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**ADVANTEST®**  
ADVANTEST CORPORATION

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*INSTRUCTION  
MANUAL*

**D3285**

*ERROR DETECTOR*

MANUAL NUMBER OEE00 9206

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Before reselling to other corporations or re-exporting to other countries, you are required to obtain permission from both the Japanese Government under its Export Control Act and the U.S. Government under its Export Control Law.



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## Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

**DANGER:** Indicates an imminently hazardous situation which will result in death or serious personal injury.

**WARNING:** Indicates a potentially hazardous situation which will result in death or serious personal injury.

**CAUTION:** Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
- Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this instrument with the case open.
- Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

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## Safety Summary

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

**DANGER:** Indicates an item where there is a danger of serious personal injury (death or serious injury).


**WARNING:** Indicates an item relating to personal safety or health.

**CAUTION:** Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.

Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.

Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used. The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.

For more information, refer to the section in this document where the parts with limited life are described.

## Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.  
Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.
- Store and operate the products under the following environmental conditions.  
An area with no sudden temperature changes.  
An area away from shock or vibrations.  
An area free from moisture, dirt, or dust.  
An area away from magnets or an instrument which generates a magnetic field.
- Make back-ups of important data.  
The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)  
(2) Mercury  
(3) Ni-Cd (nickel cadmium)  
(4) Other

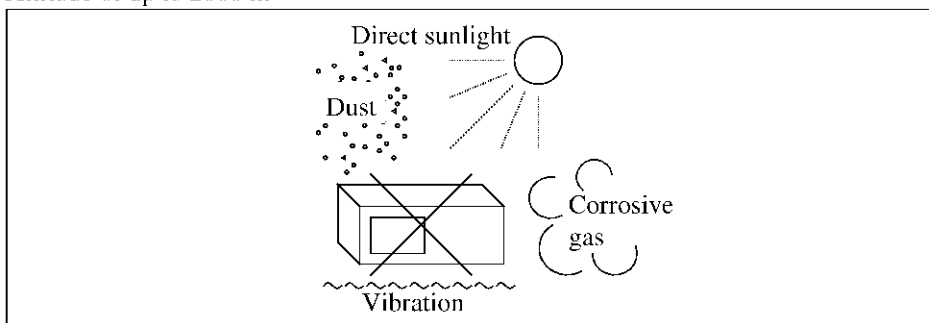
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

# Environmental Conditions

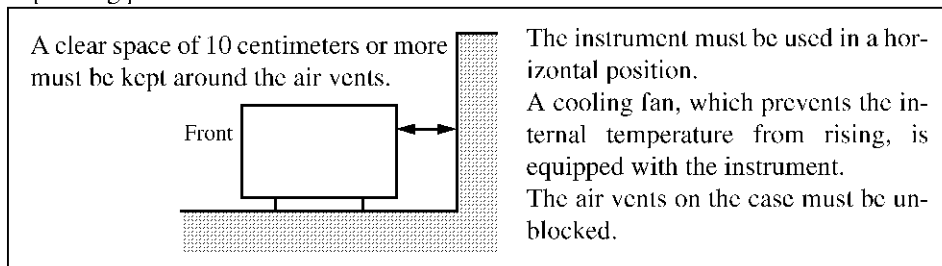
This instrument should only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m



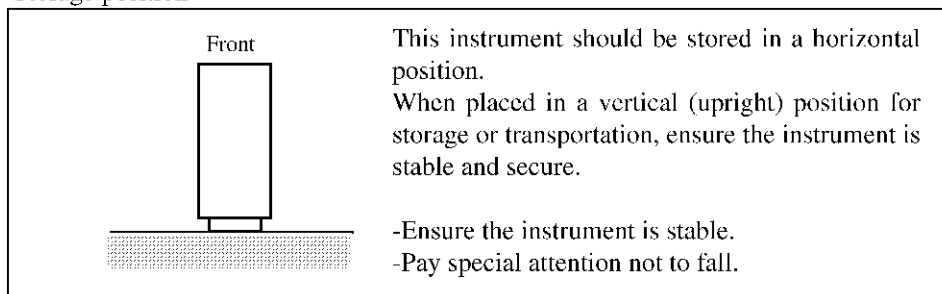
**Figure-1 Environmental Conditions**

- Operating position



**Figure-2 Operating Position**

- Storage position



**Figure-3 Storage Position**

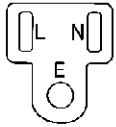
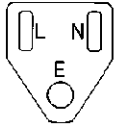
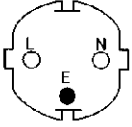
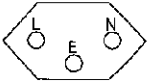
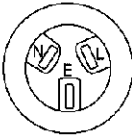

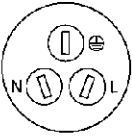
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

Pollution Degree 2

## Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: -----
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC: China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109





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Preface

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PREFACE

The D3185/D3185A pulse pattern generator is related to this equipment.



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1. GENERAL INFORMATION

1.1 General

When used in combination with the D3185/D3185A pulse pattern generator, this equipment evaluates the bit error rate of high-speed digital communication transmission systems and super high-speed devices by using pseudo random bit sequence (PRBS) pattern from  $2^7-1$  to  $2^{23}-1$  and programmable patterns up to  $2^{16}$  (65536) bits.

The D3285 error detector measures the bit error rate, error count, error second (ES), error-free second (EFS), and frequencies within a wide range from 500MHz to 10GHz.

[Features]

- (1) Displays results of measurement clearly using a large green LED
- (2) Detects INSERT (0 → 1) and OMITT (1 → 0) errors separately.
- (3) Incorporates a program pattern memory to change ten kinds of word patterns quickly.
- (4) PRBS pattern allows a mark ratio to vary within the range from 1/8 to 7/8, and 0/8 and 8/8.
- (5) Provided with a motor drive delay line of 1ps resolution, variable up to ±400ps to clock input.
- (6) Master-slave function available to use the same pattern as generated by the combined D3185/D3185A.
- (7) Equipped with the AUTO SEARCH function to search the optimum value threshold level and phase delay (phase between for data input and clock input).
- (8) Supplied with a GPIB
- (9) Provided with monitor output, synchronous output, error output, and alarm output

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1.2 Before Using the Equipment

1.2 Before Using the Equipment

1.2.1 Check of Attachments

Upon receipt of this equipment, run checks thereon as shown below.

- ① Run visual checks against any and all damages or imperfections.
- ② Check the quantity and rating of standard attachments to assure their conformance with Table 1-1.

Should there be any flaw, or damage, or missing or insufficient part, contact the nearest dealer or the sales and support offices.

Request to User: When ordering add-on attachments and the like, be good enough to stipulate the model (or stock No.) concerned.

Table 1 - 1 Standard Attachments

No.	Product name	Model	Stock No.	Q'ty	Remarks
1	BNC-BNC cable	MI-02	DCB-FF0386	1	
2	SMA-SMA cable	DGM224-00700A	DCB-FF1211x01	3	
3	K adapter (Jack-Jack)	030-672-0000- 890	JCF-BJ001Ex02	4	
4	GPIB cable	408JE-101	DCB-SS1076x02	1	
5	Power cable	A01402	DCB-DD2428x01	1	
6	Double/triple-pole conversion adapter for power plug	A09034	JCD-AL003Ex03	1	
7	Instruction manual	---	JD3285	1	Japanese
		---	ED3285		English

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1.2 Before Using the Equipment

1.2.2 Operating Environment

- (1) Avoid using this equipment where it may be exposed to a lot of dust, direct sunlight, or corrosive gases.
- (2) Operate this equipment at an ambient temperature from 0 to 40°C and a humidity of 40 to 85%.
- (3) Be careful in handling this equipment to avoid giving it any severe mechanical shock because it incorporates a quartz resonator and high precision components.
- (4) Keep at least 10cm space between the back of this equipment and a wall or other large object because this equipment has a discharge-type cooling fan. Do not block the air intake holes on the top and sides of the equipment.

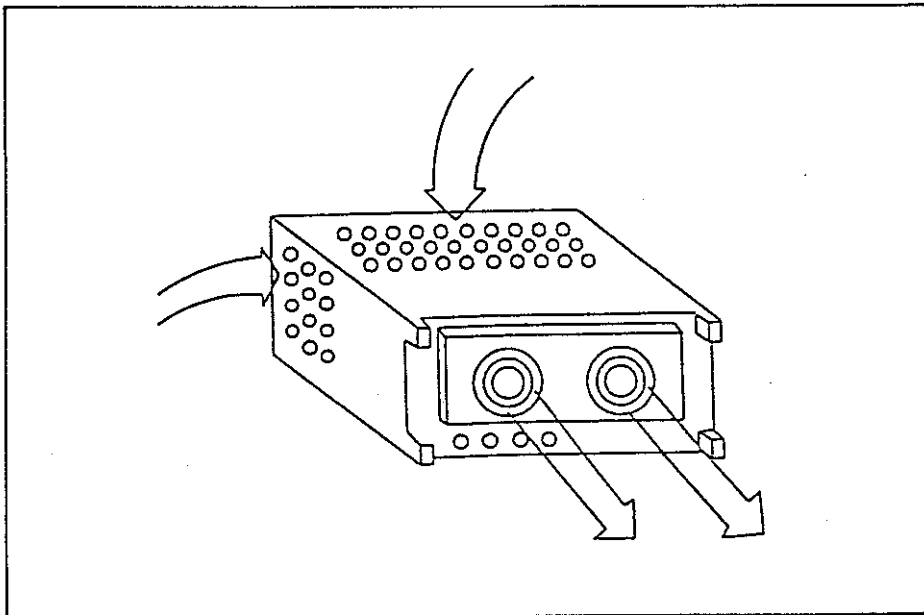


Figure 1 - 1 Ventilation with Cooling Fan

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1.2 Before Using the Equipment

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1.2.3 Notes on Storing and Transporting the D3285

(1) Notes on Storage

When the D3285 is not used for a long period of time, the equipment should be stored in a corrugated cardboard box in a place not exposed to direct sunlight which has low humidity.

This equipment must be stored at an ambient temperature and humidity within the ranges from -20 to +60°C and 30 to 85% respectively.

(2) Note on cleaning

Clean this equipment using soft cloth with alcohol periodically. Do not use any cleaner other than alcohol.

CAUTION

Never use any cleaner other than alcohol for the maintenance of this equipment.  
Organic solvent such as benzene, toluene or acetone may spoil the plastic parts of this equipment.

(3) Note on Transportation

When transporting this equipment, use its original packaging. If the packaging was lost, observe the following instructions:

- ① Cover the equipment with vinyl. (Put a desiccating agent under the vinyl cover to prevent the affects of moisture.)
- ② Put this equipment in a corrugated cardboard box. Then put a cushioning material, 40mm or more thick, between the equipment and the inner wall of the box so as to cover the equipment with the cushion.
- ③ Put the accessories of this equipment in the box, add a cushioning material and close the box. Lastly tie up the box with packing rope.

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1.2 Before Using the Equipment

1.2.4 Setting Up the D3285

(1) Supply Voltage

The AC supply voltage for this equipment is factory set and its value is displayed near the power connector on the rear panel. Check that the power line voltage corresponds to the specification for this equipment. Use this equipment at the frequency range of 48Hz to 63Hz.

(2) Power Cable

The power cable has a three-pin plug whose round pin is to be grounded. Ground this equipment before use according to one of the following methods:

- ① When using a three-pin/two-pin conversion adapter (A09034) attached to the power plug, use the green ground wire out of the conversion adapter to ground this equipment.
- ② When using the power plug without the conversion adapter, simply insert the three pin plug in a three pin receptacle.
- ③ If it is not possible to ground this equipment using the power plug, use the ground terminal on the rear panel of this equipment.

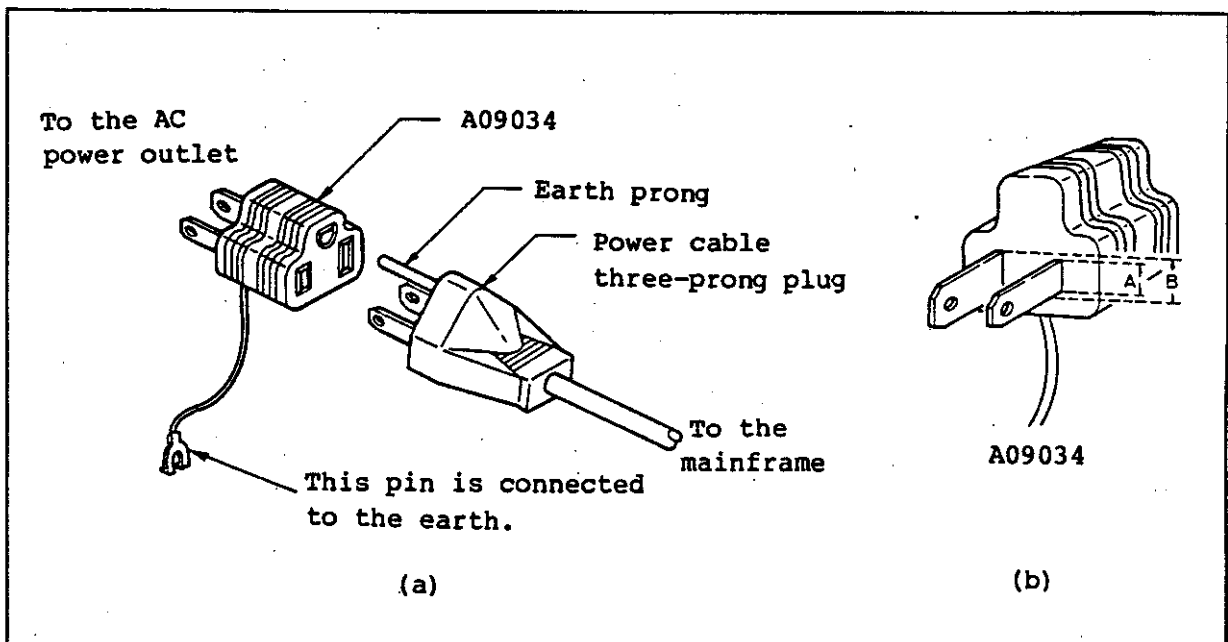


Figure 1 - 2 Power Cable Plug and Adapter

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1.3 Notes on I/O Signal Line Connection

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1.3 Notes on I/O Signal Line Connection

CAUTION

The D3285 has the RF electronics components and parts in its internal circuit. They are very sensitive and may be damaged by the statistics. Use the following notes during application.

- (1) The D3285 has the allowable input voltage of each input terminal as defined on Table 1-2. Never apply the voltage exceeding the limit to their terminals.

Table 1-2 Allowable input voltage of each terminal

Input terminal	Allowable input voltage
DATA INPUT	-4.5 V to +2.5 V
CLOCK INPUT	-2.5 V to +2.5 V (If terminating voltage is 0 V) -4.5 V to +0.5 V (If terminating voltage is -2 V)

- (2) The output terminals (MONITOR OUTPUT, SYNC OUTPUT, AND ERROR OUTPUT) must be terminated with the ground potential of 50-ohm resistor. Do not apply any voltage to them.
- (3) Connect the ground leads to the GND terminal of the D3285 rear panel. Also, connect the ground leads to the GND pin of the power plug.
- (4) Fully discharge the statistics of the cables and equipment before connecting them to I/O terminals of the D3285. The operator should be discharged by using the ground wire strap.

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2.1 Front Panel

2. IDENTIFICATION OF EACH PART

Chapter 2 describes the part names on the front panel and rear panel. Chapter 3 describes their operations.

2.1 Front Panel

Figure [2-1] shows the face layout of the entire front panel. Figures [2-2] to [2-5] respectively detail the pattern setting block, measuring block, timer/CLOCK section, GPIB section, printer control section, I/O connectors and controls.

This section explains the function and use of each part in the order of numbers in the following figures:

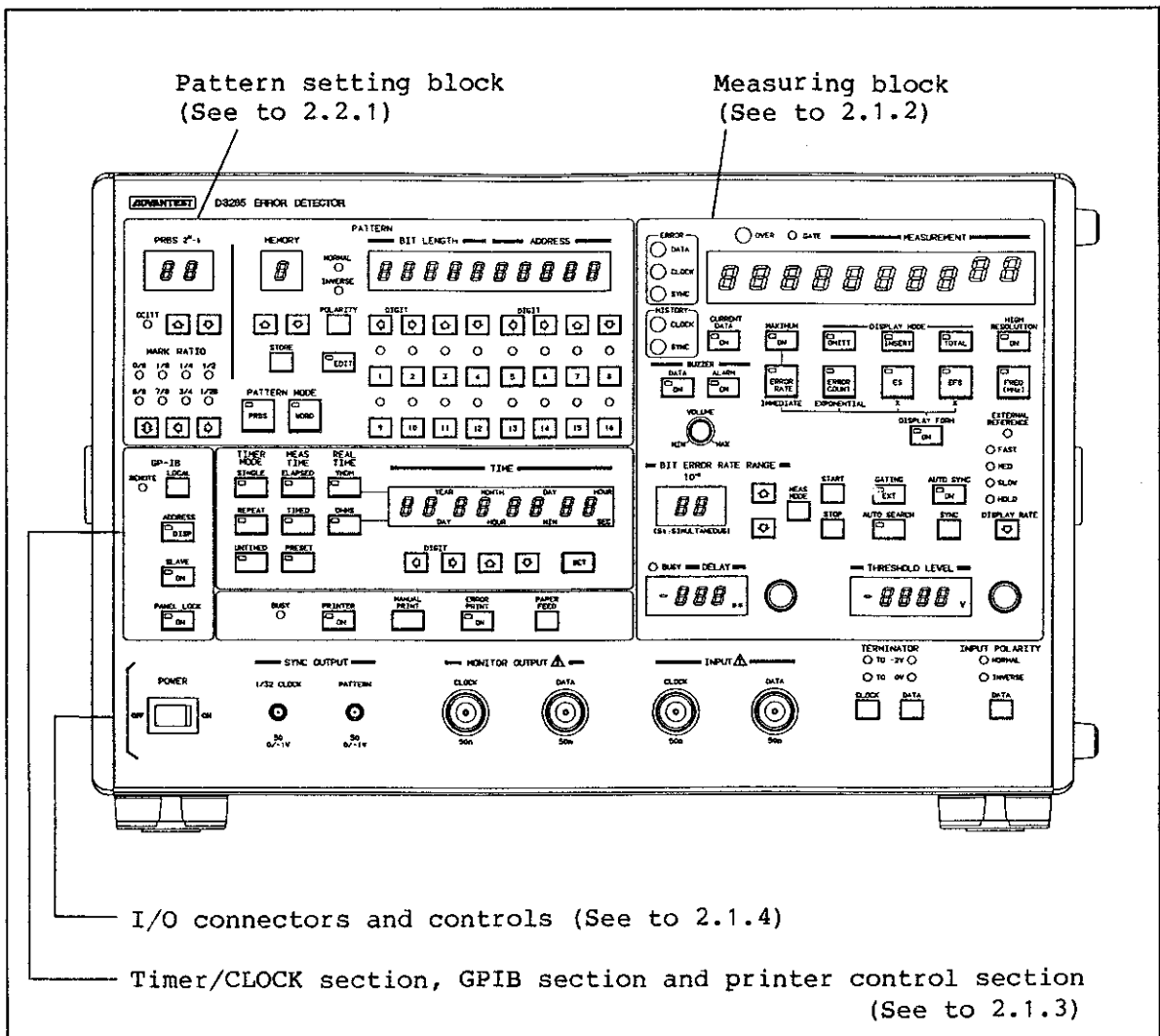


Figure 2 - 1 Front Panel





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2.1 Front Panel

2.1.1 Pattern Setting Block

Decides the contents of the comparative when measure.  
The layout of the panel is the same as the pattern setting blocks of D3185/D3185A.

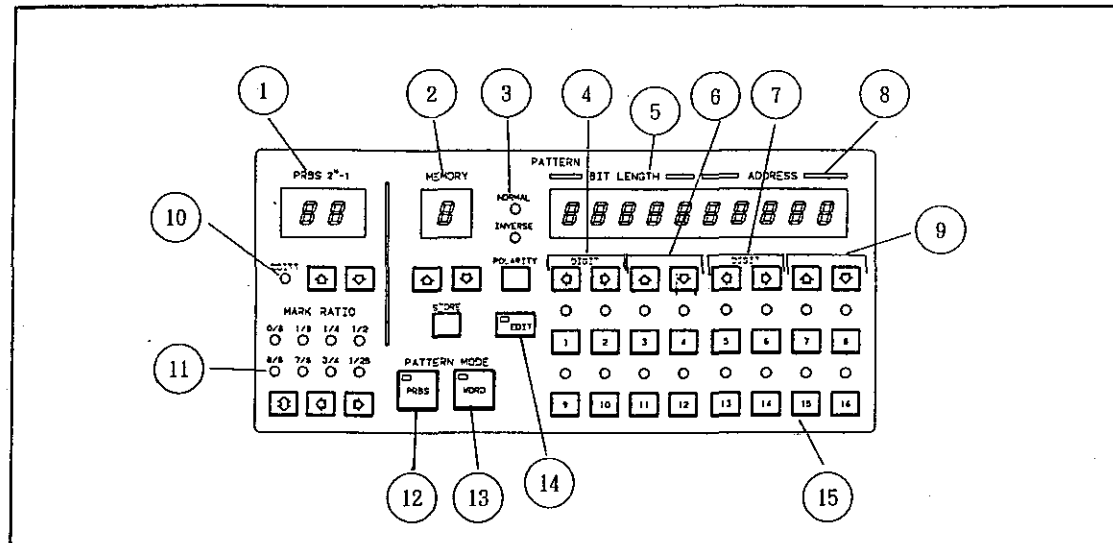


Figure 2 - 2 Pattern Setting Block

- ① PRBS stage count selector section  
Selects one of nine types of PRBS pattern stages: 7, 9, 10, 11, 15, -15, 17, 20, and 23.
- ② Memory operating section (for word pattern storage)  
Stores up to ten word patterns which have been created.
- ③ Pattern polarity selector section  
Determines the logic of a word pattern.
- ④ DIGIT keys  
Select the digit to be set for a bit length.
- ⑤ BIT LENGTH indicator  
Displays the bit length of a pattern which is being created when the EDIT key is on. The indicator displays the bit length of a stored pattern when the EDIT key is off. This indicator is cleared while the PRBS key is on.
- ⑥ Bit length setting keys  
Set the digit with a lighting pointer on the BIT LENGTH indicator.
- ⑦ DIGIT keys  
Select the digit to be set for an address number.

- ⑧ ADDRESS number indicator  
Displays the address number of the 16-bit pattern which is being monitored with a pattern indicator.
- ⑨ Address number setting keys  
Used to set address numbers.
- ⑩ CCITT LED  
Lights up when a PRBS pattern which conforms to the CCITT Recommendation is selected with the PRBS stage count selector section and the mark ratio selecting section.
- ⑪ MARK RATIO selecting section  
Selects any one of eight types of mark ratios.
- ⑫ PRBS key  
Changes the contents of comparative pattern to the pseudo-random pattern.
- ⑬ WORD key  
Changes the contents of comparative pattern to the word pattern.
- ⑭ EDIT key  
Turn off this key to use a stored pattern. Turn on this key to change the contents of stored patterns or output patterns created in real time.
- ⑮ Pattern indicators and pattern setting keys  
Pattern setting keys from [1] to [16] are available only when the EDIT key is on.

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2.1 Front Panel

2.1.2 Measuring Block

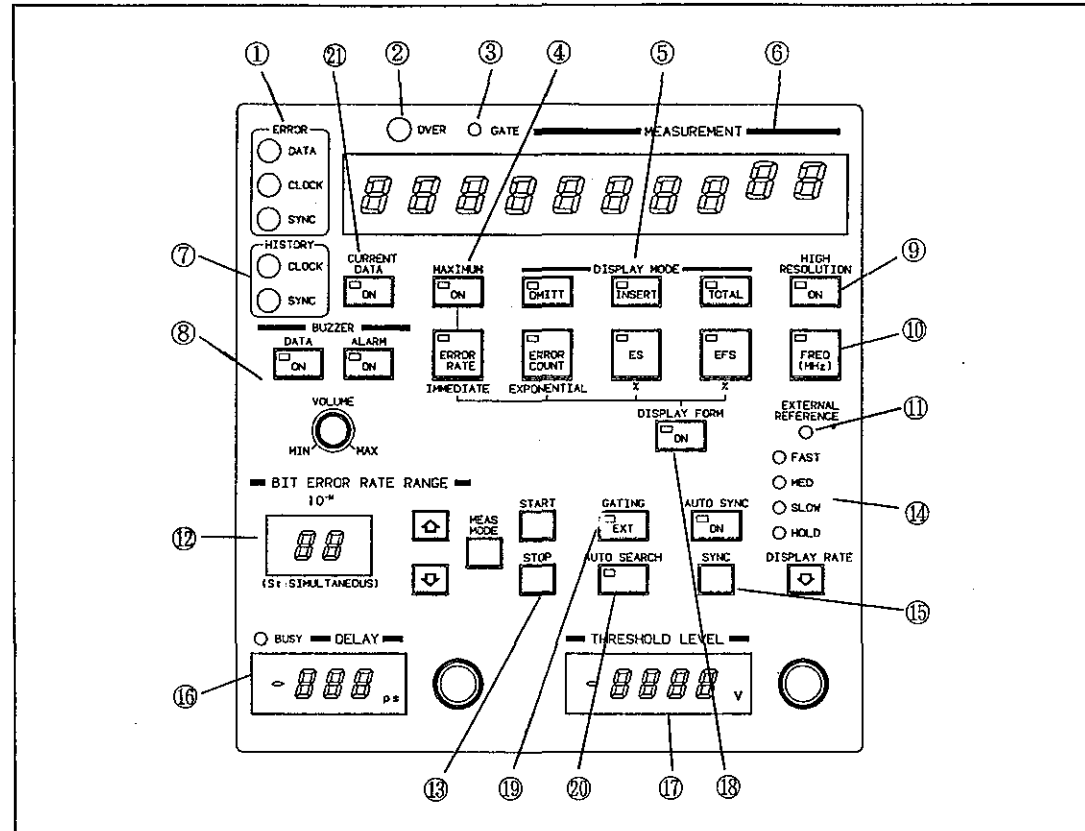


Figure 2 - 3 Measuring Block

- ① ERROR lamps  
They light if an error occurs.
- ② OVER lamp  
It indicates the excess of the measurement range or capacity displayed.
- ③ GATE lamp  
Indicates that measurement is going on.
- ④ MAXIMUM key  
Toggles the display of the maximum/present error rate.
- ⑤ DISPLAY MODE keys  
Select their respective kinds of errors displayed.
- ⑥ Measuring result indicator  
Displays the result of measurement. The display format varies with the measuring function.
- ⑦ HISTORY lamps  
Indicate the occurrence of errors.

- ⑧ BUZZER key and VOLUME knob  
The buzzer ON/OFF mode selection key and volume control knob respectively.
- ⑨ HIGH RESOLUTION key  
Toggles the resolution 1kHz or 10Hz in the frequency measurement in the individual measurement mode.
- ⑩ ERROR RATE, ERROR COUNT, ES, EFS, and FREQ (MHz) keys  
Select their respective measuring functions.
- ⑪ EXTERNAL REFERENCE lamp  
This lamp lights when the external reference CLOCK is input.
- ⑫ BIT ERROR RATE RANGE indicator and setting keys  
The keys set the error rate measuring range and the indicator displays it. When St is displayed by this indicator, measuring functions are changed to the measuring mode at the same time.
- ⑬ START and STOP keys  
Control measurement.
- ⑭ DISPLAY RATE key and FAST, MED, SLOW, and HOLD lamps  
The key selects the measuring interval time for error rate and frequency measurement in the individual measurement mode. One of the lamps lights to indicate its selected interval time.
- ⑮ AUTO SYNC and SYNC keys  
The AUTO SYNC key turns the automatic pattern synchronizing function while the SYNC key resets the synchronism.
- ⑯ DELAY indicator, knob, and BUSY lamp  
The knob sets the amount of CLOCK input phase delays and the indicator displays the set value. The lamp is lit while the motor is in operation.
- ⑰ THRESHOLD LEVEL indicator and knob  
The knob sets the threshold level of data input and the indicator displays the set level.
- ⑱ DISPLAY FORM key  
The DISPLAY FORM key is a key which immediate mode to the progressive mode at once when the error rate is measured. The DISPLAY FORM key switches integers to exponents displayed in ERROR COUNT measurement, and seconds to percentage displayed in the ES and EFS measurements.
- ⑲ GATING EXT key  
In the error count measurement, or ES and EFS measurement in the individual measurement mode, and simultaneous measurement mode the following can be selected with this key:
  - o Starting or completing the measurement is controlled by an external signal.
  - o Starting or completing the measurement is controlled by the START/STOP key and integrated timer.
- ⑳ AUTO SEARCH key  
The key to perform the execution/release for the AUTO SEARCH function.
- ㉑ CURRENT DATA key  
In the simultaneous measurement mode, the display or non-display of intermediate data (CURRENT DATA) is selected with this key.

