

Analogue Measuring Instruments

Analogue instruments register a value to be measured and show it on an analogue display, usually by a pointer on a scale. So the value is displayed in a stepless and continuous way. In opposition to digital displays, instabilities and tendencies of a value can be recognized faster and more intuitively on an analogue display. On the other hand at analogue displays exact numerical values are more difficult to read compared to a digital instrument (reading error).

Analogue instruments are on hand for a broad band of electrical values. They are available in the standardized dimensions 48x48mm, 72x72mm, 96x96mm and 144x144mm, as well as in various rectangle executions.



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Technical Features

Ambient temperature:	-10 ... +55 °C
Storage temperature:	-25 ... 65 °C
Reference temperature:	+23 °C
Relative humidity:	75 % annual average, non-condensing
Climate Class 2:	according to VDE/VDI 3540
External Magnetic field:	0.5 mT 0.4 kA/m lesser than 6% of the reference value for EQ..n/EQD..n

Accuracy class according to IEC- 60051 and EN- 60051:

Moving iron panel instruments (EQ..n)
Class 1.5

Frequency range Voltmeter:	15 ... 100 Hz
Frequency range Ammeter:	15 ... 400 Hz

Bi-metallic instruments (BIQ..n / BOQ..n):

Class 3 for bi-metallic meter movements and class 1.5 for moving iron panel instruments.

Pointer type frequency instruments (FA..n / FAG..n):

Class 0.5
Input voltage +/- 20 %
Heating period lesser than 5 minutes

Moving-coil measuring instrument (PQ..n):

Class 1.5 except for 15, 25, 40 and 60 µA class 2.5

Constructive Features

For vertical front panel mounting: +/- 5 %
+/- 10 % in EQ/EQD/PR/PQ/PAQ..n

Housing according to DIN IEC 61554:

Housing consists of self-extinguishing plastic according to UL 94-VO .

Fixing

48n- instruments:	2x grip screw
72n- and 96n-instruments:	2x snap closure (plastic clamp)
144n- instruments:	4x grip screw

Front frame according to DIN 43718:

Narrow frame colour black, similar to RAL 9005.

Front panel

The instruments are standard delivered with simple glass. The instruments can be delivered, if possible, with anti reflexing glass on request.

Degree of protection

IP 52	for EQ/PQ/PAQ/PAR/FA housing front
IP 40	for BIQ/BOQ housing front
IP 00	for clamps without electric shock protection
IP 10	for clamps with fixing electric shock protection (except for 48 and EQ/PQ instruments higher than 6A)
IP 20	for clamps with electric shock protection

Shaking resistance and mechanical shock resistance

Shaking resistance: 1.5 g at 50 Hz
(10-150-10 Hz / 0,15 mm)

Shock resistance: 15 g 11 ms
(Gravitational acceleration 1 g = 9,81 m/s²)

This can be obtained by sprung bearing jewels of the highest quality (which are saved against crushes of jewel storage).

Electrical Features

Overload according to IEC 60051 and EN 60051

Moving iron instruments (EQ..n):

Voltmeter:	1,2 x I _n : continuously 2 x U _n (max. 1000 V): 5 seconds
Ammeter 48:	10 x I _n : (max. 200 A) 5 seconds
Ammeter others:	10 x I _n : 5 second

Bi-metallic instruments (BIQ..n/BOQ..n):

1,2 x I _n : continuously
10 x I _n : 1 second

Frequency instruments (FA..n/FAG..n):

1,2 x U _n : continuously
2 x U _n : 1 second

Moving-coil instruments (PQ..n):

1,2 x I _n : continuously
2 x U _n : 5 seconds
Ammeter: 10 x I _n : 5 seconds

Testing voltage according to IEC 61010-1 and EN 61010-1

Meter type Range	Test voltage U _{tr} ; 50 Hz	Test voltage class
48n (300 / 600 V)	3,32 / 2,21 kV	CAT III / CAT II
72n-, 96n-, 144n (300/ 600V)	3,32 / 2,21 kV	CAT III / CAT II

Pointers and scales according to DIN 43802

Moving iron panel instruments (EQ..n):

90° scale. From 10 % of the scale practically linear. Coarse-fine division.

Pointer according to DIN 43802-3. In case of instruments with doubled overload range the overload range corresponds to approximately 20 % of the full scale length.

Bimetallic-instruments (BIQ..n/BOQ..n):

Bi-metallic meter movements: 90° scale. The final scale value is 1.2 x I meter movements: see moving iron panel instruments
Coarse-fine division. Knife bar pointer according to DIN 43802-3.

Frequency instruments (FA..n, FAG..n):

90° scales (FA..n), 240° scales (FAG..n). Practically linear. Coarse-fine division. Knife bar pointer according to DIN 43802-3.

Moving-coil measuring instruments (PQ..n, PAQ..n):

90° scales (PQ..n), 240° scales (PAQ..n). Practically linear. Coarse-fine division. Knife bar pointer according to DIN 43802-3.

Scales

The final scale values are determined according to the following norm line: 1-1,2-1,5-2-2,5-3-4-5-6-7,5-8 and decade multiples.

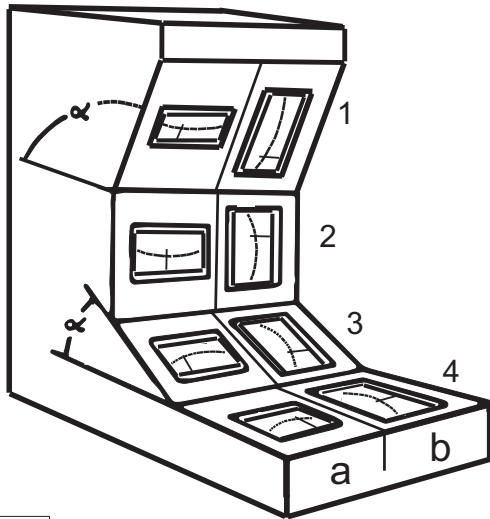
In case of instruments for current transformer connection this norm line is additionally supplemented with the standard values 1,25-1,6-1,8 and decade multiples.

Special adjustment according to norm line in any measuring size, as for example „%“, „m/s“, „Upm“, „bar“ etc.

Special adjustment beyond the norm line, measuring size in any order. Special adjustment after equation, curve or table, measuring size in any order.

General Purpose

The instruments are calibrated - if not indicated differently - for vertical purpose (pos.2). Other purposes, horizontal or diagonal, under indication of the angle against the horizontal are considered on demand. The exact storing of the instruments enables installation positions in all angles.



1	$\alpha > 90^\circ$
2	$\perp = 90^\circ$
3	$\alpha < 90^\circ$
4	$\square = 0^\circ$

Position sign	Nominal position
\perp	upright position
\square	across position
\angle_{60°	inclined position (Installation angle indicate to the across position, for example 60°)
\angle_{120°	

Standard execution: Cross scale, vertical installation

Testing voltage for executions with steel plate housing

Test voltage of the measuring range	Test voltage U_{st} ; 50 Hz	Test voltage sign
660 V	2000 V	☆
1000 V	3000 V	☆

Technical Features

Instructions

DIN 43700	Instruments for table installation, nominal and cut-out dimensions and sample size
DIN 43701	Electrical control panel measuring instruments
DIN 43718	Front frame and front plates
DIN 43780	Performance specifications for direct acting indicating instruments and their accessories
DIN 43802	Scales and pointers for electrical measuring instruments
DIN 16257	Nominal positions and position signs for measuring instruments
DIN 57410/VDE 0410	Safety requirements for indicating and writing measuring instruments and their accessories
VDE 0411	Protective measures for electronic measuring instruments
VDE 0110	Determinations for the measurements of the air and leakage path of electrical resources
DIN 40050	Degrees of protection; foreign material and waterproofing for electrical resources
VDE/VDI 3540 sheet 2	Reliability of measuring - control- and regulation instruments climatic classes for instruments and accessories).
DIN 43807	Connections and clamps
DIN 46200/46282	Connecting bolts
UL 94 V-0	According to the UL Burning property class
2006/95/EG	Rule of low tension
2004/108/EG	Rule of EMV

CE certified

Increasing Accuracy

Measuring accuracy on the increase 1 % (as far as possible)

RECTANGULAR TYPE LINE

Technical Features (rectangular type line)

Instructions

DIN 43700	Instruments for table installation, nominal and cut-out dimensions
DIN 43701	Electrical control panel measuring instruments
DIN 43718	Front frame and front plates
DIN 43780	Performance specifications for direct acting indicating instruments and their accessories
DIN 43802	Scales and pointers for electrical measuring instruments
DIN 16257	Nominal positions and position sign for measuring instruments
DIN 57410/VDE 0410	Safety requirements for indicating and writing measuring instruments and their accessories
VDE 0411	Protective measures for electronic measuring instruments
VDE 0110	Determinations for the measurements of the air and leakage path of electrical resources
DIN 40050	Degrees of protection; foreign material and waterproofing for electrical resources
VDE/VDI 3540 sheet 2	Reliability of measuring, -, control- and regulation instruments (climatic classes for instruments and accessories).

Front pane

The instruments can be standard delivered with antiglare glass on demand (non-reflecting glass) as far as available.

Degree of protection

- IP 00 for clamps without electric shock protection
- IP 20 for clamps with electric shock protection
- IP 50 for housing
- IP 40 for profile housing

Housing

Housing of plastic, self-extinguishing. exception 72 x 36 mm, 96 x 48 mm and 144 x 72 mm are made of steel plate.

Front frame

All rectangular measuring instruments are delivered with a narrow frame according to DIN 43718, colour black, RAL 9005. Colour grey, RAL 7037, RAL 7035, RAL 7032 additional charge.

Accuracy class

The accuracy class of the instruments in standard execution lies at 1.5, that means, the indication error $\pm 1,5\%$ of the measuring value final range will not be exceeded. Exceptions are indicated in the data sheets.

Testing voltage

Test voltage of the measuring range	Test voltage U_{tr} ; 50 Hz	Test voltage sign
660 V	2000 V	☆
1000 V	3000 V	☆

Shaking resistance and mechanical shock resistance

The bearing jewels are springy mounted from coarse crushes in order to protect the organ of the meter movements. The axis of the meter movement is equipped with interceptors. Thus, the dynamic surface pressure is limited which occurs in case of vibrations and crushes as a result of accelerating force.

These design features guarantee a shock resistance of 15 g and a shaking resistance up to 2.5 g on these instruments and therefore, they completely fulfil the conditions according to VDE 0410.

Climatic suitability

Standard-execution:

Climatic class 2 according to VDE/VDI 3540
Operating temperature range -25...+40° C according to DIN 43780

Transport and

Storage temperature -25 ... +65° C
Reference temperature +23° C
Relative humidity 75 % annual average,
non-condensing

Conditionally tropicalised:

Climatic class 3 according to VDE/VDI 3540
Operating temperature range: -10 ...+55° C according to VDE/VDI 3540

Transport and Storage

temperature: -25 ...+65° C
Reference temperature +23° C
Relative humidity 75 % annual average,
non-condensing

Scales

The final scale values are determined according to the following norm line: 1-1,2-1,5-2-2,5-3-4-5-6-7,5-8 and decade multiples.

In case of instruments for current transformer connection this norm line is additionally supplemented with the standard values 1, 2,5-1, 6-1, 8 and decade multiples.

Special adjustment according to the norm line, in any measuring size, as for example „%“, „m/s“, „Upm“, „bar“ etc.

Special adjustment beyond the norm line, measuring size in any order.

Special adjustment after equation, curve or table, measuring size in any order.

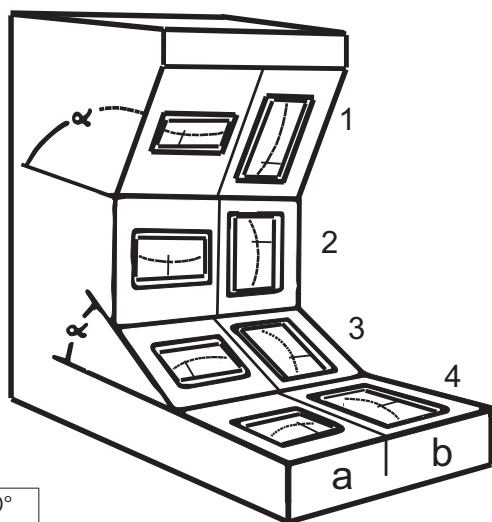
Pointers and scale division

Knife bar pointer
Division of scale: coarse-fine.

Technical Features (rectangular type line)

Position

The instruments are calibrated - if not indicated differently - for upright position (pos.2). Other positions across or inclined, under indication of the angle against the horizontal are considered on demand. The exact storig of the instruments enables installation positions in all angles.



1	$\alpha > 90^\circ$
2	$\perp = 90^\circ$
3	$\alpha < 90^\circ$
4	$\square = 0^\circ$

Position sign	Nominal position
\perp	upright position
\square	across position
\angle_{60°	inclined position (Installation angle indicate to the across position, for example 60°)

When ordering the installation position and the scale adjustment (Cross scale or horizontal) have to be indicated appropriate to the image above.

\angle_{120°	Installation inclined (indicate the angle) 1a. horizontal scale 1b. vertical scale
\perp	Installation upright 2a. horizontal scale 2b. vertical scale
\angle_{60°	Installation inclined (indicate the angle) 3a. horizontal scale 3b. vertical scale
\square	Installation across 4a. horizontal scale 4b. vertical scale

Standard execution: cross-scale, vertical installation.

Moving iron voltinstruments and moving iron aminstruments

Moving iron instruments

Jewelled. State-of-the-art construction with silicon oil damping. The flexible parts of the moving instruments are stored in springy sapphire jewels in order to protect them from crushes.

Consumption

Ammeter, voltmeter 0,5...1 VA, 1,5...3 VA
Frequency range 16%...100 Hz

Overload capacity according to DIN 43 780

Continuously 1.2 times
Short duration 10 times 5s at aminstruments
2 times 5s at voltinstruments

Connection

Hegaxon studs with screws
M3 and wire clamps: Volt and aminstruments up to 3 A
M5 and wire clamps: > 3A to 25 A

Scale course

The division of scale starts at about a fifth of the measuring value final range. In the beginning scale course compact.

Ammeter in standard execution with overload scale for doubled rated current.

Voltmeter for connection at the voltage transformer: the final scale value amounts to a 1.2 times rated voltage, for example:

- for transformer connection sec. 100 V measuring range is 0...120 V.
- for transformer connection sec. 110 V measuring range is 0...132 V.

Scale characteristic

Overload scale doubled

Special executions

Differing measuring range from the norm line

Additional measuring ranges

Measuring range with 3rd clamp
Voltmeter up to 600 V
Ammeter from 0.1 A to 25 A
in proportion 1:2 up to 1:5
with 2nd figures, however one division
with 2nd figures and 2nd division
Further measuring ranges on request

Overload scales

Aminstruments without overload scale

Scale expansion

Ammeter with expanded starting range on request
Voltmeter with scale expansion on request

Special adjustment

Adjustment for a specific frequency between 100 and 1000 Hz (as far as possible)

Suppressed zero point

Suppressed zero point (mech.) up to 30% of the final value, without zero position

Increased accuracy

Measuring accuracy on the increase 1% (as far as possible)

MOVING IRON PANEL INSTRUMENTS

EQ



Moving iron panel instruments

For alternating current 15 - 100 Hz

■ Class 1.5



EQ35p



EQ48n



EQ72n



EQ96n



Description

Moving iron panel instruments are predominantly used in the usual technical frequency range 15...100 Hz for alternating current and alternating voltage measurements in the ordinary technical frequency range 15...100 Hz.

Moving iron instruments practically show independently of the wave form - also at high harmonic content - the effective value of the alternating current.

In order to avoid overloads when starting the engines instruments are generally delivered with overload scales $2 \times I_n$ ($\neq 100\%$ overload). The final scale values correspond in $\dots/5A$ and in $\dots/1A$ to those of the current transformers.

The scale course of our moving iron instruments is in the beginning a bit compact and almost linear between 10 and 100 % of the final scale value. The length of the overload scale amounts to about 10 % for a scale of 100 % overload referred to the scale length.

The setting time accounts for approximately 1 second.

Consumption of EQ moving iron panel instruments (quadratic)

Ammeter up to 15 A	0,5 VA
Ammeter exceeding 15 A	0,8 VA
Voltmeter between	1 - 4,5 VA

Moving iron instruments can be connected in any order without observation of polarity (k-l) of the current transformer.

Moving iron instruments

Jewelled. Most modern building class with silicon oil damping. The flexible parts of the moving iron instruments are stored in springy sapphire jewels in order to protect them against crushes.

Interchangeable scales

All plastic executions (n-line) do have intercambiabile scales. This scale execution enables the easy exchange or fit of the scale (not during the operation).

Type	EQ48n	EQ72n	EQ96n	EQ144n
Front frame (mm)	48x48	72x72	96x96	144x144
Scale length (mm)	41	61	97	146

Execution for DIN rail mounting (EQ35p)

For measuring current and voltage in panel boards with 35 mm DIN rails according to DIN 50 022.

The instruments of this line are adapted by their dimensions to common installations devices. The installation width of the instruments of 45 mm corresponds to approx. 3 units. They can easily be mounted on DIN rail bars by snap on mounting.

The terminals are protected against accidental contact.

The moving iron meter is jewelled with silicon oil damping.

Consumption of EQ35p

Ammeter between	max. 0,5 VA
Ammeter 5 A	max. 0,5 VA
Voltmeter between	max. 2,5 VA
Voltmeter 100 V	max. 2,5 VA
Voltmeter 110 V	max. 2,5 VA

Table for norm-scales of voltmeters for connection to voltage transformer

* Voltmeter for connection to voltage transformer:	sec. 100 V or 110 V	
	Prim. Rated Voltage	Scale
The final scale value is 1.2 times the rated voltage, for example: for connection to transformer sec. 100 V the measuring range is 0...120 V for connection to transformer sec. 110 V the measuring range is 0...132 V Please indicate primary voltage, scale and secondary voltage when ordering..	500 V	0... 600 V
	600 V	0... 720 V
	1 KV	0... 1,2 KV
	3 KV	0... 3,6 KV
	5 KV	0... 6 KV
	6 KV	0... 7,2 KV
	10 KV	0... 12 KV
	10 KV	0... 18 KV
	15 KV	0... 18 KV
	20 KV	0... 24 KV
	25 KV	0... 30 KV
	30 KV	0... 36 KV
	33 KV	0... 40 KV
	60 KV	0... 72 KV
100 K	0... 120 KV	

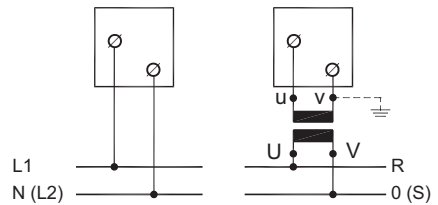
Standard Measuring Ranges

AC Voltages	AC Current
6 V	100 mA
10 V	150 mA
15 V	250 mA
25 V	400 mA
40 V	600 mA
60 V	1 A
100 V	1.5 A
120 V	2.5 A
132 V	4 A
150 V	5 A
250 V	6 A
300 V	10 A
400 V	15 A
500 V	20 A
600 V	25 A
750 V (except EQ48n/EQ35P)	30 A (except EQ35P)
	40 A (except EQ35P)
	50 A (except EQ35P)
	60 A (except EQ35P)
	100 A (except EQ48n/EQ35P)
For connection to voltage transformer .../100 V secondary .../110 V secondary	For connection to current transformer .../1 A secondary .../5 A secondary

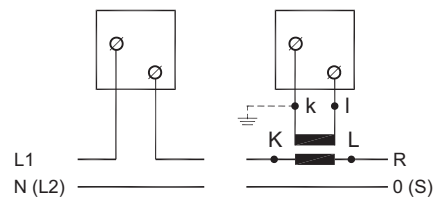
Other measuring ranges on request.

