

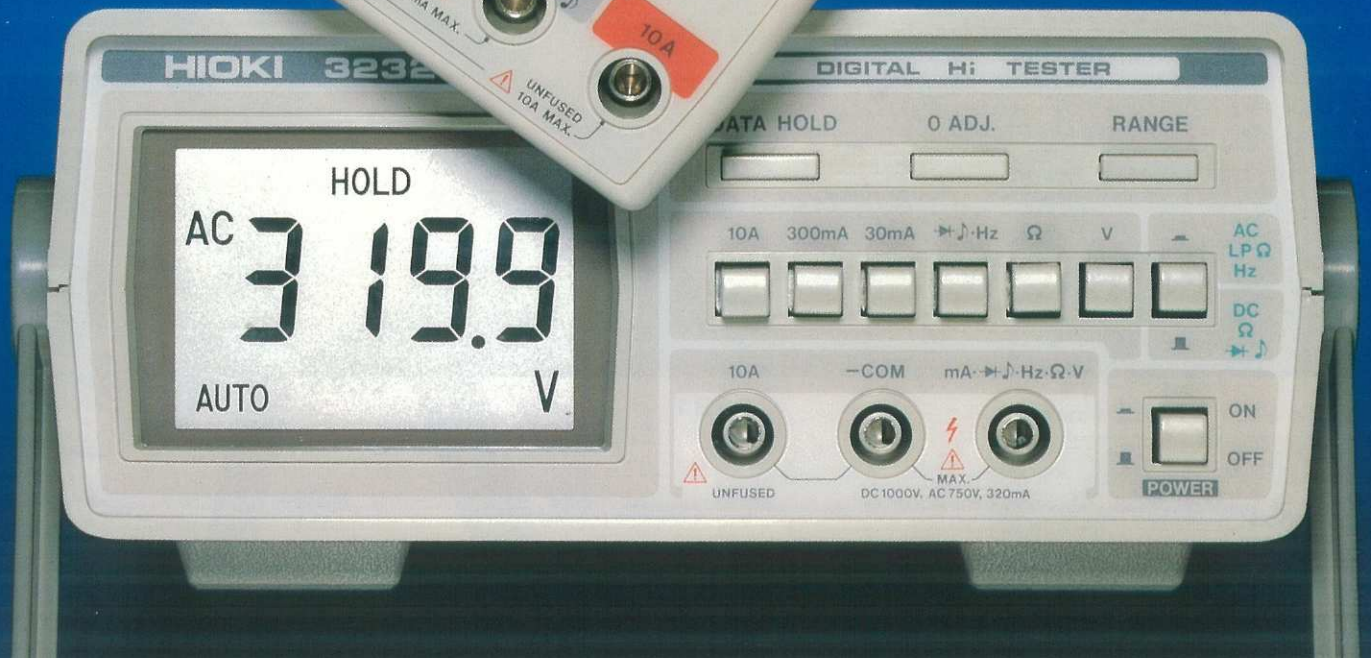
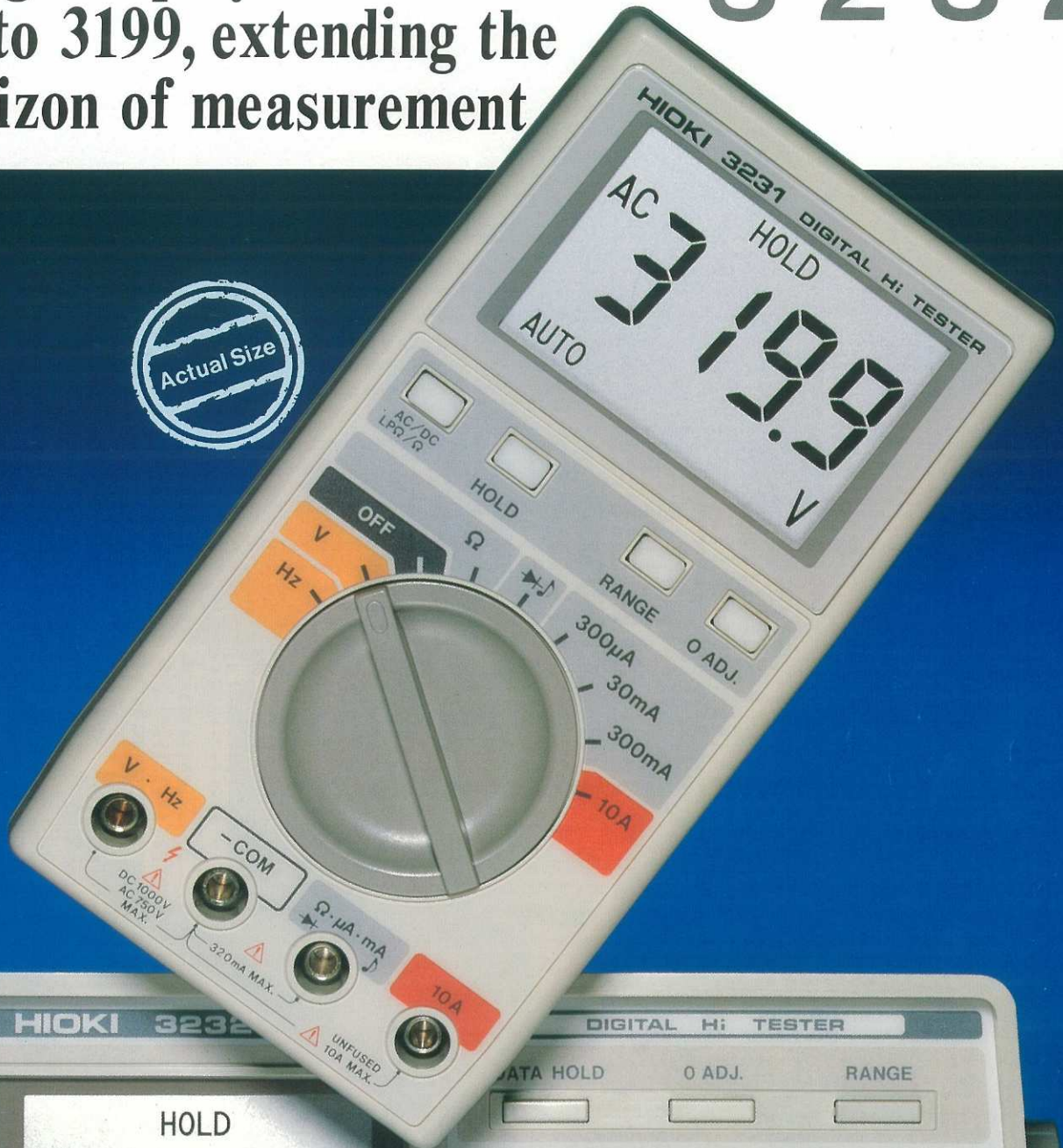
