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WHATEVER YOU MEASURE.

STANDARDS

GANZ measuring instruments are made according to the EN 60051, EN 61010-1, and DIN 43780 standards.

CLASS OF ACCURACY

0.5 , 1 , 1.5 , 2.5 , 3

The accuracy of the instruments is indicated on the de-tailed data sheets.

CASE

The dimensions of the cases and the cut-outs comply with the standard DIN 43700. The instrument cases are made of inflammable plastic according UL 94 V-1 or steel plate. See at the detailed technical data sheet. The frame dimensions of the instruments comply with the standards DIN 43718. The standard colour is black RAL 9005. On request, we can also supply with grey frame RAL 7037, RAL 7035, RAL 7032.

On special request, the instruments will be supplied with terminal cover.

POINTER

The pointer correspond to DIN 43802.
(standard version : stick pointer)

ZERO SETTING

The zero-setting knob is on the front plate.

FIXING

The instruments with plastic case are equipped with special built-on fixing elements.

The instruments with metal case can be supplied either by spring-type fixing elements up to 1...3 mm panel thickness (DIN 43835 "A"), or by screw-type clips up to 1...40 mm panel thickness (DIN 43835 "B") (Excepting the instruments in plastic case).

VIBRATIONS

The instruments will withstand a minimum vibration of ± 0.25 mm amplitude at a frequency of 50 Hz, corresponding to 2.5 g ($g=9.81 \text{ m/s}^2$). The vibration may be imposed in three mutually perpendicular directions for 20 minutes.

SHOCKPROOFNESS

The instruments will withstand shocks in three mutually perpendicular directions, even when applying five consecutive shocks at acceleration of 15 g achieved by the high quality shockproof spring-type stone bearing.

WORKING POSITION

The related symbol is indicated on the scale or on a separate data plate. (If it's not indicated, the instruments can be used in any position.)

The accuracy requirements refer only to the working position.

- \perp vertical mounting
- \dashv horizontal mounting
- $\sphericalangle 60^\circ$ inclined mounting e.g. the angle to the horizontal is 60° (see Figure 1)

The normal execution is for front mounting (vertical position \perp $\alpha = 90^\circ$). In case of different installation the working position should be indicated in the order.

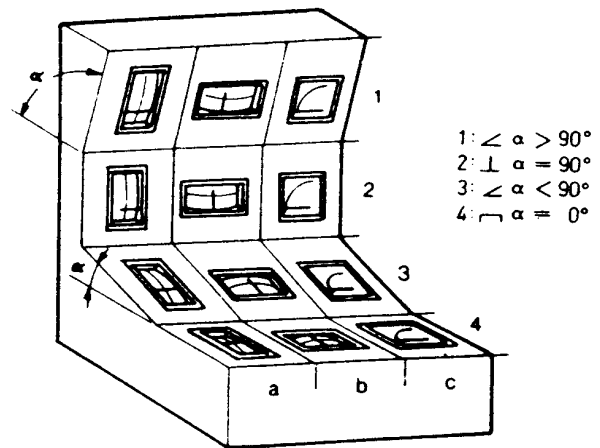


Figure 1

VOLTAGE TEST

The instruments comply with the standards EN 61010-1,

PROTECTION

Casing : IP 50

Terminals : IP 00, EN 60529

ENVIRONMENT

Calibration is for an ambient temperature of $+20^\circ\text{C}$

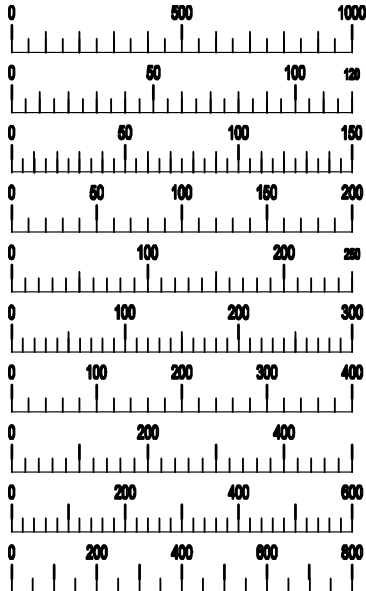
Operating temperature range : $-25 \dots +55^\circ\text{C}$

Relative humidity : $\alpha < 75 \%$

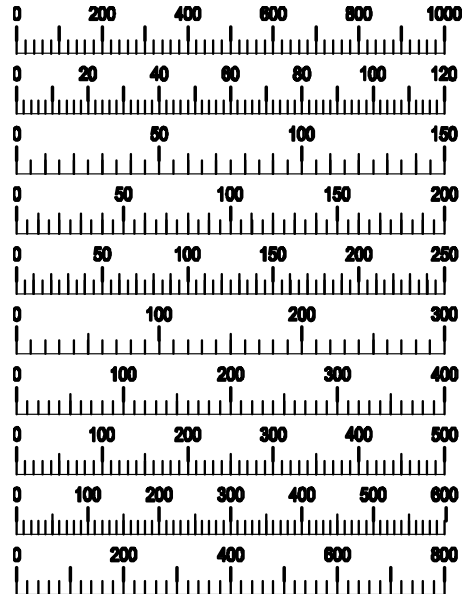


SCALES

The standard scales of our instruments (frame size 48x48, 72x72, 72x36, 72x24, 96x96, 96x48, 96x24 mm) are as follows (scale length 40-89 mm) :



for the rest of the instruments (scale length 90-179 mm) :



DECLARATION OF CONFORMITY



according to ISO/IEC guide 22 and EN45014

Manufacturer's name: GANZ Instruments Ltd.
 Manufacturer's address: H-1701 Budapest, Üllői út 200.
 H-1701 Budapest, P.O.B. 58

Declares, that the product

Product name: SWITCHBOARD INSTRUMENT

has been manufactured to the technical specifications of the product and conforms in all respects to the relevant standards and regulations in force and especially to:

- | | |
|-----------------|------------|
| EN 60051-1...-9 | EN 50081-1 |
| EN 61010-1 | EN 50082-1 |
| EN 60529 | |

The product hereby fulfil the requirements of the low voltage directive 72/23/EEC and the EMC directive 89/336/EEC amended by 93/68/EEC



48LAe, 72LAe, 96LAe, 144LAe, 48LVe, 72LVe, 96LVe, 144LVe

For measuring AC current or voltage.

Type 48L...,72L... 96L...and 144L...are with interchangeable scale.

Technical data:

Movement: Moving-iron with spring-type oil filled bearing,
vibration-free oil damping.

Instrument case: non-flammable Glass filled
polycarbonate according UL94-V-0

Scale length: 38 mm (48L...), 61 mm (72L...),
97 mm (96L...). 146 mm (144L...).

Permanent overloading: 1.2 -fold current res. voltage.

Class of accuracy: 1.5

Frequency range: 15...50...100 Hz

Pollution degree 2

Installation Categories: Size 72,96, and 144 600V CAT III.
(over voltage category) Size 48 300V CAT III.

Weight: 0.15 kg (48L...), 0.2 kg (72L...),
0.35 kg (96L...). 0.8 kg (144L...).

Fixing elements: Two M3 screws

Accessorie:

Terminal protection: Full sized polycarbonate back cover



AMMETERS		Plastic case			
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	Type 48 LAe	Type 72 LAe	Type: 96 LAe	Type: 144 LAe
		58-2015-13-... consumption	58-1640-13-... consumption	58-1636-13-... consumption	58-2549-13-... consumption
min.(400/800 mA)	001	max. 0.5 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA
1 / 2 A	005	↓	↓	↓	↓
1.5 / 3 A	007				
2.5 / 5 A	009				
4 / 8 A	011				
5 / 10 A	012				
6 / 12 A	013				
10 / 20 A	015				
15 / 30 A	017				
25 / 50 A	019				
40 / 80 A	021	max 1.5 VA	max. 2 VA	max. 2 VA	max. 2,5 VA
50 / 100 A	022	---	↓	↓	↓
60 / 120 A	023	---			
max.100 / 200 A	024	---			
* 1 / 2 A	C03	max. 0.5 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA
* 5 / 10 A	C04	max. 0.5 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA

* For current transformer connection

Note: on request types different from tables are accepted.



VOLTMETERS		Plastic case			
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat.No.	Type 48 LVe	Type 72 LVe	Type 96 LVe	Type 144 LVe
		58-2015-13-...	58-1640-13-...	58-1636-13-...	58-2549-13-...
		consumption	consumption	consumption	consumption
min. (6) V	101	max. 3 VA	max. 3 VA	max. 3 VA	max. 3.5 VA
100 V	113	↓	↓	↓	↓
150 V	115				
250 V	117				
300 V	118				
400 V	119				
500 V	120				
max. 600 V	121				
** / 100V, 120V	C05				
... / 110V, 132V	C06				

** For voltage transformer connection

Note: on request types different from tables are accepted.

Type\Dim. (mm)	a	b	c*	d	e	f**	g
48LVe 48LAe	48	43,5	53	44.5	5.5	64	45 ^{+0.6}
72LVe 72LAe	72	66	53	67.5	5.5	64	68 ^{+0.7}
96LVe 96LAe	96	90	53	91.5	5.5	64	92 ^{+0.8}
144LVe 144LAe	144	136	53	137.5	5.5	64	138 ⁺¹

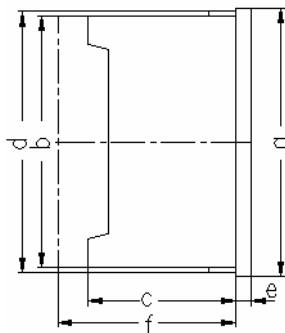
* c = 68mm, for I= 6 to 60 A

* c = 78mm, for I > 60 A

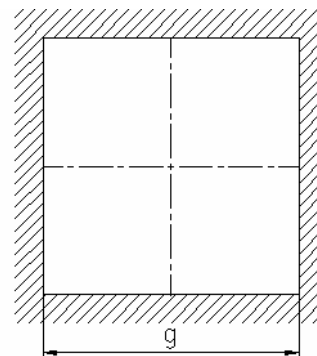
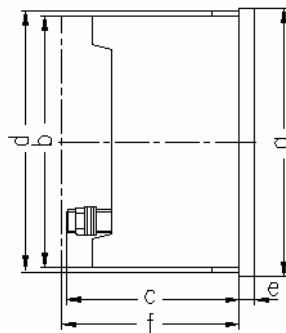
**f = 70mm, for I= 6 to 60 A

Outline drawing

For Voltmeters & Ammeters
upto 30 A



For Ammeters > 30 A



Order specification:

- Moving-iron ammeter
- Frame size: 72x72 mm
- Range: 5 / 10 A
- CT: 600/5 A
- Scale: 0...600/1200 A

Ordering data:

- Moving-iron ammeter
- Type: 72LAe
- Cat. No. 58-1640-13-CO4
- CT: 600/5 A
- Scale: 0...600/1200 A



MOVING-IRON INSTRUMENTS WITH INTERCHANGEABLE SCALES



48LA, 72LA, 96LA, 144LA, 48LV, 72LV, 96LV, 144LV

For measuring AC current or voltage.

Type 48L...,72L... and 96L... are with interchangeable scale.

Technical data:

Movement: Moving-iron with spring-type oil filled bearing, vibration-free oil damping.

Instrument case: non-flammable plastic according to UL 94-V1 or metal on request. On special request voltmeters as well as ammeters up to 6A will be supplied with plastic terminal cover.

Scale length: 40 mm (48L...), 62 mm (72L...), 102 mm (96L...), 152 mm (144L...).

Permanent overloading: 1.2 -fold current res. voltage.

Class of accuracy: 1.5

Frequency range: 15...50...100 Hz

Weight: 0.15 kg (48L...), 0.2 kg (72L...), 0.35 kg (96L...), 0.8 kg (144L...).

Fixing elements: plastic clips or two spring-type fastening clips for metal case instruments



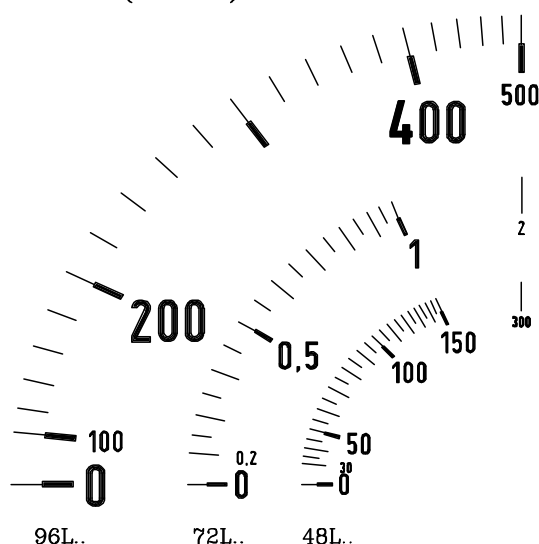
AMMETERS		Plastic case				Metal case		
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	Type 48 LA	Type 72 LA	Type: 96 LA	Type: 144 LA	Type 72 LA	Type 96 LA	Type 144 LA
		2015-13-... consumption	1640-13-... consumption	1636-13-... consumption	2549-13-... consumption	1561-13-... consumption	1560-13-... consumption	2299-13-... consumption
400/800 mA	001	max. 0.5 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA
500/1000 mA	002	↓	↓	↓	↓	↓	↓	↓
600/1200 mA	003							
1 / 2 A	005							
1.5 / 3 A	007							
2.5 / 5 A	009							
4 / 8 A	011							
5 / 10 A	012							
6 / 12 A	013							
10 / 20 A	015							
15 / 30 A	017							
20 / 40 A	018							
25 / 50 A	019							
30 / 60 A	020							
40 / 80 A	021	max. 1.5 VA	max. 2 VA	max. 2 VA	max. 2,5 VA	max. 2 VA	max. 2 VA	max. 2,5 VA
50 / 100 A	022	----	↓	↓	↓	↓	↓	↓
60 / 120 A	023	----						
100 / 200 A	024	----						
* 1 / 2 A	C03	max. 0.5 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA
* 5 / 10 A	C04	max. 0.5 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA

On request 48x48 mm instruments with metal case are possible

* For current transformer connection

Scales (M=1:1)

Note: on request types different from tables are accepted.



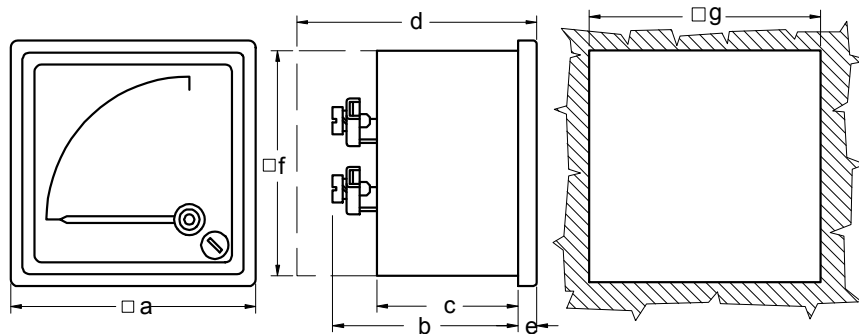


VOLTMETERS			Plastic case				Metal case		
Frame dimensions			48x48 mm	72x72 mm	96x96 mm	144x144 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	Type 48 LV		Type 72 LV		Type 96 LV		Type 144 LV	
		2015-13-...		1640-13-...		1636-13-...		2549-13-...	
		consumption		consumption		consumption		consumption	
6 V	101	max. 3 VA	max. 3 VA	max. 3 VA	max. 3.5 VA	max. 3 VA	max. 3 VA	max. 3.5 VA	
10 V	103								
15 V	105								
20 V	106								
25 V	107								
30 V	108								
40 V	109								
50 V	110								
60 V	111								
80 V	112								
100 V	113								
150 V	115								
200 V	116								
250 V	117								
300 V	118								
400 V	119								
500 V	120								
600 V	121								
**.../ 100 V	C05								
**.../ 110 V	C06								

** For voltage transformer connection

Note: on request types different from tables are accepted

Outline drawing



TypeDim. (mm)	a	b1	b2	c1	c2	*d	e	f	g
48LV	48	57.5	---	41.5	---	63	5.5	44	45 ^{+0.6}
48LA 400mA-15A 48LA 20A -50A		60.5							
72LV	72	57.5	62	41.5	51	c+25	5.5	66	68 ^{+0.7}
72LA 400mA-20A 72LA 25A -100A		60.5	69						
96LV	96	57.5	62	41.5	51	c+25	5.5	90	92 ^{+0.8}
96LA 400mA-20A 96LA 25A - 100A		60.5	69						
144LV	144	---	59	---	47	---	7	137	138 ⁺¹
144LA 400mA-20A 144LA 25A - 100A		---	70						

b1, c1 refers to plastic case instrument

b2, c2 refers to metal case instrument

* case with terminal cover

Order specification:

- Moving-iron ammeter
- Frame size: 72x72 mm
- Case: plastic
- Range: 50 / 10 A
- CT: 600/5 A
- Scale: 0...600/1200 A

Ordering data:

- Moving-iron ammeter
- Type: 72LA
- Cat. No. 640-13-CO4
- CT: 600/5 A
- Scale: 0...600/1200 A

**45LA, 45LV**

For measuring AC current or voltage.

Technical data:**Movement:** moving-iron with spring-type oil filled bearing**Instrument case:** non-flammable plastic acc. to UL 94-V1.**Scale length:** 40 mm**Permanent overloading:** 1.2 -fold current res. voltage.**Class of accuracy:** 1.5**Frequency range:** 15...50...100 Hz**Weight:** 0.15 kg**Connections:** screw terminals for cable up to 8 mm²**Mounting:** rail 35 mm (EN 50022)**AMMETERS**

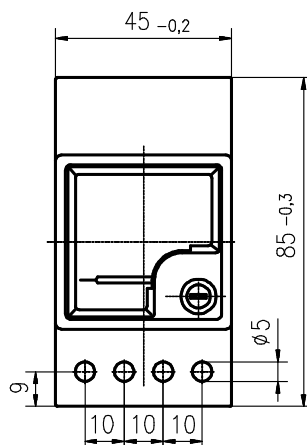
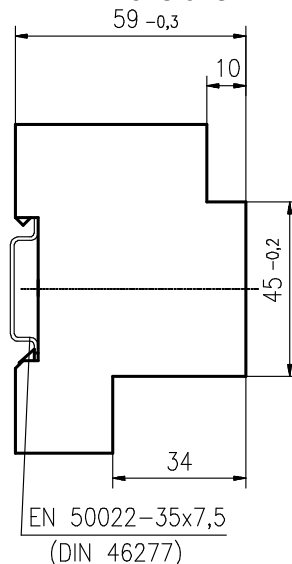
Measuring ranges:	45LA
	consumption
0 – 100/200 mA...600/1200 mA	max. 0.5 VA
0 – 1 / 2 A ... 25 / 50 A	↓
... / 1 A *	
... / 5 A *	

* with current transformer

VOLTMETERS

Measuring ranges:	45LV
	consumption
0 – 6 V ... 600 V	max. 2.5 VA
... / 100 V **	↓
... / 110 V **	

** with voltage transformer

Note: on request types different from tables are accepted**Outline drawing****Dimensions in mm****Order specification:**

-Moving-iron rail-mounted voltmeter

-Frame size: 45x45 mm

-VT: 20 kV / 100 V

-Scale: 0 – 25 kV

Ordering data:

45LV

VT:20 kV / 100 V

Scale: 0 - 25 kV



MOVING-IRON PROFILE INSTRUMENTS



72spLA, 96spLA, 144spLA, 72spLV, 96spLV, 144spLV

For measuring AC current or voltage.

Technical data:

- Movement:** moving-iron, with spring-type oil filled bearing, vibration-free oil damping.
- Instrument case:** steel plate
- Scale length:** 46mm(72sp); 62 mm(96sp), 103 mm(144sp).
- Permanent overloading:** 1.2 -fold current resp. voltage.
- Class of accuracy:** 1.5
- Frequency range:** 15 ... 50 ... 100 Hz.
- Weight:** approx. 0.2kg(72sp); 0.35kg(96sp), 0.8kg(144sp) .
- Fixing elements:** two spring-type fastening clips (DIN 43 835 "A").
with two screw-type fastening clips (DIN 43835 "B")/144sp.



AMMETERS

Frame dimensions		72x36 mm	96x48 mm	144x72 mm
Measuring range	Type Cat. No.	72 spLA	96 spLA	144 spLA
		1580-13-... consumption	1581-13-... consumption	2306-13-... consumption
400 / 800 mA	024	max. 0.5 VA	max. 0.5 VA	max. 0.7 VA
500 / 1000 mA	025	↓	↓	↓
600 / 1200 mA	026			
1 / 2 A	028			
1.5 / 3 A	030			
2 / 4 A	031			
2.5 / 5 A	032			
4 / 8 A	034			
5 / 10 A	035			
6 / 12 A	036			
10 / 20 A	038			
15 / 30 A	039			
* 1 / 2 A	C03			
* 5 / 10 A	C04			

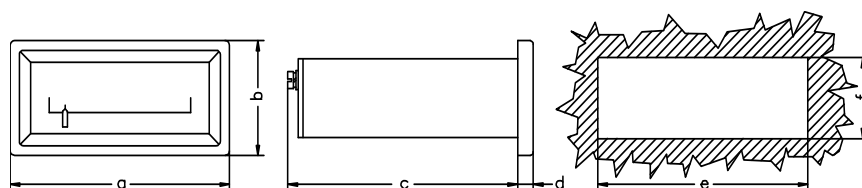
* the datas of the current transformer are required

Note: on request orders for types different from tables are accepted

VOLTMETERS

Frame dimensions		72x36 mm	96x48 mm	144x72 mm
Measuring range	Type Cat. No.	72 spLV	96 spLV	144 spLV
		1580-13-... consumption	1581-13-... consumption	2306-13-... consumption
6 V	001	max. 3VA	max. 3VA	max. 3.5VA
10 V	003	↓	↓	↓
15 V	005			
20 V	006			
25 V	007			
30 V	008			
40 V	009			
50 V	010			
60 V	011			
80 V	012			
100 V	013			
150 V	016			
200 V	017			
250 V	019			
300 V	020			
400 V	021			
500 V	022			
600 V	023			
** ... / 100 V	C05			
** ... / 110 V	C06			

** the datas of the voltage transformer are required



Type/Dim. [mm]	a	b	c	d	e	f
72spLA, 72spLV	72	36	105	5.5	68 ^{+0.7}	33 ^{+0.6}
96spLA, 96spLV	96	48	125	7	92 ^{+0.8}	44 ^{+0.6}
144spLA, 144spLV	144	72	170	8	138 ⁺¹	68 ^{+0.7}

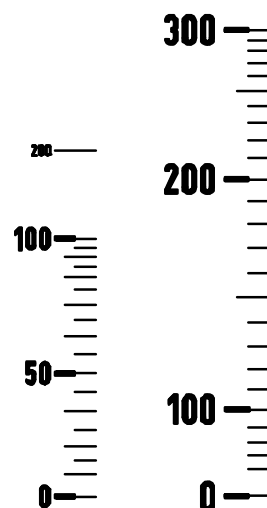
Order specification:

- Moving-iron voltmeter.
- Frame dimensions: 72 x 36 mm.
- Measuring range: ... / 110 V.
- Scale: 0...25 kV.

Ordering data:

- Moving-iron voltmeter type 72spLV.
- Cat. No:1580-13-C06.
- Scale: 0...25 kV.
- position: vertical

Scales (M=1:1)



72spL..

96spL..



TUBE-TYPE MOVING-IRON INSTRUMENTS



79LA, 119LA, 79LV, 119LV,

For measuring AC current or voltage.

Technical data:

Movement: moving-iron movement with spring-type oil filled bearing, practically vibration free oil damping.

Instrument case: non-flammable plastic according to UL 94-V1.

Scale length: 103° resp. 60 mm (79L...) and 97 mm (119L...)

Permanent overloading: 1.2 -fold current resp. voltage.

Class of accuracy: 1.5

Frequency range: 15...50...100 Hz

Consumption: max. 3 VA for voltmeter;
max. 0.5 VA for ammeter

Protection: IP40 for instrument case;
IP00 for connection-pins (DIN 40050).

Connection: 4,8 x 8 mm faston (DIN 46247)

Weight: approx. 0.11 kg (79L...); 0.2 kg (119L...)

Instrument mounting: **A.** on the frontside of the assembly-board with frame
B. on the backside of the assembly-board with special frame
C. on the backside of the assembly-board without frame (see on next page)



AMMETERS	Type 79LA	Type 119LA
Frame dimensions	80x63 mm	120x90 mm
Measuring range	Cat. No. 1537-13-...	Cat. No. 1538-13-...
1 / 2 A	029	
1.5 / 3 A	031	
2.5 / 5 A	033	
4 / 8 A	035	
5 / 10 A	036	
* .../ 1 / 2 A	C03	
* .../ 5 / 10 A	C04	

* the datas of the current transformer are required

Order specification:

- Tube-type moving-iron ammeter.
- Frame size: 120x90 mm.
- Range: 5/10 A.
- Mounting: on front side with frame.

Ordering data:

- Tube-type moving-iron ammeter.
- Type: **119LA**
- Cat. No. **1538-13-036**
- Mounting: **Type A**

Note: On request types different from table are accepted.

