HIOKI

INSTRUCTION MANUAL

3232

DIGITAL Hi TESTER

HIOKI E.E. CORPORATION

3232-6G-F

WARNING

⚠ IN HIGH POWER CIRCUIT AREA (DISTRIBUTION TRANSFORMER AND BUS BAR)

BEFORE ATTEMPTING ANY MEASUREMETNT, DOUBLE CHECK THAT THE RANGE SWITCH IS AT THE CORRECT POSITION.

IF THE RANGE IS INCORRECTLY SET, A DANGEROUS ARC OF EXPLOSION WOULD OCCUR.

Contents

1. Outline

The 3232 digital hi-tester is a digital multimeter for frequency, diode test, and continuity test functions in addition to direct current voltage, altenating current voltage, resistance, direct current, and alternating current measurement functions. It has output data and facilitates Zero adjustment at full count.

2. Specifications

Measuring method: Double intergral method

Display: 3－1/2 digits LED, character height : 18mm Max. 3199 with unit symbols (decimal point, mV, V, Ω, kΩ, MΩ, μA, mA, A, Hz, kHz, AC ⎓ ⎓ [LPΩ], [ADJ], 🔋, AUTO, HOLD, " ")

Range change: Auto & manual (manual only for current and frequency)

Input over display: "OF" or "－OF" (excluding DC1000V, AC750V, DC/AC10A)

Buzzer alam (excluding DC1000V, AC750V, DC./AC10A,Ω)

Polarity display: Only "－" is displayed automatically

Battery Low: 🔋 mark lights up (at 4.2V and less, ±0.1V)

Sample rate: 2.5times/second

Operating temperature and humidity: 0℃ to 40℃ at less than 80% humidity

Storage temperature and humidity: －20℃ to 60℃, at less then 70% humidity

Temperature property: (400 ppm + 0.3 dgt)/1℃.

AUTO POWER OFF: Power turns off 60 mihuters after the last setting. Turn to off to start measuremet.

Four size AA)

Power source: (SUM－3)×4(250 hours continuous use at DCV)

Power consumption: 15mW TYP, (DCV) 18mW TYP, (ACV)

Withstand voltage: AC 3 kV (one minute) Terminal－case

Dimensions and weight: 160(H)×85(W)×33(D)mm 800g (Approx)

Accessory: 9170 test leads; battery, SUM3×4; Spare fuse 0.5A/250V (dia. 6.4×30) nonarcing type.

Optional Accessory: 9014 high voltage probe

Maximum overload input:

V/Hz terminal: 1100VDC or DC + AC peak one minute

Ω/u mA/♪ ⊣⊢ terminal: 250V AC Max. one minute, protected by fuse

10A terminal: 12A DC/AC one minute

*Frequency measurement is separately specified.

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

After zero adjustment

Function	Range	Accuracy	Note
DCV	300mV	± (0.35%rdg+2dgt)	>100MΩ
	3V	〃	11MΩ (Approx)
	30V	〃	10MΩ (Approx)
	300V	+ (0.5%rdg+2dgt)	〃
	1000V	± (0.6%rdg+2dgt)	〃
ACV	3V	± (1.0%rdg+4dgt)	11MΩ (Approx) } 40
	30V	〃	10MΩ (Approx) } ~500Hz
	300V	〃	〃
	750V	〃	〃
Ω	300Ω	± (0.4%rdg+2dgt)	Open terminal voltage<1.5V (Approx)
	3kΩ	〃	
	30kΩ	〃	
	300kΩ	〃	0.65V ± 0.2V
	3000kΩ	± (1.0%rdg+2dgt)	
	30MΩ	+ (2.0%rdg+2dgt)	
1.PΩ	3kΩ	± (0.5%rdg+4dgt)	
	30kΩ	〃	
	300kΩ	〃	<0.45V
	3000kΩ	± (1.0%rdg+4dgt)	
	30MΩ	± (2.0%rdg+4dgt)	
DCA	30mA	± (1.0%rdg+2dgt)	10Ω (Approx)
	300mA	〃	1Ω (Approx)
	10A	± (1.2%rdg+2dgt)	<15mΩ
ACA	30mA	± (1.2%rdg+4dgt)	(Approx)10Ω } 40~500Hz
	300mA	〃	1Ω }
	10A	± (1.5%rdg+4dgt)	<15mΩ
Hz	300Hz	± (0.15%rdg+2dgt)	※10sec >approx.1MΩ
	3kHz	± (0.1%rdg+1dgt)	1sec At 1kHz
	30kHz	〃	0.1sec (30Hz~
	300kHz	〃	0.1sec 320kHz)
Continuity	Thresholed lebel: less than 2kΩ or less Responce time 100msec approx.		Open terminal voltage <about 1.5V

