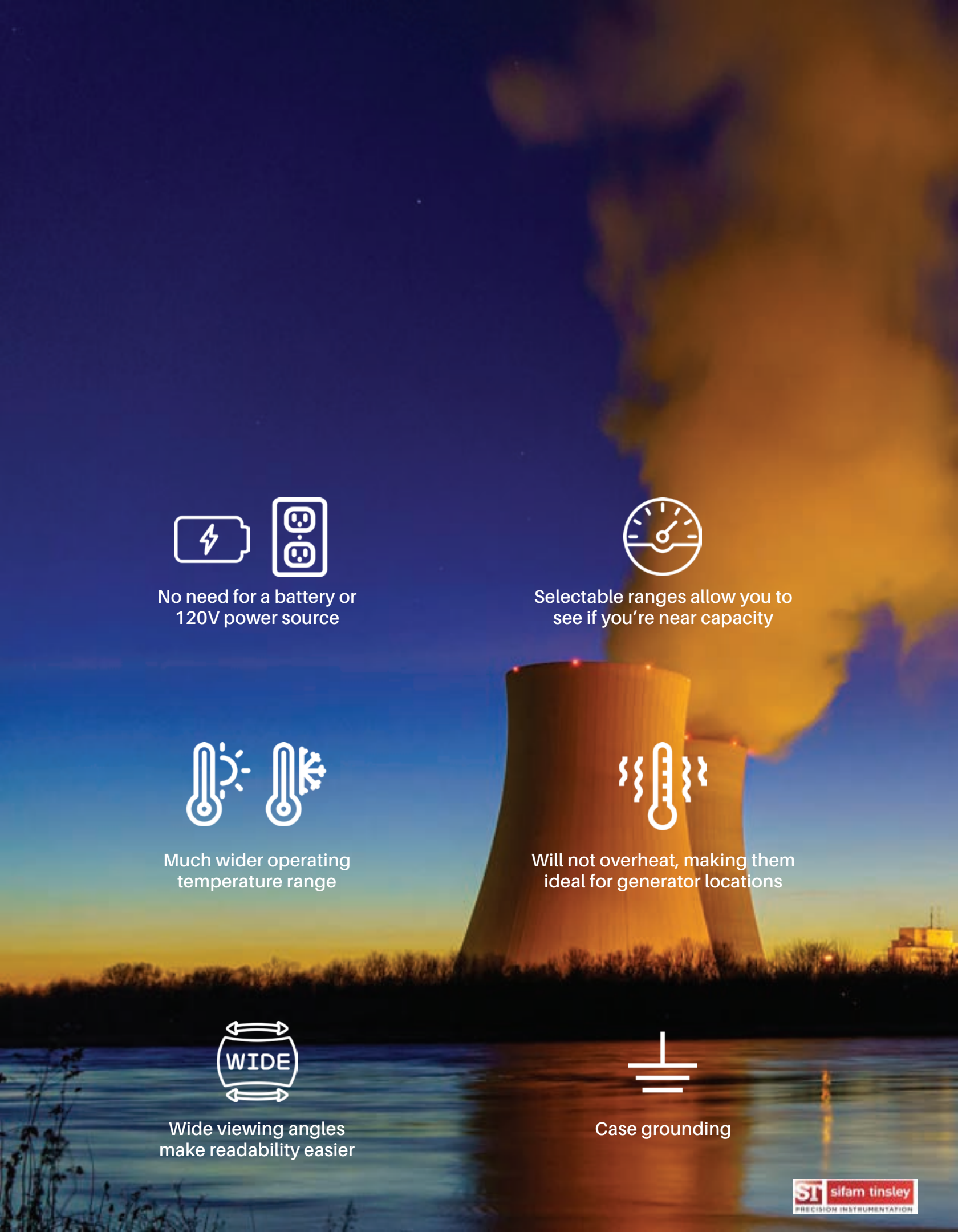
sifam tinsley
PRECISION INSTRUMENTATION

METAL CASE
SWITCHBOARD METERS
Pivot & Jewel (MCS)
Taut Band (TMCS)

2021
CATALOG

1-800-879-6171
www.sifamtinsley.com



No need for a battery or 120V power source

Selectable ranges allow you to see if you're near capacity

Much wider operating temperature range

Will not overheat, making them ideal for generator locations

Wide viewing angles make readability easier

Case grounding

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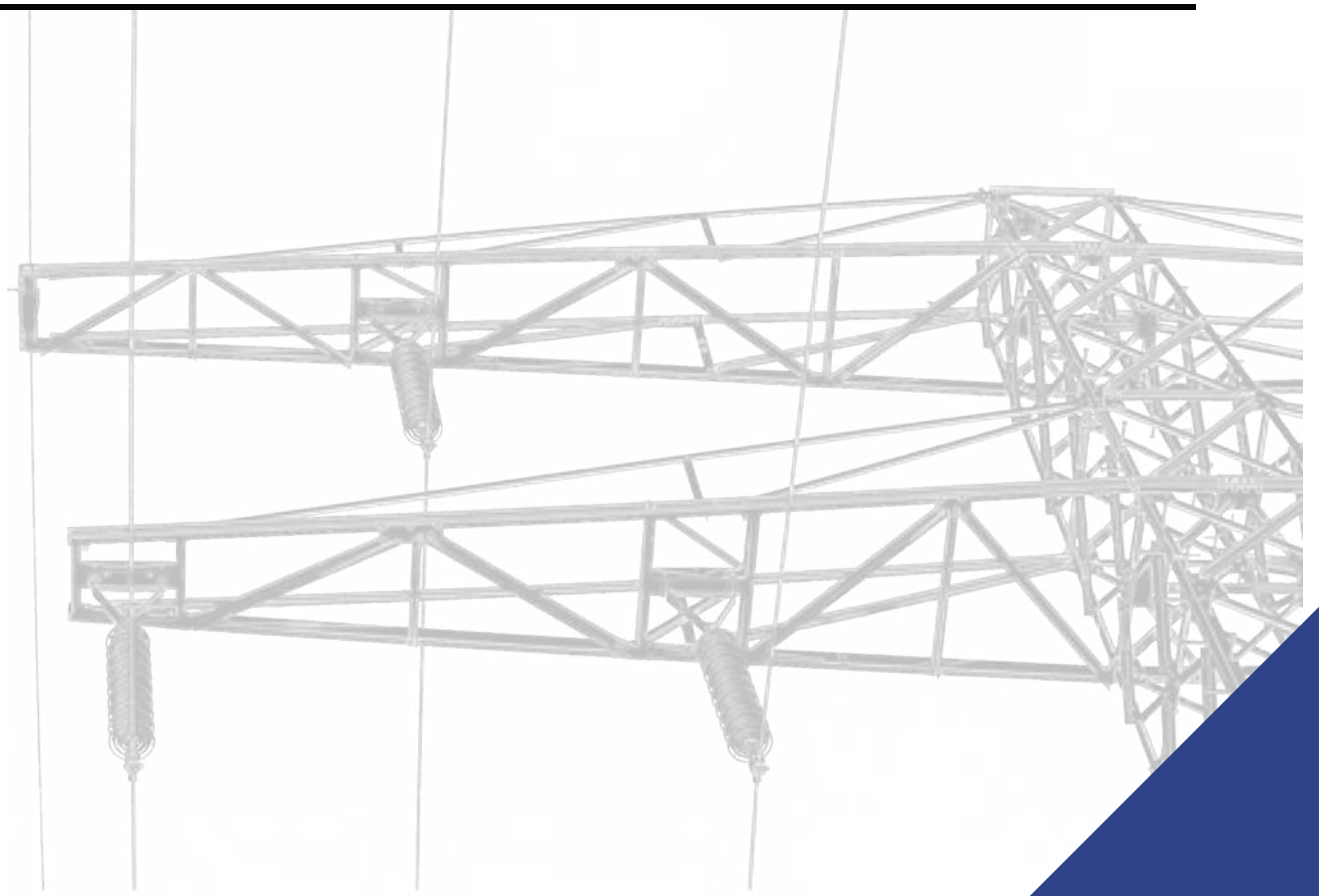
Table of Contents

Switchboard Meters



A New Addition to the Metal Case Switchboard line

The New Taut-Band

Although on the surface the Pivot and Jewel and Taut-Band appear similar, they are constructed differently. Analog meters are used on emergency standby generators and switchgear as they require no external power and are the best indicators for live and dead start up as well as continuous operation. The Taut-band was brought back to meet the needs of generator and panel builders who need meters capable of shock caused during operation, moving and transporting.

Pivot and Jewel (MCS)

Economical

Movement is spring loaded and suspended between two sapphire jewels with hardened steel pivots

Based on meter design used for over 100 years

Taut-Band (TMCS)

Built for shock and vibration

Movement is a moving element supported by a hair-like special high-strength alloy. Bands are permanently anchored to the moving element; the band is connected to the spring suspension that maintains band tension and element position.

