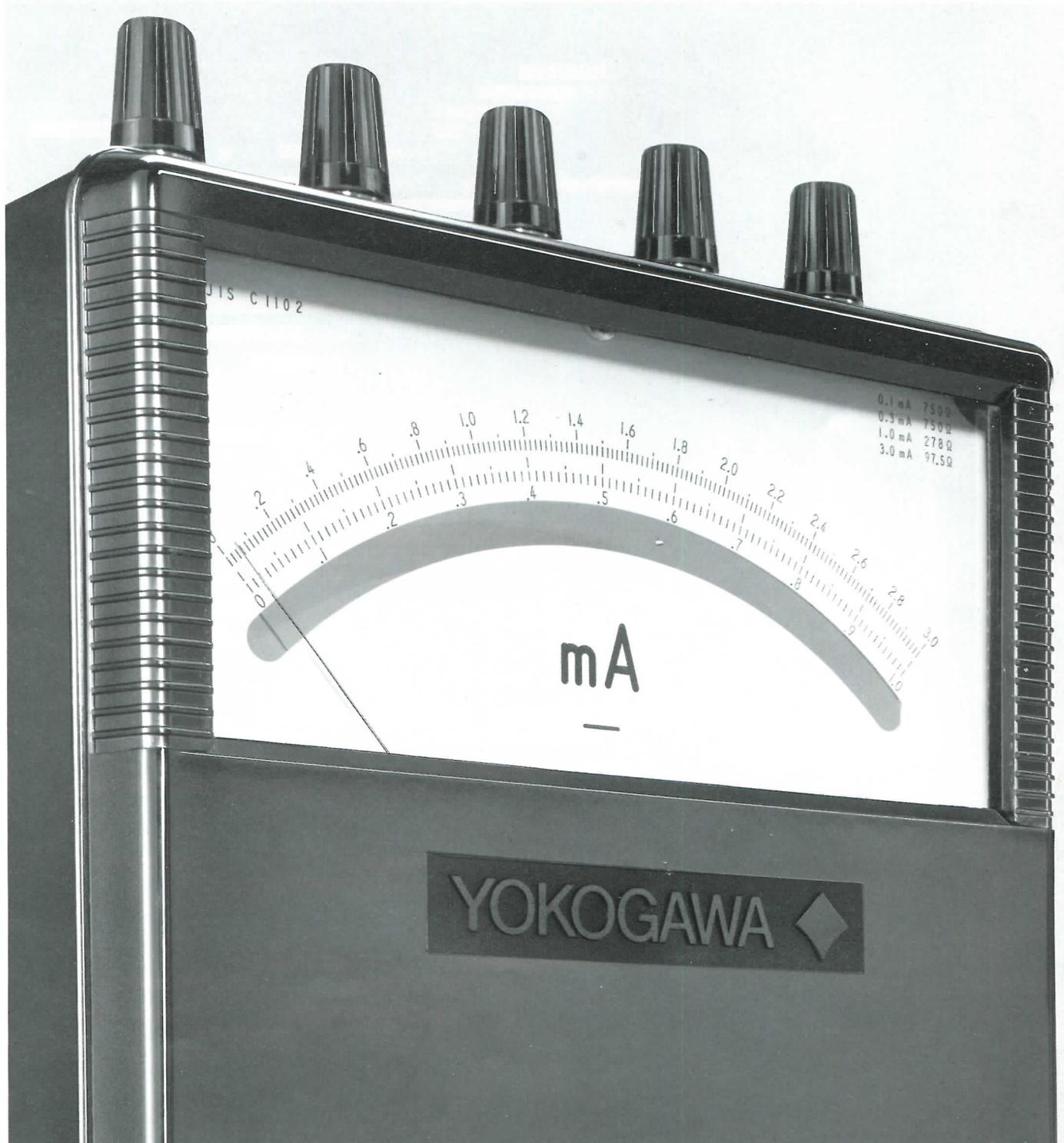


Portable Instruments

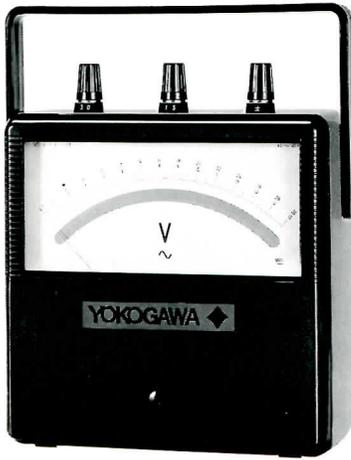


SELECTOR GUIDE FOR PORTABLE AMMETERS & VOLTMETERS

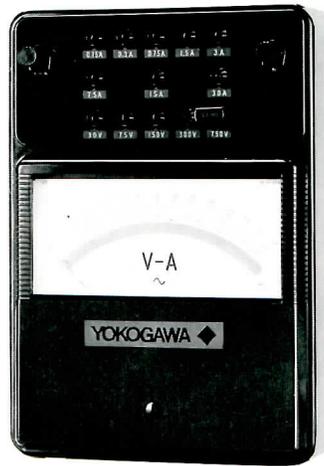
Item	Accuracy	Model	No. of ranges	Full scale (measuring ranges)								Page			
				10μA	100μA	1mA	10mA	100mA	1A	10A	100A				
DC A	±0.5%	2011	4	[Bar chart showing ranges for Model 2011]								3			
				DC A & DC V	2012	17	[Bar chart showing ranges for Model 2012]								
							DC V	2011	4	[Bar chart showing ranges for Model 2011]					
AC A	±0.5%	2013	2	[Bar chart showing ranges for Model 2013]								4			
				4	[Bar chart showing ranges for Model 2013]										
					4 (400 Hz)	[Bar chart showing ranges for Model 2013]									
		AC A & AC V	2014	13	[Bar chart showing ranges for Model 2014]										
AC V	±0.5%	2013	2	[Bar chart showing ranges for Model 2013]								4			
				2 (400 Hz)	[Bar chart showing ranges for Model 2013]										
A, V (DC, up to 5MHz)	±0.5%	2016	2	[Bar chart showing ranges for Model 2016]								5			
				V (45Hz to 10kHz)	2017	2	[Bar chart showing ranges for Model 2017]								
DC A	±1.0%	2051	2	[Bar chart showing ranges for Model 2051]								8			
				DC V	2051	2	[Bar chart showing ranges for Model 2051]								
