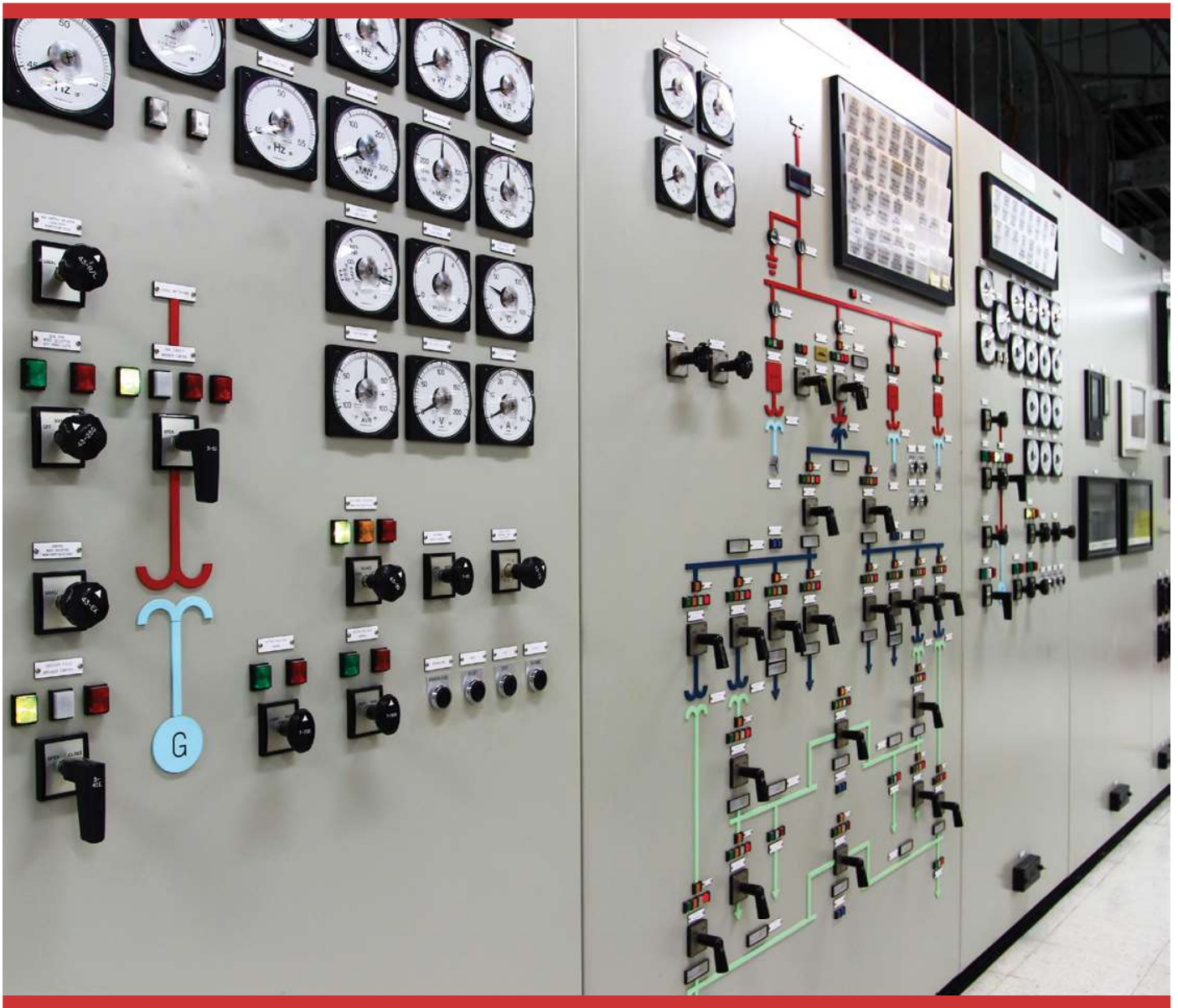


# Metal Case Switchboard Meters (MCS) Product Catalog



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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.

