Iskra, d.d.
PE Instrumenti
Otoče 5a, SI4277
Podnart
Elektriški merilni laboratorij
Electrical measuring laboratory

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TEST REPORT

Test sample	MEASURING CENTRE MC7X0
Producer	Iskra d.d.
Test	EMC, safety requirements, other tests
No. of test samples	4
Applicant	Iskra d.d., Stegne 21, 1000 LJUBLJANA

	Name	Signature	Date
Tested	Uroš Jenko		11.6.2018
Approved	Saša Noč		11.6.2018

APPLIED STANDARDS:

EN 61010-1: 2010, Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements

EN 61326-1: 2013, EMC requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

Conclusion:
MC 7x0 samples were tested regarding EMC, safety requirements and operational tests after following modification:
-New communication ETH/USB board.
-New AUX (universal supply) board.

Tested samples were in accordance with the requirements of all parts standards and technical specification.

Measurement, reference standard	Required level or standard item	Result P-pass F-fail	Tested	Date	Remarks Report item
Operational test					
Supply voltage start test	Temperature influence -15 °C to 55 °C Voltage variation 20 V – 300 V DC 20 V – 276 V AC	P	MM	11.04.2018	1
Electromagnetic compatibility (EMC)					
Conducted emission measurement CISPR 22:2008 EN 55022:2010	AC mains port 0,15 MHz to 30 MHz	P	UJ	29.03.18 - 04.04.18	2
Test of immunity to conducted disturbances, inducted by RF fields, IEC 61000-4-6:2013 EN 61000-4-6:2014	AC/DC supply Voltage/current input ETH, USB	P	UJ	11.04.18	3
Fast transient burst test IEC 61000-4-4:2012 EN 61000-4-4:2012	AC/DC supply, 2 kV Voltage/current input, 2 kV ETH, USB, 1 kV	P	UJ	11.04.18	4
Surge immunity test IEC 61000-4-5:2014 EN 61000-4-5:2014	AC/DC supply – 1kV/2kV	P	UJ	11.04.18	5
Test of immunity to electromagnetic RF field IEC 61000-4-3:2006 EN 61000-4-3:2006	10 V/m 80 MHz-1000 MHz	P	UJ	17.05.18	6

Product safety requirements (LVD)					
Check list of safety requirements IEC 61010-1: 2010		P	UJ	12.04.18	7
HV dielectric test IEC 61010-1: 2010	Uaux, 3,5 kV 50 Hz or 5 kV DC Voltage input, 2,2 kV 50 Hz or 3,1 kV DC	P	MM	12.04.18	8
Continuous operation	On/OFF 10 min/10sec All AO: load Voltage Input: 230 V+20 % Voltage supply: 230 V +20 %	P	UJ	26.10.2017 to 22.01.2018	9
Vibration test	Frequency: 25 Hz to 60 Hz Amplitude: 0,5 mm Acceleration: 1,5 g	P	UJ	19.04.2018	10

The test results are valid for samples from the list.

LIST OF TESTED DEVICE AND TEST LIST:

MC770, SN: MC028137, SW ver: 1.06, COMM ETH/USB ver: 7.8
MC770, SN: MC028138, SW ver: 1.06, COMM ETH/USB ver: 7.8
MC770, SN: MC028139, SW ver: 1.06, COMM ETH/USB ver: 7.8
MC770, SN: MC028141, SW ver: 1.06, RS485

SN: MC028137

Tested device consists from**:**

Description	Modul title	POP Code	TIV Code	Quantity
processor board	POP MC774 PROCESORSKA	022501091000	022601633004	1
input board	POP MC784 VHODNA	022501171000	022601697004	1
AUX power supply	POP MC770 NAPAJALNA UNI	022501368000	022602001000	1
ETH & USB communication board	POP MC774 POV. ETH/USB v2	022501330000	022601925000	1
2x analog output board (20 mA)	POP MC760 ANALOGNI IZHOD v4	022500846001	022601172006	2

SN: MC028138

Tested device consists from**:**

Description	Modul title	POP Code	TIV Code	Quantity
processor board	POP MC774 PROCESORSKA	022501091000	022601633004	1
input board	POP MC784 VHODNA	022501171000	022601697004	1
AUX power supply	POP MC770 NAPAJALNA UNI	022501368000	022602001000	1
ETH & USB communication board	POP MC774 POV. ETH/USB v2	022501330000	022601925000	1

Description	Modul title	POP Code	TIV Code	Quantity
2x analog output board (20 mA)	POP MC760 ANALOGNI IZHOD v4	022500846001	022601172006	2

SN: MC028139

Tested device consists from**:**

Description	Modul title	POP Code	TIV Code	Quantity
processor board	POP MC774 PROCESORSKA	022501091000	022601633004	1
input board	POP MC784 VHODNA	022501171000	022601697004	1
AUX power supply	POP MC770 NAPAJALNA UNI	022501368000	022602001000	1
ETH & USB communication board	POP MC774 POV. ETH/USB v2	022501330000	022601925000	1
Modul 1: 2x rele	POP MC760 IZ 2xALARM v2	022500845003	022601171005	1
Modul 2: COM 485	POP MC760 COM2 RS485 v2	022500902002	022601260002	1

SN: MC028141

Tested device consists from**:**

Description	Modul title	POP Code	TIV Code	Quantity
processor board	POP MC774 PROCESORSKA	022501091000	022601633004	1
input board (AAA)	POP MC784 VHODNA	022501171000	022601697001	1
AUX power supply	POP MC770 NAPAJALNA UNI	022501368000	022602001000	1
COM RS485	POP MC774 KOMUNIKACIJA RS	022501105000	022601170007	1
Modul 1: tarifa 230 V	POP MC760 TARIFNI VHOD 230V v2	022500874100	022601212002	1
Modul 2: pulzni izhod	POP MC760 IZ 2 x PO	022500845002	022601171003	1

1. Supply voltage test

Applied measurement equipment:
-AC/DC power supply, Statron
-DMM, Fluke 179
-Climatic chamber, Kambic

Sample: MC028137

Test conditions:
MC was positioned in climatic chamber.
MC was connected with power supply. USB/ETH communication was active.
Time of exposed: 4 h at one temperature.

	AC supply			**DC supply**		
	Low supply indication	Low supply indication and operating	Normal operation	Low supply indication	Low supply indication and operating	Normal operation
Temp. 23°C	9 V (Low supply!)	19,2 V э-	20 V	9,5 V (Low supply!)	19,8 V э-	20 V
	x	x	48 V	x	x	230 V
	x	x	276 V	x	x	300 V

	AC supply			**DC supply**		
	Low supply indication	Low supply indication and operating	Normal operation	Low supply indication	Low supply indication and operating	Normal operation
Temp. -15°C	10,3 V(Low supply!)	20,16 V э-	20,23 V	10,6 V(Low supply!)	20,75 V э-	20,8 V
	x	x	48 V	x	x	230 V
	x	x	276 V	x	x	300 V

	AC supply			**DC supply**		
	Low supply indication	Low supply indication and operating	Normal operation	Low supply indication	Low supply indication and operating	Normal operation
Temp. 55°C	10,57 V (Low supply!)	19,23 V э- Lcd rahlo utripa	19.98 V	10,38 V(Low supply!)	19,53 V э- Lcd rahlo utripa do 21V	21,05 V
	x	x	48V	x		230V
	x	x	276V	x	x	300V

All measured values are in accordance with the requirements.

2. Conducted emission measurement

Applied measurement equipment:
-Signalni analizator, PMM 9010
-Artificial mains network L3-32
-Power supply, Statron

Applied standard: CISPR 22, IEC 55022
Performance criteria:

0,15 MHz to 0,50 MHz	66 to 56 dB (µV) QP, 56 to 46 dB (µV) AV
0,5 MHz to 5 MHz	56 dB (µV) QP, 46 dB (µV) AV
5 MHz to 30 MHz	60 dB (µV) QP, 50 dB (µV) AV

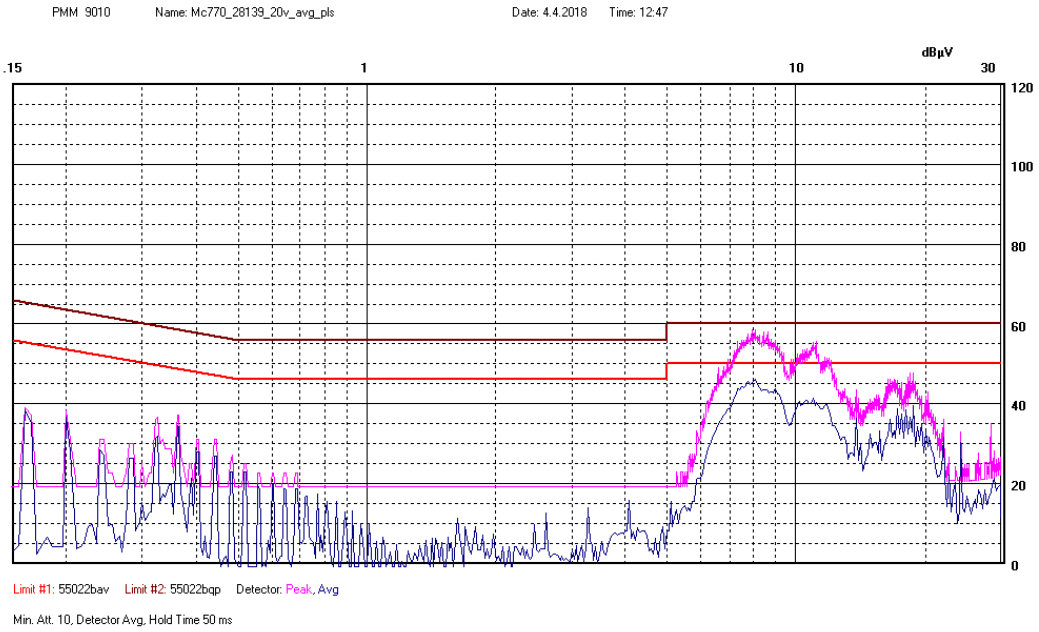
AC main port – power supply U_{aux}

Test Conditions:
Uaux: see data below
Uin: 3 x 230 V, In: 3 x 4,5 A, PF = 1
USB/ETH communication active

