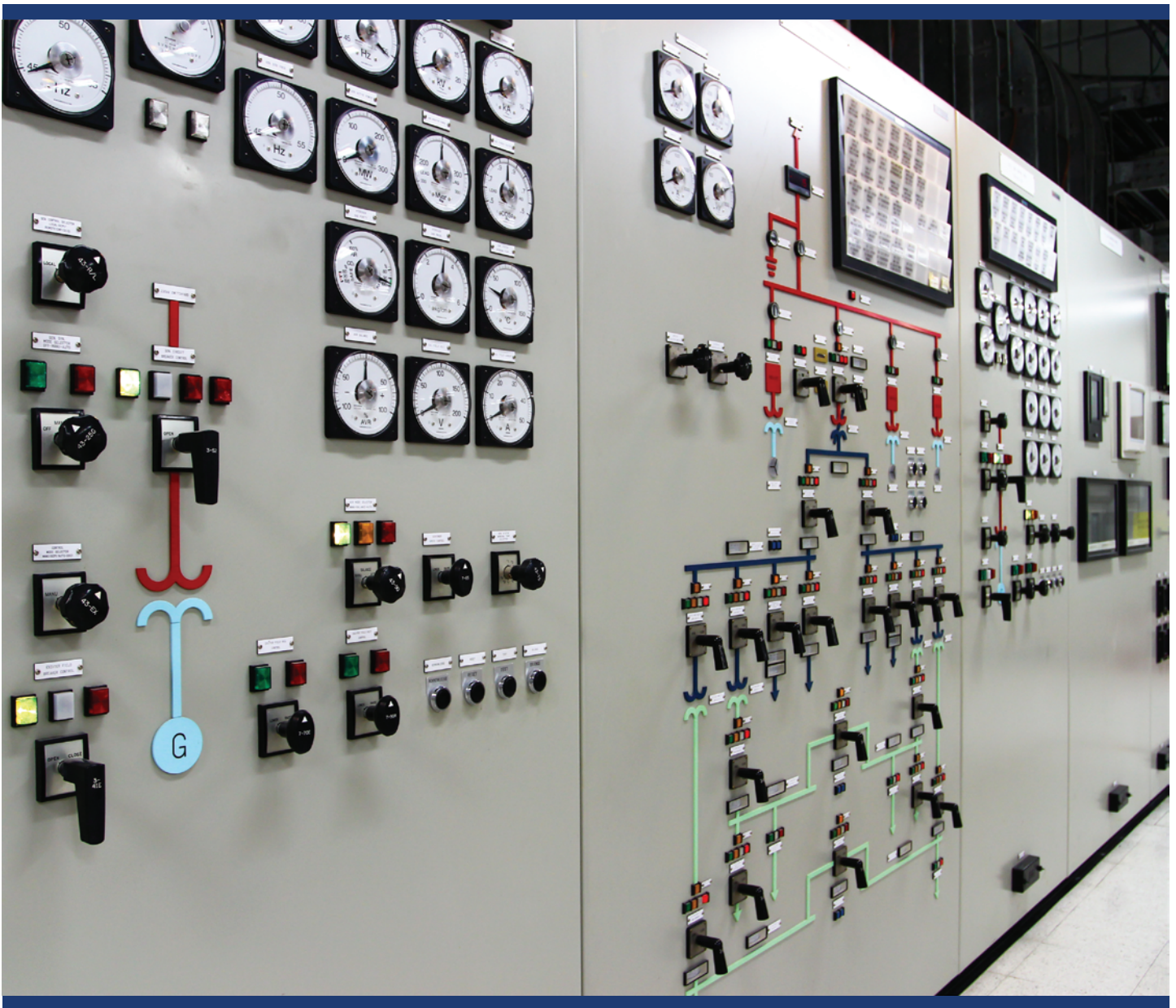


# Platinum Series

## **Metal Case** Switchboard Meters (MCS)

# Product Catalog



# Switchboard Instruments



## Precision

The new Platinum Series meter line was developed in conjunction with Sifam Tinsley, an established brand name for over 75 years; to meet today's tough metering requirements while maintaining flexibility for tomorrow's needs.

## Reliability

With years of experience backing the solutions that we provide, we are confident that we will be able to meet and exceed all of your metering needs.

## PLATINUM SERIES



UL Listed.  
E471457

The Platinum Series of high quality Switchboard Instruments complies with the American ANSI-C39.1 accuracy class 1 specification. Available in the 4 1/2 " case size, their rugged design characteristics meet the needs of the most demanding environment applications. Engineering know-how, based on time-proven designs and worldwide use, is built into every switchboard instrument. With every switchboard meter, you always get proven reliability and accuracy. Models are customizable to meet customers various requirements. Contact your sales person for more information.

As an alternate to the Analog Platinum Synchronoscope, The Platinum Digital Synchronoscope has been included as it adds the additional displays of the actual difference of voltage, frequency & phase angle between the BUS (Reference) voltage & generator (Incoming) voltage, as well as a synchronizing relay.

When two sources like the utility and a standby generator are to be paralleled it is necessary that their frequency & amplitude should be equal and phase difference be near to zero prior to the paralleling. When all these 3 parameters are within the required limits, the synchronoscope indicates that the two sources can be paralleled.

# Switchboard Instruments

## ADDITIONAL RAM METER INC PRODUCTS

### IR Windows



Ram Meter Inc. offers IR windows for new and retrofit applications. Add a barrier between your Infrared camera operators and energized equipment, protecting personnel from potential arc flash occurrences. IR Windows allow cameras to capture crisp visible and thermal images without distortions. It transmits short, mid, and longwave IR, and supports visual inspections and fusion features.

### Current Transformers



Ram Meter Inc. offers a full line of Current transformers and current Sensors. Ratios from 5-6000 amps are available from stock with the following optional features:

- Revenue grade ANSI transformers
- Instrument transformers
- C50, C100 and C200 Relay accuracy
- Solid Core
- Split Core
- Customization of range, size, and output is available.

### Thermal Imagers



FLIR Systems Thermal Imagers offer the peak of performance in the thermal vision industry, delivering exquisite image quality where other companies fall short.

