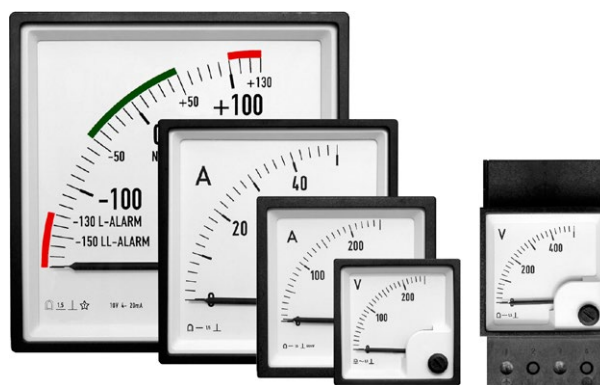


Analogue Panel Instruments





Product Range

Elektronic modules for DIN rails mounting

- Lamp Test Modules
- Diode Modules
- Rectifier Modules
- Assembly Modules
- Varistor Modules
- Failure Indication Panels
- Surpress Modules
- RC Modules
- Fuse Modules
- Potentiometerhalter-Modules
- Voltage Devider Modules
- Power Supply Modules
- Relais Modules
- Signal Transmission Modules
- Optocoupler Modules
- Transformer Modules
- Special Modules

Analogue and Digital Measuring Instrument with Accessories

- Voltmeters
- Ammeters
- Bimetal Ammeters
- Limit Contact Meters
- Active/ Reactive Power Meters
- Synchronoscopes
- Power Factor Meters
- Frequency Meters
- Temperature Meter
- Hour Counter
- Impuls Counter
- Customer Apecific Meters
- Multimeters
- Measuring Transducers
- Current Transformers
- Voltage Transformers
- Shunts
- Phase Sequence Indicator

Montagematerial für die Anlagen- und Maschinen-Installation

- Schuflex Conduit
- Schlauchverschraubungen Messing
- Schlauchverschraubungen Kunststoff
- Brass Cable Glands
- Plastic Cable Glands
- Special Glands

LED-Monitor

- Aluminium-Profilgehäuse für Lagepläne, Prozessvisualisierung, Anzeigetabellen und Hinweistafeln
- Tableau mit Einlegebögen im Format DIN A4 / DIN A3 / DIN A2
- Ansteuerung über parallele Verdrahtung, serielle Verdrahtung oder 1-Bit-Fernabfrage-System

klaus pötter

INGENIEURGESELLSCHAFT mbH

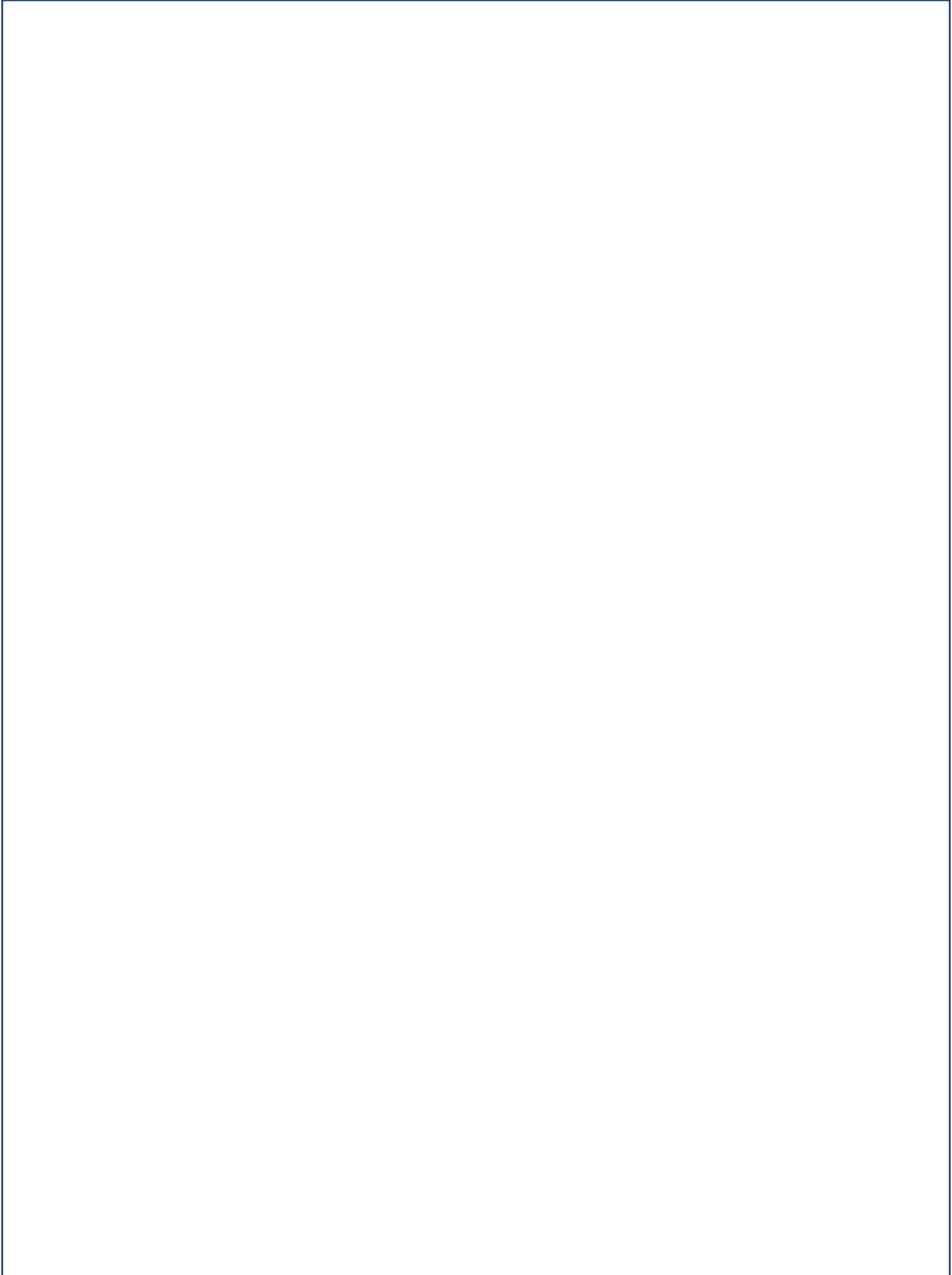
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EQ Series - Moving Iron Panel Meters

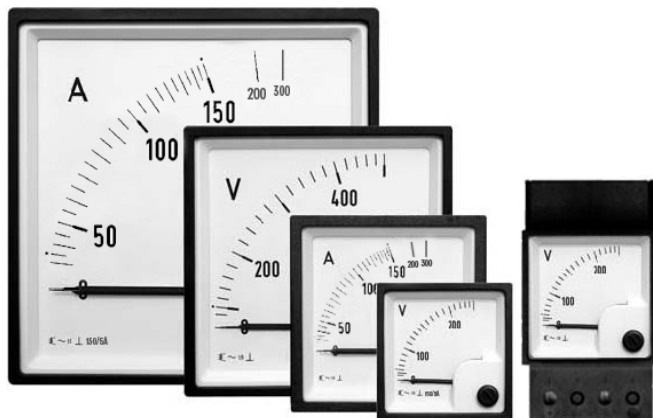


Figure 01: EQ 45...144: AC ammeters and volt meters EQ 45...144 with 90° scale

Features

- For measurement of AC currents and voltages
- Exchangeable dial
- Enhanced resistance to mechanical vibrations (option)
- Protective cover for terminals (option)
- DIN-rail mounting available (EQ 45)

Application

Moving iron instruments are intended for installation in supervision panels of power distribution stations and transformer stations or wherever AC voltages and currents are to be measured in heavy-current installation.

The incorporated moving-iron mechanism measures r.m.s. values of a.c. currents in frequency range 15 to 100 Hz, independent of curve shape, on requests and voltages.

Technical Data

Accuracy

- Accuracy class: 1.5
acc. to **EN 60 051**
(class 1.0 on request)

Design

- Material of housing: Polycarbonat
uninflammable, according to **UL 94 V-0**
- Enclosure protection: housing IP 52
terminals IP 00 (IP 20 at size 45)
according to **60529**: 1989
- Operating position: vertical $\pm 5^\circ$
- Consumption:

Ammeters 0,3...1,2 VA
Voltsmeters 1,5...4,0 VA

Measuring Range - Samples Values

Ammeters

Nominal value [mA]	100 mA up to 600 mA	
Nominal value [A]	6 A up to 60 A	
Nominal value [A] - CT	xA / 1A	xA / 5A
Size 48x48 max. 40 A	x= prim. current of current transducer	
Size 45x45 max. 25 A		

Voltsmeters

Nominal value [V]	6 V up to 800 V	
Nominal value [V] - CT	xV/ 100V	xV/ 110V

**Other ranges and interim values available, over load range
(0-400)% of I_{Nom} , standard is 100% of I_{Nom}**

Meters EQ 45 and EQ 48 comply with installation category CAT III max. 300 V against earth.

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale

Ordering examples:

- Voltmeter EQ 96, 0- 600V
- Voltmeter EQ 96, 110/0.1kV with scale 0-150kV
- Ammeter EQ 96, 60/120A direct with scale 0-60/120A
- Ammeter EQ 96, 5/10A with scale 0-1500/3000/5A

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

EQtri - Multi Voltmeter



Figure 02: EQtri: Multi voltmeter

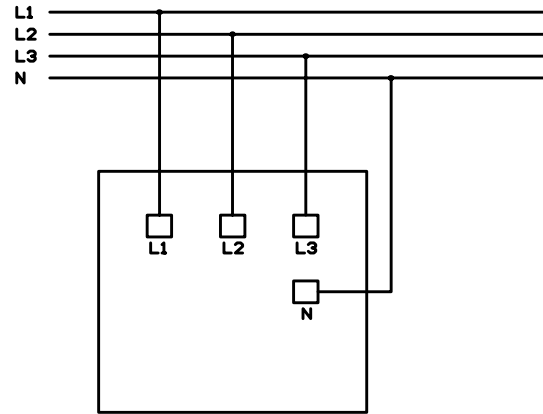


Abbildung 01: Connection diagram of EQtri 72...96

Features

- For measurement of AC voltages
- Exchangeable dial
- Enhanced resistance to mechanical vibrations (option)
- Protective cover for terminals (option)
- 6-position switch (phase against phase, phase against N)
- LED phase indicator and sequence indicator (option)

Application

This instrument type is used for measurement of voltages in three-phase networks. It can replace three voltmeters or external voltage change-over switches.

Optionally it can be equipped with a phase sequence indicator/ phase voltage indicator:

If all three phase voltages are present and if the phase sequence is correct (right rotation), the green LED of phase sequence indicator is lit. If all three phase voltages are present and if the phase sequence is changed (left rotation), the red LED of phase sequence indicator is lit.

