PANEL POWER METERS
PA39 TYPE



CE

APPLICATION

The PA39 power meter is a mowing-coil meter with a built-in measuring transducer. It is destined to measure active or reactive power in a.c. power networks.
The measured power is indicated by a magnetoelectric (moving-coil) measuring system.

These meters are delivered in following versions:

- for measuring the active power in single-phase systems,
- for measuring the active or reactive power in three-phase three-wire or four-wire symmetrically or asymmetrically loaded systems,
- with the zero graduation on the left side of the scale for measuring the unidirectional power flow,
- with the zero graduation in the middle of the scale for measuring the bidirectional power flow.

TECHNICAL DATA

Measuring ranges acc. the series or the decimal multiplication	1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 6, 7.5, 8, of one of these numbers
Input voltage	100 √3 (x/100/√3),100 (x/100), 133, 230, 280, 400, 500, 690 V
Input current	1 A (x/1 A), 5 A (x/5 A)
Active power factor	cosφ: -0.5 $_{cap}$...1...0.5 $_{ind}$
Reactive power factor	sinφ: -0.5 $_{cap}$...1...0.5 $_{ind}$
Accuracy class	1.5

Rated operating conditions:

- ambient temperature	5...23...40°C 5...35...55°C (on request, tropical execution)
- relative humidity	25...85%
- frequency of the input quantities	acc. order (table 1)
- working position	acc. order ± 5° (table 2)
- external magnetic field	≤ 400 A/m
Additional errors	acc. IEC 51/1-9 standard

Power consumption:

- voltage circuit	≤ 3 VA
- current circuit	≤ 0.25 VA

Protection degree:

- case	IP 50 or IP54 (on request)
- terminals	IP 20, with a terminal cover

Electromagnetic compatibility:

- emission	acc. EN 500 81-2 standard
- immunity	acc. EN 500 82-2 standard

The meter fulfils CE mark requirements.

Safety requirements acc. IEC 1010-1:

- installation category	III
- level of pollution	2
- working voltage in relation to the earth	600 V a.c.
Weight	400 g

We deliver with the meter:

- a guarantee certificate	1 pc
- screw holders to fix the meter on the panel	2 pcs
- a service manual	1 pc
- a terminal cover	1 pc

CHOICE OF MEASURING RANGE

1. Calculate the power from the formulas:

   $P = U_n \times I_n$ for single-phase networks

   $P = \sqrt{3} \times U_n \times I_n$ for three-phase networks

   where:

   U_n - network rated voltage:

   • for three-phase networks - phase-to-phase voltage,

   • when connected through transformers-primary rated voltage.

   I_n - rated current:

   • 5 A or 1 A,

   • when connected through transformers-primary rated voltage.

2. Round the calculated power value to the nearest value from the given sequence of numbers for the measuring range.
3. Example of measuring range choice.

   Three-phase network; rated values of transformers: 15 000/100 V and 400/5 A

   $P = \sqrt{3} \times 15\,000\ V \times 400\ A = 10{,}39\ MW\ (Mvar)$

Selected measuring range: 10 MW (Mvar)

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OVERALL DIMENSIONS

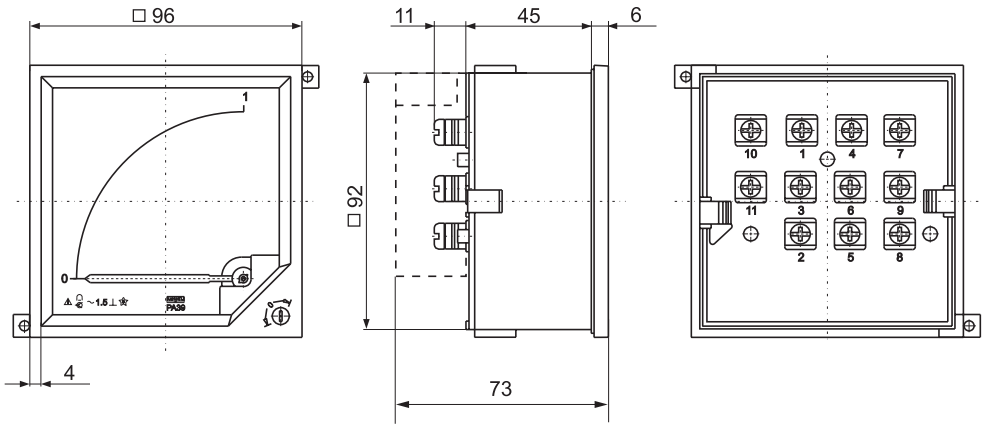


Fig.1. PA39 meter outline drawing.

