

TESTERS AND INSTRUMENTS FOR INSPECTION AND REVISION OF NETWORKS AND FOR TELECOMMUNICATIONS



METRA BLANSKO a.s.



INSULATION RESISTANCE TESTERS

PU 182.1

The instrument is above all designed for the measurement of insulation resistance of electric objects and equipments at the rated DC voltages of 100 V, 250 V, 500 V. It enables to measure AC, DC voltages to 550 V as well.



- Features and benefits:
- Easy handling and minimum maintenance
 - Inhibited measurement of insulation resistance in case of the presence of more than 25 V AC or DC voltage on the measured item
 - Automatic discharge of possible capacity of the item after the measurement
 - Automatic switch-over and AC, DC indication during the measurement of voltage, the polarity indication at DC voltage
 - Indication of insufficient voltage of accumulators
 - Instrument and accessories are with double insulation
 - Instrument complies with the safety requirements according to EN 61010-1, EMC-requirements according to EN 50081-1 and EN 50082-2 and complies with the requirements according to DIN 57 413/VDE 413, part 1

Measurement of voltage	
Voltage ranges	20 ÷ 550 V AC, DC /45 - 65 Hz/

Insulation resistance	
Measuring ranges	0,2 ÷ 1,999 MΩ 0,2 ÷ 19,99 MΩ 5,0 ÷ 199,9 MΩ 50 ÷ 1999 MΩ
Rated DC voltage	100 V, 250 V, 500 V
Rated current	1,1 mA

Accuracy	
± (2% of measured value +5D) for voltage and insulation resistance	
D - digit	
Dimensions	308 x 92 x 57 mm
Weight	approx. 500 g

The recharger ZDA 31 on the order available

PU 186

The instrument is designed for the measurement of insulation resistance up to 20 GΩ and resistance of protective conductor up to 10 Ω. It enables also to measure DC and AC voltages up to 1000 V. The insulation resistance is measured at rated voltages of 500 V, 1000 V and 2500 V. The measuring current during the resistance measurement of protective conductor is min. 200 mA.



- Features and benefits:
- Independence of mains voltage
 - Indication of the low voltage of the accumulator
 - Recharging of the accumulator inside the instrument
 - Easy handling and minimum maintenance
 - The instrument complies with requirements according to EN 61010-1, the EMC - requirements according to EN 50081-1 and EN 50082-2, DIN 57413/VDE 413, part 1, DIN 57 413/VDE 413, part 4

Dimensions	195 x 55 x 260 mm
Weight	approx. 700 g without the accumulators

The recharger ZDA 21 on the order available.

Measured value	Measuring range	Measuring voltage	Current (I _K , I _N)	Accuracy
DC voltage	(30 ÷ 1000)V			± (2%MV + 5D)
AC voltage	(30 ÷ 1000)V			± (2%MV + 5D)
Insulation resistance	(0,1 ÷ 20)MΩ	(500 + 20)V	(≤ 5mA) 1,1mA ± 0,1mA	± (2%MV+5D)
	(5 ÷ 200)MΩ			
	(50 ÷ 2000)MΩ			
	(0,5 ÷ 20)GΩ			
	(0,2 ÷ 20)MΩ	(1000 ÷ 100)V		
	(10 ÷ 200)MΩ			
	(100 ÷ 2000)MΩ			
	(1 ÷ 20)GΩ			
	(0,5 ÷ 20)MΩ	(2500 ÷ 200)V		
	(20 ÷ 200)MΩ			
	(200 ÷ 2000)MΩ			
	(2 ÷ 20)GΩ			
Resistance of the protective conductor	10 Ω	> 5V	200mA-10mA	± (2%MV+5D)

MV - measured value, D - digit
 Current I_K short-circuit current when the insulation resistance are measured, the measuring current when the resistance of the protective conductor is measured
 Current I_N Rated current at rated voltage (insulation resistance)

PU 187.1 Megmet 1000 D

The instrument is designed for measurements of insulation resistance of up to 20 G Ω and resistance of protective conductor of up to 2 k Ω , eventually its length and the overvoltage protections can be checked. It enables to measure DC and AC voltages up to 1000 V and temperature from - 20° C to + 120° C. By connecting of the external sensor from -50° C to +850° C. The insulation resistance is measured at rated voltages of 50 V, 100 V, 250 V, 500 V and 1000 V.



MV	Measured value
D	Digit
Current I_K	Short-circuit current when insulation resistance are measured, measuring current when the resistance of protective conductor is measured
Current I_N	Rated current at rated voltage (insulation resistance)
Dimensions	308 x 92 x 57 mm
Weight	approx. 500 g

Features and benefits:

- The instrument complies with the requirements according to the following standards:
DIN 57 413/VDE 0413, part 1: Insulation resistance measuring instruments
Revision and testing of the electric equipment EN 61010-1 - Safety requirements for electrical measuring, control and laboratory equipment
- Microprocessor controlled
- Digital data display of the measured value together with bargraph
- Cable length calculation from measured resistance value
- Measurement of DC, AC voltages, test of the overvoltage protections
- Measurement of the insulation resistance up to 20 G Ω
- Measurement of low resistance (length of the measured wire) with the indication of the interference voltage
- 127 measured values are memorised, possible transfer into the PC by RS 232
- User option display backlight with the auto turn-off to save the battery life
- Accumulator recharging inside the instrument
- Low weight and small dimensions
- Easy handling and minimum maintenance

