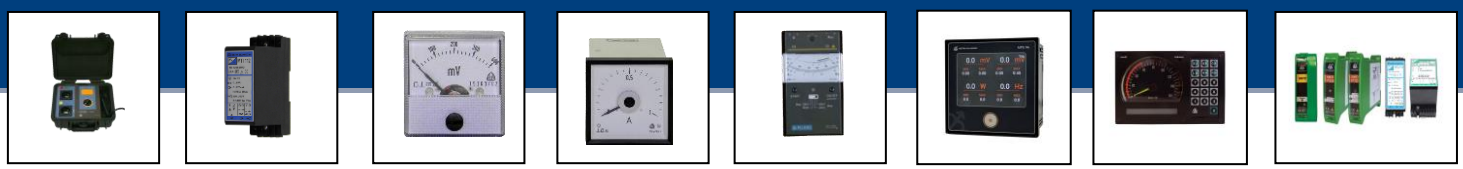
VALUE IS INSIDE

SINCE 1911

METRA BLANSKO

Switchboard instruments



METRA BLANSKO

VALUE IS INSIDE

LIST

STANDARDS

CASINGS AND SLOTS IN PANELS

The coverage degree of casings of all instruments complies with the standard ČSN EN 60529. A better protection is possible by using of various types of insulation covers of clamps.

SCALES AND POINTERS

Pointers have got blade ends, scales have got rough, or fine indexing.

TECHNICAL EXECUTION

Until otherwise determined, measuring ranges 1.0 / 1.5 / 2.5 / 4.0 / 6.0 and their decimal multiples are applied.

At the measuring current transformers application, as a standards following scales are available: 5 / 10 A - 10 / 20 A - 15 / 30 A - 20 / 40 A - 25 / 50 A - 30 / 60 A - 40 / 80 A - 50 / 100 A - 60 / 120 A 75 / 150 A - 80 / 160 A - 100 / 200 A - 120 / 240 A - 150 / 300 A - 200 / 400 A - 250 / 500 A - 300 / 600 A - 400 / 800 A - 500 / 1000 A - 600 / 1200 A - 750 / 1500 A - 800 / 1600 A - 1000 / 2000 A - 1.2 / 2.4 kA - 1.5 / 3kA - 2/4 kA - 2.5 / 5 kA - 3.0 / 6.0 kA.

At voltage transformers connection, following scales are available standardly: 6 kV - 7.2 kV - 12 kV - 24 kV - 30 kV - 36 kV - 72 kV - 120 kV - 180 kV - 300 kV - 480 kV.

At external shunts application, following scales are available standardly: 25 A - 40 A - 60 A - 100 A 150 A - 200 A - 250 A - 300 A - 400 A - 500 A - 600A - 1000 A - 1.5 kA - 2.5 kA - 3 kA - 4 kA - 6 kA - 10 kA.

SAFETY PRESCRIPTIONS

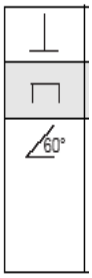
Measuring instruments comply with the standards ČSN EN 61010-1.

ACCURACY CLASS 1

Measuring instruments comply with the standard ČSN EN 60051-1. Until otherwise specified, the accuracy class 1.5 is marked on the scale.

ASSEMBLY POSITION

The required assembly position is marked on the scale, whilst an admissible deviation from this position is ± 5° and the error generated by it (together with the measurement error) must not exceed the error, corresponding to the instrument accuracy class.

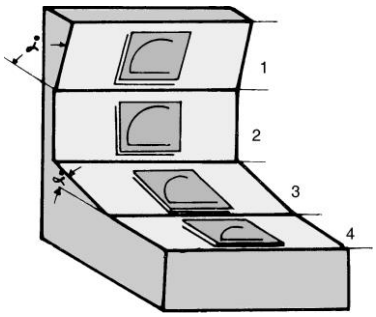


vertical

horizontal

Sloping (scale inclination against horizontal position, e.g. 60°

A required position at measurement must be specified every time, if it is different from the vertical one.



1 : ∠ ∝ > 90° 3 : ∠ ∝ < 90°

2 : ⊥ ∝ = 90° 4 : ⊓ ∝ = 0°

WORKING TEMPERATURE RANGE

These measuring instruments operate by suitable way at the ambient temperature range -20°C to + 55°C

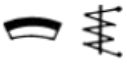
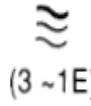
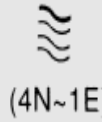
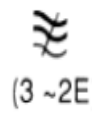
VIBRATIONS AND IMPACTS

During its vibration test the instrument is exposed to 5 cycles with frequency wobbling in the zone 10 - 150 - 10 Hz at the cycle amplitude 0.15 mm.

The impact test consists of 3 impacts, each in the both directions in three mutually perpendicular axes with acceleration amplitude 150 m/s^2 .

SYMBOLS OF THE INSTRUMENT SYSTEM

Applied measurement system is branded by following symbols

Symbol	
	Magneto-electric instrument
	Magneto-electric instrument with semi-conductor rectifier
	Electro-magnetic instrument
	Thermal instrument
	Combination of thermal and electro-magnetic instrument
	Grounding
	Attention! See Instruction Manual
	DC current
	AC current
	DC and AC currents
 (3 ~1E)	For measurement in 3-phase 3-conductor network by one measuring system
 (4N~1E)	For measurement in 3-phase 4- conductor network by one measuring system
 (3 ~2E)	For measurement in 3-phase 3-conductor asymmetrically loaded network by two measurement systems
 (4 N~3E)	For measurement in 3-phase 4-conductor asymmetrically loaded network by three measurement systems

SWITCHBOARD INSTRUMENTS WITH DEVIATION 90°

TECHNICAL DATA

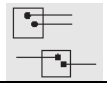
MAIN PARAMETERS

Instrument type	Electro-magnetic **(Fb…,Fb…-1)**	Magneto-electric **(Mb…,Mb…-1)**	Magneto-electric with semiconductor rectifier **Mub…)**	Magneto-electric with converter for frequency measurement **(Kb…)**	
Front face size	72 x 72 mm 96 x 96 mm	72 x 72 mm 96 x 96 mm	72 x 72 mm 96 x 96 mm	72 x 72 mm 96 x 96 mm	
Measured variable	AC current AC voltage	DC current DC voltage	AC current AC voltage	Frequency for all types of network	
Depth behind the frame *1	89 mm	58 mm	89 mm	58 mm	
Measurement ranges	See the tables with data for orders.				
Casing	Casing complies with UL 94 V-0.				
Frame	Narrow front face frame, standardly black,				
Front face	Flat glass.				
Assembly	Assembly to switchboards, raster systems on device, or instrument panels with their wall thickness up to 10 mm, in horizontal and vertical arrangements.				
Fixing on panel	Diagonally located special screw fasteners.				
Inlet clamps	Clamp yoke with screw M 4 in all instruments except Fb…-1 40 A, 60 A and Mb…-1 6 A to 60 A with clamps M6 and M 8 at Fb…-1/Mb…-1 100 A				
Assembly position	Standard with vertical scale.				
Coverage degree	Casing IP 52, except thermal instruments with the IP 40. For the inlet clamps IP 00 as per ČSN EN 60529. A better protection is possible in case various types of insulation covers are used.				
Environment	ČSN EN 60068				
Working temperature range	-20° C to + 45° C *2	-40° C to + 60° C *2	-40° C to + 60° C	-20° C to + 45° C	-20° C to + 45° C

*1 : Admissible different values for some ranges are given in individual Catalogue sheets.

*2: Measuring instruments with –1 -10° C to + 55° C

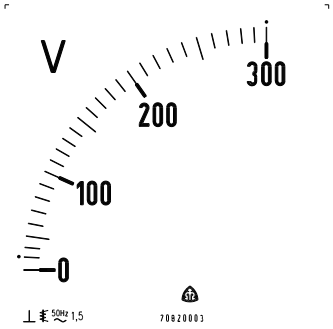
TECHNICAL DATA

Measuring system	Electro-magnetic	Magneto-electric (valid even for the system completed by a rectifier for AC current measurements)
	Electro-magnetic system with damping by silicon oil, with tip seating in bearing stones and spring at one side	Magneto-electric system with a core, tip sealing in bearing stones and springs at the both sides
Self-consumption	Ammeters : < 0.5 VA For ranges over 15A : < 0.8 VA Voltmeter : < 4.5 VA	See tables with information for orders
Long-term overload rating	1.2 x after 2 hours as per ČSN EN 60051-1	1.2 x after 2 hours as per ČSN EN 60051-1
Short-term overload rating	Ammeter Fb 72-1 / 96: 10 x I_{jm} 9 x 0,5s 1 x 5s	Ammeter 10 x I_{jm} 9 x 0,5s 1 x 5s
	Voltmeter : Fb 72-1 / 96-1: 2 x U_{jm} 9 x 0,5s 1 x 5s,	Voltmeter 2 x U_{jm} 9 x 0,5s 1 x 5s
Working life test	150,000 cycles: full deviation with standing 1s after stabilisation and 4s switch off	
Working voltage	Fb 72-1 / 96-1: 600 V	Mb, Mub 72-1 / 96: 600 V
Field of application	Reference temperature : 23° C, working temperature: - 20° C to + 45° C Storage temperature : -25° C to +55° C	
Frequency zone	As per ČSN EN 60051-1 Ammeter : 15.... 45.... 65.... 400 Hz Voltmeter : 15.... 45.... 65.... 100 Hz for other frequencies : 45 – 65 Hz reference range 15 – 400 Hz nominal range	As per ČSN EN 60051-1 15.... 45.... 65.... 400 Hz for instruments with magneto-electric system for measurement of AC current and voltage
Influence of outer magnetic field	0,5 mT ČSN EN 60051-1	
Connection for ammeter ≥15 A	Fb72/96 	
Over-voltage category	300V, CAT III as per ČSN EN 61010-1	300V, CAT III as per ČSN EN 61010-1
Degree of soiling	2 as per ČSN EN 61010-1	2 as per ČSN EN 61010-1

