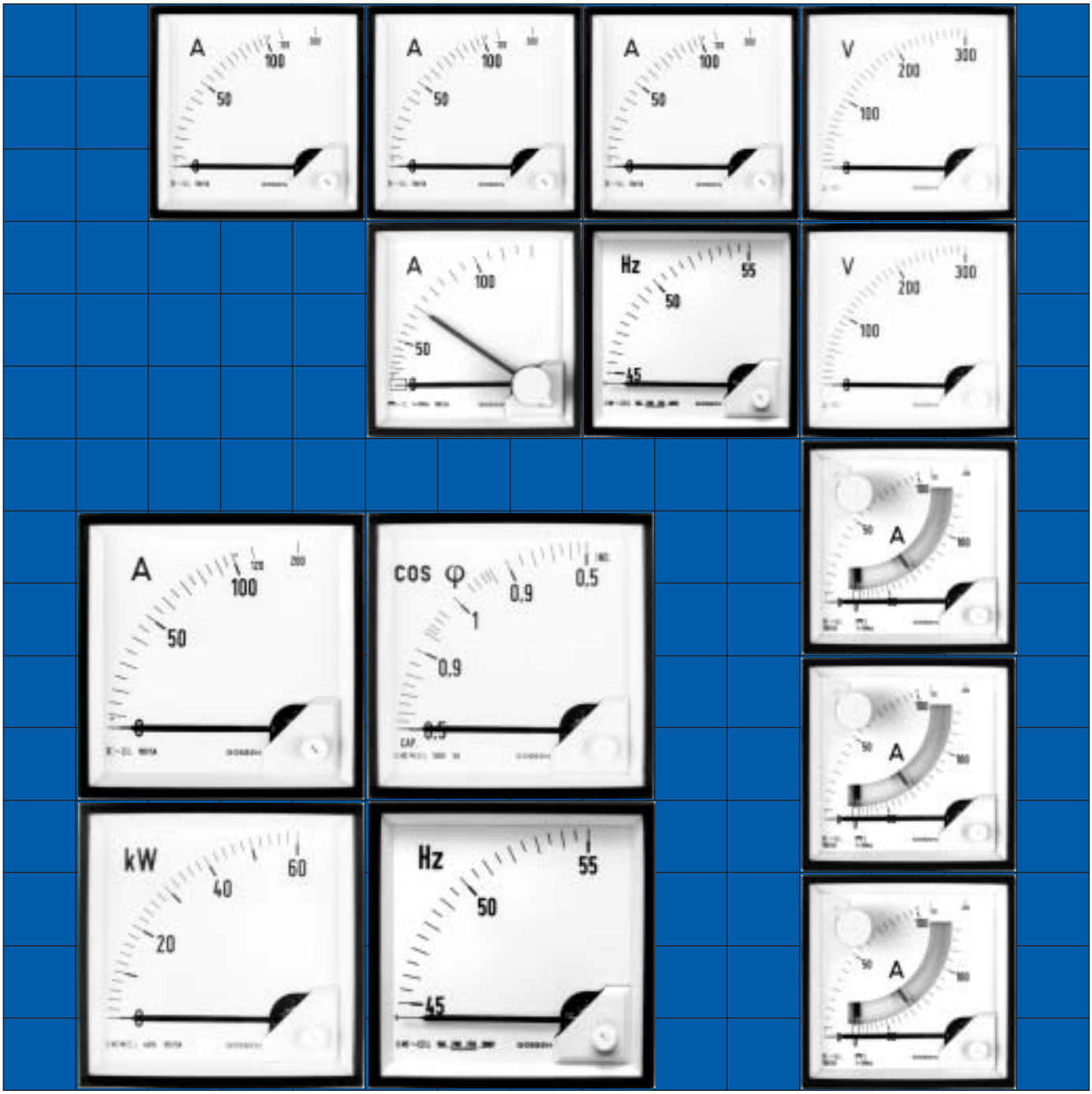
Analog Panel Meters

Standard Program
Universal Program

2003 Catalog



Metrix Electronics Limited
Minchens Court, Minchens Lane, Bramley, RG26 5BH, U.K.
Tel: +44 (0)845 034 3234, Fax: +44 (0)845 034 3233
E-mail: sales@metrix-electronics.com, Web: www.metrix-electronics.com

GOSSEN Müller & Weigert

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Address:
GOSSEN Mueller & Weigert
Kleinreuther Weg 88
D – 90408 Nuernberg
Phone +49-911-35 02-0
Fax +49-911-35 02-3 07 / 3 05
Internet: http://www.g-mw.de
e-mail: info@g-mw.de

Analog Panel Meters

Table of Contents

General Overview

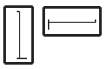
Overview (overall program) – Measuring Tasks and Formats for Analog Panel Meters

Measured Quantity	Current / Voltage					Frequency	Power	
	I– / U–	I~ / U~	I~ / U~	I~	I~	f	P / Q	cos φ
Movement Type	Moving-Coil	Moving-Coil with Rectifier	Moving-Iron	Bimetal	Moving-Iron Bimetal	Moving-Coil with Converter	see Technical Data	
								

Standard Program

Design		Front Dim.	Standard Program, Page							
Square 90° 	Single Indicator	48 x 48	10	12	14	16	–	20	–	–
		72 x 72	10	12	14	16	–	20	–	–
		96 x 96	10	12	14	16	–	20	22	26
	Double Indicator	144 x 144	10	12	14	–	–	20	22	26
		72 x 72	–	–	–	–	18	–	–	–
		96 x 96	–	–	–	–	18	–	–	–

Universal Program

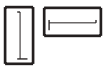
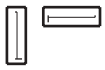
Design		Front Dim.	Universal Program, Page & Data Sheet							
Square 90° 	Single Indicator	45 x 45	46	–	52	–	–	–	–	–
		48 x 48	E1/1	E1/8	E1/10	E1/11	–	–	–	–
		72 x 72	E1/1-2	E1/8-9	E1/10	E1/11	–	–	–	–
		96 x 96	E1/1-2	E1/8-9	E1/10	E1/11+19	–	–	–	–
		96 x 96 impervious	E3/1	E3/2	E3/3	–	–	E3/4	–	–
		144 x 144	E1/1-2	E1/8-9	E1/10	E1/11	–	E1/24	E1/26	E1/27
	Double Indicator	48 x 48	70 + E3/5	–	–	–	–	–	–	–
		72 x 72	–	–	–	–	E1/12	–	–	–
		96 x 96	–	–	–	–	E1/12	–	–	–
		144 x 144	–	–	–	–	E1/12	–	–	–
Square 240° 	Single Indicator	48 x 48	40 + E1/3	48 + E1/13	–	–	–	–	–	–
		72 x 72	40 + E1/3-4	48 + E1/13-14	–	–	–	–	–	–
		96 x 96	40 + E1/3-4	48 + E1/13-14	–	–	–	–	54	–
		96 x 96 impervious	E3/1	E3/2	–	–	–	–	–	–
		144 x 144	40 + E1/3-4	48 + E1/13-14	–	–	–	–	–	–
Edgewise 	Single Indicator	48 x 24	42 + E1/5	E1/15	–	–	–	–	–	–
		72 x 36	42 + E1/5	E1/15	–	–	–	–	–	–
		96 x 48	42 + E1/5+E3/9	E1/15	50 + E1/16	–	–	–	–	–
		144 x 72	42 + E1/5	E1/15	50 + E1/16	–	–	–	–	–
	Double Indicator	96 x 48	E3/5	–	–	–	–	–	–	–
	Triple Indicator	192 x 96	–	–	E3/6	–	–	–	–	–
Slim Line 	Single Indicator	48 x 18.5	44 + E1/6	E1/17	–	–	–	–	–	–
		72 x 18.5	44 + E1/6	E1/17	–	–	–	–	–	–
		72 x 24	44 + E1/6	E1/17	–	–	–	–	–	–
		96 x 24	44 + E1/6	E1/17	–	–	–	–	–	–
		144 x 36	44 + E1/6	E1/17	–	–	–	–	–	–

Please request data sheets (E./..) if required for products and options not included in this catalog.

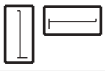
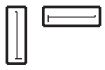
Overview (overall program) – Measuring Tasks and Formats for Analog Panel Meters

Measured Quantity	Synchronization				Temperature / Resistance	
	$\Delta f, \Delta \varphi_U$	2 x f	2 x U~	Δ U~	T	T/R
Measuring System	Electrodynamic Ratio Element (iron-free)	2 each Vibrating Reed	2 each Moving-Iron	Moving-Iron	Moving-Coil with Electronics for Thermocouple	Moving-Coil with Electronics for Resistance Thermometer, Remote Sensor
						

Universal Program

Design		Front Dim.	Universal Program, Page & Data Sheet					
Square 90° 	Single Indicator	72 x 72	–	–	–		–	E1/21
		96 x 96	58	–	–	E1/31	–	E1/21
		144 x 144	58	–	–	E1/31	–	E1/21
	Double Indicator	96 x 96	–	62	60		–	–
		144 x 144	–	62	60		–	–
Edgewise 	Single Display	96 x 48	–	–	–	–	E1/22	E1/23
Slim Line 	Single Display	96 x 24	–	–	–	–	E1/22	E1/23

Limit Transducers (MESSCONTACTER)

			Measured Quantity	Current / Voltage		Temperature / Resistance	
				I– U–	I~ U~	T	T/R
			Measuring System	Moving-Coil	Moving Coil with Rectifier	Moving-Coil with Electronics for Thermocouple	Moving-Coil with Electronics for Resistance Thermometer
							
Design		Front Dim.	Contacts	Universal Program, Page & Data Sheet			
Edgewise 	Single Indicator	96 x 48	2 Contacts	66 + E2/2	E2/9	E2/17	E2/19
			4 Contacts	E2/2-1	E2/9-1	E2/17-1	E2/19-1
Slim Line 	Single Indicator	96 x 24	2 Contacts	68 + E2/4	E2/11	E2/21	E2/23

Expansion Program

Switch Position	Operating Hours	Phase Sequence	Wall Bracket
Standard Program, Page			
64	72	73	–
Universal Program, Page & Data Sheet			
64	72	73	E1/32

Accessories

Shunt Resistors	Current Transformers	Voltage Dividers	AC-Adapter	Trimming Resistors, Seals, Terminal Covers	Interchangeable Scales
Standard Program, Page					
29	30	–	–	–	28
Universal Program, Page & Data Sheet					
29	30	E4/3	E4/5	E4/6	E4/6

Features and Benefits

- Worldwide sales and service

- Delivery within 3 working days✦
  for all panel meters,
  Shunt resistors without covers (nominal current to 1.5 kA),
  ASK 31.3/ASK 412.4 current transformers (Class 1, 50 - 60 Hz)
  ✦(from receipt of order by fax or mail until shipment from Nuremberg)
  Subject to previous sale

- Moving-iron panel meters: lower measuring range value equal to 10% of upper measuring range value

- Power meters, power factor meters and frequency meters include integrated electronic converter
  Allows for precise power measurement even for 3-phase four-wire systems with unbalanced load

- Interchangeable scales for all panel meters
  Scale replacement is quick and simple with no loss of accuracy and without tools

- Terminal block cover assures back of hand and finger contact safety in accordance with VBG4, and is included as standard equipment with all panel meters

- Screw terminals with self-lifting terminal clips for all panel meters
  Screws can be turned with cross-head or standard screw drivers. Except:
  M6 or M8 bolt terminals for moving-iron ammeters ≥40 A, and moving-coil ammeters ≥6 A

- Interchangeable bezel and glass faceplates for all panel meters

- Panel meters can be mounted to all common mosaic systems

Technical Description

Square Panel Meters

Square panel meters per DIN 43700 with
quadrant scale, dull black or dull gray (RAL 7037) bezel per DIN 43718.

Available Models:

Front Dimensions	48 x 48	72 x 72	96 x 96	144 x 144
	see page			
Moving-coil panel meters for DC	10	10	10	10
Moving-coil panel meters for AC	12	12	12	12
Moving-iron panel meters	14	14	14	14
Bimetal ammeters	16	16	16	–
Moving-iron bimetal ammeters	–	18	18	–
Pointer-type frequency meters	–	20	20	20
Power meters	–	–	22	22
Power factor meters	–	–	26	26

Interchangeable Scales

Scale replacement is quick and simple with no loss of accuracy and without tools.

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 then 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 M6 bolt terminals, and 100 A moving-iron ammeters have M8 bolt terminals.

Housings

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

Glass faceplate material: silicate glass

Bezels and glass faceplates can be easily replaced.

All panel meters are optionally available with a sheet metal housing, except for power meters and meters with front panel dimensions of 48 x 48 mm and 144 x 144 mm.

Several instruments can me 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 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 thicknesses of ≤ 40 mm.

The following are available as options:

- Sheet metal housing with screw clamp per B DIN 43835 for control panel thicknesses 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 manual grid mount, no fasteners.
- Polycarbonate housing with 2 leaf springs for standard stress requirements, also suitable for H&B Unibloc and manual grid mount for panel meters with front panel dimensions of 72 x 72 mm and 96 x 96 mm (except for power meters and 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 (Bronce springs).
- Polycarbonate housing with 4 leaf springs for heightened stress requirements (except for power meters and 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 thicknesses of ≥1 mm
  – Front mounting into grid systems (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).

Safety Precautions

- Instruments with damaged bezels or glass faceplates must be disconnected from the mains.
- Adequate safety clearance must be maintained to control panel fasteners and to sheet metal housings if non-isolated (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 VBG4.
- Scales may only be replaced under voltage-free conditions.
- Bezels and glass faceplates may only be replaced under voltage-free conditions.

IEC, EN and DIN Standards and VDE Regulations for Electrical Measuring Instruments

Our panel meters and limit transducers (MESSCONTACTER) comply with the regulations set forth in European guidelines 73/23/EWG and 89/336/EWG, which has been substantiated by adherence to the following standards:
IEC 61010-1/A2/ EN61010-1/A2/ VDE 0411-1/A1 (safety requirements)
IEC 60051/EN 60051/DIN EN 60051 (measuring instruments with scale display)
EN 50081-2: 1993 EMC (interference emission, industrial)
EN 50082-2: 1995 EMC (interference immunity, industrial)

The most important regulations for the manufacture of electrical measuring instruments included therein, as well as their characteristics, are defined below.

Accuracy

The accuracy of a measuring instrument or any of its accessories is determined by inherent deviation limits and influence error limits.

Inherent deviation is the measurement deviation of a measuring instrument and/or any of its accessories, when these are operated under reference conditions in accordance with DIN EN 60051.

Measuring instrument influence error is the difference between two indicated values for the same measured quantity, when the individual influence variable demonstrates two different, predetermined values, one after the other, within nominal range of use in accordance with DIN EN 60051.

Our measuring instruments comply with accuracy class 1.5 unless otherwise specified for individual measuring instrument types.

The accuracy class is indicated on the scale, for example Class 1.5, which means that the limits for inherent deviation are equal to ± 1.5% of the reference value.

The reference value is generally the upper measuring range limit with the following exceptions:

- Reference value is equal to the sum of the absolute values which correspond to the upper and lower measuring range values, as long as both the electrical and the mechanical zero points lie within the scale.
- Reference value is equal to 90 electrical degrees for power factor meters.

Vibration and Shock Resistance

Our measuring instruments comply with requirements per DIN EN 60051-1

Model	Vibration Test	Shock Test
Standard	10 Hz–55 Hz–10 Hz 0.15 mm (≙1.5 g at 50 Hz)	147 m/s² (15 g_n) 11 ms
Excessive Stress (order no: LN56)	5 Hz–55 Hz–5 Hz 0.25 mm (≙2.5 g at 50 Hz)	294 m/s² (30 g_n) 11 ms

Scale and Pointer Design

The scales and pointers in our instruments comply with DIN 43802, parts 2 through 4.

Protection per DIN VDE 0470, Part 1 (EN 60529)

Housing front: IP 52

Temperature Limit Values

Operating temperature range per DIN EN 60051-1: –10 ... +55 °C
Storage temperature range: –25 ... +65 °C

Applications Range (climatic category)

Our measuring instruments comply with VDI/VDE 3540, page 2:

Model		Standard	Conditionally Tropic-Proof (order no: LB4)
Climatic Category		2z	3
Temperature Limits		–10 °C ... +40 °C	–10 °C ... +55 °C
Relative Humidity:	annual average max. 30 days/yr. remaining days	≤75% (at 21 °C) ≤95% (at 25 °C) ≤85% (at 23 °C)	≤75% (at 21 °C) ≤95% (at 25 °C) ≤85% (at 23 °C)
Condensation		none	infrequent, minimal condensation

Safety Regulations

In accordance with DIN EN 61010-1 (IEC 1010-1), our measuring instruments are designed for:

- Overvoltage category III (CAT III)
- Fouling factor: 2
- Operating voltage:
  300 V or 600 V RMS for direct or alternating voltage (see table)
  (operating voltage = nominal voltage, phase-to-neutral)

for the following nominal line voltages:

Instrument Type	Nominal Voltage		
	3-phase 4-wire system	3-phase 3-wire system	Phase-to-Neutral
DS 72, DS 96, DS 144 DG 72, DG 96, DG 144 DE 72, DE 96, DE 144 FM 72, FM 96, FM 144	400/690 V	1000 V	600 V
DS 48, DG 48, DE 48 [1] BM 48, BM 72, BM 96 EB 72/2, EB 96/2 LM 96, LM 144 LF 96, LF 144	230/400 V 277/480 V	500 V	300 V

1) Operating voltage: 600 V (600 V CAT III) see Options / Order Information

The corresponding test voltages are as follows:

Instrument Type	Test Voltage Alternating Voltage, 50/60 Hz, U_{rms}, 1 min.
DS 72, DS 96, DS 144, DG 72, DG 96, DG 144 DE 72, DE 96, DE 144 FM 72, FM 96, FM 144	3.25 kV
DS 48, DG 48, DE 48 [2] BM 48, BM 72, BM 96 EB 72/2, EB 96/2 LM 96, LM 144 LF 96, LF 144	2.2 kV

2) Test voltage: 3.25 kV with option, "Operating voltage 600 V (600 V CAT III)" see Order Information

	Moving-Coil Movement	Moving-Iron Movement	Bimetal Movement
Application	Measurement of direct current or direct voltage Precision measurement of arithmetic mean value With rectifier: Measurement of alternating current or alternating voltage Measurement of rectified value, effective value display with sinewave	Measurement of alternating current or alternating voltage True RMS measurement	Alternating current measurement 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	
Damping	Eddy-current damping	Viscous damping	Thermal, time-delayed, for display of mean effective value
• Overshoot	≤5% of scale length	≤5% of scale length	
• Response Time	≤2 s per DIN EN 60061-1	≤2 s per DIN EN 60061-1	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. Ammeters upon request with double overload scale	
Measuring Range	With rectifier: for connection to transformer =120% of rated transformer value	For connection to transformer =120% of rated transformer value, Ammeters upon request, =100% of rated transformer value	For connection to transformer =120% of rated transformer value
Overload Capacity			
• Continuous	120% of rated value	120% of rated value	120% of rated value
• Short-Term:			
Current Measurement	10 x rated value, 5 s With rectifier: 2 x rated value, 0.5 s	10 x rated value, 5 s 40 x rated value, 1 s I_{max} =250 A	10 x rated value, 1 s (I_{max} =10 A)
Voltage Measurement	2 x rated value, 5 s With rectifier: 2 x rated value, 0.5 s	2 x rated value, 5 s	
Connection		Ammeters ≥40 A adjusted with horizontal cables to the outside	
Intrinsic Consumption		Ammeters: 0.4 ... 0.6 VA Voltmeters: 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 descriptions of frequency meters, active and reactive power meters and power factor meters.

Square Panel Meters for Direct Current or Direct Voltage

Moving-Coil Movement, 90° Scale
Narrow Bezel per DIN 43718

Front Dimensions	48 x 48 mm	72 x 72 mm	96 x 96 mm	144 x 144 mm
Type	DS 48	DS 72	DS 96	DS 144
Scale Length	37 mm	63 mm	97 mm	150 mm
Accuracy Class	1.5	1.5	1.5	1.5
Weight (standard model) Max.	0.12 kg	0.25 kg	0.32 kg	0.53 kg
Operating Voltage, Max.	300 V	600 V	600 V	600 V
Test Voltage	2.2 kV	3.25 kV	3.25 kV	3.25 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
				In preparation

Type DS 72

Description

Analog Panel Meter with Core-Magnet Moving-Coil Movement and Spring-Loaded Pivot Bearings

Display

Scale Graduation	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 for front panel dimensions of 72 x 72 mm and 96 x 96 mm as option.
Mounting Fasteners	Standard: S type screw clamp, except: Screw spindle for 144 x 144 mm panel meters Alternatives: see next page
Scale	Interchangeable scales ⏣ Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates ⏣ 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, except for: Direct connection ammeters ≥6 A: M6 bolt terminals.
Terminal Designation	"+11" and "12", except for: "+17" and "18" for 144 x 144 mm panel meters
Contact Protection	Finger-safe full cover included

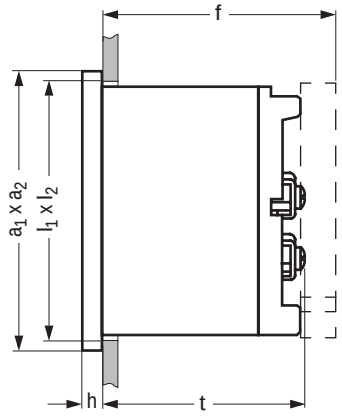
Internal Resistance / Voltage Drop / Power Consumption

Measuring Input	Ri at Zero Point			Tolerance
	left	center	10% of positive upper value	
1 mA	37 Ω	92 Ω	34 Ω	±10%
5 mA	2.5 Ω	18 Ω	–	±10%
10 mA	18 Ω	9.5 Ω	–	±10%
20 mA	3.0 Ω	1.5 Ω	2.8 Ω	±10%
4 ... 20 mA	0.7 Ω			±10%
Connection to shunt	power consumption: 6 mA lead resistance: 0.06 Ω			±10%
1 A ... 60 A	voltage drop: 60 mV			±10%
≥1 V	1000 Ω / V			± 5%

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60051

Dimensions



Front in mm	Nominal Dimensions		Cutout Dimensions, mm	Installation Depth Including Terminals (t), mm			Installation Depth Including Full Cover (f), mm		
	a_1 x a_2	h	l_1 x l_2	≤4 A (M4)	6...25 A (M6)	40...60 A (M6)	≤4 A	6...25 A	40...60 A
48 x 48	48 x 48	5	$45^{+0.6}$ x $45^{+0.6}$	54	72	–	62.5	75	–
72 x 72	72 x 72	5	$68^{+0.7}$ x $68^{+0.7}$	54	67	67	62.5	70	70
96 x 96	96 x 96	5	$92^{+0.8}$ x $92^{+0.8}$	54	67	67	62.5	70	70
144 x 144	144 x 144	8	138^{+1} x 138^{+1}	54	67	67	62.5	70	70

Order Information

Code: B0

Square Panel Meters for Direct Current or Direct Voltage

Order Example:
Moving-Coil Ammeter, 72 x 72 mm, –40 ... 0 ... 40 A
Order No.: 3150P BD2 CC40

				Front Dim. in mm	48 x 48	72 x 72	96 x 96	144 x 144
				Type	DS 48	DS 72	DS 96	DS 144
				Order No. ➡	3100P	3150P	3200P	3250P (in prep.)
				+ ⬇ + ⬇				
Meas. Input – Direct Current	Connection	Current						
Zero Point left	direct			–	+	+	+	+
center	direct			BD2	+	+	+	+
		1 mA		CB1	+	+	+	+
		5 mA		CB5	+	+	+	+
		10 mA		CB10	+	+	+	+
		20 mA		CB20	+	+	+	+
		1 A/1.5 A/2.5 A/4 A		CC1/1.5/2.5/4	+	+	+	+
		6 A/10 A/15 A		CC6/10/15	+	+	+	+
		25 A		CC25	+	+	+	+
		40 A		CC40	–	+	+	+
		60 A		CC60	–	+	+	+
10% pos. upper value	direct	–0.1 ... 0 ... 1 mA		BD3 CB1	+	+	+	+
		–2 ... 0 ... 20 mA		BD3 CB20	+	+	+	+
mech. suppressed	direct	4 ... 20 mA		BD4 –	+	+	+	+
left	at shunt resistor .../60 mV	Current: ... A		BD5 CG ...	+	+	+	+
		Current: ... kA		BD5 CH ...	+	+	+	+
center	at shunt resistor .../60 mV	Current: ... A		BD6 CG ...	+	+	+	+
		Current: ... kA		BD6 CH ...	+	+	+	+
left	at shunt resistor .../150 mV	Current: ... A		BD7 CG ...	+	+	+	+
		Current: ... kA		BD7 CH ...	+	+	+	+
center	at shunt resistor .../150 mV	Current: ... A		BD8 CG ...	+	+	+	+
		Current: ... kA		BD8 CH ...	+	+	+	+
Meas. Input – Direct Voltage	Connection	Voltage (upper range value)						
Zero Point left				–	+	+	+	+
center				BD2	+	+	+	+
10% pos. upper value				BD3	+	+	+	+
	direct	10/40/100 V		DC10/DC40/DC100	+	+	+	+
		1 to 300 V (not 10/40/100 V)		DC1 to DC300	+	+	+	+
		400/500/600 V		DC400 to DC600	+ 1)	+	+	+
Scale Graduation	corresponds to measuring range			–	+	+	+	+
	scale deviates from measuring range			GL ...	+	+	+	+
	without scale			GL95	+	+	+	+
	blank scale, lower and upper value markings, company logo, symbols			GL98	+	+	+	+
Scale Characteristics	proportional to current			–	+	+	+	+
	per curve			SD999 ...	+	+	+	+
Applications	standard			–	+	+	+	+
	conditionally tropic-proof, climatic category 3			LB4	+	+	+	+
Resistance to Vibration / Marine Applications	standard			–	+	+	+	+
	vibration resistance: 2.5 g, shock resistance: 30 g			LN56	+	+	+	+
	marine applications, German Lloyds			LN8	+	+	+	+
Operating Voltage	standard			–	+	+	+	+
	600 V (600 V CAT III)			LS9	+ 2)	– 3)	– 3)	– 3)
Bezel	dull black			–	+	+	+	+
	dull grey, RAL 7037			MA11	+	+	+	+
Glass Faceplate	standard			–	+	+	+	+
	anti-glare			MG1	+	+	+	+
	anti-glare, with red adjustable set pointer			MG98	+	+	+	+
Housing and Fasteners 4)	standard			–	+	+	+	+
	sheet metal housing with type S screw clamp			ML7	–	+	+	–
	sheet metal housing with type B screw clamp			ML8	–	+	+	–
	polycarbonate housing with 2 leaf springs			ML9	+	+	+	–
	polycarbonate housing with Subklew fasteners			ML10	+	+	+	–
Identification	none			–	+	+	+	+
	at rear:			MZ998 ...	+	+	+	+
Scale Inscription (Latin lettering)	none			–	+	+	+	+
	≤18 characters, 1 line: ..... (not possible for 2nd inscription)			SM903 ...	+	–	–	–
	≤22 characters, 1 line:			SM902 ...	–	+	+	+
	≤37 characters, 2 lines: 1st line (15 characters) .., 2nd line (22 char.) ..			SM911 ...	–	+	+	+
Additional Numbering	none			–	+	+	+	+
	2nd set of numberings, black: ...			SK982 ...	+	+	+	+
	2nd set of numberings, red (RAL 2002): ...			SK983 ...	+	+	+	+
Red Marker (RAL 2002)	none			–	+	+	+	+
	red marker at: ...			ST981 ...	+	+	+	+

Order Number Instructions:
- Select one model each for order numbers with the same sequence of letters.
- No add. entries are required for std. models (identified with bold typeface and "–" in the order no. column).
- An entry with "...." in the order no. column means that order number must be supplemented with text.

