

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

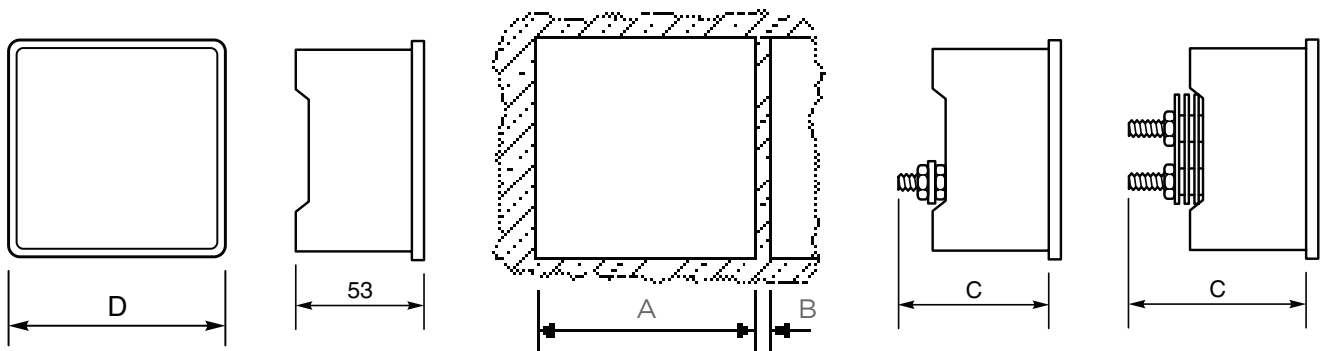
| | |
|----------------------------|---|
| Performance | BS EN60051 |
| Measuring ranges | DIN43701 |
| Accuracy overload | BS EN60051 |
| Dimensions | DIN43700 |
| Scale marking generally to | DIN43802 |
| Magnetic influence | BS EN60051 |
| Safety | BS EN61010-1 |
| Terminals | Clamp strap M4 for up 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 use 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

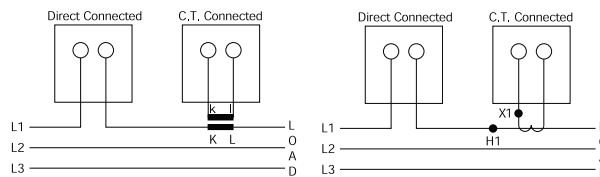
| Bezel size mm | 48 | 72 | 96 | 144 |
|---------------------|-----------|-----------|-----------|----------|
| Scale length mm | 42 | 65 | 94 | 145 |
| AC ammeter | E242-75A | E243-02A | E244-02A | E246-02A |
| x2 overload ammeter | E242-752A | E243-022A | E244-022A | - |
| x3 overload ammeter | E242-753A | 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

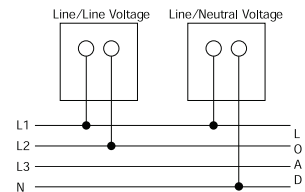
| | |
|-----------------|--|
| Accuracy | Class 1.5 |
| Frequency | 50, 60 Hz, (400 Hz on request) |
| Burden at 50 Hz | Ammeters: 0.5 VA Voltmeters: Up to 4.5 VA maximum |
| Ratings | Ammeters: 0.5-100 A AC direct connected (40 A for E242-75 A and E246-02 A) Maximum system voltage 600 V AC Low load/high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

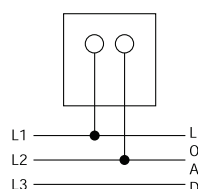
PRODUCT CODES

| 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 |
| Product codes | | |
| 8 minute time lag | | |
| without limiting CT for use with 5 A CT | E243-16B | E244-16B |
| 15 minute time lag | | |
| without limiting CT for use with 5 A CT | E243-16A | E244-16A |
| 20 minute time lag | | |
| without limiting CT for use with 5 A CT | E243-16J | E244-16J |

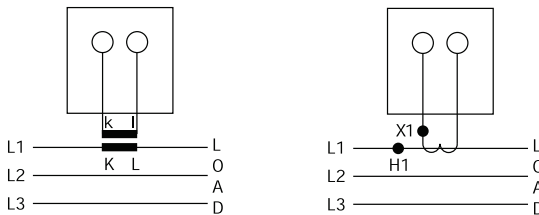
* Scaled 0/100/120% of CT primary value.

