

# MA16. MB16. MA17. MA19. MA12

## MOVING-COIL METERS AMMETERS and VOLTMETERS



MA12



MA19



MA17



MA16



MB16

### APPLICATION

The panel meters type MA12. MA16. MB16. MA17. MA19 are designed to measure current or DC voltage. Magnetolectric meters with built-in rectifier type MA12P. MA17P. MA19P. are intended for measuring the effective currents and alternating current with sinusoidal waveform. Measurement of the current and voltage of the non-sinusoidal waveform is subject to a large error proportional to the degree of deformation of the waveform. what follows from the principle of measuring the rectifier device. which reacts to the average value of the straight-run. but it is calibrated like this. to indicate the effective value of the sinusoidal waveform. Where the noninusoidal course is appropriately characterized. this measurement error is calculated.

Therefore, the requirements for the influence of the shape of the curve for the medium-responsive instrument (straightened) are not specified in the standard EN 60051-2.

MA12 meters. MA16. MA17. MA19 are suitable for mounting in a panel of thickness not exceeding 25 mm in the holes according to Figures 3 and 4. The meter MB16 is suitable for snap fastening on the 35 mm rail bracket according to EN 60715.

### TECHNICAL DATA

**Accuracy class** 1.5

**Measurement ranges for DC and AC voltage and current meters and electrical data** acc. table 1. 2. 3

#### Rated operating conditions:

- ambient temperature 5...23...55°C  
- relative humidity 25...85%

#### Notice:

The above mentioned meters with a range of ... A / 60 mV, ... A / 150 mV can be made with interchangeable indicatin dial (scale) with any measuring range of the shunt. Other ranges can also be made with an interchangeable scale provided, that the measuring range of the meter will be the equivalent of the measuring range of the measuring transducer.

#### The interchangeable scale

The interchangeable scale is inserted and removed by the sliding gap in the top or side of the housing.

### CATEGORIES OF METER CLIMATIC VERSIONS

Meters in the basic versions are designed for use in moderate climatic conditions. indoor. non-air conditioned rooms.

On customers' request. meters can be adapted to use in conditions of a dry or wet tropical climat in non-air conditioned rooms. Then. they are marked with the TIII symbol.

#### Requirements concerning safety acc. EN 61010-1 standard:

- installation category III
- pollution level 2
- maximal phase-earth working voltage 600 V

#### Electromagnetic compatibility:

- meters meet CE requirements
- noise immunity acc. to EN 61000-6-2
- noise emissions acc. to EN 61000-6-4

#### Electrical overload:

- long-term 120% In, 120% Un
- short-time current measurement 10 times for 5s
- short-term voltage measurement 2 times for 5s

#### Impact resistance

- peak acceleration 15 g
- duration of impact 11 ms

#### Shock resistance

- range of vibration frequency 10-55-10Hz
- vibration amplitude 0.15mm (corresponds to 1.5g at 50 Hz)

#### Protection Grade acc. to EN 60529 ensured by:

- housing: standard IP 52
- on request IP 65 - MA19. MA17. MA16
- terminals IP 20

#### Housing material

thermoplastic, self-extinguishing plastic (UL 94V-O)

#### Glass material

glass (in standard)  
anti-reflective glass on request

### ACCESSORIES

screw holders - 2 pcs (for MA16. MA17. MA19) or 4 pcs (for MA12).  
terminal protection cover (excluding MB16).

#### Additional setting pointer

On customers' request MA17 and MA19 meters can be equipped with an additional. setting red pointer fixed on the glass.

