



## DIN panel meters - short scale

### DIN16257 SYMBOL MEANING FOR CALIBRATION POSITION

VERTICAL



HORIZONTAL



INCLINED



Inclination of dial surface.  
Required orientation must always be stated when ordering if other than vertical mounting is required.

### GENERAL SPECIFICATIONS

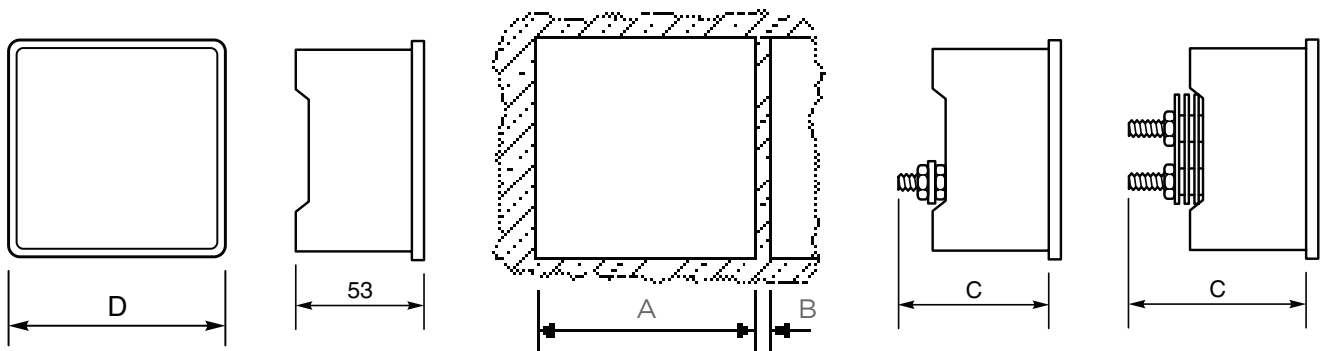
Performance	BS EN60051
Measuring ranges	DIN43701
Accuracy overload	BS EN60051
Dimensions	DIN43700
Scale marking generally to	DIN43802
Magnetic influence	BS EN60051
Safety	BS EN61010-1
Terminals	Clamp strap M4 for up to 25 A. Clamp strap M8 for over 25 A 1/4" spade terminals available for models E243 and E244
Humidity range	Up to 95% RH (non condensing)
Test voltage @50Hz	3 kV RMS for 1 minute
Ammeter ranges	1.0/1.2/1.5/2.5/5/6 and decade multiples thereof
Overload AC current	x 1.2 continuous x 10 for 5 seconds
AC voltage and frequency	x 1.2 continuous x 2 for 5 seconds
Standard calibration	23°C. Calibration at other temperatures available on request
Operating temperature	-20°C to +60°C
Damping time	Less than 3 seconds
Enclosure code	IP52 as standard IP54 on request
Case and base	Grade UL94V0
Case	Dimensions and panel cut out conform to IEC473, DIN43700. Case made from glass filled polycarbonate self-extinguishing and non drip in accordance with UL94V-0
Bezel	Slim-line DIN43802, black as standard
Bezel window	Standard sheet glass, with zero adjusters where appropriate. Non reflecting glass or polycarbonate shatterproof windows are available
Installation	Installations in switchboard panel or mosaic arrangement on equipment or machine with a panel thickness of up to 40 mm in a horizontal or vertical plane
Fixing on panel	Swivel captive fasteners, which can be fixed at either corner
Mounting position	Normal vertical mounting or as indicated on the scale in accordance with DIN16257. A deviation of $\pm 15^\circ$ is permissible
Insulation group	Insulation resistance more than $5\Omega @ 500 V$
Environmental	Measurement category III IEC 1010-1 Pollution degree 2 IEC 1010-1 Electrical rating 600 V RMS (920 V peak)
Approvals	EMC, LVD, Lloyds and UL

### DIMENSIONS

Moving coil measuring range		Moving iron measuring range	
6 - 60 A	C=67 mm	0 - 30 A	C=64 mm
>60 A	C=78 mm	>30 A	C=67 mm

### MAX. PANEL THICKNESS = 40 MM

D	A	B
48 x 48	45 x 45	4
72 x 72	68 x 68	4
96 x 96	92 x 92	4
144 x 144	138 x 138	4



Note: Product codes in this document will only show the generic codes used by the manufacturer.  
Due to the high variation of possible scaling values and options additional codes will appear in part numbers stated e.g. within price lists and other literature.

Not all products carry all stated approvals (UL, CSA, BV). Please contact us for further information.

## Short scale moving iron AC ammeters and voltmeters



Designed to measure AC current or voltage, these meters indicate true RMS values and are substantially independent of system waveform. Scales are calibrated down to 20%, and ammeters can have overload scales of x2, x3, x5 or x6 for motor start duty. Ammeters can be supplied for use with -/1 A or -/5 A current transformers, whilst voltmeters can be scaled for use with voltage transformers. Meters can be used to measure DC at reduced accuracy.

### PRODUCT CODES

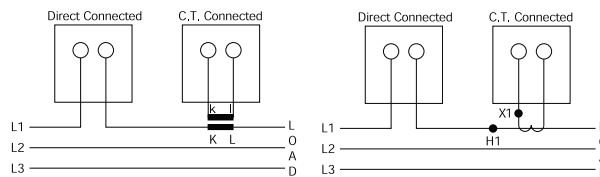
Bezel size mm	48	72	96	144
Scale length mm	42	65	94	145
AC ammeter	E242-75A	E243-02A	E244-02A	E246-02A
x2 overload ammeter	E242-752A	E243-022A	E244-022A	-
x3 overload ammeter	E242-753A	E243-023A	E244-023A	-
x5 overload ammeter	E242-755A	E243-025A	E244-025A	-
x6 overload ammeter	E242-756A	E243-026A	E244-026A	-
AC voltmeter	E242-75V	E243-02V	E244-02V	E246-02V

### SPECIFICATIONS

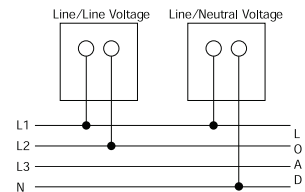
Accuracy	Class 1.5
Frequency	50, 60 Hz, (400 Hz on request)
Burden at 50 Hz	Ammeters: 0.5 VA Voltmeters: Up to 4.5 VA maximum
Ratings	Ammeters: 0.5-100 A AC direct connected (40 A for E242-75 A and E246-02 A) Maximum system voltage 600 V AC Low load/high middle, maximum 10 A
Voltmeters	6-600 V

### CONNECTIONS

#### AC ammeter



#### AC VOLTMETER



## Frequency meters



Frequency meters use an integral electronic converter and a moving coil indicator. These easy to read meters have accuracy Class 0.5.