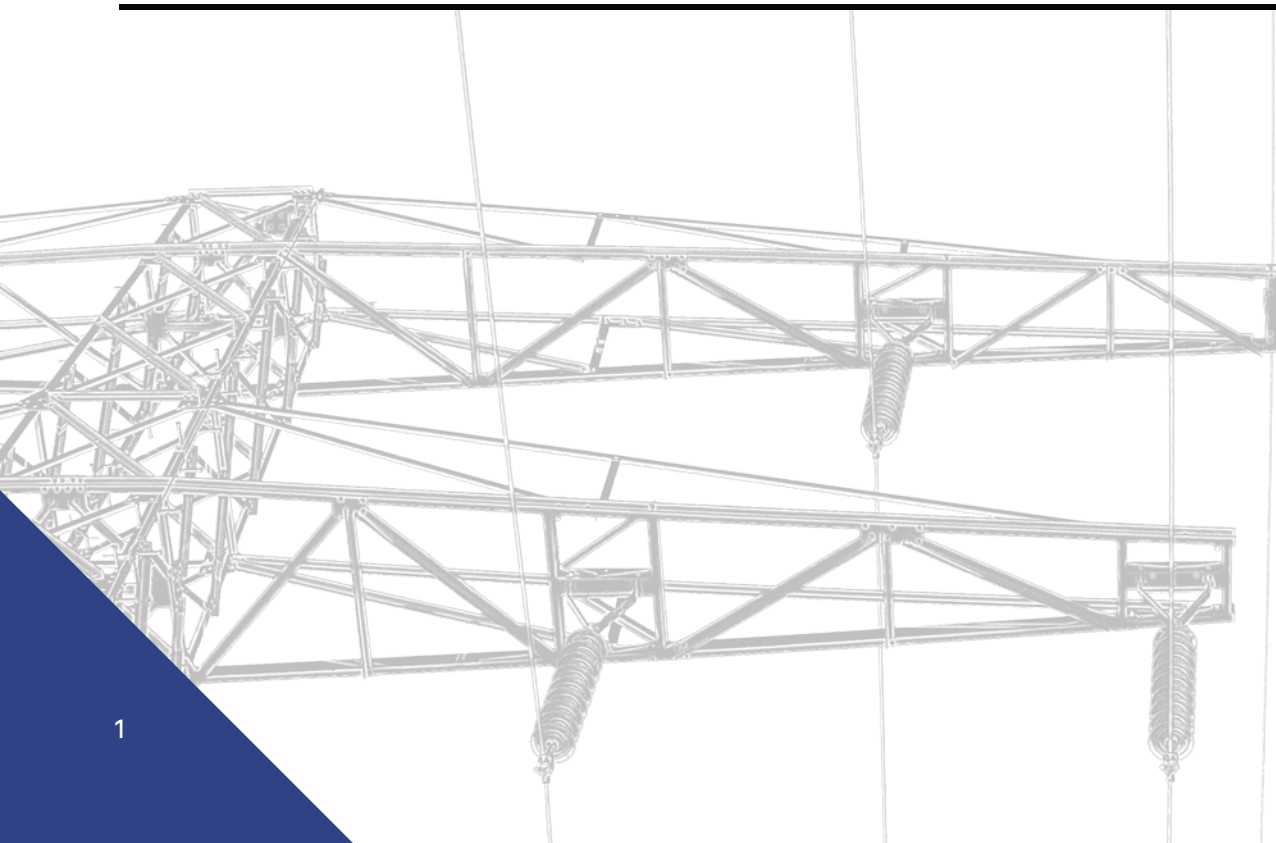
Each Fluke camera is built without compromise to the standard of "ruggedness, reliability and accuracy". Designed for everyday use, in any environment for thorough and accurate inspections.

### FT-21



This version of the Alpha meter includes a switchboard mounting enclosure. A3 meters provide a complete system for complex energy and power measurement, for all types of electric utility billing requirements. The A3 is user programmable with standard PC computers and Metercat™ software.

MCS Switchboard Instruments	Page
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## SWITCHBOARD INSTRUMENT SELECTOR GUIDE

Model Type	MCS
Case Style	4 1/4" Metal
Available	
<b>Input Rating</b>	
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



### MCS Switchboard specifications in accordance with ANSI C39.1

**Accuracy:**  $\pm 1.0\%$  of full scale basic accuracy class.

*Specific accuracies:*

*Expanded Scale Voltmeter* - 0.3% of mid-scale.

*Power factor meter* -  $\pm 1\%$  of fiducial value from 40-120% of rated current.

*Synchroscope* -  $\pm 1\%$  of scale length.

*Frequency meters* -  $\pm .15\text{Hz}$  @45-55Hz and 55-65Hz,  $\pm 0.08\text{Hz}$  58-62Hz,  $\pm 1.3\text{Hz}$  @350-450Hz.

**Position of use:** Vertical (scale)

**Full scale deflection angle:** 250°, except synchroscope is 360°

**Full scale length:** MCS - 6.9 inches.

**Scale plate:** MCS platform type 2 piece scale with graduations on the outer scale; numerals and legends on the inner scale.

**Case:** All MCS 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.

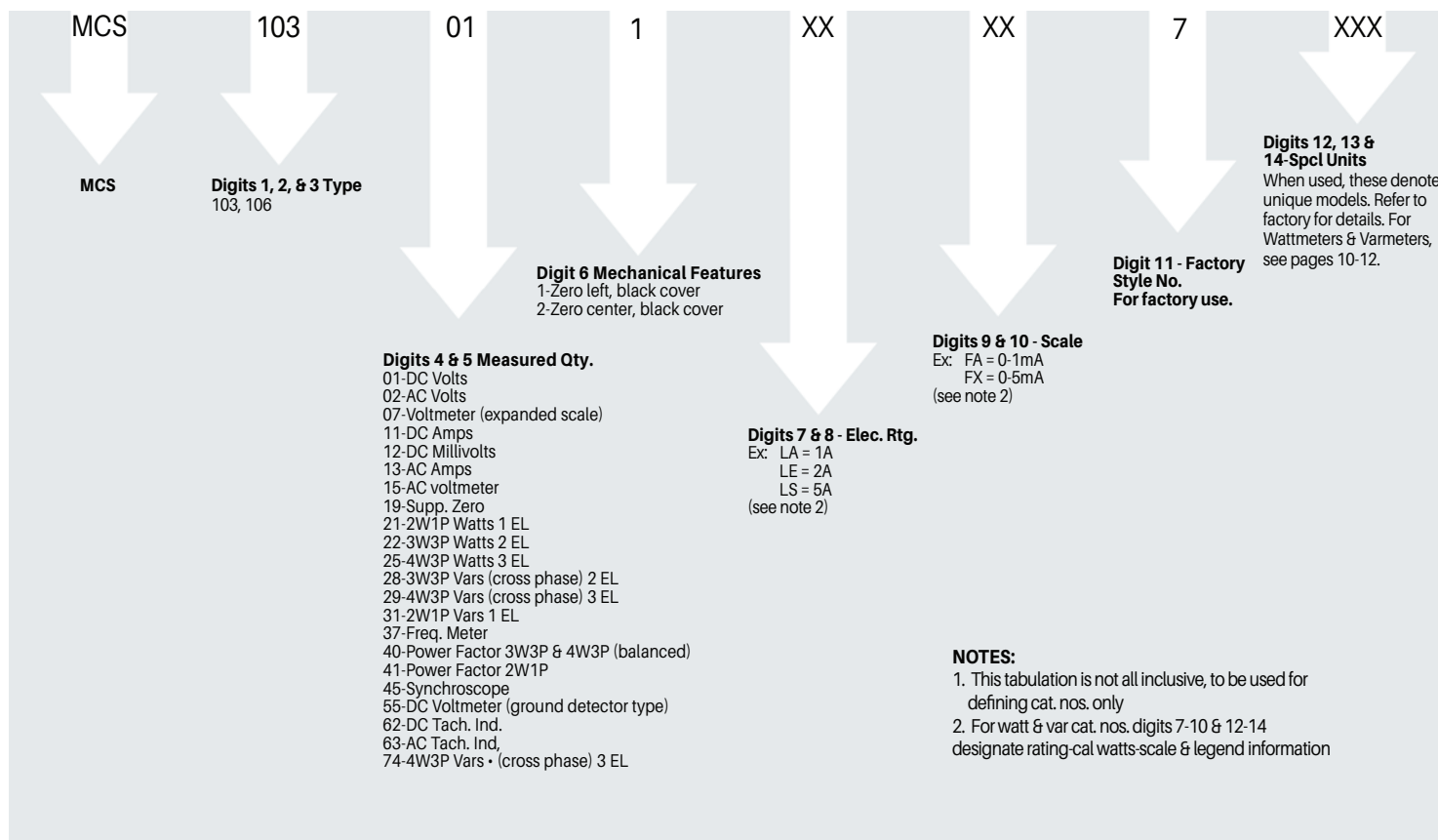
**Overload rating:** AC & DC Ammeters - 1.2 x continuous, 10 x for 0.5 seconds, repeated 10 times with 1 minute interval.

