

## LM 96

Analogue Watt Meter 90° scale - LM



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## Applications

The Watt meters, LM96 are offered for the AC systems  
 -single phase  
 -3 phase balanced load 3 or 4 wire  
 -3 phase unbalanced load 3 or 4 wire  
 These instruments are suitable to indicate forward (export / out going) and reverse (import / in coming) power flow. They can be used both on sinusoidal and non - sinusoidal current.  
 These meters offer several advantages in Switchboard and Generating Set panels. Number of meters can be mounted in a Panel Cut out (Mosaic Mounting). The Bezel, Front window glass and Dial can be easily replaced

## Applicable Standards

Nominal case and cutout dimensions for	IS 2419
indicating electrical instruments	DIN IEC 61554
Scale and pointer for electrical	IS 1248
measuring instruments	DIN 43802
Connections and Terminal markings for	IS 1248
panel meters	DIN 43807
Terminal bolts / leads	DIN 46200/46282
Clamp straps for connections	DIN 46282
Safety requirements and protective	IS 9249
measures for Electrical indicating	DIN 40050
instruments and their accessories	VDE 0110 VDE 0410 IEC 529, IEC 1010
Performance specifications for direct	IS 1248
acting indicating analogue electrical	IEC 51/DIN EN 60051
measuring instruments and their	DIN 43701
accessories	
Front frames for indicating measuring	DIN 43718
instruments principle dimensions	
Technical conditions of delivery for	DIN 43701
electrical instruments.	
UL Combustibility class	UL 94 V-O
Mechanical strength (Free fall test,	IS 1248, IEC 51
vibration test)	IS 9000 VDE 041 IEC 1010
Environmental conditions	IS: 1248 IS: 9000 VDE / VDI 3540

### Comply with following European directives

2004 / 108 / EC ( EMC directive), 2006/95/EC (low voltage directive) & amendment amendment 93/68/EEC for CE Marking.

## Scale and Pointer

Pointer	Knife - edge pointer
Pointer deflection	0 ... 90°
Scale characteristics	Linear
Scale division	Coarse-fine
Scale length	97mm

## Mechanical Data

Case details	Moulded square case suitable for mounting in Control / Switchgear panels, Machinery consoles.
Case material	Polycarbonate, flame retardant and drip proof as per UL 94 V-0.
Front facia	Glass
Colour of bezel	Black
Position of use	Vertical
Panel fixing	Mounting Clamp.
Mounting	Stackable in a single cutout
Panel thickness	> 1.5 mm
Terminals	Hexagon studs, M4 screws and wire clamps E3

## Electrical Data

Measured quantity	Active / Reactive Power
Response time	4s max.
Overload capacity	(acc to IS:1248/ IEC 51)
Continuously	1.2 times rated voltage / current
Short duration	2 times rated voltage , 5 Sec max 10 times rated current ,5 Sec max
Power consumption(Approx)	
Current path	≤ 0.2 VA
Voltage path types	
E1W, D1W, D1B, V1W, V1B	≤ 3.0 VA
E1B	≤ 3.5 VA
D2W, D2B	≤ 3.4 VA
V3W	≤ 3.9 VA
V3B	≤ 4.3 VA
Enclosures code	IP 52 case
(IEC 529)	IP 00 for terminals
insulation class	Group A according to VDE 0110
Rated insulation voltage	660 V
Proof voltage testing	2 kV
Installation category	300 VCAT III
(IEC 1010)	
insulation resistance	> 50 Mohm at 500 V d.c.

## Accuracy at Reference Conditions

Accuracy class	1.5 according to IS:1248 (IEC 51/ DIN EN 60051)
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## Reference conditions

Ambient temperature	23°C + 2°
Position of use	Nominal position ± 1°
Input	Full-scale power value P <sub>w</sub> or P <sub>b</sub>
Feasibility factor	"Lambda" = P <sub>w</sub> /P <sub>s</sub> or P <sub>b</sub> / P <sub>s</sub>
Power factor	Cos φ = 1 ± 0.01 for Watt meters & Sin φ = 1 ± 0.01 for Var meters
Voltage	Rated voltage + 2%
Frequency	45-65 Hz (50 Hz +0.1% for E1B)
Current	20% to 120% of rated current
Others	IS: 1248 (IEC 51/ DIN EN 60051)
Electrical and mechanical zero point in the meter are not necessarily identical. Zero adjustment should be done only when voltage is applied and current circuit not energised.	