See page 13 for operating position and degree of protection options.
1) Operating voltage: 600 V (600 V CAT III), only in combination with order no. LS9
2) Not possible for direct connection >6 A.
3) Standard model
4) See page 13 for additional options.

Square Panel Meters
for Alternating Current 40... 45 ... 65 ... 1000 Hz or Alternating Voltage 40... 45 ... 65 ... 10000 Hz

Moving-Coil Movement with Rectifier, 90° Scale Narrow Bezel per DIN 43718

Front Dimensions	48 x 48 mm	72 x 72 mm	96 x 96 mm	144 x 144 mm
Type	DG 48	DG 72	DG 96	DG 144
Scale Length	37 mm	63 mm	97 mm	150 mm
Accuracy Class	1.5	1.5	1.5	1.5
Weight (standard model), Max.	0.12 kg	0.2 kg	0.28 kg	0.49 kg
Operating Voltage, Max.	300 V	600 V	600 V	600 V
Test Voltage	2.2 kV	3.25 kV	3.25 kV	3.25 kV
Front Housing Panel Protection	IP 52	IP 52	IP 52	IP 52
				In preparation

Type DG 96

Description

Analog Panel Meter with Core-Magnet Moving-Coil Movement and Spring-Loaded Pivot Bearings and Rectifier

Display

Scale Graduation	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 for front panel dimensions of 72 x 72 mm and 96 x 96 mm as option.
Mounting Fasteners	Standard: S type screw clamp, except: screw spindle for 144 x 144 mm panel meters alternative: see next page
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplate 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.
Terminal Designation	"11" and "12", except: "17" and "18" for 144 x 144 mm panel meters
Contact Protection	Finger-safe full cover included

Internal Resistance / Power Consumption

Measuring Input		Internal Resistance	Power Consumption
Connection			
to transformer	current		approx. 0.15 VA
direct or to transformer	voltage	900 Ω / V ±10%	

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ±1°
Frequency	45 ... 65 Hz
Waveshape	sine, distortion factor ≤1%
Other	DIN EN 60051

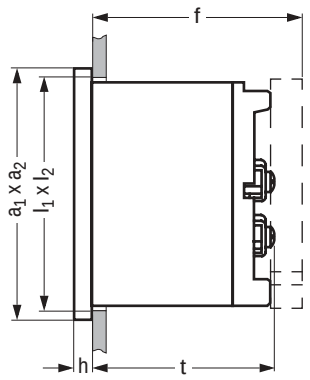
Nominal Range of Use Limits

Frequency	for alternating current, 40 ... 1000 Hz for alternating voltage, 40 ... 10000 Hz

Dimensions

With separate matching transformers for ammeters with front panel dimensions of 48 x 48 mm: L x W x H = 80 x 55 x 31 mm
Dimensional Drawing (upon request) 1303A1839H0

Dimensions



Front in mm	Nominal Dimensions, mm		Cutout Dimensions, mm	Installation Depth Including Terminals (t), mm	Installation Depth Incl. Full Cover (f), mm
	a_1 x a_2	h	l_1 x l_2	M4	
48 x 48	48 x 48	5	$45^{+0.6}$ x $45^{+0.6}$	54	62.5
72 x 72	72 x 72	5	$68^{+0.7}$ x $68^{+0.7}$	54	62.5
96 x 96	96 x 96	5	$92^{+0.8}$ x $92^{+0.8}$	54	62.5
144 x 144	144 x 144	8	138^{+1} x 138^{+1}	54	62.5

Square Panel Meters
for Alternating Current or Alternating Voltage

Code: B0

Order Example:
Moving-Coil Ammeter for AC 96 x 96 mm, 100/5 A Transformer Ratio
Order No.: 3200W BG16 CG100

			Front Dim. in mm / Type		48 x 48 DG 48	72 x 72 DG 72	96 x 96 DG 96	144 x 144 DG 144
			Order no. ➡ 3100W		3150W	3200W	3250W (in prep.)	
			+ ⬇	+ ⬇				
Meas. Input – Alt. Current	Connection	Current						
rated value 100%	direct	1.2 A [1]	–	CC1,2	+	+	+	+
		6 A [1]	–	CC6	+	+	+	+
rated value 120%	at transformer sec.: 1 A [1]	primary current: ... A	BG15	CG ...	+	+	+	+
		primary current: ... kA	BG15	CH ...	+	+	+	+
	at transformer sec.: 5 A [1]	primary current: ... A	BG16	CG ...	+	+	+	+
		primary current: ... kA	BG16	CH ...	+	+	+	+
Meas. Input – Alt. Voltage	Connection	Voltage (upper range value)						
rated value 100%	direct	60V/100V/120V/150V/	–	DC60	+	+	+	+
		250V/300V/400V/	–	to	+ [2]	+	+	+
		500V/600V	–	DC600	+ [2]	+	+	+
rated value 120%	at transformer sec.: 100 V	primary voltage: ... V	BG20	DG ...	+	+	+	+
		primary voltage: ... kV	BG20	DH ...	+	+	+	+
	at transformer sec.: 110 V	primary voltage: ... V	BG21	DG ...	+	+	+	+
		primary voltage: ... kV	BG21	DH ...	+	+	+	+
Scale Graduation	corresponds to measuring range		–		+	+	+	+
	without scale		GL95		+	+	+	+
	blank scale, lower and upper value markings, company logo, symbols		GL98		+	+	+	+
Position of use	standard		–		+	+	+	+
	0 ... 45 degrees from horizontal (bonded glass faceplate)		LA11		+	+	+	+
	46 ... 89 degrees from horizontal (bonded glass faceplate)		LA12		+	+	+	+
	91 ... 135 degrees from horizontal		LA13		+	+	+	+
Applications	standard		–		+	+	+	+
	conditionally tropic-proof, climatic category 3		LB4		+	+	+	+
Protection	standard		–		+	+	+	+
	front panel: IP 54, terminals: IP00		LH21		+	+	+	+
Resistance To Vibration/ Marine Applications	standard		–		+	+	+	+
	vibration resistance: 2.5 g, shock resistance: 30 g		LN56		+	+	+	+
	marine applications, German Lloyds		LN8		+	+	+	+
Operating Voltage	standard		–		+	+	+	+
	600 V (600 V CAT III)		LS9		+	– [3]	– [3]	– [3]
Bezel	dull black		–		+	+	+	+
	dull grey, RAL 7037		MA11		+	+	+	+
Glass Faceplate	standard		–		+	+	+	+
	anti-glare		MG1		+	+	+	+
	anti-glare, with red adjustable set pointer		MG98		+	+	+	+
Housing and Fasteners	standard		–		+	+	+	+
	sheet metal housing with type S screw clamp		ML7		–	+	+	–
	sheet metal housing with type B screw clamp		ML8		–	+	+	–
	polycarbonate housing with 2 leaf springs		ML9		+	+	+	–
	polycarbonate housing with Subklew fasteners		ML10		+	+	+	–
	polycarbonate housing with 4 leaf springs		ML11		+	+	+	–
	polycarbonate housing with mounts for H&B Unibloc grid		ML12		+	– [4]	– [4]	– [5]
	polycarbonate housing for manual grid mount, no fasteners		ML5		+	– [4]	– [4]	– [5]
Identification	none		–		+	+	+	+
	at rear:		MZ998 ...		+	+	+	+
Scale Inscription (Latin lettering)	none		–		+	+	+	+
	≤18 characters, 1 line: ..... (not possible for 2nd inscription)		SM903 ...		+	–	–	–
	≤22 characters, 1 line:		SM902 ...		–	+	+	+
	≤37 characters, 2 lines: 1st line (15 char.): ..., 2nd line (22 char.):		SM911 ...		–	+	+	+
Additional Numberings	none		–		+	+	+	+
	2nd set of numberings, black: ...		SK982 ...		+	+	+	+
	2nd set of numberings, red (RAL 2002): ...		SK983 ...		+	+	+	+
Red Marker (RAL 2002)	none		–		+	+	+	+
	red marker at: ...		ST981 ...		+	+	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries required for std. models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with text.

1) Type DG 48 with separate matching transformer
2) See "Safety Precautions" on page 8 regarding operating and nominal voltages.
3) Standard model
4) Use order number ML9 for H&B Unibloc and manual grids.
5) Standard model is suitable.

Square Panel Meters
for Alternating Current15 ... 45 ... 65 ... 400 Hz or Alternating Voltage15 ... 45 ... 65 ... 100 Hz

Moving-Iron Movement, 90° Scale
Narrow Bezel Per 43718

Front Dimensions	48 x 48 mm	72 x 72 mm	96 x 96 mm	144 x 144 mm
Type	DE 48	DE 72	DE 96	DE 144
Scale Length mm	37 mm	63 mm	97 mm	150 mm
Accuracy Class	1.5	1.5	1.5	1.5
Weight (standard model), Max.	0.1 kg	0.22 kg	0.29 kg	0.48 kg
Operating Voltage, Max.	300 V	600 V	600 V	600 V
Test Voltage	2.2 kV	3.25 kV	3.25 kV	3.25 kV
Front housing Panel Protection	IP 52	IP 52	IP 52	IP 52
				In preparation

Type DE 96

Description

Analog Panel Meter with Moving-Iron Movement and Spring-Loaded Pivot Bearings

Display

Scale Graduation	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 for front panel dimensions 72 x 72 mm and 96 x 96 mm as option.
Mounting Fasteners	Standard: S type screw clamp, except for: Screw spindle for 144 x 144 mm panel meters alternative: see next page
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates 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, except for: Direct connecting ammeters: 40 A/60 A: M6 bolt terminals, 100 A: M8 bolt terminals
Terminal Designation	"+11" and "12", except for: "+17" and "18" for 144 x 144 mm panel meters
Contact Protection	Finger-safe full cover included

Power Consumption

Connection	Measuring Input		Power Consumption
direct	current	1 A ... 10 A	approx. 0.5 VA
direct	current	≥15 A	approx. 0.8 VA
to transformer	current	sec.: 1 A or 5 A	approx. 0.5 VA
direct	voltage	120 V ... 600 V	approx. 4.0 VA
to transformer	voltage	sec: 100 V or 110 V	approx. 3.2 VA

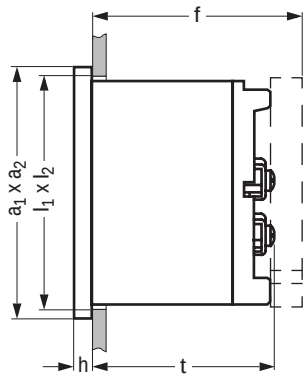
Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Frequency	45 ... 65 Hz
Other	DIN EN 60051

Nominal Range of Use Limits

Frequency	for alternating current, 15... 400 Hz for alternating voltage, 15... 100 Hz

Dimensions



Front in mm	Nominal Dimensions, mm		Cutout Dimensions, mm	Installation Depth Including Terminals (t), mm			Installation Depth Including Full Cover (f), mm	
	a_1 x a_2	h	l_1 x l_2	≤25 A (M4)	40/60 A (M6)	100 A (M8)	≤25 A	40...100 A
48 x 48	48 x 48	5	$45^{+0.6}$ x $45^{+0.6}$	54	–	–	62.5	–
72 x 72	72 x 72	5	$68^{+0.7}$ x $68^{+0.7}$	54	62	66	62.5	70
96 x 96	96 x 96	5	$92^{+0.8}$ x $92^{+0.8}$	54	62	66	62.5	70
144 x 144	144 x 144	8	138^{+1} x 138^{+1}	54	62	–	62.5	70 (40/60 A)

Square Panel Meters
for Alternating Current or Alternating Voltage

Order Example:
Moving-Iron Ammeter 96 x 96 mm, 100/5 A Transformer Ratio,
2-Fold Overload, Order No 3200E BG18 CG100

			Front Dim. in mm Type Order no. ➡ +⬇ +⬇		48 x 48 DE 48 3100E	72 x 72 DE 72 3150E	96 x 96 DE 96 3200E	144 x 144 DE 144 3250E (in prep.)
Meas. Input – Alternating Current	Connection	Current						
rated value 100%	direct		–		+	+	+	+
2-fold overload	direct		BG12		+	+	+	+
		1 A/1.5 A/2.5 A/4 A/5 A/6 A		CC1	+	+	+	+
		10 A/15 A/25 A/			+	+	+	+
		40 A/60 A		to	–	+	+	+
		100 A		CC100	–	+	+	–
rated value 100%	at transformer sec.: 1 A	primary current: ... A	BG 13	CG ...	+	+	+	+
		primary current: ... kA	BG 13	CH ...	+	+	+	+
	at transformer sec.: 5 A	primary current: ... A	BG 14	CG ...	+	+	+	+
		primary current: ... kA	BG 14	CH ...	+	+	+	+
rated value 120%	at transformer sec.: 1 A	primary current: ... A	BG 15	CG ...	+	+	+	+
		primary current: ... kA	BG 15	CH ...	+	+	+	+
	at transformer sec.: 5 A	primary current: ... A	BG 16	CG ...	+	+	+	+
		primary current: ... kA	BG 16	CH ...	+	+	+	+
2-fold overload	at transformer sec.: 1 A	primary current: ... A	BG 17	CG ...	+	+	+	+
		primary current: ... kA	BG 17	CH ...	+	+	+	+
	at transformer sec.: 5 A	primary current: ... A	BG 18	CG ...	+	+	+	+
		primary current: ... kA	BG 18	CH ...	+	+	+	+
Meas. Input – Alternating Voltage	Connection	Voltage (upper range value)						
rated value 100%	direct	120 V/150 V/	–	DC120	+	+	+	+
		250 V/300 V/400 V/	–	to				
		500 V/600 V	–	DC600	+ [1]	+	+	+
rated value 120%	at transformer sec.: 100 V	primary voltage: ... V	BG20	DG ...	+	+	+	+
		primary voltage: ... kV	BG20	DH ...	+	+	+	+
	at transformer sec.: 110 V	primary voltage: ... V	BG21	DG ...	+	+	+	+
		primary voltage: ... kV	BG21	DH ...	+	+	+	+
Scale Graduation	corresponds to measuring range		–		+	+	+	+
	without scale		GL95		+	+	+	+
	blank scale, lower and upper value markings, company logo, symbols		GL98		+	+	+	+
Applications	standard		–		+	+	+	+
	conditionally tropic-proof, climatic category 3		LB4		+	+	+	+
Resistance To Vibration/ Marine Applications	standard		–		+	+	+	+
	vibration resistance: 2.5 g, shock resistance: 30 g		LN56		+	+	+	+
	marine applications, German Lloyds		LN8		+	+	+	+
Operating Voltage	standard		–		+		+	+
	600 V (600 V CAT III)		LS9		+	– [2]	– [2]	– [2]
Bezel	dull black		–		+	+	+	+
	dull grey, RAL 7037		MA11		+	+	+	+
Glass Faceplate	normal		–		+	+	+	+
	anti-glare		MG1		+	+	+	+
	anti-glare, with red adjustable set pointer		MG98		+	+	+	+
Housing and Fasteners	standard		–		+	+	+	+
	sheet metal housing with type S screw clamp		ML7		–	+	+	–
	sheet metal housing with type B screw clamp		ML8		–	+	+	–
	polycarbonate housing with 2 leaf springs		ML9		+	+	+	–
	polycarbonate housing with Subklew fasteners		ML10		+	+	+	–
	polycarbonate housing with 4 leaf springs		ML11		+	+	+	–
	polycarbonate housing with mounts for H&B Unibloc -grid		ML12		+	– [3]	– [3]	– [4]
	polycarbonate housing for manual grid, no fasteners		ML5		+	– [3]	– [3]	– [4]
Identification	none		–		+	+	+	+
	at rear:		MZ998 ...		+	+	+	+
Scale Inscription	none		–		+	+	+	+
(Latin lettering)	≤18 characters, 1 line: ..... (not possible for 2nd inscription)		SM903 ...		+	–	–	–
	≤22 characters, 1 line:		SM902 ...		–	+	+	+
	≤37 characters, 2 lines: 1st line (15 char.):.., 2nd line (22 char.):		SM911 ...		–	+	+	+
Additional Numberings	none		–		+	+	+	+
	2nd set of numberings, black: ...		SK982 ...		+	+	+	+
	2nd set of numberings, red (RAL 2002): ...		SK983 ...		+	+	+	+
Red Marker (RAL 2002)	none		–		+	+	+	+
	red marker at: ...		ST981 ...		+	+	+	+

Order Number Instructions:
- Select one model each for order numbers with the same sequence of letters.
- No additional entries required for std. models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with text.

See page 13 for operating position and degree of protection options.

1) See "Safety Precautions" on page 8 regarding operating and nominal voltages.
2) Standard model
3) Use order number ML9 for H&B Unibloc and manual grids.
4) Standard model is suitable.

Square Panel Meters for Alternating Current

Bimetal Movement, 90° Scale
Narrow Bezel per DIN 43718

Front Dimensions		48 x 48 mm	72 x 72 mm	96 x 96 mm
Type		BM 48	BM 72	BM 96
Scale Length		34 mm	63 mm	97 mm
Weight (standard model), max.		0.1 kg	0.17 kg	0.25 kg
Power Consumption, Approx.	secondary transformer terminal: 1 A	1.1 VA	1.6 VA	1.6 VA
	secondary transformer terminal: 5 A	1.9 VA	2.5 VA	2.5 VA
Accuracy Class		3	3	3
Nominal Line Voltage	phase-to-neutral (= operating voltage)	≤300 V	≤300 V	≤300 V
	3-phase 3-wire systems	≤500 V	≤500 V	≤500 V
	3-phase 4-wire systems	≤277/480 V	≤277/480 V	≤277/480 V
Test Voltage		2.2 kV	2.2 kV	2.2 kV
Front Housing-Panel Protection		IP 52	IP 52	IP 52

Type BM 96

Description

Analog Panel Meter with Bimetal Movement

Display

Scale Graduation	Medium fine
Pointer	Bar indicator with knife-edge
	Red slave pointer for display of maximum value
	Reset button for slave pointer can be locked

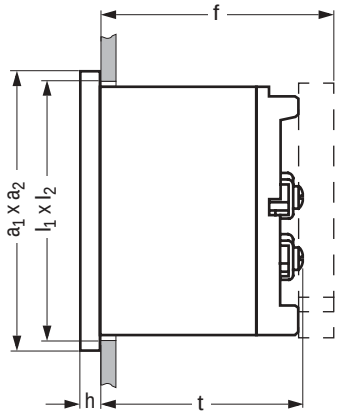
Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0 or sheet metal housing for front panel dimensions 72 x 72 mm and 96 x 96 mm as option.
Mounting Fasteners	Standard: S type screw clamp alternative: see next page
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates 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.
Terminal Designation	"11" and "12"
Contact Protection	Includes finger-safe full cover for BM 72 and BM 96, as well as finger-safe individual cover for BM 48.

Reference Conditions

Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60051

Dimensions



Front in mm	Nominal Dimensions, mm		Cutout Dimensions, mm	Installation Depth Including Terminals (t) mm	Installation Depth Incl. Cover (f) mm	
	a_1 x a_2	h	l_1 x l_2	M4	Full Cover	Individual Cover
48 x 48	48 x 48	5 mm	$45^{+0.6}$ x $45^{+0.6}$	56	–	61
72 x 72	72 x 72	5 mm	$68^{+0.7}$ x $68^{+0.7}$	54	62.5	–
96 x 96	96 x 96	5 mm	$92^{+0.8}$ x $92^{+0.8}$	54	62.5	–

Order Example: Bimetal Ammeter, 96 x 96 mm, 100/5 A Transformer Ratio, Response Time 8 min. Order No.: 3200M BG16 CG100 IB2			Front Dim. in mm Type Order no. ➡ +⬇ +⬇	48 x 48 BM 48 3100M	72 x 72 BM 72 3150M	96 x 96 BM 96 3200M
	Connection	Current				
rated value 120%	direct	1 A	BG10 CC1	+	+	+
		5 A	BG10 CC5	+	+	+
rated value 120%	at transformer sec.: 1 A	primary current: ... A	BG 15 CG ...	+	+	+
		primary current: ... kA	BG 15 CH ...	+	+	+
	at transformer sec.: 5 A	primary current: ... A	BG 16 CG ...	+	+	+
		primary current: ... kA	BG 16 CH ...	+	+	+
Scale Graduation	corresponds to measuring range		–	+	+	+
	without scale		GL95	+	+	+
	blank scale, lower and upper value markings, company logo, symbols		GL98	+	+	+
Position of Use	standard		–	+	+	+
	0 ... 45 degrees from horizontal (bonded glass faceplate)		LA11	+	+	+
	46 ... 89 degrees from horizontal (bonded glass faceplate)		LA12	+	+	+
	91 ... 135 degrees from horizontal		LA13	+	+	+
Response Time	15 min.		–	+	+	+
	8 min.		IB2	+	+	+
Bezel	dull black		–	+	+	+
	dull grey, RAL 7037		MA11	+	+	+
Glass Faceplate	standard		–	+	+	+
	anti-glare		MG1	+	+	+
Housing and Fasteners	standard		–	+	+	+
	sheet metal housing with type S screw clamp		ML7	–	+	+
	sheet metal housing with type B screw clamp		ML8	–	+	+
	polycarbonate housing with 2 leaf springs		ML9	+	+	+
	polycarbonate housing with Subklew fasteners		ML10	+	+	+
	polycarbonate housing with mount for H&B Unibloc grid		ML12	+	– [1]	– [1]
	polycarbonate housing for manual grid, no fasteners		ML5	+	– [1]	– [1]
Identification	none		–	+	+	
	at rear:		MZ998 ...	+	+	+
Constants Display	none		–	+	+	+
	display: 1-1.5-2-2.5-3-4-5-6-7.5-8-10 (for standard faceplate only)		PK5	–	–	+
Scale Inscription	none		–	+	+	+
(Latin lettering)	≤18 characters, 1 line: ..... (not possible for 2nd inscription)		SM903 ...	+	–	–
	≤22 characters, 1 line:		SM902 ...	–	+	+
	≤37 characters, 2 lines: 1st line (15 char.): ..., 2nd line (22 char.): ...		SM911 ...	–	+	+
Additional Numberings	none		–	+	+	+
	2nd set of numberings, black: ...		SK982 ...	+	+	+
	2nd set of numberings, red (RAL 2002): ...		SK983 ...	+	+	+
Red Marker (RAL 2002)	none		–	+	+	+
	red marker at: ...		ST981 ...	+	+	+

1) Use order number ML9 for H&B Unibloc and manual grids.

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in the order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

Square Panel Meters for Alternating Current

Moving-Iron Bimetal Movement, 90° Scale
Narrow Bezel per DIN 43718

Front Dimensions Type		72 x 72 mm EB 72/2	96 x 96 mm EB 96/2
Scale Length	moving-iron movement	63 mm	97 mm
	bimetal movement	42 mm	72 mm
Weight (standard model), Max.		0.21 kg	0.29 kg
Power Consumption, Approx.	secondary transformer terminal: 1 A	2.3 VA	2.3 VA
	secondary transformer terminal: 5 A	3.4 VA	3.4 VA
Accuracy Class	moving-iron bimetal movement	1.5 / 3	1.5 / 3
Nominal Line Voltage	phase-to-neutral (= operating voltage)	≤300 V	≤300 V
	3-phase 3-wire systems	≤500 V	≤500 V
	3-phase 4-wire systems	≤277/480 V	≤277/480 V
Test Voltage		2.2 kV	2.2 kV
Front Housing-Panel Protection		IP 52	IP 52

Type EB 96/2

Description

Analog Panel Meter with Moving-Iron and Bimetal Movements

Display

Scale Graduation	Coarse-fine
Pointer	Beam pointer with knife edge
	With bimetal movement:
	Red slave pointer for display of highest value
	Slave pointer reset button can be locked

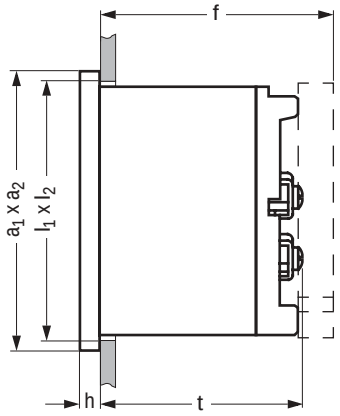
Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0 or sheet metal housing as option
Mounting Fasteners	Standard: S type screw clamp alternative: • B DIN 43835 screw clamp • Leaf springs • Subklew fastener
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates May only be replaced under voltage-free conditions!
Terminals	M 4 screw terminals with self-lifting terminal clips. Screws can be turned with cross-head or standard screw drivers.
Terminal Designation	“11” and “12”
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 °°
Other	DIN EN 60051

Dimensions



Front in mm	Nominal Dimensions, mm		Cutout Dimensions, mm	Installation Depth Including Terminals (t), mm	Installation Depth Including Full Cover (f), mm
	a_1 x a_2	h	l_1 x l_2	M4	
72 x 72	72 x 72	5	$68^{+0.7}$ x $68^{+0.7}$	54	62.5
96 x 96	96 x 96	5	$92^{+0.8}$ x $92^{+0.8}$	54	62.5

Code: B0

Order Example:
Moving-Iron, Bimetal Ammeter, 96 x 96 mm, 100/5 A Transformer Ratio,
Moving-Iron: 2-Fold Overload, Bimetal: 8 min. Response Time
Order No.: 3200C BG24 CG100 IB2

				Front Dim. in mm Type Order no. ➡ + ⬇ + ⬇		72 x 72 EB 72/2 3150C	96 x 96 EB 96/2 3200C
		Connection	Current				
	rated value 120%	direct	1 A	BG10	CC1	+	+
			5 A	BG10	CC5	+	+
Moving-Iron: 2-fold overload		direct					
Bimetal:	rated value 120%		1 A	BG22	CC1	+	+
			5 A	BG22	CC5	+	+
	rated value 120%	at transformer sec.: 1 A	primary current: ... A	BG 15	CG ...	+	+
			primary current: ... kA	BG 15	CH ...	+	+
		at transformer sec.: 5 A	primary current: ... A	BG 16	CG ...	+	+
			primary current: ... kA	BG 16	CH ...	+	+
Moving-Iron: 2-fold overload							
Bimetal:	rated value 120%	at transformer sec.: 1 A	primary current: ... A	BG23	CG ...	+	+
			primary current: ... kA	BG23	CH ...	+	+
		at transformer sec.: 5 A	primary current: ... A	BG24	CG ...	+	+
			primary current: ... kA	BG24	CH ...	+	+
Scale Graduation		corresponds to measuring range		–		+	+
		without scale		GL95		+	+
		blank scale, lower and upper value markings, company logo, symbols		GL98		+	+
Position of Use		standard		–		+	+
		0 ... 45 degrees from horizontal (bonded glass faceplate)		LA11		+	+
		46 ... 89 degrees from horizontal (bonded glass faceplate)		LA12		+	+
		91 ... 135 degrees from horizontal		LA13		+	+
Response Time		15 min.		–		+	+
		8 min.		IB2		+	+
Bezel		dull black		–		+	+
		dull grey, RAL 7037		MA11		+	+
Glass Faceplate		standard		–		+	+
		anti-glare		MG1		+	+
Housing and Fasteners		standard		–		+	+
		sheet metal housing with type S screw clamp		ML7		+	+
		sheet metal housing with type B screw clamp		ML8		+	+
		polycarbonate housing with leaf springs		ML9		+	+
		polycarbonate housing with Subklew fasteners		ML10		+	+
Identification		none		–		+	+
		at rear:		MZ998 ...		+	+
Constants Display		none		–		+	+
		display: 1-1.5-2-2.5-3-4-5-6-7.5-8-10		PK5		–	+
		(for standard faceplate only)					
Scale Inscription		none		–		+	+
(Latin lettering)		≤22 characters, 1 line:		SM902 ...		–	+
Additional Numberings		none		–		+	+
		2nd set of numberings, black: ...		SK982 ...		–	+
		2nd set of numberings, red (RAL 2002): ...		SK983 ...		–	+
Red Marker (RAL 2002)		none		–		+	+
		red marker at: ...		ST981 ...		+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in the order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