Connection diagrams

Voltmeter:

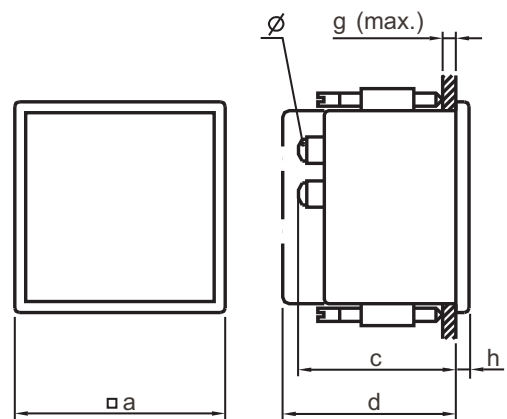


Ammeter:

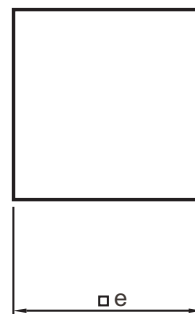
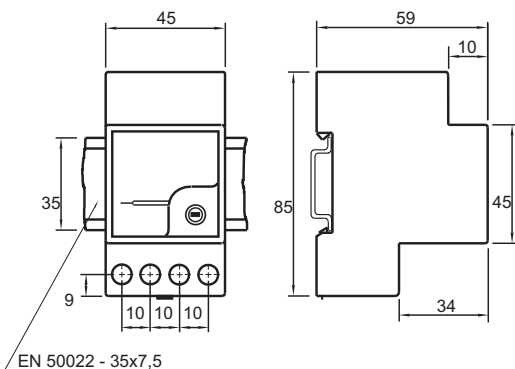


Housing dimensions of square moving iron instruments

Dimensions in mm / Weight in gramme									
Type	Dimensions	a	c	d	e	g	h	Ø	Weight
EQ 48n	25 - 40 A	48	66	72	45 ^{+0,6}	28	5	M6	190
	All others	48	55	62	45 ^{+0,6}	28	5	M4	14
EQ 72n	> 60 A	72	69	77	65 ^{+0,7}	8 ¹	5	M6	23
	25 < 60 A	72	66	74	65 ^{+0,7}	8 ¹	5	M8	280
	All others	72	55	75	65 ^{+0,7}	8 ¹	5	M4	200
EQ 96n	> 60 A	96	69	77	92 ^{+0,8}	8 ¹	5	M6	320
	25 < 60 A	96	66	75	92 ^{+0,8}	8 ¹	5	M8	365
	All others	96	55	75	92 ^{+0,8}	8 ¹	5	M4	280
EQ 144n	> 60 A	144	69	77	138 ⁺¹	41	8	M6	605
	25 < 60 A	144	66	75	138 ⁺¹	41	8	M8	665
	All others	144	53	74	138 ⁺¹	41	8	M4	590



Connection diagrams EQ35p



RECTANGULAR MOVING IRON PANEL INSTRUMENTS

EQP



Moving iron panel instruments

Profile instruments for alternating current or voltage 15 - 100 Hz

- Class 1.5 according to DIN 43 780
- Upright or across installation



EQP96x48q



EQP72x36h



EQP144x72h

Description

Moving iron panel instruments are predominantly used for alternating current and alternating voltage measurements in the usual technical frequency range of 50 up to 100 Hz, in special calibration up to 1000 Hz.

When measuring direct voltage or current there is an additional error of approximately 1 %.

Moving iron instruments indicate independently of the wave shape - even at high harmonic content - the effective value of the alternating current.

At extreme wave shapes (for example **phase-angle control** and frequencies > 100 Hz) you have to consider an exceedance of accuracy class for ammeters and voltmeters. The use for direct current or direct voltage measurements has to be specified explicitly in the order.

The EQP are especially not suited for the connection at shunt resistances or impulse transmitter because of their high consumption.

Moving iron movements

Jewelled. State-of-the-art construction with silicon oil damping. The flexible parts of the moving instruments are stored in springy sapphire jewels in order to protect them against crushes.

Consumption of EQP moving iron panel instruments (rectangular)	
Ammeter	0.5 up to 0.7 VA
Voltage meter	1.5 up to 3.5 VA

Overload capacity according to DIN 43780

Continuously	1.2 times
Short duration	10 times 5 s at ammeters 2 times 5 s at voltmeters

Front panel

Normal glass

Connection

Hexagon studs with screws

M 3 and clamp: Volt- and ammeter up to 3 A

M 5 and clamp: > 3 A up to 25 A

Position

Normal execution at profile instruments: horizontal-scale, upright installation. When ordering please indicate cross- or horizontal scale.

If no different information is provided the standard execution is delivered: front frame black, scale as the measuring range, upright mounting position, horizontal-scale.

Table for norm-scales of voltmeters for connection to voltage transformers:

* Voltmeter for connection to voltage transformer:	sec. 100 V or 110 V		
	Prim. Rated Voltage	Scale	
The final scale value is a 1.2 times the rated voltage, for example: for connection to transformer sec. 100 V the measuring range is 0...120 V	500 V	0... 600 V	
	600 V	0... 720 V	
	1 kV	0... 1,2 kV	
	3 kV	0... 3,6 kV	
	5 kV	0... 6 kV	
	6 kV	0... 7,2 kV	
	10 kV	0... 12 kV	
	10 kV	0... 18 kV	
	15 kV	0... 24 kV	
	20 kV	0... 24 kV	
for connection to transformer sec. 110 V the measuring range is 0...132 V	25 kV	0... 30 kV	
	30 kV	0... 36 kV	
	33 kV	0... 40 kV	
	60 kV	0... 72 kV	
	100 kV	0... 120 kV	
	Please indicate primary voltage, scale and secondary voltage when ordering..		

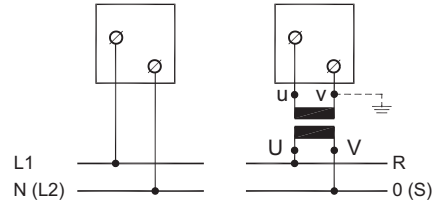
Standard Measuring Ranges

AC Voltages	AC Current
6 V	100 mA
10 V	150 mA
15 V	250 mA
25 V	400 mA
40 V	600 mA
60 V	1 A
100 V	1.5 A
120 V	2.5 A
132 V	4 A
150 V	5 A
250 V	6 A
300 V	10 A
400 V	15 A
500 V	
600 V	
For connection to voltage transformer .../100 V secondary .../110 V secondary	For connection to current transformer .../1 A secondary .../5 A secondary

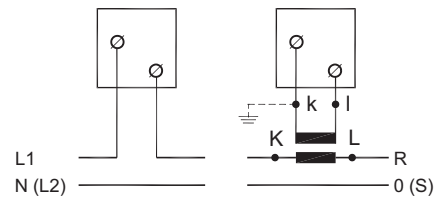
Other measuring ranges on request.

Connection diagram

Voltmeter:

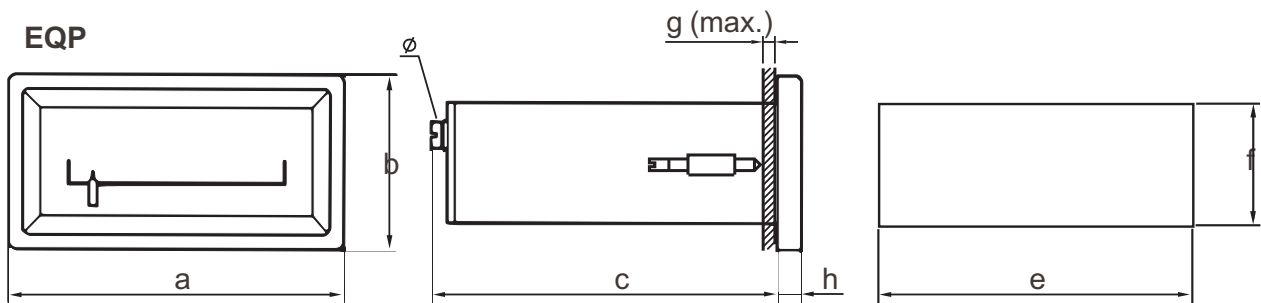


Ammeter:



Housing dimension of rectangular moving iron instruments

Dimensions in mm / Weight in gramme										
Type	a	b	c	d	e	f	g	h	Ø	Weight
EQP 72 x 36	72	36	105	-	68 ^{+0,7}	33 ^{+0,6}	40	5,5	M6	200
EQP 96 x 48	96	48	125	-	92 ^{+0,8}	92 ^{+0,6}	40	7	M4	350
EQP 144 x 72	144	72	170	-	138 ⁺¹	68 ^{+0,7}	40	8	M6	800



PR / PAR



Moving coil instruments with rectifier

For direct measurement of the alternating current and voltage
or
For connection at the current and voltage transformer

■ Class 1.5



PAR...n



PR...n

Description

These instruments do have the same features as the type PQ (see on page 4/35), but are equipped with a rectifier.

Thereby, it can be measured an alternating voltage or current up to 600 mA between 25 and 1000 Hz.

For instruments of 1-5 A: Frequency not exceeding 50-60 Hz.
(on request 400 Hz).

These instruments measure effective values at sinusoidal alternating currents and voltages.

Other kind of currents on request.

For measurements and intensity of currents exceeding 5A current transformers are used. (Current transformers see on chapter 5).

The scale course at voltage instruments is practically linear and resembles the moving coil panel instruments.

Overload capacity according to DIN 43780

continuously 1.2 times
Short duration 10 x I_N 5 s at instrument
2 x U_N 5 s at instrument

Execution with 240° round scale (PAR...n)

These instruments are similar to the PAQ...n but have an installed rectifier to measure the alternating current or voltage.

Other technical features same as PR instruments.

Internal resistance, consumption approx.				
Measuring range	PAR 48n	PAR 72n	PAR 96n	PAR 144n
6 - 60 V	1 mA			
100 - 600 V	1.12 mA			
200 - 600 μA	0.01 - 1.64 mVA			
1 - 250 mA	1.6 mVA - 0.76 VA			
400 mA - 5 A	0.38 VA			

Consumption
PR / PAR

Voltmeter: approx. 1 mA

Ammeter: up to 800 mA: 1 up to 1.5 V voltage drop
from 800 mA: approx. 0.25 VA

Standard Measuring Ranges

AC Voltages	AC Current	
	PR..n	PAR..n
6 V	60 µA	
10 V	100 µA	100 µA
15 V	150 µA	150 µA
25 V	250 µA	250 µA
40 V	400 µA	400 µA
60 V	600 µA	600 µA
132 V	1 mA	1 mA
150 V	1,5 mA	1,5 mA
250 V	2,5 mA	2,5 mA
300 V	4 mA	4 mA
400 V	6 mA	6 mA
500 V	10 mA	10 mA
600 V	15 mA	15 mA
	25 mA	25 mA
	40 mA	40 mA
	60 mA	60 mA
	100 mA	100 mA
	150 mA	150 mA
	250 mA	250 mA
	400 mA	400 mA
	600 mA	600 mA
	1 A*	1 A*
	1,5 A*	1,5 A*
	2,5 A*	2,5 A*
	4 A*	4 A*
	6 A*	6 A*
	10 A*	10 A*
For connection to voltage transformer .../100 V secondary .../110 V secondary	For connection to current transformer .../1 A secondary* .../5 A secondary*	

*At PR48n/PAR48n with external transformers

Others measuring ranges on request.

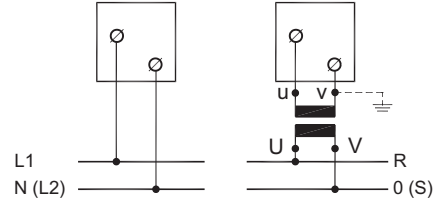
Housing dimensions of quadratic moving coil instruments with installed rectifier

Dimensions in mm / Weight in gramme							
Type	a	c	d	e	g	h	Weight
PR 48n	48	55	62	45 ^{+0,6}	28	5	280
PR 72n	72	55	74	68 ^{+0,7}	8 ¹	5	290
PR 96n	96	55	74	92 ^{+0,8}	8 ¹	5	375
PR 144n	144	53	74	138 ⁺¹	40	5	690
PAR 48n	48	53	64	45 ^{+0,6}	26	5	235
PAR 72n	72	53	64	68 ^{+0,7}	40	5	560
PAR 96n	96	53	64	92 ^{+0,8}	40	5	515
PAR 144n	144	53	64	138 ⁺¹	40	5	740

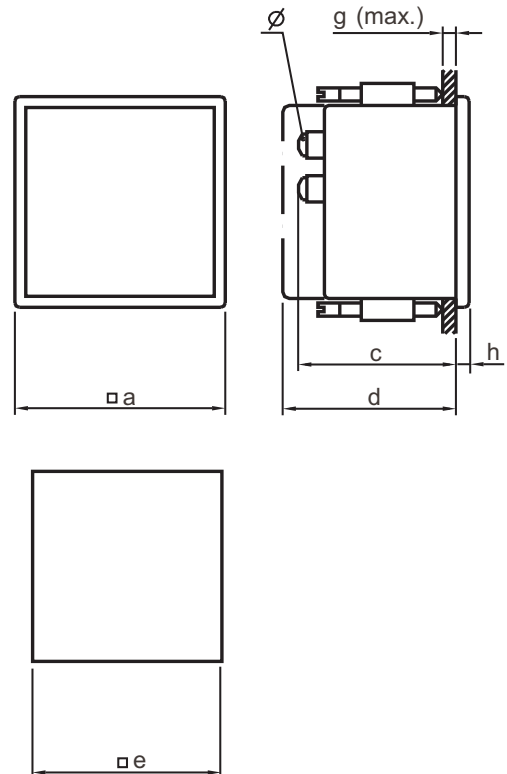
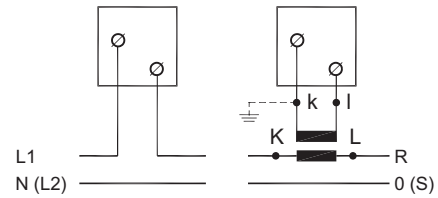
¹ 26 mm with fixing screws

Connection diagrams

Voltmeter:



Ammeter:



PRP / PRS



Rectangular moving coil instruments with rectifier

Profile instruments for a sinusoidal alternating current and voltage

- Class 1.5 according to DIN 43 780
- Upright or across installation



PRP96x24q



PRS96x24h

Description

Moving coil instruments with rectifier:

To measure the alternating current and voltage 40...50...10000 Hz.

Moving coil instruments with rectifier measure the arithmetic average value of current. Their scales are designed so that effective values are indicated in case of sinusoidal measuring sizes. The instruments don't have any overload range.

For moving coil instruments with rectifier a shape form is valid as a rated curve form at which the deviation of the sinusoidal form isn't exceeding 1% of the peak value of the fundamental vibration.

Voltmeters with end-values higher than 20 V, have an almost linear scale course.

For voltmeters with end-values up to 20 V the beginning of the scale division is a little compressed.

Overload capacity according to DIN 43780

Continuously: 1.2 times
 Short duration: 10 times 5 s at ammeters
 2 times 5 s at voltmeters

Execution profile housing PRP:

Front panel

Normal glass

Connection

Hexagon studs with screws
 M3 and clamps for volt and ammeter

Position

Normal execution at profile instruments: Horizontal scale, upright installation.

Internal resistance, consumption approx.

Measuring range	PRP 72 x 36s PRS 48 x 24p	PRP 96 x 48s PRS 72 x 24p	PRP 144 x 72s PRS 96 x 24p
$\mu\text{A}\sim$	10 - 600	-	-
$\text{mA}\sim$	1 - 600	1.2 V	1.2 V
$\text{A}\sim$	1	1.2 VA	1.2 V
	1,5		
	2,5		
	5		
$\text{V}\sim$	1.5 - 600	1000 Ω/V	0.3VA

Execution narrow profile housing PRS:

Front panel

Normal glass

Connection

Contact pin 6,3 x 0,8 mm

Position

Normal execution at profile instruments: Horizontal scale, upright installation.

Please indicate vertical or horizontal scale when ordering.