Designed in the 1950s to meet new environmental conditions

SWITCHBOARD INSTRUMENT SELECTOR GUIDE

Case Style	4¼" Metal
Available	
Input Rating	
AC Milliamperes	X
AC Amperes	X
AC Voltage	X
DC Microamperes	X
DC Milliamperes	X
DC Amperes	X
DC Millivolts	X
DC Voltage	X
Frequency	X
AC Watts	X
AC VARS	X
Power Factor	X
AC Synchroscope	X
RPM Indicator	X
Process Indicator	X

For Pivot+Jewel
use "MCS" designator

For Taut Band
use "TMCS" designator

Switchboard specifications in accordance with ANSI C39.1

Accuracy: ±1.0% of full scale basic accuracy class.
Specific accuracies:
Expanded Scale Voltmeter - 0.3% of mid-scale.
Power factor meter - ±1% of fiducial value from 40-120% of rated current.
Synchroscope - ±1% of scale length.
Frequency meters - ± .15Hz @45-55Hz and 55-65Hz, ±0.08Hz 58-62Hz, ±1.3Hz @350-450Hz.
Position of use: Vertical (scale)
Full scale deflection angle: 250°, except synchroscope is 360°
Full scale length: 6.9 inches.
Scale plate: Platform type 2 piece scale with graduations on the outer scale; numerals and legends on the inner scale.
Case: All switchboard instruments have drawn steel case with matt black powder coating.
Cover: Front cover has bezel & window made by one piece of flame retardant Polycarbonate molding with black matte finished bezel area.
Mounting studs: 1/4" x 28 thread.
Terminal studs: 10-32 thread.
Operating temperature range: 0 to 40°C (32 to 104°F).
Storage temperature range: -10 to 50°C (14 to 122°F).
Extreme temperature range: -20°C to 65°C (-4 to 149°F).
Dielectric level: 2300VAC for 1 minute between the electrical circuit and mounting studs.
Overload rating: AC & DC Ammeters – 1.2 x continuous, 10 x for 0.5 seconds, repeated 10 times with 1 minute interval.
Ac & DC Voltmeters and frequency meters – 1.2 x continuous
Response time: 3 seconds maximum

Ordering System

Key to Switchboard Numbering System (See Notes)

MCS / TMCS | 103 | 01 | 1 | XX | XX | 7 | XXX

MCS
TMCS

Digits 1, 2, & 3 Type
103, 106

Digits 4 & 5 Measured Qty.
01-DC Volts
02-AC Volts
07-Voltmeter (expanded scale)
11-DC Amps
12-DC Millivolts
13-AC Amps
15-AC voltmeter
19-Supp. Zero
21-2W1P Watts 1 EL
22-3W3P Watts 2 EL
25-4W3P Watts 3 EL
28-3W3P Vars (cross phase) 2 EL
29-4W3P Vars (cross phase) 3 EL
31-2W1P Vars 1 EL
37-Freq. Meter
40-Power Factor 3W3P & 4W3P (balanced)
41-Power Factor 2W1P
45-Synchroscope
55-DC Voltmeter (ground detector type)
62-DC Tach. Ind.
63-AC Tach. Ind,
74-4W3P Vars • (cross phase) 3 EL

Digit 6 Mechanical Features
1-Zero left, black cover
2-Zero center, black cover

Digits 7 & 8 - Elec. Rtg.
Ex: LA = 1A
LE = 2A
LS = 5A
(see note 2)

Digits 9 & 10 - Scale
Ex: FA = 0-1mA
FX = 0-5mA
(see note 2)

Digit 11 - Factory Style No.
For factory use.

Digits 12, 13 & 14-Spcl Units
When used, these denote unique models. Refer to factory for details. For Wattmeters & Varmeters, see pages 10-12.

NOTES:
1. This tabulation is not all inclusive, to be used for defining cat. nos. only
2. For watt & var cat. nos. digits 7-10 & 12-14 designate rating-cal watts-scale & legend information

How to Order - Specify the following:

1. Complete Part Number or Ordering number or ;
2. Provide significant portion of catalog number with word description for differences (e.g. "Similar to MCS103111FAFA, except scale 0-100 kilovars"), or ;
3. Provide word description including the following information:

Type: MCS/TMCS
Rating (Input):.....Amperes AC or DC.....
Volts AC or DC.....
Frequency: 60 Hz, 50 Hz, 400 Hz.....Hz
Scale: Min. Value - Max. Value, Zero left,
Zero-center or offset zero
Legend: Specify words and/or symbols exactly
Potential Transformer Ratio: .....to 120 volts
or.....to.....volts
Current Transformer Ratio:.....to 5 amperes
or .....to .....amperes
Circuit: 2-wire/single-phase, 3-wire/3 phase.
3-phase/4-wire.....other
External Devices; phase Shifting transformers, shunts
transducers, etc .....
Other Options:.....
Special features .....

Shipping & Storage Weights

Instrument		MCS/TMCS Net (lbs)	Net kg	Ship (lbs)	Ship kg
DC-A/V		1.5	.70	2.4	1.1
AC	V	1.7	.79	2.7	1.2
	A	1.8	.84	2.7	1.2
WATT/VAR	1Ø	2.8	1.3	3.6	1.7
	3Ø3W 3Ø4W	3.0	1.4	3.9	1.8
Power Factor		2.0	.95	3.0	1.4
Frequency		1.8	.82	2.7	1.2
Tachometer		1.6	.80	2.7	1.2
Synchroscope		3.9	1.8	4.8	2.2

Approximate Package Size in Inches / Centimeters

All MCS/TMCS .....6x 6x 11/15x 15 x 28
Shipping .....7x 7 x 13/18 x 18 x33

Metal Case

AC Ammeters - Rectified

Rating (Amperes)	Scale (Amperes)	Pivot+Jewel Part Num.		Taut Band Part Num.	
Self-Contained, 40/70 Hz					
1.0	0-1	MCS 103 131 LALA		TMCS 103 131 LALA	
1.5	0-1.5	MCS 103 131 LCLC		TMCS 103 131 LCLC	
2.0	0-2	MCS 103 131 LELE		TMCS 103 131 LELE	
3.0	0-3	MCS 103 131 LJLJ		TMCS 103 131 LJLJ	
5.0	0-5	MCS 103 131 LSLS		TMCS 103 131 LSLS	
7.5	0-7.5	MCS 103 131 MFMF		TMCS 103 131 MFMF	
10	0-10	MCS 103 131 MTMT		TMCS 103 131 MTMT	
15	0-15	MCS 103 131 NDND		TMCS 103 131 NDND	
20	0-20	MCS 103 131 NGNG		TMCS 103 131 NGNG	
30	0-30	MCS 103 131 NLNL		TMCS 103 131 NLNL	
Transformer-Rated, 40/70Hz					
5	0-10	MCS 103 131 LSMT		TMCS 103 131 LSMT	
5	0-15	MCS 103 131 LSND		TMCS 103 131 LSND	
5	0-20	MCS 103 131 LSNG		TMCS 103 131 LSNG	
5	0-25	MCS 103 131 LSNJ		TMCS 103 131 LSNJ	
5	0-30	MCS 103 131 LSNL		TMCS 103 131 LSNL	
5	0-40	MCS 103 131 LSNP		TMCS 103 131 LSNP	
5	0-50	MCS 103 131 LSNT		TMCS 103 131 LSNT	
5	0-75	MCS 103 131 LSPB		TMCS 103 131 LSPB	
5	0-100	MCS 103 131 LSPK		TMCS 103 131 LSPK	
5	0-150	MCS 103 131 LSPZ		TMCS 103 131 LSPZ	
5	0-200	MCS 103 131 LSRL		TMCS 103 131 LSRL	
5	0-250	MCS 103 131 LSRS		TMCS 103 131 LSRS	
5	0-300	MCS 103 131 LSRX		TMCS 103 131 LSRX	
5	0-400	MCS 103 131 LSSC		TMCS 103 131 LSSC	
5	0-500	MCS 103 131 LSSF		TMCS 103 131 LSSF	
5	0-600	MCS 103 131 LSSJ		TMCS 103 131 LSSJ	
5	0-800	MCS 103 131 LSSN		TMCS 103 131 LSSN	
5	0-1000	MCS 103 131 LSSS		TMCS 103 131 LSSS	
5	0-1200	MCS 103 131 LSSV		TMCS 103 131 LSSV	
5	0-1500	MCS 103 131 LSTC		TMCS 103 131 LSTC	
5	0-1600	MCS 103 131 LSTE		TMCS 103 131 LSTE	
5	0-2000	MCS 103 131 LSTM		TMCS 103 131 LSTM	
5	0-2500	MCS 103 131 LSTV		TMCS 103 131 LSTV	
5	0-3000	MCS 103 131 LSUA		TMCS 103 131 LSUA	
5	0-4000	MCS 103 131 LSUE		TMCS 103 131 LSUE	
5	0-5000	MCS 103 131 LSUJ		TMCS 103 131 LSUJ	
5	0-6000	MCS 103 131 LSUP		TMCS 103 131 LSUP	
5	0-7000	MCS 103 131 LSUS		TMCS 103 131 LSUS	
5	0-8000	MCS 103 131 LSUW		TMCS 103 131 LSUW	

AC Voltmeters

Metal Case

AC Voltmeters

Rating (Volts)	Scale (Volts)	Pivot+Jewel Part Num.		Taut Band Part Num.	
Self-Contained, 50/60 Hz					
150	0-150	MCS 103 021 PZPZ		TMCS 103 021 PZPZ	
250	0-250	MCS 103 021 RSRS		TMCS 103 021 RSRS	
300	0-300	MCS 103 021 RXRX		TMCS 103 021 RXRX	
500	0-500	MCS 103 021 SFSF		TMCS 103 021 SFSF	
600	0-600	MCS 103 021 SJSJ		TMCS 103 021 SJSJ	
Transformer-Rated, 50/60 Hz					
150	0-300	MCS 103 021 PZRX		TMCS 103 021 PZRX	
150	0-600	MCS 103 021 PZSJ		TMCS 103 021 PZSJ	
150	0-750	MCS 103 021 PZSM		TMCS 103 021 PZSM	
150	0-3000	MCS 103 021 PZUA		TMCS 103 021 PZUA	
150	0-5250	MCS 103 021 PZUL		TMCS 103 021 PZUL	
150	0-6000	MCS 103 021 PZUP		TMCS 103 021 PZUP	
150	0-9000	MCS 103 021 PZUY		TMCS 103 021 PZUY	
150	0-15kV	MCS 103 021 PZWZ		TMCS 103 021 PZWZ	
150	0-18kV	MCS 103 021 PZXE		TMCS 103 021 PZXE	
150	0-45kV	MCS 103 021 PZXU		TMCS 103 021 PZXU	
150	0-150kV	MCS 103 021 PZYR		TMCS 103 021 PZYR	
250	0-600kV	MCS 103 021 RSSJ		TMCS 103 021 RSSJ	
Transformer-Rated, 50/60 Hz					
110-130	110-130	MCS 103 071 PNPN		TMCS 103 071 PNPN	
Expanded Scale, Transformer Rated, 50/60 HZ					
110-130	#	MCS 103 071 PN++		TMCS 103 071 PN++	
Ground Detector Type - Single-Phase 50/60 Hz					
150	150	MCS 103 GDT PZ..++		TMCS 103 GDT PZ..++	
150	0-150	MCS 103 GDT PZPZ		TMCS 103 GDT PZPZ	
300	0-300	MCS 103 GDT RXRX		TMCS 103 GDT RXRX	
600	0-600	MCS 103 GDT SJSJ		TMCS 103 GDT SJSJ	

\# Scale per requisition.
++ Order by description. Specify P.T. (Potential Transformer) ratio if used and scale desired.

