

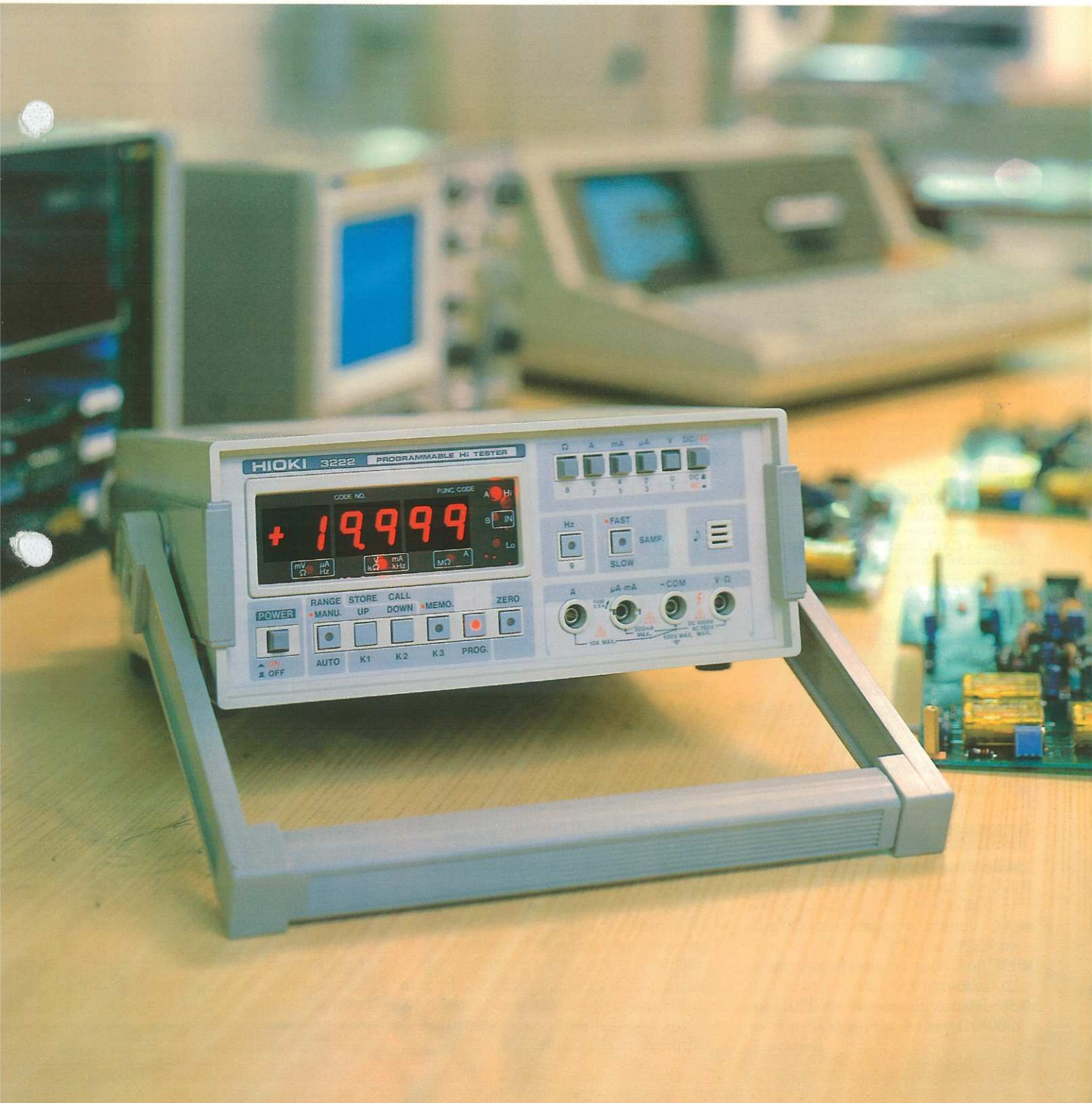


3222 PROGRAMMABLE Hi TESTER

# 3222

With Memory and Program Function

## TRMS-Responding 4 1/2-Digit DMM

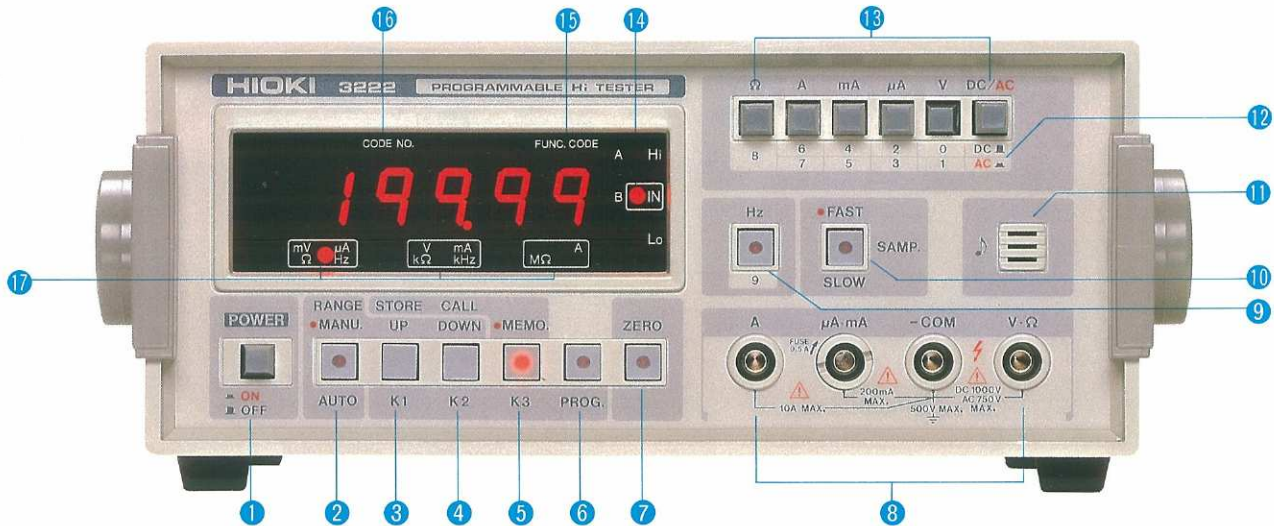


# Multifunction Digital Multimeter

The 3222 Programmable Hi Tester is a multifunction digital multimeter designed to provide the user an instrument that will give him the versatility needed in today's complex electric and electronic fields. Measurement functions include not only those found on standard DMMs (DC/AC voltage and current, and Ohms), but programmable comparator, scaling, percent

deviation, counter, dB measurement, and pulse generator functions are provided as well. Zero adjust (to full count value) is possible, as is high- and low-speed sampling. The 3222 also comes standard with a memory function, and a true RMS converter assures that AC waveforms are quantified with complete accuracy.

## Instrument Nomenclature & Function



### 1 Power switch

### 2 RANGE (MANU/AUTO) key

- ON (MANU): Measurement range selected manually through K1 and K2.
- OFF (AUTO): Ranging automatic.

### 3 STORE/UP/K1 key

- MANU (RANGE ON): Selects higher measurement range.
- Memory STORE: Specifies higher STORE NO.
- Memory CALL: Specifies lower CALL NO.
- Calculation constant setting: Specifies higher setting value.
- Counter: Starts and stops the counter.

### 4 CALL/DOWN/K2 key

- MANU (RANGE ON): Selects lower measurement range.
- Memory CALL: Specifies higher memory NO.
- Calculation setting constant: Shift setting digits one column to right.
- Counter: Clears the counter to zero.

### 5 MEMO/K3 key

- Start and stops MEMOry operation.
- Completes setting of calculation constant.

### 6 PROG key

Start and stop key for the program mode. Used in conjunction with the K1, K2, and K3 keys, executes the functions shown below.