2.1 Front Panel

2.1.3 Timer/CLOCK section, GPIB section and printer control section

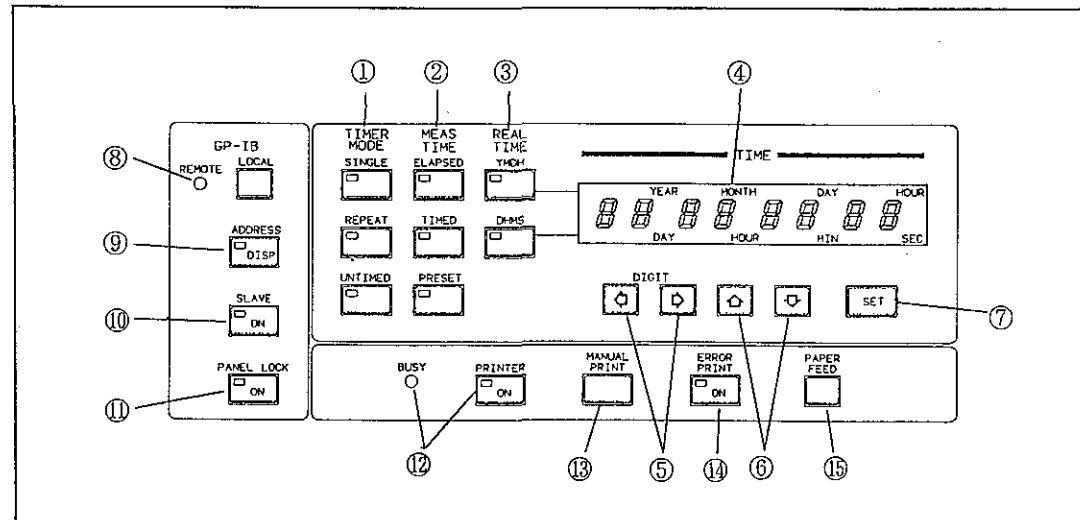


Figure 2 - 4 Timer/CLOCK section, GPIB section and printer control section

- ① TIMER MODE key  
Set their respective timer/clock display modes for error count, error second (ES), and error free second (EFS) measurement in the Individual Measurement mode. Also, they are used to select the timer operation in the Simultaneous Measurement mode.
- ② MEAS TIME key  
Set the timer/CLOCK section to timer display and setting mode for error count, or ES, or EFS measurement in the individual measurement mode, and simultaneous measurement mode.
- ③ REALTIME keys  
Set the timer/CLOCK section to realtime display and setting mode.
- ④ Timer/CLOCK indicator  
Displays the current date and time of the timer and CLOCK.
- ⑤ DIGIT keys  
Shift the time to which the timer/CLOCK indicator can be set to the left or right.
- ⑥ Timer/CLOCK change key  
Increments or decrements the set value of the digit selected by the DIGIT key ⑤ by one.
- ⑦ SET key  
Changes the operation of the timer/CLOCK section to the setting mode. After setting the value using keys ⑤ and ⑥, press this key to complete the setting.
- ⑧ REMOTE lamp and LOCAL key  
The lamp indicates that this equipment is under remote control of the GPIB controller. The key releases the equipment from the remote control.
- ⑨ ADDRESS DISP key  
Sets and displays the GPIB device address of this equipment. The device address is displayed in the pattern setting block.
- ⑩ SLAVE key  
Makes the pattern setting block of this equipment interlock with that of the D3185/D3185A pulse pattern generator.
- ⑪ PANEL LOCK key  
Locks and unlocks the keys and knobs on the front panel.
- ⑫ PRINTER ON key and BUSY lamp  
When the PRINTER ON key lights, the external printer (conforming to the specification of Centronics) connected through the connector of the rear panel can operate. When the printer is not connected or data is not transferred, the BUSY lamp remains on. After data is transferred normally, the BUSY lamp goes off. This lamp lights again when the next data is transferred.
- ⑬ MANUAL PRINT key  
Pressing this key allows measured value to be printed in arbitrary time.
- ⑭ ERROR PRINT ON key  
When this key lights, the data are printed together with the moment ERROR (DATA, CLOCK, SYNC) is generated. (PRINTER ON and using together use)
- ⑮ PAPER FEED key  
When this key is pressed, the printer enables pre-feed of paper by one line.

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2.1 Front Panel

2.1.4 I/O Connectors and Other Controls

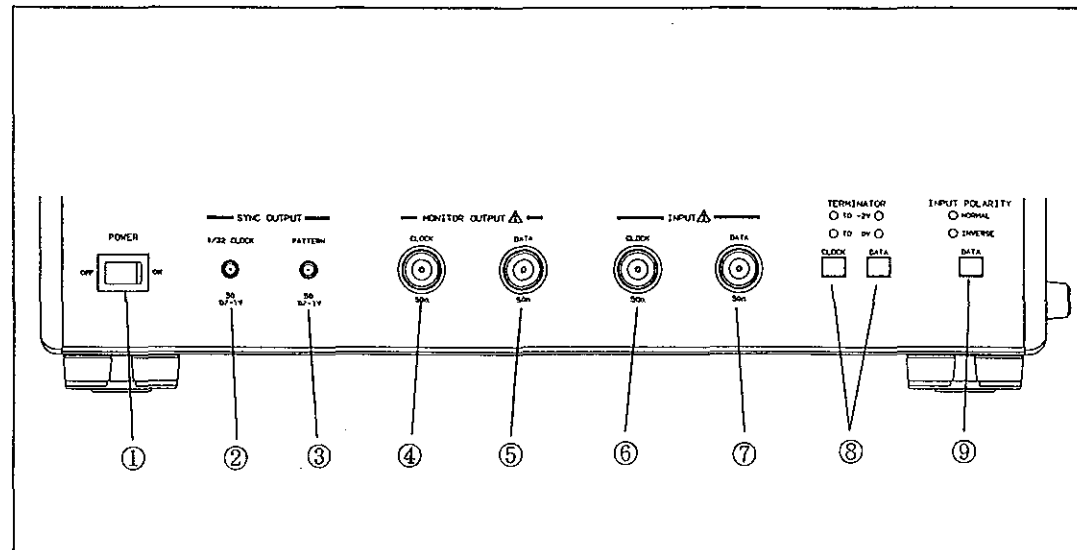


Figure 2 - 5 I/O Connectors and Other Controls

- ① POWER switch  
Turns the power on and off.
- ② SYNC OUTPUT 1/32 CLOCK connector  
1/32 divided output of the INPUT-CLOCK ⑥.
- ③ SYNC OUTPUT-PATTERN connector  
Synchronous output of internal comparative patterns.
- ④ MONITOR OUTPUT-CLOCK connector  
Monitor output of CLOCK input.
- ⑤ MONITOR OUTPUT-DATA connector  
Monitor output of data input.
- ⑥ INPUT-CLOCK connector  
CLOCK input connector.
- ⑦ INPUT-DATA connector  
Data input connector.
- ⑧ TERMINATOR keys and TO -2V and TO 0V lamps  
The keys select the terminator voltages of data input and CLOCK inputs and the lamp.
- ⑨ INPUT POLARITY key, NORMAL and INVERSE lamps  
The data input polarity is selected with this key, and the lamps indicate the polarity.

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2.2 Rear Panel

2.2 Rear Panel

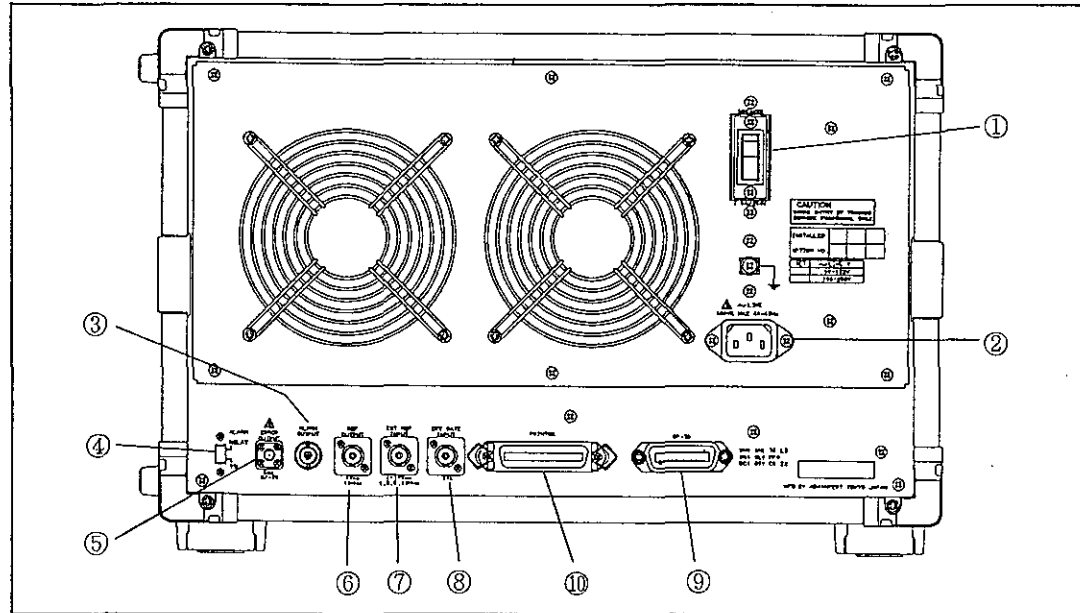
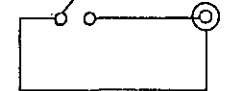
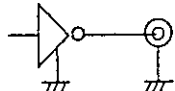
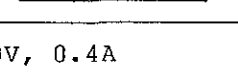
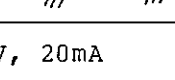
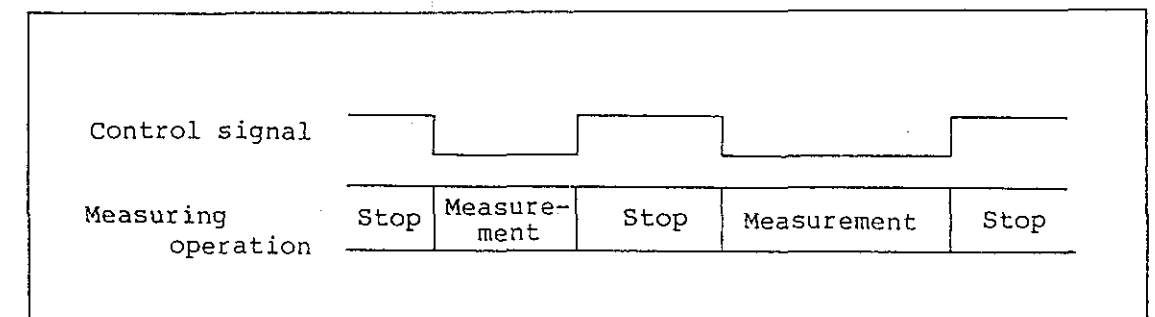


Figure 2 - 6 Rear panel

- ① BREAKER  
This switch is used to protect the AC line from overcurrent. It can be turned ON/OFF manually, too.
- ② POWER connector  
Connects AC power supply to the detector. Use the supplied power cable (A01402) for AC power connection.
- ③ ALARM OUTPUT connector  
Outputs a signal synchronized with the CLOCK error and SYNC error indication lamps on the front panel (as shown in Figure 2 - 3). By the ALARM RELAY/TTL switch ④, output signal is selected to the relay contact point signal or TTL open collector signal.

Error lamp	Relay contact point	TTL open collector
CLOCK or SYNC is on	ON 	LOW 
CLOCK and SYNC is off	OFF 	HIGH 
Maximum rating	DC 20V, 0.4A	DC +5V, 20mA

- ④ ALARM RELAY/TTL switch  
Selects the alarm output format described in ③ above.
- ⑤ ERROR OUTPUT connector  
The data error pulse is output in RZ by 1/8 of the input CLOCK rate through this connector. If an error of more than 1 bit is contained in the continuous 8 bit input data, one pulse will be output.
- ⑥ REF OUTPUT connector  
The reference CLOCK (10MHz) for measurement is output.
- ⑦ EXT REF INPUT connector  
The reference CLOCK is input through this connector when an external reference frequency CLOCK is used in the individual measurement mode and simultaneous measurement. Input the frequency 1MHz, 2MHz, 5MHz or 10MHz respectively having amplitude ranging from 1Vp-p to 10Vp-p in the reference CLOCK. The reference frequency in the individual measurement mode and simultaneous measurement is automatically switched when the CLOCK is input from outside. (EXTERNAL REFERENCE lamp on the front panel ( ⑪ in Figure 2 - 3) is lighting.) If the external reference CLOCK is not input, internal reference CLOCK is automatically selected.
- ⑧ EXT GATE INPUT connector  
When the start/stop operation is controlled by the external signal in the error count measurement, or ES or EFS measurement in the individual measurement mode, and simultaneous measurement, the signal is input through this connector. To control the above operation by the external signal, the GATING EXT key on the front panel ( ⑲ in Figure 2 - 3) must be on. The control signal must have a TTL-level negative logical value.



- ⑨ GPIB connector for GPIB  
Connector to which GPIB cable is connected for remote control from a controller or using SLAVE function.
- ⑩ PRINTER connector  
This connector is connected to the printer from Centronics.

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3.1 Turning on the Power

---

3. OPERATION METHOD

3.1 Turning on the Power

First check that the POWER switch on the front panel is off and the breaker on the rear panel is on (with the . side pressed). Then connect the power plug to the power receptacle. Avoid turning on and off the breaker frequently as a substitute for the POWER switch.

Lastly turn on the POWER switch to connect power to the D3285.

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3.2 Operation of Each Part

3.2 Operation of Each Part

This section describes the function and operation of each part of the front panel. See Figures [2-1] to [2-6].

(1) Pattern Setting Block

① PRBS Stage Count Selector Section

When you press the PRBS key ⑫, the number of PRBS stages set is displayed. 7, 9, 10, 11, 15, 17, 20 or 23 can be set as the number. However, there are two types of "15" due to different generating polynomial. If the polynomial is " $x^{15} + x^1 + 1$ ", "-15" is displayed. (See Table 3 - 1)

The number of stages increases by pressing  $\uparrow$  key, and it decreases by pressing  $\downarrow$  key.

Table 3 - 1 PRBS Pattern Generating Polynomials

$2^N - 1$	Generating polynomial	Governing specification	Applicable mark ratio	CCITT LED
N = 7	$x^7 + x^6 + 1$	CCITT V.29	1/2	On
9	$x^9 + x^5 + 1$	CCITT V.52	1/2	On
10	$x^{10} + x^7 + 1$	-	-	Off
11	$x^{11} + x^9 + 1$	CCITT O.152	1/2	On
15	$x^{15} + x^{14} + 1$	CCITT O.151	1/2B	On
15	$x^{15} + x^1 + 1$	-	-	Off
17	$x^{17} + x^{14} + 1$	-	-	Off
20	$x^{20} + x^3 + 1$	CCITT V.57	1/2	On
23	$x^{23} + x^{18} + 1$	CCITT O.151	1/2B	On

Note

Note : When the generating polynomial is " $x^{15} + x^1 + 1$ ", "-15" is displayed.

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3.2 Operation of Each Part

---

② Memory Operating Section

Generated work patterns can be stored up to ten ways.

The memory indicator indicates numeric characters from 0 to 9 and alphabetic characters A and B.

These numeric characters 0 to 9 can be used for both calling and writing, but alphabetic characters A and B are used for calling only.

The 10B1C ruled pattern of 1023 bits is stored in A and all "0" pattern in B. (When the polarity is set normal.)

Press the  $\uparrow$  key or  $\downarrow$  key to increment or decrement the memory indicator No. Each time either key is pressed, the indicator No. is incremented or decremented by 1.

When the EDIT key  $\textcircled{14}$  is set to OFF and the key  $\uparrow$  or  $\downarrow$  is pressed, the stored patterns are output according to the memory No.

When a new pattern is to be stored, press the STORE key after making sure that the EDIT key is set to ON. Then, the pattern currently being generated is stored according to the memory No. indicated in the memory indicator.

③ Pattern Polarity Selector Section

Decides the logic of a word pattern. The NORMAL and INVERSE are in the relationship of inverse logic. Press the POLARITY key to select it. The stored pattern is output in its regular form when the NORMAL polarity is selected and its inverted pattern is output when the INVERSE polarity is selected. Incidentally, the content of the pattern at that time is monitored by the pattern indicator  $\textcircled{15}$ .

④ DIGIT keys

These keys are used to select a set digit when the bit length is set.

The set digit is indicated with a pointer that is lit on the left shoulder of a numeric character.

The pointer shifts to the right when the  $\rightarrow$  key is pressed and to the left when the  $\leftarrow$  key is pressed.



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3.2 Operation of Each Part

---

⑤ BIT LENGTH indicator

When the EDIT key is set to ON, this indicator indicates the bit length of the pattern currently being generated. When the EDIT key is set to OFF, it indicates the bit length of the stored pattern. When the PRBS key ⑫ is set to ON, this indicator is blanked. The bit length is indicated with 5 digits max. in steps of one from one to 1024 bits. However, it is indicated in steps of 64 from 1024 to 65536 bits.

⑥ Bit Length Setting keys

These keys set the numeric value of the digit indicated with the pointer on the bit length indicator. When the ↑ key is pressed, the numeric value is increased and the carry is raised to the next-higher order digit. When the ↓ key is pressed, the numeric value is decreased and the borrow is raised to the next-higher order digit.

⑦ DIGIT keys

These keys select the set digit when an address No. is set. The set digit is indicated with the pointer that is lit on the left shoulder of a numeric character. The pointer shifts to the right when the → key is pressed and to the left when the ← key is pressed.

⑧ Address number Indicator

This indicator indicates the pattern address number for 16 bits which are monitored in the pattern indicator ⑮. This indicator functions even when the PRBS key ⑫ is set to ON.

⑨ Address number setting keys

These keys set an address number. The digit indicated with the pointer of the address number indicator is increased when the ↑ key is pressed and it is decreased when the ↓ key is pressed.

In either case, carry or borrow is raised to the next-higher order digit.

Set ranges are as follows.

0 to (Set bit length - 1) / 16 for word pattern.

0 to  $(2^N - 1) / 16$  for PRBS pattern.

⑩ CCITT LED

This LED lights when the content of the PRBS pattern selected by ① and ⑪ conforms to the CCITT Recommendations.

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3.2 Operation of Each Part

---

⑪ Mark Ratio Selecting Section

This section can select eight types of mark ratio of 0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4, and 1/2B.

The  key selects the upper and lower LEDs alternately (in reverse relationship to each other). The  key selects LEDs to the right, and the  key selects LEDs to the left.

⑫ PRBS Key

This key selects the setting of the output pattern to the pseudo-random mode.

⑬ WORD Key

This key selects the setting of the output key to the WORD mode.

⑭ EDIT Key

Set this key to OFF when the stored pattern is used.

Set this key to ON before changing the stored contents or outputting the generated pattern in real time.

⑮ Pattern Indicator Lamps and Pattern Setting Keys

Pattern setting keys 1 through 16 can be used only when the EDIT key is set to ON. The set pattern is monitored by the LED on the upper part of each key.

When the LED lights, it indicates logical 1 (high level).

When the bit length exceeds 17, set the pattern after updating the address number.

When a stored pattern or PRBS pattern is used, the corresponding pattern indicator lamp lights to monitor that pattern.

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3.2 Operation of Each Part

---

(2) Measuring Block (See Figure 2-3.)

① ERROR lamps

These lamps indicate the present error status.  
The D3285 error detector has two primary measuring modes: individual measuring mode and simultaneous measuring mode.

Each of these modes support five measuring functions: error rate, error count, error second (ES), error free second (EFS), and frequency measurement.

If the measuring function is switched in the individual measuring mode, the already measured values are lost. In the simultaneous measuring mode, however, five measuring functions are measured simultaneously in the detector. You can switch the measuring functions without terminating each measurement.

Various display formats can be selected for these measuring modes and functions.

Table 3-2 summarizes the available measuring modes and functions.

If the error display mode (OMITT, INSERT, TOTAL) is switched during measurement when a measuring function other than the frequency measurement in the individual measurement mode is selected, the measured values up to that time are reset and measurement is started anew.

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3.2 Operation of Each Part

Table 3-2 Measuring Modes and Measuring Functions

Measuring mode	Measuring function	Display format	Current data display	Use of timer	Display rate
In- dividual measure- ment	Error rate	—	None	Impossible	FAST, MED, SLOW, HOLD
	Error count	- Exponential format - Integer format	Yes	Possible	Fixed to approx. 0.1 sec
	Error second	- Percent (%) format - Seconds format	Yes	Possible	Fixed to 1 sec
	Error free second	- Percent (%) format - Seconds format	Yes	Possible	Fixed to 1 sec
	Frequency	- In MHz unit - In 10MHz unit	None	Impossible	FAST, MED, SLOW, HOLD
Simulta- neous measure- ment	Error rate	- Progressive mode - Immediate mode	Can be turned on or off.	Possible	Fixed to approx. 0.2 sec
	Error count	- Exponential format - Integer format	Can be turned on or off.	Possible	Fixed to approx. 0.2 sec
	Error second	- Percent (%) format - Seconds format	Can be turned on or off.	Possible	Fixed to 1 sec
	Error free second	- Percent (%) format - Seconds format	Can be turned on or off.	Possible	Fixed to 1 sec
	Frequency	In MHz unit	Can be turned on or off.	Possible	Fixed to 1 sec

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3.2 Operation of Each Part

---

(a) DATA lamp

This lamp blinks if an error occurs when there is a bit error in the input data. It does not blink, however, when the measuring function is selected to the frequency (FREQ).

(b) CLOCK lamp

This lamp lights when the clock signal is not connected or when the frequency of the input CLOCK is too low.

(c) SYNC lamp

This lamp lights when the pattern is out of synchronism. It does not light when the measuring function is the frequency (FREQ) in the individual measurement mode.

Note: When the measuring function is selected to the error rate, error count, error second (ES), and error-free second (EFS), no measurement is carried out during the occurrence of the CLOCK or SYNC error. No measurement is carried out during the occurrence of the CLOCK error if the frequency (FREQ) measuring function is selected.

② OVER lamp

This lamp indicates that the result of measurement exceeds the upper limit of the measurement range. The upper limit of the measurement range of each measuring function is shown in Table 3-3.

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3.2 Operation of Each Part

Table 3-3 Upper Limit of Measurement Range

Measuring function	Measuring mode	Display format	Bit error rate range	Upper limit of measurement range
Error rate	Individual measurement	-	10 <sup>-5</sup> -10 <sup>-9</sup>	9.9999x10 <sup>-1</sup>
			10 <sup>-10</sup>	1.0737x10 <sup>-1</sup>
			10 <sup>-11</sup>	1.0737x10 <sup>-2</sup>
			10 <sup>-12</sup>	1.0737x10 <sup>-3</sup>
	Simultaneous measurement	Cumulative Promptly	-	9.9999x10 <sup>-1</sup>
Error count	Individual measurement, simultaneous measurement	Exponent format	-	9.9999x10 <sup>18</sup>
		Integral format	-	9999999
Error second, error free second	Individual measurement, simultaneous measurement	% format	-	100.0000
		Second format	-	4.2949x10 <sup>9</sup>
Frequency	Individual measurement	MHz unit	-	10200.000
		10 Hz unit	-	10200.00000
	Individual measurement	MHz unit	-	10200.000

Note: In the error rate measurement in the individual measurement mode, when the bit error rate range is 10<sup>-10</sup> - 10<sup>-12</sup>, measurement may be possible up to an error amount over the upper limit of measurement range shown in this table.

In the frequency measurement, a frequency over the upper limit of measurement range shown in this table is displayed. However, a frequency exceeding it may not be displayed correctly.

③ GATE lamp

This lamp indicates that the measurement is going on.

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3.2 Operation of Each Part

---

④ MAXIMUM key

Toggles the display mode, the maximum error rate measured is displayed or the present error rate is displayed when the measurement function is set to error rate mode. ON or OFF is selected by pressing the key. If the key is set to ON, the lamp in the key lights. The maximum error rate measured will be reset to "0" by pressing the START key ⑬.

⑤ DISPLAY MODE keys

These keys are used to select the display mode of the result of error measurement when the measuring function is selected to the error rate, error count, error second (ES), or error-free second (EFS). The following modes (a) to (c) are displayed. When one of these keys is pressed, a lamp in the key lights and its corresponding mode is selected.

When the frequency (FREQ) is measured, this setting is disabled and all of these lamps in the keys go off.

If the mode is changed during the measurement, the measured data is reset, and a new measuring operation starts.

(a) OMITT (Omitting) mode

This mode indicates the measuring result for an error in which the data of "0" (low level) is input when the data of "1" (high level) must be input.

(b) INSERT (Inserting) mode

This mode indicates the measuring result for an error in which the data of "1" (high level) is input when the data of "0" (low level) must be input.

(c) TOTAL mode

This mode indicates the measuring result for the total sum of both errors of OMITT and INSERT.

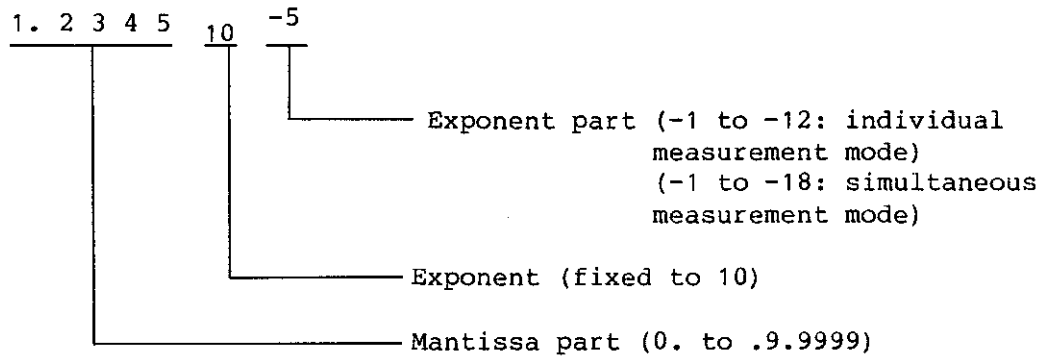
⑥ Measuring Result Indicator

This indicator indicates the result of measurement, the status of measurement operation and error status. In the following, the display format for each measuring function is explained.

(a) For error rate measurement

The bit error rate is displayed with 5 digits max. (with decimal point) in the mantissa part + exponent (10) + 2 digits max. (integer with negative sign) in the exponent part.

(Example)



This example shows that the error rate is  $1.2345 \times 10^{-5}$ .

When the result of measurement is over, the OVER lamp (2) comes on and "□.□□□□" is displayed.

(b) For error count measurement

The two display formats of exponent format and integral format can be switched over to each other with the DISPLAY FORM key ⑱.

- i) In the exponent format, the number of errors is displayed in the form of: mantissa part of up to 5 digits (with decimal point) + exponent (10) + exponent part of up to 2 digits.

(Example)

4.2836 10<sup>6</sup>     (4.2836 x 10<sup>6</sup>)

When the result of measurement is over, the OVER lamp ② comes on and "□.□□□□10<sup>19</sup>" is displayed.



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3.2 Operation of Each Part

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- ii) In the integral format, the number of errors is displayed in a 7-digit integer. When it exceeds 9999999, the OVER lamp ② comes on and the 7 low-order digits of the numeric value are displayed.

(Example)

4283643

- (c) For error second or error free second measurement

The two display formats of % format and second format can be switched over to each other by the DISPLAY FORM key ⑱.

- i) In the % format, the percentage is displayed in the form of: integer part of up to 3 digits + decimal point + fraction part of up to 4 digits.

(Example)

0.7451 (0.7541%)

When the result of measurement is over, the OVER lamp ② comes on and "▯▯▯.▯▯▯▯" is displayed.

- ii) In the second format, the number of seconds is displayed in the form of: mantissa part of up to 5 digits (with decimal point) + exponent (10) + exponent part of 1 digit.

(Example)

3.26 10<sup>2</sup> (3.26 x 10<sup>2</sup> sec)

When the result of measurement is over, the OVER lamp ② comes on and "▯.▯▯▯▯10<sup>9</sup>" is displayed.

- (d) For frequency measurement

In the frequency measurement, the display format differs with measurement mode setting and measuring resolution (set with the HIGH RESOLUTION key ⑨ described later) setting.