VOLTMETERS	Type 79LV	Type 119LV
Frame dimensions	80x63 mm	120x90 mm
Measuring range	Cat. No. 1537-13-...	Cat. No. 1538-13-...
6 V	058	
10 V	056	
15 V	054	
20 V	053	
25 V	052	
30 V	051	
40 V	050	
50 V	049	
60 V	048	
100 V	046	
150 V	043	
200 V	042	
250 V	041	
300 V	040	
400 V	039	
500 V	038	
600 V	037	
** .../100 V	C05	
** .../110 V	C06	

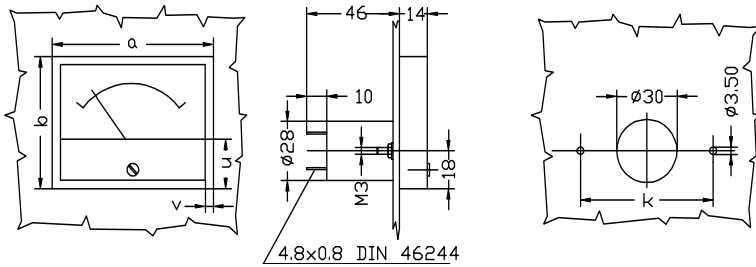
** the datas of the voltage transformer are required



TUBE-TYPE INSTRUMENTS MOUNTING

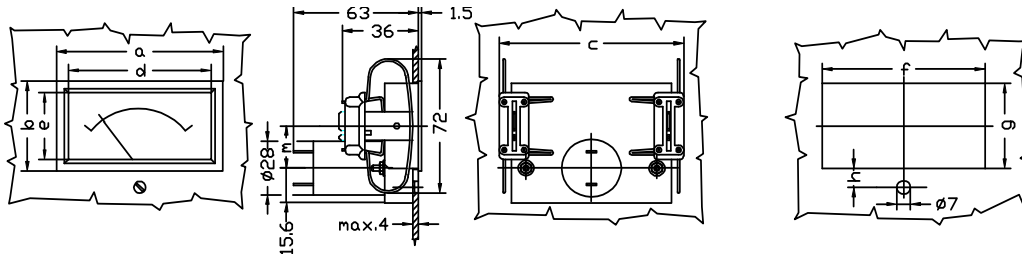


Mounting type: A



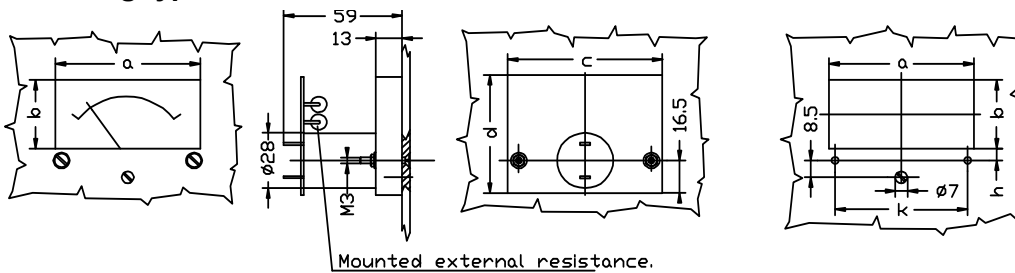
Type \ Dim (mm)	a	b	u	v	k
79...	80	63	23.5	4	66
119...	120	90	31	5	90

Mounting type: B



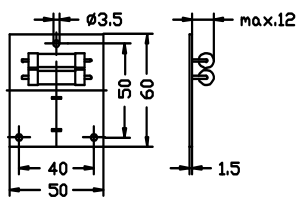
Type \ Dim (mm)	a	b	c	d	e	f	g	h	m
79...	84	47	93	72	35	82 ^{+0.4}	44.5 ^{+0.4}	9.8	23.5
119...	125	68	123	110	53	122 ^{+0.4}	64.5 ^{+0.4}	16.8	40.5

Mounting type: C

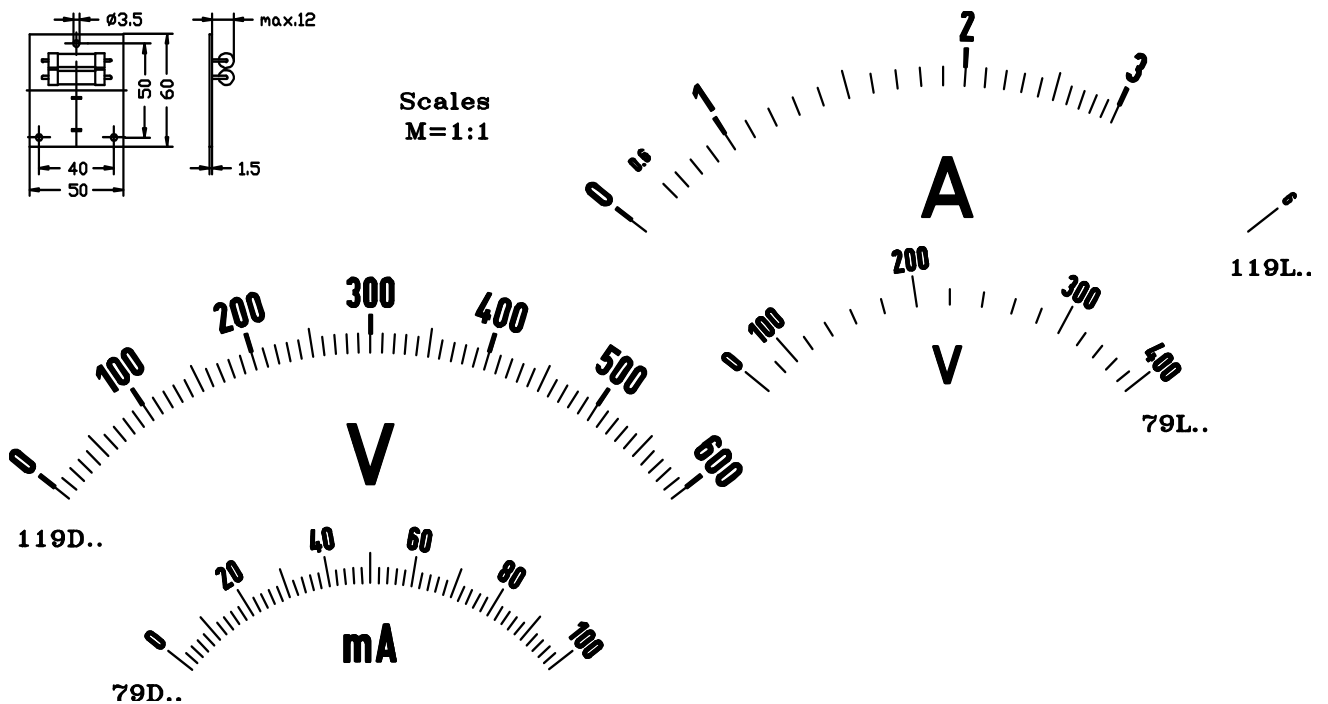


Type \ Dim (mm)	a	b	c	d	h	m
79...	72	35	77	60	6	66
119...	110	53	117	87	14	90

External resistance



Scales
M=1:1





48DAe, 72DAe, 96DAe, 144DAe, 48DVe, 72DVe, 96DVe 144 DVe

For measuring DC current respective voltage.
Types 48D.., 72D.., 96D.., and 144D.. are with interchangeable scale

Technical data:

- Movement:** Magnet core, moving-coil movement with pivot spring-type bearing
- Instrument case:** non-flammable Glass filled polycarbonate according UL94-V-0.
- Scale length:** 38 mm (48D...), 61 mm (72D...), 97 mm (96D...), 146 mm (144D...)
- Permanent overloading:** 1.2 -fold current res. voltage
- Class of accuracy:** 1.5
- Pollution degree** 2
- Installation Categories:** Size 72,96, and 144 600V CAT III. (over voltage category) Size 48 300V CAT III.
- Weight:** 0.1 kg (48D...), 0.16 kg (72D...), 0.2 kg (96D...) 0.4 kg (144D...)
- Fixing elements:** Two M3 screws



Accessorie:

Terminal protection: Full sized polycarbonate back cover

AMMETERS		Plastic case			
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	Type 48 DAe	Type 72 DAe	Type 96 DAe	Type 144 DAe
		58-2014-12-...	58-1639-12-...	58-1638-12-...	58-2557-12-...
		Approx voltage drop	Approx voltage drop	Approx voltage drop	Approx voltage drop
min. (50 μ A)	002	424 mV	424 mV	424 mV	424 mV
100 μ A	001	400 mV	400 mV	400 mV	400 mV
1 mA	011	37 mV	37 mV	37 mV	37 mV
20 mA	024	60 mV	60 mV	60 mV	60 mV
1 A	041	60 mV	60 mV	60 mV	60 mV
1.5 A	043	60 mV	60 mV	60 mV	60 mV
2.5 A	045	60 mV	60 mV	60 mV	60 mV
4 A	047	60 mV	60 mV	60 mV	60 mV
5 A	048	60 mV	60 mV	60 mV	60 mV
6 A	049	72 mV	72 mV	72 mV	72 mV
10 A	051	60 mV	60 mV	60 mV	60 mV
15 A	053	60 mV	60 mV	60 mV	60 mV
25 A	055	60 mV	60 mV	60 mV	60 mV
40 A	057	60 mV	60 mV	60 mV	60 mV
50 A	058	60 mV	60 mV	60 mV	60 mV
60 A	059	72 mV	72 mV	72 mV	72 mV
max.100 A	061	60 mV	60 mV	60 mV	60 mV
4...20 mA	501	60 mV	60 mV	60 mV	60 mV
...A/ 50mV	C01	1 k Ω /V	1 k Ω /V	1 k Ω /V	1 k Ω /V
*...A/ 60mV	C02	↓	↓	↓	↓
*...A/ 100mV	C03	↓	↓	↓	↓
*...A/ 150mV	C04	↓	↓	↓	↓

* For connection to separate shunt. The calibration of the instruments 0.035 Ω wire (=2x1 m \varnothing 1 mm) resistance is taken into consideration.
The tolerance of the internal resistance is generally \pm 20%

Note: on request types different from tables are accepted.



VOLTMETERS		Plastic case			
		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	Type 48 DVe	Type 72 DVe	Type 96 DVe	Type 144 DVe
		58-2014-12-...	58-1639-12-...	58-1638-12-...	58-2557-12-...
		Int. resist.	Int. resist.	Int. resist.	Int. resist.
min (1) V	101	1 kΩ/V	1 kΩ/V	1 kΩ/V	1 kΩ/V
10 V	111	↓	↓	↓	↓
15 V	113				
25 V	115				
30 V	116				
40 V	117				
50 V	118				
60 V	119				
100 V	121				
max.(600)V	129				

Note: on request types different from tables are accepted.

Type\Dim. (mm)	a	b	c*	d	e	f**	g
48DVe 48DAe	48	43,5	53	44.5	5.5	64	45 ^{+0.6}
72DVe 72DAe	72	66	53	67.5	5.5	64	68 ^{+0.7}
96DVe 96DAe	96	90	53	91.5	5.5	64	92 ^{+0.8}
144DVe 144DAe	144	136	53	137.5	5.5	64	138 ⁺¹

* c = 68mm, for I= 6 to 60 A

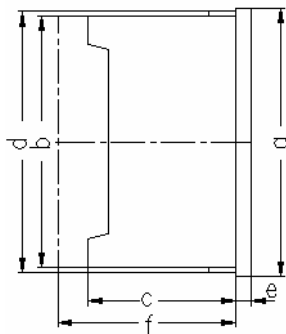
* c = 78mm, for I> 60 A

**f = 70mm, for I= 6 to 60 A

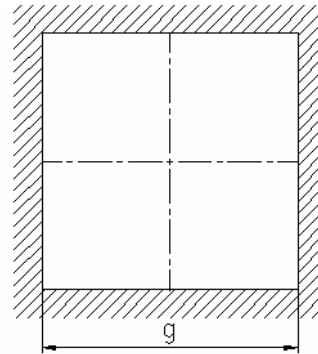
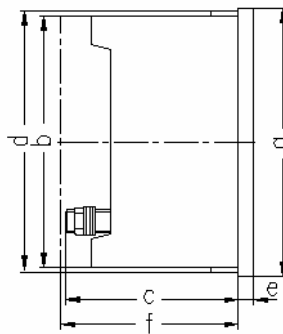
**f = 75mm, for 48x48 I>6 A

Outline drawing

For Voltmeters & Ammeters
< 6A



For Ammeters
6-100 A



Order specification:

- Moving coil ammeter
- Frame size: 72x72 mm
- Range: 1 mA
- Scale: 0...100%

Ordering data:

- Moving coil ammeter
- Type: 72DAe
- Cat. No.: 58-1639-12-011-
- Scale: 0...100%



48DA, 72DA, 96DA, 144DA, 48DV, 72DV, 96DV 144 DV

For measuring DC current respective voltage.
Types 48D..72D.. and 96D.. are with interchangeable scale

Technical data:

Movement: Magnet core, moving-coil movement with pivot spring-type bearing

Instrument case: non-flammable plastic according to UL94-V1 or metal on request.

Scale length: 40 mm (48D...), 62 mm (72D...), 102 mm (96D...), 152 mm (144D...)

Permanent overloading: 1.2 -fold current res. voltage

Class of accuracy: 1.5

Weight: 0.15 kg (48D...), 0.2 kg (72D...),
0.35 kg (96D...) 0.8 kg (144D...)

Fixing elements: plastic clips or two spring type fastening clips for metal case instruments



AMMETERS		Plastic case				Metal case		
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	Type 48 DA	Type 72 DA	Type 96 DA	Type 144 DA	Type 72 DA	Type 96 DA	Type 144 DA
		2014-12-...	1639-12-...	1638-12-...	2557-12-...	1563-12-...	1564-12-...	2303-12-...
		Int. resist. (Ω)	Int. resist. (Ω)	Int. resist. (Ω)	Int. resist. (Ω)	Int. resist. (Ω)	Int. resist. (Ω)	Int. resist. (Ω)
50 μA	002	4000	4000	4000	4500	4000	4000	4500
100 μA	001	900	1400	1400	4000	1400	1400	4000
250 μA	005	400	950	950	1400	950	950	1400
500 μA	008	200	290	290	350	290	290	350
1 mA	011	47	60	60	90	60	60	90
5 mA	018	4	5.5	5.5	8	5.5	5.5	8
10 mA	021	3	3	3	3.5	3	3	3.5
20 mA	024	2.2	2.3	2.3	2.5	2.3	2.3	2.5
25 mA	025	2.4	2.4	2.4	2.4	2.4	2.4	2.4
100 mA	031	0.6	0.6	0.6	0.6	0.6	0.6	0.6
500 mA	038	0.12	0.12	0.12	0.12	0.12	0.12	0.12
1 A	041	0.06	0.06	0.06	0.06	0.06	0.06	0.06
1.5 A	043	0.04	0.04	0.04	0.04	0.04	0.04	0.04
2.5 A	045	0.024	0.024	0.024	0.024	0.024	0.024	0.024
4 A	047	0.015	0.015	0.015	0.015	0.015	0.015	0.015
5 A	048	0.012	0.012	0.012	0.012	0.012	0.012	0.012
6 A	049	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10 A	051	0.006	0.006	0.006	0.006	0.006	0.006	0.006
15 A	053	0.004	0.004	0.004	0.004	0.004	0.004	0.004
20 A	054	0.003	0.003	0.003	0.003	0.003	0.003	0.003
25 A	055	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024
30 A	056	0.002	0.002	0.002	0.002	0.002	0.002	0.002
40 A	057	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
50 A	058	----	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012
60 A	059	----	0.001	0.001	0.001	0.001	0.001	0.001
80 A	060	----	0.00075	0.00075	0.00075	0.00075	0.00075	0.00075
100 A	061	----	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
4...20 mA	501	2.3	2.3	2.3	2.3	2.3	2.3	2.3
*...A/ 50mV	C01	10	10	10	10	10	10	10
*...A/ 60mV	C02	12	12	12	12	12	12	12
*...A/ 100mV	C03	20	20	20	20	20	20	20
*...A/ 150mV	C04	30	30	30	30	30	30	30
*...A/ 300mV	C05	60	60	60	60	60	60	60

* For connection to separate shunt. The calibration of the instruments 0.035 Ω wire (=2x1 m Ø1 mm²) resistance is taken into consideration.
The tolerance of the internal resistance is generally ±20%

Note: on request types different from tables are accepted

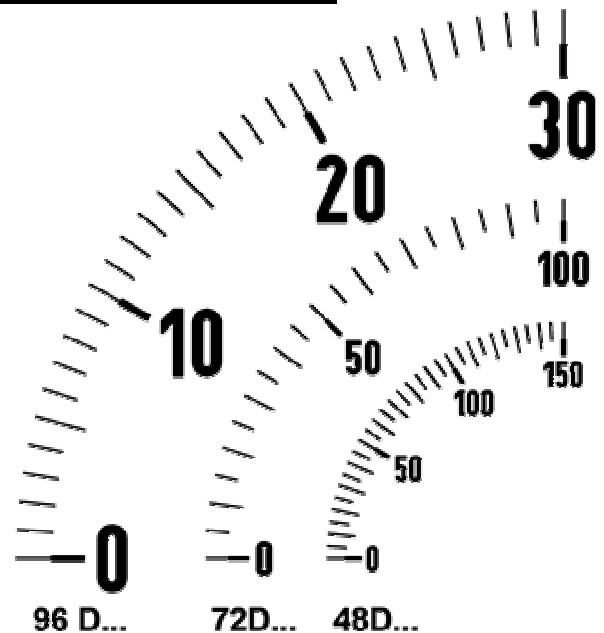
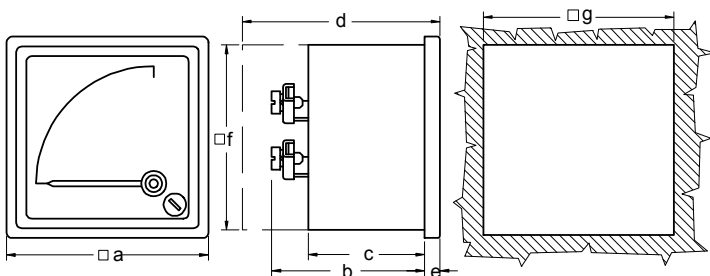


VOLTMETERS			Plastic case				Metal case		
Frame dimensions			48x48 mm	72x72 mm	96x96 mm	144x144 mm	72x72 mm	96x96 mm	144x144 mm
Measurin g range	Cat. No.	Type 48 DV		Type 72 DV	Type 96 DV	Type 144 DV	Type 72 DV	Type 96 DV	Type 144 DV
		2014-12-...		1639-12-...	1638-12-...	2557-12-...	1563-12-...	1564-12-...	2303-12-...
		Int. resist.		Int. resist.	Int. resist.	Int. resist.	Int. resist.	Int. resist.	Int. resist.
1 V	101	1000 Ω/V		1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V
1.5 V	103	↓		↓	↓	↓	↓	↓	↓
2.5 V	105								
4 V	107								
6 V	109								
10 V	111								
15 V	113								
20 V	114								
25 V	115								
30 V	116								
40 V	117								
50 V	118								
60 V	119								
80 V	120								
100 V	121								
150 V	123								
200 V	124								
250 V	125								
300 V	126								
400 V	127								
500 V	128								
600 V	129								

Note: on request types different from tables are accepted

Type\Dim. (mm)	a	b1	b2	c1	c2	*d	e	f	g
48DV	48	52.5	---	41.5	---	62.5	5.5	44	45 ^{+0.6}
48DA 50 μA – 6 A		67.5							
48DA 10A									
72DV	72	52.5	62	41.5	51	c+25	5.5	66	68 ^{+0.7}
72DA 50 μA – 6 A		67.5	75			---			
72DA 10A -60A									
96DV	96	52.5	62	41.5	51	c+25	5.5	90	92 ^{+0.8}
96DA 50 μA – 6 A		67.5	87			---			
96DA 10A - 100A									
144DV	144	---	59		47	---	7	137	138 ⁺¹
144DA 50 μA – 6 A									
144DA 10A - 100A				70					

Outline drawing



Order specification:

- Moving coil ammeter
- Frame size: 72x72 mm
- Case: plastic
- Range: 1 mA
- Scale: 0...100%

Ordering data:

- Moving coil ammeter
- Type: 72DA
- Cat. No.: 1639-12-011
- Scale: 0...100%



45DA, 45DV

For measuring DC current or voltage

Technical data:

Movement:	moving-coil with pivot spring-type bearing
Instrument case:	non-flammable plastic according to UL 94-V1.
Scale length:	40 mm
Permanent overloading:	1.2 fold current res. voltage
Class of accuracy:	1.5
Weight:	0.15 kg
Connections:	screw terminals for cable up to 8mm ²
Mounting:	rail 35 mm (EN 50022)



AMMETERS

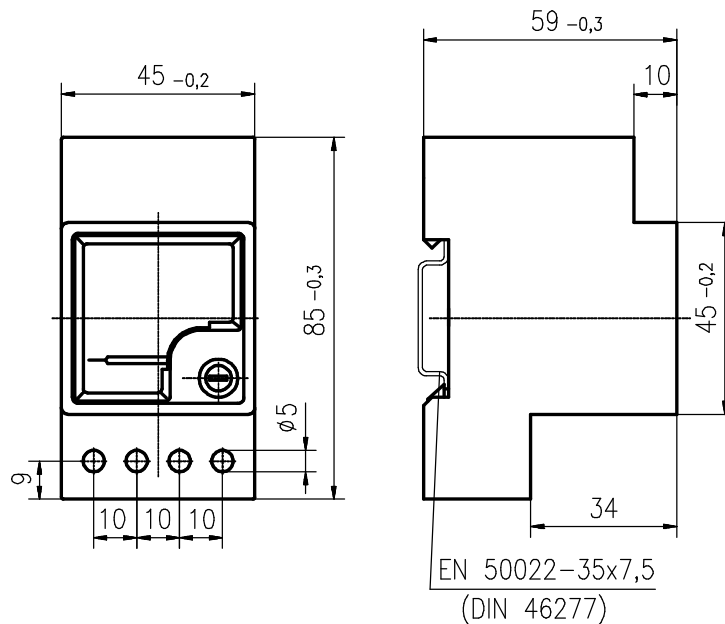
	Type: 45DA
Measuring ranges	voltage drop or int. resistance
0-50μA.....600μA	max. 200 mV
0- 1 mA.....600 mA	↓
0- 1 A..... 15 A	
4-20 mA	
....A/60 mV	12 Ω

VOLTMETERS

	Type: 45DV
Measuring ranges	int. resistance
0-50mV.....600mV	1000Ω/V
0- 1 V ....600 V	↓

Note: on request types different from tables are accepted.

Outline drawing Dimension in mm



Order specification:

- Moving-coil rail mounted ammeter
- Frame size: 45x45 mm
- Range: 1 mA
- Scale: 0...100 %

Ordering data:

- 45DA 1 mA
- Scale:0...100%



MOVING-COIL PROFILE INSTRUMENTS



72spDA, 96spDA, 144spDA 72spDV, 96spDV, 144spDV

For measuring DC current or voltage

Technical data:

Movement: moving-coil
pivot and spring-type bearing

Instrument case: steel plate

Scale length: 46mm (72sp); 62mm (96sp);
103mm (144sp)

Permanent overloading: 1.2 -fold current
res. voltage

Class of accuracy: 1.5



Weight: approx. 0.1kg (72sp); 0.35kg (96sp); 0.8kg (144sp)

Fixing elements: two spring-type fastening clips (DIN 43 835 "A") for 72sp and 96sp;
and two screw-type fastening clips (DIN 43 835 "B") for 144sp

AMMETERS Frame dimensions Measuring range	Type 72 spDA 72x36 mm		Type 96 spDA 96x48 mm		Type 144 spDA 144x72 mm	
	Cat. No. 1051-12-...	Int. Res. (Ω)	Cat. No. 1526-12-...	Int. Res. (Ω)	Cat. No. 2304-12-...	Int. Res. (Ω)
100 μA	002	870	001	870	001	4000
250 μA	004	450	005	450	005	1300
500 μA			008	80	008	310
1 mA	007	30	011	30	011	110
5 mA	011	2.5	018	2.5	018	3.5
10 mA	013	2.2	021	2.2	003	6
20 mA	015	2	024	2	006	1.5
25 mA	016	2.4	025	2.4	007	2.4
100 mA	019	0.6	031	0.6	013	0.6
0.5 A			038	0.12	001	0.12
1 A	024	0.06	041	0.06	004	0.06
1.5 A	025	0.04	043	0.04	006	0.04
2.5 A	026	0.024	045	0.024	008	0.024
4 A	027	0.015	047	0.015	010	0.015
5 A			048	0.012	011	0.012
6 A	028	0.01	049	0.01	012	0.01
10 A	029	0.006	052	0.006	052	0.006
4...20 mA	501	2	501	2	501	2
*...A/50mV	1051-12-C01	10	1526-12-C01	10	1526-12-C01	10
*...A/60mV	1051-12-C02	12	1526-12-C02	12	1526-12-C02	12
*...A/100mV	1051-12-C03	20	1526-12-C03	20	1526-12-C03	20
*...A/150mV	1051-12-C04	30	1526-12-C04	30	1526-12-C04	30
*...A/300mV	1051-12-C05	60	1526-12-C05	60	1526-12-C05	60

* For connection to separate shunt. The calibration of the instruments 0.035 Ω
wire (=2x1 m ∅1 mm²) resistance is taken into consideration.

The tolerance of the internal resistance is generally ±20%

Note: on request types different from tables are accepted

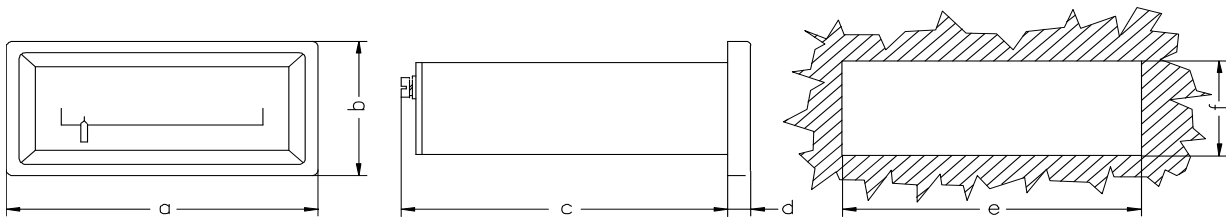


MOVING-COIL PROFILE INSTRUMENTS

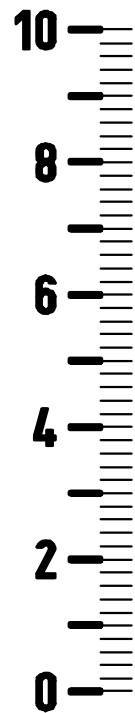


VOLTMETERS	Type 72 spDV		Type 96 spDV		Type 144 spDV	
Frame dimensions	72x36 mm		96x48 mm		144x72 mm	
Measuring range	Cat. No. 1051-12-...	Intern. Resist.	Cat. No. 1526-12-...	Intern. Resist.	Cat. No. 2304-12-...	Intern. Resist.
1 V	037	1000 Ω/V ↓	051	1000 Ω/V	001	1000 Ω/V
1.5 V	038		053			
2 V	---		054			
2.5 V	039		055			
4 V	040		057			
5 V	---		058			
6 V	041		059			
10 V	042		061			
15 V	043		063			
20 V	---		064			
25 V	044		065			
30 V	---		066			
40 V	045		067			
50 V	---		068			
60 V	046		069			
80 V	---		070			
100 V	047		071			
150 V	048		073			
200 V	---		074			
250 V	049		075			
300 V	---	076				
400 V	050	077				
500 V	---	078				
600 V	051	079				

Note: on request types different from tables are accepted



Type\Dim. [mm]	a	b	c	d	e	f
72 spDA 72 spDV	72	36	105	5.5	68 ^{+0.7}	33 ^{+0.7}
96 spDA 96 spDV	96	48	125	7	92 ^{+0.7}	44 ^{+0.7}
144 spDA 144 spDV	144	72	170	8	138 ^{+0.7}	68 ^{+0.7}



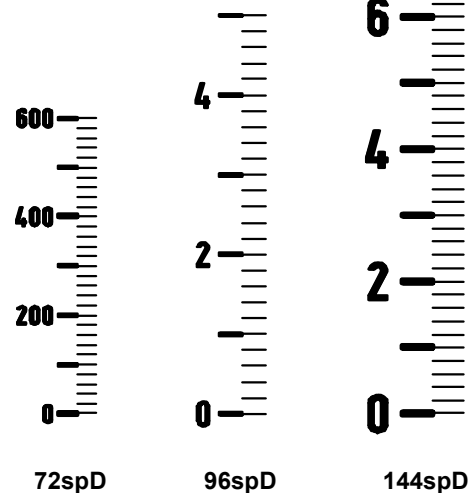
Scales (M=1:1)

Order specification:

- Moving-coil voltmeter
- Frame size: 72x36 mm
- Range: 10 V
- Scale: 0 ... 10 V

Ordering data:

- Moving-coil voltmeter
- Type: 72 spDV
- Cat. No. 1051-12-042
- position: horizontal



72spD

96spD

144spD



48vA, 72vA, 96vA
48vV, 72vV, 96vV

For measuring DC current respective voltage.

Technical data:

Movement: moving-coil,
pivot & spring-type bearing.

Instrument case: non-flammable plastic
acc. to UL 94-V1.

Scale length: 28 mm (48v...), 48 mm (72v...),
60 mm (96v...).

Permanent overloading: 1.2 fold current res. voltage.

Class of accuracy: 1.5

Connection: - 2.8 x 0.5 mm faston (DIN 46247) for types 48v... and 72v...
- 4.8 x 0.5 mm faston (DIN 46247) for types 96v...

Protection: case IP40; terminals IP00 in accordance with DIN 40050.

Weight: 0.1 kg (48v...); 0.12 kg (72v...); 0.15 kg (96v...).

Fixing elements: with two screw-type fastening.



AMMETERS

Measuring range	Frame dimensions					
	48x24 mm		72x24 mm		96x24 mm	
	Type 48 vA Cat. No. 2069-10-...		Type 72 vA Cat. No. 1093-10-...		Type 96 vA Cat. No. 1026-10-...	
	...	int. resist. Ω	...	int. resist. Ω	...	int. resist. Ω
50 μ A	001	4150	060	4800	060	5200
100 μ A	003	2800	001	3500	002	3800
250 μ A	006	440	003	550	004	600
1 mA	009	24	006	35	007	32
5 mA	014	3.5	010	3.3	011	3.6
10 mA	016	2.3	012	2.5	013	3.5
20 mA	018	2	014	2	015	2
25 mA	019	2.4	015	2.4	016	2.4
100 mA	022	0.6	018	0.6	019	0.6
0.6 A	058	0.1	061	0.1	023	0.1
1 A	059	0.06	062	0.06	024	0.06
1.5 A	060	0.04	063	0.04	025	0.04
2.5 A	061	0.024	064	0.024	026	0.024
4 A	062	0.015	065	0.015	027	0.015
6 A	064	0.01	066	0.01	028	0.01
10 A	-	-	-	-	029	0.006
4...20 mA	023	2.2	501	2.2	501	2.2
* ...A/50 mV	C01	10	C01	10	C01	10
* ...A/60 mV	C02	12	C02	12	C02	12
* ...A/100 mV	C03	20	C03	20	C03	20
* ...A/150 mV	C04	30	C04	30	C04	30
* ...A/300 mV	C05	60	C05	60	C05	60

Note: on request types different from tables are accepted

* For connection to separate shunt.

For calibration of the instruments 0.035 Ω wire resistance ($=2 \times 1 \text{m} \varnothing 1 \text{mm}^2$) is taken into consideration.
The tolerance of the internal resistance is generally $\pm 20\%$.