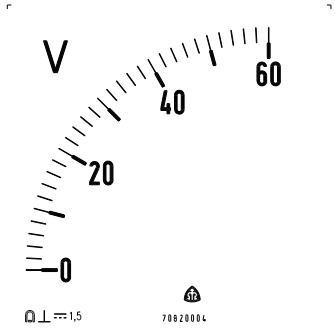
TECHNICAL DATA

VARIANTS OF SCALES

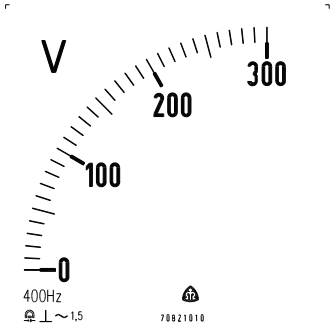
Following 9 scales can be used as examples of available variants:



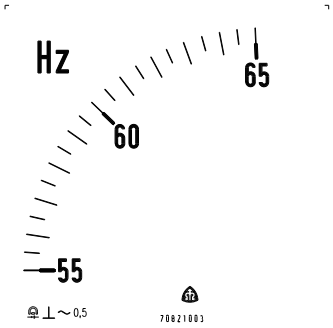
[1] Scale for electro-magnetic voltmeter



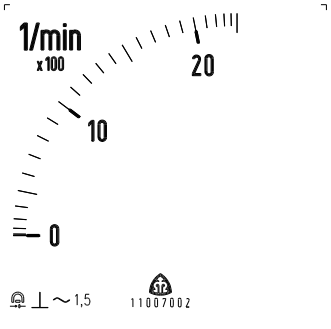
[2] Scale for magneto-electric voltmeter (measurement of DC voltage)



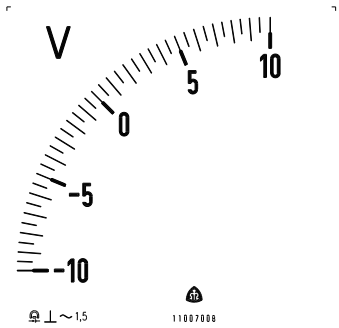
[3] Scale for magneto-electric voltmeter (measurement of AC voltage)



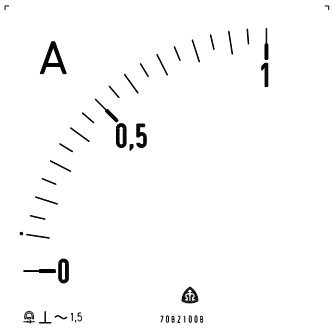
[4] Scale for frequency meter



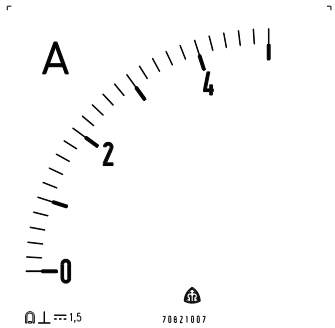
[5] Scale for speedometer



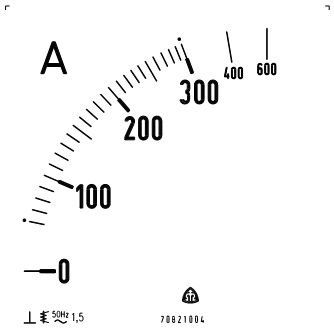
[6] Scale for voltmeter with central zero



[7] Scale for magneto-electric ammeter (for AC current measurement)



[8] Scale for magneto-electric ammeter



[9] Scale for electro-magnetic ammeter

FEATURES

CASINGS
Main parts of the casing, made of poly-carbonate, filled with glass fibres, have got their excellent mechanical features, they are stable in sizes, self-extinguishing acc. to strict criteria of the standard UL 94, flammability class FV-O.

SCALES

Modern technology and design on instruments enable application of pre-printed and nearly linear replaceable scales even for electro-magnetic instruments.

TWO DIFFERENT SIZES OF THEIR IDENTICAL STYLE at instruments -1

Front-face size 72 **x** 72 mm
Front-face size 96 **x** 96 mm

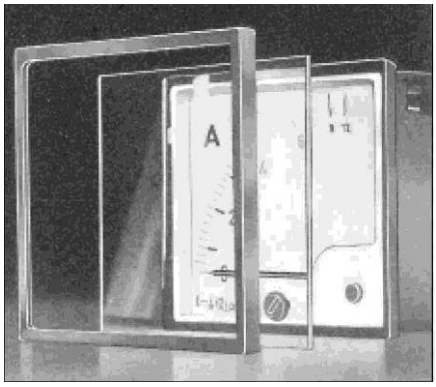
BUILT-IN CONVERTERS FOR FREQUENCY MEASUREMENTS

The built-in converters, creating one unit with the instrument, are used for frequency measurements. Their installation and connection are simple. Instruments with their front-face 96 mm are available.

FEATURES

EASY REPLACEMENT OF FRONT FACE GLASS

AT INSTRUMENTS -1



If the front face glass is damaged, it is easy to replace after the frame removal.

After the glass replacement the frame will sit to its proper position firmly and the instrument dustproof will be secured.

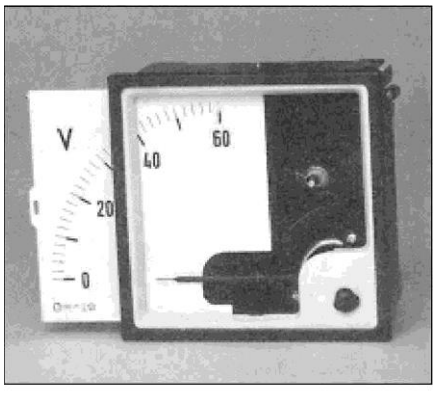
FOR SIMPLE REPLACEMENT OF SCALE NO TOOLS ARE NECESSARY

The scales are designed so that they are exchangeable at all instrument types with retained accuracy class, incl. electro-magnetic ones of size 96 x 96.

The changeability of scales enables users to keep stock of minimal number of instruments and decrease costs by this way.

The scale replacement is very easy; only the hinged window must be open, the old scale pulled out and a new inserted. The guide provides its proper position without danger of some damage of the pointer, or system. In case the assembly window is, by mistake, left open, it will be closed automatically after the instrument putting into the panel slot.

At the scale replacement, disconnect always the instrument from the measured signal.



ELECTRO-MAGNETIC INSTRUMENTS

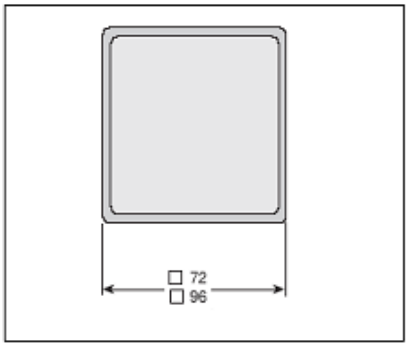
TYPE Fb…, Fb…-1

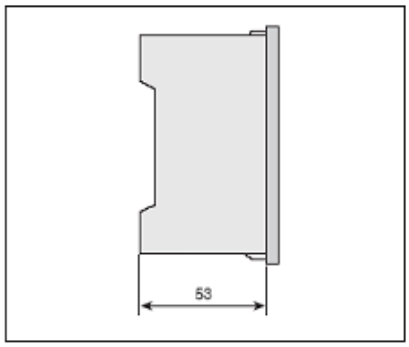
ELECTRO-MAGNETIC INSTRUMENTS FOR MEASUREMENTS OF AC VOLTAGE AND AC CURRENT

Accuracy class 1,5 as per ČSN EN 60051-1

Type	**Fb72**	**Fb72-1**	**Fb96**	**Fb96-1**
Front face size (mm)	72 x 72		96 x 96	
Slot in panel (mm)	$68^{+0.7}$ x $68^{+0.7}$		$92^{+0.8}$ x $92^{+0.8}$	
Scale length (mm)	63		97	
Depth behind the frame (mm)*2	58	53	66	53
Weight (nominal) (kg)	0.16		0.2	

Range (full deviation)	
V ~	6 10 15
	25 40 60
	100 150 250
	300 400 500
	600
With measuring transformer	x /100V x/110V
mA~	100/200 150/300 250/500 400/800 600/1200
A~	1/2 1.5/3 2.5/5
With measuring transformer	x/1A x/5A





Note: Until otherwise specified, the standard execution is delivered.
The standard execution has got the vertical scale identical with the range, black frame, frequency 50Hz.
The ammeters have got standardly twofold overload rating. The instruments Fb…-1 can have two ranges, at the ammeter in the ratio 2:1, with the accuracy class 1.5 at the higher and 2,5 for the lower ranges. At voltmeters the higher range is the five-fold of the lower one, with the accuracy class 1,5 at the higher and 5 at the lower range.

MAGNETO-ELECTRIC INSTRUMENTS (WITH SEMI-CONDUCTOR RECTIFIER), TYPE Mub …, Mub…-1

MAGNETO-ELECTRIC SYSTEM WITH SEMI-CONDUCTOR RECTIFIER FOR MEASUREMENTS OF AC CURRENT AND VOLTAGE

Accuracy class 1,5 as per ČSN EN 60051-1

Type		**Mub72**				**Mub96**			
Front face size (mm) Slot in panel (mm) Scale length (mm) Depth behind the frame (mm) Weight (kg)		72 x 72 68^{+07} x 68^{+07} 63 58 0.18				96 x 96 $92^{+0.8}$ x $92^{+0.8}$ 97 66 0.22			
Range (full deviation)		**ΔU /Ri**		**ΔU / Ri**		**ΔU / Ri**		**ΔU / Ri**	
μA~	100 150 250	1.3V 1.8V 1.9V		1.3V 2.4V 2.4V		1.3V 2.4V 2.4V		1.3V 2.4V 2.4V	
	400 600	1.5V 1.6V		2.4V 2.4V		2.4V 2.4V		2.4V 2.4V	
mA~	1 1.5 2.5	1.6V 1.3V 1.4V		2.4V 1.4V 1.4V		2.4V 1.4V 1.4V		2.4V 1.4V 1.4V	
	4 6 10	1.6V 1.6V 1.7V		1.4V 1.4V 1.4V		1.4V 1.4V 1.4V		1.4V 1.4V 1.4V	
	15 25 40	1.7V 1.7V 1.9V		1.7V 1.7V 1.7V		1.7V 1.7V 1.7V		1.7V 1.7V 1.7V	
	60 100	1.9V 2.0V		1.7V 1.7V		1.7V 1.7V		1.7V 1.7V	
V~	6 10 15	approx. 0.9 kΩ/V		approx 0.9 kΩ/V		approx 0.9 kΩ/V		approx 0.9 kΩ/V	
	25 40 60								
	100 150 250								
	300 400 500								
	600								

Note: Until otherwise specified, the standard execution is delivered.
The standard execution has got the vertical scale identical with the range, black frame, frequency 50Hz.