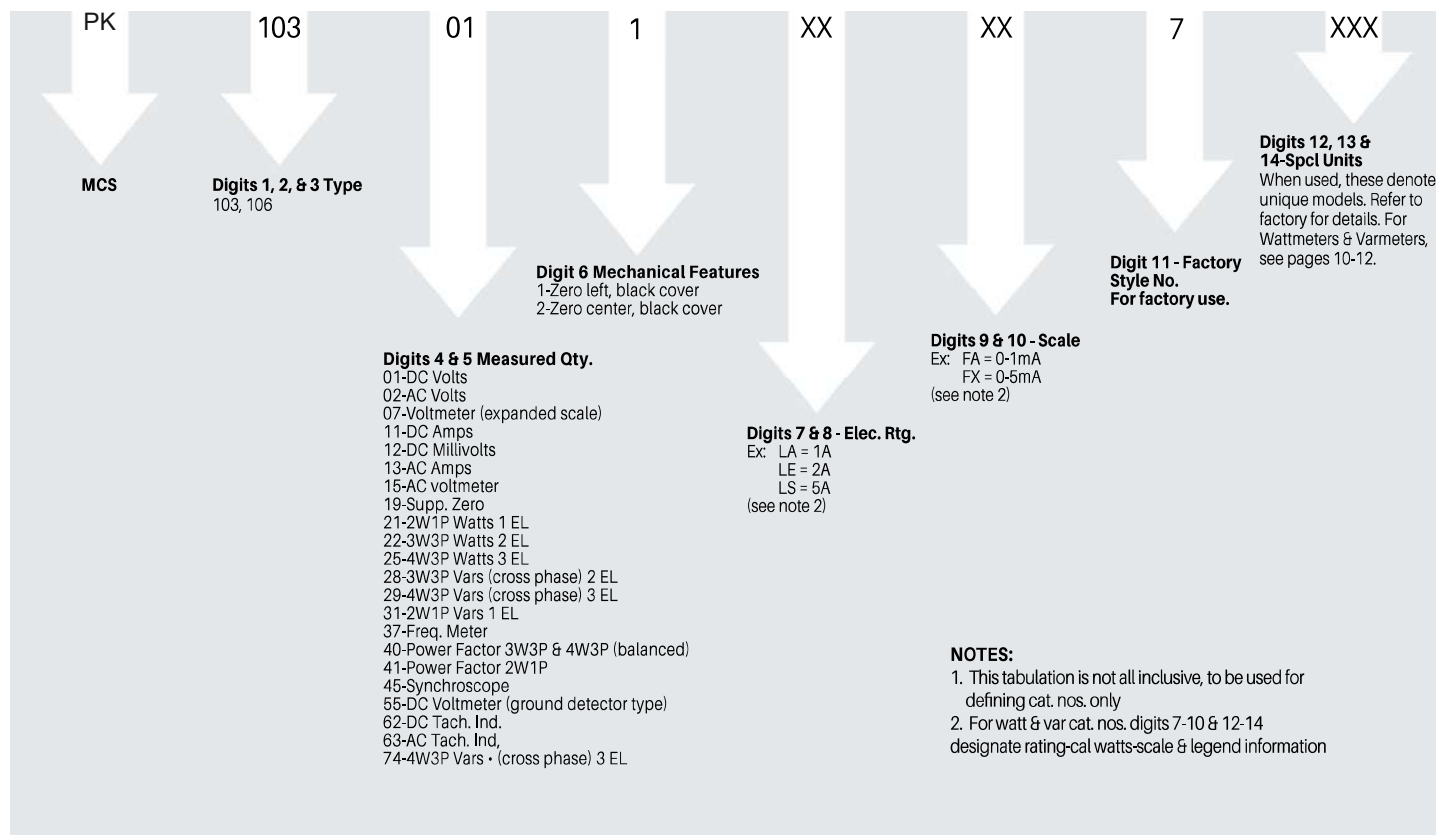
**Overload rating:** AC & DC Ammeters - 1.2 x continuous, 10 x for 0.5 seconds, repeated 10 times with 1 minute interval.

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)



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

## 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 PK 103111FAFA, 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 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 .....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
<b>Self-Contained, 40/70 Hz</b>		
1.0	0-1	PK 103 131 LALA
1.5	0-1.5	PK 103 131 LCLC
2.0	0-2	PK 103 131 LELE
3.0	0-3	PK 103 131 LJLJ
5.0	0-5	PK 103 131 LSLS
7.5	0-7.5	PK 103 131 MFMF
10	0-10	PK 103 131 MTMT
15	0-15	PK 103 131 NDND
20	0-20	PK 103 131 NGNG
30	0-30	PK 103 131 NLNL
<b>Transformer-Rated, 40/70Hz</b>		
5	0-10	PK 103 131 LSMT
5	0-15	PK 103 131 LSND
5	0-20	PK 103 131 LSNG
5	0-25	PK 103 131 LSNJ
5	0-30	PK 103 131 LSNL
5	0-40	PK 103 131 LSNP
5	0-50	PK 103 131 LSNT
5	0-75	PK 103 131 LSPB
5	0-100	PK 103 131 LSPK
5	0-150	PK 103 131 LSPZ
5	0-200	PK 103 131 LSRL
5	0-250	PK 103 131 LSRS
5	0-300	PK 103 131 LSRX
5	0-400	PK 103 131 LSSC
5	0-500	PK 103 131 LSSF
5	0-600	PK 103 131 LSSJ
5	0-800	PK 103 131 LSSN
5	0-1000	PK 103 131 LSSS
5	0-1200	PK 103 131 LSSV
5	0-1500	PK 103 131 LSTC
5	0-1600	PK 103 131 LSTE
5	0-2000	PK 103 131 LSTM
5	0-2500	PK 103 131 LSTV
5	0-3000	PK 103 131 LSUA
5	0-4000	PK 103 131 LSUE
5	0-5000	PK 103 131 LSUJ
5	0-6000	PK 103 131 LSUP
5	0-7000	PK 103 131 LSUS
5	0-8000	PK 103 131 LSUW