Ac & DC Voltmeters and frequency meters - 1.2 x continuous

**Response time:** 3 seconds maximum

# Ordering System

## Key to MCS Switchboard Numbering System (See Notes)



## How to Order - Specify the following:

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

Type: MCS  
 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				
	Net		Ship		
	(lbs)	kg)	(lbs)	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	3.0	1.4	3.9	1.8
	3Ø4W				
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 .....6x 6x 11/15x 15 x 28  
 Shipping .....7x 7 x 13/18 x 18 x33

## AC Ammeters

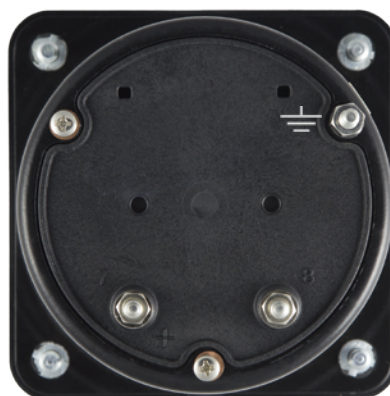


### MCS - Metal Case

#### AC Ammeters - Rectified

Rating (Amperes)	Scale (Amperes)	Part Number	Ordering Number
<b>Self-Contained, 40/70 Hz</b>			
1.0	0-1	MCS 103 131 LALA	1C9790
1.5	0-1.5	MCS 103 131 LCLC	1C9791
2.0	0-2	MCS 103 131 LELE	1C9792
3.0	0-3	MCS 103 131 LJLJ	1C9793
5.0	0-5	MCS 103 131 LSLs	1C9794
7.5	0-7.5	MCS 103 131 MFMF	1C9795
10	0-10	MCS 103 131 MTMT	1C9796
15	0-15	MCS 103 131 NDND	1C9797
20	0-20	MCS 103 131 NGNG	1C9798
30	0-30	MCS 103 131 NLNL	1C9799
<b>Transformer-Rated, 40/70Hz</b>			
5	0-10	MCS 103 131 LSMT	1C9800
5	0-15	MCS 103 131 LSND	1C9801
5	0-20	MCS 103 131 LsNG	1C9802
5	0-25	MCS 103 131 LSNJ	1C9803
5	0-30	MCS 103 131 LSNL	1C9804
5	0-40	MCS 103 131 LSNP	1C9805
5	0-50	MCS 103 131 LSNT	1C9806
5	0-75	MCS 103 131 LSPB	1C9807
5	0-100	MCS 103 131 LSPK	1C9808
5	0-150	MCS 103 131 LSPZ	1C9809
5	0-200	MCS 103 131 LSRL	1C9810
5	0-250	MCS 103 131 LSRS	1C9811
5	0-300	MCS 103 131 LSRX	1C9812
5	0-400	MCS 103 131 LSSC	1C9813
5	0-500	MCS 103 131 LSSF	1C9814
5	0-600	MCS 103 131 LSSJ	1C9815
5	0-800	MCS 103 131 LSSN	1C9816
5	0-1000	MCS 103 131 LSSS	1C9817
5	0-1200	MCS 103 131 LSSV	1C9818
5	0-1500	MCS 103 131 LSTC	1C9819
5	0-1600	MCS 103 131 LSTE	1C9820
5	0-2000	MCS 103 131 LSTM	1C9821
5	0-2500	MCS 103 131 LSTV	1C9822
5	0-3000	MCS 103 131 LSUA	1C9823
5	0-4000	MCS 103 131 LSUE	1C9824
5	0-5000	MCS 103 131 LSUJ	1C9825
5	0-6000	MCS 103 131 LSUP	1C9826
5	0-7000	MCS 103 131 LSUS	1C9827
5	0-8000	MCS 103 131 LSUW	1C9828

# AC Voltmeters



## MCS Metal Case

### AC Voltmeters

Rating (Volts)	Scale (Volts)	Part Number	Ordering Number
<b>Self-Contained, 50/60 Hz</b>			
150	0-150	MCS 103 021 PZPZ	1C9962
250	0-250	MCS 103 021 RSRs	1C9963
300	0-300	MCS 103 021 RXRX	1C9964
500	0-500	MCS 103 021 SFSF	1C9965
600	0-600	MCS 103 021 SJSJ	1C9966
<b>Transformer-Rated, 50/60 Hz</b>			
150	0-300	MCS 103 021 PZR <sub>X</sub>	1C9968
150	0-600	MCS 103 021 PZS <sub>J</sub>	1C9969
150	0-750	MCS 103 021 PZS <sub>M</sub>	1C9970
150	0-3000	MCS 103 021 PZU <sub>A</sub>	1C9971
150	0-5250	MCS 103 021 PZU <sub>L</sub>	1C9972
150	0-6000	MCS 103 021 PZU <sub>P</sub>	1C9973
150	0-9000	MCS 103 021 PZU <sub>Y</sub>	1C9974
150	0-15kV	MCS 103 021 PZW <sub>Z</sub>	1C9975
150	0-18kV	MCS 103 021 PZX <sub>E</sub>	1C9976
150	0-45kV	MCS 103 021 PZX <sub>U</sub>	1C9977
150	0-150kV	MCS 103 021 PZY <sub>R</sub>	1C9978
250	0-600kV	MCS 103 021 RSS <sub>J</sub>	1C9979
<b>Transformer-Rated, 50/60 Hz</b>			
110-130	110-130	MCS 103 071 PNP <sub>N</sub>	1C9980
<b>Expanded Scale, Transformer Rated, 50/60 HZ</b>			
110-130	#	MCS 103 071 PN <sub>++</sub>	1C9981
<b>Ground Detector Type - Single-Phase 50/60 Hz</b>			
150	0-150	MCS 103 GDT PZP <sub>Z</sub>	1D0098
150	#	MCS 103 GDT PZ <sub>..++</sub>	1D0099
300	0-300	MCS 103 GDT RXR <sub>X</sub>	1D0100
600	0-600	MCS 103 GDT SJS <sub>J</sub>	1D0101

# Scale per requisition.

++ Order by description. Specify P.T. (Potential Transformer) ratio if used and scale desired.