Remaining figure: one digit.

※Gate time

Frequency measurement Maximum input sensitivity

	LOWER LIMIT		UPPER LIMIT	Overload voltage one minute
	Sine wave	Rectangular wave		
30Hz ~320kHz	500mVrms	600mVp-p	50V AC	300V DC+ACpeak

3. Operating instructions

⚠WARNING

This instrument is desingned to prevent accidental shock to the operator when properly used. However, no engineering disign can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurement. Failure to follow directions can result in a serious or fatal accident.

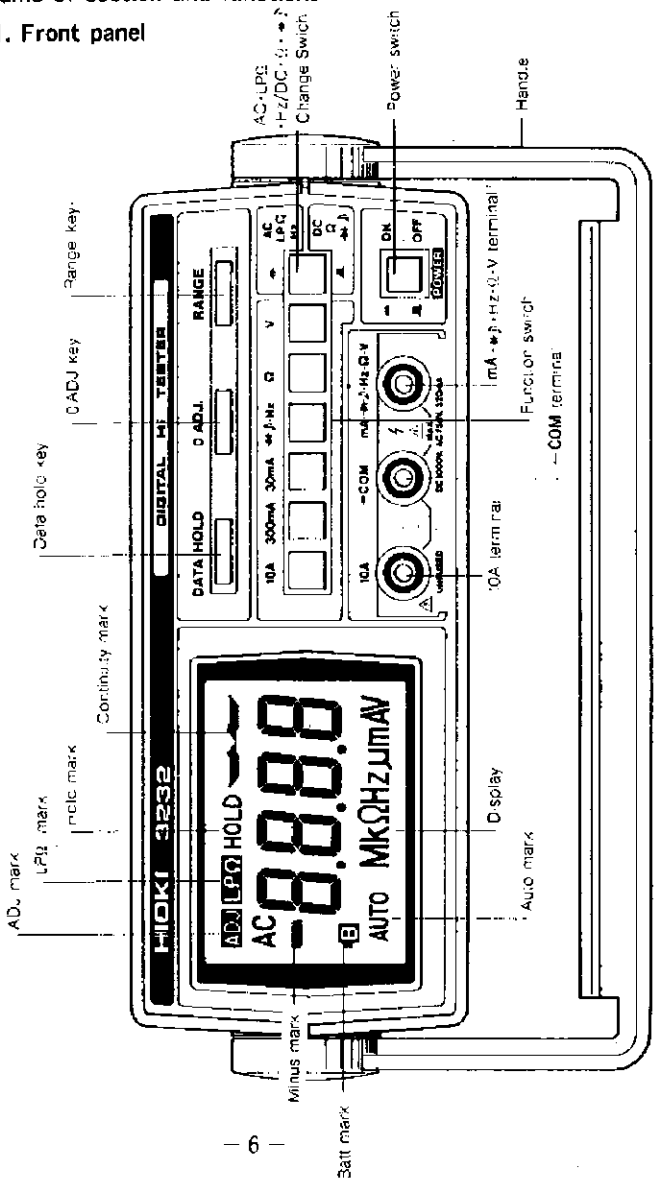
3—1. Names of sections and functions

Precautionary Notes

- The [BATT] mark appearing in the display indicates that the batteris are worn—out. Replace the batteries with new ones.
- Always turn the power switch [OFF] when not using the instrument.
- Always check to make sure that the function switch setting is correct, and that the test leads are plugged in to the proper terminals before making a measurement.
- In order to protect circuitry, a fuse is provided for V・Ω・Hz・⊣⊢♪・mA terminals. No measurement is possible at these terminals if the fuse is burned. If open—circuit is indicated (∞ ohms when touching both leads together in ⊣⊢♪ function), replace the fuse.
- Do not store the instrument in a high temperature, high humidity location, and avoid areas where condensation is likely to occur.

3－2. Name of section and functions

3－2－1. Front panel



3－2－2. Functions

(1)Autorange

In autorange the optimum range is selected automatically without setting the range key.

Set the range manually when making measurements close to full scale since the range－up moves the range higher between 2800 ~ 3200. The range－down moves the range lower at 269.

①Autorange is actuated (AUTO mark lamp glows) in the following cases.

- In V or Ω function
- AC, LPΩ/DC, Ω key is depressed
- When the range key is kept depressed for several seconds.

②Manual operation (AUTO mark lamp turns off)

- When range key is turned on.
- When the function key is turned to Hz, ⊣⊢♪, 300μA, 30mA, 300mA, 10A.
- When 0ADJ key is depressed and [ADJ] mark lamp glows

(2) 0ADJ (zero adjestment)