- i) When the HIGH RESOLUTION key is OFF in the individual measurement mode, or in the simultaneous measurement mode (Measuring resolution: 1 KHz)

The frequency of the input clock is displayed in units of MHz in the form of: integer part of up to 4 digits + decimal point + fraction part of 3 digits.

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3.2 Operation of Each Part

(Example)

3120.523 (3120.523 MHz)

When the result of measurement is over, the OVER lamp comes on and "████████.████" is displayed.

- ii) When the HIGH RESOLUTION key is ON in the individual measurement mode (measuring resolution: 10 Hz)

The frequency of the input clock is displayed in units of MHz in the form of: integer part of up to 4 digits + decimal point + fraction part of 5 digits.

(Example)

7691.068<sup>42</sup> (7691.06842 MHz)

When the result of measurement is over, the OVER lamp ② comes on and "████████.██████" is displayed.

- (e) CLOCK error

If the clock is not input or the frequency of the input clock is too low, measurement is suspended and "CLOCK.ERR" is displayed.

- (f) SYNC error

If pattern synchronization does not meet an allowable range, measurement is suspended and "SYNC.ERR" is displayed.

- (g) Status prior to a start of measurement (HALT)

In the period from switching the measuring mode or measuring function till starting measurement, "HALT" is displayed.

- (h) Status just after a start of measurement (BUSY)

In the period from starting measurement till displaying the first result of measurement, "BUSY" is displayed.

- ⑦ HISTORY lamps

This lamp indicates whether an error has occurred. If the errors are corrected, the lamp is not off. Press the START key ⑬, then the system is reset and the lamp goes off.

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3.2 Operation of Each Part

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(a) CLOCK lamp

If the clock is not input with the START key pressed or the input CLOCK frequency is below the set value, this lamp lights.

(b) SYNC lamp

If the START key is pressed and the pattern synchronization does not meet an allowable range, this lamp lights.

⑧ BUZZER keys and VOLUME knob

Buzzer ON/OFF mode selection keys (the buzzer sounds when an error occurs) and volume control knob respectively

In the following two cases, the buzzer sounds. ON or OFF can be selected both in the case (a) or (b) described below.

(a) Data error occurs

If there is incorrect bit in the input data, the buzzer sounds. The tone changes according to the number of errors per unit time. ON or OFF is selected with the DATA key of the buzzer. ON or OFF is selected by pressing the key. If the key is set to ON, the lamp in the key lights. If the measurement function is set to the frequency (FREQ) in individual measurement mode, the buzzer does not sound even if a data error occurs.

(b) CLOCK error, pattern synchronism error or setting error occurs

If no CLOCK is input, the input CLOCK frequency is below the set value, the pattern is out of synchronism or the measurement condition is set beyond the allowable setting value with the panel key or knob, the buzzer sounds. ON or OFF is selected with the ALARM key of the buzzer. ON or OFF is selected by pressing the key. If the key is set to ON, the lamp in the key lights. If the measurement function is set to the frequency (FREQ) in individual measurement mode, the buzzer does not sound even if the pattern synchronism error occurs.

⑨ HIGH RESOLUTION key

Toggles the resolution 1kHz or 10Hz in the frequency measurement in individual measurement mode. The resolution 1kHz (OFF) or 10Hz (ON) is selected by pressing this key. If the resolution is set to 10Hz, the lamp in the key lights. The input CLOCK measuring time per one measurement is as follows:

- (1) Resolution is 1kHz --- approx. 10 ms
- (2) Resolution is 10Hz --- approx. 1 sec

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⑩ ERROR RATE, ERROR COUNT, ES, EFS and FREQ (MHz) keys

These keys are used to select a measuring function.

When one of the five keys is pressed, the corresponding function is selected and the lamp in the key comes on and the lamps of the other keys go out.

In the individual measurement mode, if the measuring function or measurement mode is switched, the results of measurement up to that time are lost.

(a) ERROR RATE

The error rate is measured and displayed.

The error rate is displayed with (number of error bits) / (number of input bits). The number of input bits is equal to the number of input clocks.

Measuring operations are carried out as follows depending on each measurement mode.

In any measurement mode, if a CLOCK error or SYNC error occurs, no measurement is carried out. When the error is recovered, the measurement is automatically restarted from the beginning.

i) Individual measurement mode

The error rate is set at x10 steps within the range of  $10^5$  to  $10^{12}$  with the number of input bits as the reciprocal of the bit error rate range.

Accordingly, as the set value ( $10^{-N}$ ) of bit error rate range is smaller and the frequency of the input clock is lower, the time required for measurement becomes longer.

The minimum resolution becomes the set value of bit error rate range and the upper limit of the measurement range varies with the bit error rate range as shown in Table 3-3.

When the display rate is set at FAST, MED or SLOW, measurement is automatically repeated. When the display rate is set at HOLD, measurement is carried out once each time the START key is pressed.

ii) Simultaneous measurement mode

The measurement start/stop control method depends on GATING EXT key ⑪ setting.

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- 1) When the GATING EXT key is set to OFF (internal control)

Measurement is started by pressing the START key. To stop the measurement, press the STOP key. If the timer is set, the measurement can be stopped automatically.

- 2) When the GATING EXT key is set to ON (external control)

A measurement start/stop is controlled by the voltage of the signal (TTL level) input to the EXT GATE INPUT connector (⑧ in Fig. 2-6).

Input signal voltage	Measuring operation
+2.0 V to +5.0 V (HIGH)	Stop
0.0 V to +0.6 V (LOW)	Measurement

After measurement is started when the voltage of the input signal is LOW, the measurement can be stopped by the STOP key on the front panel. In this case, to start the next measurement, change the voltage of the input signal into HIGH and set it to LOW again. Keep the voltage of the input signal unchanged for one second.

In this mode, (number of input bits) = (frequency of input clock) x (time elapsed after a start of measurement).

Accordingly, as the elapsed time is longer, the resolution becomes higher.

In this mode, the display of intermediate data (CURRENT DATA) before an end of measurement can be turned on or off.

The display of CURRENT DATA is updated every 0.2 second or so.

The CURRENT DATA can be displayed in either the PROGRESSIVE mode or IMMEDIATE mode, and they can be switched by the DISPLAY FORM key.

In the PROGRESSIVE mode, the error rate is calculated based on the accumulation of the number of errored bits from the start of measurement and the number of input bits. In the IMMEDIATE mode, the error rate is displayed as the value in a specific period (approximately 0.2 second) between the previous display and current display.

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(b) ERROR COUNT

The error count is measured and displayed.

In the error count, the number of error bits during measurement is displayed. For the error count, the exponential format and integral format are available. These formats can be selected with the DISPLAY FORM key (18).

In the exponent format, the number of error bits is displayed in the range of 0 to  $9.9999 \times 10^{18}$ . In the integral format, the 7 low-order digits of the measured value are displayed in the range of 0 to 9999999.

The measurement start/stop control method depends on GATING EXT key (19) setting.

- i) When the GATING EXT key is OFF (internal control)

Measurement is started by pressing the START key.

The measurement is stopped by pressing the STOP key. If the timer is set, the measurement can be stopped automatically.

- ii) When the GATING EXT key is ON (external control)

A start/stop of measurement is controlled by the voltage of the signal (TTL level) input to the EXT GATE INPUT connector (8) in Fig. 2-6).

Input signal voltage	Measuring operation
+2.0 V to +5.0 V (HIGH)	Stop
0.0 V to +0.6 V (LOW)	Measurement

After measurement is started when the voltage of input signal is LOW, the measurement can be stopped by the STOP key on the front panel. In this case, to start the next measurement, change the voltage of the input signal and set it to LOW again. Keep the voltage of the input signal unchanged within one second.

While a CLOCK error or SYNC error occurs, no measurement is carried out. When the error is recovered, the measurement is automatically restarted from the beginning.

The result of measurement is displayed as follows according to each measurement mode.

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i) Individual measurement mode

The intermediate data before an end of measurement is displayed and updated every 0.1 second or so.

ii) Simultaneous measurement mode

The display of intermediate data (CURRENT DATA) before an end of measurement can be turned on or off. The display of CURRENT DATA is updated every 0.2 second or so.

(c) ES

The error second is measured and displayed.

For the error second display, the % format and second format are available. These format can be selected by the DISPLAY FORM key (18).

In the second format, the number of seconds at which errors of one bit or more have occurred for one second is displayed.

In the % format, (number of seconds at which errors of one bit or more have occurred for one second) / (number of seconds elapsed after a start of measurement) x 100 is displayed in the % unit.

The measurement start/stop control method depends on GATING EXT key (19) setting.

i) When the GATING EXT key is OFF (internal control)

Measurement is started by pressing the START key.

The measurement is stopped by pressing the STOP key. If the timer is set, the measurement is automatically stopped.

ii) When the GATING EXT is ON (external control)

A start/stop of measurement is controlled by the voltage of the signal (TTL level) input to the EXT GATE INPUT connector (8) in Fig. 2-6) on the rear panel.

Input signal voltage	Measuring operation
+2.0 V to +5.0 V (HIGH)	Stop
0.0 V to +0.6 V (LOW)	Measurement

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After measurement is started when the voltage of the input signal is LOW, the measurement can be stopped by the STOP key on the front panel. In this case, to start the next measurement, change the voltage of the input signal into HIGH and set it to LOW again. Keep the voltage of the input signal unchanged for one second.

While a CLOCK error or SYNC error occurs, no measurement is carried out. When the error is recovered, the measurement is automatically restarted from the beginning.

The result of measurement is displayed as follows according to each measurement mode.

i) Individual measurement mode

The intermediate data before an end of measurement is displayed and updated every one second.

ii) Simultaneous measurement mode

The display of intermediate data (CURRENT DATA) before an end of measurement can be turned on or off. The display of CURRENT DATA is updated every one second.

(d) EFS

The error free second is measured and displayed.

For the error free second display, the % format and second format are available. These formats can be switched by the DISPLAY FORM key (18).

In the second format, the number of seconds at which any error including one-bit error has not occurred for one second is displayed. In the % format, (number of seconds at which any error including one-bit error has not occurred for one second) / (number of seconds elapsed after a start of measurement) x 100 is displayed in the % unit.

The measurement start/stop control method depends on GATING EXT key setting.

i) When the GATING EXT key is OFF (internal control)

Measurement is started by pressing the START key. The measurement is stopped by pressing the STOP key. If the timer is set, the measurement is automatically stopped.

ii) When GATING EXT key is ON (external control)

A start/stop of measurement is controlled by the voltage of the signal TTL level) input to the EXT GATE INPUT connector (8) in Fig. 2-6) on the rear panel.



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Input signal voltage	Measuring operation
+2.0 V to +5.0 V (HIGH)	Stop
0.0 V to +0.6 V (LOW)	Measurement

After measurement is started when the voltage of the input signal is LOW, the measurement can be stopped by the STOP key on the front panel. In this case, to start the next measurement, change the voltage of the input signal into HIGH and set it to LOW again. Keep the voltage of the input signal unchanged for one second.

While a CLOCK error or SYNC error occurs, no measurement is carried out. When the error is recovered, the measurement is automatically restarted from the beginning.

The result of measurement is displayed as follows according to each measurement mode.

i) Individual measurement mode

The intermediate data before an end of measurement is displayed and updated every one second.

ii) Simultaneous measurement mode

The display of intermediate data (CURRENT DATA) before end of measurement can be turned on or off. The display of CURRENT DATA is updated every one second.

(e) FREQ (MHz)

The frequency of the input clock is measured and displayed.

Measuring operations are carried out as follows depending on each measurement mode.

i) Individual measurement mode

When HIGH RESOLUTION is set to OFF (1 KHz resolution), the gate time is 10 ms and the measurement range is 500.000 MHz to 10000.000 MHz. When HIGH RESOLUTION is set to ON (10 Hz resolution), the gate time is 1 second and the measurement range is 500.00000 MHz to 10000.00000 MHz. Correct display may not be made out of the measurement range.

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When the display rate is set to FAST, MED or SLOW, measurement is automatically repeated. When the display rate is set to HOLD, measurement is carried out once each time the START key is pressed.

While a CLOCK error occurs, no measurement is carried out. When the error is recovered, the measurement is automatically restarted.

ii) Simultaneous measurement mode

The measurement range is 500.000 MHz to 10000.000 MHz.

Correct display may not be made out of the measurement range. The measurement start/stop control method depends on GATING EXT key setting (19).

1) When the GATING EXT key is OFF (internal control)

Measurement is started by pressing the START key. The measurement is stopped by pressing the STOP KEY. If the timer is set, the measurement is automatically stopped.

2) When the GATING EXT key is ON (external control)

A start/stop of measurement is controlled by the voltage of the signal (TTL level) input to the EXT GATE INPUT connector (8) in Fig. 2-6) on the rear panel.

Input signal voltage	Measuring operation
+2.0 V to +5.0 V (HIGH)	Stop
0.0 V to +0.6 V (LOW)	Measurement

After measurement is started when the voltage of the input signal is LOW, the measurement can be stopped by the STOP key on the front panel. In this case, to start the next measurement, change the voltage of the input voltage into HIGH and set it to LOW again. Keep the voltage of input signal unchanged for one second.

The display of intermediate data (CURRENT DATA) before an end of measurement can be turned on or off. The display of the result of measurement is updated every one second.

While a CLOCK error or SYNC error occurs, no measurement is carried out. When the error is recovered, the measurement is automatically restarted.

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⑪ EXTERNAL REFERENCE lamp

The external reference CLOCK is connected to the rear panel EXT REF INPUT connector (⑦ in Figure 2 - 6), this lamp lights. When the lamp lights, it indicates that the external reference CLOCK is used, and when the lamp goes off, it indicates that the integrated reference CLOCK is used.

⑫ BIT ERROR RATE RANGE Indicator and Set keys

Sets and displays the measuring range in the error rate measurement, and set the simultaneous measurement mode.

The measuring range setting range is  $10^{-5}$  to  $10^{-12}$ , and its absolute value of exponent part is displayed in the window.

The numeric value in the display is incremented by 1 each time the  $\uparrow$  key is pressed, or decremented by 1 each time the  $\downarrow$  key is pressed.

The measurement range denotes the reciprocal number of the number of the input CLOCK pulses per one error rate measurement. For instance, when the error rate range is set to  $10^{-8}$ , the number of errors per  $10^8$  (=100 millions) in the number of input CLOCK pulses is measured. The time required for one error rate measurement is displayed as follows:

$$\frac{1}{(\text{Measurement range}) \times (\text{Input CLOCK frequency [Hz]})} \quad [\text{sec}]$$

When the measuring range is  $10^{-12}$  for instance, the time required for one error rate measurement becomes 500 sec. where the input CLOCK frequency is assumed to be 2 GHz.

Press the  $\uparrow$  key when 12 is displayed in the exponent part or press the  $\downarrow$  key when 5 is displayed there, and ' 56 ' (St = simultaneous)

appears and the device is in the simultaneous measurement mode. In the simultaneous measurement mode, five functions are executed.

⑬ START, STOP keys

These keys are used to control the measurement.

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(a) START key

The measurement of the error rate or frequency starts with this key when the DISPLAY RATE is set to HOLD in the individual measurement mode. With this key, the measurement also starts when the function is set to error count, error second (ES) or error-free second (EFS) in the individual measurement mode. In the simultaneous measurement mode, the key is used to start to measure all functions. If the GATING EXT key is set to ON, commands by this key will be ignored.

If there is a CLOCK error or SYNC error when this switch is pressed, the measurement is started after the error is recovered.

When this key is pressed during the measurement of the error rate in the individual measurement mode, a new measurement is carried out automatically after the suspension of the measurement at that time.

When this key is pressed during the measurement of the error count, error second (ES), or error-free second (EFS) in the individual measurement mode, and simultaneous measurement mode, a new measurement is started automatically after clearing the values measured so far to 0 (zero). When the timer is used, the elapsed time (ELAPSED) is reset to 0 and the remaining time (TIMED) to the value of the set time (PRESET).

(b) STOP key

This key is used to stop the measurement of error count, error second (ES), or error-free second (EFS) in the individual measurement mode, and simultaneous measurement mode.

This key is enabled even when the automatic stop function with the timer is employed.

This key has no relation except the simultaneous measurement mode to the measurement of error rate and frequency (FREQ), however.

⑭ DISPLAY RATE key and FAST, MED, SLOW, HOLD lamps

This key is used to set interval time between measurements in measurement of error rate and frequency (FREQ) in the individual measurement mode and the lamp is used to display its set value.

The measuring interval time means an interval from the end of one measurement to the start of the next measurement, and its value is approx. 0.1 sec/0.3 sec/1 sec (FAST/MED/SLOW).

When the HOLD mode is set, measure the data once when pressing the START key ⑬.

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This setting has no relation to the measurement of error count, error second (ES), error-free second (EFS) in the individual measurement mode, and simultaneous measurement.

⑮ AUTO SYNC, SYNC keys

These keys are used to turn ON/OFF the automatic pattern synchronizing function and to reset the synchronism.

Each time the AUTO SYNC key is pressed, the ON/OFF of the automatic pattern synchronizing function is changed over alternately. When the key is set to ON, the lamp in this key lights.

If the error rate rises when this key is set to ON, the system automatically goes to the status of out of synchronism (SYNC error) and searches for the pattern where the input pattern matches the comparative pattern. When matched, the system goes to the status of synchronism establishment.

When this key is set to OFF, however, the system does not make a transition to the status of out of synchronism automatically, even if the error rate rises, but it holds the status of synchronism establishment until the SYNC key is pressed.

When the SYNC key is pressed, the status of synchronism establishment is released once even if the AUTO SYNC is set to either ON or OFF, and then the system makes a status transition to the out of synchronism status, and searches for the pattern until the pattern match is taken.

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The threshold value of the error rate between the establishment of synchronism and out of synchronism is set as shown in the table below:

PATTERN MODE	BIT LENGTH	Threshold value of error rate	
		Out of synchronism establishment of synchronism	Establishment of synchronism out of synchronism
WORD	1 to 64	Approx. $9.8 \times 10^{-4}$	Approx. $1.6 \times 10^{-2}$
	65 to 256	Approx. $2.4 \times 10^{-4}$	Approx. $1.6 \times 10^{-2}$
	257 to 1024	Approx. $6.1 \times 10^{-5}$	Approx. $1.6 \times 10^{-2}$
	1088 to 4096	Approx. $1.5 \times 10^{-5}$	Approx. $1.6 \times 10^{-2}$
	4160 to 16384	Approx. $3.8 \times 10^{-6}$	Approx. $1.6 \times 10^{-2}$
	16448 to 32768	Approx. $1.9 \times 10^{-6}$	Approx. $1.6 \times 10^{-2}$
	32832 to 65536	Approx. $9.5 \times 10^{-7}$	Approx. $1.6 \times 10^{-2}$
PRBS	-----	Approx. $3.9 \times 10^{-3}$	Approx. $1.6 \times 10^{-2}$

The establishment of the pattern synchronism is released when the pattern setting section or INPUT POLARITY is changed in their setting.

⑩ DELAY Indicator, Knob, and BUSY Lamp

Used to set and display the amount of phase delay in the CLOCK input.

The delay amount can be varied with a step of 1 ps by turning the knob.

The numerals in the unit less than "ps" is rounded, and the amount is displayed.

The variable range is -400 ps to +400 ps.

Since the phase delay is varied mechanically using a motor and variable delay line, it takes some time from the turning of the knob to the end of its setting. The BUSY lamp lights during this operation.

Incidentally, CAL is displayed during automatic calibrating of the amount of phase delay.

When a malfunction occurs in this operation, "Err" is displayed and the delay line operation is stopped.

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①7 THRESHOLD LEVEL Indicator and Knob

Used to set and display the threshold level in data input.

The threshold level can be varied in 0.001 V steps by turning the knob.

The variable range is set as shown in the table below by setting the terminator (TO 0 V/TO -2 V) of DATA in the right lower part of the panel:

TERMINATOR	Variable range
TO 0 V	-2.040 V to +2.040 V
TO -2 V	-1.850 V to -0.750 V

①8 DISPLAY FORM key

Switches the display format of the error rate measurement in the Error Count, Error Second, Error-Free Second Measurement, or Simultaneous Measurement mode.

The operation of each measuring function and the actions you take are as follows:

(a) Display during Error Rate measurement

If the CURRENT DATA display is turned on in the simultaneous measuring mode, you can switch the PROGRESSIVE and IMMEDIATE display formats. The format is switched whenever you press the DISPLAY FORM key. When the IMMEDIATE display mode is selected, the lamp lights on this key.

If the CURRENT DATA display is turned off or if the individual measuring mode is released, the CURRENT DATA key is made invalid. The key lamp goes out.

(b) Display during Error Count measurement

You can switch the EXPONENTIAL and INTEGRAL display formats regardless of measuring mode selection or CURRENT DATA display on/off switching.

The display format is switched whenever you press the DISPLAY FORM key. When the EXPONENTIAL display mode is selected, the lamp lights on this key.

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(c) Display during ES or EFS measurement

You can switch the percent and second display formats regardless of measuring mode selection or CURRENT DATA display on/off switching.

The display format is switched whenever you press the DISPLAY FORM key. When the percent (%) display mode is selected, the lamp lights on this key.

The common display format is set for ES measurement and EFS measurement.

(d) Display during frequency measurement

The DISPLAY FORM key is invalid for frequency measurement. The key lamp does not light.

①9 GATING EXT key

In the error count, error second (ES) or error-free second (EFS) measurement in the individual measurement mode, and simultaneous measurement mode the followings can be selected with this key:

- Starting or completing the measurement is controlled by an external signal (EXT).
- Starting or completing the measurement is controlled by the START/STOP key and integrated timer (INT).

EXT or INT is selected by pressing this key, and the lamp in the key lights when EXT is set.

②0 AUTO SEARCH key

The AUTO SEARCH function automatically searches the optimum threshold level of data input in the D3285 (ERD) or the optimum phase (DELAY) between input data and clock.

(It also searches the optimum mark rate in the PRBS pattern mode and the optimum W.PORARITY in the WORD pattern mode. Therefore, the number of PN stages in the PRBS pattern mode and the programmable pattern in the WORD pattern mode must be set in common to the PPG and the ERD.)

Conditions for executing the AUTO SEARCH function:

- Input data level range: High level ... +2.00 or less  
Low level ... -2.00 or more
- Input data mark rate range  
: 1/8 to 7/8 (WORD pattern mode) display LED.



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AUTO SEARCH is executed once every time the AUTO SEARCH key is pressed. The lamp in the key lights during execution. "SEARCH" is displayed on the measurement display LED, and "----" is displayed on the TLVL (threshold level) display LED.

Upon completion of AUTO SEARCH operation, the lamp in the key and the measurement display LED go out. When the optimum DELAY or TLVL value is found, the value is displayed, and the measurement mode becomes the one that has been effective prior to execution.

If the optimum value is unavailable, "NOT FOUND" is displayed on the measurement display LED, and the DELAY or TLVL value returns to the one that has been effective prior to execution.

AUTO SEARCH can be cancelled by pressing the AUTO SEARCH key during operation. Measurement setting conditions return to the ones that have been effective prior to execution.

②1 CURRENT DATA key

In the simultaneous measurement mode, when CURRENT DATA (intermediate data) is set to ON, the display of the result of error rate/error count measurement is updated on the measuring result indicator 6 every 0.2 second or so and the display of error second (ES), error free second (EFS) and frequency measurement is updated every 1 second.

When CURRENT DATA is set to OFF, "BUSY" is displayed until termination of measurement. After the termination of measurement, the result of measurement is displayed.

CURRENT DATA may be switched to ON or OFF during measurement.

Each time the key is pressed, CURRENT DATA is switched to ON or OFF. When CURRENT DATA is set to ON, the lamp in the key comes on.

In the individual measurement mode, CURRENT DATA cannot be set to ON or OFF. For error rate and frequency measurement, CURRENT DATA is set to OFF. For error count, error second (ES) and error free second (EFS) measurement, CURRENT DATA is set to ON.

The display of the result of error count measurement is updated every 0.1 second or so. The display of the result of error second (ES) and error free second (EFS) measurement is updated every 1 second.

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(3) Timer/CLOCK section, GPIB section and printer control section  
(See Figure 2-4.)

① TIMER MODE (SINGLE, REPEAT, and UNTIMED) keys

Set their respective timer/clock display modes for error count, error second (ES), and error free second (EFS) measurement in the individual measurement mode. Also, they are used to select the timer operation in the simultaneous measurement mode.

When you press one of these three keys, its mode is selected and the key lamp lights. The lamps of the other two keys do not light.

You cannot change the TIMER MODE during measurement of the error count, ES or EFS in the individual measuring mode or during measurement in the simultaneous measuring mode.

(a) SINGLE mode key

Performs measurement only once.

When you press the START key, the measurement starts. This measurement ends when the time set by the timer PRESET key is expired or when you press the STOP key.

(b) REPEAT mode key

Repeats measurement.

When you press the START key, the measurement starts. When the time set by the timer PRESET is expired, the last measuring data is displayed and the next measurement starts. This measurement repeats until you press the STOP key.

(c) UNTIMED mode key

Repeats measurement regardless of the time set by the timer PRESET key.

When you press the START key, the measurement starts and it continues until you press the STOP key.

This measurement mode is the same as when you have set the timer PRESET value to "00<sub>DAY</sub> 00<sub>HOUR</sub> 00<sub>MIN</sub> 00<sub>SEC</sub>". You can change the mode without changing the PRESET value.

② MEAS TIME (ELAPSED, TIMED, PRESET) keys

These keys are used to select error count, error second (ES) or error free second (EFS) in the individual measurement mode, and select the elapsed time (ELAPSED), remaining time (TIMED) or set time (PRESET) as the TIMER/CLOCK section display mode in the simultaneous measurement mode.

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When one of the three keys is pressed, the corresponding display mode is selected and the lamp in the key comes on, and the lamps of the other key and REAL TIME key go out.

(a) ELAPSED (elapsed time)

Displays the elapsed time (DAY, HOUR, MIN, SEC) from a start of measurement. The maximum display limit is 99<sup>DAY</sup> 23<sup>HOUR</sup> 59<sup>MIN</sup> 59<sup>SEC</sup>. When this limit is exceeded, the left upper pointers of all digits are displayed.

In the error rate and frequency (FREQ) measurement in the individual measurement mode, "--" is displayed in all digits.

(b) TIMED (remaining time)

Displays the remaining time (DAY, HOUR, MIN, SEC) until the measurement time preset in the PRESET mode. When the remaining time becomes 0, measurement stops automatically.

When measurement is not yet started, when the automatic stop function using the timer is not employed, and when the error rate and frequency (FREQ) are measured, "--" is displayed in all digits.

(c) PRESET (set time)

Sets and displays the measurement time from a start of measurement till an automatic stop of measurement through the timer. The maximum limit for this setting and display is 99<sup>DAY</sup> 23<sup>HOUR</sup> 59<sup>MIN</sup> 59<sup>SEC</sup>. PRESET can be set at the step of 1<sup>SEC</sup>. When PRESET is set to 00<sup>DAY</sup> 00<sup>HOUR</sup> 00<sup>MIN</sup> 00<sup>SEC</sup>, the system enters the mode where the automatic stop function using the timer is not used. (Then, the system is stopped by using the STOP key only.)

For a change of setting, the SET key ⑦, DIGIT key ⑤ and TIMER/CLOCK change key ⑥ are available.

When TIMER MODE is set UNTIMED, the display of PRESET becomes 00 DAY 00 HOUR 00 MIN 00 SEC. When the system enters a timer setting status with the SET key ⑦ pressed, the set value is displayed and the setting can be changed. When the SET key is pressed once again to terminate the timer setting status, the display returns to 00<sup>DAY</sup> 00<sup>HOUR</sup> 00<sup>MIN</sup> 00<sup>SEC</sup>.

In the error count, error second, error free second measurement in the individual measurement mode, and in the simultaneous measurement mode, the set value cannot be changed during measurement.

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③ REAL TIME (YMDH, DHMS) key

This key is used to switch the contents of display on the TIMER/CLOCK indicator over to the real time (year, month, day, hour, or day, hour, min, sec).

When one of the two keys is pressed, the corresponding display mode is selected and the lamp in the key comes on, and the lamps of the other key and MEAS TIME key go out.

For a change of setting, press the key corresponding to the item to be changed, then operate the SET key ⑦, DIGIT key ⑤ and TIMER/CLOCK change key ⑥.

If DAY and HOUR are set on either of YMDH and DHMS, the same set values are set on the other.

(a) YMDA (year, month, day, hour)

Sets and displays YEAR, MONTH, DAY, HOUR of the real time.

(b) DHMS (day, hour, min, sec)

Sets and displays DAY, HOUR, MINUTE, SECOND of the real time.

④ Timer/CLOCK indicator

This indicator indicates the time/hour of the timer and CLOCK.

A pointer is displayed on the upper left of digits to which the time/hour can be set.

