

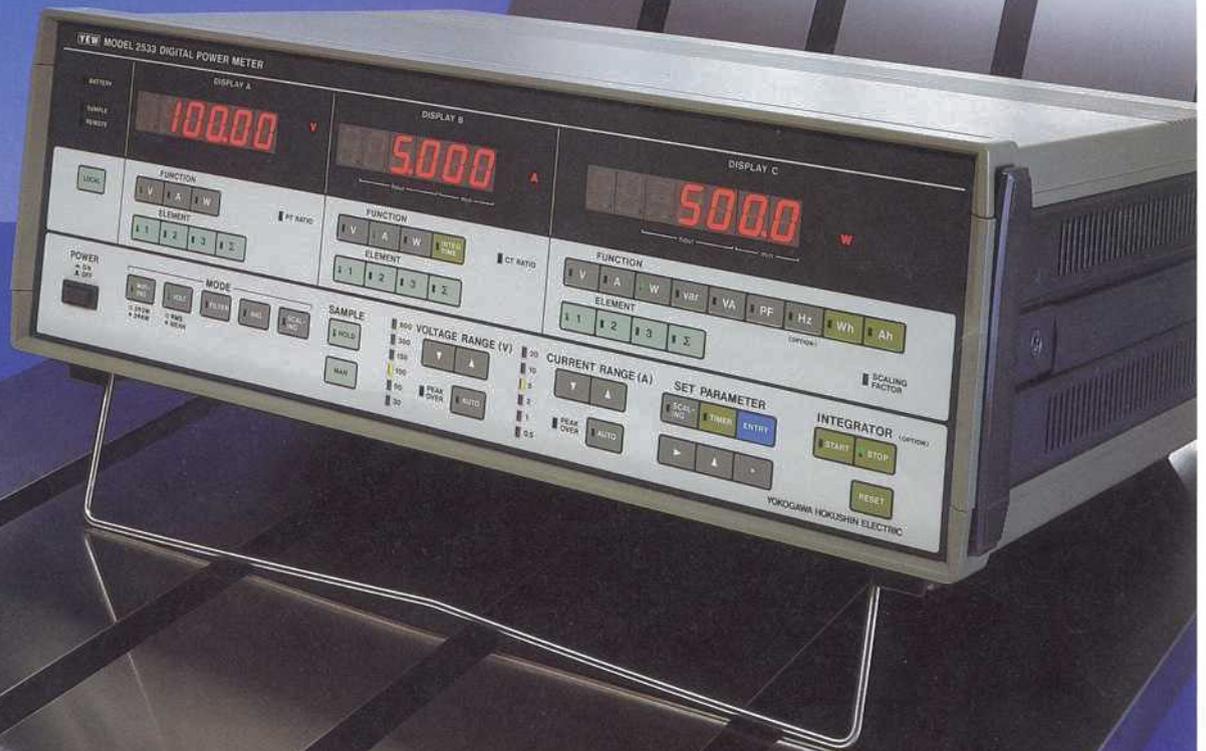
YOU & YEW
Both Winners

2500

2533 DIGITAL POWER METER

Three Displays in One ... V, A, W, \bar{V} , \bar{A} , VA, var, PF

Single-phase, 3-phase 3-wire, 3-phase 4-wire models
with DC, 10 Hz to 20 kHz range



RS-232C
GP-IB

Bulletin 2500C

YEW
YOKOGAWA HOKUSHIN ELECTRIC

Precision Measurement of Distorted Waveforms with Powerful Computing Capability.

The YEW Model 2533 Digital Power Meter is an outstanding solution to accurate power measurement of distorted waveforms with simple and fast flat-key controls. Model 2533 includes six basic models for single-phase, 3-phase 3-wire, and 3-phase 4-wire circuit with or without DC measurement. All models incorporate easy-to-use, versatile computing functions, and provide direct digital reading of voltage, current, power in each phase or total power, apparent power, reactive power, power factor, and more.

Convenient Features

- Simultaneous display of V, A & W (or VA, var, PF)
- 0.1% accuracy
- Wide frequency range — DC, 10Hz to 20kHz

Suitable for accurate power measurement of distorted waveforms and inverters.

■ Versatile computing functions

Powerful computing functions include \bar{V} (mean value of line or phase voltage), \bar{A} (mean value of phase current), VA (apparent power), var (reactive power), and PF (power factor).