If one phase voltage is absent, the rotation field is not more complete and both LED's are lit with reduced intensity. The phase indicator is realized by 3 additional red LED's.

Technical Data

Accuracy

- Accuracy class: 1.5 according to **EN 60 051**

Design

- Material of housing: Polycarbonat unflammbare, according to **UL 94 V-0**

- Enclosure protection: housing IP 52 terminals IP 00 (IP 20 at size 45) according to **60529: 1989**
- Operating position: vertical $\pm 5^\circ$
- Consumption: approx.. 1,5...4 VA
- Frequency: 50Hz +/- 20%

Measuring Range

100/110V, 300V, 400V, 500V, Other ranges on request

Ordering Data

For ordering it is necessary to specify:

- Type of meter
- Nominal Voltage respectively voltage transformer ratio
- Options for EQtri 96 [**P**] (phase indicator, [**D**] phase sequence indicator, [**DP**] both)

Ordering examples:

- Multivolt Meter EQtri 72/3 0 - 500 V
- Multivolt Meter EQtri 72/6 0 - 500 V
- Multivolt Meter EQtri 96/3 0 - 500 V
- Multivolt Meter EQtri 96/3 D 0 - 500 V
- Multivolt Meter EQtri 96/6 0 - 500 V
- Multivolt Meter EQtri 96/6 D 0 - 500 V
- Multivolt Meter EQtri 96/6 P 0 - 500 V
- Multivolt Meter EQtri 96/6 DP 0 - 500 V
- Multivolt Meter EQtri 144/3 0 - 500 V
- Multivolt Meter EQtri 144/6 0 - 500 V

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

(EQ/PQ/PQF)Ce - Contact Instruments

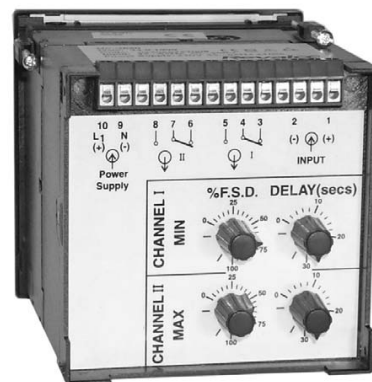
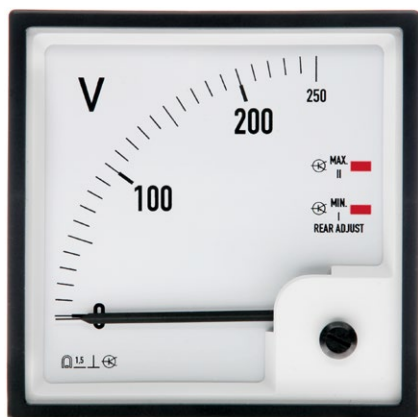


Figure 03: (EQ/PQ/PQF)Ce: Meters with limit contacts

Features

- Two integrated relays contacts (Min/Min, Min/Max, Max/Max)
- Limit adjustment via potentiometers on the rear
- Sealable terminal cover

Application

The instrument is equipped with two built-in relays with change-over contacts, which enable supervising of limit values. The switching points of the relays can be adjusted in the range 0...100% of maximum value by potentiometers on the backside. Two additional potentiometers enable a delay function for every relay in the range of 0,5...30s. Reached limit values are indicated for each relay by red LED's.

In standard configuration contact I has the function of a minimum contact, contact II has the function of a maximum contact.

Optionally two minimum contacts or two maximum contacts are available.

Technical Data

Type

EQCe: for AC-Quantities
 PQCe: for DC-Quantities
 PQFce: for Frequencies

General

Power supply: 230VAC, +/-10% at 45-65Hz,
 24V DC (option)
 Influence of power supply: <0,2%
 Weight approx.: 600g
 Front dimensions: 96 x 96 mm
 panel cut out: 92^{+0,8} mm
 Depth: 123 mm, including terminal cover

Relais

Max. Schaltvermögen bei ohmscher Last <600VA (<3A, <250V)

Measuring Ranges

EQCe - AC quantities

Voltage

Nominal voltage [V] 6 bis 600 V AC

Current

Nominal current [mA] 100...800 mA AC

Nominal current [A] 1...5 A AC

PQCe - DC quantities

Voltage

Nominal voltage [mV] 40...800 mV DC

Nominal voltage [V] 1...600 V DC

Current

Nominal current [µA] 25...600 µA DC

Nominal current [mA] 1...600 mA DC

Nominal current [A] 1...5 A DC

FQCe - Frequencies

Nominal freq. [Hz] at 60..500V AC 45...55 Hz

Nominal freq. [Hz] at 60..500V AC 48...52 Hz

Nominal freq. [Hz] at 60..500V AC 45...65 Hz

Nominal freq. [Hz] at 60..500V AC 55...65 Hz

Other ranges and interim values available

Adjustment der Schaltpunkte:

über Drehknöpfe auf der Rückseite

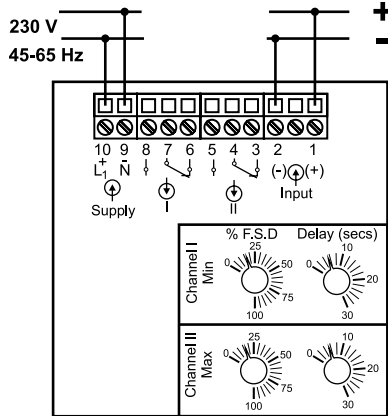
Hysteresis: <1% of scale end value

Accuracy: ±5% between 25% and 75% of the lower scale value.

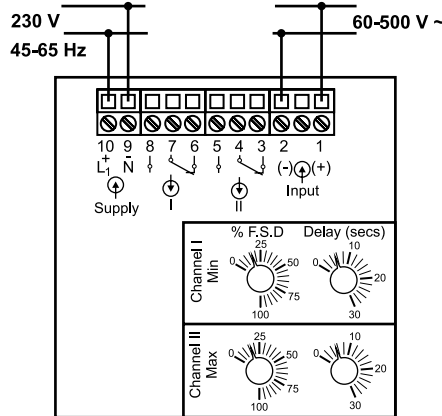
±15% between 0 and 25% of the min value and between 75% and 100% of the max value.

Connection

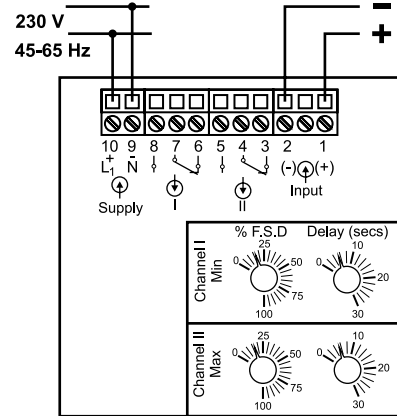
Connection of EQCe, PQCe with voltage input



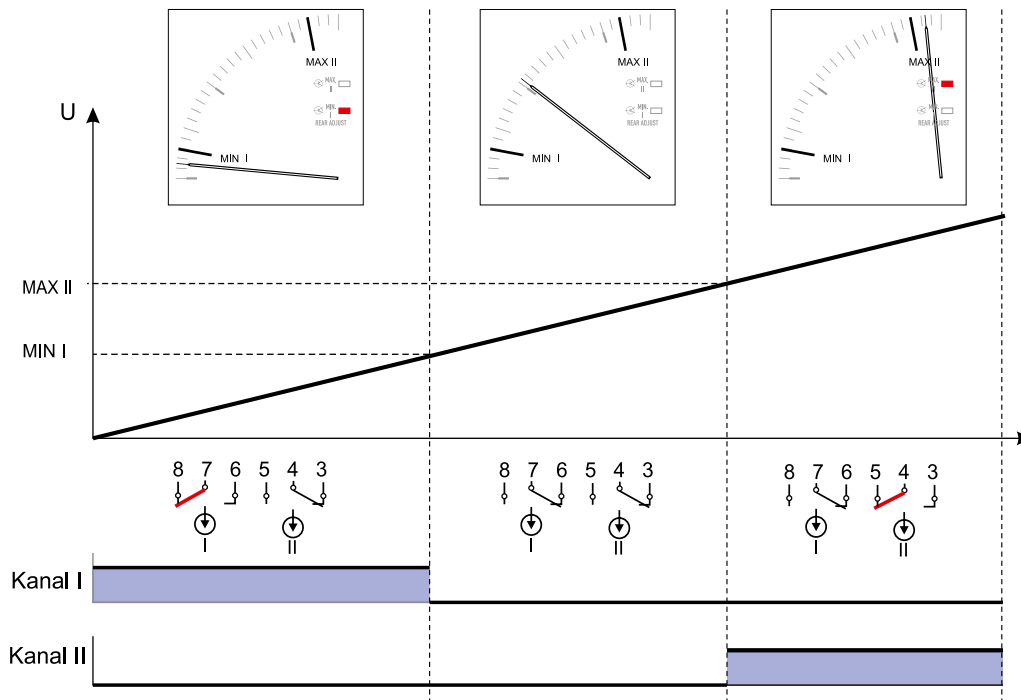
Connection of PQFCe (frequency meter)



Connection of EQCe, PQCe with current input



Operation of Min./Max. - Contact



Remark: Chanal I corresponds to the min. contact, if not used, the potentiometer should be set to 0%
Chanal II corresponds to the max. contact, if not used, the potentiometer should be set to 100%

Ordering Data

For ordering it is necessary to specify:

- Type of Instrument
- Measuring range, respectively divergent scale
- Nominal current / voltage respectively current / voltage transformer ratio
- Aux. power supply U_H (24V DC/230V AC)
- Limit contacts (Min/Max, Min/Min, Max/Max)

Ordering example:

EQCe 96 Voltmeter, 0...500V AC, U_H : 230V AC, Min/Max
EQCe 96 Ammeter, 0-200/400A/5A, U_H : 230V AC, Min/Max
PQCe 96 Ammeter, 0...100%, 4-20mA, U_H : 24V DC, Min/Min
PQFCe 96 Frequencymeter, 45-50-55 Hz, 230 V, U_H : 230 V AC, Max/Max

(K)PQ - Moving Coil Instruments

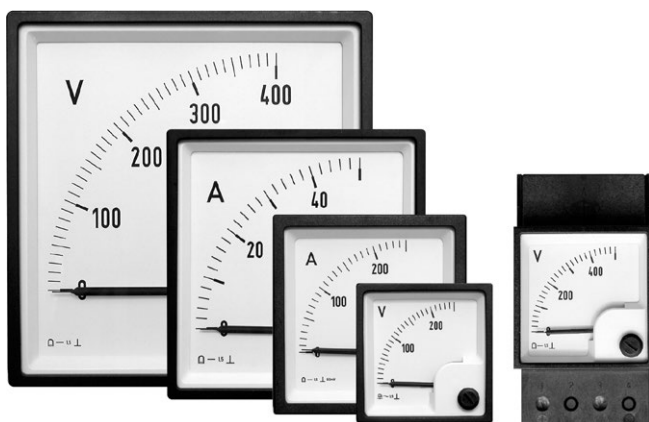


Figure 04: PQ 48...144, PQ 45¹⁾ -
DC ammeter and voltmeter with 90°-Scale

Features

- For measurement of DC currents and voltages
- Linear scale curve: PQ 90°, KPQ 240°
- Exchangeable dial
- higher resistance to mechanical vibrations (optional)
- Protective cover for terminals (optional)
- DIN-rail version available

Application

These instruments are designed for mounting into supervision panels of power distribution or transformer stations where DC current and voltage measuring instrument is required. The measuring system includes a core magnet, which is insensitive to external fields. The moving-coil is mounted on spring bearings, therefore the measuring system is highly resistive to mechanical shocks and vibrations. The scale graduation is practically linear throughout the whole range.