# AC Voltmeters



## MCS Metal Case

### AC Voltmeters

Rating (Volts)	Scale (Volts)	Part Number
<b>Self-Contained, 50/60 Hz</b>		
150	0-150	PK 103 021 PZPZ
250	0-250	PK 103 021 RSRS
300	0-300	PK 103 021 RXRX
500	0-500	PK 103 021 SF5F
600	0-600	PK 103 021 SJSJ
<b>Transformer-Rated, 50/60 Hz</b>		
150	0-300	PK 103 021 PZRX
150	0-600	PK 103 021 PZSJ
150	0-750	PK 103 021 PZSM
150	0-3000	PK 103 021 PZUA
150	0-5250	PK 103 021 PZUL
150	0-6000	PK 103 021 PZUP
150	0-9000	PK 103 021 PZUY
150	0-15kV	PK 103 021 PZWZ
150	0-18kV	PK 103 021 PZXE
150	0-45kV	PK 103 021 PZXU
150	0-150kV	PK 103 021 PZYR
250	0-600kV	PK 103 021 RSSJ
<b>Transformer-Rated, 50/60 Hz</b>		
110-130	110-130	PK 103 071 PNPB
<b>Expanded Scale, Transformer Rated, 50/60 HZ</b>		
110-130	#	PK 103 071 PN++
<b>Ground Detector Type - Single-Phase 50/60 Hz</b>		
150	0-150	PK 103 GDT PZPZ
150	#	PK 103 GDT PZ..++
300	0-300	PK 103 GDT RXRX
600	0-600	PK 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	Part Number
<b>Microammeters - Zero-Left</b>	
0-200	PK 103 111 EAEA
0-300	PK 103 111 EGEG
0-500	PK 103 111 EMEM
0-800	PK 103 111 EWEW
<b>Milliammeters - Zero-Left</b>	
0-1	PK 103 111 FAFA
0-2	PK 103 111 FGFG
0-5	PK 103 111 FAFX
0-10	PK 103 111 GZGZ
0-20	PK 103 111 HFHF
0-30	PK 103 111 HMHM
0-50	PK 103 111 HYHY
0-100	PK 103 111 JRJR
0-200	PK 103 111 KAKA
0-300	PK 103 111 KGKG
0-500	PK 103 111 KMKM
0-800	PK 103 111 KWKW
<b>Milliammeters - Suppressed-Zero (No zero set unless otherwise specified)</b>	
1-5	PK 103 191 FY**
4-20	PK 103 191 HE**
10-50	PK 103 191 HX**
<b>Ammeters - Zero-Left</b>	
0-1	PK 103 111 LALA
0-5	PK 103 111 LSL S
0-10	PK 103 111 MTMT
0-15	PK 103 111 NDND
0-20	PK 103 111 NGNG
0-30	PK 103 111 NLNL

## MCS - Metal Case



## DC Ammeters Shunt-Rated

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

## DC Voltmeters

Rating and Scale (Volts)	Part Number
<b>Zero-Left (Sensitivity is 1000 OHMS / Volt)</b>	
0-15	PK 103 011 NDND
0-30	PK 103 011 NLNL
0-50	PK 103 011 NTNT
0-75	PK 103 011 PBPB
0-150	PK 103 011 PZPZ
0-300	PK 103 011 RXRX
0-400	PK 103 011 SCSC
0-500	PK 103 011 SF SF
0-600	PK 103 011 SJSJ
<b>Zero-Center (Sensitivity is 2000 OHMS / Volt)</b>	
150-0-150	PK 103 012 PZPZ
300-0-300	PK 103 012 RXRX
500-0-500	PK 103 012 SF SF
600-0-600	PK 103 012 SJSJ
<b>Ground Detector Type - Zero-Center for 2 wire</b>	
150-0-150*	PK 103 552 PZ*
300-0-300*	PK 103 552 RX*
500-0-500*	PK 103 552 SF*
600-0-600*	PK 103 552 SJ*

\* Specify scale by order.

## Tachometer Indicators

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







**POWER  
FACTOR SCALE  
FOR  
BALANCED  
SYSTEM**

## Power Factor Meters

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



## Frequency Meters, 120V

Scale (Hz)	Center Frequency (Hz)	Accuracy (Hz)	Part Number
45-55	50	±0.15	PK 103 372 AGAG
45-65	55	±0.25	PK 103 372 AJAJ
48-52	50	±0.08	PK 103 372 AKAK
50-70	60	±0.25	PK 103 372 ALAL
55-65	60	±0.15	PK 103 372 ANAN
58-62	60	±0.08	PK 103 372 ATAT
59-61	60	±0.047	PK 103 372 ASAS
350-450	400	±1.3	PK 103 372 BHBH
390-410	400	±0.492	PK 103 372 BLBL



## Synchrosopes-Pivot & Jewel, 120 Volt

Scale	Normal Frequency	Part Number
"Slow-Fast"	50	PK 106 452 ABAA
"Slow-Fast"	60	PK 106 452 AAAA



## Synchrosopes-Digital, 120 Volt, Relay

Scale	Normal Frequency	Part Number
Volts, Frequency & Phase Angle	50 - 60	PK 106 452 DIGITAL

