16.1 Input

Voltage

Item	Specification
Input circuit type	Floating input Resistive voltage divider
Rated inputs (range rms)	600, 300, 150, 60, 30, 15 V
Input impedance	Input resistance approx.2 MΩ, Input capacitance approx.13 pF
Instantaneous maximum allowable input for 20 ms, 1 cycle	The peak is 2.8 kV or the RMS value is 2.0 kV, whichever is less.
Instantaneous maximum allowable input for 1 s	The peak is 2.0 kV or the RMS value is 1.5 kV, whichever is less.
Continuous maximum allowable input	The peak is 1.5 kV or the RMS value is 1.0 kV, whichever is less.
Continuous maximum common mode voltage (at 50/60 Hz)	600 Vrms (when the protective cover for the output connector is used) CAT II, 400 Vrms (when the protective cover for the output connector is removed) CAT II
Common mode rejection ratio at 600 Vrms between input terminals and case	50/60 Hz, better than -80 dB (±0.01% of range maximum) Voltage input terminals : short Reference value: 50 kHz max. ±{(maximum range rating)/(range rating) × 0.001 × f% of range} or less; 0.01% or more; the unit f: kHz
Input terminals	Binding posts
A/D conversion	Simultaneous sampling of voltage and current inputs; Resolution: 12 bits; Maximum conversion rate: approx. 22 μs (approx. 45 kHz)
Range switching	Range can be selected manually, automatically or by communication control.
Automatic range switching	Range up: When the measured value exceeds 110% of the rated range or the peak value exceeds approximately 300% of the rated range Range down: When the measured value becomes less than 30% of the rated range and the peak value is less than approximately 300% of the subordinate range
Measurement mode switching	The following modes can be set manually or by communication control: RMS: True RMS measurement for both voltage and current; V MEAN: Rectified Mean Calibrated to an RMS sine wave measurement for voltage, and true RMS measurement for current; DC: Mean value measurement for voltage and current

Current

Item	Specification
Input circuit type	Floating input Shunt input
Rated inputs (range rms)	Direct input: 20 A, 10 A, 5 A, 2 A, 1 A, 0.5 A, 200 mA, 100 mA, 50 mA, 20 mA, 10 mA, 5 mA External sensor input (optional): (10 V, 5 V, 2.5 V), or (200 mV, 100 mV, 50 mV)
Input impedance	Direct input: Approx. 6 mΩ + approx. 0.1 μH in the 20 A to 0.5 A range. Approx. 500 mΩ in the 200 mA to 5 mA range. External sensor input: 2.5/5/10 V - approx. 100 kΩ; 50/100/200 mV - approx. 20 kΩ
Instantaneous maximum allowable input for 20 ms, 1 cycle	20 A to 0.5 A range: Peak current of 450 A or RMS value of 300 A, whichever is less. 200 mA to 5 mA range: Peak current of 150 A or RMS value of 100 A, whichever is less. External sensor input: Peak value is 10 times the range or less.
Instantaneous maximum allowable input for 1 s	20 A to 0.5 A range: Peak current of 150 A or RMS value of 40 A, whichever is less. 200 mA to 5 mA range: Peak current of 30 A or RMS value of 20 A, whichever is less. External sensor input: Peak value is 10 times the range or less.
Continuous maximum allowable input	20 A to 0.5 A range: Peak current of 100 A or RMS value of 25 A, whichever is less. 200 mA to 5 mA range: Peak current of 30 A or RMS value of 20 A, whichever is less. External sensor input: Peak value is 5 times the range or less.
Continuous maximum common mode voltage (at 50/60 Hz)	600 Vrms (when the protective cover for the output connector is used) CAT II, 400 Vrms (when the protective cover for the output connector is removed) CAT II
Common mode rejection ratio at 600 Vrms between input terminals and case	50/60 Hz, better than -80 dB (±0.01% of range maximum) Current input terminals : open Reference value: 50 kHz max. $\pm\left\{\frac{\text{Maximum range rating}}{\text{Range rating}}\times 0.001\times \text{f\% of rng}\right\}$ (other than the 200 mA to 5 mA range) $\pm\left\{\frac{\text{Maximum range rating}}{\text{Range rating}}\times 0.0002\times \text{f\% of rng}\right\}$ (200 mA to 5 mA range) ; 0.01% or more; the unit f: kHz
Input terminals	Direct input: Large binding posts, External sensor input: Safety terminals
A/D conversion	Simultaneous sampling of voltage and current inputs; Resolution: 12 bits; Maximum conversion rate: approx. 26 μs (approx. 38 kHz)
Range switching	Range can be selected manually, automatically or by communication control.
Automatic range switching	Range up: When the measured value exceeds 110% of the rated range or the peak value exceeds approximately 300% of the rated range Range down: When the measured value becomes less than 30% of the rated range and the peak value is less than approximately 300% of the subordinate range
Measurement mode switching	The following modes can be set manually or by communication control: RMS: True RMS measurement for both voltage and current; V MEAN: Rectified Mean Calibrated to an RMS sine wave measurement for voltage, and true RMS measurement for current; DC: Mean value measurement for voltage and current