FIXATION ON THE PANEL

One should prepare in the panel a hole at dimensions: $92^{+0.8}$ x $92^{+0.8}$ mm.
The thickness of the material of which the panel is made, cannot exceed 15 mm.
The meter is fixed in the panel by two screw holders situated on arbitrary opposite corners of the case.

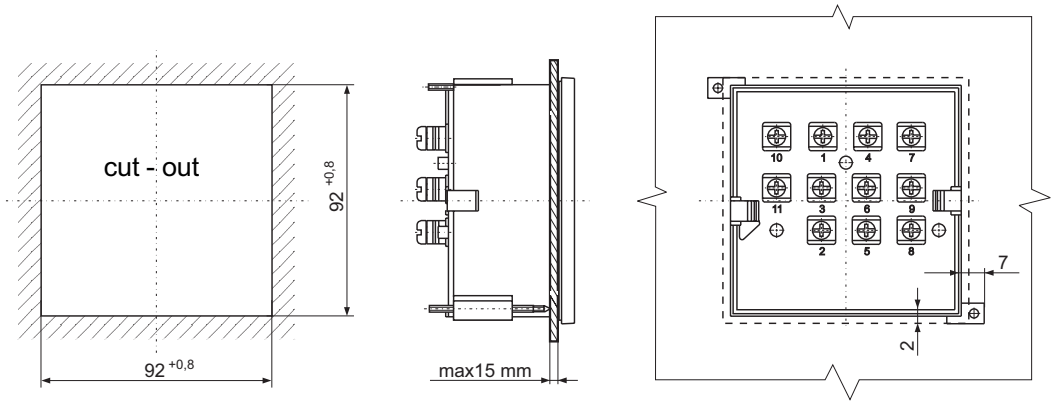


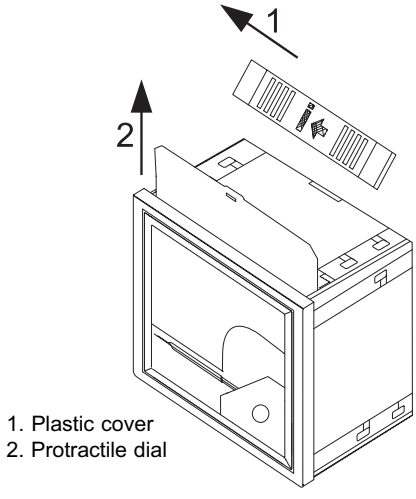
Fig.2. Way of the meter fixation on the panel.

DIAL EXCHANGE

Dials with graduated scales can be interchanged in all PA39 power meters. This is especially convenient for meters destined to co-operate with measuring transformers. In order to exchange the dial, one can take off the plastic cover (1) placed on the upper part of the case and draw out the dial (2) with a suitable tool Introduced in the dial perforation. When replacing the new dial, carefully close the slot of the case with the plastic cover (see fig. 1).

NOTE:

When changing the standard rated ranges of PA39 power meters and choosing **Un** or **In** quantities inconsistently with values included in the table 3 (measuring ranges), one must recalibrate these power meters acc. calibration instructions given by the manufacturer in the **Calibration Service Manual** (if ordered).

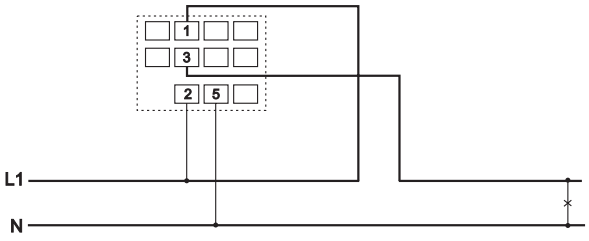


1. Plastic cover
2. Protractile dial

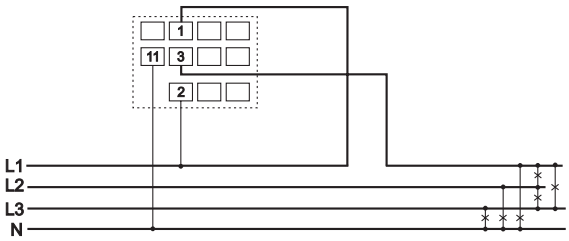
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CONNECTION DIAGRAMS OF EXTERNAL CIRCUITS

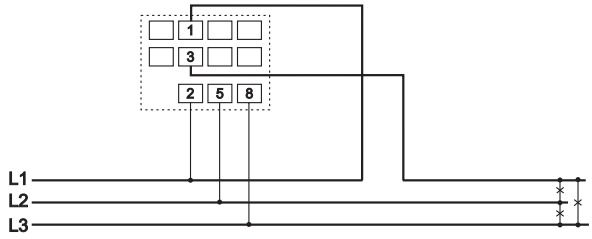
Measurement of active power in a single-phase network.



