

Large current power measurement

Current sensors & probes

With the increasing importance of energy efficiency across industries, greater efforts are being made to generate and use power more efficiently.

However, applications such as electric vehicles, railways, etc. often need high current power measurements. Yokogawa's CT series current sensors have the ideal solution to extend the capabilities of power analyzers to support such applications.

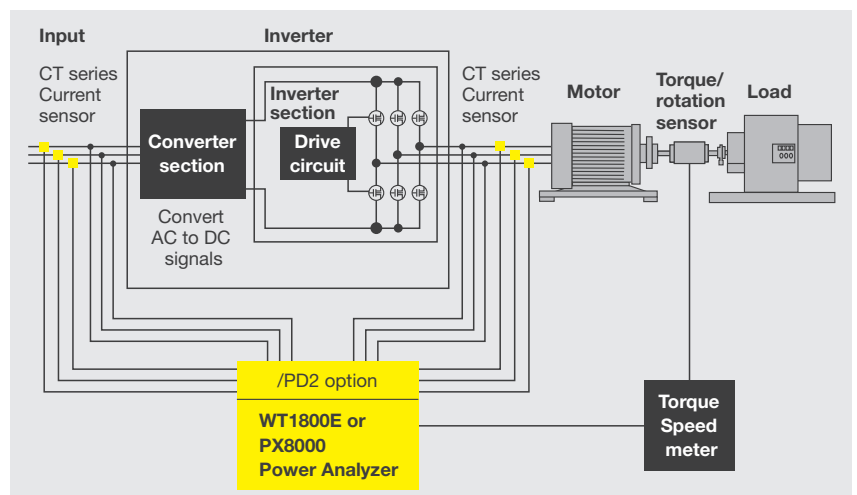
To meet stringent efficiency standards, the CT series offers a wide range of reliable current sensors optimized for multichannel measurements of large AC/DC currents.

The Yokogawa CT series delivers

Accuracy – Excellent linearity ensures precise power measurement for applications that require wide dynamic range where current levels change dramatically.

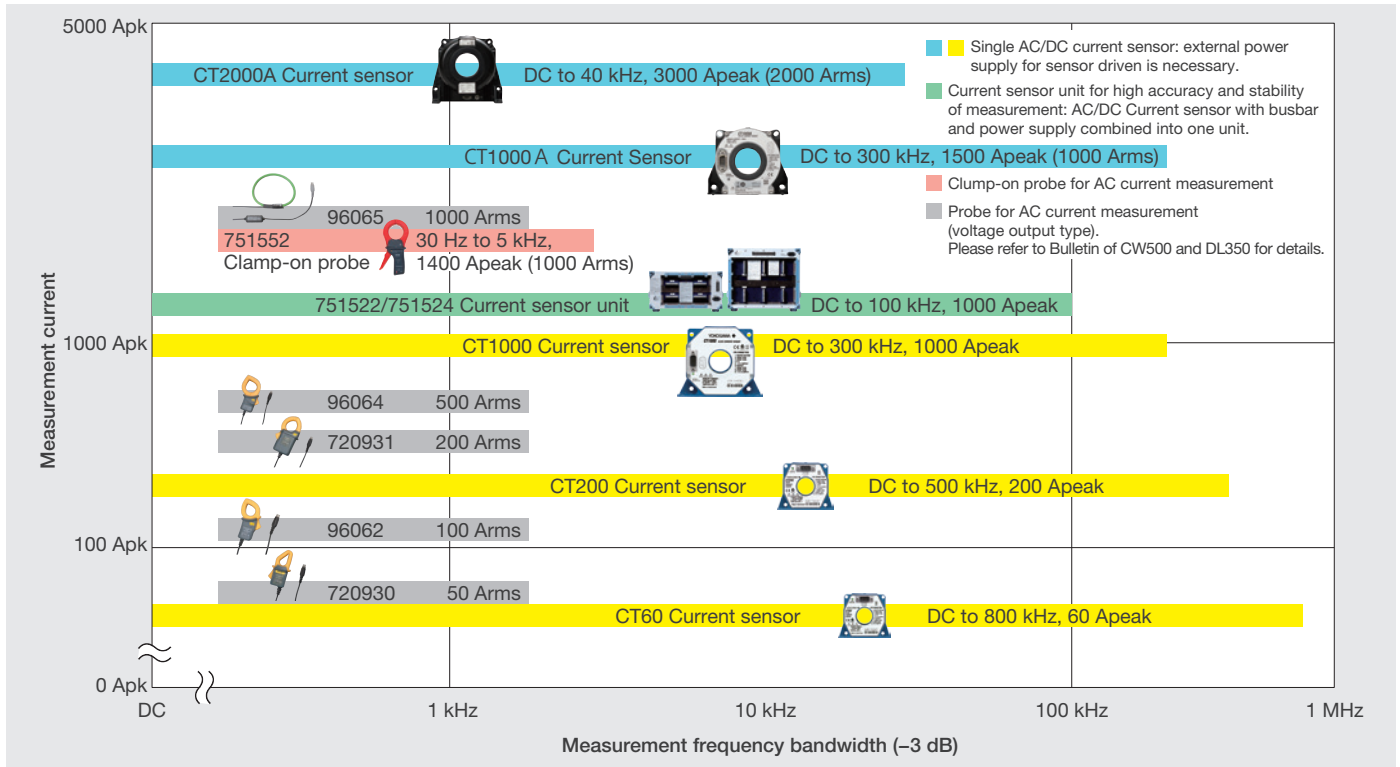
Noise immunity – High resistance to electromagnetic noise minimizes the influence on current readings and enables accurate measurements.