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 |
| Product codes | | |
| 8 minute time lag | | |
| without limiting CT for use with 5 A CT 3 VA | - | E244-16Q |
| 15 minute time lag | | |
| without limiting CT for use with 5 A CT 3 VA | E243-16C | E244-16C * |
| 20 minute time lag | | |
| 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

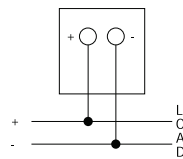
| | | | | |
|----------------------------|----------|----------|----------|----------|
| Bezel size mm | 48 | 72 | 96 | 144 |
| Scale length mm | 42 | 65 | 94 | 145 |
| Product codes | | | | |
| Ammeters | E242-89A | E243-01A | E244-01A | E246-01A |
| Ammeters suppressed zero | E242-89R | E243-01R | 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

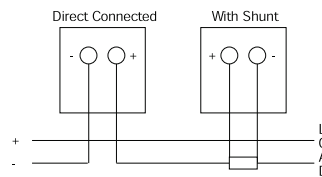
| | |
|-----------|--|
| Accuracy | Class 1.5 |
| Ratings | Ammeters: 100 μ A-25 A 4/20 mA suppressed zero 40 A for model E242, E243 and E244 up to 100 A Voltmeters: 50 mV-600 V 1/5 V suppressed zero 50, 60, 75, 100, 150 mV for use with shunts |
| Impedance | Ammeters: 75 mV internal shunt above 60mA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

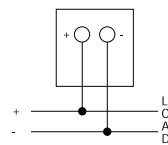
| | | | | |
|-----------------|----------|----------|----------|----------|
| Bezel size mm | 48 | 72 | 96 | 144 |
| Scale length mm | 42 | 65 | 94 | 145 |
| Product codes | | | | |
| Ammeters | E242-89B | E243-01B | E244-01B | E246-01B |
| Voltmeters | E242-89W | E243-01W | E244-01W | E246-01W |

SPECIFICATIONS

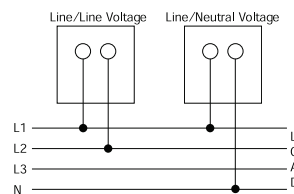
| | |
|------------|---|
| Accuracy | 1.5% ES |
| Ratings | Ammeters: 250 μ A-1 A AC Over 1 A via CTs |
| Voltmeters | 15 - 600 V AC direct connected. Models available for use with VTs |
| Frequency | 50/60 Hz, (Single frequencies 25 Hz - 1 kHz on request) |

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.

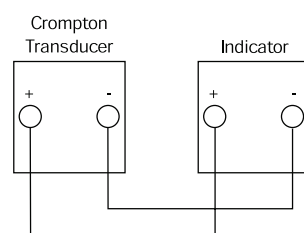
PRODUCT CODES

| | | | | |
|-----------------|----------|----------|----------|----------|
| 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.

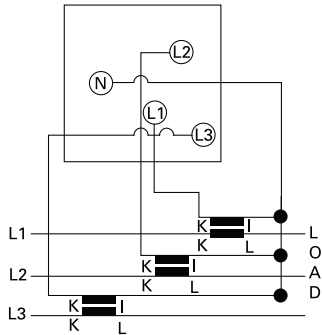
PRODUCT CODES – OPTIONS

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

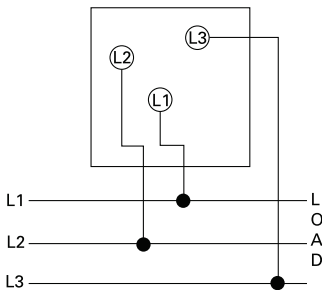
Please state any required options at time of ordering.