Special executions on request

Standard Measuring Ranges

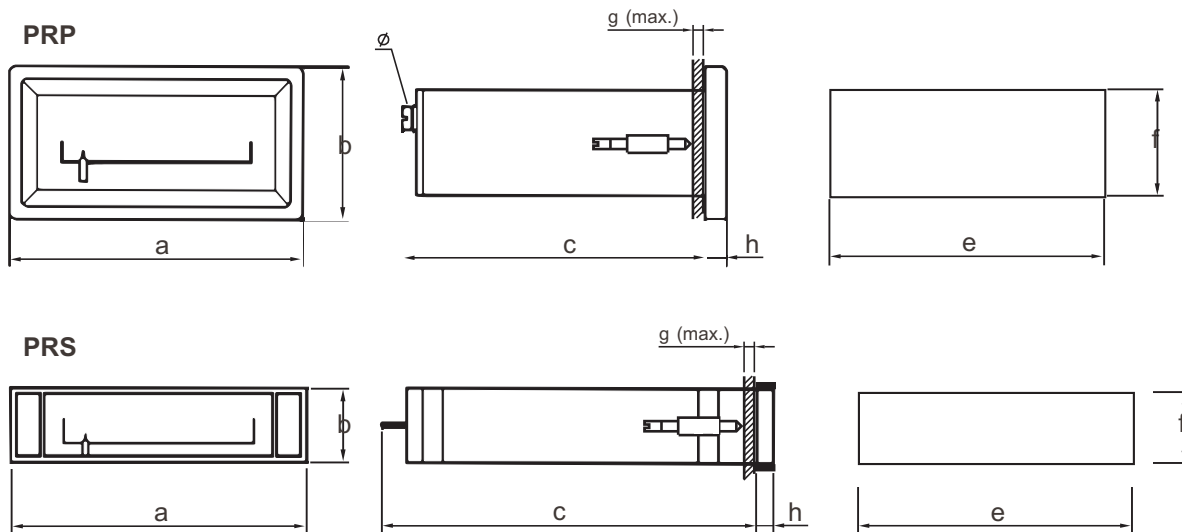
AC Voltages	AC Current
6 V	1 mA
10 V	1,5 mA
15 V	2,5 mA
25 V	4 mA
40 V	6 mA
60 V	10 mA
100 V	15 mA
150 V	25 mA
250 V	40 mA
300 V	60 mA
400 V	100 mA
500 V	150 mA
600 V	250 mA
	400 mA
	600 mA
	1 A*
	1,5 A*
	2,5 A*
	4 A*
	5 A*
For connection to voltage transformer .../100 V secondary .../110 V secondary	For connection to current transformer .../1 A secondary* .../5 A secondary*

* With external transformers

Other measuring ranges on request

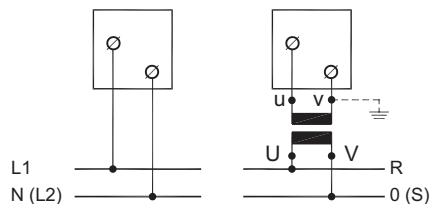
Housing dimensions of rectangular moving coil instruments with installed rectifier:

Dimensions in mm / Weight in gramme										
Type	a	b	c	d	e	f	g	h	Ø	Weight
PRP 72x36	72	36	105	-	68 ^{+0,7}	33 ^{+0,7}	40	5,5	M4	200
PRP 96x48	96	48	125	-	92 ^{+0,7}	44 ^{+0,7}	40	7	M4	500
PRP 144x72	144	72	170	-	138 ^{+0,7}	68 ^{+0,7}	40	8	M4	800
PRP 48x24	48	24	68	-	43,2 ^{+0,3}	22,2 ^{+0,3}	40	5,3	-	150
PRP 72x24	72	24	92	-	67 ^{+0,5}	22,2 ^{+0,3}	40	5,3	-	200
PRP 96x24	96	24	125	-	91 ^{+0,5}	22,5 ^{+0,3}	40	5,3	-	250

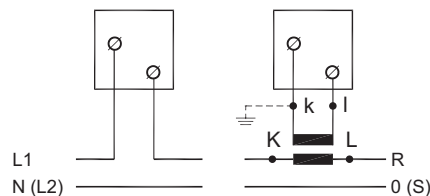


Connection diagrams

Voltmeter:



Ammeter:



SWITCHABLE MOVING IRON PANEL INSTRUMENTS

EQ..n SWT-3 / EQ..n SWT-6



Moving iron voltmeters

With integrated voltmeter switch

■ Class 1.5



Technical Features

Type		EQ72n SWT-6	EQ96n SWT-6	EQ72n SWT-3	EQ96n SWT-3
Front frame (mm)		72 x 72	96 x 96	72 x 72	96 x 96
Scale length (mm)		91	97	91	97
Weight (g)		190	230	190	230
Panel cut-out (mm)		66 + 0,7	92 + 0,8	66 + 0,7	92 + 0,8
Installation depth (mm)		55	55	55	55
Switch settings	Measuring range				
6 positions without zero position L3-L1, L2-L3, L1-L2, L1-N, L2-N, L3-N	V=				
	150	●	●	—	—
	250	●	●	—	—
	300	●	●	—	—
	400	●	●	—	—
	500	●	●	—	—
	600	●	●	—	—
For connection to voltage transformer	.../100*	●	●	—	—
.../110*	●	●	—	—	
Switch settings	Measuring range				
3 position with zero position L1-L3, L2-L3, L1-L2, OFF	V=				
	150	—	—	●	●
	250	—	—	●	●
	300	—	—	●	●
	400	—	—	●	●
	500	—	—	●	●
	600	—	—	●	●
For connection to voltage transformer	.../100*	—	—	●	●
.../110*	—	—	●	●	
Terminal cover according to VGB 4 included		●	●	●	●
Rubber grommets (per clamp); see on chapter 10 Accessories		●	●	●	●

● available ○ on request

* Please indicate primary voltage and final scale value when ordering

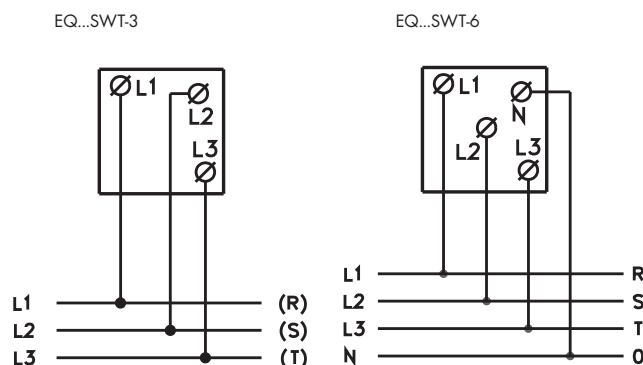
Description

These instruments with integrated switch can be used for measurements between phases or phase and zero. Thus only 1 instrument is needed for a 3-phases-grid.

Technical features see EQ-moving iron instruments (see on page 4/5).

Consumption EQ.. SWT	
EQ 72n SWT	EQ 96n SWT
3,5 VA max.	3,5 VA max.

Connection diagrams with switchable voltmeters



EQ..n SWT



Moving iron instruments

With integrated ammeter switch

■ Class 1.5



Description

These instruments with integrated switch enable the measurement of current of every single phase. Thus, you only need one instrument to measure the current in a 3-phase grid.

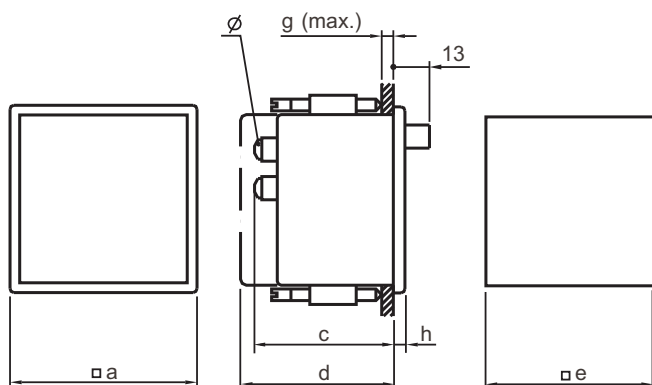
Please indicate on order if instruments are connected directly (max. 10 A), or to a current transformer. (Please indicate ratio of current transformer).

Consumption

1 VA per phase

Housing dimensions of switchable moving iron instruments

Dimensions in mm / Weight in gramme										
Type	a	b	c	d	e	f	g	h	Ø	Weight
EQ72n SWT	72	-	53	68	68 +0,7	-	40	5	M4	190
EQ96n SWT	96	-	53	68	92 +0,8	-	40	5	M4	230

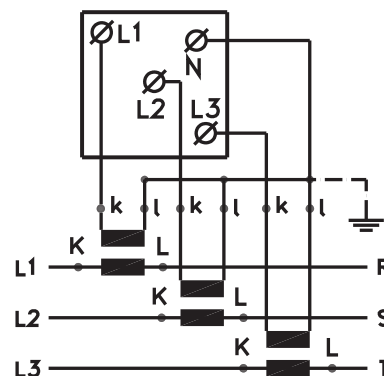


Technical Features

Type		EQ72n SWT-6	EQ96n SWT-6
Front frame (mm)		72 x 72	96 x 96
Scale length (mm)		91	97
Weight (g)		190	230
Panel cut-out (mm)		66 + 0,7	92 + 0,8
Installation depth (mm)		55	55
Switch settings	Measuring range		
4 positions L1, L2, L3, OFF	mA=	400	○
		600	○
	A=	1	○
		1,5	○
		2,5	○
		4	○
	6	○	
	For connection at the current	.../5	●
		.../1	●
Terminal cover according to VGB 4 included		●	●
Rubber grommets (per clamp); optional see chapter 10 Accessories		●	●

● available ○ on request

Connection diagram switchable ammeter



MAXIMUM DEMAND INDICATOR

BIQ...n



Maximum demand indicator

Maximum power diameter with drag indicator

- Class 3
- For connection to current transformers
- Secondary 5 A or secondary 1 A
- With interchangeable scale



Description

The system of this instrument consists of 2 bimetallic spirals which are installed working one against each other.

One bimetallic spiral works electricity driven, the other bimetallic spiral compensates by working against the other the ambient temperature which can vary from -10°C up to +55 °C.

A black pointer is coupled at this system which includes a red pointer whereat this red pointer stands still on the respectively reached highest value. The bimetallic instruments are thermally time-declined and indicate the average effective value.

Short-term current peaks don't have any influence on the measuring result. The instrument has a sealable resetting knob with which the red drag indicator can be resetted on the position of the meter's movement pointer. (Do not turn lower!).

Thermal time delay 15 min.

Maximum demand indicators are especially suited for the supervision of thermal load of cables and transformers.

Overload capacity according to DIN 43780

Continuously 1.2 times
Short duration 10 times 1 s

Adjustable scale factor disc for sticking available:

The adjustable scale factor disc extends the scale by the respectively adjusted constant.

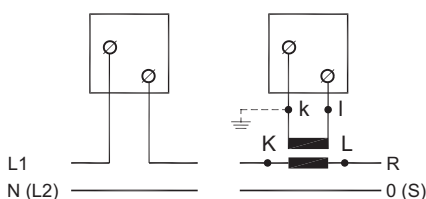
Norm-values of scale factor disc:

Type I: 1-2-2,5-3-4-5-6-7-8-9-10

Connection diagrams BIQ / BOQ

Direct connection

Connection via transformer



Technical Features

Type	BIQ72	BIQ96n	BIQ144s	
Front frame (mm)	72 x 72	96 x 96	144 x 144	
Scale length (mm)	91	97	139	
Consumption	.../5A .../1A	2,5 VA 1,6 VA	2,5 VA 1,6 VA	2,5 VA 1,6 VA
Setting time	at transformer			
15 min	.../5A .../1A	● ●	● ●	○ ○
Transformer primary current (A) = 100%		final scale value (A) = 120% Primary rated current + 20% overload		
A	5 10 15 20 25 30 40 50 60 75 100 125 150 200 250 300 400 500 600 750 800 1,0 kA 1,2 kA 1,5 kA 2,0 kA 2,5 kA 3,0 kA 4,0 kA	6 12 18 24 30 36 48 60 72 90 120 150 180 240 300 360 480 600 720 900 960 1,2 kA 1,4 kA 1,8 kA 2,4 kA 3,0 kA 3,6 kA 4,8 kA	6 12 18 24 30 36 48 60 72 90 120 150 180 240 300 360 480 600 720 900 960 1,2 kA 1,4 kA 1,8 kA 2,4 kA 3,0 kA 3,6 kA 4,8 kA	6 12 18 24 30 36 48 60 72 90 120 150 180 240 300 360 480 600 720 900 960 1,2 kA 1,4 kA 1,8 kA 2,4 kA 3,0 kA 3,6 kA 4,8 kA
Terminal cover or rubber grommets (1 set. = 2 pcs.)		● ●	● ●	● ●

● available ○ on request

Backside terminal cover for protection according to VBG 4
(Please indicate when ordering.)

BOQ...n



Maximum demand indicator with additional moving iron ammeter



- For connection to current transformer
- Secondary 5 A or secondary 1 A
- Class 3 and 1.5
- With interchangeable scale

Description

These instruments consist of a bimetallic maximum demand indicator combined with a moving iron system.

The bimetallic meter movement with its drag indicator shows the maximum value, the moving iron meter the present value. They are working smoothly at temperatures between -10 °C and +55 °C because of their robust assembling.

The instrument has a sealable resetting knob with which the red drag indicator can be reseted on the position of the meter movement's pointer. (Do not turn lower!).

The instruments can be furnished with a scale factor disc. (see BIQ, page 4/15)

The instruments are available in the size 96 x 96 also with an added saturation current transformer.

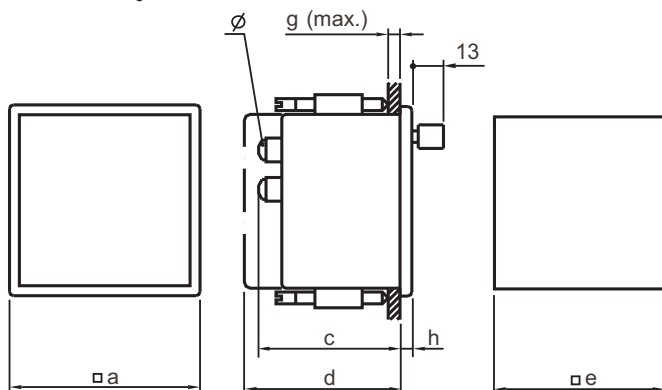
Overload capacity according to DIN 43780
 Continuously 1.2 times
 Short duration 10 times 1 s

Connection see BIQ (see on page 4/15)

Housing dimensions of bimetallic moving iron panel instruments

Dimensiones in mm / Weight in gramme									
Type	Dimensions	a	c	d	e	g	h	Ø	Weight
BIQ72n	.../5 A	72	55	74	68 ^{+0,7}	8 ¹	4,6	M6	190
	.../1 A	72	55	74	68 ^{+0,7}	8 ¹	4,6	M4	190
BIQ96n	.../5 A	96	55	74	92 ^{+0,8}	8 ¹	5	M6	250
	.../1 A	96	55	74	92 ^{+0,8}	8 ¹	5	M8	250
BIQ144s	.../5 A	144	70	-	138 ⁺¹	10	8	M4	625
	.../1 A	144	70	-	138 ⁺¹	10	8	M6	750
BOQ72n	.../5 A	72	55	74	68 ^{+0,7}	8 ¹	4,6	M8	230
	.../1 A	72	55	74	68 ^{+0,7}	8 ¹	4,6	M4	220
BOQ96n	.../5 A	96	55	74	92 ^{+0,8}	8 ¹	5	M6	290
	.../1 A	96	55	74	92 ^{+0,8}	8 ¹	5	M8	280
BEQ144s	.../5 A	144	70	-	138 ⁺¹	10	8	M4	680
	.../1 A	144	70	-	138 ⁺¹	10	8	M4	795

¹ 26 mm with fixing screws



Technical Features

Type		BOQ72	BOQ96n	BOQ144s
Front frame	(mm)	72 x 72	96 x 96	144 x 144
Scale length	(mm)			
	Bimetallic	52	71	90
	moving iron	61	90	90
Consumption	.../5A	3,4 VA	3,4 VA	2,7 VA
	.../1A	2,5 VA	2,5 VA	2,5 VA
Setting time	at transformer			
15 min	.../5A	●	●	●
	.../1A	●	●	●
Transformer primary current (A)		final scale value (A)		
= 100%		Bimetallic system	Movin iron system	
		20% overload	100% overload	
		= 120%	= 120%	
A	5	6	10	
	10	12	20	
	15	18	30	
	20	24	40	
	25	30	50	
	30	36	60	
	40	48	80	
	50	60	100	
	60	72	120	
	75	90	150	
	100	120	200	
	125	150	250	
	150	180	300	
200	240	400		
250	300	500		
300	360	600		
400	480	800		
500	600	1,0 kA		
600	720	1,2 kA		
750	900	1,5 kA		
800	960	1,6 kA		
1,0 kA	1,2 kA	2,0 kA		
1,2 kA	1,4 kA	2,4 kA		
1,5 kA	1,8 kA	3,0 kA		
2,0 kA	2,4 kA	4,0 kA		
2,5 kA	3,0 kA	5,0 kA		
3,0 kA	3,6 kA	6,0 kA		
4,0 kA	4,8kA	8,0 kA		
Terminal cover or rubber grommets		●	●	-
(1 set. = 2 pcs.)		●	●	●

● available ○ on request

Backside terminal cover for protection according to VBG 4 (Please indicate when ordering.)

TRIPLE MOVING INSTRUMENTS

EQ 192 x 96



Triple instruments

Triple combination with moving iron movements

- Class 1.5 according to DIN 43780
- Housing by DIN 43700

In a rectangular housing 192 x 96 mm, positioned side by side, or on top of each other

Description

Standard execution:

3 movements, positioned side-by-side.

These instruments are suited for alternating current 50 ... 100 Hz for simultaneous supervision of 3 phases in a three phase system. All moving iron ammeters have 2 times overload range.

On request:

3 movements positioned on top of each other

Backside plastic caps as back of hand protection according to VBG 4. (Please indicate when ordering).

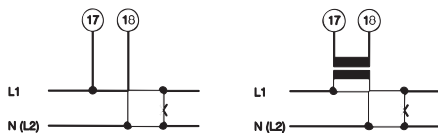
If there are no different indications, the standard execution is delivered: movements arranged side by side.

Attention:

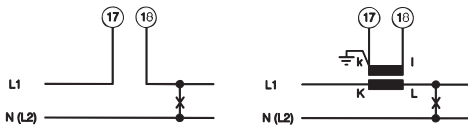
Please request the moving coil execution separately.

Connection diagrams

Voltmeter



Ammeter



Dimension diagrams see type BIQ192x96 page 4/18.

Backside terminal cover for protection according to VBG 4 (Please indicate when ordering.)

Technical Features

Type		EQ 192 x 96 side by side	EQ 192 x 96 on top of each other
Front frame (mm)		192 x 96	192 x 96
Panel cut-out (mm)		186 ^{+1,1} x 92 ^{+0,8}	186 ^{+1,1} x 92 ^{+0,8}
Installation depth (mm)		60	60
Scale length (mm)		3 x 72	3 x 72
Weight (Kg)		0,9	0,9
Measuring range mA [~]	100/ 200	●	●
	150/ 300	●	●
	250/ 500	●	●
	400/ 800	●	●
	600/ 1200	●	●
A [~]	1/2	●	●
	1,5/3	●	●
	2,5/5	●	●
	4/8	●	●
	6/12	●	●
	10/20	●	●
	15/30	●	●
	25/50	●	●
For transformer connection with 2 times overload capacity	.../1 A	●	●
	.../5 A	●	●
V [~]	6	●	●
	10	●	●
	15	●	●
	25	●	●
	40	●	●
	60	●	●
	100	●	●
	150	●	●
	250	●	●
	400	●	●
	500	●	●
600	●	●	
For transformer connection with 2 times overload capacity	.../1 A	●	●
	.../5 A	●	●
Rubber grommets (per clamp)		●	●

● available ○ on request

BIQ 192 x 96 / BOQ 192 x 96



BIQ



BOQ

Description

Standard execution:
3 movements, positioned side by side

On request:
3 movements, positioned on top of each other

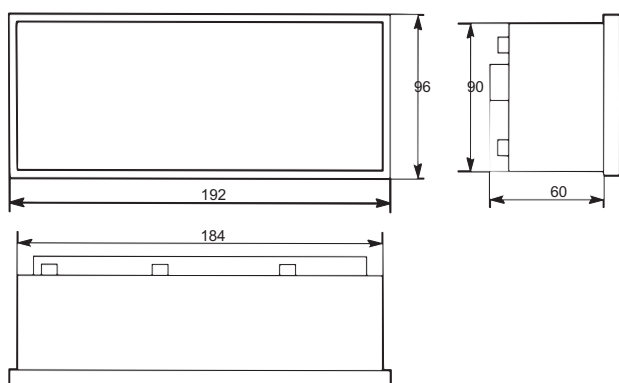
Class 1.5 (moving iron movement)
Indication error max. $\pm 3\%$ (bimetallic, movement) referred to the drag indicator.