# AC Watt & Var Meters

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

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



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



- † 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	Scale	Cat. Digit	Scale	Cat. Digit	Scale	Cat. Digit	Scale	Cat. Digit	Scale
12, 13	Scale	12, 13	Scale	12, 13	Scale	12, 13	Scale	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	3500	4160	4800
CURRENT TRANSFORMER													
RATIO	NORMAL	5KW	10KW	10KW	20KW	25KW	100KW	150KW	175KW	200KW	250KW	300KW	350KW
25/5	MAX. MIN.	6 3	10 5	12 6	25 12.5	30 15	120 60	200 100	200 100	250 125	300 150	400 200	450 225
50/5	NORMAL MAX. MIN.	10KW 12 6	20KW 20 10	20KW 25 12.5	40KW 50 25	50KW 60 30	200KW 250 125	300KW 400 200	350KW 450 250	400KW 500 250	500KW 600 300	600KW 800 400	700KW 900 450
75/5	NORMAL MAX. MIN.	15KW 20 10	25KW 30 12.5	30KW 40 20	60KW 80 40	75KW 100 50	300KW 400 200	500KW 600 300	500KW 700 350	600KW 800 400	750KW 1000 500	900KW 1200 600	1000KW 1200 600
100/5	NORMAL MAX. MIN.	20KW 25 12.5	30KW 40 20	40KW 50 25	75KW 100 50	100KW 120 60	400KW 500 250	600KW 800 400	700KW 900 450	800KW 1000 500	1000KW 1200 600	1200KW 1500 750	1200KW 1500 750
150/5	NORMAL MAX. MIN.	30KW 40 20	50KW 70 35	50KW 75 35	100KW 150 75	150KW 200 100	600KW 800 400	800KW 1200 600	1000KW 1200 600	1200KW 1500 750	1500KW 2000 1000	1800KW 2400 1000	2000KW 2500 1250
200/5	NORMAL MAX. MIN.	40KW 50 25	75KW 80 40	75KW 100 50	150KW 200 100	200KW 250 125	800KW 1000 500	1200KW 1500 750	1200KW 1500 750	1500KW 2000 1000	2000KW 2500 1250	2500KW 3000 1500	3000KW 3500 1500
300/5	NORMAL MAX. MIN.	70KW 75 35	100KW 120 60	100KW 150 75	200KW 300 150	300KW 400 200	1200KW 1500 750	1500KW 2000 1000	2000KW 2500 1250	2500KW 3000 1500	3000KW 4000 2000	3500KW 4000 2000	4500KW 5000 2500
400/5	NORMAL MAX. MIN.	75KW 100 50	125KW 150 75	150KW 200 100	300KW 400 200	400KW 500 250	1500KW 2000 1000	2500KW 3000 1500	3000KW 3600 1800	3000KW 4000 2000	4000KW 5000 2500	5000KW 6000 3000	6000KW 7000 3500
600/5	NORMAL MAX. MIN.	125KW 150 75	200KW 250 125	200KW 300 150	450KW 600 300	600KW 800 400	2000KW 3000 1500	3000KW 4000 2000	4000KW 5000 2500	5000KW 6000 3000	6000KW 8000 4000	7500KW 8000 4000	8000KW 10MW 5000KW
800/5	NORMAL MAX. MIN.	150KW 200 100	250KW 350 175	300KW 400 200	600KW 800 400	800KW 1000 500	3000KW 4000 2000	5000KW 6000 3000	6000KW 7500 3000	6000KW 8000 4000	8000KW 10MW 5000KW	10MW 12 6000KW	12MW 15 7500KW
1000/5	NORMAL MAX. MIN.	200KW 250 125	350KW 450 225	400KW 500 250	800KW 1000 500	1000KW 1200 600	4000KW 5000 2500	6000KW 8000 4000	6000KW 8000 4000	8000KW 10MW 5000KW	10MW 12 6000KW	12MW 15 7500KW	15MW 18 10
1200/5	NORMAL MAX. MIN.	250KW 300 150	400KW 500 250	500KW 600 300	1000KW 1200 600	1200KW 1500 750	5000KW 6000 3000	7000KW 8000 4000	8000KW 10MW 5000KW	10MW 12 6000KW	12MW 15 7500KW	15MW 18 10	10MW 20 10
1500/5	NORMAL MAX. MIN.	300KW 400 200	500KW 700 350	600KW 750 375	1200KW 2000 1000	1500KW 2000 1000	6000KW 8000 4000	10MW 12 6000KW	10MW 12 6000KW	12MW 15 7500KW	15MW 20 10	20MW 20 10	20MW 25 12.5
2000/5	NORMAL MAX. MIN.	400KW 500 250	750KW 800 400	800KW 1000 500	1600KW 2000 750	2000KW 2500 1250	8000KW 10MW 5000KW	12MW 15 7500KW	12MW 15 7500KW	15MW 20 10	20MW 25 12.5	25MW 30 15	30MW 35 20
3000/5	NORMAL MAX. MIN.	750KW 800 400	1000KW 1200 600	1200KW 1500 750	2000KW 3000 1500	3000KW 4000 2000	12MW 15 7500KW	18MW 20 10	20MW 25 12.5	25MW 30 15	30MW 40 20	35MW 40 20	40MW 50 25
4000/5	NORMAL MAX. MIN.	800KW 1000 500	1200KW 1500 750	1500KW 2000 1000	3000KW 4000 2000	4000KW 5000 2500	15MW 20 10	20MW 30 15	25MW 30 15	30MW 40 20	40MW 50 25	50MW 60 30	50MW 75 40