⑤ DIGIT keys

These keys are used to shift the digit (a pointer is displayed on its upper left) to which the timer/CLOCK indication can be set to the left ( ← ) or right ( → ).

If this key is pressed when the pointer is displayed on neither digit, a pointer appears on the right or left end digit.

⑥ TIMER/CLOCK set value change key

This key is used to increment the set value of the digit selected by the DIGIT key by 1 ( ↑ ) or decrement it by 1 ( ↓ ).

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3.2 Operation of Each Part

---

⑦ SET key

Used to cause the operation of the TIMER/CLOCK section to enter the setting mode. Each time this key is pressed, the pointers of set enable digits on the TIMER/CLOCK indicator ④ come on or go out. For setting, press this key to cause pointers to come on and set a numeric value with the DIGIT key ⑤ and TIMER/CLOCK change key ⑥. For termination of setting, press this key once again to cause the pointers to go out.

In setting the real time, the digits for less than 1 second are set to 0 when this key is pressed upon termination of setting.

In setting the real time, if the setting is terminated by this key again without pressing the TIMER/CLOCK change key after pointers are caused to come on by pressing this key, the set value of the real time is cancelled and no setting is performed for the internal clock.

⑧ REMOTE lamp, and LOCAL key

The REMOTE lamp lights when this equipment is under remote control from the GPIB controller. The remote control mode is released by pressing LOCAL key. However, it cannot be released if LOCAL LOCKOUT is set by the GPIB controller.

⑨ ADDRESS DISP switch

This switch is used to display/set the GPIB device address.

The device address is displayed on the word/address indicator in the pattern setting block.

Each time this key is pressed, the display/setting mode of the device address is changed over to the display/setting mode of general words/addresses alternately.

In the device address display/setting mode, the lamp in this key lights and characters of GPIB are displayed on the bit length indicator in the pattern setting block.

⑩ SLAVE key

Makes the pattern setting block of this equipment interlock with that of D3185/D3185A.

ON or OFF is selected by pressing this key. When ON is selected, the lamp in the key lights.

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3.2 Operation of Each Part

---

⑪ PANEL LOCK key

This key is used to set/release the locking of the key and knob on the front panel.

Each time this switch is pressed, the lock setting and releasing are changed over alternately.

When the locking is set, the lamp in this key lights and Keys other than this key, POWER switch, LOCAL key and the ALARM switch provided on the rear panel are disabled.

⑫ PRINTER ON key and BUSY lamp

When this PRINTER ON key is lighting, the external printer (Contronics interface) connected through the connector of the rear panel can be printed.

The BUSY lamp remains being lit if the printer is not connected or the data is not transferred.

When the data transfer is normally terminated, the BUSY lamp goes out and will be lit again at the following data transfer.

⑬ MANUAL PRINT key

When this key is pressed, measured value can be printed at arbitrary time.

⑭ ERROR PRINT ON key

If this key is lit, measured value is printed when ERROR (DATA, CLOCK, SYNC) occurs. (Uses together with PRINTER ON)

⑮ PAPER FEED key

Sends one line sheet of paper of the printer ahead.

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3.2 Operation of Each Part

---

(4) I/O Connectors and Controls (See Figure 2-5.)

① POWER switch

This is the POWER switch. It is arranged in series with the breaker on the rear panel.

② SYNC OUTPUT-1/32 CLOCK connector

This is an output of 1/32 of the input CLOCK ⑥.

③ SYNC OUTPUT-PATTERN connector

This is a synchronous output of the comparative pattern. When the pattern synchronism is established, the synchronized pulse is displayed in the input data pattern. The bit position where the pulse is output changes by 16 bits according to the pattern setting section address number.

④ MONITOR OUTPUT-CLOCK connector

This is a monitor output of the INPUT CLOCK ⑥.

⑤ MONITOR OUTPUT-DATA connector

This is a monitor output of the INPUT DATA ⑦.

⑥ INPUT-CLOCK connector

Connect the CLOCK output of the measured device or that of the D3185/D3185A to this connector. Do not apply a voltage exceeding  $2.5V_{p-p}$  to it.

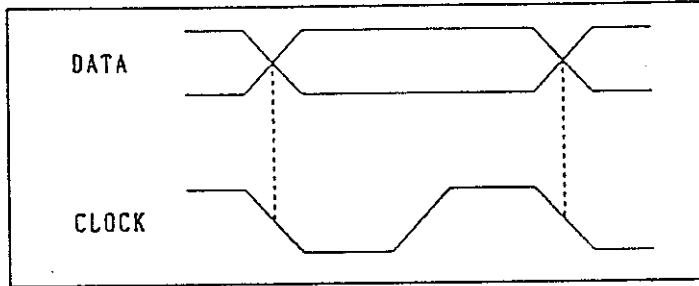
⑦ INPUT-DATA connector

Connect the DATA output of the measured device to this connector. Do not apply a voltage exceeding  $+2.5V/-4.5V$  to it. Set the phase relation with the INPUT CLOCK ⑥ as shown below:

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3.2 Operation of Each Part

This phase relation is monitored with the MONITOR OUTPUT connectors ④ and ⑤.



⑧ TERMINATOR keys and TO 0V/TO -2V lamp

These keys are used to specify the terminal voltage of the INPUT CLOCK ⑥ and INPUT DATA ⑦.

Resistance of the internal terminator is approx 50Ω. Terminator is connected to 0V in TO 0V or -2V in to -2V.

⑨ INPUT POLARITY key and NORMAL, INVERSE lamp

This key is used to change over the polarity of data input, and the lamp to display it.

Each time this key is pressed, the polarity changes over from NORMAL to INVERSE and vice versa alternately.

(a) NORMAL

Compares data input with the internal comparative pattern set in the pattern setting block as it is to detect and measure any error.

(b) INVERSE

Compares data input by inverting the pattern with the internal comparative pattern set in the pattern setting block to detect and measure any error.



*MEMO*



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4.1 Setup on the D3185/D3185A

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#### 4. SYSTEM OPERATIONS

This chapter explains how to perform the error test by connecting the D3185/D3185A pulse pattern generator, the unit under test (UUT) or device under test (DUT) to the D3285 Error Detector.

##### 4.1 Setup on the D3185/D3185A

###### 4.1.1 Setting the Clock Source and Frequency

The D3185/D3185A requires a clock source externally. Input a sine wave external clock with an amplitude of 0.7 Vp-p to 1.5 Vp-p to the INPUT CLOCK connector. When the TR4515 is used (connected to the dedicated GPIB bus) as a clock source, frequency setting can be attained by operating the frequency setting dial on the D3185/D3185A panel or operating the frequency memory.

CAUTION

If the clock frequency has been greatly changed, switch the pattern modes WORD and PRBS. Otherwise, a correct pattern may not be output to the data output.

###### 4.1.2 Setting the Data Output

Set the data output level according to the input conditions of the UUT or DUT as follows:

- (1) If the terminating voltage of the UUT or DUT data input is zero (0) volt (See Figure 4-1.)

Press the LEVEL key and set the output level so that the VARIABLE TO 0V lamp lights on the front panel. In this case, the data output offset (high level) and the amplitude can be changed. Set them by using the OFFSET and AMPLITUDE controls of the DATA section. The CLOCK (DC) output is also terminated with zero volt, and its offset and amplitude can be changed.

- (2) If the terminating voltage of the UUT or DUT data input is -2 Vdc at ECL level (See Figure 4-2.)

Press the LEVEL key and set the output level so that the ECL TO -2V lamp may light on the front panel. In this case, the data output offset (high level) is set to about -0.8 V and the amplitude is set to about 0.8 Vp-p (variable). The CLOCK (DC) output is terminated with -2 V and the offset is set to about -0.8 V and the amplitude is set to about 0.8 Vp-p (variable).

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4.1 Setup on the D3185/D3185A

- (3) If the UUT or DUT data input is used for AC-coupled termination (See Fig.4-3)

In this case, set the DATA output to the AC mode. Output level and offset setting has no connection but only amplitude setting becomes variable.

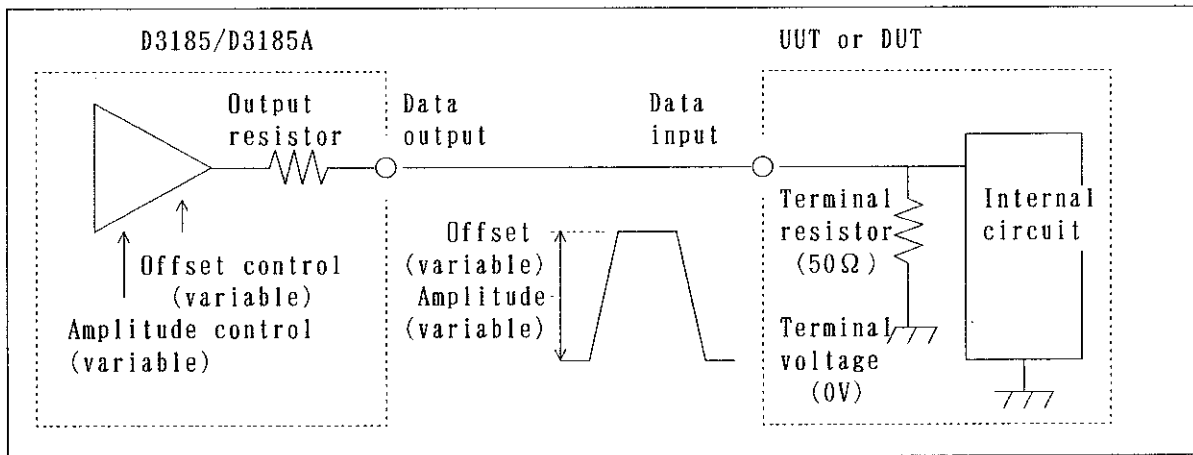


Figure 4 - 1 If DATA output is used and the terminating voltage is 0V

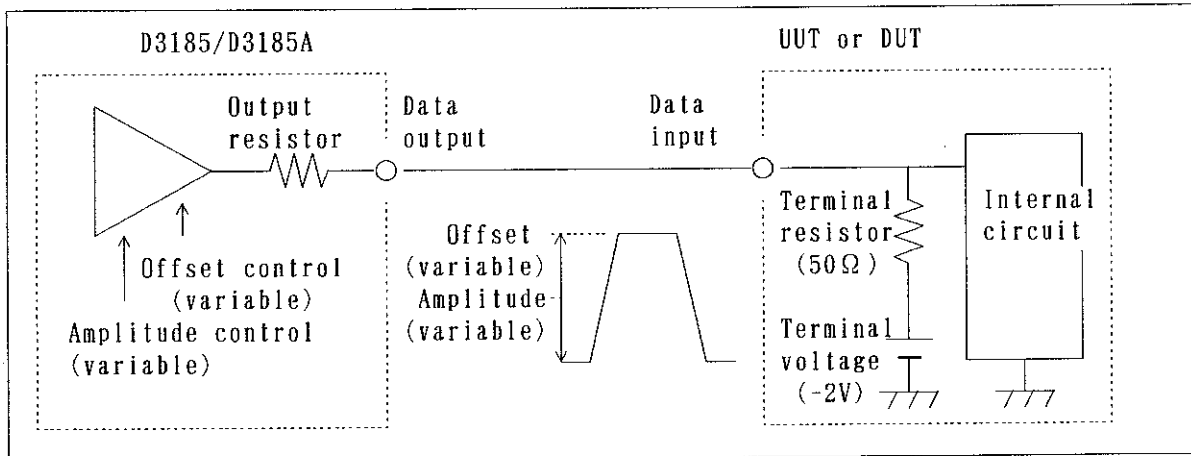


Figure 4 - 2 If DATA output is used and the terminating voltage is -2 Vdc at ECL Level

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4.1 Setup on the D3185/D3185A

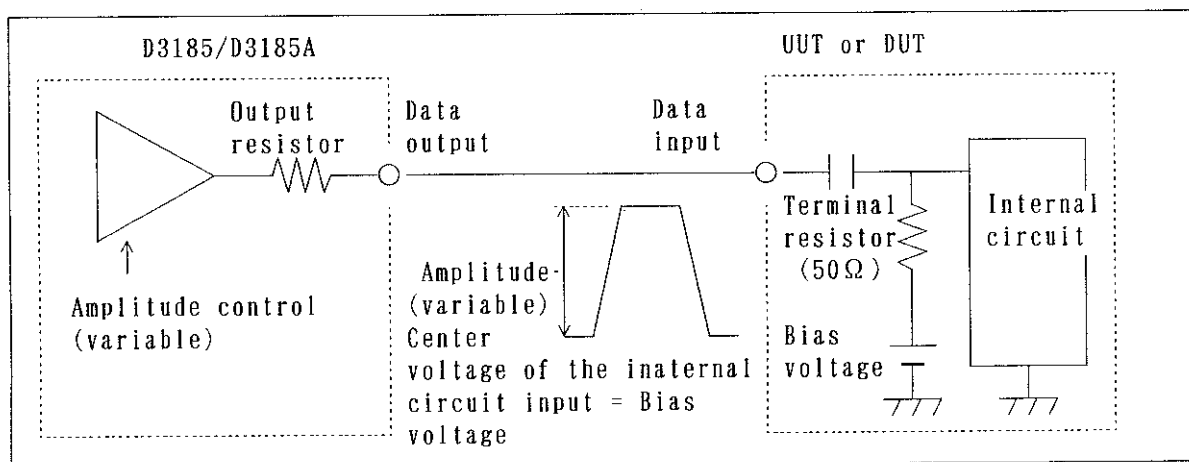


Figure 4 - 3 If DATA output is used for AC mode and AC coupled termination

#### 4.1.3 Setting the Clock Output

If the UUT or DUT requires a clock, set the generator clock output according to the UUT or DUT input conditions.

- (1) If the clock input of the UUT or DUT is DC coupled and if you want to set the offset:

Use the CLOCK (DC) output. It cannot be used if the clock input of the UUT or DUT terminates with the voltage different from the terminating voltage of the data input.

- (a) If the terminating voltage of the UUT or DUT clock input is zero (0) volt (Figure 4-4)

Press the LEVEL key and set the output level so that the VARIABLE TO 0V lamp lights on the front panel. In this case, the CLOCK (DC) output offset (high level) and the amplitude can be changed. Set them by using the OFFSET and AMPLITUDE controls of the CLOCK section. The data output is also terminated with zero volt, and its offset and amplitude can be changed.

- (b) If the terminating voltage of the UUT or DUT clock input is -2 V at ECL level

Press the LEVEL key and set the output level so that the ECL TO -2V lamp on the front panel may light on the front panel. In this case, the CLOCK (DC) output offset (high level) is set to about -0.8 V and the amplitude is set to 0.8 Vp-p (variable). At the same time, the data output is terminated with -2 V and the offset is set to about -0.8 V and the amplitude is set to about 0.8 Vp-p (variable).

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4.1 Setup on the D3185/D3185A

- (2) If the UUT or DUT clock input is used for AC-coupled termination (see Fig. 4-6.)

In this case, set the CLOCK (DC) output to the AC mode. Output level and offset setting has no connection but only amplitude setting is becomes variable.

- (3) If the UUT or DUT clock input is used for AC-coupled termination (see Fig. 4-7) or when the UUT or DUT clock input is used for AC-coupled termination but the center voltage of the amplitude should be equal to the terminating voltage (see Fig. 4-8)

In this case, the CLOCK (AC) is used. Output level, offset and amplitude setting has no connection.

The CLOCK (AC) output is used for AC-coupled termination and the amplitude is about 1 Vp-p. If a smaller amplitude is needed, use an external attenuator together.

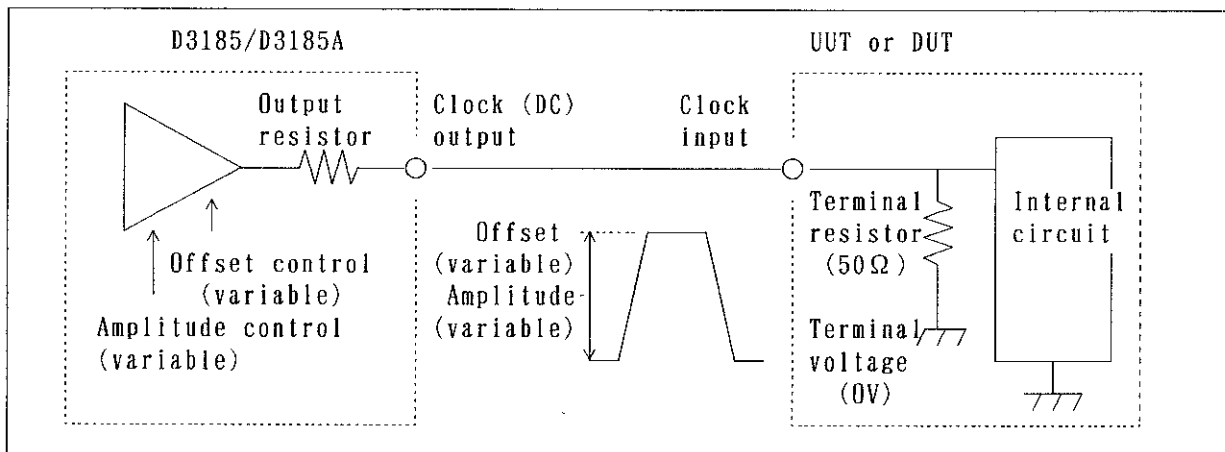


Figure 4 - 4 If CLOCK (DC) is used and the terminating voltage is 0V

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4.1 Setup on the D3185/D3185A

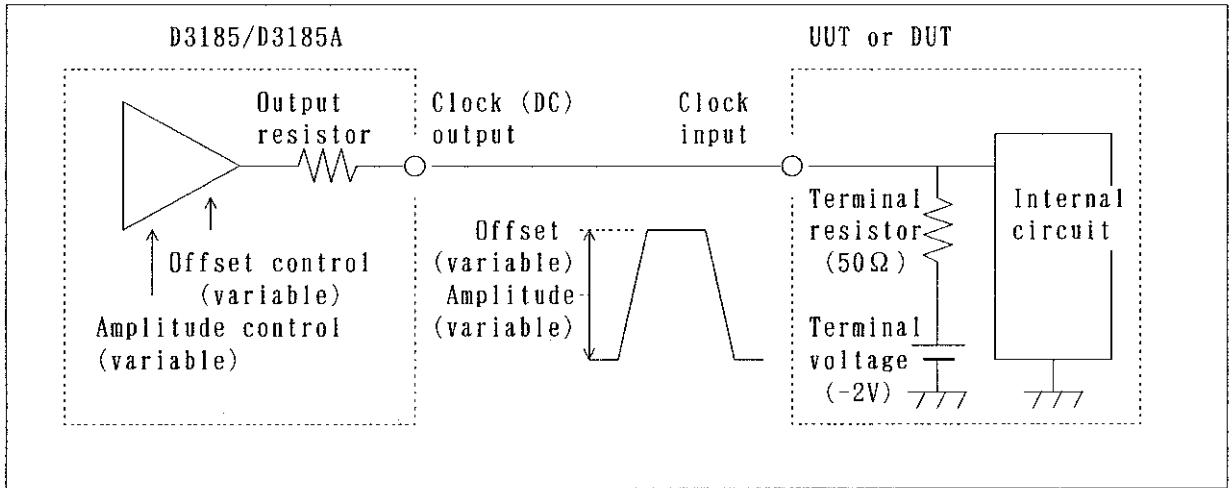


Figure 4 - 5 If CLOCK (DC) is used and the terminating voltage is -2 Vdc at ECL level

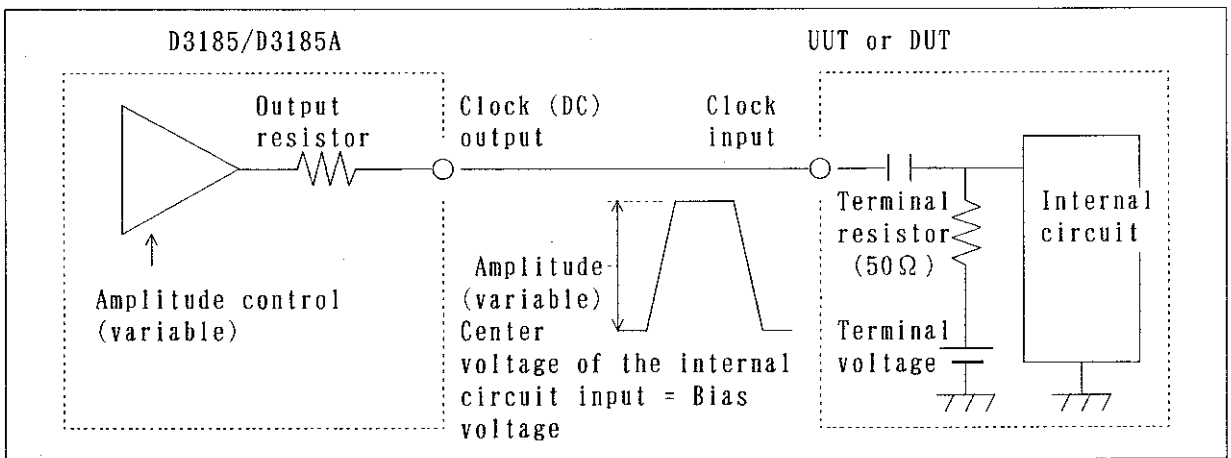


Figure 4 - 6 If CLOCK (DC) is used for AC mode and AC coupled termination



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4.1 Setup on the D3185/D3185A

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4.1.4 Setting the Pattern

Select the WORD or PRBS pattern mode. In the WORD mode, set the bit length and the logic (0 or 1) of each bit to use an already created pattern from the pattern memory. In the PRBS mode, set the pattern length of  $2^N-1$  and mark ratio.

When you set a pattern manually by using the keys on the generator panel, it is convenient to use the master/slave function to establish the linkage between the pattern on the D3285 error detector and that on the D3185/D3185A pulse pattern generator. To use this function, connect the GPIB cable between the D3285 and D3185/D3185A, turn on the SLAVE key on the D3285 front panel, and turn on the MASTER key on the D3185/D3185A front panel.

CAUTION

When using the master/slave function, do not connect any other device to the GPIB cable that is connected between the D3185/D3185A and D3285.

Also, when selecting the remote control mode on the GPIB controller, turn off both the MASTER and SLAVE keys on the generator and detector.



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4.2 Setup on the D3285

---

#### 4.2 Setup on the D3285

##### 4.2.1 Setting the Data Input

- (1) Set the terminating voltage of data input according to the output conditions of the UUT or DUT.

When the TO 0V lamp for DATA lights in the TERMINATOR section, the data input is terminated with 0 V. When the TO -2V lamp for DATA lights, it is terminated with -2 Vdc. This setup is switched whenever the DATA key is pressed.

- (2) Set the threshold of data input according to the output voltage of the UUT or DUT.

Adjust the THRESHOLD LEVEL voltage on the front panel so that it comes to the roughly center position of the output voltage of the UUT or DUT. Rotate the control knob for adjustment. The adjusting range depends on the terminating voltage of the data input.

##### 4.2.2 Setting the Clock Input

There are three sources of clock input. You must set the terminating voltage of their clock input according to the output conditions of the source.

- (1) If the clock output of the UUT or DUT is used

Set the terminating voltage of the clock input according to the output conditions of the UUT or DUT.

When the TO 0V lamp for CLOCK lights in the TERMINATOR section of the front panel, the clock input is terminated with 0 V. When the TO -2V lamp for CLOCK lights, it is terminated with -2 Vdc. This setup is switched whenever the CLOCK key is pressed.

When the UUT or DUT provides AC coupled clock output, the terminating voltage of the D3285 clock input may be either 0V or -2 Vdc.

- (2) If the CLOCK (DC) output of the D3185/D3185A is used

When the D3185/D3185A output level has been set to VARIABLE TO 0V on the front panel, the D3285 clock input is terminated with 0 V. When the D3185/D3185A output level has been set to ECL TO -2V, it is terminated with -2 Vdc.

When the TO 0V lamp for CLOCK lights in the TERMINATOR section of the D3285 front panel, the line is terminated with 0 V. When the TO -2V lamp for CLOCK lights on the D3285, it is terminated with -2 Vdc. This setup is switched whenever the CLOCK key is pressed.

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4.2 Setup on the D3285

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- (3) If the CLOCK (AC) output of the D3185 is used

In this case, the terminating voltage of the D3285 clock input may be 0 V or -2 Vdc.

#### 4.2.3 Setting the Pattern

Set the patterns in the same way as for D3185/D3185A pattern setup (see Section 4.1.4).

To use the master/slave function to establish the linkage between the pattern on the D3285 and that on the D3185/D3185A, connect the GPIB cable between the D3285 and D3185/D3185A. Then, turn on the SLAVE key on the D3285 front panel, and turn on the MASTER key on the D3185/D3185A front panel.

CAUTION

When using the master/slave function, do not connect any other device to the GPIB cable that is connected between the D3185/D3185A and D3285.

Also, when selecting the remote control mode on the GPIB controller, turn off both the MASTER and SLAVE keys on the generator and detector.

#### 4.2.4 Setting the Data Input Polarity

Set the INPUT POLARITY on the front panel according to the normal or inverted polarity of data during I/O to/from the UUT or DUT.

Press and set the INPUT POLARITY key so that the INVERSE lamp lights if the data is inverted or the NORMAL lamp lights if not.

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4.3 Connection of Signal Lines

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4.3 Connection of Signal Lines

Figure 4-9 and Figure 4-10 gives an example of signal line connection.

Connect the clock I/O signal lines by considering the use or no use of clock I/O, voltage level, and line termination of the UUT or DUT.

CAUTION

To prevent possible damage of system equipment and devices, prepare the following before connecting the signal lines:

1. Connect ground leads of all equipment and devices to a single ground (GND) terminal, and ground this terminal.
2. The operators should use the ground wrist strip to discharge statics.
3. The conductors of coaxial cables should be fully discharged before being connected to the system signal lines.
4. Set the correct output voltage and terminating voltage of each equipment.