Square Panel Meters
for Frequency (pointer-type frequency meters)

Moving-Coil Movement with Frequency Converter, 90° Scale
Narrow Bezel per DIN 43718

Front Dimensions	48 x 48 mm	72 x 72 mm	96 x 96 mm	144 x 144 mm
Type	FM 48	FM 72	FM 96	FM 144
Scale Length	37 mm	63 mm	97 mm	150 mm
Weight (standard model), Max.	0.27 kg	0.20 kg	0.28 kg	0.49 kg
Power Consumption, Approx.	5 mA	5 mA	5 mA	5 mA
Operating Voltage, Max.	300 V	600 V	600 V	600 V
Test Voltage	2.2 kV	3.25 kV	3.25 kV	3.25 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
				In preparation

Type FM 96

Description

Analog Panel Meter with Core-Magnet Moving-Coil Movement and Integrated Frequency Converter or with separate frequency converter for front panel dimensions 48 x 48 mm

Display

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

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0 or sheet metal housing as option for front panel dimensions 72 x72 mm and 96 x 96 mm
Mounting Fasteners	Standard: S type screw clamp, except for: Screw spindle for 144 x 144 mm panel meters Options: see next page
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates 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.
Terminal Designation	"11" and "12", except for: "17" and "18" for 144 x 144 mm panel meters
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°
Input Voltage	nominal voltage
Waveshape	sine, distortion factor 0%
Warm-Up Time	≥5 min
Other	DIN EN 60051

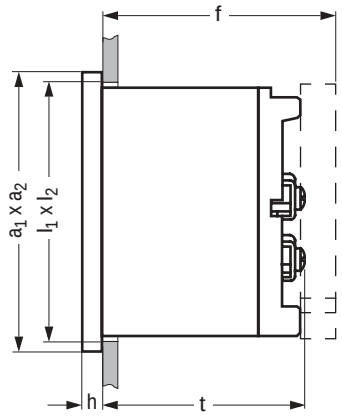
Nominal Range of Use Limits

Input Voltage	nominal voltage ± 20% Exception: Frequency meter for static transducer: 60 ... 300 V
Waveshape	sine, distortion factor ≤15%

Dimensions

For separate frequency converter (screw and snap mountable, for top-hat rails DIN EN 50 022-35 x 7.5 or DIN EN 50 022-35 x 15)
L x B x H = 70 x 45 x 114.5

Dimensions



Front in mm	Nominal Dimensions, mm		Cutout Dimensions, mm	Installation Depth Including Terminals (t), mm	Installation Depth Incl. Full Cover (f), mm
	a_1 x a_2	h	l_1 x l_2	M4	
48 x 48	48 x 48	5	$45^{+0.6}$ x $45^{+0.6}$	54	62.5
72 x 72	72 x 72	5	$68^{+0.7}$ x $68^{+0.7}$	54	62.5
96 x 96	96 x 96	5	$92^{+0.8}$ x $92^{+0.8}$	54	62.5
144 x 144	144 x 144	8	138^{+1} x 138^{+1}	54	62.5

Order Information

Code: B0

Square Panel Meters
for Frequency (pointer-type frequency meters)

Order Example:
Pointer-Type Frequency Meter, 96 x 96 mm, 45 ... 55 Hz, 208 ... 250 V AC
Order No. 3200Z EH619 IL732

			Front Dim. in mm / Type / Order no. ➡ + ⬇	48 x 48 FM 48 3100Z	72 x 72 FM 72 3150Z	96 x 96 FM 96 3200Z	144 x 144 FM 144 3250Z (in prep.)
Measuring Range							
Main Value Meter	48 ... 50 ... 52 Hz	class 0.5	EH623	+	+	+	+
	58 ... 60 ... 62 Hz	class 0.5	EH629	+	+	+	+
	380 ... 400 ... 420 Hz	class 0.5	EH674	+	+	+	+
	45 ... 50 ... 55 Hz	class 0.5	EH619	+	+	+	+
	55 ... 60 ... 65 Hz	class 0.5	EH626	+	+	+	+
	90 ... 100 ... 110 Hz	class 0.5	EH675	+	+	+	+
	180 ... 200 ... 220 Hz	class 0.5	EH635	+	+	+	+
	270 ... 300 ... 330 Hz	class 0.5	EH638	+	+	+	+
	360 ... 400 ... 440 Hz	class 0.5	EH642	+	+	+	+
	15 ... 16, 66 ... 18.4 Hz	class 0.5	EH617	+	+	+	+
	45 ... 50 ... 60 ... 65 Hz	class 1.0	EH671	+	+	+	+
For static transducers	300 ... 500 ... 750 Hz	class 2.5 for 60 ... < 150 V class 1.5 for 150 ... 250 V class 2.5 for > 250 ... 300 V	EH641	+	+	+	+
	600 ... 1000 ... 1400 Hz		EH646	+	+	+	+
	1 ... 2 ... 3 kHz		EK601	+	+	+	+
	1.8 ... 3 ... 4.2 kHz		EK603	+	+	+	+
	2 ... 6 ... 10 kHz		EK609	+	+	+	+
	6 ... 8 ... 10 kHz		EK608	+	+	+	+
Extended Range	0/10 ... 100 Hz	class 1.5	EH611	+	+	+	+
	0/50 ... 500 Hz	class 1.5	EH616	+	+	+	+
	0/0.1 ... 1 kHz	class 1.5	EK110	+	+	+	+
	0/1 ... 10 kHz	class 1.5	EK211	+	+	+	+
Nominal Voltage		100 ... 120 VAC	IL731	+	+	+	+
		208 ... 250 VAC	IL732	+	+	+	+
		380 ... 500 VAC	IL733	+	+	+	+
		150 ... 250 VAC (static transducers only)	IL734	+	+	+	+
Scale Graduation	corresponds to measuring range		–	+	+	+	+
	blank scale, lower and upper value markings, company logo, symbols		GL98	+	+	+	+
Position of Use	standard		–	+	+	+	+
	0 ... 45 degrees from horizontal (bonded glass faceplate)		LA11	+	+	+	+
	46 ... 89 degrees from horizontal (bonded glass faceplate)		LA12	+	+	+	+
	91 ... 135 degrees from horizontal		LA13	+	+	+	+
Applications	standard		–	+	+	+	+
	conditionally tropic-proof, climatic category 3		LB4	+	+	+	+
Protection	standard		–	+	+	+	+
	front panel: IP 54, terminals: IP00		LH21	+	+	+	+
Resistance To Vibration	standard		–	+	+	+	+
	vibration resistance: 2.5 g, shock resistance: 30 g		LN56	+	+	+	+
	marine applications: German Lloyds		LN8	– 1)	– 1)	– 1)	– 1)
Bezel	dull black		–	+	+	+	+
	dull grey, RAL 7037		MA11	+	+	+	+
Glass Faceplate	standard		–	+	+	+	+
	anti-glare		MG1	+	+	+	+
	anti-glare, with red adjustable set pointer		MG98	+	+	+	+
Housing and Fasteners	standard		–	+	+	+	+
	sheet metal housing with type S screw clamp		ML7	–	+	+	–
	sheet metal housing with type B screw clamp		ML8	–	+	+	–
	polycarbonate housing with 2 leaf springs		ML9	+	+	+	–
	polycarbonate housing with 4 leaf springs		ML11	+	+	+	–
	polycarbonate housing with Subklew fasteners		ML10	+	+	+	–
Identification	none		–	+	+	+	+
	at rear:		MZ998 ...	+	+	+	+
Scale Inscription (Latin lettering)	none		–	+	+	+	+
	≤18 characters, 1 line: ..... (not possible for 2nd set of numberings)		SM903 ...	+	–	–	–
	≤22 characters, 1 line:		SM902 ...	–	+	+	+
	≤37 characters, 2 lines: 1st line (15 char.): ..., 2nd line (22 char.): ...		SM911 ...	–	+	+	+
Red Marker (RAL 2002)	none		–	+	+	+	+
	red marker at: ...		ST981 ...	+	+	+	+

Order Number Instructions:

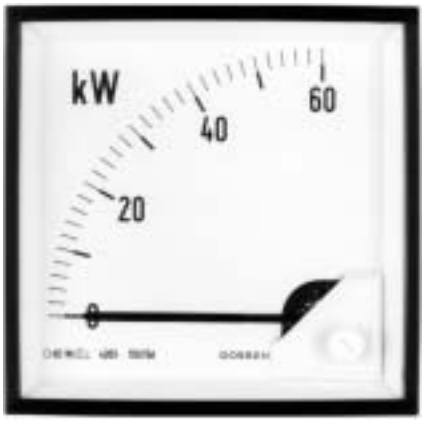
- Select one model each for order numbers with the same sequence of letters.
- No additional entries required for std. models (identified with bold type and "–" in order no. column).
- An entry with "...." in order no. column means that the order number must be supplemented with text.

1) Upon request

Square Panel Meters for Active Power or Reactive Power

Moving-Coil Movement with Power Converter, 90° Scale Narrow Bezel per DIN 43718

Front Dimensions			96 x 96 mm	144 x 144 mm
Type			LM 96	LM 144
Scale Length			97 mm	150 mm
Accuracy Class			1.5	1.5
Weight (standard model), Max.			0.8 kg	1.0 kg
Consumption, Approx.				
Current Path			0.2 VA	0.2 VA
Voltage Path	order no.:	AB1/AB2/AB12/AB5/AB15	3.0 VA	3.0 VA
		AB11	3.5 VA	3.5 VA
		AB4/AB14	3.4 VA	3.4 VA
		AB6	3.9 VA	3.9 VA
		AB16	4.3 VA	4.3 VA
Nominal Line Voltage	phase-to-neutral (= operating voltage)		≤300 V	≤300 V
	3-phase 3-wire systems		≤500 V	≤500 V
	3-phase 4-wire systems		≤277/480 V	≤277/480 V
Test Voltage			2.2 kV	2.2 kV
Front Housing-Panel Protection			IP 52	IP 52
				In preparation



Type LM 96

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 Graduation	Coarse-fine
Pointer	Beam pointer with knife-edge

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0
Mounting Fasteners	Standard: S type screw clamp, except for: Screw spindle for 144 x 144 mm panel meters alternative: • Subklew fasteners (except for 144 x 144 mm panel meters)
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates May only be replaced under voltage-free conditions!
Terminals	M 4 screw terminals with self-lifting terminal clips. Screws can be turned with cross-head or standard screw drivers.
Terminal Designation	per DIN 43807
Contact Protection	Hand-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 Hz ... 65 Hz
	50 Hz ±0.1 Hz for order no.: AB11
Current Components	20 ... 120% of rated value
Voltage Components	98 ... 102% of rated value
Warm-Up Time	≥5 min
Other	DIN EN 60051

Notes Concerning the Determination of Measuring Ranges

The upper measuring range value should be a standard value per DIN 43701:
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.

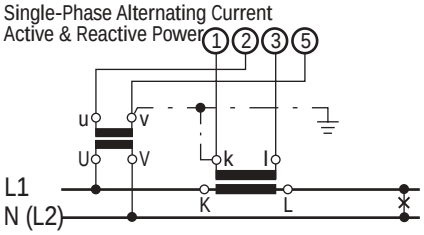
Apparent power S is calculated from the primary values from the current and voltage transformers:

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

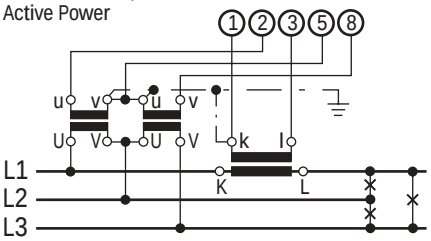
  where U equals phase-to-phase voltage

Schematic Diagrams

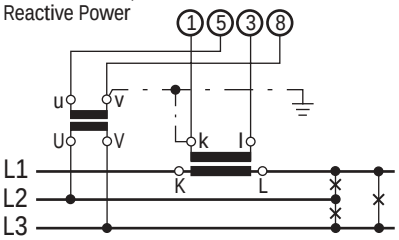
Single-Phase Alternating Current
Active & Reactive Power



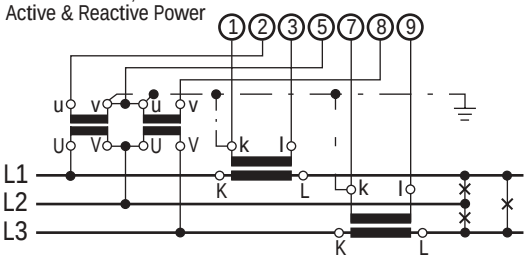
3-Phase 3-Wire, Balanced Load
Active Power



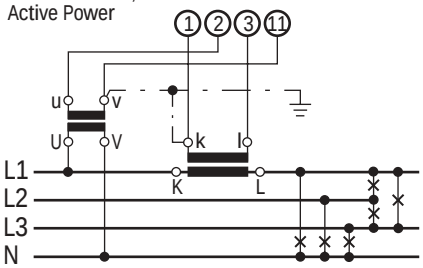
3-Phase 3-Wire, Balanced Load
Reactive Power



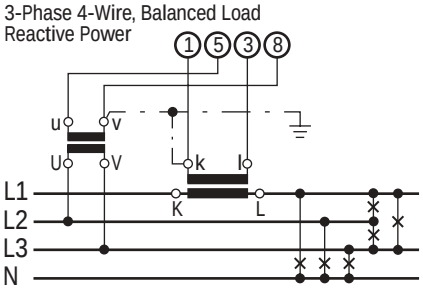
3-Phase 3-Wire, Unbalanced Load
Active & Reactive Power



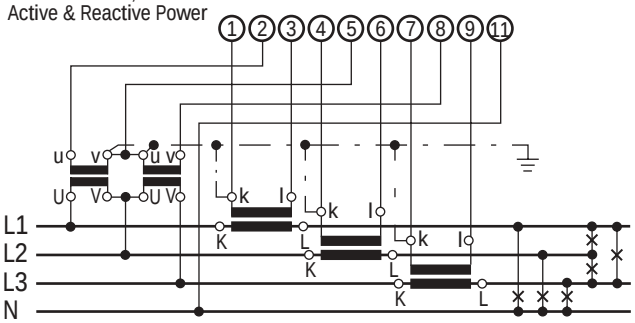
3-Phase 4-Wire, Balanced Load
Active Power



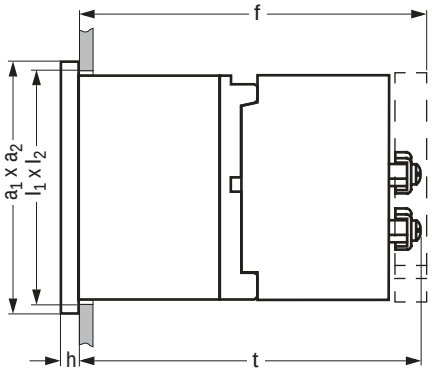
3-Phase 4-Wire, Balanced Load
Reactive Power



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



Dimensions



Front, mm	Nominal Dimensions, mm		Cutout, mm	Order No.	Installation Depth, mm	
	$a_1 \times a_2$	h	$l_1 \times l_2$		Including Terminals (t)	Including Full Cover (f)
96 x 96 144 x 144	96 x 96 144 x 144	5 8	$92^{+0.8} \times 92^{+0.8}$ $138^{+1} \times 138^{+1}$	AB1/AB11/AB2/AB12/ AB4/AB14/AB5/AB15	105	111
				AB6/AB16	131	137

Square Panel Meters
for Active Power or Reactive Power

Order Example:
Active Power Meter for 3-Wire System with Unbalanced Load, 100/5 A Transformer Ratio, 400 V Nominal Voltage, Measuring Range: 0 ... 60 kW
Order No.: 3200D AB4 BE11 CG100 IL340 NB: 0 ... 60 kW

			Front Dim. in mm Type Order no. ➡ + ⬇	+ ⬇	+ ⬇	96 x 96 LM 96 3200D	144 x 144 LM 144 3250D (in preparation)
System Type / Power Type	Voltage Path Terminal						
2-Wire System							
Active Power, Single Phase AC			AB1			+	+
	at transformer sec.: 100 V	primary voltage: ... V		BF12	DG ...	+	+
		primary voltage: ... kV		BF12	DH ...	+	+
	at transformer sec.: 110 V	primary voltage: ... V		BF15	DG ...	+	+
		primary voltage: ... kV		BF15	DH ...	+	+
	direct, 220 VAC			IL322	–	+	+
	direct, 230 VAC			IL323	–	+	+
	direct, 240 VAC			IL324	–	+	+
Reactive Power, Single Phase AC			AB11			+	+
	direct, 220 VAC			IL322	–	+	+
	direct, 230 VAC			IL323	–	+	+
	direct, 240 VAC			IL324	–	+	+
3-Wire System							
Active Power, 3-Wire, Balanced Load			AB2			+	+
Reactive Power, 3-Wire, Balanced Load			AB12			+	+
Active Power, 3-Wire, Unbalanced Load			AB4			+	+
Reactive Power, 3-Wire, Unbalanced Load			AB14			+	+
	at transformer sec.: 100 V	primary voltage: ... V		BF12	DG ...	+	+
		primary voltage: ... kV		BF12	DH ...	+	+
	at transformer sec.: 110 V	primary voltage: ... V		BF15	DG ...	+	+
		primary voltage: ... kV		BF15	DH ...	+	+
	direct, 380 VAC			IL338	–	+	+
	direct, 400 VAC			IL340	–	+	+
	direct, 415 VAC			IL661	–	+	+
	direct, 440 VAC			IL344	–	+	+
	direct, 500 VAC			IL350	–	+	+
4-Wire System							
Active Power, 4-Wire, Balanced Load			AB5			+	+
Reactive Power, 4-Wire, Balanced Load			AB15			+	+
Active Power, 4-Wire, Unbalanced Load			AB6			+	+
Reactive Power, 4-Wire, Unbalanced Load			AB16			+	+
	at transformer sec.: 100 V	primary voltage: ... V		BF12	DG ...	+	+
		primary voltage: ... kV		BF12	DH ...	+	+
	at transformer sec.: 110 V	primary voltage: ... V		BF15	DG ...	+	+
		primary voltage: ... kV		BF15	DH ...	+	+
	direct, 220/380 VAC			IL718	–	+	+
	direct, 230/400 VAC			IL723	–	+	+
	direct, 240/415 VAC			IL721	–	+	+
	direct, 254/440 VAC			IL722	–	+	+
	direct, 277/480 VAC			IL724	–	+	+
Current Path Terminal	at transformer sec.: 1 A	primary current: ... A		BE10	CG ...	+	+
		primary current: ... kA		BE10	CH ...	+	+
	at transformer sec.: 5 A	primary current: ... A		BE11	CG ...	+	+
		primary current: ... kA		BE11	CH ...	+	+
Zero Point	left		–	–	–	+	+
	center		BC2	–	–	+	+
	10% of positive upper value		BC6	–	–	+	+
Upper Measuring Range Value	(adjustable from 0.5 to 1.2 times apparent power)		NB ...	–	–	+	+

Order Number Instructions:

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- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

		Front Dim. in mm Type Order no. ➡ + ⬇	96 x 96 LM 96 3200D	144 x 144 LM 144 3250D (in preparation)
Scale Graduation	**corresponds to measuring range**	–	+	+
	blank scale, lower and upper value markings, company logo, symbols	GL98	+	+
Position of Use	**standard**	–	+	+
	0 ... 45 degrees from horizontal (bonded glass faceplate)	LA11	+	+
	46 ... 89 degrees from horizontal (bonded glass faceplate)	LA12	+	+
	91 ... 135 degrees from horizontal	LA13	+	+
Applications	**standard**	–	+	+
	conditionally tropic-proof, climatic category 3	LB4	+	+
Protection	**standard**	–	+	+
	front panel: IP 54, terminals: IP00	LH21	+	+
Resistance To Vibration / Marine Applications	**standard**	–	+	+
	vibration resistance: 2.5 g, shock resistance: 30 g	LN56	+	+
	marine applications, German Lloyds	LN8	+	+
Bezel	**dull black**	–	+	+
	dull grey, RAL 7037	MA11	+	+
Glass Faceplate	**standard**	–	+	+
	anti-glare	MG1	+	+
	anti-glare, with red adjustable set pointer	MG98	+	+
Housing and Fasteners	**standard**	–	+	+
	polycarbonate housing with Subklew fasteners	ML10	+	–
Identification	**none**	–	+	+
	at rear:	MZ998 ...	+	+
Scale Inscription (Latin lettering)	**none**	–	+	+
	≤22 characters, 1 line:	SM902 ...	+	+
	≤37 characters, 2 lines: 1st line (15 char.): ..., 2nd line (22 char.): ...	SM911 ...	+	+
Additional Numberings	**none**	–	+	+
	2nd set of numberings, black: ...	SK982 ...	+	+
	2nd set of numberings, red (RAL 2002):	SK983 ...	+	+
Red Marker (RAL 2002)	**none**	–	+	+
	red marker at: ...	ST981 ...	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
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Square Panel Meters for Power Factor

Moving-Coil Movement with Power Factor Converter, 90° Scale Narrow Bezel per DIN 43718

Front Dimensions		96 x 96 mm	144 x 144 mm
Type		LF 96	LF 144
Scale Length		97 mm	150 mm
Accuracy Class		1.5	1.5
Weight (standard model), Max.		0.38 kg	0.59 kg
Power Consumption, Approx.	current path	1.0 VA	1.0 VA
	voltage path	3.0 VA	3.0 VA
Nominal Line Voltage	phase-to-neutral (= operating voltage)	≤300 V	≤300 V
	3-phase 3-wire systems	≤500 V	≤500 V
	3-phase 4-wire systems	≤277/480 V	≤277/480 V
Test Voltage		2.2 kV	2.2 kV
Front Housing-Panel Protection		IP 52	IP 52
			In preparation

Type LF 96

Description

Analog panel meter with core-magnet moving-coil movement and integrated power factor converter. The power factor converter determines the phase angle between current and voltage. cos φ is displayed at the moving-coil movement.

Display

Measuring Range	CAP 0.5 ... 1 ... 0.5 IND
Scale Graduation	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 for front dimensions 96 x 96 mm
Mounting Fasteners	Standard: S type screw clamp, except for: Screw spindle for 144 x 144 mm panel meters Options: se next page
Scale	Interchangeable scales ➲ Scales may only be replaced under voltage-free conditions!
Replaceable	Bezels and glass faceplates ➲ 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.
Terminal Designation	Similar to 43807
Contact Protection	Finger-safe full cover included

Reference Conditions

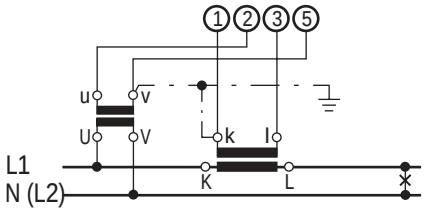
Reference Quantities	Reference Conditions
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Frequency	50 Hz ± 0.1 Hz
Current Components	95 ... 100% of rated value
Voltage Components	98 ... 102% of rated value
Waveshape	sine, distortion factor ≤1%
Warm-Up Time	≥5 min
Other	DIN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

Nominal Range of Use Limits

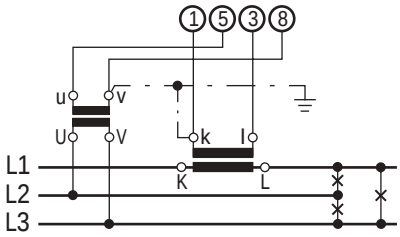
Frequency	45 Hz ... 65 Hz
	49 Hz ... 51 Hz for order no.: AB21

Schematic Diagrams

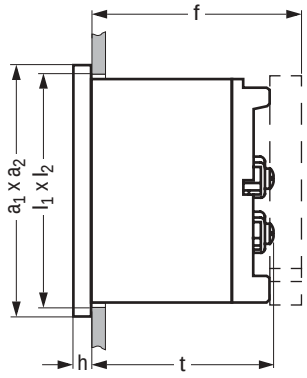
Single Phase Alternating Current



3-Phase 3-Wire, Balanced Load



Dimensions



Front in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth Including Terminals (t), mm	Installation Depth Incl. Full Cover (f), mm
	$a_1 \times a_2$	h	$l_1 \times l_2$	M4	
96 x 96	96 x 96	5	$92^{+0.8} \times 92^{+0.8}$	54	62.5
144 x 144	144 x 144	8	$138^{+1} \times 138^{+1}$	54	62.5

Code: B0

Order Example: Power Factor Meter for 3-Wire System with Balanced Load, 5 A Secondary Transformer Terminal, 500 V Nominal Voltage Order No.: 3200H AB22 BE11 IL 350		Front Dim. in mm Type Order no. ➡ + ⬇	96 x 96 LF 96 3200H + ⬇	144 x 144 LF 144 3250H (in preparation)
System Type / Power Type	Nominal Voltage			
Single Phase Alternating Current		AB21	+	+
	100 VAC	IL 310	+	+
	110 VAC	IL 311	+	+
	220 ... 240 VAC	IL 728	+	+
3-Wire System, Balanced Load		AB22	+	+
	100 VAC	IL 310	+	+
	110 VAC	IL 311	+	+
	380 ... 400 VAC	IL 727	+	+
	415 ... 440 VAC	IL 730	+	+
	500 VAC	IL 350	+	+
Current Path Terminal	at transformer sec.: 1 A	BE10	+	+
	at transformer sec.: 5 A	BE11	+	+
Position of Use	**standard**	–	+	+
	0 ... 45 degrees from horizontal (bonded glass faceplate)	LA11	+	+
	46 ... 89 degrees from horizontal (bonded glass faceplate)	LA12	+	+
	91 ... 135 degrees from horizontal	LA13	+	+
Applications	**standard**	–	+	+
	conditionally tropic-proof, climatic category 3	LB4	+	+
Protection	**standard**	–	+	+
	front panel: IP 54, terminals: IP00	LH21	+	+
Resistance To Vibration /	**standard**	–	+	+
Marine Applications	vibration resistance: 2.5 g, shock resistance: 30 g	LN56	+	+
	marine applications, German Lloyds	LN8	+	+
Bezel	**dull black**	–	+	+
	dull grey, RAL 7037	MA11	+	+
Glass Faceplate	**standard**	–	+	+
	anti-glare	MG1	+	+
	anti-glare, with red adjustable set pointer	MG98	+	+
Housing and Fasteners	**standard**	–	+	+
	sheet metal housing with type S screw clamp	ML7	+	–
	sheet metal housing with type B screw clamp	ML8	+	–
	polycarbonate housing with 2 leaf springs	ML9	+	–
	polycarbonate housing with 4 leaf springs	ML11	+	–
	polycarbonate housing with Subklew fasteners	ML10	+	–
Identification	**none**	–	+	
	at rear:	MZ998 ...	+	+
Scale Inscription	**none**	–	+	+
(Latin lettering)	≤22 characters, 1 line:	SM902 ...	+	+
	≤37 characters, 2 lines: 1st line (15 characters): ..., 2nd line (22 characters): ...	SM911 ...	+	+
Red Marker (RAL 2002)	**none**	–	+	+
	red marker at: ...	ST981 ...	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
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Interchangeable Scales for Square Panel Meters
Standard Program

Order Information

Code: B0

Order Example:
Interchangeable Scale for Moving-Iron Ammeter
96 x 96 mm,100/5 A Transformer Ratio, 2-Fold Overload
Order No.: 3209E BG18 CG100

Interchangeable Scale	for Type:	Measuring System	Front Dim. mm	48 x 48		72 x 72		96 x 96		144 x 144 (in preparation)	
			Order No. + ⬇	Order No. ⬇		Order No. ⬇		Order No. ⬇		Order No. ⬇	
	DS 48 DS 72 DS 96 DS 144	Moving-Coil Movement		3109P	+	3159P	+	3209P	+	3259P	+
	DG 48 DG 72 DG 96 DG 144	Moving-Coil Movement with Rectifier		3109W	+	3159W	+	3209W	+	3259W	+
	DE 48 DE 72 DE 96 DE 144	Moving-Iron Movement		3109E	+	3159E	+	3209E	+	3259E	+
	BM 48 BM 72 BM 96	Bimetal Movement		3109M	+	3159M	+	3209M	+		–
	EB 72/2 EB 96/2	Moving-Iron Bimetal Movement				3159C	+	3209C	+		–
	FM 48 FM 72 FM 96 FM 144	Moving-Coil Movement with Frequency Converter		3109Z	+	3159Z	+	3209Z	+	3259Z	+
	LM 96 LM 144	Moving-Coil Movement with Power Converter						3209D	+	3259D	+
➲ See appropriate types for additional order numbers for measuring input / measuring range.											
Scale Graduation		corresponds to measuring range	–		+		+		+		+
		blank scale, lower and upper value markings, company logo, symbols	GL98		+		+		+		+
Scale Inscription		none	–		+		+		+		+
(Latin lettering)		≤18 characters, 1 line: ... (not possible for 2nd inscription)	SM903 ...		+		–		–		–
		≤22 characters, 1 line:	SM902 ...		–		+		+		+
		37 characters, 2 lines: 1st line (15 characters): ..., 2nd line (22 characters): ...	SM911 ...		–		+		+		+
		➲ 1 line and 2 lines not available for types EB 72/2									
		➲ 2 lines not available for type EB 96/2									
Additional Numbering		none	–		+		+		+		+
		2nd set of numberings, black: ...	SK982 ...		+		+		+ 1)		+
		2nd set of numberings, red (RAL 2002): ...	SK983 ...		+		+		+ 2)		+
		➲ not for types EB 72/2, FM 72, FM 96 and LF 96									
Red Marker (RAL 2002)		none	–		+		+		+		+
		red marker at: ...	ST981 ...		+		+ 3)		+ 3)		+

1) Additional charge for type EB 96/2

2) Additional charge for type EB 96/2

3) Additional charge for types EB 72/2 and EB 96/2

Order Number Instructions:

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- An entry with "..." in the order no. column means that the order number must be supplemented with written text.