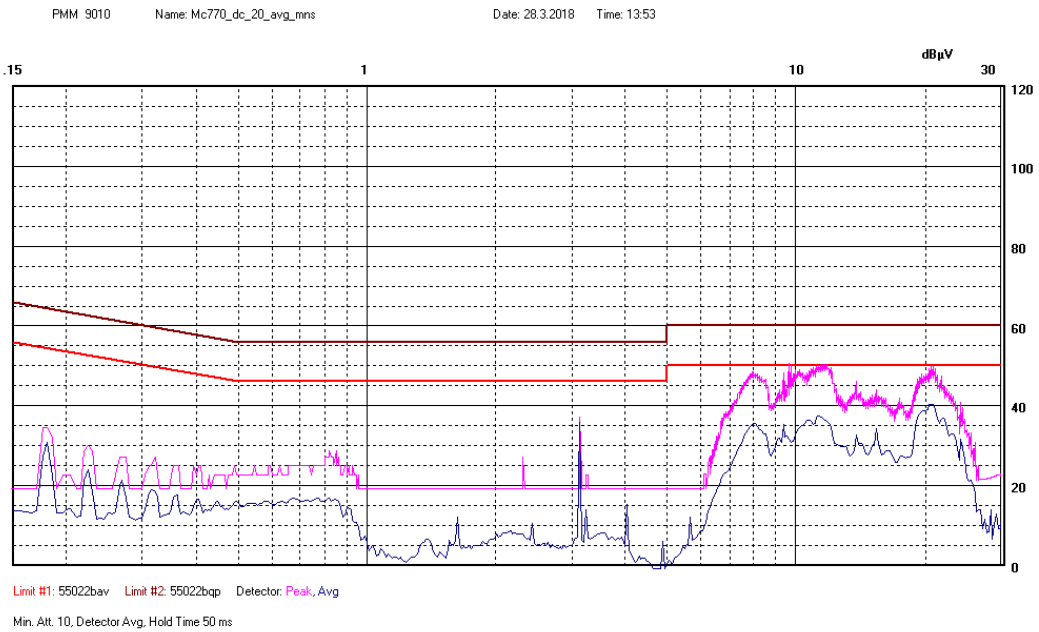
Test results:

All measured values are in accordance with the requirements.

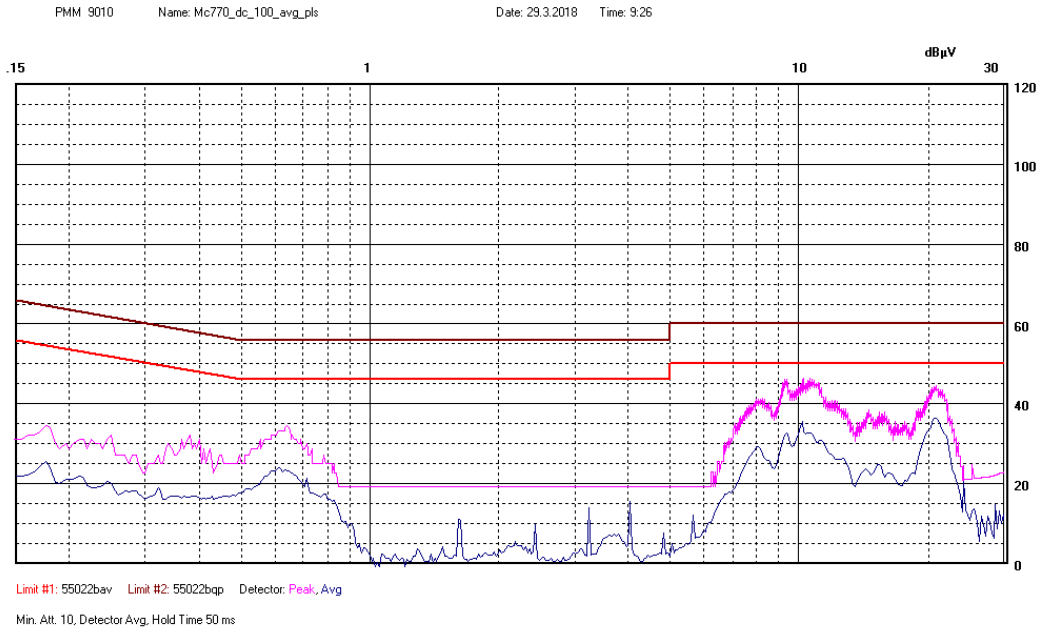
Power supply: 20 V DC
Detector: Average
Uaux: + terminal



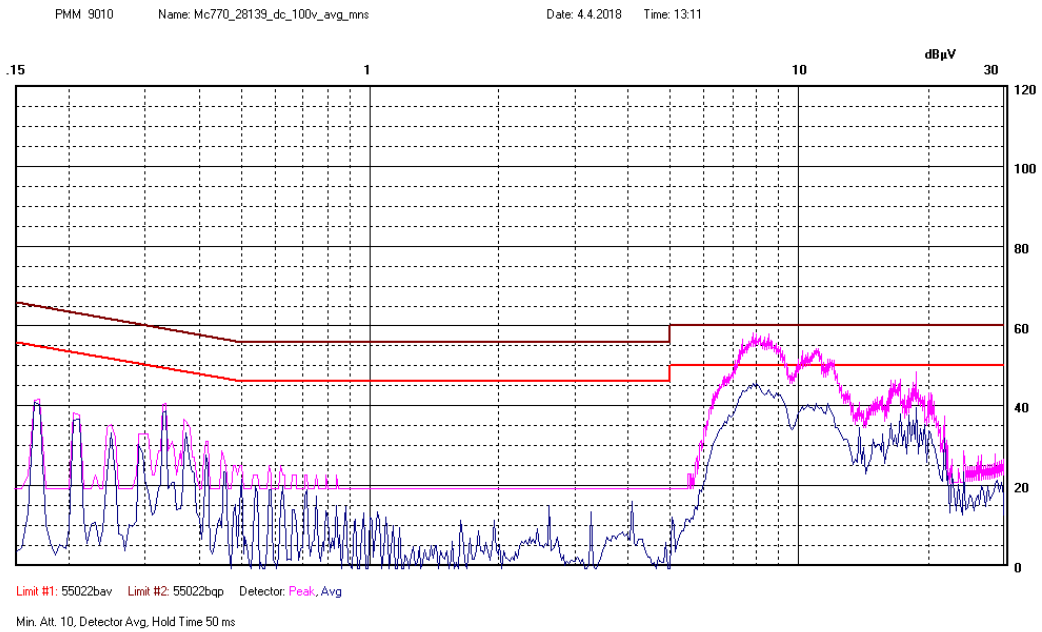
Power supply: 20 V DC
Detector: Average
Uaux: - terminal



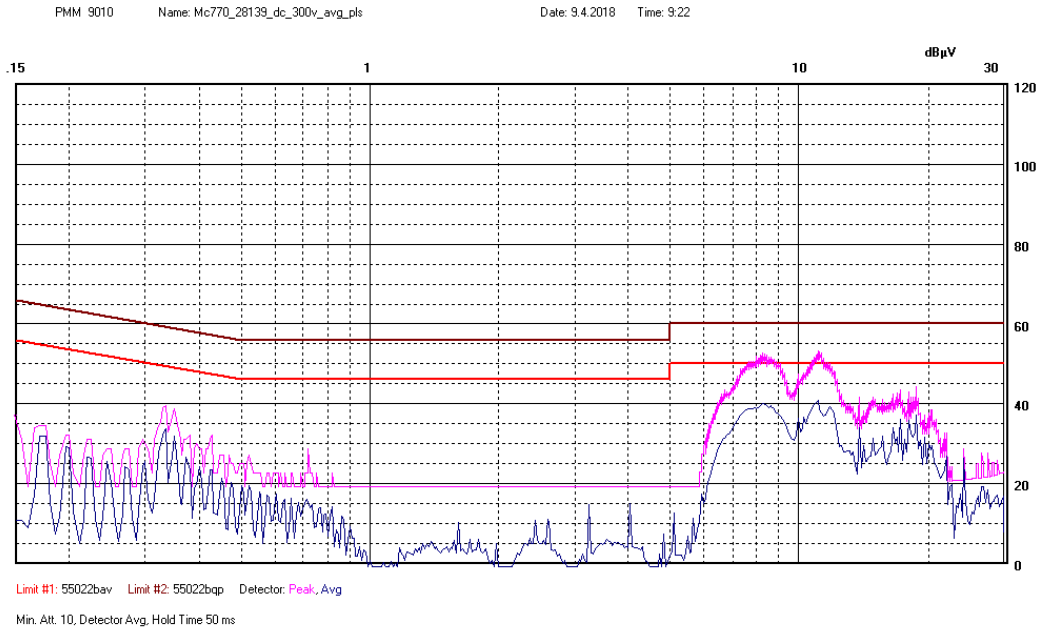
Power supply: 100 V DC
Detector: Average
Uaux: + terminal