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4.3 Connection of Signal Lines

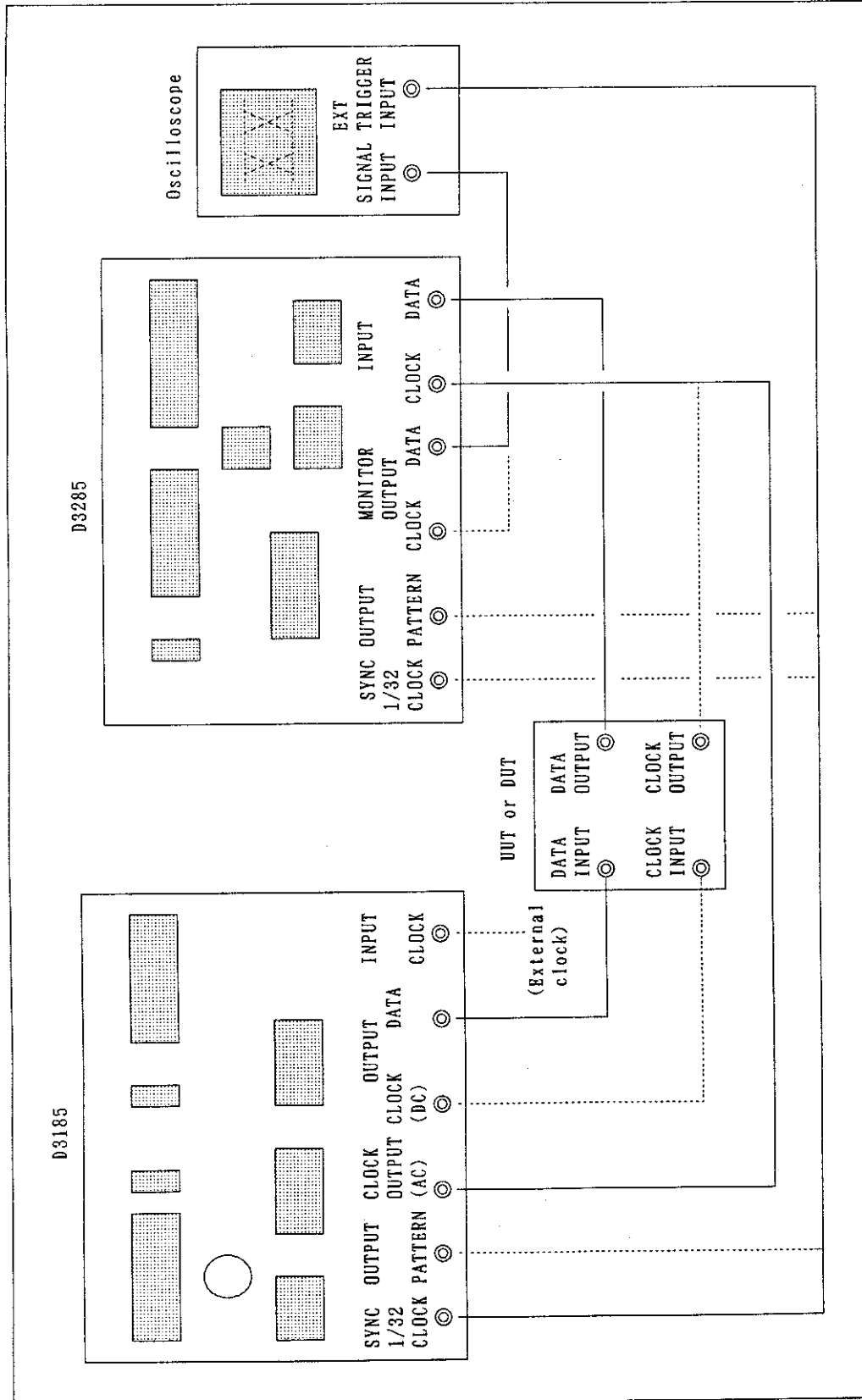


Figure 4 - 9 Signal Line Connection (D3185)

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4.3 Connection of Signal Lines

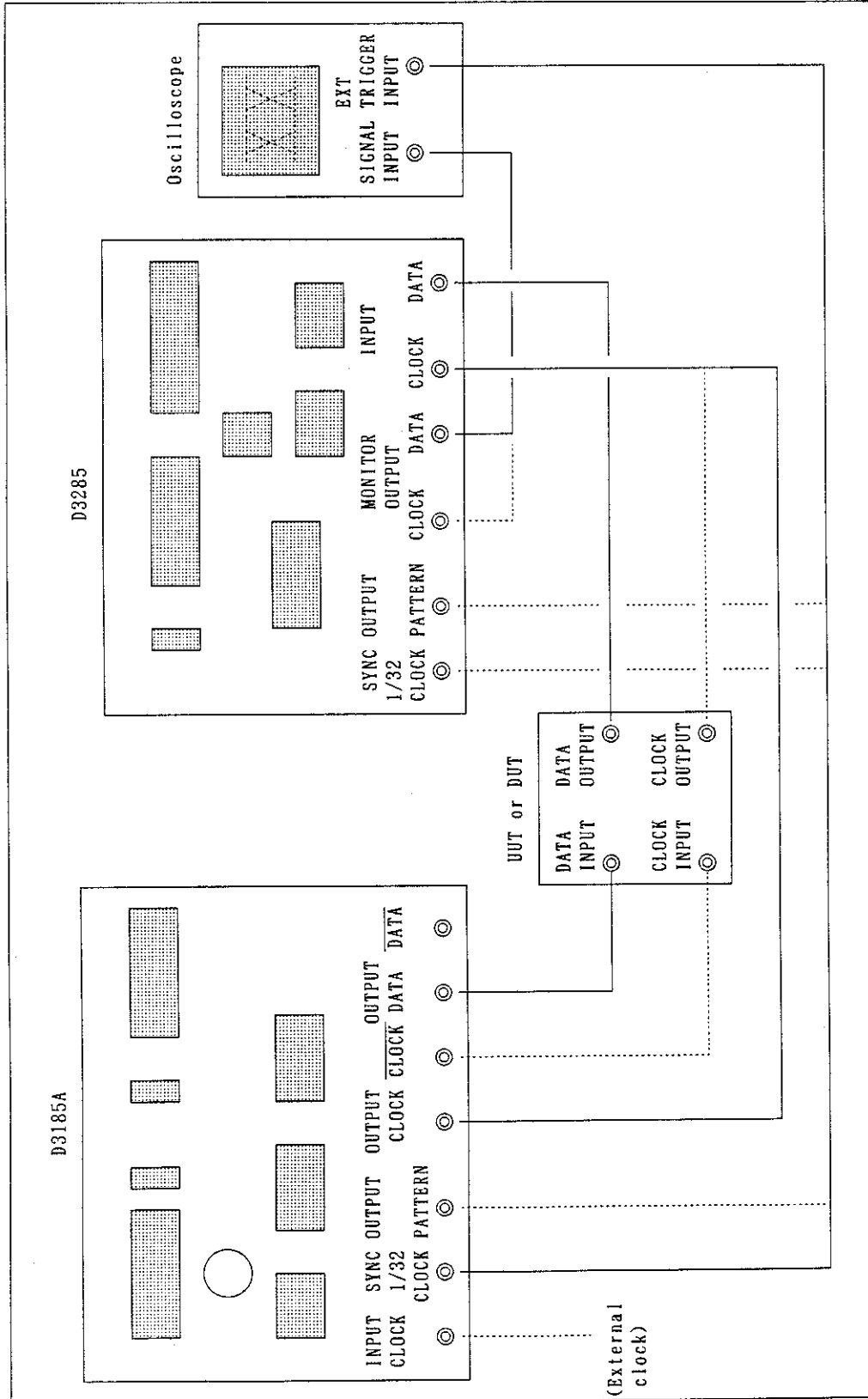


Figure 4 - 10 Signal Line Connection (D3185A)

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5.1 Introduction

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5. GENERAL-PURPOSE INTERFACE BUS (GPIB)

5.1 Introduction

The general-purpose interface bus (GPIB) is the interface system which connects the tester to the controller and/or the peripheral devices using a simple cable (bus line).

The GPIB is an easy-to-use interface system with higher expandability compared to other systems. In addition, it provides electrical, mechanical and functional compatibility with other manufacturers' products. Therefore, the GPIB can make up not only a simple system but an automatic instrumentation system using the single bus cable.

In the GPIB system, it is necessary to set the address of each component connected to the bus line. Each component may play one or more roles of the controller, talker and listener.

During operation of the system, only one talker can transmit data on the bus line while the listeners receive the data.

The controller specifies the addresses of the talker and the listeners. It transfers data from the talker to the listeners and sets the measuring conditions from itself (or the talker) to the listeners.

For data transfer among components of the system, eight data lines of the parallel/serial bit type are used for asynchronous two-way transmission. The asynchronous system allows high-speed and low-speed compound devices to be connected arbitrarily.

A collection of data (messages) sent and received among devices includes measurement data, measuring conditions (programs) and commands. The ASCII code is mainly used.

Beside the above mentioned eight data lines, the system includes three handshaking lines to control asynchronous data transfer among devices and five control lines to control the information flow on the bus.

- The following signals are used for the handshaking lines.

DAV (Data Valid) : Signal to indicate the data valid state

NRFD (Not Ready For Data): Signal to indicate the data reception enabled state

NDAC (Not Data Accepted) : Signal to indicate the reception completion state

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5.1 Introduction

- The following signals are used for the control lines:

ATN (Attention) : This signal identifies whether the signal on the data line is an address, command or other information.

IFC (Interface Clear): Signal to clear the interface

EOI (End or Identify): Signal to be used on the termination of information transfer

SRQ (Service Request): Signal to cause an arbitrary device to present a request for services from the controller

REN (Remote Enable) : Signal to be used for remote control of a remote-programmable device

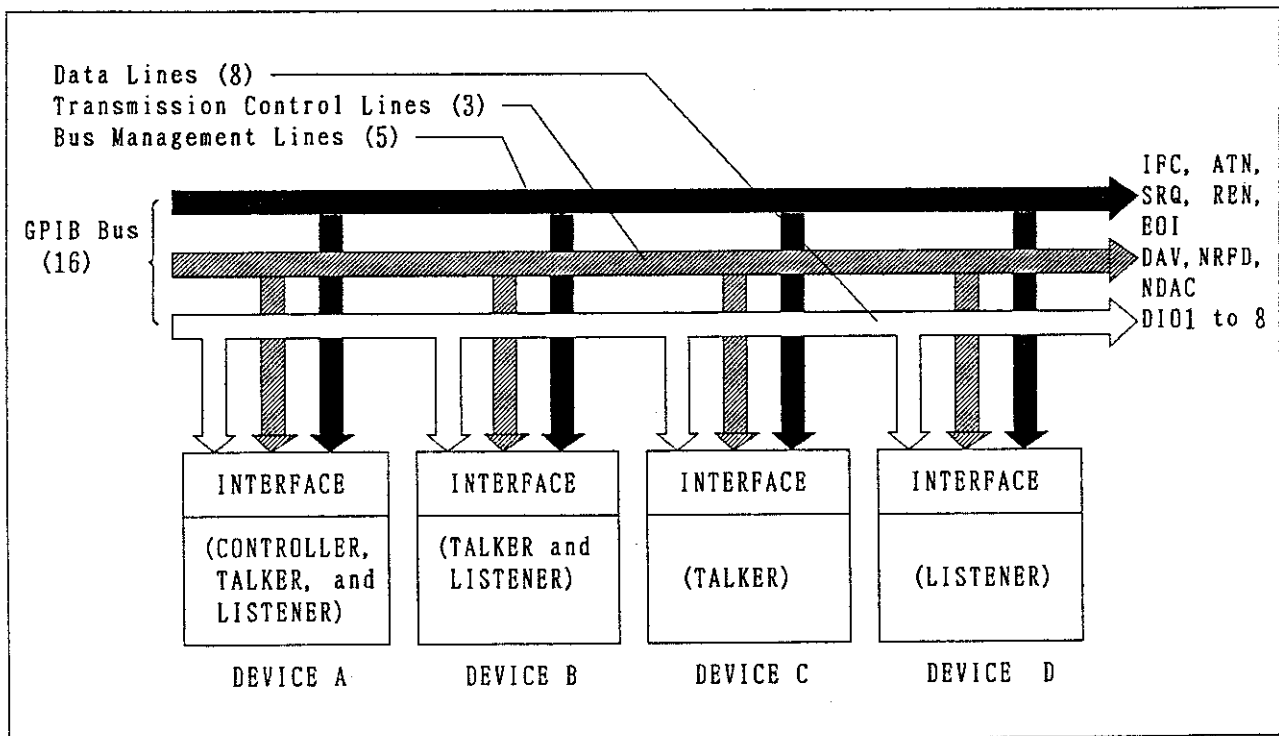


Figure 5 - 1 Outline of GPIB

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5.2 Specifications

5.2 Specifications

5.2.1 GPIB Specifications

Governing specification: IEEE standard 488-1978  
Available code : ASCII code and binary codes  
Signal level : "High" state + 2.4 V or more  
              : "Low" state + 0.4 V or less

Termination of signal conductors  
: 16 bus lines are terminated as follows:

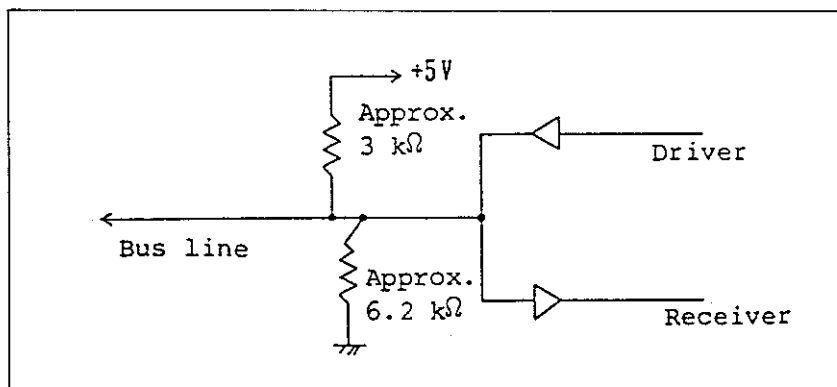


Figure 5 - 2 Termination of Signal Conductors

Driver specifications : Open collector system  
"Low" state output voltage : +0.4 V or less, 48 mA  
"High" state output voltage: +2.4 V or more, -5.2 mA  
Receiver specifications: "Low" state at +0.6 V or less  
                          : "High" state at +2.0 V or more  
Bus cable length : The length of each bus cable must not  
                          exceed: (the number of devices connected to  
                                  the bus) x 2 m or 20 m in total.  
Addressing : The address selection switch on the front  
                          panel allows  
                          32 types of talk/listen addresses to be  
                          selected.  
Applicable Connector : 24-pin GPIB connector, 57-20240-D35  
                          (Equivalent to the product manufactured by  
                          Anphenol)



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5.2 Specifications

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5.2.2 Interface Functions

Table 5-1 shows interface functions below:

Table 5-1 Interface Functions

Code	Functions and description
SH1	Source handshake function
AH1	Acceptor handshake function
T6	Basic talker function, Serial poll function, Listener-specified talker cancel function
L3	Basic listener function, Talker-specified listener cancel function, Listen-only mode function
SR1	Service request function
RL1	Remote function
PP0	No parallel poll function
DCL	Device clear function (SDC and DCL commands are available.)
DT1	Device trigger function (GET command is available.)
C0	No controller function
E2	Use of three-state bus driver

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5.2 Specifications

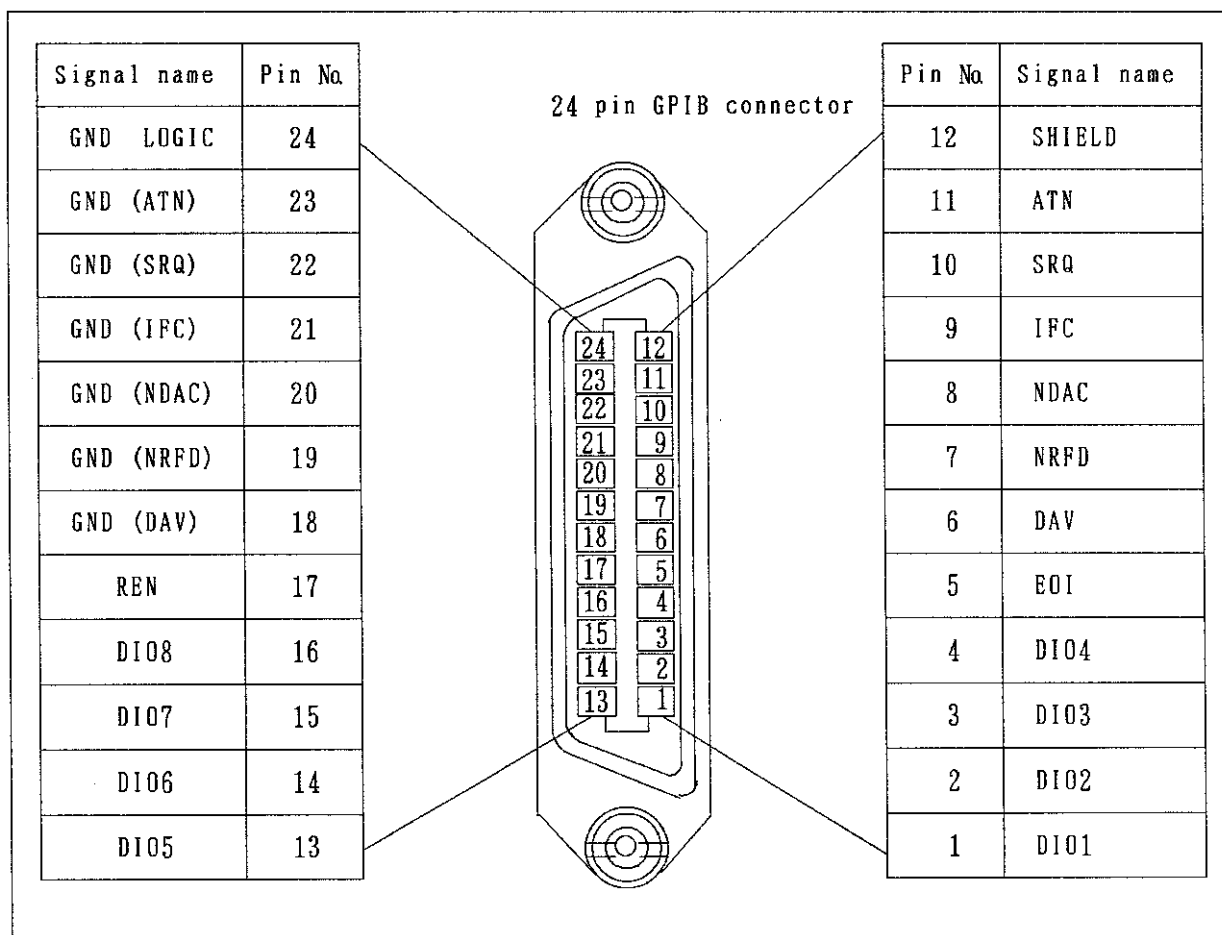


Figure 5 - 3 GPIB Connector Pin Assignment

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5.3 Notes on Use of GPIB

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5.3 Notes on Use of GPIB

This section explains the use of the GPIB.

(1) Connecting and Disconnecting the Cable

Before connecting or disconnecting the GPIB cable, turn off the power supply of every device connected to the cable. At the same time, check that the frames of the devices have been properly grounded with each another.

(2) Slave Operation

If any device except D3185/D3185A serves as a talker when the SLAVE switch on the front panel of this equipment is on, this equipment may malfunction and display an error message on the measuring result indicator in the front panel. When this happens, turn the power supply of this equipment off to disconnect the talker from it or stop operation of the talker.

Note that if the IFC line of the bus goes low with no error message displayed and the SLAVE switch on, the SLAVE switch will be turned off to stop slave operation.

(3) ATN Interrupt During Message Transfer

If an ATN request interrupts a transfer of messages between devices, the ATN takes priority and the previous state is cleared.

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5.4 Device Address Setting Procedure

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5.4 Device Address Setting Procedure

The device address of this equipment is set by using the ADDRESS DISP switch on the front panel and also the ↑ and ↓ keys under the word address indicator (ADDRESS) in the pattern setting block.

Each time the ADDRESS DISP switch is pressed, the indication of the word address indicator is selected from word address to device address and vice versa.

When the device address is indicated, the characters "GP-Ib" are indicated in the bit length indicator (BIT LENGTH), so set the device address then using the ↑ and ↓ keys.

The device address setting enable range is 0 to 30.

Set the address in order for it not to be identical with the other device address in other function.

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5.5 Listener Format (Program Code)

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### 5.5 Listener Format (Program Code)

This section describes the program code when this equipment is remote controlled using the GPIB controller.

#### 5.5.1 Basic Format

The ASCII code is used generally in the program code for the remote control, but the binary code can also be used to set the work pattern.

Although "," (comma) is used as a string delimiter when the ASCII code is used, the string delimiter can be omitted unless otherwise specified especially.

(Example): "ERC, STT" → "ERCSTT"

When the ASCII code is used, the following codes and single wire signal EOI (END OR IDENTIFY) can be used as the record delimiter:

- (a) CR, LF [+EOI]  
Key in CR (ASCII code: 13) and then LF (ASCII code: 10). EOI can be added simultaneously with LF.
- (b) LF [+EOI]  
Key in LF (ASCII code: 10).  
EOI can be added simultaneously with LF.
- (c) CR+EOI  
Add EOI simultaneously with CR (ASCII code: 13).
- (d) EOI  
Add EOI simultaneously with the last byte of the program code.

The single wire signal EOI only can be used as the record delimiter when the binary code is used.

The length of program code which can be received by this equipment at one time is 128 characters max. except when the word pattern is set. (This includes the string delimiters, but not record delimiters.)

When the program code is longer than this, and when any invalid code is included in the program code, it becomes a SYNTAX error.

When the SYNTAX error occurs, the subsequent codes up to a record delimiter are ignored.

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5.5 Listener Format (Program Code)

5.5.2 Parameter Setting Format

Parameter	Code	Content
(1) Pattern setting Block		
PATTERN MODE	WORD PRBS	Select the Pattern mode WORD PRBS
BIT LENGTH	BLdddd	Set the Bit length BL <u>dddd</u> └─ 1 to 65536
ADDRESS	ADRdddddd	Set the Address ADR <u>dddddd</u> └─ 0 to 524287
WORD PATTERN (HEXADECIMAL MODE)	WPdddd, ddd,dd ..	Set the Word pattern (Hexadecimal mode) WP <u>dddd</u> , <u>ddd</u> , <u>dd</u> ... └─ Pattern string in hexadecimal notation: 0 to 9, A to F └─ Number of characters of the pattern string: 1 to 128 └─ Head address to which the pattern string is set: 0 to 4095
WORD PATTERN (BINARY MODE)	BINdddd, dddd	Set the word pattern (Binary mode) BIN <u>dddd</u> , <u>dddd</u> └─ Number of bytes of the pattern string to be set: 0 to 8192 └─ Head address to which the pattern string is set: 0 to 4095  . This code and the data of a prescribed byte number after the delimiter are recognized as a pattern string in the binary mode.
POLARITY (WORD)	WPN WPI	Select the Word polarity NORMAL INVERSE
MEMORY STORE	WMSd	Set the Memory store WMS <u>d</u> └─ Memory No.: 0 to 9
MEMORY RECALL	WMRd	Set the Memory recall WMR <u>d</u> └─ Memory No.: 0 to 9, A, B
PRBS $2^N - 1$	PBdd, 0	PB <u>dd</u> , 0 └─ dd = 7, 9, 10, 11, 15, -15, 17, 20, 23

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Code	Content
MARK RATIO	MR1/2	Select the Mark ratio MARK RATIO 1/2
	MR1/4	MARK RATIO 1/4
	MR1/8	MARK RATIO 1/8
	MR0/8	MARK RATIO 0/8
	MR1/2B	MARK RATIO 1/2B
	MR3/4	MARK RATIO 3/4
	MR7/8	MARK RATIO 7/8
	MR8/8	MARK RATIO 8/8
(2) Measuring Block		
MEASUREMENT FUNCTION	ERR	Select the measurement function Error rate measurement
	ERC	Error count measurement
	ES	Errored second measurement
	EFS	Error-free second measurement
	FRQ	Frequency measurement
DISPLAY FORM	PRG	Select the Error rate measurement DISPLAY FORM Display PROGRESSIVE
	IMD	Display IMMEDIATE
	EXP INT	Select the Error count measurement DISPLAY FORM Display IXPONENTIAL Display INTEGRAL
ERROR DISPLAY MODE	PTON	Select ES, EFS measurement DISPALY FORM Display %(%)
	PCT	
	PTOF	Display second
	SEC	
MEASUREMENT MODE	OMI	Select the Error display mode OMITTING (1 → 0 error)
	INS	INSERTING (0 → 1 error)
	TOT	TOTAL
CURRENT DATA in the simul- taneous measure- ment mode only	IND	Select the measurement mode INDIVIDUAL measurement
	SIM	SIMULTANEOUS measurement
CURRENT DATA in the simul- taneous measure- ment mode only	CDON	Set the current data Current data on
	CDOF	Current data off
BIT ERROR RATE RANGE	RNG-dd	Set the Bit error rate range RNG-dd
		└─ Range: 5 to 12

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Code	Content
DISPLAY RATE	FST MED SLW HLD	Select the Display rate FAST MEDIUM SLOW HOLD
MEASUREMENT CONTROL	STT  E STP	Select the measurement control Start of measurement or reset  Stop of ERROR CONT, ES or EFS measurement in individual measurement mode and simultaneous measurement mode
AUTO SYNC	ASON ASOF	Select the Auto sync AUTO SYNC On AUTO SYNC Off
SYNC	SYN	Select the SYNC
BUZZER (DATA) (BUZZER DATA)	BZON BZOF	Select the Buzzer DATA BUZZER DATA On BUZZER DATA Off
BUZZER (alarm) (BUZZER ALARM)	BAON BAOF	Select the Buzzer alarm BUZZER ALARM On BUZZER ALARM Off
DELAY	DLY+ddd	Set the Delay DLY+ddd └─ DELAY: -400 to +400  . Unit: ps . The + of polarity can be left as a space or omitted.
THRESHOLD LEVEL	TLVL ±d.ddd	Set the Threshold level TLVL±d.ddd └─ THRESHOLD LEVEL: -2.040 to +2.040  . However, the threshold level range when the TERMINATOR DATA is set to TO -2 V ("DM2V") is -1.850 to -0.750. . Unit: V . The + of polarity can be left as a space or omitted.
POLARITY (DATA INPUT)	MPN MPI	Select the data input polarity NORMAL INVERSE



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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Code	Content
AUTO SEARCH	SRHGO SRHST	Set the Auto Search Operation start (START) Operation stop (STOP (CANCEL))
MAXIMUM VALUE DISPLAY (MAXIMUM)	MAXON MAXOF	Select the maximum value display Displays the maximum error rate. Displays the present error rate.
RESOLUTION (HIGH RESOLUTION)	RESON RESOF	Select the resolution Measures the frequency with high resolution (10Hz). Measures the frequency with low resolution (1kHz).
GATE CONTROL (GATING)	GTEXT  GTINT	Select the Gate control Externally controls the ERROR CONT, ES or EFS measurement in individual measurement mode and simultaneous measurement mode Internally controls the ERROR CONT, ES or EFS measurement in individual measurement mode and simultaneous measurement mode
(3) Input Block		
TERMINATOR (DATA)	DGND DM2V	Select the Terminator data To 0 V To -2 V
TERMINATOR (CLOCK)	CGND CM2V	Select the Terminator clock To 0 V To -2 V
(4) Timer/CLOCK Block		
TIME DISPLAY	RTU YMDH RTL DHMS ELP TMD PRS	Set the Time display REAL TIME YEAR:MONTH:DAY:HOURL  REAL TIME DAY:HOURL:MIN:SECL  MEASURE TIME ELAPSEDL MEASURE TIME TIMEDL MEASURE TIME PRESETL

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Code	Content
REAL TIME SET	RTS dd:dd :dd:dd :dd:dd  YMDHMS dd:dd :dd:dd :dd:dd  RTU dd:dd :dd:dd  YMDH dd:dd :dd:dd  RTL dd:dd: :dd:dd  DHMS dd:dd :dd:dd	RTS    └─ dd:dd:dd:dd:dd:dd YMDHMS └─ dd:dd:dd:dd:dd:dd └─ SEC : 0 to 59 └─ MIN : 0 to 59 └─ HOUR : 0 to 23 └─ DAY : 1 to 31 └─ MONTH: 1 to 12 └─ YEAR : 0 to 99  . The "└" indicates a space and it may be omitted.  RTU    └─ dd:dd:dd:dd YMDH   └─ dd:dd:dd:dd └─ HOUR : 0 to 23 └─ DAY : 1 to 31 └─ MONTH: 1 to 21 └─ YEAR : 0 to 99  . The "└" indicates a space and it may be omitted.  RTL    └─ dd:dd:dd:dd DHMS └─ dd:dd:dd:dd └─ SEC : 0 to 59 └─ MIN : 0 to 59 └─ HOUR: 0 to 23 └─ DAY : 1 to 31  . The "└" indicates a space and it may be omitted.
MEASUREMENT TIME PRESET	PRS dd:dd :dd:dd	Set the measurement time preset PRS └─ dd:dd:dd:dd └─ SEC : 0 to 59 └─ MIN : 0 to 59 └─ HOUR: 0 to 23 └─ DAY : 1 to 99  . The "└" indicates a space and it may be omitted.
TIMER MODE	SIN REP UTM	Select Timer mode SINGLE REPEAT UNTIMED
(5) Printer Block		
External Centronics printer (PRINTER)	PRTON PRTOF	Select the External centronics printer PRINTER ON Automatic print start PRINTER OFF Automatic print stop
MANUAL PRINT	MPRT	Select the Manual print instruction

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Code	Content
ERROR PRINT	EPRON EPROF	Select the error print ERROR PRINT ON ERROR PRINT OFF
External Centronics printer paper feed instruction	FEED	Select the Paper feed instruction
(6) Control Block		
PANEL LOCK	PLKON PLKOF	Select the Panel lock PANEL LOCK ON PANEL LOCK OFF
CLEAR	C	Initialization in operation This is equivalent to the SDC and DCL commands.
	Z	Initialization of each set parameter and the same processing as the "C" code.
(7) GPIB parameters		
OUTPUT DATA	MES TIM	Select the Output data MEASUREMENT DATA output mode TIME DATA output mode
HEADER	HDON HDOF	Adds the header to output data. Adds no header to output data.
SEND RECORD DELIMITER	DL0 DL1 DL2	Outputs two bytes of CR and LF and also the single wire signal EOI simultaneously with LF. Outputs only one byte of LF. Outputs the single wire signal EOI simultaneously with the last byte of the send data.
SRQ TRANSMISSION	S0 S1	Select the transmitt for SRQ The SRQ is transmitted. The SRQ is not transmitted.
Status byte mask (MASK)	MSdd	Set the Status byte mask MS <u>dd</u> └─ Mask bit pattern : 0 to 63 When decimal numeral "dd" is converted to binary numeral, the bit in the status byte linking the "0" bit is masked, and "0" is placed on the bit.

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5.5 Listener Format (Program Code)

5.5.3 Setting Parameter Reading (Using ? and OP codes)

The ? code and the output interrogated parameter (OP) code are used to read any parameter set for this equipment out to the GPIB controller. In general, such codes are called queries. This equipment can use both types.