**RANGE OF CURRENT AND CONTINUOUS VOLTAGE. INTERNAL RESISTANCE OR VOLTAGE DROP**

Table 1

| Frontal fame dimensions [mm]                   | 48 x 48                       |                                 |                               |                                 | 72 x 72                       |                                 | 96 x 96                       |                                 | 144 x 144                     |                                 |
|--|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|
| Scale length [mm]                              | 42                            |                                 |                               |                                 | 61                            |                                 | 95                            |                                 | 160                           |                                 |
| Weight [kg]                                    | 0.15                          |                                 |                               |                                 | 0.2                           |                                 | 0.25                          |                                 | 0.4                           |                                 |
| Type   | MA16                          |                                 | MB16                          |                                 | MA17                          |                                 | MA19                          |                                 | MA12                          |                                 |
| Internal resistance $\pm 20\%$ or voltage drop |                               |                                 |                               |                                 |                               |                                 |                               |                                 |                               |                                 |
| Measuring range                                | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale |
| 40 $\mu$ A                                     | 374 mV                        |                                 | -                             |                                 | 374 mV                        |                                 | 374 mV                        |                                 | 374 mV                        |                                 |
| 100 $\mu$ A                                    | 600 mV                        |                                 | -                             |                                 | 600 mV                        |                                 | 600 mV                        |                                 | 600 mV                        |                                 |
| 150 $\mu$ A                                    | 400 mV                        |                                 | -                             |                                 | 400 mV                        |                                 | 400 mV                        |                                 | 400 mV                        |                                 |
| 250 $\mu$ A                                    | 140 mV                        |                                 | -                             |                                 | 140 mV                        |                                 | 140 mV                        |                                 | 140 mV                        |                                 |
| 400 $\mu$ A                                    | 540 mV                        |                                 | -                             |                                 | 540 mV                        |                                 | 540 mV                        |                                 | 540 mV                        |                                 |
| 600 $\mu$ A                                    | 540 mV                        |                                 | -                             |                                 | 540 mV                        |                                 | 540 mV                        |                                 | 540 mV                        |                                 |
| 1 mA   | 37 mV                         |                                 | 60 mV                         |                                 | 37 mV                         |                                 | 37 mV                         |                                 | 37 mV                         |                                 |
| 1,5 mA   | 196 mV                        |                                 | 60 mV                         |                                 | 196 mV                        |                                 | 196 mV                        |                                 | 196 mV                        |                                 |
| 2,5 mA   | 196 mV                        |                                 | 60 mV                         |                                 | 196 mV                        |                                 | 196 mV                        |                                 | 196 mV                        |                                 |
| 4 mA   | 196 mV                        |                                 | 60 mV                         |                                 | 196 mV                        |                                 | 196 mV                        |                                 | 196 mV                        |                                 |
| 5 mA   | 196 mV                        |                                 | 60 mV                         |                                 | 196 mV                        |                                 | 196 mV                        |                                 | 196 mV                        |                                 |
| 6 mA   | 196 mV                        |                                 | 60 mV                         |                                 | 196 mV                        |                                 | 196 mV                        |                                 | 196 mV                        |                                 |
| 10 mA  | 196 mV                        |                                 | 60 mV                         |                                 | 196 mV                        |                                 | 196 mV                        |                                 | 196 mV                        |                                 |
| 15 mA  | 11 mV                         |                                 | 60 mV                         |                                 | 11 mV                         |                                 | 11 mV                         |                                 | 11 mV                         |                                 |
| 20 mA  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 25 mA  | 11 mV                         |                                 | 60 mV                         |                                 | 11 mV                         |                                 | 11 mV                         |                                 | 11 mV                         |                                 |
| 40 mA  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 60 mA  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 100 mA   | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 150 mA   | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 250 mA   | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 400 mA   | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 600 mA   | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 1 A  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 1,5 A  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 2,5 A  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 4 A  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 6 A  | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 10 A   | 60 mV                         |                                 | -                             |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 15 A   | 60 mV                         |                                 | -                             |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 20 A   | 60 mV                         |                                 | -                             |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 25 A   | 60 mV                         |                                 | -                             |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| 4...20 mA                                      | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 | 60 mV                         |                                 |
| For the connection of the shunt                |                               |                                 |                               |                                 |                               |                                 |                               |                                 |                               |                                 |
| ... A/60 mV                                    | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| ...A/150 mV                                    | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 60 mV  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 100 mV   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 150 mV   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 250 mV   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 400 mV   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |

Table 1

| Typ  | MA16                          |                                 | MB16                          |                                 | MA17                          |                                 | MA19                          |                                 | MA12                          |                                 |
|--|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|
| Internal resistance $\pm 20\%$ or voltage drop |                               |                                 |                               |                                 |                               |                                 |                               |                                 |                               |                                 |
| Zakres pomiarowy                               | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale | zero on the side of the scale | zero in the middle of the scale |
| 1 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 1,5 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 2,5 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 4 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 6 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 10 V   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 15 V   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 25 V   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 40 V   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 60 V   | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 100 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 150 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 250 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 300 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 400 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 500 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 600 V  | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 800 V  | 1000 $\Omega$ / V             |                                 | -                             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |
| 1000 V   | 1000 $\Omega$ / V             |                                 | -                             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 | 1000 $\Omega$ / V             |                                 |