Versatility – Choose from a range of sensors - from 60 A to 2000 A that operate from DC to 40 KHz for power measurement requirements across a variety of applications.

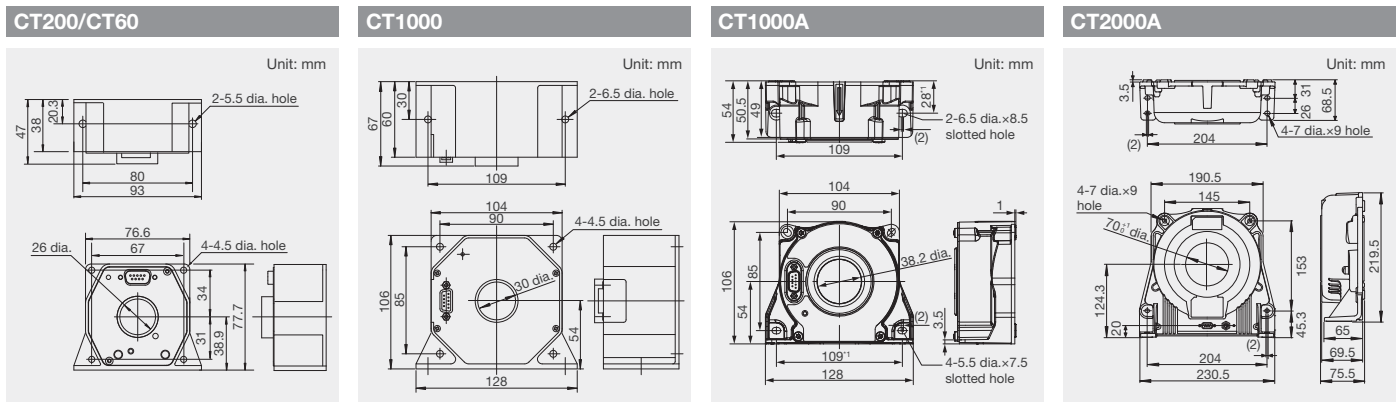


YOKOGAWA supplies many power analyzers with direct current input for precision current and power measurement. In order to measure much bigger current and power precisely, YOKOGAWA provides many current sensors and probes. These accessories support broad applications.

Current sensors & probes



Dimensions



*1 Hole position is different from CT1000.

Combination availability of CT series and current sensor cable

Input Type	Model	CT60	CT200	CT1000	CT1000A	CT2000A
Direct Input	Required load resistance	0 to 20 Ω	0 to 30 Ω	2.5 to 5 Ω	0 to 1 Ω	0 to 1 Ω
	Current Sensor Cable for direct input, 3 m Resistance 2.7 Ω A1589WL	OK	OK	OK	N.A.	N.A.
	Current Sensor Cable for direct input, 5 m No load resistance A1628WL	OK	OK	N.A.	OK	OK
	Current Sensor Cable for Shunt Resistor Box, 3 m A1559WL	OK	OK	OK	N.A.	N.A.
External Input	Current Sensor Cable for Shunt Resistor Box, 5 m A1560WL	OK	OK	OK	N.A.	N.A.
	Whether shunt resistance BOX can be used	OK A1325EZ (20 Ω)	OK A1325EZ (20 Ω)	OK A1323EZ (5 Ω) A1324EZ (10 Ω)	N.A.	N.A.

