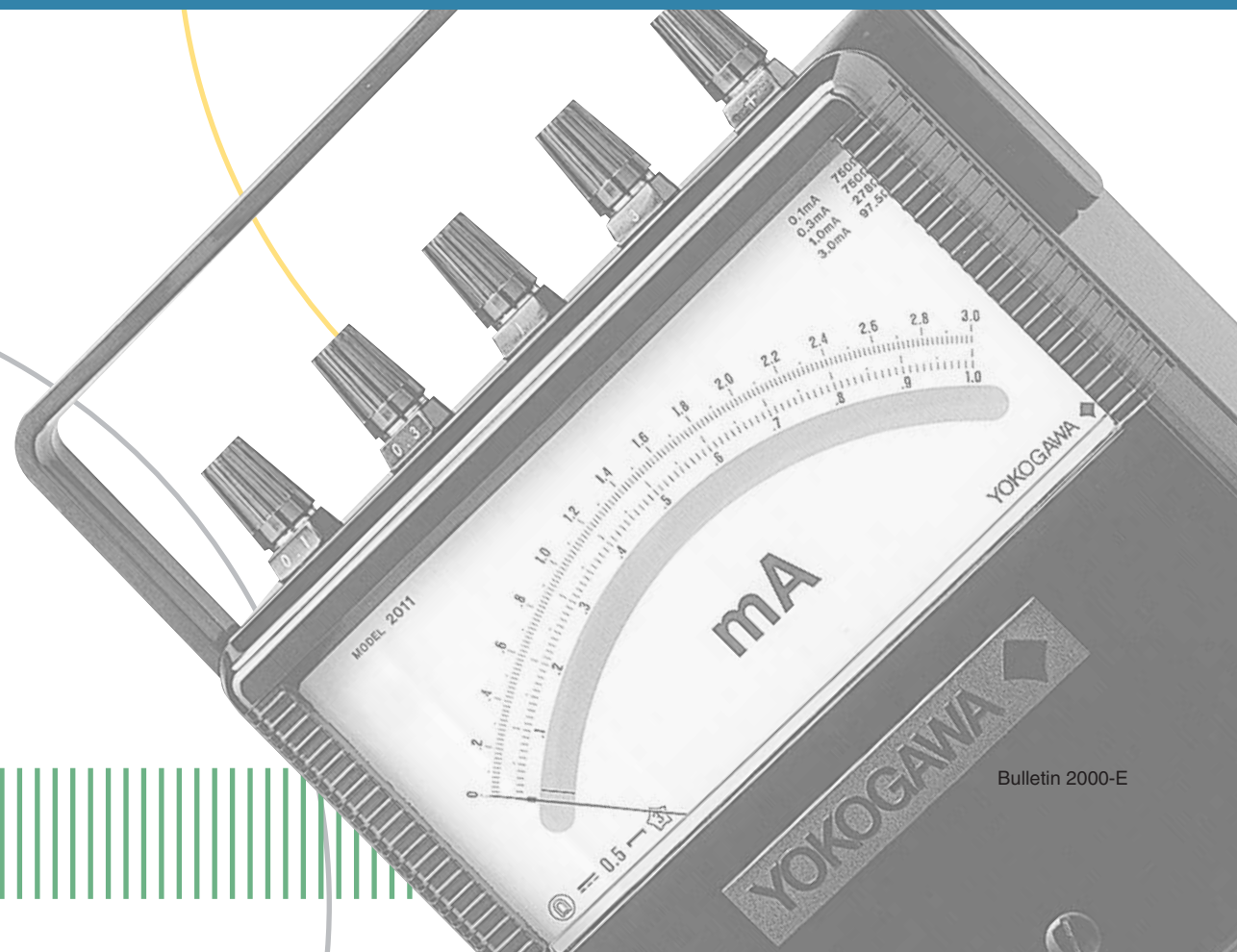
YOKOGAWA

Portable Instruments



Bulletin 2000-E

Usage Precautions

⚠ Warning: Indicates usage precautions that must be read to ensure the safety of users and the equipment.

Safety Instructions for Portable Instruments

1. Usage environment and conditions

Do not use YOKOGAWA portable instruments in locations such as the following:

- Locations where the ambient temperature is outside the range of 0 to 40°C
- Locations where relative humidity is outside the range of 25 to 80%
- Locations subject to vibrations or shock impact
- Locations subject to rain, dripping water, or direct sunlight
- Locations exposed to large amounts of dust, salt, soot, or corrosive gases (sulfurous acid gas, ammonia gas, hydrogen sulfide gas, or other gases that corrode metals or plastics)
- Locations subject to strong external noise or electromagnetic waves
- Locations subject to large amounts of static electricity
- Locations subject to large amounts of high frequencies and waveform distortion (e.g., from inverters or thyristor circuits)

2. Wiring

Adhere to the following rules when connecting the wires:

- When connecting an instrument with accessories, first make sure none of the wires are live.
- The connector terminals on the wires should be appropriate for the electricity load and terminal size.
- Connect the wires properly as illustrated in the wiring diagrams of catalogs or on product labels.
- Fasten connector terminals to the proper torque for the size of screw being used.
- Instruments that are combined with current transformers (CT) should be properly connected to the secondary side of the CT. Improper connection may result in a CT failure, burned components, or a fire. When the secondary side of a CT is disconnected, especially while the primary side is powered, the secondary side terminal will carry a high voltage which could result in electrical shock. Therefore, the secondary side should be short-circuited before the instrument is disconnected.

3. Usage precautions

- Use the instrument within the rated specifications. Failure to do so can cause the equipment to malfunction or result in a failure.
- While the power is on, do not touch any terminals or open the cover or case.
- The current transformer emits heat while powered, so do not touch it.
- Never change the plug at the terminal when operating the instruments.

4. What to do if the equipment functions abnormally or fails

- If you notice abnormal heating, or a strange odor, noises, or smoking or if the equipment seems to have failed, immediately take steps such as cutting off the input. Next, contact your YOKOGAWA sales office.

5. Maintaining and checking the equipment

To ensure that your instrument operates properly, perform the following checks on a regular basis:

- Check for damage to the instrument or accessories due to heating or other factors.
- Check for loose attachments or screws (always turn off the power before doing this to ensure safety).
- The instrument covers have been coated with an antistatic agent to block static electricity. Gently wipe dirt off the cover surfaces with a soft, dry cloth. Do not use a wet cloth as this will reduce the effects of the antistatic coating. Do not allow cloths made from synthetic materials to contact the cover for an extended period of time, and do not use benzene, paint thinner, or similar substances. Doing so may cause the cover to become deformed, discolor it, or cause cracking.
- If the indicator reading becomes unstable due to static electricity, coat the front and back of the cover with a commercially available antistatic agent.
- Instrument service life will vary according to usage conditions. In general, however, we recommend replacing the instrument after about 15 years of use.