DC MEASURING RANGES WITH EXTERNAL SHUNTS

Table 2

|  |  |
|--|--|
| <p>1 A<br/>1.5 A<br/>2.5 A<br/>4 A<br/>6 A<br/>10 A<br/>15 A<br/>25 A<br/>40 A<br/>60 A<br/>100 A<br/>150 A<br/>250 A<br/>400 A<br/>600 A<br/>1 kA<br/>1.5 kA<br/>2.5 kA<br/>4 kA<br/>6 kA<br/>10 kA<br/>15 kA</p> | <p>1. Measuring movement current considered when calibrating shunts:<br/>B2 - 60 mV – 10 mA<br/>B3 - 150 mV – 5 mA</p> <p>2. Resistance of conductors linking the meter with the shunt: 0.035 <math>\Omega</math></p> <p>3. After agreeing with the producer it is possible to offer shunts with following standardized voltage drops: 50 mV. 75 mV. 100 mV</p> <p>4. Further particulars on shunts are contained in heit data sheet available on the website <a href="http://www.lumel.com.pl">www.lumel.com.pl</a></p> |
|--|--|

## AC MEASURING RANGES

Table 3

| Frontal frame dimensions [mm] | 72 x 72  | 96 x 96 | 144 x 144 |   |
|-------------------------------|--|---------|-----------|---|
| Scale length [mm]             | 61   | 95      | 160       | Remarks   |
| Weight [kg]                   | 0.2  | 0.25    | 0.4       |   |
| Type                          | MA17P  | MA19P   | MA12P     |   |
| Measuring range               | Drop voltage or power consumption (self-consumption) |         |           |   |
| 1 mA                          | 2.4V   | 2.4V    | 2.4V      | Rated operational range<br>for frequency<br><u>40...1000</u> ...10 000 Hz |
| 1.5 mA                        | 1.4V   | 1.4V    | 1.4V      |   |
| 2.5 mA                        | 1.4V   | 1.4V    | 1.4V      |   |
| 4 mA                          | 1.4V   | 1.4V    | 1.4V      |   |
| 6 mA                          | 1.4V   | 1.4V    | 1.4V      |   |
| 10 mA                         | 1.4V   | 1.4V    | 1.4V      |   |
| 15 mA                         | 1.7 V  | 1.7 V   | 1.6 V     |   |
| 25 mA                         |  |         |           |   |
| 40 mA                         |  |         |           |   |
| 60 mA                         |  |         |           |   |
| 100 mA                        |  |         |           |   |
| 150 mA                        | 1.33V  | 1.33V   | 1.33V     |   |
| 250 mA                        | 0.8V   | 0.8V    | 0.8V      |   |
| 400 mA                        | 0.5V   | 0.5V    | 0.5V      |   |
| 500 mA                        | 1.7 V  | 1.7 V   | 1.6 V     |   |
| 2.5 mA                        |  |         |           |   |
| 600 mA                        | 0.33V  |         |           |   |
| 750mA                         | 0.27V  | 0.27V   | 0.27V     |   |
| 1A*                           | 0.20V  | 0.20V   | 0.20V     |   |
| 1.5A*                         | 0.14V  | 0.14V   | 0.14V     |   |
| 2.5A*                         | 0.80V  | 0.80V   | 0.80V     |   |
| 4A*                           | 0.50V  | 0.50V   | 0.50V     |   |
| 5A*                           | 0.40V  | 0.40V   | 0.40V     |   |
| 6A*                           | 0.03V  | 0.03V   | 0.03V     |   |
| 10A*                          | 0.02V  | 0.02V   | 0.02V     |   |
| 40 V                          | 900 Ω/V  | 900 Ω/V | 900 Ω/V   | Rated operational range<br>for frequency<br><u>40...1000</u> ...10 000 Hz |
| 60 V                          |  |         |           |   |
| 100 V                         |  |         |           |   |
| 150 V                         |  |         |           |   |
| 250 V                         |  |         |           |   |
| 400 V                         |  |         |           |   |
| 500 V                         |  |         |           |   |
| 600 V                         |  |         |           |   |