When the 0ADJ kay is depressed, [ADJ] mark lamp will light up and data turns to zero. If the value is X_0 when the 0ADJ key is depressed, display turns to $X-X_0$ for the input of a next value X. It is useful for offsetting the resistance of test leads or measuring differences. However, it compensates up to +3199 only and excessive count is shown by "OF" or "－OF". This applies when input is excessive for the range (e. g. input of ±3.2V or over in DC 3V range).

[ADJ] condition may be released by pressing the 0ADJ key or by changing the function key to AC・LPΩ・Hz/DC・Ω・⊣⊢♪ or by turning off the power switch.

Note: ADJ mark may be displayed when the key switch is depressed or when measurement result is shown.

Note: When ADJ mark is turned on, the range is fixed even in the autorange and the range cannot be changed until autorange is released.

Note: While display is blank (Hz measurement or when function is being changed), zero adjestment cannot be made.

Note: Zero adjestment cannot be made with ⊣⊢♪ function key.

Note: When ADJ conditon is released by the 0ADJ key, the conditon prior to zero adjestment will be reinstated.

(3)Hold function

Each time the HOLD key is depressed, the HOLD mark glows and all the data is hold, with the exception of mark. While data is hold no switch functions except for the HOLD key (Unless the display lamp is on.)

The HOLD condition is released by pressing the HOLD key or by turning off the power switch.

Note: Data hold does not operate in ⊣⊢♪ functions.

Note: The HOLD condition is not released by changing function.

(4)Range control function

Setting from autorange (V, Ω function) to manual range must be done each time the range key is depressed. Each time the range key is depressed the autorange is fixed and each time the key switch is depressed the range goes up one range higher. After the highest range, the dislpay returns to the lowest range, and this process is repeated.

To return to autorange, depress the range key for several seconds, change function switch to AC・LPΩ・Hz/DC・Ω・⊣⊢♪ key, or turn off the power switch.

(5)Overflow

If reading exceeds 3200 in each function range, "OF" on + side and "−OF" on − side are displayed. Decimal point, unit and symbol of that range are displayed(so is ADJ mark lamp.).

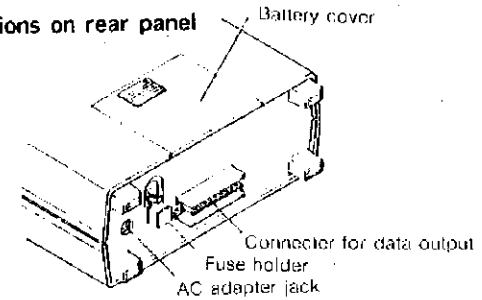
(6)Buzzer

●If reading exceeds 3200 in each function range, the buzzer sounds intermittently, except for Ω, LPΩ, ⊣⊢♪ functions.

