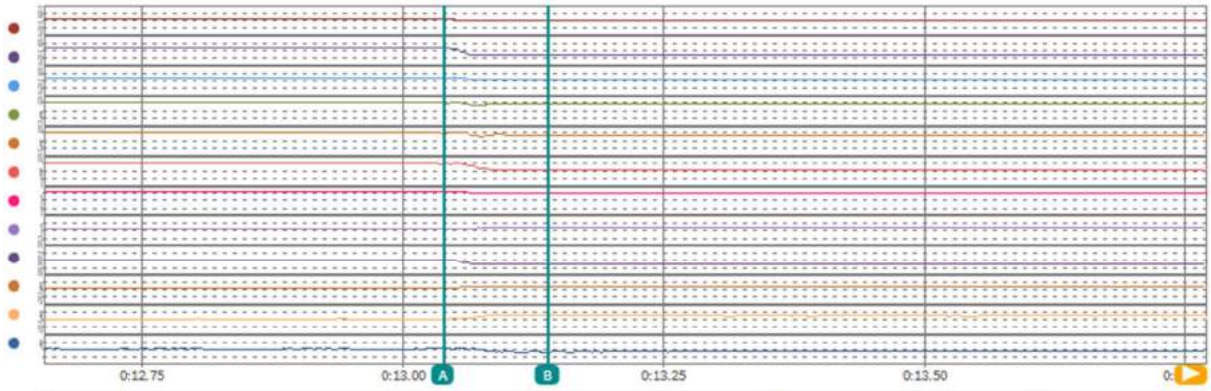
	A	B	Delta
Time [s]	0:18.6494002	0:18.6907856	0.0413854
U1_tRMS_rc@AC Group [V]	188.4826	228.5030	40.02042
U2_tRMS_rc@AC Group [V]	188.5728	228.9821	40.40926
U3_tRMS_rc@AC Group [V]	189.0061	229.9647	40.95853
I1_tRMS_rc@AC Group [A]	77.62348	35.55171	-42.07177
I2_tRMS_rc@AC Group [A]	77.76169	32.84778	-44.91391
I3_tRMS_rc@AC Group [A]	77.66827	35.78403	-41.88425
P_t_rc@AC Group [W]	23882.15	23200.34	-681.8145
Q_t_rc@AC Group [var]	36923.88	5632.579	-31291.30
U_fund_SYM+_rc@AC Group [V]	326.7961	396.8807	70.08459
U_fund_SYM-_rc@AC Group [V]	0.488314	0.607802	0.119487
I_fund_Q_SYM+_rc@AC Group	65.19308	2.020122	-63.17296
I_fund_Q_SYM-_rc@AC Group [A]	0.011457	-1.915362	-1.926819

Test 3.D.1- Asymmetrical fault (U/U_{nom} = 0,82); P = 100% ±5% P_n

0~60ms

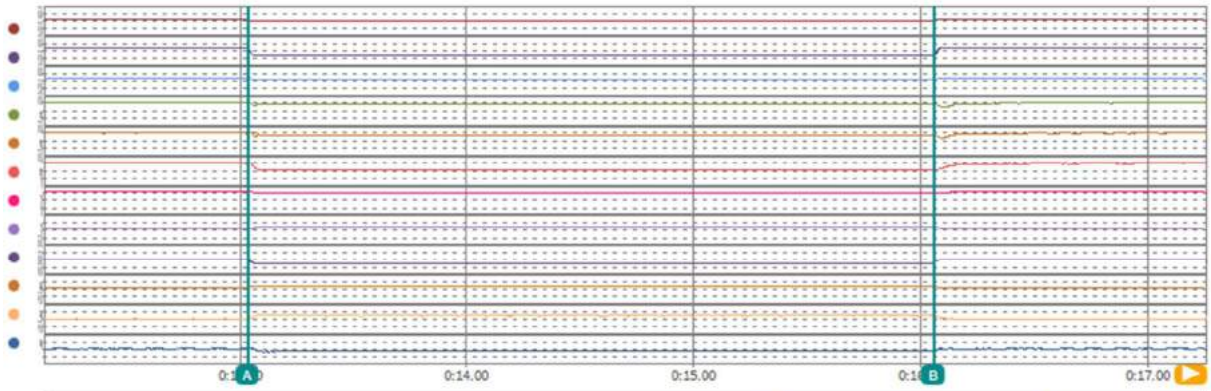
	A	B	Delta
Time [s]	0:13.039398	0:13.099813	0.060415
U1_tRMS_rc@AC Group [V]	230.7857	220.7101	-10.07562
U2_tRMS_rc@AC Group [V]	230.5918	188.1706	-42.42117
U3_tRMS_rc@AC Group [V]	229.7195	221.0735	-8.645996
I1_tRMS_rc@AC Group [A]	177.0240	170.7135	-6.310532
I2_tRMS_rc@AC Group [A]	175.2375	159.9064	-15.33110
I3_tRMS_rc@AC Group [A]	174.3510	119.5567	-54.79434
P_t_rc@AC Group [W]	121295.6	91031.09	-30264.47
Q_t_rc@AC Group [var]	2158.327	24222.52	22064.19
U_fund_SYM+_rc@AC Group [V]	398.8710	362.9039	-35.96710
U_fund_SYM-_rc@AC Group [V]	2.870929	35.73632	32.86539
I_fund_Q_SYM+_rc@AC Group	-0.198616	32.15668	32.35529
I_fund_Q_SYM-_rc@AC Group [A]	0.382133	-30.07397	-30.45610

0~100ms



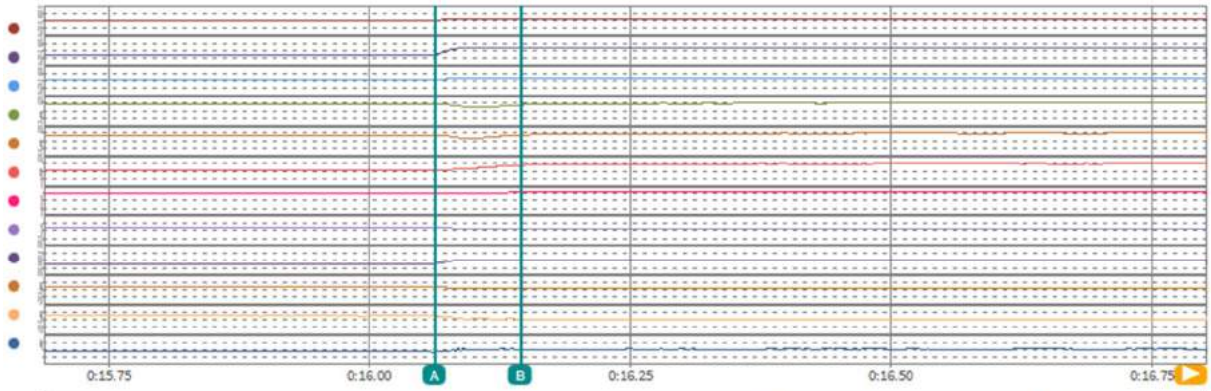
	A	B	Delta
Time [s]	0:13.039398	0:13.139475	0.100077
U1_tRMS_rc@AC Group [V]	230.7857	220.4434	-10.34232
U2_tRMS_rc@AC Group [V]	230.5918	188.1268	-42.46500
U3_tRMS_rc@AC Group [V]	229.7195	220.8474	-8.872162
I1_tRMS_rc@AC Group [A]	177.0240	169.0067	-8.017334
I2_tRMS_rc@AC Group [A]	175.2375	158.3646	-16.87288
I3_tRMS_rc@AC Group [A]	174.3510	114.6316	-59.71938
P_t_rc@AC Group [W]	121295.6	89034.86	-32260.70
Q_t_rc@AC Group [var]	2158.327	24578.63	22420.30
U_fund_SYM+_rc@AC Group [V]	398.8710	362.5982	-36.27277
U_fund_SYM-_rc@AC Group [V]	2.870929	35.53924	32.66831
I_fund_Q_SYM+_rc@AC Group	-0.198616	32.86559	33.06420
I_fund_Q_SYM-_rc@AC Group [A]	0.382133	-32.01971	-32.40184

Duration time



	A	B	Delta
Time [s]	0:13.039398	0:16.055848	3.016450
U1_tRMS_rc@AC Group [V]	230.7857	221.4074	-9.378326
U2_tRMS_rc@AC Group [V]	230.5918	187.7484	-42.84338
U3_tRMS_rc@AC Group [V]	229.7195	222.6345	-7.085052
I1_tRMS_rc@AC Group [A]	177.0240	170.8182	-6.205826
I2_tRMS_rc@AC Group [A]	175.2375	157.7155	-17.52196
I3_tRMS_rc@AC Group [A]	174.3510	116.3684	-57.98263
P_t_rc@AC Group [W]	121295.6	90217.30	-31078.26
Q_t_rc@AC Group [var]	2158.327	23936.97	21778.64
U_fund_SYM+_rc@AC Group [V]	398.8710	363.7640	-35.10696
U_fund_SYM-_rc@AC Group [V]	2.870929	38.21265	35.34172
I_fund_Q_SYM+_rc@AC Group	-0.198616	31.83714	32.03576
I_fund_Q_SYM-_rc@AC Group [A]	0.382133	-31.79826	-32.18039

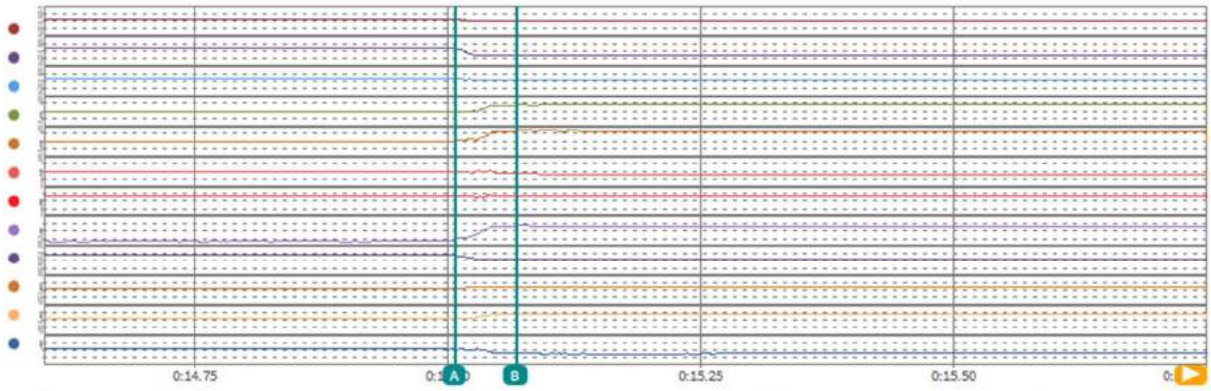
Recovery time



	A	B	Delta
Time [s]	0:16.063542	0:16.145600	0.082058
U1_tRMS_rc@AC Group [V]	220.8944	229.1544	8.259979
U2_tRMS_rc@AC Group [V]	189.7780	231.4060	41.62798
U3_tRMS_rc@AC Group [V]	220.1531	231.8897	11.73666
I1_tRMS_rc@AC Group [A]	169.8041	158.5878	-11.21632
I2_tRMS_rc@AC Group [A]	159.5088	157.8282	-1.680603
I3_tRMS_rc@AC Group [A]	115.4272	159.8410	44.41378
P_t_rc@AC Group [W]	90103.37	109899.2	19795.82
Q_t_rc@AC Group [var]	23792.37	2558.467	-21233.90
U_fund_SYM+_rc@AC Group [V]	363.3354	399.7718	36.43634
U_fund_SYM-_rc@AC Group [V]	33.99170	1.012874	-32.97883
I_fund_Q_SYM+_rc@AC Group	31.62394	-0.917164	-32.54110
I_fund_Q_SYM-_rc@AC Group [A]	-32.19498	-1.159647	31.03533

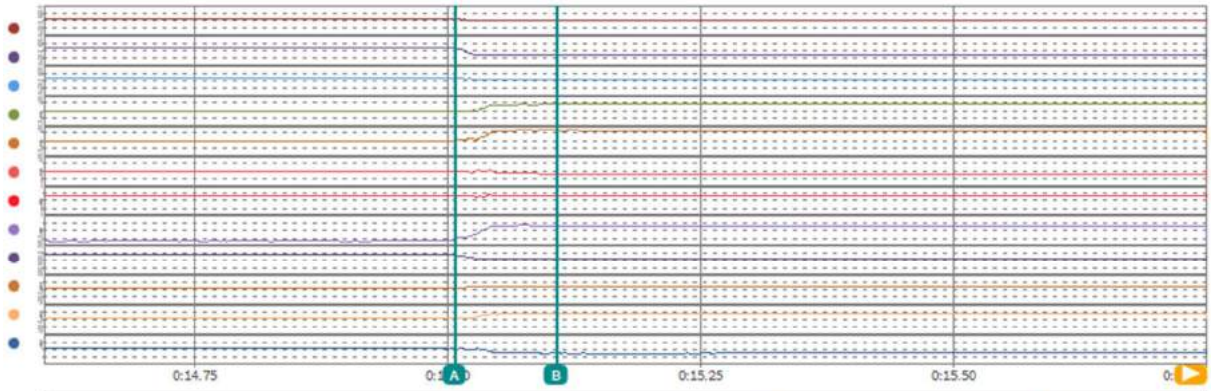
Test 3.D.2- Asymmetrical fault (U/U_{nom} = 0,82); P = 20% ±5% P_n

0~60ms



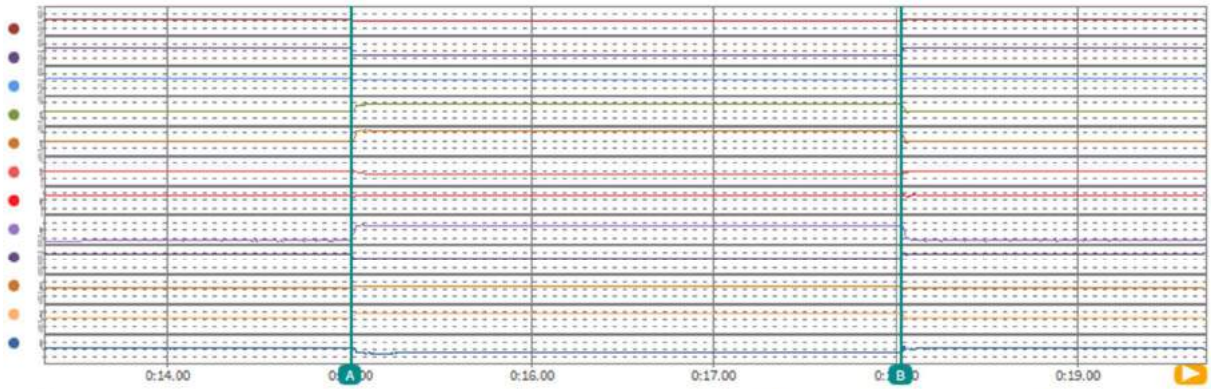
	A	B	Delta
Time [s]	0:15.008409	0:15.068841	0.060432
U1_tRMS_rc@AC Group [V]	227.5901	221.4121	-6.178040
U2_tRMS_rc@AC Group [V]	230.8546	187.2172	-43.63741
U3_tRMS_rc@AC Group [V]	230.7860	217.9995	-12.78656
I1_tRMS_rc@AC Group [A]	35.40331	61.75953	26.35622
I2_tRMS_rc@AC Group [A]	36.09163	78.81605	42.72441
I3_tRMS_rc@AC Group [A]	35.48926	29.30767	-6.181587
P_t_rc@AC Group [W]	24538.85	24137.55	-401.2930
Q_t_rc@AC Group [var]	1418.079	25094.76	23676.68
U_fund_SYM+_rc@AC Group [V]	397.8076	361.0191	-36.78857
U_fund_SYM-_rc@AC Group [V]	3.537763	35.36196	31.82420
I_fund_Q_SYM+_rc@AC Group	1.229926	33.92704	32.69711
I_fund_Q_SYM-_rc@AC Group [A]	0.323794	-29.32499	-29.64879

0~100ms



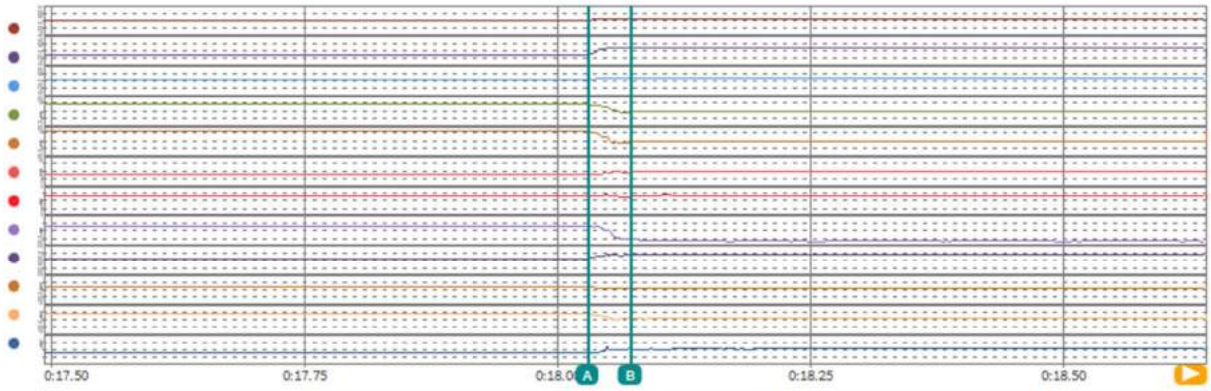
	A	B	Delta
Time [s]	0:15.008409	0:15.108568	0.100159
U1_tRMS_rc@AC Group [V]	227.5901	220.8396	-6.750488
U2_tRMS_rc@AC Group [V]	230.8546	187.5643	-43.29031
U3_tRMS_rc@AC Group [V]	230.7860	218.9628	-11.82324
I1_tRMS_rc@AC Group [A]	35.40331	63.62745	28.22414
I2_tRMS_rc@AC Group [A]	36.09163	80.42116	44.32952
I3_tRMS_rc@AC Group [A]	35.48926	26.86888	-8.620380
P_t_rc@AC Group [W]	24538.85	24138.48	-400.3633
Q_t_rc@AC Group [var]	1418.079	25370.38	23952.30
U_fund_SYM+_rc@AC Group [V]	397.8076	361.4431	-36.36453
U_fund_SYM-_rc@AC Group [V]	3.537763	35.18559	31.64783
I_fund_Q_SYM+_rc@AC Group	1.229926	34.07755	32.84762
I_fund_Q_SYM-_rc@AC Group [A]	0.323794	-31.54009	-31.86389

Duration time



	A	B	Delta
Time [s]	0:15.008409	0:18.029738	3.021329
U1_tRMS_rc@AC Group [V]	227.5901	221.4327	-6.157410
U2_tRMS_rc@AC Group [V]	230.8546	187.2679	-43.58676
U3_tRMS_rc@AC Group [V]	230.7860	221.6773	-9.108688
I1_tRMS_rc@AC Group [A]	35.40331	65.95866	30.55535
I2_tRMS_rc@AC Group [A]	36.09163	76.70036	40.60872
I3_tRMS_rc@AC Group [A]	35.48926	22.70782	-12.78143
P_t_rc@AC Group [W]	24538.85	24186.70	-352.1523
Q_t_rc@AC Group [var]	1418.079	23899.56	22481.49
U_fund_SYM+_rc@AC Group [V]	397.8076	362.9485	-34.85916
U_fund_SYM-_rc@AC Group [V]	3.537763	37.86267	34.32491
I_fund_Q_SYM+_rc@AC Group	1.229926	33.11050	31.88057
I_fund_Q_SYM-_rc@AC Group [A]	0.323794	-31.32531	-31.64910

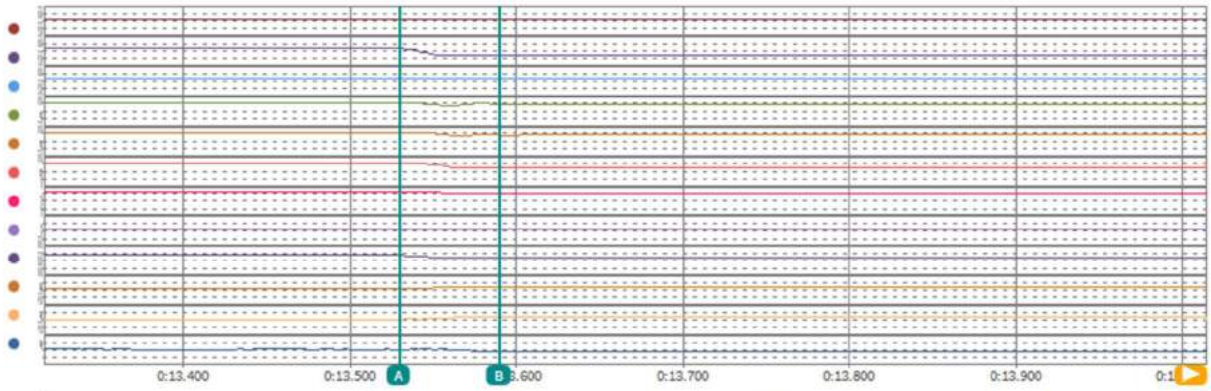
Recovery time



	A	B	Delta
Time [s]	0:18.030013	0:18.072315	0.042302
U1_tRMS_rc@AC Group [V]	221.4327	228.2005	6.767761
U2_tRMS_rc@AC Group [V]	187.2679	229.7677	42.49982
U3_tRMS_rc@AC Group [V]	221.6773	231.7886	10.11127
I1_tRMS_rc@AC Group [A]	65.95866	33.82738	-32.13128
I2_tRMS_rc@AC Group [A]	76.70036	33.98187	-42.71848
I3_tRMS_rc@AC Group [A]	22.70782	33.34059	10.63276
P_t_rc@AC Group [W]	24186.70	22851.10	-1335.596
Q_t_rc@AC Group [var]	23899.56	4317.120	-19582.44
U_fund_SYM+_rc@AC Group [V]	362.9485	398.2192	35.27075
U_fund_SYM-_rc@AC Group [V]	37.86267	1.475356	-36.38732
I_fund_Q_SYM+_rc@AC Group	33.11050	2.750504	-30.36000
I_fund_Q_SYM-_rc@AC Group [A]	-31.32531	0.160711	31.48602

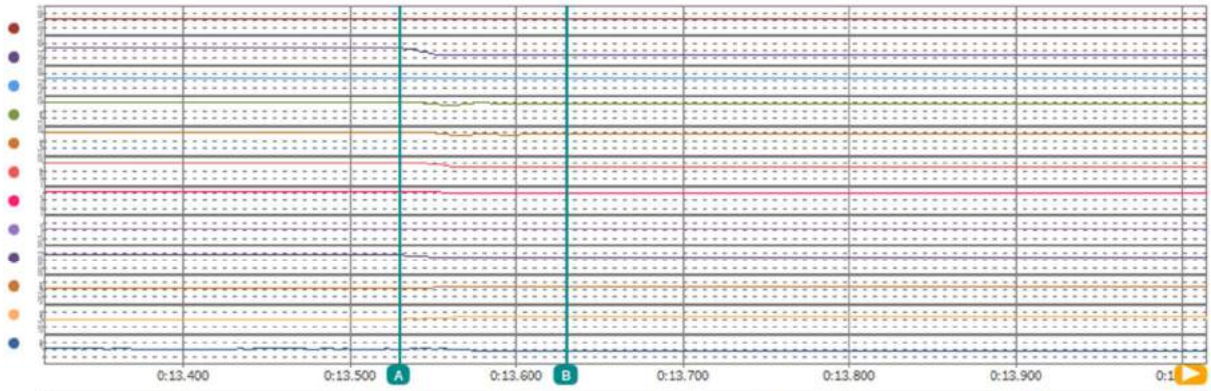
Test 3.B.1- Single phase fault (U/U_{nom} = 0,82); P = 100% ±5% P_n

0~60ms



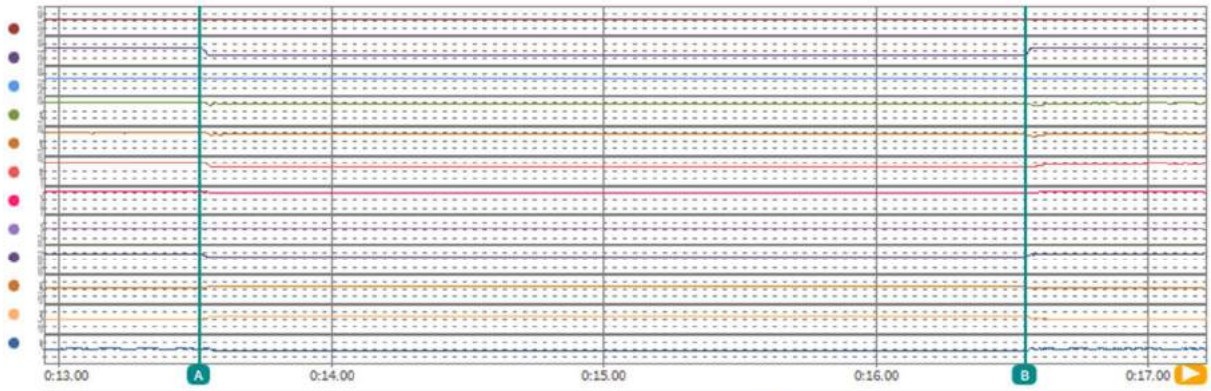
	A	B	Delta
Time [s]	0:13.53005	0:13.59006	0.06001
U1_tRMS_rc@AC Group [V]	229.6142	230.2121	0.597870
U2_tRMS_rc@AC Group [V]	230.5805	188.0761	-42.50441
U3_tRMS_rc@AC Group [V]	231.1948	231.3106	0.115799
I1_tRMS_rc@AC Group [A]	175.7023	171.2757	-4.426575
I2_tRMS_rc@AC Group [A]	174.9938	162.3090	-12.68475
I3_tRMS_rc@AC Group [A]	175.3393	137.4081	-37.93121
P_t_rc@AC Group [W]	121214.8	100519.9	-20694.93
Q_t_rc@AC Group [var]	2005.702	15709.98	13704.28
U_fund_SYM+_rc@AC Group [V]	399.1577	375.0227	-24.13504
U_fund_SYM-_rc@AC Group [V]	0.449719	23.91530	23.46558
I_fund_Q_SYM+_rc@AC Group	-0.366349	21.13713	21.50348
I_fund_Q_SYM-_rc@AC Group [A]	-0.392091	-19.67264	-19.28055

0~100ms



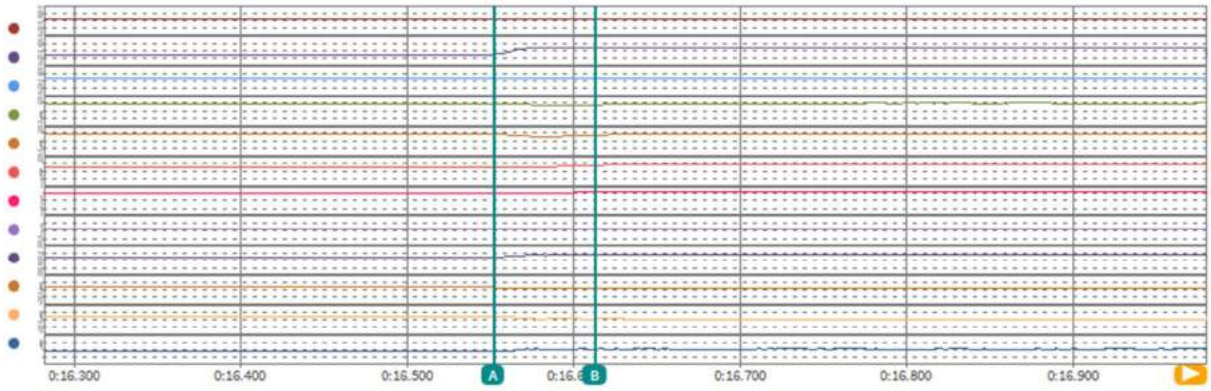
	A	B	Delta
Time [s]	0:13.53005	0:13.63035	0.10030
U1_tRMS_rc@AC Group [V]	229.6142	229.6521	0.037918
U2_tRMS_rc@AC Group [V]	230.5805	188.1527	-42.42786
U3_tRMS_rc@AC Group [V]	231.1948	230.8150	-0.379807
I1_tRMS_rc@AC Group [A]	175.7023	172.6221	-3.080185
I2_tRMS_rc@AC Group [A]	174.9938	161.9508	-13.04298
I3_tRMS_rc@AC Group [A]	175.3393	136.4161	-38.92325
P_t_rc@AC Group [W]	121214.8	100263.9	-20950.98
Q_t_rc@AC Group [var]	2005.702	16431.63	14425.93
U_fund_SYM+_rc@AC Group [V]	399.1577	374.4548	-24.70294
U_fund_SYM-_rc@AC Group [V]	0.449719	23.50819	23.05847
I_fund_Q_SYM+_rc@AC Group	-0.366349	22.57106	22.93741
I_fund_Q_SYM-_rc@AC Group [A]	-0.392091	-21.02941	-20.63732

Duration time



	A	B	Delta
Time [s]	0:13.51696	0:16.54725	3.03029
U1_tRMS_rc@AC Group [V]	229.5931	229.5345	-0.058609
U2_tRMS_rc@AC Group [V]	230.5239	189.3713	-41.15265
U3_tRMS_rc@AC Group [V]	231.0609	230.9911	-0.069748
I1_tRMS_rc@AC Group [A]	175.8586	172.9254	-2.933243
I2_tRMS_rc@AC Group [A]	175.1632	162.0862	-13.07704
I3_tRMS_rc@AC Group [A]	175.7358	137.8266	-37.90923
P_t_rc@AC Group [W]	121343.9	100958.0	-20385.88
Q_t_rc@AC Group [var]	2032.183	16035.14	14002.96
U_fund_SYM+_rc@AC Group [V]	399.0344	375.1970	-23.83740
U_fund_SYM-_rc@AC Group [V]	0.320806	22.95639	22.63558
I_fund_Q_SYM+_rc@AC Group	-0.245536	22.01374	22.25928
I_fund_Q_SYM-_rc@AC Group [A]	-0.387240	-20.39762	-20.01038

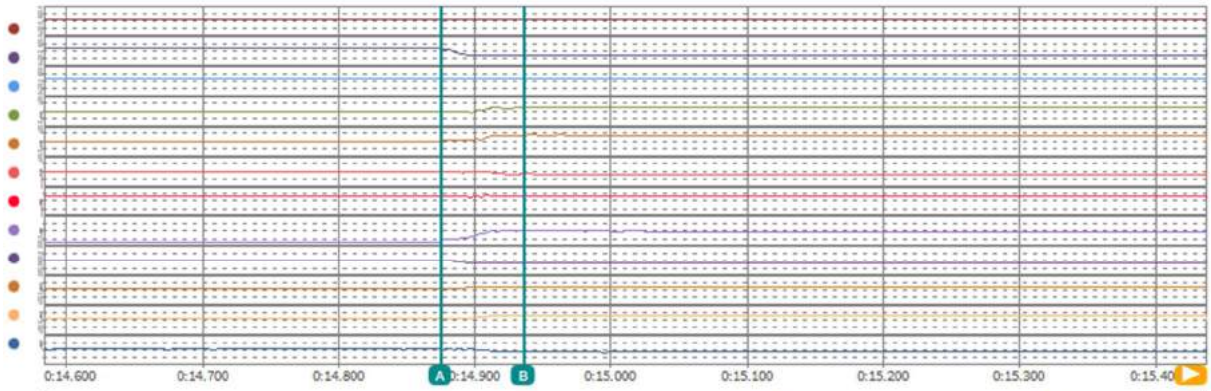
Recovery time



	A	B	Delta
Time [s]	0:16.5521109	0:16.6129740	0.0608631
U1_tRMS_rc@AC Group [V]	229.5894	229.3405	-0.248917
U2_tRMS_rc@AC Group [V]	189.4081	231.5204	42.11234
U3_tRMS_rc@AC Group [V]	231.0469	230.9958	-0.051056
I1_tRMS_rc@AC Group [A]	172.8545	158.7774	-14.07710
I2_tRMS_rc@AC Group [A]	162.0668	157.3954	-4.671387
I3_tRMS_rc@AC Group [A]	137.9217	159.5014	21.57968
P_t_rc@AC Group [W]	100992.4	109682.0	8689.625
Q_t_rc@AC Group [var]	15979.10	1900.428	-14078.67
U_fund_SYM+_rc@AC Group [V]	375.2769	399.4277	24.15073
U_fund_SYM-_rc@AC Group [V]	22.90796	0.844754	-22.06321
I_fund_Q_SYM+_rc@AC Group	21.90218	-0.693300	-22.59548
I_fund_Q_SYM-_rc@AC Group [A]	-20.21248	-0.898439	19.31404

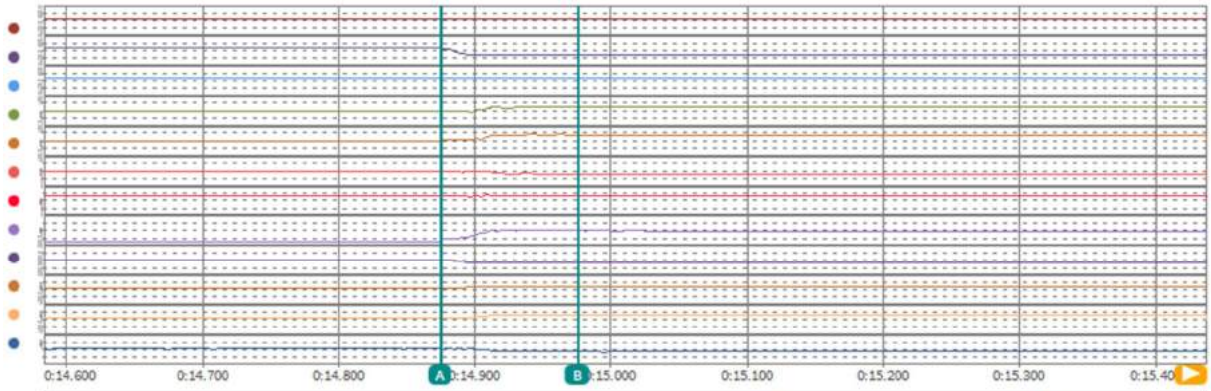
Test 3.B.2- Single phase fault (U/U_{nom} = 0,82); P = 20% ±5% P_n

0~60ms



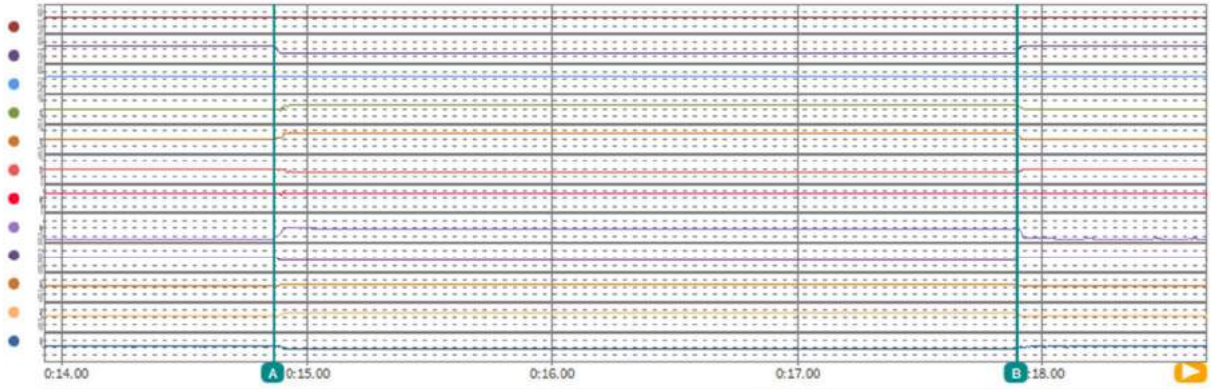
	A	B	Delta
Time [s]	0:14.875323	0:14.936114	0.060790
U1_tRMS_rc@AC Group [V]	229.1513	229.8821	0.730759
U2_tRMS_rc@AC Group [V]	229.9124	187.0374	-42.87494
U3_tRMS_rc@AC Group [V]	230.0082	229.0840	-0.924194
I1_tRMS_rc@AC Group [A]	35.67272	52.66337	16.99065
I2_tRMS_rc@AC Group [A]	35.80486	60.36186	24.55701
I3_tRMS_rc@AC Group [A]	35.46689	28.02730	-7.439592
P_t_rc@AC Group [W]	24535.92	24452.98	-82.93555
Q_t_rc@AC Group [var]	1176.446	17061.63	15885.18
U_fund_SYM+_rc@AC Group [V]	397.8269	372.9479	-24.87900
U_fund_SYM-_rc@AC Group [V]	0.428769	23.37771	22.94894
I_fund_Q_SYM+_rc@AC Group	1.213402	23.41036	22.19696
I_fund_Q_SYM-_rc@AC Group [A]	0.168179	-18.37955	-18.54773

0~100ms



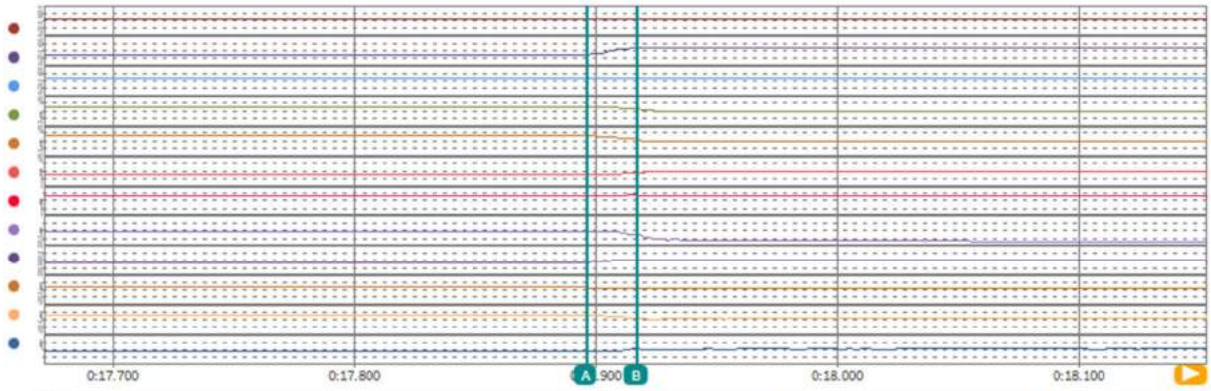
	A	B	Delta
Time [s]	0:14.875323	0:14.975942	0.100618
U1_tRMS_rc@AC Group [V]	229.1513	229.5993	0.448029
U2_tRMS_rc@AC Group [V]	229.9124	187.3844	-42.52802
U3_tRMS_rc@AC Group [V]	230.0082	229.3532	-0.654999
I1_tRMS_rc@AC Group [A]	35.67272	53.78239	18.10968
I2_tRMS_rc@AC Group [A]	35.80486	61.86857	26.06371
I3_tRMS_rc@AC Group [A]	35.46689	25.05138	-10.41551
P_t_rc@AC Group [W]	24535.92	24161.35	-374.5703
Q_t_rc@AC Group [var]	1176.446	17249.94	16073.49
U_fund_SYM+_rc@AC Group [V]	397.8269	373.1415	-24.68539
U_fund_SYM-_rc@AC Group [V]	0.428769	23.04208	22.61331
I_fund_Q_SYM+_rc@AC Group	1.213402	23.62075	22.40735
I_fund_Q_SYM-_rc@AC Group [A]	0.168179	-20.83506	-21.00324

Duration time



	A	B	Delta
Time [s]	0:14.865998	0:17.896244	3.030246
U1_tRMS_rc@AC Group [V]	229.2330	229.1188	-0.114136
U2_tRMS_rc@AC Group [V]	229.9295	188.6510	-41.27852
U3_tRMS_rc@AC Group [V]	230.1272	230.1772	0.049942
I1_tRMS_rc@AC Group [A]	35.84076	54.91721	19.07645
I2_tRMS_rc@AC Group [A]	35.65333	58.50486	22.85153
I3_tRMS_rc@AC Group [A]	35.74914	24.27544	-11.47370
P_t_rc@AC Group [W]	24616.63	24243.29	-373.3418
Q_t_rc@AC Group [var]	1084.054	16288.79	15204.73
U_fund_SYM+_rc@AC Group [V]	397.9543	374.0637	-23.89063
U_fund_SYM-_rc@AC Group [V]	0.311458	22.32877	22.01731
I_fund_Q_SYM+_rc@AC Group	1.109767	22.91813	21.80836
I_fund_Q_SYM-_rc@AC Group [A]	9.961e-3	-20.02610	-20.03606

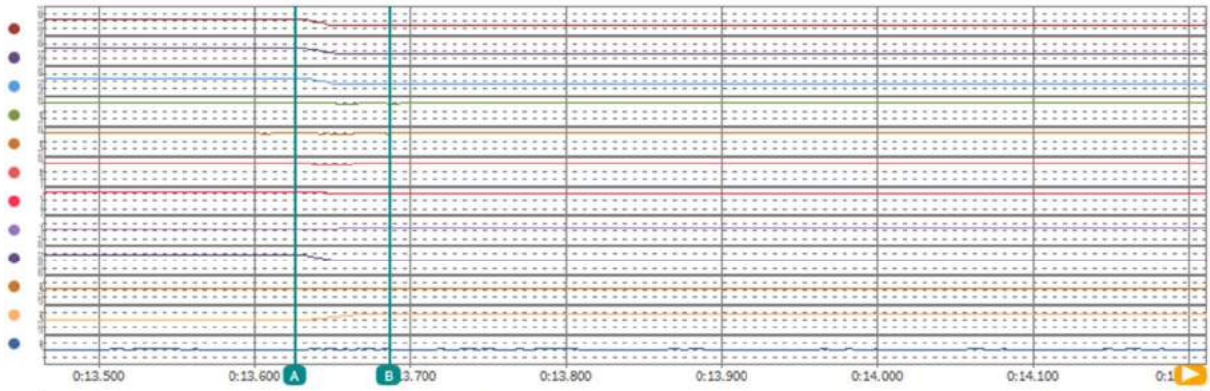
Recovery time



	A	B	Delta
Time [s]	0:17.895945	0:17.916933	0.020988
U1_tRMS_rc@AC Group [V]	229.1046	229.0084	-0.096161
U2_tRMS_rc@AC Group [V]	188.6482	229.1934	40.54521
U3_tRMS_rc@AC Group [V]	230.1713	230.8561	0.684769
I1_tRMS_rc@AC Group [A]	54.91315	47.46201	-7.451141
I2_tRMS_rc@AC Group [A]	58.57950	47.66179	-10.91771
I3_tRMS_rc@AC Group [A]	24.43005	31.99205	7.562002
P_t_rc@AC Group [W]	24293.38	26671.99	2378.613
Q_t_rc@AC Group [var]	16299.67	11831.81	-4467.863
U_fund_SYM+_rc@AC Group [V]	374.0529	397.7765	23.72360
U_fund_SYM-_rc@AC Group [V]	22.38108	0.085081	-22.29600
I_fund_Q_SYM+_rc@AC Group	22.95514	7.235687	-15.71946
I_fund_Q_SYM-_rc@AC Group [A]	-19.94810	7.323251	27.27136

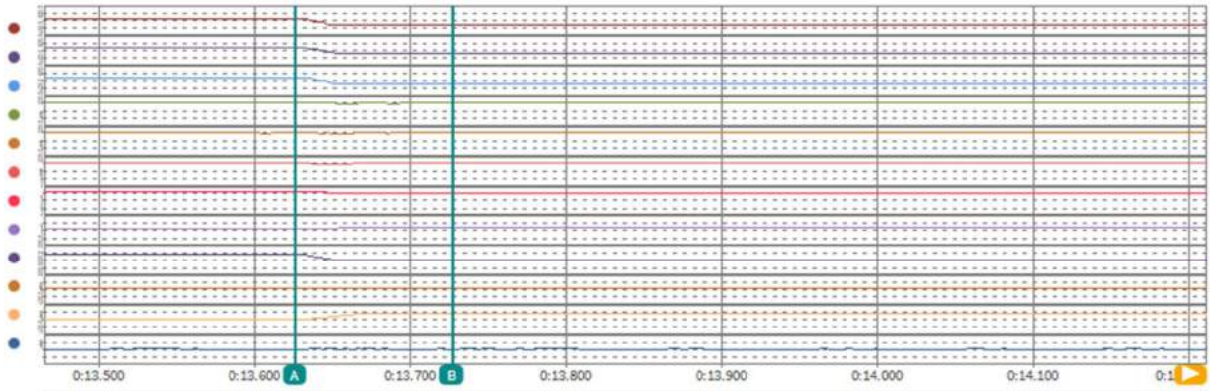
Test 4.A.1-Symmetrical fault (U/U_{nom} = 0,85); P = 100% ±5% P_n

0~60ms



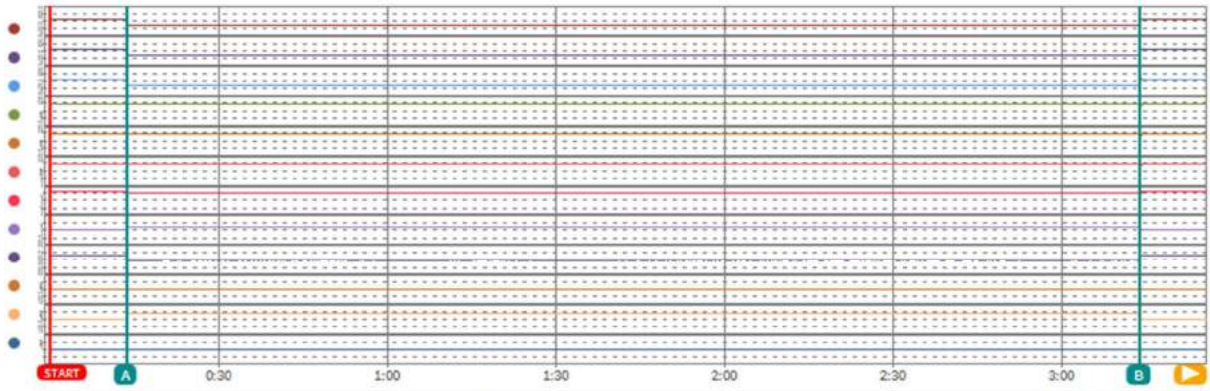
	A	B	Delta
Time [s]	0:13.6269	0:13.6870	0.0601
U1_tRMS_rc@AC Group [V]	229.4088	195.9466	-33.46216
U2_tRMS_rc@AC Group [V]	230.4333	195.4426	-34.99068
U3_tRMS_rc@AC Group [V]	231.3601	196.1110	-35.24908
I1_tRMS_rc@AC Group [A]	175.6411	175.3834	-0.257782
I2_tRMS_rc@AC Group [A]	174.9525	174.7209	-0.231613
I3_tRMS_rc@AC Group [A]	175.7871	176.5251	0.737930
P_t_rc@AC Group [W]	121258.8	98876.96	-22381.82
Q_t_rc@AC Group [var]	2193.953	29318.88	27124.93
U_fund_SYM+_rc@AC Group [V]	399.0489	339.1646	-59.88428
U_fund_SYM-_rc@AC Group [V]	0.525110	0.744223	0.219113
I_fund_Q_SYM+_rc@AC Group	-0.217595	49.51062	49.72822
I_fund_Q_SYM-_rc@AC Group [A]	-0.497365	0.737768	1.235133

0~100ms



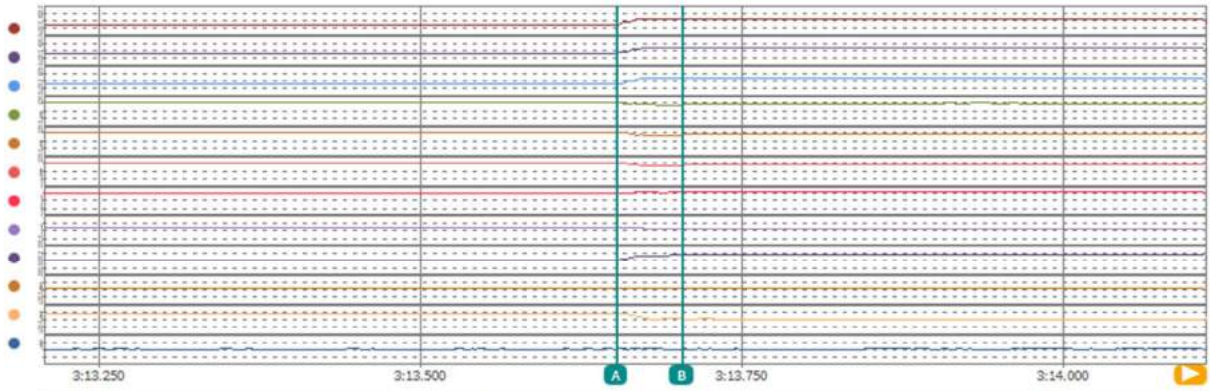
	A	B	Delta
Time [s]	0:13.6269	0:13.7273	0.1005
U1_tRMS_rc@AC Group [V]	229.4088	195.4116	-33.99721
U2_tRMS_rc@AC Group [V]	230.4333	195.3243	-35.10899
U3_tRMS_rc@AC Group [V]	231.3601	195.8292	-35.53094
I1_tRMS_rc@AC Group [A]	175.6411	178.8668	3.225677
I2_tRMS_rc@AC Group [A]	174.9525	178.8051	3.852646
I3_tRMS_rc@AC Group [A]	175.7871	179.7008	3.913666
P_t_rc@AC Group [W]	121258.8	100270.8	-20987.95
Q_t_rc@AC Group [var]	2193.953	31386.39	29192.43
U_fund_SYM+_rc@AC Group [V]	399.0489	338.6348	-60.41412
U_fund_SYM-_rc@AC Group [V]	0.525110	0.561433	0.036323
I_fund_Q_SYM+_rc@AC Group	-0.217595	53.43839	53.65598
I_fund_Q_SYM-_rc@AC Group [A]	-0.497365	-0.161598	0.335767

Duration time



	A	B	Delta
Time [s]	0:13.6269	3:13.6431	3:00.0163
U1_tRMS_rc@AC Group [V]	229.4088	195.4307	-33.97807
U2_tRMS_rc@AC Group [V]	230.4333	196.0871	-34.34615
U3_tRMS_rc@AC Group [V]	231.3601	196.8588	-34.50134
I1_tRMS_rc@AC Group [A]	175.6411	178.6648	3.023697
I2_tRMS_rc@AC Group [A]	174.9525	178.7312	3.778748
I3_tRMS_rc@AC Group [A]	175.7871	178.7708	2.983688
P_t_rc@AC Group [W]	121258.8	100584.0	-20674.78
Q_t_rc@AC Group [var]	2193.953	30670.26	28476.30
U_fund_SYM+_rc@AC Group [V]	399.0489	339.6797	-59.36923
U_fund_SYM-_rc@AC Group [V]	0.525110	0.245254	-0.279856
I_fund_Q_SYM+_rc@AC Group	-0.217595	52.06782	52.28541
I_fund_Q_SYM-_rc@AC Group [A]	-0.497365	-0.041627	0.455738

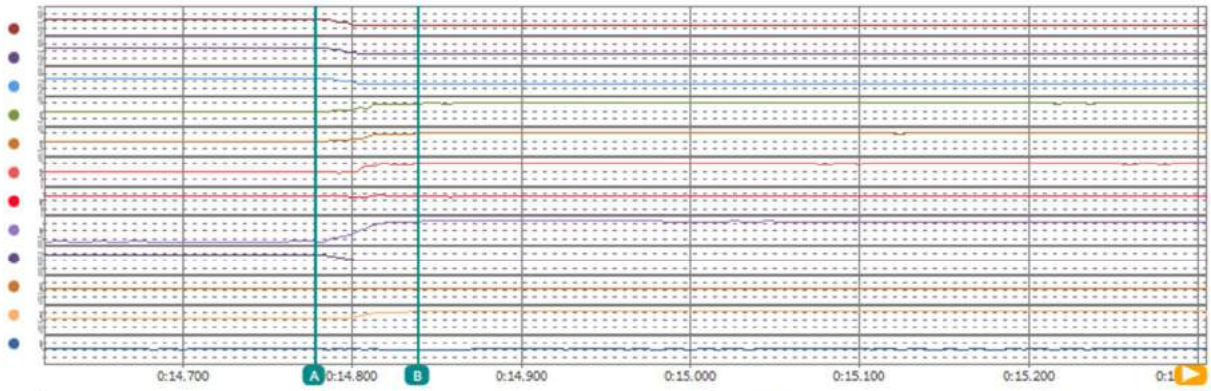
Recovery time



	A	B	Delta
Time [s]	3:13.653092	3:13.704126	0.051034
U1_tRMS_rc@AC Group [V]	195.4175	228.6110	33.19350
U2_tRMS_rc@AC Group [V]	196.2328	230.0641	33.83134
U3_tRMS_rc@AC Group [V]	196.9025	231.6993	34.79681
I1_tRMS_rc@AC Group [A]	179.2563	159.0403	-20.21609
I2_tRMS_rc@AC Group [A]	178.8827	158.6133	-20.26944
I3_tRMS_rc@AC Group [A]	178.9978	160.8451	-18.15266
P_t_rc@AC Group [W]	100845.8	109998.4	9152.656
Q_t_rc@AC Group [var]	30570.69	5114.947	-25455.74
U_fund_SYM+_rc@AC Group [V]	339.7828	398.5736	58.79080
U_fund_SYM-_rc@AC Group [V]	0.367354	1.396157	1.028803
I_fund_Q_SYM+_rc@AC Group	51.89252	0.836488	-51.05603
I_fund_Q_SYM-_rc@AC Group [A]	-0.066038	-0.844963	-0.778925

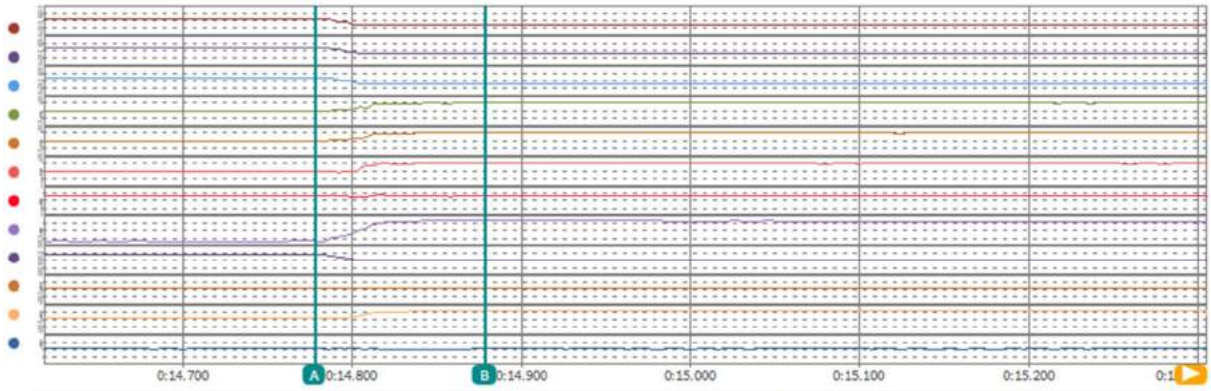
Test 4.A.2-Symmetrical fault (U/U_{nom} = 0,85); P = 20% ±5% P_n

0~60ms



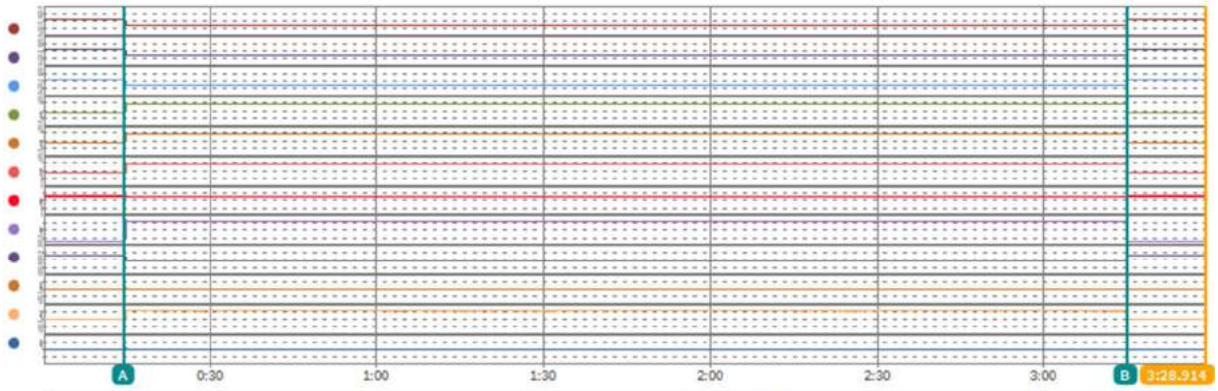
	A	B	Delta
Time [s]	0:14.7785	0:14.8394	0.0609
U1_tRMS_rc@AC Group [V]	229.1222	194.8227	-34.29953
U2_tRMS_rc@AC Group [V]	229.8622	194.3574	-35.50478
U3_tRMS_rc@AC Group [V]	230.0323	193.9015	-36.13077
I1_tRMS_rc@AC Group [A]	35.84851	66.25538	30.40687
I2_tRMS_rc@AC Group [A]	35.76048	68.37151	32.61104
I3_tRMS_rc@AC Group [A]	35.21323	69.35065	34.13741
P_t_rc@AC Group [W]	24497.62	23928.36	-569.2598
Q_t_rc@AC Group [var]	1332.840	31607.93	30275.09
U_fund_SYM+_rc@AC Group [V]	397.7970	336.6186	-61.17841
U_fund_SYM-_rc@AC Group [V]	0.245746	1.166094	0.920348
I_fund_Q_SYM+_rc@AC Group	1.176084	53.77532	52.59924
I_fund_Q_SYM-_rc@AC Group [A]	0.388801	-1.699379	-2.088179

0~100ms



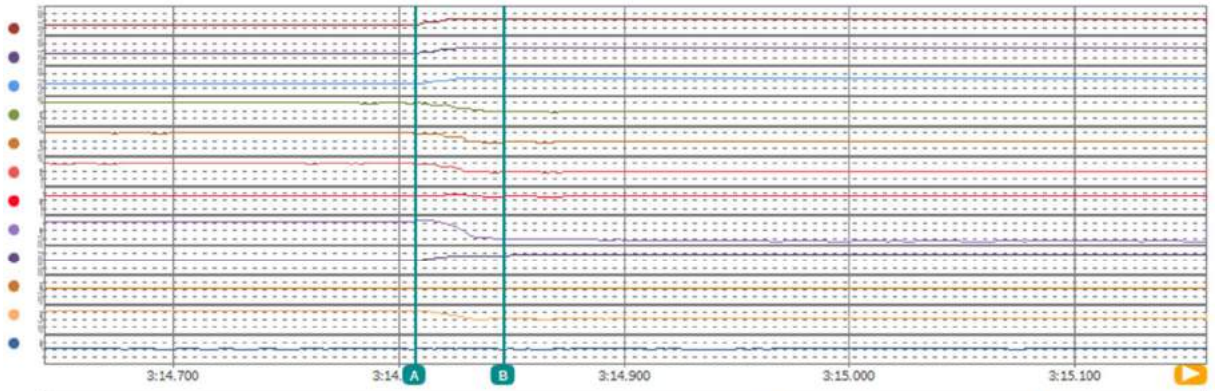
	A	B	Delta
Time [s]	0:14.7785	0:14.8790	0.1005
U1_tRMS_rc@AC Group [V]	229.1222	194.6498	-34.47244
U2_tRMS_rc@AC Group [V]	229.8622	194.2982	-35.56403
U3_tRMS_rc@AC Group [V]	230.0323	194.3614	-35.67090
I1_tRMS_rc@AC Group [A]	35.84851	70.61427	34.76576
I2_tRMS_rc@AC Group [A]	35.76048	69.74999	33.98952
I3_tRMS_rc@AC Group [A]	35.21323	70.56114	35.34791
P_t_rc@AC Group [W]	24497.62	24358.44	-139.1797
Q_t_rc@AC Group [var]	1332.840	32994.35	31661.51
U_fund_SYM+_rc@AC Group [V]	397.7970	336.7481	-61.04889
U_fund_SYM-_rc@AC Group [V]	0.245746	0.737076	0.491330
I_fund_Q_SYM+_rc@AC Group	1.176084	56.47251	55.29642
I_fund_Q_SYM-_rc@AC Group [A]	0.388801	0.237261	-0.151540

