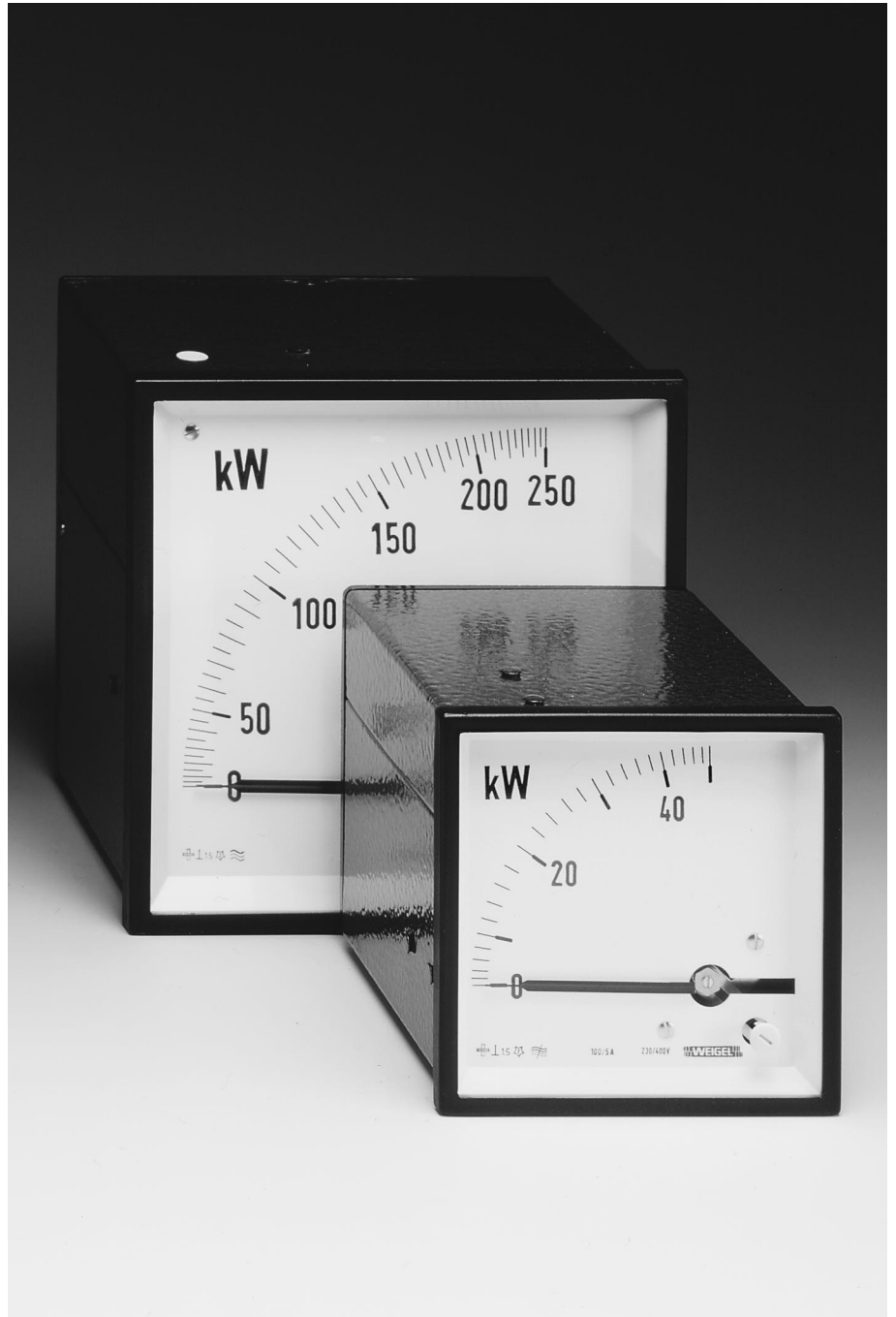




Analog Meters Electrodynamic Watt and VAr Meters 90° – Dial

LDQ 96
LDQ 144



Application

The electrodynamic Watt and VAR Meters LDQ 96/144 of the M-series are offered for the following supply systems:

- DC circuits
- single phase AC
- 3 phase balanced load, 3 or 4 wire
- 3 phase unbalanced load, 3 or 4 wire

They measure power on sinusoidal current, however, with restrictions for phase angle controls.