Measured value	Measuring ranges	Voltage	Current(I_K), I_N	Accuracy
DC voltage	0-1000 V			$\pm(2\% MV+2D)$
AC voltage	0-1000 V			$\pm(2\% MV+2D)$
Overvoltage protections	0-1000 V			$\pm(2\% MV+2D)$
Insulation resistance R_{ISO}	0,1M Ω -20G Ω	(50+15)V	$(\leq 4mA)$ 1,2 \pm 0,2mA	$\pm(2\% MV+5D)$
	0,1M Ω -20G Ω	(100+20)V		$\pm(2\% MV+5D)$
	0,1M Ω -20G Ω	(250+20)V		$\pm(2\% MV+5D)$
	0,1M Ω -20G Ω	(500+50)V		$\pm(2\% MV+5D)$
	0,1M Ω -20G Ω	(1000+100)V		$\pm(2\% MV+5D)$
Protective wire resistance R_{P-E}	20 Ω	no-load	$\geq 200mA$	$\pm(2\% MV+5D)$
	200 Ω	9 \pm 0,5V	$\geq 20mA$	
	2k Ω		$\geq 2mA$	
Temperature (int.sens.) with Pt 100 (Pt 1000)	(-20 \div 120)°C		1 mA	$\pm 3^\circ C$
	(-50 \div 850)°C		2 mA	
	(-50 \div 250)°C		2 mA	(on the order)
Cable lenght Cu, Al	0 \div 20km	(9 \pm 0,5)V no-load	$\geq 2mA$	(given by accuracy of resistance mesurement)

EARTH RESISTANCE TESTER

PU 183

The instrument is designed for the measurement of resistance of earth electrodes and of the earthing systems, for the measurement of earth resistivity and for the resistance measurement.



Dimensions	120 x 232 x 57 mm
Weight	approx. 500 g without accumulators

Accessories are on the order available: PD 183 (measuring leads (coil) of 3 m - 2 pcs, 25 m - 2 pcs, 40 m - 1 pc, measuring probe of 450 mm - 4 pcs, key, case, recharger ZDA 21 and the accumulators.

Features and benefits:

- independence on mains supply
- Suppression of the interfering mains frequency
- Measurement of ohmic resistance
- Protection of the input and output terminals
- Discharged accumulator indication
- Recharge of the accumulators inside the instrument
- Easy handling and minimum maintenance
- The instrument complies with the safety requirements according to EN 61010-1 and EMC- requirements according to EN 50082-2

Measuring ranges	Output open-circuit voltage U_L	Short-circuit current I_K
20 Ω	max. 30 V _{ef}	10 mA _{ef}
200 Ω	max. 30 V _{ef}	min. 1 mA _{ef}
2 k Ω	max. 30 V _{ef}	min. 100 μA_{ef}

Measuring frequency

128 Hz

Accuracy

$\pm (2\% \text{ of measured value } +2D)$

D - digit

MULTIFUNCTION TESTER

PU 190

The instrument is designed for the measurements of current electrical single-phase or three-phase installations with the phase voltage of 180 to 260 V and for the inspection of current protective switches (RCD) for general use (-, G) and selective ones (S). It is power supplied from the network, no battery or accumulator are required. The instrument complies with all the requirements according to respective standards. The design complies with the requirements according to EN 61557 - Devices for testing, measurement or operation following of protective means - Part No. 3 - Impedance loop and Part No. 6 - Current protective switches (RCD) in TT and TN networks. The measured values, units and other data are displayed on the illuminated LCD-display. The measured values are automatically stored (126 values). It is possible to recall them or to transmit into the PC for further processing by means of the QD 190 unit. After tripping of the RCD the measured data are displayed for 10 s at least. There are two LED-diodes indicating the connection of the instrument to the network, eventually dangerous voltage between protective conductor and earth.



The tester enables:

- To measure the voltage between the phase and protective conductor U_{L-PE}
- To measure the voltage between the phase and neutral conductor U_{L-N}
- To measure the line voltage
- To measure the mains frequency
- To measure the impedance of protective loop R_S
- To measure the impedance of protective loop R_S at low current without tripping of the RCD
- To measure the internal network resistance R_l
- To measure the actual tripping time of the RCD t_A by differential current $I_{\Delta N}$, $5 \times I_{\Delta N}$
- To test the RCDs with the ramp current to measure the tripping current of RCDs I_{Δ} and to measure the contact voltage $U_{l\Delta}$ at the moment of the RCD tripping
- To measure the contact voltage $U_{l\Delta N}$ at the nominal tripping current passage through the protective conductor without the tripping of RCDs and the non-tripping test of RCDs
- To test the fixed wiring

Measuring of Voltage

Measured value	Measuring range	Accuracy
Voltage U_{L-N}	180 V ÷ 450 V	± (1% MV + 1 D)
Voltage U_{L-PE}	0,5 U_{L-N} ÷ 260 V	± (1% MV + 1 D)
Voltage frequency U_{L-N}	45 ÷ 65 Hz	± (0,5% MV + 1D)

Impedance of protective loop and internal resistance of network

Measured value	Measuring range	Accuracy	Current max. 2,5 A
Impedance of protective loop R_S	0,00 ÷ 0,30 Ω	± 10 D	Measuring range U_{L-PE} 180 V ÷ 260 V 49,5 ÷ 50,5 Hz
	0,31 ÷ 0,50 Ω	± 10 D	
	0,51 ÷ 19,99 Ω	± (3% MV + 10D)	
Internal network resistance R_l	20,0 ÷ 199,9 Ω	± (3% MV + 10D)	Measuring range U_{L-N} 180 ÷ 260 V 49,5 ÷ 50,5 Hz
	0,00 ÷ 0,30 Ω	± 10 D	
	0,31 ÷ 0,50 Ω	± 10 D	
Impedance of protective loop R_S measuring without tripping of the RCDs	0,51 ÷ 19,99 Ω	± (3% MV + 10D)	Maximum current value at measurement 14 mA
	000 ÷ 1999 Ω	± (5% MV + 10 D)	