## DC Ammeters

### DC Ammeters Self-Contained

Scale and Rating	Part Number	Ordering Number
<b>Microammeters - Zero-Left</b>		
0-200	MCS 103 111 EAEA	1C9988
0-300	MCS 103 111 EGEg	1C9989
0-500	MCS 103 111 EMEM	1C9990
0-800	MCS 103 111 EWEW	1C9991
<b>Milliammeters - Zero-Left</b>		
0-1	MCS 103 111 FAFA	1C9992
0-2	MCS 103 111 FGFG	1C9993
0-5	MCS 103 111 FXFX	1C9994
0-10	MCS 103 111 GZGZ	1C9995
0-20	MCS 103 111 HFHF	1C9996
0-30	MCS 103 111 HMHM	1C9997
0-50	MCS 103 111 HYHY	1C9998
0-100	MCS 103 111 JRJR	1C9999
0-200	MCS 103 111 KAKA	1D0001
0-300	MCS 103 111 KGKG	1D0002
0-500	MCS 103 111 KMKM	1D0003
0-800	MCS 103 111 KWKW	1D0004
<b>Milliammeters - Suppressed-Zero (No zero set unless otherwise specified)</b>		
1-5	MCS 103 191 FY**	*TBD
4-20	MCS 103 191 HE**	*TBD
10-50	MCS 103 191 HX**	*TBD
<b>Ammeters - Zero-Left</b>		
0-1	MCS 103 111 LALA	1D0009
0-5	MCS 103 111 LSLs	1D0010
0-10	MCS 103 111 MTMT	1D0011
0-15	MCS 103 111 NDND	1D0012
0-20	MCS 103 111 NGNG	1D0013
0-30	MCS 103 111 NLNL	1D0014

### MCS - Metal Case



### DC Ammeters Shunt-Rated

Rating (Millivolts)	Scale (Amperes)	Part Number	Ordering Number
<b>With Lead Length Compensator, Catalog Number Does Not Include Shunt or Shunt Leads</b>			
50	**TBD	MCS 103 121 AB...	*TBD
50-0-50	**TBD	MCS 103 122 AB...	*TBD
100	**TBD	MCS 103 121 AE...	*TBD
100-0-100	**TBD	MCS 103 122 AE...	*TBD
<b>Zero-Left for Use with 50mV Shunts and 0.05-Ohm Shunt Leads, (Standard 5-Foot Leads).</b>			
50	0-15	MCS 103 121 CAND	1D0018
50	0-20	MCS 103 121 CANG	1D0019
50	0-30	MCS 103 121 CANL	1D0020
50	0-40	MCS 103 121 CANP	1D0021
50	0-50	MCS 103 121 CANT	1D0022
50	0-75	MCS 103 121 CAPB	1D0023
50	0-100	MCS 103 121 CAPK	1D0024
50	0-150	MCS 103 121 CAPZ	1D0025
50	0-200	MCS 103 121 CARL	1D0026
50	0-300	MCS 103 121 CARX	1D0027
50	0-400	MCS 103 121 CASC	1D0028
50	0-500	MCS 103 121 CASF	1D0029
50	0-750	MCS 103 121 CASM	1D0030
50	0-1000	MCS 103 121 CASS	1D0031
50	0-1200	MCS 103 121 CASV	1D0032
50	0-1500	MCS 103 121 CATC	1D0033
50	0-2000	MCS 103 121 CATM	1D0034
50	0-3000	MCS 103 121 CAUA	1D0035

\*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

## DC Voltmeters

Rating and Scale (Volts)	Part Number	Ordering Number
<b>Zero-Left (Sensitivity is 1000 OHMS / Volt)</b>		
0-15	MCS 103 011 NDND	1D0065
0-30	MCS 103 011 NLNL	1D0066
0-50	MCS 103 011 NTNT	1D0067
0-75	MCS 103 011 PBPB	1D0068
0-150	MCS 103 011 PZPZ	1D0069
0-300	MCS 103 011 RXRX	1D0070
0-400	MCS 103 011 SCSC	1D0071
0-500	MCS 103 011 SFSF	1D0072
0-600	MCS 103 011 SJSJ	1D0073
<b>Zero-Center (Sensitivity is 2000 OHMS / Volt)</b>		
150-0-150	MCS 103 012 PZPZ	1D0074
300-0-300	MCS 103 012 RXRX	1D0075
500-0-500	MCS 103 012 SFSF	1D0076
600-0-600	MCS 103 012 SJSJ	1D0077
<b>Ground Detector Type - Zero-Center for 2 wire</b>		
150-0-150*	MCS 103 552 PZ*	TBD
300-0-300*	MCS 103 552 RX*	TBD
500-0-500*	MCS 103 552 SF*	TBD
600-0-600*	MCS 103 552 SJ*	TBD

\* Specify scale by order.

## Tachometer Indicators

DC Volts	Part Number
Select nearest higher rated DC Voltmeter from above and specify requirements.	MCS 103 621 XXXX
AC Volts	
Select nearest higher rated rectifier type AC voltmeter from Page 5 and specify requirements.	MCS 103 631 XXXX





**POWER  
FACTOR SCALE  
FOR  
BALANCED  
SYSTEM**

## Power Factor Meters

Rating (Amperes)	Rating (L-L Volts)	Scale	Part Number	Ordering Number
<b>Single-Phase/2-Wire, 60Hz</b>				
5	120	.5-1-.5	MCS 103 412 FCAD	1D0078
<b>3-Phase 3- &amp; 4-Wire, 50/60Hz Balanced System Only</b>				
5	120	.5-1-.5	MCS 103 402 FCAD	1D0079
5	208	.5-1-.5	MCS 103 402 FDAD	1D0080
5	240	.5-1-.5	MCS 103 402 FEAD	1D0081
5	480	.5-1-.5	MCS 103 402 FFAD	1D0082



## Frequency Meters, 120V

Scale (Hz)	Center Frequency (Hz)	Accuracy (Hz)	Part Number	Ordering Number
45-55	50	±0.15	MCS 103 372 AGAG	1D0084
45-65	55	±0.25	MCS 103 372 AJAJ	1D0085
48-52	50	±0.08	MCS 103 372 AKAK	1D0086
50-70	60	±0.25	MCS 103 372 ALAL	1D0087
55-65	60	±0.15	MCS 103 372 ANAN	1D0088
58-62	60	±0.08	MCS 103 372 ATAT	1D0089
59-61	60	±0.047	MCS 103 372 ASAS	1D0090
350-450	400	±1.3	MCS 103 372 BHBH	1D0091
390-410	400	±0.492	MCS 103 372 BLBL	1D0092