AC A	±1.5%	2053	2	[Bar chart showing ranges for Model 2053]								8			
AC A	±1.5%	2052	2	[Bar chart showing ranges for Model 2052]								8			
AC V		2052	2	[Bar chart showing ranges for Model 2052]											

- Portable frequency meters (Model 2038) Page 6
- Portable power factor meters (Model 2039) Page 6
- Portable standard wattmeters (Models 2041 & 2042) Page 7
- Transformers Page 9
- Shunts & multipliers Rear cover

2013 & 2014 Portable Standard AC Ammeters & Voltmeters



2013
195 x 170 x 87 mm 1.7 kg
(7-3/4 x 6-3/4 x 3-1/2" 3.8 lbs)



2014
260 x 180 x 115 mm 4.2 kg
(10-1/4 x 7-1/8 x 4-5/8" 9.3 lbs)

Models 2013 and 2014 are moving iron type instruments using a taut-band suspension system. These instruments have excellent reproducibility and are highly resistant to vibration and shock.

- Linear scale for improved readability
- Excellent frequency characteristics
- Less internal heating due to low volt-ampere loss
- Rapid reading by high eddy current damping

SPECIFICATIONS

Principle: Moving iron type.

Rated Accuracy: $\pm 0.5\%$ of full scale.

Scale Length: Approx. 135 mm (5-3/8").

Frequency Influence: Within 0.2% of indicated value (45 to 65 Hz).

Optional Accessories: 229101 Carrying case for 2013, 229201 Carrying case for 2014.