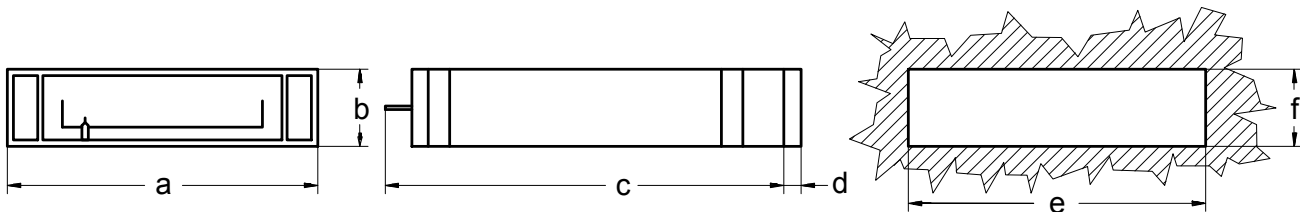


VOLTMETERS

Measuring range	Frame dimensions					
	48x24 mm		72x24 mm		96x24 mm	
	Type 48 vV Cat. No. 2069-10-...		Type 72 vV Cat. No. 1093-10-...		Type 96 vV Cat. No. 1026-10-...	
	...	Internal Resistance	...	Internal Resistance	...	Internal Resistance
0.6 V	036	1000 Ω/V ↓	045	1000 Ω/V ↓	035	1000 Ω/V ↓
1 V	037					
1.5 V	038					
2.5 V	039					
4 V	040					
5 V	053					
6 V	041					
10 V	042					
15 V	043					
25 V	044					
40 V	045					
60 V	046					
100 V	047					
150 V	048					
250 V	049					
400 V	050					
500 V	051					
600 V	052					
			045		035	
			020		036	
			021		037	
			022		038	
			023		039	
			053		053	
			024		040	
			025		041	
			026		042	
			027		043	
			028		044	
			029		045	
			030		046	
			031		047	
			032		048	
			033		049	
			035		051	
			034		050	

Note: on request types different from tables are accepted
 - The tolerance of the internal resistance is generally ±20%

Outline drawing



Scales (M= 1:1)

Type\Dim. (mm)	a	b	c	d	e	f
48 vA 48 vV	48	24	67.6	5.3	43.2 ^{+0.3}	22.2 ^{+0.3}
72 vA 72 vV	72	24	92	5.3	67 ^{+0.5}	22.2 ^{+0.3}
96 vA 96 vV	96	24	125	5.3	91.5 ^{+0.5}	22.5 ^{+0.3}



Order specification:

- Moving-coil panel mounted ammeter.
- Frame size: 72x24 mm.
- Range: 1 mA.
- Scale: 0 ... 1 mA.

Ordering data:

- Moving-coil panel mounted ammeter.
- Type: **72 vA**
- Cat. No. **1093-10-006**
- position: vertical



96vK1

Contact instruments

For measuring DC current or voltage with 2 limit contact outputs

Technical data:

Movement: moving coil
 Scale length: 60 mm
 Class of acc.: 1,5
 Adjustable ranges: max. contact: 2 ... 100 %, min. contact: 0 ... 98 %
 Hysteresis: ≤ 1%



setup knob for min. limit value

zero setting knob

setup knob for max. limit value

Aux voltage: 24V +20%-10% DC or 12V +20%-10% DC

Case: plastic, UL 94-V1
 Dimension: 96 x 24 x 125 mm
 Protection: IP40
 Weight: 0,2 kg
 Fixing elements: with two screw-type fastening
 Connection: 4,8 x 0,8 mm faston (DIN46247)
 Terminals: 1-2 aux voltage, 3-4 max.limit 5-6 min. limit, 7-8 input

Types:

96vK1

Transistor output:

Output voltage: approx. 24V DC (or approx 12V DC)
 Load: min.160 Ω at 24V DC (3,6W)
 min. 80 Ω at 12V DC (1,8W)
 Protection: against overvoltage and short circuit

AMMETERS	Type 96vK1	int. resist Ω
Frame dimensions	96x24mm	
Measuring range	Cat. No. 1470-37	
50 μA	001	6000
100 μA	002	4500
250 μA	004	1000
5 mA	011	3.6
10 mA	013	3.5
20 mA	015	2
25 mA	016	2.4
100 mA	019	0.6
1 A	024	0.06
1.5 A	025	0.04
2.5 A	026	0.024
4 A	027	0.015
6 A	028	0.01
*...A / 50mV	C01	10
*...A / 60mV	C02	12
*...A / 100mV	C03	20
*...A / 150mV	C04	30
*...A / 300mV	C05	60
4-20 mA	005	2.2

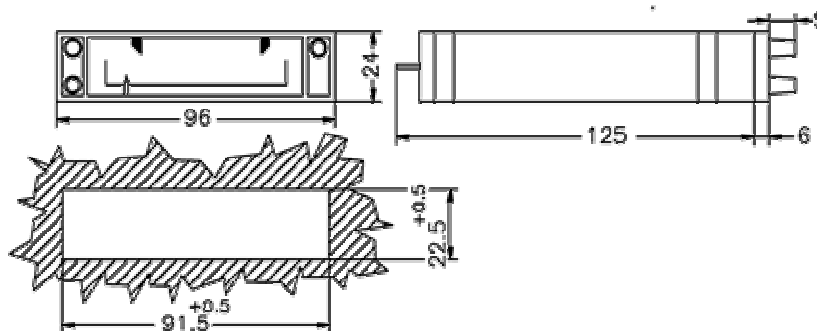
VOLTMETERS	Type 96 vK1	int. resist Ω
Frame dimensions	96x24mm	
Measuring range	Cat. No. 1470-37-	
1 V	036	1000 Ω/V
1.5 V	037	↓
2.5 V	038	
4 V	039	
6 V	040	
10 V	041	
15 V	042	
25 V	043	
40 V	044	
60 V	045	
100 V	046	
150 V	047	

Note: on request types different from tables are accepted

* For connection to separate shunt

For calibration of the instruments 0.035 Ω wire resistance (=2x1m ∅1 mm²) is taken into consideration.

The tolerance of the internal resistance is generally ±20%.



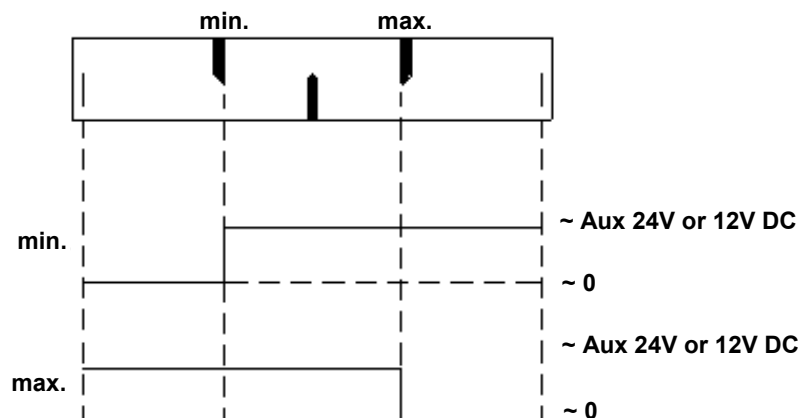
Scale (M=1:1)





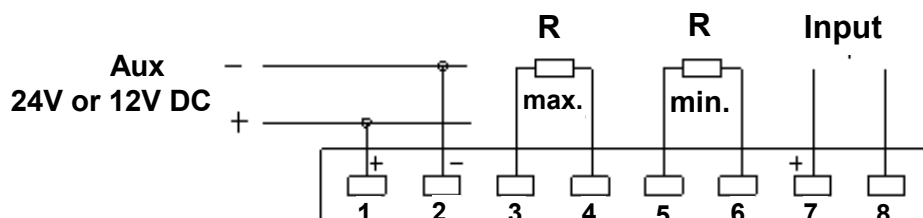
Operation diagram

The output value depends on the position of the pointer



Connection

Transistor output



Order specification:

- Panel mounted ammeter with limit value switch
- Frame size: 96x24 mm.
- Range: 5 mA
- scale: 0 ... 5 mA.
- Aux: 24V DC
- Transistor output

Ordering data:

- Type: 96 vK1
- Cat. No. 1470-37-011



TUBE-TYPE MOVING-COIL INSTRUMENTS



79DA, 119DA, 79DV, 119DV

For measuring DC current or voltage.

Technical data:

Movement: moving-coil
with pivot spring-type bearing.

Instrument case: non-flammable plastic
according to UL 94-V1.

Scale length: 103° resp. 60 mm (79D...) and 97 mm (119D...)

Permanent overloading: 1.2 -fold current resp. voltage.

Class of accuracy: 1.5

Protection: IP40 for instrument case;
IP00 for connection-pins (DIN 40050).



Connection: 4.8x0.8 mm faston (DIN 46247)

Weight: approx. 0.11 kg (79D...); 0.2 kg (119D...)

Instrument mounting: A. on the front side of the assembly-board with frame
B. on the backside of the assembly-board with special frame
C. on the backside of the assembly-board without frame (see on page after next page)

AMMETERS	Type	79DA	119DA
Frame dimensions		80x63 mm	120x90 mm
Measuring range	Cat. No.	1495-12-...	1494-12-...
	Internal resistance (Ω)		
50 μA	200	4000	
100 μA	001	1400	
250 μA	013	1020	
1 mA	031	65	
5 mA	052	5	
10 mA	061	3	
20 mA	070	2.3	
** 25 mA	073	2.3	
** 100 mA	091	0.6	
** 500 mA	112	0.12	
** 1 A	121	0.06	
** 1.5 A	127	0.04	
** 2.5 A	133	0.024	
** 4 A	139	0.015	
** 5 A	142	0.012	
** 6 A	145	0.01	
4...200 mA	146	2.3	
* ...A / 50 mV	148	10	
* ...A / 60 mV	149	12	
* ...A / 100 mV	150	20	
* ...A / 150 mV	151	30	
* ...A / 300 mV	152	60	

* For connection to separate (S-1 type, 60 mV) shunt.
For calibration of the instruments 0.035 Ω wire resistance (=2x1m Ø1 mm²) is taken into consideration.
The tolerance of the internal resistance is generally ±20%.

** Types with external resistance (see on page after next page).

Note: on request types different from tables are accepted

Order specification:

- Tube-type moving-coil ammeter.
- Frame size: 80x63 mm.
- Range: 10 mA.
- Mounting: on front side with frame.

VOLTMETERS	Type 79DV	Type 119DV	
Frame dimensions		80x63 mm	120x90 mm
Measuring range	Cat. No.	1495-12-...	1494-12-...
	Internal resistance (Ω)		
1 V	151		
1.5 V	157		
2.5 V	163		
4 V	169		
6 V	175		
10 V	181		
15 V	187		
20 V	190		
25 V	193		
30 V	196		
40 V	199		
50 V	202		
60 V	205		
80 V	208		
100 V	211		
150 V	217		
200 V	220		
** 250 V	223		
** 300 V	226		
** 400 V	229		
** 500 V	232		
** 600 V	235		

Internal resistance : 1000 Ω/V

**Types with external resistance (see on page after next page). The external resistance may be mounted on the instrument by the factory or mounted by the user anywhere in the installation they use the instrument on request.

Ordering data:

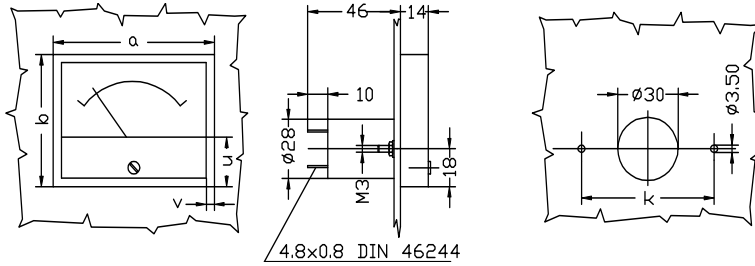
- Tube-type moving-coil ammeter.
- Type: **79DA**
- Cat. No. **1495-12-061**
- Mounting: **Type A.**



TUBE-TYPE INSTRUMENTS MOUNTING

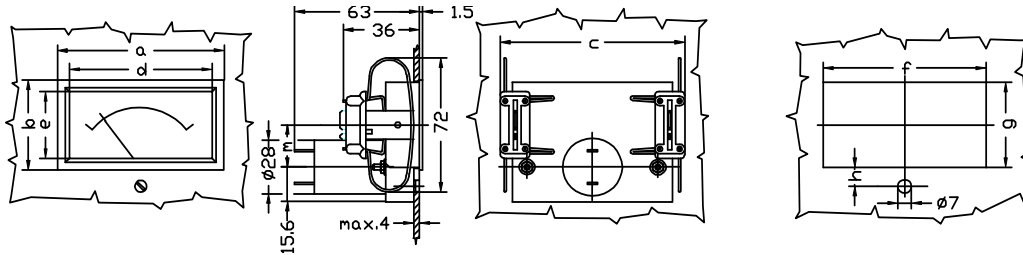


Mounting type: A



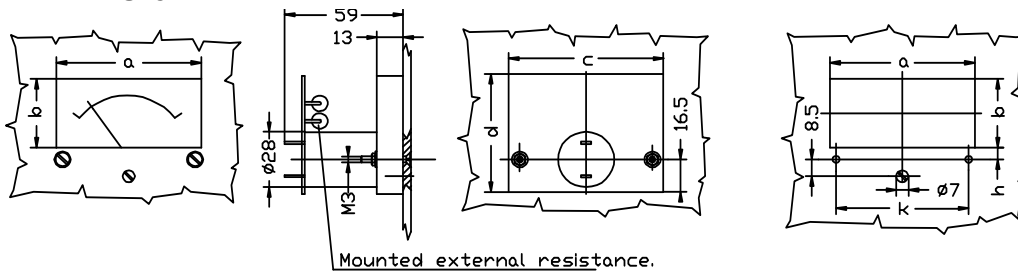
Type \ Dim (mm)	a	b	u	v	k
79...	80	63	23.5	4	66
119...	120	90	31	5	90

Mounting type: B



Type \ Dim (mm)	a	b	c	d	e	f	g	h	m
79...	84	47	93	72	35	82 ^{+0.4}	44.5 ^{+0.4}	9.8	23.5
119...	125	68	123	110	53	122 ^{+0.4}	64.5 ^{+0.4}	16.8	40.5

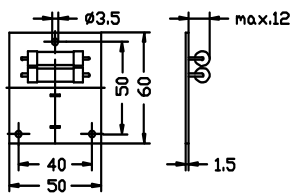
Mounting type: C



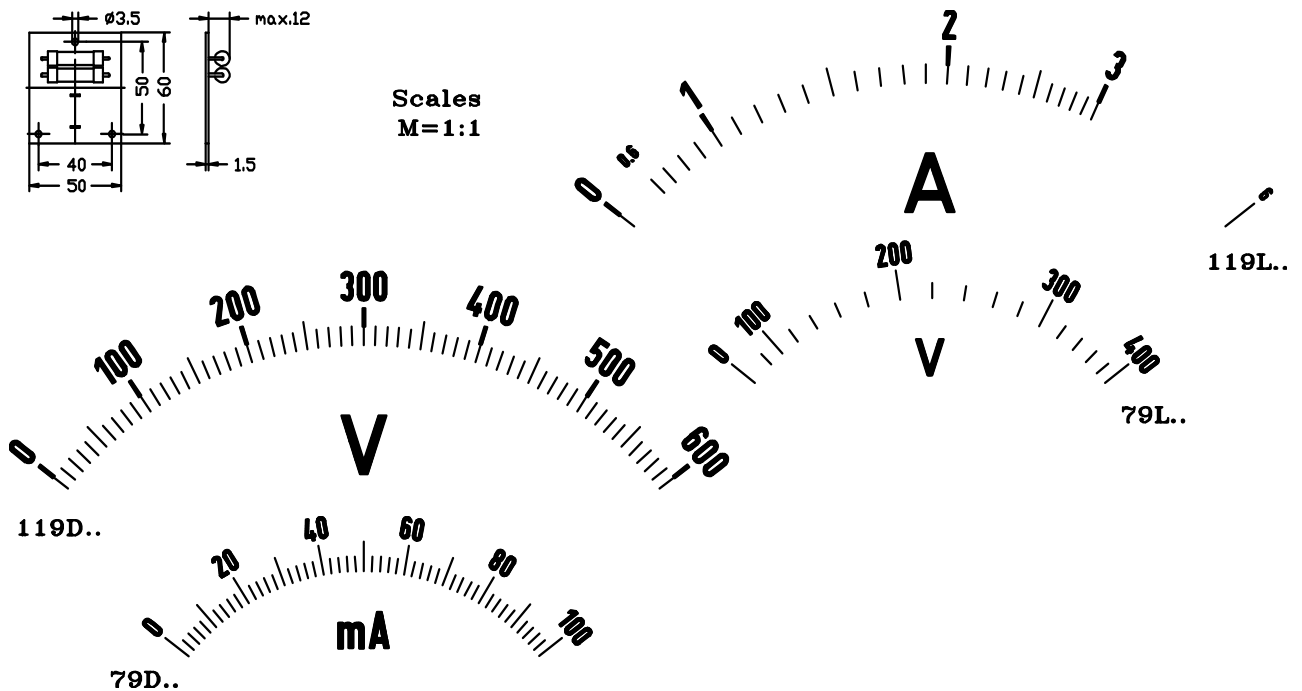
Mounted external resistance.

Type \ Dim (mm)	a	b	c	d	h	m
79...	72	35	77	60	6	66
119...	110	53	117	87	14	90

External resistance



Scales
M=1:1





48cD..., 72cD..., 96cD...144cD

For measuring DC current or voltage

Types 72cD... and 96cD... are with interchangeable scale

Technical data:

Movement: Moving-coil
with pivot spring type bearing

Instrument case: steel-plate/ (144 cD.. plastic)

On request voltmeters as well as ammeters
up to 8 A will be supplied with plastic terminal cover

Scale length: 72 mm/48cD..., 109 mm/ 72 cD...,
140mm/96cD..., 230mm/144 cD

Permanent overloading: 1.2 fold current
respective voltage

Class of accuracy: 1.5

Protection: casing IP50; terminals IP00

Weight: 0.25 kg /48cD...; 0.35 kg /72cD...;
0.5 kg /96cD..., 0.8 kg /144cD

Fixing elements: with two spring-type fastening clips
DIN 43835 "A" / (plastic clips for 144 cD..)



AMMETERS		Metal case			Plastic case
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat No.	Type: 48cDA	Type: 72cDA	Type: 96cDA	Type: 144cDA
		2115-12-...	2038-12-...	2039-12-...	2561-12-...
		Internal Resistance [Ω]	Internal Resistance [Ω]	Internal Resistance [Ω]	Internal Resistance [Ω]
100 μA	001	6200	6200	6200	6200
250 μA	005	2350	2350	2350	2350
1 mA	011	380	380	380	380
5 mA	018	8	8	8	8
10 mA	021	20	20	20	20
20 mA	024	4	4	4	4
25 mA	025	2.4	2.4	2.4	2.4
100 mA	031	0.6	0.6	0.6	0.6
500 mA	038	0.12	0.12	0.12	0.12
1 A	041	0.06	0.06	0.06	0.06
1.5 A	043	0.04	0.04	0.04	0.04
2.5 A	045	0.024	0.024	0.024	0.024
4 A	047	0.015	0.015	0.015	0.015
5 A	048	0.012	0.012	0.012	0.012
6 A	049	0.01	0.01	0.01	0.01
4...20 mA	501	80	80	80	80
*...A / 50 mV	C01	10	10	10	10
*...A / 60 mV	C01	12	12	12	12
*...A / 100 mV	C01	20	20	20	20
*...A / 150 mV	C04	30	30	30	30
*...A / 300 mV	C05	60	60	60	60

* For connection to separate (S-1 type, 60 mV) shunt The calibration of the instruments 0.035 Ω lead-wire (=2x1 m Ø1 mm²) is taken into consideration.

The tolerance of the internal resistance is generally ±20%

Note: on request types different from tables are accepted.

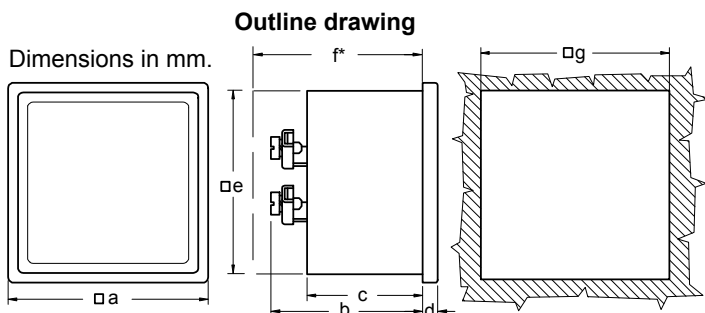


MOVING-COIL INSTRUMENTS WITH 240° CIRCULAR SCALE



VOLTMETERS		Metal case			Plastic case
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat No.	Type: 48cDV	Type: 72cDV	Type: 96cDV	Type: 144cDV
		2115-12-...	2038-12-...	2039-12-...	2561-12-...
		Internal Resistance	Internal Resistance	Internal Resistance	Internal Resistance
1 V	101	1000 Ω/V ↓	1000 Ω/V ↓	1000 Ω/V ↓	1000 Ω/V ↓
1.5 V	103				
2.5 V	105				
4 V	107				
6 V	109				
10 V	111				
15 V	113				
20 V	114				
25 V	115				
30 V	116				
40 V	117				
50 V	118				
60 V	119				
80 V	120				
100 V	121				
150 V	123				
200 V	124				
250 V	125				
300 V	126				
400 V	127				
500 V	128				
600 V	129				

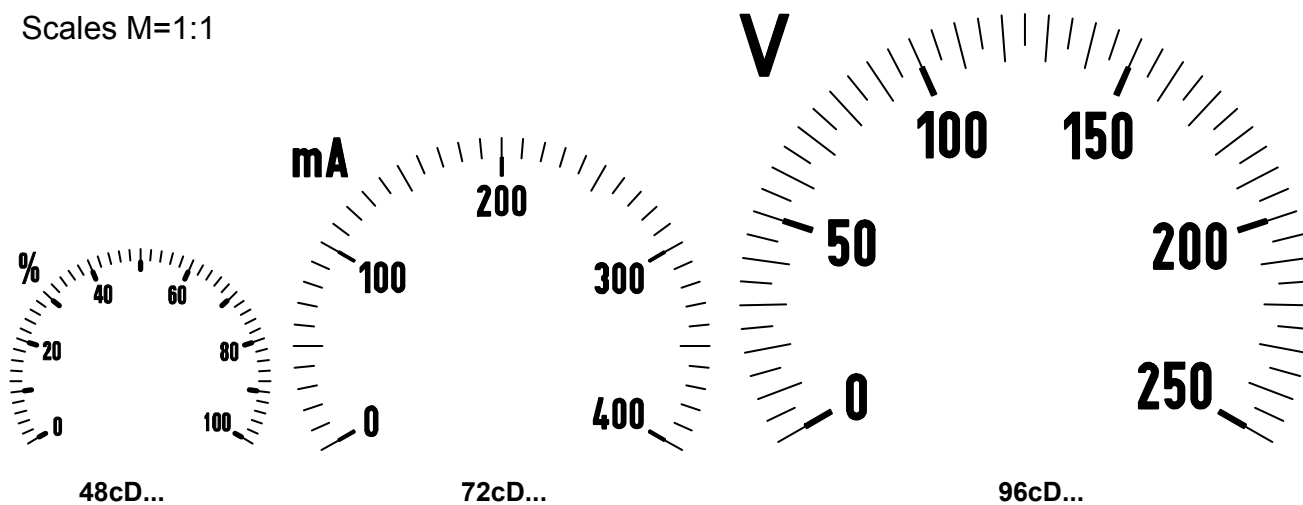
Note: On request orders for types with zero in the middle are accepted. On request types different from tables are accepted.



Type	Dimensions (in mm.)						
	a	b	c	d	e	f*	g
48cD..	48	70	55	5	44	71	45 ^{+0,6}
72cD..	72	60	51	5.5	66	76	68 ^{+0,7}
96cD..	96	60	51	5.5	90	76	92 ^{+0,8}
144cD..	144	59	47	7	137	---	138 ⁺¹

* with terminal cover

Scales M=1:1



Order specification:

- Moving-coil ammeter with 240° circular scale
- Frame dimension: 72x72 mm
- Measuring range: 1 mA

Ordering data:

- Moving-coil ammeter with 240° circular scale
- Type: 72cDA
- Cat No.: 2038-12-011



48sdD

For measuring DC current or voltage on two separate networks simultaneously.

Technical data:

- Movement:** moving-coil with pivot and spring-type bearing
- Instrument case:** steel-plate
- Frame dimension:** 48x48 mm
- Scale length:** 29 mm and 31 mm
- Permanent overloading:** 1.2 -fold current res. voltage
- Class of accuracy:** 2.5
- Protection:** casing IP50; terminals IP00 in accordance with DIN 40050
- Weight:** 0.25 kg
- Fixing elements:** with two screw-type fastening clips (DIN 43835 "B")



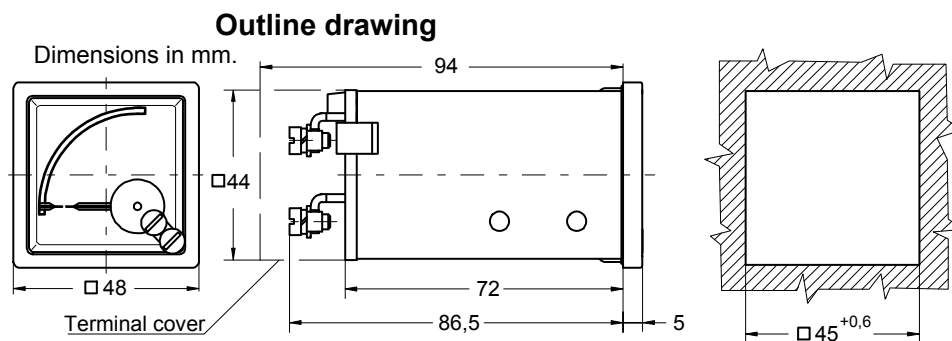
IMPORTANT: the ranges of the two movements are independent from each other.

Current ranges: +/- 50 μ A ... 1A

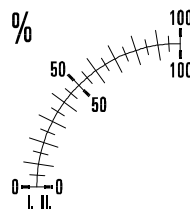
Voltage ranges: +/- 50 mV ... 300V

The tolerance of the internal resistance is generally $\pm 20\%$.

Scales for instruments as requested.



Scale M=1:1



Order specification:

- Moving-coil instrument with double movement
- Frame size: 48x48 mm
- Range: I. 50...0...50 μ A
II. 0 ... 500 μ A
- Scale I. 20 ... 0 ... 20%
II. 0 ... 100%

Ordering data:

- Moving-coil instrument with double movement.
- Type: **48sdD**
- Range: I. 50...0...50 μ A
II. 0 ... 500 μ A
- Scale I. 20 ... 0 ... 20%
II. 0 ... 100%



48DwA, 72DwA, 96DwA, 144DwA 48DwV, 72DwV, 96DwV, 144DwV

For measuring AC current or voltage

Technical data:

Movement: moving-coil, with pivot spring type bearing

Instrument case: non-flammable plastic according to UL 94-V1 or metal on request.

Scale length: 40 mm (48Dw...), 62 mm (72Dw...), 102 mm (96Dw...), 152 mm (144Dw...)

Permanent overloading: 1.2 -fold current res. voltage

Class of accuracy: 1.5 for sinusoidal AC, (calibration is true r.m.s.)

Frequency range: - 15 ... 50 ... 5000 Hz for all voltmeters and ammeters at range of 1 mA to 600 mA,
- 50 ... 60 Hz for ammeters at range of 1 A to 5 A

Weight: 0.2 kg (48Dw...), 0.25 kg (72Dw...), 0.4 kg (96Dw...), 0.8 kg (144Dw...)

Fixing elements: plastic clips or two spring type fastening clips for metal case instruments.