Duration time



Time [s]	A 0:14.7785	B 3:14.8051	Delta 3:00.0266
U1_tRMS_rc@AC Group [V]	229.1222	195.1503	-33.97192
U2_tRMS_rc@AC Group [V]	229.8622	195.3859	-34.47635
U3_tRMS_rc@AC Group [V]	230.0323	195.7146	-34.31772
I1_tRMS_rc@AC Group [A]	35.84851	68.09753	32.24902
I2_tRMS_rc@AC Group [A]	35.76048	68.20280	32.44233
I3_tRMS_rc@AC Group [A]	35.21323	68.17029	32.95705
P_t_rc@AC Group [W]	24497.62	23965.48	-532.1406
Q_t_rc@AC Group [var]	1332.840	31972.18	30639.34
U_fund_SYM+_rc@AC Group [V]	397.7970	338.4510	-59.34595
U_fund_SYM-_rc@AC Group [V]	0.245746	0.300094	0.054347
I_fund_Q_SYM+_rc@AC Group	1.176084	54.49157	53.31549
I_fund_Q_SYM-_rc@AC Group [A]	0.388801	-2.102e-3	-0.390903

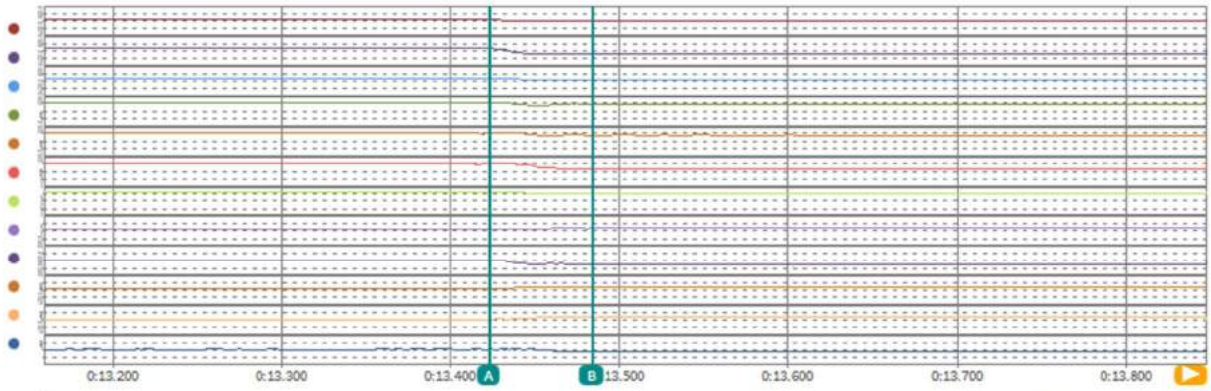
Recovery time



Time [s]	A 3:14.807538	B 3:14.846802	Delta 0.039264
U1_tRMS_rc@AC Group [V]	195.1480	228.6366	33.48854
U2_tRMS_rc@AC Group [V]	195.4001	228.7596	33.35959
U3_tRMS_rc@AC Group [V]	195.7281	229.5163	33.78824
I1_tRMS_rc@AC Group [A]	68.02256	36.70174	-31.32082
I2_tRMS_rc@AC Group [A]	68.20415	32.36282	-35.84134
I3_tRMS_rc@AC Group [A]	68.18724	33.49194	-34.69530
P_t_rc@AC Group [W]	23984.65	22779.25	-1205.406
Q_t_rc@AC Group [var]	31946.16	5700.196	-26245.97
U_fund_SYM+_rc@AC Group [V]	338.4666	396.5738	58.10721
U_fund_SYM-_rc@AC Group [V]	0.511565	0.232225	-0.279341
I_fund_Q_SYM+_rc@AC Group	54.44610	1.544353	-52.90175
I_fund_Q_SYM-_rc@AC Group [A]	-0.051967	-2.066421	-2.014454

Test 4.D.1- Asymmetrical fault (U/U_{nom} = 0,85); P = 100% ±5% P_n

0~60ms

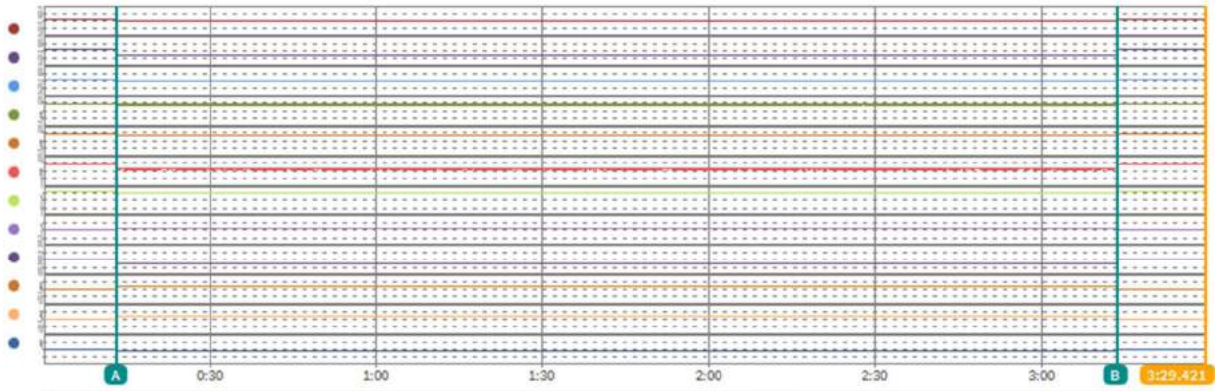


	A	B	Delta
Time [s]	0:13.4234	0:13.4843	0.0609
U1_tRMS_rc@AC Group [V]	229.0445	221.2422	-7.802307
U2_tRMS_rc@AC Group [V]	230.0193	195.2293	-34.79007
U3_tRMS_rc@AC Group [V]	232.3327	221.2952	-11.03746
I1_tRMS_rc@AC Group [A]	175.2783	168.7107	-6.567596
I2_tRMS_rc@AC Group [A]	174.7641	160.5672	-14.19688
I3_tRMS_rc@AC Group [A]	176.2968	126.8450	-49.45181
P_t_rc@AC Group [W]	121284.2	94399.09	-26885.07
Q_t_rc@AC Group [var]	2257.449	21168.95	18911.50
U_fund_SYM+_rc@AC Group [V]	399.0876	367.6388	-31.44885
U_fund_SYM-_rc@AC Group [V]	2.231610	29.19790	26.96629
I_fund_Q_SYM+_rc@AC Group	-0.508107	27.78573	28.29384
I_fund_Q_SYM-_rc@AC Group [A]	-0.418838	-24.73903	-24.32019

0~100ms

	A	B	Delta
Time [s]	0:13.4234	0:13.5240	0.1006
U1_tRMS_rc@AC Group [V]	229.0445	220.5617	-8.482834
U2_tRMS_rc@AC Group [V]	230.0193	195.1369	-34.88249
U3_tRMS_rc@AC Group [V]	232.3327	221.0747	-11.25803
I1_tRMS_rc@AC Group [A]	175.2783	170.9569	-4.321350
I2_tRMS_rc@AC Group [A]	174.7641	160.7759	-13.98814
I3_tRMS_rc@AC Group [A]	176.2968	126.9154	-49.38148
P_t_rc@AC Group [W]	121284.2	94665.14	-26619.02
Q_t_rc@AC Group [var]	2257.449	21776.79	19519.34
U_fund_SYM+_rc@AC Group [V]	399.0876	367.0700	-32.01761
U_fund_SYM-_rc@AC Group [V]	2.231610	28.90072	26.66911
I_fund_Q_SYM+_rc@AC Group	-0.508107	29.09402	29.60213
I_fund_Q_SYM-_rc@AC Group [A]	-0.418838	-25.89062	-25.47178

Duration time



Time [s]	A 0:13.4234	B 3:13.4461	Delta 3:00.0227
U1_tRMS_rc@AC Group [V]	229.0445	221.4397	-7.604782
U2_tRMS_rc@AC Group [V]	230.0193	195.5010	-34.51836
U3_tRMS_rc@AC Group [V]	232.3327	221.5329	-10.79977
I1_tRMS_rc@AC Group [A]	175.2783	172.1973	-3.081009
I2_tRMS_rc@AC Group [A]	174.7641	160.6952	-14.06886
I3_tRMS_rc@AC Group [A]	176.2968	127.7875	-48.50933
P_t_rc@AC Group [W]	121284.2	95518.58	-25765.58
Q_t_rc@AC Group [var]	2257.449	21262.65	19005.21
U_fund_SYM+_rc@AC Group [V]	399.0876	367.9076	-31.18002
U_fund_SYM-_rc@AC Group [V]	2.231610	29.54497	27.31336
I_fund_Q_SYM+_rc@AC Group	-0.508107	28.32164	28.82975
I_fund_Q_SYM-_rc@AC Group [A]	-0.418838	-25.84661	-25.42777

Recovery time

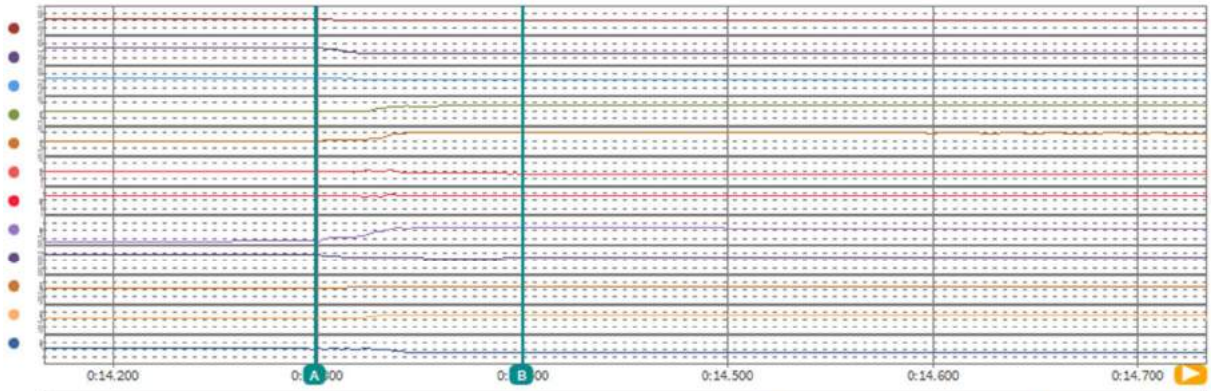
Time [s]	A 3:13.440984	B 3:13.514067	Delta 0.073084
U1_tRMS_rc@AC Group [V]	219.2738	229.3384	10.06453
U2_tRMS_rc@AC Group [V]	196.7286	231.1522	34.42360
U3_tRMS_rc@AC Group [V]	222.0150	231.8267	9.811752
I1_tRMS_rc@AC Group [A]	170.4935	159.5110	-10.98248
I2_tRMS_rc@AC Group [A]	160.6929	157.8303	-2.862595
I3_tRMS_rc@AC Group [A]	128.4366	157.5346	29.09805
P_t_rc@AC Group [W]	95190.20	109536.4	14346.16
Q_t_rc@AC Group [var]	21154.50	3283.458	-17871.04
U_fund_SYM+_rc@AC Group [V]	367.7771	399.6976	31.92053
U_fund_SYM-_rc@AC Group [V]	27.58999	0.896118	-26.69387
I_fund_Q_SYM+_rc@AC Group	28.09620	0.234678	-27.86152
I_fund_Q_SYM-_rc@AC Group [A]	-24.70898	-0.109240	24.59974

Test 4.D.2- Asymmetrical fault (U/U_{nom} = 0,85); P = 20% ±5% P_n

0~60ms

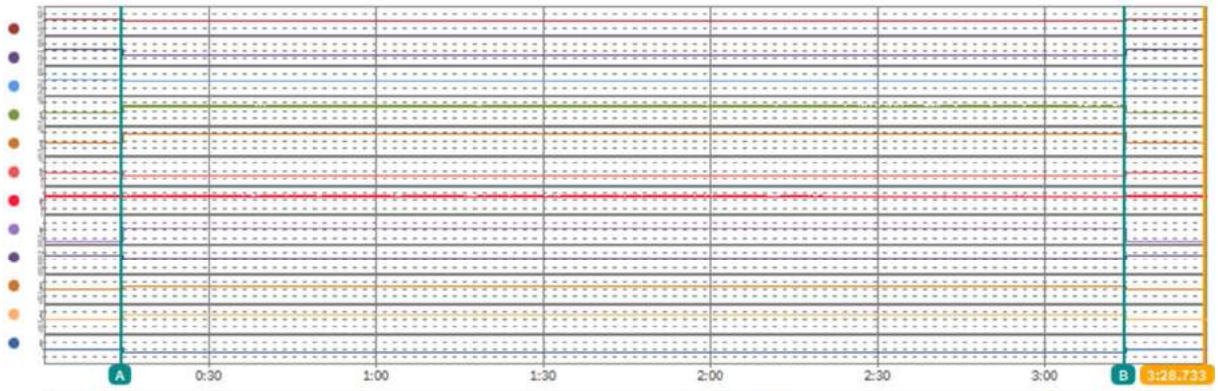
	A	B	Delta
Time [s]	0:14.2991	0:14.3595	0.0604
U1_tRMS_rc@AC Group [V]	228.8453	221.3853	-7.459946
U2_tRMS_rc@AC Group [V]	229.0301	194.2401	-34.78996
U3_tRMS_rc@AC Group [V]	231.2185	218.4765	-12.74200
I1_tRMS_rc@AC Group [A]	35.72582	56.52465	20.79883
I2_tRMS_rc@AC Group [A]	35.42946	70.12924	34.69978
I3_tRMS_rc@AC Group [A]	35.75990	29.11575	-6.644146
P_t_rc@AC Group [W]	24521.93	24143.56	-378.3652
Q_t_rc@AC Group [var]	1338.827	21751.48	20412.66
U_fund_SYM+_rc@AC Group [V]	397.7673	365.5695	-32.19781
U_fund_SYM-_rc@AC Group [V]	1.784076	28.62827	26.84420
I_fund_Q_SYM+_rc@AC Group	1.277475	29.34488	28.06741
I_fund_Q_SYM-_rc@AC Group [A]	-0.165740	-23.78607	-23.62033

0~100ms



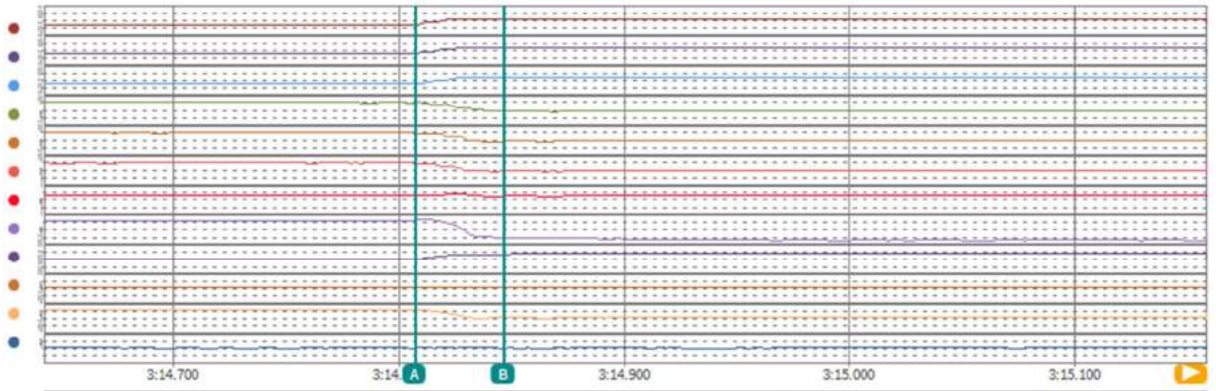
	A	B	Delta
Time [s]	0:14.2991	0:14.3999	0.1008
U1_tRMS_rc@AC Group [V]	228.8453	220.9017	-7.943558
U2_tRMS_rc@AC Group [V]	229.0301	194.4440	-34.58606
U3_tRMS_rc@AC Group [V]	231.2185	219.2559	-11.96266
I1_tRMS_rc@AC Group [A]	35.72582	58.82470	23.09888
I2_tRMS_rc@AC Group [A]	35.42946	71.50591	36.07644
I3_tRMS_rc@AC Group [A]	35.75990	27.60494	-8.154959
P_t_rc@AC Group [W]	24521.93	24362.29	-159.6387
Q_t_rc@AC Group [var]	1338.827	22186.53	20847.70
U_fund_SYM+_rc@AC Group [V]	397.7673	365.8654	-31.90195
U_fund_SYM-_rc@AC Group [V]	1.784076	28.49208	26.70801
I_fund_Q_SYM+_rc@AC Group	1.277475	30.34353	29.06606
I_fund_Q_SYM-_rc@AC Group [A]	-0.165740	-25.28105	-25.11531

Duration time



	A	B	Delta
Time [s]	0:14.2991	3:14.3231	3:00.0239
U1_tRMS_rc@AC Group [V]	228.8453	221.0907	-7.754608
U2_tRMS_rc@AC Group [V]	229.0301	194.6156	-34.41444
U3_tRMS_rc@AC Group [V]	231.2185	221.1198	-10.09872
I1_tRMS_rc@AC Group [A]	35.72582	61.11017	25.38435
I2_tRMS_rc@AC Group [A]	35.42946	68.37774	32.94828
I3_tRMS_rc@AC Group [A]	35.75990	24.61715	-11.14275
P_t_rc@AC Group [W]	24521.93	24557.66	35.72852
Q_t_rc@AC Group [var]	1338.827	20922.06	19583.24
U_fund_SYM+_rc@AC Group [V]	397.7673	366.9462	-30.82108
U_fund_SYM-_rc@AC Group [V]	1.784076	29.69838	27.91430
I_fund_Q_SYM+_rc@AC Group	1.277475	29.26532	27.98785
I_fund_Q_SYM-_rc@AC Group [A]	-0.165740	-25.25564	-25.08990

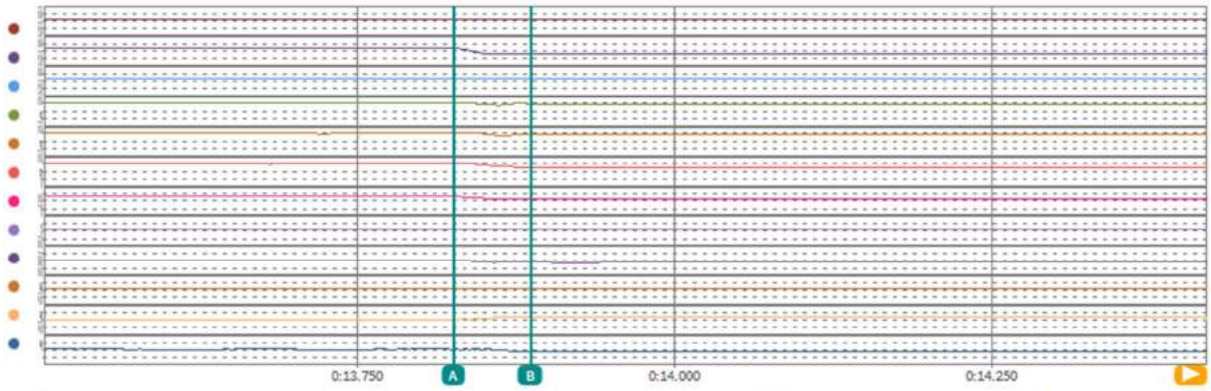
Recovery time



	A	B	Delta
Time [s]	3:14.807538	3:14.846802	0.039264
U1_tRMS_rc@AC Group [V]	195.1480	228.6366	33.48854
U2_tRMS_rc@AC Group [V]	195.4001	228.7596	33.35959
U3_tRMS_rc@AC Group [V]	195.7281	229.5163	33.78824
I1_tRMS_rc@AC Group [A]	68.02256	36.70174	-31.32082
I2_tRMS_rc@AC Group [A]	68.20415	32.36282	-35.84134
I3_tRMS_rc@AC Group [A]	68.18724	33.49194	-34.69530
P_t_rc@AC Group [W]	23984.65	22779.25	-1205.406
Q_t_rc@AC Group [var]	31946.16	5700.196	-26245.97
U_fund_SYM+_rc@AC Group [V]	338.4666	396.5738	58.10721
U_fund_SYM-_rc@AC Group [V]	0.511565	0.232225	-0.279341
I_fund_Q_SYM+_rc@AC Group	54.44610	1.544353	-52.90175
I_fund_Q_SYM-_rc@AC Group [A]	-0.051967	-2.066421	-2.014454

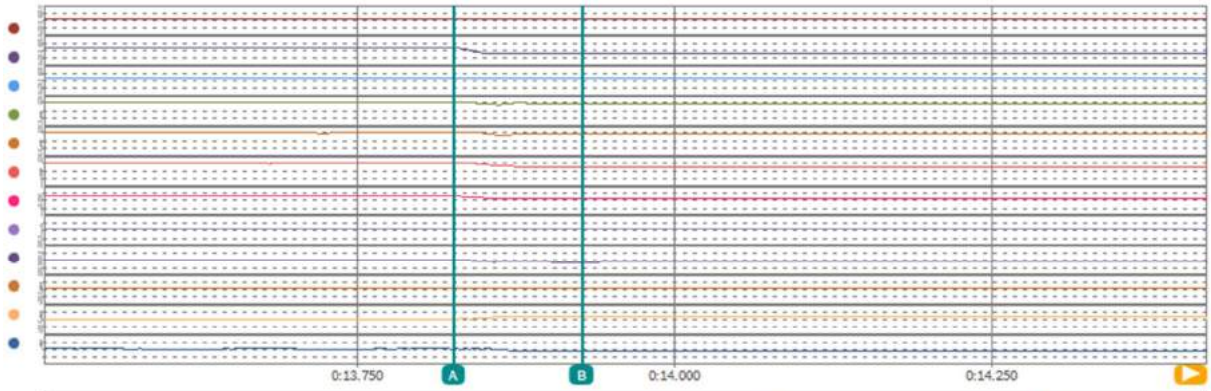
Test 4.B.1- Single phase fault (U/U_{nom} = 0,85); P = 100% ±5% P_n

0~60ms



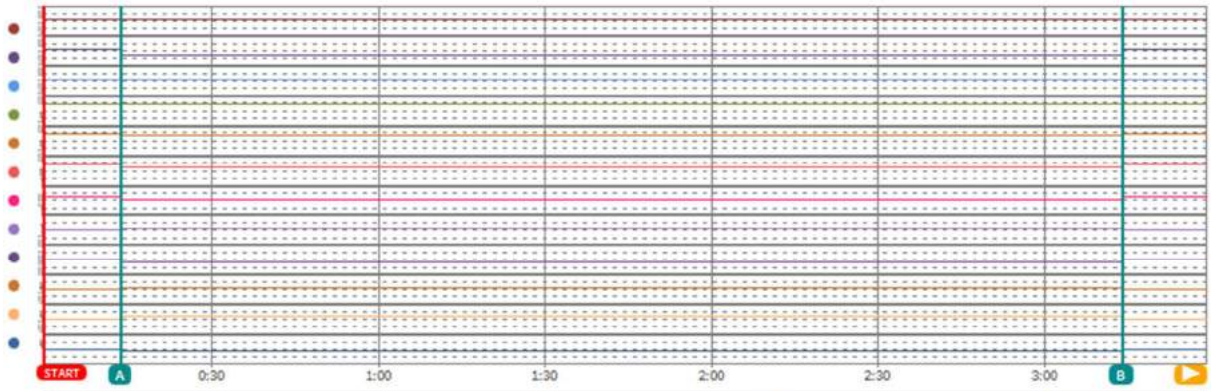
	A	B	Delta
Time [s]	0:13.8269	0:13.8871	0.0602
U1_tRMS_rc@AC Group [V]	229.6396	229.9930	0.353394
U2_tRMS_rc@AC Group [V]	230.6975	195.2684	-35.42911
U3_tRMS_rc@AC Group [V]	231.2345	231.2344	-1.221e-4
I1_tRMS_rc@AC Group [A]	175.7894	172.9184	-2.870987
I2_tRMS_rc@AC Group [A]	175.1727	164.0199	-11.15282
I3_tRMS_rc@AC Group [A]	175.0137	144.5494	-30.46429
P_t_rc@AC Group [W]	121233.6	104357.3	-16876.27
Q_t_rc@AC Group [var]	1956.315	13467.80	11511.48
U_fund_SYM+_rc@AC Group [V]	399.2623	379.0112	-20.25107
U_fund_SYM-_rc@AC Group [V]	0.385672	19.84058	19.45491
I_fund_Q_SYM+_rc@AC Group	-0.664003	17.62078	18.28479
I_fund_Q_SYM-_rc@AC Group [A]	-0.182844	-16.39627	-16.21343

0~100ms



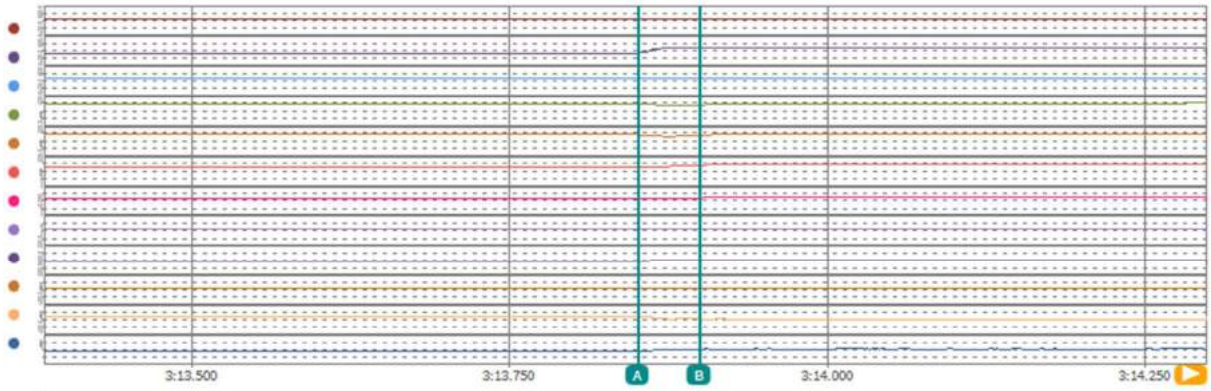
	A	B	Delta
Time [s]	0:13.8269	0:13.9275	0.1006
U1_tRMS_rc@AC Group [V]	229.6396	229.4958	-0.143860
U2_tRMS_rc@AC Group [V]	230.6975	195.3236	-35.37387
U3_tRMS_rc@AC Group [V]	231.2345	230.8609	-0.373611
I1_tRMS_rc@AC Group [A]	175.7894	173.3682	-2.421234
I2_tRMS_rc@AC Group [A]	175.1727	163.5797	-11.59299
I3_tRMS_rc@AC Group [A]	175.0137	143.2164	-31.79738
P_t_rc@AC Group [W]	121233.6	103880.8	-17352.76
Q_t_rc@AC Group [var]	1956.315	13859.80	11903.48
U_fund_SYM+_rc@AC Group [V]	399.2623	378.5385	-20.72372
U_fund_SYM-_rc@AC Group [V]	0.385672	19.49028	19.10461
I_fund_Q_SYM+_rc@AC Group	-0.664003	18.55612	19.22012
I_fund_Q_SYM-_rc@AC Group [A]	-0.182844	-17.47685	-17.29401

Duration time



	A	B	Delta
Time [s]	0:13.8269	3:13.8477	3:00.0209
U1_tRMS_rc@AC Group [V]	229.6396	229.3116	-0.328079
U2_tRMS_rc@AC Group [V]	230.6975	196.1828	-34.51471
U3_tRMS_rc@AC Group [V]	231.2345	231.1625	-0.071991
I1_tRMS_rc@AC Group [A]	175.7894	173.7314	-2.058044
I2_tRMS_rc@AC Group [A]	175.1727	163.7966	-11.37616
I3_tRMS_rc@AC Group [A]	175.0137	144.7745	-30.23924
P_t_rc@AC Group [W]	121233.6	104576.0	-16657.60
Q_t_rc@AC Group [var]	1956.315	13463.86	11507.55
U_fund_SYM+_rc@AC Group [V]	399.2623	379.1040	-20.15829
U_fund_SYM-_rc@AC Group [V]	0.385672	19.00664	18.62097
I_fund_Q_SYM+_rc@AC Group	-0.664003	18.07829	18.74229
I_fund_Q_SYM-_rc@AC Group [A]	-0.182844	-16.74150	-16.55865

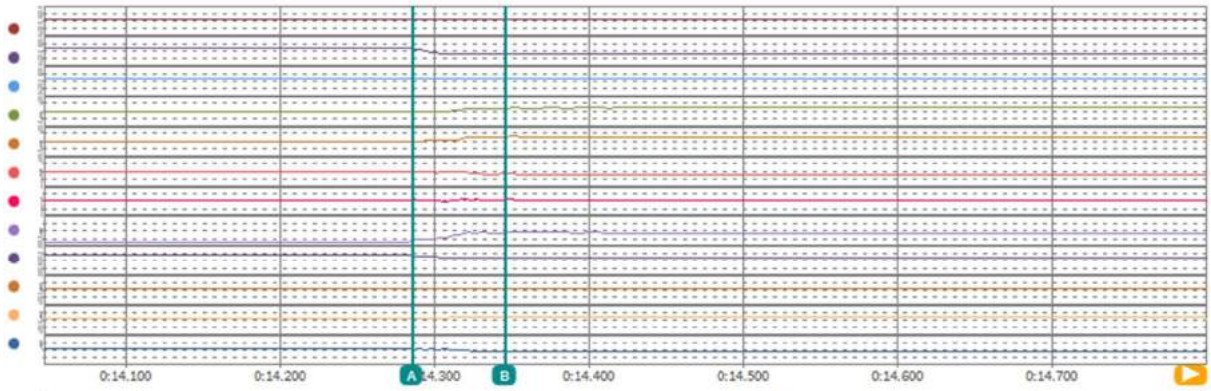
Recovery time



	A	B	Delta
Time [s]	3:13.851520	3:13.899716	0.048195
U1_tRMS_rc@AC Group [V]	229.3268	229.0995	-0.227280
U2_tRMS_rc@AC Group [V]	196.2192	230.2815	34.06233
U3_tRMS_rc@AC Group [V]	231.0950	231.1714	0.076431
I1_tRMS_rc@AC Group [A]	173.7362	159.1976	-14.53862
I2_tRMS_rc@AC Group [A]	163.7641	157.0063	-6.757767
I3_tRMS_rc@AC Group [A]	144.7065	159.7036	14.99706
P_t_rc@AC Group [W]	104550.1	109505.0	4954.945
Q_t_rc@AC Group [var]	13491.53	3019.636	-10471.89
U_fund_SYM+_rc@AC Group [V]	379.0891	398.6744	19.58533
U_fund_SYM-_rc@AC Group [V]	18.91459	0.717335	-18.19725
I_fund_Q_SYM+_rc@AC Group	18.09117	0.180835	-17.91033
I_fund_Q_SYM-_rc@AC Group [A]	-16.76367	-1.645199	15.11847

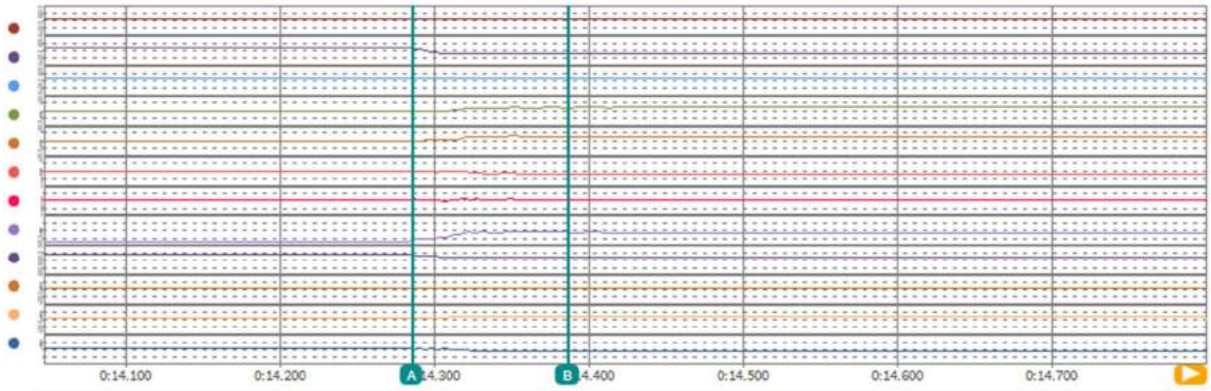
Test 4.B.2- Single phase fault (U/U_{nom} = 0,85); P = 20% ±5% P_n

0~60ms



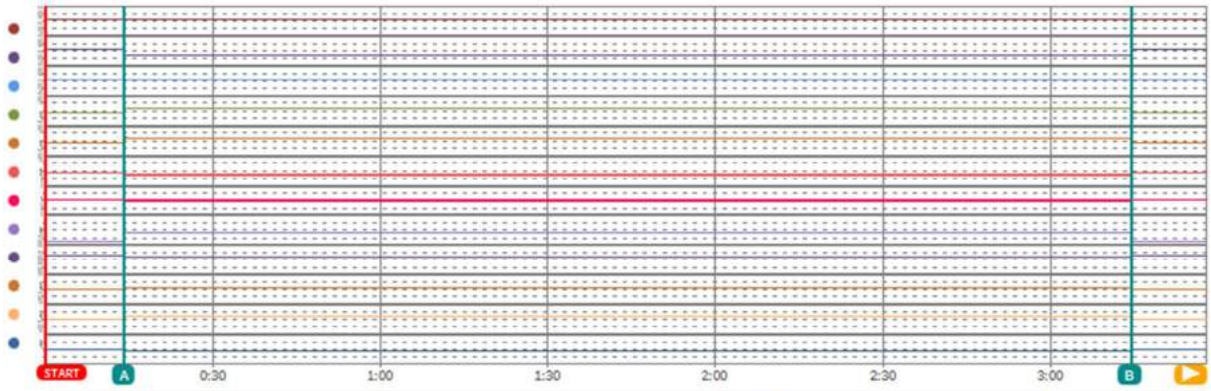
	A	B	Delta
Time [s]	0:14.2858	0:14.3459	0.0602
U1_tRMS_rc@AC Group [V]	229.2060	229.9542	0.748230
U2_tRMS_rc@AC Group [V]	229.7124	194.0975	-35.61493
U3_tRMS_rc@AC Group [V]	230.0700	229.3505	-0.719513
I1_tRMS_rc@AC Group [A]	36.06709	49.67556	13.60847
I2_tRMS_rc@AC Group [A]	35.91700	54.75117	18.83417
I3_tRMS_rc@AC Group [A]	35.37255	28.20034	-7.172211
P_t_rc@AC Group [W]	24628.28	24571.00	-57.28711
Q_t_rc@AC Group [var]	1158.918	14475.44	13316.52
U_fund_SYM+_rc@AC Group [V]	397.7818	377.2217	-20.56015
U_fund_SYM-_rc@AC Group [V]	0.477272	19.32109	18.84382
I_fund_Q_SYM+_rc@AC Group	1.252386	19.44704	18.19465
I_fund_Q_SYM-_rc@AC Group [A]	0.422448	-15.15475	-15.57720

0~100ms



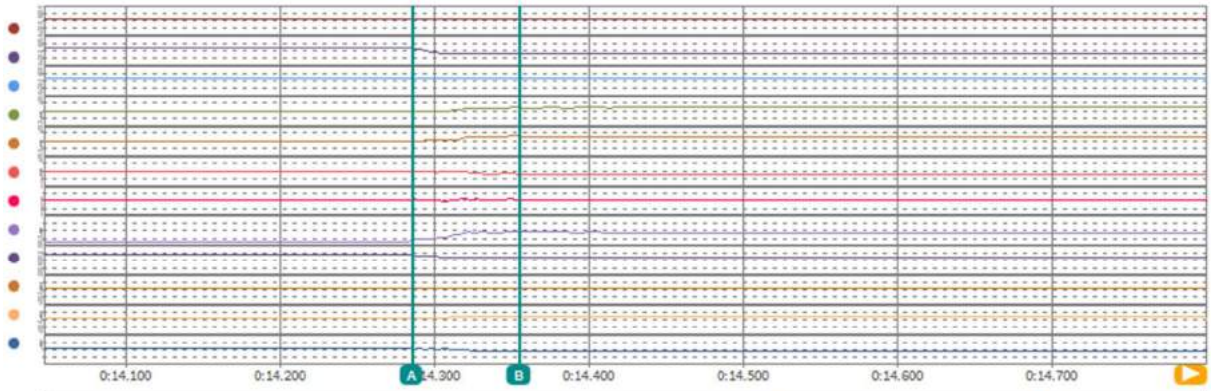
	A	B	Delta
Time [s]	0:14.2858	0:14.3866	0.1008
U1_tRMS_rc@AC Group [V]	229.2060	229.5786	0.372635
U2_tRMS_rc@AC Group [V]	229.7124	194.4374	-35.27501
U3_tRMS_rc@AC Group [V]	230.0700	229.5767	-0.493301
I1_tRMS_rc@AC Group [A]	36.06709	50.40451	14.33743
I2_tRMS_rc@AC Group [A]	35.91700	55.65697	19.73997
I3_tRMS_rc@AC Group [A]	35.37255	25.10637	-10.26618
P_t_rc@AC Group [W]	24628.28	24030.79	-597.4980
Q_t_rc@AC Group [var]	1158.918	14675.24	13516.32
U_fund_SYM+_rc@AC Group [V]	397.7818	377.3339	-20.44791
U_fund_SYM-_rc@AC Group [V]	0.477272	19.01483	18.53756
I_fund_Q_SYM+_rc@AC Group	1.252386	19.80704	18.55466
I_fund_Q_SYM-_rc@AC Group [A]	0.422448	-17.35580	-17.77825

Duration time



	A	B	Delta
Time [s]	0:14.2858	3:14.3045	3:00.0188
U1_tRMS_rc@AC Group [V]	229.2060	229.1341	-0.071823
U2_tRMS_rc@AC Group [V]	229.7124	195.4634	-34.24905
U3_tRMS_rc@AC Group [V]	230.0700	230.1840	0.114059
I1_tRMS_rc@AC Group [A]	36.06709	51.19909	15.13200
I2_tRMS_rc@AC Group [A]	35.91700	52.88834	16.97134
I3_tRMS_rc@AC Group [A]	35.37255	25.53430	-9.838251
P_t_rc@AC Group [W]	24628.28	24221.01	-407.2695
Q_t_rc@AC Group [var]	1158.918	13941.49	12782.57
U_fund_SYM+_rc@AC Group [V]	397.7818	378.0226	-19.75922
U_fund_SYM-_rc@AC Group [V]	0.477272	18.65633	18.17906
I_fund_Q_SYM+_rc@AC Group	1.252386	19.35815	18.10576
I_fund_Q_SYM-_rc@AC Group [A]	0.422448	-16.35949	-16.78194

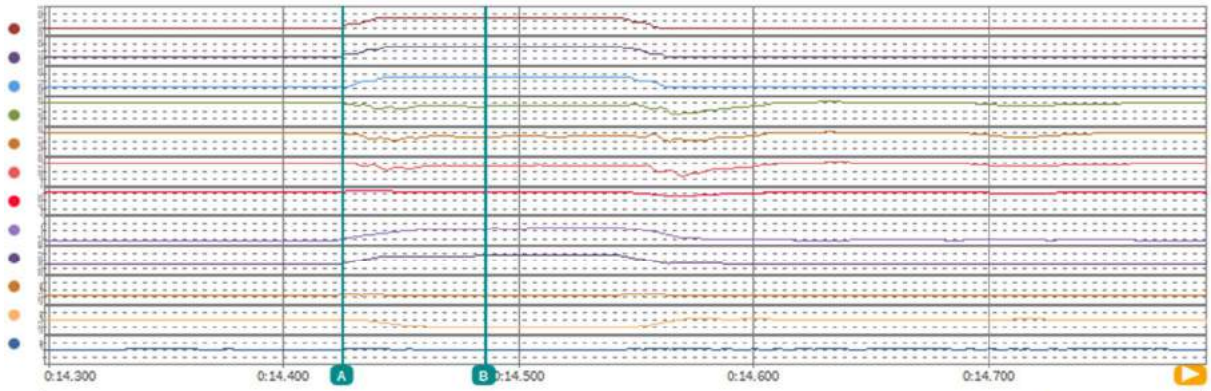
Recovery time



	A	B	Delta
Time [s]	0:14.2858	0:14.3552	0.0694
U1_tRMS_rc@AC Group [V]	229.2060	229.8173	0.611343
U2_tRMS_rc@AC Group [V]	229.7124	194.1177	-35.59477
U3_tRMS_rc@AC Group [V]	230.0700	229.2854	-0.784622
I1_tRMS_rc@AC Group [A]	36.06709	50.94274	14.87566
I2_tRMS_rc@AC Group [A]	35.91700	57.49648	21.57948
I3_tRMS_rc@AC Group [A]	35.37255	26.97265	-8.399906
P_t_rc@AC Group [W]	24628.28	24698.99	70.71094
Q_t_rc@AC Group [var]	1158.918	15298.33	14139.41
U_fund_SYM+_rc@AC Group [V]	397.7818	377.1131	-20.66876
U_fund_SYM-_rc@AC Group [V]	0.477272	19.19309	18.71581
I_fund_Q_SYM+_rc@AC Group	1.252386	20.42350	19.17111
I_fund_Q_SYM-_rc@AC Group [A]	0.422448	-17.37651	-17.79896

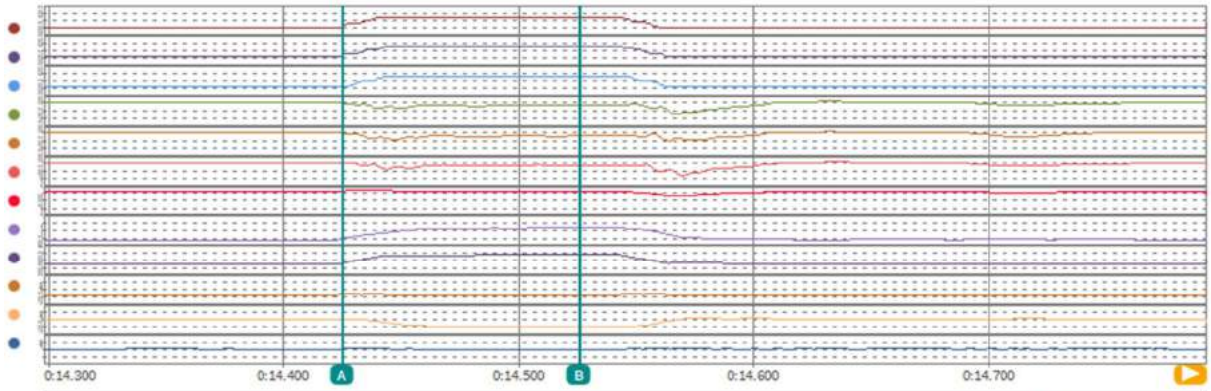
Test OV1-Symmetrical fault (U/U_{nom} = 1,25); P = 100% ±5% P_n

0~60ms



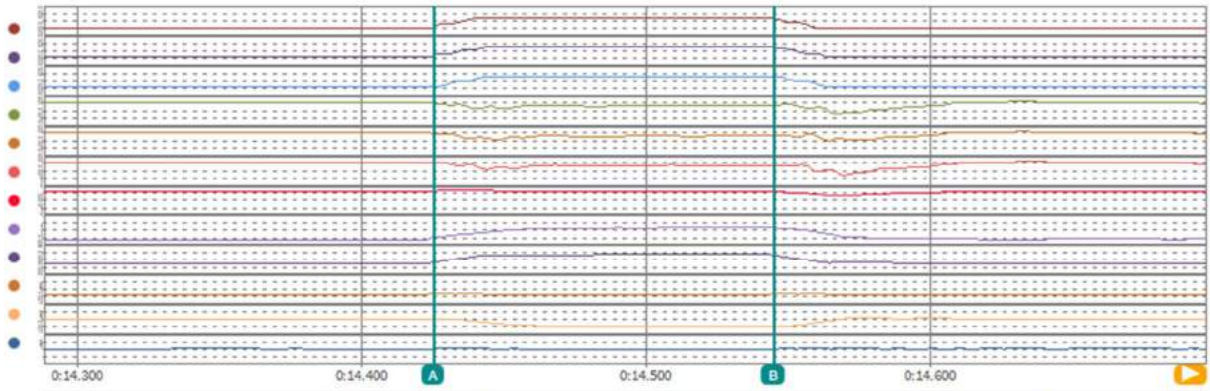
	A	B	Delta
Time [s]	0:14.4254644	0:14.4858025	0.0603380
U1_tRMS_rc@AC Group [V]	230.7136	284.9117	54.19815
U2_tRMS_rc@AC Group [V]	234.3426	287.3499	53.00737
U3_tRMS_rc@AC Group [V]	232.2052	289.3304	57.12514
I1_tRMS_rc@AC Group [A]	173.9545	160.1340	-13.82053
I2_tRMS_rc@AC Group [A]	171.9104	156.5665	-15.34390
I3_tRMS_rc@AC Group [A]	174.8791	161.4349	-13.44418
P_t_rc@AC Group [W]	120558.1	116201.0	-4357.094
Q_t_rc@AC Group [var]	10648.04	73174.47	62526.42
U_fund_SYM+_rc@AC Group [V]	402.2416	497.3887	95.14706
U_fund_SYM-_rc@AC Group [V]	3.085101	2.079070	-1.006031
I_fund_Q_SYM+_rc@AC Group	-1.759604	-84.52912	-82.76952
I_fund_Q_SYM-_rc@AC Group [A]	-0.745449	-2.842890	-2.097442

0~100ms



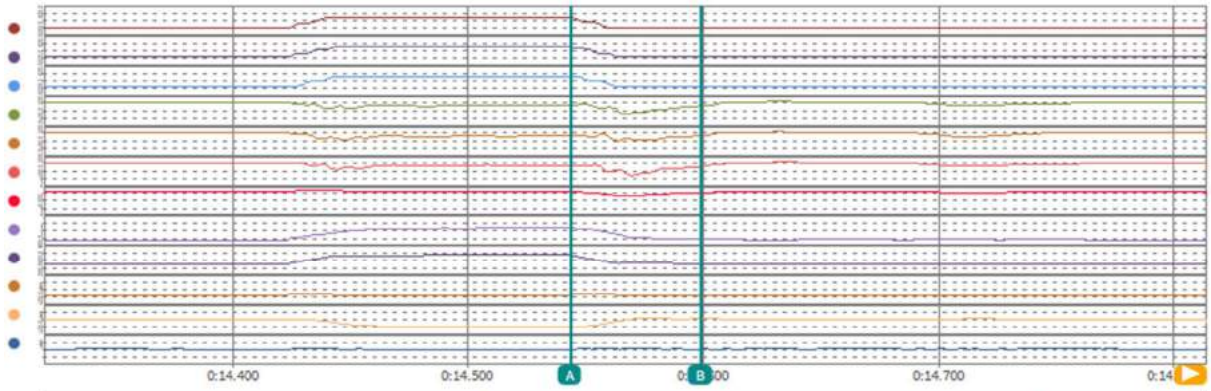
	A	B	Delta
Time [s]	0:14.4254644	0:14.5259481	0.1004836
U1_tRMS_rc@AC Group [V]	230.7136	285.5497	54.83612
U2_tRMS_rc@AC Group [V]	234.3426	287.7993	53.45674
U3_tRMS_rc@AC Group [V]	232.2052	288.9527	56.74748
I1_tRMS_rc@AC Group [A]	173.9545	164.5723	-9.382187
I2_tRMS_rc@AC Group [A]	171.9104	160.9125	-10.99785
I3_tRMS_rc@AC Group [A]	174.8791	165.0724	-9.806763
P_t_rc@AC Group [W]	120558.1	119801.3	-756.8281
Q_t_rc@AC Group [var]	10648.04	74359.08	63711.03
U_fund_SYM+_rc@AC Group [V]	402.2416	497.8137	95.57208
U_fund_SYM-_rc@AC Group [V]	3.085101	1.514009	-1.571092
I_fund_Q_SYM+_rc@AC Group	-1.759604	-86.11262	-84.35301
I_fund_Q_SYM-_rc@AC Group [A]	-0.745449	-2.317740	-1.572291

Duration time



	A	B	Delta
Time [s]	0:14.4254644	0:14.5448478	0.1193834
U1_tRMS_rc@AC Group [V]	230.7136	285.5229	54.80930
U2_tRMS_rc@AC Group [V]	234.3426	287.5403	53.19768
U3_tRMS_rc@AC Group [V]	232.2052	288.6649	56.45967
I1_tRMS_rc@AC Group [A]	173.9545	162.4192	-11.53531
I2_tRMS_rc@AC Group [A]	171.9104	162.0781	-9.832321
I3_tRMS_rc@AC Group [A]	174.8791	164.2055	-10.67360
P_t_rc@AC Group [W]	120558.1	119233.3	-1324.789
Q_t_rc@AC Group [var]	10648.04	74091.84	63443.80
U_fund_SYM+_rc@AC Group [V]	402.2416	497.4799	95.23831
U_fund_SYM-_rc@AC Group [V]	3.085101	1.471655	-1.613446
I_fund_Q_SYM+_rc@AC Group	-1.759604	-85.89752	-84.13792
I_fund_Q_SYM-_rc@AC Group [A]	-0.745449	-1.233515	-0.488067

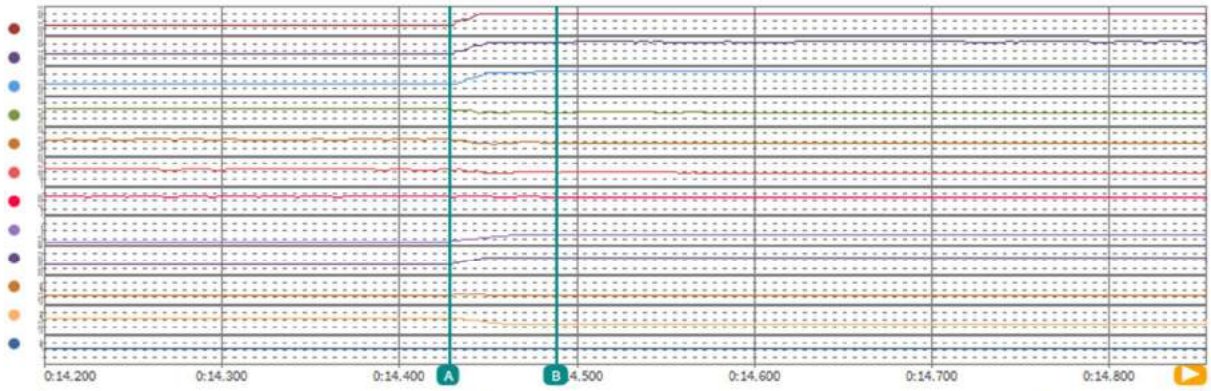
Recovery time



	A	B	Delta
Time [s]	0:14.5435496	0:14.5990185	0.0554690
U1_tRMS_rc@AC Group [V]	285.4933	230.9849	-54.50839
U2_tRMS_rc@AC Group [V]	287.5645	230.7607	-56.80373
U3_tRMS_rc@AC Group [V]	288.6754	230.5593	-58.11604
I1_tRMS_rc@AC Group [A]	162.3734	161.2704	-1.103012
I2_tRMS_rc@AC Group [A]	161.9047	161.4360	-0.468750
I3_tRMS_rc@AC Group [A]	164.1834	157.9805	-6.202835
P_t_rc@AC Group [W]	119140.3	110776.9	-8363.422
Q_t_rc@AC Group [var]	74111.74	5787.549	-68324.19
U_fund_SYM+_rc@AC Group [V]	497.4814	399.6851	-97.79626
U_fund_SYM-_rc@AC Group [V]	1.514452	0.790123	-0.724329
I_fund_Q_SYM+_rc@AC Group	-85.91568	0.557155	86.47284
I_fund_Q_SYM-_rc@AC Group [A]	-1.314972	-1.487178	-0.172206

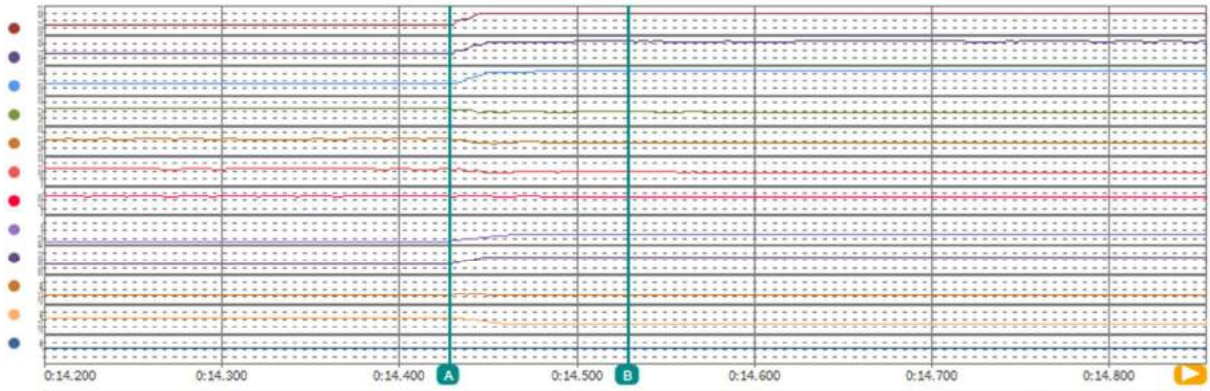
Test OV2-Symmetrical fault (U/U_{nom} = 1,20); P = 100% ±5% P_n

0~60ms



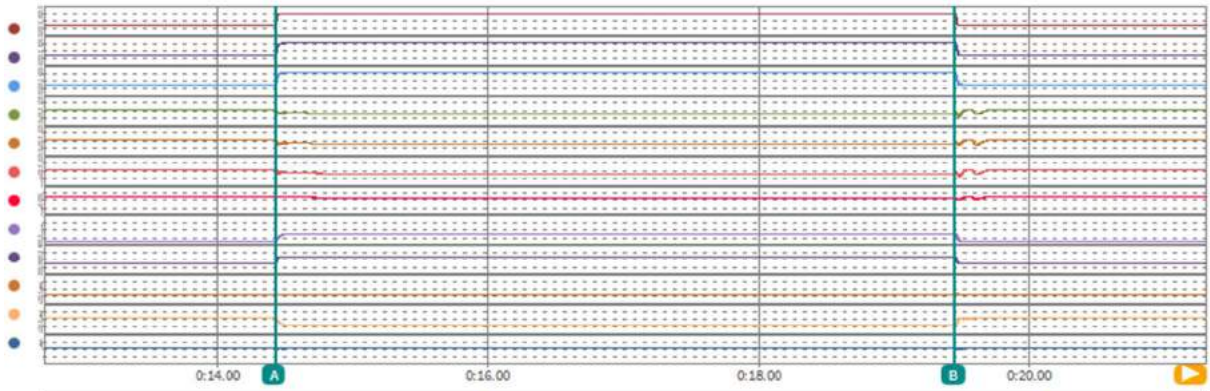
	A	B	Delta
Time [s]	0:14.42813	0:14.48876	0.06063
U1_tRMS_rc@AC Group [V]	229.3452	273.8765	44.53131
U2_tRMS_rc@AC Group [V]	230.5515	275.9635	45.41197
U3_tRMS_rc@AC Group [V]	231.2005	277.9565	46.75595
I1_tRMS_rc@AC Group [A]	176.0226	156.1476	-19.87498
I2_tRMS_rc@AC Group [A]	175.2851	155.9450	-19.34010
I3_tRMS_rc@AC Group [A]	175.0974	159.3350	-15.76237
P_t_rc@AC Group [W]	121253.2	116996.3	-4256.945
Q_t_rc@AC Group [var]	1677.121	56876.11	55198.99
U_fund_SYM+_rc@AC Group [V]	398.9905	477.8836	78.89313
U_fund_SYM-_rc@AC Group [V]	0.266797	1.977461	1.710664
I_fund_Q_SYM+_rc@AC Group	-1.397671	-68.16859	-66.77092
I_fund_Q_SYM-_rc@AC Group [A]	0.388268	-1.781419	-2.169687

0~100ms



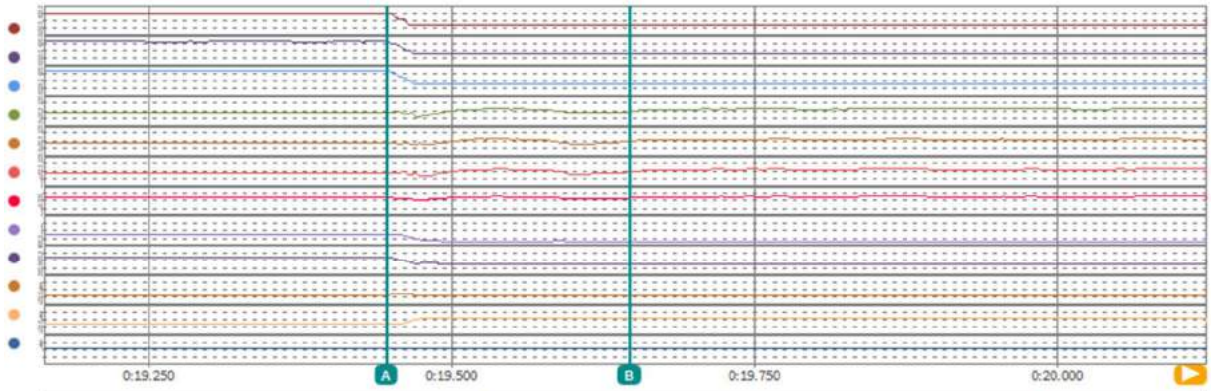
	A	B	Delta
Time [s]	0:14.42813	0:14.52899	0.10086
U1_tRMS_rc@AC Group [V]	229.3452	274.4316	45.08643
U2_tRMS_rc@AC Group [V]	230.5515	276.4549	45.90340
U3_tRMS_rc@AC Group [V]	231.2005	277.5900	46.38950
I1_tRMS_rc@AC Group [A]	176.0226	160.9821	-15.04057
I2_tRMS_rc@AC Group [A]	175.2851	157.2763	-18.00880
I3_tRMS_rc@AC Group [A]	175.0974	161.2435	-13.85387
P_t_rc@AC Group [W]	121253.2	119220.4	-2032.766
Q_t_rc@AC Group [var]	1677.121	57628.14	55951.02
U_fund_SYM+_rc@AC Group [V]	398.9905	478.2807	79.29025
U_fund_SYM-_rc@AC Group [V]	0.266797	1.195752	0.928955
I_fund_Q_SYM+_rc@AC Group	-1.397671	-69.39478	-67.99710
I_fund_Q_SYM-_rc@AC Group [A]	0.388268	-2.315914	-2.704182

Duration time



	A	B	Delta
Time [s]	0:14.42813	0:19.44766	5.01952
U1_tRMS_rc@AC Group [V]	229.3452	275.0590	45.71381
U2_tRMS_rc@AC Group [V]	230.5515	276.5016	45.95003
U3_tRMS_rc@AC Group [V]	231.2005	276.6187	45.41818
I1_tRMS_rc@AC Group [A]	176.0226	152.4630	-23.55965
I2_tRMS_rc@AC Group [A]	175.2851	151.6192	-23.66583
I3_tRMS_rc@AC Group [A]	175.0974	152.0341	-23.06329
P_t_rc@AC Group [W]	121253.2	112214.1	-9039.063
Q_t_rc@AC Group [var]	1677.121	57118.39	55441.27
U_fund_SYM+_rc@AC Group [V]	398.9905	478.1165	79.12604
U_fund_SYM-_rc@AC Group [V]	0.266797	0.522003	0.255206
I_fund_Q_SYM+_rc@AC Group	-1.397671	-68.90150	-67.50383
I_fund_Q_SYM-_rc@AC Group [A]	0.388268	-0.164117	-0.552385