16.2 Measurement Functions

Voltage/Current

Item	Specification	
Method	Digital sampling method, summation averaging method	
Frequency range	DC, 10 Hz to 50 kHz	
Crest factor	“3” at rated input	
Display accuracy (within 3 months after calibration) (Conditions) Temperature: 23 ±5°C Humidity: 30% to 75% R.H. Supply voltage: Specified Voltage ±5% Input waveform: Sine wave Common mode voltage: 0 VDC Filter: ON at 200 Hz or less Scaling: OFF This accuracy are guaranteed by YOKOGAWA calibration system.	DC : 10 Hz ≤ f < 45 Hz : 45 Hz ≤ f ≤ 66 Hz : 66 Hz < f ≤ 1 kHz : 1 kHz < f ≤ 10 kHz : 10 kHz < f ≤ 20 kHz : Reference value 20 kHz < f ≤ 50 kHz :	±(0.2 % of rdg + 0.2% of rng) ±(0.3% of rdg + 0.2% of rng) ±(0.15% of rdg + 0.1% of rng) ±(0.3% of rdg + 0.2% of rng) ±(0.2% of rdg + 0.3% of rng)±{(0.05 × f)% of rdg} ±(0.5% of rdg + 0.5% of rng)±[{0.15 × (f–10)}% of rdg] ±(0.5% of rdg + 0.5% of rng) ±[{0.15 × (f–10)}% of rdg]
Note: The unit f in accuracy expressions is kHz.		
Effective input range	With the input range at 10% to 110%, the above specified accuracy is valid. With the input range at 110% to 130%, the above specified reading accuracy increased 0.5 times is added to the accuracy.	
Accuracy (within 12 months after calibration)	The above specified reading accuracy increased 0.5 times is added to the accuracy (within 3 months after calibration).	
Temperature coefficient	±0.03% of range/°C at 5 to 18°C, 28 to 40°C	
Display update rate	4 times/s	