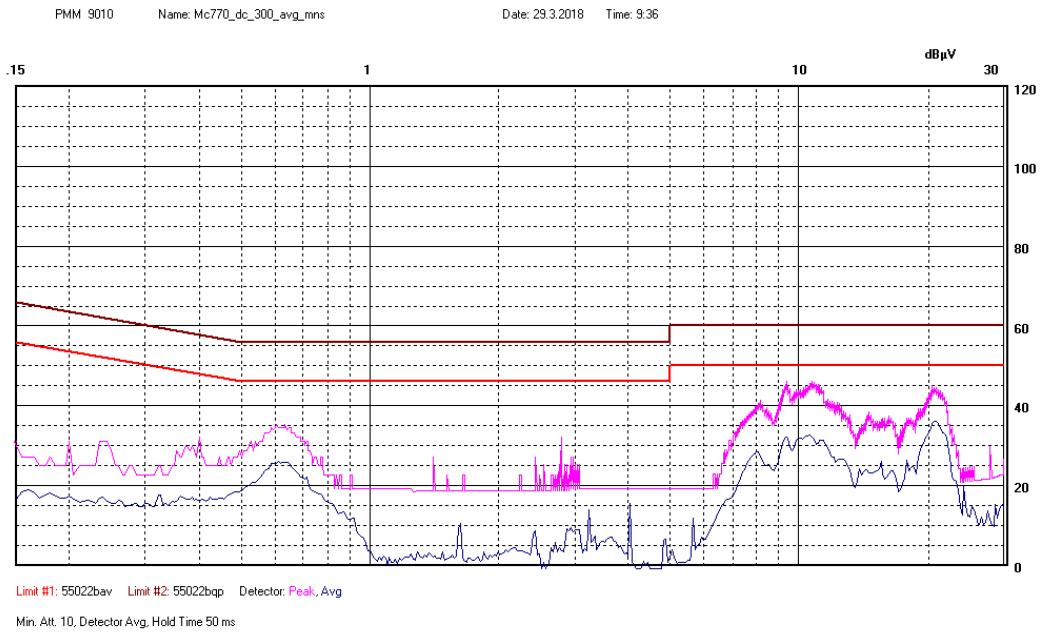
Power supply: 100 V DC
Detector: Average
Uaux: - terminal



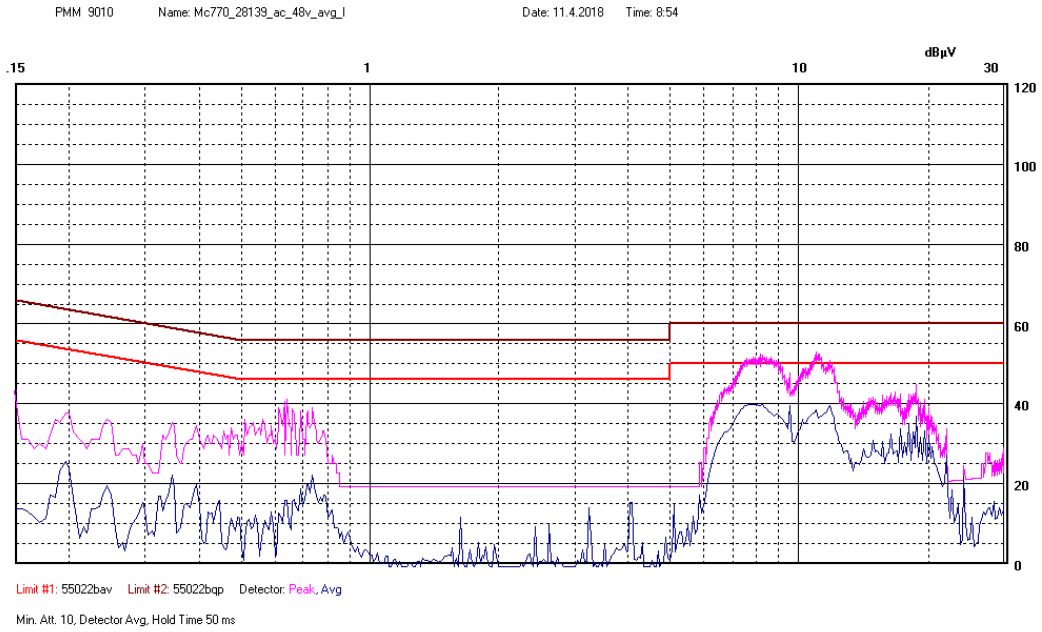
Power supply: 300 V DC
Detector: Average
Uaux: + terminal



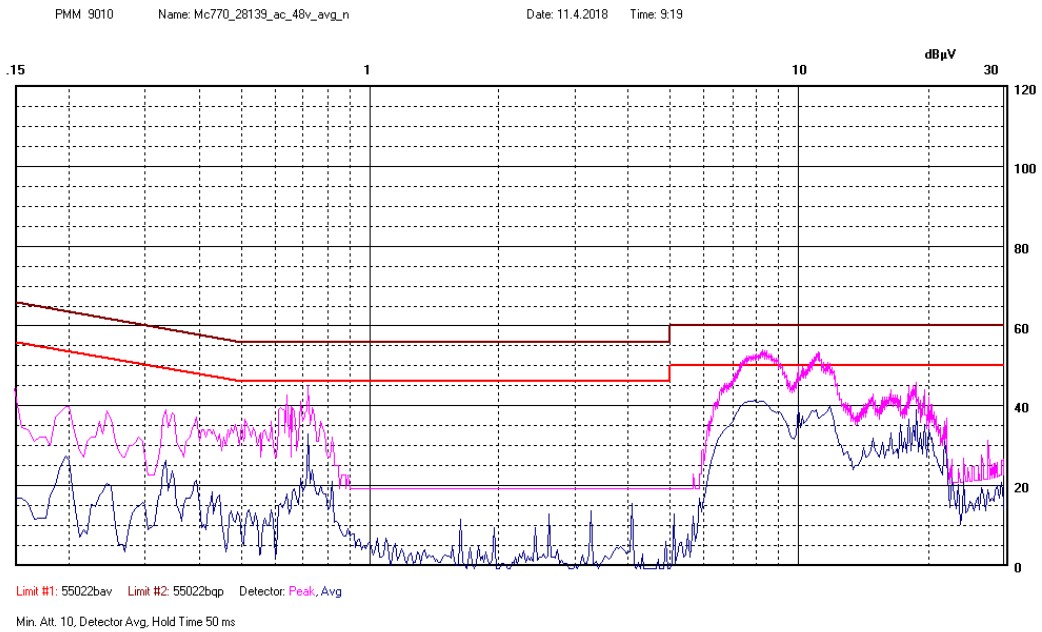
Power supply: 300 V DC
Detector: Average
Uaux: - terminal



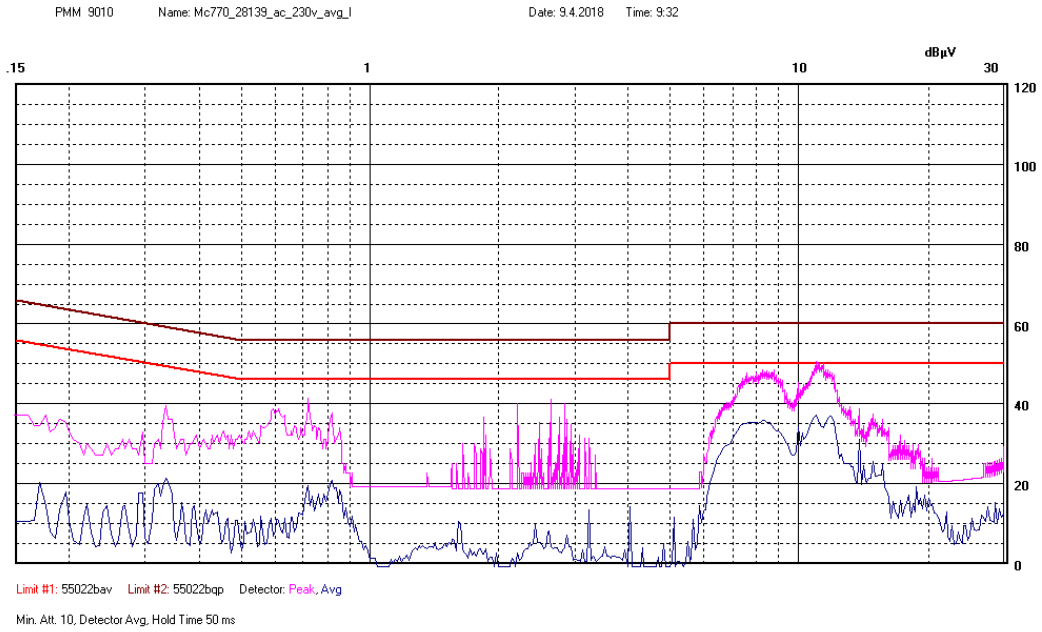
Power supply: 48 V AC
Detector: Average
Uaux: L terminal