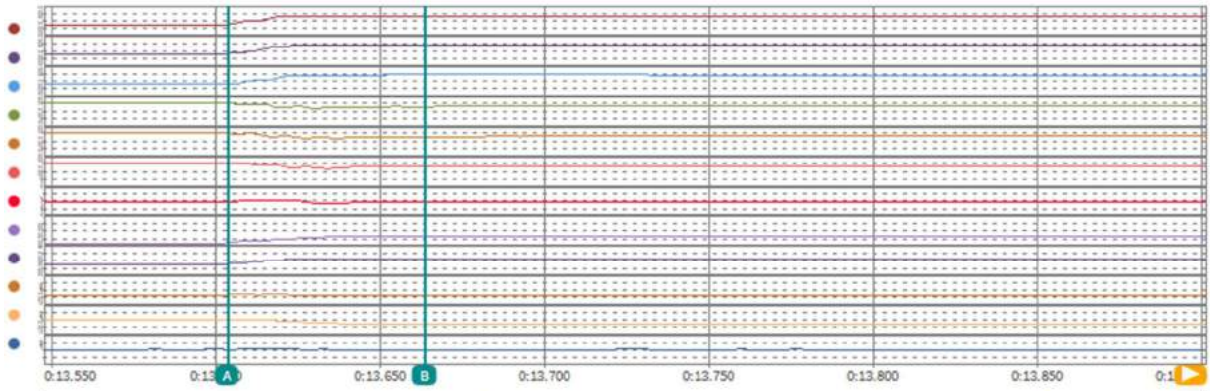
Recovery time



	A	B	Delta
Time [s]	0:19.4467442	0:19.6470681	0.2003239
U1_tRMS_rc@AC Group [V]	275.0590	229.9008	-45.15817
U2_tRMS_rc@AC Group [V]	276.5016	230.8099	-45.69162
U3_tRMS_rc@AC Group [V]	276.6187	231.2075	-45.41115
I1_tRMS_rc@AC Group [A]	152.4630	159.2843	6.821304
I2_tRMS_rc@AC Group [A]	151.6192	161.2242	9.604965
I3_tRMS_rc@AC Group [A]	152.0341	159.9885	7.954391
P_t_rc@AC Group [W]	112214.1	110714.9	-1499.258
Q_t_rc@AC Group [var]	57118.39	4878.033	-52240.36
U_fund_SYM+_rc@AC Group [V]	478.1165	399.4583	-78.65820
U_fund_SYM-_rc@AC Group [V]	0.522003	0.254620	-0.267383
I_fund_Q_SYM+_rc@AC Group	-68.90150	-0.546136	68.35537
I_fund_Q_SYM-_rc@AC Group [A]	-0.164117	0.794204	0.958321

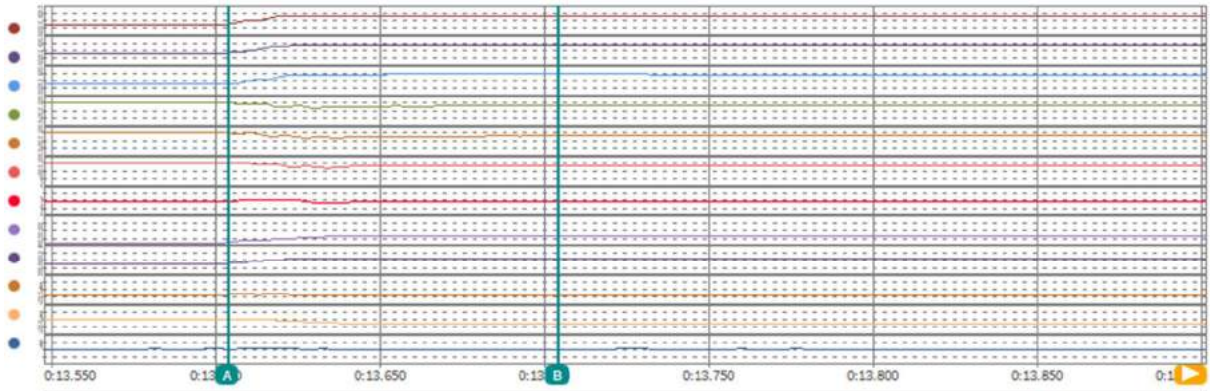
Test OV3-Symmetrical fault (U/U_{nom} = 1,15); P = 100% ±5% P_n

0~60ms



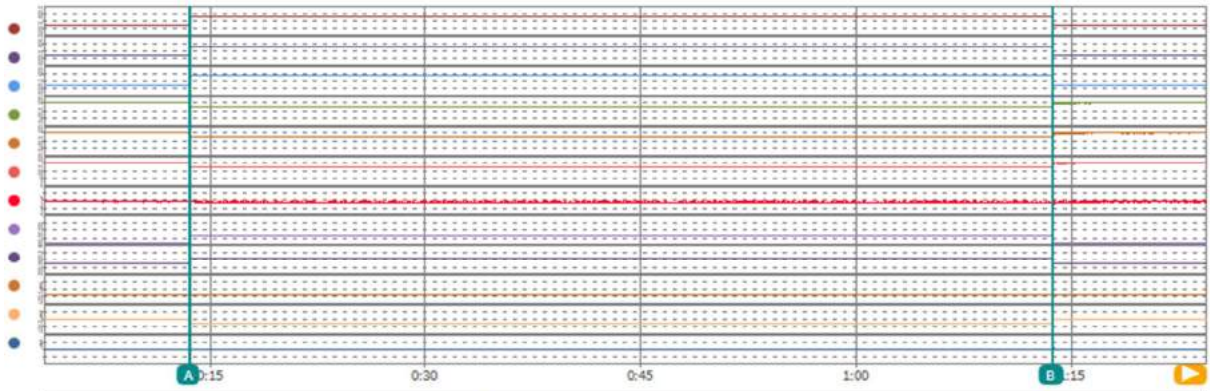
	A	B	Delta
Time [s]	0:13.6038	0:13.6637	0.0600
U1_tRMS_rc@AC Group [V]	229.3099	262.8350	33.52510
U2_tRMS_rc@AC Group [V]	230.4859	264.8102	34.32430
U3_tRMS_rc@AC Group [V]	231.1917	266.4351	35.24336
I1_tRMS_rc@AC Group [A]	175.6654	160.0217	-15.64368
I2_tRMS_rc@AC Group [A]	175.3172	159.4850	-15.83223
I3_tRMS_rc@AC Group [A]	175.2707	161.2368	-14.03383
P_t_rc@AC Group [W]	121197.8	120311.5	-886.3203
Q_t_rc@AC Group [var]	1792.606	41450.41	39657.81
U_fund_SYM+_rc@AC Group [V]	398.9277	458.4167	59.48901
U_fund_SYM-_rc@AC Group [V]	0.329419	1.599451	1.270032
I_fund_Q_SYM+_rc@AC Group	-1.260276	-51.92728	-50.66700
I_fund_Q_SYM-_rc@AC Group [A]	-0.102681	-0.865125	-0.762444

0~100ms



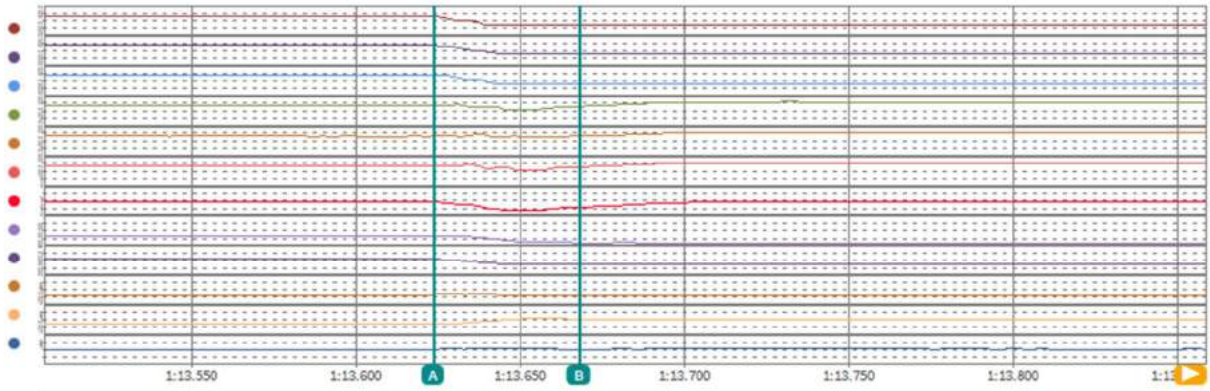
	A	B	Delta
Time [s]	0:13.6038	0:13.7041	0.1004
U1_tRMS_rc@AC Group [V]	229.3099	263.0641	33.75420
U2_tRMS_rc@AC Group [V]	230.4859	264.8673	34.38145
U3_tRMS_rc@AC Group [V]	231.1917	266.0661	34.87440
I1_tRMS_rc@AC Group [A]	175.6654	162.1504	-13.51501
I2_tRMS_rc@AC Group [A]	175.3172	160.6256	-14.69164
I3_tRMS_rc@AC Group [A]	175.2707	162.7705	-12.50012
P_t_rc@AC Group [W]	121197.8	121365.3	167.4609
Q_t_rc@AC Group [var]	1792.606	42247.02	40454.41
U_fund_SYM+_rc@AC Group [V]	398.9277	458.3856	59.45786
U_fund_SYM-_rc@AC Group [V]	0.329419	1.176177	0.846758
I_fund_Q_SYM+_rc@AC Group	-1.260276	-53.06396	-51.80369
I_fund_Q_SYM-_rc@AC Group [A]	-0.102681	-1.263884	-1.161203

Duration time



	A	B	Delta
Time [s]	0:13.6038	1:13.6225	1:00.0187
U1_tRMS_rc@AC Group [V]	229.3099	263.6461	34.33629
U2_tRMS_rc@AC Group [V]	230.4859	264.7466	34.26070
U3_tRMS_rc@AC Group [V]	231.1917	265.2734	34.08171
I1_tRMS_rc@AC Group [A]	175.6654	161.3855	-14.27988
I2_tRMS_rc@AC Group [A]	175.3172	160.4653	-14.85191
I3_tRMS_rc@AC Group [A]	175.2707	161.2289	-14.04172
P_t_rc@AC Group [W]	121197.8	120685.2	-512.6250
Q_t_rc@AC Group [var]	1792.606	42049.95	40257.34
U_fund_SYM+_rc@AC Group [V]	398.9277	458.2035	59.27576
U_fund_SYM-_rc@AC Group [V]	0.329419	0.425984	0.096565
I_fund_Q_SYM+_rc@AC Group	-1.260276	-52.89859	-51.63831
I_fund_Q_SYM-_rc@AC Group [A]	-0.102681	-0.508272	-0.405591

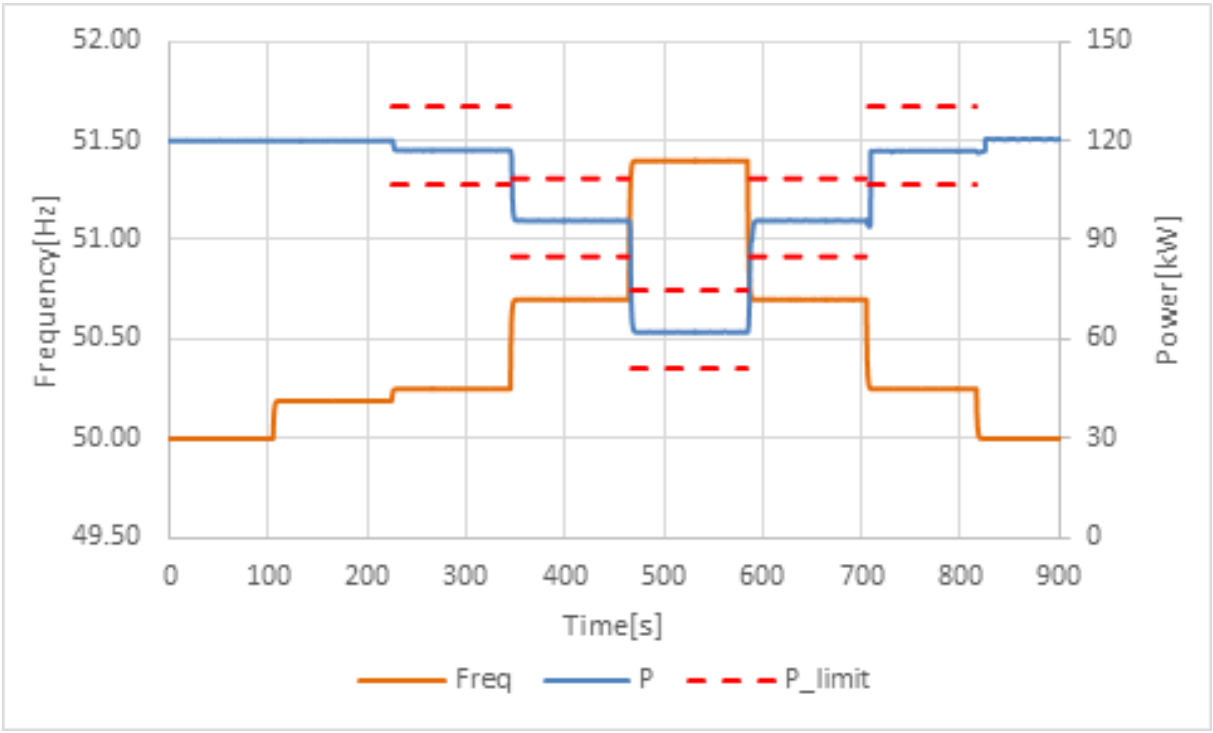
Recovery time



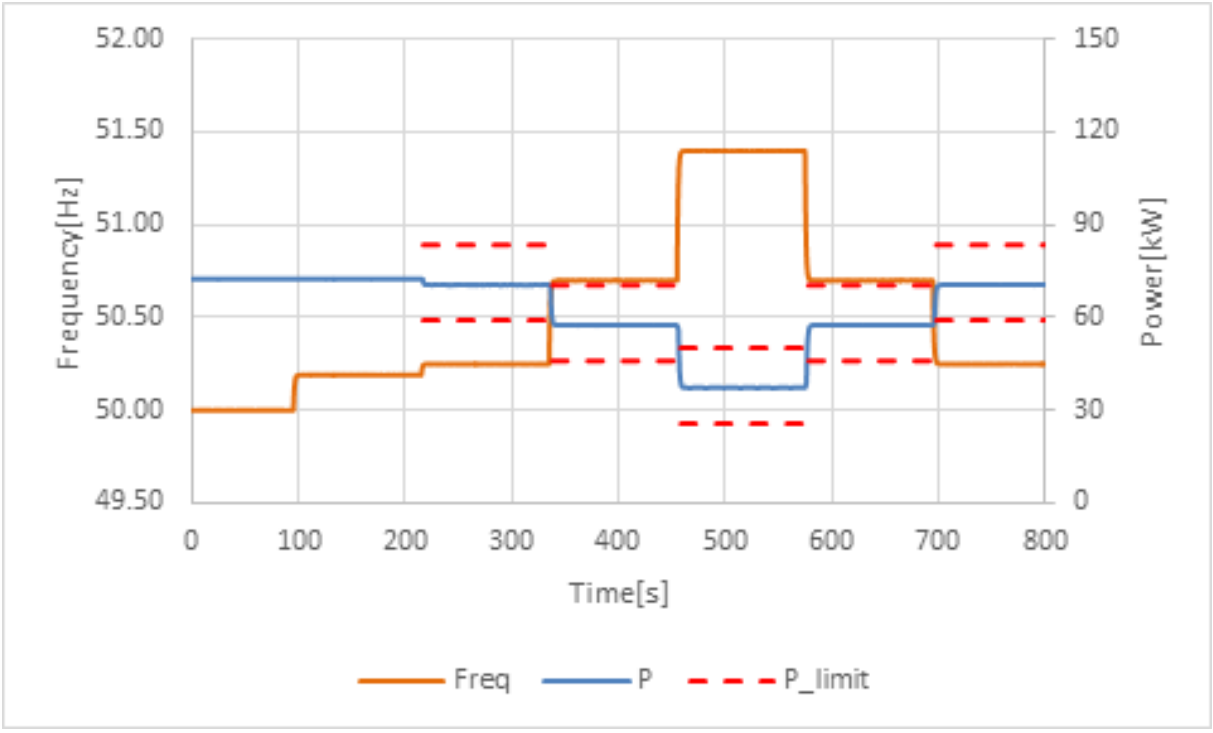
	A	B	Delta
Time [s]	1:13.6236471	1:13.6679354	0.0442883
U1_tRMS_rc@AC Group [V]	263.6468	231.1582	-32.48857
U2_tRMS_rc@AC Group [V]	264.7600	231.4284	-33.33162
U3_tRMS_rc@AC Group [V]	265.2594	231.9716	-33.28783
I1_tRMS_rc@AC Group [A]	161.3796	158.9252	-2.454407
I2_tRMS_rc@AC Group [A]	160.5020	161.3286	0.826553
I3_tRMS_rc@AC Group [A]	161.2519	157.6154	-3.636505
P_t_rc@AC Group [W]	120703.9	110573.1	-10130.79
Q_t_rc@AC Group [var]	42039.50	3704.720	-38334.78
U_fund_SYM+_rc@AC Group [V]	458.2032	400.9799	-57.22321
U_fund_SYM-_rc@AC Group [V]	0.474731	0.208406	-0.266325
I_fund_Q_SYM+_rc@AC Group	-52.88431	-0.627108	52.25720
I_fund_Q_SYM-_rc@AC Group [A]	-0.542737	-2.029279	-1.486542

EN 50549-2:2019: Active response to frequency deviation			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.6.1	Power response to over frequency	VDE V 0124-100:2020, clause 5.4.4	**P**
4.6.2	Power response to under frequency	VDE V 0124-100:2020, clause 5.4.6	**N/A**

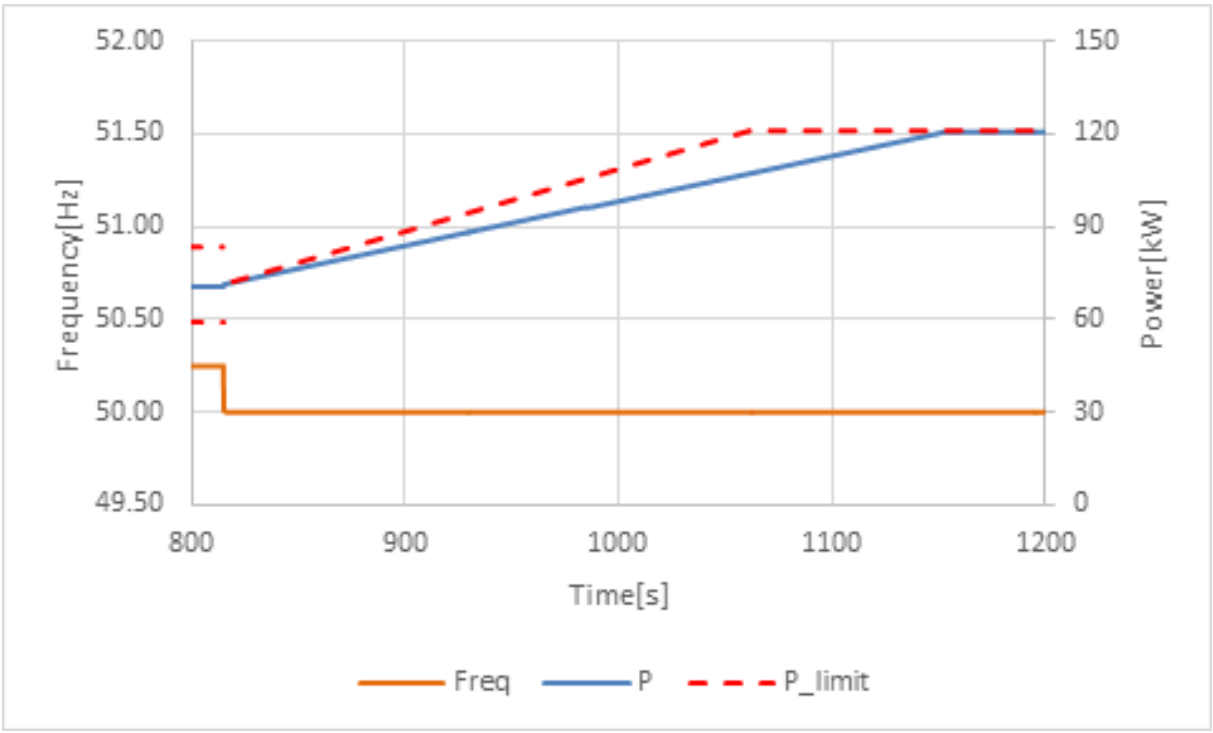
4.6.1 Power response to over frequency							P
Test result:							
1-min mean value [Hz]:	a) 50,00	b) 50,25	c) 50,70	d) 51,40	e) 50,70	f) 50,25	g) 50,00
1. Measurement a) to g): Active power output =100% P_{Emax} s=5% (40% P_{ref} / Hz), threshold frequency for start/return: 50,2Hz							
Frequency [Hz]:	50,00	50,25	50,70	51,40	50,70	50,25	50,00
$P_{setpoint}$ [kW]:	N/A	118,58	96,80	62,92	96,80	118,58	N/A
P_{E60} [kW]:	120,02	116,99	95,89	62,16	95,84	116,88	120,42
$\Delta P_{E60}/P_{Emax}$ [%]:	N/A	-1,31	-0,75	-0,63	-0,79	-1,40	N/A
1-min mean value [Hz]:	a) 50,00	b) 50,25	c) 50,70	d) 51,40	e) 50,70	f) 50,25	g) 50,00
2. Measurement a) to g): Active power output 60% after freezing = 100% P_{Emax} s=5% (40% P_{ref} / Hz), threshold frequency for start/return: 50,2Hz							
Frequency [Hz]:	50,00	50,25	50,70	51,40	50,70	50,25	50,00
$P_{setpoint}$ [kW]:	N/A	71,15	58,08	37,75	58,08	71,15	N/A
P_{E60} [kW]:	72,38	70,50	57,45	37,26	57,47	70,52	120,60
$\Delta P_{E60}/P_{Emax}$ [%]:	N/A	-0,54	-0,52	-0,41	-0,50	-0,52	N/A
Limit $\Delta P/P_{1min}$:	± 10 % of P_{Emax}						
Graph of Measurement 1.: Active power output 100% P_{Emax}							



Graph of Measurement 2.:Active power output 60% after freezing 100% P_{Emax}



Graph of power gradient:



Test:

The test is conducted for two powers. First, the test must start at a power =100% P_{Emax} ("Measurement 1"), and in a second test, for a power 60% P_{Emax} ("Measurement 2"). In the second test, after freezing of the P_M, the available active power output must be increased to a value =100% P_{Emax}, and after the network frequency of 50,2 Hz is fallen below, the rise of the active power gradient must be recorded.

Point g) must be held until the micro-generator is again feeding in with the active power output available.

Assessment criterion:

For f = 50,2 Hz, the value of the P_M active power currently being generated is "frozen".

a) For adjustable micro-generators when:

1) the active power reduces between measuring points b) and f) given above with the set gradient P_M per Hz for a increasing frequency (or rises for a frequency decreasing again).

2) the maximum active power gradient occurring in point is less than the configured maximum active power per minute

3) the reaction value of the setpoint determined by the gradient characteristic curve does not differ from P_{Emax} by more than ± 10%.

4) the settling time is equal or below 2 s with an intentional delay set to zero

b) For partly adjustable micro-generators

1) when they behave as in a) within their adjustment range, and

2) when, outside the adjustable range, the power fed in on leaving the adjustment range remains constant until shutdown. Shutdown must be no later than at 51,5 Hz.

Note:

The test method refer to clause 5.4.4 of VDE V 0124-100:2020.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

EN 50549-2:2019: Power response to voltage variations and voltage changes			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.7.2.2	Capabilities	--	**P**
4.7.2.3.2	Setpoint control modes (cos φ setpoint mode)	FGW TG3, Revision 25, clause 4.2.2	**P**
4.7.2.3.2	Setpoint control modes (Q setpoint mode, 48,43%)	EN 50438:2013, Annex D.3.4.2.1	**P**
4.7.2.2	Capabilities (Q Response time)	CEI 0-21:2022-03, Annex B.1.2.4	**P**
4.7.2.3.3	Voltage related control modes (Q (U) controls)	VDE AR 4105:2018-05, clause 5.7.2.4	**P**
4.7.2.3.4	Power related control modes (cos φ (P) curve)	VDE V 0124-100:2020, clause 5.3.6.4	**P**
4.7.3	Voltage related active power reduction (P(U) function)	CEI 0-21:2022-03, Annex B.1.3.1	**P**

4.7.2 Voltage support by reactive power 4.7.2.2 Capabilities 4.7.2.3.2 Fix control modes (cos φ setpoint mode)	P

Test result:

PF = 0,8 / Inducitive reactive power supply

Rating power [%]	Active power [kW]	Reactive power [kVar]	Power factor [cos φ]	Voltage [V]
10%	12,412	9,149	0,805	229,62
20%	24,373	18,035	0,804	229,72
30%	36,511	27,631	0,797	229,84
40%	48,679	36,619	0,799	229,95
50%	60,145	45,134	0,800	230,06
60%	72,482	53,647	0,804	230,20
70%	84,134	62,151	0,804	230,32
80%	92,414	68,460	0,804	230,40
90%	95,745	71,357	0,802	230,44
100%	98,041	71,284	0,809	230,48

PF = 0,8 / Capacitive reactive power supply

Rating power [%]	Active power [kW]	Reactive power [kVar]	Power factor [cos φ]	Voltage [V]
10%	12,187	-9,083	-0,802	229,63
20%	24,400	-18,181	-0,802	229,72
30%	36,593	-27,573	-0,799	229,81
40%	48,415	-36,308	-0,800	229,89
50%	60,554	-45,057	-0,802	229,98
60%	72,767	-53,602	-0,805	230,07
70%	84,508	-61,546	-0,808	230,17
80%	92,170	-67,885	-0,805	230,16
90%	95,430	-72,224	-0,797	230,23
100%	95,498	-72,153	-0,798	230,22

Cos phi=1 no reactive power supply

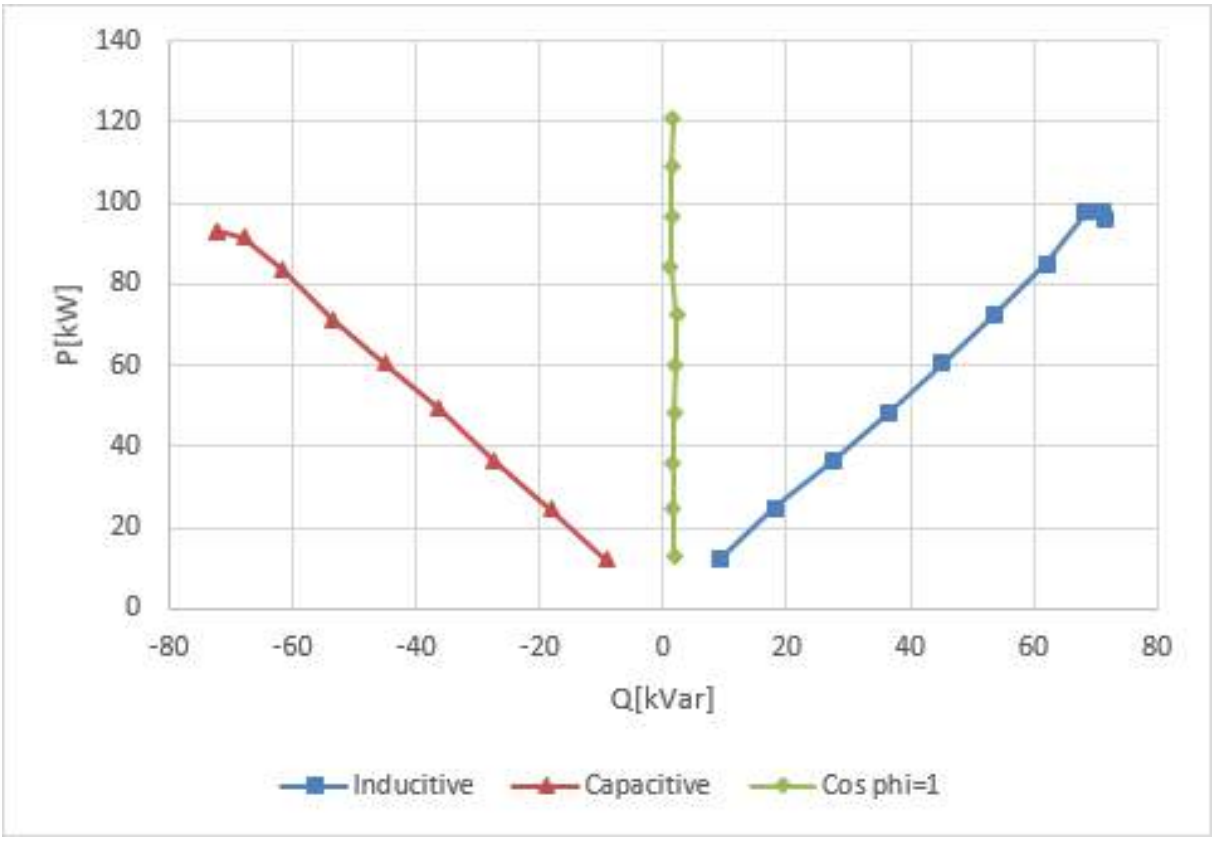
Rating power [%]	Active power [kW]	Reactive power [kVar]	Power factor [cos φ]	Voltage [V]
10%	13,003	1,828	0,989	229,71
20%	24,994	1,515	0,998	229,81
30%	35,993	1,652	0,999	229,90
40%	48,118	1,861	0,999	230,00
50%	60,245	2,081	0,999	230,09
60%	72,378	2,304	0,999	230,18
70%	84,557	1,304	1,000	230,29
80%	96,667	1,404	1,000	230,40
90%	108,805	1,332	1,000	230,51
100%	120,562	1,599	1,000	230,61

Assessment criterion:

When operating above the apparent power threshold S_{min} equal to 10 % of the maximum apparent power S_{max} or the minimum regulating level of the generating plant, whichever is the higher value, the reactive power capability shall be provided with an accuracy of ± 2 % S_{max}. Up to this apparent power threshold S_{min}, deviations above 2 % are permissible; nevertheless the accuracy shall always be as good as

technically feasible and the exchange of uncontrolled reactive power in this low-power operation mode shall not exceed 10 % of the maximum apparent power S_{max}.
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Diagram



4.7.2 Voltage support by reactive power 4.7.2.2 Capabilities 4.7.2.3.2 Fix control modes (Q setpoint mode)	P

Test result:

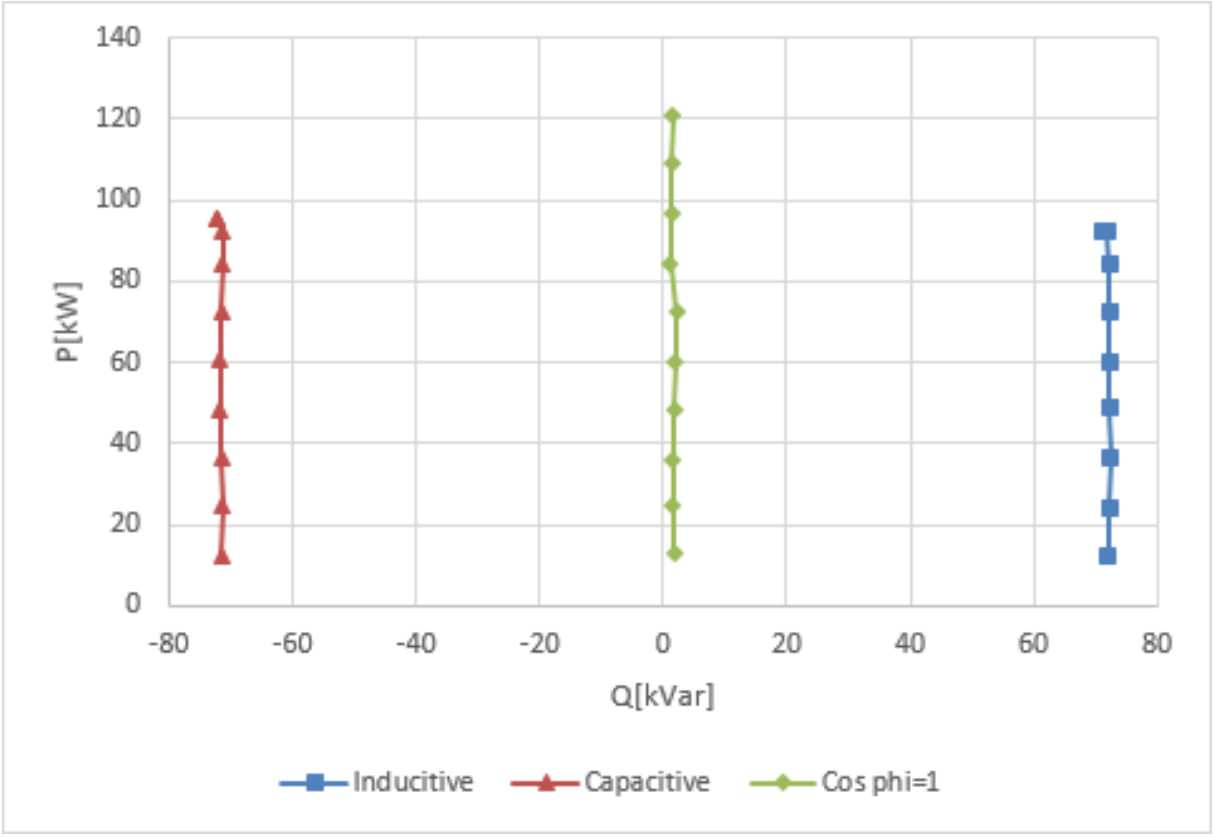
Inducitive reactive power supply				
Rating power [%]	Active power [kW]	Reactive power [kVar]	Power factor [cos φ]	Voltage [V]
10%	12,128	72,064	0,164	229,78
20%	24,787	72,228	0,325	229,91
30%	36,544	72,446	0,450	229,97
40%	48,458	72,242	0,557	230,07
50%	60,397	72,307	0,641	230,18
60%	72,699	72,166	0,710	230,21
70%	84,959	72,331	0,761	230,40
80%	97,622	71,953	0,805	230,62
90%	95,745	71,357	0,802	230,44
100%	98,041	71,284	0,809	230,48
Capacitive reactive power supply				
Rating power [%]	Active power [kW]	Reactive power [kVar]	Power factor [cos φ]	Voltage [V]
10%	12,236	-71,533	-0,169	229,65
20%	24,455	-71,296	-0,324	229,71
30%	36,632	-71,533	-0,456	229,84
40%	49,356	-71,626	-0,567	229,94
50%	60,415	-71,605	-0,645	230,03
60%	71,465	-71,481	-0,707	230,12
70%	83,627	-71,220	-0,761	230,21
80%	91,429	-71,313	-0,789	230,25
90%	95,430	-72,224	-0,797	230,23
100%	95,498	-72,153	-0,798	230,22
Cos phi=1 no reactive power supply				
Rating power [%]	Active power [kW]	Reactive power [kVar]	Power factor [cos φ]	Voltage [V]
10%	13,003	1,828	0,989	229,71
20%	24,994	1,515	0,998	229,81
30%	35,993	1,652	0,999	229,90
40%	48,118	1,861	0,999	230,00
50%	60,245	2,081	0,999	230,09
60%	72,378	2,304	0,999	230,18
70%	84,557	1,304	1,000	230,29
80%	96,667	1,404	1,000	230,40
90%	108,805	1,332	1,000	230,51
100%	120,562	1,599	1,000	230,61

Assessment criterion:

When operating above the apparent power threshold S_{min} equal to 10 % of the maximum apparent power S_{max} or the minimum regulating level of the generating plant, whichever is the higher value, the reactive power capability shall be provided with an accuracy of ± 2 % S_{max}. Up to this apparent power threshold S_{min}, deviations above 2 % are permissible; nevertheless the accuracy shall always be as good as technically feasible and the exchange of uncontrolled reactive power in this low-power operation mode shall not exceed 10 % of the maximum apparent power S_{max}.Generating plants must meet the reactive

power requirement regardless of the number of feeding phases under normal steady-state operating conditions in the voltage tolerance band +10%U_n and -15%U_n.
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Diagram



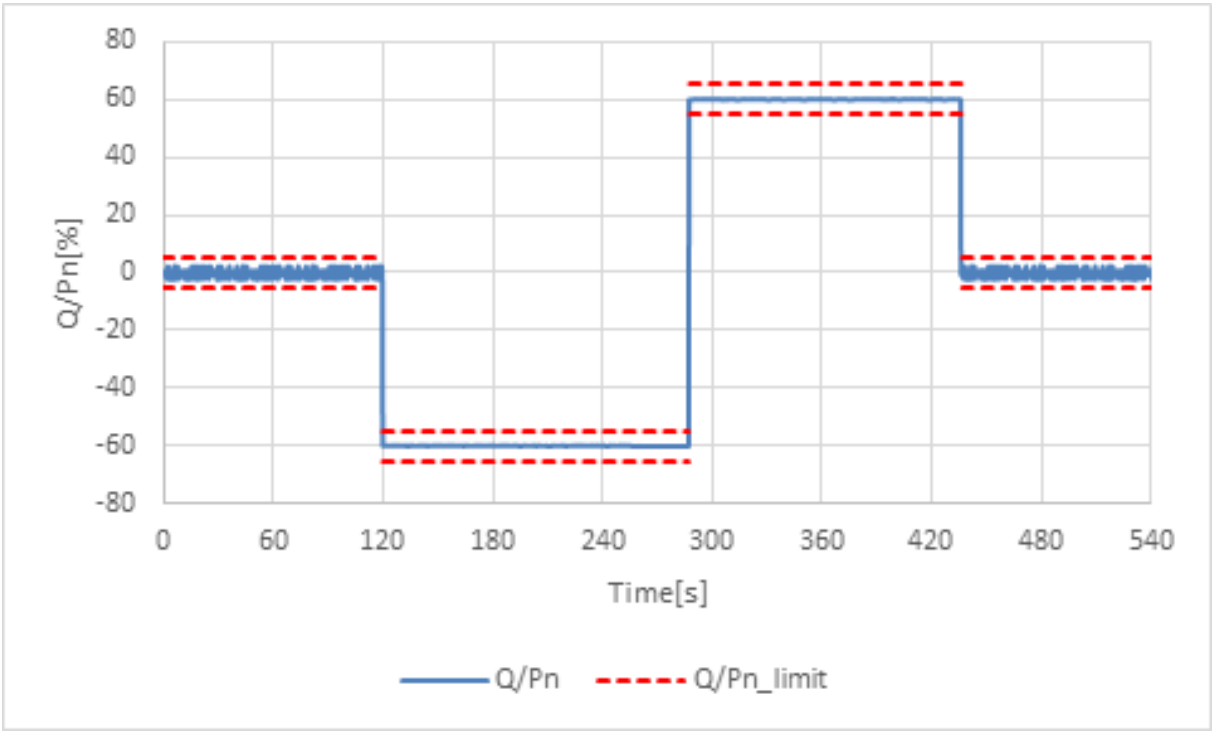
4.7.2.2	Capabilities Q Response time	P

Reaction time

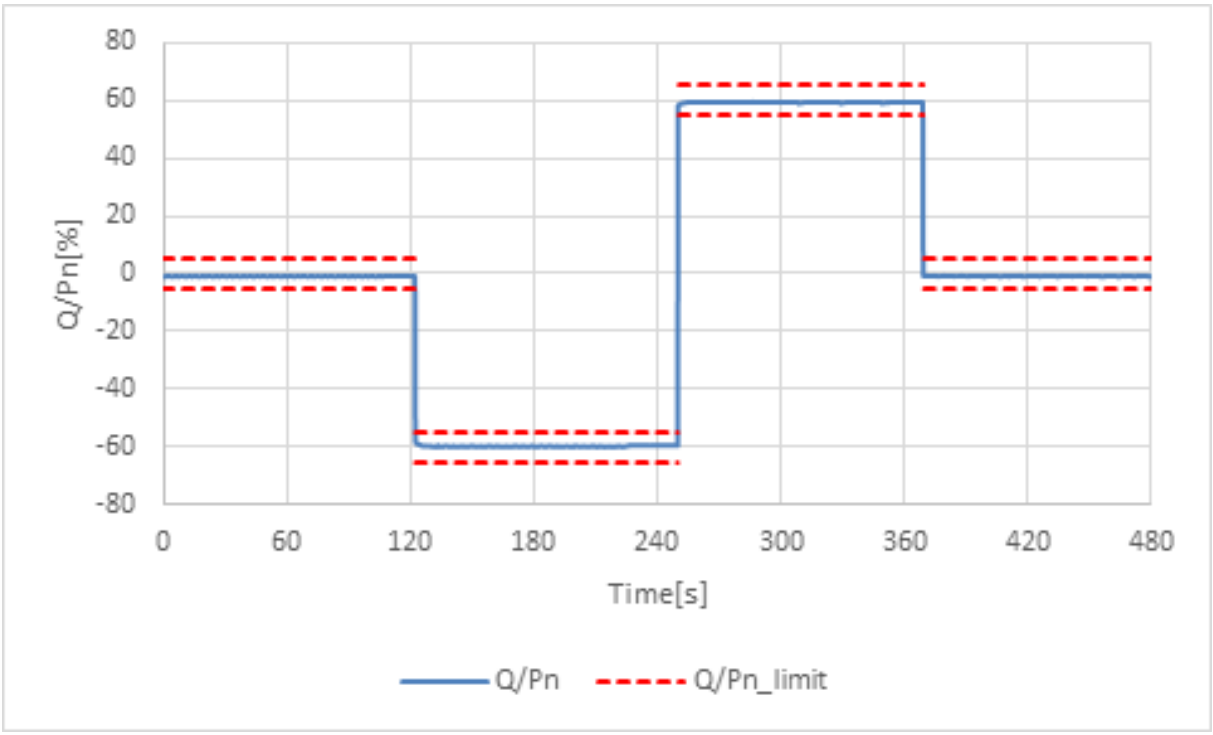
Test result:

		Time	Result
1.	Reaction time Q=0 to Qmin (50% test)	0,2 s	P
2.	Reaction time Qmin to Qmax (50% test)	0,2 s	P
3.	Reaction time Qmax to Q=0 (50% test)	0,2 s	P
4.	Reaction time Q=0 to Qmin (100% test)	0,2 s	P
5.	Reaction time Qmin to Qmax (100% test)	0,2 s	P
6.	Reaction time Qmax to Q=0 (100% test)	0,2 s	P

Graph 50%Pn



Graph 100%Pn



Assessment criterion:

DC source should be set to 50%(test1) and 100%(test2) output power micro-generator.

Starting with Q=0 then Qmin to Qmax, and then back to Q=0 in doing so each point must be kept for at least 2 minute.

The total tolerance is ΔQ ≤ ±5,0% of Pn.

The maximum response time is less than 10s.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.7.2.2 Capabilities 4.7.2.3.3 Voltage related control modes (Q (U) controls)	P

Test result:

Qmin reactive power in accordance to standard characteristic curve Q=f(V)

P/P_{Emax}	Vac [% U_n] Set point	P/P_{Emax} [%]	Vac [V] measured	Q [kVar] measured	Q [kVar] expected	ΔQ [%P_D]
< 20%	1,05Vn	10,64	241,50	-2,301	≈0	-2,38
< 20%	1,07Vn	10,62	246,09	-2,391	≈0	-2,47
< 20%-30%	1,07Vn	30,37	246,10	-36,476	-36,300	-0,18
40%	1,07Vn	40,07	246,17	-36,617	-36,300	-0,33
50%	1,07Vn	50,09	246,25	-36,329	-36,300	-0,03
60%	1,07Vn	59,14	246,10	-36,388	-36,300	-0,09
70%	1,07Vn	70,20	246,14	-36,222	-36,300	0,08
80%	1,07Vn	79,40	246,15	-36,660	-36,300	-0,37
90%	1,07Vn	89,47	246,17	-36,298	-36,300	0,00
100%	1,07Vn	95,36	246,15	-35,966	-36,300	0,35
100%	1,08Vn	82,75	248,71	-71,972	-72,600	0,65
100%-10%	1,08Vn	10,48	248,70	-72,855	-72,600	-0,26
10%→ ≤5%	1,08Vn	4,33	248,75	-2,653	≈0	-2,74

Qmax reactive power in accordance to standard characteristic curve Q=f(V)

P/P_{Emax}	Vac [% U_n] Set point	P/P_{Emax} [%]	Vac [V] measured	Q [kVar] measured	Q [kVar] expected	ΔQ [%P_D]
< 20%	0.95Vn	14,78	218,46	2,389	≈0	2,47
< 20%	0,93Vn	14,80	213,99	2,363	≈0	2,44
< 20%-30%	0,93Vn	30,18	213,98	36,402	36,300	0,11
40%	0,93Vn	40,08	213,97	36,299	36,300	0,00
50%	0,93Vn	48,46	213,94	36,450	36,300	0,15
60%	0,93Vn	59,17	214,06	35,966	36,300	-0,35
70%	0,93Vn	69,44	214,23	36,713	36,300	0,43
80%	0,93Vn	79,71	213,73	36,601	36,300	0,31
90%	0,93Vn	87,97	214,04	36,537	36,300	0,24
100%	0,93Vn	87,72	213,96	36,727	36,300	0,44
100%	0,92Vn	69,84	211,63	72,179	72,600	-0,43
100%-10%	0,92Vn	9,92	211,55	72,602	72,600	0,00
10%→ ≤5%	0,92Vn	4,03	210,84	1,915	≈0	1,98

Test:

The verification of the accuracy of the Q (U) control of the reactive power-voltage characteristic Un shown in CEI 0-21, B.1.2.6, Figure 7 is effected by a slow variation of the line voltage U_n in the range 90% U_n to 110% U_n. Depending on the type of EZE (single- or three-phase), the voltage changes must be carried out simultaneously or symmetrically on all phases.

a) In order to check the stationary accuracy, the permissible voltage range shall be passed through within steps according above table.

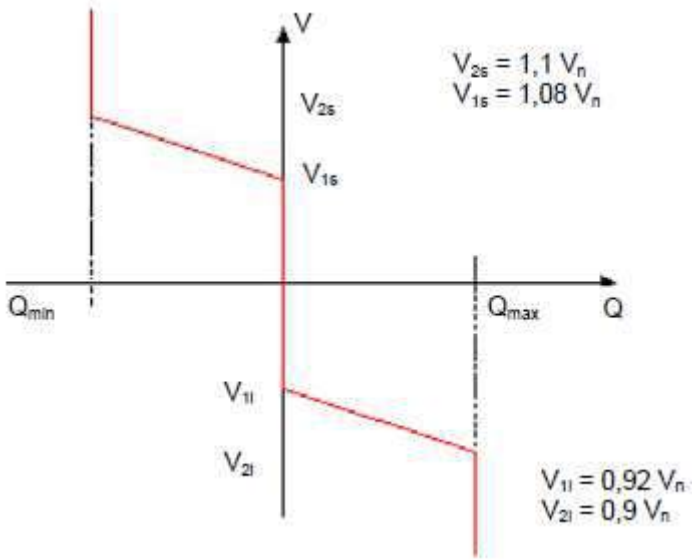


Figure 7

The voltages are to be set with a maximum deviation of 0,25% U_n.

Assessment criterion:

The value measured for each set point to the set value is $\Delta Q \leq \pm 5\ \%P_D$.

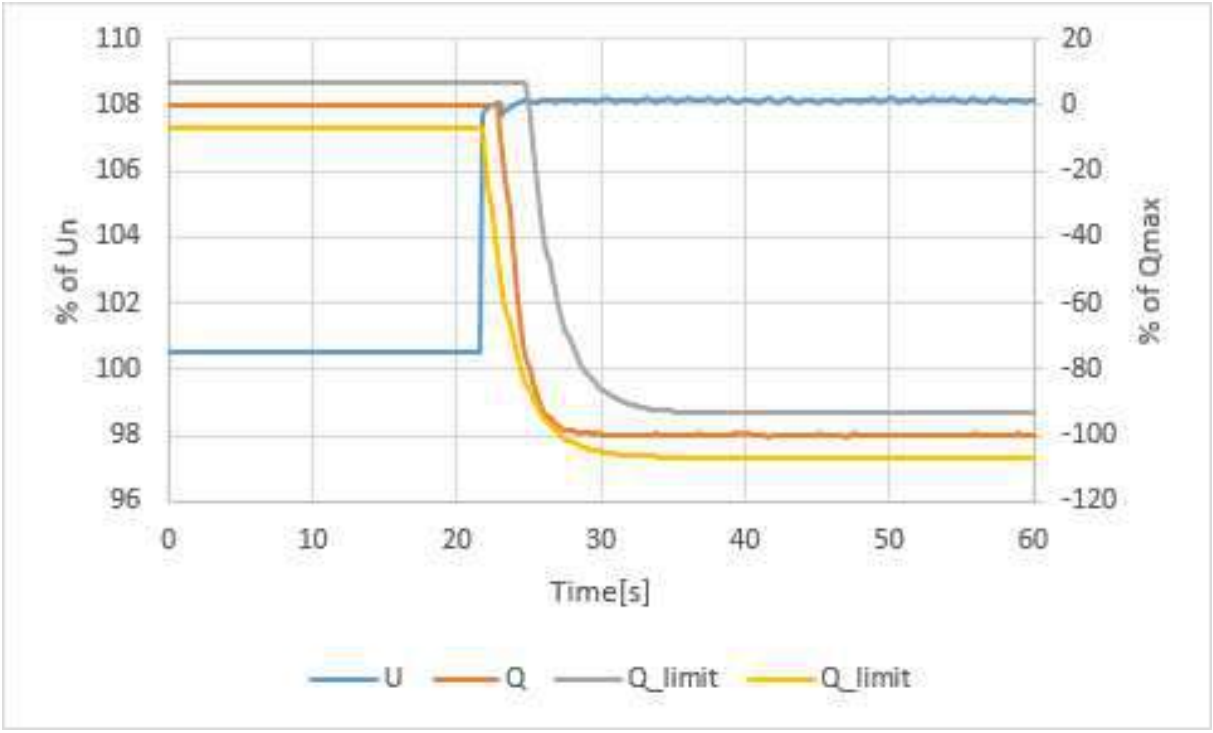
The above test data is according to the four set points: V_{1i}=0,94 Un and V_{2i}=0,92 Un, V_{1s}=1,06 Un and V_{2s}=1,08 Un, these set points are adjustable.

The $P_{lock\ in}$ is set to 20%P_{Emax} and $P_{lock\ out}$ is set to 5%P_{Emax}.

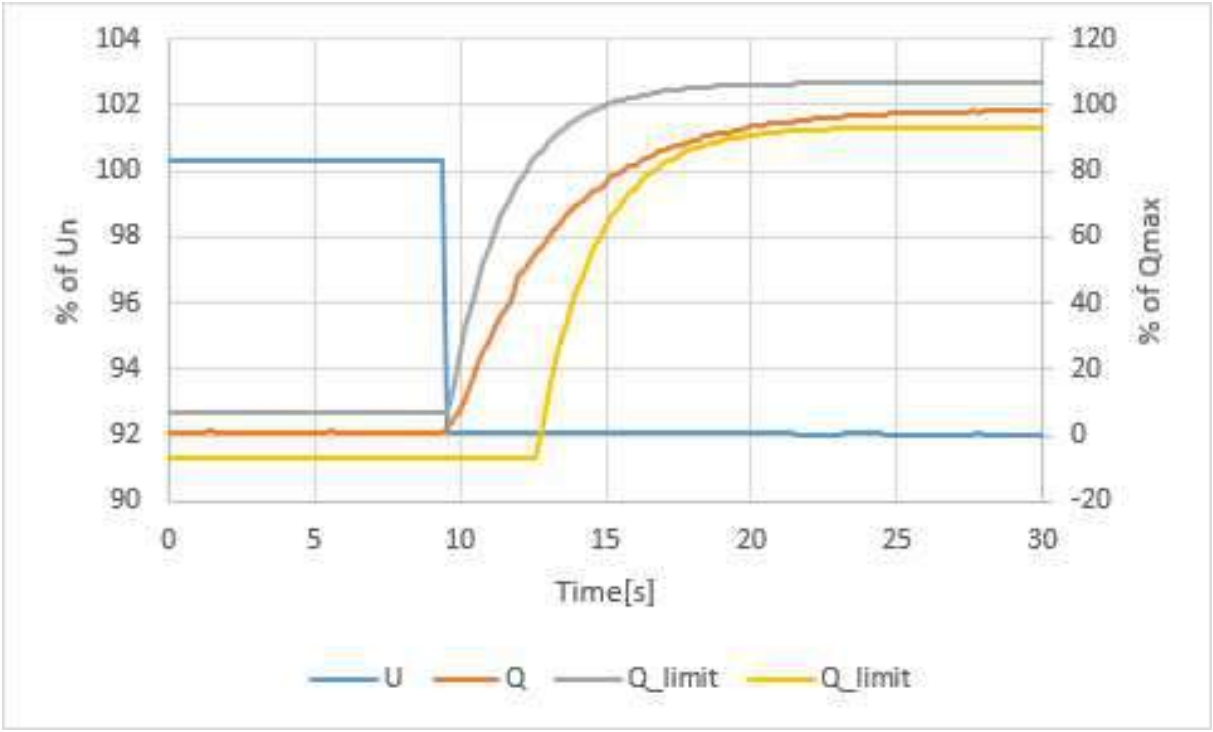
Note:

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Test of the dynamics of the Q (U) regulation			P
Test result:			
Voltage jump Vac [% U_n]	Q [kVar] measured	Q [%Qmin] measured	T=3τmeasured
100 to 108	-72,369	99,68	7,2 s
	-72,579	99,97	7,2 s
	-72,319	99,61	7,0 s
Voltage jump Vac [% U_n]	Q [kVar] measured	Q [%Qmax] measured	T=3τmeasured
100 to 92	71,642	98,68	10,0 s
	71,640	98,68	10,0 s
	71,476	98,45	9,8 s
Note: The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.			
Graph of 100%U_n to 108% U_n:			



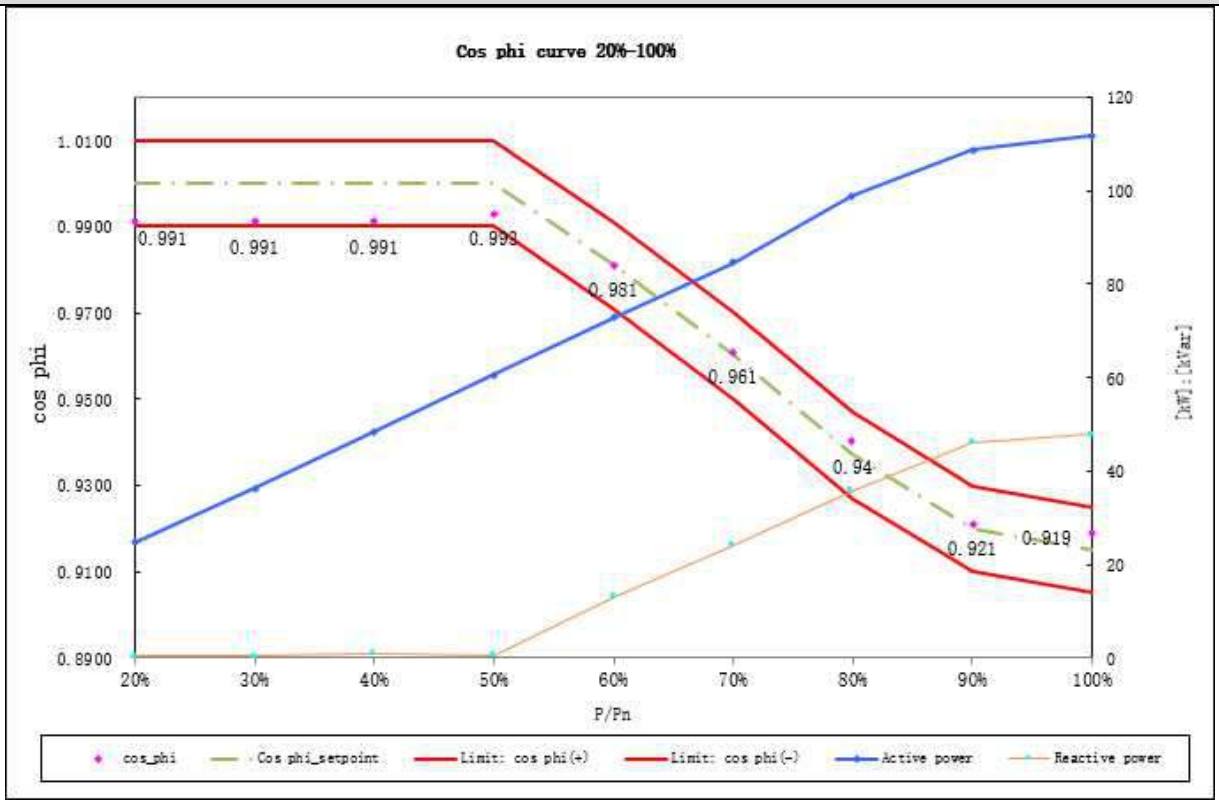
Graph of 100%U_n to 92% U_n:



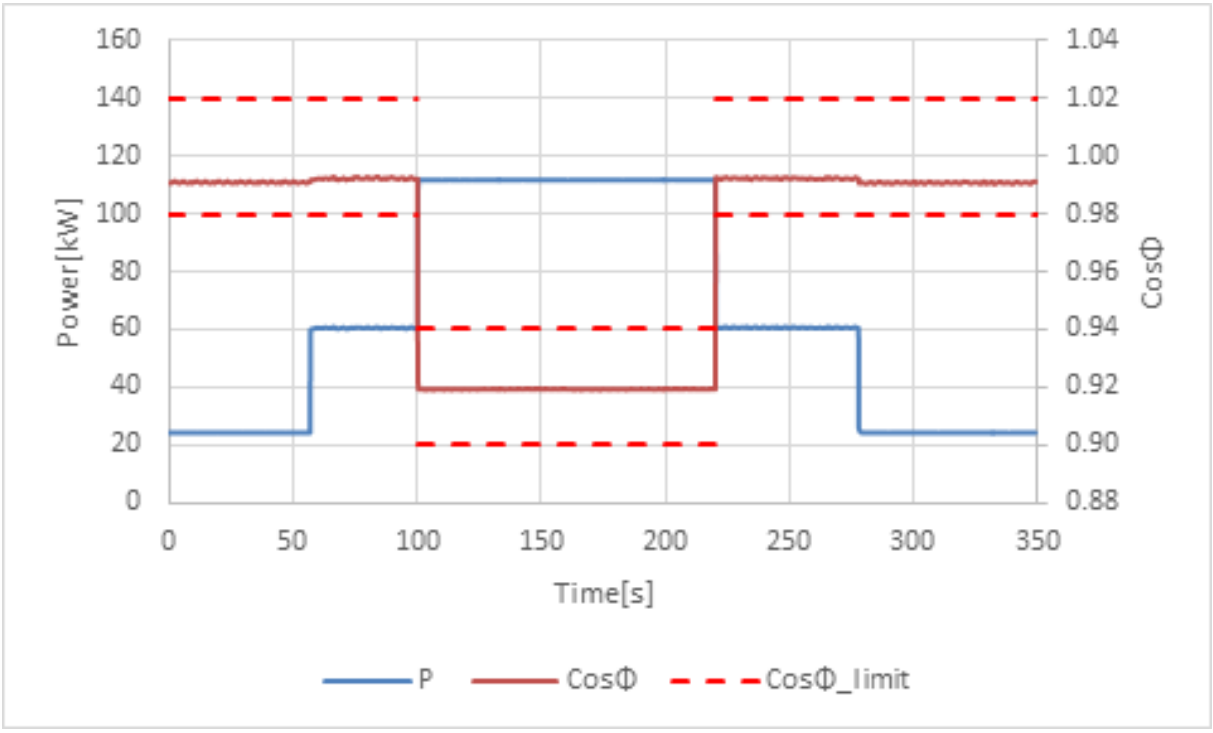
4.7.2.2 Capabilities **4.7.2.3.4 Power related Control mode (cos φ (P) curve)**									**P**
Test result:									
Test 1:									
P/P_{Emax} [%]	20	30	40	50	60	70	80	90	100
30 s mean value	20% to 100% P_{Emax}								
U [V]:	229,83	229,91	230,00	230,08	230,20	230,32	230,46	230,62	230,62
P_{E30} [kW]:	24,75	36,29	48,44	60,50	72,80	84,61	98,78	108,82	111,70
P_{E30} of P_{Emax} [%]:	20,45	29,99	40,04	50,00	60,16	69,93	81,64	89,93	92,31
Q_{E30} [kVar]:	0,34	0,35	0,95	0,45	13,10	24,13	35,89	45,90	47,75
cos φ_{E30}:	0,991	0,991	0,991	0,993	0,981	0,961	0,940	0,921	0,919
cos $\varphi_{setpoint}$ of P_{E30}:	1,000	1,000	1,000	1,000	0,980	0,960	0,937	0,920	0,915
Limit cos φ_{E30}:	cos $\varphi_{setpoint}$ ± 0,01								
Test 2:									
P/P_{Emax} [%]	20			50			100		
30 s mean value	20% to 50% to 100% P_{Emax}								
U [V]:	229,85			230,12			230,61		
P_{E30} [kW]:	24,32			60,80			111,74		
P_{E30} of P_{Emax} [%]:	20,10			50,25			92,35		
Q_{E30} [kVar]:	0,39			0,44			47,61		
cos φ_{E30}:	0,991			0,993			0,919		
cos $\varphi_{setpoint}$ of P_{E30}:	1,000			1,000			0,915		
T_0[s]:	0,2 s					1,2 s			
P/P_{Emax} [%]	100			50			20		
30 s mean value	100% to 50% to 20% P_{Emax}								
U [V]:	230,62			230,12			229,84		
P_{E30} [kW]:	111,74			60,90			24,34		
P_{E30} of P_{Emax} [%]:	92,35			50,33			20,11		
Q_{E30} [kVar]:	47,63			0,54			0,42		
cos φ_{E30}:	0,919			0,993			0,991		
cos $\varphi_{setpoint}$ of P_{E30}:	0,915			1,000			1,000		
T_0 [s]:	1,2 s					0,2 s			
Limit T_0 [s]:	10 s								
Limit cos φ_{E30}:	cos $\varphi_{setpoint}$ ± 0,02								

Test result:

Graph of cos φ(P): Test a)



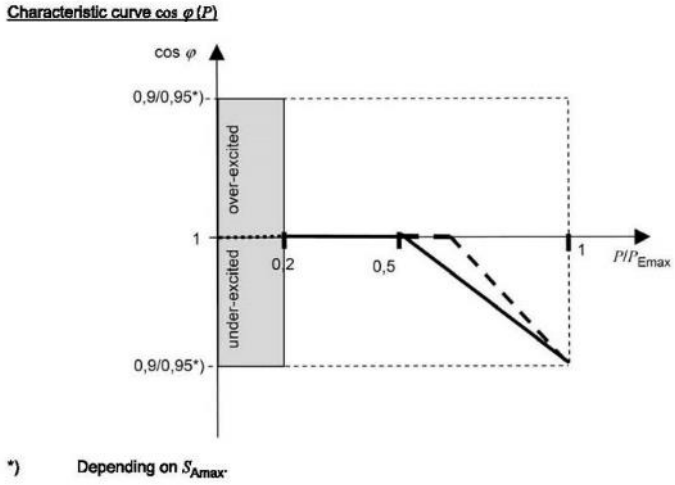
Graph of setting (T_0) time: Test b): 100% to 50% to 20% to 50% to 100%Pn



Test:

Test 1: Using the standard characteristic curve increases the active power from 20% P_{Emax} in increments of 10% P_{Emax} to P_{Emax}, The test is carried out in reverse.