Housing according to DIN 43700.

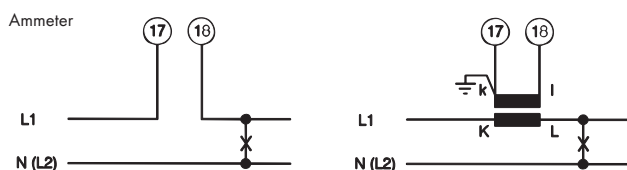
Backside plastic caps as back of hand protection according to VBG 4.
(Please indicate when ordering).

Attention:
If there are no different indications the standard execution is delivered.

Dimension diagrams



Connection diagrams



Triple Maximum demand indicators

Triple combination with bimetallic - or combined bimetallic - moving iron movements

- Class 3 / 1.5 according to DIN 43780
- Housing according to DIN 43700

In a rectangular housing 192 x 96 mm, positioned side by side, or on top of each other



Technical Features BIQ

Maximum ammeter with bimetallic movement	BIQ 192 x 96 side by side	BIQ 192 x 96 on top of each other
Front frame (mm)	192 x 96	192 x 96
Panel cut-out (mm)	186 ^{+1,1} x 92 ^{+0,8}	186 ^{+1,1} x 92 ^{+0,8}
Installation depth (mm)	60	60
Scale length (mm)	3 x 74	3 x 74
Weight (Kg)	0,7	0,7
3 bimetallic movements		
Setting time 15 min	●	●
on demand 8 min	●	●
Consumption at 1 A nominal current	3 x 1,3 VA	3 x 1,3 VA
Consumption at 5 A nominal current	3 x 3,5 VA	3 x 3,5 VA
Transformer connection .../1 A	●	●
.../5 A	●	●
Rubber grommets (per clamp)	●	●
Indicate nominal transformer current Measuring range end value = 1.2 times the nominal transformer current		

● available ○ on request

Technical Features BOQ

Maximum flowmeter with bimetallic movement	BOQ 192 x 96 side by side	BOQ 192 x 96 on top of each other
Front frame (mm)	192 x 96	192 x 96
Panel cut-out (mm)	186 ^{+1,1} x 92 ^{+0,8}	186 ^{+1,1} x 92 ^{+0,8}
Installation depth (mm)	60	60
Scale length (mm)	70 74	70 74
Weight (Kg)	1,0	1,0
3 bimetallic movements		
Setting time 15 min	●	●
on demand 8 min	●	●
Consumption moving iron and bimetallic at 1 A nominal current	3 x 2 VA	3 x 2 VA
Consumption moving iron and bimetallic at 5 A nominal current	3 x 4 VA	3 x 4 VA
Transformer connection .../1 A	●	●
.../5 A	●	●
Rubber grommets (per clamp)	●	●
Indicate nominal transformer current Measuring range end value = 1.2 times nominal transformer current		

● available ○ on demand

Backside terminal cover for protection according to VBG 4
(Please indicate when ordering.)

QUADRUPLE MOVIN IRON INSTRUMENTS

EQ...sK



Quadruple instruments

Combination as three moving iron ammeter and one moving iron voltmeter

- Class 2.5
- Housing 96 x 96 mm or 144 x 144 mm

Description

4 side by side arranged moving instruments. Each with 3 amstruments for transformer connection .../1 A or .../5 A and a voltmeter in a housing. These instruments are suited to the alternating current 15 ... 50 ... 100 Hz for synchronic supervision of 3 phases and the tension in three phase systems.

All moving iron aminstruments have 2 times overload range, voltmeter have 1.2 times overload range.

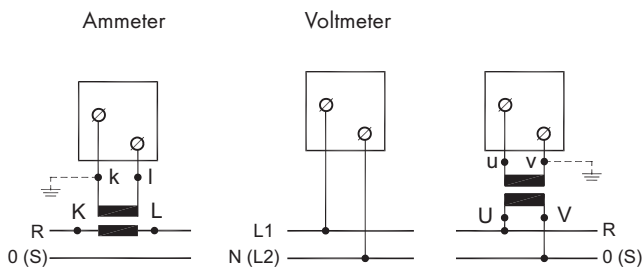
Moving iron meter

Jewelled. Most modern building class with silicon oil damping. The flexible parts of the moving instruments are stored in springy sapphire jewels in order to protect them against crushes.

Please indicate when ordering:

- 1) Housing size (96 x 96 or 144 x 144)
- 2) Primary and secondary current for aminstruments
- 3) Voltage measuring range for voltinstruments

Connection diagrams



Technical Features

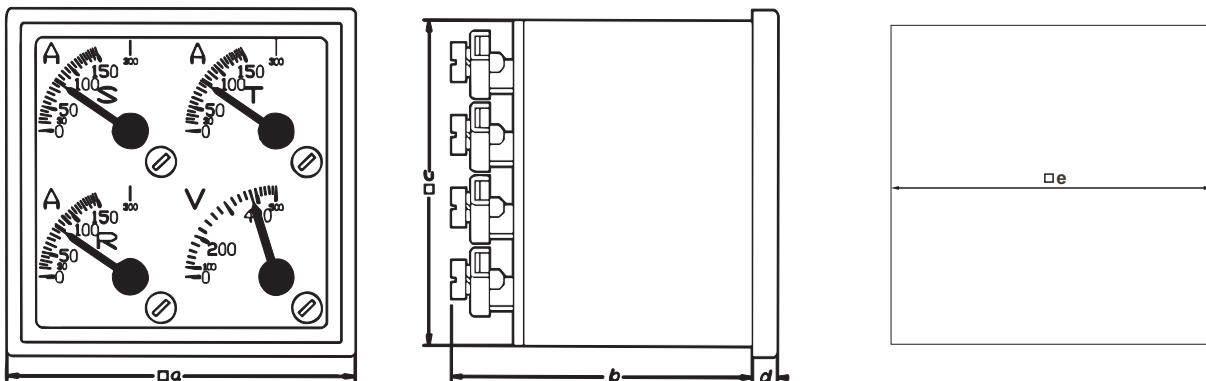
Maximum flowmeter with bimetallic moving meter	EQ 96sK		EQ 144sK	
	Front frame (mm)	96 x 96		144 x 144
Panel cut-out (mm)	92 ^{+1,1} x 92 ^{+0,8}		138 ^{+1,1} x 138 ^{+0,8}	
Installation depth (mm)	76		76	
Scale length (mm)	4 x 40		4 x 67	
Weight (Kg)	0,7		0,8	
Measuring range	Transformer connection		Transformer connection	
Voltage	.../1A	.../5A	.../1A	.../5A
V ~ 100	●	●	●	●
150	●	●	●	●
250	●	●	●	●
400	●	●	●	●
500	●	●	●	●
600	●	●	●	●
For transformer connection with 1.2 times overload range				
.../100 V	●	●	●	●
.../110 V	●	●	●	●
Rubber grommets (per clamp)	●	●	●	●

● available ○ on request

Dimensions in mm

Type	a	b	c	d	e
EQ 96sK	96	76	90	7	98 ^{+0,8}
EQ 144sK	144	76	135	7	138 ⁺¹

Dimensions diagrams:



ELECTRONIC ACTIVE POWER INSTRUMENT

DQ...n



Electronic Active Power Instrument (Wattmeter)

- For alternating current 50-60 Hz
- Class 1.5
- 90° scale



Description

The system consists of a moving coil meter with installed transducers which measures the active power in a sinusoidal or not sinusoidal current circuit and which transforms it into an analogue signal. This is then passed to the moving coil movement. The standardized scale final values are 1 - 1,2 - 1,5 - 2 - 2,5 - 3 - 4 - 5 - 6 - 8 and respectively the decimal multiples of those. Other values on request.

Consumption

The consumption per current path is < 0.2 VA

The current consumption in the voltage path amounts to: < 3.9 VA

When ordering power instruments please indicate

1. Kind of current as for example an one-phase alternating current or three-phase current with or without zero conductor, equally or unequally loaded.
2. The voltage between phases and between phase and zero conductor. When using voltage transformers please indicate the operating voltage, ratio and the switching of transformers (At more than 500V voltage transformers are required).
3. The current (max. 5 A directly). When using current transformers also indicate the ratio.
4. Indication of scale end-value at active power:

If not indicated we proceed as follows:

a) for one-phase alternating current net

$$P (W) = U (V) \times I (A)$$

b) for three-phase net

$$P (W) = U (V) \times I (A) \times \sqrt{3} \times \cos. \varphi.$$

If the $\cos. \varphi.$ is unknown, we use the value 1 for our calculations.

Technically realizable scale end-values: : P* 0.5 up to 1.2

Indication of scale end-value at reactive power:

a) for one-phase alternating current net

$$Q (var) = U (V) \times I (A) \times \sin. \varphi.$$

b) for three-phase net

$$Q (var) = U (V) \times I (A) \times \sqrt{3} \times \cos. \varphi.$$

If the $\cos. \varphi.$ is unknown, we use the value 1 for our calculations.

Technically realizable scale end-values: Q* 0.5 up to 1.2

If the zero point shouldn't be at the beginning of the scale but within the scale-range (wattmeter for the simultaneous capture of import and export) the required on the left and right of the zero point have to be indicated to. Active power instruments indicate with the needle's deflection to the right of the zero point the import of active power and on the left of the zero point the export of active power, for example, 100-0-100 kW. The same is valid for reactive power instruments.

Overload capacity according to DIN 43780

Current and voltage paths can be continuously overloaded for 20 %.

Technical Features

Front frame (mm)	96 x 96	144 x 144		
Scale length (mm)	97	146		
Weight (g)	a = 650	a = 900		
	b = 650	b = 950		
	c = 750	c = 1000		
	d = 900	d = 1100		
Measuring range	U (V)	I (A)	Type	Type
One phase alternating current ~	57,7 - 63,5 100 - 110 - 127 230 - 400	5	DQ 96n/1w	DQ 144n/1w
		1	●	●
Three-phase current balanced load ≍	100 - 110 - 230 400 440 - 500	5	DQ 96n/1d	DQ 144n/1d
		1	●	●
Three-phase current unbalanced load ≍	100 - 110 - 230 400 440 - 500	5	DQ 96n/2	DQ 144n/2
		1	●	●
Three-phase 4-wire current balanced load ≍	100 - 110 - 230 400 440 - 500	5	DQ 96n/1	DQ 144n/1
		1	●	●
Three-phase 4-wire current unbalanced load ≍	100 - 110 - 230 400 440 - 500	5	DQ 96n/3	DQ 144n/3
		1	●	●
Rubber grommets (per clamp)			●	●

● available ○ on request

Connection diagrams see page 4/25.

Dimension diagrams at DQ..n/b. (see page 4/22)

DQ..n/b



Electronic Reactive Power Instruments (Varmeter)

- For alternating current 50-60 Hz
- Class 1.5
- 90° scale



Description

The system consists of a moving coil movement with installed transducer which measures the reactive power in a sinusoidal or not sinusoidal current circuit and which transforms it into an analogue signal. This is then passed to the moving coil movement. These instruments have the same system and all technical explanations as our active power meter. (See page 4/21)
The standardized scale end-values are 1-1,2-1,5-2-2,5-3-4-5-6-8 and respectively the decimal multiples of those. Other values on request.

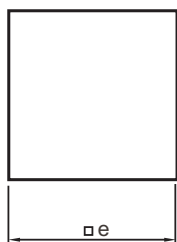
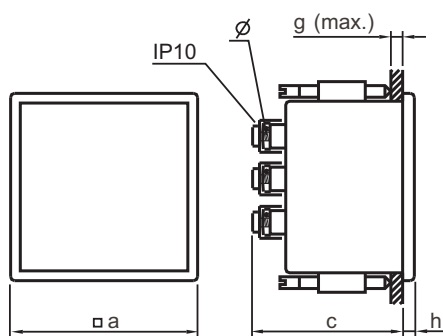
Consumption

The consumption per current path is < 0,2 VA
The current consumption in the voltage path is < 3,9 VA

Required ordering indications see at DQ..n. (see page 4/21)

Housing dimensions 90° wattmeter/varmeter

Dimensions in mm / Weight in gramme						
Type	a	c	e	g	h	∅
DQ 96n / DQ 96n/b	96	134	92 ^{+0,8}	40	5,5	M4
DQ 144n / DQ 144n/b	144	134	138 ⁺¹	40	5,5	M4



Technical Features

Measuring range	U (V)	I (A)	Type	Type
One phase alternating current	~		DQ 96n/1wb	DQ 144n/1wb
a	57,7 - 63,5 100 - 110 - 127 230 - 400	5 1	●	●
Three-phase current balanced load	≍		DQ 96n/1db	DQ 144n/1db
b	100 - 110 - 230 400 440 - 500	5 1	●	●
Three-phase current unbalanced load	≍		DQ 96n/2b	DQ 144n/2b
c	100 - 110 - 230 400 440 - 500	5 1	●	●
Three-phase 4-wire current balanced load	≍		DQ 96n/1b	DQ 144n/1b
a	100 - 110 - 230 400 440 - 500	5 1	●	●
Three-phase 4-wire current unbalanced load	≍		DQ 96n/3b	DQ 144n/3b
d	100 - 110 - 230 400 440 - 500	5 1	●	●
Rubber grommets (per clamp)			●	●

● available ○ on request

Connection diagrams see page 4/25.

ELECTRONIC ACTIVE POWER INSTRUMENT

DAQ...n



Electronic Active Power Instruments (Wattmeter)

- For alternating current 50-60 Hz
- Class 1.5
- 240° long scale



Description

The system consists of a moving coil movement with installed transducer which measures the reactive power in a sinusoidal or not sinusoidal current circuit and which transforms it into an analogue signal. This is passed to the moving coil movement. These instruments have the same system and all technical explanations as our active power meter.

The standardized scale final values are 1-1,2-1,5-2-2,5-3-4-5-6-8 and respectively the decimal multiples of those. Other values on request.

Consumption

The consumption per current path is < 0,2 VA

The current consumption in the voltage path is < 3,9 VA

When ordering please indicate power meter

1. Kind of current as for example an one-phase alternating current or three-phase with or without zero conductor, equally or unequally loaded.
2. The voltage between phases and between phase and zero conductor. When using voltage transformers please indicate the operating voltage, ratio and the switching of transformers (At more than 500V voltage transformers are required).
3. The current (max. 5 A directly). When using the current transformers also indicate the ratio.
4. Indication of scale end-value at active power:
If not indicated we proceed as follows:
a) for one-phase alternating current net
 $P (W) = U (V) \times I (A)$
b) for three-phase net
 $P (W) = U (V) \times I (A) \times \sqrt{3} \times \cos. \varphi$
If the $\cos. \varphi$ is unknown, we use the value 1 for our calculations.
Technically realizable final scale values: : P* 0.5 up to 1.2

Indication of scale end-value at reactive power:

- a) for an one-phase alternating current net
 $Q (var) = U (V) \times I (A) \times \sin. \varphi$
- b) for a three-phase moving current net
 $Q (var) = U (V) \times I (A) \times \sqrt{3} \times \cos. \varphi$
If the $\cos. \varphi$ is unknown, we use the value 1 for our calculations.
Technically realizable final scale values: Q* 0.5 up to 1.2

If the zero point shouldn't be at the beginning of the scale but within the scale-range (wattmeter for the simultaneous capture of import and export the required ranges on the left and right of the zero point have to be indicated.

Active power instruments show with the needle's deflection to the right of the zero point import of active power and on the left of the zero point the export of active power, for example,100-0-100 kW. The same is valid for reactive power instruments.

Overload capacity according to DIN 43780

Current and voltage paths can be continuously overloaded for 20 %.

Technical Features

Measuring range	U (V)	I (A)	Type	Type
Front frame (mm)	96 x 96	144 x 144		
Scale length (mm)	142	230		
Weight (g)	a = 460	a = 720		
	b = 510	b = 770		
	c = 695	c = 960		
	d = 725	d = 990		
One phase alternating current	~		DAQ 96n/1w	DAQ 144n/1w
a	57,7 - 63,5	5	●	●
	100 - 110 - 127			
	230 - 400	1	●	●
Three-phase current balanced load	≡		DAQ 96n/1d	DAQ 144n/1d
b	100 - 110 - 230	5	●	●
	400			
	440 - 500	1	●	●
Three-phase current unbalanced load	≡		DAQ 96n/2	DAQ 144n/2
c	100 - 110 - 230	5	●	●
	400			
	440 - 500	1	●	●
Three-phase 4-wire current balanced load	≡≡		DAQ 96n/1	DAQ 144n/1
a	100 - 110 - 230	5	●	●
	400			
	440 - 500	1	●	●
Three-phase 4-wire current unbalanced load	≡≡		DAQ 96n/3	DAQ 144n/3
d	100 - 110 - 230	5	●	●
	400			
	440 - 500	1	●	●
Rubber grommets (per clamp)			●	●

● available ○ on request

Connection diagrams see page 4/25.

Dimension diagrams see at DAQ..n/b.(see page 4/25).

DAQ..n/b



Electronic Reactive Power Instruments (Varmeter)

- For alternating current 50-60 Hz
- Class 1.5
- 240° long scale



Description

The system consists of a moving coil movement with installed transducer which measures the reactive power in a sinusoidal or not sinusoidal current circuit and which transforms it into an analogue signal. This is then passed to the moving coil movement. These instruments have the same system and all technical explanations as our active power meter. The standardized scale final values are 1-1,2-1,5-2-2,5-3-4-5-6-8 and respectively the 10-,100-, 1000 times etc. Other values on request.

Consumption

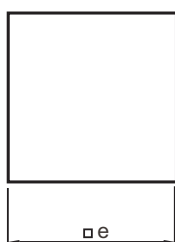
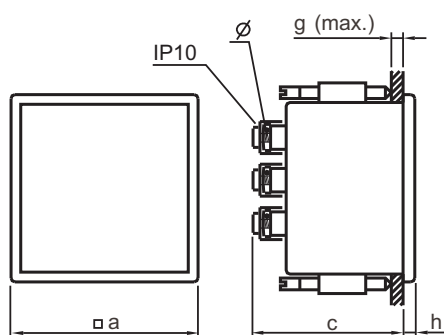
The consumption per current path amounts to: < 0,2 VA
The current consumption in the voltage path amounts to: < 3,9 VA

Required ordering indications see at DAQ..n (see page 4/23).