■ Scaling — Direct reading of V, A and W even when used with external CT and PT

■ Simplified programming and operation via membrane-sealed keyboard

■ Analog outputs (standard)

■ GPIB or RS-232C programmable (optional)

■ Integration (Wh, Ah) and frequency measurement (optional)

Examples of 2533 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.

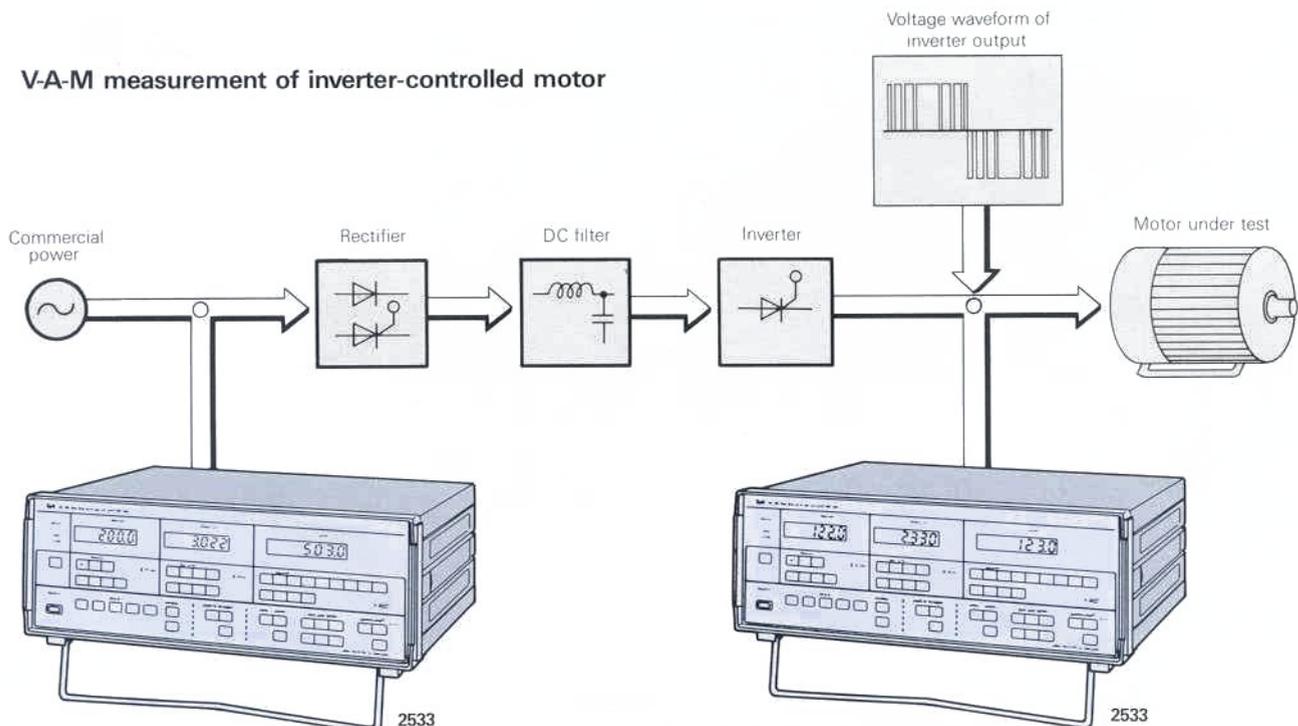
■ Metals, iron and steel

Metal rolling machines, Epstein, core loss tests.

■ Welding

Spot welding, arc-spot welding.

V-A-M measurement of inverter-controlled motor



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.