Test 2: Using the standard characteristic curve increases the active power from 20% P_{Emax} to 50% P_{Emax} and to P_{Emax}, The test is carried out in reverse, After the PGU has settled, the end value reached is determined as a 30 s mean value.



Assessment criterion:

Test 1: cos φ accuracy cos φ (±0,01)

Test 2: cos φ accuracy cos φ (±0,02)

For the test to be passed, the cos φ setpoint from the active power must be measured at the terminals of the PGU within a settling time of 10 s.

Note:

The test method refer to clause 5.3.6.4 of VDE V 0124-100:2020.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.7.3	Voltage related active power reduction (P(U) function)	P
Test result:		
5-min mean value / (P/ P_{Emax})	100% to 20%	
Settling time [s]:	9,4	
P_{E60} [%]:	19,60%	
$\Delta P_{E60}/P_{Setpoint}$ [%]:	20 % or less of P_{Emax}	
Limit settling time:	600s	

Test:

a) Set the voltage to 2% Vn lower than the activation threshold stated by the manufacturer.

b) Set the voltage to 112%Vn, The inverter now has to reduce its output power to value lower than 20%P_{Emax} within 5min.

c) Set the voltage back to 2%Vn lower than the activation threshold, Check that the active power will return to the value consistent with the power available from the primary source or simulated.

Assessment criterion:

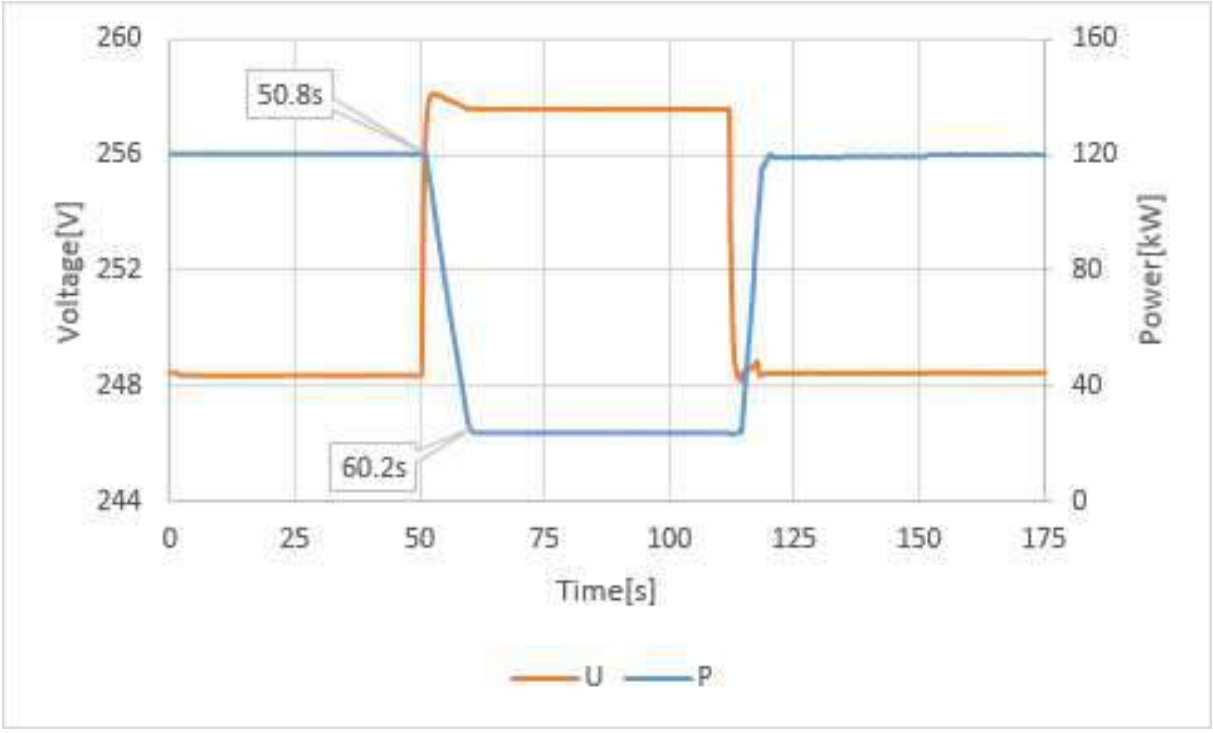
for adjustable PGUs:

- no network disconnection
- the active power value does not exceed the setpoint of 20% P_{Emax}
- the setting time determind is equal or less than 600s

Note:

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Graph:



EN 50549-2:2019: Power quality			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.8	EMC and power quality	--	**P**
	Harmonic current emission	EN 61000-3-2, EN 61000-3-12	**P**
	Harmonic current emission	EN 61000-4-7	**P**
	Switching operations	IEC 61400-21	**P**
	Voltage fluctuation and flicker	EN 61000-3-3, EN 61000-3-11	**P**
	Flicker and voltage fluctuations	IEC 61400-21	**P**
	DC injection	EN 50438, Annex D.3.10	**P**
	Immunity to voltage dips and short interruptions	G59/3-4:2018-05, clause 13.8.4.5	**P**
	Unbalance	BDEW TG3, Revision 25, clause 4.3.5	**P**

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)	P

Test result: ASW75K-LT

Watts [kW]	8,199	8,092	8,386
Vrms [V]	230,41	230,29	230,30
Arms [A]	35,64	35,16	36,44
Frequency [Hz]	50,00		
THD50 (33% output power)	0,612	0,692	0,739
PWHD50 (33% output power)	2,413	2,322	2,356

Harmonic order n	Current Magnitude [A] at 100% rated output power			% of Fundamental			Phase	Harmonic Current Limits [%]
	L1	L2	L3	L1	L2	L3	--	--
1st	35,633	35,141	36,423	32,782	32,330	33,510	Three Phase	--
2nd	0,138	0,074	0,122	0,127	0,068	0,112	Three Phase	8,00
3rd	0,155	0,423	0,457	0,143	0,389	0,421	Three Phase	21,60
4th	0,105	0,107	0,071	0,096	0,098	0,066	Three Phase	4,00
5th	0,164	0,175	0,227	0,150	0,161	0,209	Three Phase	10,70
6th	0,041	0,040	0,043	0,037	0,036	0,040	Three Phase	2,67
7th	0,144	0,151	0,174	0,133	0,139	0,160	Three Phase	7,20
8th	0,043	0,041	0,072	0,040	0,038	0,066	Three Phase	2,00
9th	0,051	0,032	0,059	0,047	0,030	0,054	Three Phase	3,80
10th	0,045	0,035	0,027	0,041	0,032	0,025	Three Phase	1,60
11th	0,065	0,072	0,087	0,060	0,067	0,080	Three Phase	3,10
12th	0,044	0,025	0,036	0,041	0,023	0,033	Three Phase	1,33
13th	0,059	0,060	0,064	0,055	0,055	0,059	Three Phase	2,00
14th	0,043	0,026	0,049	0,039	0,024	0,045	Three Phase	N/A
15th	0,028	0,032	0,037	0,026	0,030	0,034	Three Phase	N/A
16th	0,040	0,038	0,019	0,037	0,035	0,017	Three Phase	N/A
17th	0,212	0,192	0,196	0,195	0,176	0,180	Three Phase	N/A
18th	0,035	0,023	0,026	0,032	0,021	0,024	Three Phase	N/A
19th	0,211	0,209	0,212	0,194	0,192	0,195	Three Phase	N/A
20th	0,042	0,037	0,038	0,038	0,034	0,035	Three Phase	N/A
21th	0,027	0,025	0,028	0,025	0,023	0,026	Three Phase	N/A
22th	0,016	0,019	0,019	0,015	0,018	0,017	Three Phase	N/A
23th	0,156	0,154	0,161	0,144	0,142	0,148	Three Phase	N/A
24th	0,041	0,021	0,026	0,038	0,019	0,024	Three Phase	N/A
25th	0,218	0,224	0,223	0,200	0,206	0,205	Three Phase	N/A
26th	0,026	0,022	0,027	0,024	0,020	0,025	Three Phase	N/A
27th	0,016	0,018	0,015	0,015	0,016	0,014	Three Phase	N/A
28th	0,020	0,022	0,014	0,019	0,020	0,013	Three Phase	N/A
29th	0,147	0,146	0,142	0,135	0,134	0,130	Three Phase	N/A
30th	0,037	0,017	0,023	0,034	0,016	0,021	Three Phase	N/A
31th	0,186	0,176	0,181	0,171	0,162	0,166	Three Phase	N/A
32th	0,027	0,020	0,028	0,025	0,019	0,026	Three Phase	N/A
33th	0,017	0,014	0,018	0,015	0,013	0,016	Three Phase	N/A
34th	0,023	0,019	0,014	0,021	0,018	0,013	Three Phase	N/A
35th	0,118	0,123	0,116	0,109	0,113	0,107	Three Phase	N/A
36th	0,027	0,019	0,015	0,024	0,017	0,013	Three Phase	N/A
37th	0,148	0,142	0,149	0,136	0,130	0,137	Three Phase	N/A
38th	0,024	0,015	0,023	0,022	0,013	0,021	Three Phase	N/A
39th	0,019	0,014	0,013	0,018	0,013	0,012	Three Phase	N/A
40th	0,062	0,031	0,036	0,057	0,028	0,033	Three Phase	N/A
41th	0,109	0,111	0,113	0,100	0,102	0,104	Three Phase	N/A
42th	0,025	0,016	0,014	0,023	0,014	0,013	Three Phase	N/A
43th	0,123	0,123	0,120	0,113	0,113	0,111	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
44th	0,022	0,015	0,018	0,020	0,014	0,017	Three Phase	N/A
45th	0,034	0,019	0,016	0,031	0,017	0,015	Three Phase	N/A
46th	0,025	0,014	0,013	0,023	0,013	0,012	Three Phase	N/A
47th	0,089	0,094	0,090	0,082	0,086	0,083	Three Phase	N/A
48th	0,022	0,016	0,013	0,020	0,015	0,012	Three Phase	N/A
49th	0,108	0,107	0,109	0,099	0,099	0,101	Three Phase	N/A
50th	0,020	0,012	0,016	0,018	0,011	0,015	Three Phase	N/A
Watts [kW]					16,621	16,328	16,812	
Vrms [V]					230,03	230,30	230,69	
Arms [A]					72,29	70,91	72,89	
Frequency [Hz]					50,00			
THD50 (66% output power)					0,676	0,988	0,821	
PWHD50 (66% output power)					2,565	2,216	2,432	
Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	72,271	70,894	72,873	66,489	65,223	67,043	Three Phase	--
2nd	0,075	0,049	0,065	0,069	0,045	0,060	Three Phase	8,00
3rd	0,299	0,896	0,595	0,275	0,825	0,548	Three Phase	21,60
4th	0,127	0,094	0,106	0,117	0,087	0,098	Three Phase	4,00
5th	0,159	0,143	0,210	0,147	0,132	0,193	Three Phase	10,70
6th	0,032	0,048	0,041	0,029	0,044	0,037	Three Phase	2,67
7th	0,154	0,159	0,174	0,142	0,146	0,160	Three Phase	7,20
8th	0,039	0,030	0,056	0,036	0,028	0,051	Three Phase	2,00
9th	0,043	0,032	0,030	0,040	0,030	0,027	Three Phase	3,80
10th	0,036	0,024	0,024	0,033	0,022	0,022	Three Phase	1,60
11th	0,086	0,106	0,111	0,079	0,097	0,103	Three Phase	3,10
12th	0,043	0,025	0,049	0,039	0,023	0,045	Three Phase	1,33
13th	0,066	0,073	0,084	0,060	0,067	0,077	Three Phase	2,00
14th	0,038	0,024	0,040	0,035	0,022	0,037	Three Phase	N/A
15th	0,079	0,046	0,058	0,073	0,043	0,054	Three Phase	N/A
16th	0,048	0,036	0,025	0,045	0,033	0,023	Three Phase	N/A
17th	0,224	0,174	0,206	0,206	0,160	0,190	Three Phase	N/A
18th	0,036	0,019	0,034	0,033	0,018	0,031	Three Phase	N/A
19th	0,213	0,201	0,221	0,196	0,185	0,203	Three Phase	N/A
20th	0,039	0,042	0,035	0,036	0,038	0,032	Three Phase	N/A
21th	0,028	0,022	0,035	0,025	0,020	0,032	Three Phase	N/A
22th	0,023	0,021	0,023	0,021	0,019	0,021	Three Phase	N/A
23th	0,189	0,134	0,180	0,173	0,123	0,165	Three Phase	N/A
24th	0,040	0,019	0,032	0,037	0,017	0,030	Three Phase	N/A
25th	0,233	0,213	0,227	0,215	0,196	0,209	Three Phase	N/A
26th	0,029	0,020	0,030	0,027	0,019	0,028	Three Phase	N/A
27th	0,027	0,022	0,017	0,025	0,020	0,015	Three Phase	N/A
28th	0,024	0,020	0,016	0,022	0,019	0,014	Three Phase	N/A
29th	0,147	0,129	0,139	0,135	0,119	0,128	Three Phase	N/A
30th	0,029	0,018	0,019	0,026	0,017	0,017	Three Phase	N/A
31th	0,192	0,178	0,185	0,177	0,163	0,170	Three Phase	N/A
32th	0,028	0,017	0,028	0,026	0,016	0,026	Three Phase	N/A
33th	0,022	0,017	0,014	0,020	0,016	0,013	Three Phase	N/A
34th	0,028	0,018	0,016	0,026	0,017	0,014	Three Phase	N/A
35th	0,122	0,113	0,111	0,112	0,104	0,103	Three Phase	N/A
36th	0,027	0,019	0,015	0,024	0,017	0,014	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
37th	0,158	0,146	0,154	0,145	0,134	0,142	Three Phase	N/A
38th	0,026	0,014	0,024	0,024	0,013	0,022	Three Phase	N/A
39th	0,021	0,014	0,015	0,019	0,013	0,013	Three Phase	N/A
40th	0,066	0,032	0,038	0,060	0,029	0,035	Three Phase	N/A
41th	0,103	0,105	0,094	0,095	0,097	0,087	Three Phase	N/A
42th	0,024	0,016	0,013	0,022	0,015	0,012	Three Phase	N/A
43th	0,128	0,118	0,124	0,117	0,108	0,114	Three Phase	N/A
44th	0,024	0,012	0,020	0,022	0,011	0,019	Three Phase	N/A
45th	0,024	0,016	0,013	0,022	0,014	0,012	Three Phase	N/A
46th	0,027	0,015	0,013	0,025	0,014	0,012	Three Phase	N/A
47th	0,087	0,087	0,083	0,080	0,080	0,077	Three Phase	N/A
48th	0,020	0,018	0,012	0,018	0,017	0,011	Three Phase	N/A
49th	0,104	0,098	0,099	0,096	0,090	0,091	Three Phase	N/A
50th	0,021	0,010	0,020	0,020	0,009	0,018	Three Phase	N/A

Watts [kW]	24,810	24,596	25,293
Vrms [V]	229,15	230,97	232,42
Arms [A]	108,40	106,58	108,88
Frequency [Hz]	50,00		
THD50 (100% output power)	2,167	2,195	2,201
PWHD50 (100% output power)	9,421	9,432	9,740

Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	108,398	106,577	108,877	99,726	98,051	100,167	Three Phase	--
2nd	0,071	0,061	0,070	0,065	0,056	0,065	Three Phase	8,00
3rd	0,621	0,759	0,217	0,572	0,698	0,199	Three Phase	21,60
4th	0,498	0,596	0,695	0,458	0,548	0,640	Three Phase	4,00
5th	0,230	0,211	0,269	0,212	0,194	0,248	Three Phase	10,70
6th	0,297	0,146	0,323	0,273	0,135	0,297	Three Phase	2,67
7th	0,113	0,132	0,143	0,104	0,121	0,132	Three Phase	7,20
8th	0,200	0,303	0,426	0,184	0,278	0,392	Three Phase	2,00
9th	0,160	0,068	0,098	0,148	0,062	0,091	Three Phase	3,80
10th	0,122	0,263	0,187	0,112	0,242	0,172	Three Phase	1,60
11th	0,158	0,132	0,163	0,145	0,122	0,150	Three Phase	3,10
12th	0,182	0,095	0,102	0,167	0,087	0,094	Three Phase	1,33
13th	0,065	0,067	0,072	0,060	0,062	0,067	Three Phase	2,00
14th	0,229	0,154	0,366	0,211	0,142	0,336	Three Phase	N/A
15th	0,302	0,098	0,220	0,278	0,090	0,202	Three Phase	N/A
16th	0,127	0,259	0,168	0,117	0,239	0,155	Three Phase	N/A
17th	0,916	0,977	0,768	0,843	0,899	0,706	Three Phase	N/A
18th	0,230	0,137	0,123	0,211	0,126	0,113	Three Phase	N/A
19th	0,735	0,597	0,769	0,676	0,549	0,707	Three Phase	N/A
20th	0,292	0,109	0,243	0,269	0,100	0,224	Three Phase	N/A
21th	0,207	0,134	0,214	0,191	0,123	0,197	Three Phase	N/A
22th	0,255	0,179	0,207	0,235	0,165	0,190	Three Phase	N/A
23th	0,590	0,753	0,526	0,543	0,692	0,484	Three Phase	N/A
24th	0,124	0,052	0,122	0,114	0,048	0,112	Three Phase	N/A
25th	1,082	1,060	1,138	0,996	0,976	1,047	Three Phase	N/A
26th	0,140	0,132	0,053	0,129	0,121	0,048	Three Phase	N/A
27th	0,160	0,096	0,235	0,147	0,088	0,216	Three Phase	N/A
28th	0,214	0,050	0,242	0,197	0,046	0,222	Three Phase	N/A
29th	0,137	0,221	0,337	0,126	0,204	0,310	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
30th	0,284	0,155	0,143	0,262	0,143	0,131	Three Phase	N/A
31th	0,767	0,879	0,932	0,705	0,809	0,857	Three Phase	N/A
32th	0,153	0,074	0,146	0,141	0,068	0,134	Three Phase	N/A
33th	0,090	0,162	0,078	0,083	0,149	0,072	Three Phase	N/A
34th	0,107	0,089	0,185	0,099	0,082	0,170	Three Phase	N/A
35th	0,307	0,197	0,123	0,282	0,181	0,113	Three Phase	N/A
36th	0,238	0,168	0,122	0,219	0,155	0,113	Three Phase	N/A
37th	0,297	0,388	0,429	0,273	0,357	0,394	Three Phase	N/A
38th	0,131	0,162	0,111	0,121	0,149	0,102	Three Phase	N/A
39th	0,123	0,105	0,138	0,114	0,096	0,127	Three Phase	N/A
40th	0,102	0,062	0,058	0,094	0,057	0,053	Three Phase	N/A
41th	0,228	0,171	0,169	0,209	0,158	0,155	Three Phase	N/A
42th	0,118	0,118	0,048	0,109	0,109	0,045	Three Phase	N/A
43th	0,150	0,167	0,239	0,138	0,153	0,220	Three Phase	N/A
44th	0,109	0,105	0,040	0,100	0,097	0,037	Three Phase	N/A
45th	0,040	0,079	0,060	0,037	0,072	0,055	Three Phase	N/A
46th	0,057	0,053	0,079	0,052	0,049	0,073	Three Phase	N/A
47th	0,197	0,104	0,126	0,182	0,095	0,116	Three Phase	N/A
48th	0,144	0,099	0,055	0,133	0,091	0,051	Three Phase	N/A
49th	0,120	0,069	0,155	0,111	0,063	0,143	Three Phase	N/A
50th	0,091	0,025	0,103	0,084	0,023	0,095	Three Phase	N/A

Test result: ASW80K-LT

Watts [kW]	9,643	9,525	9,850
Vrms [V]	230,32	230,32	230,37
Arms [A]	41,91	41,37	42,77
Frequency [Hz]	50,00		
THD50 (33% output power)	0,519	0,605	0,635
PWHD50 (33% output power)	2,090	1,935	2,004

Harmonic order n	Current Magnitude [A] at 100% rated output power			% of Fundamental			Phase	Harmonic Current Limits [%]
	L1	L2	L3	L1	L2	L3	--	--
1st	41,899	41,355	42,757	32,853	32,426	33,525	Three Phase	--
2nd	0,039	0,038	0,032	0,031	0,030	0,025	Three Phase	8,00
3rd	0,133	0,475	0,470	0,104	0,372	0,369	Three Phase	21,60
4th	0,123	0,089	0,078	0,096	0,070	0,061	Three Phase	4,00
5th	0,176	0,185	0,243	0,138	0,145	0,190	Three Phase	10,70
6th	0,048	0,049	0,067	0,038	0,038	0,052	Three Phase	2,67
7th	0,140	0,147	0,176	0,109	0,116	0,138	Three Phase	7,20
8th	0,055	0,032	0,078	0,043	0,025	0,061	Three Phase	2,00
9th	0,043	0,042	0,036	0,034	0,033	0,029	Three Phase	3,80
10th	0,037	0,027	0,023	0,029	0,021	0,018	Three Phase	1,60
11th	0,078	0,085	0,099	0,061	0,067	0,078	Three Phase	3,10
12th	0,045	0,025	0,043	0,035	0,020	0,033	Three Phase	1,33
13th	0,056	0,054	0,064	0,044	0,042	0,050	Three Phase	2,00
14th	0,041	0,026	0,045	0,032	0,021	0,035	Three Phase	N/A
15th	0,036	0,029	0,035	0,028	0,023	0,027	Three Phase	N/A
16th	0,055	0,039	0,028	0,043	0,030	0,022	Three Phase	N/A
17th	0,219	0,188	0,204	0,172	0,147	0,160	Three Phase	N/A
18th	0,036	0,021	0,031	0,029	0,016	0,024	Three Phase	N/A
19th	0,217	0,213	0,222	0,170	0,167	0,174	Three Phase	N/A
20th	0,050	0,036	0,043	0,039	0,028	0,034	Three Phase	N/A
21th	0,034	0,027	0,031	0,026	0,021	0,024	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
22th	0,024	0,022	0,023	0,019	0,017	0,018	Three Phase	N/A
23th	0,149	0,136	0,153	0,117	0,106	0,120	Three Phase	N/A
24th	0,048	0,022	0,035	0,037	0,017	0,028	Three Phase	N/A
25th	0,220	0,212	0,213	0,172	0,166	0,167	Three Phase	N/A
26th	0,032	0,024	0,029	0,025	0,019	0,023	Three Phase	N/A
27th	0,023	0,020	0,021	0,018	0,016	0,016	Three Phase	N/A
28th	0,031	0,024	0,019	0,024	0,019	0,015	Three Phase	N/A
29th	0,153	0,147	0,147	0,120	0,115	0,116	Three Phase	N/A
30th	0,036	0,017	0,025	0,028	0,013	0,019	Three Phase	N/A
31th	0,180	0,174	0,177	0,141	0,136	0,139	Three Phase	N/A
32th	0,033	0,019	0,031	0,026	0,015	0,024	Three Phase	N/A
33th	0,025	0,016	0,018	0,020	0,012	0,014	Three Phase	N/A
34th	0,027	0,020	0,017	0,021	0,015	0,014	Three Phase	N/A
35th	0,110	0,114	0,109	0,086	0,089	0,085	Three Phase	N/A
36th	0,030	0,021	0,017	0,024	0,016	0,013	Three Phase	N/A
37th	0,155	0,145	0,149	0,121	0,113	0,117	Three Phase	N/A
38th	0,026	0,017	0,021	0,020	0,013	0,017	Three Phase	N/A
39th	0,021	0,016	0,016	0,016	0,012	0,013	Three Phase	N/A
40th	0,063	0,031	0,037	0,050	0,025	0,029	Three Phase	N/A
41th	0,112	0,110	0,113	0,088	0,086	0,089	Three Phase	N/A
42th	0,026	0,014	0,015	0,020	0,011	0,012	Three Phase	N/A
43th	0,117	0,117	0,115	0,092	0,092	0,090	Three Phase	N/A
44th	0,027	0,014	0,020	0,021	0,011	0,016	Three Phase	N/A
45th	0,039	0,019	0,015	0,031	0,015	0,012	Three Phase	N/A
46th	0,025	0,015	0,015	0,020	0,012	0,011	Three Phase	N/A
47th	0,085	0,092	0,086	0,067	0,072	0,067	Three Phase	N/A
48th	0,023	0,018	0,012	0,018	0,014	0,010	Three Phase	N/A
49th	0,108	0,109	0,110	0,084	0,086	0,086	Three Phase	N/A
50th	0,020	0,015	0,015	0,016	0,012	0,012	Three Phase	N/A

Watts [kW]	19,479	19,245	19,745
Vrms [V]	229,87	230,31	230,83
Arms [A]	84,76	83,56	85,54
Frequency [Hz]	50,00		
THD50 (66% output power)	0,565	0,786	0,744
PWHD50 (66% output power)	2,326	2,030	2,254

Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	84,754	83,554	85,534	66,455	65,514	67,067	Three Phase	--
2nd	0,055	0,047	0,031	0,043	0,037	0,024	Three Phase	8,00
3rd	0,148	0,784	0,628	0,116	0,615	0,492	Three Phase	21,60
4th	0,134	0,108	0,141	0,105	0,085	0,111	Three Phase	4,00
5th	0,154	0,133	0,203	0,121	0,104	0,159	Three Phase	10,70
6th	0,034	0,048	0,051	0,027	0,037	0,040	Three Phase	2,67
7th	0,137	0,147	0,155	0,108	0,115	0,121	Three Phase	7,20
8th	0,054	0,029	0,072	0,042	0,023	0,056	Three Phase	2,00
9th	0,030	0,029	0,028	0,023	0,023	0,022	Three Phase	3,80
10th	0,037	0,022	0,027	0,029	0,017	0,021	Three Phase	1,60
11th	0,086	0,106	0,110	0,067	0,084	0,086	Three Phase	3,10
12th	0,048	0,027	0,057	0,038	0,021	0,045	Three Phase	1,33
13th	0,086	0,086	0,098	0,067	0,067	0,077	Three Phase	2,00
14th	0,038	0,030	0,046	0,030	0,023	0,036	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
15th	0,070	0,038	0,051	0,055	0,029	0,040	Three Phase	N/A
16th	0,043	0,027	0,030	0,034	0,022	0,024	Three Phase	N/A
17th	0,248	0,183	0,217	0,195	0,144	0,170	Three Phase	N/A
18th	0,040	0,023	0,038	0,032	0,018	0,030	Three Phase	N/A
19th	0,262	0,246	0,284	0,205	0,193	0,222	Three Phase	N/A
20th	0,038	0,031	0,030	0,030	0,024	0,024	Three Phase	N/A
21th	0,021	0,030	0,035	0,016	0,023	0,027	Three Phase	N/A
22th	0,022	0,019	0,022	0,017	0,015	0,017	Three Phase	N/A
23th	0,205	0,148	0,200	0,160	0,116	0,157	Three Phase	N/A
24th	0,042	0,021	0,035	0,033	0,017	0,028	Three Phase	N/A
25th	0,228	0,222	0,232	0,179	0,174	0,182	Three Phase	N/A
26th	0,030	0,020	0,029	0,023	0,016	0,023	Three Phase	N/A
27th	0,024	0,024	0,017	0,019	0,018	0,013	Three Phase	N/A
28th	0,025	0,021	0,018	0,020	0,017	0,014	Three Phase	N/A
29th	0,156	0,132	0,142	0,122	0,103	0,112	Three Phase	N/A
30th	0,030	0,022	0,021	0,023	0,017	0,016	Three Phase	N/A
31th	0,201	0,188	0,198	0,158	0,148	0,155	Three Phase	N/A
32th	0,029	0,019	0,028	0,023	0,015	0,022	Three Phase	N/A
33th	0,023	0,018	0,016	0,018	0,014	0,013	Three Phase	N/A
34th	0,030	0,019	0,019	0,023	0,015	0,015	Three Phase	N/A
35th	0,129	0,117	0,116	0,101	0,092	0,091	Three Phase	N/A
36th	0,026	0,020	0,017	0,020	0,016	0,013	Three Phase	N/A
37th	0,164	0,156	0,165	0,128	0,122	0,130	Three Phase	N/A
38th	0,027	0,015	0,026	0,022	0,012	0,020	Three Phase	N/A
39th	0,022	0,016	0,014	0,017	0,012	0,011	Three Phase	N/A
40th	0,067	0,030	0,036	0,052	0,024	0,028	Three Phase	N/A
41th	0,107	0,106	0,098	0,084	0,083	0,077	Three Phase	N/A
42th	0,025	0,017	0,016	0,020	0,013	0,012	Three Phase	N/A
43th	0,132	0,128	0,132	0,104	0,100	0,103	Three Phase	N/A
44th	0,026	0,013	0,022	0,020	0,010	0,017	Three Phase	N/A
45th	0,021	0,016	0,014	0,016	0,012	0,011	Three Phase	N/A
46th	0,027	0,016	0,016	0,022	0,013	0,013	Three Phase	N/A
47th	0,089	0,090	0,086	0,070	0,071	0,067	Three Phase	N/A
48th	0,021	0,019	0,013	0,016	0,015	0,010	Three Phase	N/A
49th	0,107	0,105	0,107	0,084	0,082	0,084	Three Phase	N/A
50th	0,022	0,011	0,021	0,017	0,008	0,017	Three Phase	N/A

Watts [kW]	29,190	28,989	29,788
Vrms [V]	229,18	231,12	232,67
Arms [A]	127,53	125,56	128,11
Frequency [Hz]	50,00		
THD50 (100% output power)	1,870	1,898	1,870
PWHD50 (100% output power)	8,221	8,252	8,476

Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	127,483	125,508	128,062	99,958	98,409	100,413	Three Phase	--
2nd	0,049	0,054	0,077	0,038	0,042	0,060	Three Phase	8,00
3rd	0,601	0,741	0,192	0,471	0,581	0,151	Three Phase	21,60
4th	0,483	0,591	0,660	0,379	0,463	0,518	Three Phase	4,00
5th	0,238	0,214	0,273	0,186	0,168	0,214	Three Phase	10,70
6th	0,262	0,136	0,199	0,206	0,107	0,156	Three Phase	2,67
7th	0,109	0,133	0,138	0,085	0,104	0,108	Three Phase	7,20

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
8th	0,185	0,340	0,377	0,145	0,266	0,295	Three Phase	2,00
9th	0,189	0,079	0,111	0,148	0,062	0,087	Three Phase	3,80
10th	0,150	0,237	0,159	0,118	0,186	0,125	Three Phase	1,60
11th	0,152	0,129	0,162	0,119	0,101	0,127	Three Phase	3,10
12th	0,138	0,112	0,050	0,108	0,088	0,039	Three Phase	1,33
13th	0,071	0,068	0,078	0,055	0,053	0,061	Three Phase	2,00
14th	0,158	0,213	0,312	0,124	0,167	0,245	Three Phase	N/A
15th	0,337	0,116	0,235	0,264	0,091	0,184	Three Phase	N/A
16th	0,156	0,233	0,131	0,122	0,183	0,103	Three Phase	N/A
17th	0,944	1,002	0,773	0,740	0,786	0,606	Three Phase	N/A
18th	0,175	0,169	0,067	0,138	0,133	0,053	Three Phase	N/A
19th	0,722	0,569	0,780	0,566	0,446	0,612	Three Phase	N/A
20th	0,210	0,055	0,206	0,165	0,043	0,162	Three Phase	N/A
21th	0,217	0,163	0,229	0,170	0,128	0,179	Three Phase	N/A
22th	0,225	0,161	0,188	0,176	0,126	0,147	Three Phase	N/A
23th	0,663	0,776	0,531	0,520	0,608	0,417	Three Phase	N/A
24th	0,099	0,085	0,107	0,077	0,067	0,084	Three Phase	N/A
25th	1,118	1,053	1,159	0,877	0,826	0,908	Three Phase	N/A
26th	0,139	0,075	0,078	0,109	0,059	0,061	Three Phase	N/A
27th	0,222	0,088	0,285	0,174	0,069	0,224	Three Phase	N/A
28th	0,162	0,079	0,227	0,127	0,062	0,178	Three Phase	N/A
29th	0,174	0,232	0,374	0,137	0,182	0,293	Three Phase	N/A
30th	0,218	0,162	0,072	0,171	0,127	0,056	Three Phase	N/A
31th	0,820	0,936	0,980	0,643	0,734	0,768	Three Phase	N/A
32th	0,134	0,093	0,158	0,105	0,073	0,124	Three Phase	N/A
33th	0,073	0,161	0,113	0,057	0,126	0,089	Three Phase	N/A
34th	0,085	0,098	0,165	0,067	0,077	0,130	Three Phase	N/A
35th	0,359	0,207	0,156	0,281	0,162	0,122	Three Phase	N/A
36th	0,173	0,182	0,060	0,136	0,143	0,047	Three Phase	N/A
37th	0,300	0,416	0,422	0,235	0,327	0,331	Three Phase	N/A
38th	0,131	0,165	0,126	0,102	0,130	0,099	Three Phase	N/A
39th	0,125	0,118	0,180	0,098	0,092	0,141	Three Phase	N/A
40th	0,101	0,073	0,063	0,079	0,058	0,050	Three Phase	N/A
41th	0,279	0,166	0,187	0,219	0,130	0,146	Three Phase	N/A
42th	0,058	0,092	0,048	0,046	0,072	0,037	Three Phase	N/A
43th	0,149	0,165	0,221	0,117	0,129	0,173	Three Phase	N/A
44th	0,124	0,095	0,043	0,097	0,074	0,033	Three Phase	N/A
45th	0,038	0,057	0,070	0,030	0,045	0,055	Three Phase	N/A
46th	0,048	0,054	0,051	0,037	0,043	0,040	Three Phase	N/A
47th	0,216	0,100	0,123	0,170	0,078	0,096	Three Phase	N/A
48th	0,102	0,101	0,025	0,080	0,079	0,020	Three Phase	N/A
49th	0,120	0,078	0,166	0,094	0,061	0,130	Three Phase	N/A
50th	0,078	0,039	0,110	0,061	0,030	0,086	Three Phase	N/A

Test result: ASW100K-LT			
Watts [kW]	12,096	11,990	12,381
Vrms [V]	229,78	230,42	230,54
Arms [A]	52,67	52,05	53,72
Frequency [Hz]	50,00		
THD50 (33% output power)	0,400	0,503	0,531
PWHD50 (33% output power)	1,491	1,269	1,419

Harmonic order n	Current Magnitude [A] at 100% rated output power	% of Fundamental	Phase	Harmonic Current Limits [%]

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
	L1	L2	L3	L1	L2	L3	--	--
1st	52,662	52,035	53,704	33,034	32,640	33,687	Three Phase	--
2nd	0,120	0,065	0,096	0,076	0,041	0,060	Three Phase	8,00
3rd	0,134	0,591	0,562	0,084	0,371	0,353	Three Phase	21,60
4th	0,136	0,095	0,128	0,085	0,060	0,080	Three Phase	4,00
5th	0,180	0,188	0,245	0,113	0,118	0,154	Three Phase	10,70
6th	0,033	0,038	0,045	0,021	0,024	0,028	Three Phase	2,67
7th	0,172	0,163	0,203	0,108	0,103	0,127	Three Phase	7,20
8th	0,048	0,039	0,081	0,030	0,024	0,051	Three Phase	2,00
9th	0,070	0,065	0,034	0,044	0,041	0,021	Three Phase	3,80
10th	0,045	0,030	0,027	0,028	0,019	0,017	Three Phase	1,60
11th	0,079	0,091	0,097	0,050	0,057	0,061	Three Phase	3,10
12th	0,031	0,032	0,036	0,020	0,020	0,022	Three Phase	1,33
13th	0,080	0,074	0,080	0,050	0,046	0,050	Three Phase	2,00
14th	0,036	0,025	0,049	0,022	0,015	0,031	Three Phase	N/A
15th	0,050	0,036	0,042	0,031	0,023	0,026	Three Phase	N/A
16th	0,047	0,031	0,026	0,030	0,019	0,017	Three Phase	N/A
17th	0,198	0,157	0,180	0,124	0,099	0,113	Three Phase	N/A
18th	0,026	0,027	0,019	0,017	0,017	0,012	Three Phase	N/A
19th	0,200	0,174	0,206	0,126	0,109	0,129	Three Phase	N/A
20th	0,036	0,026	0,024	0,023	0,017	0,015	Three Phase	N/A
21th	0,026	0,027	0,036	0,016	0,017	0,023	Three Phase	N/A
22th	0,022	0,019	0,023	0,014	0,012	0,014	Three Phase	N/A
23th	0,137	0,105	0,152	0,086	0,066	0,095	Three Phase	N/A
24th	0,033	0,023	0,019	0,021	0,014	0,012	Three Phase	N/A
25th	0,182	0,169	0,176	0,114	0,106	0,110	Three Phase	N/A
26th	0,022	0,015	0,024	0,014	0,009	0,015	Three Phase	N/A
27th	0,029	0,027	0,018	0,018	0,017	0,011	Three Phase	N/A
28th	0,027	0,018	0,016	0,017	0,011	0,010	Three Phase	N/A
29th	0,131	0,111	0,125	0,082	0,070	0,079	Three Phase	N/A
30th	0,027	0,021	0,014	0,017	0,013	0,009	Three Phase	N/A
31th	0,165	0,148	0,156	0,103	0,093	0,098	Three Phase	N/A
32th	0,021	0,012	0,021	0,013	0,007	0,013	Three Phase	N/A
33th	0,024	0,018	0,015	0,015	0,011	0,009	Three Phase	N/A
34th	0,028	0,016	0,016	0,018	0,010	0,010	Three Phase	N/A
35th	0,107	0,091	0,098	0,067	0,057	0,062	Three Phase	N/A
36th	0,024	0,020	0,013	0,015	0,013	0,008	Three Phase	N/A
37th	0,137	0,123	0,130	0,086	0,077	0,081	Three Phase	N/A
38th	0,020	0,011	0,019	0,013	0,007	0,012	Three Phase	N/A
39th	0,021	0,018	0,014	0,013	0,011	0,009	Three Phase	N/A
40th	0,062	0,031	0,037	0,039	0,020	0,023	Three Phase	N/A
41th	0,103	0,089	0,095	0,064	0,056	0,060	Three Phase	N/A
42th	0,021	0,018	0,012	0,013	0,011	0,007	Three Phase	N/A
43th	0,118	0,105	0,111	0,074	0,066	0,069	Three Phase	N/A
44th	0,019	0,011	0,016	0,012	0,007	0,010	Three Phase	N/A
45th	0,029	0,016	0,013	0,018	0,010	0,008	Three Phase	N/A
46th	0,026	0,013	0,013	0,016	0,008	0,008	Three Phase	N/A
47th	0,083	0,076	0,080	0,052	0,048	0,050	Three Phase	N/A
48th	0,017	0,019	0,010	0,011	0,012	0,006	Three Phase	N/A
49th	0,097	0,089	0,093	0,061	0,056	0,058	Three Phase	N/A
50th	0,015	0,010	0,014	0,009	0,006	0,009	Three Phase	N/A
Watts [kW]						24,123	23,978	24,523
Vrms [V]						229,30	230,48	231,30

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
Arms [A]				105,24			104,05	106,04
Frequency [Hz]				50,00				
THD50 (66% output power)				0,465			0,640	0,632
PWHD50 (66% output power)				1,955			1,670	1,904
Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	105,224	104,040	106,023	66,004	65,261	66,506	Three Phase	--
2nd	0,057	0,046	0,037	0,036	0,029	0,023	Three Phase	8,00
3rd	0,120	0,791	0,683	0,076	0,496	0,429	Three Phase	21,60
4th	0,142	0,154	0,179	0,089	0,097	0,112	Three Phase	4,00
5th	0,154	0,120	0,191	0,097	0,075	0,120	Three Phase	10,70
6th	0,043	0,054	0,054	0,027	0,034	0,034	Three Phase	2,67
7th	0,135	0,144	0,153	0,085	0,090	0,096	Three Phase	7,20
8th	0,039	0,064	0,088	0,024	0,040	0,055	Three Phase	2,00
9th	0,056	0,031	0,051	0,035	0,020	0,032	Three Phase	3,80
10th	0,048	0,030	0,030	0,030	0,019	0,019	Three Phase	1,60
11th	0,084	0,094	0,103	0,053	0,059	0,065	Three Phase	3,10
12th	0,036	0,046	0,053	0,022	0,029	0,033	Three Phase	1,33
13th	0,093	0,092	0,097	0,058	0,058	0,061	Three Phase	2,00
14th	0,034	0,032	0,051	0,021	0,020	0,032	Three Phase	N/A
15th	0,077	0,044	0,046	0,048	0,028	0,029	Three Phase	N/A
16th	0,055	0,033	0,043	0,035	0,021	0,027	Three Phase	N/A
17th	0,220	0,152	0,192	0,138	0,095	0,121	Three Phase	N/A
18th	0,044	0,034	0,035	0,028	0,022	0,022	Three Phase	N/A
19th	0,225	0,217	0,259	0,141	0,136	0,162	Three Phase	N/A
20th	0,033	0,030	0,027	0,021	0,019	0,017	Three Phase	N/A
21th	0,022	0,037	0,039	0,014	0,023	0,025	Three Phase	N/A
22th	0,027	0,026	0,033	0,017	0,016	0,021	Three Phase	N/A
23th	0,241	0,157	0,220	0,151	0,098	0,138	Three Phase	N/A
24th	0,040	0,035	0,031	0,025	0,022	0,020	Three Phase	N/A
25th	0,268	0,256	0,284	0,168	0,161	0,178	Three Phase	N/A
26th	0,024	0,023	0,030	0,015	0,015	0,019	Three Phase	N/A
27th	0,033	0,035	0,020	0,021	0,022	0,013	Three Phase	N/A
28th	0,030	0,023	0,024	0,019	0,014	0,015	Three Phase	N/A
29th	0,175	0,136	0,149	0,110	0,086	0,094	Three Phase	N/A
30th	0,034	0,033	0,029	0,021	0,021	0,018	Three Phase	N/A
31th	0,211	0,198	0,213	0,133	0,124	0,133	Three Phase	N/A
32th	0,023	0,019	0,027	0,015	0,012	0,017	Three Phase	N/A
33th	0,031	0,023	0,017	0,020	0,015	0,011	Three Phase	N/A
34th	0,035	0,021	0,024	0,022	0,013	0,015	Three Phase	N/A
35th	0,138	0,115	0,120	0,087	0,072	0,075	Three Phase	N/A
36th	0,029	0,028	0,025	0,018	0,018	0,015	Three Phase	N/A
37th	0,174	0,161	0,178	0,109	0,101	0,111	Three Phase	N/A
38th	0,022	0,019	0,024	0,014	0,012	0,015	Three Phase	N/A
39th	0,029	0,022	0,017	0,018	0,014	0,011	Three Phase	N/A
40th	0,068	0,035	0,040	0,043	0,022	0,025	Three Phase	N/A
41th	0,116	0,103	0,098	0,073	0,065	0,061	Three Phase	N/A
42th	0,026	0,025	0,021	0,016	0,016	0,013	Three Phase	N/A
43th	0,142	0,132	0,142	0,089	0,083	0,089	Three Phase	N/A
44th	0,022	0,014	0,022	0,014	0,009	0,014	Three Phase	N/A
45th	0,028	0,024	0,015	0,018	0,015	0,010	Three Phase	N/A
46th	0,032	0,020	0,020	0,020	0,012	0,012	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
47th	0,100	0,090	0,086	0,063	0,056	0,054	Three Phase	N/A
48th	0,023	0,024	0,017	0,015	0,015	0,011	Three Phase	N/A
49th	0,119	0,110	0,120	0,075	0,069	0,075	Three Phase	N/A
50th	0,018	0,012	0,019	0,011	0,008	0,012	Three Phase	N/A

Watts [kW]	36,887	36,550	37,652
Vrms [V]	229,19	231,20	233,42
Arms [A]	161,00	158,14	161,41
Frequency [Hz]	50,00		
THD50 (100% output power)	1,638	1,651	1,668
PWHD50 (100% output power)	6,952	7,166	7,261

Harmonic order n	Current Magnitude [A] at 100% rated output power			% of Fundamental			Phase	Harmonic Current Limits [%]
	L1	L2	L3	L1	L2	L3	--	--
1st	160,949	158,092	161,357	100,959	99,167	101,215	Three Phase	--
2nd	0,058	0,089	0,092	0,037	0,056	0,058	Three Phase	8,00
3rd	0,777	0,828	0,089	0,487	0,519	0,056	Three Phase	21,60
4th	0,612	0,617	0,845	0,384	0,387	0,530	Three Phase	4,00
5th	0,251	0,202	0,257	0,158	0,127	0,161	Three Phase	10,70
6th	0,438	0,248	0,543	0,275	0,155	0,341	Three Phase	2,67
7th	0,072	0,110	0,111	0,045	0,069	0,070	Three Phase	7,20
8th	0,235	0,285	0,512	0,148	0,179	0,321	Three Phase	2,00
9th	0,375	0,206	0,182	0,235	0,129	0,114	Three Phase	3,80
10th	0,183	0,265	0,196	0,115	0,166	0,123	Three Phase	1,60
11th	0,133	0,110	0,152	0,084	0,069	0,095	Three Phase	3,10
12th	0,132	0,080	0,159	0,082	0,050	0,100	Three Phase	1,33
13th	0,046	0,051	0,064	0,029	0,032	0,040	Three Phase	2,00
14th	0,241	0,206	0,440	0,151	0,129	0,276	Three Phase	N/A
15th	0,414	0,102	0,312	0,260	0,064	0,196	Three Phase	N/A
16th	0,156	0,324	0,189	0,098	0,203	0,119	Three Phase	N/A
17th	0,963	1,111	0,763	0,604	0,697	0,478	Three Phase	N/A
18th	0,289	0,115	0,182	0,182	0,072	0,114	Three Phase	N/A
19th	0,634	0,580	0,812	0,398	0,364	0,509	Three Phase	N/A
20th	0,399	0,151	0,348	0,250	0,095	0,218	Three Phase	N/A
21th	0,280	0,139	0,262	0,176	0,087	0,164	Three Phase	N/A
22th	0,305	0,258	0,322	0,191	0,162	0,202	Three Phase	N/A
23th	0,791	0,965	0,586	0,496	0,605	0,367	Three Phase	N/A
24th	0,110	0,073	0,161	0,069	0,046	0,101	Three Phase	N/A
25th	1,015	0,969	1,056	0,637	0,608	0,663	Three Phase	N/A
26th	0,153	0,195	0,119	0,096	0,123	0,075	Three Phase	N/A
27th	0,276	0,106	0,382	0,173	0,067	0,240	Three Phase	N/A
28th	0,298	0,067	0,273	0,187	0,042	0,171	Three Phase	N/A
29th	0,150	0,436	0,516	0,094	0,274	0,324	Three Phase	N/A
30th	0,422	0,222	0,193	0,265	0,139	0,121	Three Phase	N/A
31th	0,753	0,980	0,992	0,472	0,615	0,622	Three Phase	N/A
32th	0,256	0,091	0,223	0,161	0,057	0,140	Three Phase	N/A
33th	0,147	0,262	0,124	0,092	0,164	0,077	Three Phase	N/A
34th	0,140	0,124	0,247	0,088	0,078	0,155	Three Phase	N/A
35th	0,386	0,209	0,212	0,242	0,131	0,133	Three Phase	N/A
36th	0,345	0,205	0,225	0,216	0,128	0,141	Three Phase	N/A
37th	0,243	0,411	0,470	0,152	0,258	0,295	Three Phase	N/A
38th	0,160	0,179	0,134	0,101	0,112	0,084	Three Phase	N/A
39th	0,187	0,171	0,178	0,117	0,107	0,112	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
40th	0,125	0,074	0,084	0,079	0,047	0,053	Three Phase	N/A
41th	0,265	0,182	0,151	0,166	0,114	0,095	Three Phase	N/A
42th	0,136	0,162	0,112	0,086	0,101	0,070	Three Phase	N/A
43th	0,086	0,148	0,216	0,054	0,093	0,136	Three Phase	N/A
44th	0,080	0,090	0,105	0,050	0,056	0,066	Three Phase	N/A
45th	0,046	0,151	0,097	0,029	0,095	0,061	Three Phase	N/A
46th	0,088	0,065	0,122	0,055	0,041	0,076	Three Phase	N/A
47th	0,192	0,053	0,151	0,121	0,033	0,095	Three Phase	N/A
48th	0,133	0,068	0,083	0,083	0,042	0,052	Three Phase	N/A
49th	0,087	0,080	0,146	0,054	0,050	0,092	Three Phase	N/A
50th	0,076	0,067	0,128	0,048	0,042	0,080	Three Phase	N/A
Test result: ASW110K-LT								
Watts [kW]					13,232	13,157	13,508	
Vrms [V]					230,22	230,45	230,58	
Arms [A]					57,51	57,11	58,60	
Frequency [Hz]					50,00			
THD50 (33% output power)					0,355	0,426	0,469	
PWHD50 (33% output power)					1,342	1,156	1,286	
Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	57,493	57,089	58,579	32,785	32,555	33,404	Three Phase	--
2nd	0,124	0,067	0,102	0,071	0,038	0,058	Three Phase	8,00
3rd	0,094	0,515	0,545	0,053	0,294	0,311	Three Phase	21,60
4th	0,156	0,125	0,112	0,089	0,071	0,064	Three Phase	4,00
5th	0,168	0,175	0,233	0,096	0,100	0,133	Three Phase	10,70
6th	0,029	0,036	0,042	0,016	0,021	0,024	Three Phase	2,67
7th	0,175	0,167	0,203	0,100	0,095	0,116	Three Phase	7,20
8th	0,039	0,032	0,063	0,022	0,018	0,036	Three Phase	2,00
9th	0,065	0,051	0,028	0,037	0,029	0,016	Three Phase	3,80
10th	0,040	0,033	0,022	0,023	0,019	0,012	Three Phase	1,60
11th	0,071	0,087	0,090	0,040	0,050	0,051	Three Phase	3,10
12th	0,025	0,026	0,035	0,014	0,015	0,020	Three Phase	1,33
13th	0,069	0,071	0,076	0,039	0,040	0,043	Three Phase	2,00
14th	0,027	0,020	0,037	0,015	0,012	0,021	Three Phase	N/A
15th	0,042	0,030	0,033	0,024	0,017	0,019	Three Phase	N/A
16th	0,038	0,028	0,023	0,022	0,016	0,013	Three Phase	N/A
17th	0,187	0,143	0,167	0,107	0,081	0,095	Three Phase	N/A
18th	0,019	0,021	0,021	0,011	0,012	0,012	Three Phase	N/A
19th	0,206	0,180	0,209	0,117	0,103	0,119	Three Phase	N/A
20th	0,033	0,026	0,022	0,019	0,015	0,013	Three Phase	N/A
21th	0,023	0,026	0,036	0,013	0,015	0,020	Three Phase	N/A
22th	0,018	0,024	0,025	0,010	0,014	0,014	Three Phase	N/A
23th	0,144	0,105	0,153	0,082	0,060	0,087	Three Phase	N/A
24th	0,025	0,016	0,023	0,014	0,009	0,013	Three Phase	N/A
25th	0,185	0,174	0,179	0,105	0,099	0,102	Three Phase	N/A
26th	0,020	0,015	0,025	0,011	0,008	0,014	Three Phase	N/A
27th	0,026	0,024	0,014	0,015	0,013	0,008	Three Phase	N/A
28th	0,020	0,016	0,016	0,012	0,009	0,009	Three Phase	N/A
29th	0,127	0,110	0,124	0,073	0,063	0,071	Three Phase	N/A
30th	0,018	0,015	0,015	0,010	0,009	0,008	Three Phase	N/A
31th	0,164	0,151	0,156	0,094	0,086	0,089	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
32th	0,019	0,012	0,022	0,011	0,007	0,013	Three Phase	N/A
33th	0,021	0,016	0,013	0,012	0,009	0,007	Three Phase	N/A
34th	0,024	0,015	0,017	0,014	0,009	0,009	Three Phase	N/A
35th	0,108	0,093	0,098	0,061	0,053	0,056	Three Phase	N/A
36th	0,016	0,014	0,013	0,009	0,008	0,008	Three Phase	N/A
37th	0,137	0,125	0,131	0,078	0,071	0,075	Three Phase	N/A
38th	0,018	0,010	0,021	0,010	0,006	0,012	Three Phase	N/A
39th	0,021	0,016	0,011	0,012	0,009	0,006	Three Phase	N/A
40th	0,061	0,030	0,038	0,035	0,017	0,022	Three Phase	N/A
41th	0,100	0,088	0,093	0,057	0,050	0,053	Three Phase	N/A
42th	0,013	0,014	0,012	0,007	0,008	0,007	Three Phase	N/A
43th	0,117	0,106	0,110	0,067	0,061	0,063	Three Phase	N/A
44th	0,017	0,010	0,017	0,010	0,006	0,010	Three Phase	N/A
45th	0,026	0,015	0,011	0,015	0,009	0,006	Three Phase	N/A
46th	0,022	0,013	0,013	0,013	0,007	0,008	Three Phase	N/A
47th	0,082	0,075	0,078	0,047	0,043	0,045	Three Phase	N/A
48th	0,011	0,015	0,011	0,006	0,009	0,006	Three Phase	N/A
49th	0,093	0,088	0,091	0,053	0,050	0,052	Three Phase	N/A
50th	0,012	0,010	0,015	0,007	0,005	0,009	Three Phase	N/A
Watts [kW]					26,640	26,443	26,814	
Vrms [V]					230,28	230,15	229,92	
Arms [A]					115,73	114,93	116,66	
Frequency [Hz]					50,00			
THD50 (66% output power)					0,434	0,550	0,561	
PWHD50 (66% output power)					1,797	1,622	1,734	
Harmonic order n	**Current Magnitude [A] at 100% rated output power**			**% of Fundamental**			**Phase**	**Harmonic Current Limits [%]**
	L1	**L2**	**L3**	**L1**	**L2**	**L3**	--	--
1st	115,710	114,902	116,635	65,984	65,523	66,511	Three Phase	--
2nd	0,123	0,075	0,090	0,070	0,043	0,051	Three Phase	8,00
3rd	0,151	0,678	0,659	0,086	0,387	0,376	Three Phase	21,60
4th	0,170	0,193	0,154	0,097	0,110	0,088	Three Phase	4,00
5th	0,158	0,114	0,189	0,090	0,065	0,108	Three Phase	10,70
6th	0,040	0,054	0,046	0,023	0,031	0,026	Three Phase	2,67
7th	0,133	0,142	0,149	0,076	0,081	0,085	Three Phase	7,20
8th	0,036	0,053	0,058	0,021	0,030	0,033	Three Phase	2,00
9th	0,050	0,046	0,040	0,028	0,026	0,023	Three Phase	3,80
10th	0,031	0,029	0,025	0,017	0,017	0,014	Three Phase	1,60
11th	0,082	0,086	0,100	0,047	0,049	0,057	Three Phase	3,10
12th	0,034	0,041	0,051	0,019	0,023	0,029	Three Phase	1,33
13th	0,081	0,088	0,087	0,046	0,050	0,050	Three Phase	2,00
14th	0,025	0,027	0,034	0,014	0,015	0,019	Three Phase	N/A
15th	0,067	0,037	0,054	0,038	0,021	0,031	Three Phase	N/A
16th	0,039	0,034	0,034	0,022	0,019	0,020	Three Phase	N/A
17th	0,221	0,167	0,190	0,126	0,095	0,108	Three Phase	N/A
18th	0,032	0,033	0,038	0,018	0,019	0,022	Three Phase	N/A
19th	0,225	0,218	0,244	0,128	0,124	0,139	Three Phase	N/A
20th	0,030	0,027	0,025	0,017	0,015	0,014	Three Phase	N/A
21th	0,026	0,028	0,040	0,015	0,016	0,023	Three Phase	N/A
22th	0,025	0,034	0,035	0,014	0,019	0,020	Three Phase	N/A
23th	0,231	0,167	0,214	0,132	0,095	0,122	Three Phase	N/A
24th	0,033	0,031	0,035	0,019	0,018	0,020	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
25th	0,279	0,278	0,291	0,159	0,158	0,166	Three Phase	N/A
26th	0,026	0,025	0,030	0,015	0,014	0,017	Three Phase	N/A
27th	0,028	0,029	0,020	0,016	0,017	0,012	Three Phase	N/A
28th	0,025	0,021	0,025	0,014	0,012	0,014	Three Phase	N/A
29th	0,182	0,152	0,150	0,104	0,086	0,086	Three Phase	N/A
30th	0,029	0,030	0,030	0,016	0,017	0,017	Three Phase	N/A
31th	0,223	0,219	0,222	0,127	0,125	0,127	Three Phase	N/A
32th	0,023	0,021	0,027	0,013	0,012	0,015	Three Phase	N/A
33th	0,024	0,020	0,016	0,014	0,012	0,009	Three Phase	N/A
34th	0,031	0,020	0,026	0,017	0,012	0,015	Three Phase	N/A
35th	0,141	0,123	0,121	0,080	0,070	0,069	Three Phase	N/A
36th	0,025	0,026	0,028	0,014	0,015	0,016	Three Phase	N/A
37th	0,178	0,171	0,178	0,101	0,098	0,101	Three Phase	N/A
38th	0,021	0,021	0,025	0,012	0,012	0,014	Three Phase	N/A
39th	0,023	0,017	0,017	0,013	0,010	0,010	Three Phase	N/A
40th	0,070	0,036	0,038	0,040	0,021	0,021	Three Phase	N/A
41th	0,117	0,107	0,100	0,067	0,061	0,057	Three Phase	N/A
42th	0,022	0,022	0,026	0,012	0,012	0,015	Three Phase	N/A
43th	0,143	0,143	0,142	0,082	0,082	0,081	Three Phase	N/A
44th	0,019	0,016	0,023	0,011	0,009	0,013	Three Phase	N/A
45th	0,024	0,019	0,015	0,013	0,011	0,009	Three Phase	N/A
46th	0,025	0,019	0,023	0,014	0,011	0,013	Three Phase	N/A
47th	0,101	0,091	0,086	0,057	0,052	0,049	Three Phase	N/A
48th	0,019	0,020	0,023	0,011	0,011	0,013	Three Phase	N/A
49th	0,120	0,120	0,118	0,068	0,068	0,067	Three Phase	N/A
50th	0,015	0,015	0,020	0,008	0,008	0,011	Three Phase	N/A

Watts [kW]	40,083	39,628	40,782
Vrms [V]	229,07	231,10	233,65
Arms [A]	175,07	171,54	174,70
Frequency [Hz]	50,00		
THD50 (100% output power)	1,639	1,608	1,700
PWHD50 (100% output power)	5,802	5,933	6,197

Harmonic order n	Current Magnitude [A] at 100% rated output power			% of Fundamental			Phase	Harmonic Current Limits [%]
	L1	L2	L3	L1	L2	L3	--	--
1st	175,015	171,481	174,646	99,802	97,787	99,591	Three Phase	--
2nd	0,069	0,084	0,110	0,040	0,048	0,063	Three Phase	8,00
3rd	1,150	1,074	0,568	0,656	0,612	0,324	Three Phase	21,60
4th	0,756	0,998	1,006	0,431	0,569	0,573	Three Phase	4,00
5th	0,354	0,242	0,316	0,202	0,138	0,180	Three Phase	10,70
6th	0,611	0,193	0,631	0,348	0,110	0,360	Three Phase	2,67
7th	0,046	0,067	0,025	0,026	0,038	0,014	Three Phase	7,20
8th	0,449	0,300	0,724	0,256	0,171	0,413	Three Phase	2,00
9th	0,512	0,182	0,394	0,292	0,104	0,225	Three Phase	3,80
10th	0,305	0,502	0,253	0,174	0,286	0,144	Three Phase	1,60
11th	0,187	0,183	0,196	0,107	0,104	0,112	Three Phase	3,10
12th	0,433	0,113	0,448	0,247	0,064	0,255	Three Phase	1,33
13th	0,064	0,051	0,046	0,037	0,029	0,026	Three Phase	2,00
14th	0,570	0,227	0,522	0,325	0,129	0,298	Three Phase	N/A
15th	0,425	0,107	0,511	0,242	0,061	0,291	Three Phase	N/A
16th	0,670	0,283	0,543	0,382	0,161	0,310	Three Phase	N/A
17th	0,535	1,036	0,833	0,305	0,591	0,475	Three Phase	N/A

4.8	EMC and power quality Harmonic current emission (EN 61000-3-12)							P
18th	0,662	0,384	0,440	0,377	0,219	0,251	Three Phase	N/A
19th	0,881	1,378	1,382	0,502	0,786	0,788	Three Phase	N/A
20th	0,671	0,074	0,618	0,383	0,042	0,352	Three Phase	N/A
21th	0,396	0,313	0,127	0,226	0,178	0,072	Three Phase	N/A
22th	0,063	0,309	0,339	0,036	0,176	0,193	Three Phase	N/A
23th	0,404	0,518	0,132	0,230	0,295	0,075	Three Phase	N/A
24th	0,470	0,137	0,436	0,268	0,078	0,249	Three Phase	N/A
25th	0,497	0,288	0,696	0,284	0,164	0,397	Three Phase	N/A
26th	0,532	0,407	0,183	0,303	0,232	0,105	Three Phase	N/A
27th	0,384	0,313	0,433	0,219	0,179	0,247	Three Phase	N/A
28th	0,230	0,144	0,347	0,131	0,082	0,198	Three Phase	N/A
29th	0,391	0,475	0,312	0,223	0,271	0,178	Three Phase	N/A
30th	0,256	0,367	0,162	0,146	0,209	0,092	Three Phase	N/A
31th	0,264	0,301	0,084	0,151	0,172	0,048	Three Phase	N/A
32th	0,069	0,274	0,278	0,039	0,156	0,158	Three Phase	N/A
33th	0,141	0,332	0,244	0,081	0,189	0,139	Three Phase	N/A
34th	0,287	0,055	0,279	0,164	0,032	0,159	Three Phase	N/A
35th	0,264	0,056	0,277	0,150	0,032	0,158	Three Phase	N/A
36th	0,232	0,147	0,166	0,132	0,084	0,095	Three Phase	N/A
37th	0,220	0,305	0,101	0,125	0,174	0,058	Three Phase	N/A
38th	0,093	0,191	0,121	0,053	0,109	0,069	Three Phase	N/A
39th	0,194	0,231	0,158	0,111	0,132	0,090	Three Phase	N/A
40th	0,158	0,177	0,132	0,090	0,101	0,075	Three Phase	N/A
41th	0,346	0,164	0,303	0,197	0,093	0,173	Three Phase	N/A
42th	0,074	0,083	0,049	0,042	0,048	0,028	Three Phase	N/A
43th	0,060	0,281	0,256	0,034	0,160	0,146	Three Phase	N/A
44th	0,171	0,105	0,089	0,097	0,060	0,051	Three Phase	N/A
45th	0,200	0,296	0,204	0,114	0,169	0,117	Three Phase	N/A
46th	0,134	0,159	0,230	0,077	0,091	0,131	Three Phase	N/A
47th	0,099	0,174	0,261	0,056	0,099	0,149	Three Phase	N/A
48th	0,061	0,044	0,081	0,035	0,025	0,046	Three Phase	N/A
49th	0,125	0,058	0,100	0,071	0,033	0,057	Three Phase	N/A
50th	0,129	0,073	0,138	0,074	0,041	0,079	Three Phase	N/A
Note: The tests should be based on the limits of the EN 61000-3-12 for more than 16A.								