DC Ammeters Self-Contained

Scale and Rating	Pivot+Jewel Part Num.		Taut Band Part Num.	
Microammeters - Zero-Left				
0-200	MCS 103 111 EAEA		TMCS 103 111 EAEA	
0-300	MCS 103 111 EGEG		TMCS 103 111 EGEG	
0-500	MCS 103 11 EMEM		TMCS 103 11 EMEM	
0-800	MCS 103 111 EWEW		TMCS 103 111 EWEW	
Milliammeters - Zero-Left				
0-1	MCS 103 111 FAFA		TMCS 103 111 FAFA	
0-2	MCS 103 111 FGFG		TMCS 103 111 FGFG	
0-5	MCS 103 111 FXFX		TMCS 103 111 FXFX	
0-10	MCS 103 111 GZGZ		TMCS 103 111 GZGZ	
0-20	MCS 103 111 HFHF		TMCS 103 111 HFHF	
0-30	MCS 103 111 HMHM		TMCS 103 111 HMHM	
0-50	MCS 103 111 HYHY		TMCS 103 111 HYHY	
0-100	MCS 103 111 JRJR		TMCS 103 111 JRJR	
0-200	MCS 103 111 KAKA		TMCS 103 111 KAKA	
0-300	MCS 103 111 KGKG		TMCS 103 111 KGKG	
0-500	MCS 103 111 KMKM		TMCS 103 111 KMKM	
0-800	MCS 103 111 KWKW		TMCS 103 111 KWKW	
Milliammeters - Suppressed-Zero (No zero set unless otherwise specified)				
1-5	MCS 103 191 FY**		TMCS 103 191 FY**	
4-20	MCS 103 191 HE**		TMCS 103 191 HE**	
10-50	MCS 103 191 HX**		TMCS 103 191 HX**	
Ammeters - Zero-Left				
0-1	MCS 103 111 LALA		TMCS 103 111 LALA	
0-5	MCS 103 111 LSLS		TMCS 103 111 LSLS	
0-10	MCS 103 111 MTMT		TMCS 103 111 MTMT	
0-15	MCS 103 111 NDND		TMCS 103 111 NDND	
0-20	MCS 103 111 NGNG		TMCS 103 111 NGNG	
0-30	MCS 103 111 NLNL		TMCS 103 111 NLNL	

Metal Case

DC Ammeters Shunt-Rated

Rating (Millivolts)	Scale (Amperes)	Pivot+Jewel Part Num.		Taut Band Part Num.	
With Lead Length Compensator, Catalog Number Does Not Include Shunt or Shunt Leads					
50	**TBD	MCS 103 121 AB...		TMCS 103 121 AB**	
50-0-50	**TBD	MCS 103 122 AB...		TMCS 103 122 AB..	
100	**TBD	MCS 103 121 AE...		TMCS 103 121 AE**	
100-0-100	**TBD	MCS 103 122 AE...		TMCS 103 122 AE..	
Zero-Left for Use with 50mV Shunts and 0.05-Ohm Shunt Leads, (Standard 5-Foot Leads).					
50	0-15	MCS 103 121 CAND		TMCS 103 121 CAND	
50	0-20	MCS 103 121 CANG		TMCS 103 121 CANG	
50	0-30	MCS 103 121 CANL		TMCS 103 121 CANL	
50	0-40	MCS 103 121 CANP		TMCS 103 121 CANP	
50	0-50	MCS 103 121 CANT		TMCS 103 121 CANT	
50	0-75	MCS 103 121 CAPB		TMCS 103 121 CAPB	
50	0-100	MCS 103 121 CAPK		TMCS 103 121 CAPK	
50	0-150	MCS 103 121 CAPZ		TMCS 103 121 CAPZ	
50	0-200	MCS 103 121 CARL		TMCS 103 121 CARL	
50	0-300	MCS 103 121 CARX		TMCS 103 121 CARX	
50	0-400	MCS 103 121 CASC		TMCS 103 121 CASC	
50	0-500	MCS 103 121 CASF		TMCS 103 121 CASF	
50	0-750	MCS 103 121 CASM		TMCS 103 121 CASM	
50	0-1000	MCS 103 121 CASS		TMCS 103 121 CASS	
50	0-1200	MCS 103 121 CASV		TMCS 103 121 CASV	
50	0-1500	MCS 103 121 CATC		TMCS 103 121 CATC	
50	0-2000	MCS 103 121 CATM		TMCS 103 121 CATM	
50	0-3000	MCS 103 121 CAUA		TMCS 103 121 CAUA	

*TBD - Scale marked in terms of shunt current. When ordering specify rating of shunt to be used, scale and legend.

**TBD - When ordering specify scale and legend.

DC Voltmeters

Rating and Scale (Volts)	Pivot+Jewel Part Num.		Taut Band Part Num.	
Zero-Left (Sensitivity is 1000 OHMS / Volt)				
0-15	MCS 103 011 NDND		TMCS 103 011 NDND	
0-30	MCS 103 011 NLNL		TMCS 103 011 NLNL	
0-50	MCS 103 011 NTNT		TMCS 103 011 NTNT	
0-75	MCS 103 011 PBPB		TMCS 103 011 PBPB	
0-150	MCS 103 011 PZPZ		TMCS 103 011 PZPZ	
0-300	MCS 103 011 RXRX		TMCS 103 011 RXRX	
0-400	MCS 103 011 SCSC		TMCS 103 011 SCSC	
0-500	MCS 103 011 SFSF		TMCS 103 011 SFSF	
0-600	MCS 103 011 SJSJ		TMCS 103 011 SJSJ	
Zero-Center (Sensitivity is 2000 OHMS / Volt)				
150-0-150	MCS 103 012 PZPZ		TMCS 103 012 PZPZ	
300-0-300	MCS 103 012 RXRX		TMCS 103 012 RXRX	
500-0-500	MCS 103 012 SFSF		TMCS 103 012 SFSF	
600-0-600	MCS 103 012 SJSJ		TMCS 103 012 SJSJ	
Ground Detector Type - Zero-Center for 2 wire				
150-0-150*	MCS 103 GDT PZ..++		TMCS 103 GDT PZ..++	
300-0-300*	MCS 103 GDT PZPZ		TMCS 103 GDT PZPZ	
500-0-500*	MCS 103 GDT RXRX		TMCS 103 GDT RXRX	
600-0-600*	MCS 103 GDT SJSJ		TMCS 103 GDT SJSJ	

* Specify scale by order.

Tachometer Indicators

DC Volts	Pivot+Jewel Part Num.		Taut Band Part Num.	
Select nearest higher rated DC Voltmeter from above and specify requirements.	MCS 103 621 ****		TMCS 103 621 ****	
AC Volts				
Select nearest higher rated rectifier type AC voltmeter from Page 5 and specify requirements.	MCS 103 631 ****		TMCS 103 631 ****	

POWER FACTOR SCALE FOR BALANCED SYSTEM

Power Factor Meters

Rating (L-L Volts)	Scale	Pivot+Jewel Part Num.		Taut Band Part Num.	
5 Amperes, Single-Phase/2-Wire, 60Hz					
120	.5-1-.5	MCS 103 412 FCAD		TMCS 103 412 FCAD	
5 Amperes, 3-Phase 3- & 4-Wire, 50/60Hz Balanced System Only					
120	.5-1-.5	MCS 103 402 FCAD		TMCS 103 402 FCAD	
208	.5-1-.5	MCS 103 402 FDAD		TMCS 103 402 FDAD	
240	.5-1-.5	MCS 103 402 FEAD		TMCS 103 402 FEAD	
480	.5-1-.5	MCS 103 402 FFAD		TMCS 103 402 FFAD	

Frequency Meters, 120V

Scale (Hz)	Center Freq. (Hz)	Accuracy (Hz)	Pivot+Jewel Part Num.		Taut Band Part Num.	
45-55	50	±0.15	MCS 103 372 AGAG		TMCS 103 372 AGAG	
45-65	55	±0.25	MCS 103 372 AJAJ		TMCS 103 372 AJAJ	
48-52	50	±0.08	MCS 103 372 AKAK		TMCS 103 372 AKAK	
50-70	60	±0.25	MCS 103 372 ALAL		TMCS 103 372 ALAL	
55-65	60	±0.15	MCS 103 372 ANAN		TMCS 103 372 ANAN	
58-62	60	±0.08	MCS 103 372 ASAS		TMCS 103 372 ASAS	
59-61	60	±0.047	MCS 103 372 ATAT		TMCS 103 372 ATAT	
350-450	400	±1.3	MCS 103 372 BHBH		TMCS 103 372 BHBH	
390-410	400	±0.492	MCS 103 372 BLBL		TMCS 103 372 BLBL	

Synchroscopes-Analog, 120 Volt

Scale	Normal Frequency	MCS Part Num. †		TMCS Part Num.	
"Slow-Fast"	50	MCS 106 452 ABAA		TMCS 106 452 ABAA	
"Slow-Fast"	60	MCS 106 452 AAAA		TMCS 106 452 AAAA	

† Note the Synchroscope uses a 360 degree movement that is neither Taut Band or Pivot & Jewel

Synchroscopes-Digital, 120 Volt, Relay

Scale	Normal Frequency	Part Number	Ordering Number
Volts, Frequency & Phase Angle	50 - 60	MCS 106 452 DIGITAL	1C9844

AC Wattmeters Non-Isolated (cannot be used with external Phase Shifter for Vars)

Rating (Amperes)	Rating (Volts)	Scale	Pivot+Jewel Part Num.		Taut Band Part Num.	
Single-Phase/2-Wire, 1-Element, Transformer-Rated, 50/60 Hz						
5	120	†	MCS 103 21❑A		TMCS 103 21❑A	
3-Phase/3-Wire, 2-Element, Transformer-Rated, 50/60Hz						
5	120	†	MCS 103 22❑A		TMCS 103 22❑A	
5	240	†	MCS 103 22❑C		TMCS 103 22❑C	
5	480	†	MCS 103 22❑D		TMCS 103 22❑D	
3-Phase/4-Wire, 3-Element, Transformer-Rated, 50/60Hz (Voltage balanced)						
5	69	†	MCS 103 25❑F		TMCS 103 25❑F	
5	120	†	MCS 103 25❑A		TMCS 103 25❑A	
5	208	†	MCS 103 25❑R		TMCS 103 25❑R	
5	277	†	MCS 103 25❑Y		TMCS 103 25❑Y	
3-Phase/3-Wire, 2-Element, Transformer-Rated, 50/60Hz, Center Zero						
5	120	†	MCS 103 222A...		TMCS 103 222A...	
3-Phase/4-Wire, 2-Element, Transformer-Rated, 50/60Hz, Center Zero						
5	120	†	MCS 103 222A...		TMCS 103 252A...	