Technical Data

Accuracy:

- Accuracy class 1,5

Housing:

- Material of housing: PC non-flammable, according to UL 94 V-0
- Enclosure protection: case IP 52 terminal contacts IP 00 (IP 20 for connection terminals) according to EN 60529: 1989
- Operating position: Vertical

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

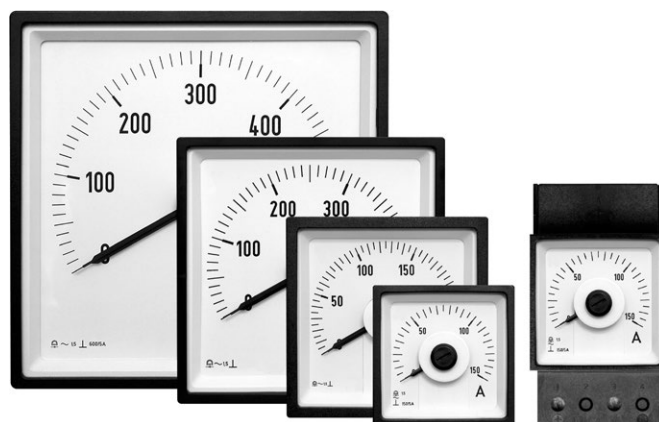


Figure 05: KPQ 48...144, KPQ 45¹⁾ -
DC ammeter and voltmeter with 240°-Scale

Measuring Ranges - Sample Values

Ammeters

	PQ	KPQ
Nominal value [μ A]	40 μ A ¹⁾ up to 600 μ A	100 μ A up to 800 μ A
Nominal value [mA]	1 mA up to 600 mA or 4-20 mA	1 mA up to 20 mA and 4-20 mA
Nominal value [A]	1 A up to 100 A ²⁾ , 60mV, 5mA ³⁾	1 A up to 60 A ²⁾
Current measuring via external shunt	60 mV or 150 mV	60 mV or 150 mV

¹⁾ PQ instruments: 40 μ A and 60 μ A for horizontal mounting only

²⁾ Ranges above 60 A, only with with separate shunt. (K)PQ 45 up to 10A max., (K)PQ 48 max. 25A

³⁾ For connectin to separate shunt, calibrated for 0,035 Ω wire resistivity For instruments (K)PQ 45 respectively (K)PQ 48 over voltage class CAT III applies, max. 300 V nominal voltage against earth

Voltmeters

	PQ	KPQ
Nominal value [mV]	100 mV up to 600 mV	60 mV up to 300 mV
Nominal value [V]	1 V up to 600V	1 V up to 600 V

other ranges and interim values available

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale

Ordering example:

- PQ 96 voltmeter, 150 V, 0 ... 150 V scale
- PQ 96 ammeter, 10 mA, 0 ... 10 mA scale
- PQ 96 ammeter, 60 mV, for connection to separate 1,5kA/60 mV shunt, 0 ... 1500 A scale

¹⁾ PQ 45 for DIN-rail mounting according to DIN 46277 and EN 50022. Bezel 45x45 mm. technical data refer to PQ 48.

(K)PQg- Moving Coil Instruments with Rectifier

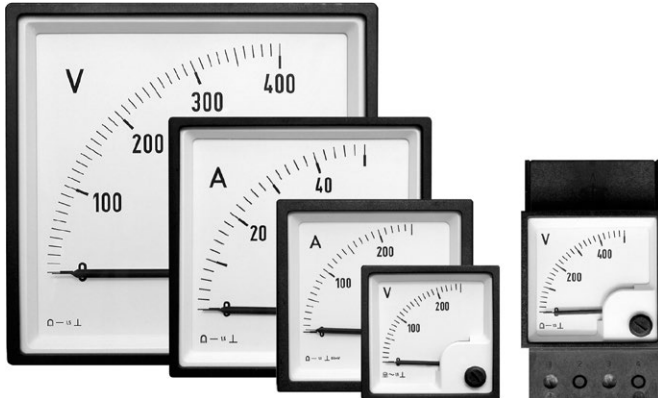


Figure 06: PQg 45¹⁾...144: AC Am- and Voltmeters with rectifier and 90° dail

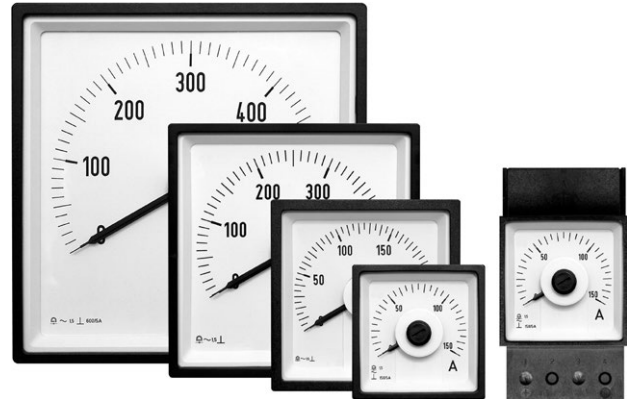


Figure 07: KPQg 45¹⁾...144: AC Am- and Voltmeters with rectifier and 240° dail

Features

- For measurement of AC currents and voltages
- Linear scale²⁾: PQg 90°, KPQg 240°
- Exchangeable dial
- higher resistance to mechanical vibrations (optional)
- Protective cover for terminals (optional)
- DIN-rail version available

Application

These instruments are designed for mounting into supervision panels of power distribution or transformer stations where AC current and voltage measuring instrument is required. The meters measure the arithmetical average of the alternating current, respectively voltage, within a frequency range of 40 to 5000 Hz. The scale shows the RMS value of the sinusoidal measurement. Distortion of the sine wave causes errors in the measurement.

Technical Data

Accuracy

- Accuracy class: 1.5 according to **EN 60 051**

Housing

- Material: Polycarbonat non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52 terminal contacts IP 00 (IP 20 for (K)PQg 45) according to **EN 60529:1989**
- Operating position: vertical ± 5°

¹⁾ (K)PQg 45 for DIN-rails mounting according to DIN 46277 and EN 50022. Frame size 45x45 mm.

²⁾ except voltmeters ≤ 10V

Measuring Ranges - Sample Values

Ammeters

	PQg	KPQg
Nominal Value [µA]	100 µA up to 800 µA	100 µA up to 800 µA
Nominal Value [mA]	1 mA up to 10 mA	1 mA up to 10 mA
Nominal Value [A] for transformer	1 A or 5 A	1 A or 5 A ⁴⁾

Voltmeters

Nominal Value [V]	2,5 V up to 600 V	2,5 V up to 600 V
Nominal Value voltages transformer [V]		xV / 100 V ³⁾ xV / 110 V ³⁾

³⁾ For transformer connection. Please state CT ratio and nominal value upon ordering.

⁴⁾ KPQg 48 only available with external current transformer 1 A/5mA or 5 A/5mA.

For instruments KPQg 48 overload category CAT III applies with max. 300 V nominal voltage to earth.

Other ranges and interim values available

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale

Ordering example:

- PQg 96 Voltmeter, 0-60 V, with scale 0-60 V
- KPQg 96 Voltmeter, 0-120 kV, for voltage transformer connection 100/0,1 kV

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dails, please see page 25 ff. and our website.

BQ - Bimetallic Maximum Ammeter

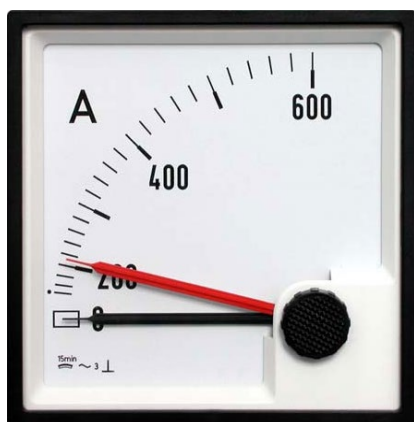


Figure 08: BQ: Bimetallic Maximum Ammeter

Features

- For measurement of maximum AC currents
- Good read-out survey on larger distance
- Exchangeable dial
- Resistance to mechanical vibrations
- Protective cover for terminals (optional)

Application

The bimetallic instruments are intended especially for thermal monitoring of transformers, cables, etc. due to their slow reaction to current changes. They indicate mean r.m.s. current value during the measuring period of the instrument. The instrument does not react to short current pulses essentially. Maximum mean value in a response time period is indicated by the red slave pointer. The latter can be reset or set to zero by means of a knob which can be sealed.

Measuring Ranges - Sample Values

Nominal Value [A] for transformer	xA / 1A	xA / 5A
	x= primary current of the current transformer	

Other ranges and interim values available

Technical Data

Accuracy

- Accuracy class: 3

Housing

- Material: Polycarbonat non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52 terminal contacts IP 00 (IP 20 for connection terminals) according to **EN 60529:1989**
- Operating position: vertical
- Test voltage: 2 kV rms in accordance to **EN 61010-1: 1990**

Consumption:

xA / 1A approx. 1,8 VA
xA / 5A approx. 2,8 VA

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale
- Response time

Ordering example:

- BQ 96, 100A/120A/5A/6A, 15 min.

Ordering example for scale:

- Scale for BQ 96, 80A/96A/1A/1,2A, 8 min.

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

BEQ - Bimetal Maximum and Moving Iron Ammeter



Figure 09: BEQ: Combined bimetal and moving iron Ammeter

Features

- For AC measurement of actual current, 15 minutes average current and maximum average current
- Good read-out survey on larger distance
- Exchangeable dial
- Resistance to mechanical vibrations
- Protective cover for terminals (optional)

Application

Combined bimetallic instruments are intended especially for thermal monitoring of transformers, cables, etc. due to their slow reaction to current changes. They indicate mean r.m.s. current value during the measuring period of the instrument. The instrument does not react to short current pulses essentially. Maximum mean value in a response time period is indicated by the red slave pointer. The latter can be reset or set to zero by means of a knob which can be sealed. Besides the bimetal system the instrument also includes a moving-iron system which measures instantaneous r.m.s. values.