Housing dimensions 240° wattmeter/varmeter

Dimensions in mm / Weight in gramme

Type	a	c	e	g	h	Ø
DAQ 96n / DAQ 96n/b	96	134	92 ^{+0,8}	40	5,5	M4
DAQ 144n / DAQ 144n/b	144	134	138 ⁺¹	40	5,5	M4



Technical Features

Front frame (mm)	96 x 96	144 x 144		
Scale length (mm)	142	230		
Weight (g)	a = 460	a = 720		
	b = 510	b = 770		
	c = 695	c = 960		
	d = 725	d = 990		
Measuring range	U (V)	I (A)	Type	Type
One phase alternating current	~		DAQ 96n/1wb	DAQ 144n/1wb
a	57,7 - 63,5	5	●	●
	100 - 110 - 127	1	●	●
	230 - 400		●	●
Three-phase current balanced load	≍		DAQ 96n/1db	DAQ 144n/1db
b	100 - 110 - 230	5	●	●
	400	1	●	●
	440 - 500		●	●
Three-phase current unbalanced load	≍		DAQ 96n/2b	DAQ 144n/2b
c	100 - 110 - 230	5	●	●
	400	1	●	●
	440 - 500		●	●
Three-phase 4-wire current balanced load	≍		DAQ 96n/1b	DAQ 144n/1b
a	100 - 110 - 230	5	●	●
	400	1	●	●
	440 - 500		●	●
Three-phase 4-wire current unbalanced load	≍		DAQ 96n/3b	DAQ 144n/3b
d	100 - 110 - 230	5	●	●
	400	1	●	●
	440 - 500		●	●
Rubber grommets (per clamp)			●	●

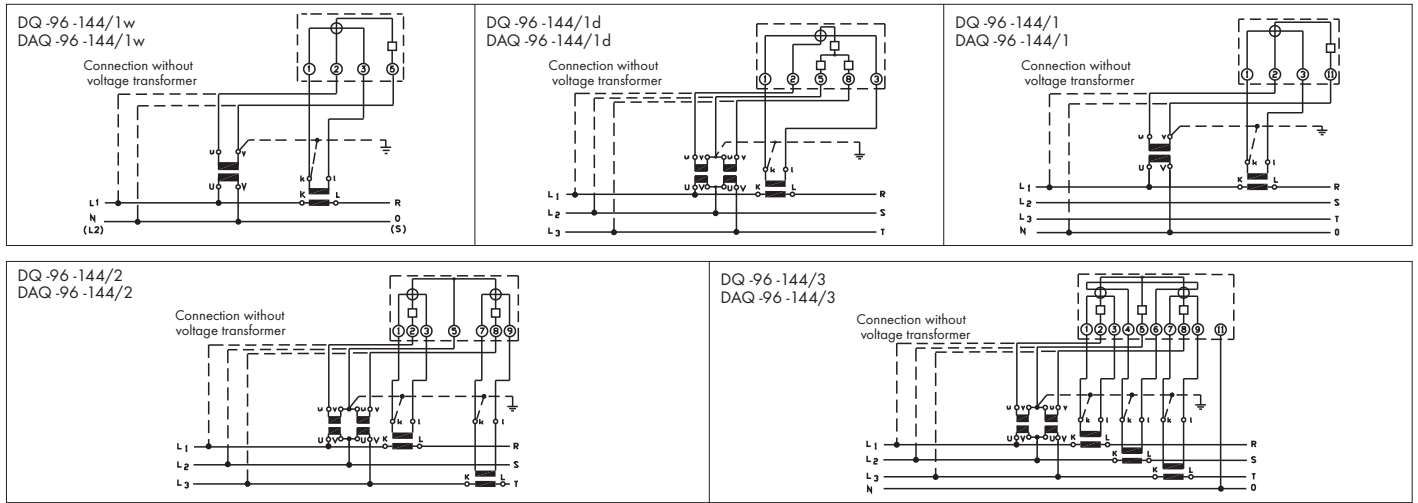
● available ○ on request

Connection diagrams see page 4/25.

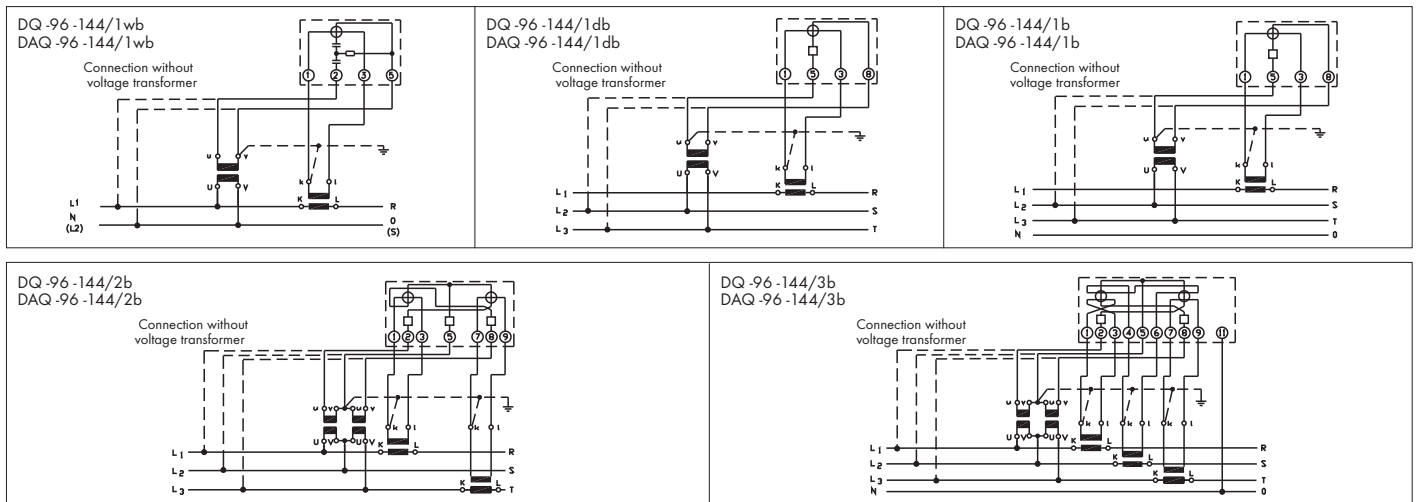
POWER INSTRUMENTS/ POWER FACTOR INSTRUMENTS

Diagram of connections for power instruments and power factor instruments

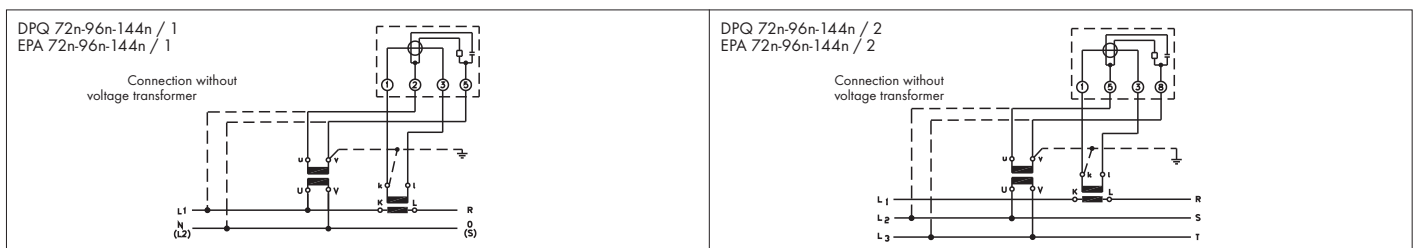
Active power instrument



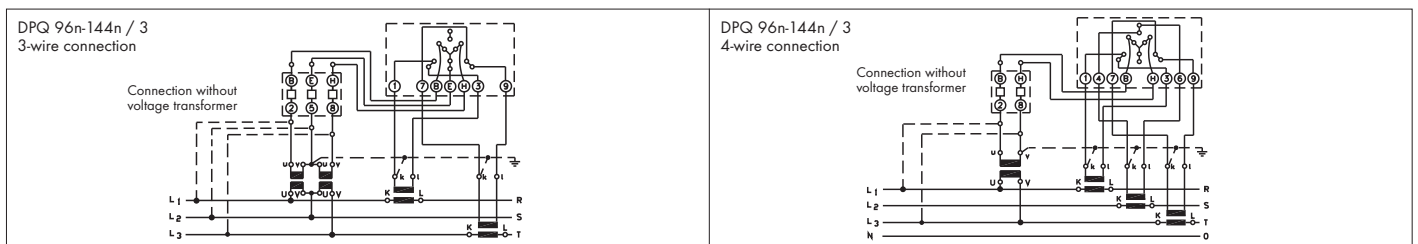
Reactive power instrument



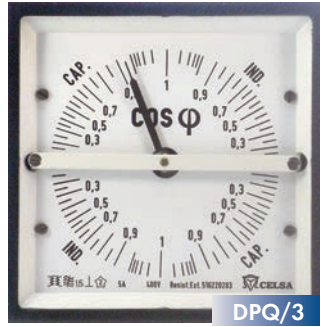
Power factor instrument



Power factor instrument



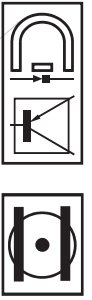
DPQ



Electronic Power Factor Instruments

With moving coil movement
or induction quotient movement

- For alternating current 50 - 60 Hz
- Class 1.5



Description DPQ/1/2 with moving coil movement

These instruments measure the $\cos \phi$ value (power factor). Our types DPQ...n/1 and DPQ...n/2 have a moving coil movement with 90° scale.

Standard scale execution:

- cap. 0,5-1-0,5 ind.
- cap. 0,8-1-0,3 ind.
- cap. 0,8-1-0,8 ind.

The type DPQ/1/2 measures the power factor in a three-phase network with balanced load.

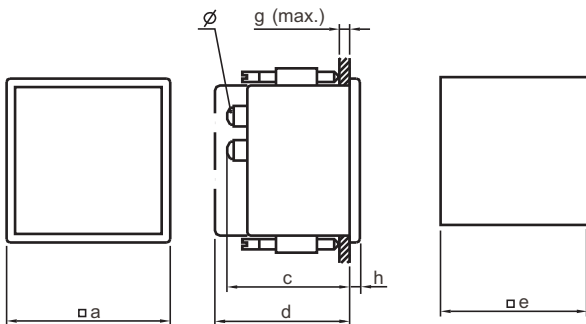
Description DPQ/3 with induction quotient movement:

The type DPQ.../3 has an induction quotient movement and is used to measure the power factor in three phase equal or unequal loaded nets with or without zero conductor. The scale is 360° to collect all values of $\cos \phi$ capacitive or inductive imported or exported energy. Minimum: $I_{min} = I_N \times 0.2$

Diagrams of connecton see page 4/25.

Housing dimensions power factor meter

Dimensions in mm / Weight in gramme								
Type		a	c	d	e	g	h	∅
DPQ 72n/1 -/2	from 240 V	72	55	65	68 +0,7	40	4,6	M4
	until 380 V	72	106	132	68 +0,7	40	4,6	M4
DPQ 96n/1 -/2	from 240 V	96	55	65	92 +0,8	40	5	M4
	until 380 V	96	106	132	92 +0,8	40	5	M4
DPQ 144n/1 -/2	from 240 V	144	53	63	138 +1	40	5,5	M4
	until 380 V	144	53	63	138 +1	40	5,5	M4
DPQ 96s/3		96	125	151	92 +0,8	10	5	M4
DPQ 144s/3		144	136	162	138 +1	10	5	M4



Technical Features DPQ/1/2

Front frame (mm)		72 x 72	96 x 96	144 x 144
Scale length (mm)		61	97	146
Weight (g)		550	600	800
Consumption				
	Current path 5 A	max. 1 VA	max. 1 VA	max. 1 VA
	Current path 1 A	max. 1 VA	max. 1 VA	max. 1 VA
	Voltage path	max. 3 VA	max. 3 VA	max. 3 VA
Voltage U (V)	Current path I (A)	Type	Type	Type
One phase alternating current ~		DPQ 72n/1	DPQ 96n/1	DPQ 144n/1
	57,5 - 100 - 110 - 120	●	●	●
	220 - 230 - 240	●	●	●
	380 - 400	●	●	●
Three-phase current balanced load ≍		DPQ 72n/2	DPQ 96n/2	DPQ 144n/2
	57,5 - 100 - 110 - 120	●	●	●
	220 - 230 - 240	●	●	●
	380 - 400	●	●	●
440 - 500	1	●	●	●
Terminal cover or rubber grommets (per clamp)		●	●	●
		●	●	●

● available ○ on request

Technical Features DPQ/3

Front frame (mm)		96 x 96	144 x 144
Scale length (mm)		200	320
Weight (g)		1450	2400
		(with external shunt)	(with external shunt)
Consumption		max. 30 mA	max. 3.5 VA
Voltage U (V)	Current path I (A)	Type	Type
Three-phase current balanced load ≍	20 ... 120%	DPQ 96s/3	DPQ 144s/3
	100 - 110	●	●
	230 ±15	●	●
	400	●	●
440	1	●	●
Terminal cover or rubber grommets (per clamp)		○	○
		●	●

● available ○ on request

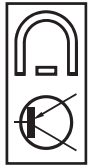
EPA...n



Electronic Power Factor Instruments

For alternating current 50-60 Hz

■ Round scale 240°



Description

These instruments measure the $\cos \varphi$ value. Our type EPA has a moving coil meter movement that shows by an electronic circuit the phase shift between voltage and current ($\cos \varphi$). Scales are available between 90° and 260° phase shift, as well as capacitive and inductive.

Standard scale execution:

- cap. 0,5-1-0,5 ind.
- cap. 0,8-1-0,3 ind.
- cap. 0,8-1-0,8 ind.

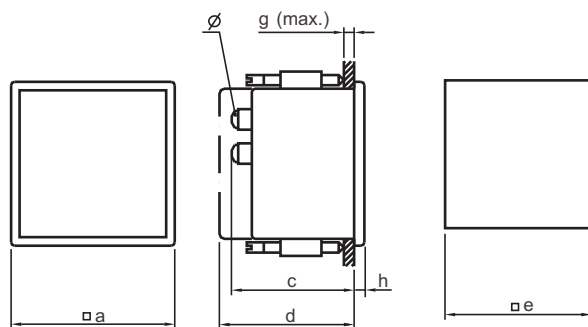
Data:

Temperature drift 0,08 % per °C.
 Consumption per voltage path approx. 3 VA
 Consumption per current path Δ approx. 1 VA
 Admissible deviation of voltage $U=U_N \pm 15\%$
 Minimal current: $I_{\min}=I_N \times 0,2$
 Notice: If $I < 0,1$ the $\cos \varphi$ is outside of the measuring range.

Connection diagrams see page 4/25.

Housing dimensions power factor meter

Dimensions in mm							
Type	a	c	d	e	g	h	Ø
EPA 72n/1 -/2	72	106	132	68 ^{+0,7}	40	4,6	M4
EPA 96n/1 -/2	96	106	132	92 ^{+0,8}	40	5	M4
EPA 144n/1 -/2	144	53	63	138 ⁺¹	40	5,5	M4



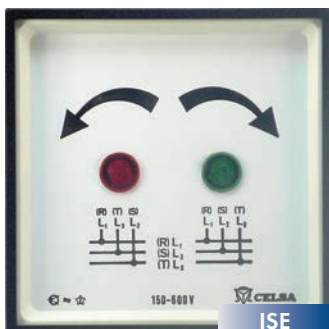
Technical Features

Front frame (mm)	72 x 72	96 x 96	144 x 144		
Scale length (mm)	106	142	230		
Weight (g)	550	680	800		
Voltage U (V)	Current path I (A)	Type	Type	Type	
One phase alternating current \sim	5	EPA 72n/1	EPA 96n/1	EPA 144n/1	
		57,7 - 100 - 110 - 120	●	●	●
		220 - 230 240	●	●	●
		380 - 400	●	●	●
440 - 500	1	●	●	●	
Three-phase current balanced load \approx	5	EPA 72n/2	EPA 96n/2	EPA 144n/2	
		57,7 - 100 - 110 - 120	●	●	●
		220 - 230 240	●	●	●
		380 - 400	●	●	●
440 - 500	1	●	●	●	
Terminal cover or rubber grommets (per clamp)		○	○	○	
		●	●	●	

● available ○ on request

Backside terminal cover for protection according to VBG 4 (Please indicate when ordering.)

ISE



Phase sequence indicators

- ISE/1 for three-phase current
- ISE/2 for three-phase current with switch contact



Description

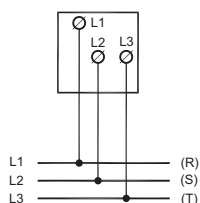
These instruments are constructed without any movable parts. Their construction is electronic. Phase sequence indicators serve to determine the phase sequence in 3-phase systems. These instruments 72s/1 and ISE 96s/1 are suited for the permanent connection at voltages between 150 and 600 V. If the phases are connected in accordance with the clamp name the green control lamp flashes. Otherwise the red control lamp flashes. For type ISE 96s/2 the rated voltage has to be indicated. It is an instrument with switch contact. As soon as the red control lamp flashes the control unit is activated. A relay output is available with an isolated switch-over contact.

Technical Features ISE96/2:

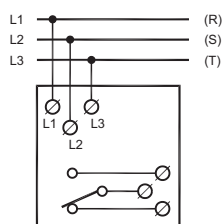
- Voltage: 110 / 230 / 400 / 440 V
50 or 60 Hz
- Switching range: $U_N +20\%$ up to $-20\% U_N$
- Relay output: 1 isolated change-over contact (changer)
- Switching capacity at ohmic load: 1×10^6 .
- Maximal switching current: 6 A, 250 V max. 300 W at alternating voltage

Connection diagrams:

ISE 72n/1
ISE 96n/1



ISE96s/2



Technical Features

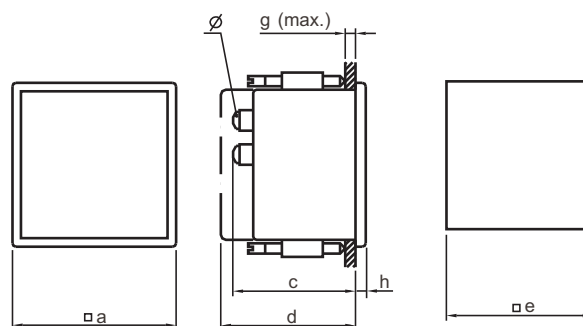
Type	ISE 72n/1	ISE 96n/1	ISE 96fs/2
Front frame (mm)	72 x 72	96 x 96	96 x 96
Weight (g)	200	250	600
Consumption	1,5	1,5	1,5
Voltage (V)			
150 - 600 V	●	●	—
110 V	—	—	○
230 V	—	—	○
400 V	—	—	●
440 V	—	—	○
500 V	—	—	○
Terminal cover or rubber grommets (per clamp)	●	●	●

● available ○ on request

Backside terminal cover for protection according to VBG 4 (Please indicate when ordering.)