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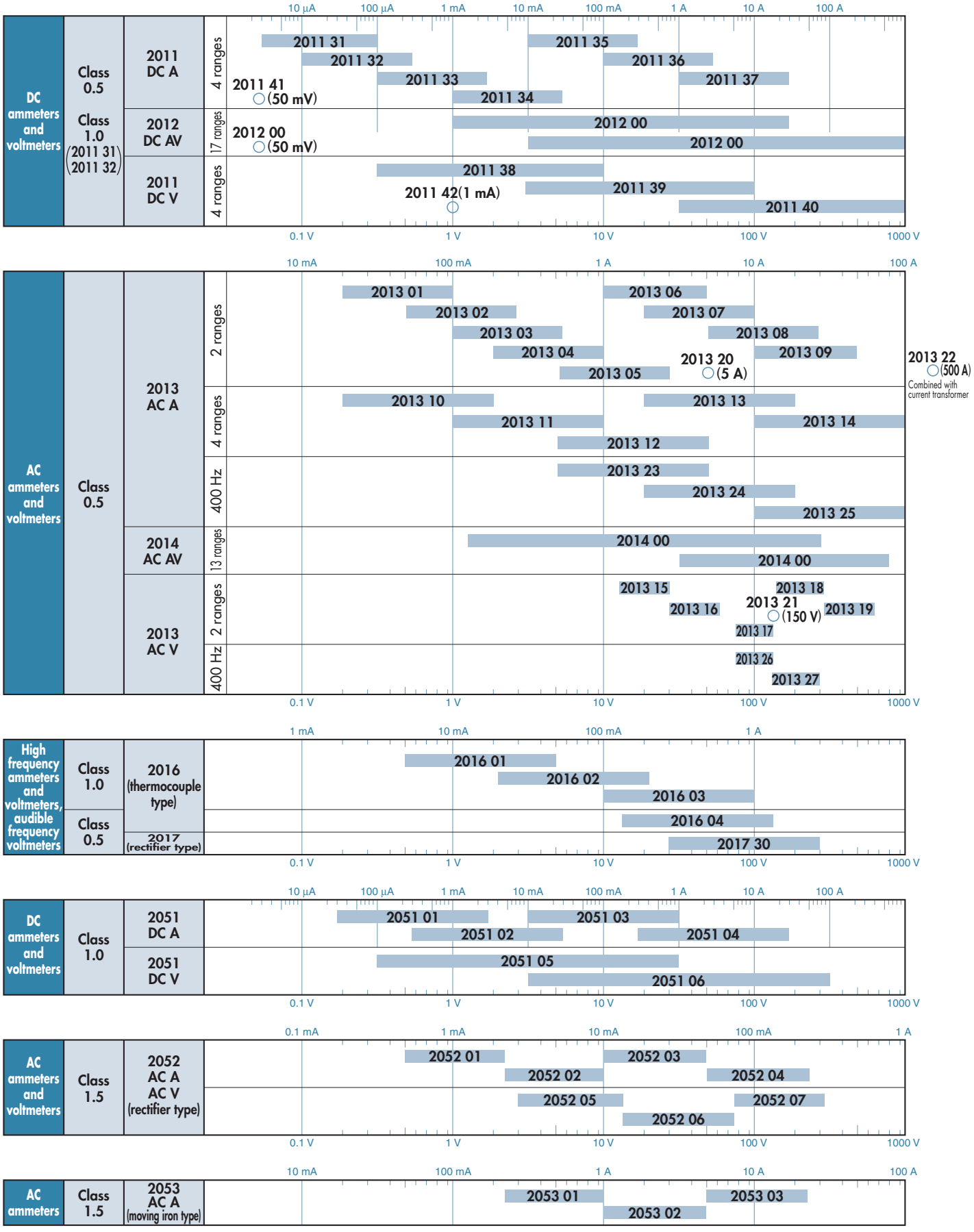
Portable Instrument (Ammeter and Voltmeter)

Category	Class	Model	Measurement range (maximum scale value)

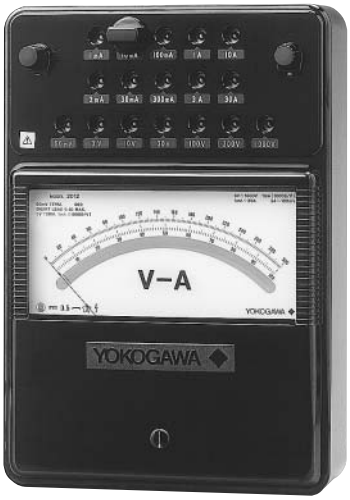


Portable DC Ammeters and Voltmeters

2011, 2012

Models 2011 and 2012 are moving coil type instruments using a taut-band suspension system. The suspension system provides excellent reproducibility without friction, and strong resistance to shock impact. These precision instruments combine a magnetic circuit (sandwich mechanism) that blocks the effects of external magnetic fields, and a superior temperature compensation circuit.

2011 33



2012 00

Features

- Taut-band suspension system eliminates friction and provides strong resistance to shock impact.
- Stable performance ensures that changes over time are negligible.
- Quick response and easy-to-read scale
- Superior temperature compensation circuit reduces external temperature effects.
- Magnetic circuit (sandwich mechanism) reduces the effects of external magnetic fields.

Specifications

Operating principle : Permanent moving coil
Class : JIS C 1102, equivalent to Class 0.5 (Notes1.)
Operating position : Horizontal
Scale length : Approximately 135 mm (deflection angle: 85°)
Scale divisions : 100/150
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500 V/More than 10 MΩ
Voltage test : Between electrical circuit and the case AC 3000 V for 5 seconds

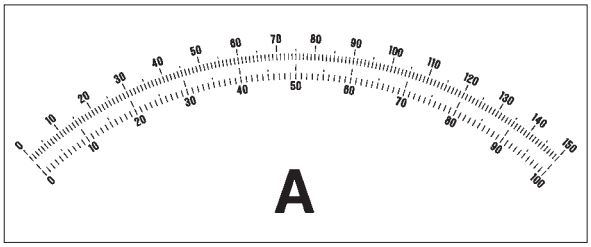
External dimensions and weight:
2011 Approximately 197 × 181 × 92 mm, approximately 1.7 kg
2012 Approximately 260 × 180 × 120 mm, approximately 2.8 kg
Standard accessories : Instruction Manual (1)
Dustproof Cover (2012 00 only)
Shunt cable (2011 41, 2012 00 only)
Optional accessories (sold separately) : 2291 01 Carrying case for 2011 (page 10)
2292 01 Carrying case for 2012 (page 10)

Model		Maximum scale value		Approximate internal resistance and consumed power	
2011	31	* 3/10/30/100	μA	5.1/18.3/7.7/2.5	kΩ
	32	* 10/30/100/300	μA	6.8/6.8/2.5/0.88	kΩ
	33	0.1/0.3/1/3	mA	750/750/278/97.5	Ω
	34	1/3/10/30	mA	23/14/4.7/1.6	Ω
	35	10/30/100/300	mA	Voltage drop 50 mV	
	36	0.1/0.3/1/3	A		
	37	1/3/10/30	A		
	38	0.3/1/3/10	V	1 mA (1000 Ω/V)	
	39	3/10/30/100	V		
	40	30/100/300/1000	V		
	41	(50 mV)		93 Ω	
	42	(1 mA)		Voltage drop 3 V (1000 Ω/V)	
2012	00	3/10/30/100/300/1000 V 1/3/10/30/100/300 mA 1/3/10/30 A/50 mV (17 different measurement ranges)		Voltage measurement range Approximately 1 mA (1000 Ω/V) Current measurement range <Range> <Voltage drop> <Range> <Voltage drop> 1 mA 24 mV 1 A 53 mV 3 mA 41 mV 3 A 56 mV 10 mA 47 mV 10 A 75 mV 30 mA 49 mV 30 A 100 mV 100 mA 50 mV 50 mV 59 Ω 300 mA 51 mV	

Notes

1. 201131 and 201132 are equivalent to Class 1.0.
2. Not JIS-approved.
3. For ranges higher than 30 A, externally connect a shunt 2215-2217 (page 10) to the 50 mV terminal on 2011 41 (50 mV instrument) or 2012, 2011 41 (50 mV instrument) and 2012 both come with a set of shunt cables (two 1.5-meter cables with 0.025 Ω resistance). Different cables may be used if the cable resistance is 0.1 Ω or less.
4. For ranges higher than 1000 V, use 2011 42 (1 mA instrument) or externally connect external multiplier 2222 or 2223 (page 10) to the 3 V terminal on 2011 or 2012.