4.8	EMC and power quality Harmonic current emission (EN 61000-4-7)	P

The currents of the interharmonics to 2 kHz must be measured in accordance with DIN EN 61000-4-7 (VDE 0817-4-7), Annex A, The measurements of higher-frequency harmonic currents between 2 kHz and 9 kHz must be conducted in line with DIN EN 61000-4-7 (VDE 0847-4-7), Annex B.

Test result: ASW75K-LT

Harmonics

P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
Order	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
1	1,301	10,626	20,587	30,339	41,242	51,225	60,272	71,310	80,294	90,258	100,167
2	0,002	0,028	0,034	0,037	0,043	0,045	0,046	0,053	0,051	0,059	0,065
3	0,010	0,423	0,461	0,514	0,596	0,640	0,673	0,707	0,703	0,700	0,698
4	0,001	0,308	0,361	0,362	0,473	0,528	0,554	0,557	0,602	0,620	0,640
5	0,008	0,337	0,323	0,296	0,312	0,286	0,271	0,260	0,262	0,254	0,248
6	0,001	0,087	0,089	0,106	0,129	0,162	0,183	0,202	0,241	0,257	0,297
7	0,006	0,080	0,146	0,142	0,135	0,139	0,130	0,125	0,128	0,129	0,132
8	0,001	0,329	0,398	0,348	0,387	0,418	0,393	0,380	0,395	0,396	0,392
9	0,001	0,096	0,047	0,085	0,108	0,121	0,099	0,092	0,103	0,126	0,148
10	0,001	0,299	0,305	0,267	0,279	0,285	0,263	0,264	0,261	0,250	0,242
11	0,004	0,193	0,173	0,164	0,193	0,179	0,191	0,180	0,173	0,157	0,150
12	0,002	0,197	0,164	0,153	0,170	0,172	0,157	0,154	0,156	0,155	0,167
13	0,004	0,041	0,039	0,044	0,062	0,053	0,069	0,085	0,075	0,077	0,067
14	0,002	0,313	0,321	0,318	0,331	0,344	0,327	0,318	0,318	0,330	0,336
15	0,004	0,039	0,054	0,063	0,091	0,092	0,155	0,195	0,224	0,250	0,278
16	0,002	0,251	0,239	0,245	0,233	0,236	0,226	0,225	0,233	0,236	0,239
17	0,003	0,854	0,900	0,876	0,899	0,904	0,906	0,869	0,864	0,875	0,899
18	0,003	0,051	0,093	0,119	0,117	0,121	0,149	0,168	0,178	0,197	0,211
19	0,004	0,877	0,804	0,738	0,739	0,820	0,728	0,708	0,713	0,720	0,707
20	0,003	0,170	0,191	0,212	0,225	0,234	0,250	0,253	0,254	0,258	0,269
21	0,006	0,047	0,046	0,072	0,089	0,132	0,139	0,159	0,175	0,181	0,197
22	0,003	0,243	0,237	0,230	0,237	0,248	0,235	0,230	0,231	0,238	0,235
23	0,006	0,293	0,398	0,487	0,481	0,489	0,556	0,614	0,640	0,663	0,692
24	0,004	0,199	0,151	0,133	0,148	0,191	0,155	0,138	0,122	0,124	0,114
25	0,004	0,690	0,778	0,843	0,855	0,928	0,977	0,975	0,988	1,031	1,047
26	0,002	0,078	0,064	0,073	0,074	0,062	0,085	0,095	0,111	0,119	0,129
27	0,003	0,063	0,046	0,057	0,073	0,069	0,066	0,090	0,137	0,176	0,216
28	0,002	0,129	0,154	0,156	0,171	0,175	0,200	0,213	0,215	0,221	0,222
29	0,002	0,168	0,088	0,081	0,112	0,131	0,169	0,208	0,243	0,280	0,310
30	0,003	0,179	0,195	0,210	0,222	0,241	0,246	0,261	0,264	0,265	0,262
31	0,003	0,209	0,312	0,410	0,437	0,467	0,573	0,667	0,728	0,785	0,857
32	0,002	0,158	0,128	0,112	0,112	0,132	0,122	0,124	0,129	0,135	0,141
33	0,003	0,056	0,073	0,074	0,091	0,100	0,088	0,097	0,115	0,133	0,149
34	0,002	0,056	0,039	0,044	0,048	0,048	0,078	0,110	0,132	0,154	0,170
35	0,003	0,206	0,194	0,180	0,166	0,183	0,192	0,211	0,230	0,256	0,282
36	0,002	0,110	0,105	0,115	0,124	0,126	0,140	0,166	0,182	0,200	0,219
37	0,005	0,052	0,074	0,126	0,168	0,193	0,251	0,288	0,323	0,355	0,394
38	0,005	0,147	0,126	0,122	0,116	0,128	0,120	0,127	0,139	0,144	0,149
39	0,003	0,033	0,034	0,043	0,049	0,052	0,057	0,072	0,092	0,108	0,127
40	0,004	0,098	0,092	0,075	0,069	0,071	0,067	0,070	0,074	0,084	0,094
41	0,005	0,181	0,171	0,165	0,150	0,160	0,167	0,169	0,185	0,196	0,209

42	0,004	0,078	0,090	0,093	0,106	0,112	0,117	0,120	0,116	0,114	0,109
43	0,004	0,090	0,041	0,058	0,069	0,089	0,139	0,176	0,191	0,209	0,220
44	0,003	0,094	0,110	0,109	0,108	0,116	0,113	0,111	0,106	0,106	0,100
45	0,003	0,028	0,037	0,042	0,043	0,053	0,060	0,053	0,059	0,064	0,072
46	0,003	0,134	0,102	0,096	0,093	0,102	0,087	0,075	0,068	0,068	0,073
47	0,003	0,124	0,146	0,153	0,149	0,158	0,157	0,161	0,170	0,178	0,182
48	0,003	0,046	0,044	0,062	0,075	0,073	0,087	0,109	0,122	0,129	0,133
49	0,004	0,134	0,112	0,070	0,060	0,058	0,047	0,074	0,097	0,121	0,143
50	0,002	0,061	0,073	0,076	0,080	0,080	0,080	0,081	0,081	0,090	0,095
Interharmonics											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [Hz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
75	0,001	0,062	0,076	0,078	0,092	0,098	0,114	0,121	0,139	0,151	0,180
125	0,001	0,082	0,095	0,104	0,116	0,126	0,128	0,142	0,141	0,161	0,171
175	0,001	0,060	0,062	0,063	0,073	0,084	0,081	0,085	0,087	0,100	0,109
225	0,001	0,068	0,071	0,070	0,079	0,084	0,083	0,088	0,098	0,104	0,104
275	0,001	0,057	0,061	0,059	0,063	0,064	0,068	0,079	0,075	0,082	0,093
325	0,001	0,056	0,066	0,059	0,060	0,072	0,079	0,080	0,079	0,079	0,085
375	0,001	0,054	0,063	0,067	0,071	0,075	0,077	0,076	0,078	0,079	0,084
425	0,002	0,048	0,054	0,054	0,057	0,064	0,062	0,065	0,069	0,067	0,067
475	0,002	0,042	0,044	0,042	0,043	0,042	0,044	0,046	0,048	0,048	0,051
525	0,002	0,069	0,062	0,061	0,067	0,069	0,062	0,063	0,065	0,068	0,069
575	0,002	0,051	0,045	0,047	0,047	0,051	0,051	0,055	0,058	0,056	0,059
625	0,002	0,057	0,059	0,061	0,057	0,058	0,057	0,059	0,061	0,064	0,069
675	0,002	0,051	0,055	0,055	0,058	0,063	0,063	0,063	0,065	0,066	0,072
725	0,002	0,050	0,051	0,050	0,055	0,062	0,061	0,058	0,061	0,066	0,064
775	0,002	0,069	0,070	0,069	0,070	0,065	0,068	0,067	0,072	0,077	0,084
825	0,003	0,065	0,065	0,068	0,072	0,075	0,072	0,071	0,076	0,081	0,088
875	0,003	0,080	0,077	0,080	0,080	0,088	0,093	0,095	0,100	0,098	0,093
925	0,003	0,070	0,082	0,088	0,085	0,088	0,091	0,096	0,102	0,104	0,108
975	0,003	0,044	0,046	0,048	0,047	0,050	0,055	0,056	0,059	0,062	0,068
1025	0,003	0,043	0,043	0,044	0,049	0,052	0,051	0,051	0,057	0,064	0,062
1075	0,003	0,072	0,064	0,062	0,057	0,066	0,061	0,064	0,064	0,061	0,063
1125	0,003	0,076	0,067	0,063	0,065	0,068	0,066	0,069	0,074	0,074	0,078
1175	0,004	0,074	0,069	0,063	0,067	0,076	0,077	0,080	0,091	0,096	0,112
1225	0,004	0,072	0,068	0,065	0,061	0,061	0,063	0,073	0,083	0,087	0,097
1275	0,004	0,044	0,043	0,044	0,042	0,047	0,053	0,054	0,057	0,057	0,059
1325	0,004	0,039	0,038	0,038	0,044	0,043	0,045	0,046	0,050	0,057	0,057
1375	0,004	0,056	0,057	0,057	0,056	0,059	0,060	0,063	0,070	0,072	0,077
1425	0,004	0,058	0,058	0,062	0,055	0,063	0,062	0,068	0,075	0,078	0,080
1475	0,004	0,070	0,061	0,057	0,057	0,063	0,060	0,060	0,062	0,068	0,076
1525	0,005	0,069	0,063	0,059	0,055	0,057	0,058	0,058	0,062	0,063	0,061
1575	0,005	0,034	0,034	0,034	0,035	0,038	0,041	0,043	0,047	0,051	0,050
1625	0,005	0,036	0,034	0,033	0,039	0,037	0,038	0,040	0,043	0,045	0,049
1675	0,005	0,046	0,045	0,048	0,050	0,049	0,051	0,054	0,058	0,060	0,070
1725	0,005	0,048	0,044	0,047	0,044	0,050	0,052	0,058	0,064	0,067	0,064
1775	0,006	0,053	0,049	0,045	0,045	0,051	0,050	0,050	0,052	0,055	0,063
1825	0,006	0,052	0,050	0,048	0,045	0,043	0,044	0,048	0,056	0,059	0,072
1875	0,006	0,031	0,031	0,029	0,030	0,033	0,033	0,034	0,035	0,037	0,040
1925	0,006	0,034	0,030	0,030	0,034	0,032	0,034	0,035	0,038	0,043	0,045

1975	0,006	0,039	0,036	0,039	0,042	0,041	0,043	0,046	0,048	0,048	0,058
Higher Frequencies											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [kHz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2,1	0,015	0,234	0,217	0,221	0,232	0,250	0,267	0,281	0,291	0,303	0,310
2,3	0,013	0,171	0,179	0,191	0,191	0,213	0,222	0,229	0,240	0,250	0,257
2,5	0,011	0,191	0,173	0,154	0,155	0,163	0,161	0,171	0,184	0,198	0,211
2,7	0,010	0,132	0,155	0,164	0,161	0,168	0,171	0,180	0,192	0,208	0,225
2,9	0,008	0,117	0,139	0,128	0,124	0,131	0,137	0,145	0,158	0,168	0,187
3,1	0,007	0,099	0,096	0,093	0,089	0,090	0,088	0,091	0,092	0,099	0,107
3,3	0,007	0,079	0,080	0,086	0,086	0,084	0,091	0,096	0,096	0,103	0,108
3,5	0,007	0,079	0,072	0,074	0,079	0,079	0,080	0,087	0,089	0,094	0,097
3,7	0,007	0,088	0,087	0,076	0,079	0,090	0,085	0,083	0,077	0,076	0,078
3,9	0,047	0,101	0,105	0,104	0,102	0,110	0,109	0,106	0,099	0,099	0,102
4,1	0,024	0,066	0,074	0,072	0,075	0,092	0,088	0,087	0,080	0,077	0,076
4,3	0,023	0,065	0,071	0,071	0,073	0,078	0,073	0,072	0,071	0,070	0,070
4,5	0,007	0,044	0,047	0,048	0,052	0,056	0,053	0,051	0,049	0,049	0,050
4,7	0,006	0,036	0,039	0,038	0,040	0,042	0,043	0,043	0,044	0,047	0,048
4,9	0,006	0,031	0,032	0,032	0,034	0,037	0,040	0,041	0,041	0,045	0,048
5,1	0,005	0,027	0,023	0,053	0,010	0,005	0,021	0,021	0,012	0,015	0,012
5,3	0,023	0,036	0,028	0,046	0,025	0,024	0,033	0,033	0,027	0,028	0,031
5,5	0,026	0,039	0,031	0,053	0,024	0,024	0,028	0,032	0,031	0,028	0,031
5,7	0,027	0,037	0,030	0,041	0,022	0,028	0,029	0,029	0,027	0,031	0,030
5,9	0,038	0,045	0,049	0,058	0,030	0,039	0,040	0,037	0,036	0,041	0,037
6,1	0,039	0,037	0,036	0,042	0,042	0,047	0,041	0,035	0,046	0,040	0,041
6,3	0,048	0,032	0,027	0,040	0,038	0,043	0,025	0,027	0,041	0,036	0,035
6,5	0,027	0,032	0,027	0,035	0,023	0,027	0,024	0,026	0,025	0,029	0,029
6,7	0,026	0,031	0,026	0,044	0,025	0,021	0,028	0,028	0,025	0,027	0,027
6,9	0,018	0,031	0,021	0,048	0,019	0,021	0,021	0,025	0,026	0,025	0,027
7,1	0,025	0,042	0,025	0,055	0,020	0,018	0,030	0,031	0,019	0,025	0,024
7,3	0,023	0,040	0,032	0,041	0,024	0,024	0,030	0,035	0,029	0,033	0,036
7,5	0,025	0,030	0,025	0,027	0,024	0,027	0,029	0,029	0,031	0,030	0,033
7,7	0,014	0,025	0,025	0,038	0,018	0,016	0,019	0,024	0,028	0,023	0,025
7,9	0,020	0,025	0,020	0,032	0,020	0,023	0,023	0,025	0,022	0,025	0,023
8,1	0,016	0,027	0,020	0,024	0,014	0,017	0,023	0,022	0,021	0,022	0,022
8,3	0,014	0,021	0,016	0,020	0,010	0,013	0,015	0,018	0,021	0,017	0,021
8,5	0,012	0,028	0,023	0,020	0,011	0,010	0,024	0,024	0,015	0,021	0,018
8,7	0,015	0,027	0,024	0,021	0,013	0,019	0,023	0,027	0,029	0,026	0,030
8,9	0,019	0,018	0,014	0,013	0,016	0,019	0,017	0,017	0,022	0,020	0,020

Note:

The normalization current is 108,696A.

The harmonics, interharmonics and higher frequencies are maximum values of all three phases.

4.8	EMC and power quality Harmonic current emission (EN 61000-4-7)	P

The currents of the interharmonics to 2 kHz must be measured in accordance with DIN EN 61000-4-7 (VDE 0817-4-7), Annex A, The measurements of higher-frequency harmonic currents between 2 kHz and 9 kHz must be conducted in line with DIN EN 61000-4-7 (VDE 0847-4-7), Annex B.

Test result: ASW80K-LT

Harmonics

P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
Order	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
1	3,209	10,477	20,617	30,320	40,255	50,370	60,456	70,494	80,502	91,533	100,413
2	0,018	0,024	0,030	0,032	0,034	0,038	0,040	0,048	0,049	0,052	0,060
3	0,183	0,378	0,413	0,423	0,511	0,551	0,589	0,605	0,600	0,586	0,581
4	0,144	0,286	0,321	0,330	0,422	0,468	0,472	0,489	0,496	0,518	0,518
5	0,171	0,290	0,269	0,252	0,264	0,241	0,222	0,225	0,220	0,215	0,214
6	0,053	0,107	0,095	0,121	0,131	0,152	0,180	0,181	0,188	0,200	0,206
7	0,125	0,068	0,129	0,116	0,117	0,117	0,110	0,105	0,112	0,112	0,108
8	0,169	0,300	0,337	0,312	0,349	0,364	0,332	0,327	0,324	0,312	0,295
9	0,059	0,076	0,046	0,077	0,093	0,096	0,086	0,090	0,103	0,122	0,148
10	0,169	0,281	0,266	0,236	0,246	0,247	0,219	0,220	0,209	0,199	0,186
11	0,122	0,162	0,152	0,144	0,161	0,157	0,164	0,152	0,140	0,130	0,127
12	0,199	0,224	0,169	0,160	0,168	0,163	0,136	0,126	0,118	0,115	0,108
13	0,066	0,034	0,032	0,037	0,055	0,049	0,066	0,069	0,066	0,061	0,061
14	0,178	0,282	0,283	0,285	0,297	0,295	0,281	0,267	0,261	0,257	0,245
15	0,043	0,042	0,042	0,049	0,080	0,092	0,146	0,177	0,206	0,235	0,264
16	0,095	0,210	0,208	0,211	0,205	0,199	0,193	0,194	0,187	0,189	0,183
17	0,566	0,736	0,766	0,728	0,761	0,781	0,760	0,744	0,748	0,772	0,786
18	0,047	0,053	0,102	0,122	0,112	0,115	0,136	0,143	0,139	0,145	0,138
19	0,482	0,748	0,667	0,617	0,644	0,693	0,599	0,612	0,624	0,618	0,612
20	0,169	0,175	0,190	0,213	0,215	0,211	0,222	0,212	0,193	0,187	0,165
21	0,072	0,042	0,036	0,070	0,078	0,106	0,127	0,146	0,154	0,170	0,179
22	0,090	0,233	0,220	0,204	0,220	0,228	0,201	0,195	0,186	0,185	0,176
23	0,158	0,265	0,344	0,432	0,407	0,419	0,505	0,542	0,557	0,588	0,608
24	0,110	0,215	0,160	0,120	0,147	0,177	0,124	0,107	0,093	0,088	0,084
25	0,238	0,575	0,651	0,716	0,739	0,799	0,829	0,830	0,868	0,898	0,908
26	0,098	0,078	0,060	0,071	0,060	0,052	0,077	0,088	0,096	0,104	0,109
27	0,051	0,084	0,051	0,060	0,067	0,060	0,062	0,098	0,141	0,191	0,224
28	0,090	0,112	0,123	0,141	0,146	0,151	0,175	0,182	0,178	0,182	0,178
29	0,141	0,143	0,082	0,082	0,093	0,115	0,156	0,195	0,230	0,264	0,293
30	0,069	0,196	0,202	0,212	0,215	0,226	0,219	0,217	0,205	0,190	0,171
31	0,072	0,174	0,266	0,375	0,376	0,409	0,517	0,587	0,642	0,709	0,768
32	0,076	0,138	0,114	0,093	0,102	0,119	0,104	0,109	0,106	0,114	0,124
33	0,031	0,072	0,090	0,080	0,090	0,095	0,074	0,089	0,102	0,117	0,126
34	0,092	0,041	0,031	0,043	0,041	0,040	0,077	0,102	0,117	0,126	0,130
35	0,062	0,176	0,165	0,136	0,135	0,153	0,163	0,189	0,218	0,254	0,281
36	0,044	0,113	0,112	0,125	0,121	0,121	0,131	0,141	0,144	0,148	0,143
37	0,050	0,039	0,058	0,124	0,148	0,171	0,225	0,253	0,280	0,306	0,331
38	0,026	0,129	0,109	0,099	0,101	0,108	0,105	0,110	0,118	0,122	0,130
39	0,059	0,038	0,034	0,048	0,051	0,051	0,053	0,069	0,090	0,113	0,141
40	0,077	0,082	0,077	0,061	0,060	0,063	0,059	0,061	0,066	0,073	0,079
41	0,040	0,156	0,149	0,139	0,128	0,131	0,138	0,153	0,173	0,194	0,219

42	0,065	0,078	0,090	0,096	0,105	0,107	0,102	0,097	0,093	0,083	0,072
43	0,082	0,084	0,036	0,055	0,061	0,079	0,130	0,153	0,169	0,175	0,173
44	0,042	0,089	0,095	0,093	0,095	0,100	0,097	0,093	0,093	0,091	0,097
45	0,051	0,028	0,033	0,041	0,045	0,052	0,053	0,045	0,046	0,049	0,055
46	0,053	0,104	0,087	0,078	0,083	0,091	0,073	0,058	0,051	0,049	0,043
47	0,049	0,116	0,126	0,132	0,127	0,132	0,129	0,143	0,155	0,163	0,170
48	0,035	0,037	0,042	0,064	0,061	0,059	0,084	0,093	0,094	0,091	0,080
49	0,087	0,117	0,099	0,054	0,053	0,050	0,044	0,067	0,089	0,114	0,130
50	0,040	0,053	0,059	0,069	0,069	0,065	0,069	0,070	0,074	0,082	0,086
Interharmonics											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [Hz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
75	0,035	0,054	0,060	0,061	0,084	0,090	0,112	0,109	0,122	0,134	0,135
125	0,048	0,071	0,082	0,086	0,098	0,107	0,120	0,126	0,125	0,139	0,146
175	0,035	0,052	0,054	0,055	0,059	0,070	0,072	0,076	0,080	0,089	0,091
225	0,042	0,058	0,061	0,059	0,063	0,068	0,074	0,080	0,086	0,093	0,095
275	0,034	0,049	0,052	0,050	0,052	0,060	0,062	0,065	0,066	0,065	0,075
325	0,036	0,047	0,053	0,053	0,054	0,056	0,062	0,068	0,071	0,067	0,072
375	0,033	0,049	0,054	0,058	0,059	0,063	0,071	0,072	0,067	0,069	0,071
425	0,029	0,042	0,046	0,045	0,049	0,052	0,055	0,058	0,060	0,060	0,060
475	0,028	0,036	0,036	0,036	0,034	0,036	0,038	0,041	0,045	0,043	0,045
525	0,042	0,059	0,055	0,053	0,056	0,051	0,055	0,059	0,062	0,059	0,056
575	0,030	0,045	0,042	0,041	0,044	0,044	0,040	0,044	0,046	0,049	0,049
625	0,037	0,048	0,047	0,051	0,051	0,050	0,050	0,052	0,053	0,053	0,055
675	0,031	0,046	0,049	0,050	0,049	0,052	0,055	0,057	0,054	0,055	0,055
725	0,030	0,045	0,046	0,045	0,047	0,052	0,050	0,052	0,052	0,054	0,055
775	0,043	0,056	0,059	0,059	0,059	0,058	0,060	0,061	0,066	0,068	0,070
825	0,040	0,056	0,058	0,059	0,060	0,060	0,062	0,065	0,065	0,066	0,070
875	0,041	0,069	0,069	0,070	0,073	0,074	0,073	0,075	0,076	0,080	0,082
925	0,038	0,057	0,064	0,070	0,071	0,077	0,087	0,085	0,082	0,081	0,092
975	0,026	0,041	0,041	0,044	0,041	0,043	0,046	0,046	0,050	0,052	0,057
1025	0,026	0,039	0,039	0,041	0,039	0,044	0,043	0,044	0,048	0,054	0,056
1075	0,040	0,060	0,056	0,051	0,052	0,055	0,051	0,051	0,053	0,056	0,054
1125	0,040	0,063	0,056	0,055	0,060	0,060	0,057	0,058	0,057	0,057	0,062
1175	0,037	0,065	0,062	0,055	0,056	0,058	0,061	0,071	0,081	0,087	0,086
1225	0,039	0,061	0,058	0,049	0,049	0,053	0,062	0,071	0,076	0,077	0,084
1275	0,023	0,039	0,040	0,041	0,038	0,042	0,042	0,043	0,045	0,048	0,052
1325	0,023	0,036	0,034	0,036	0,035	0,040	0,038	0,041	0,043	0,048	0,048
1375	0,029	0,049	0,049	0,048	0,048	0,049	0,051	0,054	0,059	0,067	0,067
1425	0,027	0,047	0,049	0,051	0,049	0,056	0,057	0,057	0,060	0,067	0,079
1475	0,032	0,060	0,054	0,049	0,048	0,047	0,049	0,054	0,057	0,058	0,059
1525	0,031	0,055	0,052	0,045	0,045	0,047	0,050	0,049	0,053	0,058	0,061
1575	0,022	0,029	0,031	0,032	0,030	0,034	0,035	0,036	0,037	0,040	0,045
1625	0,021	0,031	0,029	0,030	0,030	0,032	0,033	0,037	0,039	0,041	0,047
1675	0,029	0,041	0,039	0,041	0,042	0,041	0,048	0,051	0,054	0,052	0,050
1725	0,025	0,038	0,036	0,040	0,040	0,046	0,046	0,048	0,053	0,058	0,061
1775	0,032	0,046	0,044	0,041	0,041	0,039	0,039	0,043	0,047	0,050	0,048
1825	0,031	0,043	0,041	0,039	0,038	0,040	0,043	0,047	0,048	0,053	0,058
1875	0,022	0,026	0,026	0,026	0,026	0,028	0,029	0,029	0,030	0,032	0,033
1925	0,023	0,027	0,026	0,028	0,026	0,028	0,030	0,032	0,035	0,035	0,037

1975	0,027	0,033	0,032	0,033	0,036	0,033	0,038	0,042	0,043	0,045	0,042
Higher Frequencies											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [kHz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2,1	0,121	0,202	0,188	0,191	0,202	0,215	0,229	0,241	0,255	0,268	0,288
2,3	0,107	0,150	0,153	0,164	0,165	0,183	0,191	0,199	0,205	0,210	0,212
2,5	0,120	0,157	0,142	0,127	0,133	0,139	0,141	0,149	0,158	0,173	0,186
2,7	0,095	0,116	0,134	0,143	0,139	0,143	0,144	0,157	0,177	0,193	0,208
2,9	0,080	0,112	0,120	0,110	0,107	0,112	0,118	0,127	0,136	0,154	0,174
3,1	0,073	0,091	0,084	0,082	0,080	0,079	0,076	0,077	0,081	0,088	0,098
3,3	0,067	0,064	0,069	0,079	0,074	0,072	0,079	0,081	0,086	0,093	0,101
3,5	0,053	0,073	0,065	0,072	0,072	0,070	0,070	0,073	0,076	0,081	0,088
3,7	0,044	0,070	0,071	0,065	0,071	0,078	0,073	0,067	0,062	0,062	0,065
3,9	0,071	0,089	0,091	0,088	0,091	0,093	0,095	0,088	0,085	0,083	0,084
4,1	0,036	0,053	0,062	0,062	0,067	0,080	0,074	0,070	0,064	0,060	0,061
4,3	0,036	0,055	0,061	0,057	0,063	0,065	0,060	0,060	0,060	0,058	0,056
4,5	0,022	0,037	0,041	0,041	0,045	0,047	0,044	0,043	0,043	0,042	0,043
4,7	0,019	0,031	0,032	0,033	0,034	0,036	0,036	0,037	0,040	0,041	0,043
4,9	0,019	0,028	0,028	0,028	0,029	0,032	0,034	0,034	0,038	0,041	0,043
5,1	0,018	0,016	0,015	0,012	0,013	0,013	0,023	0,010	0,026	0,017	0,018
5,3	0,028	0,022	0,021	0,020	0,027	0,022	0,030	0,020	0,027	0,024	0,028
5,5	0,024	0,023	0,023	0,019	0,028	0,023	0,033	0,026	0,023	0,023	0,027
5,7	0,025	0,027	0,025	0,021	0,026	0,027	0,032	0,025	0,028	0,025	0,025
5,9	0,034	0,054	0,032	0,029	0,035	0,038	0,039	0,029	0,042	0,033	0,032
6,1	0,035	0,030	0,033	0,030	0,033	0,035	0,031	0,043	0,036	0,028	0,030
6,3	0,021	0,026	0,025	0,026	0,030	0,025	0,028	0,040	0,021	0,024	0,023
6,5	0,020	0,020	0,021	0,019	0,022	0,022	0,027	0,024	0,026	0,020	0,022
6,7	0,024	0,019	0,021	0,019	0,026	0,018	0,027	0,022	0,025	0,023	0,024
6,9	0,018	0,015	0,020	0,015	0,022	0,018	0,027	0,022	0,019	0,018	0,021
7,1	0,025	0,020	0,023	0,014	0,025	0,018	0,035	0,015	0,030	0,023	0,026
7,3	0,026	0,023	0,024	0,016	0,028	0,022	0,034	0,025	0,030	0,028	0,030
7,5	0,025	0,017	0,023	0,016	0,027	0,017	0,026	0,024	0,023	0,022	0,024
7,7	0,016	0,020	0,016	0,014	0,022	0,018	0,021	0,019	0,021	0,020	0,020
7,9	0,020	0,015	0,018	0,015	0,018	0,017	0,021	0,021	0,018	0,019	0,021
8,1	0,020	0,014	0,019	0,009	0,018	0,014	0,023	0,017	0,022	0,017	0,019
8,3	0,012	0,011	0,014	0,008	0,015	0,013	0,018	0,017	0,014	0,015	0,015
8,5	0,020	0,018	0,020	0,009	0,017	0,014	0,024	0,011	0,028	0,020	0,020
8,7	0,020	0,018	0,023	0,012	0,022	0,018	0,023	0,023	0,020	0,022	0,023
8,9	0,015	0,010	0,015	0,010	0,015	0,013	0,015	0,018	0,011	0,013	0,015

Note:

The normalization current is 127,536A.

The harmonics, interharmonics and higher frequencies are maximum values of all three phases.

4.8	EMC and power quality Harmonic current emission (EN 61000-4-7)	P

The currents of the interharmonics to 2 kHz must be measured in accordance with DIN EN 61000-4-7 (VDE 0817-4-7), Annex A, The measurements of higher-frequency harmonic currents between 2 kHz and 9 kHz must be conducted in line with DIN EN 61000-4-7 (VDE 0847-4-7), Annex B.

Test result: ASW100K-LT

Harmonics

P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
Order	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
1	0,886	10,383	19,649	30,502	39,731	49,906	60,026	70,117	81,231	91,197	101,215
2	0,001	0,017	0,020	0,025	0,027	0,031	0,035	0,039	0,046	0,054	0,058
3	0,008	0,306	0,328	0,409	0,460	0,490	0,493	0,485	0,485	0,469	0,519
4	0,001	0,247	0,257	0,334	0,388	0,414	0,443	0,458	0,484	0,511	0,530
5	0,005	0,235	0,205	0,214	0,194	0,176	0,181	0,175	0,175	0,165	0,161
6	0,001	0,138	0,088	0,128	0,151	0,198	0,223	0,262	0,293	0,328	0,341
7	0,004	0,057	0,100	0,091	0,094	0,086	0,086	0,087	0,085	0,073	0,070
8	0,001	0,253	0,246	0,281	0,306	0,287	0,296	0,288	0,288	0,316	0,321
9	0,001	0,042	0,065	0,071	0,072	0,063	0,066	0,091	0,120	0,205	0,235
10	0,001	0,246	0,217	0,206	0,209	0,194	0,192	0,175	0,169	0,165	0,166
11	0,002	0,119	0,116	0,131	0,124	0,128	0,119	0,106	0,101	0,098	0,095
12	0,001	0,219	0,170	0,185	0,184	0,161	0,155	0,148	0,145	0,107	0,100
13	0,003	0,032	0,024	0,042	0,038	0,055	0,049	0,049	0,044	0,035	0,040
14	0,001	0,270	0,252	0,255	0,258	0,251	0,250	0,264	0,271	0,282	0,276
15	0,003	0,044	0,049	0,064	0,078	0,121	0,146	0,168	0,194	0,239	0,260
16	0,001	0,166	0,184	0,164	0,165	0,165	0,171	0,166	0,172	0,200	0,203
17	0,002	0,590	0,578	0,601	0,617	0,599	0,595	0,610	0,635	0,687	0,697
18	0,002	0,066	0,123	0,115	0,117	0,152	0,159	0,169	0,177	0,178	0,182
19	0,003	0,609	0,525	0,505	0,545	0,466	0,489	0,493	0,476	0,483	0,509
20	0,002	0,187	0,196	0,208	0,208	0,226	0,225	0,236	0,247	0,242	0,250
21	0,004	0,037	0,033	0,053	0,081	0,103	0,117	0,126	0,148	0,150	0,176
22	0,002	0,204	0,211	0,203	0,213	0,191	0,190	0,190	0,188	0,191	0,202
23	0,004	0,217	0,313	0,328	0,332	0,406	0,430	0,457	0,480	0,577	0,605
24	0,003	0,194	0,150	0,135	0,169	0,117	0,104	0,095	0,100	0,094	0,101
25	0,003	0,470	0,544	0,561	0,620	0,645	0,662	0,704	0,725	0,669	0,663
26	0,001	0,061	0,050	0,054	0,048	0,071	0,098	0,113	0,127	0,115	0,123
27	0,003	0,091	0,067	0,076	0,062	0,063	0,072	0,106	0,143	0,193	0,240
28	0,001	0,101	0,114	0,126	0,124	0,149	0,153	0,157	0,164	0,175	0,187
29	0,001	0,089	0,056	0,070	0,084	0,126	0,156	0,180	0,209	0,280	0,324
30	0,002	0,193	0,205	0,212	0,225	0,224	0,231	0,228	0,229	0,257	0,265
31	0,002	0,181	0,247	0,299	0,326	0,418	0,473	0,527	0,600	0,582	0,622
32	0,001	0,107	0,091	0,083	0,101	0,089	0,100	0,110	0,119	0,147	0,161
33	0,002	0,087	0,090	0,100	0,101	0,091	0,095	0,108	0,127	0,152	0,164
34	0,001	0,028	0,032	0,040	0,035	0,070	0,095	0,121	0,140	0,145	0,155
35	0,002	0,127	0,135	0,112	0,121	0,110	0,137	0,158	0,194	0,214	0,242
36	0,001	0,104	0,113	0,124	0,125	0,143	0,160	0,172	0,185	0,202	0,216
37	0,004	0,030	0,070	0,117	0,140	0,190	0,219	0,245	0,281	0,264	0,295
38	0,003	0,098	0,088	0,075	0,085	0,093	0,103	0,105	0,107	0,114	0,112
39	0,002	0,049	0,054	0,063	0,062	0,065	0,070	0,077	0,089	0,101	0,117
40	0,002	0,053	0,055	0,049	0,056	0,049	0,052	0,061	0,070	0,073	0,079
41	0,004	0,130	0,114	0,105	0,110	0,097	0,099	0,111	0,122	0,148	0,166

42	0,002	0,077	0,089	0,101	0,105	0,111	0,113	0,107	0,098	0,098	0,101
43	0,003	0,062	0,027	0,046	0,061	0,105	0,124	0,141	0,156	0,133	0,136
44	0,002	0,079	0,077	0,071	0,077	0,074	0,069	0,062	0,061	0,058	0,066
45	0,002	0,036	0,036	0,045	0,051	0,057	0,055	0,066	0,074	0,091	0,095
46	0,002	0,061	0,068	0,064	0,076	0,066	0,062	0,062	0,067	0,070	0,076
47	0,002	0,109	0,106	0,100	0,103	0,096	0,097	0,105	0,112	0,117	0,121
48	0,002	0,028	0,045	0,062	0,057	0,089	0,101	0,104	0,104	0,093	0,083
49	0,002	0,095	0,072	0,047	0,040	0,049	0,062	0,072	0,094	0,080	0,092
50	0,001	0,046	0,049	0,048	0,045	0,054	0,053	0,058	0,066	0,071	0,080
Interharmonics											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [Hz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
75	0,001	0,044	0,052	0,062	0,074	0,082	0,092	0,097	0,121	0,112	0,142
125	0,001	0,059	0,064	0,080	0,087	0,094	0,095	0,110	0,133	0,137	0,131
175	0,001	0,043	0,043	0,049	0,052	0,061	0,063	0,074	0,077	0,090	0,092
225	0,001	0,048	0,047	0,053	0,054	0,062	0,065	0,071	0,075	0,085	0,100
275	0,001	0,038	0,041	0,043	0,044	0,053	0,055	0,057	0,061	0,074	0,067
325	0,001	0,043	0,045	0,044	0,043	0,053	0,056	0,055	0,059	0,073	0,065
375	0,001	0,042	0,041	0,047	0,050	0,054	0,053	0,055	0,057	0,065	0,064
425	0,001	0,038	0,039	0,041	0,040	0,044	0,044	0,046	0,050	0,054	0,062
475	0,001	0,032	0,029	0,029	0,028	0,032	0,032	0,033	0,035	0,039	0,039
525	0,001	0,044	0,048	0,045	0,043	0,048	0,050	0,049	0,046	0,055	0,049
575	0,001	0,033	0,034	0,035	0,032	0,035	0,038	0,041	0,042	0,052	0,058
625	0,001	0,041	0,042	0,042	0,042	0,040	0,043	0,045	0,046	0,054	0,052
675	0,002	0,040	0,038	0,040	0,044	0,043	0,045	0,046	0,047	0,056	0,056
725	0,002	0,039	0,037	0,040	0,039	0,041	0,043	0,045	0,046	0,049	0,050
775	0,002	0,049	0,047	0,047	0,048	0,048	0,051	0,053	0,056	0,066	0,066
825	0,002	0,045	0,050	0,051	0,045	0,051	0,053	0,052	0,054	0,060	0,064
875	0,002	0,052	0,053	0,058	0,056	0,059	0,060	0,063	0,067	0,087	0,094
925	0,002	0,050	0,054	0,058	0,064	0,066	0,063	0,064	0,074	0,096	0,102
975	0,002	0,036	0,034	0,034	0,035	0,036	0,038	0,041	0,046	0,056	0,056
1025	0,002	0,033	0,032	0,034	0,032	0,037	0,038	0,043	0,045	0,050	0,055
1075	0,002	0,050	0,046	0,041	0,043	0,041	0,044	0,045	0,049	0,055	0,056
1125	0,002	0,048	0,051	0,047	0,047	0,049	0,048	0,048	0,052	0,064	0,070
1175	0,002	0,047	0,049	0,045	0,044	0,055	0,064	0,073	0,075	0,092	0,094
1225	0,003	0,046	0,042	0,043	0,046	0,049	0,056	0,057	0,064	0,077	0,087
1275	0,003	0,035	0,033	0,033	0,033	0,034	0,038	0,041	0,048	0,057	0,059
1325	0,003	0,029	0,028	0,030	0,028	0,033	0,034	0,038	0,039	0,047	0,051
1375	0,003	0,043	0,042	0,036	0,039	0,039	0,044	0,053	0,056	0,071	0,075
1425	0,003	0,038	0,041	0,042	0,042	0,043	0,047	0,053	0,064	0,081	0,091
1475	0,003	0,044	0,041	0,039	0,036	0,043	0,046	0,048	0,049	0,060	0,060
1525	0,003	0,045	0,040	0,038	0,038	0,038	0,041	0,043	0,051	0,055	0,056
1575	0,003	0,027	0,024	0,026	0,025	0,027	0,031	0,032	0,037	0,047	0,055
1625	0,003	0,025	0,024	0,025	0,025	0,028	0,030	0,030	0,035	0,050	0,052
1675	0,004	0,034	0,034	0,031	0,034	0,038	0,040	0,039	0,042	0,048	0,054
1725	0,004	0,030	0,030	0,034	0,033	0,035	0,039	0,043	0,048	0,054	0,061
1775	0,004	0,035	0,033	0,033	0,029	0,033	0,036	0,039	0,040	0,044	0,047
1825	0,004	0,035	0,031	0,030	0,033	0,032	0,035	0,039	0,044	0,047	0,050
1875	0,004	0,023	0,020	0,021	0,023	0,022	0,024	0,026	0,029	0,034	0,038
1925	0,004	0,023	0,021	0,022	0,022	0,025	0,026	0,027	0,033	0,045	0,047

1975	0,004	0,028	0,027	0,026	0,028	0,032	0,034	0,035	0,038	0,040	0,041
Higher Frequencies											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [kHz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2,1	0,010	0,162	0,147	0,158	0,171	0,182	0,191	0,196	0,211	0,208	0,221
2,3	0,009	0,129	0,130	0,128	0,143	0,160	0,172	0,180	0,181	0,180	0,179
2,5	0,008	0,118	0,101	0,102	0,108	0,118	0,128	0,139	0,151	0,145	0,161
2,7	0,007	0,103	0,111	0,109	0,113	0,110	0,115	0,131	0,155	0,161	0,178
2,9	0,005	0,102	0,098	0,085	0,090	0,091	0,100	0,112	0,132	0,150	0,172
3,1	0,005	0,077	0,073	0,070	0,070	0,065	0,065	0,066	0,072	0,092	0,105
3,3	0,005	0,055	0,055	0,060	0,057	0,066	0,068	0,071	0,077	0,078	0,084
3,5	0,005	0,065	0,062	0,067	0,065	0,063	0,063	0,063	0,066	0,073	0,078
3,7	0,005	0,054	0,052	0,059	0,064	0,061	0,058	0,055	0,055	0,057	0,058
3,9	0,034	0,074	0,075	0,070	0,075	0,077	0,069	0,069	0,070	0,076	0,079
4,1	0,016	0,044	0,048	0,052	0,065	0,065	0,059	0,057	0,055	0,056	0,058
4,3	0,016	0,042	0,049	0,047	0,050	0,047	0,047	0,047	0,047	0,049	0,049
4,5	0,005	0,029	0,036	0,035	0,037	0,035	0,033	0,033	0,034	0,041	0,043
4,7	0,004	0,025	0,025	0,027	0,029	0,028	0,029	0,030	0,033	0,037	0,039
4,9	0,004	0,024	0,022	0,023	0,025	0,027	0,029	0,031	0,033	0,036	0,037
5,1	0,036	0,011	0,010	0,013	0,010	0,013	0,006	0,014	0,021	0,028	0,014
5,3	0,032	0,018	0,020	0,017	0,018	0,017	0,020	0,022	0,022	0,025	0,025
5,5	0,036	0,017	0,022	0,019	0,019	0,019	0,019	0,019	0,019	0,024	0,028
5,7	0,028	0,017	0,021	0,018	0,018	0,022	0,019	0,020	0,022	0,026	0,027
5,9	0,039	0,026	0,023	0,043	0,021	0,043	0,022	0,027	0,034	0,034	0,031
6,1	0,028	0,024	0,024	0,040	0,033	0,024	0,034	0,028	0,029	0,026	0,029
6,3	0,027	0,023	0,022	0,031	0,032	0,021	0,031	0,017	0,017	0,022	0,028
6,5	0,024	0,016	0,016	0,018	0,019	0,016	0,018	0,016	0,021	0,020	0,021
6,7	0,030	0,017	0,018	0,015	0,022	0,015	0,019	0,019	0,020	0,022	0,024
6,9	0,033	0,015	0,016	0,015	0,017	0,012	0,018	0,014	0,015	0,021	0,024
7,1	0,037	0,016	0,017	0,015	0,017	0,016	0,014	0,020	0,024	0,026	0,026
7,3	0,028	0,014	0,018	0,017	0,018	0,019	0,019	0,021	0,024	0,024	0,030
7,5	0,018	0,014	0,016	0,016	0,018	0,014	0,020	0,020	0,018	0,018	0,024
7,7	0,026	0,013	0,015	0,014	0,016	0,016	0,017	0,013	0,017	0,017	0,018
7,9	0,022	0,012	0,013	0,012	0,015	0,012	0,015	0,016	0,015	0,015	0,015
8,1	0,017	0,009	0,014	0,011	0,014	0,011	0,013	0,016	0,017	0,016	0,018
8,3	0,014	0,008	0,012	0,011	0,014	0,009	0,013	0,010	0,012	0,014	0,017
8,5	0,014	0,008	0,013	0,014	0,010	0,014	0,010	0,016	0,022	0,023	0,019
8,7	0,014	0,010	0,017	0,016	0,016	0,014	0,018	0,016	0,016	0,016	0,021
8,9	0,009	0,008	0,011	0,014	0,015	0,008	0,015	0,012	0,009	0,011	0,015

Note:

The normalization current is 159,420A.

The harmonics, interharmonics and higher frequencies are maximum values of all three phases.

4.8	EMC and power quality Harmonic current emission (EN 61000-4-7)	P

The currents of the interharmonics to 2 kHz must be measured in accordance with DIN EN 61000-4-7 (VDE 0817-4-7), Annex A, The measurements of higher-frequency harmonic currents between 2 kHz and 9 kHz must be conducted in line with DIN EN 61000-4-7 (VDE 0847-4-7), Annex B.

Test result: ASW110K-LT

Harmonics

P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
Order	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
1	2,428	10,084	20,688	30,507	41,182	50,189	60,746	70,487	81,179	90,262	99,802
2	0,014	0,016	0,021	0,023	0,025	0,030	0,036	0,040	0,049	0,059	0,063
3	0,140	0,288	0,319	0,379	0,421	0,442	0,432	0,424	0,428	0,468	0,656
4	0,124	0,230	0,240	0,324	0,354	0,365	0,383	0,403	0,452	0,478	0,573
5	0,130	0,215	0,183	0,189	0,169	0,164	0,159	0,155	0,151	0,147	0,202
6	0,048	0,103	0,088	0,109	0,130	0,144	0,162	0,187	0,315	0,329	0,360
7	0,087	0,065	0,086	0,087	0,081	0,077	0,081	0,081	0,068	0,064	0,038
8	0,128	0,239	0,227	0,262	0,252	0,244	0,243	0,240	0,306	0,311	0,413
9	0,038	0,025	0,056	0,065	0,057	0,056	0,075	0,097	0,177	0,204	0,292
10	0,134	0,213	0,180	0,181	0,168	0,165	0,150	0,142	0,154	0,155	0,286
11	0,091	0,108	0,102	0,115	0,120	0,112	0,100	0,094	0,091	0,085	0,112
12	0,178	0,168	0,132	0,144	0,127	0,115	0,110	0,114	0,113	0,111	0,255
13	0,047	0,030	0,027	0,039	0,043	0,052	0,049	0,043	0,031	0,038	0,037
14	0,152	0,221	0,214	0,223	0,212	0,204	0,203	0,206	0,269	0,268	0,325
15	0,031	0,033	0,039	0,054	0,097	0,122	0,150	0,172	0,208	0,234	0,291
16	0,080	0,140	0,157	0,150	0,142	0,141	0,138	0,136	0,185	0,187	0,382
17	0,407	0,560	0,544	0,555	0,565	0,547	0,549	0,568	0,608	0,621	0,591
18	0,039	0,057	0,095	0,091	0,109	0,119	0,123	0,132	0,167	0,166	0,377
19	0,362	0,537	0,468	0,472	0,436	0,441	0,453	0,445	0,432	0,450	0,788
20	0,130	0,146	0,164	0,171	0,175	0,173	0,168	0,173	0,225	0,230	0,383
21	0,062	0,031	0,042	0,058	0,081	0,103	0,113	0,130	0,135	0,154	0,226
22	0,076	0,175	0,165	0,174	0,164	0,156	0,152	0,152	0,169	0,182	0,193
23	0,107	0,197	0,305	0,294	0,352	0,394	0,416	0,438	0,522	0,549	0,295
24	0,103	0,163	0,106	0,122	0,101	0,086	0,068	0,074	0,085	0,090	0,268
25	0,166	0,422	0,506	0,534	0,590	0,594	0,628	0,648	0,588	0,575	0,397
26	0,080	0,047	0,042	0,039	0,051	0,061	0,074	0,083	0,108	0,118	0,303
27	0,041	0,068	0,050	0,054	0,044	0,057	0,100	0,135	0,166	0,209	0,247
28	0,064	0,082	0,099	0,105	0,125	0,134	0,133	0,135	0,163	0,171	0,198
29	0,112	0,083	0,046	0,069	0,107	0,139	0,174	0,202	0,253	0,291	0,271
30	0,060	0,159	0,170	0,177	0,177	0,180	0,173	0,171	0,234	0,233	0,209
31	0,040	0,140	0,243	0,264	0,346	0,407	0,464	0,524	0,514	0,551	0,172
32	0,063	0,098	0,072	0,080	0,079	0,081	0,084	0,092	0,136	0,141	0,158
33	0,025	0,069	0,067	0,078	0,069	0,068	0,084	0,101	0,140	0,149	0,189
34	0,073	0,026	0,029	0,029	0,047	0,070	0,092	0,107	0,134	0,146	0,164
35	0,049	0,120	0,112	0,099	0,103	0,126	0,153	0,182	0,181	0,204	0,158
36	0,037	0,082	0,097	0,098	0,105	0,117	0,129	0,140	0,192	0,204	0,132
37	0,022	0,026	0,073	0,102	0,149	0,174	0,202	0,229	0,241	0,271	0,174
38	0,018	0,086	0,076	0,076	0,078	0,081	0,087	0,091	0,109	0,105	0,109
39	0,048	0,034	0,040	0,045	0,043	0,050	0,068	0,088	0,091	0,105	0,132
40	0,061	0,056	0,048	0,048	0,043	0,045	0,051	0,059	0,068	0,077	0,101
41	0,028	0,111	0,100	0,093	0,086	0,094	0,109	0,123	0,127	0,146	0,197

42	0,042	0,063	0,076	0,082	0,085	0,083	0,074	0,066	0,101	0,104	0,048
43	0,049	0,057	0,036	0,042	0,079	0,101	0,117	0,125	0,124	0,125	0,160
44	0,026	0,065	0,070	0,069	0,072	0,068	0,064	0,063	0,056	0,060	0,097
45	0,049	0,026	0,032	0,037	0,043	0,040	0,043	0,050	0,082	0,085	0,169
46	0,035	0,063	0,061	0,065	0,057	0,050	0,047	0,048	0,065	0,066	0,131
47	0,043	0,082	0,093	0,089	0,088	0,091	0,102	0,107	0,098	0,098	0,149
48	0,020	0,023	0,044	0,045	0,063	0,074	0,079	0,078	0,090	0,081	0,046
49	0,056	0,089	0,054	0,044	0,031	0,043	0,059	0,077	0,072	0,083	0,071
50	0,025	0,036	0,047	0,046	0,050	0,050	0,056	0,065	0,062	0,068	0,079
Interharmonics											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [Hz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
75	0,024	0,044	0,046	0,054	0,070	0,085	0,088	0,106	0,115	0,126	0,127
125	0,033	0,056	0,067	0,073	0,078	0,086	0,102	0,101	0,123	0,130	0,136
175	0,025	0,039	0,040	0,047	0,049	0,049	0,062	0,065	0,069	0,082	0,077
225	0,029	0,043	0,044	0,046	0,052	0,057	0,062	0,070	0,080	0,078	0,073
275	0,024	0,037	0,038	0,038	0,043	0,046	0,057	0,058	0,060	0,075	0,069
325	0,026	0,039	0,036	0,042	0,044	0,048	0,053	0,056	0,063	0,058	0,061
375	0,026	0,039	0,040	0,045	0,047	0,049	0,052	0,050	0,060	0,066	0,066
425	0,021	0,034	0,033	0,036	0,038	0,040	0,043	0,043	0,048	0,053	0,058
475	0,019	0,029	0,025	0,027	0,026	0,028	0,031	0,033	0,034	0,034	0,039
525	0,029	0,041	0,041	0,039	0,037	0,039	0,044	0,043	0,051	0,043	0,054
575	0,021	0,031	0,033	0,031	0,032	0,032	0,035	0,038	0,047	0,056	0,046
625	0,026	0,037	0,036	0,038	0,035	0,037	0,040	0,041	0,048	0,047	0,052
675	0,024	0,035	0,034	0,039	0,039	0,041	0,042	0,041	0,049	0,050	0,066
725	0,023	0,034	0,033	0,035	0,038	0,038	0,039	0,040	0,045	0,046	0,055
775	0,028	0,043	0,041	0,043	0,042	0,042	0,050	0,053	0,054	0,058	0,064
825	0,029	0,041	0,046	0,043	0,044	0,044	0,048	0,050	0,054	0,058	0,069
875	0,031	0,051	0,054	0,051	0,057	0,056	0,053	0,059	0,071	0,086	0,065
925	0,028	0,048	0,051	0,054	0,058	0,061	0,060	0,060	0,076	0,092	0,053
975	0,020	0,030	0,030	0,033	0,032	0,034	0,037	0,040	0,045	0,051	0,065
1025	0,020	0,029	0,030	0,029	0,032	0,034	0,035	0,039	0,044	0,050	0,050
1075	0,028	0,045	0,038	0,037	0,038	0,038	0,038	0,041	0,045	0,050	0,062
1125	0,030	0,046	0,042	0,043	0,045	0,044	0,044	0,043	0,050	0,058	0,058
1175	0,029	0,044	0,045	0,041	0,044	0,050	0,060	0,068	0,081	0,086	0,062
1225	0,031	0,043	0,039	0,036	0,039	0,046	0,053	0,055	0,067	0,078	0,054
1275	0,019	0,029	0,028	0,031	0,032	0,033	0,034	0,037	0,045	0,053	0,057
1325	0,018	0,027	0,026	0,026	0,028	0,031	0,033	0,036	0,040	0,045	0,058
1375	0,020	0,040	0,037	0,033	0,035	0,039	0,044	0,051	0,055	0,068	0,056
1425	0,020	0,036	0,038	0,035	0,040	0,042	0,044	0,049	0,062	0,079	0,051
1475	0,024	0,041	0,040	0,036	0,034	0,036	0,044	0,046	0,058	0,057	0,058
1525	0,022	0,042	0,035	0,034	0,033	0,036	0,036	0,042	0,045	0,049	0,062
1575	0,017	0,022	0,021	0,023	0,025	0,027	0,027	0,030	0,038	0,050	0,048
1625	0,016	0,023	0,022	0,023	0,023	0,025	0,027	0,030	0,037	0,045	0,049
1675	0,019	0,030	0,028	0,028	0,031	0,034	0,039	0,040	0,044	0,051	0,050
1725	0,020	0,025	0,029	0,029	0,034	0,037	0,037	0,042	0,046	0,054	0,044
1775	0,023	0,032	0,031	0,031	0,029	0,030	0,034	0,037	0,043	0,038	0,055
1825	0,022	0,031	0,027	0,028	0,028	0,031	0,038	0,042	0,039	0,043	0,047
1875	0,017	0,019	0,018	0,021	0,020	0,021	0,023	0,026	0,029	0,034	0,047
1925	0,016	0,019	0,019	0,020	0,021	0,023	0,025	0,027	0,034	0,042	0,043

1975	0,018	0,023	0,024	0,024	0,027	0,028	0,033	0,036	0,041	0,038	0,050
Higher Frequencies											
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100
f [kHz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2,1	0,078	0,142	0,135	0,144	0,158	0,167	0,175	0,183	0,187	0,199	0,251
2,3	0,085	0,103	0,116	0,119	0,133	0,143	0,151	0,154	0,161	0,156	0,249
2,5	0,080	0,109	0,093	0,095	0,100	0,108	0,121	0,133	0,130	0,143	0,142
2,7	0,071	0,089	0,101	0,100	0,102	0,103	0,119	0,136	0,144	0,160	0,175
2,9	0,060	0,090	0,080	0,076	0,080	0,088	0,099	0,113	0,128	0,154	0,166
3,1	0,050	0,064	0,061	0,059	0,056	0,056	0,058	0,065	0,078	0,091	0,130
3,3	0,049	0,049	0,057	0,054	0,057	0,059	0,061	0,069	0,073	0,074	0,097
3,5	0,043	0,052	0,052	0,055	0,054	0,055	0,056	0,059	0,065	0,069	0,075
3,7	0,035	0,052	0,048	0,053	0,054	0,051	0,046	0,047	0,051	0,051	0,067
3,9	0,055	0,066	0,065	0,066	0,069	0,064	0,061	0,062	0,068	0,070	0,075
4,1	0,028	0,040	0,046	0,051	0,055	0,054	0,049	0,047	0,051	0,053	0,055
4,3	0,029	0,040	0,043	0,045	0,044	0,044	0,044	0,043	0,044	0,045	0,051
4,5	0,018	0,027	0,031	0,033	0,032	0,031	0,030	0,031	0,037	0,039	0,046
4,7	0,015	0,023	0,024	0,025	0,026	0,027	0,029	0,031	0,033	0,035	0,044
4,9	0,015	0,021	0,020	0,023	0,024	0,026	0,027	0,030	0,032	0,034	0,040
5,1	0,012	0,006	0,008	0,003	0,004	0,010	0,014	0,010	0,008	0,017	0,033
5,3	0,016	0,016	0,015	0,014	0,014	0,016	0,018	0,019	0,020	0,022	0,029
5,5	0,017	0,015	0,014	0,016	0,017	0,016	0,019	0,020	0,020	0,024	0,033
5,7	0,020	0,014	0,015	0,017	0,016	0,020	0,019	0,019	0,022	0,023	0,025
5,9	0,039	0,018	0,021	0,023	0,021	0,027	0,030	0,025	0,023	0,028	0,036
6,1	0,022	0,026	0,022	0,024	0,036	0,026	0,022	0,024	0,026	0,023	0,026
6,3	0,019	0,023	0,019	0,030	0,028	0,018	0,017	0,022	0,023	0,020	0,025
6,5	0,014	0,014	0,014	0,017	0,016	0,016	0,017	0,016	0,017	0,020	0,022
6,7	0,014	0,016	0,014	0,016	0,019	0,013	0,016	0,019	0,018	0,019	0,027
6,9	0,011	0,012	0,011	0,011	0,014	0,013	0,013	0,016	0,017	0,019	0,030
7,1	0,015	0,012	0,011	0,016	0,012	0,013	0,016	0,018	0,018	0,026	0,034
7,3	0,017	0,015	0,012	0,014	0,015	0,016	0,020	0,020	0,023	0,025	0,025
7,5	0,012	0,015	0,012	0,016	0,016	0,013	0,016	0,019	0,020	0,019	0,016
7,7	0,014	0,011	0,010	0,009	0,012	0,013	0,015	0,016	0,016	0,015	0,024
7,9	0,011	0,012	0,011	0,012	0,013	0,013	0,012	0,013	0,013	0,015	0,020
8,1	0,010	0,008	0,007	0,010	0,011	0,010	0,012	0,013	0,015	0,016	0,015
8,3	0,008	0,006	0,006	0,009	0,010	0,009	0,010	0,011	0,014	0,013	0,013
8,5	0,013	0,007	0,007	0,008	0,007	0,010	0,014	0,012	0,012	0,017	0,013
8,7	0,013	0,008	0,009	0,009	0,014	0,013	0,015	0,016	0,018	0,017	0,013
8,9	0,007	0,010	0,007	0,012	0,012	0,010	0,009	0,011	0,012	0,011	0,008

Note:

The normalization current is 175,362A.