Current limitations of the /PD2 option when using CT2000A

When connecting the current sensor, CT2000A, to the DC power supply option (/PD2) terminals on a WT1800E or PX8000 Power Analyzer, make sure that the output current does not exceed the range shown below.

WT1800E	PX8000
(Total current consumption for channel 1 through 6) ≤ 6 A	(Total current consumption for channel 1 through 4) ≤ 4 A

AC/DC Current sensor CT Series



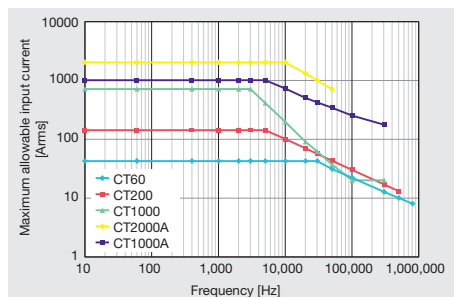
Model	CT60	CT200	CT1000	CT1000A	CT2000A	
Rated Current	DC	0 to 60 A	0 to 200 A	0 to 1000 A	0 to 1000 A	0 to 2000 A
	AC	60 Apeak	200 Apeak	1000 Apeak	1000 Arms (1500 Apeak)	2000 Arms (3000 Apeak)
Current transformation ratio	600:1	1000:1	1500:1	1500:1	2000:1	
Accuracy ^{*1}	DC ±(0.05% of rdg + 30 µA) 50/60 Hz ±(0.05% of rdg + 30 µA) Sine wave			DC ±(0.04% of rdg + 30 µA) 50/60 Hz ±(0.04% of rdg + 30 µA) Sine wave		
Guarantee accuracy period	12 months					
Effect of conductor position	±0.01% of rdg					
Measurement range	DC to 800 kHz (-3 dB)	DC to 500 kHz (-3 dB)	DC to 300 kHz (-3 dB)	DC to 300 kHz (-3 dB)	DC to 40 kHz (-3 dB)	
Temperature coefficient	±0.01%/°C or less in the ranges from 10 to 18°C and 28 to 50°C			±0.01%/°C or less in the ranges from -40 to 18°C and 28 to 85°C		
Maximum allowable continuous input	60 Apeak	200 Apeak	1000 Apeak	1500 Apeak	3000 Apeak	
Maximum allowable instantaneous input (reference value)	300 Apeak 0.1 seconds or less	1000 Apeak 0.1 seconds or less	4500 Apeak 0.1 seconds or less	5000 Apeak 0.1 seconds or less	10000 Apeak 0.1 seconds or less	
Load resistance (±15 V)	0 to 20 Ω	0 to 30 Ω	2.5 to 5 Ω	0 to 1 Ω		
Operating temperature range	10 to 50°C			-40 to 85°C		
Operating humidity range	20 to 80% RH (no condensation)					
Storage temperature range	-20 to 60°C			-40 to 85°C		
Storage humidity range	20 to 80% RH (no condensation)					
Dimensions	Approx. 93 (W) × 77 (H) × 38 (D) mm (excluding connector, conductor guide, and projections)		Approx. 128 (W) × 160 (H) × 60 (D) mm (excluding connector, conductor guide, and projections)		Approx. 230 (W) × 220 (H) × 76 (D) mm	
Primary current hole diameter	26 mm diameter		30 mm diameter	38.2 mm diameter	70 mm diameter	
Secondary connector	D-Sub-9 pin					
Weight	Approx. 0.3 kg		Approx. 0.8 kg	Approx. 1.3 kg	Approx. 4.2 kg	
Power Voltage	±(15 V ±5%)					
Maximum rated power	7 VA	11 VA	30 VA	30 VA	35 VA	
Consumption current (at each power voltage)	Approx. (80 mA + output current)		Approx. (150 mA + output current)	Approx. (120 mA + output current)	Approx. (225 mA + output current)	
Recommended fixing screw and tightening torque	M4 stainless steel screw × 4, 2.8 N·m M5 stainless steel screw × 2, 3.7 N·m		M5 stainless steel screw × 4, 3.7 N·m M6 stainless steel screw × 2, 4.4 N·m		M6 stainless steel screw × 8, 5.5 N·m	

• CT1000A takes approximately 10 seconds to turn on LED after supplying power.

