



An extensive range of 48, 72, 96 and 144mm DIN style panel meters offering measurement of all electrical and electronic parameters. Meters are shock resistant and vibration proof and supplied with terminal covers. A selection of slide in dials and customised options are available.

## Movements

In Crompton Instruments' world-patented 'Hi-Q' taut band suspension, all the delicate parts of the traditional instruments are eliminated. There are no pivots, no jewel bearings, no hair-springs and no air damping vane. Instead, a tough platinum ribbon suspends the moving element between front and rear tension springs. Specially contoured pads are fitted to the ends of the spindle, and the working gap at each end is filled with a high quality silicon fluid. The pads, together with the fluid reservoir, form a system which acts as a resilient built-in shock absorber. This provides both rotational and longitudinal damping as the moving element floats on oil with no bearing friction and is effectively cushioned against shock and vibration. 360° Synchrosopes and power factor meters have robust pivot and jewel bearings with oil damping.

## Features

- An extensive range of specialist measuring meters in 4 case sizes
- Shock resistant taut band suspension
- Vibration-proof Hi-Q damping
- Slide in dials for 90° current, voltage and frequency on models 242, 243 and 244
- Terminal covers supplied as standard

## 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

## Approvals

LRS and BV Approvals.

## Dials, Scales and Pointers

Standard dials are matt white 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 models 242, 243 and 244 90° moving iron, moving coil and frequency meters.

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' requirements.

## Illumination

Internal illumination is available in the following models:

- 244 and 246 shortscale moving coil and moving iron vane.
- 243, 244 and 246 longscale moving coil and moving iron vane.

Through dial (Translucent) illumination on 244 and 246 models.

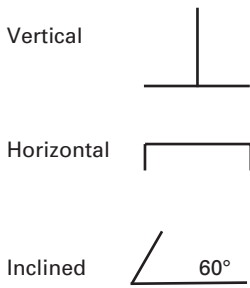
Edge illumination on 243, 244 and 246 models.

Replaceable 6, 12 or 24V lamps are used on all models except 243 longscale meters, where the lamps are internal.

## Specification

Performance	BSEN60051
Measuring Ranges	DIN 43701
Accuracy Overload	BSEN60051
Dimensions	DIN 43700
Scale Marking Generally	DIN43802
Magnetic Influence	BSEN60051
Safety	IEC414
Terminals	Clamp strap M4 up to 25A. Clamp strap M8 over 25A
Humidity Range	Up to 95% RH (non condensing)
Test Voltage @50Hz	2kV RMS for 1 minute
Overload AC Current	x 1.2 continuous x 10 for 5 seconds
Overload AC Voltage	x 1.2 continuous x 2 for 5 seconds
Frequency	See main pages for other instruments
Damping Time	Less than 3 seconds is standard. More heavily damped movements are available on request.
Standard Calibration	23°C
Operating Temperature	-20°C to +60°C
Enclosure Code	IP54 as standard (to BSEN60529). IP55 consult factory Terminals IP20B with terminal cover or terminal boots fitted
Case	Grade UL94V0
Base	Grade UL94V1

## DIN 16257 symbol meaning for calibration position

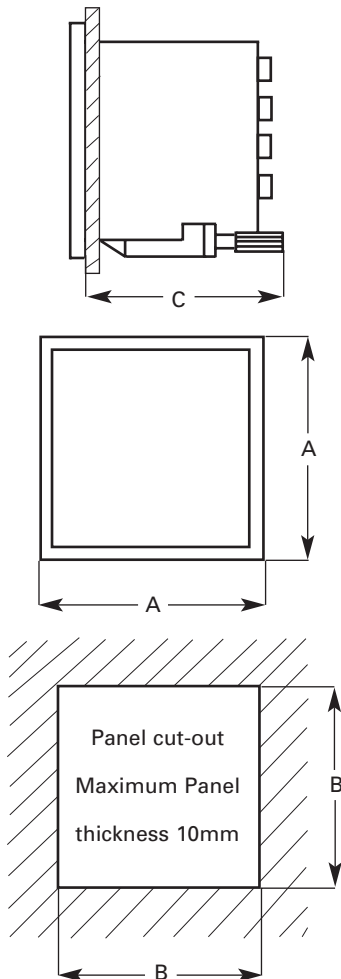


Inclination of dial surface to the horizontal e.g 60°.  
Required orientation must always be stated when ordering if other than vertical mounting is required.

## Specification Continued

Case	Dimensions and panel cutout conform to IEC473, DIN 43700. Models 242, 243 and 244 have cases and bezels injection moulded in flame retardant engineering thermoplastic, recognised by Underwriters Laboratory materials specification. All 246 models have pressed steel cases.
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. Installation Category III
Fixing on Panel	Models 242, 243 and 244 – 2 corner fixing clamps and tensioning thumb screws Model 242 – available with a one piece 'push on' clamp. Model 246 - 2 side fixing spring clips
Mounting Position	Normal vertical mounting or as indicated on the scale in accordance with DIN 16257. A deviation of $\pm 15^\circ$ is permissible
Approvals	Lloyds Shipping (LRS), Bureau Veritas (BV), EMC and LVD

## Dimensions



Model	242	243	244	246
Bezel 'A'	48 x 48	72 x 72	96 x 96	144 x 144
Panel cut-out 'B'	45 x 45	68 x 68	92 x 92	138 x 138
Scale Length: 90°	42	65	94	145
Scale Length: 240°	72	112	150	230
<b>Maximum overall depth 'C':</b>				
Ammeters and Voltmeters A.C. & D.C.*	64	64	64	60
Ammeters and Voltmeters with switch*	–	–	64	–
Dual Meters*	–	–	64	–
Elapsed Time Meter/Hours Run*	64	64	64	–
Maximum Demand Indicator*	–	64	64	60
Combined MDI & MI Indicator*	–	–	64	60
Maximum Demand Indicator with relay*	–	–	90	–
Frequency Meter 90°*	64	64	64	60
Frequency Meter 240°*	§	§	120	125
Phase Angle, Power Factor Meter 90°*	§	§	107	§
240°*	§	§	107	§
M.C. Indicator with separate transducer*	64	64	64	60
Dynamometer 360° Synchroscope*	–	–	120	125
Dynamometer 360° Power Factor Meter*	–	–	120	–
Phase Sequence Indicator*	–	64	64	–
Position Indicator*	§	§	120	125
Speed Indicator*	64	64	64	60
Temperature Indicators*	–	–	120	125
Quadra Meters*	–	–	64	–
Impulse Counters*	64	64	64	–
Wattmeter, Varmeter 90°	§	§	107	125
Wattmeter, Varmeter 240°	§	§	107	125
Model 244-21Y & 244-21Z	–	–	142	–
LED Synchroscope & Synchro Check Relay	–	–	80	–
LED 360° Synchroscope	–	–	80	–

§ Indicator Only  
\* If separate terminal cover is used add 20 mm to dimension C  
– Not available

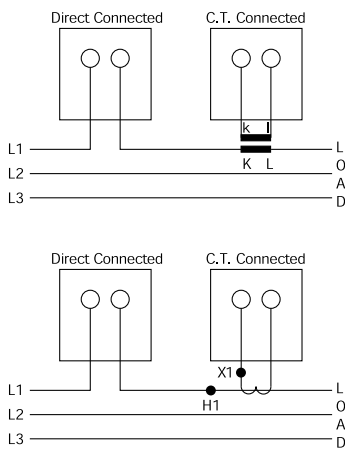


## Moving Iron A.C. Ammeters and Voltmeters

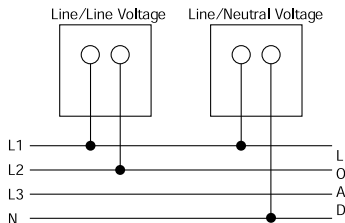
Designed to measure A.C. current or voltage, these meters indicate true r.m.s. values and are substantially independent of system waveform. Scales are calibrated down to 20%, and ammeters can have overload scales x2, x3, x5 or x6 for motor start duty. Ammeters can be supplied for use with -/1A or -/5A current transformers, whilst voltmeters can be scaled for use with voltage transformers. Heavy damping is available as an option. Meters can be used to measure D.C. at reduced accuracy.