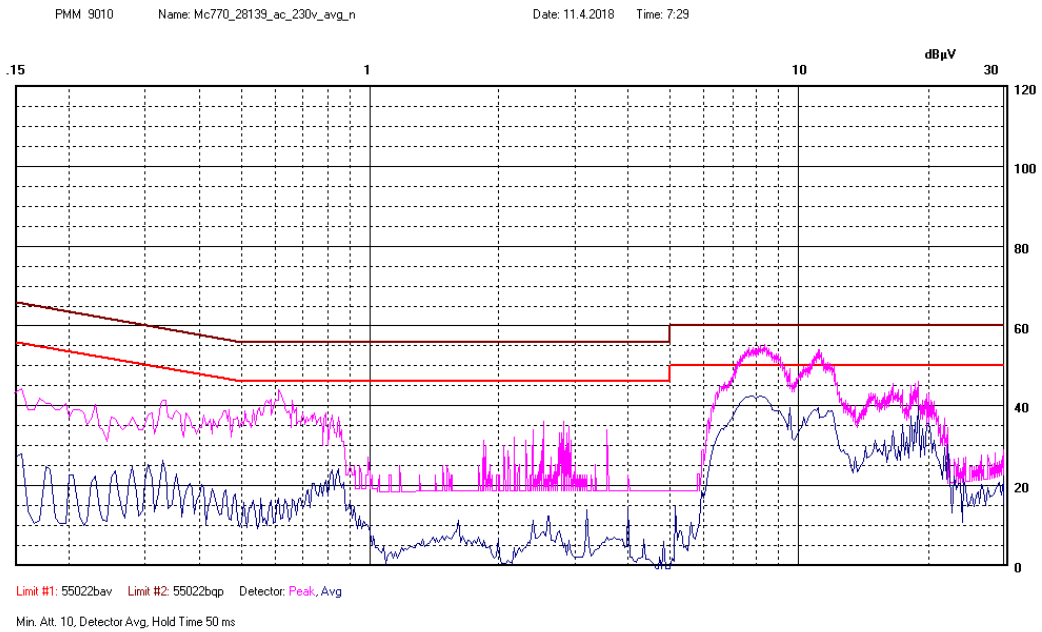
Power supply: 48 V AC
Detector: Average
Uaux: N terminal



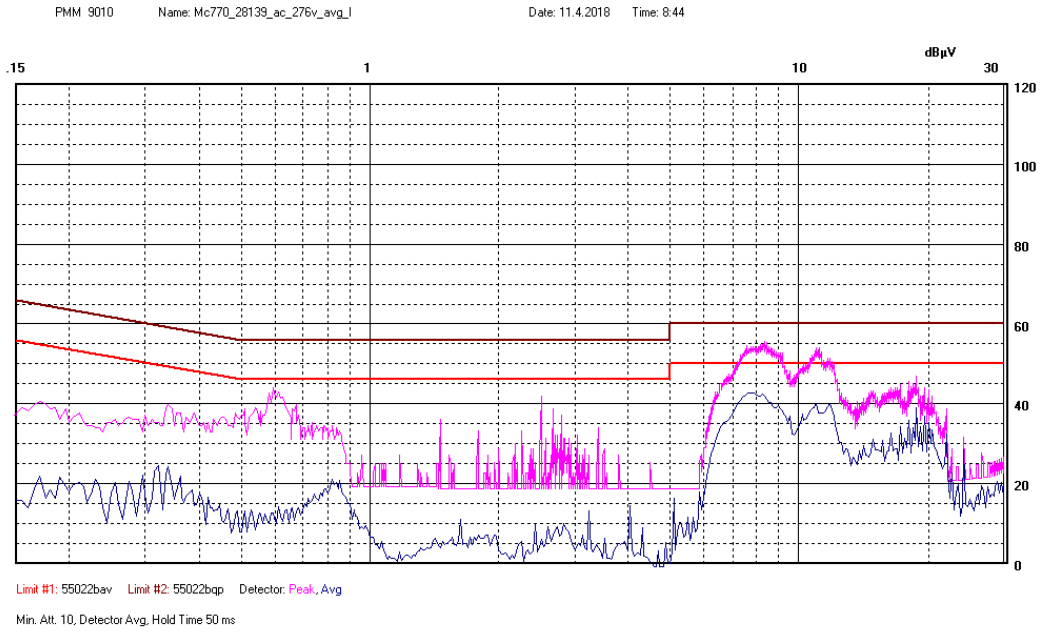
Power supply: 230 V AC
Detector: Average
Uaux: L terminal



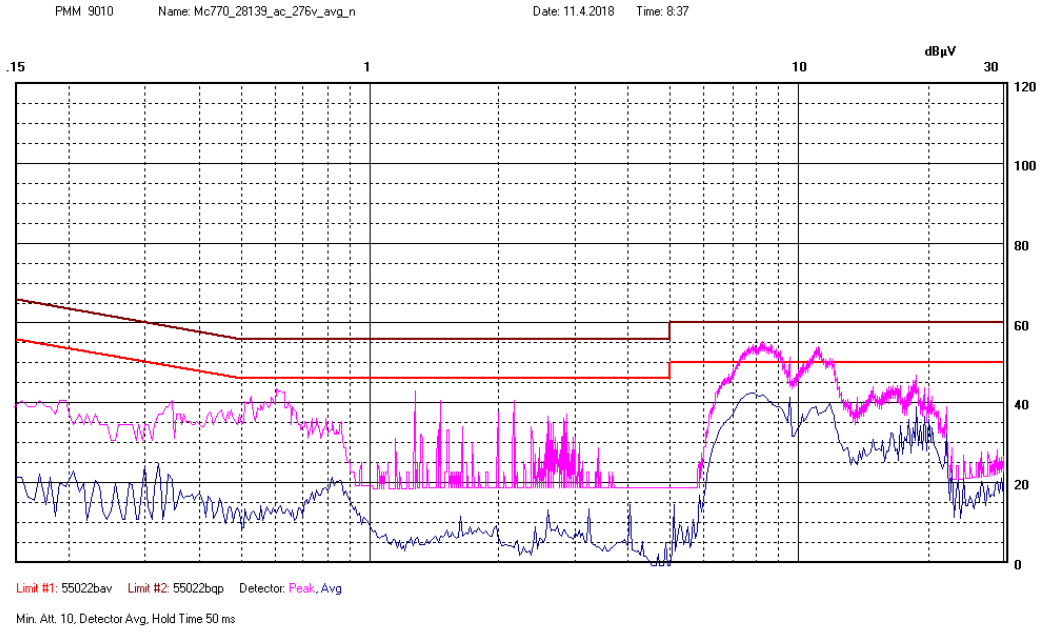
Power supply: 230 V AC
Detector: Average
Uaux: N terminal



Power supply: 276 V AC
Detector: Average
Uaux: L terminal



Power supply: 276 V AC
Detector: Average
Uaux: N terminal



3. Test of immunity to conducted disturbances

Applied measurement equipment:
- System for conducted immunity; Teseq; NSG 4070, 75 Watt
- Attenuator ATN 6075, Teseq
- CDN M2/M3- EMTEST; no 0212-10
- CDN M5 EMTEST
- CDN M4 EMTEST
- EM coupling clamp KEMZ 801A, Teseq
-Three phase power source, MTE
-Power supply, Statron

Applied standard: IEC 61000-4-6
Performance criteria A

Test parameters:
Frequency: 150 kHz - 80 MHz
Frequency step: 1 %
Level: 10 V
Modulation: 80 % AM – 1 kHz
Dwell time: 3 sec
EUT is positioned on the 10 cm support above RGP.

Test conditions:
Sample was connected to power supply 230 V 50 Hz.
Voltage and current inputs were connected to 100 V 50 Hz, 1 A 50 Hz.
Sample was connected on USB and ETH during the test.
I/O ports were active.

The error was checked using readout with program MiQen from ETH/USB communication.

Sample: MC028138

Results:
Level: 10V

	Coupling	U, I	AO	ETH/USB	Remark
Uin	CDN M5	OK	OK	OK	
Iin	CDN M4	OK	OK	OK	
Uaux	CDN M3	OK	OK	OK	
Comm, OI ports	EM CLAMP	OK	OK	OK	

All measured values are in accordance with the requirements for performance criteria A.

4. Fast transient burst test

Applied measurement equipment:
-Generator: EFT 800, EM TEST
-Coupling clamp – 1 m
-Three phase power source, MTE
-Power supply, Statron

Applied standard: IEC 61000-4-4
Performance criteria B, tested A

Test conditions:
td = 15 msec, f = 5 kHz, tr = 300 msec, t = 1 min (both polarities)

Test carried out with three phase coupling network.
Wire length for circuit under test connection is 50 cm.
EUT positioned on 10 cm support above ground plane.
Sample was connected to power supply 230 V 50 Hz.
Voltage and current inputs were connected to 100 V 50 Hz, 1 A 50 Hz.
Sample was connected on USB/ETH during the test. All IO ports were active.