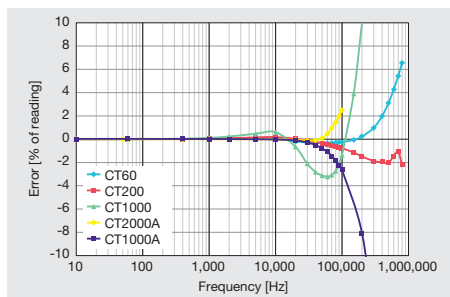
*1 Basic conditions 23 ±5°C
Common mode voltage: 0 V
Conductor: Use a linear conductor with 25 mm diameter and 300 mm or more in length.

Characteristic example

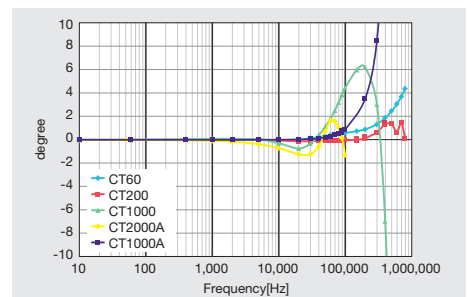
*The characteristic is a typical example, not a guaranteed one.



CT series Primary current derating by frequency example



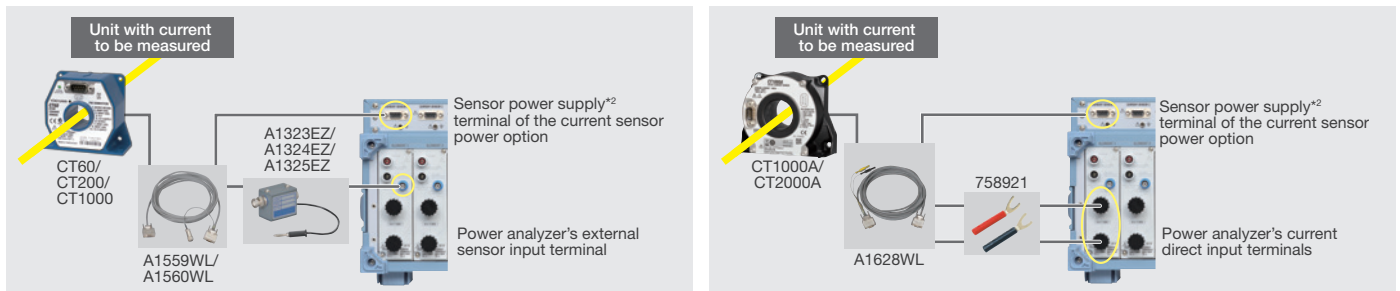
CT series Frequency characteristic example



CT series Phase characteristic example^{*1}

*1 Lead is set as Positive.

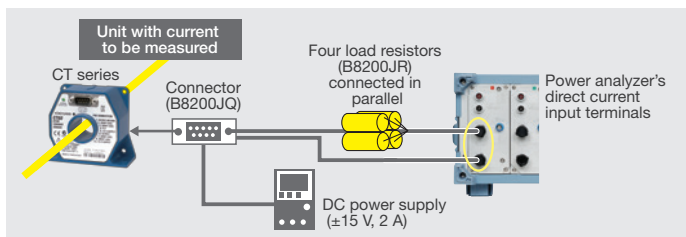
Connection examples*1 making use of built-in DC power supply (/PD2 option)



*1 Use an insulated conductor or cable for wiring on the primary side.

*2 When connected to CT2000A current sensors, use DC power supply option (/PD2) for WT1800E or PX8000. The firmware version is Ver. 3.1 or later of the WT1800E and Ver. 3.2 or later of the PX8000 for usage of /PD2 option. Please inquire about exchanging /PD option for /PD2 option.

Connection example*3, 4 Using external DC power supply



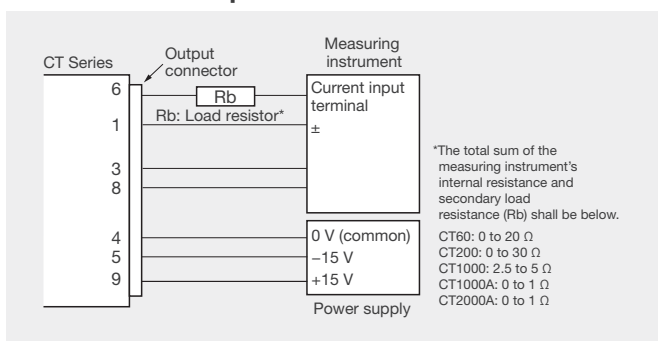
*3 Use conductors or cables with reinforced insulation for primary input.

