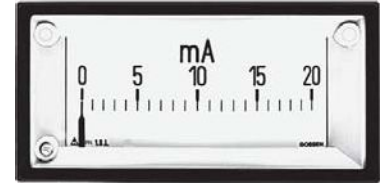


Vario-Series • Rectangular Panel Meters

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⁾

Measuring Range	Front Dim. mm				Tolerance
	48 x 24	72 x 36	96 x 48	144 x 72	
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	
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 > 400 mV	1 kΩ/V 1 kΩ/V	1 kΩ/V 1 kΩ/V	2.5 kΩ/V 1 kΩ/V	1 kΩ/V 1 kΩ/V	

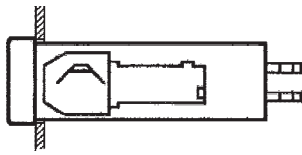
¹⁾ Indicated internal resistance is only valid for instruments with standard accuracy class.
Please inquire regarding internal resistance (Ri) for moving-coil indicators with mechanical zero point at any desired scale value.

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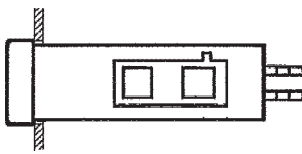


Expanding Springs



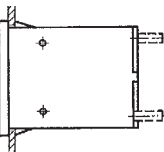
Control panel thickness ≥ 1 mm
Size 48 x 24 for mounting in DIN-Grid,
Siemens-Grid M 25 and Kreuzenbeck-Grid

Catch Spring I



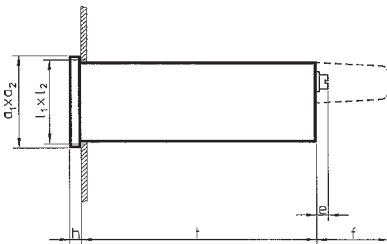
As option for size 48 x 24 for Mauell-Grid,
H & B Unibloc-Grid and Hein-Grid

Slider

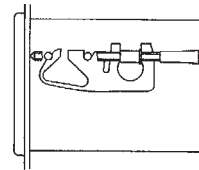


Control panel thickness 1 to 5 mm
As option for size 48 x 24 for DIN-Grid
For heightened requirements

Basic Dimensions

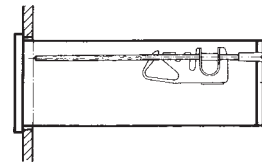


Fastener B DIN 43 835



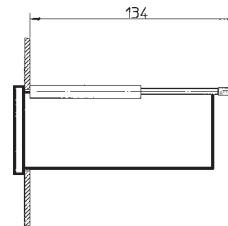
Control panel thickness 1 to 40 mm
Screw clamp M 4 for size 72 x 36 for mounting in
DIN-Grid

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			$\leq 4A$	$> 4A$	
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	—

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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
	+ ↓				
Landscape	HQ1	N	N	N	N
Portrait	HQ2	+	+	+	+
Zero Point - at left (landscape) - at bottom (portrait)					
Direct Current					
Range:					
0 ... 100 μ A	CA100	A	A	A	A
0 ... 150 μ A	CA150	A	A	A	A
0 ... 250 μ A	CA250	A	A	A	A
0 ... 400 μ A	CA400	A	A	A	A
0 ... 600 μ A	CA600	A	A	A	A
0 ... > 100 μ A ... < 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
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

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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)						
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:	CG1		+	+	+	+
1 A	CG1.5		+	+	+	+
1.5 A	CG2.5		+	+	+	+
2.5 A	CG4		+	+	+	+
4 A	CG6		+	+	+	+
6 A	CG10		+	+	+	+
10 A	CG15		+	+	+	+
15 A	CG25		+	+	+	+
25 A	CG40		+	+	+	+
40 A	CG60		+	+	+	+
60 A	CG100		+	+	+	+
100 A	CG150		+	+	+	+
150 A	CG250		+	+	+	+
250 A	CG400		+	+	+	+
400 A	CG500		+	+	+	+
500 A	CG600		+	+	+	+
600 A	CG...		+	+	+	+
0 ... > 1 A ... < 1 kA ¹⁾	CH1		+	+	+	+
1 kA	CH1.5		+	+	+	+
1.5 kA	CH2.5		+	+	+	+
2.5 kA	CH4		+	+	+	+
4 kA	CH6		+	+	+	+
6 kA	CH10		+	+	+	+
10 kA	CH...		+	+	+	+
> 1 kA ^{1) 2)}			+	+	+	+
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