Ranges:

Model	Name	Model	Range	Approx. Volt-Ampere Loss	Scale Div.		
2013	AC Ammeter	201301	20/100 mA	0.3/0.2 VA	100		
		201302	50/250 mA	0.5/0.5 VA	100/125		
		201303	100/500 mA	0.5/0.5 VA	100		
		201304	0.2/1 A	0.4/0.4 VA	100		
		201305	0.5/2.5 A	0.5/0.5 VA	100/125		
		201306	1/5 A	0.6/0.6 VA	100		
		201307	2/10 A	0.7/0.7 VA	100		
		201308	5/25 A	1/1 VA	100/125		
		201309	10/50 A	1.2/1.8 VA	100		
		201310	20/50/100/200 mA	0.4/0.3/0.2/0.3 VA	100		
	201311	0.1/0.2/0.5/ 1 A	0.2/0.3/0.4/0.5 VA	100			
	201312	0.5/1/2/5 A	0.7/0.6/0.5/0.3 VA	100			
	201313	2/5/10/20 A	0.5/0.3/0.6/0.9 VA	100			
	201314	10/20/50/100 A	0.6/0.9/1.7/2.4 VA	100			
201320	1 Range	5 A (for use with external CT)	0.22 VA	100/150			
AC Voltmeter	201315	15/30 V	3.8 VA	150			
	201316	30/75 V		150			
	201317	75/150 V		150			
	201318	150/300 V		150			
	201319	300/750 V		150			
201321	1 Range	150V (for use with external PT)	3.8 VA	100/150			
201328	3 Ranges	150/300/600V	3/3/6 VA	150/120			
AC Ammeter	201322	1 Range	500A with external 500A/5A CT		100/125		
AC 400Hz Ammeter	201323	0.5/1/2/5 A	* * * * *	0.7/0.6/0.5/0.3 VA	100		
	201324	2/5/10/20 A		0.5/0.3/0.6/0.9 VA	100		
	201325	10/20/50/100 A		0.6/0.9/1.7/2.4 VA	100		
AC 400Hz Voltmeter	201326	75/150 V	* * * * *	3.75 VA	150		
	201327	150/300 V		3.75 VA	150		
2014	AC Volt-Ammeter	201400	13 Ranges	30/75/150/300/750 V 0.15/0.3/0.75/1.5/3/7.5/ 15/30 A	** * * * *	4.5 VA in any voltage range 0.15 to 7.5A : 0.7 VA 15 A : 0.9 VA 30 A : 2 VA	150

Notes: 1. For ranges higher than 100 A, use External Current Transformers with 201320 5 A instrument.
2. For ranges higher than 750 V, use External Potential

Transformers with 201321 150 V instrument.
3. * The current transformer is built in.
4. ** The current and potential transformers are built in.

2016 Portable High-Frequency Milliammeters & Voltmeters



2016 (Ammeter)

260 x 180 x 115 mm 2.5 kg
(10-1/4 x 7-1/8 x 4-1/2" 5.5 lbs)

2017 Portable Audio-Frequency Voltmeter



201730

195 x 170 x 87 mm 1.8 kg
(7-3/4 x 6-3/4 x 3-1/2" 4.0 lbs)

Model 2016 instruments are essentially millivoltmeters of the highly sensitive moving coil type with self-contained vacuum couple. Range switching is made by connecting the vacuum thermoelement in parallel with suitable shunts.

SPECIFICATIONS

Principle: Moving coil type taut-band suspension system with self-contained vacuum couple.

Rated Accuracy: Ammeter; $\pm 1.0\%$ of full scale value at 50Hz, Voltmeter; $\pm 0.5\%$ of full scale value at 50Hz.

Frequency Coverage: From 10 Hz to 100 kHz or more depending on range. (See below.)

Frequency Influence: Max. 1.0% of indicated value within the above frequency coverage.

Maximum Input Current: 150% of the rated value.

Scale Length: Approx. 135 mm (5-3/8").

Dimensions: Milliammeters . . . 260 x 180 x 90mm (10-1/4 x 7-1/8 x 3-1/2), Voltmeter . . . 195 x 170 x 87 mm (7-3/4 x 6-3/4 x 3-1/2").