Shunt Resistors

Technical Data
Order Information
Code: B0

Technical Data

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

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 changed to 40.5 mm.

Order Example

Technical Data	Order No.
Shunt Resistor, Nominal Current: I_N 250 A, Voltage Drop: 60 mV	1700V3340

Shunt Resistor, 250 A / 60 mV

Nominal Current	60 mV			Nominal Current	150 mV		
I_N	Weight in kg, approx.	Order No.		I_N	Weight in kg, approx.	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	60 mV	
I_N	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 50022-35)

❖ Cover for shunt resistor on insulating base:

Order No.	
1700V8210	+

One Pair Cables with Cable Lugs

Length	Cross-Section	Cable per VDE 0281 Part 401	Order No.	
1.3 m	0.75 mm²	H03V-H	1700V8010	+
2.6 m	1.5 mm²	H07V-H	1700V8020	+
4.3 m	2.5 mm²	H07V-H	1700V8030	+
7.0 m	4.0 mm²	H07V-H	1700V8040	+
10.5 m	6.0 mm²	H07V-H	1700V8050	+

0.06 Ω cable resistance per cable pair

Plug-On Current Transformers
Wound-Primary Current Transformers

Type ASK 31.3

	Plug-On Current Transformers				Wound-Primary Current Transformers		
Type	ASK 31.3	ASK 412.4	ASK 63.4	ASK 105.6	WSK 30	WSK 40	WSK 70.6 N
For Rails up to	30 x 10 mm	40 x 12 mm	60 x30 mm	100 x 55 mm	–	–	–
	25.4 x 13 mm	30 x 15 mm	50 x40 mm	–	–	–	–
	2 x 20 x 10 mm	–	–	–	–	–	–
For Round Conductors to	26 mm dia.	30.5 mm dia.	44 mm dia.	55 mm dia.	–	–	–
Rated Primary Current	50 to 750 A (Cl. 0.5 as of 100 A)	50 to 1000 A (Cl. 0.5 as of 100 A)	750 to 2000 A	1500 to 4000 A	1 to 20 A	1 to 40 A	30 to 150 A
Class	1 or 0.5	1 or 0.5	1 or 0.5	1 or 0.5	1 or 0.5	1 or 0.5	1 or 0.5
Housing Material	polycarbonate	polycarbonate	polycarbonate	polycarbonate	polycarbonate	polycarbonate	polycarbonate
Transformer Width	60 mm	70 mm	95 mm	129 mm	60 mm	70 mm	70 mm [1]
Max. Weight	0.28 kg	0.45 kg	0.41 kg	1.2 kg	0.25 kg	0.4 kg	0.5 kg

[1] 136 mm including primary terminal

Description

Plug-on current transformers for direct mounting to massive copper rails or insulated round conductor and wound-primary current transformers with fixed primary coil.
Application: indirect measurement of sinusoidal alternating current.

Technical Data, Characteristic Values

Polycarbonate housing per UL 94V-0	
Angle bracket and rail mounting screws with insulated protective cover as standard mount (rail mounting screws only with plug-on current transformers)	
Tightening torque for rail mounting screws	: 2 ... 3 Nm
Maximum device voltage U_m (RMS value) = max. allowable operating voltage	: 0.72 kV
Rated short-time alternating withstand voltage (effective value) = test voltage	: 3 kV
Ambient temperature (operating temperature range)	: –5 ... 40 °C (no condensation)
Rated thermal continuous current	: 1.0 x I_n
Rated frequency	: 50 – 60 Hz
Rated thermal short-time current	: 60 x I_n
Insulation class	: E
Overcurrent limiting factor (FS)	: FS 5 for up to 1500 A rated primary current
	: FS 10 as of 1600 A rated primary current

Regulations and Standards

IEC 185/DIN VDE 0414 part 1
VBG 4
VDE 0106 part 100/DIN 57106 part 100 (safe from finger-touch)

Plug-on current transformers for marine applications with GL approval
Billing current transformers and measuring transducers for alternating current with integrated current transformer upon request

Code: B0

Type ASK 31.3

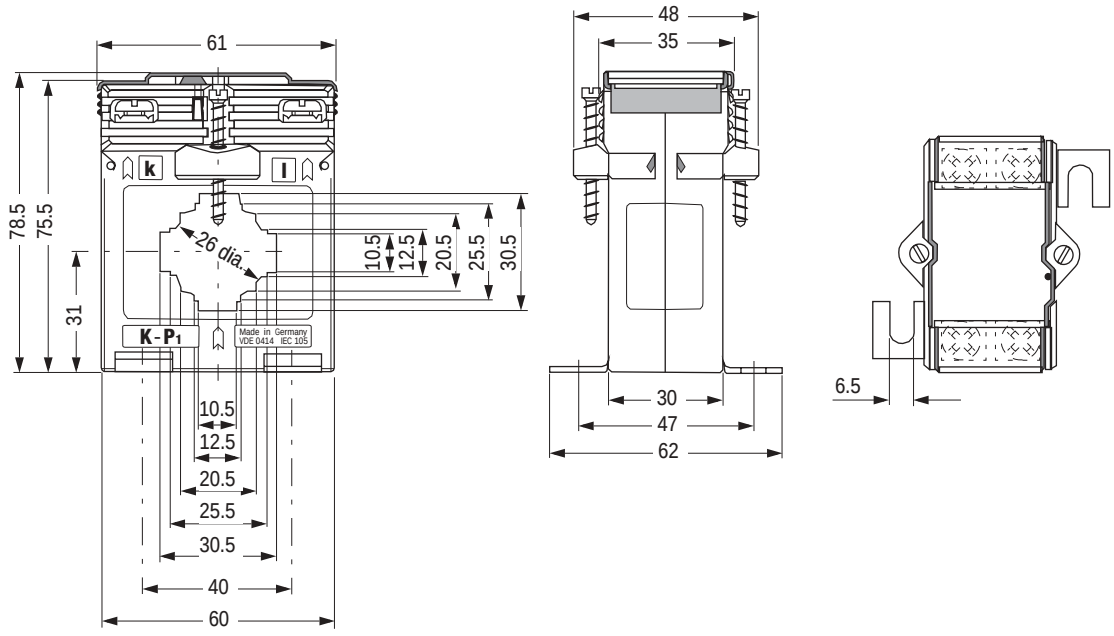
Primary Conductor	30 x 10 mm
	25.4 x 13 mm
	2 x 20 x 10 mm
Round Conductor	26 mm dia.
Transformer Width	60 mm

Rated Primary Current		Class 1				Class 0.5			
		secondary: 5 A		secondary: 1 A		secondary: 5 A		secondary: 1 A	
		Order No. 1715V		Order No. 1715V		Order No. 1715V		Order No. 1715V	
A	VA	+ ⬇		+ ⬇		+ ⬇		+ ⬇	
50	1.0	0100	+	1100	+	–	–	–	–
60	1.0	0110	+	1110	+	–	–	–	–
75	1.5	0120	+	1120	+	–	–	–	–
80	2.5	0130	+	1130	+	–	–	–	–
100	2.5	0140	+	1140	+	2140	+	3140	+
150	2.5	0150	+	1150	+	2150	+	3150	+
200	5	0160	+	1160	+	2160	+	3160	+
250	5	–	–	–	–	2170	+	3170	+
250	10	0170	+	1170	+	–	–	–	–
300	5	–	–	–	–	2180	+	3180	+
300	10	0180	+	1180	+	–	–	–	–
400	5	–	–	–	–	2190	+	3190	+
400	10	0190	+	1190	+	–	–	–	–
500	10	0200	+	1200	+	2200	+	3200	+
600	10	0210	+	1210	+	2210	+	3210	+
750	10	0220	+	1220	+	2220	+	3220	+

Rated frequency: 400 Hz = order no. 1715V...4 = additional charge

Accessories:	Order No.	
Snap-on fasteners for mounting to 35 mm top-hat rail per DIN EN 50022	1722V9010	+
Sealing cap	1722V9110	+

Dimensional Drawing



Plug-On Current Transformers

Order Information

Code: B0

Type ASK 412.4

Primary Conductor 40 x 12 mm
30 x 15 mm

Round Conductor 30.5 mm dia.

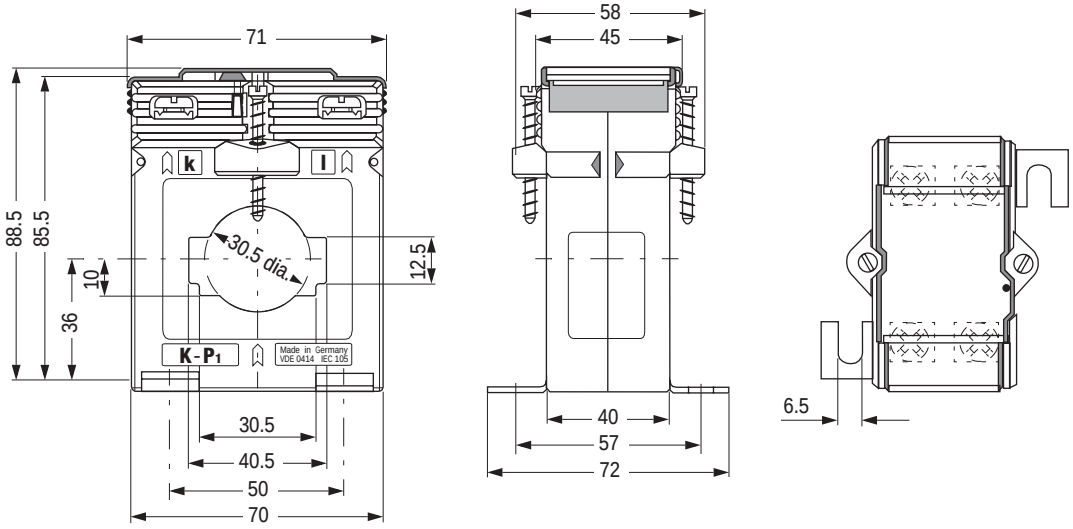
Transformer Width 70 mm

Rated Primary Current A	VA	Class 1 secondary: 5 A Order No. 1716V + ⬇		Class 1 secondary: 1 A Order No. 1716V + ⬇		Class 0.5 secondary: 5 A Order No. 1716V + ⬇		Class 0.5 secondary: 1 A Order No. 1716V + ⬇	
50	1.5	0100	+	1100	+	–	–	–	–
60	1.5	0110	+	1110	+	–	–	–	–
75	2.5	0120	+	1120	+	–	–	–	–
80	2.5	0130	+	1130	+	–	–	–	–
100	1.5	–	–	–	–	2140	+	3140	+
100	3.75	0140	+	1140	+	–	–	–	–
150	2.5	–	–	–	–	2150	+	3150	+
150	5	0150	+	1150	+	–	–	–	–
200	2.5	–	–	–	–	2160	+	3160	+
200	10	0160	+	1160	+	–	–	–	–
250	5	–	–	–	–	2170	+	3170	+
250	10	0170	+	1170	+	–	–	–	–
300	5	–	–	–	–	2180	+	3180	+
300	10	0180	+	1180	+	–	–	–	–
400	10	0190	+	1190	+	2190	+	3190	+
500	10	0200	+	1200	+	2200	+	3200	+
600	10	0210	+	1210	+	2210	+	3210	+
750	10	0220	+	1220	+	2220	+	3220	+
800	10	0230	+	1230	+	2230	+	3230	+
1000	10	0240	+	1240	+	2240	+	3240	+

Rated frequency: 400 Hz = order no. 1716V...4 = additional charge

Accessories:	Order No.	
Snap-on fasteners for mounting to 35 mm top-hat rail per DIN EN 50022	1722V9020	+
Sealing cap	1722V9120	+

Dimensional Drawing



Code: B0

Type ASK 63.4

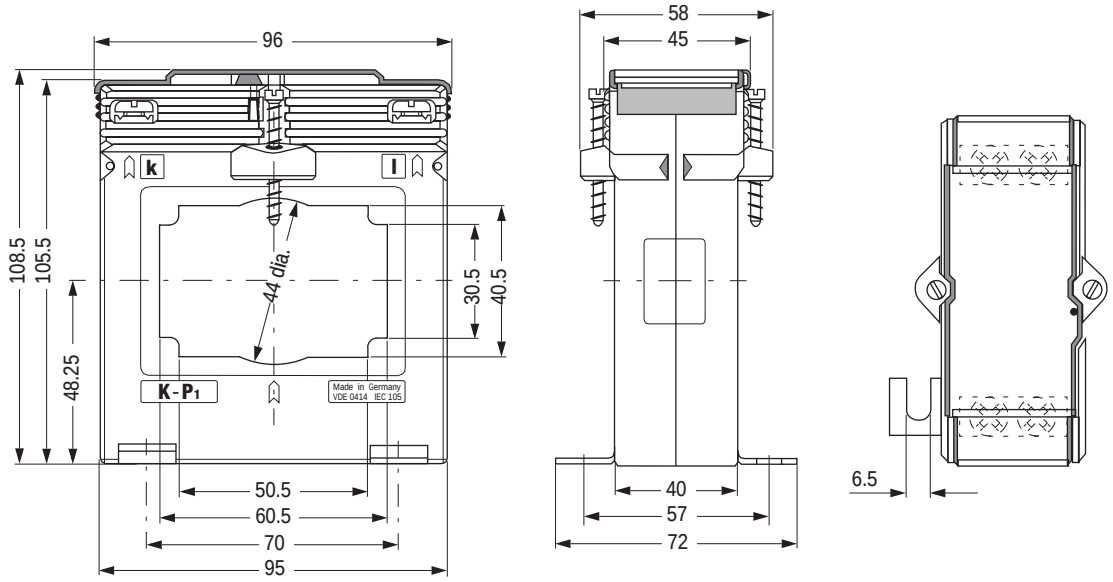
Primary Conductor	60 x 30 mm
	50 x 40 mm
Round Conductor	44 mm dia.
Transformer Width	95 mm

Rated Primary Current		Class 1				Class 0.5			
		secondary: 5 A		secondary: 1 A		secondary: 5 A		secondary: 1 A	
		Order No. 1717V		Order No. 1717V		Order No. 1717V		Order No. 1717V	
A	VA	+ ⬇		+ ⬇		+ ⬇		+ ⬇	
750	10	0220	+	1220	+	2220	+	3220	+
800	10	0230	+	1230	+	2230	+	3230	+
1000	10	0240	+	1240	+	2240	+	3240	+
1200	10	0250	+	1250	+	2250	+	3250	+
1500	10	0260	+	1260	+	2260	+	3260	+
1800	10	0270	+	1270	+	2270	+	3270	+
2000	10	0280	+	1280	+	2280	+	3280	+

Rated frequency: 400 Hz = order no. 1717V...4 = additional charge

Accessories:	Order No.	
Sealing cap	1722V9130	+

Dimensional Drawing



Plug-On Current Transformers

Order Information

Code: B0

Type ASK 105.6

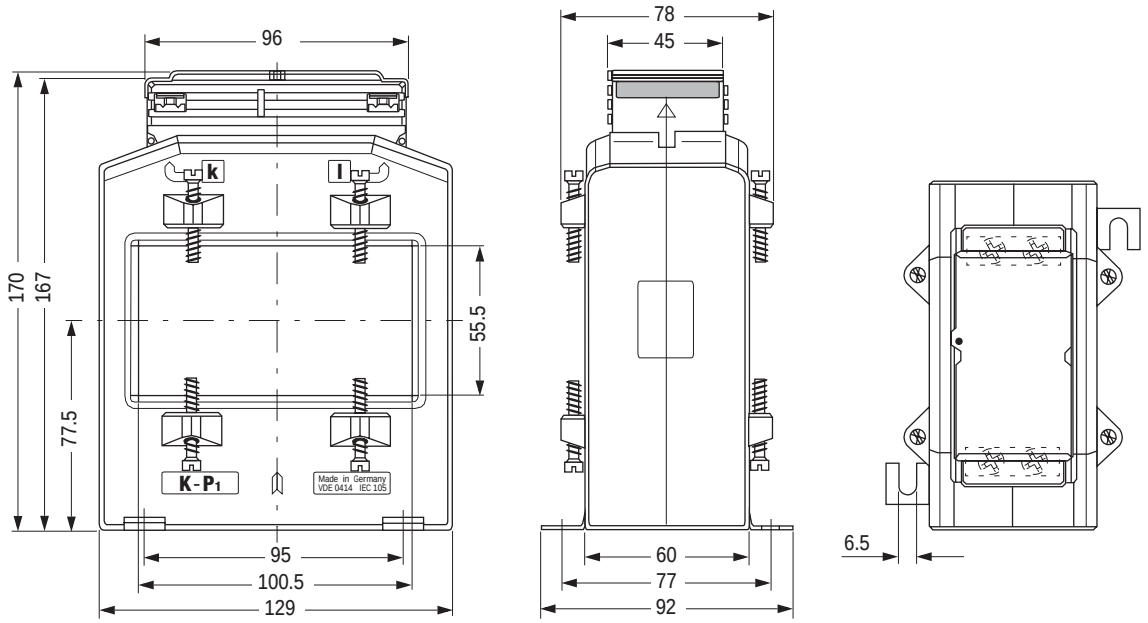
Primary Conductor	100 x 55 mm
Round Conductor	55 mm dia.
Transformer Width	129 mm

Rated Primary Current		Class 1				Class 0.5			
		secondary: 5 A		secondary: 1 A		secondary: 5 A		secondary: 1 A	
		Order No. 1718V		Order No. 1718V		Order No. 1718V		Order No. 1718V	
A	VA	+ ⬇		+ ⬇		+ ⬇		+ ⬇	
1500	10	0260	+	1260	+	2260	+	3260	+
1800	10	0270	+	1270	+	2270	+	3270	+
2000	10	0280	+	1280	+	2280	+	3280	+
2500	10	0290	+	1290	+	2290	+	3290	+
3000	10	0300	+	1300	+	2300	+	3300	+
4000	10	0310	+	1310	+	2310	+	3310	+

Rated frequency: 400 Hz = order no. 1718V...4 = additional charge

Accessories:	Order No.	
Sealing cap	1722V9130	+

Dimensional Drawing



Code: B0

Type WSK 30

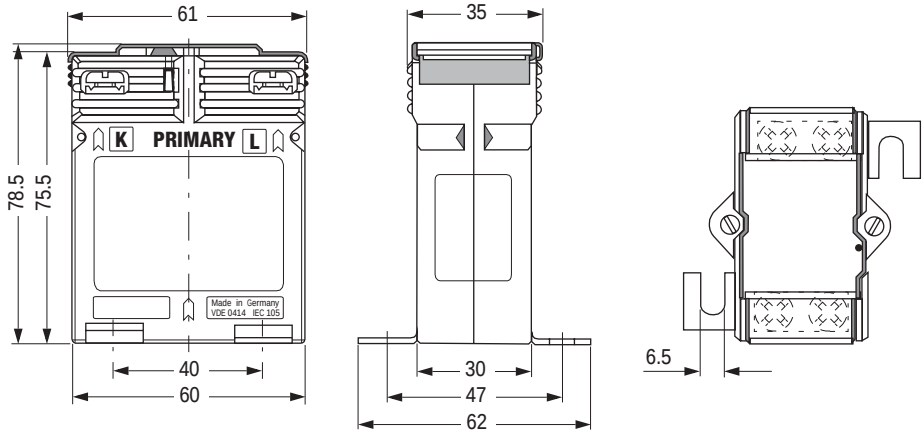
Transformer Width 60 mm

Rated Primary Current A	VA	Class 1 secondary: 5 A Order No. 1719V + ⬇		Class 1 secondary: 1 A Order No. 1719V + ⬇		Class 0.5 secondary: 5 A Order No. 1719V + ⬇		Class 0.5 secondary: 1 A Order No. 1719V + ⬇	
1	2.5	–	–	–	–	2010	+	3010	+
1	5	0010	+	1010	+	–	–	–	–
2.5	2.5	–	–	–	–	2020	+	3020	+
2.5	5	0020	+	1020	+	–	–	–	–
5	2.5	–	–	–	–	2030	+	3030	+
5	5	0030	+	1030	+	–	–	–	–
10	2.5	–	–	–	–	2040	+	3040	+
10	5	0040	+	1040	+	–	–	–	–
15	2.5	–	–	–	–	2050	+	3050	+
15	5	0050	+	1050	+	–	–	–	–
20	2.5	–	–	–	–	2060	+	3060	+
20	5	0060	+	1060	+	–	–	–	–

Rated frequency: 400 Hz = order no. 1719V...4 = additional charge

Accessories:	Order No.	
Snap-on fasteners for mounting to 35 mm top-hat rail per DIN EN 50022	1722V9010	+
Sealing cap	1722V9110	+

Dimensional Drawing



Type WSK 40

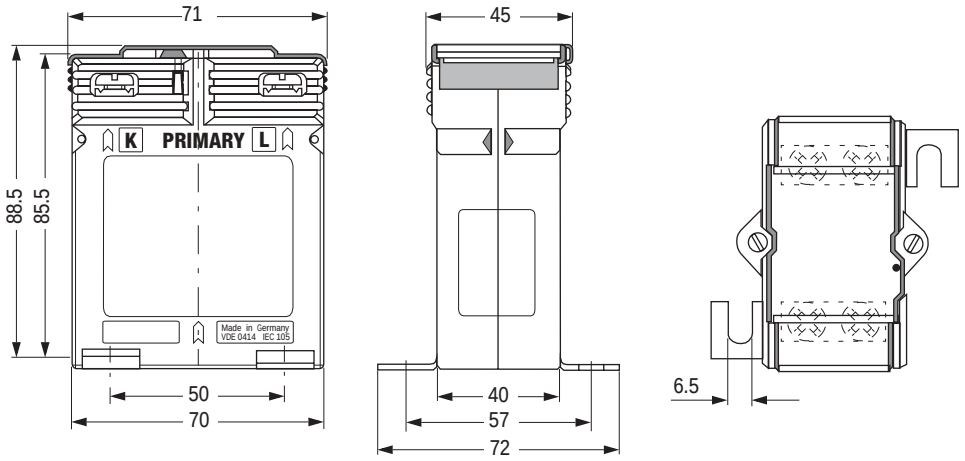
Transformer Width 70 mm

Rated Primary Current		Class 1				Class 0.5			
		secondary: 5 A		secondary: 1 A		secondary: 5 A		secondary: 1 A	
		Order No. 1720V		Order No. 1720V		Order No. 1720V		Order No. 1720V	
A	VA	+ ⬇		+ ⬇		+ ⬇		+ ⬇	
1	10	0010	+	1010	+	2010	+	3010	+
2.5	10	0020	+	1020	+	2020	+	3020	+
5	10	0030	+	1030	+	2030	+	3030	+
10	10	0040	+	1040	+	2040	+	3040	+
15	10	0050	+	1050	+	2050	+	3050	+
20	10	0060	+	1060	+	2060	+	3060	+
25	10	0070	+	1070	+	2070	+	3070	+
30	5	–	–	–	–	2080	+	3080	+
30	10	0080	+	1080	+	–	–	–	–
40	5	–	–	–	–	2090	+	3090	+
40	10	0090	+	1090	+	–	–	–	–

Rated frequency: 400 Hz = order no. 1720V...4 = additional charge

Accessories:	Order No.	
Snap-on fasteners for mounting to 35 mm top-hat rail per DIN EN 50022	1722V9020	+
Sealing cap	1722V9120	+

Dimensional Drawing



Code: B0

Type WSK 70.6 N

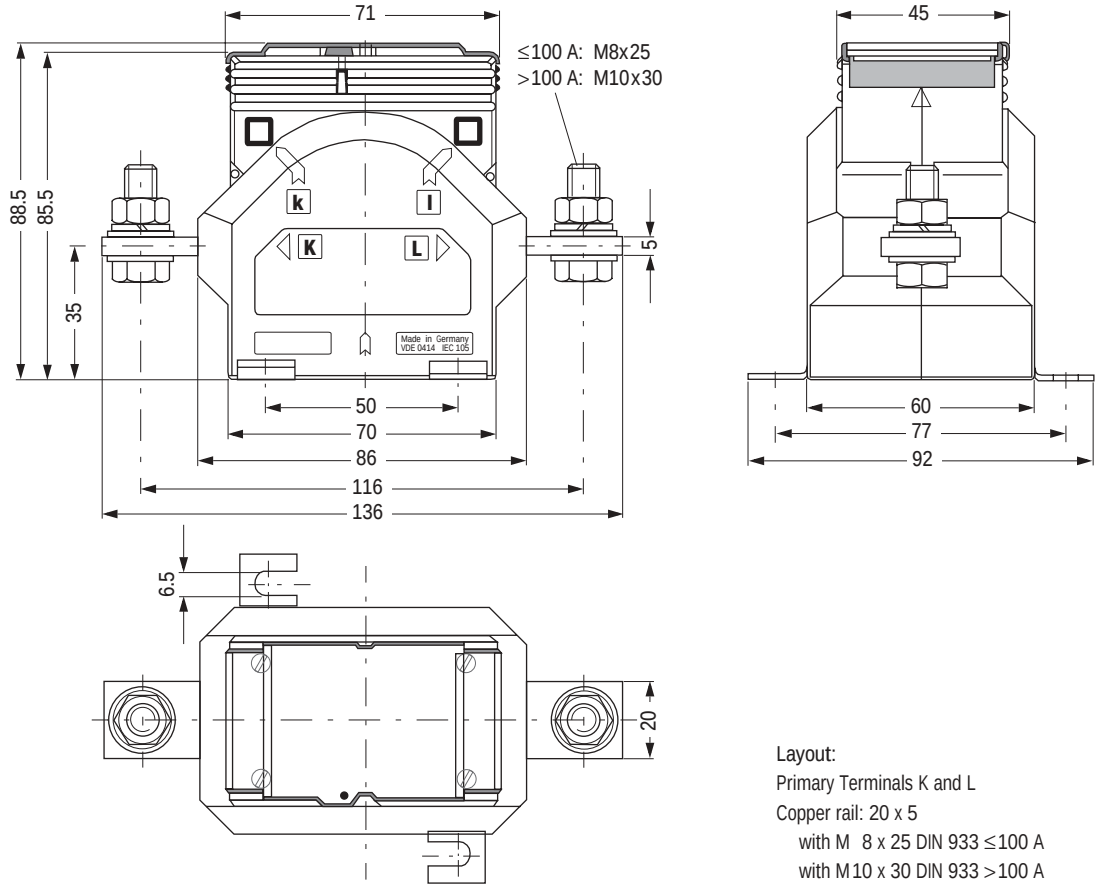
Transformer Width 70 mm

Rated Primary Current		Class 1				Class 0.5			
		secondary: 5 A		secondary: 1 A		secondary: 5 A		secondary: 1 A	
		Order No. 1721V		Order No. 1721V		Order No. 1721V		Order No. 1721V	
A	VA	+ ⬇		+ ⬇		+ ⬇		+ ⬇	
30	10	0080	+	1080	+	2080	+	3080	+
40	10	0090	+	1090	+	2090	+	3090	+
50	10	0100	+	1100	+	2100	+	3100	+
60	10	0110	+	1110	+	2110	+	3110	+
75	10	0120	+	1120	+	2120	+	3120	+
80	10	0130	+	1130	+	2130	+	3130	+
100	10	0140	+	1140	+	2140	+	3140	+
150	10	0150	+	1150	+	2150	+	3150	+

Rated frequency: 400 Hz = order no. 1721V...4 = additional charge

Accessories:	Order No.	
Sealing cap	1722V9120	+

Dimensional Drawing



Layout:
Primary Terminals K and L
Copper rail: 20 x 5
with M 8 x 25 DIN 933 ≤100 A
with M10 x 30 DIN 933 >100 A

Regulations and Standards

Our panel meters and limit transducers (MESSCONTACTER) comply with the regulations set forth in European guidelines 73/23/EWG and 89/336/EWG, which has been substantiated by adherence to the following standards:
DIN 57410 and. VDE 0410 (safety requirements for indicators)
IEC/EN 61010-1/A2, VDE 0411-1/A1 (safety requirements for limit transducers)
IEC 60051/EN 60051/DIN EN 60051 (measuring instruments with scale display)
EN 50081-2: 1993 EMV (interference emission, industrial)
EN 50082-2: 1995 EMV (interference immunity, industrial)

The most important regulations for the manufacture of electrical measuring instruments included therein, as well as their characteristics, are defined below.