Effective Power

Item	Specification
Method	Digital sampling method, summation averaging method
Frequency range	DC, 10 Hz to 50 kHz
Display accuracy (within 3 months after calibration) (Conditions) Temperature: 23 ±5°C Humidity: 30% to 75% R.H. Supply voltage: Specified Voltage ±5% Input waveform: Sine wave Common mode voltage: 0 VDC Filter: ON at 200 Hz or less Scaling: OFF This accuracy are guaranteed by YOKOGAWA calibration system.	DC : ±(0.3% of rdg + 0.3% of rng) 10 Hz ≤ f < 45 Hz : ±(0.5% of rdg + 0.3% of rng) 45 Hz ≤ f ≤ 66 Hz : ±(0.2% of rdg + 0.1% of rng) 66Hz < f ≤ 1 kHz : ±(0.5% of rdg + 0.3% of rng) 1 kHz < f ≤ 10 kHz : ±(0.3% of rdg + 0.5% of rng)±{(0.08 × f)% of rdg} 10 kHz < f ≤ 20 kHz : ±(0.8% of rdg + 0.8% of rng)±[{0.19 × (f–10)}% of rdg] Reference value 20 kHz < f ≤ 50 kHz : ±(0.8% of rdg + 0.8 % of rng)±[{0.25 × (f–10)}% of rdg]
Note: The unit f in accuracy expressions is kHz.	
Effect of power factor	cosφ = 0 45 Hz ≤ f ≤ 66 Hz:add ±0.25% of range Reference data (up to 50 kHz): add ±{(0.23 + 0.4 × f kHz)% of range} 1 > cosφ > 0 add the product of tanφ and the effect on cosφ = 0.
Note: The φ is the phase angle between the voltage and current, and the f is frequency.	
Effective input range	With the input range at 10% to 110%, the above specified accuracy is valid. With the input range at 110% to 130%, the above specified reading accuracy increased 0.5 times is added to the accuracy.
Accuracy (within 12 months after calibration)	The above specified reading accuracy increased 0.5 times is added to the accuracy (within 3 months after calibration).
Temperature coefficient	±0.03% of range/°C at 5 to 18°C, 28 to 40°C
Display update rate	4 times/s

16.3 Frequency Measurement

Item	Specification
Input	V, A
Operating principle	Reciprocal counting method
Frequency ranges	10 Hz to 50 kHz (100 Hz, 1 kHz, 10 kHz, 100 kHz, Auto range)
Accuracy	±(0.1% of rdg + 1 digit) Minimum input is more than 30% of rated range. When an input frequency is less than 200Hz, FILTER must be ON to obtain the specification accuracy. Minimum input frequency is more than 20% of frequency measurement range.

16.4 Communication (optional)

Item	Specification	
GP-IB	Electrical specifications: Mechanical specifications: Interface function:	IEEE St'd 488.2-1987 IEEE St'd 488.2-1987 SH1, AH1, T5, L4, SR1, RL1, PP0, DC1,DT1, C0
RS-232-C	Transmission mode: Start stop synchronization Baud rate: 75, 150, 300, 600, 1200, 2400, 4800, 9600 bps	

16.5 Computing Functions

	Effective Power (W)	Apparent Power (VA)	Reactive Power (var)	Power Factor (PF)	Phase Angle (deg)
1-phase 2-wire	W	VA=V×A	$\sqrt{(VA)^2-W^2}$	$\frac{W}{VA}$	$\cos^{-1}(\frac{W}{VA})$
Computating range	Depends on the selected V and A ranges	Depends on the selected V and A ranges	Same as apparent power (var ≤ 0)	–1 to 0 to 1	–180 to 0 to 180
Display resolution (when the number of displayed digits is 5)	99999	99999	99999	±1.0000	±180.0
Computing accuracy (for the value operated from the measured value)	–	±0.005% of VA range	±0.005% of var range	±0.0005	Resolution (power factor ±0.0005)

Note

- The apparent power (VA), reactive power (var), power factor (PF), and phase angle (deg) measurements in this instrument are computed digitally from the voltage, current and effective power. If the input is non-sinusoidal, the measured values may differ from those obtained with instruments employing different measurement principles.
- When the current or voltage is less than 0.5% of the range, the VA and var will be displayed as 0, and PF/deg will be displayed as an error.
- The Lead and Lag are displayed for V and A input at 50% or more. The detected lead/lag accuracy is ±5 degrees over the frequency range of 20 Hz to 2 kHz.