5000/5	NORMAL MAX. MIN.	1000KW 1250 500	1500KW 2000 1000	2000KW 2500 1250	4000KW 5000 2500	5000KW 6000 3000	20MW 25 12.5	30MW 40 20	20MW 25 12.5	40MW 50 25	50MW 60 30	60MW 80 40	75MW 80 40
6000/5	NORMAL MAX. MIN.	1200KW 1500 750	2000KW 2500 1250	2500KW 3000 1500	5000KW 6000 3000	6000KW 8000 4000	25MW 30 15	35MW 40 20	40MW 50 25	50MW 60 30	60MW 80 40	60MW 80 40	80MW 100 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 650 325	600KW 800 400	1000KW 1200 600	1500KW 1500 750	1500KW 2000 1000	1500KW 2500 1250	3000KW 5000 1500	5000KW 6000 3000	6000KW 7500 3000	15MW 15 7500KW	30MW 40 20
50/5	NORMAL MAX. MIN.	1000KW 1200 600	1200KW 1500 750	2000KW 2500 1250	3000KW 3500 1750	3000KW 4000 2000	3500KW 5000 2500	8000KW 10MW 5000KW	10MW 12 7500KW	12MW 15 7500KW	30MW 35 15	60MW 80 40
75/5	NORMAL MAX. MIN.	1500KW 2000 1000	1800KW 2000 1000	3000KW 4000 2000	4000KW 5000 2500	5000KW 6000 3000	5000KW 7500 3000	10MW 15 7500KW	15MW 15 7500KW	15MW 20 10	45MW 50 25	100MW 125 50
100/5	NORMAL MAX. MIN.	2000KW 2500 1250	2500KW 3000 1500	4000KW 5000 2500	6000KW 7500 3000	6000KW 8000 4000	7500KW 10MW 5000KW	15MW 20 10	20MW 25 12.5	25MW 30 15	60MW 70 35	125MW 150 75
150/5	NORMAL MAX. MIN.	3000KW 4000 2000	3500KW 4000 2000	6000KW 4000 2000	10MW 10 5000KW	10MW 12 6000KW	10MW 15 7500KW	20MW 30 15	30MW 35 15	35MW 40 20	90MW 100 50	200MW 250 100
200/5	NORMAL MAX. MIN.	4000KW 5000 2500	4500KW 6000 3000	8000KW 5000 2500	12MW 15 7500KW	12MW 15 7500KW	15MW 20 10	30MW 40 20	35MW 50 25	50MW 60 30	100MW 150 75	250MW 300 150
300/5	NORMAL MAX. MIN.	6000KW 8000 4000	7000KW 8000 4000	12MW 15 7.5	18MW 20 10	18MW 25 12.5	20MW 30 15	45MW 60 30	60MW 75 30	75MW 80 40	150MW 200 100	400MW 500 250
400/5	NORMAL MAX. MIN.	8000KW 10MW 5000KW	10MW 12 6000KW	15MW 20 10	24MW 30 15	25MW 30 15	30MW 40 20	60MW 80 40	80MW 100 50	100MW 120 60	200MW 300 150	500MW 600 300
600/5	NORMAL MAX. MIN.	12MW 15 7500KW	15MW 18 10	25MW 30 15	35MW 40 20	40MW 50 25	45MW 60 30	90MW 120 60	100MW 150 75	150MW 180 75	350MW 450 225	800MW 1000 500
800/5	NORMAL MAX. MIN.	15MW 20 10	20MW 25 12.5	30MW 40 20	50MW 60 30	50MW 60 30	60MW 80 40	120MW 150 75	150MW 200 100	200MW 200 100	500MW 600 300	1000MW 1200 600
1000/5	NORMAL MAX. MIN.	20MW 25 12.5	25MW 30 15	40MW 50 25	50MW 60 30	60MW 80 40	75MW 100 50	150MW 200 100	200MW 250 125	250MW 300 150	600MW 750 300	1200MW 1500 750
1200/5	NORMAL MAX. MIN.	25MW 30 15	30MW 35 20	50MW 60 30	60MW 80 40	80MW 100 50	100MW 120 60	175MW 200 100	250MW 300 150	300MW 350 175	750MW 900 450	1500MW 2000 1000
1500/5	NORMAL MAX. MIN.	30MW 40 20	35MW 40 20	60MW 80 40	75MW 100 50	100MW 120 60	120MW 150 75	250MW 300 150	300MW 350 175	350MW 450 225	900MW 1000 500	2000MW 2500 1250
2000/5	NORMAL MAX. MIN.	40MW 50 25	50MW 60 30	80MW 100 50	100MW 150 75	120MW 150 75	150MW 200 100	300MW 400 200	400MW 500 250	500MW 600 300	1000MW 1500 750	2500MW 3000 1500
3000/5	NORMAL MAX. MIN.	60MW 80 40	75MW 80 40	100MW 150 75	150MW 200 100	200MW 250 125	200MW 300 150	400MW 500 250	600MW 750 350	700MW 900 450	1500MW 2000 1000	3500MW 5000 2500
4000/5	NORMAL MAX. MIN.	80MW 100 50	100MW 125 60	150MW 200 100	200MW 300 150	250MW 300 150	300MW 400 200	500MW 800 400	800MW 1000 500	1000MW 1200 600	2000MW 3000 1500	5000MW 6000 3000
5000/5	NORMAL MAX. MIN.	100MW 120 60	125MW 150 75	200MW 250 125	250MW 300 150	300MW 400 200	400MW 500 250	750MW 1000 500	1000MW 1200 600	1200MW 1500 750	3000MW 3500 1750	6000MW 8000 4000
6000/5	NORMAL MAX. MIN.	120MW 150 75	150MW 175 80	250MW 300 150	350MW 400 200	400MW 500 250	450MW 600 300	1000MW 1200 600	1200MW 1500 750	1500MW 1750 800	3500MW 4000 2000	8000MW 10000 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
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