\* The scale is nonlinear and non-replaceable

## ORDERING PROCEDURE

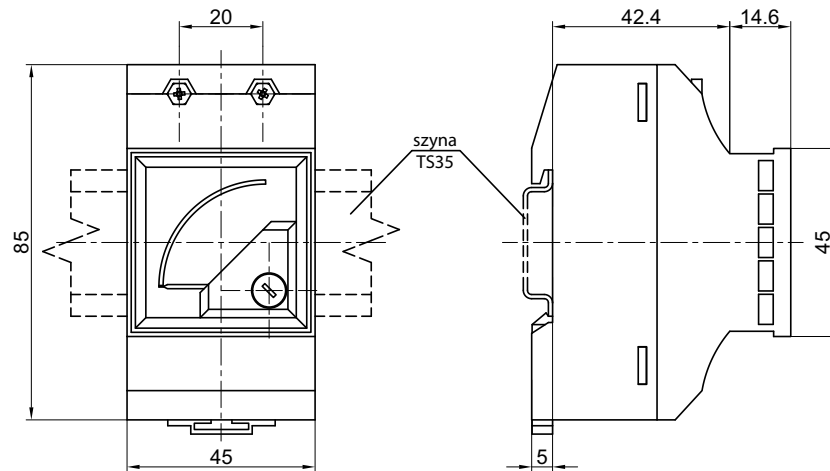
In the order one must specify: name and type of meter, measuring range, shunt data if the meter is foreseen to co-operate with an interchangeable shunt, working position and eventual additional requirements. Shunt must be ordered separately.

When ordering meters for measuring a.c. current or a.c. voltage, one must add to the meter name „rectifier” - (rectifier meter).

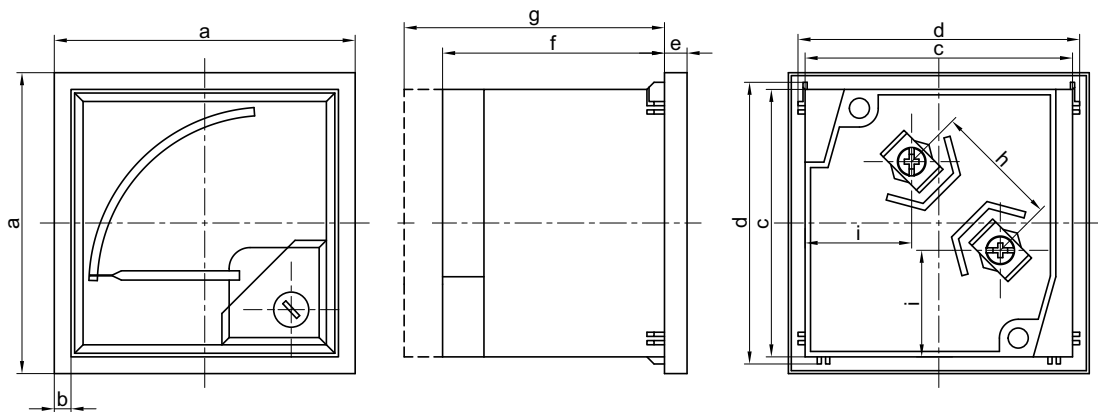
### Example of order:

Ammeter of MA16 with a range of 40 A. for use with a shunt type B2 40 A / 60 mV. vertical position 90 °. scale according to the scope without additional requirements. If the shunt is to be delivered with the meter. it should be placed in the order as a separate item eg. shunt B2 40 A / 60 mV.