Test of RCDs

Measured value	Measuring range	Accuracy	Voltage U_{L-PE} 180 V ÷ 260 V 49,5 ÷ 50,5 Hz
Contact voltage $U_{l\Delta N}$	0,0 V to 70,0 V	+ 6% MV + 10 D	Measuring current 0,4 to 0,5 $I_{\Delta N}$ for 240 ms
Tripping time t_A	600 ms	± 2 ms	1 $I_{\Delta N}$
of RCD	40 ms	± 2 ms	5 $I_{\Delta N}$ (10 mA, 30 mA)
Tripping current I_{Δ}	30 ÷ 130% $I_{\Delta N}$	± 6% $I_{\Delta N}$	

MEASURING KITS

QU 190



QU 190.1

The carry case for PU 182.1, (PU 187), PU 183, PU 190, ZDA 21, ZDA 31

QU 190.2

The carry case for PU 186, PU 190, ZDA 21

ACCESORIES TO THE TESTERS

On the order the accessories and the spare parts can be delivered to all products shown in the catalogue.

The list of accessories is given in the price list. According to the Metrology law all the instruments are calibrated. Our company provides repair and service for these instruments.

LUXMETER WITH DIGITAL DISPLAY

PU 550

The instrument is designed for the measurements of illumination in industrial shops and on workplaces with the aim of the illumination maintenance or inspection. It can be used for the illumination measurements on the roads and streets and for some laboratory measurements within the range of its technical capability.



Features and benefits:

- The measuring probe is equipped with the cosine unit for the compensation of the direction error of the measured light
- Set of light filters assembled into the measuring probe ensuring the spectral sensitivity similar to that of the human eye
- The HOLD - function for the measurements of the low level illumination
- Optional external power supply
- Easy handling and minimum maintenance

Measuring ranges	
20 lx, 200 lx, 2000 lx, 20 klx, 100 klx	
Accuracy	
± (0,5 % of measured value ± 0,5 % of measuring range + error of the photometric probe)	
Dimensions	168 x 96 x 35 mm
Weight	approx. 300 g (without probe)

PHASE SEQUENCE INDICATOR

PM 454.1



The instrument PM 454.1 is designed for the checking of the three-phase network.	
<ul style="list-style-type: none">• Detects voltage of the connected phases• Indicates the correct sequence of the connected phases	
Technical data:	
<ul style="list-style-type: none">• Input voltage U_{L-N}: 3 x 190 V to 3 x 690 V• Operating temperature: - 5° C to + 45° C• Safety according to EN 61010-1• Protective class II• Maximum voltage of any lead against the earth: 600 V_{ef}• Instrument protection IP 40, overvoltage category III• Electromagnetic compatibility (EMC) according to EN 61326-1	

Dimensions	68 x 75 x 40 mm
Weight	approx. 250 g

PU 184 DELTA

The PU 184 DELTA instrument is destined for the inspection and revision of electrical items according to ČSN 331600, ČSN 331610 (electrical appliances) and DIN VDE 0701 Part 1 and 240.



- Regulated measuring voltage for the measurement of insulation resistance
- Measurement of actual effective value of alternating quantities
- Protection of input terminals against overvoltage
- Leakage current measurement of grounded appliances (differential method)
- Easy handling and minimum maintenance
- The instrument complies with the safety requirements according to EN 61010-1 and EMC requirements according to EN 55011, EN 5082-2

Dimensions 300 x 200 x 60 mm

Weight approx. 2 kg

Measured quantity	Measuring range	Open-circuit voltage	No load current (I_K), I_N	Internal resistance	Accuracy
mains voltage	187 – 253 V				$\pm (1\% \text{ of MV} + 2D)$
current of appliance	0 – 16 A				$\pm (2\% \text{ of MV} + 5D)$
touch current	0 – 2 mA			2 k Ω	$\pm (2\% \text{ of MV} + 7D)$
insulation resistance	20 M Ω	(510 V \pm 10) DC	(< 1.5 mA)		$\pm (2\% \text{ of MV} + 5D)$
	2 M Ω		1 mA		$\pm (2\% \text{ of MV} + 5D)$
resistance of protective conductor	20 Ω	max. 20 V DC	200 mA + 10 mA DC		$\pm (2\% \text{ of MV} + 5D)$
	2 Ω				$\pm (2\% \text{ of MV} + 7D)$
leakage current	0 – 20 mA	(30 \pm 10) V	(< 8 mA)	2 k Ω	$\pm (2\% \text{ of MV} + 7D)$
	0 – 2 mA				$\pm (2\% \text{ of MV} + 7D)$
leakage current	0 – 20 mA	(differential method)			$\pm 2\% \text{ of MR}$

MV – measured value, D – digit, MR – measuring range

Current I_K short-circuit current when measuring the insulation resistance, measuring current when resistance of protective conductor is measured

Current I_N rated current at rated voltage (insulation resistance)

PU 194 DELTA, PU 194 DELTA – 10A

The PU 194 DELTA and PU 194 DELTA 10A measuring instruments are destined for the inspection and revision of electrical appliances and portable hand-operated tools with the moving or fixed conductor. The PU 194 DELTA 10A is also suitable for the revision and inspection of working machines.



The instruments comply with the requirements according to ČSN 33 1600, ČSN 33 1610, EN 60 204 - 1.

- insulation resistances R_{ISO} up to 400 M Ω on measuring voltage of 50, 100, 250 and 500 V
- resistance of protective conductor R_{PE} up to 20 Ω on DC current of min. 200 mA (with the polarity switch-over)
- resistance of protective conductor R_{PE} up to 1 Ω on alternating current of 10 A (for the PU 194 DELTA - 10 A instrument only)
- leakage currents (current passing through protective conductor I_{PE} , leakage current I_D - alternate method, leakage current I_A - differential method)
- touch current I_F , mains voltage U_N , current consumption I_N
- active input P , apparent input S and $\cos \varphi$ of electrical appliances
- temperature and number of revolutions

The instrument is equipped with the memory of 1000 measured values and enables their transmission to the PC. The 8 digit - identification code can be set by means of the keyboard or bar code reader.