*4 Make sure that the total load resistance including measuring instrument's internal resistance and external load resistance (Rb) is within the specification to prevent oscillation. And confirm the rated power specification of the load resistance.

Accessories and connection to the CT series

- D-Sub 9-pin connector
1 plug and 2 screws, part number B8200JQ
- Load resistor
2.5 Ω (10 Ω × 4, 4 resistors shall be connected in parallel.),
part number: B8200JR
Resistance accuracy: ±0.1%,
Temperature coefficient: 25 ppm/°C

Connection example



Signal assignments of secondary connector

Pin No.	Signal Name
1	Output Return
2	[Do not Connect]
3	GND Status
4	0 V Power Supply Input
5	-15 V Power Supply Input
6	Secondary Signal Output
7	[Do not Connect]
8	Operation Status
9	+15 V Power Supply Input

Current sensor unit 751522/751524

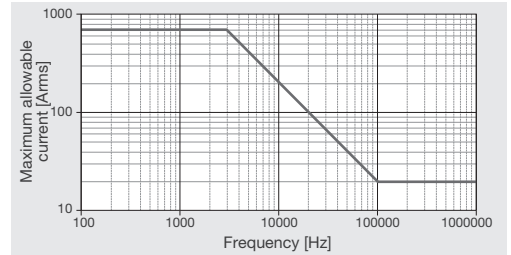


Model	751522/751524
Input type	Floating input using CT(s)
Rated currents	DC: 0 to 1000 A AC: 1000 Apeak
Input/output ratio	1500:1
Guarantee accuracy period	12 months
Amplitude accuracy (within three months of calibration)	±(0.05% of reading + 40 µA) DC ±(0.1% of reading + 40 µA) (30 Hz ≤ f < 45 Hz) ±(0.05% of reading + 40 µA) (45 Hz ≤ f ≤ 66 Hz) ±(0.1% of reading + 40 µA) (66 Hz < f ≤ 1 kHz) ±((0.05% + 0.08 × f)% of reading + 40 µA) (1 kHz < f ≤ 40 kHz) ±((0.2% × f)% of reading + 40 µA) (40 kHz < f ≤ 100 kHz) Accuracy values at frequencies over 1 kHz are provided as reference values. (Unit of f: kHz)
Reference conditions	23 ±5°C, 30 to 70% RH, AC input as sinewave Primary current: 2 to 1000 A common mode voltage: 0 V Supply voltage: rated supply voltage ±5%
Temperature coefficient	0.01%/°C (10 to 18°C, 28 to 40°C)
Frequency range	DC to 100 kHz (-3 dB)
Continuous maximum allowable input	1000 Apeak (see the diagram titled 'Primary current derating by frequency')
Instantaneous maximum allowable input	4500 Apeak for 0.1 second or less (reference value)
Continuous maximum in-phase voltage	1000 Vrms
Input terminal type	M12 nuts and bolts
Output terminal type	Screw terminal
Output load resistance	2.5 Ohm
Warmup time	Approx. 30 minutes
Operating temperature and humidity ranges	10 to 40°C, 20 to 80% RH (no condensation)
Storage temperature range	0 to 60°C (no condensation)
Rated supply voltage and allowable range of supply voltage fluctuation	100 VAC to 240 VAC/90 VAC to 264 VAC
Rated supply frequency and allowable range of supply frequency fluctuation	50/60 Hz/48 to 63 Hz
Dimensions	751522: Approx. 426 (W) × 221 (H) × 401 (D) mm 751524: Approx. 426 (W) × 355 (H) × 401 (D) mm Note: The dimensions shown exclude projections such as input terminals and base feet.
Weight	751522: Approx. 15 kg 751524: Approx. 28 kg
Consumed power	751522: Approx. 30 VA 751524: Approx. 90 VA

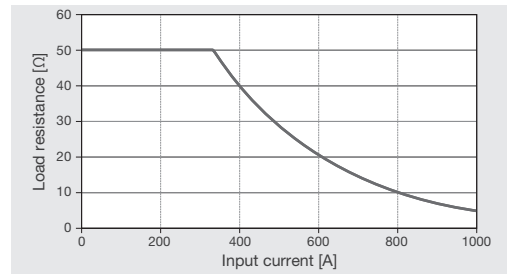
Characteristic example

*The characteristic is a typical example, not a guaranteed one.