ΔU Voltage drop on the instrument at full deviation
Ri Inner resistance

MAGNETO-ELECTRIC INSTRUMENTS, TYPE Mb…, Mb…-1

MAGNETO-ELECTRIC SYSTEM FOR MEASUREMENT OF DC CURRENT

Accuracy class 1,5 as per ČSN EN 60051-1

Type		**Mb72**	**Mb72-1**	**Mb96**	**Mb96-1**
Front face size (mm) Slot in panel (mm) Scale length (mm) Depth behind the frame (mm)*3 Weight (nominal) (kg)		72 x 72 $68^{+0.7}$ x $68^{+0.7}$ 63 58 53 0.18		96 x 96 $92^{+0.8}$ x $92^{+0.8}$ 97 66 53 0.22	
Range (full deviation)		**ΔU**		**ΔU**	
uA =	60 100 150	600mV 400mV 600mV		600mV 400mV 600mV	
	250 400 500	140mV 540mV 540mV		140mV 540mV 540mV	
	600	540mV		540mV	
mA =	1 1.5 2.5	40mV 200mV		40mV 200mV	
	4 5 6	200mV		200mV	
	10 15 20	10mV 60mV		10mV 60mV	
	25 40 60	60mV		60mV	
	100 150 250 400 600	60mV		60mV	
A =	1 1.5 2.5	60mV		60mV	
	4 6 10	70mV 60mV		70mV 60mV	
	15 25 30	60mV		60mV	
	40 60 100	60mV		60mV	
With external shunt .	/60mV /75mV /150mV	60mV 75mV 150mV		60mV 75mV 150mV	

Note: Until otherwise specified, the standard execution is delivered.

The standard execution has got the vertical scale identical with the range, black frame, frequency 50Hz.

ΔU : Voltage drop on the instrument at full deviation.

* 3 : Mb 72-1, 96-1 -6A to 60A : 67 mm and over 60A : 78 mm

: >6A at Mb 72 64 mm ; at Mb 96 83 mm

MAGNETO-ELECTRIC INSTRUMENTS, TYPE Mb…, Mb…-1

MAGNETO-ELECTRIC SYSTEM FOR MEASUREMENT OF DC VOLTAGE
Accuracy class 1,5 as per ČSN EN 60051-1

Type		**Mb72**		**Mb96**	**Mb96-1**
Front face size (mm) Slot in panel (mm) Scale length (mm) Depth behind the frame (mm)*3 Weight (nominal) (kg)		72 x 72 $68^{+0,7}$ x $68^{+0,7}$ 63 53 0.18		96 x 96 $92^{+0,8}$ x $92^{+0,8}$ 97 53 0.22	
Range (full deviation)		**Ri**		**Ri**	
mV	15 *5 25 *5 40 *5	3.33 kΩ/V		3.33 kΩ/V	
	60 100 150				
	250 400 600				
V	1 1.5 2.5	1kΩ/V		1kΩ/V	
	4 6 10				
	15 25 40				
	60 100 150	1kΩ/V		1kΩ/V	
	250 300 400				
	500 600				

Note: Until otherwise specified, the standard execution is delivered.
The standard execution has got the vertical scale identical with the range…

R_i : inner resistance

*5 : Accuracy class 2.5.

FREQUENCY METERS , TYPE Kb96, Kb120

These instruments are intended for frequency measurements in low-voltage networks in switch rooms and in other equipment, where necessity of frequency measurements are necessary. The instruments comprises the electronic frequency converter with its current output, which is measured by a magneto-electric measurement system. Power supply of the electronic circuit is provided directly from the measured circuit. The zero position of the pointer corresponds to the mechanical zero, the frequency lowest value of the given frequency range corresponds to the pointer deviation 0°. For the highest value of the frequency range the pointer deviation is 90° The output current change measured by the magneto-electric measuring system is proportional to the frequency change of the measured signal.
The instruments are equipped with the adjuster of the pointer zero position. The board of the electronic converter is built in the instrument.

Type		**Kb96**
Front-face size (mm) Slot in panel (mm) Scale length (mm) Depth behind the frame (mm)*7 Nominal weight kg Consumption approx. VA		96 x 96 92 x 92 93 58 0.38 2
Range	45 - 55 Hz 48 - 52 Hz 55 - 65 Hz 58 – 62 Hz	Accuracy class 0,5 Accuracy class 0,2 Accuracy class 0,5 Accuracy class 0,2 Accuracy class relates to the maximal range of the measured quantity.
Secondary voltage of the voltage transformer : 100V, 220V, 230V, 380V, 400V, 500V Admissible voltage variation of the measured network: ±15%. Linear distortion of the network voltage ≤ 15%.		
Over-voltage category		300 V, Cat III as per ČSN EN 61010-1
Degree of soiling		2 as per ČSN EN 61010-1

Connection of the frequency meter
For an electro-magnetic interference suppression the inlet to the frequency meter must be performed by a shielded cable of its minimal cross-section of the CU cord 1,5 mm^2, for the inlet length 5m. For any longer distances a cable of its bigger cross-section must be used. The non-shielded part of the inlet to clamps must be as short, as possible.
On the ending side at the instrument, shielding of the inlet cord must be connected by tinned Cu knitted strip 16/010 to the equipment grounding batten. Connection of the Cu strip to the cable shielding must be performed by such way, so that the proper contact is provided along the entire cable periphery. The Cu strip must be led, if possible, in parallel with the inlet cable within the longest distance, as close as possible. If more leads cable is used for connection to the frequency meter, all these leads must be connected.

OPTIONAL FEATURES

GENERAL

Scale

Uncalibrated (with printed symbols and company logo. The zero point, nominal measuring range and overload rating marked by a pencil)

Blank scale (without any print. The zero point, nominal measuring range and overload rating marked by a pencil)

Without scale (calibration is carried out in the zero position at the nominal measuring range)

Scale without the logo (equivalent of the standard scale without the company logo)

Scale 0 ... 100%

Scale acc. to customer wish

Scale different from the standard one with a course acc. to the table

Linear scale for the quantity required by the customer

Double scale

Second linear scale, incl. numeration

Second scale for the quantity required by the customer acc. to a formula, curve, table incl. numeration

Complements of standard information on the scale

Additional description, e.g. : 'charging'

Additional numeration

Red marking of an arbitrary point of the scale

Colour sectors of the scale – red, blue, green (other colours optionally)

Negative scale, black base, parting, or numeration white, or yellow

Assembly position

Different from the vertical scale

OPTIONAL FEATURES

ELECTRO-MAGNETIC MEASURING SYSTEM

Range
Different from the standard one

Frequency
400 Hz
Acc. to the customer wish in the range 50 Hz.... 400 Hz

Overload rating
Ammeter with 5x exceeded range

Calibration even for DC voltage and current

MAGNETO-ELECTRIC MEASURING SYSTEM

Range
Different from the standard one

Zero position
Between the left edge and the scale centre
4 mA … 20 mA (suppressed zero)
Right-hand pointer position

Cover of clamps
Plastic cover of inlet clamps

ORDERS

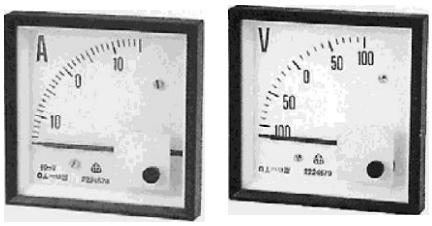
Following must be specified in your order:

- instrument name and type
- number of pc
- measuring range, eventually transformer ratio
- number of replaceable accessories
- delivery term
- delivery destination
- special requirements:
    - operational position different from vertical
    - calibration at different frequency than 50Hz
    - further symbols, or other marking on the dial
    - colour mark on the dial
    - package different from standard one
    - resistance of inlets for connection of ammeters to the shunt different from 0,01 Ω

Scope of delivery:

- 1pc switchboard instrument
- 2 pc clamps (4 pc for shockproof execution)
- Guarantee sheet
- Instruction for assembly
- transport package
- required replaceable accessories

AMMETERS AND VOLTMETERS FOR DC CURRENT WITH CENTRAL ZERO TYPE: Mb72, Mb96



APPLICATION

These instruments are intended for measurements of DC currents and voltages, or even other quantities, which can be transformed on DC current, or voltage in the both polarities

DESCRIPTION

These instruments are equipped with its measuring systems with rotary coil, rotating in the permanent magnet field. The rotary system has got its point seating with sprung stones.
Damping of these instruments is performed mostly by eddy currents, which are induced in the metallic frame of the rotary coil by motion in the magnetic field.
The instruments are commonly calibrated for the vertical position of the dial and, in this position, they have to operate within the admissible error limits. Optionally, they can be calibrated even in different positions.
The instruments are to be fixed on panels by special clamps, delivered together with the instrument.
By the instrument casing the measuring system is protected against any mechanical damage and dust.
Inlets are located on the rear side of the casing.
By the instrument xA/60mV and a separated replaceable shunt DC current can be measured from 100A to 10kA. These ammeters are calibrated with connection lead 0,05Ω. However, also calibration of different inlet resistances can be required, but max. 1Ω. From this reason the lead length must be fulfilled, as specified in the following table No. 1.