Off-set zero Wattmeters can be ordered where it depends to measure forward (export) and reverse (import) power flow.

The Watt and VAR Meters are housed in pressed steel cases suitable to be mounted in switchboards, control panels, machine tool consoles and/or mosaic grid panels.

Functional Principle

Air-cored electrodynamic movement, pivot suspension. Spring loaded jewel bearings and silicon oil damping for vibration and shock resistance.

Mechanical Data

case details	square case suitable to be mounted in control / switchgear panels or mosaic grid panels, stackable	
material of case	pressed steel	
material of window	glass	
colour of bezel	black (similar to RAL 9005)	
position of use	vertical $\pm 5^\circ$	
panel fixing	screw clamps	
panel thickness	1 ... 15 mm	
mounting	stackable next to each other	

terminals

voltage-path and current-path ≤ 4 A	hexagon studs, M3 screws and wire clamps C6
current-path > 4 A	hexagon studs, M5 screws and wire clamps C10

dimensions	LDQ 96	LDQ 144
bezel	□ 96 mm	□ 144 mm
case	□ 90.5 mm	□ 137 mm
depth	115 mm	116 mm
panel cutout	□ 92 ^{+0.8} mm	□ 138 ⁺¹ mm
weight approx.	0.9 kg	1.2 kg

Electrical Data

measuring unit	active or reactive power
frequency range	40 ... 100 Hz
overload capacity (acc. to DIN EN 60 051) continuously 5 s max.	1.2 times rated voltage / current 2 times rated voltage 10 times rated current
power consumption per voltage path per current path	approx. 18 – 20 mA
type EW 1, EB 1, DW 1, DB 1, VW 1, VB 1, DW 2, DB 2, VW 3, VB 3	approx. 2 VA approx. 3 VA

also refer to "Options"

protection class	I
enclosure code	IP 52 case IP 00 for terminals without protection against accidental contact IP 20 for terminals protected against accidental contact
insulation class	group A according to VDE 0110
rated insulation voltage	660 V
dielectric test	2 kV based on 50 Hz, 1 min acc. to DIN 57 410

Measuring Ranges

type	active /	reactive power
single phase AC system	EW 1	EB 1
3 phase 3 wire system, balanced load	DW 1	DB 1
3 phase 4 wire system, balanced load	VW 1	VB 1
3 phase 3 wire system, unbalanced load	DW 2	DB 2
3 phase 4 wire system, unbalanced load	VW 3	VB 3

selection of measuring range

The apparent power P_S is calculated from the primary ratings of current and voltage transformers:

$$\text{single phase AC} \quad P_S = U \cdot I$$

$$3 \text{ phase} \quad P_S = U \cdot I \cdot \sqrt{3}$$

Select full-scale values between 0.6 and 1.2 times the calculated apparent power, preferable from DIN series (acc. to DIN 43 701) 1 – 1,2 – 1,5 – 2 – 2,5 – 3 – 4 – 5 – 6 – 7,5 – 8 or any decimal multiple of these numbers.

example

For a system of 230/400 V and a primary transformer current of 250 A, the calculated power for the LDQ 96 VW3 will be

– as the highest full-range value

$$P_S = U \cdot I \cdot \sqrt{3} \cdot 1,2$$

$$P_S = 400 \text{ V} \cdot 250 \text{ A} \cdot \sqrt{3} \cdot 1,2$$

$$P_S = 207,6 \text{ kW}$$

standard value: 200 kW

– as the lowest full-range value

$$P_S = U \cdot I \cdot \sqrt{3} \cdot 0,6$$

$$P_S = 400 \text{ V} \cdot 250 \text{ A} \cdot \sqrt{3} \cdot 0,6$$

$$P_S = 103,8 \text{ kW}$$

standard value: 120 kW

rated voltage

single phase AC 3 phase 3 wire		3 phase 4 wire
57,7 V	(100 V : $\sqrt{3}$)	57,7 / 100 V ¹⁾
63,5 V	(110 V : $\sqrt{3}$)	63,5 / 110 V ¹⁾
100 V ²⁾		
110 V ²⁾		
120 V ²⁾		120 / 208 V ¹⁾
127 V ²⁾	(220 V : $\sqrt{3}$)	127 / 220 V ¹⁾
208 V ²⁾		
230 V ²⁾³⁾	(400 V : $\sqrt{3}$)	230 / 400 V ¹⁾
240 V ²⁾³⁾		
289 V ²⁾³⁾	(500 V : $\sqrt{3}$)	289 / 500 V ¹⁾
400 V ²⁾³⁾		
415 V ²⁾³⁾		
440 V ²⁾³⁾⁴⁾		254 / 440 V ¹⁾
480 V ²⁾³⁾⁴⁾		
500 V ²⁾³⁾⁴⁾		