●The buzzer also sounds continuosly at less than the threshold level in ⊣⊢♪ function.

3−2−3. Names and functions on rear panel

Note: See paragraph 4 for data output.



●AC Adapter jack

Connect the AC adapter (DC 6V) to this terminal. The center pin is negative. (⊕—◎—⊖)

3−3. Measuring method

Place batteries in the case, after referring to instructions for replacing battery (6).

In AC adapter operation, AC adapter cord to the AC adapter jack, and insert the adapter plug into AC outlet. Turn on the power switch.

3−3−1. Direct current voltage measurement

⚠WARNING:
Maximum allowable input is DC 1000V

①Plug the red test lead into the V terminal, and the black test lead into the −COM terminal.

②Set the range switch to V.

③Press the AC • LPΩ • Hz/DC • Ω • ⊣◀♪ key to obtain the appropriate current mode for the measurement.

④Connect the test leads to the circuit under test and read the value from the display.

⑤For manual operations, press the **RANGE** key to make the **AUTO** mark disappear from the display.

○Follow this by pressing the **RANGE** key repeatedly until the proper range is obtained.

○Short the test lead tips together and press the **0 ADJ.** key to make the [ADJ] mark appear in the display. Take the measurement and read the valur from the display.

Note: In the DC 300mV range, since input resistance is a high value (> 100MΩ), noise will cause the display to show a reading even though there is no measurement input. In this case, shout the test lead tips together and press the **0 ADJ.** key to make the [ADJ] mark appear in the display. The effectively sets the meter to the zero point.

Note: When taking voltage measurements where spikes and other distortion are present in the waveform (e. g., horizontal output from a TV set, etc.), use positive (+) polarity readings. Negative (−) polarity readings will be grossly erroneous.

3−3−2. Alternating current voltage measurement

> ⚠**WARNING:**
> **Maximum allowable input is AC/750V.**

①Plug the red test lead into the V terminal, and the black test lead into the −COM terminal.

②Set the range switch to V.

③Turn AC • LPΩ • Hz/DC • Ω • ⊣◀♪ switch to AC. (AC mark glows)

④Connect the test leads to the circuit under test and read the value from the display.

⑤For manual operations, press the **RANGE** key to make the **AUTO** mark disappear from the display.

●Follow this by pressing the **RANGE** key repeatedly until the proper range is obtained.

3−3−3. Resistance measurement (Ω)

①Plug the red test lead into the Ω terminal, and the black test lead into the −COM terminal.

②Set the range switch to Ω.

③Press the AC • LPΩ • Hz/DC • Ω • ⊣◀♪ key to obtain the appropriate current mode for the measurement.

④Connect the test leads to the circuit or component under test and read the value from the display.

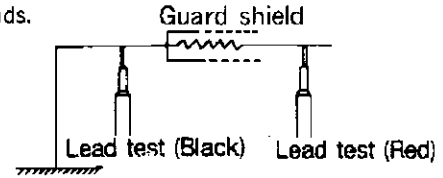
⑤To place the instrument in the manual mode, press the **RANGE** key to make the **AUTO** mark go out of the display.

●Follow this by pressing the **RANGE** key repeatedly until the proper range is obtained.

●Short the test lead tips together and press the **0 ADJ.** key to make

the [ADJ] make appear in the display. Take the measurement and read the value from the display.

Note) In high resistance measurement, apply shielding or use shielded leads.



LPΩ (low power ohm)

Many diodes and transistors are used in electronic circuits. When measuring resistance in these circuits, parts must usually be removed from the circuits, since diodes and transistors function when voltage exceeding a certain value is applied. In LPΩ, however, applied voltage is kept low to permit in-circuit measurement.