Being assigned to be the talker after receiving a query, this equipment sends the current set value of the parameter specified by the query.

After sending the set value in the above way, the equipment is in the usual mode to send measurement or time data until receiving the next query. The format of the set value of the parameter to be sent is the same as for parameter sending in Section 5.5.2.

Queries allow the equipment to read the external/internal condition of the frequency measurement standard, that cannot be set from the GPIB.

Parameter	Query	code	Content
(1) Pattern setting Block			
PATTERN MODE	PM? or OPPM	WORD PRBS	Read the set point for Pattern Mode WORD PRBS
BIT LENGTH	BL? or OPBL	BLdddd	Read the set point for Bit Length BL <u>dddd</u> └─ 00001 to 65536
ADDRESS	ADR? or OPADR	ADRdddd	Read the set point for Address ADR <u>dddd</u> └─ 000000 to 524287
WORD PATTERN	WPddd, dd? or OPWP ddd, ddd	WPddd,ddd, dd .....	Read the set point for Word Pattern WP <u>ddd</u> , <u>ddd</u> , <u>dd</u> ... └─ Pattern string in decimal notation: 0 to 9, A to F └─ Number of characters of the pattern string: 001 to 128 └─ Head address of the pattern string: 0000 to 4095  . It is impossible to read the pattern in the binary code.

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Query	code	Content
POLARITY (WORD)	WP? or OPWP	WPN WPI	Read the set point for Polarity (Word) NORMAL INVERSE
MEMORY	WM? or OPWM	WMD	Read the set point for Memory WMD └ Memory No.: 0 to 9, A, B
PRBS 2 <sup>N</sup> -1	PB? or OPPB	PBdd,d	Read the set point for PRBS2 <sup>N</sup> -1 PB dd,0 └ dd= 07, 09, 10, 11, 15, -15, 17, 20, 23
MARK RATIO	MR? or OPMR	MR1/2 ⊓ MR1/4 ⊓ MR1/8 ⊓ MR0/8 ⊓ MR1/2B MR3/4 ⊓ MR7/8 ⊓ MR8/8 ⊓	Read the set point for Mark Ratio MARK RATIO 1/2 MARK RATIO 1/4 MARK RATIO 1/8 MARK RATIO 0/8 MARK RATIO 1/2B MARK RATIO 3/4 MARK RATIO 7/8 MARK RATIO 8/8
(2) Measuring Block			
MEASUREMENT FUNCTION	MF? or OPMF	ERR ERC ES ⊓ EFS FRQ	Read the set point for Measurement function ERROR RATE ERROR COUNT ERRORED SECOND ERROR-FREE SECOND FREQUENCY
DISPLAY FORM	DF? or OPDF	PRG IMD	Select the Error rate measurement DISPLAY FORM Display PROGRESSIVE Display IMMEDIATE
	FMT? or OPFMT	EXP INT	Select the Error count measurement DISPLAY FORM Display EXPONENTIAL Display INTEGRAL
	PT? or OPPT	PTON PTOF	Select ES, EFS measurement DISPLAY FORM Display % (%) Display second

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Query	code	Content
ERROR DISPLAY MODE	DM? or OPDM	OMI INS TOT	Read the set point for Error Display mode OMITTING INSERTING TOTAL
MEASUREMENT MODE	MM? or OPMM	IND SIM	Read the set point for Measurement mode INDIVIDUAL Measurement SIMULTANEOUS Measurement
CURRENT DATA	CD? or OPCD	CDON CDOF	Read the set point for Current Data Current data on Current data off
Separate measurement mode (BIT ERROR RATE RANGE)	RNG? or OPRNG	RNG-dd	Read the set point for Separate measurement mode RNG-dd └── 5 to 12
DISPLAY RATE	DR? or OPDR	FST MED SLW HLD	Read the set point for Display Rate FAST MEDIUM SLOW HOLD
AUTO SYNC	AS? or OPAS	ASON ASOF	Read the set point for Auto Sync AUTO SYNC ON AUTO SYNC OFF
BUZZER (DATA) (BUZZER DATA)	BZ? or OPBZ	BZON BZOF	Read the set point for Buzzer Data BUZZER DATA ON BUZZER DATA OFF
BUZZER (ALARM) (BUZZER ALARM)	BA? or OPBA	BAON BAOF	Read the set point for Buzzer Alarm BUZZER ALARM is ON BUZZER ALARM is OFF
DELAY	DLY? or OPDLY	DLY-ddd	Read the set point for Delay DLY -ddd └── -400 to 400 . The " " indicates a space.
THRESHOLD LEVEL	TLVL? or OPTLVL	TLVL-d.ddd	Read the set point for Threshold Level TLVL -d.ddd └── -2.040 to 2.040 . The " " indicates a space.
POLARITY (DATA INPUT) (INPUT POLARITY)	MP? or OPMP	MPN MPI	Read the set point for Data Input Polarity NORMAL INVERSE

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Query	code	Content
MAXIMUM VALUE DISPLAY (MAXIMUM)	MAX? or OPMAX	MAXON MAXOF	Read the set point for Maximum value Display Displays the maximum error rate. Displays the present error rate.
RESOLUTION (HIGH RESOLUTION)	RES? or OPRES	RESON  RESOF	Red the set point for Resolution Measures the frequency with high resolution (10Hz). Measures the frequency with low resolution (1kHz).
GATE CONTROL (GATING)	GT? or OPGT	GTEXT  GTINT	Read the set point for Gate Control Externally controls the ERROR COUNT, ES or EFS measurement. Internally controls the ERROR COUNT, ES or EFS measurement.
REFERENCE CLOCK	REF? or OPREF	REFEXT REFINT	Read the set point for Reference Clock Selects external reference clock Selects internal reference clock
(3) Input Block			
TERMINATOR (DATA)	TD? or OPTD	DGND DM2V	Read the set point for Terminator Data TO 0 V TO -2 V
TERMINATOR (CLOCK)	TC? or OPTC	CGND CM2V	Read the set point for Terminator Clock TO 0 V TO -2 V
(4) Timer clock Block			
TIME DISPLAY	TM? or OPTM	RTU RTL ELP TMD PRS	Read the set point for Time Display REAL TIME YEAR:MONTH:DAY:HOURL REAL TIME DAY:HOURL:MIN:SEC MEASUREMENT TIME ELAPSED MEASUREMENT TIME TIMED MEASUREMENT TIME PRESET
TIMER MODE	TR? or OPTR	SIN REP UTM	Read the set point for Timer Mode SINGLE REPEAT UNTIMED

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5.5 Listener Format (Program Code)

(cont'd)

Parameter	Query	code	Content		
<b>(5) Printer Block</b>					
EXTERNAL CENTRONICS PRINTER CONTROL (PRINTER)	PRT? or OPPRT	PRTON PRTOF	Read the set point for External Centronics Printer Control Automatic print mode on Automatic print mode off		
ERROR PRINT	EPR? or OPEPR	EPRON EPROF	Read the set point for Error Print ERROR PRINT ON ERROR PRINT OFF		
<b>(6) Control Block</b>					
PANEL LOCK	PLK? or OPPLK	PLKON PLKOF	Read the set point for Panel Lock PANEL LOCK ON PANEL LOCK OFF		
<b>(7) GPIB parameters</b>					
OUTPUT DATA	OD? or OPOD	MES TIM	Read the set point for Output Data MEASUREMENT DATA TIME DATA		
HEADER	HD? or OPHD	HDON HDOF	Read the set point for Header HEADER ON HEADER OFF		
RECORD DELIMITER	DL? or OPDL	DL0 DL1 DL2	Read the set point for Record Delimiter CR, LF + EOI LF EOI		
SRQ TRANSMISSION	S? or OPS	S0 S1	Read the set point for SRQ Transmission SRQ ON SRQ OFF		
STATUS BYTE MASK	MS? or OPMS	MSdd	Read the set point for Status Byte Mask MS <u>dd</u> Mask bit pattern		
<b>(8) Other states</b>					
HISTORY	HST? or OPHST		Read the state for History		
			SYNC error	CLOCK error	DATA error
		HST0	None	None	None
		HST1	None	None	Exist
		HST2	None	Exist	None
		HST3	None	Exist	Exist
		HST4	Exist	None	None
		HST5	Exist	None	Exist
		HST6	Exist	Exist	None
HST7	Exist	Exist	Exist		

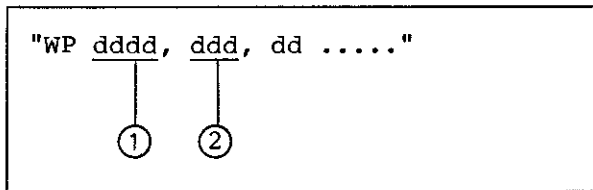


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5.5 Listener Format (Program Code)

5.5.4 Word Pattern Setting (Hexadecimal Mode)

There are two ways available in setting the work pattern from the GPIB to this equipment, one being the hexadecimal mode (ASCII code) and the other, the binary mode. This subsection describes the format of the hexadecimal mode. For the binary mode, see Section 5.5.5.



- ① Head address to which the pattern is set (decimal)

0 to 4095

- ② Number of characters of the set pattern character string (decimal)

1 to 128

- ③ Pattern character string (hexadecimal)

Transmit as many characters as specified by ② in combination of characters 0 to 9 and A to F in order of the leading bit (bit 1) of the head address specified by ①.

A 4-bit pattern is set per character, and when each character is expressed with the binary code, the LSB (the least significant bit) is assigned as the closer bit to the leading bit.

(Example) Code : "WP 12, 5, E4BA2"

Result:

Bit Address	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
12	0	1	1	1	0	0	1	0	1	1	0	1	0	1	0	1
13	0	1	0	0	X	X	X	X	X	X	X	X	X	X	X	X

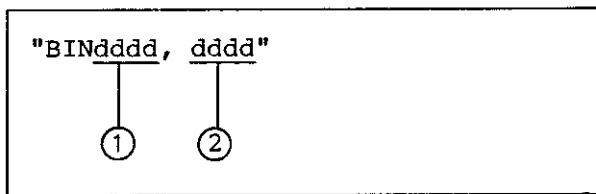
Note : X indicates a bit with no change.

5.5.5 Word Pattern Setting (Binary Mode)

This subsection describes how to set the word pattern in the binary mode. For the hexadecimal mode, see Section 5.5.4. It is set in the binary mode in two steps as follows:

(Step 1)

Specify the binary mode, head address, and the number of bytes.



- ① Head address to which the pattern is set (decimal)

0 to 4095

- ② Number of bytes of the pattern to be set (decimal)

1 to 8192

A delimiter (see the 5.5.1, "Basic Format") is allocated after this to end the processing once.

(Step 2)

Transmit the 8-bit binary code character string after step 1 for as many bytes as specified by ② in order from the leading bit (bit 1) of the head address specified by ① in step 1. An 8-bit pattern is set per byte and the LSB (the least significant bit) of these eight bits is assigned as the closer bit to the leading bit.

Add the single wire signal EOI (END OR IDENTIFY) to the last byte.

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5.5 Listener Format (Program Code)

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Upon receipt of the EOI or the number of bytes specified in (2), the pattern transfer ends, to return to the routine ASCII code reception mode.

(Example) Code: "BIN 12, 3"

Binary code (in decimal notation): 78, 171, and 2

Result:

Bit Address	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
12	0	1	1	1	0	0	1	0	1	1	0	1	0	1	0	1
13	0	1	0	0	0	0	0	0	X	X	X	X	X	X	X	X

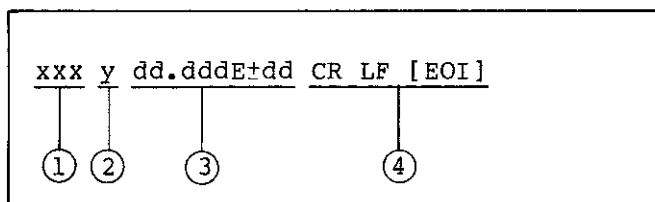
Note : X indicates a bit with no change.

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5.6 Talker Format

5.6.1 Measurement Data Format

This subsection describes the format when this equipment transmits the result of the measurement.



- ① Main header (3-digit alphabetic character or omitted)

The measurement function is shown below.

It is not transmitted when the header is set to OFF.

Main header	Measurement function
ERR	ERROR RATE
ERC	ERROR COUNT
ES_	ERRORED SECOND
EFS	ERROR-FREE SECOND
FRQ	EREQUENCY

- ② Sub-header (1-digit alphabetic symbol or omitted)

The sub-header indicates whether or not an overflow is detected in the measured value.

It is not transmitted when the sub-header is set to OFF.

Sub-header	Overflow
_(space)	Not detected
*	Detected

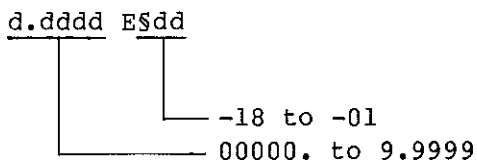
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5.6 Talker Format

③ Measured Value

Although a measured value is divided into the mantissa part (dd. ddd) and exponential part (E \$dd), the number of each digit and the existence/absence of decimal point position and exponential part vary according to the measurement function selected.

(a) ERROR RATE (ERR)

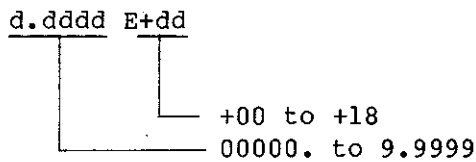


It becomes as shown below when there is an overflow:

9.9999E + 00

(b) ERROR COUNT (ERC)

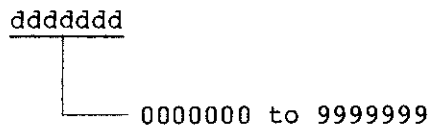
i) Exponential display



It becomes as shown below when there is an overflow:

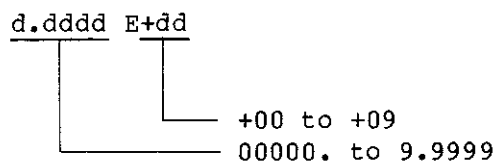
9.9999E + 19

ii) Integral display



(c) ES and EFS

i) Format of display in seconds



It becomes as shown below when there is an overflow:

9.9999E+19

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5.6 Talker Format

ii) Format of display in percentage

ddd.dddd  
└──────────┬──────────┘  
000.0000 to 100.0000

It becomes as shown below when there is an overflow:

999.9999

(d) FREQ

i) HIGH RESOLUTION mode is off at individual measurement mode, and simultaneous measurement mode. (Measuring resolution = 1kHz)

dddd.dddE + 6  
└──────────┬──────────┘  
00500.000 to 10000.000

It becomes as shown below when there is an overflow:

99999.999E + 6

ii) HIGH RESOLUTION mode is on at individual measurement mode. (Measuring resolution = 10Hz)

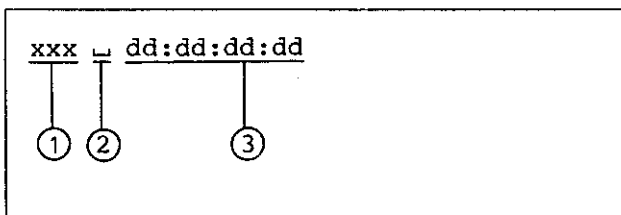
dddd.dddddE + 6  
└──────────┬──────────┘  
00500.00000 to 10000.00000

It becomes as shown below when there is an overflow:

99999.99999E + 6

5.6.2 Time Data Format

This subsection describes the format when this equipment transmits time data.



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5.6 Talker Format

① Main Header (3-digit alphabetic character or omitted)

This header indicates the type of data.  
This is not transmitted when the header is set to OFF.

Main header	Type of data
RTU	REAL TIME YEAR:MONTH:DAY:HOURL
RTL	REAL TIME DAY:HOURL:MIN:SEC
ELP	MEASUREMENT TIME ELAPSED
TMD	MEASUREMENT TIME TIMED
PRS	MEASUREMENT TIME PRESET

② Sub-Header (1-digit symbol or omitted)

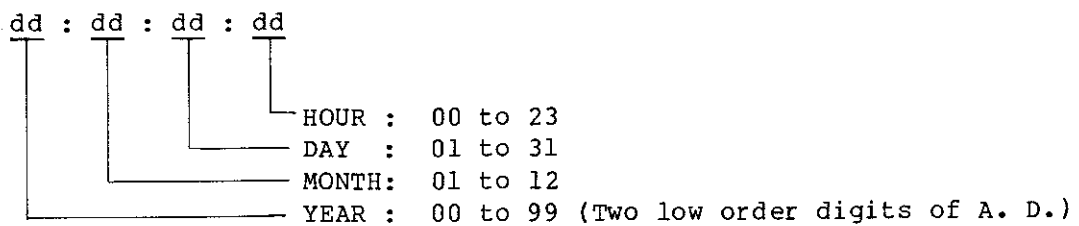
This header indicates whether the data overflow is detected or not.  
It always becomes no overflow when the type of data is not ELP.  
This data is not transmitted when the header is set to OFF.

Sub-header	Overflow
(space)	No detected
*	Detected

③ Time Data

The time data is transmitted with alphanumeric characters delimited every two digits with ":" (colon).

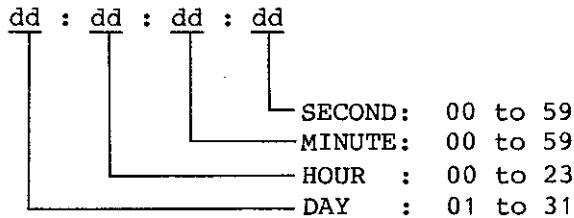
(a) REAL TIME YEAR:MONTH:DAY:HOURL (RTU)



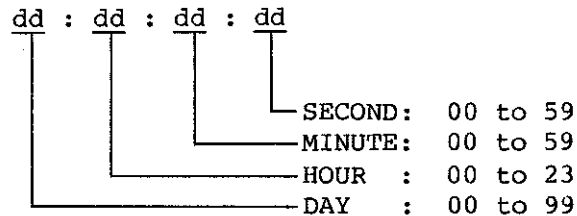
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5.6 Talker Format

(b) REAL TIME DAY:HOURL:MIN:SEC (RTL)



(c) MEASUREMENT TIME ELAPSED (ELP), TIMED (TMD) or PRESET (PRS)



The data of ELP and TMD when the measurement of ERROR COUNT, ES, or EFS is not yet started and the data of TMD when PRS is set to 00:00:00:00, becomes as shown below:

--:--:--:--

The ELAPSED and TIMED data when the measurement function is error rate or frequency in the individual measuring mode, and the TIMED data when the measurement is not started yet or when the automatic measurement stop function of the timer is not used are as follows:

99:99:99:99

5.6.3 Format of Parameter Read by OP or ? Code

The transmission format of parameters transmitted by the OP code or ? code (query) is the same as that of the parameter setting in Section 5.5.2. The leading 0 in the parameter set value is not omitted, but 0 is always transmitted.

For further details, see "Parameter Setting Format" in Subsection 5.5.2 and "Set Parameter Reading (Using OP and ? Codes)" in Subsection 5.5.3.



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5.7 Service Request and Status Byte

5.7 Service Request and Status Byte

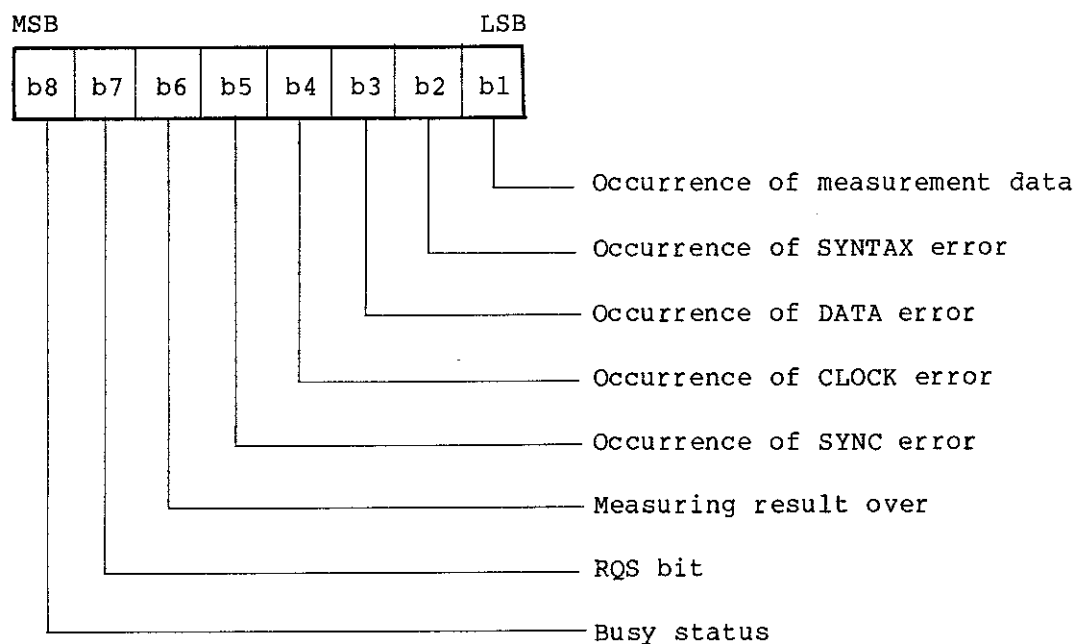
This equipment indicates the end of measurement or out of synchronism (SYNC error) status with the status byte.

In addition, it can transmit the service request signal (SRQ) for the GPIB controller when these error factors occur.

5.7.1 Status Byte

The status byte is composed of eight bits as shown below:

Upon receipt of the SPE command from the controller through the execution of the serial polling, this equipment transmits this status byte when specified as the talker.



(1) Bit b1 (Generation of measured data)

This bit is set to "1" when the measured data to be transmitted at the end of a measurement is generated.

It is cleared to "0" when the transmission of the measured data ends.

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5.7 Service Request and Status Byte

---

(2) Bit b2 (Occurrence of SYNTAX error)

This bit is set to "1" when an undefined program code is received, when a parameter value in the program code is out of the tolerable range, and when the program code is too long.

It is cleared to "0" when the valid program code is received.

(3) Bit b3 (Occurrence of DATA error)

This bit is set to "1" when a bit error is detected in the input data.

It is updated when a serial polling is executed.

(4) Bit b4 (Occurrence of CLOCK error)

This bit is set to "1" when there is no CLOCK input, or when the frequency of the CLOCK input is too low.

It is updated when a serial polling is executed.

(5) Bit b5 (Occurrence of SYNC error)

This bit is set to "1" when the pattern goes out of synchronism.

It is updated when a serial polling is executed.

(6) Bit b6 (measuring result over)

This bit is set to 1 when the measuring result is over. It is updated when serial polling is executed.

(7) Bit b7 (RQS bit)

This bit is set to 1 when one of bits b1 to b6 becomes 1. It is cleared to zero when all of them become 0.

(8) Bit b8 (BUSY status)

This bit is set to 1 while the delay of CLOCK input is being set or some setting is being changed on the pattern setting block or while the AUTO SEARCH is being set. On completion of the setting or changing, it is cleared to zero. This bit does not cause service request to be generated.

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5.7 Service Request and Status Byte

---

5.7.2 Service Request (SRQ)

When the bit RQS of the status byte is set to "1" and this equipment is set to the "S0" mode, this equipment transmits the single wire signal SRQ (SERVICE REQUEST) to report it to the GPIB controller.

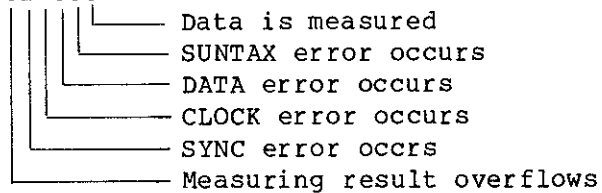
The SRQ is cleared when a serial polling is executed.

5.7.3 Status Byte Mask

This machine masks the unnecessary status byte out of the bit ranging from b1 to b6, and "0" is placed on the bit. Therefore, the SRQ can be transmitted by the necessary commands. To mask the status byte, use the program code "MSdd". The symbol "dd" is decimal numeral ranging from 0 to 63. When this is converted to a 6 bit binary numeral, the bit in the status byte linking the "0" bit is masked, and "0" is placed on the bit.

(Example) When the program code is "MS24"

Binary numeral : 011000



As shown above, only when the CLOCK error or SYNC error occurs, RQS bit (b7) is set. Then, the comand, request for service, can be transmitted.

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5.8 Device Trigger (GET Command)

---

5.8 Device Trigger (GET Command)

If the measuring function is in the individual measuring mode for Error Count, ES or EFS or in the simultaneous measuring mode, you can start the measurement by using the GET command. The GET command functions the same as the program code "STT" or "E".

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---

5.9 Device Clear (SDC/DCL Command)

5.9 Device Clear (SDC/DCL Command)

Upon receipt of the SDC or DCL command, this equipment initializes the operation. The SDC or DCL command functions the same as the program code "C".

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5.10 Initialized Status

---

5.10 Initialized Status

5.10.1 Initialized Status of Operation

Upon receipt of the SDC/DCL command or program code "C", this equipment initializes the operation as described below:

(1) Measuring Status

In the ERROR RATE and FREQUENCY measurement at individual measurement mode, after suspending the measurement, a new measurement is started.

In the measurement of ERROR COUNT at individual measurement mode, ES, EFS and simultaneous measurement mode, no measurement data is generated although the measurement is stopped as in the receipt of the STOP.

(2) Status Byte

All bits are cleared to "0".

(3) Service Request

The equipment is set to the "S1" mode.

(4) OP Code and ? code (Query)

All bits are cancelled.

(5) Word Pattern Setting Mode

The binary mode is cancelled.

However, the mode cannot be cancelled using the program code "C".

5.10.2 Initialized Value of Parameter

Each parameter is initialized by the program code "Z" as follows:

(1) Pattern setting Block

Pattern mode	: WORD	(WORD)
Bit length	: 16	(BL16)
Address	: 0	(ADRO)
Word pattern	: 0101 0101 0101 0101	(WP0,4,AAAA)
Polarity(word)	: NORMAL	(WPN)
PRBS $2^N-1$	: N = 15	(PB15)
Mark ratio	: 1/2	(MR1/2)
Contents of memory		
Bit length of memory No. 0-9	: 16	(BL16)
Even number pattern	: 0101 0101 0101 0101	(WP0, 4, AAAA)
Odd number pattern	: 1010 1010 1010 1010	(WP0, 4, 5555)

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5.10 Initialized Status

(2) Masuring Block

Measurement function	:	ERROR RATE	(ERR)
Display form			
Error rate measurement	:	PROGRESSIVE form	(PRG)
Error count measurement	:	EXPONENTIAL form	(EXP)
ES, EFS measurement	:	% form	(PTON)
Error display mode	:	TOTAL	(TOT)
Measurement mode	:	Individual measuring mode	(IND)
Current data	:	ON	(CDON)
Bit error rate range	:	10 <sup>-8</sup>	(RNG-8)
Display rate	:	FAST	(FST)
Automatic synchronism(AUTO SYNC)	:	ON	(ASON)
Buzzer (DATA)	:	OFF	(BZOF)
Buzzer (alarm)	:	OFF	(BAOF)
Threshold level	:	-0.500V (TERMINATOR DATA TO GND)	(TLVL-0.5)
	:	-1.300V (TERMINATOT DATA TO -2V)	(TLVL-1.3V)
Polarity (Data input)	:	NORMAL	(MPN)
Maximum value display (error rate display)	:	Present	(MAXOF)
Resolution (Frequency measurement)	:	OFF	(RESOF)
GATE control	:	INT	(GTINT)

(3) Input Block

Terminator (DATA)	:	TO GND	(DGND)
Terminator (CLOCK)	:	TO GND	(CGND)

(4) Timer/clock Block

Time display	:	REAL TIME DAY:HOURL:MIN:SEC	(RTL)
Measuring time (PRESET)	:	00:00:00:00	(PRS 00:00:00:00)
Timer mode	:	SINGLE	(SIN)

(5) Printer Block

Printer print mode	:	PRINTER OFF	(PRTOF)
Error print	:	ERROR PRINT OFF	(EPROF)

(6) Control Block

Panel lock	:	OFF	(PLKOF)
------------	---	-----	---------

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5.10 Initialized Status

---

(7) GPIB parameters

Output data	:	Measuring data	(MES)
Header	:	ON	(HDON)
Send record delimiter	:	CR, LF+EOI	(DL0)
SRQ transmission	:	Not transmitted	(S1)
Status byte mask	:	The bit : 1	(MS63)



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5.11 Sample Programs

---

### 5.11 Sample Programs

This section describes sample programs for reference to GPIB program generation. They are assumed to be written in BASIC on an HP9000 series 300 manufactured by Hewlett-Packard Co., as a controller.

