



# CROMPTON INSTRUMENTS ANALOGUE METERS



# ANALOGUE INSTRUMENTS

## HIGH QUALITY ANALOGUE INSTRUMENTS DESIGNED TO MEASURE AN EXTENSIVE RANGE OF ELECTRICAL AND ELECTRONIC PARAMETERS.

This comprehensive range offers DIN instruments, ANSI switchboard meters, panel indicators, sealed and Ruggedised instruments, and complementary selector switches for line-to-line and line-to-neutral readings.

Our instruments are precision engineered and robust in design, ensuring accurate measurement and display in the most demanding of environments. All instruments are available in a range of styles, sizes and specifications to meet the exacting needs of your industry.



### Features

- Extensive range
- Accurate measurement and display of electrical and electronic parameters
- Wide range of case styles and specifications
- Maximum reliability in harsh environments

### Benefits

- Low cost
- Local indication
- Ease of installation
- Minimal training
- Low maintenance
- Reasonable accuracy

### Applications

- Switchgear
- Distribution systems
- Generator sets
- Control panels
- Energy management
- Building management
- Utility power monitoring
- Process control
- Secondary metering

### Approvals

- UL, CSA, ABS, LRS, BV

### Contents

#### **DIN Panel Meters** ..... 2-26

An extensive range of 48, 72, 96 and 144 mm DIN style panel meters. Short-scale ammeters, voltmeters and frequency meters incorporate slide-in dials and terminal covers. Long-scale meters are also available. Meters for power or energy contain in-built transducers and can be customised to suit many different system configurations and ranges.

#### **Instrument Selector Switches** ..... 27

Panel mounted selector switches offering a 7-position voltmeter switch and a 4-position ammeter switch for reading line-to-line or line-to-neutral voltage and phase current.

#### **Saxon Series Panel Indicators** ..... 28-29

A range of 2½", 3½" and 4½" surface mount panel meters utilising pivot and jewel mechanisms and offering IP54 protection. The range offers iron vane and moving coil AC and DC ammeters and voltmeters, elapsed time and frequency meters. UL approvals.

#### **016 Series Fiesta Panel Indicators** ..... 30-32

A robust range of short-scale 3½" surface mount panel meters offering IP55 protection and featuring wide-view contoured windows. The range offers iron vane and moving coil AC and DC ammeters and voltmeters, elapsed time and frequency meters. UL approvals.

#### **Challenger Analogue Panel Meters** ..... 33-37

Challenger analogue panel meters feature a detachable lower fascia plate, which allows either surface or window mounting. Meters use a high torque pivot and jewel movement.

#### **Sealed and Ruggedised Panel Indicators** ..... 38-41

Designed to comply with industrial, marine and military specifications, these 240° and 90° scale meters are resistant to extreme shock, vibration, temperature, dirt and humidity. The range offers a wide range of bezel sizes fitted with toughened glass.

# DIN PANEL METERS - SHORT SCALE



## Features

- A range of the most popular short-scale measuring instruments in 4 case sizes
- Shock resistant sprung pivot and jewel movement
- Terminal covers supplied as standard
- EMC hard frequency meters are fully EMC and LVD compliant
- 1/4" 'fast on' terminals available

## Benefits

- Low cost
- Local indication
- Ease of installation
- Minimal training
- Low maintenance
- Customised options and features

## Applications

- Switchgear
- Distribution systems
- Generator sets
- Control panels
- Energy management
- Building management
- Utility power monitoring
- Process control
- Motor control

A range of 48, 72, 96 and 144mm DIN style panel meters measuring all electrical parameters and featuring moving coil or moving iron movements. All meters incorporate slide-in dials and terminal covers as standard. A range of customised options is available.

## Movements

### Moving Coil Meter

Centre cored, self shielding moving coil movement, using pivots, hairsprings and sprung jewels. Seven variations have been designed in movement ranges: all intermediate ranges are achieved by shunting the next lowest range. All DC voltmeters are 1000 ohms per volt, rectified product run at 900 ohms per volt, millivolt meters use the 5 milliamp movement.

### Moving Iron Meter

Clapper type repulsion design using pivots, hairsprings and jewel movements. The bottom jewel is oil filled to provide damping while the top is sprung for resilience. All voltmeters are manufactured with external voltage dropper resistors to substantially reduce the self heating effects.

### Frequency Meter

Meter uses a 100 microamp 4000 ohm movement driven by an EMC hard frequency conversion circuit.

### Dials, Scales and Pointers

Standard dials are white matt with black printed scales and bar knife-edge pointers. Black dials with white or yellow scales and pointers are also available. Interchangeable slide-in dials are used on the E242, E243, E244 and E246 90° moving iron, moving coil and frequency meter models.

General options include red supplementary pointers, red indexes (quadrant scales), red, green or blue lines, bands or segments, finely spaced divisions, multi-scales, special scales and captions to customer's requirements.

## Specifications

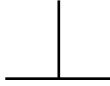
Type of instrument	Moving iron for current and voltage	Moving coil for current and voltage	Moving coil with rectifiers for current and voltage	Moving coil with built-in transducer for frequency measurement	Maximum demand indicators	Combined MD with moving iron movement
<b>Format</b>	48 x 48mm 72 x 72mm 96 x 96mm 144 x 144mm	48 x 48mm 72 x 72mm 96 x 96mm 144 x 144mm	48 x 48mm 72 x 72mm 96 x 96mm 144 x 144mm	72 x 72mm 96 x 96mm 144 x 144mm	72 x 72mm 96 x 96mm	96 x 96mm
<b>Movement type</b>	Sprung pivot jewel with silicon oil damping	Sprung pivot jewel with eddy current damping	Sprung pivot jewel with eddy current damping	Sprung pivot jewel with eddy current damping	Sprung pivot jewel with silicon oil damping	Sprung pivot jewel with silicon oil damping
<b>Burden</b>	0.5VA-15A then 0.8VA voltmeters 4.5VA	See detailed specifications	See detailed specifications	See detailed specifications	2.5VA	3VA
<b>Accuracy</b>	1.5% to DIN43780	1.5% to DIN43780	2.5% to DIN43780	0.5% to DIN43780	3%	3% on MDI 1.5% ammeter
<b>Input type</b>	AC current or voltage	DC current or voltage	AC current or voltage	AC voltage	AC current	AC current
<b>Measuring range</b>	6-600V 100mA-100A 48mm only up to 40A	50mV-600V 100µA-40A, 48mm only 25A	15-600V 1mA-100mA and 1A & 5A	57.7V @ 45Hz 500V @ 44Hz	0-1/1.2A or 0-5/6A 8, 15 or 20 minute delays	1-6A 8, 15 or 20 minute delays 0-5A/6A instantaneous
<b>Dielectric voltage withstand test</b>	3kV AC	3kV AC	3kV AC	3kV AC	3kV AC	3kV AC

## Approvals

- Lloyds:  
03/00055 - Moving coil meters  
03/00056 - Moving iron meters  
03/00057 - Frequency meters
- UL file No E203000

## 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

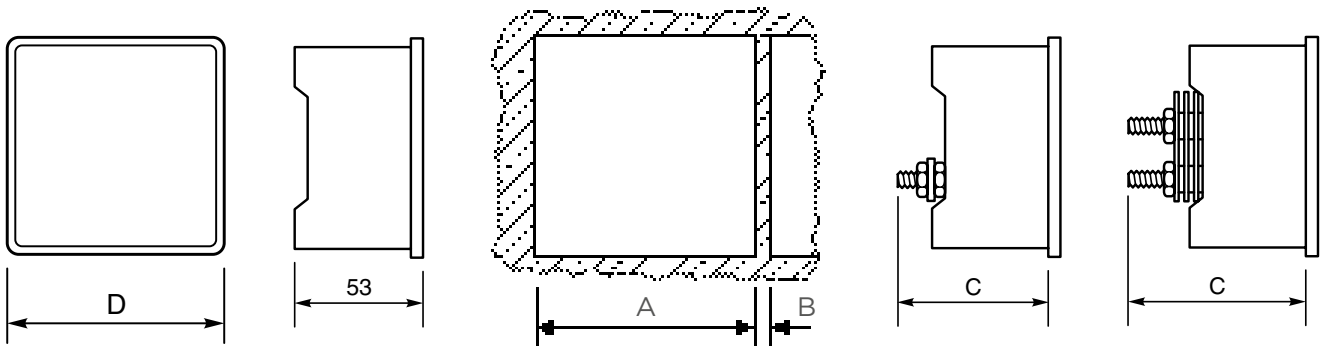
Performance:	BS EN60051
Measuring ranges:	DIN43701
Accuracy overload:	BS EN60051
Dimensions:	DIN43700
Scale marking generally to:	DIN43802
Magnetic influence:	BS EN60051
Safety:	BS EN61010-1
Terminals:	Clamp strap M4 for up to 25A. Clamp strap M8 for over 25A 1/4" spade terminals available for models E243 and E244
Humidity range:	Up to 95% RH (non condensing)
Test voltage @50Hz:	3kV 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-O
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 40mm 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 315° is permissible
Insulation group:	Insulation resistance more than 5Ω@ 500V
Environmental:	Measurement category III IEC 1010-1 Pollution degree 2 IEC 1010-1 Electrical rating 600V RMS (920V peak)
Approvals:	EMC, LVD and Lloyds

## Dimensions

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

Max. panel thickness = 40mm

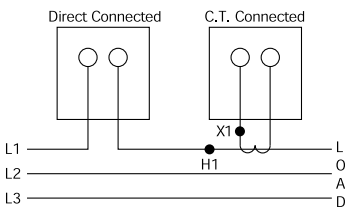
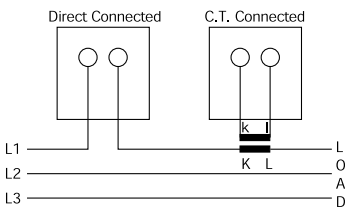
D	A	B
48 x 48	45 x 45	4
72 x 72	68 x 68	4
96 x 96	92 x 92	4
144 x 144	138 x 138	4



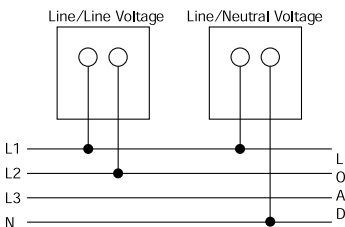


## Connections

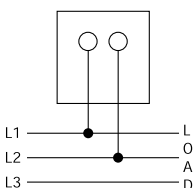
### AC Ammeter



### AC Voltmeter



## Connections



## 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 -/1A or -/5A current transformers, whilst voltmeters can be scaled for use with voltage transformers. Meters can be used to measure DC at reduced accuracy.

### Specifications

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

### 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

## Frequency Meters

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

### Specifications

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

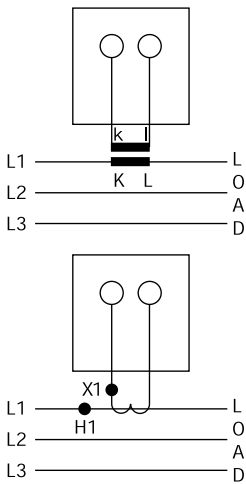
### Product Codes

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



## Connections

### Maximum Demand Indicators



## 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.

### Specifications

Accuracy:	Class 3
Options:	5A for use with separate CT 5/5A saturating CT 1/5A saturating CT
Burden at 50Hz:	MDI - 2.5VA, CT - 2VA
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:	50/60Hz

### 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 5A CT	E243-16B	E244-16B
<b>15 minute time lag</b>		
without limiting CT for use with 5A CT	E243-16A	E244-16A
<b>20 minute time lag</b>		
without limiting CT for use with 5A CT	E243-16J	E244-16J

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

## Combined AC Ammeter and Maximum Demand Indicator

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.

### Specifications

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

### Product Codes

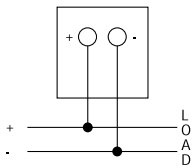
Bezel size mm	72	96
Scale length mm*	65	94
<b>Product codes</b>		
<b>8 minute time lag</b>		
without limiting CT for use with 5A CT 3VA	-	E244-16Q
<b>15 minute time lag</b>		
without limiting CT for use with 5A CT 3VA	E243-16C	E244-16C
<b>20 minute time lag</b>		
without limiting CT for use with 5A CT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

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

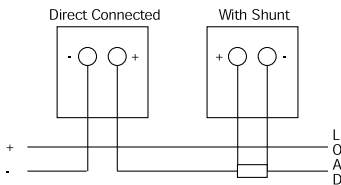


## Connections

### DC Voltmeter

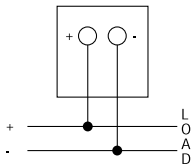


### DC Ammeter

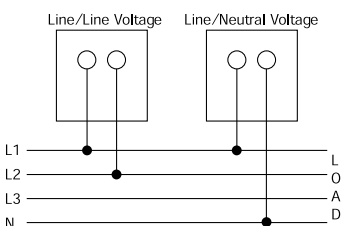


## Connections

### AC Ammeter



### AC Voltmeter



## Moving Coil DC Ammeters and Voltmeters

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.

### Specifications

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

### Product Codes

Bezel size mm	48	72	96	144
Scale length mm	42	65	94	145
<b>Product codes</b>				
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

## Moving Coil 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.

### Specifications

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

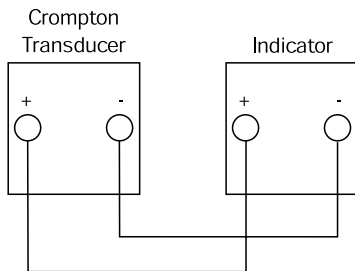
### Product Codes

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





### Connections



## 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.

### Specifications

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

### Product Codes

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



## Features

- Integral selector switch
- True RMS measurement
- Slide-in dials
- 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

## Benefits

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

## Applications

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

## Compliant with

- IEC61010-1B2001, EMC and LVD

## Moving Iron AC Ammeters and Voltmeters with Selector Switch

These 96mm and 72mm 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. Both ammeters and voltmeters feature a slide-in dial, scaled for VT or CT values to suit application primary values.

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	72mm	0/5 A AC	OFF L1 L2 L3
E244-02E-G-LS**-C7-AMP3	96mm	0/5 A AC	OFF L1 L2 L3
E243-022E-G-LS**-C7-AMP3	72mm	0/5/10A AC	OFF L1 L2 L3
E244-022E-G-LS**-C7-AMP3	96mm	0/5/10A AC	OFF L1 L2 L3
E243-02E-G-LA**-C7-AMP3	72mm	0/1 A AC	OFF L1 L2 L3
E244-02E-G-LA**-C7-AMP3	96mm	0/1 A AC	OFF L1 L2 L3
E243-022E-G-LA**-C7-AMP3	72mm	0/1/2A AC	OFF L1 L2 L3
E244-022E-G-LA**-C7-AMP3	96mm	0/1/2A AC	OFF L1 L2 L3

\*\*Insert applicable CT primary value.

### Product Codes – AC Voltmeters with Selector Switch

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

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

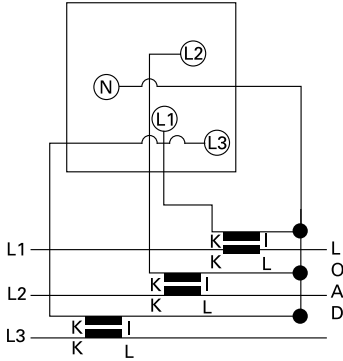
### Product Codes – Options

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

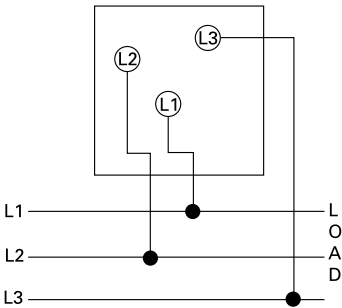
Please state any required options at time of ordering.