Accuracy

The accuracy of a measuring instrument or any of its accessories is determined by inherent deviation limits and influence error limits.

Inherent deviation is the measurement deviation of a measuring instrument and/or any of its accessories, when these are operated under reference conditions (table I-1, DIN EN 60 051). Measuring instrument influence error, on the other hand, is the error which is measured when these are not operated under reference conditions, but rather within the limits defined by the nominal range of use (table II-1, DIN EN 60 051).

Our measuring instruments comply with accuracy class 1.5 unless otherwise specified for individual measuring instrument types. The measuring instruments can optionally be optionally manufactured to higher accuracy classes (class 1), in as far as this is possible.

The accuracy class is indicated on the scale, for example:
class 1.5 for indication error expressed as a percentage of the reference value.

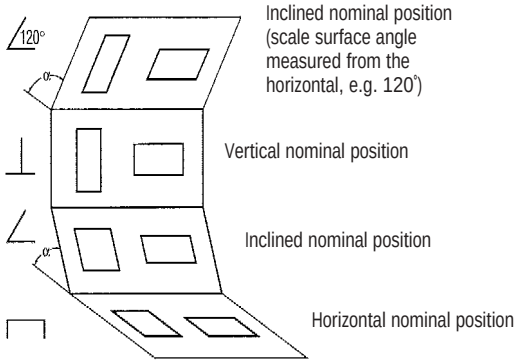
The reference value is generally the upper measuring range limit with the following exceptions:

- The reference value is equal to the sum of the electrical values which correspond to the upper and low measuring range values, independent of plus or minus sign, if both the electrical and the mechanical zero points lie within the scale.
- The reference value corresponds to one quadrant for phase sequence indicators.
- The reference value is equal to the difference between the resistance values of the upper and low measuring range values for resistance measuring instruments with linear scales.
- The reference value corresponds to the length of the scale for instruments with non-linear, contracting scales without a separate linear scale (e.g. resistance measuring instruments).
- The reference value is equal to the nominal value for accessories.

Reference Values and Influence Error

Position of Use

The nominal position of use is generally indicated with a positioning mark. The reference range includes every position between horizontal and vertical for instruments which do not include a positioning mark. The nominal range of use includes all positions within 5° in any direction from the reference position, and influence error (in addition to indication error) may not exceed 50% of the corresponding error class rating.



Operating Temperature Range

Unless otherwise specified, class 0.5 through class 5 instruments must be operated at an ambient temperature within a range of –25 to + 40 °C in order to prevent permanent damage during continuous operation.

Ambient Temperature Sensitivity

Unless otherwise specified, the reference temperature for class 0.5 through class 5 instruments is 23 °C ± 2 °C.
The nominal range of use is equal to reference temperature ±10 °C. Additional error within this temperature range may not exceed the error class rating.

Vibration and Mechanical Shock Resistance

Influence factors for vibration and shock have been set forth in DIN EN 60 051. Our measuring instruments comply with these requirements and are available as follows (see respective data sheet for individual availability):

Mechanical Stress	Shock Resistance	Vibration Resistance
Standard model	15 g_n 11 ms	0.15 mm 5 ... 55 Hz
Heightened requirements, LN56	30 g_n 11 ms	2.5 g_n 5 ... 55 Hz
Heightened requirements, LN55	50 g_n 11 ms	5.0 g_n 5 ... 55 Hz

Effects of Vibration and Shock

Unless otherwise specified, class 1 and higher measuring instruments and accessories must withstand the following shock and vibration tests, to which they are subjected during the course of type testing:

Vibration Test

Vibration testing must be performed with the following specifications:

- Sweep frequency range:
  10 Hz - 55 Hz - 10 Hz
- Wave amplitude: 0.15 mm
  (corresponds to 1.5 g_n at 50 Hz)
- Number of sweep cycles: 5
- Sweep velocity:
  1 octave per minute

The vibration plane is vertical and the measuring instrument is mounted to the vibration table in its usual operating position.

Shock Test

The shock test must be performed with the following specifications:

- Peak acceleration:
  a) 147 m/s^2 (15 g_n)
  b) 490 m/s^2 (50 g_n)
- No further explanation is required for peak acceleration value a). The manufacturer must indicate a peak acceleration value of 490 m/s^2 for value b).
- Waveshape: semi-sinusoidal
- Number of shocks: 3 shocks each in both directions for 3 mutually perpendicular axes (a total of 18 shocks)
- Shock duration: 11 ms

The measuring instrument must be secured such that one of the three axes corresponds to the direction of motion of the rotational axis of the measuring mechanism.
After completion of this test, an additional measuring error of 100% of the error class rating may not be exceeded.

Scale and Pointer Types

Scale and pointer types for quadrant and circular scales are defined in DIN 43 802, parts 2 through 4 (as of size 48 x 48 mm), as well as for horizontal and vertical scales (as of size 48 x 24 mm).

Our square and rectangular panel meters with edgewise scale are in compliance with these standards.

Unless otherwise specified, our measuring instruments and limit transducers (MESSCONTACTER) are provided with the following degree of protection in accordance with DIN VDE 0470:

IP 52 for housing front panel
IP 00 for terminals

Climate-Proof Measuring Instruments

In their “conditionally tropic-proof” versions, our measuring instruments are especially well suited for:

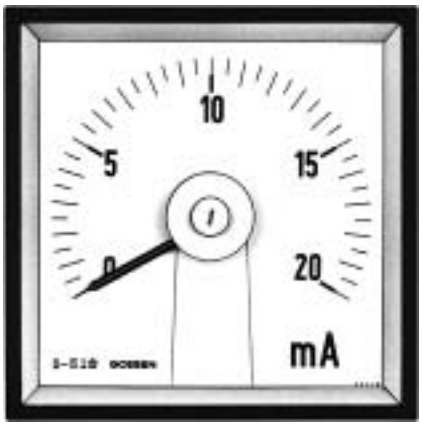
- Moisture endangered areas in the temperate zones
- Indoor use in the dry tropics
- Indoor use in the wet tropics, during which condensation or seepage water, which may be caused by air-conditioning, must be avoided.

Factor	Allowable Values	
	Standard Measuring Instruments	Conditionally Tropic-Proof Measuring Instruments
Operating Temperature Range	-25 ... + 40 °C	-25 ... + 55 °C
Relative Humidity	max. 85 % (max. temp.: + 27 °C) not for more than 60 days per year remaining days: 75% annual mean: 65%	max. 95 % (max. temp.: + 25 °C) not for more than 30 days per year remaining days: 85% annual mean: 75%
Condensation	none	none

Square Panel Meters for Direct Current or Direct Voltage

Moving-Coil Movement, 240° Scale
Narrow Bezel per DIN 43718, Dull Black

Front Dimensions Type	48 x 48 mm V-Pq 48-250	72 x 72 mm V-Pq 72-250	96 x 96 mm V-Pq 96-250	144 x 144 mm Pq 144-250
Scale Length	73 mm	113 mm	151 mm	235 mm
Accuracy Class	1.5	1.5	1.5	1.5
Weight in kg, Approx.	0.16	0.2	0.25	0.65
Nominal Insulation Voltage	660 V	1000 V	1000 V	660 V
Test Voltage	2 kV	3 kV	3 kV	2 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	type S	type S	type G
Housing Material	polycarbonate	polycarbonate	polycarbonate	sheet metal
Interchangeable Scale	yes	yes	yes	no



Type V-Pq 96-250

Description

Analog Panel Meter with Moving-Coil Movement

Display

Scale Graduation	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 (see above). Sheet metal housing for V-Pq 72-250 and V-Pq 96-250 available as option.
Replaceable	Glass faceplate, bezel and scale (no interchangeable scales for front dimensions 144 x 144 mm).
Terminals	M4 (voltmeters and ammeters ≤ 4 A) or M6 (ammeters > 4 A). 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

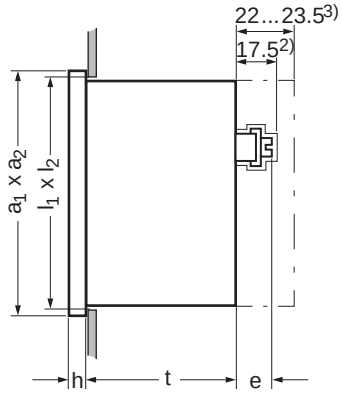
Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60051

Internal Resistance / Voltage Drop / Power Consumption[1])

Measuring Range	Ri
1 mA	337 Ω ±20%
5 mA	16.3 Ω ±20%
10 mA	3 Ω ±30%
20 mA	5 Ω ±30%
4 ... 20 mA	6.5 Ω ±30%
≥ 1 A Connection to shunt	Voltage drop 150 mV ±20% Power consumption 10 mA ±20% Lead resistance 0.06 Ω ±20%
≥1 V	1000 Ω / V ±20%

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

Dimensions



2) Individual contact protection
3) Full contact protection (22 mm only for 48 x 48 mm front dimensions)

Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth, mm	Terminals	
	a_1 x a_2	h	l_1 x l_2	(t)	≤4 A M4	> 4 A M6
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

Square Panel Meters
for Direct Current or Direct Voltage, 240° Scale

Code: B0

Order Example:
Moving-Coil Voltmeter, 96 x 96 mm,
240° Scale, 0 ... 40 V Direct Voltage
Order No. 1605P DC40

				Front Dim., mm Type Order no. ➡ + ⬇	48 x 48 V-Pq48-250 1668P	72 x 72 V-Pq72-250 1602P	96 x 96 V-Pq96-250 1605P	144 x 144 Pq144-250 1621P
Meas. Input – Direct Current	Connection							
Zero Point	left			–				
	center			BC2	+	+	+	+
	as desired			BC20	+	+	+	+
		direct	1 mA/5 mA/10 mA	CB1/5/10	+	+	+	+
			20 mA	CB20	+	+	+	+
			1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+	+	+	+
			6 A/10 A	CC6/10	–	+	+	+
			15 A/25 A/40 A	CC15/25/40	–	+	+	+
	mech. suppressed		4 ... 20 mA	BC10	+	+	+	+
	left	at shunt resistor .../60 mV		BE3	+	+	+	+
		at shunt resistor .../150 mV		BE4	+	+	+	+
Meas. Input – Direct Voltage	Connection							
Zero Point	left			–				
	center			BC2	+	+	+	+
	as desired			BC20	+	+	+	+
		direct	1/1.5/2.5/3/4/6/10 V 15/25/40/60 V 100/150/250/400/500/600 V	DC1 to DC600	+	+	+	+
Scale Characteristics	proportional to current			–	+	+	+	+
	per curve			SD6	+	+	+	+
Applications	standard			–	+	+	+	+
	conditionally tropic-proof			LB1	+	+	+	+
Protection	standard			–	+	+	+	+
	front panel: IP 54, terminals: IP00			LH21	+	+	+	+
Resistance to Vibration /	standard			–	+	+	+	+
Marine Applications	vibration resistance: 2.5 g, shock resistance: 30 g			LN56	+	+	+	+
	marine applications, German Lloyds			LN2	+	+	+	+
Bezel	dull black			–	+	+	+	+
	dull gray, RAL 7037			MA11	+	+	+	+
Glass Faceplate	standard			–	+	+	+	+
	anti-glare			MG1	+	+	+	+
Housing	standard			–	+	+	+	+
	sheet metal housing with cone-head rivets			ML4	–	+	+	– [1]
Fasteners	standard			–	+	+	+	+
	type S screw clamp			MN14	+	– [1]	– [1]	–
	4 leaf springs			MN1	+	+	+	–
Contact Protection	none			–	+	+	+	+
	full contact protection			VB2	+	+	+	+
	individual contact protection [2]			VB1	+	+	+	+
Identification	none			–	+	+	+	+
	at rear:			MZ998 ...	+	+	+	+
Scale Inscription	none			–	+	+	+	+
(Latin lettering)	≤15 characters in German			SM991 ...	+	+	+	+
	≤15 characters in other language			SM993 ...	+	+	+	+
Additional Numberings	none			–	+	+	+	+
	2nd set of numberings, black: ...			SK992 ...	+	+	+	+
Red Marker (RAL 2002)	none			–	+	+	+	+
	red marker at: ...			ST991 ...	+	+	+	+

Order Number Instructions:
- Select one model each for order numbers with the same sequence of letters.
- No add. entries are required for std. models (identified with bold type and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

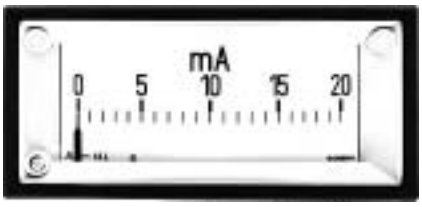
1) Standard model
2) Voltmeters and ammeters ≤ 4A

Square Panel Meters for Direct Current or Direct Voltage

Technical Data

Moving-Coil Movement, Edgewise Scale Narrow Bezel per DIN 43718, Dull Black

Front Dimensions Type	48 x 24 mm Pf 48 x 24	72 x 36 mm Pf 72 x 36	96 x 48 mm Pfn 96 x 48	144 x 72 mm Pf 144 x 72
Scale Length	29 mm	44 mm	65 mm	96 mm
Accuracy Class	2.5	1.5	1.5	1.5
Weight in kg, Approx.	0.07	0.18	0.45	1.0
Nominal Insulation Voltage	660 V	660 V	660 V	660 V
Test Voltage	2 kV	2 kV	2 kV	2 kV
Front Housing-Panel Protection	IP 50	IP 52	IP 52	IP 50
Fasteners (see next page)	expanding spring	screw spindle	screw spindle	type C
Housing Material	sheet metal	polycarbonate	polycarbonate	sheet metal



Type Pfn 96 x 48

Description

Analog Panel Meter with Moving-Coil Movement

Display

Scale Graduation	Coarse-fine Exception: special graduation for 48 x 24 mm meters
Pointer	Beam pointer with knife-edge Exception: beam pointer for 48 x 24 mm meters

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0 or sheet metal housing (see above).		
Replaceable	Glass faceplate and bezel		
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 ea. 2.8 x 0.8 (IP 20 protection)
	144 x 72	terminal clip	M 5
Contact Protection	Available as option		

Internal Resistance / Voltage Drop / Power Consumption [1])

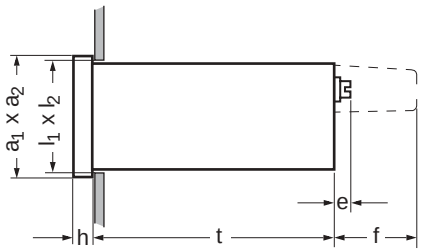
	Front Dim. in mm			
	48 x 24	72 x 36	96 x 48	144 x 72
Measuring Range	Ri	Ri	Ri	Ri
1mA	66 Ω ±20%	67 Ω ±20%	76 Ω ±20%	69 Ω ±20%
5 mA	5 Ω ±30%	41 Ω ±20%	60 Ω ±20%	5.8 Ω ±30%
10 mA	3.5 Ω ±30%	20.5 Ω ±20%	30 Ω ±20%	1.6 Ω ±30%
20 mA	3 Ω ±30%	10 Ω ±20%	15 Ω ±20%	3 Ω ±30%
4 ... 20 mA	3 Ω ±30%	10 Ω ±20%	18 Ω ±20%	3 Ω ±30%
Voltage drop at ≥ 1 A	60 mV ±20%	≤73 mV ±20%	90 mV±20%	60 mV ±20%
Power consumption for connection to shunt (lead resistance 0.06 Ω)	6 mA ±20%	6 mA ±20%	6 mA ±20%	6 mA ±20%
≥ 1 V	1 kΩ/V ±20%	1 kΩ/V ±20%	1 kΩ/V ±20%	1 kΩ/V ±20%

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

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ±1°
Other	DIN EN 60051

Dimensions



Front Dim. in mm	Nominal Dim., mm		Cutout, mm	Installation Depth	Terminals e		Contact Protection at Terminals f = Full Contact Protection
	a_1 x a_2	h	l_1 x l_2	t	≤ 4 A	> 4 A	
48 x 24	48 x 24	5	$45^{+0.6}$ x $22.2^{+0.3}$	65	11	–	31
72 x 36	72 x 36	5	$68^{+0.7}$ x 33 $^{+0.6}$	105	0	0	–
96 x 48	96 x 48	5	$92^{+0.8}$ x 45 $^{+0.6}$	126	0	0	–
144 x 72	144 x 72	8	138^{+1} x 68 $^{+0.7}$	168	4	6	–

Order Example:
Moving-Coil Voltmeter, 96 x 48 mm, Landscape Format,
0 ... 40 V Direct Voltage
Order No.: 1594P DC40

			Front Dim., mm Type Order no. ➡ + ⬇	48 x 24 Pf 48 x 24 1511P	72 x 36 Pf 72 x 36 1505P	96 x 48 Pfn 96 x 48 1594P	144 x 72 Pf 144 x 72 1584P
Format		landscape	HQ 1	+	+	+	+
		portrait	HQ 2	+	+	+	+
Meas. Input – Direct Current	Connection						
Zero Point	**left** (landscape)						
	bottom (portrait)						
	center		BC2	+	+	+	+
	as desired		BC20	+	+	+	+
		direct					
		1 mA/5 mA/10 mA	CB1/5/10	+	+	+	+
		20 mA	CB20	+	+	+	+
		1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+	+	+	+
		6 A	CC6	–	–	–	+
		10 A/15 A	CC10/15	–	–	–	+
		25 A	CC25	–	–	–	+
		40 A/60 A	CC40/60	–	–	–	+
	mech. suppressed	4 ... 20 mA	BC10/BC 14 [1]	+	+	+	+
		at shunt resistor .../60 mV	BE3	+	+	+	+
		at shunt resistor .../150 mV	BE4	+	+	+	+
Meas. Input – Direct Voltage	Connection						
Zero Point	**left** (landscape)						
	bottom (portrait)						
	center		BC2	+	+	+	+
	as desired		BC20	+	+	+	+
		direct					
		1/1.5/2.5/3/4/6/10 V	DC1				
		15/25/40/60 V	to				
		100/150/250/400/500/600 V	DC600	+	+	+	+
Scale Characteristics	**proportional to current**		–	+	+	+	+
	per curve		SD6	+	+	+	+
Applications	**standard**		–	+	+	+	+
	conditionally tropic-proof		LB1	+	+	+	+
Protection	**standard**		–	+	+	+	+
	front panel: IP 54, terminals: IP00		LH21	+	–	–	+
	front panel: IP 54, terminals: IP20		LH22	–	+	+	–
Resistance to Vibration /	**standard**		–	+	+	+	+
Marine Applications	vibration resistance: 2.5 g, shock resistance: 30 g		LN56	+ [2]	+	+	+
	marine applications, German Lloyds		LN2	–	–	– [3]	+ [4]
Bezel	**dull black**		–	+	+	+	+
	dull gray, RAL 7037		MA11	+	+	+	+
Glass Faceplate	**standard**		–	+	+	+	+
	anti-glare		MG1	+	+	+	+
Fasteners	**standard**		–	+	+	+	+
	fastening tabs		MN50	+	–	–	–
Contact Protection	**none**		–	+	+	+	+
	full contact protection		VB2	+	–	–	–
	individual contact protection		VB1	+	+	+	+
Identification	**none**		–	+	+	+	+
	at rear:		MZ998 ...	+	+	+	+
Scale Inscription	**none**		–	+	+	+	+
(Latin lettering)	≤15 characters in German		SM991 ...	+	+	+	+
	≤15 characters in other language		SM993 ...	+	+	+	+
Additional Numberings	**none**		–	+	+	+	+
	2nd set of numberings, black: ...		SK992 ...	+	+	+	+
Red Marker (RAL 2002)	**none**		–	+	+	+	+
	red marker at: ...		ST991 ...	+	+	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No add. entries required for std. models (identified with bold type and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) BC 10 for landscape format, BC 14 for portrait format
2) Only in combination with fastening tabs
3) Available as type Pf255 (data sheetE3/9)
4) 0 ... 1 mA, 0 ... 20 mA, 4 ... 20 mA, ≥ 1.5 V

Rectangular Panel Meters for Direct Current or Direct Voltage

Moving-Coil Movement, Slim-Line Scale, Dull Black Bezel

Front Dimensions Type	48 x 18.5 mm Pff 00	72 x 18.5 mm Pff 0	72 x 24 mm Pff 72 x 24	96 x 24 mm Pffn 96 x 24	
Scale Length	29 mm	50 mm	50 mm	65 mm	
Accuracy Class	2.5	2.5	2.5	1.5	
Weight in kg, Approx.	0.05	0.09	0.1	0.13	
Nominal Insulation Voltage	660 V	660 V	660 V	660 V	
Test Voltage	2 kV	2 kV	2 kV	2 kV	
Front Housing-Panel Protection	IP 50	IP 50	IP 50	IP 52	
Fasteners (see next page)	tabs	tabs	exp. spring	screw spindle	
Housing Material	sheet metal	sheet metal	sheet metal	polycarbonate	

Type Pffn 96 x 24

Description

Analog Panel Meter with Moving-Coil Movement

Display

Scale Graduation — for sizes:
- 48 x 18.5
- 72 x 18.5
- 72 x 24
- 96 x 24

→ Special graduation

Pointer — for sizes:
- 48 x18.5
- 72 x 18.5
- 72 x 24

→ Beam pointer

96 x 24 → Beam pointer with knife-edge

Mechanical Design

Housing Material: Polycarbonate, self-extinguishing and drip-proof per UL94V-0 or sheet metal housing (see above).

Replaceable: Glass faceplate and bezel

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 ea. 2.8 x 0.8 (IP20 protection)

Contact Protection: available as option

Reference Conditions

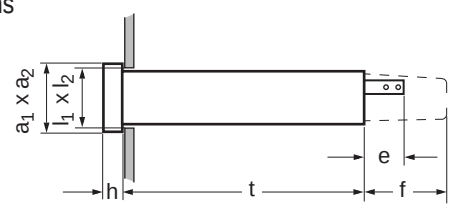
Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Other	DIN EN 60051

Internal Resistance / Voltage Drop / Power Consumption [1]

	Front Dim. in mm 48 x 18.5 72 x 18.5 72 x 24	 96 x 24	
Measuring Range	Ri	Ri	
1 mA	66 Ω ±20%	76 Ω ±20%	
5 mA	5 Ω ±30%	60 Ω ±20%	
10 mA	3.5 Ω ±30%	30 Ω ±20%	
20 mA	3 Ω ±30%	15 Ω ±20%	
4 ... 20 mA	3 Ω ±30%	18 Ω ±20%	
Voltage drop at ≥1A	60 mV ±20%	90 mV ±20%	
Power consumption at Connection to shunt (lead resistance 0.06 Ω)	6 mA ±20%	6 mA ±20%	
≥ 1 V	1 kΩ/V ±20%	1 kΩ/V ±20%	

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

Dimensions



Front Dim. in mm	Nominal Dim., mm $a_1 \times a_2$	h	Cutout, mm $l_1 \times l_2$	Installation Depth, mm 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	$68^{+0.7} \times 22.2^{+0.3}$	90	11	31
96 x 24	96 x 24	5	$92^{+0.8} \times 22.2^{+0.3}$	126	0	–

Order Example:
Moving-Coil Voltmeter, 96 x 24 mm, Landscape Format,
0 ... 40 V Direct Voltage
Order No.: 1524P DC40

			Front Dim., 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	
			Order no. ➡ / + ⬇	1194P	1196P	1515P	1524P	
Format		landscape	HQ 1	+	+	+	+	
		portrait	HQ 2	+	+	+	+	
Meas. Input – Direct Current	Connection							
Zero Point	left (landscape)							
	bottom (portrait)							
	center		BC2	+	+	+	+	
	as desired		BC20	+	+	+	+	
		direct						
		1 mA/5 mA/10 mA	CB1/5/10	+	+	+	+	
		20 mA	CB20	+	+	+	+	
		1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+	+	+	+	
	mech. suppressed	4 ... 20 mA	BC10/BC 14 [1]	+	+	+	+	
		at shunt resistor .../60 mV	BE3	+	+	+	+	
		at shunt resistor .../150 mV	BE4	+	+	+	+	
Meas. Input – Direct Voltage	Connection							
Zero Point	left (landscape)							
	bottom (portrait)							
	center		BC2	+	+	+	+	
	as desired		BC20	+	+	+	+	
		direct						
		1/1.5/2.5/3/4/6/10 V	DC1					
		15/25/40/60 V	to					
		100/150/250/400/500/600 V	DC600	+	+	+	+	
Scale Characteristics	proportional to current		–	+	+	+	+	
	per curve		SD6	+	+	+	+	
Applications	standard		–	+	+	+	+	
	conditionally tropic-proof		LB1	+	+	+	+	
Protection	standard		–	+	+	+	+	
	front panel: IP 54, terminals: IP00		LH21	–	–	+	+	
	front panel: IP 54, terminals: IP20		LH22	–	–	+	+	
Vibration Resistance	standard		–	+	+	+	+	
	vibr. resistance: 2.5 g, shock resistance: 30 g		LN56	+	+	+[2]	+	
Bezel	dull black		–	+	+	+	+	
	dull gray, RAL 7037		MA11	+	+	+	+	
Glass Faceplate	standard		–	+	+	+	+	
	anti-glare		MG1	+	+	+	+	
Fasteners	standard		–	+	+	+	+	
	fastening tabs		MN50	– [3]	– [3]	+	–	
Contact Protection	none		–	+	+	+	+	
	full contact protection		VB2	–	–	+	–	
	individual contact protection		VB1	+	+	+	+	
Identification	none		–	+	+	+	+	
	at rear:		MZ998 ...	+	+	+	+	
Scale Inscription	none		–	+	+	+	+	
(Latin lettering)	≤15 characters in German		SM991 ...	+	+	+	+	
	≤15 characters in other language		SM993 ...	+	+	+	+	
Additional Numberings	none		–	+	+	+	+	
	2nd set of numberings, black: ...		SK992 ...	+	+	+	+	
Red Marker (RAL 2002)	none		–	+	+	+	+	
	red marker at: ...		ST991 ...	+	+	+	+	