† Order by description. Specify CT (Current Transformer) and/or PT (Potential Transformer) ratios if used and scale desired.
❑ Sixth digit signifies pointer deflection (1-zero-left, 2-zero-center).

Varmeters are usually zero-center and scaled for half the scale values of the accompanying wattmeters. Example: If the Wattmeter is scaled 0-100 Kilowatts, the Varmeter is scaled 50-0-50 Kilovars.

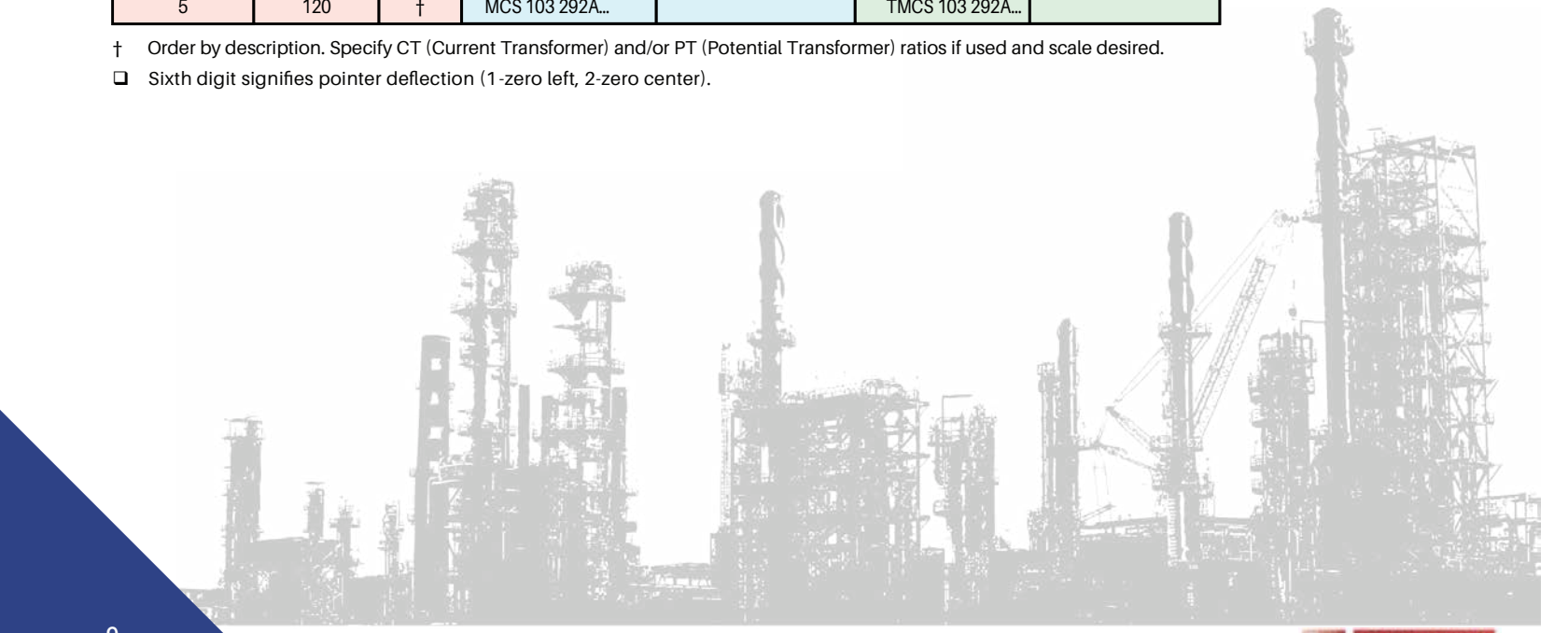
■ ***NOTE:***

See Application Guide and Tables on the following six pages for selection of commonly used Watt and Var Meters.

Varmeters (Voltage must be balanced for all polyphase Varmeters)

Rating (Amperes)	Rating (Volts)	Scale	Pivot+Jewel Part Num.		Taut Band Part Num.	
Single-Phase/2-Wire, 1-Element, Transformer-Rated, 60 Hz						
5	120	†	MCS 103 31❑A		TMCS 103 31❑A	
3-Phase/3-Wire, 2-Element, Transformer-Rated, 50/60 Hz (Cannot be used with External Phase Shifter)						
5	120	†	MCS 103 28❑A		TMCS 103 28❑A	
3-Phase/4-Wire, 3-Element, Transformer-Rated, 50/60 Hz (Cannot be used with External Phase Shifter)						
5	69	†	MCS 103 29❑F		TMCS 103 29❑F	
5	120	†	MCS 103 29❑A		TMCS 103 29❑A	
5	208	†	MCS 103 29❑R		TMCS 103 29❑R	
5	277	†	MCS 103 29❑Y		TMCS 103 29❑Y	
3-Phase/3-Wire, 2-Element, Transformer-Rated, 50/60Hz, Center Zero						
5	120	†	MCS 103 282A...		TMCS 103 282A...	
3-Phase/4-Wire, 2-Element, Transformer-Rated, 50/60Hz, Center Zero						
5	120	†	MCS 103 292A...		TMCS 103 292A...	

† Order by description. Specify CT (Current Transformer) and/or PT (Potential Transformer) ratios if used and scale desired.
❑ Sixth digit signifies pointer deflection (1-zero left, 2-zero center).



APPLICATION GUIDE FOR SELECTION OF WATTMETERS AND VARMETERS

1. For polyphase applications, see Selector Guide. These charts display complete catalog numbers for use with commonly used combinations of CT and PT ratios. For single phase applications, order by description.

For 3-wire 3-phase wattmeters rated 120 volts, 5A select line to line voltage on Scale Selector Guide.

For 3-wire 3-phase varmeters rated 120 volts, 5A select line to line voltage on Scale Selector Guide.

For 4-wire 3-phase wattmeters rated 120 volts, 5A select line to neutral on Scale Selector Guide.

For 4-wire 3-phase varmeters rated 208 volts, 5A select line to neutral on Scale Selector Guide.

2. If scale is required to be higher or lower than the pre-selected scale shown in the above charts, choose a scale value between the maximum and minimum shown on this table for the combination of CT and PT ratios. Order by description, giving CT and PT ratios and choice of scale.

3. For transformer ratios and/or ratings not shown in the above tables, see Scale Watts Formula below. This table shows minimum and maximum calibrating watts for various applications and ratings.

Scale Watts Formula:

Calibration :

For full load value of Watts or Var, assuming unity power factor:

1-phase 2-wire watts = amps x volts

3-phase 3-wire watts = amps x line-to-line volts x √3 3-phase 4-wire watts

amps x line-to-neutral volts x 3

Minimum scale values are obtained by multiplying resultant watts,

using the above formula x 0.7 and selecting next higher standard scale.

For maximum scale value, multiply x 1.3 and select the next lowest standard.

If scale calculates to an exact listed value,

use this value rather than the next higher or lower value.

Note : When ordering Wattmeters and Varmeters, please specify

CT ratio, VT ratio and required scale.

4. See tables below for scale and legend keys to catalog number.

Key to Watt/Varmeter Scales

This table shows letter combinations assigned to end-scale values to be used for digits 12 & 13 in Catalog number.

Cat. Digit 12, 13	Scale	Cat. Digit 12, 13	Scale	Cat. Digit 12, 13	Scale	Cat. Digit 12, 13	Scale	Cat. Digit 12, 13	Scale
AA	1	BA	10	CA	100	DA	1000	EA	BLANK
AC	1.2	BC	12	CC	120	DC	1200	EC	1.2
AD	1.4	BD	14	CD	140	DD	1400	EE	1.6
AE	1.5	BE	15	CE	150	DE	1500	FC	12.5
AF	1.8	BF	18	CF	180	DF	1800	FD	13
AG	2	BG	20	CG	200	DG	2000	FE	16
AH	2.4	BH	24	CH	240	DH	2400	FG	17.5
AJ	2.5	BJ	25	CJ	250	DJ	2500	FJ	26
AK	3	BK	30	CK	300	DK	3000	GB	115
AL	3.2	BL	32	CL	320	DL	3200	GC	125
AM	3.5	BM	35	CM	350	DM	3500	GD	130
AN	4	BN	40	CN	400	DN	4000	GE	160
AP	4.5	BP	45	CP	450	DP	4500	GG	175
AR	5	BR	50	CR	500	DR	5000	GH	230
AS	5.5	BS	55	CS	550	DS	5500	GJ	260
AT	6	BT	60	CT	600	DT	6000	HC	1250
AU	6.5	BU	65	CU	650	DU	6500	HD	1300
AW	7	BW	70	CW	700	DW	7000	HE	1600
AX	7.5	BX	75	CX	750	DX	7500	HG	1750
AY	8	BY	80	CY	800	DY	8000		
AZ	9	BZ	90	CZ	900	DZ	9000		

Key to Watt/Varmeter Legends

This table shows letters assigned to inner scale legends to be used for digit 14 in Catalog number

Digit 14	Wattmeters	Varmeters	Digit 14	Wattmeters	Varmeters	Digit 14	Wattmeters	Varmeters
A	None	None	D	AC Megawatts	Megavars	G	AC MW/Var* ◊	—
B	AC Watts	Vars	E	AC Watts/Vars*	—	T	Percent Horsepower	—
C	AC Kilowatts	Kilovars	F	AC KW/Var* ◊	—	U	Horsepower	—

*For wattmeters that are to be used with phase shifting transformer for measuring vars.