## Connections

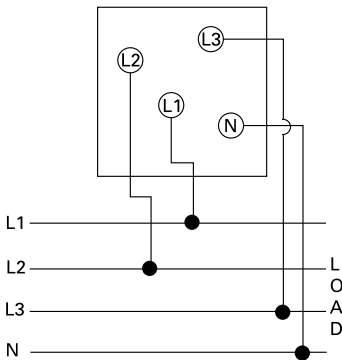
### AC Ammeter with Selector Switch



### AC Voltmeters 3-phase 3-wire



### AC Voltmeters 3-phase 4-wire

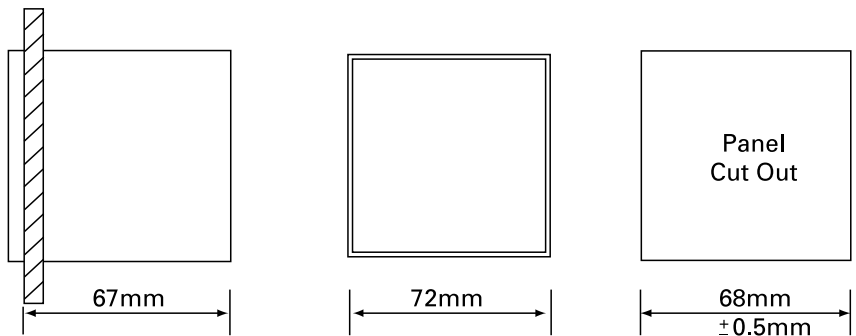


## General Specifications

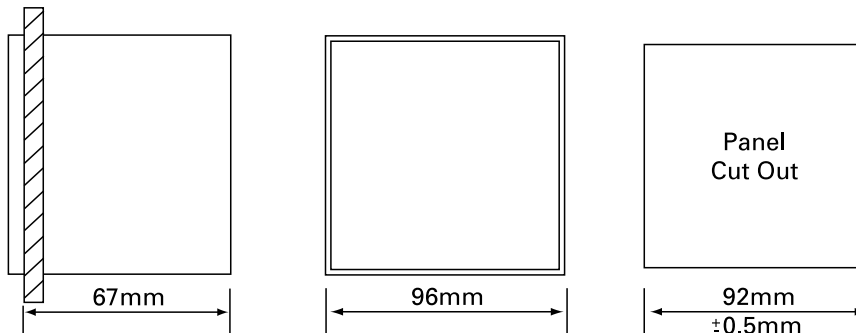
Accuracy:	1.5% of full scale deflection (FSD)
Input rating:	Ammeter: 1A, 5A 1/2A or 5/10A moving iron, direct connected Voltmeter: 120, 300, 500 and 600V AC
Frequency:	50 or 60Hz (400Hz on request)
Burden at 50Hz:	Ammeters: 0.5VA Voltmeters: 4-5VA max
Overload ammeter:	2 x I <sub>n</sub> continuous for 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: 54mm DIN96: 97mm
Enclosure style:	Panel mount to DIN42700
Enclosure material:	Grade UL94 VO
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: 96mm high x 96mm wide x 63mm deep 72DIN: 72mm high x 72mm wide x 63mm deep
Panel cut out:	DIN96: 92mm x 92mm DIN72: 68mm x 68mm
IP protection:	IP40
Weight:	E243-02E 275g E243-02Q 300g E244-02E 360g E244-02Q 390g

## Dimensions

### 72DIN Models



### 96DIN Models



# DIN PANEL METERS - LONG SCALE



## Benefits

- Local indication
- Ease of installation
- Minimal training
- Low maintenance
- Customised options and features

## Applications

- Switchgear
- Distribution systems
- Generator sets
- Control panels
- Energy management
- Building management
- Utility power monitoring
- Process control
- Motor control

A range of 48mm, 72mm and 96mm DIN style panel meters measuring all electrical parameters and featuring moving coil movements. All meters incorporate slide-in dials and terminal covers as standard. A range of customised options is available.

## Movements

### Moving Coil Meter

Centre cored, self shielding moving coil movement, made of light quality material which is not sensitive to external electromagnetic fields and is resistant to mechanical impacts and vibrations. All voltmeters are 1000 ohms per volt.

### Frequency Meter

Meter uses a 100 microamps 4000 ohm movement driven by an EMC hard frequency conversion circuit.

### Dials, Scales and Pointers

Standard dials are white matt with black printed scales and bar knife-edge pointers. Black dials with white or yellow scales and pointers are also available. Interchangeable slide-in dials are used on the M242, M243 and M244 240° moving coil and frequency meter models.

Standard options include red supplementary pointers, and non-reflecting glass.

## 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 15A. Clamp strap M6 for 15 to 40A.
Humidity range:	Up to 75% RH (non condensing)
Test voltage @50Hz:	2kV RMS for 1 minute
Overload AC current:	x 1.2 continuous, or x 10 for 5 seconds max
AC voltage and frequency:	x 1.2 continuous, or x 2 for 5 seconds max
Standard calibration:	23°C. Calibration at other temperatures available on request
Operating temperature:	-10°C to +55°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-O
Bezel:	Slim-line DIN43802, black as standard
Bezel window:	Standard sheet glass, with zero adjusters where appropriate. Non reflecting glass and polycarbonate windows are available
Installation:	Installations in switchboard panel or mosaic arrangement on equipment or machine with a panel thickness of up to 40mm in a horizontal or vertical plane
Fixing on panel:	2 captive fasteners (optional 4 on request)
Mounting position:	Normal vertical mounting or as indicated on the scale in accordance with DIN16257. A deviation of 315° is permissible
Insulation group:	Insulation resistance more than 5MΩ@ 500V
Environmental:	Measurement category III IEC 1010-1 Pollution degree 2 IEC 1010-1 Electrical rating 600V RMS (920V peak)
Approvals:	EMC and LVD, BV Approval

## DIN16257 symbol meaning for calibration position

Vertical



Horizontal



Inclined

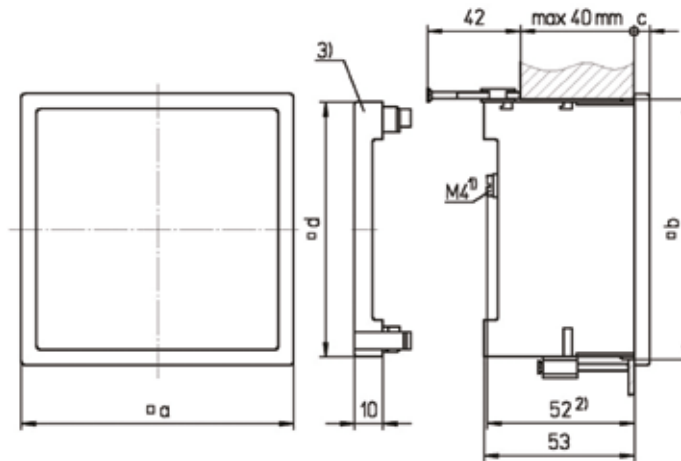


Inclination of dial surface.

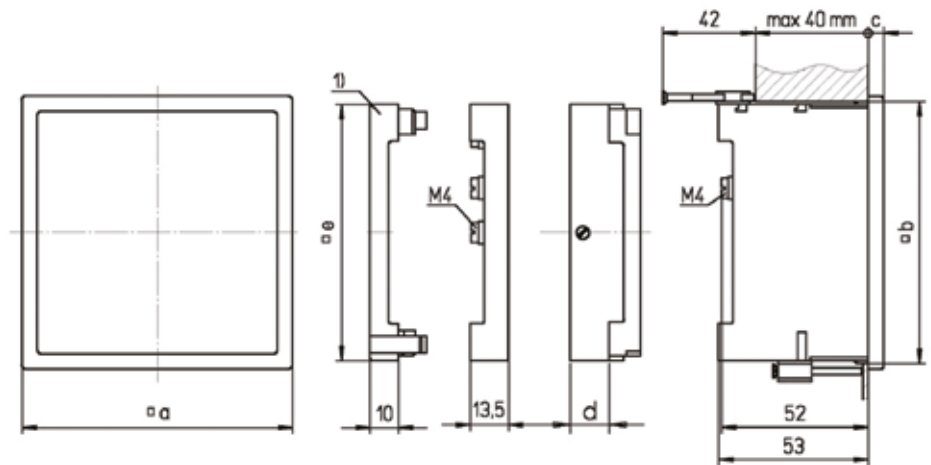
Required orientation must always be stated when ordering if other than vertical mounting is required.

## Product Dimensions

Description		M242-01*, M242-02*, M242-05*	M243-01*, M243-02*, M243-05*	M244-01*, M244-02*, M244-05*, M244-41R*, M244-41E*, M244-41L*, M244-41D*, M244-80*	M246-01*, M246-02*, M246-05*
Bezel (mm)	a	48	72	96	144
Panel cut out (mm)	b	45 (+0.6)	68 (+0.8)	92 (+0.8)	138 (+1.0)
Bezel height (mm)	c	5.0	5.5	5.5	8.0
Terminal cover (mm)	d	42.5	66.5	90	90



M242-01\*, M242-02\*, M242-05\*, M243-01\*, M243-02\*, M243-05\*, M244-01\*, M244-02\*, M244-41R\*, M244-41E\*, M244-05\*, M246-01\*, M246-02\*, M246-05\*



M244-41L\*, M244-41D\*, M244-41S\*, M244-80\* (d = 27.3 mm)



## Features

- Measures AC current or voltage
- CT connected ammeters
- Direct and VT connected voltmeters
- Linear scaling
- 240° long scale version
- x6 overload

## Benefits

- Easy to operate
- Exchangeable dial
- Low consumption
- Terminal cover included

## Applications

- AC switchgears, panels and distribution boards

## Construction

- Mean value measurement of current or voltage
- Containing germanium diodes of low reverse current
- Slot in screw fixing

## Standards

- CE marked
- BV approved

# Long Scale Moving Coil Rectified AC Ammeter and Voltmeters

## General Specification

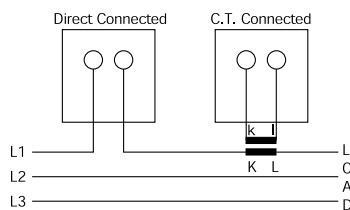
- Accuracy class - 1.5
- Maximum continuous overload -  $1.2 \times I_n$ ,  $1.2 \times U_n$
- Maximum short duration overload -  $10 \times I_n - 9 \times 0.5s + 1 \times 5s/60s$   
 $2 \times U_n - 9 \times 0.5s + 1 \times 5s/60s$
- Frequency - 50/60Hz

## Product Codes

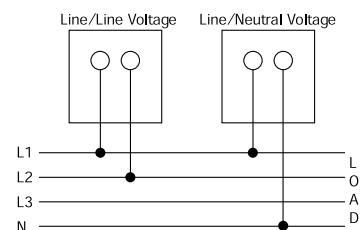
Bezel size (mm)	48	72	96	144
Scale length (mm)	71	113	155	235
AC ammeter rectified 240°	M242-05B	M243-05B	M244-05B	M246-05B
AC voltmeter rectified 240°	M242-05W	M243-05W	M244-05W	M246-05W
AC ammeter rectified 240° x6 overload		M243-056B	M244-056B	
<b>Standard input ranges</b>				
AC ammeter rectified 240° scaling (0/x A) meter (0/x A), (0/ x A x6), 1, 5A M243, M244	1, 5A (M242-05B delivered with separated current transformer)			
AC voltmeter rectified 240° scaling (0/x V)	20, 15, 20, 30, 60, 100, 150, 250, 300 (limit at M242). 400, 500, 600 V			
AC voltmeter for VT connection (0/x V)	120V (for use with VT`s x/100V), 132V (for use with VT`s x/110V), 144V (for use with VT`s 120V), 125V, 137,5V, 150V (for use with some VT`s having primary voltage less then 1kV)			

## Connection Diagrams

### AC Ammeter



### AC Voltmeter



## Order data/examples

### Ammeter

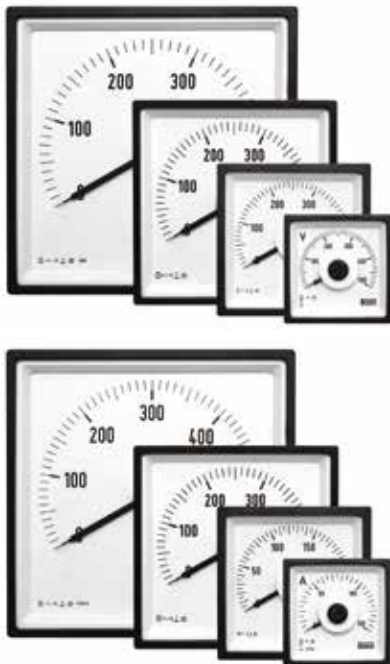
- 1) Select type: M243-05B,
- 2) Specify input: 0-1A,
- 3) Specify scaling: 0-1kA,
- 4) Specify frequency: 50/60Hz

### Voltmeter

- 1) Select type: M244-05W,
- 2) Specify input: 0-500V,
- 3) Specify scaling: 0-500V,
- 4) Specify frequency: 50/60Hz

### Voltmeter, VT connected

- 1) Select type: M244-05W,
- 2) Specify input: 0-120V,
- 3) Specify scaling: 0-12kV,
- 4) Specify frequency: 50/60Hz,
- 5) Specify VT ratio: 10/0.1 kV



## Features

- Measures DC current or voltage
- Direct and shunt connected ammeters
- Direct connected voltmeters
- Live zero ammeters and voltmeters
- Centre zero ammeters and voltmeters
- Linear scaling
- 240° long scale version

## Benefits

- Easy to operate
- Exchangeable dial
- Terminal cover included

## Applications

- DC switchgears, panels and distribution boards
- Control boards
- Process indication
- Battery supervision

## Construction

- Magnet core none sensitive to external fields
- Slot in screw fixing

## Standards

- CE marked
- BV approved

# DC Ammeters and Voltmeters

## General Specification

- Accuracy class - 1.5
- Maximum continuous overload -  $1.2 \times I_n$ ,  $1.2 \times U_n$
- Maximum short duration overload -  $10 \times I_n$  -  $9 \times 0.5s + 1 \times 5s / 60s$ ,  $2 \times U_n$  -  $9 \times 0.5s + 1 \times 5s / 60s$

## Product Codes

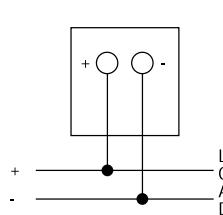
Bezel size (mm)	48	72	96	144
Scale length (mm)	71	113	155	235
DC ammeter 240°	M242-05A	M243-05A	M244-05A	M246-05A
DC voltmeter 240°	M242-05V	M243-05V	M244-05V	M246-05V
DC ammeter 240° live zero	M242-05R	M243-05R	M244-05R	M246-05R
DC voltmeter 240° live zero	M242-05S	M243-05S	M244-05S	M246-05S
DC ammeter 240° centre zero	M242-05C	M243-05C	M244-05C	M246-05C
DC voltmeter 240° centre zero	M242-05N	M243-05N	M244-05N	M246-05N

## Standard input ranges

DC ammeter 240° scaling (0/x A)	1, 1.5, 2.5, 4, 5, 6, 10, 15, 20, 25 (limit on M242), 30, 40, 50, 60 A
DC ammeter 240° scaling, process and shunt indicators	0-1, 0-5, 0-10, 0-20, 4-20 mA, 0-50, 0-60, 0-75 mV
DC ammeter 240° scaling, centre zero (x-0-x A)	1-0-1, 1.5-0-1.5, 2.5-0-2.5, 4-0-4, 5-0-5, 6-0-6, 10-0-10 (limit on M242), 15-0-15, 20-0-20, 25-0-25, 30-0-30A
DC ammeter 240° scaling, centre zero process and shunt indicators	1-0-1, 5-0-5, 10-0-10, 20-0-20 mA, 50-0-50, 60-0-60, 75-0-75 mV
DC voltmeter 240° scaling (0/x V)	10, 15, 20, 30, 60, 100, 150, 250, 300 (limit on M242), 400, 500, 600 V
DC voltmeter 240° scaling, process indicators	1-5, 2-10 V
DC voltmeter 240° scaling, centre zero (x-0-x V)	10-0-10, 15-0-15, 20-0-20, 30-0-30, 60-0-60, 100-0-100, 150-0-150 (limit on M242) 250-0-250, 300-0-300 V