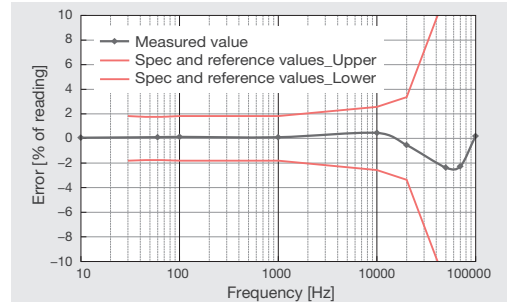
Primary current derating by frequency



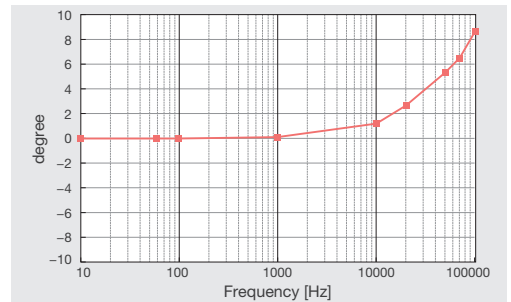
Input current derating by load resistance



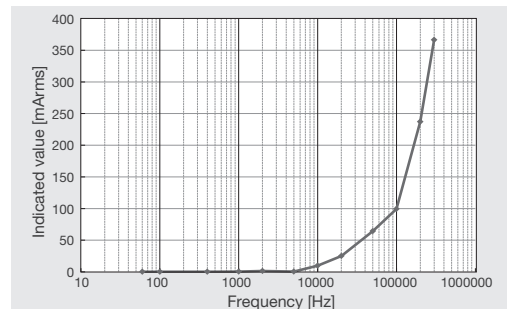
Frequency characteristic example



Phase characteristic example¹



CMRR characteristic example



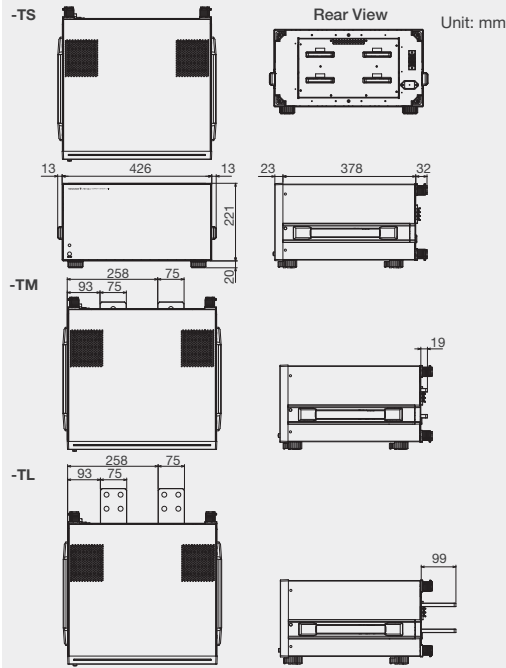
¹ Lead is set as Positive.

