

Square Panel Meters

Rectangular Panel Meters

Square panel meters and rectangular panel meters per DIN 43 700.
Front frame matt black or matt grey (RAL 7037) per DIN 43 718.

Available Models - Square Panel Meters:

Front Dimensions	48 x 48	72 x 72	96 x 96	144 x 144
	see page			
Moving-iron panel meters	36	36	36	36
Bimetal ammeters	44	44	44	44
Moving-iron bimetal ammeters	—	49	49	49
Moving-coil panel meters w. rectifier	54	54	54	54
Moving-coil panel meters for DC	62	62	62	62
Power meters	—	—	78	—
Power factor meters	—	—	82	—
Pointer-type frequency meters	84	84	84	—



Available Models - Rectangular Panel Meters:

Front Dimensions	48 x 24	72 x 36	96 x 48	144 x 72	48 x 18.5	72 x 18.5	72 x 24	96 x 24	144 x 36
	see page								
Moving-coil panel meters for DC	89	89	89	89	97	97	97	97	97
Moving-coil indicator/controller for DC	—	—	105, 111	105	—	—	—	105	105

Interchangeable Scales

Scale replacement is quick and simple with no loss of accuracy. The permanently affixed closure flap at the top, or at the left side of the housing (for 144 x 144 mm panel meters only) need only be opened, and the scale can be pulled out and removed.

Terminal Connections

M4 screw terminals with self-lifting terminal clips simplify clamping of connector wires. Terminal screws can be turned with cross-head or with standard screw drivers.

Except for ammeters with direct connection:

Moving-coil ammeters ≥ 6 A and 40 A/60 A moving-iron ammeters include M 6 bolt terminals, and 100 A moving-iron ammeters have M 8 bolt terminals

Housing

The rugged polycarbonate housing is self-extinguishing and drip-proof per UL94V-0.

Window material: silicate glass

Front frames and glass windows can be easily replaced.

All panel meters are optionally available with a sheet metal housing, **except for** power meters with front panel dimensions of 48 x 48 mm.

Several instruments can be mounted side by side without spacers for space saving installation (the "polycarbonate housing with 2 leaf springs" option is required for meters with front dimensions of 48 x 48 mm).

The housing configuration, as well as a special housing for panel meters with front panel dimensions of 48 x 48 mm (available as an option), allow for installation into the various grid mosaic systems.

Mounting

All mounting fasteners are resistant to excessive vibration and shock (order no. LN56).

The S type screw clamp supplied as standard equipment can be used with polycarbonate and sheet metal housings with a control panel thickness of ≤ 25 mm, and the screw spindle (with 144 x 144 mm panel meters only) for control panel thickness of ≤ 40 mm.

Safety Precautions

- Instruments with damaged front frame or window must be disconnected from the mains.
- Adequate safety clearance must be maintained to control panel fasteners and to sheet metal housings if non-insulated (stripped) connector wires are used.
- The terminal block cover must be snapped into place after the connector wires have been clamped in order to assure back of hand and finger contact safety in accordance with BGV A3.
- Scales may only be replaced under voltage-free conditions.
- Front frames and windows may only be replaced under voltage-free conditions.

Available Options

- Sheet metal housing with screw clamp per B DIN 43835 for control panel thickness of ≤ 40 mm (**except for** power meters and panel meters with front panel dimensions of 48 x 48 mm).
 - Polycarbonate housing with front dimensions of 48 x 48 mm for Mauell grid mount. no fasteners
 - Polycarbonate housing with 2 leaf springs for standard stress requirements. also suitable for H&B Unibloc and Mauell grid mount for panel meters with front panel dimensions of 72 x 72 mm and 96 x 96 mm (**except for** power meters and panel meters with front panel dimensions of 144 x 144 mm).
 - Polycarbonate housing with front panel dimensions of 48 x 48 mm for H&B Unibloc grid with 2 leaf springs (Bronze Springs)
 - Polycarbonate housing with 4 leaf springs for heightened stress requirements (**except for** power meters and panel meters with front panel dimensions of 144 x 144 mm).
- Advantages of leaf spring mounting:
- Time saving, front mounting into DIN control panel cutout for control panel thickness of ≥ 1 mm.
 - Front mounting into grid system (see above).
- Polycarbonate housing with Subklew fastener (screw clamp similar to type "S" with cup point) for Subklew grid (**except for** meters with front panel dimensions of 144 x 144 mm).

	Moving-Coil Movement	Moving-Iron Movement	Bimetal Movement
Application	Measuring of direct current or direct voltage Precision measurement of average value With rectifier: Measurement of alternating current or alternating voltage Measurement of rectified value, effective value sinewave display	Measurement of alternating current or alternating voltage True RMS measurement (TRMS)	Measurement of alternating current True RMS measurement (TRMS) The integrated slave pointer indicates the highest attained value
Bearings	Rugged pivot bearings with spring-loaded jewels	Rugged pivot bearings with spring-loaded jewels	Rugged bronze bearings
Damping · Overshoot · Response Time	Eddy-current damping ≤ 5% of scale length ≤ 2 s per DIN EN 60061-1	Eddy-current damping ≤ 5% of scale length ≤ 2 s per DIN EN 60061-1	Thermal, time-delayed, for display of mean effective value 15 min., alternatively 8 min
Reference Conditions · Frequency	with rectifier: 45 Hz ... 65 Hz	45 Hz ... 65 Hz	45 Hz ... 65 Hz
Nominal Range of Use · Frequency	with rectifier: Ammeter: 40 Hz ... 1000 Hz Voltmeter: 40 Hz ... 10000 Hz	Ammeter: 15 Hz ... 400 Hz Voltmeter: 15 Hz ... 100 Hz	≤ 400 Hz
Scale Characteristics	nearly linear	Lower measuring range value is approx. 10 % of upper measuring range value. Ammeter upon request with double overload scale	
Measuring Range	see technical data	see technical data	see technical data
Overload Capacity · Continuous · Short-Term: Current Measurement Voltage Measurement	1.2 x rated value 10 x rated value, 1 s with rectifier: 2 x rated value, 0.5 s 5 x rated value, 5 s with rectifier: 2 x rated value, 0.5 s	1.2 x rated value 10 x I _N 5 s 40 x I _N 1 s (max = 250 A) 2 x rated value, 5 s	1.2 x rated value 10 x rated value 1 s (max = 50 A)
Connection	see technical description	see technical description	see technical description
Power Consumption	see technical data	Ammeter: 0.4 ... 0.6 VA Voltmeter: approx. 4.0 VA	for rated transformer current: 1 A : approx. 1.6 VA (approx. 1.1 VA for BM 48) 5 A : approx. 2.5 VA (approx. 1.9 VA for BM 48)

See individual technical data for technical description of frequency meters, active and reactive power meters and power factor meters.

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 15 ... 65 Hz



Moving-iron movement, 90° scale
Narrow front frame per DIN 43 718, matt black



V-AQS 96

Technical Data

Front Dimensions mm	48 x 48	72 x 72	96 x 96	144 x 144
Type	AQS 48 W	V-AQS 72	V-AQS 96	AQS 144
Scale Length mm	34	66	94	143
Class	1.5	1.5	1.5	1.5
Weight approx. (kg)	0.15	0.2	0.25	0.7
Power Consumption				
If connected to Voltage Transformer				
sec. /100 V (120 V)	approx. 1.0 VA (1.4 VA)	approx. 1.0 VA (1.4 VA)	approx. 1.0 VA (1.4 VA)	approx. 1.0 VA (1.4 VA)
sec. /110 V (132 V)	approx. 1.4 VA (2.0 VA)	approx. 1.4 VA (2.0 VA)	approx. 1.4 VA (2.0 VA)	approx. 1.4 VA (2.0 VA)
If connected to Current Transformer				
sec. 1 A	approx. 0.25 VA	approx. 0.25 VA	approx. 0.25 VA	approx. 0.25 VA
sec. 5 A	approx. 0.30 VA	approx. 0.30 VA	approx. 0.30 VA	approx. 0.30 VA
Operating Voltage	300 V	600 V	600 V	600 V
Test Voltage	3.5 kV	5.8 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	Leaf spring	Screw Clip S	Screw Clip S	Screw Clip G
Housing Material	Polycarbonate	Polycarbonate	Polycarbonate	Sheet metal
Interchangeable Scale	yes	yes	yes	no

Description

Analog panel meter with moving-iron movement

Display

Scale Division Coarse-fine
Pointer Bar indicator with knife-edge

Mechanical Design

Housing Material Polycarbonat, self-extinguishing and drip-proof per UL 94 V - 0 or Sheet metal housing (see above)
Sheet metal housings available as option for type V-AQS 72 and Type V-AQS 96

Replaceable Front frames and glass windows
(Interchangeable scales not available for size 144 x 144 mm)
⇒ May only be replaced under voltage-free conditions!

Terminals M4 (Voltmeter and Ammeter ≤ 9 A)
M6 (Ammeter > 9 A ... ≤ 60 A)
M8 (Ammeter > 60 A ... ≤ 100 A)
Exception AQS 48 W:
M4 (Ammeter ≤ 25 A)
M6 (Ammeter > 25 A ... ≤ 40 A)
M4 screw terminals with self-lifting terminal clips. Screws can be turned with a cross-head or standard screw drivers

Contact Protection Available as option

Reference Conditions

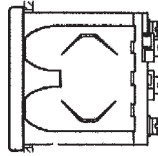
Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ±2 °C
Position of Use	control panel vertical ±1°
Other	DIN EN 60 051

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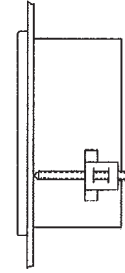


Leaf Spring



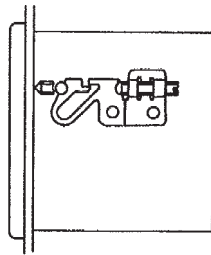
Control panel thickness 1 to 3 mm.
Size 48 x 48 mm, not appropriate for Mauell-Grid.
Also available as option for sizes 72 x 72 and 96 x 96 mm.

Screw Clip S



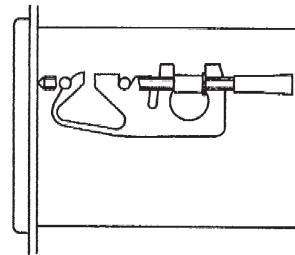
Control panel thickness 1 to 25 mm.
Special screw clamp M4 required for sizes 72 x 72 and 96 x 96 mm.
Also available as option for size 48 x 48 mm, not appropriate for Mauell-Grid.

Screw Clip G



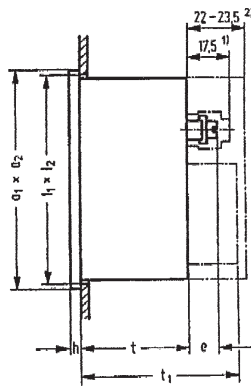
Control panel thickness 1 to 32 mm.
Special screw clamp M4 required for size 144 x 144 mm.

Fastener B DIN 43 835



Control panel thickness 1 to 40 mm.
Screw clamp M4 available as option for:
Sheet metal housings 72 x 72 and 96 x 96 mm with cone head rivets and size 144 x 144 mm.

Basic Dimensions



Dimensions for separate Series Resistor

90 x 36 x 35.5 mm (B x T x H)
Drawing to scale 1402 A 32 (on request).

Drawings to Scale (on request)

0101A258 for size 48 x 48 mm
0101A259 for sizes 72 x 72 and 96 x 96 mm
0101A261 sheet 1 for size 144 x 144 mm

Ordering Example

Panel Meter 96 x 96 mm, 90° Scale, 0 ... 100/200 A
Connection to current transformer sec. 5 A

Type V-AQS 96	Order No. 1604E, BE11, CG100, BU10
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Front Dimensions mm	Nominal Dimensions mm	h	Cutout Dimensions mm	Installation Depth mm		Terminals			for 72 x 72 mm 96 x 96 mm 144 x 144 mm
						≤ 9 A	> 9 A ≤ 60 A	> 60 A ⁴⁾ ≤ 100 A ⁴⁾	
						≤ 25 A	> 25 A ≤ 40 A		48 x 48 mm
	a ₁ x a ₂		l ₁ x l ₂	t	t ₁	M4 e	M6 e	M8 e	
48 x 48	48 x 48	5	45 ^{+0.6} x 45 ^{+0.6}	43.5	56 ³⁾	12.5	16	-	
72 x 72	72 x 72	5	68 ^{+0.7} x 68 ^{+0.7}	43.5	-	12.5	16	20	
96 x 96	96 x 96	5	92 ^{+0.8} x 92 ^{+0.8}	43.5	-	12.5	16	20	
144 x 144	144 x 144	8	138 ⁺¹ x 138 ⁺¹	43.5	-	12.5	16	-	

1) Single terminal cover

2) Overall terminal cover (22 mm for panel meters with front panel dimensions of 48 x 48 mm only)

3) > 250 V ... 660 V with attached series resistor

4) Not valid for panel meters with front panel dimensions of 144 x 144 mm

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 15 ... 65 Hz



Moving-iron movement, 90° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	AQS 48 W 1670E	V-AQS 72 ¹⁾ 1601E	V-AQS 96 ¹⁾ 1604E	AQS 144 1620E
Alternating Current						
Range:	+↕					
0 ... 50 mA	CB50		A	A	A	A
0 ... 100 mA	CB100		A	A	A	A
0 ... 150 mA	CB150		A	A	A	A
0 ... 250 mA	CB250		A	A	A	A
0 ... 400 mA	CB400		A	A	A	A
0 ... 600 mA	CB600		A	A	A	A
0 ... >0.1 A <1 A ²⁾	CB...		A	A	A	A
0 ... 1 A	CC1		+	+	+	+
0 ... 1.5 A	CC1.5		+	+	+	+
0 ... 2.5 A	CC2.5		+	+	+	+
0 ... 4 A	CC4		+	+	+	+
0 ... 5 A	CC5		+	+	+	+
0 ... 6 A	CC6		+	+	+	+
0 ... 10 A	CC10		A	A	A	A
0 ... 15 A	CC15		A	A	A	A
0 ... 25 A	CC25		A	A	A	A
0 ... 40 A	CC40		A	A	A	A
0 ... 60 A	CC60		-	A	A	A
0 ... 100 A	CC100		-	A	A	-
0 ... >1 A <40 A ²⁾	CC...		A	-	-	-
0 ... >1 A <60 A ²⁾	CC...		-	A	A	A
0 ... >1 A ≤ 100 A ²⁾	CC...		-	A	A	-
Alternating Current						
Con. to Current Transfotmer sec. 1 ABE10			+	+	+	+
Con. to Current Transfotmer sec. 5 ABE11			+	+	+	+
Scale:						
0 ... 1 A	CG1		+	+	+	+
0 ... 5 A	CG5		+	+	+	+
0 ... 10 A	CG10		+	+	+	+
0 ... 15 A	CG15		+	+	+	+
0 ... 20 A	CG20		+	+	+	+
0 ... 40 A	CG40		+	+	+	+
0 ... 50 A	CG50		+	+	+	+
0 ... 60 A	CG60		+	+	+	+
0 ... 75 A	CG75		+	+	+	+
0 ... 100 A	CG100		+	+	+	+
0 ... 150 A	CG150		+	+	+	+
0 ... 200 A	CG200		+	+	+	+
0 ... 250 A	CG250		+	+	+	+
0 ... 300 A	CG300		+	+	+	+
0 ... 400 A	CG400		+	+	+	+
0 ... 500 A	CG500		+	+	+	+
0 ... 600 A	CG600		+	+	+	+
0 ... 750 A	CG750		+	+	+	+
0 ... 800 A	CG800		+	+	+	+
0 ... >1 A <1 kA ²⁾	CG...		+	+	+	+
0 ... 1 kA	CH1		+	+	+	+
0 ... 5 kA	CH5		+	+	+	+
0 ... 10 kA	CH10		+	+	+	+
0 ... >1 kA ²⁾	CH...		+	+	+	+

1) For sheet metal housings with cone head rivets please see „Housing Variants“

2) Specify in clear text

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Moving-iron movement, 90° scale

Narrow front frame per DIN 43 718, matt black

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	Type Order No.	⇒	AQS 48 W 1670E	V-AQS 72 ¹⁾ 1601E	V-AQS 96 ¹⁾ 1604E	AQS 144 1620E
Alternating Voltage	+↕					
Range:						
0 ... 6 V	DC6		A	A	A	A
0 ... 10 V	DC10		A	A	A	A
0 ... 15 V	DC15		A	A	A	A
0 ... 25 V	DC25		A	A	A	A
0 ... 40 V	DC40		A	A	A	A
0 ... 60 V	DC60		A	A	A	A
0 ... 100 V	DC100		A	A	A	A
0 ... 150 V	DC150		A	A	A	A
0 ... 250 V	DC250		A	A	A	A
0 ... 300 V	DC300		A	A	A	A
0 ... 400 V	DC400		A	A	A	A
0 ... 500 V	DC500		A	A	A	A
0 ... 600 V	DC600		-	A	A	A
0 ... 800 V	DC800		-	A	A	A
0 ... 1000 V	DC1000		-	A	A	A
0 ... >6 V <1000 V ²⁾	DC...		A	A	A	-
Alternating Voltage						
Connection to Voltage Transformer						
.../100 V sec.	BF12		A	A	A	A
.../110 V sec.	BF15		A	A	A	A
.../100 V Transf. root 3	BF13◇		A	A	A	A
.../110 V Transf. root 3	BF16◇		A	A	A	A
.../100 V sec. root 3	BF19		A	A	A	A
.../110 V sec. root 3	BF20		A	A	A	A
Scale:						
0 ... 500 V	DG500		+	+	+	+
0 ... 600 V	DG600		+	+	+	+
0 ... >500 V <1 kV ²⁾	DG...		+	+	+	+
0 ... 1 kV	DH1		+	+	+	+
0 ... 3 kV	DH3		+	+	+	+
0 ... 6 kV	DH6		+	+	+	+
0 ... 10 kV	DH10		+	+	+	+
0 ... 15 kV	DH15		+	+	+	+
0 ... 20 kV	DH20		+	+	+	+
0 ... 25 kV	DH25		+	+	+	+
0 ... 30 kV	DH30		+	+	+	+
0 ... >1 kV ²⁾	DH...		+	+	+	+

1) For sheet metal housings with cone head rivets please see „Housing Variants“

2) Specify in clear text (1670 just until 500V)

◇ primary / secondary root3

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Moving-iron movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not

	Type Order No.	AQS 48 W ⇒ 1670E	V-AQS 72 1601E	V-AQS 96 1604E	AQS 144 1620E
GENERAL VARIANTS	Identification + ↓				
Measuring Input					
Alternating Current / Voltage	B2	N	N	N	N
Dir. / Alt. Current and Dir. / Alt. Voltage	B3	A	A	A	A
Nominal Frequency					
According to list	IK99	N	N	N	N
... Hz (Frequency in a range of > 65 ... 500 Hz) for Voltmeters ≥ 40 V with standard range and Ammeters ≤ 6 A (please specify frequency)	IK991	A	A	A	A
... Hz (Frequency in a range of > 65 ... 500 Hz) for Ammeters > 6 A (please specify frequency)	IK992	A	A	A	A
Screening					
Normal mounting	LF99	N	N	N	N
Increased stray field protection	LF9	—	A	A	A
Accuracy					
Class 1.5	IE15	N	N	N	N
Class 1.0 (only for alternating current / voltage 50 Hz) ^{1) 6)}	IE10	—	A	A	A
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other	LA999	A	A	A	A
(Please specify angle between scale and horizontal)					
Special Features					
Normal vibration and shock resistance	LNH99	N	N	N	N
Suitable for marine use with the following approvals:					
BV 0591 German Navy	LNH1	—	A ²⁾	A ²⁾	A
DNV-GL	LNH2	A	A	A	A
Vibration resis. 2.5 g, Shock resis. 30 g	LNH56	A ³⁾	A	A	A
Vibration resis. 5 g, Shock resis. 50 g	LNH55	A ⁴⁾	A	A	A ⁵⁾

1) Do not use as supply voltage voltmeter

2) Contains sheet metal housing with cone head rivets (Order No. ML4) and fastener B (Order No. MN11)

3) Available only in combination with screw clip S

4) For Voltmeters and Ammeters ≤ 9 A, only available in combination with Screw Clip S

5) Available only in combination with fastener B DIN 43835

6) Just available with knife-edge pointer and fine division

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	Type Order No. ⇨	AQS 48 W 1670E	V-AQS 72 1601E	V-AQS 96 1604E	AQS 144 1620E
SCALE VARIANTS	Identification +⇕				
Scale					
In accordance with measuring input	GF99	N	N	N	N
Blank scale (lower and upper value markings, company logos, symbols)	GF24	+	+	+	+
Division and Pointer					
Single division	GD1	N	N	N	N
Double division	GD2	A	A	A	A
Coarse-fine division	SE1	N	N	N	N
Fine division	SE3	—	A	A	A
Beam pointer with for single division	RA1	N	N	N	N
knife-edge for double division	RA2	+	+	+	+
Knife-edge pointer for single division	RA10	—	A	A	A
for double division	RA11	—	A	A	A
Additional Imprint					
Second numbering (specify in clear text)	SK992	A	A	A	A
Inscription:					
Without additional inscription	SM99	N	N	N	N
Inscription ≤ 15 characters German	SM991	A	A	A	A
> 15 characters German	SM992	A	A	A	A
≤ 15 characters other language	SM993	A	A	A	A
> 15 characters other language	SM994	A	A	A	A
(Other language in Latin lettering, specify in clear text)					
Coloured mark red RAL 2002 (Specify in clear text)	ST991	A	A	A	A
Coloured sectors yellow RAL 1021, green RAL 6018 or red RAL 2002 (Specify in clear text)	SU991	A	A	A	A
Scale Characteristics					
Interchangeable scale	SA10	N	N	N	—
Screw mounted scale	SA11	—	A	A	N ¹⁾
Overload					
No overload	BU99	N	N	N	N
1.2 x of rated value ²⁾	BU5	+	+	+	+
2 x of rated value (Ammeter only)	BU10	+	+	+	+
4 x of rated value (Ammeter only)	BU12	—	A ⁴⁾	A ⁴⁾	—
6 x of rated value (Ammeter only)	BU14	—	A	A	—

1) Standard version without extra charge

2) Do not use as supply voltage voltmeter

3) Upper value of measuring range ≤ 9 A

4) Upper value of measuring range ≤ 40 A

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	Type Order No. ⇨	AQS 48 W 1670E	V-AQS 72 1601E	V-AQS 96 1604E	AQS 144 1620E
SCALE VARIANTS	Indentification + ⇕				
Scale / Pointer Colours					
Scale white; imprint and pointer black	SG99	N	N	N	N
Scale black; imprint and pointer white	SG1	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint and pointer yellow	SG2	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Without scale; pointer black	SG10	+	+	+	—
Without scale; pointer white	SG11	A	A	A	—
Without scale; pointer yellow	SG12	A	A	A	—
<i>Versions without Scales available only for panel meters that are connected to current or voltage transformers</i>					
HOUSING VARIANTS					
Application					
Standard version	LB99	N	N	N	N
Tropic resistant	LB1	A	A	A	A
Protection Class					
Standard (see technical data)	LH99	N	N	N	N
Front housing-panel protection IP54, terminals IP00	LH21	A	A	A	A
Earthquake-proof (possible combination: LH X 99 or LH X 21)	LNH10	A	A	A	—
Front Frame Colour					
Matt black	MA2	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A	A
Matt light grey RAL 7035	MA14	A	A	A	—
Matt dark beige approx. RAL 1019	MA21	A	A	A	A
Glass Window					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Housing					
Standard housing	ML99	N	N	N	N
Sheet metal housing with cone head rivets	ML4	—	A	A	N ²⁾
Fasteners					
2 leaf springs	MN2	N	+	+	—
2 leaf spr. for H&B Unibloc-Grid (bronze springs)	MN4	+	—	—	—
4 leaf springs	MN1	A	A	A	—
Screw Clip S	MN14	A	N ²⁾	N ²⁾	—
Screw Clip G	MN13	—	—	—	N
Fastener B DIN 43 835	MN11	—	A ³⁾	A ³⁾	A
Subklew fastener (screw clip S without cone point)	MN32	—	A	A	—
Without fastener	MN88	+	+	+	+

¹⁾ Additional one-off costs for special scale printing on request

²⁾ Standard version without extra charge

³⁾ Available only in combination with Order No. MLX 4 (sheet metal housing with cone head rivets)

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 15 ... 65 Hz



Moving-iron movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No. ⇨	AQS 48 W 1670E	V-AQS 72 1601E	V-AQS 96 1604E	AQS 144 1620E
HOUSING VARIANTS	Identification +↓				
Identification					
Without identification	MZ99	N	N	N	N
Identification on the back (specify in clear text)	MZ998	A	A	A	A
Constant Display					
Without constant display	PK99	N	N	N	N
Constant display 1-1.5-2-2.5-3-4-5-6-7.5-8-10	PK5	—	A	A	A
Marker Pointer					
Without marker pointer	PM99	N	N	N	N
Adjustable red index pointer	PM1	A	A	A	A
Label Strips					
Without label strip	SS99	N	N	N	N
Inscription on front face (specify in clear text)	SS992	—	A	A	A
Contact Protection					
Without terminal cover	VB99	N	N	N	N
Overall terminal cover	VB2	A	A	A	A
Single terminal cover (Voltmeter and Ammeter ≤ 9 A or ≤ 25 A for size 48 x 48 mm)	VB1	+	+	+	+

Vario-Series · Square Panel Meters

For Alternating Current



Bimetal movement, 90° scale
Narrow front frame per DIN 43 718, matt black



V-MQS 96

Technical Data

Front Dimensions mm	48 x 48	72 x 72	96 x 96	144 x 144
Type	V-MQS 48	V-MQS 72	V-MQS 96	MQS 144
Scale Length mm	34	66	94	143
Class	3	3	3	3
Weight approx. (kg)	0.1	0.2	0.25	0.6
Operating Voltage	300 V	600 V	600 V	600 V
Test Voltage	3.5 kV	5.8 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	screw clip S	screw clip S	screw clip G
Housing Material	polycarbonate	polycarbonate	polycarbonate	sheet metal
Interchangeable Scale	yes	yes	yes	no

Description

Analog panel meter with bimetal movement

Display

Scale Division Coarse-fine
Pointer Beam pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0 or sheet metal housing (see above).
Sheet metal housings available as option for type V-MQS72 and V-MQS96

Replaceable Glass windows, front frames and scales (interchangeable scales not available for panel meters with front panel dimensions of 144 x 144 mm)
⇒ May only be replaced under voltage-free conditions!

Terminals M4 screw terminals with self-lifting terminal clips. Screws can be turned with a cross-head or standard srew drivers

Contact Protection Available as option

Power Consumption

	Front Dimensions			
	48 x 48	72 x 72	96 x 96	144 x 144
Con. to Transformer				
sec. 1 A	ap. 1.1 VA	ap. 1.1 VA	ap. 1.1 VA	ap. 1.1 VA
sec. 5 A	ap. 1.9 VA	ap. 1.9 VA	ap. 1.9 VA	ap. 1.9 VA

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ±2°C
Position of Use	control panel vertical ±1°
Other	DIN EN 60 051

Overload Capacity

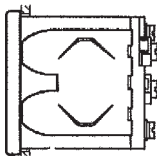
Continous	120 % of rated value
Short-term	10 x of rated value; 1 s (Imax =10 A)

Vario-Series · Square Panel Meters

For Alternating Current

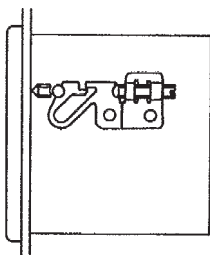


Leaf Spring



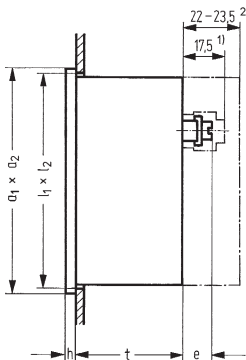
Control panel thickness 1 to 3 mm.
For size 48 x 48 mm, not appropriate for Mauell-Grid.
Also available as option for sizes 72 x 72 and 96 x 96 mm.

Screw Clip G

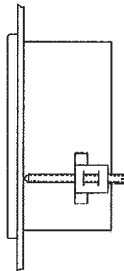


Control panel thickness 1 to 32 mm.
Special screw clamp M4 required for size 144 x 144 mm.

Basic Dimensions

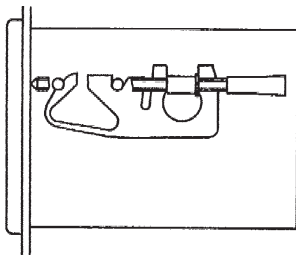


Screw Clip S



Control panel thickness 1 to 25 mm.
Special screw clamp M4 required for panel meters with front panel dimensions of 72 x 72 and 96 x 96 mm.
Also available as option for size 48 x 48 mm, not appropriate for Mauell-Grid.

Fasteners B DIN 43 835



Control panel thickness 1 to 40 mm.
Screw clamp M4 available as option for:
Sheet metal housings 72 x 72 and 96 x 96 mm with cone head rivets and size 144 x 144 mm

Dimensions for separate Current Transformer

1 A: 67 x 45 x 90 (B x T x H)
5 A: 67 x 51 x 90 (B x T x H)

Drawings to Scale (on request)

1303 A 2005 H

Ordering Example

Bimetal ammeter 96 x 96 mm
Connection to current transformer 25/5 A
Overload 1.2 x of rated value
Response time 15 min.

Techn. Data V-MQS 96	Order No. 1604M, BE11, BU5, CG25
--------------------------------	--

Front Dimensions mm	Nominal Dimensions mm		Cutout Dimensions mm $l_1 \times l_2$	Installation Depth t	Terminals M4 e
	$a_1 \times a_2$	h			
48 x 48	48 x 48	5	$45^{+0.6} \times 45^{+0.6}$	43.5	12.5
72 x 72	72 x 72	5	$68^{+0.7} \times 68^{+0.7}$	43.5	12.5
96 x 96	96 x 96	5	$92^{+0.8} \times 92^{+0.8}$	43.5	12.5
144 x 144	144 x 144	8	$138^{+1} \times 138^{+1}$	44.5	12.5

1) Single terminal cover
2) Overall terminal cover (22 mm for panel meters with front panel dimensions of 48 x 48 mm only)

Vario-Series · Square Panel Meters

For Alternating Current



Bimetal movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Note:

Choose only one of the listed measuring inputs.