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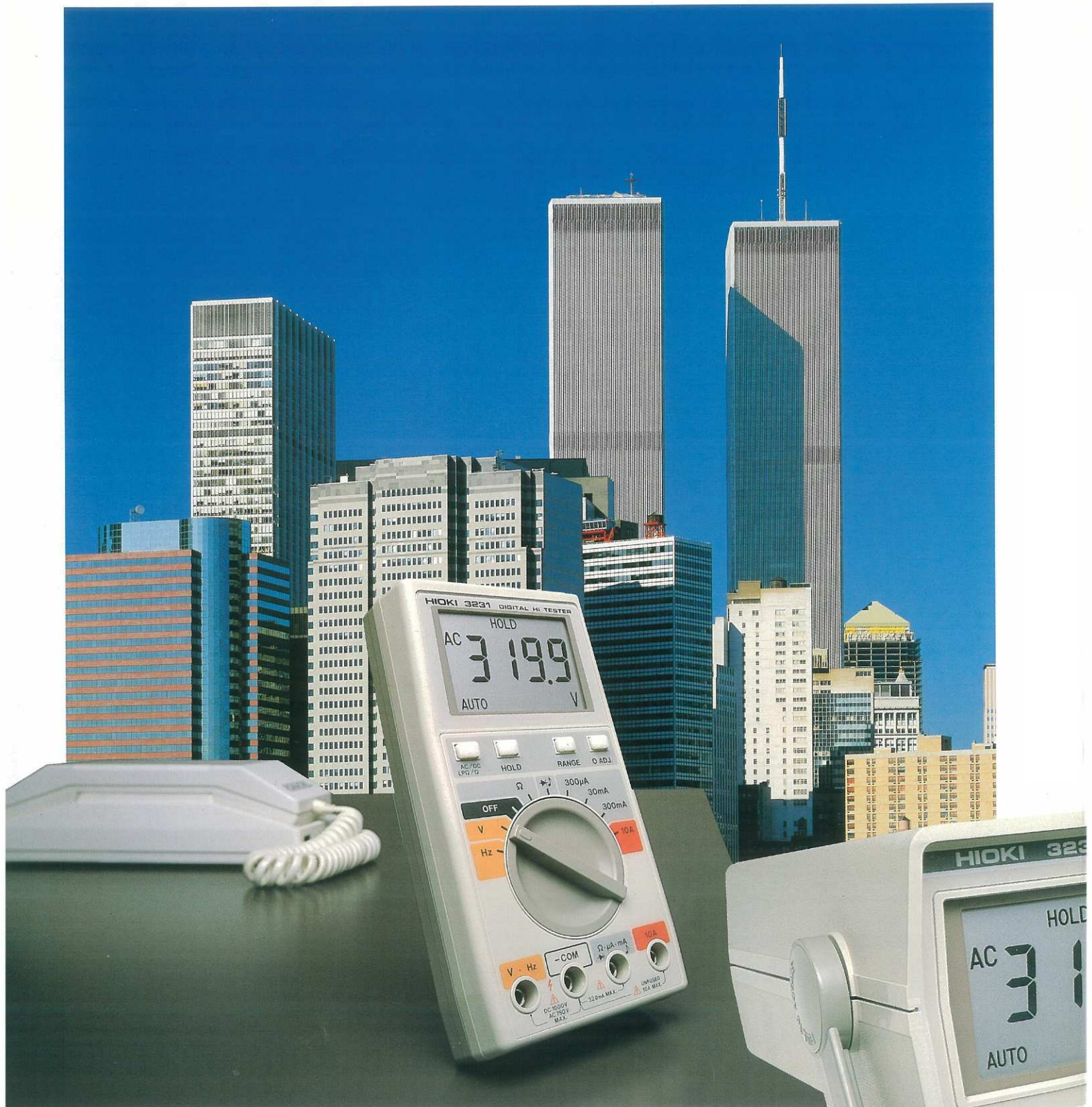
DIGITAL HI TESTER