3-3-4. Direct and alternating current measurement

⚠**WARNING:**

Maximaum allowable input 320mA.

①Plug the red test lead into μA • mA terminal, and the black test lead into the -COM terminal.

②Set the function switch to either 30mA or 300mA range.

③Press the **AC/DC** key to obtain the appropriate current mode for the measurement.

④Short the test lead tips together and press the **0 ADJ.** key to make the [ADJ] mark appear in the display.

⑤Connect the test leads to the circuit under test and read the value from the display.

10A range

⚠**WARNING:**

Maximum allowable input is 10A, and there is no circuit protection in the 10A range. Do not apply voltage to the terminals in this range.

⑥For measurements in the 10A range, plug the red test lead into the 10A terminal.

⑦Set range to 10A; take the measurement and read the value from the display. (less than 3 min. measurement)

3-3-5. Frequency measurement

Measurement range is 30Hz to 320kHz. Confirm input level before making measurement.

①Connect the red lead to Hz terminal and black lead to -COM.

②Set the function switch to Hz and AC • LPΩ • Hz/DC • Ω • ⊣◀ ♪ switch to Hz side.

③Select frequency range by pressing the range key (manual).

④Connect the test leads to object to be measured and read the display.

Note: In frequency measurement, measurement time varies due to gate time. In low frequency, two or more samplings are required.

3－3－6. Diode test, continuity test

①Plug the red test lead into the ⊣◀, ♪, μA, mA terminal, and the black lead into the COM terminal.

②Set the function switch to ⊣◀♪. Turn AC・LPΩ・Hz/DC・Ω・⊣◀♪ switch to ⊣◀♪. Reading before measurement is 1200 to 1800.

③When testing a diode, the ⊣◀, ♪, μA, mA terminal will be the + side, and the COM terminal will be the − side. The anode lead of the diode should be connected to the + side, and the cathode lead connected to the − side in order to get a forward bias reading.(Note that this voltage reading is a rough figure only.) Connecting the diode to the meter backwards produces a meter reading of battery voltage, and this can be used to indicate the good/no good condition of the diode.

④When tesing for continuity, the audible tone will sound, and the ◀▬▶ mark will appear in the display to indicate continuity.

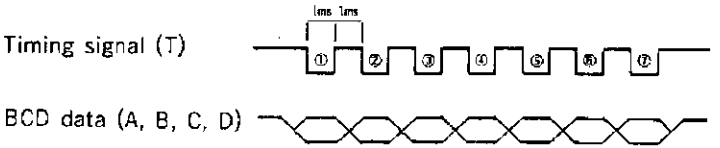
Disregard the display reading.

(The buzzer sounds at less than 2kΩ.)

4.Data output

Data is output through the BCD data terminal (A, B, C, D), synchronized with the BCD timing signal (T). Units and function codes are also output. However, 30mA and 10A range signals are output separately. A power source terminals (V, G) are provided.

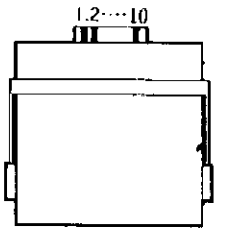
Timing chart is shown in Fig. 2 (negative logic: Active Low)



※Confirm data while timing signal is in L (＝0).

(1) Output interval: Once each 0.4 second

(2) Output terminal



1	2	3	4	5	6	7	8	9	10
G	V	N	R_2	R_1	T	D	C	B	A

R_1 :30mA range R_2 :10A range

N :No-connection

Fig. 3

(3) Output circuit

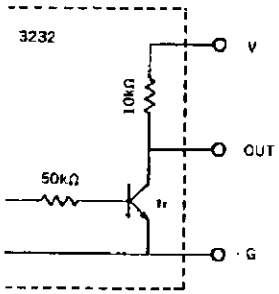


Fig. 4

V and G are supplied externally. (V: 3V to 15V)

Note: GND of the output terminal is connected to GND of batterie. in the body. GND of batteris in the body is 1.5V relative to COM terminal. Therefore, make sure that circuit to be measured and the adapter are insulated.