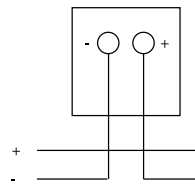
## Connection Diagrams

### DC Voltmeter

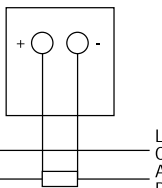


### DC Ammeter

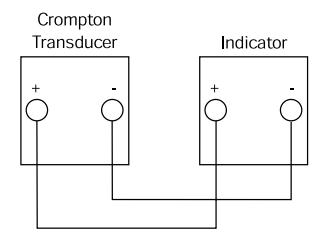
#### Direct Connected



#### With Shunt



### Transducer Indicator



## Order data/examples

### Ammeter

Example A

- 1) Select type: M243-05A,
- 2) Specify input: 0-10 A,
- 3) Specify scaling: 0-10 A

Example B

- 1) Select type: M244-05R,
- 2) Specify input: 4-20 mA,
- 3) Specify scaling: 0-100 MVA

Example C

- 1) Select type: M244-05C,
- 2) Specify input: 60-0-60 mV,
- 3) Specify scaling: 150-0-150 A

### Voltmeter

Example A

- 1) Select type: M244-05V,
- 2) Specify input: 0-15 V,
- 3) Specify scaling: 0-15 V

Example B

- 1) Select type: M244-05S,
- 2) Specify input: 2-10 V,
- 3) Specify scaling: 0-100 %

Example C

- 1) Select type: M242-05N,
- 2) Specify input: 10-0-10 V,
- 3) Specify scaling: 20-0-20 A



## Features

- Measures AC frequencies
- Pointer type available as 240° long scale version
- Reed type available with
  - 13 reeds (47-53Hz, 57-63Hz)
  - 21 reeds (45-55Hz, 55-65Hz)
- Direct or VT connected

## Benefits

- Easy to operate
- High visibility
- Terminal cover included

## 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

## Standards

- CE marked
- BV approved

# Frequency Meters with Pointer or Reeds

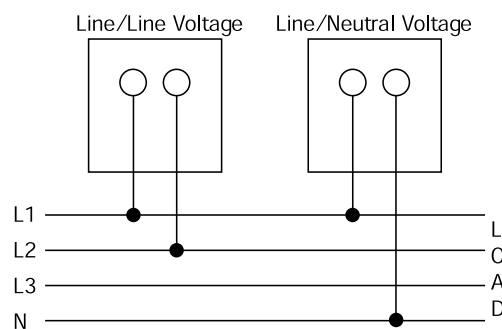
## General Specification

- Accuracy class - 0.5 - 1.2 x Un continuously
- Overload - 1.5 x Un for 2 hours (pointer type only) - 2 x Un for 5 seconds - 1 VA at nominal voltage 57-110 V and 230 V
- Burden pointer type - 1.7 VA at nominal voltage 400V - 2VA at nominal voltage 500V
- Burden 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	96
Scale length (mm)	95	135	-	-
Frequency meter 240°	-	M244-41L	-	-
Frequency meter 13 reeds	-	-	M244-41R	-
Frequency meter 21 reeds	-	-	-	M244-41R
<b>Standard input ranges</b>				
Pointer type	57-110 V, 400V +/- 20%, 500V +/-20%			
Reed type	100V, 110V, 230V, 400V +/- 20%, 500V +/-20%			
<b>Scaling</b>				
13 reeds on reed type meters with scaling	47-50-53Hz, 57-60-63Hz			
21 reeds on reed type meters with scaling	45-50-55Hz, 55-60-65Hz			
Scaling 240° pointer types	45-50-55Hz, 55-60-55Hz, 45-55-65Hz			

## Connection Diagrams



## Order data/examples

### Pointer type 240°

- 1) Select type: M244-41L,
- 2) Specify input voltage: 57-110V,
- 3) Specify frequency: 45/65Hz,
- 4) Specify scaling: 45-55-65Hz

### Reed type 13 reeds

- 1) Select type: M244-41R,
- 2) Specify input voltage: 230V,
- 3) Specify frequency: 47/53Hz,
- 4) Specify scaling: 47-50-53Hz

### Reed type 21 reeds

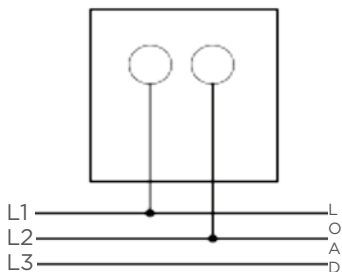
- 1) Select type: M244-41R,
- 2) Specify input voltage: 110V,
- 3) Specify frequency: 55/65Hz,
- 4) Specify scaling: 55-60-65Hz



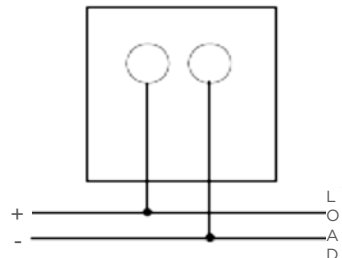
# ELAPSED TIME METERS (HOURS RUN METERS)



Elapsed Time/Hours Run Meters AC



Elapsed Time/Hours Run Meters DC



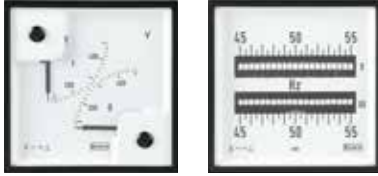
Elapsed time meters (ETM) or hours-run meters monitor “ON/RUN” time of plant and equipment, allowing the user to effectively control production efficiency, cost estimation and service period monitoring for preventative maintenance. Time is measured in increments of 0.01h up to 99999.99 hours after which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

## Specifications

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

Bezel size product codes	48mm	72mm	96mm
100-125V AC 50Hz	M242-155-G-PL-ZH-C5	M243-155-G-PL-ZH-C5	M244-155-G-PL-ZH-C5
200-250V AC 50Hz	M242-155-G-RN-ZH-C5	M243-155-G-RN-ZH-C5	M244-155-G-RN-ZH-C5
380-440V AC 50Hz	M242-155-G-RY-ZH-C5	M243-155-G-RY-ZH-C5	M244-155-G-RY-ZH-C5
100-125V AC 60Hz	M242-156-G-PL-ZH-C6	M243-156-G-PL-ZH-C6	M244-156-G-PL-ZH-C6
200-250V AC 60Hz	M242-156-G-RN-ZH-C6	M243-156-G-RN-ZH-C6	M244-156-G-RN-ZH-C6
380-440V AC 60Hz	M242-156-G-RY-ZH-C6	M243-156-G-RY-ZH-C6	M244-156-G-RY-ZH-C6
6-30V DC	-	M243-157-G-BU-ZH-DC	M244-157-G-BU-ZH-DC
12-36V DC	M242-157-G-BU-ZH-DC	-	-
10-80V DC	-	M243-157-G-NR-ZH-DC	M244-157-G-NR-ZH-DC
36-80V DC	M242-157-G-NR-ZH-DC	-	-
110V DC	M242-157-G-PM-ZH-DC	M243-157-G-PM-ZH-DC	M244-157-G-PM-ZH-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 (45-55Hz, 55-65Hz)
- Direct or VT connected

## Benefits

- Easy to operate
- High visibility
- Terminal cover included

## 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

## Standards

- CE marked
- BV approved

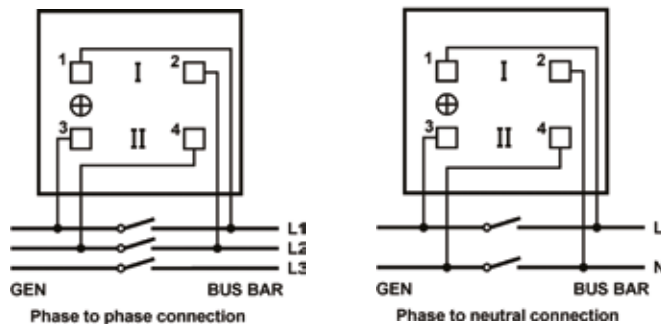
## General Specification

- 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 57-110V and 230 V - 1.7 VA at nominal voltage 400V - 2 VA at nominal voltage 500V
- Burden frequency meter - reed type - 0.7 ... 1.2 VA at nominal voltage 110-230V - 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)	300V, 500V			
Dual voltmeter (VT connected)	120V (for use with VT's x/100V), 132V (for use with VT's x/110V), 144V (for use with VT's 120V), 125V, 137.5V, 150V (for use with some VT's having primary voltage less than 1kV)			
Dual frequency meter - pointer type	57-110 V, 400V +/- 20%, 500V +/-20%			
Dual frequency meter - reed type	100V, 110V, 230V, 400V +/- 20%, 500V +/-20%			
<b>Scaling</b>				
Dual voltmeter	Specify to suit application			
Dual frequency meter - pointer type	45-50-55Hz, 55-60-55Hz, 45-55-65Hz			
Dual frequency meter - reed type	45-50-55Hz, 55-60-65Hz			

## Connection Diagrams



## Order data/examples

### Dual voltmeter - LV direct connected

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

### Dual voltmeter - VT connected

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

### Dual frequency meter - pointer type

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

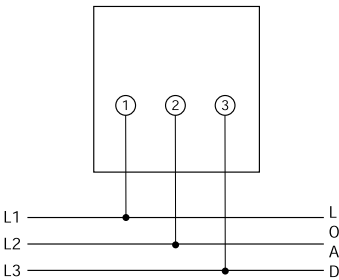
### Dual frequency meter - reed type

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

# PHASE SEQUENCE INDICATORS



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

## Dimensions

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

# 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.

## Specifications

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

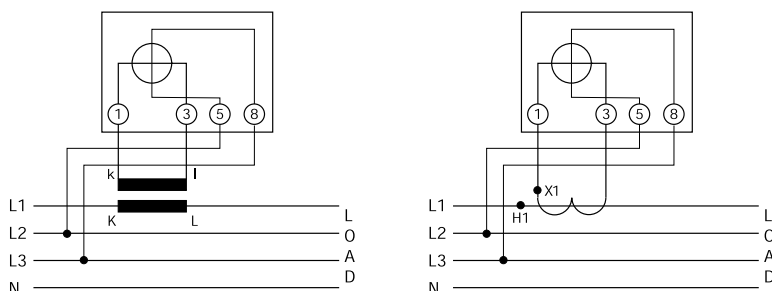
## Product Codes - Short-Scale Models

### 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

## 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

## Benefits

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

## 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

## Standards

- CE marked
- BV approved

## Order data/examples

### Single-phase

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

### 3-phase 4-wire balanced

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

## General Specification

- 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
- Voltage burden -  $<0.1V_A$  per phase
- Current burden -  $<0.1V_A$  per phase
- Frequency - 50/60Hz

## Product Codes

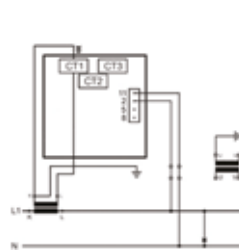
Bezel size (mm)	96	96	96	96	96
Scale length (mm)	95	95	95	95	95
Power factor meter 90°	M244-420 single-phase	M244-421 3P/3W balanced	M244-42C 3P/4W balanced	M244-423 3P/3W unbalanced	M244-424 3P/4W unbalanced
Bezel size (mm)	96	96	96	96	96
Scale Length (mm)	135	135	135	135	135
Power factor meter 240°	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

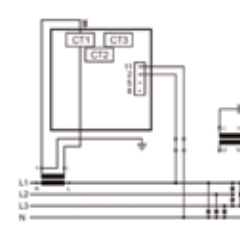
Single-phase, 3P/4W balanced, 3P/4W unbalanced	57.7V L-N/1A, 57.7V L-N/5A, 63.5V L-N/1A, 63.5V L-N/5A, 69.3V L-N/1A, 9.3V L-N/5A, 230V L-N/1A, 230V L-N/5A, 240V L-N/1A, 240V L-N/5A, 254V L-N/1A, 254V L-N/5A
3P/3W balanced, 3P/3W unbalanced	100V L-L/1A, 100V L-L/5A, 110V L-L/1A, 110V L-L/5A, 400V L-L/1A, 400V L-L/5A, 415V L-L/1A, 415V L-L/5A, 440V L-L/1A, 440V L-L/5A
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

## Connection Diagrams

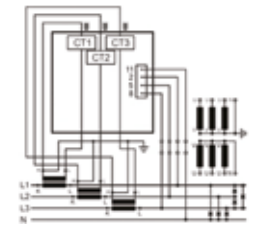
### Single-phase



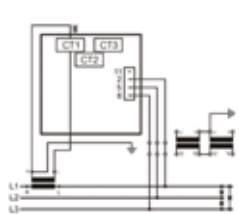
### 3-phase 4-wire (3P/4W) balanced



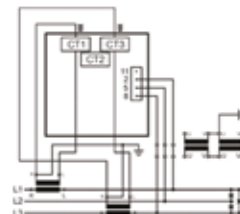
### 3-phase 4-wire (3P/4W) unbalanced



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



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



### 3-phase 4-wire unbalanced

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

### 3-phase 3-wire balanced

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

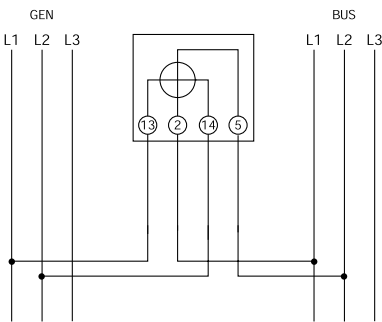
### 3-phase 3-wire unbalanced

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

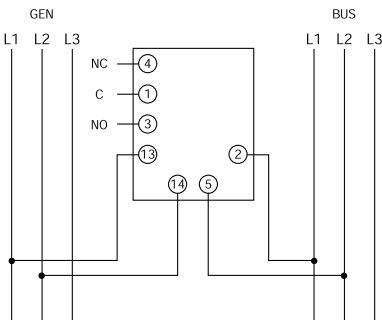
# LED SYNCHROSCOPE



## Connections 360° LED Synchroscope



## 360° LED Synchroscope and Synchro Check Relay



## 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, 480V 110/120V (115V nominal) 220/240V (230V nominal) 380/480V (430V nominal) Volts AC or via VT
Frequency:	40/65Hz
Burden at 50Hz:	4VA maximum Suitable for 1 or 3-phase systems
Safety:	IEC1010-1 (300V AC RMS installation degree 2)
Dielectric:	4kV 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 40-65Hz	Synchroscope	Synchroscope and synchro check	Synchroscope and synchro check relay (dead bus)

Product codes			
110/120V	-	244-14GG-POBX	244-14HG-POBX
220/240V	-	244-14GG-R5BX	244-14HG-R5BX
380/480V	-	244-14GG-RUBX	244-14HG-RUBX
63.5V	244-14AG-NXYY	244-14LG-NXBX	244-14DG-NXBX
110V	244-14AG-PMYY	244-14LG-PMBX	244-14DG-PMBX
220V	244-14AG-R4YY	244-14LG-R4BX	244-14DG-R4BX
230V	244-14AG-RQYY	244-14LG-RQBX	244-14DG-RQBX
240V	244-14AG-RRYY	244-14LG-RRBX	244-14DG-RRBX
380V	244-14AG-RUYY	244-14LG-RUBX	244-14DG-RUBX
400V	244-14AG-SCYY	244-14LG-SCBX	244-14DG-SCBX
415V	244-14AG-SBYY	244-14LG-SBBX	244-14DG-SBBX
440V	244-14AG-SHYY	244-14LG-SHBX	244-14DG-SHBX
480V	244-14AG-SEYY	244-14LG-SEBX	244-14DG-SEBX

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.

