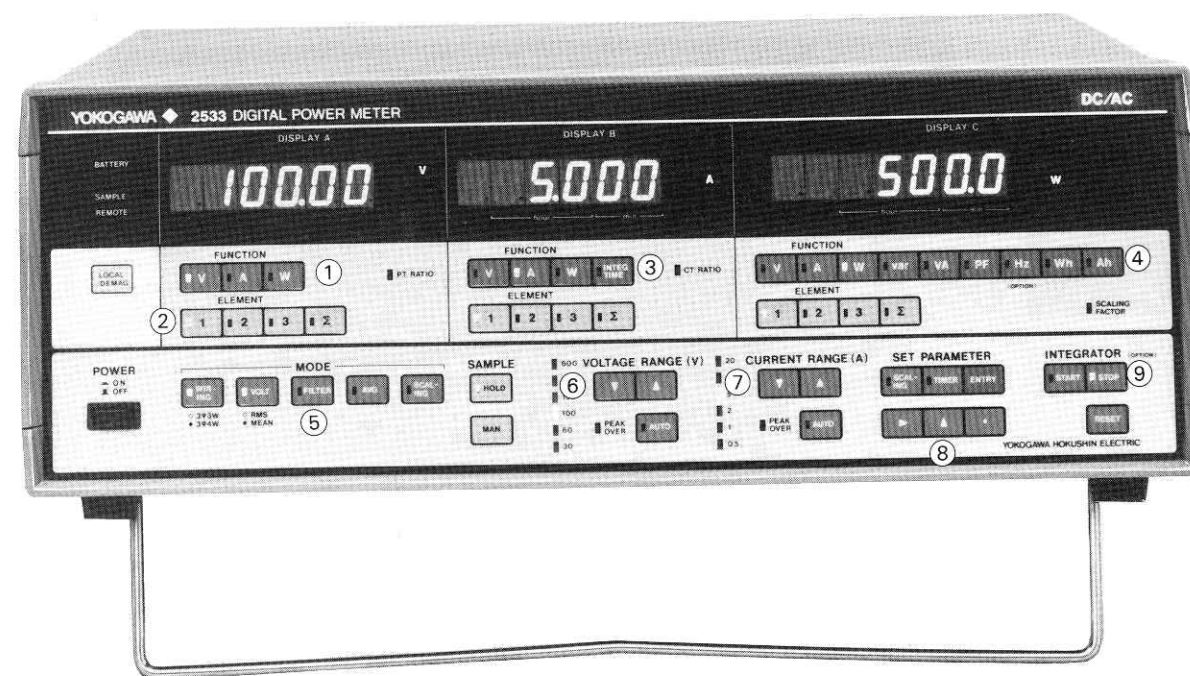


FUNCTIONS

■ DISPLAY & OPERATING FUNCTIONS



① FUNCTION keys

Selectable for V, A or W measurement.

② ELEMENT keys

Used to select each phase (or line) in 3-phase 3-wire or 4-wire circuit. Σ key provides mean value (V, A), or the sum of each power (W). (ELEMENT keys are not provided in the single-phase model)

③ FUNCTION keys

In addition to V, A and W, integration time can also be displayed as an option.

④ FUNCTION keys

In addition to V, A and W, var, VA, PF (Hz, Wh, Ah... optional) can also be selected.

⑤ MODE keys

WIRING: For 3-phase 4-wire circuit. (WIRING key is not provided in the single-phase model)
VOLT: Selectable for RMS (true rms measurement & display), or MEAN (mean value rectification measurement & rms value display).

FILTER: Provides stable measurement even for signals containing low frequency ripple. (5/0.7 Hz low pass filter)

AVG: Provides exponential averaging of 8 measured data points.
SCALING: Scaling ON/OFF key.

⑥ VOLTAGE RANGE keys

Manual selection of 6 ranges (30 to 600 V), plus autoranging. When the power is turned ON, previously entered voltage range is automatically selected.