* also for use on voltage transformer

1) external series resistor for types VW3, VB3

2) external series resistor for types DW2, DB2

3) external series resistor for types DW1, DB1

4) external series resistor for types EW1, EB1 (included with the meter supplied)



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rated current ▶

1 A*)
5 A*)

*) also for use on current transformer,
please state transformer ratio when ordering.

Scaling

pointer	bar / knife–edge pointer	
pointer deflection	0 ... 90°	
scale characteristics	practically linear	
scale division	coarse–fine	
scale length	LDQ 96	LDQ 144
	94 mm	146 mm

Accuracy at Reference Conditions

accuracy class 1.5 according to DIN EN 60 051 ▶

reference conditions

ambient temperature	23°C ± 1K
position of use	nominal position ± 1°
input	rated measuring value
voltage	rated voltage
frequency	50 Hz ± 2% ▶
wave form	sinusoidal, distortion factor < 5%
others	DIN EN 60 051

influences

ambient temperature	–25°C ... +23°C ... +40°C
position of use	nominal position ± 5°
frequency	40 ... 50 Hz ... 100 Hz
power factor	1 ind ... 0 ... 1 cap
stray magnetic field	0.5 mT

Environmental

climatic suitability	climatic class 2 according to VDE/VDI 3540 ▶
operating temperature range	–25 ... +40°C ▶
storage temperature range	–25 ... +65°C
relative humidity	≤ 75% annual average, non–condensing
shock resistance	15 g, 11 ms ▶
vibration resistance	2.5 g, 5 ... 55 Hz ▶

Rules and Standards

DIN 43 700	measuring and control instruments for panel mounting; nominal case and cutout dimensions
DIN 43 701	electrical switchboard instruments
DIN 43 718	bezels and front panels
DIN 43 802	scales and pointers for electrical measuring instruments
DIN 16 257	nominal position of use and position symbols applicable for measuring instruments
DIN 57 410 / VDE 0410	safety requirements for electrically operated measuring, control and laboratory equipment

▶ also refer to "Options"

DIN EN 60 051	direct acting indicating electrical measuring instruments and their accessories
DIN VDE 0110	dimensioning of clearances and creepage distances
DIN VDE 0411	protective measures for electronically operated measuring equipment
DIN 40 050	enclosure codes; protection of electrical equipment against ingress of solid foreign bodies and of water
VDE/VDI 3540 sheet 2	reliability of measuring and control equipment (classification of climates)

Options

measuring range

rated current	deviating from 1 A or 5 A, exceeding 5 A up to 25 A (except types DW2, DB2, VW3, VB3)
2 nd current range	in the ratio 1 : 2 only (except types DW2, DB2, VW3, VB3)
accuracy class	1.0 with fine scale division (as far as practicable)
calibration	for a definite frequency 100 ... 400 Hz
off–set zero	to measure reverse and forward power flow, pointer deflection left and right from zero
in case of active power:	reverse power flow on the right side forward power flow on the left side
reactive power:	reverse power flow inductive on the right side reverse power flow capacitive on the left side

case

window	non–glaring glass
colour of bezel	gray (similar to RAL 7037)
index marking pointer	red, front adjustable
position of use	horizontal or as specified 15° ... 165°

performance

increased mechanical loads	shock 30 g, 11 ms vibration 5 g, 5 ... 55 Hz
climatic suitability	limited use in the tropics climatic class 3 according to VDE/VDI 3540
with operating temperature range	–10 ... +55°C
marine application	non–certified
enclosure code	IP 54 splash–water protected front
dielectric test	3 kV based on 50 Hz, 1 min acc. to DIN 57 410

accessories

terminal protection against accidental contact	full–sized rear cover or protective sleeves SW6 / SW10
terminals	connector blades 6.3 x 0.8

dial

blank dial	pencil marked initial and end values
scale division and figuring	0 ... 100%, deviating from standard series; captions optional
2 nd scale division	including figuring
additional lettering	"reverse power flow – forward power flow" or as specified e.g. "generator"
additional figuring	to be specified
coloured marks	red, green or blue for important scale values
coloured sector	red, green or blue within scale division
logo on the dial	none or as specified

Preference Meter Types

The table below refers to standard measuring ranges for 230/400 V systems with secondary current transformer ratings N/1 A or N/5 A.