(4) Data format

BCD data is output consecutively from block ① to block ⑦ as shown in Fig.2. They are at H level until the next output.

In the following description, A is the lowest bit (2^0) and D the highest bit (2^3).

①The first digit (10^0) of display is output in BCD parallel.

②The second digit (10^1) of display is output in BCD parallel.

③The third digit (10^2) of display is output in BCD parallel.

Data is shown in Table 1.

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

④The fourth digit (10^3) of display is shown in Table 2.

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

× : Don't Care

Table 2

Note: Zero suppressor is shownin Table 3.

Data		A	B	C	D
①~③		1	1	1	1
④	+	1	1	1	1
	−	1	1	1	0

Table 3

Note: Overflow is shown in Table 4 and 5.

In case of (OF)

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

In case of (−OF)

Brock	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

⑤Positions of decimal points are output in BCD as shown in Table 6. P_1, P_2, P_3 are decimal positions shown in Fig.5.

Decimal points	A	B	C	D
None	1	1	1	1
P_1	0	1	1	1
P_2	1	0	1	1
P_3	0	0	1	1

Table 6

#. #. #. #
↑ ↑ ↑
P_3 P_2 P_1
Fig. 5

Note: In case of overflow, the point in the range is output.

⑥Units are output in BCD. Output codes are shown in Table 7.

Units	A	B	C	D
None	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

⑦Function codes are output in BCD. Output codes are shown in Table 8.

Func.	A	B	C
DCV	1	1	1
ACV	0	1	1
DCA	1	0	1
ACA	0	0	1
Ω	1	1	0
Hz	0	1	0
LPΩ	1	0	0
⊣⊢ · ♪	0	0	0

Table 8

Note: D (2^3) is 0 in 10A range and is 1 in other functions.

※Signal in 30mA, 10A range are shown in Table 9.

output	30mA	10A
30mA	0	1
10A	1	0

Table 9

Note: It is 1 in other than 30mA, 10A range.

Note: Data in 30mA, 10A range is equivalent to data output in 300mA range. Thus when the signal of 30mA, 10A is output, data needs correction. For instance, 20mA measured in 30mA range will show data 200.0mA which require moving the decimal point. In 10A range, mA must be changed to A.

Note: Data output while range is being changed in autorange measurement should be ignored.

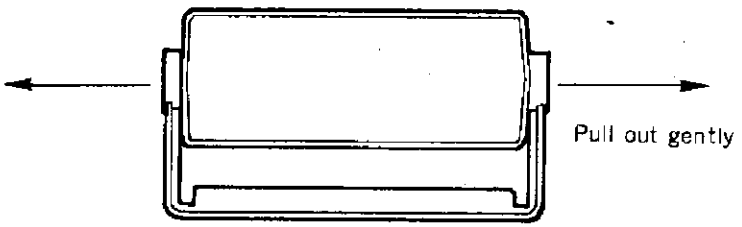
Note: In frequency measurement, data is output repeatedly every 0.4 second when gate time is long (in 300Hz and 3kHz range)

but in 30kHz and 300kHz range, data is output only every 0.4 seconds due to short gate time.

Note: Sampling time and data output are not synchronized.

5. How to operate the handle

The handle is used as a stand. Pull both ends of the handle, turn it and push it back.



6. Replacing batteries

(1) Remove the battery cover.

(2) Replace batteries, observing correct polarities.

7. Replacing fuse

A fuse is provided on the side of the rear panel. Push the upper side of the fuse holder gently with a finger, pull the fuse out and replace it.

8. Applications

As described in 4, data is output to BCD code with timing signal. An interface circuit is required to connect external circuits to the data output. An example of parallel interface circuit is shown in Fig. 6. TC4022BP is an octal counter/divider and TC4042BP is a QUAD "d" latch. Process 10^0 — 10^2 digits referring to the BCD output of Table 1 and 10^3 digit, decimal point, unit, and function referring to each code table of the BCD output.