## Synchrosopes-Pivot & Jewel, 120 Volt

Scale	Normal Frequency	Part Number	Ordering Number
"Slow-Fast"	50	MCS 106 452 ABAA	1D0093
"Slow-Fast"	60	MCS 106 452 AAAA	1D0094



## Synchrosopes-Digital, 120 Volt, Relay

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

# AC Watt & Var Meters

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

Rating (Amperes)	Rating (Volts)	Scale	Part Number	Ordering Number
<b>Single-Phase/2-Wire, 1-Element, Transformer-Rated, 50/60 Hz</b>				
5	120	†	MCS 103 21 □ A .....	TBD
<b>3-Phase/3-Wire, 2-Element, Transformer-Rated, 50/60Hz</b>				
5	120	†	MCS 103 22 □ A .....	TBD
5	240	†	MCS 103 22 □ C .....	TBD
5	480	†	MCS 103 22 □ D .....	TBD
<b>3-Phase/4-Wire, 3-Element, Transformer-Rated, 50/60Hz (Voltage balanced)</b>				
5	69	†	MCS 103 25 □ F .....	TBD
5	120	†	MCS 103 25 □ A .....	TBD
5	208	†	MCS 103 25 □ R .....	TBD
5	277	†	MCS 103 25 □ Y .....	TBD



- † 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	Part Number	Ordering Number
<b>Single-Phase/2-Wire, 1-Element, Transformer-Rated, 60 Hz</b>				
5	120	†	MCS 103 31 □ A .....	TBD
<b>3-Phase/3-Wire, 2-Element, Transformer-Rated, 50/60 Hz (Cannot be used with External Phase Shifter)</b>				
5	120	†	MCS 103 28 □ A .....	TBD
<b>3-Phase/4-Wire, 3-Element, Transformer-Rated, 50/60 Hz (Cannot be used with External Phase Shifter)</b>				
5	69	†	MCS 103 29 □ F .....	TBD
5	120	†	MCS 103 29 □ A .....	TBD
5	208	†	MCS 103 29 □ R .....	TBD
5	277	†	MCS 103 29 □ Y .....	TBD



- † 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  $\sqrt{3}$  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* $\diamond$	—
B	AC Watts	Vars	E	AC Watts/Vars*	—	T	Percent Horsepower	—
C	AC Kilowatts	Kilovars	F	AC KW/Var* $\diamond$	—	U	Horsepower	—

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

$\diamond$  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
50/5	NORMAL	10KW	20KW	20KW	40KW	50KW	200KW	300KW	350KW	400KW	500KW	600KW	700KW
	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
75/5	NORMAL	15KW	25KW	30KW	60KW	75KW	300KW	500KW	500KW	600KW	750KW	900KW	1000KW
	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
100/5	NORMAL	20KW	30KW	40KW	75KW	100KW	400KW	600KW	700KW	800KW	1000KW	1200KW	1200KW
	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
150/5	NORMAL	30KW	50KW	50KW	100KW	150KW	600KW	800KW	1000KW	1200KW	1500KW	1800KW	2000KW
	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
200/5	NORMAL	40KW	75KW	75KW	150KW	200KW	800KW	1200KW	1200KW	1500KW	2000KW	2500KW	3000KW
	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
300/5	NORMAL	70KW	100KW	100KW	200KW	300KW	1200KW	1500KW	2000KW	2500KW	3000KW	3500KW	4500KW
	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
400/5	NORMAL	75KW	125KW	150KW	300KW	400KW	1500KW	2500KW	3000KW	3000KW	4000KW	5000KW	6000KW
	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
600/5	NORMAL	125KW	200KW	200KW	450KW	600KW	2000KW	3000KW	4000KW	5000KW	6000KW	7500KW	8000KW
	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
800/5	NORMAL	150KW	250KW	300KW	600KW	800KW	3000KW	5000KW	6000KW	6000KW	8000KW	10MW	12MW
	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
1000/5	NORMAL	200KW	350KW	400KW	800KW	1000KW	4000KW	6000KW	6000KW	8000KW	10MW	12MW	15MW
	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
1200/5	NORMAL	250KW	400KW	500KW	1000KW	1200KW	5000KW	7000KW	8000KW	10MW	12MW	15MW	10MW
	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
1500/5	NORMAL	300KW	500KW	600KW	1200KW	1500KW	6000KW	10MW	10MW	12MW	15MW	20MW	20MW
	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
2000/5	NORMAL	400KW	750KW	800KW	1600KW	2000KW	8000KW	12MW	12MW	15MW	20MW	25MW	30MW
	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
3000/5	NORMAL	750KW	1000KW	1200KW	2000KW	3000KW	12MW	18MW	20MW	25MW	30MW	35MW	40MW
	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
4000/5	NORMAL	800KW	1200KW	1500KW	3000KW	4000KW	15MW	20MW	25MW	30MW	40MW	50MW	50MW
	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
5000/5	NORMAL	1000KW	1500KW	2000KW	4000KW	5000KW	20MW	30MW	20MW	40MW	50MW	60MW	75MW
	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
6000/5	NORMAL	1200KW	2000KW	2500KW	5000KW	6000KW	25MW	35MW	40MW	50MW	60MW	60MW	80MW
	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 MAX. MIN.	500KW	600KW	1000KW	1500KW	1500KW	1500KW	3000KW	5000KW	6000KW	15MW	30MW
		650	800	1200	1500	2000	2500	5000	6000	7500	15	40
50/5	NORMAL MAX. MIN.	1000KW	1200KW	2000KW	3000KW	3000KW	3500KW	8000KW	10MW	12MW	30MW	60MW
		1200	1500	2500	3500	4000	5000	10MW	12	15	35	80
75/5	NORMAL MAX. MIN.	1500KW	1800KW	3000KW	4000KW	5000KW	5000KW	10MW	15MW	15MW	45MW	100MW
		2000	2000	4000	5000	6000	7500	15	15	20	50	125
100/5	NORMAL MAX. MIN.	2000KW	2500KW	4000KW	6000KW	6000KW	7500KW	15MW	20MW	25MW	60MW	125MW
		2500	3000	5000	7500	8000	10MW	20	25	30	70	150
150/5	NORMAL MAX. MIN.	3000KW	3500KW	6000KW	10MW	10MW	10MW	20MW	30MW	35MW	90MW	200MW
		4000	4000	4000	10	12	15	30	35	40	100	250
200/5	NORMAL MAX. MIN.	4000KW	4500KW	8000KW	12MW	12MW	15MW	30MW	35MW	50MW	100MW	250MW
		5000	6000	5000	15	15	20	40	50	60	150	300
300/5	NORMAL MAX. MIN.	6000KW	7000KW	12MW	18MW	18MW	20MW	45MW	60MW	75MW	150MW	400MW
		8000	8000	15	20	25	30	60	75	80	200	500
400/5	NORMAL MAX. MIN.	8000KW	10MW	15MW	24MW	25MW	30MW	60MW	80MW	100MW	200MW	500MW
		10MW	12	20	30	30	40	80	100	120	300	600
600/5	NORMAL MAX. MIN.	5000KW	6000KW	10	15	15	20	40	50	60	150	300
		12MW	15MW	25MW	35MW	40MW	45MW	90MW	100MW	150MW	350MW	800MW
800/5	NORMAL MAX. MIN.	15	18	30	40	50	60	120	150	180	450	1000
		7500KW	10	15	20	25	30	60	75	75	225	500
1000/5	NORMAL MAX. MIN.	15MW	20MW	30MW	50MW	50MW	60MW	120MW	150MW	200MW	500MW	1000MW
		20	25	40	60	60	80	150	200	200	600	1200
1200/5	NORMAL MAX. MIN.	10	12.5	20	30	30	40	75	100	100	300	600
		20MW	25MW	40MW	50MW	60MW	60MW	75MW	150MW	200MW	250MW	600MW
1500/5	NORMAL MAX. MIN.	25	30	50	60	80	100	200	250	300	750	1500
		12.5	15	25	30	40	40	50	100	125	150	300
2000/5	NORMAL MAX. MIN.	25MW	30MW	50MW	60MW	80MW	100MW	175MW	250MW	300MW	750MW	1500MW
		30	35	60	80	100	100	120	200	300	350	900
3000/5	NORMAL MAX. MIN.	15	20	30	40	50	60	100	150	175	450	1000
		30MW	35MW	60MW	75MW	100MW	120MW	250MW	300MW	350MW	900MW	2000MW
4000/5	NORMAL MAX. MIN.	40	40	80	100	120	150	300	350	450	1000	2500
		20	20	40	50	60	75	150	175	225	500	1250
5000/5	NORMAL MAX. MIN.	40MW	50MW	80MW	100MW	120MW	150MW	300MW	400MW	500MW	1000MW	2500MW
		50	60	100	150	150	200	400	500	600	1500	3000
6000/5	NORMAL MAX. MIN.	25	30	50	75	75	100	200	250	300	750	1500
		60MW	75MW	100MW	150MW	200MW	200MW	400MW	600MW	700MW	1500MW	3500MW
8000/5	NORMAL MAX. MIN.	80	80	150	200	250	300	500	750	900	2000	5000
		40	40	75	100	125	150	250	350	450	1000	2500
10000/5	NORMAL MAX. MIN.	80MW	100MW	150MW	200MW	250MW	300MW	500MW	800MW	1000MW	2000MW	5000MW
		100	125	200	300	300	400	800	1000	1200	3000	6000
15000/5	NORMAL MAX. MIN.	50	60	100	150	150	200	400	500	600	1500	3000
		100MW	125MW	200MW	250MW	300MW	400MW	750MW	1000MW	1200MW	3000MW	6000MW
20000/5	NORMAL MAX. MIN.	120	150	250	300	400	500	1000	1200	1500	3500	8000
		60	75	125	150	200	250	500	600	750	1750	4000
30000/5	NORMAL MAX. MIN.	120MW	150MW	250MW	350MW	400MW	450MW	1000MW	1200MW	1500MW	3500MW	8000MW
		150	175	300	400	500	600	1200	1500	1750	4000	10000
40000/5	NORMAL MAX. MIN.	75	80	150	200	250	300	600	750	800	2000	5000
		120MW	150MW	250MW	350MW	400MW	450MW	1000MW	1200MW	1500MW	3500MW	8000MW