### Connections

#### A.C. Ammeter



#### A.C. Voltmeter



### Specification – Short Scale

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: 0.5A to 100A A.C. direct connected (40A for 242-75A and 246-07A). Maximum system voltage 720V A.C. Low load / high middle maximum 10A Voltmeters: 6V to 600V

### Product Codes – Short Scale

Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145
<b>Product Codes</b>				
A.C. ammeter	242-75A	243-02A	244-02A	246-07A
x2 overload ammeter	242-752	243-022	244-022	246-072
x3 overload ammeter	242-753	243-023	244-023	246-073
x5 overload ammeter	242-755	243-025	244-025	246-075
x6 overload ammeter	242-756	243-026	244-026	246-076
Low load ammeter	–	243-02H	244-02H	–
A.C. voltmeter	242-75V	243-02V	244-02V	246-07V
Low middle voltmeter	–	243-02M	244-02M	–

### Specification – Long Scale

Accuracy:	Class 1.5
Frequency:	50 or 60Hz, (400Hz on request)
Burden at 50Hz:	Ammeters: 1.5VA Voltmeters: 4.5VA maximum
Ratings:	Ammeters: 0.5A to 25A A.C. direct connected Maximum system voltage 720V A.C. Low load / high middle (maximum 10A) Voltmeters: 6V to 600V A.C.

### Product Codes – Long Scale

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230
<b>Product Codes</b>				
Ammeter	242-03A	243-03A	244-03A	246-03A
x2 overload ammeters	242-032	243-032	244-032	246-032
x3 overload ammeters	242-033	243-033	244-033	246-034
x5 overload ammeters	242-035	243-035	244-035	246-035
x6 overload ammeters	242-036	243-036	244-036	246-036
Low load ammeters	–	243-03H	244-03H	–
Voltmeter	242-03V	243-03V	244-03V	246-03V



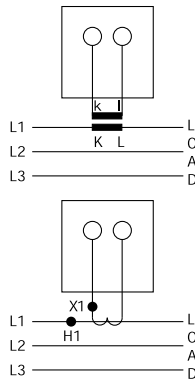
## Maximum Demand Indicators

The thermal/time characteristic of an MDI monitors the most economic use of cable, fusegear and transformers. The directly heated bimetal element indicates mean r.m.s. current over 8, 15, or 20 mins, and a red slave pointer shows the highest value reached. The reset knob is wire sealable. Scales are calibrated to match the C.T. 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.

### Specification

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

### Connections



### Product Codes

Bezel Size mm	72	96	144
Scale length mm*	65	94	145
<b>Product Codes</b>			
<b>8 Minute Time Lag</b>			
Without limiting C.T. for use with 5A C.T.	243-16B	244-16B	-
With self-contained 5/5A limiting C.T.	-	244-16R	-
<b>15 Minute Time Lag</b>			
Without limiting C.T. for use with 5A C.T.	243-16A	244-16A	246-16A
With self-contained 5/5A limiting C.T.	-	244-16E	-
<b>20 Minute Time Lag</b>			
Without limiting C.T. for use with 5A C.T.	243-16J	244-16J	246-16J
With self-contained 5/5A limiting C.T.	-	244-16K	-

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



## Combined A.C. Ammeter and Maximum Demand Indicator

Where the instantaneous and maximum demand currents are required, these instruments combine both movements in one case. It can also replace an existing A.C. Ammeter. Specification as above.

### Specification

Accuracy:	Moving Iron Ammeter: Class 1.5, MDI: Class 3
Burden at 50Hz:	MI - 0.5VA, MDI - 2.5VA, Saturating C.T. - 2VA

### Product Codes

Bezel Size mm	72	96	144
Scale length mm*	65	94	145
<b>Product Codes</b>			
<b>8 Minute Time Lag</b>			
Without limiting C.T. for use with 5A C.T. 3VA	-	244-16Q	-
With self-contained 5/5A limiting C.T. 5VA	-	244-16T	-
<b>15 Minute Time Lag</b>			
Without limiting C.T. for use with 5A C.T. 3VA	-	244-16C	246-16C
With self-contained 5/5A limiting C.T. 5VA	-	244-16F	246-16F
<b>20 Minute Time Lag</b>			
Without limiting C.T. for use with 5A C.T. 3VA	-	244-16H	-
With self-contained 5/5A limiting C.T. 5VA	-	244-16L	-

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



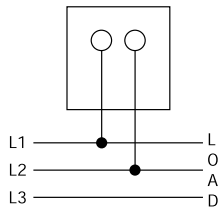
## Frequency Meters

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

### Specification

Accuracy:	Class 0.5
Ratings:	100V-125V A.C. 200V-250V A.C. 380V-440V A.C.* 500V A.C.* *For voltages above 380V use 242-013 with a 253-THZ, in place of 242-41S Models available for use with V.T.s
Frequency 0.5%:	45/55Hz, 55/65Hz, 45/65Hz, 360/440Hz Other scalings available on request
Burden:	4VA Maximum

### Connections



### Product Code

Bezel Size mm	48	48	72	72	96	96	144	144
Scale length mm	42	72	65	112	94	145		
Product Code	242-41S	242-053 +253-THZ	243-41S +253-THZ	243-053	244-41S	244-41L	246-41S	246-41L



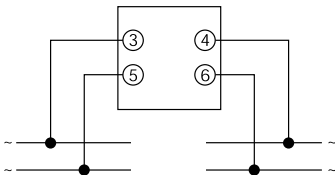
## Dual Frequency Meters

Two instruments in one case can be used to measure a wide range of frequencies. These dual instruments save both panel space and assembly time. The 244-41D is an ideal component in synchronising applications.

### Specification

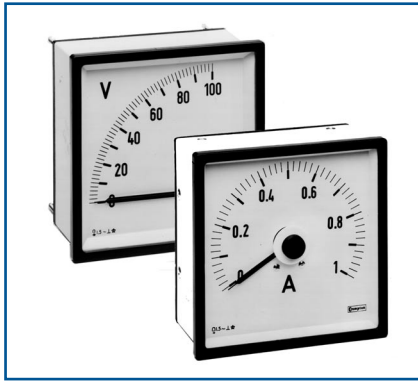
Accuracy:	Class 0.5
Ratings:	100V-125V A.C. 200V-250V A.C. 380V-440V A.C. 500V A.C. Models available for use with V.T.s
Frequency 0.5%:	45/55Hz, 55/65Hz, 45/65Hz, 360/440Hz
Burden:	4VA Maximum

### Connections



### Product Code

Bezel Size mm	96
Scale length mm	65
Product Code	244-41D



## Moving Coil Rectified A.C. Ammeters and Voltmeters

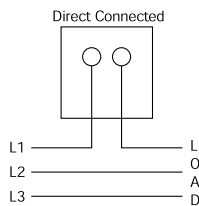
For high frequency or linear full scale A.C. measurements, these instruments measure average values of sinusoidal waveforms and are scaled in r.m.s. values. The high quality silicon bridge rectifier gives a linear scale down to near zero, where some compression occurs.