Technical Data

Accuracy

- Accuracy class bimetal system: 3
- Accuracy class moving-iron system: 1.5

Housing

- Material: Polycarbonat non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52 terminal contacts IP 00 (IP 20 for connection terminals) according to **EN 60529:1989**
- Operating position: vertical
- Test voltage: 2 kV rms in accordance to **EN 61010-1: 1990**

Consumption:

xA / 1A approx. 1,8 VA
xA / 5A approx. 2,8 VA

Measuring Ranges - Sample Values

Nominal value [A] for transformer	xA / 1A	xA / 5A

x= primary current of the current transformer

Other ranges and interim values available

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale
- Response time

Ordering example:

- BEQ 96 with scale 100A/200A/5A/10A, 15 min.

Ordering example, Scale:

- Scale for BEQ 72 80A/1A, 8 min.

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

(K)PQFe - Pointer Frequency Meter

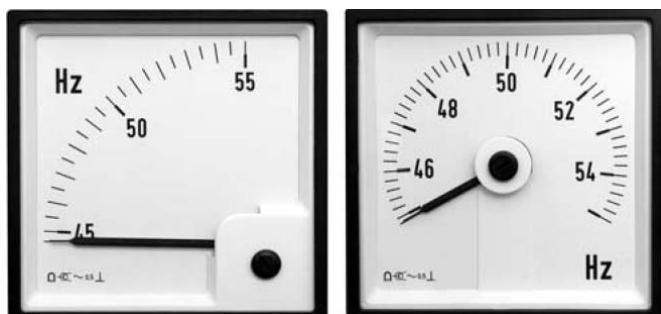


Figure 10: PQFe: Pointer Frequency Meter with 90° scale
KPQFe: Pointer Frequency Meter with 240° scale

Features

- low consumption
- Microprocessor's frequency measuring method
- Power supply from measuring circuit
- Exchangeable dial
- Protective cover for terminals (optional)

Application

Pointer frequency meter is designed for measurement of mains voltage frequency within five different measuring ranges (45-55 Hz, 48-52 Hz, 45-65 Hz, etc). Dial has to be exchanged, when the measuring range is changed. Meter consists of: power supply unit, measuring unit with microprocessor and instrument with moving coil. The meter is powered through measuring terminals. One of the following voltage ranges can be used: from 57V to 110V, 230V, 400V, 500V. Voltage range is factory preset according to customer order.

Technical Data

Accuracy

- All ranges 0.5

Input Voltage

- | | | | | |
|---------------------------|---------------|--|----------------|----------------|
| • Nominal Range U_N [V] | 57-110 | 230 | 400 | 500 |
| • Input resistance | 16 k Ω | 80 k Ω | 139 k Ω | 180 k Ω |
| • Power consumption(max) | 1 VA | 1 VA | 1,7 VA | 2 VA |
| • Overload capacity | | 1,2 x U_N continuously
1,5 x U_N up to 2 hours
2 x U_N up to 5 seconds | | |

Housing

- Material: Polycarbonat non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52 terminal contacts IP 00 (IP 20 for connection terminals) according to **EN 60529:1989**

Measuring Ranges

Type	Voltage	Range
PQFe 48	100 V/110 V 230 V	45...55 Hz
PQFe 72		48...52 Hz
PQFe 96		45...65 Hz
PQFe 144		55...65 Hz
KPQFe 48	400 V 500 V	58...62 Hz
KPQFe 72		
KPQFe 96		
KPQFe 144		

Other ranges and interim values available

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale
- Input Voltage

Ordering example:

- Pointer Frequency Meter PQFe 96, 45...55 Hz, 230V
- Pointer Frequency Meter KPQFe 144, 55...65 Hz, 100V/110V

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

PQFeDd - Double Pointer Frequency Meter



Figure 11: PQFeDd - Double Pointer Frequency Meter with Diagonal Systems

Features

- Pointer frequency meter with two separate systems
- low consumption
- usable for synchronisation purposes
- Microprocessor frequency measuring method
- Protective cover for terminals (optional)

Application

The Instruments PQFeDd are designed for measuring two separate frequencies between 45 and 65 Hz. The main application is synchronisation of two systems.

Technical Data

Accuracy

- Accuracy class: 0.5

Housing

- Material: Polycarbonat non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52 terminal contacts IP 00 (IP 20 for connection terminals) according to **EN 60529:1989**

Measuring Ranges - Sample Values

Type	Voltage	Range
PQFeDd 96	57-110 V	2x 45...65 Hz
	230 V	2x 48...52 Hz
PQFeDd 144	400 V	2x 45...65 Hz
	500 V	2x 55...65 Hz
		2x 58...62 Hz

Ordering Data

Required information:

- Instrument type
- Measuring range and scale
- Input Voltage

Ordering example:

- Double Pointer Frequency Meter PQFeDd 96, 2x 45...55 Hz, 230V

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

FQ(D) - Reed-Frequency Meter

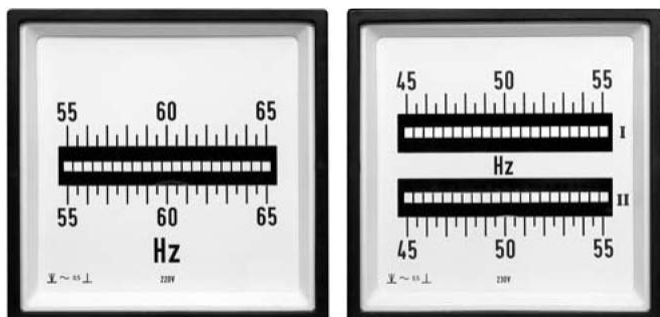


Abbildung 02: FQ 96 - Reed Frequency Meter
FQD 96 - Double Reed Frequency Meter

Features

- For measurement frequencies of AC supply
- Range from 45 Hz to 65 Hz
- Good read-out survey on larger distance
- Minimum effect of temperature
- Low power consumption

Application

The vibrating-reed frequency meter is one of the simplest devices for indicating the frequency of an AC source. They are usually in-circuit meters, used on power panels to monitor the frequency of AC. Two-systems reed frequency meters with two rows of reeds and two separate AC voltages can be used to synchronise two generators in parallel.

Technical Data

Accuracy

- Accuracy class: 0.5

Housing

- Material: Polycarbonat non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52 terminal contacts IP 00 (IP 20 for connection terminals) according to **EN 60529:1989**
- Consumption: 110V – 230V 0.7 ... 1.2 VA
Other ranges 1.4 ... 2 VAA

Variants

Range	Voltage [V]	Reed Count	FQ 72	FQ 96	FQ 144
47...53 Hz	110, 230, 380, 500	13	•	•	•
57...63 Hz	110, 230, 380, 500	13	•	•	•
45...55 Hz	110, 230, 380, 500	21	-	•	•
55...65 Hz	110, 230, 380, 500	21	-	•	•

Table 01: FQ - frequency meter with one system

Range	Voltage [V]	Reed Count	FQD 72	FQD 144
2 x 47...53 Hz	110, 230, 380, 500	2 x 13	•	•
2 x 57...63 Hz	110, 230, 380, 500	2 x 13	•	•
2 x 45...55 Hz	110, 230, 380, 500	2 x 21	•	•
2 x 55...65 Hz	110, 230, 380, 500	2 x 21	•	•

Table 02: FQD - frequency meter with two systems

• available - not available

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale
- Number of reeds

Ordering example:

- FQ 96; 55 ... 65 Hz; 110 V; 21 Reeds
- FQD 96; 2 x 47 ... 53 Hz; 230V; 2 x 13 Reeds

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

(K)DQe - Power Meter for active, reactive and apparent Power

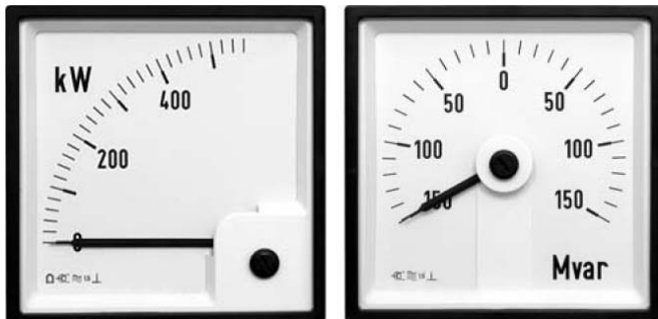


Figure 12: DQe: Active, Reactive and Apparent Power Meter with 90° scale
KDQe: Active, Reactive and Apparent Power Meter with 240° scale

Features

- Mounting in compliance with DIN 43700
- Single or three phase, 3 or 4 wire, balanced or unbalanced connection
- Power supply from measuring power system or separate
- Low self-consumption
- Wide frequency range of operation
- Exchangeable scale
- Protective cover for terminals (optional)

Application

The instrument operates on fast sampling method of input quantities (current and voltage) on all three phases. From the input data microprocessor calculates active, reactive and apparent power.

Technical Data

Voltage Input

- Nominal voltage $U_n(L-N)/U_n(L-L)$
57,7 V/100 V, 63,5 V/110 V, 230 V/110 V
- Consumption: <0,1 VA per phase
- Overload capacity: $1.5 \times U_n$ continuously,
 $2 \times U_n$ for 10 s

Current Input

- Nominal current I_n : 1A or 5A
- Consumption: <0,1 VA per phase
- Overload capacity: $3 \times I_n$ continuously,
 $25 \times I_n$ for 3 s
 $50 \times I_n$ for 1 s

Power Supply

- Nominal voltage U_n : $\pm 20\%$

Frequency

- Nominal frequency: 50/60 Hz
- Measuring range: 45...65 Hz

Accuracy

- Accuracy class: 1.5
according to **EN 60051**

Housing

- Material: Polycarbonat
non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52
terminal contacts IP 00 (IP 20 for connection terminals)
according to **EN 60529:1989**
- Operating position: Vertical
- Weight: < 500 g

Ordering Data

For ordering it is necessary to specify:

- Type of instrument
- Type of system
- Rated current or current ratio
- Rated voltage or voltage ratio
- End scale value acc. to technical data

optional:

- Auxiliary power supply

Example 1

Power Meter DQe 96/1b, 500/5A, 230V
single phase, 100kW

Example 2

Power Meter DQe 96/3u, 1000/5 A, 110/0,1 kV
3 phase, 200 MW, unsymmetrical load

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

(K)DQLe - Power Factor Meter

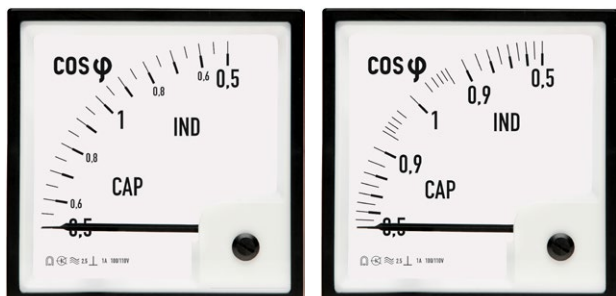


Figure 13: DQLe 96 : Power Factor Meter with 90° scale
left: linear scale
right: non linear scale



Figure 14: KDQLe 96: Power Factor Meter with 240° scale

Features

- Display of the power factor $\cos \varphi$
- Linear or non linear scale available
- Low consumption
- Wide frequency range of operation
- Stromanschluss über Durchführungswandler
- Exchangeable scale
- Protective cover for terminals (optional)

Application

The instrument operates on fast sampling method of input quantities (current and voltage) on all three phases. From the input data microprocessor calculates the power factor.