**EXTERNAL DIMENSIONS**



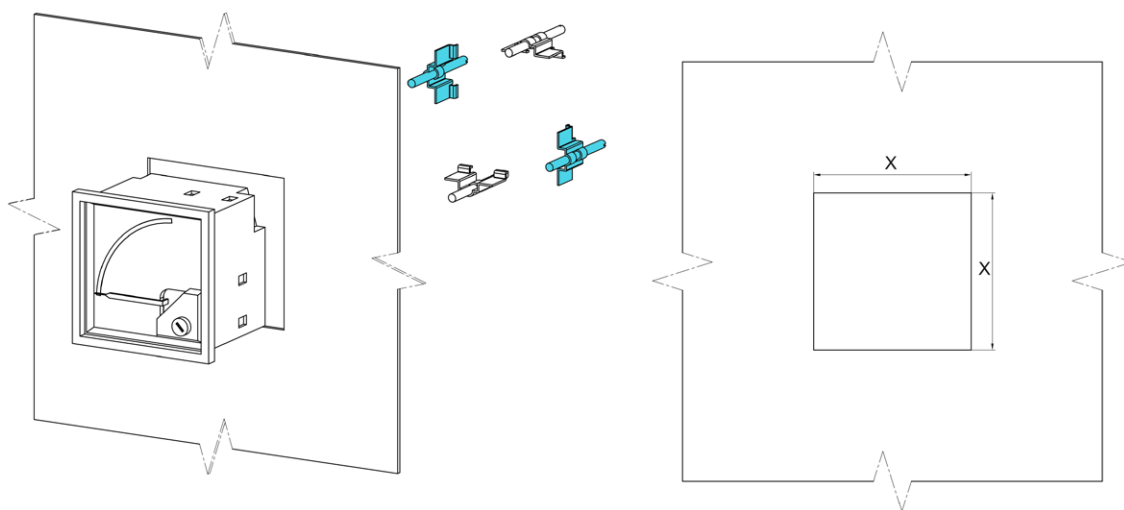
**Fig. 1. External dimensions of MB16 meter.**



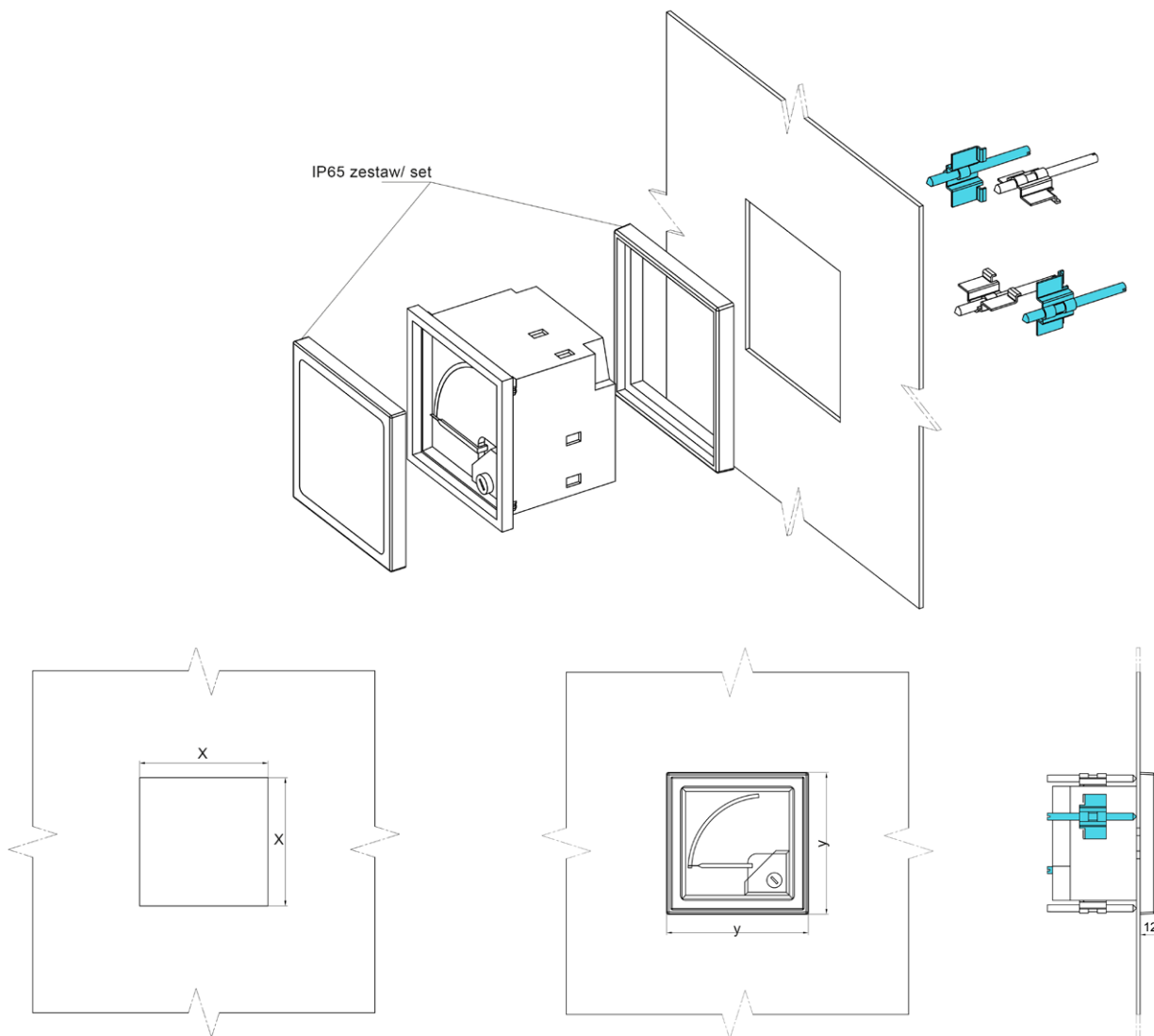
**Fig. 2. External dimensions of MA16. MA17. MA19. MA12**