### Specification – Short Scale

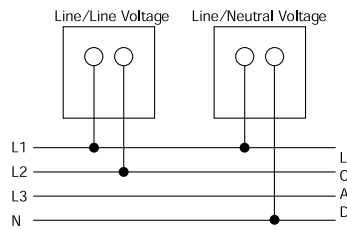
Accuracy:	1.5% ES
Ratings:	Ammeters: Model 242 from 250 $\mu$ A to 20mA Model 243 from 250 $\mu$ A to 1A Models 244/246 from 250 $\mu$ A to 20A Voltmeters: 15V to 600V a.c. direct connected Models available for use with V.T.s
Frequency:	50/60Hz, (Single Frequencies 25Hz to 3kHz on request)

### Connections

#### A.C. Ammeter



#### A.C. Voltmeter



### Product Codes – Short Scale

Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145
<b>Product Codes</b>				
Ammeters	242-89B	243-01B	244-01B	246-10B
Voltmeters	242-89W	243-01W	244-01W	246-10W

### Specification – Long Scale

Accuracy:	1.5 % ES
Ratings:	Ammeters: 250 $\mu$ A to 1A A.C. Up to 30A on models 244/246-05B Voltmeters: 15V to 600V Direct connected Models available for use with V.T.s
Frequency:	50/60Hz. (Single frequencies 25Hz to 3kHz on request)

### Product Codes – Long Scale

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230
<b>Product Codes</b>				
Ammeters	242-05B	243-05B	244-05B	246-05B
Voltmeters	242-05W	243-05W	244-05W	246-05W



## Dual A.C. Ammeters and Voltmeters

The two instruments in one case can be used for independent measurement of 2 parameters or the comparison of the two inputs. For example, when an A.C. generator is to be connected in parallel with mains supply where voltage, phase and frequency must coincide.

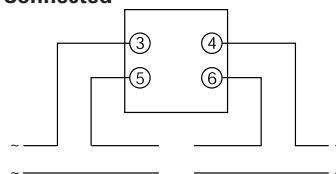
### Specification

Accuracy:	1.5% ES
Ratings:	Ammeter: 250 $\mu$ A to 10A A.C. Voltmeter: 15 to 600V direct connected
Frequency:	50/60Hz (single frequencies 25Hz to 3kHz on request)

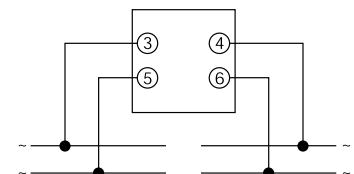
### Product Codes

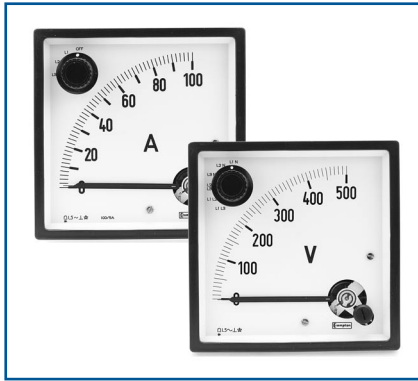
Bezel Size mm	96
Scale length mm	65
<b>Product Codes</b>	
Ammeters	244-80F
Voltmeters	244-80L

#### Dual A.C. Ammeter Direct Connected



#### Dual A.C. Voltmeter





## Moving Coil Rectified A.C. Ammeters and Voltmeters with Selector Switch

These moving coil rectified A.C. meters measure voltage or current and incorporate a selector switch which eliminates the need to fit a separate selector switch, thus saving panel space and assembly time.

A.C. Ammeters with selector switch are suitable for:

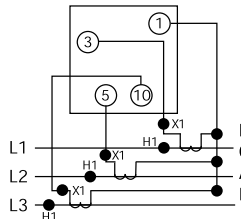
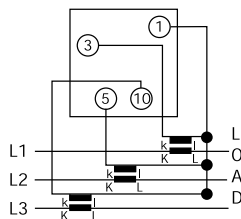
- Line current measurement in a single 96 DIN housing with an 'off' position.
- Internal 1A or 5A/10mA C.T.s are fitted to ensure the primary C.T.s are always in circuit.

A.C. Voltmeters with selector switch are suitable for:

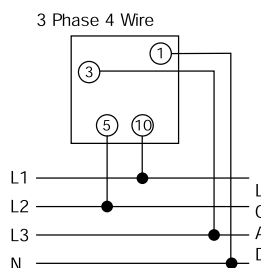
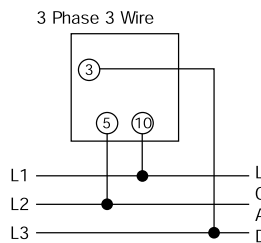
- Three phase four wire line to line and line to neutral voltage measurement in a single 96 DIN housing.
- Three phase three wire line to line voltage measurement in a single 96 DIN housing with 'off' position.

### Connections

#### A.C. Ammeters with Selector Switch



#### A.C. Voltmeters with Selector Switch



### Specification

Accuracy:	1.5% ES
Frequency:	50/60Hz (single frequencies 25Hz to 3kHz on request)
Ratings:	Ammeters: 250μA to 5A A.C. via 1:1 C.T. Over 5A via C.T.s.
	Voltmeters: 15V to 600V direct connected Models available for use with V.T.s
Bezel Size:	96mm
Scale Length:	94mm

### Product Codes – A.C. Ammeter with Selector Switch

Model	Switch Notation
244-01E-AMP1	3 (+off) switch pos; T, S, R, Off
244-01E-AMP2	3 (+off) switch pos; B, Y, R, Off
244-01E-AMP3	3 (+off) switch pos; L3, L2, L1, Off
244-01E-AMP4	3 (+off) switch pos; Off, R, W, B

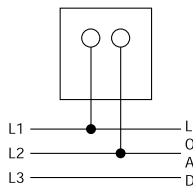
### Product Codes – A.C. Voltmeters with Selector Switch

Model	Switch Notation
244-01Q-SW1	6 switch pos; RT, ST, RS, RO, SO, TO
244-01Q-SW2	6 switch pos; RB, YR, BY, BN, YN, RN
244-01Q-SW3	6 switch pos; L1L3, L1L2, L2L3, L3N, L2N, L1N
244-01Q-SW4	3 (+off) switch pos; RT, ST, RS, Off
244-01Q-SW5	3 (+off) switch pos; RY, YB, RB, Off
244-01Q-SW6	3 (+off) switch pos; L1L2, L2L3, L3L1, Off
244-01Q-SW7	6 switch pos; RN, WN, BN, BW, WR, RB
244-01Q-SW8	3 (+off) switch pos; RW, WB, RB, Off

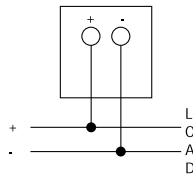


## Connections

Elapsed Time/Hours Run Meters A.C.



Elapsed Time/Hours Run Meters D.C.



## Elapsed Time Meter or Hours Run Meters

Elapsed time meters or hours run meters monitor "ON/RUN" time of plant and equipment allowing the user to perform functions such as production efficiency, cost estimating and service period monitoring for preventative maintenance etc. The time is measured in increments of 0.01h up to 99999.99 hours after which time the meter resets to zero. Meters are non resettable to prevent accidental resetting.

### Specification

Display:	99999.99
Voltage:	100-125V A.C. 200-250V A.C. 380-440V A.C.
Frequency:	50 or 60Hz
Burden:	2.5VA for D.C. input models
Voltage:	10/27V (12, 24V) D.C. 38/58V (48V) D.C. 90/132V (110V) D.C.

### Product Codes

Bezel Size mm	48	72	96
Scale length	99999.99h	99999.99h	99999.99h
<b>Product Code</b>			
50Hz	242-158	243-155	244-155
60Hz	242-159	243-156	244-156
D.C. Input	242-157	243-151	244-151

## Impulse Counters

Impulse counters can be used to measure any parameter where a pulse can be applied that is directly proportional to the parameter being measured. For example, the number of motor starts or by using a combination of Paladin Transducers, kW.h., Ampere hour, VA hour etc., can be recorded. The Impulse counter counts one digit every time an on/off voltage pulse is applied to the input terminals, and is non resettable to prevent accidental resetting.

