

LF 96

LF 144

Data Sheet

Analogue

Power Factor Meter



Application

The moving coil indicators LF 96 / 144 and a phase angle adjuster are used to monitor changing power factor conditions or ir-reversible balanced load systems.

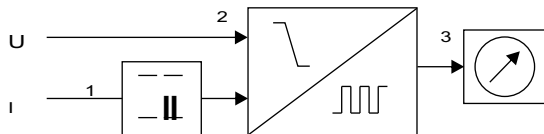
The power factor is indirectly determined by measuring the phase angle f between current and voltage (both sinusoidal). However, the indicators are calibrated in values of $\cos f$ of the angle f .

These instruments offer several advantages in switchboards and Generating Set panels. Number of meters can be mounted in a single cutout (mosaic mounting). Front window glass, Bezel and Dial can be easily replaced.

Functional Principle

The measuring system comprises a moving-coil indicator and phase angle converter attached to the case of the indicating instrument. Moving-coil movement has pivots of very high hardness. Movement is suspended between spring loaded sapphire jewels. Movement is properly shielded & critically damped by eddy currents induced in coil former.

Schematic diagram.



A current transformer 1 of the phase angle converter provides input current to the electronic circuit. Both the input voltage and the current are passed to a bistable flip-flop stage 2.

The pulse duty cycle of the flip-flop is proportional to the phase angle f . A low-pass filter allows the mean value which is proportional to the phase angle and is fed to the moving-coil movement 3.

Mechanical Data

Case details	moulded square case suitable for mounting in control / switchgear panels, machinery consoles.	57.7 63.5 100 110
Case material	Glass filled polycarbonate Flame retardant and drip proof As per UL 94 V-O	120 127 220
Front facia	Glass	230
Colour of bezel	Black	240
Position of use	Vertical	289
Panel fixing	Swivel screw	380
Mounting	Stackable in a single cutout	415
Panel thickness	≤ 40 mm	440
Terminals	Hexagon studs, M4 screws and wire clamps E3 (DIN 46282)	500

Electrical Data

Measured quantity	: Power factor
Overload capacity	(acc. to IEC 51)
Continuously	: 1.2 times rated voltage / current
Short duration	: 2 times rated voltage, 5 s max 10 times rated current, 5 s max
Power consumption :	
Current path	: ≤ 1.0 VA
Voltage path	: ≤ 3.0 VA
Enclosures code (IEC 529)	: IP 52 case IP 00 for terminals without back cover IP 20 for terminals with back cover
Insulation class	: Group A according to VDE 0110
Insulation voltage	660 V
Proof Voltage	2 kV
Installation category	300 V CAT III (IEC 1010)
Insulation resistance	> 50 Mohm at 500 V d.c.

Standard Measuring Ranges

type	
E	Single phase system
D	3 phase system balanced load

Measuring ranges

Cos f	Cap 0.5 ... 1 ... 0.5 ind
Cos f	Cap 0.8 ... 1 ... 0.3 ind
Cos f	Cap 0.8 ... 1 ... 0.8 ind

Rated voltages

Following single phase and three voltages are available as standard. The voltage will be considered as a phase voltage (between phase and neutral) in case of single phase meters and as a line voltage (between two phases) in case of multiphase 2 wire, 3 wire and 4 wire meters. Please clarify the application (3ph. 2 wire 3 wire or 4 wire)

	57.7
	63.5
	100
	110
	120
	127
	220
	230
	240
	289
	380
	415
	440
	500
Rated current	1 A 5 A

Data Sheet

Analogue Power Factor Meter

Scale and pointer

Pointer	Knife-edge pointer
Pointer deflection	0 ... 90°
Scale characteristics	Non-linear
Scale division	Coarse-fine
Scale length	CQ 96 CQ 144 97 mm 146 mm
Interchangeability	Scales are interchangeable

Accuracy at Reference Conditions

Accuracy class 1.5 according to IEC 51 / DIN EN 60051

Reference conditions

Ambient temperature	23°C ± 2°C
Position of use	Nominal position ± 1°
Voltage	Rated voltage ± 2%
Frequency	50 Hz ± 0.1%
Wave form	Sine wave
Distortion factor	≤ 1%
Current	95 ... 100% rated current
Warm-up	≥ 5 minutes at min 80% of rated current and 100% of rated voltage
Others	IEC 51 / DIN EN 60051

Nominal range of use

Ambient temperature	0 ... 50°C
Position of use	Nominal position ± 5°
External magnetic field	0.5 mT
Voltage	Rated voltage ± 15%
Current	20 to 120% of rated current
Frequency	49-51 Hz for single phase 45-65 Hz for three phase

Environmental conditions

Climatic suitability	Climatic class 3 according to VDE/VDI 3540
Operating Temperature	-10 ... + 55°C
Storage Temperature	-25 ... + 65°C
Relative humidity	≤ 75% annual average, non-condensing
Shock resistance	15g, 11 ms
Vibration resistance	10-150-10 Hz / 0.15 mm 1.5 g at about 50 Hz

Accessories

Safety Terminal Protection

Full sized polycarbonate back cover to provide protection against accidental contact (hand and fingers) acc. to VDE 0410

Applicable standards

Nominal case & cutout dimensions for : DIN 43700
indicating Electrical instruments