Ranges:

Name	Model	Range	Frequency
High-frequency Ammeter (4-Range)	201601 201602 201603	5/10/20/50 mA 20/50/100/200 mA 100/200/500/1,000 mA	DC, 10Hz to 5MHz DC, 10Hz to 2MHz DC, 10Hz to 1MHz
High-frequency Voltmeter (4-Range)	201604	15/30/75/150 V	DC, 10Hz to 100kHz

Note: Model 2016 Milliammeters contain Code 209902 (5 mA) Vacuum Couples which can easily be replaced by the user. Spare Vacuum Couples are available at extra cost as a set including mounting plate and adjusting resistor. Replacement by the user, however, results in a change of instrument accuracy; i.e., from $\pm 0.5\%$ and $\pm 1.0\%$ to $\pm 1.0\%$ and $\pm 1.5\%$ respectively.

Optional Accessories: 229101 Carrying case for 2016 Voltmeter, 229201 Carrying case for 2016 Ammeter.

Model 2017 is a rectifier type for use in the 45Hz to 10kHz audio-frequency range. This instrument is well suited as a precision flux voltmeter for use with an Epstein Iron Loss Test Set.

Common to 2016 & 2017

- True RMS measurement
- Friction-free taut band suspension system
- Superior temperature characteristics due to thermo-couple compensation

SPECIFICATIONS

Principle: Moving coil type with rectifier.

Rated Accuracy: $\pm 0.5\%$ of full scale value at 45 Hz to 10 kHz.

Range: 30, 75, 150, 300V.

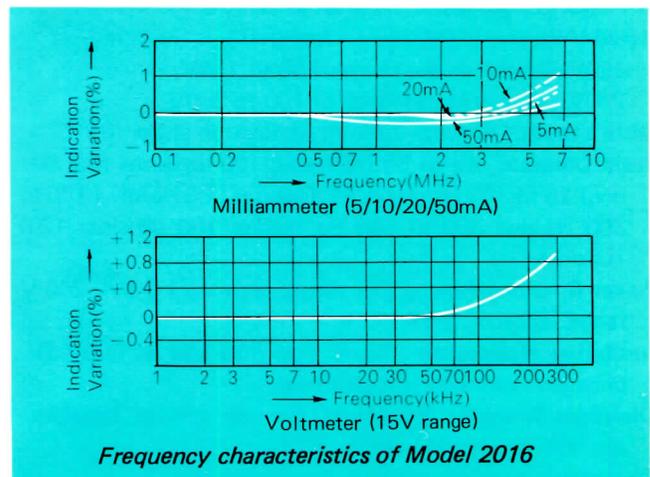
Scale Length: Approx. 135 mm (5-3/8").

Scale Divisions: 150.

Deflection Angle: 85°.

Approx. Volt-Ampere Loss: 1,000 Ω /V.

Optional Accessory: 229101 Carrying case.



2038 Portable Frequency Meters



2038

195 x 175 x 87 mm 1.8 kg
(7-3/4 x 6-7/8 x 3-1/2" 4.0 lbs)

Model 2038 uses a frequency-to-DC current transducer which drives a high sensitivity moving coil type indicator. It features accurate frequency measurements without noticeable influence of line voltage fluctuation (50 to 300V) or waveform distortion.

- Shock-and-vibration-proof taut band suspension indicator with transducer
- Negligible influence of voltage and waveform distortion
- Compact and lightweight
- Legible scale of perfect uniform graduation

SPECIFICATIONS

Ranges and Rated Accuracy:

Model	Range	Accuracy (of full scale)
203831	45 to 65 Hz	±0.2%
203832	20 to 100 Hz	±1.0%
203803	100 to 300 Hz	±0.5%
203804	300 to 500 Hz	±0.5%

Note: For voltages higher than specified, use External Potential Transformers.

Principle of Operation: Frequency sensing transducer.

Rated Voltage: 120V/240V (2 ranges),

120V: Usable in the range of 50 to 130V,

240V: Usable in the range of 130 to 300V.

Scale Length: Approx. 135mm (deflection angle: 85°).

Scale Division: 45 to 55 Hz range; 100 divisions (0.2 Hz/div.) 20 to 100 Hz range; 80 divisions (1.0 Hz/div.) 100 to 300 Hz and 300 to 500 Hz ranges; 100 divisions (2.0 Hz/div.).