The harmonics, interharmonics and higher frequencies are maximum values of all three phases.

4.8 EMC and power quality Switching operation (Rapid voltage changes)	P

The purpose of the test is to determine k_i and k_{imax}.

The following three cases must be tested (where applicable).

- Switch-on for any capacity
- Unfavourable case when switching the generator step
- Switch-on for nominal capacity
  Note: For PV-plants the inverter is the generator
- Switch-off for nominal capacity (no emergency shutdown, but operative shutdown)

If the manufacturer knows more critical cases (e.g. different cos φ parameters) then these additional have to be tested

Test conditions:

Frequency: 50 Hz ± 0,5%

THD of the voltage supply: ≤ 3 %

Voltage rise of the PGU at 100 P_{Emax} %: ≤ 3 %

Test: ASW75K-LT

Switch-on for any capacity (10% P_{Emax})

Phase	L1			L2			L3		
Single period effective values of the current [A]	17,10	22,20	18,78	23,01	18,78	23,27	18,60	19,85	20,30
Single period effective values of the voltage [V]	227,74	229,69	229,14	229,03	229,96	227,72	230,28	227,35	230,27
k_i value [1]	0,157	0,204	0,173	0,212	0,173	0,214	0,171	0,183	0,187
k_{imax} value [1]	0,214								

Unfavourable case when switching the generator step (not necessary for electronic inverter)

Phase	L1			L2			L3		
Single period effective values of the current [A]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Single period effective values of the voltage [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
k_i value [1]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
k_{imax} value [1]	N/A								

Switch-on for nominal capacity

Phase	L1			L2			L3		
Single period effective values of the current [A]	14,01	12,43	12,96	13,81	10,09	12,91	18,08	12,32	11,36
Single period effective values of the voltage [V]	230,27	230,35	228,67	227,63	229,22	230,22	229,29	228,24	228,63
k_i value [1]	0,129	0,114	0,119	0,127	0,093	0,119	0,166	0,113	0,105

4.8 EMC and power quality Switching operation (Rapid voltage changes)									P
k_{imax} value [1]	0,166								
Switch-off for nominal capacity									
Phase	**L1**			**L2**			**L3**		
Single period effective values of the current [A]	5,10	20,24	10,47	10,60	12,03	16,60	15,12	8,59	6,58
Single period effective values of the voltage [V]	222,37	223,89	223,14	224,06	223,64	223,95	224,39	223,76	223,88
k_i value [1]	0,047	0,186	0,096	0,098	0,111	0,153	0,139	0,079	0,061
k_{imax} value [1]	0,186								
Grid Frequency [Hz]	50,0								
Grid voltage [V]	230,0								
Rated current I_r [A]	108,70								
Highest k_{imax} value for all switching operations [1]	0,214								
Test: ASW110K-LT									
Switch-on for any capacity (10% P_{Emax})									
Phase	**L1**			**L2**			**L3**		
Single period effective values of the current [A]	9,78	15,99	12,40	13,67	13,75	16,24	13,35	10,80	14,11
Single period effective values of the voltage [V]	228,69	228,60	228,77	228,44	230,27	226,31	230,72	228,36	231,69
k_i value [1]	0,056	0,091	0,071	0,078	0,078	0,093	0,076	0,062	0,080
k_{imax} value [1]	0,093								
Unfavourable case when switching the generator step (not necessary for electronic inverter)									
Phase	**L1**			**L2**			**L3**		
Single period effective values of the current [A]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Single period effective values of the voltage [V]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
k_i value [1]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
k_{imax} value [1]	N/A								
Switch-on for nominal capacity									
Phase	**L1**			**L2**			**L3**		

4.8 EMC and power quality Switching operation (Rapid voltage changes)									P
Single period effective values of the current [A]	12,76	12,84	10,78	14,27	11,90	13,49	8,96	10,87	9,66
Single period effective values of the voltage [V]	227,66	229,47	228,02	229,86	230,17	229,74	229,58	228,31	230,49
k_i value [1]	0,073	0,073	0,061	0,081	0,068	0,077	0,051	0,062	0,055
k_{imax} value [1]	0,081								
Switch-off for nominal capacity									
Phase	**L1**			**L2**			**L3**		
Single period effective values of the current [A]	25,93	29,22	10,64	9,45	6,25	16,34	16,85	23,48	26,73
Single period effective values of the voltage [V]	222,41	222,50	221,61	222,25	222,36	223,15	222,83	223,17	223,59
k_i value [1]	0,148	0,167	0,061	0,054	0,036	0,093	0,096	0,134	0,152
k_{imax} value [1]	0,167								

Grid Frequency [Hz]	50,0
Grid voltage [V]	230,0
Rated current I_r [A]	175,36
Highest k_{imax} value for all switching operations [1]	0,167

Note:

Limits:

k_{imax} = 1,2 for synchronous generators with fine synchronization, converter; (electronic inverter)

k_{imax} = 4 for asynchronous generators, which are switched on at 95% to 105% of their synchronous speed, if no further details are available regarding the type of current limitation. With regard to short-term compensation processes, the condition mentioned below for very short voltage changes must also be observed.

K_{imax} = 8 for asynchronous generators that are powered up by the network if I_a is unknown. (I_a = starting current)

The tests had been performed on the ASW75K-LT and ASW110K-LT are valid for the ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.8	Voltage fluctuation and flicker	P

Test result:

Test conditions:	Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100 % power) and flicker as per EN 61000-3-3 and/or EN 61000-3-11.

Test:

Value		P_{st}	P_{lt} 2 hours	d(t) $_{500ms}$	d_c	d_{max}
Limit		1,0	0,65	3,3%	3,3%	4%
Test value	**L1**	0,342	0,310	0,000	0,171	0,61
	L2	0,257	0,254	0,000	0,142	0,587
	L3	0,252	0,251	0,000	0,127	0,573

Note:

*The stationary deviance of dc% is more relevant than the dynamic deviance of dmax at starting and stopping, Mains Impedance according EN61000-3-11:

Rmax = 0,24Ω; jXmax= 0,15Ω @50Hz (|Zmax| = 0,283Ω) for single phase inverter use also

R_n = 0,16Ω; jX_n= 0,1Ω.

Calculation of the maximum permissible grid impedance at the point of common coupling based on dc:

$Z_{max} = Z_{ref}$ * 3,3% / $d_c(P_n)$.

The tests should be based on the limits of the EN 61000-3-11 for more than 16A.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.8 Voltage fluctuation and flicker

Test:

Method: Measurement was carried out according to the procedure in IEC 61400-21.

Grid impedance angle, ψ_k	30°	50°	70°	85°
Flicker coefficient, $c(\psi_k)$	0,081	0,121	0,148	0,157
Short-term flicker, P_{st}	0,039	0,058	0,072	0,076

Note:

The table entries are worst case values.

$S_{k,fic}/S_n$ in the fictitious grid was set to: 2

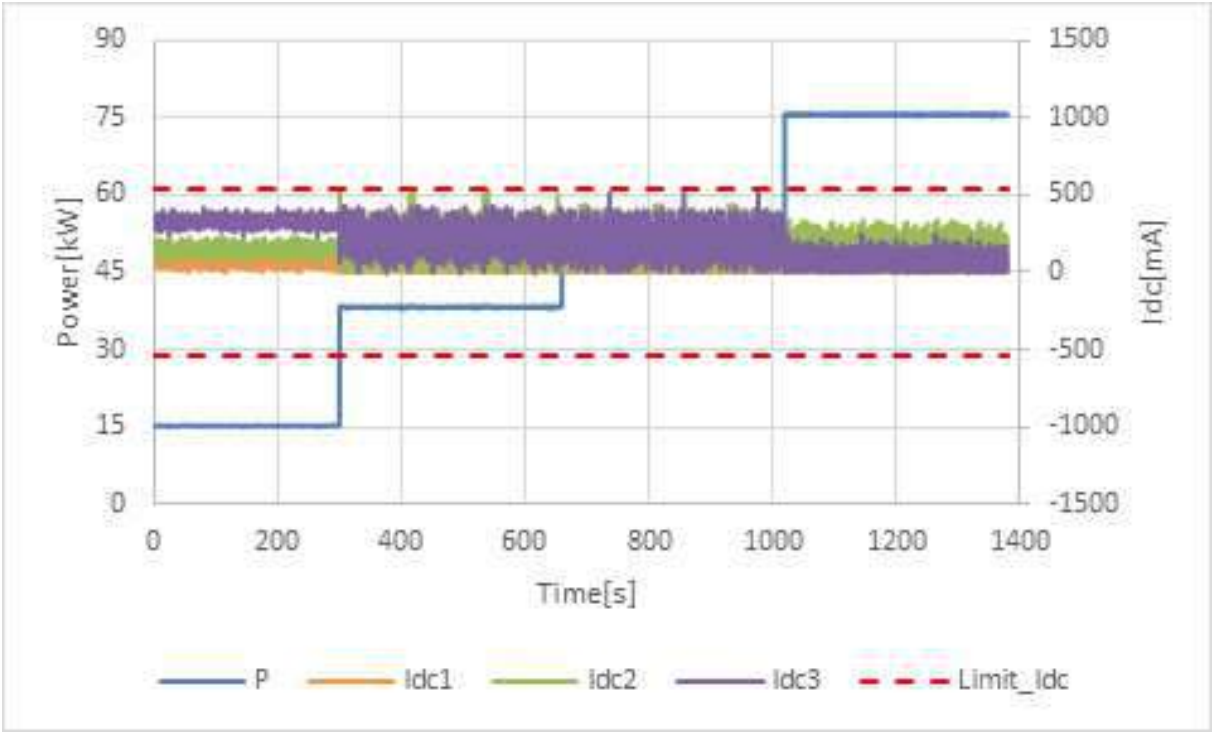
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.8	EMC and power quality DC-Injection	P

Test result: ASW75K-LT

Protection limit	Tested at four power levels limit 0,5% of $I_{AC;nom}$ (543,5mA)			
Output power	~20%	~50%	~75%	~100%
Abs. Max. Test Value:L1 [mA]	154,6	342,3	268,4	199,1
Abs. Ave. Test Value:L1 [mA]	74,9	79,7	67,7	53,5
Abs. Max. Test Value:L2 [mA]	238,4	526,5	432,7	339,2
Abs. Ave. Test Value:L2 [mA]	147,8	156,8	168,8	171,8
Abs. Max. Test Value:L3 [mA]	419,4	428,1	514,2	248,1
Abs. Ave. Test Value:L3 [mA]	330,1	229,5	201,2	71,1

Diagram of permanent dc-injection

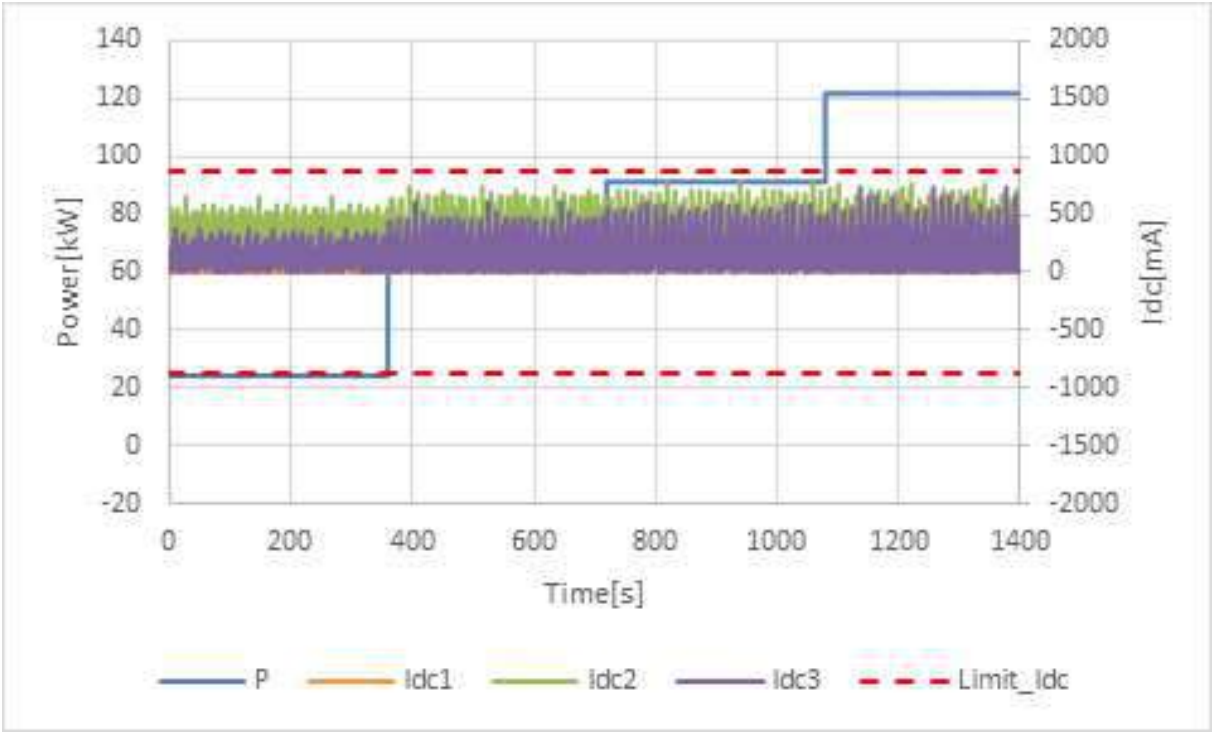


4.8	EMC and power quality DC-Injection	P

Test result: ASW110K-LT

Protection limit	Tested at four power levels limit 0,5% of $I_{AC;nom}$ (876,8mA)			
Output power	~20%	~50%	~75%	~100%
Abs. Max. Test Value:L1 [mA]	254,4	555,3	469,7	620,2
Abs. Ave. Test Value:L1 [mA]	65,8	152,7	169,5	196,5
Abs. Max. Test Value:L2 [mA]	651,5	739,4	772,3	754,1
Abs. Ave. Test Value:L2 [mA]	376,5	319,8	327,0	281,6
Abs. Max. Test Value:L3 [mA]	375,6	610,2	603,8	732,8
Abs. Ave. Test Value:L3 [mA]	144,4	176,7	220,6	227,3

Diagram of permanent dc-injection



Note:

Test method and setting value refer Annex D.3.10 of EN 50438:2013.

Testing must be performed according to WI 10.4.-03.doc rev D. The internal temperature of the EUT must be stabilized, No temperature drift of more than 2K within 1 hour is allowed.

The tests had been performed on the ASW75K-LT and ASW110K-LT are valid for the ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

4.8	Immunity to voltage dips and short interruptions				P
For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Phase 1					
Peak Short Circuit current	I_p	N/A	20ms	6,60Vac	0,00 A
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Phase 2					
Peak Short Circuit current	I_p	N/A	20ms	4,84Vac	0,00 A
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Phase 3					
Peak Short Circuit current	I_p	N/A	20ms	10,07Vac	0,00 A
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0,001s	In seconds

Note:

For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals.

* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software

4.8 Unbalance	P

Test:

P [%P_{max}]	P* [kW]	U_{1+}* [V]	U_{1-}* [V]	I_{1+}* [A]	I_{1-}* [A]	u_i* [% I_{1+}]	$u_{i\,abs}$* [% I_n]	Number of data sets
0 - 5	2,958	230,53	0,033	6,252	0,460	7,353	0,264	3
10	12,076	230,57	0,030	17,618	0,371	2,104	0,213	3
20	24,296	230,61	0,114	35,141	1,447	4,119	0,832	3
30	36,512	230,66	0,057	52,770	0,866	1,641	0,498	3
40	48,845	230,70	0,031	70,582	0,372	0,527	0,214	3
50	61,125	230,75	0,035	88,307	0,425	0,481	0,244	3
60	73,417	230,83	0,038	106,031	0,394	0,372	0,227	3
70	84,605	230,88	0,031	122,170	0,291	0,238	0,167	3
80	96,587	230,92	0,028	139,514	0,262	0,188	0,151	3
90	108,751	230,99	0,027	157,054	0,287	0,183	0,165	3
100	120,929	231,04	0,026	174,597	0,367	0,210	0,211	3

Maximum unsymmetry u_{imax} (≥10%Pn)	0,832

Note:

*1 min-average values of positive and negative sequence data.

The unsymmetry is calculated according to following equation:

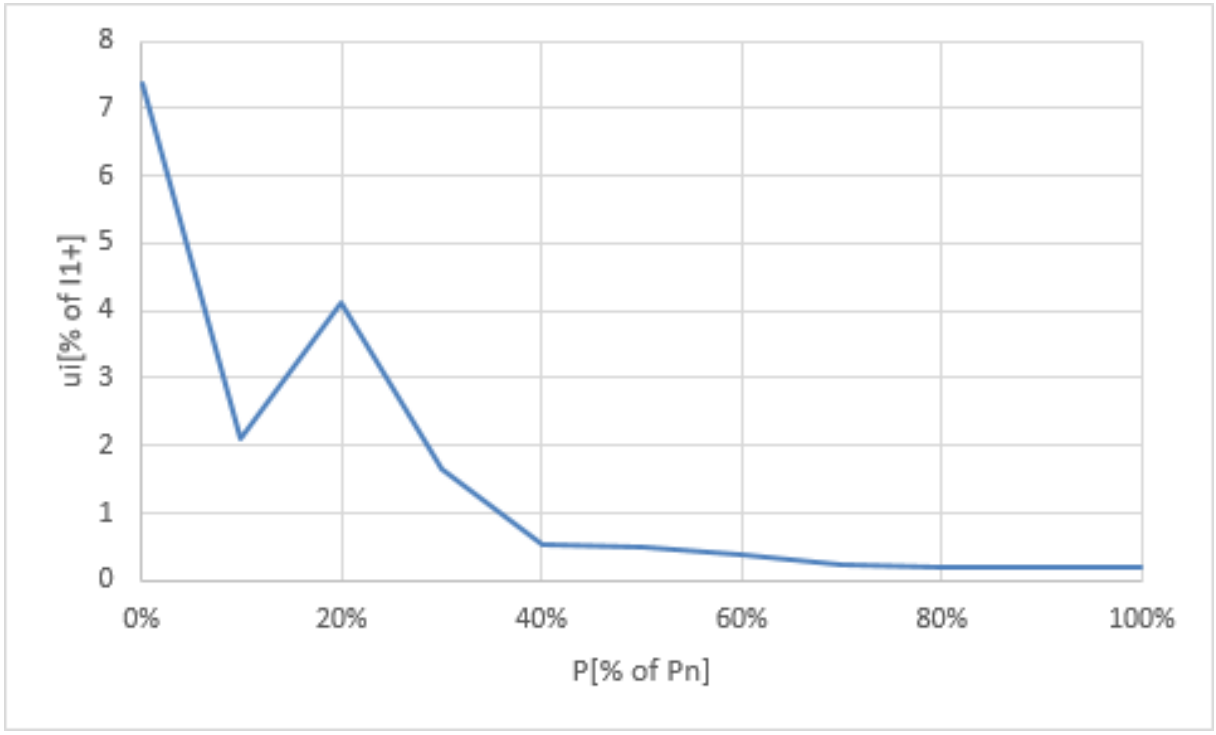
$$u_i = \frac{I_{1-}}{I_{1+}} \cdot 100\%$$

Additionally the unsymmetry is calculated relative to nominal current according to following equation:

$$u_{iabs} = \frac{I_{1-}}{I_n} \cdot 100\%$$

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software

Diagram



EN 50549-2:2019: Interface protection			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.9.3	Requirements on voltage and frequency protection	CEI 0-21: 2022-03, Annex A.3.1 to A.3.4	**P**
4.9.3.1	Undervoltage protection	EN 50438, Annex D.2.3	**P**
	Overvoltage protection	EN 50438, Annex D.2.3	**P**
	Overvoltage 10 min mean protection	EN 50160	**P**
	Underfrequency protection	EN 50438, Annex D.2.4	**P**
	Overfrequency protection	EN 50438, Annex D.2.4	**P**
4.9.4.2	Loss of Mains (LoM) detection	IEC 62116:2014	**P**

4.9.3	Requirements on voltage and frequency protection Checklist	P
Several points to check		
Clause 4.9.3.1 to 4.9.3.6	All thresholds must be adjustable	P

Voltage values						
Threshold	Stage 1 [27 <]		Stage 2 [27 <<]			
	Operate voltage	Operate time	Operate voltage	Operate time		
Range	0,2-1,0 U_n	0,1-100s	0,2-1,0 U_n	0,1-5s		
Steps	0,01 U_n	0,1 s	0,01 U_n	0,05s		
Threshold	Stage 1 [59 >]		Stage 2 [59 >>]		Overvoltage 10 min mean protection	
	Operate voltage	Operate time	Operate voltage	Operate time	Operate voltage	Operate time
Range	1,0-1,2 U_n	0,1-100s	1,0-1,3 U_n	0,1-5s	1,0-1,15 U_n	3s not adjustable
Steps	0,01 U_n	0,1s	0,01 U_n	0,05s	0,01 U_n	--

Frequency values				
Threshold	Stage 1 [81 <]		Stage 2 [81 <<]	
	Operate frequency	Operate time	Operate frequency	Operate time
Range	47,0-50,0Hz	0,1-100s	47,0-50,0Hz	0,1-5s
Steps	0,1 Hz	0,1 s	0,1 Hz	0,05s
Threshold	Stage 1 [81 >]		Stage 2 [81 >>]	
	Operate frequency	Operate time	Operate frequency	Operate time
Range	50,0-52,0Hz	0,1-100s	50,0-52,0Hz	0,1-5s
Steps	0,1 Hz	0,1 s	0,1 Hz	0,05s

4.9.2.6	Insensitive against 40ms frequency transients, so that the unit will not trip	P
Note:		

4.9.3 4.9.3.1	Requirements on voltage and frequency protection General (Interface protection: Over/under voltage) (Setting value refer EN 50549-2 for default settings)	P

Test conditions			Output power: 121kW Frequency: 50+/-0,2Hz		
Phase	**Limit [V]**	**Trip value [V]**	**Voltage step [V]**	**Disconnection time [s]**	**Limit [s]**
L1	Stage 1 115% of U_n = 264,5	263,2	230 to 269	0,135	≤3,0s
		263,3	230 to 269	0,131	
		263,4	230 to 269	0,146	
		263,8	230 to 269	0,140	
		266,1	230 to 269	0,138	
	Stage 2 125% of U_n = 287,5	287,1	230 to 292	0,138	0,1s ≤ t ≤ 0,2s
		287,3	230 to 292	0.142	
		287,5	230 to 292	0,133	
		287,5	230 to 292	0,126	
		287,2	230 to 292	0,130	
	Stage 1 80% of U_n = 184	183,5	230 to 179	2,034	2,0s ≤ t ≤ 5,0s
		183,4	230 to 179	2,011	
		183,7	230 to 179	2,044	
		183,9	230 to 179	2,025	
		183,2	230 to 179	2,030	
	Stage 2 50% of U_n = 115	115,8	230 to 110	1,020	0,1s ≤ t ≤ 2,0s
		115,5	230 to 110	1,020	
		115,7	230 to 110	1,030	
		115,3	230 to 110	1,020	
		115,6	230 to 110	1,037	
L2	Stage 1 115% of U_n = 264,5	264,8	230 to 269	0,152	≤3,0s
		264,8	230 to 269	0,149	
		264,7	230 to 269	0,137	
		264,3	230 to 269	0,149	
		264,5	230 to 269	0,137	
	Stage 2 125% of U_n = 287,5	287,5	230 to 292	0,134	0,1s ≤ t ≤ 0,2s
		287,4	230 to 292	0,121	
		287,1	230 to 292	0,133	
		287,8	230 to 292	0,114	
		287,6	230 to 292	0,145	
	Stage 1 80% of U_n = 184	185,2	230 to 179	2,026	2,0s ≤ t ≤ 5,0s
		185,3	230 to 179	2,024	
		185,2	230 to 179	2,022	
		185,8	230 to 179	2,018	
		185,2	230 to 179	2,028	
	Stage 2 50% of U_n = 115	115,3	230 to 110	1,025	0,1s ≤ t ≤ 2,0s
		115,2	230 to 110	1,028	
		115,6	230 to 110	1,040	
		115,9	230 to 110	1,032	
		115,5	230 to 110	1,034	

4.9.3 4.9.3.1	Requirements on voltage and frequency protection General (Interface protection: Over/under voltage) (Setting value refer EN 50549-2 for default settings)	P

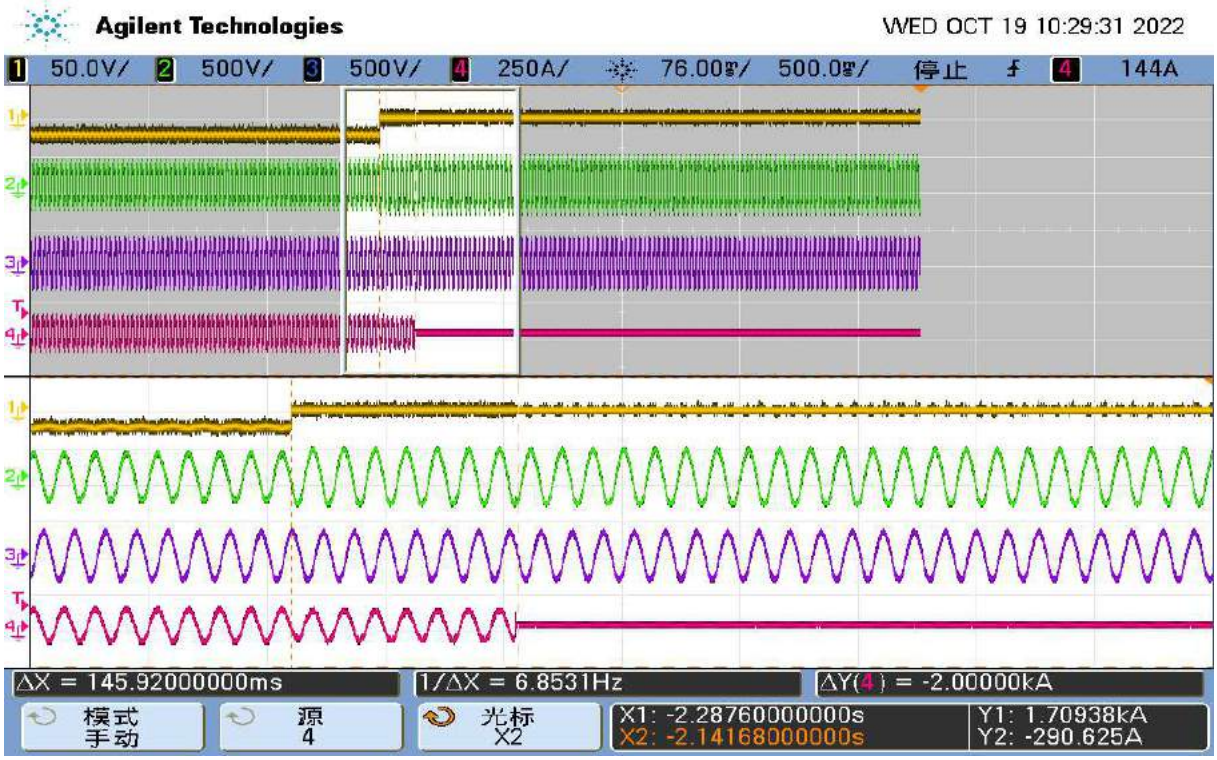
Test conditions			Output power: 121kW Frequency: 50+/-0,2Hz		
Phase	**Limit [V]**	**Trip value [V]**	**Voltage step [V]**	**Disconnection time [s]**	**Limit [s]**
L3	Stage 1 115% of U_n = 264,5	263,3	230 to 269	0,137	≤3,0s
		264,9	230 to 269	0,152	
		263,6	230 to 269	0,137	
		263,8	230 to 269	0,143	
		263,7	230 to 269	0,144	
	Stage 2 125% of U_n = 287,5	287,1	230 to 292	0,128	0,1s ≤ t ≤ 0,2s
		287,9	230 to 292	0,150	
		287,6	230 to 292	0,150	
		287,5	230 to 292	0,142	
		287,4	230 to 292	0,156	
	Stage 1 80% of U_n = 184	185,2	230 to 179	2,020	2,0s ≤ t ≤ 5,0s
		185,3	230 to 179	2,030	
		185,7	230 to 179	2,024	
		185,1	230 to 179	2,030	
		185,1	230 to 179	2,040	
	Stage 2 50% of U_n = 115	115,5	230 to 110	1,029	0,1s ≤ t ≤ 2,0s
		115,9	230 to 110	1,024	
		115,3	230 to 110	1,032	
		115,8	230 to 110	1,042	
		115,2	230 to 110	1,028	

Note:

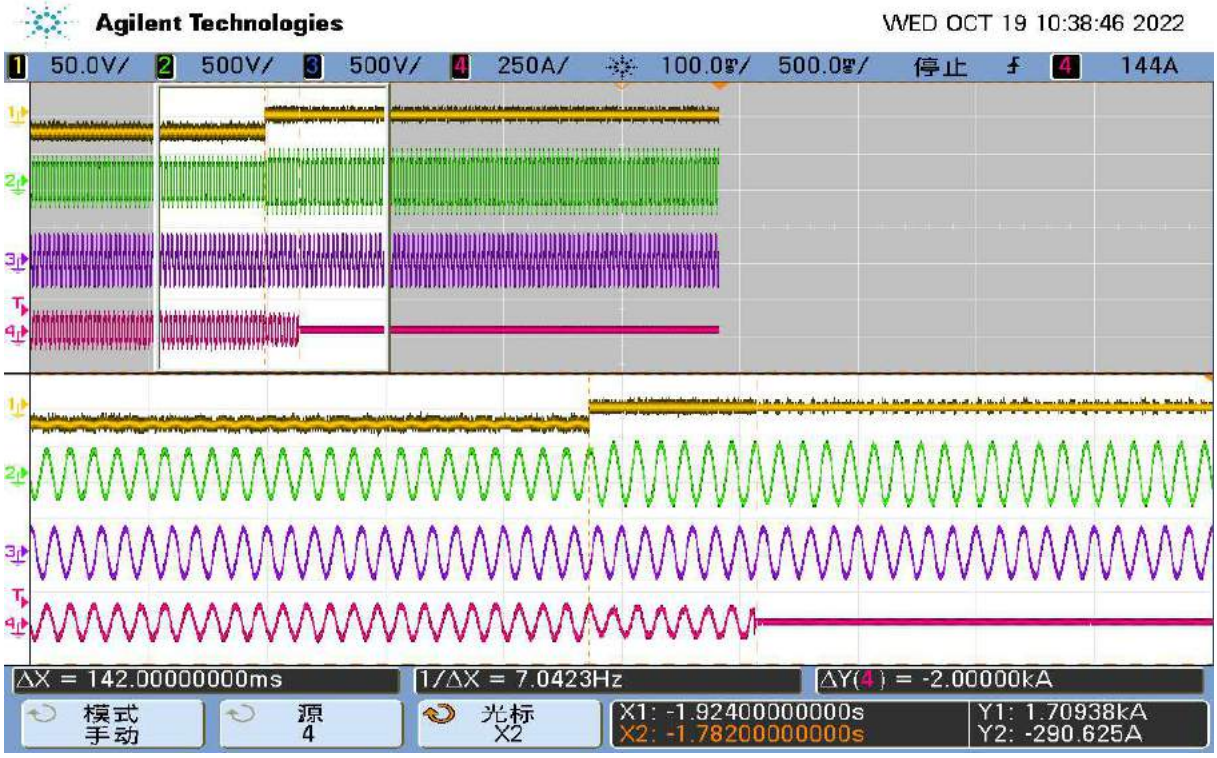
The trip values were evaluated by varying the applied voltage from U_n down to $U_{th\text{-}low}$ - 2% of U_n in steps of 0,5% of U_n for under-voltage testing as well as from U_n up to $U_{th\text{-}high}$ + 2% of U_n in steps of 0,5% of U_n for over-voltage testing, Lower and upper threshold voltage shall not fall or rise below or above 2,3V of the trip value itself, The disconnection time was measured by application of a negative voltage step from U_n to the operate value -5% of U_n as well as positive voltage step from U_n to the operate value +5% of U_n.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software

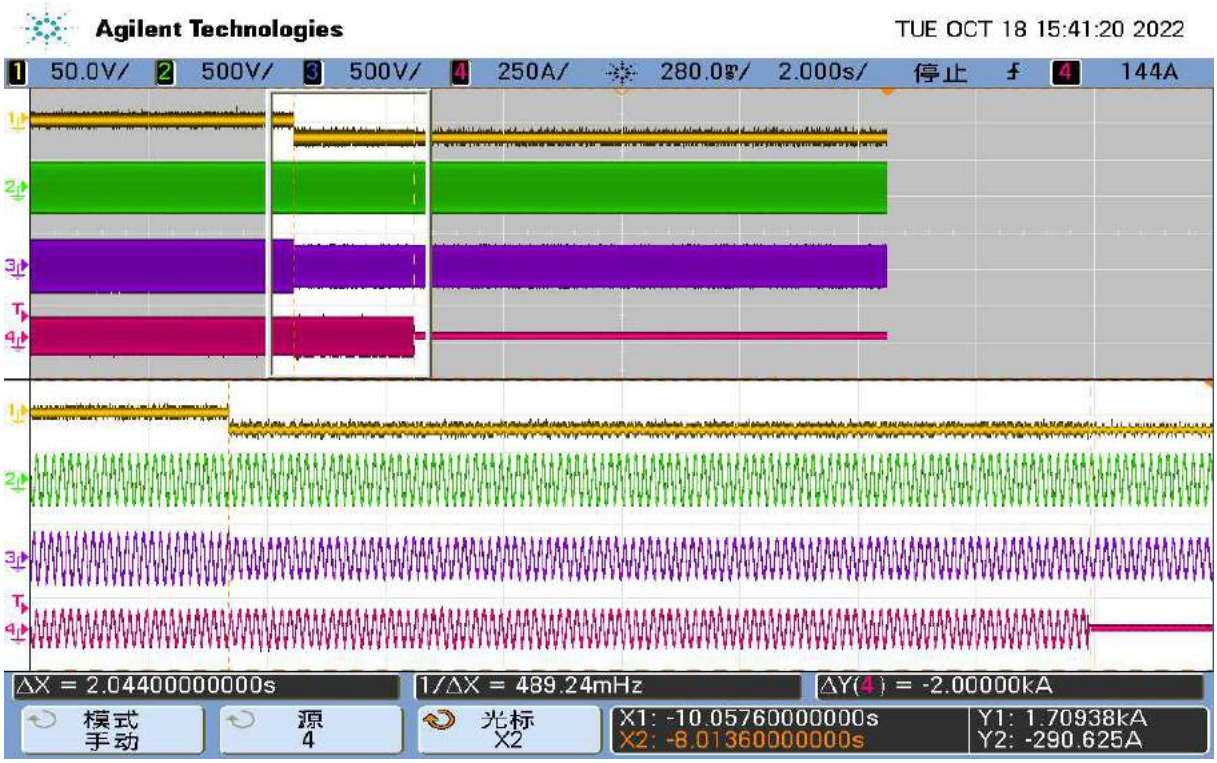
Scope pictures of the disconnection time
Over voltage - Stage 1 (L1 Phase)



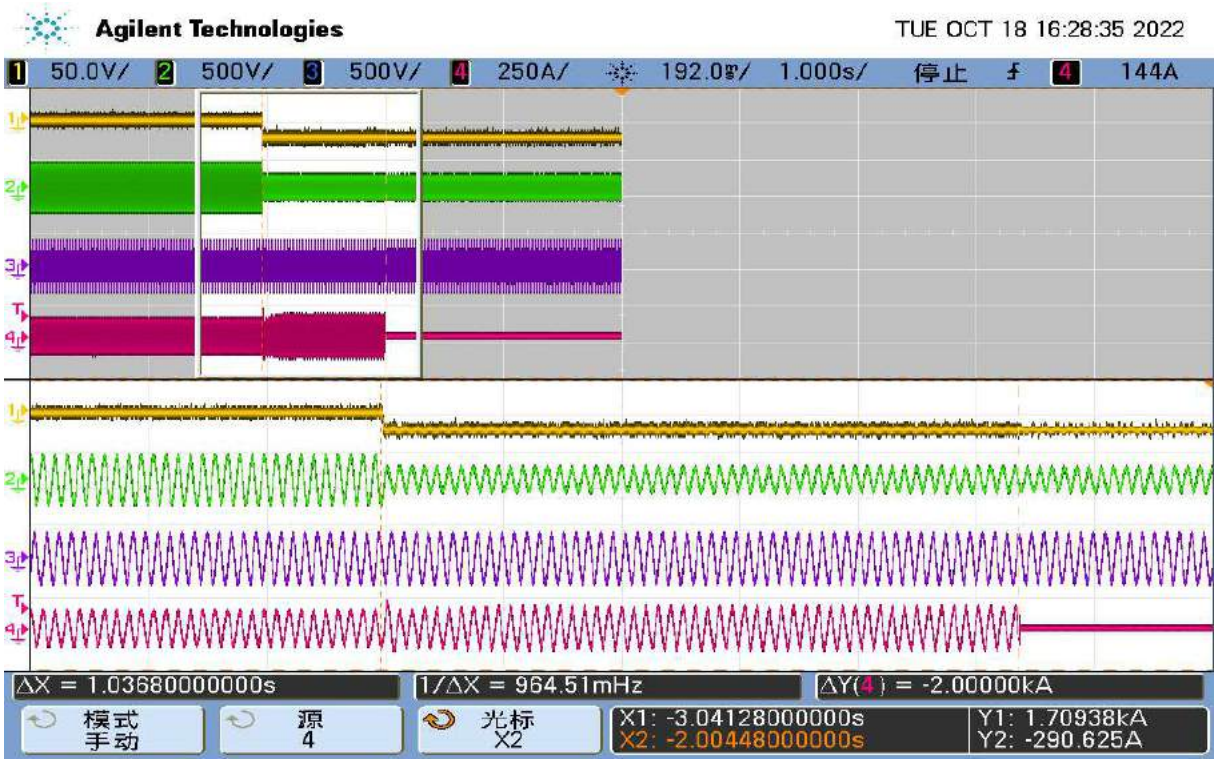
Over voltage - Stage 2 (L1 Phase)



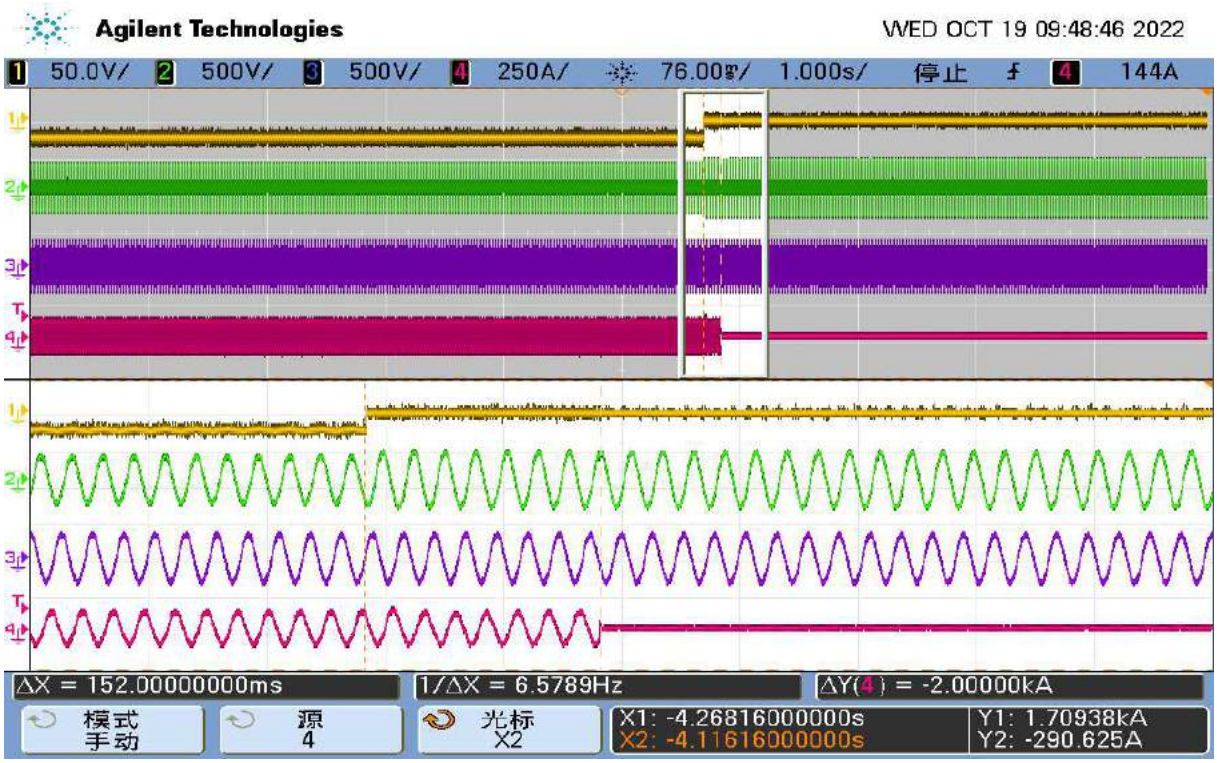
Scope pictures of the disconnection time
Under voltage - Stage 1 (L1 Phase)



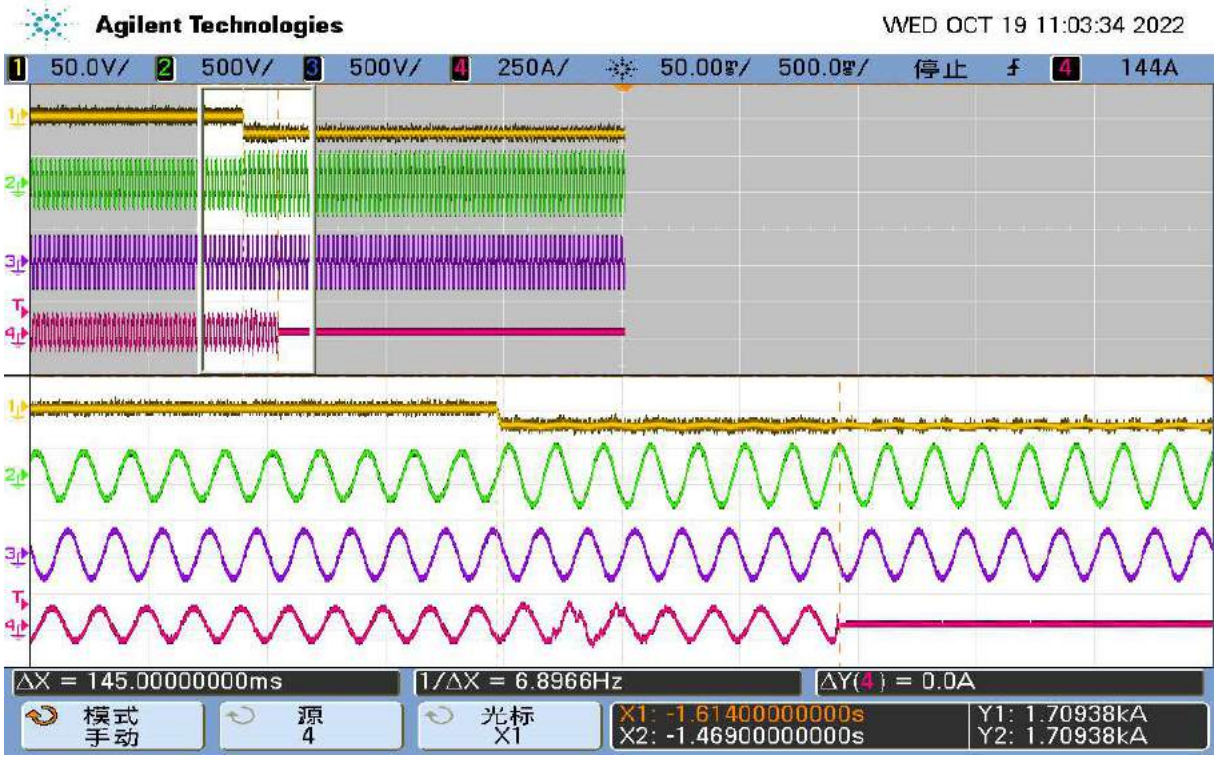
Under voltage - Stage 2 (L1 Phase)



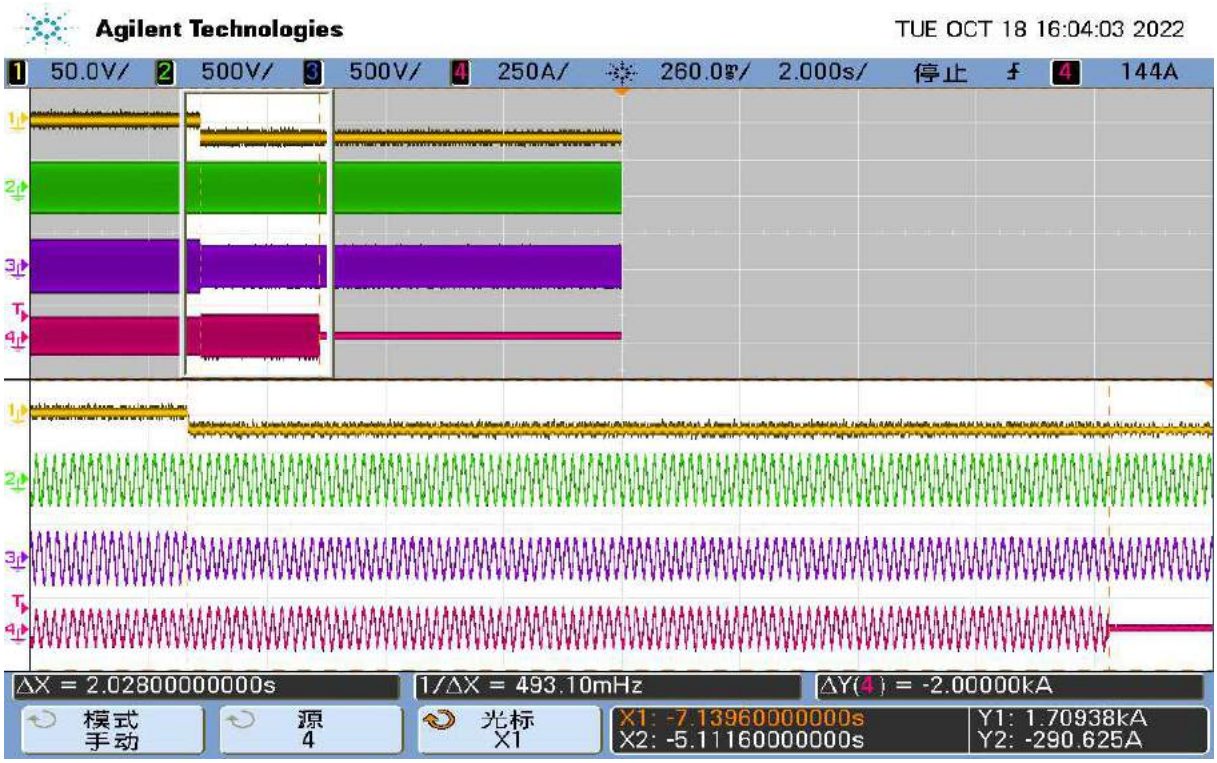
Scope pictures of the disconnection time
Over voltage - Stage 1 (L2 Phase)



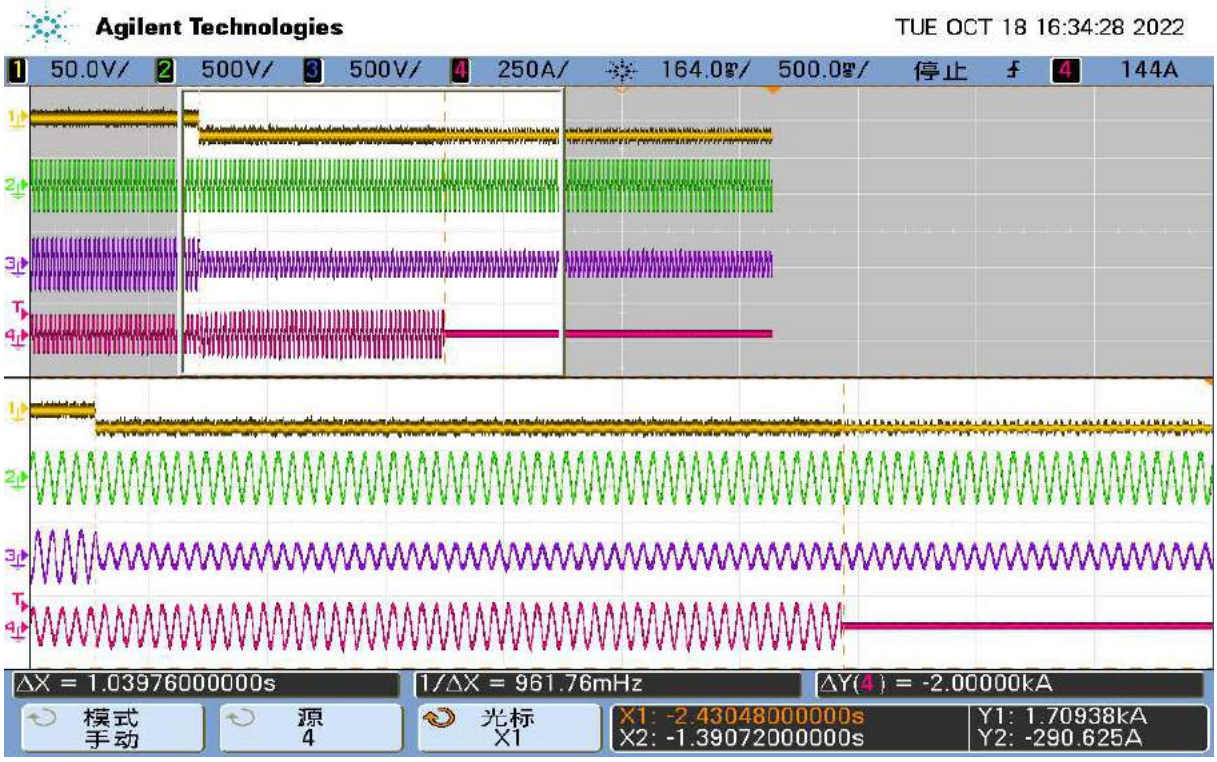
Over voltage - Stage 2 (L2 Phase)



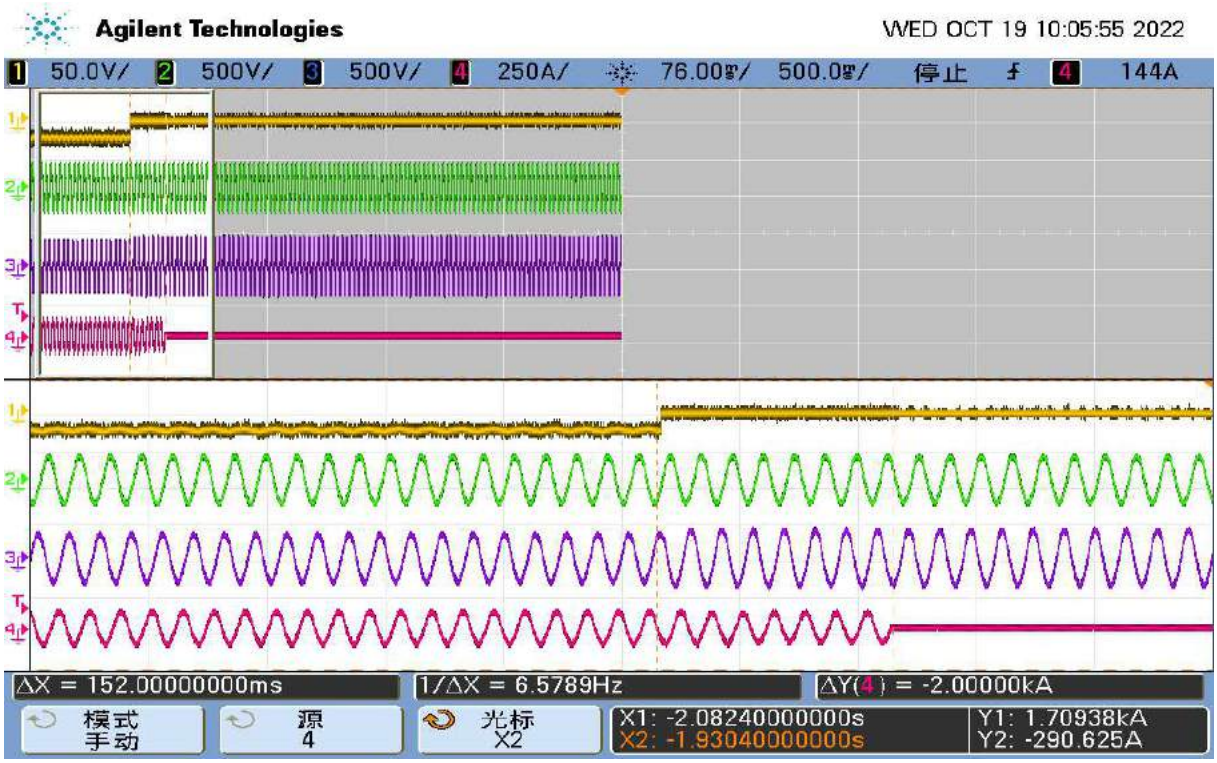
Scope pictures of the disconnection time
Under voltage - Stage 1 (L2 Phase)



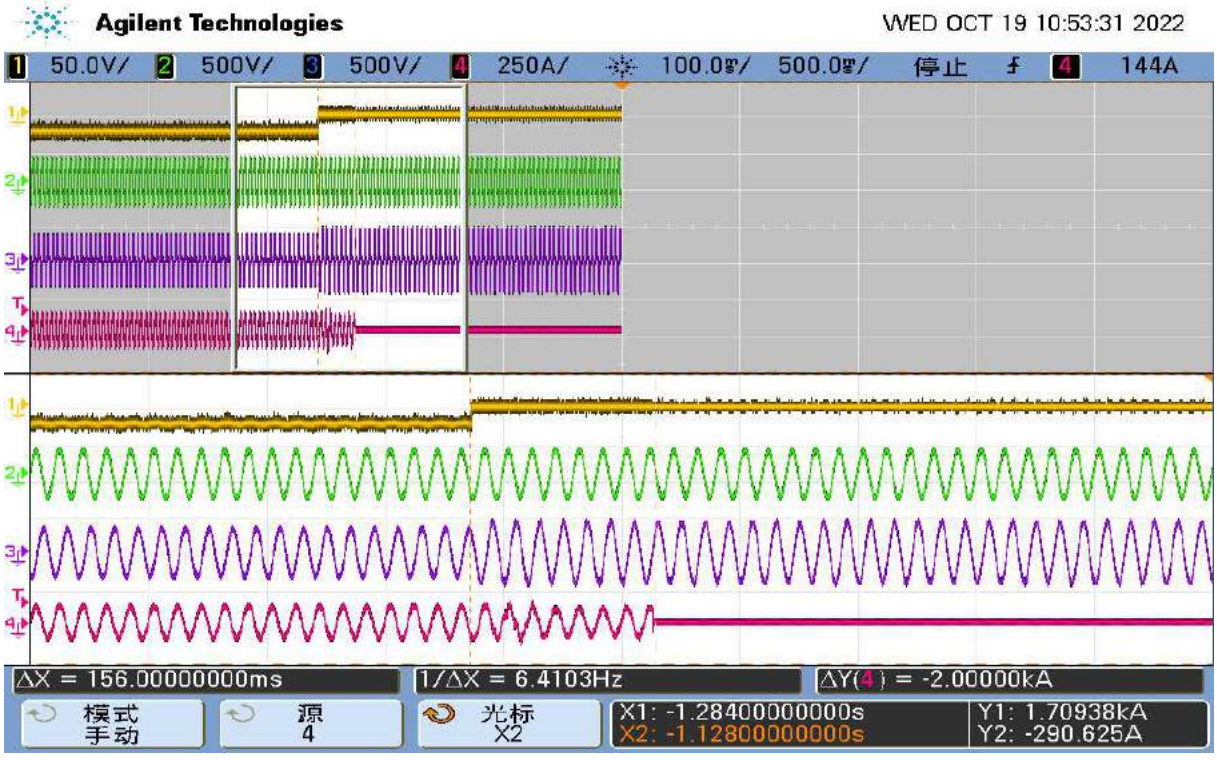
Under voltage - Stage 2 (L2 Phase)



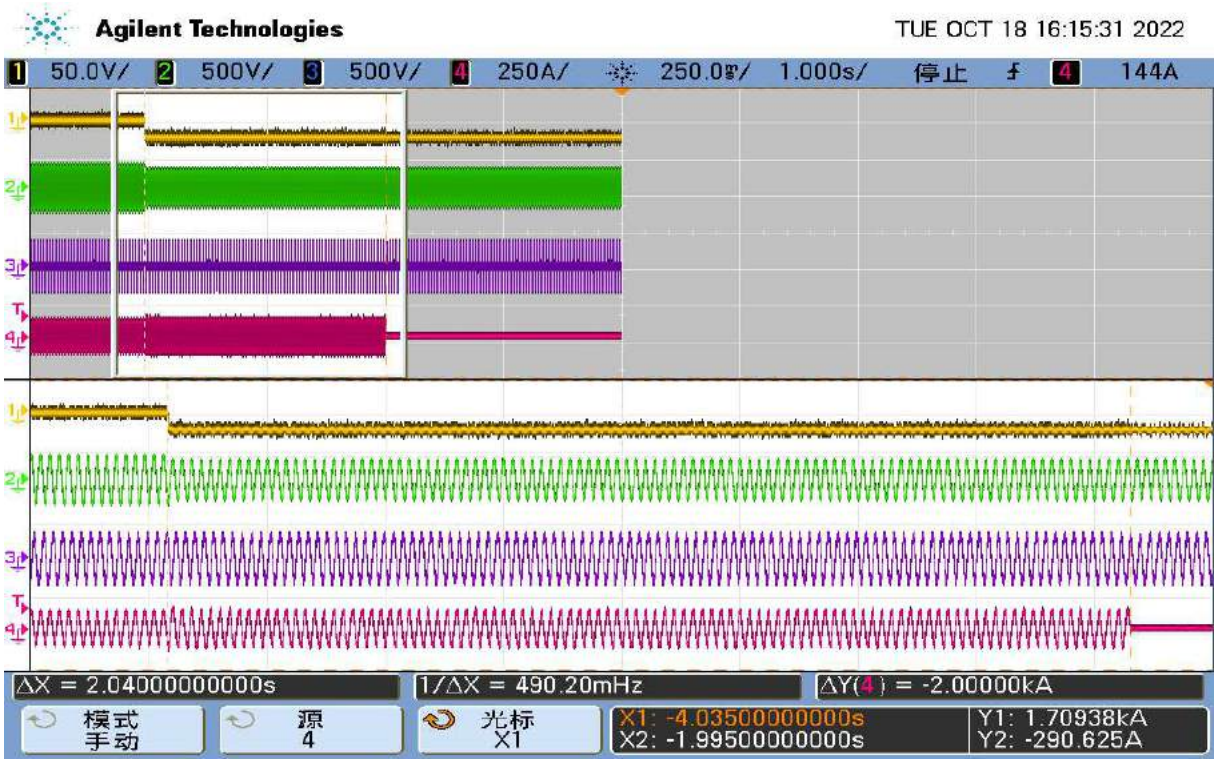
Scope pictures of the disconnection time
Over voltage - Stage 1 (L3 Phase)



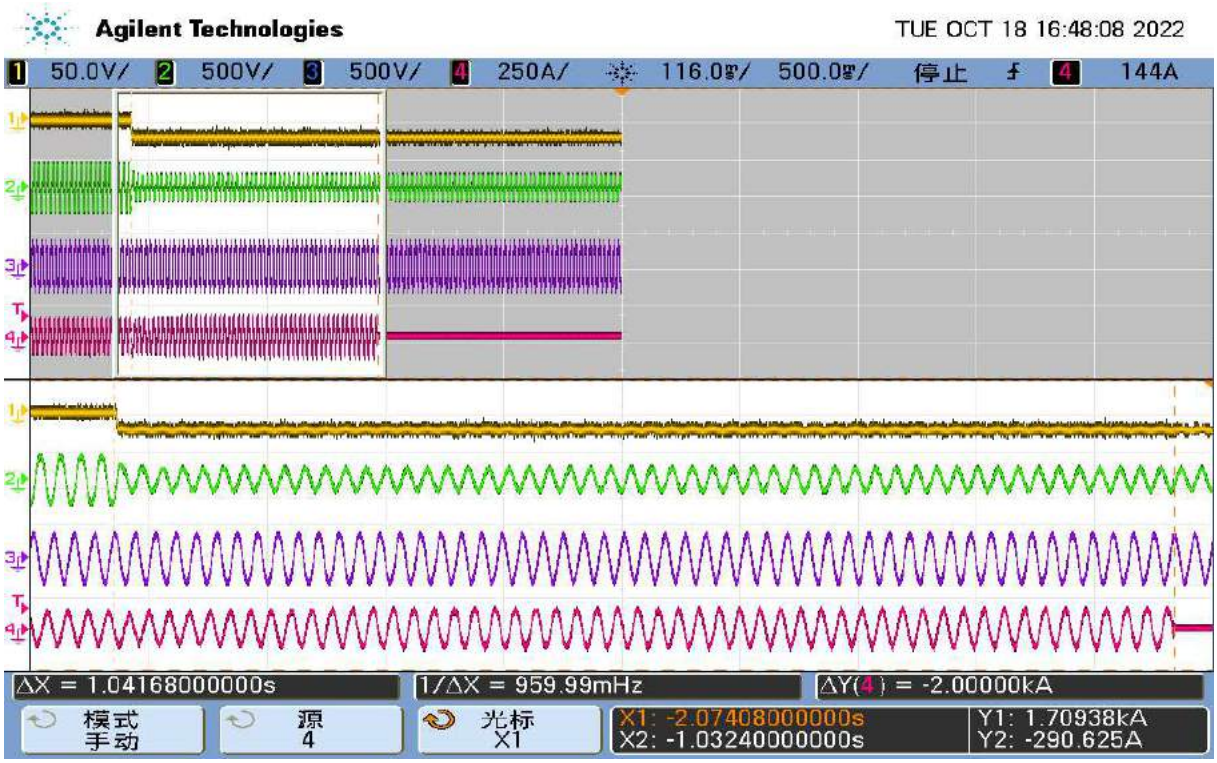
Over voltage - Stage 2 (L3 Phase)



Scope pictures of the disconnection time
Under voltage - Stage 1 (L3 Phase)



Under voltage - Stage 2 (L3 Phase)



4.9.3 4.9.3.1	**Requirements on voltage and frequency protection** **General** **(Maximum voltage 10 min mean protection according to EN 50160)** **(Setting value refer EN 50438 for default settings)**		**P**
Setting values of the protection:		Trip value Setting [V]	253
		Setting $T_{disconnection\ trip\ value}$ [s]	600
		Setting $T_{disconnection}$ [ms]	200
Test:			
		Disconnection time [s]	Limit [s]
a)	The voltage is set to 100% U_n and held for 600 s, Thereafter the voltage is set to 112% U_n, Disconnection must take place within 600 s,		
	Phase 1:	502 s	≤ 600 s
	Phase 2:	494 s	
	Phase 3:	496 s	
b)	The voltage is set to U_n for 600 s and then to 108% U_n for 600 s, No disconnection should take place,		
	Phase 1:	No Disconnection	Disconnection should not take place
	Phase 2:	No Disconnection	
	Phase 3:	No Disconnection	
c)	The voltage is set to 106 % U_n and held for 600 s, Thereafter the voltage is set to 114 % U_n, The disconnection should last for half the period as in Point a)*		
	Phase 1:	305 s	The disconnection time should be about 50 % of the value measured in a), *
	Phase 2:	299 s	
	Phase 3:	294 s	

Test:

a) This test serves as proof of the measurement accuracy and the maximum set time.

b) This test serves as proof of the measurement accuracy.

c) This test serves as proof of the correct formation of the 1 minute running mean value.