Scale



Scale on 2011 41 50 mV instrument

2011 41 50 mV instrument and 2011 42 1 mA instrument

The scale for the 50 mV instrument has 100 and 150 divisions. A 50 mV current transformer may be combined with any rated current instrument to read measurements through a simple conversion process. DC scales (single scale or dual scale) are also available by special order.

Portable AC Ammeters and Voltmeters

2013, 2014

Models 2013 and 2014 are moving iron type instruments using a taut-band suspension system. The suspension system provides excellent reproducibility without friction, and good resistance to shock impact. A cap shield mechanism serving to reduce external magnetic fields, a superior temperature compensation circuit, and other components ensure stable performance.

Features

- Taut-band suspension system eliminates friction and provides good resistance to shock impact.
- Stable performance ensures that changes over time are negligible.
- Magnetic circuit reduces the effects of external magnetic fields.
- Superior temperature compensation circuit reduces external temperature effects.

2013 14

2014 00

Specifications

Operating principle : Moving iron type
Class : JIS C 1102, equivalent to Class 0.5
Operating position : Horizontal
Scale length : Approximately 135 mm (deflection angle: 85°)
Rated Frequency : 50/60 Hz
Scale divisions : Check the symbols below against the instrument list.

A: 100 divisions B: 150 divisions C: 100/150 divisions
D: 100/125 divisions E: 120/150 divisions

Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500 V/More than 10 MΩ
Voltage test : Between electrical circuit and the case AC 3000 V for 5 seconds
External dimensions and weight :
2013 Approximately 197 × 181 × 92 mm, approximately 1.7 kg
2014 Approximately 260 × 180 × 120 mm, approximately 4.2 kg
Standard accessories : Instruction Manual (1)
Dustproof Cover (2014 00 only)
Current transformer 2244 (2013 22)
Optional accessories (sold separately) : 2291 01 Carrying case for 2013 (page 10)
2292 01 Carrying case for 2014 (page 10)

Model		Maximum scale value			Approximate internal resistance and consumed power	
		(scale divisions)				
2013	01	20/100	mA	A	0.3/0.2	VA
	02	50/250	mA	D	0.5/0.5	VA
	03	100/500	mA	A	0.5/0.5	VA
	04	0.2/1	A	A	0.4/0.4	VA
	05	0.5/2.5	A	D	0.5/0.5	VA
	06	1/5	A	A	0.6/0.6	VA
	07	2/10	A	A	0.7/0.7	VA
	08	5/25	A	D	1/1	VA
	09	10/50	A	A	1.2/1.8	VA
	10	20/50/100/200	mA	A	0.4/0.3/0.2/0.3	VA
	11	0.1/0.2/0.5/1	A	A	0.2/0.3/0.4/0.5	VA
	12	0.5/1/2/5	A	A	0.7/0.6/0.5/0.3	VA
	13	2/5/10/20	A	A	0.5/0.3/0.6/0.9	VA
	14	10/20/50/100	A	A	0.6/0.9/1.7/2.4	VA
	15	15/30	V	B	3.8 VA	
	16	30/75	V	B		
	17	75/150	V	B		
	18	150/300	V	B		
	19	300/750	V	B		
	20	(5 A)		C	0.2 VA	
	21	(150 V)		C	3.8 VA	
	22	500 A (500 A)		D	Used in combination with current transformer 2244 (accessory)	
2013 (for 400 Hz)	23	0.5/1/2/5	A	A	1.2 VA	
	24	2/5/10/20	A	A		
	25	10/20/50/100	A	A	3.5 VA	
	26	75/150	V	B	3.8 VA	
	27	150/300	V	B		
2014	00	30/75/150/300/750 V 0.15/0.3/0.75/1.5/3/ 7.5/15/30 A (13 different measurement ranges)		B	Each voltage measurement range 4.5 VA Current measurement range 7.5 A or less 0.7 VA 15 A 0.9 VA 30 A 2 VA	

Notes

1. For ranges higher than 100 A, externally connect current transformer 2241 or 2242 (page 9) to the 5 A terminal on 2013 20 (5 A instrument) or 2013, or the 7.5 A terminal on 2014.
2. For ranges higher than 750 V, use to 2013 21 (150 V instrument), or externally connect voltage transformer 2261 or 2262 (page 9) to the 150 V terminal on 2013 or 2014.
3. The scales on 2013 20 (5 A instrument) and 2013 21 (150 V instrument) are dual scale (100 and 150) with both scales printed. These standard scales are easy to use through a simple conversion process with CTs and VTs of any rating. DC scales (single scale or dual scale) are also available by special order.
4. Not JIS-approved.

Portable High-frequency AC Ammeters and Voltmeters, Portable Audio-Frequency Voltmeters

Portable High-frequency AC Ammeters and Voltmeters 2016

Portable Audio-Frequency Voltmeters 2017

Model 2016 consists of thermocouple type ammeters and voltmeters with four different measurement ranges. They are designed to provide true RMS values of inputs, so they can be used to measure high-frequency currents and voltages (DC) up to several MHz (the maximum frequency for the voltmeter is 100 kHz). The indicator is based on a taut-band suspension system, which eliminates friction, provides good resistance to vibrations and shock impact, and ensures excellent characteristics.
Model 2017 is a rectifier type, Class 0.5 voltmeter designed for the audio-frequency range.

2016 03 (ammeter)

2017 30

Features

- Taut-band suspension system eliminates friction and provides good resistance to shock impact.
- 2016: For measurements (DC) up to high frequencies
- 2017: For measurements from 45 Hz to 10 kHz with 1000 Ω/V internal resistance

Specifications

Model 2016 will be discontinued July 29, 2016.

2016

Operating principle : Thermocouple type
Class : JIS C 1102
2016 01~03 : Equivalent to Class 1.0
2016 04 : Equivalent to Class 0.5
Operating position : Horizontal
Scale length : Approximately 135 mm (deflection angle: 85°)
Scale divisions : 100 for ammeters, 150 for voltmeter
Overload : Approximately 1.5 times rated current (or approximate consumed current)
Rated Frequency : 50/60 Hz
Operating frequency : 2016 01; DC, 10 Hz to 5 MHz
2016 02; DC, 10 Hz to 2 MHz
2016 03; DC, 10 Hz to 1 MHz
2016 04; DC, 10 Hz to 100 kHz
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500V/More than 10 MΩ
Voltage test : Between electrical circuit and the case AC 2000 V for 5 seconds
External dimensions and weight:
2016 01~03 Approximately 260×180×141 mm, approximately 2.5 kg
2016 04 Approximately 197×181×92 mm, approximately 1.8 kg
Standard accessory: Instruction Manual (1)
Optional accessories (sold separately): 2291 01 Carrying case for ammeters (page 10)
2292 01 Carrying case for voltmeter (page 10)
209910-13 (origin: B9646BB) Spare thermocouple

Model		Maximum scale value		Approximate consumed current
2016	01	5/10/20/50	mA	Voltage drop: 375 mV
	02	20/50/100/200	mA	
	03	100/200/500/1000	mA	
	04	15/30/75/150	V	5 mA (200 Ω/V)