Code	Function
0	Comparator; beeper OFF
1	Comparator; INtermediate (beeper ON)
2	Comparator; HI-Lo (beeper ON)
3	dB measurements (voltage only)
4	Scaling; displays calculated value of (X-A) × B.
5	Deviation (%); displays calculated value of (X-A)/A × 100.
6	Pulse counter (gate time set by constant A)
7	Pulse generator (produces f = 8192/A at output terminal)

\* A (or Hi), B (or Lo) used as calculation constant.  
\* Comparator mode: Results sent to status indicator and output terminal.

### 7 ZERO key

Pressing this key stores zero adj value in memory.

### 8 Measurement terminal

### 9 Hz (frequency) measurements

Effective only when AC/DC switch is in AC position.

### 10 SAMP (sampling speed selector)

FAST (ON), SLOW (OFF)

### 11 Beeper

### 12 Function code

Indicates which function is being used in MEMO mode.

### 13 Function (AC/DC V, A, Ω) selector

### 14 Status display

The following conditions activate the LED indicators.

MEMO: STORE (A), CALL (B)  
PROG: ① Input constant name; (A, B)  
② Comparator decision; (Hi, IN, Lo)  
③ Counter gate ON; (A)

### 15 FUNC. CODE

In MEMO mode, measured value indicated as function code No.

① DC V, ② AC V, ③ DC μA, ④ AC μA, ⑤ DC mA, ⑥ AC mA, ⑦ DC A, ⑧ AC A, ⑨ Ω, ⑩ Hz

### 16 CODE NO.

MEMO: Indicates memory No.

PROG: Indicates calculation function code No.

### 17 Unit indicator

## Outline of Functions

The 3222 can be generally considered as having three functions.

- Ordinary Measurements
- Memory Function
- Program Function

## Ordinary Measurements

### Basic Function

- DC Voltage measurements 200mV to 1000V
- AC Voltage measurements 200mV to 750V
- DC/AC Current measurements 200μA to 10A
- Resistance measurements 200Ω to 200MΩ

## Frequency Meter

Frequency measurements 4.00Hz to 200.00kHz (Frequency measurements effective only for AC range)

### Auto and Manual Ranging

The [RANGE] key is used to select either automatic or manual ranging. For [MANU], [K1] raises the range, and [K2] lowers the range. For [AUTO], range is automatically set according to the signal strength at input.

### Zero Adjust function

When the [ZERO] key is pressed, the present input value is stored into memory as the zero adj value (X<sub>0</sub>). Hereafter, for every input (X), the zero adj value will be subtracted from it (X - X<sub>0</sub>), and this will be the value that appears in the display.

## Selecting Sample Rate

In DC and resistance measurements, sample rate can be set either fast or slow through use of the [SAMP] key. Note that with AC measurements, it is only possible to use the slow rate.  
[SLOW]: 2.5 samples per second  
[FAST]: 6.25 samples per sec. (50Hz); or 7.5 samples per sec. (60Hz) (DC, Ω only)

## TRMS Responding

For measuring distorted waveforms such as produced by SCR-controlled equipment. (AC range only)

## High Resistance Measurement

A wide range of resistance values are covered.  
maximum reading: 199.9MΩ

## Memory Function

Memory allows up to 10 sets of ordinary measurement data to be stored and recalled as required. Memory can be used to hold both measurement data, and coded function switch setting.

Pressing the **MEMO** key enables the memory mode. Continue by,

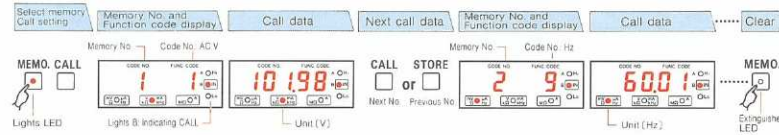
- Pressing **STORE** to enable the memory store mode.
- Pressing **CALL** to enable the memory call mode.

(Example)

● **Storing in memory** AC V(101.98V), Hz(60.01Hz), Ω (126.03Ω).....