Scales and pointer for electrical measuring instruments : DIN 43802

Connections and Terminal markings for panel meters : DIN 43807

Terminal bolts / leads : DIN 46200/46282

Clamp straps for connections : DIN 46282

Safety requirements and protective measures for Electrical indicating instruments and their accessories : DIN 40050 / 8-70
VDE 0110 / 11-72
VDE 0410 / 10-76
IEC 529, IEC 1010

Performance specifications for direct acting indicating analogue electrical measuring instruments and their accessories : IEC 51/
DIN EN 60051
DIN 43701

Front frames for indicating measuring instruments Principle dimensions : DIN 43718

UL Combustibility class : UL 94 V-O

Technical conditions of delivery for electrical instruments : DIN 43701

Mechanical strength (Free fall test, vibration test) : IEC 51, VDE 0411,
part 1, Sec.43/44,
IEC 1010

Electro Magnetic Compatibility(EMC) compliance as per following standards :

EN 50081-2, EN 50082-2, N 55011/CISPR 11,
EN 60555-2, IEC 555-2,
EN 61000-4-4 / IEC 1000-4-4,
EN 61000-4-2 / IEC 1000-4-2,
EN 61000-4-5 / IEC 1000-4-5, ENV 50140

Comply with following European directives : 89/336/EEC (EMC directive), 73/23/EEC (low voltage directive) & amendment 93/68/EEC, for CE marking.

Options

Case

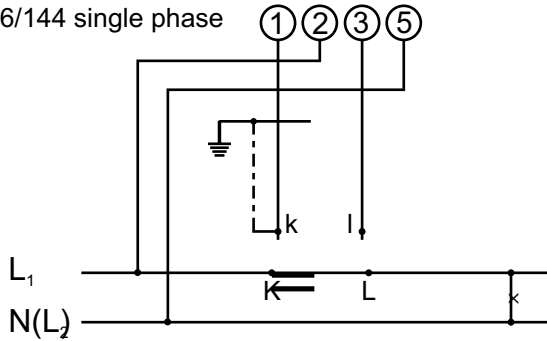
Front Facia	Antiglare glass
Colour of bezel	Red, Yellow, Blue, White
Red index pointer	Front adjustable on site
Position of use	On request 0° ... 180°

Dial

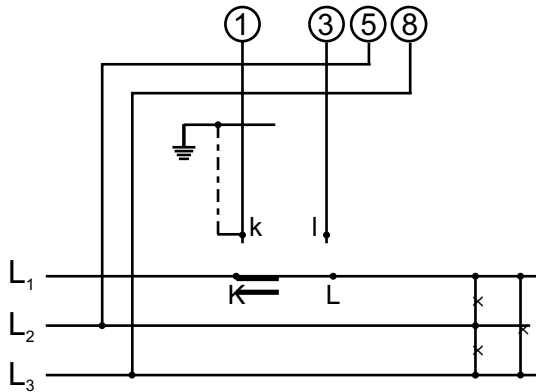
Blank dial	With initial and end values marked
Special markings	Numbering / Lettering
Division dials	Basic divisions without numbering
Colour markings/bands	Red or Green

Connections

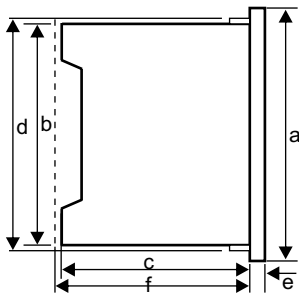
CQ 96/144 single phase



CQ 96/144 three phase balanced load



Dimensions



Dimensions (in mm)	LF96	LF144
Bezel a	□ 96	□ 144
Case b	□ 90	□ 136
Depth c*	53	53
d	□ 91.5 ^{+0.8}	□ 137.5 ⁺¹
e	5.5	5.5
cutout size	□ 92	□ 138
Wt. (approx.)	0.6 kg	0.8 kg
Depth with back cover f	64	64

Ordering Information

Type LF	Power factor meter
Front dimension 96 144	96 mm x 96 mm 144 mm x 144 mm
Type E D	Single phase system 3 phase system balanced load
Measuring range (cos f)	Cap 0.5 ... 1 ... 0.5 ind Cap 0.8 ... 1 ... 0.3 ind Cap 0.8 ... 1 ... 0.8 ind
Rated Voltages	Refer to table inside
Rated currents	1 A 5 A
Front facia	Normal glass ^{*1} antiglare glass ^{*3}
Colour of Bezel	Black ^{*1} Red, Blue, Yellow, White ^{*3}
Position of use	Vertical ^{*1} on request 0...180° ^{*3}
Terminal protection	Full sized polycarbonate back cover
Dial	Standard scale same as measuring range ^{*1} additional lettering on request ^{*3} additional numbering on request ^{*3} coloured marking Red or Green ^{*3} coloured sector Red or Green ^{*3}
logo	Without ^{*3} OEM logo ^{*3}

^{*1} standard

^{*3} please clearly add the desired specifications while ordering

Ordering example

CQ 96 D for 3 phase system balanced load, measuring range (cos f) cap 0.5 ... 1 ... 0.5 ind, rated voltage AC 230 V, rated current 1A.

Specifications are subject to change without notice (07/02)

Safety precautions

- Instruments with damaged bezels or window glasses must be disconnected from the mains.
- Adequate safety clearance must be maintained to control panel fasteners and to sheet metal housing, if non-insulated connector wires are used.
- The back cover must be snapped into place after the connector wires have been clamped for protection against accidental contact.
- Scales should be replaced under voltage-free conditions.
- Bezels and window glasses should be replaced under voltage-free conditions.

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