⑦ CURRENT RANGE keys

Manual selection of 6 ranges (0.5 to 20 A ... AC model), or 5 ranges (1 to 20 A ... DC/AC model), plus autoranging. When the power is turned ON, previously entered current range is automatically selected.

⑧ SET PARAMETER keys

Used to program scaling (PT and CT ratios), and integration time:

▶ Digit designation.

▲ Data (0 to 9) designation.

● Decimal point designation.

⑨ INTEGRATOR keys (optional)

Consist of integration START, STOP, RESET keys.

Applicable circuit

Connection	253311 253321	253312 253322	253313 253323
1 P 2 W	○	○	○
1 P 3 W	—	○*	○*
3 P 3 W (2 V, 2 A)	—	○	○*
3 P 3 W (3 V, 3 A)	—	—	○*
3 P 4 W	—	—	○

* ... Selectable by an internal DIP selector.

SPECIFICATIONS

■ INPUT

Input	Voltage	Current
Type of Input	AC model DC/AC model	CT isolation (secondary ranging) DC CT isolation (secondary ranging)
Rated Input (Range)	30, 60, 100, 150, 300, 600 V	0.5 A (AC model only), 1, 2, 5, 10, 20 A
Frequency Range	DC (DC/AC model only), 10 Hz to 20 kHz	
Max. Allowable Input (for 1 s)	3.5 × range (peak) or 1,400 Vpk (whichever is less)	10 × range (peak) or 70 Apk (whichever is less)
Max. Allowable Input (continuous, at 50 or 60 Hz)	2 × range (rms) or 1,000 V pk (whichever is less)	3 × range (rms) or 50 Apk (whichever is less)
Input Impedance or Instrument Loss	Approx. 1 MΩ on all ranges	
Max. Common Mode Voltage (continuous, at 50 or 60 Hz)	1,000 Vrms	
Effect of Common Mode Voltage (at 50 or 60 Hz)	Less than ±0.025% of range (input terminals shorted, 1,000 V applied between input and case ... V, open input terminals ... A)	

■ MEASUREMENTS

Function	Voltage	Current	Power
Operating Principle	True rms (log-antilog)/mean value rectification	True rms (log-antilog)	Feedback time division multiplier
Measure-ment	Single-phase	V_1	A_1
	3-phase 3-wire (balanced circuit)	$V_1, V_3, \frac{V_1+V_3}{2} (\Sigma)$	$A_1, A_3, \frac{A_1+A_3}{2} (\Sigma)$
	3-phase 4-wire (balanced circuit)	$V_1, V_2, V_3, \frac{V_1+V_2+V_3}{3} (\Sigma)$	$A_1, A_2, A_3, \frac{A_1+A_2+A_3}{3} (\Sigma)$
Frequency Range	DC (DC/AC model only), 10 Hz to 20 kHz		
Crest Factor	Up to 2	Up to 3 (or 50 Apk; DC/AC model)	Corresponds to V & A
Display Accuracy*	DC: ±(0.1% of rdg+0.2% of range) ... DC/AC model	DC: ±(0.1% of rdg+0.2% of range+3mA) ... DC/AC model	At cos φ = 1, DC: ±(0.1% of rdg+0.3% of range) ... DC/AC model
	45 to 60 Hz: ±(0.1% of rdg+0.1% of range) ... AC model ±(0.1% of rdg+0.2% of range) ... DC/AC model 20 to 45 Hz, 66 Hz to 2 kHz: ±(0.2% of rdg+0.2% of range) ... AC model ±(0.2% of rdg+0.4% of range) ... DC/AC model 10 to 20 Hz, 2 to 10 kHz: ±1% of range 10 to 20 kHz: ±2% of range (at 10 to 110% input)		Corresponds to V & A
Power Factor Effect	—	—	Less than ±0.5% of rdg (at cos φ = 0.5, 50 or 60 Hz)
Accuracy of Analog Output*	Display Accuracy + 0.05% of range		
Temperature Coefficient	Less than ±0.03% of range/°C (Less than ±0.02% of range/°F) (at 5 to 20°C, 26 to 40°C, or 41 to 68°F, 79 to 104°F)		

*Note: At 23±3°C (73±5°F), 45 to 75% relative humidity, 100 V±1% sine wave input, 3-month calibration cycle (common mode voltage 0 V, demagnetization ... DC/AC model).