It can be chosen between direct measuring of the power factor (linear $\cos \varphi$ -scale) and measuring of the phase angle (non linear $\cos \varphi$ scale).

Ordering Data

For ordering it is necessary to specify:

- Type of instrument
- Type of system
- Rated current or current ratio
- Rated voltage or voltage ratio
- End scale value acc. to technical data
- Auxiliary power supply.

Ordering example:

- DQLe 96 0.5cap. ...1...0.5ind., 500/5A, 230V
- KDQLe 96 0.5cap. ...1...0.5ind., 200/5A, 10kV/110V

Technical Data

Accuracy

- Accuracy class: 2.5
entsprechend **EN 60 051**

Input

- Nominal voltage U_n : 57, 100¹⁾, 110¹⁾, 230, 400, 500 V
- Nominal current I_n : 1 A or 5 A
- Frequency range: 45 ... 65 Hz
- Standard range: cap 0,5 ... 1 ... 0,5 ind
different ranges at request

Housing

- Material: Polycarbonat
non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52
terminal contacts IP 00 (IP 20 for connection terminals)
according to **EN 60529:1989**
- Operating position: vertical $\pm 5^\circ$

¹⁾ also available for voltage transformer x/100/110V

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.



(K)DQZe 96 - Power Meter with Energy Counter ZQe / ZQDe 96 - Energy Meter

(K)DQZe 96 - Power Meter with Energy Counter

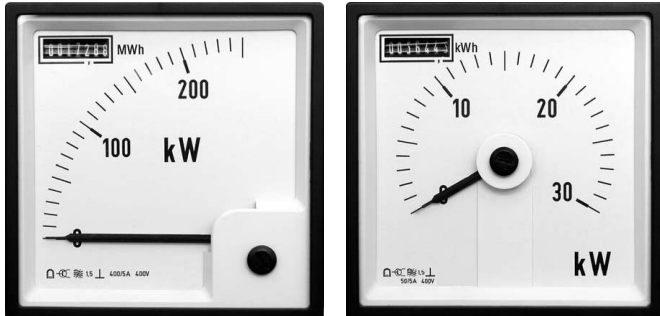


Figure 15: (K)DQZe 96 - Power Meter with Energy Counter
90° scale (DQZe) / 240° scale (KDQZe)

Features

- 7 digits electromechanical register
- Momentary power or power factor display
- Exchangeable scale
- Accuracy class EN 62053-21 class 1
- Frequency range from 16 Hz to 400 Hz
- Up to 2 pulse outputs (option)
- AC or Universal (option) power supply
- Automatic range of nominal current (max. 12.5A) and voltage (option)
- Protective cover for terminal (option)

Application

The (K)DQZe 96 is intended for energy measuring in single-phase or three-phase electrical power network. The meter measures according to the principle of fast sampling of voltage and current signals. A built-in microprocessor calculates energy, power and power factor from the measured signals.

The instrument operates on fast sampling method of input quantities (current and voltage) on all three phases. From the input data microprocessor calculates active, reactive and apparent power.

It is intended for monitoring and measuring electrical quantities of three-phase electric-energy distribution system. Meter records energy in all four quadrants. Up to 2 pulse outputs are available for measurements control.

Measurands

- Measurements of energy in all 4 quadrants
- Measurements of momentary active, reactive power and power factor ((K)DQZe only)

Energy Counter - ZQe / ZQDe

The meter is available with one or with two (KDQZe only) electro-mechanical registers. Registers have 7 digits (4 x 1.2 mm).

ZQe / ZQDe 96 - Energy Meter

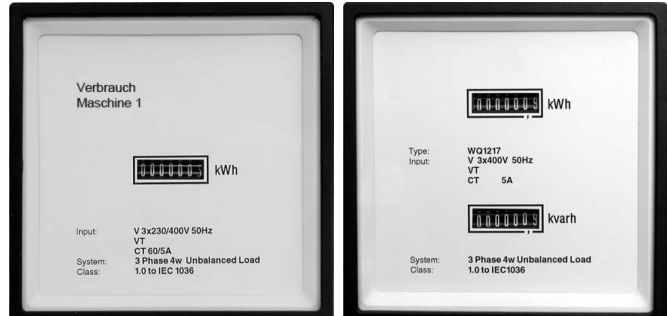


Figure 16: Energy Meter (ZQe) and Double Energy Meter (ZQDe)

Analogue Pointer

Two types of pointers are available:

DQZe have 90° scales analogue pointer.

KDQZe have 240° scales analogue pointer.

Pointer indicates the momentary active or reactive power or power factor.

Output Modules

The meter is available without or with two pulse output modules. Modules have three terminals.

Power Supply

Power supply connection of the meters is adaptive. Standard AC power supply enables connection of the meter to AC voltage (57.7 & 63.5 / 100 & 110 / 230 / 400). Option is a universal power supply which enables connection of the meter to DC (20–300 V) or AC voltage (48–276 V / 50 Hz).

Technical Data

EU-Directives:

Decree on electrical equipment designed for use within certain voltage limits URLRS 53/00

(Directive 2006/95/EC on low voltage):

SIST EN 61010-1: 2002

Safety requirements for electrical equipment for measurement, control and laboratory use, part 1: General requirements

Decree on electromagnetic compatibility (EMC) URLRS 61/00

(Directive 2004/108/EC on electromagnetic compatibility):

SIST EN 61326-1: 2007

Inputs

Input signals	Current	Voltage
Nominal frequency range		50, 60 Hz
Measuring frequency range		16-400 Hz
Nominal value (I_n, U_n)	1 / 5 A	75, 120, 250, 500 V _{L-N}
Maximal value	12,5 A	600V _{L-N}
Consumption	< 0,1 VA	

(K)DQZe 96 - Power Meter with Energy Counter

ZQe / ZQDe 96 - Energy Meter



Power Supply

	Universal	AC
Nominal voltage AC	48-276V	57,7 & 63,5, 100 & 110 / 230 / 400 V
Nominal frequency	40-65 Hz	
Nominal voltage DC	20-300 V	-
Consumption	< 0,3 VA	

Accuracy

Measurand	Accuracy
Active, reactive and apparent power	1.5
Power factor (PF)	1.5
Active energy	SIST EN 62053-21 Class 1
Reactive energy	SIST EN 62053-23 Class 2

Electromechanical register

- Number of digits: 7
- Size of digits: 4 x 1.2 mm

Relais Output

- Relais: 250 V, 6 A, 50 Hz
- Max. switching capacity: 1500 VA
- Standard puls: 10, 100/kWh (MWh)
- Relais response time: 100ms

Safety

- Protection class II
600 V installation category II
300 V installation category III
 pollution degree 2
 in compliance with SIST EN 61010-1:2002
- Enclosure material: PC/ABS
 non-flammable, according to **UL 94 V-0**
- Enclosure protection:: IP52 (IP00 for terminals)
 in compliance with SIST EN 60529: 1997
- Panel cutout: 92^{+0,8} mm
- Weight: <0.6 kg

Ambient Conditions

- Temperature range of operation: -10 to +55°C
- Storage temperature range: -40 to +70°C
- Average annual humidity: ≤75% rel. F.

Reference Conditions

- Ambient temperature: -10...23...55°C
- Voltage input: +/- 20% U_n
- Voltage input with voltage autorange: 50...500V
- Current input: 0...100% I_n
- Active/reactive power, factor: cosφ = 1 / sinφ = 1
- Waveform: sinusoidal

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Connection
- VT and CT ratio
- Voltage range
- Type of power supply
- Energy counter parameters
- Pulse output modules
- Scale data
- additional options

Basic Data

- Connection mode
 - 1b: single phase network
 - 3b: three phase network, 3 wires, symmetrical load
 - 3u: three phase network, 3 wires, unsymmetrical load
 - 4b: three phase network, 4 wires, symmetrical load
 - 4u: three phase network, 4 wires, unsymmetrical load
- Primary voltage of voltage transformer (for example 10kV)
- Nominal network voltage U_{L-N} / U_{L-L} (for example 57/100V or 230/400V) or secondary voltage of voltage transformer
- Primary current of current transformer
- Secondary current of current transformer (1A or 5A)
- Nominal frequency (50Hz or 60Hz)
- Only (K)DQZe: number of pulse outputs (0, 1 or 2)
- Nominal voltage for (optional) external power supply (for example 57, 100, 230, 400V)

Additional data for instruments with energy counters

- Active or reactive energy
- Import or export of energy (energy quadrants)
- Pulse ratio and energy unit for counter and pulse output (for example 999999,9MWh = 1p/100kWh)

Additional data for power meter (K)DQZe

- P: active power
- Q: reactive power
- S: apparent power
- Starting value of scale (for example 0kW)
- End value of scale (for example 250kW)

Ordering example:

DQZe96/4u - 10kV/100V - 100/5A - 50Hz
 Energy counter 1p/10kWh Q4, Q1 (to consumer)
 1x pulse output: 1p/10kWh Q4, Q1 (to consumer)
 Power meter: 0...1,5MW
 Uaux: 230VAC

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

EQDd - Double Voltmeter



Figure 17: EQDd - Double Voltmeter with diagonal Systems

Features

- Measuring of two AC voltages
- Used for synchronisation
- Terminal cover (Option)

Application

The instrument EQDd measures two AC voltages. It is used for synchronization.

The built-in moving iron systems display effective values of AC voltages in a frequency range 15...100Hz. Nominal voltages are available in the range of 100...600VAC.