TECHNICAL DATA

Accuracy class	1,5
Scale length MB 72 Mb 96	62,4 mm 92,7 mm
Temperature coefficient	10% accuracy class /K
Safety requirements	as per ČSN EN 61010–1
Equipment protection class	II
Degree of soiling	2
overvo-ltage category in the installation	CAT III
working voltage	600V
overload rating	as per ČSN EN 60051-1
electro-magnetic compatibility	as per ČSN EN 61326 –1 activity criterion A
coverage - front face - inlet clamps - inlet clamps with plastic cover	 IP 52 IP 00 IP 20 for size 96
mechanical strength operational vibrations immunity against contingent impacts immunity against impacts during transport	as per ČSN EN 60068 10Hz – 55Hz – 10Hz, oscillation amplitude 0,15 mm 18 impacts 150 m/s^2 3 x 1000 impacts 100m/s^2
Nominal application range temperature relative humidity pressure frequency of alternate quantity position	 -40 to 60°C 25 to 80% at 23°C 70 to 106 kPa 50 Hz ± 10% vertical ± 5°
climatic immunity	hot wet and hot dry environment as per ČSN IEC 721-2 -1
weight Mb 72 Mb 96	0,14 kg 0,19 kg

Table No.1

Lead cross-section	Lead length in m for resistance	
mm^2	0,05Ω	1Ω
0,75	2x1	2x20
1	2x1,4	2x28
1,5	2x2,1	2x42
2,5	2x3,5	2x70
4	2x5,6	2x112
6	2x8,5	2x170
10	2x14	2x208

MEASURING RANGES

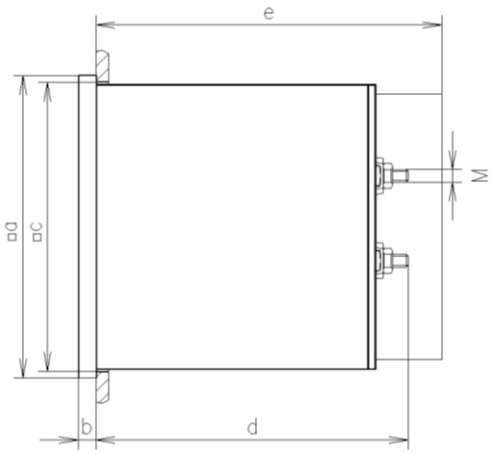
TYPE	RANGE			
	Voltmeters		Ammeters	
Mb 72 Mb 96	±25mV	1000Ω/V	±60μA	5203Ω
	±40mV	1000Ω/V	±100μA	2500Ω
	±60mV	1000Ω/V	±150μA	1090Ω
	±100mV	1000Ω/V	±250μA	500Ω
	±150mV	1000Ω/V	±400μA	190Ω
	±250mV	1000Ω/V	±600μA	130Ω
	±400mV	1000Ω/V	±1mA	40Ω
	±600mV	1000Ω/V	±1,5mA	17Ω
	±1V	1000Ω/V	±2,5mA	<10Ω
	±1,5V	1000Ω/V	±4mA	<10Ω
	±2,5V	1000Ω/V	±5mA	<10Ω
	±4V	1000Ω/V	±6mA	<5Ω
	±6V	1000Ω/V	±10mA	<5Ω
	±10V	1000Ω/V	±15mA	<5Ω
	±15V	1000Ω/V	±20mA	<5Ω
	±25V	1000Ω/V	±25mA	<5Ω
	±40V	1000Ω/V	±40mA	60mV
	±60V	1000Ω/V	±60mA	60mV
	±100V	1000Ω/V	±100mA	60mV
	±150V	1000Ω/V	±150mA	60mV
	±250V	1000Ω/V	±250mA	60mV
	±400V	1000Ω/V	±400mA	60mV
	±600V	1000Ω/V	±600mA	60mV
	±xkV/10V	2500Ω/V	±1A	60mV
			±1,5A	60mV
			±2,5A	60mV
			±4A	60mV
			±6A	60mV
			±10A	60mV
			±15A	60mV
			±25A	60mV
			±40A	60mV
			±60A	60mV
			±4-20mA	10Ω

FOLLOWING MUST BE SPECIFIED IN YOUR ORDER:

a) instrument name and type
b) number of pc
c) measuring range
d) delivery term
e) delivery destination
f) working position, if other than vertical
g) further symbols, or other marking on the dial
h) colour mark on the dial

Scope of delivery:

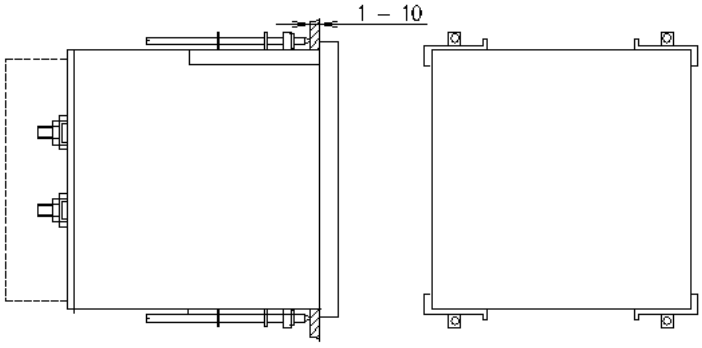
- 1pc switchboard instrument
- 2 pc clamps
- Guarantee sheet



Type		Mb72	Mb96
Front face size a		72x72	96x96
Front face size b		8,5	5,5
Slot in panel c		68x68	92x92
Depth d	Voltmeters M4	58	58
	Ammeters up to 6A - M4	66	66
	Ammeters up to 10A - M6	75	83
Depth e		-	87

All dimensions are in mm. For dimensions of holes in the panel the tolerance +0,4 mm is valid.
The depth e relates the instrument with its protecting cover against any contingent touch.
If instruments are assembled into the switchboard chock-a-block, between their front face frames a gap at least 1 mm should be left.

INSTRUMENT FIXING IN THE PANEL BY CLAMPS



SPEEDOMETERS
TYPE: Mub72, Mub96

APPLICATION

They are intended for remote permanent speed measurements of machines, used in industrial plants. The speedometers are usually calibrated in the shaft speed of the measured machine. However, the scale can be calibrated even in other quantities, depended on the speed, e.g. feed speed, power, quantity etc. Therefore the speedometers can be exploited in many ways.

The electric speedometers consist of two main parts:

1. transmitter (small generator)
2. measuring instrument – speedometer

DESCRIPTION

The transmitter – a small tacho-generator, has got its firm winding in the circular stator and six-pole rotor created by the permanent magnet. The speed of the measured machine shaft is transferred mechanically on the small generator, generating AC current, whose voltage and frequency are directly proportional to the shaft speed and they can be therefore measured by voltmeters, whose scales are calibrated directly in rpm, or m/sec. At 1000 rpm the generator voltage is about 30V with frequency about 50Hz, at higher speed the voltage and frequency are proportionally higher. Maximal permanent current load is 20mA, so that up to 4 instruments can be connected in parallel to one small generator. The instruments with their range 400 and 600 rpm are equipped with an auxiliary condenser for damping of pointer vibrations.

The small tacho-generators are reliable and safe in operation, because they have no commutators with brushes. They are not replaceable, therefore they must be calibrated individually together with the instrument. Sense of rotation has no influence to the measurement. Resistance of the connecting lead up to 50Ω has no influence on the measurement accuracy.

The tacho-generators are not comprised into the delivery.

MEASURING RANGES

TYPE	RANGE [1/min]
Mub 72 Mub 96	0 – 400 0 – 600 0 – 1000 0 – 1500 0 – 2500 0 – 4000 0 – 6000 0 – 10000

TECHNICAL DATA

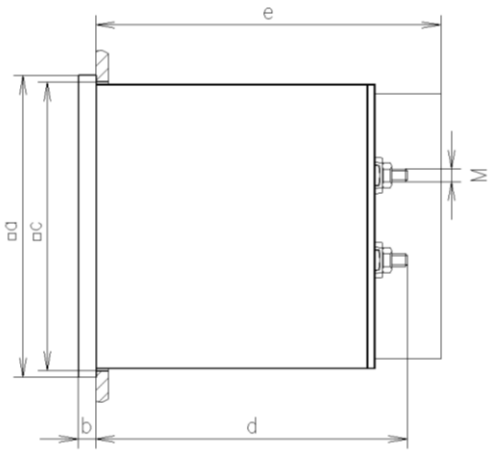
accuracy class	1,5
consumption	approx. 5mA
scale length Mub 72 Mub 96	approx. 62,4 mm approx. 92,7 mm
thermal coefficient	10% accuracy class /K
safety requirements	as per ČSN EN 61010–1
equipment protection class	II
degree of soiling	2
category of over-voltage in installation	CAT III
working voltage	600V
overload rating	as per ČSN EN 600051-1
electro-magnetic compatibility	as per ČSN EN 61326 –1 activity criterion A
coverage - front face - inlet clamps - inlet clamps with plastic caps	 IP 52 IP 00 IP 20 for the size 96
mechanical resistance operational vibrations immunity against contingent impacts immunity against impact during transport	as per ČSN EN 60068 10Hz – 55Hz – 10Hz, oscillation amplitude 0,15 mm 18 impacts 150 m/s2 3 x 1000 impacts 100m/s^2
Nominal application range temperature relative humidity pressure frequency of AC quantity position	 -40°C to 60°C 25 to 80% at 23°C 70 to 106 kPa 50 Hz ± 10% vertical ± 5°
climatic immunity	hot wet and hot dry environment as per ČSN IEC 721-2 -1
weight Mub 72 Mub 96	0,14 kg 0,19 kg

FOLLOWING MUST BE SPECIFIED IN YOUR ORDER:

a) instrument name and type
b) number of pc
c) measuring range, conversion ratio, kind of small tacho-generator
d) delivery terms
e) delivery destination
f) further symbols, or other marking on the dial
g) colour mark on the dial

SCOPE OF DELIVERY

- 1 pc switchboard instrument
- 2 pc clamps
- Guarantee sheet
- transporting package

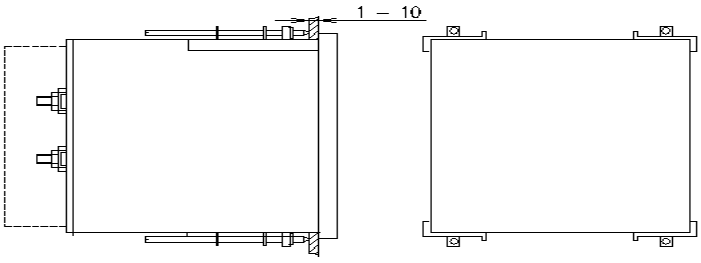


Type	Mub72	Mub96
Front face size a	72x72	96x96
Front face size b	8,5	5,5
Slot in panel c	68x68	92x92
Depth d	58	66
Depth e	-	87

All dimensions are in mm. For dimensions of holes the tolerance +0,4 mm is valid.
The depth e relates the instrument with its protecting cover against any contingent touch.
If instruments are assembled into the switchboard chock-a-block, between their front face frames a gap at least 1 mm should be left.