Power Consumption: 120V range; approx. 1.3 VA, 240 V range; approx. 2 VA.

Insulation Resistance: More than 100 MΩ at 500V DC between electric circuit and case.

Dielectric Strength: 2,000V AC for one minute between electric circuit and case.

Optional Accessory: 229101 Carrying case.

2039 Portable Power Factor Meters



2039

260 x 180 x 116 mm 2.9 kg
(10-1/4 x 7-1/8 x 4-5/8" 6.4 lbs)

Model 2039 is used for measurement in single-phase and balanced three-phase circuits. From a phase discriminating circuit, the output of the built-in transducer produces a DC proportional to the phase between voltage and current to operate the DC indicator.

- Good frequency response
Accuracy unaffected for frequencies of 45 to 60Hz.
- Excellent overload characteristics
- Excellent linearity over a voltage range of 60 to 300V

SPECIFICATIONS

Principle: Phase angle sensing transducer.

Rated Accuracy: 3.0% within the effective power factor measuring range.

Ranges:

Current	Voltage	Model
0.2/1 A	120V (Usable in the range of 60 to 300 V)	203901
1/5 A		203902
5/25 A		203903

Notes: 1. For ranges higher than 25A, use one External Current Transformer with 203902 & 203903.

2. For ranges higher than 300V, use one External Potential Transformer.

Scale: Power Factor; Lead 0–0.3–1.0–0.3–0 Lag, Phase Angle; Lead 90°–0°–90° Lag.

Effective Power Factor Measuring Range: Lead 0.5–1.0–0.5 Lag.

Scale Length: Approx. 135 mm (5-3/8").

Frequency Effects: Within ±1.5° in phase angle at 45 to 65 Hz.

Volt-Ampere Loss:

Voltage Circuit (120V) . . . Approx. 0.14 VA,

Current Circuit (5A) . . . Approx. 2.4 VA.

Optional Accessory: 229201 Carrying case.

Transformers for Portable Instruments

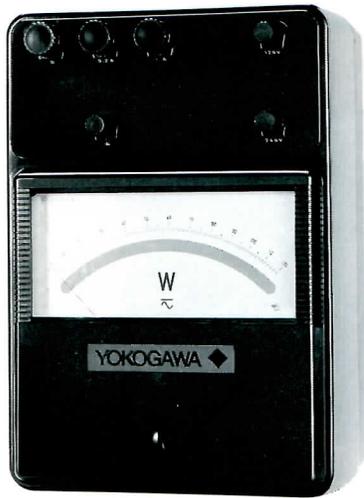


Model	224100	224200	224300	226101	226102	226103	226200
Primary rating	10/15/30/50/100/ 250/300/500/750/ 1,500A	10/15/30/50/100/ 250/300/500/750/ 1,500A	0.5/0.75/1/1.5/2/ 3/5/7.5/10/15/20/ 30/50/75/100A	220/440/2,200/ 3,300V	15/30/50/75V	100/200/300/ 500V	3,300/6,600V
Secondary rating	5A	5A	5A	110V	150V	150V	110V
Rated burden	15VA	15VA	15VA	15VA	15VA	15VA	15VA
Max. ratio error	±0.2%	±0.2%	±0.1%	±0.2%	±0.2%	±0.2%	±0.2%
Max. phase displacement	±10 minutes	±10 minutes	±5 minutes	±10 minutes	±10 minutes	±10 minutes	±10 minutes
Class	0.2	0.2	0.1	0.2	0.2	0.2	0.2
Max. line voltage	3,450V	6,900V	250V	—	—	—	—
Dielectric test voltage for one minute	10,000V	20,000V	2,000V	10,000V	2,000V	4,000V	15,000V
Rated frequency	50 to 60 Hz			50 to 60 Hz			
Dimensions	318×246×128mm (12½×9¾×5")	349×267×152mm (13¾×10½×6")	343×256×136mm (13¼×10¼×5¾")	255×240×200mm (10×9½×7¾")		294×251×216mm (11¾×9¾×8½")	
Weight	9kg(19.8 lbs)	11kg(24.3 lbs)	12.5kg(26.4 lbs)	18kg(38.9 lbs)		18kg(38.9 lbs)	

Notes: 1. 2244 is used only with the 2013 Ammeters of current range 500 A.
2. Rated burden of 2244 is 1.5VA and others 15VA.
3. Accuracy: ±0.1% of rated value for 2243, ±0.2% for 2241, 2242, and 2244.