AC Clamp-on probe 751552

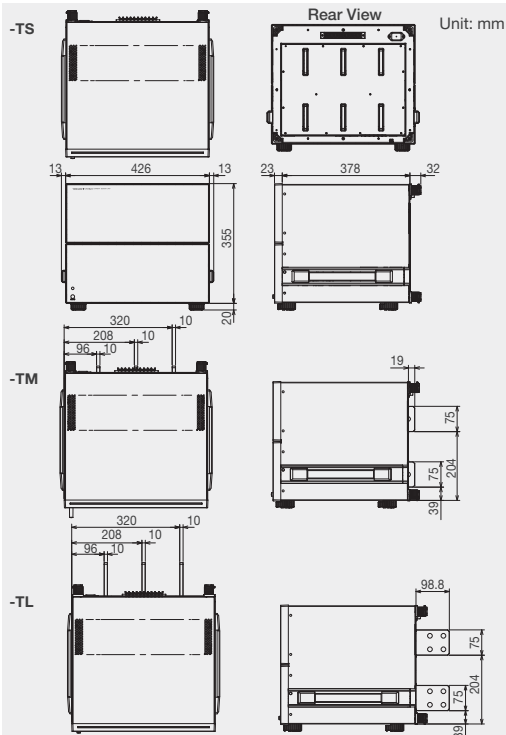


Dimensions

751522

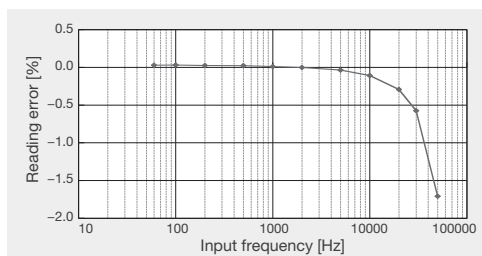


751524



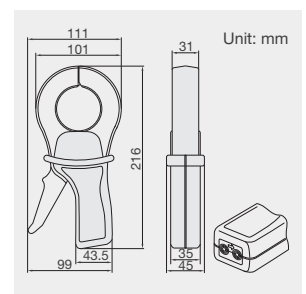
Model	751552
Rated current	AC 0.001 to 1200 Arms When inputting 1000 Arms to 1200 Arms (1 kHz), a 20-minute rest is required after 40 minutes of electrical continuity.
Current transformation ratio	1000:1
Amplitude accuracy	Input current (I) accuracy with respect to output current 1 mA ≤ I < 100 mA: ±(3% of reading + 5 μA), phase error: no spec 100 mA ≤ I < 1 A: ±(2% of reading + 3 μA), phase error: no spec 1 A ≤ I < 10 A: ±1% of reading, phase error: 2 degree 10 A ≤ I < 100 A: ±0.5% of reading, phase error: 1 degree 100 A ≤ I ≤ 1200 A: ±0.3% of reading, phase error: 0.7 degree
Reference conditions	23 ±3°C, 20 to 75% RH, 48 to 65 Hz sinewave input Input current: 0.001 to 1200 A, common mode voltage: 0 V Conductor: Clamp center Primary input: No DC current component, no AC magnetic field, external magnetic field below 40 A/m, secondary load resistance 1 Ω or less, no effects from current flowing through adjacent external conductors
Measurement frequency range	30 Hz ≤ f ≤ 5 kHz 30 Hz ≤ f < 48 Hz: Add ±0.5% of output signal 65 Hz < f ≤ 1 kHz: Add ±1% of output signal 1 kHz < f ≤ 5 kHz: Add ±2% of output signal
Conductor position effect	Add ±0.1% of reading (400 Hz or less)
DC current effect	1% of output current at superimposition of 15 Adc
Temperature effect	0.02%/°C or less of the output signal
Maximum output voltage	30 Vpeak or less
Continuous maximum allowable input	For a continuous frequency f of 1 kHz or less I ≤ 1000 A For an input signal of 1000 A < I ≤ 1200 A at 1 kHz, the probe can be used continuously for a maximum of 40 minutes. Do not perform measurement 20 minutes thereafter.
Working voltage	Maximum 600 Vrms
Secondary load resistance	1 Ω or less
Secondary load resistance effect	1 to 5 Ω: 0.1% of reading, add 0.2° phase error
Operating temperature and humidity ranges	-10 to 50°C, 0 to 90% RH (no condensation)
Storage temperature range	-40 to 70°C (no condensation)
Dimensions	Approx. 111 (W) × 216 (H) × 45 (D) mm
Measurable conductor diameter	Maximum 52 mm diameter
Output current connector	Plug-in terminal (safety terminal)
Weight	Approx. 620 g

751552 frequency characteristic example*



*It depends on the input signal frequency.
*The characteristic is just a typical example but not guaranteed one.

Dimensions



Models and Suffix Codes

AC/DC Current Sensors and Clamp-on Probe

Model	Product Name	Specifications
CT2000A	AC/DC Current sensor	Measurement range: DC to 40 kHz, basic accuracy: $\pm(0.05\%$ of reading + 30 μ A), 2000 Arms (3000 Apeak)
CT1000A	AC/DC Current sensor	Measurement range: DC to 300 kHz, basic accuracy: $\pm(0.04\%$ of reading + 30 μ A), 1000 Arms (1500 Apeak)
CT1000	AC/DC Current sensor	Measurement range: DC to 300 kHz, basic accuracy: $\pm(0.05\%$ of reading + 30 μ A), 1000 Apeak
CT200	AC/DC Current sensor	Measurement range: DC to 500 kHz, basic accuracy: $\pm(0.05\%$ of reading + 30 μ A), 200 Apeak
CT60	AC/DC Current sensor	Measurement range: DC to 800 kHz, basic accuracy: $\pm(0.05\%$ of reading + 30 μ A), 60 Apeak
751552	Clamp-on probe	Measurement range: 30 Hz to 5 kHz, basic accuracy: $\pm 0.3\%$ of reading, 1000 Arms