■ SCALING FUNCTION

Each measured value multiplied by PT ratio, CT ratio, SCALING FACTOR or others is displayed (unit is changed automatically)

Effective Digit: selected automatically according to effective digit of voltage and current ranges

Setting Range: 0.0001 to 10,000

Set Value: DISPLAY A settable for PT ratio, DISPLAY B for CT ratio, DISPLAY C for scaling factor.

■ AVERAGING FUNCTION

Principle: exponential averaging with attenuation factor K=8

■ COMPUTATION

Apparent Power, Reactive Power & Power Factor

Function	Apparent Power (VA)	Reactive Power (var)	Power Factor (PF)
1 to 3 (each phase)	$V_i \times A_i$	$\sqrt{(V_i \times A_i)^2 - W_i^2}$	$\frac{W_i}{V_i \times A_i}$
Σ (3-phase 3-wire)	$\frac{V_1+V_3}{2} \times \frac{A_1+A_3}{2} \times \sqrt{3}$	$\sqrt{\left(\frac{V_1+V_3}{2} \times \frac{A_1+A_3}{2} \times \sqrt{3}\right)^2 - (W_1+W_3)^2}$	$\frac{W_1+W_3}{\frac{V_1+V_3}{2} \times \frac{A_1+A_3}{2} \times \sqrt{3}}$
Σ (3-phase 4-wire)	$\frac{V_1+V_2+V_3}{3} \times \frac{A_1+A_2+A_3}{3} \times 3$	$\sqrt{\left(\frac{V_1+V_2+V_3}{3} \times \frac{A_1+A_2+A_3}{3} \times 3\right)^2 - (W_1+W_2+W_3)^2}$	$\frac{W_1+W_2+W_3}{\frac{V_1+V_2+V_3}{3} \times \frac{A_1+A_2+A_3}{3} \times 3}$
Computing Range	V & A range (rated value)	V & A range (rated value), var ≥ 1	-1 to 0 to +1 (10 to 110% of rated value for V & A)
Computing Accuracy*	$\pm 0.05\%$ of rated value (VA or var)		± 0.001

Notes: *1. For measured values of V, A, W.
 2. V_i, A_i ... rms value, V_1 to V_3 ... rms or mean value, A_1 to A_3 ... rms value.

■ GENERAL SPECIFICATIONS

Display: LED display.
 Display Combination:

Display Mode	Max. Reading	Display Configuration
A	± 99999	V, A, W, (1, 2, 3, Σ)*
B	± 99999	V, A, W, (1, 2, 3, Σ),* integration time ... optional
C	± 99999 (± 999999 ... Wh, Ah)	V, A, W, VA, var, PF (1, 2, 3, Σ),* (Hz, Wh, Ah ... optional)

*Notes: 1 only ... single phase model.
 1, 3, Σ ... 3-phase 3-wire model.