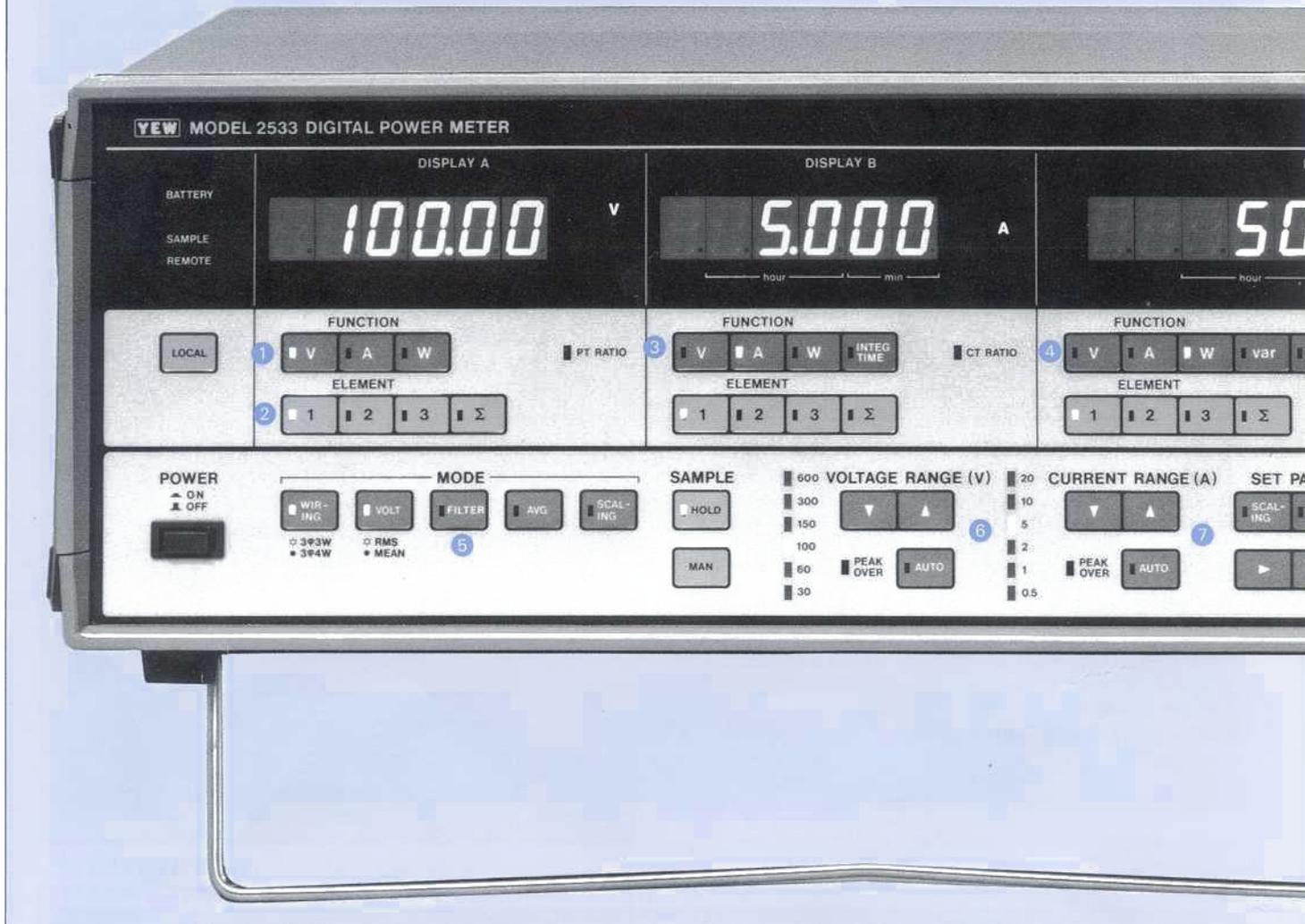
4 FUNCTION keys

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



Specifications

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)

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-232C interface).

Sample Rate: Approx. 2.5 times/s.

Range: Automatic or manual (or remote via optional GPIB or RS-232C interface).

Effective Measuring Range: 10 to 110% of rated value (range).

Response Time: Approx. 0.4 s. (at filter OFF, for analog output within ± 0.2% accuracy against an input variation from 30% to 100% of range, or from 100% to 30% of range).