## 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 ( $\pm 15\%$ )
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 MCS, no adder)
20. Custom Tagging

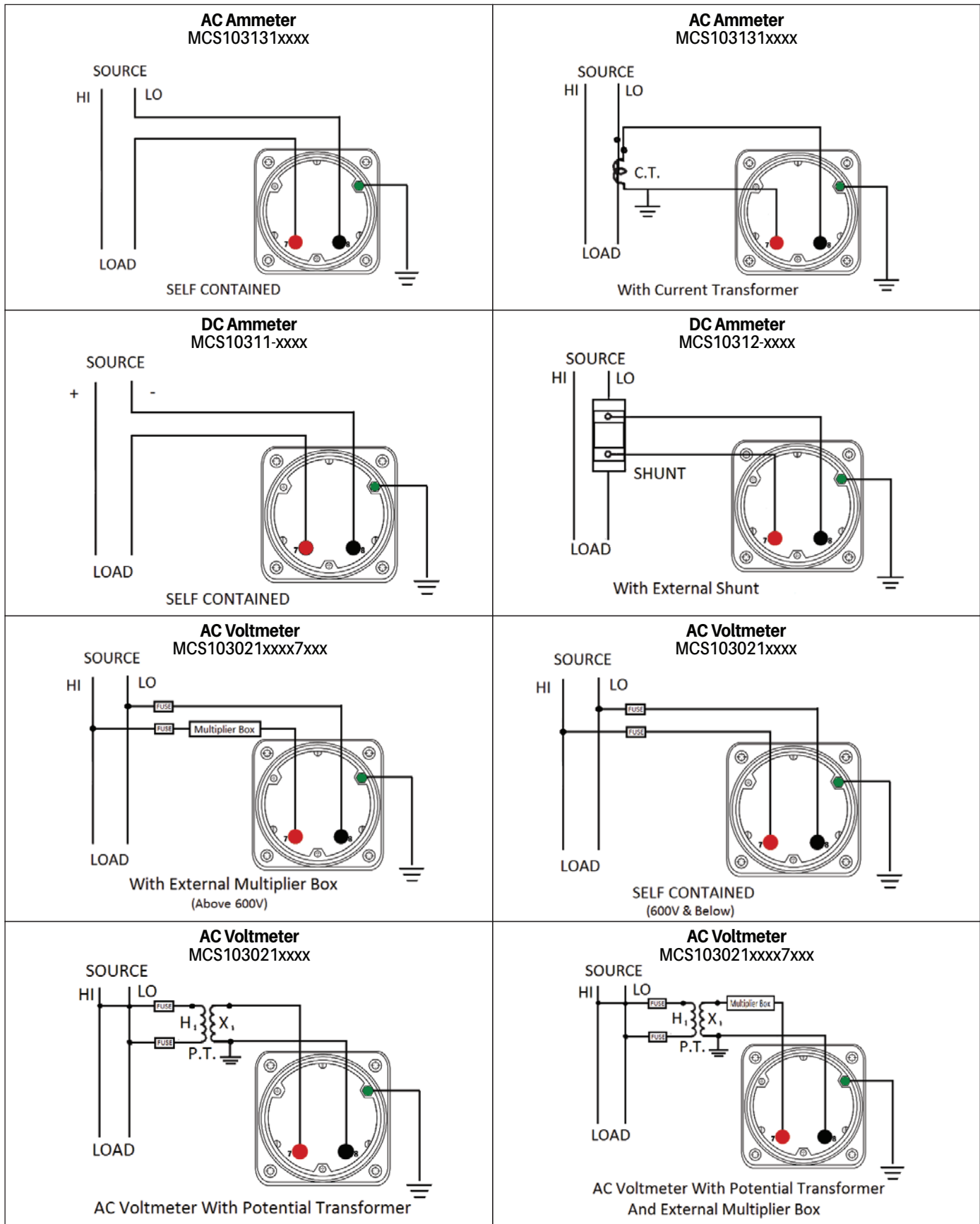
### Standard Scale Legends

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 <sub>2</sub> O
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