# SYNCHROSCOPE



## Features

- Typically used to measure between Busbar and Generator
- Available as LED indicator only, LED indicator with LCD display, LED indicator with synchro check relay, LED indicator with LCD display and synchro check relay

## Benefits

- Supports damage prevention on expensive assets
- Simple synchronisation conditions setting
- High visibility
- Terminal cover included
- Low self consumption
- Up to five meters in one unit

## Applications

- Used on manual and semi-automatic synchronising applications
- AC switchgears, panels and distribution boards
- Generator sets

## Construction

- Instruments are microprocessor based
- Slot in screw fixing

## Standards

- CE marked
- BV approved

## General Specification

### Synchronising functions

- Voltage difference setting ( $\Delta U$ ) - 1.5
- Accuracy - +/- 2.5%
- Phase difference setting - 2 ... 20° el.
- Accuracy - +/- 3° el.
- Time delay synchronisation - 0.1 ... 1 s.
- Accuracy - +/- 10%
- Synchronisation pulse duration - 300 ms
- Accuracy - +/- 30 ms
- Nominal frequency range - 45/65Hz
- Output relay specification - 250V, 6A, 50Hz, 1500 VA
- Voltage burden - <4 VA
- Overload - 1.2 x  $U_n$  permanently, 2 x  $U_n$  for 3s

### LED functions

- Resolution  $\Delta \phi$  display - 20° el.
- Magnified resolution range - +/- 15° el.
- Magnified resolution - 5° el.
- Accuracy at  $\Delta \phi = 0$  - +/- 3° el.

### LCD functions

- Accuracy voltage display - +/- 1.5%
- Accuracy frequency display - +/- 0.5%
- Phase difference accuracy Ugen to Ubb - +/- 3° el.

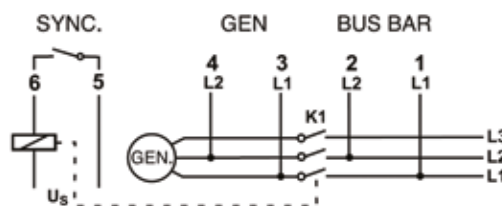
## Product Codes

Bezel size (mm)	96	96	96
	M244-14A-S LED only	M244-14L-S LED & synchro check relay	M244-14D-S LED & synchro check relay with deadbus option
Bezel size (mm)	96	96	96
		M244-14M-S LED & synchro check relay & LCD	M244-14E-S LED & synchro check relay with deadbus option & LCD display
<b>Standard input ranges</b>			
Voltage	100V L/L, 110V L/L400V L/L, 415 V L/L, 440V L/L		

## Order data/examples

- 1) Select type: M244-14M-S,
- 2) Specify input voltage: 415V,
- 3) Specify display or output: Relay output,
- 4) Specify frequency: 45-65Hz,
- 5) Specify functional description:  
Output duration 300ms

## Connection Diagrams



# POWER



## Features

- Indicates active power of electrical systems
- Several voltage ranges available
- Current connection via “through hole” CT on the instrument. No need to interrupt wiring from CT

## Benefits

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

## 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

## Standards

- CE marked
- BV approved

## Order data/examples

### Single-phase

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

### 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, 400/5A,
- 3) Specify scaling: 0-250 kW,
- 4) Specify frequency: 50/60Hz

## Wattmeters

### 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 - <0.1VA per phase
- Current burden - <0.1VA 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	57.7V L-N/1A, 57.7V L-N/5A, 63.5V L-N/1A, 63.5V L-N/5A, 230V L-N/1A, 230V L-N/5A, 240V -N/1A, 240V L-N/5A, 254V L-N/1A, 254V L-N/5A,				
3P/3W balanced, 3P/3W unbalanced	100V L-L/1A, 100V L-L/5A, 110V L-L/1A, 110V L-L/5A, 400V L-L/1A, 400V L-L/5A, 415V L-L/1A, 415V L-L/5A, 440V L-L/1A, 440V L-L/5A				

### 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	$P = U(L-N) \times I_p \times \cos \phi$	$P = 230V \times 50A \times 0.9 = 10350 W = 10.35 kW$	10 kW
3-phase 4-wire, direct voltage connection (balanced or unbalanced)	$P = 3 \times U(L-N) \times I_p \times \cos \phi$	$P = 3 \times 230V \times 400A \times 0.95 = 262200 W = 262,2 kW$	250 kW
3-phase 3-wire, direct voltage connection (balanced or unbalanced)	$P = 1.732 \times U(L-L) \times I_p \times \cos \phi$	$P = 1.732 \times 400V \times 1000A \times 0.9 = 623520 W = 623,52 kW$	600 kW
3-phase 4-wire, voltage connection via VT (balanced or unbalanced)	$P = 3 \times U_p(L-N) \times I_p \times \cos \phi$	$P = 3 \times 5770V \times 100A \times 0.95 = 1644450 W = 1,64445 MW$	1.5 MW
3-phase 3-wire, voltage connection via VT (balanced or unbalanced)	$P = 1.732 \times U_p(L-L) \times I_p \times \cos \phi$	$P = 1.732 \times 30000V \times 50A \times 0.9 = 2338200 W = 2,3382 MW$	2.5 MW

### 3-phase 3-wire balanced or unbalanced

- 1) Select type: M244-213,
- 2) Specify input voltage and CT ratio: 400V L-L, 1000/1A,
- 3) Specify scaling: 0-600 kW,
- 4) Specify frequency: 50/60Hz

### 3-phase 4-wire balanced or unbalanced, VT connected

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

### 3-phase 3-wire balanced or unbalanced

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





## Features

- Indicates reactive power of electrical systems
- Several voltage ranges available
- Current connection via “through hole” CT on the instrument. No need to interrupt wiring from CT

## Benefits

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

## 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

## Standards

- CE marked
- BV approved

## Order data/examples

### Single-phase

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

### 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, 400/5A,
- 3) Specify scaling: 0-200 kvar,
- 4) Specify frequency: 50/60Hz

## Varmeters

### General Specification

- 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
- Voltage burden -  $<0.1VA$  per phase
- Current burden -  $<0.1VA$  per phase
- Frequency - 50/60Hz

### 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	57.7V L-N/1A, 57.7V L-N/5A, 63.5V L-N/1A, 63.5V L-N/5A, 230V L-N/1A, 230V L-N/5A, 240V L-N/1A, 240V L-N/5A, 254V L-N/1A, 254V L-N/5A				
3P/3W balanced, 3P/3W unbalanced	100V L-L/1A, 100V L-L/5A, 110V L-L/1A, 110V L-L/5A, 400V L-L/1A, 400V L-L/5A, 415V L-L/1A, 415V L-L/5A, 440V L-L/1A, 440V L-L/5A				

### 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)	$Q = 3 \times U(L-N) \times I_p \times \sin \phi$	$P = 3 \times 230V \times 400A \times 0.31 = 85560 \text{ var} = 85,56 \text{ kvar}$	200 kvar
3-phase 3-wire, direct voltage connection (balanced or unbalanced)	$Q = 1.732 \times U(L-L) \times I_p \times \sin \phi$	$P = 1.732 \times 400V \times 1000A \times 0,44 = 304832 \text{ var} = 304,8 \text{ kvar}$	500 kvar
3-phase 4-wire, voltage connection via VT (balanced or unbalanced)	$Q = 3 \times U_p(L-N) \times I_p \times \sin \phi$	$P = 3 \times 5770V \times 100A \times 0.199 = 344469 \text{ var} = 344,469 \text{ kvar}$	1 Mvar
3-phase 3-wire, voltage connection via VT (balanced or unbalanced)	$Q = 1.732 \times p(L-L) \times I_p \times \sin \phi$	$P = 1.732 \times 30000V \times 50A \times 0,44 = 1143120 \text{ var} = 1,14312 \text{ Mvar}$	2 Mvar

### 3-phase 3-wire balanced or unbalanced

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

### 3-phase 4-wire balanced or unbalanced, VT connected

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

### 3-phase 3-wire balanced or unbalanced

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

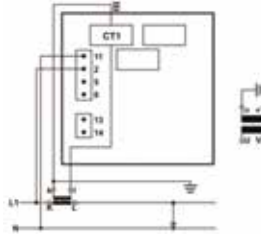




## Wiring Diagrams of Wattmeters and Varmeters

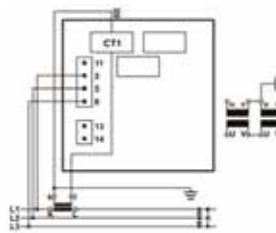
### Single-phase, direct or VT voltage connection

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



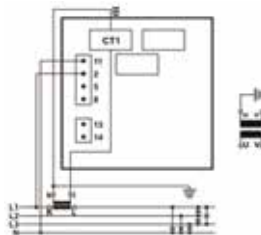
### 3-phase 3-wire balanced, direct or VT voltage connection

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



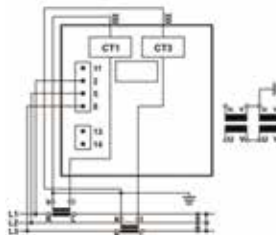
### 3-phase 4-wire balanced, direct or VT voltage

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



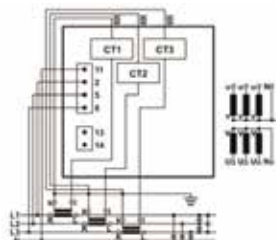
### 3-phase 3-wire unbalanced, direct or VT voltage connection

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





## Features

- Counts electrical active energy and indicates active power of electrical systems
- Several voltage ranges available
- Current connection via "through hole" CT on the instrument. No need to interrupt wiring from CT
- Pulsed output as standard

## Benefits

- High visibility
- Terminal cover included
- Low self consumption
- Separated power supply

## 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

## Standards

- CE marked
- BV approved

## Order data/examples

### Single-phase

- Select type: M244-HWG,
- Specify input voltage and CT ratio: 230V L-N, 50/5A,
- Spec. scaling: 0-10 kW,
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/10kWh,
- Select output: 1 pulsed output

### 3-phase 4-wire balanced or 3-phase 4-wire unbalanced

- Select type: M244-HWK,
- Specify input voltage and CT ratio: 230 V L-N, 400/5A,
- Spec. scaling: 0-250 kW,
- Spec. frequency: 50/60Hz,

# Active Energy Meter with Power Indicator

## General Specification

- Accuracy class active power meter - 1.5
- Accuracy class active energy meter - 1 to EN 62053-21
- Maximum continuous overload -  $2 \times I_n$ ,  $1.2 \times U_n$
- Nominal frequency - 50/60Hz
- Voltage burden -  $<0.1VA$  per phase
- Current burden -  $<0.1VA$  per phase
- Power supply - Various AC volts between 57.7 and 400
- Frequency - 40-65Hz
- Voltage burden -  $<3 VA$
- Pulsed output - 1 SO pulsed output with 1p/10kWh, 1p/100kWh, 1p/10MWh, 1p/100MWh. Maximum pulse rate may not exceed 33 pulses per second (1980 pulses per minute). If in doubt choose next higher value, e.g. 1p/100/kWh instead of 1p/10kWh

## Product Codes

Bezel size (mm)	96	96	96	96	96
Scale length (mm)	95	95	95	95	95
Active energy meter with Wattmeter 90°	M244-HWG single-phase	M244-HWH 3P/3W balanced	M244-HWV 3P/4W balanced	M244-HWJ 3P/3W unbalanced	M244-HWK 3P/4W unbalanced
Bezel size (mm)	96	96	96	96	96
Scale Length (mm)	135	135	135	135	135
Active energy meter with Wattmeter 240°	M244-HWB single-phase	M244-HWC 3P/3W balanced	M244-HWU 3P/4W balanced	M244-HWD 3P/3W unbalanced	M244-HWE 3P/4W unbalanced
<b>Standard input ranges</b>					
Single-phase, 3P/4W balanced & unbalanced	57.7V L-N/1A, 57.7V L-N/5A, 63.5V L-N/1A, 63.5V L-N/5A, 230V L-N/1A, 230V L-N/5A, 240V L-N/1A, 240V L-N/5A, 254V L-N/1A, 254V L-N/5A,				
3P/3W balanced & unbalanced	1100V L-L/1A, 100V L-L/5A, 110V L-L/1A, 110V L-L/5A, 400V L-L/1A, 400V L-L/5A, 415V L-L/1A, 415V L-L/5A, 440V L-L/1A, 440V L-L/5A				

## 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,  $\cos\phi$  = power factor

Electrical system	Formula	Example	End scale value to choose (considering 0,6 to 1.2 x S)
Single-phase, direct voltage connection	$P = U(L-N) \times I_p \times \cos\phi$	$P = 230V \times 50A \times 0.9 = 10350 W = 10.35 kW$	10 kW
3-phase 4-wire, direct voltage connection (balanced or unbalanced)	$P = 3 \times U(L-N) \times I_p \times \cos\phi$	$P = 3 \times 230V \times 400A \times 0.95 = 262200 W = 262.2 kW$	250 kW
3-phase 3-wire, direct voltage connection (balanced or unbalanced)	$P = 1.732 \times U(L-L) \times I_p \times \cos\phi$	$P = 1.732 \times 400V \times 1000A \times 0.9 = 623520 W = 623.52 kW$	600 kW
3-phase 4-wire, voltage connection via VT (balanced or unbalanced)	$P = 3 \times U_p(L-N) \times I_p \times \cos\phi$	$P = 3 \times 5770V \times 100A \times 0.95 = 1644450 W = 1.64445 MW$	1.5 MW
3-phase 3-wire, voltage connection via VT (balanced or unbalanced)	$P = 1.732 \times U_p(L-L) \times I_p \times \cos\phi$	$P = 1.732 \times 30000V \times 50A \times 0.9 = 2338200 W = 2.3382 MW$	2.5 MW

- Select pulse rate: 1p/10kWh,
- Select output: 1 puls. o/p

### 3-phase 3-wire balanced or unbalanced

- Select type: M244-HWJ,
- Specify input voltage and CT ratio: 400V L-L, 1000/1A,
- Spec. scaling: 0-600 kW,
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/10kWh,
- Select output: 1 puls. o/p

### 3-phase 4-wire balanced or unbalanced, VT connected

- Select type: M244-HWU,

- Specify VT ratio and CT ratio: 5770/57.7V L-N, 100/5A,
- Spec. scaling: 0-1.5 MW,
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/100kWh,
- Select output: 1 pulsed output

### 3-phase 3-wire balanced or unbalanced

- Select type: M244-HWD,
- Specify input VT ratio and CT ratio: 30000/110V L-L, 50/1A,
- Spec. scaling: 0-2.5MW
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/100kWh,
- Select output: 1 pulsed output



## Features

- Counts electrical reactive energy and indicates reactive power of electrical systems
- Several voltage ranges available
- Current connection via "through hole" CT on the instrument. No need to interrupt wiring from CT
- Pulsed output as standard

## Benefits

- High visibility
- Terminal cover included
- Low self consumption
- Separated power supply

## 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

## Standards

- CE marked
- BV approved

## Order data/examples

### Single-phase

- Select type: M244-HXG,
- Specify input voltage and CT ratio: 230V L-N, 50/5A,
- Spec. scaling: 0-6kvar,
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/10kvarh,
- Select output: 1 pulsed output

### 3-phase 4-wire balanced or 3-phase 4-wire unbalanced

- Select type: M244-HXK,
- Specify input voltage and CT ratio: 230 V L-N, 400/5A,
- Spec. scaling: 0-200kvar,

# Reactive Energy Meter with Power Indicator

## General Specification

- Accuracy class reactive power meter - 1.5
- Accuracy class reactive energy meter - 2 to EN 62053-23
- Maximum continuous overload -  $2 \times I_n$ ,  $1.2 \times U_n$
- Nominal frequency - 50/60Hz
- Voltage burden -  $< 0.1VA$  per phase
- Current burden -  $< 0.1VA$  per phase
- Power supply - Various AC volts between 57.7 and 400
- Frequency - 40-65 Hz
- Voltage burden -  $< 3 VA$
- Pulsed output - 1 SO pulsed output with 1p/10kWh, 1p/100kWh, 1p/10MWh, 1p/100MWh. Maximum pulse rate may not exceed 33 pulses per second (1980 pulses per minute).  
If in doubt choose next higher value, e.g. 1p/100/kWh instead of 1p/10kWh