◊ Standard Legends AC Kilowatts/Kilovars and AC Megawatts/Megavars

Watt & Var Scale Selector

PRIMARY POTENTIAL TRANSFORMER VOLTS		120 (1:1)	208 (1:73)	240 (2:1)	480 (4:1)	600 (5:1)	2400 (20:1)	3600 (30:1)	4200 (35:1)	4800 (40:1)	6000 (50:1)	7200 (60:1)	8400 (70:1)
SYSTEM VOLTS 3 PHASE 3 WIRE (L-L)		120	208	240	480	600	2400	3600	4200	4800	6000	7200	8400
SYSTEM VOLTS 3 PHASE 4 WIRE (L-N)		69	120	139	277	347	1390	2100	2400	2770	3.500	4160	4800
CURRENT TRANSFORMER													
RATIO	NORMAL	5KW	10KW	10KW	20KW	25KW	100KW	150KW	175KW	200KW	250KW	300KW	350KW
25/5	MAX.	6	10	12	25	30	120	200	200	250	300	400	450
	MIN.	3	5	6	12.5	15	60	100	100	125	150	200	225
	NORMAL	10KW	20KW	20KW	40KW	50KW	200KW	300KW	350KW	400KW	500KW	600KW	700KW
50/5	MAX.	12	20	25	50	60	250	400	450	500	600	800	900
	MIN.	6	10	12.5	25	30	125	200	250	250	300	400	450
	NORMAL	15KW	25KW	30KW	60KW	75KW	300KW	500KW	500KW	600KW	750KW	900KW	1000KW
75/5	MAX.	20	30	40	80	100	400	600	700	800	1000	1200	1200
	MIN.	10	12.5	20	40	50	200	300	350	400	500	600	600
	NORMAL	20KW	30KW	40KW	75KW	100KW	400KW	600KW	700KW	800KW	1000KW	1200KW	1200KW
100/5	MAX.	25	40	50	100	120	500	800	900	1000	1200	1500	1500
	MIN.	12.5	20	25	50	60	250	400	450	500	600	750	750
	NORMAL	30KW	50KW	50KW	100KW	150KW	600KW	800KW	1000KW	1200KW	1500KW	1800KW	2000KW
150/5	MAX.	40	70	75	150	200	800	1200	1200	1500	2000	2400	2500
	MIN.	20	35	35	75	100	400	600	600	750	1000	1000	1250
	NORMAL	40KW	75KW	75KW	150KW	200KW	800KW	1200KW	1200KW	1500KW	2000KW	2500KW	3000KW
200/5	MAX.	50	80	100	200	250	1000	1500	1500	2000	2500	3000	3500
	MIN.	25	40	50	100	125	500	750	750	1000	1250	1500	1500
	NORMAL	70KW	100KW	100KW	200KW	300KW	1200KW	1500KW	2000KW	2500KW	3000KW	3500KW	4500KW
300/5	MAX.	75	120	150	300	400	1500	2000	2500	3000	4000	4000	5000
	MIN.	35	60	75	150	200	750	1000	1250	1500	2000	2000	2500
	NORMAL	75KW	125KW	150KW	300KW	400KW	1500KW	2500KW	3000KW	3000KW	4000KW	5000KW	6000KW
400/5	MAX.	100	150	200	400	500	2000	3000	3600	4000	5000	6000	7000
	MIN.	50	75	100	200	250	1000	1500	1500	2000	2500	3000	3500
	NORMAL	125KW	200KW	200KW	450KW	600KW	2000KW	3000KW	4000KW	5000KW	6000KW	7500KW	8000KW
600/5	MAX.	150	250	300	600	800	3000	4000	5000	6000	8000	8000	10MW
	MIN.	75	125	150	300	400	1500	2000	2500	3000	4000	4000	5000KW
	NORMAL	150KW	250KW	300KW	600KW	800KW	3000KW	5000KW	6000KW	6000KW	8000KW	10MW	12MW
800/5	MAX.	200	350	400	800	1000	4000	6000	7500	8000	10MW	12	15
	MIN.	100	175	200	400	500	2000	3000	3000	4000	5000KW	6000KW	7500KW
	NORMAL	200KW	350KW	400KW	800KW	1000KW	4000KW	6000KW	6000KW	8000KW	10MW	12MW	15MW
1000/5	MAX.	250	450	500	1000	1200	5000	8000	8000	10MW	12	15	18
	MIN.	125	225	250	500	600	2500	4000	4000	5000KW	6000KW	7500KW	10
	NORMAL	250KW	400KW	500KW	1000KW	1200KW	5000KW	7000KW	8000KW	10MW	12MW	15MW	10MW
1200/5	MAX.	300	500	600	1200	1500	6000	8000	10MW	12	15	18	20
	MIN.	150	250	300	600	750	3000	4000	5000KW	6000KW	7500KW	10	10
	NORMAL	300KW	500KW	600KW	1200KW	1500KW	6000KW	10MW	10MW	12MW	15MW	20MW	20MW
1500/5	MAX.	400	700	750	2000	2000	8000	12	12	15	20	20	25
	MIN.	200	350	375	1000	1000	4000	6000KW	6000KW	7500KW	10	10	12.5
	NORMAL	400KW	750KW	800KW	1600KW	2000KW	8000KW	12MW	12MW	15MW	20MW	25MW	30MW
2000/5	MAX.	500	800	1000	2000	2500	10MW	15	15	20	25	30	35
	MIN.	250	400	500	750	1250	5000KW	7500KW	7500KW	10	12.5	15	20
	NORMAL	750KW	1000KW	1200KW	2000KW	3000KW	12MW	18MW	20MW	25MW	30MW	35MW	40MW
3000/5	MAX.	800	1200	1500	3000	4000	15	20	25	30	40	40	50
	MIN.	400	600	750	1500	2000	7500KW	10	12.5	15	20	20	25
	NORMAL	800KW	1200KW	1500KW	3000KW	4000KW	15MW	20MW	25MW	30MW	40MW	50MW	50MW
4000/5	MAX.	1000	1500	2000	4000	5000	20	30	30	40	50	60	75
	MIN.	500	750	1000	2000	2500	10	15	15	20	25	30	40
	NORMAL	1000KW	1500KW	2000KW	4000KW	5000KW	20MW	30MW	20MW	40MW	50MW	60MW	75MW
5000/5	MAX.	1250	2000	2500	5000	6000	25	40	25	50	60	80	80
	MIN.	500	1000	1250	2500	3000	12.5	20	12.5	25	30	40	40
	NORMAL	1200KW	2000KW	2500KW	5000KW	6000KW	25MW	35MW	40MW	50MW	60MW	60MW	80MW
6000/5	MAX.	1500	2500	3000	6000	8000	30	40	50	60	80	80	100
	MIN.	750	1250	1500	3000	4000	15	20	25	30	40	40	50

Watt & Var Scale Selector

PRIMARY POTENTIAL TRANSFORMER VOLTS		12KV (100:1)	14.4KV (120:1)	24KV (200:1)	34.5KV (300:1)	38KV (330:1)	46KV 400:1	92KV 800:1	115KV 1000:1	138KV 1200:1	345KV 3000:1	765KV
SYSTEM VOLTS 3 PHASE 3 WIRE (L-L)		12KV	14.4KV	24KV	34.5KV	38KV	46KV	92KV	115KV	138KV	345KV	765KV
SYSTEM VOLTS 3 PHASE 4 WIRE (L-N)		6900	8300	13.8KV	20KV	22KV	26.5KV	53KV	66KV	80KV	200KV	440KV
CURRENT TRANSFORMER												
RATIO 25/5	NORMAL	500KW	600KW	1000KW	1500KW	1500KW	1500KW	3000KW	5000KW	6000KW	15MW	30MW
	MAX.	650	800	1200	1500	2000	2500	5000	6000	7500	15	40
	MIN.	325	400	600	750	1000	1250	1500	3000	3000	7500KW	20
50/5	NORMAL	1000KW	1200KW	2000KW	3000KW	3000KW	3500KW	8000KW	10MW	12MW	30MW	60MW
	MAX.	1200	1500	2500	3500	4000	.5000	10MW	12	15	35	80
	MIN.	600	750	1250	1750	2000	2500	5000KW	6000KW	7500KW	15	40
75/5	NORMAL	1500KW	1800KW	3000KW	4000KW	5000KW	5000KW	10MW	15MW	15MW	45MW	100MW
	MAX.	2000	2000	4000	5000	6000	7500	15	15	20	50	125
	MIN.	1000	1000	2000	2500	3000	3000	7500KW	7500KW	10	25	50
100/5	NORMAL	2000KW	2500KW	4000KW	6000KW	6000KW	7500KW	15MW	20MW	25MW	60MW	125MW
	MAX.	2500	3000	5000	7500	8000	10MW	20	25	30	70	150
	MIN.	1 250	1 500	2500	3000	4000	5000KW	10	12.5	15	35	75
150/5	NORMAL	3000KW	3500KW	6000KW	10MW	10MW	10MW	20MW	30MW	35MW	90MW	200MW
	MAX.	4000	4000	4000	10	12	15	30	35	40	100	250
	MIN.	2000	2000	2000	5000KW	6000KW	7500KW	15	15	20	50	100
200/5	NORMAL	4000KW	4500KW	8000KW	12MW	12MW	15MW	30MW	35MW	50MW	100MW	250MW
	MAX.	5000	6000	5000	15	15	20	40	50	60	150	300
	MIN.	2500	3000	2500	7500KW	7500KW	10	20	25	30	75	150
300/5	NORMAL	6000KW	7000KW	12MW	18MW	18MW	20MW	45MW	60MW	75MW	150MW	400MW
	MAX.	8000	8000	15	20	25	30	60	75	80	200	500
	MIN.	4000	4000	7.5	10	12.5	15	30	30	40	100	250
400/5	NORMAL	8000KW	10MW	15MW	24MW	25MW	30MW	60MW	80MW	100MW	200MW	500MW
	MAX.	10MW	12	20	30	30	40	80	100	120	300	600
	MIN.	5000KW	6000KW	10	15	15	20	40	50	60	150	300
600/5	NORMAL	12MW	15MW	25MW	35MW	40MW	45MW	90MW	100MW	150MW	350MW	800MW
	MAX.	15	18	30	40	50	60	120	150	180	450	1000
	MIN.	7500KW	10	15	20	25	30	60	75	75	225	500
800/5	NORMAL	15MW	20MW	30MW	50MW	50MW	60MW	120MW	150MW	200MW	500MW	1000MW
	MAX.	20	25	40	60	60	80	150	200	200	600	1200
	MIN.	10	12.5	20	30	30	40	75	100	100	300	600
1000/5	NORMAL	20MW	25MW	40MW	50MW	60MW	75MW	150MW	200MW	250MW	600MW	1200MW
	MAX.	25	30	50	60	80	100	200	250	300	750	1500
	MIN.	12.5	15	25	30	40	50	100	125	150	300	750
1200/5	NORMAL	25MW	30MW	50MW	60MW	80MW	100MW	175MW	250MW	300MW	750MW	1500MW
	MAX.	30	35	60	80	100	120	200	300	350	900	2000
	MIN.	15	20	30	40	50	60	100	150	175	450	1000
1500/5	NORMAL	30MW	35MW	60MW	75MW	100MW	120MW	250MW	300MW	350MW	900MW	2000MW
	MAX.	40	40	80	100	120	150	300	350	450	1000	2500
	MIN.	20	20	40	50	60	75	150	175	225	500	1250
2000/5	NORMAL	40MW	50MW	80MW	100MW	120MW	150MW	300MW	400MW	500MW	1000MW	2500MW
	MAX.	50	60	100	150	150	200	400	500	600	1500	3000
	MIN.	25	30	50	75	75	100	200	250	300	750	1500
3000/5	NORMAL	60MW	75MW	100MW	150MW	200MW	200MW	400MW	600MW	700MW	1500MW	3500MW
	MAX.	80	80	150	200	250	300	500	750	900	2000	5000
	MIN.	40	40	75	100	125	150	250	350	450	1000	2500
4000/5	NORMAL	80MW	100MW	150MW	200MW	250MW	300MW	500MW	800MW	1000MW	2000MW	5000MW
	MAX.	100	125	200	300	300	400	800	1000	1200	3000	6000
	MIN.	50	60	100	150	150	200	400	500	600	1500	3000
5000/5	NORMAL	100MW	125MW	200MW	250MW	300MW	400MW	750MW	1000MW	1200MW	3000MW	6000MW
	MAX.	120	150	250	300	400	500	1000	1200	1500	3500	8000
	MIN.	60	75	125	150	200	250	500	600	750	1750	4000
6000/5	NORMAL	120MW	150MW	250MW	350MW	400MW	450MW	1000MW	1200MW	1500MW	3500MW	8000MW
	MAX.	150	175	300	400	500	600	1200	1500	1750	4000	10000
	MIN.	75	80	150	200	250	300	600	750	800	2000	5000