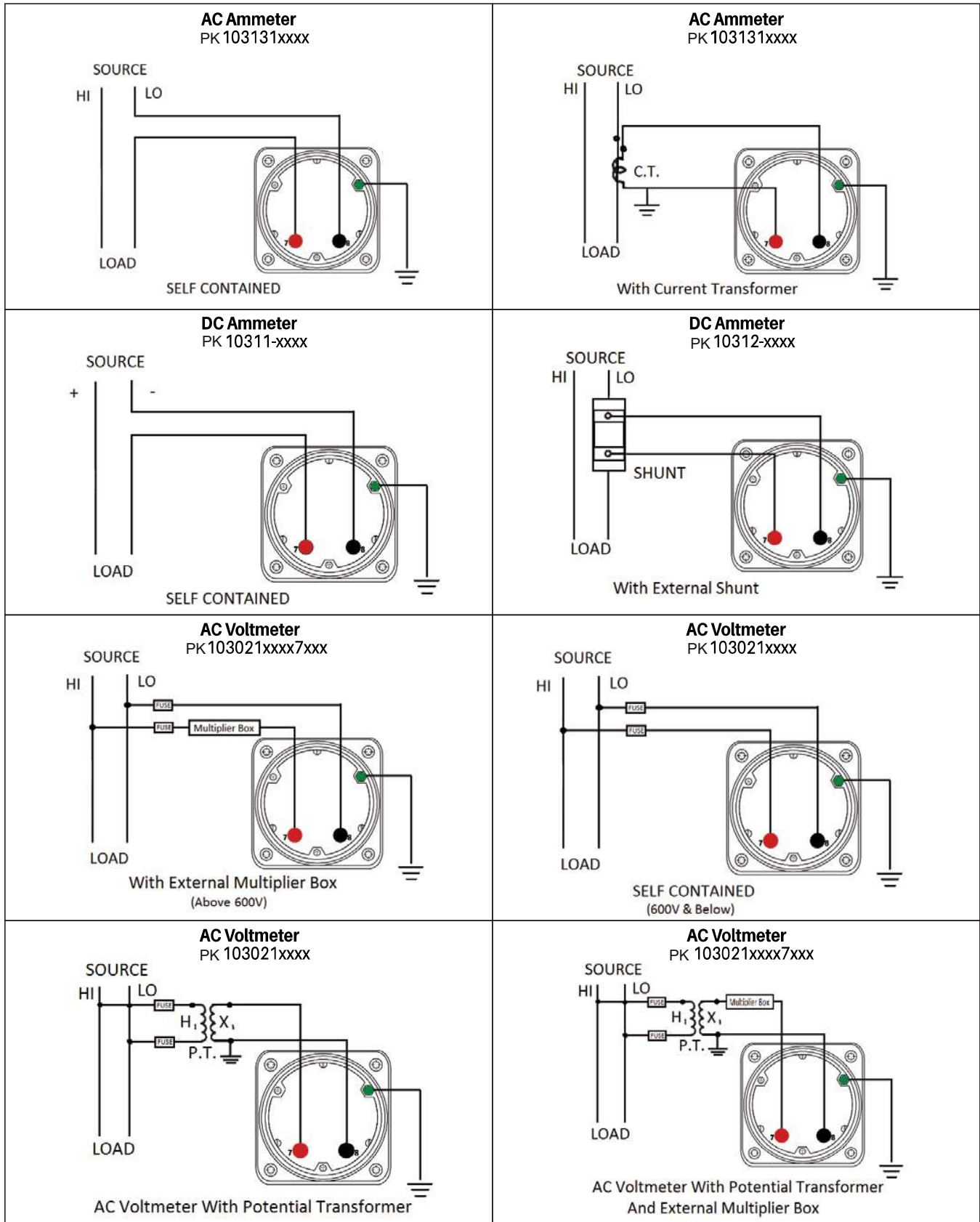
AC Volts or Kilovolts	% KW	LBS
AC Amperes, or Kiloamperes	Hz	PSIG
AC Watts, Kilowatts or Megawatts	FPS	GPH
Vars, Kilovars or Megavars	KPS	PSIA
Synchoscope	YPS	IPS
Power Factor	CPM	PPS
Hertz	FPM	RPM
Phase Angle	IPM	GPM
DC Volts, or Kilovolts	KPM	In. H <sub>2</sub> O
or Milliampere	RPM	
DC Watts or Kilowatts	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.