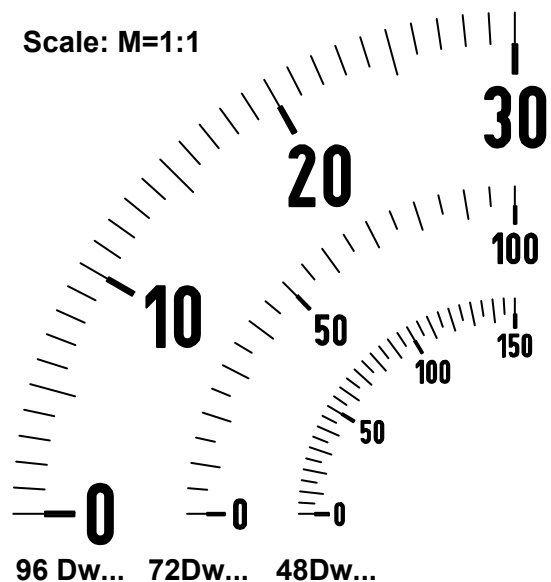


AMMETERS		Plastic case				Metal case		
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	48 DwA	72 DwA	96 DwA	144 DwA	72 DwA	96 DwA	144 DwA
		2076-12-...	2077-12-...	2078-12-...	2670-12-...	2079-12-...	2080-12-...	2499-12-...
Voltage drop or consumption								
1 mA	001	max. 1.2 V	max. 1.2 V	max. 1.2 V	max. 1.2 V	max. 1.2 V	max. 1.2 V	max. 1.2 V
500 mA	014	↓	↓	↓	↓	↓	↓	↓
600 mA	015							
1 A	016	max.0.3VA	max. 0.3 VA	max. 0.3 VA	max. 0.3 VA	max. 0.3 VA	max. 0.3 VA	max. 0.3 VA
1.5 A	017							
2.5 A	018	↓	↓	↓	↓	↓	↓	↓
4 A	019							
5 A	020							
* ... / 1 A	C01							
* ... / 5 A	C02							
** ... / 1 A	C03							
** ... / 5 A	C04							

* with current transformer

** with current transformer and 100% I_n overload scale

Note: on request types different from tables are accepted.





MOVING COIL INSTRUMENTS WITH RECTIFIER FOR AC

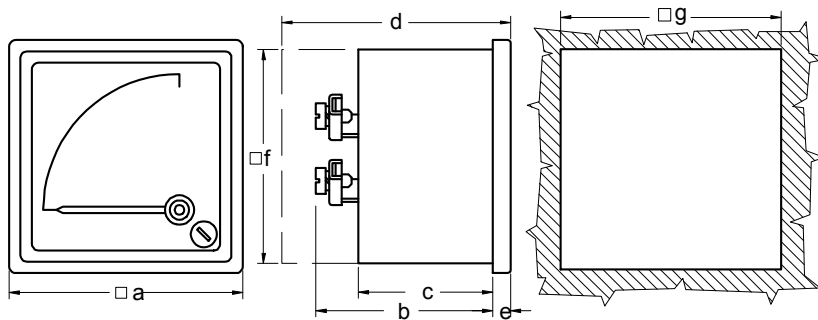


VOLTMETERS		Plastic case				Metal case		
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Cat. No.	48 DwV	72 DwV	96 DwV	144 DwV	72 DwV	96 DwV	144 DwV
		2076-12-	2077-12-	2078-12-	2670-12-	2079-12-	2080-12-	2499-12-
Internal resistance								
6 V	101	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V
10 V	102	↓	↓	↓	↓	↓	↓	↓
15 V	103							
25 V	104							
40 V	105							
60 V	106							
100 V	107							
150 V	108							
250 V	109							
300 V	113							
400 V	110							
500 V	111							
600 V	112							
* ... / 100 V	C05							
* ... / 110 V	C06							

* for connection to voltage transformer

Note: on request types different from tables are accepted.

Outline drawing



Type\Dim. [mm]	a	b1	b2	c1	c2	*d	e	f	g
48 DwA 48DwV	48	52.5	----	41.5	----	62.5	5.5	44	45 ^{+0.6}
72 DwA 72DwV	72	52.5	62	41.5	51	c+25	5.5	66	68 ^{+0.7}
96DwA 96DwV	96	52.5	62	41.5	51	c+25	5.5	90	92 ^{+0.8}
144DwA 144DwV	144		59		47		7	137	138 ⁺¹

b1, c1 refers to plastic case instrument

b2, c2 refers to metal case instrument

* case with terminal cover

Order specification:

- Moving coil ammeter with rectifier for AC
- Frame size: 72x72 mm
- Case: plastic
- Range: 1 A
- Scale: 100A

Ordering data:

- Moving coil ammeter with rectifier for AC
- Type: **72DwA**
- Cat. No.: **2077-12-C01**
- Scale: **0...100A**



45DwA, 45DwV

For measuring AC current or voltage with interchangeable scales

Technical data:

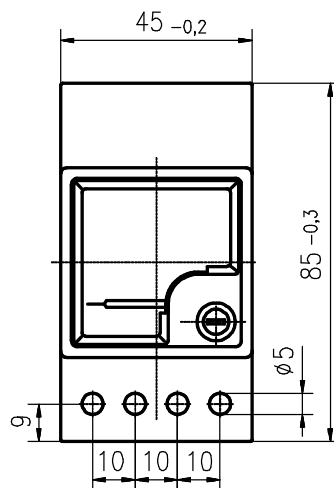
Movement:	moving-coil with pivot spring type bearing
Instrument case:	non-flammable plastics acc. to UL94-V1.
Scale length:	40 mm
Permanent overloading:	1.2 -fold current res. voltage
Class of accuracy:	1.5 for sinusoidal AC, (calibration is true r.m.s.)
Frequency range:	- 15 ... 50 ... 5000 Hz for all voltmeters and ammeters at range of 1 mA to 600 mA, - 50 ... 60 Hz for ammeters at range of 1 A to 5 A
Weight:	0.2 kg
Connections:	screw terminals for cable up to 8 mm ²
Mounting:	rail 35 mm (EN 50022)



AMMETERS

Measuring ranges	Type: 45DwA
	voltage drop or consumption
0- 1mA... ..600mA	max. 1,2 V
0- 1 A... ..5A	max. 0,3 VA
0- 1 A.....5 A	↓
.../1A *	
.../5 A *	

* with current transformer

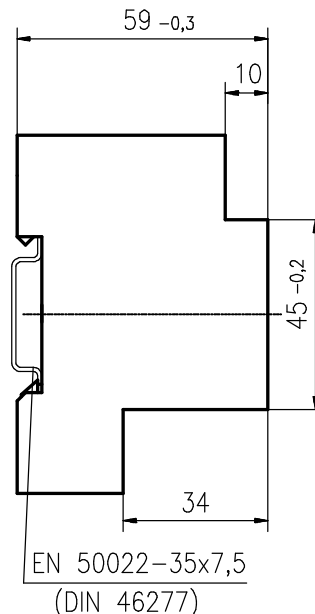


VOLTMETERS

Measuring ranges	Type: 45DwV
	int. resistance
0 - 6 V...600 V	max. 1000 Ω/V
.../100 V **	↓
.../110 V **	

** with voltage transformer

Note: on request types different from tables are accepted



Order specification:

- Moving-coil rail mounted ammeter with rectifier for AC
- Frame size: 45x45 mm
- CT: 100/1 A
- Scale: 0...100A

Ordering data:

- 45DwA
- CT: 100/1 A
- Scale: 0 – 100A



**72spDwA, 96spDwA, 144spDwA
72spDwV, 96spDwV, 144spDwV**

For measuring AC current or voltage

Technical data:

Movement: moving-coil
with pivot spring-type bearing

Instrument case: steel plate

Scale length: 46mm (72sp); 62mm (96sp);
103mm (144sp)

Permanent overloading: 1.2 -fold current res.
voltage

Class of accuracy: 1.5

Protection: casing IP50; terminals IP00 in
accordance with DIN 40050



Weight: approx. 0.2kg (72sp...); 0.5kg (96sp...); 0.8kg (144sp...)

Fixing elements: two spring-type fastening clips (DIN 43 835 "A") for 72sp and 96sp;
and two screw-type fastening clips (DIN 43 835 "B") for 144sp

AMMETERS

Measuring range	Frame dimensions					
	72x36 mm		96x48 mm		144x72 mm	
	72 spDwA Cat. No. 2317-12-...		96 spDwA Cat. No. 2318-12-...		144 spDwA Cat. No. 2319-12-...	
	...	Voltage drop or consumpt.	...	Voltage drop or consumpt.	...	Voltage drop or consumpt.
1 mA	001	max. 1.2 V	001	max. 1.2 V	001	max. 1.2 V
100mA	011	↓	011	↓	011	↓
500 mA	014		014		014	
1 A	016	max. 0.3 VA	016	max. 0.3 VA	016	max. 0.3 VA
1.5 A	017	↓	017	↓	017	↓
2.5 A	018		018		018	
4 A	019		019		019	
5 A	020		020		020	
*... / 1 A	C01		C01		C01	
*... / 5 A	C02		C02		C02	
**... / 1A	C03		C03		C03	
**... / 5A	C04		C04		C04	

* with current transformer, the datas of the CT are required

** with current transformer and 100% I_n overload scale

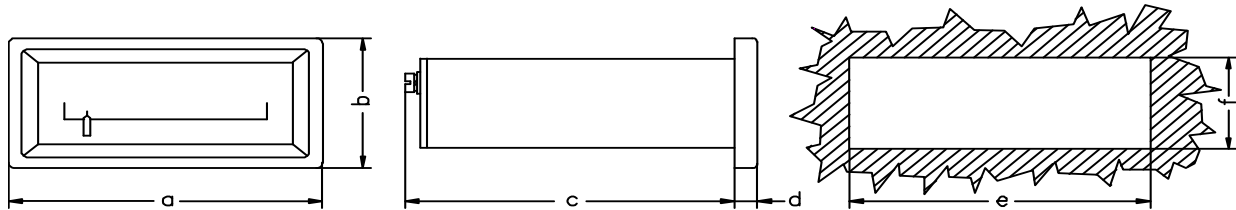
Note: on request types different from tables are accepted

VOLTMETERS

Measuring range	Frame dimensions					
	72x36 mm		96x48 mm		144x72 mm	
	Type 72 spDwV Cat. No. 2317-12-...		Type 96 spDwV Cat. No. 2318-12-...		Type 144 spDwV Cat. No. 2319-12-...	
	...	Internal Resistance	...	Internal Resistance	...	Internal Resistance
6 V	101	1000 Ω/V	101	1000 Ω/V	101	1000 Ω/V
10 V	102	↓	102	↓	102	↓
15 V	103		103		103	
25 V	104		104		104	
30 V	114		114		114	
40 V	105		105		105	
60 V	106		106		106	
100 V	107		107		107	
150 V	108		108		108	
250 V	109		109		109	
300 V	115		115		115	
400 V	110		110		110	
500 V	111		111		111	
600 V	112		112		112	
*.../ 100 V	C05		C05		C05	
*.../ 110 V	C06	C06	C06	C06	C06	C06

* the datas of the voltage transformer are required

Note: on request types different from tables are accepted



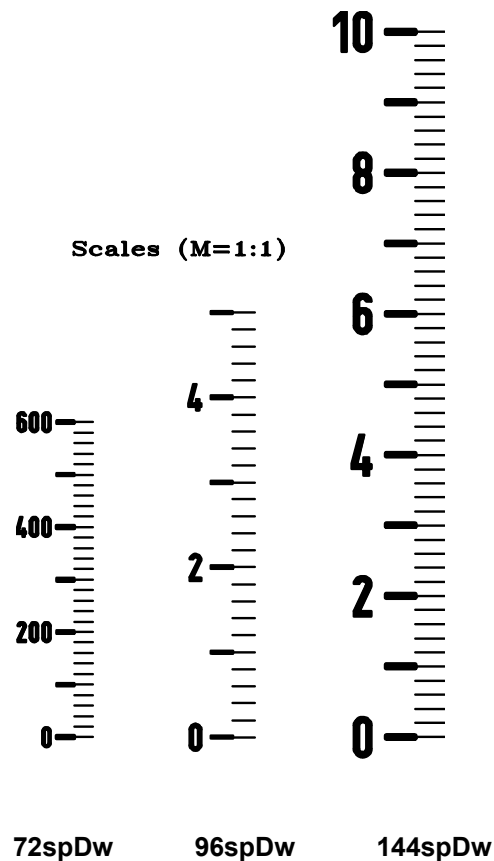
Type\Dim. [mm]	a	b	c	d	e	f
72 spDwA 72 spDwV	72	36	105	5.5	68 ^{+0.7}	33 ^{+0.7}
96 spDwA 96 spDwV	96	48	125	7	92 ^{+0.7}	44 ^{+0.7}
144 spDwA 144 spDwV	144	72	170	8	138 ^{+0.7}	68 ^{+0.7}

Order specification:

- Moving-coil panel voltmeter
- Frame size: 72x36 mm
- Range: 300V
- Scale: 0 ... 300V

Ordering data:

- Moving-coil panel voltmeter
- Type: **72 spDwV**
- Cat. No. **2317-12-115**





48vwA, 72vwA, 96vwA 48vwV, 72vwV, 96vwV

For measuring AC current or voltage.

Technical data:

Movement: moving-coil
with pivot and
spring-type bearing.

Instrument case: non-flammable plastic
acc. to UL 94-V1



Scale length: 28 mm (48vw...), 48 mm (72vw...), 60 mm (96vw...).

Permanent overloading: 1.2 -fold current res. voltage.

Class of accuracy: 1.5 for sinusoidal AC, (calibration is true r.m.s.)

Connection: - 2.8 x 0.5 mm faston (DIN 46247) for types 48vw... and 72vw...
- 4.8 x 0.5 mm faston (DIN 46247) for types 96vw...

Protection: case IP40; terminals IP00 in accordance with DIN 40050.

Weight: 0.15 kg (48vw...); 0.2 kg (72vw...); 0.25 kg (96vw...).

Fixing elements: with two screw-type fastening.

AMMETERS

Measuring range	Frame dimensions					
	48x24 mm		72x24 mm		96x24 mm	
	Type 48 vwA Cat. No. 2320-10-...		Type 72 vwA Cat. No. 2321-10-...		Type 96 vwA Cat. No. 2322-10-...	
	...	Voltage drop or consumpt.	...	Voltage drop or consumpt.	...	Voltage drop or consumpt.
1 mA	001	max. 1.2 V ↓	001	max. 1.2 V ↓	001	max. 1.2 V ↓
100 mA	011		011		011	
500 mA	015		015		015	
1 A	016	max. 0.3 VA ↓	016	max. 0.3 VA ↓	016	max. 0.3 VA ↓
1.5 A	017		017		017	
2.5 A	018		018		018	
4 A	019		019		019	
5 A	020		020		020	
* .../ 1 A	C01		C01		C01	
* .../ 5 A	C02		C02		C02	
** .../ 1A	C03		C03		C03	
** .../ 5A	C04		C04		C04	

* with current transformer

** with current transformer and 100% I_n overload scale.

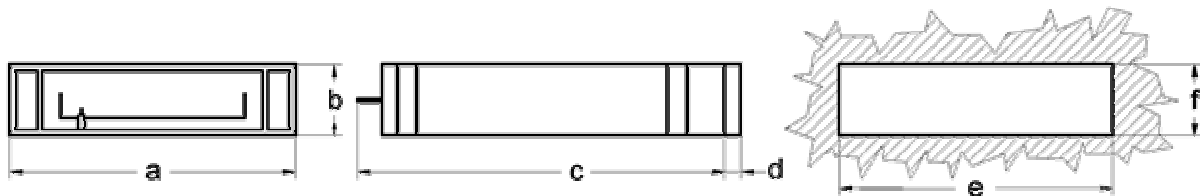
Note: on request types different from tables are accepted

VOLTMETERS

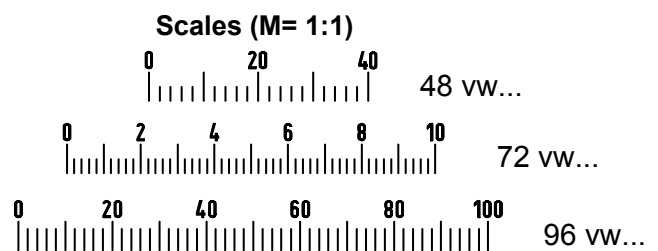
Measuring range	Frame dimensions					
	48x24 mm		72x24 mm		96x24 mm	
	Type 48 vwV Cat. No. 2320-10-...		Type 72 vwV Cat. No. 2321-10-...		Type 96 vwV Cat. No. 2322-10-...	
	...	Internal Resistance	...	Internal Resistance	...	Internal Resistance
6 V	101	1000 Ω/V	101	1000 Ω/V	101	1000 Ω/V
10 V	102	↓	102	↓	102	↓
15 V	103		103		103	
25 V	104		104		104	
40 V	105		105		105	
60 V	106		106		106	
100 V	107		107		107	
150 V	108		108		108	
250 V	109		109		109	
300 V	114		114		114	
400 V	110		110		110	
500 V	111		111		111	
600 V	112		112		112	
* ... / 100V	C05		C05		C05	
* ... / 110V	C06		C06		C06	

* for connection to voltage transformer.

Outline drawing



Type\Dim. [mm]	a	b	c	d	e	f
48 vwA 48 vwV	48	24	67.6	5.3	43.2 ^{+0.3}	22.2 ^{+0.3}
72 vwA 72 vwV	72	24	92	5.3	67 ^{+0.5}	22.2 ^{+0.3}
96 vwA 96 vwV	96	24	125	5.3	91.5 ^{+0.5}	22.5 ^{+0.3}



Note: on request types different from tables are accepted

Order specification:

- Moving-coil panel mounted ammeter with rectifier for AC.
- Frame size: 72x24 mm.
- Range: 1 mA.
- Scale: 0 ... 1 mA.

Ordering data:

- Moving-coil panel mounted ammeter with rectifier for AC.
- Type: **72 vwA**
- Cat. No. **2321-10-001**
- **position:** horizontal



**48cDwA, 72cDwA, 96cDwA, 144cDwA,
48cDwV, 72cDwV, 96cDwV, 144cDwV**

For measuring AC current respective voltage

Technical data:

Movement: moving-coil with pivot spring type bearing

Instrument case: steel-plate.

Scale length: 72mm (48cDw...),
109mm (72cDw...),
140mm (96cDw...),
230mm (144cDw...)

Permanent overloading: 1.2 -fold current
res. voltage

Class of accuracy: 1.5 for sinusoidal AC,
(calibration is true r.m.s.)



Frequency range: -15 ... 50 ... 5000 Hz for all voltmeters
and ammeters at range of 1 mA to 600 mA,
-50 ... 60 Hz for ammeters at range of 1 A to 5 A

Weight: 0.30kg (48cDw...), 0.40 kg (72cDw...),
0.55 kg (96cDw...) 0.80 kg (144cDw...)

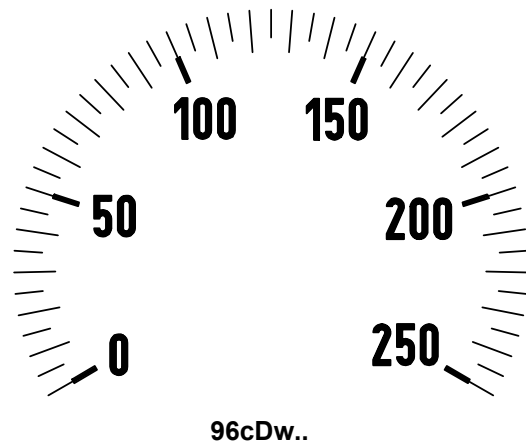
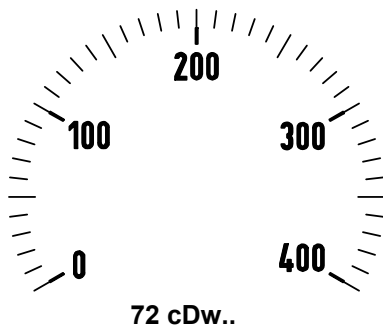
Fixing elements: with two spring type fastening clips (DIN 43 835 "A")

AMMETERS		Frame dimensions			
Measuring range	Cat. No.	Type 48 cDwA	Type 72 cDwA	Type 96 cDwA	Type 144 cDwA
		2120-12-...	2082-12-...	2083-12-...	2544-12-...
Voltage drop or consumpt.					
1 mA	001	max. 1.2 V	max. 1.2 V	max. 1.2 V	max. 1.2 V
100mA	011	↓	↓	↓	↓
500mA	015				
1 A	016	max. 0.3 VA	max. 0.3 VA	max. 0.3 VA	max. 0.3 VA
1.5 A	017				
2.5 A	018	↓	↓	↓	↓
4 A	019				
5 A	020				
* ... / 1A	C01				
* ... / 5A	C02				
** ... / 1A	C03				
** ... / 5A	C04				

* with current transformer

Note: on request types different from tables are accepted

** with current transformer and 100% I_n overload scale.



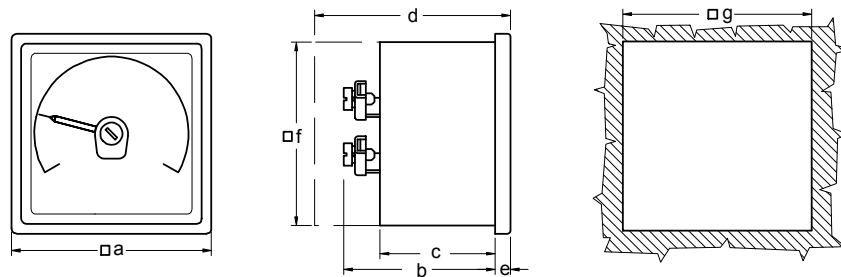


VOLTMETERS		Frame dimensions			
Measuring range	Cat. No.	Type 48 cDwV	Type 72 cDwV	Type 96 cDwV	Type 144 cDwV
		2120-12-...	2082-12-...	2083-12-...	2544-12-...
		Internal Resistance	Internal Resistance	Internal Resistance	Internal Resistance
6 V	101	1000 Ω/V	1000 Ω/V	1000 Ω/V	1000 Ω/V
10 V	102	↓	↓	↓	↓
15 V	103				
25 V	104				
40 V	105				
60 V	106				
100 V	107				
150 V	108				
250 V	109				
300 V	113				
400 V	110				
500 V	111				
600 V	112				
* ... / 100V	C05				
* ... / 110V	C06				

* for connection to voltage transformer

Note: on request types different from tables are accepted

Outline drawing



Type\Dim. [mm]	a	b	c	*d	e	f	g
48cDwA 48cDwV	48	87	72	93	5	44	45 ^{+0.6}
72cDwA 72cDwV	72	60	51	76	5.5	66	68 ^{+0.7}
96cDwA 96cDwV	96	60	51	76	5.5	90	92 ^{+0.8}
144cDwA 144cDwV	144	77	65	.....	7	135	138 ⁺¹

* -case with terminal cover

Order specification:

- Moving coil ammeter with circular 240° scale and rectifier for AC
- Frame size: 72x72 mm
- Range: 1 A

Ordering data:

- Moving coil ammeter with circular 240° scale and rectifier for AC
- Type: **72cDwA**
- Cat. No. **2082-12-016**



MAXIMUM DEMAND AMMETERS



72Be, 72BLE, 96Be, 96BLE

For measuring the maximum current in period of 8 or 15 min. The red slave maximum pointer remains always at the maximum. The pointer can be resetted by the white reset knob on the front. The 72 and 96 mm sized instruments have interchangeable scales.

Technical data:

Ranges:
 1A + 20% = 1.2A (bimetal)
 5A + 20% = 6A (bimetal)
 1A + 100% overload – moving iron
 5A + 100% overload – moving iron

Class of accuracy: ±3 % for bimetal (B)
 ±1.5 % for moving-iron (BL)

Installation Categories: 300V CAT III.

Case: - plastic, non flammable, UL 94-V1

Fixing elements: Two M3 screws



Type >		72Be	72BLE	96Be	96BLE
Frame dimensions (mm)		72x72	72x72	96x96	96x96
Scale length (mm)		61	42(B), 61(L)	96	69(B), 96(L)
Weight (kg)		0,2	0,3	0,25	0,3
case		plastic			
Ranges		.../5A* or .../1A* (with 20% overload)			
Response time		8 or 15 min			
Consumption (VA)		2,5	3	2,5	3
Scale end range	bimetal (B)	120%	120%	120%	120%
	moving-iron(L)	-	200%	-	200%

* For current transformer connection

Note: On request orders for types different from table are accepted

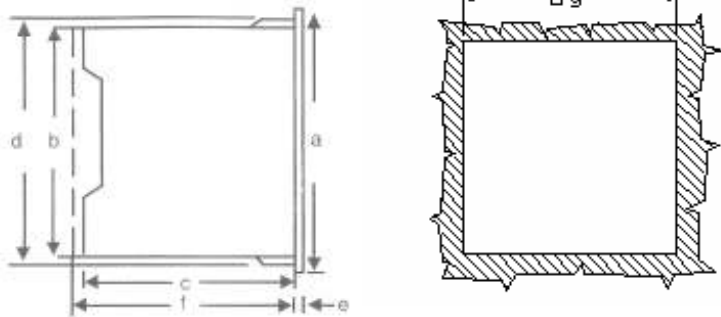
Scales for CT use		
Primary current of the CT		
10 A	125 A	1200 A
15 A	150 A	1250 A
20 A	200 A	1500 A
25 A	250 A	1600 A
30 A	300 A	2000 A
40 A	400 A	2500 A
50 A	500 A	3000 A
60 A	600 A	4000 A
75 A	750 A	5000 A
80 A	800 A	6000 A
100 A	1000 A	8000 A



MAXIMUM DEMAND AMMETERS



Outline drawing

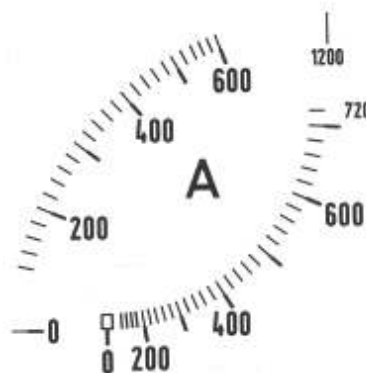
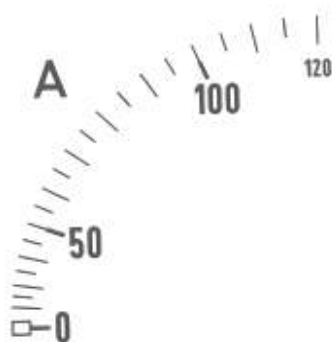


Type	Dimensions mm						
	a	b	c	d	e	f*	g
72Be, 72BLE	72	66	53	67,5	5,5	64	68 ^{+0.7}
96Be, 96BLE	96	90	53	91,5	5,5	64	92 ^{+0.8}

* Depth with back cover

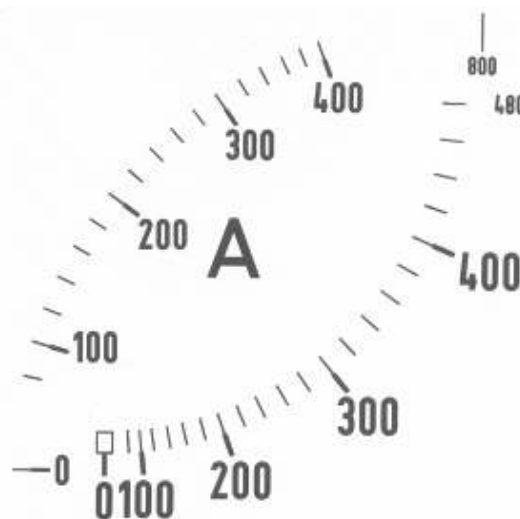
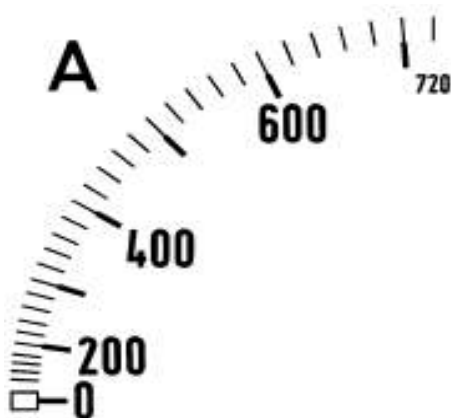
72Be

72BLE



96Be

96BLE



Order specification:

- Bimetal + moving-iron movement instrument.
- Frame dimensions: 96x96 mm
- Range: 6 A
- Response time: 15 min
- CT: 400/5A

Ordering data:

- Bimetal + moving-iron movement instrument.
- type: 96BLE
- Range: 6 A
- Response time: 15 min
- CT: 400/5A, scale: 0-400/480A



MAXIMUM DEMAND AMMETERS



48B, 48BL, 72B, 72BL, 96B, 96BL

For measuring the maximum current in period of 8 or 15 min. The red slave maximum pointer remains always at the maximum. The pointer can be resetted by the white reset knob on the front. The 72 and 96 mm sized instruments have interchangeable scales.