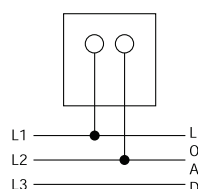
### PRODUCT CODES

Bezel size mm	48	72	96
Scale length mm	42	65	94
Product codes	E242-41S	E243-41S	E244-41S

### SPECIFICATIONS

Ratings	100 - 125 V AC 200 - 250 V AC 380 - 440 V AC* 500 V AC* *Use E242-89A and 253-THZ in place of E242-41S for voltages over 380 V Models available for use with VTs
Frequency	0.5%: 45/55 Hz, 55/65 Hz, 45/65 Hz, 360/440 Hz
Burden	4 VA maximum

### CONNECTIONS



## Short scale maximum demand indicators



The thermal/time characteristics of MDI meters monitor the most economic use of cable, fusegear and transformers. The directly heated bimetal element indicates mean RMS current over 8, 15, or 20 minutes, and a red slave pointer shows the highest value reached. The reset knob is wire sealable. Scales are calibrated to match the CT primary plus 20% overload. End values are selected from: 1.2, 1.8, 2.4, 3, 3.6, 4.8, 6, 7.2, 9 amps and their multiples of 10 and 100.

### PRODUCT CODES

Bezel size mm	72	96
Scale length mm*	65	94
<b>Product codes</b>		
<b>8 minute time lag</b>		
without limiting CT for use with 5 A CT	E243-16B	E244-16B
<b>15 minute time lag</b>		
without limiting CT for use with 5 A CT	E243-16A	E244-16A
<b>20 minute time lag</b>		
without limiting CT for use with 5 A CT	E243-16J	E244-16J

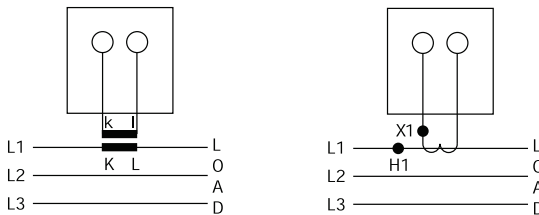
\* Scaled 0/100/120% of CT primary value.

### SPECIFICATIONS

Accuracy	Class 3
Options	5 A for use with separate CT 5/5 A saturating CT 1/5 A saturating CT
Burden at 50 Hz	MDI - 2.5 VA, CT - 2 VA
Overload withstand	Standard: 5 x FL for 5 seconds, 10 x FL for 1 second. With saturating CT: 10 x FL for 3 seconds, 20 x FL for 1 second
Frequency	50/60 Hz

### CONNECTIONS

Maximum demand indicators



## Combined AC ammeter and maximum demand indicators



Where measurement of instantaneous and maximum demand currents are required, these instruments combine both movements in one case. The meter can also replace an existing AC ammeter. Meets the same specifications listed above.

### PRODUCT CODES

Bezel size mm	72	96
Scale length mm*	65	94
<b>Product codes</b>		
<b>8 minute time lag</b>		
without limiting CT for use with 5 A CT 3 VA	-	E244-16Q
<b>15 minute time lag</b>		
without limiting CT for use with 5 A CT 3 VA	E243-16C	E244-16C *
<b>20 minute time lag</b>		
without limiting CT for use with 5 A CT 3 VA	-	E244-16H

\* Scaled 0/100/120% of CT primary value.

### SPECIFICATIONS

Accuracy	Moving iron ammeter: Class 1.5 MDI: Class 3
Burden at 50 Hz	MI - 0.5 VA, MDI - 2.5 VA saturating CT - 2 VA

\*Note: E244-162/E243-162 shares the specification of E244-16C/E243-16C with the difference that E244-162/E243-162 offers 2times overload on the moving iron movement (1.2times on MDI) to fulfill some European specifications. E244-16C/E243-16C offers 1.2times overload mainly for UK specifications.

## Short scale moving coil DC meters



Moving coil meters are suitable for all DC systems. The linear scale is calibrated down to zero and the accuracy maintained down to 10%. High currents are measured with separate shunts and suitably scaled indicators. Suppressed, centre and offset zero models are available.

### PRODUCT CODES

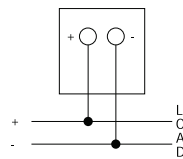
Bezel size mm	48	72	96	144
Scale length mm	42	65	94	145
Product codes				
Ammeters	E242-89A	E243-01A	E244-01A	E246-01A
Ammeters suppressed zero	E242-89R	E243-01R	E244-01R	E246-01R
Ammeters centre zero	E242-89C	E243-01C	E244-01C	E246-01C
Voltmeters	E242-89V	E243-01V	E244-01V	E246-01V
Voltmeters suppressed zero	E242-89S	E243-01S	E244-01S	E246-01S
Voltmeters centre zero	E242-89N	E243-01N	E244-01N	E246-01N

### SPECIFICATIONS

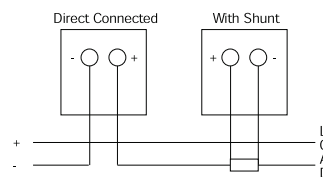
Accuracy	Class 1.5
Ratings	Ammeters: 100 $\mu$ A-25 A 4/20 mA suppressed zero 40 A for model E242, E243 and E244 up to 100 A Voltmeters: 50 mV-600 V 1/5 V suppressed zero 50, 60, 75, 100, 150 mV for use with shunts
Impedance	Ammeters: 75 mV internal shunt above 60mA Voltmeters: 1000 $\Omega/V$ above 1 V

### CONNECTIONS

#### DC voltmeter



#### DC ammeter



## Short scale rectified AC ammeters and voltmeters



For high frequency or linear full scale AC measurements, these instruments measure average values of sinusoidal waveforms and are scaled in RMS values.

The high quality silicon bridge rectifier gives a linear scale down to near zero, where some compression occurs.

### PRODUCT CODES

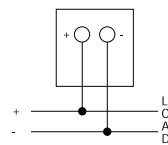
Bezel size mm	48	72	96	144
Scale length mm	42	65	94	145
Product codes				
Ammeters	E242-89B	E243-01B	E244-01B	E246-01B
Voltmeters	E242-89W	E243-01W	E244-01W	E246-01W

### SPECIFICATIONS

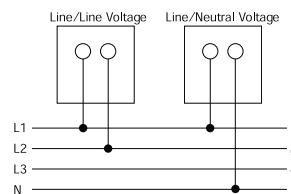
Accuracy	1.5% ES
Ratings	Ammeters: 250 $\mu$ A-1 A AC Over 1 A via CTs
Voltmeters	15 - 600 V AC direct connected. Models available for use with VTs
Frequency	50/60 Hz, (Single frequencies 25 Hz - 1 kHz on request)

### CONNECTIONS

#### AC ammeter



#### AC voltmeter



## Short scale process indicators



Meters are used to check process functions locally or remotely at centralised controls. These moving coil instruments offer a wide variety of electrical and mechanical readouts and are operated by transducer, tachogenerator, thermocouple, resistance bulb or other DC analogue signals. Suppressed, centre and offset zero models are available on request.