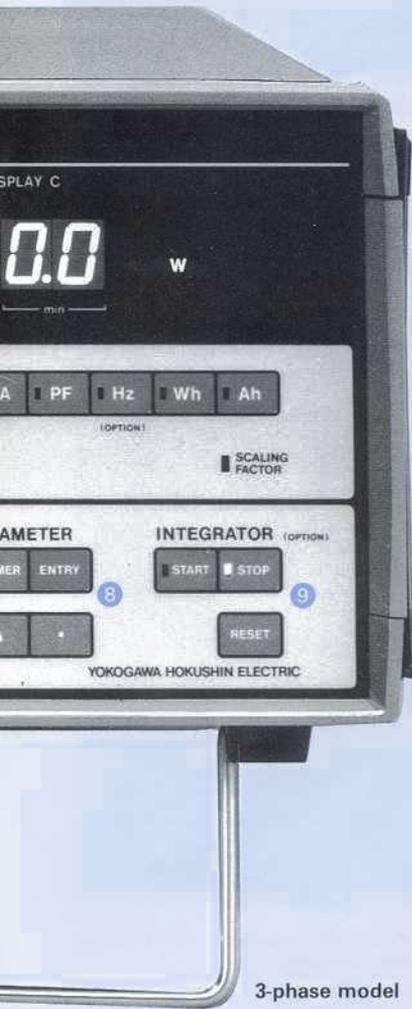
Data Outputs: Analog outputs... up to 3 signals (single-phase model), up to 9 signals (3-phase 3-wire model), up to 12 signals (3-phase 4-wire model).

display).

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

AVG: Provides exponential averaging of 8 measured data points.

SCALING: Scaling ON/OFF key.



3-phase model

6 VOLTAGE RANGE keys

Manual selection of 6 ranges (30 to 600V), 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 20A), plus autoranging. When the power is turned ON, previously entered current range is automatically selected.

8 SET PARAMETER keys

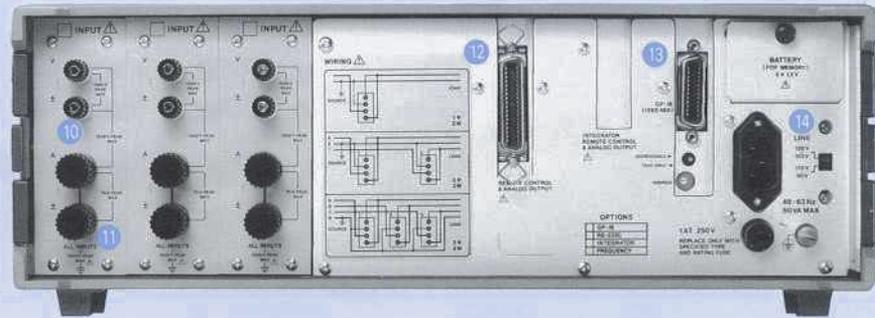
Used to program scaling (PT and CT ratios), and integration time:

- ▶ Digit designation.
- ▲ Data (0 to 9) designation.
- ◻ Decimal point designation.

9 INTEGRATOR keys (optional)

Consist of integration START, STOP, RESET keys.

- 10 Voltage input terminals
- 11 Current input terminals
- 12 Analog output connector
- 13 GPIB connector (optional)
- 14 AC power connector



Rear panel (3-phase model)

D-A output ... optional (refer to Integrator).

GPIB or RS-232C output ... optional (display 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: 3,000V AC (50, 60Hz) for one minute between input terminals and case, between input and output terminals, and between V and A terminals, 1,500V AC (50, 60Hz) for one minute between input terminals, output terminals, case and power line.

Insulation Resistance: More than 50 MΩ at 500V 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 230V AC (must be specified), 48 to 63Hz.

Power Consumption: Approx. 35 VA.

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

Weight: Single-phase model...approx. 12 kg (26.5 lbs), 3-phase model...approx. 14 kg (30.9 lbs).

Accessories supplied at no extra cost: Output connector...1 pc., fuses (1 or 0.5A)...2 pcs., batteries (SUM-3)...2 pcs., rack adapter... 1 set, power cord...1 set, instruction manual...1 copy.

Specifications

INPUT

Input	Voltage	Current
Type of Input	Direct (CT isolation after ranging)	CT isolation (secondary ranging)
Rated Input (Range)	30, 60, 100, 150, 300, 600V	0.5, 1, 2, 5, 10, 20A
Frequency Range	*(DC), 10Hz to 20kHz	
Max. Allowable Input (for 1 s)	3.5 x range (peak) or 1,400Vpk (whichever is less)	10 x range (peak) or 70Apk (whichever is less)
Max. Allowable Input (continuous)	2 x range (rms) or 1,000Vpk (whichever is less)	3 x range (rms) or 50Apk (whichever is less)
Input Impedance or Power Consumption (approx. value at 50Hz)	1MΩ on all ranges	0.05VA (0.5A range), 0.4VA (5A range) 0.07VA (1A range), 1VA (10A range) 0.1VA (2A range), 2VA (20A range)
Max. Common Mode Voltage (at 50 or 60Hz)	1,000Vrms	1,000Vrms
Effect of Common Mode Voltage (at 50 or 60Hz)	Less than ±0.025% of range (input terminals shorted, 1,000V applied between input and case... V, open input terminals... A)	

*Note: 25332□ only.