## Nominal range of use

Ambient temperature	10 ... 37°C
Position of use	Nominal position + 50
Voltage	Rated voltage + 15%
Power factor	Cos φ = 1 to 0.5 (ind.) for active power Sin φ = 1 to 0.5 (ind.) for reactive power
Frequency	45-65 Hz (50 Hz + 1% for E1B)
External magnetic field	At 0.4 kA/m, less than 6% of fiducial value (not as a percentage class index)

## Environmental Conditions

Climatic suitability	Climate category II as per IS : 1248 (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 <sub>n</sub> for pulse duration 11 ms
Vibration resistance	10-55-10Hz for ampli. 0.15mm (1.5 g at 50Hz)
Pollution degree	2

## 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 15° .... 165°
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.

## Standard Measuring Ranges

Type	Active power	Reactive power
Single phase system	E1W	E1B
3 phase 3 wire system balanced load	D1W	D1B
3 phase 4 wire system balanced load	V1W	V1B
3 phase 3 wire system unbalanced load	D2W	D2B
3 phase 4 wire system unbalanced load	V3W	V3B

### Selection of measuring range

Apparant power  $P_s$  is calculated from primary ratings of current transformer and voltage transformer.

In single phase network,  $P_s = V \cdot I$

where  $V$  = voltage between phase and neutral &  $I$  = line current.

In three phase network,  $P_s = 3\sqrt{V} \cdot I$

where  $V$  = voltage between two phase &  $I$  = line current.

Full scale value i.e range of the instrument ( $P_w$  = active power,  $P_b$  = reactive power) must be selected in such a way that the same remain between 0.5 times and 1.2 times the value of apparant power  $P_s$ .

Thus feasibility factor "Lambda" should be between 0.3 and 1.5 where "Lambda" =  $P_w/P_s$  or  $P_b/P_s$

Full scale values shall preferably be selected from standard series according to DIN 43701, 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8 and their decadic / decimal multiples.

### Rated voltage

For Single phase (E1W, E1B) :- 57.7, 63.5, 100, 110, 127, 220, 289, 380.

For Three phase (D1W, D1B, D2W, D2B, V1W, V1B, V3W, V3B) 500.

The voltage will be considered as a phase voltage (between phase an neutral) in case of single phase meters and as a line voltage (between two phases) in case of multi phase (2 wire, 3 wire and 4 wire) meters.

### Rated current

1A OR 5 A

If used on current transformer, please state transformer ratio on the order

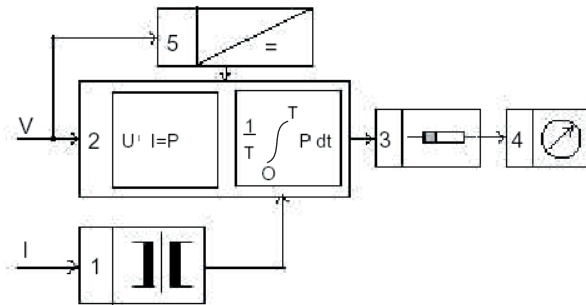
## Safety Precautions

- 1) Instruments with damaged bezel or glasses must be disconnected from the mains.
- 2) Adequate safety clearance must be maintained to control panel fasteners and to sheet metal housing. If non - insulated connector wires are used.
- 3) The back cover must be snapped into place after connector wires have been clamped for protection against accidental contact.
- 4) Bezel, Scale and Glass may only be replaced under voltage free conditions.
- 5) Instruments to be used in grounded panel.  
Specifications are subject to change without notice(02/09)

## Functional Principle

For active and reactive power measurement, a moving-coil indicator is used to indicate watts and vars for which an analogue DC signal is obtained from a power converter attached to the case of the indicator.

### Schematic diagram



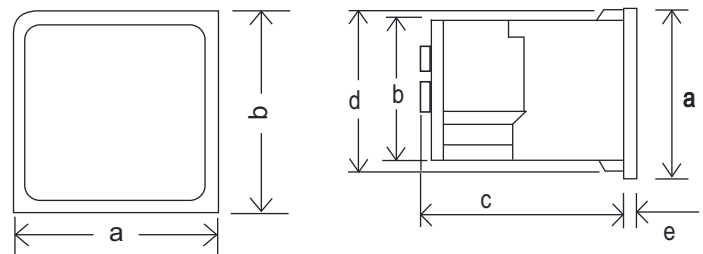
The power converter uses one, two or three for multiplier systems 2 depending on the measurement of balanced or unbalanced load AC systems. Current transformers 1 provide the input current to the multiplier circuit.

The multipliers form the product of the instantaneous values of current and voltage (TDM principle). The product resultant is integrated, thereby suppressing the AC ripple.

Subsequently product proportional output is delivered to 3. There the voltage is converted into Current, whose magnitude also depends on Feasibility Factor ( $\lambda$ ).