3 2 3 1
3 2 3 2

Large display shows values up to 3199, extending the horizon of measurement



3231 Portable model for field use, and 3232 bench



3231

Application

- On-site maintenance
- Field service
- Production line testing
- Communications service

-type model for use in factory lines

Maximum Display Value of 3199

Increases measurement range by 160% over previous digital multimeters.

Large Display With 18-mm-high Characters

The large display is easy to read and displays all of the current settings such as function, unit, etc.

Multiple Functions

In addition to ordinary measurement functions (i.e., voltage, current, resistance, and continuity), these models can measure a low-power ohm and frequency. They can also be used as diode checkers.

Automatic Range Switching

For measurements other than current and frequency, the optimum range is always selected automatically. (Manual range switching is also possible.)

Display Holding Function

Pressing the HOLD (or DATA HOLD) key makes it possible to hold the display value.

Data Output (3232 only)

Measured data is output from the BCD data terminals (A,B,C and D) synchronized with the BCD timing signal (terminal T). (for printer)

Auto Power-Off Function (3231 only)

The power automatically turns off about 60 minutes after the function switch is last rotated, to save battery power.

Frequency Counting Possible

With the frequency-measuring function, frequencies 40Hz (3232:30Hz) to 320kHz can be measured. (Minimum resolution: 0.1 Hz)

In-circuit Measurement of Resistance

Setting the function switch to the **LPO** range makes it possible to measure resistance as an in-circuit.