MEASUREMENTS

Function	Voltage	Current	Power	
Operating Principle	True rms (log-antilog)/mean value rectification	True rms (log-antilog)	Feedback time division multiplier	
Measurement	Single-phase	V_1	A_1	W_1
	3-phase 3-wire	$V_1, V_3, \frac{V_1 + V_3}{2} (\Sigma)$	$A_1, A_3, \frac{A_1 + A_3}{2} (\Sigma)$	$W_1, W_3, W_1 + W_3 (\Sigma)$
	3-phase 4-wire	$V_1, V_2, V_3, \frac{V_1 + V_2 + V_3}{3} (\Sigma)$	$A_1, A_2, A_3, \frac{A_1 + A_2 + A_3}{3} (\Sigma)$	$W_1, W_2, W_3, W_1 + W_2 + W_3 (\Sigma)$
Frequency Range	*(DC), 10Hz to 20kHz			
Crest Factor	Up to 2	Up to 3	Corresponds to V & A	
Display Accuracy**	(DC)* 45 to 66Hz: ±(0.1% of rdg + 0.1% of range)		At cos φ = 1, (DC)*: ±0.5% of range 45 to 66Hz: ±(0.1% of rdg + 0.1% of range)	
	20 to 45Hz, 66Hz to 2kHz: ±(0.2% of rdg + 0.2% of range) 10 to 20Hz, 2 to 10kHz: ±1% of range 10 to 20kHz: ±2% of range		Corresponds to V & A	
Power Factor Effect	—	—	Less than ±0.5% of rdg (at cos φ = 0.5, 50 or 60Hz)	
Accuracy of Analog Output**	(DC)* 45 to 66Hz: ±0.25% of range 10 to 45Hz, 66Hz to 2kHz: ±0.5% of range (for other frequency ranges, the same accuracy as those of display above)		Corresponds to V & A (at cos φ = 1)	
Temperature Coefficient (at 5 to 20°C, 26 to 40°C, or 41 to 68°F, 79 to 104°F)	Less than ±0.03% of range/°C (Less than ±0.02% of range/°F)			

Notes: *1. 25332□ only.

**2. At 23±3°C (73±5°F), 45 to 75 relative humidity, 100V±1% sine wave input, 3-month calibration cycle.

COMPUTATION

■ Apparent power, reactive power & power factor

Function	Apparent Power (VA)	Reactive Power (var)	Power Factor (PF)
Computing Formula	1 to 3 (each phase)	$V_i \times A_i$	$\frac{W_i}{V_i \times A_i}$
	Σ (3-phase 3-wire)	$\frac{V_1 + V_3}{2} \times \frac{A_1 + A_3}{2} \times \sqrt{3}$	$\frac{W_1 + W_3}{\frac{V_1 + V_3}{2} \times \frac{A_1 + A_3}{2} \times \sqrt{3}}$
	Σ (3-phase 4-wire)	$\frac{V_1 + V_2 + V_3}{3} \times \frac{A_1 + A_2 + A_3}{3} \times 3$	$\frac{W_1 + W_2 + W_3}{\frac{V_1 + V_2 + V_3}{3} \times \frac{A_1 + A_2 + A_3}{3} \times 3}$
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*	±0.05% of rated value (VA or var)		±0.001

■ Averaging (exponential averaging)

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.

■ Scaling

Available for measured data by setting constants (PT ratio, CT ratio, power scaling) with automatic switching of the engineering unit.

Scaling Range: 0.0001 to 10000.

Setting: Display A... PT ratio, B... CT ratio, C... scaling factor.

Optional Features

■ GPIB Interface (/GP-IB)

Functional, Electrical and Mechanical Specifications: Meets IEEE Standard 488-1975 "Digital Interface for Programmable Instrumentation."