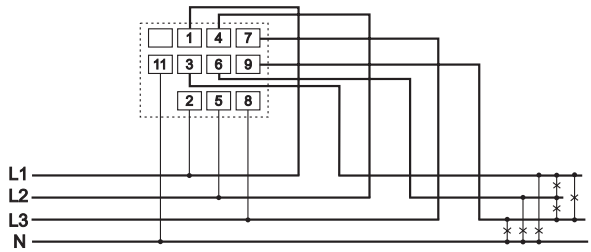
Measurement of active power in a three-phase four-wire symmetrically loaded network.



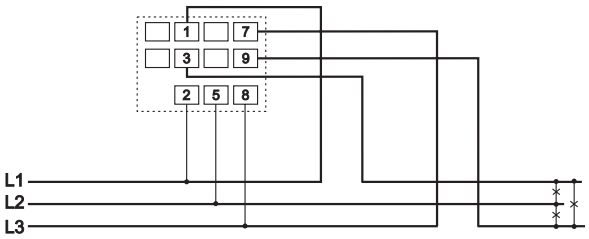
Measurement of active power in a three-phase three-wire symmetrically loaded network.



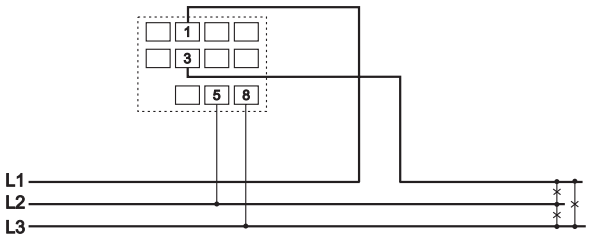
Measurement of active power in a three-phase four-wire asymmetrically loaded network.



Measurement of active power in a three-phase three-wire asymmetrically loaded network.

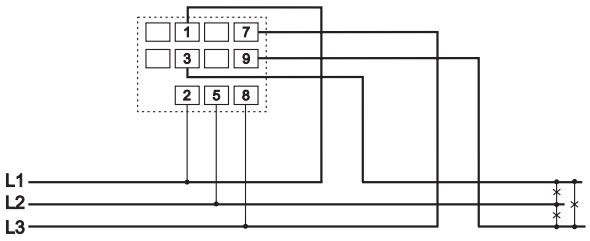


Measurement of reactive power in a three-phase three-wire symmetrically loaded network.

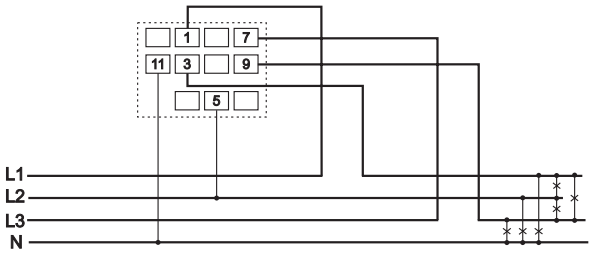


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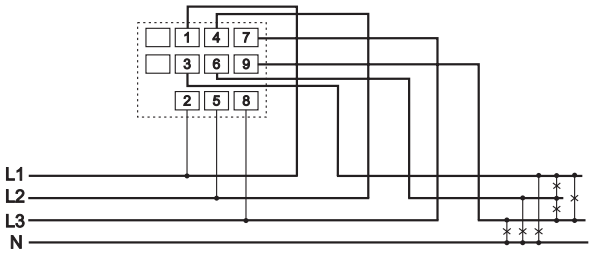
Measurement of reactive power in a three-phase three-wire asymmetrically loaded network.



Measurement of reactive power in a three-phase four-wire symmetrically loaded network.



Measurement of reactive power in a three-phase four-wire asymmetrically loaded network.