Engineering Units: m, k, M, V, A, W, VA, var, Hz, h (hour).
Function Selection: Manual for Display A, B, C each by front-panel keys (or remote via optional GPIB or RS-232-C interface).
Sample Rate: Approx. 2.5 times/s.
Ranging: Automatic or manual (or remote via optional GPIB or RS-232-C interface).
Effective Measuring Range: 10 to 110% of rated value (range).
Response Time: Approx. 0.4 s. (at filter OFF, for analog output within $\pm 0.2\%$ accuracy against an input variation from 30 to 100% of range, or from 100 to 30% of range).
Data Output: wave output; $v_1, v_2, v_3, i_1, i_2, i_3$, for monitor)
 Analog output:

$$V_1, V_2, V_3, \frac{V_1+V_3}{2} \text{ or } \frac{V_1+V_2+V_3}{3}$$

$$A_1, A_2, A_3, \frac{A_1+A_3}{2} \text{ or } \frac{A_1+A_2+A_3}{3}$$

$$W_1+W_2+W_3, W_1+W_3 \text{ or } W_1+W_2+W_3.$$

- 12 kinds output simultaneously at three-phase four-wire
- 9 kinds output simultaneously at three-phase three-wire

D-A output: one of VA, var, PF, Wh, Ah, Hz (data indicated on display C)

GPIB or RS-232-C interface (option): display data and measurement data

Remote Controls: Remote control of sample START/STOP.

Operating Temperature Range: 5 to 40°C (41 to 104°F).

Humidity Range: 20 to 80% (relative humidity).

Storage Temperature Range: -10 to 50°C (14 to 122°F), non-condensing.

Warmup Time: Approx. 30 minutes (for reading within specified accuracy).

Dielectric Strength: 3,000 V AC (50, 60 Hz) for one minute between input terminals and case, between input and output terminals, and between V and A terminals, 1,500 V AC (50, 60 Hz) for one minute between input terminals, output terminals, case and power line.

Insulation Resistance: More than 50 M Ω at 500 V DC between input terminals and case, between input and output terminals, between V and A terminals, and between output terminals, case and power line.

Power Requirements: 100, 115, 200 or 230 V AC (must be specified), 48 to 63 Hz.

Power Consumption: Approx. 40 to 50 VA.

Dimensions: Approx. 149 \times 444 \times 364 mm (5-7/8 \times 17-1/2 \times 14-3/8").

Weight: Approx. 12.0 kg (26.5 lbs) ... single phase AC model, 16.0 kg (35.3 lbs) ... 3-phase 4-wire DC/AC model.

■ OPTIONAL FEATURES

● GPIB INTERFACE (/GP-IB)

Functional, Electrical and Mechanical Specifications: Meets IEEE Standard 488-1978 "Digital Interface for Programmable Instrumentation."

Interface Function and Identification: SHI, AHI, T5, L4, SRI, RL1, PP0, DC1, DT1, C0 (Talker & Listener, Talk only).

● RS-232-C INTERFACE (/RS232C)

Functional Specifications: Hardware/software handshaking, synchronous (data transfer rates ... 75, 150, 300, 600, 1,200, 2,400, 4,800 and 9,600 bits/s).

● FREQUENCY MEASUREMENT (/FRQ)

Operating Principle: Reciprocal counting method.

Frequency Range: 10 Hz to 200 kHz (filter OFF), 2 to 500 Hz (filter ON).

Accuracy: $\pm (0.1\% + 1 \text{ digit})$.

Maximum Sensitivity: $\pm 10\%$ of full scale.

Display Range: 2.000 Hz to 240.0 kHz (4 digits).

Sample Time: 400ms.

Measuring Input: V1 or A1.

● INTEGRATOR (/INTEG)

Maximum Reading: ± 999999 (full 6 digits).

Integration Time: Up to 999 h

Integration Display: Ah or Wh (on Display C).

Timer: Automatically stops integration by presetting timer (setting range ... 000 h: 01 min to 999 h: 00 min, timer OFF at 000 h: 00 min), timer accuracy ... $\pm 0.02\%$.

Elapsed Time Display: 00 h: 01 min to 999 h: 59 min after integration start (on Display B).

Accuracy: $\pm (2533 \text{ accuracy} + 0.02\% \text{ of rdg} + 1 \text{ digit})$.

Temperature Coefficient: $\pm 0.025\%$ of range/ $^{\circ}\text{C}$ ($\pm 0.014\%$ of range/ $^{\circ}\text{F}$).