Interface Function and Identification: SHI, *AHI, T5, L4, SR1, PP0, DC1, DT1, C0 (Talker & Listener, Talk only).

■ RS-232C Interface (/RS232C)

■ Frequency Measurement (/FRQ)

Operating Principle: Reciprocal counting method.

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

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

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

Display Range: 10.00Hz to 200.0kHz (4 digits).

Sample Time: 400ms.

Measuring Input: V1 or A1.

■ Integrator (/INTEG)

Maximum Reading: ± 999999 (full 6 digits).

Integration Time: Up to 100h.

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

Timer: Automatically stops integration by presetting timer (setting range... 000h: 01min to 100h: 00min, timer OFF at 000h: 00min), timer accuracy... $\pm 0.02\%$.

Elapsed Time Display: 00h: 01min to 99h: 59min 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 or PF (display data).

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

Sample Time: 400ms.

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

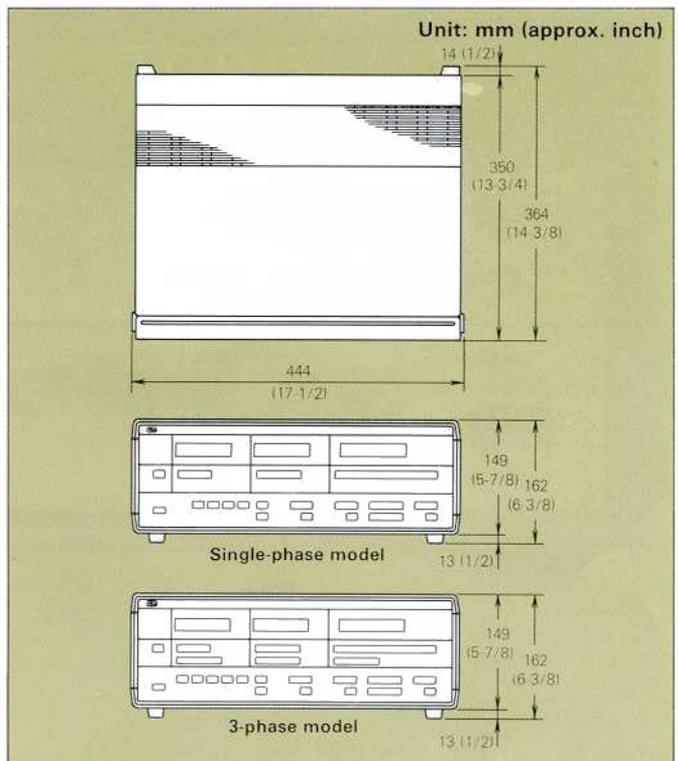
Available Models

Basic Code	Measuring Circuits	Description
253311	Single-phase (AC)	—
253312	3-phase 3-wire (AC)	
253313	3-phase 4-wire (AC)	
253321	Single-phase (DC & AC)	To be available (December 1986)
253322	3-phase 3-wire (DC & AC)	
253323	3-phase 4-wire (DC & AC)	

Optional Features

Option Code	Name	Description
/GP-IB	GPIB interface	—
/RS232C	RS-232C interface	To be available (December 1986)
/FRQ	Frequency measurement	To be available (September 1986)
/INTEG	Integrator	(September 1986)

DIMENSIONS



YOKOGAWA HOKUSHIN ELECTRIC CORPORATION
 9-32, Nakacho 2-Chome, Musashino-shi, Tokyo 180, JAPAN
 Phone: Tokyo 0422-54-1111, Telex: 02822-327 YEW MT J
TOKYO NO.2 SALES OFFICE: Shinjuku NS Bldg. (10F),
 2-4-1 Nishi Shinjuku, Shinjuku-ku, Tokyo 163, JAPAN
 Phone: 03-349-0621, Telex: J27473 YEW TOK

YOKOGAWA CORPORATION OF AMERICA
 2 Dart Road, Shenoadoah, Ga. 30265, U.S.A.
 Phone: 404-253-7000, TWX: 810-766-4760 YCA SHEN

YOKOGAWA ELECTROFACT B.V.
 Radiumweg 30, 3812 RA Amersfoort, THE NETHERLANDS
 Phone: (0)33-10543, Telex: 79118 YEF NL