I_N [A]	P_N [kW][kvar]	
	types EW/B1 calibration factor 0,87	types DW/B1 VW/B 1 DW/B 2 VW/B 3 calibration factor 0,72
connection direct 1	0,2	0,5
direct 5	1	2,5
10/1	2	5
15/1	3	7,5
20/1	4	10
25/1	5	12,5
30/1	6	15
40/1	8	20
50/1	10	25
60/1	12	30
75/1	15	37,5
80/1	16	40
100/1	20	50
120/1	24	60
150/1	30	75
200/1	40	100
250/1	50	125
300/1	60	150
400/1	80	200
500/1	100	250
600/1	120	300
750/1	150	375
800/1	160	400
1000/1	200	500
or any decimal multiple of these numbers	or any decimal multiple of these numbers	or any decimal multiple of these numbers

Watt and VAR Meters of this preference list offer advantage for users inasmuch as these meters are stocked semifinished to ensure that customers receive fast delivery.

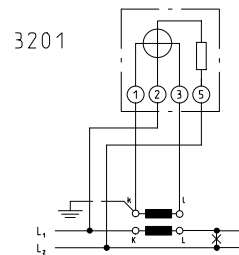
Connections

The most common connection diagrams are shown below; additional diagrams on request. Key letter "a": external series resistor box

Single-element Wattmeter

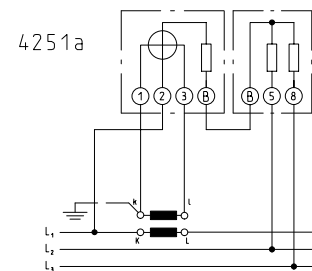
single phase AC

type EW 1



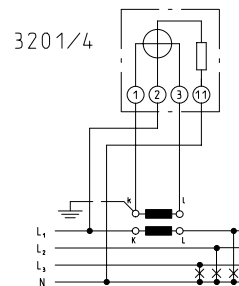
3 phase 3 wire balanced load

type DW 1



3 phase 4 wire balanced load

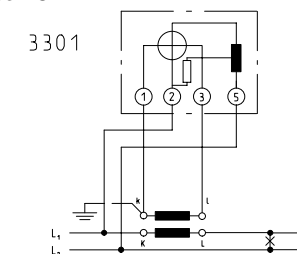
type VW 1



Single-element VAR Meter

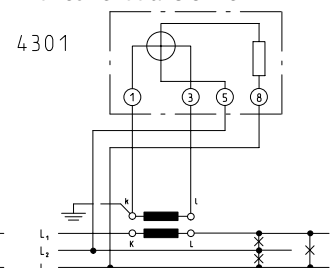
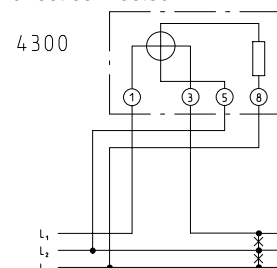
single phase AC