Technical data:

Ranges:
 1A + 20% = 1.2A (bimetal)
 5A + 20% = 6A (bimetal)
 1A + 100% overload – moving iron
 5A + 100% overload – moving iron

Class of accuracy: ±3 % for bimetal (B)
 ±1.5 % for moving-iron (BL)

Case:
 - steel plate, black colour
 - plastic, non flammable, UL 94-V1



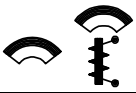
Fixing elements: 48 mm and 72 mm instruments with two spring type fastening clips (DIN 43835A)
 96 mm with two screw type fastening clips

Type >	48B	48BL	72B	72BL	96B	96BL
Frame dimensions (mm)	48x48	48x48	72x72	72x72	96x96	96x96
Scale length (mm)	35	27	60	60(B), 42(L)	95	95(B), 72(L)
Weight (kg)	0,15	0,2	0,3	0,35	0,25	0,3
case	metal			plastic		
Ranges	.../5A* or .../1A* (with 20% overload)					
Response time	8 or 15 min					
Consumption (VA)	2,5	3	2,5	3	2,5	3
Scale end range	bimetall (B)	120%	120%	120%	120%	120%
	moving-iron(L)	-	200%	-	200%	200%

* For current transformer connection

Note: On request orders for types different from table are accepted

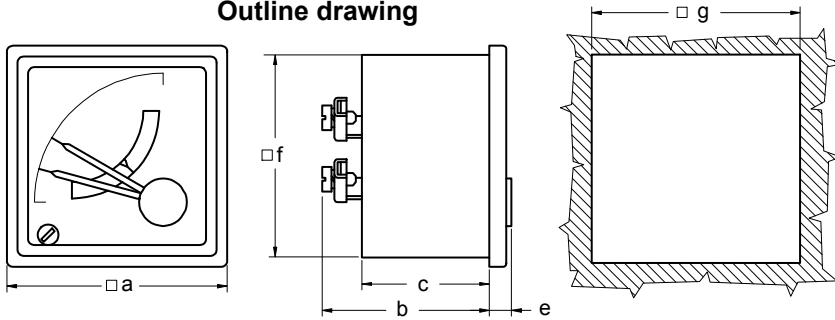
Scales for CT use		
Primary current of the CT		
10 A	125 A	1200 A
15 A	150 A	1250 A
20 A	200 A	1500 A
25 A	250 A	1600 A
30 A	300 A	2000 A
40 A	400 A	2500 A
50 A	500 A	3000 A
60 A	600 A	4000 A
75 A	750 A	5000 A
80 A	800 A	6000 A
100 A	1000 A	8000 A



MAXIMUM DEMAND AMMETERS



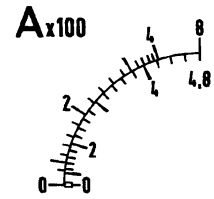
Outline drawing



Scale 48B

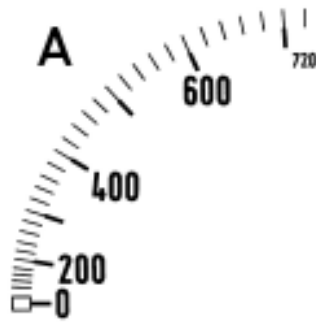


Scale 48BL

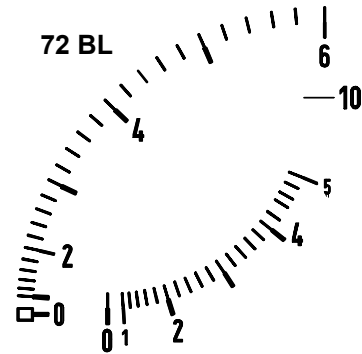


Type	Dimensions mm					
	a	b	c	e	f	g
48B	48	67	53	5,5	44	45 ^{+0.6}
48BL	48	98	83	5,5	44	45 ^{+0.6}
72B, 72BL	72	64	51	6	66	68 ^{+0.7}
96B, 96BL	96	52	37	5,5	90	92 ^{+0.8}

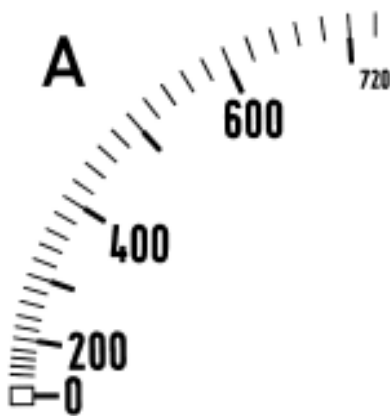
72B



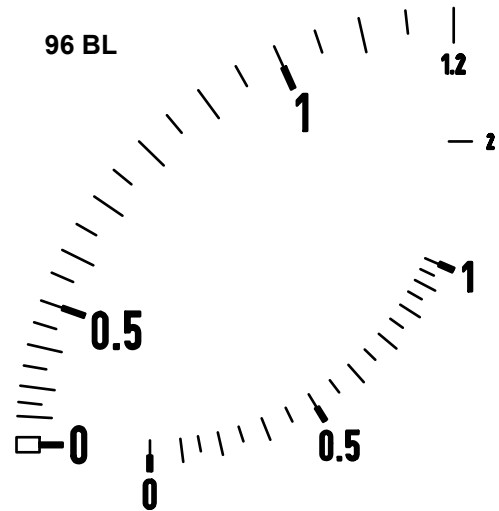
72 BL



96B



96 BL



Order specification:

- Bimetal + moving-iron movement instrument.
- Frame dimensions: 96x96 mm
- Range: 6 A
- Response time: 15 min
- CT: 400/5A

Ordering data:

- Bimetal + moving-iron movement instrument.
- type: 96BL
- Range: 6 A
- Response time: 15 min
- CT: 400/5A, scale: 0-400/480A



45B

For measuring the maximum current in period of 8 or 15 min.
 The red slave maximum pointer remains always at the maximum.
 The pointer can be resetted by the white reset knob on the front.
 The instruments have interchangeable scales.

Technical data:

Ranges: 1A + 20%= 1.2A
 5A + 20%= 6A

Class of accuracy: ±3 %

Case: plastic, non flammable, UL 94-V1

Connections: screw terminals for cable up to 8 mm²

Mounting: rail 35 mm (EN 50022)

Weight: max. 0.2 kg



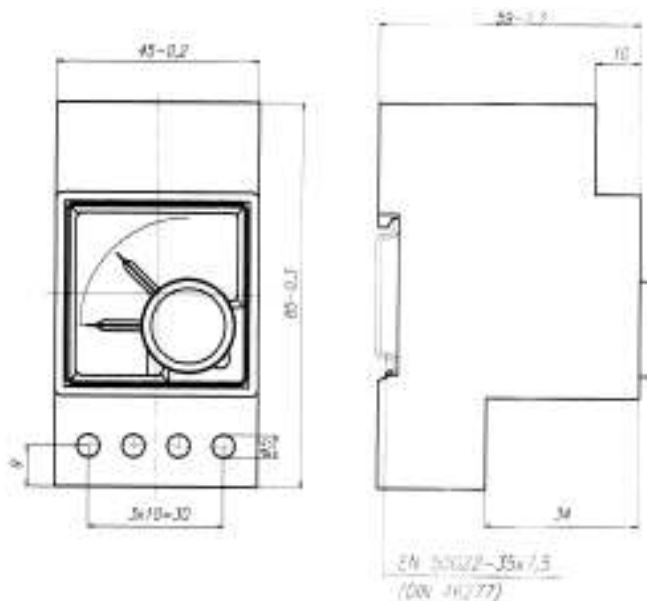
AMMETERS

Meas. range	Frame dimensions	
	45x45 mm	
	Type: 45B	
	Response time	consumption.
* ■ ... /1 A	8 min	3 VA
* ■ ... /1 A	15 min	3 VA
* ■ ... /5 A	8 min	3 VA
* ■ ... /5 A	15 min	3 VA

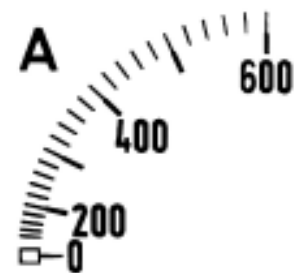
- Standard ranges.
- * for use with current transformers

Note: On request orders for types different from table are accepted.

Scales for CT. use		
Primary currents of the CT		
10 A	125 A	1200 A
15 A	150 A	1250 A
20 A	200 A	1500 A
25 A	250 A	1600 A
30 A	300 A	2000 A
40 A	400 A	2500 A
50 A	500 A	3000 A
60 A	600 A	4000 A
75 A	750 A	5000 A
80 A	800 A	6000 A
100 A	1000 A	8000 A



Scale M=1:1





48P, 72P, 96P, 96PP, 144P, 144PP

For measuring frequency in sinusoidal AC circuits

Technical data:

- Movement:** Vibrating-reed movement with reeds tuned to 1/2 Hz
- Instrument case:** steel-plate
- Scale:** 1/2 Hz subdivisions, (the smallest readable value is 1/4 Hz)
- Number of vibrating reeds:** 13 or 21 reeds depending on the measuring range
- Class of accuracy:** 0.5
- Consumption:** max. 1.5 VA
- Rated voltages:** 100...115 V, 230 V, 400 V, 500 V
- Protection:** casing IP50; adapter box IP20 and terminals IP00
- Weight:** 0.2 kg /48P; 0.35 kg /72P; 0.4 kg /96P; 0.5 kg /96PP; 0.7 kg /144P; 0.9 kg /144PP

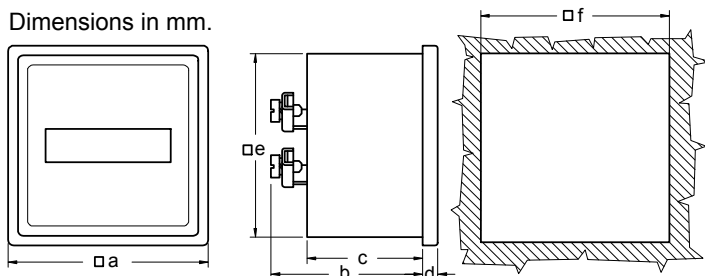


Fixing elements: with two screw-type fastening clips (DIN 43835 "B")

Measuring range	Rated voltage	Frame dimensions					
		48x48 mm	72x72 mm	96x96 mm	144x144 mm	96x96 mm	144x144 mm
		single movement				double movement	
		Type: 48P	Type: 72P	Type: 96P	Type: 144P	Type: 96PP	Type: 144PP
47 ... 53 Hz (13 res. 2x13 vibration reeds)	110 ... 115 V	x	x	x	x	x	x
	230 V	x	x	x	x	x	x
	400 V	x	x	x	x	x	x
	500 V	----	x	x	x	x	x
45 ... 55 Hz (21 res. 2x21 vibration reeds)	100 ... 115 V	----	x	x	x	x	x
	230 V	----	x	x	x	x	x
	400 V	----	x	x	x	x	x
	500 V	----	x	x	x	x	x
57 ... 63 Hz (13 res. 2x13 vibration reeds)	100 ... 115 V	x	x	x	x	x	x
	230 V	x	x	x	x	x	x
	400 V	x	x	x	x	x	x
	500 V	----	x	x	x	x	x
55 ... 65 Hz (21 res. 2x21 vibration reeds)	100 ... 115 V	----	x	x	x	x	x
	230 V	----	x	x	x	x	x
	400 V	----	x	x	x	x	x
	500 V	----	x	x	x	x	x

Outline drawing

Dimensions in mm.



Note: on request types different from tables are accepted

Type	Dimensions (in mm.)					
	a	b	c	d	e	f
48P	48	62	47	5	44	45 ^{+0,6}
72P	72	60	48	6	66	68 ^{+0,7}
96P, 96PP	96	56	44	6	90	92 ^{+0,8}
144P, 144PP	144	75	65	8	136	138 ⁺¹

Order specification:

- Vibrating reed frequency meter
- Frame dimension: 72x72 mm
- Measuring range: 47 ... 53 Hz
- Rated voltage: 100 - 115 V

Ordering data:

- Vibrating reed frequency meter
- Type: 72P 47-53 Hz 100-115 V



45P

For measuring frequency in sinusoidal AC circuits

Technical data:

Movement: Vibrating-reeds, tuned to 1/2 Hz
Instrument case: non-flammable plastic acc. to UL 94-V1.
Scale: 1/2 Hz subdivisions (smallest readable value 1/4 Hz)
Number of vibrating reeds: 13
Class of accuracy: 0.5
Consumption: max. 1.5 VA
Protection: case IP50; terminals IP00
Weight: 0.2 kg
Connections: screw terminals for cable up to 8mm²
Mounting: rail 35 mm (EN 50022)

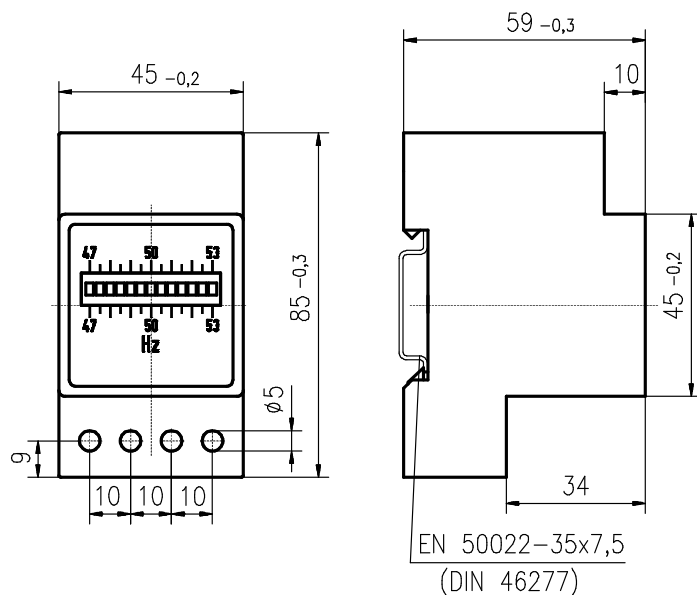


Measuring ranges:	Rated voltage	Type: 45 P
47...50...53 Hz	100V, 110V, 115V	x
	230V	x
	400V	x
57...60...63 Hz	100V, 110V, 115V	x
	230V	x
	400V	x

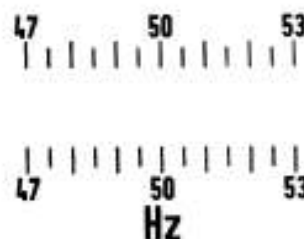
Note: on request types different from tables are accepted

Outline drawing

Dimension in mm



Scale 45P



Order specification:

- Vibrating reed frequency meter
- Frame size: 45x45 mm
- Range: 47...53 Hz
- Rated voltage: 230 V

Ordering data:

45P 47...53 Hz 230 V



MOVING COIL FREQUENCY METERS



48DPe, 72DPe, 96DPe, 144 DPe

For measuring frequency in sinusoidal AC circuits

Technical data:

Movement: moving-coil with pivot and spring-type bearing

Instrument case: non-flammable plastic according to UL 94-V1

Scale length: 40 mm (48DPe) , 62 mm (72DPe) ,
85 mm (96DPe) 152 mm (144DPe)

Class of accuracy: 0.5

Consumption: max. 10mA

Weight: 0.2 kg (48DPe) , 0.25 kg (72DPe) ,
0.4 kg (96DPe) 0.6 kg (144DPe)

Fixing elements with two screw-type (M3)

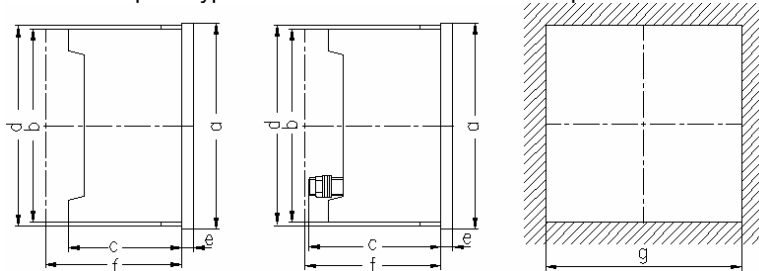


Accessorie:

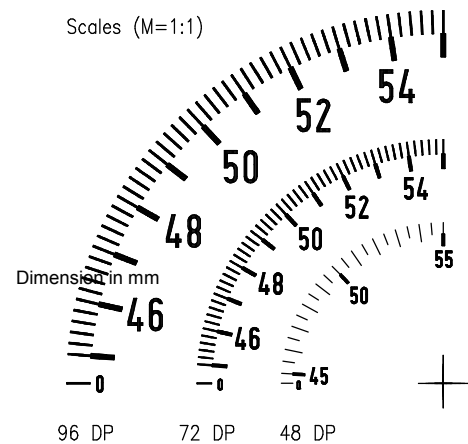
Terminal protection: Full sized polycarbonate back cover

Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Rated voltage	Type 48 DPe	Type 72 DPe	Type 96 DPe	Type 144 DPe
45...50...55 Hz	100 V	x	x	x	x
	115 V	x	x	x	x
	127 V	x	x	x	x
	230 V	x	x	x	x
	400 V	x	x	x	x
55...60...65 Hz	100 V	x	x	x	x
	115 V	x	x	x	x
	127 V	x	x	x	x
	230 V	x	x	x	x
	400 V	x	x	x	x
360...400...440 Hz	100 V	x	x	x	x
	115 V	x	x	x	x
	127 V	x	x	x	x
	230 V	x	x	x	x
	400 V	x	x	x	x
	500 V	—	x	x	x

Note: on request types different from tables are accepted



Type\	a	b	c	d	e	f	g
48DPe	48	43,5	53	44,5	5,5	64	45 ^{+0.6}
72DPe	72	66	53	67,5	5,5	64	68 ^{+0.7}
96DPe	96	90	53	91,5	5,5	64	92 ^{+0.8}
144DPe	144	136	53	137,5	5,5	64	138 ⁺¹



Order specification:

- Moving coil frequency meter
- Frame size: 96x96 mm
- Range: 45...50...55 Hz
- Rated voltage: 230 V

Ordering data:

96 DPe 45...50...55 Hz 230 V



MOVING COIL FREQUENCY METERS



48DP, 72DP, 96DP, 144 DP

For measuring frequency in sinusoidal AC circuits

Technical data:

Movement: moving-coil with pivot and spring-type bearing

Instrument case: non-flammable plastic according to UL 94-V1

Scale length: 40 mm (48DP) , 62 mm (72DP) ,
85 mm (96DP) 152 mm (144DP)

Class of accuracy: 0.5

Consumption: max. 10mA

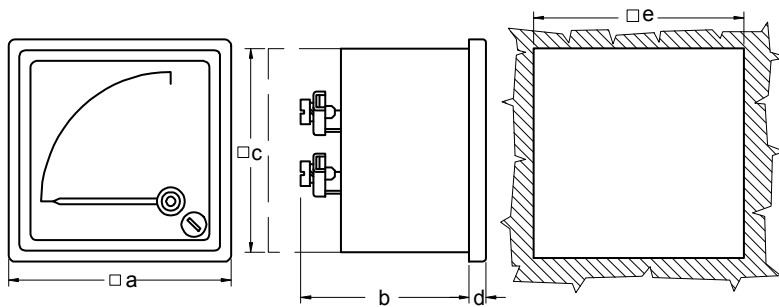
Weight: 0.2 kg (48DP) , 0.25 kg (72DP) ,
0.4 kg (96DP) 0.6 kg (144DP)

Fixing elements: plastic clips



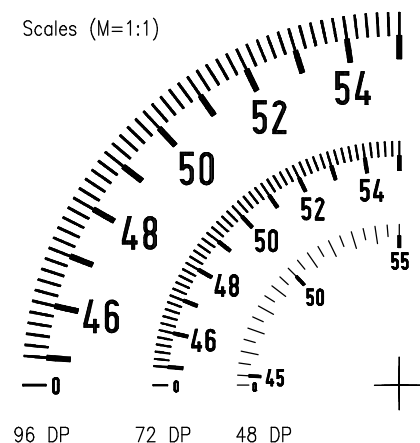
Frame dimensions		48x48 mm	72x72 mm	96x96 mm	144x144 mm
Measuring range	Rated voltage	Type 48 DP	Type 72 DP	Type 96 DP	Type 144 DP
45...50...55 Hz	100 V	x	x	x	x
	115 V	x	x	x	x
	127 V	x	x	x	x
	230 V	x	x	x	x
	400 V	x	x	x	x
	500 V	—	x	x	x
55...60...65 Hz	100 V	x	x	x	x
	115 V	x	x	x	x
	127 V	x	x	x	x
	230 V	x	x	x	x
	400 V	x	x	x	x
	500 V	—	x	x	x
360...400...440 Hz	100 V	x	x	x	x
	115 V	x	x	x	x
	127 V	x	x	x	x
	230 V	x	x	x	x
	400 V	x	x	x	x
	500 V	—	x	x	x

Note: on request types different from tables are accepted



Type	Dimensions [mm]				
	a	b	c	d	e
48 DP	48	58	45	5,5	45 ^{+0.6}
72 DP	72	58	67	5,5	68 ^{+0.7}
96 DP	96	58	91	5,5	92 ^{+0.8}
144 DP	144	70	137	7	138 ⁺¹

Scales (M=1:1)



Order specification:

- Moving coil frequency meter
- Frame size: 96x96 mm
- Range: 45...50...55 Hz
- Rated voltage: 230 V

Ordering data:

96 DP 45...50...55 Hz 230 V



45DP

For measuring frequency in sinusoidal AC circuits

Technical data:

Movement:	moving-coil with pivot and spring-type bearing
Instrument case:	non-flammable plastic according to UL 94-V1
Scale length:	40 mm
Class of accuracy:	0.5
Consumption:	max. 10 mA
Weight:	0.2 kg
Connections:	screw terminals for cable up to 8 mm ²
Mounting:	rail 35 mm (EN 50022)

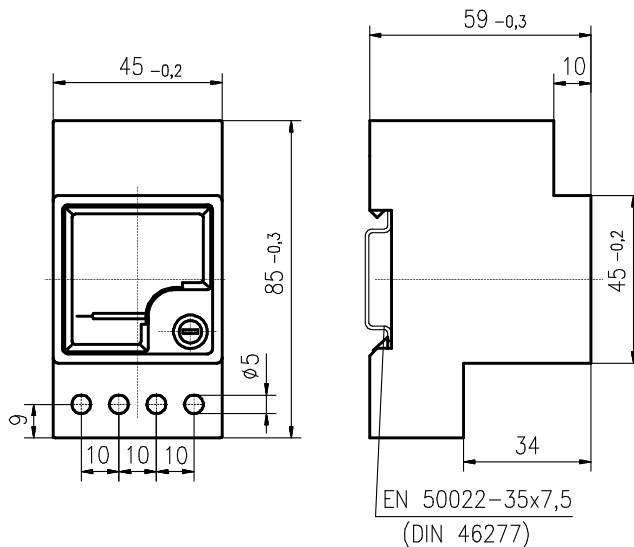
Measuring ranges:	Rated voltage	Type: 45 DP
45...50...55 Hz	100V, 110V, 115V	x
	230V	x
	400V	x
55...60...65 Hz	100V, 110V, 115V	x
	230V	x
	400V	x
360...400...440 Hz	100V, 110V, 115V	x
	230V	x
	400V	x



Scale 45DP



Outline drawing



Order specification:

- Moving coil rail-mounted frequency meter
- Frame size: 45x45 mm
- Range: 45...50...55 Hz
- Rated voltage: 230 V

Ordering data:

45 DP 45...50...55 Hz 230 V

Note: on request types different from tables are accepted.



MOVING-IRON DOUBLE VOLTMETERS



96spLVV, 144spLVV

For measuring AC voltage in two networks simultaneously.

Technical data:

- Movement:** moving-iron with spring-type oil filled bearing, practically vibration-free oil damping.
- Instrument case:** steel plate
- Frame dimensions:** 96 x 96 mm, 144 x 144 mm.
- Scale length:** 2x 62 mm 2 x 103 mm.
- Permanent overloading:** 1.2 -fold voltage.
- Class of accuracy:** 1.5
- Frequency range:** 15 ... 50 ... 100 Hz.
- Weight:** 0.7 kg (96spLVV) , 1. 2 kg (144spLVV) .
- Fixing elements:** with two screw-type fastening clips (DIN 43 835 "B")

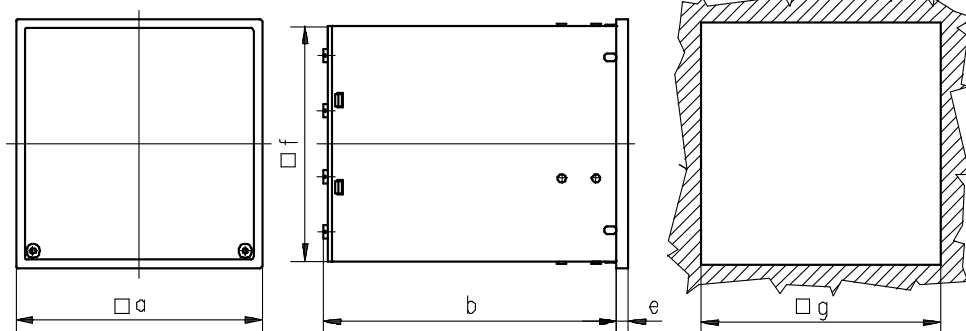


Frame dimensions		VOLTMETERS	
	Type:	96spLVV	144spLVV
Meas. range	Cat.No.	1714-13-...	2528-13-...
		Consumption	Consumption
100 V	-013	max. 2 x 3 VA	max. 2 x 3 VA
120 V	-015		
150 V	-016		
200 V	-017		
250 V	-019		
300 V	-020		
400 V	-021		
500 V	-022		
600 V	-023		
* .../ 100 V	-C05		
* .../ 110 V	-C06		

* the datas of the voltage transformer are required

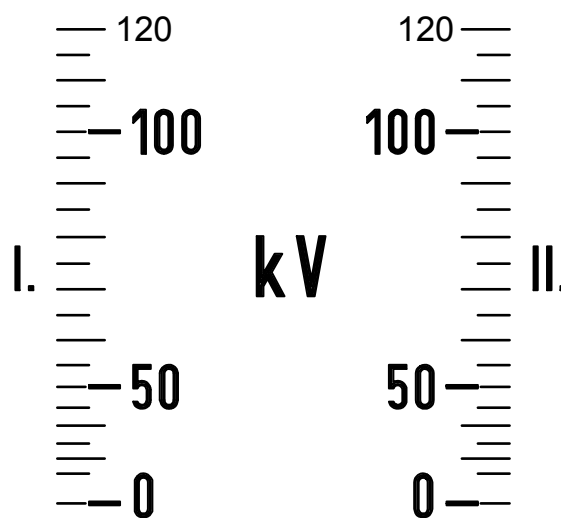
Note: on request orders for types different from table are accepted

Dimension in mm.



Type\Dim. (mm)	a	b	e	f	g
96 spLVV	96	124	6	90	92 + 0,8
144 spLVV	144	170	7	136	138 + 1

Scale M=1:1



96spLVV

Order specification:

- Double voltmeter with moving-iron movement.
- Frame dimensions: 96 x 96 mm.
- VT: 6000 / 100 V.
- Scale: 0...7,2 kV.

Ordering data:

96spLVV.
 VT: 6000/100 V.
 Scale: 2 x 7,2 kV.



MOVING-IRON DOUBLE VOLTMETERS



96LVV, 144LVV

For measuring AC voltage in two networks simultaneously.

Technical data:

- Movement:** moving-iron with spring-type oil filled bearing, practically vibration-free oil damping.
- Instrument case:** steel plate
- Scale length:** 2x51mm (96LVV), 2x72mm (144LVV).
- Permanent overloading:** $1.2 \times U_N$
- Class of accuracy:** 1.5
- Frequency range:** 15 ... 50 ... 100 Hz.
- Consumption:** max. 2 x 3 VA
- Weight:** approx. 0.5kg (96LVV), 0.8kg (144LVV)
- Fixing elements:** two spring-type fastening clips (DIN 43 835 "A").