Test result:
OK: Pass

Nivo / Level		1	2	3	4	Opombe/Remarks
U(kV)		0,5	1	2	4	
Circuit / coupling						
Uin L1	+		OK	OK		
	-		OK	OK		
Uin L2	+		OK	OK		
	-		OK	OK		
Uin L3	+		OK	OK		
	-		OK	OK		
Uin N	+		OK	OK		
	-		OK	OK		
Uin L1,L2,L3, N	+		OK	OK		
	-		OK	OK		
Iin L1	+		OK	OK		
	-		OK	OK		
Iin L2	+		OK	OK		
	-		OK	OK		
Iin L3	+		OK	OK		
	-		OK	OK		
Iin L1,L2,L3	+		OK	OK		
	-		OK	OK		
Uaux (Hi)	+		OK	OK		
	-		OK	OK		
Uaux (Lo)	+		OK	OK		
	-		OK	OK		
Uaux (PE)	+		OK	OK		
	-		OK	OK		
Uaux (Hi, Lo, PE)	+		OK	OK		
	-		OK	OK		
Eth/USB and IO CLAMP	+		OK			
	-		OK			

5. Surge immunity test

Uporabljena merilna oprema:
Applied measurement equipment:
-Generator, UCS 500-M EM TEST
-Coupling network CNI503; EM TEST
-Three phase generator, NME

Applied standard: IEC 61000-4-5
Performance criteria B (Tested A)

Test conditions:
Impulse shape: U-1,2/50 µs
Tr= 60 sec, 5 pulses ±
Phase angles: 0°, 90°, 180°, 270° for Uaux,
Wire length for circuit under test connection is approximately 50 to 70 cm.
U_{in}: 3 x 100 V 50Hz, U_{aux}: 230 V 50 Hz, I_{in}: 1A, cosfi: 1
I/O: all active
COM: Ethernet and USB connected

Test results:
Sample: MC028138

Level		0,5			1				2				4		
Supply circuits (Uaux)															
U(kV)		0,5			1				2				4		
Angle					0	90	180	270	0	90	180	270			
L-N	+				OK	OK	OK	OK	OK	OK	OK	OK			
	-				OK	OK	OK	OK	OK	OK	OK	OK			
N-PE	+				OK	OK	OK	OK	OK	OK	OK	OK			
	-				OK	OK	OK	OK	OK	OK	OK	OK			
L-PE	+				OK	OK	OK	OK	OK	OK	OK	OK			
	-				OK	OK	OK	OK	OK	OK	OK	OK			

All results are in accordance with the requirements for performance class A.

6. Test of immunity to electromagnetic RF field

Uporabljena merilna oprema:
Applied measurement equipment:

- Signal generator; Rohde &Schwarz; Type SMY 01
- Amplifier; Amplifier Reasearch; Model 50W 1000B
- Bilog Antena; Chase; CBL 6111A
- Field monitoring RadiSense; Type CTR1001A
- Power calibrator, NME

Applied standard: IEC 61000-6-2
Performance criteria A

Test parameters:

- Modulation 80% AM – 1 kHz
- Frequency 80 MHz to 1000 MHz
- Frequency step 1 %
- Level: 10 V/m
- Dwell time 3 s
- Polarization vertical and horizontal

Test conditions:
RO set to alarm.
Alarm setting: Normal
Alarm1: P> 101 W, P< 99 W, I1>1,01 A, I1< 0,99 A, U1> 101 V, U1<99 V
Connection:
MC was connected to the network supply and load with 100 V, 1 A, PF:1 from power calibrator.

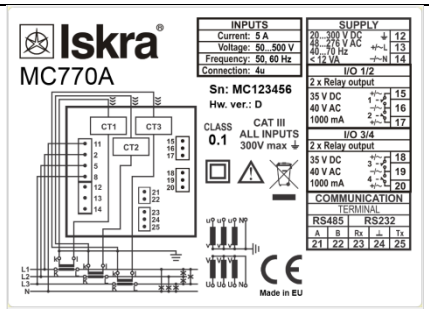
Test results:

Field strength	Max influence on the meas. error		
	Comm	VERT. POLARIZATION	HORIZ. POLARIZATION
10 V/m	OK	RO: off	RO: off

During the test sample operated correctly.

7. Check list of safety requirements

Standard EN 61010-1:2010, EN 61010-2-030:2010

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
5	**OZNAČEVANJE IN DOKUMENTACIJA / *MARKING AND DOCUMENTATION***		
5.1	**Označevanje / *Marking***		
5.1.1	General requirements Marking position – visible: - from the exterior (for rack or panel mounted allowed to be visible after removal from the rack) - after removing the cover - after opening the door without a tool - not put on the parts removable by an operator without a tool Letter symbols for quantities (IEC 60027) Graphic symbols (table 1)		P NA NA P P
5.1.2	Identification: - Name or trade mark of the manufacturer or supplier - Model number, name or other means - Identification of manufacturing location		P P P
5.1.3	Mains supply a) Nature of supply - AC: rated mains frequency and range - DC: graphic symbol – table 1 no.1 b) Rated supply voltage or the rated range of supply voltage c) Maximum rated power (W,VA or A) – allowed deviation +10% d) Setting of different rated supply voltages: - indication of voltage setting (for portable equipment it should be visible from the exterior) - changing the setting changes the indication (without use of a tool) e) Accessory mains socket outlets accepting mains plugs marking: - voltage if different from the mains supply voltage - marking in case of use only with specific equipment - for standard equipment marked with rated power or current	AC/DC universal supply Range specified	P P P NA NA
5.1.4	Fuses: Fuse identification marked besides fuseholder (5.4.5)	No fuses inside equipment	NA
5.1.5	Terminals, connections and operating devices		
5.1.5.1	General: - Where necessary for safety, indication of purpose for terminals, connectors, controls and indication marked. If insufficient space, symbol 14 used. - Push-buttons and actuators of emergency stop and indicators for warning of danger coloured red and coded as specified in IEC 60073.		P NA
5.1.5.2	Terminals - mains supply terminals identified and other terminals marked: a) functional earth terminal (symbol 5) b) protective conductor terminals (symbol 6) – close to the terminal no marking if part of mains appliance inlet c) terminals of control circuits by 6.6.3 connected to accessible conductive parts d) Hazardous live terminals supplied from the interior – ratings marked or symbol 14, no marking required in case of standard mains socket outlet		P NA NA NA
5.1.5.101	Measuring circuit TERMINALS –		
5.1.5.101.1	General – a) rated voltage to earth shall be marked b) rated voltage or current of each pair of measuring circuit shall be marked c) pertinent measurement category or symbol 14 shall be marked for each pair of measuring circuit –		P P P
5.1.5.101.2	Measuring circuit terminals rated for measurement categories II, III or IV: –		P

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
	Measurement category shall be marked as CAT II, CAT III or CAT IV		
5.1.5.101.3	Measuring circuit terminals rated for connection to voltages above the level of 6.3.1 Symbol 14 used if voltage rating above 6.3.1 but not rated as CAT II, III or IV		NA
5.1.5.101.4	Low voltage, permanently connected, or dedicated measuring circuit terminals Marking for measuring circuit terminals not needed if: a) permanently connected and not accessible b) dedicated for specific terminals of other equipment c) obvious from other indications that the rated voltage is below level of 6.3.1		 P P P
5.1.6	Switches and circuit breakers If disconnecting devices, off-position clearly marked (symbols)		 NA
5.1.7	Equipment protected by double or reinforced insulation – symbol 11 Only partially protected – symbol 11 not used		P
5.1.8	Field-wiring terminal boxes Warning marking (symbol 14) beside terminals in case temperature of the terminals or the enclosure exceeds 60 ºC	Terminals temperature does not exceed 60 °C	 P
5.2	**Opozorilni simboli / *Warning markings***		
	- Visible when ready for normal use - Placed near or on particular part if warning applies to that part - Symbol and text correct dimensions and colour contrast to background (symbol 2,75 mm, text 1,5 mm) - If necessary marked with symbol 14 - Marking and statement to isolate or disconnect for permitted access	Visible after removal from the panel. > 3mm	P P P P P
5.3	**Trajnost oznak / *Durability of markings***		
	Required markings remain clear and legible in normal use. Labels shall not become loose or edges curled . - 30 s cleaning with isopropyl alcohol and other specified agent		 P
5.4	**Dokumentacija / *Documentation***		
5.4.1	General – accompanied documentation for safety purposes: a) intended use b) technical specification c) name and address of manufacturer or supplier d) information specified in 5.4.2 to 5.4.6 e) information to mitigate risks after performed risk assessment f) statement to use only specified accessories if characteristics are relevant for safety g) guidance how to determine correct operation in case incorrect measuring or indicated harmful substances or hazardous live electrical quantities h) instructions for lifting and carrying - Warning statement and clear explanations of warning symbols - Documentation on printed or electronic media (must be available when needed) aa) information about measurement category if rated CAT II, III or IV bb) for measuring circuits not CAT II, III or IV where misuse is possible, a warning stated not to use equipment for measuring on mains and detailed ratings including transient overvoltages		 P P P P NA P P P P NA
5.4.2	Equipment ratings: a) Supply voltage (voltage range), frequency (frequency range), power or current ratings b) Description of input and output connections c) Ratings of insulation of external circuits (required by 6.6.1 b) d) Range of environmental conditions (1.4) e) Degree of protection (IEC 60529)		 P P NA P P
5.4.3	Equipment installation – instructions for: a) assembly, location and mounting b) protective earthing c) connections to supply d) permanently connected equipment - supply wiring requirements - requirements and location recommendations in case of external switch or circuit breaker e) ventillation requirements f) special services (air, cooling liquid) g) instructions relating to sound level (12.5.1)		 P NA P NA NA NA NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
	aa) for permanently connected measuring circuits of CAT II, III or IV information regarding category, rated maximum working voltage and rated maximum current bb) for permanently connected measuring circuits not CAT II, III or IV information regarding rated maximum working voltage, rated maximum current and rated maximum transient overvoltages		P NA
5.4.4	Equipment operation – required in user manual: a) Identification and use of operating controls b) Positioning for disconnection – not difficult to operate c) Interconnection to accessories d) Specification of intermittent operation limits e) Explanation of symbols used (required in Table 1) f) Replacement of consumable materials g) Cleaning and decontamination h) Listing of any poisonous or injurious gases and quantities i) Risk- reduction procedures relating to flammable liquids j) Methods of risk reduction of burns from surfaces with exceeded temperature limits (10.1) A statement about protection impaired if used in a manner not specified by the manufacturer.		P NA P NA P NA NA NA NA NA NA
5.4.5	Equipment maintenance – required in user manual:: - Sufficient preventive maintenance and inspection information - Instructions concerning detachable mains supply cords - Battery type specified - Any manufacturer specified parts - Ratings and characteristics of fuses - Instructions for service personnel a) product specific risk for service personnel b) protective measures for this risk c) verification of the safe state of equipment after repair		P NA NA NA NA NA
5.4.6	Special aspects due to integration into systems or effects resulting from special conditions.		NA
6	**ZAŠČITA PROTI ELEKTRIŠKEMU STRESU** ***PROTECTION AGAINST ELECTRIC SHOCK***		
6.1	**Splošno/ G*eneral***		
6.1.1	Accessible part not hazardous live in normal and single fault conditions. Conformity checked by determination of 6.2 and 6.3 followed by the tests of 6.4 to 6.11		P
6.1.2	Exceptions a) parts of and lamp sockets after lamp removal b) parts replaced by an operator (batteries) and may be hazardous live during replacement, accessible by means of a tool and warning mark attached aa) locking or screw-held type measuring circuit terminals, including terminals which do not require use of a tool - If parts charged from internal capacitor they shall not be hazardous live 10 s after interruption of supply (level 6.3.1.c)		NA NA NA
6.2	**Določitev dostopnih delov** ***Determination of accessible parts***		
6.2.1	The parts are determined to be accessible if they can be touched with a test finger. All actions possible during the operation should be considered (removing covers, opening, adjusting control. List of accessible parts determined with examinations 6.2.2 to 6.2.4		P
6.2.2	General examination – tested with jointed test finger applied in every possible position. (force 10 N, maximum test depth 180 mm)		P
6.2.3	Openings above hazardous live parts Metal test pin 100 mm and 4 mm diameter inserted into any opening above hazardous live parts, suspended freely.		NA
6.2.4	Openings for pre-set controls Metal test pin 3mm in diameter inserted through holes for pre-set controls.		NA
6.3	**Dovoljeni nivoji za dostopne dele** ***Permissible limits for accessible parts***		
6.3.1	Values in normal conditions		P
6.3.2	Values in single fault conditions		P
6.4	**Osnovna zaščita** ***Primary means of protection***		
6.4.1	General Accessible parts prevented from becoming hazardous live		P