Current Sensor Unit

Model	Suffix Code	Product Name	Description
751522		Current Sensor Unit (For Single-Phase)	
751524	-10	Current Sensor Unit (For Three-Phase U and V)	Measurement range: DC to 100 kHz
	-20	Current Sensor Unit (For Three-Phase U and W)	Basic accuracy: $\pm(0.05\%$ of reading + 40 μ A)
	-30	Current Sensor Unit (For Three-Phase U, V, and W)	
Input Terminal	-TS	Short Terminal Model	M12 \times 1
	-TM	Middle Terminal Model	M12 \times 1
	-TL	Long Terminal Model	M12 \times 4
Power cord	-D	UL/CSA Standard, PSE Compliant	
	-F	VDE Standard	
	-R	AS Standard	
	-Q	BS Standard	
	-H	GB Standard	
	-N	NBR Standard	

Option /CV Terminal Cover *Correspond to Input Terminal “-TS” only

*751524-10 is available for the WT3000E/WT1800E/WT500, and 751524-20 is available for the WT332E. 751522/751524 do not conform to CE Marking.

- Error for when used in conjunction with the power meter
Add the error of the power meter and that of the current sensor unit or AC/DC current sensor.
- Notes on wiring
 - Make sure the primary and secondary lines do not interfere with each other. Small currents flow through the secondary line, so it may be affected by the primary current. Make the secondary line as short as possible, allow enough space from the primary line, and make sure the secondary line is not parallel to the primary line.
 - AGW 24 or larger wire is recommended for the secondary line. A twisted-pair wire is sometimes recommended rather than a shielded wire, for example, for testing inverters.
- Since secondary output current of these current sensor units are small, please use smaller current range measurement of above power analyzers.

This is a Class A instrument based on Emission standards EN61326-1 and EN55011, and is designed for an industrial environment.
Operation of this equipment in a residential area may cause radio interference, in which case users will be responsible for any interference which they cause.

There are restrictions to some general specifications and functions. For details, see the respective product brochure.

Accessories (Sold separately)

Model	Product Name	Specifications	Sales Unit
758917	Measurement lead set	75-cm long cable, 2 pieces (red and black) in set	1
758922	Small alligator-clip adapter set	Safety terminal-to-alligator-clip adapter, 2 pieces (black and red) in set. Rated 300 V	1
758929	Large alligator-clip adapter set	Safety terminal-to-alligator-clip adapter, 2 pieces (black and red) in set. Rated 1000 V	1
758923	Safety terminal adapter set	Spring-hold type, 2 pieces (black and red) in set	1
758931	Safety terminal adapter set	Spring-fastened type, 2 pieces (black and red) in set	1
758921	Fork terminal adapter set	4-mm banana plug-to-fork terminal, 2 pieces (black and red) in set	1
B8200JQ	Output connector	D-Sub 9-pin connector with 2 screws (female on connector side)	1
B8200JR	Load resistor	10 Ω /0.25 W ($\times 4$)	1
A1323EZ	Shunt Resistor Box	5 Ω $\pm 0.05\%$, for CT1000	1
A1324EZ	Shunt Resistor Box	10 Ω $\pm 0.02\%$, for CT1000, Maximum 640 Apeak	1
A1325EZ	Shunt Resistor Box	20 Ω $\pm 0.02\%$, for CT60/CT200	1
A1559WL	Current Sensor Cable	Cable length 3 m for Shunt Resistor Box	1
A1560WL	Current Sensor Cable	Cable length 5 m for Shunt Resistor Box	1
A1589WL	Direct Current Input Cable	A cable to connect with Current Input terminals through Fork Terminal Adapter 758921 or others. Burden resistor 2.7 Ω , Cable length 3 m	1
A1628WL	Direct Current Input Cable	A cable to connect with Current Input terminals through Fork Terminal Adapter 758921 or others. Without Burden resistor, Cable length 5 m	1

⚠ Be careful not to touch the metal parts that are easily accessible. Doing so may cause an electric shock.



758917



758921



A1323EZ/A1324EZ/A1325EZ



A1559WL/A1560WL



A1589WL



A1628WL

NOTICE

- Before operating the product, read the user's manual thoroughly for proper and safe operation.

Yokogawa's Approach to Preserving the Global Environment

- Yokogawa's electrical products are developed and produced in facilities that have received ISO14001 approval.
- In order to protect the global environment, Yokogawa's electrical products are designed in accordance with Yokogawa's Environmentally Friendly Product Design Guidelines and Product Design Assessment Criteria.

YOKOGAWA

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