Optional Features

1. Uncalibrated
2. Special marked scales
3. Special legends
4. Colored markings, lines or arcs other than black.
5. Fine line marking (approximately twice the normal calibration marks — maximum 150 calibration marks
6. Black scale - white markings
7.
   a) Double set of numbers - Single set of divisions
   b) Triple set of numbers - Single set of divisions
8.
   a) Double set of numbers - Double set of divisions
   b) Triple set of numbers - Double set of divisions
9. Zero-center scales - DC ammeters, DC milliammeters, DC voltmeters, AC wattmeters and varmeters. Not available for AC ammeters, voltmeters
10. Offset-zero scale - Available for varmeters, AC wattmeters, DC ammeters and DC voltmeters

Ratings and Calibration

11. Special calibration in accordance with data supplied by customers
12. Calibration at any angle other than vertical — Specify angle. Terminal resistance and/or tolerance other than standard tolerance (±15%)
13. Special sensitivities for DC P&J voltmeters. Standard sensitivities are: zero-left: 1000 ohms/volts zero-center: 2000 ohms/volts
14. Special frequency calibration Any frequency 25 to 400 Hertz. Over 400 Hertz, consult factory.
15. Double-rated voltmeters will be manufactured by BYRAM LABS (includes doublemarked scale if required). Double ratings should be chosen to allow a single set of divisions whenever possible.

    Double-rated DC ammeters are not recommended

16. Wattmeters & varmeters with current coils rated other than 5 amperes.
17. Accuracy other than listed
18. Suppressed zero — Maximum suppression 20% of scale.

Construction

19. IP54 case (standard on metal case, no adder)
20. Custom Tagging

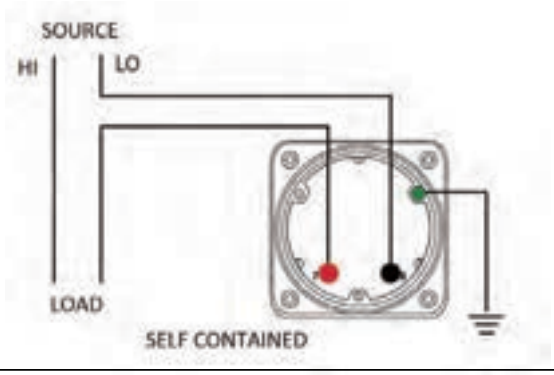
Standard Scale Legends

AC Volts or Kilovolts	% KW	LBS
AC Amperes, or Kiloamperes	Hz	PSIG
AC Watts, Kilowatts or Megawatts	FPS	GPH
Vars, Kilovars or Megavars	KPS	PSIA
Synchroscope	YPS	IPS
Power Factor	CPM	PPS
Hertz	FPM	RPM
Phase Angle	IPM	GPM
DC Volts, or Kilovolts	KPM	In. H_2O
or Milliamperes	RPM	
DC Watts or Kilowatts	YPM	
Percent-Motor-Load Current	CPH	
Percent Horsepower	FPH	
Degrees C	IPH	
Degrees F	KPH	
Degrees K	MPH	
Degrees R	RPH	
Kilo-Ohms	YPH	
Horsepower	PPH	
Percent	PSI	
Percent Load		
VA. In HG		

The words "Spindle," "Table," "Roll," "Motor," "Turbine" can be added to the above at no extra cost.
Also, when necessary, the multipliers, "X-10," "X-100," or "X-1000" will be added to these legends.

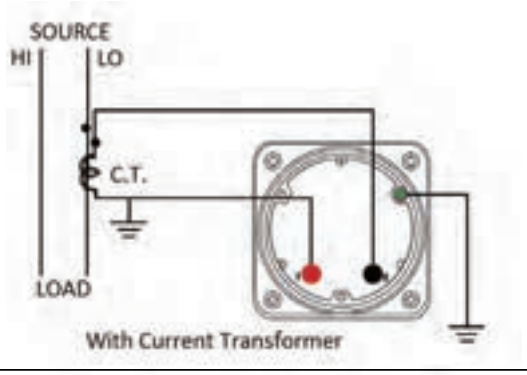
Standard Connections

AC Ammeter
*103131xxxx



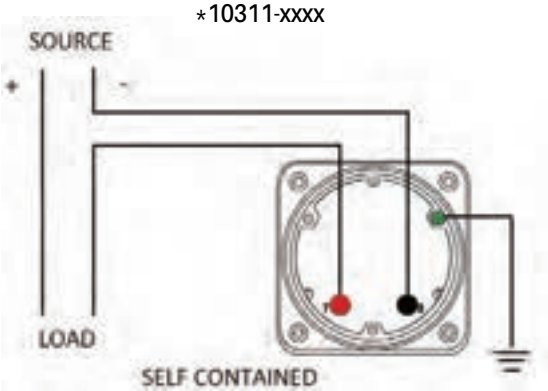
SELF CONTAINED

AC Ammeter
*103131xxxx



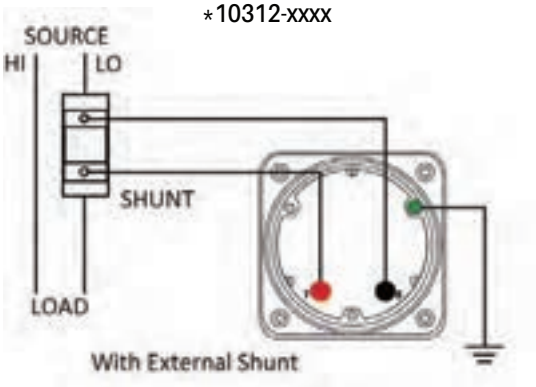
With Current Transformer

DC Ammeter
*10311-xxxx



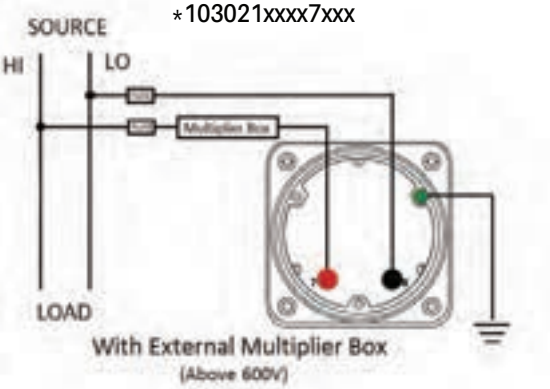
SELF CONTAINED

DC Ammeter
*10312-xxxx



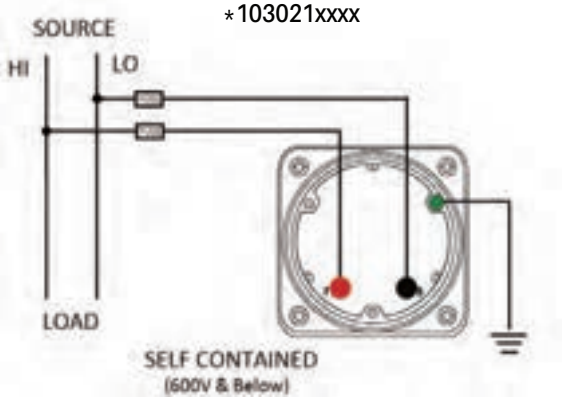
With External Shunt

AC Voltmeter
*103021xxxx7xxx



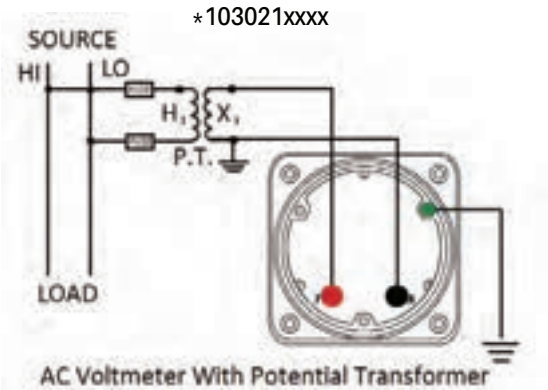
With External Multiplier Box
(Above 600V)

AC Voltmeter
*103021xxxx



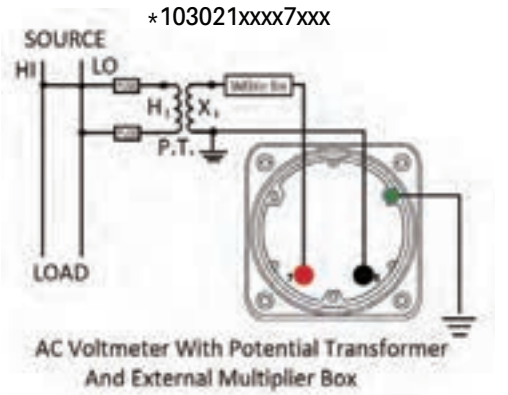
SELF CONTAINED
(600V & Below)