## Product Codes

Bezel size (mm)	96	96	96	96	96
Scale length (mm)	95	95	95	95	95
Reactive energy meter with Varmeter 90°	M244-HXG single-phase	M244-HXH 3P/3W balanced	M244-HXV 3P/4W balanced	M244-HXJ 3P/3W unbalanced	M244-HXK 3P/4W unbalanced
Bezel size (mm)	96	96	96	96	96
Scale Length (mm)	135	135	135	135	135
Reactive energy meter with Varmeter 240°	M244-HXB single-phase	M244-HXC 3P/3W balanced	M244-HXU 3P/4W balanced	M244-HXD 3P/3W unbalanced	M244-HXE 3P/4W unbalanced
<b>Standard input ranges</b>					
Single-phase, 3P/4W balanced & unbalanced	57.7V L-N/1A, 57.7V L-N/5A, 63.5V L-N/1A, 63.5V L-N/5A, 230V L-N/1A, 230V L-N/5A, 240V L-N/1A, 240V L-N/5A, 254V L-N/1A, 254V L-N/5A,				
3P/3W balanced & unbalanced	100V L-L/1A, 100V L-L/5A, 110V L-L/1A, 110V L-L/5A, 400V L-L/1A, 400V L-L/5A, 415V L-L/1A, 415V L-L/5A, 440V L-L/1A, 440V L-L/5A				

## 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	$P = U(L-N) \times I_p \times \sin\phi$	$Q = 230V \times 50A \times 0.44 = 5060 \text{ var} = 5.06 \text{ kvar}$	6 kvar
3-phase 4-wire, direct voltage connection (balanced or unbalanced)	$P = 3 \times U(L-N) \times I_p \times \sin\phi$	$P = 3 \times 230V \times 400A \times 0.31 = 85560 \text{ var} = 85.56 \text{ kvar}$	200 kvar
3-phase 3-wire, direct voltage connection (balanced or unbalanced)	$P = 1.732 \times U(L-L) \times I_p \times \sin\phi$	$P = 1.732 \times 400V \times 1000A \times 0.44 = 304832 \text{ var} = 304.8 \text{ kvar}$	500 kvar
3-phase 4-wire, voltage connection via VT (balanced or unbalanced)	$P = 3 \times U_p(L-N) \times I_p \times \sin\phi$	$P = 3 \times 5770V \times 100A \times 0.199 = 344469 \text{ var} = 344.469 \text{ kvar}$	1 Mvar
3-phase 3-wire, voltage connection via VT (balanced or unbalanced)	$P = 1.732 \times U_p(L-L) \times I_p \times \sin\phi$	$P = 1.732 \times 30000V \times 50A \times 0.44 = 1143120 \text{ var} = 1.14312 \text{ Mvar}$	2 Mvar

- Spec. frequency: 50/60Hz,
- Spec. pulse rate: 1p/10kvarh,
- Select output: 1 pul. O/P

### 3-phase 3-wire balanced or unbalanced

- Select type: M244-HXJ,
- Spec. input voltage and CT ratio: 400V L-L, 1000/1A,
- Spec. scaling: 0-500 kvar,
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/10kvarh,
- Select output: 1 pul. O/P

### 3-phase 4-wire balanced or unbalanced, VT connected

- Select type: M244-HXU,

- Specify VT ratio and CT ratio: 5770/57.7V L-N, 100/5A,
- Spec. scaling: 0-1 Mvar,
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/100kvarh,
- Select output: 1 pul. O/P

### 3-phase 3-wire balanced or unbalanced

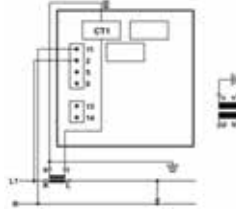
- Select type: M244-HXD,
- Specify input VT ratio and CT ratio: 30000/110V L-L, 50/1A,
- Spec. scaling: 0-2 Mvar
- Spec. frequency: 50/60Hz,
- Select pulse rate: 1p/100kWh,
- Select output: 1 pulsed O/P



## Wiring Diagrams Energy Meters

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

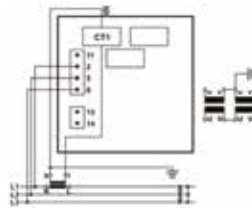
Active Energy Meter M244-HWG  
Active Energy Meter M244-HWB  
Reactive Energy Meter M244-HXG  
Reactive Energy Meter M244-HXB



Power supply:  
Terminal 13 and 14  
Pulsed output:  
Terminal 15 and 16

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

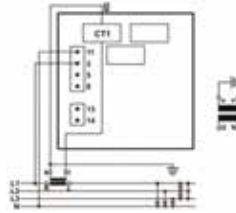
Active Energy Meter M244-HWH  
Active Energy Meter M244-HWC  
Reactive Energy Meter M244-HXH  
Reactive Energy Meter M244-HXC



Power supply:  
Terminal 13 and 14  
Pulsed output:  
Terminal 15 and 16

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

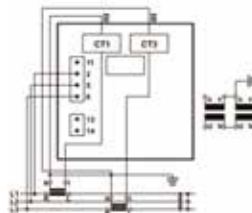
Active Energy Meter M244-HWV  
Active Energy Meter M244-HWU  
Reactive Energy Meter M244-HXV  
Reactive Energy Meter M244-HXU



Power supply:  
Terminal 13 and 14  
Pulsed output:  
Terminal 15 and 16

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

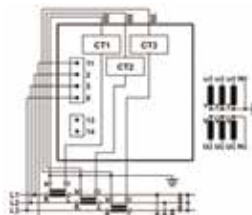
Active Energy Meter M244-HWJ  
Active Energy Meter M244-HWD  
Reactive Energy Meter M244-HXJ  
Reactive Energy Meter M244-HXD



Power supply:  
Terminal 13 and 14  
Pulsed output:  
Terminal 15 and 16

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

Active Energy Meter M244-HWK  
Active Energy Meter M244-HWE  
Reactive Energy Meter M244-HXK  
Reactive Energy Meter M244-HXE



Power supply:  
Terminal 13 and 14  
Pulsed output:  
Terminal 15 and 16

# INSTRUMENT SELECTOR SWITCHES

SW3-AMPS



SW6-VOLT

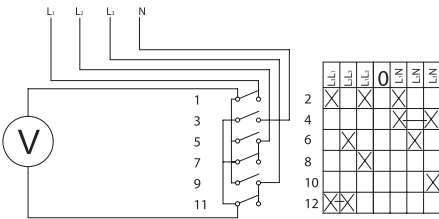


## Features

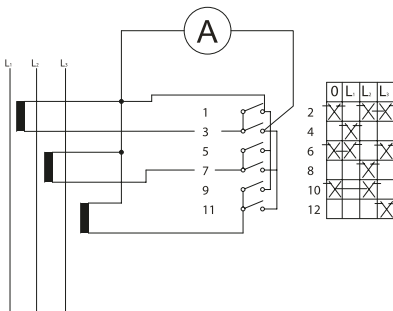
Two face plates options

## Connection Diagrams

SW6-VOLT



SW3-AMPS



Panel mounted selector switches offer a 7-position voltmeter switch and a 4-position ammeter switch for reading line-to-line or line-to-neutral voltage and phase current. Each switch is supplied with both numbered and coloured annotation.

## Specification

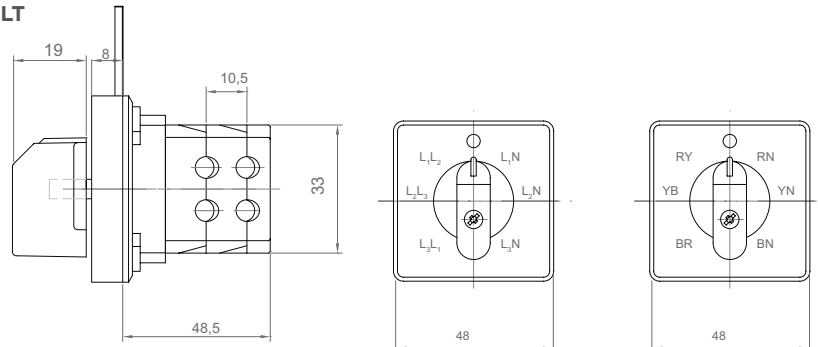
Loading capacity:	10A/500V
Switching capacity:	3.5kW at 400V, 5.5kW at 500V
Rated insulation:	500V
Rated thermal current:	10A
Operating temperature:	-20 C to +70C
Mounting installation:	2 point front fixing or 4 hole panel fixing
Dimensions front panel:	48 x 48 mm
Panel cut out:	3 drilled holes
Compliant with:	LVD and EMC EN 60947-3
IP Protection:	IP65 from front of panel, IP20 terminations
Terminal screw:	M3
Terminals, mm <sup>2</sup> :	0.5 - 2.5
Impulse withstand voltage:	4 kV
Rated short time withstand current - 1 sec:	200 A

## Product codes

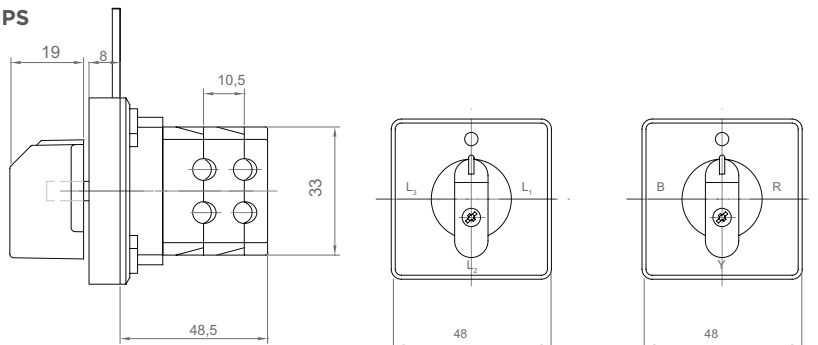
SW3-AMPS	4-position ammeter switch, with interchangeable face plate for L1,L2,L3-O and R-Y-B-O
SW6-VOLT	7-position voltmeter switch, with interchangeable face plate for L1L2,L2L3,L3L1-O-L1N-L2N-L3N and RY-YB-BR-O-RN-YN-BN

## Dimensions

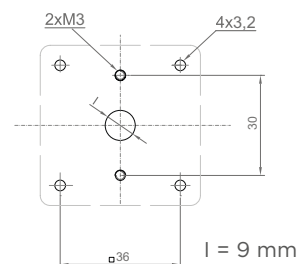
SW6-VOLT



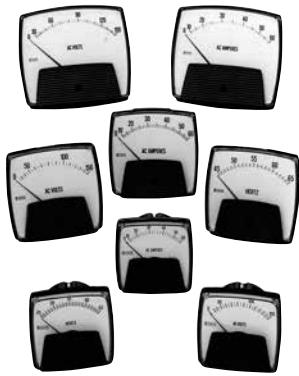
SW3-AMPS



## Panel cut-out



# SAXON SERIES PANEL INDICATORS



## Features

- Three compact case sizes
- Withstands high levels of shock, vibration, dirt and humidity
- Pivot and jewel mechanisms

## Benefits

- Complies with ANSI C39.1 (IEC 51)
- IP54 (NEMA 3) protection
- Instruments comply with BS EN61010-1 and meet IEC414 (BS5458)
- Pass dielectric test (2600V for 1min)

## Applications

- Switchgear
- Distribution systems
- Generator sets
- Control panels
- Energy management
- Building management
- Utility power monitoring
- Process control
- Motor control

## Compliant with

- UL approved file no. E203000

## Connections

See page 30

A range of 2½", 3½" and 4½" surface mount panel meters utilising pivot and jewel mechanisms and offering IP54 protection. The range includes iron vane and moving coil AC and DC ammeters and voltmeters and frequency meters designed to perform in demanding environments.

## Specifications - Frequency Meters

Accuracy:	0.15 = 60Hz, 1.25 = 400Hz, 0.15 = 50Hz, 0.25 = 55Hz
Voltage:	110/130V, 200/250V
Frequency:	50Hz or 60Hz
Burden:	4VA Maximum

## Specifications - Moving Iron AC Ammeter and Voltmeter

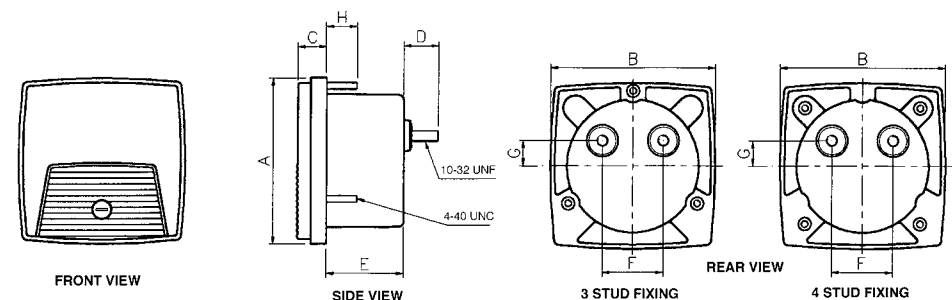
Accuracy:	±2%
Rating:	Ammeters: 1 - 30A Volts: 10V - 600V
Overload:	Ammeters: x1.2 for 2 hours, x10 for 5 seconds Volts: x1.2 for 2 hours, x2 for 5 seconds
Burden:	Ammeters: 0.5VA Volts: 4.5VA maximum

## Specifications - Moving Coil DC Ammeter and Voltmeter

Accuracy:	±2%
Rating:	Ammeters: 1 - 30A Volts: 10V - 600V
Operating temperature:	-20°C to +60°C (-4°F to +140°F)
Storage temperature:	-30°C to +70°C (-22°F to +158°F)

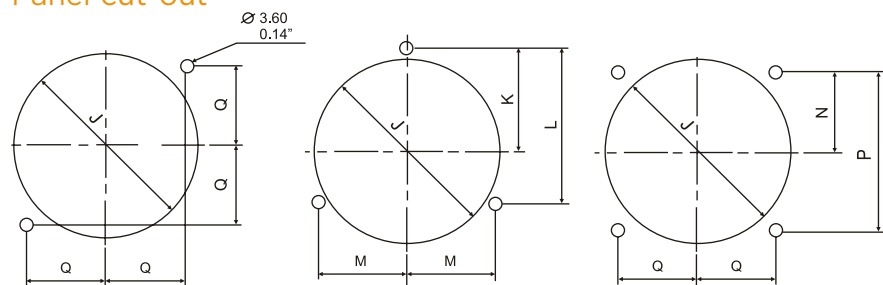
## Dimensions

Specify number of fixing studs when ordering 2½" and 3½" meters. 4½" meters are supplied with 4 fixing studs.