Notes
1. During measurements, do not allow the current to reach or exceed 1.5 times the rated current or consumed current.
2. If the thermocouple is accidentally burned, it can be easily replaced if you purchase a spare thermocouple. Note, however, that replacing the thermocouple changes the tolerance as follows: 2016 01~03: Class 1.5 2016 04: Class 1.0
3. Ammeters are enclosed in a full shield case, and are connected to the ± terminal. A milliampere terminal must be connected to the load in order to measure high-frequency currents.
4. Not JIS-approved.
5. Calibration certificate corresponds to commercial frequency (45 Hz to 65 Hz)

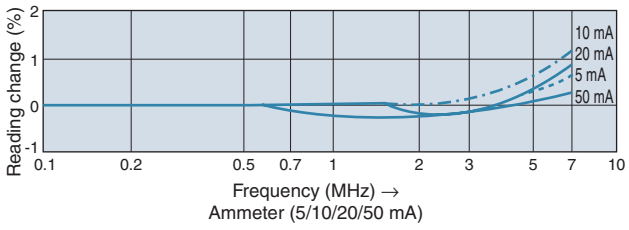
2017 30

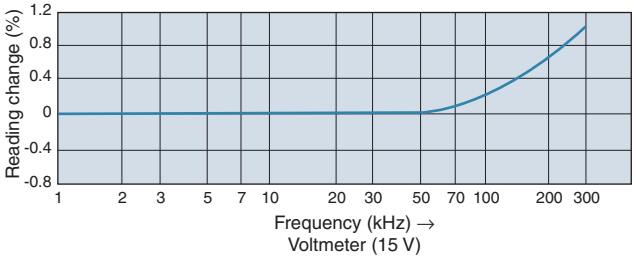
Operating principle : Rectifier type
Class : JIS C 1102, equivalent to Class 0.5
Operating position : Horizontal
Scale length : Approximately 135 mm (deflection angle: 85°)
Scale divisions : 150
Maximum scale value : 30/75/150/300 V
Rated Frequency : 50/60 Hz
Operating frequency : 45 Hz to 10 kHz
Approximate consumed current : 1 mA (1000 Ω/V)
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500V/More than 10 MΩ
Voltage test : Between electrical circuit and the case AC 2000 V for 5 seconds
External dimensions and weight : 197×181×92 mm, approximately 1.8 kg
Optional accessories (sold separately) : 2291 01 Carrying case (page 10)

Notes
1. May also be used as an Epstein testing magnetic flux voltmeter.
2. Not JIS-approved.
3. Calibration certificate corresponds to commercial frequency (45 Hz to 65 Hz)

Characteristics

2016 frequency characteristics (examples)





Portable Needle-indicator Frequency Meters

2038

Model 2038 uses a transducer to convert a measured frequency to a proportionate DC current, then shows the current as a DC current reading. The transducer, combined with a high sensitivity moving coil type indicator based on YOKOGAWA's proprietary taut-band suspension system, provides a level of performance not possible with conventional frequency meters. In addition to frequency measurements for research labs and schools, the 2038 can be used as a standard for measurement control labs and field tests.

2038 31

Features

- A wide range of frequencies (45~500 Hz) can be measured with the broad selection of models.
- True equivalent scale enables measurement of continuous frequency changes.
- A wide range of voltages (50~300 V) can be used.
- RMS response (differential system) minimizes waveform effects.
- Anti-shock structure provided by taut-band design.

Specifications

Operating principle : Needle-indicator frequency meter (differential system)
Class : JIS C 1102 (fiducial value: Max value see table below)
Operating position : Horizontal
Rated voltages : 120/240
120 V ... Can be used between 50 and 135 V.
240 V ... Can be used between 130 and 300 V.
Scale length : Approximately 135 mm (deflection angle: 85°)
Consumed power : 120 V ... Approximately 1.3 VA 240 V ... Approximately 2 VA

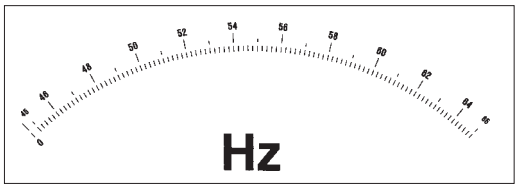
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500 V/More than 10MΩ
Voltage test : Between electrical circuit and the case AC 2000V for 5 seconds
External dimensions and weight : 197 × 181 × 92 mm, approximately 1.8 kg
Standard accessory : Instruction Manual (1)
Optional accessories (sold separately) : 2291 01 Carrying case (page 10)

Model		Measurement range	Class	Scale divisions
2038	31	45 ~ 65 Hz	Equivalent to Class 0.2	100 divisions (0.2 Hz/div)
	32	20 ~ 100 Hz	Equivalent to Class 1.0	80 divisions (1 Hz/div)
	03	100 ~ 300 Hz	Equivalent to Class 0.5	100 divisions (2 Hz/div)
	04	300 ~ 500 Hz	Equivalent to Class 0.5	100 divisions (2 Hz/div)
	11	45 ~ 55 Hz	Equivalent to Class 0.2	100 divisions (0.1 Hz/div)
	12	55 ~ 65 Hz	Equivalent to Class 0.2	100 divisions (0.1 Hz/div)

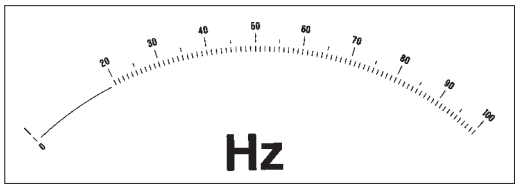
Notes

1. If the voltage exceeds 300 V, externally connect an instrument voltage transformer 2261 or 2262 (page 9).
2. Not JIS-approved.
3. Tolerance is "percentage" with respect to maximam scale value. For 203831, 65 × ±0.2% = ±0.13Hz.

Scale



45~65 Hz



20~100 Hz

(Note: Frequencies from 0 to 20 Hz are outside the measurement range.)

Portable Power Factor Meters

2039

Model 2039 is a revolutionary series of portable wattmeters in which a power factor is used to operate the DC indicator. This is done using a transducer which provides a DC current proportionate to the voltage-current phase by means of a circuit. Model 2039 can be used in single-phase and balanced three-phase circuits. The electronic transducer, combined with a high sensitivity moving coil type indicator based on YOKOGAWA's proprietary taut-band suspension system, provides a level of performance not possible with conventional power factor meters.

2039 02

Features

- For both single-phase and three-phase (balanced circuit).
- Excellent current characteristic: 20~200% of rated current (short time period)
- Wide range of applicable voltages: 60~300 V AC
- Phase angle scale included
- Taut-band suspension system eliminates friction and provides strong resistance to shock impact.

Specifications

Operating principle : Rectifier type
Class : JIS C 1102, equivalent to Class 3.0 (fiducial value: 90 DEG)
Operating position : Horizontal
Rated frequency : 50/60 Hz
Scale length : Approximately 135 mm (deflection angle: 85°)
Scale : Lead 0-0.3 to 1.0 to 0.3-0 lag (with phase angle scale)
Effective measurement range: Lead 0.5 to 1.0 to 0.5 lag
Consumed power Voltage circuit (120 V) : Approximately 0.14 VA
Current circuit (5 A) : Approximately 2.4 VA
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH

Insulation test :
Between electrical circuit and the case DC 500V/More than 10MΩ
Between current circuit and voltage circuit DC 500V/More than 5MΩ
Voltage test :
Between electrical circuit and the case AC 2000 V for 5 seconds
Between current circuit and voltage circuit AC 1500 V for 5 seconds
External dimensions and weight :
Approximately 260 × 180 × 141 mm, approximately 2.9 kg
Standard accessory : Instruction Manual (1)
Optional accessories (sold separately) : 2292 01 Carrying case (page 10)

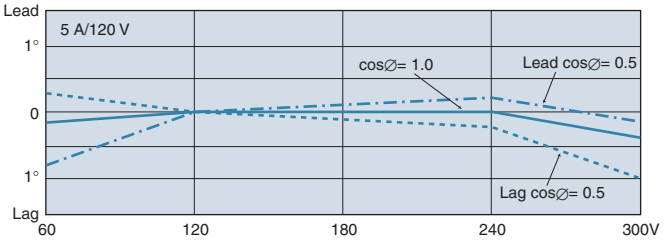
Model		Rated current	Rated voltage
2039	01	0.2/1 A	120 V (Can be used between 60 and 300 V.)
	02	1/5 A	
	03	5/25 A	

Notes

1. For measurements exceeding the rated current (25 A), externally connect a current transformer 2241-2243 (page 9) to the 5 A terminal.
2. For measurement with a voltage exceeding 300 V, externally connect a voltage transformer 2261 or 2262 to the 120 V terminal. (page 9)
3. Not JIS-approved.