Assessment criterion:

The permitted tolerance between setting value and trip value of the voltage may not exceed ± 1 % of U_N.

Limit values:

Rise-in voltage protection 1,1 U_N after a max. 600 s, the switch off after 200 ms.

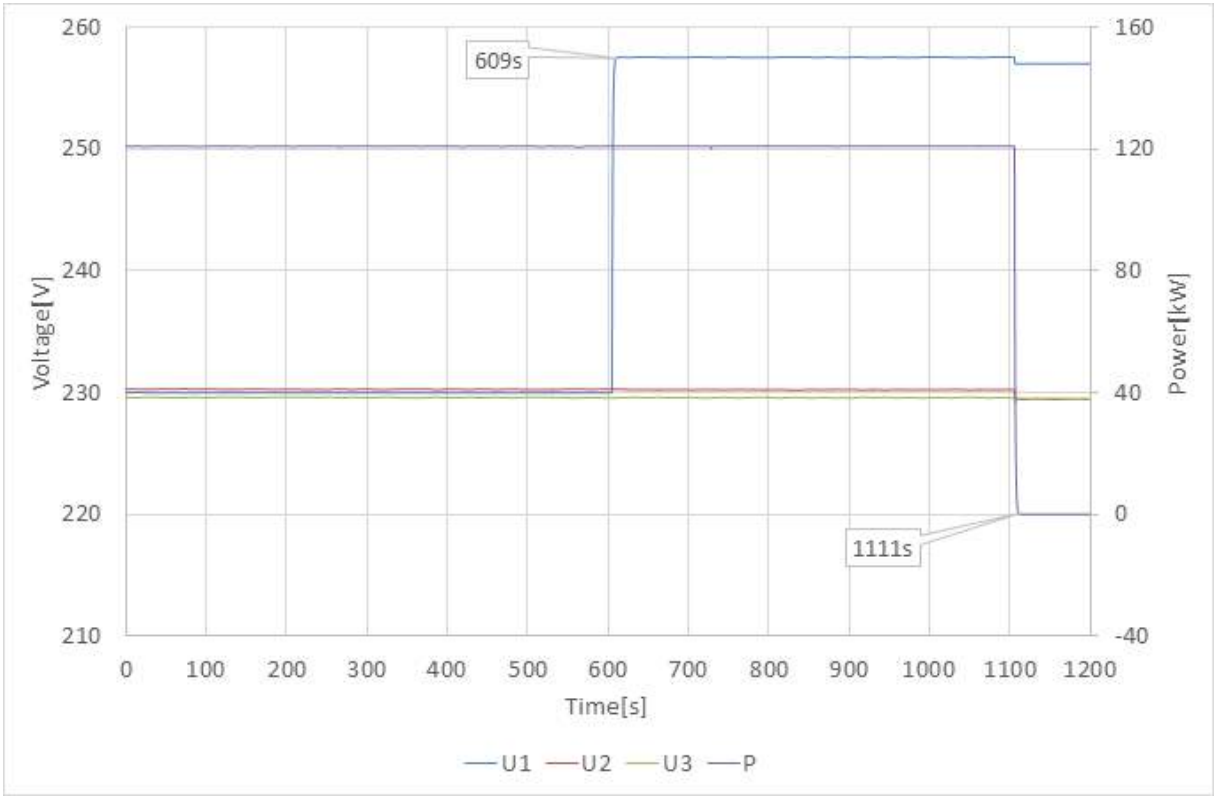
Note:

If only one integrated protection is used for the power generation systems, the value of the rise-in voltage protection of 1,1 U_N may not be changed.

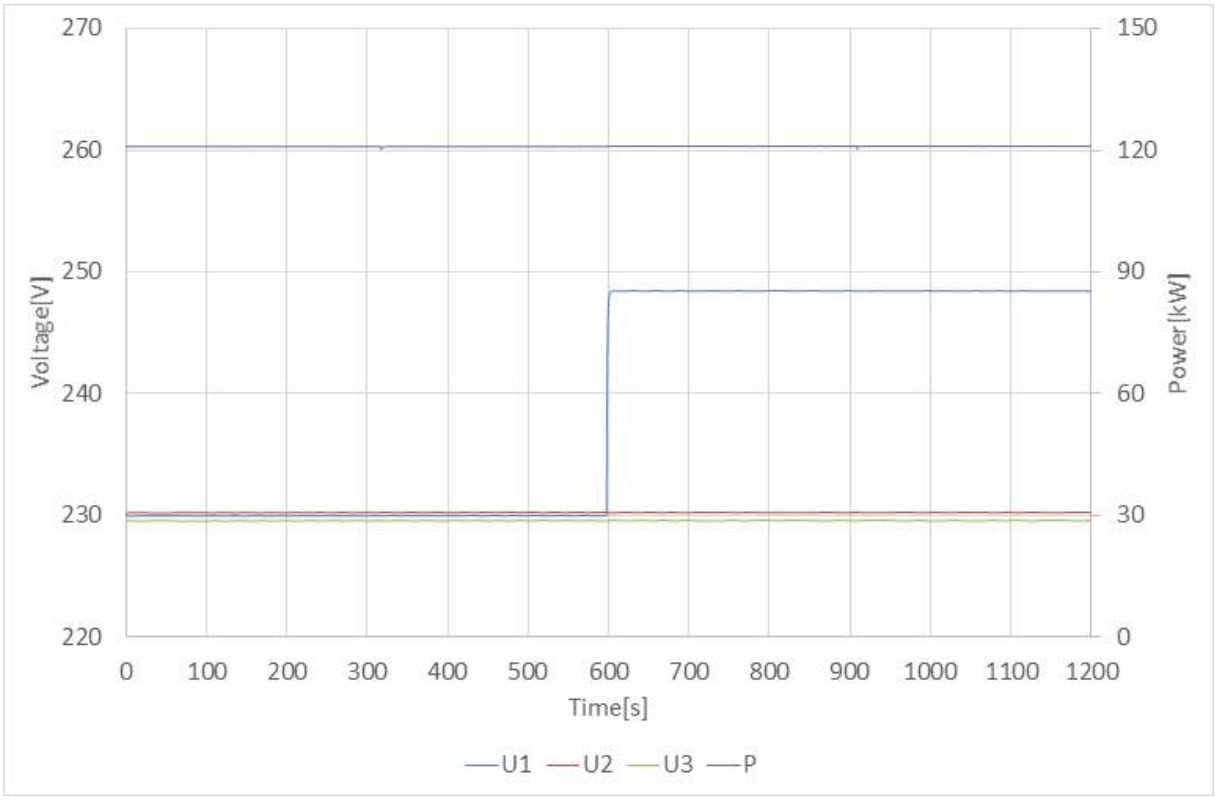
*If the setting value is set to 600 s, then the disconnection time can be in the range between 225 s and 375 s.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

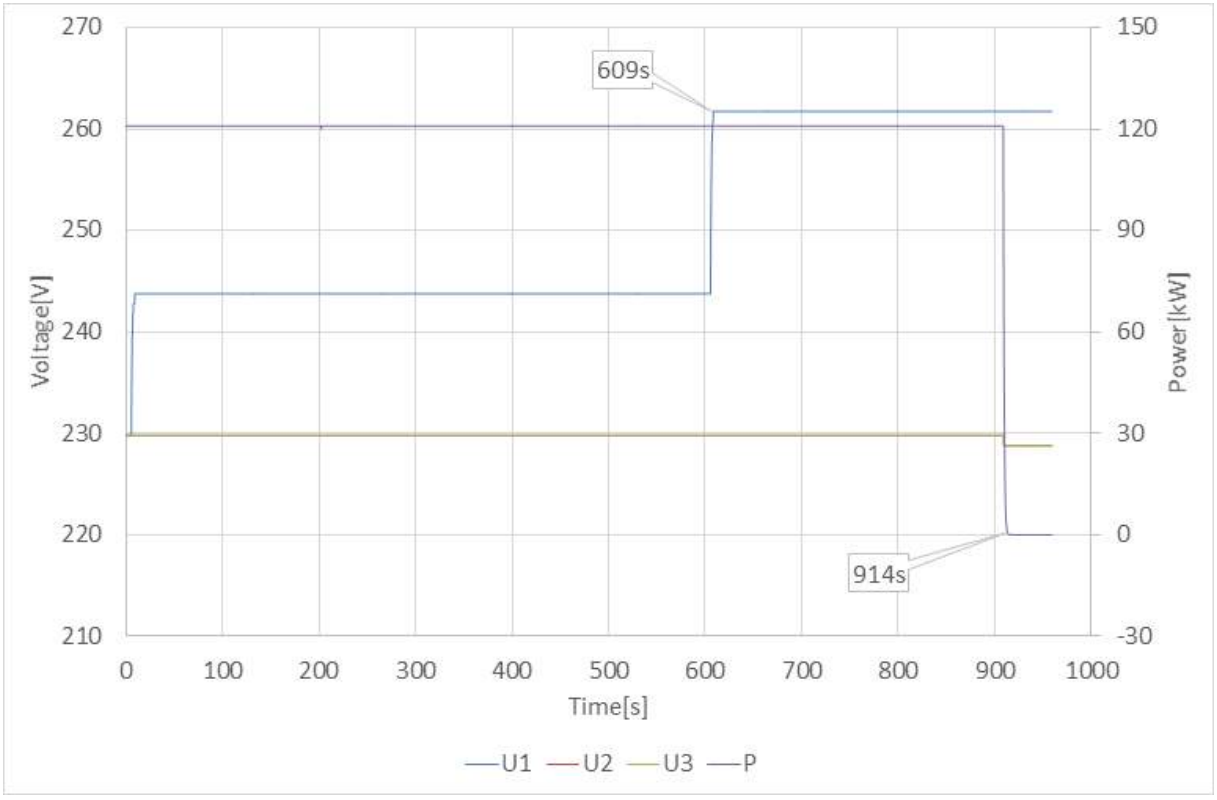
a) Voltage set to 112 % U_n for phase 1:



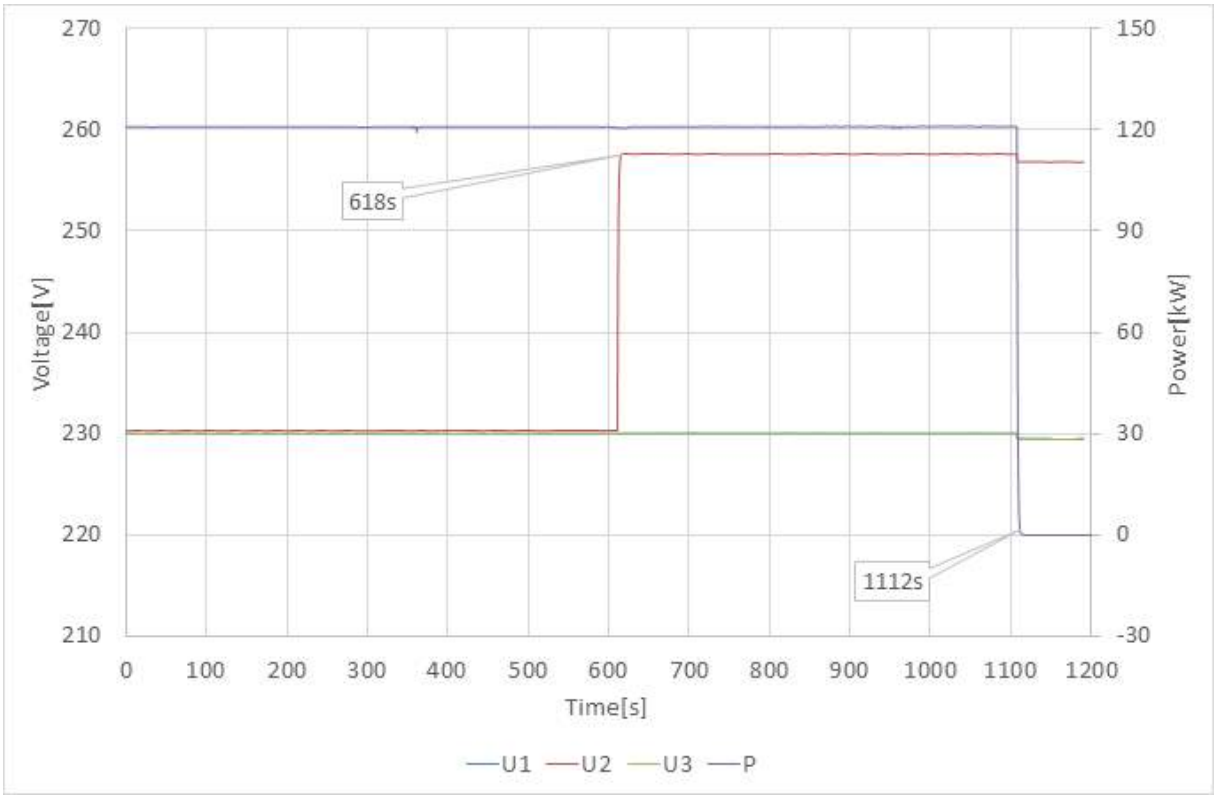
b) Voltage set to 108% U_n phase 1:



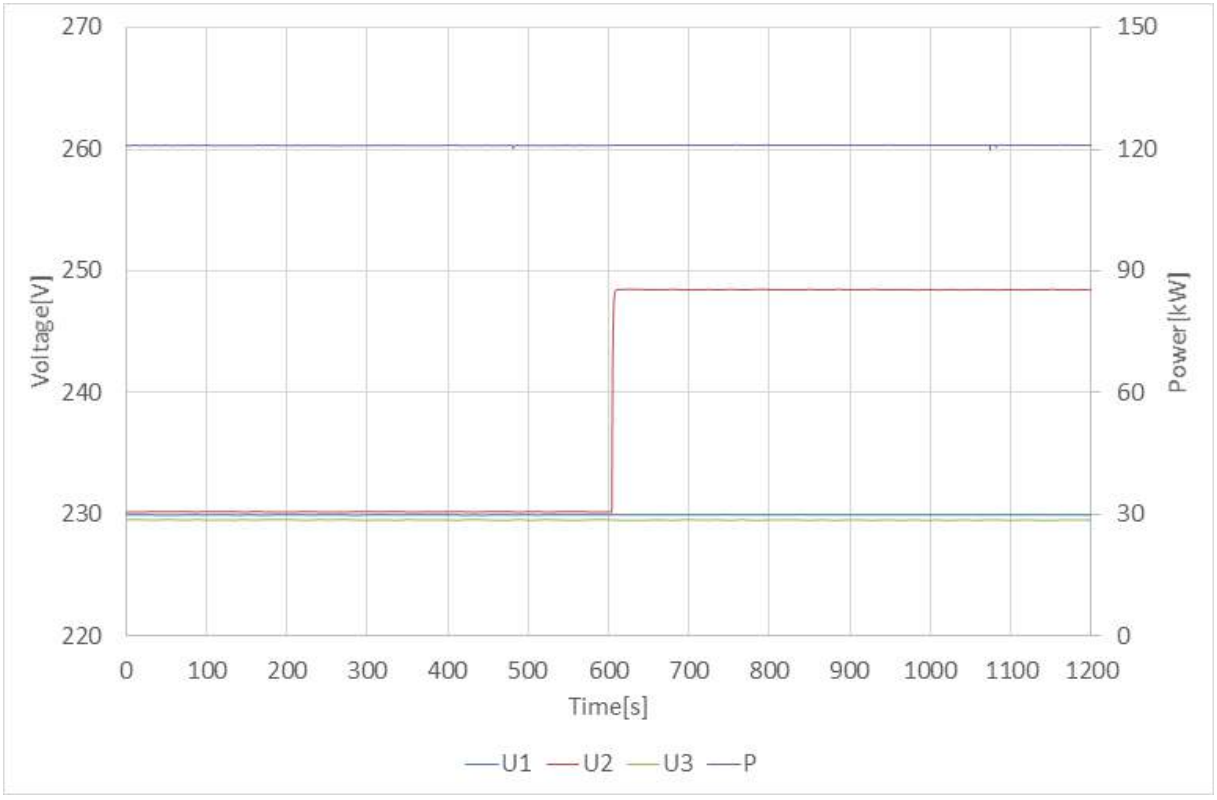
c) Voltage set to 106 % U_n, thereafter 114% U_n phase 1:



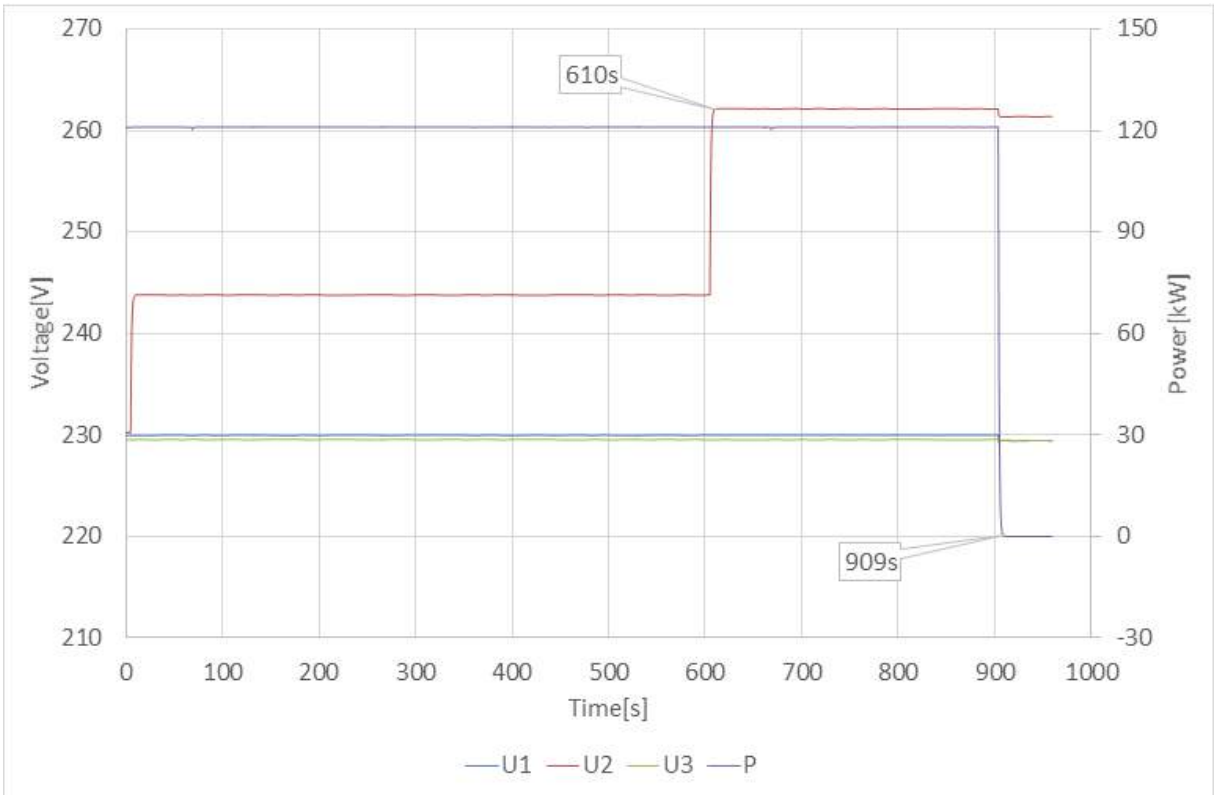
a) Voltage set to 112 % U_n for phase 2:



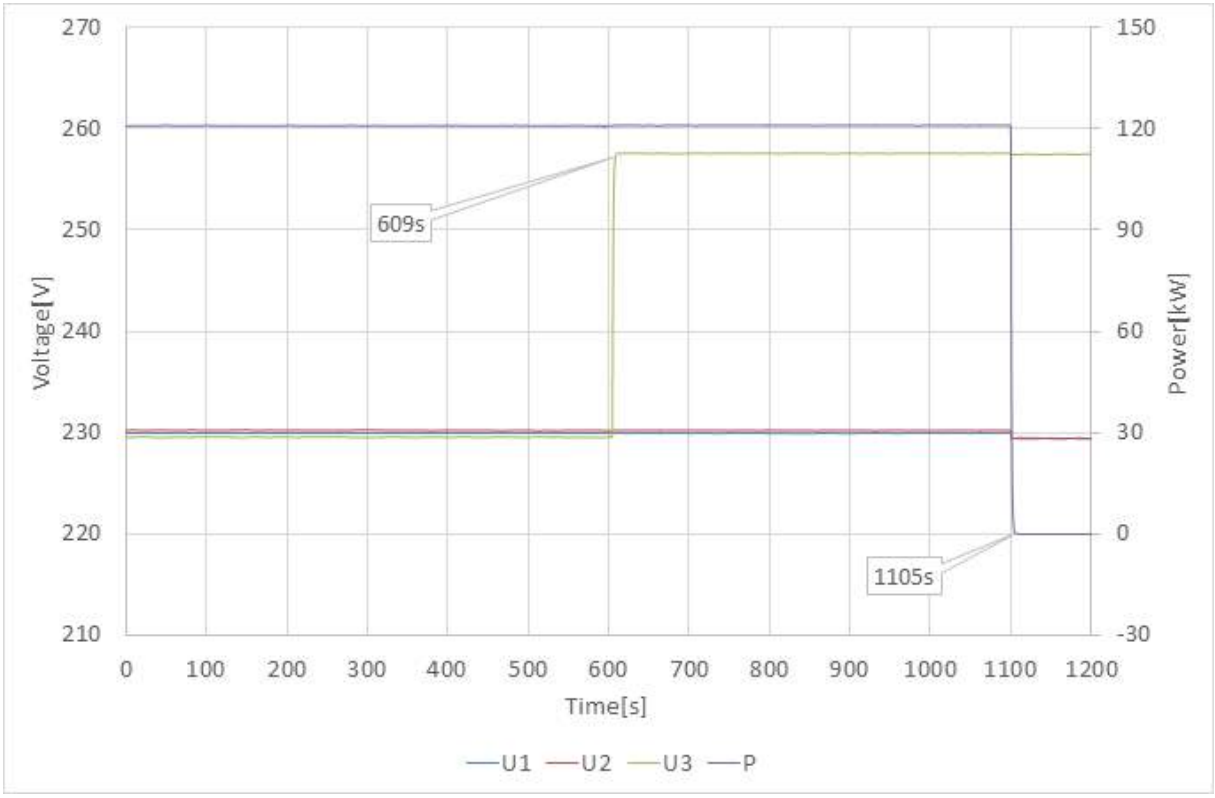
b) Voltage set to 108% U_n phase 2:



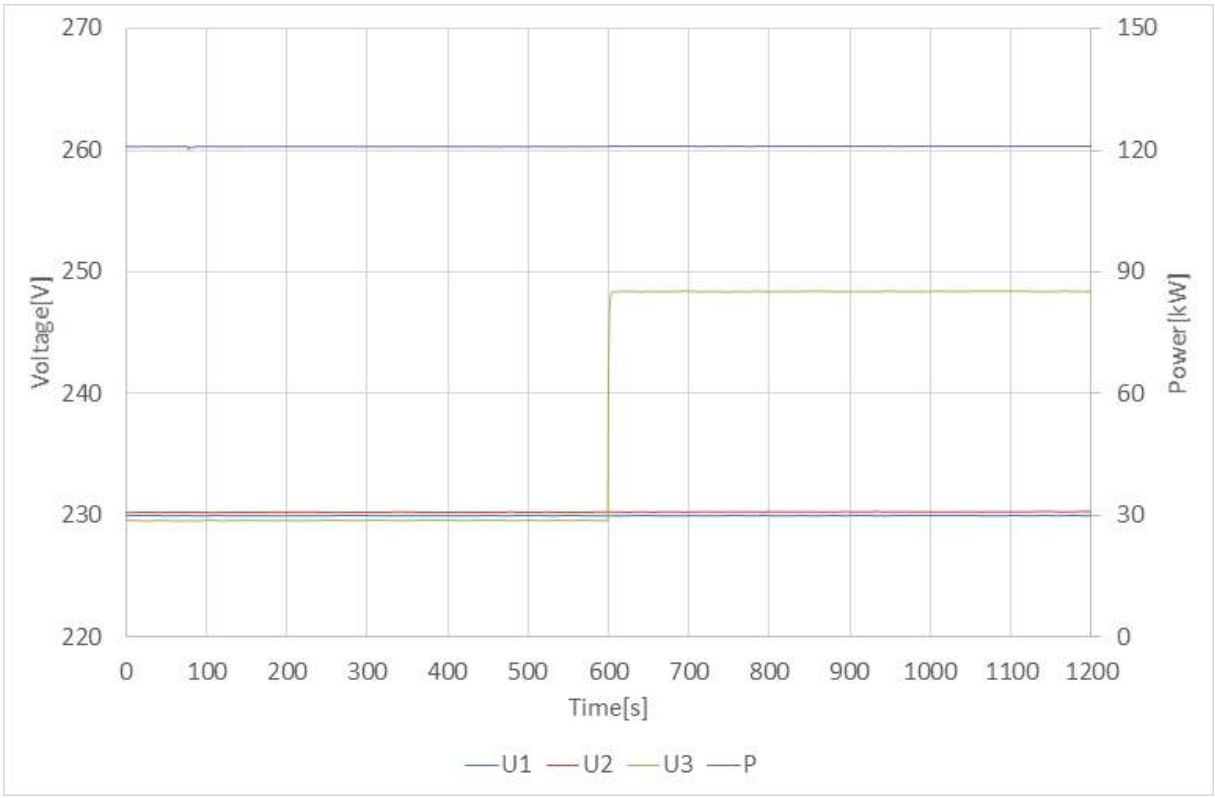
c) Voltage set to 106 % U_n, thereafter 114% U_n phase 2:



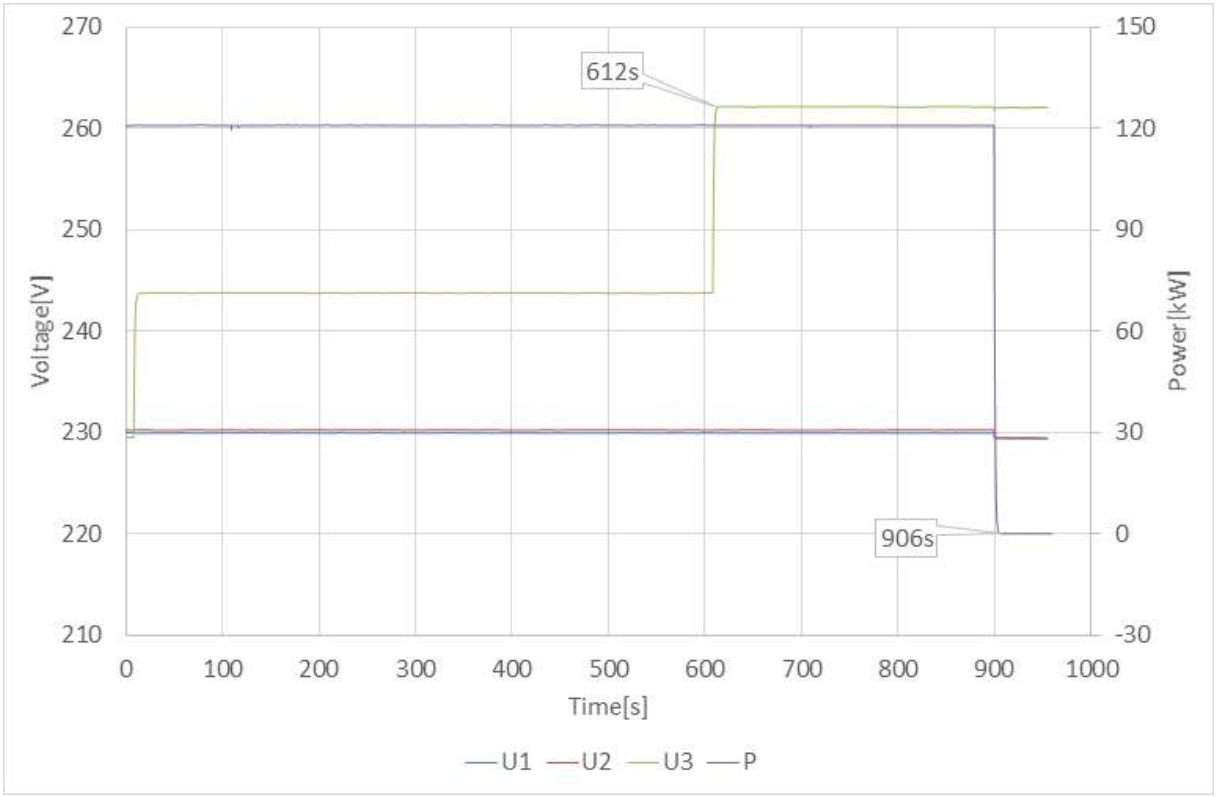
a) Voltage set to 112 % U_n for phase 3:



b) Voltage set to 108% U_n phase 3:



c) Voltage set to 106 % U_n, thereafter 114% U_n phase 3:



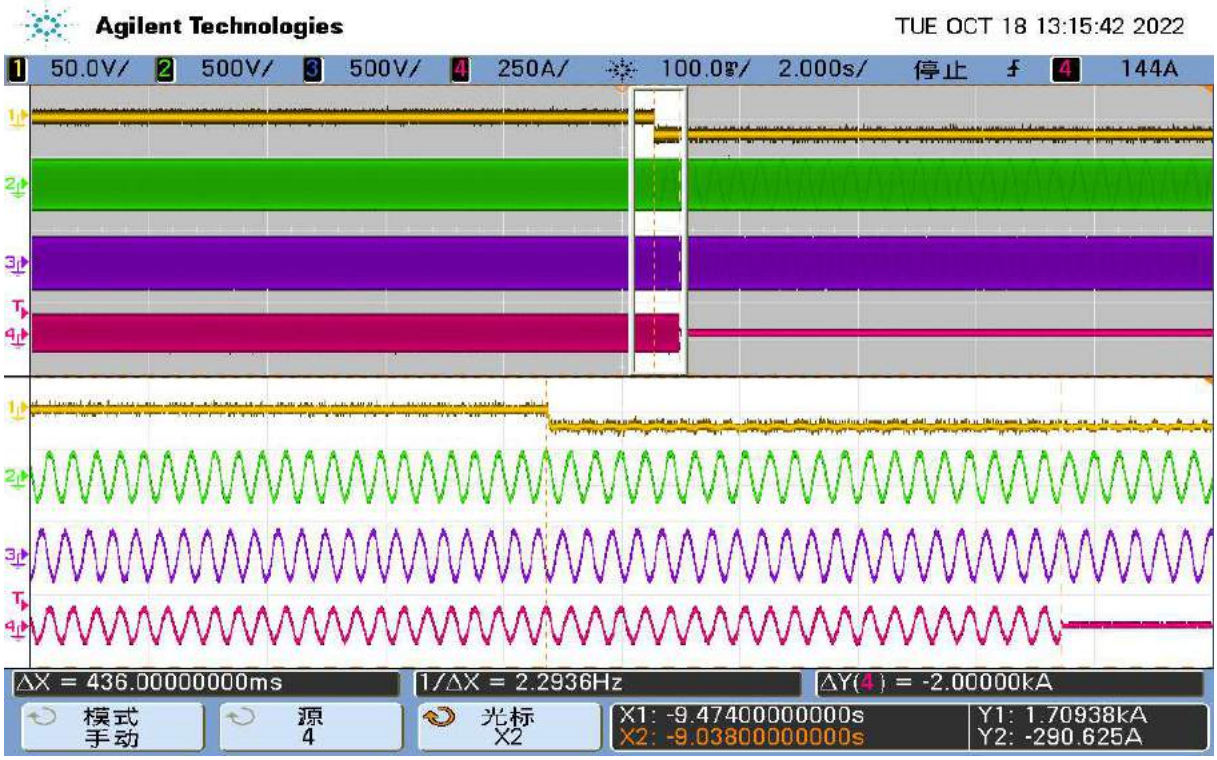
4.9.3 Requirements on voltage and frequency protection 4.9.3.1 General (Interface protection: Over/under frequency)					P
Test conditions	Output power: 121kW U_n = 230Vac				
	Under-frequency		**Over-frequency**		
Parameter	**Stage 1 Under-Frequency**	**Time**	**Stage 1 Over-Frequency**	**Time**	
Limit	47,50 Hz	0,3 ≤ t ≤ 0,5 s	51,50 Hz	0,3 ≤ t ≤ 0,5 s	
Trip value [Hz]	47,50		51,50		
	47,50		51,50		
	47,50		51,50		
	47,50		51,50		
	47,50		51,50		
Disconnection time [s]	50,00 Hz to 47,40 Hz	0,430	50,00 Hz to 51,60 Hz	0,418	
		0,436		0,416	
		0,418		0,434	
		0,436		0,430	
		0,430		0,424	
Parameter	**Stage 2 Under-Frequency**	**Time**	**Stage 2 Over-Frequency**	**Time**	
Limit	47,00 Hz	0,1 ≤ t ≤ 0,2 s	52,00 Hz	0,1 ≤ t ≤ 0,2 s	
Trip value [Hz]	47,00		52,00		
	47,00		52,00		
	47,00		52,00		
	47,00		52,00		
	47,00		52,00		
Disconnection time [s]	50,00 Hz to 46,90 Hz	0,132	50,00 Hz to 52,10 Hz	0,126	
		0,140		0,125	
		0,122		0,129	
		0,124		0,128	
		0,124		0,132	

Note:

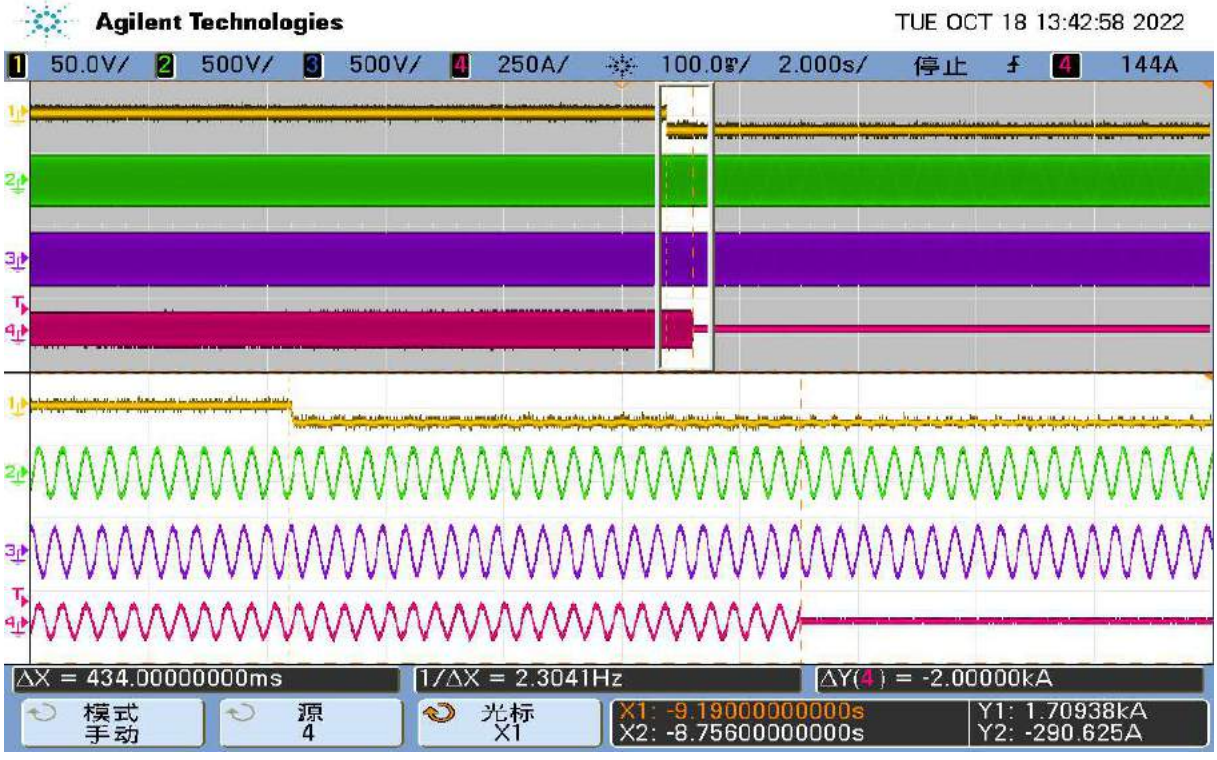
For under-frequency testing the applied frequency is varied from f_n down to $f_{th\text{-}low}$ -0,1 Hz in steps of 0,025 Hz with a time duration per step exceeding the configured disconnection time, The operate value is the value of the applied frequency at switch the protection function trips and shall be within $f_{th\text{-}low}$ ± 0,05 Hz.
For over-frequency testing the applied frequency is varied from f_n up to $f_{th\text{-}high}$ + 0,1 Hz in steps of 0,025 Hz with a time duration per step exceeding the configured disconnection time, The operate value is the value of the applied frequency at which the protection function trips and shall be within $f_{th\text{-}high}$ ± 0,05 Hz.
The disconnection time was measured by applying a negative or positive frequency ramp from f_n to the operate value -0,1 Hz or +0,1 Hz, e,g, from 50 Hz to 47,4 Hz, The time elapsed between the application of the frequency ramp and the opening of the interface switch was calculated by the measured time minus the 2500 ms from 50,0 Hz to 47,5 Hz.
The oscilloscope pictures below show the measured worst case disconnection times.
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software

Scope pictures of the disconnection time

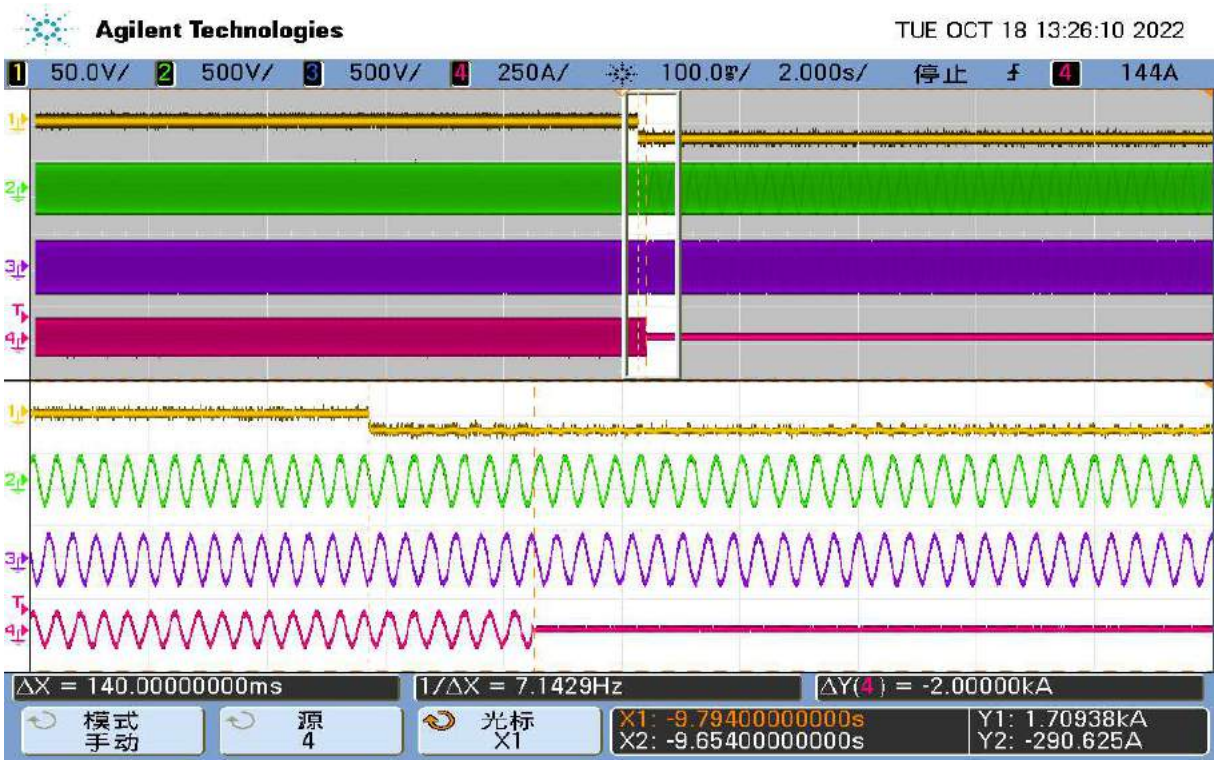
Under frequency - Stage 1



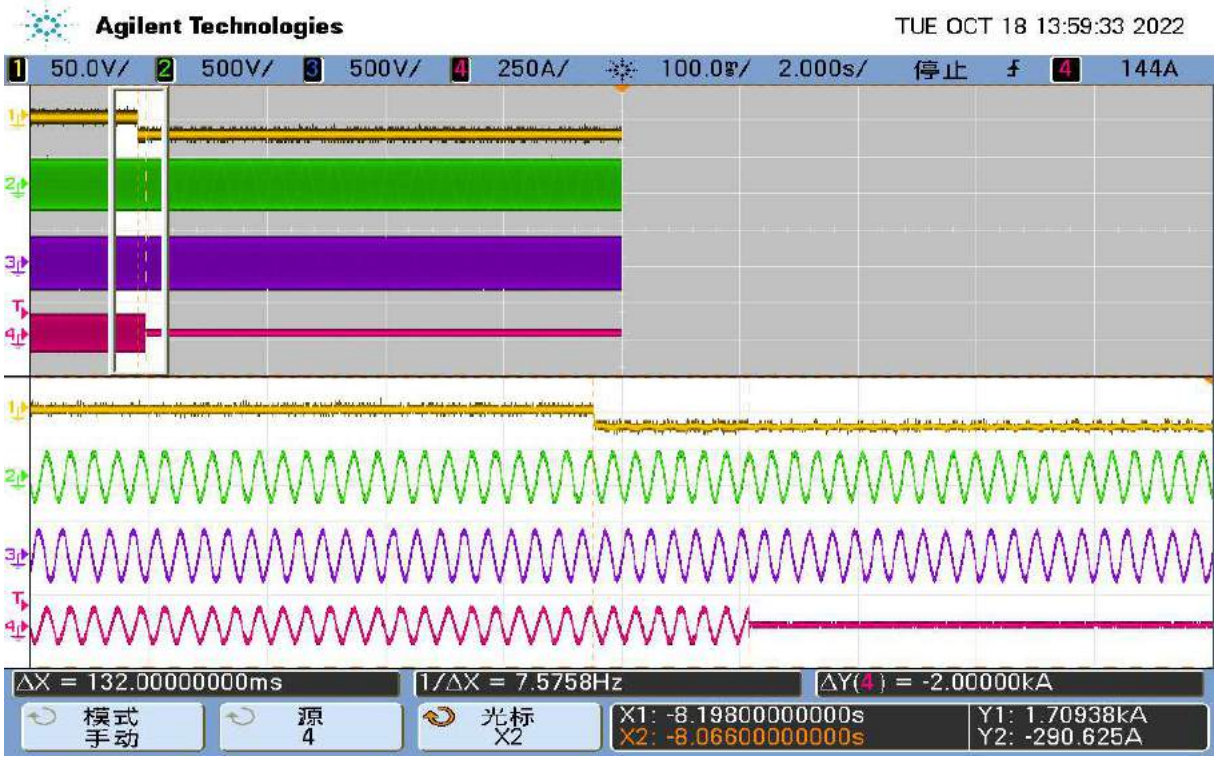
Over frequency - Stage 1



Under frequency - Stage 2



Over frequency - Stage 2



4.9.4.2 Loss of Mains (LoM) detection

Test circuit and parameters

Parameter	Symbol	Units
EUT DC Input		
DC voltage	V_{DC}	V
DC Current	I_{DC}	A
DC Power	P_{DC}	W
EUT AC ouput		
AC voltage	V_{EUT}	V
AC current	I_{EUT}	A
Real power	P_{EUT}	W
Reactive power	Q_{EUT}	VAr
Test Load		
Resistive load current	I_R	A
Inductive load current	I_L	A
Capacitive load current	I_C	A
AC (utility) power source		
Utility real power	P_{AC}	W
Utility reactive power	Q_{AC}	VAr
Utility current	I_{AC}	A

Block diagram test circuit IEC 62116:2014

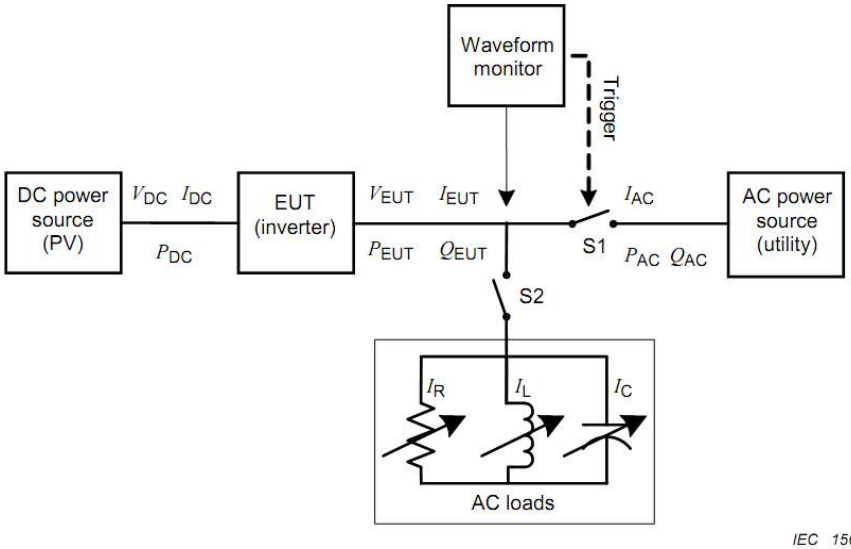


Figure 1 – Test circuit for islanding detection function in a power conditioner (inverter)

Load imbalance (real, reactive load) for test condition A (EUT output = 100%)	**P**

Test :

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1)	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [kW per phase]	V_{DC} [V]	Q_f	Run on Time [ms]	Remarks 5)
1	100	100	0	0	1,32	40,3	678	0,987	142	BL
32	100	100	-10	-10	--	40,3	678	0,833	64	IB
33	100	100	-10	-5	--	40,3	678	0,863	75	IB
34	100	100	-10	0	--	40,3	678	0,877	124	IB
35	100	100	-10	+5	--	40,3	678	0,917	107	IB
36	100	100	-10	+10	--	40,3	678	0,933	87	IB
37	100	100	-5	-10	--	40,3	678	0,883	63	IB
4	100	100	-5	-5	--	40,3	678	0,907	70	IB
5	100	100	-5	0	--	40,3	678	0,890	116	IB
6	100	100	-5	+5	--	40,3	678	0,960	154	IB
38	100	100	-5	+10	--	40,3	678	0,980	68	IB
39	100	100	0	-10	--	40,3	678	0,933	69	IB
7	100	100	0	-5	--	40,3	678	0,960	60	IB
8	100	100	0	+5	--	40,3	678	1,010	171	IB
40	100	100	0	+10	--	40,3	678	1,037	84	IB
41	100	100	+5	-10	--	40,3	678	0,980	71	IB
9	100	100	+5	-5	--	40,3	678	1,013	76	IB
10	100	100	+5	0	--	40,3	678	1,040	162	IB
11	100	100	+5	+5	--	40,3	678	1,067	101	IB
42	100	100	+5	+10	--	40,3	678	1,093	89	IB
43	100	100	+10	-10	--	40,3	678	1,047	71	IB
44	100	100	+10	-5	--	40,3	678	1,073	72	IB
45	100	100	+10	0	--	40,3	678	1,103	164	IB
46	100	100	+10	+5	--	40,3	678	1,133	111	IB
47	100	100	+10	+10	--	40,3	678	1,160	87	IB

Parameter at 0% per phase	L= 4,18mH	R= 1,31Ω	C= 2428,17µF

Note:
RLC is adjusted to min. +/-1% of the inverter rated output power
[1] P_{EUT}: EUT output power.
[2] P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility, Nominal is the 0 % test condition value.
[3] Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility, Nominal is the 0 % test condition value.
[4] Fundamental of I_{AC} when RLC is adjusted.
[5] BL: Balance condition, IB: Imbalance condition.
Condition A:
EUT output power P_{EUT} = Maximum [6]
EUT input voltage [6] = >75% of rated input voltage range
[6] Maximum EUT output power condition should be achieved using the maximum allowable input power, Actual output power may exceed nominal rated output.
[7] Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 75 % of range =X + 0,75 × (Y – X), Y shall not exceed 0,8 × EUT maximum system voltage (i,e,, maximum allowable array open circuit voltage), In any case, the EUT should not be operated outside of its allowable input voltage range.
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Scope pictures of the disconnection time

Disconnection at No. 8

Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	**P**

Test :

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1)	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [kW per phase]	V_{DC} [V]	Q_f	Run on Time [ms]	Remarks 5)
12	66	66	0	-5	--	26,6	507	0,950	66	IB
13	66	66	0	-4	--	26,6	507	0,960	68	IB
14	66	66	0	-3	--	26,6	507	0,970	114	IB
15	66	66	0	-2	--	26,6	507	0,980	78	IB
16	66	66	0	-1	--	26,6	507	0,990	160	IB
2	66	66	0	0	1,02	26,6	507	0,993	197	BL
17	66	66	0	+1	--	26,6	507	1,000	98	IB
18	66	66	0	+2	--	26,6	507	1,007	114	IB
19	66	66	0	+3	--	26,6	507	1,017	181	IB
20	66	66	0	+4	--	26,6	507	1,033	89	IB
21	66	66	0	+5	--	26,6	507	1,030	86	IB

Parameter at 0% per phase	L= 6,33mH	R= 1,99Ω	C= 1602,59µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power.

2) P_{AC}: Real power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value.

4) Fundamental of I_{AC} when RLC is adjusted.

5) BL: Balance condition, IB: Imbalance condition.