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No add. entries are required for std. models (identified with bold type and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) BC 10 for landscape format, BC 14 for portrait format
2) Only in combination with fastening tabs
3) Standard model

Rail-Mount Indicators for Direct Current or Direct Voltage

Moving-Coil Movement, 90° Scale, White Rail-Mount Housing, DIN EN 50022 - 35 x 7.5 or DIN EN 50022 - 35 x 15

Front Dimensions Type	45 x 45 mm Pqs 45 T
Scale Length	37 mm
Accuracy Class	1.5
Weight in kg, Approx.	0.14
Nominal Insulation Voltage	660 V
Test Voltage	2 kV
Front Housing-Panel Protection	IP 50
Housing Material	polycarbonate
Interchangeable Scale	yes

Type Pqs 45 T

Description

Analog Indicator with Moving-Coil Movement, for Mounting to Top-Hat Rail or Wall

Display

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

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0
Replaceable	Scale
Terminals	M4 screw 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

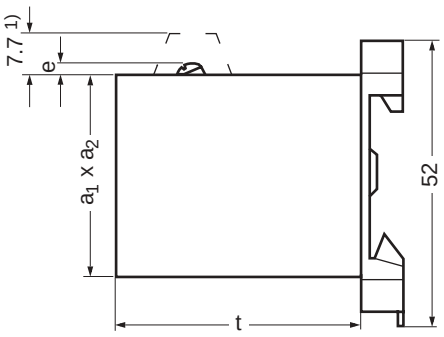
Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1 °
Other	DIN EN 60051

Internal Resistance / Voltage Drop / Power Consumption[1])

Measuring Range	Ri
1 mA	79 Ω ± 20%
1.5 mA	37.5 Ω ± 20%
2 mA	21 Ω ± 20%
2.5 mA	11.4 Ω ± 20%
4 mA	6.7 Ω ± 30%
5 mA	4.8 Ω ± 30%
6 mA	3 Ω ± 30%
10 mA	3.4 Ω ± 30%
15 mA	4 Ω ± 30%
20 mA	3 Ω ± 30%
25 mA	2.4 Ω ± 30%
> 25 mA	Voltage drop 60 mV ± 20%
Connection to shunt	Power consumption 6 mA ± 20%
≥ 60 mV	1000 Ω/V ± 20%

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

Dimensions



Front Dim. in mm	Nominal Dimensions, mm a_1 x a_2	Cutout, mm l_1 x l_2	Installation Depth, mm t	Terminals e
45 x 45	45 x 45	–	54	2

1) Full contact protection

Rail-Mount Indicators for Direct Current or Direct Voltage

Code: B0

Order Example: Moving-Coil Voltmeter, 45 x 45 mm, for Mounting to Top-Hat Rail, 0 ... 40 V Direct Voltage Order No.: 1149P DC40			Front Dim. in mm Type Order no. ➡ + ⬇	45 x 45 Pqs 45 T 1149P
Meas. Input – Zero Point	Direct Current left	Connection		
	center		BC2	+
	as desired		BC20	+
		direct 1 mA/5 mA/10 mA 20 mA	 CB1/5/10 CB20	 + +
		1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+
	mech. suppressed	4 ... 20 mA	BC10	+
		at shunt resistor .../60 mV	BE3	+
		at shunt resistor .../150 mV	BE4	+
Meas. Input – Zero Point	Direct Voltage left	Connection		
	center		BC2	+
	as desired		BC20	+
		direct 1/1.5/2.5/4/6/10 V 15/25/40/60 V 100/150/250/400/500/600 V	 DC1 to DC600	 +
Scale Characteristics		**proportional to current** per curve	– SD6	+ +
Applications		**standard** conditionally tropic-proof	– LB1	+ +
Contact Protection		**none** full contact protection	– VB2	+ +
Identification		**none** at rear:	– MZ998 ...	+ +
Scale Inscription (Latin lettering)		**none** ≤15 characters in German ≤15 characters in other language	– SM991 ... SM993 ...	+ + +
Additional Numberings		**none** 2nd set of numberings, black: ...	– SK992 ...	+ +
Red Marker (RAL 2002)		**none** red marker at: ...	– ST991 ...	+ +

Order Number Instructions:

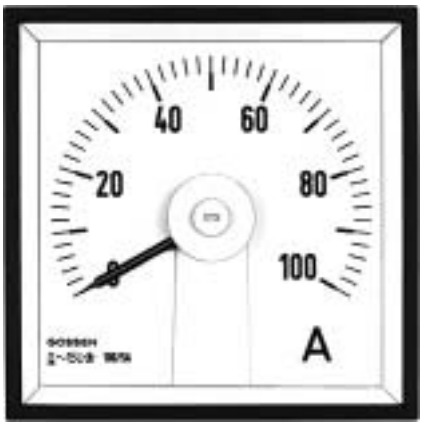
- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

Square Panel Meters

for Alternating Current 40 ... 45 ... 65 ... 1000 Hz or for Alternating Voltage 40 ... 45 ... 65 ... 10000 Hz

Moving-Coil Movement with Rectifier, 240° Scale, Narrow Bezel per DIN 43 718, Dull Black

Front Dimensions	48 x 48 mm	72 x 72 mm	96 x 96 mm	144 x 144 mm
Type	V-Pq 48-250	V-Pq 72-250	V-Pq 96-250	Pq 144-250
Scale Length	73 mm	113 mm	151 mm	235 mm
Accuracy Class	1.5	1.5	1.5	1.5
Weight in kg, Approx.	0.16	0.2	0.25	0.65
Nominal Insulation Voltage	660 V	1000 V	1000 V	660 V
Test Voltage	2 kV	3 kV	3 kV	2 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52	IP 52
Fasteners (see next page)	leaf spring	type S	type S	type G
Housing Material	polycarbonate	polycarbonate	polycarbonate	sheet metal
Interchangeable Scale	yes	yes	yes	no



Type V-Pq96-250

Description

Analog Panel Meter with Moving-Coil Movement and Rectifier

Display

Scale Graduation	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 (see above). Sheet metal housing for V-Pq72-250 and V-Pq96-250 available as option
Replaceable	Glass faceplate, bezel and scale (no interchangeable scales for front dimensions 144 x 144 mm)
Terminals	M4 screw terminals with self-lifting terminal clips. Screws can be turned with cross-head or standard screw drivers. Exception: M3 screw terminals for V-Pq48-250 ≥ 100 mA (with attached matching transformer)
Contact Protection	Available as option

Reference Conditions

Reference Quantities	Reference Condition
Waveshape	sinusoidal, total harmonic distortion ≤ 1%
Frequency	45 ... 65 Hz
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1 °
Other	DIN EN 60051

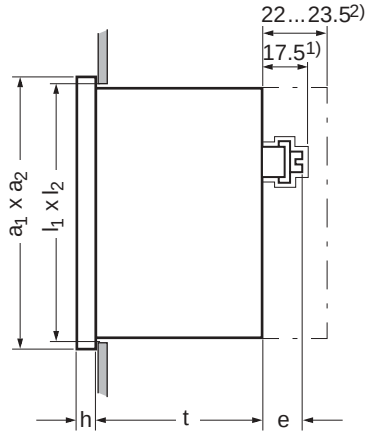
Voltage Drop / Power Consumption

Voltage Drop For Measuring Ranges	< 100 mA: approx. 1.2 V
Power Consumption For Measuring Ranges	≥ 100 mA: approx. 0.15 VA

Nominal range Of Use Limits

Frequency	alternating current: 40 ... 1000 Hz alternating voltage: 40 ... 10000 Hz

Dimensions



Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth, mm		Terminals	
	$a_1 \times a_2$	h	$l_1 \times l_2$	t	t_1	e	
						M4	≥ 100 mA M3
48 x 48	48 x 48	5	$45^{+0.6} \times 45^{+0.6}$	43.5	61.5 3)	12.5	5.5
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) Individual contact protection
2) Full contact protection (22 mm for 48 x 48 front dimensions only)
3) ≥ 100 mA with attached matching transformer

Square Panel Meters for Alternating Current or Alternating Voltage, 240° Scale

Code: B0

Order Example:
Moving-Coil Voltmeter for AC, 96 x 96 mm,
240° Scale, 0 ... 500 V
Order No.: 1605W DC500

		Front Dim., mm Type Order no. ➡ + ⬇	48 x 48 V-Pq48-250 1668W	72 x 72 V-Pq72-250 1602W	96 x 96 V-Pq96-250 1605W	144 x 144 Pq144-250 1621W
Meas. Input – Alternating Current	Connection direct 1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+	+	+	+
	at transformer sec.: 1 A	BE10	+	+	+	+
	at transformer sec.: 5 A	BE11	+	+	+	+
	at trans. sec.: 1 A (1.2-fold overload)	BE22	+	+	+	+
	at trans. sec.: 5 A (1.2-fold overload)	BE23	+	+	+	+
Meas. Input – Alternating Voltage	Connection direct 2.5/4/6/10 V 15/25/40/60 V 100/150/250/300/400/500/600 V	DC2.5 to DC600	+	+	+	+
	at transformer sec.: 100 V	BF12	+	+	+	+
	at transformer sec.: 110 V	BF15	+	+	+	+
	at trans. sec.: 100 V (1.2-fold overload)	BF25	+	+	+	+
	at trans. sec.: 110 V (1.2-fold overload)	BF26	+	+	+	+
Overload Capacity	none	–	+	+	+	+
	2-fold with integrated saturation transformer	BU20	–	–	+	+
	2-fold with separate saturation transformer *Attention: Saturation transformer only possible with connection via current transformer (order no. BE 10 and BE 11), and with nominal frequencies 50 Hz or 60 Hz.*	BU21	+	+	–	–
Scale Characteristics	proportional to current	–	+	+	+	+
	per curve	SD6	+	+	+	+
Applications	standard	–	+	+	+	+
	conditionally tropic-proof	LB1	+	+	+	+
Protection	standard	–	+	+	+	+
	front panel: IP 54, terminals: IP00	LH21	+	+	+	+
Resistance to Vibration / Marine Applications	standard	–	+	+	+	+
	vibr. resistance: 2.5 g, shock resistance: 30 g	LN56	+	+	+	+
	marine applications, German Lloyds	LN2	+	+	+	+
Bezel	dull black	–	+	+	+	+
	dull gray, RAL 7037	MA11	+	+	+	+
Glass Faceplate	standard	–	+	+	+	+
	anti-glare	MG1	+	+	+	+
Housing	standard	–	+	+	+	+
	sheet metal housing with cone-head rivets	ML4	–	+	+	–[1]
Fasteners	standard	–	+	+	+	+
	type S screw clamp	MN14	+	–[1]	–[1]	–
	4 leaf springs	MN1	+	+	+	–
Contact Protection	none	–	+	+	+	+
	full contact protection	VB2	+	+	+	+
	individual contact protection	VB1	+	+	+	+
Identification	none	–	+	+	+	+
	at rear:	MZ998 ...	+	+	+	+
Scale Inscription (Latin lettering)	none	–	+	+	+	+
	≤15 characters in German	SM991 ...	+	+	+	+
	≤15 characters in other language	SM993 ...	+	+	+	+
Additional Numberings	none	–	+	+	+	+
	2nd set of numberings, black: ...	SK992 ...	+	+	+	+
Red Marker (RAL 2002)	none	–	+	+	+	+
	red marker at: ...	ST991 ...	+	+	+	+

Order Number Instructions:

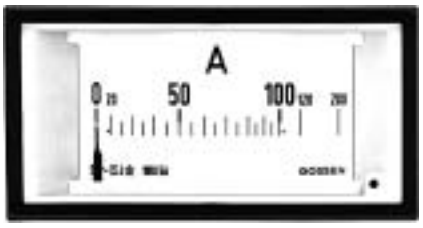
- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) Standard model

Rectangular Panel Meters for Alternating Current or Alternating Voltage 16 ... 65

Moving-Iron Movement, Edgewise Scale
Narrow Bezel per DIN 43718, Dull Black

Front Dimensions	96 x 48 mm	144 x 72 mm
Type	Af 96 x 48	Af 144 x 72
Scale Length	61 mm	96 mm
Accuracy Class for landscape	1.5	1.5
for portrait	1.5	2.5
Weight in kg, Approx.	0.5	1.2
Intrinsic Consumption with Connection via Voltage Transf.		
sec. /100 V (120 V)	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)
Connection via Current Transf.		
sec. 1 A	approx. 0.25 VA	approx. 0.25 VA
sec. 5 A	approx. 0.3 VA	approx. 0.3 VA
Nominal Insulation Voltage	1000 V	660 V
Test Voltage	3 kV	2 kV
Front Housing-Panel Protection	IP 50	IP 50
Fasteners (see next page)	type B	type C
Housing Material	sheet metal	sheet metal



Type Af 96 x 48

Description

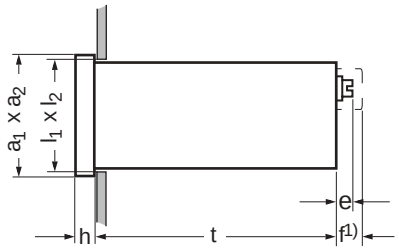
Analog Panel Meter with Moving-Iron Movement

Display	
Scale Graduation	Coarse-fine
Pointer	Beam pointer with knife-edge
Mechanical Design	
Housing Material	Sheet metal
Replaceable	Glass faceplate and bezel
Terminals	See table below
Contact Protection	Available as option (see table below)

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ±2 °C
Position of Use	control panel vertical ±1°
Frequency	16 ... 65 Hz
Other	DIN EN 60051

Dimensions



Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth	Terminals			Contact Protection at Terminals
	$a_1 \times a_2$	h	$l_1 \times l_2$	t	M4	M5	M6	f
96 x 48	96 x 48	5	$92^{+0.8} \times 45^{+0.6}$	115	3[2])	–	10[3])	16
144 x 72	144 x 72	8	$138^{+1} \times 68^{+0.7}$	168	–	6[4])	10[5])	16

1) Individual contact protection
2) ≤ 9 A
3) >9 A
4) ≤ 25 A
5) > 25 A

Rectangular Panel Meters for Alternating Current or Alternating Voltage

Code: B0

Order Example:
Moving-Iron Voltmeter, 96 x 48 mm, Landscape Format,
0 ... 300 V Alternating Voltage
Order No.: 1535E DC300

			Front Dim. in mm Type Order no. ➡ + ⬇	96 x 48 Af 96 x 48 1535E	144 x 72 Af 144 x 72 1584E
Format		landscape	HQ1	+	+
		portrait	HQ2	+	+
Meas. Input – Alternating Current	Connection				
	direct				
	1 A/1.5 A/2.5 A/4 A/6 A		CC1/1.5/2.5/4/6	+	+
	10 A/15 A/25 A		CC10/15/25	+	+
	40 A/60 A		CC40/60	–	+
	at transformer sec.: 1 A		BE10	+	+
	at transformer sec.: 5 A		BE11	+	+
Meas. Input – Alternating Voltage	Connection				
	direct				
	6/10/15/25/40/60 V		DC6/10/15/25/40/60	+	+
	100 V		DC100	+	+
	150/250/300 V		DC150/250/300	+	+
	400/500/600 V		DC400/500/600	+	+
	at transformer sec.: 100 V		BF12	+	+
	at transformer sec.: 110 V		BF15	+	+
Overload Capacity	none		–	+	+
	1.2-fold		BU5	+	+
	2-fold (for ammeters only)		BU10	+	+
Applications	standard		–	+	+
	conditionally tropic-proof		LB1	+	+
Protection	standard		–	+	+
	front panel: IP 54, terminals: IP00		LH21	+	+
Resistance to Vibration / Marine Applications	standard		–	+	+
	vibration resistance: 2.5 g, shock resistance: 30 g		LN56	+	+
Bezel	dull black		–	+	+
	dull gray, RAL 7037		MA11	+	+
Glass Faceplate	standard		–	+	+
	anti-glare		MG1	+	+
Fasteners	standard		–	+	+
	stop spring		MN21	+	–
Contact Protection	none		–	+	+
	individual contact protection		VB1	+[1)]	+
Identification	none		–	+	+
	at rear:		MZ998 ...	+	+
Scale Inscription (Latin lettering)	none		–	+	+
	≤15 characters in German		SM991 ...	+	+
	≤15 characters in other language		SM993 ...	+	+
Additional Numberings	none		–	+	+
	2nd set of numberings, black: ...		SK992 ...	+	+
Red Marker (RAL 2002)	none		–	+	+
	red marker at: ...		ST991 ...	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).h
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) For voltmeters and ammeters ≤ 6 A only

Rail-Mount Indicators for Alternating Current or Alternating Voltage 16 ... 65

Moving-Iron Movement, 90° Scale, White Rail-Mount Housing
DIN EN 50 022 - 35 x 7.5 or DIN EN 50 022 - 35 x 15

Front Dimensions	45 x 45 mm
Type	Aqs 45 T
Scale Length	37 mm
Accuracy Class	1.5
Weight in kg, Approx.	0.14
Nominal Insulation Voltage	660 V
Test Voltage	2 kV
Front Housing-Panel Protection	IP 50
Housing Material	polycarbonate
Interchangeable Scale	yes

Type Aqs 45T

Description
Analog Indicator with Moving-Iron Movement, for Mounting to Top-Hat Rail or Wall

Display

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

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0
Replaceable	Scale
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

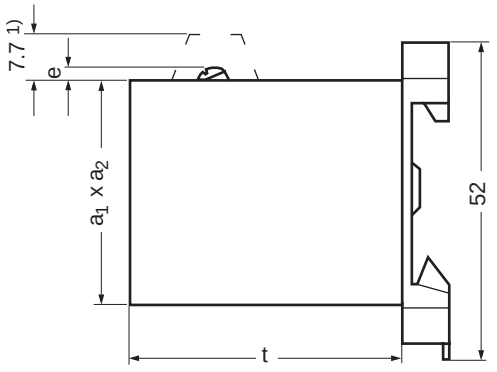
Intrinsic Consumption

For connection via current transformer	
sec. 1 A	approx. 0.25 VA
sec. 5 A	approx. 0.3 VA
Ammeters	
Depending upon measuring range	approx. 0.9 VA ... 2.5 VA

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ±2 °C
Position of Use	control panel vertical ±1°
Frequency	16 ... 65 Hz
Other	DIN EN 60051

Dimensions



Front Dim. in mm	Nominal Dimensions, mm $a_1 \times a_2$	Cutout, mm $l_1 \times l_2$	Installation Depth, mm t	Terminals e
45 x 45	45 x 45	–	54	2

Rail-Mount Indicators
for Alternating Current or Alternating Voltage

Code: B0

Order Example: Moving-Iron Ammeter, 45 x 45 mm, Rail-Mount, 0 ... 25 A Alternating Current Order No.: 1149E CC25		Front Dim. in mm Type Order no. ➡ + ⬇	45 x 45 Aqs 45T 1149E
Meas. Input – Alternating Current	Connection direct 1 A/1.5 A/2.5 A/4 A/6 A 10 A/15 A/25 A	 CC1/1.5/2.5/4/6 CC10/15/25	 + +
	at transformer sec.: 1 A at transformer sec.: 5 A	BE10 BE11	+ +
Meas. Input – Alternating Voltage	Connection direct 25/40/60 V 100 V 150/250/300 V 400/500/600 V	 DC25/40/60 DC100 DC150/250/300 DC400/500/600	 + + + +
Overload Capacity	none 1.2-fold 2-fold (for ammeters only)	– BU5 BU10	+ + +
Applications	standard conditionally tropic-proof	– LB1	+ +
Contact Protection	none full contact protection	– VB2	+ +
Identification	none at rear:	– MZ998 ...	+ +
Scale Inscription (Latin lettering)	none ≤15 characters in German ≤15 characters in other language	– SM991 ... SM993 ...	+ + +
Additional Numberings	none 2nd set of numberings, black: ...	– SK992 ...	+ +
Red Marker (RAL 2002)	none red marker at: ...	– ST991 ...	+ +

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

Square Panel Meters for Active or Reactive Power

Moving-Coil Movement with Power Converter, 240° Scale, Narrow Bezel per DIN 43718

Front Dimensions			96 x 96 mm
Type			LM 96-250
Scale Length			151 mm
Accuracy Class			1.5
Weight (standard model), Max.			0.86 kg
Intrinsic Consumption, Approx.			
Current Path			0.2 VA
Voltage Path	Order no.:	AB1/AB2/AB12/AB5/AB15	3.0 VA
		AB11	3.5 VA
		AB4/AB14	3.4 VA
		AB6	3.9 VA
		AB16	4.3 VA
Nominal Insulation Voltage			660 V
Test Voltage			2 kV
Front Housing-Panel Protection			IP 52
Fasteners			type S screw clamp
Housing Material			polycarbonate

Type LM 96-250

Description

Analog Panel Meter with Moving-Coil Movement and Integrated Power Converter for Active or 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 Graduation	Coarse-fine
Pointer	Beam pointer with knife-edge

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0
Fasteners	Standard: type S screw clamp alternative: • Subklew fasteners
Scale	Interchangeable scales Scales may only be replaced under voltage-free conditions!
Replaceable	Glass faceplate and bezel 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.
Terminal Designation	per DIN 43807
Contact Protection	Hand-safe full cover included

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ±1°
Frequency	45 Hz ... 65 Hz
	50 Hz ±0.1 Hz for order no.: AB11
Current Components	20 ... 120% of rated value
Voltage Components	98 ... 102% of rated value
Warm-Up Time	≥5 min
Other	DIN EN 60051

Notes Concerning the Determination of Measuring Ranges

The upper measuring range value should be a standard value per DIN 43701:
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 0.6 to 1.2 times apparent power.

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

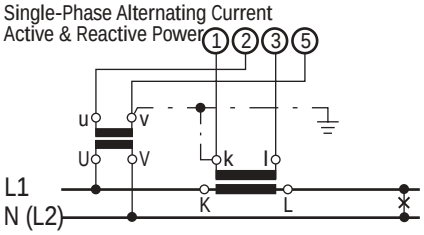
- Single-Phase AC $S = U \times I$
- Three-Phase $S = \sqrt{3} \times U \times I$

  where U equals phase-to-phase voltage

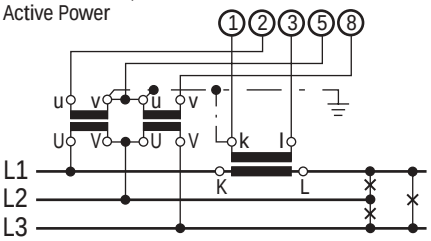
Square Panel Meters
for Active or Reactive Power, 240° Scale

Schematic Diagrams

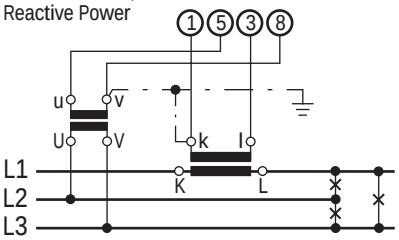
Single-Phase Alternating Current
Active & Reactive Power



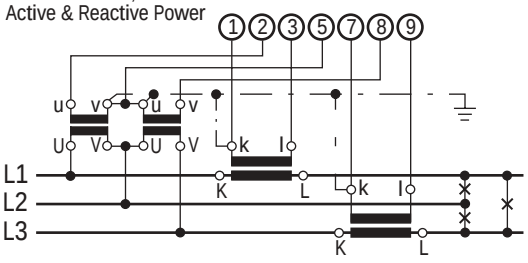
3-Phase 3-Wire, Balanced Load
Active Power



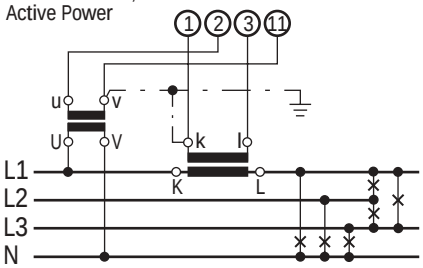
3-Phase 3-Wire, Balanced Load
Reactive Power



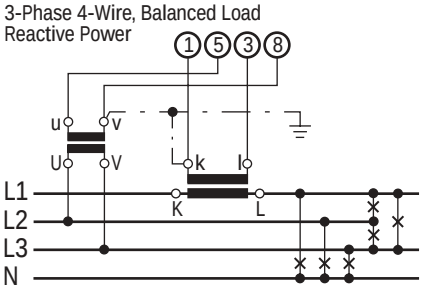
3-Phase 3-Wire, Unbalanced Load
Active & Reactive Power



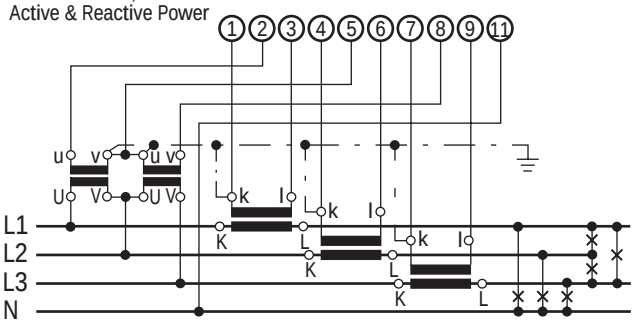
3-Phase 4-Wire, Balanced Load
Active Power



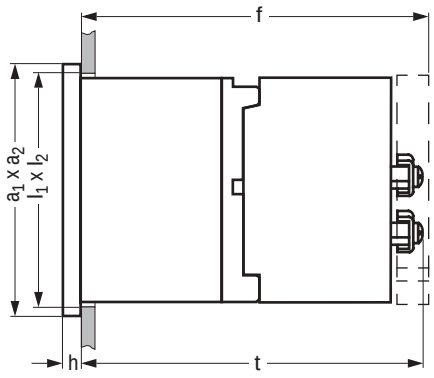
3-Phase 4-Wire, Balanced Load
Reactive Power



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



Dimensions



Front Dim., mm	Nominal Dim., mm		Cutout, mm	Order No.	Installation Depth, mm	
	$a_1 \times a_2$	h	$l_1 \times l_2$		Including Terminal (t)	Including 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	117	123
				AB6/AB16	143	149

Square Panel Meters
for Active or Reactive Power, 240° Scale

Code: B0

Order Example:
Active Power Meter for 3-Wire System, Unbalanced Load,
100/5 A Transformer Ratio, 400 V, Measuring Range: 0 ... 60 kW
Order No.: 3210D AB4 BE11 CG100 IL340 NB: 0 ... 60 kW