Note) This interface circuit is not necessarily usable for all external circuits. Interface circuit must be determined after carefully studying data input from external circuits.

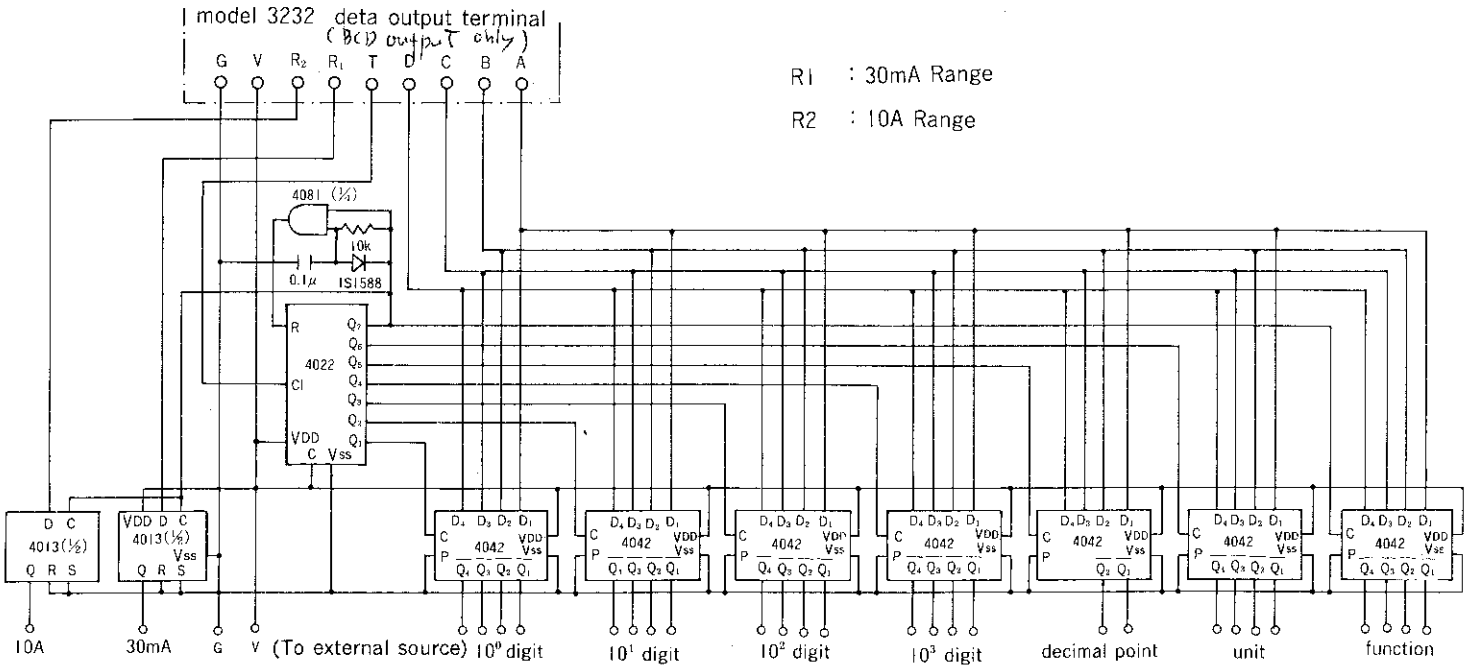

model 3232 deta output terminal
(BCD output only)
G V R2 R1 T D C B A
R1 : 30mA Range
R2 : 10A Range
4081 (¼)
10k
0.1μ
IS1588
4022
R
Cl
VDD
C
Vss
Q7 Q6 Q5 Q4 Q3 Q1 Q0
4013(½)
4042
10A
30mA
G
V
(To external source)
10⁰ digit
10¹ digit
10² digit
10³ digit
decimal point
unit
function

Fig. 6