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	V-MQS 48 1662M	V-MQS 72 ¹⁾ 1601M	V-MQS 96 ¹⁾ 1604M	MQS 144 1620M
Alternating Current	+↕					
Direct Connection						
Range:						
0 ... 1 A	CC1, BU5 ²⁾	+	+	+	+	+
0 ... 5 A	CC5, BU5 ²⁾	+	+	+	+	+
Con. to Current Transformer sec. 1 A	BE10, BU5 ²⁾	+	+	+	+	+
Con. to Current Transfotmer sec. 5 A	BE11, BU5 ²⁾	+	+	+	+	+
Scale:						
1 A	CG1	+	+	+	+	+
5 A	CG5	+	+	+	+	+
10 A	CG10	+	+	+	+	+
15 A	CG15	+	+	+	+	+
20 A	CG20	+	+	+	+	+
25 A	CG25	+	+	+	+	+
30 A	CG30	+	+	+	+	+
40 A	CG40	+	+	+	+	+
50 A	CG50	+	+	+	+	+
60 A	CG60	+	+	+	+	+
75 A	CG75	+	+	+	+	+
100 A	CG100	+	+	+	+	+
150 A	CG150	+	+	+	+	+
200 A	CG200	+	+	+	+	+
250 A	CG250	+	+	+	+	+
300 A	CG300	+	+	+	+	+
400 A	CG400	+	+	+	+	+
500 A	CG500	+	+	+	+	+
600 A	CG600	+	+	+	+	+
750 A	CG750	+	+	+	+	+
800 A	CG800	+	+	+	+	+
0 ... >1 A < 1 kA ³⁾	CG...	+	+	+	+	+
1 kA	CH1	+	+	+	+	+
5 kA	CH5	+	+	+	+	+
10 kA	CH10	+	+	+	+	+
0 ... > 1 kA ³⁾	CH...	+	+	+	+	+

1) For sheet metal housings with cone head rivets please see "Housing Variants"

2) Upper scale value = 120% of rated value

3) Specify in clear text

Vario-Series · Square Panel Meters



For Alternating Current

Bimetal movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇒	V-MQS 48 1662M	V-MQS 72 1601M	V-MQS 96 1604M	MQS 144 1620M
GENERAL VARIANTS	Identification + ↓				
Response Time					
Response time 15 min.	IB1	N	N	N	N
Response time 8 min.	IB2	+	+	+	+
Overload					
Overload 1.2 x of rated value	BU5	N	N	N	N
Overload 1.2 x of rated value with built in prot. cur. transf. 100 x of rated value / 1s	BU26	–	–	–	A
Overload 1.2 of rated value with built in prot. cur. transf 50 x of rated value / 1s	BU28	–	–	– ¹⁾	–
Overload 1.2 x of rated value with separated prot. cur. transf 100 x of rated value / 1s	BU27	A	A	A	–
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other (Please specify angle between scale and horizontal)	LA999	A	A	A	A
SCALE VARIANTS					
Scale					
In accordance with measuring input	GF99	N	N	N	N
Blank scale (lower and upper value markings, company logos, symbols)	GF24	+	+	+	+
Additional Imprint					
Second numbering (specify in clear text)	SK992	A	A	A	A
Inscription:					
Without additional inscription	SM99	N	N	N	N
Inscription ≤ 15 characters German	SM991	A	A	A	A
> 15 characters German	SM992	A	A	A	A
≤ 15 characters other language	SM993	A	A	A	A
> 15 characters other language	SM994	A	A	A	A
(Other language in Latin lettering, specify in clear text)					
Coloured mark red RAL 2002 (specify in clear text)	ST991	A	A	A	A
Coloured sector yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)	SU991	A	A	A	A
Scale / Pointer Colours					
Scale white; imprint und pointer black	SG99	N	N	N	N
Scale black; imprint und pointer white	SG1	A ²⁾	A ²⁾	A ²⁾	A ²⁾
Scale black; imprint und pointer yellow	SG2	A ²⁾	A ²⁾	A ²⁾	A ²⁾
Without scale; pointer black	SG10	+	+	+	–
Without scale; pointer white	SG11	A	A	A	–
Without scale; pointer yellow	SG12	A	A	A	–

1) On request

2) Additional one-off costs for special scale printing on request

Vario-Series · Square Panel Meters

For Alternating Current



Bimetal movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. →	V-MQS 48 1662M	V-MQS 72 1601M	V-MQS 96 1604M	MQS 144 1620M
HOUSING VARIANTS	Identification + ↓				
Front Frame Colours					
Matt black	MA2	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A	A
Matt dark beige approx. RAL 1019	MA21	A	A	A	A
Intermediate Frame, Height 3 mm					
Without intermediate frame	MC99	N	N	N	N
Intermediate frame shiny black	MC1	A	A	A	–
Intermediate frame shiny grey RAL 7037	MC2	A	A	A	–
<i>Intermediate frame available only in combination with screw clip S or fastener B DIN 43 835</i>					
Glass Windows					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Housing					
Standard housing	ML99	N	N	N	N
Sheet metal housing with cone head rivets	ML4	–	A	A	N ¹⁾
Mounting					
2 Leaf springs	MN2	N	+	+	–
4 Leaf springs	MN1	A	A	A	–
Screw Clip S	MN14	A	N ¹⁾	N ¹⁾	–
Screw Clip G	MN13	–	–	–	N
Fastener B DIN 43 835	MN11	–	A ²⁾	A ²⁾	A
Identification					
Without Identification	MZ99	N	N	N	N
Identification on the back (Specify in clear text)	MZ998	A	A	A	A
Constant Display					
Without constant display	PK99	N	N	N	N
Constant display 1-1.5-2-2.5-3-4-5-6-7.5-8-10	PK5	–	A	A	A
Contact Protection					
Without terminal cover	VB99	N	N	N	N
Overall terminal cover	VB2	A	A	A	A
Single terminal cover	VB1	+	+	+	+

1) Standard version without extra charge

2) Available only in combination with Order No. MLX 4 (sheet metal housing with cone head rivets)

Vario-Series · Square Panel Meters

For Alternating Current



Moving-iron movement and bimetal movement, 90° scale
Narrow front frame per DIN 43 718, matt black

Technical Data

Front Dimensions mm		72 x 72	96 x 96	144 x 144
Type		V-MAQS 72	V-MAQS 96	AMQS 144
Scale Length mm	Bimetal	66	94	107
	Moving-iron	60	81	143
Class	Bimetal	3	3	3
	Moving-iron	1.5	1.5	1.5
Weight approx. (kg)		0.3	0.35	1.3
Operating Voltage		600 V	600 V	600 V
Test Voltage		5.8 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection		IP 50	IP 50	IP 50
Fasteners		screw clip S	screw clip S	screw clip S
Housing Material		polycarbonate	polycarbonate	polycarbonate
Interchangeable Scales		yes	yes	yes



AMQS 144



V-MAQS 96

Description

Analog panel meter with moving-iron movement and bimetal movement

Display

Scale Division Coarse-fine
Pointer Beam pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0.
Replaceable Glass window, front frame and scale
⇒ May only be replaced under voltage-free conditions!
Terminals M4 screw terminals with self-lifting terminal clips. Screws can be turned with a cross-head or standard screw drivers
Contact Protection Available as option

Power Consumption

	Type		
	V-MAQS 72	V-MAQS 96	V-MAQS 144
Connection to transf.			
sec. 1 A			
Bimetal approx.	1.1 VA	1.1 VA	1.1 VA
Moving-iron approx.	0.25 VA	0.25 VA	0.25 VA
sec. 5 A			
Bimetal approx.	1.9 VA	1.9 VA	1.9 VA
Moving-iron approx.	0.3 VA	0.3 VA	0.3 VA

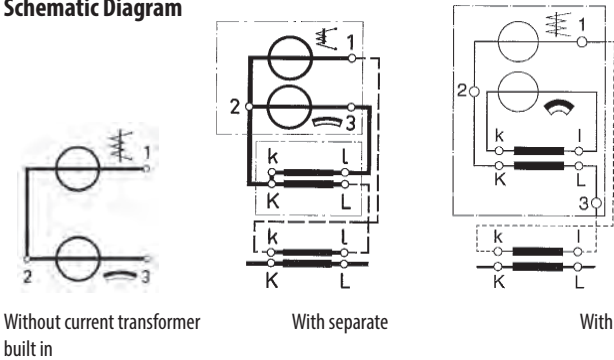
Reference Conditions

Reference Quantities	Refrence Conditions
Ambient Temperature	23 °C ± 2 °C
position of Use	control panel vertical ± 1°
Other	DIN EN 60 051

Overload Capacity of Bimetal Movement

Continous	120% of rated value
Short-term	10 x of rated value; 1 s (I _{max} = 10 A)

Schematic Diagram

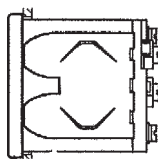


Vario-Series · Square Panel Meters

For Alternating Current

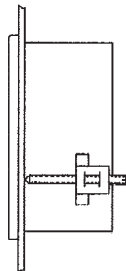


Leaf Spring



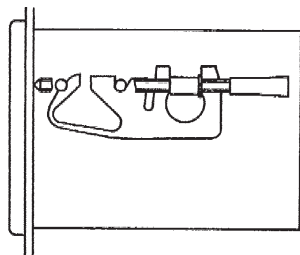
Control panel thickness 1 to 3 mm.
Also available as option for sizes of 72 x 72 and 96 x 96 mm.

Screw Clip S



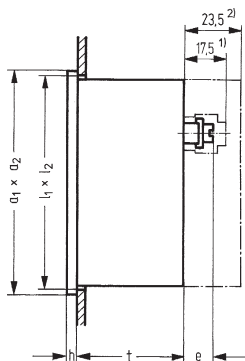
Control panel thickness 1 to 25 mm.
Special screw clamp M4 for sizes 72 x 72 and 96 x 96 mm.

Fastener B DIN 43 835



Control panel thickness 1 to 40 mm.
Screw clamp M4 as option for sizes 72 x 72 and 96 x 96 mm.

Basic Dimensions



Dimensions for Current Transformers

1 A: 67 x 45 x 90 (B x T x H)
5 A: 67 x 51 x 90 (B x T x H)

Drawings to Scale (on request)

1303 A 2005 H

Ordering Example

Panel meter 96 x 96 mm, with bimetal and moving-iron movement
Connection to current transformer 25/5 A
Overload 1.2 x of rated value for bimetal movement, 2 x of rated value for moving-iron movement
Response time 15 min.

Drawings to scale (on request)

0101A259

Techn. Data	Order No. 1606C	
V-MAQS 96	Movement I (Bimetal)	1BE11, 1BU5, 1CG225
	Movement II (Moving-iron)	2BE11, 2BW10, 2CG225

Front in mm	Nominal Dimensions		Cutout Dimensions, mm	Installation Depth	Terminals M4 e
	a ₁ x a ₂	h			
72 x 72	72 x 72	5	68 ^{+0.7} x 68 ^{+0.7}	43.5	12.5
96 x 96	96 x 96	5	92 ^{+0.8} x 92 ^{+0.8}	43.5	12.5
144 x 144	144 x 144	8	138 ⁺¹ x 138 ⁺¹	95.0	12.5

1) Single terminal cover
2) Overall terminal cover

Vario-Series · Square Panel Meters

For Alternating Current



Moving-iron movement and bimetal movement, 90° scale
Narrow front frame per DIN 43 718, matt black

Note:

Choose only one of the listed measuring inputs.

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	V-MAQS 72 ²⁾ 1603C	V-MAQS 96 ²⁾ 1606C	AMQS 144 1622C
Alternating Current¹⁾	+↓				
Movement I (bimetal)	1				
Movement II (moving-iron)	2				
	+↓				
Direct Connection					
Range:					
0 ... 1 A	...CCA1 ³⁾	+	+	+	+
0 ... 5 A	...CCA5 ³⁾	+	+	+	+
Con. to Current Transformer sec. 1 A	...BEA10 ³⁾	+	+	+	+
Con. to Current Transformer sec. 5 A	...BEA11 ³⁾	+	+	+	+
Scale:					
0 ... 1 A	...CG1	+	+	+	+
0 ... 5 A	...CG5	+	+	+	+
0 ... 10 A	...CG10	+	+	+	+
0 ... 15 A	...CG15	+	+	+	+
0 ... 20 A	...CG20	+	+	+	+
0 ... 25 A	...CG25	+	+	+	+
0 ... 30 A	...CG30	+	+	+	+
0 ... 40 A	...CG40	+	+	+	+
0 ... 50 A	...CG50	+	+	+	+
0 ... 60 A	...CG60	+	+	+	+
0 ... 75 A	...CG75	+	+	+	+
0 ... 100 A	...CG100	+	+	+	+
0 ... 150 A	...CG150	+	+	+	+
0 ... 200 A	...CG200	+	+	+	+
0 ... 250 A	...CG250	+	+	+	+
0 ... 300 A	...CG300	+	+	+	+
0 ... 400 A	...CG400	+	+	+	+
0 ... 500 A	...CG500	+	+	+	+
0 ... 600 A	...CG600	+	+	+	+
0 ... 750 A	...CG750	+	+	+	+
0 ... 800 A	...CG800	+	+	+	+
0 ... > 1 A < 1 kA ⁴⁾	...CG...	+	+	+	+
0 ... 1 kA	...CH1	+	+	+	+
0 ... 5 kA	...CH5	+	+	+	+
0 ... 10 kA	...CH10	+	+	+	+
0 ... > 1 kA ⁴⁾	...CH...	+	+	+	+

1) Specify each movement when ordering –
 please complement with: **1** for Movement I (bimetal)

2 for Movement II (moving-iron)

2) For sheet metal housings with cone head rivets please see "Housing Variants"

3) Upper scale value = 120% of rated value

4) Specify in clear text

Vario-Series · Square Panel Meters

For Alternating Current



Moving-iron movement and bimetal movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇒	V-MAQS 72 1603C	V-MAQS 96 1606C	AMQS 144 1622C
GENERAL VARIANTS	Identification + ↓			
Response Time				
Response time 15 min.	IB1	N	N	N
Response time 8 min.	IB2	+	+	+
Overload for Bimetal Movement				
Overload 1.2 x of rated value	BU5	N	N	N
Overload 1.2 x of rated value with built in prot. cur. transf. 100 x of rated value / 1s	2BU26	–	–	+
Overload 1.2 x of rated value with separated prot. cur. transf 100 x of rated value / 1s	1BU27	+	+	–
Overload for Moving-Iron Movement				
Overload 1.2 x of rated value	BW5	N	N	N
Overload 2 x of rated value	BW10	+	+	+
Position of Use				
Control panel vertical	LA1	N	N	N
Control panel horizontal	LA2	+	+	+
Other (Please specify angle between scale and horizontal)	LA999	+	+	+
SCALE VARIANTS				
Scale				
In accordance with measuring input	GF99	N	N	N
Blank scale (lower and upper value markings, company logos, symbols)	GF24	+	+	–
Additional Imprint				
Second numbering (specify in clear text)	SK992	–	A	–
Inscription:				
Without additional inscription	SM99	N	N	N
Inscription ≤ 15 characters German	SM991	A	A	A
> 15 characters German	SM992	A	A	A
≤ 15 characters other language	SM993	A	A	A
> 15 characters other language	SM994	A	A	A
(Other language in Latin lettering, specify in clear text)				
Coloured mark red RAL 2002 (specify in clear text)	ST991	A	A	A
Coloured sector yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)	SU991	A	A	A
Scale / Pointer Colours				
Scale white; imprint und pointer black	SG99	N	N	N
Scale black; imprint und pointer white	SG1	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint und pointer yellow	SG2	A ¹⁾	A ¹⁾	A ¹⁾
Without scale; pointer black	SG10	+	+	–
Without scale; pointer white	SG11	A	A	–
Without scale; pointer yellow	SG12	A	A	–

1) Additional one-off costs for special scale printing on request

Vario-Series · Square Panel Meters

For Alternating Current



Moving-iron movement and bimetal movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not

	Type Order No.	V-MAQS 72 ⇒ 1603C	V-MAQS 96 1606C	AMQS 144 1622C
HOUSING VARIANTS	Identification + ↓			
Front Frame Colours				
Matt black	MA2	N	N	N
Matt grey RAL 7037	MA11	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A
Matt light grey RAL 7035	MA14	A	A	-
Matt dark beige approx. RAL 1019	MA21	A	A	A
Intermediate Frame. Height 3 mm				
Without intermediate frame	MC99	N	N	N
Intermediate frame shiny black	MC1	A	A	A
Intermediate frame shiny grey RAL 7037	MC2	A	A	A
<i>Intermediate frame available only in combination with screw clip S or fastener B DIN 43 835</i>				
Glass Window				
Standard version	MG99	N	N	N
Anti-glare glass	MG1	A	A	A
Housing				
Standard housing	ML99	N	N	N
Sheet metal housing with cone head rivets	ML4	A	A	N ¹⁾
Mounting				
2 Leaf springs	MN2	+	+	-
4 Leaf springs	MN1	A	A	-
Screw Clip S	MN14	N	N	-
Fastener B DIN 43835	MN11	A ²⁾	A ²⁾	N ¹⁾
Identification				
Without identification	MZ99	N	N	N
Identification on the back (specify in clear text)	MZ998	A	A	A
Constant Display				
Without constant display	PK99	N	N	N
Constant display 1-1.5-2-2.5-3-4-5-6-7.5-8-10 PK5		-	A	A
Contact Protection				
Without terminal cover	VB99	N	N	N
Overall terminal cover	VB2	A	A	A
Single terminal cover	VB1	+	+	+

1) Standard version without extra charge

2) Available only in combination with Order No. MLX 4 (sheet metal housing with cone head rivets)

Vario-Series · Square Panel Meters

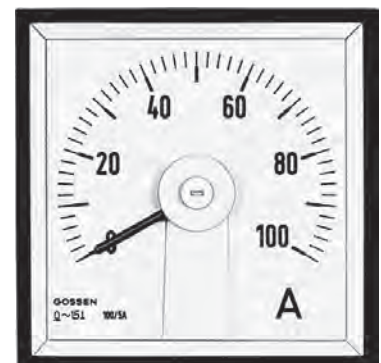
For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale
Narrow front frame per DIN 43 718, matt black



V-PQS 96



V-PQ 96-250

Technical Data

Front Dimensions mm	48 x 48	72 x 72	96 x 96	144 x 144
Type (90° Scale)	PQS 48 W	V-PQS 72	V-PQS 96	PQS 144
Scale Length mm	40	66	94	143
Type (240° Scale)	V-PQ 48-250	V-PQ 72-250	V-PQ 96-250	PQ 144-250
Scale Length mm	73	113	151	235
Class	1.5	1.5	1.5	1.5
Weight approx. (90° / 240°) (kg)	0.08 / 0.16	0.2 / 0.2	0.25 / 0.25	0.6 / 0.65
Operating Voltage	300 V	600 V	600 V	600 V
Test Voltage	3.5 kV	5.8 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	screw clip S	screw clip S	screw clip G
Housing Material	polycarbonate	polycarbonate	polycarbonate	sheet metal
Interchangeable Scale	yes	yes	yes	no

Description

Analog panel meter with moving-coil movement and rectifier

Display

Scale Division Coarse-fine
 Pointer Beam Pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0 or sheet metal housing (see above).
 Sheet metal housing available as option for type V-PQS 72, V-PQS 96, V-PQ 72-250 and V-PQ 96-250 .
 Replaceable Glass windows, front frames and scales (interchangeable scales not available for panel meters with front panel dimensions of 144 x 144 mm)
 ⇒ May only be replaced under voltage-free conditions!
 Terminals M4 screw terminals with self-lifting terminal clips. Screws can be turned with a cross-head or standard screw drivers
 Contact Protection Available as option

Voltage Drop / Power Consumption

Voltage drop with measuring range <100 mA: approx. 1.2 V
 Power consumption with measuring range ≥100 mA: approx. 0.15 VA

Reference Conditions

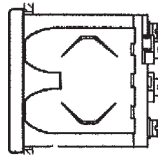
Reference Quantities	Reference Conditions
Wave Shape	sine, distortion factor ≤1%
Frequency	50 Hz ±2 %
Ambient Temperature	23 °C ±2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60 051

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz

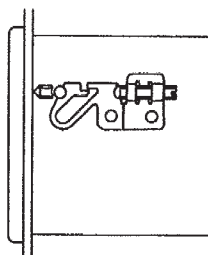


Leaf Spring



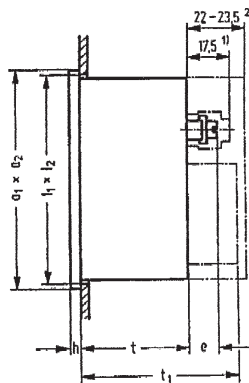
Control panel thickness 1 to 3 mm.
For size 48 x 48 mm, not available for Mauell-Grid.
Also available as option for sizes 72 x 72 and 96 x 96 mm.

Screw Clip G



Control panel thickness 1 to 32 mm.
Special screw clamp M4 required for size 144 x 144 mm.

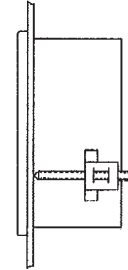
Basic Dimensions



Drawings to Scale (on request)

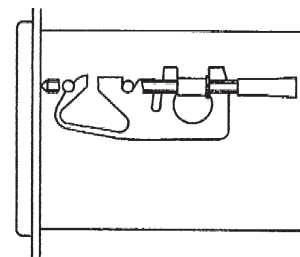
0101A258 for size 48 x 48 mm
0101A259 for sizes 72 x 72 and 96 x 96 mm
0101A261 sheet 1 for size 144 x 144 mm

Screw Clip S



Control panel thickness 1 to 25 mm.
Special screw clamp M4 required for size 72 x 72 and 96 x 96 mm.
Also available as option for size 48 x 48 mm, not available for Mauell-Grid.

Fastener B DIN 43 835



Control panel thickness 1 to 40 mm.
Screw clamp M4 as option for:
Sheet metal housings 72 x 72 and 96 x 96 mm with cone head rivets and size 144 x 144 mm.

Dimensions for separated Saturation Current Transformer

80 x 55 x 31 mm (L x B x H)

Drawing to Scale (on request)

1303A1839H0

Ordering Example

Panel meter 96 x 96 mm
Scale 240°
0 ... 40 V Alternating voltage

Type V-PQ 96-250	Order No. 1605W, DC240
----------------------------	----------------------------------

Front Dimensions mm	Nominal Dimensions		Cutout Dimensions	Installation Depth		Terminals	
	a ₁ x a ₂	h		t	t ₁	M4 e	≥ 100 mA M3 e
48 x 48	48 x 48	5	45 ^{+0.6} x 45 ^{+0.6}	43.5	61.5 ³⁾	12.5	5.5
72 x 72	72 x 72	5	68 ^{+0.7} x 68 ^{+0.7}	43.5	—	12.5	—
96 x 96	96 x 96	5	92 ^{+0.8} x 92 ^{+0.8}	43.5	—	12.5	—
144 x 144	144 x 144	8	138 ⁺¹ x 138 ⁺¹	44.5	—	12.5	—

1) Single terminal cover

2) Overall terminal cover (22 mm for panel meters with front panel dimensions of 48 x 48 mm only)

3) ≥ 100 mA with attached intermediate transformer (available only for V-PQ 48-250)

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type (90° Scale) Order No. ⇨	PQS 48 W 1670W	V-PQS 72 1601W	V-PQS 96 1604W	PQS 144 1620W
	Type (240° Scale) Order No. ⇨	V-PQ 48-250 1668W	V-PQ 72-250 1602W	V-PQ 96-250 1605W	PQ 144-250 1621W
Alternating Current ¹⁾	+↕				
Range:					
0 ... 100 µA ²⁾	CA100	A	A	A	A
0 ... 150 µA	CA150	A	A	A	A
0 ... 250 µA	CA250	A	A	A	A
0 ... 400 µA	CA400	A	A	A	A
0 ... 600 µA	CA600	A	A	A	A
0 ... >100 µA ... <1 mA ³⁾	CA...	A	A	A	A
0 ... 1 mA	CB1	+	+	+	+
0 ... 1.5 mA	CB1.5	+	+	+	+
0 ... 2.5 mA	CB2.5	+	+	+	+
0 ... 4 mA	CB4	+	+	+	+
0 ... 6 mA	CB6	+	+	+	+
0 ... 10 mA	CB10	+	+	+	+
0 ... 15 mA	CB15	A	A	A	A
0 ... 25 mA	CB25	A	A	A	A
0 ... 40 mA	CB40	A	A	A	A
0 ... 60 mA	CB60	A	A	A	A
0 ... 100 mA	CB100	A	A	A	A
0 ... 150 mA	CB150	A	A	A	A
0 ... 250 mA	CB250	A	A	A	A
0 ... 400 mA	CB400	A	A	A	A
0 ... 600 mA	CB600	A	A	A	A
0 ... >1 mA ... <1 A ³⁾	CB...	A	A	A	A
0 ... 1 A	CC1	A	A	A	A
0 ... 1.5 A	CC1.5	A	A	A	A
0 ... 2.5 A	CC2.5	A	A	A	A
0 ... 4 A	CC4	A	A	A	A
0 ... >1 A ... <5 A ³⁾	CC...	A	A	A	A
Connection to Current Transformer ¹⁾					
...A/1A	complement with CG... or CH...	A	A	A	A
...A/5A		A	A	A	A
...A/1A		A	A	A	A
...A/5A		A	A	A	A
Scale: ↕.....⇨					
1 A	CG1	+	+	+	+
5 A	CG5	+	+	+	+
10 A	CG10	+	+	+	+
15 A	CG15	+	+	+	+
25 A	CG25	+	+	+	+
40 A	CG40	+	+	+	+
60 A	CG60	+	+	+	+
100 A	CG100	+	+	+	+
150 A	CG150	+	+	+	+
250 A	CG250	+	+	+	+
400 A	CG400	+	+	+	+
600 A	CG600	+	+	+	+
0 ... >1 A ... <1 kA ³⁾	CG...	+	+	+	+
1 kA	CH1	+	+	+	+
1.2 kA	CH1.2	+	+	+	+
1.5 kA	CH1.5	+	+	+	+
>1 kA ³⁾	CH...	+	+	+	+

1) For Type PQS 48 W ± 100 mA with separate intermediate transformer

2) Not possible with 240° scales

3) Specify in clear text

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type (90° Scale) Order No. ⇒	PQS 48 W 1670W	V-PQS 72 1601W	V-PQS 96 1604W	PQS 144 1620W
	Type (240° Scale) Order No. ⇒	V-PQ 48-250 1668W	V-PQ 72-250 1602W	V-PQ 96-250 1605W	PQ 144-250 1621W
Alternating Voltage Zero Point at left Range:	+↕				
0 ... 2.5 V	DC2.5	A	A	A	A
0 ... 4 V	DC4	A	A	A	A
0 ... 6 V	DC6	A	A	A	A
0 ... 10 V	DC10	A	A	A	A
0 ... 15 V	DC15	A	A	A	A
0 ... 25 V	DC25	A	A	A	A
0 ... 40 V	DC40	A	A	A	A
0 ... 60 V	DC60	A	A	A	A
0 ... 100 V	DC100	A	A	A	A
0 ... 150 V	DC150	A	A	A	A
0 ... 250 V	DC250	A	A	A	A
0 ... 400 V	DC400	-	A	A	A
0 ... 500 V	DC500	-	A	A	A
0 ... 600 V	DC600	-	A	A	A
0 ... 800 V	DC800	-	A	A	A
0 ... 1000 V	DC1000	-	A	A	A
0 ... >2.5 V <1000 V ¹⁾	DC...	A ²⁾	A	A	A
Alternating Voltage Connection to Voltage Transformer					
.../100 V sec.	BF12	A	A	A	A
.../110 V sec.	BF15	A	A	A	A
.../100 V } Overload .../110 V } 1.2 x of .../250 V } rated val.	complement with DG... or DH...	BF25	A	A	A
		BF26	A	A	A
		BF18	A	A	A
Scale:					
0 ... 500 V	DG500	+	+	+	+
0 ... 600 V	DG600	+	+	+	+
0 ... >500 V <1 kV ¹⁾	DG...	+	+	+	+
0 ... 1 kV	DH1	+	+	+	+
0 ... 3 kV	DH3	+	+	+	+
0 ... 5 kV	DH5	+	+	+	+
0 ... 6 kV	DH6	+	+	+	+
0 ... 10 kV	DH10	+	+	+	+
0 ... 15 kV	DH15	+	+	+	+
0 ... 20 kV	DH20	+	+	+	+
0 ... 25 kV	DH25	+	+	+	+
0 ... 30 kV	DH30	+	+	+	+
0 ... >1 kV ¹⁾	DH...	+	+	+	+

1) Specify in clear text

2) 0 ... >2.5 V <500 V

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not

	Type (90° Scale) Order No.	⇒ PQS 48 W 1670W	V-PQS 72 1601W	V-PQS 96 1604W	PQS 144 1620W
	Type (240° Scale) Order No.	V-PQ 48-250 ⇒ 1668W	V-PQ 72-250 1602W	V-PQ 96-250 1605W	PQ 144-250 1621W
MOVEMENT VARIANTS	Identification + ↓				
Nominal Frequency					
Standard (50 Hz)	IK2	N	N	N	N
Nominal Frequency 60 Hz	IK3	A	A	A	A
Calibration for Direct Current (Prot. against reverse pol.)	IK70	A	A	A	A
Nominal Frequency ... Hz ¹⁾ (Frequency within a range of ≥ 40 Hz / < 1 kHz)	IK998	A	A	A	A
Nominal Frequency ... kHz ¹⁾ (Frequency within a range of ≥ 1 kHz / ≤ 10 kHz)	IK999	A	A	A	A
Internal Resistance with Voltmeters					
Standard (see technical data)	IR99	N	N	N	N
Ri approx. 10 kΩ / V (Measuring input ≥ 6 V)	IR10	A	A	A	A
Ri = 1 kΩ / V ±1% at nom. temperature (Measuring input ≥ 6 V)	IR30	A	A	A	A
Ri = 10 kΩ / V ±1% at nom. temperature (Measuring input ≥ 6 V)	IR40	A	A	A	A
Potentiometer for Adjustment with Voltmeters					
Voltmeters without potentiometer for adjustment	MP99	N	N	N	N
Voltmeters with potentiometer for adjustment	MP1	—	A	A	A
Adjustment range ±15 % (Measuring input ≥ 6 V / ≤ 550 V; Ri according to list)					
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other (Please specify angle between scale and horizontal)	LA999	+	+	+	+
Special Features					
Normal vibration and shock resistance	LN99	N	N	N	N
Suitable for marine use with the following approvals:					
BV 0591 German Navy	LN1	—	+ ²⁾	+ ²⁾	+
DNV-GL	LN2	+	+	+	+
Vibration resis. 2.5 g, Shock resis. 30 g	LN56	+ ³⁾	+	+	+
Vibration resis. 5 g, Shock resis. 50 g	LN55	+ ³⁾	+	+	+ ⁴⁾

1) Specify in clear text

2) Contains sheet metal housing with cone head rivets (Ident. ML4) and fastener B (Ident. MN11)