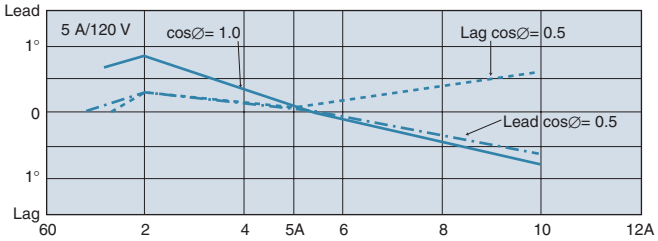
Characteristics

Voltage characteristic



• JIS specification: Error within 100% of class index within ±15% of rated voltage.

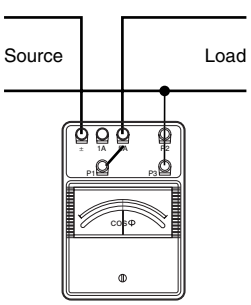
Current characteristic



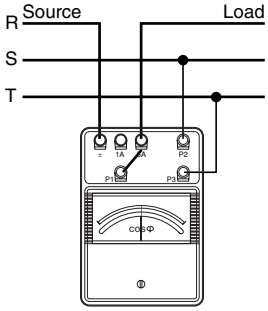
• JIS specification: Error within 100% of class index within 20% to 120% of rated current.

Connection diagrams

Single-phase circuit



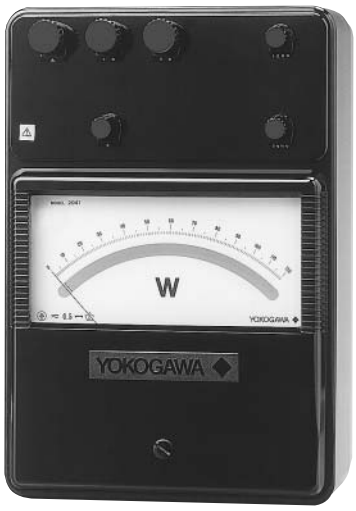
Balanced three-phase circuit



Portable Wattmeters

2041 and 2042

Model 2041 single-phase wattmeters and single-phase low-power-factor wattmeters and Model 2042 three-phase wattmeters are electrodynamometer type wattmeters with indicators based on taut-band suspension. They can handle DC and frequencies from 25 Hz to 1000 Hz, and provide excellent power factor characteristics. These instruments are shielded with dual permalloy sheets as protection against external magnetic fields.



2041 02

2042 02

Features

- Frequency range: DC, 25 Hz to 1000 Hz (2041 01~03, 2042 01~03)
- Effective for measurement of low-power-factor load power and small power (2041 11~13, 21, 22)
- Low self-consuming power
- Taut-band suspension system eliminates friction and provides strong resistance to shock impact.

Specifications

Operating principle : Electrodynamometer type
Operating position : Horizontal
Scale length : Approximately 135 mm (deflection angle: 85°)
Scale divisions : 120
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500V/More than 10MΩ
Between current circuit and voltage circuit DC 500V/More than 5MΩ
Voltage test : Between electrical circuit and the case AC 2000 V for 5 seconds
Between current circuit and voltage circuit AC 1500 V for 5 seconds
External dimensions and weight :
2041 Approximately 260 × 180 × 136 mm, Approximately 2.8 kg
2042 Approximately 260 × 180 × 136 mm, Approximately 3.2 kg
Standard accessory : Instruction Manual (1)
Optional accessories (sold separately) : 2292 01 Carrying case (page 10)

Product/model / Parameter	Single-phase wattmeter 2041		
	01	02	03
	Three-phase wattmeter 2042		
	01	02	03
Class	JIS C 1102, equivalent to Class 0.5		
Rated voltage (approximate consumed power)	120/240 V (1.2/2.4 VA)		
Rated current (approximate consumed power)	0.2/1 A (0.66/0.56 VA)	1/5 A (0.93/0.84 VA)	5/25 A (1.72/1.69 VA)
Rated power factor	1.0		
Operating frequency	DC, 25~1000 Hz		
Rated Frequency	50/60 Hz		

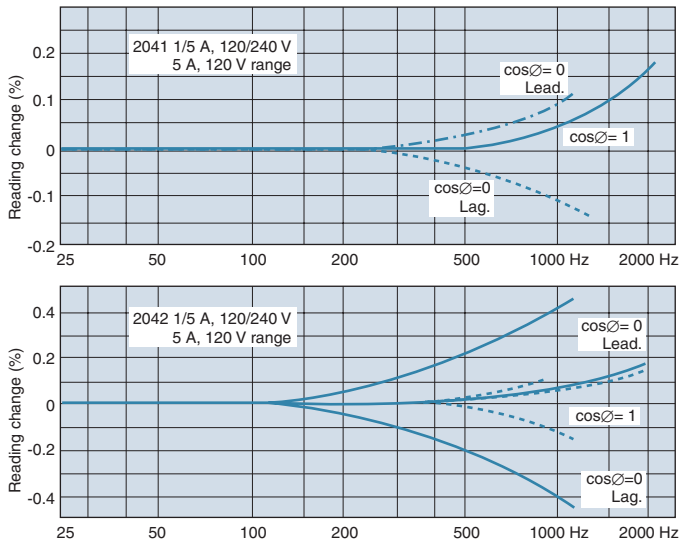
Product/model / Parameter	Single-phase low-power-factor wattmeter (Note 5) 2041				
	11	12	13	21	22
Class	JIS C 1102, equivalent to Class 0.5				
Rated voltage (approximate consumed power)	120/240 V (2.4/4.8 VA)			30/60 V (0.6/1.2 VA)	
Rated current (approximate consumed power)	0.2/1 A (1.25/1.09 VA)	1/5 A (1.7/1.5 VA)	5/25 A (2.62/2.5 VA)	0.2/1 A (1.25/1.09 VA)	1/5 A (1.7/1.5 VA)
Rated power factor	0.2				
Operating frequency	25~1000 Hz				
Rated Frequency	50/60 Hz				