ORDERING PROCEDURE

Table 1

Input voltage frequency fn (Hz)	Codes
50	**0**
60	**1**
400	**2**

Table 2

Code	Position
O	c3
A	c1
B	c2, α = 15°
C	c2, α = 30°
D	c2, α = 45°
E	c2, α = 60°
F	c2, α = 75°
H	c4, α = 105°
I	c4, α = 120°

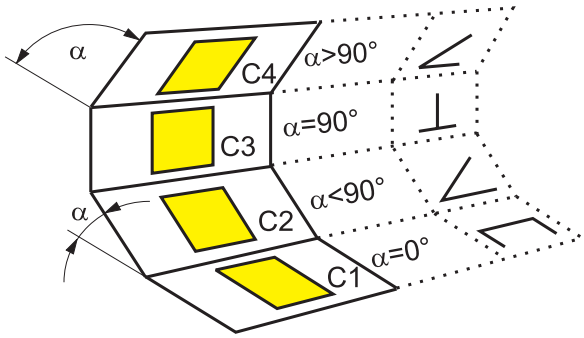


Fig.3. Codes and markings concerning the working position.

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MEASURING RANGES

Table 3

Un [V]																								
	Single phase active power	A	$\frac{100}{\sqrt{3}}$	100	230	280	400																	
	3-phase 3-wire active power symmetrically loaded	B						230	400	500	690	$\frac{3000}{100}$	$\frac{6000}{100}$	$\frac{10000}{100}$	$\frac{15000}{100}$	$\frac{20000}{100}$	$\frac{30000}{100}$	$\frac{40000}{100}$	$\frac{60000}{100}$	$\frac{110000}{100}$	$\frac{220000}{100}$	$\frac{400000}{100}$		
	3-phase 3-wire active power asymmetrically loaded	C																						
	3-phase 4-wire active power symmetrically loaded	D						$\frac{133}{230}$	$\frac{230}{400}$	$\frac{280}{500}$	$\frac{400}{690}$	$\frac{3000}{100/\sqrt{3}}$	$\frac{6000}{100/\sqrt{3}}$	$\frac{10000}{100/\sqrt{3}}$	$\frac{15000}{100/\sqrt{3}}$	$\frac{20000}{100/\sqrt{3}}$	$\frac{30000}{100/\sqrt{3}}$	$\frac{40000}{100/\sqrt{3}}$	$\frac{60000}{100/\sqrt{3}}$	$\frac{110000}{100/\sqrt{3}}$	$\frac{220000}{100/\sqrt{3}}$	$\frac{400000}{100/\sqrt{3}}$		
	3-phase 4-wire active power asymmetrically loaded	E																						
	3-phase 3-wire reactive power symmetrically loaded	F						230	400	500	690	$\frac{3000}{100}$	$\frac{6000}{100}$	$\frac{10000}{100}$	$\frac{15000}{100}$	$\frac{20000}{100}$	$\frac{30000}{100}$	$\frac{40000}{100}$	$\frac{60000}{100}$	$\frac{110000}{100}$	$\frac{220000}{100}$	$\frac{400000}{100}$		
	3-phase 3-wire reactive power asymmetrically loaded	G																						
	3-phase 4-wire reactive power symmetrically loaded	H						$\frac{133}{230}$	$\frac{230}{400}$	$\frac{280}{500}$	$\frac{400}{690}$	$\frac{3000}{100/\sqrt{3}}$	$\frac{6000}{100/\sqrt{3}}$	$\frac{10000}{100/\sqrt{3}}$	$\frac{15000}{100/\sqrt{3}}$	$\frac{20000}{100/\sqrt{3}}$	$\frac{30000}{100/\sqrt{3}}$	$\frac{40000}{100/\sqrt{3}}$	$\frac{60000}{100/\sqrt{3}}$	$\frac{110000}{100/\sqrt{3}}$	$\frac{220000}{100/\sqrt{3}}$	$\frac{400000}{100/\sqrt{3}}$		
	3-phase 4-wire reactive power asymmetrically loaded	K																						