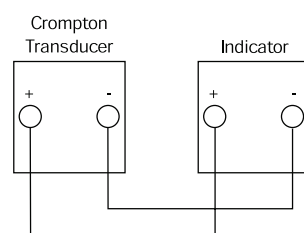
### PRODUCT CODES

Bezel size mm	48	72	96	144
Scale length mm	42	65	94	145
Product codes				
AC current	E242-89A	E243-01A	E244-01A	E246-01A
AC voltage	E242-89V	E243-01V	E244-01V	E246-0 V
Phase angle	-	E243-014	E244-014	-
Watts	-	E243-015	E244-015	-
VAR	-	E243-016	E244-016	-
VA	-	E243-017	E244-017	-

### SPECIFICATIONS

Accuracy	Class 1.5
Ratings	1, 2, 5, 10, 20 mA 4/20 mA suppressed zero

### CONNECTIONS



## AC ammeters and voltmeters with selector switch

### FEATURES

- Integral selector switch
- True RMS measurement
- Scaled for customer VT or CT primary values
- DIN 72 and DIN 96 models
- Terminal cover as standard
- Shock resistant sprung pivot and jewel movement
- x2 overload ammeters

### APPROVALS

- IEC61010-1B2001, EMC and LVD



### BENEFITS

- Space and time saving
- Competitive cost
- Local indication
- Ease of installation
- Low maintenance
- Customised options and features



These 96 mm and 72 mm units offer Class 1.5 true RMS measurement of three-phase AC voltage or current with various switch notation options. The integral selector switch eliminates the necessity for a separate selector switch, saving valuable panel space and providing installation benefits. These robust moving iron meters incorporate a clapper type repulsion design which utilises a pivot, hairspring and jewel movement. The bottom jewel is oil filled to provide damping while the top is sprung for resilience. Voltmeters are manufactured with internal voltage dropper resistors.

### PRODUCT CODES – AC AMMETERS WITH SELECTOR SWITCH

Code	Case size	Full scale deflection	Switch notation
E243-02E-G-LS**-C7-AMP3	72 mm	0/5 A AC	OFF L1 L2 L3
E244-02E-G-LS**-C7-AMP3	96 mm	0/5 A AC	OFF L1 L2 L3
E243-022E-G-LS**-C7-AMP3	72 mm	0/5/10 A AC	OFF L1 L2 L3
E244-022E-G-LS**-C7-AMP3	96 mm	0/5/10 A AC	OFF L1 L2 L3
E243-02E-G-LA**-C7-AMP3	72 mm	0/1 A AC	OFF L1 L2 L3
E244-02E-G-LA**-C7-AMP3	96 mm	0/1 A AC	OFF L1 L2 L3
E243-022E-G-LA**-C7-AMP3	72 mm	0/1/2 A AC	OFF L1 L2 L3
E244-022E-G-LA**-C7-AMP3	96 mm	0/1/2 A AC	OFF L1 L2 L3

\*\*Insert applicable CT primary value.

### APPLICATIONS

- Switchgear
- Distribution systems
- Generator sets
- Control panels
- Energy management
- Building management

### PRODUCT CODES – AC VOLTMETERS WITH SELECTOR SWITCH

Code	Case size	Full scale deflection	Switch notation	3-phase
E243-02Q-G-PM**-C7-SW6	72 mm	0/120 V AC	OFF L1L2 L2L3 L3L1	3W
E243-02Q-G-PZ**-C7-SW6	72 mm	0/150 V AC	OFF L1L2 L2L3 L3L1	3W
E243-02Q-G-PZ-PZ-C7-SW6	72 mm	0/150 V AC	OFF L1L2 L2L3 L3L1	3W
E243-02Q-G-RX-RX-C7-SW6	72 mm	0/300 V AC	OFF L1L2 L2L3 L3L1	3W
E243-02Q-G-SF-SF-C7-SW3	72 mm	0/500 V AC	L1L3 L1L2 L2L3 L3N L2N L1N	4W
E243-02Q-G-SJ-SJ-C7-SW3	72 mm	0/600 V AC	L1L3 L1L2 L2L3 L3N L2N L1N	4W
E244-02Q-G-PZ**-C7-SW6	96 mm	0/150 V AC	OFF L1L2 L2L3 L3L1	3W
E244-02Q-G-PZ-PZ-C7-SW6	96 mm	0/150 V AC	OFF L1L2 L2L3 L3L1	3W
E244-02Q-G-RX-RX-C7-SW6	96 mm	0/300 V AC	OFF L1L2 L2L3 L3L1	3W
E244-02Q-G-SF-SF-C7-SW3	96 mm	0/500 V AC	L1L3 L1L2 L2L3 L3N L2N L1N	4W
E244-02Q-G-SF-SF-C7-SW3	96 mm	0/600 V AC	L1L3 L1L2 L2L3 L3N L2N L1N	4W

\*\*Insert applicable VT primary and secondary value, e.g. 15 kV/110 V.

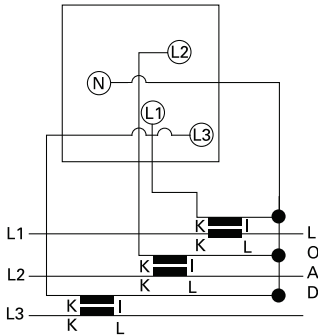
### PRODUCT CODES – OPTIONS

Description
Non reflecting glass window
Red supplementary pointer, externally adjustable
Red index mark (triangle)

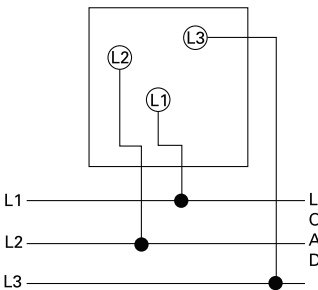
Please state any required options at time of ordering.