3) Available only in combination with screw clip S

4) Available only in combination with fastener B DIN 43835

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

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'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type (90° Scale) Order No.	⇒ PQS 48 W 1670W	V-PQS 72 1601W	V-PQS 96 1604W	PQS 144 1620W
	Type (240° Scale) Order No.	⇒ V-PQ 48-250 1668W	V-PQ 72-250 1602W	V-PQ 96-250 1605W	PQ 144-250 1621W
Identification + ↓					
SCALE VARIANTS					
Scale					
In accordance with measuring input	GF99	N	N	N	N
Blank scale (lower & upper marks, co. logo & symbols)	GF24	+	+	+	+
Scale Characteristics					
Current / Voltage linear	SD1	N	N	N	N
According to curve (not current / voltage linear)	SD6	A	A	A	A
Overload					
No Overload	BU99	N	N	N	N
2 x of rated value with built in sat. cur. transformer	BU20	–	A ^{1) 6)}	A ¹⁾	A
2 x of rated value with separated sat. cur. transformer	BU21	A	A ²⁾	A ^{2) 6)}	–
5 x of rated value with built in sat. cur. transformer	BU34	–	A ^{1) 6)}	A ¹⁾	A
5 x of rated value with separated sat. cur. transformer	BU35	A	A ²⁾	A ^{2) 6)}	–
10 x of rated value with built in sat. cur. transformer	BU44	–	A ^{3) 6)}	A ³⁾	A ⁴⁾
10 x of rated value with separated sat. cur. transformer	BU45	A ⁴⁾	A ⁴⁾	A ^{4) 6)}	–
<i>Saturation current transformer available only for connection to current transformer (Order No. BE10 and BE11) and only for a nominal frequency of 50 Hz or 60 Hz</i>					
Division and Pointer					
Single division	GD1	N	N	N	N
Double division	GD2	A	A	A	A
Coarse fine division	SE1	N	N	N	N
Fine division	SE3	–	A	A	A
Beam pointer with	RA1	N	N	N	N
knife-edge	RA2	+	+	+	+
Knife-edge pointer	RA10	A	A	A	A
	RA11	A ⁶⁾	A	A	A
Bar indicator ⁵⁾	RA40	A	A	A	A
Additional Imprint					
Second numbering (specify in clear text)	SK992	A	A	A	A
Inscription:					
Without additional inscription	SM99	N	N	N	N
Inscription ≤ 15 characters German	SM991	A	A	A	A
> 15 characters German	SM992	A	A	A	A
≤ 15 characters other language	SM993	A	A	A	A
> 15 characters other language	SM994	A	A	A	A
<i>(Other language in Latin lettering, specify in clear text)</i>					
Coloured mark red RAL 2002 (specify in clear text)	ST991	A	A	A	A
Coloured sectors yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)	SU991	A	A	A	A
Scale Characteristics					
Interchangeable scale	SA10	N	N	N	–
Screw mounted scale	SA11	A	A	A	N
Anti-parallax scale (with bar indicator and single division) ⁵⁾	SA5	A	A	A	A

1) Not available with dial illumination

2) Available only with dial illumination

3) Only for connection to transformer sec. 1 A; Not available with dial illumination

4) Only for connection to transformer sec. 1 A

5) Only with 240° Scale

6) Not available with 240° Scale

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

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	Type (90° Scale) Order No.	⇒ PQS 48 W 1670W	V-PQS 72 1601W	V-PQS 96 1604W	PQS 144 1620W
	Type (240° Scale) Order No.	⇒ V-PQ 48-250 1668W	V-PQ 72-250 1602W	V-PQ 96-250 1605W	PQ 144-250 1621W
Identification + ↓					
SCALE VARIANTS					
Scale / Pointer Colours					
Scale white; imprint and pointer black	SG99	N	N	N	N
Scale black; imprint and pointer white	SG1	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint and pointer yellow	SG2	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint white, pointer yellow	SG3	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Dial Illumination					
Without dial illumination	PA99	N	N	N	N
With direct dial illumination (Plexiglass scale, scale and dial illumination white)	PA1	–	A	A	A
<i>Note: Completion with Order No. PB necessary. (Dial illumination not available for mirror interchangeable scales and mirror screw mounted scales)</i>					
With indirect dial illumination					
Light conductor with mask, dial illumination white	PA6	–	A ²⁾	A ²⁾	A ²⁾
Light conductor with mask, dial illumination red	PA7	–	A ²⁾	A ²⁾	A ²⁾
<i>Note: Completion with Order No. PB necessary. (SG 99 as light conductor with mask not available). Dial illumination available only with screw mounted scale (Order No. SA X 11).</i>					
Voltage for Dial Illumination					
12 V	PB3	–	+	+	+
24 V	PB5	–	+	+	+
28 V	PB6	–	+	+	+
HOUSING VARIANTS					
Application					
Standard version	LB99	N	N	N	N
Tropic resistant	LB1	A	A	A	A
Protection					
Standard (see technical data)	LH99	N	N	N	N
Front housing-panel protection IP54, clamps IP00	LH21	A	A	A	A
Earthquake-proof (possible combination: LH X 99 or LH X 21)	LH10	A	A	A	A
Front Frame Colour					
Matt black	MA2	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A	A
Matt light grey RAL 7035	MA14	A	A	A	–
Matt dark beige approx. RAL 1019	MA21	A	A	A	A
Intermediate Frame. Height 3 mm					
Without intermediate frame	MC99	N	N	N	N
Intermediate frame shiny black	MC1	A	A	A	–
Intermediate frame shiny grey RAL 7037	MC2	A	A	A	–
<i>Intermediate frame available only in combination with screw clip S or fastener B DIN 43 835</i>					

1) Additional one-off costs for special scale printing on request

2) Prices on request

Vario-Series · Square Panel Meters

For Alternating Current or Alternating Voltage 40 ... 50 ... 10 000 Hz



Moving-coil movement with rectifier, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

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Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type (90° Scale) Order No.	⇒ PQS 48 W 1670W	V-PQS 72 1601W	V-PQS 96 1604W	PQS 144 1620W
	Type (240° Scale) Order No.	⇒ V-PQ 48-250 1668W	V-PQ 72-250 1602W	V-PQ 96-250 1605W	PQ 144-250 1621W
HOUSING VARIANTS					
Glass Window					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Housing					
Standard housing	ML99	N	N	N	N
Sheet metal housing with cone head rivets	ML4	–	A	A	N ¹⁾
Housing for Mauell-Grid	ML5	+	– ²⁾	– ²⁾	– ³⁾
Housing for H&B Unibloc-Grid	ML6	+ ⁴⁾	– ²⁾	– ²⁾	– ³⁾
Mounting					
2 leaf springs	MN2	N	+	+	–
2 leaf spr. for H&B Unibloc-Grid (bronze springs)	MN4	A	–	–	–
4 leaf springs	MN1	A	A	A	–
Screw Clip S	MN14	A	N ¹⁾	N ¹⁾	–
Screw Clip G	MN13	–	–	–	N
Fastener B DIN 43 835	MN11	–	A ⁵⁾	A ⁵⁾	A
Subklew fastener (Screw Clip S without cone point)	MN32	A	A	A	–
Without fastener	MN88	+ ⁶⁾	+	+	+
Identification					
Without identification	MZ99	N	N	N	N
Identification on the back (specify in clear text)	MZ998	A	A	A	A
Marker Pointer					
Without marker pointer	PM99	N	N	N	N
Adjustable red index pointer	PM1	A	A	A	A
Label Strips					
Without label strips	SS99	N	N	N	N
Label on front face (specify in clear text)	SS992	A	A	A	A
Contact Protection					
Without terminal cover	VB99	N	N	N	N
Overall terminal cover	VB2	A	A	A	A
Single terminal cover	VB1	+	+	+	+

1) Standard version without extra charge

2) Standard housing (ML99) in combination with mounting MN2, also suitable for Mauell-Grid and H&B Unibloc-Grid

3) Standard housing (ML99) in combination with mounting MN11, also suitable for Mauell-Grid and H&B Unibloc-Grid

4) Available only in combination with Order No. MN4 (2 leaf springs for H&B Unibloc-Grid)

5) Available only in combination with Order No. ML4 (sheet metal housing with cone head rivets)

6) ML5 (housing for Mauell-Grid) standard version

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43 718, matt black



PQS 48 W

Technical Data

Front Dimensions mm	48 x 48	72 x 72	96 x 96	144 x 144
Type	PQS 48 W	V-PQS 72	V-PQS 96	PQS 144
Scale Length mm	40	66	94	143
Class	1.5	1.5	1.5	1.5
Weight approx. (kg)	0.08	0.2	0.25	0.6
Operating Voltage	300 V	600 V	600 V	600 V
Test Voltage	3.5 kV	5.8 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	screw clip S	screw clip S	screw clip G
Housing Material	polycarbonate	polycarbonate	polycarbonate	sheet metal
Interchangeable Scale	yes	yes	yes	no

Description

Analog panel meter with moving-coil movement

Display

Scale Division Coarse-fine
Pointer Beam pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0 or sheet metal housing (see above).

Sheet metal housing available as option for type V-PQS 72 and V-PQS 96

Replaceable Glass windows, front frames and scales (interchangeable scales not available for panel meters with front panel dimensions of 144 x 144 mm)

⇒ May only be replaced under voltage-free conditions!

Terminals M4 (Voltmeter and Ammeter ≤ 4 A) or M6 (Voltmeter > 4 A).

M4 screw terminals with self-lifting terminal clips. Screws can be turned with a cross-head or standard screw drivers

Contact Protection Available as option

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60 051

Internal Resistance/Voltage Drop/Current Consumption ¹⁾

	Front Dimensions mm		
	48 x 48 72 x 72 96 x 96	144 x 144	
Measuring Range	Ri	Ri	Tolerance
100 µA	1943 Ω	2000 Ω	± 20 %
150 µA	1547 Ω	2000 Ω	
250 µA	1233 Ω	1080 Ω	
400 µA	375 Ω	497 Ω	
600 µA	202 Ω	163 Ω	
1 mA	79 Ω	69 Ω	
1.5 mA	37.5 Ω	26.5 Ω	
2 mA	21 Ω	20 Ω	
2.5 mA	11.4 Ω	10.8 Ω	± 30 %
4 mA	6.7 Ω	7.1 Ω	
5 mA	4.8 Ω	6.1 Ω	
6 mA	3 Ω	2.4 Ω	
10 mA	3.4 Ω	1.6 Ω	
15 mA	4 Ω	4 Ω	
20 mA	3 Ω	3 Ω	
4 ... 20 mA	3 Ω	3 Ω	
25 mA	2.4 Ω	2.4 Ω	
> 25 mA	Voltage Drop 60 mV		
Connection to shunt	Current Consumption 6 mA		± 20 %
≥ 60 mV	1000 Ω / V		

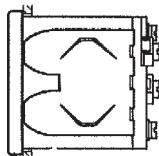
¹⁾ Indicated internal resistance is only valid for instruments with standard accuracy class.
Please inquire regarding internal resistance (Ri) for moving-coil indicators with mechanical zero point at any desired scale value.

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage

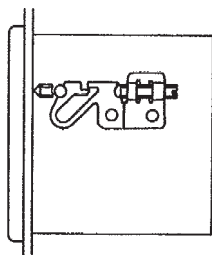


Leaf Spring



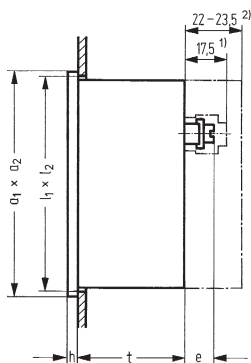
Control panel thickness 1 to 3 mm.
For size 48 x 48 mm, not available for Mauell-Grid.
Also available as option for sizes 72 x 72 and 96 x 96 mm.

Screw Clip G

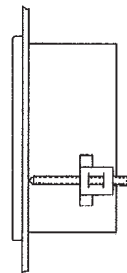


Control panel thickness 1 to 32 mm.
Special screw clamp M4 required for size 144 x 144 mm.

Basic Dimensions

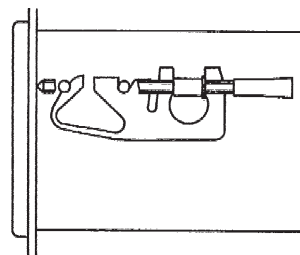


Screw Clip S



Control panel thickness 1 to 25 mm.
Special screw clamp M4 required for size 72 x 72 and 96 x 96 mm.
Also available as option for size 48 x 48 mm, not available for Mauell-Grid.

Fastener B DIN 43 835



Control panel thickness 1 to 40 mm.
Screw clamp M4 as option for:
Sheet metal housings 72 x 72 and 96 x 96 mm with cone head rivets and size 144 x 144 mm

Drawings to Scale (on request)

0101A258 for size 48 x 48 mm
0101A259 for sizes 72 x 72 and 96 x 96 mm
0101A261 sheet 1 for size 144 x 144 mm

Ordering Example

Panel meter 96 x 96 mm
90° Scale
0 ... 40 V Direct Voltage

Type V-PQS 96	Order No. 1604P, DC240
-------------------------	----------------------------------

Front Dimensions mm	Nominal Dimensions		Cutout Dimensions	Installation Depth	Terminals	
	a ₁ x a ₂	h			≤ 4 A	> 4 A
					M4 e	M6 e
48 x 48	48 x 48	5	45 ^{+0.6} x 45 ^{+0.6}	43.5	12.5	17
72 x 72	72 x 72	5	68 ^{+0.7} x 68 ^{+0.7}	43.5	12.5	18
96 x 96	96 x 96	5	92 ^{+0.8} x 92 ^{+0.8}	43.5	12.5	18
144 x 144	144 x 144	8	138 ⁺¹ x 138 ⁺¹	44.5	12.5	18

1) Single terminal cover
2) Overall terminal cover (22 mm for panel meters with front panel dimensions of 48 x 48 mm only)

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	PQS 48 W 1670P	V-PQS 72 1601P	V-PQS 96 1604P	PQS 144 1620P
Direct Current	+↕					
Range:						
0 ... 100 µA	CA100		A	A	A	A
0 ... 150 µA	CA150		A	A	A	A
0 ... 250 µA	CA250		A	A	A	A
0 ... 400 µA	CA400		A	A	A	A
0 ... 600 µA	CA600		A	A	A	A
0 ... >100 µA ... <1 mA ¹⁾	CA...		A	A	A	A
0 ... 1 mA	CB1		+	+	+	+
0 ... 1.5 mA	CB1.5		+	+	+	+
0 ... 2.5 mA	CB2.5		+	+	+	+
0 ... 4 mA	CB4		+	+	+	+
0 ... 5 mA	CB5		+	+	+	+
0 ... 6 mA	CB6		+	+	+	+
0 ... 10 mA	CB10		+	+	+	+
0 ... 15 mA	CB15		+	+	+	A
0 ... 20 mA	CB20		+	+	+	A
0 ... 25 mA	CB25		+	+	+	A
0 ... 40 mA	CB40		+	+	+	A
0 ... 50 mA	CB50		+	+	+	A
0 ... 60 mA	CB60		+	+	+	A
0 ... 100 mA	CB100		+	+	+	A
0 ... 150 mA	CB150		+	+	+	A
0 ... 250 mA	CB250		+	+	+	A
0 ... 400 mA	CB400		+	+	+	A
0 ... 600 mA	CB600		+	+	+	A
0 ... >1 mA ... <1 A ¹⁾	CB...		A	A	A	A
4 ... 20 mA ²⁾	BC10		A	A	A	A
0 / 4 ... 20 mA ³⁾	BC25		A	A	A	A
0 ... 1 A	CC1		+	+	+	A
0 ... 1.5 A	CC1.5		+	+	+	A
0 ... 2.5 A	CC2.5		+	+	+	A
0 ... 4 A	CC4		+	+	+	A
0 ... 6 A	CC6		+	+	+	A
0 ... 10 A	CC10		+	+	+	A
0 ... 15 A	CC15		+	+	+	A
0 ... 25 A	CC25		+	+	+	A
0 ... 40 A	CC40		A	A	A	A
0 ... 60 A	CC60		A	A	A	A
0 ... >1 A ... <60 A ¹⁾	CC...		A	A	A	A

1) Specify in clear text

2) Mechanical suppressed

3) Electrical suppressed

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No. →	PQS 48 W 1670P	V-PQS 72 1601P	V-PQS 96 1604P	PQS 144 1620P
Direct Current	+↕				
Con. to Shunt					
... A / 60 mV	BE3	+	+	+	A
... A / 150 mV	BE4	+	+	+	A
... A / ...>60 mV ¹⁾	BE981	A	A	A	A
Scale:					
1 A	CG1	+	+	+	+
1.5 A	CG1.5	+	+	+	+
2.5 A	CG2.5	+	+	+	+
4 A	CG4	+	+	+	+
6 A	CG6	+	+	+	+
10 A	CG10	+	+	+	+
15 A	CG15	+	+	+	+
25 A	CG25	+	+	+	+
40 A	CG40	+	+	+	+
60 A	CG60	+	+	+	+
100 A	CG100	+	+	+	+
150 A	CG150	+	+	+	+
250 A	CG250	+	+	+	+
400 A	CG400	+	+	+	+
500 A	CG350	+	+	+	+
600 A	CG600	+	+	+	+
0 ...>1 A<1 kA ¹⁾	CG...	+	+	+	+
1 kA	CH1	+	+	+	+
1.5 kA	CH1.5	+	+	+	+
2.5 kA	CH2.5	+	+	+	+
4 kA	CH4	+	+	+	+
5 kA	CH5	+	+	+	+
6 kA	CH6	+	+	+	+
10 kA	CH10	+	+	+	+
15 kA	CH15	+	+	+	+
>1 kA ¹⁾	CH...	+	+	+	+
Direct Voltage					
Range:					
0 ... 60 mV	DB60	A	A	A	A
0 ... 100 mV	DB100	A	A	A	A
0 ... 150 mV	DB150	A	A	A	A
0 ... 250 mV	DB250	A	A	A	A
0 ... 400 mV	DB400	A	A	A	A
0 ... 600 mV	DB600	A	A	A	A
0 ...>60 mV ...<1 V ¹⁾	DB...	A	A	A	A
0 ... 1 V	DC1	A	A	A	A
0 ... 1.5 V	DC1.5	A	A	A	A
0 ... 2.5 V	DC2.5	A	A	A	A
0 ... 3 V	DC3	A	A	A	A
0 ... 4 V	DC4	A	A	A	A
0 ... 6 V	DC6	A	A	A	A
0 ... 10 V	DC10	A	A	A	A
0 ... 15 V	DC15	A	A	A	A
0 ... 25 V	DC25	A	A	A	A
0 ... 40 V	DC40	A	A	A	A
0 ... 60 V	DC60	A	A	A	A
0 ... 100 V	DC100	A	A	A	A
0 ... 150 V	DC150	A	A	A	A
0 ... 250 V	DC250	A	A	A	A
0 ... 400 V	DC400	A	A	A	A
0 ... 500 V	DC500	A	A	A	A
0 ... 600 V	DC600	A	A	A	A
0 ...>1 V ...<600 V ^{1) 2)}	DC...	A	A	A	A
Connection to separate voltage divider ³⁾					
... kV / 25 V (250 µA)	BE76	A	A	A	A

1) Specify in clear text

2) Higher voltages - see voltage dividers, page 129

3) Voltage dividers - see page 129

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not

	Type Order No. ⇒	PQS 48 W 1670P	V-PQS 72 1601P	V-PQS 96 1604P	PQS 144 1620P
GENERAL VARIANTS	Identification + ↓				
Zero Point					
Zero at left	BC1	N	N	N	N
Zero point at center	BC2	A	A	A	A
Zero point as desired (specify in clear text)	BC20	A	A	A	A
Zero point at left, mech. suppressed (not 4-20 mA) (Max. Suppression 50%; measuring ranges ≥ 250 μA / ≥ 250 mV, Ri 1 kΩ/V; specify in clear text)	BC16	A	A	A	A
Internal Resistance with Voltmeters					
Standard (see technical data)	IR99	N	N	N	N
Ri approx. 10 kΩ/V (measuring input ≥ 2 V)	IR10	A	A	A	A
Ri = 1 kΩ / V ± 1 % at nominal temperature (measuring input ≥ 1 V)	IR30	A	A	A	A
Ri = 10 kΩ/V ± 1 % at nominal temperature (measuring input ≥ 2 V)	IR40	A	A	A	A
Potentiometer for Adjustment with Voltmeters					
Voltmeters without potentiometer for adjustment	MP99	N	N	N	N
Voltmeters with potentiometer for adjustment Adjustment range ± 15 % (Measuring input ≥ 6 V / ≤ 550 V; Ri as listed; Class 1.5 only)	MP1	—	A	A	A
Lead Resistor when connecting to Shunt Resistors ...A / 60 mV and ...A / 150 mV					
Standard version 0.06 Ω	IG99	N	N	N	N
Differing from 0.06 Ω (specify in clear text)	IG999	A	A	A	A
Limiting values: ...A / 60 mV for class 1.5 max. 1 Ω ...A / 150 mV for class 1.5 max. 7 Ω					
Accuracy					
Class 1.5	IE15	N	N	N	N
Class 1.0 (Measuring input ≥ 100 μA / ≥ 60 mV; with 72 x 72 in combination with fine division and bar indicator with knife-edge only)	IE10	—	A	A	A
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other (Please specify angle between scale and horizontal)	LA999	A	A	A	A
Special Features					
Normal vibration and shock resistance	LN99	N	N	N	N
Suitable for marine use with the following approvals:					
DNV-GL	LN2	A	A ¹⁾	A ¹⁾	A
BV 0591 German Navy	LN1	—	A ¹⁾	A ¹⁾	A
BV 3340 German Navy	LN6	—	— ²⁾	— ³⁾	+ ⁴⁾
Vibration resis. 2.5 g, Shock resis. 30 g	LN56	A ⁵⁾	A	A	A
Vibration resis. 5 g, Shock resis. 50 g	LN55	A ⁵⁾	A	A	A ⁶⁾

1) Contains sheet metal housing with cone head rivets (Ident. ML4) and fastener B (Ident. MN11)

2) Type PQS 72 according to special data sheet

3) Type PQS 96 according to special data sheet

4) See special data sheet

5) Available only in combination with screw clip S

6) Available only in combination with fastener B DIN 43835

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇒	PQS 48 W 1670P	V-PQS 72 1601P	V-PQS 96 1604P	PQS 144 1620P
SCALE VARIANTS	Identification + ↓				
Scale					
In accordance with measuring input	GF99	N	N	N	N
Blank scale with zero point at left (lower/upper value markings, company logos, symbols)	GF24	+	+	+	+
Blank scale with zero point at center (lower/upper value markings, company logos, symbols)	GF28	+	+	+	+
Scale Characteristics					
Current / Voltage linear	SD1	N	N	N	N
According to curve (not current / voltage linear)	SD6	A	A	A	A
Division and Pointer					
Single division	GD1	N	N	N	N
Double division	GD2	A	A	A	A
Coarse-fine division	SE1	N	N	N	N
Fine division	SE3	–	A	A	A
Beam pointer with for single division	RA1	N	N	N	N
knife-edge for double division	RA2	+	+	+	+
Knife-edge pointer for single division	RA10	A	A	A	A
for double division	RA11	A	A	A	A
Additional Imprint					
Second numbering (specify in clear text)	SK992	A	A	A	A
Inscription:					
Without additional inscription	SM99	N	N	N	N
Inscription ≤ 15 characters German	SM991	A	A	A	A
> 15 characters German	SM992	A	A	A	A
≤ 15 characters other language	SM993	A	A	A	A
> 15 characters other language	SM994	A	A	A	A
(Other language in Latin lettering, specify in clear text)					
Coloured mark red RAL 2002 (specify in clear text)	ST991	A	A	A	A
Coloured sectors yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)	SU991	A	A	A	A
Scale Characteristics					
Interchangeable scale	SA10	N	N	N	–
Screw mounted scale	SA11	A	A	A	N ¹⁾
Mirror interchangeable scale	SA8	–	–	A	–
Mirror screw mounted scale	SA9	–	A	A	A
(Mirror interchangeable scales and mirror screw mounted scales together with fine division and beam pointer with knife-edge only)					

1) Standard version without extra charge

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43718, matt black

Please note when ordering:

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	Type Order No. →	PQS 48 W 1670P	V-PQS 72 1601P	V-PQS 96 1604P	PQS 144 1620P
SCALE VARIANTS	Identification + ↓				
Scale / Pointer Colours					
Scale white; imprint and pointer black	SG99	N	N	N	N
Scale black; imprint and pointer white	SG1	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint and pointer yellow	SG2	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint white, pointer yellow	SG3	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Without scale; pointer black	SG10	+	+	+	–
Without scale; pointer white	SG11	A	A	A	–
Without scale; pointer yellow	SG12	A	A	A	–
Versions without scales available only for panel meters that are connected to transformers or shunts					
Dial Illumination					
Without dial illumination	PA99	N	N	N	N
With direct dial illumination (Plexiglass scale, scale and dial illumination white)	PA1	A	A	A	A
Note: Completion with Order No. PB necessary. Size 48 x 48: dial illumination available only for ≤ 4 A / ≤ 660 V together with single terminal cover.					
With indirect dial illumination					
Light conductor with mask, dial illumination white	PA6	–	A ²⁾	A ²⁾	A ²⁾
Light conductor with mask, dial illumination red	PA7	–	A ²⁾	A ²⁾	A ²⁾
Note: Completion with Order No. SG a , PB necessary. (SG 99 as light conductor with mask not available). Dial illumination available only with screw mounted scale (Order No. SA X 11)					
Voltage for Dial Illumination					
12 V	PB3	+	+	+	+
24 V	PB5	+	+	+	+
28 V	PB6	+	+	+	+
HOUSING VARIANTS					
Application					
Standard version	LB99	N	N	N	N
Tropic resistant	LB1	A	A	A	A
Protection					
Standard (see technical data)	LH99	N	N	N	N
Front housing-panel protection IP54, terminals IP00	LH21	A	A	A	A
Earthquake-proof (possible combination: LH X 99 or LH X 21)	LH10	A	A	A	A
Front Frame Colour					
Matt black	MA2	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A	A
Matt light grey RAL 7035	MA14	A	A	A	–
Matt dark beige approx. RAL 1019	MA21	A	A	A	A
Intermediate Frame, Height 3 mm					
Without intermediate frame	MC99	N	N	N	N
Intermediate frame shiny black	MC1	A	A	A	–
Intermediate frame shiny grey RAL 7037	MC2	A	A	A	–
Intermediate frame available only in combination with screw clip S or fastener B DIN 43 835					

1) Additional one-off costs for special scale printing on request

2) Prices on request

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

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Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇒	PQS 48 W 1670P	V-PQS 72 1601P	V-PQS 96 1604P	PQS 144 1620P
HOUSING VARIANTS	Identification + ↓				
Glass Window					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Housing					
Standard housing	ML99	N	N	N	N
Sheet metal housing with cone head rivets	ML4	–	A	A	N ¹⁾
Housing for Mauell-Grid	ML5	+	– ²⁾	– ²⁾	– ³⁾
Housing for H&B Unibloc-Grid	ML6	+ ⁴⁾	– ²⁾	– ²⁾	– ³⁾
Mounting					
2 leaf springs	MN2	N	+	+	–
2 leaf springs for H&B Unibloc-Grid (bronze-springs)	MN4	A	–	–	–
4 leaf springs	MN1	A	A	A	–
Screw Clip S	MN14	A	N ¹⁾	N ¹⁾	–
Screw Clip G	MN13	–	–	–	N
Fastener B DIN 43 835	MN11	–	A ⁵⁾	A ⁵⁾	A
Subklew fastener (Screw Clip S without cone point)	MN32	A	A	A	–
Without fastener	MN88	+ ⁶⁾	+	+	+
Identification					
Without identification	MZ99	N	N	N	N
Identification on backside (specify in clear text)	MZ998	A	A	A	A
Constant Display					
Without constant display	PK99	N	N	N	N
Constant display 1-2-3	PK1	A	–	–	–
Constant display 1-1.5-2-2.5-3-4-5-6-7.5-8-10	PK5	–	A	A	A
Marker Pointer					
Without marker pointer	PM99	N	N	N	N
Adjustable red index pointer	PM1	A	A	A	
Label Strips					
Without label strips	SS99	N	N	N	N
Label on front face (specify in clear text)	SS992	A	A	A	A
Contact Protection					
Without terminal cover	VB99	N	N	N	N
Overall terminal cover	VB2	A	A	A	A
Single terminal cover (Voltmeter and Ammeter ≤ 4 A)	VB1	+	+	+	+

1) Standard version without extra charge

2) Standard housing (ML99) in combination with fastener MN2, also suitable for Mauell-Grid and H&B Unibloc-Grid

3) Standard housing (ML99) in combination with fastener MN11, also suitable for Mauell-Grid and H&B Unibloc-Grid

4) Available only in combination with Order No. MN4 (2 leaf springs for H&B Unibloc-Grid)

5) Available only in combination with Order No. ML4 (sheet metal housing with cone head rivets)

6) ML5 (housing for Mauell-Grid) standard version

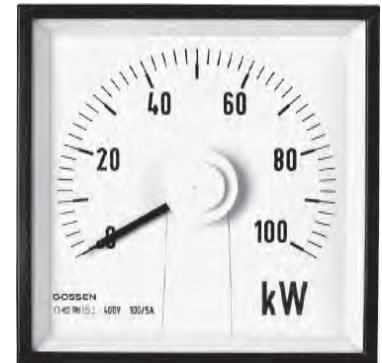
Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black



V-PQ 96-250

Technical Data

Front Dimensions mm Type	48 x 48 V-PQ 48-250	72 x 72 V-PQ 72-250	96 x 96 V-PQ 96-250	144 x 144 PQ 144-250
Scale Length mm	73	113	151	235
Class	1.5	1.5	1.5	1.5
Weight approx. (kg)	0.16	0.2	0.25	0.65
Operating Voltage	300 V	600 V	600 V	600 V
Test Voltage	3.5 kV	5.8 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	screw clip S	screw clip S	screw clip G
Housing Material	polycarbonate	polycarbonate	polycarbonate	sheet metal
Interchangeable Scale	yes	yes	yes	no

Description

Analog panel meter with moving-coil movement

Display

Scale Division Coarse-fine
pointer Beam pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0 or sheet metal housing (see above).
Sheet metal housing available as option for type V-PQS 72 and V-PQS 96

Replaceable Glass windows, front frames and scales (interchangeable scales not available for panel meters with front panel dimensions of 144 x 144 mm)
⇒ May only be replaced under voltage-free conditions!

Terminals M4 (Voltmeter and Ammeter ≤ 4 A) or M6 (Voltmeter > 4 A).
M4 screw terminals with self-lifting terminal clips. Screws can be turned with a cross-head or standard screw drivers

Contact Protection Available as option

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ±1°
Other	DIN EN 60 051

Internal Resistance / Voltage Drop / Current Consumption ¹⁾

Measuring Range	Ri	Tolerance
100 µA	10300 Ω	±20 %
150 µA	8210 Ω	
250 µA	2870 Ω	
400 µA	1770 Ω	
600 µA	773 Ω	
1 mA	337 Ω	±20 %
1.5 mA	167 Ω	
2 mA	97 Ω	
2.5 mA	52 Ω	
4 mA	25 Ω	
5 mA	16.3 Ω	
6 mA	14.2 Ω	
10 mA	3 Ω	±30 %
15 mA	6.5 Ω	
20 mA	5 Ω	
4 ... 20 mA	6.5 Ω	
25 mA	6 Ω	
> 25 mA Connection to Shunt	Voltage Drop 150 mV Current Consumption 10 mA	±20 %
150 mV	75 Ω	
250 mV	125 Ω	
400 mV	200 Ω	
600 mV	300 Ω	
≥ 1 V	1000 Ω/V	

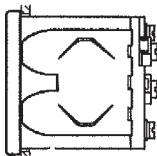
¹⁾ Indicated internal resistance is only valid for instruments with standard accuracy class.
Please inquire regarding internal resistance (Ri) for moving-coil indicators with mechanical zero point at any desired scale value.