Measuring Range

Type	Measuring Range
EQDd 96 EQDd 144	2x 100 V
	2x 110 V
	2x 120 V
	2x 130 V
	2x 150 V
	2x 250 V
	2x 400 V
	2x 500 V
	2x 600 V

Technical Data

Accuracy

- Accuracy class: 1.5

Housing

- Material: Polycarbonat
non-flammable, according to **UL 94 V-0**
- Enclosure protection: Case IP 52
terminal contacts IP 00 (IP 20 for connection terminals)
according to **EN 60529:1989**
- Operating position: vertical $\pm 5^\circ$
- Consumption: max. 4 VA
- Test voltage: 2 kV U_{eff} , 50 Hz, for 1 minute
according to **EN 61010-1:1990**

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Measuring range and scale

Ordering examples:

- EQDd 144, 500 V
AC Spannungsmesser 2 x 0-500 V, 144x144mm

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

SQ 0x04, SQ 0x14 - Synchronoscopes

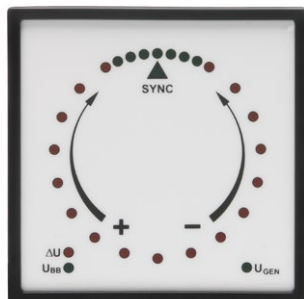


Figure 18: SQ 0204

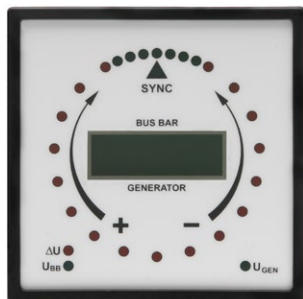


Figure 19: SQ 0214

Features

- Measurement of phase difference between bus bar and generator
- Five instruments in one (SQ 0x14)
- Circular display of $\delta\varphi$ phase difference
- Magnified display of phase difference $\delta\varphi = \pm 20$ degree
- Microprocessor controlled
- Simple synchronisation conditions setting
- Output relay for synchronisation (pulse or permanent contact)
- "Dead busbar" functionality
- Power supply from bus bar or generator
- Standard 96x96 mm or 144x144 mm din housing
- LCD with backlight for voltage, frequency and/or $\delta\varphi$ monitoring (sq 0x14 only)
- High immunity to emc disturbances
- Special functions set with three jumpers inside the instruments
- Status output (option)
- Green led for indication of both voltages
- Lloyd's and Bureau Veritas certificates (SQ 0204, SQ 0214, ship version)

Application

SQ 0204 and SQ 0x14 are microprocessor controlled synchronoscopes. They are available with or without LC-Display or output relay and can be used for manual or semi-automatic synchronisation processes. The internal output relay is activated, as soon as the prior adjusted synchronisation conditions are fulfilled. In addition the SQ 0x14 provides a LCD, which shows bus bar voltage U_{BB} and generator voltage U_{GEN} , as well as both frequencies f_{BB} and f_{GEN} or bus bar frequency f_{BB} and phase difference $\Delta\varphi$. Hence the SQ0x14 can replace two separate voltmeters and two frequency meters.

Description

The meter consists of 24 circular arranged LEDs, which show the actual phase difference $\Delta\varphi$ with a resolution of 20° . Within the synchronisation range (between -20° and $+20^\circ$) the resolution is higher (5° el. Grad). A frequency difference between the input voltages (U_{GEN} and U_{BB}) of more than 3 Hz is indicated through 3 blinking LEDs either in the FAST-range ($f_{GEN} > f_{BB}$) or in the SLOW-range ($f_{GEN} < f_{BB}$). When the synchronisation conditions are fulfilled, the green SYNC-LED is lit. A red ΔU -LED is lit, when the voltage difference is exceeding the predefined value. Three potentiometers adjusting of the synchronisation conditions can be found on the back of the meter:

- Permissible phase difference $\Delta\varphi$
- Permissible voltage difference ΔU
- Switching delay for the relay

The relay is fired (impulse or permanent contact), when the phase-difference and the voltage difference remain within the defined values for the duration of the defined switching delay. As soon as one value exceeds the conditions, the permanent contact is open immediately. The activation of the relay is indicated by the SYNC-LED on the meter.

The synchronoscopes are available:

- **Without relay**
- **With relay** (impulse- or permanent contact)
- **With "dead bus bar"-function**
the output relay will additionally be activated, when the generator voltage is higher than 80% of the nominal voltage U_N and the bus bar voltage U_{BB} is below the defined offset value. The default offset value is 20% of the nominal value.
- **With "dead bus bar" and "dead generator"-function**
the relays will additionally be activated, when one of the voltages (U_{BB} or U_{GEN}) is higher than 80% of the nominal voltage U_N and the according other voltage (U_{BB} or U_{GEN}) is lower than the defined offset value.
- **With status output (optional)**
the status output (open collector) monitors the microprocessor system. In case of a micro processor error this output has a high resistance.

The SQ 0x14 shows on its display two voltages (U_{BB} , U_{GEN}) and two frequencies (f_{BB} , f_{GEN}). If the difference between f_{BB} and f_{GEN} is less than 0.02 Hz, the phase difference $\Delta\varphi$ will be displayed.

229V 50.07Hz
231V 50.73Hz

system voltage U_{BB} and system frequency f_{BB}
generator voltage U_{GEN} and generator frequency f_{GEN}

229V 50.07Hz
231V +138.7°

system voltage U_{BB} and system frequency f_{BB}
generator voltage U_{GEN} and phase difference $\Delta\varphi$

In order to enable a correct synchronisation, the correct connection of the input voltages U_{BB} and U_{GEN} (according to model, phase-phase or phase-neutral) has to be ensured. unbalanced net loads and inverted connections can lead to malfunctions.

Technical Data

Input Voltage

- Nominal voltage u_n 57, 63, 100, 110, 230, 400, 500, 120, 220, 380, 415, 440, 600, 690 v
with u_{1-n} max = 400v
- Voltage range $u_n \pm 20\%$
- Frequency range 40 ... 70 Hz
- Consumption (network) < 4 va
- Overload $1.2 \times U_n$ permanent
 $2 \times U_n$ up to 3 s

LED-Indicators

- Resolution of phase difference indicators: 20 °el. Grad
- Magnifier range: ± 20 °el. Grad
- Resolution within magnifier range: 5 °el. Grad
- Accuracy at $\Delta\varphi = 0$: ± 3 °el. Grad

LCD Accuracy (SQ 0x14)

- Voltage u_n, u_{gen} 1,5
- Frequency f_n, f_{gen} 0,5
- Phase difference betw. U_n and U_{gen} ± 3 °el. Grad

Synchronisation Settings

- Voltage difference range: 1 ... 10 %
Accuracy $\pm 2,5$
- Phase difference range: 2 ... 20 ° El. Grad
accuracy ± 3 °el. Grad
- Synchronisation delay range: 0,1 ... 1 S
accuracy ± 10

Relay

- Switching function: permanent contact (standard),
impulse 100ms, 200ms, 300ms or different (100ms ... 1s)
- Contact rating of the relay 250 V, 1A, 50 Hz, 250 VA

Housing

- Material: pc/abs
non-flamable,
according to **ul 94 v-0**
- Enclosure protection: housing ip 52
terminals ip 20 (with protection cover)
according to **en 60529**: 1989
- Operating position: vertical
- Safety: according to en 61010-1
400v cat iii,
degree of pollution 2
- Weight: $\leq 0,6$ kg

Connection Diagram

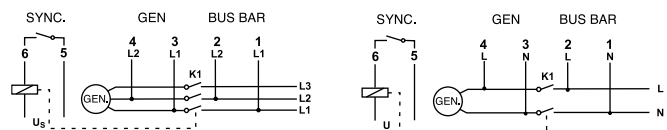


Figure 20: connection diagram SQ 0x04, SQ 0x14

Terminals

Terminals for input voltage U_{BB} and U_{GEN} as well as for relay output SYNC can be found at the back of the meter. The potentiometer for setting of the synchronisation delay(0,1...1s), phase difference $\Delta\varphi$ ($\pm 2...20$ el. Grad) and voltage difference ΔU ($\pm 1...10\%$ of nominal value) can also be found on the back of the meter.

Dimensions

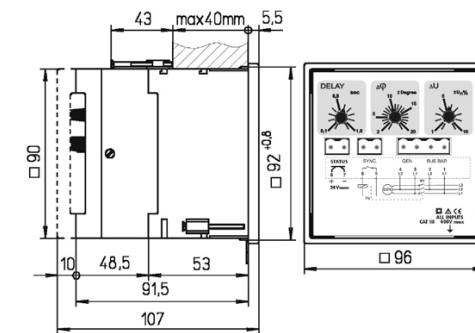
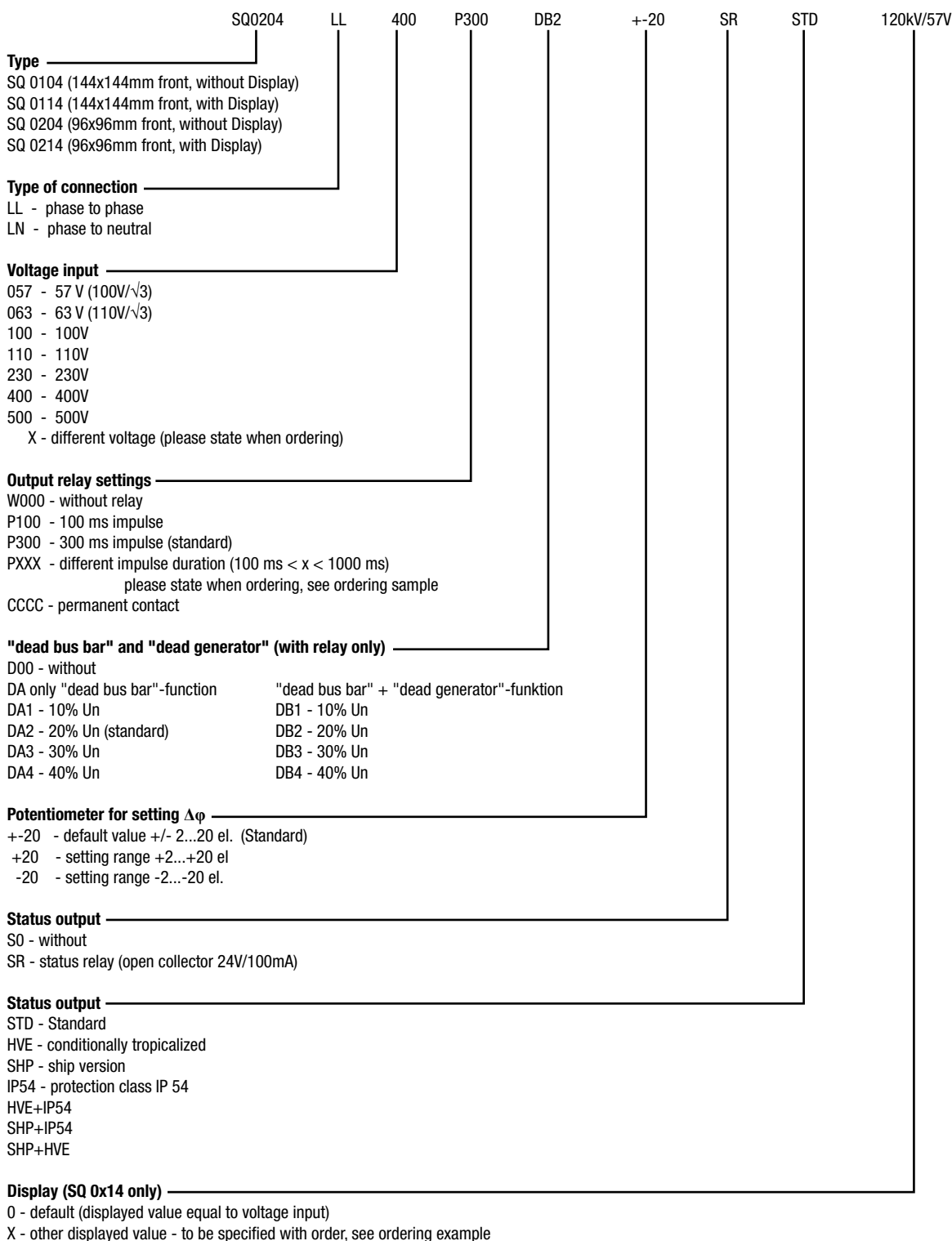