AC Voltmeter
*103021xxxx



AC Voltmeter With Potential Transformer

AC Voltmeter
*103021xxxx7xxx



AC Voltmeter With Potential Transformer
And External Multiplier Box

NOTE: UL requires a separate grounding terminal that is provided above a ground symbol (⏚)

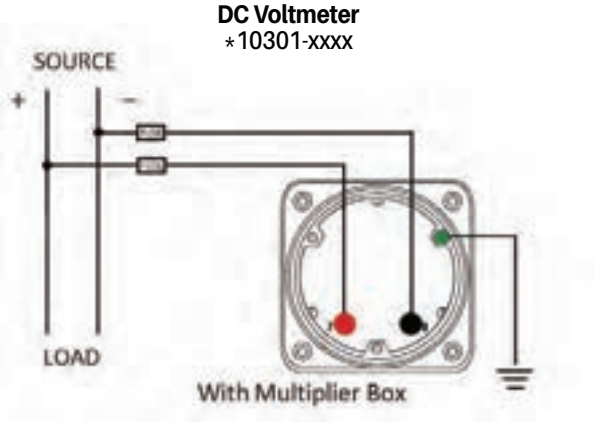
Ground Terminal
Terminal 1
Terminal 2
Terminal 3
Terminal 4
Terminal 5
Terminal 6
Terminal 7
Terminal 8
Terminal 9
Terminal 10
Terminal 11
Terminal 12

Specs subject to change without notice

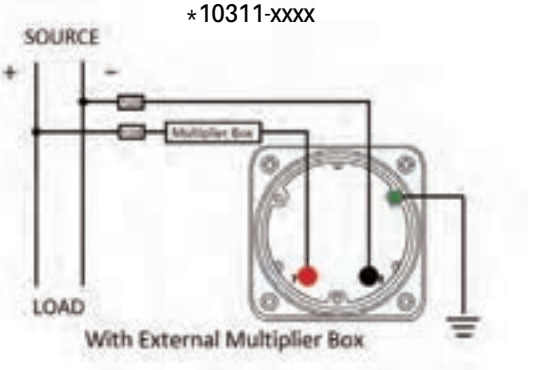
*When ordering, specify MCS / TMCS

Standard Connections

DC Voltmeter
*10301-xxxx

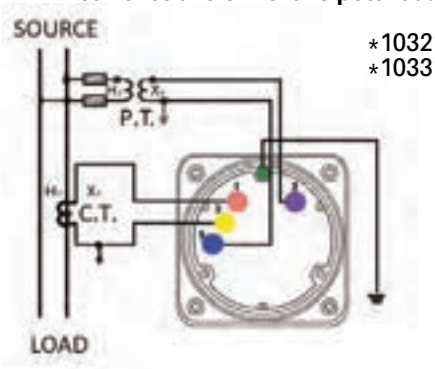


DC Voltmeter
*10317-xxxx
*10311-xxxx



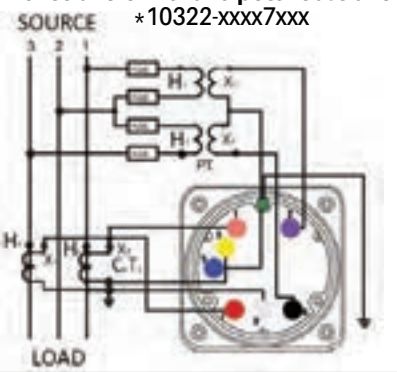
Single-phase wattmeter or Varmeter with current transformer and potential transformer

*10321-xxxx7xxx (watt)
*10331-xxxx7xxx (var)

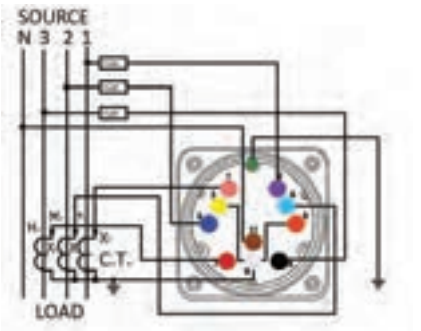


Three-wire, three-phase wattmeter with current transformer and potential transformer

*10322-xxxx7xxx

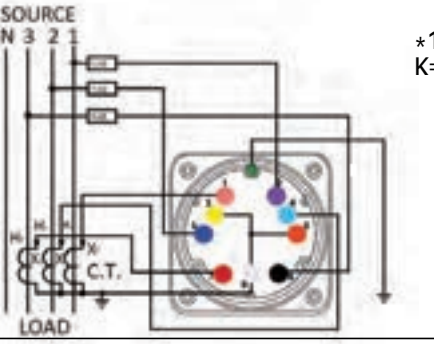


Four-wire, three-phase wattmeter with current transformer (Balanced Voltage)
*10325-xxxx7xxx

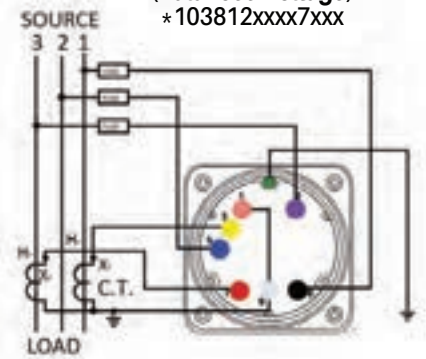


Connections for 3 element varmeter, without phase shifting transformer; used to measure vars on 4 wire, 3 phase circuits, and three current transformers: (Balanced Voltage)

*10329-xxxx7xxx, K=1.1547

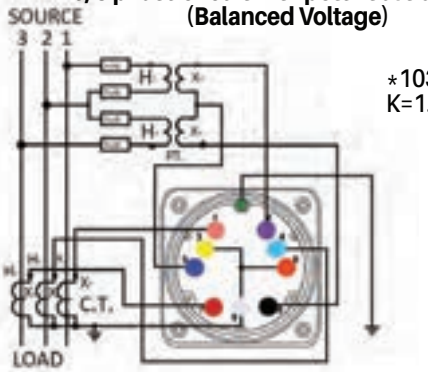


Connections for polyphase varmeters for 3 wire, 3 phase. (Balanced Voltage)
*103812xxxx7xxx



Connections for 2 element varmeter used to measure vars on a 3 wire, 3 phase circuit with potential transformer. (Balanced Voltage)

*10329-xxxx7xxx, K=1.1547



NOTE: UL requires a separate grounding terminal that is provided above a ground symbol (⏚)

Ground Terminal
Terminal 1
Terminal 2
Terminal 3
Terminal 4
Terminal 5
Terminal 6
Terminal 7
Terminal 8
Terminal 9
Terminal 10
Terminal 11
Terminal 12

Specs subject to change without notice

*When ordering, specify MCS / TMCS

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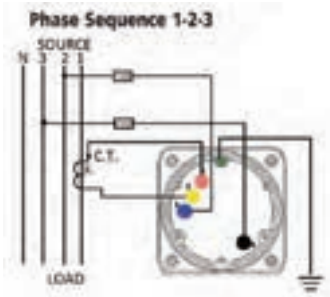
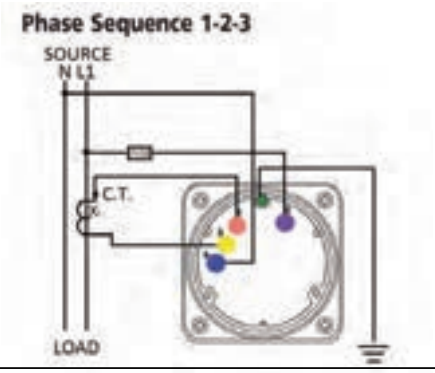
Standard Connections

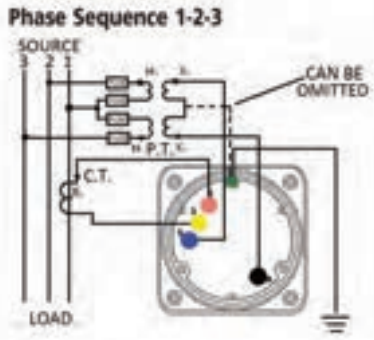
Connections for power-factor meters with 4 wire 3 phase circuits with current transformer. If using transformer with secondary voltage of 120, power-factor instrument should be rated 208 volts. (Balanced System)
*103402xxxx



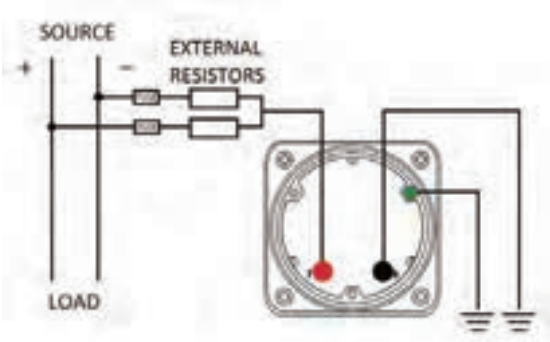
Single-phase power-factor meter with current transformer
*103412xxxx



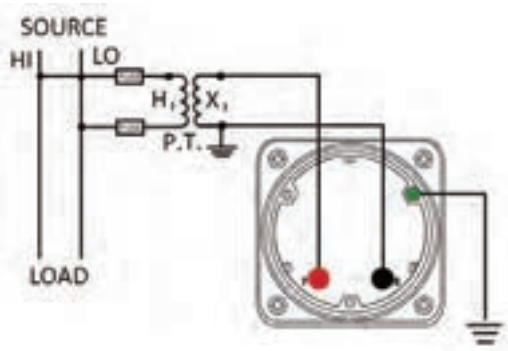
Three-wire, three-phase power-factor meter with current transformer and potential transformer (Balanced System)
*103402xxxx