External dimensions of MA16, MA17, MA19, MA12 [mm] meters.

| Type | a   | b   | c    | d     | e   | f   |       | g   |        | h    | i    | x      | y     |
|------|-----|-----|------|-------|-----|-----|-------|-----|--------|------|------|--------|-------|
|      |     |     |      |       |     | <6A | 6-25A | >6A | >6-25A |      |      |        |       |
| MA16 | 48  | 3   | 43.5 | 44.5  | 5.5 | 53  | 68    | 64  | 75     | 18.7 | 21.6 | 45+0.6 | 54.8  |
| MA17 | 72  | 4   | 64   | 67.5  | 5.5 | 53  | 68    | 64  | 69.5   | 30   | 25.7 | 68+0.7 | 79.6  |
| MA19 | 96  | 4   | 88   | 91.5  | 5.5 | 53  | 68    | 64  | 69.5   | 30   | 27.2 | 92+0.8 | 103.6 |
| MA12 | 144 | 5.5 | 136  | 137.5 | 8.5 | 53  | 68    | 64  | 69.5   | 30   | 37   | 138+1  | none  |



**Fig. 3. Fixing of meters MA16. MA17. MA19 in the panel (version with IP52) \***



**Fig. 4. Fixing of meters MA16. MA17. MA19 in the panel (version with IP65) \***

**\* Included are two screw holders which should be fixed on arbitrary, opposite case corners**

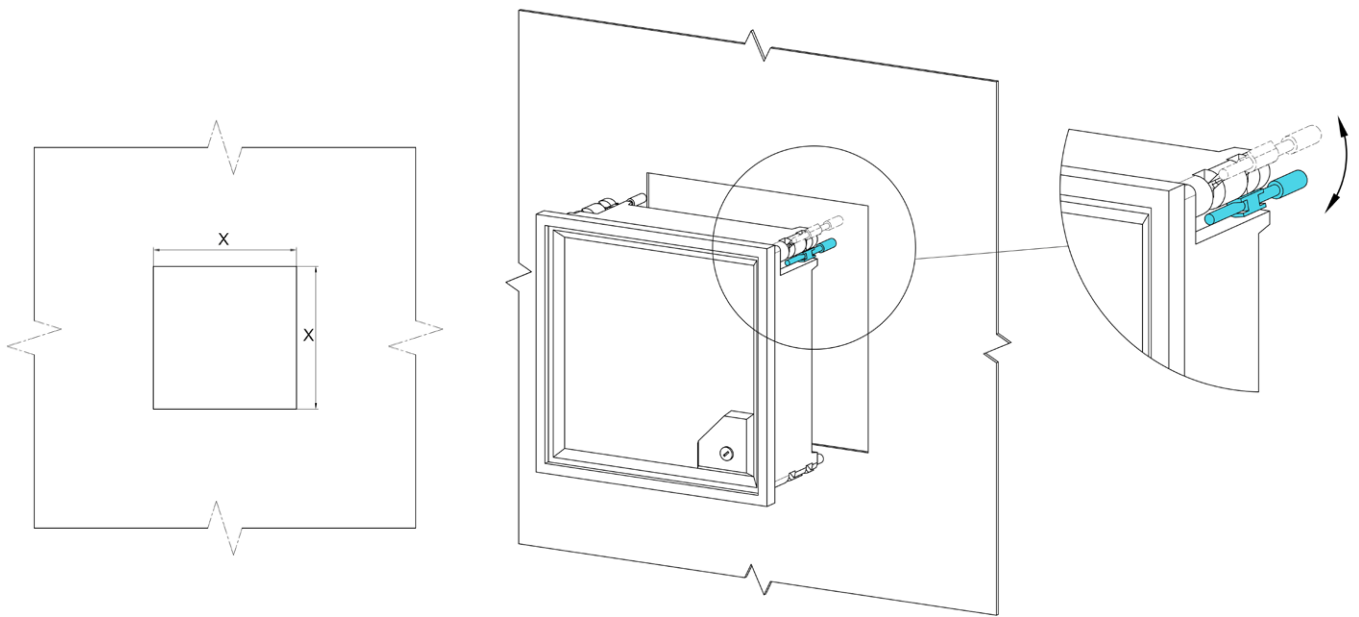


Fig. 5. Fixing of MA12 meters (version with IP52)

**CODING OF THE WORKING POSITION**

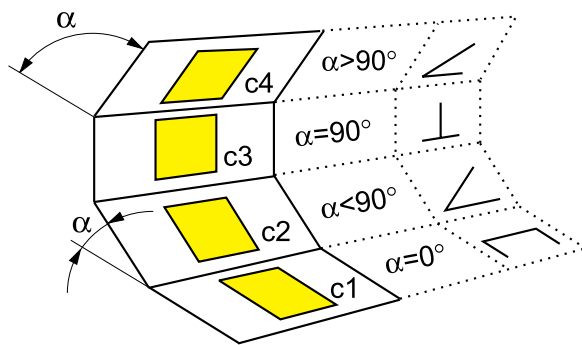
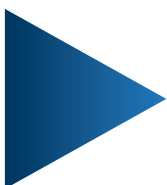


Table 4

| Code | Working position         |
|------|--------------------------|
| 0    | c3 $\alpha = 90^\circ$   |
| A    | c1 $\alpha = 0^\circ$    |
| B    | c2. $\alpha = 15^\circ$  |
| C    | c2. $\alpha = 30^\circ$  |
| D    | c2. $\alpha = 45^\circ$  |