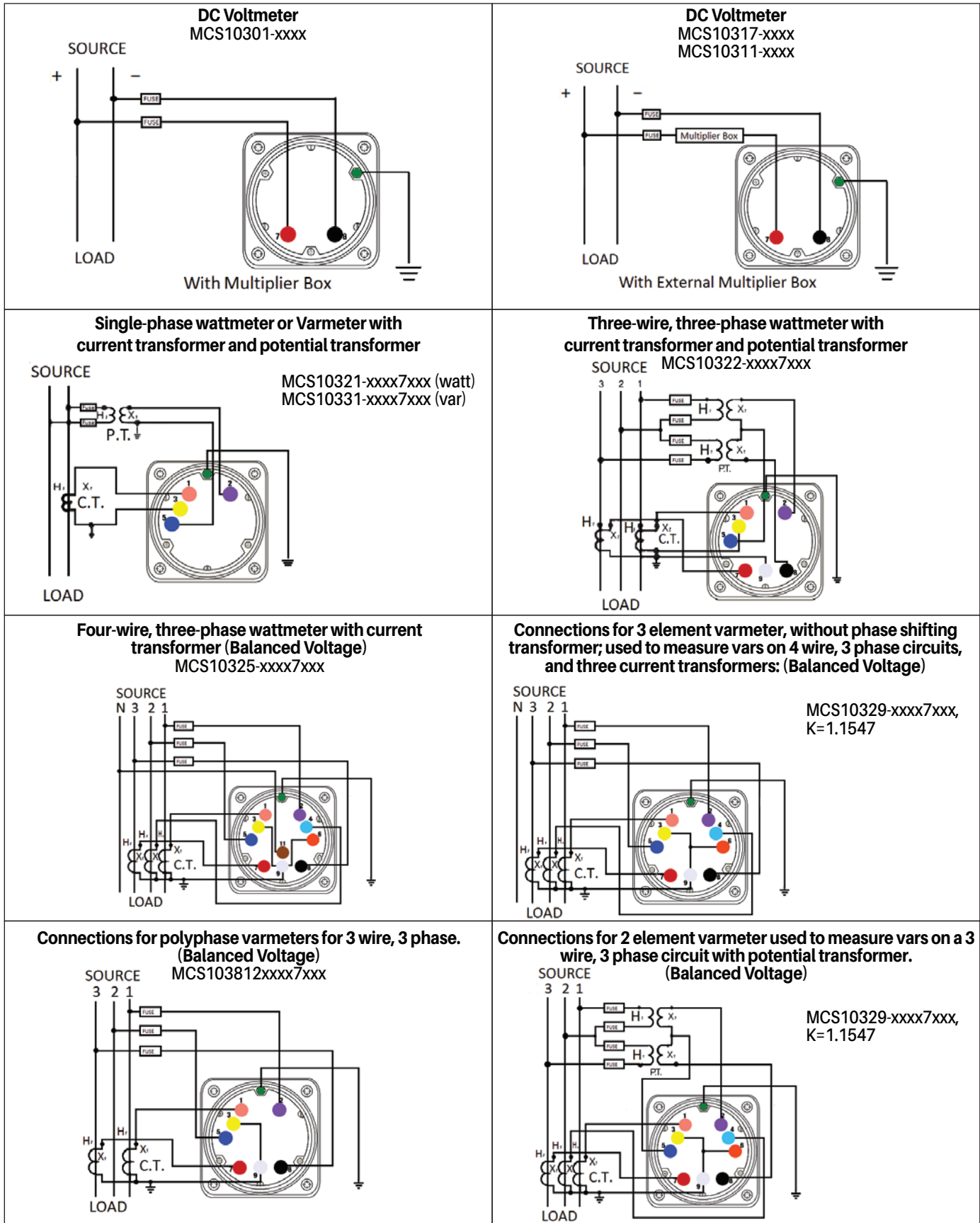


**NOTE:** UL requires a separate grounding terminal that is provided above a ground symbol (⏏)

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



# Standard Connections



**NOTE:** UL requires a separate grounding terminal that is provided above a ground symbol (  $\equiv$  )

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

Specs subject to change without notice

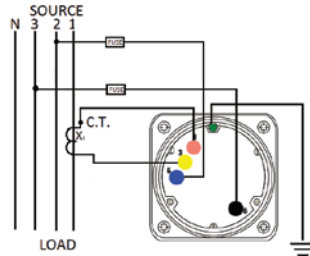


# Standard Connections

**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)**

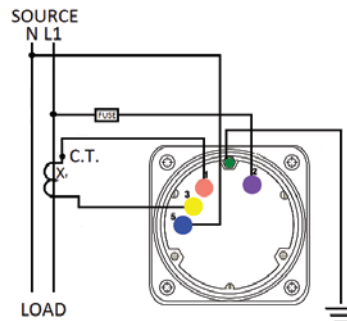
MCS103402xxxx

Phase Sequence 1-2-3



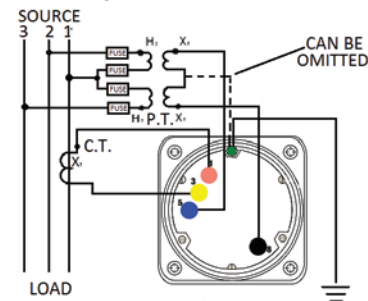
**Single-phase power-factor meter with current transformer**  
MCS103412xxxx

Phase Sequence 1-2-3

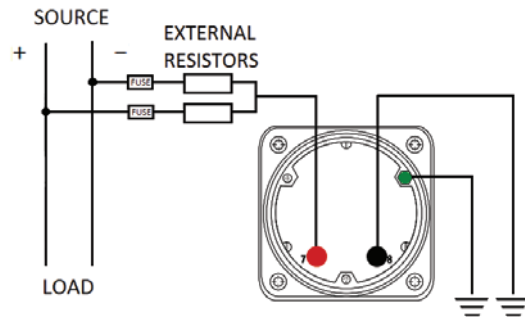


**Three-wire, three-phase power-factor meter with current transformer and potential transformer (Balanced System)**  
MCS103402xxxx