			Front Dim. in mm Type Order no. ➡ + ⬇	+ ⬇	+ ⬇	96 x 96 LM 96-250 3210D
System Type / Power Type	Voltage Path Terminal					
2-Wire System						
Active Power, Single Phase AC			AB1			+
	at transformer sec.: 100 V	primary voltage: ... V		BF12	DG ...	+
		primary voltage: ... kV		BF12	DH ...	+
	at transformer sec.: 110 V	primary voltage: ... V		BF15	DG ...	+
		primary voltage: ... kV		BF15	DH ...	+
	direct, 220 VAC			IL322	–	+
	direct, 230 VAC			IL323	–	+
	direct, 240 VAC			IL324	–	+
Reactive Power, Single Phase AC			AB11			+
	direct, 220 VAC			IL322	–	+
	direct, 230 VAC			IL323	–	+
	direct, 240 VAC			IL324	–	+
3-Wire System						
Active Power, 3-Wire, Balanced Load			AB2			+
Reactive Power, 3-Wire, Balanced Load			AB12			+
Active Power, 3-Wire, Unbalanced Load			AB4			+
Reactive Power, 3-Wire, Unbalanced Load			AB14			+
	at transformer sec.: 100 V	primary voltage: ... V		BF12	DG ...	+
		primary voltage: ... kV		BF12	DH ...	+
	at transformer sec.: 110 V	primary voltage: ... V		BF15	DG ...	+
		primary voltage: ... kV		BF15	DH ...	+
	direct, 380 VAC			IL338	–	+
	direct, 400 VAC			IL340	–	+
	direct, 415 VAC			IL661	–	+
	direct, 440 VAC			IL344	–	+
	direct, 500 VAC			IL350	–	+
4-Wire System						
Active Power, 4-Wire, Balanced Load			AB5			+
Reactive Power, 4-Wire, Balanced Load			AB15			+
Active Power, 4-Wire, Unbalanced Load			AB6			+
Reactive Power, 4-Wire, Unbalanced Load			AB16			+
	at transformer sec.: 100 V	primary voltage: ... V		BF12	DG ...	+
		primary voltage: ... kV		BF12	DH ...	+
	at transformer sec.: 110 V	primary voltage: ... V		BF15	DG ...	+
		primary voltage: ... kV		BF15	DH ...	+
	direct, 220/380 VAC			IL718	–	+
	direct, 230/400 VAC			IL723	–	+
	direct, 240/415 VAC			IL721	–	+
	direct, 254/440 VAC			IL722	–	+
	direct, 277/480 VAC			IL724	–	+
Current Path Terminal	at transformer sec.: 1 A	primary voltage: ... V		BE10	CG ...	+
		primary voltage: ... kV		BE10	CH ...	+
	at transformer sec.: 5 A	primary voltage: ... V		BE11	CG ...	+
		primary voltage: ... kV		BE11	CH ...	+
Zero Point	left		–	–	–	+
	center		BC2	–	–	+
	10% of positive upper value		BC6	–	–	+
Upper Measuring Range Value	(adjustable from 0.6 to 1.2 times apparent power)		NB ...	–	–	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

Order Information

Square Panel Meters for Active or Reactive Power, 240° Scale

Code: B0

		Front Dim. in mm Type Order no. ➡ + ⬇	96 x 96 LM 96-250 3210D
Scale Graduation	corresponds to measuring range	–	+
	blank scale, lower and upper value markings, company logo, symbols	GL98	+
Position of Use	standard	–	+
	... degrees from horizontal (bonded glass faceplate)	LA998...	+
	... degrees from horizontal (91 ... 135 degrees)	LA997...	+
Applications	standard	–	+
	conditionally tropic-proof, climatic category 3	LB4	+
Protection	standard	–	+
	front panel: IP 54, terminals: IP00	LH21	+
Resistance to Vibration / Marine Applications	standard	–	+
	vibration resistance: 2.5 g, shock resistance: 30 g	LN56	+
	marine applications, German Lloyds	LN8	– [1]
Bezel	dull black	–	+
	dull gray, RAL 7037	MA11	+
Glass Faceplate	standard	–	+
	anti-glare	MG1	+
Housing and Fasteners	standard	–	+
	polycarbonate housing with Subklew fasteners	ML10	+
Identification	none	–	+
	at rear:	MZ998 ...	+
Scale Inscription (Latin lettering)	none	–	+
	≤13 characters, one line:	SM904 ...	+
Additional Numberings	none	–	+
	2nd set of numberings, black: ...	SK982 ...	+
	2nd set of numberings, red (RAL 2002): ...	SK983 ...	+
Red Marker (RAL 2002)	none	–	+
	red marker at: ...	ST981 ...	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) In preparation

Synchronoscopes
for Varying and Steady Load 3-Phase Current

Technical Data

Electrodynamic Ratio Element, Narrow Bezel per DIN 43718, Dull Black

Front Dimensions	96 x 96 mm	144 x 144 mm
Type	SY 96	SY 144
Weight in kg, Approx.	1.0	1.1
Nominal Frequency	50 Hz	50 Hz
Intrinsic Consumption (at 100 V, 50 Hz)		
– Mains Side		
Active Component	approx. 4.5 W	approx. 4.5 W
Reactive Component	approx. 4.2 var cap.	approx. 4.2 var cap.
– Generator Side		
Active Component	approx. 4 W	approx. 4 W
Reactive Component	approx. 0.2 var ind.	approx. 0.2 var ind.
Nominal Insulation Voltage	660 V	660 V
Test Voltage	2 kV	2 kV
Front Housing-Panel Protection	IP 52	IP 52
Fasteners	type B (DIN 43835)	type B (DIN 43835)
Housing Material	sheet metal	sheet metal

Type SY 96

Description

Analog Panel Meter with Electrodynamic Ratio Elements and Rotating Pointer

Display

Scale Labelling	Red arrow identified with "+" and black arrow with "–"
Pointer	Beam pointer

Synchronoscopes

Synchronoscopes are circular scales with iron-free electrodynamic ratio elements. The scale has an indicator mark, as well as a red arrow identified with "+" and a black arrow identified with "–". The pointer is capable of rotating in both directions. It only points to the indicator mark if frequency and phase sequence are identical for both electrical circuits. If the pointer comes to rest at any other point, the frequencies may be identical but the voltages are not in phase. The direction of movement of the pointer varies depending upon how the circuit and the generator are connected to the synchronoscope (pointer can be made to move clockwise or counterclockwise for higher generator frequency).

Mechanical Design

Housing Material	Sheet metal housing
Terminals	M3 for size 96 x 96 mm M4 for size 144 x 144 mm
Contact Protection	Available as option

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Input Voltage	rated voltage range
Frequency	nominal frequency (see meas. movement variants) ± 0.2%
Other	DIN EN 60051

Nominal range Of Use Limits

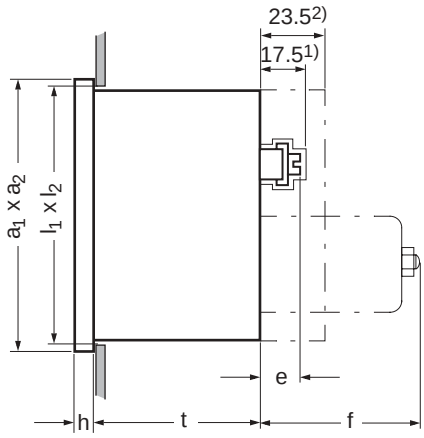
Frequency	nom. frequency	50 Hz:	48.5 ... 51.5 Hz
		60 Hz:	58.5 ... 61.5 Hz
		$16^2/_3$ Hz:	$16^1/_3$ ... 17 Hz

Dimensions for Separate Series Resistors

$102^{\pm 0.2}$ x $78^{\pm 0.4}$ x $59.5^{\pm 0.5}$ (W / D/ H)

Dimensional Drawing no. 1402 A40a (available upon request)

Dimensions



Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth	Terminals	Attachment from Rear
	a_1 x a_2	h	l_1 x l_2	t	e	f
96 x 96	96 x 96	5	$92^{+0.8}$ x $92^{+0.8}$	97.5	6 (M3)	58
144 x 144	144 x 144	8	138^{+1} x 138^{+1}	95	12.5 (M4)	58

1) Individual contact protection only possible with 144 x 144 mm front dimensions
2) Full contact protection only available with 96 x 96 mm front dimensions and with separate series resistor

Synchronoscopes
for Varying and Steady Load 3-Phase Current

Order Example: Synchronoscope, 96 x 96 mm, Nominal Voltage: 220 ... 230 V, Nominal Frequency: 50 Hz Order No.: 3240Q IL726 IK20		Front Dim. in mm Type Order no. ➡ + ⬇	96 x 96 SY 96 3240Q	144 x 144 SY 144 3290Q
Nominal Voltage Range (phase-to-phase voltage)				
	100 ... 110 V	IL 710	+	+
	220 ... 230 V	IL 726	+	+
	380 ... 400 V	IL 727	+	+
	440 V	IL 344	+	+
	450 ... 500 V	IL 720	+	+
Nominal Frequency				
	nominal freq.: 50 Hz	IK 20	+	+
	nominal freq.: 60 Hz	IK 21	+	+
	nominal freq.: 16 2/3 Hz	IK 1	+	+
Applications	**standard**	–	+	+
	conditionally tropic-proof	LB1	+	+
Protection	**standard**	–	+	+
	front panel: IP 54, terminals: IP00	LH21	+	+
Resistance to Vibration /	**standard**	–	+	+
Marine Applications	vibration resistance: 2.5 g, shock resistance: 30 g	LN56	+	+
	marine applications, German Lloyds	LN2	+	+
Bezel	**dull black**	–	+	+
	dull gray, RAL 7037	MA11	+	+
Glass Faceplate	**standard**	–	+	+
	anti-glare	MG1	+	+
Contact Protection	**none**	–	+	+
	full contact protection	VB2	+[1)]	–
	individual contact protection	VB1	–	+
Identification	**none**	–	+	+
	at rear:	MZ998 ...	+	+
Scale Inscription	**none**	–	+	+
(Latin lettering)	≤15 characters in German	SM991 ...	+	+
	≤15 characters in other language	SM993 ...	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) Only with separate series resistor (see opposite)

Double Voltmeters
for Alternating Voltage 16 ... 65 Hz

Moving-Iron Movement, Narrow Bezel per DIN 43718, Dull Black

Front Dimensions Type	96 x 96 mm AZqs 96	144 x 144 mm AZqs 144
Scale Length in mm	94/66	143/107
Accuracy Class	1.5	1.5
Weight in kg, Approx.	0.6	1.2
Nominal Insulation Voltage	660 V	660 V
Test Voltage	2 kV	2 kV
Front Housing-Panel Protection	IP 52	IP 52
Fasteners	type B (DIN 43835)	type B (DIN 43835)
Housing Material	sheet metal	sheet metal

Type AZqs 96

Description

Double Voltmeter with Two Independent Moving-Iron Movements

Display

Scale Graduation	Double graduation, coarse fine
Pointer	2 beam pointers with knife-edge

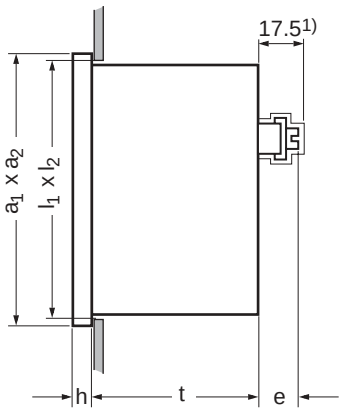
Mechanical Design

Housing Material	Sheet metal housing
Terminals	M4 Screw Terminals
Contact Protection	Available as option

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	control panel vertical ± 1°
Frequency	16 ... 65 Hz
Other	DIN EN 60051

Dimensions



Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth, mm	Terminals
	$a_1 \times a_2$	h	$l_1 \times l_2$	t	e M4
96 x 96	96 x 96	5	$92^{+0.8} \times 92^{+0.8}$	97.5	14.5
144 x 144	144 x 144	8	$138^{+1} \times 138^{+1}$	95	12.5

1) Individual contact protection

Dimensional Drawing 0101 A 261 (available upon request)

Double Voltmeters for Alternating Voltage

Order Example:
Double Voltmeter, 96 x 96 mm, 0 ... 250 V
Order No.: 1617E 1DC250 2DC250

		Front Dim. in mm Type Order no. ➡ + ⬇	96 x 96 AZqs 96 1617E	144 x 144 AZqs 144 1622E
Meas. Input – Alternating Voltage	Connection			
	direct			
	0 ... 100 V	1) • DC 100	+	+
	0 ... 120 V	• DC 120	+	+
	0 ... 150 V	• DC 150	+	+
	0 ... 250 V	• DC 250	+	+
	0 ... 300 V	• DC 300	+	+
	0 ... 400 V	• DC 400	+	+
	0 ... 500 V	• DC 500	+	+
	0 ... 600 V	• DC 600	+	+
	at transformer sec.: 100 V	1) • BF12	+	+
	at transformer sec.: 110 V	• BF15	+	+
Overload Capacity	none	–	+	+
	1.2-fold	1) • BU5	+	+
Applications	standard	–	+	+
	conditionally tropic-proof	LB1	+	+
Protection	standard	–	+	+
	front panel: IP 54, terminals: IP00	LH21	+	+
Resistance to Vibration /	standard	–	+	+
Marine Applications	vibration resistance: 2.5 g, shock resistance: 30 g	LN56	+	+
	marine applications, German Lloyds	LN2	+	+
Bezel	dull black	–	+	+
	dull gray, RAL 7037	MA11	+	+
Glass Faceplate	standard	–	+	+
	anti-glare	MG1	+	+
Contact Protection	none	–	+	+
	individual contact protection	VB1	+	+
Identification	none	–	+	+
	at rear:	MZ998 ...	+	+
Scale Inscription	none	–	+	+
(Latin lettering)	≤15 characters in German	SM991 ...	+	+
	≤15 characters in other language	SM993 ...	+	+
Red Marker (RAL 2002)	none	–	+	+
	red marker at: ...	1) • ST991 ...	+ 2)	+ 2)

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

1) Order information required for each measuring movement, only one measuring range possible for both measuring movements
   - Supplement with 1 for measuring movement I
   - Supplement with 2 for measuring movement II

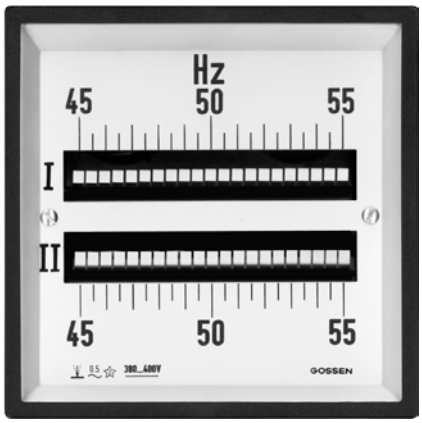
2) Price per measuring movement

Double-Reed Frequency Meters

Technical Data

Vibrating Reed Mechanism, Narrow Bezel per DIN 43718, Dull Black

Front Dimensions Type	96 x 96 mm ZF 96/2	144 x 144 mm ZF 144/2
Reed Position	horizontal	horizontal
Accuracy Class	0.5	0.5
Weight in kg, Approx.	0.6	1.0
Intrinsic Consumption (depending upon measuring range and nominal voltage)	approx. 1 ... 3 VA	approx. 1 ... 3 VA
Nominal Insulation Voltage	1000 V	660 V
Test Voltage	3 kV	2 kV
Front Housing-Panel Protection	IP 52	IP 52
Fasteners	type S screw clamp	type B (DIN 43835)
Housing Material	sheet metal	sheet metal



Type ZF 96/2

Description

Double-Reed Frequency Meter with Two Independent, Vibrating Reed Mechanisms

Display

2 rows of 13, or 2 rows of 21 reeds

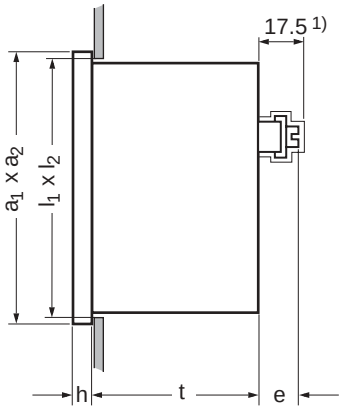
Mechanical Design

Housing Material	Sheet metal
Terminals	M4 Screw Terminals
Contact Protection	Available as option

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	23 °C ± 2 °C
Position of Use	any
Input Voltage	nominal voltage range
Other	DIN EN 60051

Dimensions



1) Individual Contact Protection

Front Dim. in mm	Nominal Dimensions, mm $a_1 \times a_2$	h	Cutout, mm $l_1 \times l_2$	Installation Depth, mm t	Terminals e
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	$138^{+1} \times 138^{+1}$	58	14

Code: B0

Order Example: Double-Reed Frequency Meter, 96 x 96 mm, 47 ... 53 Hz, 2 Rows of 13 Reeds, 220 ... 230 V Order No.: 3240F EH722 FZ14 IL726			Front Dim. in mm Type Order no. ➡ + ⬇	96 x 96 ZF 96/2 32408F	144 x 144 ZF 144/2 3290F
Nominal Voltage Range					
	2 x 100 ... 110 V		IL710	+	+
	2 x 220 ... 230 V		IL726	+	+
	2 x 380 ... 400 V		IL727	+	+
	2 x 440 V		IL344	+	+
	2 x 450 ... 500 V		IL720	+	+
Measuring Range		Number of Reeds			
	2 x 47 ... 50 ... 53 Hz	2 rows of 13	EH722, FZ14	+	+
	2 x 45 ... 50 ... 55 Hz	2 rows of 21	EH719, FZ16	+	+
	2 x 57 ... 60 ... 63 Hz	2 rows of 13	EH728, FZ14	+	+
	2 x 55 ... 60 ... 65 Hz	2 rows of 21	EH726, FZ16	+	+
Applications	**standard**		–	+	+
	conditionally tropic-proof		LB1	+	+
Protection	**standard**		–	+	+
	front panel: IP 54, terminals: IP00		LH21	+	+
Resistance to Vibration / Marine Applications	**standard**		–	+	+
	marine applications, German Lloyds		LN2	+	+
Bezel	**dull black**		–	+	+
	dull gray, RAL 7037		MA11	+	+
Glass Faceplate	**standard**		–	+	+
	anti-glare		MG1	+	+
Contact Protection	**none**		–	+	+
	individual contact protection		VB1	+	+
Identification	**none**		–	+	+
	at rear:		MZ998	+	+
Scale Inscription (Latin lettering)	**none**		–	+	+
	≤15 characters in German		SM991 ...	+	+
	≤15 characters in other language		SM993 ...	+	+
Red Marker (RAL 2002)	**none**		–	+	+
	red marker at: ...		ST991 ...	+	+

Order Number Instructions:

- Select one model each for order numbers with the same sequence of letters.
- No additional entries are required for standard models (identified with bold typeface and "–" in order no. column).
- An entry with "...." in the order no. column means that the order number must be supplemented with written text.

Contact Position Indicators for Direct Voltage or Alternating Voltage 45 ... 65 Hz

Technical Data

Glossy Black Bezel

Front Dimensions Type	25 x 25 Stq 1	25 mm Dia. St 1	32 mm Dia. 1) St 2
Weight in kg, Approx.	0.07	0.07	0.07
Nominal Insulation Voltage	250V	250V	250V
Test Voltage	1.5 kV	1.5 kV	1.5 kV
Front Housing-Panel Protection	IP 52	IP 52	IP 52
Fasteners	round nut	round nut	round nut

1) Snap on bezel included (36 x 36 mm)

Description

Contact Position Indicator for Remote Indication of Contact Positions at Power Plants and Switching Stations
Can also be used advantageously as a target indicator in mimic diagrams.

Display

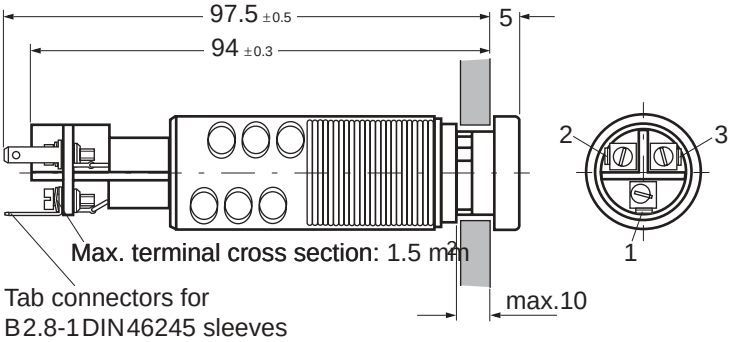
Three different displays are included: “On”, “Off” and “Error” or “Disabled”.

Mechanical Design

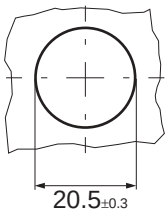
Housing Material	Polycarbonate, self-extinguishing per UL 94 V-2
Terminals	Tab connectors, 2.8x0.8 mm
Contact Protection	Available as option

Dimensional Drawing no. 1323A16

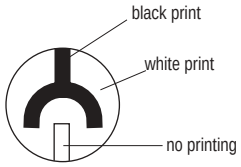
Dimensions



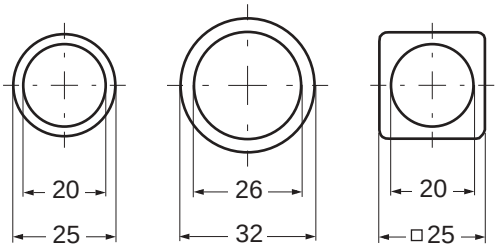
Panel Cutout



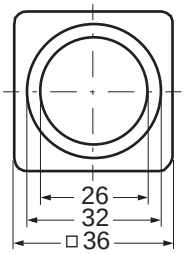
Isolating Contact



Front Panel Dimensions



Bezel snaps on to 32 mm diameter front ring.

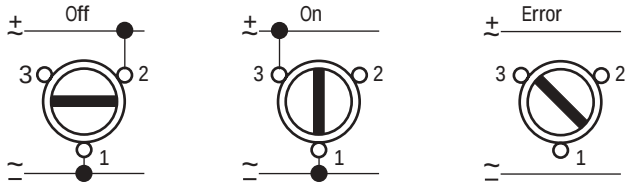


Order Information

Code: B0

Contact Position Indicators for Direct Voltage or Alternating Voltage 45 ... 65 Hz

Graphic Symbols



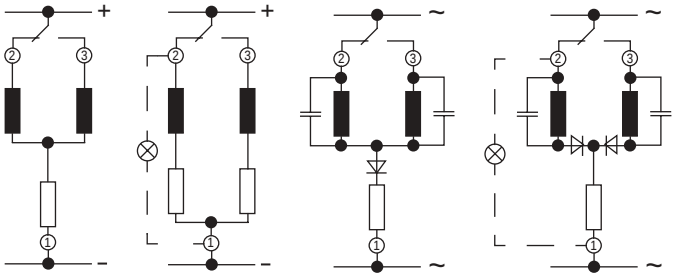
Order Example:

Contact Position Indicator, 25 x 25 mm Front Dimensions,
for Alternating Voltage 220 ... 230 V

Technical Data	Order No.
Type: Stq 1	1108B, B2, IL726

Schematic Diagrams

Direct Voltage | Direct Voltage, Parallel Load | Alternating Voltage | Alternating Voltage, Parallel Load



The following applies for the preparation of order information:
Only one identifier with a given letter sequence may be selected.
Order numbers containing N (standard model) need not be included.

	Front Dim., mm Type	25 x 25 Stq 1	25 mm dia. St 1	32 mm dia. St 2		Front Dim., mm Type	25 x 25 Stq 1	25 mm dia. St 1	32 mm dia. St 2
	Order no. ➡	1108B	1280B	1281B		Order no. ➡	1108B	1280B	1281B
	+ ⬇					+ ⬇			
Direct Voltage	B1	+	+	+	Alternating Voltage	B2	+	+	+
24 V (0.3 W) [1]	IL 224	+	+	+	24 V (0.3 VA) [1]	IL 624	+	+	+
48 V (0.3 W) [1]	IL 248	+	+	+	48 V (0.3 VA) [1]	IL 648	+	+	+
60 V (0.4 W) [1]	IL 260	+	+	+	60 V (0.4 VA) [1]	IL 660	+	+	+
110 V (0.6 W) [1]	IL 511	+	+	+	110 V (0.6 VA) [1]	IL 311	+	+	+
125 V (0.7 W) [1]	IL 512	+	+	+	220 ... 230 V (1.4 VA) [1]	IL 726	+	+	+
220 V (1.0 W) [1]	IL 522	+	+	+					
Movement Variants [2] with parallel load	INH 1	+	+	+		INH 1	+	+	+
Scale Variants [2] with isolation contact	GA 2	+	+	+		GA 2	+	+	+
Housing Variants [2] conditionally tropic-proof	LB 1	+	+	+		LB 1	+	+	+
full contact protection	VB 2	+	+	+		VB 2	+	+	+

1) Nominal voltage tolerance: ±20 %
2) Applies to all types of direct and alternating voltage

Rectangular Limit Transducers (MESSCONTACTER) for Direct Current or Direct Voltage

Technical Data

Moving-Coil Movement, Edgewise Scale, Narrow Bezel per DIN 43 718, Dull Black

Front Dim. in mm	96 x 48
Type	Pfn 96 x 48 M
Scale Length in mm	65
Accuracy Class	1.5
Weight in kg, Approx. for AC aux. voltage	0.5
for DC aux. voltage	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 Contact Marks	1 or 2
Min. Contact Mark Clearance	3% of scale length
Output Relay	integrated
Output Contact	1 changeover per contact mark
Switching Capacity with Ohmic Load	
Max. Switching Voltage	250 V AC / 250 V DC
Max. Switching Current	6 A AC / 6 A DC
Nominal Switching Capacity	500 VA / 50 W
Service Life at Nominal Switching Capacity	> 10^6 switching cycles
Max. Switching Time	500 ms
Auxiliary Voltage (U_H)	see Order Information
Power Consumption, AC Auxiliary Voltage	4 VA
Power Consumption, DC Auxiliary Voltage	4.5 W
Safety Regulations per IEC/EN 61010-1/A2 VDE 0411-1/A1	
Safety Class	II (total insulation)
Measuring Circuit:	
Overvoltage Category	CAT III
Fouling Factor	2
Operating Voltage	300 V
Operating Voltage for Voltage Measuring Ranges >250 V...≤ 600 V	600 V
Test Voltage (to housing)	5.55 kV AC
Front Housing-Panel Protection	IP 52
Fasteners	screw spindle

Description

Analog Limit Transducer (MESSCONTACTER) with Moving-Coil Movement for Direct Current or Direct Voltage

Display

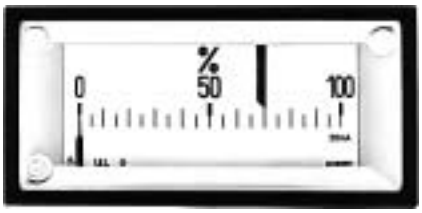
Scale Graduation	Coarse-fine
Pointer	Beam pointer with knife-edge for single and double graduation

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0
Replaceable	Glass faceplate and bezel
Terminals	Tab connectors, (IP20 protection) 1 ea. 6.3 x 0.8 mm or 2 ea. 2.8 x 0.8 mm

Reference Conditions

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



Type Pfn 96 x 48 M

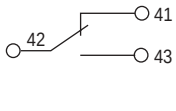
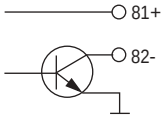
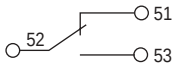
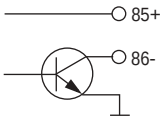
Internal Resistance / Voltage Drop / Power Consumption

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

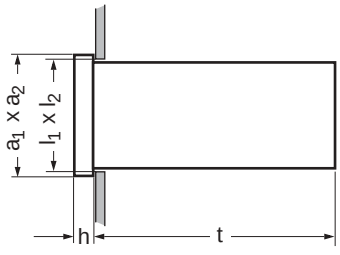
Measuring Range	Internal Resistance / Voltage drop / Power Consumption
≤ 10 mA	≤ 100 mV
> 10 mA / ≤ 6 A	≤ 100 mV
≤ 1 V	≥ 1 MΩ
> 1 V / ≤ 50 V	≥ 100 kΩ
> 50 V / ≤ 600 V	≥ 2 kΩ/V
0/4 ... 20 mA	6 Ω ± 30 %
Connection to shunt Lead resistance 0.06 Ω	6 mA ± 20 %

Contact Assignments

Measured Quantity		–	12–
		+	11+
Auxiliary Voltage	DC	+	L+
		–	L–
	AC	L	L
		N	N

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.