Remote Controls: Integrator START/STOP/RESET by external contact signal.

D-A Converter Function

Operating Principle: Pulse width modulation method (16 bits).

Output: Wh, Ah, var, VA, PF or Hz (display data).

Output Level: -7.5 to 7.5 V, 5 V/full scale, (accuracy ... 2533 accuracy + 0.1% of full scale).

Sample Time: 400 ms.

Temperature Coefficient: $\pm 0.02\%$ / $^{\circ}\text{C}$ ($\pm 0.01\%$ / $^{\circ}\text{F}$).

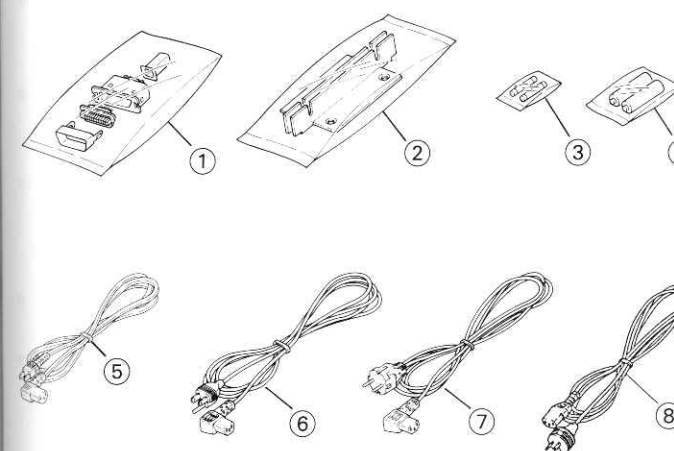
AVAILABLE MODELS

Model	Suffix Codes	Description
2533	.....	Digital power meter
11	.....	Single-phase (AC)
12	.....	3-phase 3-wire (AC)
13	.....	3-phase 4-wire (AC)
21	.....	Single phase (DC/AC)
22	.....	3-phase 3-wire (DC/AC)
23	.....	3-phase 4-wire (DC/AC)
Power Requirement	-1	100 V AC (50 & 60 Hz)
	-3	115 V AC (50 & 60 Hz)
	-5	200 V AC (50 & 60 Hz)
	-7	230 V AC (50 & 60 Hz)
Power Cord	/B	JIS standard
	/D	UL standard
	/F	VDE standard
	/G	SAA standard

STANDARD ACCESSORIES

No.	Name	Part No.	Q'ty	Description
①	Connector	A9026KC	1	For analog output
②	Rack mount adapter	B9564EL	2	—
③	Fuse*	A9050KF	2	1 A time lag type (100 V series)
		A9049KF	2	0.5 A time lag type (200 V series)
④	Battery	A9005ED	2	IEC R6P, ANSI AA-size, Mignon 1.5 V
⑤		A9009WD	1	100 V series (JIS standard)
⑥		A9008WD	1	115 V series (UL standard)
⑦		A9011WD	1	200 V series (VDE standard)
⑧		A9015WD	1	230 V series (SAA standard)
—	Instruction manual	—	1	—

*Specified one.



OPTIONAL FEATURES

Option Code	Name
/GP-IB	GPIB interface
/RS232C	RS-232-C interface
/FRQ	Frequency measurement
/INTEG	Integrator

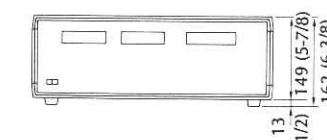
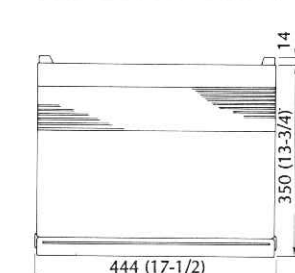
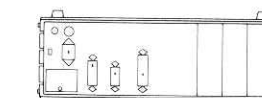
ORDERING INFORMATION

When ordering, specify:

Instrument name, model and suffix codes, and option code if required.