● **Recalling the above setup**



## Program Function

The purpose of the program function is to perform various calculations on the measurement values (obtained in the ordinary measurement mode), and output the results to the display and output terminal.

■ **Comparator mode** (Code No.0~2)

The comparator mode announces the results of a comparison operation by producing a beeper sound. The three submodes are as listed below.  
 Program Code No.0: No beeper.  
 Program Code No.1: IN with beeper.  
 Program Code No.2: Hi-Lo with beeper.

<Application Example>

- Continuity check
- A continuity check may be run using the comparator function.
- Ex) Set up so that the beeper sounds for measurements of 100Ω or under.
- 1 Select the Ω function, and set range to 200Ω
- 2 Press the **PROG** key, and set code No. 1.
- 3 Set the Hi constant to +100.00, and Lo constant to -100.00. (Actually, any negative value will do.)
- 4 If resistance is under 100Ω, the beeper will sound indicating continuity. Setting **SAMP** to fast allows a quicker decision to be made.

■ **Decibel mode (dBm or dB)** (Code No.3)

Decibel measurements are made using the input value as X, the reference value (0dB) as X<sub>0</sub>, and letting the program calculate the results Y using the equation

$$Y = 20 \log_{10} \frac{X}{X_0}$$

The results are sent to display.

On the 3222, X<sub>0</sub> may be obtained in two different ways, depending on whether the **ZERO** key is ON or OFF.

- (1) **ZERO** key OFF
- When the **ZERO** key is OFF, X<sub>0</sub> represents the voltage (0.7746V) when 1mW is dissipated into a load resistance of 600Ω.

$$Y = 20 \log_{10} \frac{|X|}{0.7746} \text{ (dBm)}$$

- (2) **ZERO** key ON
- When the **ZERO** key is ON, X<sub>0</sub> is derived by the standard decibel equation.

$$Y = 20 \log_{10} \frac{|X|}{|X_0|} \text{ (dB)}$$

■ **Scaling function** (Code No.4)

The scaling function is used to convert one set of input data units to their equivalents of a different unit. This is accomplished by the program using X as the input value, the operator entering the calculation constants A and B, and the computation made using the equation

$$Y = (X - A) \times B$$

Range for constant A: -1999~+1999  
 Range for constant B: -1999~+1999

The results Y is sent to the display.

<Application Example>

- Method for direct display of input value converted from the output of a transducer.
- Current output type power transducer having the following rating.
- Rated input 0~1kW
- Rated output 4~20mA
- Where the input power of the transducer is W, and output current is I,

$$W = (I - 4) \times \frac{1}{(20 - 4)} = (I - 4) \times 0.0625$$

In other words, setting the 3222 up to measure current, and placing the instrument in the scaling mode (Prog. No.4) allows power to be read directly from the display. In the above example, range is set to 20mA, constant A is set to 4.000, and constant B is set to 0.0625.

■ **Deviation mode (%)** (Code No.5)

The deviation mode displays the difference in percentage of the measured value and constant A, entered as a calculation constant. Where input value is X, and the constant is A, the calculated result Y is expressed in the equation

$$Y = \frac{X - A}{A} \times 100 (\%)$$

Range for constant A: -1999~+1999

<Application Example>

- Method for classifying a group of 1.2kΩ ± 10% resistors into 1% increments.
- 1 Select the Ω function, and set range to 2kΩ.
- 2 Select Code No.5.
- 3 Enter 1.2000 as constant A.
- 4 Since the display shows the error (deviation) from 1.2kΩ at a resolution of 0.01%, the 1% groupings will be displayed simply as -9.99~ -9.00, -8.99~ -8.00, -7.99~ -7.00..... +8.00~ +8.99, +9.00~ +9.99%.

■ **Counter** (Code No.6)

- Settable gate-time counter
- Set gate time A as the interval which input pulses will be counted.
- Total counter
- If constant A is set as 0, the timer function will be disabled, and start/stop operations can only be accomplished.
- Maximum counting: 99999
- Maximum setting time: 99999 sec.