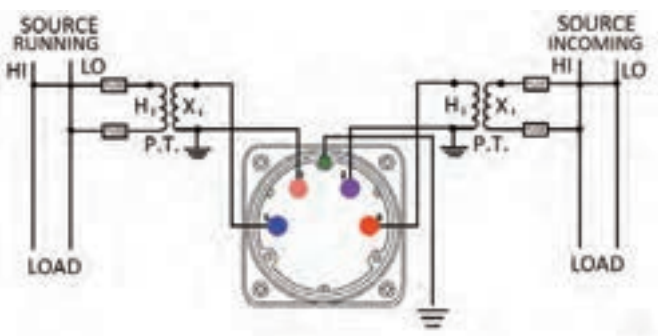
DC Ground Detector



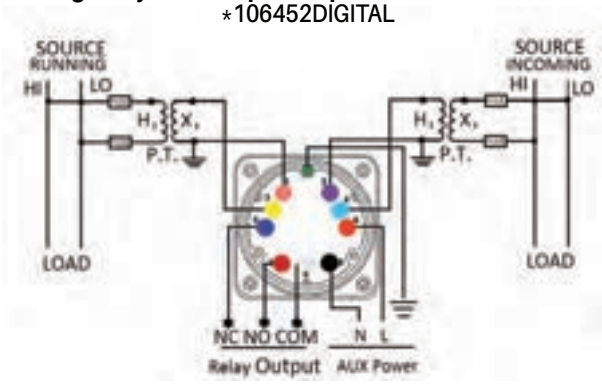
Frequency Meter with potential transformer
*103372xxxx



Synchroscope with potential transformers
*106452xxxx



Digital Synchroscope with potential transformers
*106452DIGITAL



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NOTE: UL requires a separate grounding terminal that is provided above a ground symbol (⏚)

Ground Terminal
Terminal 1
Terminal 2
Terminal 3
Terminal 4
Terminal 5
Terminal 6
Terminal 7
Terminal 8
Terminal 9
Terminal 10
Terminal 11
Terminal 12

Specs subject to change without notice

*When ordering, specify MCS / TMCS

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Min and Max Rating (MCS/TMCS)

Minimum and Maximum Ratings

Indicator	Type	Minimum	Maximum
AC Voltmeter	Rectifier	50/60 Hertz 20 Volts	50/60 Hertz 600 Volts
AC Ammeter	Rectifier	50/60 Hertz 1 Ampere	50/60 Hertz 30 Ampere
AC Wattmeter 1-phase, 2-wire	Single Phase	50/60 Hertz 69 Volt 1 Ampere	50/60 Hertz 277 Volt 5 Ampere
AC Wattmeter 3-phase, 3-wire 3-phase, 4-wire	Polyphase, Voltage Unbalanced Voltage Balanced	50/60 Hertz 69 Volt 1 Ampere	50/60 Hertz 480 Volt 5 Ampere
AC Varmeter 1-phase, 2-wire	Single Phase	50/60 Hertz 69 Volt 1 Ampere	50/60 Hertz 277 Volt 5 Ampere
AC Varmeter 3-phase, 3-wire 3-phase, 4-wire	Polyphase, Voltage Unbalanced Voltage Balanced	50/60 Hertz 69 Volt 1 Ampere	50/60 Hertz 480 Volt 5 Ampere
AC Ground Detector	Rectifier	50/60 Hertz 20 Volts	50/60 Hertz 600 Volts
Frequency Meter		10 Hertz Span (45-55 Hz)	40 Hertz Span (380-420 Hz)
Synchroscope	TBD	TBD	TBD
Power-factor Meter 1-phase, 2-wire	Single Phase	50/60 Hertz 110 Volt 1 Ampere	50/60 Hertz 480 Volt 5 Ampere
Power-factor Meter 3-phase, 3-wire 3-phase, 4-wire	Polyphase, Balanced System	50/60 Hertz 110 Volt 1 Ampere	50/60 Hertz 480 Volt 5 Ampere
DC Voltmeter		50mVolt	600 Volts
DC Ammeter		200 Micro Ampere	1 Ampere
DC Millivoltmeter		50mVolt	600 Volts
DC Microammeter		200 Micro Ampere	1 Ampere
DC Milliammeter		200 Micro Ampere	1 Ampere
DC Ground Detector		50mVolt	600 Volts

Burden Data - AC Meters

Type	Impedance in Ohms	Dielectric withstand	Overload rating	Volt – ampere	Power Factor
For Potential circuit					
AC Voltmeter	45.5 Kohms @ 120VAC	2300VAC between electronic circuit and case for 1 minute	X1.2 continuous	< 0.8 VA @ 150V	---------
AC Wattmeter or Var meter	For 3 phase 3 wire Wattmeter 316 K ohm @ 110V For 3 Phase 3 wire Var Meter 273.4 Kohm @ 110V	2600VRMS between electronic circuit and case for 1 minute	Voltage X 2 rating for 5 second Voltage x 1.2 continuous	< 4.5VA for Voltage circuit	1.0
AC Power Factor Meter	For 1 phase PF meter 95.2 K ohm @ 110V For 3 phase PF meter 124.9Kohm @ 415V	2600VRMS between electronic circuit and case for 1 minute	Voltage X 2 rating for 5 second Voltage x 1.2 continuous	< 4.5 VA for Voltage circuit	1.0
Frequency Meter	> 1 Mohm	2300VAC between electronic circuit and case for 1 minute	---------	---------	---------
Synchroscope	TBD	TBD	TBD	TBD	TBD
For Current circuit					
AC Ammeter	0.005 ohms @ 10A	2300VAC between electronic circuit and case for 1 minute	X2 continuous, X 10 for 1 second	< 0.5 VA	---------
AC Wattmeter or Var meter	For 3 phase 3 wire Wattmeter 0.1 ohm @ 1A For 3 Phase 3 wire Var Meter 0.1ohm @ 1A	2600VRMS between electronic circuit and case for 1 minute	Current X10 rating for 5 second, Current X 1.2 continuous	< 2 VA for Current circuit	1.0
AC Power Factor Meter	For 3 phase 3 wire Wattmeter 0.1 ohm @ 1A For 3 Phase 3 wire Var Meter 0.1ohm @ 1A	2600VRMS between electronic circuit and case for 1 minute	Current X10 rating for 5 second, Current X 1.2 continuous	< 2 VA for Current circuit	1.0

*Data based on a per-element basis

Burden Data - DC Meters

DC Voltmeters

Rating (Volts)	Sensitivity (Ohms Per Volt)
50mV – 800V	1,000 ohms / volt for left zero and 2,000 ohms / volt for centre zero

Rating (mV)	Calibrated for 2-way Lead Resistance of 0.04 Ohms as standard**	Ohms Terminal Resistance ± 15%
0-50	0.04	12.50 ohm
50-0-50	0.04	25.0 ohm
0-100	0.04	25.0 ohm
100-0-100	0.04	50 ohm

DC Milliammeters / Ammeter

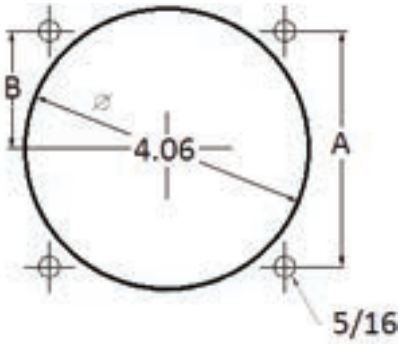
Current Rating	Ohms Terminal Resistance ± 15%
0 - 1 mA	500 ohm
0 - 5 mA	7 ohm
0 – 15 mA	3 ohm
0 – 1 A	0.075 ohm

DC Microammeters

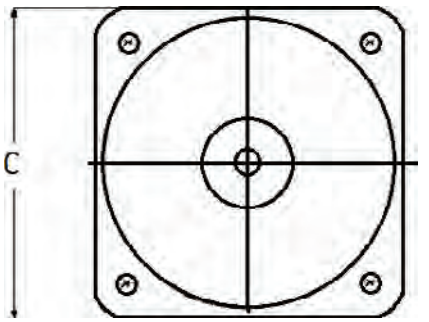
Rating (uA)	Ohms Terminal Resistance ± 15%
0-200	10 Kohm
0-400	2.52 Kohm
0-500	2.5 Kohm

Dimensions

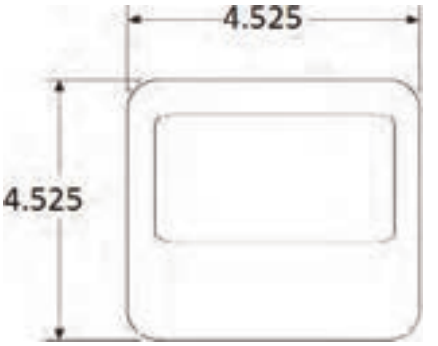
Short & Long Case



Panel Cutout



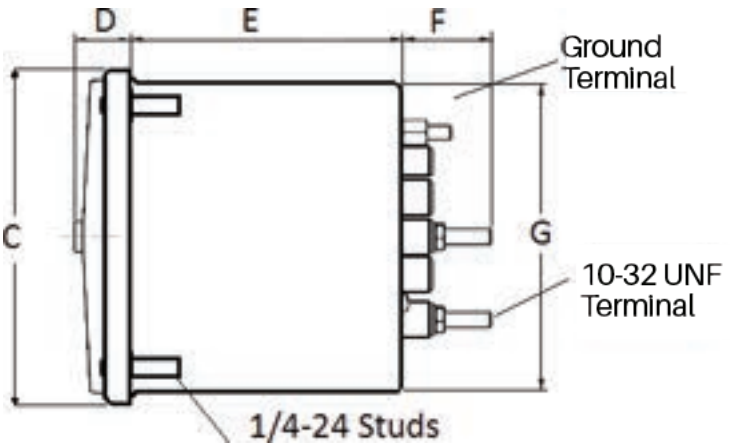
Front



Front Digital Synchroscope

Short Case - AC V / A, DC V / A, Hz, and Tach.

	Pivot & Jewel (MCS)	Taut-Band (TMCS)
	INCHES	INCHES
A	3.37″	3.37″
B	1.69″	1.69″
C	4.30″	4.30″
D	0.65″	0.65″
E	2.25″	2.65″
F	0.98″	0.98″
G	3.95″	3.95″



Long Case - Watt, Var, Power Factor, Synchroscope

	MCS		TMCS
	Wattmeter, Varmeter, PF	Synchroscope Analog/Digital	Taut-Band
A	3.37″	3.37″	3.37″
B	1.69″	1.69″	1.69″
C	4.30″	4.525″	4.30″
D	0.75″	0.77″	0.75″
E	3.35″	3.35″	3.61″
F	1.12″	1.12″	1.12″
G	3.95″	3.95″	3.95″