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage

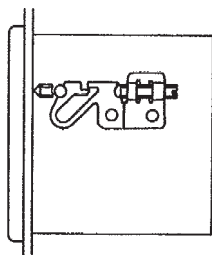


Leaf Spring



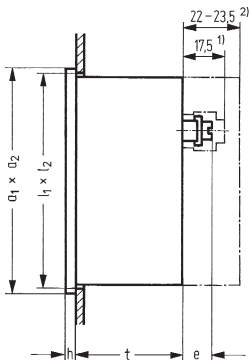
Control panel thickness 1 to 3 mm.
For size 48 x 48 mm, not available for Mauell-Grid.
Also available as option for sizes 72 x 72 and 96 x 96 mm.

Screw Clip G

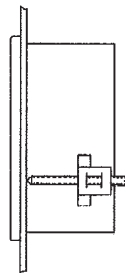


Control panel thickness 1 to 32 mm.
Special screw clamp M4 required for size 144 x 144 mm.

Basic Dimensions

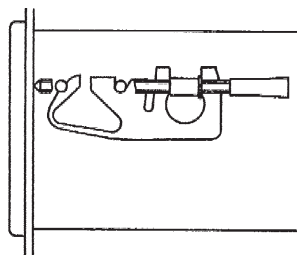


Screw Clip S



Control panel thickness 1 to 25 mm.
Special screw clamp M4 required for sizes 72 x 72 and 96 x 96 mm.
Also available as option for size 48 x 48 mm, not available for Mauell-Grid.

Fastener B DIN 43 835



Control panel thickness 1 to 40 mm.
Screw clamp M4 as option for:
Sheet metal housings 72 x 72 and 96 x 96 mm with cone head rivets and size 144 x 144 mm.

Drawings to Scale (on request)

0101A258 for size 48 x 48 mm
0101A259 for sizes 72 x 72 and 96 x 96 mm
0101A261 sheet 1 for size 144 x 144 mm

Ordering Example

Panel meter 96 x 96 mm
240° Scale
0 ... 40 V Direct Voltage

Type	Order No.
V-PQ 96-250	1605P, DC240

Front Dimensions mm	Nominal Dimensions		Cutout Dimensions	Installation Depth	Terminals	
	a ₁ x a ₂	h			≤ 4 A	> 4 A
					M4 e	M6 e
48 x 48	48 x 48	5	45 ^{+0.6} x 45 ^{+0.6}	43.5	12.5	-
72 x 72	72 x 72	5	68 ^{+0.7} x 68 ^{+0.7}	43.5	12.5	17
96 x 96	96 x 96	5	92 ^{+0.8} x 92 ^{+0.8}	43.5	12.5	18
144 x 144	144 x 144	8	138 ⁺¹ x 138 ⁺¹	44.5	12.5	18

1) Single terminal cover
2) Overall terminal cover (22 mm for panel meters with front panel dimensions of 48 x 48 mm only)

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	V-PQ 48-250 1668P	V-PQ 72-250 ¹⁾ 1602P	V-PQ 96-250 ¹⁾ 1605P	PQ 144-250 1621P
Zero Point at left	+↕					
Direct Current						
Range:						
0 ... 100 µA	CA100		A	A	A	A
0 ... 150 µA	CA150		A	A	A	A
0 ... 250 µA	CA250		A	A	A	A
0 ... 400 µA	CA400		A	A	A	A
0 ... 600 µA	CA600		A	A	A	A
0 ... >100 µA ... <1 mA ²⁾	CA...		A	A	A	A
0 ... 1 mA	CB1		+	+	+	+
0 ... 1.5 mA	CB1.5		+	+	+	+
0 ... 2.5 mA	CB2.5		+	+	+	+
0 ... 4 mA	CB4		+	+	+	+
0 ... 5 mA	CB5		+	+	+	+
0 ... 6 mA	CB6		+	+	+	+
0 ... 10 mA	CB10		+	+	+	+
0 ... 15 mA	CB15		A	A	A	A
0 ... 20 mA	CB20		A	A	A	A
0 ... 25 mA	CB25		A	A	A	A
0 ... 40 mA	CB40		A	A	A	A
0 ... 50 mA	CB50		A	A	A	A
0 ... 60 mA	CB60		A	A	A	A
0 ... 100 mA	CB100		A	A	A	A
0 ... 150 mA	CB150		A	A	A	A
0 ... 250 mA	CB250		A	A	A	A
0 ... 400 mA	CB400		A	A	A	A
0 ... 600 mA	CB600		A	A	A	A
0 ... >1 mA ... <1 A ²⁾	CB...		A	A	A	A
4... 20 mA ³⁾	BC10		A	A	A	A
0/4... 20 mA ⁴⁾	BC25		A	A	A	A
0 ... 1 A	CC1		A	A	A	A
0 ... 1.5 A	CC1.5		A	A	A	A
0 ... 2.5 A	CC2.5		A	A	A	A
0 ... 4 A	CC4		A	A	A	A
0 ... 6 A	CC6		—	A	A	A
0 ... 10 A	CC10		—	A	A	A
0 ... 15 A	CC15		—	A	A	A
0 ... 25 A	CC25		—	A	A	A
0 ... 40 A	CC40		—	A	A	A
0 ... >1 A ... <40 A ²⁾ (Max. 4 A with size 48 x 48 mm)	CC...		A	A	A	A

1) For sheet metal housings with cone head rivets please see "Housing Variants"

2) Specify in clear text

3) Mechanical suppressed

4) Electrical suppressed

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	V-PQ 48-250 1668P	V-PQ 72-250 ¹⁾ 1602P	V-PQ 96-250 ¹⁾ 1605P	PQ 144-250 1621P
Zero Point at left	+↕					
Connection to shunt (direct current)						
... A / 60 mV	BE3	+	+	+	+	A
... A / 150 mV	BE4	+	+	+	+	A
... A / ...>60 mV ²⁾	BE981	A	A	A	A	A
Scale:						
1 A	CG1	+	+	+	+	+
1.5 A	CG1.5	+	+	+	+	+
2.5 A	CG2.5	+	+	+	+	+
4 A	CG4	+	+	+	+	+
6 A	CG6	+	+	+	+	+
10 A	CG10	+	+	+	+	+
15 A	CG15	+	+	+	+	+
25 A	CG25	+	+	+	+	+
40 A	CG40	+	+	+	+	+
60 A	CG60	+	+	+	+	+
100 A	CG100	+	+	+	+	+
150 A	CG150	+	+	+	+	+
250 A	CG250	+	+	+	+	+
400 A	CG400	+	+	+	+	+
500 A	CG350	+	+	+	+	+
600 A	CG600	+	+	+	+	+
0 ...>1 A<1 kA ³⁾	CG...	+	+	+	+	+
1 kA	CH1	+	+	+	+	+
1.5 kA	CH1.5	+	+	+	+	+
2.5 kA	CH2.5	+	+	+	+	+
4 kA	CH4	+	+	+	+	+
5 kA	CH5	+	+	+	+	+
6 kA	CH6	+	+	+	+	+
10 kA	CH10	+	+	+	+	+
15 kA	CH15	+	+	+	+	+
>1 kA ²⁾	CH...	+	+	+	+	+
Direct Voltage						
Range:						
0 ... 150 mV	DB150	A	A	A	A	A
0 ... 250 mV	DB250	A	A	A	A	A
0 ... 400 mV	DB400	A	A	A	A	A
0 ... 600 mV	DB600	A	A	A	A	A
0 ...>150 mV ...<1 V ³⁾	DB...	A	A	A	A	A
0 ... 1 V	DC1	A	A	A	A	A
0 ... 1.5 V	DC1.5	A	A	A	A	A
0 ... 2.5 V	DC2.5	A	A	A	A	A
0 ... 3 V	DC3	A	A	A	A	A
0 ... 4 V	DC4	A	A	A	A	A
0 ... 6 V	DC6	A	A	A	A	A
0 ... 10 V	DC10	A	A	A	A	A
0 ... 15 V	DC15	A	A	A	A	A
0 ... 25 V	DC25	A	A	A	A	A
0 ... 40 V	DC40	A	A	A	A	A
0 ... 60 V	DC60	A	A	A	A	A
0 ... 100 V	DC100	A	A	A	A	A
0 ... 150 V	DC150	A	A	A	A	A
0 ... 250 V	DC250	A	A	A	A	A
0 ... 400 V	DC400	—	A	A	A	A
0 ... 500 V	DC500	—	A	A	A	A
0 ... 600 V	DC600	—	A	A	A	A
0 ...>1 V ...<600 V ^{3) 4)}	DC...	—	A	A	A	A
Connection to separate voltage divider⁵⁾						
... kV / 25 V (250 µA)	BE76	A	A	A	A	A

1) For sheet metal housings with cone head rivets please see „Housing Variants“

2) Upper value>60 mV

3) Specify in clear text

4) Higher Voltages - see voltage dividers, page 129

5) Voltage dividers - see page 129

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '—' = Not

	Type Order No. →	V-PQ 48-250 1668P	V-PQ 72-250 1602P	V-PQ 96-250 1605P	PQ 144-250 1621P
GENERAL VARIANTS	Identification + ↓				
Zero Point					
Zero point at left	BC1	N	N	N	N
Zero point at center	BC2	A	A	A	A
Zero point as desired (specify in clear text)	BC20	A	A	A	A
Zero point at left, mech. suppressed (not 4-20 mA) (Max. Suppression 20%; measuring ranges ≥ 250 µA / ≥ 250 mV, Ri 1 kΩ/V; specify in clear text)	BC16	A	A	A	A
Internal Resistance with Voltmeters					
Standard (see technical data)	IR99	N	N	N	N
Ri approx. 10 kΩ/V (measuring input ≥ 4 V)	IR10	A	A	A	A
Ri = 1 kΩ/V ± 1 % at nominal temperature (measuring input ≥ 1 V)	IR30	A	A	A	A
Ri = 10 kΩ/V ± 1 % at nominal temperature (measuring input ≥ 4 V)	IR53	A	A	A	A
Potentiometer for Adjustment with Voltmeters					
Voltmeters without potentiometer for adjustment	MP99	N	N	N	N
Voltmeters with potentiometer for adjustment	MP1	—	A	A	A
Adjustment range ± 15 % (Measuring input ≥ 6 V / ≤ 550 V; Ri as listed; Class 1.5 only)					
Lead Resistor when connecting to Shunt Resistors ...A / 60 mV and ...A / 150 mV					
Standard version 0.06 Ω	IG99	N	N	N	N
Differing from 0.06 Ω (specify in clear text)	IG999	A	A	A	A
Limiting values: ...A / 60 mV for class 1.5 max. 1 Ω ...A / 150 mV in Klasse 1.5 max. 7 Ω					
Accuracy					
Class 1.5	IE15	N	N	N	N
Class 1.0 (Measuring input ≥ 100 µA / ≥ 60 mV; with 72 x 72 in combination with fine division and beam pointer with knife-edge only)	IE11	—	A	A	A
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other	LA999	A	A	A	A
(Please specify angle between scale and horizontal)					
Special Features					
Normal vibration and shock resistance	LN99	N	N	N	N
Suitable for marine use with the following approvals:					
DNV-GL	LN2	A	A	A	A
BV 0591 German Navy	LN1	—	+ ¹⁾	+ ¹⁾	A
BV 3340 German Navy	LN6	—	— ²⁾	— ³⁾	+ ⁴⁾
Vibration resis. 2.5 g, Shock resis. 30 g	LN56	A ⁵⁾	A	A	A
Vibration resis. 5 g, Shock resis. 50 g	LN55	A ⁵⁾	A	A	A ⁶⁾
Class 1.5 only measuring input ≥ 250 µA ≥ 250 mV Connection to shunt ≥ 60 mV					on request

1) Contains sheet metal housing with cone head rivets (Ident. ML4) and fastener B (Ident. MN11)

2) Type PQS 72-250 according to special data sheet

3) Type PQS 96-250 according to special data sheet

4) See special data sheet

5) Available only in combination with screw clip S

6) Available only in combination with fastener B DIN 43835

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇨	V-PQ 48-250 1668P	V-PQ 72-250 1602P	V-PQ 96-250 1605P	PQ 144-250 1621P
SCALE VARIANTS	Identification +⇕				
Scale					
In accordance with measuring input	GF99	N	N	N	N
Blank Scale (lower/upper value markings, company logos, symbols)	GF28	+	+	+	+
Scale Characteristics					
Current / Voltage linear	SD1	N	N	N	N
According to curve (not current / voltage linear)	SD6	A	A	A	A
Division and Pointer					
Single division	GD1	N	N	N	N
Double division	GD2	A	A	A	A
Coarse-fine division	SE1	N	N	N	N
Fine division	SE3	–	A	A	A
Beam pointer with for single division	RA1	N	N	N	N
knife-edge for double division	RA2	+	+	+	+
Knife-edge pointer for single division	RA10	A	A	A	A
for double division	RA11	–	A	A	A
Bar indicator for single division	RA40	A	A	A	A
Additional Imprint					
Second numbering (specify in clear text)	SK992	A	A	A	A
Inscription:					
Without additional inscription	SM99	N	N	N	N
Inscription ≤ 15 characters German	SM991	A	A	A	A
> 15 characters German	SM992	A	A	A	A
≤ 15 characters other language	SM993	A	A	A	A
> 15 characters other language	SM994	A	A	A	A
(Other language in Latin lettering, specify in clear text)					
Coloured mark red RAL 2002 (specify in clear text)	ST991	A	A	A	A
Coloured sectors yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)	SU991	A	A	A	A
Scale Characteristics					
Interchangeable scale	SA10	N	N	N	–
Screw mounted scale	SA11	A	A	A	N ¹⁾
Anti-parallax scale (with bar indicator and single division) ⁵⁾	SA5	A	A	A	A

1) Standard version without extra charge

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇨	V-PQ 48-250 1668P	V-PQ 72-250 1602P	V-PQ 96-250 1605P	PQ 144-250 1621P
SCALE VARIANTS	Identification +⇕				
Scale / Pointer Colours					
Scale white; imprint and pointer black	SG99	N	N	N	N
Scale balck; imprint and pointer white	SG1	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint and pointer yellow	SG2	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint white, pointer yellow	SG3	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Without scale; pointer black	SG10	+	+	+	–
Without scale; pointer white	SG11	A	A	A	–
Without scale; pointer yellow	SG12	A	A	A	–
Versions without scales available only for panel meters that are connected to transformers or shunts					
Dial Illumination					
Without dial illumination	PA99	N	N	N	N
With direct dial illumination	PA1	–	A	A	A
(Plexiglass scale, scale and dial illumination white)					
Note: Completion with Order No. PB necessary					
Size 48 x 48: dial illumination available only for ≤ 4 A / ≤ 660 V together with single terminal cover.					
With indirect dial illumination					
Light conductor with mask, dial illumination white	PA6	–	A ²⁾	A ²⁾	A ²⁾
Light conductor with mask, dial illumination red	PA7	–	A ²⁾	A ²⁾	A ²⁾
Note: Completion with Order No. SG and PB necessary					
(SG 99 as light conductor with mask not available).					
Dial illumination available only with screw mounted scale (Order No. SA X 11)					
Voltage for Dial Illumination					
12 V	PB3	–	+	+	+
24 V	PB5	–	+	+	+
28 V	PB6	–	+	+	+
HOUSING VARIANTS					
Application					
Standard version	LB99	N	N	N	N
Tropic resistant	LB1	A	A	A	A
Protection					
Standard (see technical data)	LH99	N	N	N	N
Front housing-panel protection IP54. clamps IP00	LH21	A	A	A	A
Earthquake-proof (possible combination: LH X 99 or LH X 21)	LH10	A	A	A	A
Front Frame Colour					
Matt black	MA2	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A	A
Matt light grey RAL 7035	MA14	A	A	A	–
Matt dark beige approx. RAL 1019	MA21	A	A	A	A
Intermediate Frame, Height 3 mm					
Without intermediate frame	MC99	N	N	N	N
Intermediate frame shiny black	MC1	A	A	A	–
Intermediate frame shiny grey RAL 7037	MC2	A	A	A	A
Intermediate frame available only in combination with screw clip S or fastener B DIN 43 835					

1) Additional one-off costs for special scale printing on request

2) Prices on request

Vario-Series · Square Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No. ⇨	V-PQ 48-250 1668P	V-PQ 72-250 1602P	V-PQ 96-250 1605P	PQ 144-250 1621P
HOUSING VARIANTS	Identification + ⇕				
Glass Window					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Housing					
Standard housing	ML99	N	N	N	N
Sheet metal housing with cone head rivets	ML4	–	A	A	N ¹⁾
Housing for Mauell-Grid	ML5	+	– ²⁾	– ²⁾	– ³⁾
Housing for H&B Unibloc-Grid	ML6	+ ⁴⁾	– ²⁾	– ²⁾	– ³⁾
Mounting					
2 leaf springs	MN2	N	+	+	–
2 leaf springs for H&B Unibloc-Grid (bronze-springs)	MN4	A	–	–	–
4 leaf springs	MN1	A	A	A	–
Screw Clip S	MN14	A	N ¹⁾	N ¹⁾	–
Screw Clip G	MN13	–	–	–	N
Fastener B DIN 43 835	MN11	–	A ⁵⁾	A ⁵⁾	A
Subklew fastener (Screw Clip S without cone point)	MN32	A	A	A	–
Without fastener	MN88	+ ⁶⁾	+	+	+
Identification					
Without Identification	MZ99	N	N	N	N
Identification on backside (specify in clear text)	MZ998	A	A	A	A
Marker Pointer					
Without marker pointer	PM99	N	N	N	N
Adjustable red index pointer	PM1	A	A	A	
Label Strips					
Without label strips	SS99	N	N	N	N
Label on front face (specify in clear text)	SS992	A	A	A	A
Contact Protection					
Without terminal cover	VB99	N	N	N	N
Overall terminal cover	VB2	A	A	A	A
Single terminal cover (Voltmeter and Ammeter ≤ 4 A)	VB1	+	+	+	+

1) Standard version without extra charge

2) Standard housing (ML99) in combination with fastener MN2, also suitable for Mauell-Grid and H&B Unibloc-Grid

3) Standard housing (ML99) in combination with fastener MN11, also suitable for Mauell-Grid and H&B Unibloc-Grid

4) Available only in combination with Order No. MN4 (2 leaf springs for H&B Unibloc-Grid)

5) Available only in combination with Order No. ML4 (sheet metal housing with cone head rivets)

6) ML5 (housing for Mauell-Grid) standard version

Vario-Series · Square Panel Meters

For Active Power or Reactive Power

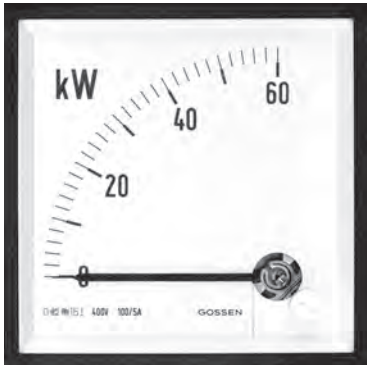


Moving-coil movement with power converter, 90° or 240° scale

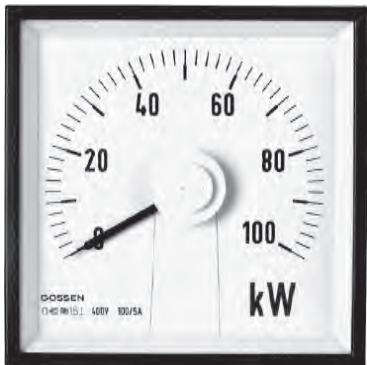
Narrow front frame per DIN 43 718, matt black

Technical Data

Front Dimensions mm	96 x 96	96 x 96
Type	V-LM 96	V-LM 96-250
Scale Length mm	97	151
Accuracy Class	1.5	1.5
Max. Weight (standard model), kg	0.8	0.8
Power Consumption approx.		
- Current Path	0.2 VA	0.2 VA
- Voltage Path	3 VA	3 VA
Order No.:		
AB1 / AB2 / AB12 / AB5 / AB15	3.5 VA	3.5 VA
AB11	3.4 VA	3.4 VA
AB4 / AB14	3.9 VA	3.9 VA
AB6	4.3 VA	4.3 VA
AB16		
Nominal Supply Voltage: Outer to Neutral Conductor (= Operating Voltage)	≤ 398 V	
3-Phase-3-Wire-Systems	≤ 690 V	
3-Phase-4-Wire-Systems	≤ 398 / 690 V	
Operating Voltage	600 V	600 V
Test Voltage	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52



V-LM 96



V-LM 96-250

Description

Analog panel meter with core-magnet moving-coil movement and built in power converter for active and reactive power.

Depending upon type of system and power, the power converter consists of one, two or three multipliers. The multipliers function in accordance with the TDM process (time division multiplier). The output signals from the multipliers are added and fed to the moving coil mechanism.

Display

Scale Division Coarse-fine

Pointer Beam pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94V-0

Mounting Fasteners Standard: Screw Clip S

 Alternative: Subklew fasteners

Replaceable Scales, glass windows and front frames

 ⇒ May only be replaced under

 voltage-free conditions!

Terminals M4 screw terminals with self-lifting terminal clips. Screws

 can be turned with a cross-head or standard screw drivers

Clamp Identification per DIN 43807

Contact Protection Finger-safe full cover included

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Frequency	45 ... 65 Hz
Current Component	20 ... 120 % of rated value
Voltage Component	98 ... 102 % of rated value
Warm-up Time	≥ 5 min.
Other	DIN EN 61010-1

Notes Concerning the Determination of Measuring Ranges

The upper measuring value should be a standard value per DIN 43 70:

1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8

and corresponding powers of ten.

The upper measuring range value must lie within a range of 0.5 to 1.2 times apparent power.

Apparent power P_s is calculated from the primary values from the current and voltage transformers:

- Single-Phase AC $P_s = U \times I$
- Three-Phase $P_s = U \times I \times \sqrt{3}$

where U equals phase-to-phase voltage.

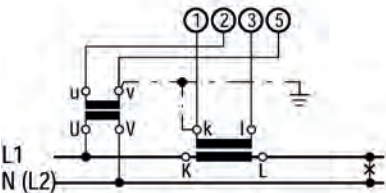
Vario-Series · Square Panel Meters

For Active Power or Reactive Power

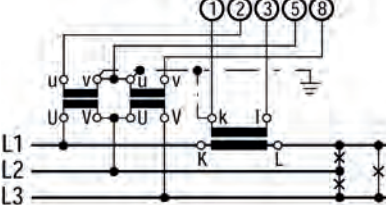


Schematic Diagrams

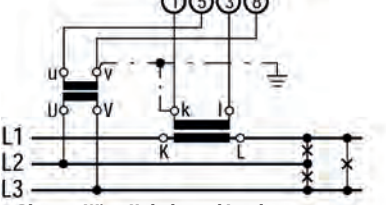
Single-Phase Alternating Current
Active & Reactive Power



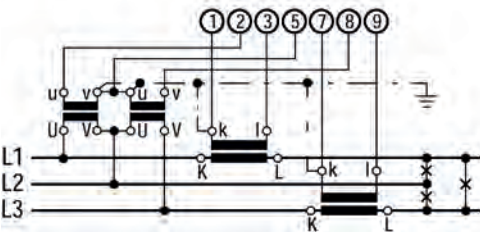
3-Phase 3-Wire, Balanced Load
Active Power



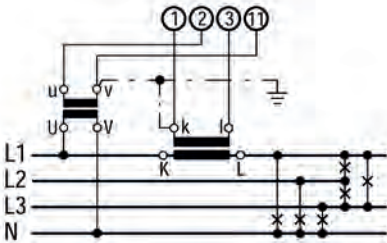
3-Phase 3-Wire, Balanced Load
Reactive Power



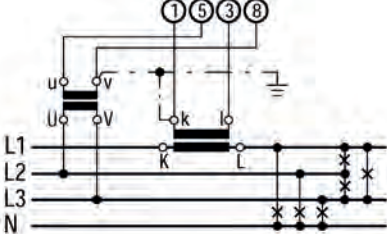
3-Phase 3-Wire, Unbalanced Load
Active & Reactive Power



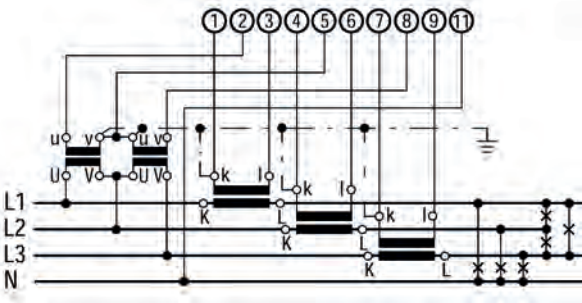
3-Phase 4-Wire, Balanced Load
Active Power



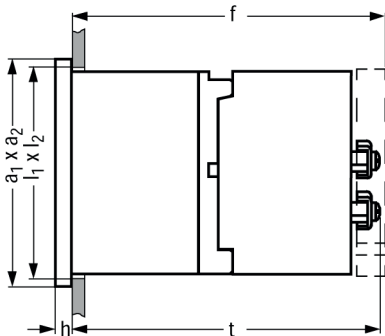
3-Phase 4-Wire, Balanced Load
Reactive Power



3-Phase 4-Wire, Unbalanced Load
Active & Reactive Power



Basic Dimensions



Front Dimensions mm	Nominal Dimen. mm		Cutout Dimensions mm $l_1 \times l_2$	Order No.	Installation Depth mm	
	$a_1 \times a_2$	h			incl. Terminals t	incl. Full Cover f
96 x 96	96 x 96	5	$92^{+0.8} \times 92^{+0.8}$	AB1/AB11/AB2/AB12/ AB4/AB14/AB5/AB15/ AB6/AB16	117	123

Vario-Series · Square Panel Meters

For Active Power or Reactive Power



Moving-coil movement with power converter, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Order No. with the same letter sequence may be chosen. Order No. with Identification N (standard model) can be left out.

An entry with "..." in the Order No. column means that the Order No. must be supplemented with written text.

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Order No. +↓	⇔ +↓	Type +↓	V-LM 96 1129D	V-LM 96-250 1115D
System Type / Power Type 2-Wire-System Active Power, Single Phase AC	Voltage Path Terminal					
	AB1				+	+
	to transf. sec.: 100 V	primary voltage: ... V	BF12	DG...	+	+
		primary voltage: ... kV	BF12	DH...	+	+
	to transf. sec.: 110 V	primary voltage: ... V	BF15	DG...	+	+
		primary voltage: ... kV	BF15	DH...	+	+
	direct 230 V AC		IL323		+	+
	direct 240 V AC		IL324		+	+
	direct 400 V AC		IL340		+	+
	Reactive Power, Single Phase AC		AB11		A	A
	direct 230 V AC		IL323		+	+
	direct 240 V AC		IL324		+	+
	direct 400 V AC		IL340		+	+
	3-Wire-System					
	Active Power, 3-Wire Balanced Load		AB2		A	A
	Reactive Power, 3-Wire Balanced Load		AB12		A	A
	Active Power, 3-Wire Unbalanced Load		AB4		A	A
	Reactive Power, 3-Wire Unbalanced Load		AB14		A	A
	to transf. sec.: 100 V	primary voltage: ... V	BF12	DG...	+	+
		primary voltage: ... kV	BF12	DH...	+	+
	to transf. sec.: 110 V	primary voltage: ... V	BF15	DG...	+	+
		primary voltage: ... kV	BF15	DH...	+	+
	direct 400 V AC		IL340		+	+
	direct 415 V AC		IL661		+	+
	direct 440 V AC		IL344		+	+
	direct 500 V AC		IL350		+	+
	direct 690 V AC		IL369		+	+
	4-Wire-System					
	Active Power 4-Wire Balanced Load		AB5		A	A
	Reactive Power 4-Wire Balanced Load		AB15		A	A
	Active Power 4-Wire Unbalanced Load		AB6		A	A
	Reactive Power 4-Wire Unbalanced Load		AB16		A	A
	to transf. sec.: 100 V	primary voltage: ... V	BF12	DG...	+	+
		primary voltage: ... kV	BF12	DH...	+	+
	to transf. sec.: 110 V	primary voltage: ... V	BF15	DG...	+	+
		primary voltage: ... kV	BF15	DH...	+	+
	direct 230 / 400 V AC		IL723		+	+
	direct 240 / 415 V AC		IL721		+	+
	direct 254 / 440 V AC		IL722		+	+
	direct 277 / 480 V AC		IL724		+	+
	direct 398 / 690 V AC		IL725		+	+
Current Path Terminal	to transf. sec.: 1 A	primary current: ... A	BE10	CG...	+	+
		primary current: ... kA	BE10	CH...	+	+
	to transf. sec.: 5 A	primary current: ... A	BE11	CG...	+	+
		primary current: ... kA	BE11	CH...	+	+

Vario-Series · Square Panel Meters

For Active Power or Reactive Power



Moving-coil movement with power converter, 90° or 240° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Order No. with the same letter sequence may be chosen. Order No. with Identification N (standard model) can be left out.

An entry with "..." in the Order No. column means that the Order No. must be supplemented with written text.