Housing dimensions phase sequence indicators

Dimensions in mm							
Type	a	c	d	e	g	h	∅
ISE 72n/1	72	58	76	$68^{+0,7}$	40	4,6	M4
ISE 96n/1	96	58	76	$92^{+0,8}$	40	5	M4
ISE 96fs/2	96	78	95	$92^{+0,8}$	10	5	M4



REED TYPE FREQUENCY INSTRUMENTS

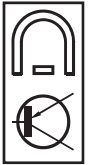
FA...n / FAG...n



Pointer Type Frequency Instruments

With moving coil movement and built-in transducer

- FA with 90° scale
- FAG with 240° round scale



Description

These instruments offer a moving coil movement with an electronic transducer. The movements are jewelled and shock-proofed by sprung jewel stocking. The display is mainly independent of curves, form errors and fluctuations of the measurement voltage.

Admissible change in rating voltage: $\pm 20\%$
 External magnet field: 0.5 mT

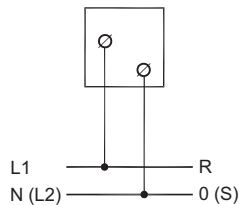
Special feature type FAG:

The large scale length enables a very exact determination of frequency.

The following types are available on request:

FA 48n FAG 48n FAG 144n

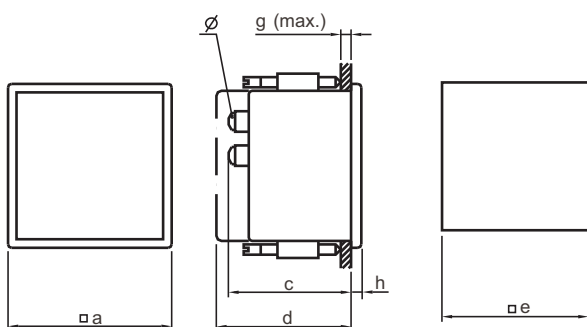
Connection diagram



Housing dimensions pointer type frequency instruments

Dimensions in mm / Weight in gramme							
Type	a	c	d	e	g	h	Ø
FA 72n	72	55	75	68 ^{+0,7}	8 ¹	4,6	M4
FA 96n	96	55	75	92 ^{+0,8}	8 ¹	5	M4
FA 144n	144	53	53	138 ⁺¹	40	5,5	M4
FAG 72n	72	53	53	68 ^{+0,7}	40	5	M4
FAG 96n	96	53	53	92 ^{+0,8}	40	5,5	M4

¹ 26 mm with fixing screws



Technical Features

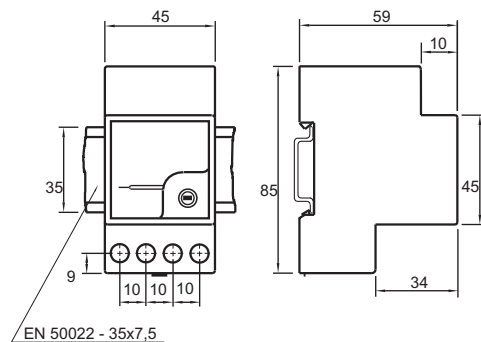
Type	FA 35p	FA 72n	FA 96n	FA 144n	FAG 72n	FAG 96n
Front frame (mm)	45 x 45	72 x 72	96 x 96	144 x 144	72 x 72	96 x 96
Scale length (mm)	40	63	97	146	106	142
Weight	165	210	280	490	210	280
Consumption		< 7 VA	< 7 VA	< 7 VA	< 7 VA	< 7 VA
Range (Hz)	U(V)					
45 - 55	100	●	●	●	●	●
45 - 55	110	●	●	●	●	●
45 - 55	230	●	●	●	●	●
45 - 55	400	●	●	●	●	●
45 - 55	440	●	●	●	●	●
45 - 55	500	○	○	○	○	○
45 - 65	100	●	●	●	●	●
45 - 65	110	●	●	●	●	●
45 - 65	230	●	●	●	●	●
45 - 65	400	●	●	●	●	●
45 - 65	440	●	●	●	●	●
45 - 65	500	○	○	○	○	○
55 - 65	100	●	●	●	●	●
55 - 65	110	●	●	●	●	●
55 - 65	230	●	●	●	●	●
55 - 65	400	●	●	●	●	●
55 - 65	440	●	●	●	●	●
55 - 65	500	○	○	○	○	○
Terminal cover with rubber grommets per clamp	-	●	●	●	●	●
	-	○	○	○	○	○

● available ○ on request

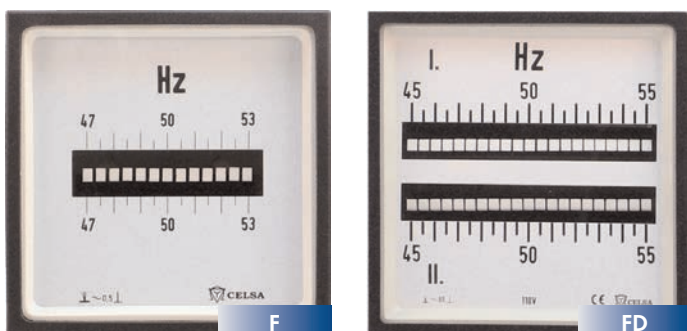
Other measuring ranges on request.

Backside terminal cover for protection according to VBG 4 (Please indicate when ordering.)

Connection diagram FA35p



F / FD



Vibrating Reed Type Frequency Instruments / Double Reed Frequency Instruments



■ Class 0.5

Description

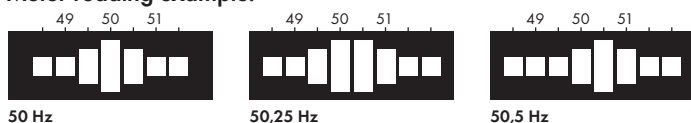
The vibrating reed type frequency instruments have a vibrating meter movement at which a ridge with sprung reeds is fastened to an electronic magnet.

If the frequency of the impressed voltage corresponds to the of resonance frequency of the reed of a vibrating meter movement this reed begins to swing. The amplitude of reeds is proportional to the squared voltage.

Double Reed Frequency Instruments:

with 2 lines of frequency reeds for 2 separated voltages for the synchronization of 2 parallel connected generators or for the measurement of two separated nets simultaneously.

Meter-reading example:



Technical Features FD

Type	FD 96s	F 96n		
Front frame (mm)	96 x 96	96 x 96		
Weight (g)	880	1260		
Consumption	max. 2 x 2.3 VA	max. 2 x 2.3 VA		
Measuring range (Hz)	U (V)	Reeds		
2 x 46 ... 50 ... 54	2 x 110	2 x 17	●	○
	2 x 230		●	○
	2 x 400		●	○
	2 x 440		●	○
2x 45 ... 50 ... 55	2 x 110	2 x 21	○	●
	2 x 230		○	●
	2 x 400		○	●
	2 x 440		○	●
2 x 56 ... 60 ... 64	2 x 110	2 x 17	●	○
	2 x 230		●	○
	2 x 400		●	○
	2 x 440		●	○
2 x 50 ... 60 ... 65	2 x 110	2 x 21	○	●
	2 x 230		○	●
	2 x 400		○	●
	2 x 440		○	●
Terminal cover or rubber grommets (per clamp)			●	○

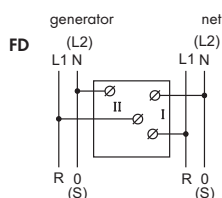
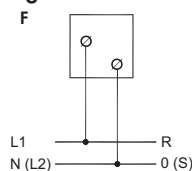
● available ○ on request

Technical Features F

Type	F 72n	F 96n	F 144s		
Front frame (mm)	72 x 72	96 x 96	144 x 144		
Weight (g)	235	440	890		
Consumption	max. 5 VA	max. 5 VA	max. 2.3 VA		
Range (Hz)	U (V)	Reeds			
47 ... 50 ... 53	100 - 110	13	●	●	●
	230		●	●	●
	400		●	●	●
	440		●	●	●
57 ... 60 ... 63	100 - 110	13	●	●	●
	230		●	●	●
	400		●	●	●
45 ... 50 ... 55	100 - 110	13	● ¹	● ¹	●
	230		● ¹	● ¹	●
	400		● ¹	● ¹	●
	440		● ¹	● ¹	●
55 ... 60 ... 65	100 - 110	13	● ¹	● ¹	●
	230		● ¹	● ¹	●
	400		● ¹	● ¹	●
	440		● ¹	● ¹	●
Terminal cover or rubber grommets (1 sent. = 2 pcs.)			●	●	○

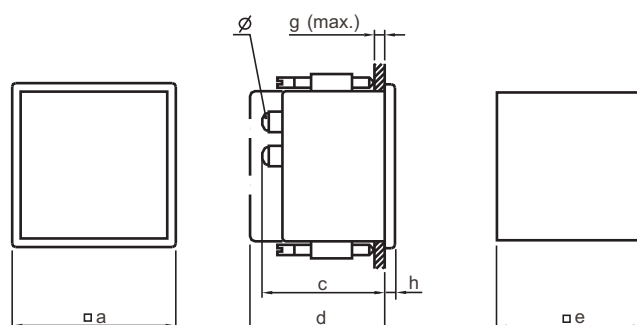
● available ○ on request ●¹: Cl. 1 ●²: 21 reeds at FD144s

Connection diagrams



Housing dimensions vibrating reed type frequency instruments

Dimensions in mm / Weight in gramme							
Type	a	c	d	e	g	h	Ø
F 72n	72	58	6	68 ^{+0,7}	40	4,6	M4
F 96n	96	58	68	92 ^{+0,8}	40	5	M4
F 144s	144	88	102	138 ⁺¹	40	5,5	M4
FD 96s	72	124	138	92 ^{+0,8}	40	5	M4
FD 144s	96	88	102	138 ⁺¹	40	5,5	M4



SYNCHRONISING INSTRUMENTS WITH WALL BRACKET

Synchronising wall bracket SW...



Synchronising wall bracket

Combination of:

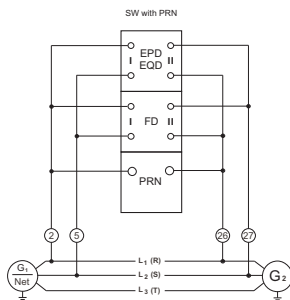
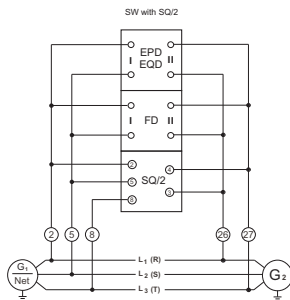
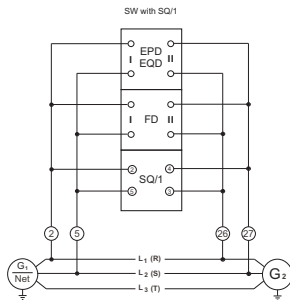
- Double voltmeter
- Double frequency meter
- Synchronoscope
- or
- Double voltmeter
- Double frequency meter
- Zero voltmeter

Description

Synchronisers are used for supervision of voltage, frequency and phasing when paralleling two generators or the net and one generator. If these instruments aren't conform when switching on the generators, heavy disturbance can occur in the entire equipment.

These synchronising instruments are built into a synchronising wall bracket. The synchronising wall bracket is available for the instrument sizes 96 x 96 mm and 144 x 144 mm. Housings are also available for both sizes. The instruments are already installed when ordering completely equipped wall brackets.

Connection diagrams



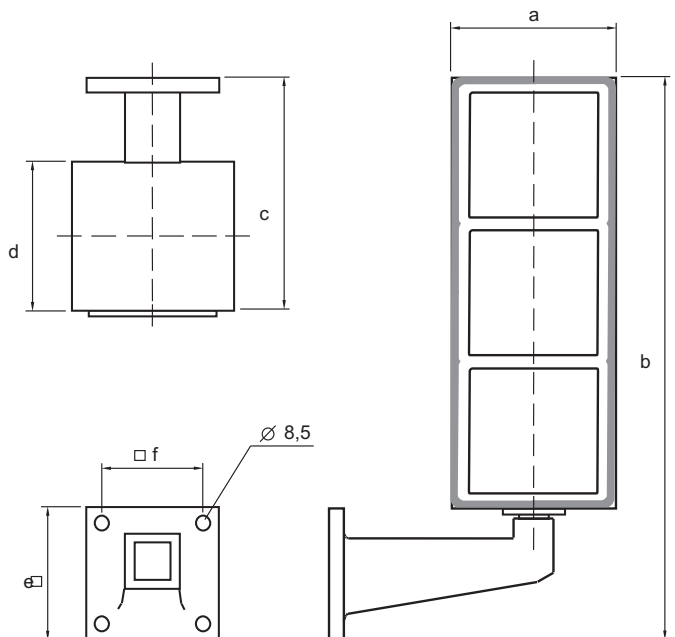
Technical Features

Type	SW96-1	SW96-2	SW96-3	SW96-4	SW96-5
Weight (Kg)	5,9	5,6	5,8	5,9	5,1
Equipment	1 x EQD 96s 1 x FD 96s 1 x SQ96s/1	1 x EQD 96s 1 x PRN 96s	1 x EQD 96s 1 x FD 96s 1 x SQ96s/2	1 x EQD 96s 1 x FD 96s 1 x SQ96s/2	1 x EQD 96n 1 x FAD 96n 1 x SQ 96n/2
	●	●	●	●	●
Type	SW144-1	SW144-2	SW144-3	SW144-4	SW144-5
Weight (Kg)	9,1	8,9	9,2	9,3	8,7
Equipment	1 x EQD 144s 1 x FD 144s 1 x SQ 96s/1	1 x EQD 144s 1 x FD 144s 1 x PRN 144s	1 x EQD 144s 1 x FD 144s 1 x SQ 144s/2	1 x EQD 144s 1 x FD 144s 1 x SQ 144s/2	1 x EQD 144n 1 x FAD 144n 1 x SQ 144n/2
	●	●	●	●	●
Housing:	SW96 / SW144 / Weight approx: 3.5 / 6.5 kg available.				

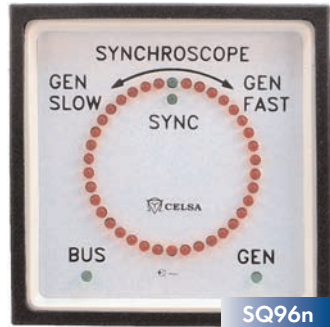
● available ○ on request

Dimension diagrams wall bracket

Dimensions in mm						
Type	a	b	c	d	e	f
SW96...	120	415	225	180	80	60
SW144...	170	580	260	180	115	85



SQ



Synchronoscope

For alternating current 50-60 Hz

- Analogue execution
- Digital LED execution



Description SQ... analogue

This instrument consists of a ferraris induction movement. The pointer can turn in both rotating directions. If the pointer turns to direction „+“ the frequency of generator G2 is higher than the one of G1. The pointer only stands at the top if frequency and phasing of both current circuits are the same. If it stands still outside of the mark, the frequencies are indeed conform but the voltages aren't in phase.

Description SQ... digital

This instrument shows as well the phasing and the frequency of two current circuits to each other. Only if phasing and frequency are the same the green LEDs are flashing in the middle on the top. When there are different phasings or frequencies the red LEDs are flashing, depending on degree of deviation per size of difference more on the left or more on the right.

Housing dimensions synchronoscope

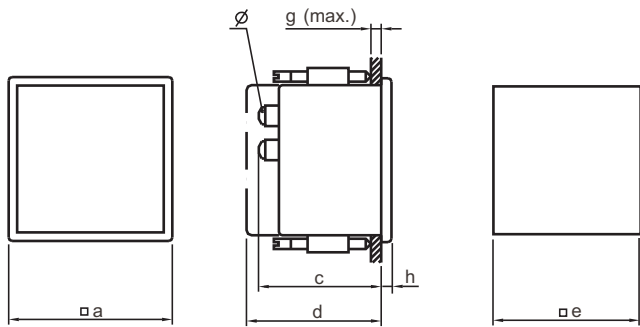
Dimensions in mm							
Type	a	c	d	e	g	h	∅
SQ 96n/1 -/2	96	107	119	92 +0,8	40	5	M4
SQ 96s/1 -/2	96	136	76	92 +0,8	10	5	M4
SQ 144s/1 -/2	144	136	95	144 +1	1	5,5	M4

Technical Features

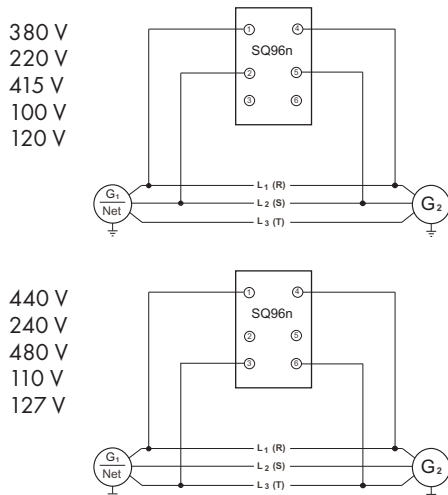
Front frame (mm)	96 x 96	96 x 96	144 x 144
Weight (g)	680	1100	1800
Measuring range U (V)	Digital type	Analogue type	Analogue type
One phase alternating current	SQ 96n/1	SQ 96s/1	SQ 144s/1
Consumption	max.6 VA	5 VA	max.25 mA
	○	○	○
100 / $\sqrt{3}$ * 100 / $\sqrt{3}$ * 100 - 110* 230*	○ ○ ● ●	○ ○ ● ●	○ ○ ● ●
Three-phase 3-wire current	SQ 96n/2	SQ 96s/2	SQ 144s/2
Consumption	max.6 VA	5 VA	max.25 mA
	●	●	●
100 110 230* 400* 440* 500*	● ● ● ● ● ○	● ● ● ● ● -	● ● ● ● ● -
Terminal cover or rubber grommets (1 set. = 2 pcs.)	-	●	-
	●	●	●

● available ○ on request

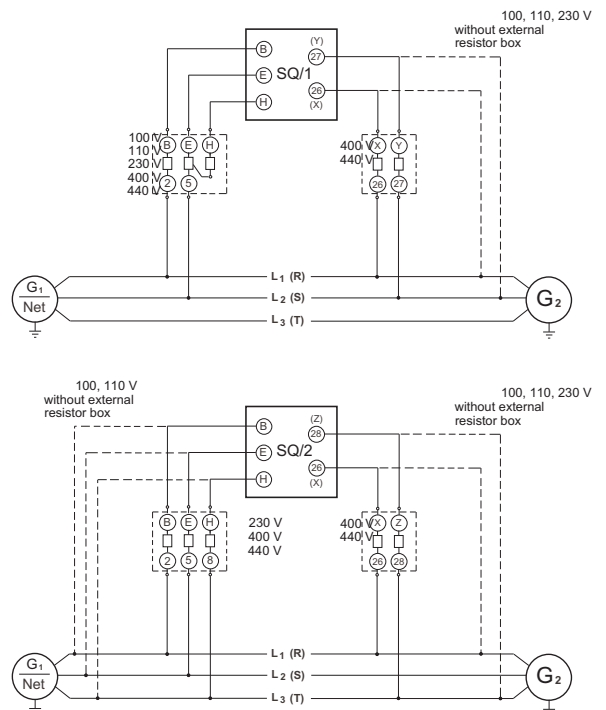
*with separated series resistor (approx. 300 gramme)



Connection diagrams SQ96n LED execution

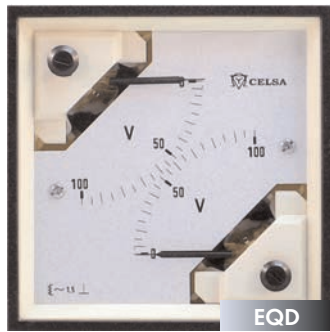


Connection diagrams SQ96s/SQ144s analogue execution



DOUBLE VOLTMETER

EPD / EQD



Double Voltmeter



- With 2 moving iron systems on opposite positions
- With 2 parallel vertical scales
- Class 1.5

Description

The instruments have 2 independent moving iron movements to measure the voltage for example between 2 generators or one generator and the net.