Electronic Buzzer

The electronic buzzer sounds when the range is changed, the function is changed, input overflow is detected or a good result is obtained with the continuity test.

High Current Measurement

Up to 10 A (AC/DC) can be measured.

Zero Adjustment (0 ADJ)

Pressing the 0 ADJ key displays the [ADJ] mark, stores the display value in memory, and resets the display to zero. After this, the measured value minus the value in memory is displayed. Since this function can be used even when the full-scale value is displayed, it is useful for measuring variation in voltage or current, or actual resistance.

However, when the [ADJ] mark is displayed, the measurement range cannot be changed, so if the input level exceeds the maximum or minimum level of the range, an overflow occurs and the OF or -OF mark is displayed.

Safety Design

Our designers always consider safety first. The panel is designed to clear the correspondence between the terminals and ranges, preventing function switch operation errors. Safety leads and terminals ensure safety.



Simplified Dust-proof Structure (3231) only

A simplified dust-proof structure is used for Model 3231. This prevents dust from entering the unit, and thus prevents short circuits due to dust.



Other Features

- * A stand is provided with the 3231 portable model, so that it can be used on a desk.
- * Although an over-voltage protection circuit (250 V AC) is provided with all models for safety, a special version of Model 3231 with a Bussman fuse (600V AC) is also available. (Models 3231-50 and 3231-51)

Ordering information

3231

- 3231-01 (with carrying case)
- 3231-50 (with 600V AC fuse)
- 3231-51 (with 600V AC fuse and carrying case)

Options

- 9014 High voltage probe
- 9145 Carrying case (for 3231)

Standard Packing (Double carton box)

| Models | Sets | N.W. (kg) | G.W. (kg) | M ³ |
|--------------|------|-----------|-----------|----------------|
| 3231, -50 | 40 | 18 | 20 | 0.10 |
| 3231-01, -51 | 30 | 18 | 20 | 0.18 |
| 3232 | 10 | 11 | 13 | 0.13 |



Specifications

Measuring Method: Double Integration Method

Display: Maximum display value of 3199. 18-mm-high display characters. Unit displays (decimal point, mV, V, Ω, kΩ, MΩ, μA, mA, A, Hz, kHz, AC, \rightarrow , \leftarrow , LPΩ, ADJ, \square), AUTO, HOLD, "—")

Range switching: Automatic and manual (manual-only for current and frequency ranges)

Input overlow indication: OF or -OF (Except for 1000 VDC, 750 VAC, and 10 A DC/AC ranges)
Alarm buzzer (Except for 1000 VDC, 750 VAC, 10 A DC/AC and resistance ranges)

Polarity indication: "—" is displayed automatically.

Battery-low indication: \square is displayed.

Sampling rate: 2.5 times/sec

Temperature and humidity:

Operating: 0~40°C, 80% RH or less, no condensation

Maximum input level:

V terminal: 1100 V DC or DC+AC peak/1minute

Ω/A/ \rightarrow terminal: 250 VAC/1minute

10 A terminal: 12 A DC/AC/1 minute
Hz terminal: 300V DC+AC peak (1k~320k Hz)

Measurement Range

(23°C±5°C, 80% RH or less, no condensation)