The PU 194 DELTA - 10 A model enables to measure the resistance of protective conductor on the alternating current of 10 A.

The instrument can be connected to the PC by means of RS 232.

Maximum current consumption of appliance - 16 A

Electromagnetic compatibility - according to EN 61326-1

Safety requirements - according to EN 61010-1: Devices with the protection class classification I for the voltage of 250 V CAT II, pollution degree 2

The utility value is extended by the optional accessories on special order:

- **PD 194.1** - test module
- **PD 194.2** - test module
- **PD 194.4** - temperature sensor (PT 100)
- **PD 194.5** - bar code reader
- **PD 194.3** - revolution sensor

MEASURING RANGES AND ACCURACY

Measured value	Measuring range	Measuring voltage	Measuring accuracy operating error	Note
mains voltage U_{LN}	(180÷253) V		$\pm (1\% \text{ of MV} + 10 \text{ D})$	
insulation	(0.1÷3.999) M Ω	50 to 70 V	¹⁾	$I_k \leq 4 \text{ mA}$
resistance R_{ISO}	(1.0÷39.99) M Ω	100 to 130 V	$\pm (5\% \text{ of MV} + 10 \text{ D})$	$I_n = 1.0 \text{ to } 1.5 \text{ mA}$
	(10÷399.9) M Ω	250 to 300 V		
		500 to 600 V		
resistance of protective conductor R_{PE}	(0.010÷3.999) Ω	max. 20 V	$\pm (5\% \text{ of MV} + 10 \text{ D})$	$I_M = \pm(200 \text{ to } 210) \text{ mA}$
	(0.01÷19.99) Ω	no-load		
	(0÷1.000) Ω	max. 25 V/DC	$\pm (5\% \text{ of MV} + 10 \text{ D})$	$I_M = 10 \text{ to } 12 \text{ A/AC}$
	(PU 194 – 10 A only)			
current I_F touch current	(0÷3.999) mA		$\pm (1\% \text{ MR})$	touch voltage $\Delta U_{\max} = 8 \text{ V}$
current I_{PE} protective conductor current	(0÷19.99) mA		$\pm (2\% \text{ MR})$	
current I_D leakage current (alternate method)	(0÷19.99) mA	max. 35 V/AC	$\pm (2\% \text{ of MV} + 10 \text{ D})$	
current I_A differential current	(0÷19.99) mA		$\pm (2\% \text{ MR})$	
current I_N current of appliance	(0÷16) A		$\pm (2\% \text{ of MV} + 10 \text{ D})$	
active input P	(0÷3700) W		$\pm (5\% \text{ of MV} + 10 \text{ D})$	max. current of 10 A
apparent input S	(0÷3700) VA		$\pm (5\% \text{ of MV} + 10 \text{ D})$	
power factor $\cos \varphi$	0.50÷1.00		$\pm 10 \text{ D}$	$0.5 \leq I_N \leq 16 \text{ A}$
revolutions	(200÷9999) min^{-1}		$\pm (2\% \text{ MV})$	
temperature t	(-20÷350) $^{\circ}\text{C}$		$\pm 5^{\circ}\text{C}$	

¹⁾ measuring accuracy up to 200 M Ω is guaranteed for the measuring voltage of 50 V and 100V

MV measured value

MR measuring range

D digit (lowest order digit)

I_n rated current (max. current at rated voltage) when measuring insulation resistance)

I_k short-circuit current passing between short-circuited measuring tips when measuring insulation resistance

I_F touch current - current passing through personnel from electrical appliances with the protection class I and II and those conductive parts of appliances with the protection class I touch accessible and not designed with the protective conductor (e.g. decorative parts) into earth (touch voltage $\Delta U = I_F \times 2 \text{ k}\Omega$)

I_M current when measuring resistance of protective conductor

I_N consumption current (supply)

The values displayed on the bargraph in the bottom part of display - informative data

In case of two-line- data the bargraph displays the data of low line.

Operating temperature: -5° C to +40° C

Accessories: mains lead, measuring leads with connector, measuring lead with pins, crocodile clamps

Weight PU 194 DELTA approx. 2.2 kg

PU 194 DELTA-10 A approx. 3.4 kg

Dimensions 170 x 220 x 120 mm

Accessories of the PU 194 DELTA instruments

PD 194.1 test module

PD 194.2 test module

The test modules are destined for the immediate informative operation checking of the PU 194 DELTA and subsequent models. The modules can be also applied for the revision instruments manufactured by the other producers according to ČSN 33 1600, ČSN 33 1610. The module connected to the revision instrument simulates the measured appliance. The PD 194.1 and PD 194.2 test modules comply with EN 61010-1. At their correct operating both the safety of attendant and test module are guaranteed. The modules comply with the EMC requirements according to EN 61326 - they do not affect the operation of the instrument tested.



PD 194.1 The phase conductor in the single-phase socket and condition of protective conductor can be indicated by test module. It enables to check the current measurement I_F , I_D , I_{Δ} , I_{PE} and insulation resistance R_{ISO} .

PD 194.2 The measurement R_{PE} can be checked by test module.



PD 194.3 REVOLUTION SENSOR

The revolution sensor is intended for the revolution sensing of rotating objects (motor pulley, gearing).

Basic information:

- guaranteed measurement range: 200-9999 rev/min
- measuring accuracy: 1 % of measured value
- distance to measured object: approx. 10 cm
- operation in invisible spectrum (IR)/ sensing/
- surveying of instrument to the rotating mark follows by means of two yellow rays.