Dimensions



Front Dim. mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth (t)	Installation Depth (t)
	a_1 x a_2	h	l_1 x l_2	Relay Output	Logic Output
96 x 48	96 x 48	5	$92^{+0.8}$ x $45^{+0.6}$	146	126

Order Information

Rectangular Limit Transducers (MESSCONTACTER) for Direct Current or Direct Voltage

Code: B0

Order Example:
MESSCONTACTER 96 x 48 mm, Landscape Format, 0 ... 100 V Direct Voltage,
Working Current Model, Min.-Max., 24 V DC Auxiliary Voltage, Relay Output
Order No.: 2594P AM10 DC100

			Front Dim. in mm Type Order no. ➡ + ⬇	96 x 48 Pfn 96 x 48 M 2594P
Format		landscape	HQ1	+
		portrait	HQ2	+
Contacting				
Closed-Circuit Current Model	Max.		AM 3	+
	Min.		AM 4	+
	Min. - Max.		AM 5	+
	Max. - Max.		AM 6	+
	Min. - Min.		AM 7	+
Working Current Model	Max.		AM 8	+
	Min.		AM 9	+
	Min. - Max.		AM 10	+
	Max. - Max.		AM 11	+
	Min. - Min.		AM 12	+
Meas. Input – Direct Current	Connection			
Zero Point	left (landscape)			
	bottom (portrait)			
	center		BC2	+
	between bottom and middle of scale		BC21	+
		direct		
		1 mA/5 mA/10 mA	CB1/5/10	+
		20 mA	CB20	+
		1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+
		6 A	CC6	+
	electrically suppressed, landscape 0/4 ... 20 mA		BC25	+
	electrically suppressed, portrait 0/4 ... 20 mA		BC27	+
		at shunt resistor .../60 mV	BE3	+
		at shunt resistor .../150 mV	BE4	+
Meas. Input – Direct Voltage	Connection			
Zero Point	left (landscape)			
	bottom (portrait)			
	center		BC2	+
	between bottom and middle of scale		BC21	+
		direct 1/1.5/2.5/4/6/10 V 15/25/40/60 V 100/150/250/400/500/600 V	DC1 to DC600	+ +
Auxiliary Voltage				
		24 V DC (20 ... 24 ... 30 V)	–[1]	+
		24 V AC (21 ... 24 ... 27 V), 45 ... 65 Hz	IV 12	+
		100 V AC (90 ... 100 ... 110 V), 45 ... 65 Hz	IV 10	+
		110 V AC (99 ... 110 ... 121 V), 45 ... 65 Hz	IV 13	+
		115 V AC (103 ... 115 ... 127 V), 45 ... 65 Hz	IV 16	+
		220 V AC (198 ... 220 ... 242 V), 45 ... 65 Hz	IV 19	+
		230 V AC (207 ... 230 ... 253 V), 45 ... 65 Hz	IV 23	+
		240 V AC (216 ... 240 ... 264 V), 45 ... 65 Hz	IV 24	+
Output				
		relay output	–[1]	+
		logic output (open collector) H = + 24 V (electrically isolated from U_H) L < + 1 V, I ≤ 50 mA for U_H DC I ≤ 20 mA for U_H AC	AU 2	+

Scale characteristics, applications, protection, bezel, glass faceplate, identification, scale inscription, additional numberings and red marker same as type Pfn 96 x 48 (see page 43)

1) Standard model

Rectangular, Slim-Line Limit Transducers (MESSCONTACTER) for Direct Current or Direct Voltage

Moving-Coil Movement, Slim-Line Scale, Narrow Bezel per DIN 43 718, Dull Black

Front Dim. in mm Type	96 x 24 Pffn 96 x 24 M
Scale Length in mm	65
Accuracy Class	1.5
Weight in kg, Approx.	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 Contact Marks	1 or 2
Min. Contact Mark Clearance	3% of scale length
Output Relay	integrated
Output Contact	1 changeover per contact mark
Switching Capacity with Ohmic Load	
Max. Switching Voltage	250 V AC / 250 V DC
Max. Switching Current	6 A AC / 6 A DC
Nominal Switching Capacity	500 VA / 50 W
Service Life at Nominal Switching Capacity	$>10^6$ switching cycles
Max. Switching Time	500 ms
Auxiliary Voltage (U_H)	24 V DC (20 ... 24 ... 30 V)[1]
Current or Power Consumption	4.5 W
Safety Regulations per	
IEC/EN 61010-1/A2 VDE 0411-1/A1	
Safety Class	II (total insulation)
Measuring Circuit:	
Overvoltage Category	CAT III
Fouling Factor	2
Operating Voltage	300 V
Operating Voltage for Voltage Measuring	
Ranges >250 V...≤ 600 V	600 V
Test Voltage (to housing)	5.55 kV AC
Front Housing-Panel Protection	IP 52
Fasteners	screw spindle

1) With separate power pack for following voltages: 24 V AC, 100 V AC, 110 V AC, 115 V AC, 220 V AC, 230 V AC, 240 V AC, ±10%, see data sheet E 4/5

Description

Analog Limit Transducer (MESSCONTACTER) with Moving-Coil Movement for Direct Current or Direct Voltage

Display

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

Mechanical Design

Housing Material	Polycarbonate, self-extinguishing and drip-proof per UL94V-0
Replaceable	Glass faceplate and bezel
Terminals	Tab connectors (IP20 protection) 1 ea. 6.3 x 0.8 mm or 2 ea. 2.8 x 0.8 mm

Reference Conditions

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

Type Pffn 96 x 24 M

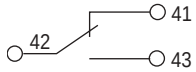
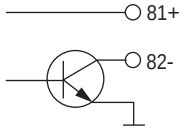
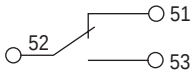
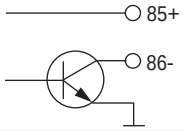
Internal Resistance / Voltage drop / Power Consumption

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

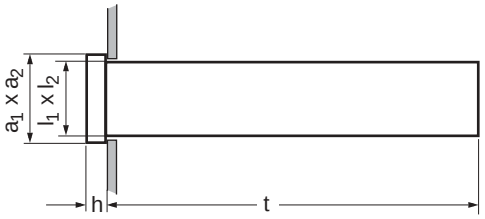
Measuring Range	Internal Resistance / Voltage Drop / Power Consumption
≤ 10 mA	≤ 100 mV
> 10 mA / ≤ 6 A	≤ 100 mV
≤ 1 V	≥ 1 MΩ
> 1 V / ≤ 50 V	≥ 100 kΩ
> 50 V / ≤ 600 V	≥ 2 kΩ/V
0/4 ... 20 mA	6 Ω ± 30 %
Connection to shunt Lead resistance 0.06 Ω	6 mA ± 20 %

Contact Assignments

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.

Dimensions



Front Dim. mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth (t)	Installation Depth (t)
	a_1 x a_2	h	l_1 x l_2	Relay Output	Logic Output
96 x 24	96 x 24	5	$92^{+0.8}$ x $22.2^{+0.3}$	146	126

Rectangular, Slim-Line Limit Transducers (MESSCONTACTER) for Direct Current or Direct Voltage

Code: B0

Order Example:
MESSCONTACTER 96 x 24 mm, Landscape Format, 0 ... 100 V Direct Voltage,
Working Current Model, Min.-Max., Relay Output
Order No. 2524P AM10 DC100

			Front Dim. in mm Type Order no. ➡ + ⬇	96 x 24 Pffn 96 x 24 M 2524P
Format		landscape	HQ1	+
		portrait	HQ2	+
Contacting				
Closed-Circuit Current Model	Max.		AM 3	+
	Min.		AM 4	+
	Min. - Max.		AM 5	+
	Max. - Max.		AM 6	+
	Min. - Min.		AM 7	+
Working Current Model	Max.		AM 8	+
	Min.		AM 9	+
	Min. - Max.		AM 10	+
	Max. - Max.		AM 11	+
	Min. - Min.		AM 12	+
Meas. Input – Direct Current	Connection			
Zero Point	left (landscape)			
	bottom (portrait)			
	center		BC2	+
	between bottom and middle of scale		BC21	+
		direct		
		1 mA/5 mA/10 mA	CB1/5/10	+
		20 mA	CB20	+
		1 A/1.5 A/2.5 A/4 A	CC1/1.5/2.5/4	+
		6 A	CC6	+
	electronically suppressed, landscape 0/4 ... 20 mA		BC25	+
	electronically suppressed, portrait 0/4 ... 20 mA		BC27	+
		at shunt resistor .../60 mV	BE3	+
		at shunt resistor .../150 mV	BE4	+
Meas. Input – Direct Voltage	Connection			
Zero Point	left (landscape)			
	bottom (portrait)			
	center		BC2	+
	between bottom and middle of scale		BC21	+
		direct 1/1.5/2.5/4/6/10 V 15/25/40/60 V 100/150/250/400/500/600 V	DC1 to DC600	+
Output				
		relay output	–[1])	+
		logic output open collector) H = + 24 V (electrically isolated from U_H) L < + 1 V, I ≤ 50 mA for U_H DC	AU 2	+

Scale characteristics, applications, protection, bezel, glass faceplate, identification, scale inscription, additional numberings and red marker same as type Pffn 96 x 24 (see page 45).

1) Standard model

Square Double Indicators for Direct Current or Direct Voltage

Moving-Coil Movement,
Narrow Bezel per
DIN 43 718, Dull Black

Type PZqsd 48 w

Type PZqs 48 w

Front Dim. in mm		48 x 48	48 x 48
Type		PZqsd 48 w	PZqs 48 w
Scale Length	Movement I (external)	31 mm (15.5 with system dev.)	33 mm
	Movement II (internal)	28 mm	33 mm (16.5 with system dev.)
Accuracy Class		2.5	1.5 (2.5 with system dev.)
Weight in kg, Approx.		0.2	0.2
Nominal Insulation Voltage		50 V	50V
Test Voltage		500 V	500 V
Front Housing-Panel Protection		IP 50	IP 50
Fasteners		type B (DIN 43835)	type B (DIN 43835)
Housing Material		sheet metal	sheet metal
Deflection	Movement I	system dev. ± 22.5° actuator position 90°	actuator position 90°
	Movement II	actuator position 90°	system dev. ± 22.5° actuator position 90°

Internal Resistance / Voltage Drop / Power Consumption [1]

Measuring Range	Pointer Deflection	Ri	Tolerance
–20 ... 0 ... +20 µA	± 22.5°	6 kΩ	
–20 ... 0 ... + 20 µA	± 22.5°	13 kΩ	± 1%
–20 ... 0 ... + 20 µA	± 22.5°	50 kΩ	
–50 ... 0 ... + 50 µA	± 22.5°	2 kΩ	± 5%
–250 ... 0 ...+ 250 µA	± 22.5°	325 Ω	
–300 ... 0 ...+ 300 µA	± 22.5°	325 Ω	± 2%
0 ... 600 µA	90°	325 Ω	
0 ... 1 mA	90°	79 Ω	± 20%
0 ... 20 mA	90°	3 Ω	± 30%
0 ... 3 V	90°	10 kΩ/V	
0 ... 5 V	90°	10 kΩ/V	± 1%
0 ... 10 V	90°	10 kΩ/V	

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

Description

Double Indicator with 2 Moving-Coil Movements

Display

Scale Graduation	Coarse-fine
Pointer	Beam pointer with knife-edge, external: beam pointer for PZqsd 48 w (movement I)

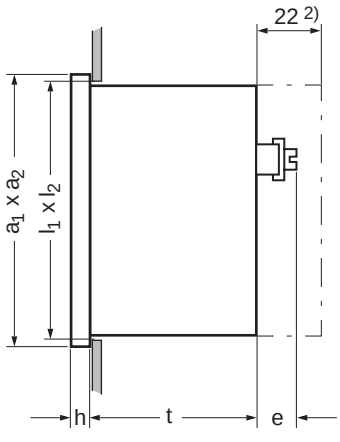
Mechanical Design

Housing Material	Sheet metal housing with cone-head rivets
Terminals	M3 screw terminals
Contact Protection	Available as option

Reference Conditions

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

Dimensions



2) Full Contact Protection

Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm	Installation Depth, mm	Terminals
	$a_1 \times a_2$	h	$l_1 \times l_2$	t	e M3
48 x 48	48 x 48	5	$45^{+0.6} \times 45^{+0.6}$	82.5	3.5
48 x 48 [3]	48 x 48	5	43 x 43	82.5	3.5

3) Manual grid-mount housing

Order Information

Square Double Indicators for Direct Current or Direct Voltage

Code: B0

Attention: Select only one of the below listed measurement inputs per movement.

		Front Dim., mm Type	48 x 48 PZqsd 48 w
		Order no. ➡	1674P
		+ ⬇	
Movement I			
System deviation: ± 22.5°		1 FU 1	+
Zero Point: center		1 BC 2	+
Scale: –10 ... 0 ... + 10		1 GL 999 1)	+
Scale: –20 ... 0 ... + 20		1 GL 999 1)	+
Measuring Range	Ri		
–20 ... 0 ... + 20 µA	6 kΩ	1 CA 20 1 IR 77	+
–20 ... 0 ... + 20 µA	13 kΩ	1 CA 20 1 IR 82	+
–20 ... 0 ... + 20 µA	50 kΩ	1 CA 20 1 IR 84	+
–50 ... 0 ... + 50 µA	2 kΩ	1 CA 50 1 IR 75	+
Movement I (alternatively)			
Actuator position: 90 °			
Scale: 0 ... 100%		1 GL 310 1 GMP 2	+
Measuring Range	Ri		
0 ... 600 µA	325 Ω	1 CA 600 1 IR 72	+
0 ... 1 mA	79 Ω	1 CB 1	+
0 ... 20 mA	3 Ω	1 CB 20	+
mech. suppressed, 4 ... 20 mA	3 Ω	1 BC 10	+
0 ... 3 V	10 kΩ/V	1 DC 3 1 IR 40	+
0 ... 5 V	10 kΩ/V	1 DC 5 1 IR 40	+
0 ... 10 V	10 kΩ/V	1 DC 10 1 IR 40	+
Movement II			
Actuator position: 90°			
Scale: 0 ... 100%		2 GL 310 2GMP02	+
Measuring Range	Ri		
0 ... 600 µA	325 Ω	2 CA 360 2 IR 72	+
0 ... 1 mA	79 Ω	2 CB 1	+
0 ... 20 mA	3 Ω	2 CB 20	+
0 ... 3 V	10 kΩ/V	2 DC 3 2 IR 40	+
0 ... 5 V	10 kΩ/V	2 DC 5 2 IR 40	+
0 ... 10 V	10 kΩ/V	2 DC 10 2 IR 40	+
mech. suppressed, 4 ... 20 mA	3 Ω	2 BC 10	+
Scale Variants 2)			
Inscription ≤ 15 characters in German		SM991	+
≤ 15 char. in other language (other languages with Latin lettering)		SM993	+
Red marker, RAL 2002		3) • ST991	+
Housing Variants 2)			
Conditionally tropic-proof		LB1	+
Dull gray bezel, RAL 7037		MA11	+
Anti-glare glass faceplate		MG1	+
Full contact protection		VB2	+

		Front Dim., mm Type	48 x 48 PZqs 48 w
		Order no. ➡	1672P
		+ ⬇	
Movement I			
Actuator position: 90°			
Scale: 0 ... 100%		1 GL 310 1 GMP 2	+
Measuring Range	Ri		
0 ... 600 µA	325 Ω	1 CA 600 1 IR 72	+
0 ... 1 mA	79 Ω	1 CB 1	+
0 ... 20 mA	3 Ω	1 CB 20	+
mech. suppressed, 4 ... 20 mA	3 Ω	1 BC 10	+
0 ... 3 V	10 kΩ/V	1 DC 3 1 IR 40	+
0 ... 5 V	10 kΩ/V	1 DC 5 1 IR 40	+
0 ... 10 V	10 kΩ/V	1 DC 10 1 IR 40	+
Movement II			
Actuator position: 90°			
Scale: 0 ... 100%		2 GL 310 2GMP02	+
Measuring Range	Ri		
0 ... 600 µA	325 Ω	2 CA 600 2 IR 72	+
0 ... 1 mA	79 Ω	2 CB 1	+
0 ... 20 mA	3 Ω	2 CB 20	+
0 ... 3 V	10 kΩ/V	2 DC 3 2 IR 40	+
0 ... 5 V	10 kΩ/V	2 DC 5 2 IR 40	+
0 ... 10 V	10 kΩ/V	2 DC 10 2 IR 40	+
mech. suppressed, 4 ... 20 mA	3 Ω	2 BC 10	+
Movement II (alternatively)			
System deviation: ± 22.5°		2 FU 1	+
Zero Point: center		2 BC 2	+
Scale: –10 ... 0 ... + 10		2 GL 999 1)	+
Scale: –20 ... 0 ... + 20		2 GL 999 1)	+
Measuring Range	Ri		
–20 ... 0 ... + 20 µA	6 kΩ	2 CA 20 2 IR 77	+
–20 ... 0 ... + 20 µA	13 kΩ	2 CA 20 2 IR 82	+
–20 ... 0 ... + 20 µA	50 kΩ	2 CA 20 2 IR 84	+
–50 ... 0 ... + 50 µA	2 kΩ	2 CA 50 2 IR 75	+

1) Provide order information as written text
2) Additional variants available
3) Supplement with 1 (movement 1) or 2 (movement 2).
4) Price per movement

Square
Operating Hours Meters

Technical Data
Order Information

Narrow Bezel per DIN 43 718, Dull Black

Front Dimensions	72 x 72 mm	96 x 96 mm
Display Range in Hours	99,999.99	99,999.99
Drive	synchronous motor	synchronous motor
Nominal Frequency	50 Hz	50 Hz
Power Consumption, Approx.	2 VA	2 VA
Nominal Insulation Voltage	660 V	660 V
Test Voltage	2 kV	2 kV
Front Housing-Panel Protection	IP 52	IP 52
Weight in kg, Approx.	0.12	0.14
Fasteners	metal clip	metal clip

Operating Hours Meter, 96 x 96 mm

Description

Operating hours meters are used to count the hours of operation which have elapsed at machines and systems - e.g. in order to monitor and assure adherence to maintenance schedules and guarantee periods.

Display

7 place display for up to 99,999.99 hours

Mechanical Design

Housing Material	Plastic
Terminals	Tab connectors, 6.3 x 0.8
Contact Protection	Individual contact protection always included

Reference Conditions

Reference Quantities	Reference Condition
Ambient Temperature	-10 °C ... +60 °C
Position of Use	any
Other	DIN EN 60051

Order Example

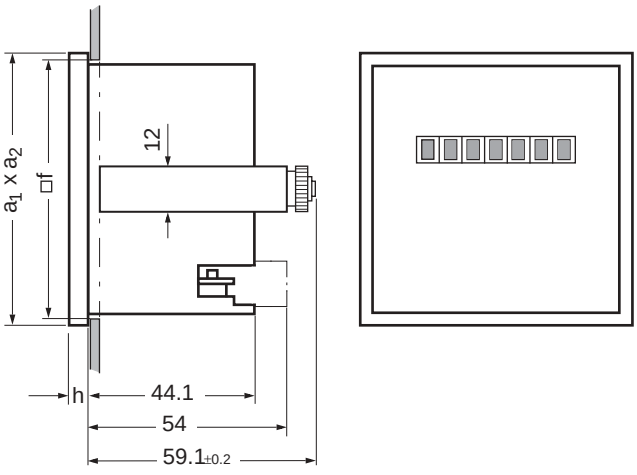
Technical Data	Order No.
Operating hours meter, 96 x 96 mm, 230 V supply power	1055Y9070

Order Information (Code B0)

Supply Power	Front Dim. in mm Order no. ➡ + ⬇	72 x 72 1029Y	96 x 96 1055Y
110V AC 1)	9030	+	+
230V AC 1)	9070	+	+
400V AC 1)	9080	+	+

1) Tolerance: ± 10%

Dimensions



Front Dim. in mm	Nominal Dimensions, mm		Cutout, mm
	a_1 x a_2	h	❑ f
72 x 72	72 x 72	5.4	$68^{+0.7}$ x $68^{+0.7}$
96x96	96 x 96	5.4	$92^{+0.8}$ x $92^{+0.8}$

Square
Phase Sequence Indicators

Narrow Bezel per DIN 43 718, Dull Black or Dull Gray, RAL 7037

Front Dimensions	96 x 96 mm
Voltage Range	100 ... 500 V
Intrinsic Consumption	approx. 0.5 VA per phase at 100 V approx. 2 VA per phase at 500 V
Frequency Range	40 ... 100 Hz
Allowable On-Time	max. 5 min.
Weight in kg, Approx.	0.4
Protection	IP 52 for housing IP 20 for terminals with contact protection
Fasteners	screw clamps for panel thicknesses of 1 ... 15 mm

Phase Sequence Indicator with Start Key

Description

Phase Sequence Indicator for Universal Use
The upper green arrow in the scale indicates the correct direction of rotation.

Mechanical Design

Housing Material	Sheet metal housing
Glass Faceplate	Anti-glare
Terminals	Hex bolts with M3 thread, C6 terminal clip and full contact protection
Heightened Mechanical Stress	30 g_n, 11 ms (shock resistance) 5 g_n, 5 ... 55 Hz (vibration resistance)
Climatic Category	3
Operating Temp. Range	–25 ... +55 °C
Storage Temperature Range	–25 ... +65 °C

Reference Conditions

Reference Quantities	Reference Condition
Position of Use	control panel vertical ± 5°

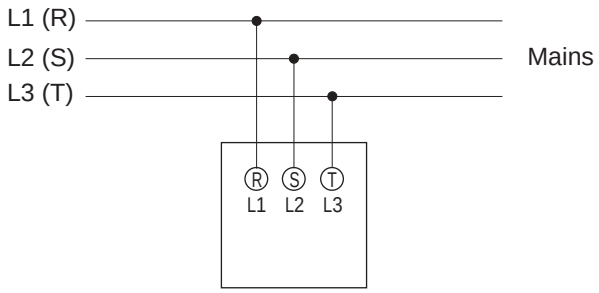
Order Example

Technical Data	Order No.
Phase Sequence Indicator with Start Key, Dull Black Bezel	1055Y9130

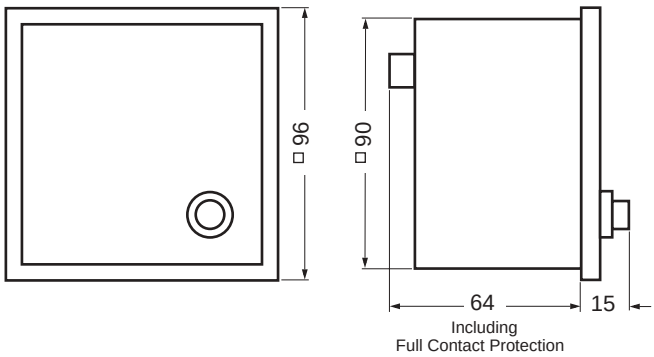
Order Information (Code B0)

	Front Dim. in mm	96 x 96
	Order no. ➡	1055Y
	+ ⬇	
Dull black bezel	9130	+
Dull gray bezel, RAL 7037	9140	+

Wiring Diagram



Dimensions in mm



Order Number Index, Overall Program

Order Number	Catalog Page or Data Sheet No. (E...)
1029Y	72
1055Y	72 & 73
1074E	E3/3
1074P	E3/1
1074W	E3/2
1074Z	E3/4
1080P	E3/1
1080W	E3/2
1108B	64
1149E	52
1149P	46
1167P	E3/9
1190E	E3/6
1194P	44, E1/6
1194W	E1/17
1196P	44, E1/6
1196W	E1/17
1280B	64
1281B	64
1505P	42, E1/5
1505W	E1/15
1507P	E3/5
1511P	42, E1/5
1511W	E1/15
1515P	44, E1/6
1515W	E1/17
1524N	E1/22
1524G	E1/23
1524P	44, E1/6
1524W	E1/17
1535E	50, E1/16
1584E	50, E1/16
1584P	42, E1/5
1584W	E1/15
1594G	E1/23
1594N	E1/22
1594P	42, E1/5
1594W	E1/15
1601E	E1/10
1601M	E1/11
1601P	E1/1
1601W	E1/8
1602P	40, E1/3
1602W	48, E1/13
1603C	E1/12
1604E	E1/10
1604M	E1/11
1604P	E1/1
1604W	E1/8
1605P	40, E1/3
1605W	48, E1/13
1606C	E1/12

Order Number	Catalog Page or Data Sheet No. (E...)
1612C	E1/12
1614G	E1/21
1614P	E1/2
1614W	E1/9
1615P	E1/4
1615W	E1/14
1616G	E1/21
1616L	E3/7
1616P	E1/2
1616W	E1/9
1617C	E1/12
1617E	60
1619P	E1/4
1619W	E1/14
1620E	E1/10
1620G	E1/21
1620H	E1/27
1620M	E1/11
1620P	E1/1 & E1/2
1620W	E1/8 & E1/9
1620Z	E1/24
1621P	40, E1/3 & E1/4
1621W	48, E1/13 & E1/14
1622C	E1/12
1622E	60
1626M	E1/19
1632W	E3/8
1633E	E1/31
1634E	E1/31
1662E	E1/10
1662M	E1/11
1662P	E1/1
1662W	E1/8
1668P	40, E1/3
1668W	48, E1/13
1670E	E1/10
1670P	E1/1
1670W	E1/8
1672P	70, E3/5
1674P	70, E3/5
1700V	29
1701V	E4/6
1702V	E4/3
1715V	30 & 31
1716V	30 & 32
1717V	30 & 33
1718V	30 & 34
1719V	30 & 35

Order Number	Catalog Page or Data Sheet No. (E...)
1720V	30 & 36
1721V	30 & 37
1722V9010	31 & 35
1722V9020	32 & 36
1722V9110	31 & 35
1722V9120	32 & 36 & 37
1722V9130	33 & 34
1733V	E4/6
1780V	E1/32
1781V	E1/32
1799V	E4/6
2524G	E2/23
2524N	E2/21
2524P	68, E2/4
2524W	E2/11
2594G	E2/19
2594N	E2/17
2594P	66, E2/2
2594W	E2/9
2596G	E2/19-1
2596N	E2/17-1
2596P	E2/2-1
2596W	E2/9-1
2999V	E4/5
3100E	14
3100M	16
3100P	10
3100W	12
3100Z	20
3109E	28
3109M	28
3109P	28
3109W	28
3109Z	28
3150C	18
3150E	14
3150M	16
3150P	10
3150W	12
3150Z	20
3159C	28
3159E	28
3159M	28
3159P	28
3159W	28
3159Z	28
3200C	18
3200D	22
3200E	14
3200H	26
3200M	16
3200P	10
3200W	12
3200Z	20

Order Number	Catalog Page or Data Sheet No. (E...)
3209C	28
3209D	28
3209E	28
3209M	28
3209P	28
3209W	28
3209Z	28
3210D	54
3250D	22
3250E	14
3250H	26
3250P	10
3250W	12
3250Z	20
3259D	28
3259E	28
3259P	28
3259W	28
3259Z	28

Notice

Product Table

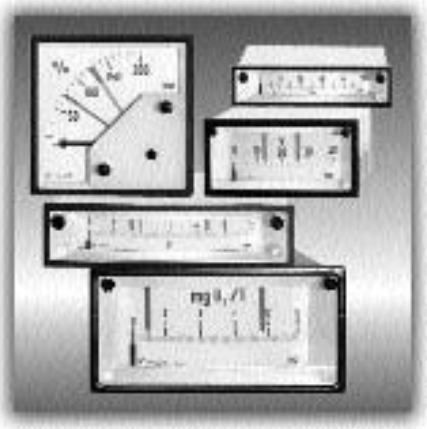
Analogue panel meters

Measuring transformers

Digital panel instruments

Electrical equipment tester

Contact devices



Text display / printer

Bargraph displays

Probes

Accessories

metrix electronics

Metrix Electronics Limited
Minchens Court, Minchens Lane,
Bramley, RG26 5BH, U.K.
Tel:+44 (0)845 034 3234, Fax:+44 (0)845 034 3233
E-mail: sales@metrix-electronics.com
Web: www.metrix-electronics.com

GMW GOSSEN Müller & Weigert

Zweigniederlassung der General Elektronik GmbH

GOSSEN Mueller & Weigert
Kleinreuther Weg 88 · D-90408 Nuernberg
Telefon (09 11) 35 02-0 · Telefax (09 11) 35 02-3 07
Internet: http://www.g-mw.de · e-mail: info@g-mw.de

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