Figure 21: Dimensions SQ 02x4 (mm)

Ordering Code

Ordering example:

Size 96 synchronoscope with LCD, phase to phase voltage 400V, relay output with 300ms impulse duration, "dead bus bar"-function with Offset of $20\%U_N$, $\Delta\phi$ range +/- 2...20 el, with status output and display value of 28kV at 400V input voltage
 = **SQ0214 LL400P300DB2+-20 SR STD 120kV/57V**



SDQ - Phase Sequence Indicator

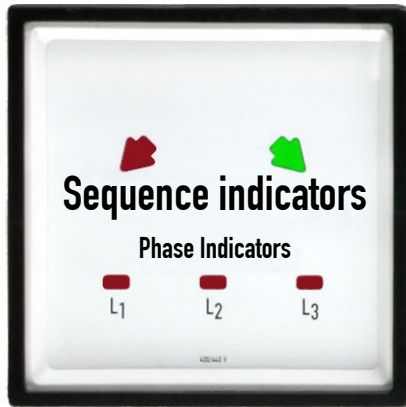


Figure 22: SDQ/P 96

Features

- Monitoring of the phase sequence
- Phase display (option)
- Relais Output (option)

Application

The panel mounted phase sequence indicators SDQ are used for supervision of phase sequence in three-phase networks. They are available in different versions and for different network voltages and frequencies. All versions have a terminal for the neutral conductor. A connection of this clamp is only necessary at versions SDQxx/P and SDQxx/PR. Otherwise in case of fault of two phase voltages the eventually present third phase voltage will not be indicated. From this reason only the versions SDQxx and SDQxx/R can be used in a three-wire network (without neutral conductor).

Function

The basic versions SDQ72 and SDQ96 are equipped with a green and a red LED.

If all three phase voltages are present and if the phase sequence is correct (right rotation), the green LED of phase sequence indicator is lit. If all three phase voltages are present and if the phase sequence is changed (left rotation), the red LED of phase sequence indicator is lit.

If one phase voltage is absent, the rotation field is not more complete and both LED's are lit with reduced intensity.

The version SDQxx/P is equipped with three additional red LED's for phase voltage indication.

The version SDQxx/R has a built-in relay, which is activated, if all three phase voltages are present and if the phase sequence is correct (right rotation).

The version SDQxx/PR is equipped with a phase voltage indicator and a relay.

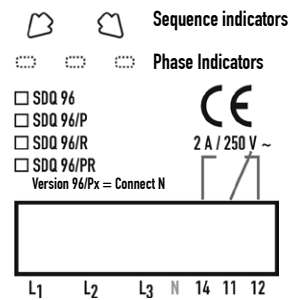


Figure 23: Label SDQ 96

Technical Data

Housing

- Material: PC/ABS non-flamable, according to **UL 94 V-0**
- Enclosure protection: housing IP 52
Terminals IP 20 (with protection cover) according to **EN 60529: 1989**
- Operating position: any
- Consumption: type dependant 1,2...12 VA

Variants - SDQ 72

Type	Voltage	Frequency	Option
SDQ 72	400 V	50 Hz	without
SDQ 72/P	400 V	50 Hz	3 phase monitoring LED's
SDQ 72/R	400 V	50 Hz	integrated relais
SDQ 72/PR	400 V	50 Hz	3 phase monitoring LED's and integrated relais

Variants - SDQ 96

Type	Voltage	Frequency	Option
SDQ 96	400 V	50 Hz	without
SDQ 96/P	400 V	50 Hz	3 phase monitoring LED's
SDQ 96/R	400 V	50 Hz	integrated relais
SDQ 96/PR	400 V	50 Hz	3 phase monitoring LED's and integrated relais

Ordering Data

For ordering it is necessary to specify:

- Instrument type
- Aussenleiter-Nennspannung
- Nennfrequenz

Ordering examples:

- SDQ 96, 400 V, 50 Hz
- SDQ 96/P, 400 V, 50 Hz, mit Phasenanzeige

Customer-specific voltages, frequencies or scale layouts are available

Further Information

For general information e.g. dimensions, ambient conditions, type of connection and information for the exchange of the dials, please see page 25 ff. and our website.

General Information

For better overview, only the most important special options are described on instrument pages.

Further more the following modifications are available:

- increased accuracy class
- Special scales (for example non-linear scales, multiple scales in combination with knife pointers), coloured scales (for example black scales with yellow types and yellow pointers), coloured marks or sectors, labels and additional prints, multiple value numbers, illuminated scales...
- Internal electronic circuits (for expanding or compressing of certain ranges on scale)
- 2 voltage inputs
- Scale mounting by screws for moving coil instruments with 240° scale (marine version)
- User adjustable instruments (with built-in potentiometer)
- Instruments with higher impedance
- Instruments with higher special protection or protection against vibration
- 1 or 2 red marker pointers

Please contact us for special feature requests.

Exchange of a scale

Press the cover, on top of the instrument, in the direction of the arrow and extract the scale with a suitable tool. After exchanging the scale, carefully close the opening with the cover.

During the replacement procedure the instrument must be disconnected.

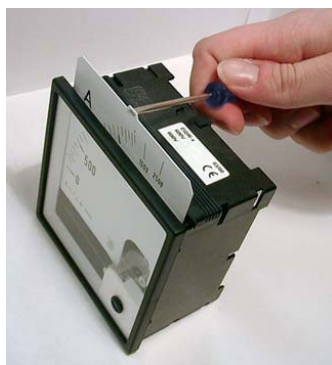
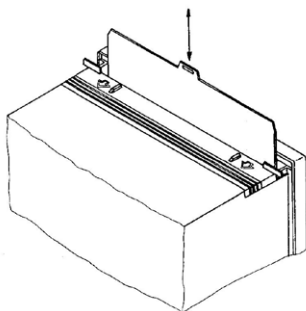


Figure 24: Exchange of a scale



Example - Customer-Specific Scales

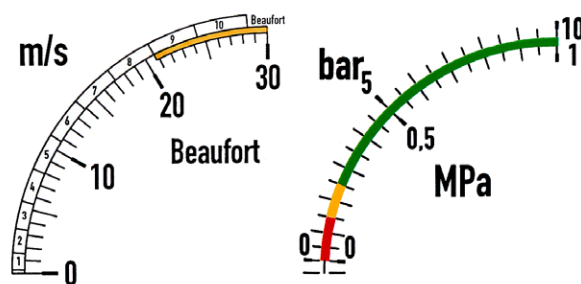


Figure 25: Sample scale for PQ 72

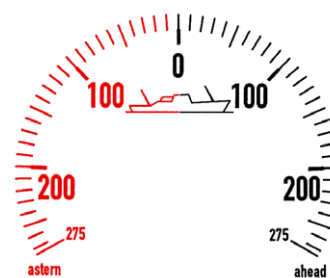


Figure 26: Special scale for KPQ 72

Ambient Conditions

- Climate class: 2
according to VDE/VDI 3540
- Temperature:
 - Reference range +18 ... +28°C
 - Operating range -25 ... +55°C
 - Storage range -40 ... +70°C
- Average annual humidity: ≤ 80 % (r. h.)

subject to alterations

Dimensions: Analogue Panel Meters

		Size				
		45	48	72	96	144
Front (mm)	□ a	45	48	72	96	144
Cutout (mm)	□ b	-	45 ^{+0,6}	68 ^{+0,8}	92 ^{+0,8}	138 ^{+1,0}
Bezel height (mm)	c	-	5,0	5,5	5,5	8,0
Terminal cover (mm)	□ d ³⁾	-	42,5	66,5	90	90
	BEQ	-	-	0,22	0,25	0,45
Weight (kg)	EQ	0,14	0,14	0,18	0,20	0,40
	(K)PQ	-	-	-	-	-
	BQ	-	-	-	-	-
	EQDd	-	-	-	0,30	0,50
	EQtri	-	-	0,24	0,30	0,50
	FQ	-	-	0,20	0,25	0,40
	FQD	-	-	-	0,38	0,52
	(K)PQFe	-	0,10	0,19	0,25	0,32
	(K)PQg	0,15	0,15	0,19	0,25	0,39
	PQFe	-	0,10	0,14	0,19	0,25
Weight (kg)	PQFeDd	-	-	-	0,25	0,32
	SQ	-	-	-	0,63	0,80
	SDQ	-	-	0,15	0,20	-

Table 03: Dimensions and weight - not available

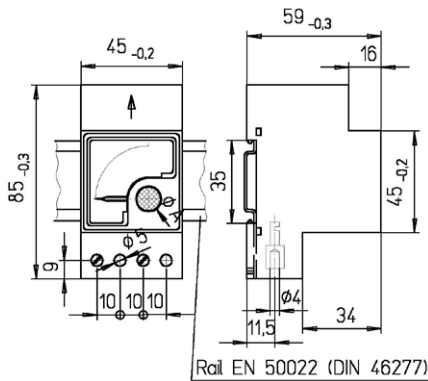


Figure 27: Dimensions EQ/(K)PQ/BQ 45 (in mm)

PQFeDd

		Size				
		45	48	72	96	144
Front (mm)	□ a	-	-	-	96	-
Cutout (mm)	□ b	-	-	-	92 ^{+0,8}	-
Bezel height (mm)	c	-	-	-	5,5	-
Terminal cover (mm)	□ e ¹⁾	-	-	-	90	-
Weight (kg)		-	-	-	0,35	-