The technical features correspond to our type EQ or EQP (see page 4/5).

Housing dimensions double voltmeter

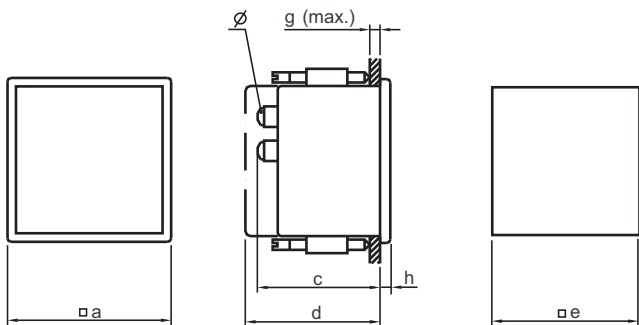
Dimensions in mm							
Type	a	c	d	e	g	h	∅
EQD 96n	96	53	64	92 ^{+0,8}	26	5,5	M4
EPD 96s	96	124	135	92 ^{+0,8}	10	5	M4
EPD 144s	144	170	181	138 ⁺¹	10	5,5	M4
EQD 96s	96	61	76	92 ^{+0,8}	10	5	M4
EQD 144s	144	61	76	138 ⁺¹	10	5,5	M4

Technical Features

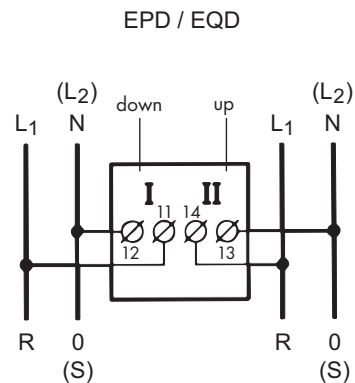
Type	EPD 96s	EPD 144s	EQD 96n	EQD 144s
Front frame (mm)	96 x 96	144 x 144	96 x 96	144 x 144
Scale length (mm)	2 x 62	2 x 103	2 x 54	2 x 90
Weight (g)	700	1200	305	550
Consumption	2 x max.3	2 x max.3	2 x max.4,5	2 x max.3,5
Voltage (V)				
2 x 100 ¹⁾	●	●	●	●
2 x 110 ¹⁾	●	●	●	●
2 x 150	●	●	●	●
2 x 230	●	●	●	●
2 x 250	●	●	●	●
2 x 300	●	●	●	●
2 x 500	●	●	●	●
Terminal cover or rubber grommets (1 set. = 2 pcs.)	-	-	●	○

● available ○ on request

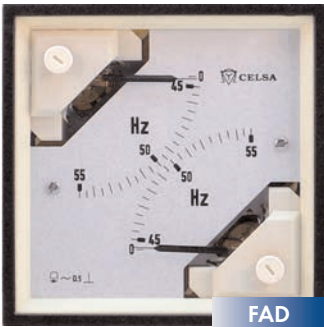
¹⁾ When connecting to the voltage transformer the indication of the transformer ratio is required.



Connection diagram



FAD / PRN



Double Pointer Type Frequency Meter

- Moving coil system with electronic transducer
For alternating current 50 - 60 Hz

Zero Voltage Meter

- Moving coil system with rectifier
For alternating current



Description FAD

The instruments have 2 independent moving coil movements to measure the frequency for example between 2 generators or one generator and the net. These instruments are made of a moving coil movement with electronic transducer. The meter movements are jewelled and shock-proofed by sprung storage of jewels. The indication is mainly independent of curves, form errors and fluctuations of the measuring voltage.

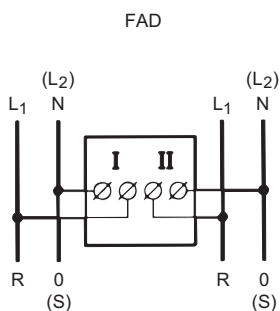
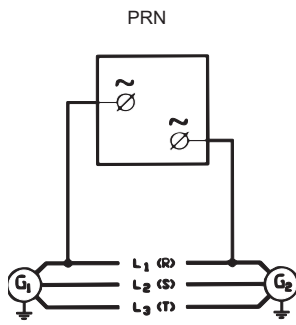
Admissible change in rating voltage: $\pm 20\%$
External magnet field: 0.5 mT

Description PRN

This instrument can be used instead of a synchroscope. It measures the difference between two sinusoidal voltages. If both voltages are the same and in phase the device indicates zero.

The system is a moving coil system with rectifier. It is very sensitive and offers a extensive protection as it can be permanently charged with the double voltage without damage.

Connection diagrams



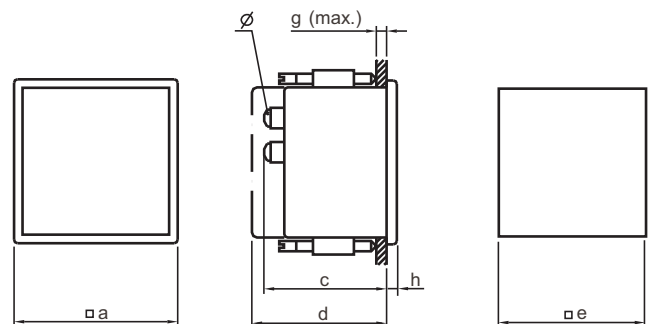
Technical Features

Type	FAD 96n	PRN 96n	PRN 144s
Front frame (mm)	96 x 96	96 x 96	144 x 144
Scale length (mm)	2 x 54	100	140
Weight (g)	260	260	530
Consumption (VA)	max.3	max.3	max.3.5
Voltage (V)			
100	●	●	●
110	●	●	●
230	●	●	●
400	●	●	●
500	○	○	○
Terminal cover or rubber grommets (1 set. = 2 pcs.)	●	●	●

● available ○ on request

Housing dimensions

Dimensions in mm							
Type	a	c	d	e	g	h	∅
FAD 96n	96	53	64	92 ^{+0,8}	26	5,5	M4
PRN 96s	96	60	76	92 ^{+0,8}	10	5	M4
PRN 144s	144	60	76	144 ⁺¹	10	5,5	M4



PQ

Moving Coil Instruments



- For DC voltage / DC current
- Class 1.5



PQ96n



PQ35p



PQ48n



PQ72n



PAQ72n



PAQ96n

Description

The system of our instruments is a moving coil movement with sprung toe bearing which is insensitive to external magnetic fields. The movable organs of the movements are stored in sprung jewels in order to protect them against crushes and vibrations. These instruments only measure DC current or DC voltage.

By using core magnets of high quality the moving coil instruments have a almost linear scale course. That's why and due to their low consumption they are especially suited for the application with shunts, impulse transmitters, thermo couples and for the connection to our electronic transducers. The instruments can be delivered for direct connection up to 100 A with a built-in shunt.

Overload capacity according to DIN 43780 is valid for all moving coil instruments

Continuously	1.2 times
Short duration	$10 \times I_N$ 5 s for amstruments
	$2 \times U_N$ 5 s for voltinstruments

Interchangeable scales

All plastic executions (n-line) have interchangeable scales. This execution enables easy exchange or fit of the changing scale (not during operating).

Execution for DIN rail mounting (PQ35P)

For measuring current and voltage in distribution systems with 35 mm DIN rail according to DIN 50 022.

The instruments of this line are adapted by their dimensions to common installation devices. The installation width of the instruemnts is 45 mm. They can be snapped easily on a 35 mm DIN rail.

The clamps are covered shockproof.

Execution PAQ...n with round scale 240°

The movements are working for the same principle as the PQ devices. The advantage of these devices is the large scale length (better resolution). These instruments only measure DC current or DC voltage. These devices also have interchangeable scales.

Internal resistance, consumption approx. in Ohm

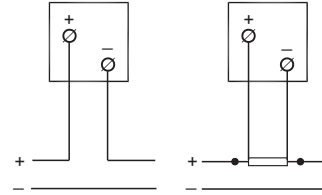
Measuring range	PQ 35G	PQ ...n	PAQ ...n	
μA	25		240 mV	
	40		374 mV	
	60	200 mV	600 mV	
	100	200 mV	400 mV	
	150	200 mV	600 mV	
	250	200 mV	140 mV	810 mV
	400	200 mV	540 mV	900 mV
mA	600	200 mV	540 mV	900 mV
	1	200 mV	37 mV	490 mV
	1,5	200 mV	60 mV	425 mV
	2,5	200 mV	60 mV	760 mV
	4	200 mV	60 mV	950 mV
	6	200 mV	60 mV	60 mV
	4-20	200 mV	1,5 V	1,5 V
A	10-800	200 mV	60-70 mV	60-125 mV
	1-100	to 15A 200 mV	60-100 mV	60 mV
	.../60...150mV	12 Ω	5 mA	67/200Ω/V
mV	15-40	1000 Ω/V	200 Ω/V	67 Ω/V
	15-40	1000 Ω/V	200 Ω/V	67 Ω/V
	60-100	1000 Ω/V	1000 Ω/V	67 Ω/V
	150-600	1000 Ω/V	1000 Ω/V	200 Ω/V
	750	1000 Ω/V	1000 Ω/V	200 Ω/V
V	1	1000 Ω/V	1000 Ω/V	200 Ω/V
	1,5-600	1000 Ω/V	1000 Ω/V	1000 Ω/V

Standard Measuring Ranges

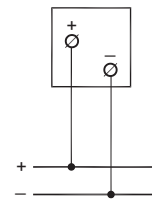
DC Voltage	DC Current
15 mV	15 µA
25 mV	25 µA
40 mV	40 µA
60 mV	60 µA
100 mV	100 µA
150 mV	150 µA
250 mV	250 µA
400 mV	400 µA
600 mV	600 µA
1 V	1 mA
1,5 V	1,5 mA
2,5 V	2,5 mA
4 V	4 mA
6 V	6 mA
10 V	10 mA
15 V	15 mA
25 V	20 mA
40 V	25 mA
60 V	40 mA
100 V	60 mA
150 V	100 mA
250 V	150 mA
300 V	250 mA
400 V	400 mA
500 V	500 mA
600 V	600 mA
800 V (except PQ48n/PQ35P)	1 A
	1,5 A
	2,5 A
	4 A
	6 A
	10 A
	15 A
	25 A (except PQ35P)
	40 A (except PQ35P)
	60 A (except PQ48n/PQ35P)
	100 A (except PQ48n/PQ35P)
For connection to shunt	Standar signals
.../60 mV secondary	20 mA
.../150 mV secondary	4-20 mA
.../300 mV secondary	1 mA

Connection diagrams

Ammeter

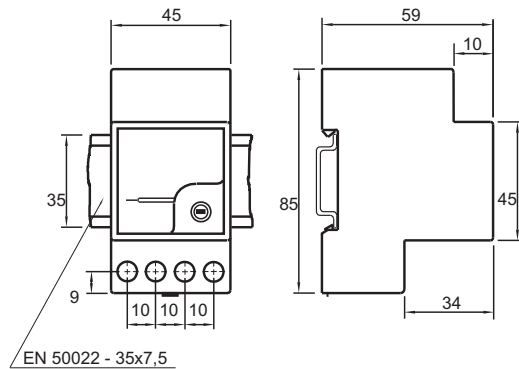


Voltmeter

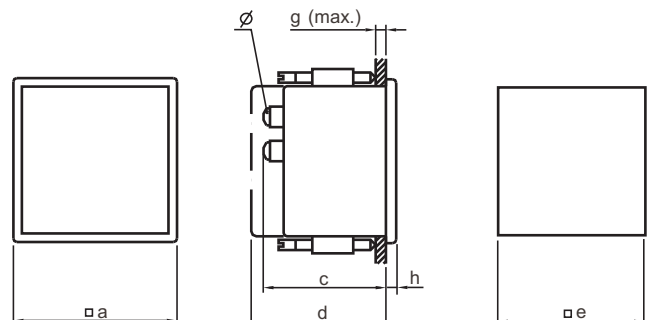


Housing dimensions

PQ35P



PQ / PAQ



Dimensions in mm / Weight in gramme

Type	Dimensions	a	c	d	e	g	h	Ø	Weight
PQ 48n	< 5... 60 A	48	70	73	45 ^{+0,6}	28	5	M6	205
	all others	48	55	62	45 ^{+0,6}	28	5	M4	150
PQ 72n	> 60 A	72	81	-	68 ^{+0,7}	8 ¹	5	M8	285
	5... < 60 A	72	70	75	68 ^{+0,7}	8 ¹	5	M6	265
	all others	72	55	75	68 ^{+0,7}	8 ¹	5	M4	210
PQ 96n	> 60 A	96	81	-	92 ^{+0,8}	8 ¹	5	M8	350
	5... < 60 A	96	70	75	92 ^{+0,8}	8 ¹	5	M6	330
	all others	96	55	75	92 ^{+0,8}	8 ¹	5	M4	275
PQ 144n	> 60 A	144	81	-	138 ⁺¹	40	8	M8	505
	5... < 60 A	144	70	75	138 ⁺¹	40	8	M6	485
	all others	144	53	64	138 ⁺¹	40	8	M4	430
PAQ 48n	10... 40 A	48	70	73	45 ^{+0,6}	26	5	M6	230
	all others	48	53	64	45 ^{+0,6}	26	5	M4	210
PAQ 72n	> 60 A	72	78	-	68 ^{+0,7}	40	5	M8	320
	6... < 60 A	72	68	-	68 ^{+0,7}	40	5	M6	385
	all others	72	53	64	68 ^{+0,7}	40	5	M4	290
PAQ 96n	> 60 A	96	78	-	92 ^{+0,8}	40	5	M8	395
	6... < 60 A	96	68	-	92 ^{+0,8}	40	5	M6	460
	all others	96	53	64	92 ^{+0,8}	40	5	M4	370
PAQ 144n	> 60 A	144	78	-	138 ⁺¹	40	8	M8	680
	6... < 60 A	144	68	-	138 ⁺¹	40	8	M6	720
	all others	144	53	64	138 ⁺¹	40	8	M4	650

¹ 26 mm with fixing screws

RECTANGULAR MOVING COIL INSTRUMENTS

PQP / PQS

Rectangular Moving Coil Instruments



PQP96x48q

- For DC voltage / DC current
- Class 1.5



PQS48x24h



PQS72x24q



PQS96x24q



PQP72x36h



PQP144x72q

Description

Constructive according to the state of the art of movement manufacturing, low consumption and high accuracy. Especially well damping. Response time at full-scale deflection approx. 1 sec., insensitive to external magnetic fields. The movable organs of the meter movements are stored in sprung jewels in order to protect them against crushes.

Consumption

See table; the mentioned inherent resistance values include a tolerance of $\pm 20\%$.

Overload capacity according to DIN 43780

Continuously 1.2 times
Short duration 10 times 5 s for amminstruments
2 times 5 s for voltinstruments

Isolation group A according to VDE 0110

Front panel: Clear Plexiglas

Connection PQP:

Hexagon studs with screws
M3 and clamping bracket: Volt and ammeter up to 3 A
M5 and clamping bracket: < 3 A up to 30 A

Connection PQS:

Contact pin 6,3 x 0,8 mm

Position

Normal execution for profile devices: horizontal scale, upright installation. If there are no special indications, the standard execution is delivered: front frame black, scale as measuring range, upright installation position, horizontal scale.

When ordering please indicate vertical or horizontal scale.