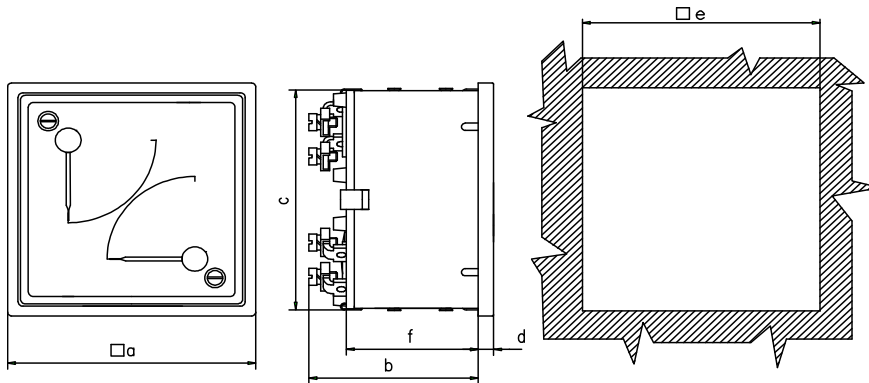
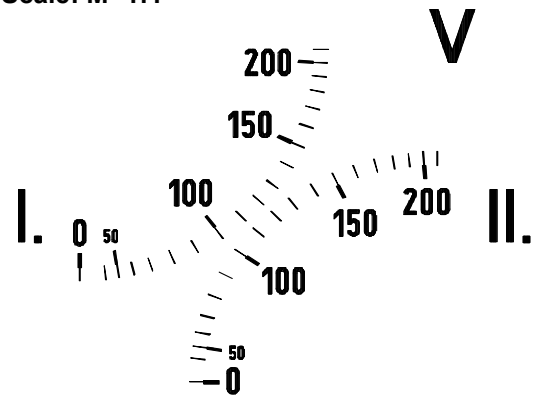
VOLTMETERS		Frame dim.	96x96mm	144x144mm
Measuring range (U_N)	* Full scale	Type: 96LVV	Type: 144LVV	
		Cat. No. 2328-13-...	Cat. No. 2329-13-...	Cat. No. 2329-13-...
2x115 V	2x210 V	-001	-001	
2x230 V	2x420 V	-002	-002	
2x400 V	2x720 V	-003	-003	
2x440 V	2x790 V	-004	-004	
2x500 V	2x900 V	-005	-005	
** ... 100 V		-C05	-C05	
** ... / 110 V		-C06	-C06	

* When nominal voltage is synchronised both pointers will be in the centre

** the datas of the voltage transformer are required

Note: on request orders for types different from table are accepted.

Scale: M=1:1



Type\Dim. (mm)	a	b	c	d	e	f
96LVV	96	65.5	90	6	$92^{+0.8}$	51
144LVV	144	76	135	6	$138^{+1.0}$	64

Order specification:

- Double voltmeter with moving-iron movement
- Frame dimensions: 96 x 96 mm.
- VT: 10000/100V
- Scale: 0-12 KV

Ordering data:

- Double voltmeter type: 96LVV.
- Cat. No: 2328-13-C05
- VT: 10000/100V
- Scale: 0-12 KV



PHASE SEQUENCE INDICATOR



96FS

For indicating the phase sequence in a three-phase system

Technical data:

Direction indicator: Light emitting diode (LED)

Instrument case: steel-plate

Operation frequency: 45-55 Hz

Rated voltage: 100-250 V or 200-600 V

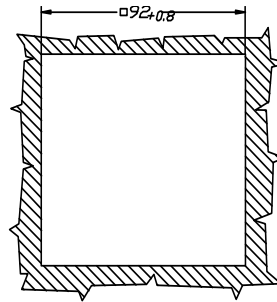
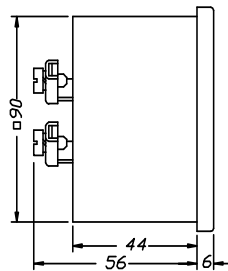
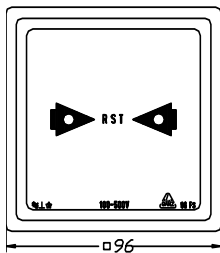
Consumption: approx. 1.7 VA at 400 V

Weight: approx. 0.3 kg

Fixing elements: with two spring-type fastening clips (DIN 43835 "A")



Type	96 FS
Measuring range	Cat. No. 2032-99-...
100-250 V	001
200-600 V	002



Order specification:

- Phase sequence indicator
- Operation frequency: 45-55 Hz
- Rated voltage: 200-600 V

Ordering data:

- Phase sequence indicator
- Type: **96FS**
- Cat. No.: **2032-99-002**



ZERO VOLTMETER



96LV0, 144LV0

The instruments are used as synchroscope. At equal voltage and frequency the instrument will indicate zero when the two circuits are in phase.

Technical data:

Movement: moving-iron movement with spring-type oilfilled bearing, vibration-free oil damping

Instrument case: steel-plate

Overload: 200 % of rated voltage

Class of accuracy: 1.5

Operation frequency: 15...50...100 Hz

Consumption: approx. 3 VA at middle scale pointer position

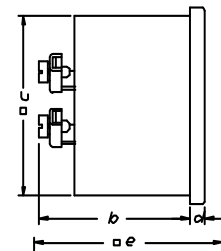
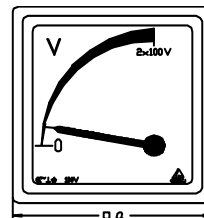
Weight: approx. 0.35 kg (96LV0), 0.8 kg (144LV0)

Fixing elements: with two spring-type fastening clips (DIN 43835 "A")

Note: scale enlargement near zero indication



Frame dimension		96x96 mm	144x144 mm
Rated voltage	Type	96 LV0	144 LV0
		Cat. No.	2010-13-...	2011-13-...
Full scale indication			
100:√3 V	001		115 V
100 V	002		200 V
110:√3 V	003		127 V
115 V	004		230 V
230 V	005		460 V
400 V	006		800 V
440 V	007		880 V



Type	Dimensions in mm				
	a	b	c	d	e
96LV0	96	62	90	5.5	92 ^{+0.8}
144LV0	144	85	136	9.5	138 ^{+1.0}

- Order specification:**
- Zero voltmeter
 - Frame dimension: 144x144 mm
 - Rated voltage: 400 V

- Ordering data:**
- Zero voltmeter
 - Type: 144 LV0
 - Cat. No.: **2011-13-006**



96 FW..., 144sFW...

For measuring active and reactive power in single-phase or three-phase networks

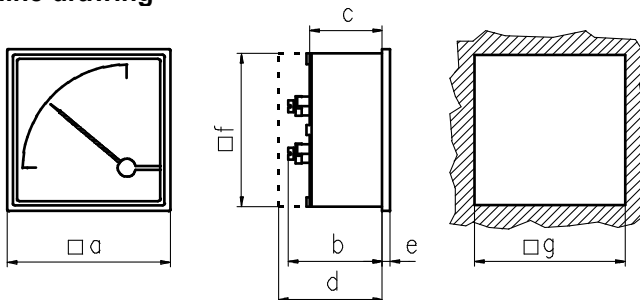
Technical data:

Movement: Iron-core, ferrodynamic, spring-type oil filled pivot bearing
Instrument case: steel-plate
Scale length: 85 mm (96FW...), 140 mm (144sFW...)
Upper measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8 and their decimally multiplied values
Rated voltages: 100 V, 110 V, 115 V, 230 V, 400 V, 500 V
Rated current: 1 A, or 5 A
Class of accuracy: 1.5
Frequency range: 45 ... 50 ... 60 Hz
Permanent overloading: 1.2 x rated current and 1.2 x rated voltage at $\cos\varphi=1$ max. 3.5 VA for all types without types ...FWd and ...FWdm of which is max. 5.5 VA
Consumption:
Protection: casing IP50; adapter box IP20 and terminals IP00
Weight: between 0.9 ÷ 1,6 kg, depending on type
Fixing elements: with two screw-type fastening clips (DIN 43835 "B")

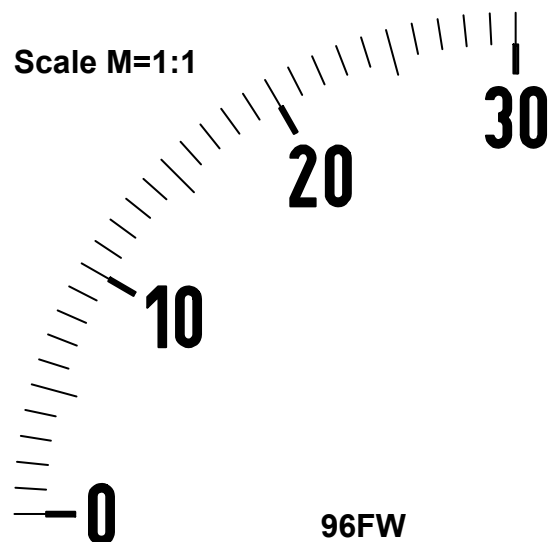


Type assortment			
Active power	Reactive power	Movement	Network
96 FWa 144 sFWa	-----	one meas. syst.	single phase
96 FWb 144 sFWb	96 FWbm 144 sFWbm	one meas. syst.	three-phase balanced
96 FWb1 144 sFWb1	-----	one meas. syst.	three-phase balanced, four wires
96 FWc 144 sFWc	96 FWcm 144 sFWcm	two meas. syst.	three-phase unbalanced
96 FWd 96 FWd	96 FWdm 96 FWm	two meas. syst.	three-phase unbalanced, four wires

Outline drawing



Scale M=1:1



Type	dimensions in mm						
	a	b	c	d	e	f	g
96FWa, b, b1, bm	96 x 96	87	73	96	7	90	92 ^{+0.8}
96FWc, d, cm, dm	96 x 96	120	106	129	7	90	92 ^{+0.8}
144sFWa, b, b1, bm	144 x 144	90	78	....	7	135	138 ⁺¹
144sFWc, d, cm, dm	144 x 144	121	109	....	7	135	138 ⁺¹

Datas to be stated in the order

- Rated voltage. (In three-phase system the rated voltage is understood as the voltage between two line (L1-L2). In four-wire, three-phase system should be given as: phase voltage/line voltage, for example 400/230 V)
- Rated current
- The ratio of the current or voltage transformer applied
- Scale range selected from the series of 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8 or their decimally multiplied values, given in W, kW, MW or var, kvar, Mvar units. (Consider the deviation from the U_{xl} or $\sqrt{3} \times U_{xl}$ apparent power should not exceed $\pm 20\%$)
- Description of special execution



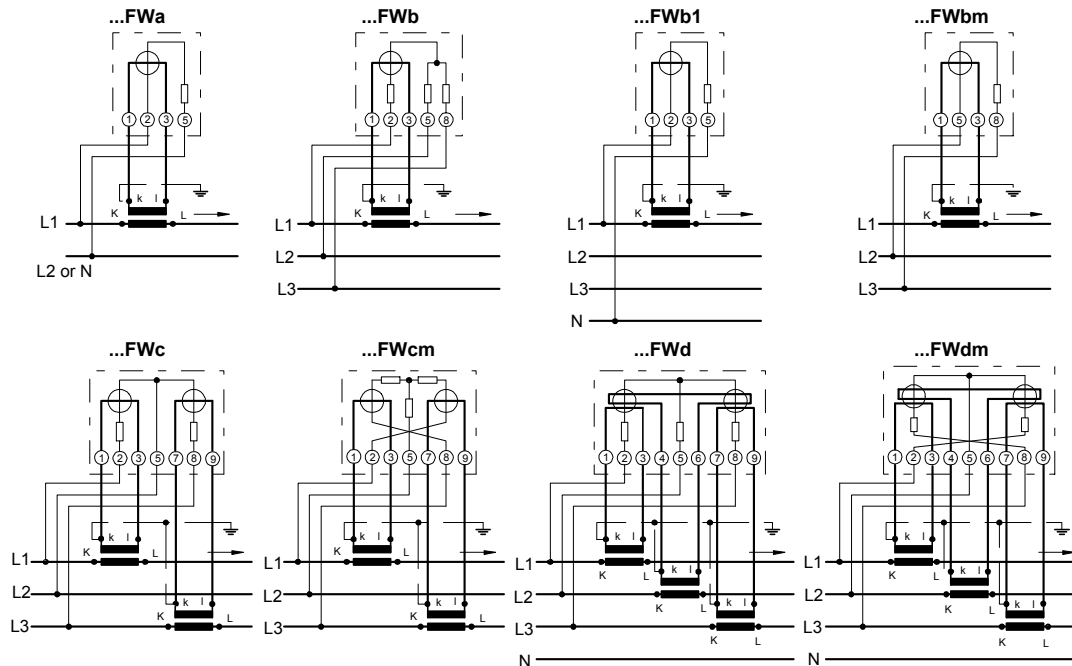
FERRODYNAMIC POWER METERS



ACTIVE POWER	Type 96FWa 144sFWa	Type 96FWb 144sFWb	Type 96FWb1 144sFWb1	Type 96FWc 144sFWc	Type 96FWd 144sFWd					
	Single phase 	Three-phase balanced 	Three-phase balanced, four wires 	Three-phase unbalanced 	Three-phase unbalanced, four wires 					
Rated voltage	Rated secondary curr. of current transformer		Rated secondary curr. of current transformer		Rated secondary curr. of current transformer		Rated secondary curr. of current transformer		Rated secondary curr. of current transformer	
	... / 5 A	... / 1 A	... / 5 A	... / 1 A	... / 5 A	... / 1 A	... / 5 A	... / 1 A	... / 5 A	... / 1 A
... / 100 V	x	x	x	x	x	x	x	x	x	x
... / 110 V	x	x	x	x	x	x	x	x	x	x
230 V	x	x	x	x	x	x	x	x	x	x
400 V	x	x	x	x	x	x	x	x	x	x
500 V	x	x	x	x	x	x	x	x	x	x

REACTIVE POWER	Type 96FWbm 144sFWbm	Type 96FWcm 144sFWcm	Type 96FWdm 144sFWdm			
	Three-phase balanced 	Three-phase unbalanced 	Three-phase unbalanced, four wires 			
Rated voltage	Rated secondary curr. of current transformer		Rated secondary curr. of current transformer		Rated secondary curr. of current transformer	
	... / 5 A	... / 1 A	... / 5 A	... / 1 A	... / 5 A	... / 1 A
... / 100 V	x	x	x	x	x	x
... / 110 V	x	x	x	x	x	x
230 V	x	x	x	x	x	x
400 V	x	x	x	x	x	x
500 V	x	x	x	x	x	x

Connection diagrams:



Order specification:

- Power meter for active power, three-phase for three wire unbalanced circuits
- Voltage transformer ratio: 6000/100 V
- Current transformer ratio: 250/5 A
- Scale range: 0 ... 2.5 MW

Ordering data:

- Power meter type: **96FWc**
- VT: **6000/100 V**
- CT: **250/5 A**
- Scale range: **0 ... 2.5 MW**



FERRODYNAMIC POWER FACTOR METERS



96FQa, 96FQb, 144sFQa, 144sFQb

For measuring power factor ($\cos\varphi$) in AC.

The ...FQa type can be used in single-phase and the ...FQb type in three-phase balanced load system.

Technical data

Movement: Iron-core, ferrodynamic, spring-type oil filled pivot bearing

Class of accuracy: 2.5

Instrument case: steel-plate

Scale length: 85 mm (96FQ...), 140 mm (144sFQ...)

Operating range: $0.2 \times I_N - 1.2 \times I_N$

Frequency range: 45 ... 50 ... 60 Hz (...FQb), 49,5...50...50,5 Hz (...FQa)

Permanent overloading: 1.2 x rated current and 1.2 x rated voltage at $\cos\varphi=1$

Consumption: max. 12 VA in the current section and max. 20 mA in the voltage section

Protection: casing IP50 and terminals IP00

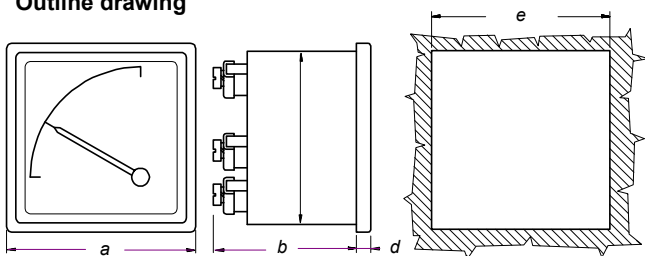
Weight: 0.8 kg (96FQ...), 1.2 kg (144sFQ...)

Fixing elements: with two spring-type fastening clips (DIN 43835 "B")



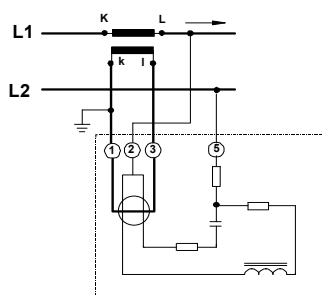
Rated secondary voltage of voltage transformer	Single phase cap. 0.4-1-0.4 ind.		Single phase cap. 0.8-1-0.2 ind.		Three-phase balanced cap. 0.4-1-0.4 ind.		Three-phase balanced cap. 0.8-1-0.2 ind.	
	Rated secondary curr. of current transformer		Rated secondary curr. of current transformer		Rated secondary curr. of current transformer		Rated secondary curr. of current transformer	
	... / 5 A	... / 1 A	... / 5 A	... / 1 A	... / 5 A	... / 1 A	... / 5 A	... / 1 A
	Type: 96FQa 144sFQa				Type: 96FQb 144sFQb			
... / 100 V	x	x	x	x	x	x	x	x
... / 110 V	x	x	x	x	x	x	x	x
230 V	x	x	x	x	x	x	x	x
400 V	x	x	x	x	x	x	x	x
500 V	---	---	---	---	x	x	x	x

Outline drawing

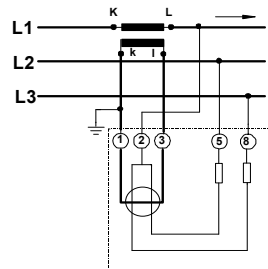


Dim(mm)	a	b	c	d	e
Type					
96FQa	96 x 96	120	90	7	92 ^{+0.8}
96FQb		90			
144sFQ...	144 x 144	162	136	7	138 ⁺¹

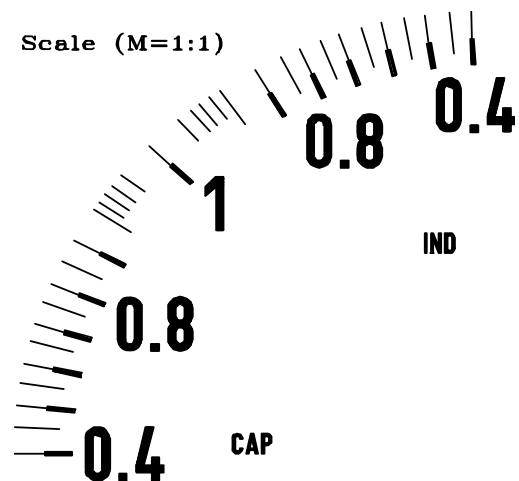
Connection diagrams:



144sFQa



144sFQb



Ordering data:

- Power factor meter type: **96FQb** 400V, 5A cap. 0.4 - 1 - 0.4 ind.



ELECTRONIC POWER FACTOR METERS



72eQa, 72eQb 96eQa 96eQb 144eQa, 144eQb

Pivot and jewel moving-coil movement with integrated electronic circuit

Technical data:

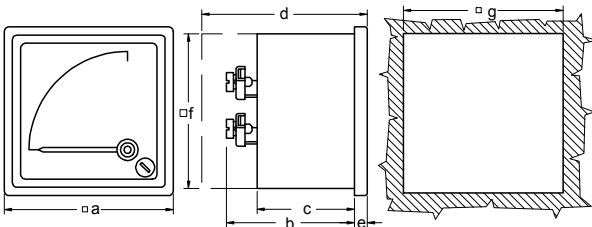
- Instrument case:** steel-plate
- Scale length:** 65mm (72eQ...), 85mm (96eQ...), 136mm (144eQ...)
- Class of accuracy:** 1.5
- Rated U_N :** 100 V, 110 V, 230 V, 400 V, 500 V
- Operating range:** $U_N \pm 15\%$
- Rated I_N :** 5 A or 1 A
- Operating range:** $0.2 \times I_N - 1.2 \times I_N$
- Frequency range:** 45...50...60 Hz
- Consumption:** max. 0.5 VA in the current circuit and max. 12 mA in the voltage circuit
- Protection:** casing IP50, terminals IP00
- Weight:** 0,4 kg (72eQ...), 0,55 kg (96eQ...), 0,9 kg (144eQ...)
- Fixing elements:** with two spring-type fastening clips (DIN 43835 "A")



Rated voltage	Single phase				Three - phase balanced			
	cap. 0,5 - 1 - 0,5 ind.		cap. 0,8 - 1 - 0,2 ind.		cap. 0,5 - 1 - 0,5 ind.		cap. 0,8 - 1 - 0,2 ind.	
	Rated current		Rated current		Rated current		Rated current	
	.../5 A	.../1 A	.../5 A	.../1 A	.../5 A	.../1 A	.../5 A	.../1 A
	72eQa, 96eQa 144eQa				72eQb, 96eQb 144eQb			
.../100 V	x	x	x	x	x	x	x	x
.../110 V	x	x	x	x	x	x	x	x
230 V	x	x	x	x	x	x	x	x
400 V	x	x	x	x	x	x	x	x
500 V	x	x	x	x	x	x	x	x

Scale

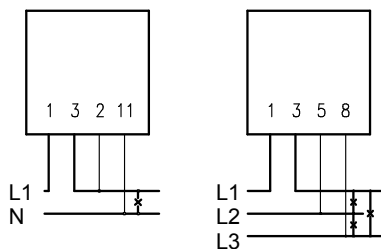
Outline drawing



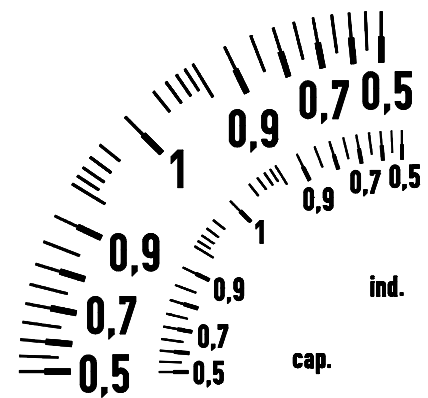
Type/Dim. (mm)	a	b	c	*d	e	f	g
72 eQa 72eQb	72	102	88	113	6	66	68 ^{+0.7}
96eQa 96eQb	96	76	61	86	6	90	92 ^{+0.8}
144eQa 144eQb	144	75	65	.....	8	136	138 ⁺¹

* case with terminal cover

Connection diagrams



72eQa, 96eQa, 72eQb, 96eQb



96eQa 72eQa
96eQb 72eQb

Order specification

Power factor meter for three-phase three wire balanced circuit
 Frame dimension: 96x96mm
 Rated voltage: 400 V
 Current transformer: .../5 A
 Range: cap. 0.5-1-0.5 ind.

96eQb	400V.../5 A	cap. 0.5-1-0.5 ind.
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ELECTRONIC POWER FACTOR METERS WITH 240° SCALE



96cQa, 96cQb 144cQa, 144cQb

Pivot and jewel moving-coil movement with integrated electronic circuit

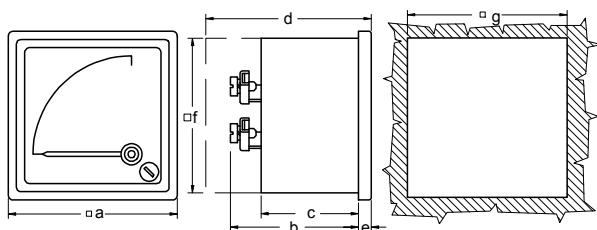
Technical data:

- Instrument case:** steel-plate
- Scale length:** 140mm (96cQ...), 230mm (144cQ...)
- Class of accuracy:** 1.5
- Rated U_N :** 100 V, 110 V, 230 V, 400 V, 500 V
- Operating range:** $U_N \pm 15\%$
- Rated I_N :** 5 A or 1 A
- Operating range:** $0.2 \times I_N - 1.2 \times I_N$
- Frequency range:** 45...50...60 Hz
- Consumption:** max. 0.5 VA in the current circuit and max. 12 mA in the voltage circuit
- Protection:** casing IP50, terminals IP00
- Weight:** 0,65 kg (96cQ...), 0,9 kg (144cQ...)
- Fixing elements:** with two spring-type fastening clips (DIN 43835 "A")



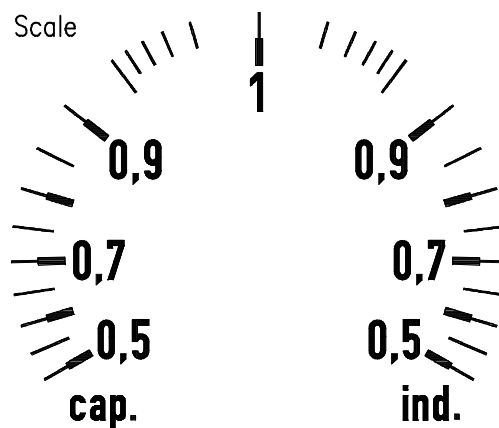
Rated voltage	Single phase ~				Three - phase balanced ≡			
	cap. 0,5 - 1 - 0,5 ind.		cap. 0,8 - 1 - 0,2 ind.		cap. 0,5 - 1 - 0,5 ind.		cap. 0,8 - 1 - 0,2 ind.	
	Rated current		Rated current		Rated current		Rated current	
	.../5 A	.../1 A	.../5 A	.../1 A	.../5 A	.../1 A	.../5 A	.../1 A
	96cQa 144cQa		96cQb 144cQb		96cQb 144cQb		96cQb 144cQb	
.../100 V	x	x	x	x	x	x	x	x
.../110 V	x	x	x	x	x	x	x	x
230 V	x	x	x	x	x	x	x	x
400 V	x	x	x	x	x	x	x	x
500 V	x	x	x	x	x	x	x	x

Outline drawing

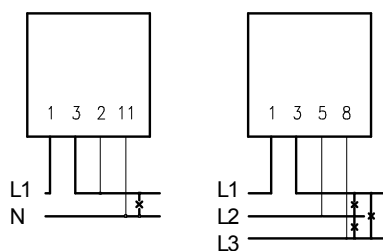


TypelDim. (mm)	a	b	c	*d	e	f	g
96cQa 96cQb	96	60	51	76	5,5	90	92 ^{+0.8}
144cQa 144cQb	144	77	65	.....	7	135	138 ⁺¹

* case with terminal cover



Connection diagrams



96cQa, 144cQa,

96cQb, 144cQb

Order specification

Power factor meter for three-phase three wire balanced circuit
 Frame dimension: 96x96mm
 Rated voltage: 400 V
 Current transformer: .../5 A
 Range: cap. 0.5-1-0.5 ind.

96cQb 400V.../5 A cap. 0.5-1-0.5 ind.



SYNCHRONOSCOPE



Type 96SY

For synchronising 2 systems, indicating if the alternator to be coupled, is more or less advanced or retarded with respect to mains or another generator.

Technical data:

Instrument function: Revolving pointer system. Indicating the synchronising moment when frequency and phase of both supplies have the same values. Then the pointer will be on the upper centre of scale.

Instrument case: steel-plate.

Frequency: For single phase 50 Hz $\pm 1\%$ or 60 Hz $\pm 1\%$.
For three phase 50 Hz $\pm 3\%$ or 60 Hz $\pm 3\%$

Consumption: Line approx. 20 mA
Generator approx. 20 mA.

Protection: Casing IP50; adapter box IP20 and terminals IP00.

Weight: Approx. 0,8 kg.

Fixing elements: with two screw-type fastening clips (DIN 43835 "A").

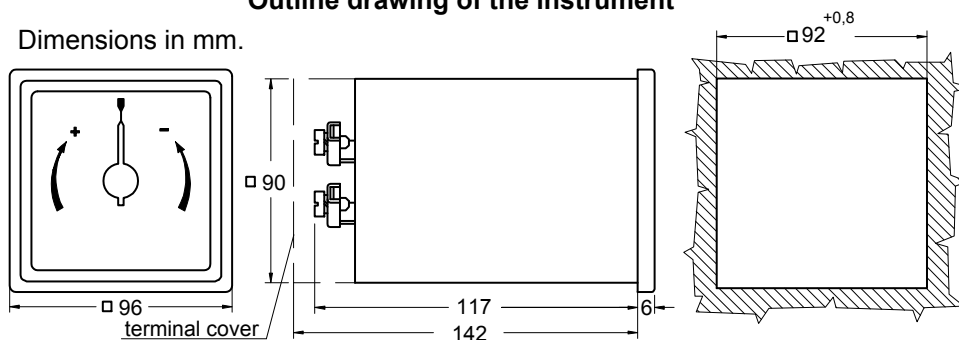


Rated voltage $\pm 15\%$	Instrument type: 96SY Cat. No. 2007-99-...	
	Type of systems	
	Single- or three-phase Connection with 2 wires	Three-phase Connection with 3 wires
100/ $\sqrt{3}$ V	-021	----
100V	-022	-032
110/ $\sqrt{3}$ V	-023	----
110V	-024	-034
120V	-001	-041
220V	-002	-043
230/ $\sqrt{3}$ V	-003	----
230V	-025	-035
240V	-004	-044
400V	-026	-036
440V	-027	-037
520V	----	-045

Note: All instruments are to be used with external box(es).