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Order No. +↓	⇒	Type	V-LM 96 1129D	V-LM 96-250 1115D
Variants						
Zero Point	at left				N	N
	at center	BC2			A	A
	10% of positive upper value	BC6			A	A
Upper value of meas. range	(from 0.5 to 1.2 x of reactive power selectable)	NB...			+	+
Scale Division	corresponds to measuring range				N	N
	blank scale (lower/upper val. markings, logos, sym.)	GL98			+	+
Position of Use	standard				N	N
	0 ... 45 degrees from horizontal (bonded glass)	LA11			A	A
	46 ... 89 degrees from horizontal (bonded glass)	LA12			A	A
	91 ... 135 degrees from horizontal	LA13			A	A
Applications	standard				N	N
	tropic resistant, climatic category 3	LB4			A	A
Protection	standard				N	N
	front panel IP 54, terminals IP00	LH21			A	A
Resistance to Vibration/ Marine Applications	standard				N	N
	vibration resistance 2.5 g; shock resistance 30 g	LN56			A	A
	marine applications, German Lloyds	LN8			A	A
Front Frame	matt black				N	N
	matt grey, RAL 7037	MA11			A	A
Glass Window	standard				N	N
	anti-glare	MG1			A	A
	anti-glare, with red adjustable index pointer	MG98			A	A
Housing and Mounting	standard				N	N
	polycarbonate housing with Subklew fasteners	ML10			A	A
Identification	none				N	N
	on the back:	MZ998...			A	A
Scale Inscription (Latin lettering)	none				N	N
	≤ 22 characters, 1 line:	SM902...			A	A
	≤ 37 characters, 2 lines: 1 st line (15 characters): ...; 2 nd line (22 char.): ...	SM911...			A	A
Additional Numberings	none				N	N
	2 nd set of numbering black: ...	SK982...			A	A
	2 nd set of numbering red (RAL 2002): ...	SK983...			A	A
Red Marker (RAL 2002)	none				N	N
	red marker at: ...	ST981...			A	A

Ordering Example:

Panel meter for active power for 3-wire-system with unbalanced load,

Connection to transformer 100/5 A, 400 V, measuring range 0...60 kW, 240° Scale

Type V-LM 96-250	Order No. 1115D, AB4, BE11, CG100, IL340, NB: 0...60 kW
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Vario-Series · Square Panel Meters

For Power Factor



Moving-coil movement with power factor converter, 90° scale
Narrow front frame per DIN 43 718, matt black

Technical Data

Front Dimensions Type	96 x 96 mm V-LF 96
Scale Length mm	94
Accuracy Class	1.5
Max. Weight (standard version.), kg	0.54
Power Consumption approx. Current Path	1.0 VA
Voltage Path	3.0 VA
Operating Voltage:	Outer to neutral conductor
	3-Phase-3-Wire-System
	3-Phase-4-Wire-System
	≤ 300 V
	≤ 500 V
	≤ 277 / 480 V
Test Voltage	3.5 kV
Front Housing-Panel Protection	IP 52

Description

Analog panel meter with core-magnet moving-coil movement and built in power factor converter. The power factor converter determines the phase angle between current and voltage. $\cos \varphi$ is displayed at the moving-coil movement.

Display

Measuring Range	CAP 0.5 ... 1 ... 0.5 IND
Scale Division	Coarse-fine
Pointer	Beam pointer with knife edge

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0 or sheet metal housing as option
Mounting Fasteners	Standard: Screw clip S. Options: see next page
Replaceable	Scales, front frames and glass windows ⇒ May only be replaced under voltage free conditions!
Terminals	M4 screw terminals with self-lifting terminal clips. Screws can be turned with cross-head or standard screw drivers.
Contact Protection	Finger-safe full cover included



V-LF 96

Reference Conditions

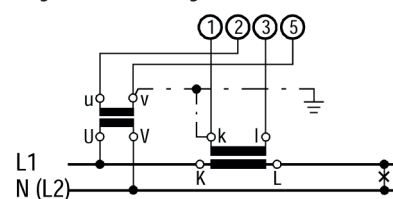
Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2°C
Position of Use	control panel vertical ± 1°
Frequency	50 Hz ± 0.1 Hz
Current Component	95 ... 100% of rated value
Voltage Component	98 ... 102% of rated value
Waveshape	sine, distortion factor ≤ 1%
Warm-Up Time	≥ 5 min.
Other	DIN EN 60051

Nominal Range of Use Limits

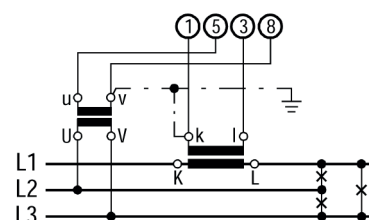
Frequency	45 Hz ... 65 Hz 49 Hz ... 51 Hz for Order No.: AB21
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Schematic Diagrams

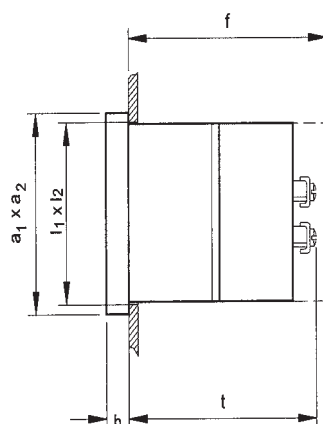
Single Phase Alternating Current



3-Phase 3-Wire, Balanced Load



Basic Dimensions



Front in mm	Nom. Dimensions. mm $a_1 \times a_2$	h	Cutout Dimensions. mm $l_1 \times l_2$	Installation Depth incl. Terminals M4 mm t	Installation Depth incl. Full cover. mm f
96 x 96	96 x 96	5	$92^{+0.8} \times 92^{+0.8}$	124 (60 projected)	133

Vario-Series · Square Panel Meters

For Power Factor



Moving-coil movement with power factor converter, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Order No. with the same letter sequence may be chosen. Order No. with Identification N (standard model) can be left out.

An entry with "..." in the Order No. column means that the Order No. must be supplemented with written text.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not

		Type Order No. +↓	⇒ +↓	V-LF 96 1129H
System Type / Power Type	Nominal Voltage			
Single Phase Alternating Current		AB21		+
	100 V AC		IL310	+
	110 V AC		IL311	+
	220 ... 240 VAC		IL728	+
3-Wire-System, Balanced Load		AB22		+
	100 V AC		IL310	+
	110 V AC		IL311	+
	380 ... 400 VAC		IL727	+
	415 ... 440 VAC		IL730	+
	500 V AC		IL350	+
Current Path Terminal	at transformer sec.: 1A	BE10		+
	at transformer sec.: 5A	BE11		+
Position of Use	standard			N
	0 ... 45 degrees from horizontal (bonded glass)	LA11		A
	46 ... 89 degrees from horizontal (bonded glass)	LA12		A
	91 ... 135 degrees from horizontal	LA13		A
Application	standard			N
	conditionally tropic resistant, climatic category 3	LB4		A
Protection	standard			N
	front panel: IP 54, terminals IP00	LH21		A
Resistance to Vibration/ Marine Application	standard			N
	vibration resistance 2.5 g; shock resistance 30 g	LN56		A
	German Lloyds	LN8		A
Front Frame	matt balck			N
	matt grey, RAL 7037	MA11		A
Glass Window	standard			N
	anti-glare	MG1		A
	anti-glare, with red adjustable set pointer	MG98		A
Housing and Fasteners	standard			N
	sheet metal housing with type S screw clip	ML7		A
	sheet metal housing with type B screw clip	ML8		A
	polycarbonate housing with 2 leaf springs	ML9		A
	polycarbonate housing with 4 leaf springs	ML11		A
	polycarbonate housing with Subklew fasteners	ML10		A
Identification	none			N
	on the back:	MZ998...		A
Scale Inscription (Latin lettering)	none			N
	≤ 22 characters, 1 line:	SM902...		A
	≤ 37 characters, 2 lines: 1 st line (15 characters): ...;			
	2 nd line (22 characters): ...	SM911...		A
Red Marker (RAL 2002)	none			N
	red marker at: ...	ST981...		A

Ordering Example

Panel meter for power factor
3-Wire-System, balanced load,
Connection to transformer sec. 5 A, 500 V

Type V-LF 96	Order No. 1129H, AB22, BE11, IL350
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Vario-Series · Square Panel Meters

For Frequency (Pointer-Type)



Moving-coil movement with frequency converter, 90° scale
Narrow front frame per DIN 43 718, matt black



V-FZQS 96

Technical Data

Front Dimensions mm	48 x 48	72 x 72	96 x 96
Type	FZQS 48 W	V-FZQS 72	V-FZQS 96
Scale Length mm	40	66	94
Weight approx. (kg)	0.08 ¹⁾	0.2	0.25
Operating Voltage	300 V	600 V	600 V
Test Voltage	3.5 kV	5.8 kV	5.8 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	screw clip S	screw clip S
Housing Material	polycarbonate	polycarbonate	polycarbonate
Interchangeable Scale	yes	yes	yes
Frequency Converter	separate	built in	built in

1) plus 0.2 kg (approx.) for separated frequency converter

Description

Analog panel meter with moving-coil movement and built in or separate frequency converter (see above)

Display

Scale Division	Coarse-fine
Pointer	Beam pointer with knife edge

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0 or sheet metal housing (see above). Sheet metal housing for type V-ZQS 72 and V-ZQS 96 as option.
Replaceable	Scales, glass windows and front frames ⇒ May only be replaced under voltage-free conditions!
Terminals	M4 screw terminals with self-lifting terminal clips. Screws can be turned with cross-head or standard screw drivers.
Contact Protection	Available as option

Reference Conditions

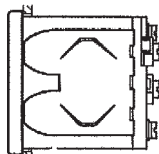
Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ±1°
Other	DIN EN 60 051

Vario-Series · Square Panel Meters

For Frequency (Pointer-Type)

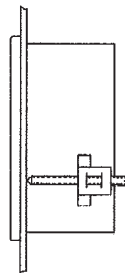


Leaf Spring



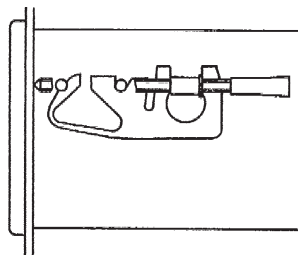
Control panel thickness 1 to 3 mm.
For size 48 x 48 mm, not available for Mauell-Grid.
Also available as option for sizes 72 x 72 and 96 x 96 mm.

Screw Clip S

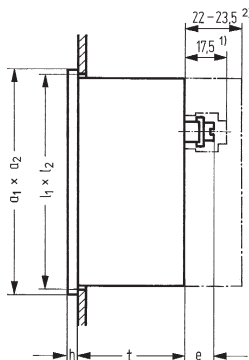


Control panel thickness 1 to 25 mm.
Special screw clamp M4 required for sizes 72 x 72 and 96 x 96 mm.
Also available as option for size 48 x 48 mm, not available for Mauell-Grid.

Fastener B DIN 43 835



Basic Dimensions



Control panel thickness 1 to 40 mm.
Screw clamp M4 as option for:
Sheet metal housings 72 x 72 and 96 x 96 mm with cone head rivets

Drawings to Scale (on request)

0101A258 for size 48 x 48 mm
0101A259 for sizes 72 x 72 and 96 x 96 mm
1325A10 for separated measuring converter
1402A32 for separated series resistance

Ordering Example

Panel meter for frequency (pointer-type) , size 96 x 96 mm
90° Scale
Nominal Voltage 230 V, Class 0.5
Measuring Range 45 ... 50 ... 55 Hz

Dimensions for separated Measuring Converter

(for size 48 x 48 only)
120 x 63 x 88 (B/T/H)
Drawing to scale No. 1325 A 10 (on request)

Dimensions for separated Series Resistance

90 x 36 x 35.5 (L x B x H)
Drawing to scale No. 1402 A 32 (on request)

Type	Order No.
V-FZQS 96	1604Z, IL323, EH619

Front in mm	Nominal Dimensions		Cutout Dimensions	Installation Depth	Terminals M4 e
	a ₁ x a ₂	h			
48 x 48	48 x 48	5	45 ^{+0.6} x 45 ^{+0.6}	43.5	12.5
72 x 72	72 x 72	5	68 ^{+0.7} x 68 ^{+0.7}	43.5	12.5
96 x 96	96 x 96	5	92 ^{+0.8} x 92 ^{+0.8}	43.5	12.5

1) Single terminal cover
2) Overall terminal cover (22 mm for panel meters with front panel dimensions of 48 x 48 mm only)

Vario-Series · Square Panel Meters

For Frequency (Pointer Type)



Moving-coil movement with frequency converter, 90° scale Narrow front frame per DIN 43 718, matt black

'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Order No.	Type ⇒	FZQS 48 W ¹⁾ 1670Z	V-FZQS 72 ²⁾ 1601Z	V-FZQS 96 ²⁾ 1604Z
General Value Measuring		+↕	+↕			
Nominal Voltage ³⁾		100–120 V IL731 208–250 V IL732 380–500 V IL733				
Measuring Range	Class					
48 ... 50 ... 52 Hz ⁴⁾	0.5	EH623	+	+	+	
58 ... 60 ... 62 Hz ⁴⁾	0.5	EH629	+	+	+	
380 ... 400 ... 420 Hz ⁴⁾	0.5	EH674	+	+	+	
45 ... 50 ... 55 Hz ⁵⁾	0.5	EH619	+	+	+	
55 ... 60 ... 65 Hz ⁵⁾	0.5	EH626	+	+	+	
90 ... 100 ... 110 Hz ⁵⁾	0.5	EH675	+	+	+	
180 ... 200 ... 220 Hz ⁵⁾	0.5	EH635	+	+	+	
270 ... 300 ... 330 Hz ⁵⁾	0.5	EH638	A	A	A	
360 ... 400 ... 440 Hz ⁵⁾	0.5	EH642	+	A	+	
15 ... 16.66 ... 18.4 Hz ⁵⁾	0.5	EH617	A	A	A	
45 ... 50 ... 60 ... 65 Hz ⁵⁾	1	EH671	+	A	+	
40 ... 50 ... 60 Hz ⁵⁾	1	EH618	A	A	A	
For static Transducers						
Nominal Voltage		250 V IL325				
Measuring Range						
300 ... 500 ... 750 Hz	Class 1.5 for 150 ... 250 V Class 2.5 for < 150 ... 60 V and > 250 ... 300 V	EH641	–	–	A	
600 ... 1000 ... 1400 Hz		EH646	–	–	A	
1 ... 2 ... 3 kHz		EK601	–	–	A	
1.8 ... 3 ... 4.2 kHz		EK603	–	–	A	
2 .. 6 ... 10 kHz		EK609	–	–	A	
6 ... 8 ... 10 kHz		EK608	–	–	A	
Weitbereich						
Nominal Voltage ³⁾		100–120 V IL731 208–250 V IL732 380–500 V IL733				
Measuring Range	Class					
0/10 ... 100 Hz	1.5	EH611	–	–	A	
0/10 ... 500 Hz	1.5	EH615	–	–	A	
0/0.1 ... 1 kHz	1.5	EK110	–	–	A	
0/0.1 ... 10 kHz	1.5	EK210	–	–	A	

1) Separated measuring converter

2) For sheet metal housings with cone head rivets please see "Housing Variants"

3) Occuring voltage fluctuations up to ±20% of nominal voltage cause an additional error in indication that is less than half of the class error

4) 72 x 72 with nominal voltage > 120 V separated series resistance, 96 x 96 and 144x144 with nominal voltage > 230 V separated series resistance

5) 72 x 72 with nominal voltage 440 V separated series resistance

Vario-Series · Square Panel Meters

For Frequency (Pointer Type)



Moving-coil movement with frequency converter, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not

	Type Order No.	⇒	FZQS 48 W 1670Z	V-FZQS 72 1601Z	V-FZQS 96 1604Z
GENERAL VARIANTS	Identification + ↓				
Position of Use					
Control panel vertical	LA1		N	N	N
Control panel horizontal	LA2		+	+	+
Other (Please specify angle between scale and horizontal)	LA999		A	A	A
Special Features					
Normal vibration and shock resistance	LN99		N	N	N
Vibration resis. 2.5 g, shock resis. 30 g	LN56		+ ¹⁾	+	+
Suitable for marine use with the following approvals:					
DNV-GL	LN2		A	A	A
Lloyd's Register of Shipping	LN3		–	+	+
SCALE VARIANTS					
Additional Imprint					
Second numbering (specify in clear text)	SK992		A	A	A
Inscription:					
Without additional inscription	SM99		N	N	N
Inscription ≤ 15 characters German	SM991		A	A	A
> 15 characters German	SM992		A	A	A
≤ 15 characters other language	SM993		A	A	A
> 15 characters other language	SM994		A	A	A
(Other language in Latin lettering, specify in clear text)					
Coloured mark red RAL 2002 (specify in clear text)	ST991		A	A	A
Coloured sectors yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)	SU991		A	A	A
Scale Characteristics					
Interchangeable scale	SA10		N	N	N
Screw mounted scale	SA11		A	A	A
Scale / Pointer Colours					
Scale white; imprint and pointer black	SG99		N	N	N
Scale black; imprint and pointer white	SG1		A ³⁾	A ³⁾	A ³⁾
Scale black; imprint and pointer yellow	SG2		A ³⁾	A ³⁾	A ³⁾
Scale black; imprint white, pointer yellow	SG3		A ³⁾	A ³⁾	A ³⁾

1) Available only in combination with screw clip S

2) Standard version without extra charge

3) Additional one-off costs for special scale printing on request

Vario-Series · Square Panel Meters

For Frequency (Pointer Type)



Moving-coil movement with frequency converter, 90° scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen.

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'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not available

	Type Order No. ➞	FZQS 48 W 1670Z	V-FZQS 72 1601Z	V-FZQS 96 1604Z
Identification				
HOUSING VARIANTS				
+⌵				
Application				
Standard version	LB99	N	N	N
Tropic resistant	LB1	A	A	A
Protection				
According to list LH99 N N N				
Front housing-panel protection IP54, terminals IP00	LH21	A	A	A
Front Frame Colours				
Matt black	MA2	N	N	N
Matt grey RAL 7037	MA11	A	A	A
Matt stone grey RAL 7032	MA12	A	A	A
Matt light grey RAL 7035	MA14	A	A	A
Matt dark beige approx. RAL 1019	MA21	A	A	A
Intermediate Frame, Height 3 mm				
Without intermediate frame	MC99	N	N	N
Intermediate frame shiny black	MC1	A	A	A
Intermediate frame shiny grey RAL 7037	MC2	A	A	A
Intermediate frame available only in combination with screw clip S or fastener B DIN 43 835				
Glass Windows				
Standard version	MG99	N	N	N
Anti-glare glass	MG1	A	A	A
Housing				
Standard housing	ML99	N	N	N
Sheet metal housing with cone head rivets	ML4	—	A	A
Mounting				
2 leaf springs	MN2	N	+	+
4 leaf springs	MN1	A	A	A
Screw Clip S	MN14	A	N ¹⁾	N ¹⁾
Screw Clip G	MN13	—	—	—
Fastener B DIN 43835	MN11	—	A ²⁾	A ²⁾
Clip Subklew fastener (Screw Clip S without cone point)	MN32	A	A	A
Identification				
Without identification	MZ99	N	N	N
Identification on the back (specify in clear text)	MZ998	A	A	A
Contact Protection				
Without terminal cover	VB99	N	N	N
Overall terminal cover	VB2	A	A	A
Single terminal cover	VB1	+	+	+

1) Standard version without extra charge

2) Available only in combination with Order No. ML4 (sheet metal housing with cone head rivets)

Vario-Series · Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, edgewise scale
Narrow front frame per DIN 43 718, matt black



Technical Data

PFN 96 x 48

Front Dimensions Type	48 x 24 PF 48 x 24	72 x 36 PF 72 x 36	96 x 48 PFN 96 x 48	144 x 72 PF 144 x 72
Scale Length mm	29	44	65	96
Class	2.5	1.5	1.5	1.5
Weight approx. (kg)	0.07	0.2	0.45	1.0
Operating Voltage	100 V	600 V	600 V	150 V
Test Voltage	1.5 kV	5.8 kV	5.8 kV	2.2 kV
Front Housing-Panel Protection	IP 50	IP 52	IP 52	IP 50
Fasteners (see next page)	expanding spring	screw spindle	screw spindle	fastener C
Housing Material	sheet metal	polycarbonate	polycarbonate	sheet metal

Description

Analog panel meter with moving-coil movement

Display

Scale Division Coarse-fine
 Exception: special division for 48 x 24 mm meters
 Pointer Beam pointer with knife-edge
 Exception: Bar indicator for 48 x 24 mm meters

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0
 or sheet metal housing (see above).
 Replaceable Glass windows and front frame
 ⇒ May only be replaced under
 voltage-free conditions!
 Terminals for sizes
 48 x 24 tab connectors 2.8 x 0.8
 72 x 36 tab connectors 6.3 x 0.8 or
 96 x 48 2 x 2.8 x 0.8
 (IP 20 protection)
 144 x 72 terminal clip M 5
 Contact Protection Available as option

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2°C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60 051

Internal Resistance / Voltage Drop / Power Consumption ¹⁾

	Front Dim. mm				
	48 x 24	72 x 36	96 x 48	144 x 72	
Measuring Range	Ri	Ri	Ri	Ri	Tolerance
100 µA	2400 Ω	2180 Ω	1920 Ω	2000 Ω	± 20 %
150 µA	1590 Ω	1040 Ω	2177 Ω	2000 Ω	
250 µA	950 Ω	458 Ω	1965 Ω	1080 Ω	
400 µA	283 Ω	155 Ω	84 Ω	497 Ω	
600 µA	140 Ω	67 Ω	77 Ω	163 Ω	
1 mA	66 Ω	18.5 Ω	76 Ω	69 Ω	
1.5 mA	30 Ω	11 Ω	72 Ω	26.5 Ω	
2 mA	17 Ω	8.5 Ω	75 Ω	20 Ω	
2.5 mA	11.3 Ω	6.5 Ω	90 Ω	10.8 Ω	
4 mA	7 Ω	4.5 Ω	74 Ω	7.1 Ω	
5 mA	5 Ω	5 Ω	60 Ω	5.8 Ω	± 30 %
6 mA	1.8 Ω	1.3 Ω	51 Ω	2.4 Ω	
10 mA	3.5 Ω	6 Ω	30 Ω	1.6 Ω	
15 mA	4 Ω	4 Ω	20 Ω	4 Ω	
20 mA	3 Ω	3 Ω	15 Ω	3 Ω	
4 ... 20 mA	3 Ω	3 Ω	18 Ω	3 Ω	
25 mA	2.4 Ω	2.4 Ω	12 Ω	2.4 Ω	
Voltage drop at > 25 mA / < 1 A ≥ 1 A	60 mV 60 mV	73 mV	300 mV 90 mV	60 mV 60 mV	± 20 %
Power consumption for connection to shunt (lead resistance 0.06 Ω)	6 mA	6 mA	6 mA	6 mA	
≥ 60 mV / ≤ 400 mV	1 kΩ/V	1 kΩ/V	2.5 kΩ/V	1 kΩ/V	
> 400 mV	1 kΩ/V	1 kΩ/V	1 kΩ/V	1 kΩ/V	

¹⁾ Indicated internal resistance is only valid for instruments with standard accuracy class.

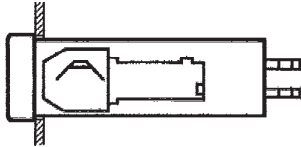
Please inquire regarding internal resistance (Ri) for moving-coil indicators with mechanical zero point at any desired scale value.

Vario-Series · Rectangular Panel Meters

For Direct Current or Direct Voltage

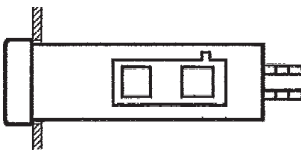


Expanding Springs



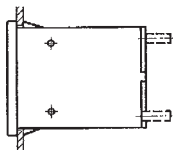
Control panel thickness ≈ 1 mm
Size 48 x 24 for mounting in DIN-Grid,
Siemens-Grid M 25 and Kreutzenbeck-Grid

Catch Spring I



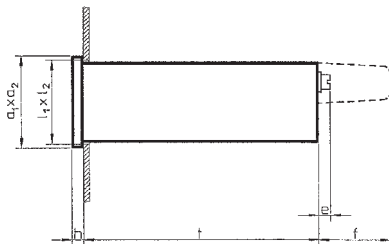
As option for size 48 x 24 for Mauell-Grid,
H & B Unibloc-Grid and Hein-Grid

Slider

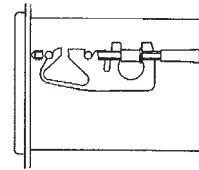


Control panel thickness 1 to 5 mm
As option for size 48 x 24 for DIN-Grid
For heightened requirements

Basic Dimensions

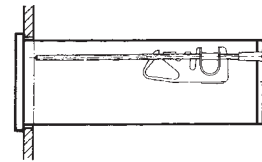


Fastener B DIN 43 835



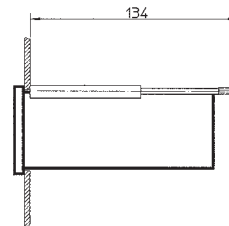
Control panel thickness 1 to 40 mm
Screw clamp M 4 for size 72 x 36 for mounting in
DIN-Grid

Fastener C DIN 43 835



Control panel thickness 1 to 40 mm
Screw clamp M 5, longer version, for size 144 x 72 for mounting in
DIN-Grid

Screw Spindle



Control panel thickness up to 40 mm
Screw spindle for size 96 x 48 for mounting in
DIN-Grid and all remaining grids

Drawings to Scale (on request)

0101A247 for size 48 x 24
0101A203 for sizes 72 x 36 and 144 x 72

Ordering Example

Panel Meter 96 x 48 mm
0 ... 40 V Direct Voltage

Techn. Data Type: PFN 96 x 48	Order No. 1594P, DC40
---	---------------------------------

Front in mm	Nominal Dimensions		Cutout Dimensions $l_1 \times l_2$	Inst. Depth t	Terminals e		Connector contact protection f = overall terminal cover
	$a_1 \times a_2$	h			≤ 4 A	> 4 A	
48 x 24	48 x 24	5	$45^{+0.6} \times 22.2^{+0.3}$	65	11	-	31
72 x 36	72 x 36	5	$68^{+0.7} \times 33^{+0.6}$	105	0	0	-
96 x 48	96 x 48	5	$92^{+0.8} \times 45^{+0.6}$	126	0	0	-
144 x 72	144 x 72	8	$138^{+1} \times 68^{+0.7}$	168	4	6	-

Vario-Series · Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

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	Type Order No. ⇒	PF 48 x 24 1511P	PF 72 x 36 1505P	PFN 96 x 48 1594P	PF 144 x 72 1584P
	+↓				
Landscape	HQ1	N	N	N	N
Portrait	HQ2	+	+	+	+
Zero Point - at left (landscape)					
- at bottom (portrait)					
Direct Current					
Range:					
0 ... 100 µA	CA100	A	A	A	A
0 ... 150 µA	CA150	A	A	A	A
0 ... 250 µA	CA250	A	A	A	A
0 ... 400 µA	CA400	A	A	A	A
0 ... 600 µA	CA600	A	A	A	A
0 ... >100 µA ... <1 mA ¹⁾	CA...	A	A	A	A
0 ... 1 mA	CB1	+	+	+	+
0 ... 1.5 mA	CB1.5	+	+	+	+
0 ... 2.5 mA	CB2.5	+	+	+	+
0 ... 4 mA	CB4	+	+	+	+
0 ... 5 mA	CB5	+	+	+	+
0 ... 6 mA	CB6	+	+	+	+
0 ... 10 mA	CB10	+	+	+	+
0 ... 15 mA	CB15	A	A	A	A
0 ... 20 mA	CB20	A	A	A	A
0 ... 25 mA	CB25	A	A	A	A
0 ... 40 mA	CB40	A	A	A	A
0 ... 50 mA	CB50	A	A	A	A
0 ... 60 mA	CB60	A	A	A	A
0 ... 100 mA	CB100	A	A	A	A
0 ... 150 mA	CB150	A	A	A	A
0 ... 250 mA	CB250	A	A	A	A
0 ... 400 mA	CB400	A	A	A	A
0 ... 600 mA	CB600	A	A	A	A
0 ... >1 mA ... <1 A ¹⁾	CB...	A	A	A	A
Mech. suppressed					
4... 20 mA landscape:	BC10	A	A	A	A
4... 20 mA portrait:	BC14	A	A	A	A
Electr. suppressed					
0/4 ... 20 mA landscape:	BC25	A	—	—	A
0/4 ... 20 mA portrait:	BC27	A	—	—	A
0 ... 1 A	CC1	A	A	A	A
0 ... 1.5 A	CC1.5	A	A	A	A
0 ... 2.5 A	CC2.5	A	A	A	A
0 ... 4 A	CC4	A	A	A	A
0 ... 6 A	CC6	A	A	A	A
0 ... 10 A	CC10	—	A	—	A
0 ... 15 A	CC15	—	A	—	A
0 ... 25 A	CC25	—	A	—	A
0 ... 40 A	CC40	—	—	—	A
0 ... 60 A	CC60	—	—	—	A
0 ... >1 A ... <6 A ^{1) 2)}	CC...	A	A	A	A

1) Specify in clear text

2) > 1 A / < 25 A with type PF 72 x 36

> 1 A / < 60 A with type PF 144 x 72

Vario-Series · Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No.	⇒	PF 48 x 24 1511P	PF 72 x 36 1505P	PFN 96 x 48 1594P	PF 144 x 72 1584P
	+ ↕					
Landscape	HQ1		N	N	N	N
Portrait	HQ2		+	+	+	+
Zero Point						
- at left (Landscape)						
- at bottom (Portrait)						
Connection to Shunt (direct current)						
... A / 60 mV	BE3		A	A	A	A
... A / 150 mV	BE4		A	A	A	A
... A / ...>60 mV ¹⁾	BE981		A	A	A	A
Scale:						
1 A	CG1		+	+	+	+
1.5 A	CG1.5		+	+	+	+
2.5 A	CG2.5		+	+	+	+
4 A	CG4		+	+	+	+
6 A	CG6		+	+	+	+
10 A	CG10		+	+	+	+
15 A	CG15		+	+	+	+
25 A	CG25		+	+	+	+
40 A	CG40		+	+	+	+
60 A	CG60		+	+	+	+
100 A	CG100		+	+	+	+
150 A	CG150		+	+	+	+
250 A	CG250		+	+	+	+
400 A	CG400		+	+	+	+
500 A	CG500		+	+	+	+
600 A	CG600		+	+	+	+
0 ...>1 A ...<1 kA ¹⁾	CG...		+	+	+	+
1 kA	CH1		+	+	+	+
1.5 kA	CH1.5		+	+	+	+
2.5 kA	CH2.5		+	+	+	+
4 kA	CH4		+	+	+	+
6 kA	CH6		+	+	+	+
10 kA	CH10		+	+	+	+
>1 kA ^{1) 2)}	CH...		+	+	+	+
Direct Voltage						
Range:						
0 ... 60 mV	DB60		A	A	A	A
0 ... 100 mV	DB100		A	A	A	A
0 ... 150 mV	DB150		A	A	A	A
0 ... 250 mV	DB250		A	A	A	A
0 ... 400 mV	DB400		A	A	A	A
0 ... 600 mV	DB600		A	A	A	A
0 ...>60 mV...<1 V ¹⁾	DB...		A	—	—	A
0 ...>100 mV...<600 mV ¹⁾	DB...		—	A	A	—
0 ... 1 V	DC1		A	A	A	A
0 ... 1.5 V	DC1.5		A	A	A	A
0 ... 2.5 V	DC2.5		A	A	A	A
0 ... 3 V	DC3		A	A	A	A
0 ... 4 V	DC4		A	A	A	A
0 ... 6 V	DC6		A	A	A	A
0 ... 10 V	DC10		A	A	A	A
0 ... 15 V	DC15		A	A	A	A
0 ... 25 V	DC25		A	A	A	A
0 ... 40 V	DC40		A	A	A	A
0 ... 60 V	DC60		A	A	A	A
0 ... 100 V	DC100		A	A	A	A
0 ... 150 V	DC150		—	A	A	A
0 ... 250 V	DC250		—	A	A	—
0 ... 400 V	DC400		—	A	A	—
0 ... 500 V	DC500		—	A	A	—
0 ... 600 V	DC600		—	A	A	—
0 ...>1 V ...<600 V ^{1) 2)}	DC...		—	A	A	—