Notes: 1. Rated burden is 15VA for all models.
2. Accuracy is ±0.2% of the rated value for all models.

2041 & 2042 Portable Standard Wattmeters



2041

260 x 180 x 136 mm 2.8 kg
(10-1/4 x 7-1/8 x 5-3/8" 6.2 lbs)



2042

260 x 180 x 136 mm 3.2 kg
(10-1/4 x 7-1/8 x 5-3/8" 7.1 lbs)

Models 2041 and 2042 are electro-dynamometer type and use the taut-band suspension system. These instruments are highly reliable, and designed for use in laboratories or factories for precision measurement of power at DC and commercial frequencies up to 1,000Hz. These instruments are housed in phenol resin cases and shielded with double permalloy sheets to block external magnetic fields.

- **Excellent power factor characteristics**
Effectively used in measurement of low power factor load power and small power
- **Shock-proof, rugged taut band suspension movement**
- **Wide current ranges of 1 : 5 ratio selectable by terminal connection method**
- **Negligible self-heating effects**

SPECIFICATIONS

- Principle:** Electro-dynamometer type.
Rated Accuracy: $\pm 0.5\%$ of full scale value.
Scale Length: Approx. 135 mm (5-3/8").
Scale Division: 120.
Frequency Ranges:
 Model 2041 ; DC, 25 to 1,000 Hz ($\cos\phi = 1.0$)
 DC, 25 to 500 Hz ($\cos\phi = 0.2$)
 Model 2042 ; DC, 25 to 1,000 Hz ($\cos\phi = 1.0$).
Optional Accessory: 229201 Carrying case.

Ranges:

Model	Name	Model	Range		Power Factor	Approx. Volt-Ampere Loss	
			Current	Voltage		Voltage Circuit	Current Circuit
2041	Portable, single-phase wattmeter	204101	0.2/1 A	120/240 V	1.0	10 mA (100 Ω /V)	0.66/0.56 VA
		204102	1/5 A				0.93/0.84 VA
		204103	5/25 A				1.72/1.69 VA
	Portable, single-phase, low-power-factor wattmeter	204111	0.2/1 A	120/240 V	0.2	20 mA (50 Ω /V)	1.25/1.09 VA
		204112	1/5 A				1.7/1.5 VA
		204113	5/25 A	2.62/2.5 VA			
		204121	0.2/1 A	30/60 V		1.25/1.09 VA	
		204122	1/5 A			1.7/1.5 VA	
2042	Portable, three-phase wattmeter	204201	0.2/1 A	120/240 V	1.0	10 mA (100 Ω /V)	0.66/0.56 VA
		204202	1/5 A				0.93/0.84 VA
		204203	5/25 A				1.72/1.69 VA

- Notes: 1. For ranges higher than 25 A, use External Current Transformer with Model 2041 or 2042 5A wattmeter.
 2. For ranges higher than 240V, use External Potential Transformer.
 3. Model 2041 Single-Phase, Low-Power-Factor Wattmeters

are recommended for use with Epstein Iron-Loss Test Sets, as well as for measurement of small or low-power-factor power. The rated power factor of 0.2 sets no restriction on the power factor of the measuring circuit. Power measurement can be made at an arbitrary power factor.