Outline drawing of the instrument

Dimensions in mm.

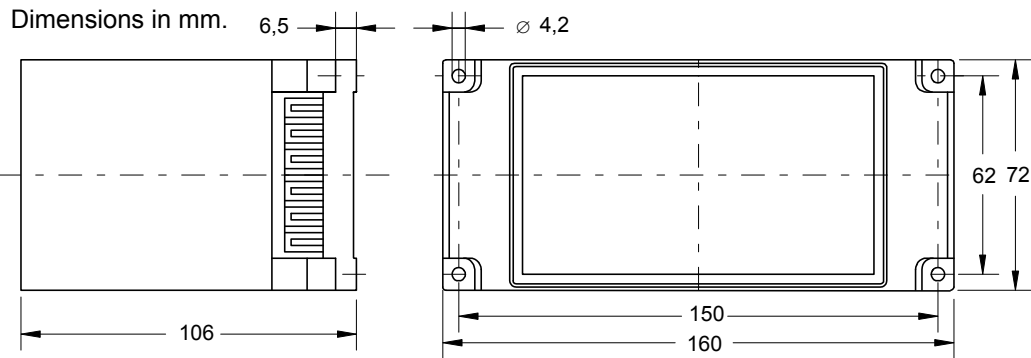




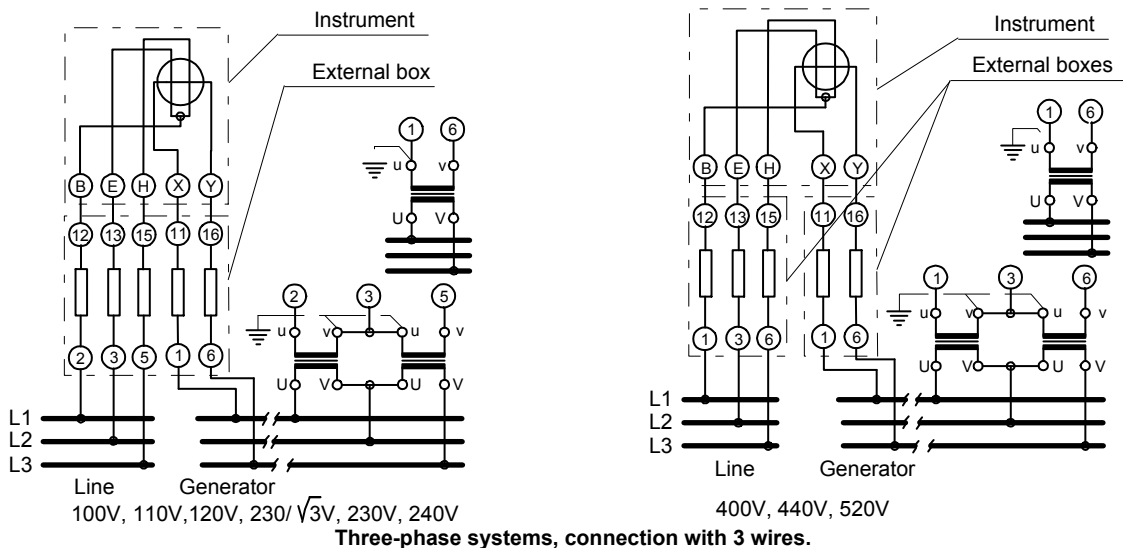
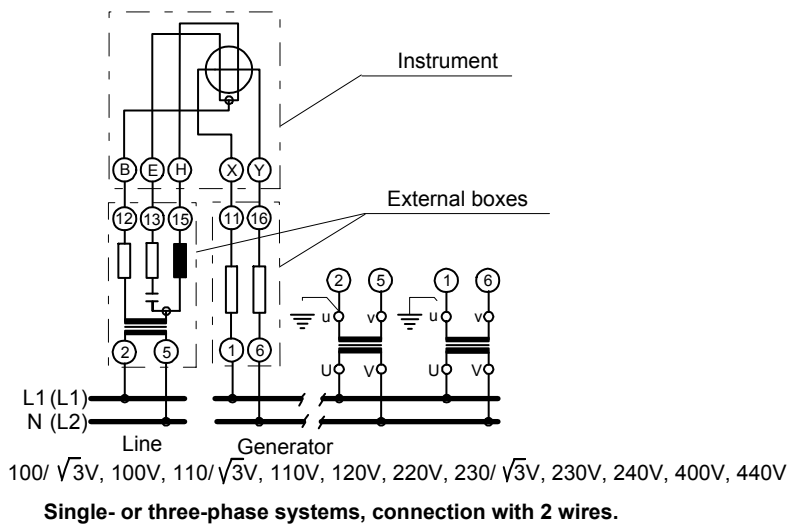
SYNCHROSCOPE



Outline drawing of the external box



Connection diagrams



Order specification:

- Synchronoscope
- For three phase system, connection to 3 wires
- Rated voltage: 400 V

Ordering data:

- Synchronoscope
- Type: **96SY**
- Cat No.: **2007-99-036**



96SVP

The instrument gives a useful aid for synchronising. The built-in moving-iron voltmeter shows the voltage, the pointer-type frequency meter shows the frequency of the generator. The built-in „0“-voltmeter indicates the alteration of the voltages on the frequency-difference of the generator, while the LED-type synchronoscope „rotates“ on the difference-frequency, in the direction of the alteration. When the synchron-status, is reached he „rotation“ of the synchronoscope is slowing-down, stops and the „0“-voltmeter indicates „0“ voltage.

Technical data

Movement: Moving-iron movement with spring-type oil filled bearings, practically vibration-free oil damping, and moving-coil movement with pivot and spring-type bearing.

Class of accuracy: 1.5 and 2.5 (voltmeters)
0,5 (frequency meter)

Permanent overload: 1.2 - fold voltage.

Scale length: 3x40 mm

Frequency range: 50 Hz or 60 Hz

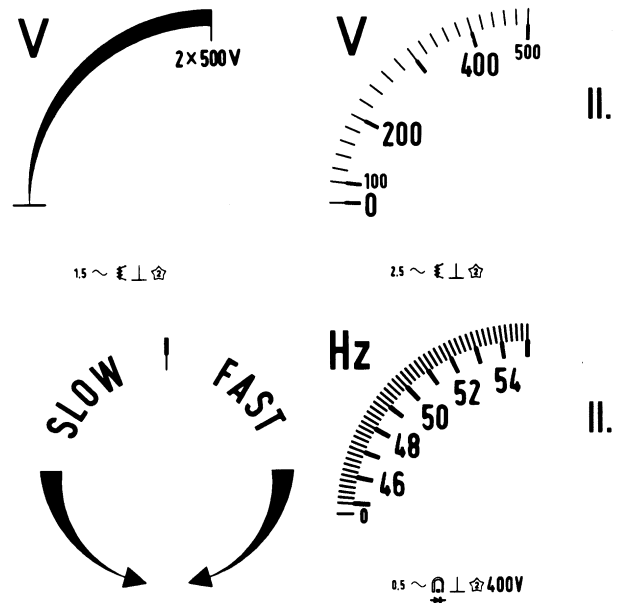
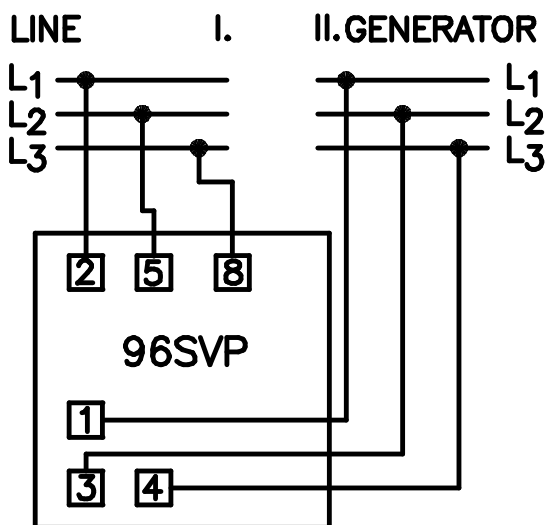
Instrument case: Made of steel-plate.

Weight: -max. 0.8 kg

Fixing elements: with two screw-type fastening clips (DIN 43 835 B)

Measuring range: 45...55 Hz or 55...65 Hz
three-phase 400V

Dimensions: 96 x 96 x 126 mm.



Order specification:

- Switchboard synchronising unit.
- Frame dimension: 96 x 96 mm
- Type: **96SVP**
- Rated voltage: **400 V**



**72VSe, 72VSe-1, 72LVSe-1,
96VSe, 96VSe-1, 96LVSe-1**

For measuring AC voltages in 4-wire or 3 wire networks by using a change over switch displayed on the front side of the instrument.

Technical data

Movement: Moving-iron movement with spring-type oil filled bearings, practically vibration-free oil damping.

Class of accuracy: ±1.5 %

Permanent overload: 1.2 - fold voltage.

Scale length: 72VSe, 72VSe-1, 72LVSe-1 55 mm,
96VSe, 96VSe-1, 96LVSe-1 100 mm.

Frequency range: 15 ... 50 ... 100 Hz.

Instrument case: plastic case

Weight: max. 0.4 kg for types 72VSe, 72VSe-1, 72LVSe-1
max. 0.5 kg for types 96VSe, 96VSe-1, 96LVSe-1

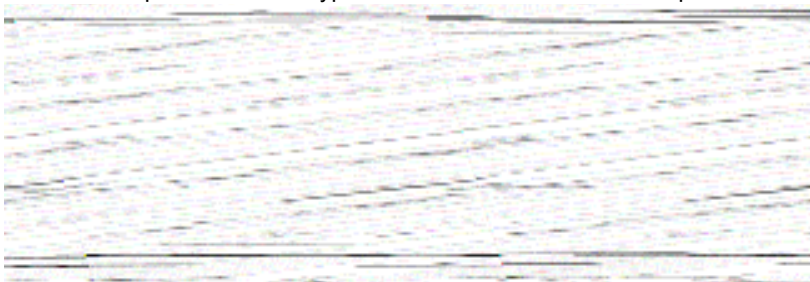
Fixing elements: plastic clips or two spring-type



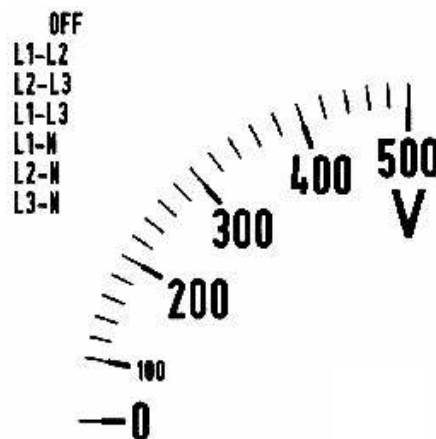
Positions:	OFF, L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N		L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N		OFF, L1-L2, L2-L3, L1-L3	
Measuring range	7 reading 4 wire		6 reading 4 wire		4 reading 3 wire	
	Frame dimensions (a)					
	72x72 mm	96x96 mm	72x72 mm	96x96 mm	72x72 mm	96x96 mm
	72 LVSe-1	96 LVSe-1	72 VSe	96 VSe	72 VS-1	96 VS-1
100 V, x/100V	001	001	011	011	011	011
110V, x/110V	002	002	012	012	012	012
120V, x/120V	003	003	013	013	013	013
x/132V	004	004	014	014	014	014
150 V	005	005	015	015	015	015
200 V	006	006	016	016	016	016
250 V	007	007	017	017	017	017
400 V	008	008	018	018	018	018
■ 500 V	009	009	019	019	019	019
600V	010	010	020	020	020	020

■ standard

Note: On request orders for types different from table are accepted. ☼



Scale 72LVSe



Type	Dimensions (in mm.)				
	a	b	c	d	e
72 VSe, 72VSe-1 72LVSe-1	72	54	66	5	68 ^{+0.7}
96VSe, 96VSe-1,96 LVSe-1	96	54	90	5	92 ^{+0.8}

Order specification:

-Moving-iron voltmeter with change over switch.
-Type: **96VSe**

-Frame dimensions:
-Voltage range:
-Scale:

96x96 mm
10/0,11kV
12 kV



MOVING-IRON VOLTMETER WITH CHANGE OVER SWITCH



72VS, 72sVS, 96VS, 96sVS, 144sVS, 72VS-1, 72sVS-1, 96VS-1, 96sVS-1, 144sVS-1

For measuring AC voltages in 4 or 3-wire networks by using a change over switch mounted on the front side.

Technical data

Movement: Moving-iron with spring-type oil filled bearings, practically vibration-free oil damping.

Class of accuracy: $\pm 1.5\%$

Permanent overload: 1.2 - fold voltage.

Scale length: -type 72 VS, 72VS-1: 50 mm
-type 96 VS, 96VS-1: 75 mm
-type 144 sVS, 144sVS: 120 mm

Frequency range: 15 ... 50 ... 100 Hz.

Instrument case: non-flammable plastic acc. to UL 94-V1, or steel-plate. (see table)

Weight: -max. 0.4 kg for types 72 VS, 72VS-1
-max. 0.5 kg for types 96 VS, 96VS-1
-max. 0.8 kg for types 144 sVS, 144sVS-1

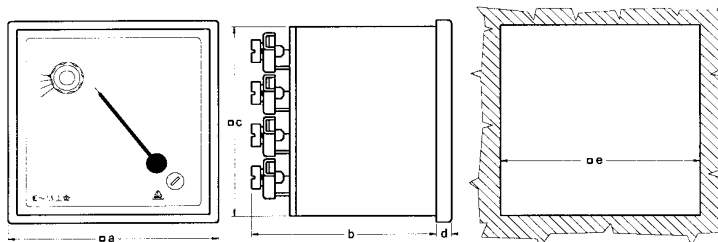
Fixing elements: with two spring-type fastening clips (DIN 43835 A) or, plastic clips



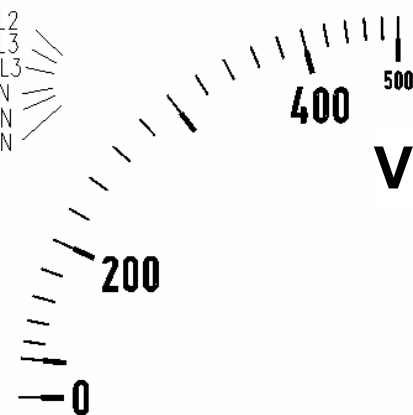
Positions: L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N						Positions: L1-L2, L2-L3, L1-L3, OFF					
Measuring range	Frame dimensions (a)					Measuring range	Frame dimensions (a)				
	Plastic case ■		Metal case				Plastic case ■		Metal case		
	72x72 mm	96x96 mm	72x72 mm	96x96 mm	144x144mm		72x72 mm	96x96 mm	72x72 mm	96x96 mm	144x144mm
	72 VS Cat. No. 2276-13-	96 VS Cat. No. 2277-13-	72sVS Cat. No. 1975-13-	96sVS Cat. No. 1784-13-	144 sVS Cat. No. 2034-13-		72 VS-1 Cat. No. 2278-13-	96 VS-1 Cat. No. 2279-13-	72sVS-1 Cat. No. 1975-13-	96sVS-1 Cat. No. 1784-13-	144 sVS-1 Cat. No. 2034-13-
100 V	001	001	007	007	001	100 V	001	001	507	507	007
150 V	002	002	005	005	002	150 V	002	002	505	505	008
200 V	003	003	005	005	003	200 V	003	003	505	505	009
250 V	004	004	004	004	004	250 V	004	004	504	504	010
400 V	005	005	003	003	005	400 V	005	005	503	503	011
■ 500V	005	006	002	002	006	500 V	005	005	502	502	012
600 V	007	007	001	001	013	600V	007	007	501	501	014

■ standard

Note: On request orders for types different from table are accepted



Scale 96VS



Type	Dimensions (in mm.)				
	a	b	c	d	e
72 VS, VS-1	72	54	66	5	68 ^{+0.7}
72sVS, sVS-1	72	54	66	5	68 ^{+0.7}
96 VS, VS-1	96	54	90	5	92 ^{+0.8}
96 sVS, sVS-1	96	54	90	5	92 ^{+0.8}
144 sVS, sVS-1	144	76	135	7	138 ^{+1.0}

Order specification:

-Moving-iron voltmeter with change over switch.
-Frame dimensions: **96x96 mm**
-Voltage range: **500 V**

Ordering data:

-Moving-iron voltmeter with change over switch.
-Type: **96 VS**
-Cat. No. **2277-13-006**



72LVS, 96LVS, 72LVS-1, 96LVS-1

For measuring AC voltages in 4-wire networks by using a change over switch displayed on the front side of the instrument. The error-display LED is indicating in case of phase drop out.

Technical data

Movement: Moving-iron movement with spring-type oil filled bearings, practically vibration-free oil damping.

Class of accuracy: ±1.5 %

Permanent overload: 1.2 - fold voltage.

Scale length: see table

Frequency range: 15 ... 50 ... 100 Hz.

Instrument case: see table

Weight: max. 0.4 kg for types 72 LVS, 72LVS-1
max. 0.5 kg for types 96LVS, 96LVS-1

Fixing elements: plastic clips or two spring-type fastening clips (DIN 43835 "A") for metal case instruments

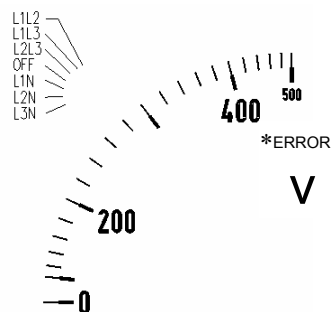
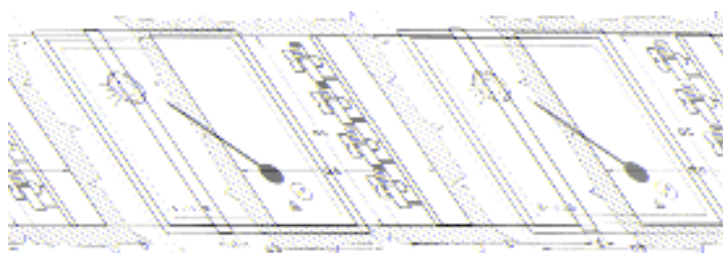


Positions:	OFF L1-L2 L2-L3 L1-L3 L1-N L2-N L3-N +ERROR	OFF L1-L2 L2-L3 L1-L3 L1-N L2-N L3-N	OFF L1-L2 L2-L3 L1-L3 L1-N L2-N L3-N +ERROR	OFF L1-L2 L2-L3 L1-L3 L1-N L2-N L3-N				
Measuring range	Plastic case ■				Metal case			
	Scale length:							
	41 mm	75 mm	41 mm	75 mm	50 mm	75 mm	50 mm	75 mm
	Frame dimensions (a)							
	72x72 mm	96x96 mm	72x72 mm	96x96 mm	72x72 mm	96x96 mm	72x72 mm	96x96 mm
	72 LVS Cat. No. 2550-13- ...	96 LVS Cat. No. 2551-13- ...	72 LVS-1 Cat. No. 2550-13- ...	96 LVS-1 Cat. No. 2551-13- ...	72 LVS Cat. No. 2119-13-...	96 LVS Cat. No. 2116-13- ...	72 LVS-1 Cat. No. 2119-13- ...	96 LVS-1 Cat. No. 2116-13- ...
100 V	001	001	011	011	001	001	011	011
150 V	002	002	012	012	002	002	012	012
200 V	003	003	013	013	003	003	013	013
250 V	004	004	014	014	004	004	014	014
400 V	005	005	015	015	005	005	015	015
■ 500 V	006	006	016	016	006	006	016	016
600V	007	007	017	017	007	007	017	017

■ standard

Scale 72LVS

Note: On request orders for types different from table are accepted. ☺



Type	Dimensions (in mm.)				
	a	b	c	d	e
72 LVS, 72LVS-1	72	54	66	5	68 ^{+0.7}
96 LVS, 96LVS-1	96	54	90	5	92 ^{+0.8}

Order specification:

- Moving-iron voltmeter with change over switch.
- Frame dimensions: **96x96 mm**
- Voltage range: **500 V**

Ordering data:

- Moving-iron voltmeter with change over switch.
- Type: **96 LVS**
- Cat. No. **2551-13-006**



MOVING-IRON AMMETER WITH CHANGE OVER SWITCH



72AS, 96AS

For measuring of line current in 3-phase networks.
The scale is calibrated according to the primary current.

ATTENTION!

The instrument can only be used with current transformer!

Technical data

Movement: Moving-iron movement with spring-type oil filled bearings, practically vibration-free oil damping.

Class of accuracy: $\pm 1.5\%$

Permanent overload: 1.2 - fold current.

Scale length: -type 72AS 62 mm
-type 96AS 102 mm

Frequency range: 15 ... 50 ... 100 Hz.

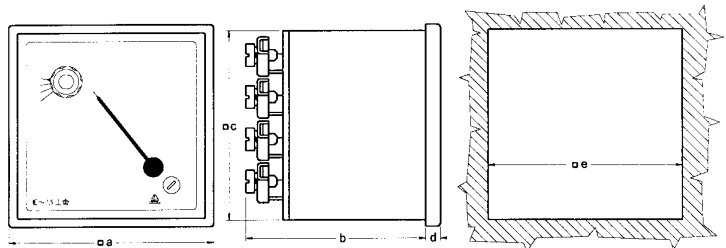
Instrument case: Made of non-flammable plastic acc. to UL 94-V1

Weight: max. 0.4 kg for types 72AS
max. 0.5 kg for types 96AS

Fixing elements: plastic clips

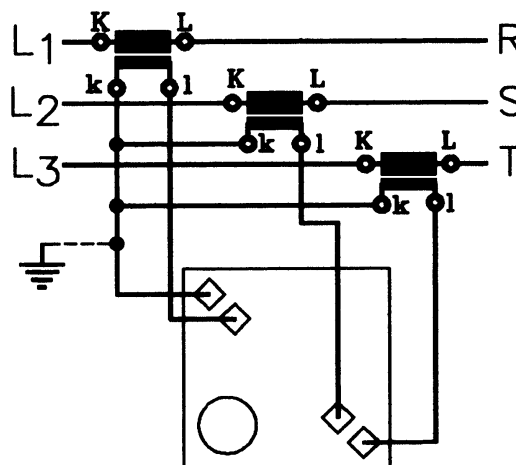
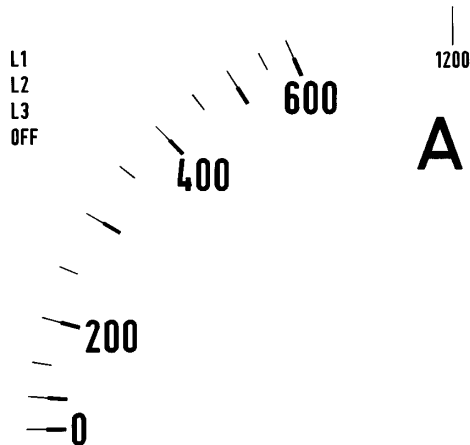


AMMETER	
Positions:	L1 L2 L3 OFF
Measure range:	.../1A or .../5A



Type	Dimensions (in mm.)				
	a	b	c	d	e
96 AS	96	54	90	5	92 \pm 0.8
72 AS	72	54	66	5	68 \pm 0.7

Scales for CT. use				
Primary current of the CT				
1A	40 A	150 A	750 A	2000 A
5A	50 A	200 A	800 A	2500 A
10 A	60 A	250 A	1000 A	3000 A
15 A	75 A	300 A	1200 A	4000 A
20 A	80 A	400 A	1250 A	5000 A
25 A	100 A	500 A	1500 A	6000 A
30 A	125 A	600 A	1600 A	



Order specification:

- Moving-iron ammeter with change over switch.
- Frame dimensions: **96x96 mm**
- Current range: **5A**
- Current transformer ratio: **250/5A**

Ordering data:

- Moving-iron ammeter with change over switch.
- type: 96AS
- CT: **250/5A**
- scale: **250(500)A**



96AS

For measuring the line current in 3-phase networks.
The scale is calibrated according to the primary current.

ATTENTION!

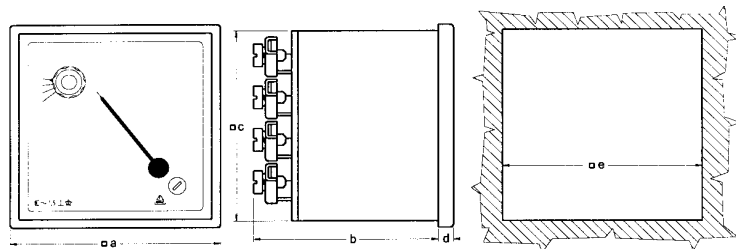
The instrument can only be used with current transformer!

Technical data

- Movement:** Moving-iron movement with spring-type oil filled bearings, practically vibration-free oil damping.
- Class of accuracy:** $\pm 1.5\%$
- Permanent overload:** 1.2 - fold current.
- Scale length:** 102 mm
- Frequency range:** 15 ... 50 ... 100 Hz.
- Instrument case:** non-flammable plastic according to UL 94-V1
- Weight:** -max. 0.5 kg for
- Fixing elements:** plastic clips (Ganz Type)

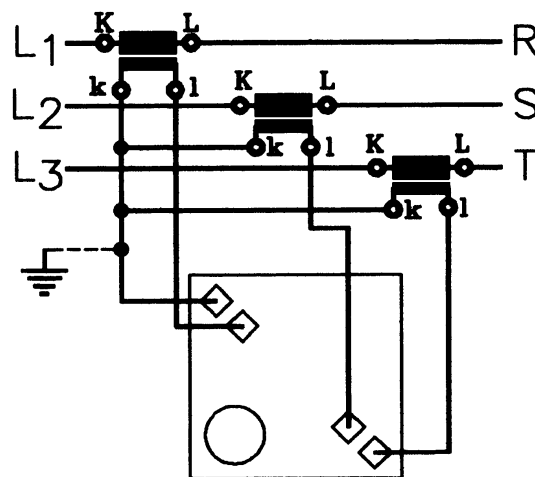
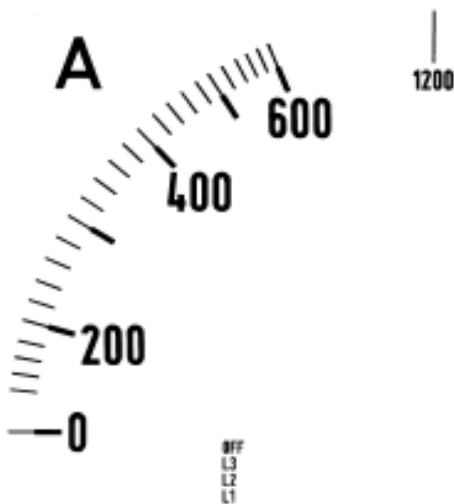


AMMETER	
Positions:	L1 L2 L3 OFF
Measure range:	.../1A or .../5A



Type	Dimensions (in mm.)				
	a	b	c	d	e
96 AS	96	54	90	5	92 \pm 0.8

Scales for CT. use				
Primary current of the CT				
1A	40 A	150 A	750 A	2000 A
5A	50 A	200 A	800 A	2500 A
10 A	60 A	250 A	1000 A	3000 A
15 A	75 A	300 A	1200 A	4000 A
20 A	80 A	400 A	1250 A	5000 A
25 A	100 A	500 A	1500 A	6000 A
30 A	125 A	600 A	1600 A	8000A



Order specification:

- Moving-iron ammeter with change over switch interchangeable scale.
- Frame dimensions: **96x96 mm**
- Current range: **5A**

Ordering data:

- Moving-iron ammeter with change over switch **interchangeable scale**
- CT: 600/5A
- scale: **interchangeable**, 600(1200)A



96AVS

The instrument is suitable for measuring of line- and phase voltage, as well as line current in 4-wire 3-phase networks. The error-display LED is indicating in case of phase drop out. The scale is calibrated according to the primary current.

ATTENTION!

The instrument can only be used with current transformer!

Technical data

Movement: Moving-iron movement with spring-type oil filled bearings, practically vibration-free oil damping.

Class of accuracy: $\pm 1.5\%$

Permanent overload: 1.2 fold voltage.

Scale length: 75 mm

Frequency range: 15 ... 50 ... 100 Hz.

Instrument case: Made of steel-plate.