■ **Pulse generator mode** (Code No.7)

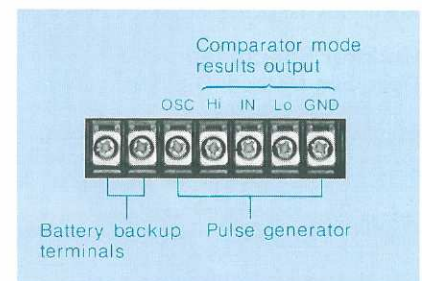
Pulse generator operations provide a pulse ranging in frequency from 0.5 to 8192Hz to the output terminal.

$$\text{Output frequency (f)} = \frac{8192}{A}$$

Where A is the setting range of the constant (1~16384)

Output duty cycle is approx. 1/2.

## Output terminal



## Memory Data and Constant Backup

The 3222 features a provision for battery backup that allows memory contents and constant setting to be held in case power is turned OFF, or a power failure occurs. This eliminates having to make new settings in such an event. The length of time battery backup is effective is approximately one week. If backup is required for longer periods of time, connect a DC source of 3 to 5.5V to the battery backup terminals.

## Specifications

### Measurement Range

Conditions: 23°C±5°C, <80%RH  
Guaranteed accuracy: 6 mos.

### DC voltage meter (following zero adj)

Sample rate: Slow

Range	200mV	2000mV	20V	200V	1000V
Resolution	10μV	100μV	1mV	10mV	100mV
Accuracy	±0.04%rdg. ±2dgt.		±0.05%rdg. ±2dgt.		
Input Impedance	>100MΩ		10MΩ (approx)		
Temperature Coefficient	(±0.005%rdg. ±0.2dgt.)/°C				
Noise Rejection Ratio	CMRR: >110dB; NMRR: 60dB				
Digit Uncertainty	±2dgt.				
Response Time	Approx. 1sec.				

Sample rate: Fast

Range	200mV	2000mV	20V	200V	1000V
Resolution	10μV	100μV	1mV	10mV	100mV
Accuracy	±0.04%rdg. ±4dgt.		±0.05%rdg. ±4dgt.		
Input Impedance	>100MΩ		10MΩ (approx)		
Temperature Coefficient	(±0.005%rdg. ±0.2dgt.)/°C				
Noise Rejection Ratio	CMRR: >110dB; NMRR: 60dB				
Digit Uncertainty	±4dgt.				
Response Time	Approx. 1sec.				

### AC voltage meter (True RMS; AC only)

Following zero adj (specified for sine wave)

Range	200mV	2000mV	20V	200V	750V
Resolution	10μV	100μV	1mV	10mV	100mV
Accuracy	40Hz~10kHz	±0.3%rdg. ±30dgt.			※±1%rdg. ±30dgt.
	10kHz~20kHz	±0.4%rdg. ±30dgt.	±1%rdg. ±30dgt.		—
	20kHz~100kHz	±2%rdg. ±100dgt.	±3%rdg. ±100dgt.	—	—
Input Impedance	2MΩ (approx), <100pF				
Temperature Coefficient	(measurement accuracy × 0.1)/°C				
Digit Uncertainty	2dgt.				
Response Time	Approx. 5sec.				
Crest Factor	4 : 1 at full-scale				

※ Measurement accuracy specified for values above 5% of full-scale value.  
※ In 750V range, frequency measurements limited to 1kHz.

## General Specifications

**Operating Method:** Digital circuits, integrating type.

**Display:** For ordinary measurements, 4 1/2-digit LED, maximum reading of "1999" (except for DC 1000V, AC 750V AC/DC 10A range).

For zero adjust function, maximum reading of "39999".