#### 5.11.1 Parameter Setting

This program measures an error rate after optimizing the phase to data input by varying the delay of CLOCK input.

Note that the threshold level must be set to the optimum point in advance.

##### (1) Program list

```
1000 Erd=708
1010 OUTPUT Erd;"ASON ERR TOT MS63"
1020 !
1030 Begin: !
1040 Dly=0
1050 GOSUB Dly
1060 IF Se=0 THEN Se0
1070 !
1080 Se1: !
1090 LOOP
1100   Dly=Dly+1
1110   EXIT IF Dly>400
1120   GOSUB Dly
1130   EXIT IF Se=0
1140   END LOOP
1150   IF Dly>400 THEN GOTO Se1
1160   Dly1=Dly
1170   !
1180   LOOP
1190   EXIT IF Dly=400
1200   Dly=Dly+1
1210   GOSUB Dly
1220   EXIT IF Se=1
1230   END LOOP
1240   Dly2=Dly
1250   GOTO Fin
1260   !
1270   Se1: !
1280   Dly=0
1290   LOOP
1300   Dly=Dly-1
1310   EXIT IF Dly<-400
1320   GOSUB Dly
1330   EXIT IF Se=0
1340   END LOOP
```

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5.11 Sample Programs

(cont'd)

```
1350 IF Dly<-400 THEN GOTO Error
1360 Dly2=Dly
1370 !
1380 LOOP
1390 EXIT IF Dly=-400
1400     Dly=Dly-1
1410     GOSUB Dly
1420 EXIT IF Se=1
1430 END LOOP
1440 Dly1=Dly
1450 GOTO Fin
1460 !
1470 Se0: !
1480 LOOP
1490 EXIT IF Dly=400
1500     Dly=Dly+1
1510     GOSUB Dly
1520 EXIT IF Se=1
1530 END LOOP
1540 Dly2=Dly
1550 !
1560 Dly=0
1570 LOOP
1580 EXIT IF Dly=-400
1590     Dly=Dly-1
1600     GOSUB Dly
1610 EXIT IF Se=1
1620 END LOOP
1630 Dly1=Dly
1640 GOTO Fin
1650 !
1660 Fin: !
1670 Dly=INT((Dly1+Dly2)/2+.5)    ! GET CENTER POSITION
1680 GOSUB Dly
1690 IF Se=1 THEN GOTO Re_try
1700 ENTER Erd;Err
1710 PRINT USING "15A,M3D,X,K";"DELAY WIDTH  :",Dly2-Dly1,"ps"
1720 PRINT USING "15A,M3D,X,K";"DELAY CENTER  :",Dly,"ps"
1730 PRINT USING "15A,2D,4DE";"ERROR RATE   :";Err
1740 PRINT "Completed"
1750 STOP
1760 !
1770 Re_try: !
1780 PRINT "Re_try"
1790 GOTO Begin
1800 !
1810 Error: !
1820 BEEP
1830 PRINT "Synchronization Error !"
1840 STOP
```

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5.11 Sample Programs

(cont'd)

```

1850 !
1860 Dly: !
1870 OUTPUT Erd;"DLY";Dly
1880 WAIT 1
1890 LOOP
1900   S=SPOLL(Erd)
1910 EXIT IF BIT(S,7)=0
1920 END LOOP
1930 Se=BIT(S,4)
1940 RETURN
1950 END

```

(2) Execution result

```

DELAY WIDTH   : 131 ps
DELAY CENTER  : 59 ps
ERROR RATE    : 00.0000E+00
Completed

```

(3) Program description:

Line No.	Function
1000	Sets the GPIB select code to 7 and the device address of this equipment to 8.
1010	Sets AUTO SYNC to ON, selects the error rate measuring function, sets the error display mode to TOTAL. Sets all bits in the status byte mask to 1.
1030	Label Begin (Start of automatic adjustment)
1040 to 1050	Sets DELAY to 0 ps.
1060	Branches to label Se0 if no SYNC error occurs.
1080	Label Sel (Occurrence of SYNC error at DELAY of 0 ps)
1090 to 1140	Increments DELAY by +1 ps until a SYNC error is eliminated.
1150	Branches to label Sell if the SYNC error still remains when DELAY becomes +400 ps.
1160	Sets DELAY when the SYNC error is removed to Dly1.
1180 to 1230	Increments DELAY by -1 ps until the next SYNC error occurs.
1240	Sets DELAY when a SYNC error occurs to Dly2.
1250	Branches to label Fin (termination).
1270	Label Sell

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5.11 Sample Programs

(cont'd)

Line No.	Function
1280 to 1340	Decrements DELAY by -1 ps from -1 ps until the SYNC error is removed.
1350	Branches to label Error if the SYNC error still remains when DELAY becomes -400 ps.
1360	Sets DELAY when the SYNC error is removed to Dly2.
1380 to 1430	Decrements DELAY by -1 ps until the next SYNC error occurs.
1440	Sets DELAY when a SYNC error occurs to Dly1.
1450	Branches to label Fin (termination).
1470	Label Se0 (No SYNC error at DELAY of 0 ps)
1480 to 1530	Increments DELAY by +1 ps from +1 ps until a SYNC error occurs.
1540	Sets DELAY when a SYNC error occurs to Dly2.
1560 to 1620	Decrements DELAY by -1 ps from -1 ps until a SYNC error occurs.
1630	Sets DELAY when a SYNC error occurs to Dly1.
1640	Branches to label Fin (termination).
1660	Label Fin (termination)
1670 to 1680	Sets DELAY to the central value within the range of DELAY where no SYNC error occurs: $\frac{Dly1 + Dly2}{2}$
1690	Branches to label Re_try if a SYNC error occurs.
1700	Obtains the measured value of error rate.
1710 to 1740	Prints the width and central value of the DELAY range having no SYNC error, and the measured value of the error rate at the central value.
1750	Stops the program.
1770	Label Re_try (retry)
1780 to 1790	Prints Re_try and returns to label Begin.
1810	Label Error (No range in which SYNC error does not occur)
1820 to 1830	Causes the buzzer to sound and prints the error message.
1840	Stops the program.
1860	Label Dly (DELAY setting subroutine)

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5.11 Sample Programs

(cont'd)

Line No.	Function
1880	Waits until the controller of this equipment terminates processing. Waits for time required for SYNC (about one second).
1890 to 1920	Executes serial polling and waits until the status byte b8 (BUSY) becomes 0.
1930	Sets the status byte b5 (SYNC error) to Se.
1940	Returns from the subroutine.
1950	Terminates the program.

5.11.2 Parameter Reading

This program reads the states of currently set parameters using the queries (? codes).

(1) Program list

```
100 DATA MF,DM
110 DATA DLY,TLVL
120 DATA PM,BL
130 DATA "WP0,4"
140 DATA ""
150 Erd=708
160 LOOP
170 READ A$
180 EXIT IF A$=""
190 OUTPUT Erd;A$;"?"
200 ENTER Erd;B$
210 PRINT B$
220 END LOOP
230 END
```

(2) Execution result

```
ERR
TOT
DLY 000
TLVL -1.300
WORD
BL 00016
WP0000,004,AAAA
```

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5.11 Sample Programs

---

(3) Program description:

Line No.	Function
100 to 140	DATA statements for the codes corresponding to parameters to be read. Place "" (NULL character string) to specify the end of a series of the codes.
150	Sets the GPIB select code to 7 and the device address of this equipment to 8.
160	Declares the start of a repeat loop.
170	Reads one code corresponding to the parameter to be read from DATA statements.
180	Exits from the loop if the read code is "".
190	Sends the read code added with ? to this equipment.
200	Reads the parameter from this equipment.
210	Prints the read parameter.
220	Terminates the loop (returning to the start of the loop).
230	Terminates the program.

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5.11 Sample Programs

5.11.3 Error Second Measurement Using SRQ

This program presets the timer to 10 seconds, reads and prints the measured values including the process of error second (ES) measurement.

The program obtains measured values using interruptions by SRQ.

For each element of the status byte other than occurrence of measurement data, the program prints the corresponding message as required.

(1) Program list

```
100   Erd=708
110   DN INTR 7 GOSUB Srq
120   ENABLE INTR 7:2
130   OUTPUT Erd;"SO ES PTON HDON MS63"
140   OUTPUT Erd;"PRS 00:00:00:10 ELP"
150   PRINT "ELAPSED TIME","ERROR SECOND"
160   I=0
170   TRIGGER Erd
180   Loop: !
190   ! *** Other Transactions Here ***
200   IF I<10 THEN GOTO Loop
210   STOP
220   !
230   Srq: !
240   S=SPOLL(Erd)
250   IF BIT(S,0)=1 THEN
260     OUTPUT Erd;"TIM"
270     ENTER Erd;T$
280     OUTPUT Erd;"ME$"
290     ENTER Erd;A$
300     PRINT T$,A$
310     I=I+1
320   END IF
330   IF BIT(S,1)=1 THEN PRINT "SYNTAX ERROR"
340   IF BIT(S,2)=1 THEN PRINT "DATA ERROR"
350   IF BIT(S,3)=1 THEN PRINT "CLOCK ERROR"
360   IF BIT(S,4)=1 THEN PRINT "SYNC ERROR"
370   IF BIT(S,5)=1 THEN PRINT "OVER"
380   IF BIT(S,7)=1 THEN PRINT "BUSY"
390   ENABLE INTR 7:2
400   RETURN
410   END
```

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5.11 Sample Programs

(2) Execution result

ELAPSED TIME	ERROR SECOND
ELP 00:00:00:01	ES 000.0000
ELP 00:00:00:02	ES 000.0000
ELP 00:00:00:03	ES 000.0000
DATA ERROR	
ELP 00:00:00:04	ES 025.0000
ELP 00:00:00:05	ES 020.0000
ELP 00:00:00:06	ES 016.6667
ELP 00:00:00:07	ES 014.2857
ELP 00:00:00:08	ES 012.5000
ELP 00:00:00:09	ES 011.1111
ELP 00:00:00:10	ES 010.0000

(3) Program description:

Line No.	Function
100	Sets the GPIB select code to 7 and the device address of this equipment to 8.
110	Defines a branch to the subroutine with label Srq when an interruption occurs from the GPIB.
120	Enables interruptions by SQR from the GPIB.
130	Sets this equipment into the S0 mode (allowing SRQ transmission), error second measurement, TOTAL measurement, % display mode, turns the header on. Sets all bits in the status byte mask to 1.
140	Sets the timer to 10 seconds and the timer/CLOCK display mode to ELAPSED TIME.
150	Prints the title.
160	Clears the measurement counter to zero.
170	Sends the measurement start instruction (GET) to this equipment.
180	Label Loop (Start of SRQ waiting loop)
190	Allows other transactions to be done here.
200	Returns to label Loop if the number of measurement times is less than 10 on the measurement counter.
210	Stops the program on completion of the tenth measurement.
230	Label Srq (SRQ interrupt subroutine)
240	Executes serial polling and reads the value of the status byte into variable S.



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5.11 Sample Programs

(cont'd)

Line No.	Function
250 to 360	Executes the following series of processings if bit 0 (LSB) in variable S is 1 (occurrence of measurement data):
260	Sets data output of this equipment to time data (ELAPSED TIME).
270	Reads time data.
280	Sets data output of this equipment to measurement data (TOTAL).
290	Reads measurement data.
340	Prints measurement data and time data.
350	Increments the measurement counter by one.
370	Prints the SYNTAX error message if bit 1 in variable S (status byte) is 1.
380	Prints the DATA error message if bit 2 in variable S (status byte) is 1.
390	Prints the CLOCK error message if bit 3 in variable S (status byte) is 1.
400	Prints the SYNC error message if bit 4 in variable S (status byte) is 1.
410	Prints the OVER message if bit 5 in variable S (status byte) is 1.
420	Prints the BUSY message if bit 7 (MSB) in variable S (status byte) is 1.
430	Enables the interruption by the next SRQ.
440	Returns from the subroutine.
450	Terminates the program.

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5.11 Sample Programs

5.11.4 Word Pattern Setting (Hexadecimal Mode)

This program converts the binary pattern (0 and 1 character string) entered from the keyboard of the GPIB controller into the hexadecimal character string and sets it as a word pattern.

(1) Program list

```
100 DIM Ps[600].Qs[512].Hs[128]
110 Erd=708
120 OUTPUT Erd:"WORD"
130 LOOP
140 INPUT "BIT LENGTH = ?",B1
150 EXIT IF B1>0 AND B1<1024
160 EXIT IF B1>=1024 AND B1<=65536 AND (B1 MOD 54)=0
170 BEEP
180 END LOOP
190 PRINT "BIT LENGTH :":B1
200 OUTPUT Erd:"BL":B1
210 LOOP
220 LOOP
230 INPUT "TOP ADDRESS = ?",Adrs
240 EXIT IF Adrs>=0 AND Adrs<=4095
250 BEEP
260 END LOOP
270 PRINT "TOP ADDRESS :":Adrs
280 INPUT "PATTERN = ?",Ps
290 L=LEN(Ps)
300 EXIT IF L=0
310 !
320 Qs=""
330 FOR I=1 TO L
340 IF Ps[I,I]="0" OR Ps[I,I]="1" THEN
350 IF LEN(Qs)<128 THEN Qs=Qs&Ps[I,I]
360 END IF
370 NEXT I
380 L=LEN(Qs)
390 EXIT IF L=0
400 !
410 IF (L MOD 4)>0 THEN
420 FOR I=1 TO 4-(L MOD 4)
430 Qs=Qs&"0"
440 NEXT I
450 L=LEN(Qs)
460 END IF
470 !
480 PRINT "BINARY PATTERN :":
490 FOR I=1 TO L STEP 4
500 PRINT Qs[I,I+3]:" ";
510 NEXT I
520 PRINT
```

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(cont'd)

```
530      !
540      HS=""
550      FOR I=1 TO L STEP 4
560          H=0
570          FOR J=0 TO 3
580              H=H+VAL(QS[I+J,I+J])*2^J
590          NEXT J
600          IF H<10 THEN
610              HS=HS&VALS(H)
620          ELSE
630              HS=HS&CHRS(NUM("A")-10+H)
640          END IF
650      NEXT I
660      Lh=LEN(HS)
670      !
680      PRINT "HEXADECIMAL PATTERN :"
690      FOR I=1 TO INT(Lh/4)*4+1 STEP 4
700          PRINT HS[I,I+3];" ";
710      NEXT I
720      PRINT
730      OUTPUT Erd:"WP":Adrs:".":LEN(HS):".":HS
740      END LOOP
750      END
```

(2) Execution result

```
BIT LENGTH : 15
TOP ADDRESS : 0
BINARY PATTERN :
1001 1011 0111 1110
HEXADECIMAL PATTERN :
9DE7
TOP ADDRESS : 0
```

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(3) Program description:

Line No.	Function
100	Declares arrays: P\$ (up to 600 characters), Q\$ (up to 512 characters), H\$ (up to 128 characters).
110	Set the GPIB select code to 7 and the device address of this equipment to 8.
120	Sets the pattern mode of this equipment to WORD.
130 to 180	Prompts the user to enter a bit length from the keyboard.
190 to 200	Prints the bit length and sets it into this equipment.
210 to 740	Prompts the user to enter the top address of a pattern and the pattern itself, converts it and sets it into the equipment. Repeats this operation until "" (Null character string) is input as a pattern.
220 to 260	Prompts the user to enter the head address to set a pattern from the keyboard.
270	Prints the head address.
280	Prompts the user to enter the pattern in binary (0 and 1 character string) from the keyboard. Any character except 0 and 1 can be inserted as a delimiter in the character string.
290	Sets the length of the input character string to L.
300	Exits from the loop if the character string length is 0.
320 to 380	Fetches only 0 and 1 from the input character string to form a new character string and sets the length of Q\$ to L. If the Q\$ exceeds 128 characters in length, the excessive characters are discarded.
390	Exits from the loop if the length of the character string Q\$ is 0.
410 to 460	Adds 0 to Q\$ so that the length of the character string Q\$ is an integral multiple of the number 4 and sets the length of the new character string to L.
480 to 520	Prints the character string Q\$ with a space between every pair of four characters so that it is easy to read.
540 to 660	Sequentially converts every set of four characters in the character string Q\$, starting from the first, into the decimal equivalent. Converts the decimal value further into hexadecimal characters to form a hexadecimal character string and sets its character string length to Lh.

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5.11 Sample Programs

(cont'd)

Line No.	Function
680 to 720	Prints the hexadecimal character string with a space between every pair of four characters so that it is easy to read.
730	Sets the head address and pattern into this equipment.
740	Terminates the loop (returning to the start of the loop).
750	Terminates the program.

5.11.5 Word Pattern Setting (Binary Mode)

This program converts the binary pattern (0 and 1 character string) entered from the keyboard of the GPIB controller into the numeric in bytes and sets it as a word pattern.

(1) Program list

```

100 DIM P$(600),Q$(512),B(64)
110 Erd=708
120 OUTPUT Erd;"WORD"
130 LOOP
140 INPUT "BIT LENGTH = ?",B1
150 EXIT IF B1>0 AND B1<1024
160 EXIT IF B1>=1024 AND B1<=65536 AND (B1 MOD 64)=0
170 BEEP
180 END LOOP
190 PRINT "BIT LENGTH :":B1
200 OUTPUT Erd;"BL":B1
210 LOOP
220 LOOP
230 INPUT "TOP ADDRESS = ?",Adrs
240 EXIT IF Adrs>=0 AND Adrs<=4095
250 BEEP
260 END LOOP
270 PRINT "TOP ADDRESS :":Adrs
280 INPUT "PATTERN = ?",P$
290 L=LEN(P$)
300 EXIT IF L=0
310 !
320 Q$=""
330 FOR I=1 TO L
340 IF P$(I,I)="0" OR P$(I,I)="1" THEN
350 IF LEN(Q$)<128 THEN Q$=Q$&P$(I,I)
360 END IF
370 NEXT I
380 L=LEN(Q$)

```

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5.11 Sample Programs

(cont'd)

```
390 EXIT IF L=0
400 !
410 IF (L MOD 8)>0 THEN
420   FOR I=1 TO 8-(L MOD 8)
430     QS=QS&"0"
440   NEXT I
450   L=LEN(QS)
460 END IF
470 !
480 PRINT "BINARY PATTERN : "
490 FOR I=1 TO L STEP 4
500   PRINT QS[I,I+3]:" "
510 NEXT I
520 PRINT
530 !
540 N=0
550 FOR I=1 TO L STEP 8
560   B(N)=0
570   FOR J=0 TO 7
580     B(N)=B(N)+VAL(QS[I+J,I+J])*2^J
590   NEXT J
600   N=N+1
610 NEXT I
620 !
630 PRINT "BYTE PATTERN : "
640 FOR I=0 TO N-1
650   PRINT USING "?.4D":B(I)
660 NEXT I
670 PRINT
680 !
690 OUTPUT Erd:"BIN":Adrs:".":N
700 FOR I=0 TO N
710   IF I<N THEN
720     OUTPUT Erd;CHRS(B(I));
730   ELSE
740     SEND 7:DATA B(N) END
750   END IF
760 NEXT I
770 END LOOP
780 END
```

(2) Execution result

```
BIT LENGTH : 15
TOP ADDRESS : 0
BINARY PATTERN :
1001 1011 0111 1110
BYTE PATTERN :
217 126
TOP ADDRESS : 0
```

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5.11 Sample Programs

(3) Program description:

Line No.	Function
100	Declares arrays: P\$ (up to 600 characters), Q\$ (up to 512 characters), H\$ (up to 128 characters).
110	Set the GPIB select code to 7 and the device address of this equipment to 8.
120	Sets the pattern mode of this equipment to WORD.
130 to 180	Prompts the user to enter a bit length from the keyboard.
190 to 200	Prints the bit length and sets it into this equipment.
210 to 770	Prompts the user to enter the top address of a pattern and the pattern itself, converts it and sets it into the equipment. Repeats this operation until ""(Null character string) is input as a pattern.
220 to 260	Prompts the user to enter the head address to set a pattern from the keyboard.
270	Prints the head address.
280	Prompts the user to enter the pattern in binary (0 and 1 character string) from the keyboard. Any character other than 0 and 1 can be inserted as a delimiter in the character string.
290	Sets the length of the input character string to L.
300	Exits from the loop if the character string length is 0.
320 to 380	Fetches only 0 and 1 from the input character string to form a new character string and sets the length of Q\$ to L. If the Q\$ exceeds 128 characters in length, the excessive characters are discarded.
390	Exits from the loop if the length of the character string Q\$ is 0.
410 to 460	Adds 0 to Q\$ so that the length of the character string Q\$ is an integral multiple of the number 8 and sets the length of the new character string to L.
480 to 520	Prints the character string Q\$ with a space between every pair of four characters so that it is easy to read.
540 to 610	Sequentially converts every set of eight characters in the character string Q\$, starting from the first, into its decimal equivalent (0 to 255). Set the number of such decimals to N.
630 to 670	Prints the hexadecimal characters in sequence.

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5.11 Sample Programs

(cont'd)

Line No.	Function
690	Sets the binary mode, head address, and the number of bytes N into this equipment.
700 to 760	Sets the word pattern into this equipment byte to byte. EOI is transmitted the moment the last byte is set.
770	Terminates the loop (returning to the start of the loop).
780	Terminates the program.



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5.12 Master-Slave Operation

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5.12 Master-Slave Operation

When this equipment is used in combination with the D3185/D3185A connect both sides of GPIB with a cable and set the SLAVE switch of this equipment to ON and the MASTER CONTROL switch of the D3185/D3185A to ON; then the setting of the pattern setting block of this equipment becomes the same as that of D3185/D3185A.

During master-slave operation, GPIB equipments of the other D3185/D3185A cannot be connected to this equipment. Also, the key-switch in the pattern setting block on the panel of this equipment is disabled at this time.

When the IFC (connector pin No. 9) of the GPIB bus line goes low, the slave function of this equipment is released and the SLAVE switch is turned off.

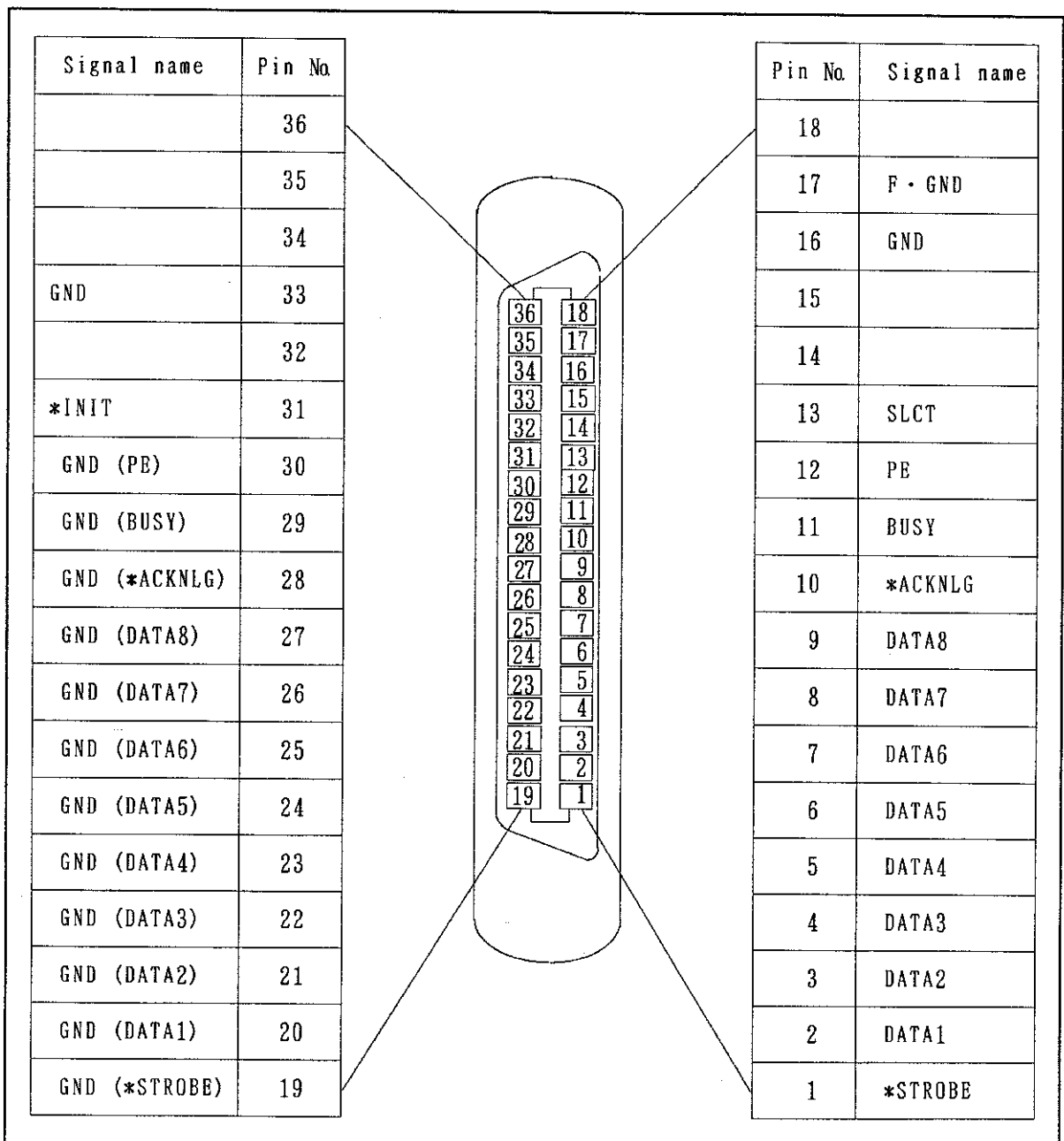
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6.1 Connector Assignment

6. PRINTER

The printer contains the GPIB interface described in Chapter 5 and printer interface that conforms to the specification of Centronics. Therefore, data on the result of measurement can be output simply by connecting the printer conforming the specification of Centronics.

6.1 Connector Assignment



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6.2 Description of interface signals

6.2 Description of Interface Signals

Pin No.	Signal name	Derection of signal	Function
1	*STROBE	Output	Synchronous signal to read data 1 to 8 at the printer
2	DATA1	Output	Signal from bet 1 to 8 in parallel data to be sent to the printer
3	DATA2		
4	DATA3		
5	DATA4		
6	DATA5		
7	DATA6		
8	DATA7		
9	DATA8		
10	*ACKNLG	Input	Signal indicating that the printer is ready to receive the next data after receiving data
11	BUSY		Signal indicating that the printer cannot receive data
12	PE	Input	Signal indicating the presence or absence of print paper
13	SLCT	Input	Signal indicating whether the printer is connected to the sending device
14			Unused
15			Unused
16	GND		Signal ground
17	F.GND		Frame ground (consisting of the signal ground and the internal part)
18			Unused
19 to 30	GND		Signal ground
31	*INIT	Output	Signal initializing the printer
32			Unused
33	GND		Signal ground
34 to 36			Unused

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6.3 Specification of interface

6.3 Specification of Interface

(1) Handshake

Two-line handshake using \*STROBE and BUSY signals

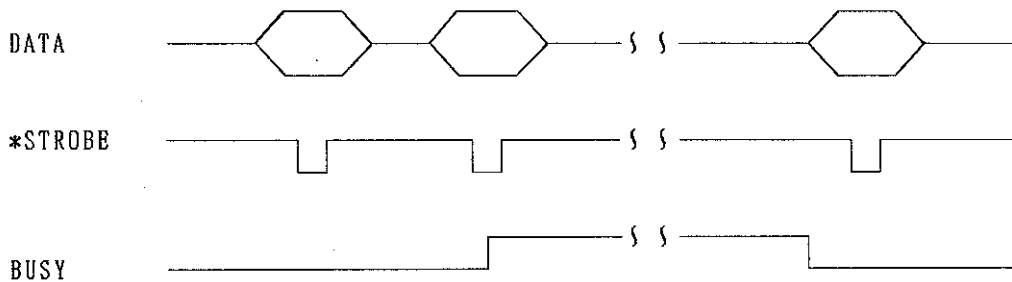
(2) Logic level

The interface signal is equivalent to the TTL level (i8255 or its equivalent is used for the LSI).

(3) Applicable connector

36-pin plug of 57-30360 (from Anphenol) or its equivalent (use the shortest interface cable)

(4) Timing chart



(5) Recommended printer

NEC PC-PR201 series or its equivalent

It is recommend that the printer satisfying the specification of Centronics and incorporating memory should be used.