### CONNECTIONS

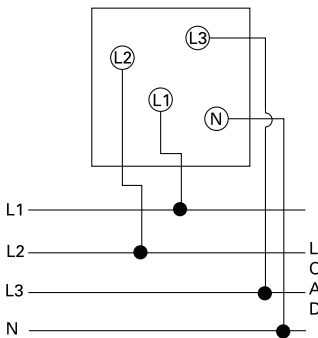
AC ammeter with selector switch



AC voltmeters 3-phase 3-wire



AC voltmeters 3-phase 4-wire

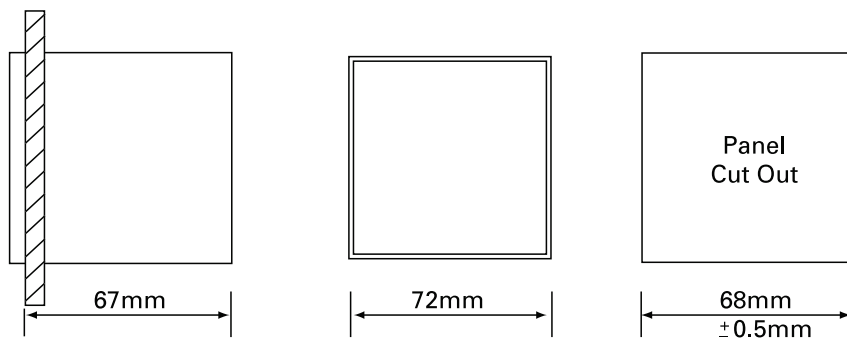


### GENERAL SPECIFICATIONS

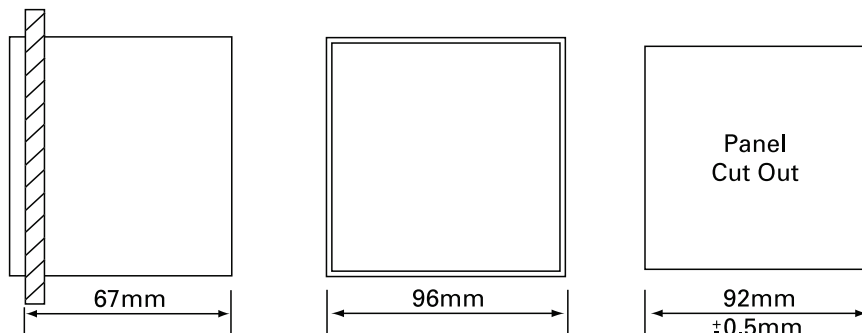
Accuracy	1.5% of full scale deflection (FSD)
Input rating	Ammeter: 1 A, 5 A 1/2 A or 5/10 A moving iron, direct connected Voltmeter: 120, 300, 500 and 600 V AC
Frequency	50, 60 Hz (400 Hz on request)
Burden at 50 Hz	Ammeters: 0.5 VA Voltmeters: 4-5 VA max
Overload ammeter	2 x I <sub>n</sub> continuous for 2 minutes, 4 x I <sub>n</sub> for 1 minute
Overload voltmeter	1.2 x continuous 2 x for 5 seconds
Movement	Moving iron shock resistant sprung pivot and jewel
Scale length	DIN72: 54 mm DIN96: 97 mm
Enclosure style	Panel mount to DIN42700
Enclosure material	Grade UL94 V0
Bezel style	Black matt DIN43802
Window	Standard sheet glass
Terminals	M4 captive screw clamp
Fixing	2 corner fixing clamps with tensioning thumb screws
Mounting position	Vertical mount to DIN16257, inclination of dial surface ±15%
Damping time	Less than 3 seconds
Compliant with	IEC61010-1B2001, CAT III 600V, EMC and LVD
Operating temperature	-20°C to +55°C
Storage temperature	-40°C to +75°C
Calibration temperature	23°C
Relative humidity	95% (non condensing)
Dimensions	96DIN: 96 mm high x 96 mm wide x 63 mm deep 72DIN: 72 mm high x 72 mm wide x 63 mm deep
Panel cut out	DIN96: 92 mm x 92 mm DIN72: 68 mm x 68 mm
IP protection	IP40
Weight	E243-02E 275 g E243-02Q 300 g E244-02E 360 g E244-02Q 390 g

### DIMENSIONS

72DIN models



96DIN models





## Elapsed time meters (hours run meters)



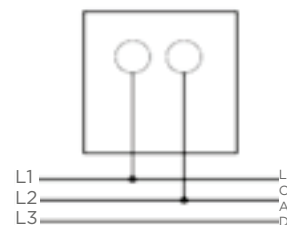
Elapsed time meters (ETM) or hours-run meters monitor “ON/RUN” time of plant and equipment, allowing the user to effectively control production efficiency, cost estimation and service period monitoring for preventative maintenance. Time is measured in increments of 0.01h up to 99999.99 hours after which the meter automatically resets to zero. Meters are non-resettable before this time to prevent accidental resetting.

### SPECIFICATIONS

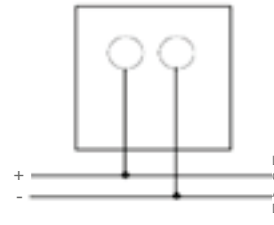
AC	
Display	99999.99
Voltage	100-125 V AC 200-250 V AC 380-440 V AC
Frequency	50 or 60 Hz
Operating temperature	-25°C to +80°C
IP Protection	IP52
Burden	1 VA (100-125 V AC) 2 VA (200-250 V AC) 3.5 VA (380-440 V AC)
DC	
Display	99999.99
Voltage	12-36 V DC 10-80 V DC 110 V DC
Operating temperature	-20°C to +70°C
IP Protection	IP52
Burden	0.5 VA (12 - 36 V AC) 1 VA (10-80 V AC) 1.5 VA (110 V AC) 0.5 VA (6 - 30 V) 1 VA (36 - 80 V)

Bezel size product codes	48 mm	72 mm	96 mm
100-125 V AC 50 Hz	M242-155-G-PL-ZH-C5	M243-155-G-PL-ZH-C5	M244-155-G-PL-ZH-C5
200-250 V AC 50 Hz	M242-155-G-RN-ZH-C5	M243-155-G-RN-ZH-C5	M244-155-G-RN-ZH-C5
380-440 V AC 50 Hz	M242-155-G-RY-ZH-C5	M243-155-G-RY-ZH-C5	M244-155-G-RY-ZH-C5
100-125 V AC 60 Hz	M242-156-G-PL-ZH-C6	M243-156-G-PL-ZH-C6	M244-156-G-PL-ZH-C6
200-250 V AC 60 Hz	M242-156-G-RN-ZH-C6	M243-156-G-RN-ZH-C6	M244-156-G-RN-ZH-C6
380-440 V AC 60 Hz	M242-156-G-RY-ZH-C6	M243-156-G-RY-ZH-C6	M244-156-G-RY-ZH-C6
6-30 V DC	-	M243-157-G-BU-ZH-DC	M244-157-G-BU-ZH-DC
12-36 V DC	M242-157-G-BU-ZH-DC	-	-
10-80 V DC	-	M243-157-G-NR-ZH-DC	M244-157-G-NR-ZH-DC
36-80 V DC	M242-157-G-NR-ZH-DC	-	-
110 V DC	M242-157-G-PM-ZH-DC	M243-157-G-PM-ZH-DC	M244-157-G-PM-ZH-DC

Elapsed time/hours  
run meters AC



Elapsed time/hours  
run meters DC



## Dual voltmeter and frequency meter

### FEATURES

- Measures AC frequencies of two independent systems
- Pointer type dual voltmeter and frequency meter with two independent 90° short scale movements
- Reed type available with two independent measuring circuits - 21 reeds (45-55 Hz, 55-65 Hz)
- Direct or VT connected



### APPLICATIONS

- AC switchgears, panels and distribution boards
- Control board
- Generator sets

### CONSTRUCTION

- Pointer type contains internal transducer, powered from input voltage and moving coil meter
- Reed type uses steel reeds in an electromagnetic field. Reeds are calibrated to its individual frequency to vibrate in resonance with the electromagnet and vibrates at full amplitude
- Slot in screw fixing