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
6.4.2	Enclosures and protective barriers Conformity check according 6.7 and 8.1		P
6.4.2	Basic insulation Clearance, creepage distances and solid insulation forming basic insulation shall meet requirements of 6.7		P
6.4.4	Impedance a) limit the current or voltage to levels of 6.3.2 b) rated for maximum rated voltage and dissipated power c) clearance and creepage distances between terminations shall meet requirements of 6.7 for basic insulation		P P P
6.5	**Dodatna zaščita pri pogojih posamezne odpovedi** ***Additional means of protection in case of single fault conditions***		
6.5.1	General Accessible parts prevented form becoming hazardous live in single fault condition. Primary protection supplemented by one of a) to d) or protection e) or f) shall be used (see Figure 4) a) protective bonding (6.5.2) b) supplementary insulation (6.5.3) c) automatic disconnection of the supply (6.5.5) d) current- or voltage-limiting device (6.5.6) e) reinforced insulation (6.5.3) f) protective impedance (6.5.4)		NA P NA NA P P
6.5.2	Protective bonding		
6.5.2.1	Accessible conductive parts shall be: - bonded to the protective conductor terminal or - separated from hazardous live parts by conductive protective screen bonded to the protective conductor terminal Conformity checked as 6.5.2.2 to 6.5.2.6 and 6.5.2.101		NA
6.5.3	Supplementary insulation and reinforced insulation Clearances, creepage distances and solid insulation shall meet applicable requirements of 6.7		P
6.5.4	Protective impedance - limit the current and voltage to the levels of 6.3.1 and 6.3.2 - terminations of protective impedance meet double or reinforced insulation requirements of 6.7 Construction: a) appropriate single component - rated for twice the maximum working voltage - if resistor rated for twice the power dissipation for maximum working voltage b) a combination of components Conformity checked by measurements according 6.3 and 6.7 and ratings inspection of single components	Applied as insulation for voltage input circuit	NA P NA P
6.5.5	Automatic disconnection of the supply - rated to disconnect load within specified time (Figure 2) - rated for the maximum rated load conditions of the equipment		NA
6.5.6	Current – or voltage – limiting device a) rated to limit current or voltage to the values of 6.3.2 b) rated for the maximum working voltage and maximum operational current c) clearance and creepage distance between terminations shall meet requirements of 6.7 for supplementary insulation Conformity checked according 6.3.2 and 6.7		NA
6.6	**Priključitev na zunanje tokokroge** ***Connections to external circuits***		
6.6.1	General In normal and single fault condition no accessible part of equipment and no accessible part of external circuit shall become hazardous live after connection of the external circuit. - Separation of circuits provided - Instructions or marking include: a) rated conditions for terminal b) rating of the insulation for external circuits Conformity check: inspection, determination of 6.2, measurements 6.3 and 6.7, voltage test of 6.8 without humidity preconditioning		P P P NA P
6.6.2	Terminals for external circuits Terminals that receive a charge from the internal capacitor shall not be hazardous live 10 s after supply interruption		NA
6.6.3	Circuits with terminals which are hazardous live - not connected to accessible conductive parts or		NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
	- not mains circuits and have one terminal contact at earth potential - no accessible conductive parts are hazardous live		
6.6.4	Accessible terminals for stranded conductors - no possibility of accidental contact between hazardous live parts and accessible conductive parts (conformity checked with 8 mm free strand in the terminal) - terminals of hazardous live circuits not work loose		NA
6.6.101	Measuring circuit terminals Conductive parts of unmated measuring circuit terminal separated by clearance and creepage distance from Table 101 from the test finger		NA
6.6.102	Specialized measuring circuit terminals Components, sensors and devices shall not be accessible and hazardous when the maximum rated voltage is applied to any other measuring circuit.		NA
6.7	**Zahteve za izolacijo** ***Insulation requirements***		
6.7.1	The nature of insulation		
6.7.1.1	General Insulation defined as combination of clearances, creepage distance and solid insulation.		
6.7.1.2	Clearances		P
6.7.1.3	Creepage distances		P
6.7.1.4	Solid insulation		P
6.7.1.5	Requirements for insulation according to type of circuit Levels for different circuits and installation category requirements specified in 6.7.2, 6.7.3 and K.1		P
6.8	Procedure for voltage tests	See item 7	P
6.9	Constructional requirements for protection against electric shock		
6.9.1	General: If failure could cause hazard: a) security of wiring connection shall not depend on soldering b) screws for removable covers captive if clearance is important c) accidental loosening of wiring, screws not cause hazard d) clearance and creepage distances between enclosure and live parts shall not reduce below values for basic insulation by loosening of parts or wires		 P NA P P
6.9.2	Insulating materials: a) easily damaged materials not used b) non-impregnated hydroscopic material not used		 P P
6.9.3	Colour coding: Green- yellow insulation used only for: a) protective earth conductor b) protective bonding conductor c) potential equalization conductors for safety purposes d) functional earth conductors		 NA NA NA P
6.9.101	Over-range indication Display shall give unambiguous indication of values above the set measuring range		NA
6.10	Connection to the mains supply source and connection between parts of equipment		
6.10.1	Mains supply cords Certified cords used or specified requirements fulfilled		NA
6.10.2	Fitting of non-detachable supply cord		
6.10.2.1	Cord entry Protected against abrasion and sharp bends at entry point by: a) an inlet or bushing with a smoothly rounded opening b) insulated flexible cord guard protruding 5 x diameter		NA
6.10.2.2	Cord anchorage a) cord not clamed by direct pressure from a screw b) knots are not used c) cannot push the cord into the equipment to cause hazard d) failure of cord insulation not hazardous if anchorage has metal parts e) use of a tool necessary to loosen the cord anchorage f) cord replacement does not cause a hazard and method of strain relief is clear		NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
	Compression bushing shall not be used as a cord anchorage Push-pull test performance		
6.10.3	Plugs and connectors: - Mains supply plugs, connectors appliance couplers… conform to relevant specifications - If equipment supplied at voltages below 6.3.2 a) or a sole source plugs of supply cord do not fit mains sockets above rated supply voltage - Mains-type plugs used only for connection to mains supply		NA
6.11	Disconnection from supply source		
6.11.1	General: Means for disconnecting from each supply source required, disconnect all current carrying conductors		NA
6.11.2	Exceptions In case short circuit or overload cannot cause hazard		NA
6.11.3	Requirements according to type of equipment		
6.11.3.1	Permanently connected equipment and multi-phase equipment - employ a switch or circuit breaker - if switch not part of the equipment, documentation shall specify: a) a switch or circuit breaker must be included in installation b) suitably located and easily reached c) marked as disconnecting device for the equipment		NA P
6.11.3.2	Single-phase cord-connected equipment Equipment provided with: a) a switch or circuit breaker or b) an appliance coupler disconnectable without tool or c) separable plug without locking device		NA
6.11.4	Disconnecting devices		
6.11.4.1	General: If part of equipment: - located close to supply - no power consuming components electrically before disconnecting device		NA
6.11.4.2	Switches and circuit breakers - Meets relevant requirements IEC 60947-1 and IEC 60947-3 - Marked to indicate function – symbols 9 and 10 - Not incorporated in mains cord - Does not interrupt protective earth conductor		NA
6.11.4.3	Appliance coupler and plugs If used as disconnecting device: - Readily identifiable and easily reached by the operator - Single phase portable equipment- cord length <3 m - Protective earth conductor connected first and disconnected last		NA
7	**ZAŠČITA PRED MEHANSKIMI POŠKODBAMI** ***PROTECTION AGAINST MECHANICAL HAZARDS***		
7.1	General The equipment not cause the hazard in normal use or in single fault condition that might not be easily noted. Hazards specified and checked as specified in 7.2 to 7.7		
7.2	Sharp edges: - easily touched parts shall be smooth and rounded and not cause injury in normal operation - not cause injury in single fault conditions unless the fault is obviously hazardous		NA
7.3	Moving parts		
7.3.1	General Hazards from moving parts shall not exceed a tolerable level. Conformity checked as specified in 7.3.2 to 7.3.5 and item 17		NA
7.4	Stability: Equipment not secured to building structure before operation shall be physically stable. Conformity checked by tests a) to e)		NA
7.5	Provisions for lifting and carrying		
7.5.1	General: If a mass of 18 kg or more - provided with means for lifting and carrying or - directions given in the instructions		NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
7.6	Wall mounted: Mounting brackets withstand four times the weight of the equipment. - test weight (x4) increased to full load in 5 to 10 s, maintained 1min - one fastener removed, test repeated with twice the weight No damage to the bracket or mounting surface, which is hazardous.	Panel mounted	NA
7.7	Expelled parts: Limitation the energy of parts which cause hazards if expelled in the event of faults. Conformity checked after fault applications of 4.4		P
8	**ODPORNOST NA MEHANSKE VPLIVE** ***RESISTANCE TO MACHANICAL STRESSES***		
8.1	General: Equipment shall not cause hazard due to mechanical stresses in normal use (energy protection level 5 J). Conformity check – tests 8.2.1, 8.2.2 and 8.3 After test: - Hazardous parts not become accessible - voltage test of 6.8 without humidity preconditioning - Inspections after tests: a) no leaks of corrosive or harmful substances b) enclosures show no cracks which could cause a hazard c) clearances are not less than their permitted values d) the insulation of internal wiring remains undamaged e) protective barriers necessary for safety not damaged or loosened f) no moving parts permitted, except as permitted by 7.3 g) no damage which could cause spread of fire		P P NA P P P P P P
8.2	Enclosure rigidity tests		
8.2.1	Static test: Force of 30 N applied – hemispherical rod of 12 mm diameter – for non-metallic enclosures test is performed at maximum rated ambient temperature.	Not tested -(same construction as MC7x0)	P
8.2.2	Impact test: One impact with a sphere with a mass 500 g, diameter 50 mm	Not tested -(same construction as MC7x0)	P
8.3	Drop test		
8.3.1	Other equipment Tilted about each bottom edge (4)– distance between opposite edge 100 mm for equipment up to 20 kg or angle 30° (whichever less)		NA
8.3.2	Hand-held equipment and direct plug-in equipment Drop distance 1 m onto 50 mm thick hardwood board (700 kg/m^3)		NA
9	**ZAŠČITA PRED ŠIRJENJEM OGNJA** ***PROTECTION AGAINST SPREAD OF FIRE***		
9.1	General No spread of fire in normal and single fault condition Conformity check – one of the methods: a) Testing in single fault condition that could cause spread of fire (4.4) b) Verifying elimination or reduction of ignition sources (9.2) c) Verifying that if fire occurs it will be contained within the equipment	Material flammability verified.	NA NA P
9.2	Eliminating or reducing the source of ignition within the equipment a) 1) voltage, current and power available to the circuit limited as in 9.4 or 2)insulation between parts at different potentials meets requirements for basic insulation or bridging the insulation will not cause ignition b) Any ignition hazard related to flammable liquids reduced to tolerable level (as 9.5) c) In circuits designed to produce heat, no ignition occurs in single fault condition		NA P
9.3	Containment of fire within the equipment, should it occur		
9.3.1	Tolerable level : a) energizing of the equipment is controlled by a switch that needs to be continuously held by the operator b) equipment and enclosure conform to the constructional requirements of 9.5		NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
9.3.2	Constructional requirements: a) Connectors and insulating materials on which components are mounted with flammability classification V2 or better (see also 14.7) b) Insulated wires and cables shall retard flame propagation (UL 2556 vW-1) c) Enclosure construction: - Bottom and sites constructed (one of the following): - no openings - metal with perforation according Table 16 - metal screen with a mesh - have openings with baffles according Figure 12 - Enclosures, baffle or barrier made of metal or non-metallic with V1 or better - Enclosure , baffle or barrier have adequate rigidity	V0- UL94 (connectors and PCB) Enclosure material PC – V0 – UL94	P P P
9.4	Limited energy circuit (all criteria fulfilled): a) Potential not more than 30 Vrms and 42,4 V peak, or 60 V DC b) Current limited by one of the following: - inherently or by impedance (limits Table 17) - overcurrent protection device (limits Table 18) - regulating network limit also in single fault condition c) Separated by at least basic insulation to all other circuits having energy values exceeding a) and b)		NA
9.5	Requirements for equipment containing or using flammable liquids Flammable liquids contained in or specified for use with equipment do not cause spread of fire in normal and single fault condition		NA
9.6	Overcurrent protection		
9.6.1	General: Overcurrent protection not in protective conductor Fuses not fitted in neutral conductor (multi-phase)		NA
9.6.2	Permanently connected equipment If none, the installation instruction shall specify required overcurrent protection in building installation.		P
9.6.3	Other equipment Protection provided within the equipment		NA
10	**TEMPERATURNE MEJE OPREME IN ODPORNOST NA VROČINO** ***EQUIPMENT TEMPERATURE LIMITS AND RESISTANCE TO HEAT***		
10.1	Surface temperature limits for protection against burns -easily touched surfaces within the limits (Table 19 in normal conditions and 105 ºC in single fault) – measurements in 10.4 - heated surfaces necessary for functional reasons or exceeding 105 ºC in single fault must be correctly marked		P NA
10.2	Temperature of windings Limits in Table 20 - normal conditions - single fault conditions		 P P
10.3	Other temperature measurements if applicable: a) field-wiring terminals box (60 ºC not exceeded) b) surface of flammable liquids and parts in contacts with liquids c) non-metallic enclosures (measured at 10.5.1 for 10.5.2) d) parts made of insulating material which support parts connected to the mains supply (establish temperature for 10.5.3) e) terminals carrying current exceeding 0,5 A (establish temperature for 10.5.3)		NA NA P NA NA
10.4	Conduct of temperature test		
10.5	Resistance to heat		
10.5.1	Integrity of clearances and creepage distances		P
10.5.2	Non-metallic enclosures Tests 8.2 and 8.3 10 minutes after temperature treatment After treatment no hazardous live parts accessible (criteria 8.1)		P
10.5.3	Insulating material a) parts supporting parts connected to mains supply b) terminals carrying current more than 0,5 A	Transformer bobbin – deflection temperature ISO 75-2 (250 ºC)	P NA
11	**ZAŠČITA PRED NEVARNOSTMI ZARADI TEKOČIN** ***PROTECTION AGAINST HAZARDS FROM FLUIDS***		