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6.4 Example of print

6.4 Example of print

(1) For ERROR PRINT OFF

Result of print	Description
92/01/01 00:00:00 ERR 00000.E-08 92/01/01 00:00:00 ERR 00000.E-08	] Individual measurement mode Result of error rate measurement
92/01/01 00:00:10 *START 92/01/01 00:00:20 *STOP	
ERC 00000.E+00	] Individual measurement mode Result of error count measurement
92/01/01 00:00:25 *START 92/01/01 00:00:35 *STOP	
ERC 0000000	] Individual measurement mode Result of error second (ES) measurement
92/01/01 00:00:40 *START 92/01/01 00:00:50 *STOP	
ES 00000.E+00	] Individual measurement mode Result of error free second (EFS) measurement
92/01/01 00:00:55 *START 92/01/01 00:01:05 *STOP	
ES 000.0000	] Individual measurement mode Result of error free second (EFS) measurement
92/01/01 00:01:10 *START 92/01/01 00:01:20 *STOP	
EFS 0001.0E+01	] Individual measurement mode Result of error free second (EFS) measurement
92/01/01 00:01:25 *START 92/01/01 00:01:35 *STOP	
EFS 100.0000	

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6.4 Example of print

(cont')

Result of print	Description
92/01/01 00:01:40 FRQ 10000.000E+6	Individual measurement mode Result of frequency measurement
92/01/01 00:01:40 FRQ 10000.000E+6	
92/01/01 00:01:45 FRQ 10000.00000E+6	
92/01/01 00:01:46 FRQ 10000.00000E+6	
92/01/01 00:01:45 *START	Simultaneous measurement mode
92/01/01 00:01:46 *STOP	
ERR 00000.E-12	Result of measured
ERC 00000.E+00	
ES 00000.E+00	
EFS 01.000E+03	
FRQ 10000.000E+6	
↑	Mesured data

Print for measured data is formatted by measurement mode and type of display.

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6.4 Example of print

(2) For ERROR PRINT ON

Result of print	Description
92/01/01 00:04:00 *START	
92/01/01 00:04:05 SYNC ERROR	SYNC ERROR generation
92/01/01 00:04:05 SYNC RECOVERY	Returns from SYNC ERROR
92/01/01 00:04:06 ERC 00001.E+00	DATA ERROR generation
92/01/01 00:04:07 ERC 0002.5E+01	DATA ERROR generation
92/01/01 00:04:15 *STOP	
ERR 0002.5E-11	Simultaneous measurement mode Result of measured
ERC 0002.5E+01	
ES 00002.E+00	
EFS 00008.E+00	
FRQ 10000.000E+6	
	Kind of print when error occurs
	Measured data

Print for measured data is formatted by measurement mode and type of display.

ERROR PRINT ON is effective at ERC of the individual measurement mode, the ES/EFS measurement, and the simultaneous measurement mode.

The measurement data when error (DATA ERROR) occurs follows the set measurement function.

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7.1 Messages Concerning Measurement

7. DISPLAY MESSAGES

7.1 Messages Concerning Measurement

This section describes special messages concerning measurement. The following messages are displayed on the measuring result indicator (⑥ in Figure 2-3) in the front panel:

Message	Meaning
C L O C . E r r	CLOCK error Corresponding to the ERROR lamp CLOCK (① in Figure 2-3), this message appears when no clock pulse is input or an input clock frequency is too low.
S Y N C . E r r	SYNC error Corresponding to the ERROR lamp SYNC (① in Figure 2-3), this message appears while the pattern is out of synchronism.
b u s y	BUSY This message appears from the start of error rate and frequency measurement at individual measurement until the result of the measurement is first displayed.
H A L T	HALT In the error count, the error second, the error free second of the individual measuring mode, and the simultaneous measurement mode, this message continues to be displayed until the measurement is started from when measurement becomes possible.
S E A R C H	SEARCH Display during the AUTO SEARCH function is executing.
n o t f o u n d	not Found Display when the AUTO SEARCH function can't search the optimum value.



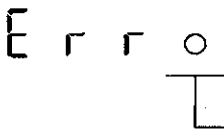
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7.2 CPU Error Messages

7.2 CPU Error Messages

This section describes error messages displayed when the CPU that controls this equipment internally malfunctions.

The messages appear on the measuring result indicator (⑥ in Figure 2-3) in the front panel.

Display format:  Error code (4-digit numeric characters)

Error code	Meaning
0001 to 1717	Memory error
8000 to 8008	Error in CPU peripheral circuit

If one of these errors is displayed, turn the D3285 power supply off, wait for more than five minutes, hold down the PATTERN setting key 2 (⑮ in Figure 2-2) and turn the D3285 power supply on again.

Hold down key 2 several minutes until a message is displayed on the BIT LENGTH indicator (⑤ in Figure 2-2) or on the ADDRESS number indicator (⑧ in Figure 2-2).

If such errors are displayed frequently, the CPU or its peripheral circuit may be faulty. Contact the nearest dealer or the sales and support offices. ADVANTEST offices and agencies are listed at the end of this manual.

### 7.3 LOW Voltage Message

When the power supply of this equipment is turned on, the following message may appear on the bit length indicator (⑤ in Figure 2-2) and address number indicator (⑧ in Figure 2-2) in the front panel:

L o b A t

This message indicates that the voltage of the Nicd battery has been lowered and set parameters have been lost because the battery backs up the memory storing them while the power supply is off.

This low battery message is displayed for about three seconds. After that the equipment operates normally, though all of the previously set parameters in the memory have been initialized. The initial value of each parameter is the same as the value initialized by the GPIB program code Z (See Section 5.10.2). When this message appears, the device address of the GP-IB is initialized to 1 and the clock is reset to 92 (year), 01 (month), 01 (day), 00 (hour), 00 (minute), and 00 (second).

To fully charge the battery in the low battery state, leave the power supply of this equipment connected with power continuously for 12 hours or more.

If the low battery message still appears after the battery is fully charged, the battery may have exhausted its life span. In this case, contact the nearest dealer or the sales and support offices.

ADVANTEST offices and agencies are listed at the end of this manual.

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7.4 Delay Trouble Indication

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7.4 Delay Trouble Indication

If the absolute value of the delay indicated in the delay setting section changes an allowable value or more, the automatic calibration routine starts and the following message is displayed for a maximum of 12 seconds:

C A L

In this case, the lower limit detection function and upper limit detection function are performed. If an error is detected, the following error indication will be made:

E r r

When this is displayed, the system is undoubtedly defective contact the nearest dealer or the sales and support offices. ADVANTEST offices and agencies are listed at the end of this manual.

While this message is displayed, the delay setting control is ineffective. To make this knob effective, turn this equipment off and turn it on again; the error indication will disappear but it will be displayed again after displaying CAL for several seconds unless the cause of the trouble is not remedied.

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8. SPECIFICATIONS

---

8. SPECIFICATIONS

● Measuring functions and measurement ranges

Individual measurement and simultaneous measurement of the following 5 functions can be made.

- Error rate measurement:

0. x 10<sup>-12</sup> to 9.9999 x 10<sup>-1</sup> (in individual measurement mode)  
(by setting the bit error rate range)

0. x 10<sup>-16</sup> to 9.9999 x 10<sup>-1</sup> (in simultaneous measurement mode)  
(Counting capacity: 0. x 10<sup>-18</sup> to 9.9999 x 10<sup>-1</sup>)

- Error count measurement:

0. x 10<sup>0</sup> to 1.0000 x 10<sup>16</sup> (in exponent display format)  
(Counting capacity: 0. x 10<sup>0</sup> to 9.9999 x 10<sup>18</sup>)  
0 - 9999999 (in integral display format)

- Error second measurement:

0.0000% to 100.0000% (in % unit display format)  
0. x 10<sup>0</sup> to 1.0000 x 10<sup>6</sup> (in second unit display format)  
(Counting capacity: 0. x 10<sup>0</sup> to 4.2949 x 10<sup>9</sup>)

- Error free second measurement:

0.0000% to 100.0000% (in % unit display format)  
0. x 10<sup>0</sup> to 1.0000 x 10<sup>6</sup> (in second unit display format)  
(Counting capacity: 0. x 10<sup>0</sup> to 4.2949 x 10<sup>9</sup>)

- Frequency measurement:

500.000 MHz to 10000.000 MHz (in individual measurement mode)  
or 500.00000 MHz to 10000.00000 MHz (at high resolution)  
500.000 MHz to 10000.000 MHz (in simultaneous measurement mode)  
(Counting capacity: approx. 440.000 MHz to 10500.000 MHz)

● Operating frequency range

500 MHz to 10 GHz

● Error display mode

Measurement by switching

OMITT : Displays the measured value of errors where logic "0"  
data was input for the expected value of logic "1".  
INSERT : Displays the measured value of errors where logic "1"  
data was input for the expected value of logic "0".  
TOTAL : Display the sum of both measured values of OMITT and  
INSERT errors.

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8. SPECIFICATIONS

---

- Display rate (effective in the error rate measurement and frequency measurement in the individual measurement mode)

FAST : Approx. 0.1 sec  
MED : Approx. 0.3 sec  
SLOW : Approx. 1 sec  
HOLD : Stop after measurement is made once.

- Bit error rate range

10-N

N = 5, 6, 7, 8, 9, 10, 11, 12 (in individual measurement mode)

N = St (in simultaneous measurement mode)

- Measurement control

START : Function measurement start or suspension and remeasurement start command for error count measurement, error second measurement and error free second measurement in the individual measurement mode and all measurement in the simultaneous measurement mode. One-measurement start command when the display rate is set to HOLD, in the error rate measurement and frequency measurement in the individual measurement mode. History function reset command.

STOP : Function stop command for error count measurement, error second measurement and error free second measurement in the individual measurement mode, and all measurement in the simultaneous measurement mode.

- Pattern synchronization

AUTO SYNC ON : Automatic synchronization  
AUTO SYNC OFF : Manual synchronization  
SYNC : Start of resynchronization

- Error display lamp

DATA error : Comes on when errors of 1 bit or more are detected, and goes out when errors are not detected any more.

CLOCK error : Comes on when the input clock is disconnected or the frequency is too low, and goes out when a clock exceeding a certain frequency level (500 MHz) is input.

SYNC error : Comes on when pattern synchronization does not meet an allowable range, and goes out when pattern synchronization meets it.

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8. SPECIFICATIONS

● History display lamp

CLOCK error : Comes on when the input clock is disconnected or the frequency is too low. The ON state continues until the START key is pressed after a recovery from the error.

SYNC error : Comes on when pattern synchronization does not meet an allowable range. The ON state continues until the START key is pressed after a recovery from the error.

● Measuring status display lamp

GATE : Comes on during measurement.

OVER : Comes on when the result of measurement is an overflow.

● Buzzer

Activated when a DATA error, CLOCK error or SYNC error occurs. ON/OFF specification is possible and its volume is adjustable.

● Error rate measurement

Bit error rate range and measurement range in the individual measurement mode:

Bit error rate range	Measurement range
10 <sup>-5</sup>	0 x 10 <sup>-5</sup> to 9.9999 x 10 <sup>-1</sup>
10 <sup>-6</sup>	0 x 10 <sup>-6</sup> to 9.9999 x 10 <sup>-1</sup>
10 <sup>-7</sup>	0 x 10 <sup>-7</sup> to 9.9999 x 10 <sup>-1</sup>
10 <sup>-8</sup>	0 x 10 <sup>-8</sup> to 9.9999 x 10 <sup>-1</sup>
10 <sup>-9</sup>	0 x 10 <sup>-9</sup> to 9.9999 x 10 <sup>-1</sup>
10 <sup>-10</sup>	0 x 10 <sup>-10</sup> to 9.9999 x 10 <sup>-1</sup> or more
10 <sup>-11</sup>	0 x 10 <sup>-11</sup> to 9.9999 x 10 <sup>-2</sup> or more
10 <sup>-12</sup>	0 x 10 <sup>-12</sup> to 9.9999 x 10 <sup>-3</sup> or more

Measuring time in the individual measurement mode:

$$1 / ((\text{Input clock frequency (Hz)}) \times (\text{Bit error rate range})) \text{ (sec)}$$

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8. SPECIFICATIONS

---

Measurement range in the simultaneous measurement mode:  
 $0 \times 10^{-R}$  to  $9.9999 \times 10^{-1}$   
where  $R = \log_{10} ((\text{Input clock frequency (Hz)}) \times$   
 $(\text{Measuring time(sec)}))$  The maximum R value is 18.

● Error count measurement

Measurement range:

0 to  $9.9999 \times 10^{18}$  (in exponent display format)

0 to 9999999 (in integral display format)

Measuring time: From START command to STOP command, until the time preset on the timer, or by external gate input.

● Error second measurement

Measuring range:

0.0000% to 100.0000% (in % unit display format)

0 to  $4.2949 \times 10^9$  (in second unit display format)

Measuring time: From START command to STOP command, until the time preset on the timer, or by external gate input

● Error free second measurement

Measuring range:

0.0000% to 100.0000% (in %unit display format)

0 to  $4.2949 \times 10^9$  (in second unit display format)

Measuring time: From START command to STOP command, until the time preset on the timer, or by external gate input

● Frequency measurement

Measurement range:

500.000 MHz to 10000.000 MHz (in individual measurement mode) or 500.00000 MHz to 10000.00000 MHz (at high resolution)

500.000 MHz to 10000.000 MHz (in simultaneous measurement mode)

Gate time : 10 ms or 1 sec (at high resolution) (in individual measurement mode)

1 sec (in simultaneous measurement mode)

Reference clock:

Internal 10 MHz 10 ppm

External 1 MHz, 2 MHz, 5 MHz, 10 MHz, 1 Vp-p to

10 Vp-p

Automatic selection

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8. SPECIFICATIONS

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● Data input

Input form : DC-terminated, DC-coupled  
Code : NRZ  
Polarity : Logical inversion is possible.  
Input amplitude: 0.2 Vp-p to 2 Vp-p  
Threshold level: -2.000 V to +2.000 V / 0.001 V step (at terminating  
voltage: 0 V)  
- 1.850 V to -0.750 V / 0.001 V step (at terminating  
voltage: -2 V)  
Terminating voltage:  
-2 V / 0 V (GND)  
Input impedance: Approx. 50 ohms  
Connector : K-type (plug)

● Clock input

Input form : DC-terminated, AC-coupled  
Duty ratio : 50%  $\pm$  5%  
Polarity : Identified by leading edge.  
Variable delay amount:  
-400 ps to +400 ps/1 ps step for data input  
Input amplitude: 0.5 Vp-p to 2 Vp-p  
Terminating voltage:  
-2 V / 0 V (GND) (This voltage can be set independently  
from the terminating voltage of data input.)  
Input impedance: Approx. 50 ohms  
Connector : K-type (plug)

● AUTO SEARCH function:

AUTO SEARCH function search automatically the optimum  
value for threshold level and delay quantity (phase  
between data input and clock input).



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8. SPECIFICATIONS

● Reference pattern

PRBS  $2^N-1$  :

Number of stages	Generating polynomial	Applicable standard
7	$x^7 + x^6 + 1$	CCITT recommendation V.29
9	$x^9 + x^5 + 1$	CCITT recommendation V.52
10	$x^{10} + x^7 + 1$	
11	$x^{11} + x^9 + 1$	CCITT recommendation O.152
15	$x^{15} + x^{14} + 1$	CCITT recommendation O.151
15	$x^{15} + x^1 + 1$	
17	$x^{17} + x^{14} + 1$	
20	$x^{20} + x^3 + 1$	CCITT recommendation V.57
23	$x^{23} + x^{18} + 1$	CCITT recommendation O.151

Mark ratio : 1/2, 1/4, 1/8, 0/8, 1/2B, 3/4, 7/8 and 8/8  
The 1/2B pattern is equal to the 1/2 pattern with inverted polarity.

Standard display lamp:

Comes on when the number of stages (generating polynomial) and mark ratio are set in conformity with the CCITT recommendation.

WORD bit length:

1 to 65536 bits/1-bit step. However, 64-bit step for 1024 bits.

WORD address : Each address is displayed in 16 bits.

WORD polarity : Logical inversion is possible.

WORD memory : Programmable pattern ... 10 types  
Fixed pattern ... 2 types

● TIMER/CLOCK display:

REAL TIME : The real time is displayed as year-month-day-hour or day-hour-minute-second.

ELAPSED : In the error count measurement, error second measurement and error free second measurement in the individual measurement mode, and in the simultaneous measurement mode, the time elapsed after a start of measurement is displayed.

The maximum value is 99 DAY 23 HOUR 59 MIN 59 SEC.

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- TIMED : In the error count measurement, error second measurement and error free second measurement in the individual measurement mode, and in the simultaneous measurement mode, the remaining time before an end of measurement is displayed.  
This setting is enabled only when PRESET is set to any value other than 00 DAY 00 HOUR 00 MIN 00 SEC and the timer mode is not UNTIMED. The maximum value is 99 DAY 23 HOUR 59 MIN 59 SEC.
- PRESET : In the error count measurement, error second measurement and error free second measurement in the individual measurement mode, and in the simultaneous measurement mode, the measuring time from a start of measurement to an end of measurement is displayed and set.  
The maximum value is 99 DAY 23 HOUR 59 MIN 59 SEC.  
When PRESET is set to 00 DAY 00 HOUR 00 MIN 00 SEC, the measuring time becomes unlimited.

● Timer mode

- SINGLE : The measurement stops when the time set by the PRESET key has expired.
- REPEAT : When the time set by the PRESET key has expired, the current measurement is stopped and its results are displayed. Then, the next measurement starts automatically. The measurement continues until the STOP key is pressed.
- UNTIMED : The measurement continues regardless of the time set by the PRESET key. The measurement stops when the STOP key is pressed.

● GPIB

Applicable standard:

IEEE 488-1978

Interface function:

SH1, AH1, T6, L3, SR1, RL1, PP0, DC1, DT1, C0, E2

Remote control: All remote control except power ON/OFF, GPIB addressing, slave function ON/OFF and alarm output signal type selection, and set status reading are possible.

Data output : The result of measurement and TIMER/CLOCK data can be output.

● Slave function

The pattern setting of the D3185/D3185A and that of this equipment can be attained in an interlocking way. However, this is possible only when other GPIB device is not connected.

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8. SPECIFICATIONS

● Panel lock

All condition setting except power ON/OFF, panel lock ON/OFF and alarm output signal type setting can be locked.

● Monitor output

Data : Data input is output through an amplifier.  
Output impedance 50 ohms  
Connector K-type (plug)

Clock : Clock input is output through an amplifier and variable delay line.  
Output impedance 50 ohms  
Connector K-type (plug)

● SYNC output

1/32 clock : Clock input is divided into 1/32 and the divided clock is output.  
Output voltage High level 0 0.2 V  
Low level -1 0.2 V  
(when a 50-ohm load is terminated with 0 V (GND))  
Output impedance 50 ohms  
Connector SMA type

Pattern : Pulses are output at the bit position set in the address of the internal comparison pattern .  
Output voltage High level 0 0.2 V  
Low level -1 0.2 V  
(when a 50-ohm load is terminated with 0 V (GND))  
Output impedance 50 ohms

Connector : SMA type

● Error output

Rate : 1/8 of clock input  
Signal type : 8-phase logical sum  
Code : RZ  
Output voltage: High level -0.2 0.3 V  
Low level -1 0.3 V  
(when a 50-ohm load is terminated with 0 V (GND))  
Output impedance Approx. 50 ohms  
Connector SMA type

● Alarm output

Activated upon occurrence of a CLOCK error or SYNC error.  
Relay contact output normal open or TTL open collector output normal high  
Relay contact rating DC 20V, 0.4 A  
Relay operating time 100 ms or more

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8. SPECIFICATIONS

---

● PRINTER

Applicable standard:

Centronics specification

Logic level : TTL level

Data output : Measurement result data can be output.

● General specifications

Numeric indicator:

Green 7-segment LED

Panel setting storage:

Two weeks or more after 12-hour operation

Operating temperature range:

+0°C to +40°C

Operating humidity range:

40% to 85%RH

Storage temperature range:

-20°C to +60°C

Storage humidity range:

30% to 85%RH

Power supply : AC 90V to 132 V (standard)

AC 198V to 250 V (option 40)

48 Hz to 63 Hz, sine wave

Power consumption:

600 VA or less

Weight : 35 kg or less

External dimensions:

Approx. 266 (H) x 424 (W) x 524.5 (D) mm

MEMO



A large, empty rectangular area with rounded corners, enclosed by a dashed border, intended for writing the memo's content.

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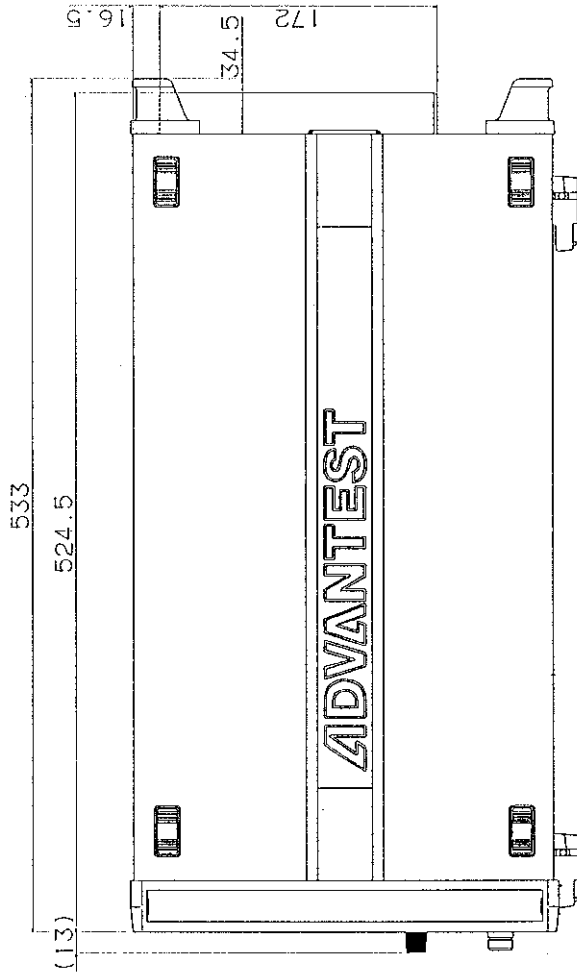
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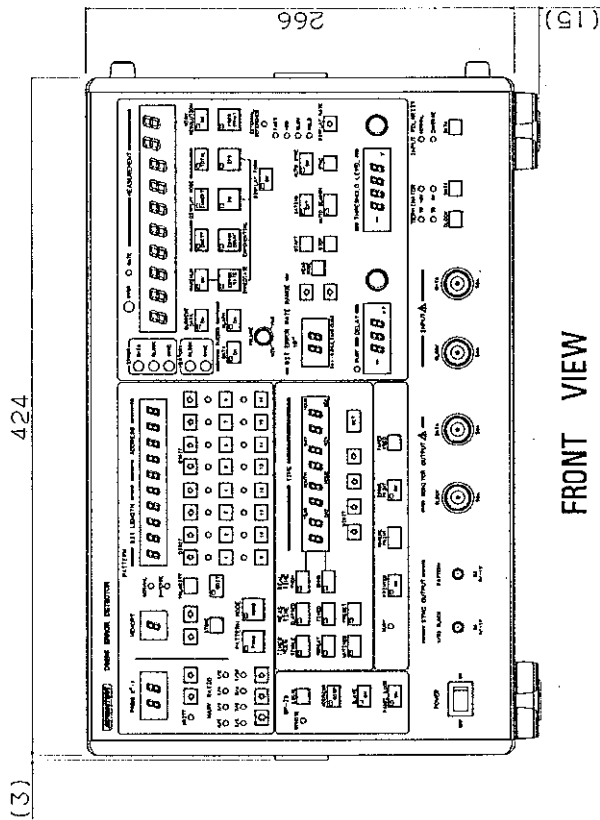




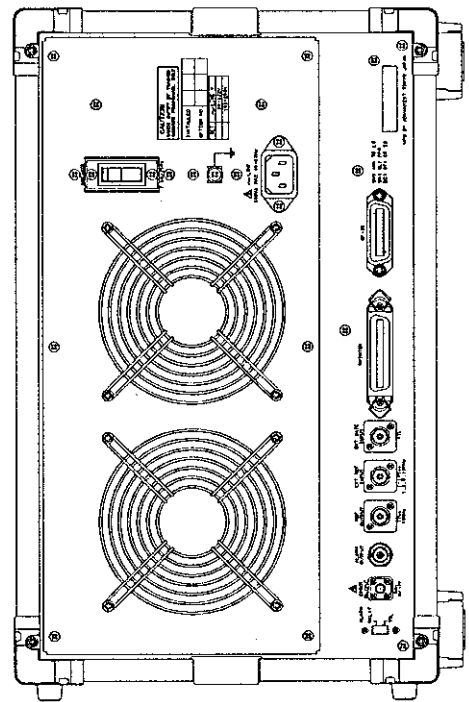
SIDE VIEW

Unit : mm

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EXTERNAL VIEW



FRONT VIEW



REAR VIEW

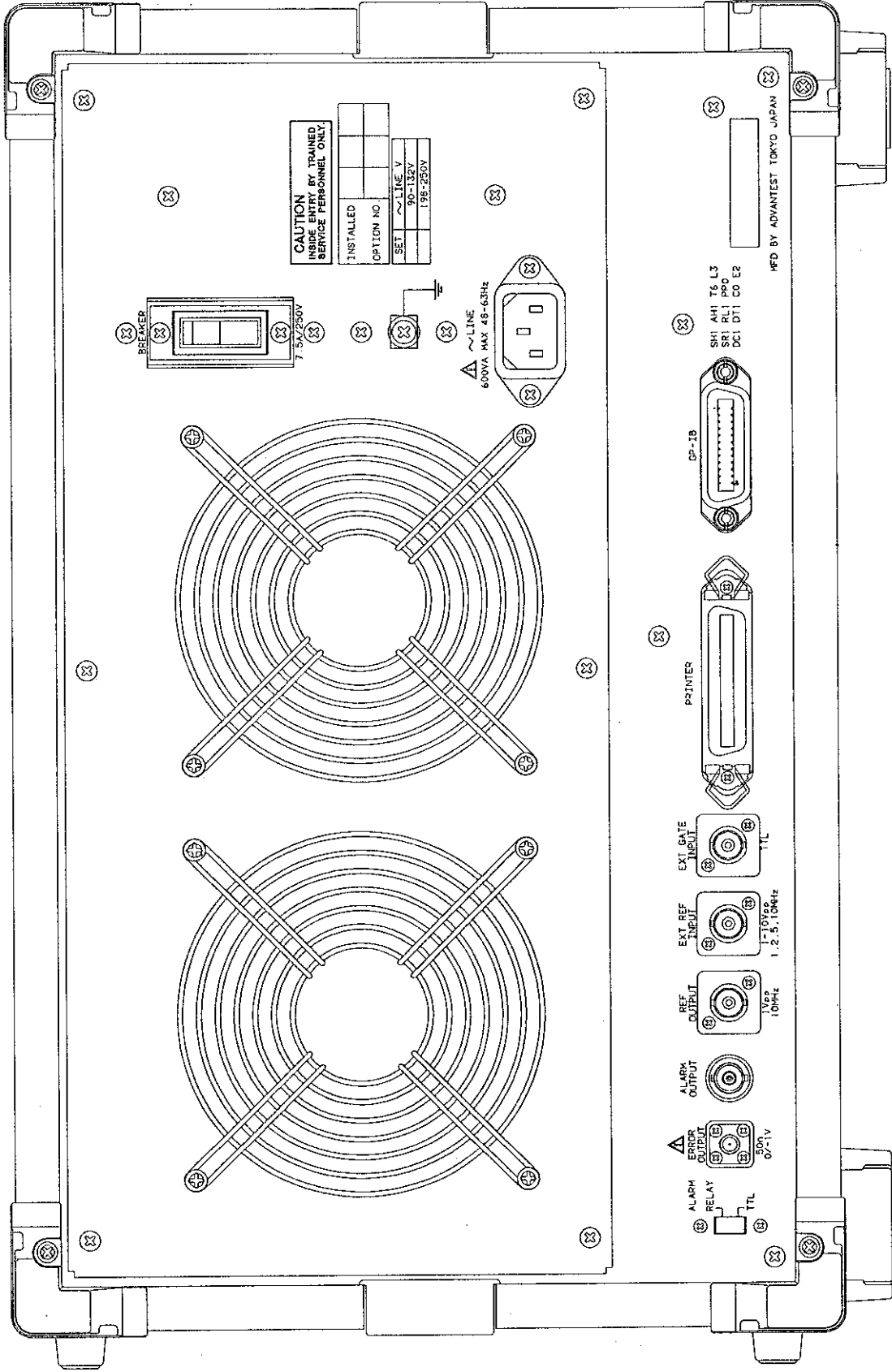
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# REAR VIEW



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