Table 04: Dimensions and weights PQFeDd

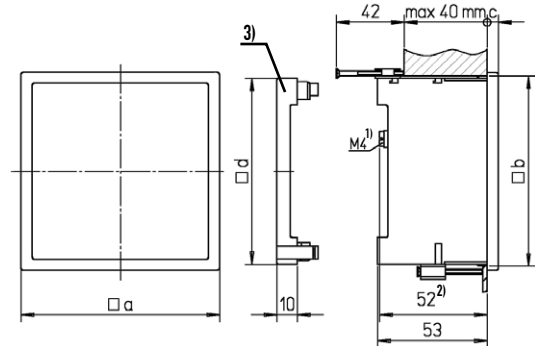


Figure 28: Dimensions EQ/(K)PQ/FQ(D) 48...144 (in mm)

¹⁾ Range from 30 to 40 A - M6 terminals

²⁾ Range from 30 to 40 A - depth 59 mm

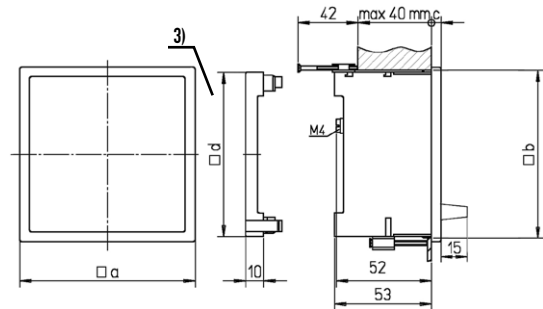


Figure 29: Dimensions EQtri 96 (in mm)

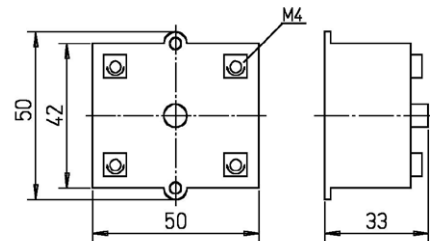


Figure 30: Separate Current Transformer for KPQg 48 (1A/5mA or 5A/5mA) all dimensions in mm

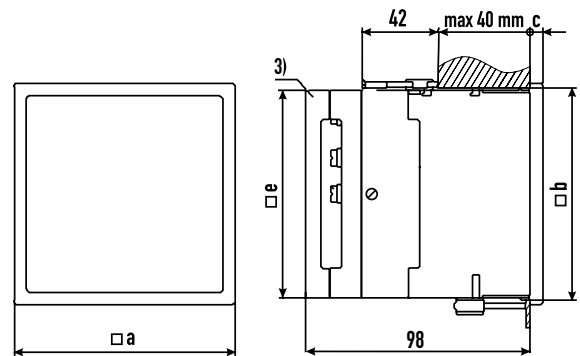


Figure 31: Dimensions PQFeDd

³⁾ Terminal Cover (Option) subject to alterations

Dimensions: Meters with Electronics

(K)DQ(L)e/(K)DQZe/ZQ(D)e

		Size				
		45	48	72	96	144
Front (mm)	□ a	-	-	72	96	144
Cutout (mm)	□ b	-	-	68 ^{+0,8}	92 ^{+0,8}	138 ^{+1,0}
Bezel height (mm)	c	-	-	5,5	5,5	8,0
Terminal cover (mm)	□ e ³⁾	-	-	66,5	90	90
	DQe	-	-	0,25	0,35	0,60
	KDQe	-	-	0,25	0,46	0,65
	DQLe	-	-	0,25	0,50	0,90
Weight (kg)	KDQLe	-	-	0,25	0,45	0,90
	(K)DQZe	-	-	-	0,62	-
	ZQ	-	-	-	0,48	-
	ZQD	-	-	-	0,53	-

Table 05: Dimensions and weight

- not available

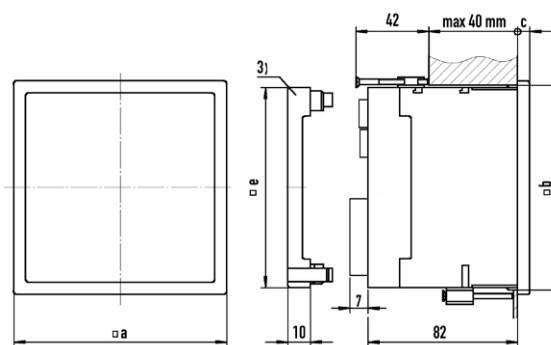


Figure 33: Dimensions (K)DQe/(K)DQLe/(K)DQZe 72



Figure 32: Dimensions (K)DQe/(K)DQLe/(K)DQZe 96

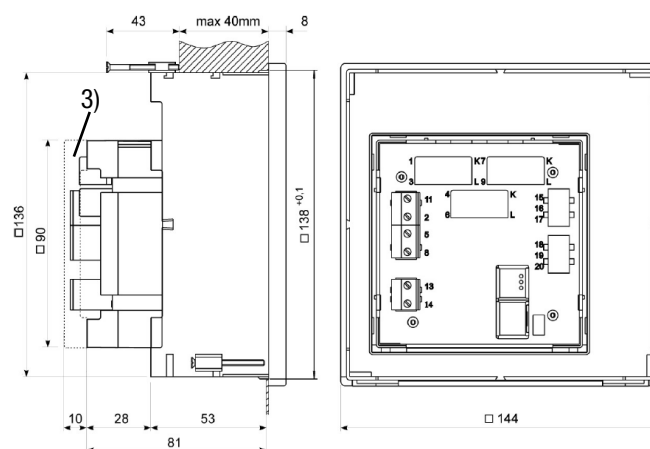


Figure 34: Dimensions (K)DQe/(K)DQLe 144

³⁾ Terminal Cover (Option)
subject to alterations

Connection Diagram for Meters with internal Electronics (K)DQ(L)e/(K)DQZ/ZQ(D)e

The instruments can be connected to single phase networks and to three-phase networks with 3 or 4 wires. Loads can be symmetrical or unsymmetrical. The instrument can be supplied by measured voltages or by an external power supply terminal.

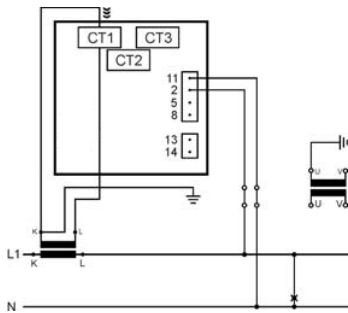


Figure 35: 1b - single-phase

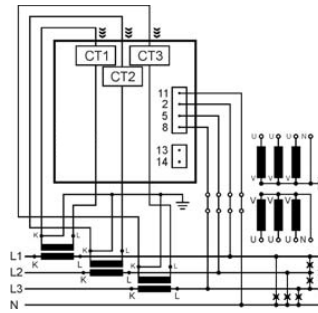


Figure 36: 4u - three-phase, 4 wire, unsymmetrical load

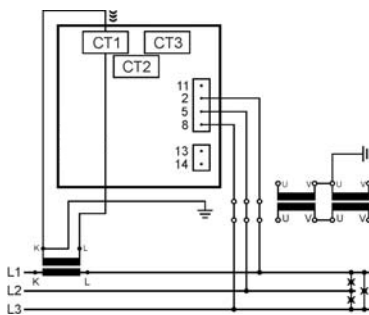


Figure 37: 3b - three-phase, 3 wire, symmetrical load

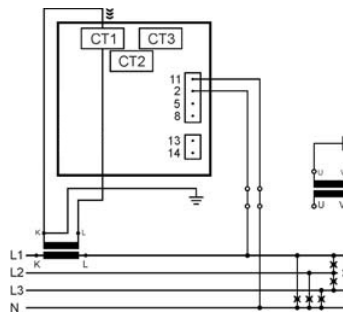


Figure 38: 4b - three-phase, 4 wire, symmetrical load

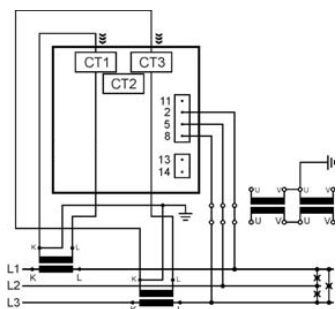


Figure 39: 3u - three-phase, 3 wire, unsymmetrical load

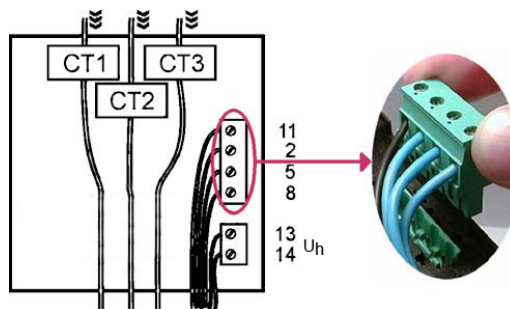
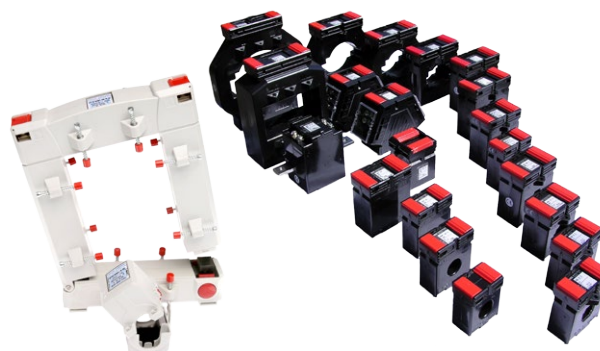


Figure 40: Complete wiring of an instrument in connection mode 4u

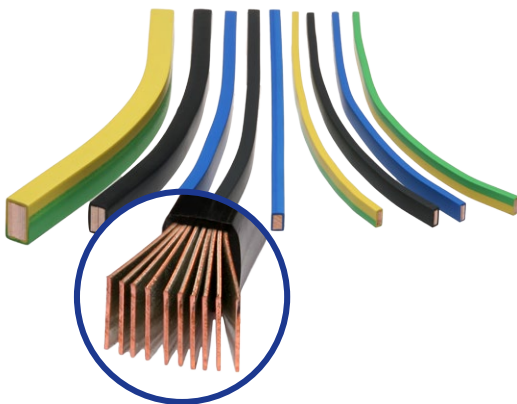
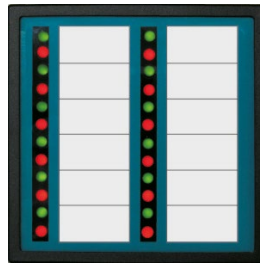
measurement technology

- hour meters
- analogue measuring instruments
- digital measuring instruments
- transducers (1-5 outputs)
- current transformers
- split-core current transformers
- voltage transformers
- shunts
- energy meters
- accessories
- custom-built solutions



electronics

- electronic modules
- custom-built electronic modules
- LED alarm meters
- LED monitor panels
- radio systems
- accessories



switch cabinet accessories

- cable protection conduits
- hose couplings
- cable glands
- laminated copper bars
- switch cabinet heatings



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A large empty rectangular box with a blue border, intended for taking notes.

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