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
11.1	General: Protection for the operator against hazards form fluids in normal use		P
11.2	Cleaning Three times cleaning carried out if specified by the manufacturer	No special cleaning defined	P
11.3	Spillage Protection if liquid is likely to be split during normal use		NA
11.4	Overflow Possible liquid overflowing from any container		NA
11.5	Battery electrolyte Electrolyte leakage shall not impair safety.		NA
11.6	Specially protected equipment In case of IP protection it shall be fulfilled (IEC 60529)		P
11.7	Fluid pressure and leakage		NA
12	**ZAŠČITA PRED SEAVNJEM, VKLJUČNO LASERSKIH IZVOROV, IN PRED ZVOČNIM IN ULTRAZVOČNIM TLAKOM** ***PROTECTION AGAINST RADIATIONS, INCLUDING LASER SOURCES, AND AGAINST SONIC AND ULTRASONIC PRESSURE***		
12.1	General: Equipment shall provide protection against internally generated ultraviolet, ionizing and microwave generation, laser sources, sonic and ultrasonic pressure. In case of sources of radiation conformity is checked according 12.2 to 12.6		NA
13	**ZAŠČITA PRED PUŠČANJEM PLINOV, EKSPLOZIJO ALI SESUTJEM** ***PROTECTION AGAINST LIBERATED GASES SUBSTANCES, EXPLOSION AND IMPLOSION***		
13.1	Poisonous and injuries gases and substances Specified in the documentation if such substances can be liberated		NA
13.2	Explosion and implosion		
13.2.1	Components For components liable to explode shall be provided. - pressure release device (discharge shall not cause danger to operator), or - equipment incorporates protection for operator (see 7.7)		NA
13.2.2	Batteries and battery charging - If explosion or fire hazard can occur(excessive charge or discharge, reversed polarity): - protection in the equipment or - manufacturers instructions to use batteries with built in protection and warning marking (symbol 14) near battery - Equipment with means for battery recharging: warning against recharging non-rechargeable batteries and type of appropriate batteries indicated (warning symbol 14) - Battery compartment design - Single component failure whose failure could cause such hazard - Attempt for reversed polarity installation if replaced by an operator		NA
13.2.3	Implosion of cathode ray tubes Maximum face dimension >160 mm: - intrinsically protected against implosion (correctly mounted), or - enclosure provides adequate protection (protective screen not in contact with tube surface)		NA
14	**KOMPONENTE IN PODSESTAVI** ***COMPONENTS AND SUBASSEMBLIES***		
14.1	General: Where safety involved, components shall meet specific requirements with conformity options in figure 15		P
14.2	Motors		
14.2.1	Motor temperature - Does not present hazard when stopped or prevented from starting (single fault test 4.4.2.5), or - Protected by overtemperature or thermal protection device meeting 14.3		NA
14.2.2	Series excitation motors If overspeeding could cause hazard it shall be connected directly to the device driven by it.		NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
14.3	Overtemperature protection device Operating in single fault conditions and meet requirements: a) reliable function ensured b) rated to interrupt maximum voltage and current c) not operate in normal use Conformity checked with single fault tests (4.4)		NA
14.4	Fuse holders No access to hazardous live parts during fuse replacement		NA
14.5	Mains voltage selection devices Accidental change not possible	High universal power supply or Low universal power supply. Change not possible.	NA
14.6	Mains transformers tested outside equipment Test specified in 4.4.2.7 followed by tests 4.4.4.1 b) and c)	Tested in the instrument.	P
14.7	Printing wiring boards Flammability classification V-1 or better Not required for boards with only limited-energy circuits (9.4)	Specified 94 V-0	P
14.8	Circuits or components used as transient overvoltage limiting devices Impulse voltage test, voltage specified in table 21 No hazard in the event that component ruptures or overheats during the test.	Varistor in power supply circuit.	P
14.101	Circuits or components used as transient overvoltage limiting devices in measuring circuits used to measure mains Impulse voltage test, voltage specified in table 102 No hazard in the event that component ruptures or overheats during the test.		P
15	**ZAŠČITA Z INTERLOCK SISTEMI** ***PROTECTION BY INTERLOCKS***		
15.1	General Interlocks designed to remove hazards before operator exposed		NA
15.2	Prevention of reactivating		NA
15.3	Reliability		NA
16	**NEVARNOSTI IZ UPORABE** ***HAZARDS RESULTING FROM APPLICATION***		
16.1	Reasonably foreseeable misuse - No hazards arise from setting adjustments, knobs or software parameters in a way not intended - Other possible reasonably foreseeable misuse addressed by risk assessment		NA NA
16.2	Ergonomic aspects If following factors could rise hazard, risk assessment shall be documented: a) limitation of body dimensions b) displays and indicators c) accessibility and conventions of controls d) arrangement of terminals		NA NA NA NA
17	**OCENA TVEGANJA** ***RISK ASSESSMENT***		
17	If other hazards than in items 6 to 16 might arise, risk assessment is required. - Tolerable risk shall be achieved and assessment documented covering: a) risk analysis b) risk evaluation c) risk reduction - Remaining risks identified in the instructions		NA
101	**MERILNI TOKOKROGI** ***MEASURING CIRCUITS***		
101.1	General – protection against hazards in normal use and reasonably foreseeable misuse a) If a hazard could result, a current measuring circuit shall not interrupt the circuit during range changing b) Electrical quantity within specification shall not cause hazard in any range and function setting (see 101.3) c) Any interconnection to other devices shall not cause hazard even if documentation prohibit the interconnection while the equipment is used for measurement purposes (see. 6.6) d) For measuring circuits with functional earth terminal a risk assessment shall address the hazards in case of		P P NA NA