In/x	In Code		Power unit	Un Code																				
	x=5	x=1		T	U	A	V	W	B	C	D	E	F	G	H	I	K	L	M	N	P	R	S
1	–	A1	W	50	100	200	250	400	400	600	800	1.2	5	10	15	25	30	50	80	100	200	400	800
5; 5/x	B5	B1		250	500	1	1.2	2	2	3	4	5	25	50	60	120	150	250	400	500	1	2	4
10/x	C5	C1		500	1	2	2,5	4	4	6	8	10	50	100	150	250	300	500	800	1	2	4	8
15/x	D5	D1		800	1.5	3	4	6	8	10	12	15	80	150	250	400	500	800	1.2	1.5	2.5	5	12
20/x	E5	E1	kW; kvar	1.2	2	4	6	8	8	12	15	20	100	200	300	500	600	1	1.5	2	4	8	15
30/x	F5	F1		1.5	3	6	8	12	12	20	25	30	150	300	500	800	1	1.5	2	3	5	10	20
50/x	G5	G1							20	30	40	50	250	500	800	1.2	1.5	2.5	4	5	10	20	40
75/x	H5	H1							30	50	60	80	400	800	1.2	2	2.5	4	5	8	15	25	50
100/x	I5	I1							40	60	80	100	500	1	1.5	2.5	3	5	8	10	20	40	80
150/x	J5	J1							60	100	120	150	800	1.5	2.5	4	5	8	12	15	25	50	120
200/x	K5	K1							80	120	150	200	1	2	3	5	6	10	15	20	40	80	150
300/x	L5	L1							120	200	250	300	1.5	3	5	8	10	15	20	30	50	100	200
400/x	M5	M1							150	250	300	400	2	4	6	10	12	20	30	40	80	150	300
600/x	N5	N1							200	400	500	600	3	6	10	15	20	30	40	60	100	200	400
800/x	P5	P1							300	500	600	800	4	8	12	20	25	40	60	80	150	300	600
1000/x	R5	R1							400	600	800	1	5	10	15	25	30	50	80	100	200	400	800
1200/x	S5	S1							500	800	1	1.2	6	12	20	30	40	60	100	120	250	500	1000
1500/x	T5	T1							600	1	1.2	1.5	8	15	25	40	50	80	120	150	300	600	
2000/x	U5	U1							800	1.2	1.5	2	10	20	30	50	60	100	150	200	400	800	
3000/x	V5	V1	MW; Mvar						1.2	2	2,5	3	15	30	50	80	100	150	200	300	600	1000	
4000/x	W5	W1							1.5	2.5	3	20	20	40	60	100	120	200	300	400	800		
6000/x	X5	X1							2	4	5	6	30	60	100	150	200	300	400	600	1000		
10000/x	Y5	Y1							4	6	8	10	50	100	150	250	300	500	800	1000			
20000/x	Z5	Z1							8	12	15	20	100	200	300	500	600	1000					

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ORDERING CODES

Table 4

PANEL POWER METER - PA39	X	X	X	XX	X	X	XX	X
Kind of measured power and measuring system:								
Measurement of active power in a single-phase network ..... **A**								
Measurement of active power in a 3-phase 3-wire symmetrically loaded network ..... **B**								
Measurement of active power in a 3-phase 3-wire asymmetrically loaded network ..... **C**								
Measurement of active power in a 3-phase 4-wire symmetrically loaded network ..... **D**								
Measurement of active power in a 3-phase 4-wire asymmetrically loaded network ..... **E**								
Measurement of reactive power in a 3-phase 3-wire symmetrically loaded network ..... **F**								
Measurement of reactive power in a 3-phase 3-wire asymmetrically loaded network ..... **G**								
Measurement of reactive power in a 3-phase 4-wire symmetrically loaded network ..... **H**								
Measurement of reactive power in a 3-phase 4-wire asymmetrically loaded network ..... **K**								
Input voltage								
write in the Un range code from the table 3 ..... **X**								
Frequency of the input voltage								
write in the frequency code from the table 1 ..... **X**								
Input current								
write in the In range code from the table 3 ..... **XX**								
Flow direction of the power								
- unidirectional, zero on the left side of the scale **0**								
- bidirectional, zero in the middle of the scale **1**								
Working position								
write in the working position from the table 2 ..... **X**								
Versions:								
catalogue **00**								
custom-made[1] ..... **XX**								
Acceptance tests:								
without additional requirements **0**								
with a quality inspection certificate **1**								
other requirements [2] ..... **X**								

[1] The ordering code is given by the manufacturer after agreement.
[2] The number code is given acc. customer's agreement.

ORDERING WAY

In any order one must specify the name and the ordering code of the power meter using the tables: 1, 2, 3, and 4.

Order example: PA39 - H - F - O - L5 - 0 - O - 00 - 0, means:

H - Reactive PA39 power meter adapted to a three-phase four-wire symmetrically loaded network.
F - Network rated voltage: 3000 V (from table 3).
O - Frequency of the input voltage: 50 Hz (from table 1).
L5 - Network rated current: 300 A (from table 3).
0 - Unidirectional power flow.
O - Working position: C3, vertical (from table 2).
00 - Catalogue version.
0 - without additional requirements concerning acceptance tests.

This power meter is destined to co-operate with **300 A/5 A** transformers and a **3000 V/100/√3 V** voltage transformers.

Note: the range of the power meter results from the given nominal values of current and voltage transformers according the table 3. For the given example above, the power range is **1.5 Mvar**.

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