type EB 1



3 phase 3/4 wire balanced load
direct connected

types DB 1/ VB 1
with current transformer



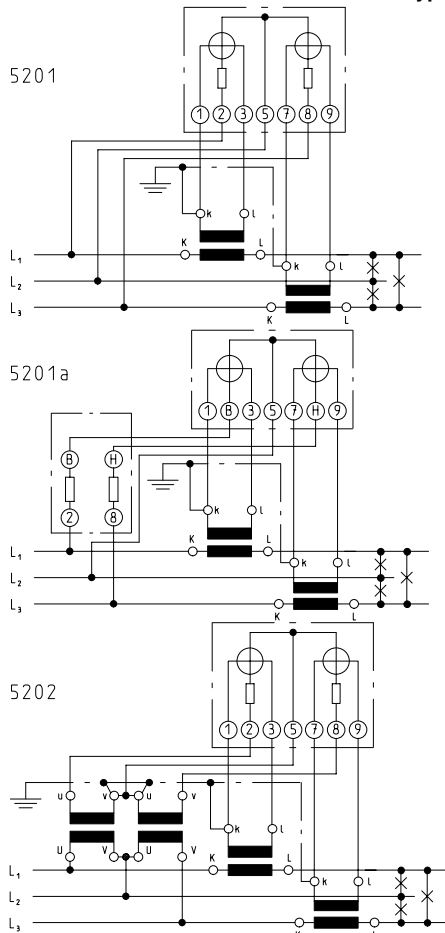


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Double–element Wattmeter

3 phase 3 wire unbalanced load

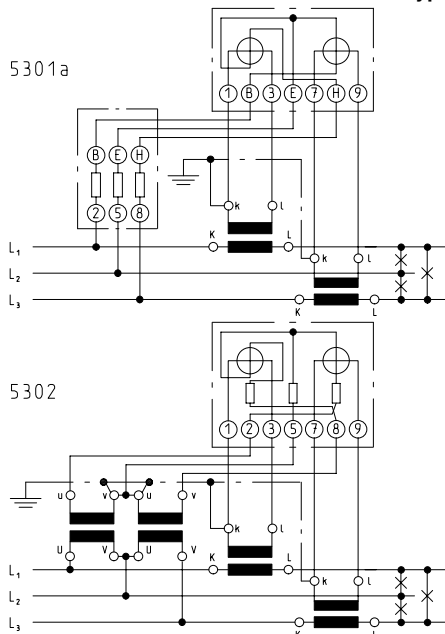
type DW 2



Double–element VAR Meter

3 phase 3 wire unbalanced load

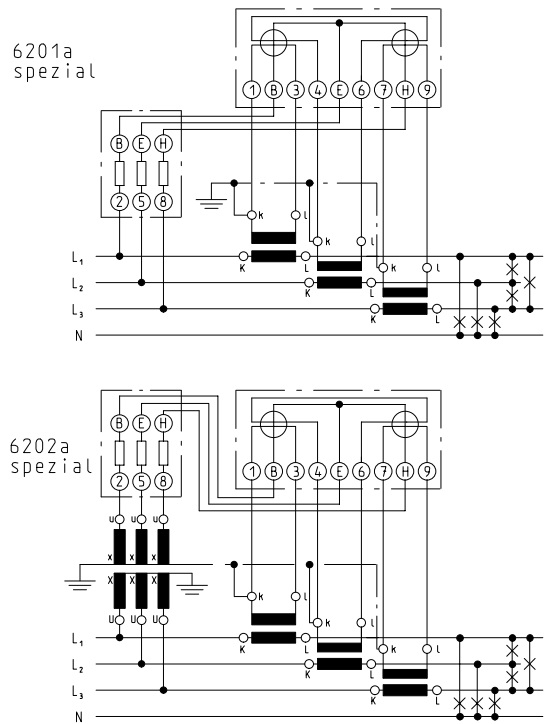
type DB 2



Triple–element Wattmeter

3 phase 4 wire unbalanced load

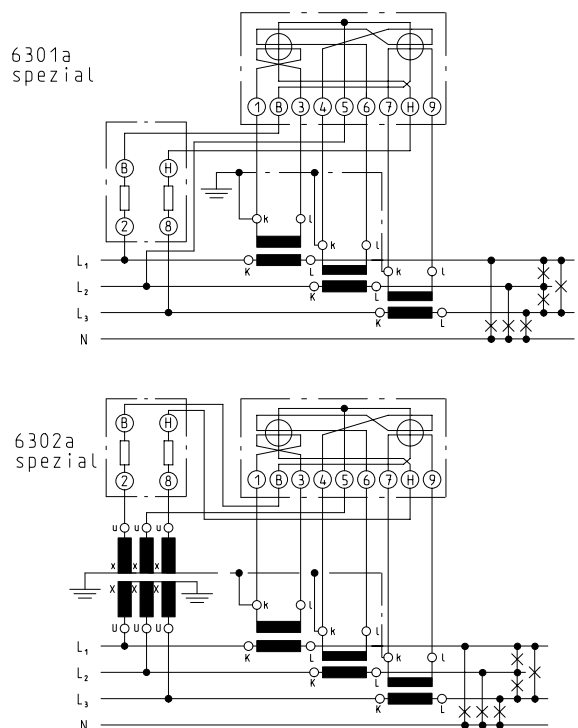
type VW 3



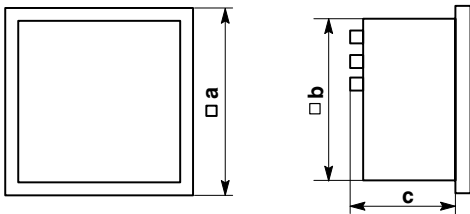
Triple–element VAR Meter

3 phase 4 wire unbalanced load

type VB 3

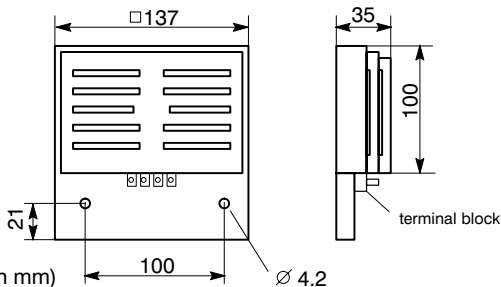


Dimensions



dimensions (in mm)	LDQ 96	LDQ 144
a	96	144
b	90	137
c	115	116

External Series Resistor Box



(scaled in mm)

Ordering Information

type LDQ	Electrodynamic Watt and VAr Meters
front dimensions 96 144	96 mm x 96 mm 144 mm x 144 mm
type identification	<p>active power (W, kW, MW) single phase AC 3 phase 3 wire balanced load 3 phase 4 wire balanced load 3 phase 3 wire unbalanced load 3 phase 4 wire unbalanced load</p> <p>reactive power (var, kvar, Mvar) single phase AC 3 phase 3 wire balanced load 3 phase 4 wire balanced load 3 phase 3 wire unbalanced load 3 phase 4 wire unbalanced load</p>
measuring ranges	refer to preceding table
rated voltage	refer to preceding table
rated current	1 A 5 A deviating from 1 A or 5 A (<5 A **) >5 A up to 25 A (***) (***)
2nd current range	none *) in the ratio 1 : 2

accuracy class	1.5 *) 1.0 with fine scale division
calibration	50 Hz *) for a definite frequency 100 ... 400 Hz
zero position	reverse or forward power flow only *) reverse and forward power flow (**)
window	glass *) non-glaring glass