## 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.

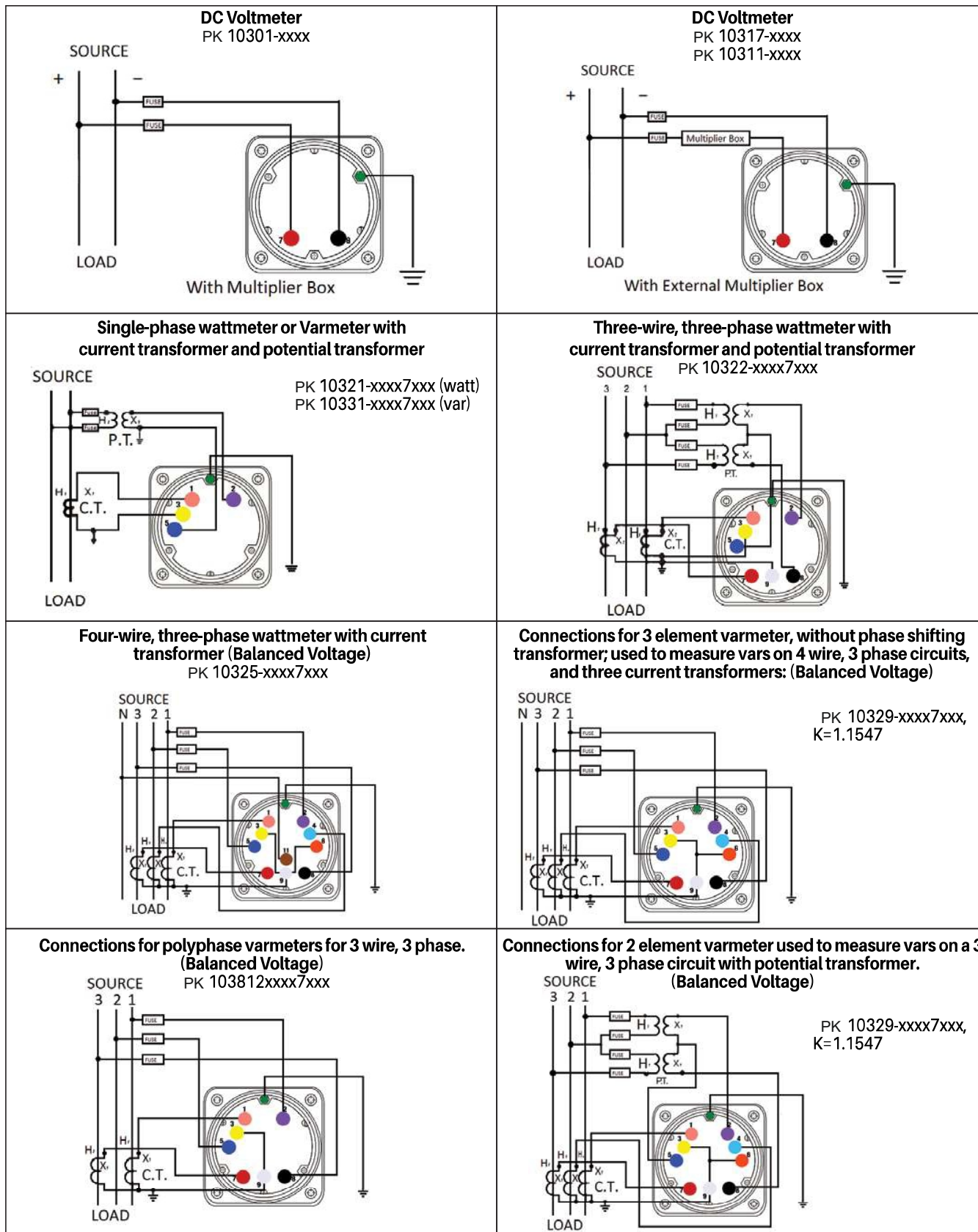
# Standard Connections



**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

# Standard Connections



**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

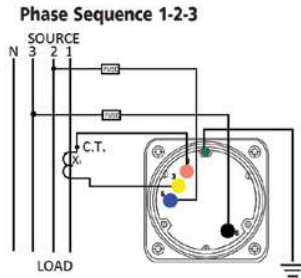
Specs subject to change without notice



# Standard Connections

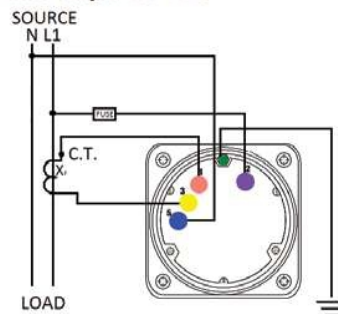
**Connections for power-factor meters with 4 wire 3 phase circuits with current transformer. If using transformer with secondary voltage of 120, power-factor instrument should be rated 208 volts. (Balanced System)**

PK 103402xxxx



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

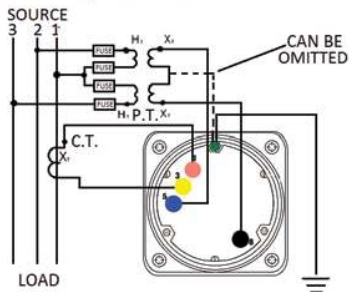
**Phase Sequence 1-2-3**



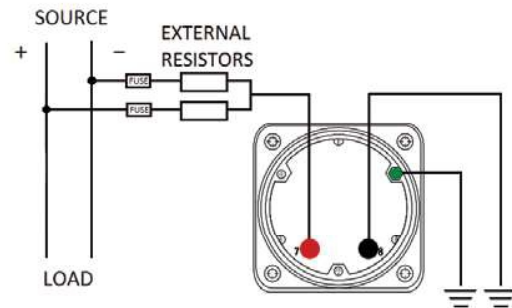
**Three-wire, three-phase power-factor meter with current transformer and potential transformer (Balanced System)**