	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
2½" mm	68.6	68.6	11.8	14.6	32.0	25.4	10.4	12.7	55.9	31.0	46.5	26.9	23.9	47.8	23.9
inch	2.70	2.70	0.46	0.57	1.26	1.00	0.41	0.50	2.20	1.22	1.83	1.06	0.94	1.88	0.94
3½" mm	88.9	88.9	11.8	14.6	36.0	25.4	10.4	12.7	69.9	40.2	60.3	34.8	28.5	57.0	28.5
inch	3.5	3.5	0.46	0.57	1.42	1.00	0.41	0.50	2.75	1.58	2.37	1.37	1.12	2.24	1.12
4½" mm	112.0	123.2	12.7	16.3	30.5	28.4	0.38	12.7	70.9				51.6	90.4	50.8
inch	4.41	4.85	0.50	0.64	1.20	1.12	0.41	0.50	2.78				2.03	3.56	2.00

## Panel cut-out







AC Ammeter



AC Voltmeter



Frequency Meter

**Product Codes - AC Ammeter True RMS Reading (Accuracy ±2% ES)**

Rating	Scaling	Cat. no.
5A	0-5A	(01*)-75AA-LSLS-C6-B*
10A	0-10A	(01*)-75AA-MTMT-C6-B*
15A	0-15A	(01*)-75AA-NDND-C6-B*
20A	0-20A	(01*)-75AA-NGNG-C6-B*
30A	0-30A	(01*)-75AA-NLNL-C6-B*
1A	Transformer rated	(01*)-75AA-LA**-C6-B*
5A	Transformer rated	(01*)-75AA-LS**-C6-B*

**Product Codes - AC Voltmeter True RMS Reading (Accuracy ±2% ES)**

150V	0-150V	(01*)-75VA-PZPZ-C6-B*
300V	0-300V	(01*)-75VA-RXRX-C6-B*
600V	0-600V	(01*)-75VA-SJSJ-C6-B*
150V	Transformer rated	(01*)-75VA-PZ**-C6-B*

**Product Codes - DC Ammeter (Accuracy ±2% ES)**

0-1mA	To suit requirements	(01*)-01AA-FA**-B*
0-5mA	0-5mA	(01*)-01AA-FXFX-B*
0-10mA	0-10mA	(01*)-01AA-GZGZ-B*
0-20mA	0-20mA	(01*)-01AA-HFHF-B*
0-50mA	0-50mA	(01*)-01AA-HYHY-B*
0-100mA	0-100mA	(01*)-01AA-JRJR-B*
0-200mA	0-200mA	(01*)-01AA-KAKA-B*
0-500mA	0-500mA	(01*)-01AA-KMKM-B*
0-1A0-1A	(01*)-01AA-LALA-B*	
0-2A0-2A	(01*)-01AA-LELE-B*	
0-5A0-5A	(01*)-01AA-LSLS-B*	
0-10A	0-10A	(01*)-01AA-MTMT-B*
0-50mV	To suit	(01*)-01AA-EC**-B*

**Product Codes - Milliammeters Suppressed Zero (Accuracy ±2% ES)**

4-20mA	To suit requirements	(01*)-01RA-HG**-B*
		**Specify scale value

**Product Codes - DC Voltmeters Sensitivity 1000Ω/Volt (Accuracy ±2% ES)**

0-15V	0-15V	(01*)-01VA-NDND-B*
0-30V	0-30V	(01*)-01VA-NLNL-B*
0-50V	0-50V	(01*)-01VA-NTNT-B*
0-150V	0-150V	(01*)-01VA-PZPZ-B*
0-300V	0-300V	(01*)-01VA-RXRX-B*
0-600V	0-600V	(01*)-01VA-SJSJ-B*

**Product Codes - Frequency Meters 120V, Self Contained**

50Hz	45-55Hz	(01*)-41SA-PNAG-AG-B*
55Hz	45-65Hz	(01*)-41SA-PNAJ-AJ-B*
60Hz	55-65Hz	(01*)-41SA-PNAN-AN-B*

**Product Codes - Elapsed Time Meters 99999.99 hours, non-resettable**

110/130V, 50Hz	-	(01*)-155A-PNZH-C5-B*
200/250V, 50Hz	-	(01*)-155A-RNZH-C5-B*
480V, 50Hz	-	(01*)-155A-SEZH-C5-B*
110/130V, 60Hz	-	(01*)-156A-PNZH-C6-B*
200/250V, 60Hz	-	(01*)-156A-RNZH-C6-B*
480V, 60Hz	-	(01*)-156A-SEZH-C6-B*

To denote the required case size, replace the 01\* in the catalogue number with 012, 013 or 014 for 2½", 3½" or 4½" respectively.

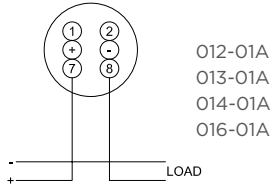
To denote the required stud fixing configuration, replace B\* with B2 (2 stud), B3 (3 stud) or B4 (4 stud).

# 016 SERIES FIESTA PANEL INDICATORS

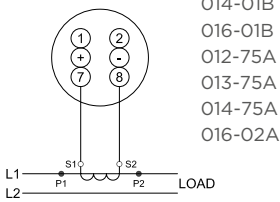


## Connections

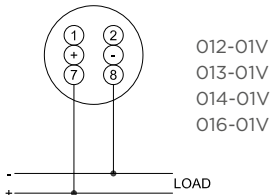
**AMMETER DC**  
Direct connected (max rating 30A)



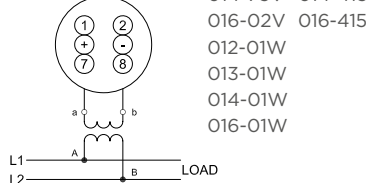
**AMMETER AC**



**VOLTMETER DC**  
Direct connected (max rating 800V)



**VOLTMETER AC/  
FREQUENCY METER**  
V.T. operated



A robust range of short-scale 3/2" surface mount panel meters offering IP55 protection and featuring a wide view contoured window. The Fiesta range includes iron vane and moving coil AC and DC ammeters and voltmeters, elapsed time and frequency meters and is ideally suited for demanding environments. Options include panel gasket.

## Specifications - Elapsed Time Meter and Frequency Meters

Voltage:	100/125V, 200/250V or 480V AC
Frequency:	50Hz or 60Hz
Burden:	4VA maximum
Operating temperature:	-20°C to +65°C (-4°F to +149°F)
Storage temperature:	-30°C to +70°C (-22°F to +158°F)

## Specifications - Iron Vane AC Ammeter and Voltmeter

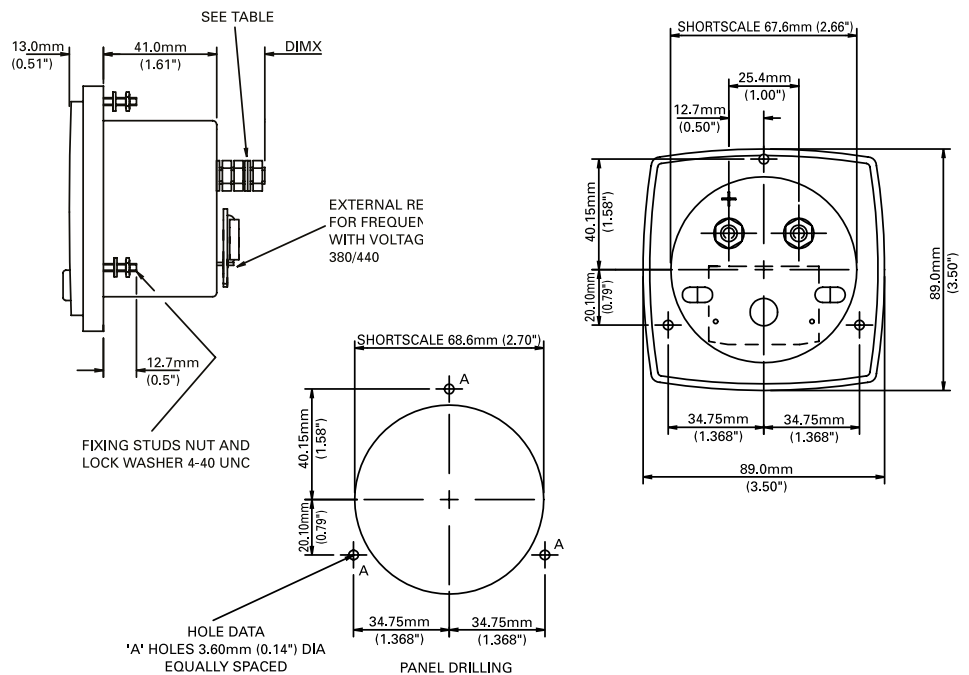
Accuracy:	Ammeters 2.5%
Ratings:	Short-scale 1 - 80A
Voltmeters:	10V - 600V
Overload:	Ammeters: x1.2 for 2 hours, 10 x for 5 seconds
Voltmeters:	x1.2 for 2 hours, 2 x for 5 seconds
Burden:	Ammeters: 0.5VA; 1.5VA
Voltmeters:	4.5VA maximum
Operating temperature:	-20°C to +65°C (-4°F to +149°F)
Storage temperature:	-30°C to +70°C (-22°F to +158°F)

## Specifications - Moving Coil DC Ammeter and Voltmeter

Accuracy:	1.5
Ratings:	Ammeters: 100µA to 30A
Voltmeters:	50mV - 600V
Overload:	Ammeters: x1.2 for 2 hours, 10 x for 5 seconds
Voltmeters:	x1.2 for 2 hours, 2 x for 5 seconds
Impedance:	Voltmeters: 1000 ohms per nominal volt
Operating temperature:	-20°C to +65°C (-4°F to +149°F)
Storage temperature:	-30°C to +70°C (-22°F to +158°F)

## Dimensions

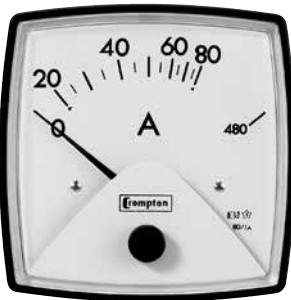
Instrument	Dim X inches	Dim X mm
MC. INSTS	1/4"-28 UNF	18.0
MI voltmeter and AMM up to 59A	1/4"-28 UNF	18.0
MI ammeter 60A and over	5/16"-24 UNF	23.0







AC Ammeter Short-scale



AC Overload Ammeter



AC Voltmeter

### AC Ammeter

Product Codes - True RMS Reading, Self Contained 50/60Hz

Rating	Scaling	Cat. no.
5A	0-5A	•016-02A*-LMLS-C7
10A	0-10A	•016-02A*-MTMT-C7
15A	0-15A	•016-02A*-NDND-C7
20A	0-20A	•016-02A*-NGNG-C7
30A	0-30A	•016-02A*-NLNL-C7
5A	Transformer rated	•016-02A*-LS**-C7

Product Codes - Moving Coil Rectified

100µA - 1A	To suit	•016-01B*-
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### AC Overload Ammeter

Product Codes - True RMS Reading, Self Contained 50/60Hz

Rating	Scaling	Cat. no.
5A	0-5-30A	•016-026*-LMLS-C7
10A	0-10-60A	•016-026*-MTMT-C7
15A	0-15-90A	•016-026*-NDND-C7
20A	0-20-120A	•016-026*-NGNG-C7
30A	0-30-180A	•016-026*-NLNL-C7
5A	Transformer rated	•016-026*-LS**-C7

### AC Voltmeter

Product Codes - True RMS Reading

Rating	Scaling	Cat. no.
150V	0-150V	•016-02V*-PZPZ-C7
300V	0-300V	•016-02V*-RXRX-C7
600V	0-600V	•016-02V*-SJSJ-C7
150V	Transformer rated	•016-02V*-PZ**-C7

Product Codes - Moving Coil Rectified

15-600V	To suit	•016-01W*-
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### DC Ammeters

Product Codes

Rating	Scaling	Cat. no.
0-50mV	To suit	•016-01A*-EC**
0-1mA	To suit	•016-01A*-FA**
0-5mA	To suit	•016-01A*-FX**
0-10mA	To suit	•016-01A*-HA**
0-20mA	To suit	•016-01A*-HF**

### Suppressed Zero

Product Codes - Milliammeters - No Zero Set Unless Specified

Rating	Scaling	Cat. no.
4/20mA	To suit	•016-01RA*-HG**

Product Codes - Voltmeter - No Zero Set Unless Specified

1-5V	To suit	016-01S*-LM**
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\* Please state A or B at time of ordering. A = ANSI B = BS89

\*\* Customer must state required scaling at time of ordering.

• UL approved



DC Voltmeter



Frequency Meter



Elapsed Time Meter

## DC Voltmeters

Product Codes – Sensitivity 1000Ω/V

Rating	Scaling	Cat. no.
0-15V	0-15V	•016-01V*-NDND
0-30V	0-30V	•016-01V*-NLNL
0-50V	0-50V	•016-01V*-NTNT
0-150V	0-150V	•016-01V*-PZPZ
0-300V	0-300V	•016-01V*-RXRX
0-600V	0-600V	•016-01V*-SJSJ

## Frequency Meters

Product Codes – 120V, Self Contained

Rating	Scaling	Cat. no. standard case
50Hz centre frequency, -0.15 accuracy	45-55Hz	•016-41S*-PNAG-AG
55Hz centre frequency, -0.25 accuracy	45-65Hz	•016-41S*-PNAJ-AJ
60Hz centre frequency, -0.15 accuracy	55-65Hz	•016-41S*-PNAN-AN
400Hz centre frequency, -1.25 accuracy	360-440Hz	•016-41S*-PNBI-BI

## Elapsed Time Meters

Product Codes – 99999.99 hours, Non-resettable

Rating	Scaling	Cat. no. standard case
110/130V, 50Hz	-	•016-155*-PNZH-C5
200/250V, 50Hz	-	•016-155*-RNZH-C5
480V, 50Hz	-	•016-155*-SEZH-C5
110/130V, 60Hz	-	•016-156*-PNZH-C6
200/250V, 60Hz	-	•016-156*-RNZH-C6
480V, 60Hz	-	•016-156*-SEZH-C6

## Transducer Indicators

Product Codes – DC Milliamp Rated

Rating	Scaling	Cat. no. standard case
Speed	To suit	016-012*
Frequency	To suit	016-013*
Phase angle	To suit	016-014*
Watts	To suit	016-015*
VArS	To suit	016-016*
VA	To suit	016-017*

\* Please state A or B at time of ordering. A = ANSI B = BS89

\*\* Customer must state required scaling at time of ordering.

• UL approved

# CHALLENGER ANALOGUE PANEL METERS



## Features

- Measurement and indication of AC amps, volts, frequency and DC signals
- Surface or window mounting
- Rear zero adjuster on moving coil meters
- High torque pivot and jewel movement
- True RMS measurement meters
- AC and DC inputs
- Up to 40A DC direct connected
- Up to 50A AC direct connected

## Benefits

- AC moving iron and moving coil mechanisms
- Reduced inventory
- 4 ANSI standard case sizes
- Detachable lower fascia plate
- Easy to modify for distributors
- Through holes for back of panel mounting

## Applications

- Marine panels
- Switchgear
- Distribution systems
- Control panels
- Embedded generation
- Energy management
- Building management
- Utility power monitoring
- Process control
- Motor monitoring

## Compliant with

- ANSI C39.1 1981
- IEC 51
- UL3111-1
- EMC
- LVD
- UL and CUL file no: E236986

The Challenger range of analogue panel meters offers accurate measurement and indication of most electrical and electronic parameters in industry standard 1½", 2½", 3½" and 4½" case sizes. This innovative design features a detachable lower fascia plate, which allows the flexibility of either surface or window mounting. The fascia is simply unclipped to achieve the completely flush panel appearance of rear of panel window mounting.

The range offers AC and DC ammeters, voltmeters and frequency meters utilising a high torque pivot and jewel movement. AC moving coil rectified meters provide 1.5% accuracy of the full scale value and feature a rear zero adjuster screw for tamperproof installation. AC moving iron meters also provide 1.5% high accuracy and true RMS measurement.

## Operation

The Challenger analogue panel meters utilise a traditional pivot and jewel movement, incorporating specially hardened steel pivots and a spring loaded jewel. This robust mechanism is ideally suited for all applications, including the most demanding conditions.

## Moving Coil Meters

These meters offer a centre cored, self-shielding moving coil movement using pivots, hairsprings and sprung jewels. Variations in movement are limited by design. All DC voltmeters are 1000 ohms per Volt, moving coil rectified products run at 900 ohms per Volt. Millivolt meters use a 5 milliamps/50mV movement.

## Moving Iron Meters

This clapper type repulsion design utilises a pivot, hairspring and jewel movement. The bottom jewel is oil filled to provide damping while the top is sprung for resilience. All voltmeters are manufactured with internal voltage dropper resistors.

## Frequency Meters

Frequency meters utilise a 1mA/35 ohm DC moving coil movement driven by an EMC hard frequency conversion circuit.