Weight: -max. 0.8 kg

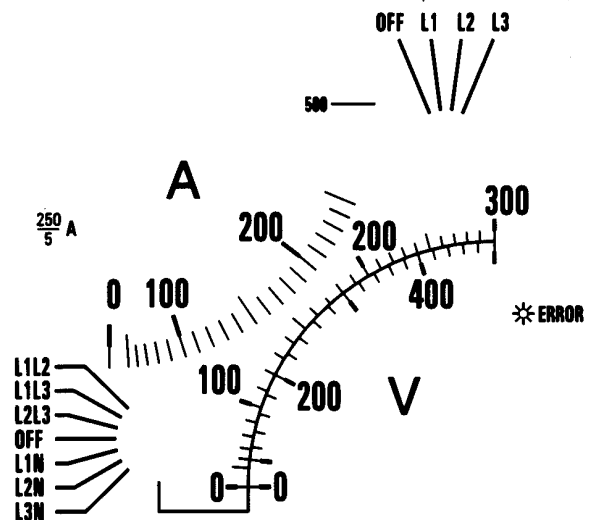
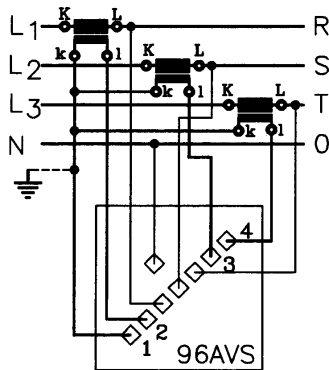
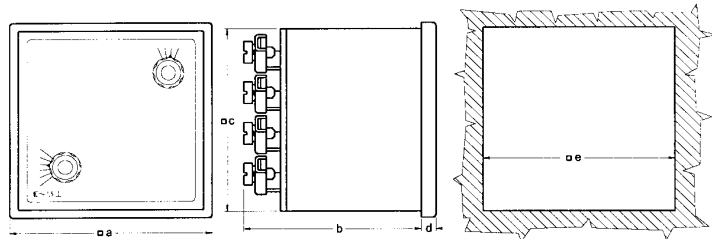
Fixing elements: with two spring-type fastening clips (DIN 43 835 A)



VOLTMETER		AMMETER	
Positions:	L1-L2 L1-L3 L2-L3 OFF L1-N L2-N L3-N	Positions:	L1 L2 L3 OFF
Measuring range:	300 / 500 V	Measuring range:	.../1A .../5A

Note: On request orders for types different from table are accepted

Type	Dimensions (in mm.)				
Type	a	b	c	d	e
96 AVS	96	84.5	90	6	92 ^{+0.8}



Order specification:

Moving-iron voltmeter and ammeter with change over switch.

Frame dimensions: **96x96 mm**

Voltage range: **300 / 500 V**

Current transformer ratio: **250/5A**

96 AVS 300/500V 250/5A

Scales for CT. use					
Primary currents of the CT					
1A	40 A	150 A	750 A	2000 A	
5A	50 A	200 A	800 A	2500 A	
10 A	60 A	250 A	1000 A	3000 A	
15 A	75 A	300 A	1200 A	4000 A	
20 A	80 A	400 A	1250 A	5000 A	
25 A	100 A	500 A	1500 A	6000 A	
30 A	125 A	600 A	1600 A	8000 A	



96sK, 144sK

For simultaneous measurement of AC current and voltage in three-phase systems (3x current and 1x voltage).

Technical data:

Movement: Moving-iron movement with spring-type oil filled bearing, practically vibration-free oil damping.

Instrument case: steel-plate.

Scale length: 4x40 mm (96sK...); 4x67 mm (144sK...).

Permanent overloading: 1.2 -fold current resp. voltage.

Class of accuracy: 2.5

Frequency range: 15...50...100 Hz

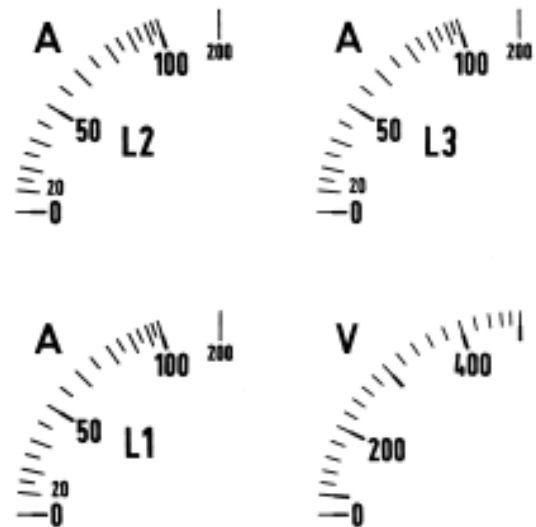
Weight: approx. 0.7 kg (96sK), 0.8 kg (144sK...).

Fixing elements: with two spring-type fastening clips (DIN 43835 "B")



Frame dim.	96x96 mm		144x144 mm	
	Current measuring range			
	*.../1A	*.../5A	*.../1A	*.../5A
	Type 96sK		Type 144sK	
	Cat. No. 2515-13-...		Cat. No. 1944-13-...	
100 V	C01	C21	C01	C21
150 V	C02	C22	C02	C22
250 V	C03	C23	C03	C23
400 V	C04	C24	C04	C24
500 V	C05	C25	C05	C25
600 V	C06	C26	C06	C26
** .../100 V	C20	C40	C20	C40

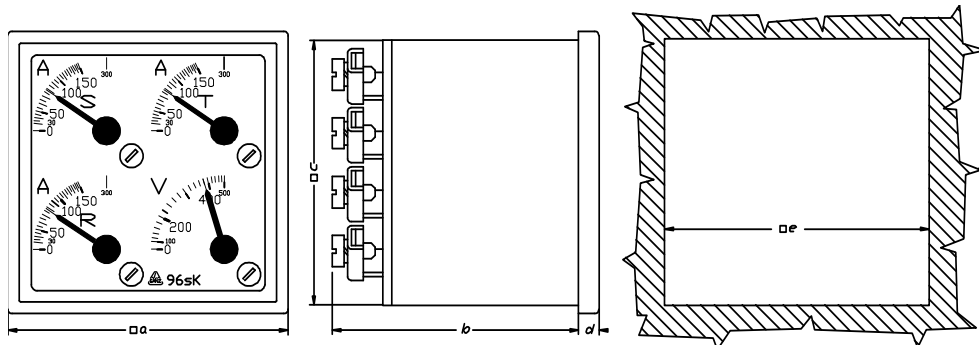
Scale 96sK



* the datas of the current transformer are required

** the datas of the voltage transformer are required

Note: On request order for types different from table are accepted.



Type \ Dim. (mm)	a	b	c	d	e
96sK	96	76	90	7	92 ^{+0.8}
144sK	144	76	135	7	138 ^{+1.0}

Order specification:

- Moving-iron instrument with four systems.
- Frame size: 96x96 mm
- Voltage range: 500 V
- Current range: 1000/5 A

Ordering data:

- Moving-iron instrument with four systems
- Type: **96sK**
- Cat. No.: **2515-13-C26**
- Current transformer ratio: **1000/5 A**



MOVING-COIL VOLTMETER WITH CHANGE OVER SWITCH, 240° INTERCHANGEABLE SCALE AND RECTIFIER FOR AC



96cDVS

For measuring AC voltages in 4- or 3 wire networks with a change over switch on the front side of the instrument.

Technical data:

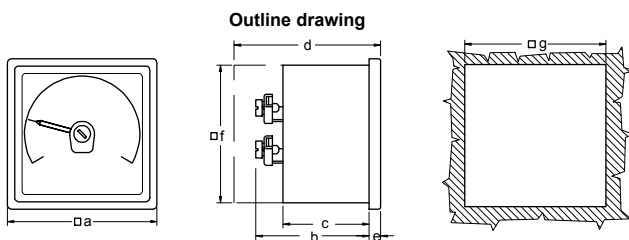
- Movement:** Moving-coil with pivot spring type bearing
- Instrument case:** steel-plate
- Scale length:** 140mm
- Permanent overloading:** 1.2 x Un
- Class of accuracy:** 1.5 for sinusoidal AC, (calibration is true r.m.s.)
- Internal resistance:** 1000 Ω/V
- Frequency range:** -15 ... 50 ... 5000 Hz for all voltmeters
- Weight:** 0.80 kg
- Fixing elements:** with two spring type fastening clips (DIN 43 835 "A")



	Positions: L1-L2, L1-L3, L2-L3, L1-N, L2-N, L3-N, OFF	Positions: L1-L2, L1-L3, L2-L3, OFF
	Cat. No.: 2539-12-...	Cat. No.: 2545-12-...
40 V	001	001
100 V	002	002
110 V	003	003
150 V	004	004
250 V	005	005
400 V	006	006
500 V	007	007
600 V	008	008
* ... / 100V	C05	C05
* ... / 110V	C06	C06

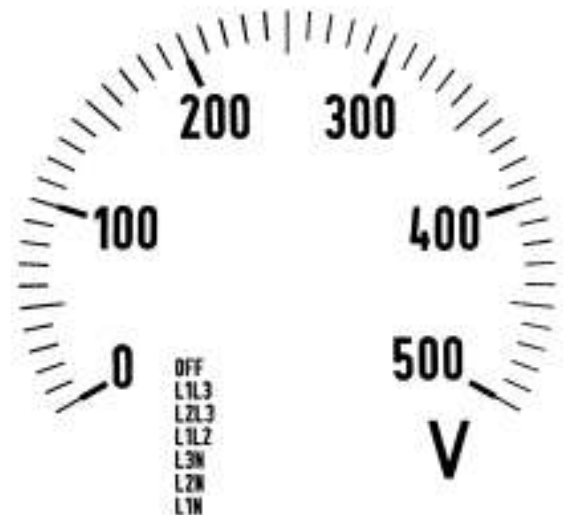
* for connection to voltage transformer

Note: on request types different from tables are accepted



Type	Dim. [mm]						
	a	b	c	*d	e	f	g
96cDVS	96	60	51	76	5.5	90	92 ^{+0.8}

* case with terminal cover



Order specification:

- Moving coil voltmeter with change over switch
- Frame size: 96x96 mm
- Range: 500V

Ordering data:

- Moving coil voltmeter with change over switch
- Type: **96cDVS**
- Cat. No. **2539-12-007**

HOUR METERS



72BS, 96BS

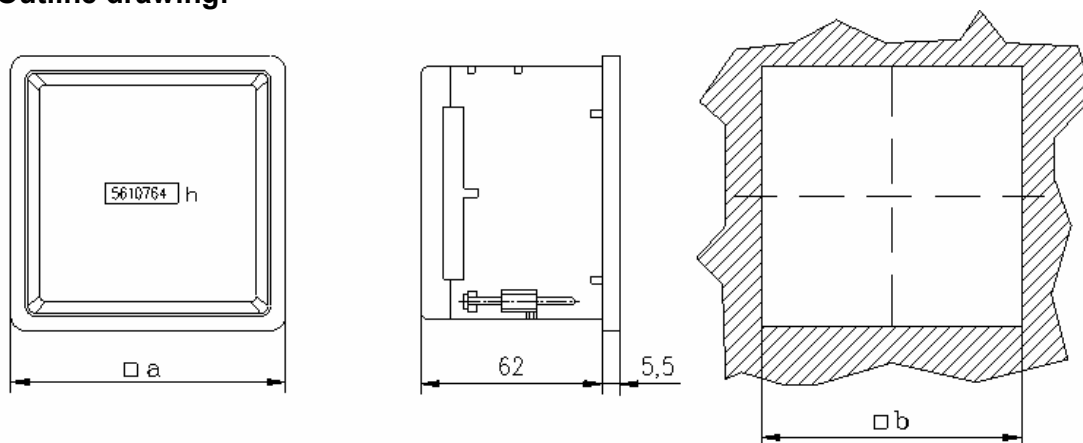
Hour meters 72BS and 96BS are mainly used in switchboard together with other instruments with the same size.
 Hour meters are connected parallel to the control circuit and are running only if the machine or apparatus is in service.
 After overflowing the 99999,99 h the counter pass the zero again.
 Zero reset is not available



Technical data	AC
Terminals:	Screw terminals
Voltage:	230V ($\pm 10\%$)
Frequency:	50 Hz
Motor:	Synchronmotor
Protection:	IP40 Front side
Operating temperature:	-25°C.....+80°C
Reading:	1/100 hour (36 sec)
Range:	99.999,99h
Number of digits:	5 numbers, 2 decimal
Digit height:	4 mm
Digit colour:	- numbers: white - decimal: red
Frame colour.	black
Fixing element:	with two screws

TypeDim. (mm)	a	b
72 BS	72	68 ^{+0.5}
96 BS	96	92 ^{+0.5}

Outline drawing:



Sample order:

72 BS
 230V 50Hz



APPLICATIONS:

Shunts provide an accurate DC millivolt signal to drive moving-coil ammeters, overload protection and control devices especially for higher ampere range.

They supply a voltage output proportional to the DC current.

GANZ shunts comply with DIN 43 703

Ratings are from 1A up to 25 000A with an accuracy class 0,5. Standard voltage drop is 60 mV or 150 mV. For intermediate current ratings, other mV outputs (30...300 mV), better accuracy is available on request.

OVERLOAD:

Brazing, soldering, ensures that the shunt will withstand temperatures up to 300°C without any permanent change.

TECHNICAL DATA:

AMBIENT TEMPERATURE: -10°C...+55°C

STORAGE TEMPERATURE: -40°C...+60°C

ACCURACY CLASS: 0,5

MATERIAL:

Resistance bars manganine

End block:

Format version **A**: high conductivity brass

Format version **B/C**: high conductivity brass or solid copper

FORMAT VERSION A:

With insulating base: up to 25 A 60,150 mV
optionally up to 200 A/60 mV
for screw mounting M8

Without insulating base: 30...150 A

FORMAT VERSION B:

L- profile end blocks

FORMAT VERSION C:

T-profile end blocks

OPTIONS:

Rated voltage drop: other than standard on request

Rated current other than standard on request
up to max. 15,000 A

accuracy class: 0,2

Insulating base suitable for shunts 30...200 A/60 mV
others on request.

Special shunts on request

ACCESSORIES:

Cover for shunts with insulating base



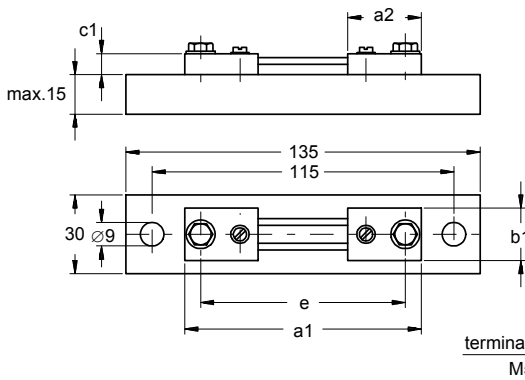
SHUNTS



Shunts type: S-1												
Voltage drop: 60 mV												
Rated current	Fig.	Cat. No.	Dimensions (mm)									
			a1	a2	b1	b2	b3	c1	c2	e	h	i
1 A	A.	0795-90-001	90	28	20	---	---	8	---	78	---	M5x12
1.5 A		-002	90	28	20	---	---	8	---	78	---	M5x12
2.5 A	↓	-003	90	28	20	---	---	8	---	78	---	M5x12
4 A		-004	90	28	20	---	---	8	---	78	---	M5x12
5 A		-009	90	28	20	---	---	8	---	78	---	M5x12
6 A		-005	90	28	20	---	---	8	---	78	---	M5x12
10 A		-006	90	28	20	---	---	8	---	78	---	M5x12
15 A		-007	90	28	20	---	---	8	---	78	---	M5x12
20 A		-018	90	28	20	---	---	8	---	78	---	M5x12
25 A		-008	90	28	20	---	---	8	---	78	---	M5x12
30 A		0796-90-001	100	33	20	---	---	8	---	80	---	M8x15
40 A		-002	100	33	20	---	---	8	---	80	---	M8x15
50 A		-003	100	33	20	---	---	8	---	80	---	M8x15
60 A		-004	100	33	20	---	---	8	---	80	---	M8x15
80 A		-005	100	33	20	---	---	8	---	80	---	M8x15
100 A		-006	100	33	20	---	---	8	---	80	---	M8x15
150 A		-008	100	33	20	---	---	8	---	80	---	M8x15
200 A	B.	0797-90-012	145	55	30	15	---	10	10	105	30	M12x40
250 A		-001	145	55	30	15	---	10	10	105	30	M12x40
300 A	↓	-003	145	55	40	20	---	10	10	105	30	M16x45
400 A		-003	145	55	40	20	---	10	10	105	30	M16x45
500 A		-004	145	55	40	20	---	10	10	105	30	M16x45
600 A		-005	145	55	40	20	---	10	10	105	30	M16x45
1000 A		-007	165	65	60	30	---	10	10	115	30	M20x50
1200 A		0798-90-002	165	65	90	21	48	10	10	115	30	M16x45
1500 A		-001	165	65	90	21	48	10	10	115	30	M16x45
2000 A		-011	165	65	90	21	48	10	10	115	30	M16x45
2500 A		-004	165	65	120	30	60	10	10	115	30	M20x50
3000 A		-013	165	65	120	30	60	15	10	115	60	M20x50
4000 A	C.	2140-90-001	165	65	120	30	60	15	10	115	60	M20x60
5000 A		-002	165	65	154	25	52	15	10	115	60	M20x75
6000 A	↓	-003	175	70	154	25	52	25	15	125	130	M20x75
8000 A		-004	185	75	206	25	52	30	20	135	170	M20x80
10000 A		-005	185	75	206	25	52	30	20	135	170	M20x80
15000 A		-006	185	75	310	25	52	30	20	135	170	M20x80
20000 A		-007	185	75	414	25	52	30	20	135	170	M20x80
25000 A		-008	185	75	518	25	52	30	20	135	170	M20x80

Fig. A.

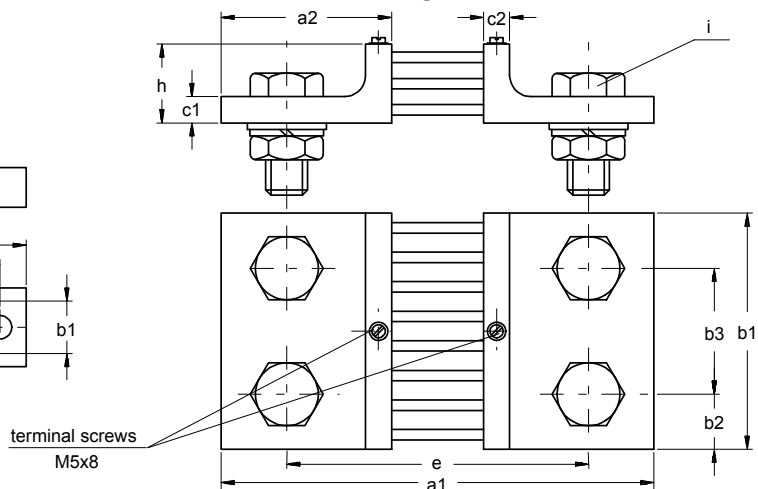
Dimensions in mm.



Order specification 1:

- Shunt.
- Range: 1200 A 60 mV

Fig. B.



Ordering data 1:

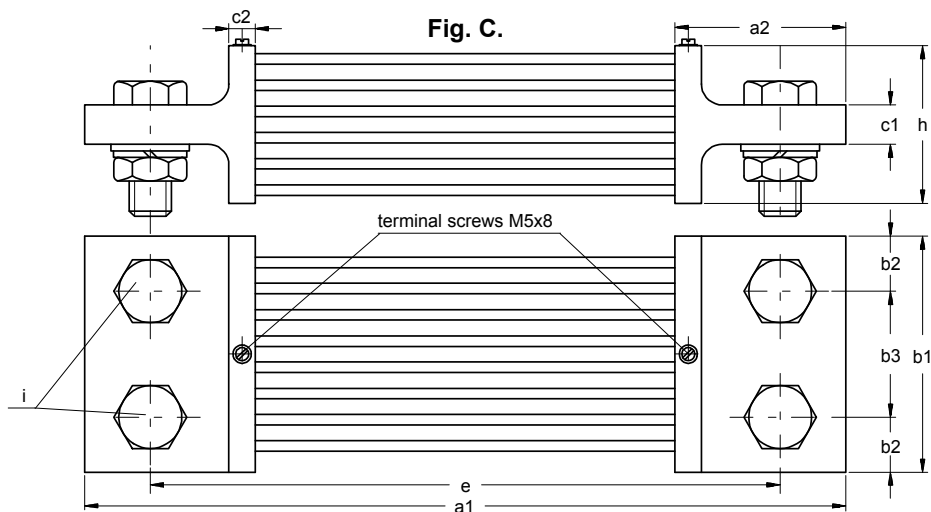
- Shunt.
- Type: S-1 1200 A
- Cat. No. 0798-90-002



SHUNTS



Shunts type: S-2													
Voltage drop: 150 mV													
Rated current	Fig.	Cat. No.	Dimensions [mm]										
			a1	a2	b1	b2	b3	c1	c2	e	h	i	
1 A	A.	0795-90-010	90	28	20	---	---	8	---	78	---	M5x12	
1.5 A		-011	90	28	20	---	---	8	---	78	---	M5x12	
2.5 A		↓	-012	90	28	20	---	---	8	---	78	---	M5x12
4 A		-013	90	28	20	---	---	8	---	78	---	M5x12	
5 A		-031	90	28	20	---	---	8	---	78	---	M5x12	
6 A		-014	90	28	20	---	---	8	---	78	---	M5x12	
10 A		-015	90	28	20	---	---	8	---	78	---	M5x12	
15 A		-016	90	28	20	---	---	8	---	78	---	M5x12	
20 A		-021	90	28	20	---	---	8	---	78	---	M5x12	
25 A		-017	90	28	20	---	---	8	---	78	---	M5x12	
30 A		0796-90-013	225	33	25	---	---	8	---	205	---	M8x15	
40 A			-009	225	33	25	---	---	8	---	205	---	M8x15
50 A			-014	225	33	25	---	---	8	---	205	---	M8x15
60 A			-010	225	33	25	---	---	8	---	205	---	M8x15
80 A			-015	225	33	25	---	---	8	---	205	---	M8x15
100 A	-011		225	33	25	---	---	8	---	205	---	M8x15	
150 A	-012		225	33	25	---	---	8	---	205	---	M8x15	
200 A	B.		0797-90-013	270	55	30	15	---	10	10	230	50	M12x40
250 A		-008	270	55	30	15	---	10	10	230	50	M12x40	
300 A		↓	-014	270	55	40	20	---	10	10	230	50	M16x45
400 A		-009	270	55	40	20	---	10	10	230	50	M16x45	
500 A		-015	270	55	40	20	---	10	10	230	50	M16x45	
600 A		-010	270	55	40	20	---	10	10	230	50	M16x45	
1000 A		-011	290	65	70	35	---	10	10	240	60	M20x50	
1200 A	C.	0798-90-015	290	65	90	21	48	15	10	240	60	M16x60	
1500 A		2523-90-001	290	65	90	21	48	15	10	240	60	M16x60	
2000 A		-002	290	65	120	30	60	15	10	240	60	M20x60	
2500 A		-003	290	65	120	30	60	15	10	240	60	M20x60	
3000 A		-004	290	65	120	30	60	15	10	240	60	M20x75	
4000 A		-005	300	70	120	30	60	25	15	250	130	M20x75	
5000 A		-006	300	70	154	25	52	25	15	250	130	M20x75	
6000 A		-007	300	70	154	25	52	25	15	250	130	M20x75	
8000 A		-008	310	75	206	25	52	30	20	260	170	M20x80	
10000 A		-009	310	75	206	25	52	30	20	260	170	M20x80	
12000 A		-010	310	75	310	25	52	30	20	260	170	M20x80	
15000 A	-011	310	75	310	25	52	30	20	260	170	M20x80		



Order specification 2:

- Shunt.
- Range: 2500 A, 150 mV.

Ordering data 2:

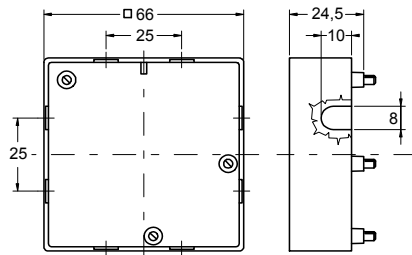
- Shunt.
- Type: **S-2, 2500 A**
- Cat. No. **2523-90-003**

TERMINAL COVER

Mounting: on the backside of the instrument
 Applicable: for all switchboard instruments type 48... 72..., 96...
 Material: non-flammable plastic

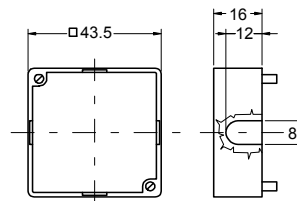
Outline drawing

Dimensions in mm. M= 1:2



For switchboard instruments type 72..., and 96...

Cat. No.: 12-1304-94

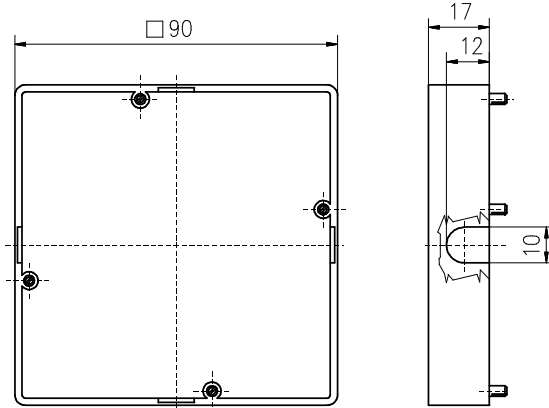


For switchboard instruments type 48...

Cat. No.: 12-2900-94

Mounting: on the backside of the instrument
 Applicable: for all switchboard instruments type 96...
 Material: non-flammable plastic

Outline drawing Dimension in mm



For switchboard instruments type 96...

Cat. No.: 12-3675-94

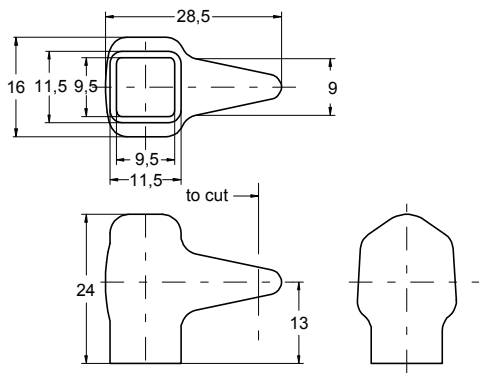
TERMINAL INSULATOR

Cat. No. 12-2933-89

For instruments without a terminal cover.

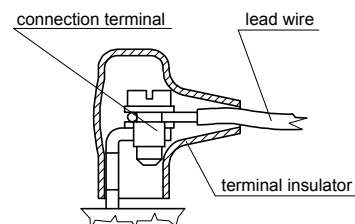
Mounting: on the terminals
 Applicable: all switchboard instruments type 48... 72..., 96... 144mm.
 Material: non-flammable elastic plastic.

Outline drawing



Dimensions in mm.
 M= 1:1

Mounted terminal insulator.





NOTICE

Horizontal lines for writing notice.



DET NORSKE VERITAS
MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 18783-2007-AQ-BUD-RvA

This is to certify that

GANZ Műszer ZRt.

H-1191 Budapest, Üllői út 200.

has been found to conform to the Management System Standard:

ISO 9001:2000

This Certificate is valid for the following product or service ranges:

Development, production and sale of electrical and electromechanical measuring equipment

Initial Certification date:
April 05, 2007

Place and date:
Budapest, April 05, 2007

This Certificate is valid until:
April 05, 2010

The audit has been performed under the supervision of

Hartmann Levente
Lead Auditor



for the Accredited Unit:
DNV CERTIFICATION B.V.,
THE NETHERLANDS

Zrupkó János
Management Representative

Lack of fulfillment of conditions as set out in the Appendix may render this Certificate invalid.
DNV CERTIFICATION B.V., Haarstechnstraat 7, 3079 DC Rotterdam, The Netherlands, TEL./INT.: +31 10 2922 688, FAX: +31 30 4796 708.

GANZ Instruments Ltd. manufactures a wide range of electric/electronic measuring and controlling equipment.

GANZ Instruments Ltd. is one of the largest manufacturers of the above products in Europe and has over 50 years experience in electrical engineering and measurement.

GANZ Instruments Ltd. manufactures and exports to around 70 countries the following products:

- Panel meter switchboard instruments (analogue and digital)
- Vibration proof instruments
- Current transformers, shunts
- Electronic energy meters (kWh-meters)
- Transducers
- Point and line recorders
- Temperature sensors
- Temperature and heating controllers
- Portable measuring instruments, multimeters
- Portable precision instruments

For additional information or your special requirements please contact us or our local representatives.



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