Finally this current is fed to the moving coil movement, 4. For the instrument DC power supply is obtained from input voltage, 5.

## Dimensions

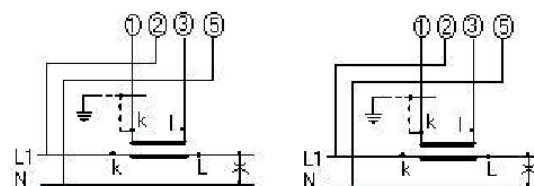


Dimensions (in mm)	LM 96
Bezel	a 96
Case	b 90
Depth	c <sup>x</sup> 106
	d 91.5
	e 5.5
	92 <sup>0.8</sup>
Cotout Size	
Depth with	
Back cover	f <sup>x</sup> 64
Weight (approx.)	0.65-0.75 kg.

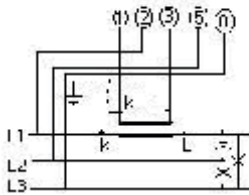
## Connections

### Active Power

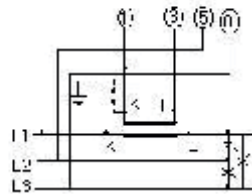
E1W-single phase(one element)E1W-single phase(one element)



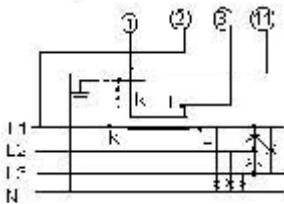
D1W-Three phase, three-wire AC supply with balanced load (one element)



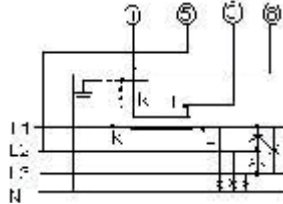
D1B-Three phase, three-wire AC supply with balanced load (one element)



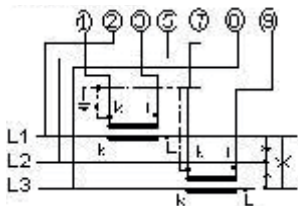
V1W-Three phase, four-wire AC supply with balanced load (one element)



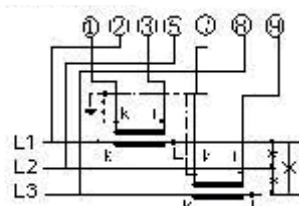
V1B-Three phase, four-wire AC supply with balanced load (one element)



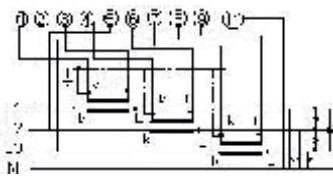
D2W-Three phase, three-wire AC supply with unbalanced load (two element)



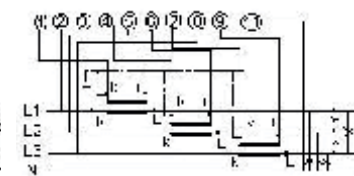
V1B-Three phase, three-wire AC supply with unbalanced load (two element)



V3W-Three phase, four-wire AC supply with unbalanced load (two element)



V3B-Three phase, four-wire AC supply with unbalanced load (two element)



### Ordering Information

Type LM	Watt and Var meter, 90° Scale	
Front Dimension 96	96mm x 96mm	
Type E1W E1B	Single phase systems	
D1W D1B	3 phase 3 wire system balanced load	
V1W V1B	3 phase 4 wire system balanced load	
D2W D2B	3 phase 3 wire system unbalanced load	
V3W V3B	3 phase 4 wire system unbalanced load	
Measuring Ranges	Specify while ordering	
Rated voltages	Refer to table inside	
Rated currents	1A, 5A	
Front facia	Normal glass <sup>1</sup> Antiglare glass <sup>3</sup>	
Colour of Bezel	Black <sup>1</sup> Red, Blue, Yellow, White <sup>3</sup>	
Position of use	Vertical <sup>1</sup> on request 15....165 <sup>0,3</sup>	
Dial	Standard scale same as measuring range <sup>2</sup> Blank dial with division <sup>3</sup> Additional lettering on request <sup>3</sup> Additional numbering on request <sup>3</sup> Coloured marking red or green <sup>3</sup> Coloured sector red or green <sup>3</sup>	
Logo	ZIEGLER <sup>1</sup>	

<sup>1</sup>Standard

<sup>3</sup>Please clearly add the desired specifications while ordering

### Ordering Example

LM 96 D V3W for active power 3 phase 4 wire system unbalanced load, measuring range 0 ... 480 kW, voltage AC 440 V, for use on current transformer 600/5A.

## ZIEGLER INSTRUMENTS

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