## Dials, Pointers and Scales

Standard dials are matt white with black printed scales and a tubular knife-edge black matt pointer. The 90° scales are balanced within 1% of scale length and feature a highly repeatable flattened arc scale shape, ensuring consistently accurate measurement readings. Dials are interchangeable between the Challenger meters for inputs within the published specifications of the meter. Options for non standard customised dials are available upon request.

## Current Transformers and Shunts

Crompton Instruments, a Business Unit of TE Connectivity Ltd, offers a comprehensive range of current transformers and shunts, for driving the Challenger panel meters for the safe and simple measurement of AC and DC currents.

Our extensive range of current transformers provides accurate measurement of AC current and ratio matching to a consistent 5 or 1 amp secondary current, proportional to the primary current.

Our range of shunts ensures a DC millivolt signal exactly proportional to the system current for driving ammeters, providing accurate measurement of DC current up to 12000A, with secondary inputs of, 50, 60, 75 or 100mV DC to match the Challenger input.



Model 361 (1 1/2")



Model 362 (2 1/2")



Model 363 (3 1/2")



Model 364 (4 1/2")

## Specifications

<b>Accuracy</b>	
DC ammeters and voltmeters:	1.5% 0-100% of full scale deflection
AC ammeters and voltmeters:	Moving iron: 1.5% 10-100% of full scale deflection Moving coil: 1.5% 10-100% of full scale deflection
Frequency meters:	0.5% of end scale value
<b>Input ratings</b>	
DC moving coil ammeters:	50µA - 40A DC. (Model 361: 10A max)
DC moving coil voltmeters:	50mV - 600V DC
DC moving coil centre zero ammeters:	+/-50mA to +/-40A DC. (Model 361: 10A max)
DC moving coil centre zero voltmeter:	+/-50mV to +/-600V DC. Standard 1k ohm/volt
DC moving coil suppressed zero ammeters:	4/20mA DC
DC moving coil suppressed zero voltmeters:	1/5, 8/16, 16/32 or 12/24V DC
AC moving coil ammeters:	100µA - 750mA AC
AC moving coil voltmeters:	20 - 600V AC. Standard 900 ohms/volt
AC moving iron ammeters:	1 - 50A AC (Model 361: non applicable)
AC moving iron voltmeters:	3 - 600V AC (Model 361: non applicable)
Frequency:	100/130V, 200/250V, 360/440V, 50Hz, 60Hz or 400Hz (Model 361: non applicable)
Burden:	Ammeter: 0.5VA Voltmeter: 4.5VA
Frequency:	4VA
Overload:	1.2 continuous x 10 for 0.5 seconds
<b>Enclosure</b>	
Movement:	High torque pivot and jewel moving coil and moving iron
Scale balance:	Within 1% of scale length
Relative humidity:	25% - 80% nominal range of use
Operating temperature:	0°C to +40°C (-32°F to +104°F)
Storage temperature:	-20°C +55°C (-4°F to +131°F)
Case and lower mask:	Black matt case UL94V. Polycarbonate cover
Window:	Shatterproof polycarbonate
Surface mounting:	4 corner studs
Rear of panel mounting:	2 through hole mounts (Model 361: facility pending)
<b>Compliant with</b>	
UL and CUL:	61010B-1 File no: E236986
Performance:	ANSI C39.1 1981 and IEC 51
Scaling:	ANSI C39.1 1981
Safety:	IEC61010-1 (LVD) and BS EN61326:1998 (EMC)
Vibration:	ANSI C39.1 1981 cl. 5.13

## Product Codes

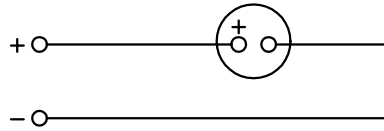
Input	Model 361 cat. no.	Model 362 cat. no.	Model 363 cat. no.	Model 364 cat. no.
DC moving coil amps	361-01A	362-01A	363-01A	364-01A
DC moving coil volts	361-01V	362-01V	363-01V	364-01V
DC moving coil centre zero amps	361-01C	362-01C	363-01C	364-01C
DC moving coil centre zero volts	361-01N	362-01N	363-01N	364-01N
DC moving coil suppressed zero amps	361-01R	362-01R	363-01R	364-01R
DC moving coil suppressed zero volts	361-01S	362-01S	363-01S	364-01S
AC moving coil amps	361-01B	362-01B	363-01B	364-01B
AC moving coil volts	361-01W	362-01W	363-01W	364-01W
AC moving iron amps	N/A	362-02A	363-02A	364-02A
AC moving iron volts	N/A	362-02V	363-02V	364-02V
Frequency	N/A	362-41S	363-41S	364-41S

Please specify current, voltage, frequency and required options at time of ordering.

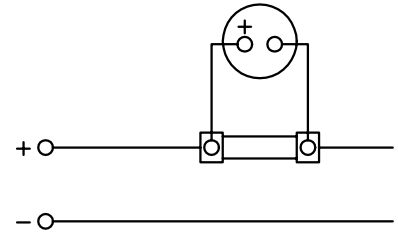


## Connections

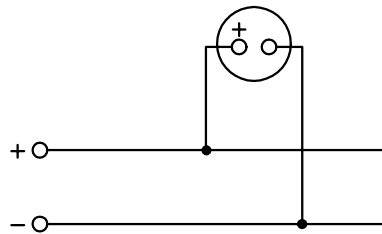
DC Amps - Self contained



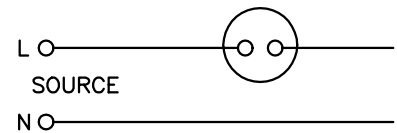
DC Amps - For use with external shunt



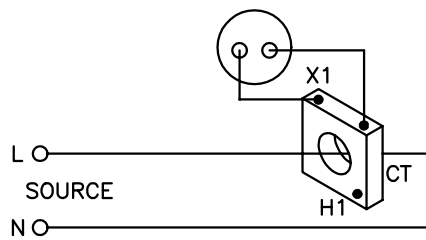
DC Volts



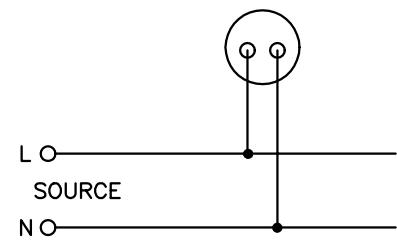
AC Amps - Self contained



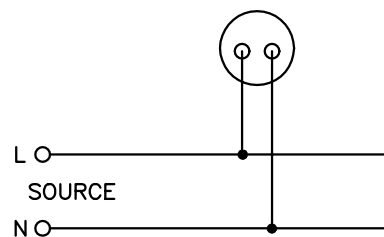
AC Amps - For use with current transformer



AC Volts

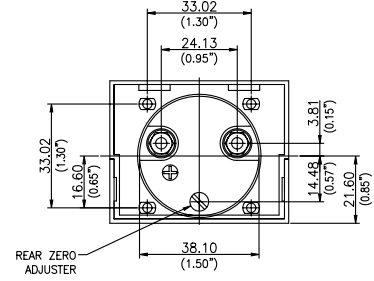
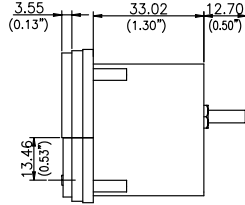
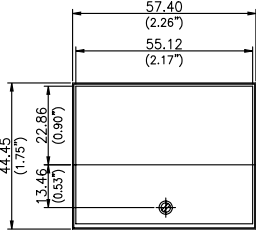


Frequency Meter

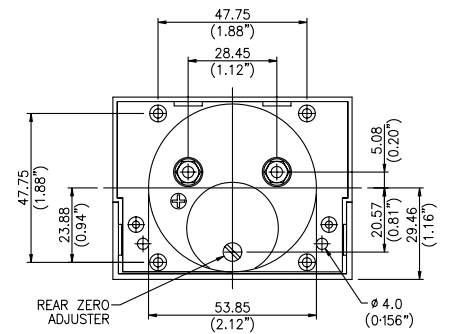
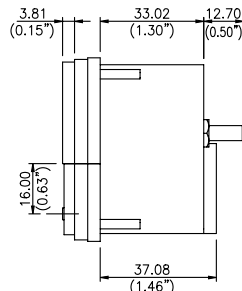
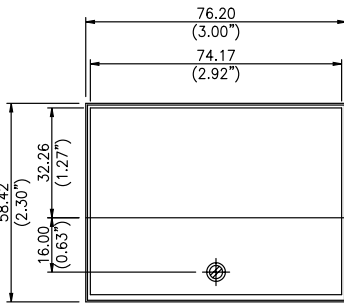


## Dimensions - Surface Mount

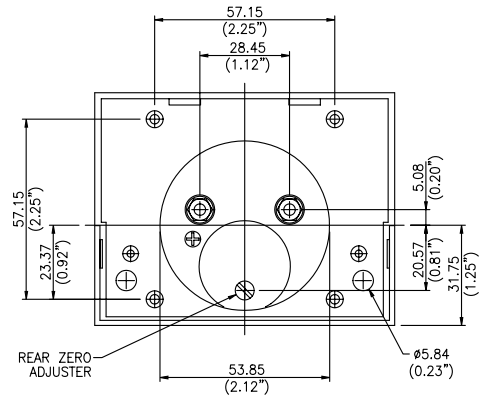
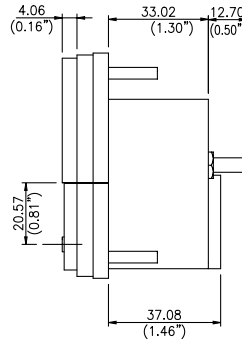
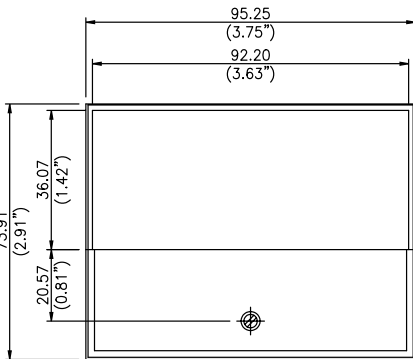
### Model 361



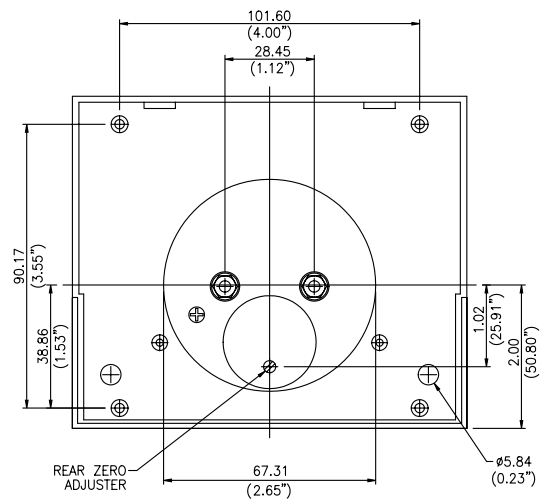
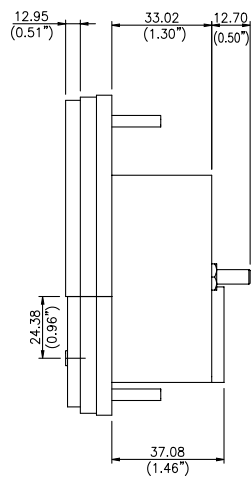
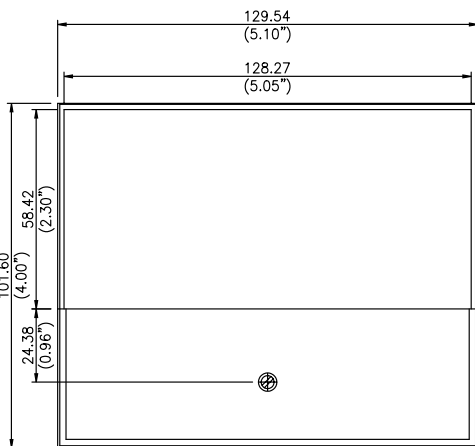
### Model 362



### Model 363

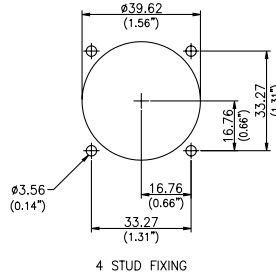


### Model 364

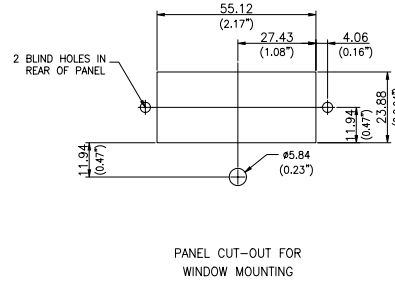


### Model 361

#### Surface Mount Cut-out

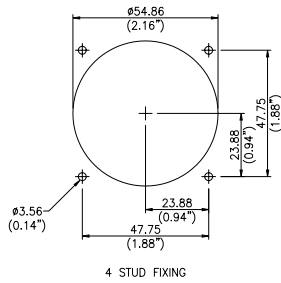


#### Window Mount Cut-out

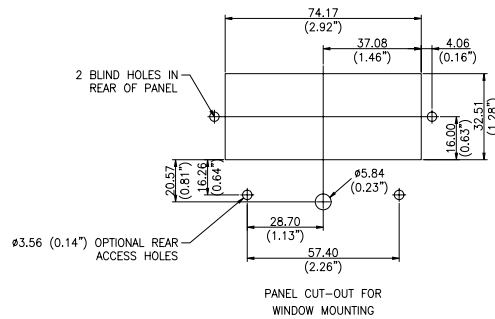


### Model 362

#### Surface Mount Cut-out

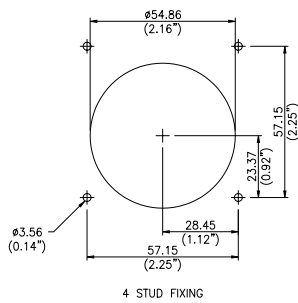


#### Window Mount Cut-out

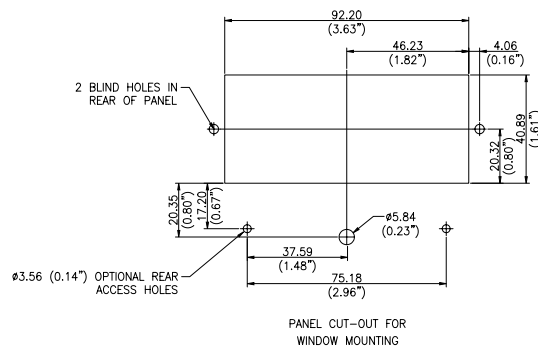


### Model 363

#### Surface Mount Cut-out

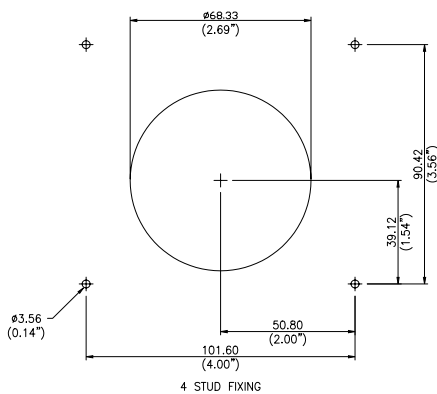


#### Window Mount Cut-out

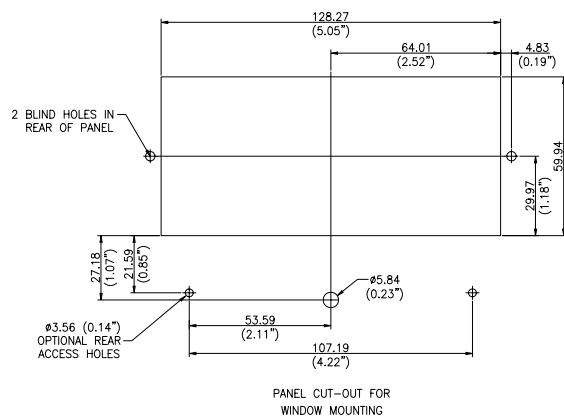


### Model 364

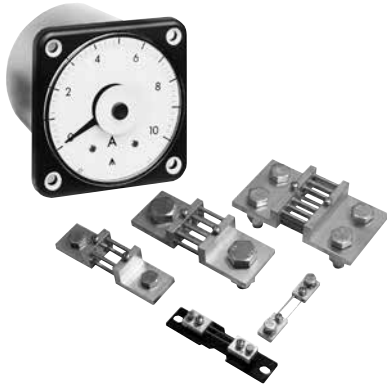
#### Surface Mount Cut-out



#### Window Mount Cut-out



# SEALED AND RUGGEDISED PANEL INDICATORS



## Features

- Designed specifically for stringent industrial, marine and military specifications
- An extensive range of high accuracy measuring instruments in 3 case sizes
- Rugged Hi-Q taut-band suspension
- Bump, shock and vibration proof

## Benefits

- Complies with BS EN60051 (IEC51)
- IP67 (NEMA 6 and 6P) protection
- Dial illumination option
- Parallax error-free platform dials for 078/087. Optional for 083/084

## Applications

- Switchgear
- Distribution systems
- Generator sets
- Control panels
- Utility power monitoring
- Process control
- Motor control
- Marine
- Military

## Approvals

- DEF STAN 66.7

## 078/080/087 Series 240° Scale

The Crompton Instruments 078/080/087 series of heavy duty sealed instruments are designed to comply with the most stringent industrial, marine and military specifications.