DIMENSIONS

Unit: mm (inch)

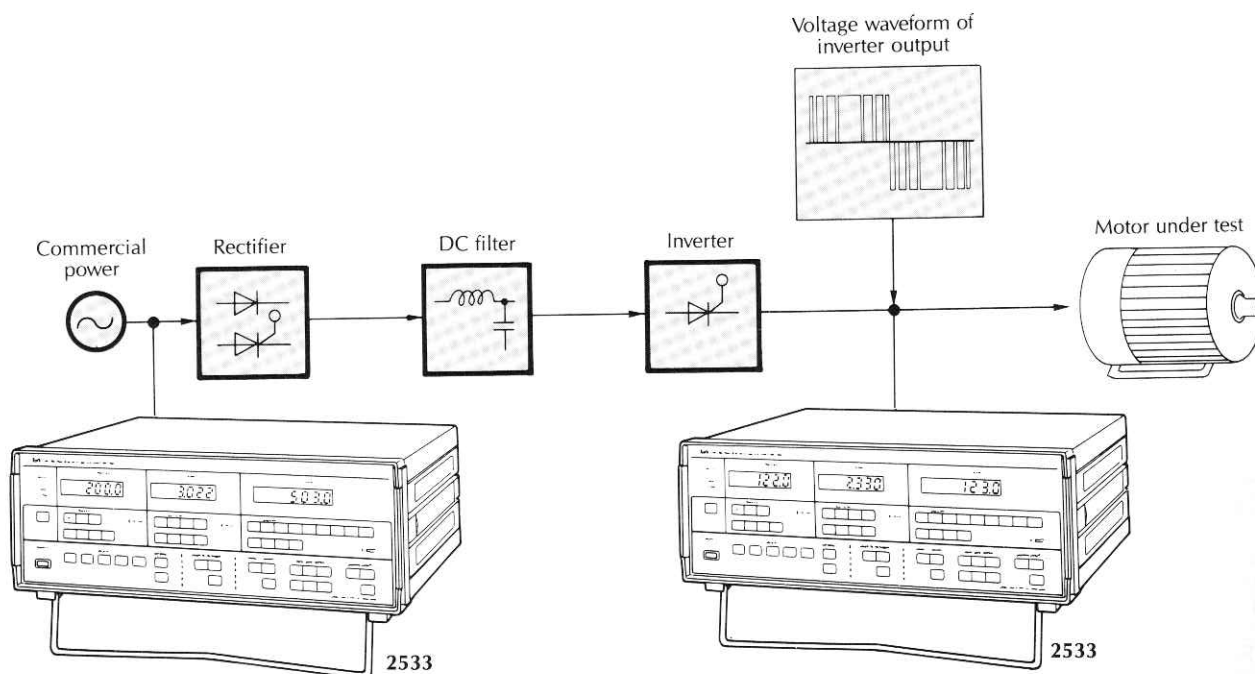


APPLICATIONS

The high-precision and wide frequency band analyzing function makes Model 2533 useful for diverse fields of applications including measurements, tests and inspections in R&D and on production lines.

- **Calibration of test and measuring instruments**
- **Audio, acoustic and household appliances**
Air-conditioners, TV sets, VTR's, refrigerators, cleaners, power amplifiers, speakers.
- **Electric and machinery**
Motors, inverters, transformers, industrial robots.
- **Power supplies**
Switching power supplies, power inverters, cycloconverters, rectifiers.

- **Lighting fixtures**
Fluorescent lamps, incandescent lamps, mercury lamps, sodium-vapor lamps.
- **Office equipment**
Facsimile equipment, electronic copiers, electronic typewriters, printers, office computers.
- **Metals, iron and steel**
Metal rolling machines, Epstein, core loss tests.
- **Welding**
Spot welding, arc-spot welding.



V-A-W measurement of inverter-controlled motor