CONNECTIONS

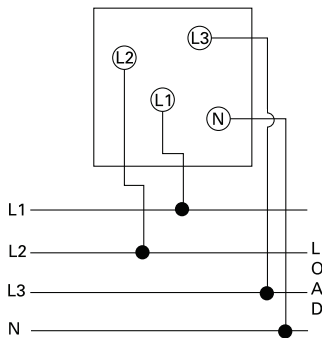
AC ammeter with selector switch



AC voltmeters 3-phase 3-wire



AC voltmeters 3-phase 4-wire

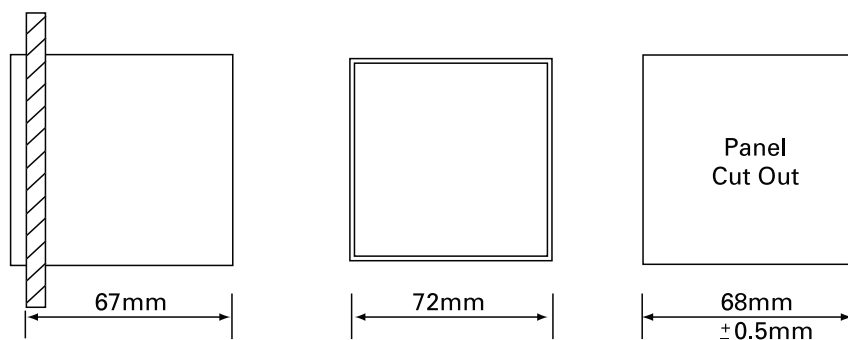


GENERAL SPECIFICATIONS

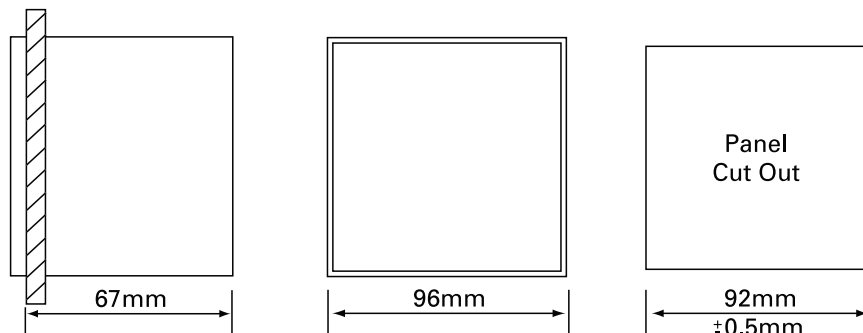
| | |
|-------------------------|---|
| Accuracy | 1.5% of full scale deflection (FSD) |
| Input rating | Ammeter: 1 A, 5 A 1/2 A or 5/10 A moving iron, direct connected Voltmeter: 120, 300, 500 and 600 V AC |
| Frequency | 50, 60 Hz (400 Hz on request) |
| Burden at 50 Hz | Ammeters: 0.5 VA Voltsmeters: 4-5 VA max |
| Overload ammeter | 2 x In continuous for 2 minutes, 4 x In 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 $\pm 15^\circ$ |
| 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)



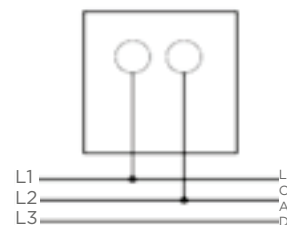
Elapsed time meters (ETM) or hours-run meters monitor “ON/RUN” time of plant and equipment, allowing the user to effectively control production efficiency, cost estimation and service period monitoring for preventative maintenance. Time is measured in increments of 0.01h up to 99999.99 hours after which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

SPECIFICATIONS

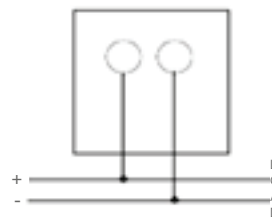
| AC | |
|-----------------------|--|
| Display | 99999.99 |
| Voltage | 100-125 V AC 200-250 V AC 380-440 V AC |
| Frequency | 50 or 60 Hz |
| Operating temperature | -25°C to +80°C |
| IP Protection | IP52 |
| Burden | 1 VA (100-125 V AC) 2 VA (200-250 V AC) 3.5 VA (380-440 V AC) |
| DC | |
| Display | 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

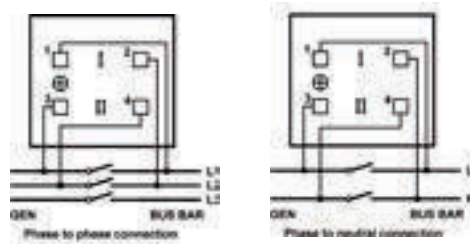
GENERAL SPECIFICATION

| | |
|--|--|
| 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 | - |
| Standard input ranges | | | | |
| 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% | | | |
| Scaling | | | | |
| 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.

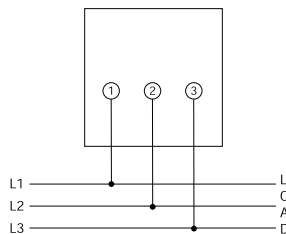
| | |
|-----------|--|
| Voltage | 151/300 V, 301/500 V 100/150 V (Model 244-12P only) |
| Frequency | 50/60 Hz |
| Burden | 2.5 VA/phase |

DIMENSIONS

| | | |
|--------------------------|---------|---------|
| Bezel size mm | 72 | 96 |
| Product codes | | |
| 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

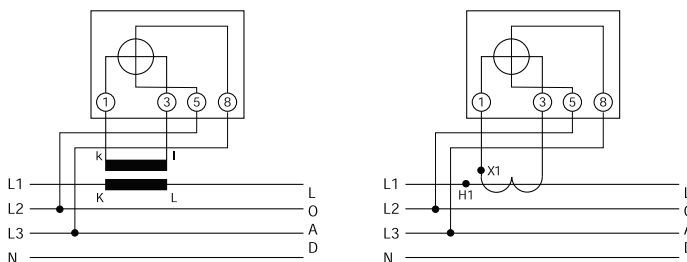
| | | |
|--------------------------------|----------|----------|
| Bezel size mm | 72 | 96 |
| Scale length mm | 65 | 94 |
| Product codes | | |
| 3-phase 3/4-wire balanced load | E243-42A | E244-42A |