Notes

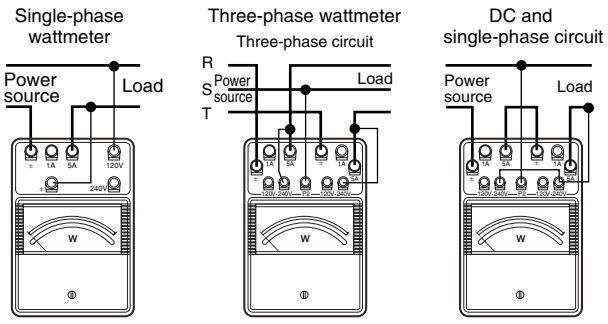
1. For measurements exceeding the rated current (25 A), externally connect a current transformer 2241-2243 (page 9) to the 5 A terminal (two required for three-phase).
2. If the rated voltage (240 V) is exceeded, externally connect an instrument voltage transformer 2261 or 2262 (page 9) (two required for three-phase).
3. The low-power-factor wattmeter is used with Epstein test sets, as well as for measurement of low-power-factor power and small power.
4. Three-phase wattmeter total consumed power = (voltage range + current range)×2
5. Single-phase low-power factor wattmeters are and "cosø = 0.2" is printed on the top right corner of scales.
6. Not JIS-approved

Characteristics

Frequency characteristic (examples)



Connection diagrams



Miniature Portable Ammeters and Voltmeters

2051, 2052, 2053

The E series of miniature portable instruments consists of JIS C 1102-2 Class 1.0 and Class 1.5 instruments. The taut-band suspension system is used in the moving parts of Models 2051 and 2052 to eliminate friction and provide strong resistance to shock impact.
These instruments are functional and compact, making them suitable for labs at research centers and schools. They are also very useful for factory setups in which numerous instruments are arranged on a small tabletop area, and they are small enough to be carried for maintenance service use.

2051 03

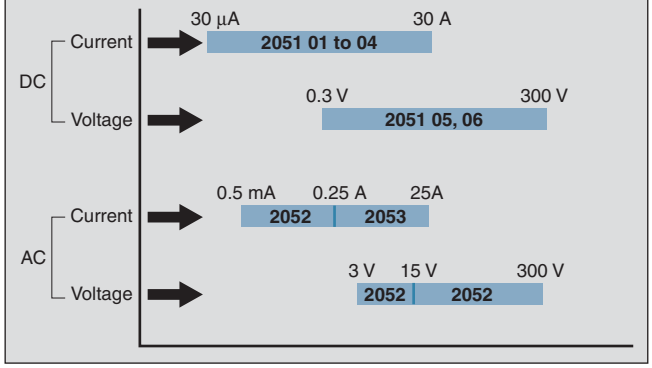
2052 06

2053 03

Features

- Useful for both high-sensitivity and large-volume measurements
  DC: 30 μA~30 A, 0.3 V~300 V
  AC: 500 μA~25 A, 3 V~300 V
- Taut-band suspension system eliminates friction and provides strong resistance to shock impact.
- Small and lightweight, with easy-to-read mirrored scale

Measurement ranges



Specifications

Operating principle : 2051 Permanent magnet moving coil type
2052 Rectifier type (approximating RMS rectifier type for 15~300 V)
2053 Moving iron type
Class : JIS C 1102
2051... Equivalent to Class 1.0, 2052, 2053...
Equivalent to Class 1.5
Scale length : Approximately 88 mm (deflection angle: 90°)
Needle : Bladed needle (red)
Operating position : Horizontal
Rated Frequency : 50/60 Hz
Operating temperature and humidity ranges : 0 to 40°C, 25 to 80%RH
Storage temperature and humidity ranges : -10 to 50°C, 25 to 80%RH
Insulation test : Between electrical circuit and the case DC 500V/More than 10MΩ
Voltage test : Between electrical circuit and the case AC 2000 V for 5 seconds
External dimensions and weight :
Approximately 113 × 106 × 46 mm Approximately 0.35 kg
Optional accessories (sold separately):
2291 02 Carrying case for E series of miniature portable instruments
A case 93042 (origin: B9604WM) that can hold the instrument as well as leads and other accessories is also available. (page 10)

Single deflecting meter

Model		Maximum scale value			Approximate internal resistance, consumed power	
2051	01	30//100/300/1000/3000	μA	DC	5/6.8/2.8/0.9/0.3	kΩ
	02	0.3/1/3/10/30	mA	DC	970/390/140/43/14	Ω
	03	10/30/100/300/1000	mA	DC	4/1.4/0.4/0.14/0.04	Ω
	04	0.3/1/3/10/30	A	DC	0.14/0.04/0.014/0.004/0.001	Ω
	05	0.3/1/3/10/30	V	DC	100 μA (10 kΩ/V)	
	06	3/10/30/100/300	V	DC		
2052	01	0.5/1/2.5	mA	AC	3 V	
	02	2.5/5/10	mA	AC		
	03	10/25/50	mA	AC		
	04	50/100/250	mA	AC		
	05	3/7.5/15	V	AC	1 mA	
	06	15/30/75	V	AC		
	07	75/150/300	V	AC		
2053	01	0.25/0.5/1	A	AC	1/1/1	VA
	02	1/2.5/5	A	AC	0.9/0.8/0.7	VA
	03	5/10/25	A	AC	0.6/0.9/2.3	VA

Zero-Centermeter

Model		Maximum scale value			Approximate internal resistance, consumed power	
2051	11	±0.15/0.5/1.5/5/15	mA	DC	970/390/140/43/14	Ω
	12	±0.3/1/3/10/30	mA	DC	1170/400/135/40/14	Ω
	13	±5/15/50/150/500	mA	DC	4/1.4/0.4/0.14/0.04	Ω
	14	±10/30/100/300/1000	mA	DC	4/1.5/0.4/0.15/0.04	Ω
	15	±0.15/0.5/1.5/5/15	A	DC	0.14/0.04/0.014/0.004/0.001	Ω
	16	±0.3/1/3/10/30	A	DC	0.15/0.14/0.11/0.004/0.001	Ω
	17	±0.15/0.5/1.5/5/15	V	DC	50 μA (20 kΩ/V)	
	18	±0.3/1/3/10/30	V	DC	100 μA (10 kΩ/V)	
	19	±1.5/5/15/50/150	V	DC	50 μA (20 kΩ/V)	
	20	±3/10/30/100/300	V	DC	100 μA (10 kΩ/V)	

Note

1. Not JIS-approved.

Instrument Transformers

2241, 2242, 2261

Instrument transformer is s general term for voltage transformers and current transformers that are used with electrical instruments. The main purpose of instrument transformers is to extend the measurement range for electrical quantities (voltage, current, power, power factor) on large-current and high-voltage circuits. They serve to convert currents and voltages to levels that are suitable for measurement, and to insulate the instrument, etc. from high-voltage circuitry.

Features

- Precision conversion of electrical quantities on AC large-current or high-voltage circuits
- Secondary circuit is isolated from primary circuit.
- Capable of wide-range measurement using numerous ranges

  Current : 10 A~1500 A
  Voltage : 220 V~3300 V
  Relative error : ±0.2%

Specifications

JIS C 1731 (equivalent) Instrument transformers

Model / Parameter	Instrument current transformer		Instrument voltage transformer
	2241 00	2242 00	2261 01
Primary	10/15/30/50/100/250/300/500/750/1500 A	10/15/30/50/100/250/300/500/750/1500 A	220/440/2200/3300 V
Secondary	5 A	5 A	110 V
Rated load	15 VA	15 VA	15 VA
Relative error	±0.2%	±0.2%	±0.2%
Phase angle	±10 minutes	±10 minutes	±10 minutes
Class	0.2	0.2	0.2
Maximum circuit voltage	3450 V	6900 V	–
Withstand voltage (for one minute)	10000 V	16000 V	10000 V
Rated frequency	50~60 Hz		50~60 Hz
External dimensions	Approximately 318×272×128 mm	Approximately 348×280×152 mm	Approximately 255 × 266 × 200 mm
Weight	Approximately 9 kg	Approximately 11 kg	Approximately 18 kg

Notes

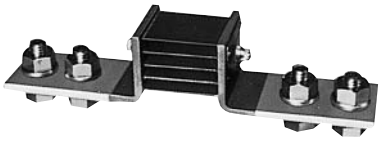
1. Current transformers 2241 and 2242 are terminal type for measurements at 100 A and below, and through type at 250 A and above.
2. In addition to 2241 through 2242, 2244 is also available. The specifications for this transformer (for current measurements only; cannot be used for power measurements) are 500 A primary, 5 A secondary (one range, through type), 1.5 VA rated load, Class 0.2 and 250 V maximum circuit voltage.