| Range | Accuracy | Note |
|-------------------|----------------------------|--|
| DC voltage | | |
| 300mV | ±0.35%rdg. ±2dgt. | 100MΩ or more |
| 3V | " | About 11 MΩ |
| 30V | " | About 10 MΩ |
| 300V | ±0.5%rdg. ±2dgt. | " |
| 1000V | ±0.6%rdg. ±2dgt. | " |
| AC voltage | | |
| 3V | ±1% rdg. ±4dgt. | About 11MΩ |
| 30V | " | About 10MΩ |
| 300V | " | 40~500 Hz |
| 750V | " | |
| DC current | | |
| 300μA | ±1% rdg. ±2dgt. | 3231 only/about 1kΩ |
| 30mA | " | Internal resistance about 10Ω |
| 300mA | " | Internal resistance about 1Ω |
| 10A | ±1.2% rdg. ±2dgt. | Internal resistance 15mΩ or less |
| AC current | | |
| 300μA | ±1.2%rdg. ±4dgt. | 3231 only/about 1 kΩ |
| 30mA | " | Internal resistance about 10Ω |
| 300mA | " | Internal resistance about 1Ω |
| 10A | ±1.5%rdg. ±4dgt. | Internal resistance 15mΩ or less |
| Resistance | | |
| 300Ω | ±0.4%rdg. ±2dgt. | Output voltage is about 1.5 V or less when terminals are open. |
| 3kΩ | " | 0.65V ± 0.2V or less (0.45V or less at LPΩ range) |
| 30kΩ | " | |
| 300kΩ | " | |
| 3000kΩ | " | |
| 30MΩ | ±1%rdg. ±2dgt. *2 | |
| Frequency | | |
| 300Hz | ±0.15%rdg. ±2dgt. | Gate time 10sec |
| 3kHz | ±0.1%rdg. ±1dgt. | Gate time 1sec |
| 30kHz | " | Gate time 0.1sec |
| 300kHz | " | " |
| Continuity | | |
| | Threshold level: about 2kΩ | |
| | Response time: 100msec | |

*1 ±0.5% rdg. ±4dgt. at LPΩ range
*2 ±4dgt. at LPΩ range

Individual Specifications of Models 3231 and 3232

| | 3 2 3 1 | 3 2 3 2 |
|------------------------------------|--|--|
| Power supply | 2 size-AA cells | 4 size-AA cells or AC adapter (6V~300mA) |
| Automatic power-off | Automatically turns off after approx.60 minutes. | |
| Dimensions and weight | 160H×85W×32.5D mm 330g | 73H×175W×200D mm 800g |
| Accessories (Fuse:non-arcing type) | 9170 test leads 0.5A fuse (φ6.4×30) Bussman fuse (-50 spec.) | 9170 test leads 0.5A fuse (φ6.4×30) |

Data Output (3232 only)

Measured data is output from the BCD data terminals (A,B,C and D) synchronized with the BCD timing signal (terminal T). The output data normally contains the display value, unit and function code. However, the 30 mA and 10 A range signals are output from other terminals (R2 and R1, respectively). Terminal V and G are the power supply and ground terminals, respectively.

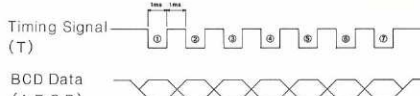


Fig. 1 Timing chart (negative logic)

1 2 3 4 5 6 7 8 9 10
G V N R₂ R₁ T D C B A

Transmission rate:
1 data per
0.4 seconds

Output terminals:

(R1: 30 mA range signal
R2: 10 A range signal
N: Not connected)

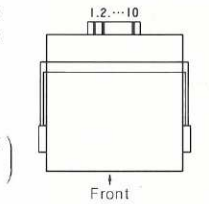


Fig. 2 Pin assignments

Output circuit:

G is connected battery GND. -COM terminal is a difference of a -1.5V from G.

V is supplied from an external source, (3~15V)

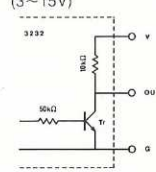


Fig. 3

Data format:

One set of BCD data consists of 7 data blocks (labelled ① to ⑦ in Fig. 1). Data blocks are output in the order of block numbers. All output lines are kept high after the last block has been output, until the next set of data is output. Terminal A outputs the least significant bit (2⁰) and terminal D the most significant bit (2³).