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

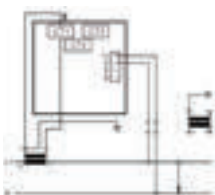
- AC switchgears, panels and distribution boards
- Control boards
- Generator sets

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



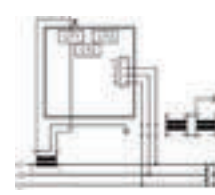
3-phase 4-wire (3P/4W) balanced



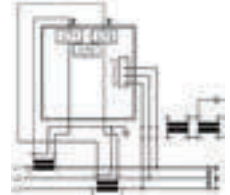
3-phase 4-wire (3P/4W) unbalanced



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.

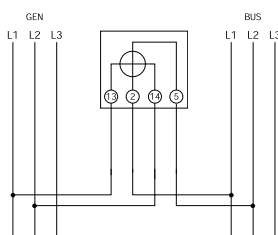
DIMENSIONS

| 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) |
| Product codes | | | |
| 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 |

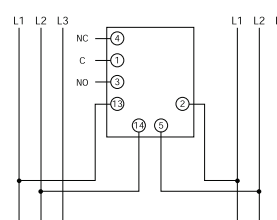
For the 244-14L and 244-14D models, the generator voltage is compared to the nominal input (bus) voltage specified at time of ordering. For the 244-14G and 244-14H models, the generator voltage is compared to the measured bus voltage.

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 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

BENEFITS

- Easy to operate
- High visibility
- Terminal cover included
- Low self consumption
- Internal power supply from voltage input
- 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 |
| 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 |
| Standard input ranges | | | | | |
| 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 | $P = U(L-N) \times I_p \times \cos$ | $P = 230 V \times 50A \times 0.9 = 10350 W = 10.35 kW$ | 10 kW |
| 3-phase 4-wire, direct voltage connection (balanced or unbalanced) | $P = 3 \times U(L-N) \times I_p \times \cos$ | $P = 3 \times 230 V \times 400 A \times 0.95 = 262200 W = 262,2 kW$ | 250 kW |
| 3-phase 3-wire, direct voltage connection (balanced or unbalanced) | $P = 1.732 \times U(L-L) \times I_p \times \cos$ | $P = 1.732 \times 400 V \times 1000 A \times 0,9 = 623520 W = 623,52 kW$ | 600 kW |
| 3-phase 4-wire, voltage connection via VT (balanced or unbalanced) | $P = 3 \times U_p(L-N) \times I_p \times \cos$ | $P = 3 \times 5770 V \times 100 A \times 0.95 = 1644450 W = 1,64445 MW$ | 1.5 MW |
| 3-phase 3-wire, voltage connection via VT (balanced or unbalanced) | $P = 1.732 \times p(L-L) \times I_p \times \cos$ | $P = 1.732 \times 30000 V \times 50 A \times 0,9 = 2338200 W = 2,3382 MW$ | 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 |
| 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, 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

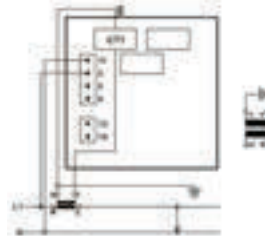
Wattmeters and varmeters wiring diagrams



WIRING DIAGRAMS OF WATTMETERS AND VARMETERS

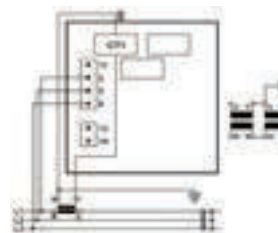
Single-phase, direct or VT voltage connection

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



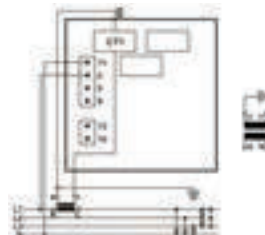
3-phase 3-wire balanced, direct or VT voltage connection

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



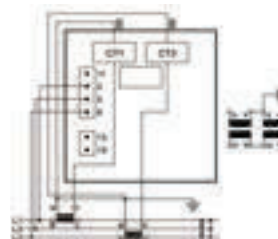
3-phase 4-wire balanced, direct or VT voltage

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



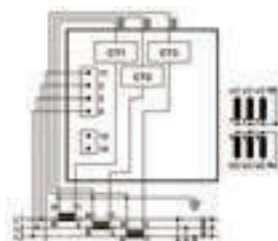
3-phase 3-wire unbalanced, direct or VT voltage connection

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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