### Specification

Accuracy:	Pulse for Pulse
Display:	6 Digit 999999
Ratings:	110V, 120V, 220V, 230V, 240V, or 415V A.C. ±10% 50/60Hz 12V or 24V D.C. ±10%
Burden:	0.75VA (110V A.C.) 2.70VA (415V A.C.) 80mW (12V D.C.)
Pulse width:	50ms Minimum
Mark/Space Ratio:	1:1

### Product Codes

Bezel Size mm	48	72	96
Scale length	999999	999999	999999
<b>Product Codes</b>			
<b>D.C. Input</b>			
12V	242-259G-MU	243-259G-MU	244-259G-MU
24V	242-259G-BD	243-259G-BD	244-259G-BD
<b>A.C. Input</b>			
110V	242-259G-PM	243-259G-PM	244-259G-PM
120V	242-259G-PQ	243-259G-PQ	244-259G-PQ
220V	242-259G-R4	243-259G-R4	244-259G-R4
230V	242-259G-RQ	243-259G-RQ	244-259G-RQ
240V	242-259G-RR	243-259G-RR	244-259G-RR
380V	242-259G-RU	243-259G-RU	244-259G-RU
415V	242-259G-SB	243-259G-SB	244-259G-SB



## Quadra 3 in 1 and 4 in 1

A range of 96mm<sup>2</sup> DIN style 3 in 1 and 4 in 1 meters offering reduced stock holding and savings on space, installation and commissioning. Ideally suited for generator set applications, the range offers measurement of A.C. and D.C., current and voltage, frequency or elapsed time. Options include customer logo on dial, coloured dial, panel mounting gasket and heavily dampened movements.

### Specification

Voltmeter:	110, 120, 200, 230, 240, 380, 400, 415, 440, 480V A.C. nominal. Maximum end scale 600 volts.
Frequency Meter Inputs:	45/55Hz, 55/65Hz, 45/65Hz, 360/440Hz Voltage inputs: As voltmeter inputs above
Ammeter inputs:	10mA A.C. 1 or 5A input (internal C.T.)
Hours Run:	110, 120, 220, 230, 240, 380, 400, 415, 440 Volts 50 or 60Hz
Hour Run Counting Range:	99999.99 hours
D.C. Current:	250 $\mu$ A to 1 Amp D.C. including 1, 5, 10, 20 and 4-20mA D.C. for transducer inputs
D.C. Volts:	50mV to 600 Volts D.C. including 50, 60, 75 and 150mV for shunt inputs
Burden:	Current: 0.75VA per phase Hours Run: 2.5VA LCD Hours Run: 0.5VA Voltage: 0.5VA Frequency: 4VA

When ordering please specify the inputs for each parameter and the scaling required.

### Product Codes

Code	Description
244-80C	ACV + DCI + ACA + DCA
244-80D	3 x DCI + D.C. ETM (LCD)
244-80G	3 x ACA
244-80H	3 x ACV + FRQ
244-80I	3 x ACA + ETM
244-80J	3 x ACA + ETM (LCD)
244-80K	FRQ + ACV +DCI
244-80N	ACA + ACV + FRQ + ETM
244-80P	3 x ACV
244-80Q	ACV // FRQ // ETM + ACA
244-80R	ACV // ETM + 2 x ACV
244-80S	2 x ACV + 2 x ACA
244-80T	FRQ // ETM + ACV
244-80U	3 x ACA + ACV
244-80W	ETM // FRQ + DCI + ACV
244-80X	4 x DCI
244-80Y	ETM // FRQ + DCI
244-80Z	ACV + ACA + FRQ // ETM
244-802	2 x ACV + ACA + ETM
244-803	ACV + FRQ + 2 x ACA
244-804	3 x ACA + DCI
244-806	3 x ACV + ACA
244-807	V, Hz, ETM + SWITCH

### Description

ACV	= Rectified A.C. voltmeter
ACA	= Rectified A.C. ammeter
DCA	= D.C. ammeter
DCI	= D.C. indicator
ETM	= Elapsed time meter
ETM(LCD)	= LCD elapsed time meter
FRQ	= Frequency Meter
//	= In parallel with



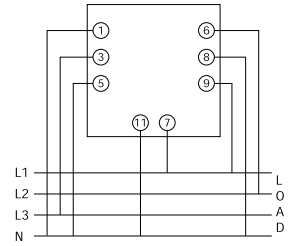
## Quadra 3 in 1 and 4 in 1

### Connections

#### 244-80H

##### Terminals

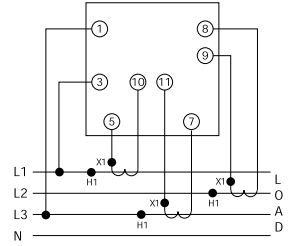
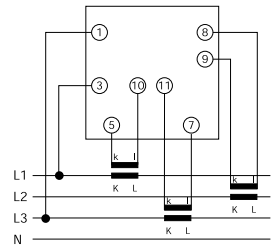
- 1 Volt Neutral L3
- 3 Volt Live L3
- 5 Frequency Neutral
- 6 Volt Live L2
- 7 Frequency Live
- 8 Volt Neutral L1
- 9 Volt Live L1
- 11 Volt Neutral L2



#### 244-80I

##### Terminals

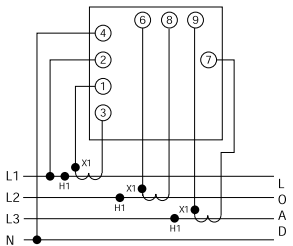
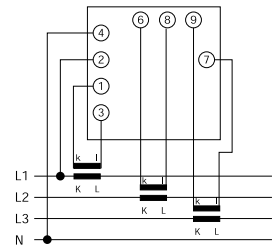
- 1 Neutral Hours Run
- 3 Live Hours Run
- 5 Current Start Red L1
- 10 Current Finish Black L1
- 11 Current Start Red L3
- 7 Current Finish Black L3
- 9 Current Start Red L2
- 8 Current Finish Black L2



#### 244-80J

##### Terminals

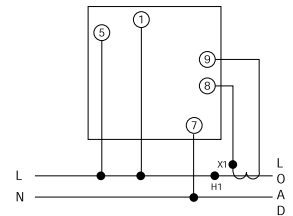
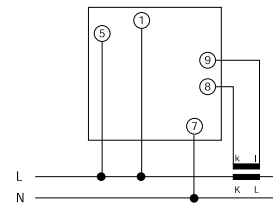
- 1 Current Start Red L1
- 3 Current Finish Black L1
- 2 Live Hours Run
- 4 Neutral Hours Run
- 6 Current Start Red L2
- 8 Current Finish Black L2
- 9 Current Start Red L3
- 7 Current Finish Black L3



#### 244-80Q

##### Terminals

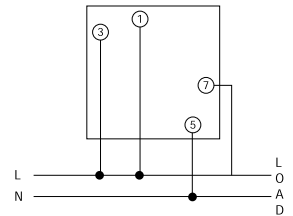
- 1 Live Hours Run
- 5 Live Volts and Frequency
- 7 Neutral
- 8 Current Start Red
- 9 Current Finish Black



#### 244-80T

##### Terminals

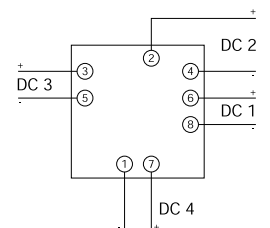
- 1 Voltmeter Input
- 3 Voltmeter Input
- 5 Hours Run & Frequency Meter Input
- 6 Hours Run & Frequency Meter Input



#### 244-80X

##### Terminals

- 2 Positive DC 2
- 3 Positive DC 3
- 4 Negative DC 2
- 5 Negative DC 3
- 6 Positive DC 1
- 7 Positive DC 4
- 8 Negative DC 1
- 11 Negative DC 4





## Moving Coil D.C. Ammeters and Voltmeters

Moving Coil Meters are suitable for all D.C. 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.

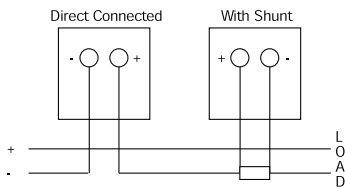
### Specification

Accuracy:	Class 1.5
Ratings:	Ammeters: 100 $\mu$ A to 25A, (200 $\mu$ A for 05 model) 4/20mA suppressed zero 40A for model 243/244-01A Voltmeters: 50mV to 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

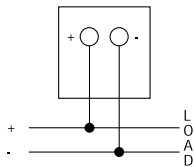
Further details on our T-Sheet T118 available on request.