Shunts and External Multipliers

Shunts 2215~2217 External Multipliers 2222 and 2223

Shunts

Permissible tolerance : ±0.2% of rated value
Rated voltage drop : 50 mV



2216 (500 A)

Model		Rating	
2215	08	15 A	50 mV
	09	20 A	
	10	30 A	
	11	50 A	
	12	75 A	
	13	100 A	
	14	150 A	
	15	200 A	
	16	300 A	

Model		Rating	
2216	01	500 A	50 mV
	02	750 A	
	03	1000 A	
2217	01	1500 A	
	02	2000 A	
	03	3000 A	
	04	5000 A	

External Multipliers

Class : JIS C 1102 equivalent to Class 0.2
Consumed current : 1 mA

2222 (1.5/3 kV)

Model		Rating
2222	01	0.75/1.5 kV
	02	1/2 kV
	03	1.5/3 kV
2223	00	3/5 kV

2291 and 2292 Carrying Cases

2291 01

2292 01

2291 02

Model		Compatible instruments
2291	01	2011, 2013, 2016 (voltmeters), 2017, 2038
2292	01	2012, 2014, 2016 (ammeters), 2039, 2041, 2042, 3254
2291	02	2051, 2052, 2053

● Carrying cases are useful for carrying and storing instruments.

List of Products

Product	Model		Specifications	
DC ammeter (4 ranges)	2011	31	3/10/30/100	μA
		32	10/30/100/300	μA
		33	0.1/0.3/1/3	mA
		34	1/3/10/30	mA
		35	10/30/100/300	mA
		36	0.1/0.3/1/3	A
		37	1/3/10/30	A
DC voltmeter (4 ranges)		38	0.3/1/3/10	V
		39	3/10/30/100	V
		40	30/100/300/1000	V
DC ammeter		41		(50 mV)
DC voltmeter		42		(1 mA)
DC ammeter and voltmeter	2012	00	17 ranges	
AC ammeter (2 ranges)	2013	01	20/100	mA
		02	50/250	mA
		03	100/500	mA
		04	0.2/1	A
		05	0.5/2.5	A
		06	1/5	A
		07	2/10	A
		08	5/25	A
		09	10/50	A
AC ammeter (4 ranges)		10	20/50/100/200	mA
		11	0.1/0.2/0.5/1	A
		12	0.5/1/2/5	A
		13	2/5/10/20	A
		14	10/20/50/100	A
AV voltmeter (2 ranges)		15	15/30	V
		16	30/75	V
		17	75/150	V
		18	150/300	V
		19	300/750	V
AC ammeter		20		(5 A)
AC voltmeter		21		(150 V)
AC ammeter		22	500 (500A)	A
AC voltmeter (4 ranges) (for 400 Hz)		23	0.5/1/2/5	A
		24	2/5/10/20	A
		25	10/20/50/100	A
AC voltmeter (2 ranges) (for 400 Hz)		26	75/150	V
		27	150/300	V
AC ammeter and voltmeter	2014	00	13 ranges	
High-frequency AC ammeter	2016*	01	5/10/20/50	mA
		02	20/50/100/200	mA
		03	100/200/500/1000	mA
High-frequency AC voltmeter		04	15/30/75/150	V
Audio-frequency voltmeter	2017	30	30/75/150/300	V

*Model 2016 will be discontinued July 29 2016.

Product	Model		Specifications	
Needle-indicator frequency meter	2038	31	45 ~ 65 Hz	120/240 V
		32	20 ~ 100 Hz	120/240 V
		03	100 ~ 300 Hz	120/240 V
		04	300 ~ 500 Hz	120/240 V
		11	45 ~ 55 Hz	120/240 V
		12	55 ~ 65 Hz	120/240 V
Power factor meter	2039	01	0.2/1 A	120 V
		02	1/5 A	120 V
		03	5/25 A	120 V
Single-phase wattmeter	2041	01	0.2/1 A	120/240 V
		02	1/5 A	120/240 V
		03	5/25 A	120/240 V
Single-phase low power factor wattmeter		11	0.2/1 A	120/240 V Power factor: 0.2
		12	1/5 A	120/240 V Power factor: 0.2
		13	5/25 A	120/240 V Power factor: 0.2
		21	0.2/1 A	30/60 V Power factor: 0.2
		22	1/5 A	30/60 V Power factor: 0.2
Three-phase wattmeter	2042	01	0.2/1 A	120/240 V
		02	1/5 A	120/240 V
		03	5/25A	120/240 V
Miniature DC ammeter	2051	01	30/100/300/1000/3000	μA
		02	0.3/1/3/10/30	mA
		03	10/30/100/300/1000	mA
		04	0.3/1/3/10/30	A
		11	±0.15/0.5/1.5/5/15	mA
		12	±0.3/1/3/10/30	mA
		13	±5/15/50/150/500	mA
		14	±10/30/100/300/1000	mA
		15	±0.15/0.5/1.5/5/15	A
		16	±0.3/1/3/10/30	A
Miniature DC voltmeter		05	0.3/1/3/10/30	V
		06	3/10/30/100/300	V
		17	±0.15/0.5/1.5/5/15	V
		18	±0.3/1/3/10/30	V
		19	±1.5/5/15/50/150	V
		20	±3/10/30/100/300	V
Miniature AC ammeter	2052	01	0.5/1/2.5	mA
		02	2.5/5/10	mA
		03	10/25/50	mA
		04	50/100/250	mA
Miniature AC voltmeter		05	3/7.5/15	V
		06	15/30/75	V
		07	75/150/300	V
Miniature AC ammeter	2053	01	0.25/0.5/1	A
		02	1/2.5/5	A
		03	5/10/25	A

Q & A

Is there a way to use the portable instruments in an upright (vertical) position?

Portable instruments must be used in a horizontal position (standard position). There is no assurance of precision within the specified ranges if a portable instrument is set in a vertical or tilted position during use. This is due to the weight balance of the moving parts, including the indicator needle. If the instrument is horizontal, there is basically no balance problem, but if it is vertical, the indicator error will be doubled. There are no strict guidelines on leveling the instrument (e.g., using a spirit level). It should be OK if it is set on a desk (or bench) that is basically level. If you really need to use your portable instrument in a vertical position, you should calibrate it in that position before use.

Can I order measurement leads from YOKOGAWA

YOKOGAWA does not carry measurement leads; you will need to purchase them separately. We do not carry leads because it is very difficult to establish a standard type of lead. This is because, with the exception of chips connected on the instrument end, line diameters, lengths, and the specifications of the remote chip being connected can vary greatly, depending on operating conditions. However, shunt cables (two 1.5-meter cables with 0.05Ω resistance) are provided with external shunt ammeters 2011 14 (50 mV) and 2012 00.

What are Class 0.5 and Class 1.0?

•The current product is not a JIS-approved.

They are precision classes specified in JIS C 1102 (“Direct Acting Indicator Electrical Instruments”). The classes refer specifically to limitations on error and influential fluctuations (characteristics), but are normally used to indicate the maximum tolerance.