-

INSTRUMENT FIXING IN THE PANEL BY CLAMPS

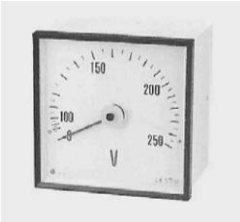


SWITCHBOARD INSTRUMENTS WITH DEVIATION 240°

LIST

CONTENTS PAGE

ELECTRO-MAGNETIC INSTRUMENTS
AMMETERS AND VOLTMETERS
TYP: Fa 96c, Fa 120c



APPLICATION

These instruments are intended for the AC voltage and current measurements in switch rooms and other electric equipment. They can be used in environments with temperatures from –20°C to 40°C, with relative humidity of air up to 75% at the temperature 22°C. Pressure of air from 86 to 106 kPa. They are not recommended for use in aggressive environments. They can measure effective values of current, or voltage within the frequency range from 40Hz to 100Hz, but they are calibrated at the frequency 50Hz, until calibration at some other frequency is required.

DESCRIPTION

The electro-magnetic instruments tape Fa 96c and Fa 120c are designed for their built-in assembly. The have got their square front face. Also the built-in part of the casing, in which the measuring system is assembled, is square-shape, as well. The instruments will be fastened to the switchboard by special clamps, which are delivered together with the instrument.
The instrument casing protects the system against mechanical damage and dust. The inlet clamps are located on the casing rear wall.
The dial is white, marking of the scale is black. The instruments are equipped with the zero position adjuster, located in the middle of the front face. The pointer is straight, ended by a blade, painted black. Its deviation is approx. 240°. The instruments are commonly calibrated for the vertical position of the dial and, in this position, they must operate within the range of admissible errors. Upon an extra wish, they can be calibrated even in some other position.
The ammeters are manufactured as two-fold overloadable, with extended scale about 100%; they should be used everywhere that current surges come up, e.g. at middle-power motors; the 100% extension is marked by main points only.

TECHNICAL DATA

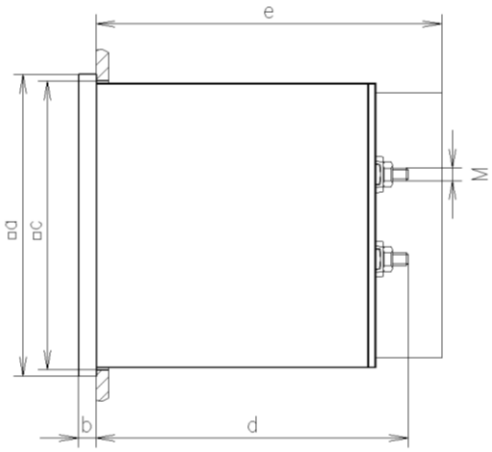
accuracy class	1,5
voltmeter consumption	approx. 5 – 8VA
ammeter consumption	approx. 2,5 VA
scale length Fa 96c Fa 120c	approx. 154 mm approx. 199 mm
Thermal coefficient	10% accuracy class /K
safety requirements	as per ČSN EN 61010 – 1
equipment protection class	II
degree of soiling	2
category of over-voltage in installation	CAT III
working voltage	600V
overload rating	as per ČSN EN 60051-1
electro-magnetic compatibility	as per EN 61326 –1 activity criterion A
coverage - front face - inlet clamps - inlet clamps with plastic caps	 IP 52 IP 00 IP 20 for the size 96
mechanical resistance operational vibrations immunity against contingent impacts immunity against impact during transport	as per ČSN EN 60068 10Hz – 55Hz – 10Hz, oscillation amplitude 0,15 mm 18 impacts 150 m/s2 3 x 1000 impacts 100m/s^2
Nominal application range Temperature Relative humidity Pressure Frequency of AC quantity Position	 -20 to 45°C 25 to 80% at 23°C 70 to 106 kPa 50 Hz ± 10% vertical ± 5°
climatic immunity	hot wet and hot dry environment as per ČSN IEC 721-2 -1
weight Fa 96c Fa 120 c	0,45 kg 0,85 kg

STANDARD MEASURING RANGES
VOLTMETERS
(with ballasts located on the instrument rear wall)

TYPE	RANGE
Fa 96c Fa 120c	10V 15V 25V 40V 60V 100V x/100V x/110V 150V 250V 400V 500V 600V

AMMETERS

TYPE	RANGE
Fa 96c Fa 120c	0,6A 1A x/1A 1,5A 2,5A 4A x/5A 6A 10A 15A 25A 40A 60A



Measuring transformers of current and voltage to the transmitting ammeters and voltmeters are not delivered by our company.
The ranges x/1A, x/5A are intended for connection of the current measuring transformers.
The ranges x/100V, x/110 V are intended for connection of the voltage measuring transformers.

FOLLOWING MUST BE SPECIFIED IN YOUR ORDER:

a) instrument name and type
b) number of pc
c) measuring range (also the conversion ratio of the measuring transformer must be specified)
d) frequency, if it is different from 50Hz. Upon an agreement with the manufacturer calibration always for one frequency is possible, within the range from 30 to 150Hz
e) delivery term
f) delivery destination
g) angle of the dial inclination in angle degrees, if different for vertical. The angle should be specified always from the horizontal position. In case the angle is determined, the instrument must be permanently turned towards the user
h) further symbols, or some different marking on the dial
i) colour mark on the dial

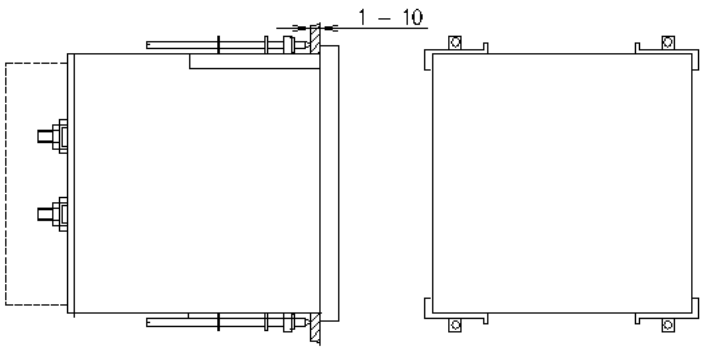
Type		Fa 96c	Fa 120c
Front face size a		96x96	120x120
Front face size b		5,5	8,5
Slot in panel		92x92	116x116
Depth d	Voltmeters M4	103	103
	Ammeters to 10A - M4	89	89
	Ammeters from 10A - M6	106	106
Depth e		110	

All dimensions are in mm. For dimensions of holes the tolerance +0,4 mm is valid.
The depth e relates the instrument with its protecting cover against any contingent touch.
If instruments are assembled into the switchboard chock-a-block, between their front face frames a gap at least 1 mm should be left.

DELIVERY RANGE

- 1 pc switchboard instrument
- 2 pc clamps
- Guarantee sheet
- transporting package

INSTRUMENT FIXING IN THE PANEL BY CLAMPS



MAGNETO-ELECTRIC INSTRUMENTS
AMMETERS AND VOLTMETERS
TYPE Ma72c, Ma72c-1, Ma96c, Ma96c-1, Ma120c

APPLICATION

The magneto-electric switchboard measuring instruments in moulded casings of thermoplastic are intended for measurement of DC currents and voltages.

They can be installed to control panels of switchboards, control panels of machine tools and raster systems. Scale covers, glass windows and scales are replaceable at the place of application.

MOVEMENT

The measuring system with the rotary coil, seated in points with sprung stones, turns in the permanent magnet field. The sprung seating provides instrument immunity against vibrations and shocks.

MECHANICAL EXECUTION

Casing — The rectangular moulded casing is suitable even for assembly chock-a-block in the control, switchboard and mosaic panels.

Material of casings complies with UL 94 V-O

Material of front face — glass

Front face frame colour — black

Working position — vertical

Fastening on the panel — clamps

Assembly — more instruments chock-a-block in one slot

Panel thickness — ≤ 10mm

Clamps

Voltmeters — hexagonal column, screw

Ammeters < 6A — M4 and leader clamp E3

Ammeters > 6A — thread bolt M6 with nut

Ammeters > 60A — thread bolt M8 with nut

STANDARD MEASURING RANGES

DC CURRENT			DC VOLTAGE	
Nominal value	Inner resistance (+20%)	Voltage drop approx.	Nominal value	Sensibility (±20%)
250μA	2500mΩ		40 mV	200Ω/V
400μA	2500mΩ		60mV	200Ω/V
500μA	2000mΩ		75mV	200Ω/V
600μA	1700mΩ		100mV	200Ω/V
1mA	270mΩ		150mV	200Ω/V
1.5mA	255mΩ		250mV	200Ω/V
2.5mA	135mΩ		250mV	200Ω/V
4.5mA	60mV		400mV	1kΩ/V
6mA	60mV		600mV	1kΩ/V
10mA	60mV		750mV	1k/V
15mA	60mV		1V	1kΩ/V
20mA	60mV		1.5V	1kΩ/V
25mA	60mV		2.5V	1kΩ/V
40mA	60mV		4V	1kΩ/V
60mA	60mV		6V	1kΩ/V
			10V	1kΩ/V
			15V	1kΩ/V
			25V	1kΩ/V
			30V	1kΩ/V
			40V	1kΩ/V
			60V	1kΩ/V
			100V	1kΩ/V
			150V	1kΩ/V
			250V	1kΩ/V

ELECTRIC DATA

Measured quantity — DC voltage, or current

Overload rating

Permanent 1,2x nominal voltage/current

Momentary $2xU_{im}10xI_{im}$ impulses 9x0,5s

1x5s

Coverage degree — IP52 casings

IP00 for clamps without caps

IP20 for clamps with caps

Insulation resistance — >50MΩ at 500V DC

SCALE, POINTER

Pointer — blade-type

Pointer deviation — 0-240°

Scale course — linear

Scale division — rough - fine

Scale length

	Ma72c	Ma96c	Ma120
mm	-1 without	-1 without	
	106	109	142 157 203

Exchangeability — exchangeable scale at Ma…-1

At calibration of mV ranges total resistance of inlets 0,035Ω is considered.