PD 194.4 TEMPERATURE SENSOR (Pt 100)

The Pt 100 temperature sensor is destined for the temperature measurement during the revisions of electrical appliances and during the service. As the PD 194.4 sensor is made of conductive material the temperature can be only measured on the non-live parts.

The test voltage between terminals and conductive sensor housing – 500 V.

Technical data:

Measuring range: -25° C to +350° C

Measuring accuracy: ± 5° C

Heat stability of instrument housing max. +370°C (measuring part with supply lead)



PD 194.5 BAR CODE READER

The CCD 1000 bar code reader is delivered as the optional accessories. The manufacturer tests the pieces and guarantees the operation of bar code reader with the basic PU 194 DELTA

Module for sheet design

It is destined for the formation of simple sheets, equipped with the sample sheets for the revision of tools and mains revision.

Module for data transmission

It is destined for the data transmission from the PU 194 DELTA, PU 191 and PU 187.1 instruments.

Module for data processing

The programme gets the data from the relevant transferable module and enables to process them in sample or newly formed sheets. Very good processed and user-friendly environment.

Module for bar code printing

It fully meets the requirements for the formation and printing of labels.

PU 191 MULTIFUNCTION TESTER

The instrument is destined for the immediate measurements of heavy current electrical single-phase or three-phase installations with the phase voltage of 190 to 260 V and for the inspection of all the RCD models - i.e. non-slow operating (-), slow operating (G) and selective RCD's (S). It is supplied from the battery or accumulators.

The measured values, units and other data are displayed on the illuminated LCD-display and are automatically stored - up to 1000 measurements. It is possible to display them or to transmit to the computer for further processing by means of the QD191 unit.

The applied wiring provides proper protection against dangerous touch voltage during the measurement. During the testing of RCD the measurement is interrupted, if the touch voltage can exceed the selected limit of 25 V or 50 V.



The PU 191 instrument enables:

- to measure the voltage between the phase and protective conductor U_{L-PE}
- to measure the voltage between the phase and neutral conductor U_{L-N}
- to measure the voltage between the neutral and protective conductor U_{N-PE}
- to measure the voltage frequency
- to measure the line voltage
- to measure the impedance of protective loop R_S and internal resistance R_I
- to measure the impedance of protective loop R_S without timing-out of current RCD
- to measure the access time of RCD t_A by differential current $I_{\Delta N}$, $5 \times I_{\Delta N}$ and pulsating current
- to test the protective switch (RCD) with gradually increasing current, to measure the actuating current of protective switch I_{Δ} (RCD) and to measure the touch voltage U_{iA} at the moment of timing-out of protective switch (RCD)
- to measure the touch voltage U_{iAN} at the nominal actuating current passage of 0.45 through the protective conductor without timing-out of RCD and to test non-timing out of RCD
- to measure the low resistance R by direct current of 200 mA
- to inspect wiring of electrical installation - state displayed by symbols

Operating temperature:

-5°C to 40°C

Memory size:

1000 measured values

Maximum time of connection to network

1 hour, 5 minutes to line voltage

Safety conditions:

The instrument complies with the requirements according to EN 61010-1: Devices with protection class II for voltage of 300 V against earth CAT II, pollution degree 2.

Electromagnetic compatibility:

The instrument meets the requirements according to EN 61326-1 - Devices class B - Interrupted operation.

Accessories:

the PD 191.2 adapter, crocodile clamp - 2 pcs

The PU 191 instrument enables:

VOLTAGE AND FREQUENCY MEASUREMENT				NOTE
Measured value	Range	Basic error	Operating error	
voltage U_{L-N}	100 V to 260 V	$\pm (1\% \text{ of MV} + 1 \text{ D})$	$\pm (2\% \text{ of MV} + 2 \text{ D})$	actual effective voltage
voltage U_{L-PE}	$0.5U_{L-N}$ to 260 V	$\pm (1\% \text{ of MV} + 1 \text{ D})$	$\pm (2\% \text{ of MV} + 2 \text{ D})$	value TRMS
voltage U_{N-PE}	20 V to $0.5U_{L-N}$	$\pm (1\% \text{ of MV} + 2 \text{ D})$	$\pm (2\% \text{ of MV} + 3 \text{ D})$	(all voltage measurements)
voltage frequency	15 Hz to 65 Hz	$\pm (0.5\% \text{ of MV} + 1 \text{ D})$	$\pm (1\% \text{ of MV} + 1 \text{ D})$	at range U_{L-N}
voltage measurement with adaptor	20 V to 450 V	$\pm (1\% \text{ of MV} + 2 \text{ D})$	$\pm (2\% \text{ of MV} + 3 \text{ D})$	DC, AC voltage
MESUREMENT OF RCD's				voltage range U_{L-PE} 190÷260 V 49.5÷50.5 HZ
Measured value	Range	Basic error	Operating error	measuring current $45\%I_{\Delta N} \pm 5\%I_{\Delta N} / 240 \text{ ms}$
touch voltage $U_{I\Delta N} \quad 1)$	0.0 V to 70.0 V	+8% of MV + 1 V	+10% of MV + 1 V	measurin current $I_{\Delta} = 100\% \text{ to } 110\% I_{\Delta N}$
access time of RCD t_A	600 ms (-, G)	$\pm (1\% \text{ of MV} + 2 \text{ ms})$	$\pm (1\% \text{ of MV} + 3 \text{ ms})$	$I_{\Delta N} \dots$ rated actuating current of RCD
	1000 ms (S)	$\pm (1\% \text{ of MV} + 2 \text{ ms})$	$\pm (1\% \text{ of MV} + 3 \text{ ms})$	
	40 ms ($5 \times I_{\Delta N}$)	$\pm (1\% \text{ of MV} + 2 \text{ ms})$	$\pm (1\% \text{ of MV} + 3 \text{ ms})$	measuring current $I_{\Delta} = 5.0 \text{ to } 5.5 I_{\Delta N}$ (6, 10, 30 mA)
actuating current of RCD I_{Δ}	30 to 130% $I_{\Delta N}$	$\pm 6\% I_{\Delta N}$ at range 50÷100% $I_{\Delta N}$	$\pm 10\% I_{\Delta N}$ at range 50÷100% $I_{\Delta N}$	maximum measuring time 1.1s(-,G) 2.2 (S)
2) 3) IMPEDANCE OF PROTECTIVE LOOP R_S				measuring current max. 2.6 A
Measured value	Range	Basic error	Operating error	voltage range U_{L-PE} 190±260 V 49.5±50.5 Hz *operating error greater than 30% of MV
impedance of protective loop R_S	0.00 Ω to 0.39 Ω 0.40 Ω to 19.99 Ω	$\pm 12 \text{ D}$ $\pm (3\% \text{ of MV} + 10 \text{ D})$	* $\pm (5\% \text{ of MV} + 10 \text{ D})$	
measurement R_S behind RCD of 300 mA	0.0 Ω to 3.3 Ω 3.4 Ω to 199.9 Ω	$\pm 10 \text{ D}$ $\pm (5\% \text{ of MV} + 10 \text{ D})$	* $\pm (10\% \text{ of MV} + 15 \text{ D})$	$I_{\Delta} < 150 \text{ mA}$
measurement R_S behind RCD of 30 mA	000 Ω to 33 Ω 34 Ω to 1999 Ω	$\pm 10 \text{ D}$ $\pm (5\% \text{ of MV} + 10 \text{ D})$	* $\pm (10\% \text{ of MV} + 15 \text{ D})$	$I_{\Delta} < 15 \text{ mA}$
MEASUREMENT OF LOW RESISTANCES R				
Measured value	Range	Basic error	Operating error	
rezistance R	0.00 Ω to 19.99 Ω	$\pm (3\% \text{ of MV} + 10 \text{ D})$	$\pm (5\% \text{ of MV} + 10 \text{ D})$	DC current of 200 mA÷15 mA max. resistance of 8 Ω to 12 Ω in accordance with battery state
measuring current		$\pm (3\% \text{ of MV} + 10 \text{ D})$	$\pm (5\% \text{ of MV} + 10 \text{ D})$	

Notes:

1) Impedance of protective loop during the measurement of touch voltage - calculated value

2) Short-circuit current - calculated value

3) Additional error during the measurement with adapter - $\pm 0.02 \Omega$.

MV measured value

D digit - resolution in the lowest order

Power supply - 4 x NiCd accumulator size AA or 4x battery size AA, total supply voltage of 4.1 V to 6.2 V

Consumption - excl. measuring sequence and without switched-on display illumination -max. 15 mA at 5 V

Weight approx. 0.78 kg

Dimensions 297 x 92 x 57 mm

INSTRUMENTS FOR TELECOMMUNICATION

M1T 450.1 Cable bridge

The cable bridge is used for the measurement and test of long-distance metallic communication and power cables and for the fault location on these ones.



Features and benefits:

- Measurement of the resistance by the Wheatstone's bridge method
- Fault location by Murray's, Varley's bridge methods
- Location of the short-circuit (leakage), cable opens and guard changes
- Measurement of the resistance unbalance by the bridge method
- Measurement of the insulation resistance by the deflection method
- Power supply from the internal accumulator
- Optional external power supply
- Built-in recharger for 230 V/50 Hz mains
- Operation under the outdoor working conditions
- It complies with the safety requirements according to EN 61010-1, EMC-requirements according to EN 61326-1

Resistance measurement		
Measuring ranges	0 to 12,222 k Ω	x0,001; x0,01; x0,1; x1; x10
DC power supply	9 V to 11 V	Ri = 330 Ω \pm 10 %
Accuracy	\pm (0,1 % of measured value + 5 m Ω)	

Location of faults		
Measuring ranges	0 to 12,222 k Ω	x0,001; x0,01; x0,1; x1; x10
Internal power supply	DC 9 to 11 V	Ri = 330 Ω \pm 10%
	DC 100 \pm 5 %	Ri = 100 k Ω \pm 1 %
	AC 1 V \pm 20%	frequency 800 Hz \pm 30%
	pulse - level 0 V	Ri = 4,7 k Ω \pm 10%
	- level 120 V \pm 20 %	Ri = 33 k Ω \pm 10 %
	- frequency	1,7 Hz \pm 30%
External power supply	DC max. 500 V	
Accuracy	\pm (0,1 % of measured value + 5 m Ω)	

Measurement of the resistance unbalance		
Measuring range	12 k Ω , resolution 1 Ω	
Accuracy	\pm (0,1 % of measured value + 5 m Ω)	

Measurement of the insulation resistance		
Measuring ranges	0 - 1 M Ω to 10 G Ω	at 100 V
	0 - 5 M Ω to 50 G Ω	at 500 V

Dimensions	346 x 296 x 138 mm
Weight	approx. 4 kg

M1T 455 Bridge for the measurement of the capacity unbalance and the capacities of the telecommunication cables

The M1T 455 bridge is designed for the measurement of the capacity unbalance and the capacities of the metallic cable pairs of the telecommunication cables, for their testing and the defect location during the repair on the local telecommunication networks.



M1T complies with the safety requirements according to EN 61010-1, EMC - requirements according to EN 61326-1.