| E    | c2. $\alpha = 60^\circ$  |
| F    | c2. $\alpha = 75^\circ$  |
| H    | c4. $\alpha = 105^\circ$ |
| I    | c4. $\alpha = 120^\circ$ |

Table 5  
(only for MA16)

| Code | Working position         |
|------|--------------------------|
| A    | c3 $\alpha = 90^\circ$   |
| B    | c1 $\alpha = 0^\circ$    |
| C    | c2. $\alpha = 15^\circ$  |
| D    | c2. $\alpha = 30^\circ$  |
| E    | c2. $\alpha = 45^\circ$  |
| F    | c2. $\alpha = 60^\circ$  |
| G    | c2. $\alpha = 75^\circ$  |
| H    | c4. $\alpha = 105^\circ$ |
| I    | c4. $\alpha = 120^\circ$ |



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[BE271NF4162000](#) [BE271NF4170000](#) [BE271NF4500000](#) [BE391NF4122000](#) [CA39 170000](#) [EA12N C70100000000](#) [EA12N C70200000000](#)  
[EA12N E20700000000](#) [EA12N E21000000000](#) [EA12N E21200000000](#) [EA12N E21300000000](#) [EA12N E40900000000](#) [EA12N E41600000000](#) [EA12N E61100000000](#) [EA12N E61500000000](#) [EA16N E20100000A0](#) [EA16N E20200000A0](#) [EA16N E20700000A0](#) [EA16N E21000000A0](#) [EA16N E41300000A0](#) [EA16N E41700000A0](#) [EA17N C70000000000](#) [EA17N C70300000000](#) [EA17N E20300000000](#)  
[EA17N E20700000000](#) [EA17N E20800000000](#) [EA17N E20900000000](#) [EA17N E21200000000](#) [EA17N E41300000000](#) [EA17N E41500000000](#) [EA19N E21400000000](#) [EA19N F21500000000](#) [EB16N E20600000A0](#) [EP27NC7060000](#) [EP27NE6150000](#) [EP29NC7250000](#)  
[EP29NE6150000](#) [EP29NE7050000](#) [HT20-1100M0](#)