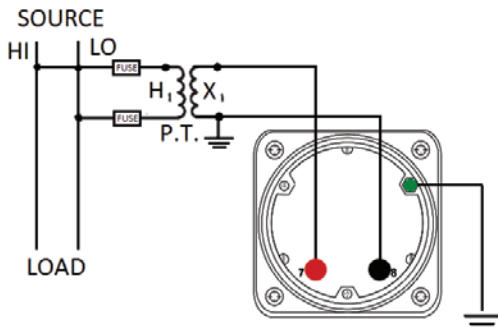
Phase Sequence 1-2-3



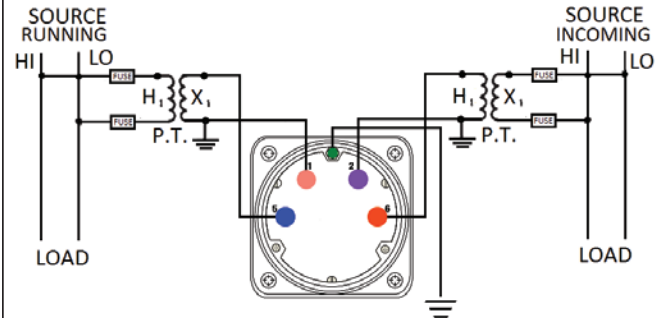
**DC Ground Detector**



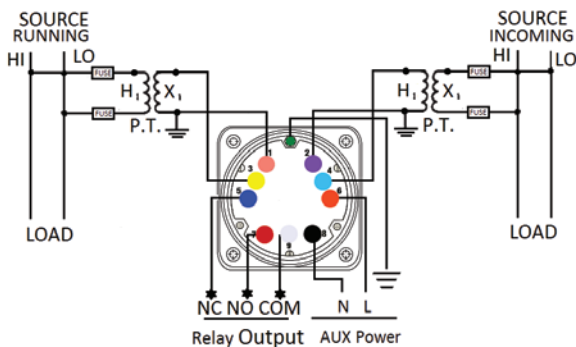
**Frequency Meter with potential transformer**  
MCS103372xxxx



**Synchroscope with potential transformers**  
MCS106452xxxx



**Digital Synchroscope with potential transformers**  
MCS106452DIGITAL



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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

# Min and Max Rating

## Minimum and Maximum Ratings for MCS

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
<b>For Potential circuit</b>					
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
<b>For Current circuit</b>					
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 Microammeters

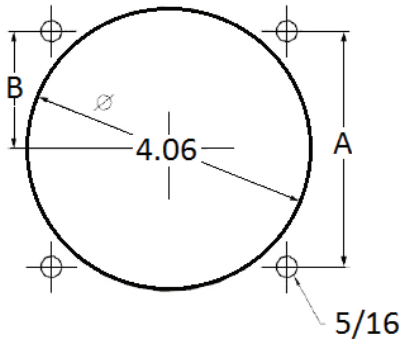
Rating (uA)	Ohms Terminal Resistance ± 15%
0-200	10 Kohm
0-400	2.52 Kohm
0-500	2.5 Kohm

### DC Milliammeters / Ammeter

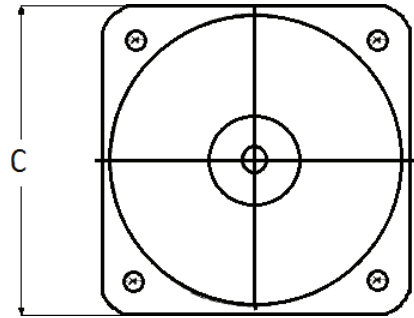
Current Rating	Ohms Terminal Resistance ± 15%
0 - 1 mA	500 ohm
0 - 5 mA	7 ohm
0 - 15 mA	3 ohm
0 - 1 A	0.075 ohm

# Dimensions

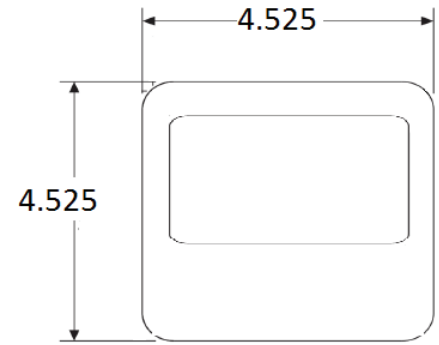
## Short & Long Case



Panel Cutout



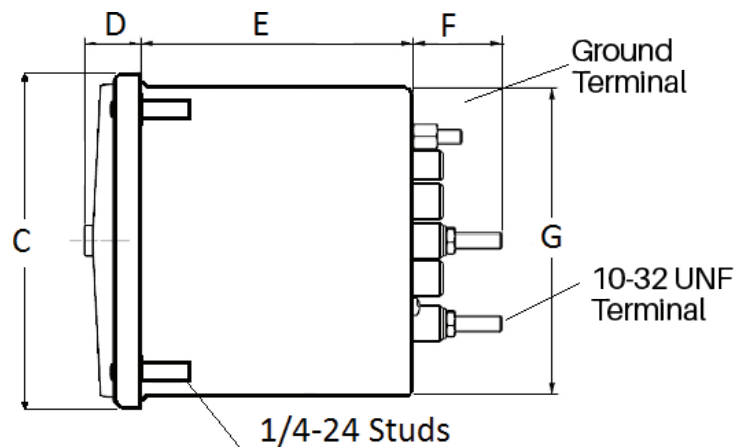
Front



Front Digital Synchroscope

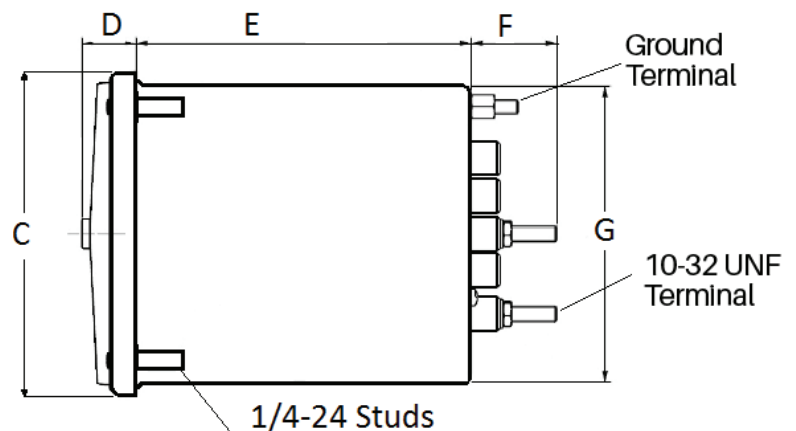
## Short Case - AC V / A, DC V / A, Hz, and Tach.

	MCS
	INCHES
A	3.37"
B	1.69"
C	4.30"
D	0.65"
E	2.25"
F	0.98"
G	3.95"



## Long Case - Watt, Var, Power Factor, Synchroscope

	MCS		
	Wattmeter, Varmeter, PF	Synchroscope Digital	Synchroscope Analog
A	3.37"	3.37"	TBD
B	1.69"	1.69"	TBD
C	4.30"	4.525"	TBD
D	0.65"	0.77"	TBD
E	3.35"	3.35"	TBD
F	1.12"	1.12"	TBD
G	3.95"	3.95"	TBD



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#### About Ram Meter Inc.

Currently headquartered in Royal Oak, MI with sales offices in Pennsylvania and Connecticut, Ram Meter Inc. has been doing business for over 75 years. It all started in 1936 on a dining room table in northwest Detroit when Russel A. Monnier (R.A.M.) began repairing electrical indicating instruments for United Motors Service, his employer at that time. It wasn't long before he quit his job to dedicate himself to repairing these instruments full time. Russ named the business Ram Meter Service and it has continued to grow ever since.

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