Block 1: BCD parallel data for display digit 1 (10⁰)
Block 2: BCD parallel data for display digit 2 (10¹)
Block 3: BCD parallel data for display digit 3 (10²)

Data values for blocks 1 to 3 are as follows.

| Data | A | B | C | D |
|------|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 2 | 1 | 0 | 1 | 1 |
| 3 | 0 | 0 | 1 | 1 |
| 4 | 1 | 1 | 0 | 1 |
| 5 | 0 | 1 | 0 | 1 |
| 6 | 1 | 0 | 0 | 1 |
| 7 | 0 | 0 | 0 | 1 |
| 8 | 1 | 1 | 1 | 0 |
| 9 | 0 | 1 | 1 | 0 |

Table 1

Block 4: Data for display digit 4 (10³)

| Data | A | B | C | D |
|------|---|---|---|---|
| 0 | 1 | 1 | 1 | × |
| 1 | 0 | 1 | 1 | × |
| 2 | 1 | 0 | 1 | × |
| 3 | 0 | 0 | 1 | × |
| + | × | × | 1 | 1 |
| - | × | × | 1 | 0 |

Table 2
×: ignored

Note: When the zero-suppression feature is effective, the above data blocks become as shown in Table 3.

| Data | A | B | C | D |
|------|---|---|---|---|
| 1~3 | 1 | 1 | 1 | 1 |
| 4+ | 1 | 1 | 1 | 1 |
| 4- | 1 | 1 | 1 | 0 |

Table 3

Note: When an overflow occurs, data blocks become as shown in Table 4 and 5.

| Block | A | B | C | D |
|-------|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 1 |
| 3 | 1 | 0 | 1 | 1 |
| 4 | 0 | 0 | 1 | 1 |

Table 4 Data for "OF"

Block 5: Data indicating the position of the decimal point as shown in Table 6 and Fig. 4.

| Block | A | B | C | D |
|-------|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 1 |
| 3 | 1 | 0 | 1 | 1 |
| 4 | 0 | 0 | 1 | 0 |

Table 5 Data for "--OF"

Note: When an overflow occurs, the decimal point position is output.

| Decimal point | A | B | C | D |
|----------------|---|---|---|---|
| No | 1 | 1 | 1 | 1 |
| P ₁ | 0 | 1 | 1 | 1 |
| P ₂ | 1 | 0 | 1 | 1 |
| P ₃ | 0 | 0 | 1 | 1 |

Table 6

#, #, #, #
↑ ↑ ↑ ↑
P₃ P₂ P₁

Fig. 4

Block 6: Data indicating the unit as shown in Table 7

| Unit | A | B | C | D |
|------|---|---|---|---|
| No | 1 | 1 | 1 | 1 |
| mV | 0 | 1 | 1 | 1 |
| V | 1 | 0 | 1 | 1 |
| mA | 0 | 0 | 1 | 1 |
| Ω | 1 | 1 | 0 | 1 |
| kΩ | 0 | 1 | 0 | 1 |
| MΩ | 1 | 0 | 0 | 1 |
| Hz | 0 | 0 | 0 | 1 |
| kHz | 1 | 1 | 1 | 0 |

Table 7

Block 7: Function code is BCD output. The output code is shown in Table 8

| Function | A | B | C |
|---------------|---|---|---|
| DC V | 1 | 1 | 1 |
| AC V | 0 | 1 | 1 |
| DC A | 1 | 0 | 1 |
| AC A | 0 | 0 | 1 |
| Ω | 1 | 1 | 0 |
| Hz | 0 | 1 | 0 |
| LPΩ | 1 | 0 | 0 |
| \rightarrow | 0 | 0 | 0 |

Table 8

*The 30 mA- and 10 A-range signals are output as shown in Table 9.

| Output | 30mA | 10A |
|--------|------|-----|
| 30mA | 0 | 1 |
| 10A | 1 | 0 |

Table 9

Notes:

- 1) With the 30 mA or 10 A range, data is output as if the 300 mA range were selected. Therefore, the output data must be corrected. For example, when 20 mA is measured with the 30 mA range, the data output is 200 mA. The decimal point must be moved one digit to the left. With the 10 A range, the unit must be changed from mA to A in addition to changing the decimal point position.
- 2) When automatic range switching is used, ignore the data output while the range is being switched.
- 3) With the 300 Hz and 3 kHz ranges, the gate time is longer than the data output interval, so the measured frequency is output repeatedly at 0.4-second intervals. With the 30 kHz and 300 kHz range, only data measured at the last gate opening is output at 0.4-second intervals.
- 4) Data output timing is not synchronized with sampling timing.

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All specifications are subject to change without notice.