DC CURRENT			DC VOLTAGE	
Nominal value	Inner resistance (+20%)	Voltage drop approx.	Nominal value	Sensitivity (±20%)
100mA	60mV		300V	1KΩ/V
150mA	60mV		400V	1KΩ/V
200mA	60mV		500V	1KΩ/V
250mA	60mV		600V	1KΩ/V
300mA	60mV		750V	1KΩ/V
400mA	60mV			
500mA	60mV			
600mA	60mV			
750mA	60mV			
1A	60mV			
1.5A	60mV			
4A	60mV			
5A	60mV			
6A	60mV			
10A	60mV			
15A	60mV			
20A	60mV			
25A	60mV			
30A	60mV			
40A	60mV			
with shunt				
50mV	200Ω/V			
60mV	200Ω/V			
75mV	200Ω/V			
150mV	200Ω/V			

AMBIENT TERMS

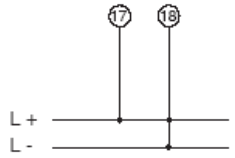
Climatic immunity	Climatic class 3
Working temperature range	-40… + 60° C -10 ... + 55° C for …-1
Relative humidity	75% r.h., without condensation
Shockproof	15g. 11ms
Vibrations	10 - 150 -10Hz/0.15 mm/5 cycles

RELATING STANDARDS

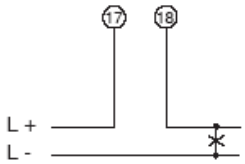
Specification of requirements on measuring instruments and their accessories	ČSN EN 60051-1
Flammability class	UL 94 V - O

Connection

DC voltage



DC current



POSSIBILITIES

Casing	
Glass	anti-reflecting only type 96
Frame colour	black
Working position	0° ... 165°
Scale	
Uncalibrated	with symbols
Blank scale	beginning and end marked by pencil
Dividing and marking	e.g. 0% to 100%
Linear scale	optionally non-standard legend
Additional legend	optional, e.g. "Generator"
Additional numbering	Optional
Colour marks	red, green, or blue for important quantities of the scale
Colour sectors	red, green, or blue inside the scale division
Logo on the scale	Without logo, or optional logo
Further	
Position of zero	Zero in the centre, or displaced
Increased sensitivity	4 kΩ/V for voltmeter 1 ... 600 V 10 kΩ/V for voltmeter 1.5 ... 150 V
Resistance setting (sensitivity)	23° C± 1%

ACCURACY AT REFERENCE TERMS

Accuracy class 1.5 as per ČSN EN 60051-1

Reference terms

Ambient temperature	23°C ± 3°C
Working temperature	nominal ± 1°
Input	nominal value of measured quantity
Others	ČSN EN 60051-1

Nominal range of application

Temperature	-40 to +60°C
Temperature for …-1	0....50°C
Working temperature	nominal ± 5°C
Outer magnetic field	0.5 mT

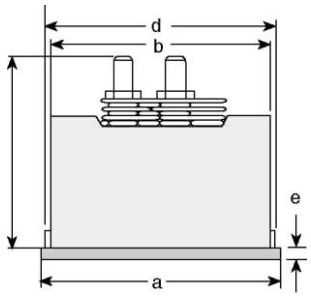
ACCESSORIES

Protection of clamps against contingent contact.
Polycarbonate rear cover (except directly connected ammeters ≥6A)

Protecting rubber caps on hexagonal bolts and screws with clamps M3.

DIMENSIONS

Dimensions (mm)	Ma72c …-1 without	Ma96c …-1 without	Ma120c
a	72	96	120
b	66 66.5	90 90.5	114.5
c	53 89	53 89	89
>6-60A	67 106	67 106	106
>60A	78	78	
d	67.5	91.5	115.
e	4 8.5	4 5.5	8.5
Slot	68^{+07}	$92^{+0,8}$	$116^{+0.4}$



DATA FOR ORDERS

Type Mac-1	Switchboard magneto-electric instrument with scale 240°
Front face size 72 96	 72 mm x 72 mm 96 mm x 96 mm
Measuring range	See the table
Front face	Common glass
Frame colour	black
Working position standardly vertical *1 , optionally 0 .... 165°*3	
Scale	Standardly identical scale as for the measuring range *1 Without scale. Uncalibrated, with symbols. Blank scale Dividing and numbering, e.g. 0...100% Linear scale*3 Auxiliary legend optionally*3 Auxiliary numbering optionally *3 Colour marks red, green, blue *3 Colour sectors red, green, blue *3
Logo	Metra*1 without logo optionally*3

*1 standardly
*3 in your orders complete kindly the required specification

Example for orders

Ma72c-1 measuring ranges 0-20, scale with linear division 0-100°C, red mark 37°C, without logo.

AMMETERS AND VOLTMETERS FOR DC CURRENT WITH CENTRAL ZERO TYPE: Ma 72c, Ma 96c, Ma 120c

APPLICATION

The instruments are intended for measurements of DC currents and voltages, or other quantities, which can be transferred on the DC current, or voltage in the both polarities.

DESCRIPTION

The instruments are equipped with the measuring system with the rotary coil, turning in the field of the permanent magnet. The rotary system has got its point seating with sprung stones.
The instrument damping is created mostly by eddy currents, induced in the metal frame of the rotary coil, by its motion in the magnetic field.
The instruments are currently calibrated for their vertical scale position and, in this position, they must operate within limits of admissible errors. Optionally, they can be calibrated even for different position.
The instruments will be fastened on the panel by special clamps, which are delivered together with the instrument.
The instrument casing protects the measuring system against mechanical damage and dust. The inlets are located on the casing rear wall.
With the instrument xA/60mV and with the separated exchangeable shunt DC currents can be measured from 100A to 10kA. However, these ammeters are calibrated with connecting lead 0,05Ω. Also calibration of a different inlet resistances can be required, but max. 1Ω. From this reason the lead length given in following table No.1 must be fulfilled.

TECHNICAL DATA

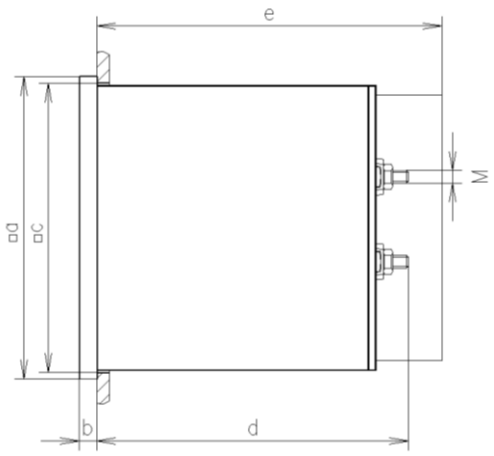
accuracy class	1,5
scale length Ma 72c Ma 96c Ma 120c	approx. 109 mm approx. 157 mm approx. 203 mm
thermal coefficient	10% accuracy class /K
safety requirements	as per ČSN EN 61010–1
instrument protection class	II
degree of soiling	2
over-voltage category in installation	CAT III
working voltage	600V
overload rating	as per ČSN EN 60051-1
electro-magnetic compatibility	as per ČSN EN 61326 –1 activity criterion A
coverage - front face - inlet clamps - inlet clamps . with plastic caps	 IP 52 IP 00 IP 20 for the size 96
mechanical strength operational vibrations immunity against contingent impacts against impacts during transport	as per ČSN EN 60068 10Hz – 55Hz – 10Hz, oscillation amplitude 0,15 mm 18 impacts 150 m/s^2 3 x 1000 impacts 100m/s^2
Nominal application range temperature relative humidity pressure frequency of AC quantity position	 -40 to 60°C 25 to 80% at 23°C 70 to 106 kPa 50 Hz ± 10% vertical ± 5°
climatic immunity	hot wet and hot dry ambient as per ČSN IEC 721-2 -1
weight Ma 72c Ma 96c Ma 120c	0,3 kg 0,7 kg 0,9 kg

Table No.1

Lead cross-section	Lead length in m for resistance	
mm^2	0,05Ω	1Ω
0,75	2x1	2x20
1	2x1,4	2x28
1,5	2x2,1	2x42
2,5	2x3,5	2x70
4	2x5,6	2x112
6	2x8,5	2x170
10	2x14	2x208

STANDARD MEASURING RANGES

TYPE	RANGE			
	Voltmeters		Ammeters	
Ma 72c Ma 96c Ma 120c	±25mV ±40mV ±60mV ±100mV ±150mV ±250mV ±400mV ±600mV ±1V ±1,5V ±2,5V ±4V ±6V ±10V ±15V ±25V ±40V ±60V ±100V ±150V ±250V ±400V ±600V ±xkV/10V	1000Ω/V 2500Ω/V	±250μA ±400μA ±600μA ±1mA ±1,5mA ±2,5mA ±4mA ±5mA ±6mA ±10mA ±15mA ±20mA ±25mA ±40mA ±60mA ±100mA ±150mA ±250mA ±400mA ±600mA ±1A ±1,5A ±2,5A ±4A ±6A ±10A ±15A ±25A ±40A ±60A ±4-20mA	800Ω 800Ω 500Ω 180Ω 180Ω 80Ω 30Ω <10Ω <5Ω 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV 60mV



Type		Ma72c	Ma96c	Ma120c
Front face size a		72x72	96x96	120x120
Front face size b		8,5	5,5	8,5
Slot in panel c		68x68	92x92	116x116
Depth d	Voltmeters M4	89	89	89
	Ammeters up to 10A - M4	89	89	89
	Ammeters from 10A - M6	106	106	106
Depth e		-	110	-

All dimensions are in mm. For dimensions of holes the tolerance +0,4 mm is valid.
The depth e relates the instrument with its protecting cover against any contingent touch.
If instruments are assembled into the switchboard chock-a-block, between their front face frames a gap at least 1 mm should be left.