**Ranging:** Automatic and manual.

**Overrange Indicator:** "1" in MSD column blinks.

**Polarity Indicator:** For ordinary measurements, only the neg (-) sign displayed.

**Sampling Rate:** Slow: 2.5 per second.

Fast (DC, Ω only): 6.25 per sec. (50Hz)  
7.5 per sec. (60Hz)

**Environmental Conditions (Operating):** 0~40°C, <80% RH.

(Storage): -10~50°C, <80% RH

**Dielectric Strength:** 500V (DC or AC peak between -COM terminal, case, and AC power line).

**Power Source:** AC 100V, 120V, 220V, 240V (Specify at order) ±10%, 50/60Hz (switchable)

**Dimensions/Weight:** 85H×250W×220D (mm)/2.1kg

## Ohmmeter (following zero adjust)

Sample rate ※: Slow

Range	200Ω	2000Ω	20kΩ	200kΩ	2MΩ	20MΩ	200MΩ ※
Resolution	10mΩ	100mΩ	1Ω	10Ω	100Ω	1kΩ	100kΩ
Measurement Current	1mA		10μA		1μA		0.1μA
Accuracy	±0.07%rdg. ±2dgt.			±0.1%rdg. ±5dgt.		±0.5%rdg. ±10dgt.	±5%rdg. ±10dgt.
Temperature Coefficient	±(0.02%rdg. ±0.5dgt.)/°C			±(0.05%rdg. ±0.8dgt.)/°C		±(0.2%rdg. ±0.8dgt.)/°C	±(0.5%rdg. ±0.8dgt.)/°C
Response Time	Approx. 2sec. (Fast: 1sec.)			Approx. 3sec. (Fast: 2sec.)			
Open-Terminal Voltage	5V (approx)						

※ At fast sampling rates, accuracy decreases by 2 digits.

※ ※ 3 1/2-digits in 200MΩ range.

## DC current meter (following zero adj)

Sample rate: Slow

Range	200μA	2000μA	20mA	200mA	2A	10A
Resolution	10nA	100nA	1μA	10μA	100μA	1mA
Accuracy	±0.4%rdg. ±5dgt.	±0.15%rdg. ±2dgt.	±0.4%rdg. ±5dgt.	±0.15%rdg. ±2dgt.	±0.6%rdg. ±5dgt.	±0.4%rdg. ±5dgt.
Internal Resistance	200Ω		2Ω		<25mΩ	
Temperature Coefficient	(±0.02%rdg. ±1dgt.)/°C					
Response Time	Approx. 1sec.					

※ At fast sampling rates, accuracy decreases by 2 digits.

## AC current meter (True RMS; AC only)

Following zero adj (specified for sine wave)

Range	200μA	2000μA	20mA	200mA	2A	10A
Resolution	10nA	100nA	1μA	10μA	100μA	1mA
Accuracy (40Hz~1kHz)	±0.7%rdg. ±40dgt.	±0.4%rdg. ±40dgt.	±0.7%rdg. ±40dgt.	±0.4%rdg. ±40dgt.	±0.9%rdg. ±40dgt.	±0.7%rdg. ±40dgt.
Internal Resistance	200Ω		2Ω		<25mΩ	
Temperature Coefficient	(measurement accuracy × 0.1)/°C					
Response Time	Approx. 5sec.					
Crest Factor	4 : 1 at full-scale					

※ Measurement accuracy specified for values above 5% of full scale value.

## Frequency meter

Specified for inputs of over 75% in the AC range in use.

Range	200Hz	2000Hz	20kHz	200kHz
Resolution	0.01Hz	0.1Hz	1Hz	10Hz
Accuracy	±0.03%rdg. ±1dgt.		±0.01%rdg. ±1dgt.	
Response Time	Approx. 1sec.			

**Accessories Furnished:** 0.5A non-arcing fuse (5mm × 20mm) for μA-mA terminal; Power supply fuse (3A, 5mm × 20mm); 9170 Test leads (red & black), 1 set.

## Optional Accessory

9084 Carrying case

## Ordering Information

3222 Standard  
3222-02 with analogue output  
3222-03 with BCD output  
3222-04 with GP-IB

Standard Packing (double carton box)	Sets	N.W.	G.W.	M <sup>3</sup>
	3	9kg	11kg	0.10

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