16.6 Display Functions

Item	Specification
Display type	7-segment LED
Number of displays	3

DISPLAY	Displayed Value	Maximum Reading
A	V, A, W, VA, var, elapsed integration time	V, A, W: 99999
B	V, A, W, PF, deg, % (contents ratio in %, THD)	Wh, Ah: 999999
C	V, A, W, V•AHz, ±Wh, ±Ah Vpk, Apk, MATH	V, AHz: 99999

Number of displayed digits	Select Hi (5 digits) or Lo (4 digits).
Unit	m, k, M, V, A, W, VA, var, Hz, h±, deg, %
Display update rate	4 times/s
Response time	Approximately 0.5 s (time for displayed value to settle within accuracy specifications of final value after step change from 0% to 100% or 100% to 0% of rated range)
Display scaling function	Significant digits: Selected automatically according to significant digits in the voltage and current ranges Reassign ratio:0.001 to 9999
Averaging function	The following two algorithms can be selected: Exponential averaging Moving averaging Response can be set; for exponential averaging, the attenuation constant can be selected and for moving averaging, the number of averages (N) can be set to 8, 16, 32, or 64.
Peak over range display	The alarm LED will light up when the RMS value is greater than 140% of the range or the peak value is greater than 300% of the range.

16.7 Integrator Function

Item	Specification
Display resolution	Depending on elapsed time value, the resolution will be changed.
Maximum display	–99999 to 999999 MWh (or MAh)
Modes	Standard integration mode (timer mode) Continuous integration mode (repeat mode) Manual integration mode
Timer	When the timer is set, integration will be stopped automatically. Setting range: 0 h:00 min:0 sec to 10000 h:00 min:00 sec (0 h:00 min:00 sec will be shown when manual integration mode is selected automatically.)
Count overflow	If the integration count flows above 999999 MWh (or MAh) or below –99999 MWh (or MAh), integration stops and the elapsed time is held on the display.
Accuracy	±(display accuracy + 0.2% of rdg) However, only when the input signal is continuous.
Timer accuracy	±0.02%
Remote control	Start, stop, and reset can be remotely controlled by external contact signals. However, the /DA4 option must be installed.

16.8 Internal Memory Function

Item	Specification
Measurement data	Number of data that can be stored: 600 blocks Writing intervals: 250 ms and 1 s to 99 h: 59 min: 59 s Reading intervals: 250 ms and 1 s to 99 h: 59 min: 59 s (both intervals can be set on a second basis)
Panel setup information	Four-pattern information can be written/read.

16.9 D/A Converter (optional)

Item	Specification
Output voltage	±5 VDC FS (approximately ±7.5 V maximum) at rated value or range Number of output channels: 4 when the /DA4 option is installed
Output current	±1 mA
Output data selection	Can be selected for each channel.
Accuracy	±(Display accuracy + 0.2% of range)
Update rate	Identical to display update interval
Temperature coefficient	±0.05% of rng/ °C

16.10 External Input (optional)

Item	Specification
Either /EX1 or /EX2 can be selected as a voltage-output-type current sensor.	/EX1: 10 V, 5 V, 2.5 V /EX2: 200 mV, 100 mV, 50 mV Specifications: Refer to section “Input.”

16.11 Comparator Output (optional)

Item	Specification
Output method	Normally open and normally closed relay contact outputs (one pair)
Number of output channels	4 (Can be set for each channel.)
Contact capacity	24 V/0.5 A
D/A output (4 channels)	Refer to section “D/A Converter (Optional).”

16.12 External Contorol and Input Signals (in combination with the D/A converter and comparator options)

Item	Specification
External Control and Input/Output signals	EXT-HOLD, EXT-TRIG, EXT-START, EXT-STOP, EXT-RESET, INTEG-BUSY (However, the /DA4 option must be installed. Only EXT-HOLD and EXT-TRIG are available if the /CMP option is installed.)
Input level	TTL negative pulse

16.13 Total Harmonic Analysis Function (optional)

Item	Specification
Method:	synchronization to the fundamental frequency by using a phase locked loop (PLL) circuit
Frequency range:	Fundamental frequency between 40 Hz and 440 Hz
Maximum reading:	9999
Items to be analyzed:	V, A, W, deg Each harmonic components, Total Vrms, Total Arms, Total effective power, PF of the fundamental, Phase-angle of fundamental, For each harmonic phase-angle related to the fundamental, Total harmonic distortion ratio in %, and contents ratio in %. However, a simultaneous analysis can be made for a specified input module.
Sampling speed/method:	The sampling speed depends on the fundamental frequency to be input:

Input frequency range	Sampling frequency	Window up to the n'th harmonic	Order
40≤f<70 Hz	f×512 Hz	1 period of f	50
70≤f<130 Hz	f×256 Hz	2 period of f	50
130≤f<250 Hz	f×128 Hz	4 period of f	50
250≤f<440 Hz	f×64 Hz	8 period of f	30

FFT number of points :	512 points FFT
FFT calculation accuracy:	32 bits
Window:	Rectangular window
Display update interval:	Approx. 3 s
Accuracy:	±0.2% of range is added to the normal display accuracy.

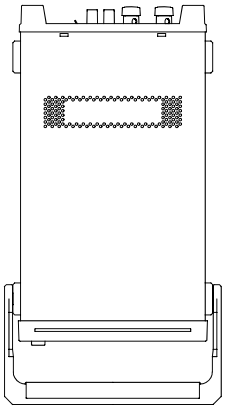
16.14 General Specifications

Item	Specification
Warm-up time	Approx. 30 min.
Ambient temperature and humidity range	5 to 40°C, 20% to 80% R.H. (no condensation)
Operating altitude	2000m or below
Storage temperature	–25 to 60°C (no condensation)
Insulation resistance	Between voltage input terminals and case Between current input terminals and output terminals Between voltage input terminals and current input terminals Between voltage input terminals and power plug Between current input terminals and power plug Between case and power plug Above: 50 MΩ or more at 500 V DC
Withstanding voltage	Between voltage input terminals and case Between current input terminals and output terminals Between voltage input terminals and current input terminals Between voltage input terminals and power plug Between current input terminals and power plug Above: AC 3700 V for 1 minute at 50/60 Hz Between case and power plug: AC 1500 V for 1 minute at 50/60 Hz
Power supply	100 to 240 V; frequency: 50/60 Hz
Vibration test condition	Sweep test - Frequency: 8 to 150 Hz sweep, all 3 directions for 1 minute Endurance test - Frequency: 16.7 Hz, all 3 directions; amplitude of 4 mm for 2 h
Impact condition	Impact test: Acceleration at 490 m/s^2, all 3 directions Free-fall test - Height: 100 mm, 1 time for each 4 sides
Power consumption	25 VA maximum (Power supply: 120 VAC) 35 VA maximum (Power supply: 240 VAC)
External dimensions	Approx. W × H × D : 213 × 88 × 350 (mm), 8-3/8 × 3-1/2 × 13-3/4 (inch), excluding projections.
Weight	Approx. 3.0 (kg), 6.6 (lbs)
Accessories	Power cord: UL/CSA, VDE, SAA or BS standard 1 pc 24-pin connector User's Manual Rubber feed
Emission	Complying Standard: EN55011-Group1, Class A This is a Class A product for industrial environment. In a domestic environment, this product may cause radio interference in which cause the user may be required to take adequate measures. Cable Condition: External Senser Input (installed /EX1 or /EX2 option) 500 mm max External Input/Output Signals (installed /DA4, /CMP option) To use shielded wires
Immunity	Complying Standard: EN50082-2:1995
Safety standard	Complying Standard: EN61010 Overvoltage Category II Pollution degree 2

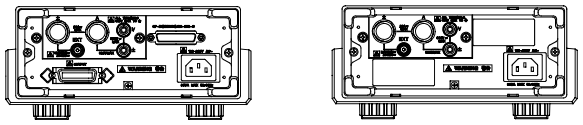
* Equipment that is connected to the WT200 through the GP-IB, RS-232-C, or Ext. I/O connector must comply with applicable safety standards (IEC60950 or IEC61010-1, for example) or some equivalent standard.