### APPROVALS

- CE marked



### BENEFITS

- Easy to operate
- High visibility
- Terminal cover included
- Marine approved

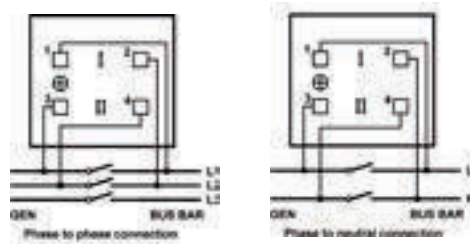
### GENERAL SPECIFICATION

Accuracy class dual voltmeter	1.5
Accuracy class dual frequency meter - pointer type	1
Accuracy class dual frequency meter - reed type	0.5
Overload	10xIn - 9x0.5s+1x5s/60s
Dual voltmeter	2xUn - 9x0.5s+1x5s/60s
Dual frequency meter - pointer type	1.2 x Un continuously, 1.5 x Un for 2 hours (pointer type only)
Dual frequency meter - reed type	2 x Un for 5 seconds
Burden frequency meter - pointer type	1 VA at nominal voltage 57 - 110 V and 230 V - 1.7 VA at nominal voltage 400 V - 2 VA at nominal voltage 500 V
Burden frequency meter - reed type	0.7 ... 1.2 VA at nominal voltage 110-230 V - 1.4 ... 2 VA at all other nominal voltages

### PRODUCT CODES

Bezel size (mm)	96	96	96	-
Scale length (mm)	41	41	-	-
Voltmeter meter 2 x 90°	M244-80L	-	-	-
Frequency meter 2 x 90°	-	M244-41D	-	-
Frequency meter 2 x 21 reeds	-	-	M244-41E	-
<b>Standard input ranges</b>				
Dual voltmeter (direct connected)	300 V, 500 V			
Dual voltmeter (VT connected)	120 V (for use with VT's x/100 V), 132 V (for use with VT's x/110 V), 144 V (for use with VT's 120 V), 125 V, 137,5 V, 150 V (for use with some VT's having primary voltage less than 1 kV)			
Dual frequency meter - pointer type	57-110 V, 400 V +/- 20%, 500 V +/-20%			
Dual frequency meter - reed type	100 V, 110 V, 230 V, 400 V +/- 20%, 500 V +/-20%			
<b>Scaling</b>				
Dual voltmeter	Specify to suit application			
Dual frequency meter - pointer type	45-50-55 Hz, 55-60-55 Hz, 45-55-65 Hz			
Dual frequency meter - reed type	45-50-55 Hz, 55-60-65 Hz			

### CONNECTION DIAGRAMS



### ORDER DATA/EXAMPLES DUAL VOLTMETER - LV DIRECT CONNECTED

- 1) Select type: M244-80L,
- 2) Specify input voltage: 500 V,
- 3) Specify scaling: 0-500 V,
- 4) Specify frequency: 50 Hz

### DUAL VOLTMETER - VT CONNECTED

- 1) Select type: M244-80L,
- 2) Specify input: 0-120 V,
- 3) Specify scaling: 0-12 kV,
- 4) Specify frequency: 50 Hz,
- 5) Specify VT ratio: 10/0.1 kV

### DUAL FREQUENCY METER - POINTER TYPE

- 1) Select type: M244-41D,
- 2) Specify input voltage: 400 V,
- 3) Specify frequency: 45/65 Hz,
- 4) Specify scaling: 45-55-65 Hz

### DUAL FREQUENCY METER - REED TYPE

- 1) Select type: M244-41E,
- 2) Specify input voltage: 110 V,
- 3) Specify frequency: 55/65 Hz,
- 4) Specify scaling: 55-60-65 Hz

## Phase sequence indicators



Electronic phase sequence indicators ensure correct phase rotation and the presence of all 3-phase supplies. Incorrect or loss of phase can cause serious damage in a wide range of electrical machines. Ship-to-shore supplies, mobile generators and remote installations are particularly vulnerable to this problem.

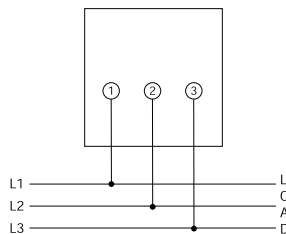
Voltage	151/300 V, 301/500 V 100/150 V (Model 244-12P only)
Frequency	50/60 Hz
Burden	2.5 VA/phase

### DIMENSIONS

Bezel size mm	72	96
<b>Product codes</b>		
Phase sequence indicator	243-12P	244-12P

### CONNECTIONS

Phase sequence indicators



## Phase angle meters

Phase angle meters indicate the phase displacement between current and voltage. They are used in applications where the phase angle must be monitored, for example with tariffs having VAR penalties, or to optimise generator power delivery.

### PRODUCT CODES - SHORT-SCALE MODELS

#### DIMENSIONS

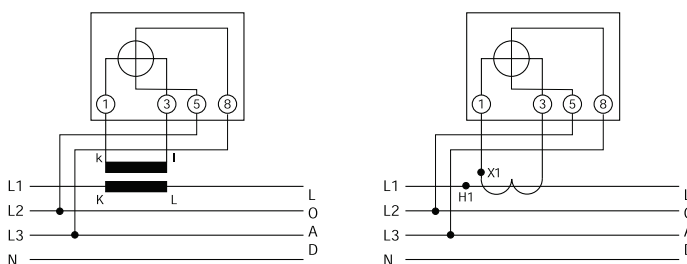
Bezel size mm	72	96
Scale length mm	65	94
<b>Product codes</b>		
3-phase 3/4-wire balanced load	E243-42A	E244-42A

### SPECIFICATIONS

Accuracy	Class 1.5
Ratings	Current: 1 A or 5 A for CTs Voltage: 110 V, 240 V, 380 V & 400 V for VT use
Frequency	50 Hz, 60 Hz
Burden at 50 Hz	Current: 1 VA Voltage: 3 VA per phase
Current range	20-120%

### CONNECTIONS

3-phase, 3/4-wire balanced systems



# Power factor meters

## FEATURES

- Indicates Power factor of electrical systems
- Several voltage ranges available
- Current connection via "through hole" CT on the instrument. No need to interrupt wiring from CT



## APPROVALS

- CE marked



## BENEFITS

- Easy to operate
- High visibility
- Terminal cover included
- Low self consumption
- Internal power supply from voltage input

## GENERAL SPECIFICATION

Accuracy class	1.5
Maximum continuous overload	3 x In, 1.5 x Un
Maximum short duration overload	25 x In for 30 seconds, 50 x In for 1 second, 2 x Un for 10 seconds
Voltage burden	<0.1 VA per phase
Current burden	<0.1 VA per phase
Frequency	50/60 Hz

## PRODUCT CODES

Bezel size (mm)	96	96	96	96	96
Scale length (mm)	95	95	95	95	95
Power factor meter 90°	M244-420 single-phase	M244-421 3P/3W balanced	M244-42C 3P/4W balanced	M244-423 3P/3W unbalanced	M244-424 3P/4W unbalanced
Bezel size (mm)	96	96	96	96	96
Scale Length (mm)	135	135	135	135	135
Power factor meter 240°	M244-135 single-phase	M244-136 3P/3W balanced	M244-13D 3P/4W balanced	M244-138 3P/3W unbalanced	M244-139 3P/4W unbalanced
Standard input ranges					
Single-phase, 3P/4W balanced, 3P/4W unbalanced	57.7 V L-N/1 A, 57.7 V L-N/5 A, 63.5 V L-N/1 A, 63.5 V L-N/5 A, 69.3 V L-N/1 A, 9.3 V L-N/5 A, 230 V L-N/1 A, 230 V L-N/5 A, 240 V L-N/1 A, 240 V L-N/5 A, 254 V L-N/1 A, 254 V L-N/5 A				
3P/3W balanced, 3P/3W unbalanced	100 V L-L/1 A, 100 V L-L/5 A, 110 V L-L/1 A, 110 V L-L/5 A, 400 V L-L/1 A, 400 V L-L/5 A, 415 V L-L/1 A, 415 V L-L/5 A, 440 V L-L/1 A, 440 V L-L/5 A				
Scaling	0.5/1/0.5 CAP/IND or 0.8/1/0.2 CAP/IND or 0.1/1/0/1/0.1 CAP/IND				