Item	Zahteve *Requirements*	Ugotovitve, opombe *Establishments, remark*	Rezultat *Result*
	disconnected protective conductor terminal and unintentional connection of functional earth terminal to any rated voltage e) Other hazards resulting from reasonably foreseeable misuse shall be addressed by risk assessment		NA
101.2	Current measuring circuits No hazard during range changing (6000 switching max. rated current) Current measuring circuits intended for current transformers without internal protection adequately protected against hazard (overload 10 times max. rated current for 1 s and 6000 switching max. rated current)	Internal automatic range selection.	P
101.3	Protection against mismatches of inputs and ranges		
101.3.1	General In normal conditions and reasonably foreseeable misuse no hazard shall arise when maximum rated voltage or current of a measuring terminal is applied to any other compatible terminal, with any combination of range and function setting. Possible techniques (see 101.3.2 or 101.3.3)		P
101.3.2	Protection by a certified overcurrent protection device Considered suitable if certified by independent laboratory for: a) ac and dc rated voltages of overcurrent protection device shall be at least as high as highest AC or DC rated voltages of any measuring circuit b) The rated time-current characteristic shall be such that no hazard will result at any combination of rated input voltages, terminals and range selections c) The ac and dc rated breaking capacities shall exceed the possible short-circuit currents Rating inspection and test with opened fuse – two times the max. rated voltage for any terminal applied to the terminals of overcurrent-protected circuit for 1 min (500 VA source)		NA
101.3.3	Protection by uncertified current limitation devices or by impedances Devices for current limitation capable of safely withstanding, dissipating or interrupting the energy applied as a result of short-circuit current in case of foreseeable misuse. Possible solutions: a) appropriate single component which is constructed: - rated for the max. voltage possible during foreseeable misuse - if resistor, rated for twice the power dissipation - meet applicable clearances of Annex K for reinforced insulation between its termination b) A combination of components: - withstand the max. voltage possible during foreseeable misuse - be able to dissipate power - meet applicable clearances of Annex K for reinforced insulation between the terminations of each component Test with max. rated voltage for any terminal for 1 minute using test leads specified in 101.3.4		NA

8. High voltage test

Applied measurement equipment:
-CE Multitester, MI 2094
-HV tester, Kikusui, TOS9201S

Applied standard: IEC 61010-1

Test setup:
The test is carried out at normal environmental conditions with no power supply on.
Hv test:
The test voltage raised gradually a few seconds to the specified value and then maintained for 1 min. Separate circuits are tested against each other.

Acceptance criteria:
The MC has passed the test if no flash over is observed during the HV test. After the test shall work according to technical data.

Test condition:
See table with results.
Test duration: 1 min

Results:

Terminal / Circuit	Terminal / Circuit	AC Voltage	DC Voltage	Current	Pass/ Fail
Hazardous live	Non Hazardous live				
U_{supply}	I/O Modul1	3,51 kV	x	0 mA	OK
U_{supply}	I/O Modul2	3,51 kV	x	0 mA	OK
U_{supply}	USB/ETH	X	5 kV	0 mA	OK
U_{supply}	U_{in}, I_{in}	X	3,1 kV	0 mA	OK
U_{in}, I_{in}	I/O Modul1	2,21 kV	x	0 mA	OK
U_{in}, I_{in}	I/O Modul2	2,21 kV	x	0 mA	OK
U_{in}, I_{in}	USB/ETH	X	3,1 kV	0 mA	OK
U_{supply}	PE (CPU)	X	3,1 kV	0 mA	OK
I/O Modul1	PE (CPU)	X	3,1 kV	0 mA	OK
I/O Modul2	PE (CPU)	X	3,1 kV	0 mA	OK
USB/ETH	PE (CPU)	X	3,1 kV	0 mA	OK

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I/O Modul1 High Voltage	I/O Modul2 Low Voltage	3,51 kV	x	0 mA	OK
I/O Modul1 High Voltage	PE (CPU)	3,51 kV	x	0 mA	OK
I/O Modul1 High Voltage	RS485/RS323	3,51 kV	x	0 mA	OK

After HV test all samples operate normally.

9. Continuous operation

Applied measurement equipment:
-Climatic chamber
-Analogue instrument, Iskra

Test condition:
Usupply: 276 V AC
Ambient temperature: 50 °C
Operation: 10 min ON /10 sec OFF
AO1-4: load with mA-meter
LCD backlight: 10/10 (light on)

Sample: MC028138

Start operating: 26.10.2017-22.01.2018, approximate time of samples operating: 3 months. After test samples work normally. Power supply on samples was switching off every 10 minutes for 10 second.

Results:

Display	Accuracy (U, I, P)	ETH/USB, IO ports
OK	OK	OK

After test all samples operate normally.

10. Vibration test

Uporabljena merilna oprema:
Applied measurement equipment:
Vibration test machine, Heckert

Test procedure:
The MC7x0 is mounted to fastening device. MC7x0 was connected to the power supply and was operating during the vibration test. Test is carried out in three axes (x,y,z).

Acceptance criteria:
After the test MC shall operate according to technical specification.
No mechanical damage shall occur on the MC which would cause that non hazardous parts become hazardous.

Sample: MC028139

Test condition:
Frequency: 25 Hz to 60 Hz
Amplitude: 0,5 mm
Acceleration: 1,5 g
Duration: 20 min per axe

Test results:

Axis	x	y	z
Pass	OK	OK	OK

After test all samples operate normally.