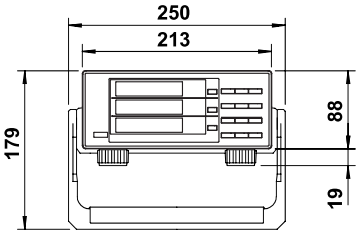
16.15 External Dimensions

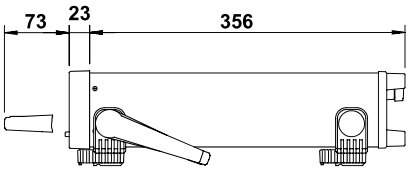
Unit: mm



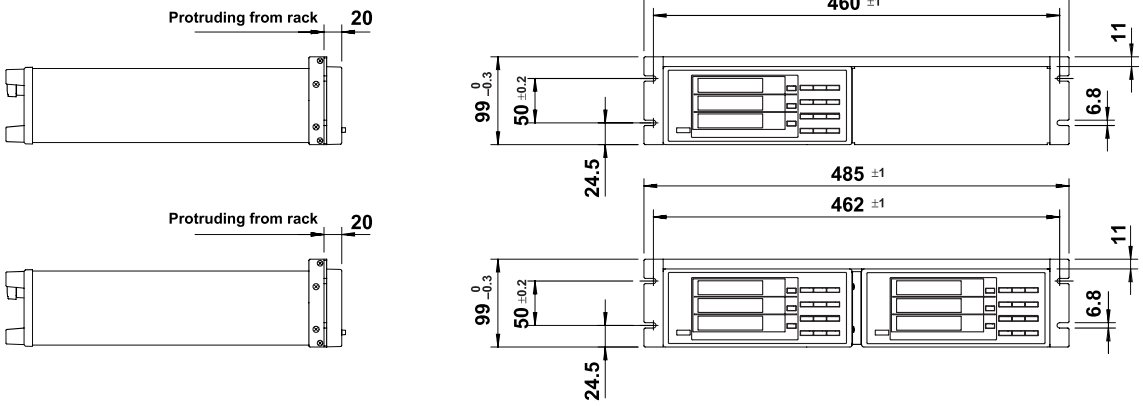
Rear



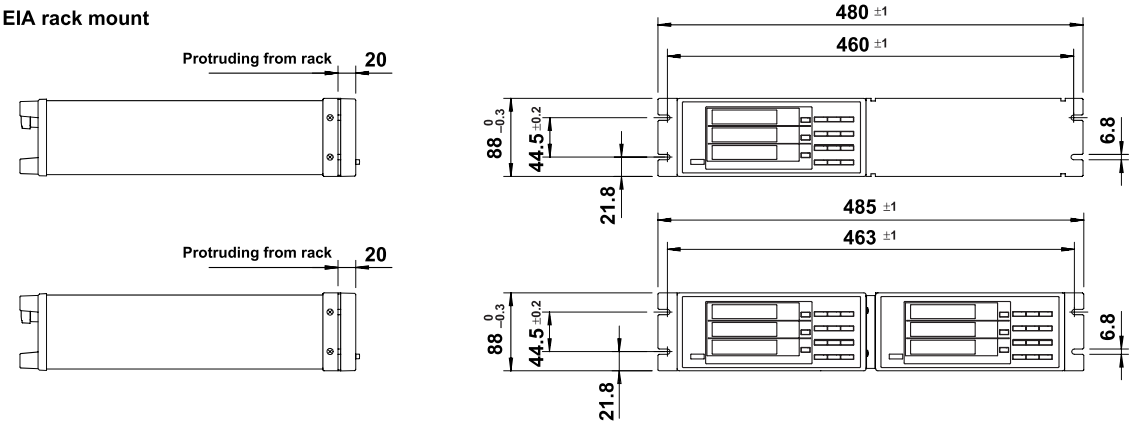




JIS rack mount



EIA rack mount



Unless other wise spcified, tolerance is ±3% (However, tolerance is ±0.3 mm when below 10 mm)