### Connections

#### D.C. Ammeter



#### D.C. Voltmeter



### Product Codes – Short Scale

Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145
<b>Product Codes</b>				
Ammeters	242-89A	243-01A	244-01A	246-10A
Ammeters suppressed zero	242-89R	243-01R	244-01R	246-10R
Voltmeters	242-89V	243-01V	244-01V	246-10V
Voltmeters suppressed zero	242-89S	243-01S	244-01S	246-10S

### Product Codes – Long Scale

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230
<b>Product Codes</b>				
Ammeter	242-05A	243-05A	244-05A	246-05A
Ammeters suppressed zero	242-05R	243-05R	244-05R	246-05R
Voltmeters	242-05V	243-05V	244-05V	246-05V
Voltmeters suppressed zero	242-05S	243-05S	244-05S	246-05S



## Moving Coil Dual D.C. Ammeters and Voltmeters

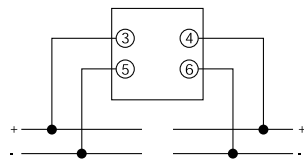
Dual instruments can be used to measure a wide range of currents and voltages, and save both space and time by requiring only one panel cut-out. The 244-80M allows for independent measurement of two D.C. currents in one case. The 244-80E allows for independent measurement of two D.C. voltages in one case.

### Specification

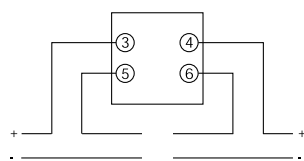
Accuracy:	Class 1.5
Ratings:	D.C. Current: 100 $\mu$ A to 25A direct connected 4/20mA suppressed zero. D.C. Volts: 50mV to 600V 1/5 volt suppressed zero 50, 60, 75, 150mV for use with shunts.

### Connections

#### Dual D.C. Ammeter



#### Dual D.C. Voltmeter



### Product Codes

Bezel Size mm	96
Scale length mm	94
<b>Product Code</b>	
Ammeters	244-80M
Voltmeters	244-80E



## Temperature Indicators

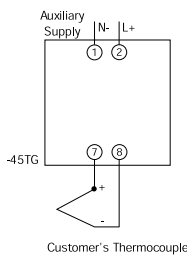
Longscale Indicators to read temperature values, usually remotely with RTD or thermocouple sensors supplied by the customer. RTD (Resistance Temperature Detector) indicators measure the change in resistance of the sensor. A 2 or 3 wire system may be used. Thermocouple indicators accept standard millivolt input signals. Cold junction compensation is provided and thermocouple break indication is incorporated.

### Specification

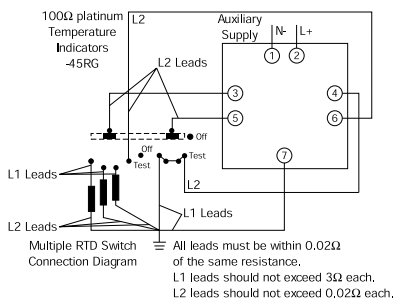
Accuracy:	Class 1.5 - Indicator only. RTD indicator suitable for 10Ω copper 100Ω platinum, 100 & 120Ω nickel sensors Power in RTD is 100μW approximately. Thermocouple indicator suitable for J (0-700°C), K (0-1200°C) 50Ω maximum Circuit Resistance.
Auxiliary Supply:	Model 45R: from 63.5V to 480V A.C. at 50/60Hz Model 45T: 110, 115, 220, 240, 380, 400, 480V A.C. and 12, 24, 48, 110, 125V D.C.
Burden:	-45R 2VA, -45T 3VA

## Connections

### Thermocouple Indicators -45TG



### RTD Indicators -45RG



### Product Codes

Bezel Size mm	96	144
Scale length mm	150	230
<b>Product Codes</b>		
RTD	244-45R	246-45R
Thermocouple	244-45T	246-45T

## Process Indicators

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

### Specification

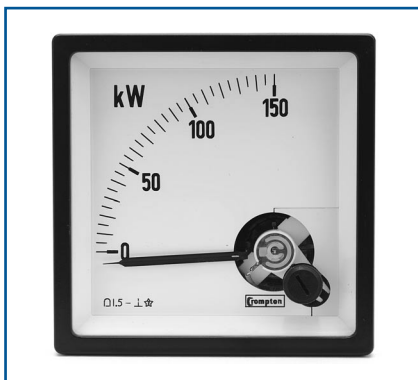
Accuracy:	Class 1.5
Ratings:	1, 2, 5, 10 & 20mA. 4/20mA suppressed zero.
Burden:	See our technical data sheet T118.

### Product Codes - Short Scale Models

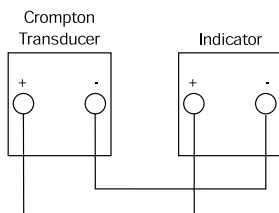
Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145
<b>Product Codes</b>				
A.C. Current	242-89A	243-01A	244-01A	246-10A
A.C. Voltage	242-89V	243-01V	244-01V	246-10V
Speed	242-892	243-012	244-012	246-102
Frequency	242-893	243-013	244-013	246-103
Phase Angle	242-894	243-014	244-014	246-104
Watts	242-895	243-015	244-015	246-105
VArs	242-896	243-016	244-016	246-106
VA	242-897	243-017	244-017	246-107

### Product Codes - Long Scale Models

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230
<b>Product Codes</b>				
A.C. Current	242-05A	243-05A	244-05A	246-05A
A.C. Voltage	242-05V	243-05V	244-05V	246-05V
Speed	242-052	243-052	244-052	246-052
Frequency	242-053	243-053	244-053	246-053
Phase Angle	242-054	243-054	244-054	246-054
Watts	242-055	243-055	244-055	246-055
VArs	242-056	243-056	244-056	246-056
VA	242-057	243-057	244-057	246-057



## Connections





## Moving Coil Tap Position Indicators

These longscale position Indicators monitor transformer tap position, hoist or valve position, etc. They employ a 3 wire system and 11 to 18 positions can be provided using 400Ω steps. The measuring system comprises a moving coil indicator, stabilised power supply & transducer. The remote potentiometer or resistance thermometer sensor to be supplied by the customer.

### Specification

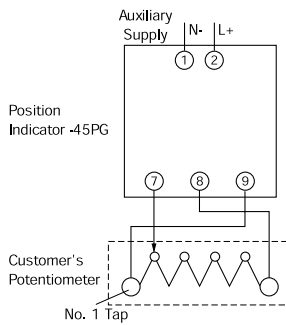
Accuracy:	Class 1.5
Auxiliary Supply:	A.C.: 50, 110, 220, 240V 50/60Hz D.C.: 50, 110, 125, 220V ±15%
Burden:	2VA

### Product Code

Bezel size mm	96	144
Scale length mm	150	230
<b>Product Code</b>		
Position Indicator	244-45P	246-45P

### Connections

Tap position indicator with self contained power source



## Phase Sequence Indicators

An Electronic Phase Sequence Indicator ensures correct phase rotation and the presence of all 3 phase supplies. Incorrect phase 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.

### Specification

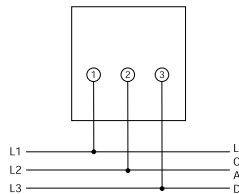
Voltage:	151/300V, 301/500V 100/150V (Model 244-12P only)
Frequency:	50/60Hz
Burden:	2.5VA/phase

### Product Code

Bezel size mm	72	96
<b>Product Code</b>		
Phase Sequence Indicator	243-12P	244-12P

### Connections

Phase Sequence Indicators





## Electronic Phase Angle Meters

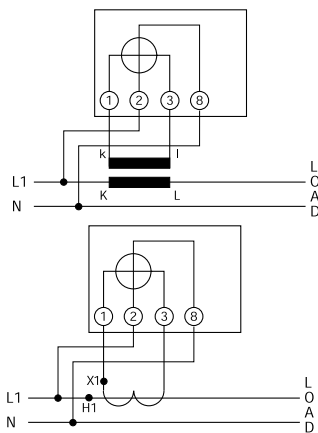
These Phase Angle meters indicate the phase displacement between current and voltage. Used in applications where the phase angle must be monitored, for example with tariffs having VAR penalties, or to optimise generator power delivery. The measuring system comprises a moving coil indicator and a phase angle transducer. The 244 and 246 models are self contained.