## APPLICATIONS

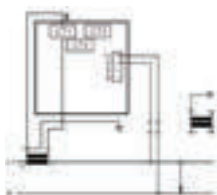
- AC switchgears, panels and distribution boards
- Control boards
- Generator sets

## CONSTRUCTION

- Instruments operate on a fast sampling method of input quantities (current and voltage) of the connected phases
- Meters include "through hole" CT connection, voltage dividers, internal microprocessor and power supply unit
- Slot in screw fixing

## CONNECTION DIAGRAMS

### Single-phase



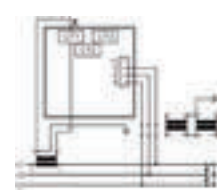
### 3-phase 4-wire (3P/4W) balanced



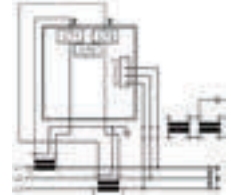
### 3-phase 4-wire (3P/4W) unbalanced



### 3-phase 3-wire (3P/3W) balanced



### 3-phase 3-wire (3P/4W) unbalanced



## ORDER DATA/EXAMPLES SINGLE-PHASE

- 1) Select type: M244-420,
- 2) Specify input voltage and current: 230 V L-N/5 A,
- 3) Specify scaling: 0.5/1/0.5 CAP/IND
- 4) Specify frequency: 50/60 Hz,

## 3-PHASE 4-WIRE BALANCED

- 1) Select type: M244-13D,
- 2) Specify input voltage and current: 69.3 V L-N/1 A,
- 3) Specify scaling: 0.5/1/0.5 CAP/IND,
- 4) Specify frequency: 50/60 Hz

## 3-PHASE 4-WIRE UNBALANCED

- 1) Select type: M244-424,
- 2) Specify input voltage and current: 230 V L-N/5 A,
- 3) Specify scaling: 0.8/1/0.2 CAP/IND
- 4) Specify frequency: 50/60 Hz

## 3-PHASE 3-WIRE BALANCED

- 1) Select type: M244-136,
- 2) Specify input voltage and current: 110 V L-L/5 A,
- 3) Specify scaling: 0.5/1/0.5 CAP/IND,
- 4) Specify frequency: 50/60 Hz

## 3-PHASE 3-WIRE UNBALANCED

- 1) Select type: M244-138,
- 2) Specify input voltage and current: 415 V L-L/1 A,
- 3) Specify scaling: 0.5/1/0.5 CAP/IND,
- 4) Specify frequency: 50/60 Hz



### 360° LED SYNCHROSCOPE AND SYNCHRO CHECK RELAY

Where manual paralleling of two AC systems is desired, the frequency of both systems can be monitored by an LED synchroscope. The systems are synchronised when the green LED is lit in the 12 o'clock position. The instrument is rated for continuous operation and connection. For the semi-automatic paralleling of two AC systems, the voltage, phase displacement and the frequency of both systems can be monitored by this LED synchroscope and synchro check relay. Controls for voltage, phase angle, and time delay are provided. The systems are synchronised when the green triangular LEDs are lit together with the GEN/BUS green LEDs. A dead bus option is also available.

### SPECIFICATIONS

Ratings voltage	63.5, 110, 120, 220, 230, 240, 380, 400, 415, 440, 480 V 110/120 V (115 V nominal) 220/240 V (230 V nominal) 380/480 V (430 V nominal) Volts AC or via VT
Frequency	40/65 Hz
Burden at 50Hz / 60Hz	4 VA maximum Suitable for 1 or 3-phase systems
Safety	IEC1010-1 (300 V AC RMS installation degree 2)
Dielectric	4 kV rms for 1 minute
Isolation	BUS/GEN/RELAY
Vibration	To Lloyds shipping specification
*Phase difference	+0-20°, +2%
*Voltage difference	+0-20%, +/-2% 0-10% for models G and H
*Time delay	0-2.5 seconds +10%
*Accuracy	Synchronisation at T.DC is +1°

\*Only for the 360° LED synchroscope and synchro check relay.

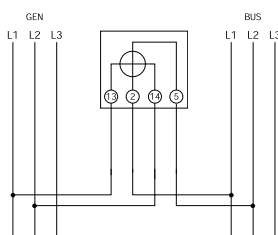
### DIMENSIONS

Bezel size mm	96	96	96
Scale length mm	360° LED	360° LED	360° LED
3- or 4-wire 40-65 Hz	Synchroscope	Synchroscope and synchro check	Synchroscope and synchro check relay (dead bus)
<b>Product codes</b>			
110/120 V	-	244-14GG-P0BX	244-14HG-P0BX
220/240 V	-	244-14GG-R5BX	244-14HG-R5BX
380/480 V	-	244-14GG-RUBX	244-14HG-RUBX
63.5 V	244-14AG-NXY	244-14LG-NXB	244-14DG-NXB
110 V	244-14AG-PMY	244-14LG-PMB	244-14DG-PMB
220 V	244-14AG-R4Y	244-14LG-R4B	244-14DG-R4B
230 V	244-14AG-RQY	244-14LG-RQB	244-14DG-RQB
240 V	244-14AG-RRY	244-14LG-RRB	244-14DG-RRB
380 V	244-14AG-RUY	244-14LG-RUB	244-14DG-RUB
400 V	244-14AG-SCY	244-14LG-SCB	244-14DG-SCB
415 V	244-14AG-SBY	244-14LG-SBB	244-14DG-SBB
440 V	244-14AG-SHY	244-14LG-SHB	244-14DG-SHB
480 V	244-14AG-SEY	244-14LG-SEB	244-14DG-SEB

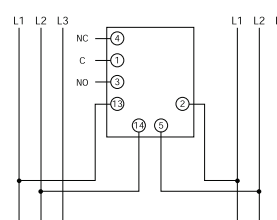
For the 244-14L and 244-14D models, the generator voltage is compared to the nominal input (bus) voltage specified at time of ordering. For the 244-14G and 244-14H models, the generator voltage is compared to the measured bus voltage.