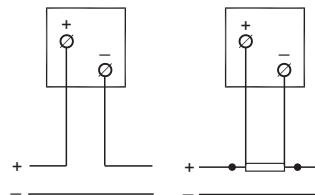
Internal resistance, consumption approx. in Ohm								
Measuring range		PQP 72 x 36	PQP 96 x 48	PQP 144 x 72	PQS 48 x 24	PQS 72 x 24	PQS 96 x 24	PQS 144 x 36
μA	50	-	-	-	4150 Ω	4800 Ω	5200 Ω	-
	60	-	-	-	3500 Ω	4350 Ω	4700 Ω	-
	100	870 Ω	870 Ω	4000 Ω	2800 Ω	3500 Ω	3800 Ω	-
	150	600 Ω	600 Ω	2000 Ω	1190 Ω	1490 Ω	1600 Ω	-
	250	450 Ω	450 Ω	1300 Ω	440 Ω	550 Ω	600 Ω	-
	400	150 Ω	150 Ω	380 Ω	175 Ω	220 Ω	240 Ω	-
	600	75 Ω	75 Ω	170 Ω	76 Ω	95 Ω	100 Ω	-
mA	1	30 Ω	30 Ω	110 Ω	24 Ω	35 Ω	32 Ω	-
	1,5	15 Ω	15 Ω	40 Ω	13,5 Ω	18 Ω	18 Ω	-
	2,5	8 Ω	8 Ω	17 Ω	6,2 Ω	8 Ω	9 Ω	-
	4	3 Ω	3 Ω	10 Ω	4 Ω	4 Ω	4,5 Ω	-
	5	2,5 Ω	2,5 Ω	3,5 Ω	3,5 Ω	3,3 Ω	3,6 Ω	-
	6	2,4 Ω	2,4 Ω	10 Ω	3,3 Ω	2,5 Ω	4 Ω	-
	10	2,2 Ω	2,2 Ω	6 Ω	2,3 Ω	2,5 Ω	3,5 Ω	-
	15	2 Ω	2 Ω	4 Ω	2,1 Ω	2,5 Ω	2,5 Ω	-
	20	2 Ω	2 Ω	1,5 Ω	2 Ω	2 Ω	2 Ω	2 Ω
	4...20	2 Ω	2 Ω	2 Ω	2,2 Ω	2,2 Ω	2,2 Ω	2,2 Ω
	25	2,4 Ω	2,4 Ω	2,4 Ω	2,4 Ω	2,4 Ω	2,4 Ω	2,4 Ω
	40	1,5 Ω	1,5 Ω	1,5 Ω	1,5 Ω	1,5 Ω	1,5 Ω	1,5 Ω
	60	1,0 Ω	1,0 Ω	1,0 Ω	1,0 Ω	1,0 Ω	1,0 Ω	1,0 Ω
100	0,6 Ω	0,6 Ω	0,6 Ω	0,6 Ω	0,6 Ω	0,6 Ω	0,6 Ω	
150	0,4 Ω	0,4 Ω	0,4 Ω	0,4 Ω	0,4 Ω	0,4 Ω	0,4 Ω	
250	0,24 Ω	0,24 Ω	0,24 Ω	0,24 Ω	0,24 Ω	0,24 Ω	0,24 Ω	
400	0,15 Ω	0,15 Ω	0,15 Ω	0,15 Ω	0,15 Ω	0,15 Ω	0,15 Ω	
600	0,1 Ω	0,1 Ω	0,1 Ω	0,1 Ω	0,1 Ω	0,1 Ω	0,1 Ω	
A	1	0,06 Ω	0,06 Ω	0,06 Ω	0,06 Ω	0,06 Ω	0,06 Ω	0,06 Ω
	1,5	0,04 Ω	0,04 Ω	0,04 Ω	0,04 Ω	0,04 Ω	0,04 Ω	0,04 Ω
	2,5	0,024 Ω	0,024 Ω	0,024 Ω	0,024 Ω	0,024 Ω	0,024 Ω	0,024 Ω
	4	0,015 Ω	0,015 Ω	0,015 Ω	0,015 Ω	0,015 Ω	0,015 Ω	0,015 Ω
	6	0,01 Ω	0,01 Ω	0,01 Ω	0,01 Ω	0,01 Ω	0,01 Ω	0,01 Ω
	10	0,006 Ω	0,006 Ω	0,006 Ω	Ω	Ω	0,006 Ω	0,006 Ω
V	.../ 60 V	12 Ω	12 Ω	12 Ω	12 Ω	12 Ω	12 Ω	12 Ω
	.../ 150 mV	30 Ω	30 Ω	30 Ω	30 Ω	30 Ω	30 Ω	30 Ω
	.../ 300 V	60 Ω	60 Ω	60 Ω	60 Ω	60 Ω	60 Ω	60 Ω
	1V - 600V	1 k Ω /V	1 k Ω /V	1 k Ω /V	1 k Ω /V	1 k Ω /V	1 k Ω /V	1 k Ω /V

Standard Measuring Ranges

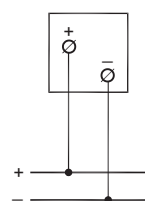
AC Voltage	AC Current
250 mV	50 μ A
400 mV	60 μ A
600 mV	100 μ A
1 V	150 μ A
1,5 V	250 μ A
2,5 V	400 μ A
4 V	600 μ A
5 V	1 mA
6 V	1.5 mA
10 V	2.5 mA
15 V	4 mA
25 V	5 mA
40 V	6 mA
60 V	10 mA
100 V	15 mA
150 V	20 mA
250 V	25 mA
400 V	40 mA
500 V	60 mA
600 V	100 mA
	150 mA
	250 mA
	400 mA
	600 mA
	1 A
	1,5 A
	2,5 A
	4 A
	6 A
	10 A
	15 A
	25 A
	40 A
	60 A
	100 A
For connection to shunt	Standards signals
.../60 mV secondary	20 mA
.../150 mV secondary	4-20 mA
.../300 mV secondary	1 mA

Connection diagrams

Ammeter

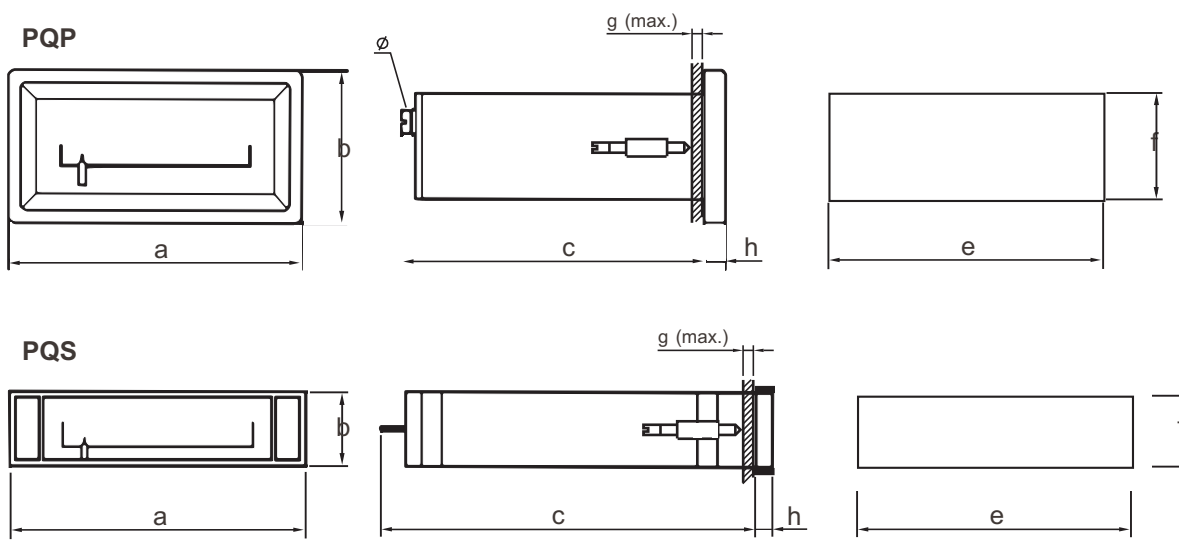


Voltmeter



Housing dimensions of rectangular moving coil instruments

Dimensions in mm / Weight in gramme										
Type	a	b	c	d	e	f	g	h	\varnothing	Weight
PQP 72x36	72	36	105	-	68 ^{+0,7}	33 ^{+0,7}	40	5,5	-	150
PQP 96x48	96	48	125	-	92 ^{+0,8}	44 ^{+0,7}	40	7	-	350
PQP 144x72	144	72	170	-	138 ^{+0,7}	68 ^{+0,7}	40	8	-	800
PQS 48x24	48	24	59	-	43,2 ^{+0,3}	22,2 ^{+0,3}	10	5	-	100
PQS 72x24	72	24	59	-	67 ^{+0,5}	22,2 ^{+0,3}	10	5	-	120
PQS 96x24	96	24	57	-	91,5 ^{+0,5}	22,5 ^{+0,3}	10	5	-	150
PQS 144x36	144	36	59	-	138 ^{+0,5}	33 ^{+0,3}	10	7	-	500



INSTRUMENTS WITH CONTACTS

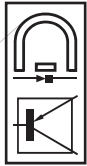
Contact instruments with dorsal adjustment

PQC



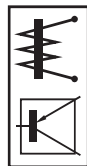
Direct current
Direct voltage

PRC



Alternating current and
alternating voltage
with rectifier

EQC



Alternating current
Alternating voltage

Contact instruments are available in the following executions: with a moving iron system = EQC, with a moving coil system = PQC, with a moving coil system including a rectifier = PRC, and a moving coil system with transducer = FAC. For the non-contact registration of limit values they have: power supply, 2 differential amplifiers, 2 time relays, 2 output relays and - adjustable from outside (on the backside) - 2 potentiometers for the adjustment of limit values and the time delay as well as 2 LED lamps on the scale for the control of the switching status. Contact instruments can be used along with corresponding transducers for the control of current, voltage (alternating and direct), frequency, active power, reactive power, power factor (phase angle), driving speed, temperature and pressure.

Both channels can be adjusted independently of each other on any point of scale by a potentiometer on the backside. Every channel has a 0-30 sec adjustable separated time relay which prevents that peak values activate the contacts. The time relay sets to zero immediately after every peak values and thus prevents a summation of several peak values.

Every channel is equipped with an output relay including change-over contact (changer) - potential-free. The potentiometers on the backside of the device are protected by a transparent cover in order to prevent accidental readjusting..

2 LEDs on the scale show the switching status.

Contact instruments are deliverable in the following executions:

EQC:	EQC 96s/1	1 max. and 1 min. contact
	EQC 96s/2	2 max. (or 2 min.) contacts
PQC:	PQC 96s/1	1 max. and 1 min. contact
	PQC 96s/2	2 max. (or 2 min.) contacts
PRC:	PRC 96s/1	1 max. and 1 min. contact
	PRC 96s/2	2 max. (or 2 min.) contacts
ISE/2:	1 contact, switches at wrong phase sequence (ISE 96s/2 see page 4/28)	

Technical features of the electronics

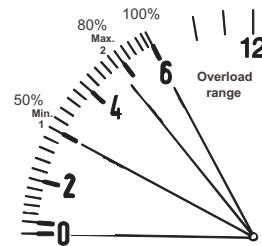
Auxiliary supply:	230 V~ ± 10 % (40-70 Hz)
Output relays:	1 change-over contact (changer) per channel - potential-free
Switching capacity at ohmic load:	Alternating current 230 V, 5 A max. 300 W Alternating current 200 V, 5 A max. 100 W
Hysteresis:	1 % of final scale value
Producing accuracy:	of final scale value 1 %
Adjustment:	From 0-100 % of the nominal value of scale, tolerance +/- 5%
Duration of life:	1 X 10 ⁷ Switching operations at rated switching power
Temperature:	10 °C up to 30 °C

Regulation examples: differential

Differentiated regulation: (.../1)

(Minimum contact at 50 % and maximum contact at 80 %)

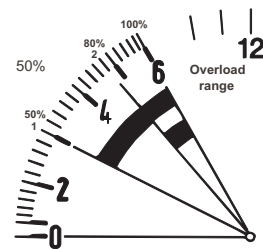
As long as the pointer is in the working range, e.g. the measuring value is higher than 50 % and less than 80 % both channels and both illuminating diodes on the scale are inactivated. If the measuring value sinks under 50 % e.g. the pointer is between 0 and 50 % so the channel I is activated, the minimum contact has switched and the illuminating diode on the scale is lighting. If the measuring value is higher than 80 % and 100 % so the channel II is activated, the maximum contact has switched and the illuminating diode for channel II is lighting while channel I is inactivated again.



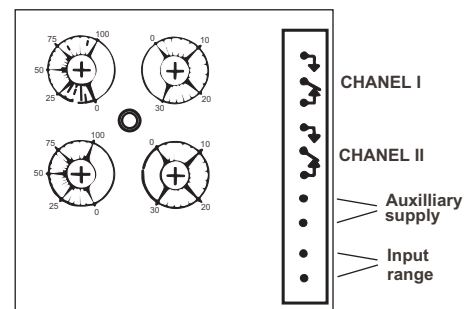
Step regulation : (.../2)

(2 maximum contact at 50 % and at 80 %)

The working range is between 0 and 50 % of the scale. If the measuring value is under 50 % both channels and illuminating diodes are inactivated and the first maximum contact was switched on. If the measuring value reaches 80 % or more both channels are activated, e.g. also channel II is switched on and both illuminating diodes are lighting.



Rear view:



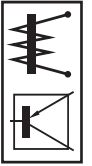
EQC96n



Moving iron instrument with electronic limit control

Backside adjustment

- With moving iron movement
- For AC current and AC voltage
- Class 1,5

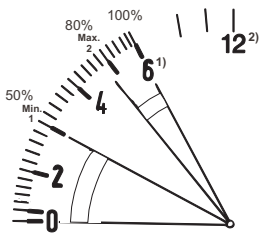


Description

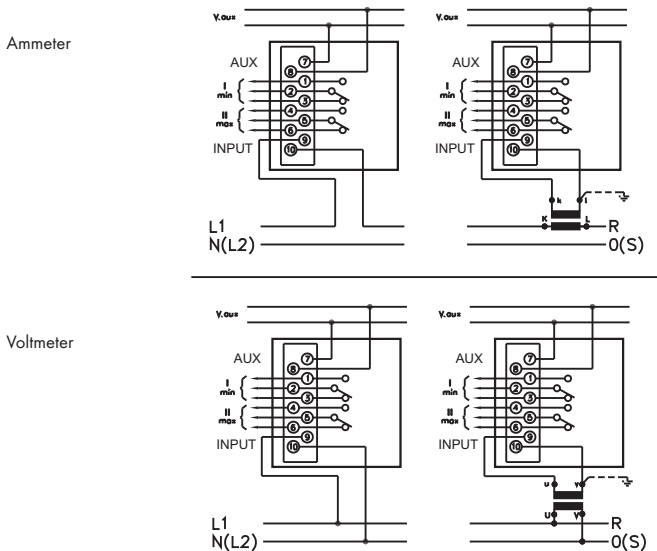
The technical features of the movements are same as the features of the moving iron instruments. Only this has an additionally electronic limit control. (Type EQ see page 4/5)

- Electronic:
 - Auxiliary supply: 230 V ~ ± 10 % (50-60 Hz) other voltages on request
 - Output relays: 2 changeover relays, potential free
 - Hysteresis: 2 % of the full scale
 - Repeatability: 1 % of the full scale
 - Adjustment with potentiometer: from 0 to 100 % of the nominal range of scale 1) Tolerance ± 5 %
 - Time delay: 0 to 20 sec. ± 3 sec.

1) Nominal current input range
 2) Nominal 100 % for voltage inputs or ammeter without overload.



Connection diagrams



Technical Features

Type	EQC 96n/1	EQC 96n/2 max. EQC 96n/2min.
Front frame (mm)	96 x 96	96 x 96
Scale length (mm)	94	94
Weight (g)	540	540
Relay output	1 max. + 1 min.	2 max. (or 2 min)
Burden auxiliary supply (VA)	3	3

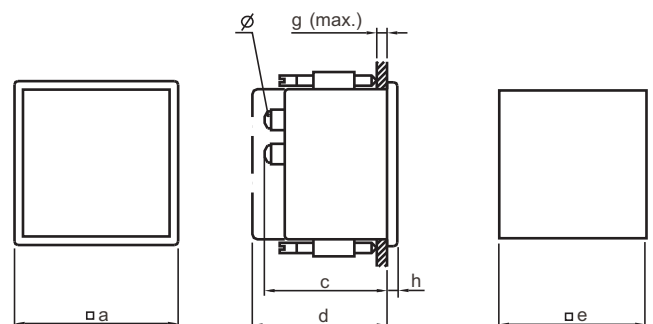
Burden of the movements see EQ-instruments on page 4/5

Standard Measuring Ranges

AC Voltage	AC Current
6 V	
10 V	
15 V	100 mA
25 V	150 mA
40 V	250 mA
60 V	400 mA
100 V	600 mA
150 V	1 A
250 V	1,5 A
300 V	2,5 A
400 V	4 A
500 V	6 A
600 V	
For voltage transformers .../ 100 V secondary .../ 110 V secondary	For current transformers .../ 1 A .../ 5 A

Dimensions

Dimensions in mm							
Type	a	c	d	e	g	h	Terminals
EQC 96n	96	99	-	92 ^{+0,8}	26	5,5	screw terminals



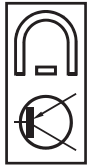
PQC96n



Moving coil instrument with electronic limit control

Backside adjustment

- With moving coil movement
- For DC current and DC voltage
- Class 1,5



Description

The technical features of the movements are same as the features of the moving coil instruments. Only this has an additionally electronic limit control. (Type PQ see page 4/35)

- Electronic:
 Auxilliary supply: 230 V ~ ± 10 % (50-60 Hz) other voltages on request
- Output relays: 2 changeover relays, potential free
- Hysteresis: 2 % of the full scale
- Repeatability: 1 % of the full scale
- Adjustment with potentiometer: from 0 to 100 % of the nominal range of scale 1) Tolerance ± 5 %
- Time delay: 0 to 30 sec. ± 3 sec. Tolerance ± 5 %

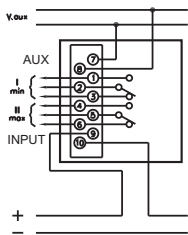
Technical Features

Type	PQC 96n/1	PQC 96n/2 max. PQC 96n/2min.
Front frame (mm)	96 x 96	96 x 96
Scale length (mm)	94	94
Weight (g)	540	540
Relay output	1 max. + 1 min.	2 max. (or 2 min)
Burden auxiliary supply (VA)	3	3

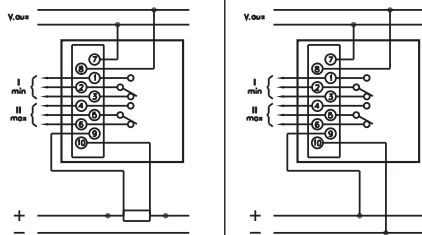
Burden of the movements see PQ-instruments on page 4/35

Connection diagrams

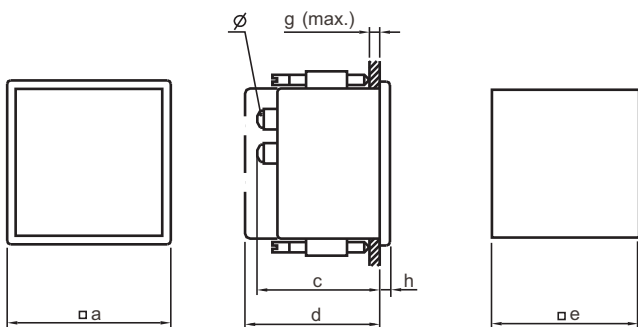
Ammeter



Voltmeter



Dimensions



Standard Measuring Ranges

DC Voltage		DC Current	
40 mV	5 V	20 µA	4 mA
50 mV	6 V	25 µA	5 mA
60 mV	10 V	40 µA	6 mA
100 mV	15 V	50 µA	10 mA
150 mV	25 V	60 µA	15 mA
250 mV	40 V	100 µA	20 mA
300 mV	50 V	150 µA	25 mA
400 mV	60 V	200 µA	40 mA
500 mV	100 V	300 µA	50 mA
600 mV	150 V	400 µA	60 mA
800 mV	250 V	500 µA	1 A
1 V	300 V	600 µA	1,5 A
1,5 V	400 V	1 mA	2,5 A
2,5 V	500 V	1,5 mA	4 A
		2,5 mA	5 A
For connection to shunt .../ 60 mV .../ 150 mV		Standard signals 20 mA 4-20 mA 1 mA	

Dimensions in mm

Type	a	c	d	e	g	h	Terminals
PQC 96n	96	99	-	92 +0,8	26	5,5	screw terminals