Features and benefits:

- Simultaneous digital and analogue display of the capacity unbalances with the resolution of 1 pF
- Possible extension of the measuring range by \pm 2000 nF
- Compensation of the capacity unbalances of the measuring cable min. by \pm 40 pF
- Autorange during the measurement of capacities
- Compensation of the capacities of the measuring cable min. by \pm 4,0 nF
- Possible check of the proper operation by the capacity standards
- Accumulator recharging from the built-in recharger connected to the supply of 230 V/50 Hz
- Power supply from the internal accumulator 12 V/2 Ah for min. 100 hours at one charge
- Low accumulator voltage warning by \leftarrow on the display
- Accumulator voltage can be displayed
- Automatic switch-off after the cover closing
- Protection of all wires of the measuring cable against overvoltage

Measurement of the capacity unbalances		
	The measuring range of \pm 1,999 nF with the resolution of 1 pF at the digital display	
	Accuracy \pm (1,5 % of measured value + 1 % of measuring range)	
	The measuring range of \pm 2 nF, accuracy 2,5 % at the analogue display	
	Frequency of 800 Hz \pm 2 % by measuring of the capacity unbalance	

Capacity measurement		
	199.9 nF with the resolution of 0,1 nF	
	1999 nF with the resolution of 1 nF	
	Accuracy \pm (1,5 % of measured value + 1 % of measuring range)	

Dimensions	346 x 296 x 138 mm
Weight	approx. 5,7 kg

PU 560

Subscriber line tester

The tester is designed for the telecommunication linesmen. The instrument is easy to use and easy to learn how to use.



Features and benefits:

- Logarithmic scale for the resistance measurement
- Power supply of 2 x 1,5 V, cells AA
- Battery voltage test
- ON/OFF button switch
- Automatic switch-off after 5 minutes
- Continuity test (buzzer)
- Protection against overvoltage at all measuring ranges
- During the continuity test it is not necessary to adjust the pointer

Dimensions 168 x 96 x 35 mm

Weight approx. 0,3 kg

Voltage measurement

- linear scale
- internal power supply not necessary

Resistance measurement

- scale from 0 to 50 k Ω , 1 k Ω in the middle
- range

x 0,01	measuring current	5 mA
x 0,1		0,5 mA
x 1		1 mA
x 10		0,1 mA
x 100		10 μ A
x 1000		1 μ A

Measurement of DC voltage

- measuring range 100 V, 300 V
- internal resistance 10 k Ω /V

Measurement of AC voltage

- range 300 V
- internal resistance 4,5 k Ω /V
- frequency from 40 Hz to 1 kHz

Accuracy

2,5 (at resistance measurement of scale length)

PU 570

Subscriber line multimeter

The multimeter is designed for the testing of the customer installations connected to the telephone exchanges.



Features and benefits:

- Measurement between the cable wires and screening without the switch-over of the measuring leads
- Digital display with the bargraph
- Manual or automatic range selection
- Measurement-stop option
- Protection against the overvoltage on all the measuring ranges
- Continuity test by beeping (<1 k Ω)
- Display backlight option
- Automatic switch-off after 5 minutes of non use
- Power supply from the internal accumulator
- Recharging from the external power supply of 12 V/0,2 A AC,DC

Dimensions 297 x 92 x 57 mm

Weight approx. 0,55 kg

Measurement of the insulation resistance

- 3 measuring ranges from 1.999 M Ω to 199.9 M Ω
- accuracy $\pm(2,5$ % of measured value + 1 % of measuring range)
- measuring voltage 100 V, rated current of min. 1 mA

Measurement of DC voltage

- measuring range ± 199.9 V, resolution of 0,1 V
- accuracy $\pm(1$ % of measured value + 0,5 % of measuring range)
- internal resistance 1 M Ω

Measurement of AC voltage

- measuring range 199.9 V, resolution of 0,1 V
- accuracy $\pm(1$ % of measured value + 0,5 % of measuring range)
- frequency range from 40 Hz to 1 kHz
- internal resistance 1 M Ω

Capacity measurement

- 3 measuring ranges from 19.99 nF to 1999 nF
- accuracy $\pm(1,5$ % of measured value + 1 % of measuring range)

Fault location

- accuracy $\pm(1,5$ % of measured value + 1 % of measuring range)
- the distance to the cable open is calculated of the measured cable capacity

Resistance measurement

- 3 measuring ranges from 199.9 Ω to 19.99 k Ω
- accuracy $\pm(1$ % of measured value + 0,5 % of measuring range)

PU 580 INSULATION TESTER

The PU 580 instrument is designed above all for the measurement on the telecommunication cables in places with the relative high interference.

The PU 580 instrument enables to measure:

- insulation resistance of **100 k Ω** to **20 G Ω** at the voltage of **100 V** or **500V**, during interference of max. 10 V and frequency lower than 1 Hz
- resistance at the ranges of **200 Ω** and **2000 Ω**
- DC voltage at the ranges of \pm **200 V** and \pm **600 V**
- AC voltage at the ranges of **200 V** and **600 V**

The analogue display of insulation resistance, the digital display of the other measured values. The tester is supplied from the internal battery and can be recharged by the internal recharger which can be connected to the network. The instrument is easy to use - the measuring ranges are switched-over by one switch button, during the measurement of insulation resistance the voltage is connected by the button **TEST** to the measured item.

The instrument is protected against the overvoltage from the external power supply at all the measuring ranges. If the instrument does not operate it will be automatically switched-over into the standby position - minimum consumption - after some minutes.