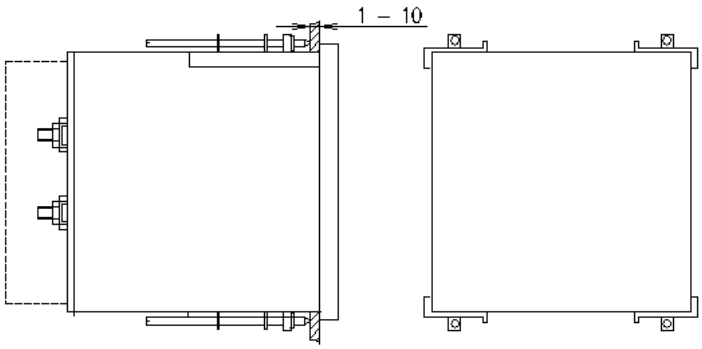
FOLLOWING MUST BE SPECIFIED IN YOUR ORDERS:

a) instrument name and type
b) number of pc
c) measuring range
d) delivery term
e) delivery destination
f) working position, if different from vertical
g) further symbols, or other markings on the scale
h) colour mark on the scale

SCOPE OF DELIVERY

- 1 pc switchboard instrument
- 2 pc clamps
- Guarantee sheet
- transporting package

INSTRUMENT FIXING IN THE PANEL BY CLAMPS



SPEEDOMETERS
TYPE: Mua72c, Mua96c, Mua120c

APPLICATION

They are intended for remote permanent speed measurements of machines, used in industrial plants. The speedometers are usually calibrated in the shaft speed of the measured machine. However, the scale can be calibrated even in other quantities, depended on the speed, e.g. feed speed, power, quantity etc. Therefore the speedometers can be exploited in many ways.
The electric remote speedometers consist of two main parts:

1. transmitter (small generator)
2. measuring instrument – speedometer

DESCRIPTION

The transmitter – a small tacho-generator, has got its firm winding in the circular stator and six-pole rotor created by the permanent magnet. The speed of the measured machine shaft is transferred mechanically on the small generator, generating AC current, whose voltage and frequency are directly proportional to the shaft speed an they can be therefore measured by voltmeters, whose scales are calibrated directly in rpm, or m/sec. At 1000 rpm the generator voltage is about 30V with frequency about 50Hz, at higher speed the voltage and frequency are proportionally higher. Maximal permanent current load is 20mA, so that up to 4 instruments can be connected in parallel to one small generator. The instruments with their range 400 and 600 rpm are equipped with an auxiliary condenser for damping of pointer vibrations.
The small tacho-generators are reliable and safe in operation, because they have no commutators with brushes. They are not replaceable, therefore they must be calibrated individually together with the instrument. Sense of rotation has no influence to the measurement. Resistance of the connecting lead up to 50Ω has no influence on the measurement accuracy.
The small tacho-generators are not comprised into our deliveries.

TECHNICAL DATA

accuracy class		1,5
consumption		approx. 5mA
scale length	Mua 72c Mua 96c Mua 120c	approx. 109 mm approx. 157 mm approx. 203 mm
thermal coefficient		10% accuracy class /K
safety requirements		as per ČSN EN 61010–1
instrument protection class		II
degree of soiling		2
category of over-voltage in installation		CAT III
working voltage		600V
overload rating		as per ČSN EN 60051-1
electro-magnetic compatibility		as per ČSN EN 61326 –1 activity criterion A
coverage - front face - inlet clamps - inlet clamps . with plastic caps		 IP 52 IP 00 IP 20 for the size 96
mechanical strength operational vibrations immunity against contingent impacts against impacts during transport		as per ČSN EN 60068 10Hz – 55Hz – 10Hz, oscillation amplitude 0,15mm 18 impacts 150 m/s2 3 x 1000 impacts 100m/s^2
Nominal application range temperature relative humidity pressure frequency of AC quantity position		 -40 to 60°C 25 to 80% at 23°C 70 to 106 kPa 50 Hz ± 10% vertical ± 5°
Climatic immunity		hot wet and hot dry environment as per ČSN IEC 721-2 -1
weight	Mua 72c Mua 96c Mua 120 c	0,3 kg 0,7 kg 0,9 kg

STANDARD MEASURING RANGES

TYPE	RANGE [1/min]
Mua 72c Mua 96c Mua 120c	0 – 400 0 – 600 0 – 1000 0 – 1500 0 – 2500 0 – 4000 0 – 6000 0 - 10000

FOLLOWING MUST BE SPECIFIED IN YOUR ORDERS:

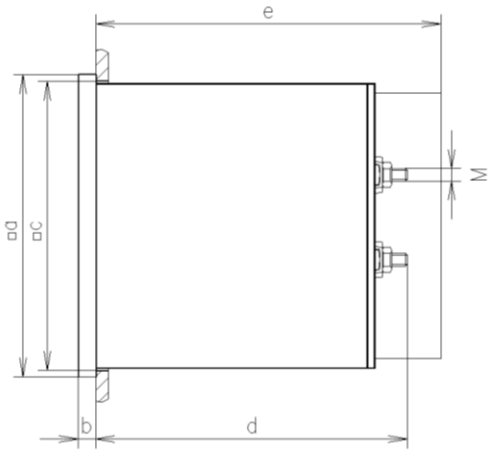
a) instrument name and type
b) number of pc
c) measuring range, conversion, kind of the tacho-generator
d) delivery term
e) delivery destination
f) further symbols, or other markings on the scale
g) colour mark on the scale

SCOPE OF DELIVERY

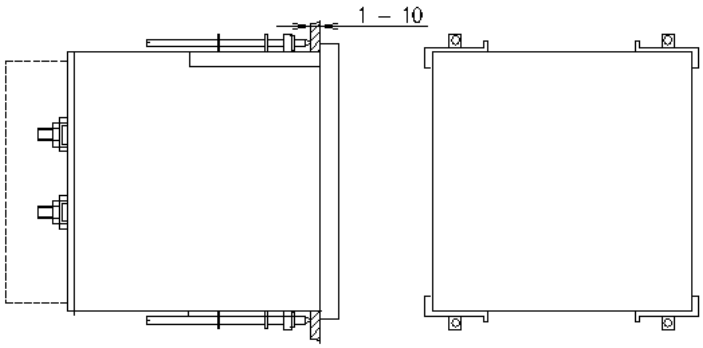
- 1 pc switchboard instrument
- 2 pc clamps
- Guarantee sheet
- transporting package

Type	Mua72c	Mua96c	Mua120c
Front face size a	72x72	96x96	120x120
Front face size b	8,5	5,5	8,5
Slot in panel c	68x68	92x92	116x116
Depth d	89	89	89
Depth e	-	110	-

All dimensions are in mm. For dimensions of holes the tolerance +0,4 mm is valid.
The depth e relates the instrument with its protecting cover against any contingent touch.
If instruments are assembled into the switchboard chock-a-block, between their front face frames a gap at least 1 mm should be left.



INSTRUMENT FIXING IN THE PANEL BY CLAMPS



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AMMETERS AND VOLTMETERS (WITH SEMICONDUCTOR RECTIFIER) TYPE: Mua72c, Mua96c, Mua120c

APPLICATION

The magneto-electric measuring instruments with their rectifiers in moulded casings of thermoplastic are intended for measurement of AC currents and voltages with sinusoidal course.

The magneto-electric instrument measures the middle value of rectified signals within the frequency range from 40Hz to 10000Hz and, at the presupposed sinusoidal course of the measured quantity, the instruments are calibrated in the effective value.

The instruments are intended for assembly to control panels of switchboards, control panels of machine tools and raster systems. Scale covers, glass windows and scales are replaceable at the place of application.

IMMUNITY AGAINST VIBRATIONS AND IMPACTS

The measuring system with the rotary coil, seated in points with sprung stones, turns in the permanent magnet field. The sprung seating provides instrument immunity against vibrations and shocks.

MECHANICAL PARAMETERS

Details of casings	The rectangular moulded casing is suitable for the assembly even chock-a-block in the control and switchboard panels, control boards of machine tools and raster systems
Material of casings	Complies UL 94V0
Material of front frame	Glass
Frame colour	Black
Working position	Vertical
Fastening on panel	Clamps
Assembly	Even more instruments to one slot
Panel thickness	≤40 mm
Inlet clamps	hexagonal column with thread M4 and lead clamp M3

Size (in mm)	**Mua72c**	**Mua96c**	**Mua120c**
Frame	72	96	120
Casing	66,5	90,5	114,5
Depth	89	89	89
Slot in panel	$68^{+0,4}$	$92^{+0.4}$	$116^{+0,4}$
Weight approx. kg	0,3	0,7	0,9

ELECTRIC PARAMETERS

Measured quantity	AC voltage, or current
Overload rating	
Permanent	1,2x nominal voltage/current
Momentary 2xU_{jm}10x I_{jm}	imulses 9x0,5s 1x5s
Coverage degree	IP52 casing IP00 for clamps without caps IP20 for clamps with caps

ACCURACY AT REFERENCE TERMS

Accuracy class	1.5 as per ČSN EN 60051-1
Reference terms	
Ambient temperature	23° ± 3° C
Working temperature	Nominal ± 1°
Input	Nominal value of measured quantity
Frequency	45 ... 50 ... 65 Hz
Course of measured quantity	Sinusoidal, distortion factor <5%
Others	ČSN EN 60051-1
Nominal range of application	
Ambient temperature	-20 – 45° C
Working temperature	nominal ± 5°
Frequency	40-50-100Hz
Outer magnetic field	0,5 mT

STANDARD MEASURING RANGES

AC CURRENT			AC VOLTAGE	
Nominal value	Inner Resistance (+20%)	Voltage drop approx.	Nominal value	Sensitivity (±20%)
1mA	≤1.5V		6V	900Ω/V
1.5mA	≤1.5V		10V	900Ω/V
2.5mA	≤1.5V		15V	900Ω/V
4mA	≤1.5V		25V	900Ω/V
6mA	≤1.5V		30V	900Ω/V
10mA	≤1.5V		40V	900Ω/V
15mA	≤1.5V		60V	900Ω/V
25mA	≤1.5V		100V	900Ω/V
40mA	≤1.5V		150V	900Ω/V
60mA	≤1.5V		250V	900Ω/V
100mA	≤1.5V		300V	900Ω/V

AC CURRENT			AC VOLTAGE	
Nominal value	Inner resistance (20%)	Voltage drop approx.	Nominal value	Sensitivity (±20%)
150mA	≤1.5V		400V	900Q/V
250mA	≤1.5V		500V	900Q/V
400mA	≤1.5V		600V	900Q/V

AMBIENT TERMS

Climatic immunity	Climatic category II acc. to the class 3
Working temp. range	-40 ... + 60° C
Relative humidity	25 to 80% at 23° C
Shockproof	≤15g. 11ms
Vibrations	10 – 150 – 10Hz/0.15 mm/5 cycles

RELATED STANDARDS

Safety requirements on measuring instruments and their accessories ČSN EN 61010-1
Flammability class UL 94 V-0

EXECUTION

Casing	
Frame colour	Black
Working position	E.g. 0° ... 165°
Scale	
Uncalibrated	with symbols
Blank	marked beginning and ending points
Scale division	e.g. 0 ... 100%
Linear scale	non-standard legend optionally
Auxiliary legend	optionally e.g. "generator"
Auxiliary numbering	optional
Colour marks	red, green, or blue for important values
Colours sectors	red, green, or blue inside the scale
Logo on the scale	without logo, or optionally
Others	
Setting of he resistance	4 k Ω/V for voltmeter 6 ... 600 V at 23°C ± 1%