### CONNECTIONS

#### 360° LED synchroscope



#### 360° LED synchroscope and synchro check relay



## FEATURES

- Indicates active power of electrical systems
- Several voltage ranges available
- Current connection via "through hole" CT on the instrument



## APPLICATIONS

- AC switchgears, panels and distribution boards
- Control boards
- Generator sets

## CONSTRUCTION

- Instruments operate on a fast sampling method of input quantities (current and voltage) of the connected phases
- Meters include "through hole" CT connection, voltage dividers, internal microprocessor and power supply unit
- Slot in screw fixing

## APPROVALS

- CE marked



- Accuracy class - 1.5
- Maximum continuous overload -  $3 \times I_n$ ,  $1.5 \times U_n$
- Maximum short duration overload -  $25 \times I_n$  for 30 seconds,  $50 \times I_n$  for 1 second,  $2 \times U_n$  for 10 seconds

## BENEFITS

- Easy to operate
- High visibility
- Terminal cover included
- Low self consumption
- Internal power supply from voltage input
- Voltage burden -  $<0.1 \text{ VA}$  per phase
- Current burden -  $<0.1 \text{ VA}$  per phase
- Frequency - 50/60 Hz

## PRODUCT CODES

Bezel size (mm)	96	96	96	96	96
Scale length (mm)	95	95	95	95	95
Wattmeter 90°	M244-210 single-phase	M244-211 3P/3W balanced	M244-21C 3P/4W balanced	M244-213 3P/3W unbalanced	M244-214 3P/4W unbalanced
Bezel size (mm)	96	96	96	96	96
Scale Length (mm)	135	135	135	135	135
Wattmeter 240°	M244-215 single-phase	M244-216 3P/3W balanced	M244-21D 3P/4W balanced	M244-218 3P/3W unbalanced	M244-219 3P/4W unbalanced
<b>Standard input ranges</b>					
Single-phase, 3P/4W balanced, 3P/4W unbalanced	57.7 V L-N/1A, 57.7 V L-N/5A, 63.5 V L-N/1A, 63.5 V L-N/5 A, 230 V L-N/1 A, 230 V L-N/5 A, 240 V -N/1 A, 240 V L-N/5 A, 254 V L-N/1 A, 254 V L-N/5 A,				
3P/3W balanced, 3P/3W unbalanced	100 V L-L/1 A, 100 V L-L/5 A, 110 V L-L/1 A, 110 V L-L/5 A, 400 V L-L/1 A, 400 V L-L/5 A, 415 V L-L/1 A, 415 V L-L/5 A, 440 V L-L/1 A, 440 V L-L/5 A				

## CALCULATION OF END SCALE VALUE

End scale value is calculated using the formula below, where correct voltage must be selected (either L-N or L-L), depending on the electrical system and the type of meter used. Scale factor, e.g. the relation between end scale value and nominal apparent power ( $\cos\phi = 1$ ) must be between 0.6 to 1.2. It is recommended selecting the scale value from 1 - 1.2 - 1.25 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8 (and their decades) closest to the calculated result.

Electrical system	Formula	Example	End scale value to choose (considering 0,6 to 1.2 x S)
Single-phase, direct voltage connection	$P = U(L-N) \times I_p \times \cos$	$P = 230 \text{ V} \times 50 \text{ A} \times 0.9 = 10350 \text{ W} = 10.35 \text{ kW}$	10 kW
3-phase 4-wire, direct voltage connection (balanced or unbalanced)	$P = 3 \times U(L-N) \times I_p \times \cos$	$P = 3 \times 230 \text{ V} \times 400 \text{ A} \times 0.95 = 262200 \text{ W} = 262,2 \text{ kW}$	250 kW
3-phase 3-wire, direct voltage connection (balanced or unbalanced)	$P = 1.732 \times U(L-L) \times I_p \times \cos$	$P = 1.732 \times 400 \text{ V} \times 1000 \text{ A} \times 0.9 = 623520 \text{ W} = 623,52 \text{ kW}$	600 kW
3-phase 4-wire, voltage connection via VT (balanced or unbalanced)	$P = 3 \times U_p(L-N) \times I_p \times \cos$	$P = 3 \times 5770 \text{ V} \times 100 \text{ A} \times 0.95 = 1644450 \text{ W} = 1,64445 \text{ MW}$	1.5 MW
3-phase 3-wire, voltage connection via VT (balanced or unbalanced)	$P = 1.732 \times p(L-L) \times I_p \times \cos$	$P = 1.732 \times 30000 \text{ V} \times 50 \text{ A} \times 0.9 = 2338200 \text{ W} = 2,3382 \text{ MW}$	2.5 MW

## ORDER DATA/EXAMPLES

### SINGLE-PHASE

- 1) Select type: M244-210,
- 2) Specify input voltage and CT ratio: 230 V L-N, 50/5 A,
- 3) Specify scaling: 0 - 10 kW,
- 4) Specify frequency: 50/60 Hz,

### 3-PHASE 4-WIRE BALANCED OR 3-PHASE 4-WIRE UNBALANCED

- 1) Select type: M244-21D,

- 2) Specify input voltage and CT ratio: 230 V L-N, 400/5 A,
- 3) Specify scaling: 0-250 kW,
- 4) Specify frequency: 50/60 Hz

### 3-PHASE 3-WIRE BALANCED OR UNBALANCED

- 1) Select type: M244-213,
- 2) Specify input voltage and CT ratio: 400 V L-L, 1000/1 A,

- 3) Specify scaling: 0 - 600 kW,
- 4) Specify frequency: 50/60 Hz

### 3-PHASE 4-WIRE BALANCED OR UNBALANCED, VT CONNECTED

- 1) Select type: M244-214,
- 2) Specify VT ratio and CT ratio: 5770/57.7 V L-N, 100/5 A,
- 3) Specify scaling: 0-1.5 MW,
- 4) Specify frequency: 50/60 Hz

### 3-PHASE 3-WIRE BALANCED OR UNBALANCED

- 1) Select type: M244-218,
- 2) Specify input VT ratio and CT ratio: 30000/110 V L-L, 50/1 A,
- 3) Specify scaling: 0 - 2.5 MW
- 4) Specify frequency: 50/60 Hz

## FEATURES

- Indicates reactive power of electrical systems
- Several voltage ranges available
- Current connection via "through hole" CT on the instrument



## APPLICATIONS

- AC switchgears, panels and distribution boards
- Control boards
- Generator sets

## CONSTRUCTION

- Instruments operate on a fast sampling method of input quantities (current and voltage) of the connected phases.
- Meters include "through hole" CT connection, voltage dividers, internal microprocessor and power supply unit.
- Slot in screw fixing

## APPROVALS

- CE marked



## BENEFITS

- Easy to operate
- High visibility
- Terminal cover included
- Low self consumption
- Internal power supply from voltage input

## GENERAL SPECIFICATION

Accuracy class	1.5
Maximum continuous overload	3 x In, 1.5 x Un
Maximum short duration overload	25 x In for 30 seconds, 50 x In for 1 second, 2 x Un for 10 seconds
Voltage burden	<0.1 VA per phase
Current burden	<0.1 VA per phase
Frequency	50/60 Hz