Design of instrument enables:

- simultaneous analogue display of insulation resistance and digital display of voltage on the measured item provide the information on the interfering signal
- automatic discharge of the measured item after measurement of insulation resistance
- minimum 1000 measurements of insulation resistance at the voltage of 100 V on one recharge for 30 s
- easy handling - to measure insulation resistance the item is switched over by button **TEST**
- digital display of measured resistance and voltage values
- protection against the overvoltage from the external power supply at all the measuring ranges
- continuity test by beeping (short-circuit)
- power supply from internal battery
- checking of battery voltage on the analogue instrument
- possible recharging from the internal adapter by connection to the mains 230 V, 50 Hz

- battery voltage is checked on the display during the recharging
- automatic switch-over into the stand-by after non-use
- housing is made of resistant plastic
- accessories: mains lead, 2 pcs measuring leads ended by pins, 2 pcs crocodile clamps

Measurement of insulation resistance

- measuring range of 100 k Ω to 20 G Ω
- measuring voltage of 100 V for the resistance greater than 100 k Ω (100 k Ω to 2 G Ω)
- measuring voltage of 500 V for the resistance greater than 10 M Ω (10 M Ω to 20 G Ω)
- rated current of 1 mA, short-circuit current of max. 15 mA
- accuracy class 5 of scale length
- permissible overvoltage by external voltage of max. 600 V for max. 10 s

Resistance measurement

- ranges 199.9 Ω resolution 0.1 Ω measuring current 10 mA
1999 Ω 1 Ω 1 mA
- accuracy \pm (1% of measured value + 0.5% of measuring range)
- continuity test beeping (\leq 100 Ω)
- permissible overvoltage by external voltage of max. 100 V for max. 10 s

Measurement of DC voltage

- ranges \pm 199.9 V resolution 0.1 V
 \pm 600 V 1 V
- accuracy \pm (1% of measured value + 0.5% of measuring range)
- internal resistance of 1 M Ω
- overvoltage: permanent 1.2 upper value limit short time 2 x upper value limit for 10 s

Measurement of AC voltage

- ranges $\pm 199.9\text{ V}$ resolution 0.1 V
 $\pm 600\text{ V}$ 1 V
- accuracy $\pm(1.5\%$ of measured value + 1% of measuring range)
- internal resistance of $1\text{ M}\Omega$
- frequency of 40 Hz to 1 kHz at the measurement of AC voltage
- overvoltage: permanent 1.2 upper value limit short time $2 \times$ upper value limit for 10 s

Operating conditions

- operating temperature -10°C to $+50^\circ\text{C}$
- relative humidity max. 85% at 23°C
- data setting time:
- max. 20 s after measurement of insulation resistance at resistance load only
- max. 5 s after the other measurements

Power supply from internal battery - 8 accumulators NiCd of 9.6 V , 600 mAh , recharging time - max. 12 hours

Battery consumption

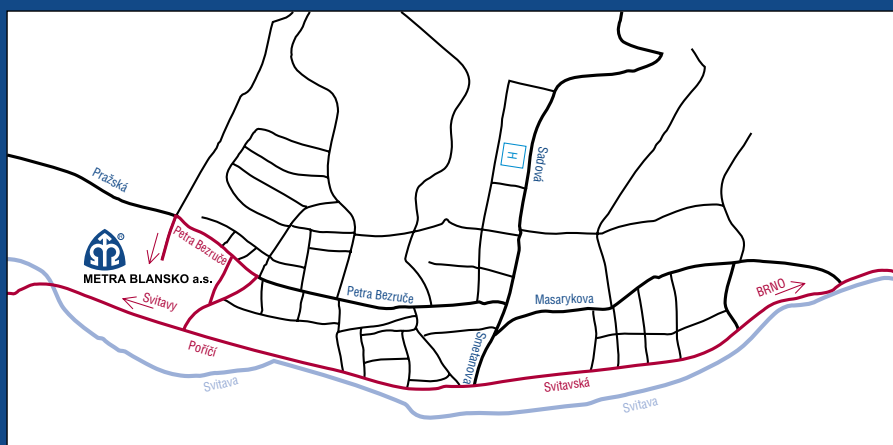
- max. 20 mA at resistance measurement, max. 10 mA at voltage measurement
- minimum consumption of max. $50\text{ }\mu\text{A}$

Weight approx. 1.8 kg incl. batteries

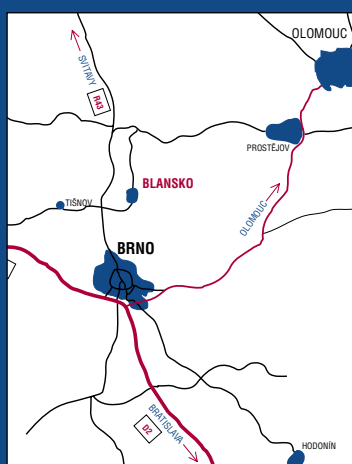
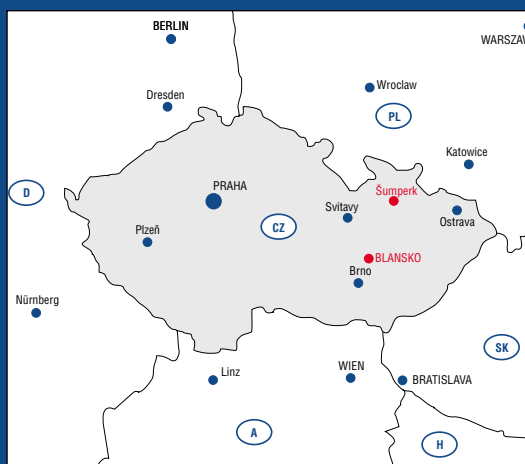
Dimensions $220 \times 170 \times 120\text{ mm}$

We produce and offer also:

Clamp meters, laboratory measuring instruments, panel and switchboard instruments, panel line recorders, converters of electric quantities, thermometers, thermostats, thermomanometers and electronic heat cost allocators.



Distributed by:



METRA BLANSKO a.s. Tel.: +420 516 59 11 11
 Poříčí 24 +420 516 59 12 39
 678 49 BLANSKO Fax: +420 516 59 12 99
 Czech Republic +420 516 41 75 55
<http://www.metra.cz>