### Specification

Accuracy:	Class 2.5 (2° electrical)
Ratings:	Current: 1A or 5A for C.T.s Voltage: 100/130V, 200-250V & 380-450V 100 - 110 for V.T. use.
Frequency:	50Hz, 60Hz, 400Hz.
Burden at 50Hz:	Current: 1VA Voltage: 4VA per Phase
Current range:	20% to 125%

### Connections

#### Single Phase Systems



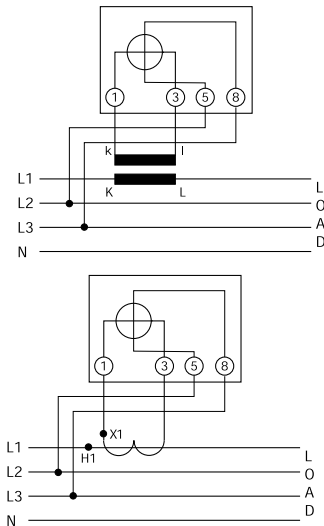
### Product Code - Short Scale Models

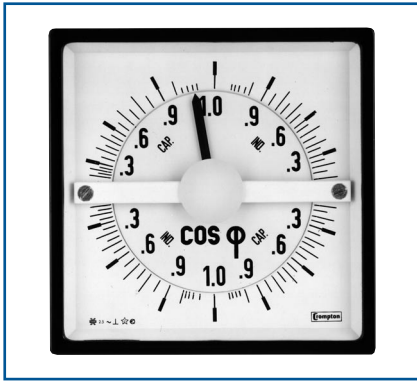
Bezel Size mm	72	96	144
Scale length mm	65	94	145
<b>Product Code</b>			
Single Phase	243-014G-FA+ 256-TPS	244-42B	246-425
3 Phase 3/4 wire Balanced Load	243-014G-FA+ 256-TPT	244-42A	246-42A

### Product Code - Long Scale Models

Bezel Size mm	72	96	144
Scale length mm	112	150	230
<b>Product Code</b>			
Single Phase	243-054G-FA+ 256-TPS	244-425	246-425
3 Phase 3/4 wire Balanced Load	-	244-427	246-427

#### 3 Phase, 3 or 4 Wire Balanced Systems





## 360° Dynamometer Power Factor Indicators

These Power Factor Indicators are suitable for generators or supplies operating in parallel. The four quadrant 360° scale calibrated  $\cos \phi$  0-1-0-1-0 indicates forward (export) and reverse (import) power flow for inductive and capacitive loads.

### Specification

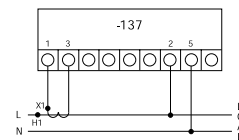
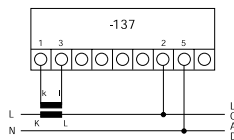
Accuracy:	Class 2.5 (2° electrical)
Ratings:	Current: -/1A or -/5A for C.T.'s Voltage: 60 to 600V, 100/110 for V.T. use.
Frequency:	50Hz or 60Hz
Burden:	Current: 2VA per coil @ 50Hz Voltage: 4VA per coil @ 50Hz (7.5VA above 250V)

### Product Codes

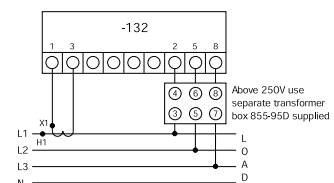
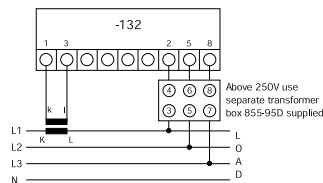
Bezel size mm	96	144
Scale length	360°	360°
<b>Product Codes</b>		
Single Phase	244-137	246-137
3 Phase 3 or 4 Wire 3 Currents + 1 Voltage	244-131	246-131
3 Phase 3 or 4 Wire 1 Current + 3 Voltages	244-132	246-132
3 Phase 3 or 4 Wire Unbalanced Load	244-136	246-136

### Connections

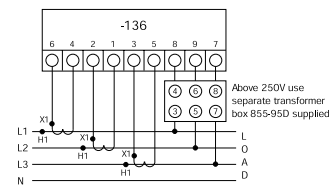
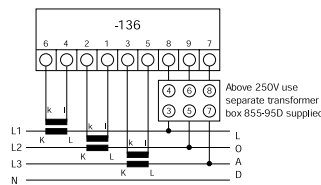
#### Single Phase



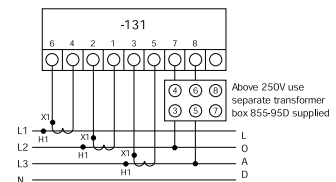
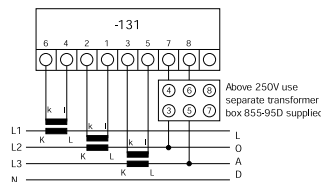
#### 3 Phase 3 or 4 Wire 1 Current 3 Voltages Balanced Load



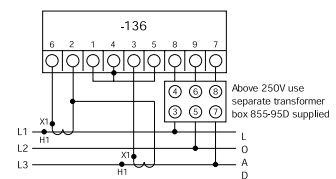
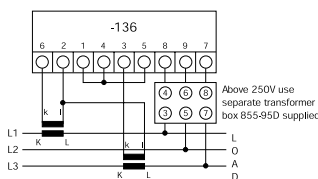
#### 3 Phase 3 or 4 Wire Unbalanced Load



#### 3 Phase 3 or 4 Wire 3 Currents 1 Voltage Balanced Load



#### 3 Phase 3 Wire Using Two C.T.s Unbalanced Load





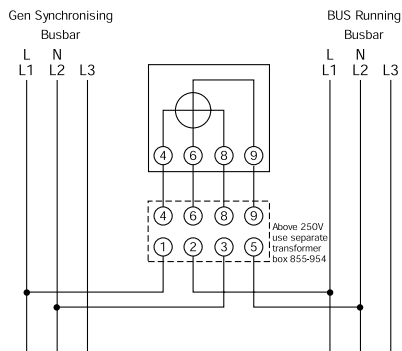
## 360° Dynamometer Synchroscope

Where manual parallelling of two A.C. systems is necessary, the frequency of both systems can be monitored by a Synchroscope. The systems are synchronised when the pointer is stationary in the 12 o'clock position. The instrument is rated for continuous operation and connection, and silicon oil damping is employed.

### Specification

Accuracy:	Class 2.5 (2° electrical)
Ratings Voltage:	100-125V, 200-250V, 380-450V* * Use transformer box 855-954 100-110V for V.T. use
Frequency:	50Hz,60Hz, 50/60Hz, 400Hz
Burden at 50Hz:	5VA maximum.

### Connections



### Product Codes

Bezel size mm	96	144
Scale length	360°	360°
<b>Product Codes</b>		
50Hz	244-145	246-145
60Hz	244-146	246-146
50/60Hz	244-147	246-147
400Hz	244-144	246-144

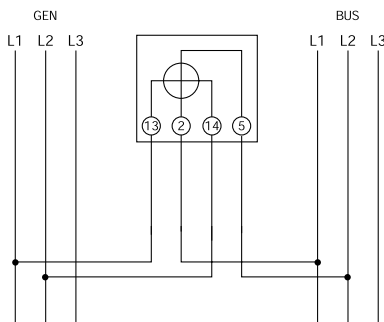


## 360° LED Synchroscope and Synchro Check Relay

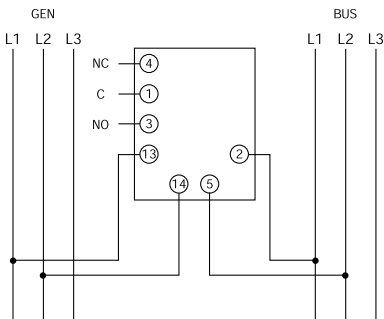
Where manual paralleling of two A.C. systems is desired, the frequency of both systems can be monitored by an LED Synchroscope. The systems are synchronised when the green LED is lit in the 12 o'clock position. The instrument is rated for continuous operation and connection. Where semi-automatic paralleling of two A.C. systems is desired, the voltage, phase displacement and the frequency of both systems can be monitored by an LED Synchroscope and Synchro Check Relay. Voltage, Phase angle and time delay controls 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.