PK 103402xxxx

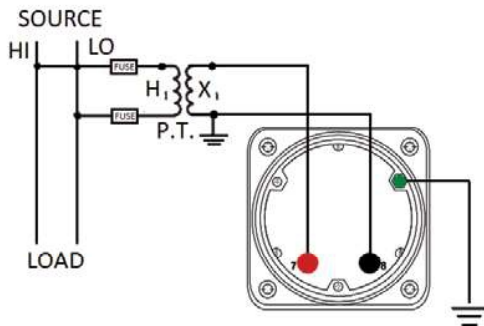
**Phase Sequence 1-2-3**



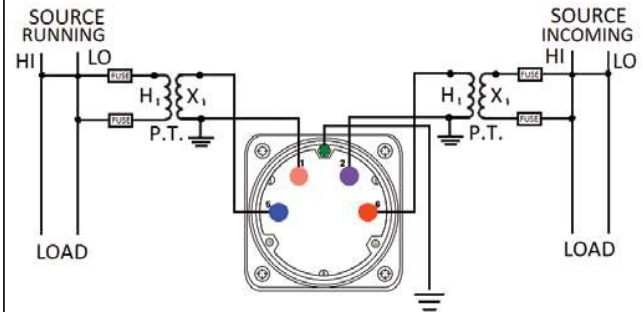
**DC Ground Detector**



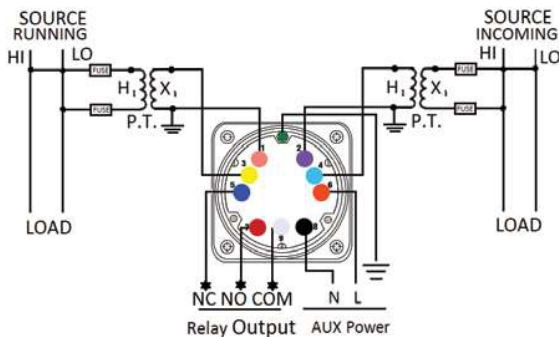
**Frequency Meter with potential transformer**  
PK 103372xxxx



**Synchroscope with potential transformers**  
PK 106452xxxx



**Digital Synchroscope with potential transformers**  
PK 106452DIGITAL



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**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

# 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 Milliammeters / Ammeter

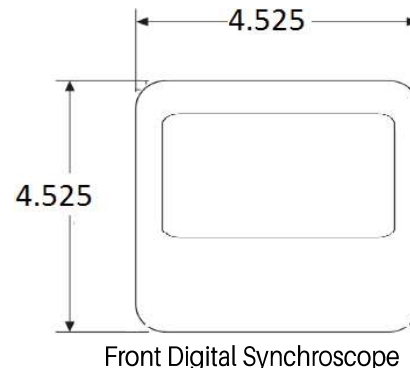
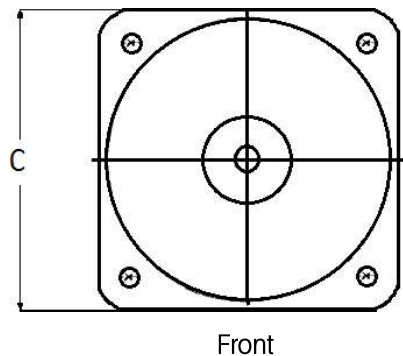
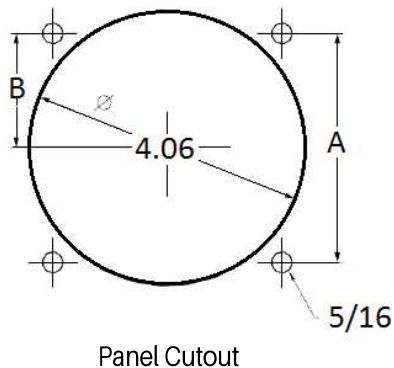
Current Rating	Ohms Terminal Resistance ± 15%
0 - 1 mA	500 ohm
0 - 5 mA	7 ohm
0 - 15 mA	3 ohm
0 - 1 A	0.075 ohm

### DC Microammeters

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

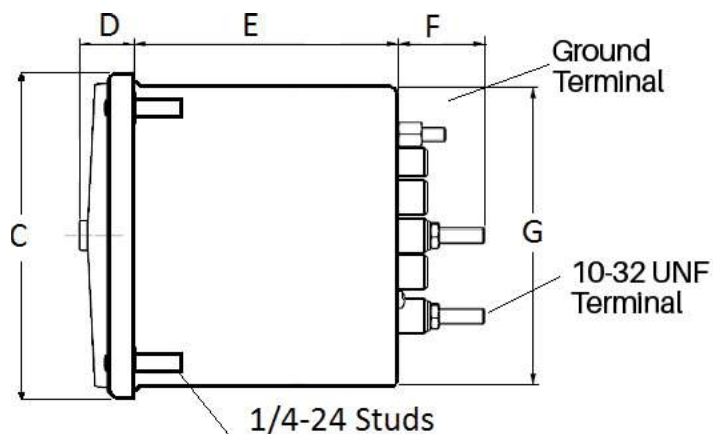
# Dimensions

## Short & Long Case



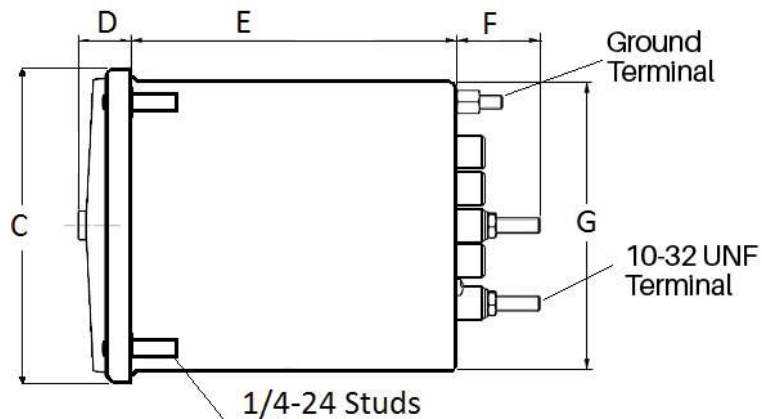
## Short Case - AC V / A, DC V / A, Hz, and Tach.

	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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