colour of bezel	black (similar to RAL 9005) *) gray (similar to RAL 7037)
index marking pointer	none *) red, front adjustable
position of use	vertical *) to special order 15 ... 165° (**)
performance loads	shock 15 g, vibration 2.5 g *) shock 30 g, vibration 5 g
climatic suitability	class 2, -25 ... +40°C *) class 3, -10 ... +55°C
marine application	none *) non-certified
enclosure code	IP 52 *) IP 54 splash-water protected front
dielectric test	2 kV *) 3 kV
terminal safety protection	none *) full-sized rear cover protective sleeves SW6 / SW10
terminals	screws and wire clamps *) connector blades 6.3 x 0.8
dial	acc. to measuring range resp. to standard series (1-1.2-1.5-2-2.5-3-4-5-6-7.5-8) *) blank dial scale division and figuring 0 ... 100% deviating from standard (**) 2 scale divisions (**) black dial, yellow scale division black dial, white scale division additional lettering "reverse power flow - - forward power flow" additional lettering to be specified (**) additional figuring to be specified (**) coloured marks red, green or blue (**) coloured sector red, green or blue (**)
logo	WEIGEL *) none OEM logo (**)

*) standard

**) Please clearly add the desired specifications.

***) types EW/B1, DW/B1, VW/B1 only

Please state transformer ratio and appropriate connection (e.g. summation connection, delta connection) if used on transformers.

ordering example

LDQ 96 VW3 for active power, 3 phase 4 wire unbalanced load, measuring range 0 ... 200 kW, rated voltage 230/400 V ~, rated current 5 A for use on CT 400/5 A, connection diagram No. 6201a, non-glaring window, WEIGEL logo

- specifications subject to change without notice; date of issue 11/93 -

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