### Connections

#### 360° LED Synchroscope



#### 360° LED Synchroscope and Synchro Check Relay



### Specification

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 A.C. or via V.T.
Frequency:	40/65Hz
Burden at 50Hz:	4VA maximum Suitable for single or three phase systems
Safety:	IEC1010-1 (300V A.C. rms installation degree 2)
Dielectric:	4kV rms for 1 minute
Isolation:	BUS/GEN/RELAY
Vibration:	To Lloyds shipping specification
*Phase difference:	+0 to 20°. +/-1°
*Voltage difference:	+0 to 20% +/-2% 0 to 10% for models G & H
*Time Delay:	0 to 2.5 seconds +10%
*Accuracy:	Synchronisation at T.D.C. is +1°

\*360° LED Synchroscope and Synchro Check Relay Only.

### Product Codes

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 Relay (Dead Bus)
<b>Product Code</b>			
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-RUY Y	244-14LG-RUBX	244-14DG-RUBX
400V	244-14AG-SCYY	244-14LG-SCBX	244-14DG-SCBX
415V	244-14AG-SBY Y	244-14LG-SBBX	244-14DG-SBBX
440V	244-14AG-SHY Y	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.



## Wattmeters & Varmeters

The 244/246 models are self contained and are available to measure active power and reactive power in both balanced and unbalanced, single and 3 phase 3 or 4 wire systems. These Wattmeters are ideal for clear precise analogue indication of power in applications such as power generation, industrial control panels and power distribution.

### Specification

Accuracy:	Shortscale Class 2.5 Longscale Class 1.5
Measuring Ranges:	Voltage 94-106% Current 0-120%
Frequency Influence:	0.4% / Hz
Rating:	Current: 0.2A to 5A direct connected 1A or 5A for C.T.'s. Voltages: From 57.7 to 480V
Overload:	120% of nominal continuous voltage up to 600V maximum
Maximum Input:	600V
Frequency:	50Hz or 60Hz
Power factor:	Unity Power Factor assumed range 0.5/1/0.5
Burden:	Current: 1VA per phase Voltage: 1VA per phase
Warm-up-Time:	<15 minutes

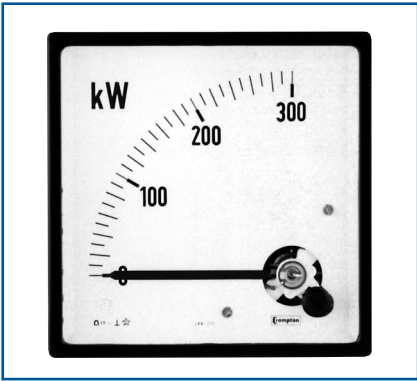
### Product Codes – Short Scale Models

Bezel Size mm	72	96	144
Scale Length mm	65	95	145
<b>Wattmeters Product Code</b>			
Single Phase	243-015G-FA+256-TWK	244-210	246-210
3 Phase 3 Wire Balanced Load	243-015G-FA+256-TWL	244-211	246-211
3 Phase 4 Wire Balanced Load	243-015G-FA+256-TWH	244-21C	246-21C
3 Phase 3 Wire Unbalanced Load	243-015G-FA+256-TWM	244-213	246-213
3 Phase 4 Wire Unbal. Star C.T.s	243-015G-FA+256-TWN	244-214	246-214
3 Phase 4 Wire Unbal. Delta C.T.s	243-015G-FA+256-TWJ	244-21E	246-21E
3 Phase 4 Wire 3 Element	243-015G-FA+256-XWW	244-21Y	246-21Y
<b>Varmeters Product Codes</b>			
3 Phase 3 or 4 Wire Balanced Load	243-016G-FA+256-TXG	244-310	246-310
3 Phase 3 Wire Unbalanced Load	243-016G-FA+256-TXM	244-31S	246-31S
3 Phase 4 Wire Unbal. Star C.T.s	243-016G-FA+256-TXN	244-314	246-314
3 Phase 4 Wire Unbal. Delta C.T.s	243-016G-FA+256-TXJ	244-31E	246-31E

### Product Codes – Long Scale Models

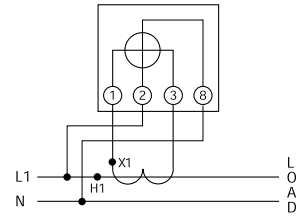
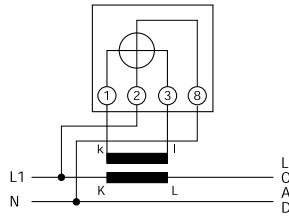
Bezel Size mm	72	96	144
Scale Length mm	112	150	230
<b>Wattmeters Product Code</b>			
Single Phase	243-055G-FA+256-TWK	244-215	246-215
3 Phase 3 Wire Balanced Load	243-055G-FA+256-TWL	244-216	246-216
3 Phase 4 Wire Balanced Load	243-055G-FA+256-TWH	244-21D	246-21D
3 Phase 3 Wire Unbalanced Load	243-055G-FA+256-TWM	244-218	246-218
3 Phase 4 Wire Unbal. Star C.T.s	243-055G-FA+256-TWN	244-219	246-219
3 Phase 4 Wire Unbal. Delta C.T.s	243-055G-FA+256-TWJ	244-21F	246-21F
3 Phase 4 Wire 3 Element	243-055G-FA+256-XWW	244-21Z	246-21Z
<b>Varmeters Product Codes</b>			
3 Phase 3 or 4 Wire Balanced Load	243-056G-FA+256-TXG	244-315	246-315
3 Phase 3 Wire Unbalanced Load	243-056G-FA+256-TXM	244-31L	246-31L
3 Phase 4 Wire Unbal. Star C.T.s	243-056G-FA+256-TXN	244-319	246-319
3 Phase 4 Wire Unbal. Delta C.T.s	243-056G-FA+256-TXJ	244-31F	246-31F

Models 243-015, 243-016, 243-055 & 243-056 use a separate transducer. Our transducer range is ideal for this application. Our product code reference assumes a 1mA output. Other outputs of 5, 10, 20 or 4/20mA can also be used.

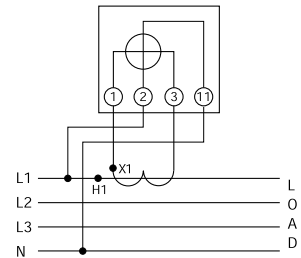
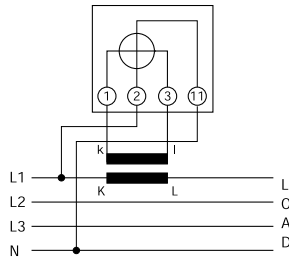


## Wattmeter Connection Diagrams

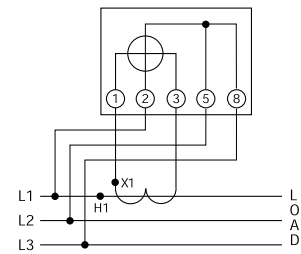
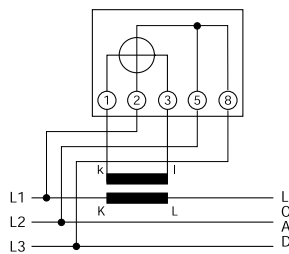
### Single Phase 224-210, 244-215, 246-210, 246-215