1) Specify in clear text

2) For higher voltages see voltage dividers

Vario-Series · Rectangular Panel Meters

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	Type Order No. ⇔	PF 48 x 24 1511P	PF 72 x 36 1505P	PFN 96 x 48 1594P	PF 144 x 72 1584P
	Identification +⇕				
	Landscape				
	Portrait				
GENERAL VARIANTS					
Zero Point					
Zero point at left (landscape)	BC1	N	N	N	N
Zero point at bottom (portrait)	BC4	+	+	+	+
Zero point at center	BC2	A	A	A	A
Zero point as disired (specify in clear text)	BC20	A	A	A	A
Zero point at left (landscape), mech. suppressed (not for 4-20 mA)	BC16	A	A	A	A
Zero point at bottom (portrait), mech. suppresses (not for 4-20 mA)	BC18	A	A	A	A
(max. supression 20 %; measuring range ≥ 250 µA / ≥ 250 mV. Ri 1 kΩ/V; specify in clear text)					
Internal Resistance with Voltmeters					
Standard (see technical data)	IR99	N	N	N	N
Ri approx. 10 kΩ/V (measuring input ≥ 2 V; exception: ≥ 5 V / ≤ 150 V with 96 x 48 a. 72 x 36)	IR10	A	A	A	A
Ri = 1 kΩ/V ± 1% at nominal temperature (measuring input ≥ 1 V)	IR30	A	—	—	A
Ri = 10 kΩ/V ± 1% at nominal temperature (measuring input ≥ 2 V)	IR40	A	—	—	A
Potentiometer for Adjustment with Voltmeters					
Voltmeter without potentiometer for adjustment	MP99	N	N	N	N
Voltmeter with potentiometer for adjustment	MP1	—	—	A	A
Adjustment range ± 15 % (measuring input ≥ 6 V / ≤ 400 V; class 1.5 only; Ri ¹⁾ according to list)					
Lead Resistance when connected to					
Shunts ...A/60 mV a. ...A/150 mV					
Standard version 0.06 Ω	IG99	N	N	N	N
Other than 0.06 Ω (specify in clear text), Limiting value: ...A/60 mV for class 1.5 max. 1 Ω ...A/150 mV for class 1.5 max. 7 Ω	IG999	A	A	A	A
Accuracy					
Class 2.5	IE25	N	—	—	—
Class 1.5 (for sizes 48 x 24 / 24 x 48 available only in combination with tube pointer)	IE15	A	N	N	N
Class 1.0 (measuring input ≥ 40 µA / ≥ 60 mV)	IE10	—	—	—	A
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other	LA999	A	A	A	A
(Please specify angle between scale and horizontal)					
Special Features					
Normal vibration and shock resistance	LN99	N	N	N	N
Suitable for marine use with the following approvals:					
DNV-GL (class 1.5 only)	LN2	—	—	—	A ²⁾
Vibration resis. 2.5 g, shock resis. 30 g	LN56	A ³⁾	A	A	A

1) Exception: The standard version (size 96 x 48) of the potentiometer for adjustment has a current consumption of approx. 100 µA

2) 0 ... 1 mA, 0 ... 20 mA, 4 ... 20 mA, ³ 1.5 V

3) Available only in combination with slider

Vario-Series · Rectangular Panel Meters

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Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

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Order No. ⇒	Type	PF 48 x 24 1511P	PF 72 x 36 1505P	PFN 96 x 48 1594P	PF 144 x 72 1584P
	Identification + ↓				
	Landscape	HQ1	N	N	N
	Portrait	HQ2	+	+	+
SCALE VARIANTS					
Scale					
In accordance with measuring input		GF99	N	N	N
Blank scale (lower/upper value markings, company logos, symbols)		GF28	+	+	+
Scale Characteristics					
Current / Voltage linear		SD1	N	N	N
According to curve (not current / voltage linear)		SD6	A	A	A
Division and Pointer					
Single division		GD1	N	N	N
Double division		GD2	A	A	A
Coarse-fine division		SE1	–	N	N
Fine division		SE3	–	–	A
Special division		SE5	N	–	–
Beam pointer with for single division		RA1	–	N	N
knife-edge for double division		RA2	–	–	+
Beam pointer with for single division		RA4	–	N	–
knife-edge and double division					
Knife-edge pointer for single division		RA10	–	–	A
for double division		RA11	–	–	A
Bar indicator for single division		RA40	N	–	–
Tube pointer for single division		RA30	A	–	–
Tube pointer for double division		RA31	A	–	–
Additional Imprint					
Second numbering (specify in clear text)		SK992	A	A	A
Inscription:					
Without additional inscription		SM99	N	N	N
Inscription ≤ 15 characters German		SM991	A	A	A
> 15 characters German		SM992	A	A	A
≤ 15 characters other language		SM993	A	A	A
> 15 characters other language		SM994	A	A	A
(Other language in Latin lettering, specify in clear text)					
Coloured mark red RAL 2002 (specify in clear text)		ST991	A	A	A
Coloured sectors yellow RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)		SU991	A	A	A

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Moving-coil movement, edgewise scale Narrow front frame per DIN 43 718, matt black

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	Type	PF 48 x 24	PF 72 x 36	PFN 96 x 48	PF 144 x 72
	Order No. ⇒	1511P	1505P	1594P	1584P
	Identification + ⇅				
	landscape				
	portrait				
SCALE VARIANTS	HQ1	N	N	N	N
	HQ2	+	+	+	+
Scale / Pointer Colours					
Scale white; imprint and pointer black	SG99	N	N	N	N
Scale balck; imprint and pointer white	SG1	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint and pointer yellow	SG2	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Scale black; imprint white, pointer yellow	SG3	A ¹⁾	A ¹⁾	A ¹⁾	A ¹⁾
Dial Illumination					
Without Dial Illumination	PA99	N	N	N	N
With direct dial illumination	PA1	–	A	A	A
(Plexiglass scale, scale and dial illumination white)					
Note:					
Completion with voltage Order No. PB necessary.					
Light conductor with mask, dial illumination white	PA6	–	–	–	A ²⁾
Light conductor with mask, dial illumination red	PA7	–	–	–	A ²⁾
Note:					
Completion with Order No. SG and PB necessary.					
(SG 99 as light conductor with mask not available)					
Voltage for Dial Illumination					
24 V	PB5	–	+	+	+
28 V	PB6	–	+	+	+

1) Additional one-off costs for special scale printing on request
2) Prices on request

Vario-Series · Rectangular Panel Meters

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	Type Order No. ⇨	PF 48 x 24 1511P	PF 72 x 36 1505P	PFN 96 x 48 1594P	PF 144 x 72 1584P
	Identification + ⇕				
HOUSING VARIANTS Application Standard version conditionally tropic resistant	Landscape				
	Portrait				
	HQ1	N	N	N	N
	HQ2	+	+	+	+
Protection According to list	LB99	N	N	N	N
	LB1	A	A	A	A
Front housing-panel protection IP54, clamps IP00 Front housing-panel protection IP54, clamps IP20 Earthquake-proof (possible combination: LH X 99 or LH X 21)	LH99	N	N	N	N
	LH21	A	—	—	A
	LH22	—	A	A	—
	LH10	A	A	A	A
Front Frame Colour Matt black Matt grey RAL 7037 Matt stone grey RAL 7032 Matt dark beige approx. RAL 1019 Matt light grey RAL 7035	MA2	N	N	N	N
	MA11	A	A	A	A
	MA12	A	A	A	A
	MA21	A	A	A	A
	MA14	A	—	A	A
Intermediate Frame, Height 3 mm Without intermediate frame Intermediate frame shiny black Intermediate frame shiny grey RAL 7037 <i>Intermediate frame with size 48 x 24 available only in combination with shortened expanding spring (MN 24)</i>	MC99	N	N	N	N
	MC1	A	—	—	—
	MC2	A	—	—	—
Glass Window Standard version Anti-glare glass	MG99	N	N	N	N
	MG1	A	A	A	A
Fasteners Expanding spring Shortened expanding spring (necessary when version with intermediate frame) Catch spring Subklew (stiled slider) Slider Angled slider for APE-Grid Fastener B DIN 43 835 Screw spindle Fastener C	MN20	N	—	—	—
	MN24	+	—	—	—
	MN21	+	—	—	—
	MN32	+	—	—	—
	MN50	+	—	—	—
	MN51	+	—	—	—
	MN11	—	—	—	—
	MN22	—	N	N	—
	MN12	—	—	—	N
Identification Without identification Identification on the back (specify in clear text)	MZ99	N	N	N	N
	MZ998	A	A	A	A
Inscription Stripes Without inscription stripes Inscription on front face on top (specify in clear text) Inscription on front face at bottom (specify in clear text)	SS99	N	N	N	N
	SS991	A ¹⁾	—	A ¹⁾	A ¹⁾
	SS992	A ¹⁾	A ¹⁾	A ¹⁾	A ²⁾
Contact Protection Without terminal cover Overall terminal cover Single terminal cover (Voltmeter and Ammeter ≤ 4 A)	VB99	N	N	N	N
	VB2	A	—	—	—
	VB1	+	+	+	+

1) For landscape only

2) For portrait only

Vario-Series · Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, slim-line scale
Front frame matt black



PFFN 96 x 24

Technical Data

Front Dimensions mm Type	48 x 18.5 PFF 00	72 x 18.5 PFF 0	72 x 24 PFF 72 x 24	96 x 24 PFFN 96 x 24	144 x 36 DPR 144 F
Scale Length mm	29	50	50	65	96
Class	2.5	2.5	2.5	1.5	1.5
Weight approx. (kg)	0.05	0.09	0.1	0.13	0.5
Operating Voltage	100 V	150 V	100 V	300 V	150 V
Test Voltage	1.5 kV	2.2 kV	1.5 kV	3.5 kV	2.2 kV
Front Housing-Panel Protection	IP 50	IP 50	IP 50	IP 52	IP 50
Fasteners (see next page)	slider	slider	exp. spring	screw spindle	screw spindle
Housing Material	sheet metal	sheet metal	sheet metal	polycarbonate	sheet metal

Description

Analog panel meter with moving-coil movement

Internal Resistance / Voltage Drop / Power Consumption ¹⁾

Display

Scale Division	for sizes	
	48 x 18.5	} Special division
	72 x 18.5	
	72 x 24	
	96 x 24	
	144 x 36	coarse-fine
Pointer	for sizes	
	48 x 18.5	} Bar indicator
	72 x 18.5	
	72 x 24	
	96 x 24	
	144 x 36	Beam pointer with knife-edge
		Bem pointer with knife-edge

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V - 0 or sheet metal housing (see above).

Replaceable Glass window and front frame.
 ⇨ May only be replaced under voltage-free conditions!

Terminals for sizes
 48 x 18.5 tab connectors 2.8 x 0.8
 72 x 18.5 tab connectors 2.8 x 0.8
 72 x 24 tab connectors 2.8 x 0.8
 96 x 24 tab connectors 6.3 x 0.8 or 2 x 2.8 x 0.8 (IP20 protection)
 144 x 36 tab connectors 4.8 x 0.8

Contact Protection available as option (not for 144 x 36)

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60 051

	Front Dimensions mm			
	48 x 18.5 72 x 18.5 72 x 24	96 x 24	144 x 36	
Measuring Range	Ri	Ri	Ri	Tolerance
100 µA	2400 Ω	1920 Ω	1706 Ω	± 20 %
150 µA	1590 Ω	2177 Ω	1706 Ω	
250 µA	950 Ω	1965 Ω	525 Ω	
400 µA	283 Ω	84 Ω	290 Ω	
600 µA	140 Ω	77 Ω	110 Ω	
1 mA	66 Ω	76 Ω	110 Ω	
1.5 mA	30 Ω	72 Ω	30 Ω	
2 mA	17 Ω	75 Ω	6 Ω	
2.5 mA	11.3 Ω	90 Ω	6 Ω	
4 mA	7 Ω	74 Ω	4 Ω	
5 mA	5 Ω	60 Ω	4 Ω	± 30 %
6 mA	1.8 Ω	51 Ω	3 Ω	
10 mA	3.5 Ω	30 Ω	3 Ω	
15 mA	4 Ω	20 Ω	4 Ω	
20 mA	3 Ω	15 Ω	3 Ω	
4 ... 20 mA	3 Ω	18 Ω	4 Ω	
25 mA	2.4 Ω	12 Ω	2.4 Ω	
Voltage drop at >25 mA / <1A	60 mV	300 mV	60 mV	± 20 %
>400 mV / ≥ 1A	60 mV	90 mV	60 mV	
Power consumption for connection to shunt	6 mA	6 mA	5 mA	
≥ 60 mV / ≤ 400 mV	1 kΩ/V	2.5 kΩ/V	1 Ω/mV	
>400 mV	1 kΩ/V	1 kΩ/V	1 kΩ/V	

¹⁾ Indicated internal resistance is only valid for instruments with standard accuracy class.

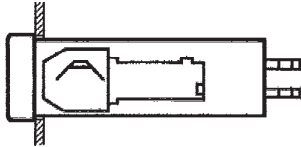
Please inquire regarding internal resistance (Ri) for moving-coil indicators with mechanical zero point at any desired scale value.

Vario-Series • Rectangular Panel Meters

For Direct Current or Direct Voltage

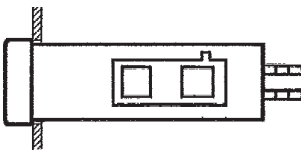


Expanding Springs



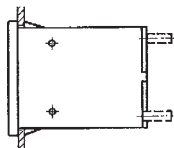
Control panel thickness ≥ 1 mm
Size 72 x 24 for mounting in DIN-Grid,
Siemens-Grid M 25 and Kreutzenbeck-Grid

Catch Spring I



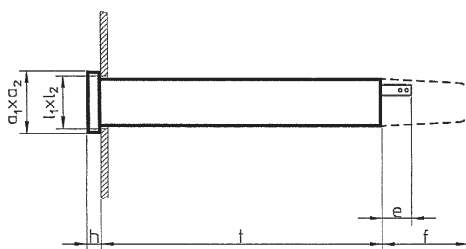
As option for size 72 x 24 for Mauell-Grid,
H & B Unibloc-Grid and Hein-Grid

Slider

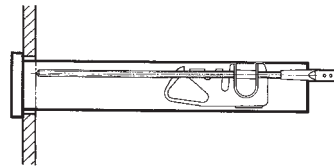


Control panel thickness 1 to 5 mm
For sizes 48 x 18.5 and 72 x 18.5 for mounting in DIN-Grid,
Also available as option for size 72 x 24.

Basic Dimensions

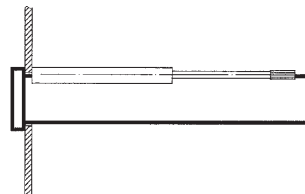


Fastener C DIN 43 835



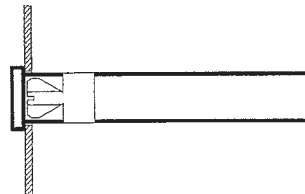
Control panel thickness 1 to 40 mm
Screw clamp M5, longer version, for size 144 x 36 for mounting in
DIN-Grid.

Screw Spindle



Control panel thickness up to 40 mm
Screw spindle for size 96 x 24 for mounting in
DIN-Grid and all remaining grids.

Clamping Springs



Control panel thickness ≥ 1 mm
Available as option for size 96 x 24, retractable from front face,
for mounting in DIN-Grid

Drawing to Scale (on request)

1303A1839H0 for size 96 x 24

Drawing to Scales (on request)

0101A226 for sizes 48 x 18.5 and 72 x 18.5
0101A247 for size 72 x 24
95.207-95 for size 144 x 36

Ordering Example

Size 96 x 24 mm
0 ... 40 V Direct Voltage

Techn. Data Type: PFFN 96 x 24	Order No. 1524P, DC40
--	---------------------------------

Front in mm	Nominal Dimensions $a_1 \times a_2$		Cutout Dimensions $l_1 \times l_2$	Inst. Depth t	Terminals e	Contact Protection at Terminals f = Full Contact Protection
48 x 18.5	48 x 18.5	5	$44.8^{+0.15} \times 17.3^{+0.15}$	56	12	-
72 x 18.5	72 x 18.5	5	$69.3^{+0.15} \times 17.3^{+0.15}$	82	12	-
72 x 24	72 x 24	5	$68^{+0.7} \times 22^{+0.3}$	90	11	31
96 x 24	96 x 24	5	$92^{+0.8} \times 22^{+0.3}$	126	0	-
144 x 36	144 x 36	8	$138^{+1} \times 32.7^{+0.6}$	202	5	-

Vario-Series • Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, slim-line scale

Front frame matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '—' = Not available

	Front Dim. mm	48 x 18.5	72 x 18.5	72 x 24	96 x 24	144 x 36
Type		PFF 00	PFF 0	PFF 72 x 24	PFFN 96 x 24	DPR 144 F
Order No. ⇒		1194P	1196P	1515P	1524P	21102...
	+↕					+↕
Landscape	HQ1	N	N	N	N	N
Portrait	HQ2	+	+	+	+	+
Zero Point - at left (landscape)						
- at bottom (portrait)						
Direct Current						
Range:						
0 ... 100 µA	CA100	A	A	A	A	...34240
0 ... 150 µA	CA150	A	A	A	A	...34270
0 ... 250 µA	CA250	A	A	A	A	...34300
0 ... 400 µA	CA400	A	A	A	A	...34320
0 ... 600 µA	CA600	A	A	A	A	...34350
0 ... >100 µA ... <1 mA ¹⁾	CA...	A	A	A	A	...31005
0 ... 1 mA	CB1	+	+	+	+	...35110
0 ... 1.5 mA	CB1.5	+	+	+	+	...35120
0 ... 2.5 mA	CB2.5	+	+	+	+	...35130
0 ... 4 mA	CB4	+	+	+	+	...35140
0 ... 5 mA	CB5	+	+	+	+	...35150
0 ... 6 mA	CB6	+	+	+	+	...35160
0 ... 10 mA	CB10	+	+	+	+	...35170
0 ... 15 mA	CB15	A	A	A	A	...35180
0 ... 20 mA	CB20	A	A	A	A	...35190
0 ... 25 mA	CB25	A	A	A	A	...35200
0 ... 40 mA	CB40	A	A	A	A	...35210
0 ... 50 mA	CB50	A	A	A	A	...35220
0 ... 60 mA	CB60	A	A	A	A	...35230
0 ... 100 mA	CB100	A	A	A	A	...35240
0 ... 150 mA	CB150	A	A	A	A	...35270
0 ... 250 mA	CB250	A	A	A	A	...35300
0 ... 400 mA	CB400	A	A	A	A	...35320
0 ... 600 mA	CB600	A	A	A	A	...35350
0 ... >1 mA ... <1 A ¹⁾	CB...	A	A	A	A	...31005
Mech. suppressed						
4...20 mA landscape :	BC10	A	A	A	A	...35195
4...20 mA portrait :	BC14	A	A	A	A	...35196
Electr. suppressed						
0/4...20 mA landscape :	BC25	A	A	A	—	...35199
0/4...20 mA portrait :	BC27	A	A	A	—	...35198
0 ... 1 A	CC1	A	A	A	A	...36110
0 ... 1.5 A	CC1.5	A	A	A	A	...36120
0 ... 2.5 A	CC2.5	A	A	A	A	...36130
0 ... 4 A	CC4	A	A	A	A	...36140
0 ... >1 A ... <4 A ¹⁾	CC...	A	A	A	A	...31005

1) Specify in clear text

Vario-Series • Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, slim-line scale

Front frame matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Front Dim. mm	48 x 18.5	72 x 18.5	72 x 24	96 x 24	144 x 36
	Type	PFF 00	PFF 0	PFF 72 x 24	PFFN 96 x 24	DPR 144 F
	Order No. ⇨	1194P	1196P	1515P	1524P	21102...
	+↕					+↕
Landscape	HQ1	N	N	N	N	N
Portrait	HQ2	+	+	+	+	+
Zero Point - at left (landscape)						
- at bottom (portrait)						
Connection to Shunt (direct current)						
... A / 60 mV	BE3	A	A	A	A	...32230
... A / 150 mV	BE4	A	A	A	A	...32270
... A / ... > 60 mV ¹⁾	BE981	A	A	A	A	...31005
Scale:						
1 A	CG1	+	+	+	+	+
1.5 A	CG1.5	+	+	+	+	+
2.5 A	CG2.5	+	+	+	+	+
4 A	CG4	+	+	+	+	+
6 A	CG6	+	+	+	+	+
10 A	CG10	+	+	+	+	+
15 A	CG15	+	+	+	+	+
25 A	CG25	+	+	+	+	+
40 A	CG40	+	+	+	+	+
60 A	CG60	+	+	+	+	+
100 A	CG100	+	+	+	+	+
150 A	CG150	+	+	+	+	+
250 A	CG250	+	+	+	+	+
400 A	CG400	+	+	+	+	+
500 A	CG500	+	+	+	+	+
600 A	CG600	+	+	+	+	+
0 ... > 1 A ... < 1 kA ¹⁾	CG...	+	+	+	+	+
1 kA	CH1	+	+	+	+	+
1.5 kA	CH1.5	+	+	+	+	+
2.5 kA	CH2.5	+	+	+	+	+
4 kA	CH4	+	+	+	+	+
6 kA	CH6	+	+	+	+	+
10 kA	CH10	+	+	+	+	+
> 1 kA ¹⁾	CH...	+	+	+	+	+
Direct Voltage						
Range: 0 ... 60 mV	DB60	A	A	A	A	...31230
0 ... 100 mV	DB100	A	A	A	A	...31240
0 ... 150 mV	DB150	A	A	A	A	...31270
0 ... 250 mV	DB250	A	A	A	A	...31300
0 ... 400 mV	DB400	A	A	A	A	...31320
0 ... 600 mV	DB600	A	A	A	A	...31350
0 ... > 60 mV ... < 1 V ¹⁾	DB...	A	A	A	—	...31005
0 ... > 100 mV ... < 600 mV ¹⁾	DB...	—	—	—	A	...31005
0 ... 1 V	DC1	A	A	A	A	...33110
0 ... 1.5 V	DC1.5	A	A	A	A	...33120
0 ... 2.5 V	DC2.5	A	A	A	A	...33130
0 ... 3 V	DC3	A	A	A	A	...33135
0 ... 4 V	DC4	A	A	A	A	...33140
0 ... 6 V	DC6	A	A	A	A	...33160
0 ... 10 V	DC10	A	A	A	A	...33170
0 ... 15 V	DC15	A	A	A	A	...33180
0 ... 25 V	DC25	A	A	A	A	...33200
0 ... 40 V	DC40	A	A	A	A	...33210
0 ... 60 V	DC60	A	A	A	A	...33230
0 ... 100 V	DC100	A	A	A	A	...33240
0 ... 150 V	DC150	—	A	—	A	...33270
0 ... 250 V	DC250	—	—	—	A	...33300
0 ... 400 V	DC400	—	—	—	A	...33320
0 ... 500 V	DC500	—	—	—	A	...33340
0 ... 600 V	DC600	—	—	—	A	...33350
0 ... > 1 V ... < 600 V ^{1) 2)}	C...	—	—	—	A	...31005

1) Specify in clear text

2) For higher voltages see voltage dividers

Vario-Series • Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, slim-line scale

Front frame matt black

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Order No. with Identification No. N (standard model) can be left out.

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	Front Dim. mm Type Order No. →	48 x 18.5 PFF 00 1194P	72 x 18.5 PFF 0 1196P	72 x 24 PFF 72 x 24 1515P	96 x 24 PFFN 96 x 24 1524P	144 x 36 DPR 144 F 21102...
	+↓ Landscape Portrait	HQ1 HQ2	N +	N +	N +	N +
GENERAL VARIANTS						
Zero pint at left (landscape)	BC1	N	N	N	N	N
Zero point at bottom (portrait)	BC4	N	N	N	N	N
Zero point at center	BC2	A	A	A	A	A
Zero point as desired (specify in clear text)	BC20	A	A	A	A	A
Zero point at the left (landscape), mech. suppressed (not 4–20 mA)	BC16	A	A	A	A	A
Zero point at bottom (portrait),	BC18	A	A	A	A	A
(Max. suppression 20 %; measuring range ≥ 250 µA / ≥ 250 mV, Ri 1 kΩ/V; specify in clear text)						
Internal Resistance for Voltmeters						
Standard (see technical data)	IR99	N	N	N	N	N
Ri approx. 10 kΩ/V (measuring input ≥ 2 V; Exception: ≥ 5 V / ≤ 150 V size 96 x 24)	IR10	A	A	A	A	A
Ri = 1 kΩ/V±1% at nominal temperature (measuring input ≥ 1 V)	IR30	A	A	A	–	A
Ri = 10 kΩ/V±1% at nominal temperature (measuring input ≥ 2 V)	IR40	A	A	A	–	A
Potentiometer for Adjustment with Voltmeters						
Voltmeters without potentiometer for adjustment	MP99	N	N	N	N	N
Voltmeters with potentiometer for adjustment Adjustment range ±15 % (measuring input ≥ 6 V / ≤ 400 V; Class 1.5 only; Ri according to list ¹⁾)	MP1	–	–	–	A	–
Lead Resistor when connecting to						
Shunt resistors ...A/60 mV and ...A/150 mV Standard version 0.06 Ω	IG99	N	N	N	N	N
Differing from 0.06 Ω (specify in clear text). Limiting values: ...A / 60 mV for class 1.5 max. 1 Ω ...A / 150 mV for class 1.5 max. 7 Ω	IG999	A	A	A	A	A
Accuracy						
Class 2.5	IE25	N	N	N	–	–
Class 1.5	IE15	A ²⁾	A ²⁾	A ²⁾	N ³⁾	N
Class 1.0 (measuring input ≥100 µA / ≥60 mV)	IE10	–	–	–	–	A
Position of Use						
Control panel vertical	LA1	N	N	N	N	N
Control panel horizontal	LA2	+	+	+	+	+
Other (Please specify angle between scale and horizontal)	LA999	A	A	A	A	A
Special Features						
Normal vibration and shock resistance	LN99	N	N	N	N	N
Vibration resis. 2.5 g, shock resis. 30 g	LN56	A	A	A ⁴⁾	A	–

1) Exception: The standard version (size 96 x 48) of the potentiometer for adjustment has a current consumption of approx. 100 µA

2) Available only in combination with tube pointer

3) Standard version without extra charge

4) Available only in combination with slider

Vario-Series • Rectangular Panel Meters

For Direct Current or Direct Voltage



Moving-coil movement, slim-line scale

Front frame matt black

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		Front Dim. mm	48 x 18.5	72 x 18.5	72 x 24	96 x 24	144 x 36
		Type	PFF 00	PFF 0	PFF 72 x 24	PFFN 96 x 24	DPR 144 F
		Order No. →	1194P	1196P	1515P	1524P	21102...
	Landscape	+↕					
	Portrait	HQ1 HQ2	N +	N +	N +	N +	N +
SCALE VARIANTS							
Scale							
In accordance with measuring input		GF99	N	N	N	N	N
Blank scale (lower/upper value markings, company logos, symbols)		GF28	+	+	+	+	+
Scale Characteristics							
Current / Voltage proportional		SD1	N	N	N	N	N
According to curve (not current / voltage proportional)		SD6	A	A	A	A	A
Division and Pointer							
Single division		GD1	N	N	N	N	N
Double division		GD2	A	A	A	A	A
Special division		SE5	N	N	N	N	A
Coarse-fine division		SE1	–	–	–	–	N
Bar indicator for single division		RA40	N	N	N	–	–
Tube pointer for double division		RA31	A	A	A	–	–
Beam pointer with knife-edge for single and double division		RA4	–	–	–	N	–
Knife-edge pointer for single division		RA10	–	–	–	–	N
for double division		RA11	–	–	–	–	A
Additional Imprint							
Second numbering (specify in clear text)		SK992	A	A	A	A	A
Inscription:							
Without additional inscription		SM99	N	N	N	N	N
Inscription ≤ 15 characters German		SM991	A	A	A	A	A
> 15 characters German		SM992	A	A	A	A	A
≤ 15 characters other language		SM993	A	A	A	A	A
> 15 characters other language		SM994	A	A	A	A	A
(Other language in Latin lettering, specify in clear text)							
Coloured mark red RAL 2002 (specify in clear text)		ST991	A	A	A	A	A
Coloured sector yell. RAL 1021, green RAL 6018 or red RAL 2002 (specify in clear text)		SU991	A	A	A	A	A

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Front frame matt black

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Front Dim. mm		48 x 18.5	72 x 18.5	72 x 24	96 x 24	144 x 36
Type		PFF 00	PFF 0	PFF 72 x 24	PFFN 96 x 24	DPR 144 F
Order No. ⇒		1194P	1196P	1515P	1524P	21102...
	↕	HQ1	N	N	N	N
	↔	HQ2	+	+	+	+
SCALE VARIANTS						
Scale / Pointer Colours						
Scale white; imprint and pointer black		SG99	N	N	N	N
Scale black; imprint and pointer white		SG1	—	—	A ¹⁾	A ¹⁾
Scale black; imprint and pointer yellow		SG2	—	—	A ¹⁾	A ¹⁾
Scale black; imprint white, pointer yellow		SG3	—	—	A ¹⁾	A ¹⁾
Dial Illumination						
Without dial illumination		PA99	N	N	N	N
With direct dial illumination		PA1	A	A	A	—
(Plexiglass scale, scale and dial illumination white)						
Note: Completion with voltage Order No. PB necessary.						
Voltage for Dial Illumination						
24 V		PB5	—	—	—	—
28 V		PB6	—	—	—	—
24 V (2 x 12 V-lamps connected in series)		PB7	+	+	+	—
28 V (2 x 14 V-lamps connected in series)		PB8	+	+	+	—

1) Additional one-off costs for special scale printing on request

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	Front Dim. mm Type Order No. →	48 x 18.5 PFF 00 1194P	72 x 18.5 PFF 0 1196P	72 x 24 PFF 72 x 24 1515P	96 x 24 PFFN 96 x 24 1524P	144 x 36 DPR 144 F 21102...
	Landscape Portrait + ↓ HQ1 HQ2	N	N	N	N	N
		+	+	+	+	+
HOUSING VARIANTS						
Application						
Standard version	LB99	N	N	N	N	N
Tropic resistant	LB1	A	A	A	A	A
Protection						
Standard (see technical data)	LH99	N	N	N	N	N
Front housing-panel protection IP54, con. IP00	LH21	–	–	A	–	A
Front housing-panel protection IP54, con. IP20	LH22	–	–	–	A	–
Earthquake-proof (possible combination: LH X 99 or LH X 21)	LH10	–	–	–	A	–
Front Frame Colour						
Matt black	MA2	N	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A	A
Matt stone grey RAL 7032	MA12	–	–	A	A	–
Matt light grey RAL 7035	MA14	–	–	A	A	–
Matt dark beige approx. RAL 1019	MA21	–	–	A	A	–
Glass Window						
Standard version	MG99	N	N	N	N	N
Anti-glare glass	MG1	A	A	A	A	A
Mounting						
Slider	MN50	N	N	A	–	–
Expanding spring	MN20	–	–	N	–	–
Catch spring	MN21	–	–	+	–	–
Screw spindle	MN22	–	–	–	N	N
Clamping Spring	MN23	–	–	–	+	–
Fastener C	MN12	–	–	–	–	–
Subklew (stiled slider)	MN32	–	–	A	–	–
Angled slider for APE-Grid	MN51	–	–	A	–	–
Identification						
Without identification	MZ99	N	N	N	N	N
Identification on the back (specify in clear text)	MZ998	A	A	A	A	A
Label Strips						
Without label strips	SS99	N	N	N	N	N
Label on front face on top (spec. in clear text)	SS991	–	–	A ¹⁾	A ¹⁾	–
Label on front face at bottom (specify in clear text)	SS992	–	–	A ¹⁾	A ¹⁾	–
Contact Protection						
Without terminal cover	VB99	N	N	N	N	N
Overall terminal cover	VB2	–	–	A	–	–
Single terminal cover	VB1	+	+	+	+	–

1) Available only for landscape format

Vario-Series • Rectangular Indicator/Controllers
For Direct Current or Direct Voltage with 2 Limit Contacts



Moving-coil movement, edgewise scale
Narrow front frame per DIN 43 718, matt black



PFN 96 x 24

Technical Data

Front Dimensions mm Type	96 x 24 PFN 96 x 24	96 x 48 PFN 96 x 48	144 x 36 KODPR 144 F	144 x 72 KODPR 144 SE
Scale Length mm	65	65	96	98
Class	1.5	1.5	1.5	1.5
Weight approx. (kg)	0.2	0.5 (at U _H AC) 0.2 (at U _H DC)	0.6	1.1
Sampling	electronic	electronic	electronic	electronic
Relative Switching Speed (max. error as related to scale length)	1 %	1 %	1 %	1 %
Repetition Accuracy (at nom. aux. voltage and 23 °C)	0.1 %	0.1 %	0.1 %	0.1 %
Number of Limits	1 or 2	1 or 2	1 or 2	1 or 2
Min. Limit Separation (of scale length)	3 %	3 %	1.5 %	1.5 %
Output Relay	built in	built in	attachable on back ²⁾	attachable on back ²⁾
Output Contact	1 changeover per limit	1 changeover per limit	1 changeover per limit	1 changeover per limit
Switching Capacity with Restive Load				
Max. Switching Voltage	250 V AC / 250 V DC	250 V AC / 250 V DC	250 V AC / 250 V DC	250 V AC / 250 V DC
Max. Switching Current	6 A AC / 6 A DC	6 A AC / 6 A DC	3 A AC / 3 A DC	3 A AC / 3 A DC
Nominal Switching Capacity	500 VA / 50 W	500 VA / 50 W	750 VA / 50 W	750 VA / 50 W
Service Life at nominal Switching Capacity	>10 ⁶ switching cycles	>10 ⁶ switching cycles	>10 ⁶ switching cycles	>10 ⁶ switching cycles
Max. Switching Time	500 ms	500 ms	50 ms	50 ms
Auxiliary Voltage (U _H)	24 V DC (20...24...30 V) ¹⁾	24 V DC (20...24...30 V) o. 24 ... 240V AC. 45...65Hz	24 V DC (20...24...30 V) ¹⁾	24 V DC (20...24...30 V) ¹⁾
Power Consumption	4 VA / 4.5 W	4 VA / 4.5 W	5 VA / 4 W	5 VA / 4 W
Safety Class	CAT III	CAT III	CAT III	CAT III
Pollution Degree	2	2	2	2
Operating Voltage	300 V	300 V	150 V	150 V
Operating Voltage for Measuring Ranges >250 V ... ≤ 600 V	300 V	600 V	150 V	150 V
Test Voltage	3.5 kV	5.8 kV	2.2 kV	2.2 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 50	IP 50
Fasteners	screw spindle	screw spindle	screw spindle	screw spindle

1)With separate power supply for following voltages:
24 V AC, 115 V AC and 230 V AC, ±10 %; see accessories, page 93

2) The relay module per contact is not included
(this must be ordered separatley,
the Art No.: 69100 00000 can be found on page 95).