## PRODUCT CODES

Bezel size (mm)	96	96	96	96	96
Scale Length (mm)	95	95	95	95	95
Varmeter 90°	M244-310 single-phase	M244-311 3P/3W balanced	M244-31C 3P/4W balanced	M244-313 3P/3W unbalanced	M244-314 3P/4W unbalanced
Bezel size (mm)	96	96	96	96	96
Scale length (mm)	135	135	135	135	135
Varmeter 240°	M244-315 single-phase	M244-316 3P/3W balanced	M244-31D 3P/4W balanced	M244-318 3P/3W unbalanced	M244-319 3P/4W unbalanced
<b>Standard input ranges</b>					
Single-phase, 3P/4W balanced, 3P/4W unbalanced	57.7 V L-N/1 A, 57.7 V L-N/5 A, 63.5 V L-N/1 A, 63.5 V L-N/5 A, 230 V L-N/1 A, 230 V L-N/5 A, 240 V L-N/1 A, 240 V L-N/5 A, 254 V L-N/1 A, 254 V L-N/5 A				
3P/3W balanced, 3P/3W unbalanced	100 V L-L/1 A, 100 V L-L/5 A, 110 V L-L/1 A, 110 V L-L/5 A, 400 V L-L/1 A, 400 V L-L/5 A, 415 V L-L/1 A, 415 V L-L/5 A, 440 V L-L/1 A, 440 V L-L/5 A				

## CALCULATION OF END SCALE VALUE

End scale value is calculated using the formula below, where correct voltage must be selected (either L-N or L-L), depending on the electrical system and the type of meter used. Scale factor, e.g. the relation between end scale value and nominal apparent power (cos-phi = 1) must be between 0.6 to 1.2. It is recommended selecting the scale value from 1 - 1.2 - 1.25 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8 (and their decades) closest to the calculated result.

$I_p$  = CT primary current,  $U_p$  = VT primary voltage,  $U$  = direct connected voltage,  $\sin \phi$  = power factor

Electrical system	Formula	Example	End scale value to choose (considering 0,6 to 1.2 x S)
Single-phase, direct voltage connection	$Q = U(L-N) \times I_p \times \sin \phi$	$Q = 230V \times 50A \times 0.44 = 5060 \text{ var} = 5,06 \text{ kvar}$	6 kvar
3-phase 4-wire, direct voltage connection (balanced or unbalanced)	$Q = 3 \times U(L-N) \times I_p \times \sin$	$P = 3 \times 230V \times 400A \times 0.31 = 85560 \text{ var} = 85,56 \text{ kvar}$	200 kvar
3-phase 3-wire, direct voltage connection (balanced or unbalanced)	$Q = 1.732 \times U(L-L) \times I_p \times \sin$	$P = 1.732 \times 400V \times 1000A \times 0,44 = 304832 \text{ var} = 304,8 \text{ kvar}$	500 kvar
3-phase 4-wire, voltage connection via VT (balanced or unbalanced)	$Q = 3 \times U_p(L-N) \times I_p \times \sin$	$P = 3 \times 5770V \times 100A \times 0.199 = 344469 \text{ var} = 344,469 \text{ kvar}$	1 Mvar
3-phase 3-wire, voltage connection via VT (balanced or unbalanced)	$Q = 1.732 \times U_p(L-L) \times I_p \times \sin$	$P = 1.732 \times 30000V \times 50A \times 0,44 = 1143120 \text{ var} = 1,14312 \text{ Mvar}$	2 Mvar

## ORDER DATA/EXAMPLES

### SINGLE-PHASE

- 1) Select type: M244-310,
- 2) Specify input voltage and CT ratio: 230 V L-N, 50/5 A,
- 3) Specify scaling: 0 - 6 kvar,
- 4) Specify frequency: 50/60 Hz,

### 3-PHASE 4-WIRE BALANCED OR 3-PHASE 4-WIRE UNBALANCED

- 1) Select type: M244-31D,

- 2) Specify input voltage and CT ratio: 230 V L-N, 400/5 A,
- 3) Specify scaling: 0 - 200 kvar,
- 4) Specify frequency: 50/60 Hz

### 3-PHASE 3-WIRE BALANCED OR UNBALANCED

- 1) Select type: M244-313,
- 2) Specify input voltage and CT ratio: 400 V L-L, 1000/1 A,
- 3) Specify scaling: 0 - 500 kvar,
- 4) Specify frequency: 50/60 Hz

### 3-PHASE 4-WIRE BALANCED OR UNBALANCED, VT CONNECTED

- 1) Select type: M244-314,
- 2) Specify VT ratio and CT ratio: 5770/57.7 V L-N, 100/5 A,
- 3) Specify scaling: 0 - 1 Mvar,
- 4) Specify frequency: 50/60 Hz

### 3-PHASE 3-WIRE BALANCED OR UNBALANCED

- 1) Select type: M244-318,
- 2) Specify input VT ratio and CT ratio: 30000/110 V L-L, 50/1 A,
- 3) Specify scaling: 0 - 2 Mvar,
- 4) Specify frequency: 50/60 Hz

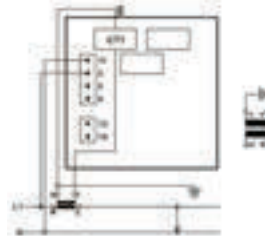
## Wattmeters and varmeters wiring diagrams



### WIRING DIAGRAMS OF WATTMETERS AND VARMETERS

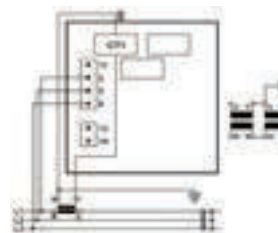
#### Single-phase, direct or VT voltage connection

Wattmeter M244-210  
Wattmeter M244-215  
Varmeter M244-310  
Varmeter M244-315



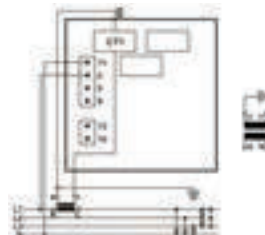
#### 3-phase 3-wire balanced, direct or VT voltage connection

Wattmeter M244-211  
Wattmeter M244-216  
Varmeter M244-311  
Varmeter M244-316



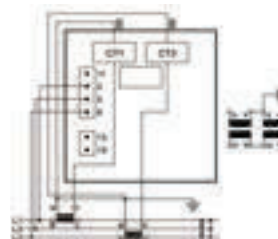
#### 3-phase 4-wire balanced, direct or VT voltage

Wattmeter M244-21C  
Wattmeter M244-21D  
Varmeter M244-31C  
Varmeter M244-31D



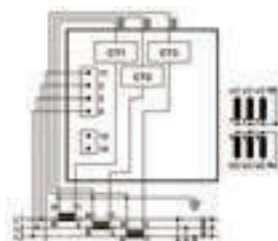
#### 3-phase 3-wire unbalanced, direct or VT voltage connection

Wattmeter M244-213  
Wattmeter M244-218  
Varmeter M244-313  
Varmeter M244-318



#### 3-phase 4-wire unbalanced, direct or VT voltage connection

Wattmeter M244-214  
Wattmeter M244-219  
Varmeter M244-314  
Varmeter M244-319





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