This metal cased range offers bezel sizes of 57mm, 83mm and 110mm all fitted with toughened glass. Indicators comply with Ministry of Defence specification DEF STAN 66.7. and operate efficiently in the most adverse environments where extreme conditions of shock, vibration, dirt, humidity and temperature variation are present.

## Description

Indicators have metal cases with bezel sizes of 50 x 57mm (083), 83mm Ø (084) and 110mm x 100mm (078/087). All indicators are fitted with toughened glass windows. The standard black matt finish can be replaced with options ranging from light admiralty grey to BS3181C No:697. To prevent fogging, all indicators have been dried, evacuated and filled with dry nitrogen during manufacturing. The case interior retains a constant pressure of at least 94kPa above the exterior with leakage not above the equivalent of 1.33 Pa ml/s of air. Except on model 083, panel sealing gaskets are standard equipment.

Standard instrument dials are finished in acrylic white matt with black printing and a parallel pointer. Scales form a true arc with zero on the left hand-side. Options include dial illumination, a centre, off-set or suppressed zero, colour index lines, bands, zones or segments, a black dial with white printing, and customer logo.

## Specifications

Performance:	BS EN60051 (IEC51) DEF STAN 66-7 on request (087 only)
Accuracy:	Refer to Product Range table
Scaling:	BS89, BS3693 or DEF STAN 66-7 and 66-9
Dielectric test:	2kV RMS to BS EN61010-1
Overloads:	x 1.2 rated current for 2 hours x 10 rated current for 5 seconds x 1.2 rated voltage for 2 hours x 2 rated voltage for 5 seconds
Enclosure code:	IP67 (NEMA 6 and 6P)
Case:	Black matt metal filled with dry nitrogen
Bezel:	Black matt metal. Optional admiralty grey No. 697
Bezel window:	Toughened glass
Operating temperature:	-40°C to +70°C (-40°F to +158°F)
Storage temperature:	-55°C to +85°C (-67°F to +185°F)
Standard calibration:	23°C (73°F)
Approvals:	EMC and LVD DEF 66.7



## 078/080/087 Series 240° Scale

### Product Range

Type of instrument	Ranges	Accuracy class	Burden VA	Case code depth behind the bezel			Product code	
DC ammeter shunt operated	50, 60, 75, 100, 150mV	2.5	See T118***	57	-	-	083-05A	
DC ammeter shunt operated	50, 60, 75, 100, 150mV	1.5	See T118***	-	59	-	084-05A	
DC ammeter shunt operated	50, 60, 75, 100, 150mV	1.5	See T118***	-	-	86	078-05A	
DC ammeter shunt operated	50, 60, 75, 100, 150mV	1.5	See T118***	-	-	86	087-11A	
DC ammeter	200QA-30A	2.5	See T118***	57	-	-	083-05A	
DC ammeter	200QA-30A	1.5	See T118***	-	59	-	084-05A	
DC ammeter	200QA-30A	1.0	See T118***	-	-	86	078-05A	
DC ammeter	200QA-30A	1.0	See T118***	-	-	86	087-11A	
DC ammeter suppressed zero	4/20mA	2.5	See T118***	57	-	-	083-05R	
DC ammeter suppressed zero	4/20mA	1.5	See T118***	-	59	-	084-05R	
DC ammeter suppressed zero	4/20mA	1.5	See T118***	-	-	86	078-05R	
DC ammeter suppressed zero	4/20mA	1.5	See T118***	-	-	86	087-11R	
DC voltmeter	50mV-600V	2.5	See T118***	57	-	-	083-05V	
DC voltmeter	50mV-600V	1.5	See T118***	-	59	-	084-05V	
DC voltmeter	50mV-800V	1.5	See T118***	-	-	86	078-05V	
DC voltmeter	50mV-800V	1.0	See T118***	-	-	86	087-11V	
DC voltmeter suppressed zero	1/5V	1.5	See T118***	-	-	86	078-05S	
DC voltmeter suppressed zero	1/5V	1.5	See T118***	-	-	86	087-11S	
AC rectified ammeter	200QA-1A	2.5	See T118***	57	-	-	083-05B	
AC rectified ammeter	200QA-1A	2.5	See T118***	-	59	-	084-05B	
AC rectified ammeter	200QA-30A	1.5	See T118***	-	-	86	078-05B	
AC rectified ammeter	200QA-30A	1.5	See T118***	-	-	86	087-11B	
AC rectified voltmeter	15-600V 25Hz/3kHz	2.5	See T118***	57	-	-	083-05W	
AC rectified voltmeter	15-600V 25Hz/3kHz	2.5	See T118***	-	59	-	084-05W	
AC rectified voltmeter	15-600V 25Hz/3kHz	1.5	See T118***	-	-	86	078-05W	
AC rectified voltmeter	15-600V 25Hz/3kHz	1.5	See T118***	-	-	86	087-11W	
Elapsed time meter	50 or 60Hz, 100-400V*			57	-	-	083-155 or 156	
Elapsed time meter	12, 24V DC			57	-	-	083-151	
Elapsed time meter	50 or 60Hz, 100-400V*			-	59	-	084-155 or 156	
Elapsed time meter	12, 24V DC			-	59	-	084-151	
Elapsed time meter	50 or 60Hz, 100-400V*			-	-	86	078-155 or 156	
Frequency meter	50/60/400Hz 100-440V*	0.5%	4	57	-	-	083-41S	
Frequency meter	50/60/400Hz 100-440V*	0.5%	4	-	59	-	084-41S/089-41S	
Frequency meter	50/60/400Hz 100-440V*	0.5%	4	-	-	86	078/087-41L	
Temperature indicator	RTD	1.5	See T118***	-	-	86	078-45 R	
Wattmeter or Varmeter	0.2-10A/100-440V*	Balanced	Current	-	-	132	132	078/087-21 or 31
Transducer operated indicator	1, 5, 10, 20 or 4/20mA	1.0	See T118***	57	-	-	083-05	
Transducer operated indicator	1, 5, 10, 20 or 4/20mA	1.0	See T118***	-	59	-	084-05	
Transducer operated indicator	1, 5, 10, 20 or 4/20mA	1.0	See T118***	-	-	86	078-05	
Transducer operated indicator	1, 5, 10, 20 or 4/20mA	1.0	See T118***	-	-	-	86	087-11

\* 100-440V = (100/125, 200/250, 380/440).

\*\*\* The T118 technical sheet is available on request.



## O80 Series 90° Scale

A range of metal case, sealed instruments for industrial and military applications involving extreme shock, vibration, temperature, dirt and humidity. Bezel sizes 57mm, 83mm comply with Ministry of Defence specification DEF STAN 66-7 or DEF STAN 66-9 for all standard ratings.

### Description

Two bezel sizes of 57 x 57mm (O83) and 83mm Ø (O84), with barrel diameters of 53mm (O83) and 67mm (O84) and toughened glass windows are used throughout the series. To avoid fogging they are dried, evacuated and filled with dry nitrogen. Panel sealing gaskets are provided as standard with the exception of Model O83. Models O83 and O84 have steel cases with fixing holes in the flange. Sealed zero adjusters are provided. Standard instrument dials are finished in a white matt with black printing and parallel pointer. The scales form a true arc with zero on the left.

### Options

Available options include dial illumination, a centre, off-set or suppressed zero, colour index lines, bands, zones or segments, a black dial with white printing and customer logo. Instruments operated by separate transducers indicate watts, VAR, frequency, phase angle, current, voltage and other physical/mechanical parameters are also available. Illumination options as follows:

Models O83/O84: Edge, white or red bulb, 12 or 24V, illumination.

## Specifications

Performance:	BS EN60051 (IEC51). DEF STAN 66-7 and 66.9 on request (O84 only)
Accuracy:	Class 2.5 frequency meter 0.5% of mid frequency
Scaling:	To BS89, BS3693 or DEF STAN 66-7 and 66-9
Dielectric test @ 50 Hz:	2kV RMS; <50V 500V RMS All for 1 minute
Overloads:	x1.2 rated current or voltage for 2 hours. x 10 rated current for 5 seconds. x2 rated voltage for 5 seconds
Burden:	AC ammeter: 1VA maximum. AC voltmeter: 3VA maximum
Frequency meter:	4VA maximum
Elapsed time meter:	2.5VA maximum
Enclosure code:	IP67 (NEMA 6 and 6P)
Case:	Black matt metal filled with dry nitrogen
Bezel:	Black matt metal
Bezel window:	Toughened glass
Operating temperature:	-40°C to +70°C (-45F to +158°F)
Standard calibration:	23°C (73°F)
Approvals:	EMC and LVD. DEF 66.7 and 66.9

## Product Range

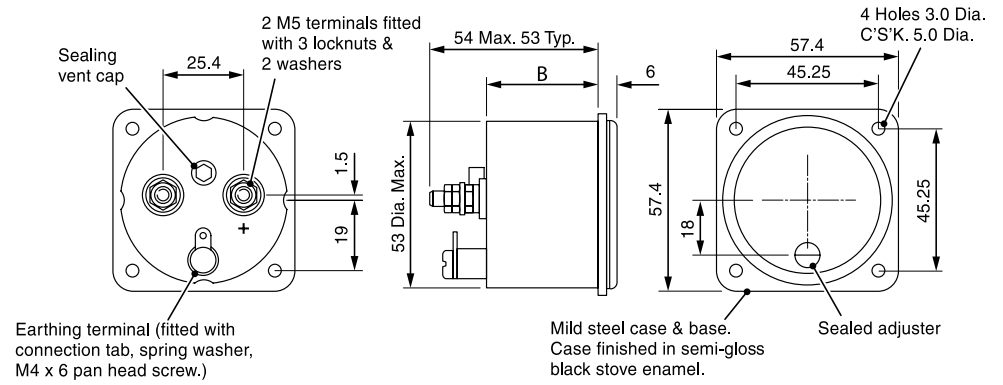
Type of instrument	Ranges	Case code		Product code
AC ammeter moving iron	1-30A	✓	-	O83-75A
AC ammeter moving iron	1-30A	-	✓	O84-75A
AC voltmeter moving iron	5-300V	✓	-	O83-75V
AC voltmeter moving iron	5-300V	-	✓	O84-75V
DC ammeter shunt operated	50, 60, 75, 100, 150mV	✓	-	O83-80A
DC ammeter shunt operated	50, 60, 75, 100, 150mV	-	✓	O84-80A
DC ammeter	50QA-30A	✓	-	O83-80A
DC ammeter	50QA-30A	-	✓	O84-80A
DC ammeter suppressed zero	4/20mA	✓	-	O83-80R
DC ammeter suppressed zero	4/20mA	-	✓	O84-80R
DC voltmeter	50mV-300V, 1000Ω/V	✓	-	O83-80V
DC voltmeter	50mV-300V	-	✓	O84-80V
DC voltmeter suppressed zero	1/5V	-	✓	O84-80S
AC rectified ammeter	100QA-500mA.25Hz/3kHz	✓	-	O83-80B
AC rectified ammeter	100QA-500mA.25Hz/3kHz	-	✓	O84-80B
AC rectified voltmeter	15-600V, 900Ω/V	✓	-	O83-80W
AC rectified voltmeter	15-600V	-	✓	O84-80W
Elapsed time meter (99999.9)	12 or 24V DC	✓	✓	O82/O83/O84-151
Elapsed time meter (99999.9)	50Hz/100-440V*	✓	✓	O83/O84-155
Elapsed time meter (99999.9)	60Hz/100-440V*	✓	✓	O83/O84-156
Frequency meter	50 or 60 or 400Hz/100-440V*	✓	-	O83-41S
Frequency meter	50 or 60 or 400Hz/100-440V*	-	✓	O84-41S
Transducer indicator speed	1, 5, 10, 20, and 4/20mA	-	✓	O84/802
Transducer indicator frequency	1, 5, 10, 20, and 4/20mA	-	✓	O84/803
Transducer indicator phase angle	1, 5, 10, 20, and 4/20mA	-	✓	O84/804
Transducer indicator watts	1, 5, 10, 20, and 4/20mA	-	✓	O84/805
Transducer indicator VARs	1, 5, 10, 20, and 4/20mA	-	✓	O84/806
Transducer indicator VA	1, 5, 10, 20, and 4/20mA	-	✓	O84/807

\*100-440V - (100/125 or 200/250 or 380/440).



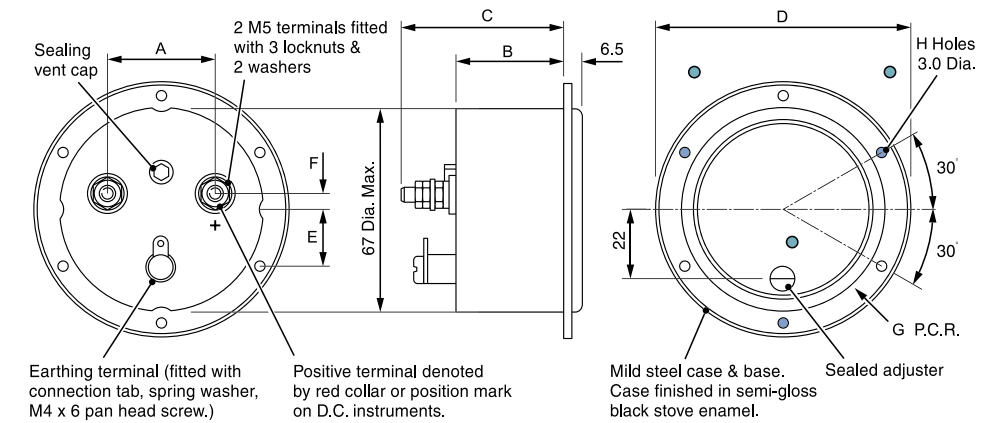
## Dimensions

### Model 083



	B
083-80	33.6
083-75	37.6

### Model 084



\*When fitted with terminal shunt for ranges above 20 amps.

	A	B	C	D	E	F	G	H
084-80	35	33.5	59	82.5	20	5	36.5	6 off
084-75	35	38	64	82.5	20	5	36.5	6 off

Panel Cut out 68.3 $\phi$  - Holes 3.8 $\phi$

These  holes on 084 only.

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## About TE Connectivity

TE Connectivity is a global, \$14 billion company that designs and manufactures over 500,000 products that connect and protect the flow of power and data inside the products that touch every aspect of our lives. Our nearly 100,000 employees partner with customers in virtually every industry – from consumer electronics, energy and healthcare, to automotive, aerospace and communication networks – enabling smarter, faster, better technologies to connect products to possibilities.

WHEREVER ELECTRICITY FLOWS, YOU'LL FIND TE ENERGY



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