Class 0.5 = ±0.5% of fiducial value; percentage of range’s maximum scale value

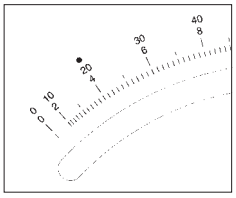
Class 1.0 = ±1.0% of fiducial value; percentage of range’s maximum scale value

What is the solid circle (•) above the scale number on the labels of Models 2013 and 2014?

This indicates the minimum value in the measurement range.

- The range from the scale value marked by the solid circle to the maximum scale value is the guaranteed precision range.
- Values below the scale value marked by the solid circle are outside the guaranteed precision range.

  This mark is specified in JIS C 1102 (“Direct Acting Indicator Electrical Instruments”).



What are the test voltages for the voltage tests on the various meters?

The test voltages are listed below. Tests are done across the input terminal (electric circuit) and the outer casing.

3000 V AC for 5 seconds; 2011, 2012, 2013, 2014

2000 V AC for 5 seconds; 2016, 2017, 2051, 2052, 2053, 2038, 2039, 2041, 2042

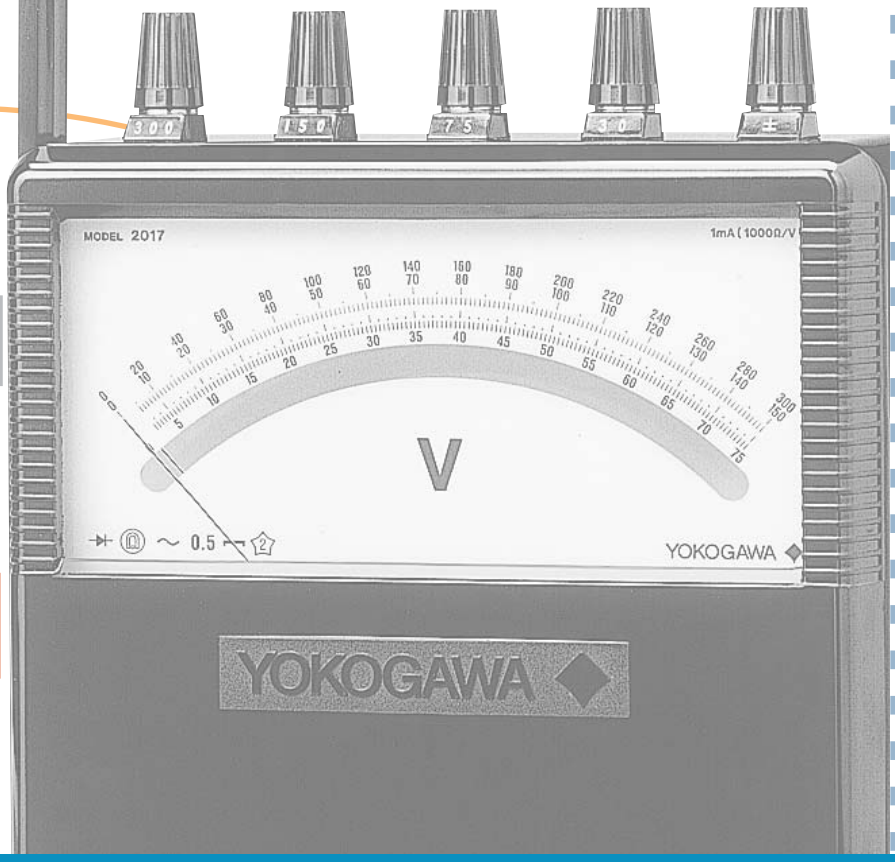
How do you calculate the internal (terminal-to-terminal) resistance or impedance?

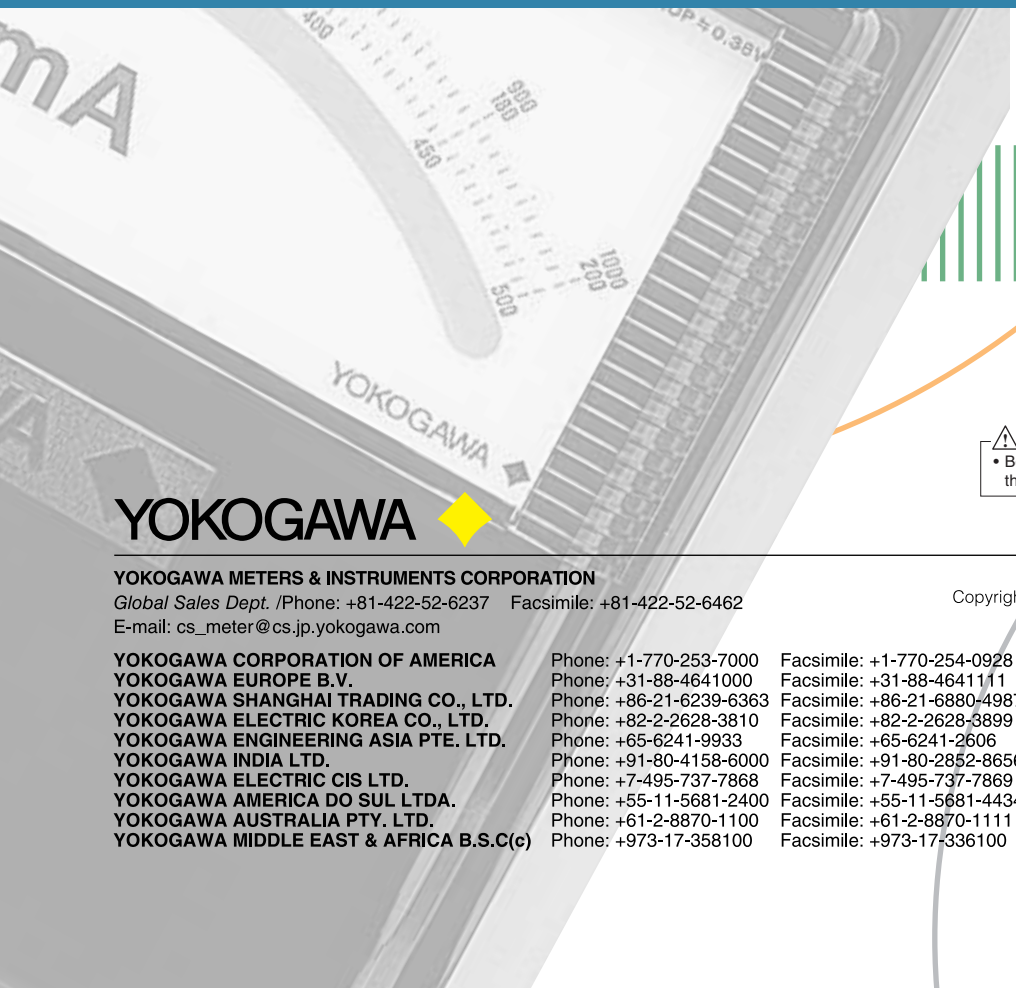
When voltage drop is given on an ammeter; Voltage drop (V)/Range’s rated current (A) = Internal resistance

When consumed current is given on a voltmeter; Range’s rated voltage (V)/Consumed current (A) = Internal resistance

When consumed power is given on an ammeter (circuit); Consumed power (VA)/Square of rated current (A) = Internal impedance

When consumed power is given on a voltmeter (circuit); Square of rated voltage (V)/Consumed power (VA) = Internal impedance





NOTICE

- Before operating the product, read the instruction manual thoroughly for proper and safe operation.

YOKOGAWA

YMI-ME-MI-SE01

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