Condition B:

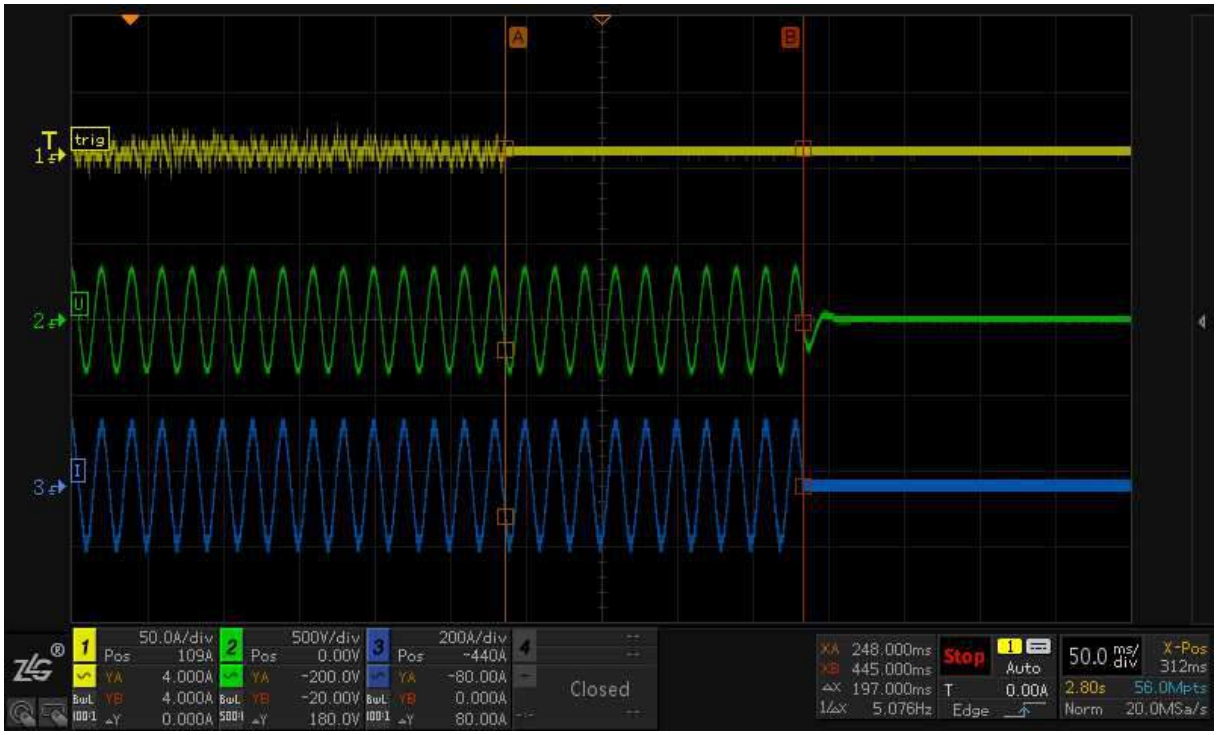
EUT output power P_{EUT} = 50 % – 66 % of maximum

EUT input voltage 6) = 50 % of rated input voltage range, ±10 %

6) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 50 % of range =X + 0,5 × (Y – X), Y shall not exceed 0,8 × EUT maximum system voltage (i,e,, maximum allowable array open circuit voltage), In any case, the EUT should not be operated outside of its allowable input voltage range.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Scope pictures of the disconnection time
Disconnection at No. 2



Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	**P**

Test :

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} [1] [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) [1]	P_{AC} [2] [% of nominal]	Q_{AC} [3] [% of nominal]	I_{AC} [4] [A]	P_{EUT} [kW per phase]	V_{DC} [V]	Q_f	Run on Time [ms]	Remarks [5]
22	33	33	0	-5	--	13,3	305	0,917	72	IB
23	33	33	0	-4	--	13,3	305	0,940	81	IB
24	33	33	0	-3	--	13,3	305	0,953	80	IB
25	33	33	0	-2	--	13,3	305	0,977	83	IB
26	33	33	0	-1	--	13,3	305	0,983	118	IB
3	33	33	0	0	0,53	13,3	305	0,997	159	BL
27	33	33	0	+1	--	13,3	305	1,013	65	IB
28	33	33	0	+2	--	13,3	305	1,020	93	IB
29	33	33	0	+3	--	13,3	305	1,037	81	IB
30	33	33	0	+4	--	13,3	305	1,057	88	IB
31	33	33	0	+5	--	13,3	305	1,070	77	IB

Parameter at 0% per phase	L= 12,66mH	R= 3,97Ω	C= 801,30µF

Note:
RLC is adjusted to min. +/-1% of the inverter rated output power
[1] P_{EUT}: EUT output power.
[2] P_{AC}: Real power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value.
[3] Q_{AC}: Reactive power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value.
[4] Fundamental of I_{AC} when RLC is adjusted.
[5] BL: Balance condition, IB: Imbalance condition.
Condition B:
EUT output power P_{EUT} = 25 % – 33 % [6] of maximum
EUT input voltage [7] = <20 % of rated input voltage range
[6] Or minimum allowable EUT output level if greater than 33 %.
[7] Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 20 % of range =X + 0,2 × (Y – X), Y shall not exceed 0,8 × EUT maximum system voltage (i,e,, maximum allowable array open circuit voltage), In any case, the EUT should not be operated outside of its allowable input voltage range.
The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Scope pictures of the disconnection time
Disconnection at No. 3

EN 50549-2:2019: Connection and starting to generate electrical power			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.10.2	Automatic reconnection after tripping	EN 50438, Annex D.3.6	**P**
4.10.3	Starting to generate electrical power	EN 50438, Annex D.3.6	**P**

4.10 Connection and starting to generate electrical power **4.10.2 Automatic reconnection after tripping** **4.10.3 Starting to generate electrical power**		**P**
Setting value	Min. voltage for connected to grid :	195,5
	Max. voltage for connected to grid :	253,0
	Min. frequency for connected to grid :	49,50
	Max. frequency for connected to grid (Normal operational start-up) :	50,10
	Max. frequency for connected to grid (Automatic reconnection after tripping) :	50,20
	Observation time (≥60s) :	60,00

Test:

	Voltage conditons	
a) Start up for voltage range	<85% Un for twice of observation time	>110% Un for twice of observation time
Connection:	No connection	No connection
Limit	No connection allowed	
b) In voltage range at start-up	≥85% Un within twice setting observation time	≤110% Un within twice setting observation time
Reconnection time [s]	63 s	63 s
Limit:	Connected after setting observation time (≥60s)	
Gradient:	The maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: disable. For recorded gradient see diagram below.	
c) In voltage range after voltage failture	≥85% Un for twice of setting observation time	≤110% Un for twice of setting observation time
Reconnection time [s]	66 s	63 s
Limit:	Reconnection after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%P_{Emax}/min. For non or partly adjustable generators the connection after trip of the interface protection is delayed by a randomised value between 1 min and 10 min. For recorded gradient see diagram below.	
	Frequency conditions	
d) Start up for frequency range	<49,50 Hz for twice of setting observation time	>50,10 Hz for twice of setting observation time
Connection:	No connection	No connection
Limit	No connection allowed	

e) In frequency range at start-up	≥49,50 Hz within twice of setting observation time	≤50,10 Hz within twice of setting observation time
Reconnection time [s]	66 s	62 s
Limit:	Connected after setting delay time(≥60s)	
Gradient:	The maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: disable. For recorded gradient see diagram below.	
f) In frequency range after frequency failture	≥49,50 Hz for twice of setting observation time	≤50,20 Hz for twice of setting observation time
Reconnection time [s]	66 s	66 s
Limit:	Reconnection after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%P_{Emax}/min. For non or partly adjustable generators the connection after trip of the interface protection is delayed by a randomised value between 1 min and 10 min. For recorded gradient see diagram below.	

Test:

Test condition b) and c): voltage within the limits of 85% to 110% U_n.

Test condition e): frequency within the limits of 49,50 Hz to 50,10 Hz.

Test condition f): frequency within the limits of 49,50 Hz to 50,20 Hz.

In order to avoid continuous starting and disengaging operations of the interface protection relay, the disengaging value of frequency and voltage functions shall be above 2 % deviating from the operate value.

Assessment criterion:

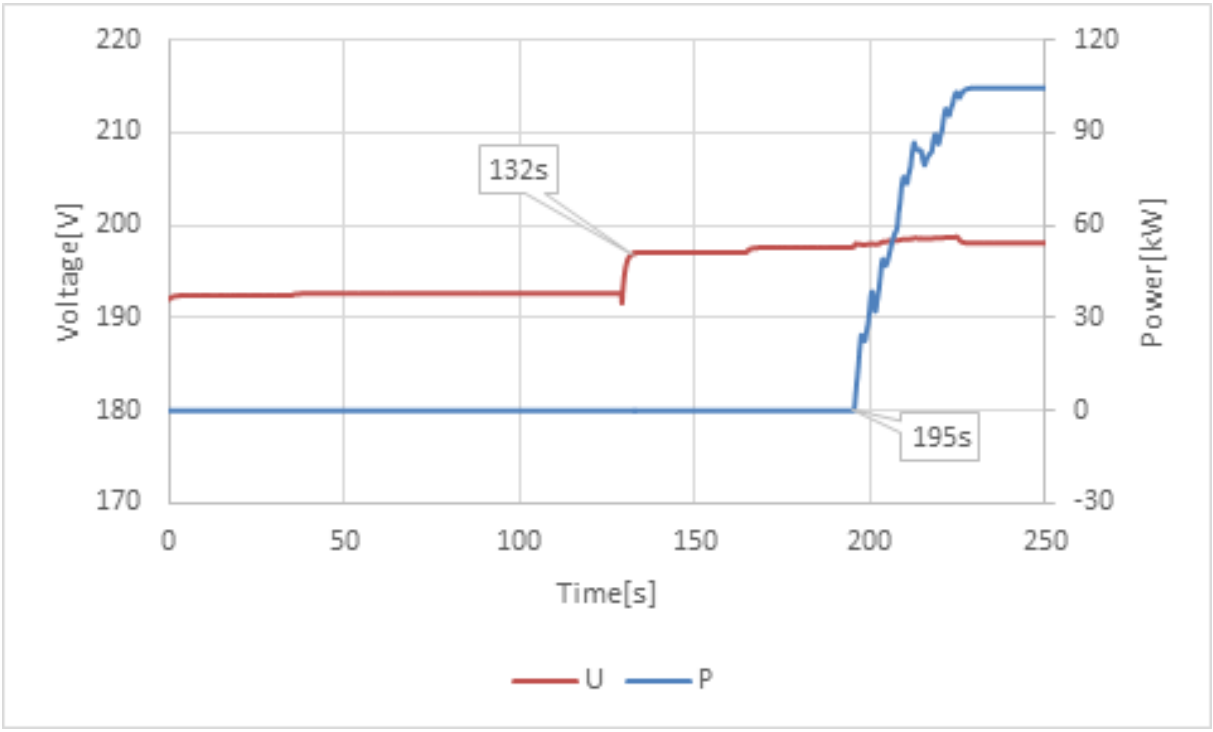
a) the micro generator connects respectively starts generating electrical power only in the permitted range of voltage and frequency and
b) for adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute and
c) for non or partly adjustable generators the connection after trip of the interface protection is delayed by a randomised value between 1 min and 10 min.

Note:

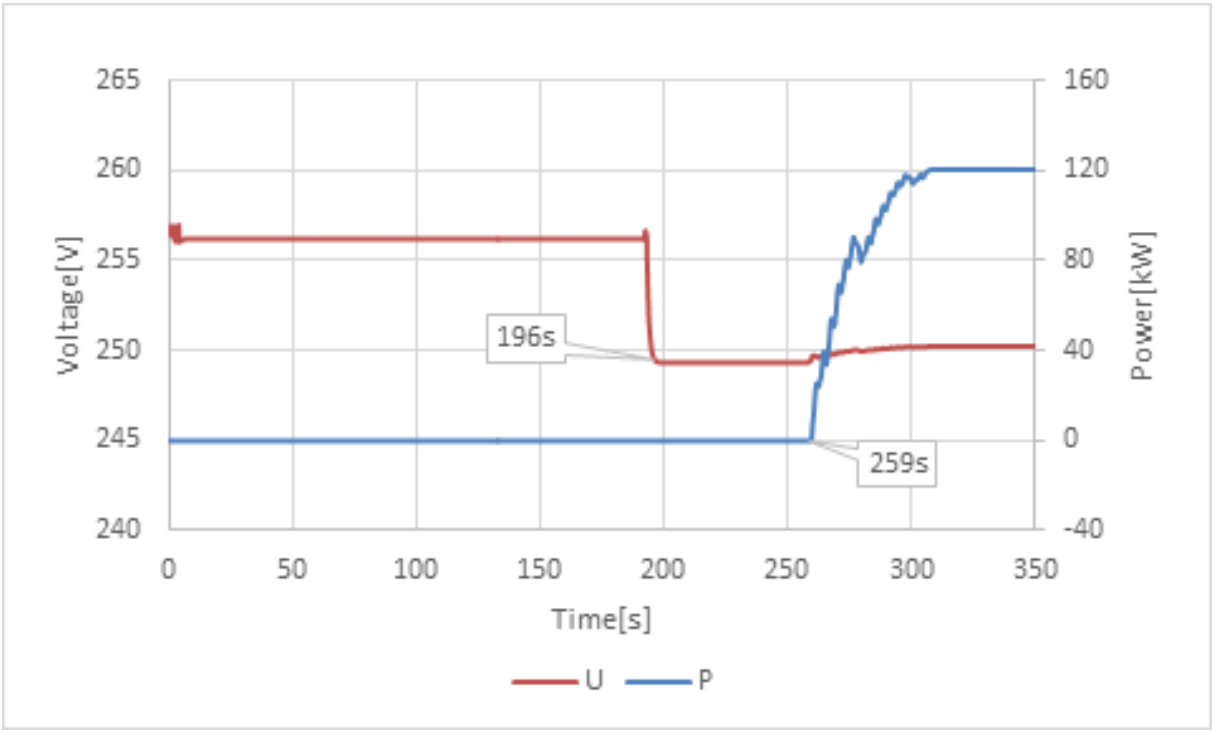
During the test, the setting protection value is consistent with the reconnection value.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

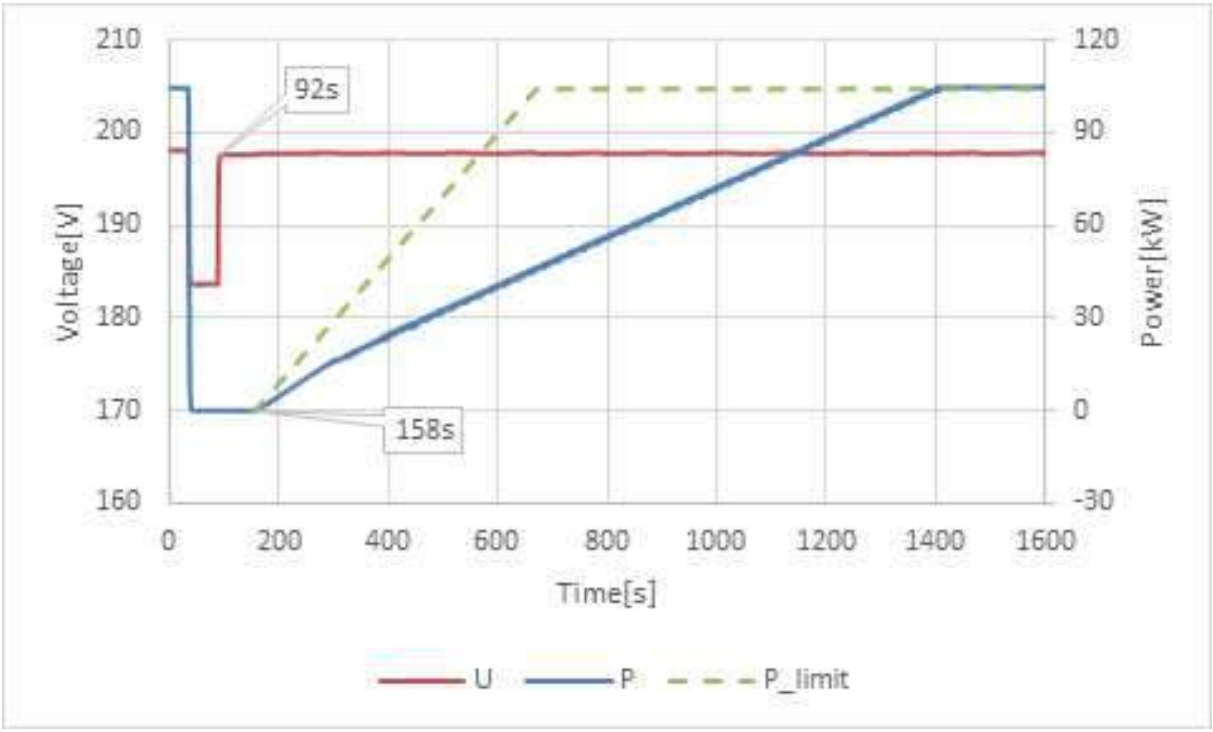
Graph of the gradual power supply : Test b) for ≥ 85% U_n



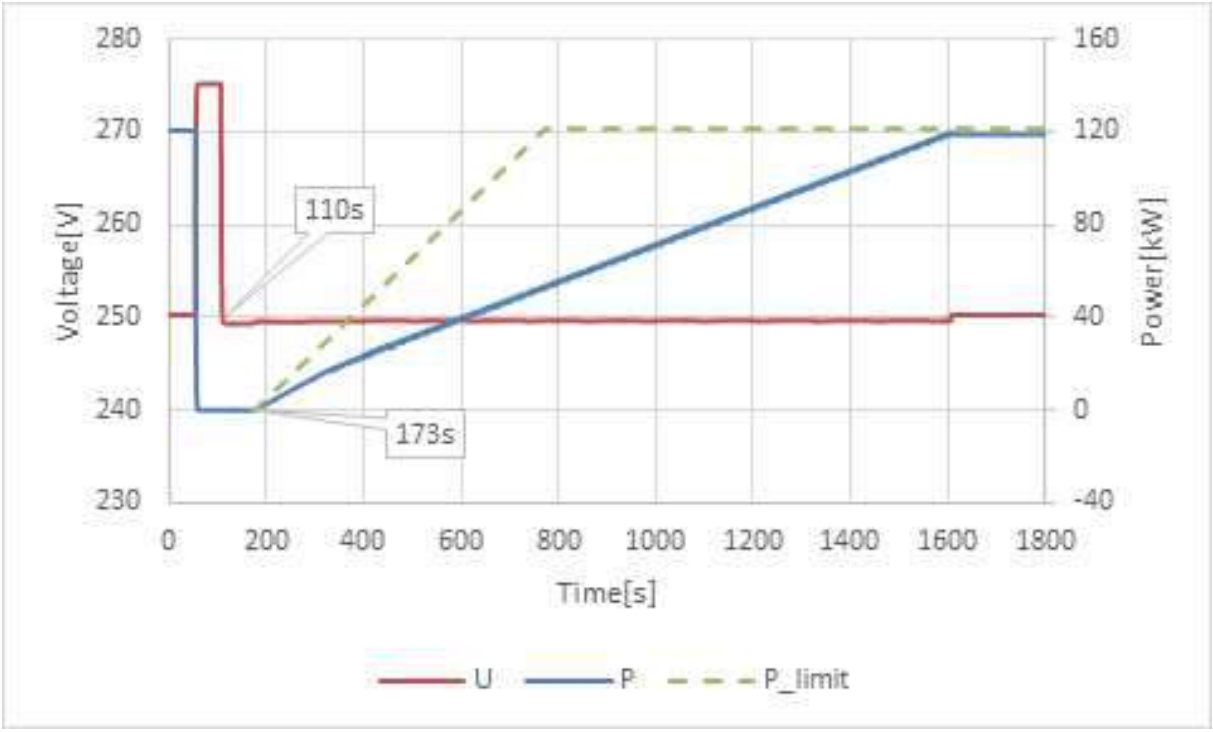
Graph of the gradual power supply : Test b) for ≤ 110% U_n



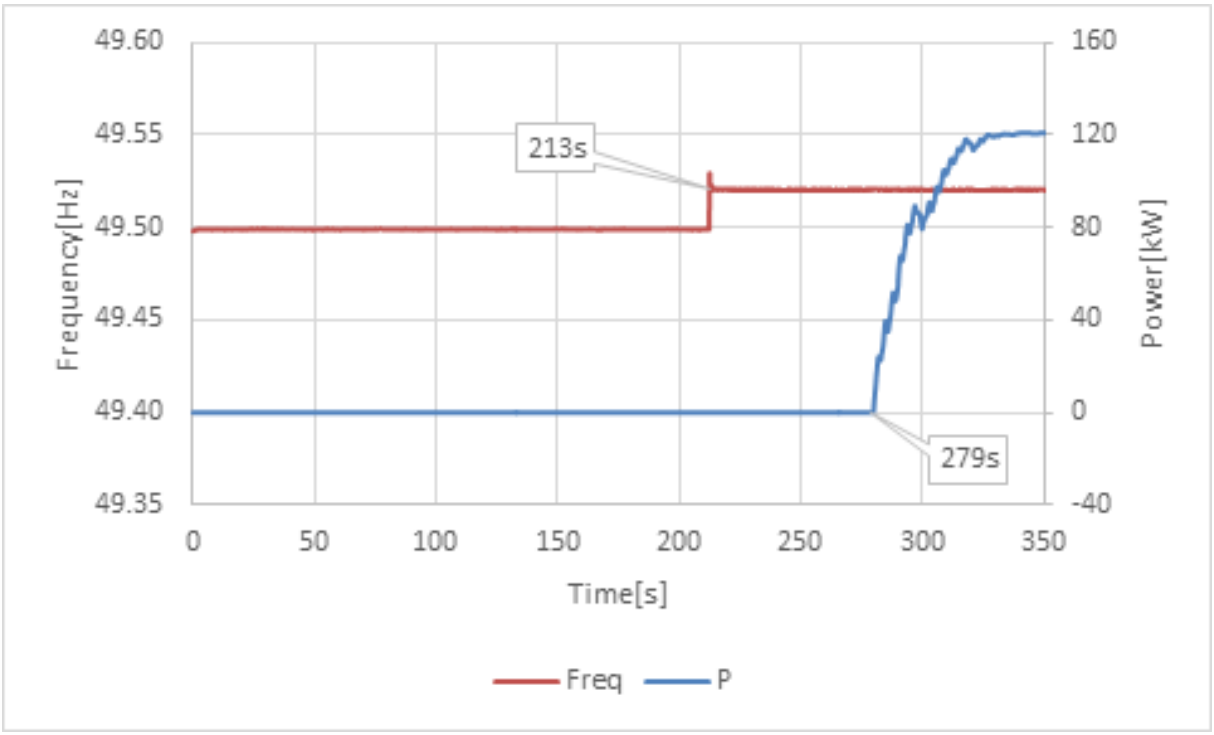
Graph of the gradual power supply : Test c) for ≥ 85% U_n



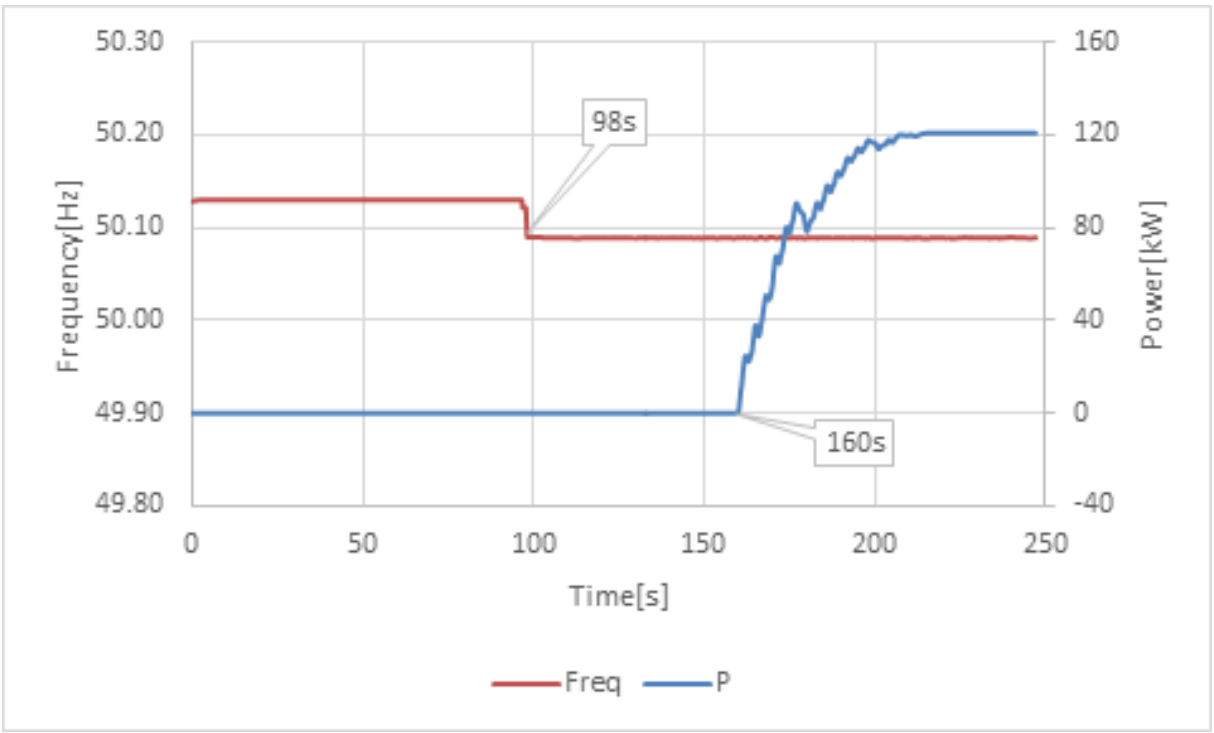
Graph of the gradual power supply : Test c) for ≤ 110% U_n



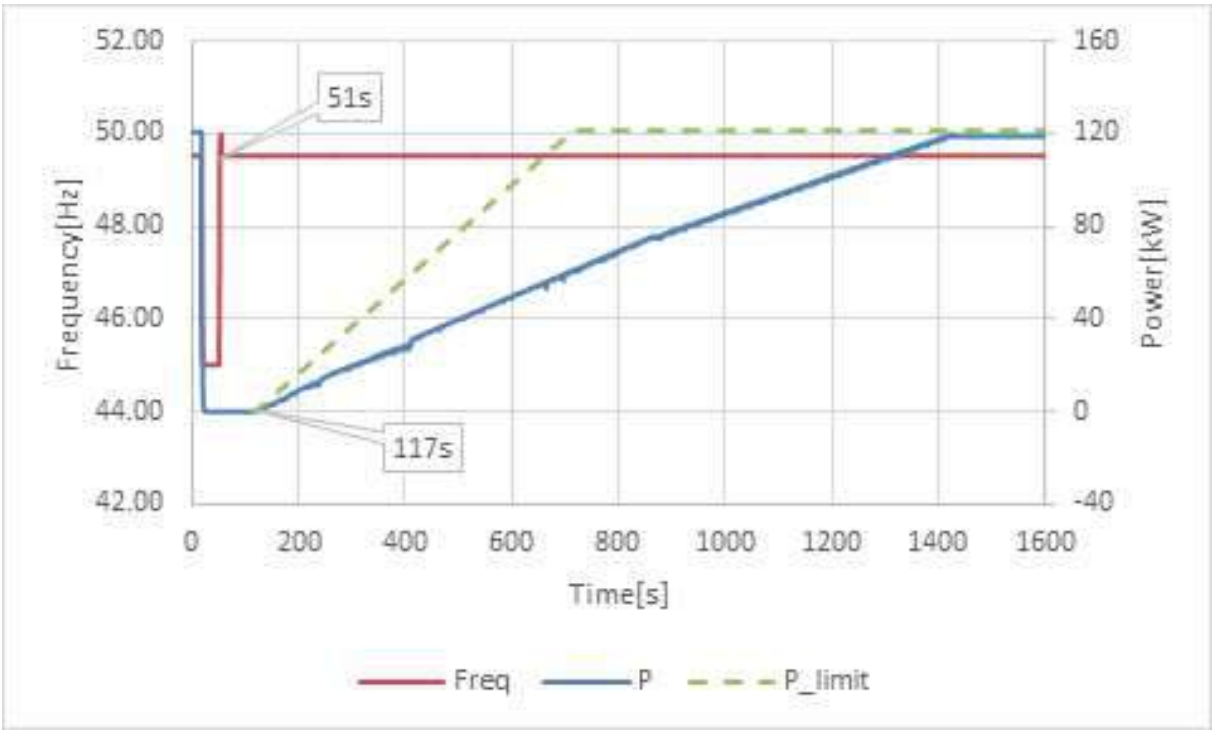
Graph of the gradual power supply : Test e) for ≥ 49,50 Hz



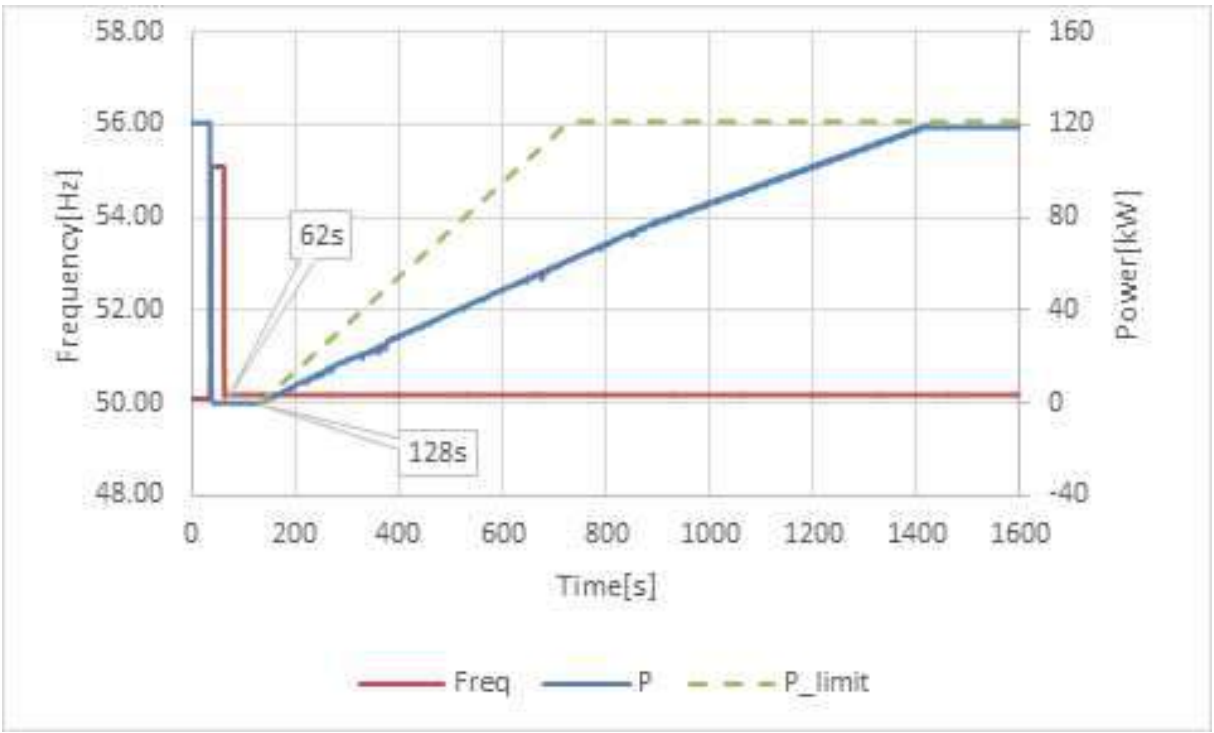
Graph of the gradual power supply : Test e) for ≤ 50,10 Hz



Graph of the gradual power supply : Test f) for ≥ 49,50 Hz



Graph of the gradual power supply : Test f) for ≤ 50,20 Hz



EN 50549-2:2019: Ceasing and reduction of active power on set point			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.11.1	Ceasing active power	CEI 0-21:2022-03, Annex A.4.3.3.2	**P**
4.11.2	Reduction of active power on a set point	FGW TG3, Revision 25, clause 4.1.2	**P**

4.11.1 Ceasing active power	P

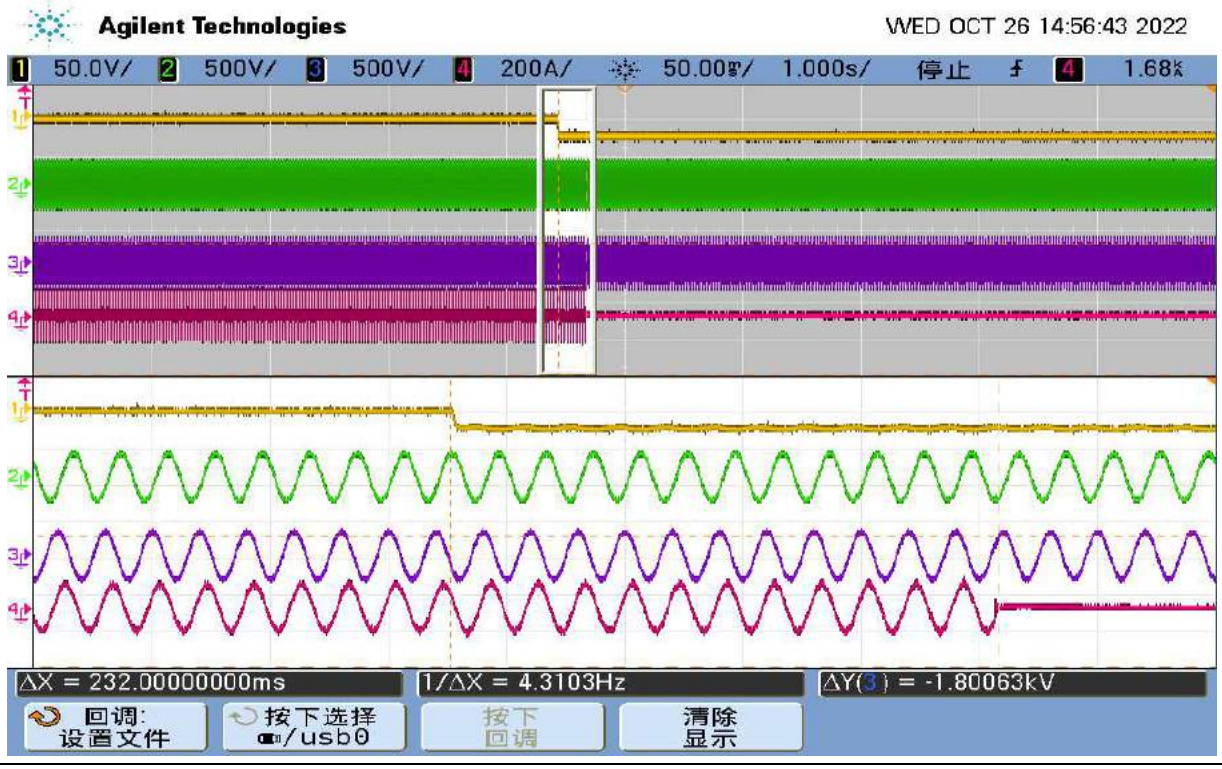
Operating time of the monitoring device	
Test:	Remote tripping signal for the external disconnection
Limit [s]:	5 s
Reaction time of the tripping value [s]:	0,232 s

Note:

The test method refer to Annex A.4.3.3.2 of CEI 0-21: 2022-03.
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. If required by the DSO and the responsible party, this includes remote operation.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Graph of Remote trip signal :



4.11.2	Reduction of active power on set point	P

Test result:

Setpoint power bin [%P_{Emax}]	P_{set} [kW]	P_{60} [kW]	Deviation [%P_{Emax}]
100%	121,00	120,80	-0,17
90%	108,90	109,07	0,14
80%	96,80	96,90	0,08
70%	84,70	84,68	-0,02
60%	72,60	70,64	-1,62
50%	60,50	60,23	-0,22
40%	48,40	48,22	-0,15
30%	36,30	36,29	-0,01
20%	24,20	24,20	0,00
10%	12,10	12,06	-0,03
0%	0,00	4,28	3,54

	Setpoint power bin [%P_{Emax}]	Deviation [%P_{Emax}]
Max. deviation	0%	3,54
Limit $\Delta P_{E60}/P_{Emax}$:	+ 5 % of P_{Emax}	

Test:

The setpoint signal must be reduced from 100% to 0% P_{Emax}:

a) for adjustable PGUs in increments of 10% Pn, 1 minute must elapse after every change to the setpoint setting so that the PGU can settle at the new setpoint, Then the active power of the PGU must be measured as a 1-min mean value.

b) setting be For all other PGUs, in line with their adjustable steps, 5 minutes must elapse after the setpoint is changed so that the PGU can settle at the new setpoint, Then the active power of the PGU must measured as a 1-min mean value.

Assessment criterion:

a) for adjustable PGUs:

- no network disconnection
- the active power value does not exceed the setpoint by more than 5% P_{Emax}
- the setting time determined this way is ≤ 1min

b) For all other PGUs:

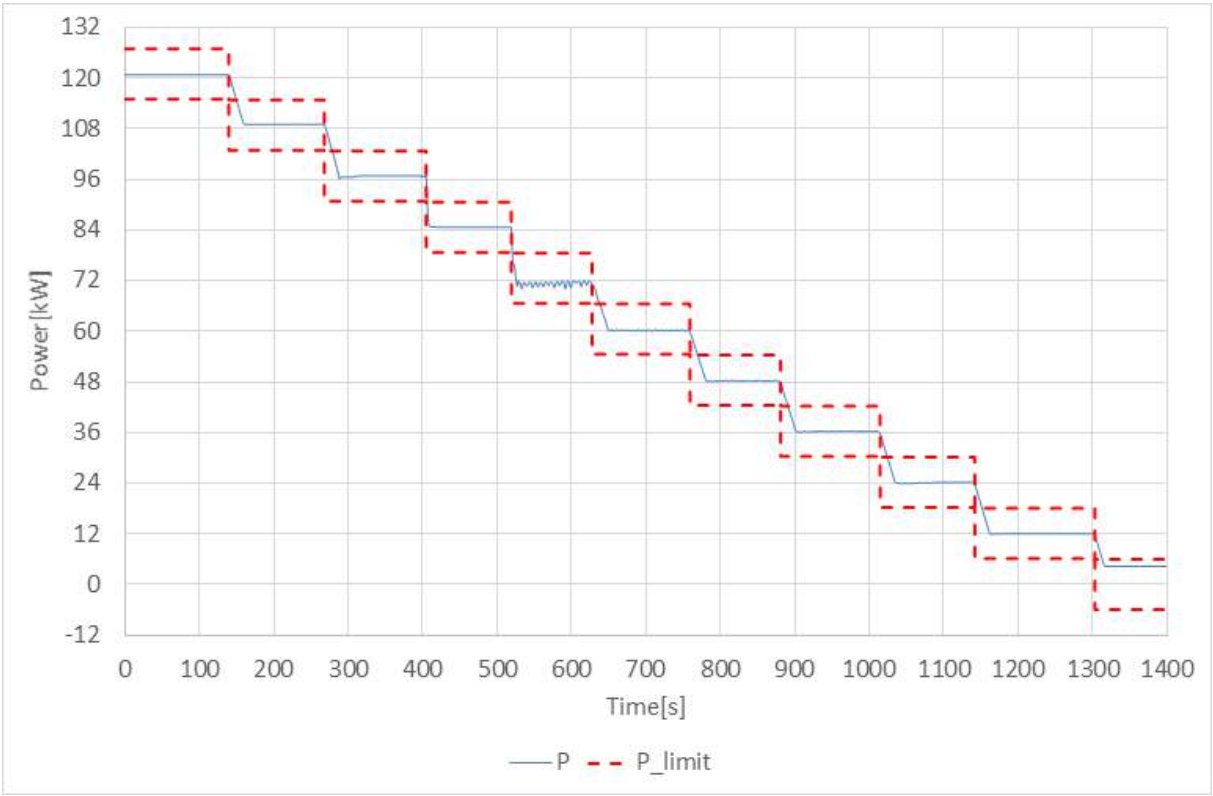
- the active power value does not exceed the setpoint by more than 5% P_{Emax} or
- the setpoint is fallen below within 5 minutes or the PGU has switched off

Note:

The setting time is ≤ 1min. See below “Graph of the setting accuracy”.

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Graph of active power on set point



EN 50549-2:2019: Requirements regarding single fault tolerance of interface protection system and interface switch			
Clause	**Test requirement**	**Test procedure according standard**	**Result**
4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	VDE V 0124-100:2020, clause 5.5.2	**P**

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCE input	Reversed	240V	850V	10min	--	--	--	DC Input: 850Vdc/ 66A/ 56.5kW AC Output: 240Vac/ 76A/ 55kW FID: Ten channels of PV are connected, Nine channels are normally connected, and one channel is inversely connected with positive and negative PV. The PV of positive and negative reverse connection is not connected to the grid.No output power feed into grid. No warning message. MT: N/A SD: ☐ Yes /☒ No GD: ☐ Yes /☒ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass/☐ Fail. DST: ☒ Pass/☐ Fail.
PCE input	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 23.5A/ 20kW AC Output: 230Vac/ 0A/ 0kW FID: The PCE is not connected to the grid. MT: N/A SD: ☒ Yes /☐ No. GD: ☒ Yes /☐ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE input	Over-voltage	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 23.5A/ 20KW AC Output: 230Vac/ 0A/ 0kW FID: The input overvoltage warning is reported. MT: N/A SD: ☒ Yes /☐ No.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch							P
Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
								GD: ☒ Yes /☐ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE input (only for multi-string)	Different input MPP1: low input MPP2: high input	230V	850V	10min	--	--	--	DC Input: Low input:460Vdc/ 21A/ 10kW High input:850Vdc/ 11A/ 10kW AC Output: 230Vac/ 25A/ 17.5kW FID: Trigger differential load drop. No error message or warning message is displayed. MT: N/A SD: ☐ Yes /☒ No GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE input (only for multi-string)	Same input (MPP1 & MPP2 from same power source)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*2A/ 22kW AC Output: 230Vac/ 31A/ 21.5kW FID: The independent mode cannot be connected to the grid, but the parallel mode can be connected to the grid successfully. MT: N/A SD: ☐ Yes /☐ No. GD: ☐ Yes /☐ No. RO: ☒ Yes /☐ No. NCD: ☒ Yes /☐ No. NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCE output	Power over-feed (OCP & OTP function controlled by DSP/ software is isable)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 14.5A*10/ 124kW AC Output: 230Vac / 175A / 121kW FID: The machine is damaged after long operation. MT: N/A SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE output	Over-voltage (OVP function controlled by DSP/ software is isable)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 14.5*10A/ 124kW AC Output: 230Vac/ 175A/ 121kW FID: The machine is damaged after long operation. MT: N/A SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCE output	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 17*8A/ 115kW AC Output: 230Vac / 159A / 110kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE output	Phase sequence or polarity incorrect	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The inverter runs normally. MT: N/A SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCE output	A-Phase mis-wiring grid connection	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE output	B-Phase mis-wiring grid connection	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCE output	C-Phase mis-wiring grid connection	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The inverter shut down immediately. No exception error or warning information is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PCE Cooling system failure	Fan locked	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Warning message 156 or 157 or 158 is reported. After warning message is reported, the machine still runs normally until over-temperature protection is triggered. Error message 40 is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes/☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCE Cooling system failure	opening blocked	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Warning message 156 or 157 or 158 is reported. After warning message is reported, the machine still runs normally until over-temperature protection is triggered. Error message 40 is displayed. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes/☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
MCU or DPS processer failure								
DSP failure	+1.2V power supply disable	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110KW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
DSP failure	+3.3V power supply disable	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
DSP failure	+5V power supply disable	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
DSP failure	reset	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
DSP failure	Misconnection with slave DSP	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch							P
Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Loss of control & Function check fault								
Watchdog failure	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac / 155A / 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
IGBT PMW	Loss / failure (no power)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 113kW AC Output: 230Vac / 155A / 107kW FID: If no grid-connected, the inverter bridge fault and relay check error are reported. MT: N/A SD: ☐ Yes /☐ No, GD: ☐ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
IGBT PMW	Loss / failure (one bridge on always)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: If no grid-connection occurs, the inverter is abnormal and pass-through protection is triggered during grid-connection. MT: N/A SD: ☐ Yes /☐ No, GD: ☐ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
IGBT PMW	Loss / failure (No driver)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PV/DC Voltage detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 500Vdc/ 22A/ 11kW AC Output: 230Vac/ 15.5A/ 10.7kW FID: Two PV channels are connected, one is normal, the other is short-connected with a 499K sampling resistance, which causes abnormal voltage sampling. The PV channel with abnormal sampling does not chase power. MT: N/A SD: ☐ Yes /☐ No, GD: ☐ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
PV/DC current detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Error message 4 is displayed, that is, the DC current component is injected too high. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
BUS Voltage detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
Inverter current detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: Vac / A / kW FID: The machines broken down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Inverter voltage detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Inverter voltage sampling loss, the machine directly off the grid; The inverter voltage sampling fault triggers overcurrent, and the relay check fault is reported. MT: N/A SD: ☒ Yes /☐ No, GD: ☒ Yes/☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No, NH: ☒ Pass /☐ Fail. DST: ☒ Pass /☐ Fail.
Grid/AC current detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: ac / A / kW FID: The machines broken down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Grid/AC voltage detector	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: Vac / A / kW FID: The machines broken down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes/☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
DC isolation device function check	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13×10A/ 110kW AC Output: Vac / A / kW FID: When connected to the power grid, the machine is not connected to the grid. After about eight minutes, error message 38 is reported, that is, insulation impedance detection failed. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
AC isolation device function check	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: Vac / A / kW FID: Not connected to the grid. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
Relay / Contactor function check (K1 o-c)	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: Vac / A / kW FID: The network connection fails and relay check fails. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
Relay / Contactor function check (K2 o-c)	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: Vac / A / kW FID: The network connection fails and relay check fails. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Relay / Contactor function check (K3 o-c)	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: Vac / A / kW FID: The network connection fails and relay check fails. MT: N/A SD: ☐ Yes/☐ No, GD: ☐ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
RCD/RCM function check	Loss / failure	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac / 155A/ 107kW FID: Report GFCI error. CT501 MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Ambient temperature detector	Loss / failure (s-c)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
Ambient temperature detector	Loss / failure (o-c)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
IGBT temperature detector	Loss / failure (s-c)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
IGBT temperature detector	Loss / failure (o-c)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Low temperature can not start or grid; High temperature triggers overtemperature load drop. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Heat-sink temperature detector	Loss / failure (s-c)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The inverter shut down immediately. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
Heat-sink temperature detector	Loss / failure(o-c)	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The inverter shut down immediately. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch							P
Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Components single fault condition and Functional insulation on PWB short circuit test								
IGBT (IGBT D-S)	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: BOOST IGBT short circuit, triggering BOOST overcurrent; INV IGBT short circuit, causing explosion. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☐ No, NCD: ☐ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
DC input Bus capacitor (420μF)	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Causing the machine to blow up. MT: N/A MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☐ Yes/☒ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
DC input filter capacitor	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine is not connected to the grid. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
LC filter capacitor	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine stopped immediately. Always report AC side current. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
Power supply transformer (TX104)	Output 12V s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine goes straight off the grid. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.
Power supply transformer (TX108)	Output 5V s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine goes straight off the grid. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch							P
Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PN Board								
Drive up transformer	s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: Causing the machine to broke down. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☐ Yes /☒ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.
SPS unit	Output s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/☐ Fail. DST: ☒ Pass /☐ Fail.

4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	P

Component No.	Fault	Test condition		Test time	Fuse No.	Fault condition		Result
		AC	DC			AC	DC	
PCB Board								
SPS unit	Output s-c	230V	850V	10min	--	--	--	DC Input: 850Vdc/ 13*10A/ 110kW AC Output: 230Vac/ 155A/ 107kW FID: The machine shut down immediately. MT: N/A SD: ☒ Yes/☐ No, GD: ☒ Yes /☐ No, RO: ☒ Yes /☐ No, NCD: ☒ Yes/☐ No, NH: ☒ Pass/ ☐ Fail. DST: ☒ Pass / ☐ Fail.

FID	Fault Indication	MT	Max. Temperature
SD	PCE Shut Down:	GD	Disconnection To Grid
RO	Recovered to Operate after removing the single fault setting	NCD	No comp. or parts damaged
NH	No hazards occurred	DST	Dielectric strength test
s-c	short-circuited	o-c	open-circuited
o-l	Over-load.		

The errors in the control circuit simulate that the safety is even under one error ensured.

Addendum – Shutdown device

Each active phase can be switched. (L and N)	Yes. In each line and neutral a Relay with min. 4,0 mm gab used.
If no galvanic separation between AC and DC (PV): Two relays in series on each active phase are necessary to fulfil the basic insulation or simple separation based on the PV working voltage.	Two relays in series on each active phase

Note:

The tests had been performed on the ASW110K-LT are valid for the ASW75K-LT, ASW80K-LT and ASW100K-LT since it is almost same as in hardware and just power derated by software.

Annex No. 1

Datasheet of the relay

HF167F-270 SOLAR RELAY

c UL us
File No.: E133481

File No.: R50374273

Features

- 270A switching capability
- Applicable to solar photovoltaic inverter
- 4.0 mm contact gap
- Low coil holding voltage contributes to saving energy of equipment
- UL insulation system: Class F
- Available with heat sink specifications for better heat dissipation

RoHS compliant

CONTACT DATA

Contact arrangement	1H
Contact resistance(initial)	≤1mΩ(6VDC 20A)
Contact material	AgNi、$AgSnO_2$
Contact rating (Res. load)	Making 50A, carrying 270A, breaking 50A, 1000VAC
Max. switching voltage	1000VAC
Max. switching current	270A
Max. switching power	270000VA
Mechanical endurance	3×10^5OPS
Electrical endurance	AgNi: ≥1×10^4OPS (85℃, 1s on 9s off, Making 50A, carrying 270A,breaking 50A, 1000VAC, Resistive load) $AgSnO_2$: ≥3×10^4OPS (85℃, 1s on 9s off, Making 50A, carrying 270A,breaking 50A, 1000VAC, Resistive load)

CHARACTERISTICS

Insulation resistance		1000 MΩ (500VDC)
Dielectric strength	Between open contacts	2000VAC 1min
	Between coil & contacts	5000VAC 1min
Surge voltage		10kV(1.2/50μs)
Operate time (at rated. volt.)		30ms max.
Release time (at rated. volt.)		10ms max.
Temperature rise		70K max. (Contact load current 270A, Rated voltage is reduced to holding voltage after 100ms of excitation, at 85℃)
Shock resistance	Functional	98m/s²
	Destructive	980m/s²
Vibration resistance		10Hz to 55Hz 1.0mm DA
Humidity		5 % to 85 % RH
Ambient temperature		-40℃ to 85℃ (Coil rated voltage is reduced to holding voltage after 100ms of excitation)
Termination		PCB
Unit weight		Approx.265g
Construction		Flux proofed

Notes: The data shown above are initial values.

COIL

Coil power	High power consumption type: Approx.5W
Holding voltage	40% to 100%UN(at 23℃) 50% to 60%UN(at 85℃)

Notes: 1)The coil holding voltage is the voltage applied to coil 200ms after the rated voltage.
2)To avoid overheating and burning, the coil can not be consistently applied to with voltage larger than maximum holding voltage.

COIL DATA 23℃

High power consumption type

Nominal Voltage VDC	Pick-up Voltage VDC max.	Drop-out Voltage VDC min.	Max. Voltage VDC[1)]	Coil Resistance Ω
6	≤4.5	≥0.3	7.2	7.2×(1±10%)
9	≤6.75	≥0.45	10.8	16.2×(1±10%)
12	≤9	≥0.6	14.4	28.8×(1±10%)
24	≤18	≥1.2	28.8	115.2×(1±10%)

Notes: Maximun voltage refers to the maximun voltage which relay coil could endure in a short period of time.

SAFETY APPROVAL RATINGS

UL/CUL	AgNi	Making 50A, carrying 270A, breaking 50A, 1000VAC, 85℃, 10000OPS, Resistive load
	$AgSnO_2$	Making 50A, carrying 270A, breaking 50A, 1000VAC, 85℃, 30000OPS, Resistive load 270A 1000VAC, 85℃, 100OPS, Resistive load
TUV	AgNi	Making 50A, carrying 270A, breaking 50A, 1000VAC, 85℃, 10000OPS, Resistive load
	$AgSnO_2$	Making 50A, carrying 270A, breaking 50A, 1000VAC, 85℃, 30000OPS, Resistive load 270A 1000VAC, 85℃, 100OPS, Resistive load

HONGFA RELAY
ISO9001、IATF16949、ISO14001、OHSAS18001、IECQ QC 080000 CERTIFIED 2022 Rev. 1.01

001

ORDERING INFORMATION

	HF167F-270/	12	-H	P	3	F	L	(XXX)
Type								
Coil voltage	6,9,12,24VDC							
Contact arrangement	**H:** 1 Form A							
Coil type	**P:** Coil power consumption 5W							
Contact material	**3:** AgNi	**T:** $AgSnO_2$						
Insulation standard	**F:** Class F							
Special Requirement	**Nil:** Standard type	**L:** With heat sink						
Special code	**XXX:** Customer special requirement	**Nil:** Standard type						

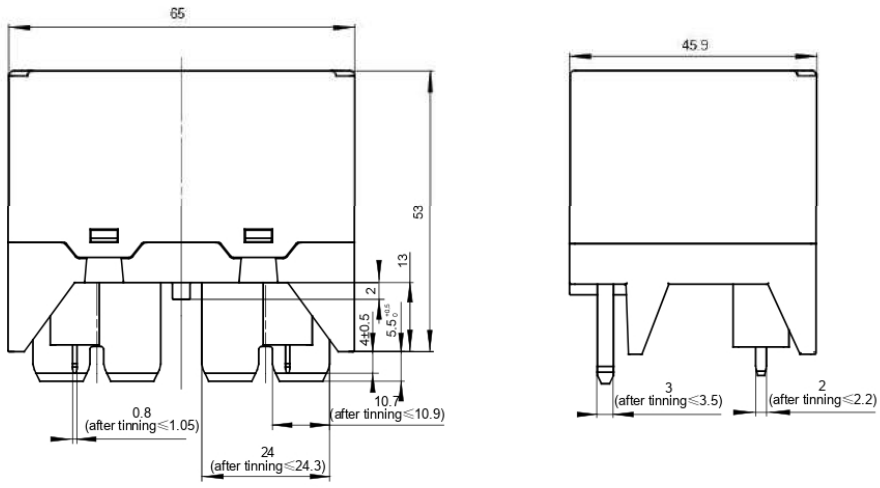
Notes: 1) Flux-proofed relays can not be used inthe environment with pollutants like H_2S, SO_2, NO_2, dust, etc.
2) Water clearing or surface process is not suggested after the flux-proofed relays are assembled on PCB.
3) The customer special requirement express as special code after evaluating by Hongfa.

OUTLINE DIMENSIONS, WIRING DIAGRAM AND PC BOARD LAYOUT

Unit: mm

Outline Dimensions

Without heat sink type:



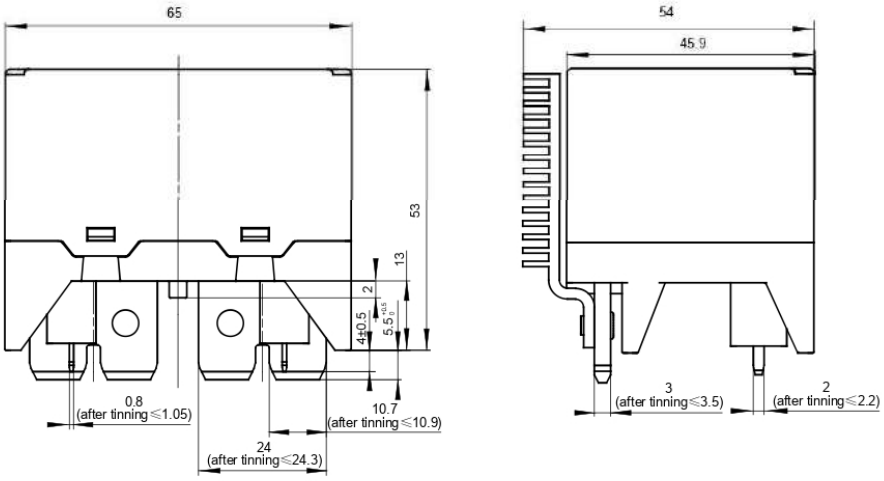
002

OUTLINE DIMENSIONS, WIRING DIAGRAM AND PC BOARD LAYOUT

Unit: mm

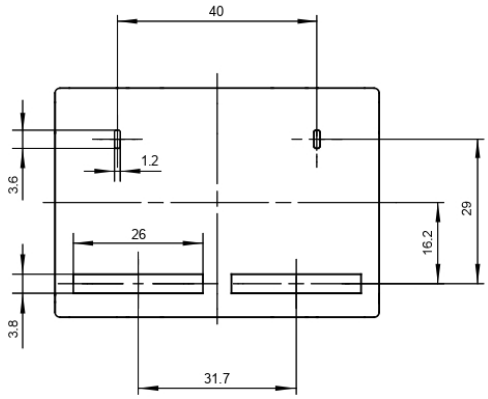
Outline Dimensions

With heat sink type:



PCB Layout

(Bottom view)

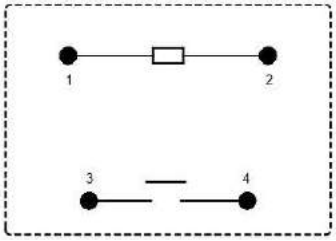


003

OUTLINE DIMENSIONS, WIRING DIAGRAM AND PC BOARD LAYOUT

Unit: mm

Wiring Diagram
(Bottom view)



Remark: 1) In case of no tolerance shown in outline dimension: outline dimension ≤1mm, tolerance should be ±0.2mm; outline dimension >1mm and ≤5mm, tolerance should be ±0.3mm; outline dimension >5mm, tolerance should be ±0.4mm.
2) The tolerance without indicating for PCB layout is always ±0.1mm.

004

Annex No. 2

Pictures of the unit

Photo of EUT

Enclosure front view

Enclosure back view

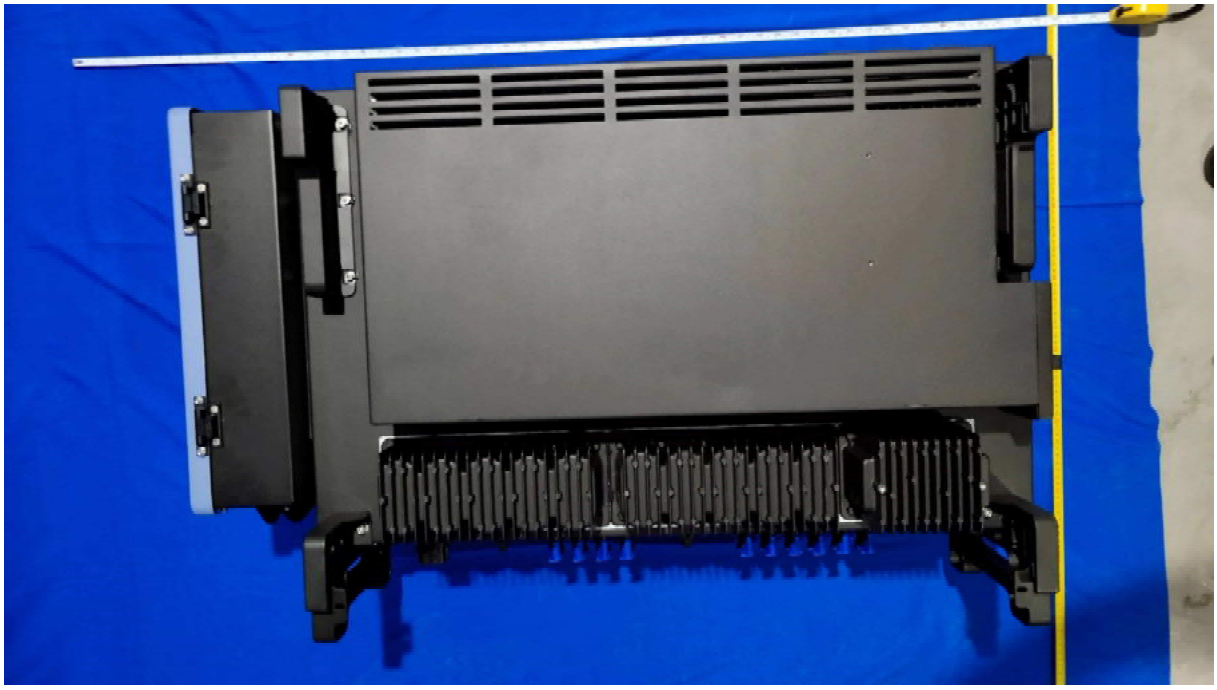


Photo of EUT

Enclosure left view

Enclosure right view

Photo of EUT

Enclosure top view

Enclosure bottom view

Photo of EUT

Internal view

Annex No. 3

Test Equipment list

Date(s) of performance test: 2022-10-18 to 2022-12-02

Equipment	Internal No.	Manufacturer	Type	Serial No.	Next Calibration
Power Analyzer	ESCGJ975	DEWETRON	TRION-1810-HV-8	A1217310	May 11, 2023
Power Analyser	SE-776	YOKOGAWA	WT1800	C3SA13008E	Jun. 09, 2023
AC Source	ESCGJ999	Kewell	KAC-400-690-33	6018888220300474	Monitored by Power Analyzer
DC Simulation Power Supply	ESCGJ768	Chroma	62180H-1800S	96218010000276	
	ESCGJ771	Chroma	62180H-1800S	96218010000257	
	ESCGJ807	Chroma	62180H-1800S	96218010000324	
	ESCGJ801	Chroma	62180H-1800S	96218010000321	
	ESCGJ802	Chroma	62180H-1800S	96218010000329	
	ESCGJ804	Chroma	62180H-1800S	96218010000313	
	ESCGJ805	Chroma	62180H-1800S	96218010000173	
	ESCGJ880	Chroma	62180H-1800S	96218010000558	
	ESCGJ881	Chroma	62180H-1800S	96218010000534	
	ESCGJ882	Chroma	62180H-1800S	96218010000516	
RLC Load	SE-124	kaixiangdianqi	AC380-750kVA-	2006275	
Amolifier AC/DC current probe	/	Tektronix	TCPA300	C038351	Jun. 07, 2023
Oscilloscope	SCGJ107	Agilent	DSO7014A	MY49110449	Jun. 07, 2023
20-Channel Armature Miltiplexer	/	KEYSIGHT	DAQM901A	MY58017574	Jun. 07, 2023
Current transducer	/	Tektronix	TCP404XL	C022615	Jun. 29, 2023
	/	Tektronix	TCP404XL	C022616	Jun. 29, 2023
	/	Tektronix	TCP404XL	C022452	May 17, 2023
	/	Tektronix	TCP404XL	C022473	May 18, 2023
Oscilloscope probe	ESCGJ777	Tektronix	P5200A	C034435	Jun. 08, 2023
	ESCGJ782	Tektronix	P5200A	C034415	Jun. 08, 2023
	SCGJ338	Tektronix	P5200A	C022123	Jun. 08, 2023
	SCGJ704	Tektronix	P5200A	C023446	Jun. 08, 2023
Temp. & Humi. Recorder	SH-001	/	HTC-1	/	Nov. 23, 2023

--End of Test Report--