2051-2053 Miniature-Size Portable Instruments

ers



205105

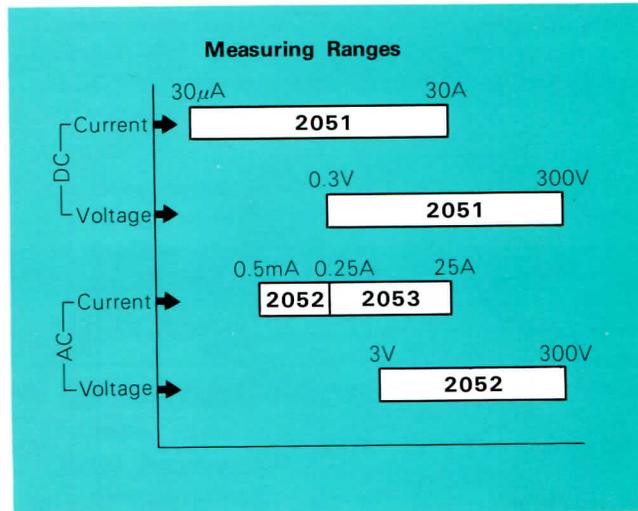
113 x 106 x 46 mm 0.35 kg
(4-1/2 x 4-1/4 x 1-7/8" 0.8 lbs)



205201

113 x 106 x 46 mm 0.35 kg
(4-1/2 x 4-1/4 x 1-7/8" 0.8 lbs)

High resistance to shock and vibration coupled with elimination of friction errors has greatly increased instrument reliability. The instruments have a knife-edge pointer and mirror scale to eliminate parallax error. From every design point, Series 2050 instruments are well suited to applications requiring small testing instruments, including laboratories, schools, workshops and field uses.



SPECIFICATIONS

Principle: 2051; Moving coil type, 2052; 15 to 300V ranges ... RMS rectifier type, 3/7.5/15V and mA ranges ... Moving coil type with rectifier, 2053; Moving iron type (pivot and jewel system).

Rated Accuracy: 2051; ±1.0% of full scale value, 2052 and 2053; ±1.5% of full scale value.

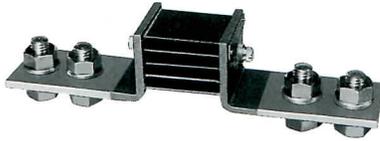
Scale Length: Approx. 88mm (3-1/2").

Pointer: Knife edge pointer (red).

Ranges:

Model	Name	Range	Internal Resistance or Current Loss
205101	DC Ammeter	30/100/300/1,000/3,000 μA	5/6.8/2.8/0.9/0.3 kΩ
205102		0.3/1/3/10/30 mA	970/390/140/43/14 Ω
205103		10/30/100/300/1,000 mA	4/1.4/0.4/0.14/0.04 Ω
205104		0.3/1/3/10/30 A	0.14/0.04/0.014/0.004/0.001 Ω
205105	DC Voltmeter	0.3/1/3/10/30 V	100μA (10kΩ/V)
205106		3/10/30/100/300 V	
205201	AC Ammeter	0.5/1/2.5 mA	3 V
205202		2.5/5/10 mA	
205203		10/25/50 mA	
205204		50/100/250 mA	
205301	AC Ammeter	0.25/0.5/1 A	1/1/1 VA
205302		1/2.5/5 A	0.9/0.8/0.7 VA
205303		5/10/25 A	0.6/0.9/2.3 VA
205205	AC Voltmeter	3/7.5/15 V	1 mA
205206		15/30/75 V	
205207		75/150/300 V	

Shunts, Multipliers & Carrying Cases for Portable Instruments



2216 (500A)



2222 (1.5/3kV)

EXTERNAL SHUNTS

Model	Rating
221508	15 A
221509	20 A
221510	30 A
221511	50 A
221512	75 A
221513	100 A
221514	150 A
221515	200 A
221516	300 A
221601	500 A
221602	750 A
221603	1,000 A
221701	1,500 A
221702	2,000 A
221703	3,000 A
221704	5,000 A
221705	7,500 A
221706	10,000 A

EXTERNAL MULTIPLIERS

Model	Rating
222201	0.75/1.5 kV
222202	1/2 kV
222203	1.5/3 kV
222300	3/5 kV

Note: Accuracy is $\pm 0.2\%$ of the rated value for all models.

CARRYING CASES



2291 01



2292 01

Model	Applicable Models
229101	2011, 2013, 2016(Voltmeter), 2038
229201	2012, 2014, 2016(Ammeter), 2039 2041, 2042

Note: Accuracy is $\pm 0.2\%$ of the rated value for all models.

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