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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	HQ1	N	N	N	N
	HQ2	+	+	+	+
Portrait	HQ1	N	N	N	N
	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 as desired (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) (max. suppression 20 %; measuring range $\geq 250 \mu\text{A}$ / $\geq 250 \text{ mV}$. Ri 1 k Ω /V; specify in clear text)	BC18	A	A	A	A
Internal Resistance with Voltmeters					
Standard (see technical data)	IR99	N	N	N	N
Ri approx. 10 k Ω /V (measuring input $\geq 2 \text{ V}$; exception: $\geq 5 \text{ V}$ / $\leq 150 \text{ V}$ with 96 x 48 a. 72 x 36)	IR10	A	A	A	A
Ri = 1 k Ω /V $\pm 1\%$ at nominal temperature (measuring input $\geq 1 \text{ V}$)	IR30	A	-	-	A
Ri = 10 k Ω /V $\pm 1\%$ at nominal temperature (measuring input $\geq 2 \text{ V}$)	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 $\pm 15\%$ (measuring input $\geq 6 \text{ V}$ / $\leq 400 \text{ V}$; 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 $\geq 40 \mu\text{A}$ / $\geq 60 \text{ mV}$)	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:					
Germanischer Lloyd (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, $\geq 1.5 \text{ V}$

3) Available only in combination with slider

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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 + ↓						
SCALE VARIANTS	Landscape	HQ1	N	N	N	N
	Portrait	HQ2	+	+	+	+
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	
Fine division	SE3	-	-	-	A	
Special division	SE5	N	-	-	-	
Beam pointer with knife-edge for single division	RA1	-	N	-	N	
Beam pointer with knife-edge for double division	RA2	-	-	-	+	
Beam pointer with knife-edge for single division and double division	RA4	-	N	N	-	
Knife-edge pointer for single division	RA10	-	-	-	A	
Knife-edge pointer 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	A	
Inscription:						
Without additional inscription	SM99	N	N	N	N	
Inscription ≤ 15 characters German	SM991	A	A	A	A	
Inscription > 15 characters German	SM992	A	A	A	A	
Inscription ≤ 15 characters other language	SM993	A	A	A	A	
Inscription > 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	

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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 + ↓					
SCALE VARIANTS	landscape	HQ1	N	N	N
	portrait	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 (Plexiglass scale, scale and dial illumination white)	PA1	-	A	A	A
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 Voltage Order No. PB... and SG 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

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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 Landscape	HQ1	N	N	N	N
	HQ2	+	+	+	+
Portrait	Landscape	N	N	N	N
	Portrait	+	+	+	+
HOUSING VARIANTS					
Application					
Standard version	LB99	N	N	N	N
conditionally tropic resistant	LB1	A	A	A	A
Protection					
According to list	LH99	N	N	N	N
Front housing-panel protection IP54, clamps IP00	LH21	A	-	-	A
Front housing-panel protection IP54, clamps IP20	LH22	-	A	A	-
Earthquake-proof (possible combination: LH99 or LH21)	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 dark beige approx. RAL 1019	MA21	A	A	A	A
Matt light grey RAL 7035	MA14	A	-	A	A
Intermediate Frame, Height 3 mm					
Without intermediate frame	MC99	N	N	N	N
Intermediate frame shiny black	MC1	A	-	-	-
Intermediate frame shiny grey RAL 7037	MC2	A	-	-	-
<i>Intermediate frame with size 48 x24 available only in combination with shortened expanding spring (MN 24)</i>					
Glass Window					
Standard version	MG99	N	N	N	N
Anti-glare glass	MG1	A	A	A	A
Fasteners					
Expanding spring	MN20	N	-	-	-
Shortened expanding spring (necessary when version with intermediate frame)	MN24	+	-	-	-
Catch spring	MN21	+	-	-	-
Subklew (stiled slider)	MN32	+	-	-	-
Slider	MN50	+	-	-	-
Angled slider for APE-Grid	MN51	+	-	-	-
Fastener B DIN 43 835	MN11	-	-	-	-
Screw spindle	MN22	-	N	N	-
Fastener C	MN12	-	-	-	N
Identification					
Without identification	MZ99	N	N	N	N
Identification on the back (specify in clear text)	MZ998	A	A	A	A
Inscription Stripes					
Without inscription stripes	SS99	N	N	N	N
Inscription on front face on top (specify in clear text)	SS991	A ¹⁾	-	A ¹⁾	A ¹⁾
Inscription on front face at bottom (specify in clear text)	SS992	A ¹⁾	A ¹⁾	A ¹⁾	A ²⁾
Contact Protection					
Without terminal cover	VB99	N	N	N	N
Overall terminal cover	VB2	A	-	-	-
Single terminal cover (Voltmeter and Ammeter ≤ 4 A)	VB1	+	+	+	+

1) For landscape only

2) For portrait only