Description

Analog indicator/controller with moving-coil movement for direct current or direct voltage

Display

Scale Division Special Division
Pointer Beam pointer with knife-edge for single and double Division

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94 V-0
Replaceable Glass windows and front frames
⇒ May only be replaced under voltage-free conditions!
Terminals Tab connectors (IP20 protection) 1 x 6.3 x 0.8 mm, 2 x 2.8 x 0.8 mm or 4.8 x 0.8 mm

Internal Resistance / Voltage Drop / Power Consumption

(Values only apply with zero point at let or at bottom)

Measuring Range	Internal Resistance / Voltage Drop / Power Consumption
≥ 100 µA / ≤ 10 mA	≤ 100 mV
> 10 mA / ≤ 6 A	≤ 100 mV
≥ 60 mV / ≤ 1 V	≥ 200 kΩ/V
> 1 V / ≤ 50 V	≥ 10 kΩ/V
> 50 V / ≤ 600 V	≥ 10 kΩ/V
0/4 ... 20 mA	6 Ω ¹⁾
Connection to Shunt	6 mA ²⁾

1) Tolerance ±30%

2) Tolerance ±20%

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ±2°C
Position of Use	control panel vertical ±1°
Other	DIN EN 60 051

Vario-Series • Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 2 Limit Contacts



General Issues

Indicator/controllers are meters with adjustable limits.

The accuracy of the limits are not influenced by the contacts.

Our meters and indicator/controllers comply with the regulations of the European Guidelines 73/23/EEG. This is proven by the compliance with the following standards: IEC 61010-1/A2 / EN 61010-1/A2 VDE 0411-1/A1 (Safety Regulations)

IEC 60051/EN 60051/DIN EN 60051 (Meters with Scale Display)

EN 50081-2: 1993 EMV (Emitted Interference, Industries)

EN 50082-2: 1995 EMV (Emitted Interference, Industries)

To protect the movable part of the indicator/controller against shocks, the bearings are spring mounted.

Application

Indicator/controllers display the actual value and energise with the help of one or more limits one or more relays. Their contacts can be used for monitoring, operating or controlling.

Indicator/controllers are also available with logic output (transistor output).

Sampling

The sampling of the indicator/controllers works contact-free.

When the pointer reaches the limit the switching operation will be disengaged.

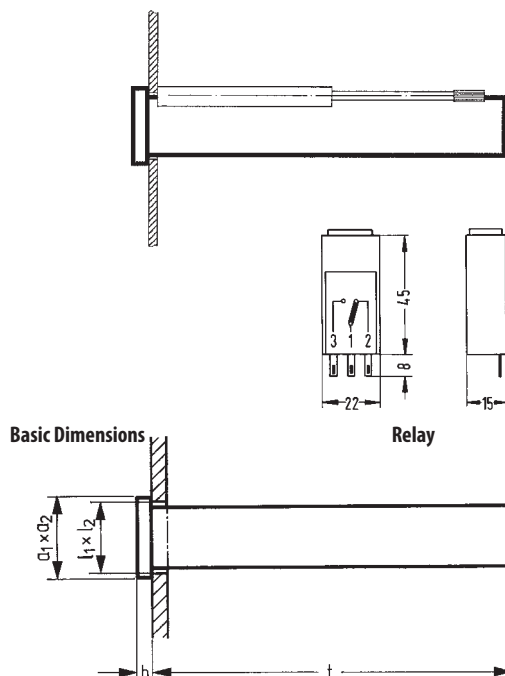
Contacting

The max. contact disengages the switching operation when it overshoots the adjusted scale value. The min. contact disengages the switching operation when it undershoots the adjusted scale value.

Fasteners

Screw spindle

(control panel thickness 1 ... 40 mm)



Basic Dimensions

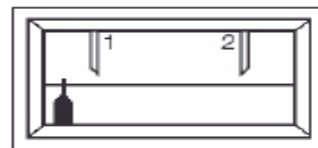
Relay

All indicator/controllers cause a permanent contact. This means that the output signal is held up as long as the pointer does not overrun the adjusted limit. The indicator/controllers are available as closed-circuit current model or working current model (see different Order No.).

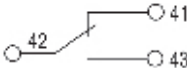
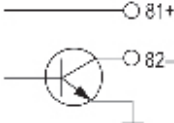
Closed-Circuit Current Model: When the indicator/controller is not-operated, a voltage is impressed on the relays (output signal H, logic output). The voltage drops as soon as one of the contact marks is undershot or overshoot. The same happens when a power breakdown or an electronic breakdown occurs and no limit is overshoot or undershot (self supervision). A short-term power failure leads to the same effect.

Working Current Model: When the indicator/controller is not-operated the relays are in zero current condition (output signal L, logic output). As soon as one of the limits is overshoot or undershot the relays pick up (output signal H).

Position of Limits



Contact Assignments (Specification for Pfn 144x36 and Pfn 144x72)

Measured Quantity		- 12-
		+ 11+
Auxiliary Voltage		DC
		- L+
		+ L-
Relay Output	Logic Output	
Limit Contact 1		
		
Limit Contact 2		
		
The output contacts are shown in the wiring diagram in the zero current condition		+ terminals are electrically connected within the instrument

Ordering Example:

Indicator/Controller 96 x 24 mm for direct voltage, landscape scale, Measuring range 0 ... 100 V, direct connection, zero point at left, Working voltage-version with 2 limit contacts (Max. - Max.)

Techn. Data	Order No.
Type: PFN 96 x 24	2524P, AM11, DC100

Front Dim. mm	Nominal Dimensions		Cutout Dimensions $l_1 \times l_2$	Installation Depth (t) Relay Output	Installation Depth (t) Logic Output
	$a_1 \times a_2$	h			
96 x 24	96 x 24	5	$92^{+0.8} \times 22.2^{+0.3}$	146	126
96 x 48	96 x 48	5	$92^{+0.8} \times 45^{+0.6}$	146	126
144 x 36	144 x 36	8	$137.5^{+0.8} \times 32.5^{+0.6}$	246	202
144 x 72	144 x 72	8	$137.7^{+0.8} \times 67.7^{+0.6}$	248	205

Vario-Series • Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 2 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not available

		Type Order No.	⇒ PFN 96 x 24 2524P	PFN 96 x 48 2594P	KODPR 144 F 61102...	KODPR 144 SE 65102...
		+↕ HQ1 HQ2	N +	N +	+↕ N +	+↕ N +
Limits	Landscape Portrait					
Closed-Circuit Current Model	Max.	AM3	+	+	+	+
	Min.	AM4	+	+	+	+
	Min. - Max.	AM5	A	A	A	A
	Max. - Max.	AM6	A	A	A	A
	Min. - Min.	AM7	A	A	A	A
Working Current Model	Max.	AM8	+	+	+	+
	Min.	AM9	+	+	+	+
	Min. - Max.	AM10	A	A	A	A
	Max. - Max.	AM11	A	A	A	A
	Min. - Min.	AM12	A	A	A	A
Zero Point - left / bottom						
Direct Current						
Range	0 ... 100 µA	CA100	A	A	...34240	...34240
	0 ... 150 µA	CA150	A	A	...34270	...34270
	0 ... 250 µA	CA250	A	+	...34300	...34300
	0 ... 400 µA	CA400	A	+	...34320	...34320
	0 ... 600 µA	CA600	–	+	...34350	...34350
	> 100 µA ... < 1 mA ¹⁾	CA...	A	A	...31005	...31005
	0 ... 1 mA	CB1	+	+	...35110	...35110
	0 ... 1.5 mA	CB1.5	+	+	...35120	...35120
	0 ... 2.5 mA	CB2.5	+	+	...35130	...35130
	0 ... 4 mA	CB4	+	+	...35140	...35140
	0 ... 5 mA	CB5	+	+	...35150	...35150
	0 ... 6 mA	CB6	+	+	...35160	...35160
	0 ... 10 mA	CB10	+	+	...35170	...35170
	0 ... 15 mA	CB15	A	+	...35180	...35180
	0 ... 20 mA	CB20	A	+	...35190	...35190
	0 ... 25 mA	CB25	A	+	...35200	...35200
	0 ... 40 mA	CB40	A	+	...35210	...35210
	0 ... 50 mA	CB50	A	+	...35220	...35220
	0 ... 60 mA	CB60	A	+	...35230	...35230
	0 ... 100 mA	CB100	A	+	...35240	...35240
	0 ... 150 mA	CB150	A	+	...35270	...35270
	0 ... 250 mA	CB250	A	+	...35300	...35300
	0 ... 400 mA	CB400	A	+	...35320	...35320
	0 ... 600 mA	CB600	A	+	...35350	...35350
	> 1 mA ... < 1 A ¹⁾	CB...	A	A	...31005	...31005
Electr. suppressed						
	0/4 ... 20 mA	landscape	BC25	A	...35199	...35199
	0/4 ... 20 mA	portrait	BC27	A	...35198	...35198
	0 ... 1 A		CC1	+	...36110	...36110
	0 ... 1.5 A		CC1.5	+	...36120	...36120
	0 ... 2.5 A		CC2.5	+	...36130	...36130
	0 ... 4 A		CC4	+	...36140	...36140
	0 ... 6 A		CC6	+	...36160	...36160
	> 1 A ... < 6 A ¹⁾		CC...	A	...31005	...31005

1) Specify in clear text

Vario-Series • Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 2 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Type Order No.	⇒ PFN 96 x 24 2524P	PFN 96 x 48 2594P	KODPR 144 F 61102...	KODPR 144 SE 65102...
		+↕			+↕	+↕
Limits	Landscape	HQ1	N	N	N	N
	Portrait	HQ2	+	+	+	+
Closed-Circuit Current Model	Max.	AM3	+	+	+	+
	Min.	AM4	+	+	+	+
	Min. - Max.	AM5	A	A	A	A
	Max. - Max.	AM6	A	A	A	A
	Min. - Min.	AM7	A	A	A	A
Working Current Model	Max.	AM8	+	+	+	+
	Min.	AM9	+	+	+	+
	Min. - Max.	AM10	A	A	A	A
	Max. - Max.	AM11	A	A	A	A
	Min. - Min.	AM12	A	A	A	A
Zero Point - left / bottom						
Connection to Shunt (Direct Current)						
	... A / 60 mV	BE3 ¹⁾	A	+	...32230	...32230
	... A / 150 mV	BE4 ¹⁾	A	+	...32270	...32270
	... A / ...>60 mV ²⁾	BE981 ¹⁾	A	A	...31005	...31005
Scale:	1 A	CG1	+	+	+	+
	1.5 A	CG1.5	+	+	+	+
	2.5 A	CG2.5	+	+	+	+
	4 A	CG4	+	+	+	+
	5 A	CG5	+	+	+	+
	6 A	CG6	+	+	+	+
	10 A	CG10	+	+	+	+
	15 A	CG15	+	+	+	+
	20 A	CG20	+	+	+	+
	25 A	CG25	+	+	+	+
	30 A	CG30	+	+	+	+
	40 A	CG40	+	+	+	+
	50 A	CG50	+	+	+	+
	60 A	CG60	+	+	+	+
	75 A	CG75	+	+	+	+
	100 A	CG100	+	+	+	+
	150 A	CG150	+	+	+	+
	200 A	CG200	+	+	+	+
	250 A	CG250	+	+	+	+
	300 A	CG300	+	+	+	+
	400 A	CG400	+	+	+	+
	500 A	CG500	+	+	+	+
	600 A	CG600	+	+	+	+
	0 ...>1 A ...<1 kA ²⁾	CG...	+	+	+	+
	1 kA	CH1	+	+	+	+
	1.5 kA	CH1.5	+	+	+	+
	2.5 kA	CH2.5	+	+	+	+
	4 kA	CH4	+	+	+	+
	5 kA	CH5	+	+	+	+
	6 kA	CH6	+	+	+	+
	10 kA	CH10	+	+	+	+
	15 kA	CH15	+	+	+	+
	>1 kA ²⁾	CH...	+	+	+	+

1) Complement with CG... or CH...

2) Specify in clear text

Vario-Series • Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 2 Limit Contacts



Moving-coil movement, edgewise scale
Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '–' = Not available

		Type Order No. ⇔	PFN 96 x 24 2524P	PFN 96 x 48 2594P	KODPR 144 F 61102...	KODPR 144 SE 65102...
		+↕ HQ1 HQ2	N +	N +	+↕ N +	+↕ N +
Limits						
Closed-Circuit Current Model	Max.	AM3	+	+	+	+
	Min.	AM4	+	+	+	+
	Min. - Max.	AM5	A	A	A	A
	Max. - Max.	AM6	A	A	A	A
	Min. - Min.	AM7	A	A	A	A
Working Current Model	Max.	AM8	+	+	+	+
	Min.	AM9	+	+	+	+
	Min. - Max.	AM10	A	A	A	A
	Max. - Max.	AM11	A	A	A	A
	Min. - Min.	AM12	A	A	A	A
Zero Point - left / bottom Direct Voltage						
Range						
	0 ... 60 mV	DB60	A	A	...31230	...31230
	0 ... 100 mV	DB100	A	A	...31240	...31240
	0 ... 150 mV	DB150	A	A	...31270	...31270
	0 ... 250 mV	DB250	A	+	...31300	...31300
	0 ... 400 mV	DB400	A	+	...31320	...31320
	0 ... 600 mV	DB600	A	+	...31350	...31350
	0 ... >60 mV...<1 V ¹⁾	DB...	A	A	...31005	...31005
	0 ... 1 V	DC1	A	+	...33110	...33110
	0 ... 1.5 V	DC1.5	A	+	...33120	...33120
	0 ... 2.5 V	DC2.5	A	+	...33130	...33130
	0 ... 4 V	DC4	A	+	...33140	...33140
	0 ... 5 V	DC5	A	+	...33150	...33150
	0 ... 6 V	DC6	A	+	...33160	...33160
	0 ... 10 V	DC10	A	+	...33170	...33170
	0 ... 15 V	DC15	A	+	...33180	...33180
	0 ... 20 V	DC20	A	+	...33190	...33190
	0 ... 25 V	DC25	A	+	...33200	...33200
	0 ... 40 V	DC40	A	+	...33210	...33210
	0 ... 50 V	DC50	A	+	...33220	...33220
	0 ... 60 V	DC60	A	+	...33230	...33230
	0 ... 100 V	DC100	A	+	...33240	...33240
	0 ... 150 V	DC150	A	+	...33270	...33270
	0 ... 250 V	DC250	A	+	...33300	...33300
	0 ... 400 V	DC400	A	+	...33320	...33320
	0 ... 500 V	DC500	A	+	...33340	...33340
	0 ... 600 V	DC600	A	+	...33350	...33350
	0 ... >1 V ... <600 V ¹⁾	DC...	A	A	...31005	...31005

1) Specify in clear text

Vario-Series • Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 2 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen. Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

	Type Order No. ⇨	PFN 96 x 24 2524P	PFN 96 x 48 2594P	KODPR 144 F 61102...	KODPR 144 SE 65102...
	+↕				
Landscape	HQ1	N	N	N	N
Portrait	HQ2	+	+	+	+
GENERAL VARIANTS					
Zero Point					
Zero point at left (landscape)	BC1	N	N	N	N
Zero point at bottom (portrait)	BC4	+	+	+	+
Zero point at center	BC2	A	A	A	A
Zero point between bottom and center of scale 1)	BC21	A	A	A	A
Position of Use					
Control panel vertical	LA1	N	N	N	N
Control panel horizontal	LA2	+	+	+	+
Other (Please specify angle between scale and horizontal)	LA999	A	A	A	A
OUTPUT VARIANTS					
Relay output	AU1	N	N	N	N
Logic output (open collector) H = + 24 V (electrically isolated from U _H) L < + 1 V, I ≤ 50 mA (20 mA at U _H AC)	AU2	+	+	+	+
AUXILIARY VOLTAGE VARIANTS					
24 V DC (20...24...30 V)	IV22	N	N	N	N
24 V AC (21...24...27 V), 45...65 Hz	IV12	A 2)	+	A 2)	A 2)
100 V AC (90...100...110 V), 45...65 Hz	IV10	-	+	-	-
110 V AC (99...110...121 V), 45...65 Hz	IV13	-	+	-	-
115 V AC (103...115...127 V), 45...65 Hz	IV16	A 2)	+	A 2)	A 2)
220 V AC (198...220...242 V), 45...65 Hz	IV19	-	+	-	-
230 V AC (207...230...253 V), 45...65 Hz	IV23	A 2)	+	A 2)	A 2)
240 V AC (216...240...264 V), 45...65 Hz	IV24	-	+	-	-
SCALE VARIANTS					
Division and Pointer					
Single division	GD1	N	N	N	N
Double division 1)	GD2	A	A	A	A
Additional Imprint					
Second numbering, black 1)	SK982	A	A	A	A
Second numbering, red (RAL 2002) 1)	SK983	A	A	A	A
Inscription:					
Without additional inscription	SM99	N	N	N	N
Inscription ≤ 15 characters German 1)	SM991	A	A	A	A
Inscription ≤ 15 characters other language 1) (Latin lettering)	SM993	A	A	A	A
Coloured mark red RAL 2002	ST981	A	A	A	A
Coloured sector red (RAL 2002) 1)	SU981	A	A	A	A
Coloured sector green (RAL 6018) 1)	SU982	A	A	A	A
HOUSING VARIANTS					
Application					
Standard version	LB99	N	N	N	N
Tropic resistant	LB1	A	A	-	-
Protection					
Standard (see technical data)	LH99	N	N	N	N
Housing panel IP 54, connections IP 20	LH22	A	A	-	-
Front Frame Colour					
Matt black	MA2	N	N	N	N
Matt grey RAL 7037	MA11	A	A	A	A
Glass Window					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Identification					
Without Identification	MZ99	N	N	N	N
Identification on the back 1)	MZ998	A	A	A	A

1) Specify in clear text

2) With external power supply unit (extra charge) for the following voltages: 24 V AC, 115 V AC and 230 V AC, ±10 %; see accessories, page 95

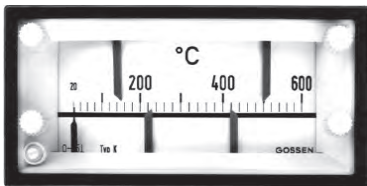
Vario-Series - Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 4 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black



PFN 96 x 48M

Technical Data

Front Dimensions mm	96 x 48
Type	PFN 96 x 48M
Scale Length mm	65
Class	1.5
Weigth approx. (kg)	0.5
for auxiliary voltage 20 ... 40 V AC / DC	0.2
Sampling	electronic
Relative Switching Speed	1 %
(max. error as related to scale length)	
Repetition Accuracy	0.1 %
(at nom. aux. voltage and 23 °C)	
Number of Limits	4
Min. Contact Limit Clearance	3 %
(of scale length)	
Output Realy	built in
Output Contact	1 changeover per limit
Switching Capacity with Ohmic Load	
Max. Switching Voltage	300 V AC / DC
Max. Switching Current	6 A AC/DC
Nominal Switching Capacity	≤ 1500 VA
Service Life at Nominal Switching Capacity	> 106 switching cycles
Max. Switching Time	500 ms
Auxiliary Voltage (UH)	see order information
Power Consumption, AC Aux. Voltage	4 VA
Power Consumption, DC Aux. Voltage	4.5 W
Safety Regulations per IEC/EN 61010-1/A2 VDE 0411-1/A1	
Safety Class	II (total insulation)
Measuring Circuit:	
Over voltage Category	CAT III
Pollution Degree	2
Operating Voltage	300 V
Operating Voltage for Voltage Measuring	
>250 V ... ≤ 600 V	600 V
Test Voltage (to Housing)	5.8 kV
Front Panel-Housing Protection	IP 52
Fasteners	screw spindle

Internal Resistance / Voltage Drop / Power Consumption

(Values only apply with zero point at left or at bottom)

Measuring Range	Internal Resistance / Voltage Drop / Power Consumption
≥ 100 µA/ ≤ 10 mA	≤ 100 mV
> 10 mA/≤ 6 A	≤ 100 mV
≥ 60 mV/ ≤ 1 V	≥ 1 MΩ
> 1 V/ ≤ 50 V	≥ 100 kΩ
> 50 V /≤ 600 V	≥ 2 kΩ/V
0/4 ... 20 mA	6 Ω ¹⁾
Connection to shunt	6 mA ²⁾

1) Tolerance ±30 %

2) Tolerance ±20 %

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1 °
Other	DIN EN 60 051

Description

Analog indicator/controller with moving-coil movement for direct current or direct voltage

Display

Scale Division Coarse-fine

Pointer Beam pointer with knife-edge for single and double division

Mechanical Design

Housing Material Polycarbonate, self-extinguishing and drip-proof per UL 94V-0

Replaceable Glass windows and front frames

⇒ May only be replaced under voltage-free conditions!

Terminals tab connectors (IP 20 protection)

1x 6.3 x 0.8 mm or 2 x 2.8 x 0.8 mm

Ordering Example:

Indicator/Controller 96 x 48 mm for direct voltage, landscape scale,

Measuring range 0 ... 100 V, direct voltage,

Closed-circuit current model, contacting Min.-Max. /Min.-Max.

Techn. Data	Order No.
Type: PFN 96 x 48M	2596P, AM40, DC100

Vario-Series · Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 2 Limit Contacts



General Issues

Indicator/controllers are meters with adjustable limits.

The accuracy of the limits are not influenced by the contacts.

Our meters and indicator/controllers comply with the regulations of the European Guidelines 73/23/EEG. This is proven by the compliance with the following standards: IEC 61010-1/A2 / EN 61010-1/A2 VDE 0411-1/A1 (Safety Regulations)

IEC 60051/EN 60051/DIN EN 60051 (Meters with Scale Display)

EN 50081-2: 1993 EMV (Emitted Interference, Industries)

EN 50082-2: 1995 EMV (Emitted Interference, Industries)

To protect the movable part of the indicator/controller against shocks, the bearings are spring mounted.

Application

Indicator/controllers display the actual value and energise with the help of one or more limits one or more relays. Their contacts can be used for monitoring, operating or controlling.

Indicator/controllers are also available with logic output (transistor output).

Sampling

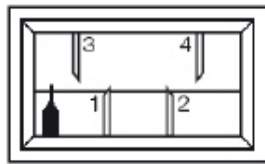
The sampling of the indicator/controllers works contact-free.

When the pointer reaches the limit the switching operation will be disengaged.

Contacting

The max. contact disengages the switching operation when it overshoots the adjusted scale value. The min. contact disengages the switching operation when it undershoots the adjusted scale value.

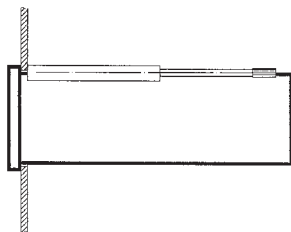
Position of Limits



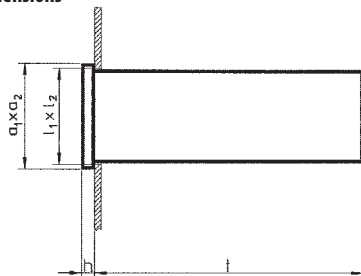
Fasteners

Screw spindle

(control panel thickness 1 ... 40 mm)



Basic Dimensions



All indicators/controllers cause a permanent contact. This means that the output signal is held up as long as the pointer does not overrun the adjusted limit. The indicators/controllers are available as closed-circuit current model or working current model (see different Order No.).

Closed-Circuit Current Model: When the indicator/controller is not-operated a voltage is impressed on the relays (output signal H, logic output). The voltage drops as soon as one of the contact marks is undershot or overshoot. The same happens when a power breakdown or an electronic breakdown occurs and no limit is overshoot or undershot (self supervision). A short-term power failure leads to the same effect.

Working Current Model: When the indicator/controller is not-operated the relays are in zero current condition (output signal L, logic output). As soon as one of the limits is overshoot or undershot the relays pick up (output signal H).

Contact Assignments

Measuring Input	- 12- + 11+
Auxiliary Voltage	20 ... 40 VAC/DC L1 L2 90 ... 127 VAC L 198 ... 264 VAC N
Relay Output	Logic Output
Limit Contact 1	
Limit Contact 2	
Limit Contact 3	
Limit Contact 4	
The output contacts are shown in the wiring diagram in the zero current condition	+ terminals are electrically connected within the instrument

Front Dim. mm	Nominal Dimensions		Cutout Dimensions	Installation Depth (t) Relay Output	Installation Depth (t) Logic Output
	a ₁ x a ₂	h	l ₁ x l ₂		
96 x 48	96 x 48	5	92 ^{+0.8} x 45 ^{+0.6}	146	126

Vario-Series · Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 4 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Type Order No. ⇒	PFN 96 x 48M 2596P
	Landscape	+ ⇅ HQ1	N
	Portrait	HQ2	+
	Contacting ¹⁾		
Min. - Max. / Min. - Max. closed current		AM40	+
Min. - Max. / Max. - Max. closed current		AM41	+
Min. - Max. / Min. - Min. closed current		AM42	+
Min. - Min. / Min. - Min. closed current and		AM43	+
Max. - Max. / Max. - Max. working current		AM49	+
Max. - Max. / Max. - Max. closed current and		AM44	+
Min. - Min. / Min. - Min. working current		AM48	+
Min. - Max. / Min. - Max. working current		AM45	+
Min. - Max. / Max. - Max. working current		AM46	+
Min. - Max. / Min. - Min. working current		AM47	+
Zero Pint - left / bottom			
Direct Current			
Range	0 ... 100 µA	CA100	A
	0 ... 150 µA	CA150	A
	0 ... 250 µA	CA250	A
	0 ... 400 µA	CA400	A
	0 ... 600 µA	CA600	A
	> 100 µA ... < 1 mA ²⁾	CA...	A
	0 ... 1 mA	CB1	+
	0 ... 1.5 mA	CB1.5	+
	0 ... 2.5 mA	CB2.5	+
	0 ... 4 mA	CB4	+
	0 ... 5 mA	CB5	+
	0 ... 6 mA	CB6	+
	0 ... 10 mA	CB10	+
	0 ... 15 mA	CB15	A
	0 ... 20 mA	CB20	A
	0 ... 25 mA	CB25	A
	0 ... 40 mA	CB40	A
	0 ... 50 mA	CB50	A
	0 ... 60 mA	CB60	A
	0 ... 100 mA	CB100	A
	0 ... 150 mA	CB150	A
	0 ... 250 mA	CB250	A
	0 ... 400 mA	CB400	A
	0 ... 600 mA	CB600	A
	> 1 mA ... < 1 A ²⁾	CB...	A
Electr. suppressed	0/4 ... 20 mA landscape	BC25	A
	0/4 ... 20 mA portrait	BC27	A
	0 ... 1 A	CC1	A
	0 ... 1.5 A	CC1.5	A
	0 ... 2.5 A	CC2.5	A
	0 ... 4 A	CC4	A
	0 ... 6 A	CC6	A
	> 1 A ... < 6 A ²⁾	CC...	A

1) Number of contacts - specify in clear text

2) Specify in clear text

Vario-Series · Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 4 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Type Order No. ⇒	PFN 96 x 48M 2596P
Zero Point - left / bottom			
Connection to Shunt (Direct Current)			
... A / 60 mV		BE3 ²⁾	A
... A / 150 mV		BE4 ²⁾	A
... A / ...>60 mV ³⁾		BE981 ²⁾	A
Scale:	1 A	CG1	+
	1.5 A	CG1.5	+
	2.5 A	CG2.5	+
	4 A	CG4	+
	5 A	CG5	+
	6 A	CG6	+
	10 A	CG10	+
	15 A	CG15	+
	20 A	CG20	+
	25 A	CG25	+
	30 A	CG30	+
	40 A	CG40	+
	50 A	CG50	+
	60 A	CG60	+
	75 A	CG75	+
	100 A	CG100	+
	150 A	CG150	+
	200 A	CG200	+
	250 A	CG250	+
	300 A	CG300	+
	400 A	CG400	+
	500 A	CG500	+
	600 A	CG600	+
	0 ...>1 A ...<1 kA ³⁾	CG...	+
	1 kA	CH1	+
	1.5 kA	CH1.5	+
	2.5 kA	CH2.5	+
	4 kA	CH4	+
	5 kA	CH5	+
	6 kA	CH6	+
	10 kA	CH10	+
	15 kA	CH15	+
	>1 kA ³⁾	CH...	+

1) Number of limits - specify in clear text

2) Complement with CG... or CH...