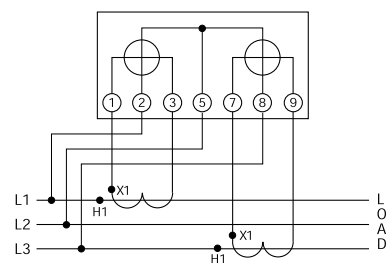
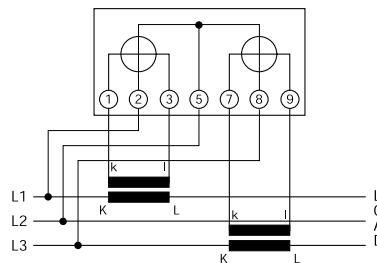
### 3 Phase 4 Wire Balanced Load 244-21C, 246-21C, 244-21D, 246-21D

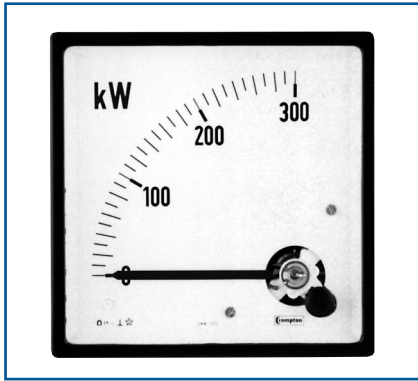


### 3 Phase 3 Wire Balanced Load 244-211, 246-211, 244-216, 246-216



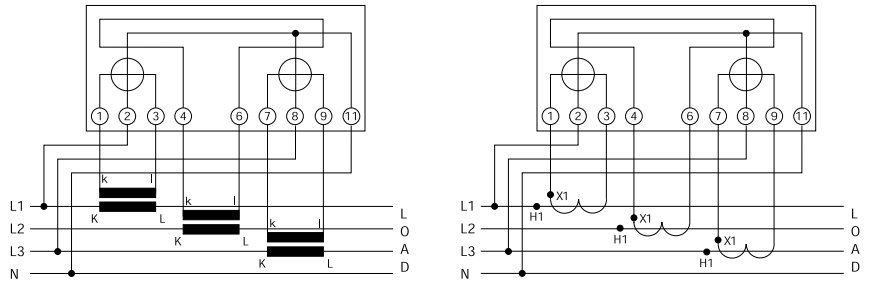
### 3 Phase 3 Wire Unbalanced Load 2 Element 244-213, 246-213, 244-218, 246-218



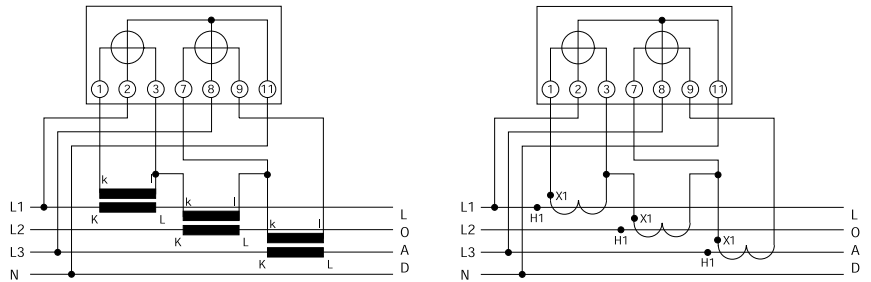


## Wattmeter Connection Diagrams

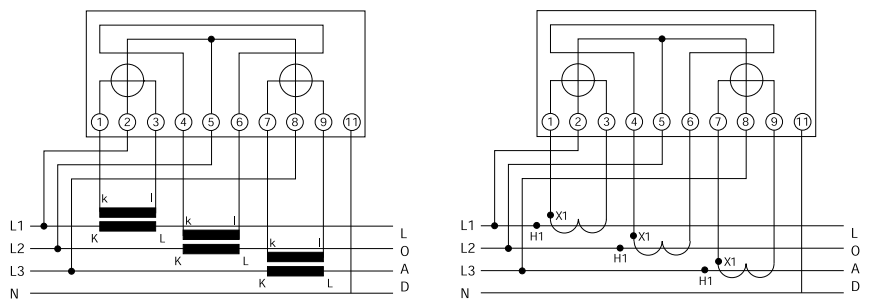
**3 Phase 4 Wire Unbalanced Load Star Connected C.T.s 2 1/2 Element**  
 244-214, 246-214, 244-219, 246-219

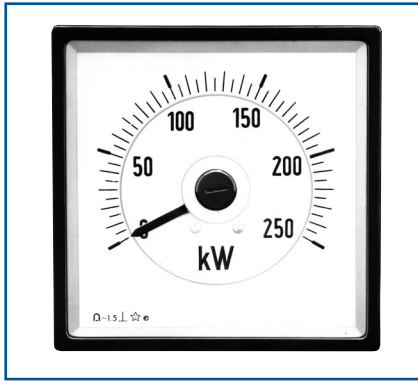


**3 Phase 4 Wire Unbalanced Load Delta Connected C.T.s**  
 244-21E, 246-21E, 244-21F, 246-21F



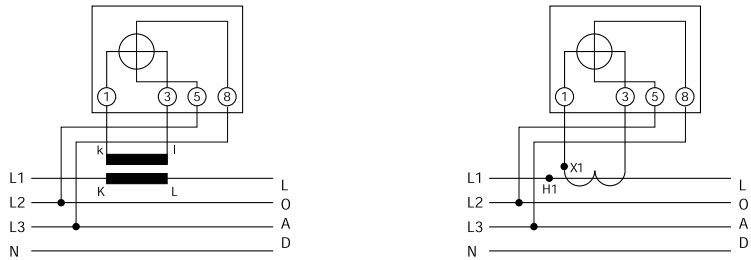
**3 Phase 4 Wire Unbalanced Load Star Connected C.T.s 3 Element**  
 244-21Y, 246-21Y, 244-21Z, 246-21Z



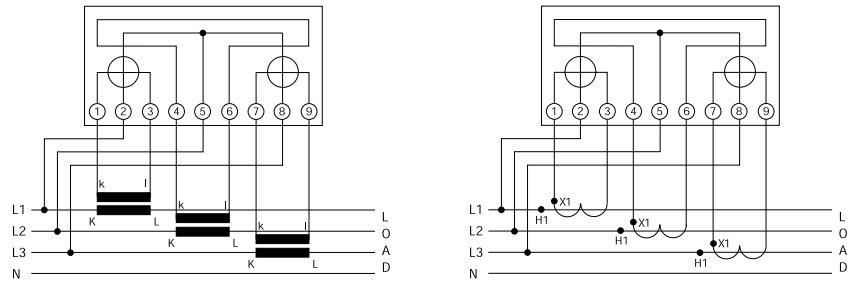


## Varmeter Connection Diagrams

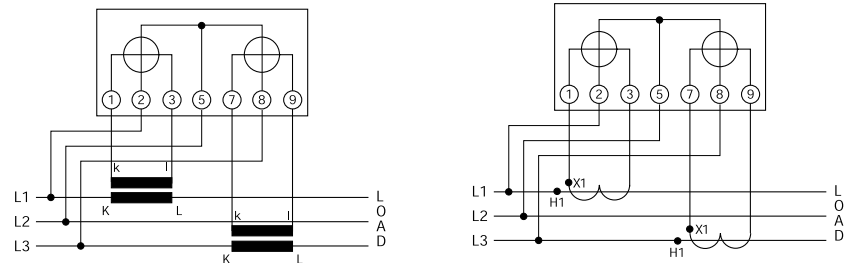
**3 Phase 3 or 4 Wire Balanced Load 1 Element**  
244-310, 246-310, 244-315, 246-315



**3 Phase 4 Wire Unbalanced Star Connected C.T.s 2 1/2 Element**  
244-314, 246-314, 244-319, 246-319



**3 Phase 3 Wire Unbalanced Load 2 Element**  
244-31S, 246-31S, 244-31L, 246-31L



**3 Phase 4 Wire Unbalanced Delta Connected C.T.s 2 1/2 Element**  
244-31E, 246-31E, 244-31F, 246-31F