SCALES AND POINTERS

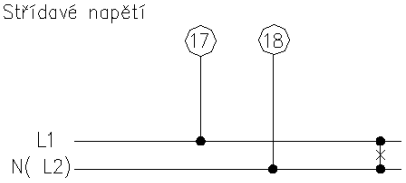
Pointer	blade-type
Pointer deviation	0-240°
Scale course	linear
Scale division	rough - fine
Scale length mm	Mua72c Mua96c Mua120c 109 157 203

ACCESSORIES

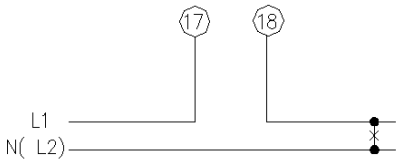
Protection of clamps against contingent contact
The polycarbonate rear cover of equal size
Protecting rubber covers on the hexagonal column screw M4 with lead clamp M3

WIRING DIAGRAM

Střídavé napětí

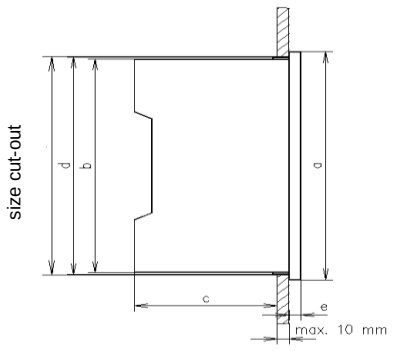


Střídavý proud



DIMENSIONS

Dimensions (in mm)	Mua72c-1	Mua96c-1
A	72	96
B	66	90
C	53	53
D	67.5	91.5
E	4	4
Slot size	□ 68^{*07}	□ 92^{+0-8}



DATA FOR ORDERS

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Type Muac-1	Switchboard magneto-electric instrument with the semiconductor rectifier with the scale 240°
Front face size 72 96	 72 mm x 72 mm 96 mm x 96 mm
Measuring range	See the table
	Glass
Frame colour	black
Working position	Standardly vertical*[1] optionally 0 .... 165°*[3]
Fastening on panel	Clamp*[1]
Protection of inlet clamps	Non rear cover, or protecting rubber caps
Increased sensitivity	4 kΩ/V for voltmeters 1...600 V*3
Scales	Standardly identical scale as for the measuring range *[1] Without scale. Uncalibrated, with symbols. Blank scale Dividing and numbering, e.g. 0...100% Linear scale*[3] Auxiliary legend optionally*[3] Auxiliary numbering optionally *[3] Colour marks red, green, blue *[3] Colour sectors red, green, blue *[3]
Logo	Metra*[1] without logo optionally*[3]

*[1] standardly
*[3] complete required specification in your order

Example of an order

Mua72c-1, measuring range 0-100mA, scale with linear division 0-100%, red mark 90%, without logo.

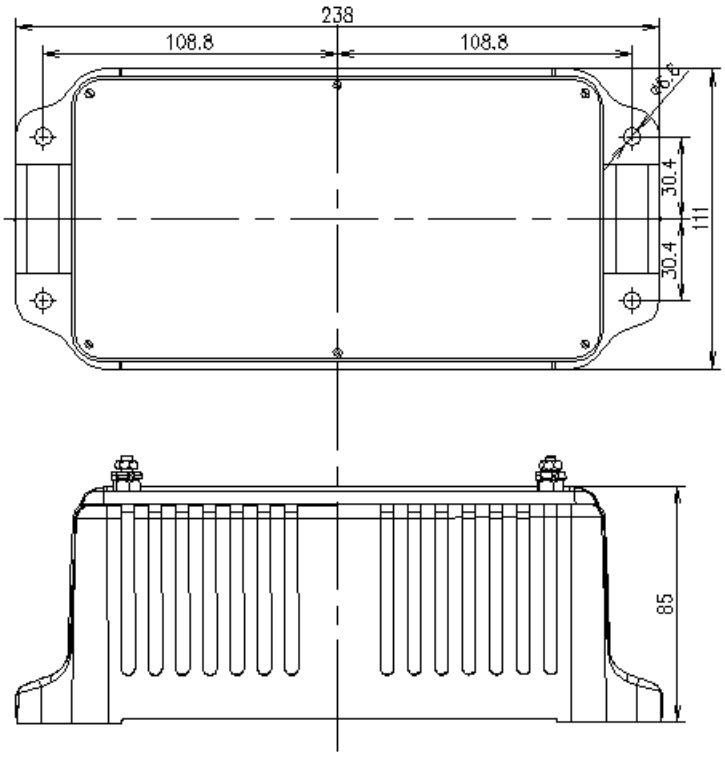
HIGH-VOLTAGE DIVIDERS – with covers

– for one instrument
it is the equipment for magneto-electric voltmeters for voltage measurements up to 2kV.
The separate voltmeter has got its range 10V with consumption 0,4mA, or 0,5mA
(types Ma.., Mb.., MP…
Range: 6kV
4kV
3kV
2,5kV

– for one, or two instruments
for connection to the magneto-electric voltmeter with its range 10V and consumption 0,4mA
(types Ma..c,Mb..,MP…)

Range: 4kV

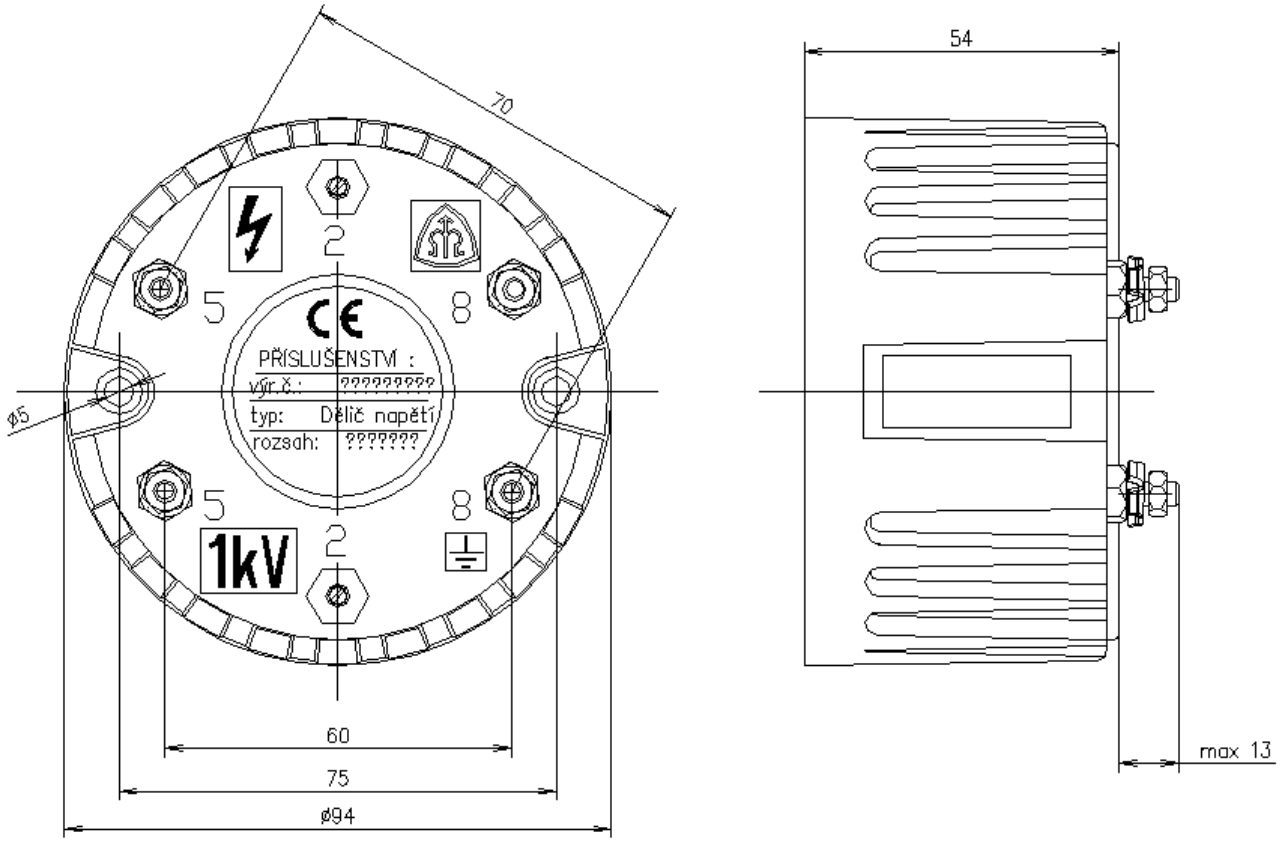
DIMENSIONAL SKETCH



– for one instrument
it is the equipment for magneto-electric voltmeters for voltage measurements up to 2kV.
The separate voltmeter has got its range 10V with consumption 0,4mA, or 0,5mA
(types Ma.., Mb.., MP…)

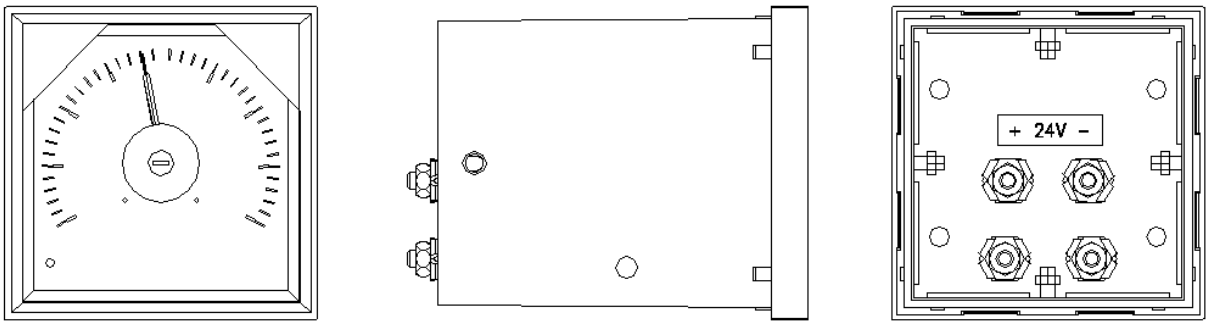
Range: 2kV
1,5kV
1kV

DIMENSIONAL SKETCH



ACCESSORIES PROD. No.
Type: Voltage divider

INSTRUMENT INNER LIGHTING



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