3) Specify in clear text

Vario-Series · Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 4 Limit Contacts



Moving-coil movement, edgewise scale
Narrow front frame per DIN 43 718, matt black

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

		Type Order No. ➞	PFN 96 x 48M 2596P
Zero Point - left / bottom			
Direct Voltage			
Range			
0 ... 60 mV		DB60	A
0 ... 100 mV		DB100	A
0 ... 150 mV		DB150	A
0 ... 250 mV		DB250	A
0 ... 400 mV		DB400	A
0 ... 600 mV		DB600	A
0 ... >60 mV ... <1 V ²⁾		DB...	A
0 ... 1 V		DC1	A
0 ... 1.5 V		DC1.5	A
0 ... 2.5 V		DC2.5	A
0 ... 4 V		DC4	A
0 ... 5 V		DC5	A
0 ... 6 V		DC6	A
0 ... 10 V		DC10	A
0 ... 15 V		DC15	A
0 ... 20 V		DC20	A
0 ... 25 V		DC25	A
0 ... 40 V		DC40	A
0 ... 50 V		DC50	A
0 ... 60 V		DC60	A
0 ... 100 V		DC100	A
0 ... 150 V		DC150	A
0 ... 250 V		DC250	A
0 ... 400 V		DC400	A
0 ... 500 V		DC500	A
0 ... 600 V		DC600	A
0 ... >1 V ... <600 V ²⁾		DC...	A

1) Number of limits - specify in clear text

2) Specify in clear text

Vario-Series · Rectangular Indicator/Controllers

For Direct Current or Direct Voltage with 4 Limit Contacts



Moving-coil movement, edgewise scale

Narrow front frame per DIN 43 718, matt black

Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen. Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '—' = Not available

	Type Order No.	⇒	PFN 96 x 48M 2596P
Landscape	+ ↕ HQ1		N
Portrait	HQ2		+
GENERAL VARIANTS			
Zero Point			
Zero point at left (landscape)	BC1		N
Zero point at bottom (portrait)	BC4		+
Zero point at the center	BC2		A
Zero point between bottom and center of scale ¹⁾	BC21		A
Position of Use			
Control panel vertical	LA1		N
Control panel horizontal	LA2		+
Other	LA999		A
(Please specify angle between scale and horizontal)			
OUTPUT VARIANTS			
Relay output	AU1		N
Logic output (open collector)	AU2		+
H = + 24 V (electrically isolated from U _H)			
L < + 1 V, I ≤ 25 mA at U _H 20 ... 40 V DC/AC			
I ≤ 10 mA at U _H 90 ... 127 V AC and U _H 198 ... 267 V AC			
AUXILIARY VOLTAGE VARIANTS			
20...40 V DC / AC, 45...65 Hz	IV62	N	
90...127 V AC, 45...65 Hz	IV60	A	
198...267 V AC, 45...65 Hz	IV61	A	
SCALE VARIANTS			
Division and Pointer			
Single division	GD1	N	
Double division ¹⁾	GD2	A	
Additional Imprint			
Second numbering, black ¹⁾	SK982	A	
Secon numbering, red (RAL 2002) ¹⁾	SK983	A	
Inscription			
Without additional inscription	SM99	N	
Inscription ≤ 15 characters German ¹⁾	SM991	A	
Inscription ≤ 15 characters other language ¹⁾	SM993	A	
(Latin lettering)			
Coloured mark red RAL 2002 ¹⁾	ST981	A	
Coloured sector red (RAL 2002) ¹⁾	SU981	A	
Coloured sector green (RAL 6018) ¹⁾	SU982	A	
HOUSING VARIANTS			
Application			
Standard version	LB99	N	
Tropic resistant	LB1	A	
Protection			
Standard (see technical data)	LH99	N	
Housing panel IP 54, connections IP 20	LH22	A	
Front Frame Colour			
Matt black	MA2	N	
Matt grey, RAL 7037	MA11	A	
Glass Window			
Standard version	MG99	N	
Anti-glare glass	MG1	A	
Identification			
Without identification	MZ99	N	
Identification on the back ¹⁾	MZ998	A	

¹⁾ Specify in clear text

Vario-Series · Special Panel Meters

Switch Position Indicator for Direct Voltage or Alternating Voltage 45...65 Hz



Front frame gloss black



ST1

Technical Data

Front Dimensions mm	25 x 25	Ø 25	Ø 32 ¹⁾
Type	STQ 1	ST 1	ST 2
Weight approx. (kg)	0.07	0.07	0.07
Operating Voltage	300 V	300 V	300 V
Test Voltage	3.5 kV	3.5 kV	3.5 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52
Fasteners	round nut	round nut	round nut

1) Snap-on front frame included (36 x 36 mm)

Description

Switch position indicator for remote indication of contact positions at power plants and switching stations. Can also be used advantageously as an indicator in mimic diagrams.

Display

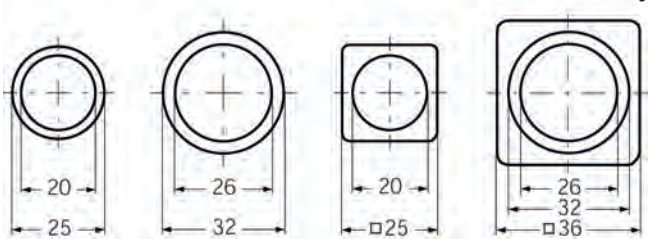
Three different displays are included: "Off", "On" and "Error" or "Disabled".

Mechanical Design

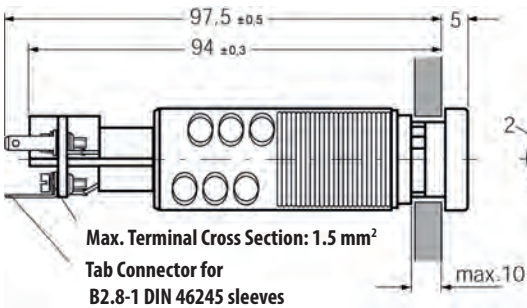
Housing Material	Polycarbonate
Terminals	tab connectors, 2.8 x 0.8 mm
Contact Protection	Available as option

Front Panel Dimensions

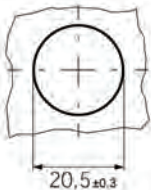
Front frame snaps on 32 mm diameter front ring



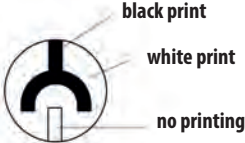
Basic Dimensions



Panel Cutout



Isolating Contact

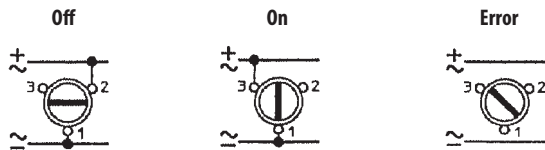


Vario-Series · Special Panel Meters

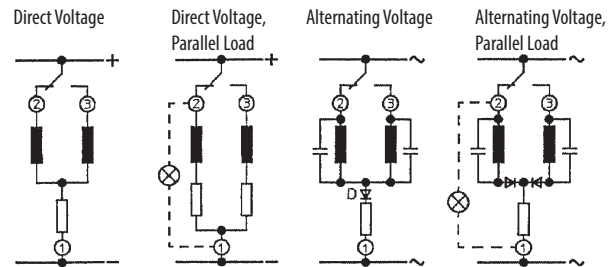
Switch Position Indicator for Direct Voltage or Alternating Voltage 45...65 Hz



Graphic Symbols



Schematic Diagrams



Please note when ordering:

Only one Identification No. with the same letter sequence may be chosen. Order No. with Identification No. N (standard model) can be left out.

'N' = Standard Version · 'A' = Extra Charge · '+' = Available without extra Charge · '-' = Not available

Type Front Dim. mm	STQ 1 25 x 25	ST 1 Ø 25	ST 2 Ø 32
Order No. ⇒	1108B	1280B	1281B
+ ↓			
Direct Voltage ¹⁾			
24 V (0.3 W)	B1	+	+
48 V (0.3 W)	IL224	+	+
60 V (0.4 W)	IL248	+	+
110 V (0.6 W)	IL260	+	+
125 V (0.7 W)	IL511	+	+
220 V (1.0 W)	IL512	+	+
	IL522	+	+
Alternating Voltage ¹⁾			
24 V (0.3 VA)	B2	A	A
48 V (0.3 VA)	IL624	+	+
60 V (0.4 VA)	IL648	+	+
110 V (0.6 VA)	IL660	+	+
220/230 V (1.4 VA)	IL311	+	+
	IL726	+	+
Movement Variants ²⁾			
with parallel load	IN1	A	A
Scale Variants ²⁾			
with isolation contact	GA2	+	+
Housing Variants ²⁾			
Tropic resistant	LB1	A	A
full contact protection	VB2	A	A

1) Nominal voltage tolerance: ±20 %

2) Applies to all types for direct and alternating voltage

Ordering Example:

Contact position indicator, front dimension Ø25 mm
for Alternating Voltage 220 / 230 V

Techn. Data Typ: ST1	Order No. 1280B, B2, IL726
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Special Panel Meters

LED-Switch Position Indicator for Direct Voltage and Alternating Voltage 45...65 Hz



Front frame gloss black



ST 1-LED

Technical Data

Front Dimensions mm	25 x 25	Ø 25
Type	STQ 1-LED	ST 1-LED
Weight approx. (kg)	0,07	0,07
Operating Voltage	300 V	300 V
Test Voltage	3,5 kV	3,5 kV
Front Housing - Panel Protection	IP 52	IP 52
Fasteners	round nut	round nut

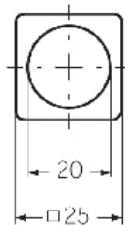
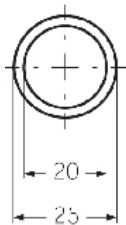
Description

Switch position indicator for remote indication of contact positions at power plants and switching stations. Can also be used advantageously as an indicator in mimic diagrams.

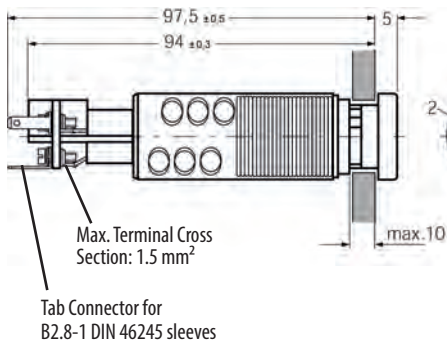
Front Panel Dimensions

Mechanical Design

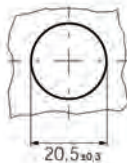
Housing Material	Polycarbonate
Terminals	tab connectors, 2.8 x 0.8
Contact Protection	available as option



Basic Dimensions



Panel Cutout

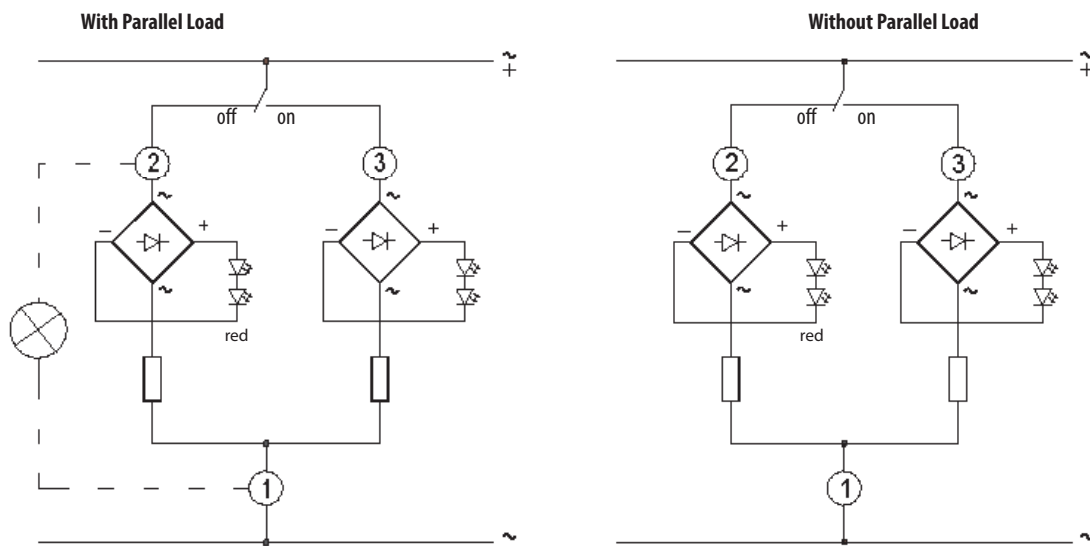


Special Panel Meters

LED-Switch Position Indicator for Direct Voltage and Alternating Voltage 45...65 Hz



Schematic Diagrams for Direct- and Alternating Voltage



Type
Front Dimension mm

STQ 1-LED
25 x 25

ST 1-LED
Ø 25

1108 BC LED
Order No.

1280 BC LED
Order No.

Direct Voltage:

24 V AC/DC

IL824

IL824

48 V AC/DC

IL848

IL848

60 V AC/DC

IL860

IL860

110 V AC/DC

IL811

IL811

125 V AC/DC

IL812

IL812

220/230 V AC/DC

IL826

IL826

Movement Variants:

without parallel load (standard)

INH002

INH002

with parallel load

INH001

INH001

Front Plate:

black (standard)

NF099

NF099

white

NF001

NF001

Symbols:

cross symbol

RS099

RS099

interruption symbol

RS001

RS001

earthing symbol

RS002

RS002

LED - Colours:

LED red / green

PE099

PE099

Cross symbol only:

- LED yellow / yellow

PE001

PE001

- LED green / green

PE002

PE002

- LED red / red

PE003

PE003

other colours on request

Housing Variants:

standard

LB099

LB099

tropicalized

LB001

LB001

without contact protection (standard)

VB099

VB099

full contact protection

VB002

VB002

Vario-Series · Accessories

Voltage Divider for Direct Voltage

Voltage divider for direct voltage,
Can be combined with any moving-coil type

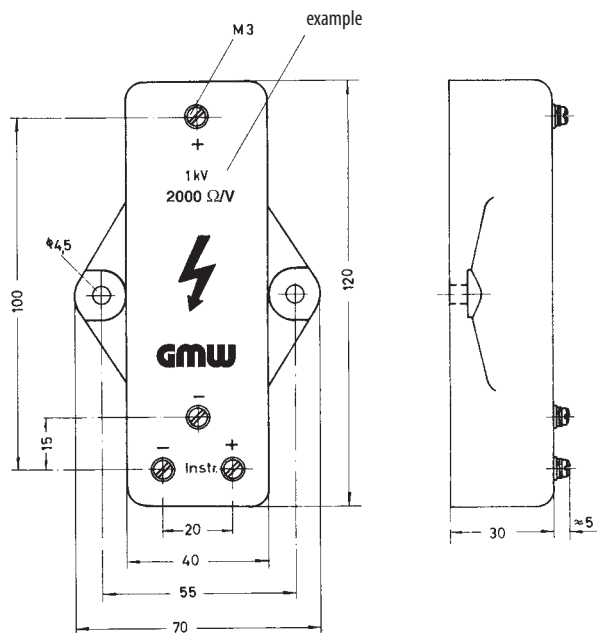
Technical Data

Design	Film resistors with porcelain insulators on pressed paper sheet
Mounting	on isolater necessary
Weight approx. (kg)	0.2
Protection	IP 00
Resistor	ca. 2 kΩ/V (voltage divider in comb. with moving-coil meter)
Terminals	can be connected to any moving-coil voltmeter

Description

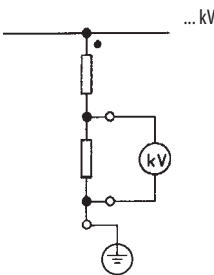
Voltage divider for direct voltage meters, made of film resistors. For Usage in single-ended high voltage facilities up to 10 kV.
Design of the test circuit: At full scale deflection of the meter, 250 µA each pass through the protective resistor an the meter.
25 V are impressed on the indicator.
 $R_1 = 100 \text{ k}\Omega$

Basic Dimensions



SP

Schematic Diagram



Order Information

Voltage Divider for Direct Current 25 V / 250 µA

Type	SP Order No.	Scale- Order No.
Nominal Voltage	↓	+ ↓
1000 V	48900 13370	DH1
1500 V	48900 13390	DH1.5
2000 V	48900 13400	DH2
2500 V	48900 13410	DH2.5
3000 V	48900 13420	DH3
4000 V	48900 13430	DH4
5000 V	48900 13440	DH5
6000 V	48900 13450	DH6
10000 V	48900 13460	DH10

Ordering Example for Meters with Voltage Divider:

Techn. Data	Order No.
Square Panel Meter with moving-coil movement V-PQS 96 Measuring range 0-1 kV	1604P, BE76, DH1

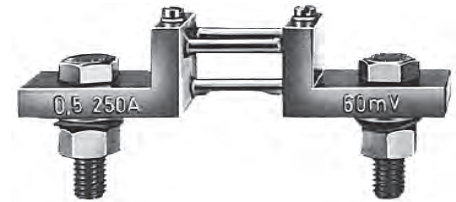
Vario-Series - Accessories

Shunt Resistors, Class 0.5

Technical Data

Type	60 mV	150 mV
Accuracy Class per DIN EN 60051	0.5	0.5
Dimensions per	DIN 43703 ¹⁾	
Balancing	An instrument power consumption value of 6 mA is taken into consideration for balancing when shunt resistors are used	

1) Model with insulation base can be screw or snap mounted (for top-hat rail per DIN EN 50022-35), overall length: 140 mm. Overall height for model with cover is increased to 40.5 mm.



Shunt Resistor, 250 A / 60 mV

Ordering Example

Techn. data	Order No.
Shunt Resistor, Nominal Current I_N 250 A. Voltage Drop 60 mV	1700V3340

Nominal Current	60 mV		Nominal Current	150 mV	
I_N	Weight approx. (kg)	Order No.	I_N	Weight approx. (kg)	Order No.
1 A	0.10	1700V3010 ◇	1 A	0.10	1700V4010 ◇
1.5 A	0.10	1700V3030 ◇	1.5 A	0.10	1700V4030 ◇
2.5 A	0.10	1700V3050 ◇	2.5 A	0.10	1700V4050 ◇
4 A	0.10	1700V3070 ◇	4 A	0.10	1700V4070 ◇
6 A	0.10	1700V3090 ◇	6 A	0.10	1700V4090 ◇
10 A	0.10	1700V3110 ◇	10 A	0.10	1700V4110 ◇
15 A	0.10	1700V3130 ◇	15 A	0.10	1700V4130 ◇
25 A	0.10	1700V3170 ◇	25 A	0.10	1700V4170 ◇
40 A	0.10	1700V3200	40 A	0.14	1700V4200
60 A	0.10	1700V3230	60 A	0.15	1700V4230
100 A	0.10	1700V3280	100 A	0.17	1700V4280
150 A	0.15	1700V3300	150 A	0.20	1700V4300
250 A	0.50	1700V3340	250 A	0.70	1700V4340
400 A	0.70	1700V3370	400 A	1.10	1700V4370
500 A	1.00	1700V3390	500 A	1.10	1700V4390
600 A	1.20	1700V3400	600 A	1.70	1700V4400
1 kA	1.45	1700V3460	1 kA	2.50	1700V4460
1.5 kA	1.95	1700V3480	1.5 kA	3.70	1700V4480
2.5 kA	2.90	1700V3520	2.5 kA	5.20	1700V4520
4 kA	4.20	1700V3550	4 kA	8.30	1700V4550
5 kA	4.30	1700V3570	5 kA	10.60	1700V4570
6 kA	10.50	1700V3580	6 kA	15.00	1700V4580
10 kA	21.00	1700V3630	10 kA	28.00	1700V4630
15 kA	32.00	1700V3650			

Nominal Current I_N	60 mV
	Order No.
40 A	1700V7200 ◇
60 A	1700V7230 ◇
100 A	1700V7280 ◇
150 A	1700V7300 ◇

◇ On insulating base (screws or snaps onto top-hat rail per DIN EN 50 022-35)
Insulating base of design A : Order No. 2431486210

◇ Cover for shunt resistor on insulating base >40A : Order No. 2786368000
Calibration Certificate on request

One Pair Cables with Cable Lugs

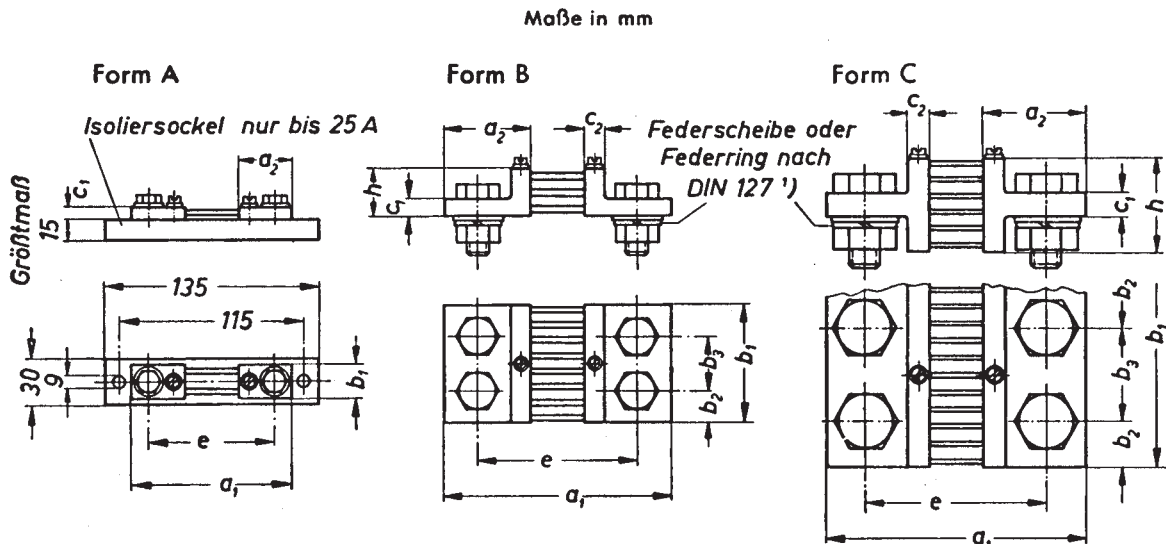
Length	Cross-Section	Cable per VDE 0281 part 401	Order No.
1.3 m	0.75 mm ²	H03V-H	1700V8010
2.6 m	1.5 mm ²	H07V-H	1700V8020
4.3 m	2.5 mm ²	H07V-H	1700V8030
7.0 m	4.0 mm ²	H07V-H	1700V8040
10.5 m	6.0 mm ²	H07V-H	1700V8050

0.06 Ω cable resistance per cable pair

Vario-Series · Accessories

Shunt Resistors, Class 0.5

Dimensional Drawings



Bezeichnung eines Nebenwiderstandes für 60 mV Spannungsabfall und 25 A Nennstrom:

Nebenwiderstand 60/25 DIN EN 60051

Spannungsabfall mV	Maß	1 1,5 2,5 4		40 60		für Nennstrom in A									
		6 10 15 25	100 150	250	400	600	1000	1500	2500	4000	6000	10000	15000		
60		Form A		Form B						Form C					
	a ₁	90	100	145			165			165	175	185			
	a ₂	28	33	55			65			65	70	75			
	b ₁	20		30	40	60	90	120	120	154	206	310			
	b ₂	—		15	20	30	21	30	30	25					
	b ₃	—		—			48	60	60	52					
	c ₁	8		10						15	25	30			
	c ₂	—		10						10	15	20			
	e	78	80	105			115			115	125	135			
	h	—		30						60	130	170			
150		Form A		Form B				Form C							
	a ₁	90	225	270			290	290			300	310			
	a ₂	28	33	55			65	65			70	75			
	b ₁	20	25	30	40	70	90	120			154	206	310		
	b ₂	—		15	20	35	21	30			25				
	b ₃	—		—			48	60			52				
	c ₁	8		10				15	25			30			
	c ₂	—		10				10	15			20			
	e	78	205	230			240	240			250	260			
	h	—		50			60	60			130	170			
Stromanschlüsse: Anzahl		2x1						2x2				2x3	2x4	2x6	
Sechskantschraube: DIN 933—5		M 5 ⁵⁾ ×12	M 8 ⁵⁾ ×15	M 12×40	M 16×45	M 20×50	M 16 ²⁾ ×45	M 20 ³⁾ ×50	M 20 ⁴⁾ ×60	M 20×75	M 20×85				
Scheibe DIN 125 Flußstahl		5,3	8,4	13,5	17	21	17	21							
Mutter DIN 934—5		—	—	M 12	M 16	M 20	M 16	M 20							
Spannungs-Anschlüsse		2 Zylinderschrauben A M 5x8 DIN 84—4 und Scheiben 5,3 DIN 433 Flußstahl													

Nicht angegebene Einzelheiten sind zweckentsprechend zu wählen

Genauigkeitsklasse 0,5 nach DIN 57410, Regeln für Meßgeräte

Nebenwiderstände austauschbar, wenn Verbrauch des angeschlossenen Meßgerätes höchstens 500 µW

1) Zwischen Scheibe und Mutter zur Erhaltung gleichbleibenden Kontaktdrucks Federscheibe oder Federring legen.

2) für 150 mV: Schraube M 16×60 3) für 150 mV: Schraube M 20×75

4) für 150 mV: Schraube M 20×60 5) Bei Schrauben M 5 und M 8 ist vorzugsweise 5 nach DIN 267 zu verwenden.

Vario-Series · Accessories and Spare Parts

Blanking Plates, Protective Caps, Rubber Seals

**Blanking Plates, protective covers, rubber seals,
Clear cover with rubber seal for IP 65**

	Type ⇅	Order No. ⇅
BLANKING PLATES		
Narrow-frame types		
clear, palin glass	Q 48 S	27863 15945
	Q 72 S	27863 15900
	Q 96 S	27863 15905
	Q 144 S	27863 15915
	PF 72 x 36	27863 15920
	PFN 96 x 48	27863 15925
	PF 144 x 72	27863 15930
opaque, white plastic	Q 48 S	27863 15946
	Q 72 S	27863 15901
	Q 96 S	27863 15906
	Q 144 S	27863 15916
	PF 72 x 36	27863 15921
	PFN 96 x 48	27863 15926
	PF 144 x 72	27863 15931
opaque, black plastic	Q 48 S	27863 15948
	Q 72 S	27863 15903
	Q 96 S	27863 15908
	Q 144 S	27863 15917
	PF 96 x 24	27863 15861
	PF 96 x 48	27863 15928
Blanking plate Q144 with DIN cutout for Q96		27863 15918
PROTECTIVE COVER		
Plexiglass protective cover for front housing-panel protection IP 54	PR 144 x 36	32512 86760
RUBBER SEAL		
(Mounting with screw clamp necessary)		
for versions with narrow front frames – for tropic resistant versions –	Q 48	1799V2290
	Q 72	1799V2230
	Q 96 S	1799V2240
	Q 96	1799V2260
	Q 144	1799V2250
	PF 72 x 36	35235 86120
	PFN 96 x 48	35235 86125
	PF 144 x 72	35235 86130
CLEAR PROTECTIVE COVER		
with rubber seal for front housing-panel protection IP 65	Q 48	27863 15955
	Q 72	27863 15950
	Q 96	27863 15960

Vario-Series · Accessories and Spare Parts

Terminal Covers, Spare Parts for Indicator/Controllers

Finger-proof full cover

Per BGV A3 / DIN 57 106, part 100

CONTACT PROTECTION for	Type ↓	Order No. ↓	
Types QS 48 und Q 48-250	R1 ¹⁾	1799V9050	
Types with screw terminals M4 (packed in pairs)	E ²⁾	1799V9110	
Types (V-)QS 72, (V-)QS 72-250, QS 144 and Q144-250 with screw terminals M6 (M8)	R2 ¹⁾	1799V9150	
Types (V-)QS 96 and (V-)Q 96-250 with screw terminals M6 (M8)	R3 ¹⁾	1799V9160	
Types PF 48 x 24 and PFF 72 x 24	R6 ¹⁾	1799V9090	
RUBBER CAPS			
All remaining square and rectangular types per DIN 43 700 (except sizes 96 x 24 mm and 96 x 48 mm)			
Screw terminals M4 or M5 (packed in pairs)	R8 ²⁾	1799V9080	
Screw Terminals M6 (packed in pairs)	R9 ²⁾	1799V9120	

1) Overall terminal cover

2) Single terminal cover

Spare Parts for Indicator/Controllers

KODPR 144 F and KODPR 144 SE

Relay for indicator/controllers	69100 00000
Compensating resistor fpr PT 100	
2-Wire	27863 88500
3-Wire	27863 88501
Cold junction for thermocouple	27863 88502
Plastic knob	22022 86010

Vario-Series · Accessories and Spare Parts

Front Windows

Front windows for all square types

	Type ←	Order No. ←
GLASS WINDOW COMPLETE (plain glass)	Q 48 S	27863 22517
	Q 72 S	27863 22519
	Q 96 S	27863 22514
	Q 144 S	27863 22521
	Q 48-250	27863 22523
	Q 72-250	27863 22525
	Q 96-250	27863 22516
	Q 144-250	27863 22528
GLASS WINDOW COMPLETE (anti-glare glass)	Q 48 S	27863 22518
	Q 72 S	27863 22520
	Q 96 S	27863 22530
	Q 144 S	27863 22522
	Q 48-250	27863 22524
	Q 72-250	27863 22526
	Q 96-250	27863 22527
	Q 144-250	27863 22529